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Pain Treatment in Polish Emergency Medical Teams—Is the Pain Management Entitlement Being Used?—A Retrospective Study

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Abstract: Introduction: Pain has been identified as the most common reason for emergency medical service (EMS) calls. Despite many years of pain research, it is still true that oligoanalgesia is an ongoing phenomenon. This demonstrates the need for the implementation of new solutions and for further analyses on the causes of inadequate pain treatment. The study was undertaken to analyze analgesic treatment implemented in specialist "S" and basic "P" Emergency Medical Teams (EMTs). Methods: This retrospective study was based on the analysis of medical records using the emergency medical service card. A total of 1333 medical files were analyzed, of which 539 cases were qualified for the study according to the inclusion and exclusion criteria. Results: The analysis has shown that the majority of interventions were undertaken by basic emergency medical teams and that acute pain was the most common reason for contacting the EMS. However, only 62.52% of patients received analgesia. It was shown that the frequency of administering paracetamol, metamizole, and ketoprofen was proportional to the increase in pain intensity. Similar correlations were identified in the cases of morphine, fentanyl, and drotaverine, which were most often administered to patients with the most severe pain. Conclusions: The nature and location of pain, as well as its intensity, affected the choice of analgesia. Opioids were administered more frequently with more extensive injuries and at greater pain intensity. Significant differences were found in the frequency at which acetylsalicylic acid was administered more often in "S" EMTs and drotaverine more often in "P" EMTs. The intravenous route was found to be the most common route of analgesia administration in EMTs.

Keywords: analgesia; pain treatment; emergency medical services; oligoanalgesia; prehospital emergency care; emergency medical team

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1. Introduction

Acute pain is the most common reason for contacting emergency medical teams, but its management is often neglected, putting patients at risk of undertreatment. This occurs despite advances in pain research, the availability of effective analgesics, and the publication of numerous guidelines [1–4]. Inadequate pain management, ranging from long waiting times to the limited provision of analgesia, is termed oligoanalgesia [5]. The International Association for the Study of Pain (IASP) has updated the 1979 definition of pain, which now reads: "pain is an unpleasant sensory and emotional experience associated with or resembling actual or potential tissue damage" [6]. Pain is a subjective experience; thus, the assessment of pain intensity often varies depending on the patient's and medical personnel's points of view. Therefore, a standardized assessment of pain along with pain management protocols has proven to be useful. Currently, however, pain management

protocols are rarely used. Thus, optimizing pain management remains an important challenge for interdisciplinary teams in the EMS, especially given the high prevalence of pain [7].

1.1. Pain Management Recommendations for Emergency Medical Teams and Emergency Departments in Poland

The National Medical Emergency System (NMES) in Poland consists of emergency medical teams (EMTs) operating in the prehospital setting and the hospital/clinical emergency department (ED/CED), providing medical assistance in life-threatening conditions. A typical EMT includes Emergency Physicians, paramedics, and Emergency Nurses. EMTs are divided into basic "P" teams, consisting of paramedics and Emergency Nurses, and specialist "S" teams, additionally including Emergency Physicians. In the NMES, the competencies of a paramedic and an Emergency Nurse are identical; however, a nurse, in order to enter the system, must meet additional requirements, regulated by the Act on Emergency Medical Services, related to additional education and relevant experience. Entering the NMES also entitles a member to perform medical triage and enhances the powers of a healthcare professional in pain management [8].

In the study by Krzyżanowski K. et al., it was shown that only 16% of adult patients received analgesic treatment during intervention by a basic emergency medical team, while specialist emergency medical team personnel applied analgesic treatment in the prehospital setting only to 18% of the patients [9]. Therefore, it became an absolute priority for the year 2019 to develop a standard for the treatment of pain caused by various factors and of different severity and to implement this standard in the form of "good practices of pain treatment in adults in basic emergency medical teams" throughout the whole country. The recommendations outline the need for a paramedic or an Emergency Nurse to assess pain at the scene with the use of a pain assessment scale. The criteria for treatment should include pain intensity, the pathomechanism of pain, and pain location. Intramuscular and rectal administration of analgesics is not recommended for emergency medical teams [10].

