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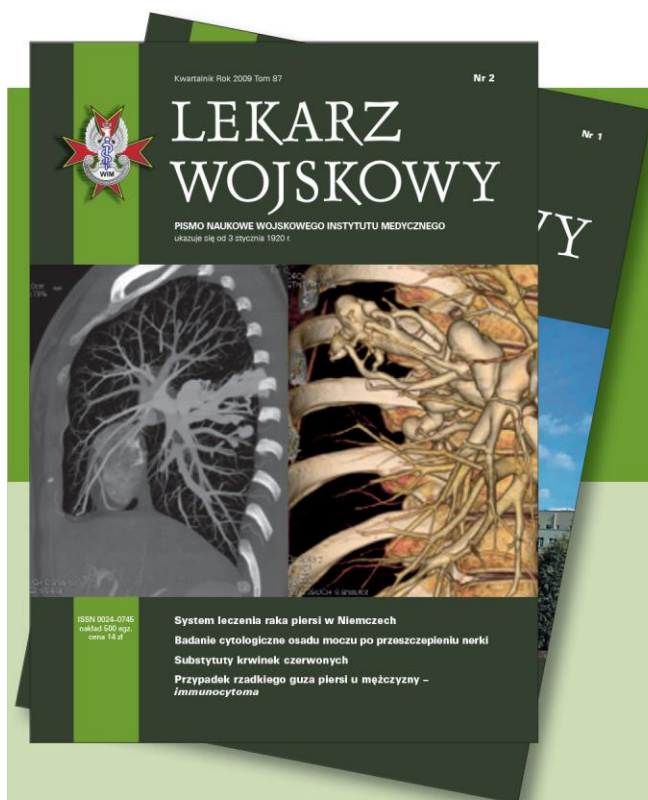
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War and traumatic stress as factors affecting aggressive behavior in combat veterans

Wojna i stres traumatyczny jako czynniki kształtujące zachowania agresywne u weteranów misji wojennych

Sylwia Szymańska, Agnieszka Czechowska, Radosław Tworus

Department of Psychiatry, Combat Stress and Psychotraumatology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Radosław Tworus MD, PhD

Abstract. The paper reviews the psychological mechanisms behind the symptomatology of PTSD. It also refers to the overview of recent research into the aggressive behavior and violence of veterans after their return from war. Studies show that the risk factors for aggressive behavior and violence are: young age, high level of combat exposure, flashbacks and substance abuse.

Keywords: PTSD, aggression, violence, veteran, family

Streszczenie. W artykule dokonano analizy mechanizmów psychologicznych stojących za symptomatologią PTSD. Odnosi się on również do przeglądu najnowszych badań dotyczących zachowań agresywnych i przemocy stosowanej przez weteranów po powrocie z wojny. Przegląd badań wskazuje na to, że do czynników ryzyka zachowań agresywnych i przemocy u weteranów należą: młody wiek, wysoki poziom ekspozycji bojowej, objawy *flashbacków* oraz nadużywanie substancji psychoaktywnych.

Słowa kluczowe: PTSD, agresja, przemoc, weteran, rodzina

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Corresponding author

Sylwia Szymańska MSc

Department of Psychiatry, Combat Stress and Psychotraumatology,

Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine

128 Szaserów St., 04-141 Warsaw 44

telephone/fax: +48261 817536

e-mail: sszymanska@wim.mil.pl

Introduction

Nowadays, research into the mental health of military combat veterans is primarily associated with post-traumatic stress disorder (PTSD). However, in the literature there have been reports regarding aggressive behaviors in veterans associated with their combat experience during missions in Iraq and Afghanistan [1, 8]. It appears that anger and aggression are the most frequently reported problems after their return from serving in combat operations [4, 18, 22]. Studies on British military personnel serving in Afghanistan and Iraq demonstrated that one of the consequences of exposure to burdensome combat experience is the increased risk of committing brutal crimes [16].

Long-term experience in clinical work with veterans of combat operations hospitalized at the Department of

Psychiatry, Combat Stress and Psychotraumatology (KPSBiP) of the Military Institute of Medicine in Warsaw demonstrated that symptoms of increased arousal (criterion D) according to the ICD-10 Classification of Mental and Behavioral Disorders [10] regarding post-traumatic stress disorder are the main reason veterans decide to seek psychiatric hospitalization. The decision often follows drastic aggressive behavior presented by the veteran towards family members or strangers as a result of PTSD symptomatology exacerbated since the return from serving in combat operations. Clinical observation following the therapy of veterans hospitalized at KPSBiP show an increasing number of veterans subject to criminal proceedings due to aggressive behavior and violence. Ten years ago, when KPSBiP began its therapeutic activity, none of the 15

hospitalized veterans was subject to criminal proceedings at any time during the treatment. Today, approximately 5 out every 15 hospitalized patients are or have been subject to criminal proceedings. Even more alarming is the tendency in physicians and psychologists professionally engaged in the mental well-being of veterans to interpret every sign of aggressive behavior as a symptom of post-traumatic stress disorder, whereas it seems that misdiagnosis of PTSD at the beginning of the patient's treatment is only a justification for further aggressive behavior or violence.

The same applies to alcohol and/or psychoactive substance abuse, and in this case it is tempting to justify alcohol abuse by the time served on combat operations. It appears that among the veterans and their commanding officers there is also tacit permission for aggressive behavior resulting from anger, as well as for alcohol consumption. "I was in combat, so I have the right to beat and drink". In the case of combat-derived PTSD, the essential question is which symptoms are due to PTSD, and when is aggressive behavior caused by other mental disorders. Which of the aggressive behaviors should be considered a symptom of PTSD, and which are, for example, signs of the veteran's previously disturbed personality structure?

Aim of the study

The aim of the study is to identify which psychological mechanisms behind the PTSD symptomatology affect aggressive behavior in veterans of combat operations, and what causes a veteran to offer violence towards another person. The article is intended to aid clinicians in diagnosing the risk factors for aggressive behavior in veterans diagnosed with PTSD.

Material and methods

The literature was reviewed from the years 2000-2015 regarding PTSD symptoms and associated aggressive behavior in combat veterans. There are several symptoms of PTSD that may be of importance in relation to aggressive behavior and violence in veterans. Firstly, symptoms resulting from persistent remembering or re-experiencing of a traumatic event (criterion B) in the form of flashbacks, vivid recollections or recurring dreams [10] that may be associated with aggression. Note: due to the common use of the term "flashback" by psychiatrists, clinical psychologists and psychotherapists, this term will be used in the paper also in the Polish version, following the above definition of the symptom. Numerous symptoms in the symptomatic cluster are of a dissociative nature, and result in the veteran's loss of contact with reality. Due to this dissociation, while re-

experiencing the traumatic event the veteran may act aggressively. Case reports supporting this theory can be found in the subject literature [5].

Symptoms associated with re-experiencing a traumatic event (group B of symptoms) have been considered to positively correlate with aggressive impulses or behavior in veterans of combat operations [7, 10, 17]. Flashback, a specific dissociative symptom, is often associated with violence. When a veteran is persistently haunted by traumatic recollections, often despite his will, he "experiences or acts as if he was re-experiencing the traumatic event(s) (the reactions described exacerbate in continuum, and their extreme form is a complete loss of a sense of reality)" [11].

Traumatic dissociation and flashbacks are two of the most important features of PTSD, and they often occur together. Traumatic flashbacks cannot occur without some form of traumatic dissociation, although dissociation may occur even without flashbacks [19]. Vivid traumatic recollections almost always contain some emotional and sensory aspects related to a given event. They are recalled with such realism and intensity that the veteran finds it hard to differentiate them from reality. In flashbacks, the trauma seems to persist or recur. In the dissociative state the veteran may not be aware of his or her actions, or experience difficulties controlling them [9]. In the United States, in many court cases regarding violence in veterans and alleged PTSD diagnosis, attorneys refer to traumatic dissociation and resulting flashbacks as a legal line of defense.

Secondly, the avoidant symptoms, from the second cluster of post-traumatic stress disorder symptoms (symptoms in group C) [10], when the veteran avoids any circumstances that might remind them about the traumatic event, may also contribute to aggression. McFall et al. [15] demonstrated in their study that avoidant symptoms constitute a strong predictor of violence. According to the researchers, avoidant symptoms are nearly as strong a predictor as the symptoms in the last cluster of increased arousal (symptoms in group D) [10], including the symptoms of increased irritability and outbursts of anger. Experience in therapeutic work with veterans suffering from PTSD demonstrates that avoidant symptoms result in a high level of stress in close relationships, which may increase the probability of a conflict. Suffering veterans rarely share the story of their traumatic experiences with their close ones, and persistent attempts to learn the truth by their life partners often lead to conflict. Escape, avoidance and distancing in veterans are positively correlated with aggression and hostility [14].

Thirdly, the earlier mentioned symptoms of arousal from the last cluster of PTSD symptoms (group D) [10] may also be associated with violence. Buckley and

Kalupek [2] showed that veterans with PTSD have higher blood pressure (RR) than individuals who also experienced trauma, but who are not diagnosed with PTSD, as well as individuals who have not had a traumatic experience. Trauma victims who are normally psychologically aroused will experience anger and aggression more intensely [23]. Lorber and O'Leary arrived at interesting conclusions in the context of the correlation between increased psychological sensitivity and arousal in veterans and aggression [13]. The researchers demonstrated that increased electrodermal conductivity of the skin positively correlated with aggression and higher blood pressure, forming a reliable predictor of aggression.

Hypervigilance, a symptom in the last cluster of PTSD symptoms (group D), may also be linked to violence. Hypervigilance may in some cases take the form of paranoid thoughts and actions, although not yet meeting the typical criteria of paranoid delusions. The constant sense of fear and uncertainty that often accompanies veterans after their return from war, as well as seeking ways around various threats and traps, may increase the probability of committing acts of violence by the veteran. This can be illustrated by the story of a veteran hospitalized in KPSBiP, who broke the nose of a random driver having dragged him out of the car through the window. He did this only because he thought the driver was following him in a strange and suspicious way. Perceiving danger is generally related to violence, and is considered to be another of its predictors [3].

Researchers are also examining the relationship between exposure to combat operations, resulting in symptoms of post-traumatic stress disorder, and aggression or the moderating effects of the feature of anger [1, 8, 23]. It seems crucial to differentiate between a feature of anger and that of a state of anger. One feature of anger is a tendency to become angry in stressful situations, whereas the state of anger is anger experienced at a given moment. Therefore, a person with high-level feature of anger becomes angry and acts aggressively in stressful situations, contrary to people with a low-level feature of anger, who do not react with anger in stressful situations. In this case, stressful combat field experience may be a stressor which recalls anger and aggression, probably mostly in soldiers who report a high-level feature of anger. It appears that veterans with a high-level feature of anger have difficulties with anger mentalization. They find it problematic to determine what made them angry and, as a result, anger becomes for them an impulse for destructive behavior. According to research, aggression is more frequently reported by soldiers whose preliminary PTSD tests were positive, and who demonstrated higher levels of the feature of anger,

whereas it is not reported by the veterans who admitted PTSD symptoms, but presented lower levels of the feature of anger [23]. Aggression appears to pose a problem and to be associated with exposure to combat operations only in those veterans who are likely to be suffering from PTSD with a higher level of the feature of anger. It is very difficult to treat or provide psychotherapeutic treatment of post-traumatic stress disorders to the group of veterans meeting those criteria. Researchers discovered that those veterans whose feature of anger levels were higher also demonstrated less improvement in PTSD symptomatology after the end of cognitive processing therapy (CPT) in comparison to those veterans whose level of anger was found to be lower [20].

A study by Sullivan and Elborn also had interesting conclusions [21]. They studied the relationship between PTSD symptoms and all types of aggressive behavior in veterans of the wars in Iraq and Afghanistan in a study group of over 3,000 soldiers. It appeared that symptoms of "flashes" of vivid traumatic memories and anger were the only PTSD symptoms predicting a higher probability of violence. The study also revealed an absence of significant results regarding avoidant symptoms and aggression, which is inconsistent with the previously discussed study results. According to the researchers, anger and hypervigilance indicated a higher probability of aggression and serious aggression towards family members. The results also indicated that the young age of a veteran and high percentage of combat events positively correlated with all types of violence. Abuse of psychoactive substances also increased the probability of violence towards strangers, but not necessarily towards family and friends. Often veterans who experience flashbacks may treat the use of psychoactive substances as a way of dealing with the fears, but this only intensifies the vicious circle of symptoms. A history of arrests of veterans positively correlated with aggression towards strangers and serious aggression towards strangers. Female veterans were more inclined to engage in domestic violence, whereas male veterans more frequently engaged in violence towards strangers. This appears to result from the fact that men and women are taught different social strategies for coping with stress. Men can use more instrumental behaviors, which enables them to initiate contacts with strangers more easily than women, hence increasing the probability of violence in men. Aggression towards strangers in women may result in social ostracism, exclusion and judgement, which may be why women restrain their aggressive behavior towards strangers.

Discussion

Not every involvement in a traumatic event results in PTSD symptoms in a veteran, just as not every case of aggressive behavior or violence in a veteran proves their presence. The information presented here seems to be important from the point of view of the clinical differentiation of aggressive behavior and violence in veterans as resulting from post-traumatic stress disorder and from other mental disorders, such as abnormal personality structure. Correct PTSD diagnosis may prevent the development of further aggressive behavior and support its therapy. It is important to consider the possibility of iatrogenic factors in the case of misdiagnosed PTSD in a veteran. Aggression with increased impulsiveness and irritability in a veteran are never isolated symptoms providing evidence for PTSD. Well-diagnosed PTSD must meet all the diagnostic criteria of this mental disorder. It is important to treat PTSD before and not after the occurrence of aggression prohibited by law. Even if a veteran suffering from PTSD presents aggressive behavior and violence, these should not be justified by participation in combat operations.

Previously, the majority of the studies referring to the fact of aggression or violence in veterans were limited to demonstrating a group of victims having aggressive behavior. They did not present the aspects of PTSD that could lead to violence. An analysis of the psychological mechanisms behind the PTSD symptoms helps clinicians to obtain information about the symptoms that need to be addressed to reduce the risk of violence.

Conclusions

Among all the PTSD symptoms, the strongest predictors of aggressive behavior and violence in veterans include:

- Traumatic dissociation and sudden flashbacks.
- A high degree of combat exposure together with high-level feature of anger.
- Risk factors of aggressive behavior, including the young age of a veteran, a high level of combat exposure, abuse of psychoactive substances, the occurrence of flashbacks and symptoms of anger outbursts.

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Specificity of the health behaviors and health-related quality of life in professional soldiers suffering from hypertension

Specyfika zachowań zdrowotnych i jakości życia uwarunkowanej stanem zdrowia u żołnierzy zawodowych z nadciśnieniem tętniczym

Urszula Ziętalewicz, Katarzyna Piotrowicz, Paweł Krześciński, Adam Stańczyk, Grzegorz Gielerak

Department of Cardiology and Internal Diseases, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine, Warsaw, Poland; head: Assoc. Prof. Andrzej Skrobowski MD, PhD

Abstract. Treatment of hypertension (HT) includes a reduction in mortality and complications as well as an improvement in the patients' quality of life. The aim of the study was to determine the specifics of functioning of professional soldiers suffering from HT in terms of health behaviors and assessment of health-related quality of life. A group of 144 patients suffering from HT underwent an initial clinical evaluation, from which a group of professional soldiers (33 males) were selected, along with a control group of civilian employees (33 males). For the evaluation of health behaviors and to assess the health-related quality of life, the Health Behavior Inventory and Quality of Life Assessment Test were used respectively. The Professional soldiers more often evinced proper dietary patterns and preventive health behaviors, assessed their physical functioning higher and felt less pain. No difference was revealed in respect of selected cardiovascular risk factors. Although the professional soldiers suffering from HT had better dietary patterns and preventive health behaviors, assessed their physical functioning higher and felt less pain, these factors did not reduce the cardiometabolic risk.

Key words: hypertension, health behaviors, health-related quality of life, professional soldiers

Streszczenie. Wstęp. Leczenie nadciśnienia tętniczego (NT) obejmuje redukcję śmiertelności i powikłań oraz poprawę jakości życia pacjentów. Celem badania było ustalenie specyfiki funkcjonowania żołnierzy zawodowych z NT w zakresie stosowanych zachowań zdrowotnych oraz w zakresie oceny jakości życia uwarunkowanej stanem zdrowia. Materiał i metody. Ocena wstępną objęto 144 osoby z NT, spośród których wyłoniono grupę żołnierzy zawodowych (33 mężczyzn) oraz grupę kontrolną pracowników cywilnych (33 mężczyzn). Do oceny zachowań zdrowotnych użyto Inwentarza Zachowań Zdrowotnych, a do oceny jakości życia uwarunkowanej stanem zdrowia - Testu Oceny Jakości Życia. Wyniki. W porównaniu z grupą kontrolną żołnierze zawodowi częściej przejawiali prawidłowe nawyki żywieniowe, częściej stosowali zachowania profilaktyczne, lepiej oceniali swoje funkcjonowanie fizyczne i odczuwali mniejsze nasilenie bólu. Między grupami nie stwierdzono różnic w zakresie wybranych czynników ryzyka sercowo-naczyniowego. Wnioski. Żołnierze zawodowi z NT ujawniają korzystniejsze nawyki żywieniowe i zachowania profilaktyczne, nie znajduje to jednak odzwierciedlenia w redukcji ryzyka kardiometabolicznego.

Słowa kluczowe: nadciśnienie tętnicze, zachowania zdrowotne, jakość życia uwarunkowana stanem zdrowia, żołnierze zawodowi

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Corresponding author

Katarzyna Piotrowicz MD, PhD

Department of Cardiology and Internal Diseases, Military Institute of Medicine

128 Szaserów St., 04-141 Warsaw

telephone: +48 22 261 816 389

e-mail: kpiotrowicz@wim.mil.pl

Introduction

The aim of treating chronic diseases, such as arterial hypertension (HT), is not only to reduce mortality but also to improve the quality of life for the individuals concerned. Therefore, the therapy of chronic diseases

should consider qualitative factors, such as the emotions experienced by the patients and their well-being, as well as self-evaluation of the condition of their health. These factors play an important role in the patient's compliance during long-term treatment [1].

Hypotensive therapy consists of the modification of lifestyle and pharmacotherapy; therefore, it is important for the purpose of treatment optimization to understand the health-related actions of HT patients, i.e. all their characteristics such as beliefs, expectations, motivations, values, personal characteristics, general behavioral patterns, actions and habits associated with the preservation, restoration or improvement of health [2]. The specificity of health-related behaviors in professional soldiers has not yet been determined, although they may be expected to differ from the health-related behaviors of other professional groups.

The aim of the study was to determine whether professional soldiers suffering from hypertension differ from other patients in terms of their health-related behaviors and health-related quality of life.

Material and methods

Study population

The study involved 144 patients with HT defined as increased values of arterial hypertension for at least 3 months. The exclusion criteria were as follows:

- confirmed secondary HT,
- chronic renal failure (GFR <60 ml/min/1.73 m² according to the MDRD formula),
- other serious comorbidities: systolic HF, cardiomyopathy, significant arrhythmias, significant valvular disease, chronic obstructive pulmonary disease (COPD), previously diagnosed diabetes, polyneuropathy, and peripheral vascular disease,
- age < 18 years and > 75 years,
- body mass index (BMI) > 40 kg/m²,
- mental diseases that prevent a full cooperation with the patient,
- cardiac rhythm other than sinus rhythm (including permanent cardiac pacing).

Out of the 144 initial study subjects, a group of professional soldiers (33 males) and a group of civilians of similar age (33 males) were selected.

Clinical study

The clinical study was conducted following current guidelines on hypertension management [3], with a particular focus on the medical history concerning cardiovascular risk factors (e.g. family history of cardiovascular disease, smoking) and the assessment of the body constitution (BMI). Metabolic syndrome (MS) was defined according to current IDF guidelines [4].

Quality of life assessment test

A quality of life assessment questionnaire (SF-36) [5] as adapted by Tylka and Piotrowicz [6] was used to assess the quality of life of the patients. It consisted of 11 questions, and enabled evaluation of the quality of life in the following dimensions: physical functioning, limitations in performing roles due to physical health, pain, general perception of one's health, vitality, social functioning, limitations in performing roles due to emotional problems and perception of one's mental health. Higher total results in different scales indicates lower quality of life in a given dimension [7].

Health Behavior Inventory HBI

To assess health behaviors, the Health Behavior Inventory was used (HBI) [8]. It comprised 24 statements constituting four scales describing the health-related behavior of people: nutritional habits, prophylactic behavior, positive mental attitude and health habits. The sum of all the responses provided a general score, and for each scale an arithmetic mean was calculated. The higher the score, the more often the patient demonstrated a health behavior.

The study protocol was approved by the Bioethics Committee at the Military Institute of Medicine (Agreement No. 21/WIM/2011), and all participants gave their written informed consent to participate in the study. The project was registered at ClinicalTrials.gov (NCT01996085).

Statistical analysis

The statistical analysis was performed with the use of IBM SPSS Statistics 21 software. The results were expressed as mean ± standard deviation (SD) for quantitative variables, and numbers and percentages for qualitative variables. The distribution of variables was assessed using the Kolmogorov-Smirnov test. The T-Student Test and Mann-Whitney U Test were used to compare differences between the groups. The assumed statistical significance level was $p < 0.05$.

Results

The comparison of basic characteristics did not reveal any statistically significant differences between the group of soldiers and the control group, either in terms of blood pressure or in metabolic disorders (Tab. 1.).

Table 1. Basic characteristic of professional soldiers (n=33) and the control group (n=33), no significant differences among the two groups

Tabela 1. Charakterystyka podstawowa żołnierzy zawodowych (n=33) i grupy kontrolnej (n=33), brak istotnych statystycznie różnic międzygrupowych

	Professional soldiers mean \pm SD or n (%)	Control group mean \pm SD or n (%)
Age (years)	45.7 \pm 7.2	45.3 \pm 8.4
SBP (mmHg)	143.8 \pm 13.7	143.5 \pm 13.7
DBP (mmHg)	91.6 \pm 10.9	93.0 \pm 8.7
Previously treated HT	7 (21.2)	9 (27.3)
BMI (kg/m ²)	28.2 \pm 5.9	28.2 \pm 6.0
Fasting glucose (mg/dl)	101.4 \pm 11.3	99.4 \pm 13.6
Total cholesterol (mg/dl)	235.3 \pm 34.8	241.6 \pm 39.0
LDL cholesterol (mg/dl)	158.3 \pm 29.9	160.1 \pm 33.3
HDL cholesterol (mg/dl)	52.5 \pm 14.3	52.7 \pm 19.2
Triglycerides (mg/dl)	177.8 \pm 95.4	188.5 \pm 72.2
MS	21 (64)	25 (76)

BMI – body mass index, DBP – diastolic blood pressure, HDL – high density lipoproteins, LDL – low density proteins, M – mean, SBP – systolic blood pressure, SD – standard deviation, MS – metabolic syndrome

Table 2. Demographics of soldiers (n=33) and the control group (n=33)

Tabela 2. Charakterystyka demograficzna żołnierzy zawodowych (n=33) i grupy kontrolnej (n=33)

		Professional soldiers n	Control group n	P value
Marital status	in a relationship	19	6	<0.05
	single	14	27	
Education	higher	28	18	<0.05
	secondary	5	15	

Table 3. Health behaviors of professional soldiers and the control group (according to Health Behavior Inventory)

Tabela 3. Zachowania zdrowotne żołnierzy zawodowych i pracowników cywilnych (wg IZZ)

HBI scales	Professional soldiers mean \pm SD	Control group mean \pm SD	P value
Regular nutritional habits	3.31 \pm 0.62	2.91 \pm 0.70	<0.05
Prophylactic behavior	3.38 \pm 0.64	2.99 \pm 0.63	<0.05
Positive mental attitude	3.34 \pm 0.68	3.32 \pm 0.68	si
Health habits	3.11 \pm 0.51	2.93 \pm 0.67	si
Total HBI score	78.00 \pm 11.64	72.93 \pm 11.82	si

ns – statistically insignificant, SD – standard deviation

Table 4. Health-related quality of life for the professional soldiers and the control group

Tabela 4. Jakość życia uwarunkowana stanem zdrowia żołnierzy zawodowych i pracowników cywilnych

Quality of life dimension	Professional soldiers mean \pm SD	Control group mean \pm SD	P value
Physical functioning	0.33 \pm 0.35	0.83 \pm 0.75	<0.05
Limitations due to physical health	0.60 \pm 0.94	1.07 \pm 1.51	si
Social functioning	0.89 \pm 0.95	1.11 \pm 0.98	si
Pain	0.91 \pm 0.57	1.66 \pm 1.11	<0.05
General perception of one's health	2.03 \pm 0.63	1.87 \pm 0.48	si
Limitations due to emotional problems	1.05 \pm 1.74	0.83 \pm 1.24	si
Vitality	2.00 \pm 1.07	2.21 \pm 0.99	si
Well-being	1.56 \pm 0.74	1.77 \pm 0.75	si

ns – statistically insignificant, SD – standard deviation

It was observed that significant differences occurred in terms of education and marital status (Tab. 2.), with the professional soldiers being better educated and their relationships more often informal.

Compared to the control group, the professional soldiers more often demonstrated regular nutritional habits and prophylactic behavior (Tab. 3.).

The health-related quality of life in both groups was good in all dimensions (as evidenced by scores close to zero). In the detailed analysis, the professional soldiers were found to assess their physical functioning as better, and to experience less pain than the patients in the control group (Tab. 4.).

Discussion

Our study results demonstrated that professional soldiers stand out from the general population in terms of certain quality of life dimensions and health behaviors. While a positive trend was observed in this area, it was not reflected in blood pressure values or the scale of diagnosed metabolic disorders. Despite the better nutritional habits and higher prophylactic awareness, the frequency of MS in professional soldiers was similar to that found in civilians. This may indicate low effectiveness of the pro-health behavior or the role of other factors affecting the cardiovascular risk.

Non-pharmacological management in HT patients is often ineffective, which may be due to numerous factors. In our study, the professional soldiers assessed their nutritional habits more favorably than the control group patients, in terms of the type of food (e.g. fruit and vegetables, wholemeal bread), as well as prophylactic behavior. Differences in that respect may be partially due to the difference in education levels between each group. There is evidence that better educated individuals demonstrate less adverse health behavior [9] and lower risk of cardiovascular diseases [10, 11]. Moreover, a positive correlation between education and systolic pressure values was found in HT patients [12].

Health-related quality of life was better assessed by professional soldiers in "physical functioning" and "pain". The first dimension refers to the evaluation of one's own health (performing daily activities and activities associated with intensive physical effort), the second one refers to experiencing physical pain within the last month as well as experiencing pain which restricts daily functioning. Differences in physical functioning may result from the fact that professional soldiers are subject to regular fitness tests, which is an external factor supporting health behavior [13]. Higher resistance to pain might be a subjective trait specific for the professional group.

However, it should be emphasized that the declared level of health behavior demonstrated by professional soldiers was not satisfactory. It was consistent with the results of studies on health behavior in soldiers, which demonstrate that this professional group is distinguished by a high rate of obese and overweight individuals [14], as well as by more frequent tobacco smoking. The two factors are found to correlate [15].

Particularly worrying is the fact that better health behavior in professional soldiers was not associated with lower cardiometabolic risk. Despite the declared better nutritional habits, no differences were found between the groups in terms of blood pressure values or the indicators of the metabolism of carbohydrates and lipids. This may be due to exposure to adverse factors related

to military service, such as stress, mass catering and shift work [16].

The obtained results should also be analyzed in the context of the specific attitude for the military environment towards this type of study. Professional soldiers are subject to regular verification of their health status (fitness tests, medical boards), and its negative outcome may significantly affect the course of service. It is possible that in the tests used in our study the professional soldiers presented their health behavior and quality of life as better than they really are in reality.

It should also be noted that high evaluation of the quality of one's life does not always equal good adaptation to a disease. Trevisol et al. [17] posed a hypothesis that it may be a sign of limited awareness of the disease and the events that led to it. It may also be a result of a subconscious denial of the disease or dysfunction, typical for social groups with hierarchical structures idealizing the cult of strength and physical fitness. Therefore, the quality of life indicator deserves close examination in terms of actual patient compliance, taking medications and introducing lifestyle changes. Following non-pharmacological recommendations and taking medications may in itself be a duty affecting the patient's quality of life; there are observations available indicating that in individuals receiving medications the quality of life is lower than in untreated ones [17]. It is advisable to treat the quality of life assessment as a pretext to discuss the therapy, the difficulties associated with it and possible means of dealing with them.

Limitations

The greatest limitation of the study was the lack of measurement of the relationship between the declared and actual health behaviors. Such information would enable objectivization of the results, as well as identification of those areas which require changing and the planning of specific pro-health actions, as there are reports on discrepancies between knowing about HT and health habits [18]. Other disturbing factors also included differences in education and marital status, which might result in the differences in demonstrated health behavior. However, detailed analysis was limited by the small size of the study group.

Conclusions

Professional soldiers with hypertension demonstrated better health behavior in terms of nutritional habits and prophylactic behavior, as well as in the quality of life dimensions, such as physical functioning and experiencing pain. However, this was not reflected in reduced risk of cardiometabolic diseases, which may

indicate low effectiveness of pro-health behavior or the role of other factors affecting the cardiovascular risk. Prophylactic actions should take into account the specific health behavior and quality of life assessments in this group of patients.

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How quickly does wasp venom immunotherapy influence IL-10, IL-21, and TGF- β 1 cytokine synthesis?

Jak szybko immunoterapia jadem osy wpływa na syntezę cytokin IL- 10, IL- 21, TGF- β 1?

Aleksander Zakrzewski,¹ Jerzy Kruszewski,¹ Andrzej Chciałowski,² Krzysztof Kłos,¹ Agnieszka Rzeszotarska,³ Jolanta Korsak,³ Ewa Nowosielska,⁴ Aneta Cheda,⁴ Jolanta Wrembel-Wargocka,⁴ Marek K. Janiak⁴

¹ Department of Infectious Diseases and Allergology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Prof. Jerzy Kruszewski MD, PhD

² Deputy Head for Science of the Military Institute of Medicine in Warsaw

³ Clinical Transfusiology Unit, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Prof. Jolanta Korsak MD, PhD

⁴ Department of Radiobiology and Radiation Protection, Military Institute of Hygiene and Epidemiology in Warsaw; head: Prof. Marek K. Janiak MD, PhD⁴

Abstract. The literature describes the influence of VIT on the synthesis of numerous cytokines. However the time required between starting the vaccination and the occurrence of changes in cytokine synthesis is unknown, although it appears to be crucial in the process of immunotolerance production. The aim of our study was to assess serum concentrations of IL-10, IL-21 and TGF- β 1 at different stages of ultra-rush VIT. The study included 18 patients allergic to wasp venom with a history of systemic anaphylactic reaction after being stung. The study was limited to the ultra-rush VIT period. The immunoenzymatic method (ELISA) was used to assess concentrations of cytokines IL-10, IL-21 and TGF- β 1 at time 0 (before VIT) and 2.5 and 24 hours after VIT. No statistically significant differences were observed in serum concentrations of IL-21 and TGF- β 1 cytokines before and 2.5 and 24 hours after the ultra-rush VIT. However, a slight but statistically significant increase was found in the serum concentration of IL-10 between 2.5 and 24 h after the ultra-rush VIT. Furthermore, no significant differences were observed in IL-10 concentration before and after the ultra-rush VIT. During the ultra-rush VIT phase, there were no significant changes in the serum concentrations of IL-10, IL-21 and TGF- β 1.

Key words: interleukins, regulatory cells, venom immunotherapy (VIT)

Streszczenie. W piśmiennictwie opisano wpływ immunoterapii swoistej jadem owadów żądających (VIT) na syntezę wielu cytokin. Nie wiadomo jednak, jak szybko od rozpoczęcia podawania szczepionki dochodzi do zmian syntezy cytokin, które - jak się wydaje - mają kluczowe znaczenie w procesie wytwarzania tolerancji immunologicznej na alergen. Celem pracy była ocena surowiczych stężeń IL-10, IL-21 i TGF- β 1, w fazie wykonywania *ultra-rush* VIT. W badaniu uczestniczyło 18 pacjentów uczulonych na jad osy, którzy w przeszłości przebyli ogólnoustrojową reakcję anafilaktyczną po żądleniu. Badania ograniczono do okresu wykonywania fazy *ultra-rush* VIT. Stężenia interleukin IL-10, IL-21, TGF- β 1 w surowicach w czasie 0 (przed VIT) oraz po 2,5 i 24 godzinach od rozpoczęcia VIT oznaczano metodami immunoenzymatycznymi (ELISA). Nie wykazano istotnych statystycznie różnic w surowiczych stężeniach cytokin IL-21 i TGF- β 1 przed rozpoczęciem *ultra-rush* VIT oraz po 2,5 i 24 godzinach od rozpoczęcia. Stwierdzono niewielkie, ale istotne statystycznie, zwiększenie surowiczego stężenia IL-10 między 2,5 i 24 godziną wykonywania *ultra-rush*. Nie obserwowano istotnych różnic w stężeniu tej interleukiny przed rozpoczęciem *ultra-rush* VIT i po jej zakończeniu. W okresie wykonywania fazy *ultra-rush* VIT nie dochodzi do znaczących zmian w surowiczych stężeniach IL-10, IL-21 i TGF- β 1.

Słowa kluczowe: interleukiny, komórki regulatorowe, immunoterapia jadami owadów błonkoskrzydłych (VIT)

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Corresponding author

Aleksander Zakrzewski MD, PhD

Department of Infectious Diseases and Allergology,

Central Clinical Hospital of the Ministry of National

Defence, Military Institute of Medicine in Warsaw

128 Szaserów St., 04-141 Warsaw

telephone: +48 261 817 519, fax +48 261 818 544

e-mail: azakrzewski@wim.mil.pl

Introduction

The development of tolerance in the course of venom immunotherapy (VIT) is a complex process involving the activation of various mechanisms, including both T and B lymphocyte regulation as well as activation of the effector cells and effector organ. The literature describes the effect of VIT on the sub-population of regulatory T-cells and the synthesis of a number of cytokines, including IL-10 and TGF- β_1 in certain periods of time after the immunotherapy [1-7]. However, it is still unclear how long it takes from start of vaccination to changes occurring in cytokine synthesis, which seem to be crucial in the process of immunotolerance production.

Aim of the study

The aim of the study was to assess changes in the serum concentrations of IL-10, IL-21 and TGF- β_1 in the early VIT period, during the ultra-rush stage.

Material and methods

Study group

A total of 18 patients were qualified for the study (7 men aged 32 \pm 3 and 11 women aged 45 \pm 8), allergic to wasp venom, with a history of anaphylactic reactions and meeting the criteria qualifying for VIT. They were accepted to the study following an allergy diagnosis according to the criteria of the European Academy of Allergology and Clinical Immunology (EAACI) and submission of a written consent to take part in the study [8].

The ultra-rush VIT procedure was performed with the use of Venomenhal vespe vaccine (HAL Allergy B.V., Netherlands). A detailed scheme of the vaccination and the study design is presented in Table 1. Patients received 10 mg of oral cetirizine (Zyrtec, UCB Belgium) one day prior to and on the first day of treatment. Blood samples were taken before (0 h) and both 2.5 (2.5 h) and 24 (24 h) hours after the beginning of the ultra-rush VIT procedure.

Cytokines

Blood samples taken for TGF- β_1 , IL-10 and IL-21 testing were centrifuged at 4°C and 2600 rpm for 15 minutes. Serum samples were placed in dry test tubes and frozen at -80°C for TGF- β_1 testing and -25°C for IL-10 and IL-21 testing.

Table 1. Study design

Tabela 1. Schemat badania

blood sampling	↓				↓		↓
time (h)	0	0.5	1	1.5	2.5	3.5	24
concentration (µg/ml)	0.1	1	10	20	30	40	
administered dose (ml)	0.1	0.1	1	2	3	4	
total dose					61.1	101.1	

Cytokine concentrations were measured with the use of the immunoenzymatic ELISA method, Awareness Stat Fax 2200 (Awareness Technology Ltd, USA) shaker with incubating function, ETI-System DiaSorin (Diasorin S.p.A, Italy) washer for immunoenzymatic tests, and BioTek Elx 800 (BioTek Instruments, Inc., USA) reader. TGF- β_1 and IL-10 levels were determined with Quantikine Human Immunoassay kits (R&D Systems Inc., USA), whereas IL-21 level was determined with a Human IL-21 Platinum ELISA kit (eBioscience Inc., USA). Measurements were made according to the instructions supplied by the manufacturers. Concentrations were measured based on the standard curves characteristic for each kit:

- Quantikine R&D Systems kit: allowed the detection of the minimum amount of TGF- β_1 serum of 1.7-15.4 pg/ml (mean 4.61 pg/ml) and maximum of 2000 pg/ml, with variation inner-assay coefficient for low serum concentrations (<100 pg/ml) of <9.1%,
- Quantikine Human IL-10 Immunoassay R&D Systems kit: allowed the detection of the minimum amount of IL-10 serum of 3.9 pg/ml and maximum of 500 pg/ml, with variation inner-assay coefficient for low serum concentrations (<100 pg/ml) of <7.5%,
- sBioscience Human IL-21 Platinum ELISA kit: allowed the detection of the minimum amount of IL-21 serum of 20 pg/ml and maximum of 5000 pg/ml, with variation inner-assay coefficient for low serum concentrations (<100 pg/ml) of <7.7% on average.

Statistical methods

Statistical analysis was performed with the use of Statistica 10 software (StatSoft, Inc. USA). As the distribution was not far from normal, the T-test for dependent samples was used. The results were presented with mean and mean standard deviation. Differences with $p < 0.05$ were considered statistically significant.

The study protocol was approved by the Bioethics Committee of the Military Institute of Medicine.

Results

The levels of IL-10, IL-21 and TGF- β_1 were measured in the serum of the 18 patients, collected prior to treatment (time 0 h) and during treatment: 2.5 hours (time 2.5 h) and 24 hours (time 24 h) after administration of the full vaccine dose, i.e. 101.1 μ g of insect venom.

The mean serum concentrations of IL-10, IL-21 and TGF- β_1 cytokines in the study periods are presented in Table 2. No statistically significant differences were observed in serum concentrations of IL-21 and TGF- β_1 cytokines before the treatment or 2.5 and 24 hours after the ultra-rush VIT. A slight but statistically significant increase in the serum concentration of IL-10 between 2.5 and 24 h after the ultra-rush VIT was observed. Furthermore, significant differences in IL-10 concentration before and after the ultra-rush VIT were not observed.

