

Assessment and Management of Blunt Chest Trauma among Patients Admitted to Al-Thowrah Hospital, Sana'a-Yemen

Ali Lotf Al-Amry^{1*}, Yasser Abdrabu¹, Valenzuela R², Ali Shawish², Samira Qubati², Bader Al-Tawhari²

¹Department of General Surgery, Faculty of Medicine & Health Sciences Sana'a University.

²Althawra General Modern Hospital –Sana'a-Yemen

Abstract

Background: Blunt thoracic injuries are directly responsible for 20-25% of all deaths, and chest trauma is a major contributor in another 50% of death. This kind of death usually occurs immediately after the trauma has occurred. **Aim:** The aim of this study was to assess and manage of blunt chest trauma in patients admitted to AMGH, Sana'a-Yemen.

Methods: A hospital based study was administered among 102 cases of blunt chest trauma presented to AMGH, Sana'a-Yemen between 1 January 2013 to February 2014. One hundred two consecutive patients with blunt chest trauma, admitted in the ward through emergency department were evaluated in regard to age, sex, type of trauma, cause of the trauma, specific type of blunt chest injuries and treatment modality.

Results: There were 83 male (81.4%) and 19 female (18.6%). The most common causes were Road traffic accident in 79 cases (77.45%), falling from height 16 cases (15.6%) and others 7 cases (6.86). The common clinical presentation is rib fracture in 74 cases (72.55%), then pulmonary contusion in 39 cases (38.23), hemo-pneumothorax in 38 cases (37.25%), pneumothorax in 26 cases (25.49%), diaphragmatic injury 3 cases (2.94%). Out of 102 patients (11.76%) were treated conservatively, thoracostomy tube insertion for 86 cases (84.31%), thoracotomy done for 1 case (0.98%), laparotomy for diaphragmatic injuries for 2 cases (1.96%) and laparotomy with thoracotomy also for one case.

Conclusions: Blunt chest trauma is an important public health problem accounting for a substantial proportion of all trauma admission among emergency patients admitted to the surgical department at AMGH. The pattern of blunt chest trauma and its management was almost similar to many studies. This study showed the pattern of injuries following blunt chest trauma. Furthermore, it was found that chest tube insertion and emergency resuscitation was adequate for majority of cases.

Keywords: Trauma, Blunt chest trauma, Blunt thoracic injuries, Pneumothorax, Yemen

Introduction:

Trauma causes more than 100,000 deaths annually in the United States [1]. Estimates of thoracic trauma frequency indicate that injuries occur in 12 persons per million populations per day. Approximately 33% of them require hospital admission. Overall, blunt thoracic injuries are responsible for 20-25% of all deaths, and chest trauma is a major contributor in another 50% of deaths. The most important cause of significant blunt chest trauma is motor vehicle accidents (MVAs). MVAs account for 70-80% of such injuries [1-3]. Sternal fractures are found in up to 8%

of blunt chest trauma patients and 18% of multiple trauma patients with thoracic injuries, and are usually the result of a direct, high-energy blow to the sternum from the steering wheel and column [4-7]. Direct lung injuries, such as pulmonary contusions, are frequently associated with major chest trauma and may impair ventilation. Pneumothoraces, hemothoraces and hemopneumothoraces, interfere with oxygenation and ventilation by compressing otherwise healthy lung parenchyma. Initial resuscitation and management of the trauma patient is based upon protocols from Advanced Trauma Life Support (ATLS). For patient

