

Original Research Article

Prospective study on incidence of adult respiratory distress syndrome in blunt injury chest

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ABSTRACT

Background: This study was done to find out prospectively the incidence of adult respiratory distress syndrome (ARDS) in a random group of patients sustaining blunt trauma to the chest of any etiology and to study the factors involved in its causation and outcome.

Methods: Totally 150 patients who admitted in surgical wards and casualty of Stanley Medical College, Tamil Nadu during the period of March 2021 to February 2022 were studied. A thorough clinical examination of the patient was then done to identify any injury to the organs in the chest. This was then followed by investigations if the patient was stable enough not to warrant any emergency surgical intervention and data were collected outcomes were studied.

Results: Out of 150 patients, 74 of them had road traffic accidents, 39 of them had history of assault, 32 of them had fall from height regarding clinical manifestations 34 of them had dyspnea, 58 of them had single rib fracture, 48 of them had multiple rib fractures, 32 of them had pneumothorax, 19 of them had hemothorax, 8 of them had hemopneumothorax, 34 of them had flail chest, 20 of them had lung contusion 2 of them had diaphragmatic injury. In view of outcome, out of 150 patients, one of them had ARDS, 47 of them had thoracostomy, two of them had mechanical ventilation, one of them had laparotomy and seven of them died.

Conclusions: According to this study, the incidence of ARDS in blunt injury of chest was <1% in this study. Road traffic accidents have been the most common reason for blunt injury of chest.

Keywords: ARDS, Blunt trauma, Hemopneumothorax, Mechanical ventilation

INTRODUCTION

The most common cause of mortality after non-communicable diseases is trauma.¹ Especially, the incidence of deaths from trauma is higher in the early decades of life.² Trauma can occur to any part of the body but thoracic injuries and related complications contribute to around 25% of all trauma-related mortality.³ The increase in speed of transport and advanced industrialization, there is a substantial increase in the number of accidents related to chest especially in the context of poly trauma. In poly trauma, thoracic injuries are found in 60% of the subjects with a mortality rate up to 25%.⁴⁻⁶

The trauma to the chest can be penetrating or blunt. The challenging one is the blunt injuries that have lot of diagnostic confusion. The need for timely intervention precedes the actual diagnosis or therapeutic management. Also, the lack of breach in the tissue integrity in blunt injuries keeps a surgeon blind to the underlying injuries. The most injury to the chest is blunt injury (70%). Most of the cases are due to road traffic accidents, fall from height or occupational injuries.⁷⁻⁹ Blunt injuries to the thoracic wall constitute around 15% of global incidence of trauma.^{10,11}

The exact correlation of mortality rate with chest trauma is hard to evaluate due to the overlapping complications, associated injuries and other factors like access to first

aid, expert care, support and management.¹² Considering the variable and inconsistent presentation, blunt injuries to the chest should be handled by a multidisciplinary team addressing all issues coherently.¹³ Conservative management may be enough in most of the cases though surgical interventional may be warranted as the first choice of treatment in near fatal conditions.¹⁴

The treatment decisions start with assessment of airways, providing oxygen support, placing thoracostomy tube, maintaining blood volume and pain control.¹⁵⁻¹⁷ Another important parameter is the age. Pediatric age groups have lesser impact due to elasticity of bones.¹⁸

The present study aimed to find out prospectively the incidence of adult respiratory distress syndrome (ARDS) in a random group of patients sustaining blunt trauma to the chest of any etiology and to study the factors involved in its causation and outcome.

METHODS

A prospective study was conducted in casualty and wards of the department of surgery (including ICU) and department of CTVS was done on patients who sustain blunt trauma to the chest as a result of various causes in Stanley Medical College and Hospital during the period of March 2021 to February 2022.

Inclusion criteria

Patients above 12 years of age. Brought to the casualty with fall from height, RTA, assault with blunt weapon or other injuries not obviously due to penetrating trauma. Treated by surgical/cardio-thoracic and vascular surgery department of Stanley Medical College and Hospital.

Exclusion criteria

Patients below 12 years of age. Any penetrating injury to the chest. Patients who are dead on arrival. Presence of pre-existing chronic respiratory conditions.

Protocol on arrival

Patients were examined in the casualty or ward for the presence of signs of blunt trauma to the chest after the initial stabilization of airway, breathing and circulation parameters.

Data was then collected regarding the cause, time and mechanism of injury to the chest. A detailed medical history of the patient was also elicited.

A thorough clinical examination of the patient was then done to identify any injury to the organs in the chest and other parts of the body.

This was then followed by investigations if the patient was stable enough not to warrant any emergency surgical intervention.

