ISSN: 2545-2533 DOI: 10.32114/CCI.2020.3.3.20.30

CCI JOURNAL CRITICAL CARE INNOVATIONS

Crit. Care Innov. 2020; 3(3):20-30

ORIGINAL ARTICLE

Comparative analysis of pharmacotherapy used by Emergency Medical Services in Poland

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ABSTRACT

INTRODUCTION: Pharmacotherapy is essential during emergency medical services (EMS). Medication administered in pre-hospital conditions enables i.a.: sedation, analgesia, treatment of arrhythmias, and resuscitation. The equipment of the paramedic's box (Drug Kit) in an ambulance depends on the Rescue System in a given country. In Poland, since several years, there has been a standardized list of medications available in the emergency medical services. The authors attempt to assess the indication of pharmaceuticals that are most commonly used and those that may turn out to be unnecessary in pre-hospital care.

MATERIAL AND METHODS: The interventions of two emergency medical teams (specialized "SEMS" and basic "BEMS") from 2019 were analyzed. The Kolmogorov-Smirnov variable distribution normality test was used for statistical analysis; Pearson correlation and Chi squared independence tests. All results were considered significant at $p < 0.05$.

RESULTS: The teams intervened 4,530 times in the analyzed period. Medications were used in 1742 cases, which accounts for 38.45% of all interventions (BEMS - 1429; 82.03% vs. SEMS: 313; 17.97%). The most commonly administered were: Natrii chloridum 0.9%, Captoprilum, Ephinephrinum and Hydroxyzinum. Drugs such as: Flumazenilum, HES - hydroxyethyl starch, Isosorbidi mononitrans, Lidocaini hydrochloridum, Urapidilum were not administered. Comparing the total amount of drugs used between the teams, a statistically strong correlation was demonstrated ($\chi 2 = 402.41$; $p = 0.000$), point out more frequent use of drugs by BEMS staff.

CONCLUSIONS: There is a group of drugs that are not used in the emergency medical service. The equipment of the paramedic's box in the BEMS can be considered as sufficient because drugs from the SEMS were used occasionally. Due to the significant differences in the frequency of administration of individual drugs, a modification of the list of medicines in the emergency medical service in Poland should be considered.

KEY WORDS: Emergency medical service, drags, pharmacotherapy, paramedic, treatment.

INTRODUCTION

Emergency medical service (EMS) is a complex of specialist treatment that are developing very quickly. Medical rescue actions (MRA) have been implement in Poland. The MRA includes procedures to provide professional assistance to patients in a state of sadden life emergency. Pre-hospital actions that can be implemented should be performed by emergency medical personnel. This ensures that vital functions are maintained and stabilized until specialist treatment is implemented. Paramedics in Poland have a range of 47 drugs. A few years ago, this kit contained only 25 drugs. The legislator, following social needs, decided that it was, insufficient. The paramedic's box was extended with painkillers, circulatory system regulators, spasmolytic, sedative and diuretic drugs.

In Poland, the system of emergency medical service began in 1891 in Krakow. This year, a group of medical students created the "emergency ambulance services". As people's needs and awareness increased, the emergency ambulance services evolved. The procedures to implement treatment at the pre-hospital stage have been developed relatively recently and are constantly being improved. Finally on September 8, 2006 the Act of the Public Emergency Medical Services came into force, creating the System of Public Emergency Medical Services (SPEMS) in Poland. It consists of basic emergency medical service ("BEMS"), specialist emergency medical service ("SEMS"), helicopter emergency medical service ("HEMS") and emergency room ("ER") [9]. The organization of this system is based on protocols of proceedings, which ensure work efficiency in every situation [1]. Efficiently operating SPEMS will ensure the minimization of mortality in the country, therefore the system requires constant improvement.

Most available of the EMS teams are without a physician (BEMS). That is why it is so important that the paramedic not only has the knowledge and skills, but also the appropriate resources so that the medical care provided by him is comprehensive. A paramedic is entitled by the legislator to independently prescribe pharmaceuticals. The last act regulating this collection entered into force on December 23, 2019. A number of changes were introduced in the field of pharmacotherapy of paramedics [2]. The complete list of drugs is provided in Table 1.

