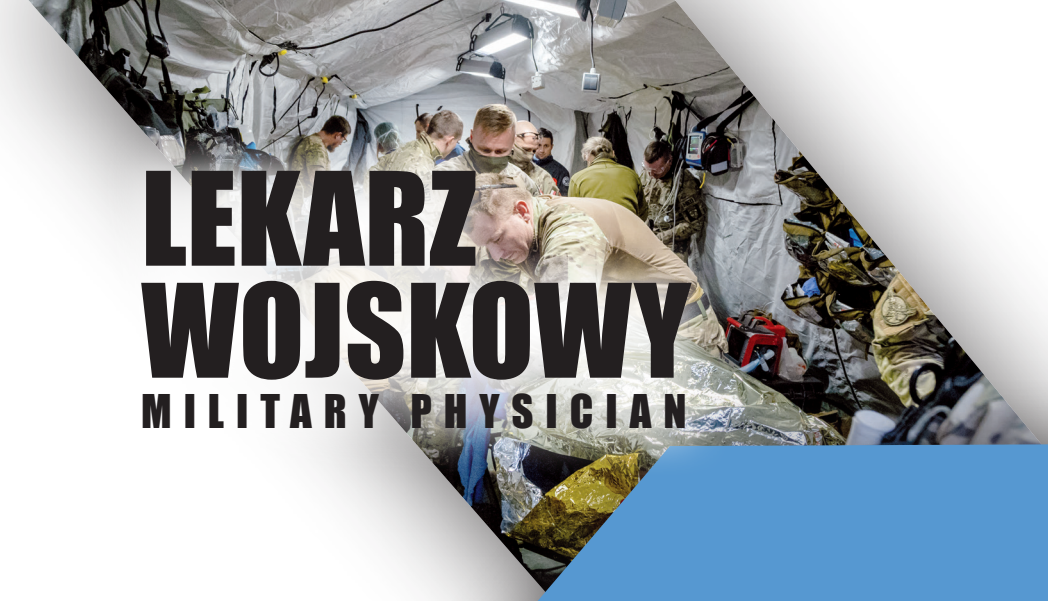

LEKARZ WOJSKOWY
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- Physiological and biological effects of a gunshot wound
- The feasibility of imprint cytology for accelerating cancer diagnosis
- Nasal reconstruction in a patient after surgical treatment of recurrent basal cell carcinoma of the left nasal wing
- Prosthetic restorations for children and adolescents under 18 years of age

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

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Letter from the Editor-in-Chief

Dear Readers!

Welcome to the year 2025 with our new issue, which opens the 103rd volume of "Military Physician". As I have already mentioned, we are eagerly awaiting the evaluation of our quarterly by a panel of experts appointed by the Minister of Science. We hope that our medical journal that has been published uninterruptedly since 1920, presenting papers on broadly understood health safety and the latest reports in the field of therapy, thus offering undeniable educational values, will be recognized by the experts. Works are also underway to include "Military Physician" in international databases.

In this issue, we continue the topic of managing the costs of services for patients with disabilities, this time focusing on the experience from Ohio. We also present a paper on prosthetic treatment for children and adolescents, which sheds light on the important challenges in paediatric dentistry.

Topics in the field of oncology and infectious diseases have also been addressed. A review of screening methods for HPV-related anal cancer in the MSM population, discussing their advantages and limitations, as well as an original paper assessing the possibility of using cytology in the rapid diagnosis of malignancies may be a source of valuable knowledge useful in clinical practice.

In this issue, you will also find publications on military and emergency medicine. The experiences of the military health service during the flood in Lower Silesia in 2024 are a valuable lesson in organizing help in crisis situations. In turn, the paper on the physiology and biological effects of gunshot wounds provides important data for doctors managing patients with ballistic injuries.

The clinical case section presents, among others, cases of intestinal tuberculosis leading to gastrointestinal perforation, a rare neurological condition in the form of seropositive longitudinal extensive transverse myelitis, as well as solitary median maxillary central incisor syndrome. Furthermore, we discuss a case of nasal reconstruction after surgical treatment of basal cell carcinoma and the experience of our Department in the management of chest injuries.

Finally, we invite you to familiarise yourself with the report of our colleagues from the Annual Meeting of the European Society for Paediatric Nephrology, which provides insights into the current trends in this field.

Recommending this issue, I wish you an interesting read and invite you to further cooperation.

Prof. Bolesław Kalicki, MD, PhD

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REPORT

MANAGING THE COST OF SERVICES FOR PEOPLE WITH DISABILITIES: INTERNATIONAL APPROACH. PART II: OHIO, UNITED STATES

Zarządzanie wydatkami na opiekę osób z niepełnosprawnościami. Podejście międzynarodowe. Część II: Ohio, Stany Zjednoczone

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Abstract

Introduction: Four years of managing a housing network for people with disabilities prompted a rethinking of the financial management of the services offered. Clients with different needs require diverse professional staff for their home care. Emergency situations require that professionals offering assistance maintain the highest level of education possible. Financial resources often limit the quality of care for people with disabilities. **Method:** This paper is based on a literature search and on professional experience (Dana Pugh) in the management of a housing program for people with disabilities in Cleveland, Ohio (USA). **Findings:** In Poland, people with disabilities usually live with their families, and specialized services are offered outside their place of living. However, community housing is being developed to resemble the family home. In the United States, individuals with disabilities often live in housing with specialized basic assistance. To improve living conditions, we suggest stratifying different levels of care to offer specialized services relative to the needs of residents at each level. **Discussion:** An international approach to the care of people with disabilities allows for a comparison of different methods of service delivery, depending on financial resources, community traditions, and the professional knowledge of care providers. The authors suggest a specific model of service that promotes a high quality of professional knowledge despite financial constraints.

Streszczenie

Wstęp: Cztery lata zarządzania siecią mieszkaniową przeznaczoną dla osób niepełnosprawnych skłoniły do ponownego przemyślenia sposobu zarządzania finansami dotyczącymi oferowanych usług. Klienci o różnych potrzebach wymagają zróżnicowanego, profesjonalnego personelu do opieki domowej. Sytuacje nadzwyczajne obligują specjalistów oferujących pomoc do utrzymywania możliwie najwyższego poziomu wykształcenia. Zasoby finansowe często ograniczają jakość opieki nad osobami niepełnosprawnymi. **Metoda:** Artykuł powstał w oparciu o kwerendę literatury oraz doświadczenie zawodowe (Dana Pugh) w zarządzaniu siecią domów opieki dla osób niepełnosprawnych w Cleveland w stanie Ohio (USA). **Wyniki:** W Polsce osoby niepełnosprawne mieszkają przeważnie z rodziną, a specjalistyczne usługi świadczone są poza miejscem zamieszkania. Tworzy się jednak budownictwo wspólnotowe na wzór domu rodzinnego. W Stanach Zjednoczonych osoby niepełnosprawne często mieszkają w placówkach mieszkalnych korzystających ze specjalistycznej podstawowej pomocy. Aby poprawić warunki życia, sugerujemy stratyfikację różnych poziomów opieki w celu zaoferowania specjalistycznych usług dostosowanych do potrzeb mieszkańców na każdym poziomie. **Dyskusja:** Międzynarodowe podejście do opieki nad osobami niepełnosprawnymi pozwala na porównanie różnych metod świadczenia usług, w zależności od zasobów finansowych, tradycji społecznych i wiedzy zawodowej świadczeniodawców. Autorzy proponują specyficzny model świadczenia usług, promujący wysoką jakość wiedzy zawodowej w warunkach ograniczeń finansowych.

Keywords: veterans; services; financial management; social work; residential care

Słowa kluczowe: weterani wojskowi; usługi; zarządzanie finansami; praca socjalna; domy opieki

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Introduction

This is the second of two articles concerning an international approach to managing the costs of services supporting people with disabilities. The goal of this work is to compare how different countries deal with the problem of the increasing cost of services for the most vulnerable groups. Various models of service provision, either proposed or already in place, consider the diverse needs of people with different levels of disability. We believe that offering more options in the system of care can be advantageous for people who need assistance. In Part I of this work, we presented a comprehensive look at healthcare and housing for people with disabilities in Poland. Here, we suggest a solution to the problem based on a model developed in Cleveland, Ohio (USA). Research methods and the theoretical background are described in Part I.

The number of adults with disabilities in Ohio reaches 28% [1]. They are affected by many health problems in more significant ways than those without any disability. Here are some numbers: 49% of all individuals with disabilities have depression, compared to 14% of those without disability; 45% of those with disability have obesity compared to 34% of those without disability who have obesity; 31% of those with disability smoke compared to 14% of those without disability who smoke; 17% of those with disability have diabetes compared to 8% of those without disability who have diabetes; and 12% of those with disability have heart disease compared to 4% of those without disability who have heart disease [1]. Disability-related healthcare costs in Ohio reach $35 billion per year [1], accounting for 37% of the state's health care spending, or $17,732 per person with a disability. These are significant numbers that require public attention.

The common approach to social policies is to treat a group of people as having the same characteristics or conditions. However, in each field of public health there is often a stratification of group members according to the severity or complexity of their needs. For example, in social work, it has become more common to apply a person-centered evaluation of the social determinants of health. We have learned that the context of the environment in which we were born and live is important for our bio-psycho-social evaluation and required treatment. As a result, the screening of social determinants of health has become an important tool in defining the scope of necessary care.

In the field of addiction, we use levels of care defined by ASAM (American Society of Addiction Medicine) criteria [2]. In the Veterans Health Administration, patient acuity is determined according to the PACT (Patient Aligned Care Team) "Primary Care" Social Work Practice Model. Each established acuity or care level verifies the intensity and complexity of care required for evaluated patients [3]. These levels of care, depending on the complexity of needs, serve several purposes. First, the level of care defines the severity of problems that need to be addressed. Second, it dictates the most appropriate services to meet the needs of a patient. As a result, it establishes the degree of education and experience of professionals that are necessary to address the health challenges of a patient. Such stratification allows for the economically optimal use of scarce institutional and human resources in patient care. We propose a system of care that is based on the idea of different needs of care for various groups of people with disabilities.

In Poland, there are several levels of public resources for the care of disabled individuals. Most of them date back to before 1989, when all public services were run by the government. Since 2010, the Social Insurance Institution (ZUS) has used the Barthel Index (or modified Barthel scale) to evaluate Activities of Daily Living. Depending on the Barthel Index score, people with disabilities receive different levels of public support [4].

One approach to decreasing the cost of services in Poland is to have a separate organization offering specialized assistance, where a person can be referred for a service. The main difference between the models in the US and Poland is the location of services in relation to housing. In Poland, people with disabilities can be referred to services outside their place of living, whereas in the US, services can be located within the place where they live. Below, we will discuss how to help people with disabilities in their homes, based on the belief that many would benefit from in-home services that do not require travel.

Case of group homes in Cleveland, Ohio

In this paper, we propose a system of care that can both decrease the cost of services and, at the same time, increase the professionalism of staff in healthcare provider homes for people with disabilities, with a particular focus on individuals with developmental disabilities. We will focus on formal care for people with severe disabilities, as a majority of them (about 60%) receive such treatment, while the rest rely on informal care from family and friends [5]. The paradigm of the proposed model is to offer the same housing standard to all clients. However, residents with higher needs can be offered higher-standard services that are already factored into the cost of housing. Our model is based on a system located in Greater Cleveland, Ohio, called The H.O.P.E. (Helping Other People Elevate) Network. This is a healthcare agency that is certified and licensed by the Ohio Department of Developmental Disabilities (DODD). The H.O.P.E. Network provides direct support, including but not limited to the promotion of health and the management of diseases/disorders, medication administration, cooking, housekeeping, toileting, bathing/showering, transportation, and social support for members of the community diagnosed with developmental disabilities (e.g. Attention-Deficit/Hyperactivity Disorder, Autism Spectrum Disorder, Cerebral Palsy, Fragile X Syndrome, Intellectual Disability, Language Disorders, Learning Disorders, Tourette syndrome) and acquired disabilities (e.g. as a result of violence or combat, see below for an example involving veterans). Many of our clients are dually diagnosed with psychiatric and/or substance use disorders. To provide the above-listed services, we hire Direct Support Professionals (DSP), paraprofessionals who receive eight hours of DSP training, as required and provided by the DODD. Although well-intentioned and equally ambitious, the structure and plan set forth by the DODD is systematically flawed and, as such, works in direct opposition to the goals shared by clients and the state of Ohio.

Educational needs of direct support professionals

The phenomenon of comorbidity among psychiatric disorders is very well known. Simonoff et al. [6] reported that "among individuals with autism spectrum disorder (ASD), some 70% have at least one comorbid disorder (most commonly social anxiety disorder), and over 40% have two or more such disorders." As such, comorbidity among individuals with developmental disabilities is more "the rule than the exception thereof" [7].

Typically, clients with developmental disabilities should be linked with case management, social workers, or psychologists and psychiatrists. Among developmentally disabled clients, there is an increased potential for more severe and longer-term psychopathological symptomatology, necessitating greater access to professional mental health services. However, despite the severity of these problems, access to mental healthcare services is not significantly greater

According to the DODD criteria for training, the Direct Support Professional (DSP) is expected to have a high school diploma or general equivalency diploma and a clean criminal background. These criteria include a course in CPR and First Aid, an eight-hour training detailing the DODD's policies and procedures directly related to the provision of support services, and, when appropriate to the needs of one or more individual clients, a two-day course in medication administration [8]. These criteria afford many citizens, particularly those for whom advanced education has been elusive, much-needed access to upward mobility via the healthcare professions. However, it can be easily argued that such limited training subsequently limits DSPs' preparedness for attending to problems commonly experienced by the populations they serve.

To suggest that there are no DSPs with outstanding professionalism and high-level healthcare-related expertise would be sheer fallacy. However, outliers notwithstanding, DSPs are undertrained and underprepared when faced with issues such as hallucinations, delusions, mania, homicidality, and suicidality, none of which are uncommon. A study conducted by Lunsky [9] found that one-third of a sample (N = 98) of individuals with intellectual disabilities reported experiences of suicidality. Further, it was concluded that "this population is vulnerable to physiological, psychological, social, economic, and environmental correlates associated with suicide risk" [9]. However, the National Action Alliance for Suicide Prevention [10] asserts that "proximity to families, caregivers, and providers" should render suicide, for individuals with developmental disabilities, a "never event." As stated above, the quality of care is often limited by the prospect of only three days of training, and this standard of care is difficult to maintain. The COVID-19 pandemic has left in its wake a hiring crisis that has further decimated the pool of optimal DSP candidates.

Professionals working with vulnerable populations need to be trained in evidence-based practices and understand how the field of helping professions is evolving in response to changes in society. Below, we present a health issue that has gained significant recognition in recent years and a practice that acknowledges the role of trauma in people's lives. Both these topics are significant in the care of people with disabilities.

Veterans with traumatic brain injury

In 2018, Yi et al. [11] published a study that linked a lifetime history of Traumatic Brain Injury (TBI) to current disability among Ohio adults. They found a significant relationship between a history of TBI and the development of serious health problems and disability within the large group studied. TBI is often described as a silent epidemic, frequently leading to disability [12]. The first large studies concerning TBI were conducted in military settings, including the Veterans' Administration (VA). TBI has come to be known as the "signature injury"' of the Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) conflicts [13]. Contemporary literature indicates that approximately 12% to 16% of veterans sustained a TBI during their deployment. Service members disproportionately return from deployment diagnosed with both a history of mTBI (m for mild) and current Post-Traumatic Stress Disorder (PTSD). Although extensive literature exists on the neuropsychological factors associated with TBI and PTSD as separate experiences, there is a dearth of research exploring their combined effects [12]. A study conducted by Combs et al. [13] revealed that the comorbid experience of TBI and PTSD results in greater and more severe cognitive deficits than PTSD alone. Given the potential for DSPs to encounter service members with histories of these experiences and associated diagnoses, it is imperative that agencies effectively recruit and appropriately compensate personnel with expertise related to a trauma-informed care approach to service provision. Neither the current level of training nor the associated rate of pay adequately support agencies' efforts to recruit or retain personnel appropriately qualified to attend to this level of client need.

Trauma-informed care

For more than two decades, the health and mental healthcare fields have advocated for a focus on trauma-informed care (TIC). Widely credited as the impetus for this movement, the Adverse Childhood Experiences (ACE) study began in 1995 and emphasized the important role played by psychological trauma experienced early in development as a determinant of physical and mental problems throughout the lifespan. The ACE study revealed an extraordinary propensity for early traumatic events and their subsequent negative impact on psychological and physical well-being, underscoring the necessity for TIC. In 2013, the Department of Developmental Disabilities (DODD) and Ohio Mental Health and Addiction Services (MHAS) created Ohio's Trauma-Informed Care Initiative to support TIC for services for people with disabilities [14].

Butler et al. [15] assert that TIC requires an understanding of "the involvement and impact of violence and victimization in the lives of most consumers of mental health, substance abuse, and other services." Further, it requires the application of "that understanding of designing service systems and providing services to accommodate the

requirements and vulnerabilities of trauma survivors and to facilitate their participation in treatment" [15].

It is widely held that individuals with a developmental disability, particularly intellectual disability, are at significant risk of experiencing adverse life events, including abuse and trauma in childhood, above and beyond what is common among the general population [16]. These findings converge with the self-reports of HOPE Network clients as well as with the data included in the individual service plans associated with HOPE Network clients. Clients report experiences of sexual and other forms of domestic abuse, environmental and community violence, abject poverty, bullying, and racism and white supremacy. Consistent with the literature, HOPE Network clients are easily observed by trained professionals to express psychological trauma in myriad ways, including but not limited to altered arousal, outwardly directed aggressive behaviors, and suicidal ideation.

Given the prevalence of such detrimental experiences and the strong correlation with severely negative outcomes within this population, the need for trauma-informed care by Team Members who provide support for individuals with developmental disabilities is substantial and undeniable.

It is clear that there is a great need for a comprehensive reevaluation of direct support professionals' training criteria, which might afford people with developmental disabilities the quality of care necessary for optimal health and well-being. An individualized approach is recommended, as each person with developmental disabilities requires DSPs with varying levels of training. In an effort to provide levels of training appropriate to individuals without significantly stagnating the training process, a tier system, the Client-Caregiver Stratified Schedule of Services (C-CSSS), is recommended.

Tier-based system related to position responsibility and compensation

Just as each individual client we encounter comes to us with a unique set of circumstances, so too do candidates for employment in the role of DSP. The resume-evaluation and interviewing processes reveal natural distinctions among candidates' levels of training, experience, and expertise.

An example of an effective three-tier system is as follows:

Position Level 1 – Team Members have completed training, acquired exceptional experience, and developed exceptional expertise in the paraprofessional, healthcare, and/or mental healthcare fields.

Training: Team Members have completed formal academic and on-the-job training related to Direct Support Specialist (DSP), State Tested Nursing Assistant (STNA), Certified Nursing Assistant (CNA), and/or Home Health Aide (HHA) duties. Team Member's training includes a noted focus on trauma-informed care (TIC). Additionally, Team Members have completed accredited academic programs in one or more of the following or appropriately comparable fields; nursing, psychology, social work, occupational therapy, physical therapy, sociology and/or education.

Experience: Team Members have two or more years of evidentiary experience performing the functions of DSP, STNA, CNA, or HHA in addition to one or more year of experience in one or more of the above-mentioned fields. This is confirmed by appropriate professional references.

Expertise: Team Members have developed exceptional expertise in one or more of the above-mentioned paraprofessional and one or more of the professional fields. This may be evidenced qualitatively by a 2.5–3 score on a three-star rating scale relative to the interview process and/or verbal confirmation from one or more prior employer references.

Associated intervention (beyond Level 2 and 3 interventions):
- Provide clients with psychoeducation related to biopsychosocial health promotion, prevention, and patient-self-management.
- Assist clients with crisis management.
- Provide supportive counseling to assist clients and families with their adjustment to a diagnosis or disability.
- Perform the function of liaison between external healthcare professionals and clients.
- Provide supervision for staff on Position Levels 2 and 3.

Position Level 2 – Team Members have undergone some training and have experience and quantifiable expertise in the paraprofessional, healthcare, and/or mental healthcare fields.

Training: Team Members have undergone formal academic training at an introductory level or cursory on-the-job training related to DSP, STNA, CNA, or HHA duties. This may include training in other related fields such as nursing, psychology, social work, sociology, and/or education. Lastly, Team Members have completed all required training and received medication administration certification (med cert) relevant to that Team Member's assignment(s).

Experience: Team Members have more than one month but less than two years of evidentiary experience performing the functions of DSP, STNA, CNA, or HHA. This is confirmed by appropriate professional references.

Expertise: Team Members have developed general expertise in one or more of the fields of DSP, STNA, CNA, or HHA. This may be evidenced qualitatively by a 1.5–2.5 score on a three-star rating scale relative to the interview process and/or verbal confirmation from one or more prior employer references. Of additional note, Team Members with their own experience of disability, but who are able to perform designated work assignments, are acknowledged, to some degree, as experts.

Associated intervention (beyond Level 3 interventions):
- Assist clients with various activities of daily living (ADLs; bathing, food preparation, eating, hygiene, and grooming).
- Administer prescribed medication to assigned clients.

- Encourage and support clients in full community participation.

This may include having the appropriate driver's license or permit and providing transportation to and from client destinations.

Position Level 3 – Team Members have no prior training, no experience in related fields, and no associated expertise.

Training: Team Members have never participated in DSP, State Tested Nursing Assistant (STNA), Certified Nursing Assistant (CNA), or Home Health Aide (HHA) training.

Experience: Team Members have never been employed by DSP, STNA, CNA, or HHA agencies, and have not performed the functions of any of the above-mentioned positions.

Expertise: Team Members have not developed any quantifiable expertise in relation to the paraprofessional, health, or mental healthcare fields. This may be evidenced qualitatively by a 0– 1.5 score on a three-star rating scale relative to the interview process and/or verbal confirmation from one or more prior employer references.

Associated interventions:
- Provide clients with camaraderie and companionship.
- Enable clients' independence.
- Offer continued encouragement and social support.

Financial support by DODD

Obstacles abound when it comes to attracting and hiring personnel with training related to TIC. Professionals with training and experience in this area tend to request higher rates of pay than what is typical in the field in Ohio, which is $13.74 as of the writing of this article, according to ZipRecruiter [17]. However, it should be noted that the Ohio House has recently taken measures to increase pay rates, with DSP wages set to rise to $17 in 2024 and to $18 in 2025. While this is an appreciated step forward, it still falls short of the necessary wage levels suitable for personnel who have acquired the training and experience necessary to effectively recognize, appropriately attend to, and optimally support lower-functioning and more severely traumatized clients.

The strides taken by the Ohio House should be viewed as foundational in recognizing the need for improved pay across the field. However, this first step in assisting agencies in the development of a more economically attractive, more competent, and safer field, with appropriate for entry-level personnel, falls short of affording Team Members an average annual salary of $47,456, which according to ZipRecruiter [17] is also consistent with the low-average salaries of social workers in Ohio [17]. In order for Team Members' pay to meet the state's average rate of pay, Ohio needs to consider the more appropriate rate of $22 per hour for Level 2 Team Members. To attract highly trained, experienced, and expert candidates, compensation should align with each tier, with Level-1 personnel being offered the appropriately higher rate of $27 per hour.

These changes are essential for promoting a necessary overhaul and increasing the sustainability of a field that currently and systematically encourages high turnover by affording hourly rates that force heads of single-earner households to work in excess of forty hours weekly or take on multiple jobs to bring their annual pay to that of the state's average. It is the opinion of The HOPE Network that these increases will help reduce current and historical turnover rates, which can negatively impact clients, particularly those with attachment problems which are commonly subsequent to neglect and abuse during early development.

It would be socioeconomically irresponsible to delay such changes for much longer. A perpetual overtime-heavy workweek is unsustainable, both for personal self-care and the well-being of personnel. A lack of self-care, including but not limited to appropriate sleep, rest, relaxation, and rejuvenation, can only have a negative impact on clients. Given the vulnerability of this particular population, it would be unethical to continue the trend of underpaying personnel who provide services for members of the community with developmental disabilities.

Financial support by legal system

The Americans with Disabilities Act (ADA) guarantees individuals with disabilities access to the same services provided by law enforcement as that provided to anyone else [18]. Exclusion, segregation, denial of same services, or discriminatory treatment of individuals with disabilities is not only unethical but illegal [16]. While the legislative power associated with the ADA is tangible in other settings, it continues to prove elusive in law enforcement "even when the communicative accommodations are relatively simple" [18]. This profound unwillingness or inability to respond to the needs of people in ways appropriate to their specific type and level of disabilities fuels negative outcomes when police interact with individuals with disabilities.

Police are routinely called upon to respond when individuals experience mental health crises. These stimulus-response situations often escalate into violence. Moreover, when the police encounter mental health conditions such as schizophrenia or Tourette's syndrome, the result is often arrest and/or brutalization [19], the ADA's protections notwithstanding.

It is noteworthy that the National Alliance on Mental Illness [10] asserts that "almost half of the people who die at the hand of police have some kind of disability." Hawkins [18] further notes that "like other cases of police shootings, much of the violence inflicted against people with disabilities is the result of law enforcement failing to communicate effectively and utilize de-escalation tactics." The likelihood of unnecessarily violent outcomes increases exponentially by intersectionality with ethnic-racial identity (ERI), class, gender, and LGBTQIAA+ status. In essence, members of any marginalized group are particularly vulnerable to police brutality [20].

For the above reasons and more, federal, and local legislation should focus on making funding available to agencies that oversee and provide support for individuals with developmental disabilities. As Benjamin

Franklin is credited with saying, "an ounce of prevention is worth a pound of cure." Assuredly, taxpayers burdened by the costs of the plethora of police brutality and wrongful death lawsuits would agree.

The criminal justice and judicial systems continue to face long-term and often fatal challenges when it comes to the treatment of people with disabilities. Calls for defunding the police abound. One place where funding could be directed to benefit both sides of this argument is the DODD, for the purpose of appropriate payment to the current paraprofessionals and future professionals who are and would be the actual first responders to incidents involving members of the community with developmental disabilities. Improved training and increased pay would reduce the likelihood of police responses to individuals with developmental disabilities, including improperly fatal ones, as well as unnecessary and inappropriate judicial and carceral outcomes. With this in mind, a call to action is made to redirect funding from systems that legally abuse and murder people with developmental disabilities and toward a system dedicated to their support, restoration, and empowerment.

International approach

Each country must address the needs of vulnerable populations because these groups usually need external assistance. People with disabilities often cannot meet their own needs. They require governmental support. In the US, there is ongoing research evaluating current policies and services for people with disabilities [21, 22], and calls for action to improve the system of care [23]. There is an inherent contradiction between the theoretical models of disability [24, 25] and the constraints of available resources and cost of services. It is interesting to compare how different countries – with their different histories of social services – take care of their vulnerable populations [26, 27]. These comparisons reveal differences in financial management [28], barriers to treatment, especially during a pandemic [29], and the dissemination of information on available support [30].

Conclusions

Our comprehensive analysis of service care for people with disabilities in Poland showed that economic constraints on the system lead to a stratification of housing offers, where higher standards of services come at higher costs. People with disabilities might be able to choose less expensive housing with essential services, but such services are often located outside their place of living. These external services might be difficult to access, often involving long waiting times. Moreover, lower housing costs may correspond to less professional care provided by direct support staff.

In contrast, the case presentation of group housing in the US demonstrates the potential for a unified housing network that employs staff with different levels of education and expertise. Depending on their proficiency, they are available to all residents of the network, addressing any crisis that may arise, although their primary responsibility is to residents requiring their services based on individualized treatment planning. This model offers continuous and broad-ranging professional assistance within a single system of care.

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REVIEW ARTICLE

PROSTHETIC RESTORATIONS FOR CHILDREN AND ADOLESCENTS UNDER 18 YEARS OF AGE

Uzupełnienia protetyczne dla dzieci i młodzieży do 18. roku życia

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Abstract

Introduction: Premature loss of primary teeth in children under 18 years of age is most often caused by active carious disease of primary and permanent teeth, especially the first molars, and the need to extract them. Missing teeth in children may also result from congenital absence of permanent dentition, developmental defects and injuries. The consequences of missing teeth depend largely on the child's age when the gaps occurred. However, they always lead to dysfunctions of the masticatory system and temporomandibular joint, speech and aesthetic disorders and, finally, lack of peer acceptance. **Aim:** The aim of the study is to review the literature on the treatment of patients with premature loss of primary teeth due to congenital defects and injuries. Studies dealing with the topic of early prosthetic rehabilitation in the group of patients under 18 years of age were taken into account. **Materials and methods:** A review of available studies on missing teeth in children and adolescents and their consequences for the development of the stomatognathic system was conducted. **Result:** All authors discussing the topic of edentulism in children point to the need for prosthetic treatment. At the same time, they recommend an individualised choice of prosthetic restorations. The child's age; the type, extent and location of missing teeth and the child's willingness to cooperate are the main determinants of this choice. **Conclusions:** Prosthetic rehabilitation should be provided to children with prematurely missing teeth as early as possible to avoid multiple short and long-term complications affecting the development of the stomatognathic system.

