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RATOWNICTWO MEDYCZNE

FLEX-TIP BOUGIE FOR ENDOTRACHEAL INTUBATION BY PARAMEDICS

MANAGEMENT OF OBESE PATIENTS IN EMERGENCY MEDICAL SERVICES

INTRAVENOUS LIDOCAINE AS SUCCESSFUL PAIN THERAPY MANAGEMENT

ASPECTS OF POLYPHARMACY IN POLAND

Vol. 12 | No 1 | 2025 January – March ISSN 2391-7822

EMERGENCY MEDICAL SERVICE

RATOWNICTWO MEDYCZNE

Vol. 12 | No 1 | 2025 January – March ISSN 2391-7822

THE JOURNAL IS AFFILIATED TO THE FACULTY OF HEALTH SCIENCES OF THE MEDICAL UNIVERSITY OF WARSAW, POLAND

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Emerg Med Serv, 2025; XII, 1: 5-8

DOI: 10.36740/EmeMS202501101

ORIGINAL ARTICLE

The comparison of flex-tip – maleable tip intubation stylet and standard bougie intubation stylet during endotracheal intubation using Macintosh laryngoscope performed by paramedics: a cross-over manikin study

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ABSTRACT

Aim: Tracheal intubation is generally considered to be an optimal method of protection of airway. Main goal of this study is the evaluation of effectiveness of intubation with the use of new type flex-tip – maleable tip intubation stylet, performed by paramedics.

Materials and methods: 158 paramedics participated in the research. After ethics committee approval intubations were performed on manikin model designed for training of endotracheal intubation. Participants trained use of studied device before study. The time needed for first pass successful intubation and possible complications were recorded.

Results: Intubation effectiveness with use of flex-tip intubation stylet was higher than the standard bougie: 67.7% (107/158 of successful first pass intubations) *vs.* 57% efficiency (91/158) when bougie was used with no statistical significance ($p>0.05$). However, the number of successful intubation performed within 30 seconds was 93/107 (87%) *vs.* 53/91 (58%) attempts for flex-tip and standard bougie intubation stylet respectively with statistical significance. Average time of first pass successful intubation with use of flex-tip intubation stylet was slightly shorter than intubation time when bougie was used: 27.3 ± 11.8 s *vs.* 29.1 ± 12.5 s in flex-tip and bougie intubation stylet respectively with statistical significance. No complications were observed.

Conclusions: The effectiveness is higher within recommende 30 sec time of intubation and the intubation time is slightly shorter when flex-tip intubation stylet is used comparing to standard intubation bougie.

KEY WORDS

intubation, paramedics, bougie, flex-tip stylet

INTRODUCTION

Intubation is considered to be most difficult to perform among airway management methods performed by paramedics [1]. Paramedics intubate rarely, estimated 2-6 times per year [1]. Paramedics should remember that in case of failed intubation attempt other techniques are avaiable [2]. However, not only better equipment may help but proper training in using this equipment, procedures and guidelines are essential for success [3].

Following Difficult Airway Guidelines the time of one intubation attempt should not exceed 30 second [2]. Some devices can be a useful adjunct to intubation equipment influencing success ratio. According to producer, use of flex-tip intubation stylet (Construct Medical Pty Ltd, Hawthorn, Australia) allows to shorten the time of intubation in comparison to short, standard intubation stylet. The flex-tip intubation stylet has movable tip within the range from 30° to 60°, depending on intubation tube diameter (Fig. 1-3.). Another advantage is easiness to use of intubation stylet, it is because of use similar to bougie and better movement control provided by inflexible middle part.

AIM

The main goal of this study was to assess the first pass success (effectiveness) of intubation and the time of successful intubation with use of flex-tip intubation stylet comparing to standard intubation bougie stylet.

MATERIALS AND METHODS

158 paramedics participated in the study. After obtaining institutional ethic committee of Medical University of Lodz approval (RNN/363/13/KB date 21.05.2014 head: prof. P. Polakowski) the study begun on manikin model designed for training of endotracheal intubation. The participants were randomly allocated into two subgroups: standard bougie or flex-tip intubation stylet. After first attempt they switched to second device. Before

Table 1. Comparison of successful intubations (p= 0.001)

	Successful attempts	Failed attempts	All
Standard intubation bougie stylet	57% [91]	43% [67]	158
Flex-tip intubation stylet	68% [107]	32% [51]	158
All	62% [198]	38% [118]	316

Table 2. Average times of succesful attemps (mean ± SD)

	Successful attempts	Successful attempts under 30 seconds	Average time of successful attempt
Standard intubation bougie stylet	91	53	29.1 ± 12,5 s
Flex-tip intubation stylet	107	93	27.6 ± 11,8 s
All	198	146	28.35 ±12,15

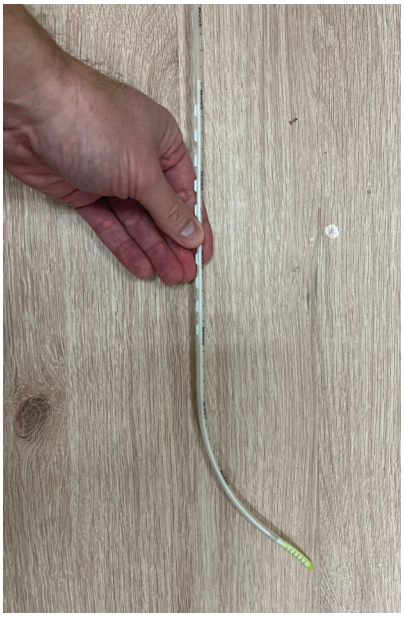

Fig. 1. Flex-tip bougie in neutral position

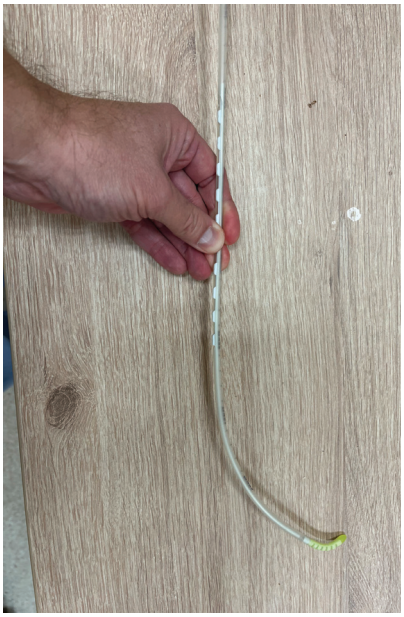

Fig. 2. Flex-tip bougie with tip aimed up by pulling the moveable reeding on bougie with thumb of operator during laryngoscopy

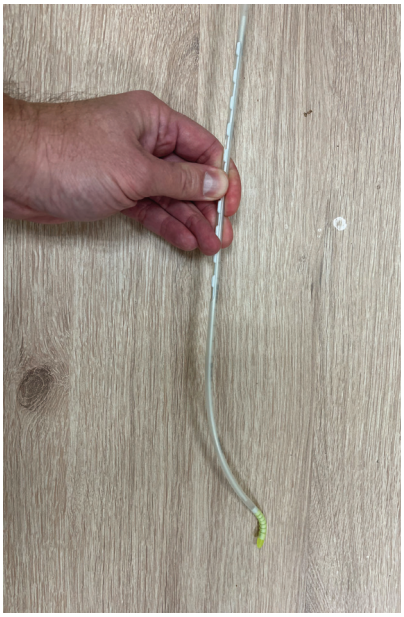

Fig. 3. Flex-tip bougie with tip aimed down by pushing the moveable reeding on bougie with the thumb of operator

the clinical study, each paramedics had a short training in use of flex-tip to become familiared with the device.

For purpose of this research, stopwatch was used to take measurements. The result was negative if time of one minute was exceeded, no maetter if the intubation was successful or not. The effectiveness of intubation was confirmed by bag ventilation of manikin`s lungs. Every paramedic had 1 attempt to simulate real conditions of endotracheal intubation in out-of-hospital settings. Nominal data are presented as n (percentage of the total) and were analyzed using the chi-square test. Continuous variables were assessed for normal distribution and are presented as means with standard deviations. Appropriate parametric tests were applied for statistical analysis. A p-value of <0.05 was considered statistically significant. All analyses were conducted using Statistica 13.1 PL software.

RESULTS

The rate of successful first-pass intubations was higher with the use of the flex-tip intubation stylet compared to the standard bougie intubation stylet: 107/158 (68%)

vs. 91/158 (57%; p>0.05; see Table 1). The number of successful intubations performed within 30 seconds was significantly higher for the flex-tip stylet: 93/158 (59%) *vs*. 53/158 (34%) for the standard bougie stylet (p<0.001). When considering only the first successful intubation, the time to success was slightly lower for flex-tip vs. standard bougie stylets: 27.3 ± 11.8 s *vs*. 29.1 ± 12.5 s (p=0.012; see Table 2).

DISCUSSION

Tracheal intubation during direct laryngoscopy is now the most popular method of advanced airway management in emergency. Frequency of intubation difficulties occurence in emergency during direct laryngoscopy is asestimated on 10-13% up to 50% [1]. In case of difficult intubation it is necessary to use of intubation aid - stylet, especially if it is performed by people who does not often do endotracheal intubation like paramedics.

The use of bougie-assisted method in intubation performed by paramedics was already assessed [4,5]. Phelan et al when compared success of styleted ETT intubation with Flex-Guide-assisted intubation found no significant difference between devices. They concluded that paramedics are more familiar styleted ETT technique [4]. Gregory et al when compared a Portex stylet, Portex and Frova single-use bougies, and a Portex reusable bougie even found that the proportion intubating within 30 s was significantly higher with the stylet compared with any bougie [5]. The results of those studies suggest that intubation stylet method is still better that other adjunct devices like bougies in case of intubation performed by paramedics.

In our research, similarly to Bell's report, it is proved that the use of new type of intubation stylet significantly shortens necessary time for intubation [6]. It might be assumed that use of this intubation stylet shortens time necessary for intubation in comparison to standard intubation stylet, both for skilled and less experienced operators [6].

In our study the number of successful first pass intubation performed below 30 s with use of flex-tip intubation stylet are 93/107 attempts. It means, when flex-tip intubation stylet is used, there are 87% successful first pass attempts that are performed in recommended time comparing to standard intubation stylet where for 91 successful intubations there are only 53 performed below time of recommended 30 seconds [2].

The results corresponds with Reus' research (in Germany) in which average time for Truflex (Truphatek, Israel) intubation stylet, which is a fex-tip intubation stylet, was 26.4 s ± 5.5 s which is comparable to our results [7]. The study of Reus` was performed on a group of anesthesiologist to make measurements but in the study there also participated people who had less than 1 year in job seniority. Similar observations had Liening et al, who compared Truflex with a hockeystick formed stylet in a simulated airway [8].

Another import aspect in use of Truflex intubation stylet is the level of visibility of entrance part of larynx on Cormack-Lehane scale, I and/or II degree and ability to use videolaryngoscope, it was presented in random research made by Al-Qasmi et al [9]. Use of Truflex intubation stylet during intubation with C-Mac videolaryngoscope facilitates visibility of entrance part of larynx. Presented study suggests higher effectiveness of Truflex intubation stylet in direct laryngoscopy in comparison with standard intubation stylet, it is due to ability to shape intubation tube in lower part, what helps to move the tube more skilfully and put it quicker into trachea. The use of Truflex stylet together with videolaryngoscopes is described in case of predicted very difficult intubations [10]. Another device which is similar to Truflex is The Flex-It stylet. However, in study of Turkstra et al the Flex-It stylet performed worse than standard intubation stylet [11]. In the study of Reus Truflex was considered to be better device that Flex-It stylet.

In the manikin simulation study Ruetzler et all found out that the flex-tip bougie offered similar overall and first attempt success rates in normal airway scenarios compared to the standard bougie. In more difficult scenarios , the flexible tip bougie was associated with similar overall success rates but less intubations attempts , less adjustments maneuvers, less dental compression, and easier use compared to standard bougie [12]. Time to intubation was similar to our results: 27 sec *vs.* 25-29 sec (scenarios A-D) in our and Ruetzler study respectivelly. In our study the success ratio was higher (68%) for flex-tip bougie but probably because group of participants: paramedics are more trained to intubate than nurses.

In other study on flex-tip bougie performed by et al. on group of 37 nurses the flex-tip bougie performed better than standard bougie [13]. The effectiveness of the first attempt intubation was 51.4% comparing to 37.8% for flex-tip and standard bougie respectivelly.

The role of bougie in intubation for resuscitation provided by paramedics was evaluated by Bonette et al [14]. On group of over 3000 pts they evaluated time of intubation and surviving ratio. They found out that use of bougie for intubation during resuscitation by paramedics prolongs time of intubation and has potential negative impact on surviving ratio. Latimer et al [15] in their study on over 800 pts intubated by paramedics in out-of-hospital settings revealed that first pass success ratio was higher when bougie was used for endotracheal intubation.

CONCLUSIONS

The flex-tip intubation stylet intubation stylet shows higher effectiveness of intubation in the first attempt within recommended 30 sec, in intubation performed by paramedics than standard intubation bougie stylet. Average intubation time is slightly shorter if flex-tip intubation stylet is used compared to standard intubation bougie stylet but without potential clinical relevance.

REFERENCES

1. Deakin CD et al. Prehospital advanced airway management by ambulance technicians and paramedics: is clinical practice sufficient to maintain skills? Emerg Med J. 2009;26(12):888-91.
2. Henderson JJ, Popat MT, Latto IP. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia 2004;59:675-694.
3. Burton HJ et al. Endotracheal intubation in a rural EMS state: procedure utilization and impact of skills maintenance guidelines. Prehosp Emerg Care. 2003;7(3):352-6.
4. Phelan MP, Moscati R, D'Aprix T, Miller G. Paramedic use of the endotracheal tube introducer in a difficult airway model. Prehosp Emerg Care. 2003 Apr-Jun;7(2):244-6.
5. Gregory P, Woollard M, Lighton D, et al. Comparison of malleable stylet and reusable and disposable bougies by paramedics in a simulated difficult intubation. Anaesthesia 2012;67(4):371-6. doi: 10.1111/j.1365-2044.2011.06999.x
6. Bell SF, Davies N, Crossley A. Glidescope guided intubation: Comparison of Frova introducer, GlideRite Rigid, GlideRite Auto and Truphatek Truflex stylets in a simulated difficult intubation. Cardiff University, Department of Anaesthesia, Intensive Care and Pain Medicine, Cardiff, United Kingdom. Airway Management 19AP 5-2, 235.2008. https://journals.lww.com/ejanaesthesiology/fulltext/2011/06001/glidescope_guided_intubation___comparison_of_frova.759.aspx [Access: December 2024].
7. Reus E, Liening K., Wrobel M. Flexible fiberoptic versus Parker Flex-It, Truflex and hockey stick formed stylet as an intubation guide with the videolaryngoscope McGRATH Series 5 in a simulated airway. University Hospital Homburg Germany Saar, Department of Anaesthesiology and Intensive Care, Homburg/ Saar, Germany. 19AP 5-10. 241 Airway Management 2008. https://journals.lww.com/ejanaesthesiology/fulltext/2012/06001/flexible_fiberoptic_versus_parker_flex_it,_truflex.800.aspx [Access: December 2024].
8. Liening K, Wrobel M, Grundmann U. Evaluation of the success rate of the intubation with the videolaryngoscope McGrath® in combination with the direction giving Truflex™ stylet versus a hockeystick formed stylet in a simulated airway, Saarland University Hospital, Department of Anaesthesiology and Intensive Care, Homburg/ Saar, Germany. 19AP 5-8 236 Airway Management 2008. Eur J Anaesthesiol. 2011;28:236-237
9. Al-Qasmi A, Al-Alawi W, Malik AM, Khan RM, Kaul N.Assessment of Truflex articulating stylet versus conventional rigid Portex stylet as an intubation guide with the D-blade of C-Mac videolaryngoscope during elective tracheal intubation: study protocol for a randomized controlled trial. Trials. 2013; 14: 298. doi: 10.1186/1745-6215-14-298
10. Gaszynski T. Comparison of the C-Mac video laryngoscope with the McGrath Series 5 video laryngoscope concerning an extremely difficult airway. Anaesthesiol Intensive Ther. 2016;48(1):55-7. doi: 10.5603/AIT.2016.0007.
11. Turkstra TP, Jones PM, Ower KM, Gros ML. The Flex-It stylet is less effective than a malleable stylet for orotracheal intubation using the GlideScope. Anesth Analg. 2009 Dec; 109 (6): 1856-9. doi: 10,1213.
12. Ruetzler K, Smereka J, Abelairas-Gomez C et al. Comparison of the new flexible tip bougie catheter and standard bougie stylet for tracheal intubation by anesthesiologists in different difficult airway scenarios : a randomised crossover trial. BMC Anesthesiol. 2020:20:90
13. Frass M, Smereka J, Ruetzler K et al. New flexible tip bougie catheter for difficult airway intubation. A randomised, crossover study. Disaster Emerg Med. 2019;4(2):50-54
14. Bonnette AJ, Aufderheide TP, Jarvis JL, Lesnick JA, Nichol G, Carlson JN, Hansen M, Stephens SW, Colella MR, Wang HE. Bougie-assisted endotracheal intubation in the pragmatic airway resuscitation trial. Resuscitation 2021 Jan;158:215-219
15. Latimer AJ, Harrington B, Counts CR, Ruark K, Maynard C, Watase T, Sayre MR. Routine Use of a Bougie Improves First-Attempt Intubation Success in the Out-of-Hospital Setting. Ann Emerg Med. 2021 Mar;77(3):296-304.

AVAILABILITY OF DATA AND SUPPORTING MATERIALS

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

CONFLICT OF INTEREST

The Authors declare no conflict of interest.

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RECEIVED: 15.10.2024
ACCEPTED: 16.01.2025

A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval

Emerg Med Serv, 2025; XII, 1: 9-17

DOI: 10.36740/EmeMS202501102

ORIGINAL ARTICLE

Interventions of emergency medical teams in children under 4 years of age – a two-year follow-up

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ABSTRACT

Aim: To analyze the incidence of emergencies in children under 4 years of age and the emergency medical services provided at the scene based on data from ambulance personnel providing services in the Kujawsko-Pomorskie Voivodeship in Poland.

Material and methods: Electronic data from the emergency medical teams' dispatch forms of the Voivodship Ambulance Station in Bydgoszcz concerning services provided to children under 4 years of age in 2018-2019 wasused for the retrospective study, (i.e.: number of interventions, medical emergency procedures performed, reason for the call, diagnosis acc. to ICD 10, elements of physical examination, decision on transport to hospital). The study obtained the approval of the Bioethics Committee KB 96/2020. The data was compiled using Microsoft Excel and the STATISTICA 10 statistical software package.

Results: There were 1988 interventions in children under 4 years of age, representing 2% of all visits. 8756 procedures were performed, most of which were basic. The most commonly administered medicine was Paracetamol. 71% of children were transported to hospital. Death was declared in 4 children.

Conclusions: Although emergencies in children in pre-hospital care are rare, one third of interventions are performed with the first urgency code. Most often, calls involve children with fever, nausea and vomiting, convulsions, cough and respiratory disorders, abdominal pain and injuries. Emergency services are usually limited to basic interventions. Advanced procedures are rarely performed.

KEY WORDS

emergency medical team, pre-hospital care, emergencies in children

INTRODUCTION

Calls for pediatric patients represent a small proportion of all pre-hospital interventions and amount to several percent [1-3], of which immediate life-threatening conditions are diagnosed in a few young patients [1, 4]. However, many diseases or emergencies and their symptoms are specific to children only [5]. Therefore, due to the specific character of pediatric patients, interventions in young patients are a challenge for emergency medical teams (EMTs) and can cause a lot of emotions, including stress, in emergency medical service team members. This is because dealing with children requires a rescuer to have specialist knowledge of the specificity of a pediatric patient: from the anatomical and physiological peculiarities depending on the child's developmental age to the precise dosage of medication. Some experience in working with children is also important. This is necessary for the correct assessment of the child's condition and then for the effective provision of assistance, the implementation of safe pharmacotherapy and the use of rescue equipment of the size appropriate for the child [6]. In view of the above, many centers introduce regular simulation exercises for medical staff to ensure high quality emergency medical care provided to children [7-9]. The promotion of this form of in-service training appears to be of particular importance for members of emergency medical teams (EMT), as it can increase staff confidence in the correct handling of life- and health-threatening emergencies in children, thus the provision of high-quality care under stressful conditions.

AIM

The aim of the study was to analyze the incidence of emergencies in children under 4 years of age and the emergency medical services provided at the scene based on data from ambulance personnel providing services in the city of Bydgoszcz and the Bydgoszcz district in Poland.

MATERIAL AND METHODS

The study was of retrospective nature. The study used electronic data from the emergency medical team dispatch form of the Voivodeship Ambulance Station in Bydgoszcz completed during interventions in children from 0 to 3 years of age of age from the 1st of January 2018 to the 31st of December 2019. The study included patients aged less than 4 years at the time of the emergency medical teams intervention. The exclusion crite-

Table 1. Number of EMT visits to children under 4 years of age-by-age category and year of visit

Year	2018		2019		Total	
Age	**N=971**	**%**	**N=1017**	**%**	**N=1988**	**%**
< 1 year (0)	293	30,1	307	30,2	600	30,2
1 year (1)	298	30,7	312	30,7	601	30,3
2 years (2)	193	19,9	213	20,9	406	20,6
3 years (3)	187	19,3	185	18,2	372	18,9
Total	971	100,0	1017	100,0	1988	100,0

Table 2. Location of the incident, urgency codes and seasonality of EMS interventions (2018–2019)

	Year	2018		2019		Total	
		N=971	**%**	**N=1017**	**%**	**N=1988**	**%**
The place of the incident	home	865	89,1	868	85,3	1733	87,2
	public	56	5,8	86	8,5	142	7,1
	street and road traffic	29	3	47	4,6	76	3,8
	school	18	1,9	14	1,4	32	1,6
	agriculture	3	0,3	2	0,2	5	0,3
	Total	971	100	1017	100	1988	100
Urgency code	urgency code 1	156	16,1	510	50,1	666	33,5
	urgency code 2	815	83,9	507	49,9	1322	66,5
	Total	971	100	1017	100	1988	100
Month	January	106	10,9	99	9,7	205	10,3
	February	107	11	111	10,9	218	11
	March	94	9,7	99	9,7	193	9,7
	April	76	7,8	83	8,2	159	8
	May	64	6,6	74	7,3	138	6,9
	June	67	6,9	83	8,2	150	7,5
	July	66	6,8	74	7,3	140	7
	August	58	6	56	5,5	114	5,7
	September	72	7,4	84	8,3	156	7,8
	October	81	8,3	87	8,6	168	8,5
	November	86	8,9	81	8	167	8,4
	December	94	9,7	86	8,5	180	9,1
	Total	971	100	1017	100	1988	100

rion was that the child had reached 4 years of age. For the purposes of the analysis, the children were divided into four age categories: under 1 year of age (0), 13-24 months (1), 25-36 months (2), 37-48 months (3).

The forms included information such as: demographic data of the children (age, sex), reason for the call, diagnosis of the disease according to ICD-10 categories, emergency medical procedures provided by the EMT, decisions on transport to hospital. The study obtained the approval of the Bioethics Committee of the Nicolaus Copernicus University in Toruń, Collegium Medicum in Bydgoszcz, Poland, KB 96/2020.

The data was developed using the standard functions of Microsoft Excel and the STATISTICA 10 statistical software package. The Student's T-test was used to compare average values between groups to assess the statistical significance of differences. The interdependence between the two variables was calculated using Spearman's R correlation coefficient. The level of significance of $p < 0.050$ corresponding to the statistical data obtained was assumed as a statistically significant relationship between variables.

RESULTS

In the years 2018-2019, there were 1988 EMT services involving children under 4 years of age, of which 1089 calls were for boys and 899 for girls. Services involving children in this age category accounted for 2.4% of all EMT interventions during the study period (N=84 208). Most interventions were for infants and children over 12 months old. (Table 1).

By far, EMTs most frequently departed for incidents that occured at home (Table 2).

The majority of incidents (n=1483, 74.6%) were recognized by the dispatcher as health or life-threatening conditions – 75.6% in 2018 and 73.6% in 2019, respectively. No significant correlation was found between the age, the gender of children and the qualification of the call as a health or life-threatening emergency ($p>0,05$). Despite this qualification of the calls, only a third of the trips were dispatched with urgency code 1 (with the siren on). What is notable, however, is the significant increase in the first urgency code trips from 16% in 2018 to 50% in 2019 (Table 2) ($t=17.248$; $df=1986$; $p=0.000$). Over the two years, four children died (two in each year studied).

The highest rate of EMTs calls in both years was in February (11%), January (10.3%), March (9.7%) and December (9.1%). While the lowest rate was in August (5.7%), May (6.9%) and July (7%). There was no statistical difference between the years of the study and the number of dispatched trips per month ($p>0.05$) (Table 2).

A total of 1988 codes for diagnoses made at the scene by EMTs were identified based on the International Classification of Diseases ICD-10 [10]. The diagnoses were classified according to ICD-10 major disease categories (Table 3). There was no statistical difference for disease diagnoses between boys and girls ($t=0,092$, $df=1986$, $p=0,927$).

Diagnoses under the R00-R99 category were predominant in each age category and most often concerned fever (20.1%, n=351), nausea and vomiting (6.7%, n=116), convulsions (4.5%, n=79), dyspnea and respiratory disorders (3.9%, n=61), cough (3.3%, n=54), abdominal pain (3%, n=49), and syncope (2.1%, n=35).

In children under a year old (0), one-fifth of the calls involved the Z00-Z99 category, which is used for the condition of a patient other than illness. Regarding the P00-P96 category for this group of children, choking diagnoses dominated, which accounted for 85.2% of diagnoses in this age group.

The proportion of J00-J99 diagnoses increased with age, among which acute upper respiratory tract infections were the most common (11.5%, n=209). There was a similar ratioof diagnoses in the S00-T98 category, among which head and craniofacial trauma were the most common (13.7%, n=220), burns to various body areas (4.4%, n=58), aspiration of foreign bodies into the respiratory tract (1.9%, n=32), and poisoning (2%, n=26).

In the I00-I99 category, 5 diagnoses were for sudden cardiac arrest and 1 for hemorrhagic stroke.

A total of 8756 procedures performed by EMTs were identified. Due to the wide variety of procedures recorded in the emergency medical services forms, the most frequent procedures and those relevant from the point of view of EMS were selected (n=5156). The most frequently performed procedures during EMT interventions were: monitoring of patients, assessment of consciousness according to the Glasgow Coma Scale, pharmacotherapy, assessment of the severity of injuries, temperature measurement and application of dressings. During the 2 years, extracorporeal cardiac massage was performed 7 times and tracheal intubation was performed 4 times (Table 4). A child's age influenced the procedures provided. More vascular accesses as well as body part immobilizations and dressings were applied in the age group of 3 years and 2 years.

The most commonly used drugs during pharmacotherapy included: the analgesic and antipyretic drug Paracetamol, nebulization drugs and the glucocorticoid drug Dexaven (Table 5). Children were also given Diazepam (most commonly used for epileptic seizures), Adrenaline (for sudden cardiac arrest or acute allergic reaction), as well as opioids and Ibuprofen. Fluid and oxygen therapy were also administered.

