Original Research Article

A Study of Patients with Blunt Trauma Chest, its Management and Outcome

Abstract

Aims and objective: This study assessed the clinical profile, management, polytrauma incidence, and outcome of 64 cases of blunt trauma chest at a tertiary care centre.

Study design: Prospective and interventional study

Place and Duration of study: Department of general surgery , Indira Gandhi Government Medical College, Nagpur ,Maharashtra, India between June 2020 to Nov 2022

Materials and methods: Data were collected on patients admitted with blunt trauma chests. Demographics, symptoms, signs, management modalities, and treatment outcomes were recorded.

Results: Vehicular accidents caused 48.4% of cases, with a mean age of 42.4 years and an M: F ratio of 6.1:1. Chest pain and tenderness were common presenting symptoms and signs. Conservative management was used in 45.3% of cases, tube thoracostomy in 54.7%, thoracotomy in 3.1%, and exploratory laparotomy with splenectomy in 1.6%.

Conclusion: Blunt chest trauma usually caused by vehicular accidents, can be managed with thoracostomy or conservative methods. Early presentation within the golden period prevents complications and reduces mortality rates.

Keywords: chest trauma, pneumothorax, thoracostomy, haemothorax

1. INTRODUCTION

Chest trauma is a common consequence of accidents and is increasing worldwide, particularly among young adults age between 15-35 years. Blunt chest injuries, such as rib fractures, are the most common type of injury and can lead to serious consequences like flail chest, pulmonary contusion, pneumothorax, and haemothorax. Chest trauma is often a part of polytrauma, which is the leading cause of death and disability in the first four decades of life and the third most common cause of death overall. Economic growth, the use of fast-moving vehicles, the availability of weapons, and crimes of passion contribute to the increasing number of polytrauma cases. The thoracic cage is a vital structure that houses important organs such as the heart, lungs, and great vessels. While the ribs, sternum, and vertebral column provide sufficient protection, certain areas such as the intercostal spaces, angles of ribs, and costochondral junctions are more susceptible to trauma. Proper diagnosis and management of thoracic injuries are critical to improving the long-term outcome. Trauma is a leading cause of mortality and morbidity in India, particularly among young individuals. The direct cost of caring for trauma victims is enormous, and the loss of productivity to society

and families is significant. Therefore, efforts should be made to prevent chest trauma by improving road safety, reducing the availability of weapons, and raising awareness about the consequences of violent behaviour. In addition, it is essential to have appropriate facilities and trained medical personnel to manage chest trauma efficiently. Early diagnosis and treatment can significantly improve the outcomes and reduce the burden of chest trauma on individuals, families, and society.

2. MATERIALS AND METHODS

This prospective study of 64 cases of blunt trauma chest due to motor vehicle accident, occupational accident, fall from height, assault with blunt object over chest carried out on patients admitted from OPD /casualty in the surgery department of the tertiary care center from June 2020 to November 2022 which included all the diagnosed and treated cases of isolated blunt trauma chest and blunt trauma chest with associated injuries in all age groups.

Inclusion criteria

Cases of blunt trauma admitted in the emergency department and diagnosed with having rib fracture, pneumothorax, haemothorax, flail chest, lung contusion and laceration, vascular injuries of thorax, oesophageal injuries, tracheobronchial injuries resulting from blunt trauma chest were included in all age groups irrespective of the sex of the patient.

Diagnostic criteria

Patients having clinically palpable rib fracture, radiologically confirmed rib fracture, flail chest, pneumothorax, haemothorax, lung contusion, and laceration were included in this study.

Exclusion criteria

All cases of trauma chest apart from blunt trauma will be excluded from this study. The patient who didn't give consent for inclusion in this study were excluded. All patients of blunt trauma included in this study were evaluated by taking a proper history (mechanism of injury), and thorough clinical and radiological examination.