Mild and moderate skin reactions (erythema) and pruritus after the administration of ultra-rush VIT were observed at the site of injection. No severe adverse reactions were observed in connection with the treatment.

Discussion

It is currently believed that classic immunotherapy with inhaled allergens causes the allergy of specific T-cells. This belief is based on the observation of a decreased proliferation of these cells under stimulation with a specific allergen. Increased synthesis of IL-10 and TGF- β_1 by regulatory T-cells, and then B-cells and monocytes, is supposed to be responsible for this phenomenon. In vitro studies showed that CD4+ lymphocytes lose the ability to proliferate and further stimulate B-cells when exposed to high concentrations of immunogenic peptides derived from allergens. When stimulated, these cells cease to produce IL-2, IL-4 and IL-5, but remain capable of IFN- γ synthesis. Additionally, it was observed that VIT with immunogenic fragments of insect venom containing fragments of A2 phospholipase, the main allergen of wasp venom, suppresses T-cell proliferation and cytokine synthesis. The second phase of the reaction involves changes in the functional phenotype of these cells, leading to their activation. Depending on the concentration of various cytokines in the microenvironment of the cell, they gain either the Th1 or Th2 phenotype. In the presence of IL-2 and IL-15 they gain the Th1 phenotype, while IL-4 promotes the change into Th2 phenotype. Thus, successful immunotherapy depends on IL-10 synthesis [9, 10].

Table 2. Concentrations of IL-10, IL-21 and TGF- β_1 cytokines before and after ultra-rush VIT

Tabela 2. Stężenia cytokin IL-10, IL-21, TGF- β_1 przed i po zakończeniu immunoterapii jadem owadów błonkoskrzydłych metodą szybką

time	mean interleukin concentration \pm SD		
	IL-10 pg/ml	IL-21 pg/ml	TGF- β_1 pg/ml
0h	11.07 \pm 2.11	109.97 \pm 2.01	882.71 \pm 166.53
2.5 h	10.91 \pm 2.04*	102.97 \pm 2.01	811.40 \pm 216.57
24 h	11.67 \pm 2.60*	102.75 \pm 1.67	883.85 \pm 190.41

* Statistical significance <0.05

SD – standard deviation

The clinical effect of the immunotherapy with inhaled allergens can be observed several weeks after the start of the therapy. In case of VIT the effect can be observed earlier, although its mechanism remains unknown.

The immunological mechanisms behind the positive clinical effect of the quick acquisition of tolerance to Hymenoptera allergens during VIT immunotherapy still need further study. The delay between the start of the therapy and the immunological tolerance for a safe therapy is still not known. By safe therapy, we mean the absence of immediate and severe anaphylactic reactions, especially in the early stage of therapy in fast and ultra-rush protocols. No reliable indicators have been developed that would be useful to assess the effectiveness of VIT in terms of the risk of severe side effects in the early stages of immunotherapy.

Mamessier et al. studied the change of Th2 lymphocytes into Th1, and stated that this change occurs relatively early, between day 15 and day 45 of the therapy. They also discovered that this reaction is faster and stronger in patients with less severe reactions (degree 1-2 under the Muller classification) to Hymenoptera venom [11].

Pereira-Santos et al. demonstrated an increase in allergen-specific Treg CD4+CD25^{bright} Foxp3+ lymphocyte population after 6 and 12 months of VIT. They also found a strong positive correlation between Treg lymphocyte changes and concentrations of IgG4 and IgE, which are responsible for allergic inflammation. A rise in IgG4/IgE ratio is connected to an increase in CD4+CD25^{bright} Foxp3+ cell count. The authors state that although these correlations do not imply a cause-and-effect relationship between changes in regulatory cells and IgG4/IgE levels, they may result from changes in Treg lymphocytes population in the process of inducing tolerance [12].

In 2010, Bussmann et al. presented markers of early immunological response rush VIT. Within 3 days the maintenance dose of 100 μ g was reached, and in 5 days a cumulative dose of 311.54 μ g of Hymenoptera venom was reached. Increased degradation of tryptophan was

demonstrated in the serum of patients in the first 24 hours of VIT. Degradation of tryptophan is linked to suppression of T-cell response and induction of immunological tolerance shown both in vitro and in vivo. In the second day of VIT an increase was observed in expression of ILT3 and ILT4 receptors on isolated monocytes. ILT3/ILT4 belong to the group of inhibitory receptors that downregulate the activity of antigen presenting cells (APCs) and have an immunosuppressive effect on T-cells. Only on the third day was a significant increase in serum IL-10 and cAMP observed in monocytes isolated from peripheral blood. It should be noted, however, that these changes were observed after administration of only 33.3 µg of venom. The researchers suggest that both markers may contribute to the induction of early mechanisms preventing allergic reactions in the process of increasing the dosage in VIT [13].

Riccoio et al. assessed the immunological activity of serum IL-10 and the CTLA-4 protein (cytotoxic T lymphocyte-associated antigen 4), which is a down regulator of T-cell activation, before and after reaching the maintenance doses of allergen vaccines prepared with different insect venoms using various immunotherapy protocols (conventional, rush and ultra-rush). A significant decrease was reported in CTLA-4 and an increase in IL-10 concentration. These results are difficult to compare to ours, due to the different times of testing [14].

Conclusion

During the ultra-rush VIT phase, there were no significant changes in the serum concentrations of IL-10, IL-21 and TGF-β₁

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The role of the pathological examination in the diagnosis of atopic dermatitis and psoriasis vulgaris

Rola badania patomorfologicznego w rozpoznawaniu atopowego zapalenia skóry i łuszczycy zwykłej

Agnieszka Terlikowska-Brzóska¹, Witold Owczarek¹, Ryszard Galus², Elwira Paluchowska¹, Wojciech Kozłowski³

¹ Dermatology Clinic, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Col. Witold Owczarek MD, PhD

² Chair and Department of Histology and Embryology, Medical University of Warsaw; head: Prof. Jacek Malejczyk MD, PhD

³ Department of Pathomorphology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Prof. Wojciech Kozłowski MD, PhD

Abstract. Atopic dermatitis (AD) and psoriasis vulgaris (PV) are chronic inflammatory skin diseases diagnosed on the basis of clinical manifestation. In doubtful cases a histopathological examination can be made. The aim of the study was to determine the relationship between the clinical diagnosis and the histopathological examination in patients with AD or PV. Patients hospitalized in the Dermatology Clinic of the Military Institute of Medicine in Warsaw (WIM) in the years 2011-2015 with clinical diagnosis of AD or PV were qualified to the study. Skin biopsies were evaluated in the Department of Pathology, WIM. A total of 66 patients were included: 24 females and 42 males. AD was clinically diagnosed in 29 and PV in 37 patients. Clinical diagnosis was confirmed by the histopathological examination in 20/29 AD patients and in 28/37 PV patients. In 4/29 AD patients PV was recognized in the histopathological examination. Moreover, the histopathological examination revealed eczema in 5/37 PV patients. In 5/66 cases the features of both eczema and psoriasis were present in the histopathological examination. In order to make a proper diagnosis of AD or PV in doubtful cases, it is necessary to correlate the results of anamnesis, physical examination and additional tests.

Keywords: atopic dermatitis (AD), psoriasis vulgaris (PV), histopathological examination

Streszczenie. Wstęp. Atopowe zapalenie skóry (AZS) i łuszczycy zwykła (PSV) należą do przewlekłych zapalnych chorób skóry rozpoznawanych na podstawie objawów klinicznych. W wątpliwych przypadkach wykonuje się biopsję skóry. Cel pracy. Ocena zależności pomiędzy obrazem klinicznym i histopatologicznym u chorych z AZS lub PSV. Materiał i metody. Do badania kwalifikowano pacjentów z AZS lub PSV hospitalizowanych w Klinice Dermatologicznej WIM w latach 2011-2015. Pobrane od pacjentów biopsje skórne były oceniane w Zakładzie Patomorfologii WIM. Wyniki. W badaniu wzięło udział 66 pacjentów: 24 kobiety i 42 mężczyzn. Klinicznie rozpoznano AZS u 29 osób a PSV u 37 osób. Rozpoznanie kliniczne potwierdzono badaniem histopatologicznym u 20/29 z AZS i u 28/37 z PSV. Histopatologiczne rozpoznanie PSV ustalono u 4/29 z AZS, a histopatologiczne rozpoznanie wyprysku u 5/37 z PSV. W 5 przypadkach na 66 w badaniu histopatologicznym stwierdzono jednocześnie cechy zarówno wyprysku jak i łuszczycy. Wnioski. W niejednoznacznych klinicznie przypadkach do rozpoznania AZS i PSV konieczna jest łączna ocena badania podmiotowego, przedmiotowego i wyników badań dodatkowych.

Słowa kluczowe: atopowe zapalenie skóry (AZS), łuszczycy zwykła (PSV), badanie histopatologiczne

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Corresponding author

Agnieszka Terlikowska-Brzóska MD

Dermatology Clinic, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw

128 Szaserów St., 04-141 Warsaw

e-mail: aterlikowska-brzosko@wim.mil.pl

Introduction

Atopic dermatitis (AD) and psoriasis vulgaris (PV) belong to the group of chronic inflammatory skin diseases. Both entities are diagnosed based on clinical symptoms. Diagnosis of atopic dermatitis is made with the use of

Hanifin and Rajka criteria - 4 major and 23 minor criteria (Tab. 1).

Atopic dermatitis often starts in childhood, with the clinical picture of the disease changing with the patient's age.

Table 1. Hanifin and Rajka diagnostic criteria. Atopic dermatitis is recognized when the patient fulfills at least 3 major and 3 minor criteria

Tabela 1. Kryteria Hanifina i Rajki. Do rozpoznania atopowego zapalenia skóry konieczne jest stwierdzenie u pacjenta co najmniej 3 kryteriów większych i 3 mniejszych

Major criteria	Minor criteria
Pruritus	Xerosis
typical distribution of lesions (face and extensor area in children flexural areas in adults)	Ichthyosis
chronic and relapsing course	Immediate hypersensitivity (type 1 reactions)
personal or family history of atopy	Elevated total IgE level
	Early onset of disease
	Frequent skin infections
	Hand and foot dermatitis
	Nipple eczema
	Cheilitis actinica
	Recurrent conjunctivitis
	Dennie-Morgan infraorbital fold
	Keratoconus
	Anterior subcapsular cataract
	Orbital darkening
	Facial pallor or erythema
	Pityriasis alba
	Anterior neck fold
	Pruritus after sweating
	Intolerance to wool and lipid solvents
	Follicular accentuation
	Food intolerance
	Exacerbations caused by emotional factors
	White dermographism

In infancy and early childhood the predominant symptoms include erythema, pustules and crusts, while in older children and adults papules and epidermis thickening prevail and exudatory lesions occur only in exacerbations. Excoriations, which are an effect of skin scratching due to pruritus, are present at all stages [1].

Psoriasis has a number of clinical manifestations, including psoriasis vulgaris, pustular psoriasis and psoriatic arthritis. Both psoriasis vulgaris and pustular psoriasis can result in psoriatic erythroderma, which is a generalized skin inflammation. Depending on the activity of the process, psoriasis vulgaris can be classified as guttae psoriasis, stable chronic psoriasis and unstable exudative psoriasis. Lesions can be distributed on the trunk and limbs, as well as limited to one region. The localization of lesions is a reason for further classification, which recognizes inverse psoriasis, psoriasis of hands, feet, scalp, nails and other locations.

Table 2. Clinical criteria for the diagnosis of psoriatic change

Tabela 2. Kliniczne kryteria rozpoznawania zmiany łuszczycowej

1	Candle grease sign	After scratching scales can be produced repeatedly
2	Last scale sign	After almost all layers of scale are removed, blood vessels can be seen through the last one, and removing it causes bleeding
3	Auspitz sign	Pinpoint bleeding occurs after removing scales

Typically psoriasis vulgaris presents with dermatoid epidermoid papules covered in a silvery-white crust. Diagnosis is made on the basis of 3 clinical criteria (Tab. 2) and Koebner's phenomenon - formation of new psoriatic papules on the site of recent damage to healthy skin in the active phase of the disease.

None of these symptoms, however, are specific for psoriasis vulgaris, so that a prolonged observation is often necessary for a certain diagnosis. A skin biopsy with histopathological examination is often performed [2].

Atopic dermatitis and psoriasis vulgaris very rarely coexist, as the pathomechanism of both conditions involve different lymphocyte populations [3] - in atopic dermatitis the Th2 lymphocytes are predominant, while in psoriasis the Th1 and Th17 are more active [4, 5]. In some cases, the clinical and histopathological images are similar [6].

Aim of the study

The study was designed to investigate a possible correlation between clinical manifestations of psoriasis vulgaris and atopic dermatitis, and the histology of skin lesions.

Material and methods

Adult patients who were hospitalized at the Dermatology Clinic of the Military Institute of Medicine in the years 2011-2015 were qualified for this clinical study.

Inclusion criteria were as follows:

- clinical diagnosis of atopic dermatitis or psoriasis vulgaris,
- free and informed consent for participation in the study.

Exclusion criteria were as follows:

- unstable systemic disease, which would interfere with the results of the histopathological examination of the collected sample,
- active systemic neoplastic disease,
- medication, either systemic (methotrexate, cyclosporin, neotigason or biologics) or local

(steroids, calcineurin inhibitors or biologics) interfering with the histopathological examination results.

The medical history was taken from the AD and PV patients who were included in the study. A medical examination was performed, and the extent of the lesions was assessed. BSA, EASI and SCORAD scales were used for the atopic dermatitis patients, while the patients with psoriasis vulgaris were assessed with the use of BSA and PASI scales. Biopsies were taken with single-use 5mm biopsy punches manufactured by Miltex, Japan. Prior to the procedure, the skin was anaesthetized with ethyl chloride (Filofarm, Bydgoszcz). After the procedure the wound was dressed. The sample was placed in a 10% buffered formalin solution and sent to the Department of Pathomorphology of the Military Institute of Medicine. Tissue sections, 2-3 µm thick, were prepared using paraffin and H&E stain. The samples were assessed according to the usual protocol, by medical pathologists from the Department of Pathomorphology of the Military Institute of Medicine.

The biopsies of the patients were approved by the Bioethics Committee.

Results

- From 2011 to 2015, 68 samples were taken from 66 AD and PV patients (2 AD patients had 2 samples taken). Samples were stained with hematoxylin and eosin and examined according to the usual protocol by the Department of Pathomorphology of the Military Institute of Medicine in Warsaw.
- 24 females and 42 males participated in the study, with 29 of the 66 patients being clinically diagnosed with AD and 37 with PV (Fig. 1).
- Routine histopathological examinations of 68 samples confirmed the diagnosis of AD in 22 of the 31 patients. The diagnosis of AD was confirmed both clinically and histopathologically in 20 of the 29 patients. In 4 of the 29 patients with a clinical diagnosis of atopic dermatitis the histological examination indicated psoriasis. In 5 of the 29 AD cases the histopathological examination was inconclusive (Fig. 2).
- In the PV patients, 28 of the 37 cases had the same clinical and histopathological diagnosis. In patients clinically diagnosed with PV, the interpreting pathomorphologist found signs of eczema in 5 of the 37 cases. In 4 of the 37 samples, the examination was considered diagnostically irrelevant (Fig. 2).
- In 18 of the 66 patients the histopathological diagnosis did not confirm the clinical diagnosis.

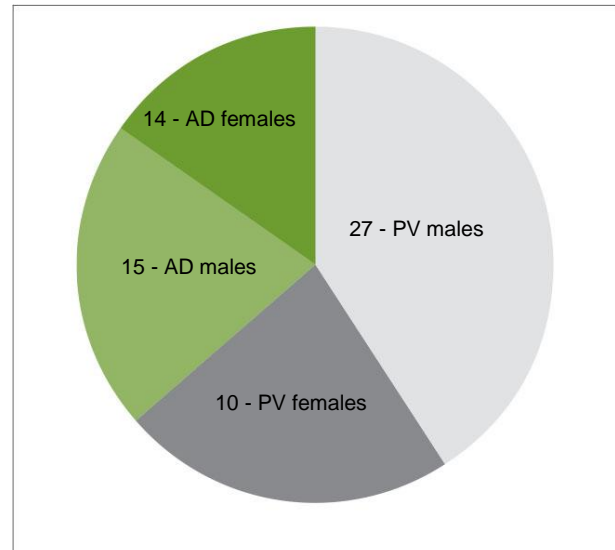


Figure 1. Structure of patients participating in the study
Rycina 1. Struktura pacjentów biorących udział w badaniu

- The set of 18 samples that were inconsistent with the clinical diagnosis were further examined:
 - 5 of the 18 - axial or oblique plane,
 - 2 of the 18 - with only remnants of the stratum corneum or lack of it,
 - 11 of the 18 - samples were technically correct.
- the remaining 11 samples were further examined:
 - 6 of 9 - second examination confirmed the clinical diagnosis,
 - 5 of 9 - the histopathological examination exhibited traits of both psoriasis and eczema (3 AD and 2 PV).

Discussion

Atopic dermatitis

Histopathological examination of the samples taken from patients with atopic dermatitis revealed acute, subacute or chronic eczema. The stratum corneum might be thickened and demonstrate areas of uncompleted cornification. The granulosa might be thickened, or become thinner in certain areas. The stratum spinosum is irregularly overgrown. Intra- and extracellular edema enhances the visibility of intercellular connections. In periods of exacerbation, epidermal vesicles are formed. The dermis demonstrates lymphocytic perivascular infiltration with eosinophilia [7, 8].

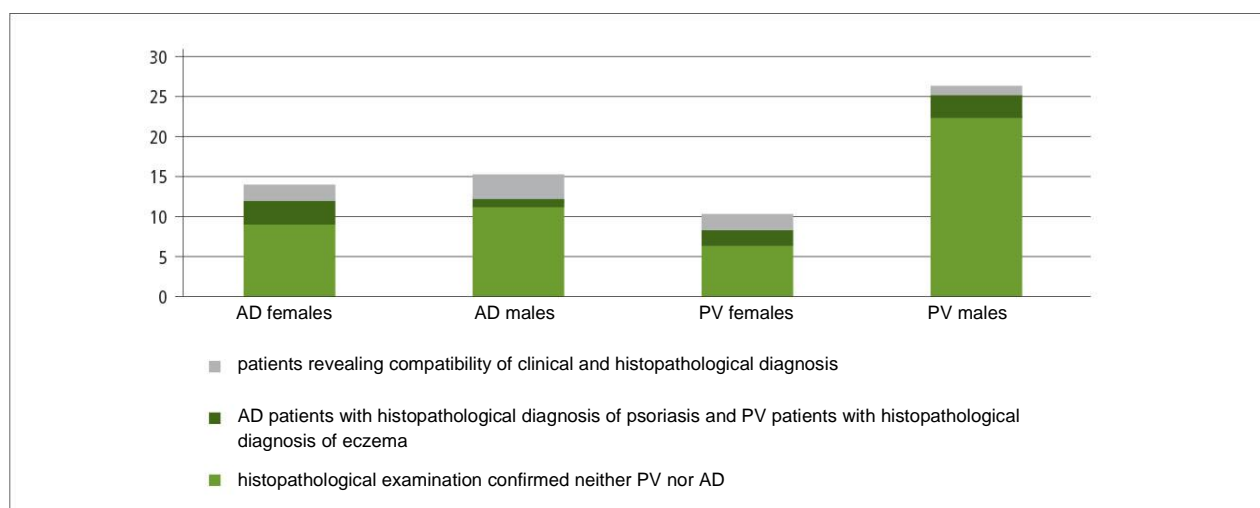


Figure 2. Compatibility between the clinical and histopathological diagnosis in patients with clinically diagnosed atopic dermatitis or psoriasis

Rycina 2. Zgodność rozpoznania klinicznego i histopatologicznego u pacjentów z klinicznie rozpoznany atopowym zapaleniem skóry (AZS) lub łuszczycą zwykłą (PSV)

Psoriasis vulgaris

In the case of psoriasis vulgaris, the histopathological image is typical mostly in the case of fully developed lesions.

Hyperkeratosis and parakeratosis can be observed in the epidermis. Concentrations of neutrophils, called Munro's microabscesses, in the stratum corneum can be observed. The granulosa is thin, or in some cases absent. The spinous layer is overgrown and its spines are regularly lengthened. The papillae of the dermis demonstrate enlarged vessels, which grow into the epidermis. Mild perivascular lymphocytic infiltration can be observed. In the upper parts of the dermis papillae exocytosis of lymphocytes and erythrocytes is often seen. Over the papillae, the epidermis is thinner. Abrasion of the parakeratotic cornified layer of the epidermis in these places results in damage to the superficial blood vessels and pinpoint bleeding - known as Auspitz sign [6-9, 11].

Discussion

In atopic dermatitis, as well as in psoriasis, the histopathological image changes in the course of time, and depends on various factors, such as:

- duration of the disease,
- phase of the disease,
- duration of a particular lesion,
- location of lesions,
- systemic and local therapy,
- irritation of lesions,
- clinical condition of the patient,
- comorbidities [10].

A particular sample might not exhibit all the traits typical for psoriasis or eczema, which is why the examining pathologist should have access to all the clinical data, as well as a macroscopic image of the lesion. A representative lesion should be chosen for sampling, to minimize the possibility of mistake.

The examined samples confirmed the clinical diagnosis in 73% of the cases (48/66). In 24% (18/66) of the cases the histopathological image did not confirm the clinical diagnosis. In 27% (7/68) of the cases, incorrect preparation of the samples made it impossible to give a clear diagnosis. The condition of the samples could have been caused by incorrect sampling, transport damage or incorrect preparation. In 16% (11/68) of the cases, although the samples did not seem in any way unreliable, the histopathological diagnosis did not confirm the clinical diagnosis. This could have been caused by insufficient information given to the pathologist. Submitting the missing information and re-examining the samples resulted in confirmation of the clinical diagnosis by the pathologist in 9% (6/68) of the cases. Only in 7% (5/68) of the cases was it impossible to give a final diagnosis in the histopathological examination, due to the traits of both diseases. This final group contained 2 cases of psoriasis (both samples exhibited prominent spongiosis) and 3 cases of atopic dermatitis (samples were taken from areas of lichenified skin, which demonstrated hypogranulosis and increased acanthosis and papillomatosis upon histological examination). In these 5 cases, the choice of sampling site impacted the result of the examination.

Conclusions

- In the case of diagnostic difficulties, it is important to collect skin samples from locations typical for the particular disease. It is advisable to collect the sample from a lesion having a typical morphology, which has not been yet subjected to local therapy.
- A valid sample should contain both dermis and epidermis with preserved stratum corneum, and be properly immersed in paraffin and cut.
- The pathologist should be given the sample, together with full information on the clinical suspicion, comorbidities, medications used (local and systemic) as well as the macroscopic morphology of the lesion.
- A final diagnosis of both AD and PV should be based on the histopathological examination, clinical condition, medical history, medical examination and additional tests.

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Eosinophilic granulomatosis with polyangiitis ANCA(-) - Churg-Strauss syndrome, treated with mycophenolate mofetil - a case report

Eozynofilowe ziarniniakowe zapalenie naczyń ANCA (-) - zespół Churga i Strauss - leczone mykofenolanem mofetylu - opis przypadku

Wawrzyniec Żmudźki, Dorota Brodowska-Kania, Ewelina Jędrych, Stanisław Niemczyk

Department of Internal Diseases, Nephrology and Dialysis, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Prof. Stanisław Niemczyk MD, PhD

Abstract. Eosinophilic granulomatosis with polyangiitis (Churg-Strauss syndrome, EGPA) is a rare systemic inflammation of the small blood vessels associated with anti-neutrophil cytoplasmic antibodies (ANCA-associated vasculitis - AAV). Its etiology is unknown, and it is advisable to individualize the therapeutic approach. The paper presents a case of a 23-year-old male with active systemic disease causing diagnostic difficulties. Clinically, swelling and redness of the ankle joints, skin changes and recurrent fevers were observed. Asthma was recognized 12 months prior to hospitalization. Laboratory tests were dominated by leukocytosis with eosinophilia of up to 45%, no presence of ANA or ANCA was detected. An abdominal ultrasound discovered hepatomegaly, enlarged kidneys (more than 16 cm each), with possible infiltration of the inflammation. Creatinine level was 1.5 mg/dl. Acute eosinophilic leukemia was excluded. A histopathology sample from the affected foot skin revealed typical granulomatous inflammation of the small vessels. Immunosuppressive therapy (GCs) and mycophenolate mofetil (MMF), due to the high disease activity, were applied. The patient showed signs of remission, his kidney function normalized and the asthma syndromes disappeared. The patient has been in the care of WIM for 24 months.

Key words: eosinophilic granulomatosis with polyangiitis, Churg-Strauss syndrome, vasculitis, ANCA antibodies, peripheral blood eosinophilia, asthma

Streszczenie. Eozynofilowe ziarniniakowe zapalenie naczyń (EGPA) to układowe zapalenie małych naczyń, zazwyczaj związane z przeciwciałami przeciwko cytoplazmie neutrofilów (AAV). Etiologia pozostaje nieznana. Wskazana jest indywidualizacja podejścia terapeutycznego. Prezentujemy przypadek 23-letniego mężczyzny z aktywną chorobą układową, sprawiającą trudności diagnostyczne. W obrazie klinicznym dominowały obrzęki i zaczerwienienie stawów skokowych, zmiany skórne oraz nawracające stany podgorączkowe. 12 miesięcy przed przyjęciem do kliniki rozpoznano astmę. W badaniach dodatkowych dominowała leukocytoza z eozynofilią do 45%, nie stwierdzono przeciwciał ANA i ANCA. W USG jamy brzusznej stwierdzono: hepatomegalię i powiększone wymiary nerek (>16 cm każda) z prawdopodobnym naciekiem zapalnym. Stężenie kreatyniny wynosiło 1,5 mg/dl. Wykluczono ostrą białaczkę eozynofilową. W badaniu histopatologicznym wycinka ze zmienionej chorobowo skóry stopy stwierdzono typowe ziarniniakowe zapalenie małych naczyń. Wdrożono leczenie immunosupresyjne - GKS, a także, z powodu dużej aktywności choroby, mykofenolan mofetylu (MMF). U pacjenta uzyskano remisję choroby, normalizację parametrów retencji azotowej i ustąpienie objawów astmy. Pacjent pozostaje pod opieką Kliniki WIM od 24 miesięcy.

Słowa kluczowe: eozynofilowe ziarniniakowe zapalenie naczyń, zespół Churga i Strauss, zapalenie naczyń, przeciwciała ANCA, eozynofilia krwi obwodowej, astma

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Corresponding author

Dorota Brodowska-Kania

Department of Internal Medicine, Nephrology and Dialysotherapy

Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine

128 Szaserów St., 04-141 Warsaw

telephone/fax: +48 22 261 816 811

e-mail: dbrodowska-kania@wim.mil.pl

e-mail: sniemczyk@wim.mil.pl



Figure 1. Images of edema and elevated purpura in the lower limbs
Rycina 1. Zdjęcia obrzęków i plamicy uniesionej w obrębie kończyn dolnych

Introduction

Eosinophilic granulomatosis with polyangiitis (EGPA), previously known as Churg-Strauss syndrome, is characterized by necrotizing vasculitis of the small and medium vessels and the occurrence of bronchial asthma. Eosinophilia in the peripheral blood count is characteristic of this condition. Anti-neutrophil cytoplasmic antibodies (ANCA) are often present [1-3]. The name originates from the authors who first reported it - Jacob Churg and Lotte Strauss. In 1951, they evaluating 13 patients with bronchial asthma and concomitant fever, hypereosinophilia and vascular changes [1, 4]. The pathogenesis remains unknown. Data on EGPA incidence are conflicting, and its incidence is estimated at 0.5 to 6.8 new cases a year per million people and 10.7-13 cases per million people [2-4]. The paper presents the case of a young patient with serious EGPA causing diagnostic difficulties.

Case report

A 23-year-old patient has for 24 months been in the care of the Department of Internal Diseases, Nephrology and Dialysis, Central Clinical Hospital of the Ministry of National Defence, WIM. He was first admitted to the

Department due to swelling of the lower limbs and feet, redness and pain of the ankle joints, as well as skin changes like elevated purpura of the lower limbs (Fig. 1) with accompanying fevers occurring for 2 months. For the 12 months prior to admission, the patient had been treated for bronchial asthma and allergic rhinitis.

A year before, the patient was diagnosed for lymphadenopathy of the neck region and enlargement of the salivary glands. The patient was diagnosed with sialosis and an antibiotic therapy was introduced, with no therapeutic effect. A suspicion of sarcoidosis was made at that time.

Laboratory tests performed upon admission revealed a high white blood count (WBC $14.56 \times 10^9/l$, including 45% eosinophils), normocytic anemia (Hb 12.1 g/dl), thrombocythemia (PLT $481 \times 10^9/l$), accumulation of nitrogenous by-products (creatinine: 1.5 mg/dl), coagulation disorders - APTT (36.2 s), decrease in complement components (C3 - 74 mg/dl, C4 - 3 mg/dl) and increased total IgE level of 839 IU/ml (N: 10.0-135.0 IU/ml). Proteinogram revealed polyclonal hypergammaglobulinemia. Neither anti-nuclear antibodies (ANA) nor anti-neutrophil cytoplasmic antibodies (ANCA) were detected.

An abdominal ultrasound revealed hepatomegaly, enlargement of both kidneys (left kidney: 162 mm in

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length, renal parenchyma: 15-26 mm; right kidney: 161 mm in length, renal parenchyma 16-27 mm) with possible inflammatory infiltration. A chest x-ray (Fig. 2) showed enlarged lymph nodes of the left pulmonary hilum and lower region of the right pulmonary hilum. A CT scan revealed thickening of the mucosa of all paranasal sinuses. Transthoracic echocardiography showed no pathology. Diagnostic bronchoscopy with bronchoalveolar lavage (BAL) confirmed a chronic inflammatory process. A cytological examination of bone marrow aspirate showed a high cellular count. The granulocytic cell line constituted 78.1% of the nucleated cells, with 37.5% eosinophils of the promyelocyte stadium. Due to the kidney enlargement, and high risk of serious damage, a kidney biopsy was not performed. A skin biopsy from the elevated purpura on the left foot was performed, the results confirming typical granulomatous vasculitis of the small vessels.

The patient was diagnosed with EGPA and began treatment with two pulses of methylprednisolone (1.0 g i.v.), and a subsequent 2 month treatment with prednisone (60 mg/d) (1 mg/kg of body mass/d; max. 60 mg/d) was started. Eosinophilic infiltration of the lymphatic system and kidneys were indicative of the need for intensive immunosuppressive treatment with mycophenolate mofetil (MMF). The recommended dosage was 2 x 1g MMF and was well tolerated by the patient, with the symptoms resolving. The nitrogenous by-products accumulation was controlled (Fig. 3), with no eosinophilia. The GCs were withdrawn after six months, and the MMF therapy 12 months from remission.



Figure 2. Patient's chest X-ray - mediastinal lymphadenopathy
Rycina 2. Badanie radiologiczne klatki piersiowej pacjenta - limfadenopatia śródpiersia

Discussion

The presented case related to a young patient with a severe course of the disease. The diagnosis of EGPA is rather infrequent, and is mostly made in patients between aged between 38 and 54 years, with a similar frequency in males and females [3, 4].

The course of the disease can be divided into 3 phases.

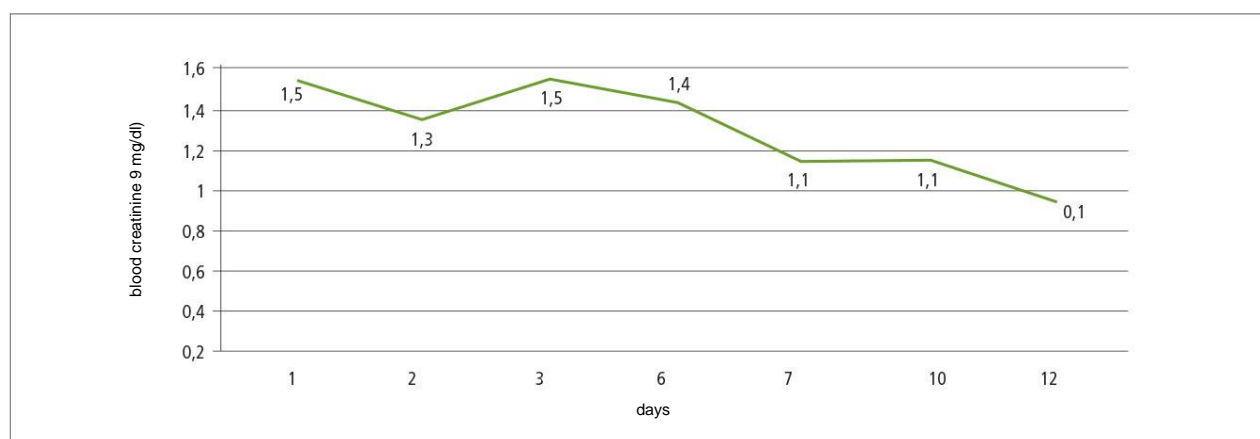


Figure 3. Blood creatinine value changes during hospitalization
Rycina 3. Zmiany wartości kreatyniny we krwi w czasie hospitalizacji pacjenta

The first phase is characterized by asthma, allergic rhinitis and sinusitis. The second, eosinophilic phase involves eosinophilic peripheral and organ infiltration, mostly in the lungs, heart and the digestive system. Vasculitis is observed in the third phase. Clinically, patients present with purpura, peripheral neuropathy, vascular and extravascular granulomas. General symptoms are also observed, such as fever, indisposition and weight loss [1, 2]. Table 1 presents the frequency of systemic involvement [2].

According to the American College of Rheumatology the diagnosis of EGPA can be made when 4 of the following 6 criteria are met:

- asthma,
- peripheral blood eosinophilia (>10% of leukocytes in blood count),
- mono- or polyneuropathy,
- changes in paranasal sinuses,
- discrete infiltration of lungs,
- extravascular eosinophilic infiltration in tissue samples [1-5].

In the presented case, the patient was a very young person. As mentioned earlier, the symptoms usually occur in patients over 38 years of age, with only a few cases of the disease in children having been reported so far [4]. The literature suggests that the course of the disease in younger patients is more severe, as was in the case in our patient [6].

The classification of EGPA is controversial, as ANCA antibodies occur only in 30-70% of patients [1, 3, 5]. These antibodies can be found in less than 40% of younger patients [6]. A discussion is in progress concerning whether the classification should be revised, as the ANCA(+) and ANCA(-) EGPA have different clinical manifestation [3-9]. This is a cause of significant diagnostic difficulties, as in the case of our patient, where a negative testing for ANCA antibodies initially made the diagnosis of vasculitis less probable. This suggests that it might be useful to differentiate two subtypes of EGPA [4, 7, 8].

The French Vasculitis Group have developed a prognostic scale for necrotizing vasculitis, called the Five-Factor Score (FFS), based on:

- increased creatinine level (>1.58 mg/dl),
- proteinuria (>1 g/d),
- digestive tract involvement,
- cardiomyopathy,
- CNS involvement [4, 7, 9].

Both the treatment and prognosis are based on FFS. According to many sources, it is advisable to use both GCs and immunosuppressive drugs in the treatment of patients with FFS score >1. Cyclophosphamide is used most often [3,8], and was in the case of our patient. As

his score was 0/1, it was decided to use MMF to induce remission. MMF was chosen due to the high activity of the process and lesser adverse effects, especially the suppressive effect of cyclophosphamide on spermatogenesis [11, 12].

Table 1. The most common clinical symptoms in EGPA and their dissemination [3]

Tabela 1. Najczęstsze objawy kliniczne w EGPA i ich rozpowszechnienie [3]

clinical symptoms	dissemination (%)
bronchial asthma	91-100
ears, nose, throat (ENT)	48-75
neuropathy	55-72
lungs	65-91
skin	40-52
kidneys	27
heart	27-35
gastrointestinal system	23-32
central nervous system	5-9

The prognosis is good and remission rate is estimated at 81-92%. However, in 26-28% of patients who are in remission, a relapse is observed. The mortality rate in patients who relapse is around 3% [3, 4, 13]. The decrease in complement components (c3 and C4) is a negative prognostic factor, as in vasculitis it is connected to the risk of renal failure [14].

Conclusion

In the diagnostic process of patients who present with eosinophilia, asthma and non-specific organ infiltration, it is important to take into consideration the less frequent conditions, such as systemic vasculitis, including EGPA. Despite the fact that EGPA was classified as vasculitis with antibodies, it is important to remember that antibodies are present in 70% of patients at most. When treatment is started, it is crucial to be aware of its side effects, especially for younger patients.

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Staphylococcus aureus sepsis in patients with Caroli's syndrome

Posocznica *Staphylococcus aureus* u chorego z zespołem Caroliego

Dorota Brodowska-Kania, Katarzyna Marciniuk, Stanisław Niemczyk

Department of Internal Diseases, Nephrology and Dialysis, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Assoc. Prof. Stanisław Niemczyk MD, PhD

Abstract. Caroli's syndrome is a congenital pathology, transmitted in an autosomal recessive way and affecting the intrahepatic bile ducts, with attendant hepatic fibrosis. It often coexists with congenital autosomal recessive polycystic kidney disease (ARPKD). Depending on the level of disease progression, complications, and also the extent of the disease process, conservative treatment or surgery may be performed. This article concerns a case of a 21-year old male with congenital polycystic kidneys and liver. The patient was also diagnosed with Caroli's syndrome with complications including portal hypertension, esophageal variceal bleeding and Staphylococcus aureus sepsis. In this case, the patient received multidrug antibiotic therapy for the sepsis and intrahepatic bile duct inflammation. Due to the coexisting end-stage renal failure and portal hypertension, the patient was sent to a transplant center in order to apply for renal and liver transplantation.

Key words: Caroli's syndrome, Caroli's disease, polycystic kidney and liver disease, end-stage renal failure

Streszczenie. Zespół Caroliego jest wrodzoną patologią dziedziczną w sposób autosomalny recesywny, dotyczącą wewnątrzwątrobowych dróg żółciowych, z towarzyszącym włóknieniem wątroby. Często współistnieje z wrodzoną autosomalnie recesywną wielotorbielowatością wątroby. W zależności od stopnia rozwoju choroby i jej powikłań, a także rozległości procesu chorobowego, prowadzi się leczenie zachowawcze lub operacyjne. W pracy przedstawiono przypadek 21-letniego pacjenta z wrodzoną torbielowatością nerek i wątroby, u którego rozpoznano zespół Caroliego. Jako powikłanie wystąpiło nadciśnienie wrotne, krwawienie z żyłaków przełyku oraz sepsa *Staphylococcus aureus*. W opisanym przypadku z powodu sepsy oraz zapalenia wewnątrzwątrobowych dróg żółciowych zastosowano antybiotykoterapię wielolekową. Ze względu na współistniejącą schyłkową niewydolność nerek i nadciśnienie wrotne chorego skierowano do ośrodka transplantologicznego w celu kwalifikacji do przeszczepienia dwunarządowego.