1.2. Rights of Paramedics and Emergency Nurses to Administer Analgesics

According to the Regulation of the Minister of Health of 16 December 2019 on emergency medical activities and health services other than emergency medical activities that may be provided by a paramedic and the Regulation of the Minister of Health of 28 February 2017 on the type and scope of preventive, diagnostic, therapeutic, and rehabilitation services provided by a nurse or midwife without a physician's order, a paramedic or an Emergency Nurse may independently administer the following analgesic and diastolic drugs (Table 1) [11,12].

Despite the wide availability of guidelines and regulations, it can be said that the availability of appropriate pain treatment is still poor, while the knowledge of healthcare professionals in this field is too limited [13]. Consequently, analgesic treatment is implemented in a delayed manner, while the applied doses are inadequate [5]. Studies show that as little as 25.4% of patients with pain complaints arriving at the emergency department receive the appropriate treatment [14], while the occurrence of oligoanalgesia in the prehospital setting is as high as 43.0% [15].

1.3. Aim

The aim of this study was to analyze analgesic treatment implemented in adults by Polish emergency medical teams.

Table 1. Analgesic and diastolic drugs are administered by paramedics and Emergency Nurses without a physician's order, with the corresponding routes of administration.

Paramedic/Emergency Nurse [1]	
Medication	**Routes of Administration**
Aspirin	tablets
Drotaverine	solution for injection
Fentanyl	solution for injection
Ibuprofen	tablets
Ketoprofen	tablets, solution for injection
Lidocaine	solution for injection, gel
Magnesium	solution for injection
Metamizole	solution for injection
Morphine	solution for injection
Papaverine	solution for injection
Paracetamol	tablets, solution for injection

[1] according to the Regulation of the Minister of Health in Poland.

2. Methods

2.1. Study Design, Setting, and Ethical Considerations

This retrospective study was conducted between October and December 2020 at a university hospital in Poland. The approval of the hospital management as well as a positive review from the Independent Bioethics Committee for Scientific Research at the Medical University of Gdańsk, no. NKBBN/427/2020, was obtained for the analysis of medical records.

2.2. Research Procedure

Initially, a total of 1333 paper emergency medical team cards were included in the analysis during the selected time frame. Finally, 539 (40.4%) cases were qualified for the analysis according to the inclusion and exclusion criteria (Figure 1). This study was based on the analysis of pain treatment in adult patients only; therefore, 95 (7.1%) cards of <18-year-old patients were excluded from the research. A total of 432 (32.4%) cards were excluded due to patients calling the EMT for a reason other than pain, while 267 (20.1%) cards were excluded due to incomplete medical records, making it impossible to objectively analyze pain treatment.

An attempt was made to answer the following research questions:

- Did the nature of the pain or injury suffered affect the type of pain treatment applied by the EMT?
- Did the type of medical rescue team (basic "P" or specialist "S") affect the pain treatment applied?
- What kind of analgesics and routes of administration were most frequently used by the EMT?

2.3. Data Collection

The research tool used in this study was a proprietary medical documentation analysis questionnaire developed on the basis of the EMT card. The questionnaire was used to collect such data as age, gender, type of emergency medical team, qualifications of the personnel taking care of the patient, type and cause of the pain, pain intensity assessed using a pain intensity assessment scale, type of analgesic treatment administered (therapeutic substance administered, dose, and route of administration).

