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CHEST INJURIES BASED ON MEDICAL RESCUE TEAM DATA

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Injuries are the leading cause of death before the age of 40 years, and the third most common incidence of death worldwide after cardiovascular diseases and cancer.
The aim of the study was to determine the number and type of chest injuries, based on EMS (Emergency Medical Service) documentation in the district of Otwock, with particular emphasis on patient age and gender at the time of injury.
Material and methods. Analysis considered data obtained from medical rescue teams of Otwock County in 2009 concerning chest injuries.
Results. The study group comprised 166 cases of chest injuries. Chest injuries were more often diagnosed in male patients. Most accidents occurred in the afternoon (between 1 and 6pm), and in the summer and winter seasons. Motor vehicle accidents and falls from heights were the most common cause of chest injuries, while the largest number of cases involved superficial chest injuries.
Conclusions. Chest injuries accounted for 12% of all medical rescue team interventions, due to injuries, most often connected with superficial contusions of the chest wall. Rib fractures are usually caused by blunt chest injuries, most often relating to the V-VIII ribs. Fractures of the I-III ribs are rare and are evidence of a significant injury. Due to the flexibility of the thoracic wall, fractures in children are less common, as compared to the adult population. Most chest injuries occur in the afternoon during increased patient activity.
Key words: chest injuries, accident, epidemiology, pre-hospital care, Emergency Medical Service

Injuries are the leading cause of death in patients before the age of 40 years and the third most common incidence of death worldwide, after cardiovascular diseases and cancer (1, 2). Chest injuries account for nearly 15% of all injuries (3).

Motor vehicle accidents are the most common cause of chest injuries. The above-mentioned injuries constitute a component of multi-organ trauma (4).

Much less likely one may deal with isolated injuries, which arise as a result of wounds inflicted by sharp instruments, fall from a height, or being crushed by a heavy object (3, 5, 6).

Chest injuries not only comprise the ribs, but also organs which are located within the rib cage. The severity of damage to these organs is proportional to damage inflicted to the chest wall (2, 7). The above-mentioned injuries and ensuing complications can vary from minor skin abrasions and contusions to possible patient death (8, 9).

At the scene of the injury patients may represent a variety of symptoms, depending on the severity of the trauma, general condition, age, chronic diseases, and coexisting injuries (10).

The examination of the patient by the Medical Rescue Team or Emergency Room personnel does not differ from the general scheme of the medical examination. Medical personnel should gather information about the accident. When observing the patient one may visualize the presence of an aspirating wound, which gives rise to the suspicion of pneumothorax, or paradoxical chest movements, which are evidence of a flabby chest. Palpation enables to recognize bone instability or the occurrence of subcutaneous emphysema. During

auscultation one may listen to the regularity of respiratory murmurs and peristalsis (5).

Patient transportation depends on the sustained injuries. One may distinguish the „stay and play" model, where the rescue team remains at the scene of the accident (airway obstruction, open pneumothorax, tension pneumothorax, cardiac tamponade) securing the basic life functions and transporting the patient to the hospital. The „scoop and run" model consists in the rapid transportation of the patient to a reference center specializing in the treatment of chest injuries (11). All activities connected with the examination of the patient, securing less-threatening injuries are performed during transportation. However, whether the former or latter model is used during transportation the patient should be subject to thorough trauma examination, in order to eliminate possible complications, as well as control the previously undertaken medical procedures.

As in any life-threatening condition chest injuries should be optimally managed. During the so-called „golden hour" after the accident the patient should be transported to a specialistic center with immediate initiation of therapy. In the hospital, the patient should be re-examined and subject to various imaging examinations, such as X-rays, computer tomography, and ultrasound (8, 10, 12).

The aim of the study was to determine the amount and type of chest injuries, based on EMC documentation in the district of Otwock with particular emphasis on patient age and gender, as well as the time of sustained injury.

MATERIAL AND METHODS

The study group comprised the analysis of 166 patients with chest injuries, based on data obtained from Medical Rescue Teams (ICD 10 classification from S20 to S29).

