

Management of Penetrating Injuries of the Lower Chest

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A prospective study of 60 patients with penetrating trauma to the lower chest admitted in Surgical Unit of Mayo Hospital, Lahore through Emergency in two years is presented. Majority (93%) of the patients were young, (mean age 30 years) male. Penetrating gunshot wounds were more common than stab injuries. Anterior and anterolateral aspect was the common site of injury. Ninety seven percent presented within 6 hours. Seventy seven percent of the patients had associated injuries to the other organs. Tube thoracostomy was the most common procedure performed. Mean hospital stay remained 14 days. The mortality was 10.2% in this series.

Key words: Penetrating injuries, lower chest

Thoracic trauma is found in the Smith Papyrus recordings which was written before 3000B.C. Fifty eight cases were described by Papyrus, 2 cases related to chest injury, one to cervical injury and one case chest wound penetrated to bone and perforated sternum¹.

Trauma is recognized as one of the common cause of death in the first four decades of life. The incidence of trauma has significantly increased in our emergencies since the introduction of Klashinkov. Mayo Hospital, Lahore being the oldest teaching hospitals receives the maximum number of penetrating trauma cases besides a fare number of patients with road traffic accidents which are referred from other parts of the province.

Low velocity gunshot wounds are most common in urban and civilian population. Penetrating trauma of the lower chest has remained a special concern of emergency surgeons. It can cause injury to the chest wall, pleural space, lung, heart, major vessels and oesophagus. Victims of the penetrating chest trauma without cardiac and major vessels involvement have unusually low mortality, while on the other hand, cardiac trauma severely affects the mortality, despite the operating room resuscitative thoracotomy. Gunshot wounds produce rating amount of injury and tissue destruction depending upon the weapon, velocity of the bullet, the distance between assailant and the victim and the extent of missile track².

Lower thoracic injuries require complete evaluation of the abdomen, for diaphragmatic penetration and associated intra-abdominal visceral involvement. 70 to 80% of the patients reaching alive to the emergency department can be managed by resuscitation and physiotherapy only³.

Major complications of the chest injuries include tension pneumothorax, exsanguination, wound infection, haemothorax and development of empyema. Injuries such as major vessels at pulmonary hilum are associated with high mortality rate⁴.

High incidence of suspicion and timely intervention can give better hope and is definitely associated with good results.

Among the penetrating chest wounds specially treacherous are those with lower thoracic injuries. Diaphragm rises to the level of nipple in normal expiration

and management of presentation in this region is dominated by the concern that subphragmatic viscera may have been penetrated. Some authorities believe that penetrating wound of the left lower chest mandates early exploration as spleen, stomach and colon may have been penetrated. As negative pressure in the chest aspirate fluids in the chest through the diaphragm wound the abdominal findings in these cases may be missing or late presented so abdominal lavage is usually negative and misleading⁵.

Consequence of error are costly because liver is the usual abdominal organ involved in the right sided stab wound of the lower chest that penetrate the diaphragm. It may be reasonable to delay the exploration until patient is more stabilized. Early abdominal exploration is required if there is continuing blood loss.

Material and Methods

All patients with penetrating injuries of the lower chest below the breast or nipple involving the front or back were admitted in one of the four surgical units of Mayo Hospital, Lahore through Emergency in year 1997-98 were included in the study. Patients under the age of 12 years were not included as they are managed in Paediatric Surgical Unit.

After the reception of patients primary survey by surgical resident was made. The physical signs were noted and presumptive diagnosis was made. Immediate resuscitative measures were adopted that involve maintenance of airway, provision of venous access and infusion of crystalloids and colloids. In haemodynamically stable patients chest radiographs are taken, decision is made about observation or thoracocentesis. Haemodynamically unstable patients were kept in the ICU for rapid resuscitation but patients in shock and severe respiratory distress were shifted to emergency operation theatre.

