MILITARY PHYSICIAN

Military Physician

Quarterly

Official Organ of the Section of Military Physicians at the Polish Medical Society

Oficjalny Organ Sekcji Lekarzy Wojskowych Polskiego Towarzystwa Lekarskiego

Scientific Journal of the Military Institute of Medicine

Pismo Naukowe Wojskowego Instytutu Medycznego

Published since 3 January 1920

Number of points assigned by the Polish Ministry of Science and Higher Education (MNiSW) – 4

Editorial Office
Military Institute of Medicine
128 Szaserów St., 04-141 Warsaw 44, Poland
telephone/fax: +48 22 681 73 80
e-mail: lekarzwojskowy@wim.mil.pl
www.lekarzwojskowy.pl

Practical Medicine Publishing House / Medycyna Praktyczna
2 Rejtana St., 30-510 Kraków
telephone: +48 12 29 34 020, fax: +48 12 29 34 030
e-mail: listy@mp.pl

Managing Editor
Lidia Miczyńska

Proofreading
Dariusz Rywczak, Iwona Żurek

Cover Design
Krzysztof Gontarski

Typesetting
Łukasz Łukasiewicz

DTP
Katarzyna Opiela

Advertising
Piotr Lorens MD
telephone: +48 663 430 191; e-mail: piotr.lorens@mp.pl

Print
TECHNET, Kraków

Circulation: 700 copies

Price PLN 14

ISSN 0024-0745

For many years, “Military Physician” has been indexed in the Polish Medical Bibliography (Polska Bibliografia Lekarska), the oldest Polish bibliographic database.

The primary version of "Military Physician" quarterly is its electronic version (www.lekarzwojskowy.pl)

The journal is financed by the Military Medical Chamber

Translation, proofreading and DTP of the English version by Skrivanek Sp. z o.o.

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Background

"Military Physician" has been published continuously since 1920, currently as a quarterly of the Military Institute of Medicine in Warsaw, Poland.

1. "Military Physician" publishes original (experimental and clinical) articles, reviews, reports on military issues, deontological papers, interesting case reports, articles on the history of medicine, descriptions of rationalization results, posthumous memoirs, letters to the editor, book reviews, article (review) summaries from international journals particularly on military health services, reports on meetings and scientific conferences, and announcements of events.

2. Before publication, each article is reviewed by 2 independent reviewers while maintaining anonymity.

3. "Military Physician" is indexed in the Polish Ministry of Science and Higher Education, number of points - 4.

4. With respect to the fact that unsolicited articles submitted to our Editorial Board are royalty-free, manuscript submission with a request for publishing will be understood as an implied consent of the Author(s) not to receive any royalty and to transfer copyright to the Military Institute of Medicine.

5. A clinical article for submission should be in accordance with the requirements of the Declaration of Helsinki. The chapter "Material and methods" should contain both the information on the approval of the Bioethical Committee and patients' informed consent to participate in a study. In case of using results of studies conducted by other centers, such information should appear either in the text or in the acknowledgements.

6. Authors of clinical studies on medications (international name) and medical procedures should provide a description of the research funding and the influence of the sponsor on the content of the publication.

7. The Author must provide the Editorial Board with the consent of the image owner to use an image in an article.

8. Please submit your article to: Editorial Board of "Military Physician", 128 Szaserów St., 04-141 Warsaw 44, Poland, or by e-mail: lekarzwojskowy@wim.mil.pl

9. All Authors who wish to publish their papers in "Military Physician" are asked to carefully read and strictly follow the guidelines listed below. Failure to follow the requirements of the Editorial Board makes editing more difficult, increases costs and delays publication. Manuscripts not meeting the requirements will not be published, and those considered inadequately prepared will be returned to the Authors for revision.

Manuscript

1. Manuscripts should be prepared using the MS Word text editor and sent by e-mail or by post on a 3.5" floppy disk or a CD.

2. The number of pages of the manuscript (including tables, figures and references) cannot exceed 30 pages for original articles, 30 for review articles, 20 for reports, 30 for articles on the history of medicine and 15 for rationalization articles. Reports on meetings and conferences should be concise (up to 5 pages) and discuss only significant issues.

3. An original publication may also take the form of a short report.

4. Materials for printing:

1) Text (with references, tables and figure captions) should be uploaded as a separate file. One page of the manuscript should contain 30 lines, about 60 characters each (must be about 1,800 characters). The text must be written in Times New Roman 12 point font and double spaced (this also applies to references, tables, captions etc.), with 2.5 cm left margin, and no right margin, i.e. with the 'flag'. Authors are asked not to format the titles, i.e., not to center or justify them, and not to use the tabulator or automatic numbering (both within the text and references). A new paragraph should be started from the left margin without paragraph indentation. Please do not insert blank lines between paragraphs or enumerations. For typefaces, bold (semi-bold) and italics for foreign phrases may be used.

2) Please do not insert any graphics into the Word manuscript. Figures and tables should be referenced in the body of the text as follows: "in Figure 1", "(Table 1)". The number of tables should be reduced to a minimum. Each table should be provided with captions in Polish and English in bold in the first row. Figures (including maps) and images should be saved in a separate file. Digital images should have a resolution of 300 dpi and be saved in a TIFF format. Good quality traditional images should be delivered on photographic paper. The reverse side of each image delivered on paper should contain the author's last name, the title of the contribution, a consecutive number and a mark indicating the top of the image.

5. Papers should be prepared carefully, in accordance with Polish spelling and with special attention to communicativeness and Polish medical nomenclature. Abstracts, keywords and figure captions translated into English should be identical with the Polish version and show an appropriate language level. Manuscripts that do not meet the criteria will be sent back to the authors for revision.

6. Each article should include the following:

1) On the first page: main title in Polish and English, Author's or Authors' (max. 10 people) first and last names, including academic degrees, full name of affiliated institute (institutes), head of the institute (academic degree, first and last name), below an abstract (up to 15 lines) with keywords in Polish and another abstract with keywords in English, corresponding author, his/her postal address with postal code, telephone (fax) and e-mail address.

2) Main text

Original articles should be prepared according to the following structure: introduction, aim, material and methods, results, discussion, conclusions, references; case reports: introduction, case description, discussion, summary (conclusions), and references.

Abbreviations and acronyms should be defined when first mentioned in the text and consequently used in the paper.

3) References should be presented according to the order they appear in the text. If the article has no more than four authors, please provide all their names; if there are more authors, three names maximum should be provided, followed by the words "et al.". References should be numbered using the keyboard, please do not use automatic numbering. Examples of citations:

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Books:

Rudzki E.: Alergia na leki: z uwzględnieniem odczynów anafilaktycznych i idiosynkrazji. Lublin, Wydawnictwo Czelej, 2002: 338-340

Chapter of a book:

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The list of references should include only those publications that were used by the Author and should be reduced to 20. All references should be cited in the text and the numbers of references should be put in square brackets. In order to avoid errors, titles should be copied from medical databases.

7. The paper should be accompanied by: a) author's request to publish the paper with a declaration that the article has not been published before and not simultaneously submitted to any other journal b) approval of the head of the clinic, head of the department or head of the institute in which the research has been conducted, and in case of a study carried out in several centers - approval of all of them, c) Declaration of Conflict of Interest, d) acknowledgements, if applicable.

8. The Editorial Board reserves the right to correct nomenclature and stylistic errors as well as to introduce abbreviations without consultation with the Author.

9. The Author receives 1 free copy of the issue in which his or her article has been published. For further copies, contact the Editor.

10. If the manuscript is not accepted for publication, the Editorial Board will return the submitted article to the Author.

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Serving the patients: 50 years of the Szaserów Street Military Hospital

W służbie choremu: 50 lat Szpitala Wojskowego na Szaserów

Danuta Augustynowicz, Aleksandra Karolak

Scientific Research Strategy and Development Section, Scientific Division, Military Institute of Medicine, Warsaw, Poland; Head: Danuta Augustynowicz MSc

Abstract. The article presents a brief history of the Military Hospital on Szaserów Street, Warsaw, founded in 1945. Initially located on Koszykowa Street, it was later moved to a new building at 128 Szaserów Street. The article commemorates 50 years of the hospital's presence in the Grochów District of Warsaw.
Key words: military hospitals - history; 20th century history of medicine

Streszczenie. Artykuł prezentuje zarys historii Szpitala Wojskowego na Szaserów, który został zorganizowany w 1945 r. w Warszawie, początkowo na ul. Koszykowej, a od 1964 roku w nowym budynku przy ul. Szaserów 128. Okazją do zaprezentowania szpitala jest jubileusz 50-lecia jego bytności na Grochowie.
Słowa kluczowe: historia medycyny XX wieku, szpitale wojskowe - historia

Delivered: 17/12/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 9-16

Corresponding author:
Danuta Augustynowicz MSc
Scientific Research Strategy and Development Section,
Scientific Division, Military Institute of Medicine
128 Szaserów St., 04-141 Warsaw, Poland
telephone: +48 22 68 16705; 0665 707 460
e-mail: daugustynowicz@wim.mil.pl

On 30 October 2014, the Military Institute of Medicine in Warsaw celebrated 50 years since the opening of its new buildings on Szaserów Street. To emphasize the importance of this date, a conference was organized at the Ministry of Defence Conference Centre: "Military hospitals in the medical system in periods of peace, crisis and war", under the honorary auspices of Bronisław Komorowski, President of the Republic of Poland and Head of the Polish Armed Forces.

The commemoration was attended by: on behalf of the Polish President – Dariusz Młotkiewicz, Deputy Head of the Presidential Chancellery; Tomasz Siemoniak, Deputy Prime Minister, Minister of National Defence; Prof. Lena Kolarska-Bobińska PhD, Minister of Science and Higher Education; Jadwiga Zakrzewska, Deputy Head of the Polish parliamentary National Defence Committee; representatives of the Polish Armed Forces command, including Gen. Mieczysław Gocuł, Chief of General Staff of the Polish Armed Forces; Lieut. Gen. Lech Majewski, Armed Forces General Commander; representatives of the Marshall of the Mazovian Voivodeship, National Health Fund, chairs of the chambers of physicians and nurses. Prof. Leszek Rafalski MD, PhD, Head of the Main Council of the Research Institutes, representatives of university authorities, commanders of military hospitals, representatives of institutions collaborating with the Military Institute of Medicine, former commanders and heads of the hospital on Szaserów Street, members of the Military Institute of Medicine Scientific Council, heads of departments and institutes, soldiers and long-time employees. Guests were welcomed by the Head of the Military Institute of Medicine, Brig. Gen. Grzegorz Gielerak MD, PhD, who referred to the institution's past, recalling its founders, origin and achievements, as well as outlining the directions for development and future strategy (Fig. 1).

The honorable speakers expressed recognition of the value of the hospital, emphasizing its achievements and important role in the development of science and medicine. "The hospital on Szaserów Street is a unique medical institution in Poland. It serves the general public, but for the armed forces it is of particular importance," [*] said the deputy Prime Minister.

[*] http://wim.mil.pl/oferta-komercyjna/1857-minister-obrony-naro-dowej-o-jubileuszu-wim [access: 13.12.2014]

Figure 1. The anniversary celebration. Photo by Andrzej Kosater
Rycina 1. Uroczystość jubileuszowa (fot. Andrzej Kosater)

Equally pleasant sentiments were expressed in the congratulatory letters received by the Head of the hospital. Bronisław Komorowski, President of the Republic of Poland, wrote: "... The hospital on Szaserów Street – the largest, flagship military clinical hospital, contributes immensely to the development of Polish medicine, medical science and medical studies. The Institute has greatly affected the potential of the Military Medical Services. I find it praiseworthy that many medical fields began their development here, and some of them were pioneer solutions in Poland. It is of great significance that the knowledge collected here is used effectively in practice, for the benefit of the whole of society."** (Fig. 2).

The military hospital on Szaserów Street has become a part of the everyday life of Warsaw and of Warsawians, and it is known in Poland and abroad. Recognition for the achievements of the hospital and respect for the people working here are due to the years of solid work by generations of physicians, and a plethora of individuals supporting the diagnostic and therapeutic processes, as well as the scientific and educational development of the institution (Fig. 3).

The Ministry of National Defence Hospital started functioning in the first months of 1945. At that time it was located in a building at 78 Koszykowa Street, and by October 1945 admitted its first patients. The hospital's first commander and organizer was Antoni Kaczkowski PhD. Very soon the most pressing need was to extend and modernize the building, which at the moment of opening the hospital did not meet the requirements of medical development of that time. The extensively developed hospital structure, including departments of all specializations, polyclinics and utility rooms, impeded the daily work and development of the institution. The decision was made to add another wing to the building on Koszykowa Street, and at the same time, a new area to build a hospital complex was sought. Due to the strategic purposes of the hospital, the need for convenient access and the possibility of having its own railway siding, a location on the right side of the Vistula River was chosen, on Szaserów Street.

Prezydent
Rzeczypospolitej Polskiej

Figure 2. Letter from the President of the Republic of Poland
Rycina 2. List Prezydenta RP

In 1952, the Ministry of National Defence Hospital was renamed the Central Ministry of National Defence Hospital, which reflected the extended scope of its operations. New positions were established, including scientific heads for the departments of surgery, internal medicine, gynecology and obstetrics. The first heads of the departments were: a surgeon, Col. Tadeusz Bętkowski MD, PhD; internists Col. Prof. Mieczysław Fejgin MD, PhD and Capt. Mieczysław Kędra MD, PhD, as well as a gynecologist, Col. Stanisław Bazarewski MD, PhD.

The continuous development of the institution was reflected in the increasing quality of medical services, but first and foremost in scientific and educational improvements. The military authorities expressed their recognition by including the hospital in the structures of the Military Medical Academy in Łódź, established by Minister of National Defence Order No. 03/org. of 9 May 1958, giving it the name: 2nd Central Clinical Hospital of the Military Medical Academy. The hospital's first commander was Col. Stanisław Noworyta MD.

** B. Komorowski, Congratulatory letter, 30th October 2014

DYREKTOR

Wojskowego Instytutu Medycznego

Pan gen. bryg. dr hab. n. med. Grzegorz GIELERAK

Szanowny Panie Dyrektorze!

Z okazji 50-lecia „szpitala wojskowego przy Szaserów", Prezes i Rada Lekarska Wojskowej Izby Lekarskiej pragną wyrazić swoje najwyższe uznanie dla wysiłku wszystkich, którzy pomogli i umożliwili tę zamierzoną, nie tylko dla podopiecznych wojskowej służby zdrowia placówkę.

Szczególne wyrazy uznania i podziękowania składamy pracownikom „szpitala wojskowego przy Szaserów" – pracownikom naukowo-dydaktycznym, lekarzom, pielęgniarkom, technikom medycznym, laborantom i pozostałym pracownikom medycznym za ich skuteczną i świadczoną na najwyższym poziomie działalność leczniczą.

Wasze wysokie zawodowe kwalifikacje i oddanie swojej pracy skutecznie przyczyniają się do niesłabnącej popularności placówki wśród mieszkańców województwa mazowieckiego oraz innych regionów Polski. Wojskowa Izba Lekarska, do której należą lekarze „szpitala wojskowego przy Szaserów", ma z tego tytułu także swoje powody do satysfakcji.

Z okazji Jubileuszu życzymy Dyrekcji, Radzie Naukowej i Pracownikom wszelkiej pomyślności, wielu sukcesów i powodów do dumy, zadowolenia pacjentów, z jakości świadczonych usług medycznych oraz kolejnych lat rozkwitu placówki.

PREZES
RADY LEKARSKIEJ
WOJSKOWEJ IZBY LEKARSKIEJ
dr n. med. Jan SAPIEJKO

WOJSKOWA IZBA LEKARSKA

Warszawa, październik 2014 r.

Figure 3. Letter from the President of the Military Medical Association
Rycina 3. List Prezesa Wojskowej Izby Lekarskiej

Construction at the new site followed a design developed by the 1st Regional Office of Projects in Warsaw, in co-operation with the Health Service Department, beginning in the 1950s. The head of the Building Committee was Div. Gen. Prof. Bolesław Szarecki MD, PhD, the main designer was Włodzimierz Zieleniewski MSc, Eng, and coordinator on behalf of the Ministry of National Defence Health Service Department was Col. Piotr Goździk MD, PhD. The building works were supervised by Col. Czesław Półtorak MD, PhD, Commandant of the Central Clinical Hospital, Military Medical Academy. As early as in 1959, this modern building, suitable to provide medical services, with well-equipped laboratory and diagnostic facilities had been completed on Szaserów Street. The possibility of conducting scientific and research work, as well as training, was also provided (Fig. 4).

The official opening of the 2nd Central Clinical Hospital of the Military Medical Academy took place on 12 October 1964. The event became a national celebration, in which participated representatives of various authorities, e.g. Marian Spychalski, Minister of National Defence, Polish Marshall; Div. Gen. Wiktor Ziemiński, Main Quartermaster of the Polish Armed Forces; Brig. Gen., Prof. Marian Garlicki, Rector of the Military Medical Academy; Jerzy

Figure 4. The hospital building in 1959 (Military Institute of Medicine archive)
Rycina 4. Budynek Szpitala w 1959 roku (z archiwum WIM)

Sztachelski PhD, Minister of Health and Social Care, and Col. Czesław Półtorak MD, PhD, Chief of the Polish Armed forces Department of Health Services. The hospital was represented by Commandant Tadeusz Rożniatowski MD (Figs. 5-7).

Initially, not all clinical departments were moved to the new building; the hospital complex at 78 Koszykowa Street was preserved as Branch No. 2 of the Central Clinical Hospital of the Military Medical Academy and its Commandant was Col. Jerzy Przygodzki MD, PhD. The hospital on Szaserów Street hired the employees of the closed 1st Military Regional Hospital, at that time situated at 27 Nowowiejska Street in Warsaw, as well as the staff of the 2nd Central Clinical Hospital of the Military Medical Academy from Koszykowa Street.

The hospital continuously pursued research activities, closely related to improving the qualifications of its staff, the development of the diagnostic resources, and extending the scope of the medical services. To benefit from well-educated employees, the institution gradually took on the task of further training of physicians and offering specializations in various fields of medicine by partially taking over the education of students of the Faculty of Medicine at the Military Medical Academy.

In July 1967, on the basis of the 2nd Central Clinical Hospital of the Military Medical Academy, the Institute of Postgraduate Education at the Military Medical Academy with the 2nd Central Clinical Hospital of the Military Medical Academy in Warsaw was created, with the rights of a Postgraduate Faculty; it took over the tasks of the Improvement and Specialization Program of the Military Medical Academy. As an institute, the facility was required to provide postgraduate education for the military health services staff, to conduct research activities in the field of medical science, particularly in relation to the state's defense, and to provide medical services.

Figure 5. Col. T. Rożniatowski PhD, arriving
Rycina 5. Meldunek składa płk dr T. Rożniatowski

Figure 6. The main hall in 1964 (Military Institute of Medicine archive)
Rycina 6. Hol główny w 1964 roku (z archiwum WIM)

Figure 7. Visitors being guided around by W. Wysznacka-Aleksandrow PhD (Military Institute of Medicine archive)
Rycina 7. Gości oprowadza dr W. Wysznacka-Aleksandrow (z archiwum WIM)

Figure 8. Prof. D. Aleksandrów (Military Institute of Medicine archive)
Rycina 8. Profesor D. Aleksandrów (z archiwum WIM)

When Brig. Gen. Prof. Dymitr Aleksandrów MD, PhD became the Commandant (Fig. 8), his deputies were: Col. Czesław Półtorak MD, PhD (responsible for training and organizational affairs) and Col. Prof. Zygmunt Ruszczewski MD, PhD (responsible for research).

The institute gained the right to establish its own Scientific Council, whose tasks included development of scientific and research plans, approval of budgets for scientific research, providing opinions on employees for research and educational positions, as well as analysis and evaluation of research and educational activities, as well as the development of the staff.

The first meeting of the Scientific Council of the Institute of Postgraduate Education of the Military Medical Academy took place on 20 November 1969. The Council comprised 33 members, including 2 full professors, 8 associate professors and 14 assistant professors, and PhDs. The chairman of the council was Brig. Gen. Prof. Dymitr Aleksandrów MD, PhD, and his deputy was Col. Assoc. Prof. Edward Waniewski MD, PhD. On 1 June 1970, the Council gained the rights to award the scientific titles of MD, PhD and associate professor MD, PhD (Tab. 1).

Table 1. The Chairs of the Scientific Council of the Institution
Tabela. 1. Przewodniczący Rady Naukowej Instytucji

Chairman of the Scientific Council	Years of holding office
Brig. Gen. Prof. Dymitr Aleksandrów MD, PhD	1967-1972
Col. Prof. Sylwester Czaplicki MD, PhD	1972-1983
Col. Prof. Tadeusz Orłowski MD, PhD	1983-1986
Col. Prof. Henryk Chmielewski MD, PhD	1986-1991
Col. Prof. Zbigniew Dumański MD, PhD	1991-1996
Col. Prof. Eugeniusz Dziuk MD, PhD	1996-2001
Prof. Marek Maruszyński MD, PhD	2001-2002
Col. Prof. Tadeusz Ptusa MD, PhD	2003-2007
Col. Prof. Edward Stanowski MD, PhD	2007
Col. Prof. Dariusz Jurkiewicz MD, PhD	2008-present

In the 1970s, the integration of open treatment in polyclinics with hospital treatment was considered an important factor affecting the quality of services. The Central Polyclinic was created in the hospital on Koszykowa Street, meaning hospital departments had to be moved to the buildings on Szaserów Street: the Observation and Contagious Diseases Department with the Tropical Medicine Office was transferred there in April 1973, followed by the Department of Surgery in 1974. The organizational structures of the hospital were modified as well; by the order of Deputy Chief of the General Staff of the Polish Armed Forces of 2 August 1974, the institute was renamed the Centre for Postgraduate Education of the Military Medical Academy. Col. Prof. Sylwester Czaplicki MD, PhD became the Commandant (Fig. 9.), having held the position of Commandant of the Institute for Postgraduate Education of the Military Medical Academy since 8 March 1972. Other changes in positions were introduced on 1 November 1974; Col. Prof. Tadeusz Mika MD, PhD became the Deputy for Training, Col. Prof. Edward Wanieski MD, PhD became the Deputy for Research, and Col. Lubomir Kuszczak MD was appointed the Deputy for Treatment. Four institutes were created in the center, and independent clinics, departments and laboratories functioned within its structures.

The Scientific Council of the Military Medical Academy comprised 45 members, including: 14 professors; 17 assistant professors; 4 associate professors; 8 MDs, PhDs, PharmD-PhDs and Military Science PhDs, one MD and one MSc. Col. Assoc. Prof. Sylwester Czaplicki MD, PhD became the Chairman of the Council.

In 1983, the Centre for Postgraduate Education of the Military Medical Academy was reorganized again. The Central Military Clinical Hospital was established within its structure and under its educational and scientific coordination. Col. Prof. Tadeusz Orłowski MD, PhD became its Commandant, and Col. Leszek Bogdał MD was appointed the Hospital Commandant.

Figure 9. Prof. S. Czaplicki (Military Institute of Medicine archive)
Rycina 9. Profesor S. Czaplicki (z archiwum WIM)

This structure lasted for three years; in 1986 both facilities were combined once more, as the Central Clinical Hospital of the Military Medical Academy, one of five basic organizational units in the Military Medical Academy. Col. Prof. Henryk Chmielewski MD, PhD was appointed the Commandant (07/01/1987). The Scientific Council of the Central Clinical Hospital of the Military Medical Academy remained an advisory and opinion providing body for the Hospital Commandant and the Military Medical Academy Commandant in matters regarding postgraduate training and specialization of the staff and employees of military healthcare service; it also provided opinions on the hospital's planned scientific and research activities.

In 1991, Brig. Gen. Prof. Henryk Chmielewski MD, PhD took over the position of Commandant and Rector of the Military Medical Academy, and the position of the Central Clinical Hospital of the Military Medical Academy was given to Col. Prof. Zbigniew Dumański MD, PhD, and then in 1996 to Col. Prof. Eugeniusz Dziuk MD, PhD.

In 1999, due to a change in the principles of hospital functioning in Poland, the Central Clinical Hospital of the Military Medical Academy was transformed into the Central Clinical Hospital of the Military Medical Academy and Polyclinic – an Independent Public Healthcare Institution.

Figure 10. Inauguration of the Military Institute of Medicine
Rycina 10. Inauguracja WIM

Figure 11. The latest hospital building
Rycina 11. Najnowszy budynek szpitala

The hospital's statutory tasks did not change and the hospital remained a faculty of the Military Medical Academy, conducting research activities and postgraduate education. The Scientific Council retained its right to grant scientific titles. On 23 May 2001, Col. Prof. Marek Maruszyński MD, PhD became the Commandant.

The reorganization of military education in 2000 by the Ministry of National Defence Department of Science and Military Education, led to the closure of the Military Medical Academy in Łódź in 2002. This decision also had consequences for the hospital on Szaserów Street. The Ministry of National Defence Resolution of 27 November 2002 stipulated that: "A research and development unit is created under the name of the Military Institute of Medicine. The Institute is supervised by the Minister of National Defence. (...) The Institute takes over the rights and duties, as well as receivables and liabilities of the former Central Clinical Hospital of the Military Medical Academy and Polyclinic, Independent Public Healthcare Institution: (...) regarding research and targeted projects, as well as investments implemented with financial resources planned in the state budget for science".

The resolution became effective on 10 December 2002. The priority purpose of establishing the Institute was to provide medical support for the armed forces, and to maintain the scientific, research and educational potential of the former Central Clinical Hospital of the Military Medical Academy. The Institute was intended to combine the status of a research and development unit with a healthcare facility.

The official and ceremonial inauguration of the institute took place on 23 April 2003, in the presence of Aleksander Kwaśniewski, President of the Republic of Poland and Head of the Polish Armed Forces (Fig. 10). The structure of the Military Institute of Medicine included: the Central Clinical Hospital of the Ministry of National Defence and scientific and research institutes. The former Commandant of the Central Clinical Hospital of the Military Medical Academy, Brig. Gen. Prof. Marek Maruszyński MD, PhD, was appointed Head of the institute, Prof. Wojciech Marczyński MD, PhD became Deputy Head for Science, and Col. Andrzej Szyszkowski MD, PhD became the Commandant of the Central Clinical Hospital of the Ministry of National Defence. On 16 August 2005, the Head of the Military Institute of Medicine was replaced by Brig. Gen. Prof. Jan K. Podgórski MD, PhD, and on 5 February 2007 Col. Prof. Waldemar Banasiak MD, PhD was appointed to the position, becoming Chief of the Inspectorate of the Polish Armed Forces a few months later. Since 11 June 2007, Brig. Gen. Grzegorz Gielerak MD, PhD has been the Head of the Military Institute of Medicine, with Col. Andrzej Chciałowski MD, PhD as Deputy Head for Science. Col. Krzysztof Staroń MD, PhD was appointed Commandant of the Central Clinical Hospital of the Ministry of Defence, and since 2001 this position has been held by Col. Janusz Hałka MD, PhD (Table 2).

Scientific and research work conducted as part of statutory activities were primarily related to the needs of national defense, as well as multi-faceted healthcare, in compliance with the highest medical standards. The scientific achievements of the facility justify its position in Poland. In 1964, first peritoneal dialysis was performed in a patient with exacerbated chronic renal failure, and in 1965 the Centre for Internal Medicine Intensive Care began operating as one of the first in the country. In the 1970s, the hospital was the first in Poland to introduce high-performance dialysis equipment by GAMBRO, and in 1979 ambulatory peritoneal dialysis was implemented (CAPD). In 1977, the echocardiography laboratory was opened, where a proprietary, original method of contrast-enhanced echocardiography examination was later developed. In the late 1970s, invasive electrophysiological methods were introduced to assess disturbances in cardiac conduction and rhythm, diagnostic laparoscopic examinations including targeted liver biopsies were introduced, as well as intracranial pressure monitoring (ICP) with an intraventricular sensor within a closed system, and proper conditions for bone marrow transplants were prepared. In 1985, the first bone marrow transplant was performed, in 1986 a successful autotransplantation of stem cells circulating in the peripheral blood was performed for the first time in Poland. For many years the hospital was the only center in Poland where bone marrow transplants were performed. In 1989 the hospital was the first to demonstrate the value of phase contrast microscopy in the differential diagnosis of hematuria in adults.

Table 2. The hospital on Szaserów Street – a **history of transformations**
Tabela 2. Szpital na Szaserów – historia przekształceń

Name of the institution (dates, location)	Commandant/Head (years in position)
2nd Central Clinical Hospital of the Military Medical Academy (1958-1964, Koszykowa St.)	Col. Stanisław Noworyta MD (1958-1961)
	Col. Assoc. Prof. Czesław Półtorak MD, PhD (1961-1963)
2nd Central Clinical Hospital of the Military Medical Academy (1964-1967, Szaserów St.)	Col. Tadeusz Rożniatowski MD (1964-1965)
	Col. Tadeusz Stasiak MD (1965-1967)
Institute for Postgraduate Education of the Military Medical Academy with 2nd Central Clinical Hospital of the Military Medical Academy (1967-1974)	Brig. Gen, Prof. Dymitr Aleksandrów MD, PhD (1967-1972)
	Col. Prof. Sylwester Czaplicki MD, PhD (1972-1974)
Centre for Postgraduate Education of the Military Medical Academy (1974-1983)	Col. Prof. Sylwester Czaplicki MD, PhD (1974-1983)
Centre for Postgraduate Education of the Military Medical Academy (1983-1986)	Col. Prof. Tadeusz Orłowski MD, PhD (1983-1986)
Central Military Clinical Hospital (1983-1986)	Col. Leszek Bogdał MD (1983-1986)
Central Clinical Hospital of the Military Medical Academy (1986-1999)	Col. Prof. Henryk Chmielewski MD, PhD, later Brig. Gen. (1986-1991)
	Col. Prof. Zbigniew Dumański MD, PhD (1991-1996)
	Col. Prof. Eugeniusz Dziuk MD, PhD (1996-1999)
Central Clinical Hospital of the Military Medical Academy and Polyclinic, Independent Healthcare Institution (1999-2002)	Col. Prof. Eugeniusz Dziuk MD, PhD (1999-2001)
	Col. Prof. Marek Maruszyński MD, PhD (2001-2002)
Military Institute of Medicine and Central Clinical Hospital of the Ministry of National Defence (since 10/12/2002)	Brig. Gen. Prof. Marek Maruszyński MD, PhD (2002-2005)
	Brig. Gen. Prof. Jan Krzysztof Podgórski MD, PhD (2005-2007)
	Col. Prof. Waldemar Banasiak MD, PhD (2007)
	Brig. Gen. Assoc. Prof. Grzegorz Gielerak MD, PhD (since 11/06/2007)

The research studies conducted in the hospital concentrated on experimental medicine, genetics, chemotherapy and transplantation of peripheral blood stem cells, molecular diagnostics and immunotherapy of neoplasms. The hospital was one of the first centers in Poland to introduce in clinical practice operations with the use of laparoscopic surgery and percutaneous renal artery angioplasty, as well as renal transplantation in the army and cryosurgical treatment of venous system diseases, or bariatric operations. NATO and European Union standards were introduced, including those regarding the treatment of the victims of terrorist attacks (biological, chemical and radioactive), comprehensive treatment of multiorgan injuries and combat trauma, as well as PTSD therapy in soldiers. These are only some of the aspects of the facility's activities, which demonstrate the scope and innovative character of its work. With regard to staff education, the courses and training organized over the years in various medical specializations draw in as many as 800 participants per year.

The Military Institute of Medicine is presently the main clinical, educational, consultative and research center for the military healthcare service. As a treatment facility, it primarily provides 24-hour inpatient and outpatient healthcare services. The effect of the statutory tasks of the Military Institute of Medicine on the level of medical support in the Polish Armed Forces is very important in

times of increasing army professionalization and the development of the military healthcare service. It is an institution organized in a modern manner, with extensive scientific and diagnostic resources, investing in the installation and implementation of new technologies in clinical, scientific and educational processes. Telemedicine, teleradiology and computer systems supporting the knowledge management processes distinguish the Institute on the science and healthcare market. The facility collaborates with numerous scientific institutions, creating scientific and industrial consortia, as well as entering into agreements.

Recent years have seen many dynamic changes: large investments in infrastructure have been implemented, including the purchase of state-of-the-art equipment, while extension and maintenance works are performed under financial support from the European Union and the Ministry of National Defence. The latest and the greatest investment in 50 years has been the building of a new hospital wing, opened on 10 December 2014 (Fig. 11.): it is, to quote the Head of the Military Institute of Medicine, "not only surface and space designed and created on a grand scale, filled with the most advanced equipment. It is also a symbol of the beginning of the next 50 years of our hospital".

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Overburden levels related to paramedics and hospital emergency departments in the health care system

Poziom obciążenia ratownictwa medycznego i szpitalnych oddziałów ratunkowych w systemie świadczeń zdrowotnych

Małgorzata Cichońska, Dorota Maciąg, Monika Borek

College of Business and Entrepreneurship in Ostrowiec Świętokrzyski, Faculty of Pedagogy and Health Sciences; Dean: Assoc. Prof. Bożena Zboina PhD

Abstract. The aim of the study is to assess the level of overburden of paramedics and hospital emergency departments providing health services in emergency cases in Ostrowiecki District. The study was carried out in 2014, based on an analysis of the data collected between 1.01.2012 and 31.06.2014, concerning the number of submissions to the emergency departments, number of patients hospitalized in one of the hospitals of Świętokrzyskie Province, and the number and structure of services provided by the rescue teams. The largest group (50%) of respondents was those transferred to the emergency departments by rescue teams and referred by the outpatient PHC (19%) or emergency assistance (16%). The primary reason for rescue team intervention (~10,000/year) was internal conditions, mainly abdominal pain (13%), chest pain (6%), fainting (6%), and injuries (31%). People with chronic diseases or in poor condition due to alcohol consumption were the most frequent patients for external rescue teams. Peripheral venous catheters (14%), drugs lowering blood pressure (57%) or painkillers (14%) were the most frequent aid provided by rescue teams. The emergency system was used largely for conditions that were not acute.
The system encourages its beneficiaries to abuse the rescue mechanisms for immediate enforcement of their rights to receive due public health care. Interventions related to conditions caused by alcohol consumption are a serious problem aggravating the rescue team system and hospital emergency departments, and which requires a systemic solution. The majority of the population receives health aid only in the case of a significant worsening of symptoms, creating a sense of threat, while the lack of a mechanism to verify the health needs of the patient causes referral of the patient to the next link in the system.
Key words: ambulance team of the emergency medical services, emergency medical services system, hospital emergency department, immediate health risk

Streszczenie. Cel. Celem pracy jest ocena poziomu obciążenia ratownictwa medycznego (RM) oraz szpitalnych oddziałów ratunkowych (SOR) udzielaniem świadczeń zdrowotnych w sytuacjach nagłego zagrożenia zdrowotnego w populacji powiatu ostrowieckiego. Materiał. Badanie zrealizowano w 2014 roku na podstawie analizy danych za okres od 1.01.2012 do 31.06.2014 roku; dotyczyło liczby zgłoszeń na SOR, liczby hospitalizowanych jednego ze szpitali w regionie świętokrzyskim oraz liczby i struktury świadczeń udzielonych przez wyjazdowe zespoły ratownictwa. Największą grupę badanych (50%) stanowiły osoby przekazane na SOR przez zespoły ratownictwa oraz skierowane z POZ (19%) lub doraźnej pomocy ambulatoryjnej (16%). Główną przyczyną interwencji zespołów ratownictwa (—10 000/rok) były stany pochodzenia wewnętrznego, a głównie: podwyższone ciśnienie tętnicze (38%), bóle brzucha (13%), bóle w klatce piersiowej i zasłabnięcia (po 6%) oraz urazy (31%). Z pomocy zespołów wyjazdowych korzystają najczęściej osoby z chorobami przewlekłymi lub takie, których stan wynika ze spożycia alkoholu. W toku interwencji wyjazdowych najczęściej zakładane jest wkłucie obwodowe (14%) i podawane są leki obniżające ciśnienie krwi (57%) lub przeciwbólowe (14%). System ratownictwa jest wykorzystywany w znacznej mierze w stanach, które nie są nagłymi zachorowaniami zdrowotnymi. Organizacja systemu świadczeń zdrowotnych doprowadziła do nadużywania przez odbiorców usług medycznych systemu ratownictwa do natychmiastowego egzekwowania prawa do należnej opieki zdrowotnej ze świadczeń publicznych. Interwencje związane ze stanami po spożyciu alkoholu stanowią poważny problem obciążający system ratownictwa medycznego i SOR, który wymaga systemowego rozwiązania. Przeważająca część populacji korzysta ze świadczeń dopiero w momencie znacznego nasilenia objawów stwarzających poczucie zagrożenia, a brak mechanizmu weryfikacji potrzeb zdrowotnych powoduje delegowanie pacjenta do kolejnego ogniwa w systemie.
Słowa kluczowe: nagłe zagrożenie zdrowotne, wyjazdowy zespół ratownictwa medycznego, szpitalny oddział ratunkowy, system ratownictwa medycznego

Delivered: 17/11/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil Phys., 2015; 93 (1): 17-22

Corresponding author:
Cichońska 32 Ogrodowa St., 27-415 Kunów
telephone: +48507 127 921
e-mail: malgosia1307@op.pl

Introduction

The State Emergency Medical Service (SEMS) was established in order to provide assistance to every person at immediate health risk [1], regardless of their age, gender, race, religious beliefs, financial capacity or insurance. The system is mainly directed to patients who experience a sudden worsening of their health, which may result in serious deterioration of the organism's functions, bodily damage or even loss of life. To provide those patients with assistance, the SEMS system was established, comprising Emergency Medical Services (EMSs) and Hospital Emergency Departments (HEDs), as well as other units co-operating with the system. EMSs deal with individuals at immediate health risk at the pre-hospital phase, and HEDs are responsible for the individuals during early hospitalization [2].

A general assessment of the functioning of the EMS system reveals that in the last few years it has ensured rapid assistance at the sites of events to people at immediate health risk; moreover, the level of healthcare provided to the population has improved due to the 6.3% increase in the number of HEDs (14 trauma centers have also been established to treat patients with severe, numerous or multiple-organ injuries), as well as due to complementing their equipment with modern devices.

However, the system ensuring the health safety of Polish citizens in immediate health risk situations is burdened with tasks which exceed the statutory tasks, and it also faces problems such as insufficient staffing in certain cases. HEDs provide health services to all patients, in compliance with the applicable standards. However, the services are also available to people who are not at health risk, even though they do not qualify for such assistance and this leads to the breaking of the law (Art. 3 Item 9 and Art. 33 section 1 of the Act of 8 September 2006 on State Emergency Medical Services) [1]. The situation causes risks to those patients who actually need help from the HED, and it may result in closing of departments if increasing costs cause an excessive financial liability for the hospital. It also results in the unjustified assignment of resources intended for financing closed treatment facilities to cover the costs of diagnostics and therapy of people who, due to their health condition, should use other forms of assistance. The problem applies to 30-80% of people using HEDs at some hospitals, according to the Supreme audit Office. These situations result from limited access to medical services, and the absence of an effective mechanism to limit those services available to patients who are not at health risk. The latter patients should be taken care of within the primary healthcare system, at specialist clinics or night and holiday emergency healthcare institutions [3]. The crisis and problems faced by HEDs are additionally aggravated by the prolonged time that patients spend at HEDs due to extended diagnostic procedures in cases where there are no places at the relevant hospital department, and for patients under the influence of alcohol (to exclude diseases unrelated to alcohol intoxication), as well as the need to repeat certain tests [3].

Another source of problems for the EMSs is the large number of calls caused by limited access to rapid consultations at outpatient clinics (long queues, long waiting for night healthcare or primary healthcare). Patients, instructed by the registered nurses and/or physicians in an outpatient PHC, call the EMS, and sometimes exaggerate the symptoms. It is also important that patients are convinced that they will receive assistance first at a HED or hospital admission room if they are brought in by ambulance. Due to the ineffective primary healthcare and night and holiday healthcare institution system, patients or their families enforce EMS intervention, and often demand that an ambulance is sent because of a lack of improvement after an appointment with a PHC physician. EMS problems also result from the fact that the reason for calling the EMS often differs significantly from the final diagnosis [3].

Aim of the study

The aim of the study is to assess the overburden level of EMSs and HEDs providing healthcare services to patients at immediate health risk.

Material and Methods

The study was conducted in 2014, based on an analysis of the data for the period between 1 January 2012 and 31 June 2014, related to patients arriving to the HED in a hospital in the Świętokrzyskie region, as well as ambulance emergency teams responsible for the health safety of a district with a population of approx. 120,000 people.

Results

The multi-profile hospital in which the study was conducted has an emergency department in compliance with the requirements related to the hospital's General Surgery Department with Trauma Unit, Internal Diseases Department, Pediatric department, Anesthesiology and Intensive Care Department, as well as Laboratory of Imaging Diagnostics. The HED provides 24-hour access to diagnostic tests performed in a medical diagnostic laboratory, to computed tomography and endoscopic examinations, including gastroscopy, rectoscopy, bronchoscopy and laryngoscopy. The scope of services provided may be assessed on the basis of data collected for the period 1 January 2012 to 31 June 2014 (Table 1). Data related to the number of patients requiring advice at

Table 1. Structure of the advice provided in the ED between 1.01.2012 and 31.06.2014
Tabela 1. Struktura porad udzielanych na SOR w okresie 1.01.2012-31.06.2014

Observation period	Patients at the HED	Patients admitted to the hospital	Advice provided at the HED	Patients without a referral	Patients under the influence of alcohol
2012	43,413	21,948	21,431	6518	1326
2013	44,626	22,705	21,910	6286	1249
1st half of 2014	22,207	12,062	10,145	3236	717

the HED indicate that in 2013 the number of recipients of services was 1,213 people higher than in 2012, a 3% increase. If the tendency in the first half of 2014 prevailed, the number of consultations would be identical to that of 2012, 3% lower than that in 2013.

Regarding the number of patients admitted to hospital, a growing trend was observed in the group of people admitted to the HED. In 2013, the number of admitted patients increased by 757, equivalent to 3.5% of the patients admitted in 2012. The number of admissions in the first half of 2014 indicated a higher number of hospitalizations, which, if it continued until the end of the year, would result in the highest number of hospitalizations since 2012.

Regarding the advice provided at the HED, the data collected demonstrated a decrease by 479 in the number of consultations, which constituted 2% of the consultations given in 2012. Based on the number of consultations provided in the first half of 2014, it may be assumed that if the trend prevailed until 2014, the number of consultations would be lower by as much as 6% in comparison to 2013.

Regarding the number of patients arriving at the hospital without a referral, a decrease by 232 consultations was observed in 2013, which was 3.5% fewer patients arriving for advice compared to 2012. In the first half of 2014, 52% of the number of patients from 2013 were admitted to the HED, equivalent to a 3% increase if the trend prevailed until the end of the year.

The significant proportion of people under the influence of alcohol is a matter of concern; in 2012 they constituted 3.1% of patients admitted to the HED. The ratio was 2.8% in 2013, and 3.2% in the first half of 2014 (1 January - 31 June 2014), although if the trend continued then the rate would be higher than in previous years.

The data analysis confirmed that of the people admitted to the HED for advice in 2012 and 2013, 51% were admitted to hospital, while in 2014 54% were admitted.

Advice provided at the HED accounted for 49% in 2012, 49% in 2013, and 46% in the first half of 2014.

The percentage of patients admitted to the HED without a referral was 15% in 2012, 14% in 2013 and 15% in the first half of 2014, which confirms the relatively stability of this indicator.

People who were admitted to the HED under the influence of alcohol in each of the analyzed periods, i.e. in 2012, 2013 and the first half of 2014, constituted 3% of all the patients admitted for advice, which confirms the stability of this indicator, and illustrates the scale of the problem for HEDs, present since the liquidation of sobering stations (Table 2).

The analysis of the results indicates relatively similar levels of values and indicators used to present the scale of assistance provided by HEDs in the form of services for patients at health risk. Simultaneously, the collected numerical data allow the preliminary conclusion that the health condition of the population covered by healthcare was rather stable. Considering the population health safety, it should also be noted that an average of 37% of the district population benefited from the assistance at HEDs annually, with hospitalized patients constituting on average of 19% of the population, and on average over 120 consultations were provided per day at the HED, of which 15% were for patients admitted without a referral, 16% for people with referrals from outpatient clinics, 19% for those with referrals for PHC, and 50% for patients brought in by the EMS units. The EMS system, which ensures the health safety of the Ostrowiecki District population for cases of health risk, provides services to 1% of the district population annually. The recipients of the services of ambulance rescue teams in the period analyzed were patients aged from a few days old to 86 years old. Considering the scale of services provided by ambulance rescue teams, the data translate to an average of 10 interventions per ambulance team per day. Outpatient advice amounted to, on average, 37 doctor consultations per day in a stationary office, with 41% being consultations provided to patients aged 0-18 years old. Additionally, outpatient healthcare (from 18:00 to 06:00, and on holidays) also entailed performing medical services including minor procedures such as injections, whose number was slightly higher than the number of outpatient doctor consultations. The highest number of ambulance calls were registered between 18:00 and 06:00, and the highest demand for outpatient doctor consultations and procedures on days when the PHC was closed, and between 18:00 to 20:00 on business days. On average, the number of services provided by ambulance teams to males and females was equal. The main reasons for interventions of ambulance teams in the analyzed group of patients were as follows: increased arterial pressure (38%), injuries (31%), abdominal pain (13%), fainting (6%), chest pain (6%) and dyspnea (6%).

Ambulance teams undertake activities associated with the treatment and stabilization of the condition of the recipients of their services, until they are transferred to a HED. In the analyzed period, in the group of people who received such assistance, an average of 28% of medical interventions were performed before patient transfer to the HED. The most frequent activities performed by ambulance rescue teams in the period before "delivery" of the patient to HED in 57% of cases involved

Table 2. Structure of the analysed advice provided in the emergency department between 1.01.2012 and 31.06.2014
Tabela 2. Struktura procentowa analizowanych porad udzielanych na SOR w okresie 1.01.2012-31.06.2014 roku

Observation period	Patients admitted to HED	Patients admitted to the hospital	Advice provided at the HED	Patients admitted without a referral	Patients under the influence of alcohol
2012	43,413	51%	49%	15%	3%
2013	44,626	51%	49%	14%	3%
1st half of 2014	22,207	54%	46%	15%	3%

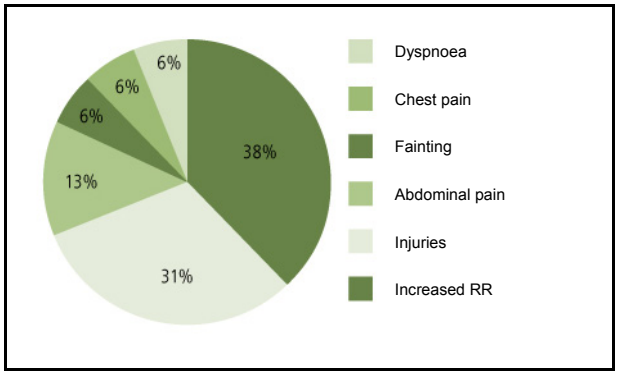

Figure 2. Structure of the most common activities undertaken by the ambulance rescue teams
Rycina 2. Struktura najczęstszych działań podejmowanych przez wyjazdowe zespoły ratunkowe

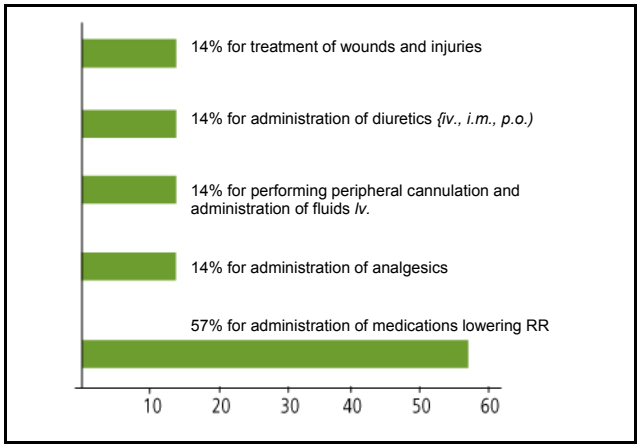

Figure 2. Structure of the most common activities undertaken by the ambulance rescue teams
Rycina 2. Struktura najczęstszych działań podejmowanych przez wyjazdowe zespoły ratunkowe

administration of antihypertensive drugs (sublingual or oral), and in 14% of cases: administration of analgesics (e.g. Ketonal), performing peripheral cannulation and administration of infusion fluids, administration of diuretics (e.g. Furosemide), and other activities, e.g. treatment of wounds and injuries (Fig. 1).

An important problem regarding the activities performed for recipients of the system's medical services involved service recipients who were under the influence of alcohol and who had health problems. In the group of patients transferred by the EMSs to HEDs, such cases were estimated to constitute 3% of all the patients treated at the HEDs per day, and as much as up to 25% of the people who receive help from ambulance teams. The reasons for providing consultations to people under the influence or after consumption of alcohol included: abdominal pain, chest pain, gastrointestinal bleeding, pancreatitis, and, most frequently, injuries. In the group of people at immediate health risk, transferred to HAD after assessment of the patient's condition by ambulance teams, 50% were hospitalized, and 50% were sent home after a consultation, with further treatment recommendations (Fig. 2).

Discussion

In evaluating the overburden of EMSs and HEDs in the health service system, it is worth noting that these problems are of interest for and analyzed by many groups nationally, which means that certain areas in the functioning of the system need improvement. The functioning of the EMS system on a national scale was analyzed in detail by the Supreme Audit Office [3], and in provinces by provincial consultants [4] and authorities [5].

On the basis of the above opinions it may be concluded that health needs regarding EMSs are similar to that in previous years. EMSs are still dedicated to patients at immediate health risk of internal (acute coronary syndromes, arrhythmias, strokes, epilepsy etc.) and external origins (injuries, poisoning, cooling etc.); however, it is not just patients at immediate health risk but also those who did not receive service at a PHC institution or specialist clinic who are admitted to HEDs. In the Supreme Audit Office report from 2012 [3] the rate of such patients was estimated at approx. 70%, and it was emphasized that the situation results in a significant work overburden for the personnel of HEDs.

As a consequence, provincial consultants in rescue medicine were required to formulate suggestions for solutions [4] which could change the scope of health services provided by the NEMS system, reducing them only to the services provided in case of immediate health

risk; increasing financial resources for the education of society, explaining the NEMS system; and recommending, after discussions and consultations with the medical milieu, the introduction of preliminary medical patient assessment to the HEDs [4].

However, the suggested solutions raise doubts whether any rationing of services for people at immediate health risk (in the form of referrals to emergency departments or sanctions for unjustified calling for the EMS) entails a high risk for patients who are not qualified to assess their health condition. Moreover, the providers of primary healthcare and outpatient medical services are hardly to be deemed responsible for the level of overburden on the HEDs, especially when patients take their own decision to seek help at the HED. An example of the suggested actions which could improve the situation is popularization of the principles of using publicly funded healthcare services in the form of a patient guide prepared by the National Health Fund [5].

Actions that have been undertaken to reduce the system overload include steps to further develop the EMS system, started in Poland in 2006 by national and provincial consultants, scientific societies and representatives of all the professional groups involved in EMSs [6].

The present solutions, not applied at the HEDs and by EMSs, do not guarantee assistance for patients who require outpatient care or doctor consultations, which poses a significant threat to the health and life, as well as forming a burden for the EMS system. According to many milieus, an improvement to the EMSs would be possible after a reform of the primary healthcare system, especially in assigning contracts for the night and holiday healthcare services outside the primary healthcare, or classification of the HEDs [7].

The suggested concept of modifications also covers regulation of contract assignment, financing of services with division into a fixed and variable part, where the basis of the approach is answering the question, or accepting the fact, whether EMSs operating within the sphere of public safety (similarly to the police or fire brigade) should be affected by economic trends through the changeability of entities and short-term contracts concluded by the National Health Fund in the mode of a tender or maybe whether a different authority should manage the resources for financing EMSs [8]. Some researchers [9-12] note that the key element of the organization of HED work, affecting the work load in the system, is the implementation of triage and designating a person responsible for it. While considering the problem of burden reduction, it is also important to assign personnel to different critical positions, to create a fast track, and to use information technology at the HEDs, e.g. registration at the patient's bed, bar codes, automatic archivization of medical procedures, instructions and drug dispensation [13].

Overburden on emergency departments is a problem known to every EMS system, including in Poland [13]. It affects equally systems where patients are insured (Poland and most other EU countries), and commercially-oriented systems (USA, Israel) [14]; therefore, it requires constant modification, improvement and development in terms of solutions and operations.

HEDs and EMSs are overburdened because they quickly find their place in ensuring the citizens' right to medical services, filling the gap between open and closed treatment facilities. The overload is aggravated by the ineffectiveness of primary healthcare, limited access to consultations and specialist examinations, and changes in the doctrine of EMS functioning, including the introduction of the model where paramedics are the core of the ambulance rescue teams.

Other factors which also affect the burden on hospital emergency departments include the reference level of the center: the higher the reference level of the facility operating the HED, the greater the burden with patients who require specialist consultations and expensive additional tests [14].

Conclusions

- The emergency system is used largely for conditions that are not acute.
- The system encourages its beneficiaries to abuse the rescue mechanisms for immediate enforcement of their rights to receive due public healthcare.
- Interventions related to conditions caused by alcohol consumption are a serious problem aggravating the rescue team system and hospital emergency departments, which requires a systemic solution.
- The majority of the population receives health aid only in the case of a significant worsening of symptoms creating a sense of threat, while the lack of a mechanism to verify the health needs of the patient causes referral of the patient to the next link in the system.

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Triage in the Emergency Department

Segregacja medyczna w szpitalnym oddziale ratunkowym

Małgorzata Sulej, Piotr Puc

No. 5 Military clinical Hospital and Polyclinic – Independent Public Healthcare Institution in Krakow, Department of Emergency Medicine, Faculty of Medical Sciences, Collegium Medicum, Jagiellonian University; Head: Assoc. Prof. Ryszard Gajdosz MD, PhD

Abstract. The role of the emergency department is to provide health care for medical emergencies that require immediate action. Despite the fact that they are assigned to react in the case of an emergency, emergency departments are full of patients who do not require immediate medical care. Due to the lack of a reliable tool to verify patients in terms of urgency, there is a need to create a procedure to indicate whether a patient requires immediate medical action. The aim of the paper is to present the results of introducing a triage in the emergency department of the No. 5 Military Hospital in Krakow. An analysis was carried out of 1000 "Triage Cards" for patients admitted 1-16 June 2014 and the results of a survey among 26 paramedics and nurses who carried out the triage in the emergency department of the No. 5 Military Hospital in Krakow. The data analysis and opinions of the triage personnel show that the triage is an effective tool to help organize the procedure of admitting patients to the emergency department. The triage is currently an essential factor in creating an efficiently operating emergency department. A triage enables the creation of an order of admission to the emergency department based on clinical indications, reducing in this way the health risk of people in an emergency situation.
Key words: emergency department, triage

Streszczenie. Wstęp. Zadaniem szpitalnych oddziałów ratunkowych (SOR) jest udzielanie świadczeń opieki zdrowotnej osobom w stanie nagłego zagrożenia zdrowotnego. Pomimo tak sformułowanej roli obecnie SOR przepełnione są pacjentami o wątpliwej pilności przypadku. W związku z brakiem „bezpiecznego" narzędzia do wstępnej weryfikacji wskazań do przyjęcia w SOR konieczne jest uporządkowanie procesu przyjęć, w sposób zapewniający utrzymanie odpowiednich priorytetów SOR, poprzez stosowanie segregacji medycznej. Cel pracy. Przedstawienie efektów wprowadzenia rutynowej segregacji medycznej pacjentów SOR 5. Wojskowego Szpitala Klinicznego SPZOZ w Krakowie. Materiał i metody. Analiza 1000 „kart triage" pacjentów przyjętych do SOR w okresie 1-16 czerwca 2014 r. oraz wyników badania ankietowego przeprowadzonego wśród 26 ratowników medycznych/pielęgniarek wykonujących triage w SOR 5. Wojskowego Szpitala Klinicznego SPZOZ w Krakowie. Wyniki. Analiza danych oraz opinia osób wykonujących triage w SOR wskazują, że segregacja medyczna stanowi skuteczne narzędzie umożliwiające właściwe uporządkowanie procesu przyjęć pacjentów w SOR. Wnioski. Segregacja medyczna stanowi element niezbędny do prawidłowego funkcjonowania SOR. Zastosowanie segregacji medycznej umożliwia określenie kolejności przyjęć do SOR na podstawie wskazań klinicznych, a tym samym redukcję ryzyka zdrowotnego pacjentów w stanie nagłym.
Słowa kluczowe: segregacja medyczna, triage, szpitalny oddział ratunkowy, SOR

Delivered: 17/11/2014
Accepted for print: 18/12/2014
No conflict of interest was reported.
Mil Phys., 2015; 93 (1): 23-32

Corresponding author:
Małgorzata Sulej, MSc
12 Michałowskiego St., 31-126 Krakow
telephone: +48 12423 41 15, +48 12634 33 97 ext. 10
e-mail: malgorzata.sulej@uj.edu.pl

Introduction

The word *triage* in French means to sort, and medical segregation, according to the *Dictionary of the Polish language,* is "dividing into groups, categories, on the basis of selected features". In emergency medicine, *triage* is associated mainly with the START system *(simple triage and rapid treatment),* used for mass events. Is it possible or necessary to use a triage system for a Hospital Emergency Department (HED)? The issue of using a triage in HEDs does not refer to mass events, but to the standard functioning of a HED, in which certain "mass characteristics" can be observed, i.e. a large number of admitted patients and insufficient resources, especially regarding personnel. As a consequence of these factors, the simultaneous and immediate treatment of all HED patients is impossible. Moreover, not all patients require immediate assistance.

Inflow of patients to HEDs

The number of HED patients increases with every passing year. The inflow of patients throughout the day varies; it is unpredictable and often changes in waves. Additionally, the clinical structures of cases

vary, as it includes patients in a serious condition who require more time and attention from the personnel as well as those patients who apparently do not need emergency procedures. However, potentially every patient admitted to a HED is someone at immediate health risk, which consists of a "sudden or soon expected occurrence of symptoms of worsening health condition, as a result of which serious damage to bodily functions, physical damage or death may ensue, requiring immediate emergency medical procedures and treatment" [1]. The task of the HED is to provide initial diagnostics and to start treatment to the extent necessary to stabilize the vital functions in these patients [2].

Available resources

The number of patients often exceeds the current admission rate to a HED. Although the regulation of HEDs describes the equipment required in detail, the terms describing minimum staffing levels are too general: "the number of physicians (...), nurses or paramedics necessary to ensure proper functioning of the department" [2]. Staffing of HEDs is often insufficient, including enough to operate the department's equipment, which limits their tasks to admitting the greatest number of patients in the shortest time possible. Those HEDs which undertake steps to admit patients more effectively by increasing the personnel become victims of their own success, due to the increased inflow of patients who require the services typically provided by primary healthcare (PHC) or by specialist clinics. HEDs are often preferred by patients, because they offer fast (within hours instead of months or years) access to specialist care and ample diagnostic facilities. The situation is additionally aggravated by the absence of health education for society regarding the functioning of the National Emergency Services system. As a consequence of HED overload due to accepting admissions in chronological order, it is possible that a person at immediate health risk may not receive assistance in time. Therefore, systemic changes which encourage patients to use other, more appropriate facilities (PHC or specialist clinics) are necessary. Until these changes are introduced, however, it is necessary to make use of tools such as triage, which enable HED priorities to be maintained.

Aim of the study

The aim of the article is to present the principles of triage at the HED, and to present the results of the early assessment of triage implemented at the HED of No. 5 Military Clinical Hospital and Independent Public Healthcare Institution in Krakow (5MCH). The study covers an analysis of patient admissions to the HED, the structure of triage priorities assigned, and the opinions of employees performing the triage.