Medical documentation analysis was performed (medical rescue team departures). Analysis considered the following: patient age and gender, time of the day and year of the sustained injury, time elapsed from the occurrence of symptoms to medical rescue team intervention, and symptoms associated with the chest injuries.

Analysis concerned the year 2009 and was based on medical data. The above-mentioned was carried out under the provisions of the Personal Data Protection Act, to which particular care was applied.

The t-Student, rang Wilcoxon, and chi-square tests, as well as Cramer's V dependency ratio were used during analysis. $\alpha = 0.05$ was considered as statistically significant.

RESULTS

The study group comprised 92 male and 74 female patients. Patient age ranged between 2 and 94 years (mean age – 38.34 years). The chi-square test showed no significant dependency between patient gender and occurrence of chest injuries ($p>0.1$).

Most spinal injuries occurred in patients aged between 20 and 29-37 years (25.69%) cases, between 30 and 39-32 years (22.22%) cases, while least likely amongst those aged above 90 years – 3 (2.08%) cases, and in children between 1 and 9 years – 4 (2.78%) cases (fig.1). Table 1 presented the detailed age distribution, considering study patients. Analysis

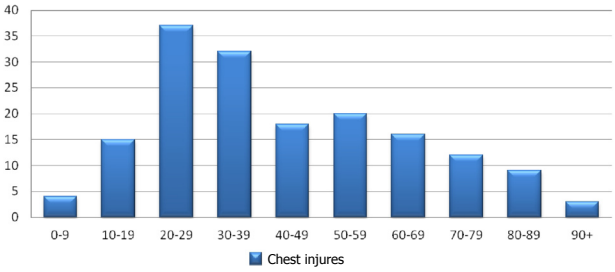

Fig. 1. Age of patients with chest injuries

Table 1. Age of patients with chest injuries

Age	n	%
0-9	4	2,78
10-19	15	10,42
20-29	37	25,69
30-39	32	22,22
40-49	18	12,50
50-59	20	13,89
60-69	16	11,11
70-79	12	8,33
80-89	9	6,25
90+	3	2,08
Total	144	100

showed a statistically significant difference considering patient age (p<0.001).

In order to determine the occurrence of chest injuries during the diurnal cycle the study material was divided into 24 groups. The highest occurrence of chest injuries is observed between 1 and 6 pm – 88 (52.41%) patients. The peak incidence is observed at 4 pm– 18 (10.84%) patients. During the night hours (between 2-6 am) there are practically no interventions-only one case was recorded (fig. 2, tab. 2) (p<0.001). An additional division of the diurnal cycle into 4 groups showed the highest occurrence of chest injuries in the afternoon hours, the lowest occurrence was observed in the late night hours (between 0-6 am) (fig. 3). The chi-square test showed a significant difference between the occurrence of chest injuries and the time (p<0.001).

The distribution of the study group depending on the month of chest injury occurrence demonstrated that in July and December patients most often sustain injuries – 20 (12.05%) cases. Amongst the female population there is only one peak in the month of November, while in male patients- July and December. The further breakdown of the season showed no statistically significant seasonal incidence of chest injuries. The Authors observed an increasing trend in the summer and winter months. In the spring one observed a decrease in the number of chest injuries (p=0.023) (fig. 4).

Amongst the causes of chest injuries motor vehicle accidents predominated – 73 (43.98%) cases, followed by falls from a height – 41 (24.7%) cases, falls – 26 (15.66%) cases, and assaults – 14 (8.43%) cases (fig. 5). Analysis

Table 2: Occurrence of chest injuries depending on the time

Hour	n	%	Hour	n	%
0	4	2,41	12	6	3,61
1	4	2,41	13	15	9,04
2	0	0	14	13	7,83
3	1	0,60	15	11	6,63
4	0	0	16	18	10,84
5	0	0	17	16	9,64
6	0	0	18	14	8,43
7	4	2,41	19	7	4,22
8	8	4,82	20	10	6,02
9	4	2,41	21	6	3,61
10	8	4,82	22	6	3,61
11	7	4,22	23	4	2,41