Table 1. List of medications administered by paramedics

No.	Medicines	Route of administration
1.	Acidum acetylsalicylicum	tablet
2.	Adenosinum	solution for injection
3.	Amiodaroni hydrochloridum	solution for injection
4.	Atropini sulfas	solution for injection
5.	Isosorbidi mononitras	tablet
6.	Budesonidum	nebuliser suspension
7.	Captoprilum	tablet
8.	Clemastinum	solution for injection
9.	Clonazepamum	solution for injection
10.	Clopidogrelum	tablet
11.	Dexamethasoni phosphas	solution for injection
12.	Diazepamum	tablet, solution for injection, wlewka doodbytnicza
13.	Drotaverini hydrochloridum	solution for injection
14.	Epinephrinum	solution for injection
15.	Fentanylum	solution for injection
16.	Flumazenilum	solution for injection
17.	Furosemidum	solution for injection
18.	Glyceroli trinitras	tablet, spray for use sublingual
19.	Glucagoni hydrochloridum	solution for injection
20.	Glucosum 5%	solution for intravenous infusion
21.	Glucosum 20%	solution for injection
22.	Heparinum natricum	solution for injection
23.	Hydrocortisonum	solution for injection
24.	Hydroxyzinum	tablet, solution for injection
25.	Ibuprofenum	tablet
26.	Ketoprofenum	tablet, solution for injection
27.	Lidocaini hydrochloridum	solution for injection, gel
28.	Magnesii sulfas	solution for injection
29.	Mannitolum – 15%	solution for intravenous infusion
30.	Metamizolum natricum	solution for injection
31.	Metoclopramidum	solution for injection
32.	Metoprololi tartras	solution for injection
33.	Midazolamum	solution for injection
34.	Morphini sulfas	solution for injection
35.	Naloxoni hydrochloridum	solution for injection
36.	Natrii chloridum 0,9%	solution for intravenous infusion
37.	Natrii hydrogenocarbonas 8,4%	solution for injection
38.	Papaverini hydrochloridum	solution for injection
39.	Paracetamolum	suppositories, tablet, solution for injection
40.	Multi-electrolyte fluid	solution for intravenous infusion
41.	Colloidal fluids that do not require blood sampling prior to injection and cross-matching (hydroxyethyl starch, Modified fluid gelatin)	solution for intravenous infusion
42.	Salbutamolum	solution for injection, nebuliser
43.	Solutio Ringeri/Balanced Electrolyte solution	solution for intravenous infusion
44.	Thiethylperazinum	suppositories, solution for injection
45.	Ticagrelor	tablet
46.	Medical oxygen	gas
47.	Urapidilum	solution for injection

The paramedic can also give you other medications, but only upon the doctor's orders. In specialist teams (SEMS), additional pharmaceuticals may be administered: Glucosum 40%, Phenazolinum, Etomidat, Dopaminum Hydrochloricum 4%, Theophylline, Methoxyflurane, Propofol 2%, Tramadol, Calcium Chloratum.

In the conducted study, the authors analyze the pharmacotherapy used by EMS. The aim was to demonstrate the frequency of administration of individual drugs in two types of teams (BEMS and SEMS) working in one operating area.

MATERIAL AND METHODS

The collected results cover the year 2019, from the W04 operational region in Poland in the Mazowieckie Voivodeship, which is operated by the Independent Public Healthcare Center "RM-MEDITRANS" Emergency Ambulance Services and Sanitary Transport Station. The SEMS and BEMS team were analyzed. During the analyzed period, the BEMS team was requested 3,650, and the SEMS team: 880 times. The following tests was used for the statistical analysis: the Kolmogorov-Smirnov variable distribution normality; Pearson correlation and Chi squared independence tests. All results were considered significant at $p < 0.05$.