A statistically significant but weak correlation was observed between age and type of medication administered ($r=0.107$; $N=1986$; $p=0.001$). The fewest drugs were administered to children under 12 months of age (16%), which concerned all preparations listed in Table 5. A relatively smaller number of drugs was also administered to 3-year-old children (21.3%), with the most drugs administered in this age group being nebulized (33.8%) and Dexaven (41.7%). The most pharmacological interventions were noted in the group of 1-year-old children (1) (35.4%). Among them, Paracetamol (44.6%), opioids (42.1%) and infusion fluids (50%) were most frequently

Table 3. ICD-10 categories of diagnoses by age

Age		< 1 year		1 year		2 years		3 years		Total	
Code ICD-10	Meaning of the code	N=600	%	N=610	%	N=406	%	N=372	%	N=1988	%
A00-B99	Infectious and parasitic diseases	4	0,7	5	0,8	6	1,5	3	0,8	18	0,9
C00-D48	Neoplasms	1	0,2	0	0	0	0	0	0	1	0,1
D50-D89	Diseases of the blood and blood-forming tissues	1	0,2	0	0	0	0	0	0	1	0,1
E00-E90	Endocrine, nutritional and metabolic diseases	2	0,3	0	0	0	0	1	0,3	3	0,2
F00-F90	Mental and behavioral disorders	0	0	0	0	3	0,7	0	0	3	0,2
G00-G99	Diseases of the nervous system	2	0,3	6	1	2	0,5	7	1,9	17	0,7
H60-H95	Diseases of the ear and mastoid process	0	0	0	0	0	0	1	0,3	1	0,1
I00-I99	Diseases of the circulatory system	3	0,5	1	0,2	1	0,2	1	0,3	6	0,3
J00-J99	Diseases of the respiratory system	50	8,3	76	12,5	55	13,5	76	20,4	257	12,9
K00-K93	Diseases of the digestive system	6	1	3	0,5	3	0,7	1	0,3	13	0,7
L00-L99	Diseases of the skin and subcutaneous tissue	1	0,2	2	0,3	1	0,2	0	0	4	0,2
M00-M99	Diseases of the musculoskeletal system and connective tissue	0	0	0	0	0	0	1	0,3	1	0,1
O00-O99	Pregnancy, childbirth and puerperium	3	0,5	0	0	0	0	0	0	3	0,2
P00-P96	Selected conditions beginning in the perinatal period	27	4,5	3	0,5	0	0	0	0	30	1,5
Q00-Q99	Congenital malformations (...)	2	0,3	0	0	1	0,2	0	0	3	0,2
R00-R99	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	243	40,5	261	42,8	191	47	153	41,1	848	42,7
S00-T98	Injury, poisoning and certain other consequences of external causes	72	12	154	25,2	94	23,2	75	20,2	395	19,9
V01-Y98	External causes of morbidity and mortality	38	6,3	22	3,6	10	2,5	19	5,1	89	4,5
Z00-Z99	Factors influencing health status and contact with health services	145	24,2	77	12,6	39	9,6	34	9,1	295	14,9
Total	600	100	610	100	406	100	372	100	1988	100	

Table 4. Selected emergency medical procedures performed at the scene of an incident by year

Year	2018		2019		Total	
Emergency medical procedures	**N=3859**	**%**	**N=4897**	**%**	**N=8756**	**%**
monitoring	847	21,9	886	18,1	1733	19,8
assessment of awareness (GSC)	818	21,2	859	17,5	1677	19,2
pharmacotherapy	174	4,5	207	4,2	381	4,4
assessment of injury severity (RTS)	165	4,3	171	3,5	336	3,8
temperature measurement	128	3,3	165	3,4	293	3,3
glycemia measurement	70	1,8	55	1,1	125	1,4
bandage	57	1,5	60	1,2	117	1,3
stopping bleeding	46	1,2	38	0,8	84	1,0
insertion of iv catheter	33	0,9	49	1,0	82	0,9
oxygen therapy	45	1,2	29	0,6	74	0,8
nebulization	35	0,9	36	0,7	71	0,8
trauma examination	26	0,7	25	0,5	51	0,6
immobilization	15	0,4	30	0,6	45	0,5
ECG	12	0,3	29	0,6	41	0,5
suction	4	0,1	5	0,1	9	0,1
ventilation	5	0,1	5	0,1	10	0,1
immobilization with a cervical collar	3	0,1	2	0,0	5	0,1
heart massage	2	0,1	5	0,1	7	0,1
intubation	2	0,1	2	0,0	4	0,0
immobilization on a long spine board	2	0,1	2	0,0	4	0,0
oropharyngeal tube	1	0,0	5	0,1	6	0,1
ventilator	1	0,0	0	0,0	1	0,0
Other	1368	35,4	2232	45,6	3600	41,1

Table 5. Drugs used in the pharmacotherapy of children by the EMS

Year	2018		2019		Total	
Pharmacotherapy	**n=215**	**[%]**	**n=249**	**[%]**	**n=464**	**[%]**
Paracetamolum	77	35,8	100	40,2	177	38,1
Nebulization drugs	39	18,1	38	15,3	77	16,6
Dexamethasonum	33	15,3	27	10,8	60	12,9
Diazepamum	17	7,9	16	6,4	33	7,1
Adrenalinum	16	7,4	10	4,0	26	5,6
Opioids	9	4,2	10	4,0	19	4,1
Ibuprofenum	5	2,3	9	3,6	14	3,0
Medical oxygen	6	2,8	8	3,2	14	3,0
Infusion fluids	2	0,9	10	4,0	12	2,6
Other	11	5,1	21	8,4	32	6,9

administered. However, the low value of the correlation coefficient suggests that age is not the main factor determining the selection of drugs used, which indicates the important role of other variables, such as the patient's clinical condition or medical indications.

By the decisions of Emergency medical teams, 71.2% (n=1416) of children were transported to hospital, 73.9% (n=718) in 2018 and 68.6% (n=698) in 2019 respectively.

DISCUSSION

Emergency medical team interventions in children and adolescents up to the age of 18 years account for 4-5.5% of all pre-hospital interventions [1, 2]. An even lower percentage is reported for children under 4 years of age [11,12]. In this study, they accounted for 2.4%. Given the age of the study population, most interventions took place at home (87%). In the study by Domański et al. [13], who analyzed the incidence of injuries in the population of children up to 12 years of age, almost half of the injuries occurred at home. In the study by Długosz et al. where the population up to 17 years of age was analyzed, the distribution was completely different. The highest number of interventions took place at school (71%), followed by those on the street and in road traffic (9%), and lastly, emergency medical team domicile visits accounted for 4.2% [6]. The highest number of trips was recorded in winter, resulting from seasonal infections or slippery conditions predisposing to injury. The fewest interventions were recorded in the summer months (July, August) and in May. A similar trend was noted by Kucap et al. in their four-year study. In turn, in the study by Domański [13], the highest number of trauma cases among children was recorded from May to October.

One-third of the trips were dispatched with urgency code 1, i.e. with the siren on, while in the second year of the analysis, this number increased threefold. Having in mind the relatively short period of observation, it is difficult to unambiguously determine the reason for this difference, but extreme caution should always be exercised in the case of children. The difference may have been due to an increase in child morbidity in the period immediately preceding the Covid-19 pandemic in Poland, or it may have been caused by emergency medical teams being dispatched with code one 'exaggeratedly' due to the dispatcher's fear of possible consequences. All the more so as the majority of incidents in children were classified by the dispatcher, similarly in both years analyzed, as an emergency condition (75%). In the study conducted by Kucap et al. [11], children under one year of age were also more likely to receive EMT in the first urgency code. Moreover, in the case of these patients, a specialist ambulance with a doctor was more often sent to the scene of the incident.[11] In the study by Harve et al., few children were diagnosed with a life-threatening condition in the pre-hospital management and half of them required transportation to hospital [1]. In our study, more than 70% of children were transported to hospital. Similar results were obtained by Kucap et al. [11] in a study of the population of children under 18 years of age. This may be indicative of the consequences of EMT interventions in the case of calls classified as life-threatening conditions or of a certain play-safe attitude of the rescuers. Neurological emergencies in the form of epileptic conditions and the postictal phases of an epileptic seizure are particularly difficult and of great concern to rescuers [14]. In such situations, the child should always be transported to hospital.

EMTs were most frequently dispatched to conditions defined as symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99), including fever, nausea and vomiting, convulsions, dyspnea and respiratory disorders, cough and abdominal pain. This applies to almost half of interventions for children in each age category. Fever was also the most common reason for intervention in the group of children aged 0-24 months in Dudziński's study [12]. Other authors, among the pediatric emergency cases that require EMT intervention, apart from general diseases with fever, also mention convulsions [12], poisoning, burns [13], dyspnea as well as psychiatric emergencies [1, 3]. Injuries, mainly head and craniofacial ones, and poisoning (S00-T98) were also frequently diagnosed in children. The highest number of diagnoses in this category was in the group of one-year-old children. According to Domański, the most common cause of injuries in children under 2 years of age are falls from heights [13]. Diseases of the respiratory system were equally frequently diagnosed (J00-J99), including acute upper respiratory tract infections, which may be due to anatomical and physiological characteristics of a small child. The smaller airway diameter in children, combined with a higher rate of oxygen consumption, makes children particularly susceptible to rapid deterioration during airway impairment [15]. A study by Aftyka et al. on the causes of EMT calls also showed a higher incidence of trauma and respiratory illness in children aged 0-9 years [16]. Other researchers indicate that pediatric emergencies were mostly related to respiratory failure [1, 3]. This was also the most common reason for transporting children to hospital [3]. This is justified because inadequate treatment of acute respiratory failure or delay of necessary medical interventions can result in hypoxia, brain damage, cardiac arrest and death of a child [17]. In infants and children under 2 years of age, one of the causes of acute respiratory failure is foreign body aspiration [12, 18]. It is also the main cause of infant death [19]. In our study, choking was most common in children under 12 months of age.

Of note is the category described as factors influencing health status and contact with health services (Z00-Z99). This includes circumstances or problems affecting the patient's health status that do not in themselves constitute illness or injury, while the contact with the healthcare system is aimed at receiving limited assistance or service appropriate to the condition [20]. This was the most common diagnosis in children up to 12 months just behind R00-R99 and successively decreased with

the increase in the child's age. This may indicate that, in the case of infants and children up to 1 year of age, parents are more likely to call the Emergency Medical Service as a precautionary measure out of concern for their child's condition. Dudziński [12] also notes the frequent occurrence of diagnoses in this category.

Cardiovascular emergencies are relatively rare in children. They are caused by heart defects, conduction disorders and acquired diseases [21]. During the study period, diseases of the circulatory system (I00-I99) were diagnosed in only six cases. In contrast, extracorporeal cardiac massage was performed seven times in children, of which four patients were intubated. Similar results were presented in their paper by Domański et al. [13]. Emergency intubation, especially in young children, is a high-risk procedure and its success rate during the first attempt in the pre-hospital setting amounts to 66-79% [22, 23]. Such infrequent performance of this procedure should be a motivation for the members of the Emergency medical teams to train systematically so that, in a life-threatening emergency situation, the procedure is performed quickly and correctly, minimizing the risk of complications. In this study, the mortality rate among children was 0.2%, similar to the study by Kucap et al. [11]. Domański also draws attention to the low mortality rate among pediatric patients [13]. The analysis of emergency medical procedures performed revealed that non-invasive activities dominated, i.e. monitoring and assessment of consciousness according to the Glasgow Coma Scale, which confirms that advanced life-saving activities are rarely performed in children. In Domański's study, monitoring and pharmacotherapy were also the most frequently performed procedures [13]. Many EMTs visits end with the measurement of basic vital signs and transporting a child to hospital according to the 'load and go' principle, without establishment of vascular access or performing other activities. This is particularly evident in the group of the youngest children, who often present a great challenge for members of EMTs. The effect of the child's age on the undertaking of rescue activities was noticed. In younger children, those activities were performed less frequently and, among others, the number of intravenous insertions or fracture immobilisations increased with the age of the child. It seems safer for first aiders to transport a young child to hospital and hand it over to pediatric specialists. In slightly older children, they try to perform medical procedures themselves.

Similar behavior can be observed for pharmacotherapy in children. Children aged up to 12 months were given fewer medication as children in other age groups. The higher the age of a child, the more often members of EMTs used pharmacotherapy. The reason for this may be, on the one hand, the difficulty of calculating doses individually in such young children and the fear of accidental overdose. On the other hand, when a child's condition is deteriorating rapidly, it may be safer to limit pharmacological treatment and transport the child to hospital as soon as possible [24]. Kaufmann et al, emphasize that in such situations, it is important to accurately complete medical records including the emergency medical procedures performed in such situations, the pharmacotherapy administered and the decision to transport to hospital [24]. In the case of pharmacotherapy for emergency conditions in children, it is very important to know the medications used in the treatment of pediatric emergencies, indications for use and changes in drug dosing regimens, as well as the availability of new preparations on the market [12, 25].

The two-year follow-up by Yuknis et al. showed few advanced life-saving interventions. The most common of them were: oxygen therapy, the use of salbutamol and the establishment of vascular access [3]. In the author's own study, the most common drug used by the EMTs was the analgesic and antipyretic drug Paracetamol, which is justified by the number of febrile diseases diagnosed, followed by nebulization drugs for upper respiratory tract infections and Dexaven, an anti-inflammatory and anti-allergic steroid used also in acute life-threatening conditions, including shock of various etiologies, cerebral edema, laryngeal and vocal cord edema, asthma and acute allergic reactions. In Dudziński's study, pharmacotherapy was more frequently used in children by specialist EMTs and the most frequently administered drug, similarly to the present study, was Paracetamol [12].

Emergency medical team trips to incidents involving children, especially the youngest ones, are fraught with stress. Their infrequent occurrence is not conducive to building self-confidence among members of medical personnel. Coping with life and health-threatening emergencies in young children requires emergency medical team members to have specialist knowledge, practical skills and appropriate equipment. Participation in training and practical courses in pediatrics can help emergency medical team members to prepare for these rare emergencies, better assess the child's condition and implement optimal treatment.

CONCLUSIONS

1. Life-threatening conditions in children in pre-hospital care are rare, yet one third of EMT trips to children take place with the first urgency code.
2. Emergency medical team visits most often involve children with fever, nausea and vomiting, convulsions, cough and respiratory disorders, abdominal pain, as well as injuries, mainly head and craniofacial ones.
3. Emergency medical services are usually limited to basic interventions. Advanced procedures are rarely performed. In pre-hospital pharmacotherapy in children, the most commonly used drug is Paracetamol.
4. It is advisable for paramedics to systematically participate in pediatric training and practical courses in order to ensure high quality diagnostic-and-therapeutic services in life- and health-threatening situations in children.

REFERENCES

1. Harve H, Salmi H, Rahiala E, Pohjalainen P, Kuisma M. Out-of-hospital paediatric emergencies: a prospective, population-based study. Acta Anaesthesiol Scand. 2016;60(3):360-9. doi: 10.1111/aas.12648.
2. Główny Urząd Statystyczny. Pomoc doraźna i ratownictwo medyczne w 2021 roku. https://stat.gov.pl/obszary-tematyczne/zdrowie/zdrowie/pomoc-dorazna-i-ratownictwo-medyczne-w-2021-roku,14,6.html [Access: 01.12.2024]
3. Yuknis ML, Weinstein E, Maxey H, Price L, Vaughn SX, Arkins T, Benneyworth BD. Frequency of Pediatric Emergencies in Ambulatory Practices. Pediatrics. 2018;142 (2):e20173082. doi: 10.1542/peds.2017-3082.
4. Brazil V, Purdy EI, Bajaj K. Connecting simulation and quality improvement: how can healthcare simulation really improve patient care? BMJ Qual Saf. 2019; 28:862–865. doi: 10.1136/bmjqs-2019-009767.
5. Kleszczyński J. Stany nagłe u dzieci. [Emergencies in children]. Wydawnictwo Lekarskie PZWL. Warszawa, 2018, pp. 15-47 [Polish].
6. Długosz K, Trzos A, Łyziński K. Specyfika pacjenta pediatrycznego w zdarzeniach masowych i katastrofach. [The specificity of the pediatric patient in mass incidents and disasters. Na Ratunek. 2018;1:36-43 [Polish].
7. Savoldelli GL, Burlacu CL, Lazarovici M, Matos MR, Østergaard D. Integration of simulation-based education in anaesthesiology specialist training: synthesis of results from an Utstein Meeting. Eur J Anaesthesiol. 2024;41(1):43-54. doi: 10.1097/EJA.0000000000001913.
8. Bielka K, Kuchyn I, Fomina H, Khomenko O, Kyselova I, Frank M. Difficult airway simulation-based training for anaesthesiologists: efficacy and skills retention within six months. BMC Anesthesiol. 2024; 24(1):44. doi: 10.1186/s12871-024-02423-x.
9. Pacheco GS, Leetch AN, Patanwala AE, Hurst NB, Mendelson JS, Sakles JC. The pediatric rigid stylet improves first-pass success compared with the standard malleable stylet and tracheal tube introducer in a simulated pediatric emergency intubation. Pediatr Emerg Care. 2023; 39(6):423–427. doi: 10.1097/PEC.0000000000002802.
10. International Statistical Classification of Diseases and Related Health Problems 10th Revision, ICD-10 Version: 2019. https://icd.who.int/browse10/2019/en [access: 27.12.2024
11. Kucap M, Biały K, Nadolny K, Ładny JR, Gałązkowski R. Pediatric Patient During Emergency Medical Team Intervention. Emerg Med Serv. 2022;9(4):217-236. doi: 10.36740/EmeMS202204104.
12. Dudziński Ł, Czyżewski Ł. Pediatric interventions in the practice of Medical Rescue Teams – observation 2019-2022. New Med. 2023;27(1):17-23. doi: 10.25121/NewMed.2023.27.1.17.
13. Domański M, Michalczewska A, Wierzejska N, et al. Characteristics of a trauma paediatric patient transported by emergency medical services: a retrospective analysis. Crit Care Innov. 2024;7(3):11-24. doi: 10.32114/CCI.2024.7.3.11.24.
14. Khojah I, Muthaffar O, Alalawi H, Alyazidi A, Alghamdi M, Alharbi O, Almuharib L, Salem M. Neuro-pediatric emergencies: clinical profile and outcomes. J Med Life. 2024;17(4):432-441. doi: 10.25122/jml-2023-0476.
15. Siu JM, Walter NE, Propst EJ. Assessing institutional pediatric airway emergency readiness: key components and practices. Curr Opin Otolaryngol Head Neck Surg. 2024; 32(6):428-437. doi: 10.1097/MOO.0000000000001020.
16. Afryka A, Rudnicka-Drożak E. Przyczyny wezwań Zespołów Ratownictwa Medycznego w materiale Wojewódzkiego Pogotowia Ratunkowego SP ZOZ w Lublinie [Medical Rescue Teams in the material of the Provincial Emergency Medical Service SP ZOZ in Lublin]. Anest Rat. 2013;7: 390-396 [Polish].
17. Daigle CH, Fiadjoe JE, Laverriere EK, et al.Difficult Bag-Mask Ventilation in Critically Ill Children Is Independently Associated With Adverse Events, Crit Care Med. 2020; 48(9):744-752. doi: 10.1097/CCM.0000000000004425.
18. Ciftci AO, Bingöl-Koloğlu M, Senocak ME, Tanyel FC, Büyükpamukçu N. Bronchoscopy for evaluation of foreign body aspiration in children. J Pediatr Surg. 2003;38(8):1170-1176. doi: 10.1016/s0022-3468(03)00263-x.
19. Doody DP. Foreign body aspiration. In: Grillo HC, editor. Surgery of the Trachea and Bronchi. 1st Ed. Ontario: BC Decker Inc. 2004;707–718.
20. Rejestr Systemów Kodowania, Międzynarodowa Statystyczna Klasyfikacja Chorób i Problemów Zdrowotnych, Rozdział XXI Z00-Z99 Czynniki wpływające na stan zdrowia i kontakt ze służbą zdrowia. https://rsk3.ezdrowie.gov.pl/resource/structure/icd10/00CD10/012/element/Z00-Z99/url%3DaHR0cHM6Ly9yc2szLmV6ZHJvd2llLmdvdi5wbC9yZXNvdXJjZS9zdHJ1Y3R1cmUvaWNkMTAvMDBDRDEw [Access:27.12.2024].
21. Rose JA. Pediatric Cardiovascular Emergencies, Pediatric Emergencies: A Practical, Clinical Guide. Oxford University Press. 2020, pp. 182-205.
22. Prekker ME, Delgado F, Shin J, et al. Pediatric intubation by paramedics in a large emergency medical services system; prosess, challenges, and outcomes. Ann Emerg Med. 2016; 67(1):20-29. doi: 10.1016/j.annemergmed.2015.07.021.
23. Tollefsen WW, Brown CA, Cox KL, Walls RM. Two hundred sixty pediatric emergency airway encounters by air transport peronnel: a report of the air transport emergency airway management (NEAR VI: "A-TEAM") project. Pediatr Emerg Care. 2013; 29(9):963-968. doi: 10.1097/PEC.0b013e3182a219ea.
24. Kaufmann J, Engelhardt T, The Expert Group coordinated by the German "Association of the Scientific Medical Societies (AWMF)". The German guidelines for medication safety in pediatric emergencies. Pediatr Anesth. 2022;32:1084-1090. doi.org/10.1111/pan.14524.
25. Shenoi RP, Timm N. Drugs Used to Treat Pediatric Emergencies. Pediatrics. 2020; 145(1): 288- 292. doi: 10.1542/peds.2019-3450.

CONFLICT OF INTEREST
The Authors declare no conflict of interest.

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RECEIVED: 15.10.2025
ACCEPTED: 05.01.2025

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Emerg Med Serv, 2025; XII, 1: 18-24

REVIEW ARTICLE

DOI: 10.36740/EmeMS202501103

Management of obese patients in transport and emergency medical services - analysis of problems and solutions

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ABSTRACT

Obesity presents significant challenges for emergency medical teams due to its impact on patient care and the complexity of medical procedures. People with obesity are at higher risk for various acute conditions, including cardiovascular diseases, respiratory complications, and metabolic disturbances, which require urgent intervention. The increased demand for specialized equipment, such as bariatric stretchers and life-support devices, complicates both patient transport and treatment, potentially delaying care. Moreover, procedures like intubation and cardiopulmonary resuscitation are more difficult in obese individuals, increasing the risk of complications. A challenge for emergency teams in the context of transporting obese patients is also the increased risk of musculoskeletal injuries for medics. Staff training in ergonomics and the specific challenges of caring for obese patients can help protect emergency team members. The aim of this paper is to analyze the practices and importance of adapting emergency medical services with specialized devices such as videolaryngoscopes, portable ultrasound devices used for both diagnostic and assistance in setting up venous access, as well as updated protocols, can significantly improve the quality and effectiveness of interventions.

KEY WORDS

emergency medical care, obesity, medical transport, prehospital care

INTRODUCTION

Obesity is one of the most significant health challenges faced by contemporary societies, with its consequences also evident in the field of emergency medical services. According to data from the World Health Organization (WHO), the number of obese individuals worldwide has doubled since 1990 [1], leading to an increasing demand for adequate medical care, including emergency interventions. Obesity, defined as an excessive amount of body fat, not only increases the risk of many chronic diseases such as heart disease, diabetes, and hypertension but also creates numerous difficulties in providing medical assistance during emergency situations [2, 3]. In 2015, overweight and obesity were responsible for approximately 4 million deaths worldwide. By 2019, the number of deaths linked to obesity was estimated at 5 million, placing a significant burden on healthcare systems in many countries. The majority of deaths related to high BMI were caused by cardiovascular diseases, with 60% of these deaths occurring among obese individuals [1, 4]. In Poland, the reimbursement of treatment costs for obesity-related complications was estimated to be at least 3.8 billion PLN in 2023. Additionally, diseases associated with obesity account for approximately 25% of hospital admissions across the country, highlighting the extensive resource utilization attributed to these conditions [5, 6]. In the context of emergency medical services, obese patients represent a higher-risk group not only due to challenges in assessing their health status but also in administering medications, transporting, and ensuring proper ventilation. Moreover, the specificity of emergency interventions requires the adaptation of medical procedures, equipment, and the skills of emergency medical teams to meet the needs of this patient group.

AIM

The aim of this paper is to present the challenges faced by emergency medical teams providing assistance to obese patients and to discuss advancements that could improve the quality and effectiveness of these interventions.

REVIEW AND DISCUSSION

INCREASED RISKS OF HEALTH PROBLEMS

Excess body weight correlates with a higher incidence of various health conditions, including cardiovascular diseases, which often have an acute course and require rapid intervention, such as myocardial infarction and stroke. The first major epidemiological study began in 1948, conducted as part of the Framingham Heart Study, confirmed that for the development of heart failure obesity is an independent risk factor, with each 1 kg/m^2 increase in BMI raising the risk of heart failure by 7% in women and 5% in men. Compared to individuals with normal body weight, obese individuals had twice the risk of heart problems, regardless of age, lifestyle, and comorbidities. This is related to chronic inflammation, insulin resistance, and elevated blood lipid levels, which are characteristic of individuals with excessive body weight [7]. Obesity also impacts the respiratory system, increasing the risk of obstructive sleep apnea, leadig to sudden hypoxemic events. In an analysis involving over 10,000 participants, obesity combined with oxygen desaturation during sleep was a significant factor in increasing the risk of cardiovascular incidents such as heart failure, myocardial infarction, and stroke [8]. Furthermore, obese individuals are more prone to acute metabolic incidents for example hyperglycemic episodes in type 2 diabetes or acute kidney failure due to excessive strain on this organ. A study conducted at Ninewells Hospital and Medical School in the United Kingdom analyzed a population of 367,051 individuals, including 8,655 diabetes patients, to determine the incidence and factors predisposing to severe hypoglycemia requiring emergency intervention. During the study period (12 months), 244 cases of severe hypoglycemia were recorded among 160 patients, with only 69 cases involving individuals with type 1 diabetes. The incidence of severe hypoglycemia was similar in patients with type 1 and type 2 diabetes treated with insulin, at 11.5 and 11.8 events per 100 patients annually, respectively [9].

In addition to internal diseases, obesity, particularly when combined with low physical activity, predisposes individuals to more frequent musculoskeletal injuries. Due to the impaired distribution of weight, patients with sarcopenic obesity have a higher risk of falling, and due to lower levels of vitamin D, which is important for bone metabolism, they are at increased risk of fractures [10]. Compared to lean individuals, there is an increased risk of wound infection in orthopedic surgeries and the development of pressure sores due to the patient's reduced mobility [11, 12].