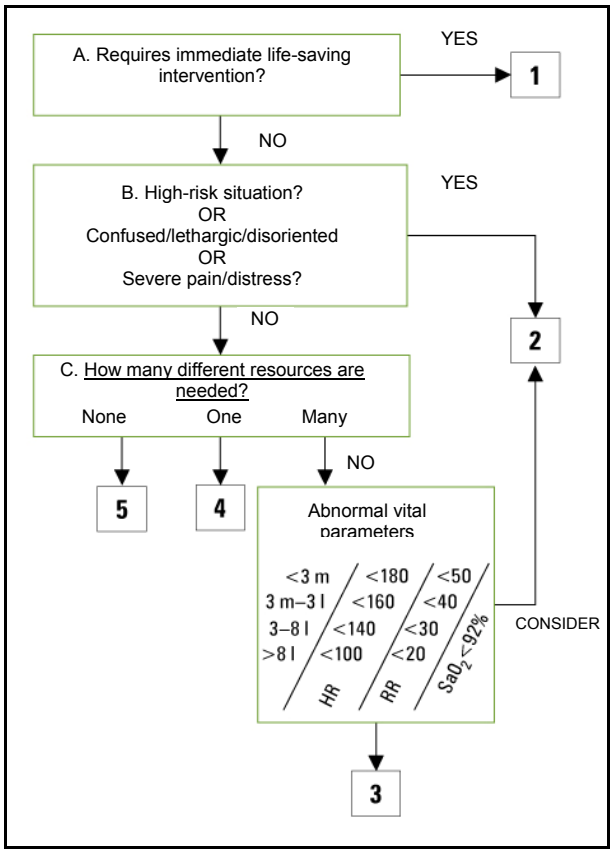

Figure 1. ESI Triage Algorithm – original version
Rycina 1. Schemat ESI – wersja oryginalna

Material and Methods

The study presents the results of the analysis of triage of patients admitted to the 5MCH HED in the period 1-16 June 2014, on the basis of the hospital computer system database and 1,000 paper-based Triage Cards, as well as the result of a survey conducted among 26 employees performing triage at the 5MCH HED.

HED medical segregation

The main purpose of medical segregation is to determine priorities for admission to the HED, i.e. to determine who should be admitted first. Triage should not be confused with the negative selection (rejection) of patients, as there is no "safe" method of preliminary verification of indications for admission to the HED. A triage is also not a form of punishment for unjustified admission to the HED.

Triage systems

The following systems can be used to implement a triage at a HED: Emergency Severity Index (ESI) and Manchester Triage System (MTS). These are 5-degree systems, adapted to the needs of HEDs.

Emergency Severity Index (ESI) is based on a simple algorithm (Fig. 1) which enables classification of the patient to one of five priorities (1 to 5), based on four key decision levels: A, B, C and D.

Patient classification starts at level A with verification of the most important priority, by answering the question: "Does the patient require immediate life-saving intervention?". If "yes", this is a priority 1 patient, a group which includes patients with any of the following issues: cardiac arrest, respiratory arrest, severe respiratory distress, unconsciousness – due to severe trauma, severe bradycardia or tachycardia – hemodynamically unstable, chest pain, pale and sweaty skin, systolic blood pressure (SPB) of 70 mm Hg or anaphylactic shock. This category comprises patients who would not survive without immediate assistance.

If a patient does not qualify as priority 1, the ESI algorithm leads to the next level of decision making, i.e. level B, where it needs to be assessed "if the patient is at high risk or confused/lethargic/disoriented, or in severe pain/distress". Confirmation of one of the criteria results in the assignment of priority 2, which covers the potential risk to life, health or an organ. A **High risk situation** is assessed on the basis of medical history, patient observation and experience of the personnel conducting the triage. It means a person who cannot wait for assistance due to the dynamics of the ongoing pathological process, with possible rapid worsening of the health condition. Examples of such situations include chest pain with high risk of acute coronary syndrome, but not requiring immediate life-saving intervention, or symptoms of cerebral stroke which do not meet the criteria for priority 1. **The terms "confused, lethargic, disoriented"** apply to patients with sudden changes of consciousness. **Assessment of pain or distress** depends on clinical observation and/or the level of pain reported by the patient on his/her own: 7 or more on a scale of 0 to 10. The pain assessment will also include facial expression, crying, profuse perspiration, posture, and changes in vital parameters (arterial hypertension, tachycardia and increased respiratory rate). With the patient's assessment of pain at the level of 7/10 or more, classification to priority 2 is possible, but not obligatory. For instance, a patient with a twisted ankle may assess the pain at 8/10, but simple measures such as use of a wheelchair, limb elevation and ice compress can reduce the pain. It is safe for this patient to wait, so classification as priority 2 solely on the basis of pain assessment would not be correct.

If the patient does not meet the criteria of priority 2, the algorithm leads to the next level of decision making, level C, which determines the required resources. This element is characteristic for the ESI system, which, apart from clinical aspects, also takes into account clinically relevant differences in the predicted need to engage different resources to properly treat the patient. The term "resources" covers things like the need for laboratory tests (blood, urine), imaging diagnostics (radiological, ultrasound, computed tomography), transfusion of fluids, administration of drugs *(i.v., i.m.,* neb.), specialist consultation or a simple procedure such as suturing a wound or placing a Foley catheter. If the patient does not require any resources, the last priority (5) is assigned, such as a patient with a sore throat who needs a prescription. A patient who requires one resource will be considered priority 4, e.g. a sprained ankle with the need to perform an X-ray.

If the assessment reveals that many diagnostic and therapeutic resources are required, the algorithm leads to the last level of decision making, level D, where the life parameters are assessed. If certain parameters exceed the normal range, the patient is classified as priority 2, while if they are normal as priority 3. ESI does not dictate any detailed time frame in which patients should be assessed by a physician, but it is assumed that patients who meet the criteria of ESI level 2 should be admitted "as soon as possible" [3, 4].

Figure 2. Index of algorithms
Rycina 2. Indeks prezentacji diagramowych

The Manchester Triage System (MTS) is based on 52 flowcharts, each presenting a different medical problem (for the index of flowcharts: see Fig. 2). During the assessment, depending on the symptoms, the patient is classified as one of 5 priorities marked by color: red – immediate assistance, orange – very urgent assistance, yellow – urgent assistance, green – standard assistance and blue – non-urgent assistance. Apart from general discriminatory criteria, taking into account things like threat to life (impairment of vital functions "ABC"), intensity of pain, bleeding, level of consciousness or body temperature, each diagram also considers criteria specific for a given medical problem. Terms in the diagrams are described in detail in the enclosed tables. An example of the "Allergy" diagram is presented in Figures 3 and 4. MTS determines the maximum time in which the patient should see the HED physician. Depending on the priority assigned, the time is: red – immediate admission, orange – 10 minutes, yellow – 60 minutes, green – 120 minutes, blue – 240 minutes. In the context of a patient waiting in the HED, especially if they are classified for standard or non-urgent assistance, it is important to stress the continuity of the triage procedure, i.e. repeating the assessment if there is a change in the patient's condition.

The detailed principles of medical segregation under the MTS system are described in the Polish edition of "*Triage* – emergency medical segregation", ed. Juliusz Jakubaszka, which serves as a manual for MTS implementation and a source of the figures presented [5].

Triage at the 5MCH HED

The No. 5 Military Clinical Hospital and Polyclinic, Independent Public Healthcare Institution in Krakow is one of five administrators of HEDs in Krakow. The hospital has approx. 400 beds at its disposal. The HED admitted 21,609 patients in 2011 and 24,318 in 2013. In the period analyzed, nearly 70 people a day were admitted.

The first attempts to introduce a triage at the 5MCH

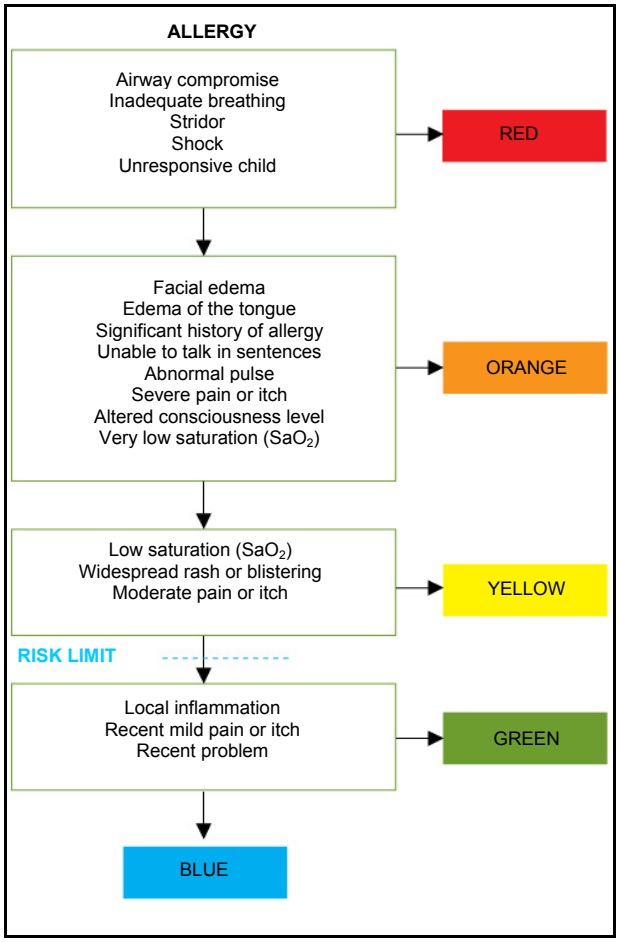

Figure 3. Algorithm – Allergy
Rycina 3. Diagram – Alergia

HED were made in May 2013. A three-grade system of patient assessment was implemented, with color codes in the medical history files (red, yellow and green). Triage Cards were not used, but patients were given colored reusable indicators, which were often thrown away. This triage method appeared to be insufficient to classify patients properly, so since November 2013 a routine medical segregation according to the modified ESI system was implemented in the HED (the algorithm made available by the HED of the University Hospital in Krakow: see Fig. 5.), with Triage Cards and a separate triage post (office). The ESI system was chosen due to the facility of using the algorithm, and its effectiveness is confirmed by the results of a survey in which 38% of the people performing a triage in the HED declared that the ESI algorithm was easy to use and effective, whereas 62% of the respondents stated that ESI was easy to understand, but in performing the triage they relied mainly on their own experience, which cannot be replaced by even the best system.

The triage at the HED covers those patients who arrive without assistance (usually on foot). The Emergency Medical Service teams (EMS) are subject to triage assessment after admission by the HED physician. This is due to the relevant legal regulations, especially the medical rescue records where the EMS team needs to obtain confirmation of the patient's admission to the HED in the form of a physician's stamp and signature, which entails examination of a patient performed personally by the HED physician. This prevents proper performance of the triage procedure at a HED by paramedics or nurses, although the procedure should involve all patients, regardless of how they are admitted to the HED, as only clinical indications can determine the order of admissions.

Process of patient admission to the 5MCH HED

A patient admitted to the HED is informed already at the entrance about the triage process on information posters at the registration desk. After starting a medical history file by the medical receptionist, information about the patient is passed to the paramedic or nurse performing triage during a given shift. Next, the patient is taken to the triage post, where a SAMPLE history is collected, and the following are performed: initial examination, vital parameters measurement (pulse, arterial pressure, saturation, temperature, glycaemia), and echocardiogram (ECG). The triage post is equipped with equipment for intravascular catheterization and administration of drugs (within the competence of paramedics / system nurses); however, it is rarely used. The procedures performed are described in the Medical Segregation Card, where the triage priority is also marked. After the triage, patients are informed about their priority (color), and if it is not contraindicated, they return to the waiting room. Currently, patients at the HED are not given any indicators. As part of triage, the maximum time to wait for admission by a physician and for diagnostic tests are determined, which provides important information for patients. The time is described also on the information posters, and, depending on the priority established, it is: red – immediate admission, orange – admission within 15 minutes (usually also immediate), yellow – within 90 minutes, green – within 4 hours and blue – within 12 hours. If there are free places and personnel are available, then patients are admitted without queues, according to the order established by the triage, while during periods of the highest inflow of patients, the waiting time often extends to the maximum expected values. The issue of re-triage has not been determined, but if the HED personnel observes changes in the health condition, or if a patient reports such changes (worsening/improvement), another assessment may be performed, and the triage priority can be modified.

NOTES ACCOMPANYING ALLERGY	
See also	**Chart notes**
Unwell adult Asthma Bites and stings	This is a presentation defined flow diagram designed to allow triage prioritization of patients who are admitted with symptoms and signs that may indicate an allergy. This flowchart was added in the second edition of the book at the readers' requests. Patients with allergic reactions range from those with life-threatening anaphylaxis to those with an itchy insect bite. In such cases a number of general discriminators are used, including life threat, consciousness level and pain. Specific discriminators should be considered to allow proper triage prioritization.
Specific discriminators	**Explanation**
Facial edema	Diffuse swelling around the face, usually involving the lips.
Edema of the tongue	Swelling of the tongue to any degree
Significant history of allergy	A known sensitivity with a severe reaction (e.g. to nuts or bee stings) is significant
Unable to talk in sentences	Patients who are so breathless that they cannot complete relatively short sentences in one breath
Abnormal pulse	A bradycardia (less than 60/min in adults), a tachycardia (more than 100/min in adults) or an irregular rhythm. Age-appropriate definitions of bradycardia and tachycardia should be used in children
Saturation (Sa02)	Low: (SaO2) <95% on air; Very low: less than 95% on O2 therapy or less than 90% on air.
Widespread rash or blistering	When the lesions cover more than 10% of the body surface area
Local inflammation	Symptoms will involve pain, swelling and redness confined to a particular site or area

Figure 4. Chart – Allergy
Rycina 4. Tabela – Alergia

Results of triage analysis

In the analyzed group most patients arrive at the HED on their own, without assistance of an EMS teams or medical transport (the percentage distribution is presented in Figure 6). Only 12% of the patients were referred to the HED by a PHC physician; the triage prioritization of these patients is presented in Figure 7. The greatest inflow of patients to the HED during the day was observed between 11:00 and 22:00, when the triage was of utmost importance (Fig. 8).

The analysis of Triage Cards indicates that the most numerous group in the HED were "green" patients, i.e. those who needed one diagnostic and therapeutic procedure, usually in order to confirm the absence of indications for further hospitalization. "Blue" patients constituted a relatively small group. It appears that despite the emphasized problem of a large number of unjustified admissions to HEDs, it was not easy to classify a patient as the lowest priority. This may be a consequence of the "carefulness" of the staff, as well as attempts by some patients to confirm indications for diagnostic procedures, which are often the purpose of the visit to the HED. "Red" and "orange" patients formed the least numerous triage group; however, these cases required the greatest attention and energy of the HED personnel, due to the gravity and dynamics of their conditions. At present, this attention is often absorbed by the too numerous "green" group. The rate of patients classified to individual triage groups is presented in Figure 9.

A similar list regarding patients arriving at the HED on their own is presented in Figure 10. The clear dominance of "green" patients, and the presence of all "blue" patients is visible, whereas among the patients brought by EMS teams (Fig. 11.), "yellow" patients dominated, "greens" were a smaller group, and "blue" patients were absent. All patients from the "orange" and "red" groups were brought by EMS teams.

The mean waiting time for a medical examination for patients admitted to the HED on their own is presented in Figure 12. The time is surprisingly short, which is probably due to using a mean value, and due to the previously mentioned fact that patients were admitted on an ongoing basis if free places were available at the HED. However, at times of high inflow of patients, the waiting time extended to the maximum values. This is also visible in the overview, and despite the longest maximum waiting time (12 h) the "blue" group did not wait the longest. Probably this was due to the short time necessary to treat those patients, contrary to the "green" ones, whose admission is associated with a wider scope of activities (blood drawing, diagnostics, waiting for test results, filling in of medical records), and results in a longer stay at the HED.

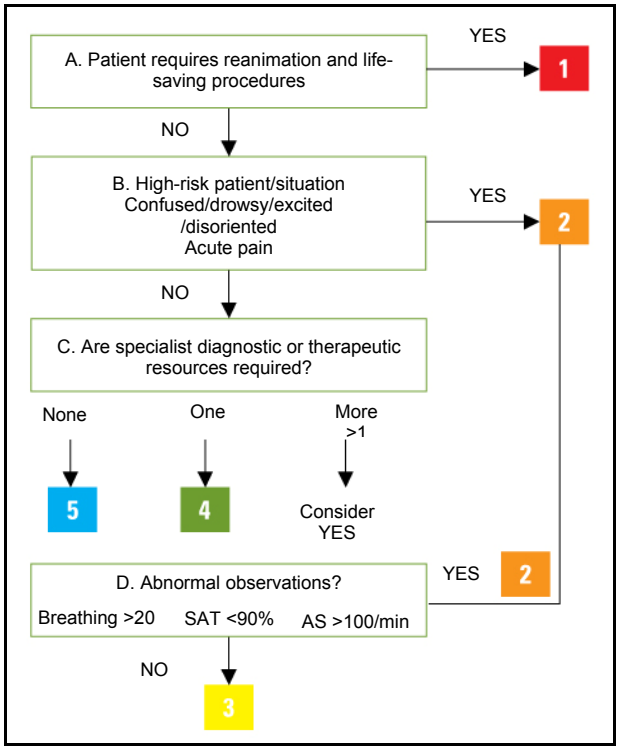

Figure 5. Modified ESI Triage Algorithm shared by Emergency Department of University Hospital in Cracow
Rycina 5. Zmodyfikowany schemat ESI udostępniony przez SOR Szpitala Uniwersyteckiego w Krakowie

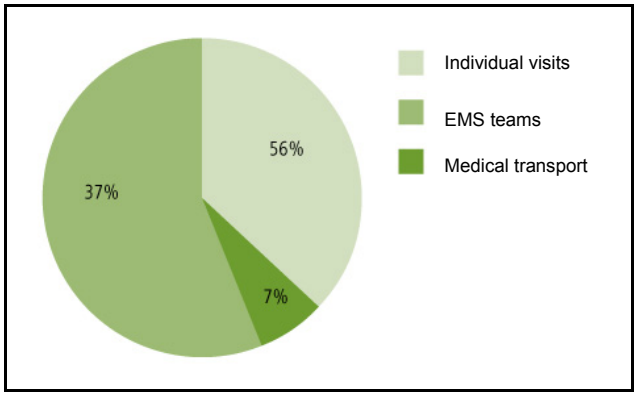

Figure 6. The number of patients admitted at the Emergency Department, divided into individual visits, being carried by Ambulance Service, or medical transport
Rycina 6. Liczba pacjentów przyjętych do SOR w podziale na: zgłoszenia samodzielne, ZRM, transport sanitarny

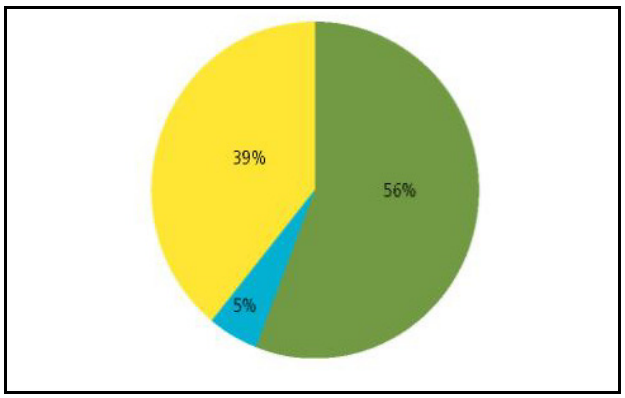

Figure 7. Patients referred to the Emergency Department by General Practitioner – according to triage groups
Rycina 7. P acjenci skierowani do SOR przez lekarza P OZ w podziale na grupy *triage*

While performing a triage, it is important to evaluate the correctness of patients' classification to individual groups. The number of patients transferred to hospital departments under different triage groups may be an indicator of such correctness. In the present analysis, referrals for further hospitalization were: 100% of "red" patients, 67% of "orange" patients, 28% of "yellow" patients, and only 3% of "green" patients. "Blue" patients were not transferred to other hospital departments.

The analysis also indicates that a triage does not significantly "discourage" patients from waiting for admission to the HED, as in the studied period only 10 people decided to leave the HED before seeing a physician.

Results of the survey

The survey conducted among paramedics and nurses performing the triage at the HED revealed that working at the triage post is not a preferred task (Fig. 13). Probably team work is preferred to an independent position, i.e. working in those areas where patients are already being treated and diagnosed. Moreover, performing a triage is a relatively difficult task. The person performing the triage makes first contact with the patient and, apart from determining the triage priority, informs the patients about the principles of admission to the HED (or the possibility to visit a PHC institution or a specialist clinic), as well as often warning that the waiting time for a visit will be long, which does not always meet with the patients' understanding. Despite the unwillingness to perform this task expressed by the employees in the survey, the majority of the survey subjects believe that the triage at the HED is needed as it enables better organization of admissions and more effective flow of patients, if the procedure is well-organized (Fig. 14). Moreover, according to the majority of the survey subjects, the triage is a great source of information for patients as it enables important principles to be communicated regarding admission to the HED, as well as preliminary information about the patient's health condition (Fig. 15). Most people also believe that medical segregation increases the sense of health safety among patients, because since the introduction of the triage the number of conflicts between HED personnel and patients decreased. Triage appeared to provide a valid argument for patients attempting to enforce faster admission without grounds for it (Fig. 16). Introducing the triage enabled patients to receive rapid contact with medical personnel; therefore, the number of complaints related to admission to the HED, including the frequent dissatisfaction with the lack of "interest" on the part of the personnel, decreased significantly.

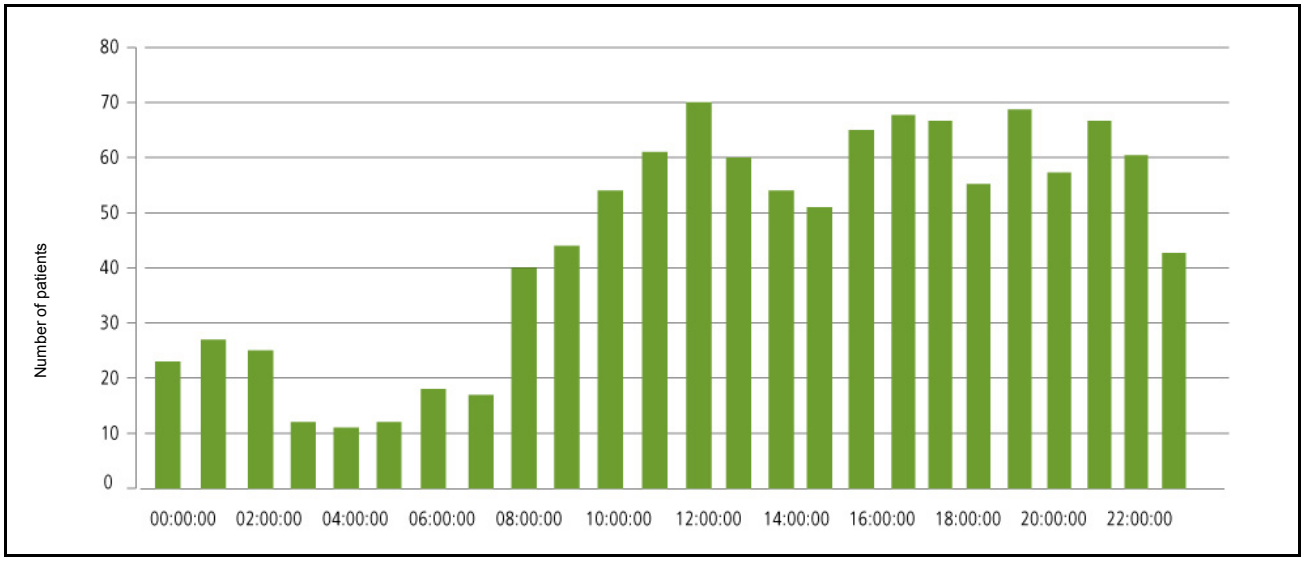

Figure 8. Influx of patients to the Emergency Department divided into particular times of admittance
Rycina 8. Napływ pacjentów do SOR w poszczególnych godzinach

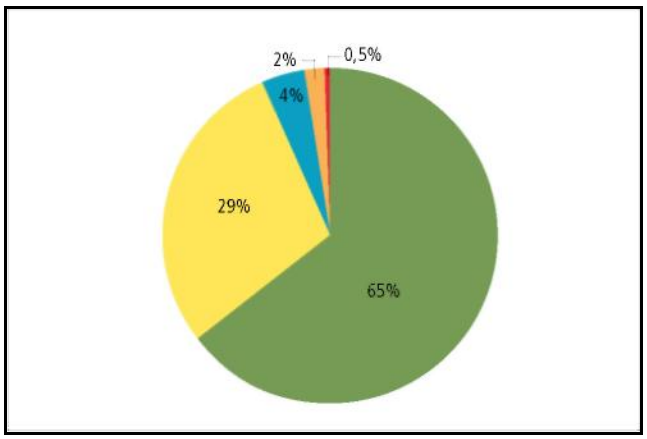

Figure 9. Number of patients in triage groups
Rycina 9. Liczba pacjentów w poszczególnych grupach triage

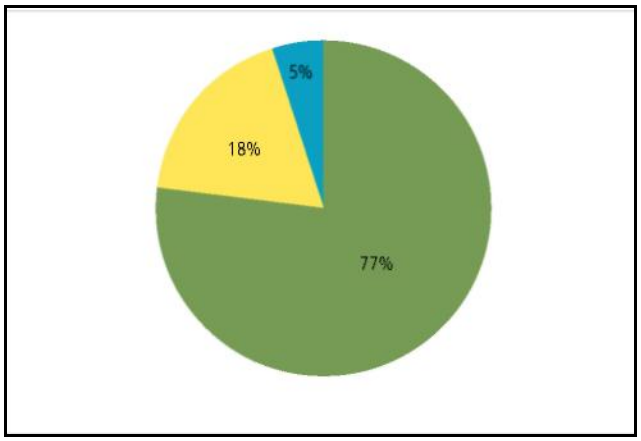

Figure 10. Patients arriving at the Emergency Department on their own - by triage group
Rycina 10. Pacjenci zgłaszający się do SOR samodzielnie w podziale na grupy triage

According to the majority of the survey subjects, introducing a triage improved the treatment of patients at immediate health risk, and they now receive assistance earlier (Fig. 17). Moreover, according to most personnel, triage should be a standard at every HED. In the additional comments, the HED personnel emphasized the problem of too scarce staffing of HEDs, which results in a reduction of the time devoted to a patient, and affects the quality of the triage, as well as the need to introduce elements of health education at HEDs.

Results

Introducing routine medical segregation of patients at HEDs significantly improves the organization of the admission process, and patients' health safety. A triage enables fast contact between patients and medical personnel. Considering the high inflow of patients that often exists, a triage is a "safe" solution for overcrowded HEDs.

Conclusions

Medical segregation at HEDs is an important element in the process of providing healthcare services, and it should be obligatory in every Hospital Emergency Department.

Acknowledgements

The Authors would like to thank Łukasz Hodana MSc, for help in obtaining data from the computer system of the 5MCH, and the HED personnel for their participation in the survey.

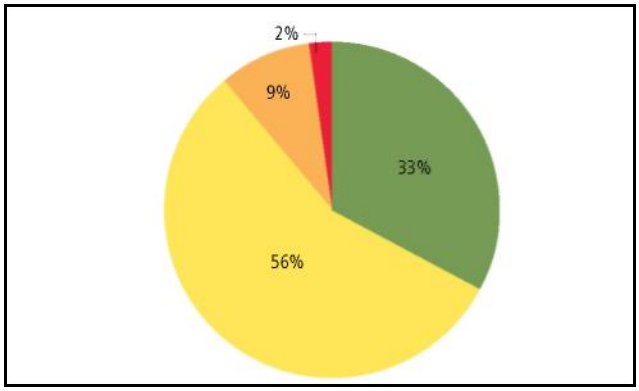

Figure 11. Patients being taken to the Emergency Department by Ambulance Service - by triage group
Rycina 11. Pacjenci przywożeni przez zespoły ratownictwa medycznego w podziale na grupy triage

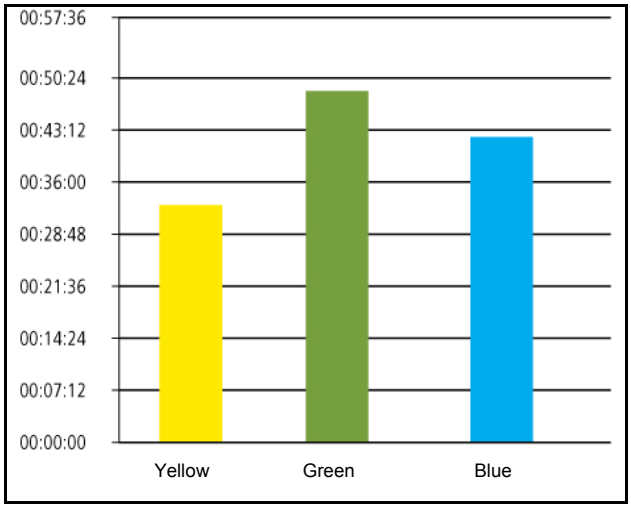

Figure 12. Average waiting time for a medical check-up by patients arriving at the Emergency Department on their own
Rycina 12. Średni czas oczekiwania na badanie lekarskie pacjentów zgłaszających się do SOR samodzielnie

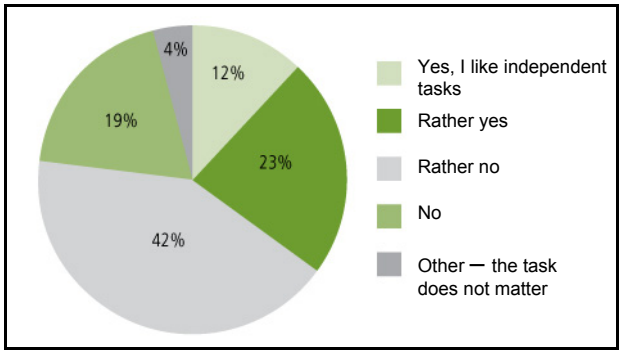

Figure 13. Do you like working at the triage post?
Rycina 13. Czy lubisz pracować na stanowisku triage?

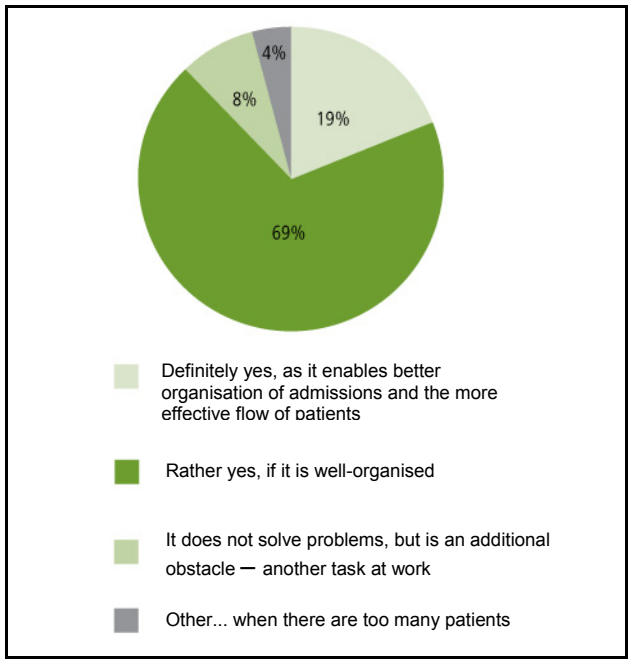

Figure 14. Is triage useful in an Emergency Department?
Rycina 14. Czy triage w SOR jest potrzebny?

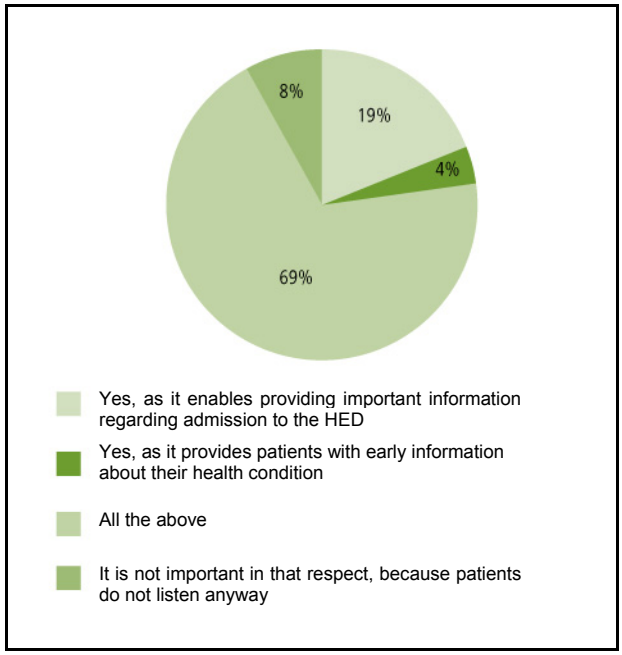

Figure 15. Is the triage an important source of information for patients?
Rycina 15. Czy *triage* ma istotne znaczenie informacyjne dla pacjenta?

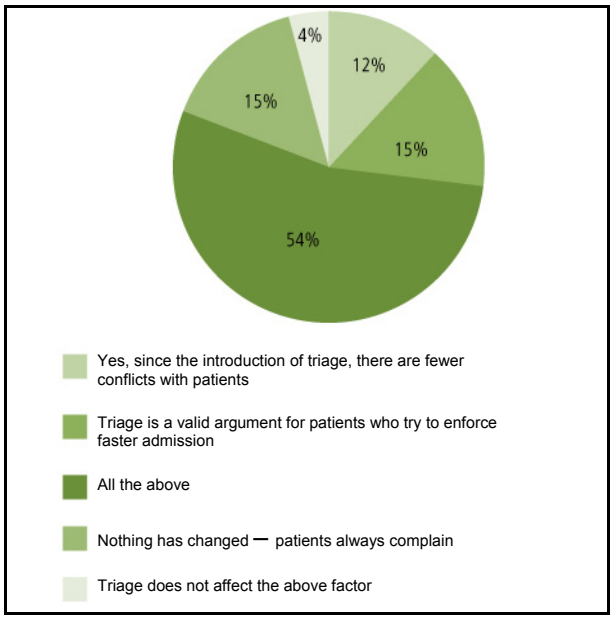

Figure 16. Does the triage influence a patient's sense of security?
Rycina 16. Czy triage wpływa na poprawę poczucia bezpieczeństwa pacjenta?

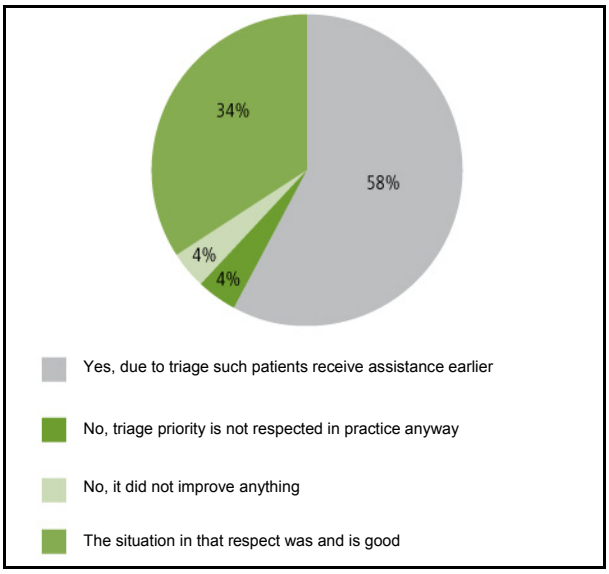

Figure 17. Did introducing the triage improve the service provided to patients in an emergency condition admitted to the Emergency Department?
Rycina 17. Czy wprowadzenie *triage* poprawiło zabezpieczenie pacjentów w stanie nagłym trafiających do SOR?

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Temporary coverage of debrided burn wounds with ionic-silver-incorporated Multipurpose Battlefield Burn Dressings (MBBD)

Czasowe pokrycie oczyszczonych ran oparzeniowych specjalnym opatrunkiem zawierającym srebro jonowe MBBD - Wielozadaniowy Polowy Opatrunek Oparzeniowy (Multipurpose Battlefield Burn Dressing)

Wojciech Witkowski, Agnieszka Surowiecka-Pastewka, Agnieszka Bielarska, Bartłomiej Zoń, Wojciech Jasek, Marzena Stępniak, Alicja Górecka, Jolanta Kowalska, Andrzej Dobrzeniecki

Clinical Department of Plastic, Reconstructive Surgery and Burns Management, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine, Warsaw; Head of Department: Col. (ret.) Wojciech Witkowski MD, PhD

Abstract. The clinical material comprised 50 burned patients, classified as fresh burn (26) and late burn (24) patients. Early (2-5 days), primarily delayed (6-10 days), or late (beyond 10 days) post-burn wound debridement procedures were performed with the use of an electric dermatome and/or a Watson-Humby knife, tangential excision in combination with water-jet technology debridement, followed by temporary coverage of wounds with a special, novel military dressing acting as synthetic skin substitute. Silver-impregnated MBBDs were clinically evaluated in 50 burn cases by means of clinical observation, and finally recognized as an efficient and advanced modality of burn wound care administered following the removal of necrotic/devitalized tissue from burn wounds. In all patients operated on with the traditional method in combination with water-jet technology, even in late burn cases where the wound was infected, the uptake of autografts following the period of temporary coverage was extraordinarily high (96%). In 24 patients, the controversial and relatively significant delay in definitive reconstruction, applied as a tactic, did not result in decreased meshed autograft uptake. Advanced early, primarily delayed, and late debridement burn wounds combined with temporary coverage of wounds with the synthetic MBBD dressing seems to be justified as a concept for burn wound treatment in the special circumstances of armed conflict at level 3 or a higher level of medical support.
Key words: combined wound debridement, military burns, special silver dressing, temporary coverage

Streszczenie. Przeprowadzono badanie 50 oparzonych klasyfikowanych jako oparzenia świeże (26 pacjentów) i zadawnione (24 pacjentów). Wykonywano wczesne (2-5 dni po oparzeniu), pierwotnie odroczone (6—10 dni po oparzeniu) oraz późne (powyżej 10 dni) zabiegi oczyszczenia ran za pomocą dermatomu elektrycznego i/lub nożem Watson-Humby'ego w formie wycięcia stycznego w połączeniu z oczyszczeniem technologią water-jet, po których następowało czasowe pokrycie ran specjalnym nowym opatrunkiem wojennym działającym jako syntetyczny substytut skóry. Wielozadaniowy Polowy Opatrunek ze srebrem impregnowanym oceniano klinicznie u 50 pacjentów metodą powtarzanej obserwacji klinicznej; został on uznany za skuteczny i nowoczesny sposób leczenia rany oparzeniowej po usunięciu martwicy/ zdewitalizowanej tkanki. U wszystkich oparzonych zastosowano metodę tradycyjną z kombinacją technologii water-jet, nawet w oparzeniach zadawnionych, kiedy rana była zakażona, wgojenie autoprzeszczepu po okresie czasowego pokrycia było nadzwyczajnie dobre. Dyskusyjne i względnie znaczące odroczenie rekonstrukcji definitywnej u 24 pacjentów jako taktyka nie wykazała pogorszenia wgojenia przeszczepów siatkowych. Wydaje się, że wczesne, pierwotnie opóźnione i późne kombinacje oczyszczenia rany oparzeniowej z następowym czasowym pokryciem syntetycznym opatrunkiem MBBD stanowią dobrą koncepcję postępowania z raną oparzeniową w wyjątkowych warunkach konfliktu zbrojnego na III i wyższym poziomie pola walki.
Słowa kluczowe: oparzenia wojenne, kombinowane oczyszczenie ran, specjalistyczny opatrunek srebrowy, opatrzenie czasowe

Delivered: 9/12/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93(1): 33-43

Corresponding author
Wojciech Witkowski MD, PhD
Clinical Department of Plastic Surgery, Reconstructive Surgery and Burn Treatment, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine
128 Szaserów St., 04-141 Warsaw
telephone: +48 22 681 72 19,
telephone:/fax: +48 22 610 01 64
e-mail: wojwit@wim.mil.pl

Introduction

Thermal burns are common to all military conflicts (D'A-vignon et al.) [1]. In present-day military operations, personnel with burns are evacuated through several medical facilities before being admitted to army medical centers in order to receive definitive care, occurring on average 2/4 to 6 days after injury. Barret et al. [2] show that early excision even before day 14 increases the survival rate in severely burned patients. In military circumstances, the application of dressings to burn wounds must require minimal expenditure, minimal medical equipment usage, minimal time and minimal resources, yet remain effective at the same time (Brown) [3]. The material applied must be readily available, superior to traditional materials, easy to use, as well as being easy to store and supply to level-based medical facilities such as field hospitals or rear-area hospitals (levels III to V). It should offer a low cost of production and storage, low antigenicity, good local antibacterial properties, the ability to promote epithelization and healing processes of burn wounds, provide proper adherence to the wound bed, maintain a moist environment in the wound, and have a pain relief effect. Moreover, it should be easy to change, while also displaying suitable absorbency and the capacity to remove and control burn wound exudate [4]. The optimal military dressing material should be useful in the conservative as well as excisional management of burn wounds at different levels of military medical aid, especially secondary, tertiary, and higher military field medical aid levels. Developments in the construction of modern dressings, especially silver-incorporated dressings acting in situ as skin-like, temporary burn wound coverage, allow wounds to be kept free of invasive infections for a relatively long time, even up to 5 days from initial application, without any special attention and control of the wound. Moreover, in order for successful grafting to be possible, the wound bed has to present almost the same properties after several days as immediately after excision. The properly planned and professionally executed early, primarily delayed, or late debridement of deep mid-dermal and deep dermal burns or primary, indeterminate-depth wounds is crucial to achieve a vitalized (viable) wound that is ready for prompt, definitive burn defect closure. This should not be performed later than after 3 weeks [5, 6].

Removing all necrotic tissue is of the highest priority with regard to reconstruction based on skin grafts and keratinocyte cultures. Fresh cadaveric skin, allografts, modern films, membranes, and dressings such as Biobrane, Coldress, Acticoat, Aquacel, Integra, Apligraft, Matriderm Suprathel, and many others are also useful and applied in clinical treatment [4,7-9]. At no time after injury must the debrided burn wound be contaminated or infected, or contain any necrotic tissue or slough, and it needs to be suitable for accepting autologic skin grafts, skin grafts joined with cellular suspensions, keratinocyte cultures, or live skin substitutes, if available [10-12]. In some cases, with regard to patients in a severe condition, there may be doubts concerning how to evaluate the sufficiency of the planned debridement, so further therapeutic strategies need to be introduced based on suitable action and treatment decisions. In such cases, the most appropriate course of action might be to use frozen/conservative skin allografts, or fresh cadaveric skin for temporary, biological covering of the wound. Early hydro-surgical debridement of hard burn eschar, even if performed with the use of water-jet technology plus handpieces, is problematic and almost impossible to execute in most cases. Water-jet debridement technology in burn wound management has been widely used in the authors' clinic since 2005. The 2007 Budapest and 2009 Lausanne EBA Congresses stated the scientific and intellectual point of view on water-jet technology and the value of silver dressings in the treatment of deep-middermal and full-thickness depth burn wounds, proving it to be fully convergent with the clinical and practical experience of our team.

The aim of this study was to determine the clinical value of burn wound treatment tactics intended to be justified in the special circumstances of military medical aid, and in conditions taking joint advantage of the current combined surgical technologies and simple, temporary silver-impregnated absorptive dressings instead of allografts or other traditional antiseptic dressings, as well as biological or synthetic materials.

Materials and methods

The innovative, self-constructed, absorptive, ionic-silver-incorporated MBBD dressing was registered and approved for serialized production (TZMO Toruń) and

clinical use in 2008 (fig. 1). The clinical material of 50 consecutive burn patients, classified as fresh burns (26 cases) and late burns, admitted to hospital more than 5-10 days after the occurrence of their injuries (24 cases), were treated with tactics based on the principles listed below. The sizes of the patients' burns were measured using the Lund and Browder chart. All cases were digitally documented. A total of 50 patients were treated for consecutive, severe flame-caused burns ranging from 10% TBSA to over 75% TBSA (mean value: 40%). The patients, initially diagnosed with third degree burns (35 cases), second/B degree burns (6 cases) or primary, indeterminate-depth wounds (9 cases), and were treated with a specific strategy comprising the following elements

1. Early excision/debridement procedures performed by a double surgical team operating simultaneously and using a combination technique. The primary operation was extremely superficial and performed with the use of the steel-based tangential excision technique (Watson knife, Humby knife, electric dermatome) in the eschar zone. The second operation was performed with the intention of applying precise tissue preservation and control water-jet debridement of the wound area located beneath the hard eschar, as well as early (2-5 days), primarily delayed (6-10 days), or late post-burn wound debridement (beyond 10 days). Controlled water-jet debridement of the wound bed was performed with the use of a classic Versajet Exact device with a soft, classic hand piece (15714 mm or 45714 mm). The Versajet Plus handpiece (45714 mm) was rarely used, and mostly in the late debridement of burn wounds (more than 10 days after injury).
2. Simultaneously, temporary coverage of post-operative skin defects was performed with the use of an innovative fiber-incorporating-silver, triple-layer military dressing invented and created by the authors, acting as an infection-control synthetic skin substitute (figs. 2-3), for a clinically adequate time with change intervals of no longer than five days (typically every 24-48 hours), and with topical antimicrobial agents applied as an interface if needed (Flammacerium, Dermazine, Flammazine, Argosulfan, Mafenide, Braunovidon, or Braunol). The main goal of these tactics was to perform adequate primary wound debridement in order to prevent the deepening of the burn wound over the first few days as a result of the conversion phenomenon. No primary grafting was performed in any of the cases. No conserved/frozen allogenic skin grafts or fresh cadaveric graft skin was used, and no biosynthetic films or advanced live skin substitutes were applied to the debrided burn wound surface. The definitive meshed skin grafting transplants were performed in a routine manner, 24-48 hours (in seven cases on day 5) following the combined, tangential debridement and coverage of the burn wound with the MBBD silver dressing.

Figure 1A. The MBBD dressing ready for use. **B-C**. Patients with temporary dressing after wound debridement, no other materials were used

Rycina 1A. Opatrunek MBBD gotowy do użycia. **B-C**. Pacjenci całkowicie opatrzeni opatrunkiem czasowym po wycięciu rany oparzeniowej, żadne inne materiały nie zostały użyte

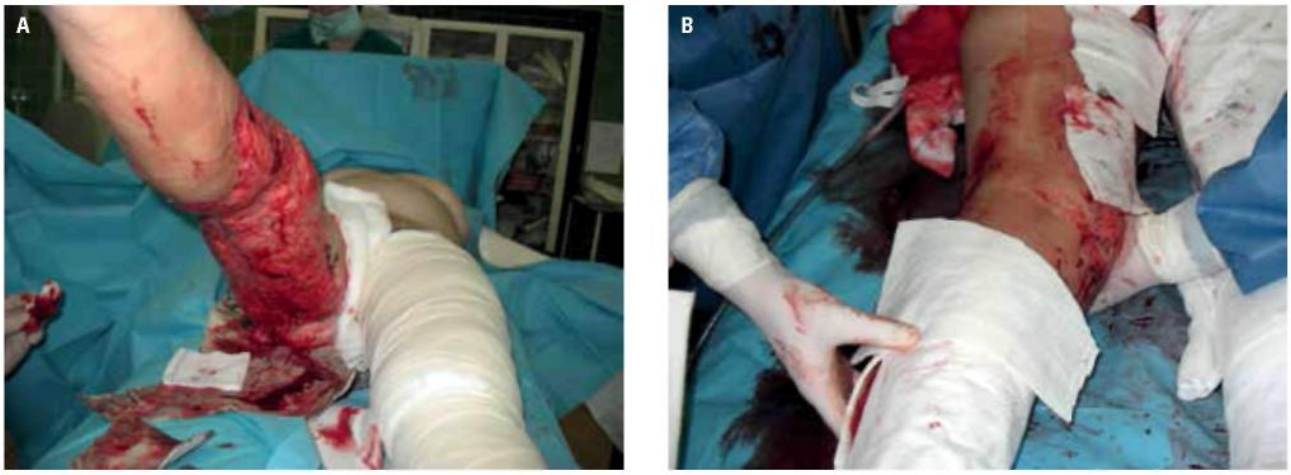
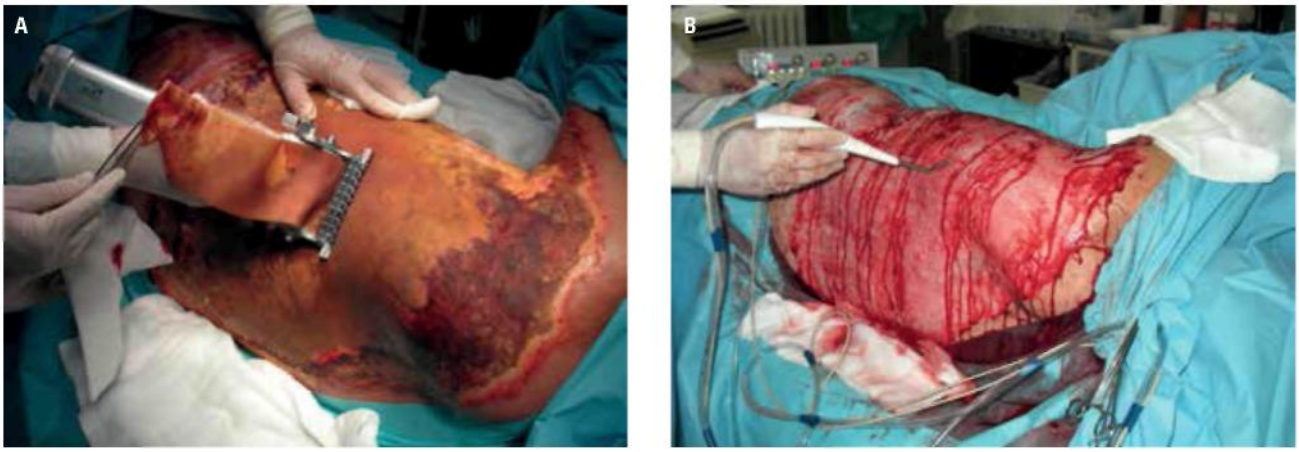


Figure 2A-B. The temporary MBBD dressing applied onto the wound immediately after excision/debridement. The clinical appearance after 2 days: debridement is perfect, and grafting should be performed immediately.
Rycina 2A-B. Czasowe opatrzenie z wykorzystanie MBBD, nakładany na ranę tuż po jej wycięciu/oczyszczeniu. Wygląd kliniczny po dwóch dniach - oczyszczenie jest idealne - należy jak najszybciej przeszczepić skórę.

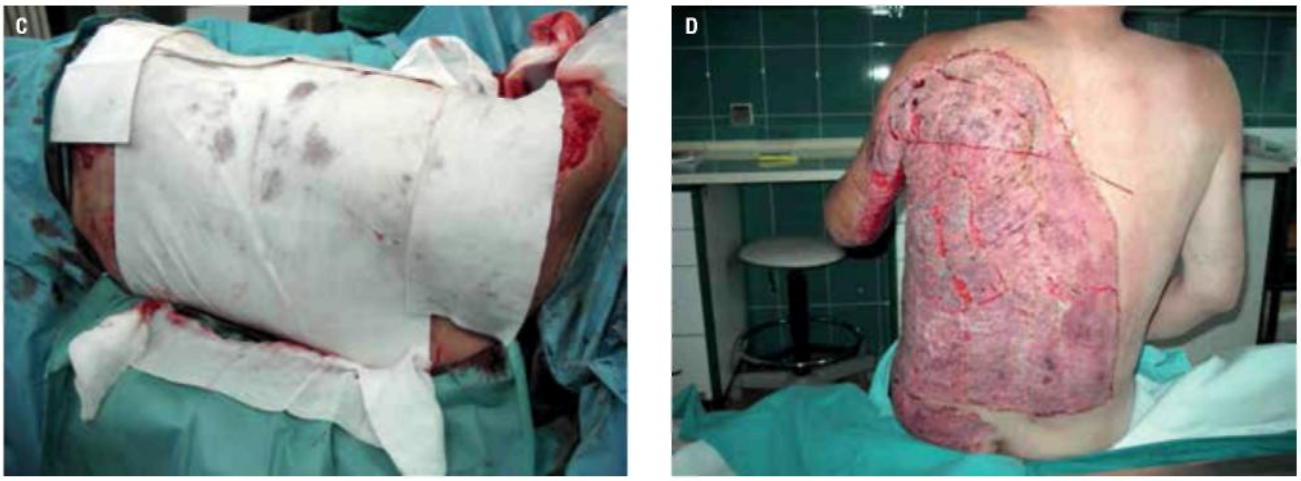
The purpose of this strategy was to avoid inadequate debridement and additional, adverse events, particularly undesirable blood loss caused by a concurrently-preformed procedure of harvesting skin grafts from extended body areas. The mean age of the study population was 52 (ranging from 26 to 69), with a mean hospitalization time of 21 days (ranging from 12 to 58). Gender structure: male - 43 patients (86%), female - 7 patients (14%). The adequacy of debridement was evaluated clinically after one to two days (in seven cases as late as 5 days following the excision/debridement). Patients whose burn wounds were evaluated as satisfactorily debrided received mesh grafts on the surface of their wounds. In cases where the outcome of wound bed preparation (WBP) was equivocal, one or more additional debridements were considered and performed as needed. In the author's clinical material the early, primary intention of the healing closure of burn wounds was a standard technique, within the first five post-burn days. Difficulties with transferring burned patients from peripheral hospitals delayed primary wound closure beyond 6-10 days, and sometimes even more than 10 days post-burn. Secondary skin grafting of granulating wounds (delayed secondary wound closure) modality was not performed in any of the cases. Water-jet debridement was performed on all late-burn cases, with prompt and successful grafting of meshed skin carried out as well (fig. 4). Indications for delayed primary debridement/closure or late debridement/closure were determined individually, depending on the exact time of the particular burn injury occurrence, difficulties with transferring patients to the hospital, problems with getting patient's consent for the proposed surgical procedure, the amount of operating time available, operating theatre availability, the occurrence of major burns in circumstances having no access to a skin bank, skin substitutes or sophisticated dressings, operating time limitations on weekends and holidays, or other reasons similar to those discussed in the medical literature [15,16]. The main contraindications for delayed or late wound debridement and grafting / temporary burn wound closure with MBBD were the signs and symptoms of invasive infection/sepsis and/or multiorgan failure. The nature of the described investigations was observational; therefore a control group was not necessary because the tactic of primarily delayed closure of the burn wound is routinely applied in our facility. Clinical experience was essential for the evaluation of the clinical value of the proposed solution. Although the study might be of lesser value than EBM clinical investigations, it is very practical while actionable results may be extremely useful in battlefield surgery and for temporary coverage of any wounds, particularly in cases where a considerable amount of body surface is affected.

Results

No severe general complications were observed in any of the investigated clinical cases. The patients' mortality rate was low, with a survival rate of 98%. Only a single patient (female, aged 72) with a third degree burn covering 75% of her TBSA died, following aggressive early excision of lower-limb eschar reaching as deep as the fascia. The initial excision/debridement procedure yielded excellent results in 70% of patients (n=35), with one or two additional water-jet debridements required in the remaining patients (n=15). As a consequence, the patients were successfully treated with meshed autografts, presenting a high intake of skin primarily grafted 1-2 days after excision/debridement, and reaching an average of 96%. In 94% of the cases no additional topical antimicrobial treatment of the



Figures 3A-B. Early excisional therapy of burn wound using electric dermatome followed by water-jet technology wound debridement
Ryciny 3A-B. Wczesna terapia wycięciowa rany oparzeniowej z zastosowaniem dermatomu elektrycznego i następowym oczyszczeniem rany metodą hydrochirurgiczną *water-jet*

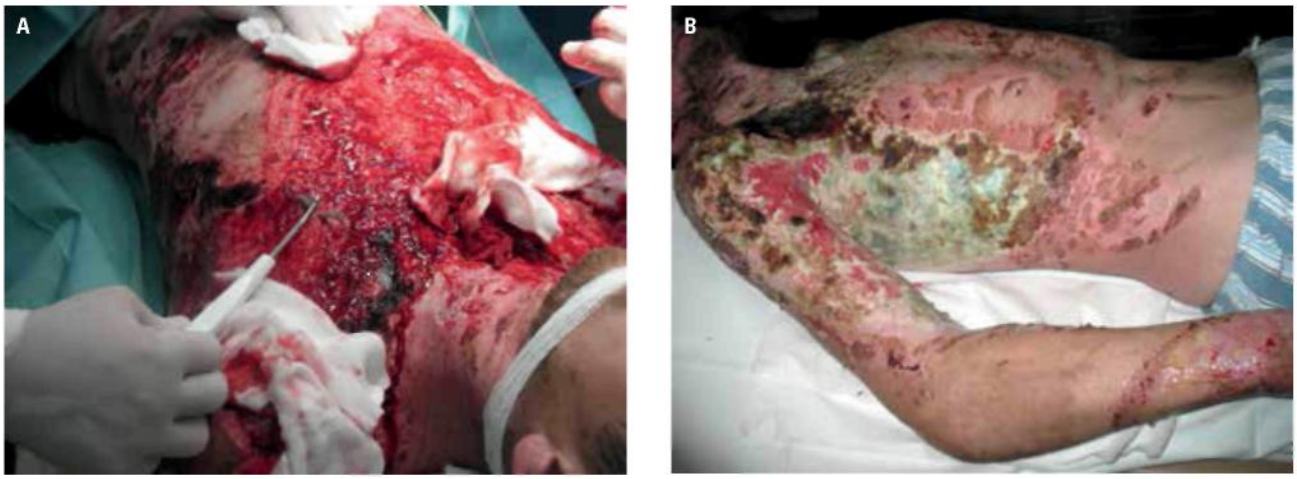


Figures 3C-D. Delayed primary reconstruction after two debridements
Ryciny 3C-D. Pierwotnie odroczona rekonstrukcja po dwóch zabiegach oczyszczenia

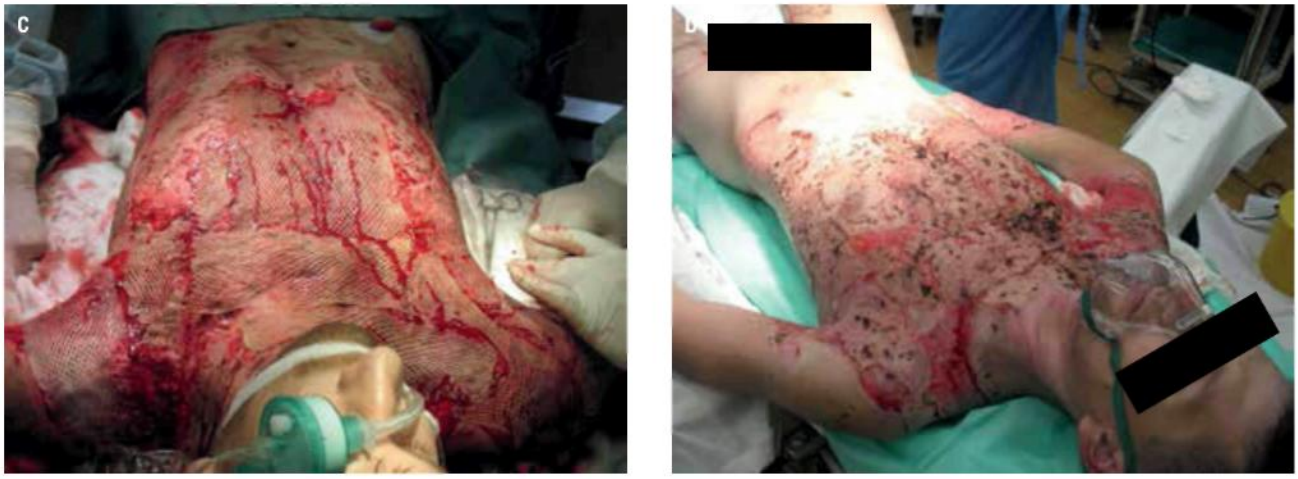
debrided wounds was required following the application of MBBD dressings. The grafting procedures were performed when the patients' general conditions were good, in order to avoid deterioration of the patients' general state due to blood loss resulting from the skin graft harvesting procedures. Secondary infectious complications were absent in the treated group of burned patients. No desiccation of the debrided burn wound was observed. The hemostatic properties of the dressing were assessed in situ, following debridement of the burn wound and the donor sites. The aim of the applied combined surgical approach was to preserve all viable tissue, thus more than 20% of the wound areas did not require deep excision. 70% of the patients (35 casualties) were grafted 24-48 hours following appropriate debridement and temporary coverage with combat MBBD dressing, and they demonstrated a graft intake rate of over 96%. 30% of the patients required more than one debridement procedure. Afterwards, the early graft intake rate was similar to that in the group of patients subjected to a single excision/debridement procedure. Flammacerium or Dermazine was applied under the MBBD dressing in only 3 cases, as a supplementary, short-term local therapy. All cases treated late (more than 10-12 days post-burn) presented symptoms of local infection; however, none of the patients were diagnosed with invasive infection. The results of the clinical investigation are presented in JPG format images captured by the author with a digital camera.

