

Pediatric interventions in the practice of Medical Rescue Teams – observation 2019-2022

Interwencje pediatryczne w praktyce Zespołów Ratownictwa Medycznego – obserwacja w latach 2019-2022

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KEYWORDS

medical rescue team, interventions, health risks, pediatrics, neonatology

SUMMARY

Introduction. Medical Rescue Teams (MRTs) are responsible for interventions with respect to people in a medical emergency. A certain proportion of interventions concern health risks to the youngest part of the population (newborns, infants). A child in a life-threatening condition requires medical assistance in a rapid and precise manner. This is only possible if medical personnel have up-to-date knowledge and skills to assist such a patient. **Aim.** Analysis of medical rescue teams interventions to pediatric patients in the age group to 24 months (0-2 years).

Material and methods. The study comprised a 4-year retrospective analysis of trips by the MRTs from the northern part of the Lubelskie Province between 1.01.2019 and 31.12.2022. 257 MRT interventions were qualified for the analysis (2019 – 50, 2020 – 59, 2021 – 90, 2022 – 58) representing 0.9% of all interventions carried out in the operational area. The data was taken from the dispatch order card (DOC)-filled out by the medical dispatcher (MD), a medical emergency response card (MERC)-filled out by the manager (leader) of the medical rescue team (MRT). Interventions caused by a health threat in the age group 0-24 months were qualified as events.

Results. Patients included in the study were male (N = 113) aged 0-24 months (mean 11.4; SD 6.79) and female N = 144 aged 0-24 months (mean 11.09; SD 7.31). The most frequently entered ICD-10 diagnosis was R50 (fever) n = 40 interventions. Pharmacology was most frequently used in the diagnosis group R (N = 29; p < 0.01). The most common reason for calling EMS was a foreign body in the respiratory tract N = 48.

Conclusions. The most common reason for calling MRT for the 0-24 months patient group is an infection manifested by fever. Among injuries in this age group, thermal burns predominate. Specialist teams are more likely to use pharmacology, which may be related to the greater knowledge, practice of doctors. All teams, regardless of type, rarely use analgesics in the trauma patient group, which may be related to the difficulty in choosing the route of administration and converting the drug dose to body weight.

SŁOWA KLUCZOWE

zespół ratownictwa medycznego, interwencje, zagrożenia zdrowotne, pediatria, neonatologia

STRESZCZENIE

Wstęp. Zespoły Ratownictwa Medycznego (ZRM) odpowiedzialne są za interwencje do osób w stanie nagłego zagrożenia zdrowotnego. Pewna część interwencji dotyczy zagrożeń zdrowotnych najmłodszej części populacji (noworodków, niemowląt). Dziecko w stanie zagrożenia życia wymaga udzielenia pomocy medycznej w sposób szybki i precyzyjny. Jest to możliwe tylko w sytuacji posiadania przez personel medyczny aktualnej wiedzy i umiejętności w zakresie niesienia pomocy takiemu pacjentowi.

Cel: Analiza interwencji zespołów ratownictwa medycznego do pacjentów pediatrycznych w grupie wiekowej do 24 miesiąca życia (0-2 lata).

Materiał i metody: Badanie obejmowało 4 letnią retrospektywną analizę wyjazdów zespołów ratownictwa medycznego w północnej części województwa lubelskiego w okresie 1.01.2019- 31.12.2022. Do analizy zakwalifikowano 257 interwencji ZRM (2019-50, 2020-59, 2021-90, 2022-58) stanowiących 0,9% ogółu interwencji zrealizowanych w rejonie operacyjnym. Dane pochodzą z dokumentacji medycznej: karty zlecenia wyjazdu (KZW) i karty medycznych czynności ratunkowych (KMCR). Do zdarzeń kwalifikowano interwencje spowodowane zagrożeniem zdrowotnym w grupie wiekowej 0-24 miesiące.

Wyniki: Do obserwacji włączono interwencje medyczne do pacjentów w wieku 0-24 miesiące: dzieci płci męskiej n=113 w wieku (mean 11,4; SD 6,79) i płci żeńskiej n=144 (mean 11,09; SD 7,31). Najczęściej wpisywanym rozpoznaniem ICD-10 było R50 (gorączka) n=40 interwencji. Farmakologię stosowano najczęściej w grupie rozpoznania R (n=29, p<0.01). Najczęstszą przyczyną wezwania ZRM było ciało obce w drogach oddechowych n=48.