RESULTS

Characteristics of the intervention

The analysis covered 4,530 trips carried out in 2019, including 3,650 (80.57%) in the BEMS and 880 (19.43%) in the SEMS. Medicines were used in 1,742 cases, which accounts for 38.45% of all interventions. Divided into teams: 1429 (82.03%) - BEMS and 313 (17.97%) - SEMS. The team with a doctor administered drugs to patients in 35.57% (n = 313) of trips, while in the team without a doctor medicines were used in 39.15 % (n = 1,429) of interventions. Among the patients, the group of women included 915 (52.53%), the group of men 818 (46.96%), and the group of undefined patients included 9 (0.52%). The average age of patients who required medication from an EMS was 60.55 years (SD ± 21.81). A detailed comparison of the patients age is presented in Figure 1.

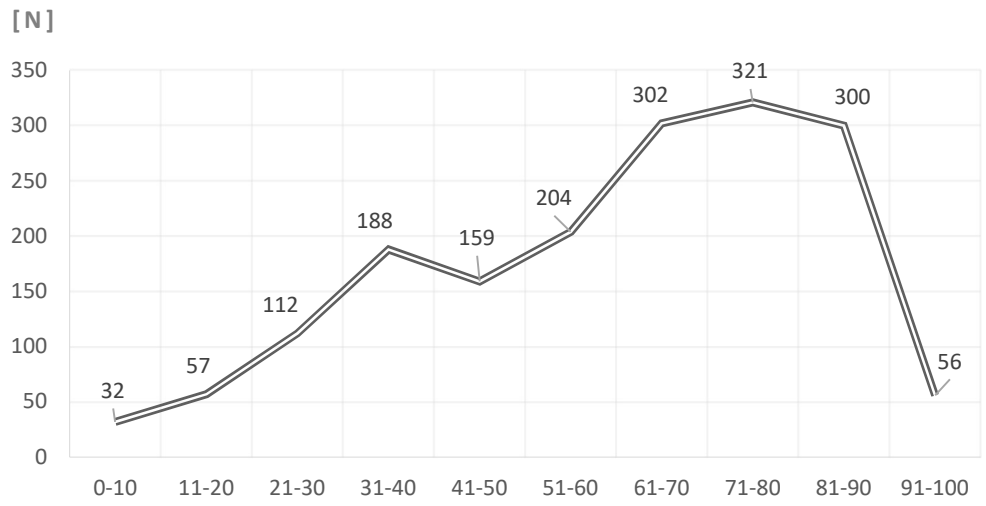

Figure 1. The number of patients divided by age groups.

The BEMS team was most often used for ICD I10 (primary essential hypertension), 192 times a year, while the SEMS team for ICD R55 (Syncope and collapse) - 37 times. More detailed data are presented in Figure 2.

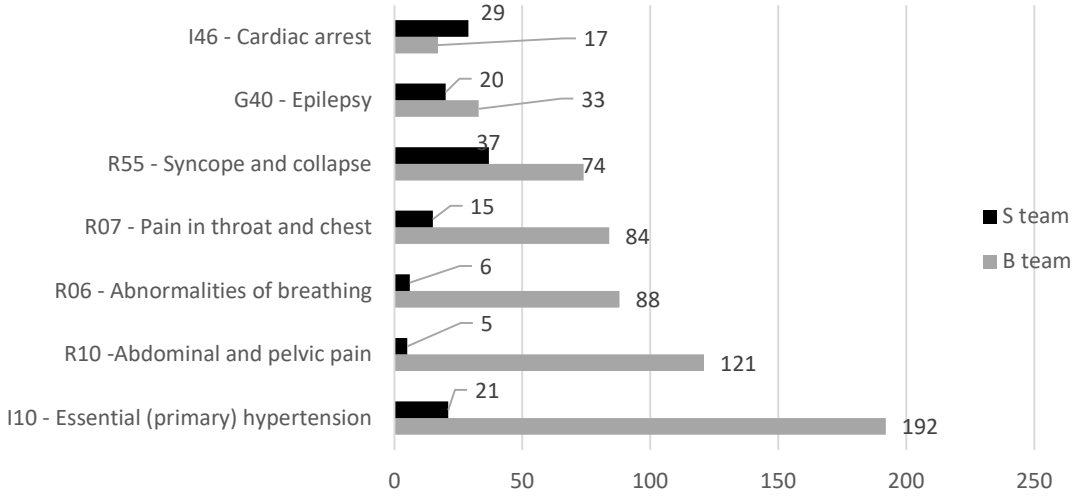

Figure 2. The most common diagnoses in emergency medical teams (acc. to ICD-10)

