

Clinical Study and Management of Hemothorax Following Blunt Thoracic Trauma in a Tertiary Care Hospital

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Abstract:

Background: Hemothorax is defined as a bleeding into the pleural cavity. Most of the hemothorax result from chest trauma. About 60% of polytraumas are associated with thoracic trauma and hemothorax is one of the most common pathologies encountered. There has been advances in critical care and trauma management, still chest trauma continues to be a major source of morbidity, mortality and hospitalization.

Aims and Objective: To determine proportion of hemothorax according to age, gender and mechanism of trauma and to assess the outcome, based on different modalities of treatment.

Materials and Methods: Hospital based observational study was conducted from 1st June 2019 to 31st May 2020 in AMCH, Dibrugarh. 97 patients of hemothorax following blunt thoracic trauma were evaluated during the study.

Results: male predominance was seen with 81.44% patients with male: female ratio of 4.39:1. Peak incidence was noted in the 20-29 years age group and the mean age was 40.34 ± 16.30 years. RTA was the most common modality of injury followed by fall from height, assault, occupational trauma and animal attack. Most of the patients presented to emergency department within 6 hours (63.92%) of sustaining trauma. Chest pain and difficulty in breathing were the most common presenting symptoms. In case of associated extra thoracic injury, common injuries were extremity fractures (27.84%) followed by head injury (18.56%), abdominal injury (11.34%) and pelvic injury (4.12%) respectively. 21.64% patients were managed conservatively with analgesics, chest physiotherapy, postural drainage, bronchodilators and close monitoring. 72.16% patients were treated with only tube thoracostomy drainage and 6.18% patients underwent thoracotomy.

Conclusion: Hemothorax following blunt thoracic trauma predominantly observed in young males and most commonly following RTA. Chest tenderness was the commonest clinical finding followed by tachypnea.

Key words: hemothorax, blunt thoracic trauma, tube thoracostomy

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I. Introduction

Hemothorax is defined as a bleeding into the pleural cavity. Most of the hemothorax result from chest trauma. About 60% of polytraumas are associated with thoracic trauma and hemothorax is one of the most common pathologies encountered. In a study conducted in 2018 it was observed that, among all trauma admissions, chest injuries were present in 30.9% of patients and out of which hemothorax was found in 51% patients.¹ In spite of the advanced critical care and trauma management, chest trauma continues to be a major source of morbidity, mortality and hospitalization. This was especially observed in young age group who are otherwise healthy.³

In the developed countries, chest injury alone is liable for 25% of trauma-related deaths. The mortality and morbidity of patients depends on many factors including severity of chest injury, condition of the underlying lungs, associated extra-thoracic injuries especially to head, abdomen and long bones.⁴

Traditionally, the initial management of hemothorax is drainage of collected blood by placement of tube thoracostomy. However, a number of potentially serious complications associated with the procedure have been documented.^{5,6,7}

Prior to the use of CT thorax, visualizing quantities of less than 1000 ml of blood on chest radiograph was a challenge. With the widespread adoption of CT 'pan-scanning', however, detection of significantly smaller volume of blood in the thoracic cavity have become possible. The clinical significance and optimal treatment of these small to moderate hemothorax remain unknown.⁸ The East American Association of Trauma guidelines suggest that all hemothorax should be considered for TT drainage.⁹

But, some retrospective studies suggest that many traumatic hemothorax can be managed expectantly without TT drainage.^{10,11,12} A prospective observational study also suggests that small to moderate hemothorax

(<300 cc of blood) can be absorbed without intervention.¹³ Similarly studies from the 1960s indicate that much larger quantities of blood get reabsorbed without intervention as well.¹⁴

According to the Advanced Trauma Life Support (ATLS) guidelines, 1500 ml of blood drainage after insertion of tube thoracostomy or >250 ml of blood drainage hourly for three consecutive hours after tube thoracostomy insertion for traumatic hemothorax are the criteria for urgent surgical exploration.

However, these criteria should be correlated with clinical status of the patient. Some of the patients may require thoracotomy in later steps for clotted hemothorax, fibrothorax and empyema.^{15,16}

Aims and Objective: To determine proportion of hemothorax according to age, gender and mechanism of trauma and to assess the outcome based on different modalities of treatment.

II. Material And Methods

Hospital based observational study was conducted from 1st June 2019 to 31st May 2020 in AMCH, Dibrugarh. 97 patients (>15 years) of hemothorax following blunt thoracic trauma were evaluated during the study.

Study design: Hospital based observational study

Place of study: Department of General surgery and Department of Cardiothoracic and vascular surgery, Assam Medical College and Hospital, Dibrugarh, Assam.

Study duration: One year (From 1st June 2019 to 31st May 2020).

Sample size : 97 patients.

Subjects and selection method : All patients with hemothorax following blunt thoracic trauma who fulfilled the criteria of inclusion and exclusion within the study period.

Inclusion criteria: All cases above 15 years admitted for hemothorax following blunt thoracic trauma.

Exclusion Criteria:-

- a) Patients with penetrating/open chest injury
- b) Patients with associated head injury and orthopaedic injuries needing surgical intervention
- c) Pediatric age group (15 years or below)
- d) Patients who declined informed consent
- e) Patients who did not complete their treatment in the hospital
- f) Patients with oesophageal and cervical injuries

Procedure and methodology

After written informed consent was obtained, Detailed History, General Examination, and Systemic Examination were done as per the pre-prepared proforma.