These conditions have profound economic and systemic implications. Obese patients often require longer hospitalizations and more frequent medical interventions, placing a greater burden on healthcare systems. For example, hospital stays for obese patients have been shown to be longer than those for slimer patients (6.4 versus 6.1 days; $P<0.05$). Costs related to the treatment of complications and specialized equipment, such as bariatric beds and monitoring devices, further increase the financial strain [13]. In emergency services face particular challenges, as obesity affects treatment efficacy, complicates transport logistics, and increases the risk of complications during procedures such as intubation or cardiopulmonary resuscitation [12]. All the aforementioned conditions lead to an increased demand for healthcare services. From the perspective of emergency services, caring for obese patients is particularly challenging. Obesity affects the effectiveness of treatment, complicates patient transport, and may require specialized equipment, such as life-support monitoring devices adapted for higher body weight. It is also important to highlight the higher risk of complications during medical procedures, such as intubation or cardiopulmonary resuscitation.

MEDICAL PROCEDURES IN PREHOSPITAL CONDITIONS AND TRANSPORT

For patients weighing over 130 kg with acute conditions such as stroke, STEMI myocardial infarction, or trauma, the average time spent by the emergency team at the scene was approximately 0.7 minutes longer compared to lighter patients [14]. Seemingly small delay can have significant consequences in emergency scenarios where every minute is critical to patient outcomes. The additional time is often attributed to the logistical challenges posed by managing obese patients, including difficulties in performing diagnostic procedures, positioning and securing them for transport. Some of the problems are related to the unavailability of specialized equipment able to bear the weight of the patient. Standard stretchers and transport devices used in EMS have limited weight capacity (usually up to 180–250 kg), which makes them difficult to use for patients with morbid obesity. The introduction of bariatric stretchers with increased weight capacity (up to 350 kg and more) and specialized emergency vehicles remains a significant challenge for many EMS systems [15]. Such equipment is more expensive and less manageable in the limited space of an ambulance, which is why not all rescue teams are equipped with the items.

The low availability of appropriate equipment (e.g., electric stretchers), organizational limitations, and the lack of regular training further exacerbate the risk of injuries to the rescue team. Lifting and moving patients is also one of the most demanding aspects of emergency medical personnel work, carrying a significant risk of musculoskeletal injuries, particularly in the lumbar spine, shoulders, and lower limbs. In the case of obese patients, the risk of skeletal system injuries for responders increases due to higher loads, non-ergonomic body positions, and prolonged exposure to forces exceeding physiological safety limits. A major risk factor is manually lifting patients, which exposes responders to spinal overload, particularly in the lumbar region. Studies have shown that the compressive forces around the L5/S1 vertebra when lifting patients can exceed 3400 N, which

is higher than the biomechanical tolerance of the spine. Patients weighing more than 135 kg generate additional stress, leading to more frequent injuries such as muscle strains, ligament tears, and chronic back pain. Research has shown that shoulder, elbow, and wrist overuse injuries are particularly common in medical personnel during the manual transport of patients onto stretchers or wheelchairs [16].

Emergency medical personnel often work in confined spaces, such as narrow staircases, elevators, or cramped rooms. These conditions force responders to adopt non-ergonomic positions, such as bending and twisting the torso, which increases the risk of injury. Stairs, in particular, are hazardous, as uneven force distribution and instability can lead to falls or sudden overloads [17].

Transporting obese individuals presents a challenge. The increased risk of musculoskeletal injuries among medical responders, combined with the lack of specialized transport equipment, results in organizational and health-related consequences for both the patients and the medical staff. To prevent the injuries, comprehensive measures are necessary. Training and the implementation of workplace safety protocols, on ergonomic posture during transport and perfoming heavy lifting with several people, can be helpful, but the most important is access to specialized equipment. These interventions can not only improve the health and safety of medical personnel but also increase the efficiency of patient care [18].

USE OF ULTRASOUND

Excessive body fat reduces the quality of images obtained through methods like computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound (US). The limitations in ultrasound imaging quality mainly result from the physical properties of adipose tissue, which attenuates sound waves and reduces their penetration, making it difficult to assess abdominal organs or the heart. Ultrasound waves are dampened by fat tissue at a rate estimated to be about 0.63 dB per centimeter of fat. In patients weighing between 113 and 136 kilograms, imaging issues become particularly noticeable. Factors influencing ultrasound image quality include two types of fat distribution: subcutaneous fat and intra-abdominal fat. In patients with similar body mass but predominantly abdominal fat, higher-quality images can be obtained compared to those with a greater amount of subcutaneous fat [19].

A key advantage of ultrasound in this environment is its ability to detect free fluid in the abdominal cavity, organ injuries, changes in organ structure, pneumothorax, and cardiovascular and vascular issues early on. Particularly, the use of the FAST protocol allows for quicker preparation of the patient for further diagnostics or surgical treatment [20]. Focused Assessment with Sonography for Trauma (FAST) is a sonographic examination specifically designed to detect hemoperitoneum or hemopericardium, which may indicate internal bleeding, cardiac tamponade or organ injury following trauma. It provides a rapid, bedside assessment to facilitate immediate decision-making, reducing delays in initiating definitive treatment. The technique is particularly valuable for hemodynamically unstable patients, where it serves as the initial step in the diagnostic algorithm to determine the need for surgical intervention. The FAST exam typically includes four standard views: perihepatic area (Morrison's Pouch) perisplenic region, pericardial and pelvic view with pouch of Douglas and rectovesical space. Results for detecting hemiperitoneum demonstrate that focused abdominal US is sensitive (94%), specific (98%), and accurate (95%) [21]. Studies have shown that pre-hospital ultrasound led to changes in the management of trauma patients in five of the nine cases analyzed [20]. Low-quality ultrasound performed under challenging pre-hospital conditions can delay the detection of internal hemorrhages or injuries in obese patients, and therefore delay life-saving treatment.

Ultrasound is also used in obese patients when there are difficulties in establishing venous access. Venous access in this group presents a significant clinical challenge due to difficulties in identifying veins suitable for cannulation. Obesity is associated with deeper vein placement and increased subcutaneous tissue, which complicates palpation and visualization. As indicated by the Society of Hospital Medicine guidelines, the use of real-time ultrasound significantly improves the success of venous access procedures. This technique allows for precise determination of vessel size and depth and the identification of anatomical variations and clots prior to the procedure. It also enables identification of veins in difficult locations, such as the external jugular vein, femoral vein, or other deep vessels, accelerating the process and reducing the risk of complications. In cases of difficult venous access, ultrasound greatly increases the chances of success, reduces the number of insertion attempts, and lowers the risk of mechanical and infectious complications [22].

Data from a study indicated that 12.7% of 55 patients with morbid obesity (BMI > 40 kg/m^2) had no clinically detectable veins in any of the seven routinely assessed locations: the dorsal hand, antecubital fossa, medial biceps groove, dorsal foot, area above the medial ankle, neck above the external jugular vein, and the groin above the femoral vein. Despite these challenges, ultrasound enabled the identification of suitable veins for cannulation in all patients, even in those where veins were not visible or palpable clinically. Particularly useful locations included the antecubital fossa, medial biceps groove, and above the external jugular vein. These areas are easily accessible in emergency situations and have a high success rate for access when using ultrasound [23].

Ultrasound in emergency medical services is a valuable tool that enhances the efficiency of pre-hospital diagnostics and treatment in emergency conditions. Despite challenges related to imaging quality or technical limitations, the use of ultrasound in procedures such as FAST, cardiovascular and vascular assessment, and venous access significantly increases the chances of saving

a patient's life. Given the increasing number of obese individuals in society, it is important to properly train personnel and ensure access to specialized devices. This will improve procedures and enhance life-saving capabilities in challenging conditions.

INTUBATION

In obese patients, the risk of difficult intubation and failure to secure the airway is significantly higher compared to the general population. The anatomy and physiology of individuals with excess fat in the neck and chest areas, along with altered respiratory parameters, contribute to complications during standard intubation procedures. Excess fat around the neck causes narrowing of the pharyngeal space and limits access to the larynx during laryngoscopy. This is particularly noticeable when the tongue is enlarged, as it may fall backward during sedation or loss of consciousness, leading to partial or complete airway obstruction. In obese patients, there is also a higher likelihood of limited neck mobility due to fat tissue in the nape and increased strain on the neck muscles and joints. Full extension of the head and neck becomes restricted, making it difficult to achieve proper airway patency. As a result, there is increased difficulty identifying laryngeal structures such as the vocal cords, arytenoid cartilages, and epiglottis, which can lead to failure during the first attempt at intubation.

A cohort study from 2011 highlighted a correlation between obesity and difficulty with endotracheal intubation in pre-hospital care settings. Patients with class III obesity were nearly 3.7 times more likely to experience difficulty in intubation compared to individuals with a BMI below 30 kg/m^2. For patients with a BMI between 30 and 40 kg/m^2 (class I and II obesity), no significant correlation was observed with difficulty in intubation. The study also found no differences in intubation difficulty based on age or sex [24]. Obese patients are also at a higher risk of complications arising from difficult intubation. In intensive care units, 41% of difficult intubations lead to severe complications. In the study hypoxemia, defined as a saturation below 80%, occurs in 17% of cases, while circulatory collapse, characterized by a drop in blood pressure below 65 mmHg, affects 26% of obese patients [25]. Another significant issue is unintended esophageal intubation, which can lead to gastric aspiration and the risk of Mendelson's syndrome, further complicating management [25].

Emergency medical responders may perform endotracheal intubation when it is necessary to ensure airway patency, provide ventilation support, and protect the patient from gastric aspiration. Common indications include sudden cardiac arrest (SCA), especially in two-person teams, where intubation allows one team member's hands to be freed for other life-saving tasks. Intubation is essential in cases where airway patency cannot be maintained through simpler methods such as bag-mask ventilation, or when trauma to the face, neck, or chest threatens the airway. According to the guidelines of the European Resuscitation Council (ERC) from 2021 and the Polish Resuscitation Council (PRC) for out-of-hospital intubation, the procedure should be performed only by responders who have a high success rate (above 95%) in two attempts, with each intubation attempt lasting no longer than 30 seconds [26]. While extended pre-oxygenation may increase oxygen reserves and reduce the risk of hypoxemia during intubation, the endotracheal intubation performed by emergency medical teams is associated with a higher failure rate and more complications compared to procedures conducted in hospital settings. This is due to challenging environmental conditions, such as limited space, poor lighting, or patient instability during transport. Devices such as supraglottic airway devices, including laryngeal masks (LMA) or i-gel devices, can serve as effective alternatives in less severe cases. Invasive methods like cricothyrotomy may be considered in extreme cases where all other methods fail.

Other major challenges include technical difficulties, such as the limited availability of advanced equipment, including video laryngoscopes, which greatly facilitate laryngeal visualization and improve the success rate of the procedure. In Poland, video laryngoscopes are primarily used by Air Emergency Medical Services (Aero-Medical), which limits their widespread use by ground teams. Additionally, the success of intubation heavily depends on the experience of the operator. Emergency responders who do not have regular opportunities to perform this procedure may struggle with intubating an obese patient, increasing the risk of complications such as esophageal intubation, hypoxemia, or mechanical trauma to the airways [27].

RESUSCITATION

Obesity, particularly morbid obesity, also affects the effectiveness of cardiopulmonary resuscitation (CPR). Studies have shown that patients with morbid obesity have a higher risk of in-hospital death following cardiac arrest compared to patients without obesity, especially when the arrest occurs later in the course of hospitalization. Analysis of the results revealed that the mortality rate in the morbidly obese group was 77% for non-VF (non-ventricular fibrillation) cardiac arrest and 65% for VF (ventricular fibrillation), compared to 73% and 58%, respectively, in the non-obese group. Prehospital challenges are particularly pronounced in the treatment of obese cardiac arrest patients. Longer response times, difficulties in patient handling, and the need for specialized equipment such as bariatric stretchers contribute to delays and reduced efficiency of care.

Morbid obesity impacts many aspects of resuscitation, including airway management, the effectiveness of chest compressions, and the success of defibrillation. Fat tissue in the chest area can limit the depth of compressions, which may reduce the effectiveness of blood circulation. Additionally, increased chest resistance, resulting from higher electrical impedance, may reduce the success of defibrillation [28].

Obesity is associated with alterations in chest wall anatomy, which can impair the delivery of effective chest compressions. Recommendations for CPR, including achieving a compression depth of 5–6 cm, often become inadequate in obese patients due to increased thoracic wall resistance. This mechanical limitation not only affects blood flow but also compromises the overall quality of resuscitative efforts. In addition, airway management in obese patients poses significant challenges. Difficulties in bag-valve-mask ventilation and intubation due to excess soft tissue in the oropharyngeal and cervical regions exacerbate the complexity of resuscitation, increasing the risk of hypoxia and ventilation failure [29, 30].

Surprisingly, the analysis of survival rates post-cardiac arrest (CA) across different BMI categories reveals nuanced relationships between body mass index and outcomes. Overweight individuals (BMI 25–29.9 kg/m^2) demonstrated significantly increased odds of survival after cardiac arrest, with an overall improvement of 17.1% (OR = 1.172, 95% CI: 1.109–1.236, $p < 0.001$). This effect was consistent across studies with low heterogeneity, which suggests a potential protective advantage for individuals in the overweight BMI range [26]. So called, the "obesity paradox"—where overweight and mildly obese patients exhibit better survival and neurological outcomes, has been observed in various cardiac arrest scenarios. This phenomenon has been attributed to factors such as greater metabolic reserves, reduced cachexia, and potential ischemic preconditioning in patients with obstructive sleep apnea, which is common in obese individuals. However, evidence remains inconsistent, with some studies showing no significant survival advantage in obese patients following out-of-hospital cardiac arrest (OHCA) [30, 31].

The findings from 2023's study set in Japan challenge the universality of this phenomenon, particularly in the context of OHCA. Patients in the obese group (BMI ≥ 30 kg/m^2) exhibited higher in-hospital mortality rates and unfavorable neurological outcomes compared to those with normal BMI. This contrasts with the protective effects often observed in the "obesity paradox" and indicates that severe obesity may exacerbate the physiological and logistical challenges associated with resuscitation and post-resuscitation care. Factors such as increased comorbidities, including hypertension and diabetes, and the inherent difficulties in delivering effective CPR due to altered chest wall mechanics and airway management issues likely contribute to these poorer outcomes. While the overweight group (BMI 25–29.9 kg/m^2) is often associated with better outcomes in other studies, this study did not provide specific data to strongly support an advantage in this subgroup over normal BMI individuals in terms of survival or neurological status. Conversely, the underweight group (BMI <18.5 kg/m^2), consistent with broader findings, showed a lower prevalence of hypertension and dyslipidemia but had poorer access to advanced emergency procedures like coronary angiography or PCI, which might contribute to worse overall outcomes.

As the study highlights interesting factors due to the limitation of the research, there is a need for a further investigation to clarify the relation between high body mass, efficacy of resuscitation and their impact on long-term outcomes in OHCA patients. One primary limitation is the geographical and demographic specificity of the cohort, which was restricted to a Japanese population. Differences in genetic, cultural, dietary, and healthcare system factors may influence the outcomes and limit the generalizability of these results to other regions or ethnic groups, including patients in the Polish healthcare system. For instance, severe obesity (BMI ≥ 30 kg/m^2) is less prevalent in Japan compared to Western populations, potentially affecting the sample size and the statistical power to detect nuanced outcomes in this subgroup. Variations in CPR protocols, access to advanced cardiac life support measures, and post-resuscitation practices, such as coronary angiography and percutaneous coronary intervention (PCI), could lead to differences in outcomes even within the same BMI categories [32].

The key role to improve the skills, confidence and educate members of the rescue team is simulation-based training, incorporate scenarios involving obese mannequins, showing with what force to press on the chest for patients with high BMI to ensure effective CPR. The implementation of bariatric-specific tools, such as stretchers or mechanical CPR devices might be helpful but not as practical to include, as sudden cardiac arrest in a patient is always an emergency situation. Although their location should be well known and marked, in situations with a limited number of rescuers involved in CPR, redundant equipment may not always be used.

CONCLUSIONS

Obesity-related complications have a significant impact on the healthcare system and prehospital care. Obese patients require specialized attention due to both the increased risk of comorbidities and the challenges of their transport and diagnosis, which is usually adapted to standard patients' body. In the context of emergency medicine, obesity affects the effectiveness of cardiopulmonary resuscitation (CPR), intubation, ultrasound diagnostics, and patient transport. Performing basic emergency procedures often requires specialized equipment or additional medical personnel, for which many systems are unprepared. This increases the risk of complications for the patient and prolongs the intervention itself.

Despite these challenges, there are strategies and technologies available that can improve the quality of care for obese patients. Equipping ambulances and emergency department units with videolaryngoscopes, bariatric stretchers, and portable ultrasound devices enhances the effectiveness of medical interventions in this patient group. At the same time, it is crucial to adjust protocols and guidelines to accommodate the needs of obese patients, as well as to train medical staff in light of the growing prevalence of obesity in society.

The growing incidence of obesity is a social problem compounded by many factors. Patient education on the complications of excess weight is a fundamental component in addressing obesity as a major public health challenge. To achieve meaningful and lasting effects, educational efforts must adopt a comprehensive approach, targeting diverse populations and involving multiple stakeholders. A significant barrier to effective obesity management is the societal perception of obesity as a personal failure rather than a chronic medical condition. This misconception contributes to stigma, reduces the likelihood of individuals seeking medical help, and delays necessary interventions. Early intervention is important in younger demographics, as the promotion of healthy behaviors during childhood has the potential to establish lifelong patterns. School programs play a central role in this context, and should emphasize balanced nutrition, regular physical activity, and the importance of maintaining a healthy weight. Adults, including those at risk of developing obesity, must also be targeted through workplace, healthcare programs and community initiatives. By addressing common misconceptions about obesity, emphasizing its classification as a chronic disease, and providing practical guidance about diets, exercises and other forms of body mass management, can significantly improve prevention of obesity, the quality and length of people's lives and reduce the overall cost and of medical and social care.

REFERENCES

1. World Health Organization. Obesity and overweight, https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [Access: 1.03.2024]
2. Sarma S, Sockalingam S, Dash S. Obesity as a multisystem disease: Trends in obesity rates and obesity-related complications. Diabetes Obes Metab. 2021;23:3-16. doi: 10.1111/dom.14290
3. Manna P, Jain SK. Obesity, oxidative stress, adipose tissue dysfunction, and the associated health risks: causes and therapeutic strategies. Metab Syndr Relat Disord. 2015;13(10):423-444. doi: 10.1089/met.2015.0095.
4. GBD 2015 Obesity Collaborators.: Health effects of overweight and obesity in 195 countries over 25 years. N Engl J Med. 2017;377(1):13-27. doi: 10.1056/NEJMoa161436
5. NFZ o zdrowiu. Otyłość i jej konsekwencje – raport. https://ezdrowie.gov.pl/portal/home/badania-i-dane/zdrowe-dane/raporty/otylosc [Access: 15.01.2025] [Polish]
6. Zatońska K, Psikus P, Basiak-Rasała A, Stępnicka Z, Gaweł-Dąbrowska D, Wołyniec M, Połtyn-Zaradna K. Obesity and chosen non-communicable diseases in PURE Poland cohort study. Int J Environ Res Public Health. 2021;18(5):2701. doi: 10.3390/ijerph18052701
7. Mandviwala T, Khalid U, Deswal A. Obesity and cardiovascular disease: a risk factor or a risk marker? Curr Atheroscler Rep. 2016;18(5):1-10. doi: 10.1007/s11883-016-0575-4
8. Kendzerska T, Leung RS, Gershon AS, Tomlinson G, Ayas N. The interaction of obesity and nocturnal hypoxemia on cardiovascular consequences in adults with suspected obstructive sleep apnea. A historical observational study. Ann Am Thorac Soc. 2016;13(12):2234-2241. doi: 10.1513/AnnalsATS.201604-263OC
9. McNaughton CD, Self WH, Slovis C. Diabetes in the emergency department: acute care of diabetes patients. Clin Diabetes. 2011;29(2):51-59. doi: 10.2337/diaclin.29.2.51
10. Rinonapoli G, Pace V, Ruggiero C, Ceccarini P, Bisaccia M, Meccariello L, Caraffa A. Obesity and bone: a complex relationship. Int J Mol Sci. 2021;22(24):13662. doi: 10.3390/ijms222413662
11. Russo MW, Macdonell JR, Paulus MC, Keller JM, Zawadsky MW. Increased complications in obese patients undergoing direct anterior total hip arthroplasty. J Arthroplasty. 2015;30(8):1384-1387. doi: 10.1016/j.arth.2015.03.002
12. Purcell KF, Bergin PF, Spitler CA, Graves ML, Russell GV. Management of pelvic and acetabular fractures in the obese patient. Orthop Clin North Am. 2018;49(3):317-324. doi: 10.1016/j.ocl.2018.02.005
13. Ghanta RK, LaPar DJ, Zhang Q, Devarkonda V, Isbell JM, Yarboro LT, Ailawadi G. Obesity increases risk-adjusted morbidity, mortality, and cost following cardiac surgery. J Am Heart Assoc. 2017;6(3):e003831. doi: 10.1161/JAHA.116.003831
14. Supples MW, Vaizer J, Liao M, Faris GW, O'Donnell DP, Glober NK. Increased weight in patients with time-sensitive diagnosis is associated with longer prehospital on-scene times. Am J Emerg Med. 2022;53:236-239. Doi: 10.1016/j.ajem.2022.01.022
15. Koba P. Identifying obstacles for the obese trauma patient. J Trauma Nurs. 2016;23(1):45-48. doi: 10.1097/JTN.0000000000000178
16. Choi SD, Brings K. Work-related musculoskeletal risks associated with nurses and nursing assistants handling overweight and obese patients: a literature review. Work. 2016;53(2):439-448. doi: 10.3233/WOR-152222
17. Dropkin J, Moline J, Power PM, Kim H. A qualitative study of health problems, risk factors, and prevention among emergency medical service workers. Work. 2015;52(4):935-951. doi: 10.3233/WOR-152139
18. Reichard AA, Marsh SM, Tonozzi TR, Konda S, Gormley MA. Occupational injuries and exposures among emergency medical services workers. Prehosp Emerg Care. 2017;21(4):420-431. doi: 10.1080/10903127.2016.1274350
19. Uppot RN. Technical challenges of imaging & image-guided interventions in obese patients. Br J Radiol. 2018;91(1089):20170931. doi: 10.1259/bjr.20170931
20. Lee C, Balk D, Schafer J, Welwarth J, Hardin J, Yarza S, Hoffmann B. Accuracy of focused assessment with sonography for trauma (FAST) in disaster settings: a meta-analysis and systematic review. Disaster Med Public Health Prep. 2019;13(5-6):1059-1064.
21. Yıldız MK, Ozkan E, Odabaşı HM, Eriş C, Günay E, Abuoğlu HH, Topaloglu U. Analysis of 120 patients with abdominal stab wound focusing on diagnostic role of FAST. Int J Clin Exp Med. 2014;7(5):1386-1390

22. Franco-Sadud R, Schnobrich D, Mathews BK, Candotti C, Abdel-Ghani S, Perez MG, Soni NJ. Recommendations on the use of ultrasound guidance for central and peripheral vascular access in adults: a position statement of the Society of Hospital Medicine. J Hosp Med. 2019;14(9):E1-E22. doi: 10.12788/jhm.3287
23. Brandt HG, Jepsen CH, Hendriksen OM, Lindekær A, Skjønnemand M. The use of ultrasound to identify veins for peripheral venous access in morbidly obese patients. Dan Med J. 2016;63(2):A5191.
24. Holmberg TJ, Bowman SM, Warner KJ, Vavilala MS, Bulger EM, Copass MK, Sharar SR. The association between obesity and difficult prehospital tracheal intubation. Anesth Analg. 2011;112(5):1132-1138. doi: 10.1213/ANE.0b013e31820effcc
25. De Jong A, Molinari N, Pouzeratte Y, Verzilli D, Chanques G, Jung B, Jaber S. Difficult intubation in obese patients: incidence, risk factors, and complications in the operating theatre and in intensive care units. Br J Anaesth. 2015;114(2):297-306. doi: 10.1093/bja/aeu373
26. Nolan JP (ed.). Wytyczne Resuscytacji 2021 [Resuscitation Guidelines 2021] (Andres J – ed of Polish edition)). Wydawnictwo Europejska Rada Resuscytacji i Polska Rada Resuscytacji, Kraków, 2021 [Polish].
27. Wojtczak P, Kluj P, Fedorczak M, Fedorczak A, Bartczak M, Gaszyński T, Ratajczyk P. Intubacja dotchawicza w praktyce Ratownika Medycznego – najnowsze spojrzenie oraz czynniki wpływające na wybór intubacji jako metody udrażniania dróg oddechowych w opiece przedszpitalnej [Endotracheal intubation in the practice of a paramedic – the latest perspective and factors influencing the choice of intubation as a method of airway management in pre-hospital care]. Anestez Rat. 2022;16(4): 193-203 [Polish]. doi: 10.53139/AIR.20221621
28. Shahreyar M, Dang G, Waqas Bashir M, Kumar G, Hussain J, Ahmad S, Jahangir A. Outcomes of in-hospital cardiopulmonary resuscitation in morbidly obese patients. JACC: Clin Electrophysiol. 2017;3(2):174-183. doi: 10.1016/j.jacep.2016.08.011
29. Ma Y, Huang L, Zhang L, Yu H, Liu B. Association between body mass index and clinical outcomes of patients after cardiac arrest and resuscitation: A meta-analysis. Am J Emerg Med. 2018;36(7):1270-1279. doi: 10.1016/j.ajem.2018.03.079
30. Lee H, Oh J, Kang H, Lim TH, Ko BS, Choi HJ, Min YG. Association between the body mass index and outcomes of patients resuscitated from out-of-hospital cardiac arrest: A prospective multicentre registry study. Scand J Trauma Resusc Emerg Med. 2021;29:1-11. doi: 10.1186/s13049-021-00837-x
31. Kakavas S, Georgiopoulos G, Oikonomou D, Karayiannis D, Masi S, Karlis G, Xanthos T.: The impact of body mass index on post-resuscitation survival after cardiac arrest: A meta-analysis. Clin Nutr ESPEN. 2018;24:47-53. doi: 10.1016/j.clnesp.2018.01.071
32. Kojima M, Mochida Y, Shoko T, Inoue A, Hifumi T, Sakamoto T. SAVE-J II study group.: Association between body mass index and clinical outcomes in patients with out-of-hospital cardiac arrest undergoing extracorporeal cardiopulmonary resuscitation: A multicenter observational study. Resusc Plus. 2023;16:100497. doi: 10.1016/j.resplu.2023.100497

CONFLICT OF INTEREST

The Authors declare no conflict of interest.

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RECEIVED: 10.12.2024
ACCEPTED: 25.02.2025

A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval

Emerg Med Serv, 2025; XII, 1: 25-30

DOI: 10.36740/EmeMS202501104

REVIEW ARTICLE

Intravenous lidocaine as a key driver of successful pain therapy management. Current prospects and trends

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ABSTRACT

Pain in its entirety is an unpleasant experience, both emotional and physical, and has a negative impact on the healing process. In the practice of medical staff, patients who experience pain or have a doloric component constitute a significant percentage of the number of interventions. The publication aims to present the concept of pain, types and characteristics as well as the process of nociception and the issue of off-label therapy related to the use of lidocaine, which is a multimodal therapy drug. This publication will present current trends and works containing the effective use of lidocaine. Pain that often varies in intensity, location or has a broad cause is a challenge for medical staff, especially in the face of complex and chronic pain. Based on a review of the latest medical literature, the authors would like to draw medical attention to expanding knowledge about pain, its nature and its formation. This has a decisive impact on reducing inflammation, shock and improving patient comfort. Therefore, the appropriate use of a multimodal strategy and adjuvant drugs is the method of choice, especially for patients reporting cancer pain, where the use of opioid drugs is significant. Also in colicky or neurogenic ailments, lidocaine is an effective drug that helps control pain. As an aid in the situation of using the drug, the authors of the article propose recommendations for the safe use of lidocaine. After reading this work, the reader at the scene of the incident should consider the adequacy of the supply of the described drug and know the mechanisms that govern pain as a process.

