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Original Article

Management of Chest Trauma in Bangladesh Perspective: Experience of a Decade

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Key Words : *Chest trauma, Road traffic accident, Bangladesh perspective*

Abstract:

Background: *Thoracic trauma is one of the leading causes of morbidity and mortality in developing countries. In this study, we present our 10-year experience in the management and clinical outcome of 437 chest trauma cases as a result of blunt and penetrating injuries in two medical college hospitals of Bangladesh.*

Methods: *We reviewed 437 cases of chest trauma between January 2006 and December 2015.The mean age of our patients was 33 ± 15 years mostly males with blunt injuries. Patients were evaluated and compared according to age, sex, etiology of trauma, thoracic and extra-thoracic injuries, complications, and mortality.*

Results: *The leading cause of the trauma was road traffic accident (61%) followed by violence (23%). Hemothorax (62%), Pneumothorax (51%), rib fractures (38%), and lung contusion (35%) were the most common types of injury. Associated injuries were documented in 35% of patients (extremities 18%, abdomen 12%, head 5%). Minority of the patients required thoracotomy (6%), and tube thoracostomy (56%) was sufficient to manage the majority of cases. Mean hospital stay was 5.5 ± 4.8 days. The overall mortality rate was 3.6%.*

Conclusion: *Road traffic accident was the most common cause of chest trauma rather than violence in this series, this necessitates epidemiologic or multi-institutional studies to know what are the causes of RTA contributes to chest trauma in Bangladesh. The number of fractured ribs can be used as simple indicator of the severity of trauma.*

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Background:

Trauma continues to be a major public health problem worldwide as it is associated with high morbidity and mortality both in developed and developing countries. Trauma is also reported as the leading cause of death, hospitalization, and long-term disabilities in the first four decades of life.[1] Thoracic trauma comprises 10-15% of all traumas.[2] Thoracic trauma directly accounts for approximately 25% of trauma related mortality and is a contributing factor in another 25%.[3] Fortunately over 80% of injuries can be managed non-operatively utilizing tube thoracostomy, appropriate analgesia and aggressive respiratory therapy.[3] South east Asian region has one of the highest rates of trauma mortalities around the world. The World Health Organization (WHO) documented over 300,000 deaths in 2008 (9% of all world deaths).[4] The etiological pattern of chest trauma varies world-wide with many environmental and socio-political factors. Road traffic accidents (RTAs) remain the cause of most chest trauma in non-war zones of the world. We present the pattern, etiology, management, and outcome of chest trauma in Enam Medical College Hospital and Care Medical College Hospital of Bangladesh over a period of 10 years.

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Methods:
Enam Medical College Hospital and Care Medical College Hospital, both are 150 bedded tertiary referral centers. These provide chest trauma care adults and pediatric patients in the emergency departments. This study included all patients who were hospitalized due to non-iatrogenic chest injuries between January 2006 and December 2015 in our study (a total of 437 cases). The hospitalization criteria were intra-thoracic injury, clinically significant rib cage injury (even one rib fracture), or clinical suspicion of significant thoracic injury like subcutaneous emphysema. We excluded from our study all patients who arrived dead or early in the emergency room, patients who did not complete their treatment in our hospital, isolated laryngeal or cervical injuries, esophageal and tracheal injuries due to foreign body swallowing or aspirating, and non-traumatic injuries to the chest (burns, electrical shocks, etc.).

There were 367 males (84%), and 70 females (16%), male to female ratio was (5.2:1). The mean age was 33 ±17 years, ranging from 11 months to 75 years. Blunt and penetrating injuries were documented in (n=298, 68%) and (n=139, 32%) patients respectively. Data were collected and analyzed retrospectively. Patients' data were analyzed according to age, sex, trauma type, etiology and hospital length of stay, Intensive care unit (ICU) admission, mechanical ventilation, surgical interventions, morbidity, and mortality.