Most pharmacotherapy interventions were performed in June (n = 169), and the least in September (n = 109). A detailed list is presented in Figure 3. The summons during which pharmacotherapy was administered most often concerned the urban agglomeration (n = 1,455; 83.52%), and much less often the rural areas (n = 287; 16.48%). There was a significant correlation between the scene of the event and the type of emergency medical team (Pearson = -0.147; p = 0.000). In SEMS, drugs were administered in 225 (71.88%) calls to the city, and in 88 (28.12%) calls in a rural area. In BEMS, drugs were administered in 1,230 (86.07%) calls to the city, and in 199 (13.93%) calls in a rural area.

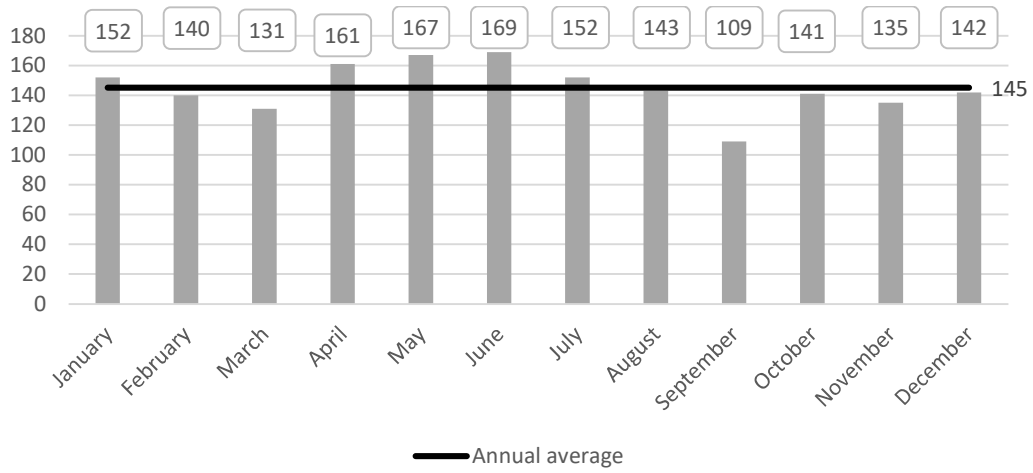

Figure 3. Number of pharmacotherapy interventions by month

Pharmacotherapy

Specialized emergency medical service teams most frequently administered: Natrii chloridum 0.9% (n = 119), Captoprilum (n = 46), Ephinephrinum (n = 41) and Hydroxyzinum (n = 30). Basic teams most often used: Captoprilum (n = 371), Natrii chloridum 0.9% (n = 270), Pyralgin (n = 191) and Hydroxizinum (n = 146). The frequency of a drug use, depending on the type of team, was also analyzed. Drugs that can be administered only by SEMS teams were excluded from the comparisons. Normality of distribution was assessed for drugs administered by SEMS (Kolmogorov-Smirnov Test = 0.296; p = 0.000) and BEMS (Kolmogorov-Smirnov Test = 0.249; p = 0.005) . The distribution of variables was not normal for both teams, which forced the use of non-parametric tests. Comparing the total amount of drugs used between the teams SEMS and BEMS, a statistically strong correlation was demonstrated ($\chi 2 = 402.41$; p = 0.000).

