Section: Cardiothoracic & Vascular Surgery

Original Research Article

AN INSIGHT INTO DEMOGRAPHICS, MECHANISMS, TRAUMA SCORES & MANAGEMENT MODALITIES OF BLUNT THORACIC TRAUMA: STUDY FROM UPPER ASSAM

Ratnesh Kumar[1], Arpita Saxena[2]

[1]Assistnat Professor, Department of Cardiothoracic & Vascular Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India.
[2]Assistant Professor, Department of Biochemistry, Peoples College of Medical Sciences and Research Centre, India.

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Corresponding Author:
Dr. Ratnesh Kumar
Email: dr.ratneshkumar@gmail.com

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Abstract

Background: To study the mechanisms, emergency department presentation, symptoms and signs, associated injuries and their severity grading, treatment modality adopted for surgical management of thoracic trauma, length of hospital stay, prognosis (short term) of patients admitted with blunt thoracic trauma **Materials and Methods:** We prospectively observed all admitted patients with blunt thoracic trauma from June 2015 – May 2016. ISS (injury severity score) and RTS (revised trauma score) and AIS-90 (Abbreviated Injury Score) were obtained for rib fractures subgroups. **Result:** Total 86 patients enrolled. Most of the patients were males (89.5%) with the peak incidence in the fourth decade of lives, most common mechanism being RTA. Chest pain (69.8%) and tenderness (83.7%) were frequent. Majority (n=43, 50%) had > 3 rib fractures. Maxillofacial (n=13, 15%), intrathoracic soft tissue injuries observed mostly with > 3 ribs fracture. Mostly associated injuries were skin structure (n=20, 22%) followed by faciomaxillary (n=15, 17.4%), craniocerebral (n=13, 15.2%). Mortality is significantly ($p<.05$) associated with severe head injury, flail chest, B/L hemopneumothorax with pneumomediastinum, ISS>16, low RTS≤5.23. Mean ISS for flail chest and >3 rib fracture are respectively 22±6.5 and 17±5. Overall complication rate is 12.7%. **Conclusion:** RTA is most common cause of injury with age group 40 – 50 years most vulnerable. The majority can be managed by simple intervention i.e. Intercostal water seal drainage (ICWSD). Thoracotomy in our series was required for empyema, and fibrothorax. Risk of mortality, length of hospital stay, injuries to other organ systems is attributable to rib fracture > 3 ($p<.05$) suggesting severe traumatic force.

INTRODUCTION

Trauma or injury has been defined as damage to the body caused by environmental energy that is beyond the body's capacity to cope.[1] Injuries are fourth most common cause of mortality in western literature. It is responsible for sizable mortality among young adults ages 1–34.[2] The World Report on Road Traffic Injury Prevention indicates that by 2020, RTI will be number one killer causing 5 lakhs deaths and 150 lakhs Disability Adjusted Life Years lost.[3,4,5] Terming RTA an "epidemic" that will become the world's fifth major cause of mortality by 2030, the report declares that high income economies have been successful in reducing deaths in stark contrast with third world economies where its menance is rising.[6] The goal of the United Nations Decade of Action for Road Safety 2011-2020 is to save 50 lakhs lives.[7]. The incidence of blunt thoracic trauma related deaths in India is much higher than its western counterparts.[8]

Aim and objective

To study the mechanisms, emergency department presentation, symptoms and signs, associated injuries and their severity grading, treatment modality adopted for surgical management of thoracic trauma, length of hospital stay, prognosis (short term) of patients admitted with blunt thoracic trauma.

MATERIALS AND METHODS

We carried out a prospective descriptive study to assess the clinical spectrum of thoracic injuries on admitted patients(n=86) in department of surgery presenting with blunt trauma chest.

Sample Size Justification

We included all patients being admitted in the department of general surgery under cardiothoracic & Vascular Surgery of Assam Medical & Hospital after applying inclusion and exclusion criteria over a period of one year. (June 2019-May 2020)

Consent

The consent was obtained from Institutes Ethics Committee.

Patient Selection

All the admitted patients with age > 12 years with signs and symptoms of blunt thoracic trauma were included for the study. Exclusion criteria being patients who did not complete their treatment in the hospital/ Isolated laryngeal or cervical injuries/ esophageal and tracheal injuries due to foreign body swallowing or aspiration/ penetrating injuries to the thorax/burn/electric shock injuries.

