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ORIGINAL ARTICLE

CLINICAL CHARACTERISTICS AND OUTCOMES OF PATIENTS ADMITTED WITH ATRIAL FIBRILLATION/ATRIAL FLUTTER TO THE EMERGENCY DEPARTMENT

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ABSTRACT

Aim: To determine the clinical characteristics and outcomes of patients with atrial fibrillation/atrial flutter (AF) admitted to the Emergency Department (ED).

Material and methods: Patients with AF at ED admission with cardiac palpitations only, thromboembolic complications, hemorrhagic complications, hemodynamic instability, other non-traumatic diseases, and trauma. Demographics, vitals, comorbidities, ECG, laboratory findings, treatment, and survival were analyzed.

Results: There were 247 patients (55.1% women, 44.9% men) admitted to the ED aged 73.8±13.0 . A total of 226 (79.8%) patients were brought to the ED by Emergency Medical Services, and 121 (49%) had palpitations as a reason for admission. The hospitalization rate was 34%. About 60% of patients were on antithrombotic treatment. Among 45 patients with AF discharged home who were not previously treated with anticoagulants, all but three patients without indications for antithrombotic therapy, received a recommendation to be treated with anticoagulants, but only half of them received a prescription. During the follow-up of 1025 (773-1197), days died 67 (27.1%) patients, and 30-day mortality was 5.3%. The lowest mortality was found in patients admitted due to cardiac palpitations.

Conclusions:1. The patients with AF admitted to the ED constitute a group of patients with a high hospitalization rate. 2. The reason for the admission to the ED of patients with AF divides this population into subgroups with different outcomes in terms of mortality and hospitalization.3. The patients discharged home who did not have been earlier treated with anticoagulants received suitable recommendations, however, only about half of them received a prescription for an anticoagulant.

KEY WORDS

emergency department, survival, atrial fibrillation, atrial flutter

INTRODUCTION

Atrial fibrillation/atrial flutter (AF) is the most common sustained arrhythmia. It is associated with significant morbidity and mortality [1]. AF was found in 3.3-10% of Emergency Department (ED) patients [2]. Raisi-Estabragh reported that in the population of patients admitted to the ED due to cardiovascular diseases about 27% of the patients have AF. Furthermore, they found that AF was the cause of admission in 10.2% of women and 9.2% of men [3]. The clinical presentation at the admission of patients with AF could be cardiac palpitations, thromboembolic or hemorrhagic complications of AF and its antithrombotic treatment, and hemodynamic instability [4]. Furthermore, AF could be just a concomitant disease in patients admitted to the ED due to other traumatic or non-traumatic reasons [4]. Cardiac palpitations in patients admitted to the ED could be the clinical symptoms of the AF event [1-4]. However, patients with chronic AF could have palpitations due to an increase in heart rate due to other reasons like infection or hemorrhage.

THE AIM

The study aimed to present the clinical characteristics of patients with AF admitted to the ED and their outcomes in terms of admissions to other hospital wards and mortality.

MATERIAL AND METHODS

The study was approved by Bioethical Commission in Wroclaw.

The study group consisted of patients admitted to the ED who had AF at admission. All patients or their next of kin gave informed consent to participate in the study.

The mode of arrival to the ED was noted as: by EMS, referred by the other physician, self-arriving.

The presentation to the ED was classified as follows: cardiac palpitations only, thromboembolic complications both central and peripheral, hemorrhagic complications of the used antithrombotic treatment, hemodynamic instability (acute altered mental status, shock, symptomatic hypotension, ischaemic chest pain or res-

piratory failure/distress), other non-traumatic diseases, traumatic injury.

The blood pressure and pulse assessed by pulse oximetry obtained during triage were noted.

The first obtained electrocardiogram was analyzed and the heart rate, right bundle branch block (RBBB), left branch bundle block (LBBB), interventricular conduction delay (IVCD) the presence of ventricular pacing, the presence of the low QRS voltage were noted.

The following laboratory findings: hemoglobin concentration, potassium level assessed as < 3.5 mEq/l, and 3.5-3.99 mEq/l, troponin> than upper limit C-reactive protein concentrations were retrieved.

The anticoagulants use before admission was noted. In the patients discharged home who was not earlier on anticoagulants, it was noted whether anticoagulants were recommended only or were prescribed.

The survival of the patients was assessed based on data from the Ministry of Digitalization on October 24th, 2022. The 30-day, one-year survival, and survival to October 24 2022 were calculated.

STATISTICAL ANALYSIS

The continuous variables were presented as means and standard deviations or medians and interquartile ranges depending on their distribution and compared with ANOVA and MANOVA respectively. The discrete variables were presented as numbers and percentages and compared with the Chi^2 test with Yates correction if indicated.

Table 1. The concomitant disease of the patients in the study group.

Comorbidities	N (%)
Arterial hypertension, n (%)	189 (76.5)
Diabetes, n (%)	75 (30.4)
Myocardial infarction, n (%)	38 (15.4)
PCI, n (%)	27 (10.9)
CABG, n (%)	3 (1.2)
Stroke, n (%)	33 (13.4)
TIA, n (%)	7 (2.8)
CHF, n (%)	62 (25.1)
Hypothyreosis, n (%)	22 (8.9)
Hyperthyreosis, n (%)	13 (5.3)
Asthma/COPD, n (%)	18 (7.3)
Renal failure, n (%)	33 (13.4)

CABG - coronary artery bypass graft; COPD - chronic pulmonary disease; CHF - congestive heart failure; PCI- percutaneous coronary intervention; TIA- transient ischaemic attack

Table 2. Demographics, triage vital signs, hospitalization, and short-term and midterm mortality of the patients admitted to the Emergency Department divided into groups based on the cause of the admission.

	Cardiac palpitations	Hemorrhage	Stroke or acute peripheral ischemia	Hemodynamic instability	Other	Traumatic injuries	P
N (% of the total group)	121 (49)	8 (3)	8 (3)	57 (23)	46 (19)	7 (3)	<0.001
Male gender, n (%)	51 (42)	3 (38)	6 (75)	26 (46)	24 (52)	1 (14)	0.21
Brought by EMS, n (%)	95 (79)	6 (75)	8 (100)	46 (81)	36 (78)	6 (86)	0.53
Age (years) Median (IQR)	71 (65-81)	78.5 (62.5-85.5)	70.5 (63-79.5)	78 (67-86)	75.5 (69-86)	88 (86-91)	0.10
Chronic AF, n (%)	4 (3)	7 (88)	5 (63)	19 (33.3)	20 (43)	2 (29)	<0.001
Systolic blood pressure, mm Hg, median (IQR) (# number of results)	127.5 (115-143.5) (# 120)	112 (90.5-130) (# 8)	155 (116.5-172) (# 8)	130 n(106-150) (# 57)	132.5 (104-148) (# 46)	138 (123-160)	0.67
Diastolic blood pressure, mm Hg, median (IQR) (# number of results)	82.5 (70-94.5) (# 120)	78.5 (58.5-90.5) (# 8)	97.5 (88-100) (# 8)	89-(74-96) (# 57)	76.5 (60-90) (# 46)	88 (80-98)	0.011
Pulse, bpm, median (IQR) (# number of results)	100 (80-120) (#115)	78 (69-103.5) (# 8)	74 (72-84) (# 5)	96 (80-110) (# 56)	80 (62-106) (# 45)	95 (93-120)	0.018
Admission to red zone, n (%)	0 (0)	0 (0)	3 (38)	0 (0)	3 (7)	0 (0)	<0.001
Hospitalization, n (%)	22 (18)	6 (75)	7 (88)	31 (54)	18 (39)	1 (14)	<0.001
30-day mortality, n (%)	0 (0)	0 (0)	2 (25)	3 (5)	5 (11)	3 (43)	<0.001
1-year mortality, n (%)	6 (5)	2 (25)	4 (50)	11 (19)	10 (22)	5 (71)	<0.001
Mortality during follow-up, n (%)	17 (14)	3 (38)	5 (63)	21 (39)	15 (33)	6 (86)	<0.001

P less than 0.05 was considered significant.

RESULTS

The study group consisted of 247 patients admitted to the ED aged 73.8±13.0. There were 136 (55.1%) women and 111 (44.9%) men.

A total of 197 (79.8%) patients were brought to the Emergency Department by ambulance of the Emergency Medical Services, 21 (8.5%) patients were referred to the ED by attending physicians, and 29 (11.7%) patients came on their own.

AF lasted up to 48 h was recognized in 115 (46.6%) patients, longer than 48 hours in 27 (10.9%), chronic in 57 (23.1%), *de novo* in 26 (10.5%), unknown duration in 22 (8.9%) patients.

The most frequent reason for the admission to the ED of patients with AF was found to be cardiac palpitations.

Table 3. Electrocardiographic, antithrombotic treatment before admission to the Emergency Department and laboratory findings in the patients admitted to the Emergency Department divided into groups based on the cause of the admission.

	Cardiac palpitations	Hemorrhage	Stroke or acute peripheral ischemia	Hemodynamic instability	Other	Traumatic injuries	P
N (%)	121 (49)	8 (3)	8 (3)	57 (23)	46 (19)	7 (3)	<0.001
HR bpm, median (IQR)	110 (95-130)	112.5 (94.5-127)	91 (82.5-109)	102 (90-130)	90 (70-110)	124 (101-138)	0.031
Bradycardia <60 bpm n (%)	3 (3)	0 (0)	0 (0)	2 (4)	4 (9)	0 (0)	0.36
Tachycardia >90 bpm, n (%)	93 (77)	6 (75)	4 (50)	38 (66)	21 (45)	6 (86)	
VES presence	4 (3)	7 (88)	5 (63)	19 (33.3)	20 (43)	2 (29)	0.004
n (IQR)	3 (2)	0 (0)	2 (25)	4 (7)	7 (15)	2 (29)	0.31
ST depression	82.5 (70-94.5) (# 120)	78.5 (58.5-90.5) (# 8)	97.5 (88-100) (# 8)	89- (74-96) (# 57)	76.5 (60-90) (# 46)	88 (80-98)	0.94
n (%)	10 (8)	2 (25)	0 (0)	4 97)	5 (11)	2 (29)	0.12
ST elevation	0 (0)	0 (0)	3 (38)	0 (0)	3 (7)	0 (0)	0.31
n (%)	2 (2)	0 (0)	0 (0)	2 (4)	1 (2)	0 (0)	0.29
RBBB	0 (0)	0 (0)	2 (25)	3 (5)	5 (11)	3 (43)	0.66
n (%)	2 (2)	0 (0)	0 (0)	2 (4)	5 (11)	1 (14)	0.18
LBBB, n (%)	5 (4)	1 (13)	2 (25)	6 (11)	3 (7)	1 (14)	0.002
IVCD, n (%)	1 (1)	1 (13)	0 (0)	3 (5)	2 (4)	0 (0)	0.017
Pacing artifacts	3 (2)	0 (0)	0 (0)	1 (2)	3 (7)	0 (0)	0.66
Low voltage QRS, n (%)	14 (12)	3 (38)	2 (25)	14 (25)	6 (13)	1 (14)	0.18
Lack of antithrombotic treatment before admission, n (%)	35 (29)	3 (38)	2 (25)	23 (40)	22 (48)	4 (57)	0.27
Haemoglobin, g/dL, median (IQR)	13.7 (12.7-15.1)	12.1 (8.9-12.6)	14.1 (12.5-15.6)	13.1 (12.1-14.9)	13.7 (12.5-15.0)	13.2 (12.9-13.5)	0.017
Increased troponin level, n (%)	30 (29) #105	2 (50) #4	3 (43) #7	27 (49) #55	16 (44) #36	4 (100) #4	0.014
Potassium level< 3.5 mEq/l	12 (9)	1 (13)	0 (0)	5 (9)	5 (11)	3 (43)	0.29
Potassium level 3.5-3.99 mEq/L	48 (40)	1 (13)	3 (38)	21 (37)	15 (33)	2 (29)	
CRP, ng/ml, median (IQR)	1.9 (0.9-4.6) #107	20.4 (2.3-144.4) #8	19.4 (5.7-41.8) #8	4.5 (2-14.8) #55	5.2 (1.7-17.2) #43	79.7 (29.1-80.4) #5	<0.001
Fenazoline n (%)	44 (37)	1 (13)	0 (0)	8 (14)	2 (4)	0 (0)	<0.001
Beta-blocker n (%)	30 (25)	0 (0)	2 (25)	11 (19)	7 (15)	0 (0)	0.29
Amiodaronen (%)	24 (20)	1 (13)	0 (0)	1 (2)	3 (7)	0 (0)	0.005
Electrocardioversion n (%)	15 (12)	0 (0)	0 (0)	3 (5)	3 (7)	0 (0)	0.35

The concomitant diseases of the study group were presented in table 1.

The most common concomitant disease was arterial hypertension, which was found in 76.5% of the patients.

A total of 158 (64%) patients at admission were on antithrombotic treatment. The percentage of patients with AF not treated with anticoagulants was 38% among patients discharged home and 33% among patients admitted to the other hospital (p=0.46).

Demographics, triage vital signs, hospitalization, and mortality in patients admitted to the Emergency Department divided into groups based on the cause of the admission were presented in table 2.

In table 3 the ECG and laboratory findings and medical treatment were presented

ELECTROCARDIOGRAM

Heart rate at admission was below 55 bpm in 8 (3%) patients, 55-90 bpm in 71 (28.7%) patients, 91-110 bpm in 68 (27.5%) patients, and 100 (40.5%) patients had heart rate above 110 bpm.

Atrial flutter was found in 47 (19%) patients- 18 (7.3%) had a typical atrial flutter and 29 (11.7%) atypical atrial flutter, 10 (4%) patients had right branch bundle block, 18 (7.3) had left bundle branch block, 7 (2.8%) Interventricular conduction delay, ventricular extrasystole were found in 18 (7.3%) patients, ventricular pacing 7 (2.8%).

ST-segment elevation was found in 5 (2%) patients, ST segment depression was found in 23 (9.3%) patients.

Low-voltage QRS complexes were found in 40 (16.2%) patients.

LABORATORY FINDINGS

Kalium concentration was lower than 3/5 mEq/l in 26 (10.5%) patients, 3.5-3.99 mEq/l in 181 (73.3%) patients, 4.0-5.0 mEq/l in 33 (13.4%), above 5 mEq/l in 2% and 5 (2%) patients and 2 (0.8%) it was not measured.

OUTCOMES

A total of 162 (65.6%) patients were discharged home whereas the rest of the patients were admitted to the other hospital ward.

Among patients discharged home 114 (72%) patients were recommended to continue current antithrombotic treatment, 45 (28%) patients were recommended to use anticoagulants, 3 (2%) patients were not recommended to use anticoagulants: 1 after left appendage occlusion and 2 patients because CHADS2 score was 0. Among patients with the recommended use of the anticoagulants, 23 (51%) received a prescription for the antithrombotic treatment and 22 (49) received a recommendation to contact the family doctor or cardiology outpatient clinic to obtain a needed prescription.

The 30-day mortality was 13 (5.3%) and the 1-year mortality was 38 (15.4%) patients.

During the follow-up of 1025 (773-1197), days died 67 (27.1%) patients.

During the follow-up died 67 (27.1%) patients. The lowest mortality rate was found in patients with cardiac palpitations as a cause of admission to the ED

DISCUSSION

The main result of the study was that patients with AF are elderly, are brought to the emergency room mainly by EMSs, and have a high rate of hospitalization and high short-term and medium-term mortality. It was appreciated that patients with AF presenting to the ED represent a special population [5]. The mean age of the patients in the present study was 73.8±13 years is similar to 74±11 years in the Blitz-AF study which was a multicentre, observational study conducted in 154 centers on patients with AF [6]. Also, the distribution of the causes of the admission to the ED was similar in the presented study than in the Blitz-AF study: noncardiovascular causes of admission were found in 23% of patients with AF in the Blitz-AF study and 22% (traumatic and other) in the presented study. However, the hospitalization rate in the presented group was 35.2% which was higher than in the BLitZ-AF study where it was 27.8%. Nonetheless, the percentage of the total population of patients admitted to the ED in the historical group from the same center was between 25.2% during the COVID-19 pre-pandemic and 32.7% during the pandemic period being still lower than the frequency of hospitalization of the patients with AF similarly to Blitz- AF study [6,7]. The women constituted more than half of the patients in the presented study and about 40% of the patients win the Blitz-AF study. The similarities between the presented study and the Blitz-AF study indicate that the presented population constitutes a representative population of all patients with AF admitted to the ED. The higher rate of hospitalization in patients with AF was also reported by Scheuermeyer et al. who reported hospitalizations rates of 50.2% of women and 41.3% of men [8].

The second finding was that the proposed classification of the reason for the admission as cardiac palpitations, hemorrhage, stroke or acute peripheral ischemia, hemodynamic instability (altered mental status, shock, hypotension, chest pain, or dyspnoea), traumatic injuries, or others reason divides the studied population into subgroups into different outcomes. Used classification into patients with AF as a primary cause of access to the ED, other cardiovascular causes, and non-cardiovascular causes is more general. The patients included in the group of patients with primary AF constituted 21.5% of patients with AF in Sadaf et al study [9]. In our study about there were 49% of patients with cardiac palpitations in whom primary AF could be recognized. The patients with AF admitted to the ED could not be classified as those with paroxysmal or persistent AF because even if the duration of the AF was short if the conversion to the sinus rhythm was obtained with any intervention the persistent AF should be diagnosed. Therefore, in the ED the classification of patients with AF needs to be different than in the Cardiology Department. The other

attitude to the classification of the AF in the ED was proposed by Caccioppo et al who used the division into a permanent or a non-permanent form [10].

The third finding of the presented study was that only about half of the patients with AF admitted to the ED were on antithrombotic treatment. Therefore, the prescription of anticoagulants for the ED for patients discharged home is an important issue, The ED is undoubtedly the first medical contact point for many patients with complaints referable to AF occurrence and AF treatment complications [11-13]. Stabilization of vital parameters is not the only task of ED physicians. The other is the Identification of patients with AF at risk of stroke and initiation the antithrombotic therapy [11]. In the present study, antithrombotic therapy was initiated in the ED in patients whereas in patients it was recommended to be initiated by the family doctors. The initiation of antithrombotic therapy in the ED was reported to decrease mortality. In the present study, it was found that about half of patients who were not earlier treated with anticoagulants and were discharged home received a recommendation to be treated with these drugs. However, only half of them received the appropriate prescription. In Stiell et al. study of patients with new-onset AF anticoagulants were routinely recommended at discharge from the ED. However, in outpatient settings physicians underprescribed oral anticoagulants and appropriate prescriptions receive 4.8% of patients [14]. The authors have expressed their concern that many patients may have trouble accessing early follow-up family doctor care and receiving a receipt. The concern may also apply to our country. Therefore, emergency physicians should be encouraged not only to recommend but also to prescribe appropriate treatment. Furthermore, the patients who received a prescription in the ED may have a higher frequency of long-term adherence to the therapy than those for whom the decision to initiate therapy was referred to another physician [15]. The frequency and reasons for the missed opportunities for appropriate anticoagulation in the ED merit further investigation. Emergency physicians related factors caused by ED overcrowding seem to play an important role.

The 30-day mortality was 5.3%. The historical data on survival in our ED determined that 30-day mortality was lower and was 3% [17].

The 1-year mortality rate was 15.4% of patients in the study group whereas the mortality rate was 9.2% in the Blitz-AF study [6]. This finding indicates the prognosis of the studied patients was worse than those of the Blitz Study. This finding is concordant with the higher hospitalization rate in the present study. However, in the Yang et al. study 1 year mortality was 14.6% which was similar to our study [16]. The variation in reported survival mainly reflects the heterogeneity of the treated populations and also care in different health systems.

LIMITATIONS

The main limitation of the study was that the studied patients were not all consecutive patients with AF admitted to the ED. Patients were randomly selected during the period when the doctor on duty had time to invite them to participate in the study, and therefore the patients were randomly selected.

CONCLUSIONS

1. The patients with AF admitted to the ED constitute a group of patients with a high hospitalization rate and increased short-term and midterm mortality
2. The reason for the admission to the ED of patients with AF divides this population into subgroups with different outcomes in terms of mortality and hospitalization.
3. The patients discharged home who did not have been earlier treated with anticoagulants received suitable recommendations, however, only about half of them received a prescription for an anticoagulant.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest.

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ORIGINAL ARTICLE

ATTITUDES TOWARDS THE COVID-19 PANDEMIC AND THE LEVEL OF KNOWLEDGE ABOUT THE PANDEMIC AMONG THE PATIENTS IN THE OPINION OF MEDICAL PERSONNEL – AN INTERNATIONAL STUDY

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ABSTRACT

Aim: To assess knowledge of the SARS-CoV-2 virus and attitudes toward the pandemic among patients in seven European countries in the opinion of medical personnel.

Material and methods: The research was conducted across seven European countries. The questionnaire included questions relating to the Covid-19 pandemic regarding medical personnel's opinions on the level of patient education, the sharing of incorrect information by patients, the following of quarantine procedures by patients, and the necessity of introducing tighter sanitary restrictions.

Results: The research indicated significant differences between countries in the answers provided by medical personnel. Medical personnel encountered the sharing of incorrect information by patients most often in Poland, and most seldom in Norway. Staff in the United Kingdom and Poland had the lowest assessment of patients following quarantine procedures, while personnel in Norway had the most positive assessment in this area. Education of the patients on the SARS-CoV-2 virus was most positively assessed by personnel in Finland, and the most poorly by staff from Poland. The necessity to impose tighter sanitary restrictions was indicated by the greatest number of personnel in Poland and the United Kingdom, and by the lowest number in Spain.

Conclusions: The research indicated significant differences between countries in the provided answers. The study also demonstrated that as a rule the sanitary restrictions were supported.

KEY WORDS

COVID-19, emergency medicine, medical personnel, questionnaire research, international study

INTRODUCTION

The COVID-19 pandemic caused considerable limitations on and difficulties in the functioning of societies in the majority of countries in the world [1, 2]. Problems arose related to the carrying out of work-related duties [3, 4], education [5], the functioning of public amenities [6], the use of public transport [7], and the functioning of healthcare systems [8]. Healthcare systems in particular faced new challenges that to a considerable degree limited or completed prevented their normal functioning [8-10]. Both emergency medical response teams and hospitals were burdened with the need to treat numerous patients whose serious condition was caused by infection with SARS-CoV-2. The additional duties placed on healthcare staff made it difficult for patients with other illnesses to access medical treatment [11]. In order to reduce the number of new COVID-19 cases and thus relieve the healthcare system, the authorities in many countries began to introduce restrictions [6]. Emphasis was also placed on educating the population about ways of protecting themselves from becoming infected with the virus [12, 13]. The only hope of finding a solution to the problems faced by the health service was the development of a vaccine against the SARS-CoV-2 virus [14, 15]. In spite of mounting scientific evidence confirming the benefits of introducing restrictions and the use of vaccines, in many countries part of the population had a negative attitude towards individual methods used to fight the pandemic [16-18].

THE AIM

The aim of the study was to assess knowledge of the SARS-CoV-2 virus and attitudes toward the pandemic

among patients in seven European countries in the opinion of medical personnel.

MATERIAL AND METHODS

DESIGN

The design of the survey included the preparation of a database of questions and an analysis of their suitability for use with a group of emergency medical system employees. Initially, closed and open-ended questions were prepared, but due to the long time required to answer them, a design was prepared using a five-point Likert scale. After development, the questionnaire was validated using the McDonald test, obtaining a score >0.7, thus demonstrating that the questionnaire has a satisfactory level of reliability. Translation of the questionnaire into each language was carried out by two independent translators. To ensure that the content of the survey was not changed as a result of the translation, it was re-translated into the base language.

