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Should basic emergency medical teams be dispatched more often than specialized emergency medical teams to patients with impaired ventilation and suspected bronchial asthma?**Klaudiusz Nadolny¹, Maciej Sterliński², Arkadiusz Niczyporuk³,
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Łukasz Szarpak⁷, Jerzy Robert Ładny¹**¹ Department of Emergency Medicine and Disasters, Medical University of Białystok² Department of Arrhythmia, The Cardinal Stefan Wyszyński Institute of Cardiology in Warsaw³ Department of Emergency Medicine and Pediatric Neurosurgery, Medical University of Silesia in Katowice⁴ Department of Anaesthesiology, Intensive Care and Emergency Medicine in Zabrze, Medical University of Silesia in Katowice⁵ Department of Emergency Medical Services, Medical University of Warsaw⁶ Department of Emergency Medicine, Faculty of Health, Medical University of Gdansk⁷ Department of Emergency Medicine, Medical University of Warsaw**Abstract**

Background. Nowadays, app. 62% of Polish medical emergency teams are basic teams without a doctor. There is a certain limitation on the scope of activities that can be performed independently by paramedics. **Material and methods.** A retrospective analysis of dispatch order forms and emergency medical procedure forms of the Voivodeship Rescue Service in Katowice in the years 2014-2015 (n = 469872). The analysis was based on the pre-hospital care of the Emergency Medical Services. **Results.** The analysis covered 57123 dispatch orders in the years 2014-2015. In the analyzed group, there were 2879 cases of diagnosed asthma, 1625 cases of COPD 52619 cases of non-traumatic conditions. There were more men than women among patients with asthma and COPD ($P < 0.001$). The average age of the analyzed group was 54.56 years. Asthma and COPD cases were more frequently accompanied with teams that included doctors ($P < 0.001$). The highest percentage of cardiac arrest cases was observed in patients with diagnosed COPD ($P < 0.0001$). There were also other advanced rescue procedures performers in the group of COPD patients. Atrial fibrillation also frequently accompanied COPD cases ($P < 0.001$). **Conclusion.** Advanced medical procedures were most frequently applied in patients with COPD. In most of cases with diagnosed bronchial asthma and COPD, there were specialized medical emergency teams dispatched to the incident location. Other non-traumatic conditions were managed by basic medical emergency teams. Having considered the results of the research, more frequent dispatch of basic medical emergency teams to suspected bronchial asthma- and COPD cases may be justified and secure. *Anestezjologia i Ratownictwo 2017; 11: 247-255.*

Słowa kluczowe: bronchial asthma, chronic obstructive pulmonary disease, emergency medical team

Introduction

The number of medical emergency team interventions in Poland is increasing every year, regardless of the incident location [1]. This phenomenon goes along with an increased number of patients with diagnosed internal non-traumatic diseases. An increase in life expectancy has been observed in the developed countries including Poland. Taking into consideration the fast developing medical technology, the number of patients with diagnosed internal and cardiological diseases has also increased. The leading cause of mortality in the world is related to cardio-vascular diseases [2]. Nowadays, approx. 62% of Polish medical emergency teams are basic teams without a doctor (consisting of paramedics and/or medical emergency nurses). There is a certain limitation on the scope of activities that can be performed independently by paramedics. Therefore, specialized teams (including a doctor) have frequently been sent to patients with dyspnea. A new regulation was implemented by the Ministry of Health on April 20, 2016. According to it, it is possible for paramedics to act independently in a broader range of cases. However, there are still better ways of pharmacological treatment for teams with doctors. What is more, there is a broader scope of medical rescue actions available to specialized teams (i.e. with a doctor). Another significant issue is that only main symptoms e.g. dyspnea (not specific diseases) are diagnosed and included in the documentation by basic emergency teams.

The aim of this thesis was an analysis of demographic data, types of dispatched medical emergency teams and advanced medical procedures implemented by the teams at the place of incident. Accompanying symptoms in patients with diagnosed asthma, chronic obstructive pulmonary disease (COPD) and other internal non-traumatic conditions were also subject to analysis.

Material and methods

A retrospective analysis of dispatch order forms and emergency medical procedure forms of the Voivodeship Rescue Service in Katowice in the years 2014-2015 ($n = 469872$). The analysis was based on the prehospital care of the Emergency Medical Services.