Table 2. The frequency of drug use depending on the type of EMS

No.	Name of the medicinal product	SEMS		BEMS		Chi²	p value	more frequent use [BEMS vs. SEMS]
		[n]	[%]	[n]	[%]			
1	Adenosinum	0	0	4	0,17	0,879	0,349	BEMS > SEMS
2	Amiodaroni hydrochloridum	4	0,78	2	0,09	9,656	**0,002**	BEMS < SEMS
3	Acidum acetylsalicylicum	12	2,34	22	0,94	6,984	**0,008**	BEMS < SEMS
4	Atropini sulfas	8	1,56	13	0,56	5,796	**0,016**	BEMS < SEMS
5	Metoprolili tartas	3	0,59	11	0,47	0,113	0,737	BEMS < SEMS
6	Budesonidum	1	0,2	14	0,6	1,311	0,252	BEMS > SEMS
7	Calcium chloratum	1	0,2	-	-	-	-	-
8	Captoprilum	46	8,98	371	15,9	16,037	**0,000**	BEMS > SEMS
9	Clemastinum	1	0,2	9	0,39	0,434	0,510	BEMS > SEMS
10	Clonazepanum	7	1,37	10	0,43	6,232	**0,013**	BEMS < SEMS
11	Clopidogrelum	1	0,2	2	0,09	0,479	0,489	BEMS < SEMS
12	Dexamethasoni phosphas	6	1,17	57	2,44	3,130	0,077	BEMS > SEMS
13	Dopaminum hydrochloricum 4%	10	1,95	-	-	-	-	-
14	Epinephrinum	41	8,01	29	1,24	80,106	**0,000**	BEMS < SEMS
15	Etomidat	1	0,2	-	-	-	-	-
16	Fentanylum	9	1,76	72	3,08	2,674	0,102	BEMS > SEMS
17	Flumazenilum	0	0	0	0	0,000	1,000	BEMS = SEMS
18	Furosemidum	19	3,71	122	5,23	2,050	0,152	BEMS > SEMS
19	Glucagoni hydrochloridum	0	0	1	0,04	0,219	0,639	BEMS > SEMS
20	Glucosum 20%	6	1,17	52	2,23	2,346	0,126	BEMS > SEMS
21	Glucosum 40%	7	1,37	-	-	-	-	-
22	Glucosum 5%	3	0,59	16	0,69	0,063	0,802	BEMS > SEMS
23	Heparinum natricum	6	1,17	12	0,51	2,890	0,089	BEMS < SEMS
24	Hydroxyethyl starch (HES)	0	0	0	0	0,000	1,000	BEMS = SEMS
25	Hydrocortisonum	13	2,54	59	2,53	0,000	0,988	BEMS < SEMS
26	Hydroxyzinum	30	5,86	146	6,26	0,113	0,736	BEMS > SEMS
27	Ibuprofenum	0	0	4	0,17	0,879	0,349	BEMS > SEMS
28	Isosorbidi mononitrans	0	0	0	0	0,000	1,000	BEMS = SEMS
29	Ketoprofenum	21	4,1	121	5,18	1,038	0,308	BEMS > SEMS
30	Lidocaini hydrochloridum	0	0	0	0	0,000	1,000	BEMS = SEMS
31	Magnesi sulfas	3	0,59	19	0,81	0,285	0,594	BEMS > SEMS
32	Mannitolum 15%	1	0,2	0	0	4,560	**0,033**	BEMS < SEMS
33	Metoclopramidum	7	1,37	104	4,46	10,687	**0,001**	BEMS > SEMS
34	Midazolamum	4	0,78	6	0,26	3,295	0,069	BEMS < SEMS
35	Morphini sulfas	9	1,76	38	1,63	0,043	0,835	BEMS < SEMS
36	Naloxoni hydrochloridum	1	0,2	2	0,09	0,479	0,489	BEMS < SEMS
37	Natrii bicarbonicum 8,4%	8	1,56	6	0,26	14,698	**0,000**	BEMS < SEMS
38	Natrii chloridum 0,9%	119	23,24	270	11,57	48,495	**0,000**	BEMS < SEMS
39	Gliceroli trinitrans	13	2,54	25	1,07	6,868	**0,009**	BEMS < SEMS
40	Drotaverini hydrochlordum	5	0,98	120	5,14	17,344	**0,000**	BEMS > SEMS
41	Papaverini hydrochloridum	1	0,2	55	2,36	10,167	**0,001**	BEMS > SEMS
42	Paracetamolum	11	2,15	69	2,96	1,003	0,317	BEMS > SEMS
43	Metoksyfluran	2	0,39	-	-	-	-	-
44	Phenazolinum	2	0,39	-	-	-	-	-
45	Propofol 2%	3	0,59	-	-	-	-	-
46	Multi-electrolyte fluid	13	2,54	71	3,04	0,371	0,543	BEMS > SEMS
47	Metamizolum natricum	11	2,15	191	8,18	23,192	**0,000**	BEMS > SEMS
48	Diazepamum	27	5,27	85	3,64	2,957	0,086	BEMS < SEMS
49	Salbutamolum	3	0,59	34	1,46	2,481	0,115	BEMS > SEMS
50	Solutio Ringeri	0	0	1	0,04	0,219	0,639	BEMS > SEMS
51	Teofilinum	5	0,98	-	-	-	-	-
52	Thiethylperazinum	0	0	14	0,6	3,086	0,079	BEMS > SEMS
53	Ticagrelorum	4	0,78	10	0,43	1,068	0,301	BEMS < SEMS
54	Medical oxygen	3	0,59	65	2,78	8,906	**0,003**	BEMS > SEMS
55	Tramadolum	1	0,2	-	-	-	-	-
56	Urapidilum	0	0	0	0	0,000	1,000	BEMS = SEMS
	Total	**512**	**100**	**2334**	**100**			(SEMS):18; (BEMS):24; (SEMS=BEMS):5