with unstable vital signs, hypoxia, or obvious severe injury, a rapid search with concurrent management of immediate life-threatening injuries of the head, cervical spine, abdomen, chest, and pelvis. Suspected tension pneumothorax is treated with immediate tube thoracostomy or needle decompression. A chest CT with contrast is performed to define the extent of thoracic injury and exclude aortic rupture. Depending on the presentation, this may be as simple as a thorough history and physical examination or may require multiple tests, including x-rays, computed tomography (CT) scans, and echocardiography. Patients with pain and tenderness of the lower ribs, especially with pleuritic complaints, or abdominal pain and tenderness, are at higher risk for both intrathoracic and intraabdominal injuries [8]. Focused Assessment with Sonography for Trauma (FAST) has become an integral part of trauma evaluation, primarily to assess for pericardial tamponade and intraabdominal injury [9-11]. Videoassisted-thoracoscopy (VATS) and thoracoscopy has also been used successfully to diagnose cardiac and diaphragmatic injuries [12-16]. Flail chest occurs when three or more adjacent ribs are each fractured in two places, creating one floating segment comprised of several rib sections and the soft tissues between them [17-20]. Blunt diaphragmatic rupture occurs in approximately 1% of thoracic trauma. Diagnosis of esophageal injury is made by endoscopy or esophagography using water-soluble contrast. CT may show subtle air leaks beside the site of perforation, although the sensitivity or specificity of such findings is unclear [19].

Aim of the study: To assess and management of the blunt chest trauma in patients admitted to Al-Thowrah Hospital, Sana'a-Yemen.

Subjects and Methods

A hospital based study was carried out among patients admitted to Al-Thowrah Modern General Hospital (AMGH) in Sana'a City-Yemen under diagnosis of blunt chest trauma during the period of January 2013 to February 2014. AMGH is the major referral hospital for emergency

cases and surgeries in Yemen. A total of 102 patients with blunt thoracic injuries presenting in emergency department were included and assessed. Patients who presented with blunt chest trauma either isolated or associated with multiple trauma were included. Patients with penetrating chest injuries were excluded from the study.

The data were collected using structured questionnaire which consisted of Demographic characteristics (age and sex), Frequency of blunt chest trauma, types of thoracic injuries in blunt chest trauma, causes of blunt chest trauma, mode of clinical presentation, type of management of thoracic injuries, complications and other injuries associated with blunt chest trauma. On arrival to emergency department all patients were assessed and resuscitated according to ATLS guideline of trauma care. Emergency tube thoracostomy was performed in life threatening chest injuries.

Secondary survey was performed once the patient had been stabilized. Associated injuries were managed on their merit. Hemoglobin levels, blood grouping and chest x rays were the main investigations done in emergency room. Ventilator support was provided where indicated. CT scan chest, were performed in the surgical ward / ICU where indicated. Data were analyzed through SPSS version 19 for frequency, percentages and cross tabulation. A written informed consent signed by the patients and his or her relatives was obtained before the procedure.

Results

A total number of 102 patients with blunt chest trauma due to different causes were admitted in surgical department during the study period. Out of 102 patients 71 patients (69.6%) sustained multiple injuries in addition to chest injury. Majority of patients were male 83 cases (81.4%) whereas 19 cases were females (18.6%). With male to female ratio (4.4:1) Most of the patients were in age group ranged from 20-30 years, mean age 30 years, table 1.

Figure 1 shows the distribution of patients according to the causes of blunt chest trauma. The findings of the study showed that most of causes of blunt chest trauma

(77.45%) were road traffic accidents followed by fall down from high (15.67%) and (6.68%) was other causes. There were 74rib fractures and 2 sternal fractures. Most of the ribs fractures (85%) were multiple, other thoracic injuries include hemopeumothorax, hemothorax, pulmonary contusion, diaphragmatic injuries. More detailed presenting in figure 2.

Associated injuries were found in 71 (69.6%) patients and the other 31.4% had isolated chest trauma. Musculoskeletal injuries were the most common 49.3% associated injuries, table 2.

Of the 12 patients with thoracoabdominal injuries, 3 patient (25%) had diaphragmatic injuries of this one had esophageal fistula, 4 had liver injuries, and 3 had splenic rupture, and a patient sustained kidney injury secondary to fracture of the 12th rib.

As regards to management of thoracic injuries, closed tube thoracostomy drainage was done in the majority of cases 84.31%.Table 3.