Słowa kluczowe: zespół Caroliego, choroba Caroliego, wielotorbielowatość nerek i wątroby, schyłkowa niewydolność nerek

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Corresponding author

Dorota Brodowska-Kania

Department of Internal Diseases, Nephrology and Dialysis, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine

128 Szaserów St., 04-141 Warsaw, Poland

telephone: +48261 816 811

e-mail: dbrodowska-kania@wim.mil.pl

Introduction

Caroli's disease is a rare congenital pathology of the intrahepatic bile ducts, manifested by their cystic dilation, retention of bile and recurring inflammation [1]. The disease was named after a French physician, Jacques Caroli, who was first to describe the above changes in 1958 [2]. Caroli's syndrome is defined as Caroli's disease accompanied by hepatic fibrosis, which is associated with a risk of portal hypertension and cirrhosis [3]. Both Caroli's disease and syndrome may lead to neoplastic transformations due to recurring inflammation and epithelium irritation caused by the retention of bile. In mild forms, conservative treatment is

used, whereas in advanced cases, depending on the extent of the disease, liver segmental or lobe resection is performed, or transplantation of the entire organ [1].

Case report

A 21-year-old patient was urgently admitted to the Department of Internal Diseases, Nephrology and Dialysis of the Military Institute of Medicine due to a fever of over 40°C, accompanied by shivers and weakness persisting for 7 days before the admission. Prior to admission the patient received only symptomatic treatment. The patient's general condition at admission was good. The medical history was Caroli's disease complicated by portal hypertension, two gastrointestinal

hemorrhages (esophageal variceal ligation was performed) and splenomegaly and gastroduodenal reflux, myocardial infarction and ischemic cerebral stroke. Other complications included end-stage renal failure due to autosomal recessive polycystic kidney disease (ARPKD), arterial hypertension, cardiac ventricular disease in the form of tricuspid valve regurgitation, as well as aortic and mitral regurgitation, and secondary hyperparathyroidism. A previous arteriovenous fistula on the left arm, and bilateral inguinal hernia. The family history revealed autosomal recessive polycystic kidney and liver disease in the patient's brother and mother. The physical examination at admission revealed hepatomegaly and pain in the right infracostal area. No peripheral edema or retention over the lung fields were found. The patient had preserved diuresis of approx. 1500 ml/day. In the laboratory tests the following results were notable: deep anemia – Hgb 7.4 g/dl (N: 11.0-18.0 g/dl), leukopenia - WBC (*white blood cell count*) – 3.5 G/l (N: 4.0-10.0 thousand/ml), thrombocytopenia: PLT – 43 G/l (N: 150-400 thousand/ml), increased values of inflammation markers: CRP (*C-reactive protein*) – 8.9 mg/dl (N: <0.8 mg/dl) and procalcitonin 0.5 ng/ml (N <0.5 ng/ml), moreover advanced parameters of renal insufficiency: creatinine concentration of 7.9 mg/dl (N: 0.7-1.2) and eGFR (*estimated glomerular filtration rate*) 9 ml/min/1.73 m². An abdominal ultrasound examination revealed: enlarged left liver lobe, intrahepatic biliary ducts partially dilated with a few small fluid spaces, portal vein of normal size with a flow of approx. 20 cm/s, gallbladder without deposits, significantly enlarged spleen – lower pole touching the hip bone). Numerous small cysts with calcifications in both kidneys. After collection of blood and urine for the microbiological tests, empirical antibiotic therapy with ciprofloxacin and ceftriaxone was introduced. On the second day, bacterial growth of *Staphylococcus aureus* of the MRSA strain (*methicillin resistant Staphylococcus aureus*) was found in the blood culture. Due to strong pain in the epigastrium and the right infracostal area, hepatic cyst inflammation was suspected. An antibiogram-based therapy was introduced as well as a multidrug antibiotic therapy (ciprofloxacin, vancomycin). When vancomycin was used, its concentration in the blood serum was monitored: the initial dose was 20 mg/kg bw, then further doses were administered, according to the concentration of the medication in the blood, the target concentration being 20-40 ng/ml. The patient also received analgesics, antipyretics and relaxants. The patient's general condition improved: the fever and abdominal pain disappeared, and after 10 days the inflammation markers were normal. A control blood culture did not

reveal any microorganisms, and a transthoracic echocardiography (TTE) did not reveal the characteristics of infectious endocarditis. The applied treatment did not result in a significant improvement of the renal function, and the patient still did not consent to renal replacement therapy. The patient was discharged to continue treatment in an outpatient clinic, with a recommendation of care under the supervision of a transplantology center, to be qualified for kidney and liver transplantation.

Discussion

This case demonstrated difficulties with the treatment of a patient with a complex Caroli's syndrome and polycystic kidneys. Despite the collection of bacteriological material and the applied treatment, it was not easy to determine whether a hepatic infection occurred. Caroli's syndrome is typically difficult to diagnose: the patient did not receive genetic tests, but Caroli's syndrome is inherited in an autosomal recessive manner, and often coexists with ARPKD. It is caused by a genetic defect of the fibrocystin-coding gene, localized on chromosome 6p12 (*PKHD1*) [2, 4], which has been identified both in patients with ARPKD and in those with Caroli's syndrome. Clinical symptoms of the syndrome may occur early or late in life [5]. In the discussed case, the patient was an adult, but it should be noted that autosomal recessive polycystic kidney disease in 50% of cases results in the death of a newborn due to respiratory failure caused by pulmonary hypoplasia. The surviving children develop arterial hypertension, renal insufficiency and portal hypertension as a result of hyperplasia of the portal system and fibrosis [6]. In the discussed case, hypotensive therapy was introduced in the first year of the patient's life. A satisfactory hypotensive effect required a combined therapy. Two years later, the beginning of renal deficiency was diagnosed. Ultrasound did not reveal hepatomegaly or increased flow in the hepatic portal system.

In older patients the clinical picture may be dominated by hepatobiliary symptoms. The progression of hepatic fibrosis and portal hypertension may result in hypersplenism with pancytopenia, as well as esophageal varices with subsequent hemorrhages from the upper gastrointestinal tract [7]. Regular monitoring to prevent recurring esophageal variceal hemorrhages is obligatory in all ARPKD patients as well as patients presenting symptoms of portal hypertension [8]. The described patient received regular gastroscopic tests since he was 3 years old, which demonstrated gradual evolution of the lesions in the esophageal mucosa, starting with a small congestion over the cardia and a limited gastropathy, to the first incident of esophageal variceal hemorrhaging at

the age of 10 years old, to another bleeding incident and gastritis.

Caroli's syndrome may also be associated with other complications, such as inflammation of biliary ducts, sepsis, choledocholithiasis, hepatic abscesses and cholangiocarcinoma [5]. A golden standard in the diagnostics of Caroli's disease or syndrome is endoscopic retrograde cholangiopancreatography and percutaneous transhepatic cholangiography. However, both methods are associated with a risk of biliary duct inflammation, or even sepsis. The best diagnostic method, used without risk, is magnetic resonance cholangiopancreatography (MRCP) [3, 9].

Therapies for Caroli's disease or syndrome may be limited to interventional treatment, such as endoscopic retrograde cholangiography and lithotripsy, in combination with antibiotics and ursodeoxycholic acid (in case of choledocholithiasis or inflammation of the intrahepatic biliary ducts), which is only a symptomatic treatment. An important argument against long-term therapy using interventional and conservative methods is the high risk of malignancy, increasing with the patient's age. Carcinogenesis in those patients is based on chronic inflammation with subsequent cell regeneration and destruction of DNA, which results in dysplasia [6]. Therefore, in cases involving stones, recurring inflammation, biliary steatosis, serious portal hypertension or suspected neoplastic process, safe management involves partial hepatic resection in limited forms of the disease, and transplantation in metastatic cases [3, 6, 9]. In patients with coexisting polycystic kidney disease and renal failure, immunosuppression used after kidney transplantation may predispose the patient to exacerbated inflammation of the biliary ducts; therefore, in cases such as the one described, the best recommended management is to consider combined liver-kidney transplantation [6].

Conclusion

Attention should be drawn to the slow and deceitful development of the lesions related to Caroli's syndrome in the described case. The chronic nature of the disease requires detailed, insightful diagnostics and regular observation to delay the occurrence of complications or to prevent them (i.e. esophageal variceal hemorrhaging, sepsis and hepatic abscesses). It is also very important to initiate at the right time the procedure preparing for organ transplantation. Caroli's syndrome is a rare disease, but it should always be considered, especially in case of cystic lesions in the liver co-occurring with polycystic kidney disease, recurring inflammation of the biliary ducts or early portal hypertension. Patients require the multi-specialty care of a nephrologist, hepatologist and clinical transplantologist.

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Extensive therapy inducing remission of systemic lupus erythematosus with renal involvement - a case report

Kompleksowa terapia indukująca remisję toczenia rumieniowatego układuowego z zajęciem nerek - prezentacja przypadku klinicznego

Dorota Brodowska-Kania, Diana Seliga, Katarzyna Tusznio, Stanisław Niemczyk

Department of Internal Diseases, Nephrology and Dialysis, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Assoc. Prof. Stanisław Niemczyk MD, PhD

Abstract. There is no clear-cut statement concerning plasmapheresis (TPE) efficiency in systemic lupus erythematosus and lupus nephritis treatment. Some studies report positive results from using TPE in the therapy, others claim that there is no beneficial effect of a TPE and immunosuppressive drug combination. The paper presents the case of a 22-year-old female with lupus nephropathy treated with TPE due to significant renal failure and no response to glucocorticoids. Adding TPE to the treatment resulted in an improvement in the renal function. The patient underwent maintenance therapy according to the EuroLupus Protocol, including cyclophosphamide i.v. and prednisone p.o., with marked improvement. This case proves that using TPE might be effective in cases of lupus nephropathy unresponsive to immunosuppressive drugs.

Key words: lupus nephropathy, plasmapheresis, systemic lupus erythematosus, TPE

Streszczenie. Nie ma jednoznacznej opinii na temat efektywności zabiegów plazmaferezy (TPE) w leczeniu toczenia rumieniowatego układuowego i nefropatii toczniowej. Niektóre badania donoszą o pozytywnych efektach leczenia z zastosowaniem TPE, inne o braku korzyści z połączenia zabiegów z leczeniem immunosupresyjnym. Prezentujemy przypadek 22-letniej pacjentki z nefropatią toczniową, u której zastosowano plazmaferezę w związku z istotnym pogorszeniem funkcji nerek i brakiem poprawy po zastosowaniu leczenia glikokortykosteroidami. W wyniku TPE uzyskano zmniejszenie parametrów retencji azotowej. Wdrożono terapię podtrzymującą remisję wg programu EuroLupus - wlewy z cyklofosfamidu i prednizon doustnie+, z dobrym efektem. Przypadek pacjentki dowodzi, że zastosowanie zabiegów plazmaferezy może być skuteczne w przypadku nefropatii toczniowej niereagującej na farmakologiczne leczenie immunosupresyjne.

Słowa kluczowe: toczeń rumieniowaty układuowy, nefropatia toczniowa, plazmafereza, TPE

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Corresponding author

Dorota Brodowska-Kania

Department of Internal Diseases, Nephrology and Dialysis,
Central Clinical Hospital of the Ministry of National
Defence, Military Institute of Medicine

128 Szaserów St., 04-141 Warsaw, Poland

telephone: +48 261 816 811

e-mail: dbrodowska-kania@wim.mil.pl

Introduction

Systemic lupus erythematosus (SLE) is an autoimmune disease resulting in a chronic inflammation process in multiple organs. Average annual incidence is 1-10/100,000 people [1], and more often affects women. The clinical course is varied: from discrete symptoms (weakness, increased fatigue, subfebrile temperature, reduced body weight) to multiorgan failure. In 30.7% of cases the kidneys are involved, which adversely affects the prognosis [2]. Lupus nephropathy is diagnosed on the basis of a histopathological examination in which five classes are distinguished. Choice of medications and prognosis depend on the advancement of the changes. The aim of lupus nephropathy treatment is to maintain

remission, reduce the risk of progression of the renal damage and death, as well as to minimize the adverse effects of the medications and procedures used. Untreated SLE with such a level of activity is a lethal disease. The therapy consists of two stages: remission-inducing treatment, where glucocorticosteroids and cyclophosphamide are of primary importance, and treatment maintaining remission. In 1976, the first therapeutic plasma exchange (TPE) procedure was performed in the treatment of rapidly progressing glomerular nephritis in the course of SLE [3]. The results were positive, but no randomized prospective studies were conducted. TPE may be a solution for patients whose condition does not improve after the use of

glucocorticosteroid and/or immunosuppressants in the treatment of severe lupus nephropathy, but it is often associated with adverse reactions. We present a case of a patient who received inducing therapy and TPE.

Case report

A 22-year-old patient with suspected SLE with renal involvement was admitted two years ago due to pain and bilateral swelling of the ankles and metatarsus, pain in the small joints of hands and feet persisting for approximately 2 months. During the admission to the Department of Internal Diseases, Nephrology and Dialysis, edema was found and the following abnormalities in the laboratory tests: reduced concentration of complement components C3 and C4, cytopenia in the complete blood count, Hb 9.6 g/dl, ES 50 mm (N <12) and CRP 0.3 mg/dl (N <0.5 mg/dl). Moreover, markers for nephrotic syndrome were found: proteinuria 500 mg/dl in the general urinalysis with active urinary sediment, proteinuria 9 g in the daily urine sample, hypoproteinemia and hypoalbuminemia. The ANA (antinuclear antibodies) value was 3.5 IU/ml (N <1), and dsDNA (double strand DNA) was 451 IU/ml (N <15); no ANCA (anti-neutrophil cytoplasmic antibodies) or antikardiolipin antibodies were found. After analysis of the test results, the patient was diagnosed with SLE with renal involvement. Glucocorticosteroid therapy was introduced: 3 pulses of Solu-Medrol, 500 mg i.v. were administered. The patient was qualified for kidney biopsy, followed by a complication: a hemorrhage controlled by endovascular treatment. A tissue sample for histopathological examination could not be obtained. Further observation revealed sudden worsening of the renal function associated with exacerbation of nephrotic syndrome: oliguria and massive peripheral edema occurred, resulting in an increase in the body weight by 10 kg. The treatment was intensified: 3 pulses of Solu-Medrol, 1,000 mg each, were administered, then the patient received Encorton at a dose of 60 mg p.o., loop diuretic in continuous infusion, and albumins. Due to the lack of clinical improvement, a decision was made to introduce therapeutic plasma exchange. A total of five plasmaphereses was performed, resulting in a reduction of nitrogen retention parameters: creatinine concentration decreased from 3.2 to 1.4 mg/dl and urea concentration decreased from 175 to 120 mg/dl, with preservation of diuresis of approx. 2.5 l/day. During hospitalization a complication was observed: herpes simplex virus (HSV) infection. A thoracic HRCT (high resolution computed tomography) examination revealed fluid in both pleural cavities and parenchymal densities in the left lung. The patient received levofloxacin, with good results. Further, immunosuppressive treatment

was planned following the Euro-Lupus regimen (6 infusions of cyclophosphamide, 500 mg each, in 2-week intervals), and continuation of prednisone at a dose of 60 mg p.o. The patient received subsequent infusions of the immunosuppressant, while the steroid doses were gradually reduced. Hydroxychloroquine was introduced to the treatment. Having received all the courses of cyclophosphamide, the patient started receiving mofetil mycophenolate, initially at a dose of 2,000 mg, then 3,000 mg. The patient remains under supervision of the Nephrology Clinic. She is in a good general condition, and has resumed her normal activities. Proteinuria persisted at a level of 500 mg/dl.

Discussion

In the discussed case we present difficulties in the treatment of nephropathy in the course of SLE. The patient experienced sudden deterioration of the renal function, which could have been due to complications after DRB or progression of the disease. Complications after the biopsy resulted in a serious risk of kidney loss. Despite intensive immunosuppressive treatment, the patient's condition deteriorated, which led to the decision to perform therapeutic plasma exchange. Indications for plasmapheresis in SLE include: lupus nephropathy resistant to conventional treatment, capillaritis (*capillaritides*), neurolupus, rapidly progressing glomerular nephritis, lupus carditis, thrombotic thrombocytopenic purpura (TTP), catastrophic antiphospholipid syndrome, hyperviscosity syndrome, cryoglobulinaemia, prevention of complete congenital heart block (anti-Ro (SSA) syndrome) and vasculitis in SLE [4]. The subject literature provides a report of a patient with acute lupus nephropathy who did not react to standard glucocorticosteroid and cyclophosphamide treatment. Introducing plasmapheresis to the therapy resulted in spectacular improvement [5]. Lewis et al. demonstrated in a randomized study that adding TPE to the therapy not only did not improve the patients' condition, but even resulted in deterioration [6], although a shortcoming of that study was oral administration of cyclophosphamide. According to another researcher, Schroeder, plasmapheresis should be followed by intravenous administration of cyclophosphamide [7]. Cyclophosphamide causes immunosuppression of lymphocytes B, and as a consequence autoantibodies are not produced in excessive quantities after their eradication due to plasmaphereses (the rebound effect). In the discussed case, the treatment was modified in that five plasmaphereses were performed due to a lack of response to intravenous glucocorticosteroids. Remission was obtained, and the results suggest that plasmapheresis, not glucocorticosteroid, contributed

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most to the improvement of the patient's condition. Therefore, the benefits of plasmapheresis in the treatment of lupus nephropathy resistant to standard therapy should be considered.

Conclusion

Plasmapheresis is increasingly often used in the treatment of lupus nephropathy resistant to conventional therapy. However, adverse reactions resulting from serious immunological disorders should be taken into account.

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Exposure to continuous noise as produced by wheeled and tracked fighting vehicles

Hałas ustalony wytwarzany w kołowych i gąsiennicowych pojazdach bojowych

Rafał Młyński¹, Emil Kozłowski¹, Jacek Usowski², Dariusz Jurkiewicz²

¹Central Institute for Labour Protection — National Research Institute in Warsaw; head: Prof. Danuta Koradecka MD, PhD

²Department of Otorhinolaryngology in the Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine; head: Prof. Dariusz Jurkiewicz MD, PhD

Abstract. The exposure of soldiers to noise during their military service involves both exposure to impulse and continuous noise. The main source of continuous noise is the engine and transmission units of fighting vehicles. The aim of this study was to evaluate exposure to continuous noise inside selected fighting vehicles used by the Polish Armed Forces. Four vehicles: two wheeled and two tracked, were included in the study. The study showed that, especially inside the tracked vehicles, the equivalent A-weighted sound pressure level was high, reaching 108 db. In such circumstances, the duration of vehicle crew exposure to noise must be significantly reduced or effective hearing protection must be used. The infrasound analysis also showed greater exposure to noise in wheeled vehicles.

Key words: noise, infrasonic noise, fighting vehicles, noise exposure

Streszczenie. Narażenie żołnierzy na hałas w trakcie służby wojskowej związane jest nie tylko z ekspozycją na impulsy, ale również na hałas ustalony. Źródłem hałasu ustalonego jest przede wszystkim praca silnika oraz zespołu przeniesienia napędu pojazdów bojowych. Celem niniejszej pracy była ocena narażenia na hałas ustalony we wnętrzach przykładowych pojazdów bojowych użytkowanych przez Siły Zbrojne RP. W badaniach uwzględniono cztery pojazdy, w tym dwa z podwoziem kołowym i dwa z podwoziem gąsiennicowym. Przeprowadzone badania wskazały, że zwłaszcza we wnętrzach pojazdów gąsiennicowych występowały duże, sięgające 108 dB, wartości równoważnego poziomu dźwięku A. W takich warunkach czas ekspozycji członków załogi na hałas musi być istotnie ograniczony lub należy stosować skuteczne ochrony słuchu. Natomiast analiza przeprowadzona dla hałasu infradźwiękowego wykazała, że większe narażenie występuje w przypadku pojazdów o podwoziu kołowym.

Słowa kluczowe: hałas, hałas infradźwiękowy, pojazdy bojowe, ekspozycja na hałas

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Corresponding author

Rafał Młyński, PhD Eng.

Central Institute for Labour Protection — National Research Institute, Vibration Hazard Institute

16 Czerniakowska St., 00-701 Warsaw

telephone: +48 22 6233 293

E-mail: rmlynski@ciop.pl

Introduction

The adverse effects of noise on human health may result in the loss of hearing, but it may also reduce the ability to perform certain activities and increase the risk of accidents while executing tasks due to deteriorated reception of useful sound signals. In the presence of noise, it is therefore possible to experience difficulties in the perception of warning signals, determining of a sound source or verbal communication.

The noise to which soldiers are exposed during their military service encompasses not only impulse noise generated by the use of firearms or by explosions

caused by various munitions [1], it also includes the continuous noise that is produced in their environment, especially inside combat vehicles. Beside the impulse noise, soldiers are exposed to continuous noise, especially low-frequency noise. Noise having a substantial part of the acoustic energy at low frequencies may cause balance organ disorders or resonance in the internal organs [2] as well as other conditions. Low-frequency noise can also result in excessive fatigue, discomfort, increased drowsiness and reduced psychomotor capabilities [2, 3].

In terms of military service, continuous noise affects soldiers mainly inside combat vehicles. The source of

the noise is the operation of the engine and the transmission. The scarce literature devoted to this topic indicates that inside the combat vehicles used in the Canadian and British armies, the A-weighted equivalent sound pressure level may be in the region of 96-115 dB [4, 5].

The aim of this study was to assess the level of exposure to continuous noise inside selected wheeled and tracked fighting vehicles used by the Armed Forces of the Republic of Poland.

Object of study

The study involved four combat vehicles. Two of them were wheeled vehicles (Rosomak armored modular vehicle and Dana self-propelled howitzer), and the other two were tracked vehicles (BWP-1 infantry fighting vehicle and BLG-67 armored bridge launcher). The studies focused on the different positions used for operating each vehicle, see Table 1.

Pictures of the vehicles used in the study, along with an indication of the measurement locations in each vehicle, are shown in Figures 1-4.

Research methodology

The study comprised measuring the parameters of continuous noise and assessing exposure to noise conducted on the basis of a comparison between the values determined in those measurements and the criterion values. The assessment of the exposure of the vehicle users to noise in the range of audible frequencies was conducted according to the Exposure Limit Values applicable in Poland. These are determined in the regulation of the Minister of Labour and Social Policy of 6 June 2014 on the maximum permissible concentrations and current concentration and intensity of harmful factors in the work environment [6]. In the case of the exposure to infrasonic noise, the assessment was carried out on the basis of the annoyance criterion values defined in the standard: PN-Z-01 338:2010 [7].

Table 1. Fighting vehicle measurement locations
Tabela 1. Miejsca przeprowadzania pomiarów w poszczególnych wozach bojowych

Type of vehicle	Point of measurement
Rosomak armored modular vehicle.	commander's compartment
	driver's compartment
	infantry squad's compartment
Dana self-propelled howitzer	driver's compartment – left seat
	driver's compartment – right seat
	gun aimer's compartment – left booth
	gun aimer's compartment – right booth
BWP-1 infantry fighting vehicle	commander's compartment
	gunner's compartment
	infantry squad's compartment
BLG-67 armored bridge launcher	commander's compartment
	driver's compartment

Since 2009, the list of Exposure Limit Values does not include infrasonic noise as a result of the decision of the Inter-ministerial Committee for the Maximum Permissible Concentrations and Intensities of Harmful Factors in the Working Environment. It stated namely that the Exposure Limit Values for infrasonic noise which had been in force until then (102 dB) represented only the threshold value of auditory perception of infrasound, and not the threshold value of harm, whereas no criterion of harm was established [8]. Exposure Limit Values for noise referred to in the regulation of the Minister of Labour and Social Policy [6] are as follows:

- 85 dB for the level of exposure in respect of 8-hour daily working time ($L_{EX\ 8h}$). This parameter is determined on the basis of A-weighted equivalent sound pressure level (L_{Aeq}) and the total duration of noise exposure,
- 115 dB for A-weighted maximum sound pressure level (L_{Amax}),
- 135 dB for C-weighted peak sound pressure level (L_{Cpeak}).

The annoyance criterion for infrasonic noise according to PN-Z-01 338:2010 [7] is 102 dB for the equivalent acoustic G-weighted instantaneous noise pressure level, applied to the 8-hour working time ($L_{Geq,8h}$). This parameter is determined on the basis of G-weighted equivalent sound pressure levels (L_{Geq}) and the total duration of noise exposure.

In order to assess the noise exposure inside fighting vehicles, it was therefore necessary to measure the following parameters which characterize this noise:

- A-weighted equivalent sound pressure level (L_{Aeq}),
- A-weighted maximum sound pressure level (L_{Amax}),
- C-weighted peak sound pressure level (L_{Cpeak}),
- G-weighted equivalent sound pressure level (L_{Geq}).



Figure 1 Measurement locations inside the Rosomak armored modular vehicle: 1 – driver's compartment, 2 – commander's compartment, 3 – infantry squad's compartment

Rycina 1. Usytuowanie punktów pomiarowych w kołowym transporterze opancerzonym Rosomak: 1 - komora kierowcy, 2 - komora dowódcy, 3 - przedział desantu



Figure 3 Measurement locations inside the BWP-1 infantry fighting vehicle: 1 - commander's compartment, 2 - gunner's compartment, 3 - infantry's compartment

Rycina 3. Usytuowanie punktów pomiarowych w bojowym wozie piechoty BWP-1: 1 - komora dowódcy, 2 - komora działonowego, 3 - przedział desantu

The next step in the study was to determine the distribution of sound pressure components constituting the range of noise frequencies in the vehicles. For this purpose, the measurements of sound pressure level were conducted in one-third-octave bands.

Measurements of the quantities listed were carried out in accordance with the measurement standards for the noise parameter at work [7, 9] in conditions common for the given operating position when driving in training areas, on a dry ground surface, at a typical average driving speed for each vehicle.



Figure 2 Measurement locations inside the Dana self-propelled howitzer: 1 - driver's compartment, 2 - gunner's compartment

Rycina 2. Usytuowanie punktów pomiarowych w armatohaubicy Dana: 1 - kabina kierowcy, 2 - kabina celowniczego



Figure 4 Measurement locations inside the BLG-67 armored bridge launcher: 1 - commander's compartment, 2 - driver's compartment

Rycina 4. Usytuowanie punktów pomiarowych w czołgu mostowym BLG-67: 1 - komora dowódcy, 2 - komora kierowcy

Measurement equipment

Measurements of the noise parameters were carried out by the means of Gras 40AN microphones installed simultaneously in different places in each of the vehicles. Measurement data acquisition was carried out by the means of 3560-C Bruel & Kjaer PULSE measuring tape, controlled by a laptop computer with specialist Bruel & Kjaer LabShop software. For calibration of measuring circuits, a Bruel & Kjaer 4231 calibrator was employed.

Table 2. Values of A-weighted equivalent sound pressure level (L_{Aeq}), A-weighted maximum sound pressure level (L_{Amax}), C-weighted peak sound pressure level (L_{Cpeak}) and G-weighted equivalent sound pressure level (L_{Geq}), for individual crew stations
Tabela 2. Wartości równoważnego poziomu dźwięku A (L_{Aeq}), maksymalnego poziomu dźwięku A (L_{Amax}), szczytowego poziomu dźwięku C (L_{Cpeak}) oraz równoważnego poziomu dźwięku G (L_{Geq}) dla poszczególnych stanowisk obsługi

Measurement conditions		L_{Aeq}	L_{Amax}	L_{Cpeak}	L_{Geq}
Type of vehicle	Crew station	dB			
Rosomak armored modular vehicle.	commander's compartment	80.1	96.3	127.1	117.2
	driver's compartment	85.5	91.6	133.1	127.2
	infantry squad's compartment	82.7	90.3	131.7	125.1
Dana self-propelled howitzer	driver's compartment — left seat	87.5	90.0	121.1	115.6
	driver's compartment — right seat	84.1	87.2	122.6	116.6
	gun aimer's compartment — booth 1	83.0	90.3	121.0	108.2
	gun aimer's compartment — booth 2	82.1	89.6	120.2	108.6
	commander's compartment	108.0	111.3	142.0	112.1
	gunner's compartment	103.3	109.3	137.3	109.1
	infantry squad's compartment	106.1	110.2	136.5	110.0
BLG-67 armored bridge launcher	commander's compartment	101.3	105.7	129.9	111.8
	driver's compartment	102.3	106.9	128.6	112.5

Tests results

The results obtained for A-weighted equivalent sound pressure level (L_{Aeq}), A-weighted maximum sound pressure level (L_{Amax}), C-weighted peak sound pressure level (L_{Cpeak}) and G-weighted equivalent sound pressure level (L_{Geq}) for individual crew stations are presented in Table 2. Figure 5 shows the sound pressure levels measured in these crew stations in the third-octave bands, in the frequency range of 0.8-20 000 Hz.

On the basis of the values presented in Table 2, it can be concluded that the highest sound levels were observed while driving the BWP-1 infantry fighting vehicle and BLG-67 armored bridge launcher. The A-weighted equivalent sound pressure level measured at the crew stations of these vehicles exceeded 100 dB. In the case of the Rosomak armored modular vehicle and the Dana self-propelled howitzer, this level did not

exceed 90 dB. In the analysis of the data compiled in Table 2, it should be noted that the limit value for the A-weighted maximum sound level A (115 dB) was not exceeded in any of the crew stations studied. The C-weighted peak sound level (135 dB), however, was exceeded inside the BWP-1 infantry fighting vehicle.

With regard to infrasonic noise, large values of the G-weighted equivalent sound level can be observed in all the crew stations, especially in the case of the Rosomak armored modular vehicle (sound level exceeding 127 dB).

Since large values of both A-weighted and G-weighted equivalent sound levels were detected, the maximum exposure duration for particular crew stations was established at a suitable level in order not to exceed the criteria (Exposure Limit Value and annoyance criterion). The defined maximum exposure duration values are presented in Table 3. Upon analyzing the data, it was noted that exceeding the Exposure Limit Value in respect of 8-hour daily working time ($L_{EX,8h}$) occurred after an exposure duration of a mere 2-7 minutes in the case of the crew of the BWP-1 infantry fighting vehicle. The crew of BLG-67 armored bridge launcher should spend a similarly brief time in the running vehicle without hearing protection so as not to exceed the limit value (maximum exposure duration is 9-11 minutes). In the case of the crew stations of the Rosomak armored modular vehicle and Dana self-propelled howitzer, the level of A-weighted equivalent sound is significantly lower. As a result, in most crew stations the limit value $L_{EX,8h}$ is not exceeded despite driving for 8 hours, with the exception of the commander of the Rosomak armored modular vehicle (maximum exposure duration 428 minutes) and the driver of the Dana self-propelled howitzer (maximum exposure duration 270 minutes).

The data presented in Table 3 also show that the crew members of the Rosomak may operate the vehicle for only 1-14 minutes, depending on the station, without exceeding the annoyance criterion of infrasonic noise. In the case of the BWP-1 infantry fighting vehicle, the exposure duration may be longer, and depending on the crew station this may amount to 47-94 minutes.

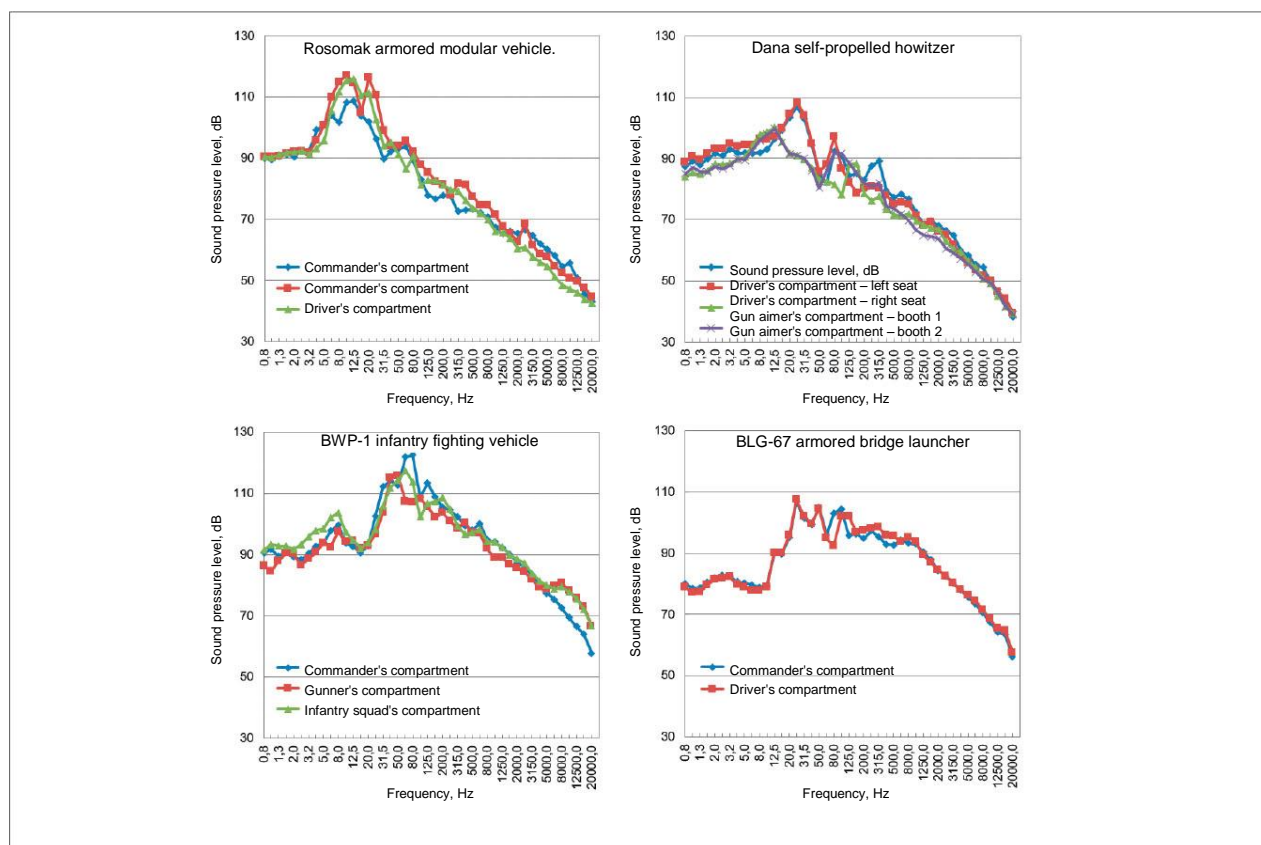


Figure 5 1/3 octave band sound pressure level measured inside vehicles in motion

Rycina 5. Poziom ciśnienia akustycznego w pasmach 1/3- oktaowych zmierzony we wnętrzach jadących pojazdów

Depending on the location of the crew station inside the vehicle, a given crew member may remain in the driven vehicle for 21 minutes (driver's compartment) or 115 minutes (gun aimer's compartment) maximum. Inside the BLG-67 armored bridge launcher, the duration of exposure to low-frequency noise should not exceed 43-50 minutes.

Upon analyzing the sound pressure level in the third-octave measured at the vehicle crew stations [Figure 5], it can be observed that the noise spectrum for the BWP-1 infantry fighting vehicle has the largest values (approx. 100-110 dB), ranging from 31.5 to 125 Hz. Similar sound pressure level values, yet in a smaller frequency range (6.3-25 Hz), may be observed in the Rosomak armored modular vehicle. This frequency range substantially affects the value of the G-weighted equivalent sound level, which can be seen in the values of this parameter compiled in Table 2. (117.2-127.2 dB). Similarly, in the low frequency range (5-25 Hz) the highest levels may be observed in the third-octave band at the gun aimer's station for the Dana self-propelled howitzer (90-100 dB). However, the maximum level in the driver compartment

moves to the higher frequency range (16-31.5 Hz). The noise spectrum measured in the BLG-67 armored bridge launcher's commander's and the driver's compartment is characterized by high sound pressure levels (90-110 dB) in a wide range of frequencies (12.5-1000 Hz).

Conclusion

Studies carried out inside combat vehicles have shown that the duration exposure of the crew members to noise must be substantially restricted in the case of tracked vehicles in order not to exceed the noise exposure levels in the audible frequency range. An opposite trend has been observed in respect of infrasonic noise, as wheeled vehicles exhibit greater exposure to such noise. For instance, the noise exposure duration for the crew of the Rosomak armored modular vehicle should be limited to single minutes to avoid exceeding the annoyance criterion.

Table 3. Maximum exposure duration with neither Exposure Limit Value nor annoyance criterion exceeded. "-" means that if assessed according to the $L_{EX,8h}$ parameter value, 8-hour duration of exposure in station is allowable
Tabela 3. Maksymalny czas ekspozycji bez przekroczenia kryterium NDN lub kryterium uciążliwości. Znak "-"
oznacza, że w przypadku oceny ze względu na wartość parametru $L_{EX,8h}$ dopuszczalna jest ekspozycja na hałas obecny na stanowisku obsługi trwająca 8 godzin

Measurement conditions		Criterion $L_{EX,8h}$	Criterion $L_{Gen,8h}$
Type of vehicle	Crew station	Maximum total duration of exposure	
		Min.	
Rosomak armored modular vehicle.	commander's compartment	-	14
	driver's compartment	428	1
	infantry squad's compartment	-	2
	driver's compartment – left seat	270	21
Dana self-propelled howitzer	driver's compartment – right seat	-	17
	gun	-	115
	gun aimer's compartment – booth 1	-	105
	gun aimer's compartment – booth 2	-	105
BWP-1 infantry fighting vehicle	commander's compartment	2	47
	gunner's compartment	7	94
	infantry squad's compartment	4	76
BLG-67 armored bridge launcher	commander's compartment	11	50
	driver's compartment	9	43

The conditions on the training grounds also need to be taken into consideration, as combat vehicle crews are often exposed to impulse noise generated by firearms. This leads primarily to high levels of noise parameters related to the instantaneous sound pressure values of the L_{Amax} and L_{Cpeak} pulses – and hence much higher values than outlined in this work.

Although noise in the range of audible frequencies may be limited thanks to tank crew helmets or hearing protection, it is important to note that these do not limit the noise in the lowest frequency range, and therefore the use of this type of protection is not an effective way of reducing exposure to infrasonic noise. It is therefore

necessary to explore other ways to reduce noise exposure in combat vehicles, such as the use of vibration isolation or soundproofing mats.