The injured patients were first triaged by a specialist in emergency medicine in the emergency department. Patients were then referred to the cardio-thoracic surgeon if needed. Patients with poor condition or those with flail chest were admitted to the ICU and mechanical ventilation was used for respiratory deficiency or severe neuro-trauma. All patients had analgesics, steroids and mucolytic treatment, provided with respiratory physiotherapy. Thoracotomy indications were: initial chest tube output > 1500 ml or hourly output > 200 ml for 4 hours, hemo-pericardium, prolonged air leakage, radiologic or endoscopic indicators of injury in esophagus, trachea and bronchi, heart and great vessels. Statistical calculations were performed using the SPSS software.

Results:
The main causes of chest trauma were Road traffic accidents (RTA, n=267, 61%), violence (n=101, 23%), and falls (n=56.13%). Other causes (n=13, 3%) included: work, domestic, and sport accidents. Among the RTA patients, 40% were pedestrians. Hemothorax, pneumothorax, rib fractures, and pulmonary contusion were the most frequent injuries accounting for 62%, 51%, 38%, 35%, respectively. Other injuries were relatively rare; diaphragmatic injury was diagnosed in (n=11, 2.5%), flail chest in (n=12, 2.8%), penetrating heart injury in (n=04, 0.8%), tracheo-bronchial injury in (n = 2, 0.4%), esophageal injury in (n=01, 0.2%), thoracic duct injury in (n=2, 0.4%). Rib fractures presented in (n=166, 38%) in this series. 25% of them had >4 rib fracture,75% of which had 4 or less rib fractures. 31% of rib fracture cases were isolated, whereas 69% had another intrathoracic injury (hemo/ Pneumothorax, lung contusion) which increased as the number of fractured ribs increased: (60%, 71%, 79%) for patients who had (1-2, 3-4, > 5) fractured ribs, respectively (p=0.02). 43% of rib fractures cases were associated with extra-thoracic injuries (mostly extremity and head injuries), which also increased as the number of fractured ribs increased. The mean hospital length of stay increased as the number of fractured ribs increased (4, 5, 7 days) for patients who had (1-2, 3-4, > 4 ribs), respectively (P= 0.0002). The mortality rate was proportional to the number of fractured ribs as well (p=0.035).

Delayed presentation of pneumothorax or hemothorax and lung contusion accompanied 5% of rib fractures cases which had no relation to the number of fractures. 18% of lower ribs fractures (9-12) were associated with intra-abdominal injuries (liver, spleen, kidney), whereas 6% of first rib fracture cases were associated with vascular injuries. 26 of rib fracture cases occurred in children; only 2 of which were non-complicated, while pneumothorax associated 20 cases, hemothorax 12 cases, lung contusion 10 cases, extra-thoracic injuries associated 15 cases.

Penetrating heart injuries occurred in (n=04, 0.8%) patients, of which were due to violence (knife stabbing in 03 cases and gun shots in 01 cases), and primary surgical repair with pericardial or Teflon pledgets were done without cardiopulmonary bypass. Atrial injury was documented in 02 cases, but rest of the 02 cases were ventricular injury and it was the right ventricle. 4 patients arrived to the hospital with profound shock, and all of them were

resuscitated successfully including 1 case of short-term traumatic arrest, but unfortunately 2 patients died.