Discussion

The present-day military surgical burn wound treatment standard has to be perceived as a more



Figures 4A-B. Late debridement of infected burn wound with water-jet technology (no sharp excision)
Ryciny 4A-B. Późne oczyszczenie zainfekowanej rany oparzeniowej z zastosowaniem technologii *water-jet* (bez ostrego wycięcia)



Figures 4C-D. Immediate reconstruction after water-jet debridement, with an excellent outcome
Ryciny 4C-D. Natychmiastowa rekonstrukcja po oczyszczeniu metodą *water-jet* ze znakomitym efektem końcowym

complicated combination of excision/debridement and closure modalities. The gold standard, however, is still immediate autografting of post-excision burn wound defects. The aim of this study was to determine the actual clinical value of burn wound treatment tactics adjusted to special military conditions, combining current operative technologies based on excision/debridement with the application of a simple absorptive silver dressing as a temporary means of covering debrided wounds and as an alternative to allografts, for example. Early surgical treatment of burn wounds is a fundamental aspect of the local care of the burn patient [15]. The main objective in burn care is to prevent any life-threatening infection: generalized burn wound sepsis. Early excision/debridement and coverage reduces the mortality rate in patients who have not sustained an inhalation injury. The availability of specialized procedures in combat zones depends on the actual location of the burned patient in the medical aid field system. In deep partial-thickness burns, dermal reconstruction is not usually required, as opposed to full-thickness burn wounds, where dermal reconstruction is a necessity. In the authors' correctly diagnosed cases, even wounds of indeterminate depth were treated in order to preserve all uninjured and viable tissue as a means of maximizing rapid patient recovery, function retention, and cosmesis. The burn injury is a dramatically violent type of trauma, therefore the treatment itself must not cause additional harm: it ought to be rather delicate (producing a wound with a smooth surface), as well as being precise in removing only necrotic tissue, debris, and possible biobacterial burdens, controlling blood loss, preserving healthy

tissue, and allowing for the efficient reconstruction of post-burn defects as early as possible, but always at a clinically optimal time. The best moment for performing surgery needs to be determined individually. Large full-thickness burns are always life-threatening until completely closed. The choice of early burn wound debridement method must always depend on the depth of the wound, the patient's condition (concomitant injuries or complications being additional and considerable death risk factors), actual surgical equipment accessible, clinical experience of the surgeon and the team, and the possibility of definitive or temporary wound closure. Initially indeterminate burn depths require exact diagnosis; therefore a specialized debridement modality is the means to achieve that need.

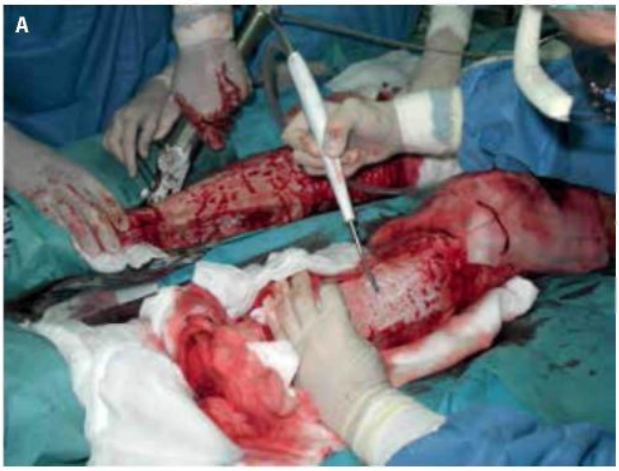
According to the authors' experience, water-jet technology is currently the best method of determining burn wound depth intraoperatively. The definitive covering of debrided burn areas may be performed at an early stage, but not exclusively so; it can be undertaken at any time after the debridement has been performed, provided that it is necessary and possible. In unstable patients, unstable circulation caused by hard burn wound excision can be followed by temporary coverage of the debrided wound surface with special dressings: natural, biosynthetic, or special silver dressings acting as skin substitutes. For this reason, the authors seek new excisional and burn wound debridement therapies, especially in order to improve the results of extensive burn treatment in military and other special conditions.

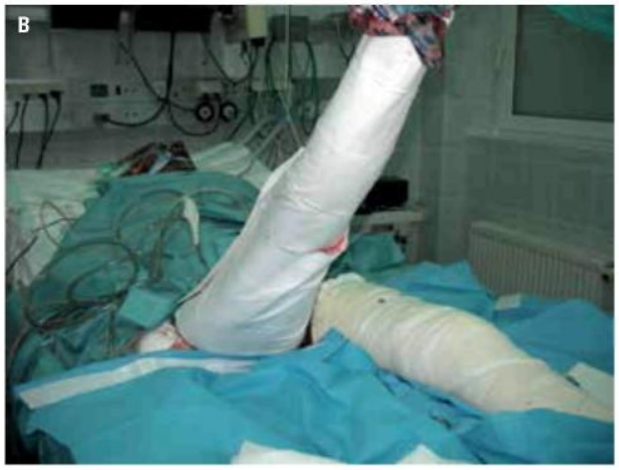
The modified approach to deep burn treatment proposed and applied by the authors includes early, highly superficial, tangential excision of the hardest part of the burn eschar with use of conventional surgical methods (electro dermatome; regulated Humby knife; Goulian knife; Watson knife; immediate controlled tissue preserving soft handpiece), deeper burn wound debridement (not Versa Jet Plus hard operating handpiece), and temporary coverage of the wound with the innovative silver dressing. No more than 20% TBSA was excised/debrided in a single stage. No allografts were required. All wounds were primarily covered with dressings containing ionic silver (self-constructed, silver-incorporated, non-releasing and non-nanocrystalline MBBD dressing). No STSG autografts or cellular suspensions were harvested, and cellular cultures were not established simultaneously (fig. 5), but with a short, controlled delay. Only when the clinician is certain that the wound bed has been prepared adequately, can definitive methods of post burn defect reconstruction be applied by an experienced burn surgeon.

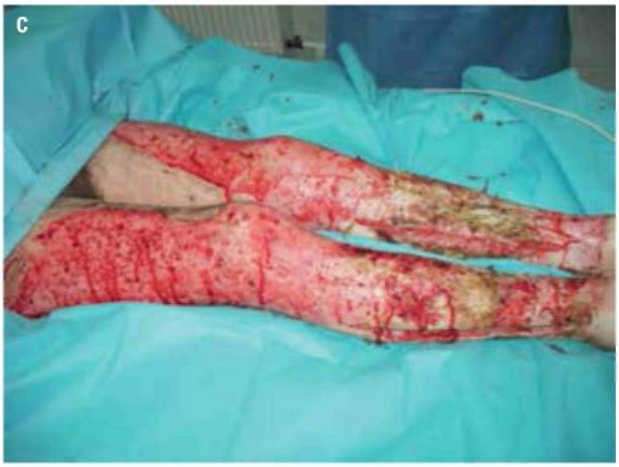
The results prove that the outcome of applying the proposed tactics in the investigated material was very good, with a good tolerance of necrotic tissue excision. Such an outcome was possible mainly due to the successful avoidance of over-excision, the additional blood loss connected with simultaneous skin graft harvesting, and the time gained to optimize all treatment methods for each case. Furthermore, the technical aspect of gaining a precise wound surface by means of debridedment is important as well; a very smooth surface gives good adhesion of the dressing or other therapeutic agents (fig. 6). Based on the presented material and over 140 of the authors' other cases where water-jet debridement was performed, the authors claim that this technique preserves the dermal elements of the skin, avoiding aggressive debridement and providing greater control than in the case of traditional steel-based methods, without unnecessary tissue loss or the final over-grafting that results from excessively aggressive excision. Moreover, hydro-surgery can be used effectively in combination with the conventional technique of sharp dissection, which makes it valuable and complementary to traditional excision methods.

Several innovative materials have become available in recent years, and new solutions continue to emerge. The majority of these materials are convenient and useful for military purposes. The main disadvantage, however, is their high price and relatively short shelf time. This new, innovative, combat, absorptive silver-incorporated dressing seems to be very useful and effective not only under combat conditions of medical burn care, but also in clinical practice. Following the excision/debridement procedure, the burn wounds were protected and controlled by the MBBD. The dressing provided a moist environment for the wound bed, and protected the burn surface from infection for 2-5 days after excisional therapy, which is an advantageous feature of a synthetic skin-substitute material. The mechanism of action of the dressing relies on ionic silver attached to an absorptive layer of fibers which is activated as the exudate is easily absorbed into the dressing. The dressing traps the bacteria-containing exudate in its fibers, where the ionic silver acts. Usage of the synthetic MBBD material instead of allografts in combat-zone medical aid would not only be simple, but also cheap and convenient. The authors observed that the concept and tactics of applying only the synthetic material to debrided burn wounds resulted in the avoidance of additional stress and shock in burned patients.

In this way excisional therapies become more tolerable by patients. The initial short delay of autografting confirms excellent burn wound bed preparation (WBP). It is important in military medical evacuation and level-based specialized field aid to prepare a second-best, alternative method of early, primary excision/debridement and closure of burned tissue. Delayed primary burn wound excision/debridement became possible with the introduction of water-jet technology to burn wound management methods. In accordance with Prasanna, Mishra, and Thomas's bold medical idea [16] and clinical experience, delaying burn wound excision/debridement/closure until 11-12 days post-burn is justified, even though it was completely impossible before. Moreover, present-day standard

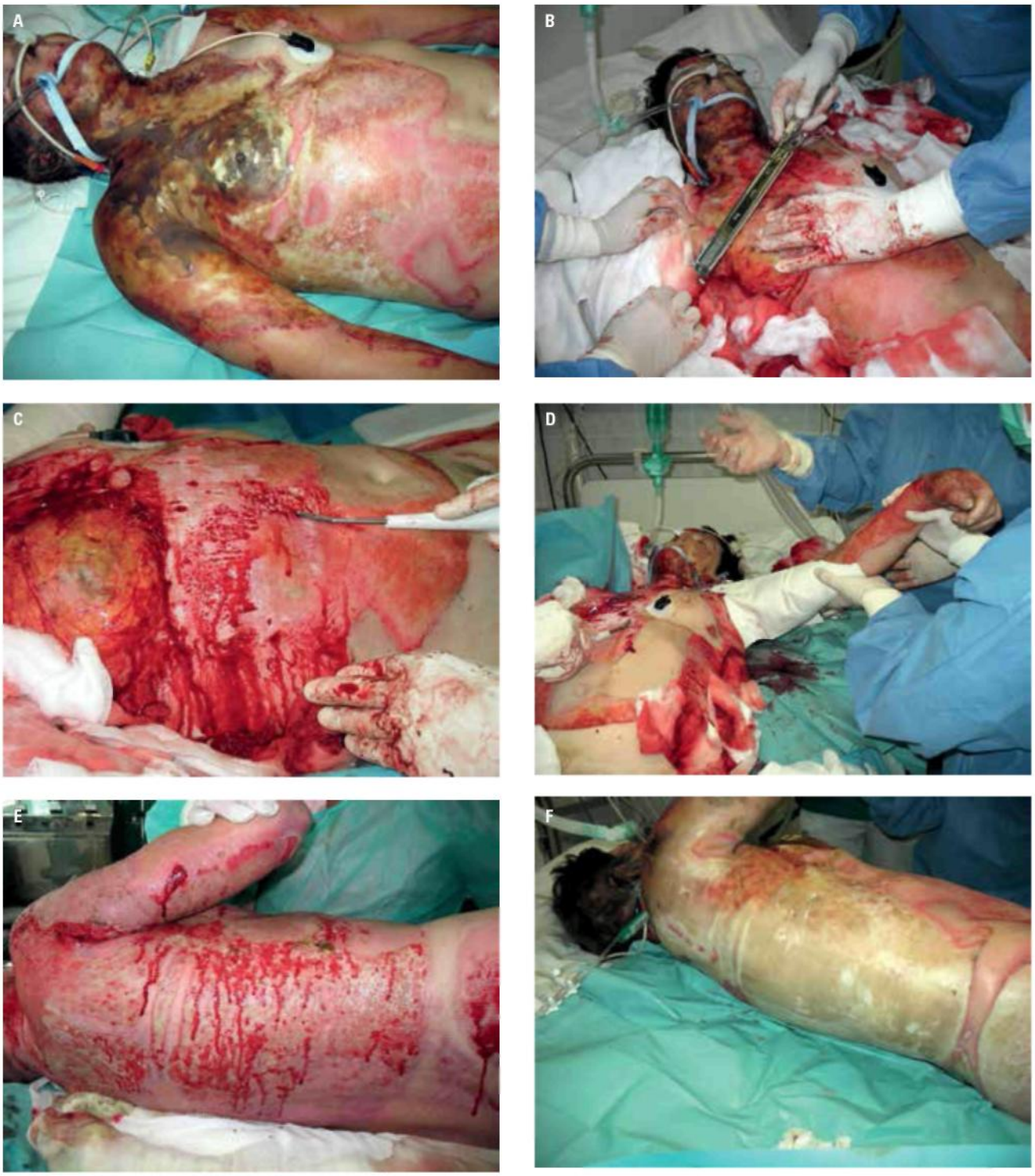




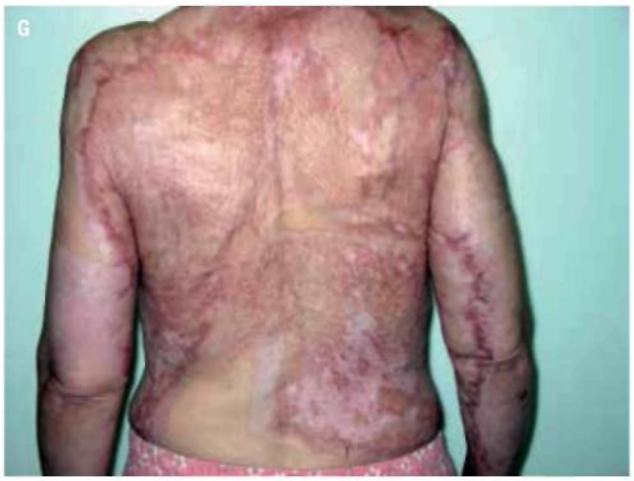


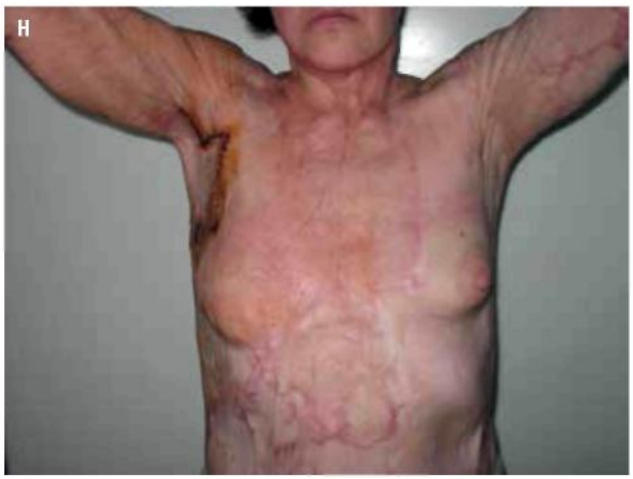
Figures 5A-B. An operating team with simultaneous temporary dressing of wounds with MBBD. **5C.** Lower limbs ready for meshed grafting to diminish the wound surface, requiring additional debridement after partial STSG reconstructive procedure or simultaneous debridement
Ryciny 5A-B. Jednoczasowo operujący zespół z tymczasowym opatrzeniem ran MBBD. C. Kończyny dolne gotowe do pokrycia przeszczepami siatkowymi w celu zmniejszenia powierzchni ran, wymagające dodatkowego oczyszczenia po częściowej procedurze WPSGG z jedno-czasowym oczyszczeniem

burn wound treatment has to be perceived as a more complex combination of methods that allow the extension of the surgical therapy of burn wounds beyond the early or primarily delayed timing range. Any attempt can be made to avoid the necessity of secondary skin grafting of granulating burn wounds. Late debridement with the use of water-jet technology alone, combined with mechanical demarcation of eschar (over 12 days post-burn), results in sub-acute burn wounds becoming an acute, clean, bacteria-and-debris-free wound environment. Nowadays, it is possible to apply primary burn wound treatment even in the late period, which is of high significance in military and field burn care: it is crucial with regard to the efficacy of specialized medical care at level III or beyond.



Figures 6A-F. A patient with extensive burn injuries operated on with combined primarily delayed primary excision/debridement, with applied MBBD
Ryciny 6A-F. Pacjent z rozległym oparzeniem leczony kombinacją pierwotnie odroczonego wycięcia/oczyszczenia z zastosowaniem MBBD





Figures 6G-H. Final result of delayed grafting
Ryciny 6G-H. Efekt końcowy odroczonej rekonstrukcji

In the authors' personal opinion, based on the presented tactics and a considerable amount of clinical water-jet debridement case follow-up data, the hospital stay was markedly shortened in comparison with SOC modality patients treated with the use of banked allogenic skin as temporary coverage. Silver-impregnated MBBDs have been evaluated and finally recognized as an efficient modality of burn wound care when applied following the removal of necrotic/devitalized tissue, debris, and bacterial biofilm from the wound even in cases where immediate autografting may be contraindicated or impossible (fig. 7). The dressing has also showed its efficacy and versatility when applied to a large number of superficial burns and wounds of different origin. It has been widely presented by the authors in Poland, as an effective and important temporary wound coverage both in clinical and military aid under the hydro-surgery technique. It can be effectively combined with all currently known burn wound care methods, not excluding the NPWT and CEA technologies. The authors' clinical material contains convincing clinical proof that water-jet technology is not to be overlooked in modern burn wound special-field therapy, particularly in combination with traditional modalities. Temporary coverage of debrided burn wounds performed with the use of modern technologies combined with classic methods and followed by silver dressing application seems to a be simple, efficient and easy-to-use solution, as an adequate debrided burn wound control procedure for MEDEVAC purposes.

Conclusion

The combined steel/water-jet early, primarily delayed, and late debridement of burn wounds followed by temporary coverage of the wound solely with an innovative silver-containing, triple-layered, absorptive military dressing (MBBD) was an efficient therapy in the treatment of 50 consecutive cases of extensive deep mid-dermal and deep dermal burns.

The MBBD battlefield dressing was successfully applied on excised/debrided burn surfaces instead of allografts and other dressings that are widely used as biological or synthetic temporary coverage for excised/debrided mid-dermal and deep dermal burn wounds. The use of this solution would be impossible without applying water-jet technology for the purpose of extra-precise burn wound debridement. Traditional technologies alone are of smaller utility, yet they are of great value when combined with water-jet technology. The authors conclude that field tactics of operative burn-wound care combined with the application of a special military dressing may be useful in early, primarily delayed, and later temporary coverage of surgically debrided wounds, which may be of high importance with regard to adherence with the rules and principles of field burn care. In all 50 patients from our clinical material, operated on with the use of water-jet technology (including late-infected ones), the intake ratio following the primary delay of definitive reconstruction with autografts was extraordinarily high.

The benefits of preserving unaffected tissue in burns seems to provide a sufficient rationale for further development of water-jet technology in combination with steel-based excision of burn wounds, and for the effort to make sure that this solution is not overlooked in modern burn wound therapy. Synthetic (non-biological) dressings may play an important role in safe temporary burn wound coverage in the special circumstances of medical aid administered under armed conflict conditions, addressing real possibilities and requirements.

Conflict of interest statement

The authors have declared no conflict of interest. The investigations were supported by an unrestricted grant from the Ministry of National Defence. The authors would like to express their gratitude to the Military Health Service Inspectorate for the financial support granted to the described scientific investigations.

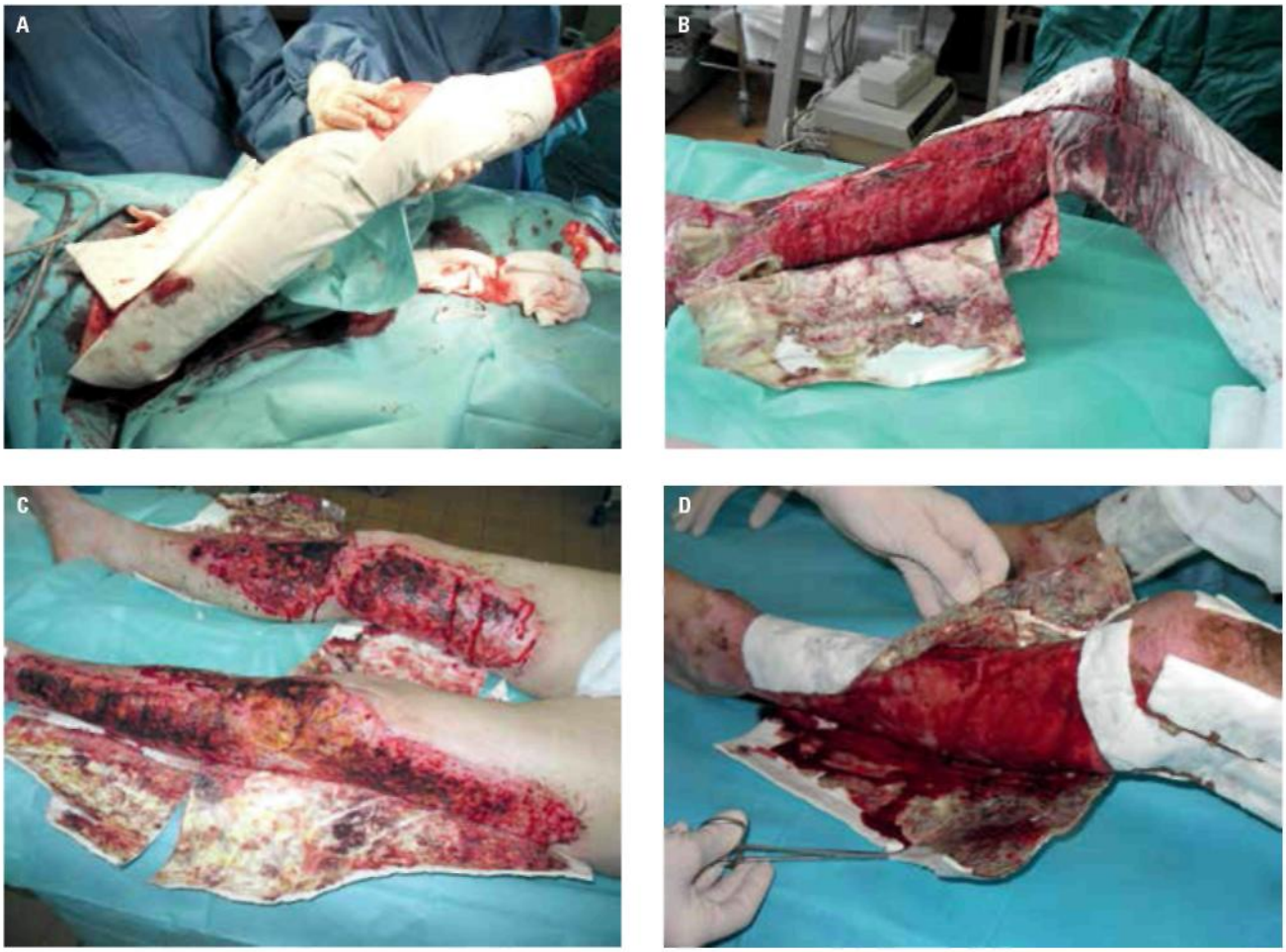


Figure 7A-D. Clinical examples of debrided burn wounds, temporarily covered with MBBD military dressing at different stages (operation, 2-5 days after surgery)
Rycina 7A-D. Kliniczne przykłady oczyszczenia ran oparzeniowych i czasowego pokrycia bojowym opatrunkiem MBBD na różnych etapach (operacja, 2-5 dni po operacji)

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Cervical vestibular evoked myogenic potentials (cVeMPs) in the diagnostics of vertigo and central balance disorders

Szyjne miogenne przedsionkowe potencjały wywołane (cVeMPs) w diagnostyce zawrotów głowy i zaburzeń równowagi pochodzenia ośrodkowego

Dominik Bień, Jacek Usowski, Dariusz Jurkiewicz

Department of Otolaryngology and Otolaryngological Oncology with Clinical cranio-maxillofacial Surgery Unit, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw. Head: Col. Prof. Dariusz Jurkiewicz MD, PhD

Abstract. The diagnostics of vertigo and central balance disorders form a significant challenge for clinicians. A wide variety of modern medical tools allows the multifaceted verification of data from interviews and physical examinations, including general, neurological and otolaryngological examinations. Imaging facilitates our understanding of the anatomical reasons for a balance deficit, while electrophysiological examinations enable assessment of the functioning of particular neural pathways. One such examination is the recording of cervical vestibular evoked myogenic potentials (cVeMPs), facilitating the assessment of the functional features of the vestibulo-cervical reflexes. The acoustic stimuli, by stimulation of the sacculus, are converted into electrical activity in the inferior vestibular nerve, lateral vestibular nucleus, lateral vestibulospinal tract and finally are responsible for contraction of the sternocleidomastoid muscle. The aim of the study was to assess the usefulness of cVeMPs recordings in CNS disorders, regardless of their etiology and location in the CNS.
Key words: central balance disorder, cervical vestibular evoked myogenic potentials, cVeMPs, dizziness, vertigo

Streszczenie. Diagnostyka zawrotów głowy i zaburzeń równowagi pochodzenia ośrodkowego jest istotnym wyzwaniem dla klinicysty. Spektrum narzędzi oferowanych przez współczesną medycynę umożliwia wielopłaszczyznową weryfikacją danych z badania podmiotowego, przedmiotowego (w tym ogólnolekarskiego), neurologicznego i otolaryngologicznego. Badania obrazowe zbliżają do poznania anatomicznych aspektów deficytu równowagi, podczas gdy badania elektrofizjologiczne pozwalają na ocenę czynnościową określonych szlaków neuronalnych. Jednym z takich badań jest rejestracja szyjnych miogennych przedsionkowych potencjałów wywołanych (cVeMPs), ułatwiająca ocenę sprawności odruchów przedsionkowo-szyjnych. Bodziec akustyczny poprzez stymulację woreczka indukuje odpowiedź elektryczną nerwu przedsionkowego dolnego, jądra przedsionkowego bocznego i drogi przedsionkowo-rdzeniowej bocznej, a efektorem jest mięsień mostkowo-obojczykowo-sutkowy. Niniejsza praca jest próbą zweryfikowania przydatności rejestrowania cVeMPs w zaburzeniach ośrodkowych, niezależnie od ich etiologii i potencjalnej lokalizacji w ośrodkowym układzie nerwowym.
Słowa kluczowe: szyjne miogenne przedsionkowe potencjały wywołane, cVeMPs, zaburzenia równowagi, zawroty głowy ośrodkowe

Delivered: 13/11/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 44-52

Corresponding author:
Dominik Bień MD
Department of Otolaryngology and Otolaryngological Oncology with Clinical
Cranio-maxillofacial Surgery Unit, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine
128 Szaserów St., 04-141 Warsaw
telephone: +48 22 681 74 79
e-mail: dbien@wim.mil.pl

Introduction

Vertigo and balance disorders are a major diagnostic problem. Regardless of the available tools, the interview remains a significant element in the differential diagnosis of peripheral and central disorders [1]. Vertigo, or hallucinations related to rotating movements of the patient or his/her surroundings, is an abstract and subjective notion. In CNS disorders, patients frequently complain about the sensations of wobbling, falling, rising, being pushed from the outside, static instability, spatial orientation disorders or indeterminate instability of posture, including while walking. Balance disorders form objective phenomena, clinical evidence of balance system disorders. An issue important for the localization of the problem lies in the beginnings of the symptoms - if the cause is central then it is usually difficult to capture and its duration may be minutes in vertebrobasilar insufficiency and months or years in degenerative CNS disorders, such as cerebral atherosclerosis or multiple sclerosis. Damage to the central part of the vestibular system may be related to various diseases or have a different background. In general, the cause of the dysfunction may be related to hereditary, inherent or perinatal cerebral diseases, craniocerebral injuries, inflammatory and neoplastic tumors of the brain or meninges, circulation disorders in the CNS or systemic diseases with a neurotoxic potential. The scarce epidemiologic data show that neurological diseases are the cause of vertigo in 10-30% of cases, with a similar value applying to systemic causes. Otologic diseases contribute to 40-50% of cases, with psychological or undefined causes to 15-50% [2]. Other metaanalyses showed discrepancies in the statistical data, indicating that 11-57.2% of cases may be CNS in character [3, 4].

The location of the lesion results in a diverse range of symptoms accompanying the balance deficiencies. The classical and most frequently used description of the vestibular system by Coats assumes a clinical division into peripheral and central parts [5-8]. The peripheral part includes: vestibulum (otholitic organs, saccule and utricule), semicircular canals (capulae), vestibular nerve and cerebellopontine angle. The fibers of the vestibular nerve within the brainstem create an ascending pathway to the cerebellum, and a descending pathway to the vestibular nuclei. The descending pathway includes the majority of the fibers. The central part consists mainly of the vestibular nuclei: superior (nucleus of Bechterew), lateral (nucleus of Deiters), medial (nucleus of Schwalbe) and inferior (nucleus of Roller), which create the second neuron of the balance sensation pathway. They are situated in the dorso-lateral and superior parts of the medulla oblongata, near the border of the pons and partially within it. They communicate between each other via various commisural fibers, via afferent pathways with the vestibular receptor, spinal cord and cerebellum, and via efferent pathways to the receptor organ (recurrent fibers in the vestibular nerve), oculomotor nuclei, spinal cord, cerebellum, reticular formation, thalamus and cerebral cortex [5-9].

The awareness of balance is created in the cortical centers via a vestibular-cortical route which has yet to be investigated fully. A major role in the regulation and integration of other elements of the organ of balance is played by the cerebellum. The anatomical complexity of the organ of balance implies multiple functional, physiological and pathological routes, which is very difficult diagnostically and results in a wide range of symptoms. Damage to the brainstem causes, for example, diplopia, incongruent nystagmus, dysarthria, dysphagia, numb feeling in the mouth area and weakened muscle tone. A damaged cerebellum may result in dysarthria, posture and gait disturbance as well as motor coordination disorders. Damage to cortical centers may lead to changes in the vision field and visual hallucinations (parietal lobe), visual, olfactory and gustatory hallucinations, aphasia and epileptic seizures in the temporal lobe pathologies. Assessing the damage location only on the basis of the symptoms is practically impossible. A detailed interview and examination, including general examination (for internal diseases), neurological examination (assessment of eyeball position and movements, assessment of nystagmus, posture and gait, static/dynamic coordination tests), otolaryngological examination (micro-otoscopy, hearing tests, caloric test) and a range of additional tests (including scans) bring the physician closer to a correct diagnosis. However, there still remains those patients in whom the use of additional tools is required to enable the functional assessment of the neuronal pathways such as Auditory Brainstem Response (ABR), Middle Latency Responses (MLR) and cortical potentials, but does not answer the question as to the location of the lesion in the CNS. Therefore, researchers are investigating methods which would enable a more precise linkage between the location of the lesion and the extensive range of vestibular system dysfunction symptoms.

A test which has recently become of diagnostic significance is the registration of cervical-vestibular evoked myogenic potentials - cVeMPs. The impulse for the development of the method was the observation that the external auricular muscles and occipital muscles contract in response to auditory, luminous and electrical stimuli. As a conclusion, it was suggested that the stimulations have a vestibular character [10, 11].

There have also been findings that there are quick responses to acoustic stimuli in the form of clicks registered from various areas of the earlobe, external auditory meatus, occipital area and skull vertex involving the myogenic and neurogenic response of the labyrinth, as well as the vestibular myogenic response. The authors ascribed the diagnostic value only to the potentials registered at the skull vertex, considering them a complex response involving all three components [12].

In studies consisting of the registration of acoustic stimulation in the region of the suboccipital muscles in patients with a damaged inner ear and following endolymphatic sac drainage, some researchers suggest that the reaction is a result of stimulation of the saccular receptors [13]. The theory of sensitivity of saccule to acoustic stimuli and vibrations, and neural pathways from the saccule to the cervical muscles has been described in detail in experimental research on animals. The proposed model assumes that information in the form of an acoustic impulse transformed to a bioelectrical one in the saccular receptors is sent via the inferior vestibular nerve

to the nucleus of Deiters and then down the vestibulospinal tract to the sternocleidomastoid muscle. This theoretical route of the stimuli forms the basis of the contemporary technology of cVeMPs registration.

In 1992, the first practical use of cVeMPs registration was described. The case involved a 38-year-old male patient with Meniere's disease treated with selective vestibular neurectomy. The cVeMPs test performed prior to and 3 months after surgery showed unchanged latency parameters after the stimulation of the non-operated ear; no hearing deficiency was found on the operated side, but acoustic stimulation did not cause any potential from the cervical muscles. The results implied the possibility of acoustic excitement of the intramedial vestibular fibers and registration of short-latency vestibulospinal reflexes [14].

The aforementioned concept was developed by the findings that there was a strong correlation between the results of the cVeMPs test and caloric tests in patients with unilateral peripheral damage to the organ of balance [15].

Many further works led to the association of deviations in the cVeMPs test with sets of various specific clinical symptoms. The technology has proved useful in the diagnosis of the following ailments: tumors of the cerebellopontine angle, vestibular neuritis, Meniere's disease, multiple sclerosis, sensorineural hearing loss and superior canal dehiscence syndrome. Apart from MS, the medical literature on the usage of cVeMPs in CNS deficiencies is still scarce.

Aim of the study

The aim of the study was to determine the usefulness of cVeMPs in the diagnosis of vertigo and central vestibular system disorders.

Material and Methods

The study was conducted in a group of 36 patients with CNS deficiency (8 males and 28 females, M/F index = 1:3.5, average age: 51.47 years) and 27 healthy volunteers (16 males and 11 females, M/F index = 1:0.69, average age: 38.25 years). The patients were diagnosed and treated for vertigo and balance disorders at the Audiology Clinic of the Military Institute of Medicine in the years 2010-2013. All the patients and volunteers signed the informed consent form and the study project with the criteria described below was approved by the Ethical Committee of the Military Institute of Medicine (Resolution no. 51/WIM/2013).

All the participants underwent a diagnostic procedure in accordance with the standards of the clinic, consisting of a full interview, physical examination (by an internal diseases specialist, neurologist and otolaryngologist), necessary scans, audiological tests (Pure Tone Audiometry and Auditory Brainstem Response) and otoneurological tests (monocular videonystagmography and registration of cervical-vestibular evoked myogenic potentials).

The exclusion criteria were as follows: failure to perform at least one element from the aforementioned diagnostic panel (regardless of the reason), diseases of cervical spine limiting neck movement, withdrawal of the informed consent form or labyrinth deficiency indicating a peripheral/mixed cause of the disorder (>25%).

The registration of the cVeMPs was performed after ipsilateral stimulation by a click with a frequency of 500 Hz and intensity of 100 dB, nHL, in the recumbent position, with head raised towards the chest (30°) and turned at least 45° to the side opposite to the stimulated ear, with dedicated GSI Audera equipment and GSI TIP-50 headphones. The stimulation was graphically represented as a curve with positive (P1) and negative (N1) segments. The comparative analysis was performed in relation to the best obtained result.

The registration of ABR (usually three- or fourfold) was performed in the recumbent position with dedicated Racia-Alvar Centor-0 equipment and Beyerdynamic DT48 headphones, with the following three-electrode configuration: active electrode on the patients forehead, reference electrode on the earlobe on the examined and opposite side, and grounding electrode on the earlobe. The analysis included wave I, III and V latencies and I-III, I-V, III-V intervals after stimulation by a sound stimulus with an intensity of 90 dB and frequency of 1 kHz.

Pure Tone Audiometry was performed in a Soncab - L Type silent cabin by Soning with a calibrated clinical audiometer by Inter-Acoustic (model AC-40 OB822) and reference headphones by Madsen (TDH 39) for air conduction and by Madsen (B71) for bone conduction, with contralateral ear masking.

Videonystagmography (VNG, registration of resting and evoked nystagmus) was performed with the use of a dedicated rotating chair, monocular camera and ATMOS Varioair 3 device for bi-caloric labyrinth stimulation. The examination consisted of the following tests: saccadic tracking with tracking speed and precision assessment, sinusoidal tracking with assessment of average bilateral amplification, posture tests in the sitting position and Rose's position, with the assessment of the horizontal and vertical nystagmatic component and the values of horizontal, vertical and diagonal speed, and labyrinth caloric tests after a 60-second stimulation (with latency) with warm air (25°C and 47°C). The quantitative analysis included the varied labyrinth excitability, absolute and relative directional preponderance, and labyrinth deficiency (canal paresis).

A descriptive statistical analysis of the collected materials included the calculation of average, maximal and minimal values, confidence intervals, variation and standard deviation for each of the parameters. The variables were checked for normal distribution by Kolmogorov–Smirnov test and Lilliefors test. The results were estimated with the use of analysis of variance (ANOVA), Student's t-test and linear correlation coefficient.

Results

The usefulness of the interview in the diagnosis of balance disorders was verified in relation to the "golden otoneurological standard", VNG. On the basis of the surveys, it was determined that the patients report vertigo (illusion of rotation) and balance disorders to the same degree (97.2%). Tinnitus was reported by 69.4% and hearing impairment by 50% of the patients. The majority (36.1%) informed that the symptoms appeared no earlier

than half a year before and were of a paroxysmal character (22 patients). At the same time, the vast majority could not determine the frequency of the ailments (58.3%), eight patients reported that the symptoms appear every day while four patients spoke about a single incident. In the majority of cases, the declared duration of the symptoms was described in minutes (30.6%), seconds (27.8%) or the whole day (19.4%). There was one case when the problem lasted about an hour. As many as twenty two patients reported that the symptoms intensify when they moved their head or changed body position. No epileptic seizure related to balance disorders was reported. The most frequent simultaneous symptoms were: nausea (61.1%), headaches (44.4%), vomiting (36%), palpitations (33.3%), anxiety (33.3%), blurred vision (30.6%) and impaired consciousness (4 patients). The data from the survey enabled a relationship to be determined between balance disorders and the potential appearance of tinnitus and hearing impairment. It was determined that in fourteen patients tinnitus appeared before the balance disorders (in half of the cases within one year), in seven patients they appeared between them (usually bilaterally) and only in four patients were they directly related to episodes of vertigo. At the same time, in three quarters of the patients, tinnitus was of a persistent character. Hearing impairment before the onset of vertigo was reported by fourteen patients (in 7 patients in > 12 months, in 9 patients bilaterally), three patients stated that they saw a correlation between hearing impairment and vertigo episodes.

One of the important parts of the interview was aimed at determining whether the patients had any other systemic problems or diseases which might contribute to balance deficiencies. These included losses of consciousness, cervical spine injuries and motion sickness (5 patients each), head injuries not related directly to the balance disorders (7 patients) and four cases of short-time exposure to noise. Three patients suffered from chronic psychoemotional stress and one reported non-orthostatic hypotension. Other ailments included: limb numbness (18 patients, half of the group), arterial hypertension (quarter of the group), coronary heart disease, olfactory disorders and hormonal disorders (4 patients, and one case of acute coronary syndrome managed by stent implant), blurred vision (2 patients) and taste disorders (1 patient). Single cases of pituitary microadenoma, SLE, insulin-dependent diabetes and microcytic anemia in the group of patients were found. In the control group, no vertigo, balance disorders or any significant problems related to the head and neck area were observed. The interview result concerning injuries, cardiovascular, respiratory and metabolic diseases was negative.

The results of ABR recording is presented in Tables 1 and 2. Statistically significant differences were observed between the groups, but absolute values of averages for left and right ear remained within the normal range, which indicated that the results were normal.

The results of a descriptive analysis of VNG and cVeMPs data for both groups are presented in Tables 3 and 4.

The analysis did not result in any statistically significant correlations between the P1, N1 and P-N latencies (cVeMP) and the values and precision of saccade tracking and average amplification of sinusoidal tracking. On the other hand, it was possible to observe statistically significant differences in P1 latency between the groups ($t = 1.978$, $p = 0.049$), P-N amplitude ($t = -3.33$, $p = 0.001$) for the right ear and P-N amplitude for the left ear ($t = -3.63$, $p = 0.001$) (Table 7). The asymmetry ratio coefficient of the P-N amplitude in the study group was 6.82% while in the control group it was 9.17%. However, both groups were characterized with large differences between individual AR values, as much as 86.75% in the study group and 73.19% in the control group, while AR values >50% are commonly considered as pathological [25]. In the study group, there were eight patients with AR >50%, while in the control group there were four such cases.

Very significant statistical differences of average amplification of sinusoidal tracking between the groups (amplification to the right: $t = -5.87$, $p = 0.000$; amplification to the left: $t = -4.18$, $p = 0.000$) confirmed the CNS nature of the disorders. However, no analogous differences were obtained for saccade tracking.

A clear correlation was obtained between the value of horizontal speed in the sitting posture (posture tests) and the P-N amplitude, but only for the right ear ($r = -0.319$, $p = 0.050$). No such correlation was confirmed between P1 and N1 latencies and the remaining components of the positional nystagmus speed. Significant statistical differences between the groups were found in the registered horizontal and diagonal components of nystagmus in the sitting position ($t = 2.236$, $p = 0.029$ and $t = 2.010$, $p = 0.049$, respectively) and the diagonal component in Rose's position ($t = 2.247$, $p = 0.028$). No case of self-induced nystagmus with the fixation removed was observed. The lack of correlation in the case of bilateral stimulation made it impossible to assign any significance to the results in this group of parameters.

As far as the bithermal caloric tests (right ear stimulation) were concerned, a relationship was found between the P-N amplitude and absolute preponderance to the right ($r = 0.731$, $p = 0.007$) and left labyrinth deficiency ($r = -0.521$, $p = 0.027$). The relationship between the P-N amplitude and labyrinth deficiency had no clinical value due to normal absolute values of caloric reaction weakening. However, the correlation of P-N amplitude with the absolute preponderance to the right (only in right ear stimulation) could indicate VOR asymmetry, but the location of the damage was difficult to determine. For the caloric responses of the lateral semicircular canals, the damage could have been related to the vestibular nuclei and/or neural CNS pathways.

Statistically significant differences were found between the groups as far as the values of labyrinth excitability to the left ($t = 2.274$, $p = 0.032$) and canal paresis of the right labyrinth ($t = -2.15$, $p = 0.041$). In the group with CNS-related disorders, there were no correlations between these values and the results of cVeMPs, so these differences were of no significant value.

Discussion

The key to the determination of the source of balance disorders involved the deviations in eyeball movements,

Table 1. Comparison of ABR results (latencies and intervals) of the study and control groups, right ear
Tabela 1. Porównanie wyników rejestracji ABR (latencji i interwałów) w grupie badanej oraz kontrolnej dla ucha prawego (UP)

	Average		difference of averages	t	P
	central deficiency	control group			
RE-I	1.714	1.776	0.062	1.44	0.152
RE-III	3.888	4.001	0.113	3.15	0.002
UP-V	5.707	5.927	0.219	4.81	0.000
RE-I-III	2.175	2.225	0.051	1.40	0.165
RE-I-V	3.993	4.151	0.158	3.59	0.001
RE-III-V	1.818	1.925	0.107	3.30	0.001

Table 2. Comparison of ABR results (latencies and intervals) of the study and the control groups, left ear
Tabela 2. Porównanie wyników rejestracji ABR (latencji i interwałów) w grupie badanej i grupie kontrolnej dla ucha lewego (UL)

	Average		difference of averages	t	P
	central deficiency	control group			
LE-I	1.766	1.762	0.004	0.136	0.892
LE-III	3.922	3.995	0.073	1.86	0.065
LE -V	5.741	5.926	0.185	3.80	0.000
LE-I-III	2.158	2.232	0.074	2.32	0.022
LE-I-V	3.974	4.167	0.193	4.45	0.000
LE-III-V	1.818	1.935	0.117	3.20	0.002

especially the registration of the vestibulo-ocular reflex in the VNG examination. Recent research shows that oculomotoric and VOR tests, both in ENG and VNG assessment, are more sensitive than MRI (or even DWI) in the diagnosis of acute balance deficiencies and differentiation of peripheral and CNS disorders [16]. It has also been proved that almost 70% of cases of anomalies in ENG correspond to a normal MRI image [17]. This is in line with the findings related to the clinical-radiological paradox in patients with multiple sclerosis (MS), where in 60% of cases there is no radiological confirmation of the neurological symptoms [18, 19]. MS is an example of a CNS pathology in which cVeMPs registration has been proved as being diagnostically useful. Bilaterally prolonged P1 and N1 latency and anomalies in the P-N amplitudes are characteristic of this disease. In the literature, there are views that P1 latency prolongation is a typical MS anomaly, while the N1 segment is prone to greater variability. The values of latency and AR are not MS-specific, but may appear in other pathologies of the brainstem and brain tumors. However, no clear correlation was found between cVeMPs values and brainstem-related deficits and MRI scans [21]. The registration of cVeMPs may be used for the detection of clinically positive symptoms of brainstem demyelination in those cases with no lesions visible in the MRI scans [21]. On the basis of the data obtained by the authors and the opinions in the literature, no clear diagnosis of MS was obtained in the group with CNS disorders. Those patients in whom a clear CNS background was suspected underwent further examinations and were treated in accordance with the diagnoses. The final results proved to be out of the planned scope of this paper.

The diagnosis of CNS disorders in the field of eyeball movements was done with the use of the following tests: saccade tracking, sinusoidal tracking, gaze test, optokinetic test and posture tests [20].

In saccade tracking, no statistically significant differences were obtained between the groups as far as the velocity and tracking precision were concerned. No patient exhibited gaze nystagmus. The optokinetic test is not used in our center as a standard diagnostic test.

Sinusoidal tracking clearly indicated that the disorders of the study group patients are of a CNS-related character. Contrary to saccade tracking, the complex route of the information via neural pathways from the macula lutea to the cerebral cortex and cerebellum does not enable the precise determination of the location of the lesion. The main centers managing the tracking reflex are the flocculonodular lobe and the adjacent part of the cerebellar vermis. Symmetric disorders may occur in older patients, people taking psychotropic, antiepileptic and sedative drugs as well as alcohol, because of the influence of these substances on the function of the cerebellum and brainstem. They may also be a consequence of fatigue and deconcentration. High-intensity disorders may suggest dispersed disease processes, such as supranuclear degeneration, cerebellar degeneration or Parkinson's disease. Asymmetric disorders may result from damage to the frontal or occipital cortex, thalamus, brainstem or cerebellum. It is important to note that no correlation was found between the results of the aforementioned tests and the cVeMP registration parameters. Apart from the clinical situation with the known CNS background described in the literature, such as multiple sclerosis where cVeMPs registration has a known clinical value, saccade and sinusoidal tracking tests cannot be considered equivalent in any dimension of the cVeMPs test. Observation of statistically significant differences between P1, N1 latencies and P-N amplitude in both groups, but without correlation, does not enable unequivocal association of cVeMPs results with CNS pathology in a specific location.

In the papers devoted to brainstem cVeMPs mapping, the researchers confirmed the usefulness of this test in the diagnosis of dispersed diseases, such as MS and basilar migraine [22]. There are some opinions suggesting that cVeMPs may be useful in the identification of lesions in the area of the pons and

Table 3. Comparison of vestibulocollic reflex recordings (VOR) during videonystagmography (VNG) in the group of patients with CNS diseases
Tabela 3. Zestawienie wyników rejestracji odruchów przedsionkowo-ocznych (V0R) w VNG w grupie chorych z dolegliwościami o podłożu ośrodkowym

	n	Average	confidence interval		median	minimum	maximum	SD±
			95%	+95%				
VNG-saccades								
to the right								
speed (deg/s)	36	464.86	420.52	509.20	454.50	303.00	1002.0	131.04
precision (%)	36	94.53	84.65	104.40	91.00	58.00	194.0	29.19
to the left								
speed (deg/s)	36	441.03	401.92	480.14	422.50	226.00	745.00	115.59
precision (%)	36	92.83	85.40	100.27	90.00	51.00	176.00	21.98
VNG -sinusoides								
R average ampl.	36	0.708	0.633	0.783	0.705	0.000	1.030	0.221
L average ampl.	36	0.778	0.719	0.838	0.770	0.520	1.350	0.176
posture tests - sitting position								
horizontal speed (deg/s)	36	0.406	0.192	0.619	0.100	0.000	2.900	0.631
vertical speed (deg/s)	36	0.539	0.269	0.809	0.300	0.000	3.400	0.798
diagonal speed (deg/s)	36	0.714	0.380	1.048	0.450	0.100	4.500	0.988
posture tests - Rose's position								
horizontal speed (deg/s)	36	0.578	0.273	0.882	0.250	0.000	3.400	0.900
vertical speed (deg/s)	36	1.297	0.673	1.922	0.500	0.100	8.900	1.846
diagonal speed (deg/s)	36	1.594	0.946	2.243	1.050	0.100	9.000	1.916
caloric tests								
excitability (deg/s) - R	17	24.72	15.31	34.13	21.40	4.300	64.4	18.31
excitability (deg/s) - R	19	41.23	27.22	55.25	31.80	2.600	102.0	29.08
directional preponderance								
absolute (deg/s) - R	12	9.44	8.90	27.78	0.85	0.000	101.0	28.86
absolute (deg/s) - R	24	6.48	2.06	15.03	2.10	0.100	101.0	20.23
relative (%) - R	10	11.60	4.15	19.05	11.00	1.000	37.0	10.42
relative (%) - L	26	19.50	13.40	25.60	15.00	1.000	50.0	15.09
deficiency (%) - R	18	8.78	5.89	11.67	7.50	1.000	22.0	5.82
deficiency (%) - L	18	13.33	10.18	16.48	11.50	3.000	24.0	6.33

anterior part of the medulla oblongata. On the other hand, there are also suggestions that organic lesions in cerebellar stroke are not reflected in the results of cVeMPs registration [23]. The same authors did not find statistically significant differences between the results in patients after a stroke of the inferior part of the brainstem and the control group, excluding differences in single cases. In the light of the aforementioned research, the results of this paper do not constitute evidence for locating a pathology within the brainstem.

The doubts as to the location of the lesions cannot be finally resolved by cortical mapping of saccule stimulation with the use of fMRI [24]. Data from the literature indicate that acoustic stimulation with airborne stimuli and saccule stimulation result in an increased activity, mainly in the temporal cortex area, insular cortex and temporal-parietal junction, including Brodmann area 8 (location of the coordinated lateral gaze center) in both hemispheres. It is also known that cortical activity in both hemispheres after the stimulation of the lateral semicircular canal (VNG) and vestibular nerve (VNG cVeMPS) is asymmetric [24]. The mechanism of influence of cortical centers on the

Table 4. Comparison of vestibulocollic reflex recordings (VOR) during videonystagmography (VNG) in the group of healthy volunteers
Tabela 4. Zestawienie wyników rejestracji odruchów przedsionkowo-ocznych (V0R) w VNG w grupie zdrowych ochotników

	n	Average	confidence interval		median	minimum	maximum	SD±
			95%	+ 95%				
VNG - saccades								
to the right								
speed (deg./s)	27	438.37	416.34	460.40	433.00	313.00	540.00	55.698
precision (%)	27	93.70	92.59	94.82	95.00	88.00	99.00	2.812
to the left								
speed (deg./s)	27	412.30	392.47	432.13	419.00	309.00	530.00	50.131
precision (%)	27	92.41	90.90	93.91	93.00	83.00	100.00	3.805
VNG -sinusoides								
R average ampl.	27	0.97	0.94	1.00	0.98	0.81	1.06	0.074
L average ampl.	27	0.93	0.90	0.96	0.94	0.73	1.06	0.082
posture tests - sitting position								
horizontal speed (deg/s)	27	0.13	0.08	0.18	0.10	0.00	0.40	0.127
vertical speed (deg/s)	27	0.27	0.17	0.37	0.20	0.00	0.80	0.254
diagonal speed (deg/s)	27	0.32	0.23	0.42	0.30	0.00	0.80	0.244
posture tests - Rose's position								
horizontal speed (deg/s)	27	0.27	0.12	0.42	0.10	0.00	1.50	0.376
vertical speed (deg/s)	27	0.62	0.36	0.88	0.40	0.00	2.30	0.660
diagonal speed (deg/s)	27	0.73	0.46	1.00	0.40	0.00	2.40	0.682
caloric tests								
excitability (deg/s) - R	19	16.02	10.55	21.48	14.90	5.30	55.60	11.334
excitability (deg/s) - L	8	16.75	6.27	27.23	13.55	4.90	36.30	12.533
directional preponderance								
absolute (deg/s) - R	18	0.53	0.36	0.69	0.50	0.00	1.20	0.329
absolute (deg/s) - L	9	0.71	0.44	0.98	0.60	0.30	1.20	0.348
relative (%) - R	16	11.69	6.35	17.03	9.00	1.00	35.00	10.025
relative (%) - L	11	13.45	6.64	20.27	13.00	4.00	39.00	10.143
deficiency (%) - R	9	14.78	8.18	21.38	17.00	1.00	24.00	8.585
deficiency (%) - L	18	14.50	11.10	17.90	15.00	3.00	23.00	6.828

modulation of response to the acoustic stimulation of the saccule is not fully known. Due to the complexity of the balance system and multicenter cortical activity, the determination of the damage focus on the basis of anomalous cVeMPs results is not yet possible. The data obtained in this study do not specify the anatomical background of CNS balance deficiency.

Conclusions

- It is impossible to locate the damaged area on the basis of cVeMPs results only, without additional tests, including scans.
- The functional assessment of the CNS in the cVeMPs reflex arc has a limited clinical value, as it requires correlation with the results of other tests.
- The usefulness of cVeMPs in the diagnosis of CNS-related balance deficiencies is limited and requires further research.

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Table 5. Comparison of cVeMPs results in the group of patients with CNS diseases
Tabela 5. Zestawienie wyników rejestracji cVeMPs w grupie chorych z dolegliwościami o podłożu ośrodkowym

	n	Average	confidence interval		median	min.	max.	SD±
			95%	+ 95%				
right ear								
P1 latency (ms)	36	18.65	17.42	19.88	18.00	10.34	27.67	3.64
N1 latency (ms)	36	27.79	26.61	28.97	27.67	21.67	36.67	3.49
amplitude (mV)	36	25.20	17.75	32.65	17.48	3.80	80.48	22.03
left ear								
P1 latency (ms)	36	18.50	16.38	20.63	17.00	13.34	51.67	6.28
N1 latency (ms)	36	27.94	25.69	30.18	27.34	18.67	58.67	6.63
amplitude (mV)	36	19.64	14.04	25.24	15.20	3.73	61.95	16.55

Table 6. Comparison of cVeMPs results in the group of patients with CNS diseases
Tabela 6. Zestawienie wyników rejestracji cVeMPs w grupie zdrowych ochotników

	n	Average	confidence interval		median	min.	max.	SD±
			95%	+95%				
right ear								
P1 latency (ms)	27	17.19	16.64	17.74	17.34	15.34	20.34	1.394
N1 latency (ms)	27	27.75	26.66	28.83	27.34	23.00	33.00	2.750
amplitude (mV)	27	51.27	35.60	66.95	41.68	8.44	188.43	39.624
left ear								
P1 latency (ms)	27	17.25	16.50	18.00	16.67	14.67	23.67	1.893
N1 latency (ms)	27	26.81	25.85	27.77	26.34	21.67	31.80	2.432
amplitude (mV)	27	41.78	29.42	54.14	36.11	5.89	136.50	31.249

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Table 7. Compared cVeMPs results in both groups
Tabela 7. Porównanie wyników rejestracji cVeMP dla obu grup

	Average		difference of averages	t	P
	study group	control group			
right ear					
P1 latency (ms)	18.65	17.19	1.46	1.978	0.049
N1 latency (ms)	27.79	27.75	0.05	0.055	0.956
amplitude (mV)	25.20	51.27	26.07	3.33	0.001
P1 latency (ms)	18.50	17.25	1.25	1.002	0.320
	27.94	26.81	1.13	0.841	0.404
amplitude (mV)	19.64	41.78	22.14	3.63	0.001

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Delayed splenic rupture - a case report

Dwuczasowe pęknięcie śledziony - opis przypadku

Edyta Santorek-Strumiłło, Marian Brocki, Anna Błażejczyk

Department of Thoracic, General and Oncological Surgery, Military Medical University Clinical Hospital in Łódź; Head: Prof. Marian Brocki MD, PhD

Abstract. Injuries of the spleen can be divided into single-stage rupture with massive bleeding and delayed, subcapsular, with the subcapsular hematoma. A capsule rupture may occur from several hours to twenty-six days after the trauma, mostly within the first seven days. Initially, the symptoms are not characteristic, abdominalgias of varying intensity, with symptoms of hemorrhagic shock appearing over time. The authors described this case to underline the possibility of subcapsular, delayed splenic rupture as a result of a slight trauma to the abdominal cavity.
Keywords: hemorrhage, spleen, trauma

Streszczenie. Urazy śledziony można podzielić na jednoczasowe pęknięcie z masywnym krwawieniem oraz odroczone, podtorebkowe z powstaniem krwiaka podtorebkowego. Do pęknięcia torebki może dochodzić od kilku godzin do 26 dni po urazie, najczęściej w ciągu pierwszych 7 dni. W początkowym okresie objawy są mato charakterystyczne, z czasem występują bóle brzucha o różnym nasileniu oraz objawy wstrząsu krwotocznego. Autorzy przedstawili poniższy przypadek, aby przypomnieć o możliwości wystąpienia podtorebkowego, dwuczasowego pęknięcia śledziony powstałego w wyniku niewielkiego urazu jamy brzusznej.
Słowa kluczowe: krwawienie, śledziona, uraz

Delivered: 23/09/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 53-54

Corresponding author:
Edyta Santorek-Strumiłło MD, PhD
1A Jagodnica St., 94-316 Łódź
telephone: +48607 42 09 15
e-mail: edysiaj@wp.pl

Introduction

Due to its structure and fragility, the spleen is one of the most frequently damaged organs of the abdomen due to blunt abdominal injuries. The spleen is usually damaged as part of injuries occurring to the left hypochondrium or left-side ribs (IX-XI).

Injuries to the spleen can be divided into single-stage ruptures with massive bleeding to the peritoneal cavity and delayed, subcapsular, with a subcapsular hematoma which breaks after various periods of time [1-3].

The most common symptoms include abdominal pain of various strengths and symptoms of hemorrhagic shock. In the case of subcapcular spleen rupture, the symptoms at the beginning are minor and it is only later, due to the increased pressure and the action of abdominal prelum, that the splenic capsule breaks and full-symptom hypovolemic shock develops [2-4].