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Cardiopulmonary exercise test in estimating exercise capacity in heart failures with preserved ejection fraction

Ergospirometria w ocenie wydolności fizycznej chorych z niewydolnością serca z zachowaną frakcją wyrzutową

Małgorzata Kurpaska, Paweł Krześciński, Agnieszka Jurek, Adam Stańczyk, Katarzyna Piotrowicz, Robert Wierzbowski, Grzegorz Gielera

Department of Cardiology and Internal Diseases, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine, Warsaw, Poland; head: Assoc. Prof. Andrzej Skrobowski MD, PhD

Abstract. Heart failure with preserved ejection fraction (HFpEF) poses a major problem to modern cardiology. Diagnosis of this disease is not always easy and clear; therefore it is essential to find diagnostic tools sufficient to objectivize initial clinical recognition. Cardiopulmonary exercise testing (CPET) becomes very useful both for diagnosing and for evaluating the prognosis and treatment of HFpEF patients. The patients' complaints are objectivized by the assessment of ability in terms of physical activity (exercise capacity) and related cardiovascular and respiratory response. Moreover, the complaints are objectivized by the assessment of stress electrocardiogram, a method also helpful in planning cardiac rehabilitation. The value of CPET is confirmed by its correlation with other non-invasive methods of assessment of left ventricle function (i.e. echocardiography and magnetic resonance imaging). The results of the studies indicate the usefulness of this method in identifying those patients with subclinical cardiac dysfunction. The aim of this paper is to present the usefulness of CPET in the clinical assessment of HFpEF patients, with particular emphasis on its prognostic value.

Keywords: cardiopulmonary exercise testing, heart failure with preserved ejection fraction, arterial hypertension, exercise capacity

Streszczenie. Niewydolność serca z zachowaną frakcją wyrzutową (HFpEF) stanowi coraz większy problem współczesnej kardiologii. Ustalenie rozpoznania tej jednostki chorobowej nie zawsze jest proste i jednoznaczne, dlatego ze wszech miar pożądane jest poszukiwanie narzędzi diagnostycznych obiektywizujących wstępną ocenę kliniczną. Badaniem bardzo przydatnym w diagnostyce, a zwłaszcza w ocenie rokowania oraz efektów leczenia w grupie chorych z HFpEF, staje się ergospirometria (CPET). Ocena zdolności do wykonania wysiłku fizycznego (wydolności fizycznej), związanej z nim odpowiedzi układu krążenia i oddechowego, uzupełnionej o ocenę wysiłkowego zapisu elektrokardiograficznego pozwala obiektywizować zgłaszane dolegliwości. Metoda ta ułatwia również planowanie rehabilitacji kardiologicznej. Jej wartość potwierdza powiązanie z innymi nieinwazyjnymi metodami oceny funkcji lewej komory (m.in. badaniem echokardiograficznym i metodą rezonansu magnetycznego). Szczególnie zachęcające są wyniki badań wskazujące na przydatność tej metody w identyfikacji chorych z subkliniczną dysfunkcją układu krążenia. Celem pracy jest prezentacja przydatności CPET w ocenie klinicznej chorych z HFpEF i zagrożonych jej wystąpieniem, ze szczególnym uwzględnieniem jej wartości rokowniczej.

Słowa kluczowe: ergospirometria, niewydolność serca z zachowaną frakcją wyrzutową, nadciśnienie tętnicze, wydolność fizyczna

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Corresponding author

Małgorzata Kurpaska MD

Department of Internal Diseases and Hematology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine

128 Szaserów St., 04-141 Warsaw, Poland

telephone/fax: +48 22261 816 389

e-mail: mkurpaska@wim.mil.pl

Heart failure with preserved ejection fraction – clinical problem and diagnosis

The 2012 guidelines from the European Society of Cardiology (ESC) [1] defines heart failure (HF) more precisely as "heart failure with preserved ejection fraction" (HFpEF). This diagnosis is made in symptomatic patients with preserved ejection fraction (EF >45-50%), and confirmed structural and functional cardiac abnormalities (left ventricular hypertrophy, left atrial dilation, diastolic dysfunction). A total of 1-2% of the adult population in developed countries suffer from HF, and half of this group are patients with HFpEF [1]. The incidence and the frequency of HF are still on the increase, which is related to changes in the demographic structure of developing societies as well as to the increasing effectiveness of therapies for acute coronary syndromes and arterial hypertension in elderly patients. In the Polish population of people over 65 years old consulting their general practitioners, HF was diagnosed in 53% of cases, of which 39% were classified as class II or IV according to the New York Heart Association (NYHA) functional classification [2].

Poor quality of life and exacerbation of clinical condition requiring hospitalization in HFpEF patients are as frequent as heart failures with reduced ejection fraction (HFrEF) [3-6]. Although the prognosis in HFpEF is better, annual mortality is still very high (HFpEF 5-8%, HFrEF 10-15%) [7], and despite the fact that the disease is increasingly diagnosed in the early stages of left ventricular diastolic dysfunction, response to treatment is often unsatisfactory [8, 9]. Therefore, HFpEF requires a particular engagement and individualization for the diagnostic and therapeutic process.

Accurate HFpEF diagnosis, particularly in its initial stage, is often difficult, mostly due to the non-specific character of the symptoms, such as reduced tolerance to effort or increased fatigue. They are often explained by age, obesity or motor organ dysfunctions. More specific symptoms include dyspnea and peripheral edema, which can help to facilitate diagnosis, particularly in the case of comorbid cardiovascular diseases such as arterial hypertension or atrial fibrillation [1]. A simple tool that enables a controlled evaluation of exercise capacity and of the relationship between the symptoms and effort is the 6-minute walk test. It allows one to assess exercise capacity and adaptation to daily activities, both in patients with cardiac diseases [10, 11] and with pulmonary diseases [12]; however, it does not provide information about the etiology of the reported symptoms. The cardiopulmonary exercise test (CPX/CPET) is a

more detailed diagnostic method to assess exercise capacity and to diagnose dyspnea as well as to differentiate the pulmonary and cardiological causes. Moreover, with an already determined HF diagnosis, CPET facilitates the assessment of the degree of disease advancement, as well as monitoring the treatment and prognosis.

The aim of this paper is to evaluate the usefulness of CPET for the clinical evaluation of patients with HFpEF or at risk of HFpEF, with particular focus on the principles of test performance and interpretation, as well as on its prognostic value.

Cardiopulmonary exercise test – methodology

The cardiopulmonary exercise test enables the comprehensive and simultaneous assessment of how the cardiovascular, respiratory and musculoskeletal system as well as systemic metabolism react to physical effort. It combines a standard exercise test with respiratory gas analysis. Before each test, a resting spirometry is performed to assess any possible respiratory tract obstruction. Forced expiratory volume in 1 second (FEV₁), vital capacity (VC) and forced vital capacity (FVC) are measured, and the FEV₁/VC or FEV₁/FVC ratio is calculated. Next, the patient performs a controlled exercise, during which the following are monitored: clinical condition, arterial blood pressure, cardiac activity, changes in ST segment in the electrocardiogram, arrhythmias and conductivity disorders, arterial blood hemoglobin oxygen saturation measured by pulse oximetry (SpO₂) and respiratory gas analysis. According to the European Association for Cardiovascular Prevention and Rehabilitation / American Heart Association (EACPR/AHA) [13] particularly important is the assessment of maximum oxygen consumption during exercise (peak VO₂, increased exercise ventilatory efficiency (VE/CO₂ slope), exercise oscillatory breathing (EOB), indicator of ventilation and perfusion in the pulmonary bed (P_{ET}CO₂), anaerobic threshold (AT) and the difference between the maximum heart rate and heart rate recovery after one minute (HRR1, Tab. 1, Fig. 1). The figure presents a sample test result for a 47-year-old male with arterial hypertension, reporting a non-specific limitation in exercise tolerance. The parameters of resting spirometry were normal.

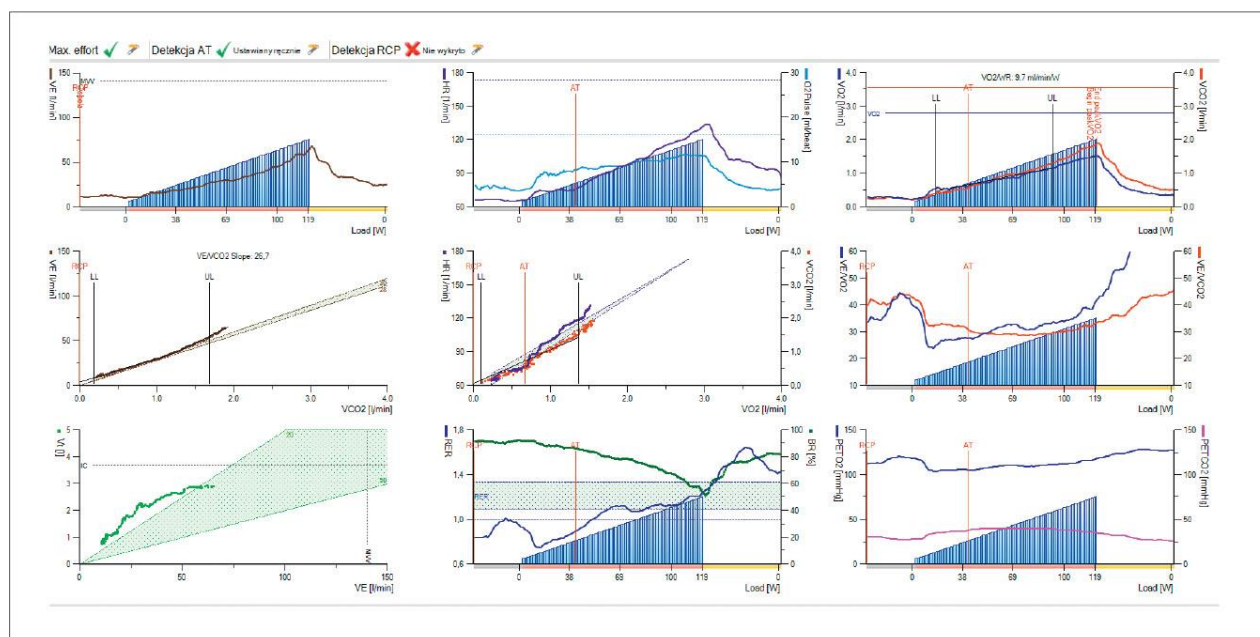


Figure 1. Model test result for a 47-year-old male with hypertension and a non-specific, reduced exercise capacity (echocardiography without significant abnormalities)

Rycina 1. Przykładowy wynik badania wykonanego u 47-letniego mężczyzny z nadciśnieniem tętniczym, zgłaszającego niespecyficzne ograniczenie tolerancji wysiłku (w badaniu echokardiograficznym bez istotnych nieprawidłowości)

The exercise test was performed using a cycle ergometer following the ramp protocol, with a load increase of 20 W/min. The exercise was interrupted at a load of 119 W due to dyspnea. The ECG did not reveal arrhythmia or any changes in the ST segment. Good exercise load (RER 1.23), reduced peak VO_2 (16.9 ml/min/kg bw – 54% of the predicted value [chart 3], AT (7.6 ml/min/kg bw – 45% of the maximum value [chart 3]) and pulse O_2 (11.5 ml/beat – 70% of the predicted value [chart 2]) and a reduced chronotropic response (76% of the heart rate limit) were observed. The result indicates a moderate reduction in exercise tolerance.

Cardiopulmonary exercise test and estimation of exercise capacity in heart failure

Exercise capacity is the ability to sustain heavy or prolonged exercise involving large muscle groups, without significant changes in the homeostasis, characterized by a prompt recovery to the resting values of the physiological indicators after the end of the exercise [15]. This depends on age, sex, fitness, condition of health and medications used [16]. To estimate exercise capacity, the following cardiopulmonary parameters are used:

- peak VO_2

- VO_2 obtained at AT,
- performed work rate, expressed in metabolic equivalents (METs) and in watts (W),
- obtained load relative to applied work (%).

Metabolic equivalent is a unit for resting oxygen intake (approx. 3.5 ml O_2 /kg bw/min), equivalent to O_2 consumption at rest. The oxygen uptake to work rate relationship (VO_2/WR) is an objective indicator, independent of factors like age, sex and height. Its reduction is a sign of essential cardiac disease, e.g. severe HF. Due to the limitations associated with chronic diseases, patients frequently end the exercise test before reaching maximum VO_2 (max VO_2), so estimation based on peak VO_2 is preferred [14]. This measurement is considered an objective prognostic indicator in HF, especially useful in establishing indications for heart transplantation. They include peak VO_2 <14 ml/kg bw/min in patients who do not receive beta blockers, and <12 ml/kg bw/min in those treated with beta blockers [17].

The cardiopulmonary exercise test also plays an important role in qualification for rehabilitation programs and monitoring the effects of cardiological rehabilitation in HF patients. CPET enables determination of optimal exercise intensity, which should correspond to a load resulting in an oxygen consumption rate of 40-70% of the max VO_2 [18].

Table 1. Clinical usefulness of selected parameters of CPET**Tabela 1. Przydatność kliniczna wybranych parametrów ergospirometrycznych [14]**

Parameter	Interpretation
peak VO_2 – peak oxygen consumption	Measurement of maximum cardiac output, identification of abnormal exercise tolerance, prognostic indicator; the lower the value, the worse the prognosis.
VO_2/WR – relationship between VO_2 and work rate	Reflects participation of oxygen metabolism in performing exercise; a low value suggests high participation of anaerobic mechanisms, occurring in patients with a significant cardiovascular dysfunction, while a normal value suggests a non-cardiological cause of dyspnea.
RER – respiratory exchange ratio	RER >1.0 is a sign of performing maximum exercise
AT, VAT – anaerobic threshold, ventilatory anaerobic threshold	A theoretical point where metabolism in the muscles is supported by anaerobic metabolic processes; indicator of capacity, useful in planning and monitoring of physical training results.
HR – heart rate	Measurement of cardiac output; interpretation of the test – performing maximum exercise, rapid increase – cardiac disease, poor physical fitness, anxiety; no increase – medications, sinus node insufficiency
HRR1 (heart rate recovery) – difference between heart rate at peak exercise and after 1 minute recovery	Reduction in the heart rhythm following exercise, depends on activation of the sympathetic and parasympathetic system: a prognostic factor
O_2Pulse (VO_2/HR) – oxygen pulse	Indicator of estimated stroke volume during exercise; reduction suggests deterioration in physical fitness, cardiovascular or pulmonary diseases
VE/VO_2 – ventilatory equivalent ratio for oxygen	Measurement of minute ventilation from which a liter of oxygen is extracted at a given stage of the exercise; no increase is observed in chronic obstructive pulmonary disease, gigantic obesity, for example
VE/VCO_2 – ventilatory equivalent ratio for carbon dioxide	Measurement of minute ventilation necessary to remove a liter of carbon dioxide; increase is observed in the case of heart failure: a prognostic factor
VE/VCO_2 slope – indicator of increased exercise ventilation	Slope of a line illustrating the relationship between VE and VCO_2 ; increase is observed in parasympathetic hyperactivation, hyperventilation, exercise ischemia, or advanced heart failure: a prognostic factor
OUES – oxygen uptake efficiency slope	Measurement of respiratory response to physical exercise, absolute VO_2 increase associated with 10-fold increase in ventilation; a prognostic factor, independent of the intensity of exercise, integrates evaluation of the cardiovascular, respiratory and musculoskeletal systems
$\text{P}_{\text{ET}}\text{CO}_2$ – end-tidal carbon dioxide partial pressure	Measurement of adequacy of ventilation and perfusion; reduction observed in hyperventilation, increase during ventilation of a large dead space: a prognostic factor

In several studies, regular physical effort provided an improvement in peak VO_2 and quality of life in patients with HFpEF and limited exercise tolerance. However, no improvement in diastolic function was observed [19, 20]. The results suggest that physical exercise may have beneficial effects due to mechanisms independent of the left ventricular function [20], and CPET enables objectivization of the scale of this effect.

Cardiopulmonary exercise test and estimation of prognosis in heart failure

The usefulness of CPET in patients with reduced EF is well-documented, both in diagnostics, therapy planning, qualification for heart transplantation, and in monitoring of treatment effects [21]. Studies regarding HFpEF patients are less numerous; however, the obtained data allow one to consider CPET a valuable and noteworthy diagnostic test. Scott et al. [22] indicate that the method is characterized by good repeatability, while Garcia et al. [23] demonstrate that abnormal CPET results

(significantly reduced peak VO_2 and VO_2/HR ratio, as well as increased VE/VCO_2 slope and HRR) distinguish patients with HFpEF from the healthy population.

Considering that in recent years the quality of treatment and survival of HFrEF patients have been improving, and that the chances of HFpEF patients remain unchanged [4], prognostic estimation in this group gains particular importance. The cardiopulmonary exercise test is becoming an increasingly useful method. It appears that HFpEF patients do not obtain better CPET results than the patients with reduced EF [5, 24, 25]. Comparative analysis between patients with HFpEF and HFrEF revealed that at similar VO_2 and VE/VCO_2 slope values they also demonstrated similar intensity of symptoms and NTproBNP concentrations [26]. Therefore, the prognosis of patients with diastolic dysfunction based on CPET is classified according to the same criteria as in patients with HFrEF [1]. Currently, the following criteria are considered good prognostics:

- peak VO_2 of at least 20 ml/kg bw/min,
- VE/VCO_2 slope <30,
- resting P_{ETCO_2} of at least 33 mm Hg,
- HRR1 >12 beats/min,
- no oscillatory ventilation (EOB) [13].

However, the prognostic value of individual spiroergometric parameters in HFpEF may vary from that in HFrEF, due to significant pathophysiological differences. Guazzi et al. [27] conducted a comparative study comparing the prognostic values of CPET in patients with HFpEF and HFrEF. It appeared that in both groups peak VO_2 and VE/VCO_2 were of prognostic value; nevertheless, patients with HFpEF were characterized by a higher VE/VCO_2 slope value, and higher peak VO_2 . VE/VCO_2 slope appeared to be a stronger predictor of cardiovascular events, independent of EF.

Oscillatory ventilation is considered to be another strong predictive factor [28-30]. HFpEF patients with EOB [31] obtained lower peak VO_2 values, higher NYHA class, and their echocardiographic tests showed higher left ventricular filling pressure (higher rate of peak early mitral inflow velocity to mitral annular early diastolic velocity [E/E']) [32]. In these patients, the prognostic value of EOB was superior to that of peak VO_2 , as well as VE/VCO_2 slope [31].

The above ventilatory disorders may be explained by impaired cardiovascular function. Higher VE/VCO_2 slope value and lower peak VO_2 are probably due to increased pressure in the pulmonary vessels, which intensifies particularly during physical effort [26, 33-35].

Cardiopulmonary exercise test and other non-invasive tests

CPET is a relatively new diagnostic method used in HFpEF patients. However, numerous studies confirmed that its results correspond to those obtained with other methods used in the diagnosis of HF patients.

CPET results in HFpEF patients were most frequently compared to echocardiographic assessment [32, 36, 37]. It has been confirmed that indicators of mitral flow assessment (E , E/E') significantly associate with peak VO_2 , VE/VCO_2 slope and P_{ETCO_2} , both at resting and at peak exercise [32]. Promising observations were also made in relation to HRR1 [32, 38]. The HRRK 16/min threshold identified patients with $E/E' > 10$, which correlated with EF and was associated with the intensity of exercise dyspnea [38]. It confirms previous observations regarding higher parasympathetic activation in patients diagnosed with left ventricular diastolic dysfunction [39-41], and its relationship with increased VE/VCO_2 slope and EOB [42]. It should be emphasized that the left ventricular mass and its end-systolic dimension did not correlate with any of the CPET parameters [32].

The usefulness of CPET in the estimation of exercise capacity in the context of cardiac magnetic resonance imaging was evaluated by Malek et al. [43]. The group of patients with non-obstructive hypertrophic cardiomyopathy (with preserved EF) demonstrated a significant correlation between left ventricular peak filling rate (PFR) normalized to left ventricular stroke volume index and peak VO_2 . Such a relationship was not observed for the index of left ventricular mass, EF or the time from the end-systole and PFR normalized to heart rhythm. Holcman et al. [44] demonstrated a negative correlation between right ventricular ejection fraction (RVEF) and depression of the ST segment, VE/VCO_2 and RER in patients with chronic HF. It was also demonstrated that resting RVEF assessed in radioisotope ventriculography correlated with peak VO_2 during maximum exercise [45].

Methods supporting cardiovascular assessment during monitored exercise are still being sought. In a large group of HF patients, Myers et al. [46] demonstrated that simultaneous impedance cardiography (ICG) may be a valuable complement to CPET. Extended hemodynamic assessment of the cardiovascular system response to physical exercise in the context of spiroergometric parameters may support more accurate identification of the causes of reported symptoms, and contribute to the evaluation of cardiovascular events. It was pointed out that peak cardiac index (CI) may have a prognostic value comparable to VO_2 and VE/VCO_2 slope. Palmieri et al.

demonstrated a relationship between echocardiographic markers of diastolic dysfunction and peak CI, identifying it as a prognostic factor of future HFpEF [47].

Cardiovascular dysfunction revealed in CPET is also reflected in NTproBNP concentration, which is increased in HFpEF and in asymptomatic patients with LV diastolic

dysfunction [48, 49]. In HFpEF patients it was demonstrated that higher NTproBNP was associated with lower exercise capacity, shorter exercise time, lower peak VO_2 and AT, and a lower number of obtained METs [50, 51].

Table 2. Comparison of test results in two females with arterial hypertension and normal (Case A) and reduced (Case B) exercise capacity due to HFpEF

Tabela 2. Porównanie wyniku badań dwóch kobiet z nadciśnieniem tętniczym o prawidłowej (Przypadek A) i zmniejszonej (Przypadek B) wydolności fizycznej w przebiegu HFpEF

	Case A	Case B
	47-year-old female patient with arterial hypertension, without symptoms	53-year-old female patient with arterial hypertension, reporting non-specific limitation of exercise tolerance
echocardiography	normal mitral flow	impaired left ventricular muscle relaxation
NTproBNP	91.1 pg/ml	87.6 pg/ml
peak VO_2 – peak oxygen consumption	19.7 ml/min/ kg bw 95% pred.	13.8 ml/min/ kg bw 47% pred.
VO_2/WR – oxygen power indicator	10 ml/min/W	10.3 ml/min/W
RER – respiratory exchange ratio	1.06	1.22
AT, VAT – anaerobic threshold, ventilatory anaerobic threshold	13 ml/min/ kg bw 66% of the peak VO_2 value	9.2 ml/min/ kg bw 67% of the peak VO_2 value
O_2 Pulse – oxygen pulse	11.1 ml 115% pred.	7.0 ml /u d. 54% pred.
HR – heart rate	143 /min 82% of the heart rate limit	147 /min 88% of the heart rate limit
HRR1 – difference between heart rate at peak exercise and after 1 minute recovery	30 /min	20 /min
VE/VO_2 – ventilatory equivalent of oxygen	31.1	35.9
VE/VCO_2 in AT – carbon dioxide equivalent	28.2	28.7
VE/VCO_2 slope – indicator of increased exercise ventilation	25.2	25.2
$\text{P}_{\text{ET}}\text{CO}_2$ – partial pressure of end-tidal CO_2	37	35

AT, VAT – anaerobic threshold, ventilatory anaerobic threshold, HR – heart rate; peak VO_2 – peak oxygen consumption, NTproBNP – N-terminal prohormone of brain natriuretic peptide, RER – respiratory exchange ratio, $\text{P}_{\text{ET}}\text{CO}_2$ – end-tidal carbon dioxide partial pressure, VE/VO_2 – ventilatory equivalent ratio for oxygen, VO_2/WR – relationship between VO_2 and work rate

However, it is emphasized that in HFpEF patients the NTproBNP concentration is lower than in HFrEF [52]. It may be reduced in this group not only due to the less pronounced remodeling of the left ventricle, but also due to frequent coexisting obesity and diabetes [53].

Cardiopulmonary exercise test and arterial hypertension

Arterial hypertension is the main risk factor for HFpEF. Increased arterial pressure contributes to adverse cardiac remodeling (primarily of the left ventricle and left atrium), excessive arterial stiffness and volume load [54]. These phenomena are reflected in CPET. Examples of varied CPET results are presented in Table 2. In the case of a patient with impaired exercise tolerance, reduced peak VO_2 (47% of predicted value) and O_2 pulse (54% of the predicted value) are worth noting. Degraded cardiovascular function is probably due to

disturbed left ventricular function, demonstrated in the echocardiographic test, although NTproBNP concentrations in both cases were similar.

The abnormal reaction of blood pressure to physical exercise, e.g. flat response of the systolic pressure or its decrease during exercise by 20 mm Hg, or its significant increase, especially accompanied by exercise dyspnea, also indicate a cardiovascular disease as an underlying cause of the reported symptoms. Dyspnea accompanied by hypertensive response to exercise (HRE) defined as systolic pressure of >210 mm Hg in men and >190 mmHg in women [55] may be an early symptom of HFpEF [56, 57], and is associated with a higher risk of cardiovascular incidents [58, 59]. Phenomena related to ventricular-vascular coupling disorders, such as increased aortic stiffness, endothelial dysfunction or increased LV mass are believed to cause HRE [60]. In many studies vascular stiffness and systemic vascular resistance were associated with reduced exercise

tolerance [61-64]. It has been observed that in patients with HfPEF, reduced peak VO_2 is more clearly related to aortic compliance than to peripheral vascular resistance [65]. Another indicator of the condition of aorta, aortic distensibility, measured with the CMR, also appeared to correlate with peak VO_2 , both in HFpEF patients and in healthy individuals [66]. Our own study [67] demonstrated in a group of patients with isolated hypertension limiting exercise capacity was associated with increased vascular stiffness (lower total arterial compliance - TAC), higher augmentation index (AI) and central pulse pressure (CPP), as well as with lower cardiac input (CI).

In HFpEF patients, hypertension is frequent and usually precedes the occurrence of symptoms. However, in certain cases the course of the disease is atypical. The LV mass/volume ratio may demonstrate elevated afterload in patients with normal pressure [5]. In such cases CPET can be a perfect tool to identify patients with masked hypertension, who experience pathological elevation in blood pressure only during physical exercise [68-70]. It is particularly important for individualizing therapy and reducing the cardiovascular risk in this group of patients.

Method limitations

It seems that cardiopulmonary exercise test is too rarely used in daily clinical practice. Certainly the reasons include cost of the equipment, relatively high workload and difficulties in interpretation of the results. The test needs to be performed with the utmost care and in strict observance of the rules. For reliable results, the device has to be properly calibrated, and the patient needs to be motivated, as the greatest interpretative difficulties are observed in those patients whose exercise was submaximal, and who did not reach the anaerobic threshold.

Conclusion

Cardiopulmonary exercise test is a diagnostic method and a valuable complement for the clinical evaluation of patients with heart failure. With established significance in the assessment of HFrEF patients, CPET is gaining importance in the diagnostics of HFpEF. Since the test is non-invasive, it can be used at every stage of the disease, and support the diagnosis, objectivization of reported symptoms, and assessment of prognosis and treatment results. It should be emphasized that CPET cannot be used for exclusive diagnosis, as it only completes the diagnostic process. Due to the objectivization of the reported symptoms, further tests are better targeted and facilitate final diagnosis. CPET

appears to be useful in the identification of individuals who may develop HF symptoms in the near future. In HT patients CPET can explain the cause of non-specific reductions in exercise tolerance.

The CPET test with simultaneous hemodynamic evaluation (e.g. by impedance cardiography) is of particular importance for understanding the complex pathophysiology related to left ventricular dysfunction. Such multiparametric assessment may contribute to treatment optimization and objectivization of therapy effects.

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Aggression, violence and crime: causes and correlations

Agresja, przemoc, przestępstwo – przyczyny i korelacje

Radosław Tworus, Stanisław Ilnicki, Sylwia Szymańska

Department of Psychiatry, Combat Stress and Psychotraumatology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw; head: Col. Radosław Tworus MD, PhD

Abstract. The paper analyzes the basic psychological and medical theories explaining the phenomenon of aggressive, violent and criminal behaviors. It is an attempt to find a correlation between these behaviors and to explain what makes humans aggressive to each other, use violence, and fall within the area of criminal activities through aggressive and violent actions.

Key words: aggression, violence, crime

Streszczenie. W pracy dokonano analizy podstawowych teorii psychologicznych i medycznych wyjaśniających zjawiska zachowań agresywnych, przemocowych i przestępczych. Jest to próba znalezienia korelacji pomiędzy tymi zachowaniami oraz wyjaśnienia, co sprawia, że ludzie są wobec siebie agresywni, posługują się przemocą i poprzez działania agresywne oraz przemocowe wchodzi w obszar działań przestępczych.

Słowa kluczowe: agresja, przemoc, przestępstwo

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Corresponding author

Radosław Tworus MD PhD

Department of Psychiatry, Combat Stress and Psychotraumatology,
Central Clinical Hospital of the Ministry of National Defence,
Military Institute of Medicine
128 Szaserów St., 04-141 Warsaw, Poland
telephone/fax + 48 22261 817 536
e-mail: rtworus@wim.am.pl

Introduction

Aggression and violence are behaviors and social phenomena reported increasingly often in the media. Every day Internet portals, tabloids, radio and television provide information about beatings, rapes, robberies, assassinations, violence at school, in the workplace, at home and in traffic. Most of these aggressive and violent behaviors meet the criteria of criminal conduct, and their perpetrators can be referred to as criminals. The aim of the study is to provide a theoretical introduction to the subject of aggressive, violent and criminal behaviors. It attempts to analyze the medical and psychological theories describing these phenomena, and to establish correlations between them. The article is the first in a cycle of publications on the subject.

Aggression

In everyday use, "aggression" means hostile movements and behavior with the intention of causing harm, damage or pain. According to Aronson, aggressive action is intentional and targeted behavior, aimed at causing

mental or physical harm. It can be both verbal and physical [1, 2].

Numerous theories have been formulated so far to explain the motivation behind aggressive behavior. The most popular researchers into aggressive behavior are Coffey and Appley, Zimbardo and Ruch, Aronson, Frączek and Reykowski [1-5].

Aggression as an instinct

Sigmund Freud and Konrad Lorenz are considered the main authors of this theory. Freud believed that, apart from the sexual instinct of life (Eros), people are characterized by a death instinct (Thanatos) consisting of a drive towards self-destruction and the return of the human body to a non-organic form. To avoid self-destruction, an individual needs to constantly release that destructive drive by directing aggression at other people. Freud's thesis that aggression is a transformed self-destruction instinct has never been widely accepted [6, 7].

According to Lorenz, aggression is an innate model of behavior which is automatically stimulated by the

presence of certain triggers in the close environment, or blocked by the occurrence of certain inhibitors. The ability to react adequately to those stimuli is inborn. Aggression is spontaneous, i.e. it may occur without any external causes. It is explained by the **hydraulic model of aggression**, assuming that aggressive energy is relentlessly produced, on its own, and stored inside the organism. This constant influx of energy necessitates its regular release through aggressive behavior, following the occurrence of typical triggers. Such a release is rewarding, bringing relief, and is therefore sought after. The longer aggression remains unreleased, the weaker the stimuli suffice to trigger it. Aggressive behavior with lethal consequences is common only in humans; in most animals intraspecific aggression rarely results in the death of the victim. The problem with human aggression is that evolution did not equip us with automatic inhibitors; they were not needed, because man does not possess the biological tools for killing, such as claws or fangs. Nature has not foreseen the possibility that people would use tools produced by themselves to kill [8].

Lorenz's theory raises a number of doubts. Firstly, the thesis that models of aggressive behavior in all animals are innate and resistant to the influence of experience is doubtful. Secondly, despite the thesis that aggression is necessary and rewarding, there is no evidence that animals seek aggression; they rather avoid it, and resort to it only when ritual means of scaring the opponent away are insufficient. Thirdly, there is no evidence that in higher animals aggressive energy is spontaneously produced and stored in the organism, and that its accumulation leads to unprovoked aggression [1, 2].

The theory of aggression as an instinct is questioned by the results of studies conducted by cultural anthropologists, who demonstrated that level of aggression in different societies varies considerably. In certain cultures it is virtually non-existent, e.g. the Arapesh of New Guinea or Kongo-Gorer Pygmies. On the other hand, the universality of this phenomenon does not prove its innate character. Almost all people watch television, if given access, but it can hardly be considered instinctual behavior [1, 2, 5, 7-9].

Aggression as a creator of drive

The most popular approach to aggression as a creator of drive is the **frustration-aggression theory** formulated by researchers from Yale University [10]. According to the theory, all aggression is caused by frustration, and all frustration results in a disposition to aggression. Frustration means a blockage in the organisms' activity directed at a given target, or a condition resulting from

such an obstacle. A propensity for aggression caused by frustration is proportionately bigger than (1) the value of the blocked target, (2) the impossibility of reaching the target due to the frustration, (3) the number of blocked actions.

Stimulations triggered by frustrations may accumulate in the organism. A stimulation aroused by frustration always leads to aggression, although it is not always revealed or directed at the frustration-causing factor, as fear of punishment inhibits the expression of aggression. If the fear is not deep enough, displacement or a change in the form of aggression ensues.

Aggression displacement consists in directing it onto a different object, associated with a smaller punishment. The change of the form of aggression consists in substituting it for another aggressive reaction, associated with lesser risk of punishment. Fear of the punishment inhibits the expression of aggression, but not the stimulation to express it. On the contrary, punishment intensifies the stimulation, because it acts as additional frustration. The only factor providing discharge of stimulation is aggressive behavior. Frustration alone merely causes a readiness to demonstrate aggression, which turns into actual action only when a suitable trigger occurs. There is no clear explanation of the term "trigger", but it is considered necessary that its use is limited to denote stimuli strongly associated with aggression, such as seeing weapons [3, 4].

Aggression as a result of learning

According to this theory aggression results from learning through the processes of instrumental conditioning and modelling. The instrumental conditioning theory stipulates that each reward intensifies aggression. The reward may be external, such as money, winning a competition and recognition of other people, or internal, i.e. increased self-esteem or sense of control over the course of the event.

As is the case with any behavior, people learn aggression not only through their own experience, but also by observation of other people's behavior and its effects. This is referred to as modelling. A person can learn new, previously foreign models of aggressive behavior by observing other people. For instance, one can learn from films how to humiliate another person. Observation of the effects of other people's aggression may intensify or reduce the inhibition of previously learnt aggressive behaviors. The behavior of other people may also facilitate demonstration of similar reactions by the observer, inciting similar emotions and motivations than in the model [9].

Violence

Violence also is aggressive behavior, destructive for another person or a group of people. Earlier, any abuse of power was considered to be violence; presently it is assumed that violence is behavior demonstrated by an individual or a group that results in a bodily or mental injury [11, 12]. Violence and aggression may be hostile, these behaviors being preceded by anger, and their direct aim is to cause pain or injury. Disinterested violence, not preceded by anger, also belongs to this group of aggressive behaviors. This behavior is based on the search for pleasure in hurting other people. Another form of violence is instrumental aggression, used to achieve a certain goal other than causing pain or injury.

According to Mellibruda, violence is always intentional and infringes on the goods or rights of an individual. It always causes harm, and if the perpetrator remains unpunished, it often repeats. Using it may be a helpless form of dealing with one's own impotence; in this case even threats of violence are still violence. Regardless of the circumstances and behavior of the victim, the perpetrator is always responsible for the violence, although not every form of such violence is prosecuted by law [13, 14].

Violence is not always the same as crime. A crime occurs when a given behavior is against the legal norms, but not necessarily against customary, social or moral standards.

Crime and the criminal

Crime in the legal and penal sense [15] means a socially dangerous behavior, prohibited and punishable by the act in force when it was committed. The most common understanding of the concept of crime is the approach referred to in criminology as "perpetrator-oriented". Its aim is to determine the characteristics of people committing crimes, as well as external circumstances which facilitate committing them. The ambiguous character of the terms "crime" and "criminal" should be emphasized. The same behavior evaluated from the perspective of one penal code will be qualified as a crime, while according to another code it may not. Apart from the legal aspects, an important role must be played by the analysis of the motivation process resulting in a breach of law by the perpetrator. Often the motives which drove the perpetrator of a crime in a legal sense are highly approved by the society. As a result, in the public perception he or she is innocent, and have been unjustly persecuted. Therefore, from a psychological point of view, the assessment of the factors leading to infringement of the legal order should be highly

individualized. In summing up, a criminal is a person who, due to personal characteristics and the specific situation, initiated the motivation leading to a goal that is socially unacceptable and prohibited by law [16-18].

Aggression, violence, crime – correlations

Studies on criminal aggression in Polish society have been conducted by Kosewski [19], Urban [20, 21], Kmiecik-Baran [22], Gierowski [15-18], Ostrowska and Wójcik [23]. The aim of the studies were to describe the phenomenon of criminal aggression and to determine predictors of such behavior.

Violence and aggression are apparently socially unacceptable behaviors. Apparently, because we witness aggression every day. We are its victims or perpetrators. Every day someone starts the day with a conflict with a spouse, a parent or a child. The conflict may be caused by the fact the child is getting dressed too slowly, the spouse or parent comments on a certain domestic affair, the bathroom is occupied for too long etc. On our way to work or school we push somebody away while getting on the bus or cut someone up in traffic. Finally, when we are late for school or for work, we are reprimanded by a teacher or superior. We then release the associated emotions by transferring the aggression to a charge or another third party in a weaker position. These are just a few of the endless examples, but the question is whether these aggressive behaviors make us criminals? Certainly not. It should also be noted that not every crime is associated with aggression (e.g. financial crime).

Aggressive crimes have a very strong media impact. Events that are heavily publicized include those in which the perpetrator is a person of good repute who commits an exceptionally cruel crime, or a series of criminal acts of aggression. Such situations raise questions about the source of aggression which led "an unusually calm person" to commit a crime.

Biological factors determining criminal behavior

Innate factors which determine criminal behavior in men have long been researched. Eric Kandel, a neurobiologist at Columbia University, wrote: "The central tenet of modern neural science is that all behavior is a reflection of brain function." The first scientific considerations regarding the biological basis of human behavior date back to the 18th century. Franz Joseph Gall (1758-1828) formulated the theory of phrenology, which attributed certain locations in the neural system to various behaviors, personality traits and mental characteristics, and stipulated that their

relative proportion in an individual could be determined on the basis of enlargements of the skull over the given area responsible for those functions [24].

Gall's successor was Francis Galton, younger cousin of Charles Darwin, who argued that mental and moral characteristics, including a variety of defects, character flaws, socially undesirable habits and propensity for crimes involving violence, are subject to the same mechanisms of heredity as physical features, e.g. height or eye color. Galton called his theory **eugenics**, from the Greek *eugenes*, meaning "well-born" [24].

