

A Descriptive 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 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. It can be managed with thoracostomy or conservative methods depending on the clinical presentation and severity.

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(1). 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(2). 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 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 centre 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. The Injury Severity Score(ISS) was calculated and score ranging from AIS-1(minor) to AIS-6(unsurvivable) were assigned form AIS manual to each injury

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 **ATLS protocol-ABCDE approach (3)**, which included ensuring airway and cervical spine protection, checking breathing, evaluating circulation, and assessing disability or neurologic condition and **exposure to environment**. 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.

Statistical analysis

Statistical analysis done by medical statistician with calculation of incidences, median age and standard deviation.

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.

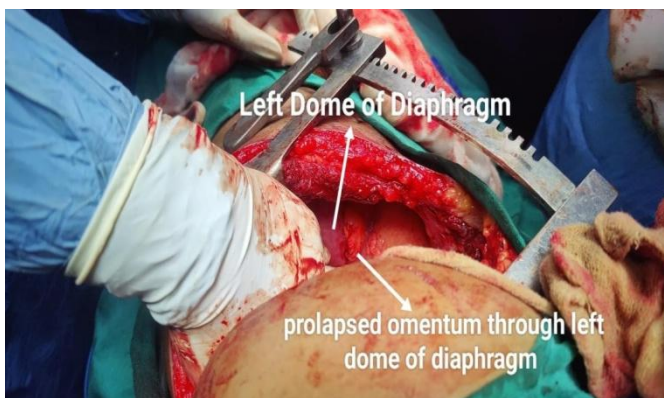


FIGURE 2: Diaphragmatic Injury with Omental Prolapse into Thorax (Intraoperative Image)

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 Oro maxillofacial 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

During the period of study there were 506 cases of trauma related admission out of which 64 were of isolated thoracic trauma and thoracic trauma with associated injuries. 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. 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 31-40 years i.e., 18.75%. Least common age group was 11-20 years. No patient seen in and group of 0 to 10 years and 71 and above. Mean age of presentation is 42.4 ± 14.16 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.

Demographics**Table 1 –**

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 Standard deviation =14.16		
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

Clinical presentation

Chest pain was the most common (100%) presenting symptom followed by breathlessness (56.3%) patients. 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. 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 2 - Clinical presentation

Symptom	No. Of cases	Percentage %
Chest pain	64	100
Breathlessness	36	56.3
Haemoptysis	0	0
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 of accessory 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

Blunt trauma chest & other	No of	Percentage%
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associated injuries		cases	
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

Management Tube thoracostomy was done, which showed pneumothorax in 12 i.e., 18.8 % cases, haemothorax (haemothorax in 9 + hemopneumothorax in 14) in 23 i.e., 35.9% cases, and hemopneumothorax in 14 i.e., 21.9% cases. 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 3 - Management

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

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

Outcome of Blunt Chest Trauma Patients 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. 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 4 - Outcome of Blunt Chest Trauma Patients

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	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. Incidence of 48.4% of vehicular accident as a cause is consistent with Kumar BA et al (4), Konstantina Chrysou et al (5) and Syed Quibtiya Et Al(6). The incidence 31.3 % of fall from height is consistent with Konstantina Chrysou Et Al (5), Kumar BA et al(4) and Syed Quibtiya Et Al (6). The incidence of 14.1% of assault with blunt object is consistent with Syed Quibtiya Et Al (6) and Kasabe PS Et Al(7). Incidence of 1.6% of animal injury is consistent with Kasabe PS Et Al(7), Kumar BA et al(4), Konstantina Chrysou Et Al (5) and Syed Quibtiya Et Al (6). After comparing the findings of present study with other studies in literature done on blunt trauma chest, it was found out that, vehicular accident is the commonest cause of blunt trauma chest followed by fall from height and assault with blunt object in decreasing order. Animal injury is least common cause of blunt trauma chest.

The mean age of 42.2 years is consistent to Kasabe PS Et Al(7), Kumar BA et al (4), Konstantina Chrysou Et Al (5) and Kelenchi E. Okonta Et al(8). After comparing the finding of present study with other studies in literature, it can be seen that 5th decade i.e., 41-50 years of life is the most common age group affected and involved with Blunt trauma Chest. Male to female ratio were 6.1:1 is consistent with Kasabe PS Et Al(7). Blunt trauma chest is more commonly seen in males as compared to females as male population is more mobile population as compared to females.

Chest pain was present in 100 % patients, which was the most common presenting symptom followed by breathlessness. Incidence of chest pain is consistent with Syed Quibtiya Et Al (6), Datey S et al (2) and Sinha PK et al (9). In the present study of Blunt Trauma Chest maximum patients suffered with vehicular accident or other modes of trauma leading to Blunt Trauma Chest and presented to us immediately after the incidence of trauma or within few hours hence chest pain was the most predominant symptom and was seen in nearly all the patients of present study. It was found out that findings of present study are not consistent with author like Sanjay Datey S et al (2), Syed Quibtiya Et Al (6), Sinha PK et al (9) 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 (2), Syed Quibtiya Et Al (6), Sinha PK et al (9). While incidence of study by Balamurugan C et al in (10) 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(11). Thus, chest tenderness is the most common sign seen in cases of blunt trauma chest, which is caused due to damage to ribs, vertebra, intercostal muscles and internal organs. In all the above mention studies, chest tenderness is the most commonly elicited sign in cases with Blunt Chest injury. Incidence of Subcutaneous emphysema is 32.8%, which is consistent with Datey S et al (2), Syed Quibtiya Et Al (6) and Shukla et al(11). Subcutaneous emphysema occurs when air escapes the tissue beneath the skin sue to traumatic injury as a result of blunt force trauma that causes a tear in the lungs. It is one of the important signs of underlying lung injury. Additionally, it can cause compression of trachea which can lead to difficulty in breathing and other respiratory complication. It is important to manage subcutaneous emphysema early in order to prevent any potential complications due to lung injury. Chest compression test was positive due to rib fractures and was elicited in 46 i.e., 71.9% patients and is consistent with Pramod et al(12) but not consistent with Sinha PK et al (9). It can be concluded that the incidence of positive chest compression test in patients with blunt trauma chest can vary widely.