Required blood investigations and radiological investigations like Chest X-Ray, CT scan of Thorax done for diagnosis of Hemothorax following blunt trauma.

Initial resuscitation was done according to Advanced Trauma Life Support (ATLS) Protocol. During primary survey, the most immediate life-threatening injuries were identified and treated. Massive hemothorax is such an immediate life threatening injury and addressed during primary survey. After stabilisation of the patient definitive treatment was given. According to the collection of blood and clinical severity, patients were managed either conservatively or Tube Thoracostomy or Surgical Intervention.

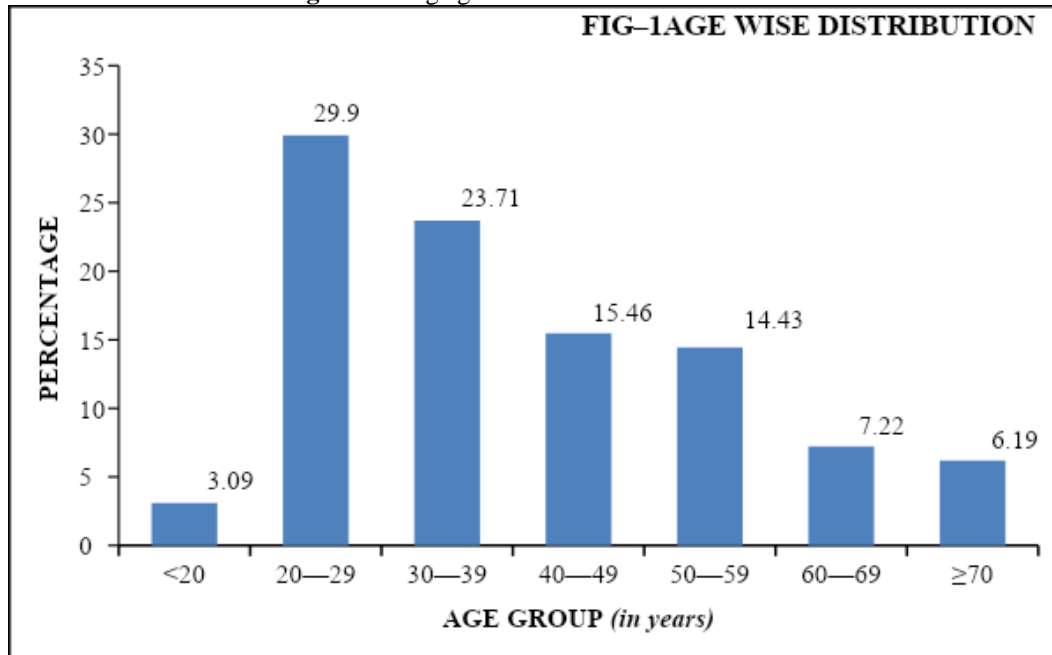
ETHICAL CLEARANCE: Ethical clearance has been obtained from the Institutional Ethics Committee (H) of Assam Medical College & Hospital.

STATISTICAL ANALYSIS

Quantitative data were presented in terms of mean \pm SD and qualitative /categorical data were presented in terms of frequency and percentages, pictorial presentations were made wherever found suitable. All the analysis were done using Microsoft EXCEL 2010.

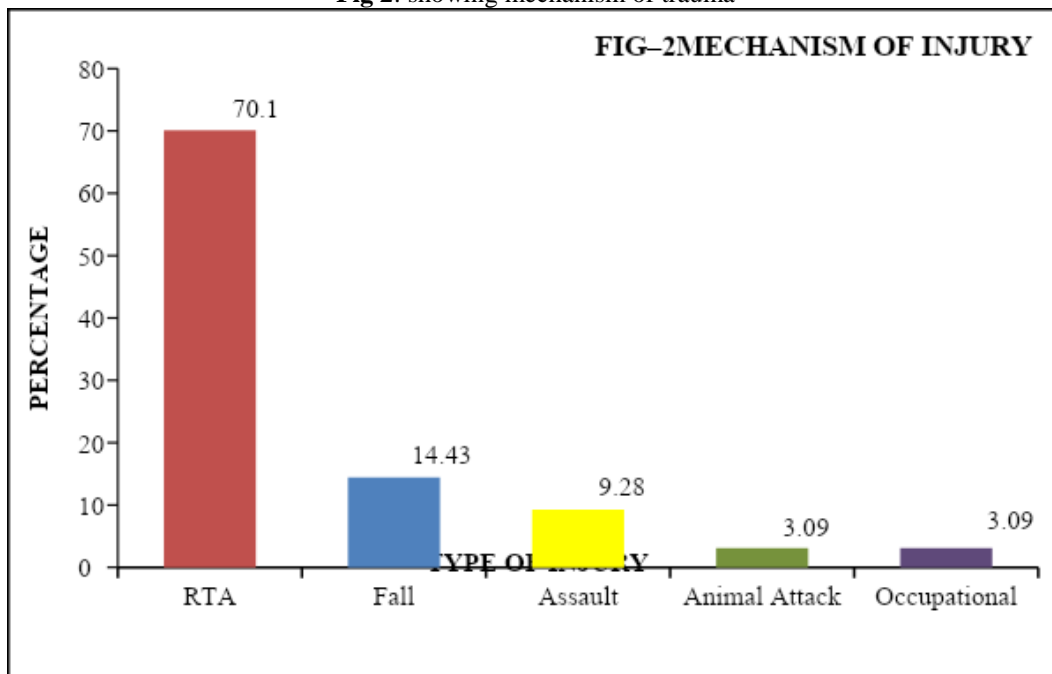
III. Results:

Fig:1 showing age wise distribution of hemothorax



Out of 97 patients 79(81.44%) were males while the rest 18(18.56%) were females. Thus, maximum hemothoraces following blunt thoracic trauma observed in males. We found mean age of 40.34 ± 16.30 years. Most of the cases were noted between the age group of 20-29 years(29.9%).