Italian psychiatrist and anthropologist, Lombroso [25], advocated a biological basis for criminal behavior, and even created the term "born criminal" in the 19th century. He claimed that criminals possess specific physical features, which he considered to be atavisms inherited from primitive man. The concept was not confirmed, and it was criticized by the advocates of psychological and sociological theories explaining criminal behavior. However, studies on the relationship between physical features and criminal behavior were continued even into the second half of the 20th century by Sheldon [19].

The following years brought more new reports about the biological predictors of aggressive crime. Due to progress in medical diagnostics, causes for aggressive behavior and resulting crimes are now sought not only in the anatomy of individual neural structures, in detailed analyses involving the hormonal system, neurochemical system, and even DNA chain structures. A study by Niehoff [24] presents an overview of the biological basis of violence, from the earliest times to the present day.

We can classify the biological factors that apparently may be associated with criminal behavior into four basic causes of criminal behavior [18]. They include:

- characteropathy, i.e. specific changes in personality and behavior resulting from organic damage or other brain dysfunctions; such changes can be innate (e.g. epilepsy), post-traumatic or caused by other exogenous or endogenous factors damaging CNS,
- temperament, as a fixed manner of emotional and physical reaction to external situations; it describes the speed of mental processes, excitability, force and time of reaction to a stimulus,
- psychopathy as a constitutionally conditioned type of personality, i.e. a set of relatively constant behavior characteristics associated with emotions and drives, as well as with motivation,
- intelligence, which reflects the level of mental development and a person's cognitive potential, i.e. operational plasticity and the ability to use one's knowledge and experience in new situations.

A common characteristic of these variables is that they are conditioned by the functional and structural

properties of the CNS. However, they do not determine the attitudes, goals, aspirations and preferred values of an individual; they merely describe certain formal behavioral features. The content of that behavior is shaped only in the interaction between innate predispositions and different categories of environmental stimuli. Numerous studies analyzed the problems of psychopathy and characteropathy as the basis for aggressive crime, as well as the problem of health. However, a relation enabling one to link a psychopathy with an aggressive crime has not been found [26-32].

Characteropathy

The concept of characteropathy was created and introduced to psychopathology by a Polish psychiatrist, Prof. Tadeusz Bilikiewicz [26]. It is one of the forms of disorder that in psychiatry is referred to as psychoorganic syndrome. The name has never found place in international lists of diseases and mental disorders. In the current ICD-10 classification the term "characteropathy" is included in the diagnosis: "personality and behavioral disorder due to brain disease, damage and dysfunction" [33]. This type of disorder is characterized by the following:

- permanently reduced perseverance in deliberate actions, especially time-consuming ones, as well as actions with delayed gratification,
- modified emotional behavior, characterized by emotional instability, empty and unmotivated cheerfulness, easily changing into irritation, and short bursts of anger and aggression,
- revealing and satisfying needs and drives regardless of the consequences and social rules,
- disorders of the cognitive processes in the form of suspicion or paranoid attitudes and excessive focus on a single, usually abstract subject,
- significant changes in the speed and coherence of speech, including symptoms such as lengthiness, excessive inclusion, viscosity; changed sexual behavior, i.e. hyposexuality or hypersexuality, and change of sexual preferences.

It is easy to present an individual with two of the selected features, as this is the diagnostic criterion, noting how easy it is for that individual to demonstrate asocial behavior.

Temperament

Temperament is an innate feature that characterizes the individual way of storing and releasing energy, expressed by the size of reaction and intensity of action, as well as describing its course in time. The theory about the role of temperament in crime was developed by Eysenck [34]. According to this researcher, the basic

dimensions of personality are extraversion and neuroticism. In this theory, extroverts are characterized by the dominance of the inhibition processes over the stimulation processes. This results in difficulties with conditioning processes, which disturbs the socialization process. Neurotics are characterized by a high level of emotional lability, which leads to uncontrolled emotional excitability. In Poland, studies on the effects of extraversion and neuroticism on criminal behavior were conducted by Ostrowska and Wójcik [23], Pospiszył [31] and Gierowski [16-18]. However, no simple relation were found between temperamental characteristics and propensity to breach legal norms [35, 36].

Psychopathy

The concept of psychopathy, more precisely "constitutional psychopathic inferiority", was introduced in 1891 by Koch to denote a permanent affective defect. However, already by 1813 Pinel had described clinical cases of patients socially inadequate in the area of models of behavior, affective and volitional disorders. He referred to these cases as "mania without delusion". Rush referred to such a disorder as "moral insanity". Psychopathy was also described as moral daltonism, moral sense anesthesia, moral disability, socio-physiological insensitivity, oligothymia and anethic syndrome [37]. The criteria of psychopathy described in the 1970s by Cleckley [27] have been universally accepted, and he distinguished the following features characterizing this type of personality disorder:

- permanent inability to engage in affective relationships with other people,
- impersonal attitude to sexual life (objectification of partners),
- lack of sense of guilt, shame, and responsibility,
- inability to delay satisfaction (striving to satisfy immediately one's drives and needs),
- fixed and inadequate antisocial behavior,
- self-destructive model of life (e.g. destroying previous achievements after a period of relatively good functioning, or even success, for reasons incomprehensible to the people around),
- inability to plan remote goals,
- inability to foresee the consequences of one's actions,
- inability to learn from previous experience (ineffective learning process),
- logically inexplicable disruption of any constructive activity,
- specific lack of insight into one's own behavior (semantic dementia),
- normal intelligence level,

- inability to see the borderline between reality and fiction, truth and lie (also referred to as "pseudology", "pseudologia fantastica", "mythomania", "Delbruck syndrome, and "pathological lying"),
- lack of fear,
- atypical or unusual reaction to alcohol,
- frequent suicidal threats, and
- a tendency for self-harm.

Due to the stigmatizing character of the term "psychopathy", it was changed in modern psychiatric terminology to "abnormal personality". In current classifications of mental disorders: ICD-10 and DSM [33, 38], this type of personality disorder is referred to as "antisocial personality" or "dissocial personality". However, Hare [39], who has been studying individuals with psychopathic personality for many years, questions the claim that "psychopathic personality" and "antisocial personality" are synonymous terms. According to this author, most criminals in penal institutions are characterized by an antisocial personality, but society abounds in people who satisfy their need by disregarding the well-being of others. Those people have never been in conflict with the law; on the contrary, they are considered respected citizens, and often hold important positions.

The genesis of psychopathic personality features has not been explained, but great significance is attributed to hereditary (innate) factors, revealed under the influence of the environment. An analysis of Cleckley's features clearly demonstrates a strong relation between crime and this type of personality, a relation confirmed by Kępiński [29], Pospiszył [32] and Hare [39]. Data regarding biological predictors of antisocial personality do not indicate the presence of any directly responsible factors [40].

Intelligence

Low intelligence, especially mental handicap, have been considered an important criminogenic factor for many years. However, recent Polish studies conducted by Namowicz-Chrzanowska [41], Firkowska-Mankiewicz [42] and Gierowski [16] do not confirm this correlation. They demonstrated only a direct relationship between low intelligence and poorer socialization processes or higher susceptibility to group influence [43, 44]. These abnormalities are revealed already at a young age, and affect the entire line. Convincing is the opinion that low intelligence does not help in the process of resocializing of offenders; it forms a cause for recidivism, usually related to the same type of offence.

Psychological and sociological concepts explaining crime

Despite the biological theories, there are also psychological and sociological theories of crime. They deal with aggression, socialization and motivation, whose impact on criminogenic behavior completes the missing elements in the biological theories. As theories related to aggression have been discussed earlier, they will be neglected in this part. It seems that some of the numerous psychological theories dealing with aggression and crime are particularly accurate in explaining such behavior.

The criminological studies by Ostrowska and Wójcik [23] and by Drwal [45] refer to the Reckless' containment theory and Rotter's locus of control theory. According to these theories, it is possible that a normally socialized person, a "normal" person, will violate the legal order. This may happen, for instance, when strong pressure applied by external situational factors occurs. Hołyst also writes about the normality of criminal behavior in "Criminology" [46]. Using the theories of Durkheim and Merton, he demonstrates that deviant behavior is normal, healthy, and even useful and necessary, and that the goal may be more important than the means of reaching it.

Walters' theory (annex) [47], confirmed by numerous further studies conducted by this author, is an interesting interpretation of criminal behavior. It is a specific attempt to combine the psychological, socialization and motivational processes.

Reckless' containment theory

The theory stipulates that the factor that determines one's engagement in crime and deviance is the level of resistance to the temptation of becoming a deviant or a criminal. Each individual is constantly tempted to become a criminal; however, there are mechanisms that enable effective resistance to these temptations, consisting of a system of external and internal controls. External control comprises all the environmental factors which set boundaries for an individual, such as legal and moral standards with their sanctions, as well as institutionalized social goals and expectations. Internal control, i.e. self-control, is formed in the process of socialization, and it is an indicator of moral development and behavior. A person with normal control has an adequate self-image, is ready to fulfil demands with clearly formulated life goals, has a realistic (relatively to the possibilities) level of aspiration, is resistant to frustration and identifies with moral and legal standards. This concept is one of several which proposes an analysis of the factors preventing people from

committing crime, as opposed to other theories that seek the factors predisposing one to criminal acts [18, 23].

Rotter's locus of control concept

This presupposes that control is a learnt mechanism, following the principles of instrumental conditioning. A sense of internal control is formed by the growing belief that there is a relation between a behavior and a reinforcement. A lack of such belief is determined by an external locus of control. The development of internal or external loci of control is determined by reinforcements received in life, as well as psychological situations. After all, behavior is a function of free choice between different possibilities that satisfy the need for the value of the reinforcement expected by an individual as a result of taking an action. Previous studies conducted on prisoners suggest that criminals demonstrate an external type of control. This is supported by data about poor developmental conditions, a lack of a sense of safety, emotional rejection from close ones, or a lack of consistency in parenting methods. These factors strengthen the external locus of power [18].

Socialization disorders

Socialization is a process of social development, resulting from the directed and intentional interactions of the social environment (upbringing), as well as from unintentional ones. It is a long process of learning the standards and rules of co-existence with other people. It follows the principles of classic and instrumental conditioning, imitation and identification. A decisive role in the process of socialization is played by the environmental and educational conditions in which a person is developing. Factors such as a negative atmosphere in family life, frequent fights and misunderstandings between parents, a lack of acceptance and adequate emotional contact with close ones, frequent stressful and frustrating situations, the dominance of inconsistently used physical punishment in upbringing, an autocratic or inconsistent parenting system or frequent models of aggressive behavior in the family and among peers result in a disturbed socialization process.

Offenders manifest various symptoms of social inadequacy as early as in childhood and adolescence. They pose serious educational problems: missed classes, running away from home, being members of demoralized peer groups, and frequent conflict with peers [45-50]. Socialization disorders may take two courses. In the first, a young person identifies with the values and goals of the criminal subculture, and as a result an antisocial personality is formed. This illustrates

again the earlier discussed differences between antisocial and psychopathic personalities; however, it is possible that, for various reasons, the psychological mechanisms responsible for socialization do not develop at all. In this case, bio-psychological variables, e.g. low intelligence or damaged CSN, play a dominant role. They impair the adaptation abilities so deeply that the individual is incapable of integrating with any social group, or accepting its norms and values. Such a disorder of the regulatory and integrative personality functions is called asociality. Socialization disorders, often referred to as sociopathies or sociopathic personality disorders, are a strong predictor of criminal behavior [18].

Motivation

An underestimated element in the analysis of aggressive criminal acts is establishing the perpetrator's motivational process. Using the term "motivational process" and not "motive" emphasizes the complexity of the phenomenon, and its extension in time. It comprises the above discussed elements of the perpetrator's personality, along with situational factors. This dualism demonstrates why often a criminal act is inconsistent with the previous image of the offender. Examples illustrating the complexity of motivation are presented by Zimbardo and Ruch [5], who described an experiment involving students acting as guards and prisoners (annex).

Walters' theory of crime as a lifestyle

This theory aims at integrating all the models of criminal behavior. It primarily analyses psychological factors in that behavior, but it also refers to innate determinants of asocial behavior.

According to Walters, a man is born neither good nor bad (he emphasizes that this is contrary to psychopathic personality theories), but since birth is concentrated on himself, is sensitive to evaluation and criticism, and interested in receiving immediate gratification regarding some of his biological needs. Due to socialization, a person gradually learns to make conformist decisions. In his development, man strives to form social bonds with close ones, to establish his level of stimulation and form a self-image. According to this theory, any deviance is an amplification of normal developmental patterns. In the early developmental period, the implementation of tasks results in the first choice of a criminal behavior. Depending on the consequences of such task implementation (positive or negative), further asocial behavior may occur. With time, the breach of social norms forms the mechanisms justifying and rationalizing

such behavior, thus allowing the preservation of a positive self-image, despite a socially unacceptable operating style. Walters created several basic premises of the theory of crime and criminals.

Criminal offenders are characterized by four basic features: irresponsibility, self-indulgence, interpersonal intrusion and chronic breaking of social norms. Irresponsibility is a permanent and learnt characteristic, not an innate feature. It affects school work, professional work, as well as familial and social relations. Irresponsibility is the source of chaotic and unforeseeable behavior, which cause irritation in parents, teachers, employers and families. Self-indulgence, i.e. the inability to delay gratification, is associated with maximizing pleasure and minimizing pain and suffering. An orientation towards pleasure is reflected in the need to attract attention, e.g. through clothes, jewelry, addictions, or tattoos. Negative attitudes towards people is demonstrated in aggressive, violent and vulgar behavior. Chronic rule breaking does not require explanation, but the sooner it occurs, the more accurately it predicts a criminal future.

A criminal lifestyle develops in a physical, social and psychological sphere as a result of an individual's interaction with the environment in the first years of life. External circumstances may encourage certain behavior, or set limitations, but they do not have a determining influence. People generally take socially acceptable decisions, only criminal offenders undertake antisocial actions.

A criminal, fearing responsibility for his choices, presents himself as a loser. Thinking about oneself as a loser, such as someone with nothing good to wait for, increases the motivation for criminal operations and reduces the attempts to lead a socially accepted life. Throughout his entire life the offender reinforces and justifies his criminal decisions. He blames external factors for his own irresponsibility or negative attitude towards people, thus justifying his behavior. Such thinking sanctions behavior other than acceptable in a given society. Despite the consequences of his behavior, due to cognitive and behavioral indolence, the offender does not attempt to change the style of his functioning.

The motives for criminal actions may be coupled in four characteristic pairs: anger/rebellion, power/control, excitement/pleasure, and greed/indolence. For a crime to take place, a favorable situation must occur. Crime is a combination of the specific way the offender thinks about himself and the world around, of one or several of the earlier discussed motives, and of behavior specific for a given situation. At the base of criminal behavior is the way an individual thinks about himself and the situation, so it is impossible to prevent further criminal

acts by an offender until he changes his way of thinking [25, 47].

This theory contains elements typical for descriptions of psychopathic personalities and theories of crime based on temperament, aggression, classical and trigger conditioning. However, it is the only one combining most of the theories with the premise that an individual is born "normal" (contrary to psychopathy), and forms his criminal way of thinking in childhood and early youth, that a criminal way of thinking, coupled with external circumstances, will help to initiate situations of conflict with social and legal norms. A person thinking this way will be a potential criminal his entire life.

ANNEX

Zimbardo's experiment

In an experimental prison created by the social psychologists Zimbardo, Haney, Banks and Jaffe, the psychological effects of a stay in prison were analyzed on the volunteers participating in the study. Both guards and prisoners were recruited through advertisements in the local press, encouraging students to participate in a two-week study on prison life. A payment of 15 dollars a day attracted over a hundred volunteers, who then underwent clinical interviews. Two dozen potential participants in the experiment were selected. They were chosen through detailed testing with personality tests to evaluate emotional stability in physically healthy, normal, average, law-abiding people without any previous experience of using violence or abusing psychotropic substances. They were told that their allocation to the group of guards or prisoners would be decided by coin toss. When asked about their preferences, they all declared they wanted to be prisoners.

Shortly after starting the experiment, pathological relations developed between guards and prisoners. Power became the main dimension to determine everyone and everything. Although at first there were no differences between the students playing the roles of prisoners and guards, performing those roles in a social situation emphasizing differences in the wielded power led to immense differences between the behavior and the emotional reactions of members of both groups. The most common forms of interaction initiated by the guards included giving orders, throwing insults at prisoners, making degrading allusions, acts of verbal and physical aggression and threats. Each guard at some point treated a prisoner in an insulting and despotic manner. Many of them seemed to enjoy the higher position provided by the uniform: their usual, everyday existence

was turned into a situation in which they had almost complete power over other people.

The guards said:

"I was surprised by myself. I made them throw insults at each other and clean toilets with their bare hands. In fact, I treated the prisoners like cattle, and constantly feared that they would try to hurt me."

"During the preparation for the first visiting night, having warned the prisoners that they should not make any complaints lest they want the visit to end quickly, we introduced the first parents. I made sure to be one of the guards in the yard, as it was my first chance at gaining the sort of power I actually enjoy: to manipulate others, to be very important, and to have complete control over what is or isn't said."

"Acting in authoritative way may be fun. Power can give great pleasure."

The experiment, initially planned for two weeks, was interrupted after six days due to the pathological reactions observed in individuals carefully chosen for their normality, health and emotional stability. No correlations were found between the results of the personality tests or other variables resulting from previous experience in the study subjects and the considerable differences in reactions demonstrated by prisoners and guards. The observed pathology could not in any way be attributed to previous personality characteristics, such as those presented by psychopathic, sadistic guards or criminal prisoners with poor control over their drives. Abnormal individual and social behavior in both groups should be best considered a result of the interaction with an environment supporting such behavior [5].

Discussion

Psychological and medical theories regarding the causes and mechanisms of the aggressive, violent and criminal behavior discussed in the study, as well as the correlations between these social phenomena, constitute only a selected fragment of the most important studies in this area. Scientific research has been conducted for years into the conditions related to aggression, violence and both social phenomena in the context of criminal behavior. Similarly to many other areas of science, numerous concepts were developed to explain why people are aggressive, use violence or commit aggressive crimes. The Zimbardo experiment appears to change significantly our understanding of aggressive and violent behavior in people. It demonstrated that people are not born bad, but that "opportunity makes the thief", as the proverb says, and it is the situation that makes us evil. It would mean that each of us is capable of causing harm to another human being, using violence

and aggression. The Stanford prison experiment questioned a number of scientific theories on aggression and violence, and it also unambiguously overturned a belief prevailing in society that aggressive crimes are committed by individuals with mental health disorders. The analysis of so-called serial killer cases also demonstrates that, according to current psychological, psychiatric and psychopathological science, the people were aware of what they were doing while causing pain and the death of others. All of the so-called great murderers of the modern world, such as Andreas Breivic, Andriej Chikatilo, Richard Kuklinski etc. were considered to be sane, that is according to the legal criteria they were capable of understanding the meaning of the acts they committed, and able to control their behavior.

Certainly, it should be noted that a variety of health reasons may cause aggression and violence. These may include primary mental disorders, such as the one presented in Alfred Hitchcock's "Psycho". They may be reactive mental disorders, as in Frank Darabont's "The Mist" (2007). They may also involve mental disorders associated with physical illness, such as epilepsy, brain tumor, encephalitis or alcohol abstinence syndrome.

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Carpal Tunnel Syndrome - an increasing clinical problem

Zespół cieśni kanału nadgarstka – narastający problem kliniczny

Marta A. Durka-Kęsy, Adam Stępień, Kazimierz Tomczykiewicz, Żanna Pastuszek

Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine; head: Prof. Adam Stępień

Abstract. Carpal Tunnel syndrome (CTS) is the most common type of entrapment neuropathy. Characteristic symptoms of CTS include wrist pain, numbness of function as an interparable biometric identifier and impairment changes in precise hand movements. The symptoms worsen at night or after exercise. In order to confirm the diagnosis, ENG/EMG or imaging studies such as ultrasound or MRI are used. The effectiveness of surgical treatment depends on the severity of the median nerve injury.

Keywords: Carpal Tunnel Syndrome, electromyography, symptoms, diagnosis

Streszczenie. Zespół cieśni kanału nadgarstka (ZCKN) jest najczęstszą neuropatią z ucisku. Charakterystycznymi objawami towarzyszącymi ZCKN są: ból nadgarstka, drętwienie palców i upośledzenie precyzyjnych ruchów ręki. Objawy nasilają się w nocy lub po wysiłku. W celu potwierdzenia rozpoznania wykonuje się badanie ENG/EMG albo badania obrazowe, tj. USG lub MR. Skuteczność leczenia chirurgicznego jest uzależniona od stopnia uszkodzenia nerwu pośrodkowego.

Słowa kluczowe: zespół cieśni nadgarstka, elektromiografia, objawy, rozpoznanie

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Corresponding author

Marta Durka-Kęsy

Department of Neurology, Central Clinical Hospital of the Ministry of National Defence, Military Institute of Medicine in Warsaw

128 Szaserów St., 04-141 Warsaw

telephone 607,432,262

e-mail: darta@wp.pl

Carpal Tunnel syndrome (CTS) is the most common entrapment neuropathy, where the median nerve is damaged. The symptoms of the disease result from chronic median nerve compression within the carpal tunnel, between the bones of the wrist and the flexor retinaculum. In the general population, CTS occurs at a rate of 3 to 6%, and it is 2 to 5 times more likely to occur in women [1-3]. However, this number is probably underestimated, as the scientific studies conducted with the use of a nerve conduction study (NCS) state a CTS incidence rate of 6.3-11.7% [4], while in epidemiological studies carried out on groups of professional manual workers CTS was reported at levels as high as 34% [5]. CTS has been recognized in 15% of employees in the fish processing industry, 8.4% in dental hygienists, 4.8% in dentists and 8.2% in construction workers [6]. No epidemiological studies have been conducted on CTS incidence for the Polish population. Such a diagnosis becomes more frequent as the dysfunction becomes increasingly known among doctors and patients.

The median nerve is a mixed one, containing both sensory and motion fibers. It comprises nerve fibers originating from the C6-Th1 spinal nerve roots, which then run in the lateral and the medial cord of the brachial plexus. The median nerve may be damaged at any of its sections along the upper limb, but the most common location of compression is the carpal tunnel between the bones of the wrist and the transverse ligament (flexor retinaculum). At this point, the median nerve damage results from degenerative disorders of the flexor retinaculum causing edema and fibrosis. Compression of the median nerve in the carpal tunnel leads to ischemia, myelin sheath damage and even loss of axons in more severe cases [7]. People with a slimmer carpal tunnel or those whose profession involves repetitive movements of the hand are more prone to CTS.

A higher inclination to CTS has been reported in people suffering from diseases involving edema or those leading to carpal tunnel stenosis, such as thyroid dysfunction, rheumatoid arthritis, wrist injuries, tumors

within the carpal tunnel, amyloidosis, sarcoidosis, and borreliosis. It is also more common among patients undergoing dialysis treatment, while CTS symptoms are often observed during pregnancy [8]. CTS development risk factors include genetic inclinations, obesity, cancer, diabetes, endocrine disorders, and rheumatic diseases [9, 10]. The symptoms appear mainly between the age of 55 and 60 [7]. The initial symptom is usually pain in the wrist that can radiate along the upper limb up to the shoulder. Subsequently, feeling disorders and paresthesia around the thumb, the index finger, and the middle and ring finger appear. With time, thenar eminence muscles diminish, and the muscles innervated by the median nerve become weaker [11-14]. Movements requiring precision, such as fastening buttons, are visibly impaired. Patients often complain about objects falling from their hands. A neurological study reveals feeling disorders in the skin innervated by the median nerve.

The occurrence of CTS can be proved by provocative tests like Tinel's sign and Phalen's maneuver. Tinel's sign involves inducing paresthesia by tapping on the median nerve in the wrist. During Phalen's test, the upper limb should be flexed in the wrist for 1 minute. A positive Tinel's sign is observed in half the people with CTS, although it may also appear in healthy people [15]. In approximately 80-90% of CTS patients, it is the dominant limb that is impaired. The symptoms occur in both limbs in approximately 50-60% patients [12]. A typical complaint among CTS patients is the escalation of symptoms at night or during activities requiring them to keep the limb bent in the wrist for extended periods, such as while cycling. Patients often report that putting the ailing hand down or shaking the hands rapidly reduces the discomfort at night [16]. Since the sensory fibers of the median nerve undergo deterioration earlier than the motion fibers, patients first complain about numbness and paresthesia. The second type to appear are motion symptoms, i.e. the loss of muscles and weakness of muscles innervated by the median nerve, which leads to difficulties in performing precise movements. Almost 11% of people in which asymptomatic ECTS features occurred did not report pain in the area of the wrist and hand.

In the first place, Carpal Tunnel Syndrome must not be confused with damage of the C6-C7 roots, because symptoms of cervical radiculopathy may be very similar to those of CTS. Pain, limited movement of the cervical spine and proximal muscle weakness indicate root damage.

Patients reporting proximal muscle weakness in the carpal tunnel may also suffer from brachial plexus damage or pronator teres syndrome.

In patients with atypical symptoms, damage at the level of the central nervous system (e.g. lacunar infarct) should be taken into account. Electrophysiological examination, comprising a nerve conduction study (NCS) and electromyography testing (EMG), is regarded as the best standard in CTS diagnostics. It allows for a fast and reliable diagnosis and assessment of the degree of the median nerve damage and its advancement. The sensitivity of this test amounts to 70-97%, whereas its specificity is at a rate of 79-98% [17-19]. A NCS/EMG examination enables the assessment of the conductive parameters in the median nerves (amplitude, speed of conduction, and final latency in the motion and sensory fibers). Selected patients undergo comparative tests to check conduction in the median and ulnar nerves. Such tests allow for CTS recognition in patients with minimal median nerve damage, where no changes are reported in a classic NCS study, as well as in patients with concurrent polyneuropathy [20]. The NCS examination enables the diagnosis of the median nerve damage at the level of the wrist and its discrimination from other diseases of similar symptoms, i.e. pronator teres syndrome, polyneuropathy, C6-C7 radiculopathy or brachial plexus damage. NCS examinations in patients with CTS shows demyelination in the damaged area with lower velocity of the sensory fiber conduction and extension of the distal latency to the abductor pollicis brevis muscle. In advanced cases, axonal changes appear, especially in the form of reduced amplitudes of the sensory and motor potentials. Severe median nerve damage in the area of the wrist is accompanied by lower nerve conduction velocity in the forearm due to Wallerian degeneration.

In the electrophysiological diagnostics of CTS, it is usually sufficient to perform the test for nerve conduction by means of surface electrodes, while needle electrodes are used in those patients with advanced median nerve damage. The results of an abductor pollicis brevis muscle EMG then show any signs of active denervation, reinnervation, or poor effort record during exercise. Upon a CTS decompression surgery, median nerve conduction parameters improve, but a mildly reduced conduction velocity in the area of the wrist may remain. As a result of effective remyelination, pulse conduction time is not the standard time, because the newly created myelin has multiple nodes of Ranvier and shorter myelinated sections. In selected cases of CTS diagnostics, imaging examinations such as ultrasound and MRI are employed. It is recommended to combine the imaging examination with an electrophysiological examination in the cases of patients with nerve tumors (e.g. neuromas or neurofibromas) or patients exhibiting other focal lesions within the area of the wrist, i.e. ganglion cysts. The diagnostic value of the median nerve

cross sectional area estimated by ultrasonography requires further assessment [21].

It is typical of CTS to produce an ultrasound image showing lesions on the median nerve in the shape of an hourglass, as well as reduced flexibility of the nerve in the carpal tunnel [22].

In the case of the mild form of CTS, an effective symptomatic treatment method may be to eliminate activities which induce the symptoms or modify the place of work, e.g. by changing to a keyboard and mouse to allow the wrist to be placed in a neutral position, while immobilizing the wrist using a rail or orthotics might be helpful in reducing the pain [23]. Should the abovementioned methods prove ineffective, pharmaceutical treatment should be applied, with non-steroidal anti-inflammatory products or glucocorticosteroids administered orally or by injection into the carpal tunnel. In such cases, 50-70% of people subjected to conservative treatment notice some improvement, but the long-lasting effects of non-surgical treatment is questionable [24, 25]. As far as glucocorticosteroid injections are concerned, it is important to remember to repeat the procedure up to 3 times, while any larger quantity can lead to the destruction of the surrounding tendons.

Indications for surgical treatment include a lack of results from the conservative treatment, significant wound pain, and symptoms of axonal damage to the median nerve. Surgery proves effective in 70-80% cases [26, 27]. Median nerve decompression is performed in the classic manner or endoscopically. Patients often choose endoscopic therapy as the wounds heal faster after this kind of treatment; however, due to poor visibility in the operating field, the intersection of lateral ligament may be incomplete, whereas incomplete decompression of the median nerve is the most common cause of failure of the operation. If patients report no improvement after the surgery, it is advisable to administer an ultrasound examination in order to discriminate between the causes of the symptoms that persist. Ultrasound scanning may reveal uncut fibers of the flexor retinaculum or scars which absorb the median nerve.

In patients with slight damage to the median nerve, it is possible that the median nerve will recover its correct function independently, without any surgical treatment. In approximately 50% of patients the median nerve damage does not intensify any further, while progression of neuropathy is observed in the remaining patients [28, 29].

Surgical treatment eliminates pain and discomfort in 85-90% of CTS patients. Wound pain disappears after several hours or days. Should the median nerve be severely damaged and many axons lost, the feeling

disorders and muscle weakness may not recede totally after the surgery.

Recurring pain after the surgical therapy may arise from the concurrence of other diseases with similar symptoms, incomplete intersection of the flexor retinaculum, median nerve damage inflicted during the surgery or from the absorption of the nerve in the surgical scar. Duration of the CTS neuropathy symptoms correlates with the severity of the median nerve damage. The effectiveness of surgical treatment is dependent on the progress of the nerve damage at the time of the operation [30-32].

CTS should be excluded in each patient reporting pain and numbness of hands, especially since CTS diagnostics involves a non-invasive and relatively inexpensive NCS examination. Furthermore, surgical treatment does not result in serious complications, and its effectiveness is contingent on the degree of median nerve damage.

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Role of smooth muscles in the respiratory tract

Rola mięśni gładkich w układzie oddechowym

Aleksandra Burysz¹, Andrzej Chciałowski²

¹Clinical Department of Pulmonology and Allergology, 10th Military Clinical Hospital with Polyclinic in Bydgoszcz; head: Cezary Rybacki MD, PhD

²Deputy Science Director of the Military Medical Institute in Warsaw

Abstract. There are several theories attempting to explain the role and importance of the smooth muscles in the bronchial tree. However, so far none of them have achieved a thorough explanation of smooth muscle function in the respiratory system. Certainly they are an important anatomical and physiological element exerting a significant influence on maintaining the patency of the bronchial tree. More often, a pathological effect is observed resulting from their contraction, contributing to airway obstruction. One of the smooth muscle properties is generating a maximum force of contraction, regardless of the fiber length. Apart from their contractile properties, the airway smooth muscles have an ability to increase the proliferation and secretion of various mediators of inflammatory processes, which further contribute to airflow obstruction, which may cause an increase in airway resistance. A relationship between the mass of smooth muscles (thickness in cross-section), and the severity of obstructive lung diseases has been demonstrated. Therefore, with absolute certainty it can be assumed that with no smooth muscles in the respiratory system, asthma and other obstructive lung diseases would not exist. An accurate understanding, especially of the physiological and pathophysiological mechanisms of the respiratory smooth muscles, could help to counteract the consequences of their pathological functions through the development of appropriate therapeutic methods.

Keywords: bronchial tree, smooth muscles

Streszczenie. Rolę i znaczenie mięśni gładkich w drzewie oskrzelowym próbuje tłumaczyć kilka teorii, jednak jak dotychczas żadna z nich nie przyczyniła się do dokładnego wyjaśnienia funkcji mięśni gładkich w układzie oddechowym. Z pewnością stanowią one istotny element anatomiczny i fizjologiczny, wywierający w znaczący sposób wpływ na utrzymanie drożności drzewa oskrzelowego. Znacznie częściej obserwowany jest jednak efekt patologiczny, wynikający z ich skurczu, przyczyniający się do upośledzenia drożności oskrzeli. Jedną z właściwości mięśni gładkich jest generowanie maksymalnej siły skurczu niezależnie od długości włókna. Oprócz właściwości kurczliwych mięśnie gładkie dróg oddechowych wykazują także zdolność do zwiększonej proliferacji oraz wydzielania różnych mediatorów procesu zapalnego, które przyczyniają się do dalszej obturacji oskrzeli, będącej między innymi przyczyną zwiększenia oporu dróg oddechowych. Wykazano zależność pomiędzy masą mięśni gładkich (grubością powierzchni na przekroju poprzecznym) i stopniem ciężkości chorób obturacyjnych płuc. Dlatego też z całą pewnością można założyć, że gdyby nie obecność mięśni gładkich w układzie oddechowym, nie istniałby problem astmy oskrzelowej i innych obturacyjnych chorób płuc. Dokładne poznanie mechanizmów z zakresu fizjologii, a zwłaszcza patofizjologii, mięśni gładkich układu oddechowego powinno się przyczynić do możliwego przeciwdziałania następstwom ich patologicznej czynności poprzez wypracowanie odpowiednich metod terapeutycznych.

Słowa kluczowe: mięśnie gładkie, drzewo oskrzelowe

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Corresponding author

Aleksandra Burysz MD

Pulmonology and Allergology Department

10th Military Clinical Hospital with Polyclinic

5 Powstańców Warszawy St., 85-915 Bydgoszcz

E-mail: aleksandra.burysz@gmail.com

Introduction

The bronchial smooth muscles constitute an important anatomical and physiological element that contributes to maintaining the patency of the bronchial tree. However, a pathological effect resulting from their contraction is much more often observed, leading to impaired bronchial patency and thus influencing the entire respiration mechanism.

This issue has been the subject of discussions for nearly 130 years and, despite the multitude of modern methods available, including the genetic and molecular ones used by physiologists, pathologists, histologists, pathomorphologists, pneumologists and allergologists, there has been no convincing explanation of the bronchial smooth muscle significance either to physiology or to such medical conditions as asthma or COPD.

The presence of smooth muscles in the respiratory tract was described for the first time by Reissesen in 1822 [1]. Numerous physiological and pathological studies conducted in the following years allowed their structure and location in the bronchi to be precisely understood [1-2]. It is currently known that they are located in both the central and peripheral sections of the bronchial tree, occupying a larger area in its peripheral sections – around 18% as compared to around 2.5% of the main bronchial area [1, 3]. Whereas their arrangement in the main bronchi is generally transversal, they take a more longitudinal (spiral) course in the peripheral bronchial area [4].

The function of the smooth muscles in the bronchial tree has been debated for years. So far no irrefutable evidence has been provided as to bronchial muscle cell contribution to the respiratory process. Several possible functions have been considered, resulting from the common embryonic origin of the respiratory tract and the alimentary system, with the peristaltic movement constituting the principal exponent, responsible for the lung liquid pressure and lung development in the prenatal period [6]. The presence of respiratory contractions in rabbit and pig embryos was initially seen as reflecting their role in the lung growth and differentiation processes, and in the branching of the bronchial tree. Unfortunately, their key role and contribution to prenatal lung development has not been confirmed. It is thought that the peristaltic wave induced by smooth muscle contractions may act merely as an element that contributes to maintaining the required pressure of the fetal lung liquid [7], which implies that smooth muscles play virtually no role in respiration physiology [6].

The exhalation supportive role of peristalsis has also been the subject of deliberations. This could be justified, since the active contraction of the bronchial smooth muscles may have a certain influence on the exhalation phase which begins in the peripheral lung area [2]. However, what seems striking is that even if the phenomenon in question does occur, its influence on the respiration physiology is probably insignificant. In addition, the supportive function of the smooth muscles in mucilage movement and their contribution to airway cleaning appears important [7]. This is based on observations of the contrast movement within the bronchial tree, visible during a radiological examination [5].

The lymphatic and venous flow is also of essence. It is assumed that the smooth muscles of the bronchial tree, by influencing the venous and lymphatic channels, perform a major function in establishing the venous flow towards the pulmonary hilum [8]. This assumption is grounded in histological observations that indicate a

broadened arrangement of blood vessels around the respiratory tract. However, as there are no values regulating flow direction, it is very unlikely that smooth muscle contractions play the major role of a pump ensuring a rhythmic liquid flow in the vessels [6].

In addition, the smooth muscles role in regulating the ventilation/perfusion relation was described more than a hundred years ago [9]. It was found that the decreasing pressure of ventilation and alveolar gas exchange during inhalation leads to the dilation of capillaries and increased pulmonary perfusion. This property is levelled off by a simultaneous decrease in airway pressure, as a result of which the role of smooth muscles as regulators of lung resistance appears rather minor. The ventilation/flow (V/Q) rate may be influenced by the local CO_2 concentration [10]. Under *in vitro* conditions, the partial CO_2 pressure reduction contributes to the contraction of the smooth muscles, whereas its increase leads to muscle relaxation. Nevertheless, both in reality and in clinical practice, the CO_2 concentration fluctuations are found to exert a limited impact on the respiratory smooth muscles [10].

Protection of the peripheral lung areas may be seen as a significant function of the smooth muscles in respiration physiology. It is known that some harmful particles or gases contribute, whether indirectly or directly, to the contraction of the muscles, rendering their further penetration impossible [11].

One of the most recent hypotheses (not confirmed through experiments) assumes the structural protection and stabilization of the bronchial tree. It implies that smooth muscles contribute to the proper tensioning of the bronchial tree walls, and hence to reduced deformation and distension of these walls [12, 13]. The contraction of the smooth muscles within the trachea and main bronchi does not usually impact on their obstruction, their clearance being preserved [5]. A different smooth muscle activity is observed in the bronchioli, where muscle contraction leads to their considerable or complete closure. It is also suggested that smooth muscles influence the optimization of the air flow speed, thus increasing the efficiency of coughing [14]. It can therefore be assumed that the airway narrowing that occurs while coughing may increase the velocity of air flow within individual segments, thus contributing to mucilage movement. However, as the coughing and smooth muscle contraction dynamics differ, this theory is hard to confirm. It nevertheless appears justified to assume that smooth muscles contribute to increasing coughing efficiency by raising the exhalation velocity of air flow [14].

So far none of the theories has furnished a precise explanation of the function of the smooth muscles in the respiratory system, leading to the assumption that,

despite their obvious significance in fetal life, these muscles no longer serve similar purposes in respiratory tract physiology. Quite to the contrary, during postnatal life they usually cause obstructive air flow disorders [6].