The study was conducted in accordance with the Declaration of Helsinki, and approved by Ethics Committee of the University of Bielsko-Biała (Decision no. 2020/03/1/1).

PARTICIPANTS

A total of 1984 doctors, paramedics and nurses from Czechia, Finland, Norway, Poland, Slovakia, Spain and

Table 1. Demographic characteristics of the study group.

	Number of participants (n = 1984)	Percentage
Country		
Czechia	117	5.9%
Finland	127	6.4%
Norway	345	17.4%
Poland	955	48.1%
Slovakia	136	6.9%
Spain	155	7.8%
United Kingdom	149	7.5%
Gender		
Female	786	39.6%
Male	1198	60.4%
Age		
18 – 30	701	35.3%
31 – 40	741	37.3%
41 – 50	390	19.7%
51 – 60	135	6.8%
over 60	17	0.9%
Profession		
Doctor	160	8.1%
Paramedic	1275	64.3%
Nurse	549	27.7%
Place of work		
Medical response team	1338	67.4%
Hospital emergency ward	646	32.6%
Work experience		
under 5 years	605	30.5%
6 - 15 years	857	43.2%
16 - 30 years	449	22.6%
over 30 years	73	3.7%

the United Kingdom participated in the study. The research was aimed at people employed in emergency response teams and hospital emergency wards. After initial analysis, the data from Denmark and Sweden was excluded as only two and three questionnaires respectively were received from these countries.

QUESTIONNAIRE

The research was conducted in March and April 2020 in the form of an anonymous internet questionnaire. The questionnaire included 24 questions. At the beginning was a clause relating to voluntary consent for participation in the research, as well as information about the research aims and the later use of the results in scientific publications. The next part of the questionnaire included questions relating to demographic data about the research participants. This required answers to questions on age, gender, profession, place of work and work experience. The main part of the questionnaire contained questions relating to the opinion of the study participants on the level of patients education and their attitudes toward the COVID-19 pandemic. To ensure the research results were objective, a five-point Likert scale was used to determine the strength of each phenom-

Table 2. Frequency of medical personnel in the countries researched encountering incorrect information shared by patients on ways of becoming infected with the SARS-CoV-2 virus.

Country	M	SD	Min	Max	Me	χ^2	df	p
						73.40	6	< 0.001
Czechia	2.74	1.11	1.00	5.0	3.0			
Finland	2.84	1.04	1.00	5.0	3.0			
Norway	3.04	1.00	1.00	5.0	3.0			
Poland	2.47	1.19	1.00	5.0	2.0			
Slovakia	2.63	1.19	1.00	5.0	3.0			
Spain	2.75	1.19	1.00	5.0	3.0			
United Kingdom	2.85	1.29	1.00	5.0	3.0			

Table 3. Opinion of medical personnel in the countries researched on patients following quarantine procedures.

Country	M	SD	Min	Max	Me	χ^2	df	p
						313.05	6	<0.001
Czechia	3.23	0.91	1.00	5.0	3.0			
Finland	3.05	0.75	1.00	5.0	3.0			
Norway	3.34	0.78	1.00	5.0	3.0			
Poland	2.50	0.82	1.00	5.0	2.0			
Slovakia	3.04	0.90	1.00	5.0	3.0			
Spain	3.08	0.94	1.00	5.0	3.0			
United Kingdom	2.49	0.93	1.00	5.0	2.0			

Table 4. Level of patients education in terms of the ways in which the SARS-CoV-2 spread in the opinion of medical personnel in the countries researched.

Country	M	SD	Min	Max	Me	χ^2	df	p
						37.44	6	<0.001
Czechia	2.82	1.01	1.00	5.0	3.0			
Finland	2.79	1.17	1.00	5.0	3.0			
Norway	3.16	1.16	1.00	5.0	3.0			
Poland	3.26	1.24	1.00	5.0	3.0			
Slovakia	2.97	1.12	1.00	5.0	3.0			
Spain	3.06	1.02	1.00	5.0	3.0			
United Kingdom	3.03	1.07	1.00	5.0	3.0			

Table 5. Need to tighten sanitary restrictions in the opinion of medical personnel in the countries researched.

Country	M	SD	Min	Max	Me	χ^2	df	p
						372.86	6	< 0.001
Czechia	3.38	1.14	1.00	5.0	3.0			
Finland	3.67	1.01	1.00	5.0	4.0			
Norway	3.42	1.05	1.00	5.0	3.0			
Poland	4.27	0.98	1.00	5.0	5.0			
Slovakia	3.81	0.96	1.00	5.0	4.0			
Spain	2.76	1.25	1.00	5.0	3.0			
United Kingdom	4.26	0.95	1.00	5.0	5.0			

Table 6. Correlation of answers on the need to tighten sanitary restrictions with the remaining three answers.

Country	Questions asked								
	Sharing of incorrect information by patients			Following of quarantine procedures by patients			Patients education in terms of the ways in which the SARS-CoV-2 spread		
	rho	p	n	rho	p	n	rho	p	n
Czechia	0.014	0.882	117	-0.065	0.488	117	0.095	0.310	117
Finland	-0.079	0.380	127	-0.199	0.025	127	-0.004	0.966	127
Norway	-0.028	0.610	345	-0.063	0.240	345	0.051	0.346	345
Poland	-0.099	0.002	955	-0.178	0.000	955	0.132	0.000	955
Slovakia	-0.093	0.279	136	-0.285	0.001	136	-0.081	0.349	136
Spain	0.239	0.003	155	0.181	0.024	155	-0.062	0.442	155
United Kingdom	-0.041	0.615	149	-0.254	0.002	149	-0.016	0.843	149

enon using the numbers 1 to 5. Using the above scale, the research participants answered, amongst others, four questions: "Do you often encounter situations in which patients share incorrect information on the ways of becoming infected with SARS-CoV-2?" (1 – very often, 5 - never); "In your opinion, are quarantine procedures among patients infected with SARS-CoV-2 correctly followed?" (1 - never, 5 - always); "In your opinion, are patients suitably well educated about the ways in which the SARS-CoV-2 virus can spread?" (1 – very well, 5 – not at all); "Do you think that the sanitary restrictions in place in your country should be tightened in order to provide relief for and improve the functioning of the healthcare system during the pandemic?" (1 – they should not be tightened, 5 – they should be strongly tightened).

DATA COLLECTION

The questionnaires were made available in each country in the form of a link with a reference to the Google questionnaire. Social media was used for this purpose. Due to the heavy workload of medical personnel during the COVID-19 pandemic, it was decided that the online questionnaire form was the most accessible way to obtain reliable responses.

STATISTICAL METHODS

During statistical analysis of the results, the assumed significance level was $p < 0.05$. The non-parametric Kruskal-Wallis and U Mann-Whitney tests were used for analysis of the qualitative variables according to group. To determine which differences between the test groups were significant, the post hoc Bonferroni pairwise comparison test was used. Selection of the most suitable test was done based on the variable distribution, which was verified with the Shapiro-Wilk test. As the distribution of tested variables differed significantly from the normal distribution, the Spearman correlation coefficient was applied to assess the co-dependency of the quantitative variables. The calculations were carried out using the R statistical environment - version 3.6.0, PSPP software and MS Office 2019.

RESULTS

Table 1 presents the demographic characteristics of the study group.

Table 2 presents how often medical personnel in the countries researched encountered incorrect information shared by patients on ways of becoming infected with the SARS-CoV-2 virus.

The differences in the frequency of patients sharing incorrect information between countries were statistically significant ($p < 0.001$). Such behaviour was most frequently mentioned by personnel in Poland, and most seldom by personnel in Norway.

Table 3 presents the opinion of medical personnel in the countries researched on patients following quarantine procedures.

The differences in the opinion of medical personnel in the countries researched on patients following quarantine procedures were statistically significant ($p<0.001$). The following of procedures by patients was most positively reported by medical personnel in Norway, and most negatively by personnel in the United Kingdom.

Table 4 presents the opinion of medical personnel in the countries researched on the level of patients education in terms of the ways in which the SARS-CoV-2 spread.

The differences in the opinion of medical personnel in the countries researched of the level of patients education in terms of the ways in which the SARS-CoV-2 spread were statistically significant ($p < 0.001$). The patients was assessed to be the most highly educated in Finland, and the most poorly in Poland.

Table 5 presents the opinion of medical personnel in the countries researched on the need to tighten sanitary restrictions in order to provide relief for the healthcare system.

The research demonstrated significant differences in the opinion of medical personnel in the countries researched on the need to tighten sanitary restrictions in order to provide relief for the healthcare system. The need for tightening restrictions was indicated most often by personnel in Poland, and most seldom by personnel in Spain.

Assessment was made of the correlation between the question relating to the need to tighten sanitary restrictions and questions relating to the sharing of incorrect information by patients, the following of quarantine procedures by patients, and patients educating. The results of the correlation are presented in Table 6.

Statistical analysis demonstrated a significant correlation in two countries between answers relating to the need to tighten sanitary restrictions and answers relating to the sharing of incorrect information by patients. The research showed a significant positive correlation in Spain and a significant negative correlation in Poland. This means that medical personnel in Spain to a significantly higher degree indicated the need to tighten sanitary restrictions, while indicating that incorrect information was shared by patients less often. Medical personnel in Poland indicated to a significantly higher degree the need to tighten sanitary restrictions, while indicating that incorrect information was shared by patients more often.

A significant correlation was demonstrated in five countries between answers on the need to tighten sanitary restrictions and answers on the following of quarantine procedures by patients. The research showed a significant positive correlation in Spain and a significant negative correlation in Finland, Poland, Slovakia and the United Kingdom. This means that medical personnel in Spain to a significantly higher degree indicated the need to tighten the sanitary restrictions, while indicating that quarantine procedures were not followed by patients less often. Medical personnel in Finland, Poland, Slovakia and the United Kingdom to a significantly higher degree indicated the need to tighten the sanitary restrictions, while indicating that quarantine procedures were not followed by patients more often.

Statistical analysis demonstrated a significant correlation in one country between answers relating to the need to tighten sanitary restrictions and answers relating to patients educating on ways in which the SARS-CoV-2 virus can spread. The research showed a significant positive correlation in Poland. This means that medical personnel in Poland to a significantly higher degree indicated the need to tighten sanitary restrictions, while indicating a low level of patients education on ways in which the SARS-CoV-2 virus can spread.

DISCUSSION

There are no similar studies in the literature on the subject. This is an innovative study conducted during a pandemic. Therefore, it is impossible to compare our own results with other scientific studies.

The SARS-CoV-2 pandemic had a significant impact on the functioning of healthcare facilities. A particular burden was placed on the shoulders of hospital emergency ward personnel and emergency medical response teams in the carrying out of their duties [11]. Of undisputable assistance in the work of such personnel would be for patients to provide reliable answers during medical consultations [19]. Our research has shown that medical personal in all the countries studied were relatively frequently faced with the sharing of incorrect information by patients during epidemiological consultations. Such situations were encountered particularly frequently by personnel in Poland. Patients' behaviour in not sharing key information or not telling the truth can make the implementation of the appropriate action by medical personnel more difficult [19].

Quarantine procedures involve maintaining isolation with regard to the person who is suspected of carrying an infectious disease. Currently, the aim of imposing the required following of quarantine procedures is mainly to prevent the spread of the SARS-CoV-2 virus among the general population. In individual countries, the way this should be followed and recommendations depend on the decisions of local authorities [20]. Our research has shown that medical personnel in the countries studied gave an average assessment of the following of quarantine procedures by patients. Significantly, negative opinions in this regard were most frequently found in personnel in Poland and the United Kingdom. Failure to abide by quarantine principles can lead to an increase in

the number of cases of COVID-19, and thus create further difficulties in the functioning of healthcare facilities during the pandemic [20].

One of the ways of fighting the COVID-19 pandemic is appropriate education of the general population on ways of ensuring protection against infection with the SARS-CoV-2 virus [12, 13]. Such action is often undertaken by the mass media, supported by the scientific community [13]. Our research has shown that medical personnel in the countries studied, to a greater or lesser degree, noted insufficient knowledge among the patients on ways in which the SARS-CoV-2 virus can spread. This can have a direct effect on the increase in the number of infections [12]. Allen et al. [21] claim that a lack of knowledge about the virus can influence the unwillingness to be vaccinated against COVID-19.

As one of the ways of fighting the COVID-19 pandemic, the authorities in many countries began to introduce various restrictions on everyday life [6, 22]. Amongst others, these involved the requirement to wear masks, maintain social distancing, a ban on gatherings, and the introduction of remote working and studying [22]. Our research has shown that the medical personnel participating in the study most frequently had a positive assessment of the need to tighten sanitary restrictions. Such responses were found most often among personnel in Poland and the United Kingdom. This could have been connected to the increasing number of infections with the SARS-CoV-2 virus in the countries studied during the research. It was also shown that opinions on the need to tighten sanitary restrictions in Poland had a significant relationship with opinions suggesting a higher rate of the sharing of incorrect information by patients and their poor level of knowledge about the virus. Meanwhile, opinions on the need to tighten sanitary restrictions in Finland, Poland, Slovakia and the United Kingdom had a significant relationship with opinions on patients not following quarantine procedures. This type of correlation between the results may result from the belief among medical personnel in these countries that if the patients lacks knowledge about the pandemic or has the wrong attitude towards it, then sanitary restrictions must be tightened. Certain differences in this regard were noted in opinions from personnel in Spain. Even if medical personnel in this country did not often encounter the sharing of incorrect information by patients or the failure of patients to comply with quarantine procedures, they still indicated the need to tighten sanitary restrictions. During the research, Spain saw a dramatic rise in the number of infections and deaths from COVID-19, which could have convinced the research participants that no matter the circumstances, the sanitary restrictions had to be tightened.

LIMITATIONS

The authors of the study realize that the main limitation of the study was that it was conducted in the form of an online questionnaire. This was due to the epidemiological situation prevailing at the time of the research. A study conducted over a different time period would have allowed for more responses.

CONCLUSIONS

Our research has shown significant differences between the answers provided by medical personnel in the countries studied. The results indicate that the research participants often encountered patients sharing incorrect information by, as well as not abiding by quarantine procedures. It was also shown that the medical personnel studied had a relatively low assessment of the patients knowledge on ways in which the SARS-CoV-2 virus can spread. What is more, the answers provided also indicate that the research participants as a rule supported the need to tighten sanitary restrictions in order to improve and relieve the healthcare system. The study authors suggest that in many countries, action should be intensified to promote a correct attitude among the general population towards the pandemic.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest.

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ORIGINAL ARTICLE

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THE IMPACT OF THE SARS-COV-2 PANDEMIC ON HOSPITAL ADMISSIONS AND DIAGNOSIS OF EMERGENCY PATIENTS

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ABSTRACT

Aim: To assess the impact of the pandemic on the number and mode of admissions and diagnoses in emergency patients transferred by emergency medical services.

Material and methods: Data provided by the National Health Fund on the number and mode of hospital admissions and diagnoses according to Uniform Patient Group sections A C D E F G H J K L M Q S for patients admitted in an emergency after being transferred by emergency medical services between March 1 and December 31, 2020 were assessed. The data were analysed by month and compared with the report for the period of March 1 to December 31, 2019.

Results: In the analysed period in 2020, the number of hospital admissions dropped by 79,867 cases (17.90%), including by 72,784 (21.14%) for conservative cases and by 7,083 (6.96%) for invasive cases. The highest number of hospital admissions was recorded in March (41,505, 11.33%), including conservative cases (32,005, 11.79%), and the highest number of surgical admissions was seen in July (10,799, 11.39%). In November, the largest decrease in the number of admissions (28,763, 7,85%), including conservative (21,140, 7.78%) and surgical (7,623, 8.04%) admissions, and the number of ICD-10 diagnoses in sections A, C, E, F, G, H , J, K, L, Q, and in sections D and S was recorded in April.

Conclusions: The number of conservative and surgical hospital admissions decreased in the investigated period.

KEY WORDS

SARS CoV-2 pandemic, emergency hospital admissions, ICD-10 diagnoses

INTRODUCTION

The SARS-CoV-2 pandemic may have contributed to changes in the number of hospital admissions, medical procedures performed and diagnoses made in patients transported by emergency medical services (EMS) and admitted to hospitals as emergency cases. As indicated by other researchers, the number of ambulance dispatches, and thus the number of hospital admissions, including emergency cases, decreased in 2020. However, these observations are limited to selected months rather than the entire year [1, 2].

Data collected by medical entities and the National Health Fund (NFZ) on the number and mode of hospital admissions and diagnoses according to the unified catalogue of Homogeneous Patient Groups (HPG) enable the settlement of benefits, and are a valuable source of information for observations and scientific research to assess the impact of the pandemic on the healthcare sector. Although the number of such observations is restricted, their findings may prove useful in limiting the impact of further increases in the incidence on the health care system in patients, including those not infected with SARS CoV-2 [3, 4].

THE AIM

The aim of the study was to assess the impact of the SARS CoV-2 pandemic on the number and mode of hospital admissions and diagnosis in emergency patients transferred by emergency medical services.

MATERIAL AND METHODS

We assessed National Health Fund (NHF) data on the number and mode of hospital admissions as well as diagnoses by section classification, i.e. groups created within the anatomical and physiological system related to the clinical area or the field of medicine, for the purposes of HPG classification, which were made in emergency patients transported by EMSs between March 1 and December 31, 2020.

The following sections of diagnoses were considered for the research: A C D E F G H J K L M Q S. Importantly, the acronyms of the National Health Fund (NHF) data for HPGs are not equivalent to the international codes for diseases and related health problems (ICD-10).

The exact meaning of each acronym and its ICD-10 equivalent are shown in Table 1.

The obtained data were analysed by month and compared with the report for the period of March 1, 2019 to December 31, 2020. The obtained results were analysed statistically. Results concerning quantitative variables are presented as average values ± standard deviation. Qualitative variables are presented as quantities (n) and percentage values of the whole group (%), while proportions in groups were assessed with a chi-squared test.

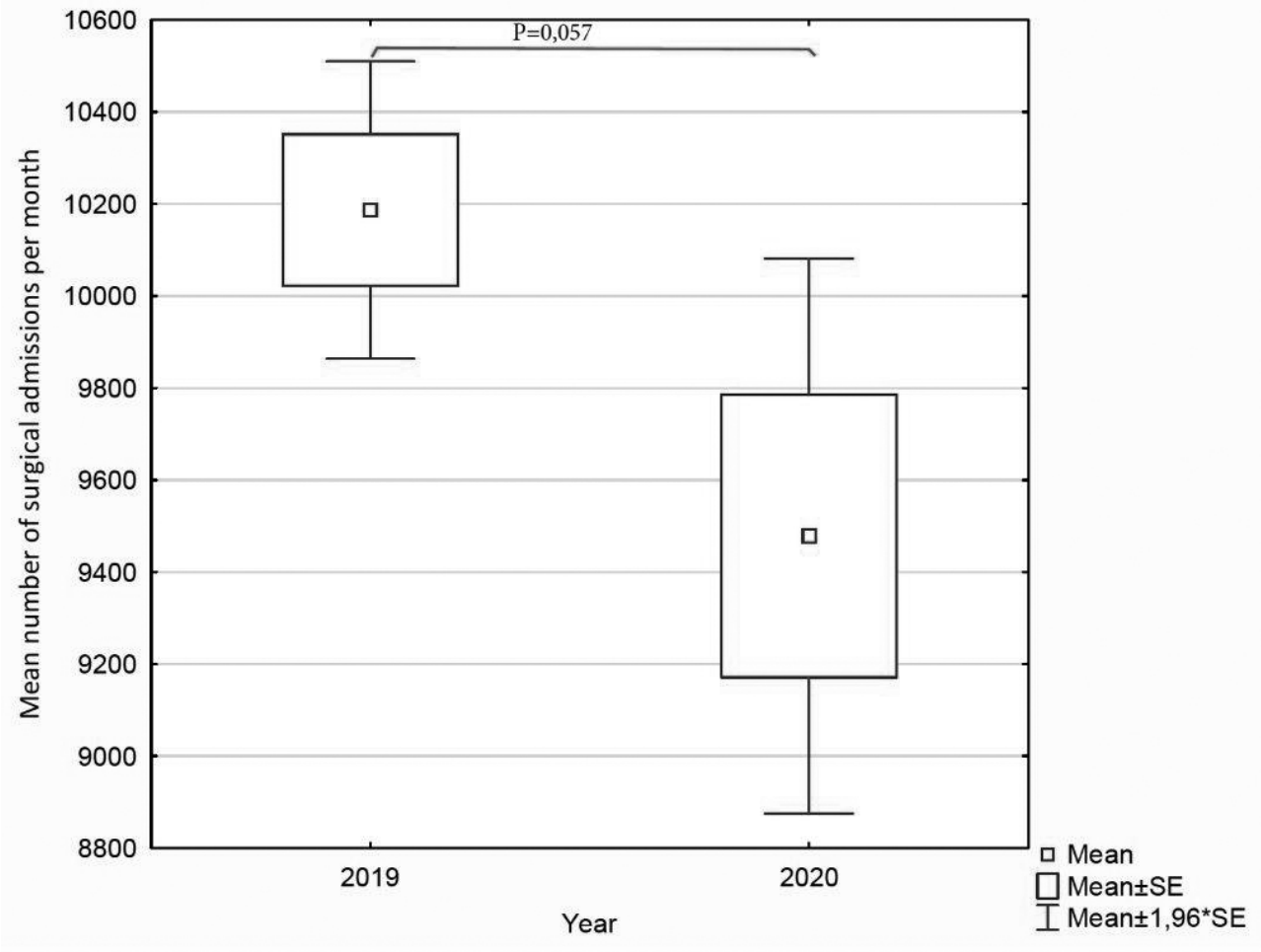

Fig. 1. Mean number of surgical admissions per month according to study group (2019 vs. 2020 year).

Table 1. HPG acronyms and ICD-10 [5, 6].

Acronym	HPG	ICD-10
A	Diseases of the nervous system,	Infectious diseases
C	Diseases of the face, oral cavity, throat, larynx, nose and ears	Neoplasms
D	Respiratory diseases	Diseases of the blood
E	Heart diseases	Endocrine disorders
F	Gastrointestinal diseases	Mental and behavioural disorders
G	Diseases of the liver, bile ducts, pancreas and spleen,	Diseases of the nervous system
H	Musculoskeletal diseases	Eye and ear disorders
J	Diseases of the breast, skin and burns	Respiratory diseases
K	Endocrine diseases	Gastrointestinal diseases
L	Diseases of the kidneys and urinary tract	Diseases of the skin and subcutaneous tissue
M	Diseases of the reproductive system	Diseases of the musculoskeletal system
Q	Vascular diseases	Developmental defects
S	Hematopoietic diseases, poisoning and infectious diseases	injuries

The t test was used to compare characteristics of hospital admissions. Statistica 13 software (StatSoft Inc., Tulsa, OK) was used in the statistical analysis. P<0.05 was set as the significance level.