Case report

A 35-year-old patient arrived at the Emergency Room (ER) due to abdominal pains. The medical history indicated strong pains in the epigastric region, lasting for several hours and accompanied by vomiting and fainting. The patient reported a blunt abdominal injury (hit in the abdomen by a ball during a football match) which had happened 5 days earlier and gave no symptoms. On the day of admission to hospital a second blunt abdominal injury took place (also during a football match). The physical examination revealed abdominal guarding, pain during palpation, clearly visible peritoneal signs and no peristalsis. Kehr's sign was described as positive. The patient was cardiovascularly and respiratorily stable, HR 85/min BP 80/140 mmHg. The results of the laboratory tests included HGB -12.2 g/L and RBC - 4.1 T/L, and in a plain abdominal X-ray could be seen a slight amount of free fluid in the abdominal cavity without the traits of pneumoperitoneum. The ultrasound (FAST) performed in ER showed free fluid in the vesicorectal space and an enlarged, heterogeneous spleen. This image led to the suspicion of a subcapsular hematoma. On the basis of the ultrasound scan it was decided that no further scans were required and the patient was sent for an urgent laparotomy and splenectomy. After opening the abdominal cavity, a substantial amount of hemolyzed blood was found in the free peritoneal cavity. In the splenic area, there was a significant amount of thrombi surrounding the whole spleen. After the thrombi had been removed, the anterior surface of the spleen became visible. It had numerous breaks and it was impossible to manage them in a safe way. Therefore, a decision was

made to perform a splenectomy. Other organs of the abdominal cavity were in good condition.

There were no complications after the surgery and the patient was discharged home on the third day after the procedure, in good general and local condition. The histopathological examination of the removed spleen confirmed the presence of many fissures and breaks (thickness up to 1 cm) and massive thrombi between the splenic capsule and the parenchyma. On the basis of the result of the histopathological examination and the clinical image, the patient was diagnosed with a delayed, subcapsular spleen rupture caused by the first injury.

Discussion

Abdominal injuries are a frequent type of injury, mainly due to the development of the automotive industry, and constitute about 4% of all bodily injuries. Due to the possible consequences of post-injury spleen rupture, both general practitioners and physicians from traumatology centers should bear in mind the possibility of a subcapsular spleen rupture. The capsule rupture may occur from several hours to 26 days after the trauma, mostly within the first seven days. Initially, the patients may not associate the present symptoms with an injury (especially if it is minor) that happened a few days earlier. In the initial phase, the symptoms are not characteristic and if a patient consults their physician it is because of additional injuries rather than a damaged spleen [3, 6]. In the beginning, the subcapsular hematoma exerts pressure on the spleen, which results in hemostasis but, due to a rapid pressure growth in the hepatic portal vein, defecation, physical effort or repeated injury, the splenic capsule breaks and causes full-symptom hemorrhagic shock along with an acute abdomen. In the first few hours after the splenic capsule rupture, the values of HGB and HCT may remain normal or be only slightly reduced [4, 7, 8]. In the studied case, the patient also did not link the symptoms with the injury he suffered five days earlier. The values of blood indicators also did not arouse any suspicion. The decisive examinations enabling a more precise diagnosis were abdominal CT and ultrasound. If a patient has recently suffered an injury and bleeding to the abdominal cavity is suspected, it is advisable to perform a FAST examination and assess if there is any free fluid in the abdominal cavity. A traditional ultrasound may, especially in the initial phase, give a falsely negative result, although repeating it during hospitalization of the patient allows the physicians to determine the correct diagnosis [2, 5, 7].

In the described case, the ultrasound image was clear and resulted in the decision concerning laparotomy and, during the surgery, concerning splenectomy. In many centers, about 50% of spleen injuries are successfully treated with conservative treatment or surgery which does not involve the removal of the spleen, but this does not apply to patients with subcapsular splenic rupture, where morphotic changes occurring between the injury and the rupture of the capsule practically exclude spleen-conserving surgery [1, 4].

Summary

The authors present this case to increase the awareness of physicians who have contact with post-injury patients, underlining that there is a possibility of delayed, subcapsular spleen rupture even in the case of a minor abdominal injury.

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Eosinophilic granulomatosis with polyangiitis (previously known as Churg-Strauss syndrome)

Ziarniniakowatość eozynofilowa z zapaleniem naczyń (dawniej zespół Churga i Strauss)

Sylwia Elert-Kopeć, Justyna Swarowska-Knap, Witold Tłustochowicz

Department of Internal Diseases and Rheumatology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw. Head: Prof. Witold Tłustochowicz MD, PhD

Abstract. Eosinophilic granulomatosis with polyangiitis (EGPA), formerly known as Churg-Strauss syndrome or allergic granulomatous polyangiitis, is a rare systemic disease of unknown etiology. EGPA is characterized by hypereosinophilia, signs of necrotizing angiitis of the small and medium-sized blood vessels, mainly in the airways. In medical practice it is a serious diagnostic and clinical problem. If diagnosed late and improperly treated, it can be hazardous to the patient's health and become life-threatening. This article presents a 53-year-old female hospitalized in the Department of Internal Diseases and Rheumatology due to recurrent fevers, hypereosinophilia with symptoms involving the respiratory and musculoskeletal systems.
Keywords: eosinophilic granulomatosis with polyangiitis, EGPA, Churg-Strauss syndrome, eosinophilia, ANCA

Streszczenie. Ziarniniakowatość eozynofilowa z zapaleniem naczyń (EGPA), zwana dawniej zespołem Churga i Strauss lub alergicznym ziarniniakowym zapaleniem naczyń, to rzadka układowa choroba o nieznanej etiopatologii. Przebiega z hipereozynofilią i objawami martwiczego zapalenia małych oraz średnich naczyń krwionośnych, głównie w drogach oddechowych. W praktyce lekarskiej stanowi poważny problem diagnostyczny i kliniczny. Zbyt późno rozpoznana i niewłaściwie leczona może stanowić zagrożenie dla zdrowia i życia chorego [1,2]. W artykule przedstawiono przypadek 53-letniej kobiety hospitalizowanej w Klinice Chorób Wewnętrznych i Reumatologii z powodu nawracających stanów gorączkowych oraz dużej hipereozynofilii z towarzyszącymi objawami ze strony układu oddechowego i mięśniowo-szkieletowego.
Słowa kluczowe: ziarniniakowatość eozynofilowa z zapaleniem naczyń, EGPA, zespół Churga i Strauss, eozynofilia, ANCA

Delivered: 03/11/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 55-57

Corresponding author:
Sylwia Elert-Kopeć MD
Department of Internal Diseases and Rheumatology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw
128 Szaserów St., 04-141 Warsaw
e-mail: sylwiaelert@op.pl

Introduction

Eosinophilic granulomatosis with polyangiitis (EGPA), previously known as Churg-Strauss syndrome, is a rare systemic disease of unknown etiology and immunopathogenesis. It was first described in 1951 as allergic granulomatous angioma and is characterized by necrotic inflammation of the small and medium vessels (secondary arteries, capillaries and secondary veins), eosinophilia in peripheral blood and the presence of granulomas and eosinophilic infiltrations in peripheral tissues [3]. The incidence in men and women is similar and the first symptoms appear usually in patients between the ages of twenty and thirty years. In about 80% of patients the disease attacks the upper respiratory tract. The characteristic symptoms include: sinusitis, allergic rhinitis and antrochoanaland ethmoidal polyps. EGPA is related to the presence of anti-neutrophil cytoplasmic antibodies (ANCA), reacting mainly with myeloperoxidase (MPO-ANCA). They are present in about 40-50% of the patients, but the lack of ANCA does not exclude the diagnosis of this disease.

Case report

A 53-year old woman was admitted to the Department of Internal Diseases and Rheumatology of the Military Institute of Medicine because of intensifying fatigue, pains in the epigastric area, generalized arthalgia, loss of weight, symmetric edema of the ankles and paresthesia in the lower limbs. The first symptoms appeared in 2011 during her stay in the USA. From then on, the patient

suffered from recurring fever up to 39°C, strong cough with expectoration of mucus and attacks of dyspnea accompanied by wheezing, requiring the administration of inhaled glucocorticoids (GCs). She was repeatedly treated with antibiotics, which brought short-term improvement. About five years earlier, she had an operation for chronic rhinosinusitis. For many years, the patient had been spending several months a year in one of the countries of the Far East. During the last stay there, due to persistent symptoms, she was diagnosed in an infectious diseases hospital. The laboratory tests revealed normocytic anemia (HGB 9.4 g/dL, HCT 27%, MCV 92%), accelerated ESR (77mm/h), increased CRP concentration (58 mg/L), significantly raised IgE titre (>1000 U/L) and severe eosinophilia (up to 60%). Diagnostic tests for tropical and parasitic diseases were negative. After the patient returned to Poland, she was diagnosed at several specialist centers. In the chest X-ray, there were massive densities in the superior field of the right lung and mottling densities in the middle field of the left lung. In the chest HRCT, one could observe ground-glass infiltrative lesions in the superior lobe of the right lung, smaller foci in the left lung and moderately enlarged mediastinal and hilar lymph nodes. A bronchoscopy with transbronchial lung biopsy (right superior lobe) and bronchoalveolar lavage (BAL) were conducted. No pathogens were cultured from the bronchial mucuc. In the BAL, a significant eosinophilia of 23.9% was determined. The histopathological examination of the lung specimen was inconclusive. Because of epigastic pains, an abdominal ultrasound was undertaken, which revealed the thickening of the gastric body wall. Later, a panendoscopy was conducted, in which an edema and congestion of the pyloric mucosa was observed. The histopathological examination of stomach specimens showed numerous infiltrations of eosinocytes. Finally, chronic eosinophilic pneumonia was diagnosed. The therapy included three pulse doses of methylprednisolone (40 mg each in I.V.) and then oral prednisone (dose: 1mg/kg bw/day, and resulted in a significant improvement of the general condition, disappearance of fever and reduction of the eosinophilia. Because of the bronchial asthma confirmed in the lung function tests, the treatment with GCs and long-acting beta-agonists (LABA) was maintained.

In the differential diagnosis, eosinophilic leukemia was also taken into account. The following examinations did not confirm this diagnosis: cytogenetic and molecular tests, trephine biopsy of the bone marrow and myelogram.

On admission to the Department of Internal Diseases and Rheumatology, the patient was in relatively good general condition, with no fever, and both cardiovascularly and respiratorily stable. The physical examination revealed she was underweight (BMI 17), with livedo reticularis on both lower limbs, symmetric edema of the ankles and bronchial murmur over the superior field of the right lung. Laboratory tests showed increased IgE titre (161 IU/mL) and slight eosinophilia (6.8%), other inflammation indicators, renal function parameters and the activity of aminotransferases remained within the norms. The tests for ANA, p/ANCA, c/ANCA and RF antibodies gave negative results, while densitometry revealed osteoporosis. The histopathological examination of a dermomuscular specimen from the deltoid muscle showed polyangitis with a major eosinophilic infiltration. Electromyography and nerve conduction tests showed a bilateral fibular neuropathy.

The whole clinical image and the results of the examinations led to the diagnosis of eosinophilic granulomatosis with polyangiitis. Methotrexate (MTX) was administered as a treatment, in the initial dose of 15 mg/week, and the oral prednisone was maintained. Due to gastrointestinal disorders (strong nausea, diarrhea) and significantly lowered mood after both oral and subcutaneous administration of MTX, it was decided to withdraw MTX and change it for azathioprine (AZA, 2.5 mg/kg bw/day). Because of the confirmation of osteoporosis in the densitometry, the prednisone dose was reduced to 0.35 mg/kg bw/day. The therapy (AZA + GCs) led to the disappearance of the inflammatory symptoms, the indicators of inflammation and number of eosinophiles returned to normal values. Check-up scans performed after six months showed full regression of the pulmonary lesions. Currently, the patient takes azathioprine (100 mg/day) and prednisone (5 mg/day).

Discussion

According to ACR criteria from 1990, the diagnosis of this disease must be based on the existence of four of six criteria: asthma, eosinophilia >10% in the blood smear, mononeuropathy (can be multifocal) or polineuropathy, slight infiltrations in the lungs, lesions in the paranasal sinuses, and extravascular eosinophilic infiltrations. The sensitivity of the ACT criteria is 71-95.3%, and its specificity ranges from 78.7 to 99.7% [4]. Our patient met all six criteria.

Researchers stress the role of ANCA antibodies against myeloperoxidase (MPO-ANCA) in the pathogenesis of the disease [5]. They are present in about 40-50% of cases of patients with Churg-Strauss syndrome. This group is characterized by higher incidence of glomerulonephrities, alveolar bleedings and mononeuritis multiplex. The remaining group of patients, in whom no ANCA are detected, feature higher peripheral blood eosinophilia and eosinophilic infiltrations in the tissues. This was the case in our patient. Asthma is a typical symptom, which may precede the phase with polyangitis by many years. Asthma is often related to allergic rhinitis, nasal polyps and chronic rhinosinusitis, exacerbations occur usually when the disease process of polyangitis turns systemic. It is resistant to treatment although its symptoms become milder after treatment with oral glucocorticoids. In 80% of patients it is impossible to remove all the symptoms of asthma in spite of applying the correct treatment.

Another typical symptom involves light alveolar densities in the lungs with no typical location or tendency to create cavities. Peripheral neuropathy is diagnosed in 50-78% of the patients; it may be of a sensory or motor character and usually is asymmetric, more often situated in the legs. It is especially frequent in the case of the sciatic nerve and its branches: the tibial nerve and the common fibular nerve, while other nerves such as the radial, ulnar and medial nerve are affected less often. Locomotor disorders may occur suddenly and may be

preceded by an attack on the sensory nerves, which leads to paresthesiae and pain in the area innervated by the damaged nerve. Of those patients with peripheral neuropathy, 50-71% have *mononeuritis multiplex,* 5-29% have asymmetric polyneuropathy and 0-35% symmetric polyneuropathy, Peripheral neuropathy does not always withdraw during the treatment. CNS damage is much less frequent than peripheral neuropathy (6.3-25% of the cases, according to the literature). Skin lesions appear in 40-70% of the patients and are usually a consequence of the inflammation of small cutaneous vessels. Purpura is visible in half of patients while subcutaneous nodules are present in approximately 30%. Biopsies may reveal extravascular granulomae. They are very characteristic but not pathognomonic. Other described lesions include: livedo reticularis (6%), urticaria (9%), point skin necrosis, nodules, blisters and ischemia of fingers. The most serious complication is cardiac involvement (up to 60% of cases), mainly in the form of myocarditis, coronary vasculitis and effusive pericarditis. It correlates with a high death risk [6]. The type of chosen treatment scheme depends on the risk of functional damage to the most important organs. A golden standard is the administration of glucocorticoids (1 mg/kg bw/day). Cyclophosphamide is used in the case of an increasing renal failure, proteinuria > 1.0 g/d, or if the disease affects the heart, CNS or gastrointestinal tract [7-9]. In other cases, glucocorticoid therapy is accompanied by methotrexate. The drugs recommended for conservative treatment include: methotrexate (15-30 mg/week), azathioprine (2 mg/kg bw/day) and, possibly, leflunomide (20-30 mg/day) [8-11].

Summary

Eosinophilic granulomatosis with polyangiitis (EGPA) still remains a difficult diagnostic problem, not only in Poland but worldwide. Thanks to combination treatment with glucocorticoids and immunosuppressive drugs, a remission was achieved. In order to keep this remission, immunosuppressive therapy will have to be continued. Long-term treatment with oral glococorticoids is not necessary and it is recommended only in very serious cases.

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The coexistence of urticaria pigmentosa and serious anaphylactic reactions to wasp venom - a case report

Współistnienie pokrzywki barwnikowej i ciężkich reakcji anafilaktycznych na jad osy - opis przypadku

Grażyna Sławeta[1], Krzysztof Kłos[2], Jerzy Kruszewski[2], Marek Niedoszytko[3], Szczepan Cierniak[4]

[1]Allergology Clinic in Starachowice; Head of the Provincial Healthcare Facility: Sebastian Petrykowski
[2]Infectious Diseases and Allergology Clinic, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; Head: Prof. Jerzy Kruszewski MD, PhD
[3]Allergology Clinic in Gdańsk; Head: Prof. Ewa Jassem MD, PhD
[4]Pathomorphology Department, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; Head: Prof. Wojciech Kozłowski MD, PhD

Abstract. The paper presents the case of a 63-year-old female patient (farmer) with chronic adult-onset urticaria pigmentosa, without manifestations of systemic mastocytosis. She had coexistent IgE-mediated hypersensitivity to Hymenoptera venom with episodes of anaphylactic reactions. The patient had been under dermatological supervision due to systemic urticaria pigmentosa since she was 49 years old. Her past medical history was negative for internal disorders. She had been stung by Hymenoptera twice (in 2004 and 2007), in her neck and right palm. The first incident (insect unknown) resulted in a severe anaphylactic reaction, grade 4 according to the Mueller scale, and the second incident, most probably a wasp sting, led to milder, but still generalized symptoms (grade 2/3). Due to the severity of anaphylactic reactions and her exposure-prone profession the patient was referred for diagnostics to a specialized center. Based on the test results, the patient was diagnosed with an IgE-mediated wasp venom allergy. Systemic mastocytosis and autoimmune urticaria were excluded. Applied oral antihistamines (H1- and H2-blockers: cetirizine dihydrochloride) and ketotifen reduced the intensity of cutaneous eruptions and itching sensations, but did not result in a complete remission. A low histamine diet was also recommended. The patient was qualified for allergen specific immunotherapy and was equipped with an anaphylaxis kit.
Key words: urticaria pigmentosa, anaphylactic reaction to wasp venom

Streszczenie. Przedstawiono przypadek 63-letniej pacjentki (rolniczki) chorującej na przewlekłą pokrzywkę barwnikową, która wystąpiła w wieku dorosłym, bez objawów mastocytozy układowej. U chorej współistniało uczulenie na jady owadów błonkoskrzydłych, warunkujące objawy układowych reakcji anafilaktycznych. Chora od 49. roku życia pozostawała pod opieką dermatologiczną z powodu uogólnionej pokrzywki barwnikowej. Wywiad internistyczny nie był obciążający. Pacjentka była dwukrotnie żądlona (2004 i 2007 r.) przez owada błonkoskrzydłego w okolicę szyi i dłoniową powierzchnię ręki prawej. Na skutek pierwszego użądlenia (owad nieznany) wystąpiła ciężka anafilaksja układowa -IV stopień wg Muellera. Drugie żądlenie (prawdopodobnie osa), wywołało objawy ogólne o łagodniejszym przebiegu -II/III stopień wg Muellera. Ze względu na wystąpienie objawów ciężkiej anafilaksji układowej i wykonywany zawód chorą skierowano do ośrodka specjalistycznego w celu przeprowadzenia dalszej diagnostyki. Na podstawie uzyskanych wyników badań udokumentowano nadwrażliwość na alergeny jadu osy, IgE-zależną. Wykluczono mastocytozę układową i pokrzywkę autoimmunologiczną. Zastosowane leki przeciwhistaminowe (H1- i H2-blokery - dichlorowodorek cetyryzyny) oraz ketotifen zmniejszały intensywność zmian skórnych i świądu, nie powodując jednak całkowitej remisji choroby. Pacjentce polecono stosowanie diety ubogohistaminowej. Zakwalifikowano ją również do immunoterapii swoistej i wyposażono w zestaw przeciwwstrząsowy.
Słowa kluczowe: pokrzywka barwnikowa, reakcja anafilaktyczna na jad osy

Delivered: 15/12/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 58-63

Corresponding author:
Grażyna Sławeta MD, PhD
Allergology Clinic
70 Radomska St., 27-200 Starachowice
telephone: +48600996 033
e-mail: gslaweta@poczta.onet.pl

The paper presents the case of a female patient with urticaria pigmentosa and episodes of severe anaphylactic reactions after stings by insects belonging to Hymenoptera (including wasps), with excluded systemic mastocytosis.

Case report

In 2008, a 63-year-old female patient, a farmer, visited the allergology clinic for diagnostic examinations due to systemic anaphylactic reactions after having been stung by insects.

The patient had been under dermatological supervision due to systemic urticaria pigmentosa since she was 49 years old (diagnosis confirmed by the histopathological examination of a skin specimen).

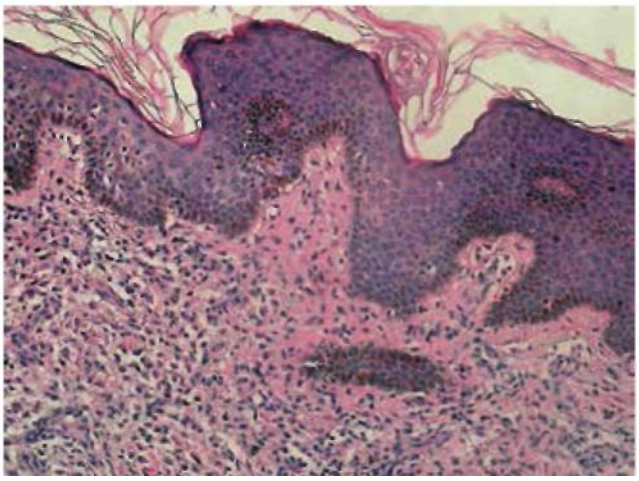

Figure 1. Urticaria pigmentosa (HE stain, magnification x 200)
Rycina 1. Pokrzywka barwnikowa (barwienie HE, powiększenie x 200)

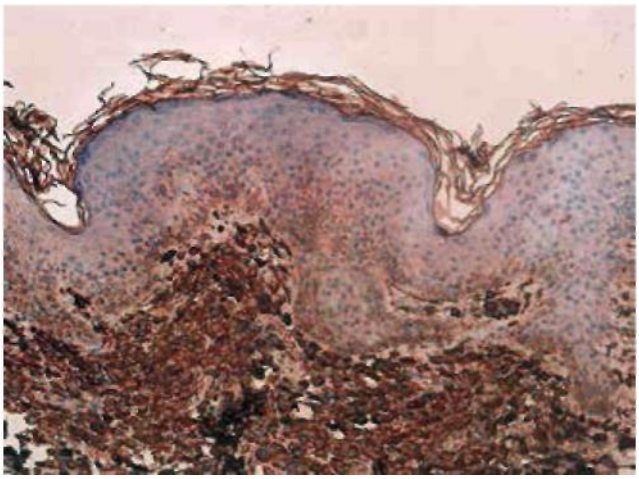

Figure 2. Urticaria pigmentosa (ICH stain, magnification x 200)
Rycina 2. Pokrzywka barwnikowa (barwienie ICH, powiększenie x 200)

1. The skin sample was covered with normal epidermis. In the dermis, averagely abundant, with perivascular inflammatory infiltrations of lymphocytes, histiocytes and numerous mast cells, as well as many dispersed mast cells, mainly in the stratum papillare. Giemsa stain (+++). The histological image may correspond to urticaria pigmentosa.
2. The microscopic image of the analyzed sample corresponds to: *Urticaria pigmentosa.* Mast cells +

On the day of consultation, the skin was covered with numerous mottling exanthema. The lesions were rounded, pink to red or yellow-brown. They were dispersed on the skin of the trunk, abdomen as well as upper and lower limbs and accompanied by slight pruritus.

Despite the treatment (second generation antihistamines - cetirizine dihydrochloride 40 mg and 20 mg a day), the lesions did not exhibit any tendency to subdue.

The first sting (insect unknown) was in the neck and took place in 2004. From the available documentation, this was an episode featuring a loss of consciousness, which can be classified as a severe anaphylactic reaction, grade 4 according to the Mueller scale. As a result of losing consciousness, the patient suffered a head injury. The wound required stitches and dressing. The family relates that trismus appeared, but no convulsions were observed. In order to exclude epilepsy, the patient was hospitalized for five days in a neurology unit, where on the basis of clinical observation and additional tests, she was diagnosed with a transitory brain ischemia in the course of the anaphylactic reaction.

The second sting (in the palm), probably by a wasp, took place in 2007 while the patient was picking apples in an orchard. It caused a systemic pruritus, weakening, anxiety and nausea, with no loss of consciousness. The patient was hospitalized in the internal diseases unit, where she was diagnosed with anaphylactic reaction, grade 2/3 according to the Mueller scale, as a result of the wasp sting.

In the allergology clinic, she underwent a broad range of diagnostic examinations, including an assay of serum concentration of venom-specific IgE (SIgE wasp 0.65 kU/L, SIgE bee 0.32 kU/L [East Allergy test, immunoenzymatic method) and triptase activity (norm: 0-11.4 µg/L [UniCAP, Białystok]) and, because of the severe anaphylactic reaction and the profession, she was referred for further diagnosis to the Clinic of Infectious Diseases and Allergology in Warsaw and to the Allergology Clinic of the Medical Academy Hospital in Gdańsk. The results of the examination led to the conclusions that there were no abnormalities in the scans, triptase activity, C3 or C4 components, autologous serum test or myelogram (average number of cells in the bone marrow, normal image). Systemic mastocytosis and autoimmune urticaria were excluded (in bone marrow cytology and peripheral blood cytometry).

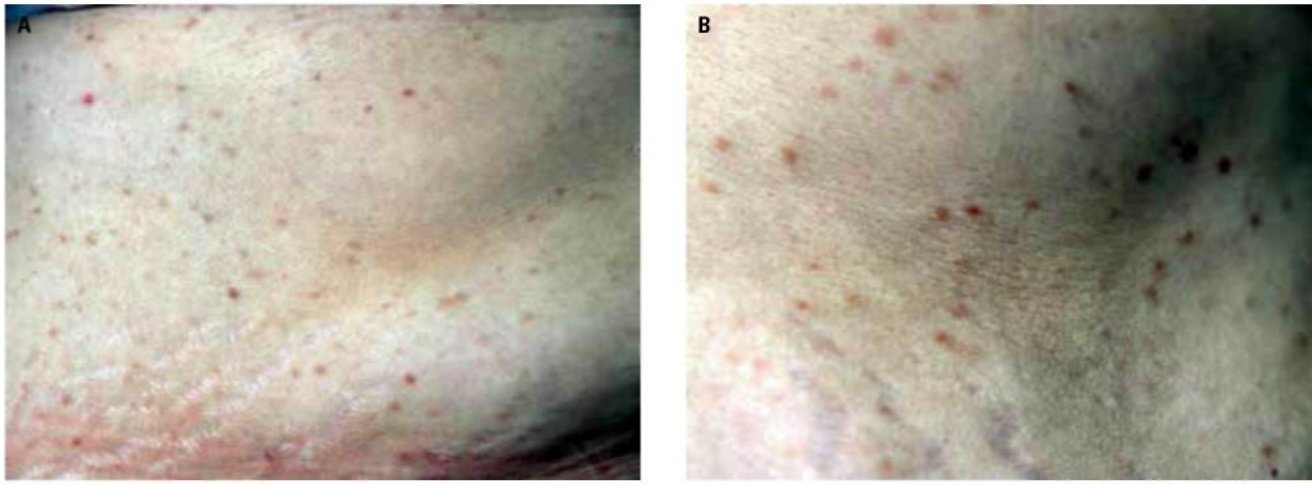

Figure 3A-B. Urticaria pigmentosa macular lesions
Rycina 3A-B. Pokrzywka barwnikowa, zmiany plamiste

Bone marrow cytology

Follicular bone marrow of average cellularity. Erythroblastic system: normoblastic maturation route, no dysplastic lesions. Granuloid cell system: normal. Lymphatic system: normal. Thrombopoietic system represented by numerous megakaryocytes.

Conclusions: No morphological traits of systemic mastocytosis (K.L. MD, PhD).

Genetic test for D816V mutation of KIT gene (result: >3%).

Assay of serum concentration of venom-specific IgE: SIgE wasp 0.65 kU/L - class 2, SIgE bee 0.32 kU/L - class 0 (East Allergy test, immunoenzymatic method).

The results of skin prick tests with wasp venom (concentrations: 1 µg/mL and 100 µg/mL) were negative, the positive control was positive and the negative control was negative. The intradermal tests with insect venoms confirmed the hypersensitivity to wasp venom (the results were positive for the venom concentration of 0.001 µg/mL, so tests with larger concentration were not performed).

Methods: prick skin tests with insect venom, two concentrations 0.001 µg/mL and 100 µg/mL, with positive control (histamine) and negative diluent test (saline), done with prick skin test method; intradermal tests for insect venom with the venom concentrations 0.0001 µg/mL, 0.001 µg/mL, 0.01µg/m:, 0.1 µg/mL and 1 µg/mL, with positive and negative controls as above).

Recommended antihistamine drugs (H1- and H2-blocks, cetirizine hydrochloride, 40 mg once a day and 20 mg once a day), including periodic ketotifen 2 mg a day, reduced the intensity of the lesions and pruritus, but did not lead to full remission of the disease. The patient was recommended to begin a low-histamine diet and was sent for VIT desensitization for wasp venom with the use of the conventional method. She was instructed how to respond in case of a future sting and equipped with an anti-shock first aid kit.

Currently, the patient is treated with conventional allergen immunotherapy to wasp venom in the Allergology Department of the University Hospital in Kraków. The initial vaccine was Venomenhal wasp, and then Alutard SQ wasp 100 µg in maintenance doses (one application every 6-8 weeks). The desensitization has no local or systemic complications. In the morning of the vaccination day, the patient takes fexofenadine hydrochloride (180mg once a day). The vaccinations have no impact on the course of urticaria pigmentosa. The exenthum does not change morphologically and persists.

In the second year of desensitization, after a sting by a bee in the middle finger of the right hand, the patient had no symptoms of anaphylactic reaction.

Discussion

The studied case shows a rare coexistence of urticaria pigmentosa and hypersensitivity to Hymenoptera venom, manifesting itself through severe systemic anaphylactic reactions. This concurrence was the basis to suspect systemic mastocytosis that, as a heterogeneous group of rare (>0.01% of the population) diseases characterized by overproliferation and accumulation of mast cells in the skin and/or internal organs, could be the basis of the anaphylactic symptoms in the patient. On the basis of the diagnostic tests, systemic mastocytosis was definitely excluded.

The bone marrow trephine biopsy and cytology (no characteristic morphological traits of mastocytosis), immunohistochemical tests, histopathological examination, genetic tests for the D816V mutation of *KIT* gene (>3%) and the triptase activity of 3.37 µg/mL (norm: 0-11.4 µg/L) excluded aggressive mastocytosis. Systemic mastocytosis is diagnosed by

the presence of 1 major and 1 minor, or 3 minor, WHO criteria [1, 2].

The major criterion is the determination of multifocal, cohesive mast cell infiltration (MC) >15 MC in the aggregate from bone marrow or other organs apart from the skin by means of IHC stains (triptase) or other specific stains. Minor criteria include the observation of over 25% of mast cells of atopic shape in the cytology, point mutation *c-kit* in codon 816 in the bone marrow, blood or organs other than skin, expression of CD2 and CD25 on monocytes and active triptase (>20 μg/mL) in the peripheral blood serum [1].

Urticaria pigmentosa is an acknowledged risk factor for the development of severe anaphylactic reactions. Those patients with any type of mastocytosis may experience life-threatening symptoms caused by the rapid release of mast cell mediators, such as: hypotension, anaphylactic reactions, hypertension, diarrhea, abdominal pains, fever and dyspnea. The symptoms may be induced by allergens, mainly wasp, bee and hornet venom, food and air-related allergens, a range of drugs, such as non-steroidal anti-inflammatory drugs, (NSAIDs), anesthetic drugs, antibiotics, opioids and a- and P-blockers, as well as physical factors such as effort, stress, low or high temperature and alcohol [3-10].

The clinical systemic symptoms are therefore caused by factors triggering IgE-dependent reactions or by other immune mechanisms [4, 5]. The symptoms may be intensified by concurrent diseases, such as IgE-dependent allergies, active infections, autoimmune diseases or gastric or duodenal ulcers.

It is worth noting that diagnostic skin tests in patients with urticaria pigmentosa should be done with special care, having ensured venous access and antishock treatment possibilities [11]. It is known that a special form of intolerance is hypersensitivity to drugs. There are described cases of patients with urticaria pigmentosa who died of shock after orthopedic surgery or during endoscopy [12, 13].

Those patients with urticaria pigmentosa are also a high-risk group in relation to the development of anaphylactic reactions following stings by Hymenoptera insects and exposure to various environmental allergens, drugs or physical factors.

Therefore, the recommendations include a low-histamine diet and avoiding drugs which may induce the non-immune degranulation of the mast cells, as well as physical factors which may lead to massive histamine release and exacerbate skin reactions (sudden temperature changes, mechanical irritation, massage, sudden physical effort, etc.) [14-16].

In this context, it was very important to diagnose the allergies to insect venom in the patient and recommend immunotherapy, which as can be seen from the further course of the disease enabled limitation of the activity of one of the factors which causes sudden, life-threatening histamine release.

In the case of hypersensitivity to the venom of Hymenoptera, the most advisable treatment for patients with grade 3/4 according to the Mueller scale [17] is venom immunotherapy (VIT) [18-20]. The risk of systemic reaction after a sting in the general population of this group of patient is about 70%, while in the patients with mastocytosis it reaches 100%. In the case of a wasp sting, the risk is lesser because the venom may not penetrate into the body [21]. VIT is a form of subcutaneous injection, and the initial phase of VIT can be conducted with the conventional, rush or ultrarush method. After reaching the maintenance dose, the risk of anaphylactic reaction decreases to 2-3% and is similar to the risk of such reaction in the general population. In the majority of cases, the desensitization lasts 5 years, while in those patients with concurrent mastocytosis it should be maintained till the end of their lives [19].

The described patient was sent for desensitization due to the past anaphylactic reactions, her profession (farmer) as well as high levels of fear and lowered life quality related to the danger of a future sting and a systemic reaction. The hypersensitivity to wasp venom was confirmed by sIgE tests for wasp venom and by intradermic tests. Mastocytosis is one of the risk factors of VIT in patients hypersensitive to the venom of Hymenoptera [22, 23]. Some centers consider mastocytosis to be a counterindication against this type of treatment, mainly due to the more frequent adverse effects and lesser efficiency [24]. Other centers consider it as an indication to VIT [18, 23, 25]. Currently, it is impossible to assess the risk of an anaphylactic reaction in patients with mastocytosis on the basis of diagnostic tests.

The frequency of adverse effects during the treatment depends on the venom used, and it is higher in patients treated for allergy to wasp venom. There are studied cases of deaths of patients with mastocytosis, who died despite earlier immunotherapy [26]. Because of the adverse effects, premedication methods are used which consist of the administration of antihistamine drugs, steroids, cromoglycates, monitoring of the patient [27], depot administration as well as administration of omalizumab [20, 21, 24, 26-29]. The latest research into anti-IgE therapy (omalizumab) indicate a possibility of preventing anaphylaxis in patients with systemic mastocytosis [29].

The wasp venom immunotherapy in the studied patient did not result in any complications. The maintenance dose of the vaccine was 100 μg of the venom. No provocations by living insect have been made. The lesions characteristic of urticaria pigmentosa are still present and rather than being related to venom hypersensitivity they are only concurrent with it. The appearance of the exanthum has not changed. In the second year of the desensitization, a bee sting caused no anaphylactic reaction symptoms. The patients should remain under dermatological supervision and be treated allergologically. In patients with adult-onset urticaria pigmentosa, the lesions are usually of stationary character or their number increases with the course of

the disease. In the majority of cases, after some time the disease transforms into its systemic form, affecting the bone marrow, digestive system and other organs [3, 7, 30-32, 35, 38].

Systemic mastocytosis is a rare and serious disease affecting mainly adults. The disease process usually affects the bone marrow, bones, liver, spleen and lymph nodes. Mast cell infiltrations appear also in the digestive system, kidneys, lungs, skeletal muscles, cardiac muscle, pericardium, intestines and many other tissues [7, 30, 32, 35]. Sometimes the skin lesions subdue without treatment over many years [30].

Child-onset urticaria pigmentosa has generally a mild course and in many cases (approx. 50%) disappears before or during puberty. Very rarely, it transforms into another hematological disease, associated clone hematologic non-MC-lineage disease (AHNMD) [8, 34, 36, 37].

The aggressive form of the disease is very rare, occurring in less than 5% of adult patients and extremely rarely in children [1, 37]. Skin mastocytosis and benign systemic mastocytosis require medical supervision and symptomatic treatment. In the case of single lesions, local steroid creams or ointments are used together with antipruritic medications. In patients with dispersed lesions, antihistamine drugs are used from H_1 and H_2 receptor antagonists, doxepin, ketotifen, NSAIDs and sodium cromoglicate. General therapy with corticosteroids usually does not bring the desired effects, but may sometimes be used in patients with severe forms of dispersed skin mastocytosis and people with absorption disorders.

Cyclosporine A is also used, and the latest research indicates good results of general therapy with a_2b interferon. In the case of dispersed skin mastocytosis, i.e. urticaria pigmenrosa or telangiectasia macularis eruptiva perstans, the advisable treatment is PUVA therapy [30]. The observations of American researchers suggest the possibility of treatment of severe cases of chronic urticaria resistant to traditional treatment with omalizumab, a humanized monoclonal IgGI antibody which recognizes and masks specific epitomes of IgE antibodies and therefore blocks this immunoglobulin from binding with receptors on the surface of the mast cells and basophiles. The obvious limit of introducing this therapy as a routine one is its very high cost as well as the lack of controlled clinical trials associated with it [38, 39]. Splenectomy is recommended for reducing thrombocytopenia in the course of aggressive mastocytosis [3]. Some researchers have shown a beneficial impact of *KIT* ligand inhibitors in the therapy of mastocytosis in adults and atypical cases of this disease in children. Cladribine (2-chlorodeoxyadenosine) is efficient here, and is also used in the therapy of chronic lymphoproliferative disorders i.e. non-Hodgkin lymphoma with low degree of malignancy and chronic lymphocytic leukemia [41].

It is recommended that patients with mastocytosis should be on a low-histamine diet [3] and carry an anti-shock first aid kit - a syringe with epinephrine [1, 21, 24]. If the lesions are very intense and there is high risk of shock, the patients should carry information about their disease (e.g. a bracelet) and inform the anesthesiologist about it in the case of anesthesia [5].

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Laboratory tests during ISAF operations in Afghanistan

Badania laboratoryjne w warunkach operacji ISAF w Afganistanie

Sylwia Płaczkowska,[1] Jakub Szyller,[2] Lilia Pawlik-Sobecka,[1] Izabella Kokot,[1] Grażyna Goryszewska[3]

[1] Department of Professional Training in Clinical Chemistry, Faculty of Pharmacy with Medical Laboratory Diagnostics Unit, Wroclaw Medical University; head: Lilia Pawlik-Sobecka PhD
[2] Student Scientific Association of the Department of Professional Training in Clinical Chemistry, Faculty of Pharmacy with Medical Laboratory Diagnostics Unit, Wroclaw Medical University
[3] Military Centre of Preventive Medicine in Krakow

Abstract. The military activities in Afghanistan are among the most dangerous operations in the world. Every year, dozens of soldiers and civilians lose their lives, and hundreds are wounded. It is very important to provide them with access to high level medical care. This involves not only basic ambulatory assistance, but creating a field hospital with emergency rooms, operating rooms, intensive care units, diagnostic imaging equipment and medical laboratory. The ability to perform appropriate medical diagnosis is important due to the nature of the diseases caused by environmental factors such as warfare, harsh climatic conditions, and low hygiene and sanitary standards. The study briefly describes the nature of the medical assistance as well as the structure and operation of a laboratory under field conditions illustrated by the example of the Medical Support Group in the Polish Military Contingent in Afghanistan.
Key words: laboratory diagnostics, Afghanistan, ISAF

Streszczenie. Działania militarne w Afganistanie należą do najniebezpieczniejszych operacji na świecie. Każdego roku dziesiątki żołnierzy i osób cywilnych tracą życie, setki zostają ranne. Bardzo ważne jest zapewnienie im dostępu do opieki medycznej na wysokim poziomie. Wiąże się to nie tylko z udzielaniem podstawowej pomocy w trybie ambulatoryjnym, ale również ze stworzeniem szpitala polowego mającego w swojej strukturze izbę przyjęć, sale operacyjne i intensywnej opieki medycznej, sprzęt do diagnostyki obrazowej oraz laboratorium medyczne. Możliwość wykonania odpowiedniej diagnostyki medycznej jest ważna ze względu na choroby spowodowane czynnikami środowiskowymi, takimi jak działania wojenne, ciężkie warunki klimatyczne czy niski poziom higieniczno-sanitarny. W pracy przedstawiono specyfikę zabezpieczenia medycznego oraz strukturę i funkcjonowanie laboratorium w warunkach polowych na przykładzie Grupy Zabezpieczenia Medycznego w Polskim Kontyngencie Wojskowym w Afganistanie.
Słowa kluczowe: diagnostyka laboratoryjna, Afganistan, ISAF

Delivered: 19/08/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 64-69

Corresponding author:
Sylwia Płaczkowska
Department of Professional Training in Clinical Chemistry
211 A Borowska St., 50-556 Wrocław
telephone: +48 71 784 01 53,
telephone /fax: +48 71 784 01 54

Introduction

The armed conflict in Afghanistan, continuing since 2001, is the longest conflict of its type since the Vietnam War, and one of the most dangerous military operations in the world. Stabilization in Afghanistan is maintained by the International Security Assistance Force (ISAF), operating on behalf of NATO (North Atlantic Treaty Organization). At the end of 2013, the ISAF comprised 87,000 soldiers and military employees from 49 countries, including the Polish Military Contingent (PMC) of 1,170 soldiers [1]. In June 2013, after 12 years of stabilization activities, the responsibility for the country's safety was passed to the Afghan forces. Due to the large number of people engaged in the conflict, and the losses suffered by both soldiers and civilians, it was necessary to provide proper medical support in compliance with the Geneva Conventions. In the years 2001-2003, 3,409 people of the coalition forces lost their lives; in the U.S. Forces alone 19,500 soldiers were injured [2, 3]. Estimations regarding Afghan citizens, available at the Cost of War project website, mention approximately 19,000 civilians killed during the conflict [4]. The numbers presented indicate the need to provide medical care of

the highest possible quality. According to the NATO procedures, medical support is a significant element of military operations. Apart from soldiers participating in combat, the military health service is also engaged in conflicts. The Medical Support Group (MSG, level 2) of the PMC in the Ghazni base in eastern Afghanistan comprised physicians, nurses, paramedics, laboratory diagnosticians and support staff. In the largest military bases in Bagram, Mazar-e-Sharif, Kandahar as well as Ghazni, the field hospitals included integrated diagnostics laboratories.

This article presents the specifics of medical support, as well as the structure and functioning of a laboratory in field conditions, based on the Medical Support Group of the Polish Military Contingent in Afghanistan.

Medical support for military operations

Following the NATO Allied Joint Medical Support Doctrine AJP-4.10 (A), a four-level structure of medical support was implemented *(Roles 1-4).* Each level was characterized by increasing the scope of the medical services provided (Table 1) [5]. The hierarchical division of competences enables assistance to be offered at the appropriate time for the order and scope of the procedures [6]. An effectively functioning system ensures proper medical care for each soldier, while if the provision of such care is not possible, e.g. in the combat zones, the system enables MEDEVAC *(medical evacuation)* to levels 1 to 4 (Roles 1-4) of the military treatment facilities (IMTF). The type of activities and the medical equipment used at different levels is conditional upon the scope of the procedures applied. At level 1 basic medical care may be supported by laboratory tests, while the highest level, available outside the military theatre *(Role 4),* provides full, multi-profile medical care, and thus the widest range of laboratory tests.

The primary tasks of medical personnel in the armed conflict area, resulting from the basic principles of emergency medicine, include the evacuation of casualties from the combat zone, triage, stabilization and maintaining of vital functions or performing life-saving procedures. Care over casualties in the combat zone is based on the TCCC (tactical combat casualty care) principles, and requires the unconditional subordination of the medical personnel to the tactical situation [7]. Tasks performed in a field hospital typically occur away from the combat zone, and therefore do not require the direct involvement of the medical personnel (including laboratory diagnosticians) in tactical or combat operations, as is the case with paramedics operating outside the military base area. However, this does not mean that special training or preparation for performing tasks in specific circumstances are not necessary for the medical personnel of a stationary field hospital. Although prehospital activities conducted in the combat zones by trained medical staff (mostly paramedics) significantly differ from those performed in civil environment, the performance of laboratory tests in the war zone should comply with the general standards for diagnostic laboratories.

Environmental dangers regarding military operations in Afghanistan

Afghanistan is a high-altitude country with a dry, subtropical climate. In the hottest months (July-August) the temperature reaches 45°C in the eastern part of the country, whereas it is only 5°C in the Hindu Kush area. Winters are cold, while daily and yearly temperature amplitudes may be very large. Due to these climatic conditions, one of the greatest dangers to the health of the soldiers participating in operations in Afghanistan was thermal injury. The significant physical effort caused by frequent long distance foot patrols, and the associated dehydration, resulted in an immediate threat to the health or life [8]. On the other hand, the participants of the military mission in Afghanistan experienced low temperatures which, since they were at high altitudes, led to the risk of hypoxia and hypopressure [9].

Due to the difficult epidemiological situation in Afghanistan, both the local population and soldiers of the international forces were exposed to gastrointestinal pathogens *(Escherichia coli, Shigella, Salmonella, and Campylobacter),* as well as respiratory system pathogens *(Streptococcus pneumoniae, Mycoplasma pneumoniae and* adenoviruses) [10]. According to Aronson et al., over half of the U.S. Forces soldiers deployed to Afghanistan reported at least one episode of diarrhea during performance of their mandatory tasks [11]. In 2012, among 213 PMC soldiers hospitalized in the Medical Support Group in eastern Afghanistan (level 2), 8.1% had infectious diarrhea, 8.5% had non-infectious gastrointestinal diseases and 5.1% had respiratory diseases [12].

Combat trauma

Almost every day soldiers from the military contingents participating in the ISAF operation were exposed to rocket attacks, shootings or improvised explosive devices (IED), which were the main causes of combat injuries. In 2013 a total of 49 ISAF forces soldiers died as a result of IED explosion [2]. Combat trauma was one of the most frequent causes of evacuation of soldiers from PMC Afghanistan to Poland [12]. Currently, field surgery is based on the damage control principle, which means stabilization of the patient's condition, basic treatment of bodily injuries and performing the most pressing emergency procedures, without comprehensive treatment.

Table. Levels of medical support for allied NATO operations (based on AJP-4.10(A) Allied Joint Medical Support Doctrine) [5]
Tabela. Poziomy zabezpieczenia medycznego operacji sojuszniczych NATO (na podstawie AJP-4.10(A) Sojuszniczej Połączonej Doktryny Zabezpieczenia Medycznego) [5]

	Medical support level			
General scope of medical and diagnostic activities	1	2	3	4
	Basic medical care, triage, patient resuscitation and stabilization, and basic laboratory tests	Tactical evacuation, supporting vital functions, emergency surgical procedures, and laboratory tests with access to blood	Specialist surgical treatment and medical care, evacuation, wide range of laboratory and microbiological tests, and blood bank	Long-term treatment of casualties, reconstructive surgery and rehabilitation, and full laboratory diagnostics

Laboratory diagnostics in the military operation area

Due to the injuries suffered, the injured and victims of the conflict often arrive at the hospital in a critical condition. Apart from imaging studies, laboratory tests are required to perform a full evaluation of the patient's condition. The indications for laboratory tests of armed conflict casualties do not differ significantly from those known and used in civilian health services. The scope of laboratory tests performed depends on the need to assess parameters relevant for the type of assistance provided. Laboratory diagnostic procedures should be performed according to the principles adopted in a given country, both for civilian health service in times of peace and under combat zone conditions. A considerable and noticeable difference often lies in the equipment used in the laboratories, the time available and the social conditions. Diagnostic laboratories operating as part of field hospitals are usually situated in containers, and are adapted to difficult environmental conditions. The availability of urgent analyses depends on the type and profile of the laboratory. In case of laboratory diagnostics under military mission conditions, all tests are considered urgent, as there is a high risk of rapidly progressing hemodynamic, respiratory and metabolic disorders in the casualties. In such situations, the time required to undertake proper action is crucial for the patient's prognosis.

Performing laboratory diagnostic tests during the PMC mission in Afghanistan was associated with multiple difficulties. These included a lack of running water, problems related to storing reagents (e.g. due to lack of a freezer in the microbiological laboratory), prolonged procedures for ordering reagents (several months between placing the order and delivery from Poland), lack of backup analyzers necessary in the case of device failure, and the necessity to transport the devices to Poland for servicing (time-consuming). All this required extensive experience from the laboratory diagnosticians, and proper preparation for work in the specific and extraordinary conditions of a military mission [13].

Laboratory structure and equipment

The Medical Support Group Laboratory of the field hospital in FOB (Forward Operating Base) Ghazni, a level 2 unit (Table 1), performed tests for soldiers, other military employees, civilians, Afghan forces and contract employees. The laboratory operated continuously, 24 hours a day, and comprised a general laboratory and microbiological laboratory [14]. The equipment allowed biochemical, gasometric, coagulology, hematological, immunochemical and serological diagnostic testing, as well as general diagnostics, microbiology and parasitology testing. Importantly, physicochemical and microbiological water tests were also conducted, as well as purity tests of the equipment in the field hospital and in the military gastronomic facilities [13].

The laboratory equipment comprised stationary and portable devices. Stationary analyzers enabled determination of lipid profile, liver and pancreatic enzymes, urea, creatinine, complete blood count with white blood cell differentiation, and urinalysis. The POCT portable analyzer of critical blood parameters, part of the equipment of the PMC in Afghanistan, was used to test concentrations of electrolytes, hemoglobin, urea, creatinine, certain cardiac markers and acid-base homeostasis parameters. This type of analyzer enables tests to be made at the patient's bed, and prompt passing of information to the physician. Immunochromatographic tests were also important, although they did not play any significant role in the diagnostics of patients in life-threatening condition. The Medical Support Groups used tests for the detection of malaria, syphilis, anti-HCV antibodies, anti-HIV antibodies, and HBs antigen, as well as tests for pregnancy, fecal blood and the presence of narcotics in urine. Access to microbiological and parasite tests is an important element of medical support during military operations in areas of low sanitary and hygienic standards. The microbiological laboratory of the PMC MSG in Afghanistan had at its disposal equipment for extensive microbiological diagnostics; it also had media and reagents which enabled the culturing of a wide spectrum of microorganisms, their identification and differentiation [13, 14].

Blood bank and serological tests

One of the tasks of the medical laboratory was to run a blood bank in the PMC MSG in Afghanistan, which was of great importance for trauma patients suffering from massive blood loss. It was an integral part of the general laboratory, where red blood cell concentrate (RBCC) was stored, mostly group 0 (including at least 20% of group 0 Rh minus), and fresh frozen plasma of groups 0, A, B and AB. The blood bank also provided cryoprecipitate, used in severe coagulation disorders and after massive hemorrhages (in this case, usually due to trauma) together with RBCC and fresh frozen plasma [14, 15]. In the field hospital *(Role 3)* at the Camp Marmal base (Mazar-e-Sharif) in northern Afghanistan in 2011, the German armed forces in co-operation with the military blood bank of the Dutch Armed Forces introduced platelet concentrates (PC), which required proper adjustments to the laboratory and storage space for the preparations [16]. The US Armed Forces Hospital at Bagram Airfield *(Role 3)* also had PC collected from donors participating in the military operations, as well as frozen red blood cell concentrate (FRBCC). The PMC MSG in Afghanistan had a 'walking blood bank', where previously tested volunteers with a given blood type were called to be donors when the transfusion of full blood was required. The full blood collected in this system provided the recipient with all morphotic elements and coagulation factors. One unit of full blood equals one unit of red blood cell concentrate and one unit of plasma, and it is recommended when there is no access to blood products [15]. The MSG laboratory tested potential blood donors on site, at FOB Ghazni, providing full blood count and blood type determination, as well as serological tests [13].

The treatment of patients with the use of blood products is of great importance in the combat zone. Between 1 April 2008 and 30 March 2010, 27% of the patients admitted to the British Field Hospital in Camp Bastion required a transfusion, and 11% of patients needed a massive transfusion, i.e. at least 10 units of red blood cell concentrate. Currently, MERT (medical emergency response team) may begin blood transfusion in an emergency situation in prehospital conditions. At the Camp Bastion hospital laboratory shock packs were prepared containing group 0 RhD red blood cell concentrate and group AB fresh frozen plasma [17]. In 2009, soldiers of the British army suffering from combat trauma who required massive transfusion received an average of 22 units of blood elements, while 12% of casualties needed the transfusion of over 100 units (there is a report of one case when a transfusion of 237 units was necessary) [18]. Between March 2003 and July 2007, during operations in Afghanistan and Iraq, the Americans transfused a total of 6,000 full blood units to patients with massive trauma [19].

Selected laboratory tests and their role

In Afghanistan, one of the most common causes of hospitalization was bodily injury, often extensive, so determination of blood loss and body hydration level was necessary. Rapid diagnostics played an important role in this process, including laboratory tests which enabled the assessment of blood loss or patient hydration, taking decisions to begin transfusion of blood products or full blood, and monitoring of adequate ventilation in intubated patients. Complete blood count results (hemoglobin, hematocrit or red blood cell markers) also provide additional information about the blood loss and the effectiveness of treatment with blood products. Leukocyte count is useful in the diagnostics of inflammation and bacterial infection or to diagnose the so-called 'acute abdomen' as well as helping to decide if a surgical procedure is urgently needed. Determination of C-reactive protein (CRP) is also important, and this test was performed in the PMC MSG laboratory. Platelet count enables determining of partially blood coagulation potential, which is an important factor during surgical interventions (including neurosurgical procedures due to cerebrocranial injuries). Interesting studies are available on tests which enable early detection of cerebral injuries in combat zone conditions, and which consist of the determination of specific biomarkers in the blood, e.g. the S100B protein and neuron-specific enolase [20]. Trauma-induced hemostasis disturbances require immediate diagnosis and treatment. At the MSG in FOB Ghazni, the coagulation system was assessed based on parameters such as time of clotting after activation (ACT/APTT), prothrombin time (PT) and INR index, which were determined with the use of a POCT analyzer [13].

A group which requires particular medical care involves individuals with internal organ trauma, as well as those who need artificial respiration or controlled respiration due to acute respiratory failure, e.g. in ARDS (adult respiratory distress syndrome). Monitoring the condition of these patients is based on assessment of the values of acid-base homeostasis parameters, which requires constant access to equipment and qualified personnel. In this case it is also necessary to evaluate the causes of hypoxemia and hypercapnia, using gasometric tests: blood pH, concentration of hydrogen carbonate ions and alkaline deficiency. It is also important to determine blood electrolyte concentrations, not only because of diseases or combat trauma, but also due to the climate in Afghanistan. Soldiers performing physical work were at risk of water and electrolyte loss, while their organisms could become overheated during daily professional tasks or during sports exercises [8]. Other laboratory parameters were used to assess kidney function (urea, creatinine, general urine test), liver (alanine aminotransferase, aspartate aminotransferase, bilirubin, gamma-glutamyl transferase, alkaline phosphatase), pancreas (glucose, amylase) or heart (troponin I, CK, CKMB).

Their values help to determine the level of organ failure e.g. after trauma, in infectious diseases or systemic diseases.

As previously mentioned, the laboratory of the PMC MSG in Afghanistan could perform microbiological examinations to diagnose diseases of the gastrointestinal, urinary and respiratory system, as well as wound infections; API (analytical profile index) biochemical tests and parasitology diagnostic tests were also available. Examinations covered detection of pathogens such as *Shigella, Salmonella, Yersinia, Candida spp., Clostridium difficile, Haemophilus, Streptococcus, Enterococcus, Staphylococcus,* adeno- and rotaviruses, and intestinal parasites [13].

Summary

Laboratory tests significantly facilitate and often enable proper diagnosis. Prompt diagnosis and implementation of the correct treatment reduces the duration of disease or injury [14]. The personnel of the PMC MSG laboratory in Afghanistan often had to perform tests under the dual pressures of time and stress that accompany people involved in emergency medicine, and which in Afghanistan was intensified by the armed conflict. Although laboratory medicine in any place in the world is governed by similar principles and interpretation of results, performing tests in a country at war requires suitable training of the laboratory diagnosticians and special skills regarding work under specific conditions. The laboratory needs to provide the possibility of determining most parameters routinely used in peacetime conditions, and be prepared to perform tests necessary in states of sudden threat to the life and health of the casualties. Laboratory diagnostics largely contributes to diagnosis, assessment of disease severity, prognosis and choice of therapy. Therefore, the organization of work and co-operation of the entire medical personnel are of key importance in patient care [13, 14].

It is worth remembering the thought known to every participant in a military mission, especially one burdened with such risk as the operations in Afghanistan: *Those who were not there will not understand. Those who were will never forget.*

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System and principles of military case law in Poland

System i zasady orzecznictwa wojskowego w Polsce

Piotr Wróblewski[1], Janusz Maciorowski[2]

[1] Chairman of the Regional Military Medical Board in Warsaw
[2] Chairman of the Central Military Medical Board in Warsaw

Abstract. The article discusses the scope of competences and the tasks performed by military medical boards (MMBs) in Poland. It presents the formal and legal fundamentals of military case law, issues related to the legitimacy and enforceability of medical board rulings, as well as military members referred to MMBs. With reference to the existing legal acts, the article describes in detail the scope of activities undertaken by MMBs, with particular emphasis on MMB rulings on medical fitness for military service, sick leaves, disability or ineligibility for military service, and injury.
Key words: military case law, military medical boards

Streszczenie. W pracy omówiono zakres kompetencji oraz czynności, jakie wykonują wojskowe komisje lekarskie (WKL) w Polsce. Przedstawiono podstawy formalno-prawne orzecznictwa wojskowego, zagadnienia związane z prawomocnością i wykonalnością orzeczeń oraz kierowaniem orzekanych do WKL. Na podstawie obowiązujących aktów prawnych szczegółowo omówiono kierunki działalności WKL ze szczególnym uwzględnieniem orzekania o zdolności do pełnienia służby wojskowej, orzekania o urlopach zdrowotnych, niezdolności do służby zawodowej i inwalidztwie, jak również orzekania o uszczerbku na zdrowiu.
Słowa kluczowe: orzecznictwo wojskowe, wojskowe komisje lekarskie

Delivered: 30/09/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 70-83

Corresponding author:
Lt. Col. Piotr Wróblewski MD
Regional Military Medical Board
78 Koszykowa St., 00-911 Warsaw
telephone: +48 504 003 590
e-mail: rwklwarszawa@wp.mil.pl

Introduction

The current structure of the Military Medical Ruling in Poland was created on 1 January 2013. The reduction in the number of military medical boards was associated with a reduction in the number of military units in the process of advancing the professionalization of the army. At present there are eleven basic-level boards and one Central Military Medical Board, acting as a higher-level (appeal) board. Over the years, the Polish Armed Forces have undergone a significant transformation. As a result of the changes, the number of soldiers decreased from 200 000 in 2000 to 150 000 in 2003 and to approx. 100 000 in 2012. The Polish Armed Forces also underwent a decrease in the number of military medical personnel, which was mainly due to the liquidation of the Military Medical Academy, guaranteeing a steady supply of medical officers. The liquidation of medical education to suit the needs of the army also caused implications for military medical boards, which have struggled with a scarcity of staff. The liquidation of the previously existing 28 military medical boards and the creation of 12 in their place was inevitable, partly for economic reasons.

The main task carried out by military medical boards (MMBs) is military medical certification. MMBs also perform mobilizational, organizational tasks and tasks related to human resources and recording and reporting. Within certification, military medical boards are concerned with evaluating the health status of candidates for professional military service, soldiers performing military service, retired soldiers and military pensioners. Military medical boards rule on the physical and mental capabilities for active military service, for professional military service, capabilities for service in the various types of Polish armed forces, as well as on detriment to the health as a consequence of an accident or a disease. In addition,

MMBs determine the connection between a disease and infirmity and military service, a connection between death and military service, and also taking a decision on disability and the inability to live independently.

