Penetrating Chest Trauma In North Of Jordan: A Prospective Study
M Khammash, F El Rabee

Abstract
The aim of this report was to see the rate of penetrating chest trauma in the North of Jordan, identifying its causes and the outcome of its management. During the year 2004, 26 patients were managed, 25 males and one female, the mean age was 22.5 years. Stabbing by knife was the cause in 24, gunshot in one and falling on a sharp object in another one. Pleural penetration was excluded by immediate and follow up chest x-ray. in two patients (7.6%). Thoracotomy was performed for four patients (15.4%), two urgently and two after a period of observation. Twenty were successfully managed by the insertion of thoracostomy tube only. Complication rate was 11.5% (3 patients), it was pneumonia in one patient and wound infection in two. The main cause of this kind of trauma in this area is stabbing by a knife in 92%. Initial and follow-up chest x-ray after 6 hours of observation could be enough to exclude pleural penetration. The rate of thoracotomy is comparable with other reports and we stress on the role of the thoracic surgeon who should deal with these cases and its complications if occurred.

INTRODUCTION
Princess Basma Teaching hospital is situated in the center of Irbid city, North of Jordan. It is affiliated to the faculty of medicine, Jordan University of Science and Technology; it has the main accident and emergency department of Irbid province, which has a population of around 600,000. Penetrating injuries of the chest are a common cause of admission to the hospitals, especially those with first line emergency departments. Its main causes are chest stabbing by a sharp object or a gunshot. Conservative management of these cases, by the insertion of thoracostomy tube and in-hospital observation to manage any complications that may evolve is the main line of treatment. This prospective study aimed at seeing the rate of this kind of injury per year, its causes and the outcome of its management in the general surgical ward.

MATERIALS AND METHODS
During the year 2004, all patients with suspected penetrating chest wounds were prospectively included in the study. Their management protocol was to admit to the general surgical ward of the hospital under the care of the chest surgeon. After resuscitation in the emergency department and wound care chest x-ray was requested to exclude the presence of hemothorax or pneumothorax or both, as well as any mediastinal or pericardial size abnormalities. For those who have normal findings, the chest x-ray was repeated after 6 hours of admission. Abdominal and pericardial ultrasound, chest and abdominal computerized tomography scans (CT) were requested when indicated. Thoracostomy tube was inserted in the fifth intercostal space of the mid-axillary line, of the affected side, for patients with positive clinical and radiological findings of hemothorax or pneumothorax or both. The drainage was recorded, on insertion of the tube and hourly later on, till its removal. Thoracotomy was performed for patients having signs of suspicious cardiac penetration, immediate drainage of around 1000 milliliters of blood from the chest tube with signs of hemodynamic instability, in spite of continued resuscitative measures, or when the amount of blood drainage was not decreasing during follow up. The cause, number and site of the wound, being in the anterior or posterior chest wall and its location if in the upper or lower part of the chest, where also recorded. The duration and amount of thoracostomy tube drainage was recorded. Any wound or post intervention complications were also noticed and recorded. The patients where discharged from the hospital one day after removal of the chest tube, unless they were needed to stay in the hospital for the treatment of other associated injuries or complications. Patients were later followed in the out patients clinic for an average of three months or according to need.
RESULTS

Twenty-six patients with penetrating chest wound were admitted to the general surgical ward of Princess Basma Teaching Hospital, Irbid Jordan during the year 2004. They where 25 males and one female, age ranged between 17 and 50 years (mean 22.5 years). The cause of the wound was stabbing with a knife, during a quarrel, in 24 patients, falling on a sharp object in a workshop in one, and another one which was caused by a gunshot. The chest wounds were single in 24 patients, double in one patient, while the last patient had multiple stab wounds on his extremities beside a single chest wound. The sites of the wounds were mostly located anteriorly and on the upper half of the chest (table 1).