Primary survey

The primary survey involved the assessment of patients with the ABCD protocol, which included ensuring airway and cervical spine protection, checking breathing, evaluating circulation, and assessing disability or neurologic condition. Mass casualty patients were triaged and managed accordingly. Stabilization of patients involved pain management, oxygen support, and fluid replacement for shock. Patients with blunt trauma chest underwent necessary investigations after a thorough clinical examination

Investigations

Patients were investigated with plain x-ray chest posteroanterior view, ultrasound thorax, ultrasound abdomen if necessary, and Computed Tomography thorax/abdomen if there was a

specific indication. Routine investigations like complete blood count, kidney function test, liver function test, blood group, HIV, and HBsAg status were done.

Diagnosis

Diagnosis of blunt trauma chest leading to rib fracture, pneumothorax, pneumohemothorax, surgical emphysema, flail chest, lung contusion and laceration, retained haemothorax, post-traumatic empyema was made based on history, clinical examination, and radiological findings.

Management

Blunt trauma injuries were managed conservatively or with an interventional approach depending on the nature and extent of injuries. Conservative management included keeping the patient stable, O2 inhalation, IV fluids, analgesics, antibiotics, blood transfusions, broncho-pulmonary toilet, and physiotherapy. The interventional approach included intercostal tube drainage or thoracotomy. Indications for intercostal tube drainage included an X-ray chest showing pneumothorax or haemothorax, tachypnoea with decreased or absent air entry and mediastinal shift, and recurrence of pneumothorax after removal of an initial chest drain. Thoracotomy was indicated for drainage of blood from the intercostal tube at a rate of more than 300ml/hr for 3 consecutive hours or >1500 ml of blood after chest tube placement.

Intercostal tube drainage procedure

Insertion of the intercostal tube drain (FIGURE 1) at the safest site in the "triangle of safety" under adequate local anaesthesia to include the pleura. The drain is passed over the upper edge of the rib to avoid the neurovascular bundle that lies beneath the rib. The retaining stitch will be secured and care is taken not to obliterate the drain. The drain will be connected to an underwater seal device which functions as a one-way valve.

FIGURE 1: Intercostal Tube Drain In Case Of Pneumohemothorax Secondary to Blunt Trauma Chest

Thoracotomy

Thoracotomy was indicated for drainage of blood from the intercostal tube at a rate of more than 300ml/hr for 3 consecutive hours or >1500 ml of blood after chest tube placement, Diaphragmatic tear (FIGURE 2) with herniation of stomach, small or large intestine, liver, spleen, omentum with contamination of pleural cavity, Tracheo bronchial rupture, for resection of a portion of lung, Resuscitative thoracotomy, air leak persisting for more than 7 days after ICD insertion. The decision to perform thoracotomy depended on clinical assessment, chest radiograph findings, and CT thorax.

Common Steps of Thoracotomy

Insertion of an epidural catheter for analgesia and the patient is placed under general anesthesia using double-lumen tracheal intubation, in a lateral decubitus position with the side to be explored positioned up. Non-invasive monitoring of pulse rate, arterial pressure, oxygen saturation, electrocardiogram, and Et Co2 is carried out during the procedure. Injectable antibiotics are given at the time of induction, and foley catheterization is performed. The thorax is entered through a posterolateral thoracotomy, long enough (15 cm) to allow the introduction of one hand for manual exploration. The incision is carried down to the intercostal muscle on the superior aspect of the 5th or 6th rib, with care given not to cut through the intercostals into the underlying pulmonary parenchyma. The evacuation of blood with clots and organized purulent collection and decortication is performed to achieve the maximum possible lung expansion. The diaphragm is routinely separated from the lung and from adhesions. All fibrin septae are destroyed, and the fissures are liberated completely. At the end of the operation, two large-bore chest tubes are placed in the pleural cavity through separate incisions, secured, and connected to under-seal water bags. The incision is closed in layers, and cleaning and dressing are performed.

