

EMERGENCY MEDICAL SERVICE

RATOWNICTWO MEDYCZNE

ELECTRONIC VERSION



VALUE EWS IN PREDICTING MORTALITY AMONG COVID-19 PATIENTS

COOLING THE BURN WOUND AMONG THE CHILDREN AND TEENAGERS

“MINI-MIDLINE”: VASCULAR ACCESS IN SPECIFIC SITUATIONS

**EVACUATION OF THE WOUNDED FROM THE BATTLEFIELD
AS AN IMPORTANT COMPONENT OF EMERGENCY MEDICAL CARE**

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February 24, 2023

PROGNOSTIC VALUE OF EARLY WARNING SCORES IN PREDICTING IN HOSPITAL MORTALITY AMONG COVID-19 PATIENTS IN AN EMERGENCY DEPARTMENT

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ABSTRACT

Aim: The emergence of a new pathogen, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has resulted in a surge of new patients requiring hospitalisation. The rapid identification of patients with severe SARS-CoV-2 infection has become a key challenge for healthcare systems. The aim of the study was to assess the prognostic value of early warning scores in predicting mortality in COVID-19 patients.

Material and methods: The study involved a retrospective analysis of the medical records of 2,449 patients with COVID-19 admitted to emergency care, for whom five early warning scores were calculated based on the data obtained.

Results: In order to assess the usefulness of NEWS, NEWS2, MEWS, SEWS and qSOFA in predicting in-hospital mortality in COVID-19 patients, AUC (area under the ROC curve) values were calculated. They were, respectively: 0.76 (95% CI 0.72-0.79), 0.75 (95% CI 0.72-0.79), 0.64 (95% CI 0.60-0.69), 0.61 (95% CI 0.57-0.66) and 0.55 (95% CI 0.50-0.59).

Conclusions: NEWS demonstrated the highest discriminatory power, indicating that it can be used to predict in-hospital mortality in COVID-19 patients.

KEY WORDS

emergency department, prognostic value, mortality, early warning scores

INTRODUCTION

At the end of December 2019, a new, highly transmissible pathogen was identified in Wuhan, China. On 12 January 2020, the World Health Organization (WHO) named it "severe acute respiratory syndrome coronavirus 2" (SARS-CoV-2). In humans, SARS-CoV-2 causes coronavirus disease 2019 (COVID-19) [1-3]. Since the beginning of the pandemic, which was declared as such by the WHO on 11 March 2020, over 651 million infections and more than 6.5 million deaths from COVID-19 have been reported worldwide [4]. The first case of SARS-CoV-2 in Poland was reported on 4 March 2020 [5]. Poland has recorded over 6 million coronavirus cases and more than 118 thousand coronavirus deaths since the beginning of the pandemic and COVID-19 mortality rate is 2% [6].

Most people with coronavirus have no clinical symptoms. Clinical manifestations of COVID-19 in symptomatic individuals include a diverse range of symptoms, which may resemble a cold [7,8]. However, some patients with SARS-CoV-2 infection develop severe, very severe or even critical illness. As reported by numerous

researchers, the mortality rate in these patients ranges from 11% to 62% [7, 9-12].

The SARS-CoV-2 pandemic has brought changes to healthcare systems around the world. The rapid surge of new coronavirus cases has resulted in an increase in the number of patients requiring hospitalisation. Due to limited medical resources, healthcare systems became inefficient within a short time. Given the large number of COVID-19 cases, finding an effective method for rapid identification of patients whose clinical condition required or might soon require advanced medical interventions became a major challenge. The identification of such patients could help reduce mortality in patients with SARS-CoV-2 infection [13, 14].

In current clinical practice, markers such as white blood cell count, C-reactive protein and D-dimer are used to assess COVID-19 patients for disease severity. However, these markers are not specific to COVID-19 [7, 13]. Another way to predict prognosis in COVID-19 patients is to use the existing early warning scores (EWS). Different early warning scores are currently used in clinical practice, including the National Early Warning Score

(NEWS), the National Early Warning Score 2 (NEWS2), the Modified Early Warning Score (MEWS), the Standardised Early Warning Score (SEWS) and the Hamilton Early Warning Score (HEWS) [13, 14].

Early warning scores are widely used in the clinical practice of emergency departments [13,15]. Their use has become particularly relevant during the SARS-CoV-2 pandemic, as stressed in a number of scientific publications [13, 16-23]. Therefore, the aim of this study was to evaluate the prognostic value of early warning scores in predicting mortality in patients with COVID-19 admitted to emergency care.

MATERIALS AND METHODS

DATA SOURCE

The study was carried out based on a retrospective analysis of the medical records of patients admitted to the emergency department of the Central Clinical Hospital of the Ministry of Interior and Administration in Warsaw. The study covered the period between March 2020 and April 2021. All patients in the database received in whom SARS-CoV-2 was identified by laboratory testing (molecular (RT-PCR) test) and/or whose final diagnosis ICD-10 (International Classification of Diseases 10) code was U07.1 [24] were included in the study. The only exclu-

sion criterion was gaps in the medical records as regards data required to retrospectively calculate early warning scores and carry out the analysis. A total of 2,449 cases were included in the final analysis.

The medical records of the patients were analysed in order to obtain the following data: age and sex of the patients, length of hospital stay, basic vital signs, medical procedures performed, clinical symptoms and comorbidities as well as outcomes of hospitalisation (survival, transfer to ICU or death). Based on the vital signs of the patients recorded on admission to the emergency department, National Early Warning Score (NEWS), National Early Warning Score 2 (NEWS2), Modified Early Warning Score (MEWS), Standardized Early Warning Score (SEWS) and Sequential Organ Failure Assessment Score (Quick) (qSOFA) values were calculated retrospectively.

MEWS, which was described in 2000, is a simple score used to assess the clinical status of patients based on the following basic vital signs: respiratory rate, temperature, systolic blood pressure, heart rate and AVPU [25] (Table 1).

SEWS was proposed by Paterson et al. in 2006. It is based on the following parameters: heart rate, respiratory rate, systolic blood pressure, temperature, oxygen saturation and level of consciousness [26] (Table 2).

Table 1. Calculation of the Modified Early Warning Score (MEWS) [25].

	3	2	1	0	1	2	3
Heart rate [beats/min]		<40	40-50	51-100	101-110	111-130	>130
Systolic blood pressure [mmHg]	<70	70-80	81-100	101-200		>200	
Respiratory rate [breaths/min]		<9		9-14	15-20	21-30	>30
Temperature [°C]		<35		35-38,4		≥38,5	
AVPU score				A	V	P	U
Worried about patient's condition: 1 point							
Urine production < 75 ml during previous 4 hours: 1 point							
Oxygen saturation < 90% despite adequate oxygen therapy: 3 points							

*AVPU assessment (A – alert; V – reacting to voice; P – reacting to pain; U – unresponsive)

Table 2. Calculation of the Standardised Early Warning Score (SEWS) [26].

	3	2	1	0	1	2	3
Respiratory rate [breaths/min]	≥36	31 – 35	21 – 30	9 – 20			≤8
SpO ₂ [%]	<85	85 – 89	90 – 92	≥93			
Temperature [°C]		≥39	38 – 38.9	36 – 37.9	35 – 35.9	34 – 34.9	≤33.9
Blood pressure [mmHg]		≥200		100 – 199	80 – 99	70 – 79	≤69
Heart rate [beats/min]	≥130	110 – 129	100 – 109	50 – 99	40 – 49	30 – 39	≤29
AVPU* response				Alert	Voice	Pain	None

*AVPU assessment (A – alert; V – reacting to voice; P – reacting to pain; U – unresponsive)

NEWS was developed by the Royal College of Physicians (RCP) in 2012 to improve detection of patient deterioration. It is a simple scoring system based on the following parameters: heart rate, respiratory rate, systolic blood pressure, temperature, oxygen saturation and level of consciousness. Each parameter is scored from 0 to 3 and added together to give an overall score. An additional two points are added for patients requiring supplemental oxygen (Table 3) [27].

In 2017, NEWS was updated by the RCP to NEWS2. NEWS2 differs from NEWS in that it provides an additional oxygen saturation scale, which should be used on patients with hypercapnic respiratory failure (SpO₂ Scale 2) and incorporates “new confusion” (new-onset confusion, disorientation and/or agitation in patients whose mental state was previously normal) as a category for consciousness (Table 4) [28].

qSOFA is used to identify patients with suspected infection who are at higher risk of deteriorating. It is based on three criteria: systolic blood pressure, respiratory rate and GSC (Glasgow Coma Scale) as a measure of level of consciousness [29].

ETHICS

The study was carried out in accordance with the principles of the Declaration of Helsinki, and reports from the database did not permit identification of individual patients at any stage of the study. The study protocol was submitted to the Bioethics Committee at the Medical University of Warsaw, which confirmed that the study did not require consent due to its retrospective nature (AKBE/13/2022).

STATISTICAL ANALYSIS

All statistical analyses were carried out using the STATISTICA software, version 13.2 (Tibco Software Inc., Palo Alto, CA, United States). Categorical variables were presented as numbers [n] and percentages [%], whereas continuous variables were reported using medians (Me) and interquartile ranges (IQR). The normality of the distribution of variables was tested using the Kolmogorov-Smirnov test and the Lilliefors test. Categorical variables were compared using the chi-square test for independent samples, whereas continuous variables were compared using the Mann-Whitney U-test. The prognostic

Table 3. Calculation of the National Early Warning Score (NEWS) [27].

	3	2	1	0	1	2	3
Respiratory rate [breaths/min]	≤8		9 – 11	12 – 20		21 – 24	≥25
Oxygen saturations [%]	≤91	92 – 93	94 – 95	≥96			
Any supplemental oxygen		Yes		No			
Temperature [°C]	≤35.0		35.1 – 36.0	36.1 – 38.0	38.1 – 39.0	≥39.1	
Systolic blood pressure [mmHg]	≤90	91 – 100	101 – 110	111 – 219			≥220
Heart rate [beats/min]	≤40		41 – 50	51 – 90	91-110	111-130	≥131
Level of consciousness				A*			VP or U*

* A – alert; V – reacting to voice; P – reacting to pain; U – unresponsive

Table 4. Calculation of the National Early Warning Score 2 (NEWS2) [28].

	3	2	1	0	1	2	3
Respiratory rate [breaths/min]	≤8		9 – 11	12 – 20		21 – 24	≥25
SpO ₂ scale 1 [%]	≤91	92 – 93	94 – 95	≥96			
SpO ₂ scale 2 [%]	≤83	84 – 85	86 – 87	88 – 92 ≥93 on air	93 – 94 on oxygen	95 – 96 on oxygen	≥ 97 on oxygen
Air or oxygen		Oxygen		Air			
Systolic blood pressure [mmHg]	≤90	91 – 100	101 – 110	111 – 219			≥220
Pulse [per minute]	≤40		41 – 50	51 – 90	91-110	111-130	≥131
Consciousness				Alert			CVPU*
Temperature [°C]	≤35.0		35.1 – 36.0	36.1 – 38.0	38.1 – 39.0	≥39.1	

* A – alert; V – reacting to voice; P – reacting to pain; U – unresponsive

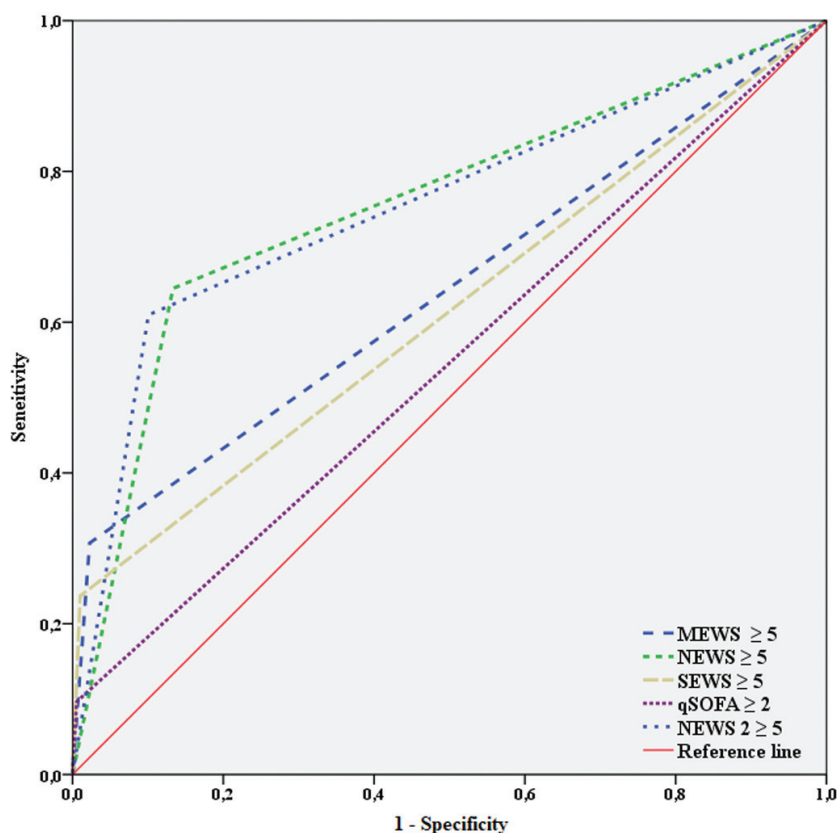


Fig. 1. Receiver Operator Characteristic curves illustrating the ability of MEWS score ≥ 5 , NEWS score ≥ 5 , SEWS score ≥ 5 , qSOFA score ≥ 2 , NEWS 2 > 5 criteria at emergency department admission to predict severe disease from COVID-19.

Table 5. Calculation of the Sequential Organ Failure Assessment Score (Quick) (qSOFA) [29].

Assessment	qSOFA score
Low blood pressure (SBP ≤ 100 mmHg)	1
High respiratory rate (≥ 22 breaths/min)	1
Altered mentation (GCS ≤ 14)	1

value of early warning scores in predicting in-hospital mortality was assessed using ROC curves. AUC (area under the ROC curve) values and their 95% confidence intervals (CI) were calculated. AUC values for clinical risk assessment were compared using the DeLong's test. Accuracy, sensitivity, specificity, the positive predictive value (PPV) and the negative predictive value (NPV) were then calculated. The following recommended and commonly used cut-offs were used in the analysis: NEWS ≥ 5 , NEWS2 ≥ 5 , SEWS ≥ 5 , MEWS ≥ 5 ; qSOFA ≥ 2 . The significance level was set at $p < 0.05$.

RESULTS

Most of the patients included in the study were male (71.3%). The median age of the patients was 53 years and the median length of hospital stay was 4 days. More than 5% of the patients had to be admitted to ICU, 56 patients required mechanical ventilation and more than 14% of the patients required nasal high-flow therapy. The most

commonly reported comorbidities were hypertension (20.1%) and diabetes (9.9%). Detailed results are shown in Table 6.

Our analysis showed that the mortality rate was significantly higher among male patients than among female patients (64.9% vs. 35.1%) ($p < 0.001$). The median age of patients who did not survive was significantly higher than that of patients who survived (75 years vs. 50 years). Similarly, the median length of hospital stay was significantly longer for patients who did not survive (3 days vs. 9 days) ($p < 0.001$). The mortality rate was significantly higher for patients who had to be admitted to ICU due to their clinical condition (45.6% vs. 1.6%), who required mechanical ventilation (22.8% vs. 0.2%) and who required nasal high-flow therapy (41.2% vs. 11.8%) ($p < 0.001$). Moreover, the groups analysed differed significantly in terms of the prevalence of comorbidities, diastolic blood pressure, mean arterial pressure, respiratory rate, heart rate and EWS values ($p < 0.05$). Details are shown in Table 6.

Table 6. Patient characteristics and outcome at emergency department admission in patients with COVID-19 infection.

Variables	Total (n = 2449)	Survivor (n = 2251)	Non-Survivor (n = 228)	p-Value
Sex – n (%)				
Female	1208 (48.7)	1128 (50.1)	80 (35.1)	0.000
Male	1271 (71.3)	1123 (49.9)	148 (64.9)	
Age [years] – Me (IQR)	53 (38-69)	50 (37-66)	75 (67-83)	0.000
Duration of hospital stay [days] – Me (IQR)	4 (0-11)	3 (0-11)	9 (3-15)	0.000
ICU admission – n (%)	139 (5.61)	35 (1.6)	104 (45.6)	0.000
Ventilator therapy – n (%)	56 (2.3)	4 (0.2)	52 (22.8)	0.000
Nasal high-flow therapy – n (%)	359 (14.5)	265 (11.8)	94 (41.2)	0.000
Chronic conditions				
Hypertension – n (%)	498 (20.1)	412 (18.3)	86 (37.7)	0.000
Diabetes – n (%)	245 (9.9)	171 (7.6)	74 (32.5)	0.000
ACS – n (%)	135 (5.5)	100 (4.4)	35 (15.4)	0.000
Stroke history – n (%)	95 (3.8)	67 (3.0)	28 (12.3)	0.000
Cancer – n (%)	79 (3.2)	51 (2.3)	28 (12.3)	0.000
Heart failure – n (%)	210 (8.5)	113 (5.0)	97 (42.5)	0.000
COPD – n (%)	54 (2.2)	36 (1.6)	18 (7.9)	0.000
Renal failure – n (%)	110 (4.4)	73 (3.2)	37 (16.2)	0.000
Smoking – n (%)	112 (4.5)	89 (4.0)	23 (10.1)	0.000
SBP (mmHg) – Me (IQR)	132 (120-147)	132 (120-147)	132 (116-150)	0.588
DBP (mmHg) – Me (IQR)	81 (73-90)	82 (74-90)	78 (67-89)	0.000
MAP (mmHg) – Me (IQR)	99 (90-108)	99 (90-108)	97 (84-110)	0.007
RR (breaths/min) – Me (IQR)	18 (16-20)	18 (16-20)	20 (18-25)	0.000
HR (beats/min) – Me (IQR)	85 (75-98)	85 (75-97)	90 (78-107)	0.000
MEWS ≥ 5 – n (%)	120 (4.8)	50 (2.2)	70 (30.7)	0.000
NEWS ≥ 5 – n (%)	446 (18.0)	299 (13.3)	147 (64.5)	0.000
NEWS2 ≥ 5 – n (%)	365 (14.7)	226 (10.0)	139 (61.0)	0.000
SEWS ≥ 5 – n (%)	76 (3.1)	22 (1.0)	54 (23.7)	0.000
qSOFA ≥ 2 – n (%)	31 (1.3)	9 (0.4)	22 (9.6)	0.000

Me – median; IQR – interquartile range; ICU – intensive care unit; ACS – acute coronary syndromes;

COPD – chronic obstructive pulmonary disease; SBP – systolic blood pressure; DBP – diastolic blood pressure; MAP – mean arterial pressure;

RR – respiratory rate; HR – heart rate; MEWS – Modified Early Warning Score; NEWS – National Early Warning Score;

NEWS2 – National Early Warning Score2; SEWS – Standardised Early Warning Score; qSOFA – Sequential Organ Failure Assessment Score (Quick)

Table 7. Performance of EWS in Predicting in-Hospital Mortality of COVID-19 Patients.

Score	AUC (95% CI)	SEN (%)	SPE (%)	PPV	NPV	Difference with AUC of MEWS ≥ 5 (95% CI)	p-value
MEWS ≥ 5	0.64 (0.60-0.69)	30.7	97.7	57.9	93.3	-	0.000
qSOFA ≥ 2	0.55 (0.50-0.59)	9.7	99.5	64.7	91.6	0.10 (0.07-0.13)	0.000
NEWS2 ≥ 5	0.75 (0.72-0.79)	61.0	89.9	38.0	95.8	-0.11 (-0.08-0.14)	0.000
NEWS ≥ 5	0.76 (0.72-0.79)	64.5	86.7	32.9	96.0	-0.11 (-0.08-0.15)	0.000
SEWS ≥ 5	0.61 (0.57-0.66)	23.7	98.9	70.1	92.8	0.03 (0.01-0.05)	0.003

AUC – area under the receiver operating characteristic curve; SEN – sensitivity; SPE – specificity; NPV – negative predictive value; PPV – positive predictive value

ROC analysis was conducted to assess the prognostic value of early warning scores in predicting in-hospital mortality in COVID-19 patients (Fig. 1). AUC values were as follows: NEWS ≥ 5 0.76 (95% CI 0.72-0.79), NEWS2 ≥ 5 0.75 (95% CI 0.72-0.79), MEWS ≥ 5 0.64 (95% CI 0.60-0.69), SEWS ≥ 5 0.61 (95% CI 0.57-0.66), qSOFA ≥ 2 0.64 (95% CI 0.60-0.69). NEWS ≥ 5 had the highest AUC, a sensitivity of 64.5% and a specificity of 86.7% for predicting in-hospital mortality. MEWS (cut-off ≥ 5), which has been used in the emergency department of the Central Clinical Hospital of the Ministry of Interior and Administration in Warsaw during the pandemic, ranked third in predicting in-hospital mortality. MEWS at a cut-off of 5 had a sensitivity of 30.7% and a specificity of 97.7%. The prognostic accuracy of MEWS ≥ 5 was higher compared to SEWS ≥ 5 and qSOFA ≥ 2 (difference: MEWS ≥ 5 vs SEWS ≥ 5 : 0.03 (95% CI 0.01-0.05), $p=0.003$; MEWS ≥ 5 vs qSOFA ≥ 2 : 0.10 (95% CI 0.07-0.13), $p < 0.001$) (Table 7).

DISCUSSION

Since the beginning of the pandemic, more than 651 million infections and over 6.5 million deaths from COVID-19 have been reported worldwide. More than 770 thousand new cases and over 3.5 thousand deaths from COVID-19 are now reported daily, which indicates that COVID-19 remains a serious threat to global public health [4]. The COVID-19 pandemic and its consequences are discussed extensively in scientific publications, with special focus on risk factors for severe COVID-19 disease and in-hospital death from COVID-19, treatments used, effectiveness of vaccination and the use of early warning scores to identify patients at higher risk of severe disease and death from COVID-19 [30-39].

Our analysis showed that the median age of the patients included in the study was 53 years. Patients who did not survive were older by a median of 25 years compared to those who survived. Most patients were male. The mortality rate was higher among male patients than among female patients. A meta-analysis by Pijls et al. showed that patients aged 70 or over, especially men, are at higher risk of severe illness from COVID-19, ICU ad-

mission and death [40]. Similar findings were reported by Hu et al. and Gray et al. [30, 41].

It should be stressed that, according to the literature on the subject, comorbidities are among the most common risk factors for in-hospital death from COVID-19. The most common comorbidities reported in the literature are diabetes, renal failure, heart failure, chronic obstructive pulmonary disease and cancer [13, 30, 34, 42-44]. Our analysis showed that hypertension was the most common comorbidity in the patients included in our study (it was present in one in five of the patients), which is consistent with findings from other authors. Moreover, all comorbidities were found to be significantly associated with higher mortality.

The in-hospital mortality rate among the COVID-19 patients included in the present study was over 10%. Cicceri et al. reported a 30-day mortality of 17% for a group of Italian patients [45]. A study by Aygun et al. (2022) on COVID-19 patients in Turkey showed that the 28-day mortality rate among the patients was 16.8% [46]. In a study by Rentsch et al. on patients who tested positive for COVID-19 in the USA, the 30-day mortality was 10.7% [20], which is similar to our findings.

The use of early warning scores may effectively help to identify patients whose clinical condition is deteriorating. No scoring systems specific to COVID-19 are currently available. One solution may be to apply the existing scores which are used to assess patients with sepsis, injuries or other severe illness [36,47]. Our analysis showed that NEWS on admission to an emergency department had the highest discriminatory power (AUC 0.76) of the early warning scores studied, indicating that it may be useful for medical personnel in assessing COVID-19 patients. All the other early warning scores were found to be acceptable for screening COVID-19 patients. Our findings are consistent with those from a study by Hu et al., who assessed the predictive value of five early warning scores based on an analysis of the medical records of a group of Chinese patients with COVID-19. The study showed that the AUC value of NEWS was 0.809 and was higher than the AUC values of NEWS2, HEWS, SEWS and

MEWS [13]. In a study by Myrstad et al. (2020) comparing the prognostic value of five early warning scores in predicting severe disease in COVID-19 patients, NEWS2 ≥ 5 (AUC 0.82) was found to be superior to other clinical risk scores for the assessment of patients with COVID-19. In a study by Aygun et al., which evaluated the effectiveness of MEWS and TREWS in predicting in-hospital mortality in COVID-19 patients admitted to an emergency department, the AUC value of MEWS was 0.83 and the AUC value of TREWS was 0.823. The authors found that MEWS calculated on admission to an emergency department is effective in identifying critically ill COVID-19 patients and predicting the 28-day mortality in COVID-19 patients [20].

LIMITATIONS

The present study is probably the first to evaluate the prognostic value of five early warning scores in predicting in-hospital mortality in Polish COVID-19 patients. However, it should be noted that, as any other analysis, this study has limitations. First, it was a single-centre

study. Second, it was carried out based on a retrospective analysis of medical records, which had data gaps, were not completed in a uniform manner and included entries made by different staff members involved in the care of the patients. Third, the primary outcome measure was in-hospital mortality. Thus, all discharged patients were considered not to have died. However, we made every effort to ensure that the study is of high quality despite its limitations. Given the limitations referred to above, further research is necessary on the use of prognostic tools to assess disease severity and in-hospital mortality in COVID-19 patients in order to improve patient care management and resource use.

CONCLUSIONS

Early warning scores, which are fast and easily calculable scoring methods, can assist in rapid identification of patients in critical condition. In the present study, NEWS was found to have the highest discriminatory power, indicating that it can be used to predict in-hospital mortality in COVID-19 patients.