RESULTS

The analysis covering the period from March 1 to December 31 showed that the number of hospital admissions was 366,310 in 2020 and 446,177 in 2019 (P =0.260). There were 271,526 conservative admissions (74.12%) and 94,784 surgical admissions (25.97%) in 2020 compared to 344,310 conservative admissions (77.17%) and 101,867 surgical admissions (22.83%) in 2019. According to the observations, the number of hospital admissions in 2020 decreased by 79,867 (17.90%), including conservative admissions by 72,784 (21.14%) and surgical admissions by 7,083 (6.95%). Monthly surgical admissions were 10,187 ± 521 patients in 2019, and 9,478 ± 972 patients in 2020 (P = 0.057) (Fig. 1. - monthly conservative admissions were 34,431 ± 1,583 patients in 2019 and 27,153 ± 3,430 patients in 2020 [P <0.001] – Fig. 2).

The dynamics of SARS CoV-2 cases showed monthly variations, therefore the number and type of hospital admissions in individual months of the year was another analysed criterion.

Our data showed that in the investigated period, the highest and the lowest numbers of admissions were recorded in March (41,505, 11.33%) and November (28,763, 7.85%), respectively. In 2019, the highest number of hospital admissions was recorded in October (47,058, 10.55%), and the lowest in September (41,062, 9.20%). In 2020, the highest number of conservative admissions was recorded in March (32,005, 11.79%) and the fewest admissions were reported in November (21,140, 7.78%), while in 2019, the highest and the lowest number of conservative admissions was recorded in October (36,381, 10.56%) and September (31,425, 9.13%), respectively. The number of invasive hospital admissions recorded in 2020 was 94,784 and was lower by 7,083 (6.95%), with the highest number of admissions in July (10,799, 11.39%), and the lowest in November (7,623, 8.04%). In 2019, the highest and the lowest number of invasive admissions was reported in July (11,045, 10.84%) and November (9,498, 9.32%), respectively (Fig. 3).

The diversified number of cases and the resulting dysfunctions could have influenced EMS dispatches and the

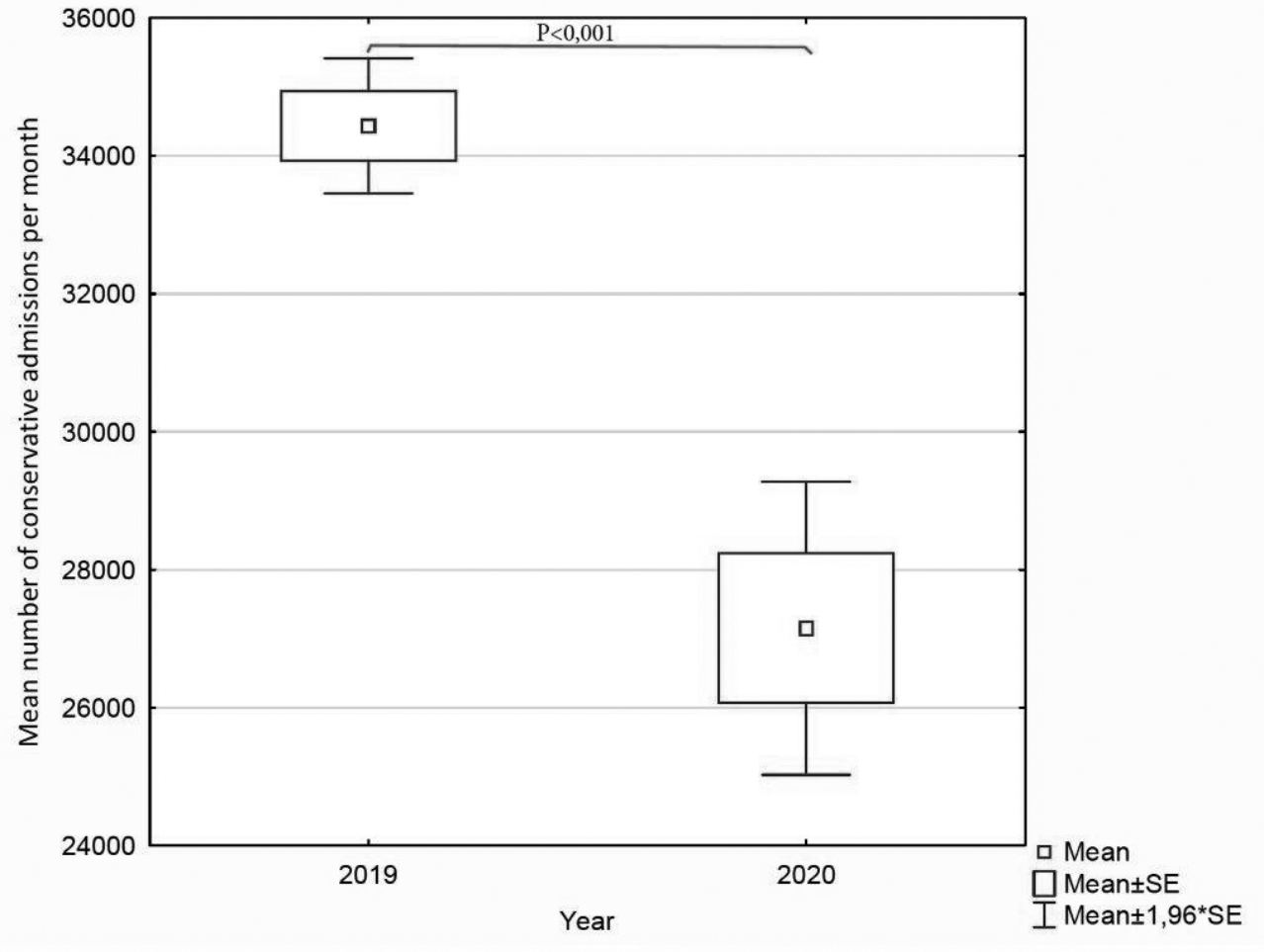

Fig. 2. Mean number of conservative admissions per month according to study group (2019 vs. 2020 year).

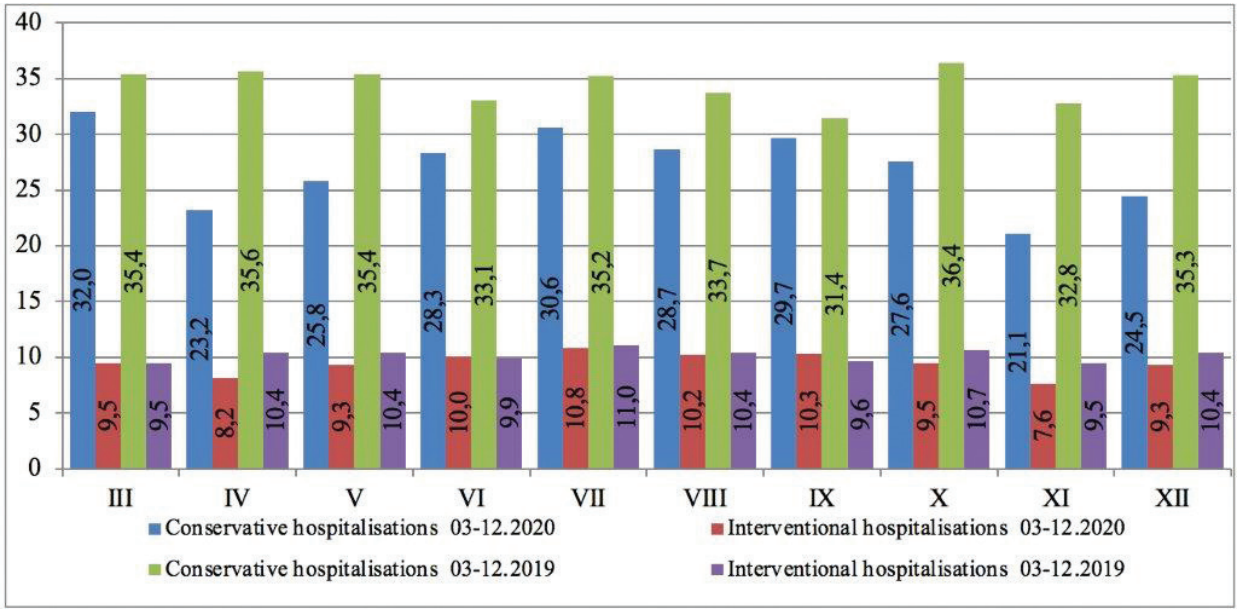

Fig. 3. Invasive and conservative admissions (thousands) in the investigated period by month.

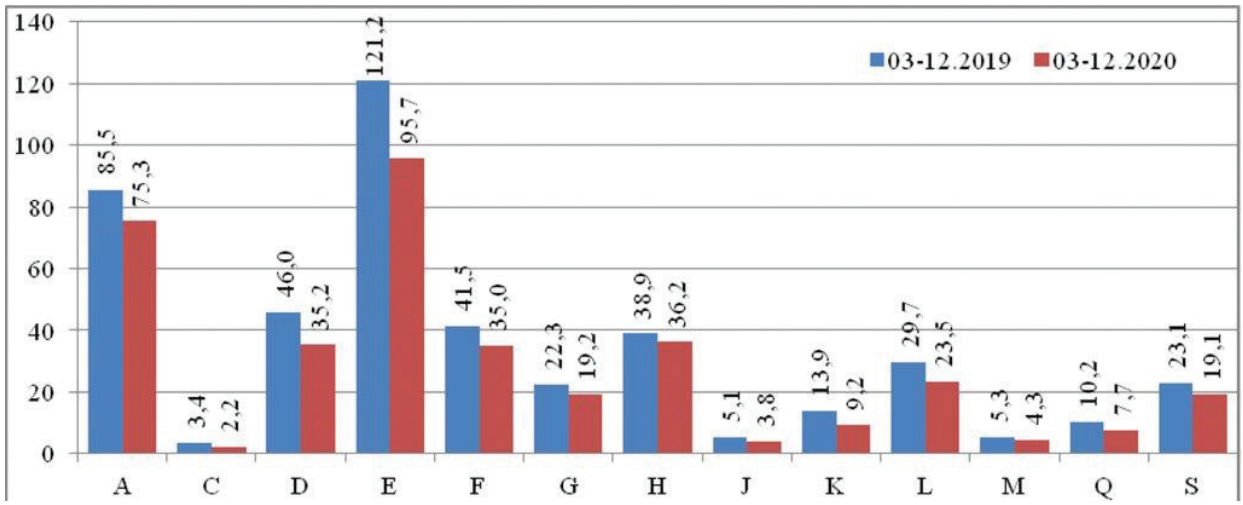

Fig. 4. Interventional and conservative hospitalisations (thousand) by HPG sections in the analysed period of March-December 2019 and March-December 2020 [7].

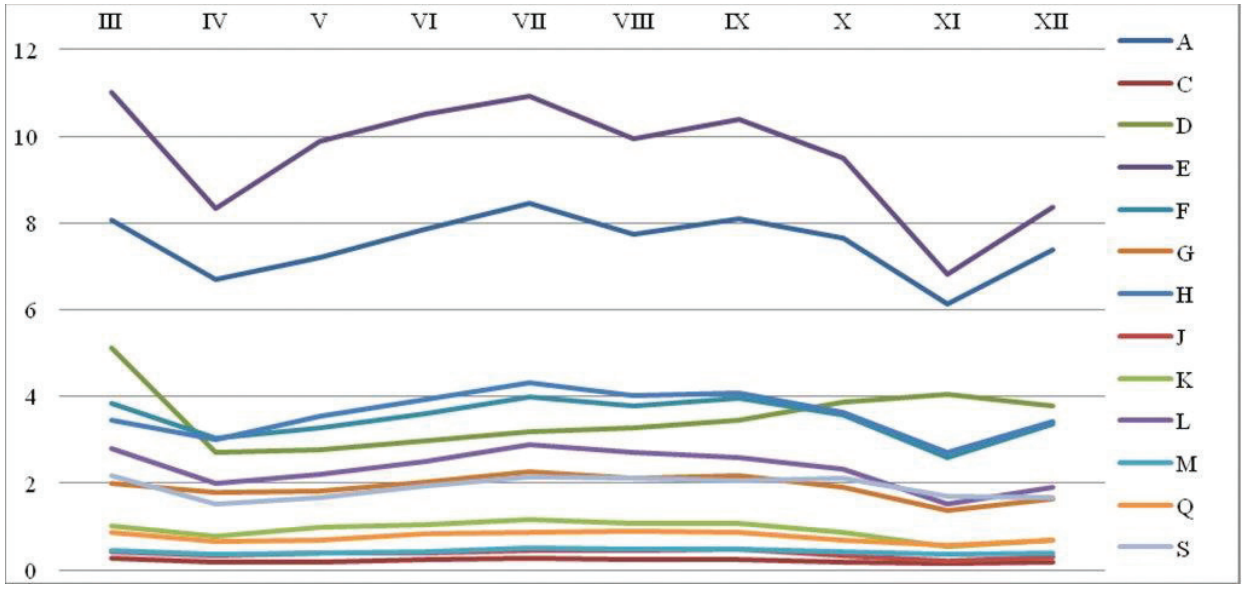

Fig. 5. Invasive and conservative procedures (thousands) by HPG sections and by month (March to December 2020) [7].

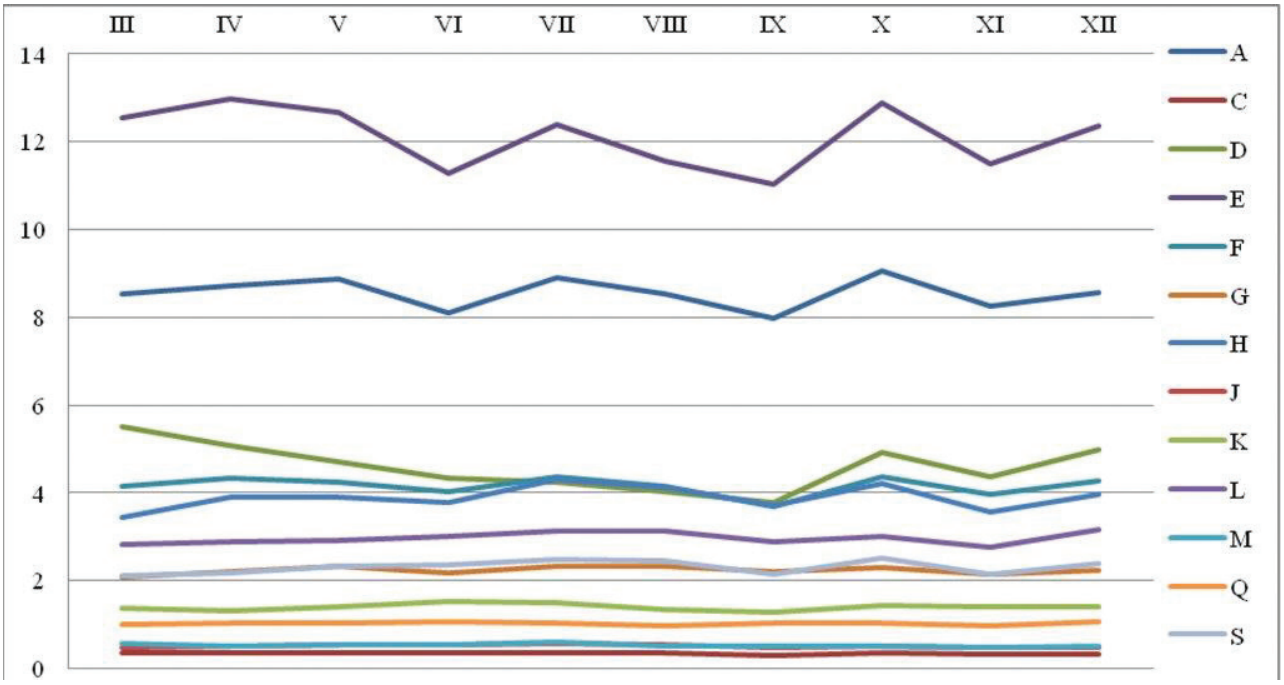

Fig. 6. Invasive and conservative procedures (thousands) by HPG sections and by month (March to December 2019) [7].

diagnostic profile during hospitalisation, hence medical diagnoses made during hospital treatment were analysed by sections, i.e. clinical groups in the anatomical and physiological system.

A decrease in the number of all diagnoses in 2020 compared to the number recorded in 2019 was found in the analysed HPG sections. Considering the individual sections, this decrease was as follows: A - 10,217 diagnoses (11.95%) (P=0.673), C - 1,179 (34.86%) (P=0.004), D - 10,753 (23.39%) (P= 0.404), E - 25,507 (21.05%) (P=0.166), F - 6,505 (15.67%) P=0.020), G - 3157 (14.15%) (P=0.446), H - 2729 (7.01%) (P=0.798), J - 1320 (25.84%) (P=0.049), K - 4729 (9.47%) (P=0.224), L - 6213 (20.91%) (P=0,412), M - 1037 (19.54%) (P=0.254), Q - 2586 (25.26%) (P=0.015) and S - 3935 (17.06%) (P=0.573). The analysis showed that the largest drop in the number of diagnoses was recorded for sections C and J, while the smallest decrease was shown in sections H and K (Fig. 4).

The variability in the number of dispatches in the individual months could result from the varying monthly number of cases and had an effect on the number and the catalogue of diagnoses made during hospital stays, hence the diagnoses were analysed by section and by month.

Based on the conducted research, it was shown that in the analysed period, out of 75,315 diagnoses recorded in section A, this number was the highest in July (8,442, 11.21%), and the lowest in November (6,145, 8.16%), while in 2019, out of 85,532 diagnoses, this number was the highest in October (9,055, 10.58%) and the lowest in September (7,979, 9.33%). In section C, out of 2,203 diagnoses, the highest number was recorded in July (276, 12.53%), while the lowest in November (148, 6.72%). In 2019, this number was 3,372 and was the highest in May (358, 10.62%), and the lowest in September (297, 8.81%). In section D, out of 35,227 diagnoses, the largest number was recorded in March (5,120, 14.53%), and the lowest in April (2,724, 7.73%), while in 2019 this number was the highest in March (5,498 out of 45,980, 11.96%), and the lowest in September (3,789, 8.24%). The majority of the 95,682 diagnoses from section E in 2020 were recorded in March (11,013, 11.51%), and the least in November (6,810, 7.12%). For comparison, there were 121,189 diagnoses in 2019, most of which were made in April (12,970, 10.71%), and the least in September (11,046, 9.11%). Out of 35,014 diagnoses made in 2020, the highest number of F-section diagnoses was reported in July (3,979, 11.36%), and the lowest in November (2,583, 7.38%). In 2019, out of 41,519 diagnoses from this section, the largest number was made in July (4,378, 10.54%), and the lowest in September (3,692, 8.89%).

Our observations have shown that out of 19,155 G-section diagnoses, the largest number was made in July (2,254, 11.77%), and the lowest in November (1,380, 7.20%). In 2019, there were a total of 22,312 diagnoses form this section, with the highest number in August (2,339, 10.48%), and the lowest in March (2,077, 9.31%). Out of 36,168 H-section diagnoses, the highest number was recorded in July (4,307, 11.91%), and the lowest in November (2,725, 7.53%), while in 2019 this number was 38,897 and was the highest in July (4,314, 11.09%), and the lowest in March (3430, 8.82%).

Out of the total number of 3,788 J-section diagnoses reported in 2020, the majority were recorded in September (474, 12.51%), and the least in November (225, 5.94%). In 2019, 5,108 J-section diagnoses were recorded, with the highest number in July (570, 11.16%), and the lowest in September (464, 9.08%). Our observations have shown that there were 9,203 K-section diagnoses in the inves-

tigated period, with the highest number in July (1,158, 12.58%), and the lowest in November (545, 5.92%). Out of the 13,932 K-section diagnoses in 2019, most were recorded in June (1,510, 10.84%), and the least in September (1,287, 9.24%). Out of the 23,499 L-section diagnoses in 2020, most were recorded in July (2,880, 1.22%), and the lowest number was recorded in November (1,527, 6.50%), while in 2019, 29,712 diagnoses from this section were recorded, with the highest number in December (3,162, 10.64%), and the lowest number in November (2765, 9.31%). As for the M section, most of the 4,271 diagnoses were recorded in July (505, 11.82%), and the least in November (356, 12.55%), while there were a total of 5,308 diagnoses in 2019, including the highest number in July (597, 11.25%), and the lowest in November (487, 9.17%).

Out of 7,652 Q-section diagnoses, the highest number was recorded in August (898, 11.73%), and the lowest in November (561, 7.33%). In the same observation period in 2019, the highest number of diagnoses in this section was reported in December (1061 out of 10,238; 10.36%), and the lowest in November (954, 9.32%). In 2020, out of 19,133 S-section diagnoses, the majority were recorded in March (2166, 11.32%), and the least in April (1519, 7.94%). In 2019, out of the total of 23,068 diagnoses from this section, the majority were recorded in October (2508, 10.87%), and the least in March (2103, 9.11%) (Fig 5-6).

DISCUSSION

The data analysis showed that the number of emergency admissions of patients transported by EMS decreased by 79,867 thousand (17.90%) in the period from March 1 to December 31, 2020, including by 72,784 admissions (21.14%) for conservative mode and by 7,083 admissions for the invasive mode (6.95%), which resulted in a reduced number of diagnoses. The decrease in the number of recorded diagnoses was the largest in section C and decreased by 1,179 diagnoses (34.86%), and section J, where the number of diagnoses decreased by 1,320 (25.84%). In November, the largest monthly decrease in the number of hospital admissions and diagnoses was by 28,763 admissions (32.15%), including by 21,140 (7.78%) for conservative admissions and by 7,623 (8.04%) for invasive admissions. Also in November, the fewest diagnoses were recorded in sections A, C, E, F, G, H, J, K, L, Q, while in April in sections D and S.

The obtained results correlate with those presented by other researchers from Poland and abroad, as well as with the reports of the Central Statistical Office and the National Monitoring Centre for Emergency Medical Services (Krajowe Centrum Monitorowania Ratownictwa Medycznego, KCMRM). Kucap et al. showed that in the period 15th March – 15th May 2020, compared to the same period in 2018-2019, the number of EMS dispatches in Poland decreased by 25%, from 550,815 to 400,878, by 22-33% in each province, regardless of the reason for the dispatches, with the exception of dispatches for sudden cardiac arrest (increase from 4,518 to 5,084) [8].

The analyses of the Central Statistical Office showed that the number of dispatches was 2.76 million in 2020 and was lower by 341.1 thousand (11%) compared to 2019. The number of patients managed by EMS also decreased and was 2.763 million, i.e. lower by 11.4% compared to 2019 (356,000). The percentage of persons per 1,000 population who were assisted by EMS was 72.1 in 2020 compared to 81.3 in 2019. The decrease in the number of hospital admissions and diagnoses shown in the present research is associated with a decrease in the number of EMS dispatches. This applies to incidents in road traffic (1,504,000 vs. 1,133000), workplaces (68.4000 vs. 53.3000), schools (32.1000 vs. 13.5000), patients' homes (22,378,000 vs. 21,48,000) and other sites (6,112,000 *vs*. 4,307,000).

Considering two age categories:

- 0-18 year-olds (1,884,000 vs. 1,256,000);
- >65-year-olds (14,154,000 vs. 13,596,000).

The decrease in the number of hospital admissions may have also resulted from the increase in the number of ambulance trips to patients not in a state of sudden health risk and not requiring hospitalisation, who were provided with assistance at the scene of an event. This percentage was 20.4% in 2019, and increased to 55.9% in 2020 [9].

Disturbing observations in this area were reported by Gąsior et al., who showed that the number of diagnosed myocardial infarctions among EMS patients in the region of Silesia, Opole and Podlasie decreased in the years 2019-2020, in the period from March 9 to April 16. There was a decrease of 22.3% (533 vs. 414) and 11.7% in the number of reports related to chest pain (6564 vs. 7307). This may indicate the scale of anxiety among patients, fear of infection, but also society's unawareness about the possible causes and effects of delays in the event of myocardial infarction and insufficient media coverage of how emergency services and medical facilities function in the era of the pandemic and the introduced restrictions [10].