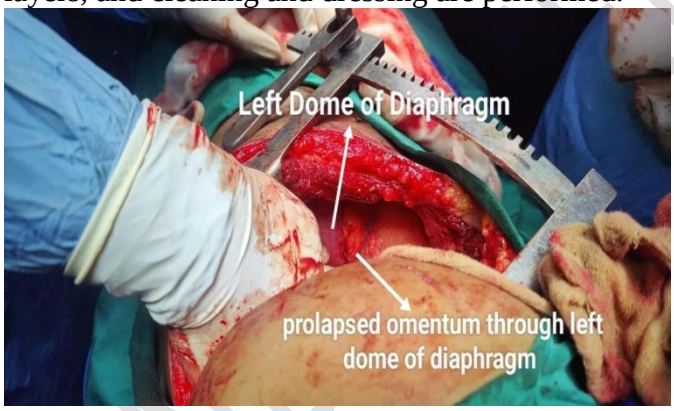

FIGURE 2: Diaphragmatic Injury with Omental Prolapse Into Thorax (Intraoperative Image)

Postoperative management

During postoperative recovery, patients are monitored in the operating theatre and then shifted to the surgical intensive unit for observation. They are kept nil by mouth and given intravenous fluids as needed. Mobilization is encouraged, and oral sips of clear fluids are allowed, followed by a normal diet if permitted. Systemic antibiotics and analgesics are given, and a respiratory rehabilitation program is initiated. Chest and limb physiotherapy is also started. The length of ICU stay is based on vital parameters and the need for mechanical

ventilation. If the postoperative hemoglobin is less than 8 gm%, patients are transfused with packed cells. The chest is examined daily for improvement of air entry and any collection, and postoperative review chest X-rays are done on days 1, 3, and 5. Intercostal drain output is monitored and recorded, and drains are removed only after cessation of air leakage and minimal drainage volume for 24 hours or confirmation that the drained pleural fluid is free of blood. Suture site infection and wound gaping, if present, are managed accordingly. Patients are followed up in the outpatient department at 2 weeks, 1 month, and 3 months.

In cases of blunt trauma abdomen with blunt trauma chest, exploratory laparotomy if required is performed under general anesthesia by a midline incision and extended upwards or downwards depending on the suspected and/or diagnosed trauma-related injury of the abdomen. Repair of traumatic bowel perforation, hemoperitoneum, diaphragmatic hernia, and other GI tract injuries or perforation is done. Splenectomy is performed for associated splenic injury with hemoperitoneum. Associated head injury is diagnosed and managed conservatively or with craniotomy after consulting a neurosurgeon. Associated facial injuries and long bone injuries are managed after consulting an oromaxillofacial surgeon and orthopedic department, respectively. Patients are followed up after discharge at 2 weeks, 1 month, and 3 months, and data is collected and analyzed by the principal investigator.

3. RESULTS

Total Patients of Blunt Trauma Chest Due to Different Modes

Out of total 64 cases of blunt trauma chest, vehicular accident comprises of 31 i.e. (48.4%) cases, fall from height comprise of 20 i.e. (31.3%) cases, assault with blunt object comprise of 9 i.e. (14.1%) cases, fall of heavy object comprise of 2 i.e. (3.1%) cases, assault with fist and blows comprise of 1 i.e. (1.6%) cases and other included injury by animal comprising 1 i.e. (1.6%) cases

Table 1 -Total Patients of Blunt Trauma Chest Due to Different Modes

MODE OF INJURY	NO OF CASES	PERCENTAGE %
Vehicular accident	**31**	**48.4**
Fall from height	**20**	**31.3**
Assault with blunt object	**9**	**14.1**

Fall of heavy object	**2**	**3.1**
Assault with fist and blows and kicks	**1**	**1.6**
Others (animal injury)	**1**	**1.6**
Total	**64**	**100**

Age wise Distribution

Maximum number of patients were found in present study group of 41-50 years age i.e., 25% patients, followed by age group of 51-60 years i.e., 21.8% followed by age group 3140 years i.e., 18.75%. Least common age group was 1120 years. No patient seen in and group of 0 to 10 years and 71 and above. Mean age of presentation is 42.4 years. 55 i.e. (85.9%) were males and 9 i.e. (14.1%) were females. The male to female ratio comes out to be 6.1:1.