By comparing the number of interventions with pharmacotherapy of teams SEMS vs. BEMS (N_{SEMS} = 313; 35.57% vs. N_{BEMS} = 1429; 39.15%) there are significant differences in the frequency of use of individual drugs in favor of the BEMS team (Table 2). Analyzing the group of 47 drugs available in both teams (SEMS and BEMS), more frequent use of drugs by basic team in the case of 24 drugs was noted. The SEMS team administered 18 drugs more often than the BEMS team.

Taking into account the most common causes of calls, the most common pharmacotherapy used by basic and specialized teams was correlated. In the case of essential (primary) hypertension, Captoprilum was used for 8/10 patients (N_{SEMS} = 13, N_{BEMS} = 160), which accounts for almost 50% of the total pharmacotherapy used in this case. Pharmacotherapy that was used supportively: Hydroxyzinum (N_{SEMS} = 7, N_{BEMS} = 67), Furosemidum (N_{SEMS} = 5, N_{BEMS} = 60), Glycerol trinitras (N_{SEMS} = 6, N_{BEMS} = 18). For patients with ICD R55, both teams with the doctor and without (paramedics only) most often administered Natrii chloridum 0.9% (N_{SEMS} = 17, N_{BEMS} = 28) and Captoprilum (N_{SEMS} = 5, N_{BEMS} = 17). Additionally more: Multi-electrolyte fluid (N_{SEMS} = 3, N_{BEMS} = 11), hydroxyzinum (N_{SEMS} = 4, N_{BEMS} = 5) and metoclopramidum (N_{SEMS} = 1, N_{BEMS} = 8).

It was shown that the SEMS team having nine more drugs at their disposal used them occasionally. Most often (N = 10) doctors used Dopaminum. Ten of the fifty-six drugs (i.e. 17.86%) were not used by the SEMS team at all (Adenosinum, Flumazenilum, Glucagoni hydrochloridum, HES - hydroxyethyl starch, Ibuprofenum, Isosorbidi mononitrans, Lidocaini hydrochloridum, Solutio Ringerapi, Thiethylperazinum). The basic team never used only six drugs (12.77%) (Flumazenilum, HES - hydroxyethyl starch, Isosorbidi mononitrans, Lidocaini hydrochloridum, Mannitolum 15%, Urapidilum).