Fig 2: showing mechanism of trauma



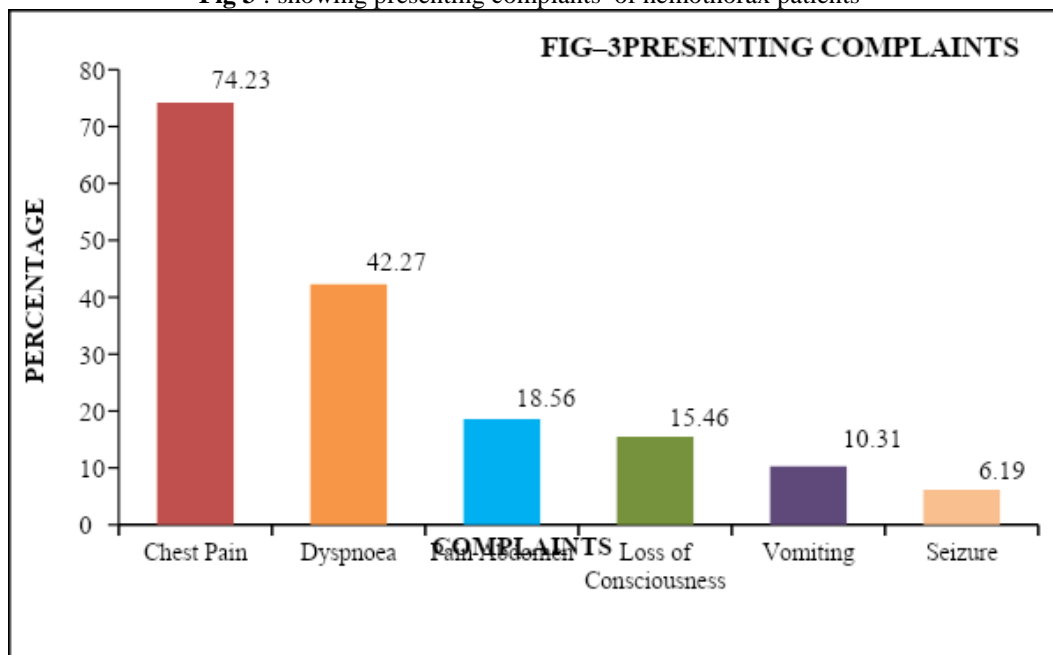
Out of 97 patients, 68 (70.10%) patients presented with RTA, 14 (14.43%) patients with fall from height, 9 (9.28%) patients with physical assault, 3 patients (3.1%) presented with animal attack and 3(3.1%) patients with sustained trauma due to occupational work (trauma by objects/machineries).

Table1: showing time interval between trauma and arrival at casualty

TIME INTERVAL (in hours)	NUMBER	PERCENTAGE
0—6	62	63.92
7—12	18	18.56
13—24	8	8.25
25—48	6	6.19
>48	3	3.09
TOTAL	97	100.00
Mean ± S.D.	9.36 ± 10.85 hours	

63.92% (62) patients reached emergency department within 6 hours of trauma, while 18.56% (18) reached within 7-12 hours. As a whole 90.72% (88) patients attended within 24 hours of trauma, whereas remaining 9.28% (9) patients attended after 24 hours of sustaining trauma.

Fig 3 : showing presenting complaints of hemothorax patients



Chest pain is the most common presenting symptom in 74.23% (72) of patients followed by dyspnea/difficulty in breathing in 42.27% (41) patients. Other symptoms due to associated polytrauma are pain abdomen (18.56%), LOC (15.46%), vomiting (10.31%) and seizure (6.19%).

Table 2: showing clinical findings

CLINICAL FINDINGS	NUMBER	PERCENTAGE
Tenderness	84	86.60
Tachypnea	41	42.27
Palpable Fracture	32	32.99
Bony Crepitus	27	27.84
Subcutaneous Emphysema	11	11.34
Tracheal Deviation	2	2.06
Paradoxical respiration	2	2.06

Most frequent sign was chest tenderness found in 86.6% (84) patients. Tachypnea was found in 42.27% (41) patients. Palpable rib fracture noticed in 32.99% (32) patients, while bony crepitus in 27.84% (27) and subcutaneous emphysema in 11.34% (11) of patients, while tracheal deviation were found in 2.06% (2) patients.