End Points

The primary endpoint was death from any cause/ discharge from hospital after cure and secondary end point were 30-day all-cause mortality.

Statistical Methods

The numeric data were summarised by descriptive statistics like N, mean, standard deviation, median, minimum and maximum. For statistical significance of numeric data, t tests were used. The categorical data were summarised by frequency count and significance was analysed using chi-square/fisher exact test. A value of $p < 0.05$ was considered significant. Data was recorded on Microsoft excel and further tabulated and analysed using SPSS Statistics for Windows, version 16.0 (SPSS Inc., Chicago, Ill., USA).

RESULTS

Among all admissions, 86 patients were enrolled for the study. Mechanism of injury were- Road traffic accident 57%(n=49) accounted followed by fall 34.9%(n=30), physical assault were 7.0%(n=6), occupational injury were 1.2%(n=1). The most common findings on clinical examination were unilateral chest tenderness (83.7%). Patients suffering from hemothorax (with no pneumo component) (/ and pulmonary contusion) were 44.1%(n=38). Hemopneumothorax (/ and pulmonary contusion) was observed in 28/86 i.e. 32.5% patients. Pneumothorax (with no hemothorax) (/ and pulmonary contusion) was found in 7/86 i.e. 8.1% patients. Lung contusion was found in 24/86 i.e.27.9% patients .

For purposes of analysis and objective assessment patients were divided into 6 groups on basis of no. of ribs fractured: Group I- 0 rib fracture were 18.6% (n=16), Group II- only 1 rib fractured were 5.8% (n=5), Group III- 2 ribs fractured were 9.3% (n=8), Group IV- 3 ribs fractured were 10.5% (n=9), Group V- >3 ribs fractured were 50.0% (n=43), and Group VI- Flail Chest were 5.8%(n=5). Bilateral rib fractures were found in 32.5% (n=28) patients. In patients with rib fractures > 3 and flail chest, significant hemopneumothorax were observed. Unilateral and bilateral isolated hemothorax is significantly ($p<.05$) associated with rib fractures > 3. Unilateral Lung contusion is significantly ($p<.05$) observed in rib fractures >3.

37.2 % (n=32) patients were managed conservatively only with analgesics, physiotherapy, and tracheobronchial secretions drainage by postural therapy, bronchodilators.

55.8 %(n=48) patients required unilateral intercoastal water seal drainage (ICWSD) while 6.9 % (n=6) patients required bilateral ICWSD. None of the patients required early thoracotomy. However late thoracotomy was required in 8.1% (n=7).

The maximum AIS for head and neck observed in present study is 4/6 in 1.1% (n=1) while most of the injuries noted were 3/6 10.4% (n=9) [Table 1].

Table 1: Mean AIS-90 scores were calculated taking into account individual system specific injuries and mean calculated in patients having particular system specific injuries

Associated injuries	No. of patients	Mean AIS-90 scores
Craniocerberal Trauma	13	2.9
Faciomaxillary injury	15	2.3
Pelvic & skeletal injury	8	3.38
Clavicle injury	10	Not Applicable
Skin structure injury	20	1.95
Abdominal injury	7	2.57
Diaphragmatic injury	2	Not Applicable

The mean ISS for flail chest is 22±6.5 (significant, $p<.05$) while that for more than 3 rib fracture group it is 17±5.4(significant, $p<.05$) while for the rest of the rib fractures group ISS is not significantly different than with patients of zero rib fracture subgroup of blunt thoracic trauma [Table 2].

Table 2: Injury Severity Scores (ISS) among rib fracture groups

Rib fracture	Mean ISS values	No.of cases	Standard Deviation	p value
zero	13.87	16	10.07	>.05
1 rib #	13.60	5	4.77	>.05
2 rib #	15.50	8	13.58	>.05
3 rib #	13.77	9	3.59	>.05
>3 rib #	17.02	43	5.43	<.05*

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flail chest	22.20	5	6.53	<.05*
total	16.05	86	7.51	<.05*

#- fracture
*- significant

Mean RTS observed in present study is 7.64 with SD ± 0.56. In maximum numbers of patients 93%(n=80) have RTS of 7.84. While most of the patients belonging to >3 rib fractures have RTS of 7.84, 6.9%(n=6) patients have RTS of 7.85. Mortality rate is 3.4%(n=3) [Table 3]. Mortality in present series is 3.5% (n=3). In all deaths mechanism of injury is RTA with patients having high velocity and severe thoracic or craniocerebral truma