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DETERMINANTS OF EFFECTIVE CARDIOPULMONARY RESUSCITATION PERFORMED BY MEDICAL PERSONNEL

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ABSTRACT

Aim: The aim of this paper is an attempt to analyse the determinants of effective cardiopulmonary resuscitation (CPR) performed by medical personnel over a five-year span.

Material and methods: An original research questionnaire was used to collect and process data for the purposes of this retrospective observational study. The research sample consisted of 167 patients aged between 16 and 102 who had in-hospital sudden cardiac arrest (SCA) and underwent cardiopulmonary resuscitation (CPR).

Results: The most common causes of SCA in the study group of patients were cardiovascular diseases, and the mechanism of asystole was responsible for half of the recorded sudden cardiac arrests. While performing CPR, chest compressions were the most frequently applied procedure, whereas defibrillation or the Esmarch (jaw-thrust) maneuver were used less often. The effectiveness of resuscitation in almost a half of the cases was unsatisfactory, whereas the average time of performing resuscitation was 27,83 minutes. Pronouncement of death was made with regard to patients on whom resuscitation was performed for the longest time. On the other hand, among patients who were resuscitated for less than 20 minutes, breathing, blood circulation and consciousness were restored, or only breathing and circulation were restored.

Conclusions: The main cause of sudden cardiac arrest in the study period were non-shockable heart rhythms, whereas the restoration of spontaneous circulation and breathing was achieved in the cases when resuscitation was performed for less than 20 minutes. The survival rate after successful resuscitation is comparable to the results obtained in other hospitals in Poland and Europe, as well as statistical data from scientific publications.

KEY WORDS

cardiopulmonary resuscitation, sudden cardiac arrest, effectiveness, medical personnel

INTRODUCTION

Sudden cardiac arrest (SCA) is connected with impaired cardiac function or complete cessation of heart function, the symptoms of which include loss of consciousness, absence of pulse or breath or agonal breathing [1, 2]. It is one of the leading causes of death in Western civilization. The most common causes of SCA are ventricular arrhythmias resulting from cardiac ischemia; nonetheless, pulmonary diseases, cerebrovascular diseases, injuries, asphyxiation, drug overdose or drowning cannot be excluded [1, 3, 4]. In emergency cases - that are strictly connected with hospitalisation and concurrence of SCA - myocardial infarction, cerebrovascular accidents, circulatory insufficiency, exacerbation of asthma or chronic obstructive pulmonary disease and self injury play the main role [1, 5].

According to data obtained from the American Heart Association (AHA), approximately 400 000 out-of-hospital cardiac arrests are recorded a year, whereas approximately 209 000 in-hospital cardiac arrests are observed

[6]. According to the guidelines by the European Resuscitation Council (ERC) from 2015, an estimated 350 000 up to 700 000 incidents of sudden cardiac arrests are recorded in Europe [7]. Currently in Europe, out-of-hospital incidences of sudden cardiac arrest are at the level of 67-170 incidences per 100 000 citizens, whereas in-hospital SCA are at the level of 1,5-2,8 incidences per 100 hospital admissions. On the basis of the Utstein-style guidelines, which is a uniform method of reporting data on SCA in out-of-hospital and in-hospital conditions, there is a possibility of conducting comparative analysis of the effectiveness of resuscitation in given facilities in the entire Europe [8]. Medical personnel are obliged to know the current guidelines for cardiopulmonary resuscitation and apply them according to their abilities, experience and the individual health situation of the patient. ERC guidelines, based on scientific evidence, allow for getting an overview of how to properly, effectively and safely perform resuscitation. The patient's well-being and the provision of high quality medical services – especially

those on which the patient's survival depends - lie within the responsibility of the medical personnel. Irreversible brain injury occurs approximately after 5 minutes following cardiac arrest; therefore, only prompt and proper reactions of the medical personnel increase the chances of restoration of life-sustaining functions. They are: Basic Life Support (BLS), that is, basic resuscitation procedures performed in in-hospital conditions by bystanders, who are not necessarily part of medical personnel, followed by Advanced Life Support (ALS) performed by medical personnel, who call for the resuscitation team and undertake advanced procedures: cardiopulmonary resuscitation, defibrillation, pharmacotherapy and oxygen therapy [3]. The frequency of SCA occurrences in Poland is estimated to be at the level of 170 cases per 100 000 citizens, whereas the frequency of performing CPR is estimated at the level of 97 cases per 100 000 citizens [8].

THE AIM

This paper aims to analyse the determinants of effective cardiopulmonary resuscitation (CPR) performed by medical personnel over a five-year period.

MATERIAL AND METHODS

The study was conducted on the basis of a retrospective analysis of medical records of patients hospitalised in the Independent Public Health Care Centre (IPHCC) in Przeworsk from 2015 to 2019. The medical records of patients on whom cardiopulmonary resuscitation was performed due to in-hospital cardiac arrest were subject to the analysis. The number of patients treated in the Independent Public Health Care Centre in Przeworsk in the study period was: 14 312 patients in 2015, 14 319 patients in 2016, 13 417 patients in 2017, 14 284 patients in 2018 and 14 515 patients in 2019. A total of 1260 deaths were recorded over the five-year period [9]. Based on inclusion criteria, the patients who at the time of SCA were in hospital were included, and their medical records included information on "defibrillation", "indirect cardiac massage", "manual resuscitation" procedures, and in the case of an intervention, a protocol of resuscitation was filled out. Patients on whom CPR was performed before their arrival at the hospital were excluded from the study, as were the patients for whom it was impossible to collect the required data for analysis. In order to obtain data for the study, paper-based medical records and protocols of resuscitation made available by the IPHCC were used. The Asseco Medical Management Solutions system (AMMS), a comprehensive and integrated suite of IT systems, was used for database searches regarding the performed medical procedures. The data was later applied to the original research questionnaire, in which the data on CPR performed in the case of in-hospital cardiac arrest was gathered, maintaining full confidentiality of the patients' personal details. The protocol contains information required for the study, including resuscitation procedures performed by medical personnel, the process of CPR, and the Utstein guidelines (which

included variables regarding the patient, cardiac arrest, and the results of resuscitation).

After verifying the normality of distribution of variables using the Kolmogorov-Smirnov test, nonparametric tests were used. The Mann-Whitney U test and the Kruskal-Wallis test were used when normal distribution of variables was not assumed. The Pearson's χ^2 test was used to analyse differences between qualitative variables. The level of significance was set at $p < 0,05$, and the calculations were made with the use of the IBM SPSS Statistics 20 software.

RESULTS

A total of 167 patients were included in the analysis: 28,7% of them were women and 71,3% of the patients were men (N=119). The patients included in the analysis were between 16 and 102 years old, with an average age of $71,38 \pm 13,52$ years (SD=13,516). Half of the research sample were patients over 72 years old, while 19,2% of the study group (N=32) were patients up to 60 years of age. The largest group of patients who underwent cardiopulmonary resuscitation were aged between 61 and 70 (28,7%, N=48), patients aged between 71 and 80 accounted for 24,6% of the study group (N=41), and 27,5% of the patients were aged 80 or over (N=46).

The analysis of the reasons for admission to the ward has shown that the majority of patients had problems with the circulatory system (N=106, that is, 61,7%), respiratory system diseases (N=36, 21,6%), while other systemic diseases that were the basis for admission were observed less frequently: cardiorespiratory diseases (10,2%) and nervous system diseases (2,4%) respectively.

In the study group, the most frequently diagnosed cases were decompensated chronic circulatory insufficiency (N=39, that is, 23,9%), followed by acute circulatory insufficiency or pulmonary inflammation/edema (each of them: N=23, that is, 14,1%) (Figure 1).

The majority of the studied patients were hospitalised at the Anaesthesiology and Intensive Care unit (AIC) (60,5%), followed by the Cardiology unit (26,3%), whereas the remaining patients were hospitalised at non-invasive treatment wards and surgical wards. The vast majority of patients included in the study (89,2%) were admitted to hospital in an emergency situation. Male patients were prevalent among all the admitted patients.

Resuscitation procedures were most often performed by the resuscitation team (62,8%), followed by medical personnel of a given ward (30,5%), whereas resuscitation was performed the least frequently by other members of staff or bystanders. Among the causes of cardiac arrest, the most commonly indicated ones were connected with the circulatory system (63,5%), followed by the respiratory system (21,6%) and other systems. The mechanism of asystole was responsible for a half of all recorded sudden cardiac arrests (50,3%), bradycardia preceding sudden cardiac arrest was observed among 34,7% of patients, Ventricular Fibrillation (VF) was observed among 18% of patients, Pulseless Electrical

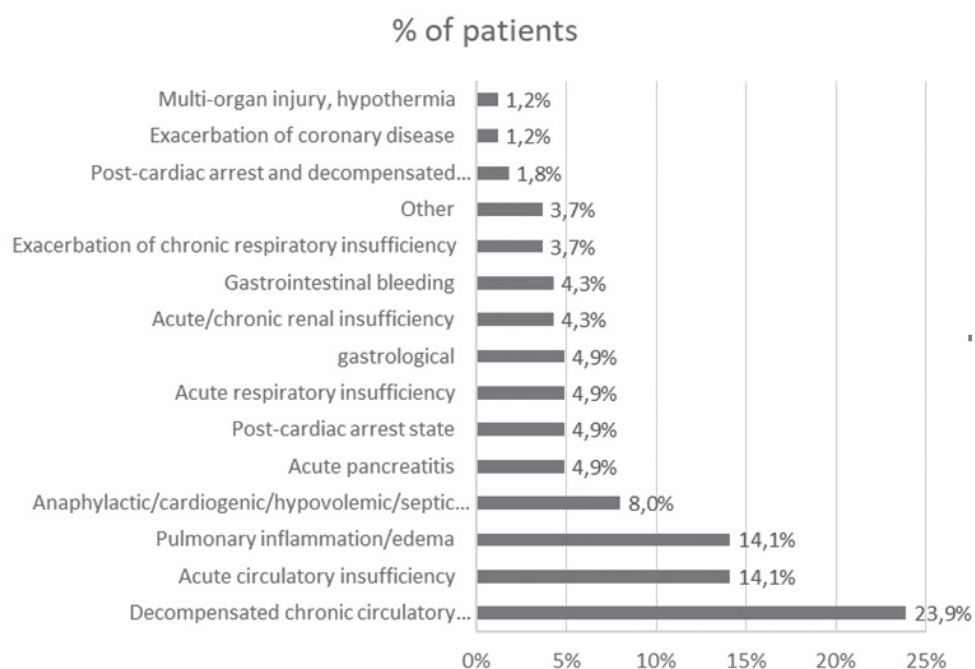


Fig. 1. Diagnosis, reason for hospitalisation (N=163).

Table 1. Effects of resuscitation, comorbidities.

		Comorbidities		Total	
		no	yes		
Results of resuscitation	death	N	16	66	82
		%	59.3%	47.1%	49.1%
	return of breathing, circulation, consciousness	N	0	19	19
		%	0.0%	13.6%	11.4%
	return of breathing and circulation	N	4	2	6
		%	14.8%	1.4%	3.6%
	return of breathing up to 20 min.	N	3	29	32
		%	11.1%	20.7%	19.2%
	return of circulation 20 min.-24 h	N	1	16	17
		%	3.7%	11.4%	10.2%
	return of circulation over 24 h	N	3	8	11
		%	11.1%	5.7%	6.6%
Total	N	27	140	167	
	%	100.0%	100.0%	100.0%	

$\chi^2=19.047; p=0.0019$

*Pearson's χ^2 test

Activity (PEA) - 6%, Polymorphic Ventricular Tachycardia (pVT) - 5,4%, and electro-mechanical dissociation - 4,2%. Defibrillation was performed in the case of every fourth patient (25,7%). The most often used technique for relieving airway obstruction was tracheal intubation (87,2%), followed by a mask (6,7%) and Guedel airway (6,1%).

The frequency of performing intubation allowed for applying respiratory therapy in 60% of all performed cardiopulmonary resuscitations, whereas 40% of them were aimed at providing mechanical ventilation with the use of a bag valve mask. Chest compressions was the most frequently applied procedure (94,6% of CPR), followed by defibrillation (25,7% of CPR), ECG recording (7,8%), and the Esmarch (jaw-thrust) maneuver (1,8%).

The effectiveness of resuscitation in almost a half of the cases was unsatisfactory (49,1%). Return of breathing, circulation and consciousness was observed only in 11,4% of the cases, whereas restoration of breathing and circulation without the restoration of consciousness was recorded in the case of 3,6% of the patients. In the case of the remaining patients, circulation was restored within the following timeframes: up to 20 minutes (19,2%), and between 20 minutes and 24 hours (10,2%). The survival rate in the group of patients on whom cardiopulmonary resuscitation was performed was 41,3%.

Resuscitation was performed for a total of 25 minutes for half of the patients, while the average time of resuscitation was 27,83 minutes (SD -17,91) and ranged between 5 and 100 minutes. It was observed that death was pronounced more frequently among patients without diagnosed comorbidities (59,3%) than among those with diagnosed comorbidities (47,1%). These differences were statistically significant ($p=0,0019$) (Table 1).

While performing CPR, the Anaesthesiology and Intensive Care unit performed chest compressions in the first place (99%), followed by the Cardiology unit. Defibrillation was most often performed at the Cardiology unit (45,5%), whereas ECG recordings in the Anaesthesiology and Intensive Care unit (11,9%) (Table 2).

Death was most common among the patients who were resuscitated the longest period (33,35 minutes on average). Breathing, circulation and consciousness were restored simultaneously in the case of patients, who were resuscitated for a short period of time (less than 20 minutes) ($p<0,001$) (Table 3).

It was observed that the patients hospitalised at non-invasive treatment wards died more often (91,7%) than in other wards. In the Anaesthesiology and Intensive Care unit, circulation was successfully restored within 20 minutes (26,7%), whereas in the Cardiology unit, the restoration of circulation, breathing and consciousness was achieved in 29,5% of all the cardiopulmonary resuscitation interventions.

The analysis has shown that survival rate of over 3 months was higher for patients hospitalised at the Anaesthesiology and Intensive Care unit (49,5%) compared to other units (Cardiology - 29,5%, non-invasive treatment wards - 16,7%, surgical wards - 40%) (Table 4).

No significant correlation between the cause of cardiac arrest and the results of resuscitation procedures was observed. Similarly, no correlation between survival rate after performing CPR and the cause of cessation of circulation was observed.

The number of deaths in the analysed years was higher in the years 2015-2017 (at the level of 55%), but it decreased in 2018 (51,1%) and then decreased significantly in the subsequent year (32,5%). These differences were statistically significant ($p<0,001$) (Table 5).

The survival rate of patients on whom CPR was performed was the highest in 2019 (65%), relatively high in 2018 (40%) and the lowest in the years 2015-2017 (2015 - 24,1%, 2016 - 37,8%, 2017 - 25%). Nonetheless, no correlation between survival rates and the mechanism of cardiac arrest was observed.

DISCUSSION

Early diagnosis of the patient's health deterioration and prompt and effective recognition and confirmation of cardiac arrest are crucial parts of the first link in the chain of survival [10,11]. The success of the emergency procedures depends not only on the patient and the causes of SCA, but also on the experience of medical personnel, who by following guidelines, algorithms, standards, procedures and scientific research provide first aid in order to restore life sustaining functions and stabilise the patients' condition [12]. Numerous studies confirm that if cardiac arrest occurs in in-hospital conditions, an average of 20% patients will survive and be discharged from the hospital [13, 14]. Therefore, monitoring in-hospital cardiac arrests is justified, as it allows for identifying hospital units in which the above-mentioned occurrence takes place the most frequently. On the other hand, analysing the causes of SCA and undertaken procedures allows for evaluating the effectiveness of activities undertaken [11].

A total of 167 cases of resuscitation were recorded in the studied Health Care Centre over a five-year span. 1260 out of 70 545 patients died. The frequency of resuscitations in in-hospital SCA was at the level of 0,24%, and thus it was similar to the data obtained from European and American hospitals [15, 16]. The obtained results did not diverge significantly from the frequency of undertaken resuscitation procedures in Polish hospitals [17]. The most frequent causes of death were cardiovascular system diseases, respiratory system diseases, neoplasms and injuries, which was consistent with the obtained results [18].

While analysing the data, it has been shown that tracheal intubation was the most common method of relieving airway obstructions during CPR. Numerous authors emphasise the importance of the gradual progression of methods for removing respiratory tract obstructions, beginning with basic methods and moving on to more advanced methods of airway management [19]. Nevertheless, tracheal intubation allows for uninterrupted chest compressions during ventilation and also

Table 2. Performed procedures and the place of incident.

		Comorbidities								p
		Cardiology unit		AIC		non-invasive treatment wards		surgical wards		
		N	%	N	%	N	%	N	%	
chest compressions	no	2	4.5%	1	1.0%	2	16.7%	4	40.0%	$\chi^2=26.794$; p=0.0002
	yes	42	95.5%	100	99.0%	10	83.3%	6	60.0%	
defibrillation	no	24	54.5%	79	78.2%	11	91.7%	10	100.0%	$\chi^2=15.357$; p=0.0177
	yes	20	45.5%	22	21.8%	1	8.3%	0	0.0%	
Electrocardiogram recordings	no	43	97.7%	89	88.1%	12	100.0%	10	100.0%	$\chi^2=19.004$; p=0.0042
	yes	1	2.3%	12	11.9%	0	0.0%	0	0.0%	
Esmarch (jaw-thrust) maneuver	no	41	93.2%	101	100.0%	12	100.0%	10	100.0%	$\chi^2=6.081$; p=0.4142
	yes	3	6.8%	0	0.0%	0	0.0%	0	0.0%	
no records in AMMS	no	44	100.0%	101	100.0%	10	83.3%	7	70.0%	$\chi^2=8.54$; p=0.2012
	yes	0	0.0%	0	0.0%	2	16.7%	3	30.0%	

*Pearson's χ^2 test

Table 3. Results of resuscitation and time of resuscitation (min.).

Results of resuscitation	Time of resuscitation (min.)					
	Average	SD	Median	Min.	Max.	N
death	33.35	17.89	30.0	10	100	75
return of breathing, circulation, consciousness	18.82	17.90	10.0	5	70	17
return of breathing and circulation	17.50	5.00	20.0	10	20	4
return of circulation up to 20 min.	23.15	13.24	20.0	5	70	27
return of circulation 20 min.-24 h	23.75	20.37	20.0	5	75	16
return of circulation over 24 h	24.38	17.41	25.0	5	60	8
Total	27.83	17.91	25.0	5	100	147
	p	0.0001				

*Kruskal-Wallis test

protects the airway from aspiration. Furthermore, it is the initial preparation of the patient for mechanical ventilation and further treatment upon the return of spontaneous circulation (ROSC) [7].

The analysis has shown that spontaneous circulation was successfully restored in 41,3% of the cases. In spite of the above-described procedures, 45% of patients died within 24 hours after resuscitation, and 31,9% of them did not survive until discharge. Only 21,7% of patients were discharged from the hospital after successful resuscitation. The studies carried out in the United Kingdom indicate lower survival rate before discharge (18,4%); however, 97,5% of patients in this group were discharged in good neurological condition [16]. The study

conducted by Piankowski indicates the return of spontaneous circulation in 47% of instances; nevertheless, 28% of the resuscitated patients died within 24 hours [20]. Similar results were arrived at by other researchers [21,22]. While comparing the survival rates before the discharge from hospital, significant differences between the results obtained by the researchers are observed: Piankowski - 11% [20], Nowińska and Włodarski - 14,7% [21], Gajewski et al. - only 9% [22].

In the case of in-hospital SCA, mainly non-shockable rhythms were observed [15, 20], which was also confirmed in this study: more than half of SCA began with the mechanism of asystole, whereas bradycardia constituted 34,7% of the reasons for initiating resuscitation

Table 4. Survival rates and place of incident.

			Place of incident				Total
			Total	AIC	non-invasive treatment wards	surgical wards	
Survival rate longer than 3 months	no	N	31	51	10	6	98
		%	70.5%	50.5%	83.3%	60.0%	58.7%
	yes	N	13	50	2	4	69
		%	29.5%	49.5%	16.7%	40.0%	41.3%
Total	N	44	101	12	10	167	
	%	100.0%	100.0%	100.0%	100.0%	100.0%	

$$\chi^2=8,322; p=0,0398$$

*Pearson's χ^2 test

Table 5. Results of resuscitation in subsequent years.

			Year					Total
			2015	2016	2017	2018	2019	
Results of resuscitation	death	N	16	21	9	23	13	82
		%	55.2%	56.8%	56.3%	51.1%	32.5%	49.1%
	restoration of breathing, circulation, consciousness	N	5	2	4	3	5	19
		%	17.2%	5.4%	25.0%	6.7%	12.5%	11.4%
	restoration of breathing and circulation	N	1	0	1	4	0	6
		%	3.4%	0.0%	6.3%	8.9%	0.0%	3.6%
	restoration of circulation up to 20 min.	N	1	4	1	8	18	32
		%	3.4%	10.8%	6.3%	17.8%	45.0%	19.2%
	restoration of circulation 20 min.-24 h	N	4	7	0	2	4	17
		%	13.8%	18.9%	0.0%	4.4%	10.0%	10.2%
	restoration of circulation over 24 h	N	2	3	1	5	0	11
		%	6.9%	8.1%	6.3%	11.1%	0.0%	6.6%
	Total	N	29	37	16	45	40	167
		%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

$$\chi^2=46.131; p<0.001$$

*Pearson's χ^2 test

procedures. According to the ERC guidelines, if the first observed rhythm was ventricular fibrillation, it constituted an optimistic prognosis of the patient's survival [8]. Own research has revealed a significant correlation between the time of performing CPR and survival rates as well as the patient's recovery, which is consistent with the results obtained by Goldberger et al. [23].

The analysis has shown a significant correlation between the time of performing CPR and the survival rate of the patients as well as their recovery. The average time for performing resuscitation (the time that has elapsed between the commencement of CPR and the return of spontaneous circulation or the cessation of CPR procedures and pronouncement of death) was 27,83 minutes.

Among more than half of the patients, this time was shorter than 25 minutes, whereas a short time of resuscitation (less than 20 minutes) was observed among patients, whose breathing, circulation and consciousness were restored or only breathing and circulation were restored. Similar conclusions were drawn by Bradley et al., who indicated that in the analysed group of 31 198 patients, among whom ROSC occurred after in-hospital cardiac arrest, 87,6% had their spontaneous circulation restored within 30 minutes from the commencement of resuscitation [24].

The ERC guidelines indicate that asystole lasting longer than 20 minutes together with simultaneous provision of advanced resuscitation procedures and the lack

of reversible causes of cardiac arrest is a justified indicator of the cessation of CPR procedures [7, 25].

A crucial aspect of resuscitation is the proper training of medical personnel in terms of the recognising SCA and providing resuscitation from Basic Life Support to Advanced Life Support in compliance with the current ERC guidelines. In the study at hand, the resuscitation team undertook resuscitation procedures in 62,8% of instances of SCA, which were later continued by the personnel of a given unit in 30,5% of cases. Therefore, it is necessary to indicate the necessity of undertaking CPR by the first witnesses of the occurrence, (who are nursing staff in in-hospital conditions), until the resuscitation team takes over and continues these procedures. Conducting regular trainings and periodic refresher trainings every two to twelve months is thus justifiable [26].

CONCLUSIONS

During resuscitation provided by resuscitation teams and qualified medical personnel at the Cardiology unit and the Anaesthesiology and Intensive Care unit, the return of spontaneous circulation and breathing was observed more often. In the majority of cases, airway obstructions were relieved by means of tracheal intubation, whereas ventilation was more often performed with the use of ventilators rather than bag valve masks. The main cause of sudden cardiac arrest in the study period was non-shockable heart rhythms, whereas the restoration of spontaneous circulation and breathing was achieved in the cases when resuscitation was performed for less than 20 minutes. The survival rate after successful resuscitation is comparable to the results obtained in other hospitals in Poland and Europe, as well as statistical data from scientific publications.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest.

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CURRENT ASPECTS OF URGENT SURGICAL ASSISTANCE IN PATIENTS WITH DIABETIC FOOT SYNDROME

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ABSTRACT

Aim: Improving emergency surgical care for patients with diabetic foot syndrome.

Materials and methods: We conducted treatment of 268 patients with diabetic foot syndrome (DFS). The first group (136 patients) consisted of patients admitted to the hospital in 2012-2016, organ-preserving operations were performed according to the methods developed in the clinic (126 patients). The second group (132 patients) consisted of patients admitted in 2017-2021.

Results: In the main group, surgical treatment was determined by the form of DFS. There were in the neuropathic form: stage I – surgical treatment of the focus, and stage II – plastic closure of the wound. There were in neuroischemic form (60 patients): stage I – correction of ischemia; stage II – surgical treatment of the focus; stage III – plastic closure of the wound. In 10 (7.3%) patients of the main group amputations were performed at the level of the shin and the thigh. In the control group, in 19 (14.4%) patients, amputation was performed at the level of the thigh.

Conclusions: Organ-preserving treatment of DFS should be carried out in accordance with the form of DFS with determination of tissue viability. Among the factors influencing the rate of healing, the shape of the wound, its size and localization are important.

KEY WORDS

diabetic foot syndrome, treatment, urgent care

INTRODUCTION

Nowadays diabetes mellitus (DM) is regarded as a non-infectious epidemic affecting 2–5% of the working-age population in industrialized countries [1, 2]. Currently, more than 300 million people in the world suffer from DM, and every 13-15 years their number doubles. One of the most frequent and severe complications of diabetes mellitus is diabetic foot syndrome (DFS), which complicates the course of almost 30-80% of such patients [3, 4].

DFS is a specific complex of foot lesions in diabetes mellitus, the basis of which is damage to the vessels, nerves of the lower extremities and bones of the foot with the development of wounds, trophic ulcers, fungal infections of the feet and gangrene. Diabetic foot ulcers in the absence of adequate treatment cause early disability of patients, and the risk of gangrene of the lower extremities in these patients is twenty times higher [5, 6]. In 85% of cases, all amputations are preceded by ulcerative defects [3, 7].