Figure 1

Table 1: Sites of the penetrating chest wounds

<table>
<thead>
<tr>
<th></th>
<th>Upper half</th>
<th>Lower half</th>
<th>Total No. (26)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Side</td>
<td>6</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Left Side</td>
<td>9</td>
<td>6</td>
<td>15</td>
</tr>
</tbody>
</table>

Normal and follow up chest x-ray, after 6 hours, excluded pleural penetration in two patients (7.6%). The initial chest X-ray of the remaining 24 revealed pneumothorax in 8 patients and hemopneumothorax in 16; of whom one showed large pericardial shadow with clinical and echocardiography picture of cardiac tamponade, this patient's wound was in left upper half of the left chest. Abdominal ultrasound was done for 8 patients, as their wounds were located in the lower half of the chest together with upper abdominal tenderness suggestive of intraperitoneal bleeding. Two of these were positive for intraperitoneal blood secondary to liver injury, confirmed later by abdominal CT scan to be a superficial liver tear.

Management: The two patients with normal and follow up chest x-rays where discharged from the hospital the next morning. Thoracostomy tube insertion with wound care was sufficient for 20 patients, the tube drained air mainly in 8 patients and blood mainly in 12 patients, and the amount of blood drained immediately was between 100 and 500 ml. This amount was decreasing during the hourly observations till removal of the tube. Thoracotomy was needed for four patients (16.6%). It was performed within the first hour for two, the first was to suture a right ventricle stab which caused hemopericardium and cardiac tamponade, while the second because of excessive immediate blood from the chest tube (900ml) as well as hemodynamic instability, which was found to be caused by a left ventricle stab as well as diaphragmatic tear. In both patients, the tamponade was confirmed by performing urgent cardiac ultrasound. The other two thoracotomies were performed after few hours of admission, because of continuous non-decreasing amount of bleeding through the chest tube. The source was the intercostal vessels and lung parenchyma in one, while the second was bleeding from an injured mammary artery. Their operative procedures were suturing the right ventricle stab in the first, suturing the left ventricle wound and repairing the diaphragmatic tear in the second, ligation of the intercostal vessels and suturing the lung parenchyma tear in the third and ligation of the internal mammary artery in the fourth patient.

For all patients, whether having pneumo or hemothorax or after thoracotomy, the tube stayed between 2 to 6 days (mean 3 days). All where discharged from hospital one day after removal of the chest tube, except the patient with diaphragmatic tear who needed to stay 12 days for the treatment of left sided pneumonia and another patient who had the gunshot that injured his dorsal spine and needed orthopedic and neurosurgical management of his paraplegia. Regarding the chest wall wounds, they healed well with simple debridement and primary suturing when needed, however the wounds of the gun shot and the fall on the sharp object where left to heal without suturing. Only two patients had mild wound infection at the site of penetration that cured later by frequent dressings.

DISCUSSION

Civilian violence resulting in penetrating chest trauma continues to be a common cause of admission to the hospital for the treatment of its complications and reducing its mortality. Its common causes are stabbing by knife and gun shot injuries. The percentage of these causes vary in different countries according to the accessibility of firearms to the civilian population, being more when it is easy accessible (2, 3, 4). In Jordan; firearms are not freely accessible, except by special permit, as well as it is not carried routinely by the owners, this may explain the low percentage of penetrating bullet injuries of the chest in our patients (4 %). The obvious findings secondary to chest wall penetration are pneumothax and hemothorax or both; these can result from injury of the chest wall, lung, diaphragm and more urgent cardiac and major vascular injuries. The main line of treating hemothorax and pneumothorax secondary to penetrating injury is conservative, by stabilizing the patient's circulation and the insertion of thoracostomy tube to drain the collected blood or air from the pleural cavity. This is usually sufficient in around 80 to 90 % of the cases as bleeding tends to stop spontaneously, the low pulmonary
Penetrating Chest Trauma In North Of Jordan: A Prospective Study

pressure as well as the hemostatic property of the lung tissue help it. However, mediastinal and major vascular injuries usually cause significant hemodynamic instability necessitating urgent surgical intervention (\( \beta_4 \)).