Streszczenie

Wprowadzenie: Przedwczesna utrata zębów mlecznych u dzieci poniżej 18. roku życia jest najczęściej spowodowana aktywną chorobą próchnicową zębów mlecznych i stałych, zwłaszcza pierwszych trzonowych, oraz koniecznością ich ekstrakcji. Braki zębowe u dzieci wynikają również z wrodzonych braków zębów stałych, wad rozwojowych i urazów. Konsekwencje braków zębowych zależą w dużej mierze od wieku dziecka, w którym wystąpiły luki, zawsze jednak prowadzą do dysfunkcji narządu żucia, stawu skroniowo-żuchwowego, do wad wymowy, zaburzeń estetycznych i ostatecznie do braku akceptacji ze strony rówieśników. **Cel pracy:** Celem pracy jest przegląd literatury dotyczącej leczenia pacjentów z brakami zębowymi wynikającymi z przedwczesnej utraty zębów mlecznych, wad wrodzonych i urazów. Uwzględniono prace podejmujące tematykę wczesnej rehabilitacji protetycznej w grupie pacjentów poniżej 18. roku życia. **Materiały i metody:** Przegląd istniejących badań dotyczących braków zębowych u dzieci i młodzieży oraz ich konsekwencji dla rozwoju układu stomatognatycznego. **Wynik:** Wszyscy autorzy poruszający temat bezzębia u dzieci widzą potrzebę leczenia protetycznego. Jednocześnie zalecają indywidualny dobór uzupełnień protetycznych. Głównymi czynnikami determinującymi ten wybór są wiek dziecka, rodzaj, wielkość i umiejscowienie brakujących zębów oraz chęć współpracy dziecka. **Wnioski:** Aby uniknąć licznych wczesnych i odległych powikłań w rozwoju układu stomatognatycznego u dzieci z przedwczesnym brakiem zębów, należy jak najwcześniej zapewnić dzieciom rehabilitację protetyczną.

Keywords: premature tooth loss; paediatric dentures; prosthetic rehabilitation

Słowa kluczowe: przedwczesna utrata zębów; protezy dziecięce; rehabilitacja protetyczna

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Introduction

Prosthetic rehabilitation of the youngest children with premature loss of primary teeth is particularly challenging. It must take into account the dynamic changes that occur during the development of the stomatognathic system. Missing teeth give rise to many stomatognathic complications. However, these may be prevented if prosthetic treatment is properly implemented in this age group.

Studies have shown that the problem of missing teeth affects a large group of children and adolescents. Over 13% of 3–8-year-olds have prematurely lost teeth. More than 20% of children and adolescents aged 7–16 years qualify for prosthetic treatment [1]. Premature loss of primary teeth occurs 3–4 years before normal physiological exfoliation [1]. It may arise from many abnormalities dependent or independent of the child or parental behaviour, including environmental or socio-economic factors.

The causes of missing teeth in children and adolescents include:

- Dental caries resulting from the lack of or improper oral hygiene, insufficient home-based prophylaxis, poor dietary habits. It is also a result of failure to undertake treatment in the case of initial dental caries or lack of regular check-ups. The rapidly progressing carious process typical of primary teeth leads to their complete destruction, which often necessitates extraction [1–8].
- Injuries, such as crown or root fractures, damage to enamel or dentin, partial or complete avulsion. Injuries to primary teeth can also cause damage to permanent tooth buds. Incisors are particularly susceptible to trauma. Primary tooth trauma is most likely to occur at the age of 1–2 years and 4–6 years [1, 3, 9].
- Hypodontia or anodontia of primary or permanent teeth. These disorders are significantly more common in permanent teeth, which means that they occur in the older group and are identified during tooth replacement. In this case, mandibular second premolars, maxillary lateral incisors and maxillary second premolars are most likely to be missing.
- Genetic factors.
- Environmental factors, such as improper nutrition, hormonal disorders, maternal health problems and/or pharmacotherapy during pregnancy.
- Congenital absence of tooth buds, which is associated with disorders such as ectodermal dysplasia syndrome, Down syndrome, primary and secondary clefts.

The consequences of premature loss of primary teeth depend on the number and location of missing teeth, as well as the age at the time of their loss [1, 10, 11]. It has been shown that the earlier the tooth loss occurs and in greater number, the more serious the short- and long-term consequences will be [2]. The most severe sequelae of premature loss of primary teeth, depending on the number and location of lost teeth, and the absence of permanent tooth buds, include:

- Inhibited bone growth due to insufficient functional stimulation [1, 6, 10, 11]. Premature extraction of primary teeth results in the lack of occlusal/modelling forces that guide the growth of the alveolar process. They are necessary for the correct three-dimensional growth of the alveolar process, and when absent, one- dimensional vertical growth of the processes occurs.
- A change in the mandibular position due to limited functional stimuli as a result of reduced chewing surface. Additionally, consolidation of muscle work patterns gives rise to malocclusion or consolidation of the existing tendency [1, 12].
- A change in the height of the alveolar process along with the teeth in the segment devoid of opposing teeth.
- Formation of a dense bone scar, which will delay or even prevent eruption of permanent teeth.
- Tongue dysfunction, breathing through the mouth and infantile swallowing pattern. These disorders will contribute to the development of malocclusions and speech defects [13].
- Malocclusions and facial defects caused by the dysfunction of the masticatory muscles as a result of compensation.
- Malocclusions caused by the loss of space for permanent teeth due to shifting of previously erupted teeth, which may contribute to midline shift, crowding, and other orthodontic problems [13].
- Displacement, mesial or distal tilting of the teeth adjacent to the gap.
- The load on the teeth remaining in the arch, which take over the function of the missing teeth.
- Occlusal disorders, formation of traumatic nodes, bite disorders, excessive tooth wear, temporomandibular disorders.
- Mental and emotional problems, especially in teenagers, due to missing teeth, permanent in particular.

Prosthetic treatment should be started as early as possible. The age of 5–6 years is most often mentioned, which usually results from the significantly greater chances of cooperation between the child and the doctor and the patient's compliance with medical recommendations [14]. According to some researchers dealing with prosthetic restorations, 3 years is the appropriate age for prosthetic interventions in children. Such an early onset of treatment allows for the most effective rehabilitation of children [15–17]. In the developmental period, prosthetic treatment is temporary due to the constant growth of

the child and the development of their stomatognathic system [14, 17].

In older age groups, prosthetic treatment depends on the stage of development of permanent dentition, including the roots, and the maturity of the stomatognathic system.

Prosthetic treatment of adolescent patients can be classified into three categories proposed by Carrel and Christiani, depending on the age, type of defects and their location [5]:

- Class I. Patient age:
  A. from infancy to 6 years,
  B. from 6 to 12 years,
  C. from 12 to 18 years;
- Class II. Location of missing teeth or tissues:
  A. intraoral;
  B. extraoral;
- Class III. Type of tooth loss:
  A. acquired (injury, tumour, disease, caries),
  B. congenital (e.g. ectodermal dysplasia, clefts).

Aim

The aim of the study was to review the literature on the treatment of paediatric patients with missing teeth, to discuss the consequences of the above-mentioned problem and the possibilities of preventing complications resulting from premature loss of primary dentition and missing permanent tooth buds, as well as to answer the question whether prosthetic rehabilitation of the youngest children is necessary and feasible.

Results

Treatment of patients up to 6 years of age

This age group is characterised by the most intensive development of the stomatognathic system, with dynamic growth of the mandible, maxilla, alveolar processes and the teeth themselves. It is particularly important to stimulate the proper growth of these structures in the group of the youngest children. Therefore, all actions of parents and dentists to support this development are crucial. In the case of prematurely missing teeth in the youngest and the need for prosthetic rehabilitation, all measures should be taken to provide the child with care as soon as possible.

The time between 5 and 6 years of life is critical. This is when eruption of the first permanent molars is expected to begin. Their occurrence in the oral cavity determines certain functional and structural changes in the future permanent dentition. These changes include stabilisation of the occlusal height, support in maximum intercuspation, protection of TMJ structures from compression, stimulation of growth, anteriorization of the mandible. Hence the important role of prosthetic rehabilitation of children up to the age of 6 years [18, 19].

Prosthetic solutions used in this group of patients should support and stimulate the development of the entire stomatognathic system. The occlusion should be set in a construction position, anatomically and functionally appropriate for this age [14, 17].

Premature loss of individual primary teeth most often occurs in this age group, usually causing dental displacement and the risk of loss of space for permanent teeth. Space maintainers should be used in children with premature loss of single primary teeth, second molars in particular. They enable maintaining appropriate space for a permanent tooth. Space maintainers prevent the teeth surrounding the gap from shifting, and thus from closing or significantly reducing the space for a permanent tooth expected to erupt in place of a prematurely lost primary tooth. Space maintainers can take the form of permanent metal orthodontic rings or removable devices, as part of a functional appliance, or a removable plate precisely fitting against the mucosa [17].

Partial or even complete removable dentures are used in this age group in the case of premature loss of a larger number of primary teeth [18]. Depending on the purpose and development status of the stomatognathic system, they are classified as preventive, therapeutic and retention ones.

Preventive dentures are designed to enable the proper three-dimensional growth of the alveolar processes, maxillary and mandibular development, proper eruption of permanent teeth, as well as to prevent malocclusions in the case of significant edentulism. Their task is to maintain the continuity of the dental arches. These dentures are constructed in a habitual bite [13].

The second group of prosthetic devices is used in children with missing teeth and coexisting malocclusion. These are the so-called prosthetic-orthodontic appliances. These devices are in a construction bite and are enriched with active elements, such as screws and springs [1, 6, 8,12]. Retention dentures consolidate the outcomes of orthodontic treatment, supplement missing teeth in correct occlusion, but also ensure proper chewing, speech and aesthetics [13].

The types of dentures for edentulous patients, depending on the child's needs (i.e. the number of missing teeth, correct occlusion or malocclusion), are summarised in Table 1.

The use of removable dentures in children requires special care and adherence to the principles of their manufacture so that they do not inhibit the growth of dental arches, but promote their proper development. They should not contain clasps if possible. Retaining elements in the form of Adams clasps, arrowhead clasps, half-arrowhead clasps or ball clasps may be present during the initial adaptation period, but should be removed later.

Table 1. Prosthetic restorations for children with primary teeth used depending on the needs

Types of prosthetic devices
Complete maxillary denture
Complete mandibular denture
Complete maxillary/mandibular overdenture (OVD)
Maxillary partial denture with orthodontic clasps and a central screw
Partial maxillary denture with reduced vestibular screen
Partial mandibular denture with orthodontic clasps

The denture should be retained by means of adhesion, cohesion and impaction [1, 2, 4].

The acrylic screen should be separated from the mucosal side by about 1 mm. Such design of a denture will not interfere with the growth of the alveolar processes.

The dentures should contain no vestibular screen. Such a screen is used in complete dentures and generates the need for frequent replacement of the appliance and the use of a short screen [1, 4, 5, 8].

These should always be mucosal dentures that can be easily adapted to the changes occurring during maxillary and mandibular growth.

It should be easy to put on and take off dentures, as well as to maintain their hygiene. Also, the appliance should be inexpensive due to the need for its frequent replacement.

When using dentures in children, class IA dentures in particular, the intensive growth of all stomatognathic structures needs to be considered. The growth and development of the alveolar processes, maxillary and mandibular bones and finally the teeth make it necessary for the attending specialist to arrange frequent patient check-ups. As a result of the above changes, dentures need to be frequently replaced to support the proper development of all structures. Prosthetic appliances should be replaced every 8–10 months up to the age of 11 years, every 1.5 years between 11 and 15 years, and every 2 years between 15 and 18 years of age. All suggested dates for replacing dentures are conventional and depend on the pace of the child's development. In practice, dentures should be replaced as often as needed [4, 18].

The changes occurring in the oral cavity and the need to adjust the denture require good parent-doctor cooperation. Follow-up visits are recommended every 2–3 months, or even every month if necessary [8, 12]. After ensuring that the denture fits in the oral cavity, necessary corrections should be made so that it adheres properly to the supporting tissue and has proper contact with the opposing teeth. If necessary, the physician should adjust the denture during the follow-up visit by filing down its unnecessary fragments that may delay the growth of the alveolar processes or teeth blocked by the denture. The denture may be supplemented with rapidly polymerizing mass if needed.

It should also be appreciated that a denture intended for a child must be comfortable and acceptable for the patient. This is extremely important as the appliance is worn throughout the day, and in the case of a medical denture, also at night [6, 18].

Prosthetic treatment for children aged 6 to 18 years

Mainly clasp-free dentures or those with orthodontic clasps are recommended in this age group. Depending on the diagnosis, prosthetic and orthodontic restorations are used. Prosthetic solutions in the form of crown-root inlays are allowed in the case of significant carious destruction of the permanent tooth provided that accurate and effective root canal treatment of the tooth with completed development and a closed root apex was performed. Prosthetic crowns are a temporary solution in young patients. They may be acrylic, composite, metal or acrylic/metal. The use of ceramics, which requires excess preparation of the teeth, is not recommended.

Two-abutment bridges are an unacceptable method for treating missing teeth in this age group. This solution prevents maxillary growth. However, dentures with one abutment are acceptable, especially in children over 10 years of age [18].

Prosthetic treatment of edentulism in adolescents over 16 years of age is similar to the one used in adults. It usually takes place in two stages:

- Stage I – clasp-free partial dentures;
- Stage II – skeletal dentures, with possible implants after reaching maturity [18].

Rochette and Meryland bridges, as well as adhesive bridges made of glass fibres also represent prosthetic solutions acceptable in this age group. Such appliances can be used after the age of 12 years. It is important that they do not inhibit the development of the alveolar process. Classical bridges are not allowed in this patient population [18, 20–23].

In the case of extensive agenesis, congenital defects, e.g. ectodermal dysplasia, and in the absence of favourable conditions for retaining dentures in the child, implants may be used as elements to increase denture retention and stabilisation. However, this is not a commonly used method as the implant may dislocate as a result of growth processes (resorption and apposition in various maxillary and mandibular regions. Implants may be safely used after the growth of the stomatognathic system is completed [1, 2, 4, 8, 14, 15].

The choice of dentures should be based on oral examination, including the quality of supporting tissues, the extent of missing teeth and the child's/parental willingness to cooperate. This is extremely important because prosthetic treatment of children up to 6 years of age is intensive, based on response to constant and rapid changes in the child's stomatognathic system.

Analysis of clinical cases allowed for establishing a prosthetic treatment algorithm for patients with missing teeth. The therapeutic methods used were the result of the assessment of prosthetic tissue support in relation to the patient's age, taking into account the indications and contraindications to individual types of prosthetic devices, as well as the child's/parental willingness to cooperate. The management algorithm proposed by Wojtyńska is presented in Table 2 [19].

Discussion

The demand for prosthetic treatment among Polish children remains high. As reported by Strada et al., 15,000 children aged 7–16 years, including 21.72% qualified for prosthetic treatment, were assessed by Faliński et al. [18] Similarly, in their study conducted in Warsaw among 200 high school students, Krzeski and Tarcz found missing teeth requiring dentures in 20.81% of the assessed ado-

Table 2. Algorithm for the treatment of children with primary teeth proposed by Wojtyńska [19]

Patient's oral cavity status	Management
The teeth present in the oral cavity, due to their arrangement and shape, allow for the retention of the orthodontic appliance	Functional appliances or orthodontic plate prosthesis that will stimulate growth and will be adapted to the changing supporting tissue
The number of teeth, their arrangement and shape do not guarantee the correct functional effect of a removable orthodontic appliance	Paediatric prostheses with orthodontic clasps and a reduced vestibular screen
The number of teeth, their arrangement, shape and the condition of the supporting tissues do not guarantee proper retention of partial dentures	OVDs covering suboptimal clinical crowns
Anodontia or loss of all teeth due to dental caries	Conventional full dentures
Inadequate supporting tissue	Direct denture relining with silicone-based material, with unburdening of the areas around erupting teeth
In each case, it is necessary to establish an individual follow-up schedule, depending on the patient's growth profile and the stage of stomatognathic development	
Uncooperative patients	It is recommended to schedule adaptation visits to accustom the child to both medical personnel and dental office. Motivation and dental education of parents are essential. Providing parents with impression trays, allowing the child to get accustomed to a tray being introduced into their mouth and preparing them for office procedures through play will have beneficial effects

lescents [18]. Olczak-Kowalczyk, who assessed a Warsaw group of children aged 3 to 8 years, reported that 13.06% of them required prosthetic treatment but still had a correct bite, while combined prosthetic/orthodontic treatment was needed in 4.29%. Such a large percentage of children requiring prosthetic management due to missing teeth indicates that the problem is underestimated and undertreated [10].

Many authors point to the relationship between the method of prosthetic treatment in children and the child's age, the type and extent of missing teeth, and consider the above factors to be the main determinants of the choice of dentures [19–22].

Mainly removable dentures are used in children up to 6 years of age due to the development of the facial part of the skull. Their purpose is to stimulate the correct three-dimensional growth of the alveolar processes, maintain the correct shape of dental arches and prevent horizontal and vertical shifting of teeth and malocclusions. If the patient has multiple missing teeth (regardless of aetiology), removable dentures are recommended, with a reduced vestibular screen, with or without expansion screws (depending on the needs), as well as with orthodontic clasps and springs [19]. The range and shape of the designed prosthetic plate should consider the quantity, quality and arrangement of the remaining teeth in the oral cavity. In the case of acceptable retention, partial removable dentures with orthodontic clasps and a reduced vestibular screen can be used [23, 24].

Similar recommendations were proposed, based on their experience, by Bidra et al., Pae et al., and Tarjan et al., who emphasized the need to consider such factors as facial skeleton growth dynamics and the eruption of permanent teeth in the prosthetic treatment of the youngest children [24–27].

Despite the recommendations to start treatment in children with premature loss of primary teeth as early as possible, the issue of its actual initiation seems to be controversial, with varying opinions among authors.

The need for early prosthetic rehabilitation of children with prematurely lost primary teeth in the group up to 6 years of age is supported by the fact that these patients show significantly faster adaptation to the appliance, with simultaneous stimulation to effectively change children's habits, such as swallowing, chewing, and mouth breathing. Children of this age get used to dentures faster and easier. Also, they rapidly learn daily functioning with these devices. Such conclusions were presented by Tarjan et al. [27] and Paschos et al. [28].

The success of prosthetic rehabilitation depends to a large extent on the willingness of the child to cooperate with the doctor. Some authors believe that dentures should be used in children as young as 3 years of age [1, 2, 6]. Others consider it reasonable to begin treatment at the age of 4 years, suggesting that such children are more cooperative and the adaptation process lasts about 3–7 days [15]. Still, other authors consider the age of 5–6 years as the most effective for treatment due to good cooperation [19].

Missing permanent tooth buds, carious processes, especially in the first molars, with significant loss of hard tissue or tooth extraction, make it necessary to implement early rehabilitation of missing permanent teeth.

In the older age group, prosthetic rehabilitation is particularly important for emotional and psychological reasons. Missing teeth at this age are a source of lower self-esteem and psychological problems. Implants are particularly beneficial and expected in the older age group and they are usually more acceptable as a convenient and natural way to replace missing teeth, as noted by many authors [29, 30].

However, all authors emphasise the importance of child and parental cooperation in the process of prosthetic re-

habilitation. The child's acceptance of the denture is the basis for both good cooperation and the actual use of the device [13, 15, 19, 29].

Studies investigating paediatric prosthetic appliances encounter a number of limitations that may affect the results and their interpretation. The most important include:

- **Variations in growth and development.** Children are at different stages of growth and development, which may affect the fitting and long-term effectiveness of their dentures. The changing mandibular and dental dimensions may require frequent prosthetic adjustments.
- **Lack of standardisation.** The lack of uniform protocols and standards for paediatric dentures makes it difficult to compare different studies. Different diagnostic and therapeutic approaches can lead to variable results.
- **Short-term data.** Most of the available research focuses on short-term treatment outcomes; long-term studies assessing the durability and functionality of prosthetic appliances in children are missing.
- **Patient cooperation.** Children may have difficulty cooperating and accepting the prosthetic treatment process, which may affect the effectiveness and comfort of using dentures.
- **Ethical and practical challenges.** Conducting clinical trials involving children requires meeting strict ethical requirements, which may limit the number of available studies and their scope.
- **Costs and availability.** Paediatric prosthetics can be expensive and access to specialist prosthetic services is limited in some regions, which prevents extensive research.

Taking these limitations into account is crucial for the interpretation of research and for further development of effective prosthetic approaches for paediatric patients.

Conclusions

Rehabilitation and prosthetic treatment in children should consider such factors as the clinical picture (location and extent of teeth loss, heath of the supporting tissue), the age of the patient and the dynamics of the development of the stomatognathic system.

Prosthetic treatment should be undertaken as early as possible from the point of view of cooperation between the child, the doctor and the caregivers. Good cooperation of the child and parental involvement will allow for achieving the expected results. Early treatment helps avoid possible consequences of failure to intervene, such as improper growth and development of the masticatory system.

When planning prosthetic treatment in young children, individual solutions adapted to the age and needs of the child, including orthodontic needs at a given treatment timepoint, need to be considered.

When treating a child up to 6 years of age, their dynamic growth should be considered. Changes occurring during this period prompt frequent check-ups and require awareness of the need to modify the prosthetic device. The doctor, parents and the child should also be prepared for relatively frequent replacement of the prosthetic device (every 8–10 months).

Prosthetic treatment in the age group of 6–18 years may be easier and more desirable by the patients themselves, especially in those between 16 and 18 years of age. Implants are a particularly attractive treatment approach for young people.

Prosthetic treatment in the older age group is very important due to the mental state of children and lower self-esteem in the case of extensive and noticeable hypodontia.

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NAVIGATING THE LANDSCAPE OF HUMAN PAPILLOMAVIRUS-RELATED ANAL CANCER SCREENING: A REVIEW FOR MEN WHO HAVE SEX WITH MEN

Przegląd badań przesiewowych w kierunku raka odbytu związanego z wirusem brodawczaka ludzkiego: analiza dla mężczyzn mających kontakty seksualne z mężczyznami

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Abstract

Introduction: Human papillomavirus (HPV) infection presents a significant global health concern, particularly due to its association with anal cancer, disproportionately affecting men who have sex with men (MSM). There is an urgent need for tailored screening strategies for this demographic. This review provides an overview of HPV-related anal cancer screening methods in MSM, highlighting their strengths, limitations, and future research directions. **State of knowledge:** Epidemiological studies have elucidated the prevalence of HPV-associated anal squamous intraepithelial lesions among MSM, underscoring the necessity for targeted screening. Various methods, including anal cytology, high-risk HPV (hrHPV) testing, and high-resolution anoscopy, have been proposed and evaluated. Despite challenges, tailored screening protocols have been developed to accommodate high-risk populations. **Conclusions:** Targeted screening strategies, especially for MSM living with HIV, are pivotal in mitigating the burden of HPV-related anal cancer. Expanding access to high-resolution anoscopy and addressing knowledge gaps are imperative. Further research into effective screening methods, including HPV-related biomarkers, is essential to enhance early detection and improve outcomes for at-risk MSM populations. This synthesis of evidence provides valuable insights for healthcare providers, policymakers, and stakeholders engaged in anal cancer prevention and control efforts.

Streszczenie

Wprowadzenie i cel: Zakażenie wirusem brodawczaka ludzkiego (HPV) stanowi istotny problem zdrowia publicznego na całym świecie, szczególnie ze względu na jego związek z rakiem odbytu, który częściej dotyka mężczyzn mających kontakty seksualne z mężczyznami (MSM). Istnieje pilna potrzeba opracowania dostosowanych strategii badań przesiewowych dla tej grupy. Niniejszy artykuł oferuje przegląd metod badań przesiewowych w kierunku raka odbytu związanego z HPV w populacji MSM, omawiając ich mocne strony, ograniczenia oraz kierunki przyszłych badań. **Stan wiedzy:** Badania epidemiologiczne wykazały zwiększoną częstość występowania związanych z HPV zmian śródnabłonkowych odbytu wśród MSM, co podkreśla potrzebę prowadzenia ukierunkowanych badań przesiewowych. Przedstawiono i oceniono różne metody, w tym cytologię odbytu, testy na występowanie wysokiego ryzyka HPV oraz anoskopię wysokiej rozdzielczości. Pomimo wyzwań opracowano specjalne protokoły badań przesiewowych, które uwzględniają populacje wysokiego ryzyka. **Podsumowanie:** Ukierunkowane strategie badań przesiewowych, zwłaszcza dla MSM żyjących z HIV, są kluczowe w redukcji obciążenia rakiem odbytu związanym z HPV. Konieczne jest poprawienie dostępu do anoskopii wysokiej rozdzielczości oraz uzupełnienie luk w wiedzy. Dalsze badania nad skutecznymi metodami przesiewowymi, takimi jak biomarkery związane z HPV, są niezbędne dla lepszego wczesnego wykrywania i poprawy wyników zdrowotnych w populacjach MSM. Niniejszy przegląd literatury dostarcza cennych informacji dla pracowników służby zdrowia, decydentów oraz interesariuszy zaangażowanych w działania na rzecz profilaktyki i kontrolowania raka odbytu.

Keywords: HPV; cancer screening; MSM; anal cancer

Słowa kluczowe: HPV; badania przesiewowe; MSM; rak odbytu

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The human papillomavirus (HPV) infection represents a significant public health concern on a global scale, particularly due to its association with anal cancer, a malignancy that affects men who have sex with men (MSM) in a disproportionate manner [1]. While there has been an increase in the incidence of anal cancer globally, the disease has a greater impact on MSM than on the general population [2, 3].

Epidemiological studies have elucidated the prevalence and distribution of HPV-associated anal squamous intraepithelial lesions (ASIL) among MSM, highlighting the need for targeted screening and prevention efforts [4, 5].

In response to the increasing prevalence of HPV-related anal cancer, a number of screening methods have been proposed and evaluated for their efficacy in detecting precancerous lesions and early-stage disease. These include anal cytology, high-risk human papillomavirus (hrHPV) testing, cytology and hrHPV co-testing, high-resolution anoscopy (HRA), and digital anal rectal examination (DARE) [6–8]. However, the implementation of these screening modalities presents challenges and limitations, including resource constraints, healthcare provider training, and patient acceptability [9, 10].

The objective of this review is to provide a comprehensive overview of the current state of knowledge regarding HPV-related anal cancer screening methods in MSM. By synthesizing evidence from epidemiological studies, meta-analyses, and clinical guidelines, we aim to delineate the strengths and limitations of existing screening strategies, identify areas for improvement, and outline future research directions. Ultimately, the objective is to inform healthcare practitioners, policymakers, and stakeholders involved in anal cancer prevention and control efforts, with the overarching goal of reducing the burden of this preventable disease among MSM populations.

Description of the state of knowledge

Epidemiology of HPV-related anal cancer in MSM

Despite its relative rarity, anal cancer incidence is projected to increase significantly, with an estimated surge to 78,000 cases by 2040. MSM represent a demographic at heightened risk for this malignancy, particularly those with Human Immunodeficiency Virus (HIV) infection, who exhibit the highest incidence rates [11]. Notable disparities are evident in the prevalence of anal high-grade squamous intraepithelial lesions (HSIL+) among MSM. HIV-positive individuals demonstrate a pooled prevalence of 22.4%, compared to 11.3% in HIV-negative counterparts. Moreover, there is considerable heterogeneity across studies, contributing to variability in prevalence estimates. Among HIV-negative MSM, the prevalence of anal HPV16 is 13.7%, with a corresponding prevalence of hrHPV at 41.2%. Conversely, HIV-positive MSM exhibit higher rates, with an anal HPV16 prevalence of 28.5% and an hrHPV prevalence of 74.3%. The detection of HSIL+ exhibits considerable variation, with rates ranging from 7.5% to 54.5% in HIV-positive MSM. After adjusting for heterogeneity between studies, HIV status emerges as a significant predictor of HSIL+, HPV16-positive HSIL+, and HSIL+ specifically in HPV16-positive MSM. Notably, the prevalence of HSIL+ among HPV16-positive individuals increases with age. In light of these findings, HIV-positive MSM represent a priority population for targeted anal cancer screening, particularly in the context of initiatives aimed at addressing HPV16-positive HSIL+ [3].

Screening populations

Several population groups have been identified as being at an increased risk of developing anal cancer. These include individuals with a weakened immune system, such as those living with HIV, MSM, and women with genital HPV-associated diseases, even after successful treatment [6]. Screening protocols for anal cancer are designed to target these elevated-risk groups, with recommendations varying based on specific risk factors. For MSM living with HIV, screening is recommended from the age of 35 years onwards. Conversely, for individuals with HIV who do not identify as MSM, as well as for MSM without HIV, the recommended age to initiate screening is 45 years [12].

It is essential to guarantee the availability of sufficient human resources for the provision of screening services, as denoted by the capacity to perform an HRA evaluation within a six-month period following an abnormal screening test in the eligible population. Conversely, a scarcity of such resources will inevitably result in a prolonged wait times for HRA. These screening strategies are designed for populations with access to HRA [12]. Where HRA availability is lacking, screening may be restricted to DARE for the detection of anal cancer [13, 14].

Screening methods

The low prevalence of anal cancer in the general population represents a significant challenge to the implementation of routine screening protocols. Nevertheless, evidence indicates that targeted screening of selected populations may prove to be a more effective strategy.

It is thought that early identification of anal intraepithelial neoplasia will contribute significantly to a reduction in the incidence of invasive anal cancer. A variety of screening methods have been proposed, including DARE, anal cytology, HPV co-testing, and HRA [7]. These strategies are based on findings from systematic reviews and meta-analyses, primarily conducted among individuals living with HIV (PWH). Research has demonstrated that anal cytology, HPV16 genotyping, and hrHPV-cytology co-testing are effective approaches for screening for anal cancer, demonstrating satisfactory performance indicators [15].

Anal cytology

Anal cytology has emerged as a pivotal element in anal cancer screening initiatives, particularly in developed countries where recent endeavors have been concentrated [16]. Early detection and subsequent treatment of high-grade anal intraepithelial neoplasia (HGAIN) are of paramount importance in reducing the incidence of anal cancer. Anal cytology is a valuable tool for the detection of HGAIN, with evidence indicating that annual screening for HIV-positive MSM and biennial screening for HIV-negative MSM is a cost-effective approach. In cases of abnormal cytology findings, referral for HRA and biopsy is indicated [17]. Anal cytology is an acceptable method for screening for anal cancer. Individuals presenting with atypical squamous cells of undetermined significance (ASC-US) or worse cytology results should be immediately referred for HRA [12]. Those with negative cytology findings should undergo repeat screening after 12 months, while unsatisfactory cytology results necessitate a repeat examination [18].