Basis of formal and legal military ruling in Poland

From the point of view of the formal and legal basis, MMB rulings are divided into two groups. The first group includes the issue of classification of an individual to a specific category of capabilities for military service, as well as the capability to serve. An MMB ruling on these matters is binding for the settlement bodies calling up a person for military service or deciding on an exemption from such service. Military medical boards working on the issues of officers or candidates for uniformed services (including candidates for soldiers) are public administration bodies and their decisions take the form of administrative decisions or judgements. These judgements combine elements of medical knowledge with elements typical of administrative jurisdiction. They include medical diagnosis (the medical knowledge element) and determination of military categories or determination of the connection between a disease, disability and service (the certification element). The third obligatory component is the justification to demonstrate the validity of the medical diagnosis and inclusion in the given service category or the ability to determine the connection between a disease, disability and service. This points clearly to the one-sidedness of the activities of the boards and confirms the validity of these activities being qualified as administrative decisions. The second group of MMB rulings are judgements diagnosing the illnesses of given people, the connection between them and military service for the purpose of compensation, general pension or retirement pension. The basis for such judgements are, in the current legal status, the provisions of the Act of 11.09.2003 on professional military service (Journal of Laws No. 179, item 1750, as amended), the Act of 29.05.1974 on provision for war and military invalids and their families (Journal of Laws of 2002, No. 9, item 87, as amended), the Act of 11.04.2003 on benefits or compensation payable in the event of accidents and diseases in connection with military service (Journal of Laws No. 83, item 760, as amended), and finally the Law of 10.12.1993 on retirement benefits for professional soldiers and their families (Journal of Laws of 2004, No. 8, item 66, as amended). The decisions of MMBs are reviewed by the courts of appeals recognized as part of the decisions on compensation benefits, pension or retirement pensions. This happens because administrative decisions concerning these matters are not issued by military medical boards but by other bodies (a military pension authority or a social security authority). The decisions of MMBs in these proceedings are purely preliminary rulings, being one of the conditions for the settlement of the case and cannot be appealed to any administrative court.

The confirmation of this position is the view fixed in administrative case law that administrative courts have no jurisdiction over complaints on the judgements of military medical boards on the connection between diseases (disability) and military service (resolution of seven judges of the Supreme Court dated 10.27.1999, file reference III ZP 9/99, OŚNO 2000/5/167). This position was also taken by the Supreme Administrative Court by the order of seven judges of the Supreme Administrative Court dated 6.11.2000 (file reference OSA 1/100 ONSA 2001/2/47) in relation to a decision regarding the assessment of the health status of a soldier and the connection between military service, among other things, and diseases found for the purposes of the retirement (pension), stating that appeals are not allowed in such matters. Against the background of the legal status, the quoted position is still valid, as confirmed by the Supreme Administrative Court in the judgement of 9.03.2005 (file reference OSK 1203/04).

Decisions taken by regional military medical boards (RMMBs), being the basic-level boards, are allowed to be appealed to a higher-level board. The higher-level board, in relation to RMMBs, is the Central Military Medical Board in Warsaw.

The requirement of two-instance proceedings derives from the Code of Administrative Procedure and the case of the Supreme and the Province Administrative Courts ruling that MMB rulings concerning the ability or inability of the military service are administrative decisions (SA/Wr 1279/94 - Judgement of the NSA in Wrocław of 30.11.1994).
In the judgement of 10.28.1992 (SA/WR 841/92/ONSA 1994 No. 1, item 23), the Supreme Administrative Court expressed the following view:

1. district and provincial military medical boards and military medical boards established on the basis of Art. 26 Paragraph 1 in conjunction with Art. 29, par. 1, point 1 of the Act of 21.11.1967 on the universal obligation to defend the ability of military service are, according to the meaning of these provisions and the provisions of the Administrative Procedure Code, government administration bodies;
2. rulings of district and provincial military medical boards and military medical boards on being fit for military service and determining the category of the capability are administrative decisions within the meaning of Art. 1 § 1 point 1 and Art. 196 § 1 and 2 of the Code of Administrative Procedure, subject to appeal to the administrative court; in addition, supervision over the military medical boards operating in the Ministry of Defence shall be held by the Central Military Medical Board, as superior to the others.

The Supreme Administrative Court treats the principle of two-instance proceedings as a fundamental procedural guarantee of respecting citizens' rights in the proceedings. Moreover, it

demands from authorities that they execute the guarantee in its entirety. It follows that the two-instance principle does not mean only two successive decisions at various levels but, above all, that substantive proceedings are to be conducted twice to double-rate evidence in a factual manner, analyze all of the arguments and opinions, and consequently issue a judgement corresponding best to the law, the public interest and the legitimate interests of the parties.

MMBs at the higher level examine appeals by a panel of three medical officers. The panel composition may also include medical officers who exercise professional military service. MMBs at the higher level rule on the appeal by a majority of the panel.

The Minister of National Defence may revoke any MMB ruling being against the law or published without the relevant facts. Such a power is also granted to the President of the Central Military Medical Board. In revoking any ruling, the Minister of National Defence or the President of the Central Military Medical Board, respectively, indicates circumstances requiring explanation in subsequent proceedings.

Legitimacy and enforceability of rulings

On the basis of § 24 point 1 of the Regulation of the Minister of National Defence of 29.01.2008 on the release of soldiers from professional military service (Journal of Laws of 13.02.2008), a soldier who has been recognized by a MMB as unfit for military service, becomes exempt from service on the date on which the board's decision becomes final. The question of the legitimacy of decisions and the associated issue of feasibility are convoluted and ambiguous. In accordance with Art. 363 § 1 of the Code of Civil Procedure, the decision becomes final at:

- the time limit for bringing an ordinary law remedy (appeal),
- the end of the legal-administrative path, when remedies have not been taken and the time limit for an appeal to the administrative court has expired.

Definitive decisions become final following an appeal to the administrative court:

- when the court rejects it because of a defect in the appeal, lack of jurisdiction,
- when the appeal is unacceptable,
- when the appeal was deemed unfounded or the proceedings became irrelevant.

From a practical point of view, the most important is when a decision in the form of a ruling issued by a board is executed, and begins to bind the control body. This happens at the moment when the certification is final or definitive. In a case where the decision is in line with the expectations of the parties, after two weeks (time limit for bringing an ordinary remedy / appeal) it becomes final. However, if the appeal is brought, the path for a decision to become final can be extremely long and time-consuming. A party may appeal to a board at a higher level, then appeal to the Province Administrative Court and then to the Supreme Administrative Court.

On the basis of the provision cited above, decisions of the central board (CMMB) are final in the administrative course of the proceedings on the day of issue and, with their finality quality, bind the commander of a military unit and are enforceable. Appeals against final judgements can be brought to the administrative court.

In the case of an appeal being brought against the judgement of the central board, the mode of the administrative court proceedings is extraordinary in nature for contesting final decisions. Protection of such decisions was expressed as a general rule concerning the durability of final administrative decisions in Art. 16 § 1 of the Act of 14.06.1960 - Code of Administrative Procedure (Journal of Laws of 2013, item 267). According to this piece of legislation, repealing or amending final decisions (those in the case of which administrative instance appeals are not allowed as well as requests for a retrial), their annulment and reopening of the proceedings may take place only in the cases provided for in the Code of Administrative Procedure or in special laws.

Reasons for annulment were exhaustively defined in Art. 156 § 1 of the Code of Administrative Procedure. A public administration body can annul a decision that:

- was issued in violation of the provisions on jurisdiction,
- was released without any legal basis or with gross violation of the law,
- applies to cases previously adjudicated under another final decision,
- was addressed to a person who is not a party in the case,
- was not feasible at the date of issue and its impracticability is permanent,
- if its implementation would create criminal offence,
- contains a defect which renders it null and void under the law.

This statement is a closed list of reasons for the annulment of a decision. This provision, given the exceptional nature of this institution, does not allow the use of a broad interpretation in relation to its content. A decision declaring the nullity of a decision may be taken only when the authority is satisfied that the decision was taken in the circumstances referred to in Art. 156 § 1 of the Code of Administrative Procedure. However, in the absence of grounds for the annulment of the decision, the administrative authority refuses its annulment.

Referring subjects to Military Medical Boards

Referring and other persons authorized to refer subjects to MMBs are described in the following acts:

- Art. 29 point 2 of the Act of 21.11.1967 on the universal obligation to defend the Republic of Poland (Journal of Laws of 2012, item 461),
- Art. 5 of the Act of 11.09.2003 on professional

military service (Journal of Laws 2010, no. 90, item 593),

- Art. 13, point 1 of the resolution of the Minister of National Defence of 10.01.2006 on disability certification for professional soldiers, soldiers exempt from professional military service and military pensioners as well as the properties and mode of conduct for military medical boards in these matters (Journal of Laws 2006, no. 12, item 75).

For the purposes of determining the capability for active military service, the following refer to military medical boards:

- a military draft officer - soldiers and other persons seeking appointment to active military service,
- a commander of the unit in which the soldier is put into active military service.

For the purposes of the determination of the capability for professional military service the following can refer to military medical boards:

- a military draft officer - soldiers and other persons seeking appointment to professional military service,
- a commander of a military unit, a court,
- a prosecutor, a commander of an organizational unit of the Military Police and other bodies before which proceedings are pending in cases of offences,
- the Minister of National Defence - all professional soldiers.

For retired military personnel and pensioners to be examined who requested their determination of entitlement to a retirement pension, the director of a military pension authority having jurisdiction to determine the right to receive pensions and cash benefits in respect of that benefits, determined by the Minister of National Defence, refers to the MMBs.

The mode of certifications of MMBs is described in the following legislation:

- Art. 14 of the Regulation of the Ministry of National Defence of 25.06.2004 on the ability to rule on active military service and the mode of conduct of military medical boards in these matters (Journal of laws of 2004 No. 151, item 1595 as amended).
- Art. 22 of the Regulation of the Ministry of National Defence of 08.01.2010 on the ability to rule on professional military service and the mode and properties of conduct of military medical boards in these matters (Journal of laws of 2010 No. 15, item 80 as amended),
- Art. 21 of the resolution of the Minister of National Defence of 10.01.2006 on disability certification for professional soldiers, soldiers exempt from professional military service and military pensioners as well as the properties and mode of conduct for military medical boards in these matters (Journal of laws of 2006 No. 12, item 75 as amended).

The composition of military medical boards includes three medical officers. The panel composition may also include physicians who do not exercise professional military service. The presiding judge shall appoint the chairman of a military medical board. MMBs rule by majority vote of the panel.

Subjects, upon receipt of referral, are registered at the Office of a regional MMB and receive a document with a specified set of examinations and consultations to be done, adapted to the purpose of the study specified in the referral. Modification of the set of examination depends on the decision of the adjudicative team and the data resulting from medical history or information about the conditions and the course of military service, as attached to the referral. The scope of research for people sent and returning from international military operations is included in the Regulation of the Ministry of National Defence of 23.12.2010 on certain health care services available to professional soldiers (Journal of Laws 2011, no. 8, item 36). The medical history and the questionnaire for the initial assessment of the mental health of professional soldiers referred before and after they return from an international military operation are also listed in the Appendices thereto. The health criteria specified in Group I of Appendix 1 to the Regulation of the Ministry of Defence of 8.01.2010 and the sets of examinations for candidates to serve abroad became the starting point for the development of tests for candidates for military service and candidates of certain types of services, such as police military, landing and air space forces, units representative of the Polish Army, and similar. Rulings are issued on the basis of medical examinations, the results of specialized tests, medical records and information and other documents, in particular:

- a copy of the professional military service record from the personnel files of professional/non-professional soldiers,
- service-medical opinions, taking into account the history of the disease, the course of treatment and its results and risk factors at the job position currently held of the professional/non-professional soldier or held in the past by a professional soldier released from military service, or information about the characteristics and the course of military service,
- medical history of outpatient and hospital treatment,
- measurements of harmful factors in the environment of the service,
- medical records of a professional soldier,
- periodic and preventive examination sheets,
- information contained in a written statement of a professional soldier, military pensioner or a retired soldier.

The body referring to a MMB forwards to a specific territorial board the available information and documents that relate to the health of professional soldiers, pensioners and retired soldiers and non-pensioners or not retired soldiers or soldiers dismissed from professional military service, which may be relevant to the determination of disability, connection or lack of connection between active military service

and disability and the connection or an absence of connection between a disease, disability and death and active military service, and the inability to work and inability to live independently. If, in the determination of the ability of the active military service, a MMB finds in a professional soldier, a pensioner or a retiree or a pensioner who is not a soldier released from professional military service at least one disease or infirmity remaining in conjunction with active military service and at the same time causing the inability to serve, the inability to serve being determined as remaining in conjunction with active military service.

Deciding on the connection to the death of a professional soldier, a pensioner or a retiree or pensioner who is not a soldier released from professional military service during active military service, the MMB also establishes whether the death was a consequence of an accident being in connection with the performance of active military service or a disease arising in connection with the specific characteristics or conditions of such a service in respect of which compensation is provided under the Act of 11.04.2003 on compensation benefits payable in the event of accidents and diseases in connection with military service. In the assessment of a disease connection with military service, MMBs are guided by the criteria set out in the list of health diseases and established on the basis of Art. 20 paragraph 4 of the Act of 10.12.1993 on retirement benefits of professional soldiers and their families (Journal of Laws of 2013, item 666) as well as the Regulation of the Minster of National Defence of 31.03.2003 on the establishment of the list of diseases arising in connection with the specific characteristics or conditions of military service and diseases that existed before the establishment of military service but deteriorated or emerged during the service due to the particular characteristics or conditions of service at certain positions (Journal of laws of 2003 No. 62, item 567 as amended). The basis for determining the connection between diseases and military service is to find two conditions simultaneously, namely the diagnosis of a disease included in the list of diseases which constitutes Appendix 1 or 2 to the above-mentioned Regulation of the Ministry of National Defence of 31.03.2003, and to declare the specific characteristics or conditions of the service at the positions held, as specified therein, using the information contained in the documents required before the decision and provided by the authorities referring to the MMB, in accordance with § 14 of the Regulation of the Ministry of National Defence 08.01. 2010, as shown in § 21 of this Regulation. In addition, in accordance with § 23 paragraph 1 of the Regulation cited above, if the decision requires additional documents, the MMB calls the professional soldier in writing to deliver them within 14 days. Documents confirming the existence of particular characteristics or conditions of service are generated in the implementation of the executive regulations to the Labor Code: Chapter X of Occupational Health and Safety. They define who and in what mode generates the documents, where they should be stored, for how long and in what mode they should be made available to those interested. They are an integral part of the evidence for the existence of particular characteristics and conditions of service at the positions held. No documentation of any of the conditions gives the MMB no grounds to determine the connection between the disease and military service. The basic documents confirming the presence of the specific characteristics and conditions of service (factors harmful to health), referred to in Appendix 1 are:

- register of harmful factors and measurement sheet of harmful factors, as listed in § 18 paragraph 1 of the Regulation of the Minister of Health of 02.02.2011 on the tests and measurements of harmful factors in the work environment (Journal of Laws of 2011, no. 33, item 166),
- description sheets of official positions, referred to in Art. 6 paragraph 1 point 11a of the Law on professional military service dated 11.09.2003 (Journal of Laws of 2010 No. 90, item 593) and § 22 paragraph 2 of the Regulation of the Ministry of National Defence of 08.01.2010
- information about the conditions and the course of service for the needs of military medical boards, referred to in § 22 paragraph 1 point 2 of the Regulation of the Ministry of National Defence cited above of 08.01.2010, indicating the existence of the specific characteristics and conditions of service for the occupied positions,
- the results of measurements of harmful factors on the occupied positions, as conducted by the competent military preventive medicine centers in accordance with the Regulation of the Minister of Health of 02.02.2011,
- qualification protocols of positions where harmful factors are present,
- qualification records of soldiers to serve in harmful conditions, the drawing up of which is the task of the employees of the occupational health and safety military units,
- extracts of daily orders of the commander of a military unit on the qualifications of those positions with harmful factors,
- extracts of daily orders concerning the qualifications of soldiers to serve in harmful conditions.

The basic documents confirming the presence of the specific characteristics and conditions burdensome to health), referred to in Appendix 2 to the Regulation of the Minister of National Defence of 31.03.2003 are:

- a copy of the professional military service record from the personnel files of a professional soldier,
- information about the conditions and the course of military service for the needs of the military medical board.

The basis for the determination of the connection of a disease and military service include earlier decisions establishing the connection between military

service and diseases, as well as the documentation referred to in the Regulation of the Ministry of National Defence of 15.09.2003 on the treatment in the event of an accident or illness disclosure in connection with the performance of active service military (Journal of Laws 2010, no. 90, item 593). On the basis of them, a legal qualification is issued according to the appropriate jurisdiction, declaring the connection with military service or the military medical board ruling on the health damage caused by the disease in connection with military service in respect of which compensation benefits are granted (Regulation of the Ministry of National Defence of 01.08.2003 on the list of diseases in connection with military service in respect of which compensation benefits are granted [Journal of laws of 2003 No. 143, item 1397 as amended).

The main directions of the activities of MMBs include rulings on:

- capability for active military service,
- capability for professional military service,
- capability for professional military service with restrictions.
- prior to referring to perform professional military service outside the country, and after returning to the country,
- capability for serving in Airborne Shock Troops, Military Police, Military Intelligence Service, Military Counterintelligence Service,
- health detriment as a consequence of an accident or a disease,
- connection between illness and disability and the specific characteristics or conditions of service,
- connection between the service and death,
- disability and inability to live independently,
- connection between the service and disability,
- need to give the soldier sick leave,
- connection between diseases and hostilities and military service - for the purposes of Social Security,
- capability for service in the Military Intelligence Service and the Military Counterintelligence Service,
- correctness of a decision concerning sick leave,
- connection between sick leave and the military service.

Rulings of MMBs, depending on the purpose for which they are used, include:

- designation of a public administration,
- date of the certification,
- identification data of the subject,
- diagnosis,
- determining the capability for active service or professional military service and including a professional soldier, a pensioner or a retiree not being a pensioner who is not a soldier released from professional military service to one of the categories of capability for active service/professional military service,
- the board's position on including a professional soldier, a pensioner, to one of the groups of disability and to determine the date or period of the beginning of disability, and the date of commencement of disability,
- to determine the connection or lack of connection between disability and active military service and to determine whether the disability arose as a result of an accident or illness in connection with active military service in respect of which compensation benefits are granted,
- to establish the connection or lack of connection between a disease and disability and military service,
- the board's position on the incapacity and inability to live independently, and in the case of a determination of incapacity for independent existence - to determine the date of the occurrence of this inability,
- follow-up examination date of a disabled person,
- justification of the decision of the established category of health and disease connections with military service,
- instruction on the right to appeal.

Ruling on active service capability

The medical military board system of ruling upon the capability for active military service includes regional and district military medical boards (Fig. 1.). Provincial medical boards (PMBs) complement the military system of case law in the conduct of medical care qualifications, which cover all the men and women aged from 19 to 24 in a given calendar year. Qualifications by provincial boards are carried out by creating district and provincial medical boards. Each provincial governor appoints boards annually for the province and district territory administered by them, with the participation of the heads of the provincial military headquarters and village mayors, governors, and city presidents; these boards function from January to May for each year. The schedules of military qualifications are established annually by the regulations of the Ministry of National Defence and the Ministry of Interior Affairs.

MMBs are competent to carry out qualifications for active military service at a time when PMBs do not operate. Since 1 January 2013, as a result of the restructuring of the military medical ruling, a single two-tier structure has existed (Fig. 2).

Rulings on the capability for active service, medical boards operate under Art. 30a paragraphs 1, 2 and 3 of the Act of 11.21.1967 on the universal obligation to defend the Polish Republic (Journal of Laws of 2012, item 461, as amended); §8, 10 and 17 paragraph 1 of the Regulation of the Ministry of National Defence of 25.06.2004 on the ability to rule on active military service and the mode of conduct of military medical boards in these matters (Journal of Laws of 2004 No. 151, as amended, item 1595, as amended) and § 5 and 7, paragraph 1 of the Regulation of the Ministry of National Defence of 24.08.2012 on military medical boards and determination of their premises, range and properties (Journal of Laws of 2012, item 1013).

In the Act of 21 November 1967 on the universal obligation to defend the Polish Republic, Art. 30a defines the categories of health determining the capability for active service:

- category A - capable of active military service, means the capability for military service, extended compulsory military service, military activities during the course of higher education, military training, periodic military service, military exercises, compulsory military national service and training in civil defense, alternative service, as well as military service in the event of mobilization and in time of war,
- category B - temporarily unfit for active military service, which means a transient impairment of general health or acute or chronic diseases in the case of which, in the period up to 24 months from the date of the examination, recovery of the capability for military service in time of peace is possible,
- category D - unfit for active military service in time of peace,
- category E - permanently unfit and completely incapable of active military service in peacetime and in the event of mobilization and in time of war.

Polish citizens who are 18 years old are subject to registration and military qualification. Registration is conducted by mayors or presidents of cities competent for the place of permanent residence or temporary residence of the persons covered by the registration. The registration does not require the attendance, consent or notification of the person that the registration concerns. Carrying out military qualifications in the poviat (cities and towns) is the responsibility of the governor (mayor). Supervision over carrying out military qualifications, including inspections, is carried out by the minister responsible for internal affairs. Military qualifications include activities related to:

- checking the identity of persons subject to military qualification,
- finding out the capacity for active military service,
- the initial designation of persons subject to the qualifications to specific forms of duty to defend the Republic of Poland and the acceptance of requests for designation to alternative service,
- creating or updating military records and the processing of data collected in the records,
- the issue of military documents,
- the transfer of persons subject to the qualifications to the reserve and the issue of, upon their request, certificates on regulated military service,
- military recruitment preparation for voluntary military service.

The obligation of being subject to military qualifications is one of men who are 19 years old in the given calendar year and continues to the end of the calendar year in which the person subject to this obligation is 24 years old. Military qualifications may also include volunteers, including women, to the end of the calendar year in which they turn 24 years old, if

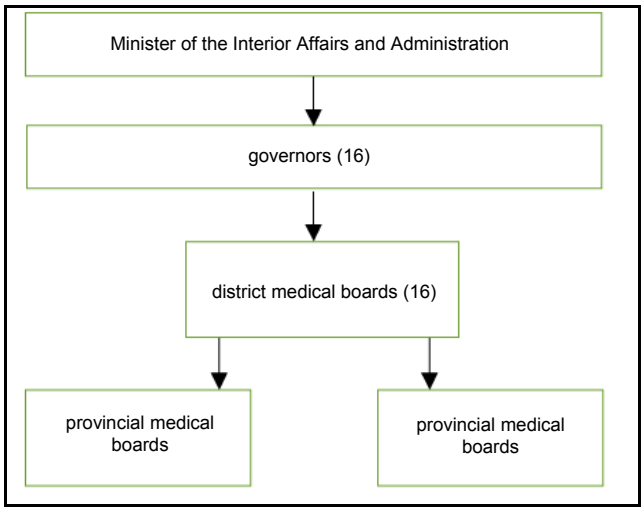

Figure 1. Organizational chart for provincial and district medical boards
Rycina 1. Schemat organizacyjny wojewódzkich i powiatowych komisji lekarskich

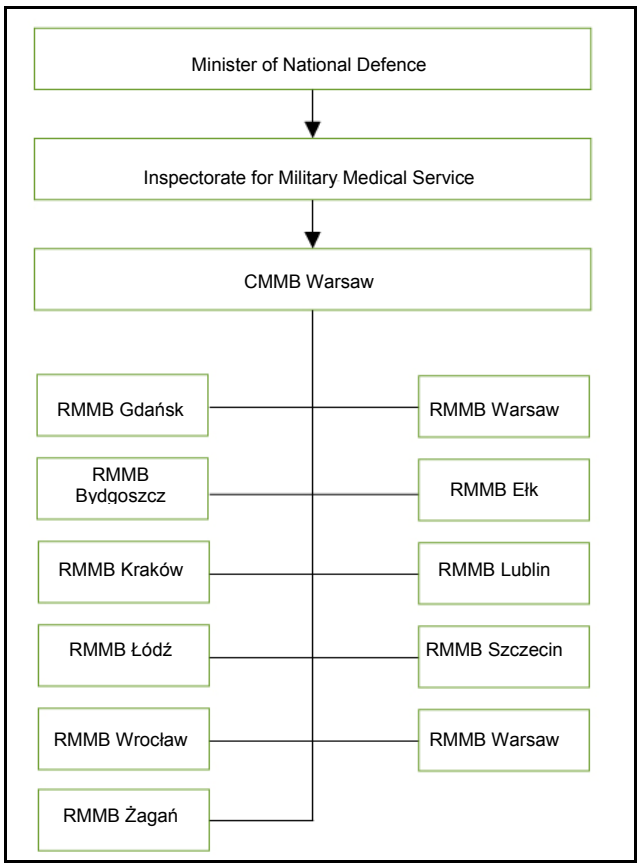

Figure 2. Organizational chart for military medical boards
Rycina 2. Schemat organizacyjny wojskowych komisji lekarskich

they are at least 18 years of age. Volunteers who presented themselves for military qualification, on the day of the qualification, are subject to active military service on general principles. In case of the failure to appear for military qualifications without a reasonable cause, the mayor or governor (president of the city) ex officio or upon the request of the chairman of the medical board of the district draft military commander imposes on the person subject to qualification a fine in order to compel the person or orders forced bringing the person by the police for military qualification under the provisions on administrative enforcement proceedings. The minister responsible for internal affairs and the minister of national defense annually specify, by regulation, the date (or dates) of the notice of military qualification and its (or their) duration in the territory and the age cohorts and groups of people that are required to attend military qualifications.

MMBs have jurisdiction to rule on the capability for active military service in the case of:

- people with irregular military service at a time when no provincial medical military board operates,
- soldiers serving on active military service,
- reserve soldiers,
- people transferred to the reserve who are not soldiers,
- other persons subject, due to the age, to compulsory military service who have asked to volunteer for the event.

MMBs also rule on:

- the capability to perform duties outside the country,
- the capability to serve in the army and the types of services and positions and military functions requiring special health predispositions,
- the need to give soldiers sick leave,
- determining the connection between disease, death and military service.

The following are referred to MMBs:

- candidates for active and professional military service,
- people with irregular military service at a time when no provincial medical military board operates,
- soldiers serving active military service,
- reserve soldiers,
- people transferred to the reserve who are not soldiers,
- other persons subject, due to the age, to compulsory military service who have asked to volunteer for the event,
- candidates to serve outside the country,
- candidates to serve in the army and the types of services and positions and military functions requiring special health predispositions.

In rulings on the ability of active military service, military medical boards are guided by a list of diseases and disabilities, as defined in Appendix 1 to the Regulation of the Ministry of Defence of 20.10.2006, which changes the Regulation of the Ministry of Defence of 25.06.2004 on rulings on the capability for active military service and the procedure to be followed by medical boards in these matters. The subjects were divided by this regulation into four groups:

- Group I - those subject to military qualifications, soldiers of compulsory and extended military service, candidates for extended military service, soldiers undergoing military training, persons performing alternative service,
- Group II - reserve soldiers,
- Group III - candidates to serve in Airborne Shock Troops, representative and Military Police units,
- Group III - candidates to serve outside the country, in the range of the microwave and with electrical power.

In addition to determining the capability for active military service, MMBs also issue decisions on the ability or inability to serve:

- in the composition of the flight crew and ground handling of flights (guided by the criteria set out in Appendix 2 of the above-mentioned Regulation)
- on warships and other vessels of the Navy and as divers (guided by the criteria set out in Appendix 3 of the aforementioned Regulation).

Each of the diseases referred to in the above-mentioned Appendices has a health category assigned according to the severity of the disease and impairment of the body caused by it (example - see tab. 1.).

It should be noted that, in the past, people who had health categories B, D or E were often referred to MMBs and, for various reasons, applied for a change to the health category A. An amendment of Act of 2007, pursuant to paragraph 5 Art. 29, allowed for referring to serve those people with irregular military service, reserve soldiers and other persons subject to it, due to the age of compulsory military service, who have asked to volunteer for the event, only if there were draft needs for the Armed Forces. The Act of 01.09.200, amending the law on universal duty to defend the Republic of Poland and other acts (Journal of Laws No. 22, item 120 and No. 161, item 1278) included the added Art. 3a stating that, in peacetime, people subject to a final ruling determining the category of capabilities to active military service as D or E are not be referred to MMBs.

Having health category D does not prevent the exercise of professional military service. Pursuant to Art. 5 paragraph 2 of the Act dated 11.09.2012 (Journal of Laws of 2012, item 461, as amended) on professional military service of professional soldiers and another persons who reported the desire to perform professional military service, are referred to an MMB to determine their physical and mental ability to perform this service. That provision is mandatory and is an independent and sufficient basis for referral to a MMB of a person applying for the establishment of their professional military service. Decisions on the capability for medical service are regulated by the findings of the Act of 11.21.1967 on the universal duty to defend the Republic of Poland. The procedure for persons subject to the obligation to perform active military service results from the findings in the said Act

Table 1. An indicative lists of diseases and disabilities (Chapter IV - The organ of sight) Including categories of medical fitness for active military service with differences between the studied groups
Tabela 1. Przykładowy wykaz chorób i ułomności (Rozdział IV - narząd wzroku) z kategoriami zdrowia do służby czynnej różniącymi się między grupami badanych.

Paragraph	Point	Diagnosis	Group I	Group II	Group III	Group IV
44	6	Abnormal biochemical markers of liver function for diagnosis	N	Z	Z/N	Z
44	7	Recent viral hepatitis	N	Z	Z/N	Z
44	8	Chronic hepatitis	N	Z	N	Z/0

and the Regulation of the Minister of Defence of 25.06.2004, and the procedure for persons who have to perform professional military service is based on the Act of 11.09.2003 on professional military service, as well as the Regulation of the Minister of National Defence of 8.01.2010 on the capability to decide on the professional military and the properties and mode of conduct of military medical boards in these matters (Journal of laws of 2010 No. 15, item 80 as amended). Such a legal interpretation was issued by the Legal Department, the Defence Ministry on 04.05.2009. (No. 16/5/09/ES).

Ruling on professional service capability

In rulings on the capability for military service, MMBs act on the basis of Art. 5 paragraphs 1, 6 and 7 of the Act of 11.09.2003 on professional military service and §16, 21 paragraphs 1 and 2 and § 24 paragraph 1 of the Regulation of the Minister of National Defence of 08.01.2010 on the capability to decide on professional military service and the properties and mode of conduct of military medical boards in these matters and § 5 and 7, paragraph 2 of the Regulation of the Ministry of National Defence of 24.08.2012 on military medical boards and determination of their premises, range and properties.

Professional soldiers are referred to MMBs when:

- they do not perform official duties due to an illness lasting continuously for three months,
- their health condition deteriorated and prevented or reduced the performance of official duties,
- they were injured while performing professional military service or declared a disease being a consequence of the specific characteristics or conditions of military service,
- in order to conduct periodic or occasional medical examinations if they were among specific groups of persons,
- before being referred to perform professional military service outside the country and after returning to the country,
- if the decision of an MMB is necessary in criminal proceedings or in cases of misconduct,
- before being assigned to an official position,
- in connection with the transfer to another corps or other personal group
- before being released from professional military service for reasons other than due to the state of health,
- in the case of not taking their physical fitness test when prescribed,
- when awarded a failing grade during the physical fitness test,
- being a soldier and another person who reported the desire to perform professional military service.

In addition, the following are compulsorily referred to MMBs:

- pensioners, where there has been, confirmed by a doctor, deterioration of their health,
- not being retirees or pensioners, professional soldiers exempt from military service, who have applied retroactively to receive pensions and cash benefits by virtue of this,
- the disabled under control examinations.

In rulings on the capability for professional military service, MMBs are guided by the list of diseases and disabilities attached hereto as Appendix 1 to the Regulation of the Ministry of National Defence of 08.01.2010 on the capability to decide on the professional military and the properties and mode of conduct of military medical boards in these matters. In rulings on the capability for service in the composition of the crew, ground security of flights on warships and naval vessels as well as divers, MMBs decide on the basis of Appendix 2.

Subjects of MMBs for their capability for professional military service, as in the case of the appendix on the capability to decide on active service, were divided into four groups:

- Group I - persons applying for admission to professional military service, candidates to serve in representation units, Airborne Shock Troops, special units and the Military Police,
- Group II - professional soldiers already performing military service and professional candidates to serve on the third and subsequent years of study,
- Group III - candidates to serve outside the country, soldiers during extended service and applying for admission to professional service, professional

soldiers serving in representation units, Airborne Shock Troops, special units, the Military Police and provided for appointment to official positions in the units, officers, non-commissioned officers and a number of professionals referred for specialist courses for NCO schools and officers, candidates to serve in the range of microwave and electric current,

- Group IV - professional soldiers and former professional soldiers referred to the service at a specific official position who have suffered bodily injury as a consequence of an accident or a disease in connection with military service.

The list of diseases and disability includes nineteen chapters, listed in order of severity. Each disease has a specific paragraph and point assigned and a respective category in each group. Appendix 2 for the Air Force and Navy was drafted in the same manner. The list of diseases and disabilities of Appendix 1 includes the following categories of diseases:

- Chapter I - body,
- Chapter II - skin, subcutaneous tissue, lymph vessels and lymph nodes,
- Chapter III - skull,
- Chapter IV - organ of vision,
- Chapter V - organ of hearing,
- Chapter VI - mouth,
- Chapter VII - nose, throat, larynx,
- Chapter VIII - neck, chest, spine,
- Chapter IX - respiratory system,
- Chapter X - cardiovascular system,
- Chapter XI - digestive system,
- Chapter XII - genitourinary system,
- Chapter XIII - endocrine glands,
- Chapter XIV - other internal diseases,
- Chapter XV - nervous system,
- Chapter XVI - mental state,
- Chapter XVII - limbs,
- Chapter XVIII - cancer,
- Chapter XIX - reproductive organ.

It should be noted that a disease that causes category N health in the first group (candidates for military service), often does not result in the lack of capability of the second group (soldiers already performing service) and in the third group (e.g. for people sent to serve outside the country) is defined as Z/N or N/Z, which means that a board must decide which category to rule, taking into account other relevant circumstances for the situation (see tab. 2 for an example).

Detailed explanations contained in the comments for the majority of the diagnoses defined clarify the circumstances that a medical board should consider classifying subject a particular category of health in such cases.

Ruling on health leaves

According to Art. 62 paragraph 8 point 1 of the Act of 11.09.2003 on professional military service, a professional soldier may be granted a sick leave for up to six months. The mode of ruling on the need for a sick leave and the competent authorities in these matters are regulated by the Regulation of the Ministry of National Defence of 30.12.2009 on professional soldiers' leave (Journal of Laws of 2010 No. 2, item. 9, as amended).

According to § 17 paragraphs 1 and 2 of the regulation, a sick leave may be granted after treatment in a health care institution, in justified cases, for outpatient treatment. Sick leave is granted especially when the soldier no longer requires further treatment in a health care institution, but has not yet fully regained the capability to perform duties (§ 17 paragraph 3 of the above-mentioned Regulation). In the light of §19, a sick leave shall be granted after the passage of three months of being exempt from the execution of their duties. At the same time, in accordance with Art. 5 paragraph 3 points 1 and 2 of the Military Pragmatic Act (the Act of 11.09.2003 on professional military service) compulsory referral to MMBs relates to professional soldiers when they do not perform their duties because of a disease lasting continuously for three months, and if their health condition deteriorated preventing or reducing their performance of official duties. Attendance at a medical commission does not preclude the exercise of the professional soldier's sick leave. **According to the judgement of the Regional Administrative Court in Warsaw dated 22.09.2006 (Ref. II SA/WA 1036/06), the fact of being on a sick leave in a situation where it is indicated that the patient cannot walk cannot justify failure to attend a medical board.** It follows that, in the present case, a MMB also executes a legal possibility to hear cases to provide soldiers a sick leave at the time.

MMBs rule on professional soldiers for further capacity for professional military service in Group II, a 5-column list of diseases constituting Appendix 1 to the Regulation of the Ministry of National Defence of 08.01.2010. Qualifications for a specific category of professional capacity to perform military service are ruled by MMBs depending on the disease and its severity according to the aforementioned groups, specifying category Z - capable for professional military service, or category N - unable to perform professional military service. In the case of specifying category N health in the case of a professional soldier incapable of further service, military boards should rule on the disability.

Ruling on incapability for professional service and disability

Pursuant to Art. 2, paragraph 2 of the Resolution of the Minister of National Defence of 10.01.2006 on disability certification for professional soldiers, soldiers exempt from professional military service and military pensioners as well as the properties and mode of conduct for military medical boards in these matters

Table 2. A list of diseases and disabilities (Chapter XI - The digestive system) Including categories of medical fitness for active military service with differences between the studied groups
Tabela 2. Wykaz chorób i ułomności (Rozdział XI - układ trawienia) z kategoriami zdrowia do służby zawodowej różniącymi się między grupami badanych

Paragraph	Point	Diagnosis	Group I	Group II	Group III	Group IV
13	3	Visual acuity of each eye at least 0.5-correction spherical lenses, greater than 3.0 D to 6.0 D, or cylindrical greater than 1.0 D to 3.0 D	A	A	N	N/Z
13	4	Visual acuity of each eye at least 0.5-correction spherical lenses, greater than 6.0 D, or cylindrical greater than 3.0 D	D	D	N	N
13	5	Single visual acuity of at least 0.5 and the second 0.1-0.4 with optimum correction with spherical or cylindrical lenses	D/E	D/E	N	N

(Journal of Laws of 2006 No. 12, item 75, as amended), a disabled soldier is a soldier released from professional military service due to the state of health, as considered totally unfit for the service, having acquired category N. For an MMB to qualify a soldier as belonging to category N, at least one disease diagnosed during the examination should be qualified for the paragraph and the corresponding point, listed in Group II of Appendix 1 to the Resolution of the Ministry of Defence of 08.01.2010 on the classification of the subject to a specific disability group, is decided by the criteria contained in art. 12 and 13 of the Act of 17.12.1998 on pensions from the Social Insurance Fund (Journal of laws of 2004 No. 39, item 353 as amended). These criteria are used in military and medical ruling on the basis of Art. 14, point. 2 of the Regulation of the Ministry of Defence 10.01.2006 (Journal of laws of 2006 No. 12, item 75 as amended).

RMMBs rule on belonging to the first group of disability where the subjects were considered unable to perform professional military service and completely lost any ability to work due to the disability and their capability to recover after reclassification is not likely to be regained.

RMMBs rule on belonging to the second group of disability where the subjects were considered unable to perform professional military service and where, due to disability, partially lost the ability to work in accordance with the level of qualifications.

RMMBs rule on belonging to the third group of disability where the subjects were considered unable to perform professional military service but the decreased efficiency of the body did not cause their loss of earning capacity or their capability to recover after reclassification is likely to be regained.

Disability is related to military service when the diseases causing inability to perform professional services that are the cause of disability are in connection with this service. RMMBs rule on subjects' incapability of independent existence when their decreased physical fitness necessitates constant care and the assistance of another person to satisfy the basic needs of life.

Pursuant to Art. 13, point 1 paragraph 1 of the Resolution of the Ministry of National Defence of 10.01.2006 on rulings on disability of professional soldiers, exempt from professional military service and military pensioners, as well as the properties and mode of conduct of military medical boards in these matters, military retirees and pensioners and professional soldiers exempt from military service upon their request are referred to an MMB if there has been, confirmed by a doctor, a deterioration of their health (Journal of laws of 2006 No. 12, item 75 as amended). Pursuant to Art. 21a of the Act dated 10.12.1993 on retirement benefits of professional soldiers and their families (Journal of Laws of 2013, item 666), MMBs perform first control examinations of the disabled three years from the date of the judgement on disability, and the following checks at least every five years, on the date specified by the MMB. The medical board may set a schedule for control examinations before the end of the above-mentioned period when it is assumed that the disability group determined may change. The board may also decide that a check is unnecessary if the disease causing disability indicates that a change in a fixed group of disability does not occur at all (Art. 21a paragraph 3 of the Act of 10.12.1993 on retirement benefits of professional soldiers and their families). No examinations are carried out when disabled women turn 55 years of age and men turn 60 years of age or

when the disability lasts continuously for more than 10 years (Art. 21a paragraph 4 of the Act of 10.12.1993). Since the disability pension granted pursuant to the above-mentioned act is paid to soldiers released from professional military service in limited circumstances, pursuant to Art. 19, medical boards determine whether any disability occurred while the service or within 3 years after release, and whether the disabling disease occurred during the military service.

Ruling on bodily detriment

The basic legal act regulating the rules relating to the determination of the degree of health detriment is the Act of 11.04.2003 on compensation benefits payable in the event of accidents and diseases in connection with military service (Journal of Laws 2003, no. 83, item 760). Soldiers who due to an accident or a disease suffered permanent or long-term health detriment are entitled to one-time compensation. For each percentage of permanent or long-term health detriment, they are entitled to compensation in the amount of 20% of the average gross salary. If, as a result of health status, the permanent or long-term health detriment is increased, one-time compensation is granted only if the detriment increased by more than 10 percentage points in relation to the predetermined condition. Obtaining compensation is conditioned by:

- health detriment caused by an accident within 3 years from the date of the accident,
- health detriment caused as a result of a disease, not later than 3 years from the date of release from active military service.

Pursuant to Art. 5 of the above-mentioned Act, an accident is a sudden event caused by external causes, resulting in injury or death, which occurred during or in connection with:

- performance of duties or orders of superiors,
- carrying out activities in the interest of military service, even without orders of superiors,
- saving people from imminent danger or rescuing property from damage or being captured,
- participation in the chase or recognition of persons suspected of committing a crime or protecting others from assault,
- travelling to and from a place of the activities referred to in paragraphs 1 and 2.

Diseases for which compensation benefits are granted are listed in the Regulation of the Ministry of National Defence of 01.08.2003 on the list of diseases in connection with military service in respect of which compensation benefits are granted (Journal of laws of 2003 No. 143, item 1397 as amended). The Regulation also lists the specific conditions and characteristics of military service characterized by the possibility of harmful factors influencing the emergence of certain diseases associated with the performance of military service. The benefits set out in the act are not granted when:

1) the cause of the accident or the disease has been proven by a competent authority to be a deliberate or grossly negligent act or omission of the soldier, being a violation of applicable laws or orders,
2) in the event of an accident:

a) of the soldier during:

- stay on a leave or a pass, except during travelling to the leave or passing back and forth,
- leaving the military unit or designated whereabouts without permission or willful remaining outside,

b) significantly caused by the behavior of the soldier, due to his state of intoxication or taking drugs or psychotropic substances,

3) if the health detriment or death of the soldier were caused by him intentionally.

MMBs issue a decision on the determination of the degree of health detriment, guided by the standards list attached as Appendix 2 to the Regulation of the Ministry of National Defence of 08.08.2003 on determining the degree of health detriment and connection between the death of soldiers in military service and an accident or disease (Journal of laws of 2003 No. 163, item 1578 as amended). MMBs shall take their decision after medical examination, using:

- a copy of the military service record from the personnel files of the soldiers,
- information on the conditions and characteristics of military service, taking into account the history of the disease, the course of treatment and its results and risk factors at official positions,
- medical histories of outpatient and hospital treatment,
- results of measurements of harmful factors in the given environment of the service,
- medical records of the soldiers,
- accident protocol.

The list setting standards for the assessment of health detriment contains a description of the detriment and determines the range of values that need to be addressed while determining body detriment associated with a disease. Medical boards, while determining body detriment, are required to indicate whether the detriment is permanent or long-term and give the item of the list of standards

according to which they assessed the degree of the detriment. In addition, the ruling must include a decision whether the detriment occurred in the period of 3 years from the date of the accident, and the justification should include indication of the basis on which the accident or the disease causing detriment were considered in connection with military service. In the event of an accident it is a legal decision of the Provincial Chief of Military Staff appropriate, in the case of a disease, to make a final MMB decision on the disease connected with the occurrence of conditions harmful at the positions held by the subjects.

Ruling on the control of sick leave and the connection between sick leave and military service

From 01.06.2014, MMBs launched their activities related to ruling over the control of the accuracy of temporary incapacity to serve due to a disease and the resulting exemptions from military service pursuant to the provisions of the Act of 01.24.2014 amending the Law on Police, Law on Border Guard, Law on the State Fire Service, Law on Government Protection Office, Law on Internal Security Agency and the Intelligence Agency, Law on professional military service, Law on the Central Anti-Corruption Bureau, Law on the officers of the Military Counterintelligence Service and the Military Intelligence Service, Law on Prison Service and other laws (Journal of Laws of 2014, item 502).

In the case of the control of the regularity of ruling temporary incapacity to serve due to a disease (sick leave), soldiers are referred by their commander to an MMB and provide complete medical records compiled the medical doctor determining the sick leave and, in particular, the documents referred to in § 22 paragraph 1 of the Regulation of the Ministry of Defence of 08.01.2010 on the capability to decide on the professional military and the properties and mode of conduct of military medical boards in these matters (Journal of laws of 2010 No. 15, item 80 as amended). It should be remembered that, pursuant to Article 111, paragraph 4 of the Act of 11.09.2003 on professional military service (Journal of Laws of 2010 No. 90, item 593, as amended) a professional soldier is released from professional military service as a result of the refusal to accept a referral or unjustified failure to attend a board appointment within a specified time and place, or not being subject to testing required by the medical board. In light of the above consequences, the soldier's referral notification procedure (by hand, with return receipt requested), and his attendance at the board at a time strictly defined by the commander is of particular importance. If, as a result of control, the military medical board determines a date on which the incapacity for service stopped being earlier than the date in the sick leave, the professional soldier loses the right to the salaries for the period from that date until the end of the sick leave.

In the case of establishing a connection between the sick leave and military service, the Act of 24.01.2014 provides for the possibility for the professional soldier to keep the right to 100% of the salaries, if the sick leave covers the period for which he was released from official duties, including due to an accident in connection with the service or disease arising in relation to the specific characteristics and conditions of military service.

The connection with military service is determined by the appropriate Regional Chief of the Military Staff pursuant to the Regulation of the Ministry of National Defence of 15.09.2003 on the treatment in the event of an accident or a disease disclosure in connection with the performance of active military service (i.e. Journal of Laws of 2014, item 1083).

In the current state of the law, a disease arising in connection with the specific characteristics and conditions of military service is a disease listed in the list of diseases attached as Appendix 1 to the Regulation of the Ministry of National Defence of 31.03.2003 on the list of diseases arising from the specific characteristics and conditions of military service and diseases and conditions that existed through the period of military service, but deteriorated or emerged during the service due to the particular characteristics or conditions of service at certain positions (Journal of laws of 2003 No. 62, item 567 as amended). The list includes a number of harmful factors which soldiers during military service may be exposed. Their occurrence should be documented in accordance with § 2 of the above-mentioned Regulation, in particular based on the results of measurements of harmful factors occurring in the environment of the service. Accordingly to the above, diseases arising in relation to the specific characteristics and conditions of military service are diseases related to exposure to noise, vibration, microwave, electromagnetic, infrared, ultraviolet radiation, ionizing radiation, dust, harmful chemicals, infectious agents, irritants or allergenic agents,

carcinogenic agents, freezing temperatures, sudden changes in pressure, the effect of acceleration, jobs that require long-term burden on limited groups of muscles and acute and chronic psychological trauma caused by accidents while on duty (PTSD).

Professional soldiers are obliged to provide the commander of their military unit a sick leave within 7 days of receipt. For the period of being on a sick leave not related to military service, a professional soldier receives 80% of their salary.

Literature

Legal acts in force in the military case law in Poland have been included in the text, taking into account the pattern and the position in the Official Gazette.

Restructuring of military case law in Poland

Restrukturyzacja orzecznictwa wojskowego w Polsce

Piotr Wróblewski[1], Janusz Maciorowski[2]

[1]Chairman of the District Military Medical Board in Warsaw
[2]Chairman of the Central Military Medical Board in Warsaw

Abstract. The article presents the new organizational structure of the military medical boards (MMBs) introduced in January 2013 and the scope of competence and tasks performed by the Central and Provincial Military Medical Boards. As a result of the restructuring of military jurisprudence in Poland the number of MMBs was reduced from 28 to 12. This has led to the improvement in the effectiveness of MMBs, the reduction in personnel, assets and property expenditure, and the standardization of military jurisprudence, making it closer civilian case law. The authors paid attention to the management and financing of the MMBs and the allocation of funds for the activities of MMBs. The authors have also created a list of applicable legal regulations concerning military case law in Poland.
Key words: military case law, military medical boards

Streszczenie. W pracy przedstawiono nową, funkcjonującą od stycznia 2013 roku, strukturę organizacyjną wojskowych komisji lekarskich (WKL) oraz szczegółowy zakres działania Rejonowych i Centralnej Wojskowej Komisji Lekarskiej. W wyniku restrukturyzacji orzecznictwa wojskowego w Polsce dokonano redukcji WKL z 28 do 12, co pozwoliło na zwiększenie efektywności działania, zmniejszenie wydatków osobowych, rzeczowych i majątkowych, a także przybliżyło strukturę orzecznictwa wojskowego do orzecznictwa cywilnego. Zwrócono uwagę na zarządzanie i finansowanie WKL oraz przepływ środków finansowych na działalność orzeczniczą. Sporządzono również wykaz obowiązujących regulacji prawnych dotyczących orzecznictwa wojskowego w Polsce.
Słowa kluczowe: orzecznictwo wojskowe, wojskowe komisje lekarskie

Delivered: 30/09/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 84-92

Corresponding author:
Lt. Col. Piotr Wróblewski MD
Provincial Military Medical Board
78 Koszykowa St., 00-911 Warsaw, Poland
telephone: +48 504 003 590
e-mail: rwklwarszawa@wp.mil.pl

Introduction

In recent years, there has been a reduction of the medical staff in the Armed Forces of the Republic of Poland, mostly due to closing of the Military Medical Academy, which provided a constant supply of officer-physicians. Liquidation of the school preparing military physicians had devastating effects, and today the deficits of higher medical personnel in all positions are noticeable. Education of physicians at the military medical faculty of the Medical University of Łódź was intended to improve the situation, but their number is still insufficient. These deficits in the medical staff have also affected Military Medical Boards (MMBs). An important factor is that experienced certifying physicians leave to work in other healthcare structures, where they receive higher incomes.

The reduction in the number of Military Medical Boards was inevitable due to the dissolution of many military units in some regions of the country, so that maintaining the original number of MMBs became economically unjustified. The suspension of regular military service duty also drastically reduced the number of decisions issued by MMBs. The last military conscription took place in 2008, and dismissal of the last conscripts from regular military service took place in 2009, at which point the number of MMB decisions decreased by half (fig. 1).

Throughout the years the profile of decisions issued by MMBs has also changed. The number of decisions regarding fitness for active service decreased significantly, whereas the number of decisions regarding fitness for professional military service issued to candidates for professional service, disability and determining the degree of damage to health increased.

The number of disability decisions issued by basic level MMBs, and control examinations (provision of pension benefits) in consecutive years was as follows: 2008 – 6111; 2009 – 5878; 2010 – 6160; 2011 – 5210; 2012 – 3693; 2013 – 3844; and 2014 – 3474.

The number of decisions regarding the percentage of damage to health issued by the basic level MMBs in the consecutive years was: 2008 – 2798; 2009 – 2849; 2010 – 3813; 2011 – 3971; 2012 – 4002; 2013 – 4758;

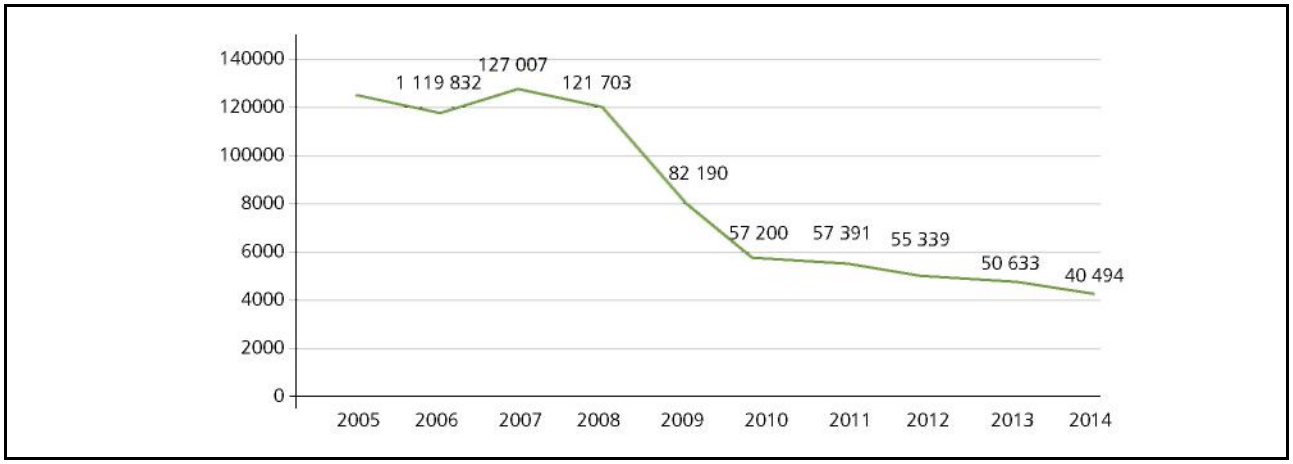

Figure 1. Total number of MMBs decisions issued between 2005 and 2014
Rycina 1. Ogólna liczba orzeczeń wydawanych przez wojskowe komisje lekarskie w latach 2005-2014

and 2014 – 4449.

Participation in military operations abroad, implemented in difficult environmental conditions, as well as the specificity of military service require high levels of mental and physical strength from soldiers, and considerable motivation to act in dangerous circumstances. Commanders of units and subunits must be able to take fast and correct decisions independently under high stress. In many cases the decisions are of strategic importance, and may determine the military and political success or failure of the entire operation. Therefore, the proper selection and choice of people in military service is very important.

Implementation of tasks expected from MMBs requires, apart from specialist certifying knowledge, constant improvement of medical and military qualifications and, following technical and tactical changes in the armed forces, as well as a good understanding of the legal issues and acts related to civilian medical certification, familiarity with administrative law and with other legal acts in force in the national defence department.

MMB decisions should include:

- medical diagnosis;
- determination of the category of fitness for active military service and, if diseases or deficits are found, establishing their relevance for military service;
- detailed justification.

The type and scope of medical examinations recommended by MMBs depends on the purpose of the decision.

2013 was a time of great changes regarding Military Medical Boards. The number of MMBs was reduced, and their locations were adjusted according to the administrative division of the country and to the newly developed concept of medical regions in the military forces. Large scale investment and purchasing plans were also made, especially for the necessary computer equipment, indispensable for the creation of databases and the issuing and archiving of decisions. The LOGIS-MOW system of military medical certification, prepared by the Centre for Information Technology Projects Management, was also implemented.

The system comprises the following modules:

- examined individual registration;
- issuing referrals for tests and medical consultations;
- decision issuing;
- analytical accounts regarding board, tests and decisions.

The system serves as a database of previously issued decisions, which facilitates the work of certifying physicians, as immediately upon registration they may verify if any previous decisions have been issued for the person referred to by the MMB. Quick access to previous decisions prevents oversight of previously existing diseases, e.g. those which do not result in incapacity for professional military service, but exclude service abroad.

In 2014, work began on creating a modern computer system based on Internet browser technology to support the decision issuing process.

MMBs organizational structure

The military medical certification institutions include:

- higher level board – Central Military Medical Board (CMMB);
- basic level boards – Provincial Military Medical Boards (PMMBs) operating in Warsaw, Kraków, Wrocław, Ełk, Szczecin, Lublin, Bydgoszcz, Łódź and Żagań, as well as the Provincial Military Aero-Medical Board in Warsaw (PMAMB in Warsaw) and Provincial Military Maritime Medical Board in Gdańsk (PMMMB in Gdańsk).

The Central Military Medical Board (CMMB) in Warsaw took over the tasks of previous higher level boards located in Bydgoszcz, Wrocław, Warsaw and Kraków, of the Military Medical Board of the Air forces, and the Military Navy Medical Board in Gdańsk. As a result of the restructuring, the number of MMBs was reduced from 28 to 12, the human and financial resources involved in military certification procedures were concentrated in order to improve the effectiveness of actions while reducing personnel, asset and financial expenditure; the military certification structure was also made similar to civilian certification (ZUS certification, disability certification), where one administrative unit comprised one higher level board (appeal body) and several basic level boards.

The tasks of CMMB concentrate on the management and coordination of affairs related to military medical certification, and preparation of medical boards to performing their tasks in crisis and during war. CMMB organizes the military medical certification system. It is a higher level board compared to the eleven basic level boards. It supervises the activity of and manages the subordinate MMBs in accordance with the principles established in separate executive documents. The main tasks of CMMB include:

- maintaining constant combat and mobilization readiness of the CMMB in Warsaw and its subordinate organizational units;
- programming, planning of organization, development and technical modernization of the military medical certification department;
- initiating and providing opinions on the drafts of legal acts regarding the medical certification activity of MMBs;
- reporting needs regarding preparation of legal acts and providing suggestions for legal solutions;
- conducting organizational and employment affairs, as well as human resource affairs related to the department of military medical certification;
- financial planning regarding the activity of the department of military medical certification;
- organization of protection of classified information in POMBO in Warsaw and in subordinate units;
- diligent supervision over the activity of all the MMBs;
- providing guidelines to MMBs regarding certification;
- reviewing appeals and objections to decisions issued by PMMBs, PMAMB and PMMMB, and approving decisions issued by these boards;
- analyzing all the aspects of the military medical certification and medical certification activities of MMBs;
- cooperation with healthcare facilities, including those established by the Minister of National Defence, outpatient clinics, outpatient clinics with infirmaries, and basic healthcare physicians in military units, medical universities or universities conducting educational and research activity in medical science, research and development units in the field of medical science, as well as with authorities and organizational units conducting medical certification activities;
- co-operation in matters related to certification with commanders, military authorities and the Military Chamber of Physicians;
- forming morale and work discipline in soldiers in order to ensure full readiness to perform tasks;
- gathering conclusions and experiences related to participation of the Polish Armed forces in military operations abroad, and presenting suggestions as to their implementation within its jurisdiction.

Provincial Military Medical Boards (PMMBs) are organizational units entitled to perform tasks related to military medical certification according to their jurisdiction and scope of competence in peace, crisis and war. The main tasks of PMMBs include:

- performance of military medical certification tasks regarding soldiers and candidates to be soldiers, according to the board's jurisdiction and scope of competence;
- maintaining combat and mobilization readiness, as well as the readiness to perform tasks in crisis situations;
- programming, planning of organization, development and technical modernization of PMMBs;
- providing opinions on received drafts of legal acts regarding medical certification activities;
- reporting needs regarding preparation of legal acts and providing suggestions for legal solutions;
- conducting the organization and employment affairs, as well as human resources affairs of PMMBs;
- financial planning of the functioning of PMMBs;
- organization of protection of classified information in PMMBs;
- analyzing all aspects of the medical certification activity in PMMBs;
- co-operation regarding military certification with treatment entities established by the Minister of National Defence, outpatient clinics, outpatient clinics with infirmaries and basic healthcare physicians in military units, medical universities or universities conducting didactic and research activities in medical science, research institutes according to jurisdiction and scope of competence;
- co-operation regarding certification with unit commanders and military authorities, according to jurisdiction and scope of competence;
- forming morale and work discipline in soldiers in order to ensure full readiness to perform tasks;
- gathering conclusions and experiences related to participation of the Polish Armed forces in military operations abroad, and presenting suggestions as to their implementation within its jurisdiction.

The internal organization structure of PMMBs including division into military and civilian positions; qualification requirements and classification of individual positions to employment grade and

remuneration group, as well as direct reporting relationships are determined by POMBO employment plans.

Management and financing in MMBs

MMBs are state institutions, financed by the state budget, and their activity is indirectly coordinated by the government. MMBs are not intended to bring profits, but to provide necessary goods and services for the state and its citizens. The activities of MMBs, as for most of the public sector, concentrate on providing social care and safety to the citizens. MMBs are financed by the third degree financial resources administrator. Each year a tender is organized for performance of examinations and consultations with physicians, and for laboratory tests for the needs of MMBs. Examinations and consultations with physicians are performed by a Healthcare Institution, while laboratory tests are usually performed by other facilities (subcontractors). The contract for the above services is concluded between the ordering party (Healthcare Institution), contractor (MMB), and payer (third degree financial resources administrator – the military unit financially responsible for the given MMB).

Changes in the financial plan for MMBs are introduced by:

- for payroll – second degree state budget resources administrator;
- for other expenses – third degree state budget resources administrator.