Fig 4 : showing associated thoracic injury

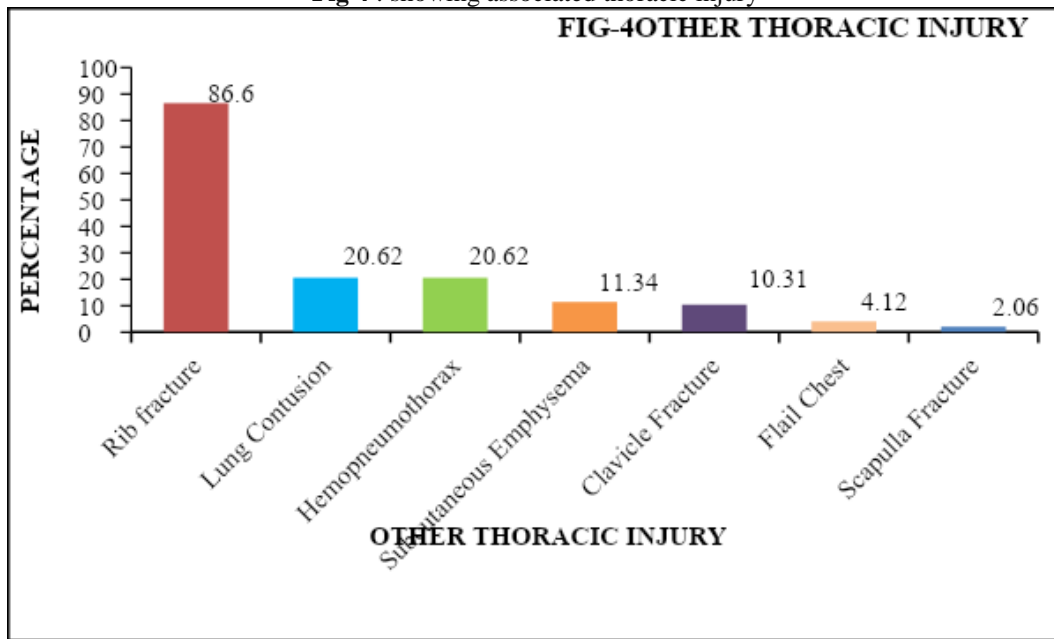
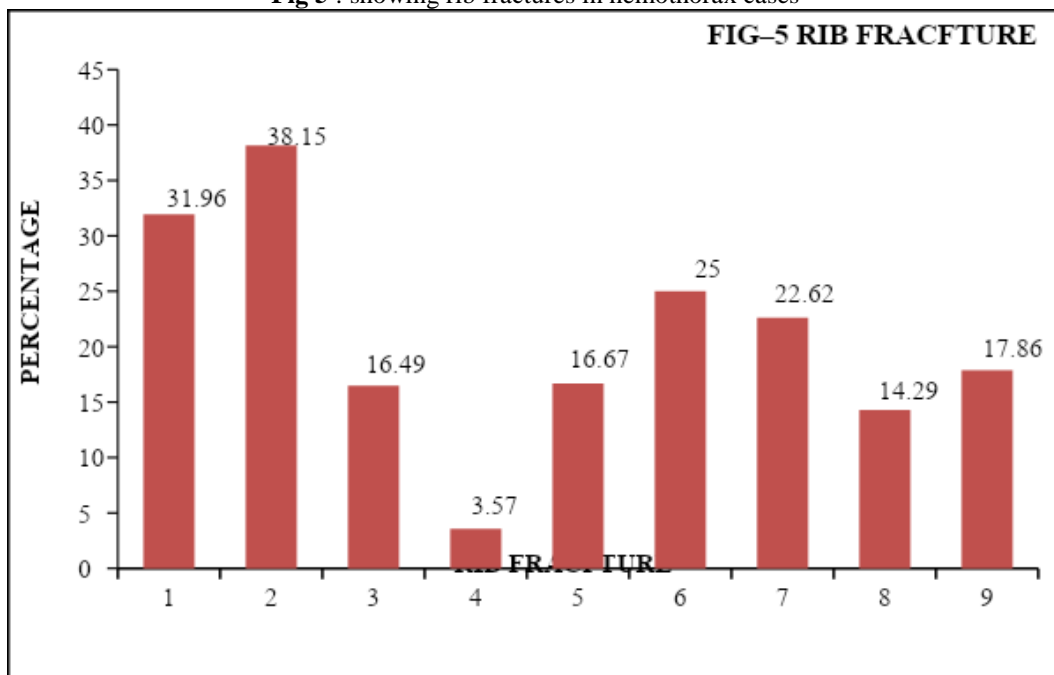


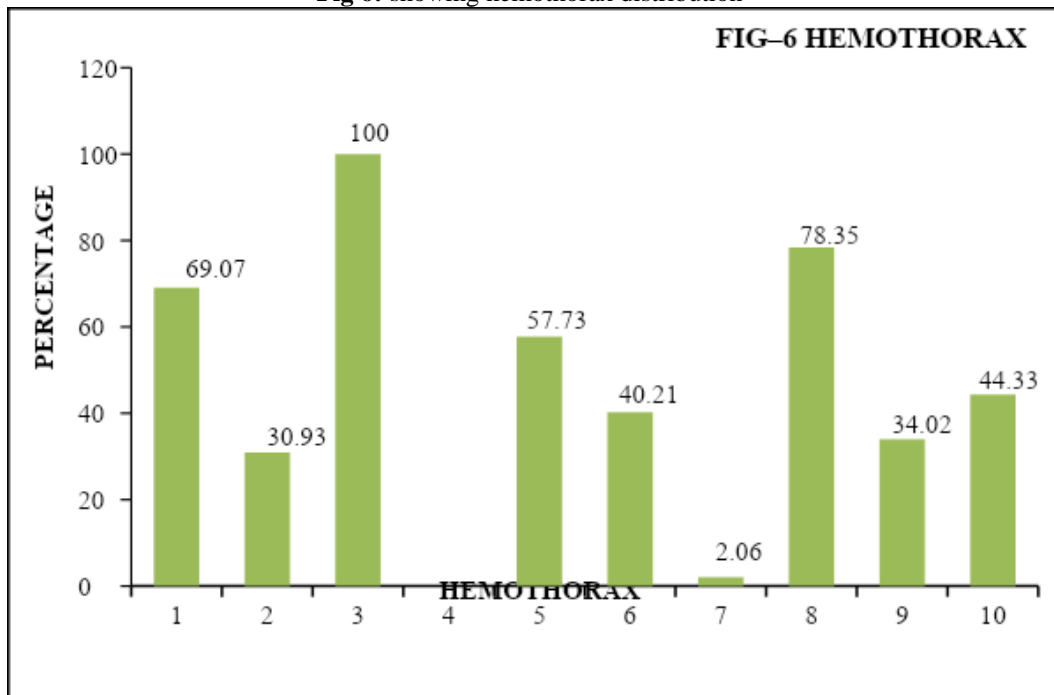
Fig 5 : showing rib fractures in hemothorax cases