Guidelines targeting specific populations, such as solid-organ transplant recipients and HIV-positive individuals, emphasize the importance of anal cytology screening. For HIV-positive MSM, recommendations stress the need for regular cytology follow-up. This should be conducted on an annual basis for those with normal results, while in cases of squamous cytological abnormalities, prompt referral for anoscopy/HRA is advised.

It is noteworthy that, while anal cytology has traditionally been performed using methods such as the anal Pap smear, its ability to accurately predict histological dysplasia is being questioned. Despite its utility, anal cytology has several limitations, including subjectivity, restricted sensitivity, and the need for frequent repetition, similar to cervical cytology. In high-risk populations, such as HIV-positive MSM, the accuracy of anal cytology remains a topic of debate, with evidence suggesting poor correlation with histological findings. Consequently, there is growing interest in exploring HPV-related biomarkers to enhance the effectiveness of anal cancer screening [19, 20].

hrHPV testing

HPV 16, one of the hrHPV genotypes, is identified as the predominant genotype in both anal HSIL and squamous cell carcinoma within the general population. Nevertheless, there is a paucity of research examining the distribution of other hrHPV genotypes in the anus of PWH [21].

The use of hrHPV testing in anal cancer screening has emerged as a promising approach, comparable to its role in cervical sample analysis. It has been demonstrated that tests for the presence of HPV DNA exhibit high sensitivity (92.4%, 95% CI 84.2%–96.5%), although they are associated with a notably low level of specificity (41.7%, 95% CI 33.9%–44.9%). This indicates the potential value of these tests in screening procedures, particularly when followed by a subsequent test with higher specificity [22].

In anal cancer screening, hrHPV testing as a standalone approach is deemed an acceptable option. In the event of a positive result for hrHPV, an immediate referral for HRA is indicated. Conversely, individuals testing negative for hrHPV should undergo repeat screening within 12–24 months. Triage of hrHPV-positive individuals using cytology can help reduce the number of immediate referrals for HRA, and is therefore considered an acceptable strategy. Furthermore, if the screening test includes HPV genotyping, immediate referral HRA is recommended for individuals testing positive for HPV16, irrespective of cytological findings [12].

The evaluation of hrHPV genotypes, including HPV16, serves two purposes in anal cancer screening. Firstly, it assists in the initial detection of infection. Secondly, it facilitates the monitoring of infection clearance or persistence over time. This information is crucial for guiding treatment decisions and ongoing disease monitoring efforts [23].

Cytology and hrHPV co-testing

The incorporation of cytological and hrHPV testing into screening algorithms has significantly improved sensitivity for the identification of anal precancerous lesions and cancer within high-risk populations [24]. Co-testing enhances the specificity of atypical cytology diagnoses, thereby aiding in the identification of individuals requiring further intervention [25]. Immediate referral for HRA is recommended in the following scenarios: individuals with ASC-US or worse cytology alongside a positive hrHPV test result; those with atypical squamous cells, cannot exclude a high-grade squamous intraepithelial lesion (ASC-H) or a HSIL cytology result irrespective of hrHPV status; and individuals testing positive for HPV16, regardless of cytological findings. It is recommended that individuals with ASC-US cytology testing negative for hrHPV undergo repeat screening within 12 months. Similarly, individuals with negative for intraepithelial lesions or malignancy (NILM) cytology testing negative for hrHPV should be screened again within 12–24 months. The management of NILM cytology with a positive hrHPV result or low-grade squamous intraepithelial lesion cytology with a negative hrHPV result is at the discretion of the healthcare provider, who may elect to refer the patient for HRA or schedule repeat screening in 12 months. In settings where HRA capacity is limited, immediate referral for HRA is recommended for individuals with ASC-H or HSIL cytology, regardless of hrHPV result, as well as those testing positive for HPV16, irrespective of cytological findings [12].

Digital anorectal examination

It is recommended that MSM undergo a DARE every 1–3 years [8]. DARE should be conducted at all screening visits following the collection of samples for cytology and/

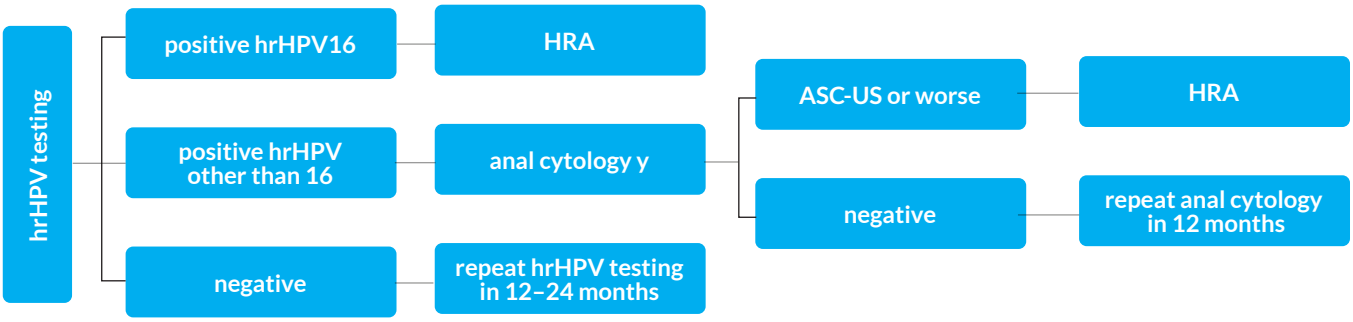

Figure 1. Anal cancer screening algorithm

or hrHPV testing. It serves as a means of screening for early-stage anal cancers that may be detectable through palpation. In cases where HRA referral is unavailable, routine DARE is recommended for populations identified for anal cancer screening [12].

High-resolution anoscopy

HRA plays a pivotal role in the identification of precancerous lesions by providing comprehensive visualization of the anal canal and rectum. This allows for the detection of abnormal tissue changes that are indicative of HPV-related anal cancer [26]. HRA is a vital diagnostic tool for detecting ASIL, particularly among individuals at elevated risk of anal cancer, such as MSM and those with HIV. The histopathological results from HRA-guided biopsies are considered the gold standard for confirming the presence of ASIL [27]. Individuals presenting with condyloma typically undergo resection, though HRA remains imperative for localizing and treating microscopic disease [28].

Challenges and limitations in screening practices

Notwithstanding the potential of screening strategies, a number of challenges and limitations remain. The paucity of cases of anal cancer in the general population presents logistical challenges to the implementation of routine screening programs. Furthermore, barriers to accessing HRA, coupled with a lack of awareness and the social stigma surrounding the issue, impede the participation of sexual minority men in screening and treatment procedures. To address these challenges, a multifaceted approach is required, encompassing improvements in access to screening services, the resolution of knowledge disparities, and the mitigation of stigma and discrimination.

Although anal cytology is considered an acceptable screening method, its limitations in terms of subjectivity and sensitivity highlight the need for additional screening modalities.

Many PWH, especially those at high risk of developing anal cancer, encounter difficulties in accessing HRA, whether on-site or through referral at their HIV care facility [29]. A significant issue highlighted in recent studies is the impact of patients' knowledge gaps regarding HPV-related health conditions on their screening practices. Lack of awareness is often linked to a sense of invulnerability, which in turn leads to delays in seeking medical care. Furthermore, the use of language associated with cervical cancer screening and treatment when discussing anal cancer care presents unique challenges to sexual minority men. This population is already sensitive to societal confusion surrounding sexual orientation and gender identity, which further complicates their engagement with screening and treatment [30].

Conclusions

The increasing global incidence of anal cancer, particularly among MSM, underscores the urgent need for effective preventive measures and screening strategies. The correlation between HPV16 and anal HSIL+ in HIV-positive MSM reinforces the necessity for targeted initiatives to reduce the prevalence of anal cancer in this demographic.

It is imperative that screening protocols are implemented for high-risk populations to facilitate early detection and prevention efforts. Screening at defined ages, based on risk profiles, facilitates the optimal allocation of resources and ensures the timely implementation of interventions. Nevertheless, it is of the utmost importance to address the obstacles preventing marginalized MSM populations from accessing screening services, in order to guarantee equitable healthcare access and outcomes.

A variety of screening techniques, including anal cytology, hrHPV testing, and HRA, present promising avenues for anal cancer screening in MSM. The potential of hrHPV testing, either alone or in combination with cytology, is emphasized, as is the importance of HPV16 genotyping in guiding treatment decisions and monitoring infection, as outlined in Figure 1. Continued research into more effective screening methods, including the exploration of HPV-related biomarkers, is needed to further enhance early detection and reduce the burden of anal cancer in MSM populations. Improving access to HRA and addressing knowledge gaps surrounding HPV-related health conditions are crucial steps toward enhancing early detection and prevention efforts. Additionally, initiatives to promote awareness, reduce stigma, and improve healthcare access for sexual minority men are essential for achieving equitable health outcomes in this population.

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REVIEW ARTICLE

PHYSIOLOGICAL AND BIOLOGICAL EFFECTS OF A GUNSHOT WOUND

Fizjologiczne i biologiczne efekty rany postrzałowej

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Abstract

The paper was inspired by reports on the Russian-Ukrainian war in terms of the ammunition used by the Russian army despite the introduced restrictions in this regard. The aim of the paper was to analyse and describe phenomena that occur during soft tissue penetration by a bullet. The paper presents a synthetic description of the ongoing research and the development of the discipline of wound ballistics. The beginnings of experiments that provided the basis for the development of a research and numerical apparatus for the description of wound ballistics are discussed. Further parts of the paper describe the phenomena occurring in soft tissue during bullet penetration, discusses the process of creating a permanent channel and a temporary cavity, depending on the type and technical parameters of bullets used, as well as present sample images from the conducted experiments. The presented description concerns only the mechanism of the projectile-soft tissue interaction and does not take into account other destruction factors, such as fragments from artillery shells, rockets, grenades or mines. The severity and profile of injuries change as a result of bullet rotation. When the projectile rotates at a 90-degree angle, it crushes the tissue with its side surface. This also results in an increase in force. It should be borne in mind that the rate of energy transfer along the wound channel is not uniform throughout the body, as the projectile may change trajectory or undergo fragmentation during penetration. Additionally, human tissue is not homogeneous. A temporary cavity may develop depending on several factors, such as the shape, velocity, calibre of the projectile, the penetrated organs through or near which the trajectory of the projectile passes, and the pressure or shock wave that may cause both proximal and distal injuries.

Streszczenie

Inspiracją do powstania pracy były doniesienia o tym, co się dzieje na wojnie rosyjsko-ukraińskiej w zakresie amunicji stosowanej przez stronę rosyjską, pomimo obowiązujących obostrzeń w tej kwestii. Celem artykułu jest analiza oraz opisanie zjawisk, które występują podczas penetracji tkanki miękkiej przez pocisk. W pracy przedstawiono syntetyczny opis prowadzonych badań i rozwoju dyscypliny, jaką jest balistyka rany. Omówiono początki eksperymentów, które dały podstawy do opracowania aparatu badawczego i numerycznego do opisu balistyki rany. W dalszej części opisano zjawiska zachodzące w tkance miękkiej podczas penetracji przez pocisk, omówiono proces tworzenia się kanału trwałego oraz jamy chwilowej w zależności od rodzaju użytych pocisków i ich parametrów technicznych oraz przedstawiono przykładowe zdjęcia z przeprowadzonych eksperymentów. Przedstawiony opis dotyczy tylko mechanizmu interakcji pocisk–tkanka miękka, nie uwzględnia innych czynników rażenia, takich jak odłamki po uderzeniu pocisków artyleryjskich, rakiet, granatów czy też min. Ciężkość obrażeń i ich profil zmienia się w wyniku obrotu pocisku. Gdy obraca się pod kątem 90 stopni, miażdży tkankę boczną powierzchnią. Skutkuje to również wzrostem siły. Należy pamiętać, że szybkość transferu energii wzdłuż kanału rany nie jest jednolita w całym ciele, ponieważ pocisk w czasie penetracji może zmieniać trajektorię czy też fragmentować. Ponadto tkanka ludzka jest niejednorodna. Jama chwilowa może powstać w zależności od kilku czynników: kształtu, prędkości, kalibru pocisku, penetrowanych narządów, przez które lub w pobliżu których przechodzi trajektoria lotu pocisku oraz ciśnienia lub fali uderzeniowej, która może powodować zarówno bliższe, jak i dalsze obrażenia ciała.

Keywords: bullet; gunshot; permanent wound channel; temporary cavity; wound ballistics

Słowa kluczowe: pocisk; postrzał; kanał trwały; jama chwilowa; balistyka rany

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Historical outline

The field of wound ballistics is about 1,000 years old, or at least that is how old the first records of the ancestor of the modern gun, a small wrought-iron or bronze cannon secured with a leather strap, are. The gun of that time used an iron ball about 0.09 m in diameter as a projectile. Black gunpowder weighing about 0.1 kg was used as propellant [1]. The gun, which was 0.34 m long and weighed 3.5 kg, was called the Heilongjiang hand cannon by Chase and Needham [2–3]. From that moment on, the evolution of propellants and the ammunition used in these guns began, giving rise to the development of a new scientific discipline known as wound ballistics. The 1830s can be considered as the time when it began, while the first significant breakthrough occurred in the 1870s, when Emil Theodor Kocher, a Swiss surgeon, developed a hydrodynamic theory for the effect of gunshot wounds, which was the foundation for the development of the discipline. In 1895, he was the first scientist to use gelatin to conduct a ballistic experiment, the purpose of which was to simulate the penetration of soft tissue by a bullet [4]. The innovative design of the experiment using the technical solutions available at that time, combined with Kocher's interest in wound ballistics, provided the foundation for the development of rational principles constituting the scientific basis for modern wound ballistics.

Louis Anatole La Garde, a Colonel in the US Army Medical Corps, was another person who contributed to the development of the discipline. In the 1890s, he conducted ballistic experiments to demonstrate that higher-velocity hard core bullets caused less damage when penetrating soft tissue than larger-caliber soft core projectiles [5]. La Garde focused his research on the transfer of kinetic energy of a moving bullet to soft tissue. He concluded that the energy transfer in soft tissue depends on the projectile velocity at impact [5].

In 1901, General John T. Thompson and Colonel Louis Anatole La Garde found that the kinetic energy of a bullet is not always the main factor determining the severity of injury in a permanent cavity created by a bullet as it penetrates the soft tissue [5–7]. Furthermore, they both confirmed that large-caliber bullets can cause more damage than their small-caliber counterparts [5].

General Julian Hatcher, who developed a model that took into account momentum rather than kinetic energy (Hatcher's model), was another person who contributed to the development of wound ballistics. Hatcher realized that bullets fired from handguns caused less internal damage outside the permanent wound tract than rifle bullets [8].

Lindsey and Mendelson were researchers who performed histopathological and biophysical measurements in the 1950s (before the Vietnam conflict), based on which they developed models of correlations between absorption of energy and tissue damage as functions of the depth of the wound tract [7].

In the late 1970s and early 1980s, Swedish scientists Janzon and Seeman [9] attempted to determine if quantitative relationships existed between energy and tissue damage using the amount of debrided tissue as an index of tissue damage [9]. All these attempts and studies gave impetus to the significant development of the work by Colonel Martin L. Fackler from the US Army, who was the first to compare material imitating human tissue (ballistic gelatin) with living tissue (experiment on pigs). This way, he established and introduced into the literature a model of 10% gelatin, which allowed for research in a medium imitating human muscle tissue [10, 11]. He was the first to introduce calibration of ballistic gelatin to ensure consistency between manufactured gelatin batches and to compare the results of ballistic tests. For this purpose, he used an air gun, from which he fired pellets at a specific speed at a gelatin block. This was steel pellets with a uniform shape, which prevented deviation from a given direction, deformation and fragmentation. The proposed calibration method allowed for correlating data from various previously conducted experiments [12].

Physiological and biological effects of gunshot wounds in a living organism

Mechanisms of injury

Wound ballistics can be defined as a study of the interaction between a projectile and the tissue [13]. The biological effect of this interaction can be determined based on:

- design parameters of the projectile: weight, shape, material, construction, calibre, speed;
- soft tissue parameters: density, elasticity, viscosity, structure, anatomy.

These parameters are schematically presented in Figure 1. A projectile moving through the air is subject to aerodynamic drag (air resistance) and gravity, with gravity having constant direction and magnitude, and with variable air resistance. In order for the aerodynamic drag force not to cause the projectile to tumble, the gyroscopic phenomenon is used for stabilization, which requires that the projectile has a high rotational velocity (typically about 200,000 rpm). Lateral drift of the bullet, directed to the right for bullets spinning clockwise and to the left for bullets spinning counterclockwise, is an additional effect related to the gyroscopic phenomenon. The drift is very slight and is of practical significance only when shooting at long distances.

The amount of projectile's kinetic energy to inflict damage (penetration centre) depends largely on the energy at impact, which in turn depends on the velocity at impact and the mass of the projectile.

Additional factors that determine projectile behaviour during penetration in the medium depend on its design: i.e. the material it is made of, projectile deformation of fragmentation.

The bullet kinetic energy at impact with the target can be determined using the following formula:

$$E_i = \frac{m \times V^2}{2} \qquad (1)$$

where: V – bullet velocity, m –bullet weight,

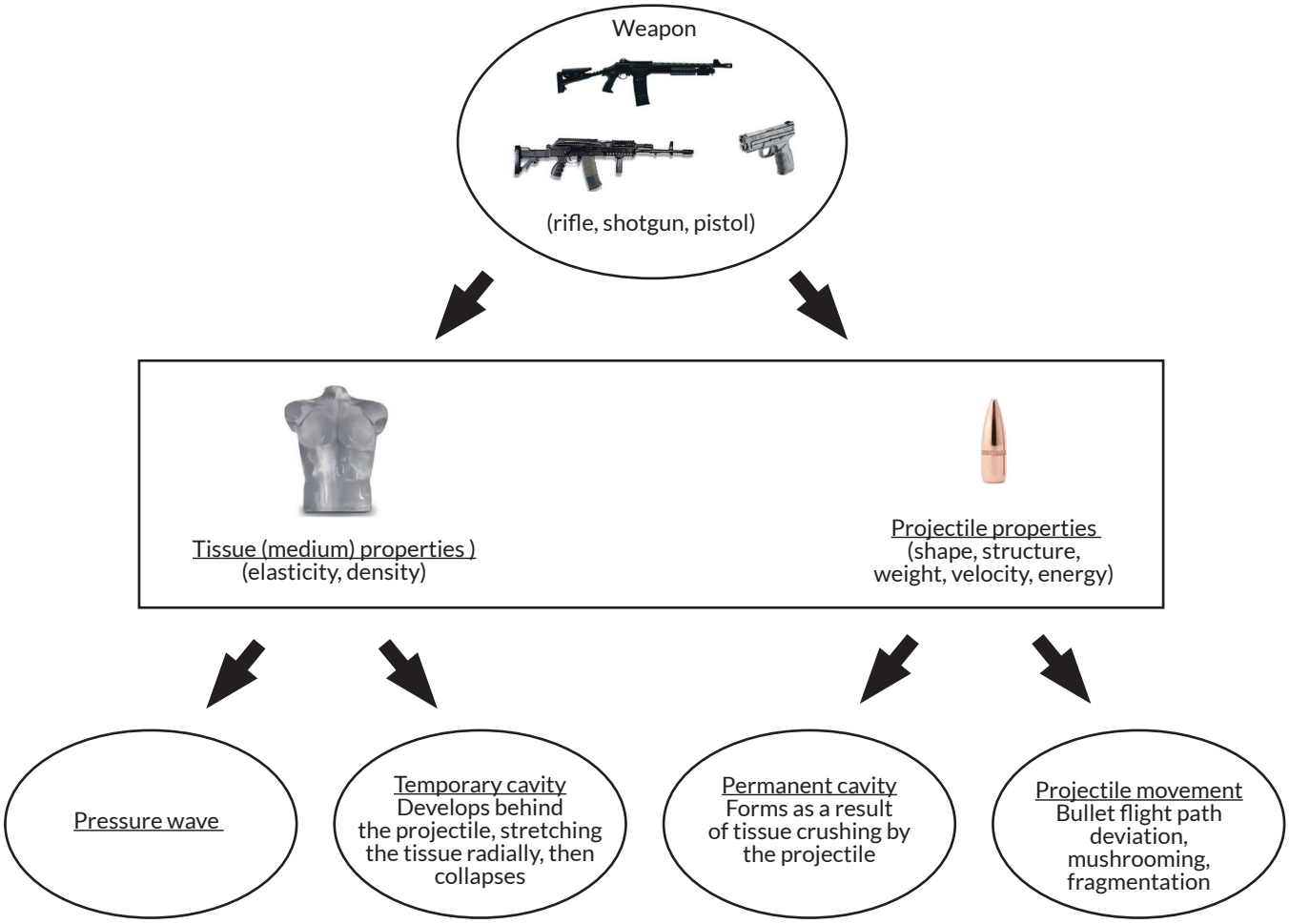

Figure 1. Factors affecting wound severity. Own elaboration

The energy balance of a bullet in a medium imitating soft tissue can be expressed as follows:

$$E_r = E_i - E_{def} - E_d \quad (2)$$

where: E_r – residual kinetic energy of the bullet, E_i – impact energy, E_{def} – kinetic energy used by bullet deformation, E_d – kinetic energy dissipated in the medium.

The kinetic energy dissipated in the penetration medium may be described using an equation proposed by Martel and presented by Kneubueh [14]:

$$Ed = Cv \times V \quad (3)$$

where: CV – material constant of the penetration medium, V – volume of the permanent wound tract.

The kinetic energy of a bullet passing through soft tissue decreases, which is caused by a significant reduction in its velocity. The bullet slows down, converting kinetic energy into work, which is performed during crushing, tearing, and stretching of the soft tissue in front of and around the bullet's penetration path, with the penetrated tissue being simultaneously driven outward in a radial direction, thus creating a temporary cavitation with a diameter much larger than the calibre of the penetrating bullet. This phenomenon was first described by Wooduff and presented by Jussili [7]. It is schematically shown in Figure 2.

The unstable motion od a projectile, its deformation and fragmentation increase the amount of energy dissipated, thus increasing the size of the temporary cavity. In the initial period of penetration, the diameter of the inlet hole increases rapidly, then the temporary cavity undergoes a series of gradual pulsations and contractions of smaller amplitude before finally resolving, leaving a permanent cavity (channel), which arises from crushed and fragmented tissue. Examples of temporary and permanent cavitations are shown in Figure 3 and Figure 4.

A penetrating projectile can cause soft tissue damage via two different mechanisms: crushing and stretching [16–18].

Crushing mechanism, permanent cavitation

Soft tissue in the trajectory of the moving projectile is crushed and torn away by the dynamic pressure generated in front of the tip of the moving projectile. This causes tissue breakdown, and consequently formation of a permanent wound channel [16, 17, 19].

The higher the velocity of the projectile, the further the tissue will move away from it, as the level of tissue stress

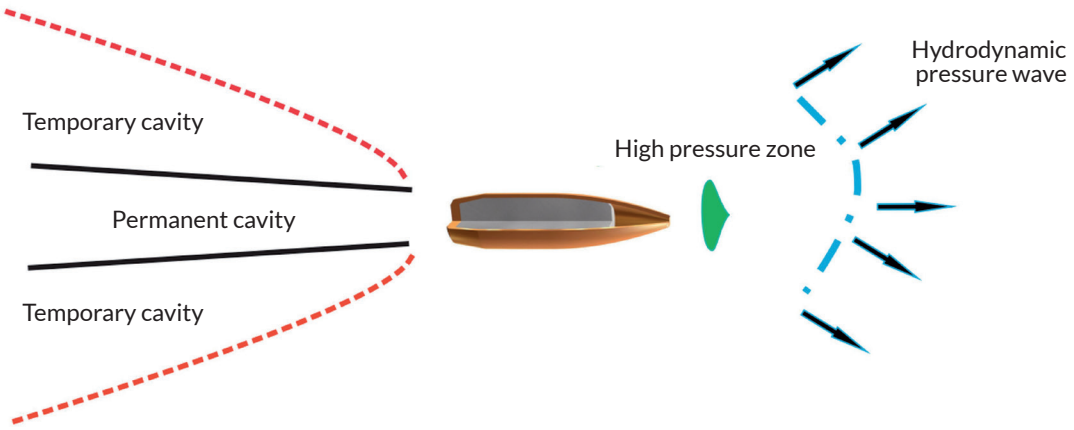

Figure 2. Schematic drawing of the phenomenon that occurs as a result of human tissue penetration by a projectile. Own elaboration based on Fackler [15]

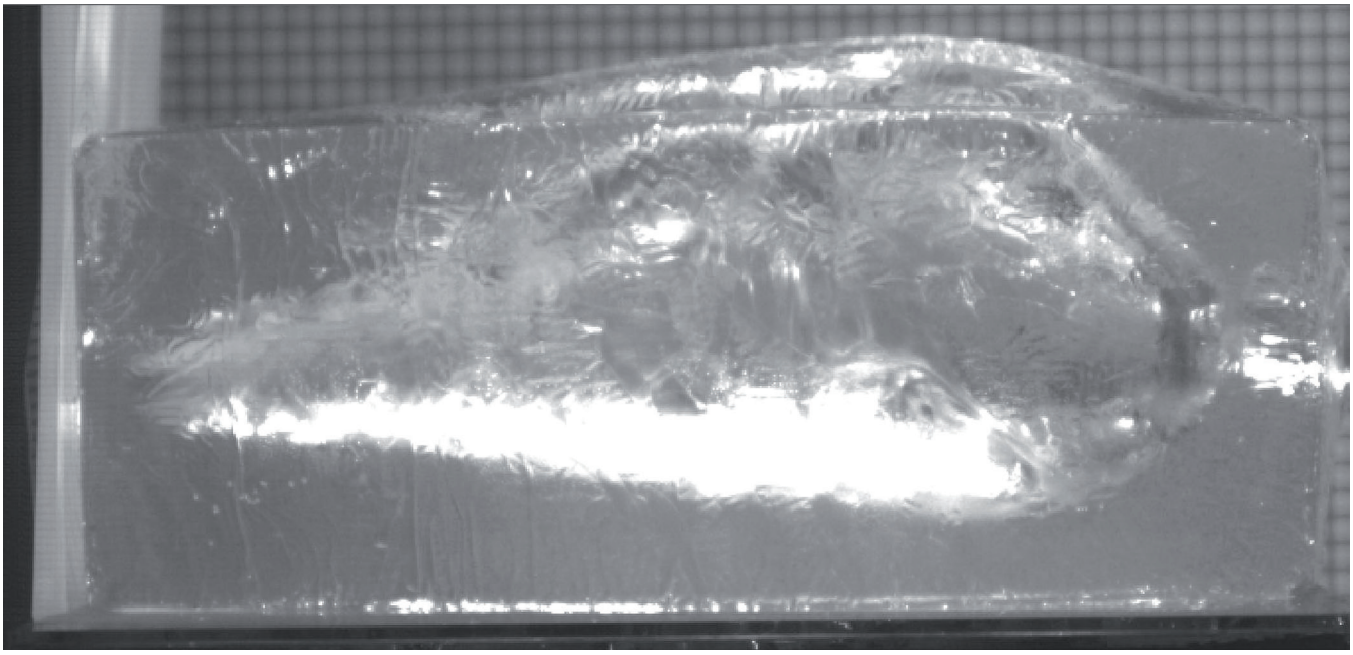

Figure 3. Temporary cavity in ballistic synthetic gelatin created by a .308 Win caliber bullet. Photo by G. Motrycz

in relation to its elastic limit depends on the amount of stored energy (a function of the projectile resistance force). In order for permanent damage to occur and a permanent cavity to form, the tissue or organ must move as a result of bullet penetration. After exceeding the elastic threshold of the tissue or organ, permanent damage (cracks, tears) caused by stress occurs.

Stretching mechanism, temporary cavitation

When analysing a temporary cavitation mechanism, a distinction should be made between high-velocity projectiles (usually rifle bullets) and low-velocity projectiles (intended for a pistol or revolver). However, it should be remembered that these terms are imprecise and can sometimes be misleading, as subsonic rifle bullets reaching a speed of 325 m/s, which are intended for short-barrel rifles with silencers, are also available on the market. The bullet loses kinetic energy during target penetration, which results in significant differences in forces on the tissue and wound profiles.

As pointed out by Fackler: *'Kinetic energy' … reveals nothing about the magnitude, type and location of tissue disruption… The force interactions between penetrating projectile and tissue remain hidden behind the abstract 'kinetic energy' discussions*" [6, 20]. This force (force of interaction between the projectile and the tissue) is the local rate of change of kinetic energy at a given penetration depth. The value of this force (interaction of the projectile with the tissue) is the local rate of change of the value of kinetic energy at a given penetration depth. The quantity of kinetic energy lost by the projectile is equal to the work done on the tissue. The rate of energy loss in the body as the bullet penetrates equals the force at each point (tissue). The magnitudes of the forces on the tissue allow for determining

Figure 4. Permanent cavity in ballistic synthetic gelatin created by a .308 Win caliber bullet. Photo by G. Motrycz

the extent of tissue damage. The area under the curve for the relationship between force and penetration depth equals the total energy lost by the bullet as it penetrates. The total energy lost is less than the impact.

The onset of energy transfer by a non-ricocheted bullet penetrating soft tissue is as shown in Figure 5. Depending on its design and penetration depth, there is a change in the point of curve of the force as a function of displacement.

The increase in the force shown schematically in Figure 5 can only occur in the case of an increase in the penetrated area resulting from the deviation (deviation of the axis of projectile from its trajectory, i.e. a rotational moment caused by the inhibitory force on the front part of the projectile).