Following this the patients were monitored in the ward or ICU setting and interventions performed for the injuries sustained were recorded. The outcome of the interventions done and that of ARDS was then followed up till discharge/death of the patient.

Criteria for diagnosis of ARDS (Berlin criteria)

Acute onset of impaired oxygenation. Severe hypoxia where $pO_2: FiO_2$ ratio <200 . Bilateral diffuse infiltrates on chest x-ray. A pulmonary capillary wedge pressure (PCWP) <18 mmHg and a normal CVP (to exclude cardiac failure).

Sample size calculation

$$N = \frac{DF \times Z^2 pq}{d^2}$$

N- sample size

Z- standard deviation for significant confidence interval (1.96).

p- estimated prevalence (6%)

q- 100-p

d- standard error (5%)

DF- design effect 1.5

Applying above value give that- 130.5

Non response date 10% thus- $130 + 13 = 143$

Hence 150 participants were recruited.

Ethics statement:

The study involving human participants were reviewed by institutional ethical committee of Stanley Medical College and Hospital. Written and informed consent was provided by their legal guardian/next of kin.

Data collection

By direct interview of patients/relatives and clinical examination. Analysis of case records.

Data analysis and interpretation

All data was tabulated in excel and analyzed using IBM SPSS v23. Frequency and percentage analysis was done.

Cross-tabulation and chi-square analysis was done to compare between variables.

RESULTS

The mean age of the participants is 34.8 years (SD=8.7). Out of 150 participants, majority were males (n=125, 83.3%) and the rest of them were females (n=25, 16.7%) (Figure 1).

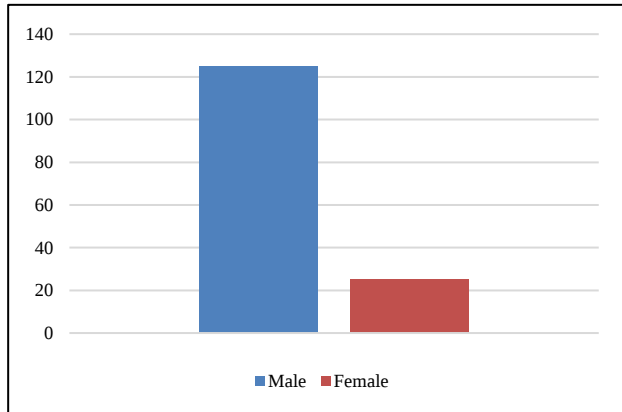


Figure 1: Gender distribution.

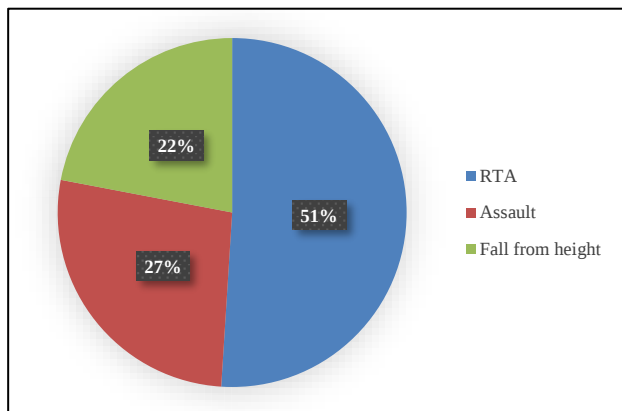


Figure 2: Mode of injury distribution.

Out of 150 patients, 76 of them had road traffic accidents (51%). Out of 150 patients, 41 of them had history of assault (27%) (Figure 3), and 33 of them had fall from height (22%) (Figure 2).

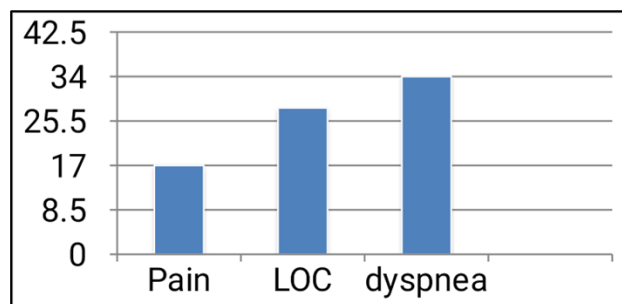


Figure 3: Distribution of symptoms.

Out of 150 patients, 95 of them had pain (63.3%), 28 of them had loss of consciousness (18.7%), 34 of them had dyspnea (22.7%) (Figure 3).