Single rib fracture was found in 3 (three) patients and all are on right sided. 2 (two) ribs fracture were observed in 14 (fourteen) patients. 3 (Three) ribs fracture in 21 (twenty one) patients. 4 (four) ribs fracture were observed in 19 patients. 5 (five ribs) fracture were observed in 12 (twelve) patients and more than 5 (five) ribs fracture were observed in 15 (fifteen) patients.

The most common extrathoracic injury associated with chest trauma was extremity fractures seen in 27.84% (27) patients followed by head injury 18.56%, abdominal injury 11.34 %, faciomaxillary injury in 6.19% (n=6) and pelvic injury 4.12% respectively. As a whole, 42.27% (41) patients had associated injuries while 57.73% (56) patients had isolated thoracic injury.

Fig 6: showing hemothorax distribution



All the 97 cases of hemothorax were diagnosed by CT thorax. However, chest x ray could diagnose only 69.07%. Unilateral hemothorax was observed in 76 patients (78.35%), right sided hemothorax in 33 (34.02%) patients and leftsided hemothorax in 43 (44.33%) patients, while bilateral hemothorax was observed in only 21(21.64%) patients. Mild hemothorax was observed in 57.73% (56) cases, moderate hemothorax in 40.21% (39) cases and only in 2 (2.06%) cases massive hemothorax was found

TABLE-3
TREATMENT

TREATMENT	NUMBER	PERCENTAGE
Conservative	21	21.65
Only Tube Thoracostomy	70	72.16
Thoracotomy	6	6.18
TOTAL	97	100.00

Fig 7: showing tube thoracostomy drainage

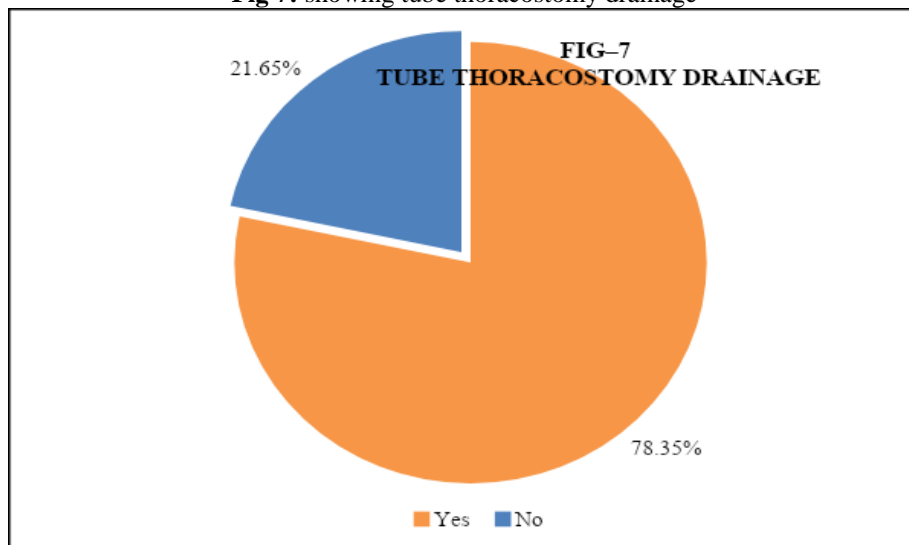
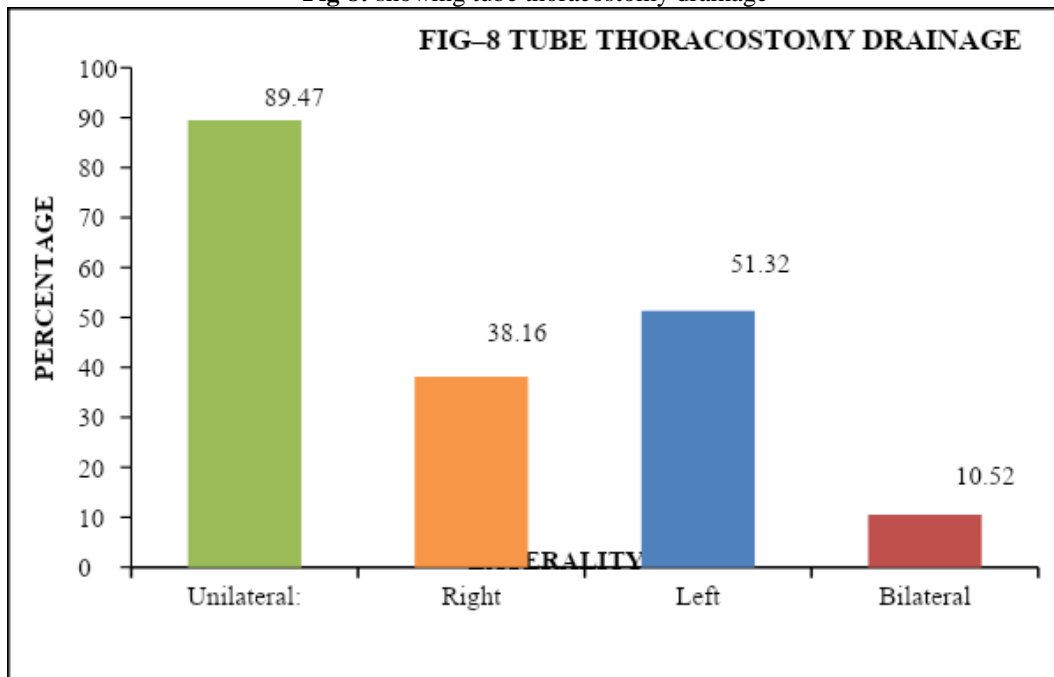