As already mentioned, soft tissue penetration depends on multiple factors. These include:

- design and material of the bullet – bullets with high hardness and strength do not undergo plastic deformation during penetration, while soft bullets are deformed or defragmented;

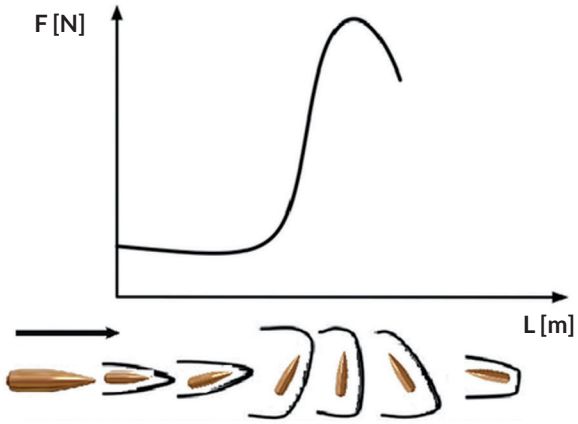

Figure 5. Schematic diagram of the force (F) course as a function of projectile length (L) in soft tissue. Own elaboration

- bullet outline – spitzer bullets tend to quickly lose stability in soft tissue, which causes them to tumble and lose speed faster than round nose bullets;
- bullet velocity – depending on the velocity, the bullet may break, which means that the shape of the temporary cavity and the nature of the bullet deformation may change.

It is mainly spitzer bullets, the design of which is associated with poorer or difficult mushrooming, that lose stabilization. Despite its streamlined shape, the bullet starts to tumble as a result of the loss of stabilization in the tissue, which is about 890 times denser than air, leading to more severe damage.

In the case of full metal jacket rifle bullets resistant to deformation, with a low ballistic coefficient, the trajectory during soft tissue penetration will not change, the flight path will be stable, and the damage will be smaller.

Conclusions

- The severity (profile) of injury changes as a result of bullet rotation. When the bullet rotates at a 90-degree angle, the force increases, translating into kinetic energy transfer to the tissue.
- The rate of energy transfer along the wound tract is not uniform in the tissue, as the bullet may change its trajectory (tumble) or fragment as it penetrates. Additionally, the penetrated tissue is not uniform.
- The shape of temporary cavitation depends on the shape of the bullet, its velocity, calibre, the penetration site in the tissue (organs) through or near which the bullet passes, and the pressure of the shock wave, which can cause both proximal and distal injuries.
- Wounds caused by shrapnel, mine or rocket fragments have a different shape due to the additional effect of pressure and temperature.
- The wound profile will be different for a tactical vest. When penetrating soft tissue, the bullet will have less kinetic energy, but there will be chest injuries caused by costal cartilage fractures.

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THE FEASIBILITY OF IMPRINT CYTOLOGY FOR ACCELERATING CANCER DIAGNOSIS

Ocena możliwości wykorzystania cytologii odbitkowej w szybkiej diagnostyce nowotworu złośliwego

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Abstract

Introduction and objective: Pathomorphological examination is one of the main pillars of cancer diagnosis, and the information obtained is important for making treatment decisions. Imprint cytology is a type of pathomorphological examination, where cells are obtained by moving a glass slide over a fresh cross-section of the tissue being examined, such as a cross-section of a tumour or a lymph node. The main objective of the paper was to investigate whether imprint cytology can be an alternative to intraoperative frozen section analysis. **Materials and methods:** The results of imprint cytology and intraoperative frozen sections performed in the Department of Thoracic Surgery General and Oncological Surgery at the Military Medical Academy Hospital in Łódź between 2020 and 2023 were analysed and compared with the final histopathological examination. A group of 58 patients undergoing elective surgery for malignant tumours of the lung, mediastinum, colon, stomach and gallbladder was included in the study. **Results:** Both frozen section analysis and imprint cytology showed 97% concordance with final histopathology. Imprint cytology yielded a false-negative result in two cases, with a malignant neoplasm confirmed in frozen section and the final histopathological examination. In two cases, a small-cell malignant neoplasm was diagnosed with imprint cytology, which was later confirmed in the final examination, while frozen section yielded a result inconsistent with the routine examination. **Conclusions:** Imprint cytology is a reliable method that can be used to accelerate the diagnosis of cancer. When intraoperative examination is not possible, imprint cytology allows for obtaining a rapid diagnosis, while at the same time the specimen taken does not have to be immediately transported to the pathomorphology department.

Streszczenie

Wprowadzenie i cel: Badanie patomorfologiczne stanowi jeden z głównych filarów diagnostyki w onkologii, a informacje uzyskane dzięki niemu mają istotne znaczenie w podejmowaniu decyzji leczniczych. Jednym z jego rodzajów jest cytologia odbitkowa, w której komórki są pozyskiwane poprzez przesuwanie szkiełka podstawowego po świeżo wykonanym przekroju badanej tkanki, np. przekroju guza lub węzła chłonnego. Głównym celem pracy było zbadanie, czy cytologia odbitkowa może być alternatywą dla badania śródoperacyjnego przeprowadzonego techniką mrożakową. **Materiał i metody:** W Klinice Chirurgii Klatki Piersiowej Chirurgii Ogólnej i Onkologicznej Szpitala im. Wojskowej Akademii Medycznej w Łodzi w latach 2020–2023 przeprowadzono analizę wyników badania cytologii odbitkowej oraz badania śródoperacyjnego wykonanego techniką mrożakową i porównano je z ostatecznym wynikiem badania histopatologicznego. Badanie przeprowadzono w grupie 58 pacjentów operowanych w trybie planowym, u których wykonano resekcję guza nowotworowego jelita grubego, pęcherzyka żółciowego, żołądka, płuca oraz śródpiersia. **Wyniki:** Zarówno badanie doraźne, wykonane techniką mrożakową, jak i odbitka cytologiczna okazały się w 97% zgodne z wynikiem ostatecznym badania histopatologicznego. W badaniu cytologii odbitkowej w dwóch przypadkach uzyskano wynik fałszywie ujemny, natomiast w badaniu doraźnym i ostatecznym badaniu histopatologicznym potwierdzono nowotwór złośliwy. W dwóch przypadkach w cytologii odbitkowej zdiagnozowano nowotwór złośliwy drobnokomórkowy, co później potwierdzono w badaniu ostatecznym, natomiast w badaniu doraźnym uzyskano wynik niezgodny z badaniem rutynowym. **Wnioski:** Cytologia odbitkowa jest wiarygodnym badaniem, które może być wykonywane w celu przyspieszenia rozpoznania choroby nowotworowej. W przypadku braku możliwości wykonania badania śródoperacyjnego cytologia odbitkowa daje możliwość szybkiego uzyskania rozpoznania, a jednocześnie pobrany preparat nie musi być natychmiast przetransportowany do zakładu patomorfologii.

Keywords: histological examination; intraoperative examination; imprint cytology

Słowa kluczowe: badanie histopatologiczne; badanie śródoperacyjne; cytologia odbitkowa

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Introduction

Pathological examination is one of the main pillars of cancer diagnosis. It delivers information of significant importance in making treatment decisions. Since histopathology, which is the basis for the diagnosis, is time-consuming, other methods, such as a frozen section analysis (FSA) and cytology, are utilised. Cytology, also known as a cytopathology, is a diagnostic method based on the assessment of cells under a light microscope. Body secretions, fluids from body cavities (exfoliative cytology), or cells retrieved by fine-needle aspiration may be used [1].

Exfoliative cytology involves microscopic evaluation of cells that have spontaneously shed from the surface of an organ or tissue, or have been collected as a smear. The harvested specimen may include, for example, sputum, bronchial secretions or washings, fluid from body cavities, cystic contents, or a cervical smear. The fluid should be placed in a clean container with a few drops of heparin and immediately sent unfixed to the pathology laboratory or facility. To perform a smear, specimens are harvested from the surface of a lesion or mucous membrane, and then applied directly to a microscope slide.

Fine needle aspiration biopsy (FNA) is a way to obtain samples for microscopic examination from sites suspected of pathology by puncture and aspiration of cells. Endobronchial ultrasound (EBUS) and endoscopic ultrasound (EUS) are special types of FNA. The obtained material is immediately spread on glass slides and fixed (cytology smears), or part or whole of the aspirated material is immediately fixed in a fixative, as in the case of tissue samples (cell blocks) [2]. A cell block is prepared by fixing the aspirated cells and embedding them in a paraffin block. Cell blocks allow for obtaining microscopic sections and thus for a greater number of additional tests necessary to reach the diagnosis and determine the predictive factors necessary for choosing the therapy. Crush preparations, where the sample is ground or crushed directly on a glass slide, can also be used. Imprint cytology (IC), in which cells are obtained by moving a glass slide over a fresh cross-section of the investigated tissue, e.g. a cross-section of a tumour or a lymph node, is another increasingly popular method. A similar specimen can be obtained by crushing a fragment of tissue on a glass slide [1, 3]. Further management depends on the type of material collected and the method of its preservation. Both fixed or unfixed specimens can be sent to the cytology laboratory. In the case of a specimen intended for a cell block, it is fixed in 10% buffered formalin with a pH of 7.2–7.4 or in 96% alcohol (50–70% in some cases). Crush and imprint specimens are fixed in alcohol [3].

Intraoperatively, the so-called frozen section analysis is usually performed. Intraoperatively collected, unfixed specimens are transferred to the pathology laboratory and assessed by freezing the specimens at low temperature, followed by their sectioning in a cryostat and staining with haematoxylin and eosin [3].

Objective

The main aim of the study was to assess whether imprint cytology may be an alternative to intraoperative FSA, which is considered the gold standard.

Materials and methods

We analysed the results of IC and intraoperative FSA and compared them with final histopathology. The study included 58 patients treated at the Department of Thoracic, General and Oncological Surgery, University Clinical Hospital of the Military Medical Academy between 2020 and 2023, who underwent elective surgeries for lung, mediastinal, colon, gastric or gallbladder cancer. Each patient underwent tumour resection, with cytological imprints taken, an intraoperative frozen section and a routine histopathology. The specimens harvested for intraoperative frozen section were not fixed in any way. The specimens collected for cytology were obtained by moving a glass slide over a fresh cross-section of the investigated tissue and fixed in alcohol. Regardless of the positive qualification, participation was voluntary. Each participant could refuse or withdraw consent to participate in the study at any time, without giving a reason and without any consequences, while maintaining the right to treatment in the same Department.

Results

The study included 58 patients treated surgically for cancers (Fig. 1). Malignancy was confirmed in 54 patients, benign lesions were diagnosed in 4 patients, as confirmed with all three methods (IC, intraoperative FSA and routine histopathology).

IC confirmed atypical or malignant cells in 52 cases and yielded a false negative cytological diagnosis in 2 cases, with malignancy confirmed in FSA and final histopathology. False negative results were obtained for lung tumours.

These were squamous cell lung cancer in one case, and a metastatic melanoma to the lung in the other case.

In two cases, IC diagnosed a small cell lung cancer, which was later confirmed in the final histopathology, while FSA suggested non-small cell lung cancer and anaplastic carcinoma.

Intraoperative FSA correctly diagnosed non-small cell carcinoma in 44 cases, whereas a more detailed diagnosis of squamous cell carcinoma and adenocarcinoma was obtained in 8 cases, whish was also consistent with histopathology (Fg. 2).

Both intraoperative FSA section and IC showed an efficiency of 97%.

Discussion

The advances in oncology have given rise to challenges for surgeons and pathologists, which aim at rapid, minimally invasive and accurate histopathological diagnosis allowing for immediate anticancer treatment. Several studies may be found in the literature that have confirmed the usefulness and effectiveness of cytology as an intraoperative diagnostic tool. According to these studies, the advantage of cytology is that it is much less time-consuming, easy to use and, apart from a microscope, does not require additional specialist equipment.

Compared to histopathology, cytology is less invasive and repeatable. Lower material costs and shorter duration of the test are also important. Inability to assess tissue topography, which means that cytopathological findings should be confirmed in doubtful cases by histopathology, which allows for assessing a greater number of microscopic image details, is a limitation [4].

Esbona et al. reviewed the literature on the assessment of excised tissue margins in patients who underwent breast-conserving treatment. Two intraoperative methods for margin assessment were used: FSA and IC. Although FSA was performed most frequently, it was shown to be associated with artifacts in the fatty tissue arising from the freezing and thawing process, which led to tissue loss. For this reason, IC has been proposed as an alternative. This technique for assessing margins in breast cancer patients undergoing breast-conserving surgery has been found to be sufficiently rapid and reliable to be utilised as an intraoperative aid. IC can effectively reduce the need for additional surgeries to achieve negative margins in these patient populations. Intraoperative IC took less than 15 minutes compared to 30 minutes for intraoperative FSA [5].

Ahuja et al. conducted a meta-analysis of studies on the diagnosis of lymph node metastases in breast cancer. Although the sensitivity of FSA was higher than that of IC in detecting micrometastasis, IC was found to be a rapid, inexpensive technique that can be used, for example, in the absence of a cryostat. The sensitivity of both techniques for detecting metastasis was comparable, making IC a useful tool for the rapid diagnosis of lymph node involvement. This meta-analysis highlighted the accuracy of IC and FSA in the diagnosis of lymph node metastases of breast cancer [6].

Jaswal et al. assessed 160 intraoperative imprints from 52 patients. These were patients with various cancer locations, mostly with head and neck tumours. The authors

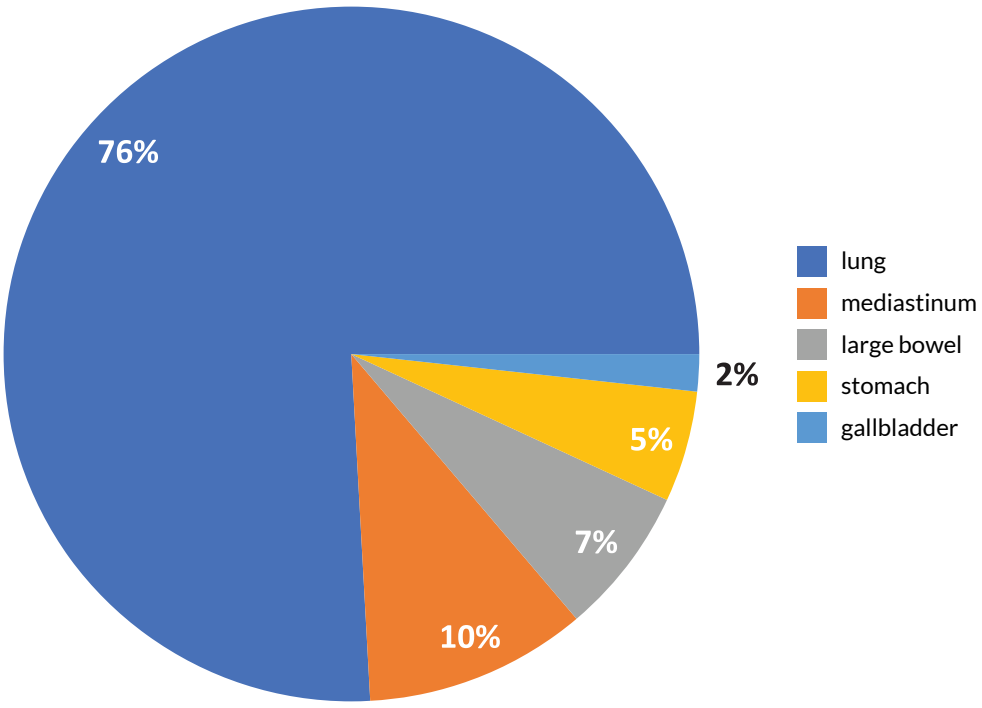

Figure 1. Tumour site

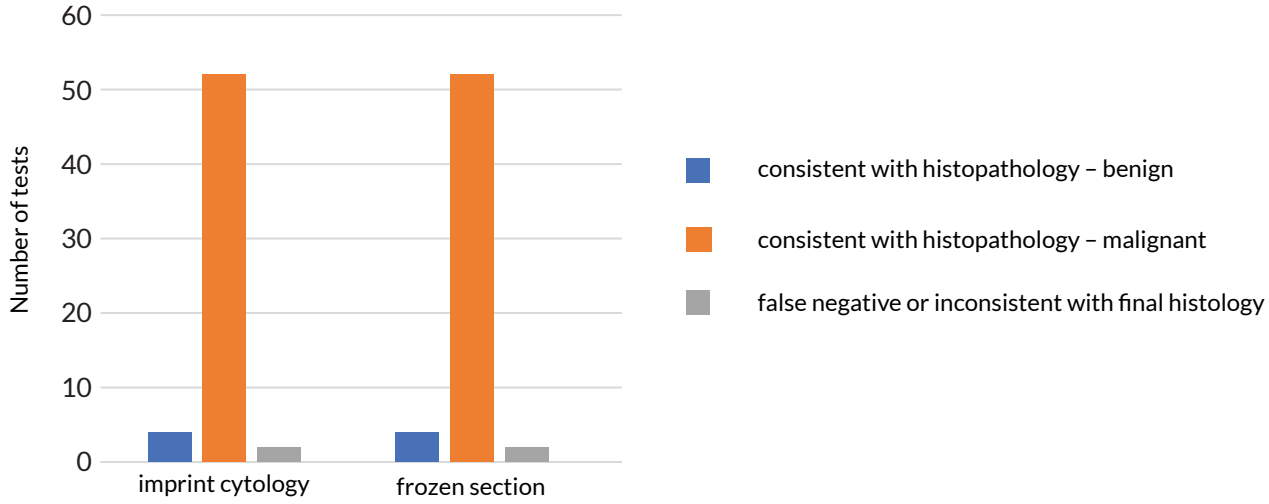

Figure 2. Concordance between imprint cytology and frozen section and the final histopathology

considered IC to be a rapid, inexpensive, and reliable diagnostic tool. The simplicity, speed, and cost-effectiveness of this technique, along with its ability to maximise cell recovery from very small tissue fragments, make IC a valuable tool. The limitations of intraoperative cytology are the same as those of cytology in general. These include sampling errors, inability to distinguish *in situ* malignancy from invasive lesions, inability to assess the depth of invasion in detail, and limited detection of micrometastasis [7].

Shubha et al. included 50 patients operated on for cancers of various locations in their study. The overall diagnostic accuracy was 94% for IC in various organs, and 98% for intraoperative FSA. The total diagnostic accuracy was 98%. The false negative and false positive rates for IC were 4% and 2%, respectively. The false negative rate for FSA was 2%. Of the three discordant IC cases, two were due to misinterpretation and one was due to an error during sample collection. The diagnostic accuracy of IC and FSA for malignancies was 96% and 98%, respectively [8].

Pallialil et al. assessed IC and frozen sections. A total of 157 tissue imprints were collected for the study and divided into specimens based on tumour type, tumour margin, and lymph node involvement. The overall diagnostic accuracy for tumour type detection was 97.9% for IC and 98.6% for FSA. The authors concluded that IC has many advantages, is technically simple, quick, and has a low learning curve. However, it also has some disadvantages, such as the inability to distinguish *in situ* carcinoma from invasive disease and to obtain information on the depth of invasion [9].

Biancosino et al. assessed the value of intraoperative IC. To this end, a total of 532 intraoperatively harvested specimens out of the 518 resected thoracic tumours from 360 patients were examined. The specimens were assessed using intraoperative IC, which was later compared with the final histology. The sensitivity and specificity of IC were 82% and 99%, respectively. The authors concluded that intraoperative IC is a rapid, accurate, and sensitive method allowing for intraoperative decision-making and is clearly a helpful alternative or adjunct for the thoracic surgeon, provided that they appreciate the potential limitations of this technique [10].

It seems obvious that neither an intraoperative frozen section nor imprint cytology will provide a precise diagnosis, but determining whether the lesion is benign or malignant and whether the tumour is small-cell or non-small-cell makes it much easier for the surgeon to make a decision on further treatment.

The importance of IC increases when a pathologist is not available at the time of the procedure. Since the collected specimen does not need to be immediately transported to the pathology department, the material can be collected in the afternoon, at night and on holidays, when ad hoc tests are typically unavailable. The importance of rapid diagnosis is of great importance in the era of fast-track oncology pathway. By obtaining a preliminary diagnosis immediately after the procedure, the patient can benefit from accelerated diagnostic process and prepare for further anticancer treatment.

Conclusions

- The analysis showed that imprint cytology is a reliable tool that can be used to accelerate the diagnosis of neoplastic diseases and can be an alternative to intraoperative frozen section analysis.
- Combining imprint cytology with frozen section helps achieve high diagnostic accuracy.
- If intraoperative examination cannot be performed, imprint cytology allows for rapid diagnosis, without the need to immediately transport the collected specimen to the pathology department.

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SUPPORT OF THE POLISH NATIONAL SYSTEM BY MILITARY MEDICAL SERVICES DURING NATURAL DISASTERS – WIM-PIB EXPERIENCES FROM THE 2024 FLOOD IN LOWER SILESIA

Wsparcie systemu krajowego przez wojskową służbę zdrowia w czasie klęsk żywiołowych – doświadczenia WIM-PIB zebrane w trakcie powodzi na Dolnym Śląsku w 2024 roku

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Abstract

Introduction and objective: In September 2024, Lower Silesia was affected by an unprecedented flood, resulting in the destruction of infrastructure, limited access to healthcare, and an increase in epidemiological risks. In response to this situation, the Military Health Service, as part of the Military Task Group "Lower Silesia," took action to support the national healthcare system. The aim of this study was to analyse the activities of military medical teams carried out during the rescue operation in the aftermath of the flood, identify operational challenges encountered, and develop recommendations for future interventions in crisis situations. **Materials and methods:** The study was based on the analysis of operational reports, medical documentation, and field observations of the activities undertaken by military medical teams. The organizational structure, areas of operation, and scope of healthcare services provided were described. **Results:** Over the course of seven days of operations, the military medical teams provided assistance to 338 patients, mainly those with respiratory infections, injuries, and exacerbations of chronic diseases. A total of 126 post-exposure vaccinations were also administered. Organizational challenges included difficulties in the continuous supply of medical materials, limited communication, and the absence of clear logistical procedures. **Conclusions:** The actions of the Military Health Service played a crucial role in stabilizing the health situation in the flood-affected areas. Based on the experiences gained, the need for better organization of logistics, communication, and resource acquisition in similar operations was highlighted.

Streszczenie

Wprowadzenie i cel: We wrześniu 2024 roku Dolny Śląsk został dotknięty powodzią o niespotykanej dotąd skali, co doprowadziło do zniszczenia infrastruktury, ograniczenia dostępu do opieki zdrowotnej i wzrostu zagrożeń epidemiologicznych. W odpowiedzi na tę sytuację wojskowa służba zdrowia, w ramach Wojskowego Zgrupowania Zadaniowego Dolny Śląsk, podjęła działania mające na celu wsparcie krajowego systemu ochrony zdrowia. Celem pracy była analiza działań wojskowych zespołów medycznych, realizowanych w ramach akcji ratunkowej podczas powodzi, identyfikacja napotkanych problemów operacyjnych oraz opracowanie rekomendacji dla przyszłych interwencji w sytuacjach kryzysowych. **Materiał i metody:** Badanie opierało się na analizie raportów operacyjnych, dokumentacji medycznej oraz obserwacji terenowej działań wojskowych zespołów medycznych. Opisano strukturę organizacyjną, obszary działania oraz zakres udzielanych świadczeń zdrowotnych. **Wyniki:** W ciągu siedmiu dni działań wojskowe zespoły medyczne udzieliły pomocy 338 pacjentom, głównie z infekcjami dróg oddechowych, urazami oraz zaostrzeniami chorób przewlekłych. Przeprowadzono także 126 szczepień poekspozycyjnych. Problemy organizacyjne obejmowały trudności w bieżącym zaopatrzeniu w materiały medyczne, ograniczoną łączność oraz brak jednoznacznych procedur logistycznych. **Wnioski:** Działania wojskowej służby zdrowia odegrały kluczową rolę w stabilizacji sytuacji zdrowotnej na terenach dotkniętych powodzią. Na podstawie uzyskanych doświadczeń wskazano na potrzebę lepszej organizacji logistyki, komunikacji i pozyskiwania zasobów w przypadku podobnych akcji.

Keywords: flood; military health service; natural disaster; crisis management

Słowa kluczowe: powódź; wojskowa służba zdrowia; klęska żywiołowa; zarządzanie kryzysowe

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Introduction

In September 2024, Lower Silesia was hit by one of the most severe floods in the history of this region. Intense and prolonged rainfall led to a rapid increase in the water level of rivers, including the Odra, Nysa Kłodzka and Bystrzyca, as well as destruction of flood infrastructure. Many towns were completely isolated from the rest of the country. Bridges, roads and power lines were destroyed, making it significantly difficult to implement rescue interventions. Thousands of homes, schools, medical facilities and public utility buildings were under water. The situation required immediate mobilisation of rescue forces, including the military, fire brigades, police and medical services. Thousands of residents were evacuated from risk areas. The destruction of water and sewage infrastructure gave rise to epidemiological threat, which increased the risk of infectious diseases.

Furthermore, many medical facilities were partially or completely flooded, including the District Hospital in Nysa, the 23rd Military Health Resort and Rehabilitation Hospital in Lądek-Zdrój, the Rehabilitation and Care Centre in Wleń, the Care and Treatment Centre in Paczków, and the Provincial Centre for Long-Term Psychiatric Treatment in Stronie Śląskie. According to data from the Ministry of Health, about 390 different medical facilities were temporarily excluded from providing services at that time. Pharmacies were also closed in the affected areas.

In the face of these challenges, the Military Health Service supported the evacuation of patients from risk areas, and then actively organised and run temporary medical points (clinics). Military medics from all over Poland cooperated with local authorities and emergency services, coordinating interventions to minimise the consequences of the flood and ensuring continuity of health care for Lower Silesians. Mobile medical units made it possible to access hard-to-reach areas, increasing the effectiveness of rescue operations [1–3].

The paper describes the scope of support of the national system by the Military Health Service, provided within the Lower Silesian Military Task Group, from the perspective of the experience of a team deployed by the Military Institute of Medicine - National Research Institute.

Aim

The aim of this paper was to perform a thorough assessment of interventions undertaken by the medical forces of the Military Institute of Medicine - National Research Institute in the flood-affected areas as part of the Military Task Group "Lower Silesia" in September 2024. An additional aim of the analysis was to identify operational difficulties encountered and to develop universal recommendations that could be used in similar future crisis situations.

Materials and methods

The task of arranging medical support in the flood-stricken area was assigned to the 4th Military Clinical Hospital with Polyclinic in Wroclaw, which supervised medical teams sent by: Military Institute of Medicine – National Research Institute in Warsaw (WIM-PIB), Military Institute of Aviation Medicine in Warsaw (WIML), 10th Military Clinical Hospital with Polyclinic in Bydgoszcz (10th WSzKzP), 5th Military Clinical Hospital with Polyclinic in Krakow (5th WSzKzP), 7th Naval Hospital with Outpatient Clinic in Gdańsk, and 2nd Military Field Hospital in Wrocław (2nd WSzP).

The interventions were carried out between 20 and 28 September 2024. The actual provision of medical services took place between 21 and 27 September 2024, while coordination briefings, organisation of departure and transportation of teams from and to parent units took place on 20 September 2024 and 28 September 2024. The flooded regions were divided into three zones of operation: Kłodzko Valley, Nysa, and Lewin Brzeski.

Due to the size of the area, medical teams from three facilities were deployed to the Kłodzko Valley as part of the Lądek-Zdrój Task Group: 10th WSzKzP (doctor, nurse, rescue driver), WIML (doctor, rescue driver) and WIM-PIB (three doctors, three paramedics, operations officer, driver), as well as a driver with an ambulance from 2nd WSzP. Thus, four medical teams were deployed. The command of the Lądek-Zdrój Task Group was assumed by the deputy commander of the CSK MON WIM, Colonel Jarosław Kowal, MD, who took part in daily briefings of the Crisis Management Team in Lądek-Zdrój, and then assigned tasks in response to the reported needs of the local population. The WIM-PIB operations officer was responsible for coordinating interventions and communicating with 4th WSzKzP.

Accommodation and meals were arranged on the premises of 23rd WSUR in Lądek-Zdrój, where a vaccination point (Military Centre of Preventive Medicine and a civilian one), a warehouse for cleaning agents,

and a warehouse for medications and medical supplies were also installed (by entities independent of the medical teams).

The ongoing situation in the region and the health care needs were identified based on reconnaissance conducted personally by the commander of Lądek-Zdrój Task Group and his participation in the meetings of the Crisis Management Team in Lądek-Zdrój. The locations where services were provided were selected based on the needs reported by the heads of flooded villages or towns, as well as an independent identification of local needs and the possibility of reaching a given destination. The optimal working time of mobile medical teams (doctor, paramedic or nurse, rescue driver) was defined as 12-hour shifts, including the time spent travelling to and from the place of providing services.

The paper summarises medical reports submitted daily to the 4th WSzKzP by Lądek-Zdrój Task Group, describing the location and scope of services delivered along with encountered challenges.

Results

During 7 days of field operations, Lądek-Zdrój Task Group (4 mobile teams) provided medical services as part of rotating, mobile medical clinics in the following towns: Lądek-Zdrój, Stronie Śląskie, Trzebieszowice, Żelazno, Gorzanów, Krosnowice (Fig. 1).

In total, 338 medical interventions were performed. The reasons for these interventions mainly included respiratory and gastrointestinal infections, minor injuries sustained during flood damage removal, exacerbations of chronic diseases, and the need for continued chronic treatment. Two patients were handed over to the national emergency medical system due to life-threatening symptoms (gastrointestinal bleeding, ventricular arrhythmias in a hemodynamically unstable patient). Figure 2 and Figure 3 show the detailed distribution of healthcare services provided over time and their types, respectively.

Medical services were provided directly from ambulances stationed in locations indicated by the head of a given village or town, as well as at the place of call (so-called home visits in the case of bedridden patients, small children and women in advanced pregnancy), or in buildings made available by local authorities (including primary schools in Krosnowice and Żelazno, the village cultural centre in Gorzanów) (Fig. 4, Fig. 5, Fig. 6, Fig. 7).