Patients who have undergone amputation of a limb constitute an unfavorable prognostic group, both in terms of the risk of loss of the second limb, and in terms of mortality after amputation [4, 8]. Thus, the lethality within three years in the specified contingent after amputation varies from 35 to 50%. Therefore, an important problem remains the optimization of organ-preserving treatment of such patients, which allows maintaining

the support function and improving the quality of life of patients [4, 9].

The above indicates the urgency of the problem, which requires comprehensive research aimed at improving the provision of emergency surgical care to such patients, reducing the frequency of high amputations of the limb, the mortality rate and improving their quality of life.

THE AIM

improving emergency surgical care for patients with complications of diabetic foot syndrome, reducing the frequency of high limb amputations and mortality.

MATERIALS AND METHODS

We have carried out a comprehensive examination and treatment of 268 patients with DFS with stage I-V for Meggit-Wagner, who were treated in the Surgical department No. 1 of the Poltava city hospital No. 2 during 2012-2021. The first (main) group (136 patients) consisted of patients admitted to the surgical hospital for the period from 2012 to 2016. The second (control) group (132 patients) consisted of patients admitted in the period from 2017 to 2021. In the first group, organ-preserving operations were performed according to the methods developed in the clinic (126 patients), taking into account the prevalence of destructive changes by

determining tissue viability by measuring the electrical resistance of limb tissues.

All patients underwent a comprehensive examination, which included a general clinical examination, radiography of the foot, ultrasound duplex angioscanning of the lower extremities, dopplerometry, bacteriological, cytological examination and measurement of the area of wounds according to indications.

Patients with DFS from both groups were divided into 2 subgroups: I – neuropathic form, II – neuroischemic form. In terms of age and sex composition, both in the first and second groups, women aged 50 to 70 years prevailed. Insulin-dependent DM was in 22 (16.2%) patients of the main group and in 40 (30.3%) patients of the control group.

RESULTS

The diagnosis of neuroischemic form of DFS was established in 60 (44.1%) patients of the main group and 64 (48.5%) patients in the control group. Other patients had a neuropathic form of DFS. The average area of ulcerative defects was $2.4 \pm 0.3 \text{ cm}^2$, they were localized in areas of the greatest pressure when walking.

A clinical study of the state of peripheral somatic innervation showed that manifestations of neuropathy are typical for all patients. The main blood flow in the femoral-popliteal segment was preserved in 127 (93.4%) patients of the main group. An ankle-brachial index less than 0.6 was found in 9 (6.6%) patients. In the control group, in 68 (51.6%) patients, the main blood flow through the arteries of the foot was preserved, in 56 (42.5%) patients, stenosis-occlusion of the arteries of the legs was found. Eight (5.9%) patients in the control group had popliteal artery occlusion.

Destructive bone changes without skin damage occurred in 4 (2.9%) patients of the main group. The combination of bone destruction with soft tissue defects was in 22 (16.2%), soft tissue defects were in the form of a fistula, phlegmon and deep foot ulcers. In 10 patients, signs of bone destruction were detected intraoperatively.

Patients of both groups were prescribed basic drug therapy, which included compensation of carbohydrate metabolism (insulin therapy); antibacterial therapy, taking into account the sensitivity of the microflora; elimination of manifestations of critical ischemia of the foot; in the neuropathic form of DFS, metabolic therapy was prescribed; symptomatic therapy; foot unloading.

In the main group, surgical treatment was performed in several stages and was determined by the anatomical and clinical form of DFS. There were in the neuropathic form (76 patients): stage I – surgical treatment of the purulent-necrotic (P-N) focus, and stage II – plastic closure of the wound with local tissues or combined plasty with local tissues and a split skin flap. In the neuroischemic form (60 patients), surgical treatment was carried out as follows: stage I – medical correction of ischemia; stage II – surgical treatment of the P-N focus; stage III – plastic closure of the wound with local tissues or combined plasty with

local tissues and a split skin flap. In particular, the opening of the abscess and phlegmon of the foot was performed in 54 (39.7%) patients of the main group, amputation and disarticulation of the fingers – in 78 (57.4%), resection or amputation of the foot – in 14 (10.3%) patients, necrectomy, including multiple (staged) were performed in 132 cases. Surgical treatment was not performed in 2 (2.6%) patients of the main group due to the presence of a clean ulcer of the first finger. In 4 (2.9%) patients, amputations were performed at the level of the shin and in 6 (4.4%) – at the level of the thigh.

In the control group, opening of the abscess and phlegmon of the foot was performed in 30 (22.7%) patients, amputation and disarticulation of the fingers – in 124 (93.9%), resection or amputation of the foot – in 26 (19.7%), necrectomy, including reusable (staged) were performed 148 times. In 19 (14.4%) patients, amputation was performed at the level of the middle or upper third of the thigh.

DISCUSSION

Surgical interventions for P-N lesions of the foot are not only a stage of preparation for amputation at the level of the shin or thigh, but they have their own meaning, as evidenced by the majority of studies, the authors of which support small, organ-preserving amputations, which are aimed at maintaining the supporting function of the limb [3, 10, 11].

The tactics of surgical treatment of P-N lesions of the foot in DM is based on the question of the possibility of saving the limb, which was decided taking into account the anamnesis, the course of DM, accompanying diseases, as well as, according to the examination of patients, the clinical form of DFS, the characteristics of the P-N focus, and the prospects for its subsequent rehabilitation [10, 11]. The treatment of a neuropathically infected form of the lesion is based on a number of fundamental positions: complete unloading of the limb, radical surgical treatment of the P-N focus, and regional antibiotic therapy [1, 3, 12]. In the ischemic-gangrenous form, first of all, it is necessary to resolve the issue of the possibility of vascular reconstructive operations in order to restore peripheral circulation [3, 8, 11].

The link, by acting on which it is possible to reduce the number of amputations in diabetes, can be considered the first protracted phase of the wound process: the phase of its cleaning. The impossibility of onset the second phase of the wound process: the phase of proliferation, ultimately leads to the inevitability of amputation of the limb [9, 4, 11].

According to the timing of the surgical intervention, we considered it optimal to divide patients into several groups [3, 11]. Emergency surgical interventions within 2–12 hours were required by patients with the development of wet gangrene; foot phlegmon; phlegmon of the foot with the transition to the shin; P-N process causing the development of DM decompensation. Emergency surgical interventions were performed in 24–72 hours for

patients with deep foot abscesses; P-N wounds without adequate drainage; P-N wounds against the background of stable hyperthermia; the development of distant septic metastatic foci; detection of new abscesses and purulent pockets. Planned surgical treatment was carried out in patients with chronic osteomyelitis; limited secondary necrosis in a wound or in a trophic ulcer; dry gangrene of the fingers or part of the foot with a clear demarcation and the absence of an intoxication syndrome; wound defect of the skin and soft tissues of the foot (various options for reconstructive and plastic surgery).

At the same time, it should be said that we refrained, as far as possible, from carrying out emergency surgical interventions, especially at night. This was due to the fact that patients with DFS were hospitalized in a state of DM decompensation, with severe intoxication. In such cases, we carried out complex conservative therapy until the patient's condition stabilized, and only after that did we perform surgical treatment.

When choosing a method of surgical treatment, the general condition of the patient, the presence of concomitant diseases, the nature and extent of the purulent focus, its localization, the degree of ischemia, and the risk of anesthesia were taken into account [10, 11].

Surgical treatment was carried out in patients with stage 1B-5 according to Meggit-Wagner. Surgical treatment of the purulent focus was performed with wide incisions, removal of necrotic tissues, creation of conditions for drainage, which prevented the spread of the destructive process.

In patients with DM, P-N lesions of foot tissue are characterized by blurred demarcation boundaries between necrotic and viable areas, so even radical operations do not exclude the possibility of repeated interventions. Adequate surgical treatment of P-N lesions of DFS is impossible without diagnosing the viability of foot tissues. To do this, we proposed a preoperative assessment of tissue viability by determining the electrical resistance of limb tissues [13]. This method was used with fuzzy boundaries of destruction in 44 (32.4%) patients of the main group.

There was an increase in electrical resistance on the affected limb with necrotic changes (421.11 ± 15.5 k Ω) in comparison with a healthy limb (185.33 ± 7.4 k Ω) by more than 2 times. An almost 2-fold (342.0 ± 12.0 vs. 178.0 ± 9.6) increase in electrical resistance was also detected with manifestations of necrobiosis. When conducting a morphological study in these cases, disorganization of the tissue structure, pronounced cell dystrophy, and cell-free areas of necrosis were observed. If the ratio of electrical resistance on the pathologically changed (185.0 ± 7.6 k Ω) and healthy (153.33 ± 8.8 k Ω) limb did not exceed two times, then the studied limb tissues were considered viable, which was confirmed by the data of the morphological study. On days 7 and 14 after surgery, the resistance decreased to 150–200 k Ω . The subsequent tendency to decrease in resistance may indicate an increase in the blood supply to the tissue.

Amputation of the first finger was performed in 22 (16.2%) patients of the main group and in 32 (24.2%) patients of the control group. Necrectomy in the area of the first finger resulted in wounds ranging in size from 4.9 cm² to 28.8 cm². The rate of wound reduction averaged 1.4% per day.

Necrectomy of the site of the fifth finger was carried out in 36 patients of the main group and in 30 patients of the control group. Amputation of the second-fourth fingers was performed in 20 (14.7%) patients of the main group and 62 (46.9%) patients in the control group. The consequence of necrectomy of the second-fourth fingers area, accompanied by their removal, was the formation of wedge-shaped wounds with an area of 5.4 to 9.1 cm². The wound reduction rate averaged 7.1% per day.

The study of the size of wounds and cytological examination of wound prints in the course of treatment showed that not only the size of the wound, but also its shape affect the timing of cleansing and healing of wounds. To identify the influence on the course of the wound process of such factors as the shape and localization of the wound (ulcerative) defect, a study was made of the rate of reduction of wounds of various localizations. It turned out that the most favorable in terms of healing is the localization of the wound in the region of the second-fourth fingers; wounds that formed after necrectomy in this area in the form of a wedge or trapezium heal faster than a flat wound formed after necrectomy in the area of the first finger. The delay in healing after the exarticulation of the first finger is associated, firstly, with a large gaping of the wound, and secondly, with the fact that the wound at the site of the removed first finger is subjected to great pressure when the foot performs a supporting function [3, 7, 12].

Thus, amputation of the first and fifth fingers leads to a partial loss of foot function. At the same time, the wedge-shaped form of the wound after operations in the area of the second-fourth fingers suggests a smaller gaping, which makes wound contraction significant in the healing process [3, 10, 12, 14]. To ensure the healing of wounds resulting from operations on the finger, it is desirable to preserve the proximal phalanx of the finger and the supporting function of the foot. Therefore, we tried, if possible, to preserve even a small stump of the proximal phalanx, especially the finger, since its complete removal causes difficulty in walking in patients.

Opening of phlegmon was performed in 54 (39.7%) patients of the main group and in 30 (22.7%) patients in the control group. In the surgical treatment of phlegmon of the foot, we tried not to make linear incisions, which often open phlegmon, since this forms narrow wounds and does not eliminate the conditions for anaerobiosis. In the presence of an anaerobic infection, we performed wide window or U-shaped skin incisions followed by a wide dissection of the tissues, performed a revision of the wound, and radically excised all the altered anatomical elements of the soft tissues. If new foci of necrosis appeared, they were immediately removed due to the

risk of spreading the infection. In case of anaerobic infection of soft tissues, we did not allow closure of the postoperative wound with sutures. In some cases, to open deep plantar phlegmons, we used typical incisions on the plantar surface of the foot, proposed by Delorme.

The result of the opening of the phlegmon of the foot was the formation of large wounds on the plantar and inner surfaces of the foot with an area of 8.3 to 96.4 cm². The area of the wounds grew and in the final version ranged from 20.5 to 108 cm². The rate of wound reduction varied within 1.1–2.9% per day and averaged 1.8% per day, and complete closure of wound surfaces occurred within 7–10 weeks.

After surgical treatment with radical treatment of the P-N focus, significant wound defects are formed, which further need to be closed. As our clinical experience shows, the most accessible and safe method for the patient is autodermoplasty. As a rule, autodermal closure of wound defects after surgical treatment is carried out in the absence of infection in the wound and the maturation of granulation tissue and sufficient blood circulation in the limb. More often it is 10–15 days of the postoperative period. Our experience has shown that in a third of cases in patients with DFS of both clinical groups, signs of a secondary infection in the wound appeared on the 4–5th day after this treatment, the formation and growth of granulation tissue was delayed, and conditions were created for prolonging the process. In our opinion, which is further confirmed by clinical results, early plastic closure of wound defects can prevent the mentioned complications.

Dermoplasty was performed in 21 (15.4%) patients of the main group with destructive forms of DFS. Wound defects appeared as a result of amputations of the toes with resection of mold bones (12 patients) and opening of large phlegmons of the plantar and inner surface of the foot (9 patients). Autodermoplasty included early closure of wound defects with skin flaps 5–7 days after necrectomy in the absence of prolongation of the process, which helps prevent contamination of microorganisms in the wound and the addition of secondary microflora.

The main indications for performing autodermoplasty were: radical surgical debridement of the P-N focus, which should be carried out taking into account the specifics of the process in DFS; the presence of a clean, moderately bleeding wound surface with granulation tissue and the absence of prolongation of the process after surgical treatment; cytological picture of a smear-imprint from a wound of an inflammatory-regenerative type. We performed autodermoplasty according to the methods of Tirsch, Davis or Yanovich-Chayinsky, preparing skin areas with an area of 0.5–3.0 cm² and a thickness of 0.2–0.4 mm under local anesthesia, which were additionally perforated. Engraftment of skin flaps was found in 18 cases out of 21 (85.7%).

The impossibility of performing radical surgical treatment, in our opinion, is not contraindicated for autodermoplasty. In patients with DFS, the processes of

wound cleansing are slowed down and therefore the expectation of complete necrolysis is unreasonable. This primarily concerns patients with a polyphasic course of the wound process, who underwent dermoplasty with signs of its transition from the inflammation phase to the regeneration phase. Despite the rejection of many flaps (40–50%), their positive effect on the course of the wound process was observed: the processes of cleansing and regeneration of the wound surface were accelerated, that made it possible to carry out subsequent transplantations with a positive effect.

When deciding on the need and the optimal level of amputation, we were based on the following studies: clinical data, local blood flow velocity, Doppler ultrasound of the arteries of the lower extremities, arteriography, radiography of the feet, computed tomography. We considered amputations at the level of the foot in diabetic patients with an extremely low level of blood circulation only after deciding on the possibility of reconstructive vascular surgery.

Amputations at any level, if possible, were performed in a patchwork manner within healthy tissue. We do not follow any template and believe that the level of amputation should be chosen on a case-by-case basis, depending on the extent of the P-N process. In order to determine the viability of foot tissues and select the level of amputation, we conducted a study of the electrical resistance of tissues. In patients with severe spread of P-N lesions and the presence of anaerobic infection, the surgical wound was not sutured after amputation. It was also left open in cases where there were doubts about the viability of tissues at the level of amputation. After the elimination of the inflammatory process, a stump was formed by applying secondary sutures.

The main point in the amputation of the foot at different levels is the need for maximum preservation of soft tissues and skin in order to further form a functional stump and maintain the supporting function of the limb, taking into account the possibility of further prosthetics.

Transmetatarsal amputation of the foot was performed in 8 (5.9%) patients of the main and 6 (4.6%) patients in the control group. The high frequency of transmetatarsal amputations is due to the fact that the operation has a higher probability of successful wound healing than the isolated removal of one or more fingers and allows you to save the supporting function of the limb. This type of surgical interventions on the foot was performed in patients with sufficient blood supply to the foot against the background of neuropathy and infection with lesions of the distal foot; patients with ischemic form of DFS on the background of microangiopathy, with limited gangrene of most of the fingers.

Lisfranc or Chopard amputations were performed in 6 (4.4%) patients of the main and 20 (15.2%) patients in the control group. Such types of surgical interventions were performed in cases where other types of distal amputations were impossible. In the postoperative period, we always used immobilization of the foot.

Indications for primary amputation of the lower limb in DFS were subtotal and total necrosis of the foot and ankle joint, since in these forms it is impossible to maintain the support function of the foot, the absence of signs of wound repair for 1–2 weeks against the background of organ-preserving treatment of vascular operations. Wounds healed by primary intention in 51 (37.5%) patients of the main group and 26 (19.7%) patients in the control group. In the control group of patients, the average length of inpatient treatment was 29.3 ± 0.7 , and in the main group – 15.2 ± 0.4 . Carrying out early autodermoplasty on days 5–7 made it possible to reduce the time of treatment of patients in the hospital by an average of 14.1 ± 0.3 days. This indicates the effectiveness of early closure of wound defects in patients with DFS by autodermoplasty.

The rate of wound reduction in the main group was $1.2 \pm 0.2\%$ per day, in the control group – 2.6 ± 0.3 per day. Conducting staged necrectomy within viable tissues, as determined by the study of electrical resistance and improved local treatment of cytological examination, the clinical form of DFS and multi-component application therapy using several medications, made it possible to accelerate the rate of wound reduction by more than two times.

Amputations at the level of the thigh and shin were performed in 10 (7.4%) patients of the main group and in 19 (14.4%) patients in the control group. During the treatment, 3 (2.2%) patients of the main group died. In the control group, 8 (6.1%) patients died. The average age of the dead was 66.1 ± 0.4 years. In 3 of them, the

cause of death was sepsis and multiple organ failure, in 2 – heart failure, in 2 – pneumonia, in one patient – acute cerebrovascular accident.

The above treatments are cost-effective, as they can reduce the healing time of the ulcer, inpatient treatment, prevent the spread of the P-N process and reduce the risk of high amputation of the limb. An almost 2-fold decrease in the number of high amputations and a reduction in the treatment duration, a 2.7-fold reduction in mortality ($p < 0.05$), confirm the promise of the organ-preserving direction in DFS surgery.

CONCLUSIONS

The conditions for organ-preserving treatment of DFS are the preservation of the main blood flow in the arteries of the lower leg with an ankle-brachial index > 0.6 , the absence of destructive changes in the area of the ankle joint. It should be carried out according to the form of DFS and the condition of the diabetic wound.

An express method for determining tissue viability in patients with DFS complications by measuring the electrical resistance of limb tissues allows for limb resection in the required volume, which reduces the frequency of high limb amputation.

Among the factors influencing the rate of healing of a diabetic wound, the shape of the wound, its size and localization are important. In case of necrectomy in the region of the 1st and 5th toes, it is necessary to preserve the stump of the main phalanx to maintain the support function and accelerate wound healing.

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CONFLICT OF INTEREST

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THE EFFECT OF WORKING IN SHIFTS ON THE NUTRITION HABITS OF EMERGENCY RESPONSE TEAM PARAMEDICS

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ABSTRACT

Aim: Paramedics carry out their work duties in a shift system. Shift work is related to a multitude of health complications, disrupting their biological habits and natural rhythm, impeding their private life and negatively affecting nutrition and the quality of sleep. The aim of the study was the evaluation of the effect of shift work on the nutrition habits of paramedics.

Material and methods: The study was carried out in the period between in 2019 using diagnostic survey methodology among a group of 238 paramedics from mobile Emergency Response Teams of the Mazovian voivodeship. The mean age of the participants was 39.03 ± 9.27 years for males and 31.93 ± 7.76 years for females. In order to examine the differences between the groups, the χ^2 test was used with an established statistical significance level of $p < 0.05$.

Results: Among the paramedics, the mean value of BMI was at a level of 24.99 ± 3.36 . 56.30% ($n = 134$) of the participants indicated exhibiting improper nutrition habits. As the research found, the reasons for the improper nutrition habits in this occupational group are primarily shift work (151; 63.44%) and hurry (87; 36.54%).

Conclusions: In order to minimize the possible health consequences related to the nutrition habits of paramedics, it seems essential to incorporate issues concerning the rules of proper nutrition in the health education process, as well as continuously monitoring their condition as part of occupational medicine practice.

KEY WORDS

paramedics, shift work, nutrition

INTRODUCTION

Shift work, understood as working at different times of the day, is the basic form of functioning of the healthcare system, which includes the national Emergency Medical Services (EMS). An example of employees working in such a system of work organization are Emergency Response Team (ERT) paramedics. Adopting this system of work organization is related to the necessity to provide prehospital aid to people whose health or life is at risk.

The basis of the functioning of Medical Services in Poland is governed by the law of the 8th of September 2006 [1] as well as the Regulation of the Minister of Health dated 16th of December 2019 [2].

Due to the nature of their professional duties, paramedics are one of the healthcare occupational groups that come in the most frequent contact with patients. Therefore, they are expected to exhibit a responsible approach towards the health and safety of the patients, as well as their own. Both the working environment and its conditions, as well as its nature carries a range of various

negative health consequences. Healthcare workers are diagnosed with the highest number of occupational illnesses every year. This state of affairs is largely related to the disregard for hygiene and safety regulations at work and not following hygiene and health guidelines [3-10].

THE AIM

The aim of the present study was the evaluation of the effect of shift work on the nutrition habits of ERT paramedics. The reason for undertaking this study was the fact that such research into the relationship between shift work and the nutrition habits of ERT paramedics has not yet been conducted in Poland. The following paper fills this knowledge gap and may serve as a starting point for the development of health-promoting initiatives directed at this professional group.

MATERIAL AND METHOD

According to the data from Statistics Poland for 2019, there were 1577 (100%) mobile ERTs functioning

in the country as part of the National Emergency Medical Services (EMS). At the time of the study, there were 200 mobile ERTs functioning in the Mazovian Voivodeship, making up 12.7% of the national total [11].

The study was carried out as part of a collaborative project between the Health Department of the Mazovian Voivodeship Office in Warsaw and the Health and Social Policy Department of the Marshal's Office for the Mazovian Voivodeship in Warsaw. It was conducted on a group of professionally active ERT paramedics from the 5 operational regions of the Mazovian Voivodeship located in Warsaw, Płock, Ostrołęka, Siedlce and Radom.

The sample choice was deliberate, given that on the national scale, the Mazovian voivodeship has the highest number of mobile ERTs functioning. The data was collected using a self-developed, anonymous interview questionnaire created for the purpose of the present study.

The study was carried out in compliance with the rules outlined in the Helsinki Declaration [12], being anonymous and voluntary in nature. All of the participants granted informed consent regarding their participation, having been informed about the aims of the study, as well as their ability to withdraw participation at any stage, and their participation being voluntary. The questionnaires were filled out independently without the presence of the researcher.

The diagnostic tool was used to evaluate the nutrition habits of paramedics working in a shift system. The self-developed, anonymous interview questionnaire, which included 25 closed and partially open items, encompassed the following elements: sociodemographic data (age, gender, years of work experience, level of education, body weight and height), as well as nutrition

habits.

Incidence (n) and frequency (%) values were provided for the qualitative variables, while for the quantitative variables such as age and years of work experience, basic statistical measures describing the variables were given (value of the mean, standard deviation, minimum and maximum values) and the non-parametric Mann-Whitney U test was used. The Body Mass Index (BMI) was presented basing on the ratio equation of the body mass to the height in meters squared, which was followed by creating a qualitative variable which allowed to indicate the ranges of the aforementioned BMI and group the participants into four classes: people with underweight, normal weight, overweight and obesity. In order to investigate the relationship between the gender as well as the level of education of the participants and the effect of shift work on their nutrition habits, the χ^2 test of independence was used. The statistical analysis was conducted using the Statistica 13.1 PL statistical software. The study established a significance level of $\alpha = 0.05$. Taking into account that the education requirements for paramedics (at the time of the study's duration) [13] include the completion of an undergraduate degree, in the examination of the relationship between the level of education and the effect of shift work on the nutrition habits of the paramedics, the level of education was defined as secondary (including upper secondary) and higher (including a vocational or masters degree).

RESULTS

The final analysis incorporated 238 participants (100%), including 223 males and 15 females. The mean age of the participating males was 39.03 ± 9.27 years, while for females it was 31.93 ± 7.76 years (Table 1).

Table 1. The ages of the participants between genders.

Participant gender	n	M	SD	Min	Max	p-value
Male	223	39.03	9.27	23.00	65.00	0.003*
Female	15	31.93	7.76	23.00	50.00	

*Mann-Whitney U Test, $p < \alpha$, $\alpha = 0.05$

Table 2. Years of work experience of the participants between genders.

Participant gender	n	M	SD	Min	Max	p-value
Male	223	12.62	9.41	0.50	41.00	0.000*
Female	15	5.36	7.04	0.50	28.00	

*Mann-Whitney U Test, $p < \alpha$, $\alpha = 0.05$

Table 3. Level of education of the participants between genders

Level of education	n (%)	Secondary / Upper Secondary	Higher (Vocational)	Higher (Masters)	p-value	p-value
Male	223 (100.00)	48 (21.52)	132 (59.19)	43 (19.28)	41.00	0.109*
Female	15 (100.00)	1 (6.67)	8 (53.33)	6 (40.00)	28.00	

* χ^2 test, $p > \alpha$, $\alpha = 0.05$

The mean years of work experience of the paramedics differed significantly between genders ($p = 0.000$). Among males, it was 12.62 ± 9.41 years, while for females, it was 5.36 ± 7.04 years. In each of the participating groups, the shortest work experience was around half a year (Table 2).

The observed paramedics declared possessing a higher vocational degree ($n = 140$), a masters degree (49) and secondary or upper secondary education (49). The level of education was not related to the gender of the participants ($p = 0.109$). (Table 3). Due to the small size of the female participant population, a further between-gender analysis of the collected data was not carried out for the participants.