Extra-thoracic injuries occurred in (35%) patients; extremities in (n=78, 18%), abdominal in (n=53, 12%), neurotrauma in (n=22, 5%). The mean hospital stay was longer (5.4 ± 4.6 days) compared to pure thoracic injury group (4.2±4.5 days) (p=0.0004). Tube thoracostomy was performed in 245 (56%) cases, whereas thoracotomy in 26 (6%) and Extra-thoracic major intervention in 78 (18%). most of these being laparotomy (n=48, 11%). The main indication for surgical exploration was uncontrolled hemorrhage, re-exploration was required for 2 patients. The mean hospital length of stay was 4.5 ± 4.6 days, ranging from 1 to 45 days. Blunt trauma victims stayed in hospital for longer time (5.2 ± 0.2 days) than penetrating trauma patients (3.9 ± 0.2 days) ($p < 0.0001$). The mean hospital length of stay was more when complication of treatment occurred (13.5 + 8.7 days) ($p < 0.0001$). Intensive care unit admission was required for 36 (8.2%) patients. Mechanical ventilation was required for 18 patients (4.3%) for a mean duration of 7.2 ± 8 days. 16 patients died with an overall mortality of 3.6 %. 9 (56%) of these succumbed early (within 48 hours), and 7 (44%) late in the course of treatment.

Mortality rate was higher in traffic accidents comparing to other causes of trauma ($p = 0.045$)

Table-I

Thoracic injuries diagnosed by surgical exploration (N=437).

Type of injury	Blunt trauma	Penetrating trauma	No of patient
Cardiac injury	0	04	04
Intercostal vessel injury	01	02	03
Pulmonary laceration	03	16	19
Diaphragm injury	04	07	11
Internal mammary vessel	0	04	04
Chest wall injury	03	10	13
Haemothorax	07	06	13
Subclavian vessel injury	01	02	03
Tracheal laceration	0	02	02
Chylothorax	01	01	02

Table-II

Associated extra-thoracic injuries (N=437).

Site of injury	Number of cases	Percentages (%)
Extremity injury	78	18
Abdominal injury	52	12
Head injury	22	05
Total	152	35%

Table-III

Complications of Chest injuries in the study population (N=437).

Morbidity	No of cases	Percentage (%)
Prolonged air leak	14	3.2
Clotted hemothorax	7	1.6
Atelectasis	02	0.46
Pneumonia	05	1.14
Empyema	05	1.14
ARDS	03	0.69
Surgical bleeding	02	0.46
Total	38	8.69%

and when neurotrauma associated thoracic injury, when ICU admission was required, when ventilator was required and when a complication of therapy occurred.

Discussion:

Trauma has the tendency to affect young males in the productive period of life.[5-7] Many series derived from the South East Asian region had even younger patients comparing to studies done in the developed countries.[8-14] Blunt trauma was more frequent than penetrating trauma in our series which is compatible with other series.[2,5,11,12,15] The literature suggest that traffic accidents is the leading cause of chest trauma in most series, our study showed the same picture.[2,5,8-16] Violence was the second leading cause in our series. The current study showed only two centre report, and this result cannot be generalized until a broad-based epidemiological study is performed. Seat belt is the most effective method for reducing injuries due to traffic accidents[17] and seat belt enforcement (among other traffic laws) has reduced the severity of trauma among traffic accident victims. Rib fractures occurred in 34% of patients and was the most common type of injury due to blunt trauma in our series which was comparable with other series.[5, 8,12,16] It is widely accepted that the number of fractured ribs indicates the severity of trauma and closely correlates with morbidity and mortality.[7,18-20] Many studies could prove this correlation for mortality and some indicators of morbidity. Our results were significant also for mortality, hospital length of stay, thoracic, and extra-thoracic injuries. Flagel et al. reported the increase of mortality, pneumonia, Acute Respiratory Distress Syndrome (ARDS), pneumothorax, empyema, ICU length of stay, and hospital length of stay for each additional rib fracture.[18] Most rib fractures cases (69%) are associated with other thoracic injury mainly hemopneumothorax and lung contusion, 5% of which diagnosed after 24 hours of trauma. This rate showed no significant difference according to the number of fractures, which dictates follow up for 2-3 days for all rib fracture cases even with one rib fractured and no other thoracic injury at the moment of admission. Follow-up could be as out-patient basis according to most authors; however, some authors recommend hospitalization of all patients.[19] Flail chest was diagnosed in 21 patients (2.4%). While the indications and value of surgical fixation is still debated,[20] we performed surgical fixation in two cases in the course of thoracotomy for another indication. We had 11 (2.5%) patients diagnosed with diaphragmatic injury, 33% of which due to blunt injury and were mainly front seat passengers RTAs and left sided injury, and 67% of diaphragmatic injuries due to thoraco-abdominal penetrating wounds where the associated injuries dictates the surgical approach for repair (in our series most diaphragmatic injuries were repaired through laparotomy). It is not rare to miss a diaphragm injury since non-invasive diagnostic measures have little value to diagnose non-complicated diaphragmatic injury. Late diagnosis is associated with significant morbidity and mortality. One third of thoraco-abdominal wounds associated with diaphragmatic injuries.[21,22] VATS is an accurate method for identifying diaphragmatic injuries and can be used when there is no indication for laparotomy or thoracotomy, but its indications is still unclear, Freeman et al. identified five independent predictors of diaphragmatic injuries after penetrating chest trauma which can be used as indications of VATS; abnormal chest radiograph, associated intra-abdominal injuries, high-velocity mechanism of injury, entrance wound inferior to the nipple line or scapula, and right-sided entrance wound.[22] Tracheo-bronchial injuries reported in 1-3% of trauma victims in the literature, most of these cases die before arriving at a hospital.[23] Tracheo-bronchial injuries were documented in 5 (0.56%) patients in our series, cervical trachea injuries (2 cases) were due to sharp cutting trauma, whereas bronchial injuries (3 cases) were due to high velocity blunt trauma.