DISCUSSION

The specificity of the operation of emergency services in a given country varies depending on the legal conditions, the level of health care and sociodemographic factors. On the European scale, the preparation of emergency medical personnel is assessed at a fairly high level, and the eligibility of paramedics include a wide range of medical activities and medicines that they can administer to patients themselves.

Pain is one of the first symptoms of an ongoing disease or injury [3]. It always causes suffering and other pathological processes, therefore people treat themselves [4,5]. A significant proportion of the population uses painkillers, mainly non-steroidal anti-inflammatory drugs (NSAIDs) [6]. Nevertheless, Captopril (n = 371) from the group of angiotensin converting enzyme inhibitors turned out to be the most frequently used drug in the emergency medical services. This is more than three times the total use of NSAIDs in BEMS teams (n = 147; 6.30%). There are three NSAIDs in the paramedic's box. These are Ketoprofen, ibuprofen and acetylsalicylic acid. The first one is a drug that is used relatively often. It was placed sixth (n = 121; 5.18%). More than three-quarters of ketoprofen (76.86%) was used for back pain - dorsalgia (ICD10: M54), abdominal and pelvic pain (ICD10: R10), injuries (ICD10: S), and where it was difficult to identify the origin (ICD10: R52). Other NSAIDs are used less frequently, namely Ibuprofen (n = 4; 0.17%) and acetylsalicylic acid (n = 22; 0.94%). Considering that the EMS teams are committed with controlling greater pain, the use of ibuprofen is negligible. On the other hand, acetylsalicylic acid in EMS is mainly used by its anti-aggregation effect as one of the first-line drugs in patients with suspected ACS (ICD-10: I21=63.64% and R07=36.36%). Drugs that do not count as NSAIDs include paracetamol and metamizole [7]. Paracetamol (n = 69; 2.96%) is in the 12th position of the drugs most commonly used in the basic teams with analgesic and antipyretic properties. In the BEMS team it was mainly used for elderly people over 60 years old in contrast to the SEMS team, where it was prescribed mainly to children up to 10 years of age. It was used primarily as an antipyretic drug ICD10: R50 (66.67%) and for minor injuries of ICD10: S and T (20.29%). The most commonly used painkiller was metamizole known as Pyralgina. It took 3rd place in the most frequently used drugs in the basic emergency medical services teams (n = 191; 8.18%). Used to protect patients with ICD codification N20-23 (urolithiasis - 9.95%), R10 (abdominal and pelvic pain - 46.6%) and R50 (fever - 21.99%).

Drugs from the benzodiazepine group were administered most of the times in BEMS teams: Clonazepamum (N_{SEMS} = 7; 1.37% vs. N_{BEMS} = 10; 0.43%); Midazolamum (N_{SEMS} = 4; 0.78% vs. N_{BEMS} = 6; 0.26%); Relanium (N_{SEMS} = 27; 5.24% vs. N_{BEMS} = 85; 3.64%). However, considering the significant disproportion of BEMS vs. SEMS (1429 vs. 313), the percentage of drug supply in relation to the total use of pharmacotherapy, therefore the result tilts in favour of SEMS teams. The above-mentioned drugs in basic teams are mainly used in ICD10: G40 and R56 cases. It is similar in the team with the doctor, but considering

the work with patients in more severe condition, the ratio of use is different. The main benzodiazepine that was used are Diazepam, by both SEMS (n = 27) and BEMS (n = 85). It is ranked 9th in basic teams and 5th in specialized teams in terms of total number of drugs used.

An analysis of the use of opioids showed a divisible proportion. Morphini sulfas in percentage terms was slightly more often administered in the SEMS teams (N_{SEMS} = 9; 1.76% vs. N_{BEMS} = 38; 1.63%), while Fentanylum was much more often administered in the BEMS teams (N_{SEMS} = 9; 1.76% vs. N_{BEMS} = 72; 3.08%) both quantitatively and as a percentage. Statistical analysis showed no significant differences in the percentage of Morphine (p = 0.835) and Fentanyl (p = 0.102) applications between the teams. Morphine (MF) is more commonly used than fentanyl (FNT) in acute myocardial infarction in both BEMS and SEMS teams (MF_{SEMS} = 4 vs. MF_{BEMS} = 7; FNT_{SEMS} = 0 vs. FNT_{BEMS} = 5), despite the fact that it shows decreasing functioning of the activity of other anti-aggregating drugs [10].