KEY WORDS

lidocaine, pain, multimodal therapy, coanalgesia, pharmacotherapy

INTRODUCTION

It is indisputable that healthcare professionals encounter pain patients on a regular basis. As healthcare professionals, doctors, nurses and paramedics are equipped with the necessary tools and expertise to effectively manage pain. As part of their training, medical students are required to complete a course in clinical pharmacology. This subject covers pain, pain management and the appropriate use of pharmacotherapy. The same is true of training programmes for nurses and paramedics. The International Association for the Study of Pain defines pain as An unpleasant sensory or emotional experience associated with actual or potential tissue damage, or expressed in terms of such damage (1986). The pain is typically caused by a specific stimulus that initiates damage. The literature distinguishes between two categories of pain based on duration: acute, which has a duration of less than three months, and chronic, which has a duration of more than three months. In addition to the aforementioned criteria, the pain classification takes into account the pain location. Somatic pain is defined as a sensation associated with the perception of nociception from superficial tissue structures, including the skin, muscles, and osteoarticular system. It is acute, localised and typically straightforward for the patient to describe. Visceral pain is a diffuse, poorly demarcated sensation that is difficult for the patient to localise. It arises through nociception from organs located inside body cavities. A further classification is that of the aetiology of pain. This includes pain associated with inflammation, tissue trauma, neuropathic and neoplastic pain [1]. Another publication emphasises the importance of an appropriate approach to pain and effective pharmacotherapy. It demonstrates the significance and relevance of pain polytherapy, correct knowledge of the additive effect and drug synergism of effective analgesia and coanalgesia [2]. It is essential to provide an appropriate combination of medications to effectively manage pain, particularly chronic pain that triggers inflammatory responses.[3] Additionally, the treatment procedures employed were not always aligned with the patient's current condition and reported pain on the NRS scale. In a paper published in Anaesthesiology and Emergency Medicine, Kosinski et al. examined the pain scores of patients encountered by paramedics on the scene. In nearly 1,600 trips in the Kraków region (the Małopolskie Province), questions about pain and its intensity were assessed. In almost 26% of all trips, the question about pain as a sensation was asked together with an assessment of its intensity. However, in almost

29% of paramedic charts, there was a lack of pain assessment and recording in the documentation. This resulted in inadequate or ineffective analgesia. [4] According to Polish legislation, the patient has an inalienable right to pain treatment. This is guaranteed by the Act of 6 November 2008 on Patients' Rights and Patients' Rights Ombudsman, which was amended (Journal of Laws 2017, item 836) by adding a new regulation, Article 20a, stating that every patient has the right to this regardless of having insurance [5]. It should be noted that patients reporting pain are not limited to those experiencing acute pain. They also include those suffering from chronic diseases or cancer, as well as the elderly. When treating this population group, pharmacotherapy must take into account both the pathomechanism of pain and the type and route of administration of analgesics, as well as the risk of adverse effects. Personalisation of management is essential, with the patient and their specific complaints being the primary focus [6]. In the geriatric population, the vast majority of patients suffer from chronic pain, with one in two over the age of 65. The authors attribute this to inappropriate pharmacotherapy, the use of monotherapies and the special pharmacodynamics and pharmacokinetics of drugs in the geriatric population [7]. As one of the basic symptoms in medicine, pain is a major challenge for modern medicine. There is no doubt that its proper management, especially of chronic pain, significantly improves the quality of life of patients and their families in all aspects of life. In the monograph Chronic Pain. A clinical and psychological approach, the scientific team led by Wojciech Leppert discusses the assessment and diagnosis of pain, as well as co-analgesic and multimodal treatment of the entire pain-related process [8]. Nociception is the process by which nerve receptors respond to potentially damaging stimuli, such as mechanical, chemical, thermal damage or those resulting from inflammation or infection. These responses are then transmitted to higher centres of the CNS, such as the periaqueductal grey matter or thalamus, where they are made aware of by the patient. This process is essential for survival and minimising tissue and organ damage. Nociceptors are responsible for detecting stimuli when tissue damage occurs. There are three main types of pain receptors: high-threshold mechanoreceptors (HTM), which respond to mechanical deformation, pinching or pricking; and polymodal mechanical heat nociceptors (PMNs), which respond to a range of noxious stimuli, including pressure, temperature extremes (<8°C and >42°C) and chemical mediators (known as allogens). These can be exogenous (e.g. capsaicin) or endogenous and may be released by damaged cells as a result of noxious stimulation (bradykinin, serotonin, P substance, histamine, prostaglandins, leukotrienes, cytokines, H+, K+ ions). PMNs are the most prevalent pain receptors. It is notable that they do not undergo stimulus adaptation and also demonstrate sensitisation to repeated pain stimuli, which can lead to hyperalgesia. Additionally, there are silent receptors, which only activate when there is tissue inflammation.

There are two main categories of nociceptor fibres, which are distinguished by their fibre structure. Aδ-type fibres transmit impulses produced in response to mechanical and thermal stimuli. They are myelinated fibres with a large diameter and high impulse conduction velocity (up to 20 m/s). They facilitate the perception of an initial, acute pain sensation, which is clearly localised in terms of its anatomical location and is of a somatic nature. C-type fibres conduct impulses generated in response to thermal, mechanical and chemical stimuli. They are non-myelinated fibres, with a small diameter and a resulting low conduction velocity (0.5-2 m/s). They are responsible for the transmission of dull, poorly localised visceral pain. Anatomically, they are mainly a component of the ascending sympathetic nervous system [9, 10].

Afferent neurons are responsible for transmitting nociceptive impulses from peripheral receptors via the spinal-thalamic tract (spinothalamic tract). A first-order neuron (C or Aδ fibre) transmits potentials from the nociceptor to the substantia gelatinosa (Rexed lamina II) or nucleus proprius (Rexed laminae III, IV and V) in the dorsal horn of the spinal cord. In the posterior year of the spinal cord, a first-order neuron forms a synaptic connection with a second-order interneuron [11]. The second-order interneuron crosses into the anterior spinal cord and then runs in the spinal-thalamic pathway (mainly lateral) up to the thalamus. A third-order neuron transmits impulses to the somatosensory cortex. Only those sensations that have passed through the thalamus are perceived by the patient [12].

The pain impulse pathway is slightly different for nociception from the facial region. A first-order neuron (C or Aδ) transmits potentials from the facial nociceptors to the trigeminal nucleus. Most of this sensory information is transmitted to the brain via the trigeminal nerve, but a small number of sensory neurons of the pharynx and ear pass through the lingual-pharyngeal (NC IX) and vagus (NC X) nerves. Independently of the cranial nerve, all sensory afferent fibres synapse with second-order neurons in the trigeminal nucleus, the equivalent of the dorsal horn of the spinal cord. Second-order neurons travel to the thalamus to transmit impulses to the somatosensory cortex via third-order neurons [11, 13].

AIM

The objective of this paper is to provide a comprehensive overview of the current state-of-the-art on lidocaine, its applications and research directions that may influence development and innovation in this area. The paper will review current trends in the use of lidocaine in medicine, and discuss new formulations, application techniques as well as potential therapeutic applications. It will also address challenges related to the safety and efficacy of lidocaine and future research directions that may contribute to a better understanding of its mecha-

nisms of action and the development of new clinical opportunities.

MATERIAL AND METHODS

In order to achieve the stated objective, the review paper will be based on a literature analysis including a review of available scientific publications on lidocaine, including clinical trials, meta-analyses and review articles from recent years, with the focus being on studies in anaesthesiology, pharmacology and pain medicine. Databases such as PubMed, Scopus, Web of Science and Google Scholar will be used to identify the most current and relevant research papers on lidocaine applications. A critical analysis of the quality of the publications will then be attempted, taking into account the methodology, results and conclusions, in order to identify the strengths and weaknesses of current research.

REVIEW AND DISCUSSION

Lidocaine is a sodium channel blocker classified as a type Ib antiarrhythmic agent and is also an amide local anaesthetic. The FDA has approved its use for local and regional anaesthesia, as well as for the treatment of ventricular arrhythmias. In Poland, it is available in ampoule form, Lignocain 2%, 20 mg/ml solution for injection, in manufacturer-dependent volumes.^([14]) The toxicity and pharmacokinetics of lidocaine have been known since the 1940s. Following clinical studies, it was developed in conjunction with adrenaline. It has been established that the maximum safe dose of lidocaine without adrenaline is 3 mg kg-1, while with adrenaline in a 0.5-2% solution injected into well-circumscribed tissue (e.g. during intercostal nerve block) it is 7 mg kg-1. After local administration, lidocaine is not metabolised by muscle or fat structures. It is absorbed by blood vessels whose flow is slowed by the effects of adrenaline, causing the capillaries to constrict as the substance is introduced at a pressure greater than that prevailing in the capillaries. Both topical and intravenous lidocaine is transported to the liver. There it is degraded into metabolites by the CYP 3A4 enzyme of cytochrome P-450: MEGX-monoethylglyoxylidine, GX-glyoxylidine. The kidneys are responsible for the removal of these substances. Drugs containing cytochrome P-450 enzyme inducers, such as phenobarbital, rifampicin and phenytoin, can boost the metabolism of lidocaine, which may impair its effect. Furthermore, in cases where lidocaine is part of the pharmacological treatment plan, it is essential to ascertain whether the patient is taking any medications that may inhibit isoenzyme activity, such as erythromycin or ketoconazole, which are serotonin reuptake inhibitors. Under such circumstances it is necessary to either discontinue the drugs or, if this is not possible, reduce the maximum dose by 20-30%. The final step in the excretion of lidocaine is its removal by the kidneys [15].

In a clinical trial for adults, lidocaine was used to treat both acute and chronic pain conditions, including but not limited to neuropathic pain, headache and renal colic, as well as post-operative pain. The authors concluded that systemic lidocaine was more effective than placebo in controlling neuropathic pain. However, the study included patients with different types of neuropathic pain syndromes, making it unclear whether lidocaine is more effective for some types of neuropathic pain compared to others. Furthermore, the evidence is not as strong when lidocaine is compared with other drugs (ketamine, morphine and amantadine) used to treat neuropathic pain[16]. The use of lidocaine to control cancer-related pain yielded mixed results. An analysis of the data from the 11 patients with cancer-related neuropathic pain who were administered a lidocaine infusion at a dose of 5 mg/kg revealed no significant improvement in pain intensity. On the other hand, a case series detailed the successful use of lidocaine by continuous infusion for the treatment of intractable pain in six hospice patients at home with a mean dose of 44 mg/hour (range 10-80 mg/hour) [17]. Two retrospective reviews describe the effective use of lidocaine by continuous infusion (dose range 1-4 mg/min for 2-15 days) for the treatment of chronic headache in adults. One study describes the use of the drug in the treatment of chronic daily headache associated with overuse of previous pharmacotherapy, with a observed reduction in the average number of days with headache per month from 29 to 15 after lidocaine infusion [18]. The case studies describe the use of intravenous lidocaine (dose range 1.3 mg/kg/hr to 3.3 mg/kg/hr) for the treatment of short-term unilateral neuralgic headache. The results demonstrate variable efficacy, with some patients noting minimal benefit and most noting significant benefit only during the lidocaine infusion. Lidocaine has been demonstrated to be more effective than a placebo in the treatment of acute migraine or headaches applied by the emergency ward when administered at a dose of 1 mg/kg for a period of 2 minutes. A small randomised single-blind study demonstrated that chlorpromazine was significantly more effective than lidocaine (boluses of 50 mg to a maximum of 150 mg) in the treatment of acute headache. Additionally, the study showed that lidocaine and dihydroergotamine had similar effects on pain scores in patients with acute headache [18].

Lidocaine has been the subject of study in patients with renal colic, both as a standalone treatment and in conjunction with opioids. A randomised, double-blind study was carried out to compare the efficacy of intravenous lidocaine (1.5 mg/kg) with that of a placebo. The results demonstrated that lidocaine produced a more pronounced reduction in pain intensity than morphine within the first 30 minutes ($P = 0.0001$) [16]. A further study compared the efficacy of lidocaine (1.5 mg/kg) and morphine (0.1 mg/kg) with that of morphine alone (0.1 mg/kg) in the treatment of renal colic. There was a reduction in pain scores across both groups, although the differences between them were not statistically significant. However, the combination of lidocaine and morphine resulted in a faster resolution of pain. Furthermore, the authors ob-

served a notable decrease in the duration of nausea-free time in the lidocaine/morphine group compared to the morphine-only group. Intravenous lidocaine infusions have demonstrated the potential to reduce opioid consumption during the postoperative period, particularly in patients undergoing abdominal surgery. Additionally, lidocaine infusions have been shown to shorten the duration of postoperative bowel obstruction and decrease the length of hospital stay by 8–24 hours[17].

A series of case studies demonstrate the efficacy of continuous intravenous lidocaine administration in the treatment of dinutuximab-induced neuropathic pain in patients with neuroblastoma. Furthermore, case series and expert opinion articles illustrate the successful use of continuous intravenous lidocaine for intractable cancer pain. The doses used for these indications range from 0.5 to 2 mg/kg/hour by continuous infusion, with or without a saturating dose of 1 to 2 mg/kg over 30 minutes. One case study describes a dose escalation to 3.8 mg/kg/hour after more than two months of intravenous lidocaine therapy for severe neuropathic pain due to terminal cancer. However, such high doses should only be considered in extreme circumstances where the benefits outweigh the risk of toxicity and the patient continues to receive pain relief with dose escalation[18].

A small randomised controlled trial demonstrated the efficacy of continuous intravenous lidocaine therapy in the treatment of postoperative pain in children. The study involved 12 paediatric patients (aged 1-6 years) who were administered perioperative lidocaine at a dose of 1.5 mg/kg/hour. The infusion was initiated with a bolus of 1.5 mg/kg 20 minutes before incision and continued until six hours after surgery. Lidocaine levels were monitored and no patient reached levels >5 micrograms/ml. Patients receiving intravenous lidocaine had a significantly shorter length of stay and significantly lower opioid consumption compared to the placebo group. The expert opinion also supports the use of lidocaine for postoperative pain control [19]. It is thought that the administration of lidocaine affects a number of other clinically relevant outcomes, including wound healing, analgesia, coagulation, postoperative cognitive impairment and bowel obstruction. By characterising the beneficial effects of intravenous lidocaine administered in the perioperative period, lidocaine may provide a safe and alternative strategy to epidural analgesia to improve perioperative outcomes [18].

Furthermore, a retrospective review of cases in adolescents demonstrated the efficacy of intermittent intravenous lidocaine administration in the treatment of various types of chronic pain, including headache, neuropathy, sickle cell disease and skeletal pain. In this study, 15 patients underwent a total of 58 infusions, with a reduction in pain intensity reported after 41 of these. A 2018 retrospective review outlined the use of continuous lidocaine in refractory migraine in 26 paediatric patients. Following the administration of a saturating dose of lidocaine 3 mg/kg over 90 minutes, a continuous infusion was initiated at 1 mg/kg/hour (range 1.125-2.25 mg/kg/hour with titration). The average time to achieve a 50% reduction in pain scores was 16 hours (± 12 hours), with complete resolution achieved in 28 out of 31 patients after an average of 19 hours (± 19 hours). Unfortunately, 16 out of the 31 patients experienced a recurrence of pain at the time of discharge, but the pain intensity was significantly lower than at the time of admission [19].

Lidocaine is also applied to the treatment of cancer pain. A continuous infusion of lidocaine at a dose of 4-5 mg/kgmc, with an infusion lasting 30 to 80 minutes, has been shown to reduce pain sensation by at least 50% [20].

Meta-analyses indicate that intravenous lidocaine at doses up to 1.5 mg/kgmc intravenous bolus has a significantly reducing effect on the incidence of cough induced by opioid administration. However, doses as low as 0.5 mg/kgmc iv. bolus with an effective antitussive may reduce the incidence of adverse effects.[21].

It is essential to bear in mind that even very low doses of lidocaine (even 40 mg of intra-venous bolus) can cause seizure disorders [22]. It is imperative that intravenous infusions of lignocaine are carried out under conditions of access to resuscitation drugs and equipment to monitor the patient and secure the airway (including instrumented).

LAST – LOCAL ANAESTHETIC SYSTEMIC TOXICITY

LAST is the systemic toxicity of a local anaesthetic drug. It results from exceeding the maximum plasma concentration of LMZ. Classically, LMZs were thought to act by binding to and inhibiting voltage-gated sodium channels, suppressing action potential propagation along nerves. In fact, all widely used LMZs are amphipathic (have hydrophobic properties and hydrophilic groupings), making them capable of binding hydrophilic proteins (solubilised in the cytosol) and hydrophobic proteins (solubilised in the lipid bilayer of the cell membrane or organelle) [23]. To be more precise LMZ has been demonstrated to bind with voltage-gated potassium and calcium channels, as well as sodium channels. This inhibits intracellular signal transduction following G-protein activation. By inhibiting voltage-gated calcium channels, LMZ slows down cardiac automaticity (bradycardia) and conduction (blocks). Similarly, inhibiting voltage-gated sodium and potassium channels slows action potential propagation and repolarisation, promoting tachycardia before asystole has occurred [24].

LAST symptoms originate from the cardiovascular system and the central nervous system. CNS symptoms include tingling around the mouth and on the tongue, a metallic taste in the mouth, ringing in the ears, and a feeling of light-headedness. This is followed by slurred speech, muscle tearing, loss of consciousness, convulsions, coma and respiratory arrest. Cardiovascular symptoms include myocardial suppression, arrhythmias, particularly conduction blocks and cardiac arrest. Importantly, clinically we may be confronted with two types of LAST, the so-called Fast LAST, in which symptoms appear

within minutes of drug administration, and the so-called Slow LAST, in which symptoms may appear half an hour after drug administration or even later [25].

The guidelines explicitly state the necessity of monitoring the patient during anaesthetic supply and for meticulous observation following the supply. In the event of LAST, the key element is the intravenous supply of 20% lipid emulsion at an initial bolus dose of 1.5 ml/kgmc, followed by the initiation of a continuous intravenous infusion of 15 ml/kgmc/h (0.25 ml/kgmc/min). Should there be no improvement, it is recommended that further intra-venous boluses be administered. A further 1.5 ml/kgmc should be administered at 5 and 10 minutes, with the infusion rate increased to 30 ml/kgmc/h (0.5 ml/kgmc/min). In the event of tachyarrhythmia, it is imperative to refrain from administering beta-blockers and Ca-blockers. Similarly, when treating hypotension, it is crucial to avoid supplying vasopressin. In the case of SCA, it is essential to reduce adrenaline boluses to a maximum of 1mcg/kgmc and prepare for prolonged resuscitation, lasting up to 1.5-2 hours [26, 27].

CONCLUSIONS

There is clear evidence that lignocaine used in multimodal therapy has a significant effect on pain rating and intensity compared with placebo, particularly in the early phases of pain onset. There is also some evidence that it has additional effects on other important clinical outcomes, such as improved gastrointestinal function, reduced nausea and opioid requirements. Analyses of available studies have shown that intravenous lidocaine is particularly useful as an adjunct to multimodal therapy in the management of colic pain. It is therefore reasonable to use it in terms of the work of hospital wards as well as pre-hospital medicine as a complementary medicine during pharmacological interventions. A full medical history, thorough anamnesis, medical records and full monitoring of vital signs appear essential. These procedures will minimise possible side effects, resulting in a full spectrum of pain relief. When intravenous lidocaine is administered, the patient should be closely monitored, especially from the LAST risk perspective.

REFERENCES

1. Dobrogowski J, Ładny J, Wordliczek J, Woroń J. Co należy wiedzieć o leczeniu bólu w ratownictwie medycznym [What you need to know about pain management in emergency medicine]. Medical Education; Warszawa, 2019
2. Pathak A, Sharma S, Jensen MP. The utility and validity of pain intensity rating scales for use in developing countries. Pain Rep. 2018 Aug 6;3(5):e672. doi: 10.1097/PR9.0000000000000672
3. Marcianò G, Vocca C, Evangelista M, and et al. The Pharmacological Treatment of Chronic Pain: From Guidelines to Daily Clinical Practice. Pharmaceutics 2023;15(4):1165. doi: 10.3390/pharmaceutics15041165
4. Kosiński S, Bryja M, Wojtaszowicz R, Górka A. Incidence, characteristics and management of pain in one operational area of medical emergency teams. Anaesthesiol Intensive Ther. 2014 Apr-Jun;46(2):83-7. doi: 10.5603/AIT.2014.0016. PMID: 24858966.
5. Ustawa z dnia 6 listopada 2008 roku o prawach pacjenta i Rzeczniku Praw Pacjenta, (Dz.U. z 2017 r., poz. 836) [Polish]
6. Corsi N, Roberto A, Cortesi L, Nobili A, Mannucci PM, Corli O; REPOSI Investigators. Prevalence, characteristics and treatment of chronic pain in elderly patients hospitalized in internal medicine wards. Eur J Intern Med. 2018 Sep;55:35-39. doi: 10.1016/j.ejim.2018.05.031
7. Prostran M, Vujović KS, Vučković S et al. Pharmacotherapy of Pain in the Older Population: The Place of Opioids. Front Aging Neurosci. 2016 Jun 16;8:144. doi: 10.3389/fnagi.2016.00144
8. Leppert W, Majkowicz M. Ból przewlekły. Ujęcie kliniczne i psychologiczne [Chronic pain: clinical and psychological approaches]. PZWL, Warszawa; 2018 pp. 2-5.
9. Oxford Specialist Handbooks in Anaesthesia Regional Anaesthesia, Stimulation, and Ultrasound Techniques. Warman P, Nicolls B, Conn D, Wilkinson D., Oxford University Press, 2014
10. Fishman SM, Ballantyne JC, Rathmell JP. Bonica's Management of pain, 4th edn., Lippincott Wiliams&Wilkins, 2010
11. Anwar K. Pathophysiology of pain. Dis Mon. 2016 Sep;62(9):324-9. doi: 10.1016/j.disamonth.2016.05.015
12. Mears L, Mears J. The pathophysiology, assessment, and management of acute pain. Br J Nurs. 2023 Jan 26;32(2):58-65. doi: 10.12968/bjon.2023.32.2.58
13. Schoenen J. Clinical neurophysiology of headache. Neurol Clin. 1997 Feb;15(1):85-105. doi: 10.1016/s0733-8619(05)70296-6
14. National Center for Biotechnology Information (2024). PubChem Compound Summary for CID 6314, Lidocaine Hydrochloride. Retrieved September 2, 2024 https://pubchem.ncbi.nlm.nih.gov/compound/Lidocaine-Hydrochloride [Access December 2024]
15. Samdal F, Amland PF, Bugge JF. Plasma lidocaine levels during suction-assisted lipectomy using large doses of dilute lidocaine with epinephrine. Plast Reconstr Surg. 1994 May;93(6):1217-23. doi: 10.1097/00006534-199405000-00017
16. Filipczak-Bryniarska I, Bryniarski K., Woroń J, Wordliczek J, Mechanizmy przewodzenia bólu. Rola układu odpornościowego w regulacji odczuwania bólu [The mechanisms of pain. Role of immune system in regulation on the pain experience]. Anestez Rat 2010;4:500-509 [Polish]
17. Voute M, Morel V, Pickering G. Topical Lidocaine for Chronic Pain Treatment. Drug Des Devel Ther. 2021 Sep 29;15:4091-4103. doi: 10.2147/DDDT.S328228
18. Torp KD, Metheny E, Simon LV. Lidocaine Toxicity. [Updated 2022 Dec 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan. https://www.ncbi.nlm.nih.gov/books/NBK482479/ [Access: December 2024]
19. Karnina R, Arif SK, Hatta M, Bukhari A. Molecular mechanisms of lidocaine. Ann Med Surg (Lond). 2021 Aug 17;69:102733. doi: 10.1016/j.amsu.2021.102733
20. Lee JT, Sanderson CR, Xuan W, Agar M. Lidocaine for Cancer Pain in Adults: A Systematic Review and Meta-Analysis. J Palliat Med. 2019 Mar;22(3):326-334. doi: 10.1089/jpm.2018.0257. Epub 2019 Jan 7. PMID: 30614748.

21. Sun L, Guo R, Sun L. The impact of prophylactic intravenous lidocaine on opioid-induced cough: a meta-analysis of randomized controlled trials. J Anesth. 2014 Jun;28(3):325-33. doi: 10.1007/s00540-013-1732-3. Epub 2013 Oct 31. PMID: 24173406
22. Ayas M, Işık B. Does Low Dose Lidocaine Cause Convulsions? Turk J Anaesthesiol Reanim. 2014 Apr;42(2):106-8. doi: 10.5152/TJAR.2014.21043. Epub 2014 Jan 6. PMID: 27366401; PMCID: PMC4894158.
23. Antel R, Ingelmo P. Local anesthetic systemic toxicity. CMAJ. 2022 Sep 26;194(37):E1288. doi: 10.1503/cmaj.220835
24. Long B, Chavez S, Gottlieb M, Montrief T, Brady WJ. Local anesthetic systemic toxicity: A narrative review for emergency clinicians. Am J Emerg Med. 2022 Sep;59:42-48. doi: 10.1016/j.ajem.2022.06.017
25. Wadlund DL. Local Anesthetic Systemic Toxicity. AORN J. 2017 Nov;106(5):367-377. doi: 10.1016/j.aorn.2017.08.015
26. Neal JM, Neal EJ, Weinberg GL. American Society of Regional Anesthesia and Pain Medicine Local Anesthetic Systemic Toxicity checklist: 2020 version. Reg Anesth Pain Med. 2021 Jan;46(1):81-82. doi: 10.1136/rapm-2020-101986
27. Ok SH, Hong JM, Lee SH, Sohn JT. Lipid Emulsion for Treating Local Anesthetic Systemic Toxicity. Int J Med Sci. 2018 May 14;15(7):713-722. doi: 10.7150/ijms.22643

CONFLICT OF INTEREST
The Authors declare no conflict of interest.

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RECEIVED: 08.12.2024
ACCEPTED: 25.02.2025

Ⓐ – Work concept and design, Ⓑ – Data collection and analysis, Ⓒ – Responsibility for statistical analysis, Ⓓ – Writing the article, Ⓔ – Critical review, Ⓕ – Final approval

Emerg Med Serv, 2025; XII, 1: 31-34

DOI: 10.36740/EmeMS202501105

REVIEW ARTICLE

Polypharmacy as a medical challenge: Prevalence, risks, and management in Poland

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ABSTRACT

Polypharmacy, or the simultaneous use of multiple drugs, is a growing global concern, particularly in aging populations. In Poland, the older adults population is steadily increasing, with over 23 million people having been prescribed medications, averaging 3.7 active substances per prescription. Around 11.7% of the population experiences multidrug use, with the elderly most affected. This raises significant concerns, as polypharmacy can lead to adverse drug reactions, lower medication adherence, and higher healthcare costs.