One of the smooth muscle properties is generating a maximum force of contraction, regardless of the fiber length [15, 16, 24], owing to their ability to adapt to fiber length changes in relation to the resting length [17, 24]. This results from the plastic myofilament network that consists of actins (thin filaments), myosins (thick filaments) and intermediate filaments, i.e. proteins that bind the filaments together. Such a dynamic structure fosters the maintenance of the force of contraction along the entire muscle length, which is indispensable to its physiological function [17, 18, 24]. The adaptation of the muscle length may be induced by a single contraction [19], a short-term activation series [20], or a continual sub-maximum activation lasting several dozen minutes [16]. So far the mechanisms of the smooth muscle adaptation have not been fully understood and explained. Studies show an increased content of filaments, especially myosins, in the cells during contraction, along with adjustment of the duration, which may vary considerably even for a span of a few seconds. It is probable that the entire process depends on the balance of the filament and non-filament components of the myosins [21-24]. Also, the regulatory light chain of myosin (RelC), the phosphorylation of which leads to filament stabilization, may constitute an important element of the system [23, 25]. It seems that the myosin thick filament lability, especially during relaxation, is the key property that lets muscles adjust the actual changes to the filament network, their size and mechanical stresses [24].

However, it also seems that the experimental studies conducted both *in vitro* and *in vivo* treat the muscle fiber length changes as the major pathology concomitant with bronchial asthma, and in particular with its acute forms. It is known that airway narrowing entails an excessive shortening of the smooth muscles in the bronchial tree.

Apart from their contractile properties, the airway smooth muscles show an ability for increased proliferation and secretion of cytokines and other mediators of the inflammatory process, which are significant to the pathogenesis of obstruction diseases, including bronchial asthma in particular [31]. *In vitro* studies reveal that an array of the mediators of the mitogenic signals, including the transforming growth factor (3 - TGF- β), the nerve growth factor (NGF), the platelet-derived growth factor (PDGF) and the epidermal growth factor (EGF) may induce proliferation, thus increasing the mass of the respiratory smooth muscles. This results from the interactions between muscle cells and inflammatory cells, including T lymphocytes and

eozynophiles, as well as the structures of the surrounding intercellular environment [26]. Moreover, myocytes constitute an important source of cyclooxygenase products, including prostaglandins E₂ (PGE₂) and prostacyclins, as a result of stimulation by the interleukin IL-1 β , the tumor necrosis factor alpha (TNF- α) and interferon- γ (IFN- γ) or bradikinin [27, 28]. These mediators also induce the synthesis and release of phospholipase A₂ [27-29]. As a result of IL-1 β stimulation, muscle cells increase mRNA expression for enzymes of the 5-lipoxygenase route, including epoxide hydrolase, leukotriene-C₄ (LTC₄) synthase and C-glutamylotranspeptidase, and LTB₄ and Cys-LT₁ receptors [27]. Under *in vitro* conditions they generate the granulocyte-macrophages colony stimulating factor (GM-CSF), having been stimulated by the IL-1 β and TNF- α mixture [29]. The IL-1 β stimulated supernatants from muscle cell culture trigger an increased survivability of eozynophiles, this effect being blocked by anti-GM-CSF antibodies [28]. People suffering from atopic asthma display an increased IL-5 and IFN expression and release, along with raised mRNA receptor expression. The above results indicate that smooth muscle cells form the source of mediators that are typical of lymphocytes of both the Th1 and Th2 phenotype [30].

All the processes described lead to hyperplasia and hypertrophy of the bronchial smooth muscle cells and contribute to irreversible bronchial obstruction, thus increasing airway resistance. A relationship between the mass of smooth muscles (thickness in cross-section), and the severity of obstructive lung diseases has been demonstrated. Therefore, with absolute certainty it can be assumed that with no smooth muscles in the respiratory system, there would be no problem of asthma or other obstructive lung diseases. Accurate understanding, especially of the physiological and pathophysiological mechanisms of the respiratory smooth muscles, could help to counteract the consequences of their pathological functions through the development of appropriate therapeutic methods.

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They were the authors of the “Lekarz Wojskowy” journal in the interwar period. University of Warsaw lecturers in the journal's first decade. Part III

Oni tworzyli „Lekarza Wojskowego” w okresie dwudziestolecia międzywojennego. Wykładowcy Uniwersytetu Warszawskiego w pierwszym dziesięcioleciu działalności czasopisma – nauki teoretyczne. Część III

Danuta Augustynowicz¹, Aleksandra Karolak¹, Hanna Grodzka², Andrzej Kosater²

¹Section of Scientific Research Strategy and Development, Military Institute of Medicine; head: Danuta Augustynowicz MSc

²Scientific Library, Military Institute of Medicine; head: Anna Kot MSc

Abstract. At the foundation of Warsaw University in 1816, medicine was one of the five original departments established by the edict of Tsar Alexander I. The university was a sanctuary of Polish identity and an important scientific and teaching center. The goal of this article, the third in the series: "They were the authors of the Lekarz Wojskowy (Military Physician) journal in the interwar period", is an attempt to present the contribution of the university professors to the journal in the 1920s. They were the representatives of important organizational units of the university, such as the Department of Forensic Medicine, the Department of Descriptive Anatomy, the Department of Physiological Chemistry, the Department of Pathological Anatomy, and the Department of General and Experimental Pathology at the College of Veterinary Medicine. The material has been divided into two parts, and this one introduces the second part, dedicated to the contributors having influence on the development of theoretical sciences. The following people published their works in Military Physician: Wiktor Grzywo-Dąbrowski, Józef Grzybowski, Aleksander Krasuski, Franciszek Goebel, Karol Chodkowski, and Karol Fegler. The group also included the employees of the Department of History and Philosophy of Medicine and the Department of Polish Language: Henryk Nusbaum and Stanisław Szober.

Key words: history of 20th century medicine, medical journals, physicians

Streszczenie. Od początku istnienia Uniwersytetu Warszawskiego, tj. od 1816 r., w którym na mocy edyktu cara Aleksandra I powołano uczelnię z pięcioma wydziałami, funkcjonował Wydział Lekarski. Uniwersytet był ostoją polskości i silnym ośrodkiem naukowo-dydaktycznym. Autorzy niniejszej pracy, będącej trzecim artykułem z cyklu „Oni tworzyli »Lekarza Wojskowego« w okresie dwudziestolecia międzywojennego”, podjęli się zadania przedstawienia współpracy wykładowców Uniwersytetu z „Lekarzem Wojskowym” w latach 20. XX wieku. Byli to reprezentanci ważnych jednostek organizacyjnych UW, takich jak Katedra i Zakład Medycyny Sądowej, Katedra i Zakład Anatomii Opisowej, Katedra i Zakład Chemii Fizjologicznej, Katedra i Zakład Anatomii Patologicznej oraz Zakład Patologii Ogólnej i Doświadczalnej Studium Weterynarii UW. Materiał składający się na artykuł został podzielony na dwie części; obecnie przekazujemy Czytelnikowi część drugą, poświęconą autorom mającym istotny wpływ na rozwój nauk teoretycznych. Na łamach „Lekarza Wojskowego” publikowali: Wiktor Grzywo-Dąbrowski, Józef Grzybowski, Aleksander Krasuski, Franciszek Goebel, Karol Chodkowski i Karol Fegler. W gronie tym znaleźli się również pracownicy Katedry i Zakładu Historii i Filozofii Medycyny oraz Katedry Języka Polskiego: Henryk Nusbaum i Stanisław Szober.

Słowa kluczowe: historia medycyny XX w., czasopisma medyczne, lekarze

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Corresponding author

Danuta Augustynowicz MSc

Military Institute of Medicine, Scientific Division

128 Szaserów St., 04-141 Warsaw

telephone +48 22 261 816 705, 665 707 460

e-mail: daugustynowicz@wim.mil.pl

Only a life lived for others is a life worth living.
Albert Einstein

Better than a thousand days of diligent study is one day with a great teacher
(Japanese proverb)

The activities of the medical departments in the interwar period were limited to teaching the "foundations of the medical sciences" and "learning methods applied in these sciences". The early functioning of universities was very difficult, as there was a shortage of funds for the development of scientific resources, a significant part of the equipment and teaching aids having been taken abroad by the Russians, with some also being destroyed as a result of war operations. Scientific research conducted by particular departments mainly concerned theoretical sciences, detached from the social background and practical issues related to health protection [1].

In the first decade of its existence, Military Physician published 26 articles written by the representatives of the university staff from departments and institutes of the University of Warsaw dealing with theoretical sciences.

One of the issues in the first year presented the works of **Wiktor Grzywo-Dąbrowski**, who from 1921 was the head of the Department and Institute of Forensic Medicine of the University of Warsaw, established at the end of 1919 (Fig. 1). Wiktor Grzywo-Dąbrowski graduated from the Jagiellonian University in 1911, and during the first years of his professional work he gained experience and skills in several centers, including the Mental Health Hospital in Kochanówka, where he was the head of a department and a prosecutor, and the hospital for patients with typhoid in Łódź [2-4]. The work published in issue 7 of Military Physician in 1920 had its origins in the Łódź Prosectorium and the prosectorium of the Infant Jesus Hospital in Warsaw. In the article *Ogniskowe zapalenie gruźlicze opon miękkich na powierzchni półkul mózgowych* [Focal tuberculous inflammation of soft meninges on the surface of cerebral hemispheres] the author described six cases of this rare disease and compared his experiences to other publications including those authored by E. Flatau, N. Zyberlastówna, H. Koch and H. Oppenheim.

The same issue presented two other works by Grzywo-Dąbrowski, one on the contemporary outbreak of encephalitis, the other on the early diagnosis of typhus. A work that was not related directly to research was a report on a visit of the professor to the institutes of forensic medicine at the universities in Paris, Lyon, Nancy and Strasbourg, financed within the framework of

the scholarship of the Department of Sciences of the Ministry of Religious Denominations and Public Education. Summarizing his experiences from the journey, the professor wrote: "(...) we come to a conclusion that, although these institutes are neither too large nor have luxury equipment (excluding of course the new institute in Paris), they operate very actively and effectively: as usual it is the people who determine everything, or rather a single person, which is, among other things, proved by the great collections of the Lacassagne Museum in Lyon" [5]. The wide range of interests of the professor, also manifested in the publications presented in Military Physician, constituted a very valuable contribution to the substantive content of the journal.

The times in which Professor Grzywo-Dąbrowski was the head of the Institute of Forensic Medicine were also the times in which the works of Józef Grzybowski and Aleksander Krasuski were created.

The year 1923 was one in which the article *8 przypadków zbrodniczego rozkawałkowania zwłok* [8 cases of maleficent body dismemberment] by **Józef Grzybowski** was published. The author referred to cases described by other authors and supplemented that material by including eight further medico-legal cases recorded in the collections in Warsaw. Józef Grzybowski, brother of Marian Grzybowski, dermatologist and venereologist¹, was awarded the diploma of doctor of all-medical sciences at the Faculty of Medicine at the Jan Kazimierz University in Lviv in 1922 and moved to Warsaw in the same year. He started work as a forensic medicine assistant, and then transferred to the Institute of Descriptive Anatomy [6-8]. It was the first center launched by the Preparatory Medical Department at the Faculty of Mathematics and Natural Sciences, transformed in 1916 into an independent Faculty of Medicine headed by Prof. Edward Loth (1884-1944), a pioneer of the anthropomorphology of primary soft tissues (particularly muscles), and creator of modern statistical methods in anthropometric techniques [9, 10].

¹ The profile of Marian Grzybowski was described in the part "Clinical sciences" (Mil. Phys. 2016; 94 [1]: 12)

Figure 1. The Department of Forensic Medicine building

Rycina 1. Gmach Zakładu Medycyny Sądowej



One of the students of the Sanitary Training Centre, Tadeusz Rożniatowski, reminisced about Józef Grzybowski as a lecturer in the following way: "(...) The classes (on topographic anatomy) were held in our school's anatomicum and proved very useful. I have a feeling that if it wasn't for them, many of us would have faced serious problems in the final exam. (...) [11].

Two works authored by **Aleksander Krasuski**, published in 1923 and 1924, were also descriptions of cases. The first was on intersex in legal and social terms, the other was a contribution on skull puncture wounds, prepared on the basis of six cases from the Institute of Forensic Science, where the author began his academic career. Aleksander Krasuski was a graduate of the Faculty of Medicine at the University of Warsaw, he was awarded the diploma of doctor of all-medical sciences in 1922. He also graduated from history studies and received the title of doctor of philosophy. He worked at the Institute of History of Medicine of the Faculty of Medicine at the University of Warsaw [12].

Issues in biochemistry were popularized in *Military Physician* in the years 1922-1927 by **Franciszek Goebel**, a graduate of the University of Warsaw, a soldier of the Polish Army from 1918. He associated his academic career with the Institute of Physiological Chemistry, where he was a professor and a lecturer. The institute was organized in 1916 by an outstanding Polish biochemist, Prof. Jakub Karol Parnas (1884-1949), who was its head for the first three years. The Department conducted scientific research on the biochemistry of muscles and blood, enzymology, and the biochemistry of proteins, sugars and nucleotides [9, 13]. In the article *Normy odżywiania w armji polskiej i w armjach obcych* [Nutrition standards in the Polish and foreign armies] Franciszek Goebel cited the words of Jędrzej Śniadecki "*Teorja jestestw organicznych*" ["The theory of organic creatures"] Ch. XLI): ...in the case of low nutrition

foods... work is the most common reason for exhaustion, or depletion of meat, blood and other parts of the body from all nutrients, and therefore the source of the most common diseases. This is also the case in soldiers who are usually drafted from farmland or a workshops and almost always athletic: if during work, in battles or on forced marches the soldiers need to get a sufficient supply of matter able to produce blood. Therefore... a poorly provisioned army is a target and a victim for the most serious diseases" [14].

Nineteen twenty-seven was the year in which an article by Franciszek Goebel on acidosis was published, originating from the Department and Institute of General and Experimental Pathology, the head of which at that time was Franciszek Venulet (1878-1967).

The subject of pathological anatomy was taught for the first time in Kraków by a professor of the Department of Internal Medicine, Józef Dietl (1804-1878). The Institute was founded at the University of Warsaw in 1919 in the Anatomicum building, and was headed by Professor Józef Hornowski (1874-1923), author of numerous publications, particularly valuable in the field of research on adrenal glands and the thymus. After the professor's death the position was taken by Ludwik Paszkiewicz (1878-1967), creator of a school of anatomo-pathologists, one member of which was **Karol Chodkowski**, who graduated the Faculty of Medicine at the University of Warsaw in 1928.

Chodkowski started to work as an assistant at the Institute of Pathological Anatomy, and in 1936 took the position of head of the Department, which he held until 1938 [9,15,16]. He published a review article in *Military Physician* on malignant pancreatic tumors, in which he compared his own conclusions, drawn on the basis of the analysis of dissected material of the Institute, with the data of other researchers, referring to 93 items from worldwide literature (Tab. 1).

Table 1. Theoretical science publications¹

Tabela 1. Publikacje z zakresu nauk teoretycznych

Forensic science

1. Wiktor Grzywo-Dąbrowski

- *Ogniskowe zapalenie gruźlicze opon miękkich na powierzchni półkul mózgowych* [Focal tuberculous inflammation of soft meninges on the surface of the cerebral hemispheres]. 1920; 1 (7): 15-28
- *Przyczynę do anatomii patologicznej obecnie panującej epidemii zapalenia mózgu (Encephalitis epidemica, s. choreiformis s. lethargical* [A contribution to pathological anatomy of the contemporary outbreak of encephalitis (Encephalitis epidemica, s. choreiformis s. lethargical.)). 1920; 1 (18/19):27-34
- *W sprawie wczesnego rozpoznawania duru plamistego* [On the issue of the early diagnosis of typhus]. 1920; 1 (31): 9-10
- *Obrzmienie mózgu a śmierć nagła* [Brain swelling and sudden death]. 1921; 2 (5): 133-143
- *Przeszczepienie narządów płciowych oraz próby leczenia operacyjnego niektórych objawów starości* [Transplantation of the sex organs and attempts at surgical treatment for certain symptoms of ageing]. 1921; 2 (16): 486-494
- *Podstawy anatomiczne homoseksualizmu i jego leczenie operacyjne* [Anatomic basis of homosexuality and its surgical treatment]. 1921; 2 (30): 953-959
- *Klasyfikacja uszkodzenia ciała. Według Kodeksu Karnego z 1903 r., obowiązującego na ziemiach b. zaboru rosyjsk* [Classification of bodily injuries. According to the 1903 Penal Code, in force in the territory of the former Russian Partition]. 1922; 3 (10): 815-827
- *Zakłady medycyny sądowej we Francji: (Wrażenia z wycieczki naukowej, odbytej w lipcu i sierpniu r. 1923)* [Institutes of forensic medicine in France: (Impressions from a research trip conducted in July and August of 1923)]. 1923; 4 (10): 920-925

Józef Grzybowski

- *8 przypadków zbrodniczego rozkawałkowania zwłok* [8 cases of maleficent body dismemberment]. 1923; 4(7): 588-598

Aleksander Stanisław Krasuski

- *Obojactwo pod względem prawnym i społecznym: (Na podstawie dwóch przypadków kazuistycznych)* [Intersex in legal and social terms: (Based on two rare cases)]. 1923; 4 (12): 1067-1076
- *Przyczynę do ran kłutych czaszki* [A contribution to skull puncture wounds]. 1924; 5 (9): 776-789

Physiological chemistry

2. Franciszek Goebel

- *Normy odżywiania warmji polskiej i w armjach obcych* [Nutrition standards in the Polish army and foreign armies]. 1922; 3 (9): 723-727
- *Cholesteryna, a odczyn Wassermanna* [Cholesterin and the Wassermann reaction]. 1924; 5 (3): 224-230
- *O kwasicy* [On acidosis]. 1927; 10 (2): 125-132

Pathological anatomy

3. Karol Chodkowski

- *Mezenchymalne nowotwory złośliwe trzustki w świetle danych piśmiennictwa (z uwzględnieniem materiału sekcyjnego Zakł. An. Pat. U. W.)* [Mesenchymal malignant pancreatic tumors in the light of literature data (taking into account the dissection materials of the Department of Pathological Anatomy of the University of Warsaw)]. 1929; 13 (7): 321-338

The diversity of topics covered in the journal is shown by the works from the Institute of General and Experimental Pathology at the College of Veterinary Medicine of the University of Warsaw (Fig. 2.), the head of which was Prof. Włodzimierz Lindeman (1868-1933). The college was one of the six, and at the same time the oldest, faculty in Poland educating veterinarians. Its origins date back to 17 July 1824, when the State Veterinary Institute in Buraków near Warsaw was opened. In 1889, the school was granted the status of higher education institution. After 1918, veterinary studies were initiated at the Faculty of Medicine at the University of Warsaw, and an independent Faculty of Veterinary Medicine was founded in 1927 [17].

In the years 1927-1928, an employee of the College, **Jerzy Fegler**, educated in Odessa and Warsaw, authored works published in *Military Physician*. In 1918, he joined the Polish Army, with which he was associated until 1937. He began his academic career in 1924 at the University of Warsaw [18, 19]. As a scientist he was incredibly inquisitive and persistent, believing that each published experiment has to be confirmed earlier by detailed research. His two first works originated from the

Clinic of Internal Diseases at the Ujazdów Hospital, the head of which was Prof. Edward Żebrowski.² Further works, published in the years 1927-1931, were affiliated with the Institute of General Pathology at the College of Veterinary Medicine (Tab. 2).

The publications presented in *Military Physician* in the 1920s also included works written by **Henryk Nusbaum** from the Department and Institute of History and Philosophy of Medicine, a center launched in December 1920, headed by Franciszek Giedroyc, located in his private apartment. Franciszek Giedroyc lectured in the years 1921-1931. In 1931, the institute received premises in the building at 2 Oczeni St., and became headed by Ludwik Zembruński [9].

² The profile of Professor Edward Żebrowski was presented in the article *Wykładowcy Uniwersytetu Warszawskiego na łamach 'Lekarza Wojskowego' w pierwszym dziesięcioleciu działalności czasopisma. Część II* [Professors of Warsaw University publishing in 'Military Physician' in its first decade] (*Mil. Phys.* 2016; 94 [1]: 103, 105)



Figure 2. The Veterinary Institute building
Rycina 2. Gmach Instytutu Weterynarii

Table 2. Warsaw University, the College of Veterinary Medicine publications

Tabela 2. Publikacje ze Studium Weterynarii UW

Institute of general and experimental pathology

1. Jerzy Fegler

- *O odczynie ponukleinowym płytek krwi. Doniesienie tymczasowe* [About the post-nucleic reaction of platelets. A provisional report]. 1924; 5 (10): 902-911
- *O własnościach fizjologicznych płytek krwi i o roli ich w patologii w świetle badań najnowszych* [About the physiological properties of platelets in the light of the most recent research]. 1925; 6(11): 966-985
- *Badania doświadczalne nad rolą śledziony w regeneracji białych ciałek krwi* [Experimental research on the role of the spleen in the regeneration of white blood cells]. 1927; 10(1): 17-23
- *Badania doświadczalne nad wpływem zatrucia trójnitoluolem na narządy krwiotwórcze* [Experimental research on the influence of trinitrotoluene poisoning on the hematopoietic organs]. 1927; 10 (5-6): 443-467
- *Badania doświadczalne nad mechanizmami odczynu leukocytów po adrenalinie* [Experimental research on the mechanisms of post-adrenaline reaction of leucocytes]. 1927; 10 (3): 248-262
- *O efekcie chemicznego podrażnienia czuciowych zakończeń nerwowych w płucach* [About the effect of the chemical irritation of sensory nerve endings in the lungs]. 1928; 12 (4): 233-237
- *Badania nad rodzajem działania na oddech i układ krążenia niektórych arsinów chlorowatych* [Research on the type of effect of certain chlorinated arsenics]. 1929; 13 (1): 1-7
- *Badania nad wartością leczniczą tlenu wprowadzonego drogą pozapłucną* [Research on the therapeutic value of oxygen introduced through extrapulmonary ways]. 1931; 18 (1/2): 40-49

Henryk Nusbaum studied medicine in the years 1867-1872 at the Main School and at the University of Warsaw. He started work at the cholera hospital in the Wola district, then he worked at the cholera department of the St. Lazarus Hospital in Warsaw. He specialized in physiology and neuropathology in Vienna, Berlin and Paris. At the Institute of Physiology, headed by Feliks Nawrocki,³ he conducted research on the innervation of the bladder, the physiological action of poisons, the impact of the spleen on certain poisons and the role of white blood cells in metabolism. In his academic work, he manifested a methodical and original approach, as well as consequences in drawing conclusions.

³ Feliks Franciszek Nawrocki (1837-1902), a doctor specializing in physiology, professor of the Main School and the University of Warsaw. In 1870 he took the position of head of the Department of Physiology at the University of Warsaw.

Being unable to continue academic work as a result of the lack of approval for his habilitation by the head of the Warsaw district (1882), he mainly focused on philosophical and medical activities. The scope of his interests covered very difficult issues, related things to the physiology of suffering, goodness and ethics as well as the role of the philosophical education of physicians in relation to the profession [20, 21]. Teresa Ostrowska wrote in her biographical work on the professor: "(...) The issue of moral and physical pain constituted a frequent subject of his deliberations from the point of view of physiology, psychology, and ethics; the fight against suffering became an essential issue to him, as he claimed that it was the most significant phenomenon in human life" [22].

In his first article published in *Military Physician* (1923), Nusbaum presented his general view on the phenomenon of life in the light of contemporary knowledge. This is where the following thought appeared: "(...) Medicine is both science and art. The

task of medicine as science is: aiming to illuminate, to reach the final solution, if possible at all for the human genius, to the mystery of the phenomenon of life. A physician is by profession a collaborator in this field of human genius, and therefore he agrees to be aware of how the phenomenon of life is presented in the light of contemporary knowledge" [23].

The invitations of representatives of the academic world from a variety of academic fields by the editorial board of *Military Physician* are further confirmed by the presentation of publications written by Professor **Stanisław Szober**, an employee of the Department of Polish Language at the University of Warsaw, linguist, and lecturer on historical grammar (Tab. 3). The professor focused mainly on the psychological mechanism of linguistic processes and the issues of syntax and etymology [24, 25]. The editorial board of the journal explained the creation of the linguistic section in

the following way: "Linguistic studies, just like any living branch of human knowledge, is subject to constant progress. We wish that our dear Colleague Associates of our journal to be properly made aware of the issues concerning modern language purity rules, as well as the correctness of style, syntax, etc. the Editorial Board of 'Military Physician' beseeched Prof. of philology at the University of Warsaw, Mr. Stanisław Szober, for his kind cooperation within the scope of his specialty" [26].

In the first article, published in 1922, Stanisław Szober wrote: "(...) A thought becomes real in the processes of the formation of linguistic form and achieves complete clarity and plasticity only when it finds the proper linguistic expression. If anyone thinks he claims the content of his mind as his own, yet cannot express it in linguistic form, he is subject to a very dangerous illusion(...)" [27].



Wiktor Grzywo-Dąbrowski (born 15/08/1885 in Zadońsk, died 21/12/1968 in Warsaw). He graduated from medical studies at the Jagiellonian University and received his diploma recognized in Kazań in 1911. He was professionally associated with many locations and positions, he worked in many places, such as at the Mental Health Institute near Warsaw, the Mental Health Hospital in Kochanówka, where he headed a department and was a prosecutor at the hospital for patients with typhoid in Łódź, where he simultaneously held the position of head, head of the department, as well as the Prosecutor of Łódź. After moving to Warsaw, he took the position of forensic physician at the Regional Court, and simultaneously was a prosecutor at the Infant Jesus Hospital. In 1921, he was appointed head of the Institute of Forensic Medicine at the University of Warsaw, which he headed until 1950. In the years 1921–1929, he supervised the design and construction of the Forensic Medicine building at 1 Oczki St. In the years 1932–1933 and 1938–1939, he was the Dean of the Medical Faculty at the University of Warsaw. He devoted the final years of his professional activity to being head of the Main Library of the Medical Academy (1950–3/09/1962), which he organized.

He left over 200 publications covering the issues of pathological anatomy, psychiatry, forensic medicine, criminology and medical ethics. He participated actively in the academic life of the nation; he was the founder of the Polish Society of Forensic Medicine and Criminology in 1938, as well as its chairman until 1955, from 1937 he was a corresponding member of the French Society of Forensic Science. He edited the journal "*Archiwum Medycyny Sądowej i Kryminalistyki*" ["Archives of Forensic Medicine and Criminology"], he also conducted lectures, classes and exams for students of medicine, physicians and the students at the Faculty of Law at the University of Warsaw.

Publications in *Military Physician*

- *Ogniskowe zapalenie gruźlicze opon miękkich na powierzchni półkul mózgowych* [Focal tuberculous inflammation of soft meninges on the surface of the cerebral hemispheres]. 1920; 1 (7): 15-28
- *Przyczynę do anatomii patologicznej obecnie panującej epidemii zapalenia mózgu (Encephalitis epidemica, s. choreiformis s. lethargica)* [A contribution to pathological anatomy of the contemporary outbreak of encephalitis (*Encephalitis epidemica, s. choreiformis s. lethargica*)]. 1920; 1 (18/19): 27-34
- *W sprawie wczesnego rozpoznawania duru plamistego* [On the issue of the early diagnosis of typhus]. 1920; 1 (31): 9-10
- *Obrzmienie mózgu a śmierć nagła* [Brain swelling and sudden death]. 1921; 2 (5): 133-143
- *Przeszczepienie narządów płciowych oraz próby leczenia operacyjnego niektórych objawów starości* [Transplantation of the sex organs and attempts at surgical treatment for certain symptoms of ageing]. 1921; 2 (16): 486-494
- *Podstawy anatomiczne homoseksualizmu i jego leczenie operacyjne* [Anatomic basis of homosexuality and its surgical treatment]. 1921; 2 (30): 953-959
- *Klasyfikacja uszkodzenia ciała. Według Kodeksu Karnego z 1903 r., obowiązującego na ziemiach b. zaboru rosyjsk* [Classification of bodily injuries. According to the 1903 Penal Code, in force in the territory of the former Russian Partition]. 1922; 3 (10): 815-827
- *Zakłady medycyny sądowej we Francji (Wrażenia z wycieczki naukowej, odbytej w lipcu i sierpniu r. 1923)* [Institutes of forensic medicine in France: (Impressions from a research trip conducted in July and August of 1923)]. 1923; 4 (10): 920-925

Table 3. History and philosophy of medicine and linguistics publications**Tabela 3. Publikacje z historii i filozofii medycyny oraz językoznawstwa**

Department and institute of history and philosophy of medicine

1. Henryk Nusbaum

- Pogląd ogólny na zjawisko życia w świetle wiedzy współczesnej: Z cyklu odczytów filozofii medycyny [General view on the phenomenon of life in the light of contemporary knowledge: From a series of lectures on philosophy of medicine]. 1923; 4 (7): 560-578
- Pogląd ogólny na zjawisko choroby: Z cyklu odczytów filozofii medycyny [General view on the phenomenon of disease: From a series of lectures on philosophy of medicine]. 1923; 4 (8): 655-668
- Pogląd ogólny na zadania i stanowisko społeczne zawodu lekarskiego: Z cyklu wykładów filozofii medycyny w Uniw. Warsz. [General view on the tasks and social position of the medical profession: From a series of lectures on philosophy of medicine at the University of Warsaw]. 1924; 5(1): 3-16

Department of Polish language

2. Stanisław Szober

- [S.S.] Linguistic section in Military Physician, its justification, needs and tasks. 1922; 3 (9): 886-887
- Główne zasady układu wyrazów w zdaniu [The main rules for ordering words in a sentence]. 1923; 4 (2): 172-174



Józef Grzybowski (born 08/10/1897 in Saint Petersburg, died 05/08/1944 in Warsaw). He studied medicine at the Imperial Military Medical Academy, then he continued his studies at the Jagiellonian University in Kraków and at the Faculty of Medicine at the Jan Kazimierz University in Lviv, where in 1922 he was awarded the diploma of doctor of all-medical sciences. In the same year, he moved to Warsaw, where for a few months he worked as a forensic medicine assistant, then he started work at the Institute of Descriptive Anatomy under Prof. Edwarda Lotha. His circle of interests included comparative anatomy studies of the cerebral cortex of rams, horses, pigs and cows, the innervations of the dura mater in humans and dogs, the venous system of the brain in dogs, and the morphology and mechanics of the jaw. He was also an outstanding surgeon, in 1938 he received the degree of associate professor in operative surgery and topographic anatomy at the University of Warsaw and took the position of head of the Institute of Operative Surgery and Topographic Anatomy. From September 1940, he was employed at the department of surgery of the Wola Hospital at 26 Płocka St.

Apart from the regular duties, by order of the authorities of the Underground University of Warsaw, he taught normal anatomy to the students of the University of

Warsaw. On 4 December 1941, he participated in the famed operation of freeing a prisoner from the Pawiak prison – Stanisław Tomaszewski "Malarz". On 5 August 1944, he was murdered by the Germans with a group of patients, wounded and the medical personnel of the Wola Hospital.

Publications in Military Physician

- 8 przypadków zbrodniczego rozkawałkowania zwłok [8 cases of maleficent body dismemberment]. 1923; 4 (7): 588-598

Aleksander Stanisław Krasuski (born 3/05/1890 in Warsaw, died 1940 in Kharkiv). He graduated from the Faculty of Medicine at the University of Warsaw, in 1922 he was awarded the diploma of doctor of all-medical sciences, and after he graduated history studies he received the title of doctor of philosophy in history. He associated the beginnings of his professional work with the Institute of Forensic Science at the University of Warsaw, he was also a physician for the Social Insurance Institution in Warsaw. In the years 1923-1924 he published works affiliated with the Institute of History of Medicine of the Faculty of Medicine at the University of Warsaw. He was interested in the history of diseases, such as influenza and artificial pneumothorax, he devoted his habilitation work to the history of the plague in Poland during the reign of Stanisław August Poniatowski (the monograph was destroyed as a result of military operations in 1939). His other works included *Na co chorowano i jak się leczono w dobrach magnatów polskich w końcu 18-go wieku* [What were the diseases and how were they treated in the estates of the magnates of Poland at the end of the 18th century] and *Parę słów o znaczeniu historii i medycyny dla lekarza* [A few words on the meaning of history and medicine for a physician]. At the beginning of the war he was detained by the NKVD in Starobielsk, he was later murdered in Kharkov.

Publications in Military Physician

- *Obojnactwo pod względem prawnym i społecznym: (Na podstawie dwóch przypadków kazuistycznych)* [Intersex in legal and social terms: (Based on two rare cases)]. 1923; 4(12): 1067-1076
- *Przyczynę do ran kłutych czaszki* [A contribution to skull puncture wounds]. 1924; 5 (9): 776-789

Franciszek Goebel (born 24/10/1885 in Poznań, died 1940 in Kharkiv). He studied at the University of Warsaw, and he was a soldier of the Polish Army from 1918. He associated his academic career with the Department and Institute of Physiological Chemistry, where he was a professor and a lecturer. The Department conducted scientific research on the biochemistry of muscles and blood, enzymology, and the biochemistry of proteins, sugars and nucleotides.

Publications in Military Physician

- *Normy odżywiania warmth polskiej i w armjach obcych* [Nutrition standards in the Polish and foreign armies]. 1922; 3 (9): 723-727
- *Cholesteryna, a odczyn Wassermann* [Cholesterin and the Wassermann reaction]. 1924; 5 (3): 224-230
- *O kwasicy* [On acidosis]. 1927; 10(2): 125-132

Karol Chodkowski (born in 1899 in the village of Pomaski Wielkie, died in 1940 in Katyn). He began his studies at the Faculty of Philosophy of the University of Warsaw, he terminated them and started to work as a teacher at a higher school in Maków Mazowiecki. In 1920, he joined the Polish Army as a volunteer and as a gunner of the 1st battalion of the 8th Field Artillery Regiment, taking part in the battles against the Bolshevik army near Pułtusk on the Wkra, near Nasielsk and Chorzele. After the war, he undertook studies in philosophy, and then started to study at the Faculty of Medicine, from which he graduated in 1928. He worked at the Department and Institute of Pathological Anatomy, first in the position of senior assistant, and after he was awarded the degree of *doktor habilitowany* in 1936 he was appointed head of the department. He was mobilized by the Polish Army in 1939 and was captured by the Soviets. He died in Katyn.

Publications in Military Physician

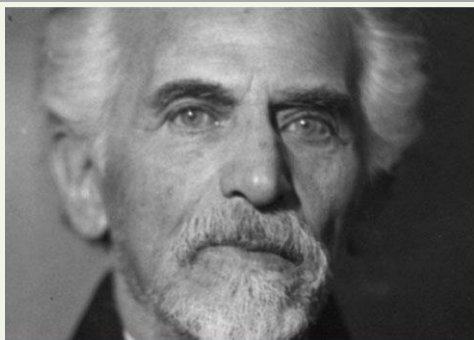
- *Mezenchymalne nowotwory złośliwe trzustki w świetle danych piśmiennictwa (z uwzględnieniem materiału sekcyjnego Zakł. An. Pat. U. W.)* [Mesenchymal malignant pancreatic tumors in the light of literature data (taking into account the dissection materials of the Department of Pathological Anatomy of the University of Warsaw)]. 1929; 13 (7): 321-338

Jerzy Fegler (born 02/02/1899 in Kherson in Ukraine, died 23/09/1958 in Cambridge). He received his education in Odessa and Warsaw and then in 1918 joined the Polish Army. In 1924, he received the title of doctor and began to work at the University of Warsaw, then he worked with the staff of the Institute of Chemical Defence at the Institute of Aviation Medicine. At the same time he lectured on physiology at the University of Warsaw. He received the title of professor in experimental pathology in Kraków. In 1939, he was supposed to begin work at the Department of Physiology in Vilnius, but the outbreak of the war shattered all those plans; he was mobilized. After the failure of the September Campaign he escaped through Romania to France, and then to Great Britain, to Edinburgh. There, in the years 1941-1946, he was a physiology professor at the Polish Medical Faculty. In 1949, he was granted British citizenship, and was appointed the director for scientific research at the Agricultural Research Council's Institute of Animal Physiology in Abrahams, Cambridge.

His research focused on hematology, neurochemistry and toxicology, diseases of the respiratory system, health issues related to aviation and human physiology in mountain conditions, he also significantly contributed to the development of physiology of the circulatory system.

Publications in Military Physician

- *O odczynie ponukleinowym płytek krwi. Doniesienie tymczasowe* [About the post-nucleic reaction of platelets. A provisional report]. 1924; 5 (10): 902-911
- *O własnościach fizjologicznych płytek krwi i o roli ich w patologii w świetle badań najnowszych* [About the physiological properties of platelets in the light of the most recent research]. 1925; 6 (11): 966-985
- *Badania doświadczalne nad rolą śledziony w regeneracji białych ciałek krwi* [Experimental research on the role of spleen in the regeneration of white blood cells]. 1927; 10 (1): 17-23
- *Badania doświadczalne nad wpływem zatrucia trójnitrotolueolem na narządy krwiotwórcze* [Experimental research on the influence of trinitrotoluene poisoning on the hematopoietic organs]. 1927; 10 (5-6): 443-467
- *Badania doświadczalne nad mechanizmami odczynu leukocytów po adrenalinie* [Experimental research on the mechanisms of post-adrenaline reaction of leukocytes]. 1927; 10 (3): 248-262
- *O efekcie chemicznego podrażnienia czuciowych zakończeń nerwowych w płucach* [About the effect of chemical irritation of the sensory nerve endings in the lungs]. 1928; 12 (4): 233-237
- *Badania nad rodzajem działania na oddech i układ krążenia niektórych arsinów chlorowatych* [Research on the type of effect of certain chlorinated arsenics]. 1929; 13 (1): 1-7
- *Badania nad wartością leczniczą tlenu wprowadzonego drogą pozapłucną* [Research on the therapeutic value of oxygen introduced through extrapulmonary ways]. 1931; 18 (1/2): 40-49



Henryk Nusbaum (Nussbaum) (born 22/04/1849 in Warsaw, died 18/02/1937 in Warsaw). In the years 1867-1872 he studied medicine at the Main School and the University of Warsaw. He started his professional career at the cholera hospital in the Wola district, then he worked at the cholera department of the St. Lazarus Hospital in Warsaw. From 1923, he was a lecturer at the University of Warsaw and the State Institute of Dentistry in Warsaw. His scientific interests included physiology, biology and pathology. He was one of the first to prove experimentally the presence of a center accelerating the heart rate in the heart, he explained the dynamics of this phenomenon and the tract of sympathetic fibers connecting this center to the cardiac muscle. He was also the first to prove the paralyzing effect of curare on the vagus nerve. In 1882 the head of the Warsaw district did not approve his habilitation, and Nusbaum focused on philosophical and medical issues.