Table 4 reveals to the types of complications of blunt chest trauma. The results showed that6 cases developedatelectasis, 5 cases were ARDS (acute respiratory distress syndrome), 4 cases pneumonia and 3 cases complicated by empyema due to super imposed infection to retained hemothorax treated by open decortication. One hospital death due to associated major head injury with intracerebral lhemorrhage.

Table 1: Distribution of blunt chest trauma among patients by age and sex.

Age groups (years)	Sex				Total	
	Male		Female		F	%
	F	%	F	%		
<10	3	2.94	2	1.96	5	4.90
10-20	16	15.69	4	3.92	20	19.60
21-30	29	28.43	5	4.90	34	33.34
31-40	12	11.76	5	4.90	17	16.67
41-50	8	7.85	1	.98	9	8.83
51-60	5	4.90	0	0	5	4.90
61-70	8	7.85	2	1.96	10	9.80
>70	2	1.96	0	0	2	1.96
Total	83	81.38	19	18.62	102	100

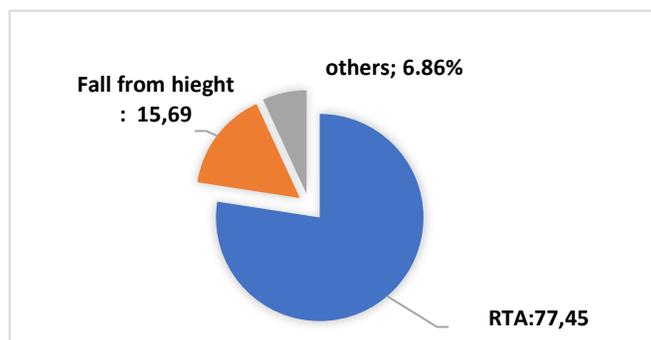


Figure1: Distribution of the patients by the causes of blunt chest trauma:

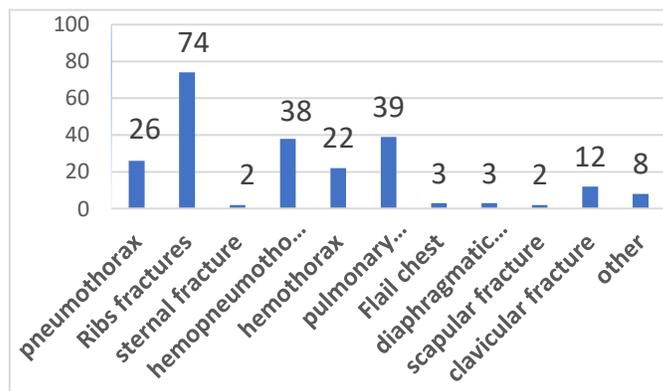


Figure 2: Types of thoracic injuries in blunt chest trauma



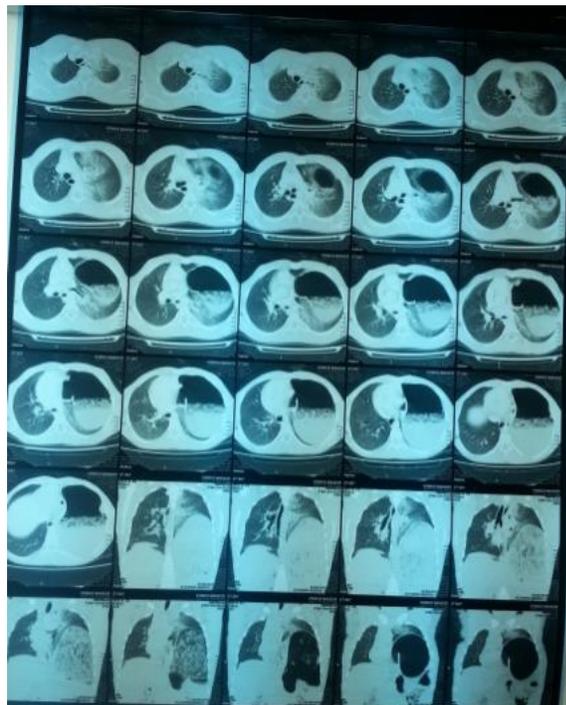


Figure 3: CXR for 6 years female child post falling from height show: right side pneumothorax. CXR and chest CT scan for patient post falling from high show stomach herniate to the chest through diaphragmatic injury