The mean value of the participant BMI was at a level of 24.99 ± 3.36 . The most prominent group consisted of people where this parameter was in the normal range (139; 58.40%), followed by values suggesting overweight (64; 26.89%) and obesity (32; 13.44%). A small fraction of the participants were underweight. While analysing the obtained results, the fact that almost 40% of the participating paramedics have overweight or obesity becomes concerning. An important aspect of the work of a paramedic is maintaining good health, and the discussed factor may predispose people to cardiovascular diseases and determine a higher level of biochemical parameters, which directly and indirectly affect the health of the participants (Table 4, Fig. 1).

56.30% ($n = 134$) of the participants indicated exhib-

iting improper nutrition habits. What further becomes concerning is the fact that 76.88% ($n = 183$) of the participants declare consuming less than 3 meals a day, while their consumption of those meals during the day is irregular (142; 59.66%). As the research finds, the reasons for improper nutrition habits are shift work (151; 63.44%) and hurry (87; 36.54%) (Table 5).

The participating paramedics reported that the food products they most often consume include: vegetables (230; 99.63%), fruit (201; 84.44%), milk and milk products (166; 69.73%), red meat and meat products (138; 57.97%). However, the fact that a significant percentage of the participants (66.79%, $n = 159$) consume fast food dishes is concerning (Table 6).

DISCUSSION

The study was an attempt at an evaluation of nutrition habits among ERT paramedics undertaking professional duties in a shift work system. The present study showed that shift work fosters improper eating habits such as: skipping meals, eating meals at irregular times, more frequent consumption of fast foods, and hurried eating. The obtained results indicated an insufficient engagement of paramedics in following rational eating rules, which translates into the incidence of nutrition state disorders, such as excessive weight. The aforementioned findings are concurrent with the findings obtained in the research carried by Souza et al. [14, 15].

Regular and frequent consumption of food products

Table 4. Participant BMI.

Examined characteristic	Overall n (%) 238 (100.00)
BMI (kg/m ²)	Mean.±SD 24.9±3.6
Underweight (≤ 18.5 kg/m ²) n (%)	3 (1.26)
Normal range (18.5–24.9 kg/m ²) n (%)	139 (58.40)
Overweight (25.0–29.9 kg/m ²) n (%)	64 (26.89)
Obesity (≥ 30.0 kg/m ²) n (%)	32 (13.44)

Table 5. Subjective evaluation of the nutritional habits of the participants depending on their level of education.

Variable options	Secondary n (%)	Higher n (%)	Overall n (%)238 (100.00)	p-value	
Nutrition habits	Proper	16 (6.72)	88 (36.97)	104 (43.70)	$p > 0.05$
	Improper	33 (13.86)	65 (27.30)	134 (56.30)	
Number of meals during the day	< 3 meals	39 (16.38)	144 (60.49)	183 (76.88)	$p > 0.05$
	> 3 meals	10 (4.20)	45 (18.90)	55 (23.10)	
Regularity of the meals	Yes	28 (10.76)	68 (28.56)	96 (40.14)	$p = 0.007$
	No	21 (8.82)	121 (50.83)	142 (59.66)	
Causes of eating meals at different times	Shift work	26 (10.92)	125 (52.51)	151 (63.44)	$p > 0.05$
	Hurry and lack of time	23 (9.66)	64 (26.88)	87 (36.54)	

* χ^2 Test, $p > \alpha$, $\alpha = 0.05$

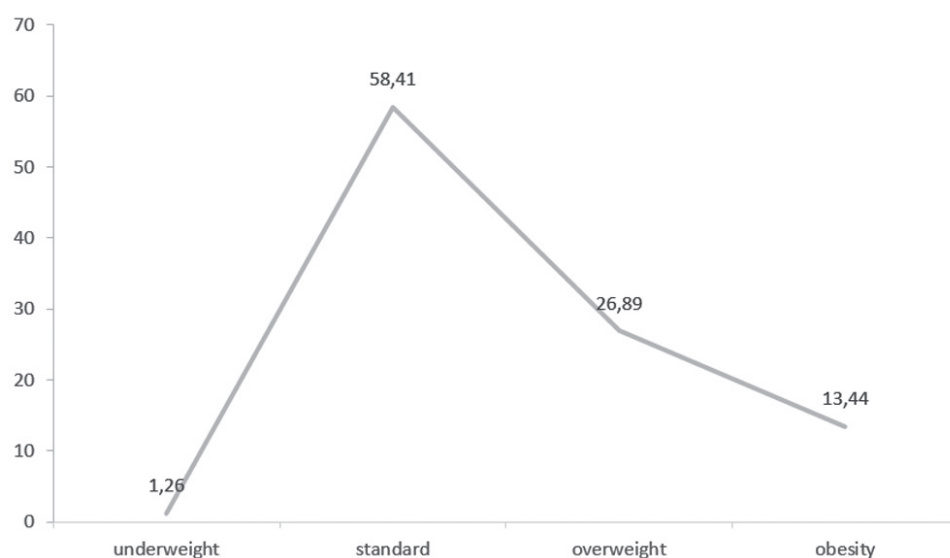


Fig. 1. Body Mass Index (BMI) of the participants (data in %).

Table 6. Frequency of consumption of a selection of food products between the levels of education of the participants.

Evaluated parameters		Secondary n (%)	Higher n (%)	Overall n (%) 238 (100.00)	p-value
Red meat and meat products	Multiple times a week	17 (17.14)	121 (50.83)	138 (57.97)	p < 0.001
	Less	32 (13.44)	68 (28.56)	100 (42.01)	
Fish	Multiple times a week	22 (9.24)	102 (42.84)	124 (52.09)	p > 0.05
	Less	27 (11.34)	87 (36.55)	114 (47.89)	
Fruit	Multiple times a week	43 (18.06)	158 (66.37)	201 (84.44)	p > 0.05
	Less	6 (2.52)	31 (13.02)	37 (15.54)	
Vegetables	Multiple times a week	48 (20.16)	182 (76.45)	230 (96.63)	p > 0.05
	Less	1 (0.42)	7 (2.94)	8 (3.36)	
Bread of preference	white	37 (15.54)	122 (51.25)	159 (66.80)	p > 0.05
	wholemeal	11 (4.62)	60 (25.20)	71 (29.83)	
Milk and milk products (including cheese)	Multiple times a week	36 (15.12)	130 (54.60)	166 (69.73)	p > 0.05
	Less	13 (5.46)	59 (24.78)	72 (30.25)	
Pastries and confectioneries	Multiple times a week	40 (16.80)	155 (65.11)	195 (81.92)	p > 0.05
	Less	9 (3.78)	34 (14.28)	43 (18.06)	
Fast food consumption	Multiple times a week	25 (10.50)	134 (56.29)	159 (66.79)	p = 0.008
	Less	24 (10.08)	55 (23.10)	79 (33.19)	
Instant food consumption	Yes	26 (10.92)	101 (42.43)	127 (53.36)	p > 0.05
	No	23 (9.66)	88 (36.97)	111 (46.63)	
Declaring a limited consumption of salt	Yes	19 (7.98)	79 (33.18)	98 (41.17)	p > 0.05
	No	30 (12.60)	100 (42.01)	130 (54.62)	

* χ^2 Test, p > α , $\alpha = 0.05$

supplies the body with essential nutrients and energy, allowing it to ensure and maintain good health. A multitude of studies conducted among healthcare workers proves that shift work is the factor which significantly affects the development and consolidation of negative eating habits, consequently leading to many negative health consequences [16-19].

Studies show that shift work may lead to the development of various lesions such as metabolic syndrome, obesity, cardiovascular disease risk, gastro-intestinal discomfort, blood glucose disorders, type II diabetes, cancers, stress, depression and sleep disturbances, therefore it is crucial to identify the factors contributing to the development and consolidation of negative eating habits in paramedics as a professional group [19-26].

Proper nutrition habits were found to be disordered in the BMI analysis of the participating ERT paramedics. The causes of the improper nutrition habits of the ERT paramedics participating in research may be found primarily in the shifting work hours and the high pace of work. The present findings find confirmation in the studies conducted among healthcare workers which found that the justification for improper eating attitudes is having to work in a shift system and the lack of time resulting from the excess of professional duties [26-28].

In his research, Jasik showed that almost 36.5% of the participants exhibited excessive BMI values [29]. Meanwhile, in the research carried out by Bator amongst 113 employees of a hospital in the Silesian Voivodeship, BMI values above the normal range were found in 45% of the participants [30]. In the research by Rębak et al. conducted on a group of 140 paramedics, it was shown that the mean BMI was above the normal range and was worth 28.2 ± 4.1 kg/m², suggesting the prevalence of obesity in the observed group [31]. The aforementioned findings correlate with the BMI results of the participants in the present study.

Meanwhile, the research conducted by Gacek found that improper nutrition and anti-health behaviors contribute to the development of overweight and obesity [32]. These findings, which were obtained in the observation of a group of doctors, correlate with the present study's findings, as shown by the BMI scores of the participating paramedics.

Nutrition guidelines suggest that the daily number of meals should be around 4 or 5 [33]. In her study, Gacek showed that in the participant group, a 3-meal model dominated [32]. Meanwhile, in their study, Sińska et al. found that 43% of the participants (n = 68) working in a two-shift system declared consuming 3 meals a day [26]. The aforementioned findings correlate with the results obtained in the previous study regarding this

issue.

The present research showed a high irregularity in meal consumption, which finds confirmation in other studies concerning shift workers [14, 19, 33].

A change in lifestyle, including an improvement in nutrition habits, plays a significant role in the prevention of chronic non-communicable diseases in the paramedic professional group.

LIMITATIONS

A cost-effective tool used in studies such as these are validated questionnaires. The authors are aware of the limitations of the present study. These limitations are a result of a financial barrier, which involves an inability to access diagnostic tools free of cost, as well as limiting the scope of the research. It has to be stressed that the number of participants was limited and included only inhabitants of one Voivodeship, which has an effect on the reliability of the collected data. The sample size is generally an accurate representation of the paramedic population from this one Voivodeship, however it is not representative enough for paramedics on a national scale.

CONCLUSIONS

The nutrition habits of ERT paramedics in their work environment have a significant effect on the character of their work and the way it is carried out.

ERT paramedics do not have total control over where they will eat, when they will eat, or if they will eat at all. The nature, environment and conditions of their job affect the individual ability to make healthy consumption choices.

The study showed that increased support is required from the governing bodies of the EMS, such as through the promotion of healthy nutrition habits among paramedics, as well as through ensuring proper hygiene and health conditions during work.

The health education of paramedics in regard to the principles of healthy nutrition is an important measure of support for the personnel, which may bring about positive results. Addressing healthy eating habits as part of the occupational education and professional development of the paramedics may ensure the improvement of the individual health condition.

Undertaking further research concerning the strategies which would enable paramedics to make better choices in regard to food products and meals in the context of their work overload and environment is justified in the light of possible health complications which may arise in relation to the nutrition habits of this professional group.

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COOLING THE BURN WOUND AMONG THE CHILDREN AND TEENAGERS IN THE FIREFIGHTER PRACTICE

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ABSTRACT

Aim: The analysis of the cases of cooling the burns by NFRS firefighters.

Material and methods: The data of Decision Support System of State Fire Brigade made accessible by the State Fire Bureau of the Operation Planning was analyzed concerning cooling the burns among the children between 1.01.2019-31.12.2020. 49 incidents were analyzed in terms of the mechanism, localization, depth, extend of the burns, season of the year and day.

Results: Burns were cooled in 1211 out of 126241 casualties, including 1023 of 7616 in fires and 188 of 118625 in local threats. Burn were cooled in 49 children out of 1211 casualties- 23 in local threats and 26 in fires. Cooling burns more often concerned in thermal (45), contact burns (27), I/II (48), up to 10% TBSA (32), in boys (25), 14-17 years (18), in October (9), from 1-11 p.m. (27) and in IV quarter of the year (19).

Conclusions: 1. Among the injured the minor ones with the burns are not often cases. 2. Cooling the burns is more often associated with those ones injured in the fires and in boys. 3. Among the injured up to 17 years cooling the burns is more often seen during afternoon and autumn-winter season. 4. The firefighters more often cool thermal, contact, superficial ones of minor burns and concerning different parts of the body within the upper parts.

KEY WORDS

children, firefighters, cooling, burns

INTRODUCTION

In the medical incidents to which the firefighters of the National Fire and Rescue Services (NFRS) in Poland the certain group of the injured ones in the local threats and fires are the minors. The medical actions taken by the firefighters are fulfilled in accordance with the procedures of the qualified first aid (QFA). The burns are associated with the procedure no 13 (thermal burns) and no 14 (chemical burns). Apart from the procedure which should be followed in the case of the burns, the firefighters are also provided with the appropriate medical equipment– the set of sterile dressings and hydrogel dressings. The burn is the local damage of the tissues caused by external factors: thermal, chemical, electric or the ionizing radiation and are determined as one of the most destroying and difficult in curing injuries. For the severity of the burn influences the depth and the spread of the burn, the burned parts of the body, the age of the injured one and the coexisting diseases [1].

It's estimated that about 30% of the burned are children and teenagers. The children who are burnt in compared to the adult ones, are the special group of the injured. The thinner skin, the different proportion of the surface to particular parts of the body to the whole its surface, increases the threat of the deep burns, the heat and plasma loss from the burn wounds and also of the hypothermia among the children [2].

THE AIM

The aim of the study was the analyses of the burns among the children and the teenagers whom the firefighters of NFRS were cooling the burns.

MATERIAL AND METHODS

The cases of cooling burns in children and adolescents by NFRS firefighters in Poland in the period 1.01.2019-31.12.2020 were analyzed. The data collected in the Decision Support System of the State Fire Service (DSS-SFS) was subject to observation and made accessible by the Bureau of the Operation Planning of the State Fire Service (BOP SFS). There were 49 cooling-burn events in children aged 0-17 analyzed. In the analyzed material mechanism, location, depth and extent of burns as well as sex of the injured were analyzed. The age of victims was analyzed in the range of 0-1, 2-3, 4-6, 7-13 and 14-17 years. Cooling burns were also observed in the distribution by season of the year and day. The following measures were used to characterize the variables: number (n) and frequency (%). For the purposes of the analysis of official documentation from the DSS-SFS system, the approval of the bioethics committee was not obtained. The analysis is fully anonymous for the victims and officers involved in the described events, and in accordance with the principles of the Declaration of Helsinki.

RESULTS

In the analyzed period there were 126241 injured recorded including 118625 in local threats (94%) and 7616 in fires (6.03%). The burn was cooled in the case of 1211 people out of 126241 (0.96%), including 188/118625 in the local threats (0.16%) and 1023/7616 in the fires (13.43%). Among the 1211 cases of cooling the burns by firefighters, 49 were associated with children (4.05%), including 23/188 in the local threats (12.23%) and 26/1023 in the fires (2.54%). Data are presented in figures 1-2. General characteristics of events, with variables such as time of the 24-hour cycle of events, quarter of the year, type of burn, extent and mechanism are presented in table 1.

In addition, according to the collected data, apart from those presented in Table 1, 48 burns of the 1st/2nd degree (97.96%) and one case of the 3rd degree burns (2.04%) were recorded, but no burns of the 1st, 1IB and 4th degree were recorded.

Another observation criterion was the burnt area of the body (Fig. 3) and the extent of the burns. In the group under consideration, burns covering various parts of the body, mostly upper parts, prevailed

DISCUSSION

Saving of human life is the major priority of the NFRS units [3]. The NFRS units firefighters are trained to provide QFA to the injured ones in the case of the burns wounds dressing, the protection against the cold, the initial anti-shock treatment, cleaning the upper respiratory tract, and the oxygen therapy. The evacuation of the injured from the place of the incident, the conduction of the initial medical segregation and also providing with the psychological support are also included in the competences of the firefighter [4].

Apart from psychological support for the fulfillment of the mentioned activities the set of emergency

Table. 1 General characteristics of the analyzed cases of children's burns.

Variable	Variable details	N	%
Type of event in the study group	Fires	26	2.54
	Local hazards	23	12.23
Children's gender	Girls	24	48.98
	Boys	25	51.02
Children's age	0-12 months	8	16.33
	1-3 years	9	18.37
	4-6 years	2	4.08
	7-13 years	12	24.49
	14-17 years	18	36.73
Season - quarters	I	11	22.45
	II	7	14.28
	III	12	24.49
	IV	19	38.77
Part of the day	0:00-6:59	4	8.20
	7:00-12:59	18	36.70
	13.00-23:59	27	55.10
Type of burn	Thermal	45	91.84
	Chemical	3	6.12
	Electric	1	2.04
	Contact	27	55.10
Mechanism	Pouring	20	40.82
	Inhalation	2	4.08
Burn extent according to TBSA	0-10%	32	65.31
	11-20%	14	28.75
	>20%	3	6.12

TBSA - Total Body Surface Area

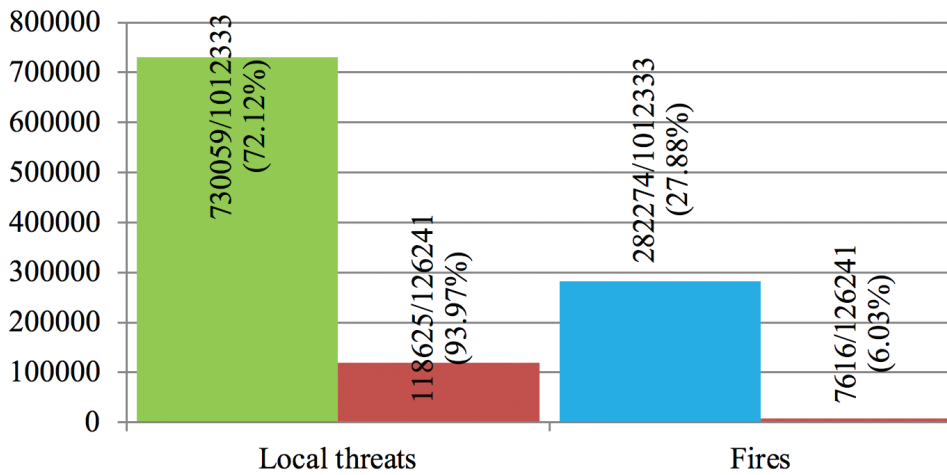


Fig. 1. The injured ones of the local threats and the fires in the analyzed period.

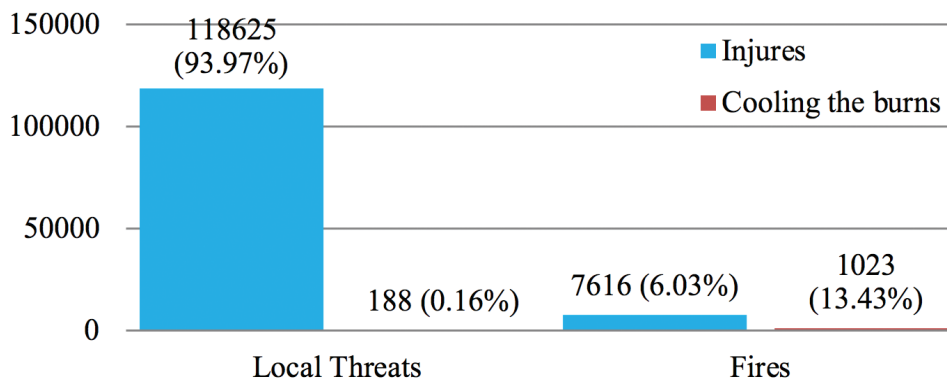


Fig. 2. Burns cooling in relation to total number of casualties and type of accidents.

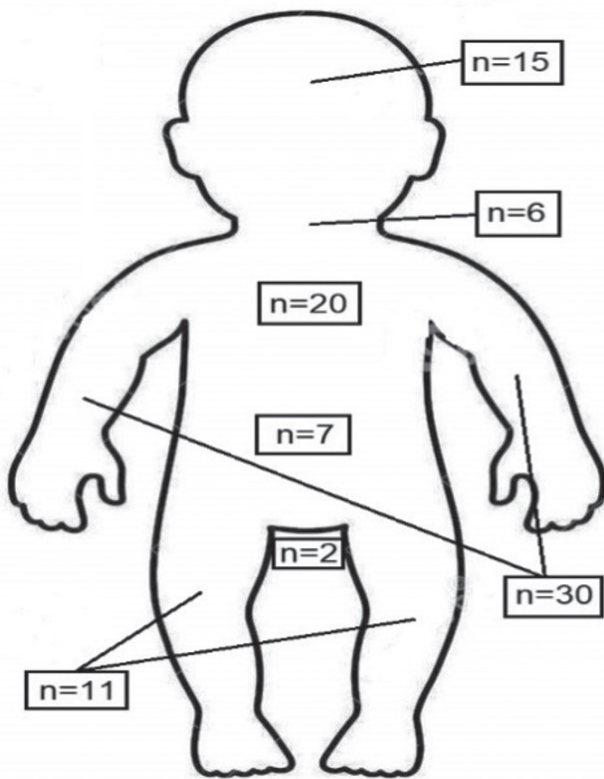


Fig. 3. Burned surface area in the study group, n=49.



Fig. 4. Facial burns cooling by the hydrogel dressing (BurnTec, Kikgel®).

Source: own archive, done 17.06.2022.

medical services bag R1, which includes, among other means for the oxygen therapy (oxygen, facial masks with the reservoir, nasal catheters) and also the devices for clearing the upper respiratory tracts (oropharyngeal airway tubes, laryngeal mask airway/tubes). For cooling of the burned wounds, the sterile gauze dressings, 0.9% NaCl solution and non-stick hydrogel dressings, including the hydrogel dressings enabling covering of 4000 cm² are applied for cooling the burns of the face [5] (Fig. 4).

In own paper cooling burns by firefighter required 1% of injured to whom firefighters provided QFA, including 12% in fires and 0.16% in local threats. In Poland in the years 2017-2018 in the activities of the NFRS units, the local threats were dominant ones. QFA was provided to 137436 injured, including 6% in the fires, which indicates for the decrease the number of the injured ones, within those injured in the fires [6, 7]. In 2019-2020 in Scotland firefighters provided QFA to 24472 people injured due to burns out of 91971 (24%), including more often in fires (79%, 807/1024) [8].

Firefighters more often provide QFA to adults with burns than children. In own study children accounted 4% of the victims. There were more often children injured in local threats - 12% than in fires- 2%. In Scotland firefighters more than 7-times more likely provide help for children and teenagers with burns as a result of a fire, and in England 5-times more. According to the statistical data of the Fire Service in Scotland and England, people aged 0-16 with burns as a result of a fire in 2019-2020 accounted for 14% of the injured (118/807), while in England 10% (678/6932) [8, 9].

In the study group burns was slightly more often affected in boys (51%) than girls (49%) and in adolescents aged 14-17 (37%), which should be associated with a small study group and correlates with other reports [10, 11].

The analysis of data from Fire Brigades in England showed that people aged 11-16 accounted for 58% of injured in fires (38/65) [9]. Different observations were made by authors of other papers from Poland and abroad, who in the practice of health care institutions showed the prevalence of burns in younger children [11-15].

Based on the analysis of the number of the events broken down by month, season of the year and day the highest number of cases of cooling burns wound was noticed in October (18%), in IVth quarter of the year (39%), and between 1:00-11:59 p.m. (55%).

The increase of the number of burns during autumn and wintertime could be caused by the influence of the weather conditions, heating the houses with the usage of the fireplace and also with more often preparation and eating of hot meals [16, 17]. The increase of the number of burns during the afternoon and evening has found the confirmation in the papers of the authors from Poland, India, Bangladesh, China and Belarus [10, 12, 16, 18-20].

Own results also correlate with data from England, where firefighters more often helped children with burns between 1:00-11:59 p.m. (67%, 44/65) than 0:00-6:59 a.m. (12%, 8) and 7:00-12:59 a.m. (18%, 12) [9]. The analysis of information about the incident due to the causes of the incidents among in children and adolescents in the day schedule can be helpful in the organization of prevention activities and the preventive campaign in the field of the public health.

In the study group prevailed thermal burns (92%), resulting from contact (55%), including contact with flame (89%), and scalds (41%). Burns affecting the upper parts of the body, first and second degree (98%), up to 10% TBSA (65%) were dominated. According to domestic and foreign literature, children most often suffer from thermal, superficial, superficial partial and minor burns. These burns wound mainly affect the upper parts of the body and require immediate and reasonable cooling [17, 18].

There is still the lack of the consensus in the recommendations determining the optimal temperature of the cooling factor and the method of the burn cooling [21-23].

The current guidelines of ISBI (International Society for Burn Injuries) recommend sprinkling, immersing, or the wound cooling with clean, running water at the temperature of 15°C for 15-20 minutes [22]. The European Resuscitation Council recommends cooling the burns for 20 minutes and covering them with wet, sterile dressing or with the plastic wrap [21].

The experts of EBA (European Burns Association) recommend cooling the burns for 20 minutes during three hours just after the burning, covering the burn with the wet compress, and in the case of the lack of the access to the running water, with the hydrogel dressing. Cooling the burns for 20 minutes increases the risk of hypothermia, that is why after cooling the burn it is crucial to provide the injured one with the heat. EBA recommends prolonging the time of cooling of the chemical burn up to 45 minutes, and in the case of the chemical eye burn even up to 60 minutes [23]. However from the recommendations of ANZABA (Australian and New Zealand Burn Association) come that in order to cool the burn with the running water for 20 minutes or with two wet towels which should be changed every 15 seconds. In the case of the lack to the access to the water and to the burns of 10% TBSA, the hydrogel dressing can be applied [24]. The other authors recommend cooling the thermal burns with the water of temperature 12-18°C [25].

In own paper burn wound over 10% TBSA were cooled in 34% of injured children. According to the current recommendations, the use of hydrogel dressing for cooling burns wound over 10% TBSA should be avoided in children due to the risk of hypothermia [25].