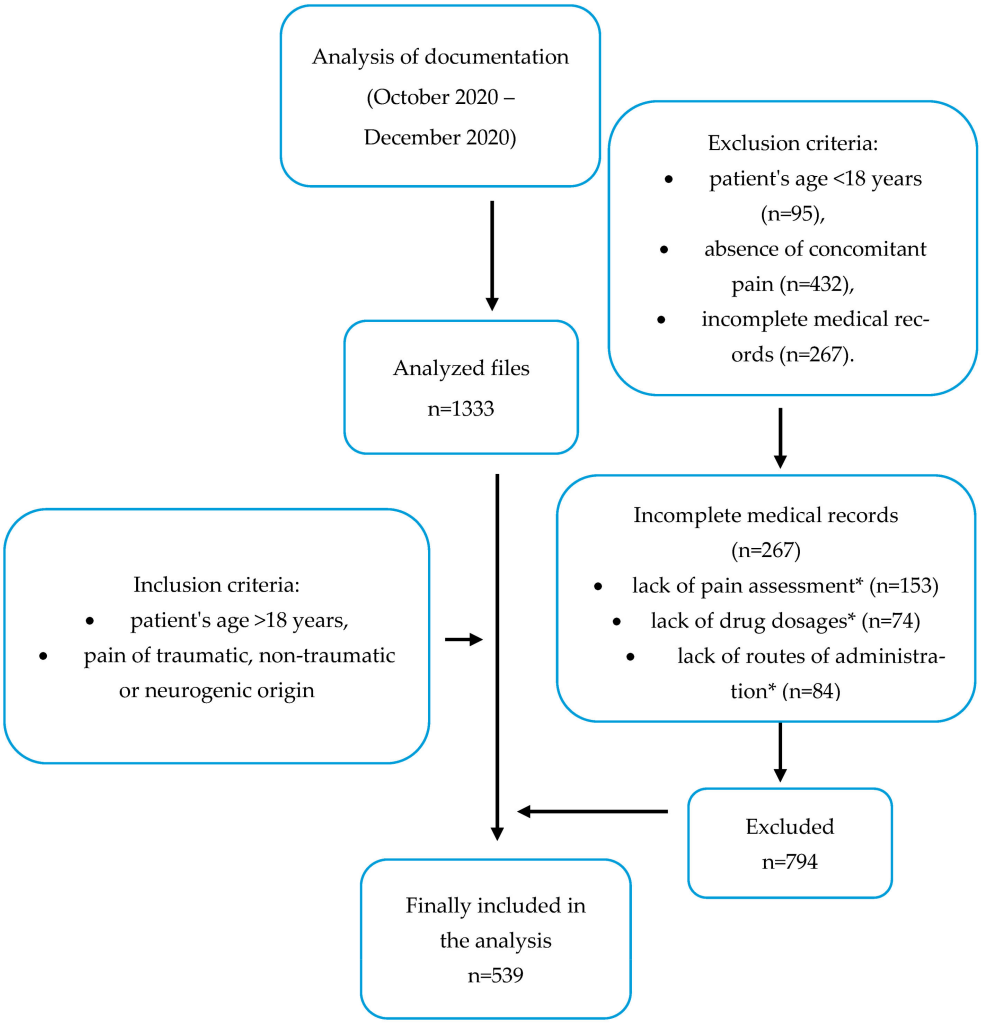

Figure 1. Flow diagram. * in some medical record files, the listed errors occurred simultaneously.

2.4. Inclusion and Exclusion Criteria of the Given Medical Records in the Analysis

The following criteria were determined for including medical records in the analysis:

- patient's age is over 18 years;
- pain of traumatic, non-traumatic, or neurogenic origin.

The following criteria were determined for excluding medical records from the analysis:

- patient's age is under 18 years;
- absence of concomitant pain;
- incomplete medical records.

2.5. Statistics

Due to the quantitative nature of this study, it was necessary to perform a statistical analysis of the collected data to identify relationships between subsequent variables. In view of the nominal nature of most of the dependent variables, Pearson's chi-square test was most often used in intergroup comparisons. For quantitative variables, e.g., drug doses, testing the normality of the distribution of variables was performed using the Shapiro–Wilk test or the Kolmogorov–Smirnov test, depending on the sample size. The homogeneity of variance was verified using the Levene test. The significance level of alpha = 0.05 was adopted in this study, which means that the results of analyses were considered significant when $p < 0.05$. Statistical calculations were performed in STATISTICA v.13 (TIBCO Software Inc. (2017), Kraków, Poland).

3. Results

3.1. Characteristics of This Study Group

The patients whose records were analyzed were classified into four age groups: I: 18–30 years, II: 31–50 years, III: 51–70 years, and IV: over 70 years. The largest group of study patients was in the age range of over 70 years—33.02%; while the smallest was in the age range of 18–30 years—12.80%. The size of groups II and III was comparable at 25.97% and 28.20%, respectively (Figure 2).