The definition of the department of military medical certification, presently comprising 12 MMBs, was dictated by the need to use standardized forms and principles in certification and to clarify functional responsibility. By order no. 6/IWSZ/2008 of 25 June 2008 regarding direct subordination of organizational units in charge of or supervised by the Head of the Military Healthcare Inspectorate, the Head of the Military Healthcare Inspectorate passed direct charge of MMBs to the Head of the CMMB. The structure of the certification department was reorganized in January 2013. In the new employment structure the tasks and organizational subordination of MMBs were established anew.

MMB operations, including resources for remuneration of professional soldiers and salaries for military employees (certifying physicians and administration personnel), are financed by the Ministry of National Defence. The logistics costs of MMBs are covered by the Economic Departments, according to assigned financial resources. Financial resources for certification are allocated by the Armed Forces Support Inspectorate for individual Economic Departments which conclude contracts with Independent Public Healthcare Institutions, and the Head of the CMMB co-operates in planning and allocation of these resources to individual MMBs. Centralization of the budget for certification on the one hand facilitates allocation of financial amounts for different MMBs and the transfer of resources according to needs, while on the other hand it is an obstacle, as annual tenders for medical services for all MMBs are organized centrally in Warsaw.

Each MMB is covered by an employment plan, has a National Official Register of Business Entities (REGON) number, and its head, as manager of the unit, is bound by all the obligations of an employer. Chapter 5 of the Act on military service of professional soldiers obliges the Head of the CMMB to issue administrative decisions for heads of MMBs and their deputies regarding assignment of:

- service anniversary awards,
- annual awards,
- allowance for long military service,
- financial payment due to discharge from professional military service and other financial payments listed in Art. 73, Para. 1 of the above act.

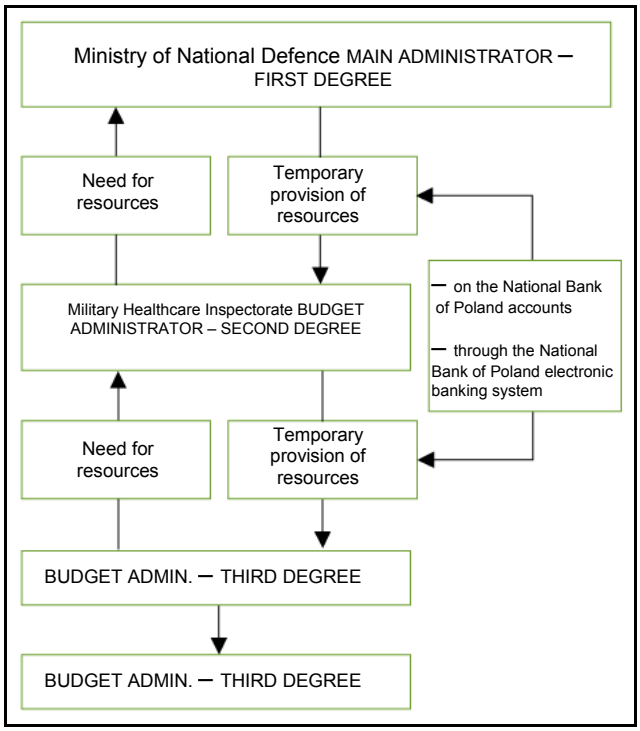

Figure 2. Allocation of funds for the military medical board activities
Rycina 2. Przepływ środków finansowych na działalność orzeczniczą WKL

Table. Detailed scope of competence of the Provincial and Central Military Medical Boards
Tabela. Szczegółowy zakres działania Rejonowych oraz Centralnej Wojskowej Komisji Lekarskiej

Type of board	Scope of competence
Provincial Military Medical Boards in Bydgoszcz, Ełk, Krakow, Lublin, Łódź, Szczecin, Warsaw, Wrocław and Żagań	Issue decisions regarding: 1) physical and mental fitness for active military service; 2) fitness for professional service in individual types of the Armed Forces of the Republic of Poland, and types of armed forces and services, as well as in different positions, abroad, within the range of microwave radiation, in proximity of electric currents, and fitness for professional military service with limitations; 3) damage to health due to accident or disease; 4) relation between a disease or deficit and specific properties or conditions of the military service; 5) relationship between death and active military service, service in the Military Counterintelligence Service and Foreign Intelligence Service, or with war or war-like operations; 6) disability and incapacity to function independently; 7) relationship between disability and active military service; 8) the need to grant a soldier medical leave; 9) the need to grant a soldier relief in service; 10) validity of the diagnosis of temporary inability to perform service (medical leave); 11) relation between medical leave and military service.
Military Aero-Medical Board in Warsaw	Issues decisions regarding: 1) fitness for active military service and classification into the category of fitness for the service, as well as fitness for active military service as part of the flight personnel, flight management ground personnel, and aerial engineering service personnel; 2) in case of soldiers referred for military service in the Air Force units, regarding fitness for active and professional military service: a) abroad; b) in airdrop and assault units; c) in representational units of the Armed Forces of the Republic of Poland; d) within the range of microwave radiation; e) in the proximity of electric currents; 3) the need to grant a sick leave; 4) damage to health due to an accident or disease; 5) relation between the disease, deficit or death and active military service; 6) the need to grant a soldier relief in service; 7) validity of the diagnosis of temporary inability to perform service (medical leave); 8) relation between medical leave and military service.
Provincial Military Maritime Medical Board in Gdańsk	Issues decisions regarding: 1) fitness for active military service and fitness for active military service on battleships and other watercraft of the Navy; 2) in case of soldiers performing military service in the Navy units, regarding fitness for active and professional military service: a) abroad; b) in airdrop and assault units; c) in representational units of the Armed Forces of the Republic of Poland; d) as divers and scuba divers; e) within the range of microwave radiation; f) in the proximity of electric currents; 3) the need for sick leave for soldiers performing regular military service in the Navy units; 4) damage to health due to an accident or disease; 5) the need to grant a soldier relief in service; 6) validity of the diagnosis of temporary inability to perform service (medical leave); 7) relation between medical leave and military service; 8) in case of soldiers performing active military service in the Navy units, regarding relation between a disease, deficit or death and military service.

The Head of the CMMB approves for payment applications in writing from heads of MMBs and their deputies regarding leave compensation, payment of equivalence for transport once a year to a chosen place, business trips, as well as grants for discretionary awards and annual leaves. It should be emphasized that heads of MMBs, as heads of institutions, are obliged to conclude employment

Table. Detailed scope of competence of the Provincial and Central Military Medical Boards – continued.
Tabela. Szczegółowy zakres działania Rejonowych oraz Centralnej Wojskowej Komisji Lekarskiej - cd.

Central Military Medical Board in Warsaw	Jurisdiction of the Central Military Medical Board in Warsaw includes: 1) reviewing appeals to decisions of Military Medical Boards; 2) stating opinions regarding objections to drafts of decisions and decisions of Military Medical Boards; 3) approving decisions and certain drafts of decision of Military Medical Boards; 4) diligently supervising the activity of Military Medical Boards, including settlement of issues raising serious doubts, or discrepancies in certification, as well as providing binding recommendations in that respect; 5) analyzing all aspects of military medical certification and the medical certification activity of Military Medical Boards; 6) co-operation with treatment entities, basic healthcare physicians in military units, medical universities, research institutes and authorities and organizational units performing medical certification activities; 7) co-operation with commandants and military authorities, as well as with the Military Chamber of Physicians; 8) initiating and providing opinion on drafts of legal acts regarding medical certification activity of military employees.

contracts with civilian employees, keep personal files, prepare employment plans and salary plans, and maintain budget discipline. These are additional duties, apart from the certification activity which they are legally required to perform. Another problem is the distribution of MMBs all over the country, away from Warsaw where the units responsible for providing financial support of certification activity are located, as well as the CMMB, the only higher level board authorized to review appeals, and approve decisions and drafts of decisions issued by the basic level boards. Documents are sent by mail, which is time and cost consuming. Since 2010, work on the technical modernization of MMBs has been in progress, and computer systems supporting the certification activity of the boards have been implemented. However, creating the network infrastructure and providing electronic connections between boards and other organizational units of the Ministry of National Defence which use MMBs services is problematic. Since March 2013, SI ARCUS, an experimental system of electronic registering and circulation of certification documents, has been implemented in POMBO in Warsaw. However, it functions within a local network, and its purpose is primarily to facilitate communication with CMMB. The works on connecting CMMB and POMBO in Warsaw to the INTER-MON or MIL-WAN network are still ongoing.

Human resources in MMBs

Positions in MMBs are given to officers-physicians and civilian employees. The main stem of certification staff are military physicians who graduated for the Military Medical Academy (MMA), a higher education facility which operated in Łódź in 1957-2003, and prepared health service officers (physicians, dentists, pharmacists and psychologists) for the Armed Forces. After the dissolution of MMA, the task of preparing medical staff for the army was taken over by the Centre for the Training of Military Medical Service (CTMMS), established in Łódź by the decision of the Ministry of National Defence of 6 September 2002. After 1 January 2011, CTMMS was transformed into the Military Centre for Medical Education (MCME). The main tasks of MCME include co-operation with the Military Medical Faculty of the Medical University of Lodz, and Military Academy of Land Forces in Wrocław in the process of educating candidates for professional soldiers in the medical personnel corps.

Officers employed in MMBs are required to:

- be a licensed physician,
- be allowed to process classified information,
- have a medical specialization or over 3 years,
- experience working in a military unit, complete a specialization course for an officer degree in MCME.

In POMBO officers are employed in the following positions:

- heads of MMB,
- deputy heads of MMB,
- specialists – certifying physicians, and junior specialists – certifying physicians.

In the CMMB three additional positions were created for main specialists who supervise certification teams and a specialist position for a lawyer.

MMBs usually employ a military physician who understands the specifics of service in different types of Armed Forces. The Ministry of National Defence Regulation of 15 November 2010 amending the regulation on certification regarding the disability of professional soldiers, soldiers dismissed from professional military service, military pensioners, as well as jurisdiction and procedures applied by Military Medical Boards in these cases (Journal of Laws of 2010, No. 225, Item 1467) enabled civilian physicians

also to be employed in MMBs. According to the previous Regulation of the Ministry of National Defence of 10 January 2006 on certification regarding the disability of professional soldiers, soldiers dismissed from professional military service and military pensioners (Journal of Laws of 2006, No. 12, Item 75), as well as the jurisdiction and procedures applied by MMBs in these cases, the boards issuing decisions comprised three officer-physicians. Without such a composition of the decision panel, the board could not function. The regulations in force since 15 December 2010 have introduced fundamental changes in the MMBs certification system.

Civilian employees are hired by MMBs on the basis of a Supra-institutional Collective Bargaining Agreement for Employees of Military Budget Section Organizational Units, entered into on 8 June 1998 between the Minister of National Defence, acting on behalf of employers hiring employees of military budget section organizational units, with offices in Warsaw, and acting on behalf of employees General Board of the Independent Self-Governing Trade Union of Military Employees, with its offices in Warsaw, and State Committee of the Solidarity Independent Self-Governing Trade Union in Gdańsk. Civilian employees are hired by MMBs as senior assistants, assistants, specialists and independent clerks or proxies for classified information.

Legal regulations regarding military medical case law in Poland

A. Act of 21 November 1967 on the universal obligation to defend the Republic of Poland (i.e. Journal of Laws 2012, No. 0, Item 461):

- Regulation of the Minister of National Defence of 7 June 2004 on the award of contracts for diagnostic tests and specialist consultations (Journal of Laws 2004, No. 144, Item 1520).
- Regulation of the Minister of National Defence of 24 August 2012 on Military Medical Boards and determination of their offices, scope of competence and jurisdiction (Journal of Laws 2012, No. 0, Item 1013).
- Regulation of the Minister of National Defence of 25 June 2004 on certification regarding fitness for active military service and the procedures applied by Military Medical Boards in these cases (Journal of Laws 2004, No. 151, Item 1595).
- Regulation of the Minister of National Defence of 20 October 2006 on certification regarding fitness for active military service and the procedures applied by Military Medical Boards in these cases (Journal of Laws 2006, No. 211, Item 1557).
- Regulation of the Minister of National Defence of 16 June 2009 on certification regarding fitness for active military service and the procedures applied by Military Medical Boards in these cases (Journal of Laws 2009, No. 106, Item 886).
- Regulation of the Minister of National Defence of 24 August 2010 on certification regarding fitness for active military service and the procedures applied by Military Medical Boards in these cases (Journal of Laws 2010, No. 189, Item 1268).
- Regulation of the Minister of National Defence of 13 December 2010 on certification regarding fitness for active military service and the procedures applied by Military Medical Boards in these cases (Journal of Laws 2011, No. 6, Item 24).
- Regulation of the Minister of National Defence of 2 May 2012 amending the Regulation on certification regarding fitness for active military service and the procedures applied by Military Medical Boards in these cases (Journal of Laws 2012, No. 0, Item 548).
- Regulation of the Minister of National Defence of 19 October 2010 on detailed principles of assigning service to people considered fit for active military service and subject to regular military service duty (Journal of Laws 2010, No. 201, Item 1329).

B. Act of 11 September 2003 on military service of professional soldiers (Journal of Laws 2010, No. 90, Item 593):

- Regulation of the Minister of National Defence of 8 January 2010 on certification regarding fitness for active military service and the procedures applied by Military Medical Boards in these cases (Journal of Laws 2010, No. 15, Item 80).
- Regulation of the Minister of National Defence of 4 December 2012 amending the Regulation on certification regarding fitness for professional military service, as well as jurisdiction and procedures applied by Military Medical Boards in these cases (Journal of Laws 2012, Item 1481).

- Regulation of the Minister of National Defence of 30 December 2009 on leaves for professional soldiers (Journal of Laws 2010, No. 2, Item 9).
- Regulation of the Minister of National Defence of 3 November 2010 amending the Regulation on leaves for professional soldiers (Journal of Laws 2010, No. 216, Item 1425).
- Regulation of the Minister of National Defence of 23 December 2010 on certain healthcare benefits to which professional soldiers are entitled (Journal of Laws 2011, No. 8, Item 36).

C. Act of 10 December 1993 on pensions for professional soldiers and their families (Journal of Laws 2013, Item 666, as amended (i.e. Journal of Laws 2013, Item 666, as amended):

- Act of 4 April 2014 amending the Act on pensions for professional soldiers and their families and the Act of pensions for officers of the Police Forces, Internal Security Agency, Foreign Intelligence Agency, Military Counterintelligence Service, Military Foreign Intelligence Service, Central Anticorruption Bureau, Border Guard, Government protection Bureau, State Fire Service, Prison Service and their families (Journal of Laws 2014, Item 696).
- Regulation of the Minister of National Defence of 10 January 2006 on certification regarding disability of professional soldiers, soldiers dismissed from professional military service and military pensioners, as well as jurisdiction and procedures applied by Military Medical Boards in these cases (Journal of Laws 2014, Item 1078).
- Regulation of the Minister of National Defence of 31 March 2003 on the preparation of the list of diseases associated with specific properties or conditions of military service, as well as diseases and conditions which existed prior to the military service, but exacerbated or became apparent during the service due to specific properties or conditions of the military service in given positions (Journal of Laws 2003, No. 62, Item 567).
- Regulation of the Minister of National Defence of 17 March 2009 on the preparation of the list of diseases associated with specific properties or conditions of military service, as well as diseases and conditions which existed prior to the military service, but exacerbated or became apparent during the service due to specific properties or conditions of the military service in given positions (Journal of Laws 2009, No. 52, Item 426).

D. Act of 11 April 2003 on compensations provided in case of accidents or diseases related to military service (i.e. Journal of Laws 2014, Item 213):

- Regulation of the Minister of National Defence of 8 August 2003 on establishing the degree of damage to health and relation between soldiers' death and military service in case of accident or disease Journal of Laws 2014, Item 839).
- Regulation of the Minister of National Defence of 1 August 2003 on the list of diseases associated with military service which entitle to compensation (Journal of Laws 2003, No. 143, Item 1397).
- Regulation of the Minister of National Defence of 17 March 2009 amending the Regulation on the list of diseases associated with military service which entitle to compensation (Journal of Laws 2009, No. 52, Item 426).

E. Act of 19 August 2011 on veterans of operations beyond the borders of the state (Journal of Laws 2011, No. 205, Item 1203):

- Regulation of the Minister of National Defence of 28 March 2012 on monitoring provision of healthcare services to injured veterans (Journal of Laws 2012, No. 0, Item 351).

F. Act of 29 May 1974 on provision for war invalids and their families (i.e. Journal of Laws 2010, No. 101, Item 648):

- Regulation of the Minister of National Defence of 31 March 2003 on the preparation of the list of diseases associated with specific properties or conditions of military service, as well as the list of diseases which are significant exacerbations of illnesses due to specific properties or conditions of the military service (Journal of Laws 2009, No. 62, Item 566).
- Regulation of the Minister of National Defence of 2 June 2009 amending the regulation on the preparation of the list of diseases associated with specific properties or conditions of military service, as well as the list of diseases which are significant exacerbations of illnesses due to specific properties or conditions of the military service (Journal of Laws 2009, No. 93, Item 765).

G. Act of 2 September 1994 on financial benefit and rights of regular military service soldiers forcibly recruited in coal mines, quarries, uranium ore facilities and construction battalions (i.e. Journal of Laws 2014, Item 1373).

H. Act of 9 June 2006 on the service of the officers of Military Counterintelligence Service and Military Foreign Intelligence Service (i.e. Journal of Laws 2014, Item 1106):

- Regulation of the Minister of National Defence of 26 September 2006 on certification regarding disability of professional soldiers, soldiers dismissed from professional military service and military pensioners, as well as jurisdiction and procedures applied by Military Medical Boards in these cases (Journal of Laws 2014, Item 1641).
- Regulation of the Minister of National Defence of 25 September 2006 on the list of diseases and conditions associated with service in the Military Counterintelligence Service and Military Foreign Intelligence Service (Journal of Laws 2006, No. 176, Item 1303).
- Regulation of the Minister of National Defence of 12 October 2006 on certification regarding disability of professional soldiers, soldiers dismissed from professional military service and military pensioners, as well as jurisdiction and procedures applied by Military Medical Boards in these cases (Journal of Laws 2014, Item 615).

Methods and medical aid principles for burns caused by chemical weapons

Metody i zasady pomocy medycznej w oparzeniach bojowymi środkami chemicznymi

Wojciech Witkowski, Agnieszka Surowiecka-Pastewka

Clinical Department of Plastic Surgery, Reconstructive Surgery and Burn Treatment, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine. Head: Wojciech Witkowski MD, PhD

Abstract. Due to the current and increasing risk of terrorist attacks with chemical weapons, and reported military use of vesicants, more attention is being paid to a better understanding of the effects of toxic substances, principles of providing medical aid to the victims and minimizing the effects of intoxication. Guidelines for action in areas at risk of chemical warfare and the recommendations for paramedics and casualties at ground zero, in field hospitals or in higher-level medical facilities are being created. The aim of this paper is to provide information on the chemical warfare agents that cause severe burns.
Key words: chemical weapons, vesicants, medical aid principles

Streszczenie. Ze względu na wciąż aktualne i stale zwiększające się ryzyko ataku terrorystycznego z użyciem broni chemicznej oraz doniesienia o bojowym wykorzystaniu chemicznych środków parzących coraz więcej uwagi poświęca się lepszemu poznaniu mechanizmów działania substancji toksycznych oraz sposobów pomocy rannym, poszkodowanym w wyniku działania środków chemicznych i zapobiegania intoksykacji. Tworzone są wytyczne postępowania w strefach zagrożenia atakiem z użyciem broni chemicznej oraz zalecania dla ratowników i poszkodowanych w strefie zerowej, w szpitalach polowych oraz na wyższych poziomach pomocy medycznej. Celem pracy jest przedstawienie informacji na temat bojowych środków chemicznych wywołujących ciężkie oparzenia.
Słowa kluczowe: broń chemiczna, chemiczne środki parzące, zasady pomocy

Delivered: 30/09/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 93-99

Corresponding author:
Wojciech Witkowski MD, PhD
Clinical Department of Plastic Surgery, Reconstructive Surgery and Burn Treatment, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine
128 Szaserów St., 04-141 Warsaw, Poland
telephone: +48 22 68 17 219, fax: +48 22 61 00 164
e-mail: wojwit@wim.mil.pl

Introduction

Following the NATO definition, the term chemical warfare agents refers to substances used in armed actions in order to kill, seriously injure or incapacitate the opponents by affecting their organisms' functions [1, 2]. Chemical weapons are inexpensive and easily synthesizable toxic agents [1, 3]. They may be sprayed or placed in missiles or containers such as plastic bags [1]. They are classified according to the mechanism of operation or activity time in a given environment [1]. The most frequently used and the simplest classification, i.e. the warfare classification, groups chemical weapons according to the system they affect the most [1, 3, 4]. We may then distinguish chemicals affecting the nervous system, lungs, blood and skin [5]. However, this does not mean that chemicals are harmful only to certain organs. A choking agent may at the same time burn and paralyze the nervous system. Modern classifications distinguish paralyzing and convulsion-inducing, as well as hallucinogenic and tranquilizing chemicals (nerve agents), vesicants, choking agents, emetics, asphyxiants, lachrymators and incapacitants [3, 4, 6].

Chemical weapons are usually associated with poison gases due to the fact that the first substances used during World War I and World War II were gases. Moreover, most agents at room temperature have the form of easily vaporized liquids [4], and they require higher temperatures and humidities to transform into aerosols. Intoxication may be a result of inhalation or skin contact with the substance [7]. The symptoms indicating use of chemical weapons may include: shortness of breath, stridor, pulmonary edema, convulsions, coma [3], erythema, blisters and lacrimation. The intensity of the symptoms depends on

the substance, time of exposure, environmental factors and general condition of the casualty [3]. Victims of the same attack may present different symptoms occurring at different times within, for example, a 72-hour latency period, which makes diagnosis and rescue actions very difficult [3]. Substances which could act as a universal antidote to chemical weapons are still being sought. Despite causing different symptoms, the effects that all chemical weapons share are inflammation and stimulation of cytokine secretion, therefore using anti-inflammatory drugs is suggested, with Ibuprofen being recommended to minimize intoxication symptoms [8].

Management principles in case of chemical warfare

In battlefield conditions, early recognition of the threat of chemical warfare is the key to effective rescue action. Any signs of smoke, gas, fog, droplets on objects or specific smells should raise suspicions [1]. Rescuers providing first aid in a contaminated area should be properly protected, i.e. wear protective clothes and gas masks [1, 6, 9]. Masks can be removed only in safe areas, after decontamination of the equipment and removal of clothes [9].

There has been extensive discussion on when it is safe to take off the masks if there is no order from the superiors. Protocols provide for the use of detection kits where, if the detectors do not detect any hazard, one or two soldiers inhale without a mask by removing their masks for 5 minutes and putting them back on again. After a further 10 minutes of observation, if no symptoms of intoxication occur, a signal to remove masks may be given. In the absence of detectors, a selected soldier inhales and opens the mask valve. If after 5 minutes no ocular symptoms occur, the soldier inhales deeply 3 times. If there are no signs of intoxication after 10 minutes of observation, the area is considered safe.

Due to the significant risk of chemical warfare, soldiers in many armies, including the American army, are additionally equipped with special medical kits, including masks, intravenous and intramuscular antidotes (atropin, pralidoxime, diazepam, sodium nitrite, sodium thiosulfate, dimercaprol and epinephrine) [9], as well as devices for restoring airways, including pharyngeal tubes, nasopharyngeal tubes and laryngeal masks.

A chemical attack casualty should be immediately transported outside the danger zone, where the victim's equipment and uniform can be safely removed and the patient decontaminated by intensive rinsing with water. In the safe zone, the ALS protocol should be followed [7], of which providing airway patency is the most important step [3]. If intoxication is suspected by paralyzing agents, then atropin and oximes should be administered, and prophylactic administration of benzodiazepine derivatives should be considered [1, 3]. Cyanides can be neutralized with Lilly Antidot (containing sodium nitrite and thiosulfates) [3].

Not all vesicants can be effectively neutralized with the available substances, and in some cases using neutralizers may even be harmful. Neutralizing chemical reagents entails the risk of an exothermic reaction, resulting in exacerbation of the thermal injury. In case of suspected contamination with sodium, potassium, lithium or cesium, do not use water because magnesium, white phosphorus, sulfur and zinc combust immediately upon contact with air, and pouring water on will only spread the burning material over a larger area. These elements are better decontaminated with "dry" methods, using powders such as *fuller's earth* (a type of complex mineral absorbent of natural origin, e.g. bentonite), or by using thick, moist compresses of gauze wetted with water. Despite certain limitations, dissolution of a chemical by intensive spraying with water is still commonly perceived as the most effective mechanism for removing chemicals [7]. Rinsing with water should also be avoided in case of contact with phenol, quicklime (exothermic reaction), as well as sodium, potassium and lithium (spontaneous combustion of these elements). Decontamination and neutralization are intended to remove chemicals from the body, clothing and equipment of the casualty, to minimize the amount of absorbed toxin, and to prevent contamination of other people [10].

In the contamination process four elements need to be considered: time, concentration, temperature and physical state. The longer the casualty is exposed to the toxin, and the higher its concentration, the greater the penetration of the substance and the damage it causes. The effects of toxins are stronger at high temperatures, while gases and aerosols penetrate clothing and skin more easily [10].

Decontamination after a mass incident should be divided into five steps. The first one involves controlling the crowd and directing casualties along a formed corridor toward an uncontaminated area, and then performing triage [10, 11]. If possible, the chemical weapons used should be identified, e.g. using toxidromes (a set of clinical signs specific for intoxication with a given class of poison) observed in victims. After securing vital functions according to the ALS algorithm, individuals who require decontamination should be selected, and the proper procedures applied.

Decontamination starts with removal of contaminated clothing, which should be secured to prevent dispersal of toxins. Body decontamination in field conditions usually consists of intensive rinsing of the body with water. Those casualties in good condition should be encouraged to self-decontaminate. Skin rubbing and irritating should be avoided. Casualties who require further medical assistance should be referred to proper medical facilities. Military hospitals at the third level of medical support should have specially trained personnel and rooms for decontamination of victims, as well as a laboratory to identify the chemical agent used [11].

Chemical military vesicants

Yperite

Mustard gas (sulfur yperite) is a chemical weapon known since the World War I, used in military actions and currently in terrorist attacks. It was used during the Iran-Iraq conflict in the 1980s and in the Persian Gulf in the 1990s [7, 12, 13]. Until now unknown amounts of yperite remain at the bottom of the sea as one of the sources is the military arsenal of the Third Reich sunk in the North Sea and the Baltic Sea during World War II [14]. There have been reports of intoxication of civilian fishermen and weaponry collectors [12].

Mortality as a result of yperite burns is 3% [1] to 13-15% [14, 15]. Deaths are usually associated with pulmonary edema, secondary pneumonia and sepsis [5].

Yperite was synthesized in 1922 [14, 16]. According to the NATO military nomenclature, the symbol of pure yperite is HD [3, 16]. The name is derived from the town of Ypres in Belgium, where in 1917 the chemical was used for the first time for military purposes. Sulphur yperite is also known as mustard gas, due to its characteristic smell. At room temperature it is a volatile, viscous, yellowish liquid [1, 3, 17] with the delicate odor of mustard and garlic [1, 16, 17]. There are two forms of yperite: sulfate and nitrite, although the latter has not been used as a weapon [5]. The freezing point is 14.4°C, so yperite cannot be used during the winter. Attempts have been made to combine yperite with lewisite in order to lower the freezing point [5]. At 38-49°C, HD vaporizes into a dangerous aerosol [5]. Attacks with the use of yperite were often performed at night as, at the lower temperatures, it remained a liquid until, with the increasing temperature of the day, it vaporized and affected the opponent [5].

Yperite is highly lipophilic, and easily penetrates through the epidermis [16]. In warm and humid conditions it vaporizes, and the aerosol penetrates through clothing [1], causing skin damage [17]. A 10 µg droplet causes blisters [5]. Only 10-20% of yperite on the skin surface penetrates it, the remaining part evaporates [16]. Yperite is quickly absorbed, but its half-life is long [16]. Intensively proliferating tissues such as bone marrow, intestinal epithelium and ocular epithelium are at the greatest risk of being affected by HD.

Yperite is a strong alkylating agent which binds and alkylates DNA and RNA molecules, proteins and lipid membranes [1, 3, 16]. It binds particularly strongly with the N-terminal part of guanine in the DNA [2, 18]. It causes hexokinase inhibition, decreases concentrations of glutathione and lipid peroxidase [16, 18]. DNA damage results in activation of polymerase, reduced NADH (nicotinamide adenine dinucleotide) concentration, and protease stimulation which leads to apoptosis [16, 18]. Another possible mechanism of damaging cells is reducing their ability to remove free radicals by glutathione inactivation [2, 16], and damaging the intracellular metabolism of calcium ions [14], whose high concentration activates protease, phospholipase and endonuclease [5]. Moreover, yperite stimulates the muscarinic and nitotinic receptors, demonstrating a cholinergic activity [5]. Due to the cell apoptosis-inducing properties of yperite, its derivatives are used in oncology [16].

Characteristic for HD is the latency period between intoxication and presentation of the symptoms. Contact with yperite is not painful, and the only sensation it provides is the perceptible smell of garlic [14, 16]. Yperite is absorbed through the skin, eyes and respiratory epithelium. It penetrates better in the moist areas of the body. After absorption, due to the strong lipophilic properties, yperite is accumulated in the fat and nervous tissues. The first symptoms are burning in the eyes and lacrimation, then respiratory, gastrointestinal and skin symptoms. In case of severe intoxication, the symptoms usually occur early, approximately 4 hours after exposure; in mild poisoning, they appear later. Skin lesions take the form of erythema, which appears a few hours after exposure, then turns into erythematous eczema with blisters [3, 17]. The blisters are thin-walled, large, filled with serous content, and they break easily [1, 3]. As the blistering is subepidermal, Nikolsky's sign is often present [14, 16].

Yperite mostly damages the intensively proliferating cells of the basal epidermal layer [16]. Hemidesmosomes between the basal layer cells and keranocytes in the epidermis are damaged [14]. The liquid in the blisters does not contain HD, and it is not harmful for the environment. Skin lesions usually affect places such as armpits, groin and the joints [3, 17]. In these areas wounds are deeper, while in the remaining area the burns are usually more superficial. Blistering often occurs around the erythema, resembling a string of pearls [5]. Blisters later become scabs. The process of epithelialisation, which takes place underneath [17], is slower than in case of thermal burns, for example, due to DNA damage [14]. A complication associated with skin lesions is the occurrence of treatment-resistant discolorations [3, 16, 17], resulting from the accumulation of melanin and melanophages in all epidermal layers [14]. Histological effects of HD resemble known diseases. They may present as vascular or lichenoid dermatitis, spongiform or vesicular dermatitis with or without acantholysis, increased melanisation and scleroderma-like lesions [2].

HD damages the respiratory epithelium, and the resulting inflammation depends on the dose of yperite; it may be mild or critically severe. The first symptoms usually include: watery, runny catarrh, cough and dyspnea [3, 17]. In mild intoxication, coughs and sneezing occur. Severe poisoning may lead to laryngeal edema and bronchial spasms. The damaged epithelium undergoes necrosis and exfoliation, blocking the airways [5]. Additionally, edema occurs.

As a result of HD, bronchitis may develop, initially non-bacterial, then with secondary superinfection. No data is available on damage to the pulmonary tissue. Burns of the eyes, the most sensitive organ to yperite [16], appear first, usually in the form of conjunctivitis, lacrimation, swelling of the eyelids, sensitivity to light and narrowing of the pupils. HD may lead to localized necrosis and ulceration of the cornea [17]. Despite high sensitivity of the gastrointestinal tract cells, symptoms are usually of negligible intensity. Nausea, vomiting and diarrhea are the dominant ones. Convulsions may occur during intoxication. The most severe complication following exposure to yperite is bronchial epithelial necrosis and bone marrow damage resulting in myelosuppression [17]. Initially, leukocytosis develops, and after approximately 7 days it turns into severe leukopenia and aplastic anemia [17]. Systemic symptoms of yperite intoxication resemble the side effects of radiotherapy and chemotherapy (Tab.) [16].

The methods of yperite detection in the organism are available only in some laboratories, and consist in mass spectrometry and immunochemical DNA analysis. Spectrometry enables detection of yperite metabolites combined with glutathione and cysteine in the urine and blood [12, 13, 16], even 3 weeks after exposure [13].

In case of suspected yperite intoxication, immediate decontamination should be performed. In battlefield conditions, decontamination must be performed by the casualty, without waiting for medical personnel [5]. Some armed forces are equipped with skin decontamination substances, such as M291 (USA), RSDLTM (Canada) or *fuller's earth* (Great Britain) [14, 16]. Intensive rinsing with water causes dispersal of the substance; however, if it is sufficiently long and ample, it may effectively remove the yperite remains from the skin [16]. After contamination, contact lenses should be removed immediately from the eyes, the conjunctival sacs should be rinsed with a saline solution, and decontamination should be followed by the application of steroid ointment [16]. Cooling down the burnt skin has an analgesic effect. In the case of more pronounced symptoms, use of analgesics is recommended, following the analgesic ladder [16]. Prompt administration of non-steroid anti-inflammatory drugs is necessary [5]. Dimercaprol cream may be used on the skin lesions [5].

Currently, in case of yperite contamination, only symptomatic treatment is available; this consists in maintaining the function of the systems and reducing the general symptoms [17]. The respiratory and gastrointestinal systems are supported, and blood count is controlled. Management should be the same as for thermal burns, except for liquid resuscitation. Due to skin lesions, casualties do not lose liquids, normovolemia is preserved, and thus they do not require administration of liquids in the amounts specific for thermal burns [1,3]. Moreover, there is no relation between the body surface contaminated with HD and mortality. Another difference between a chemical and thermal burn is the fact that yperite-induced skin lesions take much longer to heal than burn wounds, which is associated with DNA damage [1].

The main complication of a skin burn is skin infection [14], so blisters and wounds should be covered with sterile bandages [5]. Small blisters are left, and antibacterial silver ointments are applied on them. Using steroid ointments reduces edema and the burning sensation [17]. Large blisters are removed in the operating theatre. If deep skin damage is found, the necrotic and infected tissue should be carefully removed, and immediate or delayed autogenic skin transplantation should be performed. Analgesics and antipruritics are adapted to the patient's condition [5]. In the case of severe bone marrow suppression, use of the growth factors GM-CSF and G-CSF is recommended [3, 16, 17].

Presently no specific methods for the treatment of HD burns are available. Studies are being conducted on cellular and animal models to improve our understanding of the adverse intracellular effects of HD, and to find methods and drugs alleviating the outcomes of intoxication. One of the models consists of human keranocytes, used by Smith et al. to demonstrate the protective effect of niacinamide on the survival of cells after exposure to HD [18]. Sawyer et al. conducted a study on CHO-K1 cell cultures, and demonstrated reduced HD toxicity in an alkaline pericellular environment [19]. Also hypothermia has a protective effect on human keranocyte cultures, and cooling the skin lesions may minimize the damage. Mi et al studied these properties on guinea pigs which were cooled with cold compresses 5 minutes after exposure to HD [20]. Another model is the mouse ear on which Casillas et al studied the effects of substances in topical therapy. The analysis involved 33 agents used superficially, and five mechanisms of action: anti-inflammatory, protease inhibition, radical scavenging and chelating, PARP inhibition and calcium modulation. Olvanil (capsaicin derivative), indomethacin and hydrocortisone, used 10 minutes after yperite intoxication, demonstrate a protective effect and reduce edema. Additionally, Olvanil reduced tissue damage, which was confirmed by histopathological examination. Other studies on animals revealed that administration of N-acetylcysteine up to 20 minutes after exposure reduces organ damage [21].

Lewisite

Lewisite is an arsenic derivative, first synthesized in 1918 [19], known as the "Dew of Death". It is an oily liquid with a delicate, geranium-like odor [19]. Although its structure differs from that of yperite, it also causes blisters on the skin. Contrary to yperite, intoxication symptoms occur immediately after exposure [7,14]; they affect mostly the eyes, respiratory system and skin. Pain, pruritus and erythema occur as soon as within 3-5 minutes, and full syndrome develops within

Table. HD intoxication symptoms
Tabela. Objawy intoksykacji iperytem

Organ	Symptoms		
	Mild	**Moderate**	**Severe**
Eyes	Conjunctivitis, foreign body sensation, lacrimation	Corneal edema, sensitivity to light, blepharospasm	Severe corneal damage, ulceration and corneal perforation
Respiratory system	Irritation of the nasal mucosa, hoarseness, sneezing, cough	Lacrimation, catarrh, anosmia and dysgeusia, nasal bleeding, choking cough, *tracheobronchitis,* pseudomembranes	Edema of lower and upper respiratory tract, ulceration
Skin	Erythema, pruritus	Erythematous eczema, blisters	Quickly progressing erythematous-vesicular eczema, ulceration
Systemic toxicity	Nausea, vomiting, loss of appetite		Immunosuppression, leukopenia, diarrhea, fever, cachexia

a few hours. Lewisite causes deep burns and skin necrosis more often than yperite. Capillaries become damaged and start to leak, which results in hemoconcentration, hypovolemia, shock and organ damage [5,7]. This syndrome is referred to as "lewisite shock", and results from exposure to large quantities of the substance [5]. Damage to the nervous system is more serious than with yperite [14]. Lewisite does not cause bone marrow suppression [5]. Damage to the respiratory epithelium resembles yperite intoxication [5]. Lewisite inhibits the activity of many important intracellular enzymes, such as pyruvate oxidase, hexokinase and dehydrogenase, as well as impeding the metabolism of hydrogen carbonates [5]. Approximately 5 minutes after contact with lewisite, the first blisters appear in the center of erythematous lesions, and, with time, they cover the entire inflamed surface. Re-epithelisation is faster than in yperite-induced damage, and skin hyperpigmentation is rarer. The vesicant can be found in the blisters, which should be noted by the rescuers providing assistance, as it is dangerous for them. Skin lesions heal faster than HD-induced ones, but secondary wound infections are much more frequent [5].

Lewisite inhalation does not damage the respiratory system directly. After contact with the skin, hemoconcentration and hypovolemia may develop; lewisite enters the blood stream and may damage the pulmonary capillaries, resulting in pulmonary edema.

There are no methods for lewisite identification. Disease history and clinical symptoms are used to make diagnosis. Initial management is similar to that applied in yperite intoxication. The casualty needs to be carefully decontaminated. An antidote is available, namely dimercaprol – BAL (British Anti-Lewisite) [7, 14]. Dimercaprol is available in the form of an eye ointment, a preparation for the skin and for intramuscular injections [14]. Its administration is recommended in casualties with severe symptoms within 15 minutes following exposure [19]. Intramuscular injections should be repeated 4, 8 and 12 hours after intoxication. In case of pulmonary edema, a second dose should be administered after 2 hours, continuing the doses for up to 4 days. Further treatment is only symptomatic and non-specific.

Phosgene oxime

This is not a typical vesicant. The skin symptom of intoxication is the occurrence of small lesions, typical of urticaria. Phosgene is a liquid that vaporizes at approx. 38°C. The mechanisms of intracellular damage are still being studied. It is postulated that the cell damage results from the reaction of chlorides with cellular enzymes. Cells die directly or indirectly due to stimulation of inflammation and macrophages. After intoxication, capillaries are damaged and leakage ensues, which may result in shock. Phosgene damages the eyes, skin and lungs.

Compared to other vesicants, it causes the most serious damage. After contact, pain, burning and urticaria occur immediately. With time the erythema turns grayish, and the center of the lesions becomes necrotic. Lesions in the eyes and lungs resemble those caused by other chemical warfare agents [5]. At the moment there are no methods for phosgene detection, and no guidelines and methods for specific and effective targeted treatment. Medical management is mostly symptomatic and typically preventive [5].

Summary

Chemical weapons still pose a real threat, although they are legally forbidden. Understanding of the effects of military vesicants and the management principles in case of exposure to them is crucial for both military and civilian physicians, who may face a mass incident or a terrorist attack. There are no standardized tests for the diagnosis of the chemical agent used, so

knowing the intoxication symptoms is of great importance while providing first aid.

The casualty should be transported to a safe place immediately. Rescuers should wear protective clothing and masks, which they may remove only in a safe zone. Decontamination is performed in a safe zone, which under field conditions means intensive rinsing with water or use of absorbent powders; in the hospital environment more specific substances are used.

Regarding resuscitation, chemical burn treatment protocols are the same as in thermal burns. In topical treatment, the basic procedure is rinsing with water, referred to as *dilution rather than neutralization,* except for burns induced by sodium, lithium or potassium, which should be treated with oil, e.g. silicone oil. All patients with chemical burns must be examined and treated by a burns specialist. Surgical treatment is implemented to prevent exacerbation of the burn, or performed later to remove the necrotic tissue entirely and effectively close the wounds with transplants.

Despite our understanding of the mechanisms of the intracellular action of chemical warfare agents, there are still no highly specific methods for the prevention and treatment of their effects. Researchers from the Military Institute of Medicine, in co-operation with the Faculty of Chemistry of the University of Warsaw, are studying new possibilities of fighting the effects of chemical warfare agents at the early medical aid stage. The studies conducted in laboratory conditions consists of the evaluation of the effectiveness of bandages and anti-burn preparations (powders) in the neutralization and removal of a given burn agent, using a complex experimental model.

Acknowledgement

The authors would like to thank the Military Health Service Inspectorate of the Ministry of National Defence for the financial support of the research (research project reference 09/WNM/2007; subject: Management principles in the treatment of trauma and burn wounds induced by NBC agents – guidelines for instructions).

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The role of rotablation in contemporary interventional cardiology

Miejsce rotablacji we współczesnej kardiologii interwencyjnej

Władysław Witczak, Grzegorz Sobieszek, Wojciech Kula

Clinic of Internal Diseases, Department of Cardiology of the 1st Military Research Hospital and Polyclinic (Health Maintenance Organization) in Lublin; head Prof. Władysław Witczak MD, PhD

Abstract. Rotablation is one of the most modern techniques applied in interventional cardiology. Following the balloon angioplasty era was the stage of coronary artery stenting and this led to rotablation used as the treatment strategy for very tough and calcified atherosclerotic lesions in the coronary arteries, which previously could be treated only surgically by coronary artery bypass grafting. Rotational atherectomy is an intravascular method based on the mechanical modification of unsusceptible plaque by using a small drill coated with diamond particles, introduced into the coronary artery. It enables initial lesion site preparation before stent implantation.
Keywords: rotational atherectomy, calcified atherosclerotic lesions, DES, restenosis, TLR

Streszczenie. Rotablacja to jedna z najnowocześniejszych technik stosowanych w kardiologii inwazyjnej. Po erze angioplastyki balonowej nastąpił etap stentowania tętnic wieńcowych, a ten ostatni dał podstawy do zastosowania rotablacji jako metody leczenia bardzo uwapnionych i twardych zmian miażdżycowych w tętnicach wieńcowych, które wcześniej można było leczyć jedynie operacyjnie za pomocą wszczepienia pomostów aortalno-wieńcowych. Aterektomia rotacyjna to wewnątrznaczyniowa metoda mechanicznej modyfikacji niepodatnej blaszki miażdżycowej z użyciem niewielkich rozmiarów wiertła pokrytego drobinkami diamentu wprowadzanego do tętnicy wieńcowej. Umożliwia wstępne przygotowanie miejsca zmiany w tętnicy wieńcowej przed wszczepieniem stentu.
Słowa kluczowe: rotablacja, zwapniałe zmiany miażdżycowe, DES, restenoza, TLR

Delivered: 12/09/2014
Accepted for print: 18/12/2014
No conflict of interest was reported.
Mil. Phys., 2015; 93(1): 100-106

Correspondence address
Prof. Władysław Witczak MD, PhD.
23 Racławickie Avenues, 20-049 Lublin
telephone: +48 81 718 32 04 e-mail:
hemodynamika@1wszk.pl

Introduction

Interventional cardiology has thrived in recent years. Since the first angioplasty of coronary vessels was performed by A. Gruentzig in 1977 [1] there has been outstanding progress in terms of technology as well as the understanding of pathophysiology, treatment options and the extension of indications for invasive procedures on coronary vessels. The use of more refined materials for making catheters, balloons, guide wires, metal stents and drug-eluting stents (DES) led to the standardization of invasive methods in the treatment of the ischemic heart disease, acute coronary syndromes in particular. At the same time, together with the improvement of therapeutic outcomes and an increasing survival rate, a certain shift in the profile of patients subjected to coronary interventions has become noticeable. Along with technological change and the improvement of the abilities and the increase in experience among the physicians who perform procedures, interventions are undertaken in patients who only a few years ago would have been denied the treatment by percutaneous methods on account of their angiogram or clinical presentation of the disease.

In the event of multi-vessel diseases, complex stenoses with heavy calcifications and hard lesions that are difficult to overcome and resistant to widening with a balloon, the application of standard coronary angioplasty procedures may not be possible. In connection with an unfavorable geometry of a vessel, calcification hampers the delivery of the balloon catheter and correct stent expansion, resulting in the ineffectiveness of the procedure or a high percentage of restenosis and the necessity of performing another target lesion revascularization (TLR). Surgical treatment in the form coronary artery bypass grafts is

not always an efficient and beneficial solution for patients either on account of the increased risk from the procedure, which is most often related to age, concomitant diseases and the morphology of changes in the coronary vessels. An alternative method of revascularization in such patients is the procedure of coronary angioplasty with the application of rotablation (rotational atherectomy), which, due to the modification of the unsusceptible, calcified lesion, enables optimal stent implantation and the obtaining of the desired effects.

Historical Overview and Present-Day Application

The rotablation technique was developed by David Auth [2] in the early 1980s. The first reports as regards the experimental use of the method in treating atherosclerosis in the femoral arteries of animals were published in 1988 [3]. Soon after, in 1989, the first rotablation procedures of the coronary (M. Bertrand) and peripheral (N. Zacc) vessels in humans were performed [4, 5]. The first rotablation procedure in Poland was performed in the Silesian Centre for Heart Disease in Zabrze (P. Buszman) in 1994. The method was disseminated in the 1990s, particularly in the USA, where it was used in 7% of all balloon angioplasty procedures [6]. Reducing the hardness and rigidity in calcified or fibrosed unsusceptible lesions enabled their expansion with the use of balloon catheters. A large percentage of cases of restenosis after rotablation procedures (over 40-50%) [7] remained an unsolved problem, unchanged by the dissemination of metal stents (still a large percentage of restenoses – 22.5%) [8]. Comparing rotablation with balloon angioplasty in the treatment of complex lesions in COBRA and ERBAC studies did not reveal any advantage for the methods being used individually in terms of long term results [9], although rotablation had a better angiographic effect. This led to a certain regression of the method and in the years 2003-2004 the percentage of rotablation in Europe and the USA remained at a rate of less than 5% of all procedures [10].

The revival of rotational atherectomy was brought about by the combination of this method with DES implantation, which prevents complications in the form of restenosis. At the same time rotablation enables modification and fragmentation of calcified, unsusceptible plaque and results in the possibility of extending the lesion with a balloon catheter, without the use of excessively high pressures for the expansion and the avoidance of the risk of vessel wall barotrauma, dissection or perforation. As a consequence, the placement and the expansion of the stent is much easier, which has been proven by research [11]. Thereby the use of rotablation enables a procedure on coronary vessels when standard methods fail (balloon catheter, stent), and, in combination with them, it reduces the risk of complications (dissection, perforation of the vessel wall) [12].

Indications

The guidelines of European Society of Cardiology on the revascularization of myocardium, which were published in 2010, recommended rotablation for the preparation of lesions with considerable calcification or increased fibrosis that were impossible to be pushed apart with a balloon or properly expanded before stent therapy: class IC indications [13]. The authors of the most recent guidelines on the revascularization of the myocardium from 2014 [14] underline the role of rotablation as a technique enabling the treatment of calcified lesions, yet without a particular indication class. At the same time they stress its usefulness for the optimization of lesions before the implantation of bioabsorbable stents.

The guidelines make the assertion that rotablation alone is not effective in treating restenosis in the stent. However, in combination with the implantation of a drug-eluting stent (DES), as it is done now, it may be an effective tool in preparing the lesion for stent therapy and become one of the variant methods of treating restenosis in the stent [15].

Procedure Technique

The rotablation procedure is performed with a high-speed diamond coated drill bit. The bit has a diameter of 1.25–2.5 mm and is placed on top of a ductile core coated with a plastic sheath that is rinsed with a NaCl solution and heparin during the procedure (additionally with adenosine in the authors' facility) (Fig. 1). Through use of an advancer (Fig. 2), the whole bit is connected to a turbine motor (Fig. 3) powered by compressed gas. The rotational speed of the device during operation is 130 000 – 160 000 rev/min, depending on preference (the rotational speed in the authors' facility is 130 000 rev/min; in the event of difficult lesions some facilities allow a higher speed for short sessions). The bit is guided into the vessel along a special ductile wire guide using the dyna-glide technique in order to minimize friction through a guiding catheter with a diameter of 7F. The procedure may also be conducted with the use of 6F catheters, especially for radial access. The stenosis is tackled with short backward and forward movements (a *pecking technique*) by withdrawing the bit to the starting position, checking the rotational speed (attention should be paid to decelerations >5000 rev/min) and the length of a single rotablator session (should not exceed 15-20 s). The sessions should be repeated until the bit has been through the lesion several times.

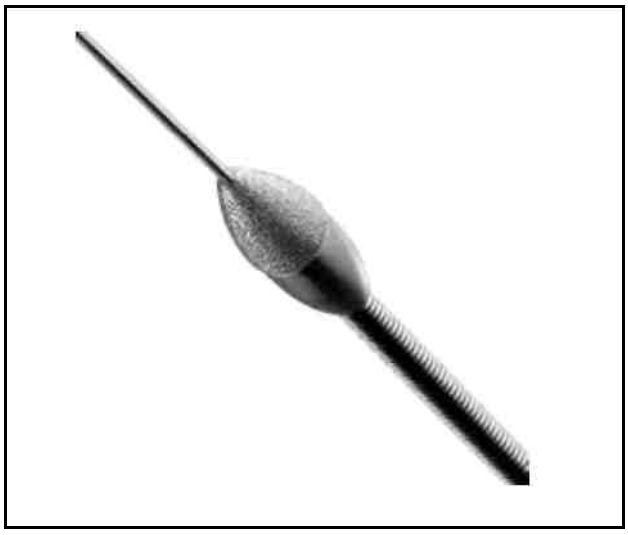

Figure 1. Rotablation drilling burr
Rycina 1. Wiertło do rotablacji

Figure 2. Advancer
Rycina 2. Advancer

Figure 3. The rotablator console
Rycina 3. Konsola rotablatora

Mechanisms of plaque modification

In the course of the procedure, hard, unsusceptible, calcified and fibrosed elements of the plaque are fragmented and destroyed without damaging susceptible soft tissue, which easily yields to the spinning bit [4, 6].

The result is dust particles of sizes less than 10/μm (5/μm on average) which are evacuated with the blood without clogging up microcirculation [16]. In this way the plaque is modified, its calcified elements are removed and the vessel wall is left smooth and devoid of endothelium with a wide passageway, which enables the effective subsequent use of balloon angioplasty (indication for the use of low pressures and a large sized balloon catheter to minimize barotrauma) and the implantation of a stent. On account of the huge risk of restenosis, the implantation of DES is recommended. An example of applying rotablation in the course of the angioplasty of the right coronary artery is shown in figures 4-6.

Complications and Contraindications

On account of extensive endothelium damage and possible disturbed microcirculation flow caused by the particles from the drilled elements of the plaque, a generalized vessel contraction and a *no-flow* image are the most frequent complications during rotablation [16]. Normally, disturbed circulation is temporary in nature, and is prevalent among women in the course of procedures involving long, calcified lesions situated on winding sections and during rotablation of the right coronary artery. The treatment includes nitroglycerin, adenosine or intracoronary administration of verapamil; adenosine may be administered by intravenous infusion. The need to administer IIb/IIIa receptor antagonists is rare. The increase of troponin concentration after rotablation procedures is observed in 6-30% of patients [16]. A rare complication after the rotational atherectomy procedure is a vessel perforation. Other complications typical for coronary angioplasty occur with a similar frequency to standard procedures [17].

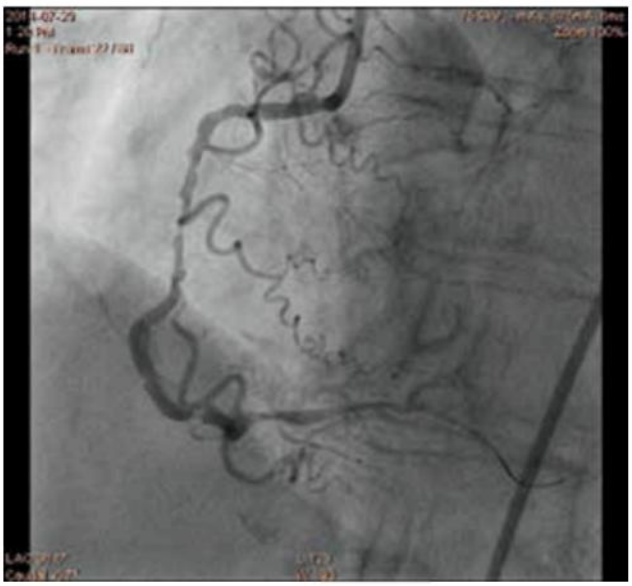

Figure 4. Coronary catheterization of the right coronary artery – a long calcified narrowing in segments 1-3
Rycina 4. Koronarografia prawej tętnicy wieńcowej - długie uwapnione zwężenie w segmentach 1-3

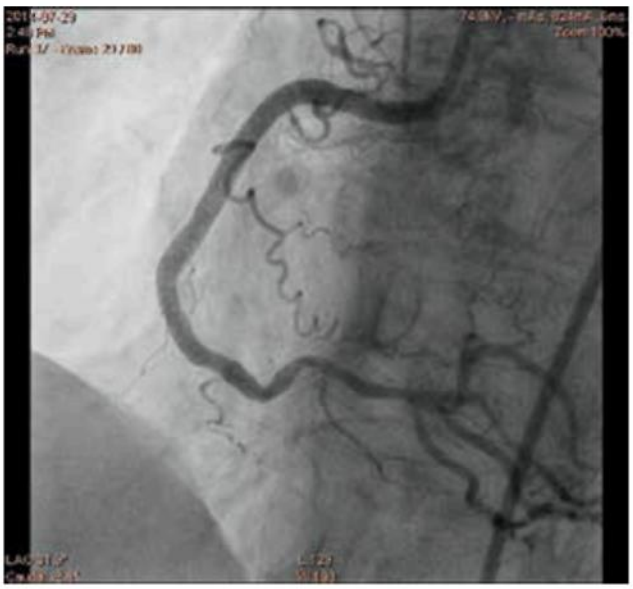

Figure 6. The effect of coronary angioplasty after rotablation and stent implantation
Rycina 6. Efekt angioplastyki wieńcowej po rotablacji i wszepieniu stentu

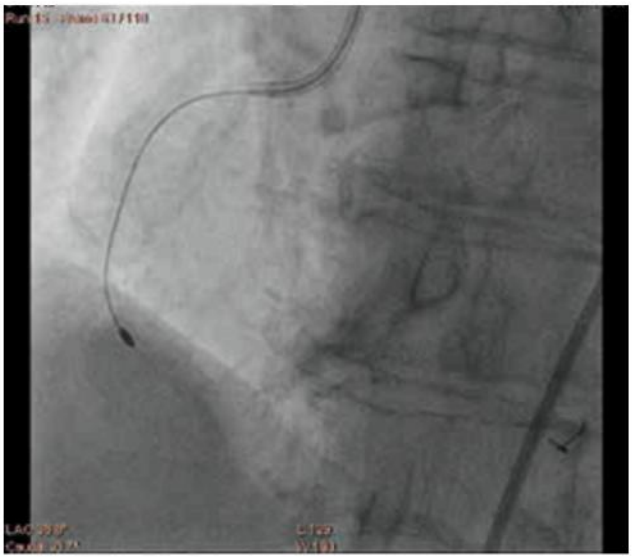

Figure 5. Rotablation atherectomy procedure
Rycina 5. Zabieg rotablacji

Prevention of complications during rotablation procedures entails using the right-sized bit (ratio of the bit diameter to the diameter of the vessel reference interval <0.6-0.7) or the two-bit technique (initial use of an under-size bit, usually 1.25 mm, followed by a second one that fits the size of the vessel), administration of nitroglycerin *i.c.* after the rotablation session, controlling the rotational speed (130 000-140 000 rev/min – the rotational speed determines the activation of the platelet release of kinins), short individual rotablator operation sessions (up to 20-30 seconds in order to reduce the release of particles and prevent hypotonia, bradycardia and *no-flow* phenomena) as well as particular care while performing procedures at the bifurcation of arteries. A special approach should be used as regards rotablation of long lesions with distal critical narrowing, as the accumulation of particles before the narrowing followed by their sudden release to the distal section of the artery after the rotablation of a critical lesion may trigger the *no-flow* effect. In such cases it is helpful to apply predilation of the narrowing with a small-diameter balloon catheter. CARAT and STRATAS studies have revealed that intensive rotablation and the use of a larger bit more frequently cause dangerous complications and have poorer long term results [18].

Very winding sections of coronary arteries, like the presence of a blood-clot, may form grounds for a counterindication against using rotablation.

Prospects and new applications

ROTA-DES

The treatment of complex, calcified lesions in coronary vessels still remains a challenge for interventional cardiologists. The reason for this lies not only in the technical difficulties that might occur during the procedure, such as a proper withdrawal or the expansion of the balloon catheters and stents, the necessity to use high pressures connected with the high risk of the occurrence of complications, such as dissection or perforation, as well as with the high risk of restinosis and the necessity for frequent revascularization (TLR). In the era of drug-eluting stents (DES) the frequency of occurrence of restenosis should be minimized. However, a problem remains in the right positioning and expansion of DES in vessels with massive calcifications, unfavorable geometry and eccentric hard stenoses. Additionally, the implantation of DES in calcified lesions with the use of high pressures is linked to the damaged layer of polymer

and incomplete distribution of the drug from an ineffectively expanded stent. Incomplete expansion of the stent and the apposition of struts in calcified lesions increase the risk of restenosis and thrombosis in the stent [19]. A more frequent occurrence of major adverse cardiac events (MACE) and TLR has been revealed in patients after DES implantation in complex, calcified lesions than in the case of stenoses without calcification [20].

It appears that rotablation is an indispensable tool for solving the issue of effective treatment of calcified lesions with DES. Nowadays, rotational atherectomy procedures are used in conjunction with standard balloon angioplasty and the final implantation of DES [21]. This technique is called ROTA-DES and it enables an effective procedure for lesions which are complex, calcified and not susceptible to being expanded with a balloon catheter, when the application of standard angioplasty is ineffective. The application of rotablation through the modification of the plaque enables the suitable preparation of the stenosis for an optimal stent implantation, which is responsible for the direct and long term result of the procedure. At the same time the application of DES considerably minimizes the risk of restenosis. The ROTA-DES technique enables interventional procedures in patients who so far have not quailfied on account of the complexity of the lesions and becomes an alternative for cardiac treatment. Studies prove the effectiveness of the ROTA-DES combination in the treatment of calcified lesions as well as an additional prognostic benefit compared with the application of DES without rotablation [22-24] or the application of rotablation in conjunction with the implantation of bare-metal stents (BMS) [23, 25]. The size of the plaque is known to have a decisive impact on the frequency of restenosis with 50% residual stenosis resulting in twice the frequency [26]. Rotablation through modification and the decrease in size of the plaque may significantly reduce the incidence frequency of restenosis in DES, where the occurrence is relatively rare already.

The comparisons between patients treated with ROTA-DES and with only a DES implant in the lesions that do not require rotablation did not reveal significant prognostic differences between the groups of patients [27], which suggests the conclusion that the ROTA-DES technique in complex, calcified stenoses is as good as treatment with DES implantation in those lesions that are less complex. Other studies have only proved the efficacy of the ROTA-DES procedures [28], while a profile analysis of patients who have been subjected to this method (older age, complexity of lesions, numerous concomitant diseases) revealed a relatively small mortality rate and frequency of MACE incidence [29, 30].