The surgical repair was successful in all cases, and no complication or mortality were documented. Kiser et al. reviewed all patients with blunt tracheobronchial injuries published in the literature and he stated that delayed treatment does not affect successful surgical repair[23].

Most victims of heart injuries die at the scene of accident, even patients who arrive at hospital alive have high mortality rate (10-50%).[24] Our results on penetrating cardiac injuries were comparable to other series where most cases are caused by violence using sharp weapons or less frequently firearms, the victims are mostly males under 40 years, most

injuries occurred in one chamber more frequently in right ventricle, primary repair can be used in most cases without cardiopulmonary bypass, mortality rate depends mainly on the nature of the injury and the hemodynamic status upon arrival.[24,25]

Tube thoracostomy was the main treatment modality for the majority (56%) of patients, open thoracotomy was performed in 6% of patients, these ratios are similar to previously published results.[2,6-8,10-16] Intrathoracic hemorrhage was the main indication of early thoracotomy, while late thoracotomies were performed to evacuate clotted hemothorax, or to repair diaphragmatic injuries in most cases. The mortality rate (3.6%) is relatively low in this study. The predictors of mortality were; RTAs, hemodynamic status upon arrival, GCS upon arrival, neurotrauma, ICU admission, ventilator use, and complication of therapy. The predictors of prolonged hospital stay were; blunt trauma, number of fractured ribs, associated extra-thoracic injuries, and complications of therapy.

Conclusion:

Chest trauma is a major health problem because it has high morbidity and mortality rate. Road traffic accident is the most common cause of chest trauma. Civil violence is the second common cause of chest trauma. Among several trauma severity score systems; simple fractured ribs number is a precise and fast one which indicates the severity of thoracic and extra-thoracic injuries and predicts the prognosis. Mortality predictors in RTA are hemodynamic status upon arrival, GCS upon arrival, neuro-trauma, ICU admission, ventilator use, and complication of therapy. The predictors of prolonged hospital length of stay are: blunt trauma, number of fractured ribs, associated extra-thoracic injuries and complications of therapy.

Conflict of Interest - None.