Publications in Military Physician

- *Pogląd ogólny na zjawisko życia w świetle wiedzy współczesnej: Z cyklu odczytów filozofii medycyny* [General view on the phenomenon of life in the light of contemporary knowledge: From a series of lectures on the philosophy of medicine]. 1923; 4(7): 560-578
- *Pogląd ogólny na zjawisko choroby: Z cyklu odczytów filozofii medycyny* [General view on the phenomenon of disease: From a series of lectures on philosophy of medicine]. 1923; 4 (8): 655-668
- *Pogląd ogólny na zadania i stanowisko społeczne zawodu lekarskiego: Z cyklu wykładów filozofii medycyny w Uniw. Warsz.* [General view on the tasks and social position of the medical profession: From a series of lectures on the philosophy of medicine at the University of Warsaw]. 1924; 5 (1): 3-16



Stanisław Szober (born 6/11/1879 in Warsaw, died 29/08/1938 in Warsaw). He studied at the Russian University of Warsaw and privately under J. Karłowicz, and subsequently in Moscow. He lectured on historical grammar at the Higher Education Courses in Warsaw. In 1919, he received the title of a professor of the University of Warsaw, he also lectured at the Catholic University of Lublin. He was an editor of works on philology and coeditor of "*Poradnik Językowy*", a linguist, pedagogue and lexicographer. He was a member of many scientific and educational associations, in the years 1926-1928 he was the general secretary of the Warsaw Scientific Society. A member of the Polish Academy of Learning, co-organizer of the Institute Supporting Polish Literary Creation. He published a number of works on language theory, comparative grammar and the methodology of teaching Polish at school, the history and psychology of language, as well as popular dictionaries. He published in "*Język Polski*" and "*Poradnik Językowy*", wrote a column on linguistic correctness in *Kurier Warszawski* and hosted a show on Polish Radio.

Publications in Military Physician

- [S.S.] Linguistic section in *Military Physician*, its justification, needs and tasks. 1922; 3 (9): 886-887
- *Główne zasady układu wyrazów w zdaniu* [The main rules for ordering words in a sentence]. 1923; 4 (2): 172-174

Conclusion

The Editorial Board of *Military Physician* attributed a major role to the scientific value of the presented works. The primary objective set by the Military Sanitary Council was the constant development of the medical staff, and from 1925 "of the entire Sanitary Corps of members in active service and the reserve". The articles were also addressed to the pharmacists, sanitary officers and dentists "(...) so as not to, unlike before, provide the

opportunity, but also to stimulate the exchange of thoughts, motivate all the officers of the corps to work. (...) Our deepest desire is to not allow anyone to doze off for a moment, as it is often just a step away from torpor" [28].⁴

⁴ Words of Col. Prof. Z. Dmochowski, the first Chairman of the Military Sanitary Council, founded in 1919.

Following this idea, the journal opened its pages to the outstanding representatives of science and teachers from Polish universities. Due to the close cooperation between the Polish Army and the University of Warsaw, it functioned as their representatives, publishing them in the pages of *Military Physician* that were presented in the first two articles outlining the relations of the journal with the most important educational and didactic centers in the Poland of the interwar period.

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Infectious disease in the Polish Army stationed in the Eastern Borderlands, 1918-1921

Choroby zakaźne w wojsku polskim na Kresach Wschodnich w latach 1918-1921

Paweł Klocek, Czesław Jeśman

Department of the History of Medicine, Pharmacy and Military Medicine of the Medical University in Łódź; head: Prof. Czesław Jeśman MD PhD

Abstract. The article deals with the occurrence of infectious diseases in the Polish Army while stationed and taking part in military operations in the Eastern Borderlands, in the years 1918-1921. It has been emphasized repeatedly in the war histories that the losses resulting from poor sanitary conditions were often greater than those on the battlefield. While engaged in open warfare with the Soviet Army in the Eastern Borderlands, the Polish Army also had to cope with morbidity due to numerous infectious diseases, tuberculosis and venereal diseases. Epidemics involving various types of typhoid and cholera occurred within the area of military operations. The terrible social and living conditions of the native civilians favored the spread of tuberculosis, and it should be emphasized that venereal diseases were endemic in the areas of Eastern Poland. To combat the spreading epidemics, the office of Naczelny Nadzwyczajny Komisarz (Supreme Extraordinary Commissioner) was appointed. Help was also offered by the American Red Cross and the British Government.

Keywords: infectious diseases, military health service, Eastern Borderlands

Streszczenie. W artykule przedstawiono zagadnienia dotyczące występowania chorób zakaźnych w szeregach armii Wojska Polskiego stacjonującego i prowadzącego działania wojenne na Kresach Wschodnich w latach 1918-1921. W historii wojen wielokrotnie podkreślano, że straty sanitarne wynikające z niewłaściwych warunków sanitarno-higienicznych były często większe niż straty związane z działalnością wojsk. Wojsko Polskie, prowadząc otwartą wojnę z armią sowiecką na Kresach Wschodnich, musiało dodatkowo sprostać zachorowalności na dużą grupę chorób zakaźnych, gruźlicę oraz choroby weneryczne. Były to obszary występowania epidemii różnych postaci durów i cholery. Tragiczne wręcz warunki socjalno-bytowe okolicznej ludności cywilnej sprzyjały szerzeniu się gruźlicy, a obszar wschodniej Polski był obszarem występowania endemicznie chorób wenerycznych. Do walki z szerzącymi się epidemiami powołano urząd Naczelnego Nadzwyczajnego Komisarza; pomoc Polsce zaoferowały również Amerykański Czerwony Krzyż i rząd brytyjski.

Słowa kluczowe: choroby zakaźne, wojskowa służba zdrowia. Kresy Wschodnie

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Corresponding author

Paweł Klocek MD

Department of the History of Medicine, Pharmacy and Military Medicine of the Medical University of Łódź;

7/9 Żeligowskiego St., 90-643 Łódź

telephone: +48 42639 32 70, +48510568 976

e-mail: pawelklocek10@wp.pl

Introduction

The years 1918-1921 were a period of war between Polish and Soviet forces. The migrations of civilian population and the shift away from pre-World War I trench warfare towards maneuverable warfare helped to contribute to outbreaks of infectious diseases among soldiers. The wet, boggy areas of the Eastern Borderlands, essentially without a drainage system, made fertile grounds for malaria.

Weakened by the heavy mental and physical strain of warfare, and often without access to dry clothes, the soldiers were more prone to contract influenza, diphtheria, scarlet fever and epidemic meningitis.

The hardships of war and the resultant emaciation were also a major factor in tuberculosis morbidity and mortalities, as well as increasing trachoma morbidity.

The poor sanitary conditions and consumption of water from random sources resulted in an outbreak of typhoid fever and dysentery among Polish troops. There was also an increase in the incidence of cholera as a

result of exposure to civilians from cholera-infected areas.

Battle wounds led to the development of tetanus, while venereal-disease incidence also increased to epidemic proportions, the latter attributable to soldiers being away from their wives combined with compromised morality and poverty among local women, who increasingly resorted to prostitution.

Infectious diseases in the years 1918-1921

An increased incidence of **cholera** was recorded in the territory of Poland in the years 1918-1921. This development was attributable to the military operations and concerned mainly the eastern provinces. The epidemic developed essentially in three areas: Lida, Grodno and Brest-on-the-Bug. Infections were transmitted by Soviet soldiers, prisoners of war and the local population. Within a short period of time, 42 cases of cholera were diagnosed among soldiers in Lida, 2 new cases near Grodno and 8 cases in Brest-on-the-Bug.

In addition to the physicians, the responsibility for reporting new cases in cholera-affected areas lay with clergymen. Some districts in Grodno and Lida were military-only areas, where the authorities ordered the cleaning of municipal filter stations and water supply systems. A number of buildings near Lida were repurposed to serve as hospitals for cholera patients, large amounts of the "TETRA" vaccine were sent to cholera-affected areas, with the epidemic finally coming to an end in late January 1921.

Endemic **dysentery** concerned southern and south-eastern Poland. The Polish army struggled with the dysentery epidemic from July 1919 to October 1921, with about 38,700 cases of dysentery and 4,100 dysentery-related deaths being recorded in this period.

Underlying the outbreak of **cholera** was the Polish army's entry into Ukraine, which had a long history of cholera outbreaks. Infections were transmitted by convalescent prisoners of war and individuals with attenuated forms of cholera. The conditions in which Polish soldiers operated were also a factor: front-line soldiers were often stationed away from food-supply services, being forced to take water from unsafe sources.

Etiologically, the 1920 epidemic was caused by the Shiga-Kruse bacillus, and the regions with the worst epidemiological rates included Lublin, Kraków, Lviv, Toruń, Brest and Grodno. The authorities of these regions issued vaccination recommendations.

In 1920, there was a surge in **typhoid fever**, correlated with the Polish-Soviet war. The increase in epidemiological rates in 1921 was typical for diseases

with longer incubation periods. The epidemiological rates were much more favorable for soldiers than civilians, the reason being that Polish soldiers had been vaccinated earlier while they served in the armies of occupation. Preventive vaccination in the Polish Army was administered until 1919. The highest morbidity rates were recorded in August, September and October, which was directly attributable to the military operations. Typhoid fever morbidity increased as a result of the poor condition of water intakes in garrisons, while sanitary conditions were found to be alarmingly poor in the military hospitals in Vilnius, Brody and Równe (Rivne). Tests conducted at these sites showed that bacteriological and chemical waste levels were above normal by 31 and 49 percent, respectively.

It was prohibited to sell foodstuffs, fruit and vegetables within the barracks to try to prevent the epidemic from spreading. Water chlorination eventually helped to bring the populations of germs causing cholera, typhoid fever and dysentery down to manageable levels.

Russia was the main **typhus focus** for Poland; indeed, epidemiological rates in central Poland were much lower than in the east. In 1919, the morbidity and mortality rates in the Polish Army were nine- and seven-times higher, respectively, than among civilians. The epidemic grew worse between March and September, which means that there was a seasonal drop in the incidence of petechial typhus. The largest surge, involving 2010 new cases, was recorded in June.

The highest incidence rates were typically found on the Lithuanian-Belarusian, and Podolian and Volhynian fronts. An increased incidence rate was also reported in central Poland and in the Puck Bay ports, mainly caused by fugitives and refugees from the east transmitting diseases.

Starting from 1919, countermeasures against the spread of petechial typhus were led by the Central Anti-Typhus Committee (CKDur). The Expert Assessment of the Sanitary Chief of Command of the Polish Army in Lviv issued "Front anti-epidemic laws" on 23 May 1919. These laws placed special emphasis on housing units in rural areas in cabins, contacts with civilians were prohibited, and turnpikes were set up on roads to control civilian traffic.

After a meeting in Vilnius on 3 January 1920, the authorities set up

- regional CKDur offices in Vilnius;
- dressing stations closer to the front as well as bathing and disinfection trains;
- anti-epidemic units and CKDur hospitals.

The health service was responsible for the routine examination of soldiers for pediculosis and also for

disinfecting clothes. Soldiers were required to take a bath every 10-14 days.

On 11 February 1920, the Sanitary Chief of Command issued an instruction on "The Prevention of Typhus in the Field". The instruction was applicable to civilians as well, they being required to clean their homes thoroughly every two weeks and maintain personal hygiene. Each community was required to have a bathhouse and disinfection facilities, and people were recommended to air their clothes and expose them to the sun. Every soldier travelling by train also had to hold a "Healthy-Disinfected" certificate.

The most severe epidemic situations occurred in Volhynia and southern Podolia. Col. H.S. Shaw, Chief of the Infectious Diseases Division of the League of Red Cross and Red Crescent Societies, developed a comprehensive plan against petechial typhus in Poland. A propaganda campaign using posters, bills, the press and instructional films was launched to improve hygiene and sanitary habits.

On 31 January 1920 the position of Chief Extraordinary Commissioner for Combating Petechial Typhus was instituted. It was entrusted to Prof. Emil Godlewski, and was responsible for remaining in constant contact with the Sanitary Chief of Command and the Chief of the Sanitary Department of the Ministry of Military Affairs. Following a suggestion from the Sanitary Chief of Command, Col. Wojciech Rogalski PhD, sanitary cordons were set up in the Eastern Borderlands:

- for division-level gathering points;
- for POW camps;
- for gathering points from where POWs were sent out and transported.

Two cordons of the State POW, Refugee and Worker Assistance Office (JUR) were formed. The first covered Płaskinów, Równe, Zdołbunowo, Szepietówka, Sarny, Łuminiec, Brest, Białystok, Lida, Grodno and Dorohusk, while the second one included Winnica, Krasne, Tarnopol and Husiatyn. Quarantine rooms were designated in these places, and observation typically lasted 21 days.

While there are accounts of **influenza** dating back to the Middle Ages, it was not until 1933 that the actual virus was discovered. The disease spreads from the west to the east, the last pandemic in Europe taking place in the 1918-1919 period, being brought to Europe by American soldiers.

The influenza epidemic that struck the Polish Army in the years 1919-1920 was caused by severe warfare conditions. It reached its peak in December 1919 to March 1920. A total of 20,021 influenza cases were recorded in the first half of 1920 in the Warsaw, Łódź,

Kielce, Lublin, Kraków, Poznań and Grodno Military Districts.

This adverse development was caused, among other factors, by the conditions in which newly-enlisted soldiers were transported: unheated rail cars, scarce food and inadequate clothing. It was impossible at that time to prevent influenza outbreaks through vaccination, emphasis rather being placed on providing proper nutrition for patients. The patients were recommended to drink hot beverages and take potassium chlorate lozenges, while those with pulmonary symptoms were usually cupped.

Epidemic meningitis can be considered a disease of war. This disease was characterized by high mortality rates relative to morbidity. From 1920, Poland recorded increasing morbidity, with mortality rates in 1921 reaching nearly 60 percent. Inconsistent food supply due to the movement of the military units, stress and the tremendous physical effort involved in military operations caused meningitis to take an epidemic form.

In the years 1919-20, Poland had some of the highest **scarlet-fever** epidemic and mortality rates in Europe. Seasonal surges in morbidity were recorded during the summer months, including September. Mortality in the Polish army was two to three times higher than for civilians. To prevent the spread of scarlet fever, patients were quickly isolated and disinfection measures were taken. In the years 1919, 1920 and 1921, the National Institute of Hygiene produced 59, 105 and 124 liters of scarlet-fever serum, respectively.

Warfare also involved increased **tetanus** morbidity. A passage from a Head Quartermaster's order reads "To prevent tetanus cases caused by soiled wounds, it is recommended to give all the wounded, whether with minor or heavy wounds, tetanus serum shots as quickly as possible after being wounded." By September 1920, the High Command received 64,175 tetanus-serum bottles, the administration of which reduced mortality by 20 percent.

India, China and Russia were the endemic focuses from which **smallpox** was transmitted to Europe. Before World War I, Congress Poland had the highest smallpox morbidity rates, whereas in the Prussian partition this disease was merely sporadic.

Due to incomplete reporting, smallpox data in 1919-1920 did not reflect the full picture.

Table 1. Smallpox in the Polish army in 1919-1921**Tabela 1. Ospa w Wojsku Polskim w latach 1919-1921**

Year	Number of cases	Number of deaths	Morbidity per 1,000	Mortality per 1,000	Mortality (%)
1919	100	8	0.48	0.04	8
1920	180	14	0.61	0.05	7.8
1921	63	16	0.19	0.05	25.4

Even these incomplete data show that soldiers were affected by higher morbidity rates (Table 1).

To prevent the spread of smallpox, a special law was enacted on 19 July 1919 to institute mandatory vaccination. The National Institute of Hygiene produced smallpox vaccines, with a total of 2,015,000, 5,384,082 and 4,432,538 vaccine units being produced in 1919, 1920 and 1921, respectively. The National Smallpox Vaccination Institute was set up in Vilnius, and vaccinations were further increased before the 1920 offensive. A mass vaccination and disinfection/disinfestation campaign was undertaken across the country.

Malaria in the Polish Army was a serious problem. Compared to civilians, malaria morbidity among soldiers was extensive and the disease was one of the greatest health-related concerns of the Polish army. In 1920 and 1921, morbidity rates among soldiers were 270 and 95 times higher, respectively, than among civilians. The highest morbidity affected Brest, caused by the canal connection between the Dnieper and Bug Rivers, as well as Brest being a major transit center.

Adverse morbidity rates were recorded in garrisons located near rivers and bodies of water.

The 1921 epidemic was caused by warfare, with rainwater gathering in the numerous abandoned trenches, dugouts and shell craters, providing perfect conditions for mosquitoes to transmit malaria. Malaria morbidity increased as early as in March, to reach its peak in May and June. To prevent the spread of malaria, an order was issued to set up camps away from malarial locations and to protect barrack room windows with screens. Soldiers on night watch were equipped with masks and gloves.

Special care was taken of sapper units, bridge and rail companies and subunits operating near bodies of water. As a preventive measure, the soldiers were administered 1 pill of quinine every 5 days.

The largest Malaria Department (800 beds) was set up in the Podhale Rifles Hospital in Nowy Sacz.

Table 2. TB mortality rate in 1919-1921**Tabela 2. Umieralność na gruźlicę w latach 1919-1921**

Year	Warsaw	Lviv	Poznań	Kraków	Average
1919	7.84	6.05	4.67	4.61	5.80
1920	5.93	7.56	4.32	4.76	5.64
1921	3.40	4.43	3.35	3.69	3.72

TB in the Eastern Borderlands

Tuberculosis is primarily associated with poor living conditions and hygiene, emaciation, undernourishment and over fatigue. Soldiers of the Polish Army fighting in the Eastern Borderlands were clearly exposed to these risks, and due to the chronic nature of tuberculosis, the effects of increased morbidity became noticeable several years after the war.

During World War I, as a result of the inadequate examinations, a substantial number of enlisted recruits suffered from tuberculosis. Increased tuberculosis mortality caused by warfare was reported in Warsaw, Lviv, Poznań and Katowice, with tuberculosis mortality primarily affecting Lviv and Warsaw.

In 1919 tuberculosis observation departments were set up in all regional hospitals. Individual patients were observed for up to 14 days and then they were referred for treatment in a hospital or sanatorium. The Kraków region had the largest number of beds for TB patients.

In 1920, the number of TB patients increased further as Soviet prisoners of war were admitted to hospitals. In 1921, tuberculosis accounted for 317 of every 1000 deaths among soldiers, which was a 32 percent mortality rate. Pulmonary tuberculosis was the prevailing type (91.4 percent), with cases of bone and joint and lymphatic node tuberculosis being less frequent.

A framework for counteracting the disease was provided by the draft "Act on counteracting tuberculosis in Poland". The draft was prepared in 1918 by the Minister of Public Health, with the Drafting Committee being headed by Prof. Alfred Sokołowski. A major contribution was also provided by the head of the Anti-Tuberculosis Department, Maj. S. Rudzki PhD.

Table 3. Venereal diseases in the 6th Army field and stage hospitals in 1920/1921**Tabela 3. Choroby weneryczne w szpitalach polowych i etapowych 6. Armii w roku 1920/1921**

Year: 1920/21	Number of cases			
Month	Gonorrhea	Syphilis	Chancroid	Total
October	650	600	147	1337
November	500	400	90	990
December	322	180	38	540
January	727	415	148	1130
February	567	316	20	903
March	486	400	103	989
April	439	187	65	731

Passed on 3 April 1919, the Act stipulated that special care should be taken of children. Unfortunately, with the authorities having to focus on other infectious diseases, the Act ultimately did not come into force.

Special sanatoriums were set up to fight tuberculosis more effectively, with the Polish Army having its sanatorium in Zakopane 1921. The sanatorium was operated by the Polish Red Cross.

An epidemic of venereal diseases among soldiers

In the years 1878-1903, the percentage of venereal diseases relative to all diseases was 1.7 percent for the 5th Poznań Corps, 7.4 percent for the Austrian 11th Lviv Corps, 4.6 percent for the 2nd Przemyśl Corpse, and 3.6 percent for the Vilnius Military District. During World War I more than 112,800 soldiers of Polish descent contracted venereal diseases, of which 50,427 contracted syphilis. Cities had the highest epidemiological rates, while the morbidity figures in the countryside remained relatively low. A number of endemic-syphilis cases were reported in Hutsul Land.

The years 1919-1920 saw a surge in the number of venereal-disease cases. Particularly alarming reports came from line units fighting in the east. In November 1920 a total of 1402 cases of gonorrhea, 292 cases of syphilis and 89 cases of chancroid were found in a number of divisions. The decreased morbidity rates in 1921 were clearly attributable to the end of the Polish-Soviet War. Syphilis affected 1.5 percent of the Army's headcount in the first months of 1921, and the number of new cases decreased by three-fold in the months that followed.

According to the 1921 records, the most prevalent venereal disease was gonorrhea, accounting for 53

percent of all venereal diseases, followed by syphilis (34 percent) and chancroid (about 22-23 percent).

In 1918, the authorities began to clamp down on prostitution, which was considered to be a key factor in the spread of venereal diseases. All prostitutes were monitored by the Office for Sanitation and Prostitution Monitoring, there being 14 such agencies in Poland at the time, mainly in the largest cities. Almost every district and factory city/town set up a sanitation and prostitution monitoring station. District physicians were responsible for the sanitary monitoring of prostitutes.

During the formation of the Polish Army, all soldier-patients were referred to venereal disease hospitals in Modlin and Kraków.

In response to the growing number of venereal patients in the Eastern Borderlands, the Sanitary Department of the Ministry of Military Affairs decided in 1919 to set up offices for sanitation and prostitution monitoring under the respective government departments of the Eastern Borderlands, to close all brothels there, and to provide 1000 beds in areas near the front for women with venereal diseases. Also, an order was issued to treat prostitutes and a recommendation was given for weekly examinations of soldiers in garrisons.

Health Committees under the Army Command were appointed, venereal clinics were established in the operational areas of six armies, including in Równo in the 41st Provisional Hospital in Lutsk, the 72nd Provisional Hospital in Tarnopol, the 61st Provisional Hospital in Czortków and the 63rd Provisional Hospital.

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Infectious diseases in the Polish Army, 1922-1939

Choroby zakaźne w Wojsku Polskim w latach 1922-1939

Paweł Klocek, Czesław Jeśman

Department of the History of Medicine, Pharmacy and Military Medicine of the Medical University in Łódź; head: Prof. Czesław Jeśman MD, PhD

Abstract. The article deals with the occurrence of infectious diseases in the Polish Army following the Polish-Soviet War period, in the years 1922-1939. The formation of a new military health service began on signing the peace treaty with Soviet Russia. Military medical personnel had to face epidemics of infectious diseases, tuberculosis and venereal diseases. The first post-war years had significantly poorer indicators than the following years. The health service had to cope with such diseases as typhoid fever, typhus, diphtheria and bacillary dysentery. Another problem was influenza, with its seasonal nature. Moreover, high mortality rates were associated with widespread meningitis, while venereal diseases still constituted a serious problem. At the beginning of 1930s, endemic syphilis was detected among the Old Believers population in the Braśławski region of the Wileńskie voivodship. To better counter the spreading epidemics, the civilian health service closely cooperated with the Sanitary Department of the Ministry of Military Affairs. Furthermore, a number of instructions were introduced to better tackle diseases, such as instructions on fighting venereal disease in the Polish Army: "San 15", and "Instrukcja Zwalczania Chorób Zakaźnych i Wenerycznych w Wojsku" (Instruction on Fighting Infectious and Venereal Diseases in the Army) introduced in 1929.

Keywords: infectious diseases, military health service. Eastern Borderlands

Streszczenie. W artykule przedstawiono zagadnienia dotyczące występowania chorób zakaźnych w Wojsku Polskim po okresie prowadzenia działań wojennych, w latach 1922-1939. Po podpisaniu traktatu pokojowego z Rosją Sowiecką rozpoczął się nowy etap formowania wojskowej służby zdrowia. Lekarze wojskowi musieli zmierzyć się z epidemiami chorób zakaźnych, gruźlicy i chorób wenerycznych. Pierwsze lata powojenne charakteryzowały się znacznie gorszymi wskaźnikami niż lata następne. Służba zdrowia musiała sprostać takim chorobom, jak dur brzuszny, dur osutkowy, błonica i czerwonka bakteryjna. Problem stanowiła również grypa ze swoją charakterystyczną sezonowością. Wciąż dużym odsetkiem śmiertelności charakteryzowało się nagminne zapalenie opon mózgowo-rdzeniowych. Poważny problem stanowiły choroby weneryczne. Na początku lat 30. wykryto endemiczną kiłę wśród ludności wyznania staroobrzędowego w województwie wileńskim, w powiecie braśławskim. W celu lepszej walki z szerzącymi się epidemiami cywilna służba zdrowia ściśle współpracowała z Departamentem Sanitarnym MSWojsk. Przyjęto również liczne instrukcje mające na celu sprawniejsze zwalczanie chorób, np. dotyczące zwalczania chorób wenerycznych w Wojsku Polskim— instrukcję „San 15” oraz wprowadzoną w 1929 r. „Instrukcję Zwalczania Chorób Zakaźnych i Wenerycznych w Wojsku”.

Słowa kluczowe: choroby zakaźne, wojskowa służba zdrowia. Kresy Wschodnie

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Corresponding author

Paweł Klocek MD

Department of the History of Medicine, Pharmacy and Military Medicine of the Medical University in Łódź

7/9 Żeligowskiego St., 90-643 Łódź

telephone: +48 42639 32 70, +48510568 976

e-mail: pawelklocek10@wp.pl

Introduction

The years 1922-1939 constitute the period following the end of the Polish-Soviet War. The Treaty of Riga, signed in 1921, signaled the end of military actions and the beginning of a period of stabilization of the military health service. The profile of diseases changed, with a larger percentage of soldiers having access to qualified medical assistance. The initial post-war years were characterized by significantly degraded epidemiological indicators than the following years, which were the result

of the detrimental war conditions, sanitary negligence and excessive physical efforts. The increase in epidemiological indicators in the interwar period, especially the mortality rates, was related to the May Coup carried out by Marshal Józef Piłsudski in 1926.

The years 1928-1931 brought stabilization of the indicators – both in terms of incidence and mortality rates. The years 1932-1935 brought a slight increase in mortality rates, related to the increased burden of certain

infectious diseases. A similar situation, but with less intensity, occurred in 1935.

The year 1925 saw an unexpected increase in infectious disease incidence, mainly as a result of the deterioration of indicators related to influenza, or rather influenza-like diseases (the diagnosis was mainly based on finding a set of clinical symptoms), as well as scarlet fever, diphtheria and common parotitis.

Owing to the organized structure for the prevention and fighting of venereal disease, the incidence decreased by nearly 50%, both in the military and among civilians.

A certain stabilization in incidence was characteristic of tuberculosis, though at the turn of the 1920s a decrease in this indicator was recorded.

Epidemiological analysis of infectious diseases in the Polish Army in 1922-1939

During the interwar years in Poland the diphtheria epidemiological indicators were characterized by an upward trend. The lowest incidence rate was recorded in 1922 and the highest in 1937.

The increase in the incidence occurred in the late autumn, which is typical of diphtheria. An interesting situation related to diphtheria was observed in the Polish Army, where the incidence moved in the direction of the draftable age population. The incidence and mortality rates in the years 1922-1931 in particular districts of the corps are listed in Table 1.

As the source of infection was infected people, all infected soldiers were isolated from the rest of the subdepartment, and subjected to initial and final disinfection.

The basic method of prevention was the use of protective vaccinations. In the case of diphtheria treatment, diphtheria serum was used in intramuscular doses of 6-30 thousand units, vitamins (in particular vitamin C), gargling with various antiseptics, salicylates, aminopyrine, bromine compounds, and phenobarbital. Complicated cases were treated with the use of intubation or tracheotomy. The carriers of the bacteria were identified by means of the Schick test.

In the years 1920-1934, the diagnosis of **bacillary dysentery** in Poland was based on clinical symptoms. The areas with an endemic occurrence of this disease were the eastern and south-eastern provinces, the result of the poorer sanitary conditions in the eastern areas of the country.

Table 1. Diphtheria incidence and mortality rate in 1922-1931

Tabela 1. Zapadalność i umieralność na błonicę w latach 1922-1931

Corps district	Incidence rate	Mortality rate
Warsaw	79	2
Lublin	10	1
Grodno	13	0
Łódź	10	0
Kraków	2	0
Lviv	18	0
Poznań	6	0
Toruń	46	2
Brest	14	3
Przemyśl	23	0

The highest incidence rate was recorded in 1924, with 1565 cases. This was a record year, with a significant contribution by the epidemic in the area of the Poznań Corps District, where the number of cases amounted to 705. The incidents began in June and peaked in August.

Bacillary dysentery is a dirty hand disease – the soldiers infected with it ate fruit and vegetables that lacked proper preparation, while bacteria were also transmitted by flies and other insects. The most often infected soldiers were those who served in the area of road and railway junctions, as well as in major cities. The mortality rate on average amounted to 3.7%.

Prevention consisted of improving the sanitary and hygiene conditions. Polyvalent vaccine as a subcutaneous injection was used, produced by the National Institute of Hygiene. Vaccinations were particularly popular in such districts as Lviv, Kraków, Lublin, Toruń and Brest. Those infected were also treated with castor oil, liquid paraffin, linseed, belladonna, papaverine, poppy seed cake and charcoal.

Typhoid was one of the most dangerous diseases in the Polish Army, with the typhoid incidence rate being closely related to the sanitary conditions. In 1922 there were 299 cases recorded in the Polish Army, and 1000 cases in 1932.

The epidemic in the army reached the garrisons in Łódź, Katowice and Lida. The incidence rate was indirectly affected by the Besredka method of oral vaccinations, a method that achieved much poorer results than with subcutaneous vaccinations.

In all the cases of epidemics, leaves were suspended in the area of the garrison, the infected were hospitalized and all the people from the unit were isolated. The year 1932 saw the highest number of deaths being recorded, namely 89.

The higher typhoid incidence rate among soldiers resulted from the suboptimal condition of the water sources for more than 30% of the garrisons. When tested, the water sources were found to be characterized by a high *Coli* titer, excessive amounts of nitrites and excessive oxidizability of the water.

The highest typhoid incidence rates were recorded in September and October, which related to the participation of soldiers in activities on the training areas. The typhoid mortality rate in comparison to the civilians was also higher, at 12%. The worst rate was characteristic of the Corps Districts in Grodno, Łódź, Przemyśl and Warsaw.

Typhoid prevention mainly consisted of the use of preventive vaccinations. The most popular vaccine was known as "Tetra" (cholera, typhoid, paratyphoids A and B, later also C). There were compulsory vaccinations of soldiers on active service, recruits and cadets in officer schools. The first vaccination was conducted during the enlistment process, the second one 6 months later. Reservists drafted for activities in training areas were only vaccinated once. Employees of the army were vaccinated at their own request. The treatment consisted in administering various serums and a symptomatic treatment: diet, hydration of the patient and cool baths. In the 1930s neosalvarsan was used in the treatment.

In 1922 **typhus** was the cause of 43,000 infections and 3200 deaths. In the following years a significant decrease in the epidemiological indicators was recorded. The incidence rates among the residents of Poland were as follows:

- Vilnius and Polesie area – 0.2/1000,
- East Małopolska region – 0.26/1000,
- Volhynia and Lublin region – 0.05-0.14/1000,
- Central region (Kraków, Kielce, Łódź and Warsaw Provinces) – 0.04/1000,
- Pomeranian, Poznań, and Silesian provinces – free from typhus.

The economic crisis of the 1930s contributed to the deterioration of these rates. In 1922, there were 1041 cases among soldiers, while in 1931 there were only 5. The worst epidemiological results were related to the following Corps Districts: IX Brest, III Grodno, II Lublin, VI Lviv and I Warsaw. In the years 1923-1931, there were 109 recorded deaths.

Typhus prevention consisted in maintaining personal hygiene and the use of disinfestation and disinfection procedures. The most important method was the use of the *Rickettsii* vaccine attenuated with a 5% phenol solution. The inventor of the vaccine was Col. Prof. Rudolf Weigl, who manufactured it in a laboratory in Przemyśl.



Narodowe Archiwum Cyfrowe, sygn. I-W-715

Figure 1. Soldiers being examined by a military physician. National Digital Archive

Rycina 1. Lekarz wojskowy w trakcie badania żołnierzy. Narodowe Archiwum Cyfrowe

Until the 1930s **influenza** was only described on the basis of similar disease symptoms, the influenza virus being finally described in 1933. In the Polish Army, the incidence rate fluctuated from 1149 cases in 1925 to 5026 cases in 1930, the incidence rates increasing in November, December and January. The highest incidence rates were recorded in the following Corps Districts: Grodno, Brest, Lublin, Łódź and Warsaw. The highest mortality rates were recorded in January – 11, March – 9, May – 6 and November – 1. In order to prevent new cases in the Polish Army the following recommendations were introduced:

- morning training in clothes,
- providing soldiers with warm underwear and thorough oiling of the shoes,
- increase in the calorific value of the meals for soldiers,
- airing of the soldiers' rooms,
- maintaining an appropriate temperature in the soldiers' rooms.

The treatment of uncomplicated influenza consisted in the use of acetylsalicylic acid, aminopyrine and quinine. Recommendations included barbitone, panodine injections, gargling and codeine. Strychnine, morphine and glucose were administered intravenously in tough cases.

In the years 1922-1939, Poland was characterized by average epidemiological indicators concerning **epidemic meningitis**. Epidemics were recorded every 8 years: 1920-1923, 1928-1929, 1935-1938. The year 1937 saw the highest number of cases being recorded, at 1812. The diagnosis was determined by means of a set of symptoms, not the result of cerebrospinal fluid culture. In the Polish Army meningitis was characterized by a high mortality rate, which amounted to almost 50%.

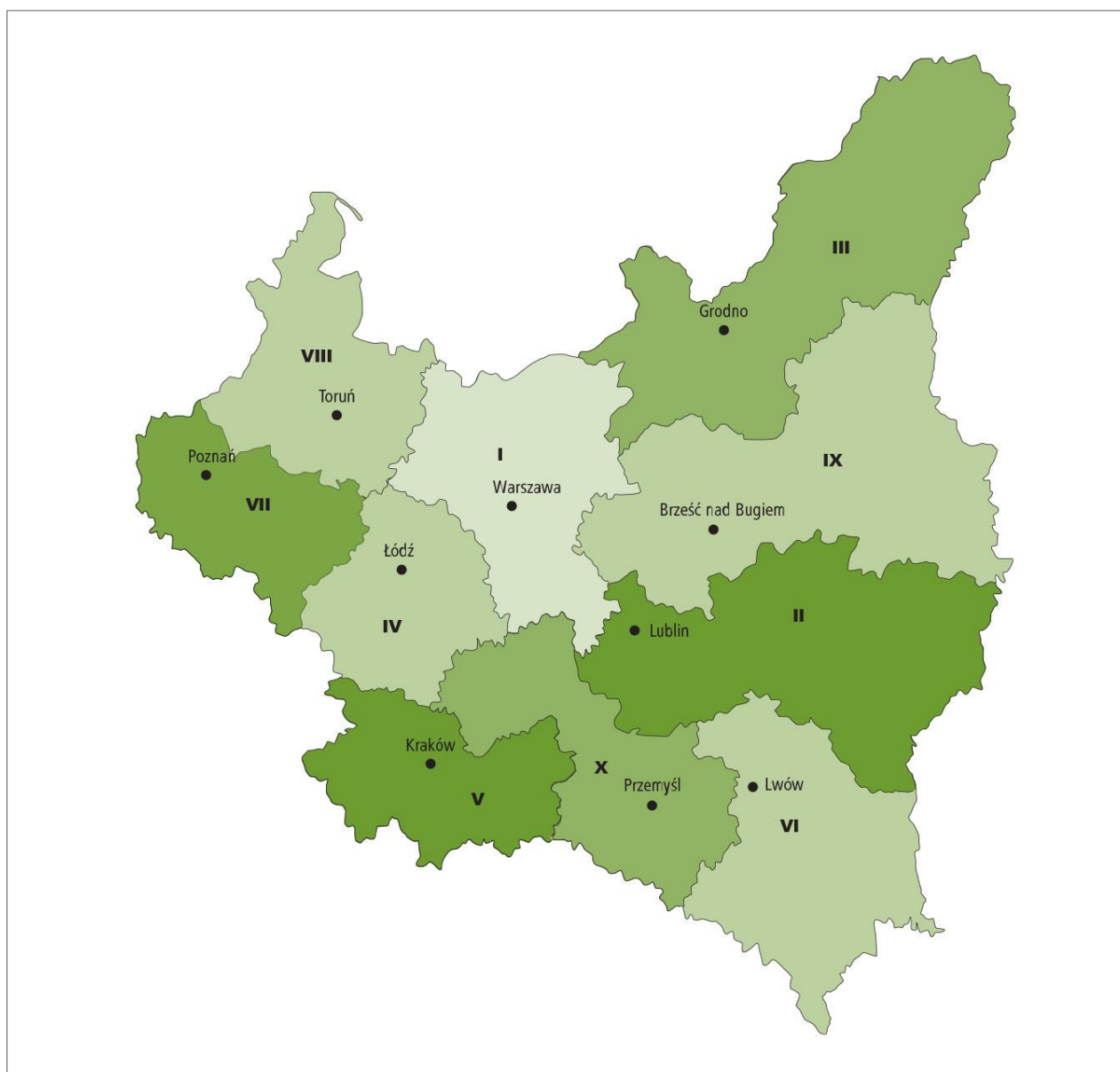


Figure 2. Corps districts in 1939
Rycina 2. Okręgi Korpusów w 1939 r.

The incidence rate vastly increased in 1935, which was related to the poor living conditions in the barracks. The disease was referred to as the "accommodation hygiene indicator", and the highest incidence rates were recorded in the following districts: Grodno, Lviv and Brest-on-the-Bug. In the years 1922-1931, there were 250 recorded deaths – 10 times more than among civilians; in 1935 it was 29 times more. This was, among other things, related to the decrease in the immunity of soldiers, caused by excessive physical effort. Prevention of the disease consisted in gargling with kitchen salt

solutions and a 3% solution of hydrogen peroxide, while the mucous membranes were also swabbed with an 8% solution of iodine and glycine. Meningococcal serum was used as part of the treatment, administered upon an earlier lumbar puncture.

The highest **parotitis** epidemic incidence rate in the Polish Army, at 1285, occurred in 1928, with the lowest in 1923. The increased incidence rate was typical of the first half-year. The worst indicators occurred in the following Corps Districts: Grodno, Lublin, Brest and Łódź.