CTO

It seems that the ROTA-DES technique is also a new alternative solution in the case of chronic total occlusion (CTO). In about 7% of cases of procedures related to the CTO, although the sites of closure were forced open with the guide wire, it was not possible to run the balloon catheter through. According to study research, the application of rotablation may safely and efficiently solve this problem through the modification of the plaque, enabling the introduction of balloon catheters and stents [31].

Ostial lesions

Calcified ostial stenoses are yet another difficult challenge for interventional cardiologists. Rotablation with subsequent DES implantation is a good solution here too [32].

Left coronary stem disease

The European Society of Cardiology recommends CABG with the class I recommendation for patients with stenosis of the left coronary stem disease [14]. These arguments gain strength in reference to the lesions that are strongly calcified and when the SYNTAX score exceeds 22. However, it seems that for patients who flatly refuse operational treatment, the rotablation of calcified lesions in the left coronary stem is a relatively safe and effective therapeutic alternative. The justification may be found in the most recent observational studies [33].

Restenosis in the stent

The application of rotablation for in-stent restenosis (ISR) still remains debatable, which is related to the ambiguous test results (ROSTER, ARTIST). However, it seems that neointimal elimination facilitates the full expansion of the balloon and the implantation of DES, which contributes to the optimum result of the procedure [34].

Bifurcations

Interventions that concern lesions placed in the bifurcations of coronary arteries are linked to poorer procedure results, a large percentage of restenosis and a high incidence of MACE and TLR. In spite of DES introduction, the long-term results of bifurcation procedures remain unsatisfactory. During the procedure, there is a problem related to plaque shift and focal restenosis, predominantly at the ostium of the side-branch in the so-called true bifurcation stenoses (Medina 1.1.1). The modification of the plaque with rotablation – both the main vessel and the ostium of the side-branch – prevents the occurrence of plaque shift reducing the risk of closing the side-branch. At the same time, such an approach reduces the risk of the occurrence of ostial restenosis [35]. Rotablation is particularly recommended in bifurcation stenoses with the Medina 1.1.1 classification, calcifications at the ostium of the side-branch or large plaque. In the light of available studies it is provisional stenting that remains the most effective bifurcation treatment method; however, some individual works have also proved equally good long-term effects from the double crush double kissing technique. Apparently, rotablation of the exit of the side-branch with the subsequent application of the provisional stenting method is an effective strategy for treating bifurcation with the use of a stent in the main vessel [35].

Disseminated Atherosclerotic Lesions

During procedures, long, disseminated atherosclerotic lesions which hamper the passage of balloon catheters or stents to target lesions still remain a problem during procedures. Balloon angioplasty and consequently stenting of long sections of coronary arteries bring about

full-metal-jacket images in the coronary artery and an increased percentage of MACE and TLR. Perhaps, as demonstrated by the study results [28], spot rotablation of those sections that precede the target lesion to enable the passage of the stent does mean these points always also need stents, such that stenting would only be required for short sections of the arteries [32].

Radial access

The procedures of rotational atherectomy have typically been limited by its access through the femoral artery and the use of 7Fr introducers. In recent years, with the dissemination of radial access connected to the smaller number of local complications, rotablation procedures are also performed through radial arteries with the use 6Fr, or even 5Fr sheaths [36]. This is particularly significant among the population of older patients with calcifications of the artery walls as they are the most susceptible to local complications, and who at the same time form the group of patients frequently recommended for rotablation. Studies with randomization have proved good results of rotational atherectomy with radial access and a small percentage of vascular complications, even in the group of patients with an exceptionally small-sized radial artery [37]. At the same time it was observed that the use of smaller-size bits in comparison with a more aggressive technique of applying larger-sized bits was related to a similar broadening of the vessel's diameter and the long-term effect (TLR frequency), which resulted, however, in a smaller number of periprocedural complications. For this reason the limitations in rotablation bit sizes related to the size of the sheath (for 5Fr – a bit with a maximum diameter of 1.25 mm, for 6Fr – maximum diameter of 1.5 mm) do not play a significant role in the majority of patients. In those cases when the use of a large-size bit is necessary, the best solution would be the use of a sheathless guiding catheter, e.g. 7.5Fr with a diameter of 0.081 inch, which allows the use of 1.75 and 2 mm bits [38].

The external size of the catheter is usually smaller than the size of 6Fr arterial introducers. It appears that the use of radial rotablation with the use of small-size bits is an effective interventional method with limitations of local vascular complications and forms an interesting alternative, especially in patients with a high risk of incidence of complications and peripheral artery disease [39].

Atherosclerosis of Peripheral Arteries

Studies on the application of rotablation with subsequent directional atherectomy and the removal of plaque in the treatment of stenoses in the arteries of the lower limbs revealed good synergy from combining both methods [40, 41].

Conclusions

Since interventional cardiology is dominated by stents, especially by drug-eluting stents (DES), the key to a successful procedure is the possibility of delivering the stent to the site of stenosis and its subsequent optimum expansion. This facilitates the procedure, reducing the risk of restenosis, thrombosis, and complication incidence. At the same time, in connection with a higher survival rate due to coronary interventions, there is a growing number of older patients burdened with many health issues, renal failure, diabetes and, above all, angiograms with complex lesions, calcifications, fibrosis, and old artery closures that disqualify them from cardiac surgical procedures. The results for patients where the cardiovascular procedures involve standard methods can be far from satisfactory. It appears that the solution for these issues is the application of rotational atherectomy, a technique that modifies the plaque and allows the avoidance of complications related to barotrauma, the aggressive passage of interventional tools, while enabling optimum stent placement and expansion.

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Lasers in ophthalmology

Lasery w okulistyce

Magdalena Gorczyca-Bojko[1], **Hanna Grajek**[2]

[1]Ophthalmology Ward of the Nicolaus Copernicus Municipal Polyclinic Hospital in Olsztyn; coordinated by: Dariusz Wilczek MD
[2]Department of Physics and Biophysics, the University of Warmia and Mazury in Olsztyn; head: Zbigniew Wieczorek PhD

Abstract. Lasers are widely used in various branches of medicine and find particular application in ophthalmology. The introduction of lasers into the diagnosis and treatment of diseases has resulted in huge progress in the treatment of ophthalmic diseases, such as diabetic retinopathy or glaucoma. They are used for the diagnosis and treatment of glaucoma and retinal diseases. This paper aims to present the wide range of applications for lasers in ophthalmology and the methods of generating a powerful laser beam illustrated with the example of an argon laser.
Keywords: diabetic retinopathy, glaucoma, photocoagulation, refractive surgery, ruby laser

Streszczenie. Lasery są powszechnie wykorzystywane w różnych gałęziach medycyny. Szczególne zastosowanie znajdują w okulistyce. Wprowadzenie laserów do diagnostyki i leczenia spowodowało znaczny postęp w leczeniu chorób okulistycznych, takich jak retinopatia cukrzycowa czy jaskra. Lasery służą również do diagnostyki i leczenia między innymi jaskry oraz chorób siatkówki. Praca ma na celu przedstawienie szerokiego wachlarza zastosowań laserów w okulistyce oraz zaprezentowanie sposobu otrzymywania silnej wiązki laserowej o dużej mocy na przykładzie lasera argonowego.
Słowa kluczowe: chirurgia refrakcyjna, fotokoagulacja, jaskra, laser rubinowy, retinopatia cukrzycowa

Delivered: 29/09/2014
Accepted for print: 18/12/2014
No conflict of interest was reported.
Mil. Phys., 2015; 93(1): 107-113

Correspondence address
Hanna Grajek PhD
Department of Physics and Biophysics
The University of Warmia and Mazury in Olsztyn
4 Oczapowskiego St.,10-719 Olsztyn
telephone: +48 89 523 42 55, fax: +48 89 523 38 61
e-mail: grajek@uwm.edu.pl

Introduction

Lasers are widely used in many branches of medicine. In ophthalmology they are used both in diagnostics and treatment. In the 18th century the first descriptions of retinal damage induced by solar radiation appeared, and it was at that time the idea of utilizing high-power light for treating retinal diseases through destroying asphyxiated sites with a laser was born. The observation of changes on the retina caused by sunlight was made possible by the first ophthalmoscope, a device used for the examination of the eye fundus constructed by Herman Ludwig Ferdinand von Helmholtz in 1851 [1]. Photocoagulation of the retina was first used for medicinal purposes in the late 1960s. It featured a xenon arc lamp, whose light spectrum was similar to sunlight. Some of its downsides included causing large coagulation foci (about 2mm) on the retina, which were painful to the patients and caused the destruction of all retinal layers over a vast area [1]. It was not until T. Maiman constructed the first ruby laser in 1960 that the use of laser light enabled he construction of a device known as the ruby coagulator.

The first ruby coagulator appeared in Poland in 1964. The device emitted light at a wavelength of 694 nm, which was not well absorbed by the retina. It was not until blue and green argon lasers with wavelengths of 488 nm and 514 nm were created that retinal treatment was revolutionized. In the 1980s new types of lasers were introduced: the krypton laser, the dye laser and the diode laser, finding an increasing number of new applications. Modern ophthalmology could not exist without lasers [1-3].

The operating principle of the laser by the example of the ruby laser

The word laser is an acronym of: *light amplification by stimulated emission of radiation* [1, 4, 5]. The first laser was built on a solid, a ruby, by T. Maiman. Ruby is an aluminum oxide crystal (Al_2O_3) with the 0.05% of Cr_20_3 dope. Some aluminum ions (Al^{3+}) in the crystal structure of the ruby were replaced by chromium ions (Cr^{3+}) which are active in the laser action. It is this that gives ruby crystals their red hue. The laser operates through exciting the ions of chromium atoms with a high-pressure flash lamp at a wavelength of 560 nm. After the electrons of the inner layers of Cr^{3+} chromium ions have absorbed h_v light quanta, they are carried from the E_0 ground state to the short lived E_1 excited state. A simplified diagram of ruby energy lasers is shown in figure 1. (As a rule, the atoms of different compounds stay in an excited state only for a short time, just a few nanoseconds, and subsequently fall back and illuminate the absorbed energy quanta in the form of fluorescence. Light in the excited state is not used in lasers on account of the low power.)

Chromium ions also have a third energy state, E_2 (long-lived - metastable), to which excited Cr^{3+}make a non-radiative transfer. The ions may remain in this state for a very long time, as long as 3 ms, which amounts to 10 000 times the E_r state and which is why a large number of excited chromium ions accumulate in the E_2 state (the so-called optical pumping of ions to this state). A massive number of ions are transferred to the long-lived state using large intensity pumping, until a population inversion occurs – when there are more ions in the excited E_2 state than in the ground state, E_r. At this point, when hit with luminous energy quanta, a stimulated emission is induced wherein all the excited ions are simultaneously transferred to the ground state, emitting a strong beam of coherent high-energy laser light.

Fig. 2 shows a ruby laser diagram. Optical pumping in the first commercial ruby laser was performed with a spiral-shaped flash lamp [4, 5] which surrounded the laser core. A modern ruby laser uses oblong flash lamps which are laid in parallel to the laser core [1].

The pulsed light from the flash lamp is focused using a reflector at the laser core with a length of 120 mm and a diameter of 10 mm. As a result of the dispersed light reflections, the laser is uniformly excited and thereby emits a beam of photons which is reflected many times from opposite mirror surfaces and interacts with the newly excited ions, hence inducing an increasing number of photons. In this way a photon avalanche creates the laser light, which is emitted via a semi-permeable mirror. The light of the ruby laser is red and is sent at a wavelength of λ = 694.3 nm. The ruby laser operates in a pulse mode [1]. The total energy radiated during one laser action from lasers with uncontrolled pulsation amounts to 100 J and is emitted as a random sequence of impulses

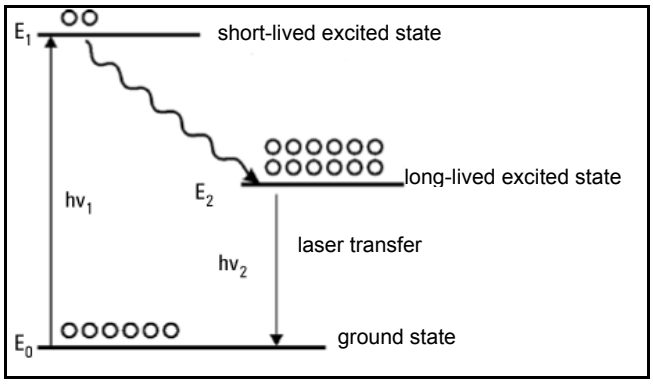

Figure 1. Simplified energy level diagram of ruby laser. E_0-ground state of Cr^{3+}ions, E, - excited state, E_2 - metastable state
Rycina 1. Schemat poziomów energetycznych w rubinie ukazujący akcję laserową. E_0-stan podstawowy jonu chromu, E, -stan wzbudzony, E_2-stan metatrwaty

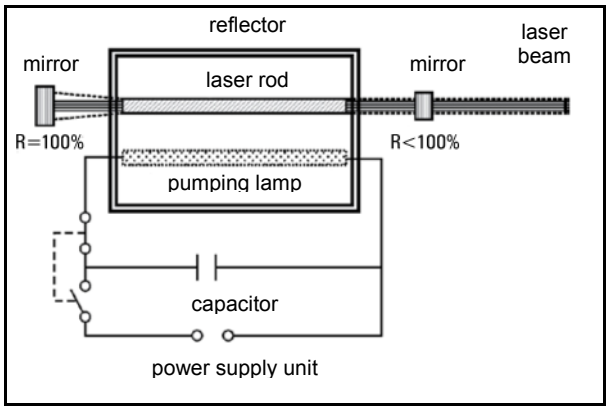

Figure 2. Principle setup of a ruby laser (acc. to: bibliography no. 1, p. 59)
Rycina 2. Schemat lasera rubinowego
(za: 1. pozycja piśmiennictwa, str. 59)

where each lasts about 1 ms and repeats several times per minute. The peak power for the duration of the impulses reaches several dozen kW. In lasers having a modulated quality factor for the resonator, when the shutter closes the population inversion of energy levels in the laser rod may rapidly increase over the threshold level (corresponding to an open shutter), and then the entire excitement of the active substance in the laser is released in a very short time (in several ns). This helps the emitted radiation achieve hundreds of MW power in an impulse [5].

For the construction of lasers the following gain mediums are used: free atoms, ions, molecules and molecule ions in gas, molecular dyes dissolved in liquids, atoms and ions built in solids, doped semiconductors and free electrons. The following lasers have been applied in medicine: CO_2, argon (Ar), krypton (Kr), neodymium - Nd:YAG (Nd:$Y_3Al_5O_{12}$), erbium - Er:YAG (erbium ions Er^{3+} in the solid material of yttrium aluminum garnet), holmium - Ho:YAG, dye, diode, HeNe and GaAs and excimer lasers (which operate on excited dimers).

Interaction of laser radiation with living organisms

Laser light that interacts with tissue may bounce off the skin, be dispersed, pass through the tissues, or be partially or entirely absorbed. The reflection coefficient for human skin fluctuates between 0.2 and 0.5 [6]. The transmission of laser radiation through the body is highest at a wavelength of 550-950 nm. This is why this wavelength range is most frequently used for biomodulator interactions in therapies. Light from the visible spectrum and near-infrared has the strongest impact on tissues. Light at a wavelength of 820–840 nm achieves the deepest penetration in tissues, penetrating up to 60 mm [6]. The radiation of the helium-neon laser (wavelength of 632.8 nm) penetrates tissue up to 10-15 mm, whereas semiconductor lasers at a wavelength of 780-940 nm (infrared) penetrate up to 30-50 mm [6, 7]. Wavelengths from the visible spectrum have a poor ability to penetrate because they are absorbed by dyes, hemoglobin and ribonucleic acids. The light is reflected many times and dispersed on the structural elements of the tissues. If the tissues contain a lot of water, a strong absorption of ultraviolet and the far infrared takes place. Some of the energy from the incident laser light is reflected (43-45%) from the tissue surface, whereas its remaining part, which is delivered to the tissue, is called the effective energy.

The impact of light is dependent on the power, the energy of laser radiation and the time of exposure.

Applications for Lasers in Ophthalmology

Ophthalmology makes use of lasers of different kinds, depending on the wavelength of the emitting light. On account of the different wavelengths they are used for different purposes. A diode laser is used in diagnostics; the argon laser is used for the treatment of diseases at the back of the eye, such as diabetes; the YAG laser is used at the front of the eye (glaucoma); the excimer, femtosecond laser is used for the cornea (refractive surgery), whereas the erbium laser is used in eye protection apparatus (plastic surgery, surgery of lacrimal pathways) [8, 9].

Lasers in Ophthalmological Diagnostics

In diagnostics, lasers are used in equipment for potential visual acuity measurements, holography, mapping of the tissue surface, optical cross-sectioning, tissue thickness measurements, tear film level, intraocular pressure measurements, and vascular flow measurements (e.g. indocyanine angiography). They enable the application of objective, quantitative, specific and repetitive methods of diagnosing many diseases, chiefly glaucoma and retinal diseases [8, 10]. Scanning laser ophthalmoscopes with a laser for imaging retinal sections and the optical nerve disc are the most frequently used equipment for diagnostic tests.

HRT *(Heidelberg retina tomograph)* creates an image of the optical nerve disc and the retina thanks to the scanning of individual layers by the beam of a diode laser at a wavelength of 670 nm. The use of the confocal optical system enables the information from thin layers to be processed to form a three-dimensional image. HRT has a wide application in the diagnostics of glaucoma.

GDx – scanning laser polarimeter, an analyzer of nerve fiber layer thickness in individual quadrants of the optic nerve disc, measuring the changes in polarization caused by the axon birefringence of the retinal nerve fiber layer (NFL). GDx is used in the diagnostics and monitoring of glaucoma.

OCT - optical coherence tomography – a non-invasive, non-contact visualization system that achieves high-resolution cross-sections of the retina, vitreous humor and the optic nerve. It makes use of interferometry. OCT is commonly applied in the diagnostics of the diseases of the macula, retina and glaucoma [8, 10-12].

Lasers in the treatment of ophthalmological diseases

Lasers are used in the treatment of many diseases of the front and the back of the eye. Common lasers used in the treatment of corneal diseases and refractive surgery include excimer, picosecond and femtosecond lasers, whose gain medium is the titanium-doped sapphire crystal (Ti:Al203). Refractive surgery in PRK *(photorefractive keratectomy),* LASIK *(laser in situ keratomileusis),* LASEK *(laser sub-epithelial keratomileusis* and Epi-LASIK methods use the excimer laser for the ablation of corneal tissue at an accurately defined depth with minimum destruction of the surrounding tissues. The newest techniques in refractive surgery, such as SBK (*epi-Bowman's keratectomy*), enable a correction of higher refractive errors, especially in patients with an insignificantly thick cornea. They also enable quick healing and reduce the return time to visual acuity. In simple terms, by comparing the femtosecond laser and the excimer laser, the former is an ideal tool for effecting precision cuts in the cornea, whereas the latter is useful for molding and cutting of the stroma of the cornea [13, 14]. Described below are some of the individual methods used in refractive surgery.

PRK *(photorefractive keratectomy)* – a procedure that consists in the mechanical removal of the corneal epithelium in the center over an area of 6-8 mm, and the subsequent performance of photoablation with an excimer laser, molding the corneal tissue to a set depth so that its shape, and consequently its refractive power, are changed. In the case of correcting short-sightedness, deeper photoablation is necessary in the center of the cornea so that it is flattened; whereas paracentrally for the correction of hyperopia. Procedures with the application of PRK are performed for low refractive errors.

LASIK *(laser in situ keratomileusis)* – laser photoablation is performed after the surgical stripping of a corneal flap approx. 160 μm thick. The flap is stripped with a special tool called a microkeratome

with the use of a disposable knife. Over a period of several dozen seconds the laser molds the corneal shape and changes its optical properties. Towards the end of the procedure the flap of the cornea is returned to its original position. Following the procedure visual acuity normalizes in about a week. The LASIK method is used mainly for the correction of high refractive errors.

LASEK *(laser epithelial keratomileusis)* – a newer method of refractive error correction which consists in stripping the corneal epithelium and the performance of laser photoablation. At the end of the procedure the flap of the epithelium is returned to its original position, and a medicinal contact lens is placed on the eye. This method is used for the correction of low and medium refractive errors.

EPI-LASIK *(epithelial LASIK)* - the EPI-LASIK method is an improvement to the LASEK method. In the EPI-LASIK method the epithelium is not removed. An epithelial flap with a hinge is made via a separator (epikeratome), as in the LASIK method. During the laser photoablation the flap is tilted sideways and restored to its original position after the laser work finishes. The epithelium is still live, for which reason the pain is less intense after the procedure. As with PRK and LASEK procedures, a medical contact lens is placed on the eye.

SBK-LASIK *(sub-Bowman's keratomileusis)* is a modern method. In the course of SBK-LASIK treatment a corneal flap is created that is smaller than for the traditional LASIK procedure. It is approx. 90 μm thick and is made just below the Bowman's membrane. A microkeratome is used for this procedure. In this way a correction for higher refractive errors is possible, especially in patients with a cornea of low thickness. It also enables quick healing and reduces the return time to visual acuity.

EBK *(epi-Bowman's keratectomy).* During EBK treatment layers of the epithelium are gradually and gently removed. After the epithelium has been removed, there is no need for further removal of tissues. There is no possibility of causing permanent damage to the cornea, for which reason the procedure is exceptionally safe. EBK is the only procedure which ensures the precise removal of the entire epithelium without damaging the layers underneath it.

The most modern methods of laser correction of vision defects include: **ReLEx FLEX** (refractive lenticule extraction - femtosecond lenticule extraction) and **ReLEx SMILE** (refractive lenticule extraction - small incision lenticule extraction). The essence of their innovation is in the exclusive use of a femtosecond laser for the procedure. In the FLEX and SMILE methods, the change in the curvature of the cornea is effected by means of a femtosecond laser, which brings about the delamination of a given part of the cornea, known as the lens, with a thickness and shape that is dependent on the type of visual impairment. In the FLEX method, the lens is removed from the cornea after the corneal flap created by the femtosecond laser has been opened. In the SMILE method, the corneal flap is not created, and the lens is formed inside the cornea through the delamination of a part of the cornea with the femtosecond laser. The lens is removed through a small (up to 4 mm) incision to the cornea.

Another application of the femtosecond laser in refractive surgery is in the treatment of the keratoconus. The most modern methods of treating the keratoconus with the use of the laser are known as corneal cross-linking (CXL) and the implantation of intrastromal corneal rings. The corneal cross-linking technique consists of the topical administration of riboflavin (vitamin B_2) and exposure of the corneal tissue to ultraviolet A light (wavelength of 365 nm). The formerly administered riboflavin forces the absorption of the UVA light by the cornea. The exposure of the cornea to ultraviolet light causes the formation of collagen cross linking in the cornea, which makes it stronger, more rigid and less susceptible to deformations. This enables the inhibition of further keratoconus development. In the method where intrastromal corneal rings are implanted, the laser is used to create arched tunnels in the cornea for the intrastromal corneal rings. With the aid of a high-precision laser, total control of the incision depth and length is possible, which yields an optimal refractive effect.

Another application of the laser in keratoplasty is corneal transplantation. The femtosecond laser enables high-precision incisions of the transplantation flap, as well as minimal deformations of the flap during the incision. Lamellar keratoplasty with the application of the femtosecond laser ensures perfect matching of the donor's and the recipient's flap via the application of the same laser parameter settings. FLEK (*femtosecond laser assisted endothelial keratoplasty)* is a new procedure which enables the preparation of the endothelium and its easy replacement with a donor's endothelium via precise focusing [14].

Lasers have also been used in Photo-Therapeutic Keratectomy for the precise stripping of pathological tissue in the case of inflammatory and degenerative lesions, scars, etc. In corneal diseases the laser is used for closing pathological blood vessels in the cornea [8, 14, 15].

Lasers are becoming increasingly common in the diseases of the protective apparatus. They are used in eyelid surgery, eyelid aesthetic surgery, abnormal growth of eyelashes, obliteration of lacrimal points, recanalization of tear ducts (laser DCR performed through the nose or transcanalicular laser DCR), tumor surgery and surgery of the orbital cavity. In the surgery of the protective apparatus of the eyeball, CO_2 erbium, holmium, argon and semiconductor lasers are used [8, 9].

Treatment of Glaucoma

Lasers in glaucoma are used for the improvement of drainage, the circulation of aqueous humor and the reduction of its production. The laser is used in the case of ineffective pharmacological treatment or in

connection with conservative treatment for a better therapeutic effect. Laser procedures applied in glaucoma treatment include laser iridotomy performed with the YAG Q-switch 1064 nm laser. Indications for laser iridotomy include: predisposition to the original primary angle closure suspect (PACS), primary angle closure glaucoma (PACG), primary angle closure (PAC), the other eye in patients having acute angle closure and secondary angle closure with pupillary block.

Another laser procedure used in the treatment of glaucoma is argon laser trabeculoplasty (ALT), which consists of the creation of foci with the laser within the trabeculation (a structure similar to the sieve in the anterior chamber angle through which approx. 90% of aqueous humor is drained), which facilitates the drainage of aqueous humor and decreases intraocular pressure. ALT is used in open angle glaucoma usually as an auxiliary treatment. Another therapy is a selective laser trabeculoplasty (SLT). This is a newer method that makes use of the second harmonic at 532 nm of the Q-switch Nd:YAG laser with a narrowed impulse (the so-called yellow YAG), which enables photocoagulation with a selective effect on the melanin, which is a dye in the trabeculum. The effect is selective so does not destroy the remaining cells and trabeculation structures. Another laser procedure used in glaucoma is laser iridoplasty, which consists in widening the iridocorneal angle through provoking the contraction of the peripheral iris, and at the same pulling it away from the angle. The indications are plateau iris syndrome and glaucoma with a closed iridocorneal angle. A diode laser at a wavelength of 810 nm (diode laser cycloblatin - DLC) is used in the cyclodestructive procedure, decreasing the intraocular pressure through the destruction of the secretory epithelium of the ciliary body, which decreases the production of aqueous humor [8, 10, 16-19].

Other laser procedures in glaucoma surgery include trabeculopuncture, trans-scleral coagulation, sclerostomy (a procedure which consists of the creation of a fistula connecting the anterior chamber with the subconjunctival space), laser incision of sutures, and others.

Treatment of Cataracts

A cataract is a persistent ailment that consists in a partial or complete opacification of the lens. Basic symptoms of the disorder include a progressive deterioration of visual acuity, which is usually described by patients as an impression of blurry vision. Standard cataract treatment consists of its surgical removal, i.e. phacoemulsification of the lens with the use of ultrasound. A laser has been used for the removal of an opaque lens for only a short time. Some types of operation that are performed with the use of microsurgical tools in the standard method are now performed with a femtosecond laser. Therefore, in comparison with a standard phacoemulsification operation of the cataract, the new method is gentler, safer and more precise. The method is a true revolution in ophthalmology [20]. Posterior capsulotomy is a laser procedure that is used for treating secondary cataracts formed after the removal of the cataract. The opacification that ensued is removed with the use of the Nd:Yag laser by making an aperture in the opaque posterior capsule, which results in the correction of vision [8, 20, 21]. The lasers used in lens surgery include: femtosecond, erbium, Nd:YAG, argon, and second harmonic Nd:YAG.

Lasers are commonly used in the treatment of the posterior segment of an eyeball in forms of therapy that include vitreolysis, laser vitrectomy, laser retinotomy, coagulation and endocoagulation, endovaporisation, heat therapy and the photodynamic therapy.

Treatment of Retinal Diseases

In the treatment of retinal diseases that contain the VEGF (vascular endothelial growth factor) as one of the key compounds in the pathogenesis of the formation of new vessels, a variety of methods are available: intravitreal injections of anti-VEGF, intravitreal injections of steroids, laser therapy and surgical treatment, which is vitrectomy through the flat part of the ciliary body, and others. Although modern methods of treating retinal diseases are available, laser therapy still remains one of the most basic and effective forms of treatment [8, 22-29].

The lasers which are commonly used in the treatment and diagnostics of the diseases to the posterior segment of the eye include the argon laser - 514 nm, CO_2 laser - 10 600 nm, Nd:YAG laser, Q-Switch - 1064 nm, Er:YAG laser - 2940 nm, krypton laser - 647 nm and the diode laser - 810 nm. The most essential applications of lasers in retinal diseases are discussed below.

Laser photocoagulation of the retina is performed in order to form choroidal retinal adhesions, withdrawing from neovascularisation and decreasing the retinal edema. The indications for laser photocoagulation (FL) include apertures, retinal tear and degeneration that may turn into a clinical retinal detachment (subclinical detachment of the retina connected to the large symptomatic horseshoe tear located in the superior-temporal quadrant, a large horseshoe tear in the superior-temporal quadrant of the eye with an acute symptomatic PVD (posterior vitreous detachment), horseshoe tear with a flap with a choked blood vessel, if the pulling of the vessel causes hemorrhage to the vitreous humor, lattice degeneration, if there had been a retinal detachment in the other eye in the past). The purpose of the treatment is the formation of additional choroidal retinal adhesions that stabilize a given area of the retina [8].

Diabetes

Another, and very common, indication is diabetic retinopathy; photocoagulation aims at the closure of pathological vessels, destruction of the areas of retinal

hypoxia and the creation of additional choroidal retinal adhesions. In the treatment of diabetic retinopathy three basic forms of photocoagulation are used: focal coagulation in the focal, clinically significant diabetic macular edema; grid photocoagulation in the spilt macular edema with the detachment of the vitreous humor and the panphotocoagulation in proliferative retinopathy of high risk, in acute non-proliferative retinopathy and in neovascularisation on the iris (rubeosis iridis) and in the iridocorneal angle [3, 8, 22-29].

Central Retinal Vein Thrombosis

Central retinal vein thrombosis is yet another disease for which a laser is used. Laser therapy is used for the ischemic occlusion of the central retinal vein in the occurrence of neovascularisation (formation of pathological vessels) in the iridocorneal angle or the rubeosis iridis (growth of irregular vessels in the iris). The aim of the treatment is the destruction of the vessels which are the source of the shunt, as well as the ischemic areas in the retina and the formation of additional choroidal retinal adhesions. In the case of the macular edema, laser coagulation is not effective. A variety of different new methods of treatment are used, such as intravitreal injections of anti-VEGF or intravitreal injections of commonly used steroids [8].

Retinopathy of Prematurity

Treatment with laser coagulation with the diode laser is used in the retinopathy of prematurity. Retinopathy of prematurity is the main cause of blindness in prematurely born children of low birth weight or intrauterine hypotrophy. On account of their undeveloped antioxidant mechanisms, these children are exposed to damage to the vessels in an immature retina during the oxygen therapy used in incubators. This may lead to the development of retinopathy of prematurity that, if left untreated, leads to retinal detachment and irreversible binocular blindness. An indication for laser therapy in retinopathy of prematurity is a threshold disease when fibrous vascular proliferation is continuous over a period of five consecutive hours, or when dispersed foci take a total of eight hours (third stadium of retinopathy of prematurity) in the first or second zone, related to the 'plus' disease. The 'plus' symptom is characterized by the widening of veins and the curvature of arteries in the posterior pole. The 'plus' disease means a tendency towards progress. The aim of laser therapy is the destruction of peripheral, immature areas of a nonvascularised retina and the creation of additional choroidal retinal adhesions [8].

Age-related Macular Degeneration

Age-related macular degeneration (AMD) is connected with lesions that cover the macula, which is located in the central part of the retina. The macula, especially its fovea situated in the center, is that eye structure which is primarily responsible for the acuity of vision. It is used for work at close range, e.g. reading, driving or a variety of other tasks that require precise vision. Two clinical presentations of AMD can be differentiated: dry and exudative. The exudative form is the rarer of the two, but it has a more violent course leading to a considerable vision impairment. At the root of the pathogenesis of this presentation of AMD is the neovascularisation of choroid origin [8].

A basic form of treatment in the exudative form of AMD takes the form of anti-VEGF injections. Another form of therapy is photocoagulation of extrafoveal neovascular membranes with the argon laser (if the membrane lies in the center of the fovea, PDT therapy is used) [8].

Photodynamic therapy (PDT) – currently being displaced by the VEGF therapy, is used in the exudative form of age-related degeneration of the macula for the occlusion of neovascular membranes situated at the center of the macula or in the papillomacular bundle. It consists in administering Visudyne (verteporfin, a light activated substance) intravenously and exposing the membrane to the diode laser light at a relatively low power. Influenced by the processes induced by verteporfin and the laser light, local inflammation and occlusion of vessels is brought about in pathological vessels of the membrane. The subfoveal, predominantly classical neovascular membrane not larger than 5400/im with a visual acuity of 6/60 or better is an indication for PDT [8].

Conclusion

The paper has demonstrated the broad array of laser applications in ophthalmology. In modern ophthalmology lasers are indispensable both in diagnostics and the treatment of many diseases, chiefly glaucoma and retinal diseases, as well as refractive surgery. Further advancement of lasers will undoubtedly lead to their even broader application in ophthalmology.

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Chronic throboembolic pulmonary hypertension - a difficult clinical problem

Przewlekłe zakrzepowo-zatorowe nadciśnienie płucne - trudny problem kliniczny

Andrzej Teplicki[1], Rafał Czekiel[2], Anna Brzecka[3]

[1]Department of Internal Diseases of the 4th Military Research Hospital and Polyclinic in Wrocław; head: Prof. Andrzej Szuba MD, PhD
The Hospital Emergency Ward of the 4th Military Research Hospital and Polyclinic in Wrocław; head of the department: Daniel Bujak MD
Department and Clinic of Pulmunology and Lung Neoplasms of the Medical University in Wrocław; head: Prof. Renata Jankowska MD, PhD

Abstract. Chronic thromboembolic pulmonary hypertension (CTEPH) is a primary arteriopathy of the pulmonary vessels leading to pulmonary hypertension and severe progressive right heart failure. The aim of the study was to discuss the epidemiology, risk factors, pathophysiology, clinical picture and methods of treatment of CTEPH. Initially, CTEPH is poorly symptomatic and dyspnea develops insidiously. CTEPH should be suspected in patients with symptoms of progressive pulmonary hypertension. Diagnostic tools mainly include echocardiography and right heart catheterization, as well as ventilation/perfusion lung scintigraphy, angio-CT and pulmonary angiography. In the treatment of CTEPH the method of choice is pulmonary endartectomy (PEA), for which only some patients are qualified.
Key words: chronic thromboembolic, pulmonary hypertension, pulmonary endarterectomy, pulmonary embolism, pulmonary hypertension

Streszczenie. Przewlekłe zakrzepowo-zatorowe nadciśnienie płucne (CTEPH) to pierwotna arteriopatia prowadząca do powstania nadciśnienia płucnego i ciężkiej, postępującej niewydolności prawokomorowej. W pracy omówiono epidemiologię, czynniki ryzyka, patofizjologię, obraz kliniczny oraz metody leczenia CTEPH. Początek CTEPH jest skąpoobjawowy, a duszność wysiłkowa rozwija się podstępnie. CTEPH należy podejrzewać u pacjentów z objawami postępującego nadciśnienia płucnego. Głównymi narzędziami diagnostycznymi są: echokardiografia i cewnikowanie prawej komory serca oraz scyntygrafia perfuzyjno-wentylacyjna, angiograficzna tomografia komputerowa i angiografia płucna. Wleczeniu CTEPH metodą z wyboru jest endarterektomia płucna (PEA), do której kwalifikuje się część chorych.
Słowa kluczowe: przewlekłe zakrzepowo-zatorowe nadciśnienie płucne, endarterektomia płucna, zatorowość płucna, nadciśnienie płucne

Delivered: 4/06/2014
Accepted for print: 18/12/2014
No conflict of interest was reported.
Mil. Phys., 2015; 93(1): 114-118

Correspondence address
Andrzej Teplicki
18 Majowa St., 52-200 Wysoka
telephone: +48 698 568 797
e-mail: a.teplicki@wp.pl

Introduction

A chronic thromboembolic pulmonary hypertension (CTEPH) develops following an overt or latent pulmonary embolism. However, it is not only a simple consequence of the obstruction of the pulmonary vessels but a primary arteriopathy of the pulmonary vessels with concomitant disorders of the functions of the endothelium leading to the formation of secondary *in situ* thrombosis [1]. Organized fibrous lesions that grow into the middle coat of the vessels develop in the pulmonary arteries [2]. In the classification that is currently applied, among the five groups of pulmonary hypertension, CTEPH has a separate entry next to pulmonary arterial hypertension (PAH), a pulmonary hypertension caused by the disease of the left part of the heart, pulmonary hypertension in the course of the lung disease and/or hypoxia, and a pulmonary hypertension with an unexplained or/and multifactorial pathomechanism [1].

CTEPH leads to the development of a severe right ventricle failure and consequently to death, unless suitable surgical treatment is initiated.

Pathophysiology

Pathological lesions observable in CTEPH include the formation of thromboses that organize themselves in the pulmonary vessels, remodeling of the small and large pulmonary vessels and their obstruction [1]. Bands, or in other words phrens, may form in the pulmonary arteries, which partially or completely close their channel [2]. In CETPH, unlike in PAH where the remodeling of vessels regards small pulmonary vessels, the lesions are chiefly related to stenoses in larger vessels. The pathophysiology of CTEPH remains unclear. Normally, the lesions are justified by the fact that CTEPH is a result of single or relapsing incidents of pulmonary embolism that have been caused by venous thrombosis (the thrombosis hypothesis) [3]. Perhaps CTEPH is a consequence of *in situ* thromboses formed in the lungs as a result of primary arteriopathy and endothelial dysfunction similar to the one present at the PAH [4]. Probably CTEPH is caused by two concomitant processes: thromboembolic lesions in large pulmonary vessels and the arteriopathy of small pulmonary vessels [5]. It progresses when the emboli in the pulmonary artery, which cover small or large vessels, are not absorbed, but become the cause of the progression of fibrosis in the large vessels and the remodeling of small pulmonary vessels, affected by inflammatory, infectious or neoplastic factors [6, 7].

Risk Factors

The main risk factor of the CTEPH progression is the history of an acute pulmonary embolus. If CTEPH progresses after the episode of pulmonary embolism, then the time between this event and the first clinical symptoms of CTEPH oscillates between a few months and a few years [9]. Among the patients who were observed after an episode of pulmonary embolism, the progression of CTEPH was diagnosed in a small fraction of cases: 1-4% [7, 8]. However, in 25% of the patients with CTEPH, which is indicated by the data from a large international register of patients with this syndrome, there are no clinical data that would testify to the history of pulmonary embolus [9]. In other studies, the percentage of CTEPH patients with no history of pulmonary embolus is similar or even larger, up to 63% [6, 7]. The symptoms of deep vein thrombosis, an important factor of pulmonary embolism, are present in 56% of patients [9].

One of the important factors that is conducive to CTEPH progression is the removal of the spleen [7]. Among all CTEPH patients, a splenectomy had been performed in 5.5-8.6% of cases [7, 10]. The most likely cause of the CTEPH progression after splenectomy is an excessive activation of the coagulation system. A connection between splenectomy and the CTEPH may be the result of the presence of damaged erythrocytes which are removed by the spleen in a healthy individual. An incorrect expression of phosphatidylserine on the damaged surface of the erythrocytes may be the cause of the activation of coagulation processes and result in the gathering of embolic material [11]. An increased number of platelets is observed in 75% of post-splenectomy patients and may lead to an excessive activation of the coagulation system and thrombosis [6].

An increased risk of CTEPH development may result from the occurrence of chronic inflammatory diseases. Increased markers of the inflammatory process are diagnosed in CTEPH patients, including the following interleukins: IL-lb, IL-2, IL-4, IL8 and IL-10. In one of the studies where patients were observed following pulmonary embolus, a chronic inflammatory process was diagnosed in 10% of the patients who had developed CTEPH and in none of the patients who had not developed CTEPH (odds ratio 67, 95% CI: 7.90-8.83) [6]. Additionally, an increased risk of the development of CTEPH was observed in patients with a chronic marrow inflammation and people with inflammatory bowel diseases [6]. Hydrocephaly patients with an atrioventricular valve, as well as patients with an infected pacemaker, are known to be at an increased risk of developing CTEPH [6]. The occurrence of the antiphospholipid syndrome is also related to an increased risk of developing CTEPH. There is data indicating that hypothyroidism may also be a risk factor for developing CTEPH [7]. One of the studies revealed that about 20% of CTPEH patients suffered from hypothyroidism and required the hormones of the thyroid gland to be replenished [7]. Patients with hypothyroidism treated with levothyroxine were observed to have higher concentrations of Von Willebrand factor, which is why the risk of developing CTEPH among these patients may result both from illness and treatment [12].

In the CTEPH risk group there are also patients who have had neoplasms. The neoplasms that may precede the diagnosis of CTEPH by 5-10 years include breast cancer, digestive system neoplasms, melanoma, prostate cancer and seminoma [7]. A history of neoplasms was identified nearly three times more often in CTEPH patients than in pulmonary hypertension patients of a different etiology: 12.2% *vs* 4.3% [7]. In other studies, CTEPH patients were not observed to have any inconsistencies in the structure and function of fibrinogen. It was revealed that fibrinogen in CTEPH patients was more immune to fibrinolysis than in healthy individuals [13].

Symptoms

CTEPH is a disease with an insidious and progressive development. In the initial period it is usually asymptomatic. The complaints are usually unspecific. Patients usually complain about progressive dyspnea on exertion. On account of the non-specificity of early CTEPH symptoms, diagnostic errors are commonly made or the diagnosis is belated. The complaints are attributed to age-related limited exercise capacity, temporary form slump, neurosis or other diseases, such as COPD or ischemic heart disease [9]. In the later period, collapse occurrences during physical exertion, chest pains, or even hemoptysis were described. A physical examination sometimes reveals vascular murmur above the peripheral parts of the lungs which results from the flow of blood through narrowed vessels at a higher pressure, split S2 above the pulmonary artery or systolic murmur of the tricuspid valve regurgitation. Right ventricular failure is a relatively late CTEPH symptom: widening of the jugular veins, peripheral edema, ascites, and sometimes cyanosis [14]. There are no differences in CTEPH symptomatology in patients after a pulmonary embolus

and in patients without such data in their medical history.

Diagnosis

Diagnosing CTEPH is difficult, especially when the symptoms at the initial stage are unspecific and there are no unambiguous risk factors that would explicitly indicate the possibility of a progressively increasing pulmonary hypertension with a thromboembolic etiology. Patients complaining about dyspnea are often submitted to an examination of arterial blood gas. It may reveal traces of hyperventilation, i.e. hypoxemia with hypocapnia [14]. The result of the chest X-ray is often normal; however, it sometimes indicates pulmonary hypertension, such as the widening of the pulmonary artery or enlargement of the right atrium, or suggests an embolic etiology, if the so-called amputation of the pulmonary hilum or poor pulmonary vascular pattern has been identified [15]. Irregularities in the chest X-ray suggesting pulmonary hypertension (e.g. enlargement of the cardiac silhouette) require echocardiographical verification [16].

Echocardiography examination is one of the most basic and commonly used diagnostic tools for pulmonary hypertension. It may indirectly indicate CTEPH features and exclude other causes of pulmonary hypertension, such as intracardiac shunts or left heart diseases. Symptoms which indicate pulmonary hypertensions cover the dilatation of the right ventricle, its hypertrophy, overload, hypokinesis, enlarged right atrium and tricuspid regurgitation. The authors of the ESC (European Society of Cardiology) and ERS (European Respiratory Society) guidelines recommend a periodic echocardiography evaluation in patients after an acute pulmonary embolism who display the characteristics of pulmonary hypertension or right ventricular dysfunction for an early detection of pulmonary hypertension [17].

A basic method of diagnosing pulmonary hypertension and evaluating hemodynamic disorders in the course of CTEPH is cardiac catheterization. An average pressure in the pulmonary artery >25 mm Hg, pulmonary wedge pressure <15 mm Hg and pulmonary vascular resistance > 2 Wood units prove the diagnosis [17]. Cardiac catheterization is also used for the evaluation of operational risk in CTEPH patients. Excessive increases of the pulmonary vascular resistance (PVR) with a visible narrowing may testify to an increased operational risk and some cases of nonoperational CTEPH with significant vascular involvement [18].

One of the most important examinations in CTEPH diagnostics is ventilation/perfusion scintigraphy. A correct scintigraphic image usually excludes CTEPH. An image of wedge-shaped perfusion loss with correct ventilation in a patient who has been diagnosed with pulmonary hypertension is characteristic for CTEPH [16]. It was revealed that perfusion disorders are present in 98.7% of CTEPH patients, and ventilation loss in 19% [9].

In order to confirm the CTEPH diagnosis other imaging scans need to be performed, primarily computer tomography (CT), preferably multislice [16]. It is a fast, widely available and inexpensive technique; however, on account of the large doses of radiation it is not suitable for a series of examinations. CT is good for imaging the widening of the right ventricle. The comparison of right and left ventricle size during the diastole and the coefficient with the diameter of RV/LV > 1:1 indicate the dilatation of the right ventricle [16].

The angioCT may reveal the presence of thromboses in proximal pulmonary vessels or symptoms of vascular amputation. The widening of the bronchial arteries is sometimes discernible, which is a positive symptom, especially in patients with planned operational CTEPH treatment. The widening of the proximal segments of the pulmonary arteries and mosaic vascularization image is often visible too [9].

Contrast-enhanced MR angiography (CEMRA) is an expensive and not easily available examination. On account of the lack of ionizing radiation the technique may be used in young individuals who require a series of examinations, e.g. post-operative assessment. Typical CTEPH images visible up to the level of segmental vessels include intravascular grids and bands, lost/disrupted vessels, or organized central clots. CT and MR are complementary techniques and their combination becomes a basic route to imaging pulmonary hypertension [16].

The "gold standard" in diagnosing and defining the advancement and prognosis for CTEPH is pulmonary artery angiography. The examination enables the exclusion of other forms of pulmonary hypertension. Although pulmonary artery angiography is an invasive examination, it is relatively safe, provided it is performed by an experienced team. It may also be performed in patients with severe pulmonary hypertension. This examination may be used to identify segmental widening above the narrowing of the pulmonary artery and the intravascular membranes, and demonstrate any areas of weaker perfusion of pulmonary tissue [16]. A pulmonary angiography should be performed in all patients with suspected CTEPH whose scintigraphic examination reveals disorders of the ratio of pulmonary ventilation to pulmonary perfusion and other results that are unspecific.

Treatment

The method of choice for the treatment of CTEPH patients is pulmonary endarectomy (PEA). PEA is effective, especially when the thrombotic lesions are situated in the proximal segment of the pulmonary artery. The method consists of the surgical removal of the thrombotic material from the vascular bed. The procedure is performed by a direct sternotomy with the use of extracorporeal circulation and profound hypothermia (approx. 17-20°C) [19]. The decision to operate is made on the basis of the severity of clinical symptoms, amount of thrombotic material and its surgical availability, degree of impairment of pulmonary circulation and concomitant diseases. Approximately 60% of CTEPH patients may be qualified for PEA [14]. 75% of patients after PEA have good functional results, as well as an increased tolerance for physical exertion [18]. The degree of pulmonary hypertension reduction varies, but in many cases it may recede altogether with the restoration of pulmonary hemodynamics. In 60-100% of CTEPH patients before operation an intensification of hemodynamic lesions was identified, which enabled the qualification for NYHA functional classes II and IV; after PEA the number of

patients remaining in either of the classes dwindled to 0-21% [20].

The procedure is subject to a high complication rate, which may occur in about 50% of the patients. These include infectious (pneumonia, mediastinitis, sepsa), neurological and hemorrhagic complications [21]. The risk of death in the perioperative period is about 10% [21]. The main reason for deaths in the perioperative period is relentless pulmonary hypertension and the increase of pulmonary vascular resistance or pulmonary edema as a result of reperfusion [19]. However, PEA remains the sole method that enables the recovery of CTPEH patients. In patients after PEA the 5-year survival rate is 74-89% [2]. In 11-35% of patients after PEA, pulmonary hypertension may remain or it may relapse [20].

Patients with a distal CTEPH who are not qualified for PEA may consider percutaneous transluminar pulmonary angioplasty (PTPA) as an interesting option. It may considerably improve the hemodynamic function of the pulmonary arteries [23].

All CTEPH patients require a life-long anti-thrombotic therapy, which may lower the pulmonary hypertension and the overload of the right ventricle [22]. A chronic use of anti-thrombotic medicines is necessary in all patients after PEA in order to lower the risk of pulmonary hypertension relapses [12]. Medicines administered to patients with other forms of pulmonary hypertension may be applied in patients with non-operative CTEPH, as well as symptomatic/residual or recurrent CTEPH after PEA, before a planned PEA procedure or when preoperative treatment leads to hemodynamic improvement [24]. Recently, in a clinical study with randomization with a stimulator of soluble guanylyl cyclase, a significant improvement of distance in a marching test was observed among CTEPH patients, and among patients with persistent or relapsing pulmonary hypertension after operation. The medicine (riociguat) stimulates guanylyl cyclase. Soluble guanylyl cyclase is a key enzyme in the nitrogen signal path that catalyzes the synthesis of the second relay of the cyclic guanosine monophosphate (cGMP), which is conducive to the widening of vessels and inhibiting the proliferation of the smooth muscles, leucocyte recruitment, platelet aggregation and vascular remodeling. It is the first medicine in the world to be approved for CTEPH treatment [26].

Rehabilitation may be of utmost importance, including in patients not qualified for an operation or with relentless pulmonary hypertension after PEA. It is normally well tolerated, lengthens the six-minute walking test, increases peak oxygen uptake and the ability to reach maximum exertion capacity, as well as improves the quality of life. Beneficial effects of physiotherapy in the treatment of patients with non-operative CTEPH and the remaining chronic thromboembolic pulmonary hypertension are indicated by the significant improvement of the value of NTproBNP [25].

Although PEA is a treatment of choice it is still not clear if patients with mild CTEPH should undergo the operation. There are test results indicating that patients with a mild CTEPH may only be treated conservatively, i.e. administered anti-thrombotic medicines; pulmonary hypertension may thereby be decreased, as well as the overload of the right ventricle [22].

Conclusion

All patients with risk factors should be suspected of CTEPH. The diagnostics must include the abovementioned imaging. There is a particular justification for echocardiographic monitoring of patients after pulmonary embolism with a view to detect developing or intensifying characteristics of pulmonary hypertension. CTEPH is a severe, lethal disease which may, in a high percentage of cases, be cured if it is quickly diagnosed and proper operative treatment is administered.

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History of the military medical examination in Poland

Historia orzecznictwa wojskowego w Polsce

Piotr Wróblewski[1], Janusz Maciorowski[2]

[1] Head of the District Military Medical Board in Warsaw
[2] Head of the Central Military Medical Board in Warsaw

Abstract. The article presents the development of military case law in Poland with particular emphasis on the organizational structure and the activities of the military medical boards (MMBs) following World War II. Attention is paid to the evaluation of military case law regulations, the procedures followed by MMBs, the establishment of health requirements for enlistment, and a list of medical fitness categories both for active-duty soldiers and candidates for military service. The final section briefly discusses the recent restructuring of military jurisprudence, which took place in 2013.
Key words: military medical examination, military medical boards

Streszczenie. W pracy przedstawiono rozwój orzecznictwa wojskowego w Polsce, ze szczególnym uwzględnieniem struktury organizacyjnej i działalności wojskowych komisji lekarskich (WKL) po II wojnie światowej. Zwrócono uwagę na ewaluację przepisów orzeczniczych, tryb postępowania WKL, ustalanie kryteriów zdrowotnych wymaganych do służby, jak również wykazy kategorii zdrowia żołnierzy oraz kandydatów na żołnierzy. W końcowej części omówiono w skrócie współczesną restrukturyzację orzecznictwa wojskowego, która nastąpiła w 2013 roku.
Słowa kluczowe: orzecznictwo wojskowe, wojskowe komisje lekarskie

Delivered: 30/09/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93(1): 119-128

Corresponding author:
Lt. Col. Piotr Wróblewski MD
District Military Medical Board
78 Koszykowa St., 00-911 Warsaw
telephone: +48 504 003 590
e-mail: rwklwarszawa@wp.mil.pl

Military history and the beginning of the military medical examination in Poland

The history of the Military Health Service has for a long time been inextricably connected with the history of the armed forces and wars. Along with the formation of the first organized military formations, sick and wounded soldiers were provided with care. Wound dressing is the oldest sanitary procedure, and later on hygienic procedures emerged. All knightly and mercenary armies had specialized medics with various qualifications, including healers, barber-surgeons, and finally doctors. Most often these individuals were civilians summarily conscripted for specific military expeditions, and the army was not involved in their professional training. In military communities, being large population centers involved in warfare, health-related problems were commonplace. This gave rise to attention being applied to the healthcare of soldiers and efforts to recruit qualified medical professionals [1].

Since time immemorial, those who have served in the army have usually been strong and healthy. Nowadays, it is difficult to determine which criteria conditioned one's acceptance into the army, as well as who established th0se criteria, and whether barber-surgeons/doctors participated in the selection of candidates for service. The health of a medieval soldier was generally poor. Peasants, though without military obligations towards the state, were conscripted into the army in special circumstances, while the obligation to defend cities fell on the burghers. The necessity to travel large distances in difficult weather

conditions resulted in weak and sickly individuals dropping out of their units. General health was also strongly conditioned by numerous epidemics, and warfare was conducive to their development. According to historians, in the 14th century at least one out of three people living at the time died of the plagues. “The Black Death” was first recorded in Europe in 1347 in the Crimea, when the Mongolian army led by Jani Beg laid siege to Caffa. At the time some soldiers died in battle; however, most of them were bested by infectious diseases, also referred to as “plagues” [2].

In the 12th and 13th centuries, knights constituted the main military force of the state. In exchange for the right to use land, the knight had to report for duty when summoned by the king or duke. A wealthy knight would turn up to fight along with his retinue (pol. *poczet*), which was the smallest military organizational unit, while poorer knights reported for duty on their own. In this way the class of knights was created, whose community was governed by the same rights and obligations. With time, out of this diverse group, the nobility emerged.

During the time of the Nobles´ Republic in the 13th and 14th centuries, Poland's borders were defended by means of a mass levy. At the time, the nobility was not subject to examinations by barber-surgeons/doctors; however, the selection was necessitated by the needs of the service. In the 16th century a regular, professional Polish Army started to emerge, amounting to 2,000 soldiers in times of peace and approx. 20,000 in war. Unfortunately, the lack of constant funding of the army had an adverse effect on the training, equipment and health of the soldiers. This situation was improved by reforms passed by the Sejm in 1562-1563, introducing the so-called 'quarter army'. Its upkeep was maintained by spending a quarter (a fifth from 1567) of the income from royal properties. These funds allowed the constant upkeep of an army totaling 2,000-6,000 soldiers. At the end of the 17th century, Poland had a modern army consisting of cavalry as well as infantry units. It also included advanced artillery and regiments of Registered Cossacks, which were established by Sigismund II Augustus in 1570. An important change in the manner of funding the army took place in 1652, when the so-called *komput* was introduced, the regular army of the state. The year 1655 saw the first compulsory draft due to the Swedish Deluge, where the conscripts included fee and homestead soldiers, enlisted in the infantry or cavalry from 5-20 rural **fees** (pol. *łan*) or 25-50 urban **homesteads** (pol. *dym*).


POLSKA ZBROJNA

PISMO CODZIENNE

Sowiety do świata o Polsce i Piłsudskim

Inwalidzi

Stan wojenny na Ukrainie

Owacje Francji na cześć Polski

Figure 1. One of the first issues of the "Armed Poland" magazine (disability pensions for veterans after World War I), Source: Archive CBW, PZ No 3
Rycina 1. Jeden z pierwszych numerów Polski Zbrojnej (renty dla inwalidów po I wojnie światowej). Źródło: Archiwum CBW, PZ Nr 3

The progressing economic and political disintegration of the state at the turn of the 18th century resulted in the decline of the armed forces. King Stanisław II August attempted to reform the army and increase its numbers. Unfortunately, due to the exercise of the liberum veto by members of the Sejm, who had been bribed by Russia or Prussia, this was not accomplished. As a result, the army remained sparse (approx. 40,000 soldiers in 1763), ill-armed and ill-commanded.

The development of science in the second half of the 18th century facilitated the development of medical solutions and ideas. This was the beginning of the law-regulated military medical examination to assess an individual’s fitness for military service. The Military Ordinance of Gen. Alojzy Briihl, sanctioned by the Sejm of the Republic of Poland, entered into force on 6 May 1774 [3]. In 1786 the “Camp and Garrison Rules of the Commonwealth” was introduced, which forbade conscripting “vagabonds, swindlers, the sickly

and innocents, villains, and wanted individuals (...)" The Great Sejm (1788-1792) passed the establishment of a 100-thousand-strong army, as well as defined the criteria of the military draft and introduced the army-financing reform, such as by way of the first population census in Poland, which made it possible to pass a resolution on tax to cover the upkeep of a regular 100-thousand-strong army. At that time the health service in Poland was regulated by the ordinances of the Military Commission. The rules on staff-medics and staff-surgeons were passed on 29 October 1790, and 11 February 1791 saw the passing of rules on lower-rank medical personnel. The duties of staff-medics included, among other things, conducting medical check-ups of soldiers in two divisions per year, as part of the inspection trips. The assessment of fitness for service included three criteria: health, age and height. The examination and determination of fitness for military service was given a legal nature [4].

Unfortunately, some influential magnates did not want to comply with the laws established by the Constitution of 3 May 1791, and entered into conspiracy in Targowica (in fact under the banner of Catherine the Great in Saint Petersburg) on 27 April 1792, which was disclosed on 14 May as the Targowica Confederation. Its establishment gave Russia an excuse for a military intervention in Poland, and contributed to the outbreak of the Polish–Russian War of 1792. Stanisław II August, deprived of military support, was forced to join the Confederation. After the premature surrender of the Polish Army, the Targowica confederates seized all Polish voivodeships thanks to the support of the Russian forces, removing the authorities established by the Great Sejm, leading to the economic and financial collapse of the state. In 1793 the Grodno Sejm carried out the Second Partition of Poland. Most leaders of the Targowica Confederation were sentenced to death and hanged during the Kościuszko Uprising, which began in spring of 1794. A military dictatorship was established under the leadership of Tadeusz Kościuszko. Kościuszko issued a universal proclamation, pursuant to which one clothed, groomed recruit equipped with a rifle, pike or axe was to report for duty from every 5 homesteads (*dyms*), while one mounted recruit was to report from every 50 homesteads. In addition to the conscription, there were also volunteers who joined the artillery, engineering service or infantry as riflemen. Kościuszko also introduced duty in the militia, which applied to men aged 18-28 who did not fit in the regular army. Municipal battalions, and at times even infantry regiments cooperating with the regular army, were established out of militia officers. There were serious problems with armament supply, which necessitated the establishment of scythe-bearer units, armed with pikes and scythes, with blades facing upwards. Over the eight months of the Kościuszko Uprising, the Polish side mobilized around 150,000 people, including nearly 100,000 for duty in regular units and 50,000 in the militia and mass levy. 70,000 people gathered in military and insurgent camps. The Uprising failed and was followed by the Third Partition of Poland. King Stanisław II August left Warsaw and went to Grodno accompanied by Russian dragoons, where he remained under the custody and control of the Russian viceroy, and relinquished the throne to Russia on 25 November. After the loss of statehood, many Polish citizens, especially military officers, emigrated to Saxony, Italy and France, many tying their fates to Napoleon Bonaparte. With his consent, in January 1797 they created two Polish Legions led by Gen. Henryk Dąbrowski and Gen. Karol Kniaziewicz [5].