Table 2: Extrathoracic injuries associated with blunt chest trauma:

Site of Injury	F	%
Extremity	35	34.1
Pelvis	7	6.86
Intra- abdominal	12	11.76
Craniofacial trauma	13	12.74
Spinal/vertebral	4	3.92
Total	71	69.38

Table 3: Type of management of thoracic injuries

Type of treatment	F	%
Conservative	12	11.76
Tube Thoracostomy	86	84.31
Tube Thoracostomy&Thoracotomy	1	0.98
Laparotomy & tube thoracostomy	2	1.96
Laparotomy&thoracotomy	1	0.98
Total	102	100



Figure 4: Right anteriolateral thoracotomy for patient in AMGHS with right side diaphragmatic injury and liver herniation through a big defect to the chest repaired by mesh.

Table 4: Types of Complications

Types of Complications	F	%
Empyema	3	2.94
Atelectasis	6	5.88
ARDS	5	4.90
Contusion superimposed with infection	4	3.92
Esophageal fistula	1	0.98
Death	1	0.98

Complications of chest tube insertion tube (out of the AMGHS) one adult male patient post car accident with right side pneumohemothorax with chest tube inserted to the liver, as appeared in the followed thoracoabdominal CT scan below.

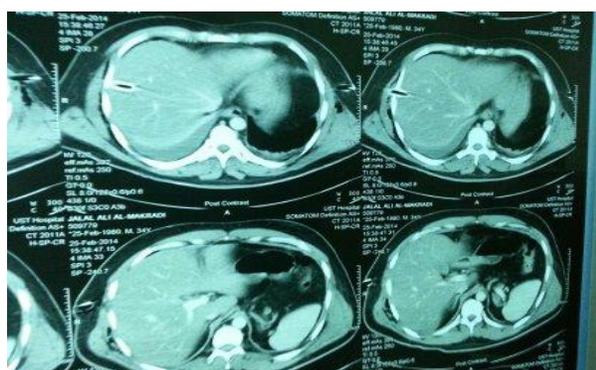
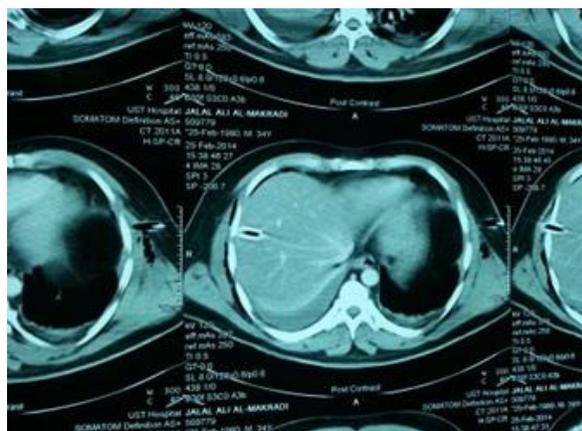


Figure 5: thoracoabdominal CT scan for adult male post RTA patient with mild pneumothorax did for him thoracostomy wrongly inserted to the liver parenchyma.

Discussion

Significant number of chest trauma patient (102) were encountered in this study, this only that admitted to the surgical department of AMGH- Sana'a between Jan 2013 – Feb 2014. The results of this study about the clinical evaluation of blunt chest trauma and its management was in conformity with many other series done both in developing and developed countries. The distribution of chest injury by age and sex was slightly different from other series. Young male individuals were commonly involved in chest trauma. In our study the chest trauma was more in male (81.4%) and (18.6%) were female, the mean age was 31.3 years, with males and females mean age 33.1 and 27.5 years respectively. and the male to female ratio was (4.4:1). E. Sanidas et al, in Greece found (69.9%) male with mean and age of 45 years, and (30.1%) female