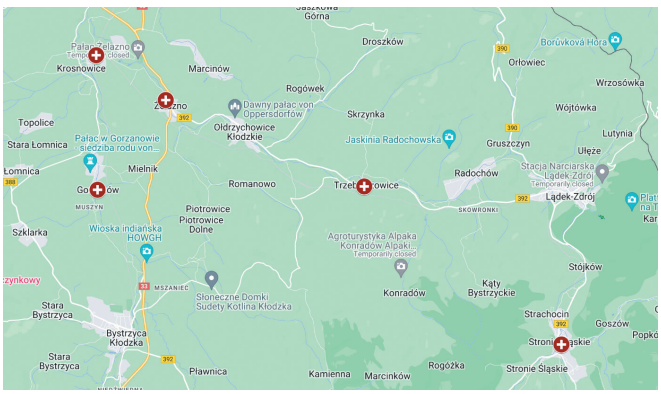

Figure. 1. Map of the area of operations of the Lądek-Zdrój Task Group (our data)

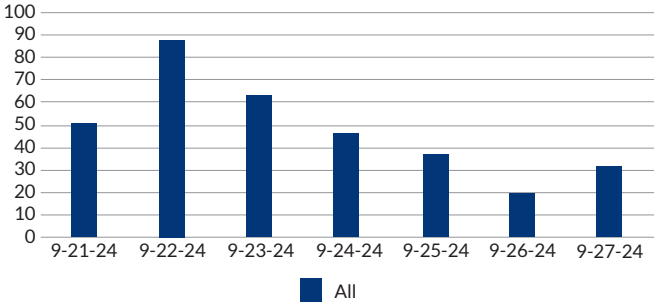

Figure. 2. Number of medical services provided by the Lądek-Zdrój Task Group

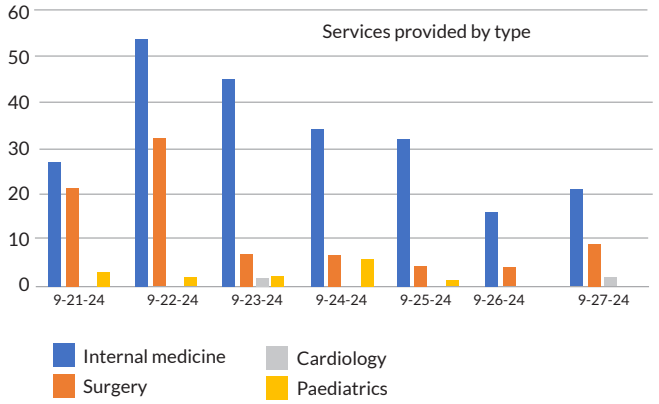

Figure. 3. Type of medical services provided by the Lądek-Zdrój Task Group

The vaccines provided by 4th WSzKzP allowed for post-exposure immunisation against tetanus and hepatitis A at mobile medical clinics of Lądek-Zdrój Task Group. A total of 78 vaccinations against tetanus and 48 vaccinations against hepatitis A were administered.

Population vaccinations were administered by local sanitary/epidemiological stations and military preventive medical facilities.

Figure. 4. Temporary medical care point in Gorzanów (own material)

Figure 5. Mobile medical care point in Stronie Śląskie (own material)

During the implementation of interventions, the following problems (typical of disasters of such scale) were encountered:

- variable and imprecise information on the needs, received at the stage of preparation for departure, regarding the type of services to be provided, the duration of the task, the period for which preparation should be made; as a result, detailed reconnaissance was done only when on-site implementation of tasks already began;
- difficulties in estimating the number of people in need resulted in varying consumption of available medical supplies and medications, and regional logistical problems made it difficult to develop a uniform system for obtaining these supplies;
- periodic absence of telephone and Internet coverage, which significantly hindered communication between teams, other uniformed services operating in the region and direct communication with 4th WSzKzP, especially in terms of keeping up-to-date electronic medical records.

Discussion

Natural disasters such as floods, hurricanes, large-scale fires, and earthquakes pose serious challenges to the healthcare system in any country. In such situations, when civilian infrastructure is overloaded or destroyed, the Military Health Service plays a key role by offering its resources and experience. Owing to its high mobility, training in crisis management and specialist

Figure 6. Temporary medical care point in Żelazno (own material)

equipment, this service can act in Poland as a strategic support, enabling a rapid and effective response to crisis situations [4].

In the face of one of the most serious floods in the history of Lower Silesia, the mobilization of military medical teams from all over Poland made it possible to support the local health care system. The Military Institute of Medicine - National Research Institute took up the task with intention to provide support to the population af-

Figure 7. Temporary medical care point in Gorzanów (own material)

fected by the disaster in the most feasible and comprehensive way possible. To this end, an internist/cardiologist, a paediatrician and an infectious disease specialist were delegated to provide services among flood victims. The medical teams were also joined by experienced paramedics and rescue drivers, who used their expertise and practical skills to effectively support rescue operations. The Lądek-Zdrój Task Group, established on site, was joined by a surgeon, a nurse and a rescue driver from the 10th WSzKzP, as well as an emergency medicine physician and a rescue driver from WIML. Both doctors and paramedics had extensive experience in crisis management, gained both in peacetime and during military combat missions. This unique combination of expertise and practical skills allowed for the highest level of comprehensive medical care provided, addressing diverse health needs of those affected by the disaster. In the context of organising medical teams during crisis operations, incorporation of two additional members responsible for command and logistics support, i.e. a team commander and an operations officer, was found to be an effective solution. It allowed for sustained contact with the Crisis Management Team, regular reporting, effective work organization and coordination of interventions with local authorities and emergency services on site. Additionally, it enabled efficient identification of operational needs and logistic planning of activities, without the need to engage medical personnel directly responsible for providing healthcare services.

The main organizational challenges faced by military medical services during natural disasters include the lack of access to medical infrastructure, shortages of medical equipment, logistic difficulties in transporting the wounded, and limited access to medications and dressings. Additionally, changing conditions necessitate rapid adaptation of management plans and there is a need to ensure effective communication between other emergency services [5, 6]. Similar challenges were faced by the Lower Silesian Military Task Group, Lądek-Zdrój Task Group in particular, during tasks performed in the flooded area. Given the lack of access to permanent medical infrastructure, it was assumed that healthcare would be provided in the first days of interventions via mobile medical care, directly from ambulances. However, the aim was for the local authorities to allocate rooms that could be adapted to serve as makeshift medical facilities. This solution was preferred by both medical personnel and residents of flooded towns due to unfavourable weather conditions during field operations, as well as the availability of electricity and running water, essential for powering devices and preventing infectious diseases. Additionally, the WIM-PIB team was equipped with a medical tent that could be used as an alternative to ambulances.

Each military hospital involved made an effort to equip its personnel as optimally as possible with medical equipment, medications, personal protective equipment, and dressings. The amount and type of equipment and medical supplies that could be transported was, however, limited by the space in the vehicles. Additionally, the time for which the medical teams were deployed was not initially specified. Considering the closed pharmacies in the flood zone and the victim's expectations to receive the medicines that were prescribed during medical appointment "instantly" or "offhand ", the supplies brought by the teams exhausted after 3 days of interventions. The situation slightly improved as a result of donated funds received by the teams through local authorities. In this aspect, however, the problem of the lack of a uniform, central system for obtaining medicines and other medicinal products was evident.

Limited telephone and Internet coverage in most flood-affected towns made communication between teams, as well as between teams and 4th WSzKzP, and coordination of interventions with other uniformed services difficult or impossible. In the future, other, independent communication systems should be used for similar tasks.

Communication within the Lądek-Zdrój Task Group was conducted using a commercially available encrypted messenger. It primarily included reporting on the relocation of the Team's vehicles, changes of locations where tasks were carried out, emergency situations, hours of daily briefings, numerical data for daily reports, as well as required supplies and medicines.

Due to limited access to the Internet, keeping electronic documentation of the healthcare services provided was another major challenge. Most of the records were initially kept in paper form and then, in accordance with the regulations in force in Poland, electronically supplemented.

According to the World Health Organization (WHO), mechanical injuries, hypothermia, infections, infectious diseases and mental disorders are the most common health problems among populations affected by this type of disasters. The incidence of infectious diseases increases due to water pollution, limited access to hygiene products and overcrowding in temporary shelters [7]. Inhabitants of flood-stricken areas faced similar health problems. Acute respiratory and gastrointestinal infections and minor injuries sustained during removal of flood debris were the most common emergencies. Exacerbations of chronic diseases (e.g. high blood pressure, arrhythmias despite treatment), or the need to continue chronic treatment due to lack of access to prescriptions (closed primary health care facility) or medicines (closed pharmacies).

A high level of willingness and need to undergo post-exposure vaccinations (against tetanus and hepatitis A) in the event of injury or wound contamination with sewage were observed during flood among the local community. Additionally, many people reported their willingness to undergo preventive vaccinations. This suggests relatively high awareness of epidemiological threats among the population facing this crisis situation.

The actions of medical troops within the Lower Silesia Military Task Group were completed when local primary healthcare centres and pharmacies resumed their work, and as a result, the number of medical services provided by mobile teams decreased.

Conclusions

Professionalism, commitment and high level of organisation of military health service during the flood in Lower

Silesia in 2024 enabled effective support for the local health care system. Productive cooperation with civilian emergency services and local authorities allowed for the rapid control of the crisis situation and minimisation of health losses among the inhabitants.

Based on the experience gained, proposals were put forward for the organisation and equipping of military medical teams in the event of natural disasters, which are a valuable, practical extension of previous publications in this field [8].

Medical teams should incorporate qualified personnel with appropriate experience, and the operations require a unified command system. It is also essential to ensure the possibility of keeping medical records based on a reliable, interference-resistant communication system independent of the local mobile network infrastructure. Medical transport should enable efficient relocation in areas with varying degrees of destruction of road infrastructure. An easily accessible medical supplies system is also an important operational element: medicines, dressings, rescue equipment, with the possibility of their flexible replenishment to meet the dynamically changing needs.

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GASTROINTESTINAL TUBERCULOSIS AS THE CAUSE OF DIGESTIVE TRACT PERFORATION

Gruźlica jelit jako przyczyna perforacji przewodu pokarmowego

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Abstract

Tuberculous bowel perforation is a rare yet severe complication of tuberculosis. Tuberculous lesions most commonly localize in the ileocecal region, leading to ulcers, mucosal hypertrophy, strictures, and intestinal perforation in extreme cases. This article presents a case of a 46-year-old patient admitted with abdominal pain, nausea, vomiting, and cessation of flatus and bowel movements. Computed tomography raised a suspicion of prepyloric perforation. Laparotomy revealed ileal perforation, approximately 15 cm proximal to the ileocecal valve. The affected bowel segment was resected, and a two-layer side-to-side anastomosis was performed. Despite effective surgical treatment and intensive postoperative care, the patient died on postoperative day 9. Autopsy revealed advanced caseating granulomas of tuberculosis.

Streszczenie

Gruźlica jelit jako przyczyna perforacji przewodu pokarmowego stanowi rzadkie, lecz istotne powikłanie gruźlicy. Ogniska gruźlicze najczęściej lokalizują się w okolicy krętniczo-kątniczej i skutkują powstaniem owrzodzeń, przerostu błony śluzowej, zwężenia, a w skrajnych przypadkach perforacją jelita. W artykule opisano przypadek 46-letniego pacjenta z bólami brzucha, nudnościami, wymiotami i zatrzymaniem gazów oraz stolca. Na podstawie wyniku tomografii komputerowej wysnuto podejrzenie perforacji w okolicy przedodźwiernikowej. W trakcie laparotomii odkryto przedziurawienie jelita krętego około 15 cm przed zastawką krętniczo-kątniczą, następnie resekowano jelito z zespoleniem dwuwarstwowym bok do boku. Mimo skutecznego leczenia chirurgicznego i intensywnej opieki pooperacyjnej pacjent zmarł w 9. dobie po operacji. Badanie autopsyjne ujawniło zaawansowaną gruźlicę serowaciejącą.

Keywords: intestinal perforation; gastrointestinal tuberculosis

Słowa kluczowe: perforacja przewodu pokarmowego; gruźlica jelit

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Introduction

Gastrointestinal tuberculosis (GITB) is very rare, accounting for only 2% of all TB cases worldwide [1]. It occurs by the ingestion of infected sputum or as a result of blood-borne infection. Although any part of the digestive tract may be affected, ileocecal involvement is observed in 1/3 of cases [2]. Appendicitis or intestinal obstruction may be the initial diagnosis [1, 3]. The disease develops slowly and insidiously [2]. Patients experience signs such as subfebrile temperature, night sweats, weight loss, diarrhoea, vomiting and abdominal pain, which may prompt diagnosis for inflammatory bowel disease (IBD), colon cancer, lymphoma, and gastritis [2, 3]. Physical examination reveals abdominal distension and tenderness in 50% of cases. Ascites, acute abdomen, abdominal organomegaly and palpable masses, as well as, in rare cases, abscesses and fistulas may be found. GI symptoms may be accompanied by episodes of cough or dyspnoea [2].

GITB causes mucosal ulceration or hypertrophy leading to intestinal stenosis and obstruction. Some patients may develop perforation after ingesting sputum containing a large dose of virulent bacilli, which usually involves the antimesenteric edge of the terminal ileum. Although advances in surgical approaches to manage bowel perfo-

ration have significantly improved treatment outcomes, it is still fatal in many cases, especially in malnourished patients [4].

The diagnosis of extrapulmonary TB poses a major diagnostic challenge due to the difficulty in collecting specimens from the affected sites and their paucibacillary nature. Histopathology is important in such cases; however, tuberculosis-like granulomas may occur in many clinical conditions, and not all TB cases are caseating [2, 3].

Causal treatment involves antituberculosis chemotherapeutics. Surgical interventions should be used in patients who do not respond to antibiotic therapy and in the case of severe complications such as obstruction, perforation, abscesses and fistulas [1].

Case report

A 46-year-old male patient was admitted to hospital as an emergency case due to severe diffuse abdominal pain accompanied by nausea, an episode of vomiting, and gas and faecal retention since the day before admission. The patient also reported fever, lack of appetite, weight loss, dyspnoea, and cough with expectoration of yellow sputum. He reported no history of chronic diseases, and denied alcohol consumption. He smoked two cigarettes a day.

On admission, the patient was in a serious general condition. Emaciation, low muscle mass, and profound malnutrition were found on physical examination. Abdominal examination revealed reduced peristalsis, board-like abdominal rigidity, tenderness on palpation, and peritoneal symptoms. Auscultation found asymmetrical vesicular murmur with right-sided bronchial murmur. Quiet heart sounds, regular heart rate. Other than that, no deviations from normal were found.

Laboratory workup on admission found mild normocytic anaemia (Hb 12.0 g/dL, MVC 82.9 fL) and high C-reactive protein (CRP 212.7 mg/L). An AP chest X-ray showed medium- and coarse patchy opacities, most likely corresponding to post-specific changes, emphysematous lung apices, and a small amount of fluid in the right pleural cavity. Supine abdominal X-ray showed dilated bowel loops in the mid-abdomen and small pelvis (Fig. 1). Due to the patient's serious condition, with clinical symptoms of GI perforation, the diagnosis was extended to include non-contrast-enhanced abdominal and pelvic computed tomography (CT). A large volume of abdominal gas and very dense intraperitoneal free fluid with gas bubbles were detected. The anterior wall of gastric antrum was considered to be the probable site of GI perforation (Fig. 2).

The patient was qualified for surgical treatment. Empirical antibiotic therapy (cefuroxime, metronidazole) was started. The procedure was performed under general endotracheal anaesthesia.

An upper median incision was performed to open the abdominal cavity. Laparotomy found an enlarged, macroscopically normal liver and some cloudy fluid, which was aspirated. The stomach and duodenum were palpated and investigated visually. No abnormalities were found. The incision of the integuments was extended. The small bowel was investigated, and an ileal perforation was found, approximately 15 cm proximal to the ileocecal valve. The intestine was resected within the margin of macroscopically healthy tissue. A two-layer side-to-side bowel anastomosis was performed, and then checked for patency, tightness and blood supply. The peritoneal cavity was thoroughly washed. After postoperative count of dressing materials and instruments, anti-dehiscence sutures were placed, the incision was closed layer-by-layer, and dressings were applied.

The patient's postoperative condition was moderately severe (Fig. 3). There was a persistent cough with expectoration of a large amount of secretion and lazy peristalsis. The GI function did not normalise. HIV screening was performed and was negative. Laboratory workup revealed signs of malnutrition with protein deficiency, lipid and ionic disorders. The patient was qualified for parenteral nutrition. The volume of the nutritional mixture was gradually increased. He received 400 mL (approx. 330 kcal), 700 mL (486 kcal), and 1200 mL (830 kcal) on subsequent days 1, 2 and 3. On the day that followed, the patient was in a serious general condition, without logi-

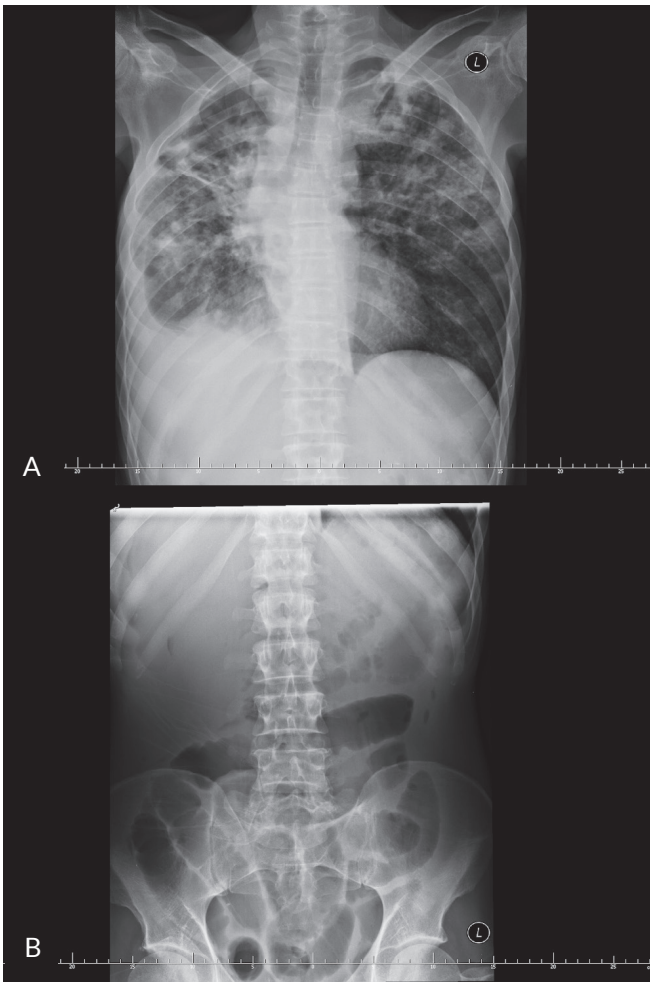

Figure 1. Plain chest (**A**) and abdominal (**B**) radiograph taken in the supine position on admission showing medium- and coarse patchy opacities, probably corresponding to post-specific changes, emphysematous clearings at the apices of both lungs, and a small amount of pleural fluid (**A**). Dilated bowel loops in the mid-abdomen and pelvis were also described (**B**)

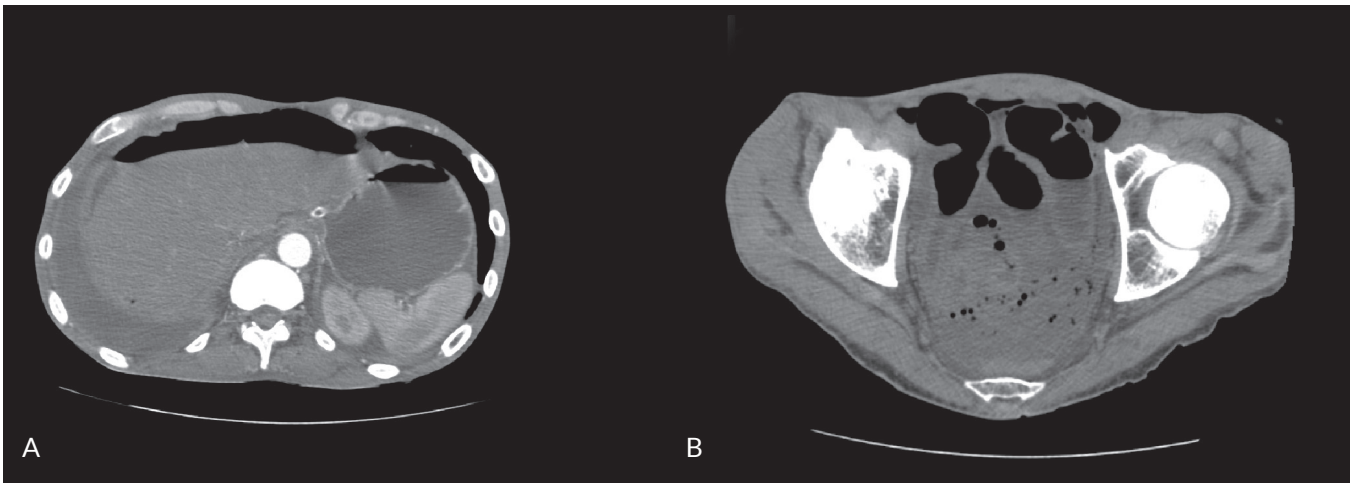

Figure 2. Non-contrast-enhanced CT on admission. A large volume of free gas in the abdominal cavity (**A**). In the pelvis, free purulent intraperitoneal fluid with gas bubbles (**B**)

cal contact and with increasing respiratory failure. Bradycardia and cardiac arrest occurred. Cardiopulmonary resuscitation was successfully performed. The patient was transferred to the intensive care unit, where pressor amines were used and antibiotic therapy was modified based on the obtained cultures: *Candida albicans* from the peritoneal fluid collected intraoperatively (Fluconazole) and *Stenotrophomonas maltophilia* from the respiratory tract (Biseptol). Parenteral nutrition was continued. Despite intensive treatment, the patient's condition deteriorated, with cardiac arrhythmias, coagulation disorders, and anaemia requiring packed red blood cell (RBC) transfusion. Hypotension persisted despite infusion of pressor amines. Death was confirmed on postoperative day 9. An autopsy was done. Advanced caseous tuberculosis, focal lung abscesses and isolated small bowel ulcers, most likely of tuberculous aetiology, were found. Status post segmental resection of the small bowel, well-sealed anastomosis.

Discussion

The incidence of tuberculosis ranged from 9.7/100,000 population in 2021 to 19.6/100,000 in 2012 in Poland. It increased to 11.4/100,000 in 2022, which means that 4,314 new TB cases were registered. Patients with simultaneous TB involvement of the lungs and other organs are registered as pulmonary TB, with 13 such cases recorded in 2022. Additionally, 10 patients were diagnosed with focal tuberculosis limited to the gastrointestinal tract. Men accounted for 73.8% of all TB cases [5].

As mentioned earlier, although TB foci can locate along the entire GI length, the terminal ileum is most commonly involved [2]. Abundant lymphatic tissue and functional slowing of intestinal transit are observed in the area of the ileocecal valve, which increases the time of mucosal adhesion of the ingested bacilli that move with the peristaltic wave. The bacilli penetrate the mucosa and cause local inflammation, which results in mucosal and serous thickening, and abscess formation, which may consequently lead to perforation and fibrosis [6].

Patients diagnosed with GITB most often present with abdominal pain (74%), nausea and vomiting (31%), altered bowel habits (24%), and symptoms resulting from the ongoing inflammatory process, such as weight loss (59%), fever (19%), and night sweats (18%). Some patients may also experience cough and dyspnoea, with most of them reporting more than one of the above symptoms [3, 7]. Case reports show that patients seek medical attention late [2], reporting with abdominal pain, fever, weight loss, diarrhoea or constipation, and a history of cough or dys-

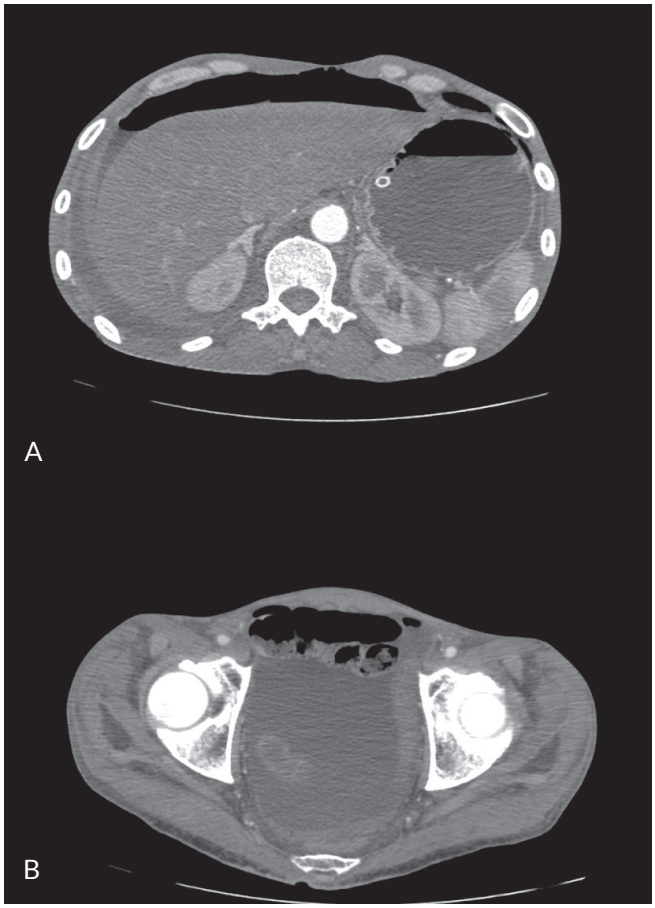

Figure 3. Follow-up CT on postoperative day 2. Free gas at the anterior abdominal wall (residue after recent surgery) (**A**), and free fluid in the abdominal cavity, mainly between the pelvic loops (**B**)

pnoea [7, 8]. They also report due to symptom exacerbation in the period immediately preceding admission [9]. Serious GI complications may be the first manifestation of the disease, and a case of asymptomatic perforation has also been reported [8]. CT may show thickening of the intestinal wall and/or peritoneum, intra-abdominal lymphadenopathy, and fluid collections. Magnetic resonance imaging (MRI) may also show intraabdominal fistulas and ileitis, while ascites or thickening of the intestinal wall can be observed on ultrasound [7].

Gastrointestinal perforation usually develops as a complication of tuberculosis shortly after the initiation of antituberculosis treatment [4], or as a consequence of surgical intervention [10]. Regardless of the cause, GI perforation is associated with approximately 11% mortality, which depends on the patient's clinical status, especially shock on admission, elevated creatinine and severe leukocytosis [11]. In Poland, TB mortality rates were 1.2/100,000 population in 2022, with 426 and 14 fatal cases due to pulmonary and extrapulmonary TB, respectively. At the same time, TB deaths account for 0.1% of all deaths and 20.1% of deaths caused by infectious and parasitic diseases [5]. Due to the small research sample, it is not possible to draw conclusions about the coexistence of TB and perforation or their mutual influence on the risk of death, with long-term outcomes depending on the individual clinical case. There is no doubt, however, that survival prognosis is poor in such cases [10, 12].

Conclusions

Due to the poor prognosis for tuberculosis complicated with perforation, especially when perforation is a manifestation of the disease, measures to improve patient's health status and eliminate the risk of death should be directed at the earliest possible diagnosis of the disease. Diagnosis of asymptomatic tuberculosis is, however, extremely difficult, as the lesions resemble those seen in inflammatory and neoplastic processes.

Considering GITB in patients presenting with abdominal symptoms already at the time of hospital admission and paying special attention to the possible coexistence of respiratory symptoms could contribute to therapeutic efficacy.

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SEROPOSITIVE LONGITUDINALLY EXTENSIVE TRANSVERSE MYELITIS FOLLOWING UNILATERAL PNEUMONIA

Seropozytywne poprzeczne zapalenie rdzenia kręgowego w następstwie jednostronnego zapalenia płuc

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Abstract

Longitudinal extensive transverse myelitis is an exceedingly rare condition with several known triggering factors, both viral and bacterial. While it has been widely associated with COVID-19, it can also occur following pneumonia caused by other agents. The underlying mechanism can include aquaporin-4 antibodies (AQP4-Ab). It causes major neurological manifestations and poses a life-threatening risk, particularly by affecting respiratory muscles. This case report delineates longitudinal extensive transverse myelitis following unilateral pneumonia, associated with AQP4-Ab, in a 62-year-old woman who experienced abdominal pain, a gradual loss of sensation in the extremities, and eventual inability to walk with a total loss of sensation. Her spinal MRI revealed increased T2 signal, consistent with longitudinal extensive transverse myelitis. AQP4-ab antibodies were present. Treatment with methylprednisolone led to symptom improvement. Protein levels in the cerebrospinal fluid were also analyzed. Our findings suggest a potential difference in protein levels in cerebrospinal fluid between bacterial and viral longitudinal extensive transverse myelitis. Magnetic resonance imaging is the primary method of diagnosis and can help exclude other possible etiologies of neurological symptoms. When managing longitudinal extensive transverse myelitis, timing is critical to prevent paralysis of the respiratory muscles. Although extremely rare, longitudinal extensive transverse myelitis can have diverse origins as well as clinical manifestations, and its management continues to present a significant challenge.