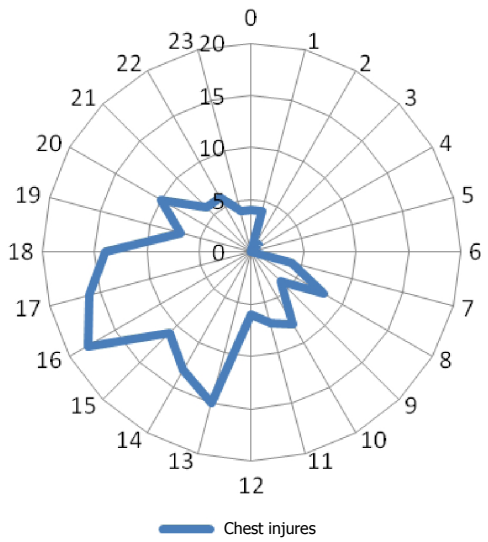

Fig. 2. Occurrence of chest injuries depending on the hour

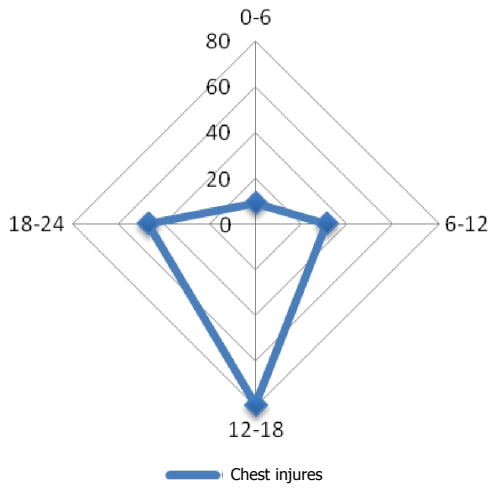

Fig. 3. Occurrence of chest injuries depending on the time of the day

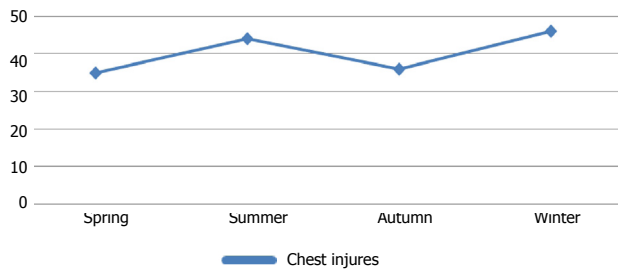

Fig. 4. Seasonal incidence of chest injuries

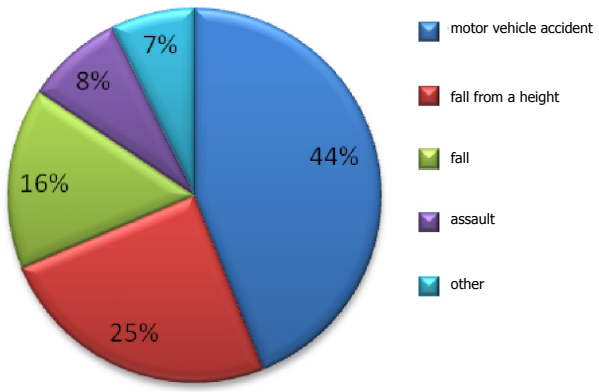

Fig. 5. Cause of chest injuries

showed the difference between the frequency of causes responsible for chest injuries ($p<0.001$).

Superficial chest contusions dominated – 85 cases. Table 2 presented the detailed distribution of sustained injuries, according to the ICD-10 classification.

The presented table did not mention vascular chest injuries (S25), cardiac injuries (S26), crush chest injuries, and traumatic amputations of thoracic segments (S28), since no such cases were observed.