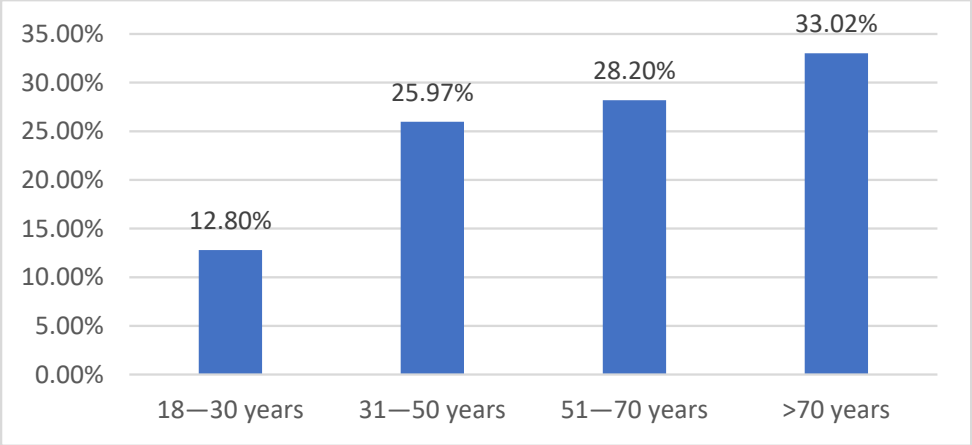

Figure 2. Age distribution of this study group.

No significant differences were noted with regard to gender, due to the fact that the number of patients of a given gender was similar—52.87% of patients were women (n = 285) and 47.13% were men (n = 254).

The analysis of the EMT cards also allowed the characteristics of the medical rescue teams that assisted study patients in the prehospital setting to be determined. It was shown that the vast majority of medical interventions were undertaken by the basic emergency medical team (84.04%) rather than the specialist one (15.96%) (Table 2). Most often, a paramedic was the leader of the team—84.78% of cases—while a nurse was selected the least frequently—1.48%. The EMT staff used only the NRS pain scale to assess the pain.

Table 2. Characteristics of EMTs.

Type of EMT		**N**	**%**
Basic "P"		453	84.04%
Leader of the team [1]	Paramedic	449	98.12%
	Nurse	4	0.88%
Specialist "S"		86	15.96%
Leader of the team [2]	Paramedic	8	9.30%
	Doctor	74	86.05%
	Nurse	4	4.65%
Leader of the team ("S" and "P") [3]	Paramedic	457	84.78%
	Doctor	74	13.74%
	Nurse	8	1.48%

[1] characteristic of the leaders in type "P" basic emergency medical team interventions; [2] characteristic of the leaders in type "S" specialist emergency medical team interventions; [3] characteristic of the leaders in all emergency medical team interventions.

3.2. The Characteristics of Pain

An analysis in terms of the etiology and nature of pain was also performed. The results are presented in the table below (Table 3). It was demonstrated that acute pain was the most common reason for calling emergency medical services—59.92%—whereas a significant proportion of the remaining cases—33.39%—reported pain of traumatic origin. Patients with non-traumatic pain accounted for more than half of these study participants, with chest pain representing the most common pain etiology (38.03%).

Table 3. The nature of pain and the characteristics of the etiology.

		N	% [1]
The nature of pain	acute	323	59.92
	traumatic	180	33.39
	neuropathic	26	4.82
	chronic	10	1.85
Non-traumatic pain [2]	abdominal pain	94	17.43
	chest pain	205	38.03
Traumatic pain	head trauma	70	12.99
	chest trauma	13	2.41
	upper limb trauma	20	3.71
	lower limb trauma	37	6.86
	multiple injuries	40	7.42
	other [3]	34	6.3

[1] percentage of the total of 539 cases; [2] including acute, neuropathic, and chronic pain; [3] of an acute, chronic, neuropathic, or traumatic nature with an etiology different from that highlighted by this study.