A 2020 decrease in the number of patients admitted to hospitals was also demonstrated in the USA. In their study, Birkmeyer et al. showed in a group of 505,560 patients that in the period February-April 2020, compared to 2019, the number of non-COVID-19 admissions decreased by over 20%, and among the Hispanic community by over 32%, including by 44% for pneumonia, 40% for bronchial asthma, 25% for sepsis, 24% for urinary tract infections and 22% for myocardial infarction. The authors of the study indicate the need to provide patients with acute and life-threatening symptoms with access to hospital care in order to avoid adverse effects and an increase in avoidable deaths [11].

Patients' concerns about the condition of healthcare facilities and the risk of infection are highlighted by the findings presented by other researchers. A study conducted by Laukannen et al. in the Northern Ostrobothnia region of Finland in March-April 2016-2020 showed a 5.7-13.6% decrease in the number of ambulance dis-

patches, a significant increase in the number of non-transported patients (39.9% vs. 36, 1%; P<0.001) and not requiring hospitalisation (42.2% vs. 39.1%; P<0.001) [12].

The decrease in the number of admissions and diagnoses recorded in our research, especially in the period of the highest number of cases, resulted from a reduced number of EMS dispatches and could have been dictated by patients' fears, misconceptions about the limited availability of ambulances following an example of changes introduced in primary healthcare facilities, as well as fear of contact with medical staff and other patients in healthcare facilities. The recorded decrease in the number of EMS dispatches, hospital admissions, including surgical ones, and the number of traffic accidents could have also resulted from the lockdown introduced on March 20, 2020, which limited catering, commercial, cultural, sports and recreational activities, as well as the reduced number of accidents in road traffic [13].

Our observations have shown that the fewest hospital admissions and diagnoses were recorded in November and April. The obtained results partly correspond to KCMRM data, which show that the number of emergency dispatches in Poland in 2020 was the lowest in December and November, i.e., 8.15% and 8.17%, respectively, of all 2,332 million dispatches in the year [14]. Data on the range, number, mode and causes of hospital admissions and EMS dispatches and their monthly variations may indicate trends and threats occurring during the pandemic, which was analysed by various researchers in other countries [15-18].

These data can also be a valuable source of information on the availability of the health care system, facilitating the development of solutions against the upcoming increase in infections, assessing the dynamics of the pandemic, and in the field of hospital care, they closely correlate with EMS interventions.

CONCLUSIONS

The number of conservative and invasive hospital admissions decreased. The largest drop in the number of diagnoses was found for diseases of the face, oral cavity, throat, nose and ears, as well as diseases of the breast, skin and burns. The largest drop in hospital admissions was recorded in November and April. The SARS-CoV-2 pandemic resulted in a decrease in elective procedures that did not take place as a result of the overloaded healthcare system due to the pandemic and its negative effects.

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CONFLICT OF INTEREST
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INFLUENCE OF THE WORKPLACE ON THE FEELING OF SAFETY AMONG EMERGENCY MEDICAL PERSONNEL IN SELECTED EUROPEAN COUNTRIES DURING THE COVID-19 PANDEMIC

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ABSTRACT

Aim: The COVID-19 pandemic is still a real threat to global public health. Medical personnel face new, previously unencountered challenges, and their feeling of physical and psychological safety is under threat. The aim of the paper is to examine the differences in the feeling of safety among emergency medical personnel during the COVID-19 pandemic in selected European countries.

Material and methods: The study group consisted of 1984 people working in the emergency medical services in seven countries. The research tool was a proprietary internet questionnaire, which prior to commencement of the research was validated using the Mc-Donald test, achieving a result of > 0.7, which underlines a satisfactory level of reliability. In the statistical analysis, a significance level of $p = 0.05$ was adopted. Analysis of the quantitative variables, presented by division into groups, was conducted using the non-parametric Mann-Whitney and Kruskal-Wallis tests. The choice of tests was conducted on the basis of the distribution of variables, verified by the Shapiro-Wilk test.

Results: During the COVID-19 pandemic, the feeling of safety among employees of the emergency medical services and the feeling of danger to health and life as a result of infection with the SARS-CoV-2 virus was varied and depended on the job position. Principles for observing the sanitary regulations and the level of fear of infection are at a similar level and depend on place of work.

Conclusions: Those most at risk from a lack of safety are emergency medical response teams.

KEY WORDS

COVID-19, pandemic, emergency medical response team, hospital emergency department, feeling of safety, emergency system, public health

INTRODUCTION

The COVID-19 pandemic caused by the SARS-CoV-2 virus caused unprecedented levels of psychological stress among people around the world, and still remains a threat to global public health. Medical personnel face new, previously unencountered challenges, and their feeling of physical and psychological safety is under threat [1]. The growing uncertainty and fear in the workplace are often the result of a lack of appropriate competencies required for completing assigned tasks. In addition, the low level of support, poor motivation on the part of superiors and also the loss of control over professional duties compound these negative feelings [2]. Above all, medics were faced with the danger of exposure to the SARS-CoV-2 virus, as an additional professional danger. This was worsened by limited hospital resources, longer shifts and the resulting disruptions to sleep and balance between professional and private life. The COVID-19 pandemic made it necessary to conduct emergency medical procedures differently to normal standards. Working with new and often changing working protocols, caring for very sick and rapidly worsening patients, as well as caring for colleagues who had also fallen ill, became a previously unseen test of psychological resilience [3, 4]. Another burden was fear of contact with the family members of patients in isolation, as well as a lack of sufficient communication and up-to-date information. All these factors have been determined as

principal elements contributing to physical and psychological exhaustion, stress, fear, a lack of a feeling of safety and professional burnout in all the medical services [5].

The COVID-19 pandemic placed a burden on healthcare systems all around the world, in particular on Emergency Medical Response Teams and Hospital Emergency Departments, which are often the first point of access to medical services, especially for serious conditions. It is in the emergency medical services that immediate engagement and concentration of additional resources and means are made in the fight with this new disease, and the subsequent natural fear among people working in the front line. The waves of infections with the SARS-CoV-2 virus occur during the peak of the flu season, which causes an additional burden in already difficult working conditions [6].

THE AIM

The aim of the paper is to investigate the differences in the feeling of safety among employees of the emergency medical services resulting from employment in Emergency Medical Response Teams and Hospital Emergency Departments in the face of the COVID-19 pandemic in selected European Union countries. It was assumed that the emergency medical services are organised in a similar way in European Union countries, and that the differences between working in A&E departments and Emergency Medical Response Teams can have an effect on the feeling of safety of employees in the exceptional situation created by the COVID-19 pandemic.

MATERIALS AND METHODS

The research was conducted during the COVID-19 pandemic, beginning on the 27th March 2020, and finishing on the 20th April 2020. The chosen form was an internet questionnaire, which ensured the anonymity of the respondents. To obtain coherent answers from all countries, the homogeneous committee translation method was used for the questionnaire text. Every questionnaire was translated into the appropriate language of a given country by two independent translators so as to limit the risk of respondents not understanding individual questions. The research tool was made available to respondents via suitable social media, as well as via information posted on the websites of the operational units engaged in conducting the research. The central unit coordinating the research was the Department of Emergency Medicine in the Faculty of Health Sciences at the University of Bielsko-Biała, Poland. The research project received the approval of the Ethics Committee (Decision no. 2020/03/1/1).

STUDY GROUP

The study group consisted of 1984 people working in the emergency medical services in seven countries – Poland, Czechia, Finland, Spain, Norway, Slovakia and the United Kingdom. The form of employment and competencies of employees of the emergency medical services in the selected European Union countries are not homogeneous. However, in all the countries included in the research, the healthcare system included hospital emergency departments and emergency medical response teams. The study group consisted of doctors, paramedics and nurses.

Table 1. Statistical analysis of study group.

Profession	Frequency	Percentage
Doctor	160	8.10%
Nurse	549	27.70%
Paramedic	1275	64.30%
Workplace	**Frequency**	**Percentage**
Hospital/A&E/	646	32.60%
Medical Response Team	1338	67.40%
Work experience	**Frequency**	**Percentage**
Up to 5 years	605	30.50%
6 - 15 years	857	43.20%
16 - 30 years	449	22.60%
More than 30 years	73	3.70%
Gender	**Frequency**	**Percentage**
Female	786	39.60%
Male	1198	60.40%
Age	**Frequency**	**Percentage**
18 -30 years	701	35.30%
31 - 40 years	741	37.30%
41- 50 years	390	19.70%
51 - 60 years	135	6.80%
Above 60 years	17	0.90%
Country	**Frequency**	**Percentage**
Czechia	117	5.90%
Finland	127	6.40%
Spain	155	7.80%
Norway	345	17.40%
Poland	955	48.10%
Slovakia	136	6.90%
United Kingdom	149	7.50%

INCLUSION AND EXCLUSION CRITERIA

An inclusion criterion for the research was obtaining a significant number of respondents, as well as answers to all the questions included in the questionnaire. After initial analysis, data from the beginning of the analysis was excluded from Denmark and Sweden, as a total of only 5 questionnaires were received from both these countries. Statistical data received from respondents in Czechia and

Finland was only for the professional groups of nurses and paramedics. Meanwhile, the results from Spain were limited to doctors and nurses. Respondents from Slovakia were excluded from the statistical analysis as all the respondents worked only in emergency medical response teams. The demographic characteristics of the study group are presented in Table 1.

METHODS AND RESEARCH TOOLS

The research tool was a proprietary internet questionnaire that was validated before the beginning of the research using the Ω Mc-Donald test, achieving a result of > 0.7, which underlines the satisfactory level of its reliability [7]. The questionnaire consisted of three parts and included 24 questions in total. The first part referred to the research aim, a voluntary consent clause for participation in the research, as well as information about the use of the results in further scientific papers. The second part contained questions to determine the demographic characteristics of the participants, that is: profession, workplace in the healthcare system, work experience, age and gender. The third part was linked to questions about the feeling of safety while administering emergency medical procedures during the pandemic. In order to verify the posed research hypothesis, analysis was conducted of respondents answers to the questions: 'Do you feel safe administering medical procedures on patients with suspected COVID-19?', 'In your opinion, how great a threat is there to your health and life in the case of infection with COVID-19?', 'In your opinion, are the rules regarding sanitary restrictions (in your workplace) observed by the medical services?', 'Are you afraid that you will fall ill with COVID-19?' In order to objectivize the answers, a five-point Likert scale was used to determine the intensity of a given phenomenon, from its absence (1 - in order: I do not feel safe, ever, at all, never) to a very high intensity (5 - in order: I feel very safe, very strongly, always, very much). The individual questions contained in the questionnaire were formulated in a simple way so that answers could be provided in the shortest time possible. For each country included in the research, statistical correlation was conducted between the degree of feeling of safety experienced by the respondents while administering emergency medical procedures and their workplace. So as to obtain reliable answers, the committee translation method was used when translating the questionnaire into the required languages. Every questionnaire was translated into the required language by two independent translators, and for validation purposes was then translated into the base language so as to limit as far as possible the risk of respondents not understanding individual questions [8].

STATISTICAL ANALYSIS

In the statistical analysis, a significance level of p = 0.05 was adopted. Analysis of the quantitative variables, presented by division into groups, was conducted using the non-parametric Mann-Whitney and Kruskal-Wallis tests. As part of the post hoc Bonferroni test, pairwise comparison was used in order to determine which differences between the groups studied were significant. The choice of tests was conducted on the basis of the distribution of variables, verified by the Shapiro-Wilk test. The calculations were carried out in the R version 3.6.0 statistical environment, PSPP software and MS Office 2019.

RESULTS

Table 2 presents analysis of the feeling of safety among medics according to workplace in the emergency medical services of individual countries. During the research, no statistically significant differences were found in this regard (p>0,05), however, it was shown that the greatest differences in the feeling of safety between medics working in A&E and medical response team (MRT) personnel were in Finland (A&E M=3.13, MRT M=2.92).

Table 2. Level of feeling of safety among emergency medical service personnel while administering medical procedures to patients with suspected COVID-19.

				Descriptive statistics				
Country	Workplace	U	p	M	SD	Min	Max	Me
Poland	A&E	106535.00	0.393	1.91	1.03	1.00	5.00	2.00
	MRT			1.93	0.97	1.00	5.00	3.00
Czechia	A&E	1569.50	0.899	2.88	0.98	1.00	5.00	3.00
	MRT			2.91	1.06	1.00	5.00	3.00
Finland	A&E	423.00	0.587	3.13	0.83	2.00	4.00	3.00
	MRT			2.92	1.13	1.00	5.00	3.00
Spain	A&E	1512.0	0.412	2.57	1.09	1.00	5.00	3.00
	MRT			2.42	1.21	1.00	5.00	2.00
Norway	A&E	2556.50	0.838	3.44	1.26	1.00	5.00	3.50
	MRT			3.52	0.99	1.00	5.00	4.00
United Kingdom	A&E	1615.0	0.578	2.31	1.11	1.00	5.00	2.00
	MRT			2.18	1.01	1.00	5.00	2.00

U – test statistic; p – statistical significance; M – mean; SD –standard deviation; Me – median; Min – minimum result; Max – maximum result

Additionally, it was found that among the respondents from all the countries, the greatest feeling of a lack of safety was experienced by both A&E and MRT personnel in Poland. Those who felt the safest were medics from Norway, irrespective of their place of work.

Table 3 presents the level of the feeling of danger to health and life due to infection with SARS-CoV-2 among medics from individual countries according to workplace. Significant statistical differences were observed only in Finland, where emergency medical response team personnel perceived a greater danger to health and life during the COVID-19 pandemic than medics working in hospital A&E departments.

Table 4 presents the statistical dependency between the degree of observation of sanitary regulations by medics in correlation with the place of work in the medical emergency services in the studied populations. Only in Poland were significant statistical differences found depending on the place of work with regard to the level of medical service personnel adhering to sanitary regulations in the workplace. Medics working in A&E decidedly more often adhere to sanitary regulations than MRT personnel.

Table 5 presents the perceived level of fear of falling ill with COVID-19 while administering medical procedures depending on place of work. No statistically significant differences were shown in any of the individual countries; however, it was demonstrated that the greatest discrepancy in the feeling of fear at falling ill was between medics working in A&E and MRT personnel in Spain.

DISCUSSION

The feeling of safety is the ability to maintain self-confidence in changing circumstances. It is of particular importance in the medical profession, irrespective of the type of work and the place where it is conducted. Minimizing negative experiences increases the feeling of control and effectiveness in maintaining awareness of one's own competencies. Numerous scientific studies have shown that the provision of medical services is burdened by a certain level of psychological discomfort resulting from many aspects of the work involved. Determining the level of safety among such a diverse study group is very difficult as it is multi-dimensional and comprises multiple aspects. The type of research documented in this article is pioneering as it has not been conducted previously, and as such relating the results to the literature is not possible. The presented research material is representative and the methodology suitable to the assumptions of the research programme.

Medics working in emergency medical response teams and hospital emergency department personnel are a professional group from whom in particular rapid, effective and coordinated action is required. As underlined by Behnammoghadam, the character of such specific action can be a predisposition to previously unencountered negative experiences and strengthen the effect of any previously existing unfavourable factors [9]. The results presented in this paper do not show any statistically significant differences in the feeling of safety according to place of work. The questionnaire data from individual countries was varied, which may be connected to the differences in the organizational structures in these countries, as well as to different methods of selection, as well as the level of education and scope of work of medics. In his research, Iranmanesh revealed a high instance of stress-related disorders among these medical groups. However, he demonstrated that overall, hospital A&E personnel had a lower average level of negative feelings than ambulance medical personnel. In research conducted by Mealer et al., the results were similar although the differences were not statistically significant. It can be assumed that this noticeable trend in results may be due to the better diagnostic and staffing resources available to A&E departments working in difficult conditions and at crisis workloads, which undoubtedly is the case with the ongo-

Table 3. Differences in the feeling of serious danger to health and life in the case of infection with SARS-CoV-2.

				Descriptive statistics				
Country	**Workplace**	**U**	**p**	**M**	**SD**	**Min**	**Max**	**Me**
Poland	A&E	109158.0	0.799	3.90	1.02	1.00	5.00	4.00
	MRT			3.92	1.00	1.00	5.00	4.00
Czechia	A&E	1523.50	0.690	2.97	1.11	1.00	5.00	3.00
	MRT			2.88	0.88	1.00	4.00	3.00
Finland	A&E	276.00	0.025	3.38	0.92	2.00	5.00	3.00
	MRT			3.99	0.67	2.00	5.00	4.00
Spain	A&E	1606.00	0.711	4.31	0.72	2.00	5.00	4.00
	MRT			4.23	0.82	3.00	5.00	4.00
Norway	A&E	2379.50	0.487	4.13	0.89	2.00	5.00	4.00
	MRT			3.98	0.88	1.00	5.00	4.00
United Kingdom	A&E	1610.50	0.495	3.93	0.92	2.00	5.00	4.00
	MRT			3.83	0.76	2.00	5.00	4.00

U – test statistic; p – statistical significance; M – mean; SD –standard deviation; Me – median; Min – minimum result; Max – maximum result

Table 4. Opinions on the degree of adhering to sanitary regulations in the workplace as respected by medical service personnel.

				Descriptive statistics				
Country	**Workplace**	**U**	**p**	**M**	**SD**	**Min**	**Max**	**Me**
Poland	A&E	101118.50	0.023	3.11	0.98	1.00	5.00	3.00
	MRT			3.24	0.97	1.00	5.00	3.00
Czechia	A&E	1577.50	0.936	3.82	0.85	1.00	5.00	4.00
	MRT			3.79	1.04	1.00	5.00	4.00
Finland	A&E	409.00	0.440	3.75	0.46	3.00	4.00	4.00
	MRT			3.89	0.73	1.00	5.00	4.00
Spain	A&E	1619.50	0.767	3.98	0.82	2.00	5.00	4.00
	MRT			3.96	0.60	3.00	5.00	4.00
Norway	A&E	2002.00	0.062	4.31	0.48	4.00	5.00	4.00
	MRT			4.00	0.66	1.00	5.00	4.00
United Kingdom	A&E	1495.50	0.216	3.86	0.79	2.00	5.00	4.00
	MRT			3.59	0.98	1.00	5.00	4.00

U – test statistic; p – statistical significance; M – mean; SD –standard deviation; Me – median; Min – minimum result; Max – maximum result

Table 5. Feeling of fear of falling ill with COVID-19.

				Descriptive statistics				
Country	**Workplace**	**U**	**p**	**M**	**SD**	**Min**	**Max**	**Me**
Poland	A&E	108173.50	0.619	3.77	1.11	1.00	5.00	4.00
	MRT	0.05		3.82	1.06	1.00	5.00	4.00
Czechia	A&E	1512.00	0.638	2.89	1.03	1.00	5.00	3.00
	MRT	0.12		2.77	0.90	1.00	4.00	3.00
Finland	A&E	419.00	0.558	3.25	1.04	2.00	5.00	3.00
	MRT	0.25		3.00	1.13	1.00	5.00	3.00
Spain	A&E	14.82.00	0.329	3.50	1.12	1.00	5.00	4.00
	MRT	0.27		3.23	1.18	1.00	5.00	4.00
Norway	A&E	2533.50	0.794	2.75	0.86	1.00	4.00	3.00
	MRT	0.03		2.72	1.15	1.00	5.00	3.00
United Kingdom	A&E	1719.00	0.916	3.79	1.26	1.00	5.00	4.00
	MRT	0.07		3.86	1.12	1.00	5.00	4.00

U – test statistic; p – statistical significance; M – mean; SD –standard deviation; Me – median; Min – minimum result; Max – maximum result

ing COVID-19 pandemic [10]. The pandemic in progress during the research resulted in an increase in continually new duties under changing working conditions. What is more, the lack of personnel due to illness or quarantine among colleagues created an additional burden. Kikuchi showed that the length of work during overtime has a linear connection to various psychosomatic reactions to stress [11]. Meanwhile, Halpern additionally presented the dependency between stress symptoms and time away from work [12]. Sumra also underlined that the quality of roles and not their number may be the most important predictor of positive and negative feelings [13]. According to Hayes, the demanding and relatively non-supportive role of medics in an environment in which the demands of work exceed the possibilities of coping with a given situation intensify negative feelings [14]. Kaburi additionally proved that a lack of the appropriate skills for carrying out routine tasks, as well as the uncertainty with regard to one's professional role, have a negative impact on psychological comfort [15]. It can therefore be said that the lack of a feeling of safety and the negative feelings among medics working on the front line during COVID-19 is highly complex and is not necessarily merely the result of the battle against a dangerous microbe in such unfavourable working conditions.

The pandemic made it all too clear that there existed an invisible but seriously life-threatening enemy. The initial lack of sufficient knowledge on the virulence of the SARS-CoV-2 virus may have additionally compounded feelings of danger and fear of infection. In his work, Halpern underlines that one's own strength of knowledge and awareness can ease stress levels [16]. What is more, initial disinformation on the required level of personal protection for medics, combined with growing problems in the supply of protective equipment, did not allow for psychological comfort. A paper by Wen Lu showed that

medical personnel working in close contact with patients infected or potentially infected with COVID-19, irrespective of their place of work, were almost twice as likely to suffer from fear of falling ill as non-clinical personnel or those working on wards with a low risk of infection with SARS-CoV-2 [17]. During analysis of our research, significant differences were observed in Finland in a greater perception of danger to health and life due to infection with SARS-CoV-2 among medics working in emergency medical response teams than among personnel in hospital A&E departments. Interestingly, both of these groups admitted a considerably lower level of fear of falling ill and death. Despite this danger, the level of respect for sanitary regulations in the workplace varied, and significant differences were observed in this regard in Poland. It was proven that people working in hospital clearly less often followed sanitary regulations, which may be linked to a greater feeling of safety.

Determining the causes of stress in every profession requires analysis of the presence and intensity of stress factors in the workplace. However, the definition of specific stress factors requires deeper analysis of the interaction between stress factors and the results of stress, as underlined by Johnson in his observations [18]. The atmosphere in the workplace, in particular the focus on safety, can play a key role in the attitudes, beliefs and intention to adopt behaviours that are conducive to vigilance. Here, we can repeat Patterson's claim that there is too little research with the participation of medical personnel providing services in many fields in order to be able to unequivocally answer these questions [19].

CONCLUSIONS

1. During the COVID-19 pandemic, the feeling of safety among emergency medical service personnel in selected European Union countries is varied and depends on the work position.
2. During the COVID-19 pandemic, the feeling of danger to health and life due to infection with the SARS-CoV-2 virus among emergency medical service personnel in selected European Union countries is varied and depends on the place of work.
3. The rules for observing sanitary regulations for employees of emergency medical service personnel in selected European Union countries are similar and depend on the place of work.
4. The level of fear of infection with COVID-19 among emergency medical service personnel in selected European Union countries is similar.
5. The greatest difference in the feeling of safety among emergency medical service personnel, depending on work position, was in Poland, Spain and Finland. Those who suffer most from a lack of safety are emergency medical response teams.

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CONFLICT OF INTEREST
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ORIGINAL ARTICLE

INTRODUCTION TO ECOLOGICAL INNOVATIONS IN RESUSCITATION TRAINING. DOES *MADE OF CARDBOARD* HAS TO MEAN *SINGLE-USE*?

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ABSTRACT

Aim: To assess the initial usefulness of an innovative, ecological manikin made of cardboard and coconut fiber, which is intended for resuscitation training.