The analysis covered emergency cases with a final basic diagnosis according to ICD-10:

1) Bronchial asthma (J45-J46),

- 2) Chronic obstructive pulmonary disease - COPD (J44),
- 3) Other – arterial hypertension (I10), myocardial infarction (I20-I25), atrial fibrillation (I48), pulmonary oedema (J81) and conduction disorders (I45-I45).

Calculations have been made by means of the IBM SPSS 24.0 software. Contingency tables and chi-squared test were applied to assess the relations between the specific qualitative variables. Distributions deviated from normal distribution. Therefore, non-parametric methods have been applied. The differences between the three groups have been estimated by means of the Kruskal-Wallis test. Diagrams have been prepared for statistically significant values. $P < 0.05$ values have been adopted as statistically significant.

It was officially clarified that the Bioethics Committee consent was not required to analyse the retrospective data for the research. A detailed analysis has been carried out on demographic data i.e. sex and age. It has been differentiated between cases with basic teams and cases with specialized teams. The specific medical rescue action types have been analyzed on the basis of emergency medical procedure forms.

Results

The selection criteria enabled to select 57123 out of all 469782 emergency cases reported in the years 2014-2015 in the Voivodeship Rescue Service area.

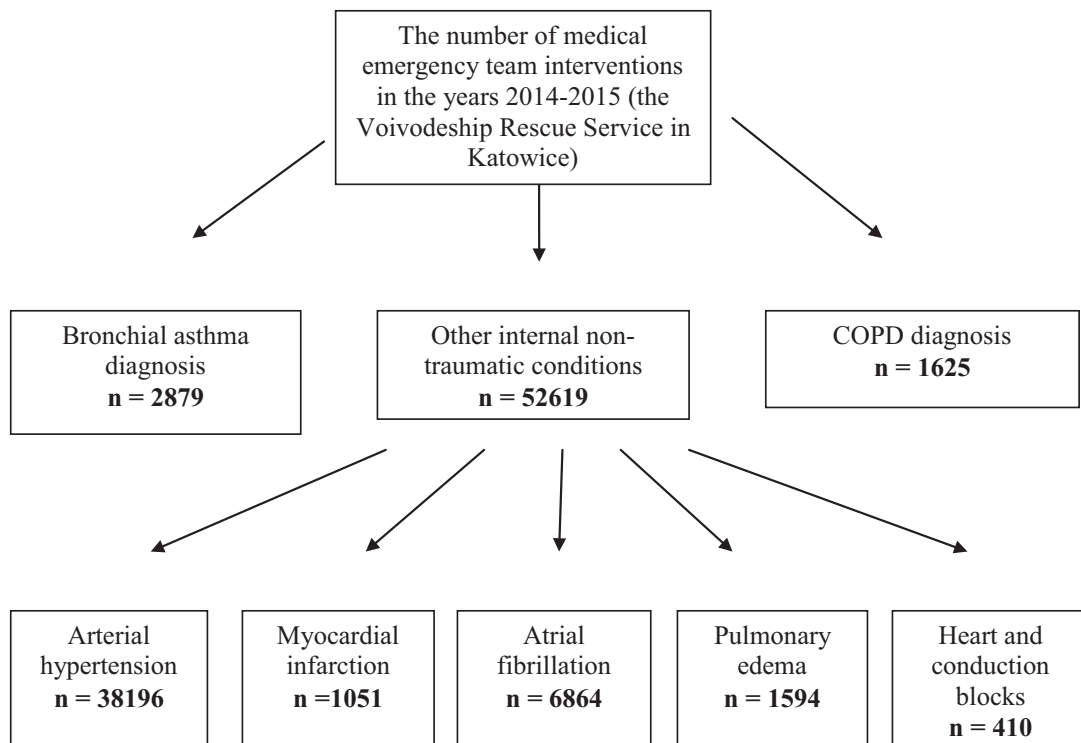
In the selected research group, there were 2879 diagnosed asthma cases, 1625 COPD cases and 52619 internal non-traumatic cases (table I). The average age of the group was 54.56 years. Among patients with asthma, there were more women than men (60.2% vs. 39.8%; $P < 0.001$). In the COPD group, however, there were more men than women (56.4% vs. 43.6%; $P < 0.05$). Finally, the percentage of women in the internal non-traumatic group was 56.55% vs. 43.45% men ($P < 0.001$).