Table 2 – Age wise Distribution

AGE GROUP (IN YEARS)	**NO OF PATIENTS**	**PERCENTAGE %**
UPTO 10	**0**	**0**
11-20	**5**	**7.8**
21-30	**11**	**17.2**

31-40	**12**	**18.75**
41-50	**16**	**25**
51-60	**14**	**21.8**
61-70	**6**	**9.4**
71 AND ABOVE	**0**	**0**
TOTAL	**64**	**100**
MEAN AGE = 42.4 YEARS		

Incidence of Presenting Symptoms in Polytrauma Along with Blunt Trauma Chest

Chest pain was the most common (100%) presenting symptom followed by breathlessness (56.3%) patients.

Table 3 - Incidence of Presenting Symptoms in Polytrauma Along with Blunt Trauma Chest

SYMPTOM	**NO. OF CASES**	**PERCENTAGE %**
Chest pain	64	100
Breathlessness	36	56.3
Hemoptysis	0	0

Signs in Polytrauma Along with Blunt Trauma Chest

Tenderness over chest was elicited in 52 i.e., 81.3% patients and was the most common sign observed. Tachypnoea was the presenting sign in 36 i.e. (56.3%) patients

Table 4 - Signs in Polytrauma Along with Blunt Trauma Chest

SIGNS	**NO. OF CASES**	**PERCENTAGE %**
Tachycardia	29	45.3
Pallor	5	7.8
Hypotension	8	12.5
Tachypnoea	36	56.3
Tenderness over chest	52	81.3
Involvement accessory of muscles of respiration	14	21.9
Bony crepitus	46	71.9
Chest compression test	46	71.9
Subcutaneous emphysema	21	32.8
Decreased air entry	34	53.1

Exclusive Blunt Trauma Chest and Other Associated Injuries with Blunt Trauma Chest

In our study of 64 patients, exclusive blunt trauma chest was seen in 46 i.e.,78.9% patients. Head injury is most common associated injury along with blunt chest trauma seen in 8 i.e. (12.5%) patients followed by clavicular fractures in 5 i.e. (7.8%) patients. Abdominal trauma comprises 5 i.e. (7.8%) patients which included equal incidence of splenic and liver laceration in 2 i.e. (3.1%) patients each and contusion over kidney in 1 i.e. (1.6%). Long bone fractures and spine injury seen in 2 i.e. (3.1%) patients each. Least common associated injuries included, Facial bone fracture, scapular fracture and pelvic bone fractures seen with equal incidence in 1.6% cases each.

Table 5 - Exclusive Blunt Trauma Chest and Other Associated Injuries with Blunt Trauma Chest

Blunt trauma chest & other associated injuries		**No of cases**	**Percentage%**
Exclusive blunt trauma chest		46	78.9
Head injury		8	12.5
Clavicular fracture		5	7.8
Facial bone fracture		1	1.6
Long bone fracture		2	3.1
Abdomen injury	spleen	2	3.1
	LIVER	2	3.1
	KIDNEY	1	3.1
Spine injury		2	3.1
Scapular fracture		1	1.6
Pelvic bone fracture		1	1.6
Sternal fracture		0	0

Tube Thoracostomy

Tube thoracostomy was done, which showed pneumothorax in 12 i.e., 18.8 % cases, haemothorax (hemothorax in 9 + hemopneumothorax in 14) in 23 i.e., 35.9% cases, and hemopneumothorax in 14 i.e., 21.9% cases.

Table 6 - Tube Thoracostomy

Finding	**No of cases**	**Percentage**
Pneumothorax	12	18.8
Haemothorax	9	14.06
Hemopneumothorax	14	21.9

Treatment in Polytrauma Along with Blunt Chest Trauma Patients

In this study of 64 patients, 29 i.e. 45.3% patients were managed conservatively, tube thoracostomy was done in 35 i.e., 54.7 % patients, thoracotomy done in 2 i.e., 3.1 % cases and exploratory laparotomy with splenectomy in 1 i.e.,1.6% patients.