Material and methods: The study was conducted with the use of a mechanical chest compression device and assistance of human subjects. The first phase quantified the initial durability of the manikin. Phases two and three initially assessed manikins' mechanical properties, its resistance to repetitive chest compression training, and the quality of chest compressions performed on the tested manikin.

Results: 268 and 49 participants took part in the first and the second phase of the study, respectively. The total number of chest compressions performed on the manikin was 30.736 and 4.928, respectively. The number of mechanical chest compressions reached 75.000 in phase three. The mean compression depth ranged between 47.1 ± 1.4 and 52.7 ± 0.6 mm, and the compression force ranged from 577 ± 10.0 to 686 ± 187 N. The rate of compressions ranged from 99.5 to 133/min, and the percentage of complete chest recoil ranged from 62.1 ± 20.3% to 100%.

Conclusions: The tested ecological manikin invented for the purpose of resuscitation training provides the parameters necessary for students to master the ability to deliver high-quality chest compressions in terms of depth, rate, full recoil and force needed to perform chest compressions in a large adult. Durability tests showed that a manikin made of ecological materials can also be used multiple times, for many training groups.

KEY WORDS

cardiopulmonary resuscitation, medical education, ecology, manikin

INTRODUCTION

Although more than 30 years have passed since the creation of the Chain of Survival for sudden cardiac arrest (SCA) victims, the implementation of its practical application to the general population is still difficult [1-3]. While the transfer of knowledge in a wide spectrum is much easier with the use of the Internet, the issue of practical training can be a challenge as it requires actual hand-on training [4-7]. This, in turn, entails costs associated with both the organization of courses and the purchase of equipment, i.e., cardiopulmonary resuscitation (CPR) manikins. At the moment, there are at least a dozen well-known manikin models on the market, the prices of which range from about $ 40 to $ 2,000 or more, depending on the level of advancement, a real time feedback system or whether it is a torso or a full-body version.

The cheapest versions were created for parallel exercises of multiple trainees or popularization of mass CPR training. However, they are all made of some type of plastic, polyvinyl chloride (PVC), low density polyethylene, rubber, silicone etc., which are mostly hardly- or non-recyclable and troublesome waste. As the life cycle of these products is also limited, this can be very problematic from an environmental perspective. In recent years, attempts at evaluating the possibility of creating homemade manikins from commonly available materials, such as Polyethylene Terephthalate bottles, have become increasingly popular. In this concept, no additional waste material is generated, as something that is already in the possession of potential trainees is used [8-9]. While the very concept of promoting resuscitation or teaching simple skills, such as the frequency of compressions, is possible with the use of these simple homemade constructions, achieving full effectiveness similar to the characteristics of the human chest can be difficult. It is also worth noting that many manikins already available on the market, especially low-cost ones, are not scientifically verified in terms of their ability to adequately mimic the human chest, or the parameters indicated in the guidelines. As these features are potentially necessary to achieve effective cardiac and cerebral perfusion in real-life situation, it is worth reaching a compromise between low-cost, availability and providing appropriate muscle memory in training.

In the light of the above issues, new, innovative solutions combining care for the natural environment and effective training in sudden cardiac arrest may be of interest. For this reason, the presented work aims to initially assess the usefulness of an innovative, ecological resuscitation manikin mainly made of cardboard and coconut fiber.

THE AIM

The main objective of this study was to quantitatively and qualitatively assess the potential effectiveness of the tested manikin for chest compressions (CCs).

The specific objectives included:

- evaluation of the tested ecological manikins' (TEM) resistance to chest compressions performed by a human continuously for 240 minutes,
- assessment of the mechanical properties and resistance of the TEM in relation to the depth, rate and force of CCs performed by a trained human,
- assessment of the mechanical properties and resistance of the TEM in relation to the depth, rate and force of CCs performed by a mechanical chest compression device (MCCD).

MATERIAL AND METHODS

STUDY SETTING

The data was collected from March 15, 2023 to May 11, 2023. The study was conducted with the use of an MCCD and assistance of human subjects. The first phase of the study was to quantify the initial durability of the analyzed manikin in relation to human-generated chest compressions. Phases 2 and 3 consisted of parallel tests that initially analyzed the manikins' mechanical properties and resistance to repetitive chest compression training and quality of CCs performed on the TEM. For maximum reliability of the collected data, three manikins were used during the tests, one for each phase of the study. Participation in both phases of the study was voluntary for the participants. The study was approved by the Bioethics Committee at the Medical University of Lodz (number RNN/54/23/KE).

PHASE 1

The first phase of quantitative tests took place during the Open Day of the Medical University of Lodz 2023. The invited guests, i.e. high school students and students of medical faculties, were asked to perform CCs on the TEM continuously for at least 240 minutes, as part of a campaign to promote continuous chest compressions and willingness to conduct CPR by potential witnesses of SCA. In the course of phase 1, two possible scenarios were taken into account: recording the number and depth of compressions until manikin destruction (defined as damage preventing further use), or recording the number of

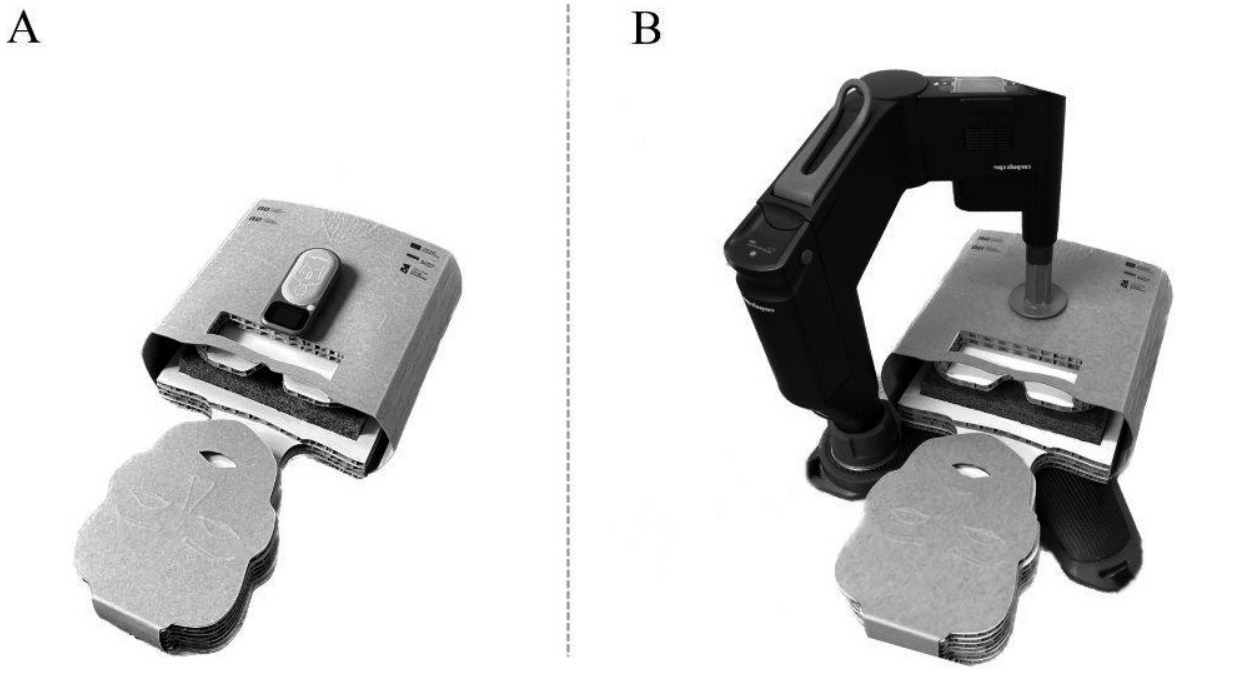

Fig. 1. Locating the CPR Meter 2 device on the TEM's chest (A) and positioning the TEM in the Corpuls CPR device (B).

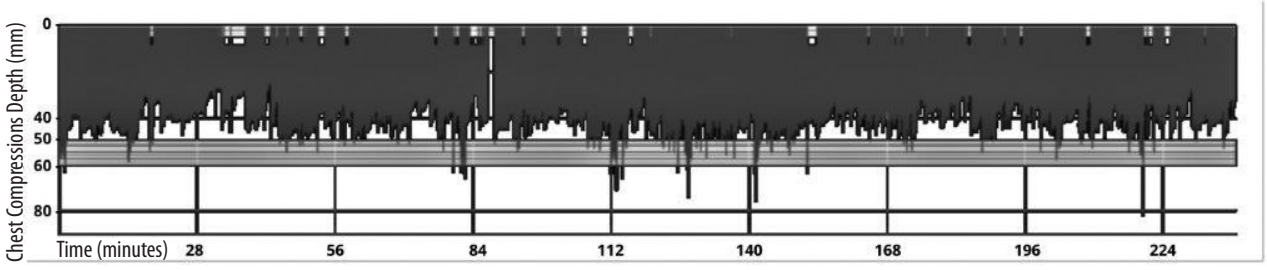

Fig. 2. Presentation of chest compression depth during Phase 1.

compressions for 240 minutes, the lapse of which meant the end of the event. Each participant in this phase of the study received a short (1-2 minutes) instruction on how to use the manikin and how to perform CCs correctly during resuscitation. CPR knowledge, skills or prior experience in resuscitation training were not evaluated in this phase.

PHASE 2

The second phase of the study was based on a qualitative analysis of CCs made by human participants, i.e. second year students of the Emergency Medicine Faculty. Based on sample size calculation, 55 students were invited via direct communication during lectures and online. All of them had received prior training in performing proper CCs as part of the university curriculum (both in the field of basic life support and advanced life support). Exclusion criteria were: reported spine, wrist or knee injury in the month preceding the study. Each participant was asked to perform 100 CCs (±5). A measuring device for data collection, CPR Meter 2, was permanently placed on the TEM's chest using a double-sided adhesive tape supplied with the manufacturer's kit (Fig. 1). Apart from the number and depth of CCs, compression force was also recorded.

PHASE 3

In phase three, data on CCs provided by MCCD were collected. It was planned for the number of compressions that the TEM will endure in the first phase until it is destroyed, or for 75.000 compressions, which is the equivalent of training at dozen or so courses of CPR (with assumption 6 - 8 participants and 3000 - 6000 CCs per course). The number of CCs, their depth and the force needed to achieve the required depth were analyzed. The way of placing the TEM in the device is shown in Figure 1.

DATA SOURCES/MEASUREMENT

ECO CPR manikin (Medical University of Lodz; Lodz, Poland), an innovative construction created for resuscitation training and made of biodegradable and easily recyclable materials was used as an exemplary TEM. The course of the first phase was recorded with a GoPro HERO 4 camera (GoPro, Inc., San Mateo, USA) for documentation purposes. CPR Meter 2 (Laerdal Medical AS; Stavanger, Norway) was used to quantify the compressions performed in phase one and to qualitatively evaluate human compressions in phase two. Corpuls CPR and Corpuls Manager apps (Corpuls GS Elektromedizinische Geräte G. Stemple GmbH; Kaufering; Germany) were used to analyze the mechanical properties of the TEM's chest compressions.

STATISTICAL ANALYSIS

Statistical analyzes were performed using Statistica 13.1. Elements of descriptive statistics were used to determine the mean (x), minimum (Min), maximum (Max), percent (%) and standard deviation (SD). Sample size for phase 2 was calculated with G* power 3.1.9.2 software. At least 48 participants were needed to reach power = 0.90 and error = 0.05. To provide a safety margin in case of missing data or non-participation, the minimum size of the study group for phase 2 was increased to 55.

Table 1. Phase 2 - Qualitative validation of the tested manikin - human participants.

N = 49 (Male = 27)	x ± SD
Age (years)	25.6 ± 6.2
Body weight (kg)	74.6 ± 10.2
Heigh (cm)	173.3 ± 9.8
BMI	24.7 ± 2.1
Total number of compressions: 4.928	
Flow Fraction (%)	91.5 ± 13.6
Average depth (mm)	47 ± 8.2
Average rate (per minute)	105.7 ± 8.5
Full chest recoil (%)	94.2 ± 8.3
Average peak force (kgf)	68.2 ± 19.1
Average peak force (N)	686 ± 187

x - mean; SD - standard deviation; kg - kilogram; cm – centimeters; kgf - kilogram-force; N – newtons; mm – millimeters; BMI (Body Mass Index)

Table 2. Phase 2 - Qualitative validation of the tested manikin - mechanical chest compression device.

CORPULS CPR	x ± SD		
Total number of compressions	57.754	2.918	14.328
Average depth (mm)	47.1 ± 1.4	50.1 ± 0.6	52.7 ± 0.6
Average rate (per minute)	99.5 ± 1.1	109,4 ± 1.3	99.5 ± 1.1
Average peak force (N)	577 ± 1.6	577 ± 10.0	578 ± 4.7

x - mean; SD - standard deviation; N – newtons; mm – millimeters

RESULTS

In the first phase, which took place during the Open Day of the Medical University of Lodz, March 15, 2023, 268 participants were enrolled, of which 82% were high school students visiting the university and 18% were students of medical faculties. A total of 30.736 continuous CCs were performed on TEM within the planned period of 240 minutes. The average depth of compressions achieved was 36.6 ± 6.1 mm and full chest recoil was present in 62.1 ± 20.3%. Mean rate was 133 per minute. In accordance with the assumptions, the first phase ended at the pre-set time, and the TEM was assessed for destruction of its parts. No damage preventing further use was found. Figure 2 shows the course of compressions in terms of their depth.

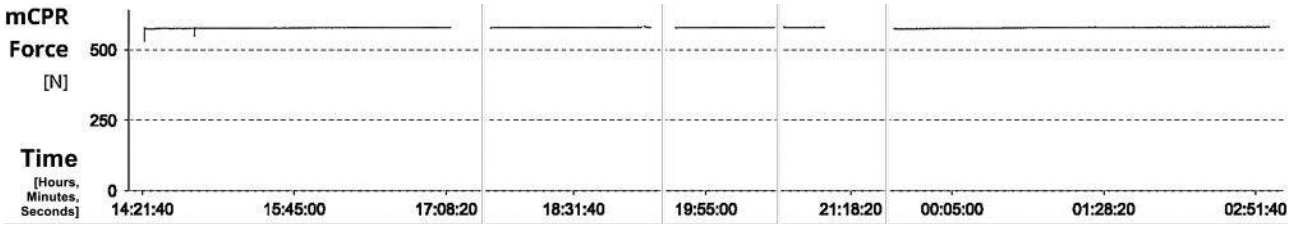

Fig. 3. Presentation of the course of the curve recording the compression force during the longest test on the Corpuls CPR (vertical lines represent technical breaks for cooling the device).

In the second phase of the study, data from 49 CC sessions were collected for analysis. Due to unknown technical issues, CCs of 6 participants were not recorded by the measuring device. They were therefore excluded due to missing data. The general characteristics of the study group and the results of chest compression parameters are presented in Table 1.

During the tests with the use of MCCD, the longest cycle in one attempt lasted 12 hours, 36 minutes and 48 seconds, excluding technical breaks for cooling the device; the active phase of the test lasted 9 hours 10 minutes and 22 seconds (Fig. 2.). In the case of other cycles, 30 – 45 minute time limit periods were used and various settings of chest compression rate and depth ranges offered by the Corpuls CPR were used. A summary of the analyzes of the reported results is presented in Table 2.

A total of 75.000 compressions were performed in the range of 47.1 to 52.7 mm at a rate of 99.5 to 109.4 per minute. The compression force of particular sessions is shown in Table 2 and Figure 2 (visualization for the first 57.754 chest compressions), and was automatically generated by the device in response to chest resistance. Importantly, it was maintained throughout the tests at an equal level.

DISCUSSION

The aim of the study was to assess the usefulness of an exemplary ecological manikin. ECO CPR manikin, an innovative construction created for the purpose of resuscitation training and made of biodegradable and easily recyclable materials was used as an exemplary tested manikin (TEM). The ECO CPR manikin had its premiere at the International Intellectual Property, Invention, Innovation and Technology Exposition (IPITEx) 2023 in Bangkok and is made of cardboard, coconut fiber and metal springs.

Since the materials from which the manikin is constructed may raise serious doubts about its potential effectiveness during repetitive CPR training, endurance and the ability to achieve the parameters indicated as targets during both training and real resuscitation were analyzed in the presented study. The first phase of testing consisted in assessing resistance to repetitive continuous human-generated chest compressions. Since this phase was intended to be performed under real conditions, it was assumed that participants can compress the manikin's chest in the way they want. This allowed to expose the TEM to potentially unskillful training. Continuous chest compressions for 240 minutes allowed to achieve the number of 30.736 CCs with no loss of manikin's functionality.

Depth, rate, and complete recoil are essential parameters for high-quality CCs. In the first phase of the study, where the participants were mainly high school students, these parameters were as follows: depth - 36.6 ± 6.1 mm; rate - 133/min; full chest recoil - 62.1 ± 20.3%. Although Stiell et al. (study based on 9136 adult patients with SCA) and several recent studies suggest an effective depth of compressions to be less than 50 mm [10-12], the depth achieved by the study participants in the first phase is not satisfactory from the point of view of the European Resuscitation Council (ERC) and American Heart Association (AHA) guidelines [4-7]. It is worth considering that the presence of an unknown specialized device on the manikins' chest (CPR Meter 2) could cause non-standard hand positioning by the participants of this phase.

The results obtained by emergency medical students in the second phase of the study were characterized by significantly greater depth of compressions, pace within the normal range and a much higher percentage of chest relaxation (respectively: 47 ± 8.2 mm; 105.7 ± 8.5 / min; 94.2 ± 8.3%). The obvious reason may be a much higher level of CPR training in this group. Still, the average depth did not reach the recommended guidelines [4-7]. However, it is worth noting that these results are comparable to the those reported by other scientists in similar study groups [13-15]. In the third phase, the mechanical arm of the Corpuls CPR device pressed the TEM, depending on the pre-set value, in the range of depth from 47.1 ± 1.4 to 52.7 ± 0.6 mm, with rate matching the values set on the device in the range of 99.5 ± 1.1 - 109, 4 ± 1.3 per minute. Full chest recoil was present in 100%.

In phase 3 of the study, in terms of its durability, the number of compressions performed on the TEM with a MCCD was 75.000. Most manikin manufacturers do not specify in their specification or warranty cards how many compressions the manikins are designed to last. They usually indicate the time for which the product warranty is valid when used correctly. The situation is slightly different in the case of Laerdal AS (Stavanger; Norway) products, which, in relation to the low-cost Mini Anne manikin (price approximately - $40), defines its compression resistance at 5000 [16]. In the case of the more expensive version, the classic manikin known as Little Anne QCPR (price approx. - $250-300) guarantees 500.000 compressions [17]. A low-cost manikin from another manufac-

turer, Nasco Healthcare Nasco Healthcare (Fort Atkinson; USA), Prompt CPR Adult manikin (price approx. - $120), is described as durable enough to withstand the equivalent of 10.000 student usages (not defined in the description) [18]. As the TEM's construction has withstood the tests while maintaining its functionality, trials will be implemented in the future to perform more than the planned 75.000 compressions. In the present study, the methodology was only to determine the initial durability as an equivalent of a minimum of a dozen or so training groups (3000 - 6000 CCs per course) [19].

Phases 2 and 3 were intended to assess the training suitability and the possibility to conduct high-quality chest compressions on TEM. Studies on humans show that the force required to properly compress the chest in an adult person, depending on the patient's anatomy and physique, is in the range of approximately 300 to 600 Newtons [20-23]. Measurements performed in phases 2 and 3 with CPR Meter 2 and Corpuls CPR showed that TEM's chest provides 5 cm of compression depth when a force range from 577 ± 10.0 to 686 ± 187 N is applied. These results indicate that the TEM chest can provide a realistic training environment and simulate the body of even a large adult person [14].

The results clearly indicate the potential usefulness of a manikin made of ecological materials such as cardboard, coconut fiber or easily recyclable metal springs. It is extremely important that the TEM can be used for high-quality chest compression training as it meets the criteria for the possibility of compressing to a depth of at least 50 mm, obtaining the recommended rate of compressions, full chest relaxation and CC resistance adequate even for a large adult human. Furthermore, its ecological design does not have to mean it is a single-use product as it can endure multiple resuscitation training sessions, for many training groups consisting of several or a dozen participants, each of whom will perform several hundred chest compressions.

LIMITATIONS

This study has several limitations. Evaluation of the strength and effectiveness of only one type, and thus one design, of an ecological resuscitation training manikin was the main limitation of the study. Also, the small number of participants in phase two may be considered a weakness. Furthermore, the study did not analyze TEM's properties and durability under transport or storage conditions. In addition, a comparative analysis of the capabilities and characteristics and durability in relation to other low-cost manikins made of non-ecological materials was not performed. The devices used to analyze the quality of chest compressions performed on the TEM have been developed by manufacturers for clinical use on humans and may not be fully reliable when used on a manikin's artificial chest.

CONCLUSIONS

The tested ecological manikin invented for the purpose of resuscitation training can provide the parameters necessary for students to master the ability to deliver high-quality chest compressions in terms of depth, rate, full recoil and force needed to compress the chest of a large adult. Durability tests, based on the number of performed compressions, prove that the manikin made of ecological materials can also be used multiple times and for many training groups.

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INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Bioethics Committee at the Medical University of Lodz (number RNN/54/23/KE).

INFORMED CONSENT STATEMENT

Patient consent was waived due to Bioethics Committee at the Medical University of Lodz decision.

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CONFLICT OF INTEREST

Filip Jaskiewicz is founder, medical consultant and co-constructor in "ECO CPR" project, financed by the program "Innovation Incubator 4.0" as part of the non-competitive project entitled "Support for the management of scientific research and commercialization of the results of R&D works in scientific units and enterprises" under the Intelligent Development Operational Program 2014-2020 (Measure 4.4). There is no other conflict of interest or financial relationship with manufacturers or products to declare.

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REVIEW ARTICLE

NUTRITION IN THE PREVENTION AND MANAGEMENT OF ENDOMETRIOSIS SYMPTOMS - A CURRENT LITERATURE REVIEW

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ABSTRACT

Endometriosis is a chronic hormone-dependent inflammatory condition whose growth and maintenance depends on oestrogen. Treatment options are limited until its aetiology is established. The following literature review provides an extensive discussion of the relationship between diet and endometriosis and identifies the importance of nutrition in relation to symptoms. An extensive manual search of the main electronic databases (PubMed, EMBASE, Web of Science and Google Scholar) was conducted in March 2023 to identify relevant studies published on the relationship between diet and endometriosis.

The anti-inflammatory properties of a plant-based diet may be beneficial for women with endometriosis. The Mediterranean diet shows similar properties in reducing many persistent symptoms. Dairy products, on the other hand, are a source of calcium, vitamin D, oestrogens, progesterone and anti-cancer and anti-inflammatory components. A decrease in endometrial implants can be observed in women supplementing with omega 3 and 6 acids. Vitamins D, C and E are also essential dietary components, as they are sources of antioxidants that strongly reduce free radicals. An inverse correlation was observed with red meat consumption. The treatment of endometriosis requires a holistic approach focused on reducing bothersome symptoms and inflammation, and therefore the inclusion of a dietitian in the treatment may be of great benefit to endometriosis patients. Further research is needed, especially randomised clinical trials to clarify the role of diet in endometriosis.