Out of 150 patients, 58 of them had single rib fracture (26%). Out of 150 patients, 48 of them had multiple rib fractures (22%). Out of 150 patients, 32 of them had pneumothorax (14%). Out of 150 patients, 19 of them had hemothorax (9%). Out of 150 patients, 8 of them had pneumohemothorax (4%). Out of 150 patients, 34 of them had flail chest (15%). Out of 150 patients, 20 of them had lung contusion (9%). Out of 150 patients, 2 of them had diaphragmatic injury (1%) (Figure 4).

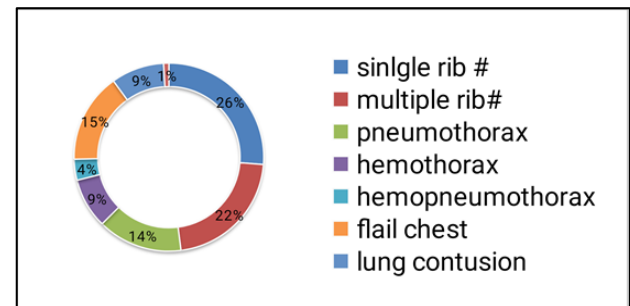


Figure 4: Various forms of thoracic injury.

None of them had any history of alcoholism. Out of 150 patients, 56 of them had diabetes mellitus (37.3%). Out of 150 patients, 46 of them had hypertension (30.7%). Out of 150 patients, 15 of them had bronchial asthma (10%). Out of 150 patients, seven of them had TB (4.7%). Out of 150 patients, 10 of them had CAHD (6.7%). Out of 150 patients, 8 of them had COPD (5.3%) (Figure 5).

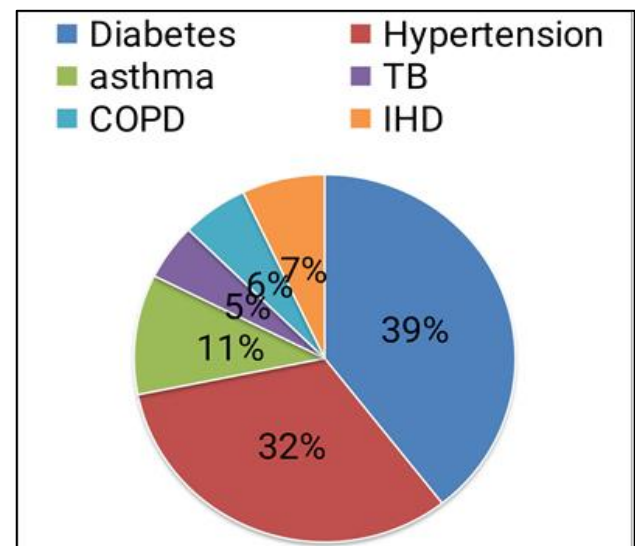


Figure 5: Comorbidities.

Out of 150 patients, one of them had ARDS, 47 of them had thoracostomy (31.3%). Out of 150 patients, two of them had mechanical ventilation (1.3%). Out of 150

patients, one of them had laparotomy (0.7%). Out of 150 patients, seven of them died (4.7%) (Figure 6).

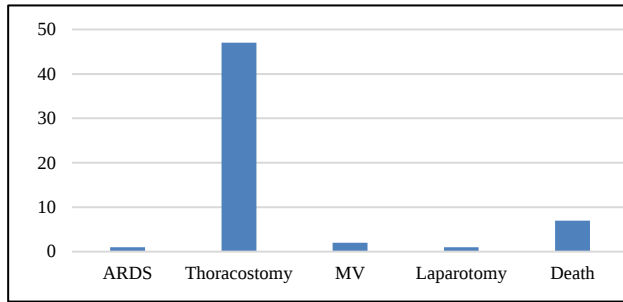


Figure 6: Outcome of blunt chest trauma.

DISCUSSION

The trauma to the chest can be penetrating or blunt. The challenging one is the blunt injuries that have lot of diagnostic confusion. The need for timely intervention precedes the actual diagnosis or therapeutic management.⁷⁻⁹ Conditions are life threatening and needs immediate attention of a surgeon; obstruction to airway, open pneumothorax, tension pneumothorax, flail chest, pericardial tamponade, massive hemothorax. Potentially fatal conditions are: injury to oesophagus, disruption of thoracic aorta, injury to myocardium, pulmonary contusion, injury to diaphragm, injury to the tracheobronchial system. They are called as deadly dozen injuries in blunt trauma of thorax.¹³

The risk factors affecting the morbidity and mortality of the blunt injuries of the chest are: age, mode of injury, number of fractures, grading and severity, comorbid conditions, time of intervention, need for mechanical ventilation, other organ injuries, presence of hypotension, low Glasgow coma score (GCS), delayed pulmonary complications.¹⁷⁻²⁶