The analysis showed that in one case firefighters cooled electric burn. The literature shows that the current causes deep burns, therefore it's not recommended to cool electric burns [26].

NFRS firefighters in Poland provide QFA in accordance with the current and unified procedures. There is a lot of attention paid to the risk of the hypothermia, the need for making the observation of the symptoms of the chilling during the cooling of the extended burns. The firefighters are also obliged to cool the thermal burns and also chemical ones up to the 10% TBSA for 5-10 minutes. The time of cooling of the extended burns over the 10% TBSA should be shorter, 1-2 minutes [5].

LIMITATIONS

Our analysis was limited by the short period of analysis accessed. A proportionally longer analyzed period could result in more cases included in the analysis. In addition, the analysis included only those victims who were helped by firefighters and prepared documenta-

tion (QFA card). If in an event in which children were injured, EMTs intervened with equal travel time, then medical assistance and appropriate documentation formed the ambulance crews.

CONCLUSIONS

1. Among the injured the minor ones with the burns are not the often cases.
2. Cooling the burns is more often associated with those ones injured in the fires and in boys.
3. Among the injured up to 17 years cooling the burns is more often seen during afternoon and autumn-winter season.
4. The firefighters more often cool the thermal, contact, superficial ones of minor burns concerning different parts of the body within the upper its parts.

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EVACUATION OF THE WOUNDED FROM THE BATTLEFIELD AS AN IMPORTANT COMPONENT OF EMERGENCY MEDICAL CARE

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ABSTRACT

Aim: To reveal the main ways and means of evacuating the wounded from the battlefield.

Materials and methods: Research methods: analysis and generalization of scientific and educational literature, data from the Internet; study and generalization of the experience of combat operations in Ukraine in 2014-2022, the experience of the armies of the leading countries of the world and NATO on ways and means of evacuating the wounded from the battlefield. It was found that any evacuation is carried out only under cover, with high speed and minimizing the time and visibility of rescuers. The main ways and means of evacuating the wounded from the battlefield, which are used in the red, yellow, and green zones, were revealed. Their advantages and disadvantages were presented.

Conclusions: Providing timely emergency pre-medical care saves the lives of the wounded and sick, and timely evacuation from the battlefield prevents re-injury or death.

KEY WORDS

evacuation, transportation, wounded, pre-medical care

INTRODUCTION

The scientists [1, 2] conditionally distinguish three stages of providing pre-medical care: 1) providing pre-medical care in the area of shelling; 2) transportation (movement) of the wounded from the battlefield to the shelter sector (safe zone); 3) assisting in the shelter sector. Transportation (movement) of the wounded to a safe zone is an important component of the system of measures to provide pre-medical care on the battlefield [3, 4]. An important principle of assisting wounded soldiers in tactical conditions is to prevent the emergence of new injured persons. The movement of the wounded is carried out following the rescue plan in full compliance with the above principle. The development of the wounded rescue plan in the shelling zone should always be in the first place, even when it is necessary to assist the wounded [5].

According to the experts [6, 7], the critical point for survival on the battlefield is the time factor. There is a concept of the "golden hour" i. e. the time required for the wounded to receive the necessary amount of medical care. That is, rapid evacuation from the battlefield to a field or specialized hospital is crucial to saving the wounded. It is also worth noting that modern military

personal protective equipment, combat gear, ammunition, emergency equipment, water, communications, and other equipment significantly increase the weight of soldiers (by 25-30 kg) i. e. a wounded soldier with all his equipment can weigh up to 150 kg [8]. In this regard, the evacuation of the wounded can be significantly complicated. Therefore, knowledge of the basic ways and means of evacuating the wounded from the battlefield is an important area in the training of rescuers and a necessary condition for saving the lives of the wounded.

THE AIM

The aim is to reveal the main ways and means of evacuating the wounded from the battlefield.

MATERIALS AND METHODS

The research was conducted at the Department of Legal Psychology of the National Academy of Internal Affairs (Kyiv, Ukraine) and the Department of Physical Education, Special Physical Training and Sport of S. P. Koroliiv Zhytomyr Military Institute (Zhytomyr, Ukraine) in 2020-2022.

Research methods: analysis and generalization of scientific and educational literature, data from the In-

ternet (12 sources on the topic of the article from the scientometric databases PubMed, Scopus, Web of Science Core Collection and others were analyzed); study and generalization of the experience of combat operations in Ukraine in 2014–2022, the experience of the armies of the leading countries of the world and NATO on ways and means of evacuating the wounded from the battlefield.

The research was performed according to the requirements of the Regulations on Academic Honesty at the National Academy of Internal Affairs, which were developed on the basis of Ukrainian and world experience of ethical rulemaking. This document was approved by the Academic Council of the National Academy of Internal Affairs. According to its provisions, the members of the scientific community are guided by the rules of ethical conduct and professional communication; respect the principles, values, norms, rules, and conditions of academic honesty in their activities.

REVIEW

Summarizing the experience of combat operations in Ukraine and the experience of NATO armies shows that it is necessary to plan the number of rescuer fighters and the number of soldiers from the fire support team after receiving an order from the commander to move the wounded from the shelling zone to the shelter zone. It is necessary to plan the routes of approach and retreat and identify the most dangerous areas in advance. It is required to plan and distribute places in the firing zone among the evacuation team that can be used as temporary protection in case of a change in the combat situation. The servicemen must check their weapons, personal protective equipment, and necessary medical equipment of all members of the evacuation team. It is obligatory to remind all members of the evacuation team how to maintain communication and the procedure for working in the affected area. Next, it is necessary to try to establish voice contact with the wounded soldiers. When establishing voice contact with the wounded, it is necessary to demand that the wounded person take action to leave the area of fire on his own, and, if necessary, to apply a tourniquet. If the wounded is helpless, voice communication with him is maintained continuously until the moment of contact. Such actions are aimed at reducing the risk of combat trauma for all soldiers during the evacuation of the wounded.

The following principles must be observed when assisting the wounded in tactical conditions: wait until the combat mission is completed and obtain permission from the commander to evacuate; take all measures to reduce the risk of unnecessary injuries among the personnel; assist the wounded only following your personal professional training and to the extent stipulated by the tactical area. The main ways to evacuate the wounded from the battlefield in the red and yellow zones are described below.

EVACUATION OF THE WOUNDED IN THE PRONE LYING POSITION (RED ZONE)

It should be remembered that independent movement of the person with neck and spine injuries is prohibited and is possible only if there is a threat to his life. Evacuation in the prone lying position can be used in situations where the wounded needs to be evacuated from the enemy's fire zone. When approaching, it is important to minimize your silhouette, i. e., press down as hard as possible to the ground without raising your head. If possible, you should crawl to the side of the wounded person's head and warn him of your approach to protect yourself from friendly fire. You must keep his hands, weapons, grenades, and knife in sight. When approaching, examine the visible parts of the wounded person's body and the area around for bloody spots, which will help determine the presence of critical bleeding. If the wounded is conscious, talk to him, this will help relieve panic, and the person will be able to help you in the evacuation process. It is important to know that a soldier's behavior after being wounded can be unpredictable. When you approach the wounded, first of all, take his weapon away from him. If the soldier refuses to give it back, clinging to it, use the following method: 1) unfasten the magazine from the wounded soldier's weapon; 2) rack the slide to extract the bullet out of the barrel chamber. Be aware of the gun, knife, and grenades. Turn the wounded on his side, facing you: 1) the soldier's body and equipment will protect you from bullets and shrapnel; 2) you will have visual and verbal contact with the wounded; 3) all limbs are available for tourniquet application. Without raising your head, pressing down to the ground, turn your head to the shelter; press tightly to the wounded; put your arms around the wounded person's shoulders, your foot around his lower limbs, and press tightly. Throw the wounded person on you with a jerk. Start moving towards the shelter, leaning on your elbow, helping with your free leg. This method is mostly used to evacuate the wounded under cover of fire.

The advantages of this method include the fact that a rescuer can deliver scattered fire toward the enemy using his weapon or the wounded soldier's weapon; and the maximum protection of the rescuer by the wounded person's body. Among the disadvantages is the difficulty of the technique; the slow movement of the wounded compared to other methods.

"GRAB AND RUN" OR "DRAGGING" (RED ZONE)

The name of this method of evacuating the wounded in the red zone makes its principle clear: it is necessary to quickly drag the wounded to a shelter under the cover of massed intense fire. The main factor is speed. This method is effective over short distances. It is necessary: 1) to approach the wounded under the cover of massed intense fire – the faster the better. If the tactical situation requires, fire at the enemy; 2) take the wounded soldier by the strap of the body armor or

by the evacuation loop on the back of the body armor and bring him to the shelter as soon as possible. If the tactical situation requires it, move with your back to the front, firing at enemy positions. Dragging the wounded by two rescuer fighters makes it possible to drag the wounded faster and easier, but it exposes two soldiers to enemy fire at once, creating a more convenient group target. The advantages of this method include the ability to conduct scattered fire toward the enemy and the relatively high speed of moving the wounded. The risk of a rescuer fighter's injury is the disadvantage of this method.

All other evacuation methods are used outside the enemy's fire zone (in the yellow zone), are more convenient to perform, and allow the wounded soldier to be carried longer, further, and faster.

"GIVE ME YOUR WATCH" (YELLOW ZONE)

Approach the wounded, if possible from the head, and warn him of your approach to protecting yourself from friendly fire. Keep his hands, weapons, grenades, and knife in sight. As you approach, examine the visible parts of the wounded soldier's body and the area around him for bloody spots, which will help determine if there is critical bleeding. Grab the wounded by the shoulders or straps of the body armor, lift the body in one sharp movement, and put your knee to the back, creating support. It will be easier to work with the wounded in this position, as his body weight is on your knee, and both hands are free. In the event of a threat, return fire, hiding behind the wounded soldier's body and equipment. Holding the weight of the wounded person's body with your knee, slide your hands under the soldier's arms, and firmly grab his wrists (where the watch is worn). Thus, you get four places of fixation of the wounded: two in the armpit and two on the wrists. Holding the wounded by the wrists, get up from your knee and start moving to the shelter. It is important to remember that the back receives a heavy load, so you need to keep it straight, and lift the wounded soldier's weight with the power of the legs, not the back. The advantages of this method are the speed of transportation of the wounded (small friction area); maximum protection of the rescuer. The disadvantages are the backward movement and the inability to use weapons during the evacuation of the wounded.

CARRYING ON THE BACK (YELLOW ZONE)

The wounded soldier's right arm is placed over the rescuer's right shoulder (or vice versa). This method allows one rescuer to carry the wounded soldier for a long time at a fast pace, while one arm remains free. This method is useful if the wounded is conscious and able to stand. If he does not: 1) ask other soldiers to lift the wounded soldier; 2) pull the wounded to a wall (tree), lift him to a standing position, pressing him against support. Grasp the wounded soldier's right wrist with your left hand (or vice versa). Turn your back

on the wounded, squat, and rest your shoulder comfortably under the wounded person's armpit. Hold the soldier's wrist firmly. Place the wounded soldier's hand under your armpit and press it firmly against the chest with your left hand. Take the wounded soldier's elbow and hold it firmly against you. Thus, there are two places to fix the wounded person's arm: elbow and armpit. Lean forward, pushing the wounded onto his back. Start moving, holding the weapon with your free hand. The advantages of this method include the relative speed of transportation of the wounded, while the disadvantages include the risk of injury to the rescuer and the possibility of increased pain in the wounded.

There are also methods of transferring the wounded by two rescuer fighters: "One by one" or "Supporting" method, but these methods are quite complicated and expose the soldiers to enemy fire.

Evacuation equipment (straps, soft stretchers or skidders, tactical stretchers) can be used to help rescue and move wounded soldiers. The main advantage of using a skidder is a significant reduction in friction when dragging the wounded along the ground. The procedure for using the main evacuation equipment is described below.

EVACUATION SLING (RED ZONE)

It has a wide range of applications, the most common way is to evacuate the wounded soldier from under fire to a shelter. It is a polyamide sling stitched with a certain pitch, with a carbine, grappling hook, or any other fixation attached to the end. If you find a wounded soldier in the area of enemy fire, act following the action plan in case of detecting a wounded person. After receiving the command to conduct a rescue operation, draw up an action plan, and clearly define the roles and responsibilities of all participants. The situation described below involves 3 soldiers. On command, one soldier runs out of the shelter to the wounded with an evacuation sling, while the others cover his movement with fire. The main factor is speed. It is necessary to minimize the time spent by the rescuer in the danger zone. Once in the safe zone, start moving the wounded to a shelter, using the support position of your legs and body to speed up the process. There is a risk that the enemy will continue to shoot at the wounded so suppress enemy positions with fire. In actual combat operations, 2-3 soldiers should be involved in pulling the wounded soldier out of the shelling zone using an evacuation sling.

SOFT STRETCHERS (YELLOW, GREEN ZONE)

The military, rescuers, and special forces use tactical or soft stretchers. They are lightweight, compact, and fit into a small utilitarian pouch. They are a rectangle made of dense fabric, mostly cordura, measuring 190x70 cm (may vary depending on the manufacturer), with sewn polyamide slings, handles, and straps for fixing the wounded. They can be used to transport the

wounded either by a group of 2-6 soldiers or independently, pulling a stretcher with the wounded soldier on the ground (cordura reduces friction on the surface). Before working with the wounded, assess the tactical situation, and provide fire cover for the area of assistance and evacuation routes. Approach the wounded, and take a "down on one knee" position. Unfold the soft stretcher and prepare it for use. Turn the wounded to the side away from you. Put the soft stretcher in the place where the wounded soldier was lying, and move it close to the body. Be aware of the possibility of mining the wounded body. If the wounded soldier is not identified by you, demand that measures be taken to check for the possibility of a mine. Turn the wounded over onto his back. Straighten the edges of the soft stretcher on the far side of you. Check that the wounded is evenly positioned on the plane of the soft stretcher. Secure the wounded with special straps. The wounded is ready for transportation. Distribute the soldiers evenly around the perimeter of the soft stretcher, avoiding excessive sagging. The soldier standing near the head commands the transportation process, and monitors the wounded soldier's condition, breathing, consciousness, and upper airway patency. The wounded is transported with his feet forward, as the one in front is more likely to stumble, which can lead to a fall of the wounded, a head injury, complications of existing injuries, and a general deterioration of the condition. Transportation begins from the "on one knee" position.

DISCUSSION

On the battlefield, the experts [9] divide the wounded into three main categories: the wounded who will live regardless of receiving any medical care; the wounded who will die regardless of receiving any medical care; the wounded who will die if they do not receive timely and proper medical care. According to the scientists [10], about 15-27 % of the wounded who die before reaching a medical facility can be saved if all necessary measures are taken, among which rapid and properly organized

evacuation is an important one.

According to the scientists [11], good medicine can be a bad tactic. A rescuer or medical instructor must know what he is doing and when he should do it. Medically correct intervention at the wrong time can lead to additional unnecessary injuries. In urban environments, the wounded should be moved to better tactical conditions as quickly as possible, before they are treated. Snipers pose a particular danger in urban areas due to the large number of places to set up firing points. Open areas are often under enemy observation. It is necessary to use various means to rescue the wounded and methods that prevent active enemy actions (fire superiority, sabotage, smoke, specially made or improvised devices for moving the wounded, evacuation slings with carbines, etc.) [12].

Our research has shown that each method of evacuating the wounded from the battlefield has its advantages and disadvantages. All actions must be carried out by an order of the commander and following a specific evacuation plan. This should take into account the combat situation, the area (zone) where the fighting is taking place, the distance of evacuation, the severity of the injury, the equipment of the wounded, the availability of personnel for evacuation, the availability of possible means for evacuation, the possibility of being visible to the enemy, the threat of being wounded by a rescuer.

CONCLUSIONS

It was found that any evacuation is carried out only under cover, with high speed and minimizing the time and visibility of rescuers. The main ways and means of evacuating a wounded person from the battlefield, which are used in the red, yellow, and green zones, were revealed. Their advantages and disadvantages were presented. It was established that timely emergency care saves the lives of the wounded and sick, and timely evacuation from the battlefield prevents re-injury or death.

Prospects for further research are to study the tactics of first medical care in the yellow zone (the procedure for primary and secondary examination of the wounded).

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“MINI-MIDLINE”: VASCULAR ACCESS IN SPECIFIC SITUATIONS

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ABSTRACT

Peripheral intravenous catheters (PIVCs) play a particularly important role in Emergency Departments (ED), during the administration of anesthesia in the operating room, in post-operative and monitored wards of various specialties, in cases when the patient requires access to the vein due to intensive and varied intravenous therapy. Using short peripheral intravenous catheters carries a high risk of complications, despite their prevalence and staff experience. Patients with DIVA require a comprehensive approach not only during elective (scheduled) intravenous therapy, but also in the aforementioned departments and during emergency interventions in case of deterioration in Non-Intensive-Care-Units. Emergency intravenous access is required for the implementation of many procedures, so it is reasonable to introduce methods that increase the safety and quality of therapy. Midline catheters (MCs) are becoming increasingly popular in Poland. However, based on our experience, they are not the optimal solution in every situation. “Mini-midlines” can be clinically useful in patients with DIVA whose therapy is expected to exceed 5 days. They may be applied in patients who require a secure and rapid insertion of the cannula into the vein and greater fluid flow than via a classic MC. Regardless of the equipment used, the ultrasound-guided mini-midline implantation procedure is simple and quick. Based on available research and experience at our centres, we follow a management regimen for patients who arrive in the ED, have no intravenous access and the team is faced with the clinical dilemma of choosing which cannulation method should be used. Proper patient enrollment and subsequent cannula maintenance increases the quality of care and patient satisfaction. It is advisable to introduce local protocols for selecting appropriate intravenous access and to run prospective studies regarding the topic under discussion.

KEY WORDS

ultrasound, infusion, vascular access, cannulation, difficult intravenous access, mini-midline

LIST OF USEFUL ABBREVIATIONS USED IN THE TEXT

ANTT - aseptic non-touch technique
DIVA - difficult intravenous access
ED - emergency department
MC - midline catheter
LPIVC - long peripheral intravenous catheter
PIVC - peripheral intravenous catheter

INTRODUCTION

A peripheral intravenous catheter (PIVC) is most frequently used for venous access. Out of all the hospitalized patients, 70% require at least one PIVC during their hospital stay [1]. They play a particularly important role in Emergency Departments (ED), during the administration of anesthesia in the operating room, in post-operative and monitored wards of various specialties [2], in cases when the patient requires access to the vein due to intensive and varied intravenous therapy. Using short peripheral intravenous catheters carries a high risk of complications, despite their prevalence and staff experience [2]. It has been shown that the most common complications asso-

ciated with PIVC are phlebitis 23.8%, extravasation 13.7%, occlusion 8%, pain 6.4% and displacement 6.0% [3]. In addition to the complications associated with PIVC maintenance, an important issue is their implantation, particularly in difficult intravenous access (DIVA) situations, which affect up to 15% of patients [4].

Patients with DIVA require a comprehensive approach not only during elective (scheduled) intravenous therapy, but also in the aforementioned departments and during emergency interventions in case of deterioration in Non-Intensive-Care-Units. Peripheral vein cannulation can be problematic, while multiple failed attempts are time-consuming and carry additional risks,

such as pain, nerve damage and iatrogenic arterial puncture [5-7].

Emergency intravenous access is required for the implementation of many procedures (medical stabilization, anesthesia, imaging studies with contrast), so it is reasonable to introduce methods that increase the safety and quality of therapy [8]. In this way, it is possible to take into account the patient's current limitations regarding IV access and avoid complications that may arise later, such as those mentioned above, as well as pain and discomfort for the patient. It also helps to avoid increased treatment costs and prolonged hospital stay [6, 9]. Emergency access in the group of patients under discussion should be based on the use of equipment that allows a specific therapy to be carried out at a specific time, and to continue for the following days of the patient's hospital stay. This is particularly important in view of current recommendations that intravenous cannulas needn't be removed at specific time intervals and the increasingly widespread use of ultrasound, also by nursing and emergency personnel [10, 11].

Midline catheters (MCs) are becoming increasingly popular in Poland. However, based on our experience, they are not the optimal solution in every situation. Particularly challenging are emergency patients awaiting anesthesia for surgery, requiring significant volumes of intravenously administered medications and fluids, often for >5 days, or patients with difficult intravenous access. An alternative peripheral solution to PIVCs and MCs are long peripheral intravenous catheters (LPIVCs), also referred to as "mini-midlines" in the literature. According to the literature, they are characterized by lower complication rates (e.g., 25% vs. 70% for PIVC) and are used in monitored wards [11, 12].

THE AIM

The aim of the study is to present how mini-midline cannulas are used in difficult intravenous access situations when patients require reliable and fast venous access. The paper is based on own experience.

REVIEW AND DISCUSSION

LONG PERIPHERAL INTRAVENOUS CATHETERS

LPIVCs are intravenous cannulas between 6 cm and 15 cm in length inserted using a traditional over the needle approach or the Seldinger Technique, usually under ultrasound guidance (Fig. 1 and 2). In the literature, different names are used for cannulas longer than the classic PIVC >6 cm and shorter than MC <15 cm. The term "mini-midline" should be used to describe intravenous catheters that are made of a material that allows them longer dwell time than PIVCs, which are placed using a technique that facilitates insertion into the veins at a depth of over 7 mm, as opposed to a large group of LPIVCs, also including classic cannulas, that differ from PIVCs only in length (Fig. 3). Qin et al. take a different approach and suggest the term "long intravenous cannula" should be adopted for the cannulas described [12]. Our



Fig. 1. Leaderflex 100 mm 4Fr inserted using the Seldinger method.

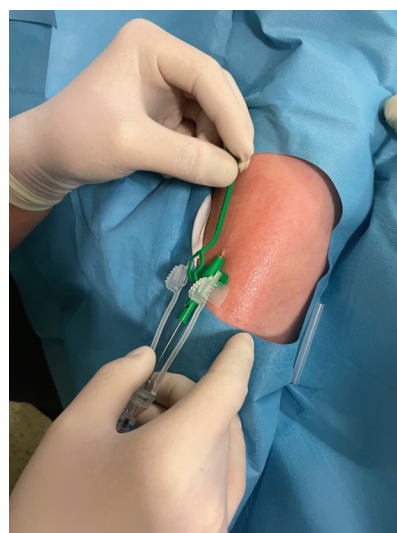


Fig. 2. BullPup 98 mm 18G inserted using the post-needle method.



Fig. 3. 60 mm 12G and 105 mm 16G long peripheral intravenous catheter.

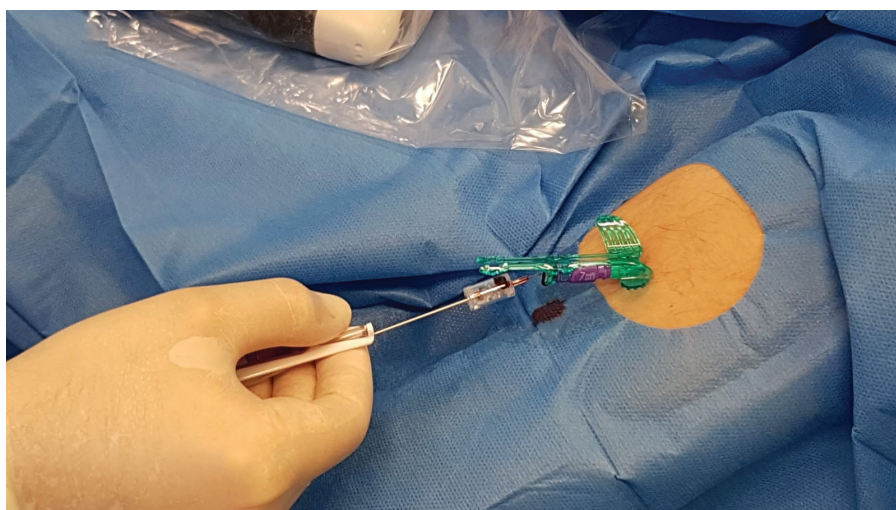


Fig. 4. PowerGlide 80 mm 18G inserted using the Seldinger method in an integrated housing.

Table 1. Comparison of midline vs mini-midline vs PIVC infusion parameters.

	Midline			Mini-midline		PIVC
Cannula name	Smartmidline Vygon	Teleflex Arrow	LeaderFlex Vygon	Bullpup Scientific	BD PowerGlide	IV cannula Kit-Kath
Gravity flow	21 ml/min	28 ml/min	30 ml/min	60 ml/min	60 ml/min	90 ml/min
Pressure flow	5 ml/s	2 ml/s	5 ml/s	7 ml/s	6 ml/s	5.3 ml/s [15]
Length	20 cm	20 cm	8 cm	9.8 cm	10 cm	38 mm
Diameter	4 Fr	4 Fr	4 Fr	18G	18G	18G
	1.2 mm	1.2 mm	1.2 mm	1.2 mm	1.2 mm	1.2 mm

Compiled from manufacturers' brochures.

experience with the use of different types of peripheral cannulas points to the term "mini-midline" as more intuitive, given the indications, expected duration of therapy and implantation techniques.

Currently, there are many mini-midline cannulas on the market that vary in terms of insertion technique. In our centers, we have used: Leaderflex Vygon (Seldinger technique), Bullpup Scientific (needle-by-needle implantation method) and BD PowerGlide (Seldinger technique with an integrated guidewire) (Fig. 3). There are reports in the literature of polyurethane cannulas registered as mini-midlines for arterial cannulation [13].

APPLICATION

"Mini-midlines" can be clinically useful in patients with DIVA whose therapy is expected to exceed 5 days. They may be applied in patients who require a secure and rapid insertion of the cannula into the vein and greater fluid flow than via a classic MC (Table 1), while the expected dwell time is also from 5 to 14 days.