KEY WORDS

endometriosis, diet, anti-inflammatory

INTRODUCTION

Endometriosis is a debilitating, chronic disease that affects approximately 10% (190 million) of women of reproductive age worldwide [1]. It is associated with the presence of endometrial tissue outside the uterine lining usually on the outer surface of the uterus, fallopian tubes, ovaries, abdominal wall or intestines. It is characterised by pelvic pain, stress, fatigue and infertility [2]. Endometriosis has a significant impact on psychological, biological and social wellbeing.

Treatment options for endometriosis are limited. Hormonal, analgesic and surgical treatments, used to relieve pain, improve fertility and slow tissue growth, are associated with numerous complications and recurrences.

The role of nutrition in endometriosis is suggested by the effect of diet on inflammatory processes, as well as estrogen activity [3]. Increasing dietary fibre and decreasing fat decreases circulating oestrogen levels, prompting consideration of the potential benefits of introducing nutritional interventions in sufferers, as this is an oestrogen-dependent disease. Meat consumption has also been shown to be associated with a higher risk of developing endometriosis, in contrast to a plant-based diet. Estrogen-modulating properties have been shown in seaweed, which benefits both premenopausal and postmenopausal women. On the other hand, an antioxidant effect has been proven for vitamin D, which thus reduces pain, as does supplementation with vitamins C and E. More randomised clinical trials are needed to clarify the role of diet in endometriosis [3].

THE AIM

The following literature review provides an extensive discussion of the relationship between diet and endometriosis and identifies the importance of nutrition in relation to symptoms. The review highlights the picture of endometriosis, including aetiology, symptoms and treatment. We also analyse different diets and nutrients, vitamins and metals in relation to endometriosis This article summarises recent scientific reports to address these topics.

MATERIAL AND METHODS

An extensive manual search of major electronic databases (PubMed, EMBASE, Web of Science and Google Scholar) was conducted in March 2023 to identify rel-

evant studies published on the association of diet and endometriosis. A lower term was not specified. Articles were restricted to those published in English and Polish. Multiple search terms were used, including "endometriosis", "diet", "nutrition", "endometriosis and nutrients", "endometriosis and vitamins", "endomeriosis and etiology", "endometriosis and treatment". Articles were analysed first by title, then by abstract and finally by full text. All selected articles were the most relevant available articles for this review.

REVIEW AND DISCUSSION

Endometriosis is a chronic, estrogen-related inflammatory condition. In this condition, ectopic endometrial glands and lining develop outside the uterine cavity, most commonly in the pelvic region (ovaries, fallopian tubes and peritoneum, but also in the intestines, bladder, ureters), leading to anatomical deformities within the uterus [4]. Some reports also indicate rare locations such as the brain, lungs and retina [5]. Four pathological stages of endometriosis should be distinguished: I-minimal, II-mild, III-moderate and IV-severe. These take into account, among other things, the location and presence of adhesions and implants [6].

It is difficult to accurately estimate the prevalence of endometriosis. It ranges from 6 to 10 per cent [7]. It is also thought to exceed 33% in patients with acute pelvic pain [5]. Other authors report that in North America, Europe and Australia, the prevalence of this condition is estimated to be 1-5% in women of reproductive age [8]. In contrast, other articles indicate 190 million women of reproductive age worldwide, including 2 million with endometriosis in the UK [9].

The symptoms of endometriosis are extensive and involve multiple systems. The predominant symptoms are debilitating pain, dyspareunia, dysmenorrhea, gastrointestinal problems, depression, chronic fatigue, bloating, constipation and diarrhoea [10].

Infertility is more common in women with this condition (10-15%) than in the general population (9%) [11]. In addition, irritable bowel syndrome (IBS) is three times more common in endometriosis than in the general population, as repeatedly indicated by various studies [12]. The variety of symptoms has an adverse impact on women's standard of living, leading to reduced quality of life, disrupted relationships and careers [11]. Due to the lack of specificity of symptoms, diagnosis is often delayed and preceded by a variety of referrals and consultations with other specialists [13].

7-12 years - this is the length of time women wait for a correct diagnosis of endometriosis. Difficulties in making the diagnosis may be due to the lack of clear recommendations. Previously considered the gold standard for diagnosing endometriosis, diagnostic laparoscopy with biopsy was identified as one of the possible options in the latest ESHRE 2022 guidelines [1]. In the UK, diagnosis is made in a number of ways - ultrasound, MRI, laparoscopy or blood test for CA 125 [14].

ETIOLOGY

The aetiology and pathogenesis of endometriosis are still not clarified and remain poorly understood. There are various theories that include inflammation, retrograde menstruation, oxidative stress, hormonal activity, immune dysfunction, genetic profile, organic chloride burden, apoptosis suppression and metaplastic processes [15]. One paper identifies a disproportion between increased production of pro-inflammatory cells and the adhesive, invasive and proliferative properties of endometrial cells as the cause of the disease [16]. Another well-known hypothesis is that ovarian metaplasia through the coelomic epithelium results in peritoneal lesions and cysts [17]. Others, however, believe that it is the outward migration of endometrial tissues through the fallopian tubes that is the cause of the condition in question [8]. Immune dysfunction may be the origin of the movement of ectopic endometrial implants into the peritoneal cavity, allowing abnormal tissues to survive, which should be naturally eliminated. The implants exacerbate oxidative stress and therefore inflammation. On the other hand, studies from 2022 indicate a dependence of endometriosis on angiogenesis, which shows a significant effect on the progression of endometrial tissue [17].

TREATMENT

Symptom relief and treatment options for endometriosis are similar for all age groups. Management is not standardised and both surgical and pharmacological treatments are followed by recurrence. Pharmacological interventions including painkillers and hormonal therapies are the most common. These treatments inhibit endogenous estrogen production and include progestins, gonadotropin-releasing hormone agonists and antagonists, combined oral contraceptives, aromatase inhibitors and testosterone analogues [18]. However, their efficacy is limited - they do not cause the disappearance of endometriosis foci. They are also associated with many side effects, e.g. reduced fertility, decreased libido, weight gain, headaches, nausea, mood changes [19]. They also cannot be used during pregnancy [8]. In one study, it was shown that 60% of patients have chronic pain that adversely affects quality of life despite treatment [20]. It should also be noted that cessation of treatment is associated with reactivation of the disease.

Another treatment option for endometriosis is its laparoscopic removal in the form of excision and ablation of the foci. However, it is often associated with high reoperation rates due to incomplete resection or recurrence of adhesions, as well as lack of pain relief [21]. A 2020 Cochrane review of 14 randomised trials concluded that "compared with diagnostic laparoscopy, it is uncertain whether laparoscopic surgery reduces overall pain associated with minimal or severe endometriosis" [22]. Hysterectomy is also a recommended treatment, but it should be borne in mind that this is a major operation that ends fertility [23].

DIET AND ENDOMETRIOSIS

The variation in the incidence of endometriosis between parts of the world cited above may point to lifestyle, environmental factors and diet as likely aetiological factors [24]. As an inflammatory oestrogen-dependent disease, endometriosis can be alleviated by various dietary interventions, as certain nutrients have the ability to mimic l oestrogen and interfere with endogenous hormone metabolism [25]. Scientific evidence suggests that increasing dietary fibre and reducing fat reduce circulating oestrogen concentrations, which is associated with a reduction in pain symptoms [3]. The effect of diet may also be due to changes in prostaglandin metabolism and smooth muscle contractility [26].

PLANT-BASED DIET

Increased amounts of polyphenols that reduce inflammation have been shown in plant-based foods compared to omnivorous diets, as evidenced by the higher content of anti-inflammatory compounds in the gut microbiome of people following a plant-based diet [27]. These reports are also corroborated by the American Heart Association on the basis of a several-week study of 100 participants, which showed the presence of less inflammation in those following a vegan diet compared to a meat-based diet that those following a strictly vegan diet [28]. Barnard N., on the other hand, discusses observations of a reduction in the duration and severity of pain and relief of premenstrual symptoms in women on a low-fat vegan diet due to an increase in the plasma concentration of the sex hormone-binding globulin SHBG, which in turn causes a decrease in oestrogen [29]. This is followed by a reduction in the proliferation of prostaglandin-producing tissues and estrogen stimulation of the endometrium. It is also worth noting that an anti-inflammatory diet containing a lot of fruit, vegetables, legumes, but eliminating meat, is characterised by positive effects on fertility and the perinatal period [30].

The Mediterranean diet is similar in composition to a plant-based diet, with fruit, vegetables, nuts and legumes, fish and dairy dominating. Such a diet has been shown to have a positive effect on gynaecoloigical diseases, but has also been shown to reduce dysmenorrhoea, dyspareunia, pain and dyschezia in women suffering from endometriosis. The preventive benefits of cancer and cardiovascular disease are also worth mentioning [31].

Foods such as soya, corn, tomatoes, beans, tomatoes and tea are high in nickel. One study showed that gastrointestinal and gynaecological symptoms, which occur with high frequency in women with endometriosis, can be alleviated by following a low-nickel diet [32].

Another recommended dietary intervention for people with the condition is a low-FODMAP diet low in fermentable polyols, oligo- and monosaccharides. Restriction of these compounds is associated with less visceral complaints. There are few studies showing its long-term effects, but it should be emphasised that it cannot be used long-term [33].

DAIRY

Dairy products are a source of calcium, vitamin D, oestrogens, progesterone and anti-cancer and anti-inflammatory components [25]. Nodler et al showed a lower incidence of endometriosis diagnosis in adulthood among adolescent girls consuming larger portions of dairy [26]. Similar findings were made by Youseflu et al [25]. With a daily intake of ≥3 portions of dairy products, significant effects can be observed in reducing endometriosis foci [34].

MEAT

Red meat, by decreasing SHBG globulin, increases estradiol levels [35]. Estrone levels also increase, leading to the persistence of endometriosis [36]. One study found a correlation between frequent consumption of red meat and a higher risk of endometriosis. This observation leads to the conclusion that a reduction in meat consumption may benefit from less pain syndrome [35].

FISH

Pereira et al. in an experimental study in rats noted that nutraceuticals omega 6/3 and omega 9/6 did not improve fertility, but reduced pain associated with endometriosis [37]. In contrast, other researchers have demonstrated in female rats the withdrawal of endometrial implants in association with the intake of omega 3 fatty acids [38]. Further scientific evidence shows a correlation between higher levels of omega 3 eicosapentaenoic acid and an 82% lower risk of developing endometriosis [39].

VITAMINS

Vitamin D_3 and its metabolite are important antiproliferative and immunomodulatory mediators [40]. Female patients report a significant reduction in pelvic pain syndrome when taking vitamin D regularly [41]. One meta-analysis presented an association between low levels of the vitamin and higher symptom severity and risk of endometriosis diagnosis [42]. These conclusions were confirmed by Mehdizadehkashi A et al. in a randomised trial. Additionally, the researchers indicated a reduction in C-reactive protein (CRP), suggesting the involvement of an anti-inflammatory and antioxidant process [43].

Humans are incapable of synthesising vitamin C, one of the most important antioxidants that strongly reduces free radicals. Therefore, supplementation and consumption of foods such as broccoli, peppers, citrus, potatoes, strawberries and kiwi is important [40]. In 2009, based on a study, the authors showed that women with endometriosis had a 30% lower intake of vitamin C and 40% less vitamin E, compared to healthy patients [44]. In a later randomised controlled trial, a reduction in endometriosis symptoms was proven in association with vitamin C and E supplementation [45]. In contrast, Amini et al. confirmed the effect of a decrease in systemic oxidative stress markers in endometriosis patients taking vitamins C and E [46]. In contrast, other researchers have provided

evidence of vitamin C's relationship to a reduction in endometrial implant induction and growth, and to improved fertility [47].

As with the other vitamins discussed, vitamin B12 is assumed to have a positive effect on inflammatory processes and endometriosis [48].

COFFEE AND TEA

One meta-analysis suggested that caffeine intake below 300 mg/day is not associated with an increased risk of developing endometriosis [49]. However, there is a lack of large-scale, randomised studies determining the correlation between coffee and the condition described. Green and white tea, on the other hand, are characterised by antioxidant properties compared to black tea due to their catechin (polyphenol) content [50].

SPICES AND HERBS

Referring to polyphenols, spices and herbs are also characterised by their presence, especially flavonoids and phenolic acids. The spices with the best-known anti-inflammatory effects include mint, basil, thyme, oregano, ginger, nutmeg, rosemary, mint, sage, turmeric, cloves, dill, cinnamon, parsley, lemongrass, pepper, fenugreek and chilli peppers [51]. A marked reduction in pain and reduction in non-steroidal anti-inflammatory drugs was seen in one study in women supplementing 210 g of Curcuma longa dry extract, 200 mg quercetin and 150 mg acetylcysteine for 2 months [52].

Also worth mentioning is curcumin, which reduces estrogen and inflammatory mediators and inhibits angiogenesis, which classifies it as a spice with proven anticancer and anti-inflammatory properties [53].

GLUTEN-FREE DIET

There are many common features between coeliac disease and endometriosis, such as oxidative stress or immune dysfunction and chronic inflammation. Marziali et al. showed that a gluten-free diet followed in several hundred women with endometriosis resulted in significantly better quality of life, improved social and physical functioning and had a positive impact on symptoms [54]. A case of a woman with coeliac disease and endometriosis whose fertility was improved by following a gluten-free diet was also reported [55].

FRUIT AND SOYA

Fruits are another product containing anti-inflammatory, antioxidant and anticancer polyphenols [56]. Phytoestrogens show homology with oestrogens [57]. They are found in fruit, but also in beans, grains, cabbage, soya, among others. Youself et al. proved an inverse correlation between the level of lignan and isoflavone intake by 78 patients with confirmed endometriosis and the risk of endometriosis in 78 healthy women [25]. Other authors have linked anti-inflammatory, pro-apoptotic and anti-proliferative effects on cultured cells to the properties of phytoestrogens [57].

Another polyphenol found in berries, grapes, among others, is reseratrol [58]. Many studies have proven its anti-invasive and pro-apothelial role [59].

Researchers also point to pain relief and reduction of dysmenorrhoea as actions of reseratrol [60].

CONCLUSIONS

Endometriosis is an inflammatory chronic disease of undetermined aetiology. Until it is established and treatment is clarified, women with this condition can benefit significantly from insights into environmental and lifestyle factors. Nutritional interventions have a significant impact in both areas, the scientific evidence presented here suggests. Constituents in plant-based foods, especially antioxidants and polyphenols, and vitamins D, C and E, have been shown to have positive effects in the treatment, prevention and relief of endometriosis symptoms, while consumption of red meat, trans fats and palmitic acid are associated with an increased risk of the condition. Treating endometriosis requires a holistic multi-specialist approach, focused on reducing bothersome symptoms and inflammation, so it can be hugely beneficial for endometriosis patients to include a nutritionist in their treatment.

Clearly, further research is needed, especially randomised clinical trials to clarify the role of diet in endometriosis.

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CONFLICT OF INTEREST
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REVIEW ARTICLE

PRACTICE OF PROVIDING PSYCHOLOGICAL ASSISTANCE TO LAW ENFORCEMENT OFFICERS IN EXTREME (CRISIS) SITUATIONS

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ABSTRACT

Aim: To identify approaches to the practice of providing psychological assistance to law enforcement officers in extreme (crisis) situations.

Material and methods: Research methods: bibliosemantic, forecasting, comparative, analysis, and generalization. Clarification of the etymology of extreme (crisis) situations allowed us to identify approaches and techniques of psychological assistance to law enforcement officers after their stay in extreme (crisis) situations and stressful conditions.

Law enforcement officers often experience such emotions in extreme situations and stressful conditions as fear, anger, powerlessness, despair, and confusion. The use of psychological debriefing in work with law enforcement officers can help overcome the negative effects of stress after a crisis incident, as well as develop skills that may be needed in the event of a repeated encounter with similar events.

Conclusions: The toolkit of professional psychological assistance to law enforcement officers should focus primarily on increasing their communicative openness and social confidence. The psycho-correctional practice involves the best possible adaptation of law enforcement officers to the requirements of an extreme situation, enabling them to master it, weaken or mitigate these requirements, and try to avoid or get used to them.

KEY WORDS

law enforcement officers, debriefing, psychological assistance, extreme situations, mental self-regulation techniques

INTRODUCTION

When faced with extreme conditions and various kinds of stressful situations, any person experiences great and sometimes extreme stress, observing what is happening around him or her. The person thinks hard, evaluates, draws conclusions, makes decisions, looks for ways and strategies of behavior, mobilizes his or her strengths and capabilities, overcomes internal difficulties, subordinates his or her behavior to solving specific tasks, etc. What happens in the psyche inevitably affects the quality of one's activities and individual actions.

It should be noted that the psychogenic impact of extreme conditions consists not only of a direct, immediate threat to a person's life but also of an indirect one related to his or her expectations. Mental reactions to crises are not specific, but rather universal reactions to danger, and their frequency and depth are determined by the suddenness and intensity.

According to scientists [1-3], psycho-traumatic events have a significant impact on the psycho-emotional state of people, which is manifested in an increase in the incidence of anxiety and depression, uncontrolled aggression or suicidal thoughts, etc. During this period, a person often recalls what was valuable and important to him or her. That is why high-quality support from relatives or colleagues, as well as the help of a professional psychologist, facilitate the process of adaptation, as well as a return to the usual mode of life (as far as possible) because reorientation of the person's internal resources to priority goals and needs can reduce the impact of stressful situations on him or her. Specialists in crisis correction rightly point out the expediency of using modern psychological approaches in working with specific categories of people i.e. rescuers, servicemen, combatants, and other categories of subjects whose professional activities take place in emergency (crisis) conditions [4-6]. Undoubtedly, such categories of subjects include law enforcement officers. Taking into account narrowly focused scientific positions [7-9], it can be concluded that most of them understand law enforcement activities generally as a set of actions of an authorized subject associated with the multivariance of professional tasks and their intellectual as well as emotional intensity, high probability of danger, a system of external influences, etc.

Law enforcement officers who have experienced a traumatic event caused by extreme situations of service activities, combat operations, etc. are characterized by a narrowed consciousness, fixed on specific events, and have an urgent need to talk about their experience, to realize it during communication, including with the hope of sympathy and understanding for their suffering. In the absence of such social and psychological support, victims experience aggression, anger and other maladaptive manifestations of social and psychological deformation, which are considered to be the consequences of the trauma they have experienced. This confirms the expediency of using modern approaches to the psychological correction of law enforcement officers' personalities.

THE AIM

The aim of this study is to identify approaches to the practice of providing psychological assistance to law enforcement officers in extreme (crisis) situations.

MATERIALS AND METHODS

The research methods were chosen taking into account the aim, as well as the need for a comprehensive study of the means of providing psychological assistance to law enforcement officers who are (were) in extreme (crisis) situations: 1) the bibliosemantic method was used to conduct an analytical review of scientific sources on the outlined range of issues; 2) the method of analysis allowed us to learn the patterns of formation and implementation of the processes of preventive and operational protection of the psyche from stressful influences; 3) the method of forecasting was used to predict changes in the personality of law enforcement officers in the constantly changing professional environment, as well as to determine the behavioral patterns of employees, taking into account the factors of the surrounding reality; 4) the comparative method was used to correlate the factors that form the mechanisms of mental regulation of overcoming stress and personal crisis; 5) the method of generalization was used to formulate the conclusions of the research and practical recommendations for the organization of measures to provide psychological assistance to law enforcement officers who are (were) in extreme (crisis) situations.

The research was conducted in compliance with the requirements of the Regulations on Academic Integrity at the National Academy of Internal Affairs, which was developed based on Ukrainian and international experience in ethical rulemaking. This document was approved by the Academic Council of the National Academy of Internal Affairs (Minutes No. 5 of March 27, 2018) and put into effect by the order of the Rector of the Academy (Order No. 422 of March 30, 2018).

REVIEW

Faced with the experience of service and combat situations, law enforcement officers often perceive various emotions: fear, anger, powerlessness, despair, and confusion. Such a reaction is quite natural for psycho-traumatic events. In the course of evolution, the human psyche has developed adaptation mechanisms that help to ensure vital activity even in very difficult situations. Traditionally, reactions to danger are manifested in the following ways: "escape", "hit" or "freeze", which stipulated the corresponding forms of behavior. The reaction is regulated by different branches of the nervous system: the sympathetic system, which is responsible for "hit" or "escape" and the parasympathetic system, which is responsible for "slow down" and "freeze". Both systems are designed to keep a person in balance under stress.

Under conditions of professional stress, law enforcement officers activate the structures of the limbic system of the brain, which keep adrenaline levels high and send signals about a potential threat. When an extreme threat is combined with helplessness, as often happens during service (combat) activities, the brain can send a signal to the body: "freeze". As a result, the heartbeat slows down, blood pressure, body temperature, and movement intensity decrease. When law enforcement officers are systematically exposed to extreme situations, such reactions can be immediate and temporary, or they can last for several days or even weeks. It all depends on the mental state and the severity of the traumatic event. In addition, the limbic system can send signals to the hippocampus, the area of the brain responsible for storing memories, not remembering traumatic events. Therefore, law enforcement officers need to forget certain details, and sometimes to completely supplant information about the stressful events they experienced.

Some researchers believe [10, 11] that one of the most effective forms of emergency psychological assistance in modern conditions is psychological debriefing, which is usually conducted with groups of people who have experienced stressful or tragic events together. It should be noted that debriefing involves a specially organized group discussion by recreating traumatic events i. e. chronology, participants, details, actions, etc. [12]. This is a conversation between a psychologist and victims that should be held no earlier than 24 hours and no later than 72 hours after the traumatic event. Such approaches to work with law enforcement officers can help overcome the negative effects of stress after a crisis incident, as well as develop skills that may be needed in the event of a repeated encounter with a similar situation. Of course, the most important point is the specifics of the debriefing, namely, the organization of a group discussion in a professional circle of law enforcement officers. It should include speaking, listening, decision-making, training, and bringing the meeting to a logical conclusion and positive result. In addition, it should be noted that other functions of the process coordinator may become relevant, such as using the laws of group dynamics, controlling the movement of group members inside and outside the classroom (other office space), time control, individual and additional consultations, etc. Although these functions are important, they should be subordinate to the main

tasks. It should also be noted that debriefing works more effectively in group communication, although it can also be used individually. It seems to us relevant to use it for participants (rapid response teams, patrols, crews, etc.) who are united by common professional functions and tasks: release of hostages, repulsion of attacks on premises and buildings, joint patrolling, combat operations under martial law, etc. Given the above, we propose an algorithm for using debriefing for the psychological recovery of law enforcement officers, optimization of their moral and psychological state, and increase of the level of psychological readiness for further performance of assigned tasks.

The first stage of a psychological debriefing with law enforcement officers includes the process of processing feelings, analysis of their emotions, and states. The sequence of participants' actions involves moving from introductory positions to formulating their thoughts and attitudes. From here, the group members get to know each other better before starting work. This activity may be excluded if the group includes representatives of the same professional team (squad, patrol, crew, etc.). Next, the rules that are common to any psychological correctional measure are introduced and discussed (voluntary participation, no criticism, etc.). Then the procedure of direct discussion of the crisis begins. To this end, each member of the group is asked to state the facts related to the emergency he or she experienced. The following questions may be appropriate: "How can you explain the situation?"; "What do you think was the difficulty of holding this event?"; "What could this be due to?", etc. If the participants understand the content of the questions, the psychologist-moderator invites them to express their thoughts, opinions, and feelings. After establishing psychological contact and overcoming barriers, the psychologist stimulates the analysis with orienting questions: "What were your impressions of what was happening around you?"; "How did the circumstances begin to develop?"; "What was strange to you?", etc. This stage ends with a discussion of law enforcement officers' feelings. Usually, servicemen and law enforcement officers do not only feel comfortable nor yet got accustomed to talking about their feelings and emotions, but the fact is that participants experience very strange (from their point of view) feelings, which they do not think are appropriate to share. However, these difficulties are gradually overcome, and with the successful overcoming of psychological barriers, the group (or the most active participants) can reach the level of disclosure of their feelings and experiences. To do this, the psychologist should ask questions such as: "What feelings did you have while perceiving the surrounding reality?"; "What was your first reaction?"; "How did your colleagues and/or other people react to the event?"; How can you explain their reaction?", etc.

