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Chest trauma in children

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Abstract

Objectives: Chest trauma in childhood is uncommon in clinical practice. The management and treatment principles of children with thoracic trauma were discussed with the data reported in the literature. **Methods**: Of the chest injury diagnosed in 1653 patients, 225 were children in the last 17-year period. There were 199 boys (88.44%) and 26 girls (11.55%). The most common causes were blunt injuries in 135 cases (60%), stab wounds in 67 cases (29.77%) and gunshot wounds in 22 cases (9.77%). **Results**: Out of 225, 217 patients were treated conservatively and eight patients were treated surgically. There was no mortality and morbidity. **Conclusions**: The prevalence of chest trauma in children due to blunt injuries is high in Turkey. Extremity injury is thought to be the most commonly associated extra-thoracic injury. However, thoracic trauma in children can be managed conservatively in most of the cases. © 2002 Elsevier Science B.V. All rights reserved.

Keywords: Chest trauma; Children

1. Introduction

The first known description of chest wall trauma appeared in a papyrus, written in about 1600 BC, when 48 clinical cases were described, four of which involved wounds to the ribs and sternum. This scroll is believed to be a copy of an older text that was written about 3000 BC, possibly by Inhotep, the grand vizier, chief architect, and royal medical adviser of Egypt [1]. In the 20th century of high-speed travel and violence, chest trauma is occurring with ever increasing frequency. Today, death resulting from thoracic trauma ranks third after cancer and cardiovascular diseases [2]. Despite major developments in the management of trauma, it remains the leading cause of mortality in children and adolescents [3]. Many thoracic traumas can result in death at the place where trauma occurred. Therefore, in thoracic trauma series, the mortality rate is found to be decreased [4].

This study was undertaken in order to examine our experience in dealing with chest trauma in children, and to compare our results with the data reported in the literature.

2. Methods

This retrospective study of 225 children treated for chest trauma was performed at the Department of Thoracic Surgery of the Medical School of Selcuk University, from January 1983 to December 2000. Of the 1653 patients treated for thoracic trauma, 225 patients were children (13.61%). There were 199 boys (88.44%) and 26 girls (11.55%). The majority of injury was in the 12–15 age group (99 cases), while the minority was in the 0–2 age group (12 cases) (Table 1).

Observing the types of the injuries, blunt injuries were found in 135 patients (60%), stab wounds in 67 (29.77%) and gunshot wounds in 22 (9.77%) (Table 2). The patients had 71 hemo-pneumothorax, 68 pneumothorax, 66 hemothorax, 117 pulmonary contusion, 16 rib fractures and three clavicula fracture diagnosed (Table 3).

Out of 225, 32 patients had associated injuries, the most common being extremity injury (21 cases). The other associated injuries are listed in Table 4. Management of the patients with thoracic injury was begun with a careful history and physical examination, with their patent airway

Table 1
Distribution of the patients according to their ages and sex

Age	Male	Female	Total
0–2	9	3	12
3–5	23	4	27
6–8	33	8	41
9–11	43	3	46
12–15	91	8	99
Total	199	26	225

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Table 2
Causes of injuries

Type of injury	Male	Female	Total
Blunt injury	118 (52.44%)	17 (7.55%)	135 (60%)
Gunshot wounds	20 (8.88%)	2 (0.88%)	22 (9.77%)
Stab wounds	61 (27.11%)	6 (2.66%)	67 (29.77%)
Dog bite	0 (0%)	1 (0.44%)	1 (0.44%)
Total	199 (88.44%)	26 (11.55%)	225 (100%)

passage and adequacy of ventilation, blood pressure, pulse and mental state evaluation. The X-ray studies were performed on all of them. Then, all patients were taken to the intensive care unit and full monitorization (including electrocardiography, blood pressure, pulse, fever, respiratory rate) was performed. Electrocardiography was observed for rhythm and voltage disturbances. Chest computed tomography was only used in four cases for differential diagnosis of the parenchymal lesion from intra-pleural hematoma.

Primary conservative treatment was performed on all patients initially, if this treatment was insufficient, surgery was indicated. At this stage, criteria for operation were as follows: organized hematoma comprising 1/3 of the lung or more (in order to prevent fibrosis and/or infection occurrence in the late-term follow-up), 50–100 ml/h hemorrhagic drainage, which is considered according to age, in the tube thoracotomy performed patients because of hemothorax and prolonged air leakage despite a negative vacuum support.

3. Results

Out of 225, 217 patients were treated conservatively. Most of these patients were transfused blood and intravenous (i.v.) fluid. Bronchial mucus was drained with nasotracheal or bronchoscopic aspiration and so breathing was relieved. The nasogastric tube was only inserted in patients who were suspected of having an esophageal rupture. In addition, nasal oxygen, non-steroid anti-inflammatory drugs, analgesic drugs, antibiotics and mucolitics were given to most of the patients. The other conservative treatments are shown in Table 5.