In the research group, the average age data of the affected patients were as follows:

- Bronchial asthma: 57.71 years;
- COPD: 62.17 years;
- Internal non-traumatic: 54.16 years ($P < 0.05$);
 - Atrial fibrillation: 67.16 years;
 - Arterial hypertension: 51.15 years (figure 1).

The type of the medical emergency team has been taken into account in the research. There were

Table I. The distribution of diagnosis in patients with an internal non-traumatic diagnosis (relates to medical emergency team interventions of the Voivodeship Rescue Service in Katowice in the years 2014-2015)



COPD – chronic obstructive pulmonary disease

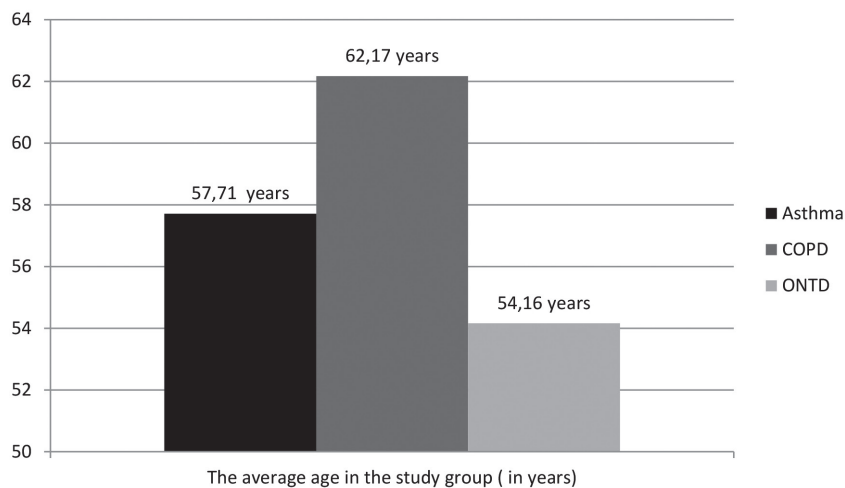


Figure 1. The characteristics of the group with regard to age. The oldest patients are in the COPD group (62.17 years) and the youngest patients in the internal non-traumatic group (54.16 years; $P < 0.005$).

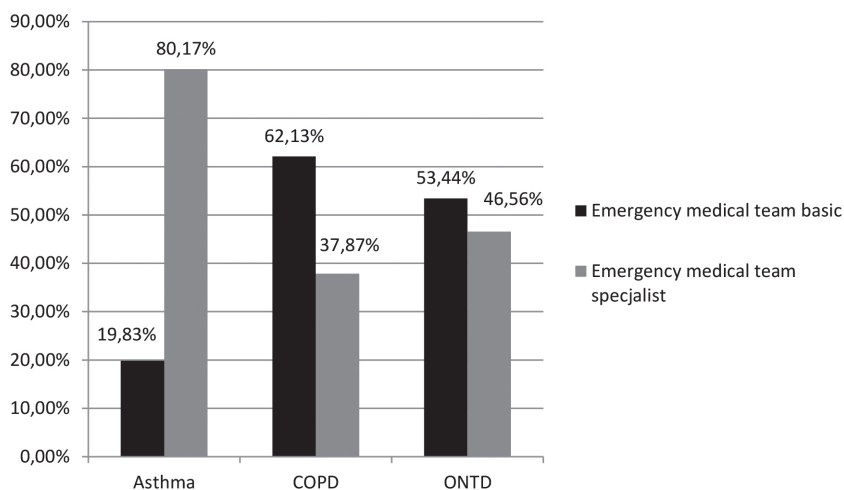


Figure 2. Groups of interventions divided according to the type of medical emergency team. Specialized teams (with a doctor) were dispatched more often to bronchial asthma and COPD cases ($P < 0.001$), and basic teams (with paramedics and/or medical emergency nurses).