An analysis was also performed in terms of the frequency of pain of a specific intensity, presented on a scale from 0 to 10. It was shown that in the emergency medical setting, 5.75% of patients could not be assessed for their pain because of certain disturbances, such as unconsciousness or being unable to respond logically (Table 4). In the EMT setting, patients most often described their pain at level 3 and least frequently at level 9.

Table 4. The frequency of pain has a specific intensity.

	N	% [1]
0	56	10.39
1	24	4.45
2	70	12.99
3	82	15.21
4	74	13.72
5	65	12.05
6	39	7.23
7	43	7.98
8	28	5.2
9	13	2.41
10	14	2.59
impossible to evaluate [2]	31	5.75

[1] percentage of a total of 539 cases; [2] patients were unconscious and unable to respond logically.

3.3. The Analysis of Pain Treatment Implemented by the EMT

The next step was to analyze the prevalence of analgesic treatment in EMT. It was shown that in the ambulance, 62.52% of patients received analgesic treatment.

Statistically significant differences were demonstrated in the administration of acetylsalicylic acid administered almost exclusively in acute pain ($p = 0.00$, $Chi^2 = 20.8$), fentanyl administered mainly in traumatic pain ($p = 0.00$, $Chi^2 = 25.71$), papaverine administered mainly in chronic pain ($p = 0.04$, $Chi^2 = 8.31$), and drotaverine administered in acute pain ($p = 0.00$, $Chi^2 = 23.63$) (Table 5).

Table 5. Comparison between the nature of pain and the implemented treatment.

Implemented Treatment	Acute (n = 323)	Chronic (n = 10)	Neuropathic (n = 26)	Traumatic (n = 180)	Chi^2	df	*p*
acetylsalicylic acid	n = 33 10.22%	n = 0 0.00%	n = 0 0.00%	n = 1 0.56%	20.85	3	0.000
fentanyl	n = 2 0.62%	n = 0 0.00%	n = 3 11.54%	n = 16 8.89%	25.71	3	0.000
papaverine	n = 10 3.10%	n = 1 10.00%	n = 1 3.85%	n = 0 0.00%	8.31	3	0.040
drotaverine	n = 36 11.15%	n = 0 0.00%	n = 1 3.85%	n = 0 0.00%	23.63	3	0.000

In terms of the relationship between analgesic treatment and the type of trauma, a statistically significant difference was obtained for metamizole most commonly administered in multiple traumas ($p = 0.01$, $Chi^2 = 19.45$), morphine administered in lower extremity trauma ($p = 0.00$, $Chi^2 = 22.81$), and fentanyl used in upper extremity trauma ($p = 0.07$, $Chi^2 = 13.98$).

The relationship between the type of emergency medical team and the frequency of administering particular drugs was also analyzed. Statistically significant differences were found in the use of acetylsalicylic acid, which was administered considerably more often in specialist rescue teams ($p = 0.001$, $Chi^2 = 10.37$), and in the use of drotaverine, which was administered much more frequently in type "P" rescue teams.

A comparative analysis was also performed between individuals with different pain intensities in terms of the frequency of administering particular analgesics. Since the pain was assessed on a 10-point scale, a decision was made to reduce this parameter to three groups, i.e., mild (1–3), moderate (4–7), and severe (8–10) pain. Patients whose pain intensity could not be assessed and patients with no pain complaints were not included in the analysis. In reference to EMTs, pain intensity was shown to be a directly proportional variable affecting the frequency of administering paracetamol ($p = 0.015$, $Chi^2 = 8.44$), metamizole ($p = 0.00$, $Chi^2 = 48.50$), and ketoprofen ($p = 0.035$, $Chi^2 = 6.70$) as pain intensity increased (Table 6). Similar correlations were identified for morphine ($p = 0.00$, $Chi^2 = 29.35$), fentanyl ($p = 0.00$, $Chi^2 = 29.35$), and drotaverine ($p = 0.00$, $Chi^2 = 49.07$), but these drugs were not administered at all if the intensity of pain was not at least moderate. This is because they were most often administered to patients with the most severe pain. A different correlation was noted for papaverine, which was most frequently administered to patients with moderate pain rather than severe or mild pain ($p = 0.014$, $Chi^2 = 8.55$).