Clinicians should consider multiple factors when evaluating patients with blunt chest trauma, including the results of chest compression test as a clinical sign.

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 consistent with Zahida Akhter et al (1), Srinivas B et al(13). The clinical significance of associated head injury in cases of blunt trauma chest is that it can lead to serious and potentially life-threatening complications. Head injuries can cause a wide range of symptoms including confusion, memory loss, difficulty speaking and even coma or death. Additionally, skull fractures can cause bleeding, cerebral edema which can also be life threatening. Overall associated head injuries in cases of blunt trauma chest is a serious concern that requires prompt comprehensive management and preventing the complication and ensure a positive outcome for the patient. 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 consistent with Shukla et al(11), Srinivas B et al(13) and Syed Qubtiya Et Al (6). In cases of blood trauma chest there is a potential for associated abdominal organ injury as well this is because the force of impact or the compression that causes the chest injury can also cause injury to the organ located within the abdominal cavity such as liver spleen and kidneys the clinical significance of associated abdominal organ injuries in cases of blunt trauma chest lies in the fact that these injuries can be life threatening requiring the early diagnosis and treatment as it can lead to internal bleeding which can further result in shock, hypotension and hypoxia to the vital organ leading to dysfunction of the vital organs. This can result in multi organ failure and death if not treated promptly. Symptoms of abdominal organ injury include abdominal pain, tenderness or distention, nausea, vomiting or changes in bowel function. Diagnosis of associated abdominal organ injury may include physical examination and imaging studies such as ultrasound abdomen, Computed Tomography scan. In conclusion, associated abdominal organ injury in cases of blunt chest trauma can be life threatening if not treated hence its early recognition and appropriate management is of vital importance for better outcome of patient survival. Diaphragmatic injury was seen in 1 i.e., 1.6% patient and is consistent with Kumar BA et al (4) and Shukla et al(11). The clinical significance of diaphragmatic injury in blunt trauma chest lies in the fact that it can cause both

respiratory and abdominal complications. In cases of respiratory complications, the diaphragmatic injury can lead to difficulty breathing, decreased lung expansion, hypoxia. In severe cases the injury can cause herniation of the abdominal organs into the chest cavity which can compromise the lung function. In cases of abdominal complications, the diaphragmatic injury can cause herniation of the abdominal contents into the chest cavity which can lead to breathlessness, abdominal pain and bowel obstruction. Spine injury was seen in 2 i.e., 3.1 % cases which is consistent with Srinivas B et al(13), Kumar BA et al (4) and Zahida Akhter et al(1). From this comparison, it can be inferred that the results of present study are consistent with the existing literature, and that findings in the present study support the conclusion that spine injury is one of the commonest associated injuries in cases of polytrauma associated with blunt trauma chest. This comparison strengthens the validity of present study and adds to the overall understanding of the relationship between polytrauma associated with blunt trauma chest and spinal injury.

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 7th, 8th 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 **consistent** with Atri M et al(14), Pramod T et al(12) and Sinha PK et al (9). Incidence of patients managed by tube thoracostomy is 54.7% which is **consistent** with Pramod T et al(12) , Atri M et al(14) and Sinha PK et al (9). Incidence of patients managed by thoracotomy is 3.1% which is comparable with Atri M et al(14). **Comparing the results with above literature it was seen that , most commonly the patients of blunt trauma chest were managed by tube thoracostomy followed by conservative management. Thoracotomy was done in least number of cases but it was a major intervention to prevent imminent dreaded complications of severe blunt trauma chest.**

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(7), Syed Quibtiya Et Al (6), Shukla et al(11). The lesser average duration of hospital stay in the present study may be due to a greater number of patients detected with less severe blunt trauma chest leading to less hospital stay, early recovery and early discharge.

The importance of this discussion lies in its contribution to the understanding of blunt trauma chest in different age groups. By comparing the findings of this study with existing literature, the study provides valuable insights into the causes, clinical presentation, associated injuries, management approaches, and outcomes of blunt trauma chest. The article is to gain knowledge about the incidence, common age groups affected, presenting symptoms, signs, associated injuries, and management strategies related to blunt trauma chest. It is a comprehensive overview of blunt trauma chest, including its epidemiology, clinical features, associated injuries, and management options. Additionally, the discussion highlights the consistency of the study findings with previous research, which strengthens the validity and reliability of the results. The implications on further studies include the need for more research to explore the specific mechanisms and risk factors associated with different causes of blunt trauma chest. Further studies could investigate the long-term outcomes, complications, and prognostic factors related to this condition.

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. **Though thoracotomy was done in least number of cases but it was a major intervention to prevent imminent dreaded complications of severe blunt trauma chest. The average length of hospital stay for patients with blunt trauma chest was relatively short, with most patients being discharged within two weeks.**

6. LIMITATION

-Limitations of this study may include its single-center design, which could limit the generalizability of the findings.

-The study might also be prone to selection bias as it includes only patients who presented to the particular hospital.

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CONSENT- obtained from all subjects with maintained confidentiality.

ETHICAL APPROVAL: As per Institutional Ethical committee, Indira Gandhi government medical college Nagpur.

(Figure 1 and 2 mentioned in the materials and methods are taken from patients of our institution with their written and informed consent.)

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