The next step in conducting a psychological debriefing is to provide a sense of calm and support. At this stage, there should be psychological processing of the symptoms of law enforcement officers who have been in extreme situations (stressful conditions). Participants are encouraged to talk about the symptoms they experienced during and after the emergency (crisis). To visualize this process, it is worth using visual materials on which participants can record their own experiences, symptoms, and states. If any of the participants noticed any changes in physical and/or mental well-being, they can supplement the existing information with new entries. To intensify the work, the psychologist-moderator should ask orienting questions, in particular: "What physiological changes did you experience during or after the emergency?"; "Do you feel any psychological discomfort?"; "How can you explain the changes in your body and/or psyche?". During the group discussion, participants with similar symptoms can talk about their experiences and conditions in sequence and alternately. This allows participants not only to better understand each other but also to look at their symptoms from the outside, thus detaching themselves from them. This practice significantly reduces psychological stress during the training, partially relieves anxiety, overcomes fears of disclosing their feelings and emotions, etc. Later, the psychologist, with the help of the participants themselves, synthesizes the information received from them about their symptoms and reactions to the emergency. As a result, the law enforcement officer participating in the debriefing develops a clearer picture of the incident; realizes that he or she was not alone in the situation; develops a sense of support and confidence, etc.

A similar practice of psychological assistance ends with the stage of mobilizing resources and providing information. This stage represents psychological re-adaptation. Participants in the debriefing are already aware of the symptoms and difficulties they have encountered or may face in the future. Unlike the previous stages, this one is focused on the prospects for further professional activities of law enforcement officers. It addresses the issues of choosing the most favorable and appropriate measures to smooth out the symptoms or prevent them. During the analysis and discussion, all training participants (including the psychologist) should come to a common denominator. The group can agree on the need for additional consultations or an individual correctional meeting with a psychologist.

Thus, a properly organized communication analysis makes it possible to distract law enforcement officers from the consequences of being in extreme situations. The debriefing should clearly define a combination of emphases. It is advisable to use temporal, spatial, objective, and/or productive emphasis to draw attention to specific conditions and situations of law enforcement (combat) activities. It is worth noting that group debriefing uses the same mechanisms as group psychotherapy, namely, that initially, participants believe that their symptoms and experiences are unique. Nevertheless, over time, when law enforcement officers begin to share their feelings, they realize that everyone has similar experiences and similar feelings. This reassures participants and

gives them a sense of security and belonging, psychological support, etc.

Since a law enforcement officer is constantly exposed to various adverse factors, an important task for him or her is to master involuntary functions, the ability to control them arbitrarily, and to implement them at the right time. This task can be solved with the help of mental self-regulation as one of the most effective ways to provide psychological assistance. That is why, within the scope of our research, it is worth talking about the appropriate technique of mental self-regulation of law enforcement officers. The sequence of mental self-regulation techniques involves a conscious determination of the goal of mental self-regulation; preparation of the psyche (changing the ratio of conscious and unconscious); implementation of basic self-hypnosis formulas or other, previously prepared approaches.

A prominent place in the technique of mental self-regulation is occupied by special exercises that help the psyche become receptive to self-regulatory influences. In almost all self-regulation techniques, these special exercises are based on the use of body systems [13, 14] that are subject to conscious control and at the same time are automated, and perform involuntary functions. These are, first of all, the respiratory and muscular systems at the physiological level, as well as attention and the image-bearing sphere of productive memory at the mental level. Breathing and muscle tone are a kind of "bridge" from consciousness to subconscious, a combination of voluntary and involuntary. All systems in the body are interconnected, and if a person controls breathing, he or she can use it to relax muscles (muscle relaxation). By relaxing the muscles, the person relaxes the nervous system, i. e., implements the process of inhibition in the peripheral nerves. The process of inhibition is transmitted to the brain, covers the cerebral cortex, and is inhibited. Only the fixation on the object of self-hypnosis (the attitude to certain changes in the body or actions) remains in the inhibited cortex. Moreover, since there are no obstacles to its spread in the relaxed cortex, the effect spreads unlimitedly to all structures of the law enforcement officer's brain, causing objective physiological and corresponding mental changes.

A special place in mental self-regulation belongs to image-bearing management since the mental, sensory image actively affects the state of all systems of the human body. Replacing real objects and sensations with imaginary ones can have a significant effect, especially if these images are based on real-life or professional experience rather than abstract constructs. For example, a visual image of a strong person combined with the corresponding physical sensations of muscle elasticity and internal feelings of self-confidence can reorganize the mental and physical state of a law enforcement officer at a crucial moment of performance of service duties. Thus, the psychological aspect of mental self-regulation is the subordination of the dominant of excitation or inhibition of the cerebral cortex depending on the consciously set task, the solution of which is directed to the energetic ultra-mobilization of the subconscious reserves of the individual.

DISCUSSION

The substantive specificity of current social changes, which is manifested in the network principles of communication and collective organization, determine the need for law enforcement officers to constantly "complete" the trajectories of realizing their professional status, and objectively lead to other problems that they have not previously encountered in their lives and work, and which pose new psychological challenges to them. At the same time, the high speed of social change is difficult to master and overcome. Thus, the requirements of law enforcement and combat activities not only inevitably actualize the personal potential of a specialist, but also pose difficult tasks for his or her continuous development in extreme (crisis) situations [2, 7, 15].

It is also necessary to take into account several fundamental positions that are strengthened during the performance of tasks in extreme situations (combat operations), namely: 1) the stressfulness of a typical situation in which a law enforcement officer usually operates can be exacerbated by the awareness of emergency conditions and his or her participation in them; 2) reflection of the peculiarities of individual indicators (professionally significant qualities) manifested in his or her coping behavior.

With a further increase in the intensity of mental stress under the influence of negative psychological phenomena, mistakes begin to appear even in practiced (typical) situations, their number gradually increases, and the effectiveness of law enforcement (combat) activities rapidly decreases [9, 16]. The emergence of excessive tension progresses the emergence of fatal mistakes (for example, the use of firearms in the presence of the slightest suspicion); the acquired knowledge and instructions on response and interaction tactics "disappear"; there are manifestations of outright cowardice, refusal to perform risky assignments, deception, dishonesty, etc. If psychological assistance is not provided promptly, the negative consequences of the impact of traumatic situations on the personality of a law enforcement officer are manifested: various forms of destructive behavior, ranging from alcoholism to suicide, acts of conflict aggression against work and/or service colleagues, facts of ignoring security measures, etc.

CONCLUSIONS

Based on our analysis, we have presented and substantiated approaches to the practice of providing psychological assistance to law enforcement officers who are (were) in extreme (crisis) situations. It was established that the goals of such assistance should primarily be diagnostics of the personal potential of a law enforcement officer; assistance in understanding new experiences; support in activating their resources to continue the service and perform professional tasks, etc.

It was found that using debriefing as a psycho-correctional practice helps to prevent the development and

intensification of the impact of stress on the individual; promotes understanding of the causes of the mental state; awareness of the actions to be taken to alleviate the adverse effects of such impact. Also the focus of modern medical and psychological attention should be on the psychological stability of a law enforcement officer's personality, his or her endurance, resilience, and flexibility. Therefore, if there is a need to overcome feelings of anxiety and excitement, it is necessary to learn mental self-regulation techniques, acquire effective communication skills.

Prospects for further research include the study of potential changes in the personality of a law enforcement officer while performing service duties under martial law.

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REVIEW ARTICLE

ATAXIA IN CHILDREN IN THE PRACTICE OF A PARAMEDIC

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The article has been withdrawn in accordance with the anti-plagiarism policy.

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REVIEW ARTICLE

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THE USE OF DRONES IN EMERGENCY MEDICINE

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ABSTRACT

In the 21st century, we are experiencing the widespread use of new technologies that are designed to make work and daily life easier. The emergence of unmanned aerial vehicles (UAVs) has also opened up new opportunities for medical rescue support. This paper explores the various aspects of using medical drones to aid rescue operations. These devices can move at high speeds, traverse difficult terrain that ground vehicles cannot, and have many capabilities depending on their equipment. Currently, the use of UAVs is limited to rescue operations of an extreme nature, such as searching for missing individuals in dangerous or vast areas, or providing support during mass events.The paper describes the potential possibilities of using drones in rescue operations, such as delivering critical medicines, first aid equipment, or collecting information on hazards relevant to rescue planning. It is important to note that UAVs are still a relatively new technology that requires reliable safety systems, especially in the context of medical use. Possible threats, such as hacking attacks, collision risks in different environments, and the level of training of personnel involved in UAVs management, were also presented. Additionally, the paper addresses current legal and systemic issues in Poland and the European Union. Lastly, the results of public opinion polls on confidentiality and consent to the use of medical drones were mentioned.

KEY WORDS

drones, medical rescue, new technologies

INTRODUCTION

The present era is characterized by a significant technological advancement, where machines and computers are becoming integral to daily tasks to ease the burden on individuals. Over the past decade, unmanned aerial vehicles (UAVs), commonly known as drones, have gained immense interest due to their versatile use in various fields [1]. This paper delves into the utilization of these flying devices in emergency medicine and explores their potential future value.

HISTORY OF THE USE OF AIR TRANSPORT IN EMERGENCY MEDICINE

In the 21st century, there has been a significant development in unmanned aircraft technology. This progress has been greatly influenced by advances in technology and decreasing production costs [2]. Air transport, in the form of aircraft or helicopters, has long been used in military or civilian emergency medicine due to its speed, ability to cover long distances, and lack of limitations characteristic of ground transport [3]. However, aircraft also has negative aspects such as dependence on a qualified air crew, high maintenance costs, lower payload capacity compared to ground transport, and reliance on weather conditions. The creation of ground-controlled drones via radio waves marked a new era in aviation and emergency medical services.

THE AIM

This paper explores the various aspects of using medical drones to aid rescue operations. Additionally, the paper addresses current legal and systemic issues in Poland and the European Union. Lastly, the results of public opinion polls on confidentiality and consent to the use of medical drones were mentioned.

REVIEW

DELIVERY OF MEDICAL SUPPLIES

One of the most significant drone applications in emergency medicine is the delivery of medical supplies to hard-to-reach locations. Drones can effectively deliver the required items in case of natural disasters, dangerous, non-urbanized areas, car crashes, or other challenging situations where rapid delivery of equipment and medicines is necessary]. It is expected that drones will be utilized to transport materials between hospitals and research center's and even support helicopters and ambulances by transporting patients in further stages of the project [4]. At this moment, delivery of medical materials and transport of patients using drones is prohibited, but the development of the project will allow for further pro-

gress, which will undoubtedly support the work of the medical rescue system.

DRUG DELIVERY

Drones have become an appealing option for the transportation of medical products due to their speed and ability to traverse impassable terrain. The first medical drone delivery took place in the United States in 2015, utilizing a drone designed in compliance with state government regulations [5]. This technology was used to expedite the process of delivering medicines to a clinic in Virginia, resulting in reduced patient treatment time and confirming the effectiveness of drones in medical transportation, thus paving the way for further project development.

In the chain of patient survival, pre-hospital care, initiation of treatment, and transport of the victim are crucial. In cases of severe neurological damage, such as strokes, overdoses, and cardiac arrest, response time is of utmost importance [6]. According to information provided on the Polish Ministry of Health website, the average time to reach a patient in an urban area with a population of over 10,000 in Poland is 8 minutes, whereas in rural, remote, geographically challenging areas, or heavily congested cities, it can exceed 15 minutes [7]. Similar findings have been reported in the United States [6]. To decrease waiting time for medical assistance, the use of drones has been deemed a viable option for providing pre-hospital aid.

EPINEPHRINE

Allergic reactions to a particular agent are not uncommon, and in some cases, can lead to anaphylaxis, a severe condition that can quickly lead to death if left untreated. The treatment for this condition is epinephrine. In Poland, there are two prescription epinephrine preparations available, which come in the form of an auto-injector and an ampoule-syringe [8]. The products vary in storage requirements depending on the company. Auto-syringes are resistant to light and temperature changes, while the glass ampoule-syringes must be refrigerated at 2-8°C, making it more challenging to access the drug in everyday life. Since anaphylactic attacks can be life-threatening, the use of drones as epinephrine transporters for pre-hospital assistance is a promising solution. Currently, the durability of auto-injectors for anaphylaxis during drone transport has been validated, but more research is necessary to determine the effectiveness of using UAVs in situations involving people in anaphylactic shock [6].

NALOXONE

Administering drugs rapidly is critical in several cases, including fatal opioid overdose. In such situations, naloxone is recommended for intranasal administration, and even bystanders can administer the drug [9]. The drug being available on prescription only for at-risk individuals, which reduces its availability and affects the number of fatal drug overdoses, especially in rural areas. A 2020 study validated that drone-delivered naloxone can potentially reduce the time it takes for bystanders to administer the drug, following the directions of a 911 emergency line dispatcher, to a person in need [5]. The researchers emphasize the need to encourage the development of such a system and to continue researching its effectiveness [9].

ANTIEPILEPTIC DRUGS

Epilepsy is characterized by a sudden increase in electrical activity in the brain or a specific area, resulting in a disruption of interneuronal communication [10]. Epileptic seizures require immediate treatment, and a longer seizure duration is associated with an increased incidence of epileptic symptoms and mortality. Studies have shown that administering benzodiazepines prehospital for a seizure lasting more than 5 minutes reduces the duration of the seizure itself and the likelihood of recurrence [11]. However, this drug is under close scrutiny due to its strong addictive properties. Using drones to assist individuals with epilepsy could provide quick and efficient help to those in need while controlling access to controlled substances. Although the idea is currently being considered in the realm of modeling work, it offers hope for modernizing emergency medicine systems and providing faster response times [12].

DELIVERY OF MEDICAL EQUIPMENT

UAVs have found applications in providing automated external defibrillators (AEDs) for those assisting victims with cardiac arrest in the field of emergency medicine. A defibrillator is a device used to detect and treat cardiac arrhythmias. During cardiac arrest, a defibrillator can save a patient's life by delivering electrical impulses to the heart muscle that restore its normal function. Out-of-hospital cardiac arrest is considered one of the most urgent life-threatening situations [13]. According to an analysis of statistics, in the United States, 350,000 people suffer cardiac arrest, and the survival rate is less than 10%. In Poland, an average of 40,000 people die each year as a result of sudden cardiac arrest [11]. The use of an automated external defibrillator in the early stages of cardiac arrest is associated with a significant increase in survival [12]. AEDs are often available in public places, but the essence of rapid deployment of this device requires facilitating accessibility. In this context, drones can play an important role in the delivery of emergency medical equipment. Transporting defibrillators to the scene of an emergency can speed up the time it takes for rescue operation to begin. In addition, for hard-to-reach areas such as mountains or non-urbanized areas, UAVs may be the only way to quickly deliver AEDs to the scene of an accident. A 2016 computer simulation study showed that in Salt Lake County, Utah, proper drone deployment would allow 96% of the county's population to receive an AED in less than 1 minute [14]. At the same time, only 4.3% of ambulances arrived. However, the pro-

ject faces current problems such as high collision rates, airspace regulation, and human screening. Although the 2016 computer simulation study showed impressive results, the system requires further research and development of the drone technology used.

THREAT MONITORING

Drones do not require a crew, which enables them to safely and efficiently monitor disaster sites and areas at risk without putting those controlling the device in harm's way [4]. Many drone models also come equipped with specialized tools that can aid in search and rescue operations, such as thermal imaging cameras and GPS tracking systems. This provides hope for the development of a more efficient and safer emergency medical system.

SUPPORT FOR SEARCH AND RESCUE OPERATIONS

Drones have emerged as a valuable asset in emergency services as they can transmit information and medical supplies from one location to another without the need for human interaction. In particular, drones equipped with thermal imaging cameras can survey large areas and locate people in hard-to-reach places, thereby avoiding the risk of putting rescue teams in danger [15]. Furthermore, rescue drones come equipped with signal lights, spotlights, and speakers that can illuminate the search area, indicate a trail, and issue voice commands to those in need of rescue. Additionally, drones have proven effective in delivering much-needed life-saving equipment. A recent example was in 2022, when a drone was used to deliver blankets and heaters to three stranded hikers on Kondracka Kopa, allowing them to survive until rescuers arrived [16].

Drones have also demonstrated effectiveness in searching for people at risk of drowning as well as those who are already drowning [17, 18]. In a simulation study that conducted 28 tests to compare drone-assisted and non-drone-assisted operations, UAVs were found to be effective in providing swimmers with buoyancy equipment quickly and safely [17]. Another study by Claesson and colleagues found that using a UAV in rescue operations reduced response times by 3 minutes and 38 seconds, showing great potential in saving lives [18]. Subsequent tests have also confirmed the effectiveness of drones in identifying people simulating drowning as well as real people in danger of drowning [19].

EXAMINATION OF AREAS FOR PHYSICAL AND CHEMICAL FACTORS

Unmanned aerial vehicles have become a useful tool in assessing environmental risks associated with heavy metals, aerosols, and radiation. In southern Italy, a study was conducted in Trentola Ducenta, Caserta province, using drones equipped with high-resolution photogrammetry software to analyze geogenic and anthropogenic soil contamination with copper in agricultural areas. The results of the study confirmed the significant potential of UAVs in detecting and predicting cancer risks based on copper concentrations [20].

In 2016, Brady and colleagues demonstrated the use of a drone with an integrated sampling platform to accurately measure aerosol and trace gas levels in the environment. This technology has enabled early detection of physical and chemical factors in areas highly exposed to these agents, such as uranium mine sites, which is particularly important for rescue operations [21, 22].

USE DURING DISASTERS AND MASS CASUALTIES

The utilization of drones for responding to mass casualties and disasters is becoming increasingly popular due to their ability to swiftly navigate hard-to-reach areas and carry additional equipment. UAVs provide faster response times, which can significantly impact the chances of survival for those in need.

In the case of natural disasters, such as hurricanes, earthquakes, or forest fires, drones equipped with thermal imaging cameras or search sensors can be deployed to search for people who may be trapped in areas with limited accessibility. They can effectively analyze the terrain in search of victims and provide critical information about the situation. For instance, after Typhoon Haiyan hit the Philippines in 2013, drones were used to assess the damage, gather necessary information to determine rescue efforts, and provide medical aid [5]. These devices were equipped with cameras, thermal imaging sensors, and telecommunication systems that allowed them to collect information and issue commands to victims.

Disasters are often characterized by limited resources and a complex structure for supervising rescue teams. The use of drones significantly aids in executing operations effectively. One of the primary advantages of drones is their ability to provide virtual surveillance of the situation [23]. The speed and camera capabilities of the devices allow for safe monitoring, up-to-date analysis, and planning of further actions. As demonstrated in a simulation study, drones provide valuable information for increased field segregation, casualty evacuation methods, and patient segregation, without sacrificing accuracy [23]. These results are consistent for both daytime and nighttime operations. Drones equipped with speakers and microphones can also provide commands to event participants and rescuers [24].

The continued development of UAV technology and regulatory alignment will allow for even broader utilization of drones in the field of emergency medicine during disasters with mass casualties.

CURRENT CHALLENGES AND SECURITY

The use of UAVs for medical rescue support is still in its nascent stages. While research into and use of drones in extreme situations such as catastrophes and search and rescue missions are currently underway, it will likely take several more years before UAVs become a

standard tool in rescue operations. The main hindrance to the widespread adoption of drones in emergency medicine is regulatory issues. Efforts are currently being made at both the international and regional levels of the European Union to establish common rules for the use of UAVs.

The integration of drones as a standard in emergency medicine necessitates the development of solutions to technical and operational challenges. This involves establishing the equipment design standards, as well as for the maintenance of the drones themselves and their use. Despite the significant benefits that the use of UAVs can bring to rescue missions, potential risks associated with this technology must also be considered. Because UAVs are relatively new technology, it is likely that issues and glitches will arise during their use. For instance, rescue drones are particularly vulnerable to hacking attacks [17]. Therefore, control of these devices requires the continuous transmission of data from the ground station and the securing of the connection against unauthorized third-party interference. Currently, measures are being taken to create safeguards against third-party interference with radio transmission between the device and the ground station [25].

Although UAVs can move quickly and cover areas that ground vehicles may have difficulty accessing, there is a risk of accidents, particularly in urban infrastructure. To minimize the likelihood of drone collisions, research is being conducted on technologies that aid flight and orientation in the field [25]. Several systems have already been developed, including those based on neural networks that allow for orientation in natural environments like forests and can predict flight at distances of up to 1 km [26]. Another proposition involves the use of "computer vision" techniques that rely on algorithms that calculate changing conditions in real-time [27]. In 2019, researchers Passalis and Tefas presented a method based on deep reinforcement learning that promises to improve flight precision [28] and is likely to be the most effective system for drone use in emergency medicine.

To ensure maximum safety during rescue missions, a team of trained personnel should be in place to operate the UAVs effectively and be aware of the potential risks associated with equipment failure and dangerous situations. Moreover, a practical and convenient system of cooperation between drone operators and rescuers must be established.

POLISH PERSPECTIVE, LEGAL ASPECTS

In Poland, drones are currently utilized primarily by GOPR services. The use of UAVs for medical rescue is governed by the Regulation of the Minister of Health from May 9, 2018, concerning the qualifications of medical rescue personnel, as well as the organization and operation of entities engaged in these activities ((Dz.U.2018 poz. 1006). According to this regulation, the transportation of individuals and medical equipment via UAVs is only permissible if it adheres to medical principles and transport procedures. The designated operator of the transport must possess the necessary qualifications to operate drones, and it is not permitted to transport patients via UAV alone. However, the delivery of medicines, medical equipment, and laboratory specimens is already authorized, provided they are properly packaged and secured for transport.

It should be noted that specific regulations regarding the use of drones in emergency medicine are currently lacking in Poland. The aforementioned regulation represents a crucial initial step towards the creation of an innovative system to support emergency medicine throughout the country.

DISCUSSION

Undoubtedly, drones are poised to become the future standard in medical rescue. As with any introduction of new technology, public response is an important consideration.

Most rescue drones are equipped with the capability to communicate remotely with individuals in need of medical assistance. As a result, obtaining special permission to process protected health data is necessary [29]. Medical drones must be designed to comply with the Health Insurance Portability and Accountability Act (HIPAA), which includes safeguarding confidential patient information and in Poland Directive No. 95/46/CE on the protection of sensitive data and additionally the GDPR.

According to public opinion surveys concerning the use of drones in emergency medicine, a majority of respondents view UAVs positively in emergency medical care, citing their ability to improve response times and enhance the quality of care provided during accidents and mass casualties [2]. Nevertheless, some individuals expressed concerns about privacy and the security of medical data, as well as potential risks associated with drone malfunctions or technical issues.

The findings suggest the need to educate the public on the use of drones in emergency medicine, in order to raise awareness regarding the benefits and limitations of these technologies. Additionally, it is crucial to ensure that medical data is kept secure in order to foster public trust.