with mean age of 54 years. As is notice that there is a different in male/female ratio between our study and other specialty in Greece, refer to the conservative nature of the society in which the male are dominant. Road traffic accident is the most common cause (77.45%) of blunt chest trauma in our study. Reported the car accident was by far the most frequent cause of trauma (57.9%). Another study found 81.7% cases had blunt trauma chest with Road Traffic Accidents (RTA) being the mode of injury. E. Sanidas et al in Greece found fall from height and road traffic accidents the most common mechanisms of injury for both men and women. Most of patients with blunt chest trauma came complaining of chest pain and dyspnea. Ribs fractures occurred in 72.55% of patients and were the most common type of injury due to blunt trauma in our series which was comparable with other series [5,21-25]. Children's rib fractures are less common than adults because they have more elasticity of their bones than adults, however when rib fracture occurs it indicates severe trauma in children and associates with high rates of thoracic and extra thoracic injuries. Follow up is essential for all patients who had the diagnosis of rib fractures. Most rib fractures cases are associated with other thoracic injury mainly hemopneumothorax and lung contusion. Hemopneumothorax occurred in 39% of blunt chest trauma followed by pneumothorax and hemothorax. Conn JH. et al, in USA revealed Hemothorax in 23.2% of patients with blunt chest trauma. Stark P reported hemothorax is seen in approximately 50% of patients who sustain blunt chest trauma. Flail chest was diagnosed in three cases (2.94%) all of them were adults, one female and two males thoracotomy and surgical fixation was done for one of them for another indication which is right side massive hemothorax. no mortality reported in our study due to flail chest. And in comparison, with another flail chest occurred in 72 cases (1.7%), In all cases with flail chest, they did not apply surgical stabilization. with mortality rate was 11.1% of cases [26-28].

In our study 3 (3.4%) patients diagnosed with diaphragmatic injury, all cases are male and one of them on right side with liver herniated to the chest treated through laparotomy and right anterolateral thoracotomy with diaphragmatic injury repaired by using mesh due to large defect in the diaphragm and the other two treated through midline laparotomy by simple primary repair. Two cases of traumatic diaphragmatic hernia due to old trauma, came with intermittent abdominal pain and constipation, and by examination and CT scan reveal that the patients had diaphragmatic injuries with part of GIT herniated to the thoracic cavity.

In our study sixty percent of diaphragmatic injuries due to blunt trauma are on the left side, 20% on the right side and 20% bilateral. A large collective review, in 1995, suggested that 75% of the injuries to the diaphragm are caused by blunt trauma. The incidence of diaphragmatic injury is reported to be between 0.8 and 7% when associated with blunt trauma. In a literature review, it was reported that in North American series blunt trauma accounts for 10–30% of traumatic diaphragmatic ruptures, whereas in Western Europe series blunt trauma accounts for 80–100% of diaphragmatic injury. Blaisdell F. et al, in Germany revealed Rupture or laceration of the diaphragm occurs in 3% of patients with blunt chest trauma. Some study reported incidences of 3% and 3.3%, respectively, of ruptured diaphragm in those patients experiencing severe blunt trauma who survived long enough to be admitted to the hospital. During this study about 9 cases of thoracic empyema, the patients coming to hospital late with history of blunt trauma inappropriately managed, neglected or not attended for medical helps [27-29].

Tube thoracostomy was the main treatment for the majority (84.31%) of patients in our study. Open thoracotomy was performed in only two patients, the massive hemothorax was the main indication of early thoracotomy for one and the other patient thoracotomy-laparotomy was indicated to repair the right-side diaphragmatic injury, using mesh and while late

thoracotomies were performed to evacuate clotted blood and empyema. Tube thoracostomy was administered in 40% of all cases, whereas thoracotomy was performed in 6% (n=252), of which 209 were early interventions (P=0.001). Intrathoracic bleeding was the leading pathology in 50% of patients. The mortality rate was 6.8% patients with blunt chest trauma. The relatively low mortality rate (0.98%) one patient in this study may be interpreted by high pre-hospital mortality rate. We did not include pre-hospital death, because of lack of data; also we did not analyze pre-hospital transportation times [30-32].