Observations conducted in the District Hospital in Warsaw in the 1930s indicate that the course of disease in soldiers hospitalized in the years 1932-1933 was mild. In the years 1934-1935, complications occurred in 30% of the cases and mainly included orchitis and meningitis. Treatment consisted in administering antipyretics and analgesics, as well as the use of heating rubs. The infected soldiers were isolated and the soldiers' rooms were disinfected.

Measles rarely appeared in the Polish Army, although the incidence rate increased every 2-3 years. In 1920, the incidence rate was 0.9/1000, while it was lowest in 1924 at 0.09/1000. The highest indicators applied to the following Corps Districts: Grodno, Łódź, Warsaw, Lviv, Brest and Toruń. An increase in incidence was typical for the autumn months. In the years 1922-1931 there were 10 deaths caused by measles. If measles was diagnosed in soldiers, the rooms were disinfected, while 2 weeks of observation and preventive throat iodination were recommended.

The head of the Sanitary Department of the Ministry of Military Affairs, Gen. Rouppert, issued an order in 1937 on the collection of blood from convalescents in order to obtain serum. Serum obtained in such a way was used for passive immunization.

Scarlet fever is a disease that most often occurs in children aged 0-14 years, though in the military it was an epidemic disease with approximately 130 incidences and 6 deaths being recorded annually. This significant incidence rate is explained by the fact that most of the recruits came from rural regions, and most of them were not vaccinated. Once enlisted and encumbered with greater effort, they became susceptible to the disease. The incidence rate increased in the autumn and winter months, and until 1930 there was an upward trend. The highest numbers of cases were recorded in the Warsaw, Grodno and Kraków Corps Districts.

In 1926, a vaccination campaign for the children of officers and cadets was initiated. Treatment of soldiers consisted of compulsory isolation and hospitalization.

In 1922 there was a significant decrease in **malaria** incidence. In 1922 there were 17,611 cases, in 1923 there were 4770, and then from 1926 the incidence rate dropped below 1000, until the years 1930-1938 when it was down to 5. The highest malaria incidence rates mainly occurred in the Eastern Borderlands, which is the area with the largest number of water reservoirs and marshlands. The epidemic was brought to Poland from Central Asia and the Caucasus, with the highest incidence rate being recorded in the Polesie Province. The disease was most often caused by *Plasmodium vivax*.

The highest number of cases in the Polish Army was recorded in 1922 at 3806, with a seasonal increase usually occurring in June and July. A large habitat of *Plasmodium* was the area of the IX Corps District, Brest-on-the-Bug. The epidemiological indicators recorded in the Polish Army were much higher than among civilians, e.g. in 1929 the incidence rate was 4.5 times higher.

An intensive malaria control program was launched in the years 1921-1926. The methods used during the war were also successfully used in the post-war years. An obligation to report new cases of disease was introduced, mosquitoes and larvae were exterminated, and 0.5 g of quinine was administered as a preventive measure. In 1926, administering of synthetic anti-malarial agents was initiated, such as amido-quinine and quinoplasmin, being a combination of aminoquinine and quinine; Salvarsan was also used.

Epidemiological characteristic of the prevention and fighting of other infectious diseases in the Polish Army

Smallpox appeared in the Polish Army very rarely outside the war period. In the years 1922-1931, there were 18 recorded cases, 2 of which ended in death (Tab. 2). Treatment was symptomatic and prevention was based on the use of preventive vaccinations. Soldiers on active service, recruits and cadets were vaccinated.

Chickenpox rarely appeared in this period (Tab. 3).

Rabies was not an issue in the Polish Army, with not a single case of this disease being recorded in this period. Each case of a soldier having been bitten by an animal had to be reported to the municipal or the district physician. It was recommended to place the bitten soldier under the care of a military physician, and if the bite was extensive or in the area of the head, to direct the patient to the nearest branch of the National Institute of Hygiene. The treatment consisted in administering anti-rabies serum, and the observation period in the Military Hospital or in the infirmary was 20 days.

In the years 1922-1931, there were 30 recorded cases of **tetanus**, 25 of which ended in death. The low incidence rate was caused by the introduction of preventive vaccinations, within the framework of which tetanus anatoxin was administered in the form of a subcutaneous injection.

Tuberculosis in the Polish Army, 1922-1939

In the period 1922-1930 there was a visible upward trend in tuberculosis incidence, whereas in 1931 a slight decrease was recorded. The mortality rate in 1926 amounted to 2.6/1000, whereas in 1936 it amounted to 1.56/1000.

Table 2. Smallpox incidence and mortality rate in 1922-1931
Tabela 2. Liczba zachorowań i zgonów z powodu ospy prawdziwej w latach 1922-1931

Corps district	Incidence rate	Mortality rate
Warsaw	2	1
Lublin	2	0
Grodno	6	1
Kraków	3	0
Przemyśl	5	0

Table 3. Chickenpox incidence in 1922-1931
Tabela 3. Liczba zachorowań na ospę wietrzną w latach 1922-1931

Corps district	Incidence rate
Warsaw	21
Lublin	2
Grodno	11
Łódź	6
Kraków	2
Lviv	16
Poznań	2
Toruń	12
Brest	5
Przemyśl	3

Tuberculosis was one of the most dangerous diseases in the Polish Army. In 1932-1936, the rate of soldiers released from military service due to military tuberculosis amounted to 0.004%, with tuberculosis of the lungs at 2.2%, and of the organs at 0.26%. There were about 2.2-3% of soldiers in total released from service due to tuberculosis. Telatycki wrote in 1934: "due to the delay in the introduction of special legislation on the compulsory registration of tuberculosis incidence, we are not able to assess the size of the failure accurately. We do not know what the mortality rate in the infected is, and therefore it is difficult for us to assess the chance of recovery for particular patients".

In 1922-1931, there were 1657 people in the Polish Army infected with pulmonary tuberculosis, 8 soldiers infected with military tuberculosis, and 227 patients with tuberculosis of the organs. Pulmonary tuberculosis was the most common form (Tab. 4).

The highest incidence rate was recorded in the Kraków and Lublin Corps Districts, with the former having the largest number of anti-tuberculosis beds available. The highest incidence rate fell during the winter period and peaked in March. The highest mortality rate was recorded in the following Corps Districts: Kraków, Warsaw and Łódź. In 1922 there were 581 recorded deaths, and then 593 in 1923. By 1930-1931, the mortality rate was 4-5 times lower.

Each case of the disease had to be reported to the appropriate sanitary and municipal authorities. This obligation was imposed on all practicing physicians. In the case of the death of an infected person then disinfection procedures were to be conducted in their apartment. In general hospitals, a certain number of beds was allotted to tuberculosis patients. In the case of outpatient health care, the most important link involved the anti-tuberculosis outpatient clinics. Veterinary supervision was increased in order to prevent the spread of tuberculosis by way of consuming infected milk.

The Tuberculosis Control Committee, founded in 1922, involved 15 tuberculosis control associations and was responsible for the fight against tuberculosis. In December 1924, the Tuberculosis Control Association commenced operations. In 1927, there were 136 branches of the association, 140 tuberculosis control outpatient clinics, 3058 hospital beds and 3769 sanatorium beds. In 1928, a Tuberculosis Control Section was created in the Supreme Health Council. These institutions closely cooperated with the Department of Health of the Ministry of Military Affairs and the field military health service. In 1939, mass radiological examinations were proved to be the best and most reliable way of identifying and isolating those infected. Important facilities treating patients infected with tuberculosis were the military sanatoriums in Zakopane, Rajcza, Hołosko, Pustelnik, Ciechocinek, Inowrocław, Busk and Krynica.

Venereal disease epidemics among soldiers

It was difficult to estimate the number of people infected with venereal diseases. In 1922 there were 30,000 infected people, 52.3% of whom had gonorrhea, 43.8% had syphilis, and 3.9% had soft chancre.

The highest incidence rate applied to the inhabitants of cities, mainly the workers' districts where, due to poverty, a significant number of women dabbled in prostitution. Also, those recruits with origins in municipal environments had a higher percentage of venereal diseases than those from rural environments. The increases in incidence occurred in July and August, the period in which soldiers travelled to their training areas.

In the Warsaw garrison, 2-3% of new cases were identified in infantry and administration units, whereas

the highest percentage, of up to 9%, occurred in the vehicle squadron.

Table 4. TB mortality rate in 1922-1931

Tabela 4. Umieralność z powodu gruźlicy w latach 1922-1931

1922	1923	1924	1925	1926	1927	1928	1929	1930	1931
28.00%	29.00%	26.90%	11.80%	14.60%	11.20%	7.50%	7.00%	4.30%	5.90%

The proportions in incidence between different forms of syphilis were as follows: primary syphilis – 12.5, secondary syphilis – 32.6, and tertiary syphilis – 1 case.

The most common venereal disease was **gonorrhea**; in the Toruń Corps District the incidence rate amounted to 27.0/1000, in Łódź 21.8/1000, and in Lviv 20.0/1000.

The lowest number of soldiers of the Polish Army were infected with **soft chancre** – the incidence rate amounting to 1-5/1000 soldiers. At the end of 1930s, the venereal disease incidence rate had decreased by half in comparison to 1922.

In 1923, venereal disease control outpatient clinics were created in Hutsulshchyna and Podolia. Special sanitary and vice police brigades were created in large cities, and the Polish Committee against the Trafficking of Women and Children was founded. In 1926, 250,000 examinations and consultations were conducted for venereal disease sufferers in 11 operating sanitary and vice departments. In 1928, the Venereal Disease Control Association commenced its operations. In 1929, there were 22 state and 71 local government venereal disease control outpatient clinics.

At the beginning of 1930s, endemic syphilis was detected among the Old Believers population in the Braśławski region, in the Wileńskie voivodship. This concerned the families that were resettled to these regions from areas near the Volga River as a part of the penalty for russification.

With respect to prevention and fighting venereal diseases, the district physicians were obliged to cooperate closely with the chief physicians of the military units. In the Polish Army, the highest incidence in a year was identified in January (the post-holiday upsurge), in October (arrival of recruits) and in July and August (training ground activities).

Venereal diseases were fought in the Polish Army on the basis of two documents: the "San 15" instruction and the "Instrukcja Zwalczania Chorób Zakaźnych i Wenerycznych w Wojsku" (Instruction on Combating Infectious and Venereal Diseases in the Army), introduced in 1929.

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A military physician with an artistic soul - Col. Teofil Tadeusz Ziemski PhD (1914-2004)

Lekarz wojskowy o duszy artysty – płk dr n. med. Teofil Tadeusz Ziemski (1914-2004)

Zbigniew Kopociński, Krzysztof Kopociński, Czesław Jeśman

Department of the History of Medicine, Pharmacy and Military Medicine of the Medical University in Łódź; head: Prof. Czesław Jeśman MD, PhD

Abstract. The article presents the life of a Polish military physician from the Eastern Borderlands of the Republic of Poland, one who was also a painter. He was born in Strusow, in Tarnopol Province, on 24 March 1914. In 1938, he graduated from the famous Jan Kazimierz University in Lviv, then in 1939 he fought against Germany and Russia. During the Soviet and German occupation he worked as a physician in hospitals in Stanisławów and Trembowla. In 1944, he became an officer in the 5th Infantry Division of the 2nd Polish Army. After World War II, Lt. Col. T.T. Ziemski became the commandant of 105th Military Garrison Hospital in Żary and afterwards he worked as a consultant for the 5th Military District Hospital in Krakow. He was very popular as a painter, well recognized throughout the Krakow world of art. His numerous works include portraits, landscapes, etc. He died on 27 January 2004 at the age of 90.

Keywords: army physician, painter, Ziemski, military hospital Żary, Krakow

Streszczenie. W artykule przedstawiono sylwetkę polskiego lekarza wojskowego z Kresów Wschodnich Rzeczypospolitej Polskiej, który był także artystą malarzem. Urodził się 24 marca 1914 r. w Strusowie w województwie tarnopolskim. W 1938 r. ukończył sławny Uniwersytet Jana Kazimierza we Lwowie. Brał udział w wojnie z Niemcami i Rosją w 1939 r. Podczas sowieckiej i niemieckiej okupacji pracował jako lekarz w szpitalach w Stanisławowie i Trembowli. W 1944 r. został oficerem w 5. Dywizji Piechoty w składzie II Armii Wojska Polskiego. Po zakończeniu II wojny światowej ppłk TT. Ziemski był komendantem 105. Wojskowego Szpitala Garnizonowego w Żarach, a potem asystentem 5. Wojskowego Szpitala Rejonowego w Krakowie. Jako malarz był osobą bardzo popularną, rozpoznawalną w całym artystycznym świecie miasta Krakowa. Namalował wiele obrazów: portretów, pejzaży itp. Zmarł 27 stycznia 2004 r. w wieku 90 lat.

Słowa kluczowe: lekarz wojskowy, malarz. Ziemski, szpital wojskowy.

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Corresponding author

Zbigniew Kopociński MD, PhD

105th Kresy Military Hospital with Outpatient Clinic,
Subdepartment of Ophthalmology

2 Domańskiego St., 68-200 Żary

telephone: +48 68 470 78 62

e-mail: zkopocinski@wp.pl

For the centuries that the medical profession has existed, those who practiced it were recognized as the local elite. However, this was not only a result of the major significance of their skills in regard to diagnosing and treating diseases, but also their general education in the humanities, which entitled them to speak out on various issues of importance to the community, ones that were not necessarily related to health care. Almost every historical novel includes motifs presenting the

leaders of small localities, usually with doctors and clergymen among them. This was no accident, as both these groups received a good education that was not only limited to learning subjects related to the profession from a narrow point of view, but allowed them to become familiar with the achievements of the humanities in the broad sense. This was fostered by the very good model of education in secondary schools, in particular in Poland during the interwar period. It was not without a

reason, albeit slightly exaggerated, that many older people for years continued to repeat the following maxim: "a pre-war secondary school certificate means more than after-war studies". It was definitely not just the model of education, but also the people who took on the hardship of medical studies that determined the later image of the entire community.



Figure 1 Col. Teofil Tadeusz Ziemiński PhD (1914-2004), 1960s
Rycina 1. Płk dr n. med. Teofil Tadeusz Ziemiński (1914-2004), lata 60.

These were people with an interest in the humanities (though with exceptions), often exceeding the narrow field of medical and natural sciences. The result of such a situation was a large group of medics who were simultaneously artists, representatives of different art disciplines (music, painting, literature), who achieved professional skills in many fields of life activities. Everyone is familiar with the achievements of such people as Mikhail Bulgakov, Stanisław Lem, Krzysztof Komeda, Felicjan Sławoj Składkowski, Jerzy Woy-Wojciechowski, Tadeusz Boy-Żeleński and many others. *Toutes proportions gardées* this outstanding group of physicians-artists should include Col. Teofil Tadeusz Ziemiński MD PhD, military surgeon and anesthesiologist, decorated with the Cross of Valor, and at the same time a professional artist in paint.



Figure 2. Medical student Teofil Tadeusz Ziemiński drawing a caricature of one of the Lviv professors, Jan Kazimierz University in Lviv, 1930s

Rycina 2. Student medycyny Teofil Tadeusz Ziemiński rysuje karykaturę jednego z lwowskich profesorów, Uniwersytet Jana Kazimierza we Lwowie, lata 30. XX wieku

He was born on 24 March 1914 in Strusów in Tarnopol Province, to the family of Ludwik and Julia Ziemiński. The south-eastern borderlands of the Polish Republic were at that time under the rule of Austria-Hungary, but soon the First World War led this monarchy to its fall, and as a result of the new geopolitical situation and armed struggle Poland regained its independence. Young Teofil received an education in his homeland, which was now free, and it undoubtedly contributed to his outstanding intellectual development. He passed his final secondary school examination in 1932 at the 2nd Juliusz Słowacki State Gymnasium in Tarnopol, and then began his studies at the Faculty of Medicine at the renowned Jan Kazimierz University (JKU) in Lviv. The atmosphere in his family home and the undeniable loveliness of nature in the eastern borderlands promoted the formation of his sensitivity to beauty and art. His doubtless talent, especially in the field of drawing, is splendidly documented in a photo from his time as a student, showing a caricature of one of the JKU professors from Lviv that he had drawn in chalk on the board (Fig. 2). He received his medical diploma in 1938, and then underwent military training as a cadet of the

Reserve Battalion of the famous Medical Officer Cadet School (MOCS) of the Sanitary Training Centre in Warsaw (Fig. 3).

After the attack by Germany followed by Russia on Poland in 1939 he took part in the defensive war; he was lucky to avoid captivity, but found himself in the area of the Soviet zone of occupation [1, 2]. In the years 1940-1943, he was a doctor at the Infectious Diseases Hospital in Stanisławów, and then he worked at the Municipal Hospital in Trembowla.



Figure 3. Cadet Teofil Tadeusz Ziemiński, Warsaw, 1938

Rycina 3. Podchorąży Teofil Tadeusz Ziemiński, Warszawa, 1938 r.

It is important to remember that this was an incredibly dramatic and dark period, an apogee of the genocide of the Polish (and not only Polish) population organized by the criminal Ukrainian Insurgent Army (UPA) and the Organization of Ukrainian Nationalists (OUN). The Poles living in the area of the south-eastern borderlands of the Polish Republic were at that time hounded and threatened. They spent entire nights in all kinds of provisional hiding places (basements, mounds and stacks of hay), the glowing fires of burning Polish estates and settlements visible around, as well as the

shots and shouts of the murdered. This was the everyday life of Ziemiński and his family, a description of which remained in his memoirs. The actions of the Red Army against the Polish Army, although it meant the loss of sovereignty, was at the same time a salvation from the axe or saw of Bandera's butchers. Unfortunately, this tragic paradox ended with the loss of the eastern borderlands by Poland, including that great center of Polish art, science and culture – the "Always Faithful" Lviv.

In 1944, Ziemiński joined the Polish Army and took the position of physician in the independent training battalion of the 5th Infantry Division. With his unit, he followed the entire battle trail of the 2nd Polish Army. He brought particular credit during the battles at the Lusatian Neisse and near Budziszyn, as a result of which he was decorated with the Cross of Valor (a typical combat award, rarely awarded to the personnel of sanitary services, which should be emphasized in particular).

After the end of the Second World War he remained in military service, at first as a senior physician of the 15th Infantry Regiment in Skwierzyn, and then from 1948 a consultant of the Department of Surgery at the 111th Military District Hospital in Poznań [2-5]. In February 1958, he was appointed the commandant of the 105th Military Garrison Hospital (MGH) in Żary.

The time of relative stabilization favored the development of his interest in the arts, which was aided by a peculiar coincidence. During the inspection of the lofts of the hospital facilities, conducted with quartermaster Capt. Edmund Babicz, they found a great "Blutner" piano, which they renovated with their own means. This allowed, owing to the ingenuity and involvement of Ziemiński, to organize piano concerts by world-famous musicians in the hospital club, such as those of Prof. Stanisław Szpinalski (awarded 2nd Prize in the International Chopin Piano Competition in 1927) and Prof. Władysław Kędra (awarded 4th Prize in the International Chopin Piano Competition in 1948, who, after 1957, settled in Western Europe and became very popular throughout the music world).

Nowadays probably no head or commandant of a hospital, especially in a small town, would make a bid for such an enterprise, most would not even come up with the idea in the course of the constant struggles for limits, procedures, financial resources, etc. Which military facility would now be able to organize a concert of artists of such class as Rafał Blechacz or Krystian Zimerman? Which of them has a piano of an appropriate quality at its disposal? These are rhetorical questions, which reveal the uniqueness of the figure of Lt. Col. T.T. Ziemiński, who operated in conditions that were much more difficult than nowadays, yet he also deemed it necessary to satisfy the spiritual needs of the patients

and the personnel. He was in incredibly close relations with the latter, which is well illustrated by his decision in regard to the further fate of the above-mentioned instrument: "Together with Capt. Babicz we decided that we donate the above-mentioned piano to the Employees of the Hospital, for their attitude and devotion, many a time in hard work". After T.T. Ziemiński moved to Kraków, the great "Blutner" piano went missing and its later fate remains unknown [6-9].

In April 1957, the then Lt. Col. T.T. Ziemiński took the position of senior consultant at the 5th Military District Hospital in Kraków; with specializations in surgery and anesthesiology he was active in both of these fields of medicine, but mainly in the latter one. Kraków, similar to Lviv in terms of architecture and mentality, made the passion for drawing and painting alive again in the soul of the borderland medic.



Figure 4 Winter landscape of Krakow by Teofil Tadeusz Ziemiński

Rycina 4. Zimowy pejzaż Krakowa namalowany przez Teofila Tadeusza Ziemińskiego

The pursuit of artistic passions never resulted in the negligence of his official duties. In this respect he was not a typical representative of the Bohemian style, i.e. "nose in the clouds", who did not care for everyday matters, apart from art. The best confirmation of this was his PhD viva for the thesis: "Foreign bodies in the esophagus vs. self-harm" on 21 February 1969 at the Faculty of Medicine of the Medical Academy in Kraków. The supervisor of the thesis was Prof. Jan Sekuła, and it

was created on the basis of materials collected at the District Prison Hospital of the Central Prison at Montelupich Street in Kraków.

He ended his military service in 1974, with the final rank of colonel. His leaving the service was probably in a certain part affected by his great passion for painting, which he had been increasingly devoted to from the beginning of the 1970s. He became a member of the Creative Artists' Club at the Cultural Centre in Kraków

and started to create his own paintings. He mainly used the oil painting technique, and his works were very different in terms of their themes: portraits, landscapes, generic scenes, fragments and details of architecture (Fig. 4). He was definitely innately sensitive to color, light and form, which is apparently typical of the people of borderland origin. In March 1984, at the Gallery of the International Press and Book Club in Kraków, a solo exhibition of the works of T.T. Ziemiński was organized, and presented 29 of his works. More than 40 paintings appeared at the next solo exhibition he organized in May 1987 at the Garrison Club in Kraków. He repeatedly participated in the National Post Open-Air Painting Exhibition "Kraków – Testimony to History", winning numerous prizes. He often donated his works free of charge to different social initiatives, e.g. in 1989 the painting "Na smętną nutę" ["On a melancholic note"] appeared in an auction, the proceeds from which provisioned the National Fund for the Revalorization of Historic Buildings and Monuments in Kraków. Throughout the years of his artistic activity, he became a well-known person in the world of painting in Kraków, and he had several solo exhibitions. His works are in private collections, different museums, galleries, as well as in hospitals. Sometimes he carried out a project at the special request of his friends.

Col. Teofil Tadeusz Ziemiński MD PhD died on 27 January 2004. He was buried at the cemetery at 1 Darwina Street in Kraków, burial plot VI/2/10.

For his many years of brave service he was decorated with numerous awards, including the Cross of Valor, the Knight's Cross of the Order of Polonia Restituta, the Gold Cross of Merit, the Medal "For the Capture of Berlin", the Medal "For the Oder, the Nissa and the Baltic", the Grunwald Medal and many others.

The family traditions in the field of medicine were continued by his son Janusz and daughter-in-law Barbara Strzelecka – both of them physicians [1, 2].

Until the end of his life he reminisced about the Eastern Borderlands and his "105th Hospital in Żary" with great sympathy. In the latter, in May 2014, a

commemorative plaque was revealed to honor all the commandants of this facility, in particular T.T. Ziemiński MD, the person who is still remembered and extremely respected in this capital of Polish Lusatia.

It should be emphasized that he was a very extraordinary person, a great physician, and at the same time a professional artist. The dramatic experiences of the Second World War period did not manage to destroy the innate sensitivity of his soul to the beauty and suffering of another human being. He combined these two types of sensitivity in his way of life, finding fulfilment both in the profession of a physician and in painting. His example should incline contemporary teachers at Medical Universities to attempt to educate young adepts of medicine into being doctors with open minds, not just proficient craftsmen in a very narrow field of science.

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Medical and social issues concerning public health in western Belarus / eastern Poland during the inter-war period

Medyczne i społeczne aspekty zdrowia publicznego zachodniej Białorusi/wschodniej Polski w okresie międzywojennym

Eugeny Tishchenko

Grodno State Medical University, Head of the Department of Public Health and Organization of Health Services, Grodno, Belarus

Abstract. The hostilities which took place in the eastern parts of Europe during the First World War followed by the Polish-Soviet war had a very negative effect on the sanitary and epidemiological situation and contributed to the spread of contagious and parasitic diseases among the local population. The aim of the study was to present the epidemiological situation in western Belarus and eastern Poland during the Inter-war period, with the emphasis on the prevalence of infectious diseases, anti-epidemic measures, sanitary conditions and the standard of living. Particular attention was paid to the medical and social aspects of the public health care system in the inter-war reality of Eastern Europe.

Keywords: eastern Poland, Inter-war Period, public health, western Belarus

Streszczenie. Działania wojenne, które miały miejsce na wschodnich rubieżach Europy w okresie I wojny światowej, a następnie wojny polsko-radzieckiej, w znaczący sposób przyczyniły się do pogorszenia stanu sanitarno-epidemiologicznego oraz rozwoju chorób zakaźnych i pasożytniczych wśród ludności miejscowej. Celem pracy było przedstawienie sytuacji epidemiologicznej zachodniej Białorusi i wschodniej Polski w okresie międzywojennym, z uwzględnieniem rozpowszechnienia chorób infekcyjnych, działań przeciwepidemicznych, warunków sanitarnych oraz poziomu życia mieszkańców. Szczególną uwagę poświęcono medycznemu i społecznym aspektom zdrowia publicznego w międzywojennej rzeczywistości Europy Wschodniej.

Słowa kluczowe: zdrowie publiczne, zachodnia Białoruś, wschodnia Polska, okres międzywojenny

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Address for correspondence

Prof. Eugeny Tishchenko

Grodno State Medical University

Department of Public Health and Organization of Health Services

Gorkiy Str. 80, 230009 Grodno

telephone: +37 5 152 434 687, +37 5 297 833 049

e-mail: tishchenko.60@mail.ru

e-mail: health@grsmu.by

The hostilities that took place in the eastern parts of Europe during the First World War, and then during the Polish-Soviet war, had a very negative effect on the sanitary and epidemiological situation and contributed to the spread of contagious and parasitic diseases among the local population. In the early 1920s, the threat of epidemics in western Belarus / eastern Poland was eliminated through some extreme disease prevention measures taken at the central government level. In 1922

the incidence of typhus was 52.9 per 10,000 people in the Novogrudok province and 67.7 per 10,000 in the Polesye province, with the incidence of recurrent typhus being 53.4 and 148.8, respectively. At the initiative of the All-Russian Extraordinary Commission (Cheka) for Combating Epidemics (operating from 1920 to 1923) sanitary buffer zones (cordons) were arranged along the migration routes for incoming refugees and repatriates. For example, in the Novogrudok province a staging post

(Stolbtsy) and a repatriation post (Baranovich) were arranged at the railway stations of both cities, with the help of the League of Nations. These posts provided the decontamination of people, disinfection of personal belongings and vaccinations. With a similar purpose, inoculation, bathing (Grodno, Lida, and Pruzhany) and bacteriological (Baranovich) stations were organized. In addition, in several towns (Grodno, Lida, Brest, and Luninets) domestic staging posts were also arranged, the latter being supplied with isolation stations in which repatriates could stay for up to five days. A repatriation post was also established next to the road bypassing Molodechno.

The All-Russian Extraordinary Commission for Combating Epidemics played the main role in the foundation of specialized hospitals. For example, between 1921 and 1922 in the Novogrudok province alone, a hospital with 1,100 epidemic beds was set up, and in Baranovich a similar number of hospital beds were arranged for repatriates. Later, the majority of the hospitals founded by Cheka were reorganized into governmental hospitals. In mid-1923, in the Novogrudok province a total of 16 out of every 20 beds (88.1%) were in government hospitals, while in Polesye province the figure was 21 out of every 24 beds (85.4%).

Appropriate medical measures and initiatives (diagnostics, registration, isolation, hospitalization and inoculation) helped to stabilize the situation but did not eliminate the potential risk of the spread of parasitic typhus. Therefore, in the Polesye province alone, the incidence of typhus fever in 1928 was 1.0 per 10,000 inhabitants, while the incidence of typhoid fever was 1.8 per 10,000, and in 1938 4.0 per 10,000 and 1.5 per 10,000 respectively. It should be noted that in 1938 the incidence of the parasitic forms of typhus in the Novogrudok, Polesye and Vilna provinces was the highest in Poland. Furthermore, the epidemic outbreaks of these diseases occurred on a regular basis in rural areas. It should be mentioned that during the inter-war period there were no sanitary services operating in western Belarus / eastern Poland outside of a few cities and even there only to a limited extent. For example, in the 1920s, a sanitary department affiliated with the municipal government of Grodno (Magistrate) was established, and in the early 1930s, sanitary offices (bureaus) were set up in several out-patient institutions (Baranovich, Brest, and Pinsk). Still, the actual number of sanitary personnel did not change: in 1925 there were 2 sanitary physicians and 4 disinfectors in the Novogrudok province, and in 1936 the same number of physicians and 11 sanitary inspectors. In the 1930s, only a limited number of laboratories (in Belostok, Brest, and Grodno) were capable of conducting foodstuff investigations. With the purpose of controlling epidemic

outbreaks, special epidemic convoys (disinfector, hygienist, and disinfection apparatus) were arranged to manage the foci of infections. In 1928 there were 2 such convoys in the Vilna province, and in 1938 there were 7. Sanitary functions were allocated to district physicians and primary care physicians, who were principally responsible for other tasks.



Figure 1. Sanitary center of the Polish Red Cross, Baranowicze 1931

Rycina 1. Punkt sanitarny Polskiego Czerwonego Krzyża, Baranowicze 1931

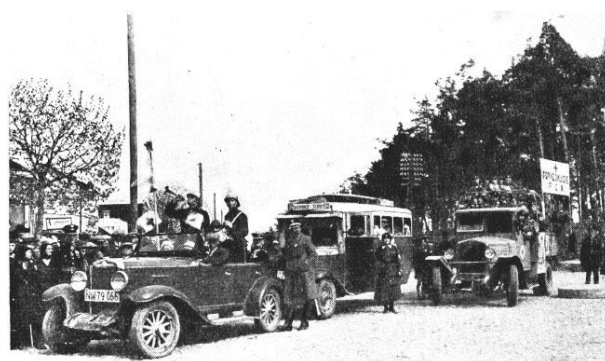


Figure 2. Sanitary center of the Polish Red Cross, Baranowicze 1931

Rycina 2. Punkt sanitarny Polskiego Czerwonego Krzyża, Baranowicze 1931

One physician, D. Kezevich, noted: "Communicable disease control, industry and trade, school, home and estate, drinking water, sewage disposal, statistics and sanitary education - all these things are left without a responsible official, without proper sanitary consideration".

It should be noted that funds for sanitary and anti-epidemic measures were mainly allocated by central government or municipal treasuries. However, some other non-governmental institutions were also engaged in providing financial support, while the Red Cross

society was involved in health promotion as well as in forming and supporting epidemic convoys (Picture 1-2).

From 1936 to 1939, the Polesye division of the Polish Hygiene Society in Brest popularized issues related to hygiene and sanitation (traveling exhibitions, lectures, courses, and publishing booklets). In addition, private bacteriological laboratories were also established, with 7 such laboratories in the Novogrudok province in 1936.

The unfavorable sanitary and living conditions were the main cause of the spread of various forms of parasitic typhus. In 1928, only 2 out of 9 cities in the Novogrudok province had public bath houses, 1 city had a water supply system, and 2 had a sanitary brigade. In 1934, 80% of the streets in Baranovichi were not paved. The unfavorable living conditions are partly illustrated by the data in Table 1.

The poor sanitary conditions in schools should be considered as well. In 1928, 57% of the schools in the Novogrudok province were not supplied with washing facilities, 38% did not have toilet facilities, 36% lacked wells, and 2.4% did not have flooring. Thus, all initiatives aimed at sanitary and hygiene improvements, such as paving and conservation of streets, arrangement of markets and slaughterhouses, building public bath houses, provision of safe water supply and waste water disposal systems were of paramount importance. In order to promote good hygiene practices, a series of sanitary regulations were issued: on maintaining cleanliness in the home and outdoors (1922, 1932), in shops and other public utility buildings (1923), in hairdressing premises (1922, 1935), in schools (1930), at railway and bus stations (1932); on building and maintaining wells (1920), on maintaining water supply and sewage systems (1922); and on supervision over the manufacturing and selling of food (1928). It should be mentioned that approximately 85% of the funds allocated to the health care service was spent on the "prevention of diseases", i.e. on the implementation of the abovementioned initiatives rather than on sanitary service organization. In 1929, campaigns began with the intention of promoting the use of public services and utilities in urban and rural areas. In the course of such campaigns (1935), Brest was divided into districts, and under the municipal head's supervision sanitary guardians were appointed (1933), these guardians exercising control over the condition of streets and residential areas. In the 1930s, water supply and sewage systems as well as a sewage treatment plant were built in Brest. However, the general sanitary conditions did not improve radically. For example, in 1938, 62% of food stores, 40% of bakeries, 34% of bath houses, 30% hairdresser's, 23% of hotels, 40% of meat samples, 30% of water samples, and 8% of milk

samples that were examined in the Polesye province did not comply with the sanitary requirements. Furthermore, general sanitary literacy showed little improvement. During the inter-war period, anti-epidemic measures against social diseases (trachoma, tuberculosis, and venereal diseases) were taken by the government. New cases were identified and registered by specialized independent dispensaries (the first ones in Novogrudok town and province were anti-venereal, 1923; anti-tuberculosis, 1925; anti-trachoma, 1926). In 1933, there were 12 anti-trachoma, 8 anti-tuberculosis and 3 anti-venereal dispensaries in the Polesye province.

Table 1. Living conditions in three cities of the Novogrudok province in 1928

Tabela 1. Warunki zakwaterowania w trzech miastach województwa nowogródzkiego w 1928 roku

Types of houses	Percentage of houses		
	Baranovichi	Novogrudok	Lida
wooden houses	94	90	86
single-room houses	36	42	35
mean number of residents per room	3.3	2.9	2.7
Houses with an electrical supply	47	40	44
houses supplied with a trash can	61	63	80
houses with toilet facilities	5.2	21.7	11.2
houses with straw thatched roofs	6.1	1.9	14

Each of these laboratories received funding from local and central government. In the late 1920s, several new outpatient medical institutions were opened in western Belarus (Slonim, 1926; Vileyka, Glubokoye, 1929). According to the regulations, their main tasks included implementing and coordinating disease prevention measures, as well as preventing and detecting social diseases, providing medical care with elements of prophylactic medical examinations for certain population groups (pregnant women, mothers, children), and providing medical assistance to the general population. These health centers were mainly funded by local authorities and central government (e.g., in 1930, in the Novogrudok province 73.5% of all expenditures were from local and 22.7% from public funds). Occasionally some health centers received funding from other sources. For example, in 1930 a district health center in Lida received 25.6% of its funding from a social insurance office, 22.6% from municipalities, 20.8% from the city council, and 14.9% from the provincial council.

In the 1930s, the number of health care facilities increased significantly (e.g. the number in the Polesye province increased from 4 in 1933 to 27 in 1938). Health centers functioned according to the territorial principle (one per 8,000-15,000 population within a radius of 10-15 km) were headed by primary care physicians and were usually adequately staffed with nurses and physicians. However, this was not always the case, as in 1938 about a half of the health care facilities in the Polesye province were not fully staffed with physicians. The majority of health centers consisted of three units: anti-trachoma, anti-tuberculosis and anti-venereal dispensaries. In 1933, in the Vilna province, 85.5% of all visits to a doctor were due to trachoma, 5.5% due to tuberculosis, and 3.1% due to venereal diseases. Traditionally, a dispensary occupied one office in a rented building. Health centers were usually supplied with poor quality equipment (microscope, weigh-scales, and quartz lamps); moreover, even in the city health care facilities (e.g. the Brest municipal center, 1936) medical assistance was only provided for a few hours weekly. Thus, their capability to provide treatment was limited.

In order to limit the spread of trachoma (e.g. in 1928 the Vilna and Novogrudok provinces ranked third and fourth in Poland as to the prevalence of the disease, while the incidence rate in Vilna province was critical: 1926 - 51 and 1928 - 156 per 100,000 inhabitants), and so a series of disease prevention measures were introduced, including obligatory registration and examination (1928) of infected patients by district physicians; the annual inspection of schoolchildren, adoption agency children and army draftees; and the organizing of anti-epidemic convoys.

Tuberculosis was also a topical issue in the Inter-war period, as in 1930 the incidence of TB in the Pinsk province was the highest in Poland. In line with the Statutes, anti-tuberculosis societies organized specialized dispensaries (Grodno, 1926), carried out sanitary educational work (anti-tuberculosis days: December 1934, Brest; travelling exhibition: 2 December 1934 - 1 April 1935, Polesye province). There were two anti-tuberculosis sanatoria (Malorita, 1924; Novoyelnya, 1928); however, in the 1930s, only a few health centers provided BCG vaccinations, Pirquet's test, Biernacki's test, radiological examination or quartz treatment. In 1938, a draft law on tuberculosis control was prepared.

Within the inter-war period, police supervision over prostitution was introduced (1922), while measures to control STDs were taken by some civilian institutions as

well (registration, district commissions). Syphilitic patients could receive free salvarsan in health care centers, although the medicine was sometimes lacking.

Between 1920 and 1931, Poland introduced a law to restrict the marketing of strong alcoholic beverages, and a nationwide anti-alcohol campaign was launched (commissions under government supervision). Special educational campaigns for the general public were initiated (Polesye province, December 1928), and the first anti-alcohol dispensaries were opened (one in 1936, Belostok province).

Maternity departments were also organized in the health care centers; in 1928 in the Polesye province there was 1 maternity department, while in 1938 22 of the 27 stations were organized as part of the functioning of health care centers. Such institutions were funded by non-governmental organizations as well; for example, in 1929, in Vilna province 3 out of 6 maternity departments were organized by the trade union of working women, although they provided care for a limited number of children and women (e.g. in 1933 in Belostok province up to 13% of children were born under their care and in hospitals of the Vilna province 2.4% of deliveries were performed according to their recommendations). At certain health care centers there were dairies for neonates (e.g., in 1933 in the Vilna province there were 4 and in Belostok province there were 10).

Schools were subject to hygiene supervision by district and primary care physicians, and hygienist-nurses (e.g., in 1930 in the Polesye and Novogrudok provinces there were only 6 of these for each province). In 1933, only 33.6% of schools and 35.4% of children were examined by medical professionals in Belostok province. 8.3% of the examined children did not maintain personal hygiene and 5.4% were infested with lice. Throughout the 1930s there was a high prevalence of diphtheria, scarlet fever, measles, tuberculosis and trachoma among children.

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**płk w st. spocz. prof. dr hab. n. med. Sylwester Czaplicki
(1925-2016)**

Z głębokim żalem żegnamy
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specjalistę chorób wewnętrznych i kardiologii,
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