An analysis was also performed to study the analgesic treatment used in EMTs, including drug doses and routes of administration. It was shown that the most common route of drug administration in an EMT was the intravenous route. In the case of papaverine, only the intramuscular route was used (n = 12), while in the case of acetylsalicylic acid, oral administration was used (n = 34). In the minority of cases, metamizole (4.2%, n = 5), ketoprofen (16.7%, n = 2), and drotaverine (5.4%, n = 2) were also administered via the intramuscular route. Paracetamol was most frequently administered via the intravenous route (76.2%, n = 16), but sometimes the oral route was also used (23.8%, n = 5).

Table 6. Comparison between the implemented treatment and pain intensity.

Implemented Treatment	Mild (n = 108)	Moderate (n = 234)	Severe (n = 34)	Chi^2	df	*p*
Paracetamol	n = 23 21.30%	n = 67 28.63%	n = 9 26.47%	2.05	2	0.359
Metamizole	n = 4 3.70%	n = 45 19.23%	n = 7 20.59%	15.01	2	0.001
Ketoprofen	n = 9 8.33%	n = 40 17.09%	n = 8 23.53%	6.45	2	0.040
Morphine	n = 0 0.00%	n = 1 0.43%	n = 1 2.94%	4.36	2	0.113
Fentanyl	n = 0 0.00%	n = 1 0.43%	n = 0 0.00%	0.61	2	0.738
Drotaverine	n = 1 0.93%	n = 4 1.71%	n = 1 2.94%	0.72	2	0.698

4. Discussion

This study revealed that to assess pain in an EMT, only the NRS scale was used. Both Polish and foreign pain assessment guidelines recommend the use of the NRS scale as a standardized tool, whereas the EUSEM also recommends the VAS scale for assessing pain [10,16].

It has also been shown that in the prehospital setting, pain treatment was administered to 62.52% of patients. This represents a high score compared to the results of Krzyżanowski et al., who demonstrated the use of analgesic treatment in only 16.1% of patients. However, in the work of Albrecht et al., where such treatment was given to as many as 84.0% of patients, much broader possibilities of analgesia use were demonstrated [9,17].

This study addressed many aspects of pain management, taking into account factors that differentiate between particular medications and their administration. Acetylsalicylic acid administration has been shown to be conditioned by the onset of acute pain in an EMT, which was also the case for the vast majority of drotaverine administration cases. This is in line with the guidelines of Basinski et al., where drotaverine is recommended for the treatment of acute localized abdominal pain. The authors also suggest the drug should be combined with metamizole [10]. The foreign guidelines reviewed in this article do not mention drotaverine as a pain management measure.

In contrast, fentanyl was administered far more frequently to patients with neuropathic and traumatic pain and was not used to relieve acute or chronic pain. In reference to the study of Basinski et al. and the EUSEM guidelines, the above proves to be a compatible procedure, as opioids such as fentanyl and morphine are recommended in trauma regardless of pain intensity. Moreover, the use of broader pharmacotherapy in the form of ketamine, propofol, or methoxyflurane is also recommended in type "S" EMTs [10,16]. Foreign guidelines specify morphine and fentanyl as first-line drugs in severe pain [16,18]. Papaverine was most commonly used in cases of chronic pain. There were no reports of the use of papaverine in the guidelines. Differences in the use of particular analgesics in relation to the type of trauma were also outlined. In EMTs, metamizole was administered to patients with all types of trauma, yet most frequently to those with multiple traumas. Morphine was mainly used for lower extremity injuries, whereas fentanyl was used for upper extremity injuries. A similar relationship was demonstrated in the study of Silk et al., where patients with lower extremity trauma were more likely to receive opioids than in other injuries [19]. Krzyżanowski et al. found that in order to treat pain in trauma patients, ketoprofen was most commonly used, while opioids were used less frequently [9]. Polish guidelines on traumatic pain treatment distinguish only opioids in the form of morphine or fentanyl in pharmacotherapy, making no division to pain intensity levels, which are assessed on a scale [10]. Foreign guidelines do not distinguish pain etiology in