Moreover, they are used in situations when the patient arrives in the Emergency Department, Operating Room, or under the care of the interventional team, there are difficulties in establishing peripheral access,

and for some reason there is no possibility or there are counterindications for intraosseous access or central vein cannulation, and/or insertion of a PIVC is impossible (the vessel lies too deep relative to the length of the needle or it is impossible to place the cannula in the vein for 2/3 of its length) [10].

The use of mini-midlines can solve immediate problems with peripheral vascular access: they can be inserted quickly (on average in 10 minutes under ultrasound guidance) and can be used on consecutive days of hospital stay (if necessary for up to 29 days, although the average dwell time reported in the literature is 7-15 days) [8, 9, 12, 14].

BENEFITS AND COMPLICATIONS

The authors of many available research articles on mini-midlines report a reduction in the number of attempts during cannulation of patients with DIVA and a high success rate in vein insertion. In a systematic review of 16 papers, the success rate ranged from 86% to 100% [8], and a success rate of 100% was also reported [6, 11]. Compared to PIVCs, mini-midlines are more expensive, but easier to implant successfully at the first attempt and last longer causing fewer complications. They allow high-pressure

Table 2. Performing the procedure of mini-midline implantation [16].

Performing the procedure of mini-midline implantation. Seldinger's technique	
Subsequent steps of the procedure	
1	Assess the veins with ultrasound and select the site for cannulation (Fig. 4)
2	Prepare the kit using the ANTT
3	Insert the needle into the vein under ultrasound guidance - confirmation is free flow of blood (Fig. 5)
4	Then insert the guidewire through the needle
5	Withdraw the needle leaving the guidewire in the vein (Fig. 6)
6	After removing the needle, release the tourniquet and then insert the catheter and remove the guidewire (Fig. 7)
7	Flush the catheter with 10 ml of 0.9% NS, fix with a sutureless securement device and secure with a transparent dressing
8	Record cannula implantation in the documentation according to local hospital procedures

Table 3. Modified A-DIVA scale (van Loon FHJ et al. 2019).

Risk factors	Points
No palpable vein after tourniquet placement	1
No visible vein after tourniquet placement	1
History of a difficult intravenous cannulation	1
Practitioner's expectation of a difficult intravenous access	1
Diameter of the vein less than 3 millimeters after tourniquet placement	1

injections (for contrast administration during imaging studies) and reduce tissue traumatization by using the classic Seldinger method [14]. The procedure is not complicated and can be performed in a relatively short period of time, which can be convenient in the ED and Operating Room settings. In Qin's 2021 systematic review, 12 out of 16 papers on the use of mini-midline involved EDs, including Intensive Care Units [8].

Mini-midlines make it possible to conduct complete peripheral intravenous therapy. In the study by Gilardi E et al., 79%-82% of the cannulas were removed due to the termination of therapy [9, 14]. Complications, such as accidental removal or problems with patency, occurred in 17% of the insertions [9]. Complications that have been presented in the studies available range from 4.3% to 52.5% of all catheters [3]. Significant complications that have been considered in the literature include: accidental removal, occlusion in the lumen of the cannula, thrombosis and phlebitis, catheter-associated infections, extravasation, and displacement of the cannula causing dysfunction [3, 9, 13, 14].

IMPLANTATION PROCEDURE

Regardless of the equipment used, the ultrasound-guided mini-midline implantation procedure is simple and quick. The venous vessel is identified using a linear ultrasound transducer, and the cannulation site should

be prepared for peripheral cannulation in the usual manner. Mini-midline implantation can be performed relatively quickly (<10-20 minutes). At our center, we usually implement a modified surgical Aseptic Non-Touch Technique (ANTT) using a large fenestrated sterile drape, a medical cap, a surgical mask, sterile gloves and a sterile drape for the ultrasound probe. In special situations, implantation is performed in full surgical ANTT when the conditions of cannulation may affect the difficulty of maintaining the sterility of the procedure (e.g., limited space in the patient's room, uncooperative patient).

According to the recommendations of the Infusion Nurses Society, the choice between standard and surgical ANTT should be based on an assessment of the benefits and risks of field contamination [10]. In the case of the mini-midline, either kits containing multiple integrated components or kits for the classic Seldinger technique with relatively short guides are used, so the risk of contamination by an experienced operator is low. The local hospital procedure should determine the standard of practice. The subsequent steps of the implantation procedure are outlined in table 2.

CARE AND MAINTENANCE OF THE MINI-MIDLINE

The principles for maintaining a mini-midline are the same as for midline catheters >15 cm. It is crucial to use standard ANTT during injections and connecting

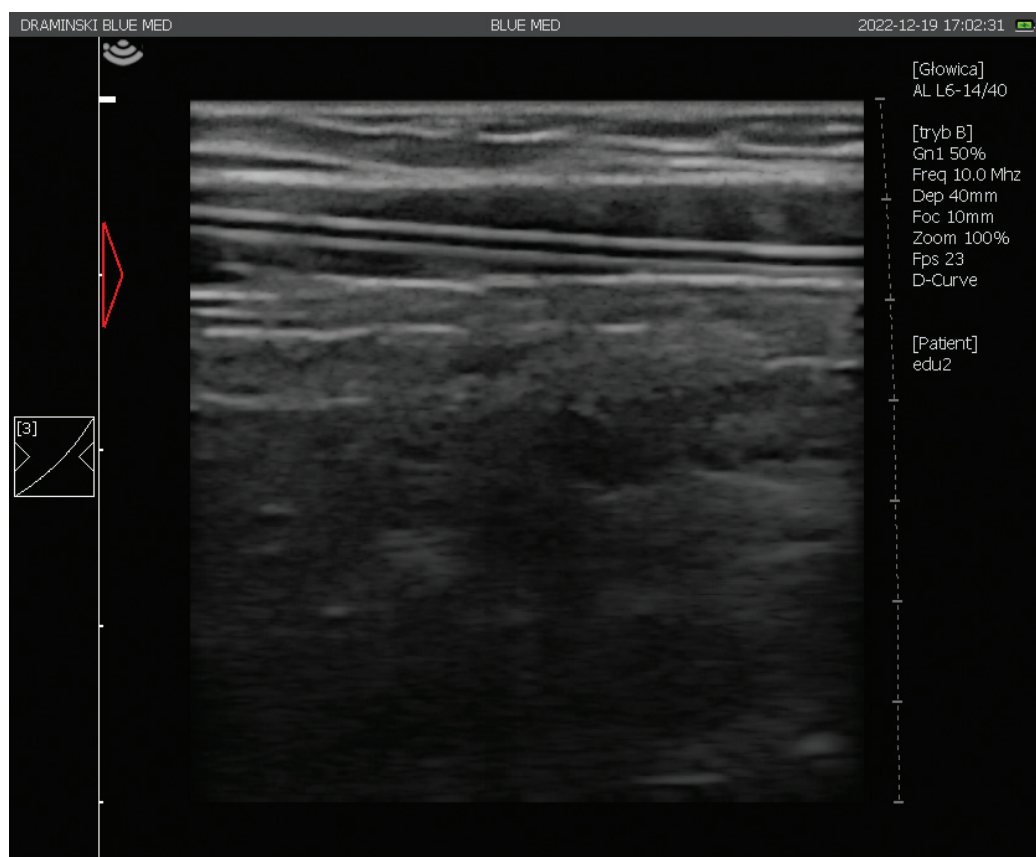


Fig. 5. Intravenous cannula visible in in-plane projection.



Fig. 6. Intravenous cannula visible in out-of-plane projection.

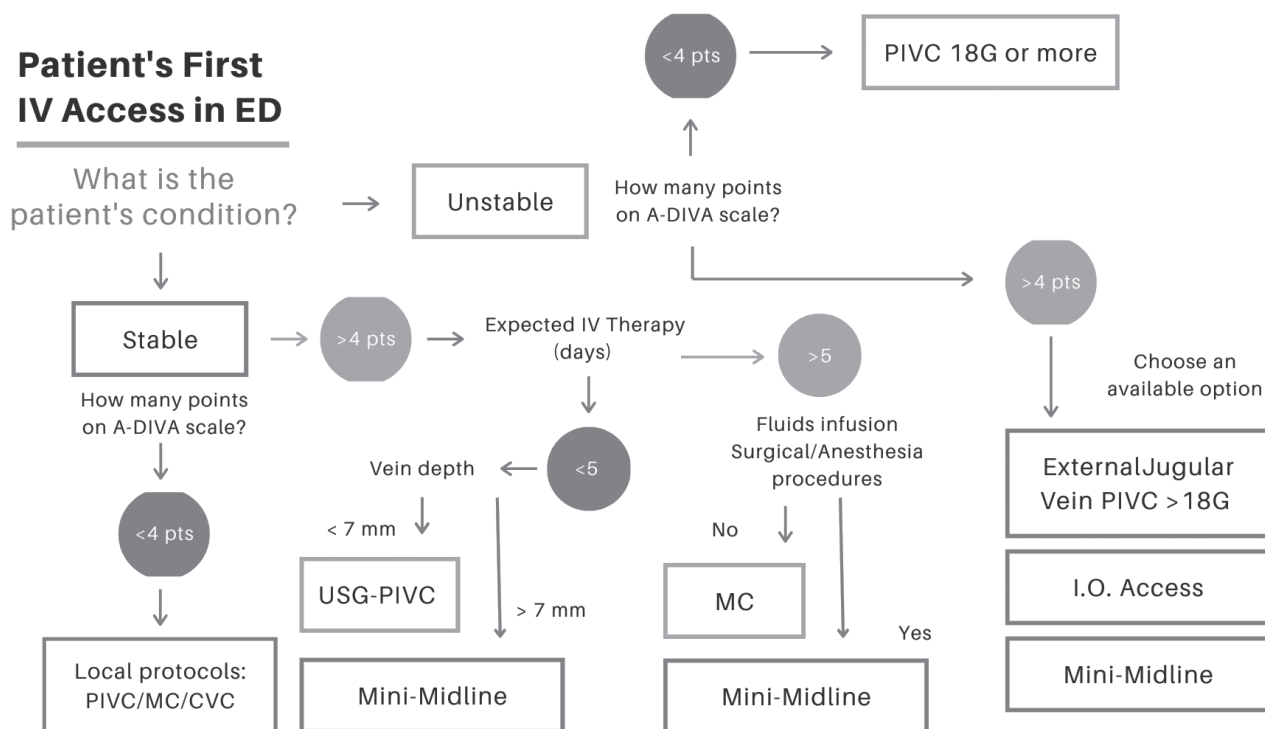


Fig. 7. Protocol for selecting the "first" intravenous access in the ED.

drip infusions and syringe pumps using either active, or passive disinfection. Due to the length of the cannula, patency should be maintained before and after the administration of medicines by performing flushes with 10 ml of 0.9% Normal Saline (NS) using the bolus method. It is possible to draw venous blood samples for laboratory tests; remember to discard waste blood 3 times the space of the dead cannula and after sampling to flush the line with 20 ml of 0.9% NS. Cannulas usually come with sutureless securement devices, and it is recommended that they be used to minimize the risk of accidental removal or displacement. Depending on the hospital procedure, a nonwoven or transparent dressing should be used to secure peripheral catheters. Following the recommendations on kits allows the catheter to be maintained until the end of therapy minimizing the risk of complications.

PROPOSED MANAGEMENT PROTOCOL

Based on the research and experience available at our centres, we follow a management regimen for patients who arrive in the ED and have no intravenous access, meaning that the team is faced with the clinical dilemma of choosing which of the various methods of cannulation to choose (Fig. 7). When deciding on the first intravenous access, the factors that must be considered are: the patient's condition, assessment of anticipated difficult intravenous access and the use of ultrasound, the anticipated duration of intravenous therapy and technical limitations of the different types of intra-

venous cannulas. In stable patients, potential difficulties should be assessed, e.g. using the A-DIVA predictive scale on which the more points the investigator assigns, the higher the risk of failure at the first cannulation attempt (Table 3) [17]. In the group of patients with no anticipated difficulties in cannulation, local protocols for the selection of intravenous access should be used. With an A-DIVA score of 4, the length of the anticipated intravenous therapy should be considered. Therapy <5 days is an indication for the use of a PIVC or mini-midline. In our experience, PIVCs placed in veins deeper than 7-10 mm show a shorter dwell time, so a longer mini-midline can be used in such cases. Therapy >5 days in the absence of the need for higher flow is an indication for an MC, otherwise we suggest a mini-midline >18G.

In unstable patients without difficult intravenous access (A-DIVA <4 points), PIVC >18G is optimal. The management of DIVA requires clinical assessment of the patient and the rate and volume of intravenous therapy planned. This will determine the choice between external jugular vein cannulation, intraosseous access and mini-midline access. Each of these accesses can be obtained in a relatively short period of time, but not all the options are always available in practice (no visible external jugular veins for various reasons, no access kits, no ultrasound available).

Each option presented in figure 7 depends on the patient's condition, the urgency of the therapy and the capacity of the centre, but can serve as a hint in decision-making, allowing the use of an appropriate 'first' access

method to administer the necessary drugs or intravenous fluids. The chosen type of intravenous access may be used once the patient's condition has been stabilised or may be changed to a more appropriate one for further therapy.

CONCLUSIONS

Difficult intravenous access can be problematic for healthcare providers, especially in areas where the timing and reliability of inserting the cannula is crucial. Depending on the clinical situation, the availability of multiple

solutions makes it possible to implement a well-thought-out vascular access strategy. The mini-midline allows rapid insertion under ultrasound guidance, implementation of appropriate intravenous therapy, and then use of the access on subsequent days, when the patient's condition stabilizes. Proper patient enrollment and subsequent cannula maintenance increases the quality of care and patient satisfaction. It is advisable to introduce local protocols for selecting appropriate intravenous access and to run prospective studies regarding the topic under discussion.

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CONFLICT OF INTEREST

Maciej Latos, Marceli Solecki and Artur Szymczak teach commercial courses in ultrasound-guided cannulation and midline catheters placement using equipment from Vygon and Teleflex, but declare that they receive remuneration only for hands-on training of participants. The other Authors report no conflicts of interest.

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MASS CASUALTY INCIDENT – TRAINING BASED ANALYSIS OF STATE EMERGENCY MEDICAL SYSTEM

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ABSTRACT

Aim: Mass casualty incident is a challenge for the whole Emergency Medical System. The training had been prepared in order to optimize the readiness and to implement and practice the procedures issued by the ministry regarding mass casualty incidents.

Material and method: The article analyzes the response capabilities of Emergency Medical System along with cooperating units, in case of mass casualty road traffic accident. Proper allocation of patients, following the procedure and the availability of forces and resources within the operational area were analyzed. Accident involved 30 casualties and was responded by numerous emergency units, such as Emergency Medical Teams, State Fire Service, Voluntary Fire Service, Police and City Guard. Emergency Medical System units implemented the procedures issued by the Ministry of Health regarding mass casualty incidents correctly. The leader of the first Emergency Medical Team to arrive served as the Action Medic in Charge. Further Emergency Medical Teams to arrive undertook proper cooperation with Medic in Charge. Allocation of patients to hospitals was correct. After the accident one casualty left the scene, which made the rescue action more complex.

Conclusions: Simulating such incidents may prepare the medical personnel for real-life action. Regular training is the best form of gathering knowledge and increasing patients' safety. Communication during incidents of this kind is problematic and requires high-priority improvement.

KEY WORDS

emergency medical service, mass accident, paramedic

INTRODUCTION

State Emergency Medical System is a crucial mainstay of healthcare. Maintaining health safety is one of the basics which state has to guarantee for its citizens. According to definition, State Emergency Medical System was founded in order to provide help for individuals in direct health or life hazard. It functions on the basis of plans effective for województwo-regions, supervised by Minister of Health who has full insight into data regarding system functioning and the right to control it [1]. Units creating State Emergency Medical System are: Hospital Emergency Departments, Emergency Medical Service Teams and Helicopter Emergency Medical Service. Cooperating units are: State Fire Service and its subordinate units, Mountain Rescue Service, Water Rescue Service and all other rescue organizations, obliged by their statute to cooperate with system and provide help to people in health hazard [2].

Situation which may greatly disturb EMS system functioning is a mass casualty incident. Depending on its location and cause the possibilities of utilizing forces and resources necessary to prevent the incident may vary. Situations which may put health and life of

many people at risk are apartment block fires, terrorist attacks, industrial accidents and road traffic accidents. For the article presented, authors have focused on road traffic accident, where the number of casualties significantly exceeded response possibilities of the EMS system and cooperating units.

THE AIM

The aim of the thesis was training focusing on implementing mass casualty incident response procedures issued by the Minister of Health. Cooperation and capabilities to provide help after mass casualty incident were analyzed. Authors focused on analyzing training which took place on December 3rd, 2022 in the city of Jaworzno. The article presents course of training and the possibilities of response by local EMS Teams and cooperating units, such as: State Fire Service, Voluntary Fire Service, City Guard and Police units. Multi-specialty hospital with ED also participated, admitting some patients. Such incidents occur rarely, but emergency services should be always ready to respond rapidly. To do so they should have necessary competences: the ability to properly counteract the results of incident and the capability to provide fast medical help for all casualties.

REVIEW AND DISCUSSION

ROAD TRAFFIC ACCIDENTS

AND EMS SYSTEM STRUCTURE IN OPERATIONAL AREA

According to data published by the Central Statistical Office the number of road traffic accidents per year decreases since 2015. In 2015 there were 3792 accidents reported. Central Statistical Office defines accidents as events within traffic on public roads, leading to people dying or becoming injured. 2021 data shows significantly lower number of accidents (2203) (Fig. 1) [3]. One has to mention large number of on-road incidents, which were not qualified as an accident, yet were potentially

dangerous for road traffic. Number of vehicles increases yearly, which leads to increased risk of an accident.

In 2022 Polish Emergency Medical System had a total of 1602 EMS teams and 21 HEMS team bases at disposal. System also comprised 237 hospital Emergency Departments, 156 hospital admission rooms, 17 Trauma Centers and 11 Trauma Centers for children. These units have to care for health safety of patients, and remain in readiness for all time. The article focuses on selected region of Poland, the Ambulance Service of Sosnowiec (Samodzielny Publiczny Zakład Opieki Zdrowotnej Rejonowe Pogotowie Ratunkowe w Sosnowcu).

POLAND – total road traffic accidents by region

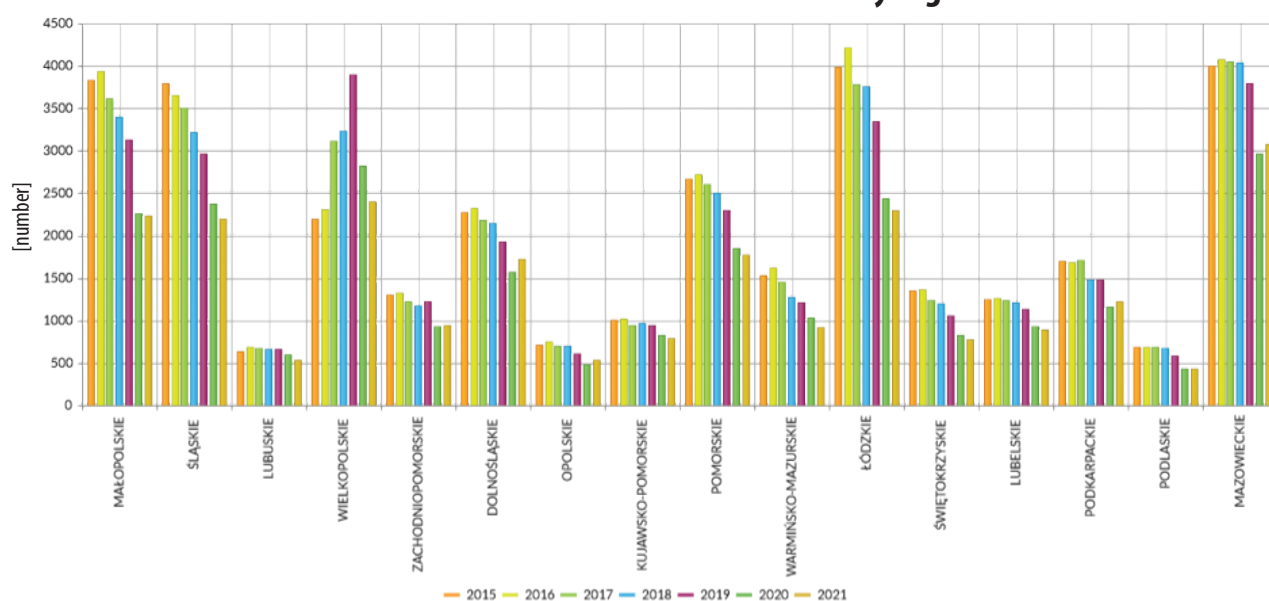


Fig. 1. Total road traffic accidents 2015-2021 (source: Central Statistical Office data).

Table 1. Road traffic accidents in operational area of Sosnowiec Ambulance Service (own work).

Name	Total number of accidents						
	2015	2016	2017	2018	2019	2020	2021
	[no.]	[no.]	[no.]	[no.]	[no.]	[no.]	[no.]
POLAND	32 967	33 664	32 760	31 674	30 288	23 540	22 816
Powiat Będziński region	124	99	62	87	88	90	71
Powiat Zawierciański region	83	78	111	105	73	84	89
City of Dąbrowa Górnicza	100	95	95	88	95	75	68
City of Jaworzno	43	36	36	29	28	28	22
City of Sosnowiec	185	199	190	162	140	102	89
Sosnowiec Ambulance Service operational area – total	535	507	494	471	424	379	339

Source: Central Statistical Office data

Sosnowiec Ambulance Service operates in part of Silesia (Województwo Śląskie), where the following operational areas can be indicated [4, 5]:

- Sosnowiec – total of 5 EMS teams in two bases:
 1. Address: ul. 3 Maja 33 – 1 Specialist EMS team (EMS-S team) and 3 paramedical EMS teams (EMS-P teams)
 2. Address: ul. Ogrodowa 1 – 1 EMS-P team
- Będzin – total of 5 EMS teams in 4 bases:
 1. Address: ul. Kościuszki 72 – 2 EMS-P teams
 2. Address: ul. Kolejowa 4 – 1 EMS-P team
 3. Address: ul. Warszawska 8a – 1 EMS-P team
 4. Address: ul. Wojkowicka 2 – 1 EMS-P team
- Dąbrowa Górnicza – 2 bases with total of 4 EMS-P teams:
 1. Address: ul. Łącząca 24 – 3 EMS-P teams
 2. Address: ul. 23 Stycznia 25- 1 EMS-P team
- Jaworzno - 1 base with a total of 3 EMS-P teams
- Zawiercie - 4 bases with total of 2 EMS-S and 4 EMS-P teams [6]:
 1. Address: ul. Obrońców Poczty Gdańskiej 93 – 1 EMS-S team, 2 EMS-P teams
 2. Address: ul. Senatorska 3 – 1 EMS-P team
 3. Address: ul. Batalionów Chłopskich 33 – 1 EMS-P team
 4. Address: ul. Jana Pawła II 6 – 1 EMS-S team

Table 1 presents data regarding the number of accidents reported according to Central Statistical Office definition within the operational area of Sosnowiec Ambulance Service, with powiat-regions indicated. Road traffic accidents are just a small percentage of total number of responses to which EMS teams were dispatched. In 2021 EMS teams provided on-scene medical help for nearly 3,1 million individuals [7]. EMS system functions by the rule of sustainability – if the available number of

EMS teams on incident scene is not capable of assisting all patients in need, further EMS team (closest to the incident scene) is dispatched. Data presented in Table 1 shows gradual decrease in the number of accidents. In the operational area of of Sosnowiec Ambulance Service their number in 2021 was by 36,6% lower than in 2015.

COURSE OF MASS CASUALTY INCIDENT SIMULATION

On December 3rd, 2022 at 10:05 am operator of 112 number received a call reporting collision of two passenger vehicles. All casualties stepped out of the vehicles unassisted. Nobody reported any symptoms. Smoke came out of vehicles, and oil leak was observed. State Fire Service unit, along with the closest EMS team were dispatched. After reaching the scene of an accident by the first Fire Service units, officer-in-chief of rescue operation stated, that probably due to adverse weather conditions (fog) the damaged vehicles were further hit by a bus and another passenger car. There was potentially large number of casualties. Mass casualty incident scenario predicted 30 casualties. In order to create realistic conditions, each person was thoroughly trained in terms of part to play. All wounds and other injuries were prepared in realistic way. Additionally, in order to provide the highest possible educational value, actors manifested all symptoms of pain, discomfort and fear. Vehicles were prepared for destruction (in case of the need to cut the car body for casualty extrication). None of trainees were informed about the incident location or casualties.

ACCIDENT SCENE ORGANIZATION

Incident took place on Piotr Grocholicki two-way street in Jaworzno. After reckoning the accident scene and implementing the procedure of mass casualty inci-



Fig. 2. Incident scene map. Source: Google Maps, own work.

dent the officer-in-chief of rescue action asked the dispatcher to direct all forces and resources from the direction of Józef Chełmoński street (Fig. 2).

Accident scene is marked by black dot, the arrow above shows the direction of traffic. Further points marked are:

- No. 1 Sosnowiec Ambulance Service base
- No. 2 Multi-specialty hospital in Jaworzno
- Arrow no. 3 – direction to the closest State Fire Service house

ANALYSIS OF DATA COLLECTED

For the needs of the article presented, the following aspects were analyzed: the capabilities of EMS system and cooperating units to respond and the aspect of ability and capabilities of following the procedures issued by the Ministry of Health [8]. The procedures indicated were created by a team of medical rescue and emergency medicine experts. Each professional working within the EMS system should know the procedures and be capable of implementing them in case of responding a mass casualty incident. Data gathered and presented includes: the number of units responding the incident, arrival time, information about organization and action. Article also presents conclusion of debriefing after the simulation. Debriefing is practice within medical professions, which makes reflective learning easier; reflective learning being the basic element of learning-through-experience process. Both during simulated scenarios and in real-life work environment [9, 10]. The article does not mention the problem of medical action on scene – this will be covered in further publication.