Table 3: Tabulation of Revised Trauma Score (RTS) frequency among Rib fracture groups

	RTS values									
Rib# groups	5.03	5.23	5.96	6.81	6.9	7	7.1	7.55	7.84	7.85
None	1	0	1	0	0	0	1	0	13	0
1 rib#	0	0	0	0	0	0	0	0	4	1
2 rib#	0	1	0	0	0	0	0	0	5	2
3 rib #	0	0	0	0	0	0	0	1	7	1
>3 rib#	0	0	0	1	1	1	3	2	29	6
flail chest	0	1	0	0	0	0	0	1	3	0

#: fracture

Invasive ventilation was required in 4.8% (n=4) patients of flail chest while non-invasive ventilator support in form of CPAP was required in 10.5% (n=9) patients. Complication rate is 14% (n=12). Empyema was found in 4.6% (n=4) of chest injuries with hemothorax, who underwent thoracotomy. Superficial wound infection at site of ICWSD insertion was found in 5.90% (n=5) patients. While 2.36% (n=2) patients had incomplete lung expansion with collapse of underlying basal segment of lung with crowding of ribs underwent thoracotomy with decortication of pleura. Only 1.15% (n=1) patient presented with retained hemothorax. The mean hospital stay is 13.5±7 days. The discharged patients were followed up during the one-year study period ranging from one month – 11 months. 86%(n=74) patients came for follow up out of which 62.7% (n=54) had complete recovery while 6.9%(n=6) patients had persistent chest pain, 3.4%(n=3) had cough, 6.1%(n=5) had skin infection at ICWSD insertion site while 2.3%(n=2) had incomplete lung expansion with basal atelectasis, 4.6%(n=4) developed thoracic empyema. 9.2 %(n=8) were lost to follow up as patients did not visit outpatient department on scheduled days and/ could not be followed up

DISCUSSION

The most common mechanism of injury is Road Traffic Accident (RTA) (57%) followed by fall (34.9%), physical assault (7.0) & occupational injury (1.2%). Srimali M et al (2003) also reported similar findings as RTA (60.2%), fall (22.2%) & physical assault (9.8%).[19] However in war striven Syria, Al–Koudmani (2012) reports most common MOI as physical assault (41%), followed by RTA (33%).[21] The 39 patients admitted with hemothorax: 23 were managed with U/L ICWSD, 3 with B/L ICWSD while 13 patients who had minimal hemothorax were managed without ICWSD. 32/86 i.e. 37.2% patients were managed conservatively with analgesics, physiotherapy, postural drainage, and bronchodilators while 20% were managed conservatively by Sharma PP et al (2016).[20] Trupka et al (1998).[23] observed similarly that most of the isolated thoracic injuries can be adequately treated by conservative means i.e. adequate analgesia, drainage of intrapleural air or blood, physiotherapy and clearance of bronchial secretions. Operative intervention is rarely indicated. Maloney (1961) proposed "wait and watch" policy for patients with minimal hemothorax as it gets resorbed and needs no further surgical intervention.[24]. In another study by Trupka et al 41% of thoracic injuries were managed by ICWSD.[25] Adegboyeas et al (2002) found requirement of ICWSD placements in 72.9% of patients.[26] Following removal of ICWSD, residual intrapleural collections were found in 6.9% (n=6) patients. Minimal collections responded to conservative approach while thoracotomy was needed in 2.4% (n=2) patients. None of the patients in present study developed persistent air leak or pneumothorax following removal of ICWSD. Types of analgesia used for adequate pain relief are NSAIDS in 69.8. The available evidence for patients with three or more rib fractures suggests that epidural analgesia provides more effective pain relief in comparison with other analgesic modalities, and it is most applicable to patients with functional respiratory compromise secondary to pain.[27] Thoracotomy is of two types: early or late. Early thoracotomy as advocated by Demetriades et al (1986) is required in cardiac arrest, persistent shock, tracheobronchial, and esophageal injury in setting of blunt thoracic trauma.[28] In the present study, none of the patients required emergency or urgent resuscitative thoracotomy or early planned thoracotomy. thoracotomy (late) was required only in 6.9% (n=6) of patients for empyema, ,retained