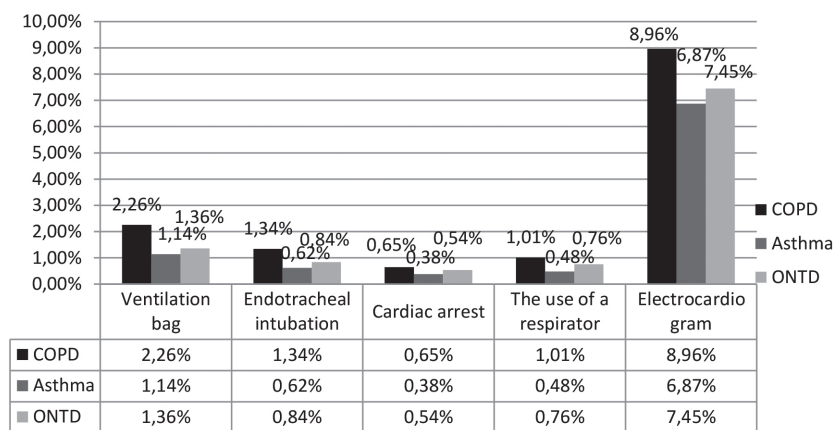


Figure 3. A comparative analysis of medical rescue actions performer in the three groups (asthma, COPD, and internal non-traumatic). The highest rate of cardiopulmonary unstable patients was noted in the group with diagnosed COPD. Therefore, sudden cardiac arrest was more frequent in this group, and more advanced medical rescue actions were taken (e.g. endotracheal intubation, using a ventilator, making an ECG report).

specialized teams (with a medical emergency doctor) dispatched to 80.17% of asthma patients, and basic teams (with paramedics) dispatched to 19.83% of the cases ($P < 0.001$). In the COPD group, there were specialized teams dispatched to 62.13% of the cases and basic teams dispatched to 37.87% of the emergency situations ($P < 0.001$). Finally, internal non-traumatic cases involved specialized teams in 46.56% of the cases and basic teams in 53.44% of emergency calls

($P < 0.001$) (figure 2).

The highest percentage of specialized team interventions in the internal non-traumatic group was related to heart conduction blocks (74,15%). It was just in cases of arterial hypertension that basic teams were more frequently engaged than specialized teams 59.18% vs. 40.82% ($P < 0.001$).

In all three groups, most patients were cardiovascular and respiratory stable and did not require any

Table II. A comparison of procedures in the specific research groups

	Ventilation bag	Endotracheal intubation	SCA	Ventilator	ECG
Chi-square	1586.048	3.945	53.397	6.706	10.93
df	2	2	2	2	2
p	< 0.0001	0.139	< 0.0001	0.035	0.004

SCA – sudden cardiac arrest

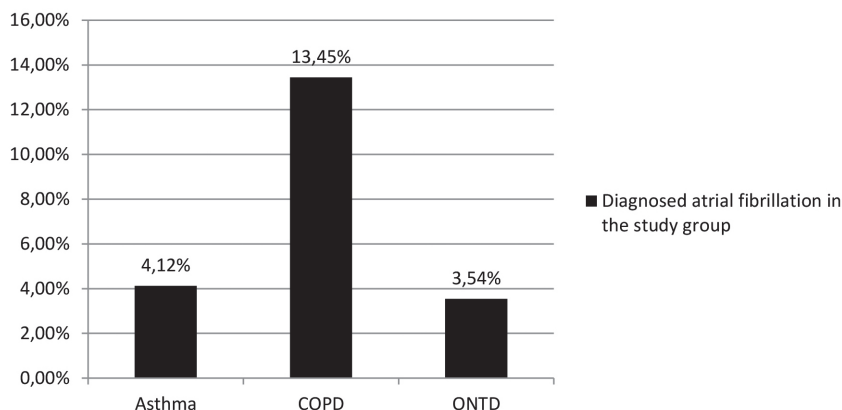


Figure 4. Diagnosed atrial fibrillation in the three research groups. In the group of COPD patients atrial fibrillation was observed more often during an ECG examination ($P < 0.001$).

implementation of advanced procedures according to the ALS (Advanced Life Support) standards. The highest percentage of non-hospital sudden cardiac arrest (SCA) has been observed in patients with diagnosed COPD (0.65%). What is more, other advanced procedures (e.g. intubation, using a ventilator or the ventilation bag) were applied in cases with COPD patients as well. However, the differences were not statistically significant. The distribution of the frequency of the specific procedures were not significantly different ($P = 0.08$) (figure 3). A comparison of procedures for each group separately is indicated in table II.