COURSE OF ACTION, ORGANIZATION, RESULTS

The initial report was different from what the units have come across upon arrival. This created a disparity between forces and resources available and those required. Firefighters quickly divided tasks, secured the damaged vehicles and access route. They have initiated casualty extrication from vehicles. Because of large number of casualties an officer of State Fire Service was assigned to triage patients. Paramedic leading the EMS-1 team, which was the first to arrive, was assigned the role of Action Medic in Charge by the dispatcher. Medic in Charge has to be in constant contact with dispatch center, coordinate work on accident scene and cooperate with officer-in-chief of rescue operation. Therefore the Action Medic in Charge did not participate in triage. Issues with communication between the Action Medic in Charge and officer-in-chief of rescue operation have appeared, therefore a firefighter was assigned to the medic for help in communication. Places for gathering casualties with given priorities were appointed for the tents to be raised. At 10:31 am the necessary equipment was delivered, and tents were raised in order to secure thermal and psychological comfort of patients in respective zones. Each zone had a person responsible (EMS system

Table 2. Units dispatched to the accident (own work).

No.	Unit	Unit type
1	EMS-1 team	EMS-P, 2 medics
2	EMS-2 team	EMS-P, 2 medics
3	EMS-3 team	EMS-P, 2 medics
4	EMS-4 team	EMS-P, 2 medics
5	EMS-5 team	EMS-P, 2 medics
6	EMS-6 team	EMS-P, 2 medics
7	JRG Jaworzno Fire Service	Fire engine GBA 2,5/16/2,4 SCANIA
8	JRG Jaworzno Fire Service	Fire engine GBA 2/16 PR 750 RENAULT
9	JRG Jaworzno Fire Service	Quartermaster car SLKW MERCEDES
10	JRG Jaworzno Fire Service	Light reckon-rescue car SLRR FORD
11	JRG Jaworzno Fire Service	Fire engine GBA 3/24/4,3 RENAULT
12	OSP Dąbrowa Narodowa Fire Service	Fire engine GBA 3/24/4,3 RENAULT
13	OSP Długoszyn Fire Service	Fire engine GBA 3/16/4 MERCEDES
14	OSP Ciężkowice Fire Service	Fire engine GBA 4,5/27 RENAULT
15	OSP Jeleń Fire Service	Fire engine GBA 3/16/4 VOLVO
16	OSP Osiedle Stałe Fire Service	Fire engine GBA 3/30/4,7 MAN
17	OSP Byczyna Fire Service	Fire engine GBA 3/24/4,3 RENAULT

Table 3. EMS team's arrival time (own work).

Team	Dispatch time	Arrival time
EMS-1 team	10:05:00	10:10:00
EMS-2 team	10:10:00	10:14:00
EMS-3 team	10:10:00	10:23:00
EMS-4 team	10:10:00	10:22:00
EMS-5 team	10:10:00	10:26:00
EMS-6 team	10:10:00	10:27:00

professional). Limited number of paramedics lead to decision that patients with „green” priority were assisted by qualified-first-aid level rescuer. After arrival of additional Fire Service units, a landing spot for Helicopter Emergency Rescue Service was marked. Adverse weather conditions made it impossible for the helicopter to be dispatched (Table 2).

On the basis of information given by the first EMS team to arrive the dispatcher qualified the accident to proper category. Action Medic in Charge reported the estimated number of EMS teams needed for the action (EMS-P teams, EMS-S teams and HEMS team). Radio correspondence discipline was necessary to be introduced, and EMS team members had to be informed about the rules of using the radio during the course of action on accident scene (Table 3).

After brief reconnaissance of the accident scene, dispatcher was informed about around 21 casualties (at 10:15 am). Initial triage results were as follows: 1 black, 5 red, 5 yellow, 6 green. Triage was done at the same time by EMS team members available and State Fire Service firefighters. At the early phase inaccuracies in number of patients and priorities given were observed.

The total number of patients involved in the accident was 30. Initial problems with estimating their number were probably the result of large chaos on scene and patients greatly outnumbering rescuers. Another report concerning number of casualties was reported to the dispatcher at 10:41 am. 27 casualties were reported. At 11:02 am the following patients were reported: 5 people marked black, 6 people marked red, 11 people marked yellow and 8 people marked green.

DIRECTING PATIENTS REQUIRING HIGH-PRIORITY HELP

Evacuating patients to specialist facilities, where treatment will take place, is equally important to rapid on-scene action. Table 4 presents hospitals close to accident scene, with distance in kilometers and estimated transport time (using optimal route and in moderate traffic). In the moment of mass casualty incident occurrence the great responsibility falls on Action Medic in Charge and Medical Dispatcher. Medic in Charge, on the basis data gathered on scene and received from Medical Dispatcher decides where to direct patients. One has to remember that proper allocation of casualties increases the chance implementing proper treatment in relevant time. This improves treatment prognostics and decreases the risk of complications. Despite the closest hospital being 1 km away from accident scene, it was not possible to direct all patients there. Capabilities of helping patients in EDs and other specialist facilities are also limited. Directing 30 patients there at once would cripple facility functioning, bringing no advantage to patients. This would also be adverse for patients already treated in given hospital.

ACTION MEDIC IN CHARGE

The appointed Action Medic in Charge is responsible for medical aspects of action. Medic should utilize the available forces and resources and coordinate passing patients to EMS teams arriving on scene. Cooperation with large number of people makes it wise to establish some structure of communication. Paramedic, who arrived first on the scene with Action Medic in Charge present was assigned to initial triage and constant reporting. Further

Table 4. Healthcare facilities along with distance from accident scene and optimal arrival time – own work.

Healthcare facility name	Estimated time of arrival from accident scene	Distance from accident scene
Szpital wielospecjalistyczny w Jaworznie (Hospital)	3 minutes	1 km
Samodzielny Publiczny Zakład Opieki Zdrowotnej Szpital nr 2 w Mysłowicach (Hospital)	24 minutes	16 km
Szpital Powiatowy w Chrzanowie (Hospital)	20 minutes	17 km
Centrum Zdrowia Dziecka i Rodziny im. Jana Pawła II w Sosnowcu (Hospital)	19 minutes	14 km
Zagłębiowskie Centrum Onkologii Szpital Specjalistyczny im. Sz. Starkiewicza (Hospital)	30 minutes	20 km
Górnośląskie Centrum Medyczne im. prof. Leszka Gieca Śląskiego Uniwersytetu Medycznego w Katowicach (Hospital)	38 minutes	32 km
Szpital Powiatowy im. św. Maksymiliana w Oświęcimiu (Hospital)	30 minutes	24 km
Nowy Szpital w Olkuszu (Hospital)	32 minutes	28 km
Wojewódzki Szpital Specjalistyczny nr 5 im. św. Barbary – Centrum Urazowe (Trauma Center)	31 minutes	25 km

team arriving was assigned to manage red and yellow medical segregation zones. Establishing such structure allowed the Action Medic in Charge to transfer some duties to others. As a result EMS-1 team and EMS-2 team were present on scene throughout the action. Upon receiving information from coordinators of medical aid points (red and yellow) regarding the severity of patients' condition and equipment needed, Action Medic in Charge could properly coordinate evacuation to hospitals, where patients were further treated.

Table 5 shows data regarding patients' designation, target facility and EMS teams' time of arrival and return on scene. Times regarding transport to Jaworzno hospital are actual. Multi-specialist Hospital in Jaworzno participated in training, so each patient directed there was given further help. Deliberately as many as 7 patients were transported there (3 red, 3 yellow and 1 green). Time of transport to other hospitals was shortened.

Patients transported to hospitals by EMS teams required high-priority help. Transporting patients 12 and 3 together was due to the fact that they were a child (severely injured) and its parent (in stable condition). Patients number 24 and 25 were in stable condition, which qualified them to transport by a single ambulance. In-

dividuals in no life threat turned out problematic. They required minor assistance, such as surgical treatment of wound or x-ray of bruised limbs (with no clear symptoms of fracture). After consulting officer-in-chief of rescue operation a decision was made to dispatch a bus, which will transfer all those patients to hospital. A hospital not yet engaged in helping high-priority patients was chosen. Transfer assisted by qualified first aid rescuers and one paramedic brought no issues.

UNPREDICTABLE SITUATIONS

Mass casualty incidents will always leave many questions unanswered. But not only the number of patients and severity of injuries may turn out problematic. Strong emotions, both among the medical personnel and casualties, are a big challenge. People who witness such events frequently undergo trauma, especially if someone close to them suffers major injuries. Actors serving as the casualties were told to immerse in their part as deeply as possible and go through actual emotions, adequate to such events. Large group of patients qualified to green group turned out surprising and difficult. Directing those patients to „green gathering point” was insufficient. Injuries they have sustained allowed

Table 5. Data regarding EMS teams working on accident scene (own work).

No.	Team	Patient designation	Target facility	Time of leaving accident scene	Time of returning to accident scene
1	EMS-1 team	-	-	-	-
2	EMS-2 team	-	-	-	-
3	EMS-3 team	11	Sosnowiec (pediatric center)	10:47:00	11:03:00
4	EMS-4 team	28	Jaworzno (ED)	10:51:00	11:02:00
5	EMS-5 team	12,3	Jaworzno (ED)	10:54:00	11:16:00
6	EMS-6 team	5	Jaworzno (ED)	10:46:00	10:58:00
7	EMS-6 team	3	Sosnowiec (trauma center)	11:16:00	11:32:00
8	EMS-4 team	15	Chrzanów (ED)	11:15:00	11:32:00
9	EMS-3 team	1	Mysłowice (admissions room)	11:14:00	11:26:00
10	EMS-5 team	7	Jaworzno (ED)	11:30:00	11:45:00
11	EMS-3 team	16	Sosnowiec (pediatric center)	11:34:00	11:51:00
12	EMS-4 team	26	Dąbrowa Górnicza (ED)	11:42:00	11:58:00
13	EMS-6 team	9	Jaworzno (ED)	11:50:00	12:03:00
14	EMS-5 team	25,24	Chrzanów (ED)	12:02:00	
15	EMS-3 team	20	Sosnowiec (pediatric center)	11:58:00	
16	EMS-4 team	21	Jaworzno (ED)	12:13:00	
17	EMS-6 team	23	Mysłowice (admissions room)	12:15:00	

most of them to walk unassisted. They have moved from place to place, curious of others' fate, which made rescue units' work more difficult. They would leave the place, where they were supposed to stay, ask questions, frequently making it difficult to assist high-priority patients, which all greatly destabilized the work of emergency services. Another difficulty occurred when one of the patients had left the accident scene unnoticed. This called for further complications, including the use of remote controlled drone with thermographic camera for search. This person was found after about 30 minute search, in the woods, 1 kilometer away from the accident scene. Patient was transported back with the use of quad bike, which along with drone is at disposal of Fire Service. This transport brought no major issues. After handing the patient over to paramedics she was triaged „yellow”. Such situation is dangerous for both the patient and services on scene. Moreover, search requires employing additional forces and resources, which are already in shortage on scene.

Another unexpected event was related to patient not speaking Polish. Emotions, large number of casualties and time pressure make rescuers' action much more difficult and yet more difficulty occurs in case of problems with communication. Patient spoke Spanish. None of the rescuers on scene spoke that language, which significantly delayed interviewing and examining the patient.

CONCLUSIONS

Mass casualty incident with 30 casualties turned out a great challenge for the emergency services. The following professionals worked on scene:

- 12 EMS paramedics
- 13 State Fire Service rescuers
- 33 Voluntary Fire Service rescuers
- 5 Police officers
- 4 City Guard officers

Mass casualty incident procedure issued by the Health Minister was implemented properly. On-scene action led to many conclusions, the most important are worth noticing:

- Communication and radio correspondence play a major part in the process of minimizing the effect of mass casualty incident. Training based on mass casualty incident further underlined the importance of proper and clear communication.
- Regular organization of this type of training can help work out local possibilities of cooperation, which will be best for patients' safety.
- Assigning a firefighter with radio to officer-in-chief of rescue operation makes cooperation between services significantly better.
- Assigning a firefighter with radio to patient care zones greatly improves the flow of information.

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COMPLETE KNOCKOUT OF A PERMANENT TOOTH – INTERDISCIPLINARY PROBLEM OR HOW TO HELP SO THAT IT DOES NOT HARM – CASE STUDY

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ABSTRACT

In recent years, there has been an increase in the incidence of dental injuries among children and adolescents, which is associated with a change in lifestyle activity, practicing various sports during which there is frequent damage to various parts of the body.

At the same time, there is a growing need to know the procedures for proper conduct in providing first aid for dental injuries by people caring for children and adolescents, i.e. teachers, trainers but also medical personnel (doctors, paramedics, school nurses).

One of the most serious injuries affecting permanent teeth is the complete knockout of the tooth. Failure to perform immediate tooth replantation within 30 minutes (insertion of the tooth into the socket) may result in premature tooth loss. The International Association of Dental Traumatology (IADT) has developed guidelines for dealing with dental injuries, in which it recognizes that in the event of tooth extraction, the most important factor for a good prognosis is to perform immediate replantation, and if this is impossible, transport the tooth in an appropriate way and send the patient to the dentist as soon as possible. This article describes the procedure for performing immediate replantation in the case of complete knockout of a permanent tooth and presents a clinical case in which the key to the success of treatment was to perform this procedure by the patient immediately after the injury, after a telephone conversation with her mother, who a few days earlier watched a film about such an injury and while remaining calm, ordered her daughter to insert the tooth into the socket. This case demonstrates the need for the necessary broad social education in this area.

KEY WORDS

case, complete tooth extraction, replantation, first aid and management

INTRODUCTION

For years, we have also been observing lifestyle changes in Poland, characterized by the growing popularity of physical activity, which is the most desirable phenomenon. Not only competitive sport, but even activities such as cycling or scootering, playing on the trampoline and participation in team games such as football or basketball are the cause of 21% of injuries requiring dental assistance [2]. Also important is the growing impact of traffic accidents involving children and cases of physical violence, during which more serious injuries often occur, requiring multidisciplinary treatment. Some diseases such as ADHD, epilepsy, cerebral palsy, hearing disorders etc. may also predispose to the increased incidence of dental injuries as well as some malocclusion (undershot with protrusion of incisors, open bite). Injuries are more likely to affect boys and most often affect the medial incisors of the upper permanent.

As a result of the injury, various types of damage may occur: crown fractures (80% of all injuries), root fractures, tooth dislocations, tooth injection, tooth knockout - total

dislocation (0.5-16%, more often incisors in the jaw than in the mandible) and others. [3,4] Dental injuries have been described in many classifications e.g. according to Andreasen. It was first presented in 1970, in 1972 and 1994 its subsequent modifications were published [5].

DENTAL INJURIES

There are following types of dental injuries:

- tooth fractures within the tissues of the tooth crown,
- crown-radicular fractures,
- fracture of the tooth root tooth shock
- subluxation
- protrusion (extrusion) of the tooth from the socket
- lateral dislocation of the tooth
- forcing (intrusion) the tooth into the tissues
- complete dislocation (knockout) of the tooth (Fig. 1-2).

Properly provided first aid immediately after the injury is of great importance and determines the course and results of treatment and provided in accordance with the standards radically reduces the number and scope of

complications, including distant ones. Studies conducted on various professional groups show that knowledge of the subject of dental injuries is insufficient. On the basis of surveys they showed that 70% of the surveyed paramedics did not have basic knowledge of the principles of first aid for dental injuries and the most problems were caused by a seemingly simple question: What to do with a broken tooth before the victim goes to a specialized facility? [2].

Surveys conducted in Israel showed that only 4% of medical doctors were able to act correctly in the case of a knocked out tooth [3]. In New Zealand groups of parents, trainers and teachers were surveyed. Here the situation turned out to be no better. Therefore, there is a great need to conduct a fairly common, but specialized education in the field of first aid after dental injuries both in medical professional groups: family doctors, nurses, paramedics as well as among teachers, trainers, parents, guardians who may witness such injuries and at the same time the first people providing help [5]. For this purpose, popular and effective (reaching the above-mentioned professional groups) means of media communication should be used, including social media. The International Association of Dental Traumatology (IADT) makes appropriate recommendations available through its website, posters or mobile application in order to promote appropriate behaviour. [6]

One of the most serious dental injuries is the knocking out of the tooth i.e. the complete loss of contact between the tooth and the alveolus. It is this injury that requires quick and correct handling of first aid, which is crucial for the further success of treatment. The priority is to maintain periodontal viability, whose cells die by the minute. It is important to act quickly. The knocked out tooth should be inserted into the socket as soon as possible. It is best when the time from tooth loss to its replantation does not exceed 30 minutes. This procedure can be performed by any doctor, rescuer, nurse, teacher, trainer or parent. Such a quick intervention causes that the periodontal tissue can be regenerated and the success rate is as high as 85-97%. If the time of immediate replantation is extended to 90 minutes, the statistical chance of success will be 43%, above 90 minutes – it drops to only 7%. [3]. Replantation is performed only in the case of permanent teeth.

CARRY OUT IMMEDIATE TOOTH REPLANTATION

The correct way to carry out immediate tooth replantation:

1. insert the tooth into the bleeding socket, holding it by the crown, without touching the root and modeling on the location of the adjacent tooth. When the tooth is in the right place, the patient should be advised to bite a tissue;
2. if the tooth is contaminated, it should be rinsed under running cold water before replantation;
3. if immediate replantation is not possible, it is recommended to place the tooth, holding it by the crown

in a container with milk, saline or in special liquids Save-A Toth, Hanks solution or in a liquid for storing contact lenses;

4. a knocked out tooth can also be stored for the time of obtaining help from the dentist in the mouth, in saliva. However, this is not recommended due to the possibility of accidental aspiration into the respiratory tract, as well as the risk of infection of periodontal cells;
5. describe the circumstances of the accident, the time elapsed from breakout to replantation, whether there was contact with the ground, etc;
6. send the patient to the dentist as soon as possible (recommended time is 60 minutes).

Further long-term treatment is the responsibility of the dentist, but the decisive and crucial for the long-term success of treatment, i.e. tooth maintenance, is first aid after the injury. Incorrect or sluggish operation can lead to premature tooth loss in the aesthetic zone and this can have serious consequences in terms of further development, including psychological development [6]. Therefore, knowledge of the algorithms of management after permanent tooth extraction should be disseminated throughout society and in particular among medical staff, teachers and trainers.

THE AIM

The work describes a case encountered on a daily basis, especially in the population of juvenile patients, of an injury of an isolated tooth during everyday activity.

THE CASE REPORT

A patient at the age of 9 came to the Dental Center due to a tooth 21 injury (an injury in the school playground as a result of a girl being pushed by a friend and hitting her face on the metal element of the goal). As a result of the injury, tooth 21 was injured, which was completely knocked out. After a quick intervention and contact with the mother, the tooth was maintained by the patient in the oral cavity. Within about 10 minutes, they went to the Dentistry Center where they received immediate help. Everything was carried out according to the recommended procedure of immediate replantation. Parental knowledge is very important, because it was thanks to my mother, who a few days earlier watched a program about dental injuries and provided the first effective and best help remotely in the case of a complete tooth knockout, that good therapeutic results were achieved.

The interview showed that at the time of the injury the patient did not have contact of the tooth with the ground (vs. tetanus protection), did not lose consciousness, had no disease burden and was vaccinated in accordance with the vaccination calendar.

A preliminary examination of the patient was performed and a radiological picture was taken, followed by cleaning of the wound and correction of the replanted tooth (under radiological control) and elastic-rigid

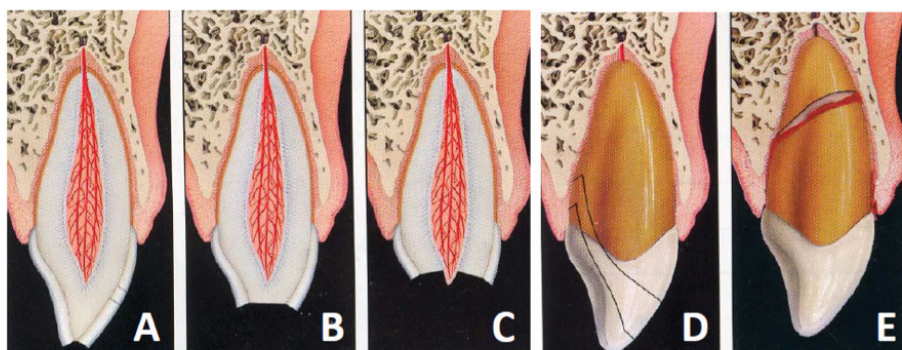


Fig. 1. A-C - tooth fractures within the tissues of the tooth crown; D- crown-radicular fractures; E – fracture of the tooth root

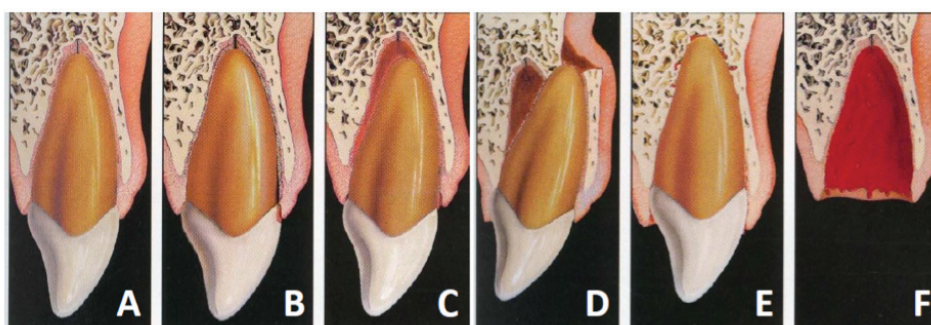


Fig. 2. A - tooth shock; B – subluxation; C - protrusion (extrusion) of the tooth from the socket; D - lateral dislocation of the tooth; E - forcing (intrusion) the tooth into the tissues; F - complete dislocation (knockout) of the tooth [5]



Fig. 3. X-ray of tooth 21 after immediate replantation. The condition with which the patient reported to the dental office.

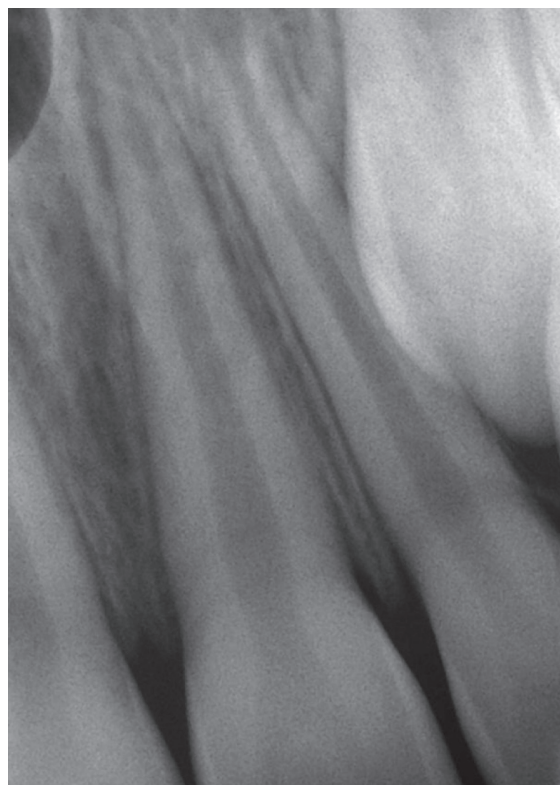


Fig. 4. X-ray of tooth 21 after correction of tooth replantation performed in the dentist's office.



Fig. 5. Intraoral image with flexible splint – rigid made of orthodontic wire 0.12 Niti.



Fig. 6. Intraoral picture after removing the splint 3 weeks after the injury .



Fig. 7. Intraoral image – condition after eruption of permanent teeth, before the start of phase II orthodontic treatment 2 years after the injury. Tooth 21 with slightly discolored crown.

immobilization of tooth 21 with 0.12 NiTi orthodontic wire. The patient was recommended a mushy diet, proper oral hygiene and follow-up visits for endodontic treatment of the tooth 21. Prophylactic antibiotic therapy with amoxicillin at a dose of 475mg / 5ml every 12 hours for a period of 7 days and supplementation with probiotics were implemented. Possible complications during treatment as a result of the injury suffered were reported and particular attention was paid to the pos-

sibility of root resorption (root shortening) or ankylosis (tooth fusion with the alveolar bone). The canal was developed according to the indications of the endometer and filled with MTA (BIODENTINE) biological material. Control radiological images were taken. The damaged mesial angle of the tooth was secured and rebuilt with an aesthetic composite material.