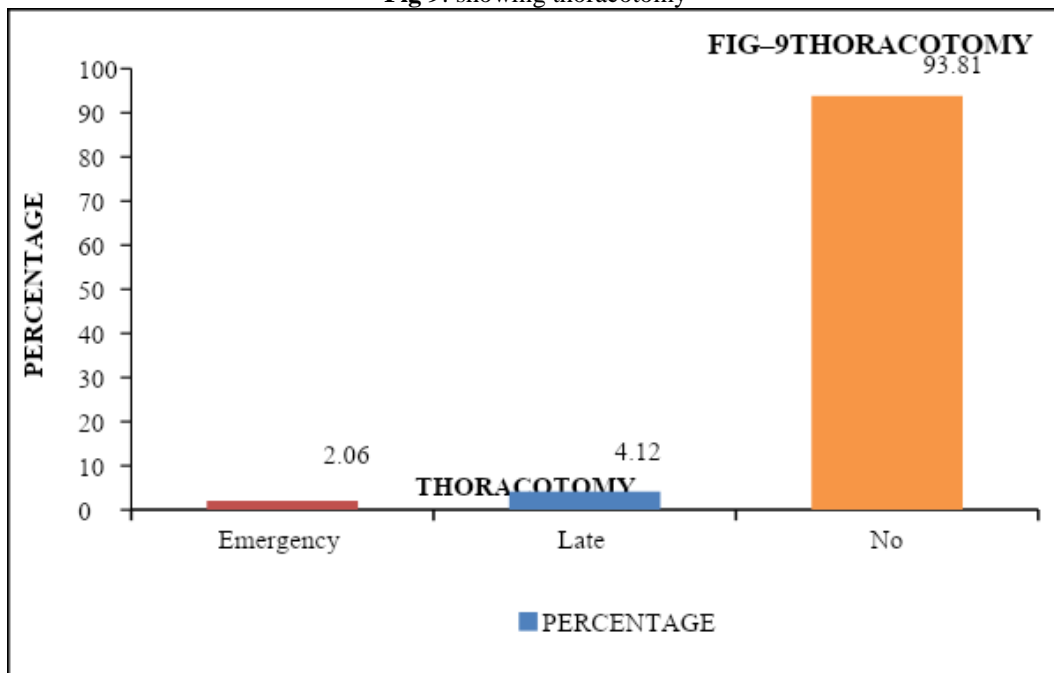
Fig 8: showing tube thoracostomy drainage



The study population consists of a total of 97 patients, out of which 21(21.64%) patients are managed conservatively with analgesics, chest physiotherapy, postural drainage, bronchodilators and close monitoring. However initially 27(27.83%) patients were started with conservative management and out of them 6 patients did not respond and underwent tube thoracostomy. Tube thoracostomy was performed in 76 patients. Out of which

70 patients (72.16%) were treated with only tube thoracostomy drainage. But total 76 patients (78.35%) needed tube thoracostomy, out of these 76 patients 68 (89.47%) required U/L tube thoracostomy and 8 (10.52%) patients required B/L tube thoracostomy. Emergency thoracotomy was required in 2 patients for massive hemorrhage, while late thoracotomy was carried out in 4 patients for empyema and retained or clotted hemothorax. All thoracotomy patients were initially treated with tube thoracostomy. In present study, mean duration of thoracostomy drainage was observed as 7.83 ± 2.54 days.

Fig 9: showing thoracotomy



Total 6 patients (6.18%) underwent thoracotomy. Only 2 patients required emergency thoracotomy due to massive bleeding.

Late thoracotomy was required in 4 patients. Out of which, 2 (2.06%) patient underwent late thoracotomy for residual hemothorax, while 2 (2.06%) patients underwent thoracotomy for empyema thoracis.