Wnioski: Najczęstszą przyczyną wezwania ZRM do grupy pacjentów 0-24 miesiące jest infekcja objawiająca się gorączką. Wśród urazów tej grupy wiekowej dominują oparzenia termiczne. Zespoły specjalistyczne częściej stosują farmakologię, co może być związane w większą wiedzą lekarzy. Wszystkie zespoły, niezależnie od rodzaju rzadko stosują leki przeciwbólowe w grupie pacjentów urazowych, co może być związane z trudnością w wyborze drogi podania i przeliczenia dawki leku na masę ciała.

INTRODUCTION

Medical Rescue Teams (MRTs) are responsible for interventions with respect to people in a medical emergency. A certain proportion of interventions concern health risks to the youngest part of the population (newborns, infants). A child in a life-threatening condition requires medical assistance in a rapid and precise manner. This is only possible if medical personnel have up-to-date knowledge and skills to assist such a patient (1).

Units of the State Medical Rescue Service (SMRS) system in Poland include Hospital Emergency Departments (EDs) and Medical Rescue Teams (MRTs). The main staff working in these units are paramedics. During their education, each of them had to acquire both knowledge and skills in giving advanced emergency medical treatment to the adult and pediatric patient (2).

In 2019, Poland's SMRS system comprised 1,577 MRTs, including only 369 specialised (S) teams with a doctor. In subsequent years, the trend for MRT-S was downward. With the SMRS system, there are 17 trauma centres, and 8 trauma centres for children, which are defined as a hospital ED, where the specialist parts allow rapid diagnosis and treatment of the pediatric trauma patient (3).

Most of the MRTs intervening in Poland are of B type, mainly staffed by paramedics. The qualifications and authorisations of a paramedic particularly include health services in the fields of emergency medicine, anaesthesiology and intensive care, as well as a number of other clinical fields (traumatology, internal diseases, neonatology, pediatrics,

obstetrics and gynaecology, surgery, anaesthesiology, cardiology, neurology, neurotraumatology, psychiatry) (4-6).

In Poland, there is also a neonatology ambulance team designated with the symbol N. This is a specialised ambulance used to transport neonatal patients, equipped with a transport incubator, infusion pumps, humidifiers and air warmers. In accordance with National Health Fund (NHF) contracting, the 'N' team does not carry out medical emergency orders, as do the S and P system teams. The 'N' team carries out transports of neonates requiring treatment at a higher level of reference than that of the medical facility (7).

AIM

Analysis of medical rescue teams interventions to pediatric patients in the age group: from birth to 24 months (0-2 years).

MATERIAL AND METHODS

Study design

The study comprised a 2-year (2019-2022) retrospective analysis of 257 MRT trips from the northern part of the Lubelskie Province. The data was taken from records functioning in the State Medical Rescue Service (SMRS) system:

- the dispatch order card (DOC)-filled out by the medical dispatcher (MD),
- a medical emergency response card (MERC)-filled out by the leader of MRT.

Interventions meeting the two criteria established for the purpose of the study were included in the study:

- MRT calls to a patient of either sex from the day of birth until the age of 24 months (up to two years of age),
- the dates of the start of MRT intervention between 1.01.2019 at 0.00 a.m. and 31.12.2022 at 11.59 p.m.

Research setting

The database was prepared in Microsoft Excel using MS Office 2016 for Windows 10. Interventions meeting the inclusion criteria were entered into the database, taking into account: date and time of the intervention, length of the intervention (from the moment the ambulance leaves for the incident until the decision of the team - leaving at the scene or transferring to the ED), type of ambulance – B or S, age and sex of the patient, reason for the call, location of the incident – urban and rural division, rescue procedure, ICD-10 medical diagnosis, use of pharmacological agents.

Ethical considerations

In June 2022, consent to access medical records was obtained from the director of the unit executing trip orders in the operating area under study. Data on the injured, the composition of the Medical Rescue Teams and the collaborating services were not disclosed in the analysis, the cases described are fully anonymous in accordance with the Declaration of Helsinki, and therefore no approval was sought from the bioethics committee for the study.

Statistical analysis

Results for quantitative variables are presented as mean values \pm standard deviation. A one-way analysis of variance (ANOVA) test was used to characterise the comparative 'reason for call'. Linear regression analysis (Pearson) was used to detect and describe the strength and direction of the correlation of time and age intervention. Qualitative variables (age, sex) were presented as quantitative values

(n) and percentages of the total group (%), while proportions within groups were assessed using the chi-square test. For comparative age characteristics, the Student's t-test was used. Statistica 13 software (StatSoft Inc., Tulsa, OK) was used for statistical analysis. The significance level was taken as $p < 0.05$.