There were statistically significant differences between the groups in cases with a ventilation bag ($P < 0.001$), a ventilator ($P = 0.035$), ECG ($P = 0.004$) applied, and SCA ($P < 0.001$). In the three research groups, the 12-lead ECG and diagnosed atrial fibrillation were analyzed. The ECG was most frequently performed in COPD patients (8.96%) and was the least performed in patients with diagnosed asthma (6.87%). For the sake of the research, internal non-traumatic patients with diagnosed atrial fibrillation were excluded from the group (13.04% of the group). The highest percentage of ECG reported atrial fibrillation has been

noted in the COPD group (13.45%), whereas the lowest percentage has been observed in the internal non-traumatic group without atrial fibrillation as a basic diagnosis (3.54%; $P < 0.001$; figure 4).

Discussion

In the early 90s in the USA, the Global Initiative for Asthma, GINA, was settled [3]. It was already in 1995 that the first guidelines of the initiative were published. The last ones were published later in 2014 [4]. The main objective of GINA was to decrease bronchial asthma incidence and mortality. The 1998 report introduced inhaled corticosteroids to treatment [5]. Although bronchial asthma is a well common disease, there is no definition of this disease [6]. According to the newest definition asthma is a heterogeneous disease characterized by chronic inflammation. The disease is diagnosed through medical history including symptoms related to the respiratory system (i.e. wheezing, dyspnea, chest discomfort and coughing) that vary in time and intensification, and a fluctuating upper respiratory tract obstruction [7,8]. The intensification of the symptoms may vary. It is quite frequent that the

symptoms are self-limiting or resolve under treatment [9]. The symptoms cover mainly dyspnea that is most often an expiratory and paroxysmal one, with variable intensification [10]. It is important to remember that when bronchial asthma suddenly becomes acute, wheezing may not be audible. This phenomenon is called the „silent chest” [11]. In 1962, the American Thoracic Society, ATS, defined chronic bronchitis as chronic coughing that lasts for at least 3 months in the last 2 years [12]. Anatomically, emphysema was described as an increase of the surface of pulmonary alveolus but without fibrosis symptoms [13]. The current name of the disease, COPD, chronic obstructive pulmonary disease, was suggested by Briscoe and Nash [14].

COPD is the most frequent chronic lung disease and one of the most frequent chronic diseases in Poland [15]. It is also the fourth top cause of death [16]. In western Europe, COPD costs of treatment reach app.1500 € per capita in a year, and are twice as high as cost of asthma treatment [17]. Therefore, COPD in Poland and all developed countries is a serious medical and social burden [18]. COPD is a very common disease: every tenth adult suffers is affected [19,20]. A spirometric test enables to diagnose the disease in its early stage [21]. Quitting smoking decreases the progress of the disease [22,23]. Generally, the frequency of chronic bronchitis incidence has been estimated to 6.4%, isolated emphysema to 1.8%, and COPD (confirmed by means of a spirometric test) in patients older than 40 8.9% [24]. Generally, it is estimated that COPD occurs twice as frequent in men as in women [25]. In Poland, there has been no detailed epidemiological research on the frequency of COPD incidence yet. Changes in the respiratory system indicating a possible COPD development have been observed in app. 10% of population aged more than 40 [26].

Smoking is said to be the most significant risk factor in COPD development. According to various research results, smoking is responsible for 9.7-97.9% COPD incidents [27]. In the Lundback et al. research [28], COPD-indicating symptoms could be observed in 50% of smoking participants.

Therefore, smoke-free steps are the basic medical procedure in preventing and decreasing of the progress of COPD [29,30].

For the sake of the retrospective research, population was divided into three groups and analyzed. These groups included: bronchial asthma patients, COPD patients and internal non-traumatic patients (the last

group covering arterial hypertension, myocardial infarction, conduction blocks, pulmonary edema and atrial fibrillation. The analysis covered exclusively prehospital care within medical emergency services in Poland.

The results of the research have indicated that the percentage of bronchial asthma, COPD and internal non-traumatic disease mentioned above was quite low in the context of all emergency interventions in the period under research (12.15%). It is also worth noticing that most of Polish medical emergency teams (app. 62%) are basic teams [31] with a paramedic as a team leader. Paramedics are not allowed to diagnose disease entities (unless the entity is previously confirmed in a medical history). As a result, they most frequently describe main symptoms (and not the specific disease entities) observed in patients.