Streszczenie

Poprzeczne zapalenie rdzenia kręgowego jest niezwykle rzadką jednostką chorobową, z kilkoma znanymi czynnikami wyzwalającymi – zarówno wirusowymi, jak i bakteryjnymi. Powszechnie wiąże się ją z COVID-19, jednakże może występować po zapaleniu płuc spowodowanym innymi czynnikami. Podstawowy mechanizm może obejmować przeciwciała przeciwko akwaporynom-4 (AQP4-Ab). Choroba ta wywołuje istotne objawy neurologiczne i poprzez uszkodzenie mięśni oddechowych powoduje poważne zagrożenie życia. W pracy opisano przypadek poprzecznego zapalenie rdzenia kręgowego po jednostronnym zapaleniu płuc związanym z AQP4-Ab u 62-letniej kobiety, u której wystąpiły bóle brzucha, stopniowa utrata czucia w kończynach, a następnie niezdolność do chodzenia, z całkowitą utratą czucia. Badanie MRI kręgosłupa wykazało zwiększony sygnał T2, zgodny z poprzecznym zapaleniem rdzenia kręgowego. Stwierdzono obecność AQP4-ab. Leczenie metyloprednizolonem przyniosło poprawę w zakresie objawów. Stężenie białka w płynie mózgowo-rdzeniowym sugeruje potencjalne różnice między wirusowym a bakteryjnym poprzecznym zapaleniem rdzenia kręgowego. Obrazowanie MRI jest podstawową metodą diagnostyczną, umożliwiającą wykluczenie innych możliwych przyczyn objawów neurologicznych. Podczas leczenia kluczowe jest odpowiednie czasowe działanie w celu zapobieżenia paraliżowi mięśni oddechowych. Poprzeczne zapalenie rdzenia kręgowego pozostaje nadal niezwykle rzadkim schorzeniem, które może mieć różne pochodzenie oraz manifestacje kliniczne, a jego leczenie pozostaje istotnym wyzwaniem.

Keywords: neuromyelitis optica; neuroimmunology; longitudinally extensive transverse myelitis; LETM

Słowa kluczowe: *neuromyelitis optica;* neuroimmunologia; poprzeczne porażenie rdzenia; LETM

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Introduction

Longitudinal extensive transverse myelitis (LETM) is a type of spinal cord lesion spanning at least three vertebrae, leading to significant neurological impairment [1]. LETM is often associated with a neuromyelitis optica spectrum disease (NMO-SD) [2]. The condition is related to a severe autoimmune response. It can accompany various diseases including multiple sclerosis and systemic lupus erythematosus. Moreover, LETM can occur as a result of various infections, such as Mycobacterium tuberculosis [3]. However, there are considerably fewer cases of para-/post-bacterial LETM in comparison with viral infections. Mycoplasma is a known causative agent for LETM associated with pneumonia, with neurological complications observed in 0.01% to 4.8% of patients [4]. There is significant evidence suggesting the role of viruses in central nervous system (CNS) invasion, leading to neurological symptoms, including coronaviruses [5, 6]. While coronaviruses are primarily recognized for causing respiratory and enteric infections, often mild or even asymptomatic, they have also been identified as potential triggers for transverse myelitis (TM) [7]. There have also been numerous reports of LETM occurring after COVID-19 vaccination [8]. The most distinctive marker of LETM, as well as NMO-SD, are aquaporin-4-antibodies (AQP4-Ab) [9]. Aquaporin 4 (AQP4) is a water channel targeted by immunoglobulin G autoantibodies in NMO-SD. AQP4 is expressed in the foot processes of astrocytes in the CNS, as well as in skeletal muscle and epithelial cells in the kidney, lung, and gastrointestinal organs. It plays a significant role in the movement of water into and out of the brain, migration of astrocytes, glial scar formation, and neuroexcitatory processes. AQP4 monomers assemble into tetramers in membranes, which then aggregate to form orthogonal arrays. The pathogenic mechanism involving AQP-Ab in NMO-SD includes complement- and cell-mediated astrocyte cytotoxicity, which leads to an inflammatory response with damage to oligodendrocytes and demyelination [10]. However, AQP4-Ab are not present in every patient. According to a study conducted in the United Kingdom, they occur in approximately 58% of cases [11]. Here, we report a rare case of rapid-onset LETM with the presence of AQP4-Ab, which occurred shortly after symptoms of bacterial pneumonia.

Case report

A 62-year-old woman was admitted to our hospital with acute girdle pain in the abdomen, radiating to the lumbar region, rated as 10/10 on the NRS scale, in October 2023. The patient reported general malaise, weight loss of five kilograms, and pyrexia. The pain had persisted for four days and worsened on breathing. The patient had not moved her bowels for two days. On examination, no peritoneal symptoms were found. Ultrasonography of the abdomen showed a 41-mm cyst in the left kidney, while the rest of the findings were unremarkable. Four days before admission, urinalysis, conducted at another hospital, revealed a urinary tract infection (UTI). Ciprofloxacin was administered orally. On admission, the patient presented no signs of UTI, and she tested negative for COVID-19. During hospitalization, she developed pneumonia, presenting with fever, moderate dyspnea, and fatigue. On auscultation, respiratory sounds were muted over the base of the left lung. A chest X-ray showed no signs of pneumothorax or fluid, but a 35-mm limited area of density in the lower lobe of the left lung, along with tubercular lesions and pleural nodules in the upper lobe of the left lung. High-resolution computed tomography of the thorax revealed plates of atelectasis and signs of pneumonia in the lower lobe of the left lung, with parenchymal densities near the interlobar fissure. Smaller subpleural areas of density were found in segments 1 + 2 and 6 of the left lung. An air bronchogram confirmed inflammation. Blood tests showed the following results: procalcitonin: 0.11 ng/ml, C-reactive protein: 153 mg/l, while other markers were normal. A blood culture was taken. The patient was started on intravenous ceftriaxone and metronidazole. Later that evening, the patient began to feel muscle numbness that progressed to difficulty walking. She denied pain but reported symmetrical paresthesia in the lower extremities. The following day, the patient was unable to walk. Moreover, hiccups and vomiting ensued. She vomited once or twice a day over the next three days. On physical examination, paresis of all muscle groups in the lower extremities, with no superficial sensation, was diagnosed. The patient denied any prior trauma or accident. A neurological consultation was sought, with LETM, meningitis, systemic lupus erythematosus (SLE), or syphilis suspected. The differential diagnosis included vitamin B_{12} deficiency ANA, ANCA, Borrelia, and WR, all of which were negative. The manifestations progressed the following day, as the patient reported loss of control over urinary sphincters. MRI of the vertebral column (C-Th-LS) revealed signs of LETM (Fig. 1). Blood was taken to assess AQP4-Ab and anti-Myelin Oligodendrocyte Glycoprotein antibodies (anti-MOG) in the serum. AQP4-Ab antibodies were detected at a titer of 1:640. A glycemic profile was also established. The following medications were administered:1 g of methylprednisolone i.v., low-molecular-weight heparin, and proton pump

Figure 1. Thoracic spine MRI showing increased T2 signal, consistent with LETM

inhibitors. The patient was transferred to the Neurology Department (ND). On admission, severe paresis of the lower extremities, with little movement only in the digits of the left foot observed. Patellar reflexes were present symmetrically, plantar reflexes weaker in the left extremity, with Babinski reflex present bilaterally, and no superficial sensation bilaterally from Th6 downwards to the level of the upper part of the lower leg, hyperesthesia present in the parts of the lower extremities below. Antibiotic therapy and methylprednisolone treatment were continued, both at a dose of 1 g. Significant improvement in the mobility of lower extremities was observed in the following days. However, after the third infusion of methylprednisolone, rash and dyspnea occurred, so the dose was reduced to 256 mg and the administration route was changed to oral. Plasmapheresis was performed five times. A lumbar puncture was subsequently conducted, revealing a high level of protein (268 mg/dl) in the cerebrospinal fluid (CSF) and cytosis of 13. CSF was also tested for PCR test of adenoviruses, CMV, EBV, Borrelia antibodies, and oligoclonal antibodies. All of them were negative. No atypical cells were shown in flow cytometry. The diagnosis was expanded by an ophthalmologic consultation. Visual evoked responses were intact, with no signs of neuropathy or ophthtalmoneuritis found. During hospitalization, a slow but gradual improvement in neurological function was observed. Unfortunately, the patient developed diabetes, with fasting blood glucose levels of 156 mg/dl, most likely as a result of corticosteroid therapy. Metformin (1 g once daily) was administered along with a diabetic diet, which led to the normalization of glucose levels. Moreover, the patient experienced a recurrence of hemorrhoids (after many years). An ointment containing tribenoside and lidocaine hydrochloride was prescribed. NMO-SD was diagnosed based on the clinical presentation (LETM), positive test for AQP4-Ab IgG, acute myelitis, and the exclusion of alternative diagnoses. The diagnosis was made according to the consensus diagnostic criteria [12], which are presented in Table 1. The patient was transferred to the Neurological Rehabilitation Department at Wolski Hospital on November 11th, 2023, to continue methylprednisolone treatment (64 mg p.o. for the next 5 days, then reduced to 32 mg). A follow-up was planned for January 2024.

Discussion

To the best of our knowledge, we report the first case of LETM in Poland. Only cases of TM, other than LETM, have been reported previously. The case occurred in an immunocompetent host. LETM is a rare entity that can lead to severe and potentially irreversible clinical complications. LETM is often associated with a poor prognosis, especially if it occurs in conjunction with NMO [13]. Moreover, it can co-exist with other lesions in the CNS, such as spinal cord infarction, acute disseminated encephalomyelitis, and multiple sclerosis [14]. A retrospective study (n = 192) found a recurrence rate of approximately 57% [15]. Multiple risk factors for recurrence were identified, including African American race, female sex, and the development of NMOSD [16]. Transverse myelitis is an inflammatory process affecting the spinal cord, strongly associated with an immune response. The clinical course of LETM is characterized by at least one episode of paraparesis or tetraparesis [17]. Furthermore, it is often associated with sensory deficits and disturbances in bowel/bladder function. There are two types of TM based on their causative agent: idiopathic TM and secondary TM [18]. Secondary TM can have a variety of origins. Potential causative agents include HIV, coronaviruses, CMV, Borrelia, Mycoplasma, Mycobacterium, as well as autoimmune diseases such as SLE and others. All these factors must be taken into consideration when managing patients with LETM. Severe cases can lead to respiratory failure, which is the primary concern in cases with a rapid onset. This was also a major issue in our case; hence, we acted promptly to provide a rapid diagnosis and implement appropriate treatment with methylprednisolone, which remains the therapy of choice. LETM can occur with, which was the case of our patient, or without AQP-Ab. There are significant differences between these two variants of the disease, for example, patients with positive AQP4-Ab are substantially more prone to recurring episodes of central nervous system inflammation and less likely to develop initial urinary retention than patients without these antibodies [19]. In contrast, our patient developed initial urinary retention despite the presence of AQP-4Ab. Clinical diagnosis of LETM is based primarily on spinal MRI showing a lesion spanning at least three vertebral segments [20]. The diverse nature of LETM and its association with various underlying conditions and diseases highlights the importance of a thorough evaluation for an accurate diagnosis and appropriate management. In our case, conditions such as COVID-19, meningitis, SLE, syphilis, vitamin B12 deficiency, Borrelia infection, and others were discarded, leading to the conclusion that LETM in our patient was caused by bacteria responsible for the original left-sided pneumonia. This is an unusual occurrence, especially given the moderate severity of the infection and the patient's overall good condition. We conducted a thorough search through PubMed and Google Scholar for cases of bacteria-associated LETM, and only five were found, as described in Table 2. The clinical courses of these cases varied significantly from ours. Their first manifestations were diversified, with only one of them beginning with abdominal pain. In none of them, AQP4-Ab were present, and neither were anti-MOG Ab, nor post-steroidal diabetes. On the other

Table 1. Consensus diagnostic criteria for NMO-SD

1. At least 1 core clinical characteristic 2. Positive test for AQP4-IgG (cell-based assay recommended) 3. Exclusion of alternative diagnoses	Core clinical characteristics: 1. Optic neuritis 2. Acute myelitis 3. Area postrema syndrome 4. Acute brainstem syndrome 5. Symptomatic narcolepsy 6. Symptomatic cerebral syndrome with NMOSD-typical brain lesions

Table 2. Clinical course of other bacteria-caused LETM cases

Case author	Causative bacterium	First manifestation	Urinary retention	MRI – increased T2 signal	AQP4-Ab	anti-MOG	Post-steroidal diabetes
Williams, and Thorpe [21]	*S. pneumoniae*	Increasing lower limb weakness	+	+	-	-	-
Kilic [22]	*M. pneumoniae*	Back pain, lower limb weakness, dizziness	+	+	-	-	-
Heller et al. [23]	*S. pneumoniae*	Bilateral hip-pain	+	-	-	-	-
Csabi et al. [24]	*M. pneumoniae*	Severe abdominal pain	+	+	-	-	-
He et al. [25]	*M. pneumoniae*	Lower extremity weakness, paresthesia, decreased sensation	+	+	-	-	-

hand, urinary retention was observed in four out of five cases, and so was increased T2-signal on MRI. Furthermore, our patient presented with persistent hiccups and vomiting, which are very rare findings in LETM patients – both post-viral and post-bacterial. Most of the cases identified in the literature were caused by SARS-CoV-2. Our patient was COVID-19 negative and responded positively to ceftriaxone treatment. Therefore, we suspect cross-reactivity between the bacteria which caused the unilateral pneumonia and AQP-4. However, one study involving 114 patients found no evidence for this molecular link with Klebsiella pneumoniae [26]. Hence, we hypothesize that different bacteria were the causative agent. We reviewed SARS-CoV-2 provoked cases of LETM in order to compare the level of protein in CSF with our patient, for whom it was 268 mg/dl. We included 25 cases into our analysis and the results were as follows: range 39–281 mg/dl, average 100.5 mg/dl ± 25.5. In comparison, our patient presented a relatively high level of protein, which might be a potential differentiating factor between viral and bacterial LETM. The patient's response to treatment, including intravenous methylprednisolone, plasmapheresis, and antibiotic therapy, along with the gradual improvement in neurological function during hospitalization, demonstrates the importance of early intervention and a multidisciplinary approach to managing cases of LETM. However, caution is needed when administering steroids for LETM treatment, given the risk of developing diabetes. Our patient, unfortunately, developed post-steroidal diabetes in the course of treatment and required metformin. While this additional medication can impact the patient's quality of life, it was necessary to prevent more serious complications. It is also important to be aware of possible hemorrhoids occurrence; therefore, physiotherapy and rehabilitation ought to be implemented as early as possible.

Conclusions

The reported case is highly unusual, given the fact that it occurred following bacterial pneumonia and presented with persistent hiccups and vomiting. The novelty of this case also lies in its atypical onset with initial presentation as girdle pain in the abdomen. Magnetic resonance imaging is the primary method of diagnosis and can help exclude other possible etiologies of neurological symptoms. When managing LETM, timing is critical to prevent paralysis of the respiratory muscles. LETM remains an extremely rare condition and with diverse origins as well as clinical manifestations, and its management continues to present a significant challenge.

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SOLITARY MEDIAN MAXILLARY CENTRAL INCISOR SYNDROME – A CASE REPORT AND LITERATURE REVIEW

Zespół pojedynczego siekacza w szczęce – opis przypadku i przegląd piśmiennictwa

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Abstract

Introduction: Solitary median maxillary central incisor syndrome is rare, with only single reports in the literature. This congenital defect affects both primary and permanent teeth. It is rarely an isolated anomaly, but usually a set of general symptoms. **Objectives:** The aim of the study was to collect reports on single incisor syndrome and analyze them in the context of our own case. **Materials and methods:** We assessed available literature reports on solitary median maxillary central incisor syndrome, including case reports. We also presented our own case based on systemic, dental, and radiological examination. **Results:** The described case was a single maxillary incisor syndrome confirmed by dental and radiological examinations. The patient presented with oral symptoms typical of the disorder, and a systemic interview confirmed extraoral symptoms. **Conclusions:** Solitary median maxillary central incisor syndrome is a rare midline defect that is usually not an isolated genetic disorder. The multitude of symptoms and disorders throughout the body requires an interdisciplinary and individualized approach to the patient.

Streszczenie

Wstęp: Zespół pojedynczego siekacza szczęki występuje rzadko. Dostępne są nieliczne doniesienia na jego temat w literaturze. Jest to wada wrodzona, która dotyczy uzębienia mlecznego i stałego. Rzadko występuje w sposób izolowany, zwykle jest to zespół objawów ogólnych. **Cel:** Celem pracy było zebranie doniesień na temat zespołu pojedynczego siekacza i prześledzenie tych doniesień w kontekście przypadku z doświadczenia własnego. **Materiał i metody:** Istniejące w literaturze doniesienia na temat zespołu pojedynczego siekacza szczęki wraz z przedstawionymi w literaturze opisami przepadków. Obserwacja pacjenta (przypadek własny) na podstawie badania ogólnoustrojowego, stomatologicznego oraz radiologicznego. **Wyniki:** Opisywany przypadek to potwierdzony badaniami stomatologicznymi oraz radiologicznymi zespół pojedynczego siekacza szczęki. Występują w nim charakterystyczne dla zburzenia objawy w obrębie jamy ustnej, a przeprowadzony jednocześnie wywiad ogólnoustrojowy potwierdza objawy występujące poza jamą ustną. **Wnioski:** Zespół pojedynczego siekacza szczęki to rzadko występujące zaburzenie w linii pośrodkowej ciała, które zwykle nie jest izolowanym zaburzeniem genetycznym. Mnogość objawów i nieprawidłowości w obrębie całego organizmu wymusza interdyscyplinarne i indywidualne podejście do pacjenta.

Keywords: solitary median maxillary central incisor; genetic disorders; dental anomalies

Słowa kluczowe: zespół pojedynczego siekacza szczęki; zaburzenia genetyczne; anomalie zębowe

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Introduction

Solitary median maxillary central incisor syndrome (SMMCIS) is a disorder affecting the structures in the midline of the body, mainly the head. It is a rare congenital defect characterized by the presence of a single maxillary central incisor. Both primary and permanent dentition may be affected. The anomaly is associated with abnormal development of the oral vestibule and face. This rare disorder may pose a diagnostic and therapeutic challenge and requires an interdisciplinary approach [1].

Epidemiology

SMMCIS is relatively rarely discussed in medical literature due to its rarity. However, isolated reports may be found [2].

The syndrome is most often diagnosed in early childhood and may affect both primary and permanent dentition. Its incidence is estimated at 1 in 50,000–100,000 births [3]. Data shows that the incidence of SMMCIS varies among different ethnic groups [3]. The epidemiology of the disorder is based mainly on individual reports and case descriptions available in the medical literature, therefore it is difficult to precisely determine the incidence of this defect and its population or ethnic distribution [3].

Etiology

SMMCIS is a rare anomaly caused by various etiological factors, including genetic, environmental, or other developmental factors. It is a set of multiple congenital defects mainly affecting the midline parts of the body. They are caused by an unknown factor [4].

SMMCIS is generally considered a genetic defect that may arise from gene mutations. Several potentially involved mechanisms have been described in the literature. The most important are:

- Missense mutations in the *SHH* gene at locus 7q36;
- Mutations in Homeobox (HOX) genes. These genes are responsible for regulating cell growth and differentiation, including teeth, during embryonic development;
- Mutations in genes that control midline facial movements. Disturbances in these genes during embryonic development may lead to defects in the structure of the frontal part of the face;
- Genetic factors related to maxillary incisors. Functional abnormalities of these genes can cause SMMCIS. A solitary incisor may be an indicator of disturbed tooth morphogenesis;
- Gene expression during the embryonic period, as confirmed by relevant research. Abnormal gene expression at a specific time and place during embryonic development may contribute to facial skeleton defects, including SMMCIS [4, 5].

Abnormal migration of mesoderm in the frontonasal process and its fusion in the midline between 35 and 38 days of fetal life are considered to be the most probable cause of the defect [6, 7].

SMMCIS may be inherited in an autosomal dominant manner. There are associations between this disorder and other syndromes and genetic defects. Authors of case reports postulate a link between SMMCIS and Pallister-Hall syndrome caused by a mutation in the *GLI3* gene. Spontaneous mutations may occur in some cases, causing SMMCIS independently of family history of defects [5].

Clinical symptoms

The presence of a single maxillary incisor in the midline is the main symptom of SMMCIS. Instead of two central incisors, patients have one tooth in the central location. The tooth has a symmetrical crown [8].

In addition to the primary and most obvious symptom, SMMCIS patients may present with many other craniofacial abnormalities. Facial dysmorphia may vary from patient to patient. The most common dysmorphic features include:

- Changes in the structure of the nose, e.g. its altered shape, a wide bridge, a rounded tip or other deviations from the correct structure, nasal malformations in the form of choanal atresia, pyriform aperture stenosis (in about 90% of patients).
- Changes in the structure of the lips, usually defects of the upper lip: altered shape, atypical vermilion.
- Asymmetries or changes in facial structure: altered shape of the cheekbones, changes in the structure of the chin in the form of micrognathia (mandibular hypoplasia).

In addition to abnormal central maxillary incisors, other dental anomalies may also occur, such as abnormal position and/or number of other teeth and hypodontia [9, 10]. Defects in the number and position of teeth give rise to occlusal problems in these patients.

In addition to craniofacial anomalies, disorders of various systems may develop, with the heart, urinary system, and nervous system most often involved [11]. SMMCIS malformations also generate problems with the auditory system, speech development, and chewing functions [12].

SMMCIS-associated middle ear defects in the form of malformations of the auditory bones or organs may impair sound conduction and affect hearing. In some patients, underdevelopment of auditory structures may occur, leading to hearing deficits, especially in childhood.

Furthermore, patients with SMMCIS present with phonation disorders. These result from abnormal craniofacial structure, including nasal hypoplasia, as well as abnormal chin and airway structure. The affected patients may also suffer from a cleft palate, which additionally compromises speech development. All these disorders may generate problems with the articulation of sounds.

SMMCIS seems to have a major impact on chewing function. Here, the potential structural effects of SMMCIS on the mandibular articular-ligamentous apparatus and the general structure of the oral cavity play an important role. Developmental defects of the oral cavity, such as dental anomalies, hypodontia, malocclusion, and palatal hypoplasia, will undoubtedly affect chewing function. All these abnormalities affect the way food is chewed. Patients have particular difficulty chewing hard foods or foods that require long chewing. This in turn generates abnormal loading of the dental system and promotes the development of malocclusions [12].

Other developmental disorders that may be associated with SMMCIS include congenital heart defects (25% of cases), including tetralogy of Fallot (15%), scoliosis (14%), esophageal atresia (10%), hypoplasia of the clavicles, anosmia, renal agenesis, hypothyroidism and chronic anterior pituitary insufficiency, brain malformations, mild to

severe mental retardation (50%). About 50% of children with SMMCI have short stature [13].

Treatment

Treatment of patients with SMMCIS requires an interdisciplinary approach. The team should consist of a dentist, orthodontist, speech therapist and otolaryngologist.

The affected patients often require orthodontic teeth alignment and bite correction. Cooperation between speech therapist, orthodontist, and otolaryngologist is necessary in the treatment of speech, breathing, and chewing disorders. Surgical intervention may be needed in some cases. Surgery is indicated in the case of structural defects of the facial skeleton [14].

Case report

A 10-year-old boy was admitted to a dental clinic for diagnostic purposes and a possible referral for treatment at a specialist clinic. His psychosomatic development was normal. He had no history of chronic conditions or regular pharmacotherapy. He developed allergies to grasses the summer, as reported by the mother (no tests were run to confirm this). According to the mother, the boy did not sustain any oral injuries in his early childhood, or the mother did not recall any. The child expressed a desire for treatment for aesthetic reasons and social problems at school.

Materials and methods

The case analysis was based on the data collected during the patient's visit to the dental clinic. Dental and general medical history, radiological documentation, as well as extraoral and intraoral radiographs were used for case description.

Results

The patient presented with the typical feature of SMMCIS in the form of a single permanent maxillary central incisor (Fig. 1). The tooth had an symmetrical crown and lacked differentiation of the incisal angles. Both angles resembled the distal angle of a normal incisor (Fig. 2 and Fig. 3).

Characteristic changes in oral soft tissues included the absence of the superior labial frenulum and the incisive papilla, whereas changes in maxillary structure included V-shaped palate. The patient also had a prominent ridge in the midline of the hard palate and width growth deficiency. External anomalies included indistinct philtrum and an arched upper lip.

Discussion

SMMCIS is a rare abnormality that usually does not occur as an isolated genetic defect [15–19]. Although some authors classify this syndrome as a separate disease entity [20, 21], SMMCIS is more often considered to accompany other developmental abnormalities, e.g. holoprosencephaly [17–22].

According to Hall, unknown etiological factors affecting the embryo between the 35 and 38 weeks gestation are

Figure 1. Extraoral X-ray showing a single maxillary incisor

Figure 2. Model of the patient's jaw showing a single maxillary central incisor

Figure 3. Comparison of the patient's maxillary and mandibular models. The panoramic X-ray shows a single central incisor located in the midline. Apart from this defect, the buds of all permanent teeth are present, including the maxillary and mandibular wisdom teeth (Fig. 4)

Figure 4. Patient's panoramic radiograph

the cause of SMMCIS [2]. They inhibit or slow down the transverse growth of the maxilla and the midline structures, which in turn leads to fusion of the left and right dental lamina [20]. These disorders result in the formation of a symmetrical single upper incisor, as well as impaired formation of the palatine suture and the superior labial frenulum [20].

Similarly to reports by other authors, our patient presented with clinical features indicating SMMCIS.

A reduced number of teeth is one of the basic symptoms accompanying a solitary maxillary central incisor. Hypodontia is more likely to involve permanent (1–10%) than primary teeth (0.4–0.9%) [14–16]. In the discussed case, apart from the anomaly in the form of a single central incisor, no missing teeth were observed, what is more, the buds of all molars were present. However, the shape of the upper incisor and its position in the midline of the body indicated SMMCIS.

Other symptoms typical of SMMCIS and mentioned by other authors were observed in the discussed patient: absence of the superior labial frenulum and flattened, arched upper lip without Cupid's bow [15, 20, 22]. The patient also had a short, narrow V-shaped maxilla and a prominent palatine ridge on the highly arched palate. According to Kjaer et al., these features constitute the diagnostic criterion for holoprosencephaly. This is the most severe manifestation of SMMCIS, which involves structural abnormalities of the central nervous system (CNS), the base of the skull, and the face [8].

Due to the patient's narrow jaw and mixed dentition, treatment with removable appliances could be considered, as recommended by Barcelos et al. Its aim was to improve the inclination of the central incisor [22]. According to the treatment protocol proposed by Hall, intervention is not recommended at the stage of mixed dentition, but is started after primary tooth shedding is completed. According to this protocol, maxillary expansion, shifting of central incisor and recovery of space for prosthetic reconstruction of the second central incisor are implemented [2]. Machado et al. recommend rapid maxillary expansion (RPE) in the first stage of treatment and fixed appliance in the next stage [17].

As pointed out by some authors, maxillary expansion may not proceed as planned. This is due to the lack of anterior palatal suture. Maxillary osteotomy is recommended before starting orthodontic treatment to successfully expand the maxilla [16].

Conclusions

Reports on SMMCIS are scarce due to its rarity and the limited number of cases described in the literature.

Dysmorphic features in SMMCIS may differ significantly among patients, therefore they should be diagnosed individually and carefully. Additional investigations (specialist consultations, imaging) are often needed. Only thorough diagnosis allows for identification of patient's symptoms and therapeutic needs in detail. Patients with SMMCIS should be regularly monitored by an interdisciplinary team consisting of dentists, orthodontists, speech therapists, otolaryngologists and internal medicine specialists.

Due to potential ear defects, SMMCIS patients need to be put under otolaryngological monitoring for hearing deficits. Such monitoring should be started already during the developmental period.

Regular monitoring of speech development is recommended in children with SMMCIS. Early detection of problems in this area allows for the implementation of timely and individualized speech therapy. Such intervention improves the patient's everyday functioning, and allows for proper development and learning in a peer environment.

If chewing disorders are diagnosed, appropriate therapeutic intervention should be implemented by a speech therapist or orthodontist. Early intervention in a child with SMMCIS can significantly improve their chewing and swallowing functions.

Patients with SMMCIS require interdisciplinary care. Collaboration between orthodontist, dentist, maxillofacial surgeon, pediatrician and speech therapist supports the proper physical, intellectual and social development of children.

Parental and patient education is an important aspect of treating a child with SMMCIS. The awareness of the need for regular monitoring and treatment of developmental defects and its benefits for the child's future health and functioning is crucial.

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NASAL RECONSTRUCTION IN A PATIENT AFTER SURGICAL TREATMENT OF RECURRENT BASAL CELL CARCINOMA OF THE LEFT NASAL WING

Rekonstrukcja nosa u pacjentki po leczeniu operacyjnym wznowy raka podstawnokomórkowego lewego skrzydła nosa

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Abstract

Basal cell carcinoma is the most common skin malignancy. Surgical excision is the basic treatment method. According to experts, the margin of macroscopically healthy tissue should be about 4 mm for primary lesions and about 10 mm for recurrence. The procedure is often associated with significant tissue defects. Facial lesions are often challenging because of the facial structure and the goal to maintain aesthetics. We describe a case of a patient with a third recurrence of basal cell carcinoma in the area of the left wing of the nose. Due to the expected significant loss of full-thickness tissues of the nasal wing, we planned reconstruction using two flaps: a lipocutaneous flap harvested from the nasolabial fold and a Mustarde rotation flap. The reconstruction was supplemented with split-thickness skin grafts. This approach allowed us to achieve full coverage of the tissue defect immediately after wide resection of the tumour. As a next step, we planned to reconstruct the nasal cartilage scaffold to improve nasal functionality and aesthetics. The described case is intended to present one of the reconstructive options for large post-resection tissue defects in the nasal wing area.