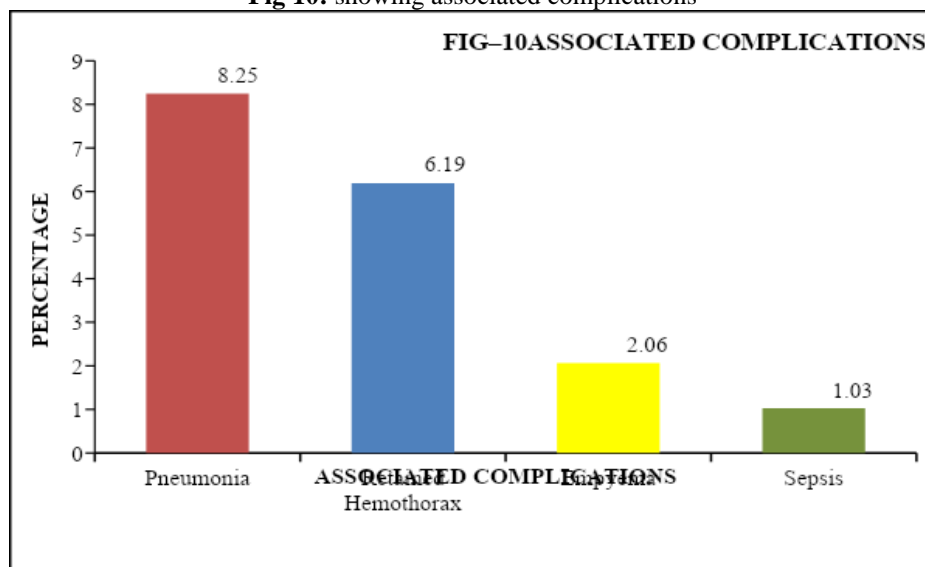
The patients with associated injuries were managed conservatively (patients with associated head injury and orthopedic injuries requiring surgical intervention were not considered as per exclusion criteria).

In the present study, out of 97 patients, 2 patients expired. Mortality being 2.06%.

Invasive ventilation was required in (n=7.21%) patients of hemothorax. Mean ventilator duration was 4 ± 1.85 days.

Overall mean hospital stay was found to be 10.58 ± 4.78 days.

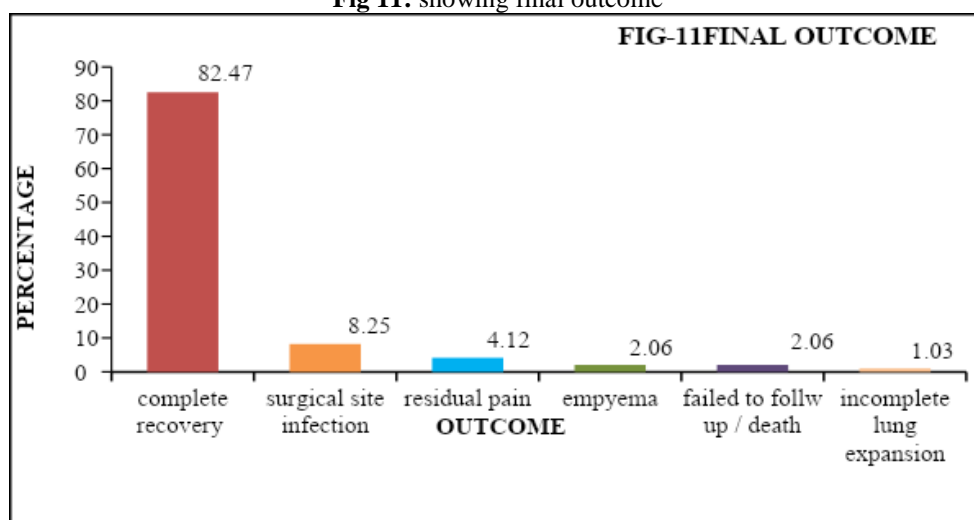
Fig 10: showing associated complications



17 patients (17.52%) out of 97 presented with complication in the present study. 8 (8.25%) patients developed pneumonia and treated conservatively with antibiotics. 6 (6.19%) patients had retained hemothorax and 2 out of them underwent late thoracotomy and evacuation of clot. 2 (2.06%) patients developed empyema thoracis. They were treated with open thoracotomy and decortications of pleura with drainage of pus. 1 (1.03%) patient who developed sepsis and ARDS expired.

In this study, total 76 patients needed tube thoracostomy, out of them 14 (18.42%) developed thoracostomy related complications. We observed surgical site infection in 8 patients, tube dislodgement in 3 cases, non functioning tube in 2 cases, subcutaneous emphysema in 1 case.

Fig 11: showing final outcome



The follow up period in this study was 1 week, 1 month and 3 months following discharge.

Out of 97 patients, 80 (82.47%) had complete recovery while 8 (8.25%) patients had surgical site infection, 4 (4.12%) patients had residual pain, 2 patients had empyema, 1 patient had incomplete lung expansion and 2 patients failed to follow up (expired).

IV. Discussion:

The study population included patients from >15 years of age with a mean age of 40.34±16.30 years. Peak incidence of hemothorax following blunt thoracic injury was noted in the age group of 20-29 years (29.90%). This shows that hemothorax following blunt thoracic trauma is most common in young adults in their most productive years of life. In a study conducted in 2015 found that 24% of patients who sustained chest trauma had hemothorax.¹⁷ Similarly in 2016 it was found that the mean age of blunt chest trauma patients was 33 ± 15 years. Males constituted 81.44% and females constituted 18.56% of patients. So male predominance was seen. Similarly **Chrysou K et al (2017)** in their study noted 74.5% male cases.¹⁸

In the present study, RTA (70.10%) was the most common mode of injury followed by fall from height (14.43%). **Sharma P et al (2016)** also found that road traffic accidents were the most common reason for blunt chest injuries (79.72%) followed by fall from height (11.50%) and assault (6.43%).²