Preventing and managing drug interactions is crucial for patient safety and requires proactive efforts from healthcare professionals. In Poland, challenges include limited communication between providers and the absence of standardized guidelines. To tackle this issue, a multidisciplinary approach involving healthcare providers, policymakers, and researchers is essential. Managing polypharmacy involves various strategies, including medication reviews, prescription waivers, and family involvement. Tools such as MUSE and ARMS-P can help assess and improve medication adherence. Additionally, further research is needed to explore how cognitive ability, particularly in conditions like dementia, affects pharmacotherapy outcomes. In conclusion, addressing polypharmacy in Poland requires comprehensive strategies that incorporate various management techniques and consider cognitive factors. Ongoing research is vital to ensure optimal care for the aging population in a rapidly changing healthcare environment.

KEY WORDS

polypharmacy, aged, primary health care, medication adherence, drug adherence, medication compliance

INTRODUCTION

Polypharmacy, the simultaneous use of multiple prescription drugs, has become an increasingly significant medical issue worldwide, particularly in aging populations. This review aims to analyze the problem of polypharmacy in Poland, assess its causes and effects, and explore strategies for its prevention and management. Additionally, it provides an in-depth discussion on tools available to assist healthcare professionals in optimizing pharmacotherapy and ensuring patient safety.

MATERIAL AND METHODS

This review is based on a comprehensive analysis of existing literature, national health reports, and clinical guidelines concerning polypharmacy in Poland. The primary sources of data include peer-reviewed journal articles, government publications, and international frameworks such as the World Health Organization (WHO) guidelines and the Beers Criteria. The search strategy involved querying databases such as PubMed, Scopus, and Google Scholar using keywords including "polypharmacy," "medication adherence," "elderly patients," "drug interactions," and "Poland." Studies included in this review were selected based on their relevance, methodological rigor, and applicability to the Polish healthcare context.

To ensure a balanced and evidence-based discussion, the collected information were categorized into the following domains: prevalence and causes of polypharmacy, its impact on patients, common drug interactions, and strategies for polypharmacy management. Particular emphasis was placed on clinical decision-support tools, deprescribing initiatives, and patient-centered approaches. The review also incorporates statistical data from national healthcare databases to provide insights into the scale of the problem within the Polish population.

REVIEW AND DISCUSSION

DEFINITION AND CAUSES OF POLYPHARMACY

Polypharmacy is most commonly defined as the use of five or more medications per day, as outlined by the World Health Organization (WHO) [1,2]. The primary driver of polypharmacy is the demographic shift towards an aging population. In Poland, the percentage of people over 60 years old increased from 17.2% in 2005 to 25.7% in 2021 and continues to rise [3]. This demographic shift is accompanied by a higher prevalence of multimorbidity, which necessitates complex pharmacological treatment. While polypharmacy can be appropriate when multiple medications are necessary for managing chronic conditions, it also introduces risks such as drug interactions, reduced adherence, and increased healthcare costs.

THE IMPACT OF POLYPHARMACY ON PATIENTS

The consequences of polypharmacy include an increased likelihood of adverse drug reactions, non-adher-

ence to prescribed treatment, and higher financial costs for both individuals and healthcare systems [5]. Studies indicate that as medication regimens become more complex, patients are more prone to confusion, missed doses, and non-compliance with treatment recommendations [6]. This, in turn, can lead to higher rates of hospitalizations, emergency department visits, and complications related to chronic conditions.

PREVALENCE OF POLYPHARMACY IN POLAND

Polypharmacy is a widespread issue in Poland, affecting approximately 11.7% of the population, with 1.6% of individuals regularly consuming ten or more medications, a condition known as ultrapharmacotherapy [7]. Among elderly individuals aged 65–80, 38% take five or more medications, with the percentage rising to over 50% among those older than 80. The lack of standardized pharmacotherapy reconciliation and coordination among healthcare providers further exacerbates the problem. Moreover, the use of over-the-counter medications and dietary supplements without medical supervision further contributes to the complexity of polypharmacy management.

COMMON DRUG INTERACTIONS AND THEIR CONSEQUENCES

The risk of drug-drug interactions (DDIs) increases with the number of medications prescribed. A study of oncology patients in Poland found over 1,800 DDIs among 490 patients, with 4.2% of these interactions classified as "avoid combinations" according to the Beers Criteria [8,9].

One particularly dangerous drug interaction occurs between warfarin, an anticoagulant, and aspirin, an anti-inflammatory agent. The combined effect of these drugs significantly raises the risk of severe bleeding, particularly in elderly patients. The Beers Criteria and the STOPP/START criteria serve as essential tools in guiding clinicians to identify potentially inappropriate medications and prevent harmful interactions [10].

TOOLS AND STRATEGIES FOR MANAGING POLYPHARMACY

Reducing the severity of the polypharmacy problem requires a multidisciplinary approach involving healthcare providers, policymakers, and researchers to develop research-based guidelines, improve medication management systems, and improve communication among healthcare professionals. By understanding and mitigating the risks associated with polypharmacy, Poland can optimize patient care, improve healthcare outcomes, and reduce the burden on the healthcare system.

In general, there are several ways to help manage polypharmacy. Some of them do not involve patient action at all - an example of this is the actions of pharmaceutical companies that seek to include two or more drugs in a single pill, reducing the number of drugs needed by some people (Fig. 1). This approach does not, in fact, decrease the risk of DDI, however, it improves medication adherence in an overloaded patient.

Other methods described involve the patient only marginally—the most common of which are medication review and prescription waivers [11].

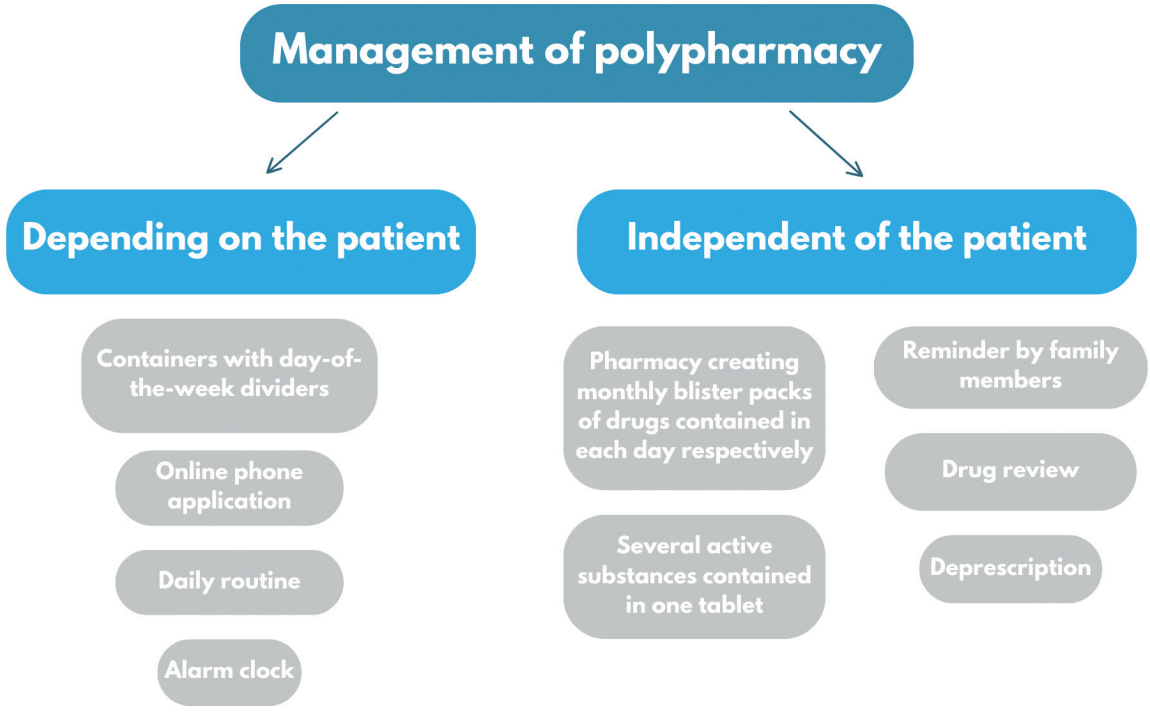

Fig. 1. Methods of polypharmacy management

HEALTHCARE PROFESSIONAL-ORIENTED TOOLS

To reduce the risks associated with polypharmacy, healthcare professionals can utilize several evidence-based tools:

- Beers Criteria: Identifies medications that may be inappropriate for older adults.
- STOPP/START Criteria: Helps recognize potentially inappropriate prescriptions and missing beneficial treatments.
- Electronic Medical Records (EMRs): Improves communication between physicians and provides real-time access to patients' medication histories.
- Comprehensive Medication Reviews (CMRs): Conducted by physicians or pharmacists to identify redundant medications and prevent drug interactions [11,12].
- Clinical Decision Support Systems (CDSS): These systems provide real-time alerts to physicians regarding potential DDIs, inappropriate prescriptions, and optimal treatment alternatives.

PATIENT-CENTERED APPROACHES

Patients can also adopt strategies to improve adherence and medication safety:

- Pill Organizers: Weekly pillboxes help patients manage their regimens.
- Medication Reminder Apps: Digital reminders enhance adherence.
- Educational Programs: Increased awareness about potential drug interactions and the importance of adherence improves patient outcomes.
- Self-Assessment Tools: Instruments such as the MUSE (Medication Understanding and Use Self-Efficacy Scale) and ARMS (Adherence to Refills and Medications Scale) help evaluate patient adherence [13-16].
- Regular Deprescribing Evaluations: Encouraging routine reassessment of medication regimens by physicians can help identify unnecessary or potentially harmful drugs.

THE ROLE OF FAMILY SUPPORT
IN MEDICATION ADHERENCE

Family members play a crucial role in assisting elderly patients with their medication routines. They help ensure adherence, recognize side effects, and communicate concerns to healthcare providers. Collaboration between medical personnel and caregivers enhances treatment effectiveness and patient safety. Additionally, caregiver training programs can provide valuable education on polypharmacy risks and management techniques.

COGNITIVE IMPAIRMENT
AND ITS EFFECT ON MEDICATION ADHERENCE

Cognitive impairment further complicates adherence to polypharmacy regimens. Patients with dementia or mild cognitive decline may struggle to follow complex medication schedules, leading to suboptimal treatment outcomes. Research suggests a strong correlation between cognitive impairment and non-adherence, emphasizing the need for tailored interventions such as simplified dosing regimens and caregiver involvement [17-20]. Despite its significance, the relationship between cognitive function and medication adherence remains underexplored and warrants further study. Future research should focus on the development of cognitive-friendly pharmacotherapy management strategies and assess their effectiveness in real-world clinical settings.

CONCLUSIONS

- Polypharmacy is a growing challenge in Poland, particularly among the elderly population.
- The risks associated with polypharmacy include adverse drug interactions, non-adherence, and increased healthcare costs.
- Several tools, including the Beers Criteria, STOPP/START criteria, and electronic medical records, can help healthcare professionals optimize pharmacotherapy.
- Patient-centered strategies and caregiver involvement play a key role in improving medication adherence.
- Further research is needed to explore the relationship between cognitive impairment and adherence to polypharmacy treatment.
- The implementation of deprescribing strategies and decision-support systems can further enhance polypharmacy management and patient safety.

REFERENCES

1. Quinn KJ, Shah NHA dataset quantifying polypharmacy in the United States. Scientific Data, 4, 170167 (2017). https://doi.org/10.1038/sdata.2017.167 [Access: December 2024].
2. World Health Organization (2019). Medication safety in polypharmacy. http://apps.who.int/bookorders [Access: December 2024].
3. GUS (2022). Population. Size and structure by territorial division. Statistical Office in Szczecin. https://szczecin.stat.gov.pl/en/population-size-and-structure/ [Access: December 2024].
4. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. Lancet (London, England) 2012;380(9836):37-43. doi: 10.1016/S0140-6736(12)60240-2
5. Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. Expert Opin Drug Saf. 2014;13(1):57-65. doi: 10.1517/14740338.2013.827660
6. Lee VW, Pang KK, Hui KC, Kwok JC, Leung SL, Yu DS, Lee DT. Medication adherence: is it a hidden drug-related problem in hidden elderly? Geriatr Gerontol Int. 2013;13(4):978-985. doi: 10.1111/ggi.12042

7. Kardas P, Urbański F, Lichwierowicz A, Chudzyńska E, Kardas G, Czech M. (2021). Prevalence and Age Structure of Polypharmacy in Poland: Results of the Analysis of the National Real-World Database of 3Front Pharmacol. 2021 Apr 15;12:655364. doi: 10.3389/fphar.2021.6553648 Million Citizens. Frontiers in pharmacology, 12, 655364. doi: 10.3389/fphar.2021.655364
8. Ramsdale E, Mohamed M, Yu V, et al. Polypharmacy, Potentially Inappropriate Medications, and Drug-Drug Interactions in Vulnerable Older Adults With Advanced Cancer Initiating Cancer Treatment. Oncologist 2022;27(7):e580–e588. doi: 10.1093/oncolo/oyac053
9. By the 2023 American Geriatrics Society Beers Criteria® Update Expert Panel (2023). American Geriatrics Society 2023 updated AGS Beers Criteria® for potentially inappropriate medication use in older adults. J Am Geriatr Soc. 2023 Jul;71(7):2052-2081. doi: 10.1111/jgs.18372
10. O'Mahony D, Cherubini A, Guiteras AR, et al. STOPP/START criteria for potentially inappropriate prescribing in older people: version 3. Eur Geriatr Med. 2023;14(4):625-632. doi: 10.1007/s41999-023-00777-y
11. Kurczewska-Michalak M, Lewek P, Jankowska-Polańska B, et al. Polypharmacy Management in the Older Adults: A Scoping Review of Available Interventions. Front Pharmacol. 2021;12:734045. doi: 10.3389/fphar.2021.734045
12. Page AT, Etherton-Beer CD, Clifford RM, Burrows S, Eames M, Potter K. Deprescribing in frail older people--Do doctors and pharmacists agree? RSAP 2016;12(3):438-449. doi: 10.1016/j.sapharm.2015.08.011
13. Cameron KA, Ross E L, Clayman ML, et al. Measuring patients' self-efficacy in understanding and using prescription medication. Patient Educ Couns. 2010;80(3):372-376. doi: 10.1016/j.pec.2010.06.029
14. Lamarche L, Tejpal A, Mangin D. Self-efficacy for medication management: a systematic review of instruments. Patient Prefer Adherence. 2018 Jul 20;12:1279-1287. Doi: 10.2147/PPA.S165749
15. Kripalani S, Risser J, Gatti ME, Jacobson TA. Development and evaluation of the Adherence to Refills and Medications Scale (ARMS) among low-literacy patients with chronic disease. Value Health 2009;12(1):118-123. doi: 10.1111/j.1524-4733.2008.00400.x
16. Lomper K, Chabowski M, Chudiak A, Białoszewski A, Dudek K, Jankowska-Polańska B. Psychometric evaluation of the Polish version of the Adherence to Refills and Medications Scale (ARMS) in adults with hypertension. Patient Prefer Adherence. 2018;12:2661-2670. doi: 10.2147/PPA.S185305
17. Cummings JL, Tong G, Ballard C. Treatment Combinations for Alzheimer's Disease: Current and Future Pharmacotherapy Options. Journal of Alzheimer's Disease, 2015;52(3):545-562
18. Pickett J, Bird C, Ballard C, et al. A roadmap to advance dementia research in prevention, diagnosis, intervention, and care by 2025. Int J Geriatr Psychiatry 2018;33(7):900-906. doi: 10.1002/gps.4868
19. Hajjar ER, Cafiero AC, Hanlon JT. Polypharmacy in elderly patients. Am J Geriatr Pharmacother. 2007;5(4):345-351. doi: 10.1016/j.amjopharm.2007.12.002
20. Marcum ZA, Gellad WF. Medication Adherence to Multidrug Regimens. Clin Geriatr Med. 2012;28(2):287-300

CONFLICT OF INTEREST

The Author declares no conflict of interest.

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RECEIVED: 10.12.2024
ACCEPTED: 28.02.2025

Ⓐ – Work concept and design, Ⓑ – Data collection and analysis, Ⓒ – Responsibility for statistical analysis, Ⓓ – Writing the article, Ⓔ – Critical review, Ⓕ – Final approval

Emerg Med Serv, 2025; XII, 1: 35-41

DOI: 10.36740/EmeMS202501106

REVIEW ARTICLE

The role of emergency medical teams in natural disasters – an analysis of strategies, challenges and best practices in rescue operations

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ABSTRACT

Natural disasters such as earthquakes, floods, hurricanes, forest fires, and epidemics caused by climate change are an increasing threat to the global community. These events result in significant material destruction and numerous human casualties, which require an immediate and coordinated response from emergency services. Emergency Medical Services (EMS) play a key role in such situations, providing first aid, stabilizing the condition of the injured, and organizing evacuations in difficult and often unpredictable conditions. Paramedics must handle extreme challenges, such as destroyed infrastructure, lack of access to water and energy, and difficult terrain. Additionally, the constantly changing crisis situation, where every decision is critical, presents ongoing challenges. These circumstances require not only quick decision-making but also effective cooperation with other emergency services and the use of modern technologies. To meet these challenges, regular, specialized training for paramedics is crucial. Educational programs should combine theory with practice, equipping responders with the necessary skills to operate effectively in challenging conditions. This type of preparation is essential to ensuring a swift and effective response to natural disasters, minimizing their tragic consequences, and saving lives.

KEY WORDS

paramedics, Emergency Medical Services (EMS), natural disaster

INTRODUCTION

Natural disasters, including earthquakes, floods, hurricanes, forest fires, as well as epidemics caused by climate change, have become an increasingly frequent threat to communities around the world in recent decades [1-5]. Their effects not only cause huge material losses, but also lead to numerous human casualties, requiring an immediate and coordinated response from emergency services [1, 3, 5-7]. In these conditions, the key role is played by emergency medical teams (EMTs), which are responsible for providing first aid, stabilizing the health of the injured and organizing evacuation in extreme conditions [1, 6].

The role of EMTs in the context of natural disasters is not limited to providing medical assistance. Rescuers must operate in difficult, often unpredictable conditions, such as destroyed infrastructure, lack of access to water sources, electricity or information [1, 4, 8]. In addition, their work requires the ability to make decisions quickly in crisis situations, coordinate actions with other emergency services, military and humanitarian organizations, as well as use modern technologies that enable more effective and faster access to victims [1, 6].

AIM

The aim of this article is to analyze the role of Emergency Medical Teams in responding to natural disasters, present the challenges they face and indicate best practices that can increase the effectiveness of rescue operations.

REVIEW AND DISCUSSION

NATURAL DISASTERS

Natural disasters are phenomena that can lead to serious environmental damage and have a far-reaching impact on human health. The most common types of natural disasters include earthquakes, floods, hurricanes, forest fires and volcanic eruptions [4, 5, 8, 9]. Each of these phenomena can lead to immediate injuries, as well as long-term health problems, such as respiratory

diseases or mental illnesses. In the case of earthquakes, in addition to direct threats such as building collapse or infrastructure damage, there is also a risk of wounds and fractures that require immediate medical intervention [4, 5]. Furthermore, in regions affected by this phenomenon, drinking water is often contaminated, which promotes the spread of infectious diseases [5]. Floods, which usually occur after heavy rainfall or as a result of snow melting, lead not only to material damage but also to serious health problems related to water and soil contamination, including the development of waterborne diseases. The risk of skin infections also increases, especially in the case of long-term contact with contaminated water [4, 5]. Hurricanes and typhoons, especially in tropical regions, can cause mechanical injuries, such as cuts or fractures caused by flying objects, and also affect the mental health of victims, causing post-traumatic stress. These phenomena also pose a threat to the respiratory system due to the presence of dust, smoke and other air pollutants [5]. Volcanic eruptions, although less frequent, have a major impact on the health of people living nearby. Volcanic ash containing toxic substances can lead to respiratory problems, and contamination of water and soil can cause long-term health problems. Eruptions also often result in fires, which pose an additional risk [5].

PLANNING AND ORGANIZATION OF RESCUE OPERATIONS

Effective planning and organization of rescue operations in response to natural disasters are the foundation of the effectiveness of the intervention of emergency medical teams. A key element is the preparation of appropriate procedures and strategies that take into account the specifics of different types of natural disasters. Good planning includes the creation of early warning systems that allow for a faster response and minimization of losses, as well as setting priorities in terms of evacuation, transport of victims and ensuring access to places affected by the disaster [8]. The organization of rescue operations should be based on a thorough assessment of the situation, which takes into account the availability of resources such as medical personnel, rescue equipment, as well as logistical possibilities [8,10]. Cooperation between various emergency services, such as the fire brigade, police, army, as well as humanitarian organizations, is essential for coordinating actions and optimal use of available resources [8, 9]. The modern approach to planning also takes into account the integration of modern technologies, such as crisis management systems, drones, telemedicine, or mobile applications, which enable faster and more precise action [8]. Equally important is conducting training and simulation exercises for rescue teams, which allows for the development of efficient procedures and preparation of personnel for work in extreme conditions. Through proper organization and flexibility in operation, rescue teams are able to effectively respond to a dynamically changing crisis situation, maximizing the effectiveness of the assistance provided [8, 10].

PLANNING AND ORGANIZING RESCUE OPERATIONS: ORGANIZATIONAL MODELS (NIMS, ICS)

Effective planning and organization of rescue operations in the face of natural disasters require the use of proven organizational models that enable rapid and coordinated action by rescue services [8,11]. One of the most commonly used systems in this area is the National Incident Management System (NIMS), developed in the United States, which is a framework for crisis management in catastrophic situations. NIMS integrates various aspects of crisis management, including communication, resource coordination and cooperation between agencies [11,12]. In turn, the Incident Command System (ICS), which is part of NIMS, offers a structured approach to crisis management, enabling flexible adjustment of the number of units, depending on the scale and nature of the event. Thanks to ICS, it is possible to ensure a clear hierarchy, assignment of responsibility and efficient use of resources in dynamic and unpredictable conditions [13,14]. These models, through their organization and flexibility, allow for effective management of rescue operations, minimizing chaos and ensuring an appropriate response to the needs of victims during and after a disaster. In the context of medical rescue in natural disasters, proper implementation of such organizational models can be crucial in ensuring efficient evacuation of victims, coordination of medical assistance and integration of activities of various services [11-14].

NATIONAL INCIDENT MANAGEMENT SYSTEM (NIMS)

The National Incident Management System is a comprehensive crisis management system developed by the United States Department of Homeland Security (DHS), which aims to standardize and streamline incident management processes at the national level. It was created in response to the need to improve the coordination and effectiveness of rescue operations in the face of various threats, such as natural disasters, terrorist attacks, and other crisis situations [11-14].

NIMS ensures the consistency of rescue operations by introducing uniform standards and procedures that are used by both government agencies and non-governmental organizations and the private sector [11,12]. Key elements of NIMS include: organizational structure, process standardization, resource management, and communication. The organizational structure according to NIMS is based on a flexible, scalable model that can be adapted to the scale and specificity of a given incident [11-13]. This includes, among others, the command hierarchy and assignment of responsibility, which allows for effective coordination of rescue operations. Standardization of processes in accordance with NIMS establishes uniform rules regarding, among others, communication, operational procedures and logistics, which facilitates cooperation between different agencies and organizations operating

at different levels [11-13]. NIMS includes central resource management, enabling efficient allocation and monitoring of equipment, personnel and other resources during a crisis. This helps avoid unnecessary delays and ensures more efficient use of available resources. The key role of NIMS is to establish a communication system that allows the exchange of information between all units involved in the rescue operation. This ensures that decisions are made based on consistent and up-to-date data, which increases the effectiveness of rescue operations [11,12,14].

INCIDENT COMMAND SYSTEM (ICS)

Incident Command System is an organizational structure that is part of NIMS, which focuses on the management of the incident itself. ICS is designed to be flexible, scalable and easy to apply to various crisis situations, regardless of their size and characteristics [7,13,14]. The main features of ICS include a single-person command (Incident Commander, IC), which prevents confusion and enables faster decision-making, as the IC has full responsibility for coordinating the activities during an incident [13,14]. The ICS system divides the management of an incident into key functions, such as operations, which is responsible for implementing rescue and relief activities; logistics, which deals with the supply of resources, transportation, and other technical needs; planning, which is responsible for forecasting needs, monitoring the situation, and preparing reports; and finance and administration, which manages financing, human resources, and documentation of activities [13,14]. ICS is scalable and flexible, allowing the management structure to be adapted to the scale of the incident – for small incidents, a minimal team can be used, while in the case of large disasters, the structure can be expanded to include additional levels of command and support [13,14]. The system also enables clear division of responsibilities and delegation of tasks at different levels, which ensures the effective management of large and complex rescue operations, minimizing the risk of duplication of effort and missing important issues. Furthermore, ICS supports inter-agency coordination by enabling collaboration between different organizations, which is crucial for harmonizing activities and sharing information in situations where multiple actors are involved [13, 14].

COORDINATION BETWEEN RESCUE SERVICES, ADMINISTRATION, NON-GOVERNMENTAL ORGANIZATIONS

In the face of natural disasters, where the scale of the threat can be huge and resources are limited, a key element of effective rescue operations is efficient coordination between various entities - rescue services, public administration, non-governmental organizations and the private sector [7-9,15]. These operations must be organized in a way that allows for a rapid response, minimizing the time needed to mobilize resources, identify priorities and adapt activities to the dynamically changing crisis situation [7-9].

Rescue services, including the fire brigade, police, army, as well as medical rescue teams, play a key role in the direct response to the disaster [8, 9]. Their activities must be closely coordinated to avoid duplication of tasks, delays in reaching the victims and to ensure the safety of all involved [8, 9]. The common tool for organizing such activities is the Incident Command System, which allows for the creation of flexible but coherent command structures, enabling rapid transfer of information and delegation of responsibility [13, 14].

Coordination between rescue services and public administration during natural disasters is crucial for effective crisis management and minimizing the effects of disasters [16, 17]. In situations such as floods, earthquakes or forest fires, efficient cooperation between various services and state administration bodies allows for faster response, better organization of evacuation, providing assistance to victims and ensuring public order [16, 17]. Joint planning, exchange of information, as well as establishing clear communication and decision-making procedures are the foundation for effective action in crisis situations [16, 17].

Non-governmental organizations (NGOs) play an irreplaceable role in crisis situations, especially in the field of humanitarian, logistic and psychological support [7, 9, 15]. Emergency medical teams often cooperate with organizations such as the Red Cross, Doctors Without Borders or other local associations that offer assistance in the form of medical care (e.g. mobile field hospitals), psychological support for disaster victims, as well as the provision of basic food products, water and clothing [7, 9]. Non-governmental organizations often operate in places where government structures have limited access or where assistance is needed in a short time. Additionally, their flexibility in obtaining funds and rapid mobilization of volunteers allow for effective supplementation of rescue services [7, 9, 15].