Out of 225, eight patients were treated surgically. Four of them had an intra-thoracic hematoma and thickened pleura that resulted from an inappropriate chest tube drainage, therefore, delayed thoracotomy and decortication were performed on them. In one of the two patients with laparotomy, the diaphragm was repaired for diaphragmatic rupture and colostomy was performed for transverse colon perforation. The other one was drained for retroperitoneal hematoma by laparotomy. End to end anastomosis was performed in one out of the two patients with peripheral arterial injury. The other was applied graft interposition.

Table 4
Associated injuries

Associated injuries	Number
Extremity injuries	21
Peripheral vascular injuries	2
Abdominal injuries	3
Medulla spinalis injuries	3
Cerebral edema	2
Traumatic meningitis	1

4. Discussion

The chest injuries of children may result from different reasons such as penetrating and blunt traumas. The thoracic injury among children hospitalized for blunt and penetrating trauma ranges from 0.1 [5] to 12% [4]. Blunt injuries of the chest result mainly from traffic accidents, while penetrating injuries result from gunshots or stab wounds. It is generally accepted that thoracic injury in children most commonly results from blunt trauma [5]. Also, the main reason in our series was blunt injuries (60.00%). The most common penetrating thoracic injuries, such as pneumothorax, hemothorax and hemo-pneumothorax are reported to be managed only with chest drainage in about 50% of the cases [6]. But, there were 85.7% in our series. Children's chest injuries differ from adults' because of the pliant nature of a child's ribs. A simple injury may easily damage the intra-thoracic organs, but contrary to that in adults, the flail chest is a rarely seen condition in pediatric population [7]. Our series consisted of a period of 17 years, and in this period there were no flail chest and death. This suggests that in the cases leading to death in the childhood period traumas, the patient dies before he is brought to hospital, or the death occurs in the emergency service during the acute period. Therefore, early diagnosis and management are essential to avoid death from chest injury in children.

In our clinic, what should be considered first for a patient

Table 3
Trauma types and corresponding lesions[a]

	Pneumothorax	Hemothorax	Hemo-pneumothorax	Rib fract.	Pulm. contus.	ARDS	Clavicula fracture
Blunt injury	41	29	40	15	103	1	3
Gunshot wounds	6	5	9	1	14		
Stab wounds + dog bites	21	32	22				
Total	68	66	71	16	117	1	3

[a] Rib fract., rib fracture; pulm. contus, pulmonary contusion.

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Table 5
Conservative treatments

Treatment	Number
Tube thoracotomies	193
Thoracentesis	11
Tracheostomy	2
Blood and serum replacement	114
Nasotracheal aspiration	145
Bronchoscopic aspiration	18
Nasal oxygen	225

who has been hospitalized with injuries to the chest is to obtain an airway passage. To achieve this, secretions into the upper respiratory airways should be aspirated via nasotracheal or bronchoscopic route. The second is an echocardiographic examination performed for any suspected cardiac injury under fully monitored conditions. We had no finding that may suggest a cardiac injury in our patient's follow-up in the intensive care unit. The third is that, if necessary, blood and i.v. fluids should be replaced depending on the hemodynamic conditions. Blood volume/body weight of children is higher than the adults. Therefore, very little bleeding may lead to hypovolemia and shock [8].

Many children with thoracic trauma exhibit wet lung, a syndrome characterized by a combination of pulmonary contusion, pneumonia and atelectasis [9]. We had one child suffering from this condition, but pulmonary contusion was observed in 117. Awareness of these serious complications is in itself the best treatment. Therefore, we administered fluid restriction, diuretics, corticosteroids and antibiotics to patients with pulmonary contusions, atelectasis and pneumonia.

When pneumothorax, hemothorax and hemo-penumothorax are detected as the cause of respiratory distress by clinical investigations and chest X-ray, they should immediately be drained with a tube thoracotomy. Computed tomography is of great value in the diagnosis of blunt chest trauma, but it is not essential [10]. If there is an open injury on the chest, it should be closed immediately. In addition, antibiotics should be given, and, if necessary, tetanus prophylaxis should be done.

If the conservative treatment mentioned previously is not sufficient, early or late thoracotomy should be performed. If there are other injured organs, they should be operated immediately (for instance: abdominal or vascular injury).

Finally, many chest injuries of children can be treated without surgery. The percentage of the patients treated without surgery was 96.45% in our series. Early diagnosis and management are essential to avoid serious complication of chest injury in children.

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