Streszczenie

Rak podstawnokomórkowy jest najczęściej występującym nowotworem złośliwym skóry. Podstawowa metodą leczenia jest wycięcie chirurgiczne. Według opinii ekspertów, w przypadku pierwotnej zmiany należy zachować margines około 4 mm makroskopowo zdrowych tkanek, a przypadku nawrotu – około 10 mm. Takie postępowanie często wiąże się z powstaniem znacznych ubytków tkanek. Zmiany występujące na twarzy nierzadko są problematyczne, biorąc pod uwagę jej budowę i dążenie do zachowania estetyki. Opisujemy przypadek pacjentki z trzecią wznową raka podstawnokomórkowego skóry w okolicy lewego skrzydła nosa. Ze względu na spodziewany duży ubytek tkanek pełnej grubości skrzydła nosa, zaplanowano rekonstrukcję dwoma płatami – płatem skórno-tłuszczowym z fałdu nosowo-policzkowego i płatem rotacyjnym Mustarde'a. Rekonstrukcję uzupełniono o przeszczepy skóry pośredniej grubości. Stosując tę metodę, uzyskano pełne pokrycie ubytku tkanek bezpośrednio po szerokiej resekcji nowotworu. Zaplanowano również kolejny etap – odtworzenie rusztowania chrzęstnego nosa w celu poprawy funkcjonalności i estetyki nosa. Opisywany przypadek ma na celu przedstawienie jednej z możliwości rekonstrukcji dużych poresekcyjnych ubytków tkanek w okolicy skrzydła nosa.

Keywords: basal cell carcinoma; skin cancer; reconstruction of nasal wing; flap reconstruction; plastic surgery

Słowa kluczowe: rak podstawnokomórkowy; nowotwór złośliwy skóry; rekonstrukcja skrzydła nosa; rekonstrukcja płatowa; chirurgia plastyczna

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Introduction

Basal cell carcinoma (BCC) is the most common type of skin malignancy and the most common cancer in Caucasians [1]. It accounts for 75–80% of all cancers [2]. Although BCC very rarely spreads to other organs, several hundred cases of metastasis of this tumour have been described worldwide, most often to lymph nodes, lungs, and bones, with an estimated incidence of metastasis of about 0.0028–0.5% [3]. Surgery is the first-line treatment. This is the only approach allowing for histopathological verification of the lesion [4]. It is considered that conservative treatment should no be used for tumours with a difficult location (near the eyelid, lips, nose) [5]. For primary lesions, resection with a macroscopically healthy tissue margin of at least 4 mm is recommended [6]. In case of high risk of recurrence, the recommended margin of healthy tissue is up to 15 mm. Risk factors for recurrence include size ≥2 cm, location in central face, periorbital skin, nose, lips and ears, poorly defined border assessed as poorly demarcated histopathological margin, aggressive pathologic features (vascular and/or neural involvement), and failure of previous treatment [5]. After surgical removal of the lesion, the tissue defect is closed with simple skin suture, flap reconstruction or skin graft.

We present a case of a patient with recurrent BCC in the region of the left nasal wing. The woman had a history of tumour excision, with the defect covered with a buccal fat advancement flap, followed by radiation therapy due to the non-radical nature of the treatment. Due to tumour recurrence with perforation of the nasal wing, an extensive resection with lipocutaneous advancement flap harvested from the nasolabial fold and a Mustarde cheek rotation flap. A free split-thickness skin graft (STSG) was used to reconstruct the nasal mucosa. A good coverage of the extensive defect and oncological radicality were achieved. Subsequent reconstruction of the nasal skeleton using a rib fragment was also planned.

Case description

We present a case of a patient qualified for resection of recurrent BCC located in the nasal wing with its perforation, and simultaneous reconstruction using advancement flaps. The patient had previously undergone two surgeries to remove the tumour from the same location and close the defect with a split-thickness skin graft. Histopathology identified the lesion as BCC. Due to non-radicality of the procedure, the patient was qualified for radiation therapy. However, the tumour recurred after several years, causing perforation of the left nasal wing (Fig. 1). Computed tomography (CT) did not reveal any invasion of the nasal septum. Figure 2 shows a schematic drawing of the planned radical tumour resection using advancement flaps. The tumour was excised with a 10-mm margin of macroscopically healthy tissue. The resulting defect was covered with a nasolabial flap, and the defect after the buccal flap was covered with a Mustarde rotation flap. The inner side of the reconstructed left nasal wing was covered with STSG. STSG was also used to cover a fragment of tissue defect in the region of the nasal bridge, which could not be reached by the edge of the buccal flap. A fragment of the Foley catheter wrapped in a dressing soaked in liquid paraffin was left in the left nostril on the first postoperative day to prevent the nasal wing from collapsing, which could adversely affect STSG healing process. Figure 3 shows the patient's postoperative status on day 2 after surgery. No disturbances in the blood supply to the flaps, and no signs of exudate from the suture site were observed. A relatively pale colour of the STSG was noted, which could indicate delayed healing. The operated area was significantly oedematous, with signs of subcutaneous haemorrhages, which tended to subside over postoperative days. Considering the normal healing process, a decisions was made to discharge the patient home, with arranged follow-up appointments according to the schedule. Histopathological examination confirmed oncological radicality. The patient was offered

Figure 1. Recurrent tumour with perforation of the left nasal wing

Figure 2. A schematic drawing of the planned radical tumour resection with flap reconstruction

another hospital admission after completed healing process and obtaining histopathological findings in order to perform reconstruction of the cartilaginous part of the nose using a rib cartilage graft.

Discussion

We described a case of extensive resection of skin cancer using combined reconstructive techniques. Excision with histopathological evaluation of surgical margins is the treatment of choice in suspected BCC [7]. A lipocutaneous nasolabial flap, a Mustarde rotation flap, and two split-thickness skin grafts were used to close the post-resection defect and reconstruct the nasal mucosa. During resection, a healthy tissue margin of 10 mm was marked, in accordance with expert recommendations for high-risk BCC [7]. The patient presented with high-risk factors for recurrence, such as location in the nasal region, incomplete excision of the tumour in the past. Lipocutaneous nasolabial flaps are often used to cover tissue defects in the region of the nasal wing. They belong to the group of flaps transferred from an area adjacent to the defect. The shape and size of the flap is selected depending on the defect. The teardrop shape is most commonly used as it ensures the most optimal aesthetic effect [8]. Due to the large size of the secondary defect after transferring the buccal flap, it was decided to use a Mustarde flap, achieving complete coverage of the primary and secondary tissue defect.

Figure 3. Patient's status on postoperative day two

The Mustarde flap is a rotational cheek flap, often used for the reconstruction of tissue defects in the infraorbital region and lower eyelid [9]. In order to ensure optimal conditions for STSG healing on the inner side of the flap, a dressing was made using a fragment of a Foley catheter wrapped in a dressing soaked in liquid paraffin. Such dressing ensured proper compression of the grafts to the recipient site, maintaining the patency of the newly created nostril. Fixing the STSG with skin sutures and pressing it to the recipient site is recommended to prevent the grafts from moving [10]. This allowed for avoiding any disturbances in STSG healing over the postoperative days. No disturbances in the blood supply to the flaps were also observed. As a result of the treatment used, a complete excision of the tumour and an aesthetic effect acceptable for the patient were achieved. In the next stage, reconstruction of the cartilaginous part of the nose was planned in order to improve its functionality and aesthetics. Continuation of the treatment will be possible once the nose has completely healed after reconstruction and a histopathological result confirming total excision of the tumour has been obtained.

Conclusions

Reconstruction of tissue defects after resecting large skin cancer lesions while maintaining histopathological radicality is a major challenge in oncological surgery. The use of advancement flaps and the possibility of combining reconstructive methods allow for covering large defects that are difficult to close using conventional techniques. The combination of a lipocutaneous flap harvested from the nasolabial fold and a Mustarde rotation flap using split-thickness skin grafts can be successfully used to cover full-thickness defects after resection of nasal wing lesions.

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DESCRIPTION OF SELECTED CASES OF PATIENTS WITH CHEST INJURIES TREATED AT THE DEPARTMENT OF GENERAL, ONCOLOGICAL, METABOLIC AND THORACIC SURGERY

Opis wybranych przypadków pacjentów po urazach klatki piersiowej leczonych w Klinice Chirurgii Ogólnej, Onkologicznej, Metabolicznej i Torakochirurgii

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Abstract

The article presents clinical cases of patients admitted to the Trauma Centre of the Military Medical Institute – National Research Institute in the second half of 2024. Patients were treated in accordance with current medical knowledge in the Department of General, Oncological, Metabolic and Thoracic Surgery and the Department of Anaesthesiology and Intensive Care. Effective pleural drainage was the most common minimally invasive method used in our patients. Some cases required a more complex procedure, such as video assisted thoracoscopic surgery. Surgical approaches using the Matrix or Stratos set, which allows for chest reconstruction after injuries with rib fractures, was the most expensive techniques used. Modern contemporary surgical techniques, such as video assisted thoracoscopic surgery, are used not only for elective oncological surgeries, but also in traumatic emergency patients. A minimally invasive approach in a trauma patient reduces hospital stay, recovery time, and exclusion from professional life. Considering the needs of the Polish Armed Forces in terms of thoracic procedures, which are addressed by the Military Institute of Medicine – National Research Institute in Warsaw, the paper indicates increasing challenges in this field of medicine. The procedures described below are a standard known from prestigious European thoracic surgery centers. The constant development of thoracic surgery seems to be justified, especially in the military health service. We believe that continuous education and implementation of these techniques is crucial for maintaining proper protection of the Polish Armed Forces.

Streszczenie

W artykule przedstawiono przypadki kliniczne chorych, którzy trafili do Centrum Urazowego Wojskowego Instytutu Medycznego – Państwowego Instytutu Badawczego w drugim półroczu 2024 roku. Pacjenci byli leczeni zgodnie z aktualną wiedzą medyczną w Klinice Chirurgii Ogólnej, Onkologicznej, Metabolicznej i Torakochirurgii oraz Klinice Anestezjologii i Intensywnej Terapii. Skuteczny drenaż opłucnej był małoinwazyjną, najczęściej stosowaną metodą. Niektórzy pacjenci wymagali bardziej skomplikowanej procedury jaką jest chirurgia torakoskopowa wspomagana wideo. Inną metodą, ale najdroższą pod względem materiałowym, była operacja z wykorzystaniem systemu Matrix lub Stratos, która umożliwia rekonstrukcję klatki piersiowej po urazach ze złamaniami żeber. Nowoczesne techniki operacyjne, takie jak chirurgia torakoskopowa wspomagana wideo, nie są wykorzystywane wyłącznie w onkologicznych operacjach planowych, ale znajdują zastosowanie również u pacjentów urazowych w trybie dyżurowym. Użycie małoinwazyjnych technik u pacjenta urazowego skraca czas hospitalizacji, rekonwalescencji i wykluczenia z życia zawodowego. Biorąc pod uwagę potrzeby Sił Zbrojnych RP w zakresie procedur torakochirurgicznych, na które odpowiada Wojskowy Instytut Medyczny – Państwowy Instytut Badawczy w Warszawie, przedstawiony artykuł wskazuje, że wyzwania w tej dziedzinie medycyny są

coraz większe. Opisane poniżej procedury stanowią standard, znany z prestiżowych europejskich ośrodków torakochirurgicznych. Stały rozwój torakochirurgii wydaje się uzasadniony, szczególnie w wojskowej służbie zdrowia. Potrzeba ciągłego kształcenia i wdrażania tych technik jest zdaniem autorów kluczowa dla utrzymania właściwej ochrony Sił Zbrojnych RP.

Keywords: thoracic surgery; minimal invasion; VATS; military medicine

Słowa kluczowe: torakochirurgia; minimalna inwazja; VATS; medycyna wojskowa

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Introduction

The Department of General, Oncological, Metabolic and Thoracic Surgery with the Unit of Thoracic Surgery supports the Trauma Centre for patients with chest injuries. Here, doctors face everyday challenges, choosing appropriate treatment techniques to fight for the life and health of their patients.

According to data from the Central Statistical Office, up to 3.8 million people were treated in hospital emergency departments (EDs) and admission rooms (ARs) in Poland in 2022 [1]. At that time, 2.8 thousand patients were admitted to 17 active trauma centres in Poland.

It is estimated that chest injuries account for 61% of all bodily injuries resulting from traffic accidents [2]. Traffic accidents and falls from heights are the most common causes [3–5].

Many therapeutic approaches have been developed for chest conditions. Known conventional procedures, such as thoracotomy, are not routinely used despite the fact that high-energy trauma most often requires urgent surgical intervention already in the ED setting. Other, minimally invasive techniques are available. Appropriately trained medical team will be able to use an adequate minimally invasive approach, previously known from the thoracic surgery setting for elective treatment of cancer. Minimally invasive methods such as pleural drainage, video-assisted thoracoscopic surgery (VATS), and thoracoscopy are increasingly utilised, even in those with extensive injuries. Titanium plates similar to orthopaedic sets are successfully used in special cases requiring chest wall reconstruction.

Aim

The aim of the study was to present the profile of patients admitted for chest injuries, as well as to analyse the choice of treatment methods.

Materials and methods

The descriptive data and images were obtained in the second half of 2024 in a group of patients with chest injuries transported to the Trauma Centre at the Military Institute of Medicine – National Research Institute (WIM-PIB) in Warsaw. The patients were admitted as emergency cases and underwent further specialist treatment in the Department of General, Oncological, Metabolic and Thoracic Surgery and the Department of Anaesthesiology and Intensive Care. Data such as age, gender, type and mechanism of injury, diagnostic and therapeutic methods used, the length of hospital stay, and treatment outcomes were included in the analysis. Selected cases were described.

Case 1

A 47-year-old female patient was admitted with symptoms of respiratory failure as a result of a traffic accident with crashing into a concrete column. Extended focused assessment with sonography for trauma (eFAST) showed pneumothorax and right pleural fluid, as well as a small volume of abdominal fluid. Drainage of the right pleural cavity was performed in the Emergency Department, which collected 1800 mL of blood. The patient was qualified for video-assisted thoracic surgery (right-sided VATS) and a wedge resection of the lower lobe of the right lung within the fragmented and lacerated lung parenchyma, with evacuation of haematoma, followed by drainage of the right pleural cavity. The patient is currently under the care of the thoracic surgery clinic. (Pre- and postoperative status is shown in Figure 1).

Case 2

A 51-year-old man was admitted with symptoms of chest pain after being hit by an electric scooter. An X-ray and computed tomography (CT) of the chest revealed multiple fractures of left ribs 4–11, including comminuted fractures. The fractures of ribs 4 and 9 were stable and wedged; additionally, a pleural haematoma and a parenchymal tear in the lower lobe due to fragments of ribs 5–8 displaced into the chest and penetrating the lung were detected. The patient was qualified for haematoma evacuation, with suturing of the lung parenchyma, and chest wall stabilisation by means of conventional posterolateral thoracotomy using the Matrix system. Blood was sucked out, the parenchyma was sutured in

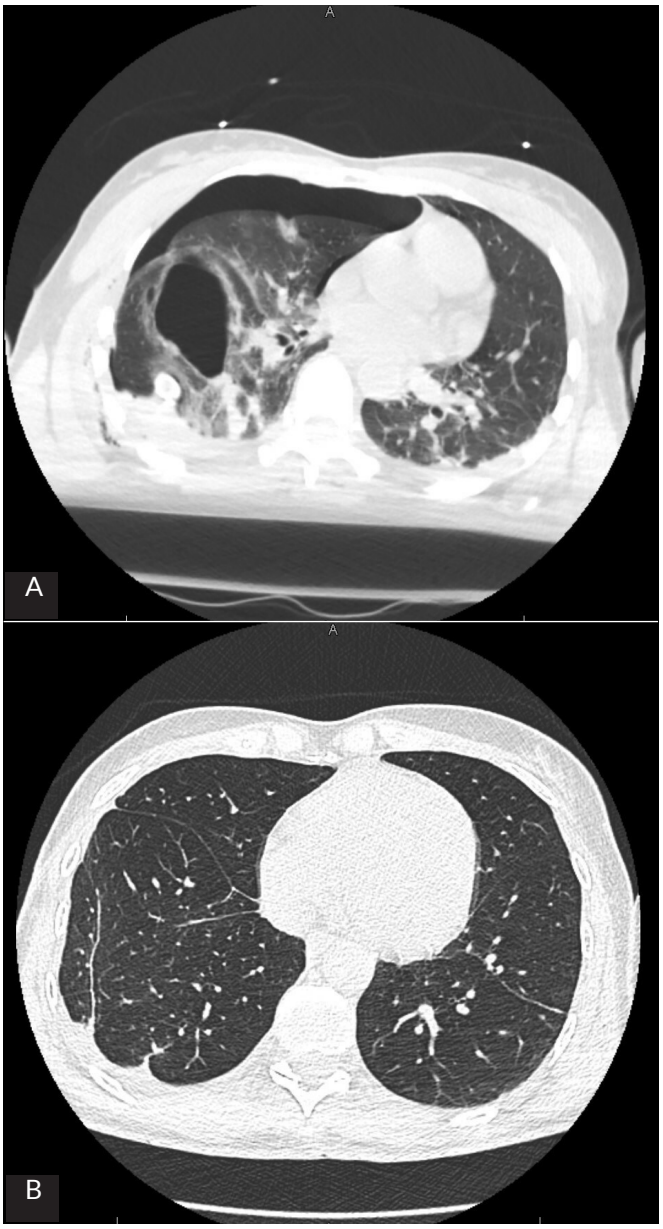

Figure 1. Case 1. Computed tomography findings. **A.** Preoperatively. **B.** Postoperatively

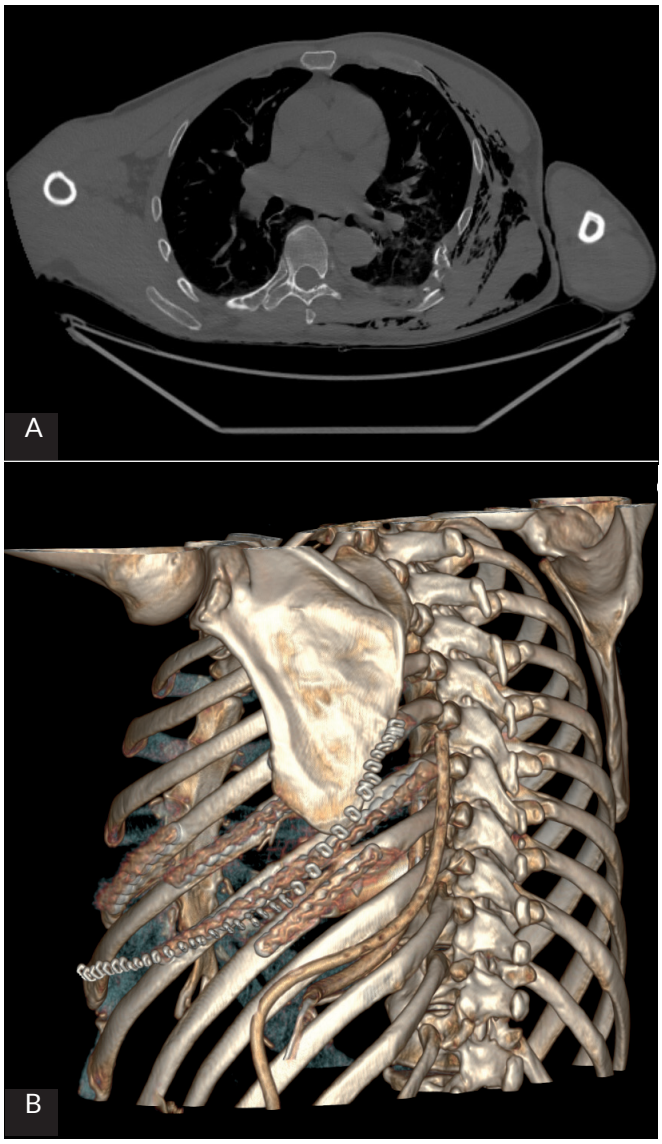

Figure 2. Case 2. Computed tomography findings. **A.** Preoperatively. **B.** Postoperatively

two layers with a 3/0 monofilament suture. Each suture line was sealed with haemostatic and aerostatic TachoSil sponge. The intermediate bone fragments of rib 5 in the anterior and posterior axillary line were intraoperatively fixed with two titanium plates (Matrix 10 cm universal). Ribs 6 and 7, fractured in three places, were stabilised with dedicated 15 cm rib plates adjusted to "rib left" body side, and rib 8 was fixed the same way, using a 10 cm universal plate from the set. Double pleural drainage was used, as well as continuous epidural anaesthesia was administered pre- and postoperatively until day 10. The patient continues follow-up at the outpatient thoracic surgery clinic. (Pre- and postoperative status is shown in Figure 2).

Case 3

A 67-year-old woman was admitted with symptoms of chest pain after a fall from her own height. X-ray revealed fractured right clavicle and ribs 2–4 on the right side and pneumothorax with pleural haematoma. A drainage tube was inserted into the pleural cavity in the emergency room. Due to the symptoms of a flail chest and an onset of respiratory failure, as well as the risk of inflammatory lung disease, the patient was qualified for surgical treatment. Simultaneously, after stabilisation of the right clavicle fracture using the VariAx plate (Stryker) at the Traumatology Clinic of the Military Institute of Medicine–National Research Institute using minimally invasive techniques with access through right VATS and minithoracotomy above the fifth rib, decortication of the right lung was performed, adhesions were released, the pleural haematoma was aspirated, and the fractures of ribs 2, 3, 4 were reconstructed using the Stratos system, achieving stabilisation of the chest wall. Additionally, a double drainage of the right pleural cavity was placed. The patient underwent respiratory rehabilitation and was mobilised. Sustained aeration of the lung tissue was achieved and a significant improvement in the clinical

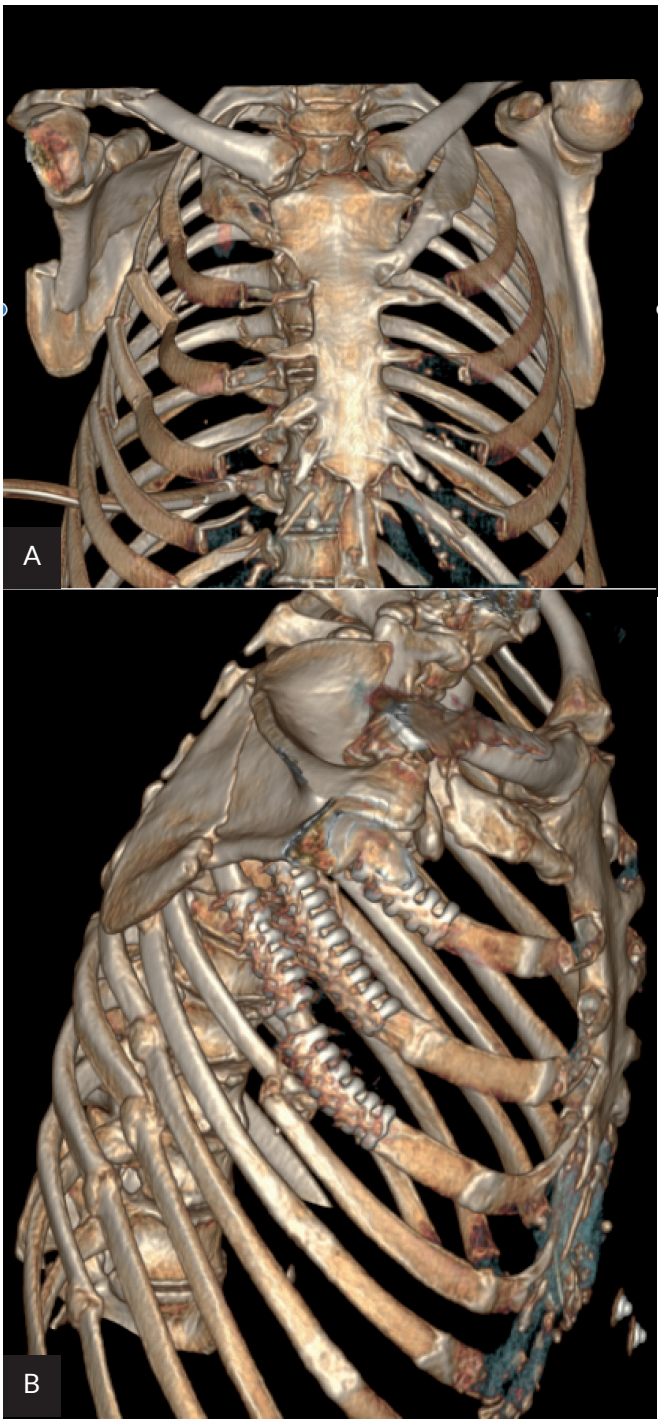

Figure 3. Case 3. Computed tomography findings. **A.** Preoperatively. **B.** Postoperatively

status and physical capacity was achieved. The treatment was completed after a check-up at the thoracic surgery clinic. A visit to the orthopaedic clinic was recommended, and the patient continued further primary care. (Pre- and postoperative status is shown in Figure 3).

Case 4

A 53-year-old man was admitted after a traffic accident with symptoms of dyspnoea and left-sided chest pain. Several years earlier, the patient received two Matrix

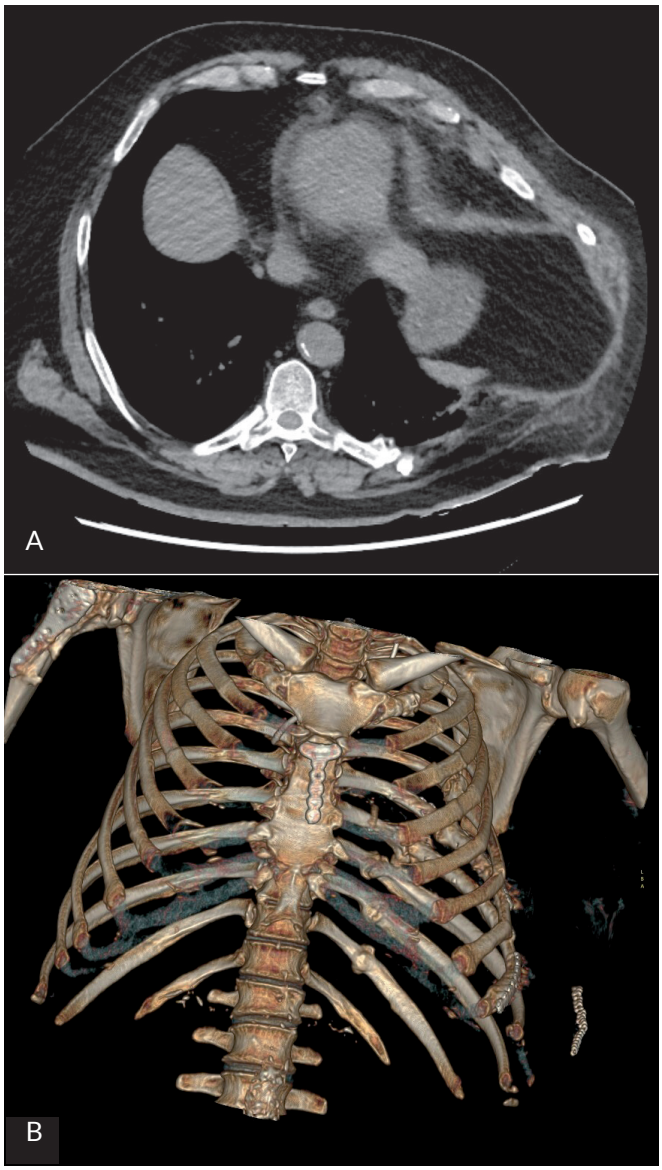

Figure 4. Case 4. Computed tomography findings. **A.** preoperatively. **B.** postoperatively

chest plates in Germany due to fractures of the lower left ribs 7 and 8 in the posterior sections in a traffic accident. A CT scan was taken and showed fractured sternal body with dislocation and haematoma near the fracture gap, fractures of the left ribs 1–8, surgically treated fractures of ribs 7 and 8, and a dislocated sternal fracture with post-traumatic chest wall hernia involving the stomach and adipose tissue. After appropriate preparation of the patient, surgical stabilisation of the chest was performed and the fracture of rib 8 was treated with a universal Matrix 10 cm plate, achieving reinforcement of the replaced rib. Then, the hernia was treated by reducing the viscera into the abdominal cavity. The hernial orifice between ribs 8 and 9 was secured with ZipFix tapes and sutured in layers. Additionally, the dislocated sternum was repositioned and fixed with a T-plate. In the postoperative period, the patient was gradually mobilised, and after the improvement of his health condition, he was transferred to outpatient care. (Pre- and postoperative status is shown in Figure 4).