Table 7 - Treatment in Polytrauma Along with Blunt Chest Trauma Patients

Treatment	**Number of patients**	**Percentage%**
Conservative	29	45.3
Tube thoracostomy	35	54.7
Thoracotomy	2	3.1
Exploratory laparotomy with splenectomy	1	1.6

Length of Hospital Stay

Largest number of patients of blunt trauma stayed in the hospital for less than 7 days. All the patient were discharged within 2 weeks of hospitalisation. Average length of stay was 5.03 days with a span of 2 to 11 days

Table 8 - Length of Hospital Stay

Stay in hospital	**No of patient**	**Percentage**
0-7 days	56	87.5
8-14 days	8	12.5
>2weeks	0	0
Total	64	100
Mean	**5.03**	

Outcome of Blunt Chest Trauma Patients

In this study of blunt trauma chest out of 64 cases in the study, 30 i.e. 46.9% patients who were managed conservatively were discharged and 34 i.e. 53.1 % patients who were managed after interventional management were discharged. No death reported due to injury.

Table 9 - Outcome of Blunt Chest Trauma Patients

Outcome	Number of patients	Percentage
Discharged after conservative management	30	46.9
Discharged after interventional management	34	53.1
Death due to injury	0	0

4. DISCUSSION

This is the study of blunt trauma chest in all age groups, which include 64 patients with blunt trauma were studied, out of them, the incidence of vehicular accident leading to blunt trauma chest is 48.4%, fall from height is 31.3%, assault with blunt object is 14.1%, fall of heavy object is 3.1%, assault with blows and kicks is 1.6% and others (animal injury) is 1.6%. Incidence of 48.4% of vehicular accident as a cause is comparable with Kumar BA et al (1)and Konstantina Chrysou et al (2) and is near comparable with Syed Quibtiya Et Al(3) . The incidence 31.3 % of fall from height is comparable with Konstantina Chrysou Et Al (2) and near comparable with Kumar BA et al(1) and Syed Quibtiya Et Al (3). The incidence of 14.1% of assault with blunt object is comparable with Syed Quibtiya Et Al (3) and near comparable with Kasabe PS Et Al(4). Incidence of 1.6% of animal injury is comparable with Kasabe PS Et Al(4), Kumar BA et al(1), Konstantina Chrysou Et Al (2) and Syed Quibtiya Et Al (3).

The youngest patient is 14 years and oldest patient is 70-year-old. The mean age of patient with blunt trauma chest is 42.2 years. Out of 64 patients, 16 i.e., 25% patients were between the age group of 41-50 years which is the highest in our study age group and is the most common age group in our study. The least common age group is 11-20 years with least incidence of 7.8%. The mean age of 42.2 years is comparable to Kasabe PS Et Al(4) , Kumar BA et al (1), Konstantina Chrysou Et Al (2)and Kelenchi E. Okonta Et al(5). Male to female ratio were 6.1:1 is comparable with Kasabe PS Et Al(4).

Chest pain was present in 100 % patients, which was the most common presenting symptom followed by breathlessness. Incidence of chest pain is comparable with Syed Quibtiya Et Al (3) and near comparable with Datey S et al (6) and Sinha PK et al (7). It was found out that findings of present study are not comparable with author like Sanjay Datey S et al (6), Syed Quibtiya Et Al (3), Sinha PK et al (7) which have more incidence of breathlessness as compared to present study. This could be because the patients in the above-mentioned studies could have had more incidence of major chest trauma leading to increased incidence of breathlessness in Datey S et al (6), Syed Quibtiya Et Al (3), Sinha PK et al (7). While incidence of study by Balamurugan C et al in (8) considering breathlessness as presenting symptom was less as compared to present study because they have considered ARDS as a criterion for inclusion in their study, while in this present study only the incidence of breathlessness was studied.