The patient is constantly subject to dental check-up. About 6 months after the injury and tooth replantation,

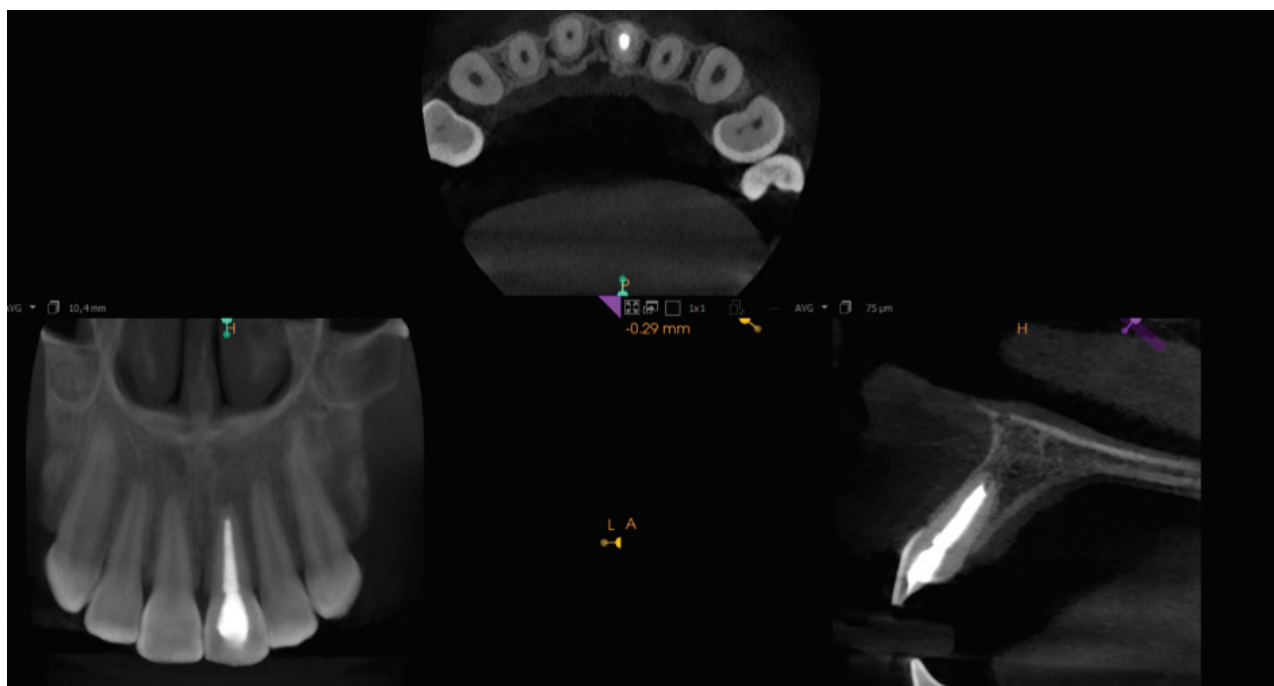


Fig. 8. CBCT (conical tomography) of the incisors and canines of the jaw taken 2 years after the injury, before the start of phase II orthodontic treatment. Visible filled tooth canal 21 with slightly shortened root apex, with preserved periodontal fissure (no ankylose).



Fig. 9. Intraoral image – condition 2 years after the end of orthodontic treatment, 5 years and 9 months after injury. Tooth 21 without ankylosis features, slightly discolored crown.

orthodontic treatment was started due to jaw stenosis, lack of space for tooth 23 and displacement of the upper dental median line to the left, as well as slight crowding of the incisors in the mandible. The treatment was carried out in the second phase using hyrax, lip bumpers and then (after eruption of permanent teeth) a distalizer and a fixed apparatus in the upper arch. Throughout orthodontic treatment tooth 21 was radiologically monitored. The crown of the traumatic tooth changed color to a darker color and the root was slightly shortened. To this day the patient is under constant control in the local Centre, and traumatic tooth 21 is correctly positioned in the dental arch and the root does not undergo resorption and ankylosis (Fig. 3-4).

To sum up, the above treatment in a juvenile was successful primarily by proper, effective first aid - immediate replantation and quick professional help of a dentist (Fig. 5-10).

CONCLUSIONS

The described case shows how important it is to take action to increase the level of knowledge about everyday dental injuries in adolescents among parents, teachers, school nurses, trainers or paramedics. It is extremely important to know how to deal with a knocked out tooth, so as to enable you to maintain your own tooth for the life of a juvenile patient in order to maintain not only physical health but what is

important- mental. A prerequisite for a good prognosis and treatment of trauma of complete tooth knockout is the correct provision of first aid in the shortest possible time after the injury. Immediate replantation should be

performed (or if this is not possible properly secure the tooth transport) and immediately refer the patient to a facility where he will receive a quick and professional dental therapy.



Fig. 10. Intraoral pictures of the smile before and after orthodontic treatment.

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CONFLICT OF INTEREST

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ABSTRACT BOOK

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MANIFESTATIONS OF LIFE-SAVING BEHAVIOR IN EMERGENCY AND URGENT SITUATIONS

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ПРОЯВИ ЖИТТЄЗБЕРІГАЮЧОЇ ПОВЕДІНКИ В УМОВАХ ЕКСТРЕННИХ ТА НЕВІДКЛАДНИХ СТАНІВ

Белікова І. В., Голованова І. А., Ляхова Н. О., Хорош М. В.
 ПОЛТАВСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ, ПОЛТАВА, УКРАЇНА

Вступ: В сучасних умовах розвитку громадського здоров'я в Україні вивченню життєзберігаючої поведінки приділяється все більшої уваги, оскільки культура самозбереження – важливий засіб захисту здоров'я населення та майбутніх поколінь.

Мета: Дослідити фактори поведінки людини, що пов'язані зі збереженням здоров'я.

Матеріали і методи: Методи: бібліосемантичний, контент-аналіз. Матеріали: статистичні дані ДУ «Центр медичної статистики МОЗ України», літературні джерела, присвячені проблемам здоров'я зберігаючої поведінки.

Результати: Під самозбережною поведінкою розуміємо систему дій та відносин, спрямованих на збереження здоров'я протягом повного життєвого циклу, на продовження термінів життя в межах цього циклу. Ставлення до свого здоров'я є одним з елементів самозбережної поведінки. Поведінка індивіда щодо здоров'я та спосіб життя формуються як під впливом об'єктивних та суб'єктивних факторів. Також поведінка індивіда залежить від розуміння цінності здоров'я та культури ставлення до нього. Науковці, які досліджували культуру самозбереження, ставлять здоров'я на найвищий рівень в особистісній структурі життєвих цінностей, що визначає активність щодо здоров'я; виключення з життя факторів ризику захворювань через грамотність та поінформованість дозволяє нейтралізувати наявні та ймовірні фактори ризику виникнення захворювань, забезпечує людину навичками підтримки здоров'я та продовжує тривалість життя.

Серед важливих факторів поведінки, що пов'язані зі здоров'ям, слід назвати:

- навички здорового способу життя;
- інформаційна гігієна;
- стресостійкість,
- збереження репродуктивного здоров'я та сексуальної активності
- вакцинація;
- культура споживання медичних послуг, тощо.

Зазвичай поведінку, що пов'язана зі здоров'ям поділяють на поведінку здорової людини, поведінку людини, що тимчасово хворіє та поведінку людини, яка набула певного статусу внаслідок своєї хвороби. В першому випадку прийнято говорити про формування у населення навиків здорового способу життя та навиків життєзбереження. На жаль, здоровий спосіб життя, турбота про власне здоров'я не завжди є цінностями населення в сучасних політичних та соціально-економічних умовах. Найчастіше, за наявності проблем зі здоров'ям, люди звертаються за медичною допомогою лише у разі гострої хвороби чи травми. Для багатьох людей перший контакт із системою охорони здоров'я відбувається саме при зверненні за екстреною медичною допомогою. Існує важлива проблема, коли люди закликають із викликом бригади екстреної медичної допомоги, що відтермінує час надання кваліфікованої медичної допомоги та ускладнює прогноз на видужання, працездатність, здоров'я, життя. Також, існує і інша проблема, коли викликають бригаду екстреної медичної допомоги у випадках, коли стан пацієнта не відповідає ознакам екстреності, тим самим знижуючи шанс отримання вчасної медичної допомоги іншим. Знання населення, які можуть зберегти як власне життя так і життя іншої особи, мають бути популяризовані та скласти основу життєзберігаючої поведінки. Слід пам'ятати, що основними принципами функціонування системи екстреної медичної допомоги в Україні є: постійна готовність до надання екстреної медичної допомоги; оперативне та цілодобове реагування на виклики екстреної медичної допомоги; доступність та безоплатність екстреної медичної допомоги, її своєчасність, якість та пріоритетність; послідовність та безперервність надання екстреної медичної допомоги та її відповідність єдиним вимогам. Так, за даними ДУ «Центр медичної статистики МОЗ України» у 2021 році всього по Україні зареєстровано викликів бригад екстреної медичної внаслідок нещасних випадків, травм, отруєнь – 540253 (у 2020 – 541055), в т.ч. у Полтавській області – 23569 (у 2020 – 21282) непрофільних викликів зареєстровано в Україні – 190674 (у 2020 – 220458), в т.ч. в Полтавській області – 10244 (у 2020 – 10334); в наслідок ДТП кількість виїздів всього в Україні – 42648 (у 2020 – 41217), в т.ч. у Полтавській області – 1446 (у 2020 – 1351); кількість літальних випадків внаслідок ДТП – 2175 (у 2020 – 2184), в т.ч. в Полтавській області – 96 (у 2020 – 103).

Висновки: При сформованості у населення навиків життєзберігаючої поведінки та культури споживання медичних послуг, система екстреної медичної допомоги здатна забезпечити оперативне надання допомоги пацієнтам з невідкладними станами навіть до встановлення діагнозу, гарантуючи безперервність медичного обслуговування та безпечний для здоров'я маршрут пацієнта.

Ключові слова: життєзберігаюча поведінка, фактори поведінки

Key words: life-saving behavior, behavioral factors

EMERGENCY MANAGEMENT OF ACUTE APICAL PERIODONTITIS IN PREGNANT WOMEN

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Introduction: Acute dental pain in pregnant women caused by symptomatic apical periodontitis refers to emergency conditions, as it creates a stressful situation with release of catecholamines by the adrenal glands, which can subsequently provoke tachycardia, peripheral vasoconstriction and decrease placental blood flow in the maternal circulation [E.D. Andrade et al., 2014; L.P. Araújo et al., 2022]. There is no doubt that emergency care is necessary, because there is a risk of occurrence of adverse pregnancy outcomes. That is why the treatment of acute apical periodontitis should be carried out regardless of the trimester of pregnancy in order to relieve the pain and eliminate the inflammatory process in periapical tissues as soon as possible by removing the source of inflammation or infection by local operative interventions. Today, for effective relief of acute pain due to periapical infections, transitional therapy is used.

The aim: To evaluate the treatment effectiveness of symptomatic apical periodontitis in pregnant women with the use of transitional therapy.

Materials and methods: Among 15 pregnant women with acute apical periodontitis, 8 pregnant patients of the main group were treated by the method of transitional therapy, 7 pregnant patients of the control group – by traditional endodontic therapy according to the treatment protocol approved by the Ministry of Health of Ukraine (Order No. 1852 dated 31.08.2021, code ICD K 04.5). Transitional therapy consisted chemomechanical debridement of the root canal system without complete mechanical instrumentation, and with the use of antibacterial medications in the root canals throughout the pregnancy period [F. Zhang et al., 2022]. In the first visit, we carried out the following manipulations: local anaesthesia, coronal opening of the tooth, irrigation with 2.5% sodium hypochlorite and exploration of root canals with a manual K-file and PathFile files, instrumental processing of root canals with ProTaper Universal files, the root canal irrigation with 3% sodium hypochlorite solution and 15% EDTA solution, temporal filling with calcium hydroxide paste. In the second recall the removing of Ca(OH)₂ paste, filling the root canals with Abscess Remedy paste and a provisional restoration with glass ionomer cement were performed.

Results: The main clinical comparative parameters between the groups were the absence of pain or postoperative sensitivity and signs of spreading infection or symptoms of general intoxication, the results of horizontal percussion, the absence of pathological changes of oral mucosa in the root projection of affected tooth, the occurrence of disease recurrence after conservative treatment of symptomatic apical periodontitis.

Positive dynamics of treatment were observed in patients of both groups; there were no signs of systemic involvement and spreading of the infection. All pregnant women of the main group had no complaints of pain already on the 3rd day of observation, the reaction to percussion of the tooth was painless, pathological changes of oral mucosa in the root projection of affected tooth were not diagnosed. Recurrences of infection during pregnancy after transitional therapy were not observed. In the control group, 2 patients showed a slight postoperative sensitivity, the result “absence of pain and infection” was observed in a week of the beginning of treatment. In one clinical case, a recurrence of the disease was diagnosed, which required repeated treatment.

Conclusions: The transitional therapy is efficient and safe in the management of acute apical periodontitis in pregnant women and provides analgesic effect, painless state throughout pregnancy, absence of recurrences, the shorter clinical time of the procedure. The use of the suggested treatment approach contributed a long-lasting constant antibacterial effect in the root canals for successful healing of periapical lesions and prevention of further reinfection.

Key words: emergency dental care, pregnancy, apical periodontitis, endodontics

EMERGENCY PRIMARY MEDICAL CARE OF A FAMILY DOCTOR

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Introduction: Primary health care is the starting point of contact between the patient and the health system, which gives people access to the information and resources they need to achieve optimal health outcomes.

Primary care professionals typically work with many different patients and have extensive knowledge of the various physical, psychological and social illnesses that can affect their patients.

A family doctor must provide emergency care for various life-threatening conditions: cardiac arrest, respiratory arrest, broncho-obstructive syndrome, hypertensive crisis, pain.

The aim: The main goal is to show the importance of emergency primary health care, which consists in improving the health of the population by providing easy access to medical care.

Materials and methods: Analysis and synthesis of literary sources and Internet data on the implementation of emergency medical assistance, systematic analysis and generalization.

Results: According to the World Health Organization (WHO), primary health care practitioners perform several key roles in achieving this goal. This includes:

- Ensuring greater health care coverage
- Prevention of social inequalities in the healthcare sector
- Organization of health services to meet health needs
- Help to make health and healthcare part of public policy in all areas
- Help educate leaders on effective health care
- Increasing the level of participation of all those who have an interest in health, whether they are patients, physicians, public health workers or employees of allied health services.

Conclusions: If the organization of effective provision of emergency medical care will increase the number of saved lives, therefore, it is necessary to develop emergency medical care programs, conduct a wide information campaign, which is now being done in European countries.

Key words: urgent, primary, aid, family doctor, primary care

SEXUAL VIOLENCE DURING THE WAR

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Introduction: In Ukraine, from the first days of a large-scale invasion of the Russian invaders, the enemy uses sexual violence as a means of torture and intimidation of people. Rape during war is not only a criminal offense but also a war crime. A tribunal is provided for wartime violence. Nowadays, it is more important than ever to be able to provide psychological first aid to people who have suffered from sexual violence. Often, doctors become the first witnesses of a crime, they are the ones who should support the victim psychologically.

The aim: to convey to fellow doctors the importance of treating not only physical, but also psychological injuries of victims.

Materials and methods: the biblical semantic method, system analysis and system analysis.

Results: Sexual violence is acts of a sexual nature committed in a violent manner without the voluntary consent of the victim. It is important to understand that it is not only rape. This includes nudity, forcing to contemplate sexual abuse, injury to genitals and others. All these actions are a war crime and violation of human rights. Protection of women's rights and prevention of violence is regulated by the Istanbul Convention. Victims of sexual violence are provided with medical assistance in health care facilities. The main goal of the doctor is to eliminate the consequences of the negative impact on the person. It is important not to leave the patient alone, to support, to show compassion. Examine and interview victims in compliance with moral and ethical standards. The victim must be referred to a specialist in psychological health for further rehabilitation. Do not ask, do not try to force the person to tell the details, but listen if you are trusted. Do not rate, do not comment. The doctor is obliged to guarantee confidentiality. It is necessary to inform the relevant authorities about the fact of the crime.

Conclusions: in connection with the military aggression of the Russian Federation, the issue of combating sexual violence requires special attention. Along with the need to treat the body, it is important to treat the soul as well. One should show empathy for the victim and be able to provide psychological assistance.

Key words: Sexual violence, sexualized violence, psychological support, war

THE USE OF TELEMETRIC CARDIOLOGY TECHNOLOGIES ON THE EXAMPLE OF THE EXPERIENCE OF THE "POLTAVA REGIONAL CENTER FOR EMERGENCY AID AND DISASTER MEDICINE"

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ВИКОРИСТАННЯ ТЕЛЕМЕТРИЧНИХ КАРДІОЛОГІЧНИХ ТЕХНОЛОГІЙ НА ПРИКЛАДІ ДОСВІДУ КУ «ПОЛТАВСЬКИЙ ОБЛАСНИЙ ЦЕНТР ЕКСТРЕНОЇ ДОПОМОГИ ТА МЕДИЦИНИ КАТАСТРОФ»

Рак Т. І., Коршенко В. О., Матвієнко Т. М., Романюк М. В., Комишан І. В., Саргош О. Д., Приліпка К. О., Буря Л. В., Філатова В. Л., Юркова М. С.
ПОЛТАВСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ, ПОЛТАВА, УКРАЇНА

Вступ: Телеметричні центри - це сучасні впровадження в екстреній медицині, які шляхом передавання інформації (ЕКГ) та використання віддаленого консультування створюють бази даних та узгоджують маршрути для пацієнтів, яким необхідна госпіталізація, суттєво полегшують роботу медичним працівникам різного профілю в екстрених ситуаціях. Основними завданнями переходу до використання телеметричних систем є наступні: забезпечення доступності висококваліфікованої кардіологічної допомоги незалежно від місця звернення; забезпечення екстреної кваліфікованої ЕКГ-діагностики та допомоги; створення системи виявлення і профілактики серцево-судинних хвороб на ранніх стадіях; зменшення рівня інвалідизації внаслідок серцево-судинних захворювань у людей працездатного віку; створення реєстру кардіологічних даних для здійснення моніторингу серцево-судинних захворювань у пацієнтів.

Мета: Дослідити ефективність впровадження телеметричних кардіологічних технологій в КУ «Полтавський обласний центр екстреної допомоги та медицини катастроф» в 2020-2022 рр.

Матеріали і методи: Застосовано статистичний метод та метод контент-аналізу. Матеріали: статистичні дані КУ «Полтавський обласний центр екстреної допомоги та медицини катастроф» за 2020-2022 рр.

Результати: У 2013 році в Полтавській області було створено КУ «Полтавський обласний центр екстреної допомоги та медицини катастроф», виїзними бригадами якого обслуговувалось 27 районів. Основна кількість персоналу, яка «не читає» ЕКГ, гостро потребувала допомоги фахівця в діагностиці на місці, під час надання допомоги та госпіталізації хворих. Тому в районних центрах бригади забезпечувалися електрокардіографами типу ЮКАРД, і завдяки цьому фельдшерським бригадам вдалося впровадити ревазуляризацію міокарда при гострому інфаркті міокарда вже на місці події, що значно покращило результати лікування таких хворих. За допомогою дистанційної передачі ЕКГ, фахівці консультативного центру отримали змогу аналізувати ЕКГ, вчасно та правильно їх діагностувати. Зокрема, кількість ЕКГ-передач до телеметричного центру КУ «Полтавський обласний центр екстреної допомоги та медицини катастроф» тільки по Полтавському району становила: за 2020 рік - 1517 кардіограм, за 2021 рік - 1855 кардіограм, за 2022 рік - 2207 кардіограм. Враховуючи кількість первинних звернень бригад ЕМД можемо сказати, що з кожним роком рівень переданих ЕКГ даних до телеметричного центру в Полтавському районі зростає. Відомо, що летальність у разі консервативного лікування (допомога вдома, неправильне інтерпретування ЕКГ, відмова від госпіталізації) складала на даному етапі 90%, а при механічній ревазуляризації в умовах стаціонару після госпіталізації 60%. При використанні телеметричного кардіологічного комплексу забезпечується також маршрутизація пацієнтів з гострим коронарним синдромом. При передачі ЕКГ електронною поштою завдяки попередженню інтерверсійного кардіолога реперфузійного центру час перебування бригади на виклику зменшується вдвічі. Таким чином, використання телеметричного кардіологічного комплексу надає екстреній медичній допомозі статусу повноцінного учасника реперфузійної мережі, а не просто перевізника пацієнтів.

Висновки: Отже, за допомогою телеметричних технологій створюються технічні умови для проведення висококваліфікованого кардіологічного обстеження на відстані та, за необхідності, надання вчасної медичної допомоги.

Ключові слова: телеметричний центр, екстрена ЕКГ-діагностика
Key words: telemetry center, emergency ECG diagnostics

PROVISION OF URGENT ASSISTANCE TO CHILDREN WITH TRAUMATIC INJURIES OF THE SOFT TISSUES OF THE MAXILLO-FACIAL REGION

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НАДАННЯ НЕВІДКЛАДНОЇ ДОПОМОГИ ДІТЯМ З ТРАВМАТИЧНИМИ УШКОДЖЕННЯМИ М'ЯКИХ ТКАНИН ЩЕЛЕПНО-ЛИЦЕВОЇ ДІЛЯНКИ

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 ПОЛТАВСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ, ПОЛТАВА, УКРАЇНА

Вступ: В останні роки прослідковується чітка тенденція до збільшення кількості пацієнтів з травматичними ушкодженнями різних частин тіла особливо внаслідок бойових дій, які відбуваються на території України. Особливого значення це набуває коли мова йде про лицеву частину черепа, яка являється найбільш відкритою і не захищеною від впливу травмуючого агента. На ушкодження м'яких тканин у дітей приходиться до 90% від усіх травми обличчя та шиї. При цьому досить важливу роль відіграє тяжкість самого пошкодження і вірогідність виникнення на цьому фоні кровотечі, яка, враховуючи добру васкуляризацію тканин обличчя, може супроводжуватися значною кровотратою. В основу принципів надання невідкладної медичної спеціалізованої допомоги таким дітям закладено вікові анатомо-фізіологічні особливості будови щелепно-лицевої ділянки і наявність в цій зоні важливо життєвих органів, які забезпечують життєдіяльність всього організму. За умов своєчасного проведення первинної хірургічної обробки травмованих м'яких тканин зменшується ризик виникнення на ранніх етапах гемомікроциркуляторних та метаболічних порушень як на місцевому, так і загальному рівнях.

Мета роботи: Проаналізувати варіанти надання невідкладної допомоги дітям при травматичному ушкодженні м'яких тканин різної тяжкості.

Матеріали і методи: Ми проаналізували 121 випадок спостереження за дітьми з різними видами травматичного ушкодження м'яких тканин за 5 років (2018-2023), які лікувалися за амбулаторних і стаціонарних умов на базових клінічних закладах кафедри дитячої хірургічної стоматології.

Результати дослідження: Із 121 пацієнта у 28 – 25,7%, було діагностовано забиття, яке супроводжувалося формуванням гематоми. У 10 дітей (8,1%), у яких було ушкоджено крупні судини і у зв'язку з чим вона мала значні розміри на час первинного звернення проведено аспірацію крові за рахунок проведення пункції. Завдяки цій маніпуляції завжди вдавалося досягти евакуації значної кількості крові і зменшити, відповідно, об'єм гематоми. У 3 випадках із 10 – 23,1%, не дивлячись на таку процедуру відбулося нагноєння досить великих за розмірами гематом, що потребувало в подальшому стаціонарного лікування. Їх консервативний супровід відбувався за класичними варіантами - на першу добу прикладали холод, а потім призначали теплові та фізіотерапевтичні процедури, за виключенням гематом, що супурували. У 31 пацієнта (25,6%) було діагностовано садна, які потребували лише санації епідермального шару, а сама рана у всіх випадках загоювалася під струпом. Слід зауважити, що не дивлячись на неускладнений перебіг в посттравматичному періоді навкруги садна завжди мав місце набряк і ознаки перифокальної інфільтрації. На рани припадало 62 випадки (48,7%). Із них у 56 пацієнтів (90,3%) вони були без дефекту тканин і у 6-9,7% з дефектами різної складності. В їх структурі за характером травмуючого агента превалювали рвані та змішані і від їх виду залежала клінічна тактика. Слід зауважити, що у всіх випадках це супроводжувалося внутрішньою і зовнішньою кровотечею. У 59 дітей (95,1%) первинна хірургічна обробка ран була проведена – до 36 годин, у 2–3,2% віддалена до 48 годин і у 1–1,7% пізніше (72 години). До визначення методу знеболення підходили індивідуально з врахуваннями клінічної ситуації, віку дитини та умов за яких проводилося надання медичної допомоги. У 35 пацієнтів (56,4%) первинну хірургічну обробку рани було проведено під загальним знеболенням. Із них у 17-49,8% застосовували інтубаційний варіант і найчастіше це стосувалося осіб з проникаючими пораненнями в ротову порожнину. В інших випадках мова йшла про внутрішньовенний або внутрішньом'язовий шляхи анестезіологічного забезпечення, що вирішувалося колегіально з анестезіологом. У 27 постраждалих (43,6%) первинна хірургічна обробка рани проведена під місцевим знеболенням, коли інфільтраційна анестезія поєднувалася з провідниковою. У всіх випадках, в меншій чи більшій мірі, хірургічне втручання супроводжувалося кровотечею, вираженість якої залежало від типу судин і їх діаметру, але за любых умов ми в першу чергу проводили зупинку кровотечі. Після цього проводилася ревізія рани з уточненням ходів раньових каналів і стану оточуючих тканин, встановлювали співвідношення їх до важливих органів та наявність сторонніх тіл. Під час оперативного втручання обов'язково проводили антисептичну обробку і санацію ексудату із глибоких відділів і ніш раньових каналів. Ушивання рани відбувалося пошарово з врахуванням рекомендацій класичних напрацювань, як і ведення пацієнтів в ранньому післяопераційному періоді. Первинним натягом рани загоїлися у 56 пацієнтів (90,3%) і у 6–9,7% відбулося їх нагноєння, що потребувало застосування іншого тактичного підходу.

Висновок: Таким чином, вид та обсяг лікувальних заходів у дітей з травматичним ушкодженням м'яких тканин в значній мірі залежить від виду і характеру травмуючого агента. Найчастіше дитячому хірургу-стоматологу доводиться мати справу з ранами, які характеризуються порушенням цілісності м'яких тканин і які мають індивідуальні особливості, що слід враховувати при проведенні їх первинної хірургічної обробки та визначенні обсягу медичного супроводу в ранньому післяопераційному періоді.

Ключові слова: діти, травматичні ушкодження м'яких тканин, щелепно-лицева ділянка, невідкладна допомога

Key words: children, traumatic injuries of soft tissues, maxillofacial region, emergency care

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