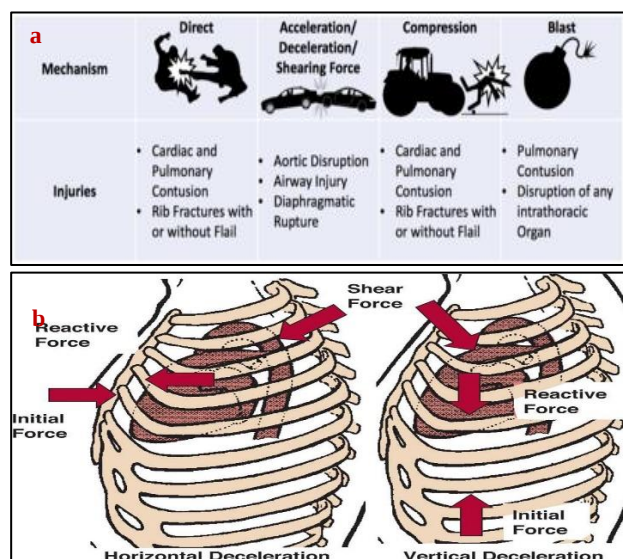


Figure 7: Mechanism of chest injury.

The morbidity and mortality are dependent on the mechanism and force of the injury (Figure 7 a and 7 b).

There are four mechanisms namely a) direct impact (violence), b) compression of thorax (fall from height), c) acceleration and deceleration injuries (common in car accidents), d) blast injuries.²⁷⁻³⁵

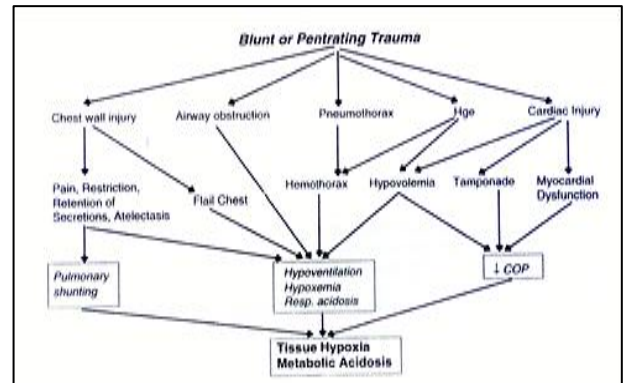


Figure 8: Pathophysiology of chest injury.

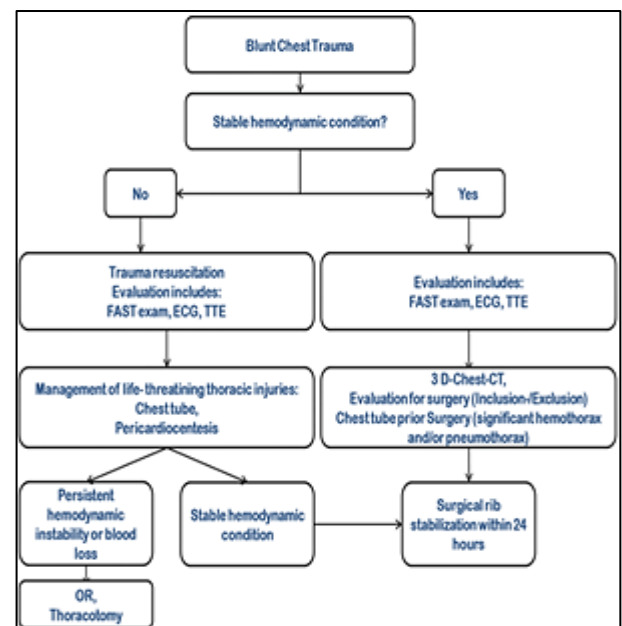


Figure 9: Management of trauma.

Understanding pathophysiology (Figure 8) of trauma is important in management of chest wall trauma (Figure 9).

Here, the study aimed to know about incidence and analyse the etiological factors contributing to blunt trauma chest, study other injuries associated with blunt trauma chest in a polytrauma patient, study the factors which are fore-runners of serious injuries resulting from blunt trauma chest and to identify the factors which are the pointers of clinical deterioration. Considering the variable and inconsistent presentation, blunt injuries to the chest should be handled by a multidisciplinary team addressing all issues coherently.

There were some limitations. It was a single institutional study. We included polytrauma patient thus including head injury patients.

CONCLUSION

We concluded various previous studies has increased prevalence of ARDS in blunt injury chest but with the management of ATLS protocol decrease the incidence to 1% and also most common mechanism causing is road traffic accident. We stress about the importance of ATLS protocol in management of trauma.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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