LOGISTICS AND RESOURCE MANAGEMENT

Logistics and resource management are a key element of rescue operations of medical teams during natural disasters. Effective management of access to resources, such as medical equipment, means of transport, water supplies, food or fuel, is essential to ensure the efficiency of rescue operations [3, 10]. In crisis situations, where infrastructure is destroyed and communication routes are damaged, ensuring continuity of supply and optimal use of available resources becomes a logistical challenge. It requires a fast and flexible organization to effectively respond to changing conditions [3, 8, 10].

Another key aspect is the management of personnel, who must be properly trained and assigned to specific tasks depending on the situation. Appropriate allocation of forces and resources allows for the maximum use of available resources, which is extremely important in difficult conditions of natural disasters. Depending on the situation, it allows for the effective use of forces and resources in difficult conditions [3, 18].

Logistics in rescue operations includes, among others: transport of the injured, delivery of humanitarian aid to isolated areas, and rapid deployment of rescue units to the most affected areas [4, 10]. Proper management of resources not only increases the effectiveness of rescue operations but also supports long-term rehabilitation and reconstruction of disaster-affected areas [8, 10].

In the context of transport and distribution of medical supplies, logistics play a key role in ensuring that the necessary resources reach those in need of assistance in the shortest possible time. During a crisis, chaos, destruction of infrastructure, road closures and difficult access to disaster areas often occur [4, 8, 10, 18]. In such conditions, effective transport management and coordination of activities become essential to enable rapid provision of medical assistance [8, 10].

Similarly, ensuring access to basic resources such as water, medicines and food is one of the most important logistical challenges. In the face of destruction of critical infrastructure and disruptions in supply systems, effective management of these resources can be crucial for the survival of the victims, as well as for preventing further consequences of the disaster. Effectiveness in this area determines a quick response to human needs and minimizing the effects of the crisis [8, 10].

DIFFICULTIES IN ACCESSING DISASTER-AFFECTED AREAS

One of the main challenges faced by emergency medical teams during natural disasters is the difficulty in reaching victims, especially due to severe infrastructure damage, difficult terrain conditions and lack of access to roads [4, 8]. Infrastructure damage such as collapsed bridges, damaged roads, destroyed power lines or severed telecommunications networks constitute serious obstacles to organizing effective assistance [4, 5, 8]. In such situations, standard methods of transport become unavailable and rescue teams must rely on alternative solutions such as helicopters or drones to assess the situation and transport injured people [19,20].

PSYCHOSOCIAL FACTORS: TRAUMA AMONG RESCUERS

During natural disasters, in addition to logistical and medical challenges, one cannot forget about the extremely important psychosocial factors that affect paramedics. These professionals are exposed to enormous psychological stress, related not only to the danger that threatens their life and health in difficult conditions, but also to the responsibility for the lives of others, especially in the face of mass disasters [2, 21]. Daily confrontation with tragic images, suffering and death, especially in cases where help is insufficient, can lead to serious psychological consequences. Paramedics are particularly vulnerable to burnout, emotional disorders, depression, anxiety and post-traumatic stress disorder (PTSD) [2, 21]. Long-term exposure to traumatic situations associated with suffering and death can also increase the risk of depression, anxiety, and lead to addiction problems such as alcoholism or drug addiction [2,21]. Additionally, the stress associated with working in extreme conditions – especially when there is a lack of necessary resources, logistical or medical support – can cause a sense of hopelessness and exhaustion. Such emotions and reduced work efficiency can negatively affect the quality of life-saving, as well as the mental health of paramedics themselves [2, 21]. In the face of these challenges, it is crucial to provide adequate emotional support, education in stress management, and prepare teams to work in such extreme conditions. To overcome these difficulties, psychoeducation and psychological support are extremely important. For paramedics, it is important to implement psychological support programs, including therapy sessions, support groups, and the availability of psychologists and therapists during and after the rescue operation [2, 21].

Improving Rescue Procedures: Using Simulations and Training in Preparation for Natural Disasters

In the face of the growing number and scale of natural disasters, improving rescue procedures and preparing rescue teams to act effectively in crisis situations is becoming crucial [6,22]. One of the most effective ways to achieve this goal is to regularly conduct simulations and training, which allow for practical testing of the readiness of rescue teams and improve cooperation between various services [6, 22]. Crisis simulations, which reflect real disaster conditions, allow for the identification of potential problems in logistics, work organization, and coordination of activities between rescuers, administration and non-governmental organizations [6, 22]. In such simulations, which often take the form of exercises in the field or on computer simulators, rescuers have the opportunity to practically improve their decision-making skills under time pressure, resource management and first aid in difficult conditions [6, 22].

TEAMS PROJECT

An example of training for rescuers in the event of disasters is the international TEAMS project. It all started with the TEAMS 1.0 project. It created an innovative operational training package that focuses on teamwork, helping EMS teams prepare for operations in the field. After its completion in 2018, paramedics from all over the world had access to free training based on simulations of situations that may occur during real rescue missions. The aim of these exercises was to improve their performance in difficult conditions [6,23]. The TEAMS 2.0 project went a step further by developing a "Train the Trainers" program, which included e-learning modules and on-site workshops. This program aimed to train future team leaders and training managers in EMS organizations to be able to use the TEAMS package effectively. The project also created an e-learning platform "Trainers' Compasses" [6,23] available online. TEAMS 3.0 builds on previous projects by involving new partners

and EMT organizations from across the European Union. The project introduces new scenarios and exercises that prepare paramedics to respond to epidemic outbreaks, man-made disasters and other threats that may occur in different countries. Additionally, the TEAMS 3.0 project broadly introduces an updated training package, engaging EMT teams in Europe in joint exercises and training programs aimed at improving cross-border cooperation in crisis management. This initiative also supports the activities of the World Health Organization (WHO) in the area of emergency medical services [6, 23].

MODERN TECHNOLOGIES IN TRAINING PARAMEDICS IN THE EVENT OF DISASTERS

In recent years, the use of virtual reality (VR) and mixed reality (MR) technologies in training paramedics during natural disasters has been gaining importance. These technologies offer modern, effective tools that enable simulation of difficult and dangerous scenarios in a safe environment, preparing paramedics for real challenges [24,25]. Thanks to VR and MR, training participants can experience realistic crisis situations, such as evacuating the injured from rubble, providing first aid in disaster conditions or managing chaos after an earthquake, without having to expose them to risk [24, 25]. These technologies allow for interactive exercises in which rescuers can navigate in virtual environments, test their skills, respond to dynamically changing conditions and make decisions in real time [24, 25]. Moreover, MR allows training to be enriched with elements of cooperation with real objects, which increases the realism of the simulation. This approach not only improves practical preparation, but also shortens the response time of rescue teams, increasing their effectiveness in real crisis situations [24, 25].

APPLICATION OF ARTIFICIAL INTELLIGENCE IN RESCUE OPERATIONS DURING NATURAL DISASTERS

Artificial intelligence (AI) is playing an increasingly important role in rescue operations during natural disasters, offering new opportunities for faster data analysis, crisis forecasting and operational decision support [26, 27]. In the context of emergency medical teams, AI supports triage processes, i.e. assessment of the condition of injured people, by analyzing medical images, monitoring vital signs or automatically generating suggestions for treatment priorities [28]. AI-based technologies, such as early warning systems or applications for analyzing maps and meteorological data, enable precise forecasts and better allocation of resources, which is crucial in situations where response time is crucial [26,27]. Additionally, AI plays an important role in optimizing aid distribution and resource allocation by analyzing large data sets, such as the location of injured people, resource availability, terrain conditions and weather forecasts. Thanks to this, AI-based systems can create the most effective strategies for delivering aid, prioritizing the transport of equipment, medicines, and medical personnel, minimizing the time it takes to reach those most in need [26,27]. In addition, AI supports coordination between rescue units, optimizing routes to reach the injured, and monitoring resource consumption in real time. This approach allows for dynamic adjustment of actions to the changing situation, increasing operational efficiency and reducing the risk of resource shortages or excess in specific areas [26,27]. Despite many benefits, implementing AI in emergency medical services is associated with challenges, such as the need to integrate various information systems, ensuring appropriate data quality, and issues related to information security and privacy. Nevertheless, the development of these technologies gives hope for improving the efficiency and effectiveness of rescue operations in the face of natural disasters [26, 27].

CONCLUSIONS

Emergency medical teams play a key role in responding to natural disasters, where their task is not only to provide medical assistance, but also to effectively coordinate actions in difficult conditions. The challenges they face include infrastructure damage, difficulties in accessing victims, the need for quick decision-making and cooperation with other emergency services and humanitarian organizations. Effective planning, organization of actions and implementation of proven crisis management models, such as NIMS and ICS, allow for optimal use of resources and faster response to the needs of victims. In the context of logistics, ensuring access to basic resources and effective management of personnel is crucial, which significantly affects the quality of rescue operations.

Modern technologies, such as drones, telemedicine or crisis management systems, significantly support the effectiveness of rescue operations, allowing faster access to victims and more accurate monitoring of the situation. Equally important is providing emotional support for rescuers who are exposed to stress and trauma related to working in extreme conditions. Improving rescue procedures through regular simulations and training is essential for rescue teams to effectively respond to dynamically changing crisis situations.

Examples of international projects such as TEAMS show the importance of international cooperation and developing rescuer competences in the face of increasingly complex threats. Modern technologies, including VR and MR, have the potential to revolutionize the way rescuers are trained, providing them with better preparation to respond to natural disasters and other crisis situations.

In addition, artificial intelligence is playing an increasingly important role in improving the effectiveness of rescue operations, enabling faster data analysis, better crisis forecasting and optimizing resource allocation. In the face of the growing number of natural disasters, investing in modern training and technologies is crucial to ensuring the fastest and most effective assistance to victims.

REFERENCES

1. Hamilton ARL, Södergård B, Liverani M. The role of emergency medical teams in disaster response: a summary of the literature. Natural Hazards. 2021;110:1417-26. doi: 10.1007/s11069-021-05031-x
2. Zahos H, Crilly J, Ranse J. Psychosocial problems and support for disaster medical assistance team members in the preparedness, response and recovery phases of natural hazards resulting in disasters: A scoping review. Australas Emerg Care. 2022 Sep;25(3):259-266. doi: 10.1016/j.auec.2021.12.005
3. Ghaffari Z, Nasiri MM, Bozorgi-Amiri A, Rahbari A. Emergency supply chain scheduling problem with multiple resources in disaster relief operations. Transportmetrica A: Transport Science. 2020;16:930-56. doi: 10.1080/23249935.2020.1720858
4. Alpert EA, Jaffe E. EMS Catastrophic Events. 2022 Sep 12. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan.
5. Hidalgo J, Baez AA. Natural Disasters. Crit Care Clin 2019;35:591-607. doi.org/10.1016/j.ccc.2019.05.001
6. Kaim A, Bodas M, Camacho NA, Peleg K, Ragazzoni L. Enhancing disaster response of emergency medical teams through "TEAMS 3.0" training package - Does the multidisciplinary intervention make a difference? Front Public Health. 2023 Apr 12;11:1150030. doi: 10.3389/fpubh.2023.1150030
7. Wanner GK, Loyd JW. EMS Care Teams In Disaster Response. 2022 Sep 26. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan.
8. Jiang Y, Yuan Y. Emergency Logistics in a Large-Scale Disaster Context: Achievements and Challenges. Int J Environ Res Public Health. 2019 Mar 4;16(5):779. doi: 10.3390/ijerph16050779
9. Klein TA, Irizarry L. EMS Disaster Response. 2023 Jul 17. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan.
10. Alem D, Clark A, Moreno A.Stochastic network models for logistics planning in disaster relief. Eur J Operat Res. 2016;255:187-206. doi: 10.1016/j.ejor.2016.04.041
11. Salzman SM, Clemente Fuentes RW. EMS National Incident Management System. 2023 Aug 8. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan.
12. Lincoln EW, Freeman CL, Strecker-McGraw MK. EMS Incident Command. 2023 May 16. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan.
13. Jensen J, Thompson S. The Incident Command System: a literature review. Disasters. 2016 Jan;40(1):158-82. doi: 10.1111/disa.12135
14. Furin M, Freeman CL, Goldstein S. EMS Incident Command System. 2024 Feb 24. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan.
15. Khaledi H, Marzaleh MA, Peyravi M, Rezaee R. Non-Governmental Organizations (NGOs) in Disaster Management: A Qualitative Study. Trauma Monthly 2023;28:678-86. doi: 10.30491/tm.2023.368785.1525.
16. Rijal S, Suherlan, Ausat, AMA. The Role of Public Administration in Natural Disaster Mitigation and Its Implications for Economic Stability. Indo-Fintech Intellectuals 2024;4(3):872-83. doi: 10.54373/ifijeb.v4i3.1475
17. Farazmand A, De Simone E, Gugg G. Natural Disasters and Public Administration Capacity Building: Key Challenges and Lesson Drawing. An Introduction [Internet]. Public Organization Review. Springer Science and Business Media LLC; 2024. doi: 10.1007/s11115-024-00802-z
18. Rustian R, Sumartono S, Hermawan H, Wardhono H. Implementation of Supply Chain and Logistics for Natural Disaster Management in Indonesia: A Smart Governance Perspective. Int J Criminol Sociol 2021;10:1699-706. doi: 10.6000/1929-4409.2021.10.192
19. Ishiwatari M. Leveraging Drones for Effective Disaster Management: A Comprehensive Analysis of the 2024 Noto Peninsula Earthquake Case in Japan. Progress in Disaster Science 2024;23:100348. doi: 10.1016/j.pdisas.2024.100348
20. Hatami M, Marzaleh MA, Bijani M, Peyravi M. Factors affecting the preparedness of Helicopter Emergency Medical Services (HEMS) in disasters: a systematic review [Internet]. BMC Emerg Med. 2023;23:135. doi: 10.1186/s12873-023-00908-5
21. Alghamdi AA. The Psychological Challenges of Emergency Medical Service Providers During Disasters: A Mini-Review February 2022. Front Psychiatry. 2022 Feb 28;13:773100. doi: 10.3389/fpsyt.2022.773100
22. Catlett CL, Jenkins JL, Millin MG. Role of Emergency Medical Services in Disaster Response: Resource Document for the National Association of EMS Physicians Position Statement Prehosp Emerg Care. 2011 Jul-Sep;15(3):420-5. doi: 10.3109/10903127.2011.561401
23. Training for Emergency Medical Teams and European Medical Corps 3.0 (TEAMS 3.0). https://civil-protection-humanitarian-aid.ec.europa.eu/funding-evaluations/financing-civil-protection/prevention-and-preparedness-projects-civil-protection/overview-past-track-i-and-track-ii-projects/training-emergency-medical-teams-and-european-medical-corps-30-teams-30_en [Access: January 2025].
24. Baetzner AS, Wespi R, Hill Y, et al. Preparing medical first responders for crises: a systematic literature review of disaster training programs and their effectiveness. Scand J Trauma Resusc Emerg. 2022 Dec 24;30(1):76. doi: 10.1186/s13049-022-01056-8
25. Alshowair A, Bail J, AlSuwailem F, Mostafa A, Abdel-Azeem A. Use of virtual reality exercises in disaster preparedness training: A scoping review. SAGE Open Med. 2024 Apr 14:12. doi: 10.1177/20503121241241936
26. Bari LF, Ahmed I, Ahamed R, et al. Potential Use of Artificial Intelligence (AI) in Disaster Risk and Emergency Health Management: A Critical Appraisal on Environmental Health. Environ Health Insights. 2023 Dec 10:17. doi: 10.1177/11786302231217808
27. Ramos Chaparro PA, Hernández Rincón EH, Osorio Betancourt GA, Melo Sierra N, Moreno Gómez MDM, Jaimes Peñuela CL. Artificial intelligence for the prediction of health emergencies and disasters. Disaster Emerg Med J. 2024;9:250-8. doi: 10.5603/demj.101110
28. He J, Baxter SL, Xu J, Xu J, Zhou X, Zhang K. The practical implementation of artificial intelligence technologies in medicine. Nat Med. 2019;25:30-6. doi: 10.1038/s41591-018-0307-0

CONFLICT OF INTEREST
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RECEIVED: 15.12.2024
ACCEPTED: 27.02.2025

A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval

Emerg Med Serv, 2025; XII, 1: 42-46

CASE STUDY

DOI: 10.36740/EmeMS202501107

Cardiac arrest during stadium test event: case report

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ABSTRACT

Out-of-hospital cardiac arrest (OHCA) is a rare but potentially life-threatening condition that can occur in various settings, including during sporting events at venues. The medical management of such patients is both challenging and time-sensitive, making the preparedness of the venue's medical team crucial. Reports have documented instances of OHCA occurring at the venue (OHCA-V), with outcomes often being more favorable compared to general OHCA statistics. Key factors in improving prognosis include the identification of OHCA triggers and prompt medical response. In this paper, we present the case of a 32 year-old male who suffered an OHCA during a test event at a newly built football stadium. The patient had no significant medical history but was found to have consumed alcohol in combination with other substances prior to the event. Immediate cardiopulmonary resuscitation (CPR) was administered, and the final outcome was favorable. The OHCA-V was the first manifestation of the Wolff-Parkinson-White syndrome (WPW), which was triggered by the use of a mixture of substances and heightened emotional stress during the sporting event. Although a detailed diagnostic workup was planned in the hospital, the patient was discharged on his own request before completing the final tests.

KEY WORDS

out-of-hospital cardiac arrest, resuscitation, major sporting event, sport venue, WPW syndrome, OHCA trigger, mass gathering medicine

INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a life-threatening condition in which treatment outcomes and the risk of long-lasting sequalae depend greatly on timely medical intervention and the patient's underlying medical condition. Early bystander cardiopulmonary resuscitation (CPR) and rapid medical response are crucial for a favorable outcome [1-4].

Key parameters for assessing OHCA include patient age and sex, the location where the OHCA occurred, whether bystander CPR was performed, the first arresting rhythm, and the presumed etiology [2]. Assessment of medical response includes emergency medical system (EMS) response time, time to first defibrillation, medications administered, the presence myocardial infarction, coronary angiogram, reperfusion attempts, and the type of hospital where OHCA was treated [2]. Outcomes assessment includes patient survival following OHCA, return of spontaneous circulation (ROSC), transport to the hospital, 30-day survival or survival to hospital discharge, and favorable neurological outcomes [2].

Sport venues are not the primary locations for OHCA incidents, however such events are reported, particularly during mass sporting events (MSE) [5-9]. Several factors have been identified as influencing the risk of OHCA-at-the-venue (OHCA-V) in spectators, including large crowds, long travel distances to the venue, emotional stress, MSE duration, weather conditions, and the consumption of alcohol and other substances [5-12].

The implementation of venue medical contingency plans (MCP) for MSE is now routine [5-10, 13, 14]. During the preparedness phase of a newly built venue, several important elements must be addressed, primarily the

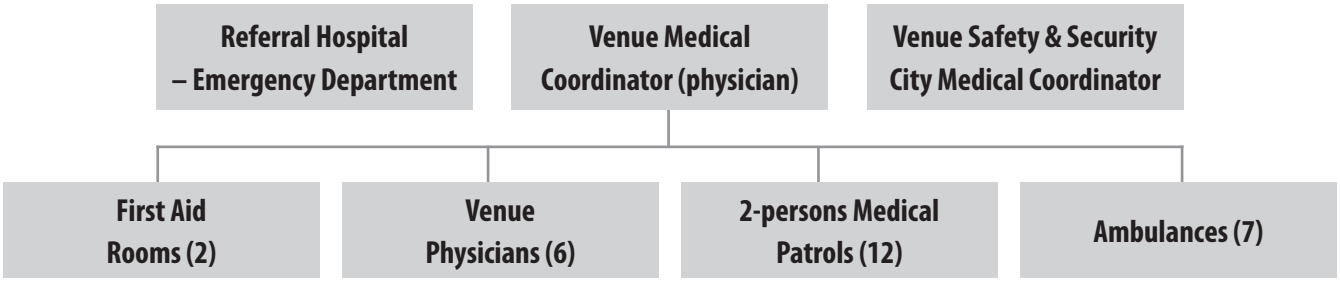

Fig. 1. The structure of the venue medical team

preparation of the MCP at the venue, followed by the recruitment and training of staff. Medical professionals must be trained both within the venue and as part of the team to work efficiently during MSE. Additionally, referral hospitals are designated for MSE spectators [5-7, 14].

The final phase is the test event, which aims to assess operational effectiveness of the MCP and implement necessary improvements. Experienced observers should assist the medical team to ensure high-quality recommendations. Upon completion of this process, the medical team at the venue is fully operational.

CASE DESCRIPTION

We present a case description of an OHCA-V incident that occurred during the test event at the newly built football stadium with a capacity of 43,000. The MSE was a boxing gala lasting nine hours, designed to allow the audience to experience the new venue. The weather conditions were favorable. The structure of the MCP is shown in Figures 1. Additionally, two medical observers and firefighter teams were present.

The patient was a 32-year-old male who described himself as a dedicated sports fan. He had no prior medical history, no diagnosed cardiac conditions, and no relevant family history. He was a heavy smoker, consuming 20 cigarettes daily for the past 10 years.

As later established, during the week leading up to the event, he consumed alcohol on a daily basis. He also admitted to taking several methylenedioxy-methamphetamine (MDMA, "ecstasy") tablets, combined with some energy drinks on the day of the event.

The OHCA-V incident occurred in the stands. Access to the patient was difficult due to the crowded passages filled with spectators, the patient's location in a narrow and congested area between the seats, and challenges in identifying the exact location of the incident due to the inexperience of the safety staff.

CPR was initiated not by bystanders, but by an emergency physician, one of the medical observers. Approximately six minutes later, firefighters arrived at the scene with a stretcher, followed immediately by the medical team carrying a defibrillator.

Ventricular fibrillation (VF) was confirmed, but three defibrillation attempts failed to restore a normal rhythm. Initially, the patient could not be intubated, and venous access was not secured. Due to challenging conditions at the scene – narrow space, darkness, and cold – a decision was made to swiftly evacuate the patient to the nearby hospitality area.

Once there, CPR was performed according to the advanced life support (ALS) guidelines [1, 3] and was successful after about 15 minutes. Sinus rhythm was re-

Fig. 2. Fragment of the patient's 24-hour Holter ECG

The upper line reveals sinus tachycardia at approximately 100/min, with a PQ interval of 160 ms and widening of the QRS complex to about 120 ms, likely indicating nonspecific intraventricular conduction disturbances.

The lower line shows sinus rhythm at 72/min, with PQ shortening to 110 ms, a QRS duration of 120 ms, and a visible delta wave, typical of pre-excitation (black arrows).

Atrial fibrillation in patients with ventricular pre-excitation is a potentially life-threatening condition that can lead to cardiac arrest through the mechanism of ventricular fibrillation. The transient ventricular pre-excitation documented during Holter ECG recording in this patient case is the most probable cause of the cardiac arrest

Table 1. OHCA data from the sport venues

Sport venue	Country	Stadium capacity	Period	Number of spectators	Number of OHCA	Incidence of OHCA per 100,000	Male Sex (%)	ROSC (%)	Bystander CPR (%)	Medical response time	30-days survival (%)
Gillette Stadium [5]	Boston, USA	65 878	2010 - 2019	7 767 345	21	0.27	95.2	15 (71.4)	13 (68.4)	2 (1-6)	13 (61.9)
First and Second Football League [9]	Germany	N/D	2008 – 2010	N/D	52	N/D	N/D	50 (96)	N/D	N/D	N/D
Football clubs [19]	Australia	N/D	2007 - 2015	N/D	6	N/D	N/D	3 (50)	3 (50)	6 (5-9)	N/D
20 Stadiums[10]	Netherlands	3 600 – 51 600	2006 – 2008	12 822 034	22	0.73	N/D	18 (82)	N/D	Immediate	N/D
AZ Alkmaar [6]	Netherlands	17 000	2006 - 2007	over 800 000	3	0.38	100	3 (100)	N/D	Immediate	3 (100)
Camp Nou [7]	Barcelona, Spain	98 260	2000 - 2001	N/D	7	N/D	100	6 (85.7)	N/D	Immediate	N/D
Celtic Park [8]	Glasgow, Scotland	60 832	1999 - 2000	1 333 046	1	0.17	100	1 (100)	N/D	Immediate	1
Total					**112**			**96 (85.7)**			

stored, the patient was intubated, venous access was secured and adrenaline was administered. After the return of sinus rhythm, the patient had a seizure episode, which was successfully managed with clonazepam.

The patient was transported to the referral hospital. Laboratory tests revealed severe hypokalemia. Coronary angiography showed no significant changes in the coronary arteries, and intracranial bleeding was excluded. The electrocardiogram (ECG) revealed sinus rhythm with a widened QRS complex, which did not meet the criteria for either right or left bundle branch block. Echocardiography revealed generalized hypokinesia of the left ventricular walls and an ejection fraction (EF) of 30%. After three days, the patient was extubated.

A follow-up echocardiographic examination showed no abnormalities in left ventricular wall contractility, and the EF had improved to 50%. A 24-hour Holter ECG revealed sinus rhythm, periodic shortening of the PQ interval to 110 ms and a widening of the QRS complex to 140 ms. Pre-excitation Wolff-Parkinson-White syndrome (WPW) was suspected as the most probable cause of cardiac arrest, potentially triggered by atrial fibrillation in the context of electrolyte disturbances, which degenerated into ventricular fibrillation, and by MDMA use. A fragment of the patient's 24-hour Holter ECG is shown in Figures 2.

The patient was scheduled for further cardiac evaluation. However, before the diagnostic process was completed, he left the hospital and failed to return for the planned re-hospitalization.

DISCUSSION

OHCA is one of the leading causes of death worldwide. According to international registries, the annual incidence of OHCA treated by EMS staff is estimated to range from 30.0 to 97.1 per 100,000 population globally, with figures of 35.0 to 40.6 per 100,000 reported in Europe [15-17]. The outcomes of OHCA patients are relatively poor, with survival to hospital discharge or 30-day survival rates ranging from 3.1% to 20.4% [15, 16] Furthermore, the rate of favorable neurological outcomes is even lower, ranging from 2.8% to 18.2% [15].

OHCA most frequently occurs at home (51.6% to 85.3%) [15, 18]. It is relatively rare at sport venues, with an incidence of 0.2% to 3.2% [15]. While there is no established OHCA-V reporting system, several publications have reported on its incidence and outcomes. These data are presented in the Table 1.

The incidence of OHCA-V (0.17–0.73 per 100,000 spectators) is significantly lower than global rates [5, 6, 8, 10]. The reported age range for OHCA-V patients is 48–73 years [5-8], which is similar to that of the general population [15]. Our patient was the youngest in this group.

Almost all OHCA-V patients were male – 59 out of 60 (98%). This can be attributed not only to the male predominance observed in worldwide reports, which show that 57,1%–68,3% of OHCA patients are male [15], but also to the fact that men constitute the largest group of the football spectators.

In 16 general registries, the first recognized shockable rhythm in OHCA was identified in a minority of cas-

es (7.9–36.5%) [15]. There is currently insufficient data to draw any conclusions regarding the first recognized cardiac rhythm or underlying cardiac disease in OHCA-V patients. However, in data from Gillette Stadium, the rate of shockable rhythms in OHCA-V patients was notably higher, with 15 out of 19 patients (71.4%) presenting with a shockable rhythm [5]. At the AZ Alkmaar Stadium, all three patients who were resuscitated on-site had VF [6]; and OHCA was the first recognized sign of cardiac disease. The prompt response by the medical team was likely life-saving for these patients [6, 7].