DISCUSSION

Chest injuries constitute 12% of all sustained injuries. Literature data even mentioned 15% (3). The above-mentioned are the third most common cause of death worldwide, after cardiovascular diseases and cancer (1). Polish medical literature lacks epidemiological data concerning pre-hospital chest injuries. American and Western European studies are the major source of epidemiological analysis (3, 7, 13).

The extent of chest injuries and their consequences are diverse, beginning with minor injuries and death included (9, 14). Therefore, a precise history of the accident and patient traumatic examination are important factors, when determining the proper diagnosis and predicting the consequences of the injury. The history of the injury should comprise the detailed mechanism of the trauma (2).

Based on available medical data male patients sustained chest injuries more often, as compared to female patients (7, 15), which is consistent with our results.

Chest injuries were observed in all age groups (7) with the peak incidence considering patients aged between 20 and 29 years.

Literature data lacks publications considering the incidence of chest injuries, depending on the time of day and year. Based on analysis most chest injuries occur in the afternoon hours (between 1 and 6 pm), which is probably associated with the increased activity of the population, and home returning.

Considering the seasonality of chest injuries the incidence of the above-mentioned remained at a similar level with insignificant increases during the summer and winter.

The causes of chest injuries are consistent with available literature data (1, 3). The insig-

Table 3. Chest injuries according to the ICD-10 classification

ICD-10	Type of injury	Male patients (n)	Female patients (n)	Total (n)
S20	superficial chest injuries	55	30	85
S21	open chest wounds	9	3	12
S22	fractured ribs, sternum, and vertebral column (th)	15	6	21
S23	dislocations, sprains, and strains of joints and thoracic ligaments	1	0	1
S24	injuries of the nerves and thoracic spinal cord	0	1	1
S27	injuries of other unspecified chest organs	1	0	1
S29	other unspecified chest injuries	11	34	45

nificant share of penetrating injuries is worth notice, being lower than in literature data (14, 16) with the simultaneous increase of blunt injuries mainly associated with motor vehicle accidents (17).

Considering the analysed material motor vehicle accidents were the cause of 43.98% of chest injuries, falls from the height – 24.7%, falls – 15.66%, while assaults – 8.43%. The above-mentioned results are comparable with those obtained by other authors (1, 18, 19, 20).

Chest wall contusions and rib fractures were most frequently observed. Tension pneumothorax was diagnosed in 8 patients, subcutaneous pneumothorax in 5, while sternum fractures in two cases. Considering literature data the number of patients requiring management of pneumothorax or pleural hematoma was significantly higher, amounting to nearly 70% (3, 17).

Cardiac tamponade or tracheobronchial injuries were not observed. Rib fractures are diagnosed more often in middle-aged patients, due to the fact that in children their is greater flexibility of the rib cage (8, 20). Fractures of ribs V to VIII were most frequently observed. At the time of trauma greatest tension was located in the posterior axillary line, where most fractures occurred (7, 21). Fractures of ribs I to III are relatively rare, being protected by the shoulder girdle. Their fracture is evidence of significant trauma with an increased probability of internal organ injuries (3, 18, 21).

A special type of rib fractures is the so-called „flabby chest" associated with the fracture of at least three consecutive ribs in two places or lateral fracture of three ribs with simultaneous separation of the costal cartilages corresponding to the ribs. The above-mentioned characteristic type of fracture was observed in three patients. All were associated with motor vehicle accidents. Thus far, the following view prevailed that the main cause of ventilation impairment resulting from the presence of a "flabby chest" was associated with mechanical ventilation disturbances. Nowadays, it is suspected that impaired ventilation is associated with lung contusion (4).

CONCLUSIONS

1. Chest injuries accounted for 12% of all Medical Rescue Team interventions, due to trauma with superficial chest contusions as the dominating injury.
2. Rib fractures usually occur as a consequence of blunt chest injuries, most frequently of ribs V-VIII. Fractures of ribs I-III are rarely observed, being evidence of significant trauma. Due to the elasticity of the chest wall the above-mentioned fractures are less frequently observed.
3. Chest injuries most frequently occur in the afternoon hours, during increased patient activity.

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