Tenderness over chest was elicited on 52 i.e., 81.3% patients which is the most common sign seen in cases of patients with blunt chest injury is comparable with Shukla et al(9). Incidence of Subcutaneous emphysema is 32.8%, which is comparable with Datey S et al (6), Syed Quibtiya Et Al (3) and Shukla et al(9). Chest compression test was positive due to rib fractures and was elicited in 46 i.e., 71.9% patients and is near comparable with Pramod et al(10).

Exclusive blunt trauma chest was seen in 46 i.e.,78.9% patients. Head injury is most common associated injury along with blunt chest trauma seen in 8 i.e. (12.5%) patients and is comparable with Zahida Akhter et al (11)and near comparable with Srinivas B et al(12). Associated abdominal injury was seen in 5 i.e. 7.8%. It includes equal incidence of splenic and liver laceration in 2 i.e. (3.1%) patients each and contusion over kidney in 1 i.e. (1.6%) and is is comparable with Shukla et al(9), Srinivas B et al(12) and near comparable with Syed Quibtiya Et Al (3). Diaphragmatic injury was seen in 1 i.e., 1.6% patient and is comparable with Kumar BA et al (1)and near comparable with Shukla et al(9). Spine injury was seen in 2 i.e., 3.1 % cases which is comparable with Srinivas B et al(12) and near comparable with Kumar BA et al (1) and Zahida Akhter et al(11).

In this study of 64 patients, 29 i.e. 45.3% patients were managed conservatively, tube thoracostomy was done in 35 i.e., 54.7 % patients, thoracotomy done in 2 i.e., 3.1 % cases. Intraoperatively in right sided posterolateral thoracotomy, there was evidence of moderate haemothorax with blood clots with continuous air leak with collapsed lower lobe with laceration of lower lobe with subtotal transection of right lower lobe of lung. Non anatomical stapler resection of subtotal transected segment was done. In another case of with left posterolateral thoracotomy, there was displaced fracture of 7^{th}, 8^{th} anterolateral ribs 250 ml of haemothorax with rent of size 3.5 X 1 cm in left hemidiaphragm through which continuous oozing of blood was going and there was prolapse of omentum through the rent in the diaphragm. The prolapsing omentum was reduced back in peritoneal cavity and diaphragmatic injury repaired with prolene no 1 round body.

Incidence of patients managed conservatively is 45.3%, which is comparable Atri M et al(13), Pramod T et al(10) and nearly comparable with Sinha PK et al (7). Incidence of patients managed by tube thoracostomy is 54.7% which is comparable with Pramod T et al(10) and nearly comparable with Atri M et al(13) and Sinha PK et al (7). Incidence of patients managed by thoracotomy is 3.1% which is comparable with Atri M et al(13).

Largest number of patients of blunt trauma stayed in the hospital for less than 7 days. All the patient were discharged within 2 weeks of hospitalisation. Average length of stay was 5.03 days with span of 2 to 11 days and this average hospital stay is less as compared to Kasabe PS Et Al(4), Syed Quibtiya Et Al (3), Shukla et al(9). The lesser average duration of hospital stay in the present study may be due to more number of patients detected with less severe blunt trauma chest leading to less hospital stay, early recovery and early discharge.

5. CONCLUSION

Blunt trauma chest is commonly caused by vehicular accidents and falls from heights, and is more common in males in their fifth decade of life. Patients commonly present with chest pain and tenderness over the chest, and may have associated injuries such as head trauma, abdominal trauma, and fractures of the clavicle, long bones, or spine. Early presentation to the hospital is important for timely detection and management of injuries, which can be done conservatively, through tube thoracostomy, or thoracotomy if necessary. Tube thoracostomy is an effective method for treating blunt thoracic injuries such as

pneumothorax, haemothorax, and hemopneumothorax. Early presentation and timely management can help prevent complications and reduce morbidity and mortality in cases of blunt trauma chest.

CONSENT- obtained from all subjects with maintained confidentiality.

ETHICAL APPROVAL - As per Institutional Ethical committee, Indira Gandhi government Medical college Nagpur.

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