In general registries, the underlying medical condition was identified as the cause of OHCA in the majority of patients (52–94%), while drug or substance overdose was relatively rare, occurring in 6% or fewer of cases across 11 out of 16 registries [15]. In the Boston stadium analysis, 12 patients (57.1%) had documented underlying cardiac disease [5]. In the Netherlands, all three patients had underlying heart disease, which was diagnosed during post-OHCA-V hospital treatment, and all were treated sucessfully [6].

Regarding the outcomes of OHCA-V, the results are significantly better compared to general OHCA data, with 76.6% of OHCA-V patients achieving ROSC. In the Boston stadium analysis, 60% of patients were alive 30 days after OHCA and 47.4% had good neurological outcome [5]. In Leusveld's report all three patients had good neurological outcome [6].

Our paper has certain limitations, primarily the incomplete cardiac diagnosis of the presented OHCA-V patient due to his refusal to undergo final cardiac tests. Additionally, variations in the scope of information from other stadiums resulted in incomplete data, limiting the ability to draw more precise conclusions. There is limited medical data regarding the follow-up diagnosis, treatment, and outcomes of the OHCA-V patients. This underscores the need to strengthen medical cooperation between venue medical teams and referral hospitals.

CONCLUSIONS

OHCA is a life-threatening medical condition that rarely occurs during MSE. Treatment outcomes for OHCA-V patients can be more favorable compared to the general OHCA population.

In this case, despite underlying medical condition (undiagnosed WPW syndrome), certain triggers – such as emotional stress, alcohol or a combination of other substances – likely contributed to electrolyte disturbances and the occurrence of OHCA. The prompt medical response by the venue medical team significantly influenced the favorable outcome in this patient.

This case highlights the clear need for a structured medical reporting system for OHCA-V during major sporting events and for coordinated follow-up in partnership with the referral hospitals.

REFERENCES

1. Soar J, Bottiger BW, Carli P, et al. European Resuscitation Council Guidelines 2021: Adult advanced life support. Resuscitation 2021;161:115-151.
2. Bray JE, Grasner JT, Nolan JP, et al. Cardiac Arrest and Cardiopulmonary Resuscitation Outcome Reports: 2024 Update of the Utstein Out-of-Hospital Cardiac Arrest Registry Template. Circulation. 2024;150:e203-e223. doi: 10.1161/CIR.0000000000001243
3. Berg KM, Bray JE, Ng KC, et al. 2023 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. Circulation 2023;148(24);e187-e280 doi: 10.1161/CIR.0000000000001179
4. Brooks SC, Clegg GR, Bray J, et al. Optimizing Outcomes After Out-of-Hospital Cardiac Arrest With Innovative Approaches to Public-Access Defibrillation: AScientific Statement from the International Liaison Committee on Resuscitation. Circulation. 2022;145:e776-e801. doi: 10.1161/CIR.0000000000001013
5. Goldberg SA, Battistini V, Cash RE, et al. A retrospective review of out of hospital cardiac arrest at Gillette Stadium: 10 years of experience at a large sports venue. Resusc Plus. 2023;14:100386. doi: 10.1016/j.resplu.2023.100386
6. Leusveld E, Kleijn S, Umans V. Usefulness of Emergency Medical Teams in Sport Stadiums. Am J Cardiol. 2008 Mar 1;101(5):712-4
7. Grima RS, Carreño MJ, Abadal LT, et al. Acute coronary events among spectators in a soccer stadium. Rev Esp Cardiol. 2005;58:587-591
8. Crawford M, Donnelly J, Gordon J, et al. An analysis of consultation with the crowd doctors at Glasgow Celtic football club, season 1999-2000. Br J Sport Med. 2001;35:245-250.
9. Luiz T, Preisseger T, Rombach D, Madler C. Cardiac arrest in spectators in German football stadiums. Precautionary measures, frequency and short-term outcome. Anaesthesist. 2014 Sep;62(8-9):636-42. doi: 10.1007/s00101-014-2354-3
10. van de Sandt F, Umans V. Acute cardiac events and deployment of emergency medical teams and automated external defibrillators in large football stadiums in the Netherlands. Eur J Cardiovasc Prev Rehabil. 2009 Oct;16(5):571-5. doi: 10.1097/HJR.0b013e32832d1927
11. Witte DR, Bots ML, Hoes AW, Grobbee DE. Cardiovascular mortality in Dutch men during 1996 European football championship: longitudinal population study. BMJ 2000;321:1552-4
12. Wilbert-Lampen U, Leistner D, Greven S, et al. Cardiovascular events during World cup soccer. N Engl J Med 2008;358:475-483
13. Pons PT, Holland B, Alfrey E, Markovchich V, Rosen P, Dinerman N. An advanced emergency medical care system at National Football League games. Ann Emerg Med. 1980;9:203-206
14. Roberts DM, Blackwell TH, Marx JA. Emergency medical care for spectators attending national football league games. Prehosp Emerg Care. 1997;1(3):149-155. doi: 10.1080/10903129708958809
15. Kiguchi T, Okubo M, Nishiyama C, et al. Out-of-hospital cardiac arrest across the World: First report from the International Liaison Committee on Resuscitation (ILCOR). Resuscitation 152(2020)39-49. doi: 10.1016/j.resuscitation.2020.02.044

16. Berdowski J, Berg RA, Tijssen JGP, Koster RW. Global incidences of out-of-hospital cardiac arrest and survival rates: systematic review of 67 prospective studies. Resuscitation 2010;81:1479-87.
17. Atwood C, Eisenberg MS, Herlitz J, Rea TD. Incidence of EMS-treated out-of-hospital cardiac arrest in Europe. Resuscitation 2005;67:75-80.
18. Rudner R, Jalowiecki P, Karpel E, et al. Survival after out-of-hospital cardiac arrest in Katowice (Poland): outcome report according to the 'Utstein style'. Resuscitation 2004;61:315-25.
19. Sekendiz B. Incidence, bystander emergency response management and outcomes of the out-of-hospital cardiac arrest at exercise and sport facilities in Australia. Emerg Med Australas. 2021;33:100-106.

CONFLICT OF INTEREST

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RECEIVED: 10.12.2024
ACCEPTED: 25.02.2025

Ⓐ – Work concept and design, Ⓑ – Data collection and analysis, Ⓒ – Responsibility for statistical analysis, Ⓓ – Writing the article, Ⓔ – Critical review, Ⓕ – Final approval

Emerg Med Serv, 2025; XII, 1: 47-62

DOI: 10.36740/EmeMS202501108

ABSTRACT BOOK

V All-Ukrainian scientific and practical conference with international participation

«Emergency and urgent aid in Ukraine: Organizational, legal, clinical aspects»

February 28, 2025, Poltava, Ukraine

ABSTRACTS WERE PUBLISHED IN THE ALPHABETICAL ORDER OF AUTHORS' LAST NAMES

Emergency dental care for patients with systemic connective tissue diseases

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Introduction: Introduction: Systemic connective tissue diseases (SCTDs), including rheumatoid arthritis (RA), systemic lupus erythematosus (SLE), systemic sclerosis (SSc), and dermatomyositis, are associated with oral tissue involvement and an increased risk of dental complications. These patients frequently develop acute inflammatory processes in the maxillofacial region, as well as atrophic and erosive-ulcerative lesions of the oral mucosa, and exacerbations of periodontal diseases, which complicate emergency dental care.

Aim: To optimize approaches to emergency dental care for patients with SCTDs, considering their immune status, specific concomitant therapy, and potential risks of complications, in order to enhance treatment effectiveness and safety.

Materials and methods: The protocols of emergency dental care in patients with SCTDs were analyzed, along with clinical cases of acute dental conditions and their management considering comorbidities. Special attention was given to the use of anesthesia, anti-inflammatory and antibacterial therapy, physiotherapy methods, and postoperative management.

Results: The management of emergency dental care in patients with SCTDs requires a comprehensive approach, including pain and inflammation relief, minimizing invasive procedures in cases of osteonecrosis, rapid drainage in infectious complications, antibacterial prophylaxis, and rheumatologist consultation before surgical interventions. Careful selection of anesthesia is essential, as vasoconstrictors can elevate the risk of cardiovascular complications. The optimal choice is anesthetics with minimal vasoconstrictor content, such as 3% mepivacaine or 4% articaine without a vasoconstrictor.

In patients receiving bisphosphonates, traumatic interventions should be avoided due to the risk of osteonecrosis. Preoperative additional diagnostics (CBCT) and antibacterial prophylaxis are recommended.

In cases of acute inflammatory conditions affecting the maxillofacial region (periodontal abscess, periostitis, phlegmon, etc.), prompt drainage and antibacterial therapy, considering microbial sensitivity, are necessary. Surgical interventions should be minimally traumatic, utilizing laser or ozone therapy.

The treatment of erosive-ulcerative lesions of the oral mucosa (in SLE, SSc, RA) includes the application of local anesthetics and anti-inflammatory agents to alleviate pain and reduce inflammation, the use of keratoplastics to stimulate tissue regeneration, antibacterial therapy in cases of secondary infection, as well as physiotherapeutic methods. Patients with immunosuppression (SLE, dermatomyositis, RA on biological therapy) require antibacterial prophylaxis before invasive procedures. The optimal choice is amoxicillin or clindamycin in case of β-lactam allergy. Long-term glucocorticoid therapy may necessitate steroid background adjustment to prevent adrenal crisis.

The interaction of nonsteroidal anti-inflammatory drugs with the baseline therapy of SCTDs should be considered, especially in patients with SLE or RA. An alternative is selective COX-2 inhibitors combined with gastroprotective agents.

Postoperative control involves regular monitoring of the healing process, early detection of complications, and adjustment of medication therapy in collaboration with a rheumatologist. During remission, thorough sanitation of odontogenic infection foci and prevention of their occurrence are necessary.

Conclusions: Patients with SCTDs require a specialized approach to emergency dental care due to an increased risk of complications. Optimizing local anesthesia, antibacterial therapy, and minimally invasive techniques significantly enhances treatment outcomes. A multidisciplinary approach is crucial for enhancing treatment effectiveness, minimizing complications, and enhancing patients' quality of life.

Key words: connective tissue disorders, oral complications, dental emergencies, anesthesia selection, antibacterial prophylaxis, postoperative management, rheumatology collaboration

Prevention of complications associated with the use of topical anesthetics in children requiring dental care

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Introduction: Statistical data of recent years demonstrate a significant prevalence of dental pathology among the pediatric population, which requires urgent or planned intervention and where the need for pain management is practically always present. In pediatric dentistry, previous experience of painless treatment is the foundation for adequate communication with the child, the formation of a certain attitude to personal health and the implementation of the doctor's recommendations in the future. Eliminating the discomfort that causes pain during treatment or using anesthetics as a means of managing a child's behavior during certain types of examination, preventing the onset of a gag reflex, etc. is possible thanks to the various dosage forms of existing drugs and methods of use. In general, anesthetics are distinguished for conductive, infiltrative, and topical anesthesia. The mucous membrane of the child's oral cavity has a relatively high permeability. This property becomes more pronounced on the background of both physiological and pathological processes. The signs of gingivitis with impaired regenerative processes in the gingival epithelium can develop during physiological teeth replacement. The discomfort caused by increased tooth mobility leads to poor oral hygiene and significant plaque accumulation. The lack of tight contact between the teeth in case of carious cavities or insufficient restorations also leads to inflammation of the gingival papilla. The inflammatory changes significantly increase the ability of the medicines to penetrate deep into the mucosa. At present, topical anaesthetics in the form of a benzocaine-based gel are the most popular in paediatric dentistry.According to the manufacturers' recommendations, the anaesthetic effect occurs in the interval from 30 seconds to 2-3 minutes, depending on the concentration, and lasts for about 5 to 10 minutes. The time increases when applied to dry mucosa. Such recommended conditions of administration are difficult to reproduce in whole volume at a paediatric appointment. Sometimes the application of anaesthetic is an element of behavioural management and is aimed at distracting the child from the main procedure. This requires time and sometimes even reapplication of the medication. The treatment of the oral diseases, accompanied by the formation of painful elements of lesions requires multiple processing of the mucosa during the day. Such situations can cause an overdose of the drug with undesirable effects.
Aim: optimisation of the dosage of topical anaesthetics to prevent complications in children requiring dental care.
Materials and methods: The portions of topical anaesthetic equal 0.2 ml were dosed using a composite cannula and syringe. They were applied to the plate, marked with a 1 mm step. The length of the gel strip on the plate was measured.
Results: The 30 samples were examined. The length of a strip of gel applied through a standard cannula in a 0.2 ml portion to a marked plate was about 1 cm in all cases.
Conclusions: The dosing of topical anaesthetic by this method can be recommended for use. The methodology allows to use the amount of the drug recommended by manufacturers and prevent overdose.

Key words: children, topical anaesthetics, benzocaine, dosing

Analysis of the work of a military hospital in response to the beginning of the active phase of the Russian-Ukrainian war

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Introduction: The Russian-Ukrainian war began in 2014 and for the first eight years was a hybrid conflict. In 2022, it entered an active phase, accompanied by open hostilities between the armed forces of both states. During active hostilities, various gunshot and explosive injuries come to the fore, which poses a challenge for the medical care system, which must respond to such a picture of pathology. In parallel with various injuries, during hostilities, various stress factors can exacerbate the course of somatic diseases, as well as cause various stress disorders.

Aim: The aim of this study was to analyze the performance indicators of an institution providing medical care to military personnel using the example of the Poltava Military Hospital against the backdrop of the full-scale invasion of the Russian Federation into Ukraine.

Materials and Methods: To achieve the goal, a set of general methods was used: bibliosemantic and statistical. For analysis, reports of the work of the Poltava Military Hospital for 2022 and 2023 were taken. The data were analyzed using the growth (decrease) rate. The MS Excel 2016 package was used for calculations.

Results: As it was established, during the reporting period, there was a significant increase in the incidence of medical care for such categories of military personnel as officers (growth rate 5.31%) and contract servicemen (growth rate 14.75%). At the same time, there was a decrease in bed-days for these categories: the number of bed-days for officers increased by 45.06% and for contract servicemen - by 64.15%. In parallel, there was a decrease in the number of such categories of patients as conscripts (growth rate -83.78%) and cadets (growth rate -64.94%). A similar picture was observed in the number of bed-days - a decrease in bed-days by 83.62 and 59.96, respectively. If we consider the use of bed capacity since the beginning of the war in Ukraine by military category, we can note that the largest number of patients was among those serving on a contract basis in surgical and traumatology departments: from 533 in 2022 to 617 in 2023 (growth rate 15.76). In traumatology - from 289 to 671 (growth rate 132.18). Similar changes occurred with such an indicator of inpatient care as bed days. In second place in terms of the number of patients in the department was the neurological and therapeutic department. Although, as can be seen from the table, already in 2023 the number of patients in the neurological department decreased from 534 to 339 (growth rate -36.52). In therapy, there are slight fluctuations, ranging from 414 to 394 (growth rate -4.83). In second place among the categories of military personnel who were inpatients were officers, the number of whom in the hospital as a whole increased slightly from 414 to 436 people (growth rate 5.31%), bed days increased by 45.06%. The largest share of officers was in the therapeutic department and amounted to 153 in 2022 and 142 in 2023 (decrease rate – -7.2) in the surgical department, the number of those treated increased by 39.6%. The smallest number of people treated in the hospital were soldiers. 148 in 2022 and 24 in 2023 (rate of decrease – -83.7%). Accordingly, bed days decreased by 83.6%.

Analyzing the average duration of treatment at the Poltava Military Hospital for the period 2022-2023, it was found that during the reporting period there was an increase in the duration of treatment of contract servicemen (by 47.78%), officers (by 35.96%) and cadets (by 8.11%), while the duration of treatment of conscript servicemen showed a decrease of 8.26%.

Regarding the duration of treatment by department, the greatest prolongation of treatment terms was observed in the surgical and neurological departments, while in the traumatology and therapeutic departments the increase was less pronounced. At the same time, the indicators of the duration of treatment significantly decreased in the infectious and dermatovenereological departments.

Conclusions: Thus, it is clear that in response to the outbreak of hostilities, a number of changes have been observed in the work of the hospital. First of all, there has been a change in the structure of patients due to an increase in the number of officers and contract military personnel. There has also been a redistribution of resources due to an increase in the number of patients in some departments (surgery and neurology) and a decrease in others (infectious and dermatovenereological).

Key words: military hospital, active phase of the Russian-Ukrainian war

Emergency care for patients with oncological ENT pathologies: features and management strategies

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Introduction: Oncological diseases of ENT organs account for 8-10% of all malignant tumors and are often associated with emergency conditions requiring urgent intervention. The global incidence of laryngeal cancer is 2.76 per 100,000 population, while pharyngolaryngeal cancer occurs at a rate of 0.8 per 100,000. Among malignant tumors of ENT organs, laryngeal cancer is the most common (50-70% of cases), followed by nasopharyngeal cancer (20%) and oropharyngeal cancer (15%). Late diagnosis increases the risk of asphyxia (up to 30%), profuse bleeding (10-15%), septic complications (20%), and severe pain syndrome (60-70%).

Aim: To assess the effectiveness of emergency interventions in ENT oncology patients and determine key factors affecting clinical outcomes.

Materials and methods: A total of 84 clinical cases of patients with acute conditions caused by ENT malignancies (mean age – 58.4±6.2 years) were analyzed at pre-hospital and hospital stages. The effectiveness of emergency measures such as tracheostomy, hemostasis, antibiotic therapy, and palliative pain management was assessed. Methods of evaluation included clinical-instrumental studies (CT, MRI, PET/CT with FDG, ultrasound) and laboratory tests.

Results: Emergency care for patients with oncological ENT pathologies focuses on resolving life-threatening conditions and stabilizing the patient's overall condition. The main urgent conditions requiring immediate intervention include acute respiratory failure, profuse bleeding, septic complications, and intractable pain. Key risk factors contributing to emergency conditions in ENT oncology patients were identified. The most effective emergency interventions included surgical airway restoration and comprehensive intensive therapy. Tracheostomy was performed in 39.3% of cases due to airway obstruction, with a success rate of 95%. Surgical hemostasis was effective in 86.9% of bleeding cases, while vascular embolization was used in 10.7%. Antibiotic therapy reduced the sepsis risk in 76.2% of cases, with severity monitored via procalcitonin and lactate. Palliative pain management with opioids significantly improved quality of life in 82.1% of cases. Additionally, in resistant cases, intrathecal administration of analgesics and peripheral nerve blocks were used. Early tumor detection allows for less traumatic organ-preserving surgeries, leading to improved survival rates and enhanced quality of life. Nutritional disorders are a common issue among patients with malignant ENT tumors. Significant weight loss (>10%) and swallowing difficulties require early detection and correction. Nutritional status was assessed using the MUST scale, and immunonutritional supplements were administered when necessary. Interventional feeding methods (naso- and gastrostomy tubes, parenteral nutrition) were effective in 78.6% of cases. Radiotherapy targeting the head and neck region frequently results in xerostomia and impaired salivary gland function, heightening the risk of dentoalveolar infections and osteoradionecrosis. Careful monitoring of dental status and the use of artificial saliva substitutes were recommended to prevent complications. The overall effectiveness of the proposed approaches contributed to an improved quality of life and a reduction in the incidence of severe complications.

Conclusions: Timely diagnosis, a multidisciplinary approach, and standardized emergency care protocols significantly improve outcomes for ENT oncology patients. The most effective emergency interventions include early tracheostomy and surgical hemostasis, contributing to a 15-20% reduction in mortality. A targeted antibiotic therapy strategy effectively reduces the incidence of infectious complications. Effective palliative pain management improves patient stability and overall quality of life. Additionally, nutritional support and dental care play a crucial role in preventing complications and improving long-term outcomes.

Key words: ENT malignancies, urgent conditions, tracheostomy, surgical hemostasis, sepsis

Emotional burnout syndrome and its threats to human physical, psychological and social well-being

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Синдром емоційного вигорання та його загрози для фізичного, психічного та соціального благополуччя людини

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ПОЛТАВСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ, ПОЛТАВА, УКРАЇНА

Вступ: Сучасний світ створює сприятливі умови для виникнення синдрому емоційного вигорання, що є наслідком професійного стресу та виникає у тих випадках, коли адаптаційні ресурси людини в стресовій ситуації перевищені. Це явище стосується фізичного, психологічного, соціального благополуччя людини та є серйозною проблемою сьогодення. Проаналізувавши літературу, ми дійшли висновку, що основну групу ризику становлять фахівці професій типу «людина-людина» та працівники, які виконують різні складні завдання у повсякденній та оперативній роботі, зазнаючи постійного тиску термінів та високого рівня відповідальності.
Метою: дослідження є виявлення впливу синдрому емоційного вигорання на фізичне, психологічне та соціальне благополуччя людини.
Матеріали і методи: Матеріали: літературні джерела та інтернет-ресурси за темою дослідження. Методи: бібліосемантичний, історичний, контент-аналіз.
Результат:. На підставі проведеного аналізу наукової літератури визначили основні загрози синдрому емоційного вигорання, що мають багатогранний характер. Вони включають вплив на різні складові здоров'я та благополуччя людини.
Погіршення фізичного здоров'я:
- хронічна втому (постійне відчуття виснаження);
- проблеми зі сном (низька якість сну або безсоння);
- підвищення ризику хвороб (зниження імунітету, що призводить до частих застуд або інших захворювань);
- проблеми із серцево-судинною системою (підвищений ризик серцевих нападів, гіпертонії або інших серцевих хвороб);
- порушення травлення (розлади апетиту, виразки, гастрити).

Психологічні ризики:
- тривожність (страх перед невдачами, критикою, постійна напруга);
- депресія (апатія, втрачений інтерес до життя, відчуття безнадійності);
- занижена самооцінка (невпевненість у собі, відчуття неповноцінності);
- суїцидальні думки (думки про самогубство, як про вихід з ситуації, що склалася).

Професійні наслідки:
- конфлікти на роботі (байдужість до колег та людей, що є клієнтами або пацієнтами, роздратування, агресія);
- зниження продуктивності (неможливість виконувати роботу якісно та концентруватись на завданнях);
- ризик втрати роботи (низька ефективність роботи або конфлікти в колективі).

Соціальні наслідки:
- ізоляція (бажання усамітнитись, уникати людей);
- погіршення стосунків (конфлікти у сім'ї, емоційне відчуження, байдужість до близьких);
- втрата соціальної підтримки (відчуття самотності та незрозумілості).

Ризик залежностей:
- гаджети та соціальні мережі (втеча від реальності, маскування проблеми);
- переїдання та недоїдання (їжа в аспекті, як засіб заспокоєння, або ж як блок організму при стресі - несприйняття їжі);
- алкоголь, наркотики чи куріння (пошук шляхів вирішення проблеми через шкідливі звички).

Вплив на довготривалі перспективи:
- зниження якості життя (втрата задоволення від щоденних справ та досягнень);
- вигорання у сфері особистих цінностей (втрата інтересу до власних поставлених цілей та мрій);
- кар'єрна стагнація (застій) (неможливість адаптуватися до нових викликів або домогтися кар'єрного зростання).

Висновки: Результати аналізу наукових джерел свідчать, що синдром емоційного вигорання можна умовно

вважати різновидом неінфекційного захворювання, яке включає в себе метаболічні та поведінкові фактори ризику та негативно впливає на всі сфери особистого та професійного життя людини, що ще раз доводить актуальність проблеми цього феномену. Тож реальна або потенційна можливість розвитку синдрому вигорання на будь-якому етапі професійної чи життєвої діяльності людини свідчить про необхідність розроблення профілактичних заходів, які б знижували ризик та нейтралізували його негативні наслідки.

Key words: burnout syndrome, threats, physical, psychological and social well-being
Ключові слова: синдром емоційного вигорання, загрози, фізичне, психологічне та соціальне благополуччя

The influence of genetic factors on the development of scoliotic disease in children (according to scientific literature)

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Вплив генетичних чинників на розвиток сколіотичної хвороби у дітей (за даними наукової літератури)

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Вступ: Захворювання опорно-рухового апарату, зокрема сколіозу, у дитячому віці стають дедалі більш актуальною проблемою сучасності. Сколіоз — це тривимірна деформація хребта, яка характеризується боковим викривленням одного або кількох сегментів. З'ясування етіології його виникнення сколіозу є фундаментальною проблемою сучасної захворюваності.

Мета: Ознайомитися із впливом генетичних факторів як одного із основних причин виникнення та розвитку сколіотичної хвороби у дітей шкільного віку.

Матеріали і методи: Методи: бібліосемантичний, метод структурно-логічного аналізу. Матеріалами дослідження сталі наукові джерела та інтернет-ресурси за темою дослідження.

Результати дослідження: На динаміку окремих ознак фізичного розвитку суттєво впливають генетичні, природні та антропогенні фактори Так, одним із основних факторів є спадковість, яка визначає здатність організму дітей шкільного віку змінюватися внаслідок впливу переміни чинників зовнішнього середовища, зокрема, ступінь його резистентності по відношенню до зовнішніх впливів, здатність до прискорення або уповільнення росту і розвитку в залежності від характеру дії зовнішніх умов, встановлює рівень функціональних можливостей і працездатності.

Сколіотична хвороба вражає всі вікові групи. Одним факторів ризику його виникнення спадковість. Так, для ідіопатичного сколіозу генетичні фактори класифікуються на три групи: гени, пов'язані зі сприйнятливістю; гени пов'язані з прогресуванням захворювання та третя група об'єднує дві перші групи разом. Популяційні дослідження незмінно виявляють, що ідіопатичний сколіоз найкраще пояснюється моделлю полігенної спадковості, в якій багато генетичних факторів ризику поєднуються, щоб спричинити захворювання. Дані дослідження пов'язують сколіоз з генетичними маркерами поблизу цікавих генів-кандидатів, включаючи гомеобоксний транскрипційний фактор LBX1 , зв'язаний з білком G рецептор GPR126 , парні боксові транскрипційні фактори PAX1 і PAX3 , а також SRY-box SOX9 . Крім того, націлювання на гени в модельних системах рибок даніо та мишей виявило гени-кандидати, які пропонують захоплюючу нову область дослідження молекулярних механізмів.

Гени-кандидати наразі ідентифікували функцію в специфікації м'язів, нервів і хрящів на ранніх етапах розвитку, що свідчить про походження нервово-м'язових та/або хрящових захворювань, але їхня роль у подальшому розвитку людини та зростанні осьового відділу хребта є невивченою областю біології розвитку. Постійні зусилля з відкриття генів за підтримки геномних платформ наступного покоління є пріоритетом для галузі та забезпечать інструменти для біологічних досліджень патогенезу.

Висновки: Сколіоз є складним, багатогранним захворюванням із значною мірою загадковим походженням і механізмами прогресування і потребує постійного наукового контролю.

Key words: scoliotic disease, children, genetic factors, influence.