CONCLUSIONS

The use UAVs in emergency medicine is considered to be an innovative solution with the potential to greatly enhance the efficiency of rescue efforts. The utilization of drones in medical transports, searching for people in hazardous areas, and supporting response efforts during natural disasters has already proven to be hugely beneficial. The use of drones in emergency medicine has the potential to significantly improve emergency services' response times, ultimately saving more lives.

It is important to note that appropriate laws governing the use of medical drones are still being developed,

and public education on the benefits and proper use of UAVs in rescue efforts is necessary to increase public trust and understanding of these technologies. Nonetheless, current research and efforts to establish UAVs as a standard tool in emergency medicine are significant steps towards innovation and progress in the field.

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CONFLICT OF INTEREST
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CASE STUDY

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PRE-HOSPITAL MANAGEMENT OF ACUTE PERICARDITIS BASED ON A CASE STUDY

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ABSTRACT

Aim: Indication of appropriate treatment of the emergency medical team towards a patient with acute pericarditis being a life-threatening condition.

Material and method: The retrospective study included two men to whom EMT (Emergency Medical Team) was called for chest pain and in the second case due to the correlation of chest pain, ECG changes and pathological results of ultrasensitive cardiac troponin and CRP. Both patients developed acute pericarditis as a result of the infection they were currently undergoing. In this paper, the case study method was used. The research material was obtained through the analysis of medical rescue cards, EMT departure order cards and hospital treatment information cards.

Conclusions: Among cardiac patients with stenocardial pain, regardless of age and other factors, an examination should always be carried out and discriminatory diagnostics should be implemented, m.in. for suspected acute pericarditis. Medical interview, in particular epidemiological history, plays an important role.

KEY WORDS

acute pericarditis, emergency procedures, life-threatening condition

INTRODUCTION

The pericardium, which is made up of two layers: visceral, or epicardium, and fibrous wall lamina, is a baggy structure protecting the heart muscle [1]. It is responsible for stabilizing the location of the heart in the mediastinum, has a protective function against muscle infections, and the fluid between the plaques in a physiological amount of 10-50 ml minimizes friction [2]. Diseases of the pericardium are primarily pericarditis, accumulating excess fluid in the pericardial sac cardiac tamponade, constrictive pericarditis, as well as pericardial tumours [3,4]. Pericarditis is classified as acute, chronic or recurrent, however, hospitalizations for acute type were the most frequently reported [1,5]. Based on previous research, it is estimated that pericarditis is the cause of 0.1% compared to all hospitalizations, and that of all people presenting to hospital emergency departments due to the presence of chest pain, about 5% of them have pericarditis [6,7]. Diagnosis and pre-hospital management should be based primarily on current ESC guidelines for the diagnosis and treatment of pericardial diseases, taking into account the limitations of Emergency Medical Teams compared to the possibilities at the hospital stage.

CRITERIA FOR THE DIAGNOSIS OF ACUTE PERICARDITIS

The diagnosis of acute pericarditis requires meeting at least 2 of the 4 criteria:

1. chest pain of a pericardial nature
2. pericardial friction
3. newly detected ST segment elevation or PR segment reduction in multiple leads electrocardiogram
4. fluid in the pericardial sac (newly formed or increasing fluid volume).

The diagnosis is also supported by such symptoms as an increase in the concentration of inflammatory markers (a.o. C-reactive protein, accelerated erythrocyte fall reaction and leukocytosis in the blood) and exponents of pericarditis on radiological examination (CT, CMR) [1,8,9]. In order to determine the actual etiology of the condition, it is important to test the fluid from the pericardial sac, however, non-invasive techniques play a key role in the diagnosis and treatment [11].

FACTORS OF POOR PROGNOSIS IN ACUTE PERICARDITIS

The main factors that may prognosis a severe course and a higher risk of serious complications of acute pericarditis are: high fever >38°C, subacute course of the disease, persistent complaints for at least a few days without a clear acute phase, symptoms of the presence of a large amount of fluid in the pericardial sac, tamponade, as well as lack of response to non-steroidal anti-inflammatory drugs (NSAIDs) within a week [10].

SUBJECTIVE AND OBJECTIVE EXAMINATION OF THE PATIENT

The aim of the subjective and objective examination is to make an initial diagnosis and focus on further diagnostics and to determine the most likely etiology of the pa-

tient's disease state. The history determines the nature of chest pain, provides information about recent respiratory tract infections, symptoms that have occurred or are still occurring, as well as the patient's medical history, in particular heart attack, cardiac surgery, radiotherapy in the chest, coexistence of connective tissue diseases or cancer. In the objective examination, auscultating the patient's chest in the presence of pericarditis, we can hear the murmur of pericardial friction [11]. This murmur is described as similar to the sound of scratching or crunching snow. It consists of two or three short sounds per one heart cycle (one for heart contraction and one or two for diastole). The most common auscultation site is the left edge of the sternum at levels II–III of the intercostal. In order to strengthen the hearing, the membrane is pressed harder against the skin, the patient can be asked to take the knee-elbow position and hold his breath for a moment. The possibility of confusion with the sound of rubbing the handset against the chest hair should also be excluded. For a patient with acute pericarditis, there is a risk of the presence of an increased amount of fluid in the pericardial sac and complications of cardiac tamponade. The diagnosis of tamponade is noted only in the presence of clinical signs: shortness of breath, dilation of the jugular veins, tachycardia, suppression of the heart tones, hypotonia, paradoxical pulse [12, 13]. Electrocardiographic examination may be helpful, in the ECG it is possible to observe the alternation of the amplitude of QRS syndromes or low amplitude of QRS syndromes, i.e. <0.5 mV in limb leads and <1.0 mV in pre-cardiac leads [13].

ECG IN PERICARDITIS

From clinical observation, it has been observed that people with a significant amount of fluid in the pericardial sac have a typical decrease in the amplitude of QRS syndromes and T waves. In the ECG itself, other characteristic changes in patients with acute pericarditis can also be seen, which consist of four phases:

1. visible in many leads concave elevation of the ST segment, mostly in I, II, aVL, aVF, V3–V6 and the lack of their mirror lowering of ST segments in opposite leads as is usually the case with acute coronary syndrome (ACS) and horizontal reduction of the PQ interval (PR)
2. gradual flattening and reversal of the T waves with typical normalization of ST segment elevation and visible reduction of PQ interval (PR)
3. reversal of T waves noticeable in many leads
4. ECG is normalized [11].

PRE-HOSPITAL ACTIVITIES AND TREATMENT

In the case of diagnosis of pericarditis in pre-hospital management, the main task of EMT is to ensure basic life functions, cardiopulmonary stabilization and initial implementation of treatment based on current ESC guidelines. In emergency medical teams, first-line drugs are: acetylsalicylic acid and ibuprofen. Second-line drugs include glucorticosteroids.

Recommendations and dosage of drugs according to ESC:

- ASA 750–1000 mg every 8 hours. duration of treatment 1–2 weeks
- Ibuprofen 600 mg every 8 hours. treatment duration 1-2 weeks
- Colchicine 0.5 mg 1 x/d (body weight <70 kg) or 0.5 mg 2 x/d (body weight >70 kg), duration of treatment 3 months – drug not available in EMT, for use in hospital and outpatient treatment [1].

Further management and treatment depends on the patient's condition and accompanying symptoms, sometimes it may require the implementation of oxygen therapy and pain medication. The course of transport itself should take place on a stretcher to limit effort, with constant monitoring of the clinical condition, which can range from a severe episode resembling a heart attack, to a light one, sometimes mistakenly described and underestimated as only an ongoing respiratory infection. Helpful in diagnosing pericarditis is an ultrasound examination, which reveals the initial amount of fluid present in the pericardial sac and confirms or excludes cardiac tamponade in other clinical symptoms. Further hospital treatment depends on the results of laboratory tests, the current condition of the patient, which sometimes requires a longer time of hospitalization and the implementation of appropriate antibiotic therapy [8, 11].

THE AIM

The aim of the study was to indicate the appropriate procedure within the medical rescue team for a patient with acute pericarditis being a life-threatening condition.

MATERIAL AND METHODS

The retrospective study included two men to whom EMT was called for chest pain and in the second case due to the correlation of chest pain, ECG changes and pathological results of ultrasensitive cardiac troponin and CRP. Both patients developed acute pericarditis as a result of the infection they were currently in. In this paper, the case study method was used. The research material was obtained through the analysis of medical rescue cards, EMT departure order cards and hospital treatment information cards.

CASE REPORTS

CASE 1

On 12.01.2023 at 22:44, the Specialist Medical Rescue Team consisting of 3 paramedics (EMT) was dispatched in code 1 to the event in the description of which the medical dispatcher included an interview: chest pain, crushing, burning, radiating to the throat, ailments from 40 minutes, shortness of breath. The team was about 3km away from the scene. The time of arrival to the patient was noted at 22:51. A 39-year-old man was found at the scene, who confirmed the symptoms reported to the medical dispatcher, supplementing the interview with the occurrence of chest pain of the nature given above

and radiation to both upper limbs. Symptoms worsened during breathing and occurred for about 40 minutes. For 5 days, the patient felt symptoms of infection in the form of malaise, hot flashes (he did not measure temperature) and observed a raid on the pharyngeal tonsils. As part of self-medication, he applied Zinnat (Cefuroximum) for 5 days, negated allergies, confirmed nicotine addiction. The EMT study noted: blood pressure (BP) 120/90 mmHg, SpO_2 98%, heart rate 100 beats/minute, glycemic level 85 mg%. During auscultation, a bilateral alveolar murmur occurred without additional respiratory artifacts. During auscultation, a bilateral alveolar murmur occurred without additional respiratory artifacts. The tones of the heart were clear, steady and well accentuated. The temperature measured in the external ear canal was 37.5°C. The description states that the patient is conscious, oriented, circulatory and respiratory stable. There were no neurological defects, the abdomen was soft and painless. In the performed 12-lead ECG, ST segment elevations in I, II, aVF, V5, V6 and the occurrence of ST depression in V1 were noted. The patient was consulted by remote transmission with the invasive cardiologist on duty, receiving an order to be transported to the emergency room (ER) of the hospital. At the place of call, due to severe pain, analgesia was used in the form of administration of 5 mg Morphini Sulfas (iv). 300 mg ASA (after) and 250 ml infusion of 0.9% NaCl (iv) were also administered during transport to maintain the puncture. The patient was taken to the ER for further diagnosis at 11:18 p.m.. In the basic studies performed in ER, a sinus rhythm, measured, with a frequency of 75 beats / minute, normogram was noted on the ECG. The q-wave in lead III and the elevation of the ST segment in leads I, II, III, aVF and V2-V6 are also described. The following pathologies occurred in laboratory tests: leukocytosis (12.34 G/l) – norm (4.23-9.07 G/l), neutoriflia (7.97 G/l) – norm (1.78-6.04 G/l), CRP (24.7 mg/l) – norm (<5 mg/l), AST (73 U/L) – norm (0-40 U/L), Troponin Ths (1578 pg/ml) – norm (0-14 pg/ml), D-Dimer (0.64 uq/ml) – norm (0-0.5 uq/ml), NT–proBNP (986 pg/ml) – norm (0-125 pg/ml). In connection with the results of the tests and the diagnosis of suspected acute pericarditis, the patient was admitted to the Cardiology Department for further diagnosis. During this stay, a gradual decrease in the level of Troponin Ths to the normal value was observed, normalization of the level of leukocytes and neutrophils and a decrease in the level of CRP was achieved. Holter ECG and echocardiography were also performed, without revealing any significant pathologies. In addition, on echocardiography, the left ventricular ejection fraction was determined to be 65%, no segmental or global contractility disorders were observed, which allowed to confirm the diagnosis of acute pericarditis and the exclusion of ACS. The discharge ECG presented sinus rhythm, measured with a frequency of about 60 beats / minute, normogram, q wave in lead III. The duration of stay in the Department was 6 days, after which the patient was discharged home with a recommendation for referral to outpatient treatment. It was recommended to visit the cardiology clinic with consideration of MRI of the heart and limitation of physical activity for a period of 1 month. It was recommended to take colchicine for 1.5 months (Fig. 1).

CASE 2

On 12.01.2023 at 23:38, a specialist EMT was dispatched in code 1 to the unit of night and holiday healthcare (pl. nocna i świąteczna pomoc lekarska – NŚPL) for intervention with an interview: suspected myocarditis / ACS, Troponin 160, CRP 202 – performed in NŚPL. On ECG flat elevations ST II, III, aVF. Patient undergoing treatment of angina. The team was about 19 km away from the scene and the travel time to the patient was 13 minutes. A 38-year-old man was found at the scene reporting chest pain of a tight nature. The above-mentioned laboratory test results were performed in the NPM, 300 mg of ASA and 25 mg of Hydroxyzine were administered. The patient denied the occurrence of chronic diseases, denied taking medication permanently, did not report any allergies and addiction to alcohol or nicotine. From the day according to the doctor's recommendation takes Amoksiklav. In the EMT examination, it was found

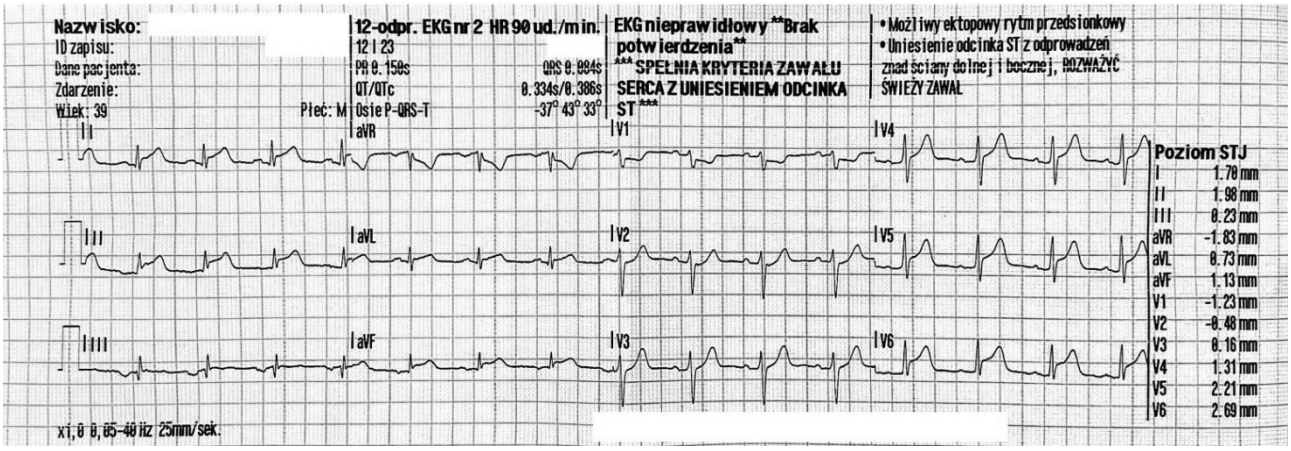

Fig. 1 Record 12 lead ECG (case 1).

that the man maintains consciousness and logical verbal contact, is stable circulatory and respiratory, in the ECG there is a sinus rhythm, measured with a frequency of about 100 beats/minute, 0.5 mm of ST segment elevation is present in leads II, III and aVF. Auscultation, symmetrical alveolar murmur occurred bilaterally without additional respiratory artifacts. The patient's vital signs are: 12 breaths/minute – no respiratory effort, CTK 110/80 mmHg, SpO_2 98%, heart rate 100/minute, temperature 36.2°C, glycemic level 105 mg%. No pharmacotherapy was used during medical rescue operations (MDD) on the part of MSD. The patient was transferred for further diagnosis at IP at 00:42. On the ECG during the reception, sinus rhythm was described, measured with a frequency of about 60 beats/minute, 0.5 mm of ST segment elevation in leads II, III, aVF with PQ segment reduction. After laboratory tests, the following pathologies were noted: leukocytosis (9.2 G/l) – norm (4.23-9.07 G/l), neutrophils (6.46 G/l) – norm (1.78-6.04 G/l), CRP (183.5 mg/l) – norm (<5 mg/l), Troponin Ths (250.4 pg/ml) – norm (0-14 pg/ml), D–Dimer (1.24 uq/ml) – norm (0-0.5 uq/ml). Based on the results obtained, the patient was hospitalized in the Department of Cardiology for 5 days. Normalization of inflammatory parameters (reduction of leukocytosis, neutrophilia and CRP) was achieved, as well as a decrease in the level of Troponin Ths. Echocardiography determined the left ventricular ejection fraction (EF) at 65%. Disorders of global and segmental contractility were excluded, which in correlation with the patient's clinical condition allowed to exclude ACS and confirm acute pericarditis. The patient was discharged for outpatient treatment, recommending the continuation of antibiotic therapy, the use of a non-steroidal anti-inflammatory drug (NSAID) – ibuprofen and taking colchicine for 3 months (Fig. 2).

DISCUSSION

Pericarditis is most often preceded by the occurrence of a chronic infection or other factor that may be responsible for it. One of the factors causing pericarditis may be the presence of COVID-19 infection. In their paper, Dini FL et al. presents follow-up results in a group of 180 patients who had COVID-19 and who had new, recurrent symptoms at least 12 weeks after testing negative for COVID-19. Symptoms reported by patients included malaise, shortness of breath and shortness of breath (52%), palpitations (37%) and chest pain (34%). The entire research group underwent a thorough physical examination. Patients who had complaints that may result from myocardial dysfunction were also subjected to echocardiography. Factors qualifying for the diagnosis of pericarditis were taken into account: chest pain, pericardial friction, electrocardiogram changes and pericardial effusion. In the study group, the criteria for pericarditis were met by 22% of this group, i.e. 39 patients. Among them, 28 patients met 2 of the 4 classical criteria, 10 patients met 3 of the 4 criteria, and only 1 patient met all 4 of the 4 classic criteria for pericarditis. The least specific symptom of acute pericarditis is considered to be pericardial friction because it occurred in only 1 out of 39 patients in the study group who had acute pericarditis. In addition, it is not certain that this was a symptom specific to pericarditis, because this patient had a serious history of cardiovascular disease. On echocardiography in the pericarditis group, changes were found in 10 patients, including: 8 (5%) had right ventricular dysfunction, 1 had cardiomyopathy and 1 had left ventricular dysfunction. Other specific symptoms included moderate to mild pericardial effusion (5-12 mm) in 12 (31%) patients, while 27 patients had less than 5 mm of pericardial fluid. ECG changes in ST segment elevation or T-wave reversal in multiple leads were observed in 15 (39%) patients in the pericarditis group. In the study group, the occurrence of concomitant diseases was also taken into account. A higher incidence of pericarditis was observed in patients with: allergic asthma, Hashimoto's disease, psoriasis, fibromyalgia and autoimmune myositis compared to patients without pericarditis [14]. The most common situations of pericarditis are a complication of viral diseases, however, there are cases of bacterial diseases, which can also be an etiological factor of pericarditis. This situation was observed by Weber DC et al. in the case of a 79-year-

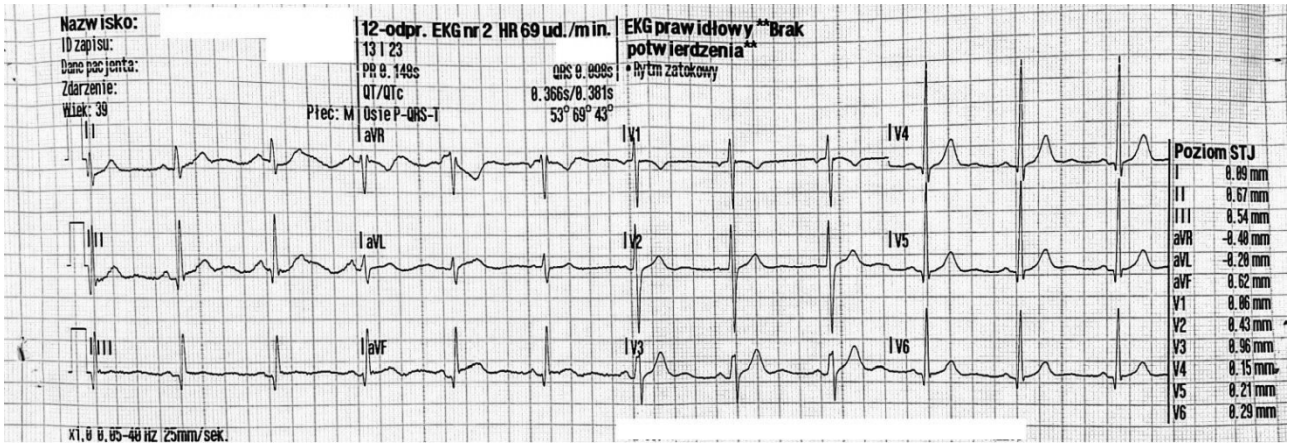

Fig. 2 Record of 12 lead ECG (case 2).

old patient treated for a big toe infection with Staphylococcus aureus. In the course of this infection, the man experienced septic shock and circulatory failure. On the ECG, elevations of the ST segment from above the lower wall were observed. The patient was initially classified as STEMI and through pharmacotherapy ASA and ticagrelor was prepared for invasive surgery. Laboratory tests revealed significant leukocytosis, renal failure, elevated lactate and CRP levels. What was puzzling, however, was the low level of Troponin Ths. In this regard, pericarditis began to be suspected. A chest X-ray was also taken, revealing an enlargement of the heart muscle. The patient in the further course of hospitalization had an infected big toe amputated and was given empirical antibiotic therapy until he received a culture. Despite the removal of the etiological factor, on the next day after the procedure, an increase in leukocytosis and deterioration of circulatory fitness were observed in this patient. A chest CT scan was performed, revealing the occurrence of effusion in the pericardial sac. After receiving the results of culture from the amputated big toe, targeted antibiotic therapy was initiated using ampicillin with sulbactam, vancomycin and piperacillin with tazobactam. Despite the implemented therapy, the patient's general condition deteriorated. In the echocardiography performed, about 20mm effusion was observed in the pericardial sac. Pericardial tamponade was decompressed, evacuating 250ml of amber fluid, which was also examined in terms of bacteriology, revealing the presence of Staphylococcus aureus [15]. Pericarditis can also be a rare complication of esophageal injuries. Such a case is presented in his work by Osório C et. al. It describes the hospitalization story of an 81-year-old patient who had suffered an episode of choking on fish bone 2 days earlier. As part of the differential diagnosis, laboratory and imaging tests were performed, revealing significant leukocytosis, significantly elevated CRP, metabolic acidosis, and in CT mediastinal pneumothorax with a periesophageal fluid area corresponding to esophageal perforation. In addition, pericardial effusion corresponding to secondary pericarditis was found as a result of esophageal perforation and transmission of the etiological factor by this route. The patient underwent decompression of pericardial tamponade. Empirical antibiotic therapy was undertaken, observing a positive response to the implemented treatment. However, the woman died after 40 days due to the development of ventilator pneumonia [15].

CONCLUSIONS

1. Any call for chest pain in a patient with an upper respiratory tract infection may be associated with acute pericarditis.
2. Acute pericarditis can be a complication of both viral and bacterial infection.
3. A critical complication of acute pericarditis, correlating with circulatory stability disorder, may be pericardial tamponade in the exudate route due to ongoing infection.
4. There are determinants (chest pain, shortness of breath, ECG changes, increased levels of inflammatory indicators, pericardial effusion, pericardial friction) with different specificity and sensitivity that may indicate acute pericarditis.
5. Acute pericarditis is a common complication of the passage of COVID-19 infection.
6. Elevated levels of cardiac troponin with acute pericarditis may indicate simultaneous inflammation of the heart muscle- myopericarditis.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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