If haemothorax is detected clinically, knowing the site and the track of penetrating injury, mediastinal shift, reduced air entry on the effective site, thoracotomy tube was introduced, without radiological confirmation; otherwise portable radiographs are taken.

Digital palpation was performed after putting retractors at the site of thoracostomy before insertion of

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tube and diaphragm, lungs tract and chest wall are palpated. Digital exploration was done to avoid damage to diaphragm during chest intubation.

Chest tube was removed when fluid drainage stopped or when normal excursion of fluid level in under water seal system had stopped and lungs have expanded. Digital palpation was also done to detect any early injury to the diaphragm, lungs and abdominal viscus.

Patients having cardiac mediastinal vascular injury and if the blood loss through the thoracostomytube is more than 1500ml/hr or 2ml/kg/hr for more than 4 hours with haemodynamic instability were shifted to the operating room for thoracotomy.

Results

During the study period of two year, 60 patients with penetrating lower chest trauma were managed. Age and sex distribution have shown in table 1

Table 1. Age and sex distribution

Year	Male	Female	Total
13-20	10	0	10
21-30	18	0	18
31-40	16	2	18
41-50	10	2	12
>50	2		2
(n=60) Male:56		Female 4	

Mechanism of injury in 42 patients (70%) was gunshot and in 18 patients (30%) stab with different sharp objects, 42 patients (70%) had penetrating injuries involving the front and the anterolateral aspect of chest as shown in table.2. Fifty eight patients(96 %) presented within six hours as shown in table 3.

Table 2. Sites of injury

Penetrating Agent	Right Side			Left Side		
	Front	Back	n=	Front	Back	n=
Gunshot	18	8	26	10	6	16
Stab	4	2	6	10	2	12
Total	22	10	32	20	8	28

Table 3. Time of presentation

Time	No. of patients	%age
Within one hour	16	26.6
Within three hours	32	53
Within six hours	10	16.5
Within eight hours	2	3.3

Eighteen patients (30%) received resuscitative measures before reaching the hospital and had lot of impact on the over all mortality, as all deaths (14.2%) were among the rest of the patients (64%) who did not receive resuscitation. Only 14(23%) had isolated injury to the chest, whereas majority (77%) had associated injuries as shown in table 4.

Table 4. Distribution of injuries in abdomen and chest

Site of injuries	GW	SW	Total
Isolated chest	6	8	14
Chest and abdomen	28	8	36
Chest and limbs	8	2	10
Chest, abdomen and spine	4	0	

Digital palpation lead to early exploration in 28 patients (46.6%) by feeling rent in the diaphragm placed mostly anteriorly it was negative in 8 patients (13.3%) in which signs of peritonitis appeared later on and laparotomy was performed. Tube thoracostomy was the most common procedure performed in 56 patients (93%), either isolated or combined with procedures, other had thoracotomy (33%), tube thoracostomy and laparotomy, as shown in the table 5. Liver was the most common abdominal organ involved Table 6

Table 5. Types of treatment

Type of treatment	GW	SW	Total	%age
Tube thoracostomy	42	16	58	96
Thoracotomy	4	1	5	8.3
Tube thoracostomy and laparotomy	28	8	36	60
Thoracotomy and laparotomy	2	0	2	3.3
Observation	0	2	2	3.3

Table 6. Abdominal organs involved in association with low chest injuries.

Site of injuries	GW	SW	Total
Diaphragm	28	8	36
Liver	18	6	24
Spleen	10	6	16
Stomach	10	6	16
Colon	10	1	11
Small gut	10	-	10
Pancreas	2	-	2
Gallbladder	1	-	1

The hospital stay ranged between 12-16 days with mean stay of 14 days. There was six deaths in this series as shown in table 7.