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hemothorax and atelectasis/trapped lung. Samson & Burford recommended thoracotomy and decortication in post-traumatic empyema in presence of more than 25% lung compression.[29] Canserver L et al (2005).[31] was of opinion that the decision of exploration or conservative treatment rests on patient's clinical status after removal of chest tube. 2.3% (n=2) of patients underwent thoracotomy for incomplete lung expansion. These patients presented at about end of 1 month on follow up with complaints of cough. On Chest Xray and CECT Scan (Thorax) basal atelectasis with pleural thickening were present which were managed with late thoracotomy. Similarly, Kulshrestha et al.[27] reported 6.4% of patients to have required late thoracotomy.[32] Associated head injuries were noted in 11.5% while Al Koudmani et al (2012) reported associated head injury as 8.4%.[21] Naclerio et al (1969) stressed that combined thoracic and head injured patients should be closely monitored for signs of raised ICT and should be taken up for decopmressive craniotomy based on the intracranial pathology.[33] The maximum score noted for faciomaxillary trauma is 3/6 in 7 patients (8.1%) while scores of 2/6 is found in 6 patients (6.9%) who had >3 rib fractures. All required maxillofacial fixations. Faced with facial injuries Emil a Naclerio (1971) opined that it is dangerous only if complicated by profuse bleeding or airway obstruction [33]. Intra group variations of ISS SCORE among fracture groups with 0,1,2,3 number of rib fractures are not significant (ANOVA p =.236 i.e. p>.05). These results are in accordance with the finding of Liman ST et al (2003) who found that mortality rate increases with increasing ISS and an ISS of 16 or more has been found in major trauma.[34] Similarly, Mayberry et al (1997) found that hospital rates for mortality for isolated chest injuries was 4 to 8% which increased to 13 to 15% when another organ system was involved and 30-35% when more than 1 organ was involved.[35] There is a strong correlation between RTS and mortality. (0.580 Pearson's two tailed test (p<.01) at 99% Confidence interval). This indicates as the grade of physiological injury scale increases the probability of mortality increases. This is in accordance with findings of Watts FH. (2012) who found RTS had strong correlation with mortality.[36] The correlation between RTS and number of ribs fractured is though positive but very weak which signifies that other factors play role i.e. physiological state of patient, presence of hemopneumothorax and associated head injury. But again while comparing > 3 ribs fractures, a significant correlation is found with RTS scores than with rib fractures ≤ 3. Essentially high scores of ISS and low scores of RTS are significant predictors of mortality. Similarly, Watts HF et al (2012) reported ISS and RTS were better predictors of mortality and correlate with each other.[36] Complication rate in present study was observed in 14% which is quite lower than complication rate of 38% as reported by Shorr RM et al in 1987. [37]

CONCLUSION

Since RTA accounted for majority of thoracic trauma in present study, traffic controls and security belt use should be strictly obeyed. Commonly affected are males of productive age.

The ability to identify high risk cases quite early in Emergency Department based on history regarding mechanisms of injury, past medical history, meticulous clinical examination, prompt radiological assessment, ICWSD in emergency department if urgent and in CTVS OT if non urgent, nonoverzealous thoracotomies and intensive ICU care with ventilatory support as means of internal fixation particularly in flail chest when required, ensures efficient management of blunt thoracic injuries.

Limitation

The study was limited by exclusion of penetrating injuries to chest which involves laceration of tracheobronchial tree, heart, great vessels and more emergent kind of presentations.

Declaration

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Conflicts of interest/Competing interests: none of the authors have any conflict of interests.

Ethics approval

approved by institutional ethical committee with clearance number-AMC/EC/PG1799

Consent to participate

Consent from patients were taken on patient information sheet(PIS) and patient informed consent sheet(PICS) in English and vernacular language (Assamese) Consent for publication: Patients were explained that their participation and publication of study may contribute to the advancement of the knowledge about blunt chest injury regarding recovery, management, updating guidelines for such patients, in India which may translate into management strategies conforming to Indian needs which might have a positive implication on overall health status of patients. Availability of data and material all the data and material is maintained in SPSS Statistics for Windows, version 16.0 (SPSS Inc., Chicago, Ill., USA)

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