Ключові слова: сколіотична хвороба, діти, генетичні фактори, вплив

Electrodiagnostics of infraorbital nerve conductivity disorders in patients with zygomatic bone fractures using nucleotides

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Електродіагностика порушення провідності інфраорбітального нерва у хворих з переломами виличної кістки при використанні препарату нуклеотидів

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[1]ВІННИЦЬКИЙ НАЦІОНАЛЬНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ ІМ. М. І. ПИРОГОВА, КАФЕДРА ХІРУРГІЧНОЇ СТОМАТОЛОГІЇ ТА ЩЕЛЕПНО-ЛИЦЕВОЇ ХІРУРГІЇ, М. ВІННИЦЯ, УКРАЇНА

[2]ВІННИЦЬКА МІСЬКА КЛІНІЧНА ЛІКАРНЯ ШВИДКОЇ МЕДИЧНОЇ ДОПОМОГИ, М. ВІННИЦЯ, УКРАЇНА

Вступ: Пошуки засобів і методів лікувального впливу на процеси, які відбуваються в ушкоджених нервах під час переломів кісток лицевого скелету, з метою стимуляції їх відновлення, залишаються однієї з актуальних завдань хірургічної стоматології. Одним з найбільш частих ускладнень, що виникають при переломах виличної кістки, є ушкодження та затискання уламками інфраобітального нерву. Цей нерв є периферичною гілкою трійчастого нерва, ушкодження якого викликає ряд фізіологічних і морфологічних змін у тканинах обличчя. Порушення функції нерва різному ступеня виникає при безпосередній травмі нерва під час зсуву уламків під час перелому виличної кістки, а також при компресії нерва післяопераційним набряком або гематомою в просвіті інфраобітального каналу. Незалежно от виду ушкодження нерва в каналі, відбувається компресійна й токсична травма інфраорбітального нерва.

Матеріали і методи: Проведено обстеження 28 пацієнтів з переломами виличної кістки з помірним зміщенням, що знаходились на лікуванні у Вінницькій міській клінічній лікарні швидкої медичної допомоги. Хворі були поділені на 2 групи: основну групу (25 пацієнтів) та групу порівняння (23 пацієнтів). В групі порівняння проводився лише комплекс лікувальних заходів, який містив: операцію репозицію виличної кістки, використання антибіотика широкого спектру дії на протязі 10 днів (Цефуроксим) парентерально (в/в), нестероїдного протизапального препарату (Декскетопрофен) парентерально (в/м). В основній групі проводився комплекс лікувальних заходів, який містив: операцію репозицію виличної кістки, використання антибіотика широкого спектру дії (Цефуроксим) протягом 10 днів парентерально (в/в), нестероїдного протизапального препарату (Декскетопрофен) парентерально (в/м) та вводився препарат нуклеотидів (Нуклео ЦМФ форте) протягом 10 днів (парентерально 1 ін'єкція в день в/м). Хворим проводилося комплексне обстеження, яке включало загальноклінічні, рентгенологічні методи та додатково проводилось визначення електропровідності інфраорбітального нерва.

Для кількісної об'єктивної характеристики сенсорних порушень в дослідженні використали метод визначення порогів больової чутливості (ПБЧ). Метод заснований на зіставленні сили подразника, застосування якого викликає відповідні відчуття у пацієнта. Точність виміру фізичних параметрів подразнення, особливо при використанні електричного струму, як правило, значно вище, ніж суб'єктивний аналіз своїх відчуттів пацієнтом, отже метод можна вважати найбільш об'єктивним. Поодинокі імпульси струму однаковою мірою можуть збуджувати будь-які групи чутливих нервових волокон. Тому при їх дії у пацієнтів можуть виникати як больові, так і не больові відчуття. Перевагою цього подразника є можливість дозування і зміни сили і тривалості струму, а також багатократного застосування без порушення цілісності досліджуваних тканин. Для подразнення тканин в проведеній роботі використали пульптестер Pulp Tester DY310. Слід зазначити, що прилад генерує імпульси тільки негативної полярності, які відповідають натуральній полярності нерва. Сигнали такої полярності застосовуються в Pulp Tester DY310 та інших сучасних приладах. Окрім цього, в електроодонтометрії ще застосовуються радянські прилади ЕОМ-1, методику дослідження яких знають багато стоматологів. Важливо відмітити, що прямо зіставити ці два прилади неможливо з наступних причин. Сигнал синусоїдальної форми (позитивний і негативний), генерований електроодонтометром ЕОМ-1, мікроамперметр вимірює діючі значення Ief, а не максимальний - амплітудний Im, співвідношення яких Aμ для синусоїдального сигналу Ief = Im/√2=0.707 Im або Im = 1.41 Ief. Отже реакцію живої пульпи 6 - 12 Aμ (згідно з літературними даними) виміряну приладом ЕОМ-1 потрібно помножити на 1,41 і її значення тоді буде 8,5 - 17. Це дуже наближена корекція, щоб зіставити прилади ЕОМ-1 і PULPTESTER. У цифровому вираженні пік електростимулу доводиться

на 80. Якщо у діапазоні від 0 до 40 пацієнт відчуває біль, це означає, що нерв повністю життєздатний. Коли подібна реакція спостерігається в діапазоні від 40 до 80, це означає, що настав часткове пошкодження нерва. Якщо при показнику 80 вищеописаної реакції не спостерігається, констатується відмирання нерва.

При визначенні порогів чутливості використали критерії, по яких орієнтується пацієнт, що відповідають визначенню цих понять, прийнятих Міжнародною асоціацією по вивченню болю.

- Поріг відчуттів (ПО) - найслабкіші відчуття, які першими з'являються при збільшенні інтенсивності подразника. При порогових небольових відчуттях відбувається збудження товстих мієлінових нервових волокон групи А-бета, що передають сигнали з високою швидкістю (40-80м/с), які є провідниками тактильної чутливості.
- Поріг болю (ПБ) - відчуття, при яких тільки з'являється неприємний відтінок. При порогових неприємних, больових відчуттях відбувається збудження тонких мієлінових нервових волокон групи А-дельта, що передають сигнали з меншою швидкістю (5-40 м/с), проводять сигнал від різних рецепторів (тактильних, температурних, деяких больових) і відповідають за гострий біль.
- Рівень витривалості болю (РВБ) - неприємні відчуття, подальшого збільшення інтенсивності яких пацієнт не бажає. Досягши межі витривалості болю відбувається збудження тонких безмієлінових нервових волокон групи С, що передають сигнали з найбільш повільною швидкістю (0,2-2 м/с) від больових рецепторів, терморецепторів і рецепторів тиску. Для контролю проводили таке ж дослідження на протилежній непошкодженій стороні. Методика визначення порогу відчуттів за допомогою поодиноких імпульсів струму полягає в плавному збільшенні інтенсивності подразнення до появи у пацієнтів виразних небольових відчуттів при визначенні порога відчуттів (ПВ), далі плавному збільшені інтенсивності до появи перших больових відчуттів при визначенні порогу болю (ПБ) і до того часу коли пацієнт не бажає продовжувати із-за болю і неприємних відчуттів при визначені рівня витривалості болю (РВБ). Дослідження проводилось тричі і вираховувався середній результат.

Результати дослідження: В групі порівняння було виявлено значне порушення провідності нижнього альвеолярного нерва на основі визначення порогу відчуттів (ПВ), порогу болю (ПБ), рівня витривалості болю (РВБ). Характерно, що величини на протязі періоду лікування не зазнавали значних змін, що клінічно спостерігалось збереженням порушення чутливості в зоні іннервації нижнього альвеолярного нерва ($p>0,05$). Про що свідчать показники ПВ, ПБ та РВБ на 7 і 14 добу. В основній групі відмічається значне покращення функціонування нижнього альвеолярного нерва. На час першого обстеження (1 доба) в даній групі відмічались показники такі ж, як і в групі порівняння, або і дещо гірші ($p>0,05$). На період 7 доби покращення спостерігалось незначне, в зв'язку з тим, що препарат Нуклео ЦМФ форте використовувався з 4 доби лікування і не дав достатнього терапевтичного ефекту ($p>0,05$). Але, на 14 добу лікування покращення було значне і показники ПВ, ПБ, РВБ відповідно зменшились в 1,68 ($p<0,05$), 1,85($p<0,05$) і 2,4 ($p<0,05$) рази. Показники порогу відчуттів, порогу болю та рівні витривалості болю на час закінчення стаціонарного лікування (14 доба) майже знизились до рівня показників протилежної неушкодженої сторони.

Висновки: Проаналізувавши дані електродіагностики провідності інфраорбітального нерва методом дослідження порогів чутливості, порогів болю, рівня витривалості болю з використанням апарату для електродіагностики Pulp Tester DY310, прийшли до висновків:

1. За допомогою апарату для електродіагностики Pulp Tester DY310 можливо чітко прослідкувати процес відновлення провідності нерва методом дослідження порогів чутливості, порогів болю, рівня витривалості болю.
2. При використанні препарату нуклеотидів (Нуклео ЦМФ форте) спостерігається значне покращення показників порогів чутливості, порогів болю, рівня витривалості болю. Отже, використання препарату Нуклео ЦМФ форте є виправданим в комплексній терапії переломів кісток лицевого скелету, що супроводжується клінічними проявами пошкодження інфраорбітального нерва.

Key words: electrodiagnostics, nerve conduction disorders, nucleotides, trigeminal nerve
Ключові слова: сколіотична хвороба, діти, генетичні фактори, вплив

APPLICATION OF ULTRASOUND IN THE DIAGNOSIS OF PATHOLOGICAL PROCESSES OF THE HEAD AND NECK IN CHILDREN

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Застосування ультразвукового дослідження в діагностиці патологічних процесів голови та шиї у дітей

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ПОЛТАВСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ, ПОЛТАВА, УКРАЇНА

Вступ: В клінічній медичній практиці досить широко використовуються сучасні методи дослідження, серед яких найбільш діагностично вагомими та інформативними є променеві – комп'ютерна та магнітно-резонансна томографії і ультразвукове дослідження. Але в повсякденній лікувальній роботі спостерігається невпинне зростання частоти застосування саме ультразвукового дослідження, сучасний варіант якого для м'яких тканин обличчя і шиї виконується без використання будь-яких спеціальних пристроїв, що робить його досить розповсюдженим в клініці щелепно-лицевої хірургії та хірургічної стоматології, зокрема і в дитячій практиці.
Кольорове доплерівське дослідження у більшості випадків є єдиним можливим діагностичним вибором для дитячої групи пацієнтів, а використання при скануванні сучасних спеціалізованих датчиків дозволяє поліпшити візуалізацію і провести більш точну діагностику.
Мета – проаналізувати ефективність використання ультразвукового дослідження в діагностиці патологічних процесів щелепно-лицевої ділянки у дітей.
Матеріали і методи: Нами обстежено 78 пацієнтів віком від 3 місяців до 17 років з різною патологією голови і шиї. Хлопчиків було 43, дівчаток 35.
В рамках вказаної роботи було виконано 9 доплерографій.
Обстеження проводилось на апараті Samsung Medison RS85 лінійним датчиком LA3-16A. Максимальна проникність в глибину тканин становила 8.3 см, а частота коливань – 3-16 МГц.
Ультразвукове дослідження застосовували не тільки з діагностичною метою, але і при вже визначеному діагнозі для виявлення індивідуальних особливостей динаміки перебігу захворювання, які могли мати важливе значення при плануванні лікування.
Результати дослідження: Ультразвукове дослідження захворювань великих слинних залоз робило істотний внесок в діагностику різновидів їхніх форм, дозволяючи ефективно провести диференційну діагностику хронічних сіаладенітів і реактивних змін великих слинних залоз, розмежовуючи хірургічну патологію з нехірургічною.
Лімфатичний вузол без патологічних змін при ультразвуковому дослідженні має знижену ехогенність порівняно з оточуючими тканинами, що в порівняльному аспекті дозволяє візуалізувати змінені лімфатичні вузли за низкою основних ознак і з високою достовірністю реконструювати структурні зміни, що відбуваються в них залежно від нозологічної форми.
Ультразвукове дослідження вроджених кіст голови, шиї та порожнини рота давало можливість їх візуалізації, уточнення структури та органотопічних характеристик, на підставі чого формуються і плануються базові заходи визначення обсягу і етапу оперативного втручання. Такі кісти найчастіше доводилося диференціювати з кістозною формою лімфангіом.
За необхідності для визначення характеру кровотока застосовували доплерографію, що здебільшого проводилось при патології лімфатичної системи.
Висновок: Отримані результати дозволяють стверджувати, що ультразвукове дослідження, відрізняючись безпечністю і результативністю, є досить перспективним, потребуючи більш широкого використання в діагностиці та диференційній діагностиці захворювань слинних залоз, патології м'яких тканин щелепно-лицевої ділянки, лімфатичних вузлів, судинних утворень. На тлі його високої інформативності досить обґрунтованим виглядає можливість деякого обмеження застосування діагностичних рентгенологічних методик й інвазивних діагностичних втручань і більш раціонального застосування інших променевих методів обстеження – комп'ютерної та магнітно-резонансної томографій.

Key words: children, ultrasound examination, dopplerography, maxillofacial region, salivary glands, lymphadenitis, neck cysts
Ключові слова: діти, ультразвукове дослідження, доплерографія, щелепно-лицева ділянка, слинні залози, лімфаденіт, кісти шиї

Traumatic injuries of the mandibular condylar process in children

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Травматичні ушкодження суглобового відростка нижньої щелепи у дітей

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ПОЛТАВСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ, ПОЛТАВА,УКРАЇНА

Вступ: Кількість дітей з травматичними ушкодженнями щелеп та кісток обличчя має тенденцію до певного зростання, на теперішній час сягаючи 30% від загального числа ургентних госпіталізацій. Такі пацієнти посідають провідне місце в структурі контингенту стаціонарних хворих поряд з гострими запальними процесами щелепно-лицевої ділянки. Статистичні дані вказують, що здебільшого причинним фактором ушкоджень являються дорожньо-транспортні пригоди і спортивні та побутові травми. Серед пацієнтів превалюють хлопці. Найчастіше від ушкодження потерпає нижня щелепа (н/щ), а саме виникають переломи її суглобового відростка. У значної частини таких хворих після лікування визначаються анатомо-функціональні порушення розвитку н/щ. Враховуючи те, що шийка суглобового відростка являється активною зоною росту, це у подальшому в значній мірі впливає на ймовірність розвитку зубо-щелепних деформацій, сприяючи формуванню вад прикусу з невтішними наслідками.

Мета роботи – висвітлити узагальнений досвід надання спеціалізованої допомоги дітям з травматичним ушкодженням суглобового відростка нижньої щелепи.

Матеріали та методи. Під нашим наглядом та лікуванням протягом 5 років знаходилося 68 дітей віком від 3 до 17 років з травматичними ушкодженнями нижньої щелепи. Із них у 30 дітей (44,1%) діагностовано поєднання ушкоджень н/щ на різних рівнях з безпосереднім переломом кістки в ділянці розташування суглобового відростка.

На час госпіталізації для обстеження пацієнтів були залучені загальноклінічні, функціональні, суто стоматологічні і променеві методи й, за необхідності, в деяких випадках вони проводились в динаміці спостереження.

Результати та їх обговорення. Узагальненням клінічних даних встановлено частоту переломів суглобового відростка нижньої щелепи: 16-53,3% – діти віком від 12 до 17 років, 9-30,0% – 7-12-річні пацієнти, 13,3% (4 випадки) – хворі 3-7 років. У однієї 6-річної дитини (3,3%), що потрапила з рідними в дорожньо-транспортну пригоду та отримала політравму, було діагностовано двобічне ушкодження суглобового відростка. Отже, спостерігається певна вікова закономірність травматизму, що пов'язано із підвищеною руховою активністю дітей, спортивним навантаженням і соціальними факторами.

При цьому локалізація лінії переломів безпосередньо в інших ділянках нижньої щелепи була різною, але найчастіше поєднувалася з порушеннями цілісності суглобових відростків при її ушкодженні в ділянці тіла та кута нижньої щелепи (14-46,6 % і 12-40,0% відповідно). Звертає на себе увагу той факт, що такі комбіновані переломи досить часто супроводжувалися й травматичним ушкодженням зубів, фронтальної ділянки альвеолярного відростка, м'яких тканин обличчя, поєднуючись з черепно-мозковою травмою, що потребувало залучення спеціалістів суміжних профілів при проведенні діагностично-лікувальних заходів.

Однобічне ураження мало місце у 19 дітей (63,3%), а двобічне – у 11 (36,7%).

Госпіталізація постраждалих в спеціалізоване відділення протягом 1-2 діб була проведена 26 дітям (86,7%), а 4 (13,3%) допомога була надана в більш пізні терміни, що переважно залежало від якості діагностики при первинному зверненні за допомогою, загальносоматичного стану хворого та ступеня тяжкості самої травми.

При обстеженні травмованих дітей на час госпіталізації скарги залежали від характеру ушкоджень, але найчастіше вони і їхні рідні акцентували увагу на наявності вираженої больової симптоматики та утрудненні або взагалі неможливості прийому їжі. Візуально у всіх дітей визначалися асиметрія обличчя, множинні рани, садна, крововиливи в м'які тканини. Функціональний стан нижньої щелепи обумовлювався ступенем відкривання рота і обсягом її рухів в різних площинах. Зсув н/щ в один бік свідчив про одностороннє пошкодження шийки її суглобового відростка, а ретроположення н/щ вказувало на ймовірність двобічного перелому. З діагностичною метою також проводили оцінку співвідношень розташування точок між центральними різцями за умови збереження останніх. Визначення характеру мобільності суглобових голівок проводилося під вилицевою дугою попереду козелка вуха шляхом введення в зовнішні слухові проходи вказівних пальців чи мізинців.

Значну увагу приділяли вивченню результатів променевих методів дослідження, що дозволило з великим ступенем вірогідності та досить точно встановлювати патологічні зміни в структурних компонентах скронево-нижньощелепного суглоба. При нескладних переломах достатнім було проведення рентгенографії нижньої

щелепи в прямій і бокових проекціях чи ортопантомографії. В складних випадках залучали КТ-дослідження з 3D-реконструкцією, що дозволяло об'єктивно визначитися з обсягами та вибором оптимального варіанта методики консервативного лікування чи оперативного втручання.

У 5-ти дітей (16,7%) старшого віку, коли не спостерігалося значної диспозиції уламків, лікування проводилось за допомогою пов'язки Померанцевої-Урбанської при дотриманні щадного режиму. У 16-53,3% для іммобілізації зміщених кісткових фрагментів використовувалося лігатурне зв'язування за допомогою двощелепного шинування із защіпними петлями і накладанням прокладки між жувальними зубами. Із них у 5 випадках (16,7%), коли не відбувалося значне розходження кісток в лінії перелому, накладалась гладка дротяна шина, а у 4 пацієнтів (13,3%) було проведено оперативне втручання по реплантації дистопованого малого кісткового фрагмента, представленого самим суглобовим відростком, за допомогою металевої спиці в нашій модифікації. На даний час ми у співпраці з ортодонтами відслідковуємо найближчі та віддалені результати лікування, і за необхідності пацієнти отримують ортодонтичну допомогу.

Висновок. Травматичні ушкодження суглобового відростка нижньої щелепи досить часто поєднуються з порушенням цілісності інших її ділянок. В таких випадках високорезультативними, в діагностичному плані, являються променеві методи обстеження, які дозволяють отримати вичерпну інформацію стосовно стану та взаємовідношення кісткових уламків. В аспекті лікувальних заходів є прийнятним застосування як консервативних, так і хірургічних методик репозиції та фіксації кісткових фрагментів, але при цьому в кожному випадку повинна враховуватися конкретна клінічна ситуація.

Key words: children, lower jaw, articular process, traumatic injury, treatment
Ключові слова: діти, нижня щелепа, суглобовий відросток, травматичне ушкодження, лікування

EMERGENCY CARE FOR CHILDREN WITH ACUTE PURIFYING SUBMANDUBIAL LYMPHADENITIS: DESCRIPTION OF THE CASE

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Надання невідкладної допомоги дітям із гострии гнійним піднижньощелепним лімфоаденітом: опис випадку

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ПОЛТАВСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ, ПОЛТАВА, УКРАЇНА

Вступ: В дитячій стоматології гостре запалення розглядається як невідкладний стан. Воно супроводжується болем, підвищенням температури тіла, набряком та почервонінням тієї чи іншої щелепно-лицьової ділянки і, як наслідок, супроводжується занепокоєнням та стурбованістю батьків. Ускладнений карієс посідає провідне місце серед етіологічних чинників гострих запальних процесів в щелепно-лицьовій ділянці. При залученні в запальний процес регіональних лімфатичних вузлів та м'яких тканин дитина потребує невідкладної допомоги в умовах стаціонару та призначення антибіотикотерапії. Викликає значне занепокоєння той факт, що ускладнений карієс займає вагоме місце серед стоматологічних захворювань у дітей. Неспроможність інвестувати в профілактичну допомогу призвела до досить невтішних наслідків. Висока поширеність ускладненого карієсу як тимчасових, так і постійних зубів, свідчить про недостатньо ефективну стоматологічну профілактику в цілому та недосконалі методи лікування карієсу. Подальші перспективи викликають іще більше занепокоєння, оскільки відповідно до Закону від 19.10.2017 № 2168-VIII «Про державні фінансові гарантії медичного обслуговування населення», стоматологія винесена в «червону зону», тобто ніякої державної підтримки стоматології сьогодні, на жаль, немає. Більше того, серед населення існує думка, що стан зубів і порожнини рота ніяк не пов'язані із загальним здоров'ям. Нажаль, батьки досить часто не усвідомлюють необхідності санації порожнини рота у дітей, що в подальшому нерідко призводить до важких наслідків. Невилікуваний хронічний періодонтит часто стає джерелом хронічної інтоксикації дитячого організму, підтримує чи викликає запальні процеси в інших органах і системах - ендокардити, ревматичні артрити, нефрити, тонзиліти тощо.

Так, за даними Ірини Мазур 2018р., отриманими при співпраці стоматологів з фахівцями Національного наукового центру «Інститут кардіології імені М.Д. Стражеска Національної академії медичних наук (НАМН) України» у пацієнтів, які перенесли заміну клапана серця, у зразках, виділених із клапана серця, наявні представники мікрофлори порожнини рота. Фахівці спрогнозували, що через короткий період відбудеться деструкція клапана, і постане необхідність повторного оперативного втручання. Крім того, через наявність мікробних бляшок ризик антибіотикорезистентності у цих пацієнтів був значно вищий.

Мета: Проаналізувати причини, які сприяють виникненню гострих запальних процесів ЩЛД у дітей та ознайомити з алгоритмом надання невідкладної допомоги при гострих запальних процесах на прикладі клінічного випадку.

Опис випадку: Останнім часом значно збільшилась кількість пацієнтів, яких направляють хірурги-стоматологи стаціонарного відділення для консультації.

Так, 29 серпня 2023 року до нас направили батьків з дитиною 7 років зі скаргами на наявність нориці з гнійним виділенням в підщелепній ділянці.

Із анамнезу з'ясовано, щов березні лікували 36, 46 з приводу гострого глибокого карієсу.

- В червні звернулись за допомогою до лікаря-стоматолога зі скаргами на біль в зубі на нижній щелепі праворуч.
- Встановлено діагноз: хронічний фіброзний пульпіт 46. З подальшим тимчасовим пломбуванням кореневих каналів кальційумісними препаратами.
- В серпні госпіталізована до стаціонарного відділення з діагнозом гострий гнійний під нижньощелепний лімфоаденіт зліва. В стаціонарному відділенні під загальним знеболенням зовнішнім доступом гостро і тупо проведено розтин абсцесу, отримано гнійний ексудат, рана промита і дренована з подальшим лікуванням за протоколом ведення гнійної рани. Рана загоїлась вторинним натягом. Через сім днів дитина виписана із стаціонарного відділення з покращенням загального стану.
- Через декілька днів звернулися за консультацією до професора Ткаченка П.І. зі скаргами на появу нориці з гнійним ексудатом на місці післяопераційного рубця. Встановлено діагноз: Загострення хронічного гранулюючого періодонтиту 36, нориця в підщелепній ділянці ліворуч. Направлена до терапевта-стоматолога для уточнення діагнозу та подальшого ендодонтичного лікування 36.

При об'єктивному обстеженні конфігурація обличчя не змінена, в піднижньощелепній ділянці ліворуч нориця з гнійним ексудатом. В 36 пломба, відповідає клінічним вимогам, зуб тьмяного кольору. Перкусія 36 безболісна,

відмічається глухий перкуторний звук. Ясна в ділянці проекції керенів 36 ціанотичного кольору, безболісні при пальпації.

На контактній внутрішньоротовій рентгенограмі визначається дифузне розширення періодонтальної щілини медіального кореня 36 зуба, розширення періодонтальної щілини в ділянці верхівки дистального кореня з нечіткими контурами. Стадія формування коренів – ріст та формування, корінь сформований на 2/3 довжини.

Встановлено діагноз: Загострення хронічного гранулюючого періодонтиту 36.

План лікування: 1 відвідування-видалення пломби, розкриття порожнини 36, евакуація путритного розпаду, механічна, медикаментозна обробка кореневих каналів. В кореневих каналах залишена медикаментозна суміш: димексид, крезодент, метронідазол, амоксицилін під герметичну пов'язку на 5-7 днів.

2 відвідування (через тиждень) – скарги відсутні, в піднижньощелепній ділянці наявний післяопераційний рубець, без ознак функціонування нориці. Герметична пов'язка збережена, перкусія 36 безболісна. Видалення герметичної пов'язки, механічна, медикаментозна обробка кореневих каналів, кореневі канали обтуровані Calcisole-C з гутаперчевими штифтами 0.6, тимчасова пломба, контрольний огляд через місяць.

3 відвідування (через місяць) – скарги відсутні, в 36 тимчасова пломба збережена, відповідає клінічним вимогам, перкусія 36 безболісна, ясна і перехідна складка в ділянці проекції коренів 36 блідо-рожевого кольору, безболісна при пальпації.

На контактній внутрішньоротовій рентгенограмі в кореневих каналах 36 визначається пломбувальний матеріал, який щільно прилягає до їх стінок, має однорідну рентген контрастність, заповнює кореневі канали до верхівок.

Контрольний огляд через місяць.

Висновки: Аналізуючи клінічний випадок ми припустили, що перша помилка була допущена лікарем-стоматологом у перше відвідування, коли було встановлено діагноз: гострий глибокий карієс 36,46 замість первинно хронічного фіброзного пульпіту 36,46.

Друга помилка - лікар недостатньо видалив розм'якшений, інфікований дентин, поставив лікувальну прокладку, сподіваючись на ремінералізацію дна каріозної порожнини. Проте цього не сталося, і, як наслідок, у зубі 46 розвинувся первинно хронічний пульпіт, який клінічно себе проявив у червні (через 3 місяці), а у зубі 36 розвинувся первинно хронічний періодинтит, який проявив себе клінічно у серпні (через 6 місяців).

Третя помилка – лікар-хірург-стоматолог не провів детальне обстеження зубних рядів, не направив на рентген діагностику причинного зуба та не акцентував увагу на необхідності ендодонтичного лікування 36.

Key words: caries, periodontitis, lymphadenitis, children
Ключові слова: карієс, періодонтит, лімфоаденіт, діти