RESULTS

Using the inclusion and exclusion criteria, 257 MRT trips representing 0.90% of the total interventions were selected for analysis (tab. 1).

Table 2 shows the detailed age distribution of patients expressed in months within the assumed methodology (0-24 months), with a slight predominance of female children.

The most commonly used diagnosis according to the ICD-10 classification (8) (fig. 1) was code R50 (fever), P24 (neonatal choking), and R56 (convulsions not classified elsewhere)

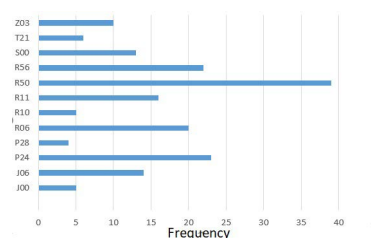


Fig. 1. Diagnosis categories according to the ICD-10 classification (for $N > 4$)

Z03 – Medical observation and evaluation of cases suspected of disease or similar conditions; T21 – Thermal and chemical burn to the trunk; S00 – Superficial head injury; R56 – Unclassified seizures; R50 – Fever of other or unknown cause; R11 – Nausea and vomiting; R10 – Pain in the abdominal and pelvic area; R06 – Breathing disorders; P28 – Other respiratory disorders beginning in the perinatal period; J06 – Acute infection of the upper respiratory tract; J00 – Acute nasopharyngitis

Tab. 1. General characteristics of the number of interventions in the analyzed period

Variable-year	Overall events in the area	N included	%
2019	7624	50	0.65
2020	7054	59	0.83
2021	7069	90	1.27
2022	6769	58	0.85
Total	28516	257	0.90

Tab. 2. Characteristics of patients' age by gender (expressed in months)

Variable-gender	N	Min	Max	Mean	SD
Male	113	1	24	11.40	6.79
Female	144	1	24	11.09	7.31
Total	257	1	24	11.21	7.10

Tab. 3. Comparative analysis of MRT types in relation to the use of pharmacotherapy

MRT	No pharmacology	%	Pharmacology	%	P
B	84	40.78	17	33.33	0.329
S	122	59.22	34	66.67	
Total	206		51		

Tab. 4. Comparative analysis: use of pharmacotherapy vs grouped ICD-10 codes

Pharma	R	J	P	Z	T	S	X	G	W	Other	K	P
NO	78	18	26	20	16	25	3	3	8	6	3	< 0.001
%	72.90	78.26	100.0	100.0	55.1	89.29	100.0	75.00	100.0	100.0	100.0	
YES	29	5	0	0	13	3	0	1	0	0	0	
%	27.10	21.74	0.00	0.00	44.83	10.71	0.00	25.00	0.00	0.00	0.00	
Total	107	23	26	20	29	28	3	4	8	6	3	

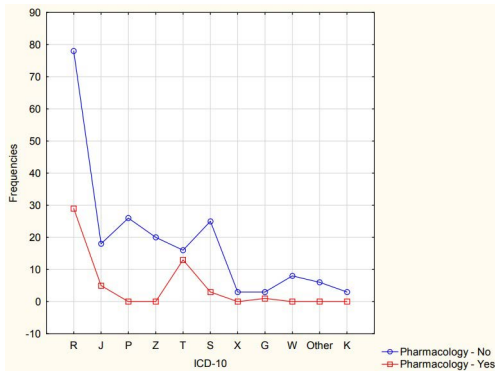


Fig. 2. Multiplicity interactions between pharmacotherapy use and ICD-10 groups

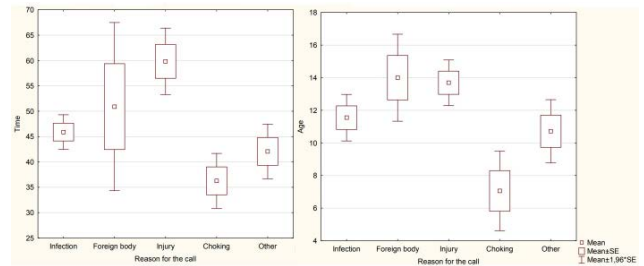


Fig. 3. Analysis of age and intervention time depending on the reason for the call

Tab. 5. General characteristics of the intervention depending on the group – reasons for the call

Reason for the call P	Infection	Foreign body	Injury	Choking	Other
N	97	11	55	37	56
Time	46 ± 17	51 ± 28	60 ± 25	36 ± 17	42 ± 21 < 0.001
Age	12 ± 7	14 ± 5	14 ± 5	7 ± 8	11 ± 11 < 0.001
Sex, male, n, %	40.41	3.27	31.56	12.32	27.48 0.118
MRT-S, n, %	63.65	4.36	31.56	22.60	36.64 0.376
Medical doctor, n, %	54.56	3.27	26.47	20.54	25.45 0.334
City, n, %	19.20	4.36	16.29	19.51	13.23 0.006
Pharmacotherapy, n, %	25.26	nd	14.25	1.3	11.20 0.126

MRT-S – medical rescue teams-specialist

mainly in the course of infection and high temperature. In the group of trauma patients, thermal injuries of the chest area and upper limbs (the mechanism of pouring a hot drink on oneself) and head injury due to a fall (falling out of a stroller, carriers) prevailed.