The characteristic of the group shows that the older the patient the more frequent the COPD diagnosis. In the conducted research, the average age was 62.17 years. What is more, many of the participants were older than 70. According to WHO, COPD is one of the most frequent cause of death in the population [16,32]. It occurs in app.10% of the population. COPD is a systemic disease that can be prevented and treated. These characteristic features require correct preventive, diagnostic and therapeutic procedures [33]. In cases with bronchial asthma, the average age was 57.71 years. Patients from the internal non-traumatic group were the youngest, with just 54.16 years on average. In the internal non-traumatic group, the youngest were patients with diagnosed arterial hypertension (51.15 years on average). It was only in the group of COPD patients that the proportion of men exceeded the proportion of women (56.4% vs. 43.6%, $P < 0.0001$). It is worth noticing that the most significant difference was noted in bronchial asthma patients: there were 60.2% of women and 39.8% of men ($P < 0.001$). The last data provided confirm scientific publications on bronchial asthma epidemiology [34]. There are app. 235-300 million people suffering from asthma in the world [35,36].

The Polish medical emergency services consist of basic and specialized teams [31]. 62% of them are basic teams and 38% are specialized units. The highest percentage of reported specialized teams interventions involved bronchial asthma (80.17%; $P < 0.001$), and the lowest percentage was related to internal non-traumatic diseases (46.56%). It needs to be underlined that there has been a process in progress in the last years that

aimed at centralizing medical dispatch centers. Medical dispatchers in Poland are also obliged to proceed according to procedures facilitating decisions and incident coding (code-1, code-2). This coding regulates the time for accepting visits, dispatching teams and emergency team preparation and departure [37,38].

The different rates in diagnosis between basic and specialized teams may result from:

- difficulties in diagnosis the disease entity;
- different level of access to pharmaceuticals and different possibilities of administering them (i.e. if the incident is caused by dyspnea or respiratory failure, and there is a specialized team available, this team is dispatched to the incident location in the first place);
- taking over unstable patients by specialized teams from basic teams in the incident location.

In all groups involved, most patients were cardiopulmonary stable and no advanced ALS and European Resuscitation Council procedures were required. If there were any advanced procedures (e.g. cardiac massage, intubation, using a ventilator) they were related mostly to COPD patients, with a much lower rate in diagnosed bronchial asthma cases (figure 4). However, the differences were not significant and the distribution of the frequency of the procedures performer were not significantly different between the specific diagnostic cases ($P = 0.08$).

Sudden cardiac arrest would occur most frequently in the group with COPD (0.65%). The lowest rate of cardiac arrest incidence was observed in the group with bronchial asthma (0.38%). The high SCA rate in COPD patients results from the age of the patients (taking into account that age is related to cardiorespiratory difficulties). Ensuring patency of respiratory tract was more often than sudden cardiac arrest. This means that cardiopulmonary failure was observed in many patients and the emergency team leader decided to ensure patency of respiratory tract by means of endotracheal intubation. It is worth noticing that, nowadays, basic team without doctors on board is allowed to start intubation only on one condition, i.e. in case of non-hospital sudden cardiac arrest [39,40]. Endotracheal intubation was mostly performed in patients with COPD (1.34%) and least frequent in the group with bronchial asthma (0.62%). However, a ventilation bag was more frequently used than endotracheal intuba-

tion. A ventilation bag was applied in 2.26% of COPD patients, in 1.36% of internal non-traumatic cases, and in 1.14% of patients with asthma.

There was also an analysis of the 12-lead ECG report performed in the groups on the spot. Again, the percentage of ECG reports was the highest in the COPD group (8.96%). The rates in the other groups reached 7.45% in internal non-traumatic diseases, and 6.87% in asthma cases. It appears that patients with reported and diagnosed symptoms such as dyspnea, anxiety, chest pain and palpitation should always have an on the spot full 12-lead ECG report done.

The three groups of patients were also compared and contrasted in the context of atrial fibrillation diagnosis. For the sake of the analysis, internal non-traumatic patients with a diagnosed basic atrial fibrillation were excluded from this comparison. It is also in the context of atrial fibrillation that the frequency of occurrence is the highest in COPD patients (13.45%) with the lowest rates in internal non-traumatic patients (3.54%).

Conclusions

Advanced medical procedures in the analyzed group were most frequently applied in patients with chronic obstructive pulmonary disease. In most of cases with diagnosed bronchial asthma and chronic obstructive pulmonary disease, there were specialized medical emergency teams dispatched to the incident location. Other non-traumatic conditions were rescued by basic medical emergency teams. Having considered the results of the research, more frequent dispatch of basic medical emergency teams to suspected bronchial asthma- and chronic obstructive pulmonary disease cases may be justified and secure.

Conflict of interest

None

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