The clinical examination of the patient on arrival to the emergency room together with chest x-ray can usually suggest the presence of pleural penetration. However, repeating the x-ray after 6 hours of observation will be more confirmative in excluding any hemo or pneumothorax that might have been collecting in the chest within this period, and the patient might be discharged after this period of observation in the emergency department (\( \gamma_{7:8} \)). Two of our patients could have not been admitted to the ward, as their wounds were limited to the chest wall and did not develop these complications (7.6%). The insertion of the underwater seal thoracostomy tube, after clinical and chest X-ray confirmation of the presence of blood in the pleural cavity, gives an idea about the severity of bleeding within the chest cavity through the amount of the blood drained immediately and during the coming hours of observation. An amount of around 1000 ml of immediate drainage is considered an indication for thoracotomy (\( \delta \)). While when it is less that that, especially when decreasing during the follow-up hours, can be considered as a favorable sign to continue patient’s observation. The other indication for urgent thoracotomy is on suspecting cardiac tamponade, regardless the degree of hemothorax, to evacuate the blood from the pericardium and deal with its source (\( \epsilon \)). On looking at our patients the insertion of chest tube and observation policy was satisfactory in 20 of the 24 patients who had pleural penetration (83.3%), a percentage that meets with other reports (\( \mu_{9:11} \)). In our patients, two needed urgent thoracotomy because of the large amount of drainage in one and the cardiac stab in one. On the other hand, a moderate amount of blood drained after inserting the chest tube should not give the treating physician the feeling of safety; as the bleeding might be continuous and could necessitate surgical intervention within the coming hours (\( \iota_2 \)). This was seen in two of our patients.

Regardless the size of the external wound in the chest wall, the extent of the intrathoracic trauma may vary in it’s magnitude according to it’s site and the direction of the stabbing object, or the kinetic energy in case of missile injury, being more destructive with high velocity missiles (\( \iota_3 \)). However, the main line of management is essentially the same, regardless the cause (\( \iota \)). In our region stabbing with a knife was shown to be the main cause of penetrating chest wounds, in fact two of them where actually limited to the chest wall and did not need more than observation. Our findings confirmed also the need to exclude intra-abdominal organ injuries, especially when the stabbing is located in the lower chest, by further investigations like abdominal ultrasound and computed tomography scans (\( \kappa_{12:15} \)). In general, there are many options that encounter the treating surgeon, once surgery is indicated. These may range from the simple ligation of bleeding intercostal vessel, diaphragmatic repair, suturing a lung parenchyma tear, lobectomy, pneumonectomy or controlling a major vascular injury (\( \lambda_\)). Recently video-assisted thoracic surgery has shown to play a valuable role in evaluating and treating intrathoracic injuries in hemodynamically stable patients (\( \lambda_{17:19} \)). These varieties of options should confirm the need of an expert chest surgeon, within the hospital or in the nearest referral center, to deal with this kind of trauma.

In conclusion, the number of patients presented might be relatively small; still it is significant for a period of one year. It showed that stab wounds constitute the main cause of penetrating chest trauma in our area. Although these can be treated conservatively in the majority of cases within the general surgical ward, still some might need surgical interference that necessitates the presence of chest surgeon around; who should be able to deal with any complications should it occur. Stabs in the upper chest could cause cardiac or mediastinal injury, while stabs in the lower half of the chest might cause intra-peritoneal organs injury.

References

8. Shatz DV, de la Pedraja J, Erbella J, Hameed M, Vail SJ. Efficacy of follow up evaluation in penetrating thoracic
Author Information

Muhammad R. Khammash, FRCSI
Associate Professor Surgical Department, Faculty of Medicine, Jordan University of Science and Technology

Fuad El Rabee, M.D.
Consultant Chest Surgeon, Princess Basma Teaching Hospital