reference to the use of treatment but focus on pain intensity as a determinant of appropriate pharmacotherapy. The results showed an increasing trend in the treatment of traumatic pain with opioids. When comparing the frequency of administering particular drugs in both "P" and "S" types of medical rescue teams, the difference was observed only in the case of acetylsalicylic acid, which was more frequently administered in "S" type rescue teams, and in the case of drotaverine, which was more frequently administered in "P" type rescue teams. None of the guidelines refers to the use of acetylsalicylic acid. This might be related to the specifics of chest pain complaints, in which case the administration of acetylsalicylic acid is recommended in the prehospital setting, as specified in the guidelines of the European Resuscitation Council from 2021 [20]. The less frequent use of aspirin in type "P" EMTs may indicate some kind of deficit in medical practice. Further research is necessary in this regard. The Polish guidelines by Basinski et al. distinguish drotaverine for the treatment of acute localized abdominal pain in both "P" and "S" types of emergency medical teams [10].

It has been shown that the intravenous route of administration predominates. All of the guidelines reviewed identified the intraosseous or intravenous route as the recommended method of pain management in the prehospital setting. The only exception is the use of paracetamol or ibuprofen orally, but mainly to treat mild to moderate complaints [10,16,18].

Another aspect analyzed was the dependence of the used therapeutic substances on the level of pain intensity assessed by a patient on a scale. A correlation between the more frequent use of paracetamol, metamizole, and ketoprofen in EMTs and the intensity of pain was demonstrated. Morphine, fentanyl, and drotaverine were most commonly administered in cases of severe pain. The results obtained in the prehospital setting corresponded with the guidelines developed by Basiński et al., and with the results of Albrecht et al. demonstrating a positive relationship between pain levels and doses of fentanyl [10,17]. There is also a growing body of literature that recognizes an increasing trend in treating pain with opioid medications as early as at the onset of moderate pain [18,19,21]. Monitoring the level of analgesia and the experience of the healthcare professional ordering the treatment are both necessary for opioids to be used. The use of NSAIDs is not recommended in the ambulance, especially for pain of a traumatic etiology, because of possible adverse reactions. The exception is the use of ibuprofen and ketoprofen recommended by Polish guidelines in headache treatment [10]. The oral and intravenous administration of paracetamol is recommended in mild pain, which, as this analysis has shown, is used in such a manner [22].

5. Limitations

The limitation of this study was the analysis of data from only one center in the country. Hence, the results may have depended on the guidelines as well as the customs found in a particular hospital. It does not allow for a comparison of results and, therefore, a formulation of general conclusions. Further research is thus required.

6. Conclusions

The choice of analgesics depended on the nature and location of the pain as well as its level of intensity. Of particular note was the administration of opioids, which were administered more frequently with more extensive injuries and greater pain intensity.

Significant differences in the frequency of analgesic administration depending on the type of EMT were demonstrated in the use of acetylsalicylic acid, administered more frequently in "S" type EMTs, and drotaverine, administered more frequently in "P" type EMTs.

The most common route of administration of analgesic drugs was intravenous, which coincides with the recommendations provided in the analyzed guidelines.

The rare use of acetylsalicylic acid in "P" type EMTs requires further analysis in order to find any correlations and possible deficits in medical practice.

7. Implications for Practice

This study has the following implications for practice:

- The vast majority of interventions were undertaken by a basic EMT consisting of paramedics and/or nurses. This indicates a significant need for pain management training and the creation of improved guidelines for these healthcare professionals.
- A significant percentage of Emergency Medical Service interventions were undertaken in the case of pain localized in the chest. Pharmacotherapy for this specific type of pain requires experience and special training due to the specific etiology of the complaint. Moreover, the rare administration of aspirin in type "P" emergency medical teams may indicate a need for the training of healthcare staff in this area.

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Informed Consent Statement: Not applicable.

Data Availability Statement: A dataset will be made available upon request to the corresponding authors one year after the publication of this study. The request must include a statistical analysis plan.

Conflicts of Interest: The authors declare no conflict of interest.

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