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Comparison of pediatric and adult patients with thoracic trauma in emergency department

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ABSTRACT

Anatomical and physiological characteristics of adults and children with are different from each other. Therefore management of similar thoracic injuries may be different between adults and children. Adult and pediatric patients admitted to the emergency department with thoracic trauma were compared in this study. Patients were divided into adults and pediatric. They were evaluated in terms of age, gender, month of admission, etiology of the trauma, thoracic complaints and other accompanying complaints, treatment methods applied the clinics in which they were followed, and outcomes. Of the cases, 82.8 % were male in Group I, and 77.8% of the patients in Group II were male. Of the cases, 220 (64.4%) were blunt traumas, eighty-one (35.6 %) were penetrating traumas. Penetrating traumas were 85.2% in Group I. While the most frequent cause for blunt in Group I was traffic accident in vehicle (43.8%), it was out of vehicle traffic accidents (31.1%) in Group II. Pneumothorax and hemothorax were the most common injuries in both groups, and tube thoracostomy was the most common type of treatment. In addition, determining the ratio of penetrating trauma in the pediatric group was an important finding of our study.

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1. Introduction

Thoracic traumas are common and life-threatening traumas that result from traffic accidents, occupational accidents and daily activities. They account for 25% of trauma-related deaths and are the third leading trauma following head and extremity traumas (Regel et al., 1995 ; Oikonomou and Prassopoulos, 2011).

Thoracic trauma-related clinical manifestations form a wide spectrum from a simple soft tissue injury to life-threatening thoracic injuries. The most common clinical condition is thoracic wall injury followed by severe thoracic injuries such as parenchymal injury, hemothorax, pneumothorax, and flail chest (Kishen and Lomas, 2003). Respiratory system of children has anatomical and physiological differences than adults. Their chest contains a higher rate cartilage and not completed ossification of ribs. For this reason, in pediatrics, chest wall flexible and mediastinal structures mobile. This features lead to intrathoracic injuries such as pulmonary contusion and pneumothorax without rib fracture (Ekinci and Çiftçi, 2007). Morbidity and mortality rates due to thoracic traumas may be reduced with early and correct diagnosis, tube thoracostomy and appropriate surgical intervention when needed.

The aim of this study is to investigate adult and pediatric cases admitted to emergency department (ED) due to chest trauma and contribute to the epidemiological data of our country.

2. Methods

In our study, the records of the total of 317 patients who visited the ED in the Faculty of Medicine of Yuzuncu Yil University in Van, Turkey during the period from January 2008 to August 2011 due to thoracic trauma were screened retrospectively. Sixteen cases were excluded from the study due to

a lack of records. Three hundred and one cases were allocated to two groups according to age. Cases in Group I (>16 years) and Group II (≤16 years) were evaluated in terms of age, gender, month of admission, etiology of the trauma, thoracic and other accompanying system injuries, treatment methods applied in emergency department and the outcomes. Other patients were examined by emergency medicine assistant and specialist while cases which needed tube thoracostomy and thoracotomy and hospitalization evaluated by thoracic surgery specialist which was studying as consultant.

Statistical analysis

The descriptive statistics were expressed as mean, standard deviation, and minimum and maximum values for constant variables, while categorical variables were expressed as number and percent. A chi-square test was used to determine the relationship between the groups and categorical variables, and the Student t-test was applied to compare the mean values of the constant variables. The Statistical Package for the Social Sciences (SPSS) (version 15, Chicago, USA) program was used for calculations, and $p<0.05$ was considered statistically significant.

3. Results

The mean age of all cases was 35.4±17.3 (2-85 years). The distribution of gender according to age groups is given in Figure 1. There was no statistically significant difference between genders when compared according to age groups (p=0.42).