Conclusion

Blunt chest trauma is an important public health problem accounting for a substantial proportion of all trauma admission among emergency patients admitted to the surgical department at AMGH. The pattern of blunt chest trauma and its management was almost similar to many studies. RTA continues to be the major etiological factor for chest injuries and the commonly affected victims are young adult males in their productive and reproductive age group. Diagnosis and management can still rely to a great extent on physical examination and the use of simple and affordable tools such as standard radiograph and thoracic echography. Sophisticated tools such as CT scanning and video-assisted thoracoscopy would not be considered a priority in our environment.

Recommendations

1. Urgent preventive measures targeting at reducing the occurrence of RTAs is necessary to reduce the incidence of chest injuries.
2. Young school age group individuals and productive members of the society are affected mostly; there is a need of a big research on this age group to establish the risk factors. This will help to establish and give the necessary information on the preventive measures on this risk age group.
3. Clinical types of chest injuries are similar in most series, management protocol or guideline review is suggested to

have better and early intervention of which closed tubes thoracostomy is the main stay.

4. Every patient with blunt thoracic and thoracoabdominal trauma should anticipate diaphragmatic injury until prove otherwise in order not to miss this missable organ injury.

5. Record of all prehospital death patients especially due to trauma, to make medical policy to deal with the deferent causes of trauma death and how to minimize it.

References

1. Liman ST, Kuzucu A, Tastepe AI, et al. Chest injury due to blunt trauma. *Eur J CardiothoracSurg* 2003; 23:374.
2. Rodriguez RM, Hendey GW, Marek G, et al. A pilot study to derive clinical variables for selective chest radiography in blunt trauma patients. *Ann Emerg Med* 2006; 47:415.
3. Nirula R, Talmor D, Brasel K. Predicting significant torso trauma. *J Trauma* 2005; 59:132.[4-7].
4. Arthurs ZM, Starnes BW, Sohn VY, et al. Functional and survival outcomes in traumatic blunt thoracic aortic injuries: An analysis of the National Trauma Databank. *J VascSurg* 2009; 49:988.
5. Fitzharris M, Franklyn M, Frampton R, et al. Thoracic aortic injury in motor vehicle crashes: the effect of impact direction, side of body struck, and seat belt use. *J Trauma* 2004; 57:582.
6. McGwin G Jr, Reiff DA, Moran SG, Rue LW 3rd. Incidence and characteristics of motor vehicle collision-related blunt thoracic aortic injury according to age. *J Trauma* 2002; 52:859.
7. Fitzgerald M, Spencer J, Johnson F, et al. Definitive management of acute cardiac tamponade secondary to blunt trauma. *Emerg Med Australas* 2005; 17:494.
8. Holmes JF, Ngyuen H, Jacoby RC, et al. Do all patients with left costal margin injuries require radiographic evaluation for intraabdominal injury? *Ann Emerg Med* 2005; 46:232.
9. Omert L, Yeane WW, Protetch J. Efficacy of thoracic computerized tomography in blunt chest trauma. *Am Surg* 2001; 67:660.
10. Brink M, Deunk J, Dekker HM, et al. Added value of routine chest MDCT after blunt trauma: evaluation of additional findings and impact on patient management. *AJR Am J Roentgenol* 2008; 190:1591.
11. Dissanaik S, Shalhub S, Jurkovich GJ. The evaluation of pneumomediastinum in blunt trauma patients. *J Trauma* 2008; 65:1340.
12. Grove CA, Lemmon G, Anderson G, McCarthy M. Emergency thoracotomy: appropriate use in the resuscitation of trauma patients. *Am Surg* 2002; 68:313.
13. Fialka C, Sebök C, Kemetzhofer P, et al. Open-chest cardiopulmonary resuscitation after cardiac arrest in cases of blunt chest or abdominal trauma: a consecutive series of 38 cases. *J Trauma* 2004; 57:809.
14. Stockinger ZT, McSwain NE Jr. Additional evidence in support of withholding or terminating cardiopulmonary resuscitation for trauma patients in the field. *J Am CollSurg* 2004; 198:227.
15. Powell DW, Moore EE, Cothren CC, et al. Is emergency department resuscitative thoracotomy futile care for the critically injured patient requiring prehospital cardiopulmonary resuscitation? *J Am CollSurg* 2004; 199:211.
16. Cothren CC, Moore EE. Emergency department thoracotomy for the critically injured patient: Objectives, indications, and outcomes. *World J EmergSurg* 2006; 1:4.
17. Cassada DC, Munyikwa MP, Moniz MP, et al. Acute injuries of the trachea and major bronchi: importance of early diagnosis. *Ann ThoracSurg* 2000; 69:1563.
18. Balci AE, Eren N, Eren S, Ulkü R. Surgical treatment of post-traumatic tracheobronchial injuries: 14-year experience. *Eur J CardiothoracSurg* 2002; 22:984.
19. Mirvis SE. Imaging of acute thoracic injury: the advent of MDCT screening. *Semin Ultrasound CT MR* 2005; 26:305.