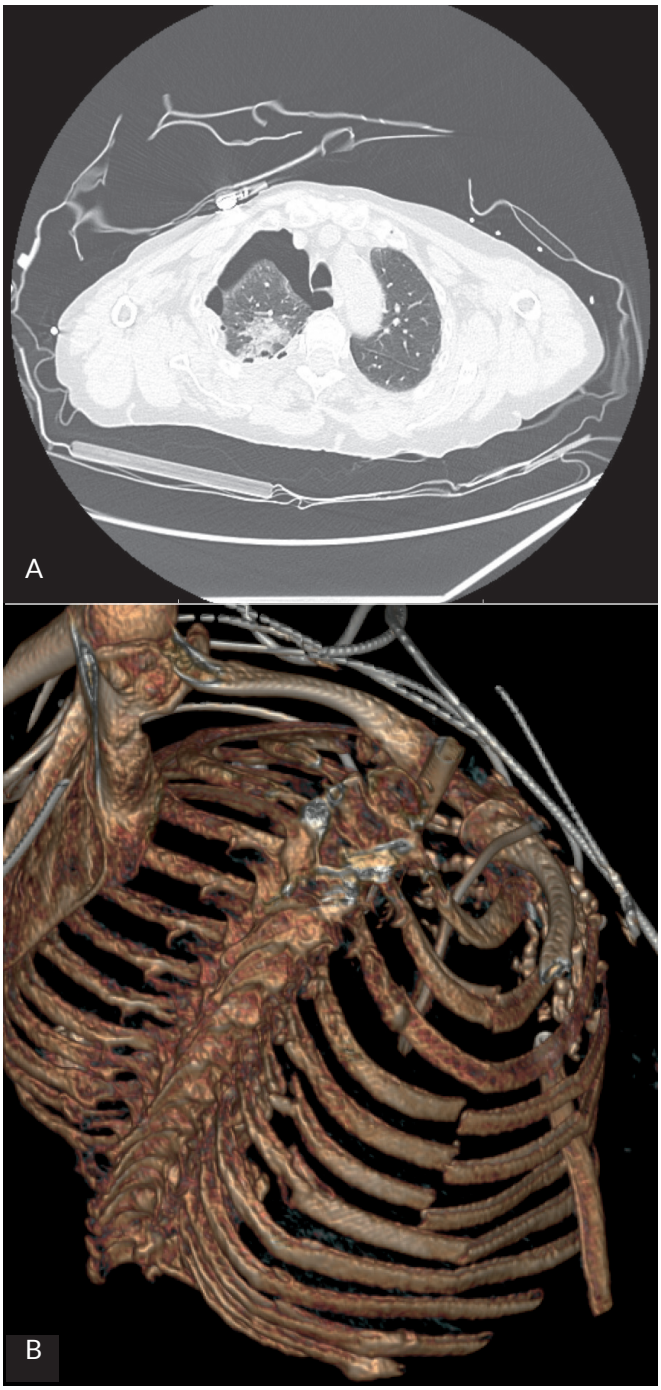

Figure 5. Case 5. Computed tomography findings. **A.** preoperatively. **B.** postoperatively

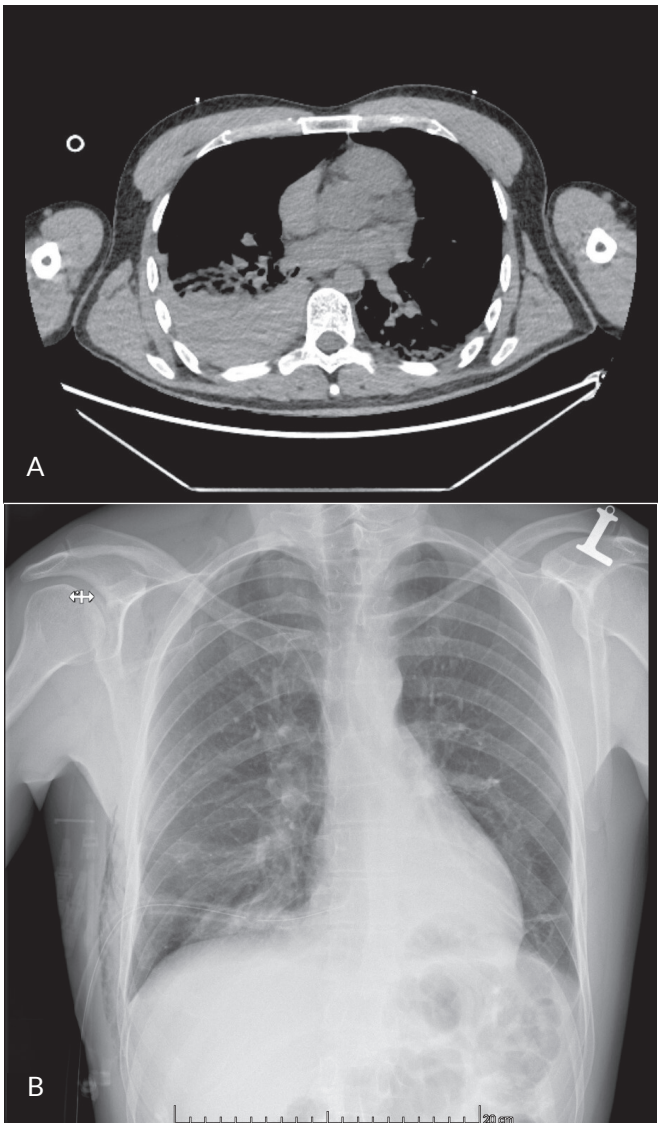

Figure 6. Case 6. **A.** Preoperative computed tomography. **B.** Postoperative x-ray

Case 5

A 71-year-old woman was admitted with symptoms of respiratory failure after being hit by a car. As a result of the incident, she suffered a head and chest injury. A CT scan revealed multiple fractures of ribs 3–9 on the right side, a right-sided pneumothorax with haematoma, as well as pelvic and limb injuries. After orthopaedic care at the Traumatology Clinic, further treatment was continued in the Department of Intensive Care due to the extremely serious general condition, where effective thoracic drainage was performed. Given the high risk of complications, surgical stabilisation of the chest wall was temporarily abandoned. Once her clinical condition stabilised, the patient was transferred to the Traumatology Clinic for surgical treatment of pelvic fractures with possible simultaneous chest wall stabilisation. The patient remains under the care of the Traumatology Clinic. (Pre- and postoperative status is shown in Figure 5).

Case 6

A 32-year-old man was admitted with symptoms of dyspnoea after receiving a stab chest wound (knife) in the lower part of the sternum. Drainage of the right pleural cavity in the Emergency Department, collected 250 mL of blood and the patient was transported for an urgent trauma scan. The results of the examination and the patient's clinical condition did not indicate the need for additional emergency interventions. Once the acute stab wound was managed, the patient's condition improved significantly, with spontaneous healing of the wound. The man was discharged home to continue outpatient follow-up. (Pre- and postoperative status is shown in Figure 6).

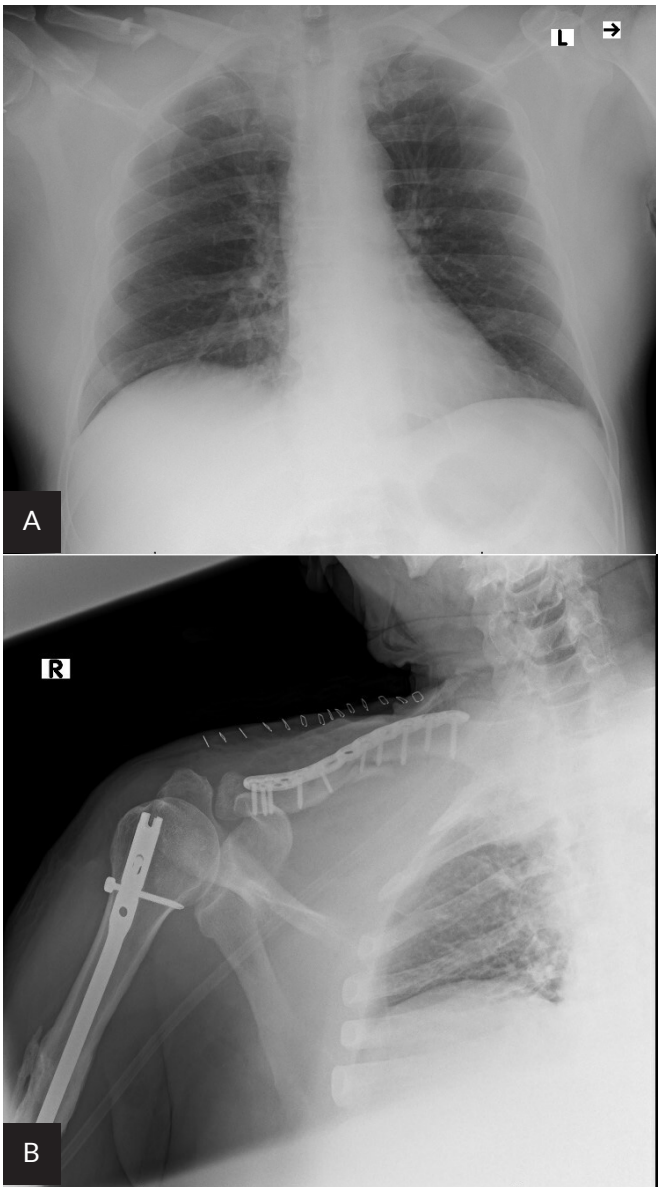

Figure 7. Case 7. X-ray. **A.** After conservative treatment. **B.** After surgery

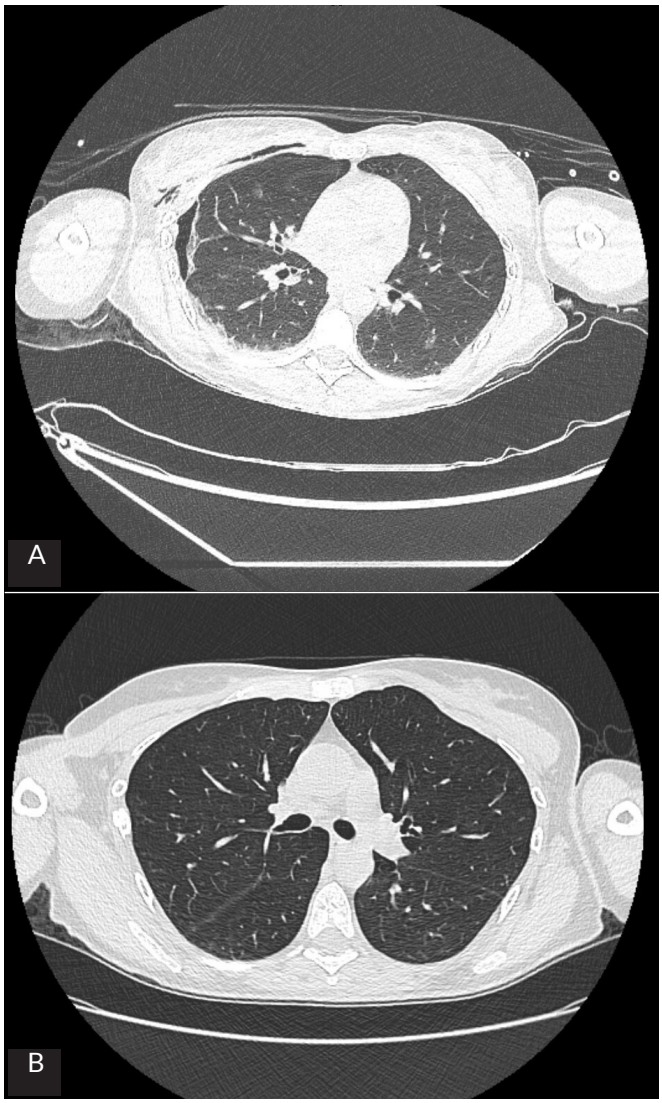

Figure 8. Case 8. Computed tomography findings. **A.** On admission. **B.** At discharge

Case 7

A 49-year-old patient was admitted with a crush chest injury after being buried under a pile of earth. Diagnostic imaging on admission revealed a fracture of the right clavicle with the presence of free bone fragments, paravertebral and parasternal fracture of the first rib, fractured ribs 2–4 in the anterior axillary line, a dislocation of the first sternocostal joints, gas collections in the soft tissues along the cervical blood vessels, at the clavicular and sternocostal joints of ribs 1–3 on the right side and along the first right rib, and suspected damage to the right subclavicular vein. After consulting a vascular surgeon, the patient did not require additional interventions and continued conservative treatment. Once the patient's health improved, he was qualified by a traumatologist for surgical treatment of the right clavicular fracture. During his stay at the Department of Surgery, conservative treatment was used and the patient's health condition was monitored. Diagnostic workup, including echocardiography, was done and pericardial sac fluid was excluded. Ultimately, no surgical interventions were needed, and the patient was transferred to the Traumatology Clinic, where an open reduction with internal stabilisation of the fractured clavicular shaft was performed using the VariAx Clavicle plate (Stryker). The patient was discharged home in good general and local condition, with instructions for further outpatient care. (After conservative treatment and postoperative status is shown in Figure 7).

Case 8

A 42-year-old woman was admitted due to multiple-site trauma sustained as a result of a fall from a horse and subsequent crushing. The patient complained of multisite pain. Trauma scan showed right-sided pneumothorax and fractures of ribs 4–9 on the right side and ribs 6–11 on the left side, as well as pubic and sacral fractures. After consultation, it was decided to treat the patient con-

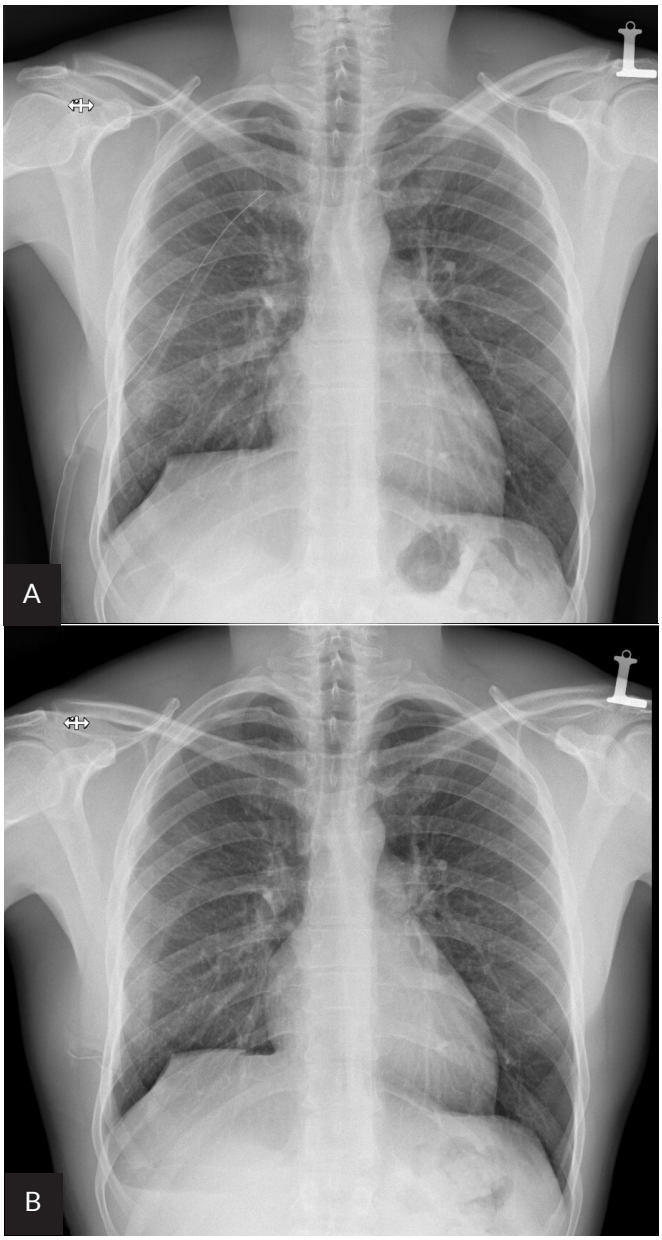

Figure 9. Case 9. X-ray**. A.** After drain. **B.** At discharge

servatively. Analgesic treatment and respiratory training led to spontaneous regression of pneumothorax. Further treatment of the pelvic fractures was continued by the team of the Traumatology Clinic. (Status on admission and at discharge is shown in Figure 8).

Case 9

A 36-year-old soldier was admitted with symptoms of dyspnoea after intensive physical exertion. X-ray revealed spontaneous right-sided pneumothorax. The patient was transported from the Polish Military Contingent with emergency pleural drainage. At WIM–PIB, he was first treated with chest drainage alone, followed by surgery using the right-sided VATS approach. A resection of the right lung apex, as well as pleurectomy and pleurodesis were done. These were followed by intensive respiratory rehabilitation, which resulted

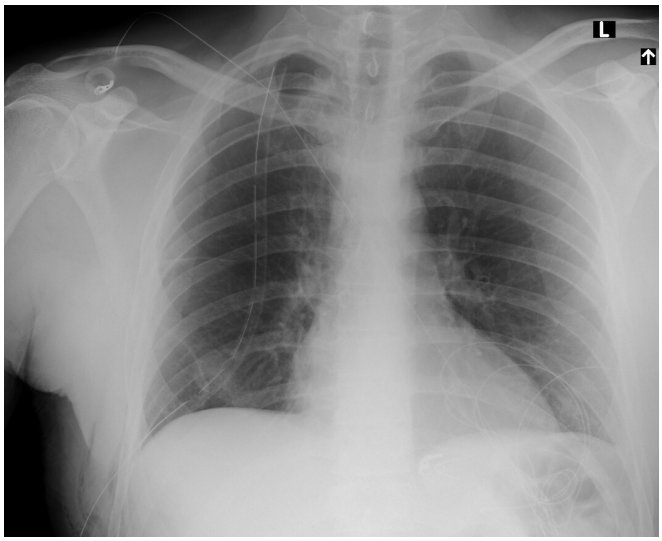

Figure 10. Case 10. X-ray after drain and VATS

in full sustained aeration of the lung, confirmed by imaging. The patient was discharged for outpatient follow-up. (Status post-drainage and on discharge is shown in Figure 9).

Case 10

A 36-year-old man was admitted due to sudden dyspnoea that occurred during a parachute jump. An X-ray showed spontaneous pneumothorax. The patient received a pleural drainage and was transported from the district hospital. Chest CT showed emphysematous bullae originating from the middle lobe and a residual pneumothorax. He was qualified and prepared for surgical treatment. A decision was made to perform decortication and marginal resection of middle lobe alveoli. The patient was discharged home on postoperative day 3 and continues outpatient care. (Status post-drainage and VATS is shown in Figure 10).

Case 11

A 47-year-old woman was admitted after a traffic accident, during which she suffered multiple organ injuries. Trauma scan showed a fracture of the pelvis, left lower limb and left ribs; a tear along the entire length of the diaphragm, from the sternum to the spine; and a traumatic thoracic hernia involving the abdominal organs: the transverse colon, greater omentum and stomach. After preparation, the patient underwent surgery using the VATS approach and left anterolateral thoracotomy with laparoscopy. The abdominal organs were reduced and repositioned below the sutured diaphragm, the remaining abdominal organs were checked and this stage of the surgery was closed. Then, a wedge resection of the upper lobe was performed due to adhesions, a fragment of the torn lingula was removed, and the upper lobe parenchyma was sutured using haemostatic and aerostatic TachoSil sponge. After surgery, the patient was transferred to the intensive care unit and as of the date of writing this paper, she continues her care there. (Pre- and postoperative status is shown in Figure 11).

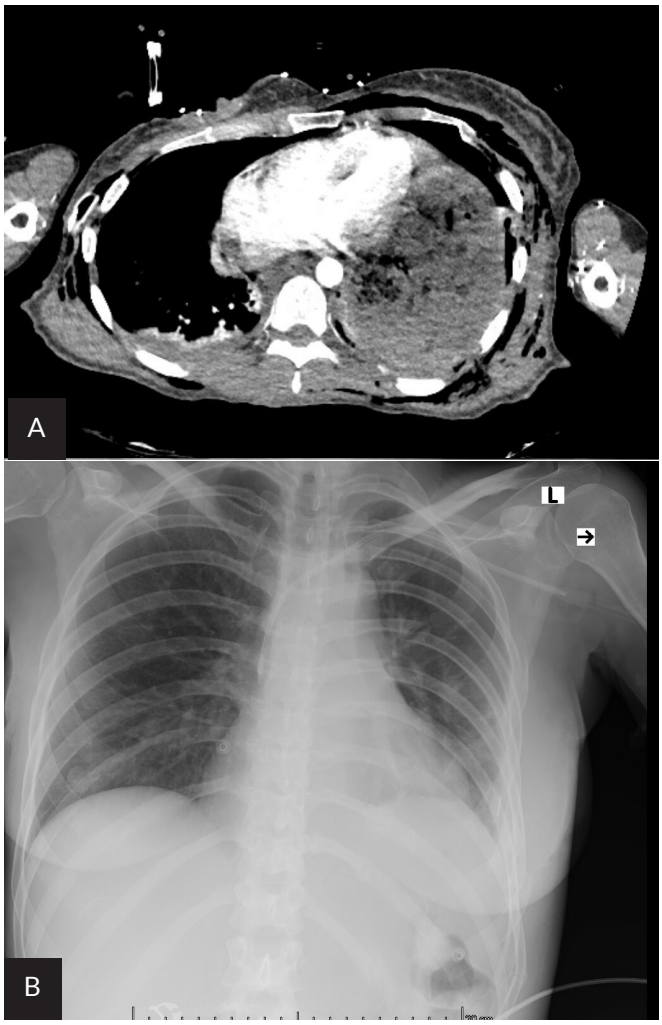

Figure 11. Case 11. **A.** Preoperative computed tomography. **B.** Postoperative x-ray

Discussion

Despite the decreasing number of fatal traffic accidents in Poland over the last twenty years [6], a total of 20,936 such incidents, with 24,125 people injured, were recorded in our country in 2023 [7]. The growing popularity of electric scooters, of which one of the described patients was a victim, also contributed to the increase in the frequency of accidents [8]. Currently, the Military Medical Institute - State Research Institute is the only military hospital with the Department of Thoracic Surgery, which supports the Trauma Centre. Since the procedures described above represent a standard known from European thoracic surgery centres, it seems justified to develop this field of surgery, especially in the military health service. The Extended Focused Assessment with Sonography in Trauma (E-FAST) [9, 10] should be a standard assessment and one of the first to be performed in a trauma setting. Chest drain for life-threatening pneumothorax is the first invasive procedure performed immediately after ultrasound if indicated [11]. The presented cases indicate that minimally invasive thoracic surgery is used in the treatment of patients with chest trauma [12–14]. The average length of stay in the Department of Surgery was 7 days in the presented cases, which was 10 days shorter than the length of stay after multiorgan injuries reported by Pape et al. in their literature review [15]. Healthcare staff who are first to take charge of patient care in the hospital setting should receive basic training in thoracic surgery. Training and implementation of minimally invasive techniques is essential in modern and effective treatment in order to meet the needs of the Polish Armed Forces.

Conclusions

The study has shown that the extent of chest injuries has an impact on the direct threat to the patient's health and life. Immediate diagnosis and treatment already in the Emergency Department are often needed. Medical history, physical examination, and eFAST allow for rapid patient qualification for emergency chest drainage in order to stabilise their condition. After the initial treatment, further thoracic surgical management depends on CT findings.

Minimally invasive surgical techniques such as thoracoscopy/VATS can be successfully used in the treatment of chest trauma.

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56TH ANNUAL MEETING OF EUROPEAN SOCIETY FOR PAEDIATRIC NEPHROLOGY

56. Doroczny Zjazd Europejskiego Towarzystwa Nefrologii Dziecięcej

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Abstract

The paper is a report on the 56th Annual Meeting of European Society for Paediatric Nephrology in Valencia (Spain) in 2024. The conference began with a series of parallel workshops on acute kidney injury, urolithiasis and genetics. Over the next three days, the most current topics in paediatric nephrology were discussed, including voiding disorders, urinary tract defects, nephropathy, glomerulopathy, rare diseases and renal replacement therapy. Poland was represented by 39 people from several national paediatric nephrology departments and clinics.

Streszczenie

Artykuł jest sprawozdaniem z 56. Zjazdu Europejskiego Towarzystwa Nefrologii Dziecięcej, który odbył się w Walencji (Hiszpania) w 2024 roku. Konferencję rozpoczęła seria równolegle trwających warsztatów na temat ostrego uszkodzenia nerek, kamicy układu moczowego i genetyki. Przez kolejne trzy dni poruszono najbardziej aktualne tematy z zakresu nefrologii dziecięcej, dotyczące zaburzeń mikcji, wad układu moczowego, nefropatii, glomerulopatii, chorób rzadkich oraz terapii nerkozastępczej. Polskę reprezentowało 39 osób z większości krajowych oddziałów i klinik nefrologii dziecięcej.

Keywords: conference; ESPN; renal diseases

Słowa kluczowe: konferencja; ESPN; choroby nerek

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The 56th Annual Meeting of European Society for Paediatric Nephrology (ESPN) was held in Valencia (Spain) from 24 to 27 September 2024. The conference commenced with a series of parallel workshops on acute kidney injury („Acute kidney injury"), urolithiasis („Clinical approach in kidney stones", and genetics („When to order and how to read genetic report").

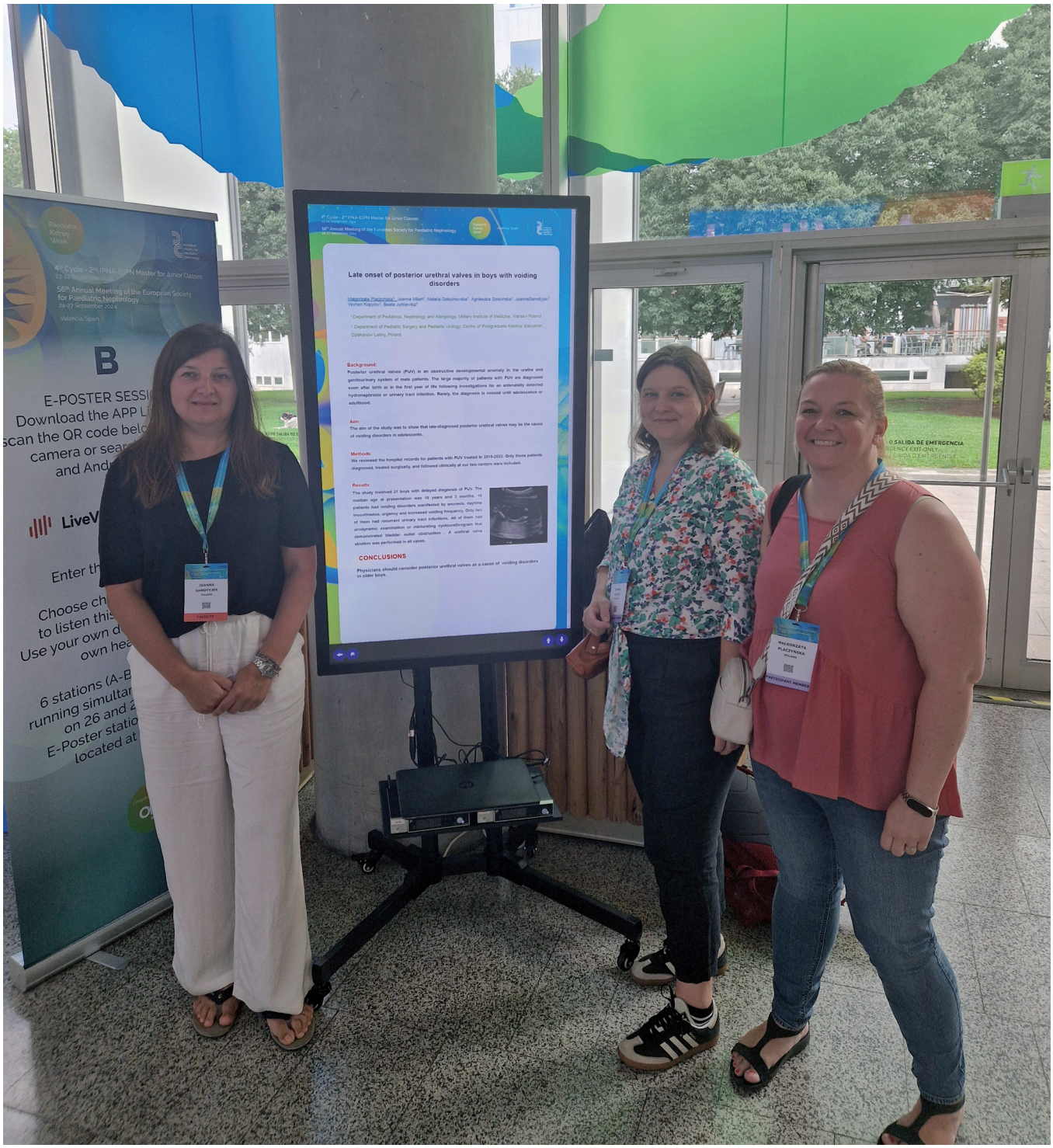
The opening of the conference on September 24 culminated with a lecture by Professor Nine Knoers from the Department of Genetics at the University Medical Center in Groningen in the Netherlands, provocatively entitled "Will genetics replace nephrology?". Professor Knoers discussed the current and future role of genetics in the diagnosis of paediatric nephrology patients. She predicted that genetic tests will soon precede any other investigations to provide the basis for further diagnosis and treatment planning.

Over the following three days, the most current topics in paediatric nephrology, such as voiding disorders, urinary tract defects, nephropathy, glomerulopathy, rare diseases and renal replacement therapy, were discussed during lectures held simultaneously in three auditoriums.

Many young scientists had an opportunity to present their research during short, 3-minute sessions. A review of newly launched research and disease registries was also presented.

Much attention was paid to the genetic background of kidney diseases, urinary tract defects in particular.

Topics important for young scientists, such as public presentations ("Public speaking workshop – learn by doing") and publishing scientific articles ("Meet the editor: How to get your paper published?"), were also addressed.



[From left] Joanna Samotyjek, Joanna Milart and Małgorzata Placzyńska next to shared poster

The afternoon of the last day of the conference was devoted to lectures entitled “Work-life balance”, to which the families of the participants were also invited.

For the first time, the ESPN conference was merged with the 52nd Annual Meeting of the European Working Group on Psychosocial Aspects of Children with Chronic Renal Failure (EWOPA).

Poland was represented by 39 specialists from most of the country’s paediatric nephrology departments and clinics. The Department of Paediatrics, Paediatric Nephrology and Allergology of the Military Institute of Medicine was represented by Małgorzata Placzyńska, MD, PhD; Anieszka Gościńska, MD; and Joanna Milart, MD, who presented the following works during the poster session: ”The usefulness of calprotectin and YKL-40 in urinary tract infections diagnosis in children up to 2 years of age” and “Late onset of posterior urethral valves in boys with voiding disorders”.

The possibility of bringing children, for whom a nursery and kindergarten were arranged throughout the dura-

tion of the conference, was a novelty and convenience for young parents.

Participation in the conference, enjoying lectures and taking part in in workshops, as well as conversations and meetings behind scenes, were a source of inspiration and new ideas for scientific work and joint projects, both in the national and international arena.