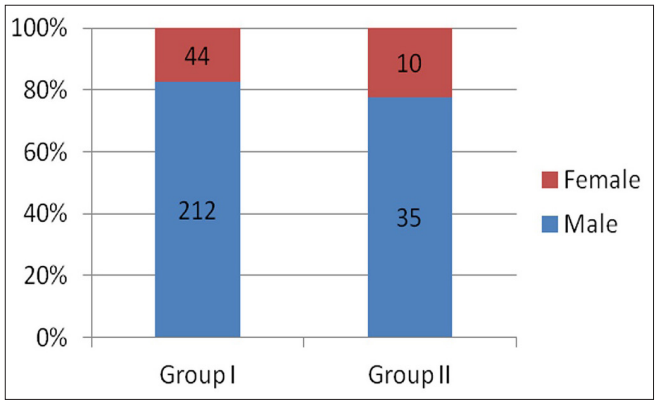

Fig. 1. Distribution of groups according to age groups

When the groups were analyzed according to the month of admission, in Group I, the most common season was summer (n:72, 28.1%), followed by spring (n:70, 27.3%), autumn (n:65, 25.4%), and winter (n:49, 19.1%), while in Group II, the most common season of admission was summer (n:20, 44.4%), followed by autumn (n:12, 26.7%), spring (n:11, 24.4%), and winter (n:2, 4.4%) (p=0.02).

Of all cases, trauma was blunt in 220 (64.4%) and penetrating in 81 (35.6%). The most common cause of blunt traumas was traffic accidents (152 cases, 50.5%). All of the cases admitted following assault, and 85.2% of blunt traumas were seen in Group I. While the most common cause of blunt trauma was from an in-vehicle traffic accident (43.8%) in Group I, it was from out-of-vehicle traffic accident (31.1%) in Group II. There was statistically significant difference between groups according to etiology (p<0.0001) (Table 1).

Table 1. The distribution of the groups according to the etiology

	Group I n(%)	Group II n(%)	Total n(%)	p value
Blunt trauma	**187 (73.1)**	**33 (73.3)**	**220 (64.4)**	<0.001
Pedestrian injury	112 (43.8)	14 (31.1)		<.0001
In-vehicle traffic accident	14 (5.5)	12 (26.6)		<.0001
Violence	21 (8.2)	0(0)		<.0001
Fall from height	40 (15.6)	7 (15.6)		<.0001
Penetrian trauma	**69 (26.9)**	**12 (26.7)**	**81 (35.6)**	
Stab injuries	60 (23.4)	9 (20)		<0.001
Gunshot wounds and land mine explosion	9 (3.5)	3 (6.7)		<0.001
Total	**256 (100)**	**45 (100)**		

The intrathoracic, extrathoracic injuries and accompanying chest wall injuries of cases shown in tables 2, 3 and 4 respectively.

Table 2. Intrathoracic injuries

	Group I n(%)	Group II n(%)	p value
None	66 (25.8)	7 (15.6)	>0.05
Pneumothorax injuries	63 (24.6)	15 (33.1)	>0.05
Hemothorax injuries	65 (25.4)	14 (31.1)	>0.05
Diaphragma injuries	1 (0.4)	0 (0)	>0.05
Pulmonary contusion injuries	1 (0.4)	0 (0)	>0.05
Pneumothorax-Pulmonary contusion injuries	2 (0.8)	0 (0)	>0.05
Pneumothorax - Pulmonary contusion - Hemothorax injuries	1 (0.4)	1 (2.3)	>0.05
Pneumothorax - Hemothorax injuries	54 (21.1)	7 (15.6)	>0.05
Diaphragma-Pulmonary contusion injuries	1 (0.4)	0 (0)	>0.05
Hemothorax-Pulmonary contusion injuries	2 (0.8)	1 (2.3)	>0.05
Total injuries	256 (100)	45 (100)	

In Group I, while the most chest wall injury was rib fracture (n=68, 26.6%), in Group II, subcutaneous emphysema (n=9, 20%) was detected. There was no statisttycal significance between groups (p=0.31) (Table 4).

In group I, the most inthratoracic injuries were isolated hemothorax (n=65, 25.4%), isolated pneumothorax (n=63, 24.6%), hemo-pneumothorax (n=54, 21.1%) respectively. In group II, the most inthratoracic injuries were isolated pneumothorax (n=15, 33.1%), isolated hemothorax (n=14, 31.1%), hemo-pneumothorax (n=7, 15.6%). There was no significant difference between groups (p=0.57). In group and group II, the most extrathoracic injury was extremity trauma (respectively 20.3%, 17.8%) There was no significant difference between groups (p=0.49).

A total of 201 (78.5%) cases in Group I and 34 (75.6%) cases in Group II were followed in the Thoracic Surgery Clinic. The distribution of hospitalized clinics is presented in Figure 2.