Some of the drugs from basic and specialized team list were used occasionally or not at all during the study period. This proves the necessity to reconsider what pharmaceuticals should be in the paramedic's box. The limitation of the list of the drugs that are not administered in EMS teams and the extension of the new one, such as dopaminergic medicines, should bring noticeable benefits for the fulfilling emergency medical services by paramedics in BEMS teams. Other pharmaceuticals that have been scientifically proven to work and be suitable for pre-hospital use should also be considered.

CONCLUSIONS

There is a group of drugs that are not used in emergency medical services. The equipment of the BEMS kit box can be considered as sufficient because additional drugs from the SEMS team were used occasionally. Due to the significant differences in the frequency of administration of individual drugs, a modification of the range of drugs in the emergency medical services in Poland should be considered. It is suggested to add dopaminergic drugs to the paramedic's box, which are used in specialized teams.

Disclosure statement

The authors did not report any potential conflict of interest.

REFERENCES

[1] Furtak-Niczyporuk M, Drop B. Efektywność organizacji systemu państwowe ratownictwo medyczne. Studia Ekonomiczne. 2013; 168: 53-67.

[2] Kleszczyński J, Zawadzki M. Leki w ratownictwie medycznym. PZWL. Warszawa 2015, wyd. 1.

[3] Berben SA, Schoonhoven L, Meijs TH, van Vugt AB, van Grunsven PM. Prevalence and relief of pain in trauma patients in emergency medical services. Clin J Pain. 2011; 27(7): 587-592.
doi: https://doi.org/10.1097/AJP.0b013e3182169036

[4] Zduńczyk Ł., Leszczyński PK, Detsyk O, Charuta A. Analgesia in trauma patients administered by Emergency Medical Services. Crit. Care Innov. 2019; 2(1): 11-21.
doi: https://doi.org/10.32114/CCI.2019.2.1.11.21

[5] Kiszka J, Ozga D, Szela S, Wordliczek J. Stosowanie leków przeciwbólowych w Zespołach Podstawowych Ratownictwa Medycznego - doniesienie wstępne. Anestez Ratow. 2017; 11(3): 282-290.

[6] Synoweć J, Pogorzelczyk K, Robakowska M, Ślęzak D, Żuratyński P, Nadolny K, et al.. Następstwa stosowania ogólnodostępnych niesteroidowych leków przeciwzapalnych (NLPZ). Med Rodz. 2018; 21(3): 281-291.
doi: https://doi.org/10.25121/MR.2018.21.3.281

[7] Krzyżak-Jankowicz M, Jankowicz R. Metamizol i paracetamol - leki podobne, ale nie takie same. Med Paliat Prakt. 2015; 9(2): 59–65.

[8] Goniewicz M. Effect of military conflicts on the formation of Emergency Medical Services systems worldwide. Academic Emergency Medicine. 2013; 20: 507–513.
doi: https://doi.org/10.1111/acem.12129

[9] Remba SJ, Varon J, Rivera A, Sternbach GL. Dominique-Jean Larrey: the effects of therapeutic hypothermia and the first ambulance. Resuscitation. 2010; 81(3): 268−271.
doi: https://doi.org/10.1016/j.resuscitation.2009.11.010

[10] Hobl EL, Stimpfl T, Ebner J, Schoergenhofer C, Derhaschnig U, Sunder-Plassmann R, et al.. Morphine decreases clopidogrel concentrations and effects: a randomized, double-blind, placebo-controlled trial. J Am Coll Cardiol 2014; 63(7): 630–635.
doi: https://doi.org/10.1016/j.jacc.2013.10.068