Military medical examinations in the 19th century and early 20th century

During the time of the Duchy of Warsaw, between 1807 and 1815, efforts were made again to establish the structures of the Polish Army. While formally independent, the Duchy was actually subordinate to Napoleonic France. The two Northern Legions and the remnants of the Polish Legions acted as the germs of the Duchy's army. Volunteers were recruited into the army, mostly noblemen and burghers. On 16 November 1806 General Dąbrowski announced a decree on conscription in the Poznań Department. The rule in force was – one infantry conscript from 10 homesteads, and one mounted conscript from 45 homesteads. In March 1810 the army of the Duchy of Warsaw included 17 infantry regiments, 16 cavalry regiments, and an artillery and engineering corps. In May 1811 and in the winter of 1812 the army was subsequently reformed at the request of Napoleon Bonaparte. Within the framework of the Great Army, the 5th corps, under the command of Duke Poniatowski, was established and referred to as the Polish Army. The remaining Polish units were placed under the respective French corps. At that time, the rules governing military medical examination and its organization were specified in respect of the draft of

conscripts for the armed forces. The Decree of Duke Frederick Augustus II (King of Saxony and Duke of Warsaw) on the military draft was published on 9 May 1808. It introduced enrolment councils (draft boards) composed of military and civilian surgeons and representatives of civilian and military administrations. The Decree also introduced the rule on the general obligation of military service: all males aged 20-28 were enrolled. Registering information included basic personal data as well as a space for an item on the mental health of conscripts. These items provided general and laconic observations of those making record entries, using expressions like: "a weakling," "poor eyesight," "bad legs," "unable to hear," "defective" and "suffers from grand mal seizures."

The Decree also determined the age limits of citizens included in the reserve: from 28 to 50 years. It also defined the professions exempt from military service, which were: civil servants, teachers and clergymen of all denominations.

The passing of this Decree resulted in an organizational breakthrough, as, for the first time, there was a specific organizational and administrative unit entrusted with the implementation of the act. This was the Draft Board, sometimes referred to as Enrolment Councils, and was composed of two Department councilors nominated by the Minister of the Interior, two surgeons (one military and one civilian), one officer and one secretary. The so-called Department Prefect was the chairman of the Council, and presided over its work. On 19 September 1809, under a decree of Duke Frederick Augustus II, the General Medical (Physician's) Council was established to deal with the problems of public health, including the medical examination of conscripts and soldiers and reporting in this field. The Council issued instructions for medical examiners, entitled: *Diseases and disabilities that make soldiers and conscripts unfit for military service.*

The defeat of Napoleon's forces in 1812 and the fall of the Duchy of Warsaw brought the development of Polish military ideas to a halt. In 1815, following the Congress of Vienna, the borders of the Partitions were defined (with an adjustment in 1833) up to autumn 1918.

The development of the Polish Army was halted with the loss of independence and the Polish nation was forced to adopt the laws imposed by the partitioning nations. The Kingdom of Poland went through systemic transformations, which were largely influenced by the January and November Uprisings. By 1832 the Kingdom was a constitutional monarchy in a personal union with Russia, after 1832 it was a Russian province with a certain systemic autonomy, and after 1864 the country was unified with the Russian empire, with the Kingdom being regarded as the Vistula Land. In the 1830s, Russian rules on medical examination were in force in the Kingdom of Poland and the conscription system was conditional on the rules in force in the partitioning countries, e.g. in Tsarist Russia on the *Selection of laws, acts and ukases*, which concerned the draft of conscripts in the Russian Empire. After the closure of the University of Warsaw, the conferring of doctor licenses fell to the General Medical Council, also referred to as the Medical Council of the Kingdom of Poland.

In 1839 the Medical Council issued a set of instructions entitled: *Diseases and disabilities that make soldiers and conscripts unconditionally unfit for any military service*. These instructions included a list of impediments and diseases resulting in being unfit for military service. They listed, among other things, long-term and incurable nervous-system diseases, weakened mental faculties, sexually transmitted diseases, paralysis, edema, consumption, and venous dilatation. In 1864 the Medical Council introduced further instructions, organizing the medical certificates into the group of certificates on incurable diseases and disabilities causing complete unfitness for military service, the group of certificates on disease exempting one from military-service obligation in three consecutive examinations, and the groups of certificates on diseases disallowing conscription in the present draft (deferment of military service).

World War I (1914-1918) was the greatest military conflict in Europe since the Napoleonic Wars, and it was the first war to see the use of chemical weapons, airplanes, submarines, tanks and trucks. The period after World War I was a time of rebirth for the Polish Army, with military medical examinations being based on the applicable rules of the partitioning nations. The Polish Legions used the rules and regulations of the Austro-Hungarian army, Polish formations in Russia were based on Russian models, and the Blue Army of Gen. Haller employed French rules. On 26 October 1918 a Decree of the Regency Council was issued to transform the Military Board of the Kingdom of Poland into the Ministry of Military Affairs, which included the Sanitary Department responsible for the appropriate draft of conscripts and the health of conscripted soldiers. These tasks were to be carried out by draft boards, military medical boards, military hospitals and

military doctors. On 10 December 1918, under a Decree of the Chief of State, medical boards were established at district and regional military draft offices. These boards consisted of two military doctors, or one civilian and one military doctor, and were to perform medical check-ups of conscripts drafted for active military service. In January 1919 the Care Section was established under the Sanitary Department. The Section devised instructions for doctors examining ill and wounded soldiers, and cared for war disabled persons. Temporary qualifying military medical boards, examining the health of soldiers returning from partitioning nations' armies who wished to join the Polish Army, were established at the General District Commands. They were dissolved in 1920, and replaced by permanent Medical Review and Super-Review Boards. These boards examined the health of soldiers and determined their fitness for military service. At the time the right of appeal was introduced to medical examination (Super-Review Boards supervised certificates issued by Review Boards). The Review Boards, in addition to military doctors, included representatives of other military services, such as the personnel department, commissariat and the draft department. After the regaining of independence, it was necessary to regulate matters connected with providing aid to the victims of catastrophes, natural disasters, military conflicts and wars at home and abroad. At the request of the Sejm Committee for the Disabled, an act on the disabled was passed on 18 March 1921.

The Air Forces, under construction after World War I, required the organization of healthcare for aircrew. *The Medical rules of examining fitness for the air-force service* were drawn up in 1921. The medical examination rules and structure were gradually changed and adapted to the development of military technology. Candidates for pilots were examined at district military hospitals. Issues in the field of medical examinations contributed to the development of air medicine in Poland.

Between 1923 and 1928 a comprehensive reorganization of the medical examination practices in the Polish Army was carried out. Ordinary and Extraordinary Boards were established, and these Boards were established at the Ministry of Military Affairs for generals and senior officers; at district (corps) commands for officers and non-commissioned officers; and at military hospitals for privates and conscripts. The establishment of these military boards made it possible to discharge conscripts unfit for military service for health-related reasons within three weeks from their drafting to mandatory military service. Conscripts could appeal to appellate boards against decisions issued by all types of military boards. In addition to the examination structure dealing with fitness for military service in ground forces, in January 1928 the Centre of Aviation Medical Examination (CBLL) was established. This center had the task of providing aircrew with healthcare services. In 1931 the first hypobaric chamber was constructed and pilots were examined in such chambers as part of a standard procedure – once or twice a year. Every pilot had his/her own **medical record book,** which included entries on the pilot's health in a given year.

Military medical examinations after World War II

Pursuant to the order of the Commander-in-Chief of the Polish Armed Forces, Soviet rules governing the military medical examination translated into Polish were adapted for the purposes of military medical examinations in Poland. The examination system between 1945 and 1954 was based on medical boards operating on the premises of military hospitals. Two examination boards were established at every hospital; lower-tier boards and upper-tier (appellate) boards. Furthermore, since 1944 three air medical boards operated in Poland: The Mobile Army Board, the Aviation Medical Board at the Aviation Hospital in Otwock, and the Aviation Medical Board at the Military Academy (Zamość/Dęblin). The establishment of the Mobile Sanitary-Epidemiological Laboratory, at the Polish Air Forces Command and later transformed into the Aerial Physiology and Hygiene Laboratory, served as the germ of the main aerial medicine center. In June 1946 the laboratory was transformed into the Central Aviation Medicine Laboratory with a hospital and the Aviation Hospital in Otwock, together with its Aviation Medical Board, were included in its structure.

In May 1947 it was renamed the Central Institute for Aviation Medical Examination (CIBLL), and its headquarters was moved to Warsaw. In 1955 the Institute was renamed to the Military Medical Research and Experiential Institute, which, pursuant to the Regulation of the Minister of National Defence of 21 May 1958, was renamed the Military Institute of Aviation Medicine.

The examination rules adopted in 1945 and amended in 1947 remained in force until 1951. They included the list of diseases and a classification of soldiers by function and operated equipment. Rules on

the medical examination and the assessment of fitness for military service, including the list of diseases, were introduced under the order of the Minister of National Defence of 7 February 1947. These rules also encompassed the following health categories [6]:

- fit for front-line service;
- fit for non-combatant service;
- deferment until the next draft;
- temporarily unfit for military service; and
- completely unfit for military service by conscripts.

The act on the general obligation of military service of 4 February 1950 and its amendment of 21 April 1950 specified new health categories, with the same names as before, from “A” to “E”. This act also authorized local public administration bodies to draft and examine the health of conscripts, using district medical boards. The act on the draft of conscripts, which functioned as the precursor of the act on the general obligation to defend the Republic of Poland, entered into force on 8 January 1951.

The Order of the Minister of National Defence of 11 April 1951 on the authorization and introduction of the *Rules on medical examination and physical and mental assessment of fitness for military service* updated the selection criteria for military service. The applicable categories at the time were:

- “A” – fit for front-line military service;
- “B” – temporarily unfit for military service;
- “C” – fit for military service (restrictions apply);
- “D” – fit for non-combatant service – unfit for service in time of peace;
- “E” – completely unfit for military service.

The list of diseases included in the aforementioned rules was similar to the *Rules of medical examination and assessment of physical fitness of university students for military training* applicable under the Order of the Minister of National Defence No. 35/MON of 14.08.1954, which included separate rules for professional-service candidates. In 1954 further reforms of the military medical assessment structure were carried out. Lower-tier Garrison Military Medical Boards and upper-tier (appellate) Regional Military Medical Boards were established to replace the Medical Boards at military hospitals. The competences and territorial scope of these boards depended on the military area in which the board was located. The operations of the Garrison Military Medical Boards and the Regional Military Medical Boards were regulated in the following acts:

- Act of 30 January 1959 on the general obligation of military service (Journal of Laws No. 14, Item 75);
- Act of 13 December 1957 on the military service of the officers of the Armed Forces (Journal of Laws 1958 No. 2, Item 5);
- Act of 6 June 1958 on the military service of the privates and non-commissioned officers of the Armed Forces (Journal of Laws of 1958 No. 36, item 164 and of 1959 No. 14, item 75).

In 1959 the *Instruction on the medical examination and assessment of physical fitness for military service* was drawn up and adopted under the Regulation of the Minister of National Defence of 17 February 1959, Ref. No. Zdr. 16/MON.

Military medical boards after 1967

After the act on the general obligation to defend the republic of Poland of 21 November 1967 (Journal of Laws of 2012, item 461, as amended) had entered into force – and which continues in force subject to amendments – Poland continued to adapt its military medical examination laws to the changing structure and profile of the Polish Army. In the years that followed, the authorities specified the examination requirements for emerging military specialties and women's military service. The Regulation of the Ministry of National Defence of 22 August 1979 provided temporary changes to the health categories, as defined by the act on health categories, by introducing *'A temporary instruction on the assessment of the physical and mental fitness for military service'.* The instruction defined three major health categories, with health category "A" having three sub-categories:

- "A" with sub-categories ("A1", "A2", "A3") – fit for military service;
- “B” – temporarily unfit for military service;
- “E” – permanently unfit for military service.

In 1979 the Garrison Military Medical Boards changed their name to the District Military Medical Boards (DMMBs). Also, the Ministry of National Defence issued further orders (instructions) to specify the MMBs' responsibilities, and also laws on how to assess fitness for military service. These included:

- *A temporary instruction on the assessment of physical and mental fitness for military service* (Ref No. Zdr. 195/79) and *Amendments and additions to the temporary instruction on the assessment of physical and mental fitness for military service* (Ref No. Zdr. 197/80), adopted under the Regulation of the Minister of National Defence No. 41/MON of 17

October 1980 (Journal of Ordinances of the Ministry of National Defence of 1980, item 64);

- *Instruction on the Military Medical Boards* (Ref No. Zdr. 200/81) adopted on 1 January 1982 under the Regulation of the Minister of National Defence No. 29/MON of 30 June 1981 (Journal of Ordinances of the Ministry of National Defence of 1981, item 43) to replace the *Instruction on the Military Medical Boards* (Ref No. Zdr. 65/59),
- *Instruction on the assessment of the physical and mental fitness for military service* (Ref No Zdr. 206/84) adopted under the Regulation of the Minister of National Defence No. 9/MON of 14 February 1984 (Journal of Ordinances of the Ministry of National Defence of 1984, item 9) to replace the *Temporary instruction on the assessment of physical and mental fitness for military service* (Ref No. Zdr. 195/79) and *Amendments and additions to the Temporary instruction on the assessment of the physical and mental fitness for military service* (Ref No. Zdr. 197/80),
- *Laws governing the assessment of physical and mental fitness for military service* (Ref No Zdr. 224/89), adopted under the Regulation of the Minister of National Defence No. 19/MON of 13 April 1989 (Journal of Ordinances of the Ministry of National Defence of 1989, item 22).

Adopted on 10 June 1992, the Regulation of the Minister of National Defence on the rules of determining fitness for active military service and on the relevant competences of and procedures to be followed by military medical boards (Journal of Laws No. 57, item 278) compiled and regulated the instructions, temporary instructions and other regulations governing military medical examination. This regulation once again redefined and renamed health categories by introducing categories "A", "B", "D" and "E" for conscripts and soldiers in mandatory military service, and also categories "Z" and "N" for professional soldiers. Categories "A1", "A2" and "A3" were replaced by categories "A" or "D". The Regulation comprehensively regulated the laws on the competences of and procedures to be followed by the military medical boards, and the procedures for determining fitness for active and professional service. Also, subsequent appendices to the Regulation set forth health requirements to serve in aviation, air traffic control, on ships, and in the navy. There were also separate provisions. These, however, governed exclusively matters that required determining whether there was any health impairment and how substantial it was, whether there was any relation between medical conditions and injuries and warfare, and also whether the resultant disabilities were related to military service.

The Regulation of the Minister of National Defence of 10 June 1992 defined the following health categories:

- "A" – fit for military service, which means fitness for mandatory and extended mandatory military service, military classes for university students, military training, temporary military service, military practice, mandatory civil-defense service or training for conscripts, alternative civilian service, and also for military service in the event of mobilization and war;
- "B" – temporarily unfit for military service, which means temporary impairment of the general state of health or acute or chronic medical conditions which can be reasonably expected to cease to affect fitness for military service within 24 months;
- "D" – unfit for military service;
- "E" – unfit for military service in time of peace and in the event of mobilization and war;
- "Z" – fit for professional military service, which means fitness for professional military service on a permanent or contractual basis, and also fitness for service as a candidate for professional service;
- "N" – permanently or temporarily unfit for professional military service, and unfit for service as a candidate for professional service.

The military medical boards also determined the fitness or unfitness for service for shock troops, for parachutist instructors and experimental parachutists, divers and scuba divers, the Polish Army's Honor Guard, for aircrew and air traffic controllers, for aviation maintenance technicians, and also for service on ships in the navy.

For the first time, a ministerial regulation defined the types and competences of the military medical boards. It failed, however, to specify how many such boards are required, where they should be located and what their jurisdictions should be. The District Military Medical Boards, the District Military Navy Medical Board, the Regional Military Medical Boards (Military Aviation Medical Board, Central Military Aviation Medical Board, Military Naval Medical Board, Military Navy Medical Board, and Military Medical Board for the Central Institutions of the Ministry of National Defence, also called the CI MND Military Medical Board) and the Central Military Medical Board were established under the Regulation.

Table 1. An indicative list of diseases and disabilities (Chapter IV-The organ of sight) including categories of medical fitness for active military service with differences between the studied groups
Tabela 1. Przykładowy wykaz chorób i ułomności (Rozdział IV- narząd wzroku) z kategoriami zdrowia do służby czynnej różniącymi się między grupami badanych

Paragraph	Section	Diagnosis	Group I	Group II	Group III	Group IV
13	3	each eye has a visual acuity of at least 0.5, with corrective lenses for over 3.0 D up to 6.0 D and cylindrical lenses for over 1.0 D up to 3.0 D	A	A	N	N/Z
13	4	each eye has a visual acuity of at least 0.5, with corrective lenses for over 6.0 D and cylindrical lenses for over 3.0 D	D	D	N	N
13	5	one eye has a visual acuity of at least 0.5, and the other eye 0.1 up to 0.4, with the appropriate corrective spherical and/or cylindrical lenses	D/E	D/E	N	N

Table 2. A list of diseases and disabilities (Chapter XI - The digestive system) including categories of medical fitness for active military service with differences between the studied groups
Tabela 2. Wykaz chorób i ułomności (Rozdział XI - układ trawienia) z kategoriami zdrowia do służby zawodowej różniącymi się między grupami badanych

Paragraph	Section	Diagnosis	Group I	Group II	Group III	Group IV
44	6	Abnormal results of liver function tests to be further diagnosed	N	Z	Z/N	Z
44	7	Condition following a recent viral hepatitis	N	Z	Z/N	Z
44	8	Chronic hepatitis	N	Z	N	Z/O

Following Decision No. 29/Org/P-5 of the Minister of National Defence of 2 April 2001 on the reorganization of the division of military medical examination, the regime of military medical examination in Poland changed once again. Lower-tier boards included eighteen Local Military Medical Boards (in Bydgoszcz, Dęblin, Ełk, Gdańsk, Gliwice, Kołobrzeg, Kraków, Legionów, Lublin, Łódz, Olsztyn, Poznań, Przemyśl, Szczecin, Warsaw, Wrocław and Żary), two Military Aviation Medical Boards, one Military Naval Medical Board in Gdańsk and one Capital Military Medical Board. The last one dealt with the military medical examination for institutions established by the Minister of National Defence.

The upper-tier boards included four District MMBs (in Warsaw, Wrocław, Kraków and Bydgoszcz) and the Military Air Force Medical Board, and the Military Navy Medical Board. The district MMBs in Elbląg, Opole, Toruń and Wałcz were closed and names were changed, with the Local Military Medical Board replacing the District Military Medical Board, and the District Military Medical Board replacing the Regional Military Medical Board. This change also caused some downsizing in the boards and reduced the military ranks of medical examiners. These organizational changes in the MMBs coincided with the emergence of an expeditionary policy of the Polish Armed Forces and the increasing professionalization of the army.

In 2003, following another amendment to the act on the general obligation to defend the Republic of Poland (the Act of 29 October 2003 on amending the act on the general obligation to defend the Republic of Poland and on amending certain other acts (Journal of Laws of 2003 No. 210, item 2036), the names of health categories were included in Art. 30 to be defined as follows:

- "A" – fit for active military service, which means fitness for active military service or a specific type of military service, and also fitness for civil-defense service and alternative civilian service;
- "B" – temporarily unfit for active military service, which means temporary impairment of the general state of health or acute or chronic medical conditions which can be reasonably expected to cease to affect fitness for military service within 24 months;
- "D" – unfit for active military service in time of peace;

- "E" – permanently and completely unfit for military service in time of peace and in the event of mobilization and war.

Extensive secondary legislation was adopted in 2004 to provide a basis for the regulations governing the military medical boards, and these regulations continue in force to this day. The Regulation of the Minister of National Defence of 16 June 2004 on the medical examination of professional soldiers assigned to serve outside Poland and those who return to Poland after completing such service (Journal of Laws No. 148, item 1557) made it necessary to standardize military medical examination procedures for all MMBs. This regulation imposed an obligation on the MMBs to perform specific medical examinations both before the soldier leaves the country for military service and after his/her return, and which gave rise to similar requirements for professional-service candidates. The Regulation of the Ministry of National Defence of 25 June 2004 on establishing military medical boards and defining their locations, territorial scope and competences (Journal of Laws No. 151, item 1594) legitimated the changed MMB terminology. Further legislation drew a distinction between the laws governing active-service military medical examination and those governing professional service. The Regulation of the Ministry of National Defence of 25 June 2004 on examining fitness for active military service and the procedures to be followed by the military medical boards in this regard (Journal of Laws No. 151, item 1595) became a separate law, as it arose directly from the provisions of the Act of 21 November 1967 on the general obligation to defend the Republic of Poland. The Regulation of the Minister of National Defence of 10 May 2004 on examining fitness for professional military service and the competences and procedures to be followed by the military medical boards in this regard (Journal of Laws No. 133, item 1422), in turn, was adopted as secondary legislation to the Act of 11 September 2003 on professional military service.

This piece of legislation had an important effect in imposing on the referring authorities the obligation to produce specific documents, based on which the MMBs were to make examination decisions. These documents included a copy of the record of military service, a soldier evaluation report, an outpatient-treatment record, a statement of harmful-factor measurement results, a professional-soldier medical record book, and a periodical medical examination record.

Of major importance at the time were two governmental projects. One was the so-called minor amendment, which enabled voluntary enlistment and the formation of the professional-army corps since 2008. The other project was the so-called major amendment, which defined the HR management rules and new forms of military service specific to the professional Polish Armed Forces. Changes were also adopted through the third parliamentary project – the so-called indirect amendment of the act on

Figure 2. Territorial scope of the activities of the Regional Military Medical Boards. Based on: Central Military Medical Board in Warsaw
Rycina 2. Terytorialny zasięg działania Rejonowych Wojskowych Komisji Lekarskich. Na podst: Centralna Wojskowa Komisja Lekarska w Warszawie, http://www.cwkl.wp.mil.pl

professional military service. Some changes were also adopted (three times) while amending other acts.

Between 2008 and 2009, the primary legislation governing military service underwent a range of amendments relating to the professionalization of the Polish Armed Force. These included:

- amendment to the Act of 24 October 2008 on amending the acts on the general obligation to defend the Republic of Poland and professional military service (Journal of Laws of 2008 No. 206, item 1288); sections 4c and 3a stipulated that individuals who were examined and found to be assigned category D or E were not to be referred to district medical boards or military medical boards; graduates and students of higher-education schools were to engage in military classes, receive military training and serve in mandatory military service under different requirements and conditions; mandatory military service was limited to up to 36 months, and also extended mandatory military service was to be served under different requirements and conditions;
- amendment to the Act of 24 October 2008 on amending the act on professional military service and amending certain other acts (Journal of Laws of 2008 No. 208, item 1308), which changed the rules governing legal and reconversion assistance for soldiers (Art. 129a, 133a and 133b);
- amendment to the Act of 9 January 2009 on amending the act on the general obligation to defend the Republic of Poland and amending certain other acts (Journal of Laws of 2008 No. 22,

item 120), which abolished the terms of "conscription" and "conscript", and the term "registration and conscription" in Chapter II of the Act was replaced with "military registration and qualification";
- the Act of 22 May 2009 on amending the act on the general obligation to defend the Republic of Poland and the act on physical culture (Journal of Laws of 2009 No. 97, item 801), which provided for compulsory safety education classes for lower-secondary schools, basic vocational schools, general secondary schools, profiled general secondary schools and technical schools;
- "major amendment", namely the Act of 27 August 2009 on amending the act on the general obligation to defend the Republic of Poland and amending certain other acts (Journal of Laws of 2009 No. 161, item 1278), which specified in more detail the rules of military registration and qualification, defined the primary rules of securing human resources for the National Reserve Forces, the rules of receiving military training, preparatory military service, military exercises and periodical military service.

As the Armed Forces progressed towards professionalization, further regulations were adopted to draw a distinction between the laws governing the active-service examinations and those governing the professional-service examinations. Currently, the military medical boards operate and examine fitness for active service on the basis of the Regulation of the Minister of National Defence of 25 June 2004 on examining fitness for active military service and the procedures to be followed by the military medical boards in this regard (Journal of Laws of 2004 No. 151, item 1595), including its amendment of 2 October 2006 (Journal of Laws 2006 No. 211, item 1557). Fitness for professional service is examined on the basis of the Regulation of the Minister of National Defence of 8 January 2010, which superseded the Regulation of the Minister of National Defence of 10 May 2004 (Journal of Laws 2004 No. 133, item 1422), including its amendment of 29 November 2005 (Journal of Laws 2005 No. 253, item 2130). The Regulation of the Minister of National Defence of 8 January 2010 introduced the "Z/O" health category – fit for military service for a specific position (relevant only to those who sustained injuries or developed medical conditions while in service outside of Poland).

Restructuring military medical examinations in Poland in 2013

The legislative changes were followed by the physical restructuring of military medical examination in Poland. Put into force on 1 January 2013, the restructuring included the establishment of a uniform, two-tier examination system. The system comprised 11 lower-tier military medical boards and one upper-tier body – the Central Military Medical Board. The Regulation of 24 August 2012 on the military medical boards and defining their locations, territorial scope and competences (Journal of Laws of 2012, item 1013) disbanded the then-existing 29 military medical boards, effective as of 31 December 2012. This required extensive liquidation procedures covering Local Military Medical Boards, District Military Medical Boards and the Central Military Medical Board that existed until 31 December 2013. Liquidation files were compiled for these institutions, and all employees were issued notices of the termination of employment. Examination archives and documentation were passed on to the legal successors in line with their newly defined competences and territorial scope. The Central Military Medical Board based in Warsaw, the District Military Aviation Medical Board based in Warsaw, the District Military Naval Medical Board based in Gdańsk, and the District Military Medical Boards based in Bydgoszcz, Ełk, Kraków, Lublin, Łódz, Szczecin, Warsaw, Wrocław and Żagań were established. The Central Military Medical Board in Warsaw covered the entire territory of the Republic of Poland. The territorial scope of the District Military Medical Boards is presented in Figure 2.

The responsibilities of the former Local Military Medical Boards and the District Military Medical Boards from across the country were re-delegated to the newly established District Military Medical Boards.

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75th anniversary of the liquidation of the 3rd Regional Hospital in Grodno - a short history of its establishment and development

75. rocznica likwidacji 3. Szpitala Okręgowego w Grodnie - zarys historii powstania i rozwoju

Zbigniew Kopociński, Krzysztof Kopociński, Czesław Jeśman

Department of the History of Science and History of Military Medicine of the Medical University in Łódź. Head: Prof. Czesław Jeśman MD, PhD

Abstract. The article presents a short history of the 3rd Regional Hospital of the Polish Army in Grodno. It was established in 1919 as the Grodno Stronghold Hospital and was used during the war against Russia in 1920. The interwar period saw the dynamic development of the hospital as it became one of the most well-known in the region. In September 1939, it was used in the defense of Grodno against the Red Army, and in 1940 many of the physicians were murdered in Katyn and Kharkov by the Soviet NKVD. The year 2014 saw the celebration of the 95th anniversary of establishing the 3rd Regional Hospital and the 75th anniversary of its liquidation.
Keywords: military hospital, army physician, Grodno, Katyn

Streszczenie. Artykuł przedstawia zarys historii 3. Szpitala Okręgowego Wojska Polskiego w Grodnie. Został on sformowany w 1919 roku jako Szpital Twierdzy Grodno i brał udział w wojnie Polski z Rosją w 1920 roku. W okresie międzywojennym dynamicznie się rozwijał i był jednym z najbardziej znanych w całym regionie. We wrześniu 1939 roku brał udział w obronie miasta Grodno przed Armią Czerwoną. Duża część lekarzy tego szpitala została zamordowana w 1940 roku przez sowieckie NKWD w Katyniu i Charkowie. W 2014 roku przypadła 95. rocznica powstania 3. Szpitala Okręgowego w Grodnie i 75. rocznica jego likwidacji.
Słowa kluczowe: szpital wojskowy, lekarz wojskowy, Grodno, Katyń

Delivered: 6/10/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 129-134

Corresponding author:
Zbigniew Kopociński MD, PhD
105th Kresy Military Hospital and Public Outpatient Clinic, Subdepartment of Ophthalmology
2 Dąbrowskiego St., 68-200 Żary
telephone +48 68 470 78 62
e-mail: zkopocinski@wp.pl

The year 2014 marked the 75th anniversary of the start of the aggression by Germany and Soviet Russia against Poland, an event which marked the official beginning of World War II. As a result of this war, millions of people died, thousands of villages and towns ceased to exist, and the possessions gathered by entire generations were left in ruins. For Poland, the first country to attempt armed resistance against Adolf Hitler's efforts to control a large part of the world, it was a complete disaster. Although from the first day of World War II Poland was a part of an anti-Hitler coalition, and the Polish Army was engaged in military combat on all fronts of the conflict and paid a high price in blood, the victory of the Allies was not tantamount to a victory for Poland. As a result of the shameful treaties of Yalta and Potsdam, the most loyal ally of the Big Three (Russia, USA and Great Britain) lost sovereignty and entered the direct sphere of influence of its eastern neighbor. This loss of a large part of the territory included a number of historical centers of Polish science and culture, such as Lviv, Grodno and Vilnius.

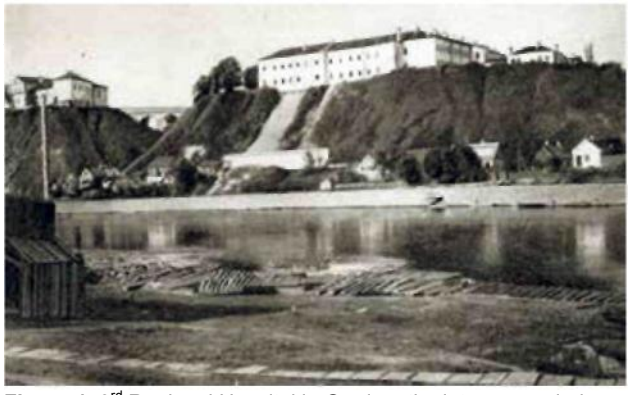

Figure 1. 3rd Regional Hospital in Grodno, the interwar period
Rycina 1. 3. Szpital Okręgowy w Grodnie, okres międzywojenny

military medical support institutions existing in the area of the Eastern Borderlands, including four large hospitals: Fort Hospital in Vilnius, 3rd Regional Hospital in Grodno, 9th Regional Hospital in Brześć-on-Bug, and 6th Regional Hospital in Lviv. They were all respected and recognized institutions, employing numerous outstanding medical officers, many of whom later were killed and buried in pits in Katyn. The aim of this article is to remember the history of the creation and liquidation of the 3rd Regional Hospital in Grodno, one of the most distinguished of Polish military treatment facilities in the Eastern Borderlands, which actively participated in the daring defense of its town against the Red Army in September 1939.

Location

The 3rd Regional Hospital was located on Zamkowa Street in Grodno, within the walls of the New Castle, in close proximity to the Old Castle. The history of this area is colorful, while at the same time it is surrounded by a beautiful landscape. The first castle, known as the "Old Castle", was erected during the reign of duke Vytautas, and in the chronicles of the Teutonic Knights it was referred to as the Upper Castle. Some historians believe it was built even earlier, in the times of Witenes, ca. 1280, but there is no convincing evidence. On the site of the future hospital were situated the Grand Duke's chambers (Domus Regia), where the rulers resided and, on 7 June 1492, Great King Casimir Jagiellon passed away.

The Old Castle was rebuilt as a residential building by an Italian architect, Scoto of Parma, as late as the reign of King Stefan Bathory. This is where this great leader died on 12th December 1586, while preparing for another military expedition against Russia. The actual rooms of the future hospital were built by the command of King Augustus III, who ordered the erection of a bridge over the Neman River and the impressive New Castle. Outstanding Saxon architects were engaged in the works in 1734-1751: Joachim Jauch, Friedrich Pöppelman and Johann Friedrich Knobel. They created a palace in the style of Louis XV, horseshoe-shaped, featuring a beautiful room in the center, the senatorial chamber, as well as a chapel. The central part of the building was decorated with pilasters crowned with capitals. The entry gate, comprising two columns and two pilasters, led to the courtyard. The pilasters were ornamented with stylized and decoratively modeled war trophies, while the

Figure 2. The gateway of the New Castle (former 3rd Regional Hospital) in Grodno, 2003
Rycina 2. Brama wejściowa Zamku Nowego (dawny 3. Szpital Okręgowy) w Grodnie, 2003 rok

columns featured ashlar groups presenting sphinxes and cupids, *a'la* Jacques Francois Blondel. The columns were made of brick and plastered with lime mortar, their cornices and bends were well shaped. On either side of the entry gate was a small building: one for the guards the other to house the royal kitchen. The Old Castle was then joined to the New castle with a permanent bridge that replaced the former movable one [1, 2].

In 1789, during the reign of the last king of Poland, Stanislaus Augustus Poniatowski, the New Castle was rebuilt according to the design of an Italian architect, Giuseppe de Sacco of Verona. Numerous meetings of parliament of the Republic of Poland were hosted there. The beautifully decorated senatorial chamber saw the last session of the Seym in the free Republic of Poland between 17 June and 24 November 1793, called by Empress Catherine II in order to accept treaties with Russia and Prussia, forced upon Poland and sanctioning the second partitioning of Poland. This is how the second partitioning of Poland became a fact, in the building of the future 3rd Regional Hospital. It also witnessed the symbolic end of the First Republic of Poland, when, following the fall of Kościuszko Uprising on 25 November 1795, King Stanislaus Augustus Poniatowski signed the famous abdication act in the castle chambers, sanctioning the last partitioning of Poland [1-3].

The following years were a time of numerous wars and occupation, with the New Castle falling into ruin and often serving as military quarters. During World War I and the German occupation, a military hospital with 500 beds was located here. After the town was taken over by the Polish Armed Forces, the condition of the building left much to be desired; it required immediate overhaul and the remaining hospital equipment was limited to only a few dozen beds. Following the end of war, the New Castle was provisionally rebuilt, and began operating within the framework of the military health service as a district hospital.

Creation and development of the hospital in the interwar period

With the end of World War I in November 1918, Poland was restored as a state after years of partition, even though it was still fighting for its borders. In the spring of 1919, the Operational Group of Col. Frey was stationed in Grodno. Their physician, Capt. Dr Kazimierz Łukiewicz, became the Chief Physician of Grodno Stronghold. He took over the former German military hospital from the municipal administration authorities, both the pavilion system with a capacity of 250 beds and the New Castle hosting a larger military hospital for 500 beds. The latter required a major overhaul of the electrical, water and sewage systems, as well as all the rooms and corridors. As for medical equipment, only about 20 beds remained, with a steam disinfection chamber and a small bathing device. Due to the prevailing epidemics of infectious diseases, the urgent restoration of the bath and delousing room was performed. The military physicians of the Grodno garrison from the start worked with energy on creating the basis for the functioning of the military treatment facilities. In May 1919, Maj. Dr Stefan Hubicki became the leader of the team as the Medical Support Chief of Grodno Stronghold. He replaced Capt. Kazimierz Łukiewicz, commandant of the Grodno Stronghold Hospital. His work was continued creatively from 1 June 1919 by the next Medical Support Chief of the Stronghold and Commandant of the Grodno Stronghold Hospital, Maj. Dr Adam Roenig, who moved from the position of Medical Support Chief of the 2nd Legionary Division. He managed to hire more physicians and maintain the therapeutic use of the hospital with 250 beds and three departments: surgery, internal medicine and infectious diseases. The facility also had at its disposal a laundry, bath with delousing room, two permanent disinfecting devices, two mobile disinfecting devices (one of which was damaged), a machine for disinfecting homes, a pharmacy and a dental outpatient clinic. The absence of any means of transport for patients was a considerable problem for the command of the hospital, and an order for such vehicles was placed with the command of the Lithuanian and Belarusian front.

On 1 February 1920, the Commanding Officer of Grodno General District, Gen. Stefan Mokrzecki, issued an order changing the name of Grodno Stronghold Hospital to Military Regional Hospital. Simultaneously, an order was made to increase the number of beds in Grodno to 2,000. Despite a significant staff shortage, the order of 19 February 1920 by the Commanding Officer of Grodno General Region to allocate students of medicine exclusively to health service units led to an increase in the number of places in hospitals.

Apart from the district hospital, a distribution point was established in the town, as well as an infectious diseases hospital for prisoners of war and a military epidemic hospital [4-9, 20, 21]. It was a very difficult time for Poland, as the Soviet army offensive was gaining momentum, forcing the Polish Army into retreat and necessitating the evacuation of military hospitals further into the country, and then to prepare medical support for the injured and ill there. In July 1920, before the town was taken over by the 3rd Cavalry Corps of Gaj-Chan, the Regional Hospital was evacuated from Grodno to Grudziądz, where it operated as Evacuated Grodno Regional Hospital, providing 570 beds. Between 28 August and 18 October 1920, the battle of the Niemen River was fought, successfully for Poland, and as a result Grodno was freed. Following the liberation of Bathory's town, the evacuated Regional Hospital returned from Grudziądz and started operating in the New Castle as Military Hospital no. 1, providing 400 beds.

Relatively soon after the military operations ended, demobilization took place, and military units, including the military medical service, was transformed to fulfill the requirements of the time of peace. On 16 March 1921, the institution was renamed the Regional Hospital, providing 350 to 1,000 beds, with a decreasing tendency. It was actually the end of the war period in the history of the hospital in Grodno, which remained in the same condition until the "Organization of the health service in the time of peace" was issued on 20 August 1921, and the facility was gradually reorganized to become a district hospital. At that time Poland was divided into ten Corps Regions (CR): I - Warsaw, II - Lublin, III - Vilnius, IV - Łódź, V - Krakow, VI - Lviv, VII - Poznań, VIII - Toruń, IX - Brześć on Bug, and X - Przemyśl. The Medical Support Chief of the CR was in charge of the Heads of Medical Support Districts, Regional Hospital and Staff of the Backup Medical Support Company. Moving the headquarters of the District Command to Vilnius resulted in a reduction of the significance and role of Grodno. It became a seat for the Management of the Medical Support District and District Hospital, providing 300 beds in the New Castle. At that time, the latter functioned as the former military hospital, and the number of beds it provided ranged between 300 and 865 (1922 – 300-865, 1923 – 337-400, 1924 – 300, and 1925 – 300), with a decreasing tendency. For the entire period of its operation, i.e. in the years 1922-1925, the hospital's Commandant was Maj. / Lt. Col. Dr Mikołaj Werakso [11-15,19,21]. On 18 June 1925, the "New Organization of the Health Service in the Time of Peace" was published, which for Grodno meant a return to the situation in 1921, i.e. to being the headquarters of the medical support authorities of the district, and of the main military treatment facility in the region, the 3rd Regional Hospital.

On 16 October 1925, the District Hospital in Grodno was formally reorganized as the 3rd Regional Hospital, whereas the former 3rd Regional Hospital in Vilnius was named the Military Fort Hospital. The hospital in Vilnius, due to an agreement concluded in 1921 between the Stefan Bathory University and the Medical Support Department of the Ministry of Military Affairs, became also a seat of the university clinical hospitals, which greatly increased the quality of services provided in the military facility as well as solving the university's accommodation problems. Therefore, the agreement was beneficial for both sides. The hospital in Grodno comprised the following structures: commandant's team, patient departments (internal medicine, surgery with gynecology and obstetrics subdepartment, neurology, dermatology and venereal diseases, otology, and ophthalmology), X-ray laboratory, bacteriological laboratory, dental clinic, hospital and garrison pharmacies and specialist outpatient clinics.

The 3rd Regional Hospital did not have a psychiatric department, and patients had to be transferred to the Military Fort Hospital in Vilnius, where such a department existed. The district unit was the principal treatment facility in the district, and it provided a specialist

background for other, smaller hospitals and infirmaries [16, 19, 21].

In 1931, the last important changes regarding the military health service were introduced before the outbreak of World War II. The most important novelty was incorporating mobilization structures into the framework of the district hospital. This was associated with additional tasks for the district facility, namely keeping records of the medical service regular personnel, and officer personnel of the Corps Regional reserve, completing the staff of non-recorded health service units in the district, mobilization and demobilization of all the health service formations in its area regarding both human resources and materials, and storage and maintenance of the materials necessary for mobilization. New tasks were implemented by the Backup Staff (BS) of the 3rd Regional Hospital, established as a result of the renaming and reorganization of the 3rd Medical Support Battalion in Grodno. The first Commanding Officer of the BS, and at the same time Deputy Commandant of the hospital, was Lt. Col. Dr Otton Samójłowicz-Salamonowicz. Contrary to most district facilities, the Backup Staff of the 3rd Regional Hospital did not reside on the hospital site, in Grodno, but several dozen kilometers away, in Sokółka. Following the new regulations of September 1931, the 3rd Regional Hospital comprised: hospital command, patient's departments (400 beds in total) of internal medicine, surgery, gynecology and obstetrics, dermatology and venereal diseases, neurology, laryngology, ophthalmology, pharmacy, dental clinic, X-ray laboratory, bacteriological laboratory and specialist outpatient clinics. This hospital structure remained unchanged until the outbreak of World War II [17,18].

Liquidation of the 3rd Regional Hospital

The peace-time operation of the 3rd Regional Hospital ended on 31 August 1939, when the general mobilization was announced. Earlier, on the night of 22 to 23 August, Marshall Edward Rydz-Śmigły announced the second-line alarm mobilization, including the 3rd Regional Hospital. The war started for Grodno on 1 September, at dawn, with heavy bombing. Many people were killed or injured; the latter received prompt and effective assistance at the military hospital. At the morning briefing, the last Commandant of the facility, Lt. Col. Dr Dyonizy Krechowicz, handed the physicians sealed envelopes with mobilization allocations. Most of them left their town forever, and reservists from the Backup Staff replaced professional officer-physicians posted to the front.

Grodno, together with its military hospital, gained fame during the September campaign, due to the heroic defense against overwhelming Soviet divisions. The battle of Grodno was fought on 20-22 September 1939, between the forces of Grodno Fortress, led by Col. Piotr Siedlecki (from 21 September by Div. Gen. Janusz Michał Przeździecki), and the soldiers of the 15th Armored Corps of Gen. Pietrow. The town's deputy mayor, Roman Sawicki, and commandant of the local Army Recruiting Command, Maj. Benedykt Serafin, were the brains and driving force behind the entire heroic defense of the town. They had only two infantry battalions and small subdivisions from Vilnius and Lida at their disposal. Significant assistance was provided by scouts, who received military training and could not imagine submitting their town to the Soviets. The Polish defense lines were partially based on the Niemen River, the Old Castle and the New Castle. This area was defended by Maj. Benedykt Serafin's and Capt. Piotr Korzon's battalion. During difficult combat, where the Russians lost several different armed vehicles and suffered about 200 killed or injured, the military hospital in Grodno provided assistance both to Polish casualties and those of the aggressors, cultivating the most honorable traditions of the Polish military health service.

The value of the 3rd Regional Hospital for Poles at that time is demonstrated in the description of the death of Tadzio Jasiński, a famous 13-year-old defender of Grodno: "... he is dying in his mother's arms and on a piece of free Poland, as the military hospital is still in our hands...". The last bastion for the defenders was the Old Castle, which was still responding with fire on the night of 21-22 September 1939. On the next day the Soviets entered Bathory's town. After the town surrendered, some members of the hospital staff, together with other defenders, retreated to Lithuania, where they were interned.

The fate of those who were taken into captivity by the Russians was tragic. Promptly after taking the town, the Red Army soldiers executed approximately 300 defenders, including teenage boys. Many officers were murdered by a shot to the back of the head in Katyn or Kharkov. The list of people killed there includes over 50 military physicians of the 3rd Regional Hospital or reservists allocated to the Backup Staff of this facility. It should be emphasized that many of the hospital management were murdered there: the Commandant, two senior heads of departments, heads of the pharmacy and the radiology laboratory. Also three former commandants of the hospital and several former heads of departments were buried in the pits in Katyn and Kharkov. Some of the physicians from Grodno, who managed to avoid the eastern massacre, entered the Polish Army formed in Soviet camps. After the hardship of wandering in Russia, former commandant of the District Hospital in Grodno, Col. Dr Mikołaj Werakso, died in the Middle East. The former senior head of surgery of the 3rd Regional Hospital, Maj. Dr Adam Kiełbiński, and the last chaplain, Wiktor Judycki, decorated with the Virtuti Militari Cross, gained recognition in the 2nd Polish Corps [17,22,23].

Conclusions

The history of the military treatment facility in Grodno reflects changes affecting the entire military health service in the interwar period. Initially, it was a stronghold hospital, then a regional hospital and stage hospital no. 51, before becoming a district hospital in 1922. Those changes were required by the needs of the war with Russia and the extensive epidemic of dangerous infectious diseases, which necessitated the presence of a well-organized and fully developed health service. Controlling the epidemics and the end of the armed conflict was associated with demobilization of the army, and, as a result, with a reduction in the military medical support and the hospitals. In this peaceful situation, the Grodno facility was reduced to a small district hospital.

Dynamic development of the hospital in Grodno began in 1925, when it was transformed into the 3rd Regional Hospital. In the last year of its existence, the hospital normally provided 400 beds in seven departments. Therefore, in 20 years, the number of beds had doubled, and the hospital had at its disposal almost all the necessary specialist departments, except for a psychiatric one. It was the largest and best treatment facility in Grodno, with twice as many places as any civilian hospital, and the only one in the town offering departments of ophthalmology, laryngology and neurology. Its impressive development was certainly due to the work of the excellent medical staff, who were mostly physicians who had gained significant experience during World War I and the war with Russia in 1920, and demonstrated extensive professional skills. The relatively well-organized postgraduate education system in the Polish Armed Forces enabled physicians from Grodno to continue to develop their professional qualifications, which contributed to the respect and recognition they cherished in the entire region. This allowed them to become a core team of specialists for other treatment facilities in the town, helping to improve the health of the Grodno population. The main therapeutic problems the physicians from the Grodno facility faced were largely associated with the region's geographical location. The Eastern Borderlands, an area adjacent to Russia, was at constant risk of dangerous infectious diseases. It is worth emphasizing that, during the most significant epidemics of typhus in 1919-1920, many physicians from the regional Hospital in Grodno died while fighting the disease. The activities of the military hospital, contrary to the civilian facilities, were of a much larger scope. Apart from inpatient and outpatient treatment, it was responsible for mobilization support, training, case law and care for disabled soldiers.

The functioning of the branch hospital in Druskieniki was an interesting element in the history of the facility. It operated from 1926, constantly increasing the number of places, and enjoying great popularity among patients from all over Poland. This was certainly due to the effective organization and great engagement of the staff of the 3rd Regional Hospital, who helped to develop the branch, situated in Marshall Józef Piłsudski's favorite spa location.

The assessment of the functioning and organization of the 3rd Regional Hospital in Grodno leads to the conclusion that the hospital staff performed very difficult work. They created from the beginnings a recognized hospital, raising it from the post-war ruins, and making it the largest and best equipped medical facility in the town and in the region. Operating in one of the most underdeveloped regions of Poland, impeded by years of exploitive policy by the partitioner country, they created a medical facility equal to other units of its type in Poland. The attitude of the military physicians from Grodno during the last war deserves utmost appreciation, from a professional, moral and patriotic point of view. Over 50 employees of the hospital or reservists allocated there lost their lives. Six former commandants of the facility, and the majority of the management staff did not live to see the end of the war. It is worth noting that the 3rd Regional Hospital in Grodno was located in one of the most beautiful buildings available to the military health service, with a most interesting history. The hospital grounds witnessed the deaths of monarchs as well as times of glory and defeat, fame and betrayal. The interwar period, when the hospital was operating there, can certainly be viewed as some of the brightest years in the history of the New Castle.

The New Castle, burnt down in 1944 and rebuilt in the social realist style, now hosts a Belarusian museum, without any notice of the achievements of the 3rd Regional Hospital and the Polish military physicians. Unfortunately, the promise made by Gen. Władysław Sikorski in 1941 to grant Grodno the title: "Always Faithful", and the Virtuti Militari Cross was not fulfilled. In our hearts, this town of Bathory has those honorable distinctions, and they were partially earned by the military hospital team.

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Lt. Col. Karol Rumeld (1899-1979), in memory of the first commandant. Celebrating the 70th anniversary of the 105th Military Hospital and Outpatient Clinic

Ppłk dr Karol Rumeld (1899-1979) - pamięci pierwszego komendanta w 70. rocznicę powstania 105. Szpitala Wojskowego z Przychodnią w Żarach

Zbigniew Kopociński, Krzysztof Kopociński, Czesław Jeśman

Department of the History of Science and History of Military Medicine of the Medical University in Łódź. Head: Prof. Czesław Jeśman MD, PhD

Abstract. The article presents the life of a Polish medical officer who took part in the war against Russia in 1920 and World War II. During the German occupation he was the deputy head of the Health Service of Armia Ludowa (the People's Army). In October 1944, Lt. Karol Rumeld become the commandant of the 8th Mobile Field Surgical Hospital of the 2nd Polish Army. This was formed in 1944 in Kock and followed the trail of combat from Kock to Ruszów. In 1946, the hospital arrived in Żary, where it remains to this day. Karol Rumeld worked as a physician until the end of his life. He is a guiding light for all army physicians.
Key words: army physician, military hospital, Rumeld, Żary

Streszczenie. W artykule przedstawiono sylwetkę polskiego lekarza wojskowego, który brat udział w wojnie z Rosją w 1920 roku iw II wojnie światowej. Podczas niemieckiej okupacji byt zastępcą szefa służby zdrowia Armii Ludowej. W październiku 1944 roku por. Karol Rumeld został komendantem 8. Polowego Ruchomego Szpitala Chirurgicznego w składzie II Armii Wojska Polskiego. Szpital powstał w 1944 roku w Kocku i przeszedł cały szlak bojowy od Kocka do Ruszowa. W 1946 roku przybył do miasta Żary, gdzie stacjonuje do dzisiaj. Karol Rumeld pracował jako lekarz do końca swego życia. Jest wzorem do naśladowania dla wszystkich lekarzy wojskowych.
Słowa kluczowe: szpital wojskowy, lekarz wojskowy. Żary, Rumeld

Delivered: 6/10/2014
Accepted for print: 18/12/2014
No conflicts of interest were declared.
Mil. Phys., 2015; 93 (1): 135-138

Corresponding author:
Zbigniew Kopociński MD, PhD
105th Kresy Military Hospital with Public Outpatient Clinic,
Subdepartment of Ophthalmology
2 Domańskiego St., 68-200 Żary
telephone: +48 68 470 78 62
e-mail: zkopocinski@wp.pl

The 70th anniversary of the 105th Military Hospital and Outpatient Clinic in Żary was celebrated in October 2014. It is noteworthy that this modern facility is simultaneously a veteran of the Second World War; as the 8th Mobile Field Surgical Hospital (8. PRSzCh) it accompanied the soldiers of the 2nd Polish Army (II AWP) on the combat trail, and passed its war exam during exceptionally bloody combat as part of the crossing of the Nysa Łużycka River in April 1945. The facility was moved to its permanent location in Żary in May 1946, and there for more than 68 years it has provided diagnostic and treatment services for the population of the Lubuskie region, particularly for the soldiers of the famous King Jan III Sobieski 11th "Lubuska" Armoured Cavalry Division.

Karol Rumeld, the first commandant and founder of the 8th Mobile Field Surgical Hospital, which would later form the basis for the future 105th Military

Figure 1. Karol Rumeld (1899-1979) (with permission of M. Rumeld)

Rycina 1. Dr Karol Rumeld (1899–1979) (za zgodą M. Rumelda)

Hospital in Żary, was born on 8 April 1899 in the Lasek district of Nowy Targ, to a family of Jewish intelligentsia (teachers). His parents, Herman and Antonina nee Herzman, had four children: three sons (including twins) and a daughter. Initially, they lived in Tarnów, where in 1905-1909 Karol attended a common school. Next, they moved to Kraków, where the future commandant attended the St. Anne Grammar School (1909-1917). When the October Revolution broke out, he began studies at the Faculty of Medicine of the Jagiellonian University in Kraków. After the outbreak of the First World War, his father, Herman, was called up for military service in the Imperial-Royal Army.

As a result of the Great War, those countries previously conquered by the fighting powers of Russia, Prussia and the Austro-Hungarian Empire, could return to the map of Europe. It was a great opportunity for Poland and, due to the immense sacrifice of thousands of Polish citizens and soldiers, it was not wasted.

At the time his homeland was being rebuilt following 123 years of foreign rule, so Karol Rumeld stopped his studies and, like thousands of other young patriots, he joined the Polish Army. Already on the verge of independence, a great danger hovered over the Polish state, namely the Bolshevik invasion of 1920. At that time, the future hospital commandant served as a junior physician / officer cadet in District Hospital no. 5 and the POW Camp in Badów. It should be noted that Russian prisoners of war were decimated by epidemics of dangerous infectious diseases (typhoid, dysentery, smallpox etc.), which also posed a real danger for the Polish personnel; however, it did not prevent them from providing necessary medical assistance.

During the Battle of Warsaw, Cadet Karol Rumeld served in the 4th Guard Battalion in Warsaw [2, 3]. After the war he was demobilized and returned to his alma mater to complete his studies. Rumeld received a PhD in medical sciences in 1925, and started work in the civil health service. He participated in several exercises of the military reserve and in 1925 was promoted to the rank of second lieutenant. In 1932, he was promoted again, to that of lieutenant. Documents surviving from that time indicate that he held leftist views with a tendency for communism, which was then quite popular in intelligentsia circles, especially among Jews. It did not affect in any way the patriotism of Lt. Rumeld, who was mobilized in 1939 in the position of junior head surgeon in Field Hospital no. 252, organized by the Reserve Staff of the 2nd District Hospital. With great engagement and sacrifice he helped injured Polish soldiers, while participating for the second time in military actions.

After the defeat of the September campaign in 1939, he managed to avoid imprisonment and started work in the Maternity Hospital in Stary Sambor. At the risk of arrest, in 1942 he moved to Warsaw, where he actively engaged in left-wing conspiracy, and became a Deputy Chief of the Sanitary Division of the People's Guard, later the People's Army (Polish Gwardia Ludowa, later Armia Ludowa). His nom-de-guerre at that time was "Dr. Kazimierz". When the Warsaw Uprising began, he was outside the capital, which prevented him from sharing the fate of the entire People's Army staff and death from the bombs of German Stukas. On 14 August 1944, Rumeld joined the Polish Armed Forces as a volunteer, initially as a gynecologist in the newly formed Sanitary Headquarters of the 2nd Polish Army in Lublin.

By the Order of the Commander-in-Chief of Polish Armed Forces no. 8 of 20 August 1944, thirteen field hospitals were established in the Czemierniki-Kock-Siedlce region, including the 8th Mobile Field Surgical Hospital. In mid-October 1944, Lt. Karol Rumeld MD, departed with four physicians, four nurses and ten paramedics to a new location, thus establishing the 8th Mobile Field Surgical Hospital, and the history of the present 105th Military Hospital and Outpatient Clinic in Żary. The place where everything started, the Jabłonowski Palace in Kock, is very symbolic; this is where the surrender was signed by Brig. Gen. Franciszek Kleeberg, Commanding Officer of the "Polesie" Independent Operational Unit, the last

Figure 2. Michał Rumeld against the background of the commemoration plaque in honor of all hospital commandants, including Karol Rumeld, 105th Military Hospital and Outpatient Clinic in Żary, Żary, 9 May 2014
Rycina 2. Dr Michał Rumeld na tle tablicy pamiątkowej ku czci wszystkich komendantów szpitala, w tym dr. Karola Rumelda, 105. Szpital Wojskowy z Przychodnią w Żarach, Żary, 9 maja 2014 roku

Figure 3. Commemoration plaque with an inscription in honor of all hospital commandants, 105th Military Hospital and Outpatient Clinic in Żary, Żary, 9 May 2014
Rycina 3. Tablica pamiątkowa z inskrypcją ku czci wszystkich komendantów szpitala, 105. Szpital Wojskowy z Przychodnią w Żarach, Żary, 9 maja 2014 roku

organized unit of the Polish Army fighting the Germans and Soviets, until 5 October 1939. It was right here that, some five years later, one of the best field hospitals of the entire 2nd Polish Army was established. It is, then, safe to assume that the spirit of the virtuous general aided Karol Rumeld PhD and his colleagues. For a soldier who remembered the defeat of the September campaign, the symbolism of this experience was truly uplifting: the fallen and enslaved homeland was being reborn, like a phoenix from its ashes.

Half of the Jabłonowski property was taken over by the 8th Mobile Field Surgical Hospital, while the other half contained the 21st Mobile Field Internal Medicine Hospital, commanded by Lt. Witold Świątnicki MD. A field surgical hospital is a facility with 100 beds, two departments and the following at its disposal: pharmacy, X-ray apparatus, specialist equipment and accommodation facilities, as well as its own kitchen. The first order of the day for the 8th Mobile Field Surgical Hospital (field post office no. 56881) was issued on 31 October 1944, and began the process of creating the structures of the unit, enrolling new soldiers and coordinating the entire team. At that time there were few casualties being treated at the hospital, only patients with diseases and primarily involving appendicitis or hernias. In the second half of December 1944, thanks to the immense engagement of the entire personnel, the hospital became a fully organized military medical support unit. On 22 December 1944, Lt. Karol Rumeld MD, by the Order of the Commander-in-Chief of Polish Armed Forces no. 98 was promoted to the rank of major, which certainly proved the superiors' appreciation for the organizational efficacy of the commandant of the 8th Mobile Field Surgical Hospital.

On 14 January 1945, the hospital left the comfort of the Jabłonowski Palace in Kock and moved to the mansion in Leszczyny in the district of Garwolin, where it set up camp under canvas. Subsequently, by

Order of the Day no. 15 of 18 January 1945, it transferred all the remaining patients to the 12th Mobile Field Surgical Hospital before departing for a new location – the town of Koło upon the Warta River. The unit positioned itself in the neighborhood of some multi-family residential buildings and, just as it had in Kock, it shared the premises with its partner, the 21st Mobile Field Internal Medicine Hospital. During the month spent in Koło, the hospital was held in a state of constant readiness, concurrently filling staff shortages and providing training to encourage a cooperative spirit among the personnel. No injured soldiers arrived at that time, although a few German patients were treated, which reflected well on the moral condition of the physicians and nurses, some of whom having lost their loved ones during mass murders organized by the German nation (including the Holocaust).

Certainly this was largely due to the hospital commandant, Maj. Karol Rumeld MD, whose family had also suffered from Nazi persecution; however, a proper education and upbringing ensured that he took care of his humanistic values, resisting blind vengefulness and guiding his subordinates in this direction.

While the 8th Mobile Field Surgical Hospital was stationed in Koło, Maj. K. Rumeld MD, on 15 February 1945 delegated command over the hospital to Lt. Col. Andrzej Szkwara [1, 2, 4, 5]. Over the next few years, Karol Rumeld PhD was the Head of Healthcare of the 4th Military District Command, and then in 1948 he was transferred to the reserve with the rank of lieutenant colonel. After leaving the army, he worked as a physician in civil healthcare facilities, and in 1953 was recognized as a degree two specialist in gynecology and obstetrics. Rumeld returned to Warsaw, a city he knew from the time of occupation, and for many years was the head of Municipal Hospital no. 8. He remained professionally active for the rest of his life. Apart from his work, he loved travelling, and at over 80 years old, he travelled across the Sahara. In recognition of his achievements, he was awarded the Commander's Cross of the Order of Polonia Restituta, the Silver and Bronze Cross of Merit, the 3rd Class Cross of Grunwald, the Partisan Cross, the Medal of the 10th Anniversary of the People's Poland and Gold Decoration of Honor for work for the city of Warsaw.

Lt. Col. ret. Karol Rumeld PhD passed away on 11 July 1979, and was buried in the Powązki Military Cemetery, in the C35/7/2 quarter [2, 6].

Following the initiative of the authors of this article, on 9 May 2014, on the northern wall of the Polyclinic of the 105th Military Hospital and Outpatient Clinic, Independent Public Healthcare Institution in Żary, a commemorative plaque was presented to honor all commanding officers of this facility since 1944. The plaque was designed by Zbigniew Kopociński. Under the inscription "Exegi monumentum aere perennius", the first name mentioned is Karol Rumeld PhD, the founder and first commanding officer of the 8th Mobile Field Surgical Hospital, the forerunner of today's military hospital in Żary. The celebration was honored by the presence of Michał Rumeld PhD, son of the former commandant, who continues the family tradition, as an anesthesiologist. His father, Lt. Col. Karol Rumeld, despite having experienced two tragic wars, occupation and the Holocaust, never lost his vocation for medicine, and almost until his last days helped patients and alleviated their suffering. In an era of few authorities, he is doubtlessly a model to follow for young disciples of medicine.

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