Pharmacology was used more frequently by S teams (tab. 3), with the following preparations being the most common: paracetamol 125 mg, n = 34, releds 5 mg, n = 6, ibuprofen in various doses n = 3. Pharmacological agents were most frequently used for ICD-10 diagnoses in groups R (fever, convulsions, dyspnoea), and T (thermal burns). The results are presented in table 4 and figure 2.

The reasons for MRTs interventions (tab. 5) were grouped into 4 types of health risks.

In the age group of 0-24 months, interventions for children's respiratory tract infections predominate, in this group pharmacotherapy was also most often used, mainly symptomatic in the case of fever. Choking on food (milk) was

more often the cause of EMT intervention than a foreign body swallowed by the child.

The correlation analysis presented in figure 3 showed no effect of the child's age on the timing of the intervention (R = 0.087; P = 0.164)

DISCUSSION

Interventions for life-threatening conditions associated with airway obstruction in pediatric patients are some of the most challenging events. In young children, the most common cause of acute airway obstruction is a foreign body due to unconscious ingestion. The cause of choking, in children and infants, is food, as well as small toys (or parts of toys), or other small objects and household items, including coins. Aspiration of a foreign body causes obstruction at the level of the upper airways, trachea, bronchi. Choking involves partial or complete blockage of the airway at the level of the pharynx, larynx or trachea (9).

A cross-sectional randomized study by Van de Voorde, et al. identified evidence showing that key interventions (back blows, epigastric compressions, chest compressions/compressions, Magill forceps, manual removal of obstructions from the mouth, suction-based airway devices) are effective in alleviating the effect of foreign body airway obstructions (FBAO) (10). And an in-house analysis showed 48 airway obstruction events due to food choking, or a foreign body swallowed by an infant.

Airway obstruction was also the cause of Chen's 2022 analysis. Asphyxiation due to blockage of the airway by a foreign body is a common cause of accidental death in infants. As infants are unable to express themselves verbally, first aiders must provide immediate assistance depending on the infant's symptoms and response when an airway obstruction occurs (11).

This type of risk was also addressed by Chapin. Choking is one of the leading causes of morbidity and death in children, especially < 3 years of age. The estimated incidence of death due to choking is 1.4/100,000 of the US population, making it the fifth cause of infant death. In contrast, the incidence of emergency department visits due to choking episodes in children < 14 years of age is approximately 20/100,000 (12).

Engelhardt, on the other hand, points to the physiology of respiration and the pathophysiology of respiratory disorders. Hypoxia can manifest as an altered mental state, which in the infant often manifests as apathy. Anxiety towards a stranger is a normal developmental symptom in infants aged 9 to 18 months, and the absence of such a defensive response is concerning. The authors also point to anatomical differences between the infant and adult in the form of a greater proportion of the head and occiput to the rest of the body relative to the adult, resulting in excessive flexion of the airway when lying flat and supine (13).

Popescu's paper discusses the diagnosis, prevention and management of neonatal sepsis. Sepsis accounts for one-third of neonatal deaths worldwide each year. The World Health Organisation recognises neonatal sepsis as a major global health problem in low- and middle-income countries because there is a lack of accurate diagnostic tools for neonatal sepsis. In our own collected material, there were cases of MRTs intervening to patients with various infections, but none were diagnosed with sepsis at the prehospital stage (14).

The Cena publication (2021) refers to COVID-19 infection in infants. The authors highlight cases of SRAR-CoV-2 infection confirmed by nasopharyngeal and rectal swabs up to 48 hours after birth. In the majority of infected infants under 1 year of age, the infection is asymptomatic or mildly symptomatic at the time of diagnosis, while the severe form requiring hospital admission is about 10%. In our observation, there were 3 cases of COVID-19 infection in female patients aged 1, 1, 23 months. All cases manifested as fever in the child and were taken to hospital for observation (15).