In our study 63.92% patients reached emergency department within 6 hours of trauma, while 18.56% reached within 7-12 hours. As a whole 90.73% patients attended within 24 hours of trauma. **Narayanan R et al (2018)** found Only 10% patients were brought within the Golden Hour and majority reached within 6 h of injury.¹

Chest pain was the most common presenting symptom in 74.23% of patients followed by dyspnea/difficulty in breathing in 41.24% patients. Most frequent sign was chest tenderness found in 86.60% (84) patients. Tachypnea was found in 40.21% (39) patients. **Narayanan R et al (2018)** found that at presentation, chest compression test (CCT) tenderness was found to be positive in 67.25% patients and chest tenderness in 67.25%.¹

In the present study, 42.27% patients had associated injuries while 57.73% patients had isolated thoracic injury. The most common injury associated with chest trauma noticed was extremity fracture in 27.84% patients followed by head injury (craniocerebral injury) in 18.56%. Similarly **Chrysou K et al (2017)** found the most common associated injury was extremity fractures in patients with chest trauma.¹⁸

27 (27.83%) patients were treated with conservative management comprising of analgesics, chest physiotherapy, postural drainage, bronchodilators, close monitoring and repeated chest radiographs. Out of them 21 patients improved satisfactorily without further intervention, 6 patients did not respond and underwent tube thoracostomy. Four of them developed respiratory distress and all of them showed further increase in the volume of blood collected in the pleural space. **Wells BJ et al (2015)** stated that 66% hemothorax were drained while 34% were managed expectantly. They concluded that expectant management of minimal traumatic hemothorax may be safe and had advantages like shorter hospital stay, no empyemas, and no increase in mortality.¹⁹

In the present study 70 patients (72.16%) were treated with only tube thoracostomy drainage. However total (including thoracotomy patients) 76 patients (78.35%) required tube thoracostomy. Out of which 68 (70.10%) patients required U/L tube thoracostomy and 8 (8.24%) patients required B/L tube thoracostomy. All the patients of hemothorax associated with pneumothorax needed tube thoracostomy. In a study by **Narayanan R et al (2018)**, 87% percent of patients with hemothorax required ICD insertion.¹ **Chrysou K et al (2017)** showed that chest tube insertion was indicated in 54.5% patients with hemo/pneumothorax.¹⁸

In our study we used 28F chest tube for drainage of hemothorax. According to two studies conducted by **Khandhar SJ et al** and **Broderick SR et al** most of the hemothorax can be managed with at least 28F thoracostomy tube.^{10,20}

In the present study, mean duration of thoracostomy drainage was observed as 7.83 ± 2.54 days. Similarly **Narayanan R et al (2018)** found the mean duration of ICD was 6.94 ± 4.21 days with a median of 6 days (range 1–32 days).¹

In our study chest tube was removed when there was less than 50 ml of non-infected fluid output in 24 hours, no air leak, patient was clinically stable and not in distress with normal respiratory parameters.

Among tube thoracostomy patients, 18.42% developed thoracostomy related complications. Similarly **Vilki VA et al (2019)** in their study on complications related to tube thoracostomy found that 19.9% patients had complications.²¹

Overall thoracotomy was done in 6 (6.18%) patients.

In the present study emergency thoracotomy (planned) was done in 2 (2.06%) patients with massive hemothorax and the bleeding was found to be due to rupture of intercostal artery.

In the present study late thoracotomy was required in 4 (4.12%) cases, of which thoracotomy was done in 2 (2.06%) patients for retained hemothorax and in another 2 (2.06%) patients for empyema thoracis. Clot

evacuation was done in retained hemothorax while decortication was done in empyema thoracis.

Similarly **Sharma P et al (2018)** showed that open thoracotomy was done in 3.18% while VATS was done in 1.6% patients.²² **Shah JV et al (2015)** stated that only 4% patient underwent thoracotomy.¹⁷

17 patients (17.52%) out of 97 presented with complication in the present study. 8 patients developed pneumonia and was treated conservatively with antibiotics. 6 patients had retained hemothorax and 2 out of them underwent late thoracotomy and evacuation of clot. 2 patients developed empyema thoracis. They were treated with open thoracotomy and decortications of pleura with drainage of pus. 1 patient who developed sepsis and ARDS expired.

In the present study mortality was observed in 2.06% (n=2) patients. In the study of **Hanafi M et al (2015)** of blunt chest trauma over all mortality was 1%.²³

Overall mean hospital stay was found to be 10.58 ± 4.78 days. Similarly **Narayanan R et al (2018)** found the mean hospital stay was 10.09 ± 8.18 days with a median of 8 days (range 0 to 68 days).¹

The follow up period in this study was 1 week, 1 month and 3 month following discharge. They were examined clinically and radiologically.

The patients which were managed conservatively, hemothorax was found to resolved completely during follow up in third month.

Out of 97 patients, 80(82.47%) had complete recovery while 8 (8.25%) patients had surgical site infection, 4(4.12%) patients had residual pain, 2 patients had empyema, 1 patient had incomplete lung expansion and 2 patient failed to follow up (expired).

Limitations of the study:-

a. The study included patients above 15 years of age

b. Patients with associated head injury and orthopaedic injuries needing surgical intervention are excluded from the study

V. Conclusion:-

Hemothorax following blunt thoracic trauma was predominantly observed in young males and most commonly following RTA. Selected cases of clinically stable minimal hemothorax can be managed conservatively with supportive treatment and close observation. Majority of the cases of hemothorax can be managed with tube thoracostomy drainage and only a minority of cases need emergency thoracotomy and late thoracotomy.

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