- 20.Nursal TZ, Ugurlu M, Kologlu M, Hamaloglu E. Traumatic diaphragmatic hernias: a report of 26 cases.Hernia. Mar 2001;5(1):25-9..
- 21.E. Sanidas, A. Kafetzakis, K. Valassiadou, G. Kassotakis, J. Mihalakis, J. Drositis, G. Chalkiadakis, D.Tsiftsis. Management of simple thoracic injuries at a Level I trauma centre: can primary health care systemtake over?. Injury, Int. J. Care Injured 31 (2000) 669–67591.
- Haratian Z, Zarei S, Lashkari MH. Surveying the frequency of chest trauma (blunt and penetrating) in Air Force Hospital. 2002–2004. Med Sci J Islamic Azad University 2005; 15(3):
22. Conn JH, HardyJD, Fain WR, Netterville RE. Thoracic trauma: analysis of 1022 cases. J Trauma 1963
23. Stark P. Pleura. In: Stark P, editor. Radiology of Thoracic Trauma. Andover Medical Publishers; Boston: 1993. p. 54–72.
- 24.Hanafi M, Al-Sarraf N, Sharaf H, Abdelaziz A: Pattern and presentation of blunt chest trauma among different age groups.Asian Cardiovasc Thorac Ann 2011, 19(1): 48-51.
- 25.Richardson JD, Adams L, Flint LM. Selective management of flail chest and pulmonary contusion. Ann Surg 1982; 196:481.
- 26.Blaisdell F, Trunkey D. Trauma management: cervicothoracic trauma. Vol 3; Stuttgart, Germany: Thieme, 27.1986.
- 27.Nursal TZ, Ugurlu M, Kologlu M, Hamaloglu E. Traumatic diaphragmatic hernias: a report of 26 cases.Hernia. Mar 2001; 5(1): 25-9.
- 28.Chughtai TS, Sharkey P, Brennehan F, Rizoli S. Blunt diaphragmatic rupture mandates a search for blunt aortic injury: an update. Ann Thorac Surg 2007; 83:1234.
- 29.Barkin AZ, Fischer CM, Berkman MR, Rosen CL. Blunt abdominal trauma and a diaphragmatic injury. J Emerg Med 2007; 32:113.
- 30.Grove CA, Lemmon G, Anderson G, McCarthy M. Emergency thoracotomy: appropriate use in the resuscitation of trauma patients. Am Surg 2002; 68: 313.
- 31.Cothren CC, Moore EE. Emergency department thoracotomy for the critically injured patient: Objectives, indications, and outcomes. World J Emerg Surg 2006; 1:4.
- 32.Enderson BL, Abdalla R, Frame SB, et al. Tube thoracostomy for occult pneumothorax: a prospective randomized study of its use. J Trauma 1993; 35:726.