Table 7. Hospital stay and mortality

Organ system	No. of Patients	Mean Hospital Stay	Mortality %age
Isolated chest injury	14	12	14.2
Chest and associated injuries	46	16	8.6
Total	60	14	11.4

Four patients with fire arm injury developed empyema thoracis which were treated with delayed thoracotomy with decortication in the Department of Chest Surgery. Two patients had pancreatic fistula after distal pancreatectomy which settled with conservative management. Eight

patients had some form of wound infection which was later controlled with antibiotics.

Discussion

The increase in incidence of violence continues unabated. Increased social disharmony, frustration, and a lack of faith in the institutions responsible for law and order and delivery of justice encourages a fatalistic attitude to settle issues by violent means. Emergency rooms in major urban hospitals are inundated by trauma. Penetrating chest injuries constitute a major source of morbidity and mortality in this group⁶.

In practice less than 15% of the patients with chest injuries requires major surgical intervention. Basis of this successful management of thoracic trauma is effective cardiopulmonary resuscitation followed by early detection and correction of life threatening injuries⁷.

Primary survey must take into account the mechanism of injury when thoracocage and underlying lungs are injured. Hypoxia, acidosis caused by untreated haemopneumothorax compound the effects of direct head injury in patients with multiple trauma.

The clinical skill and judgement along with radiographs form basis for treatment in most cases. More sophisticated imaging techniques except angiography have limited role to play⁸.

X-ray chest C.T. scan as well as ultrasound scanning and monitoring of blood gases analysis are important tools for diagnosis and surgical strategy⁹.

Current indications for chest intubation include traumatic haemothorax, pneumothorax iatrogenic pneumothorax¹⁰.

Table Indications for drainage of traumatic pneumothoraces¹¹

If pneumothorax > 1.5cm (at level of 3 rd costochondrial junction)
Whether intermittent positive ventilation is required or not.
If Pneumothorax < 1.5cm but intermittent positive pressure ventilation is required for surgery as there is bilateral pneumothorax.
If pneumothorax < 1.5cm in patient with chronic obstructive respiratory disease, restrictive lung and chest wall disease, high spinal cord injury or contralateral lung injury.
All tension pneumothoraces or haemothoraces.

Prophylactic drainage of pleural space in patients with subcutaneous emphysema should be used only when patient requires assisted ventilation or G/A when no such intervention is needed, patient is followed and a chest tube is inserted if indicated after delayed pneumothorax in haemothorax. Before chest tube is inserted chest x-rays should be taken unless there is absolute emergency like tension pneumothorax.

Post intubation x-rays are taken to check the position of tube. Amount of blood evacuated at initial intubation is measured and rate at which it is coming out is checked. Because it might lead us to the need for thoracotomy.

Ascending contamination with infection of pleural cavity is the complications which result from incomplete

drainage of pleural space and lack of complete occupation of pleural space by lungs contribute to morbidity¹².

Those patients requiring thoracotomy most are treated by simple oversewing of lungs. Some may require resection. The decision of resection is made on operating table depending upon location and severity of injury and should be the procedure of last resort¹³.

The incidence of combined thoracoabdominal injuries was 60% in our study and role of digital palpation cannot be ignored. The significant percentage had diaphragmatic injury followed by the liver.

Presence of associated injuries along with chest had an effect over mean hospital stay and morality. Chest intubation is the most common method of treating early lower thoracic penetrating injuries. Male are most prone to chest injuries with ratio of 56:4.

In most cases anterior chest was inflicted deflecting the attitude of victim and majority of stab wounds were on left chest as many assailants are right handed.

Importance of chest physiotherapy immediate after tube insertion or thoracotomy, effective analgesic and early removal of drain is stirred to prevent complications and to reduce morbidity and mortality.

Conclusion

Rapid evaluation of extent of injury, path of penetrating age with haemodynamic status help early assessment of patients. Primary management are prompt restoration of normal cardiopulmonary functions, control of haemorrhage early detection of associated abdominal injuries in order to prevent sepsis and other complications.

Recommendations should be made about limitation of firearm weapons among public.

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