In the emergency department, tube thoracostomy was applied to 159 (62.1%) cases in Group I and to 33 (73.3%) cases in Group II. Eighty (31.2%) cases in Group I and 9 (20%) cases in Group II received only conservative therapy (anal-

Table 3. Extrathoracic injuries

	Group I n(%)	Group II n(%)	p value
None	159 (62.1)	29 (64.5)	>0.05
Liver	9 (3.5)	0 (0)	>0.05
Spleen	4 (1.6)	1 (2.2)	>0.05
Head	16 (6.2)	5 (11.1)	>0.05
Extremity	52 (20.3)	8 (17.8)	>0.05
Head-Extremity	11 (4.3)	1 (2.2)	>0.05
Urinary-Extremity	3 (1.2)	0 (0)	>0.05
Spleen- Extremity	1 (0.4)	0 (0)	>0.05
Spleen- Head	1 (0.4)	1 (2.2)	>0.05
Total	256 (100)	45 (100)	

gesia, fluid support, O2). One case with a sternum fracture in Group I was followed with echocardiography, electrocardiography, creatine kinase (CK)-MB, and troponin I levels. Three (1.2%) cases in Group I died in ED.

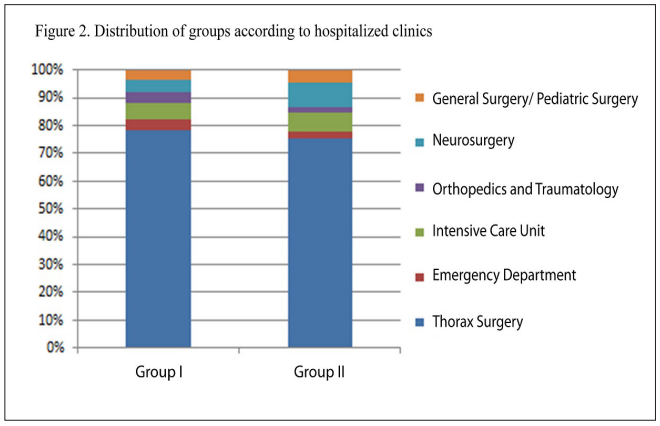

Fig. 2. Distribution of groups according to hospitaiized clinics

4. Discussion

While thoracic traumas are the second leading cause of trauma-related deaths in children, they account for 25% of blunt trauma-related deaths in adults (Çağırıcı et al., 1998 ; O'Neill, 2000).

Thoracic traumas in the pediatric age group are believed to differ from those in adults in terms of both anatomic differences and trauma mechanisms (Nakayama et al., 1989). Thoracic traumas are reported to be seen in 50% of children with multiple traumas (Peres et al., 2010)

In the study by Şentürk et al. (2010) evaluating adults, they reported that 73% of the cases were males, and Çağırıcı et al. (1998) reported this percentage as 83.3%. Similarly, Ismail and Al-Refaie (2012) reported that 79.2% of the pediatric patients with thoracic traumas were males. In our study, 82.2% of the patients in Group I and 77.8% of the cases in Group II were males, which is consistent with the findings in the literature.

Leblebicioğlu et al. (2005) reported that both blunt and penetrating traumas are most commonly seen in autumn. In our study, cases in Group I and Group II were most commonly seen in summer. We think that increase of trauma frequent in summer months derive from group of adults and their children who spend more time together outdoors due to their holiday and being in the traffic more than ever.

In various studies in the literature, the number of blunt

Table 4. Injuries of the chest wall

	Group I n(%)	Group II n(%)	p value
None	60 (23.5)	17 (37.8)	>0.05
Subcutaneous emphysema	43 (16.8)	9 (20)	>0.05
Sternal fracture	1 (0.4)	0 (0)	>0.05
Rib fracture	68 (26.6)	5 (11.1)	>0.05
Tissue defect	28 (10.9)	6 (13.3)	>0.05
Subcutaneous emphysema-Rib fracture-Tissue defect	1 (0.4)	0 (0)	>0.05
Rib fracture-Tissue defect	5 (1.9)	1 (2.2)	>0.05
Subcutaneous emphysema-Rib fracture	21 (8.2)	4 (8.9)	>0.05
Subcutaneous emphysema-Tissue defect	29 (11.3)	3 (6.7)	>0.05
Total	256 (100)	45 (100)	>0.05