Patients in pain are an important part of MRT trips. The use of pain medication and encouraging staff to use it. In introducing a section for pain, no lower age limit was set for the use of a numerical scale. For the purpose of the analysis, it was assumed that reliable information on the location and intensity of pain could be obtained from children aged 10 years and above. When analysing the data, the authors did not use the division between acute and chronic pain (16).

A specific type of injury with significant traumatic pain is burns. Burns are the fourth cause of injury worldwide and the fifth among children. Epidemiological data show that burns contribute to a total of 18 million years of life lost. More than half of the years of life lost are in children up to the age of 14 years (17).

To assess the severity of acute pain in neonatal patients, the Neonatal Infant Pain Scale (NIPS), or the Noncommunicating Children's Pain Checklist (NCCPC) scale, is used for infants and children up to four years of age. The idea behind using these scales is to assess a patient with whom it is not possible to make logical contact. These scales are helpful to health care professionals in the process of selecting the supply of appropriate medications, with a reduced risk of adverse effects from opioid analgesics (18-20).

In Poland, the FACE scale, the VAS scale or, for larger children capable of logically defining pain, the NRS scale are used in prehospital rescue. In the Basinski recommendations for pain management, these scales should be used at the point of call, dividing pain into two groups: traumatic and non-traumatic pain, taking into account the pathomechanism of pain onset and location. The authors point out that currently only 20% of children with trauma receive analgesic treatment at the prehospital stage. In our study, analgesic treatment was implemented 11 times, including 10 times for burns and once for bone injury (21, 22).

Hewes also confirms the problematic nature of determining the pain scale in children, due to lack of logical contact, or developmentally limited patients. According to the authors, younger pediatric patients have less documented pain and receive analgesics at lower rates than adult patients (23).

A 2017 study of analgesic use in a group of children showed frequent use of paracetamol 500 mg by intravenous (2.1%), oral (0.4%), and rectal (0.6%) routes at 125 mg. Paracetamol in suppository form was administered due to ease of administration as an alternative route when it was difficult to establish intravenous access. Our analysis confirms these observations. In addition, attention should be paid to the child's ability to co-operate, which improves after administration of the pain-relieving drug (24).

The authors point to the infrequent use of ibuprofen, which is affected by the route of administration and limitations for paramedics (B teams), who may not be able to administer the drug in a syrup, only in a tablet, with the child weighing at least 20 kg. In an in-house analysis, the

administration of this preparation was demonstrated three times in the form of rectal suppositories (25).

In the following paper, the authors highlight the effects of paracetamol by quoting the product data sheet. This drug is commonly used for the relief of moderate pain and for the treatment of sub-febrile conditions, fever in adults and children (including infants). The drug is safe as its toxic concentration is 6 to 10 times higher than the therapeutic concentration. In our study, the preparation for febrile conditions was used 20 times (26, 27).

One route of drug administration in prehospital emergency care – nebulisation as a technique for administering aerosolised drugs was found in our analysis, in a patient with severe laryngitis manifested by a barking cough. Other authors point to the multiple clinical conditions in which drugs can be administered by this route and the advantages of use such as easy administration to uncooperative patients and the possibility of selecting an individual drug dose. They also point out the disadvantages of inhalation therapy, among them the need to master the correct way to use the device and the technique of inhalation itself (28, 29).

Dispatching is an important part of the intervention of the MRTs. A 2016 paper analysed the legal acts dedicated to medical dispatchers do not specify the type of calls for which they should dispose of a specific type of MRTs – MRT-B, MRT-S, or refuse to dispatch an ambulance.

Due to the different scope of medical emergency activities, dispatching translates into time and type of assistance provided (30).

LIMITATIONS OF THE STUDY

The observed health emergencies, in line with the objective of the study, represent a small % of MRTs interventions in the area, but these events are characterised by high dynamics, variability of the clinical condition, posing a challenge to the units implementing prehospital rescue. The hospital procedures implemented for patients transported to hospital are not known to the authors, the consent to access medical records did not refer to hospital treatment, only to the records of the ambulance teams.

CONCLUSIONS

The most common reason for calling MRT for the 0-24 months patient group is an infection manifested by fever. Among injuries in this age group, predominate thermal burns (around the chest and upper limbs) and head injuries (after a fall). Specialist teams are more likely to use pharmacology, which may be related to the greater knowledge and practice of doctors. All teams, regardless of type, rarely use analgesics in the trauma patient group, which may be related to the difficulty in choosing the route of administration and converting the drug dose to body weight.

CONFLICT OF INTEREST KONFLIKT INTERESÓW

None
Brak konfliktu interesów

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