thoracic traumas is reported to range from 34-85% and penetrating traumas from 15-64% (Çağırıcı et al., 1998; Cangır et al., 2000; Özçelik et al., 2000; Çakan et al., 2001; Demirhan et al., 2001; Leblebicioğlu et al., 2005). Nakayama et al. (1989) evaluated thoracic traumas in patients under 17 years old and found that the rate of penetrating traumas was 2.9% and of blunt traumas was 97.1%. Ismail and Al-Refaie (2012) found the rates for these two types of trauma to be 2.1% and 97.9%, respectively. In terms of the most common cause of blunt traumas as out-of-vehicle traffic accidents, Nakayama et al. (1989) and Ismail and Al-Refaie (2012) reported rates of 25.7% and 38.3%, respectively, for this type of trauma. Meller et al. (1984) found that penetrating thoracic traumas were seen less in children compared to adults, being most commonly seen in late childhood. Farber et al. (1995) commented that blunt traumas were more common in children, and the most common cause was traffic accidents. In our study, blunt and penetrating trauma rates were compatible with literature. In Group II, penetrating trauma was determined in 26.7% of patients, and the mean age was 12.6 years. The most common cause of blunt traumas in Group II was out-of-vehicle traffic accidents (31.1%), a result that is consistent with the literature. We believe that the higher ratio of penetrating traumas in pediatric group compared to the literature can be attributed to the sociocultural circumstances and the lower level of education in the study region.

In various studies investigating thoracic traumas in adults, the incidence of accompanying systemic injuries was reported to range from 14-75% (Çağırıcı et al., 1998; Başoğlu et al., 2004; Leblebicioğlu et al., 2005). Bayreuther et al. (2009) also reported that 68.4% of thoracic traumas in children were accompanied by other systemic injuries. Farber et al. (1995) reported that abdominal and head traumas accompanied blunt thoracic traumas. İsmail and Al-Refaie (2012) reported that head traumas accompanied 38.9% of pediatric thoracic traumas, while extremity fractures accompanied 33.5% of pediatric thoracic traumas. Present study, the most extremity injury was accomplished both group I and group II.

Rib fractures are seen less in children as their ribs are less mineralized and more flexible (Kılıç et al., 1998). In one study excluding pediatric cases, the most common thoracic injuries were rib fracture (44.1%) and hemopneumothorax (33%) (Çağırıcı et al.,1998). Nakayama et al. (1989) reported isolated or combined lung contusion (53.3%), rib fractures

(49.5%), pneumothorax (37.1%), and hemothorax (13.3%) among pediatric intrathoracic injuries. Farber et al. (1995) commented that rib fractures were seen more frequently than sternum fractures. İsmail and Al-Refaie (2012) reported that the most common thoracic injury was lung parenchyma contusion (27.1%) followed by rib fractures. However, in studies in Turkey evaluating pediatric and adult cases, the most common pathology was seen to be rib fractures (Tekinbaş et al., 2003 ; Şentürk et al., 2010). In the current study, while sternum fracture was not seen in Group II, it was seen in 1 case in Group I. The most isolated and combinated pneumothorax were detected both group I and Group II.

Meller et al. (1984) evaluated the children receiving thoracic surgery and reported that the most common surgical intervention was tube thoracostomy. Ismail and Al-Refaie (2012) stated that 29.9% of their cases were followed conservatively; 58.1% underwent tube thoracostomy and 12.1% underwent thoracotomy. Leblebicioğlu et al. (2005) found that 38.1% of cases were followed conservatively, and 52% underwent thoracostomy. In our study, the most common surgical intervention was tube thoracostomy in both the pediatric and adult patients. Thoracotomy was required for 5.9% of the cases in Group I and 6.7% for those in Group II in hospitalized clinics. Twenty percent of pediatric cases were followed conservatively.

The mortality rate has varied between 4-7.2% in children with thoracic trauma in various studies (O'Neill, 2000; Ismail and Al-Refaie, 2012). The mortality rate in adults was reported by Şentürk et al. (2010) as 3.6% and by Çağırıcı et al. (1998) as 2%. In our study, the mortality rate was 4.4% in thoracic traumas for patients under 16 years (Group II) and 3.4% in adults (Group I), which is consistent with the findings in the literature.

In conclusion, the results of our study reveal that the most common etiology was out- of-vehicle traffic accidents in the pediatric age group and in-vehicle traffic accidents in adults, and summer season was risk for both group I and group II. Pneumothorax and hemothorax were the most common injuries in both groups, and the most common treatment approach was tube thoracostomy. In addition, ın pediatric group, ratio of penetrating traumas was higher than in the literature was an important finding of our study and considered to be closely related to the sociocultural conditions and lower educational level in the study region.

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