References:

1. Hoyt DB, Coimbra R, Potenza B. Management of Acute Trauma. In: Townsend JR. *Ed. Sabiston Textbook of Surgery*,17 edition. Philadelphia: Elsevier; 2004: 483-532.
2. Demirhan R, Onan B, Oz K, Halezeroglu S. Comprehensive analysis of 4205 patients with chest trauma: a 10-year experience. *Interact Cardiovasc Thorac Surg* 2009; 9(3): 450-453.
3. O'Connor JV, Adamski J. The diagnosis and treatment of non-cardiac thoracic trauma. *J R Army Med Corps* 2010; 156(1):5-14.
4. WHO.int [Internet]. Mortality and Global Burden of Disease. Geneva: World Health Organization; c2009-10; [updated 2011 Jun 22; cited 2011 Jul 7]. Available from: http://www.who.int/entity/gho/mortality_ burden_ disease/ countries/deaths/en/index.html..
5. Mefire AC, Pagbe JJ, Fokou M, Nguimbous JF, Guifo ML, Bahebeck J. Analysis of epidemiology, lesions, treatment and outcome of 354 consecutive cases of blunt and penetrating trauma to the chest in an African setting. *S Afr J Surg* 2010; 48(3): 90-93.
6. Lema MK, Chalya PL, Mabula JB, Mahalu W. Pattern and outcome of chest injuries at Bugando Medical Centre in Northwestern Tanzania. *J Cardiothorac Surg* 2011; 6: 7.
7. Liman ST, Kuzucu A, Tastepe AI, Ulasan GN, Topcu S. Chest injury due to blunt trauma. *Eur J Cardiothorac Surg* 2003; 23(3):374-378.
8. Hanafi M, Al-Sarraf N, Sharaf H, Abdelaziz A. Pattern and presentation of blunt chest trauma among different age groups. *Asian Cardiovasc Thorac Ann* 2011; 19(1):48-51.
9. Zargar M, Khaji A, Karbakhsh Davari M. Thoracic injury: a review of 276 cases. *Chin J Traumatol* 2007; 10(5): 259-262.
10. Yalçinkaya I, Sayir F, Kurnaz M, Cobanoðlu U. Chest trauma: analysis of 126 cases. *Ulus Travma Derg* 2000; 6(4): 288-291.
11. Demirhan R, Küçük HF, Kargi AB, Altintaº M, Kurt N, Gülmen M. Evaluation of 572 cases of blunt and penetrating thoracic trauma. *Ulus Travma Derg* 2001; 7(4):231-235.
12. Segers P, Van Schil P, Jorens P, Van Den Brande F. Thoracic trauma: an analysis of 187 patients. *Acta Chir Belg* 2001; 101(6):277-282.
13. Kulshrestha P, Munshi I, Wait R. Profile of chest trauma in a level I trauma center. *J Trauma* 2004; 57(3) :576-581.
14. Pamerneckas A, Pijadin A, Pilipavicius G, Tamulaitis G, Toliusis V, Macas A, et al. The assessment of clinical evaluation and treatment results of high-energy blunt polytrauma patients. Medicina (Kaunas) 2007; 43(2) :137-144.
15. Cakan A, Yuncu G, Olgaç G, Alar T, Sevinç S, Ors Kaya S, et al. Thoracic trauma: analysis of 987 cases. *Ulus Travma Derg* 2001; 7(4) :236-241.
16. Veysi VT, Nikolaou VS, Paliobeis C, Efstathopoulos N, Giannoudis PV. Prevalence of chest trauma, associated injuries and mortality: a level I trauma centre experience. *Int Orthop* 2009; 33(5):1425-1433.
17. Cummins JS, Koval KJ, Cantu RV, Spratt KF. Do seat belts and air bags reduce mortality and injury severity

after car accidents? *Am J Orthop* (Belle Mead NJ) 2011; 40(3): E26-E29.

18. Flagel BT, Luchette FA, Reed RL, Esposito TJ, Davis KA, Santaniello JM, et al. Half-a-dozen ribs: the breakpoint for mortality. *Surgery* 2005; 138(4):717-725.
19. Karadayi S, Nadir A, Sahin E, Celik B, Arslan S, Kaptanoglu M. An analysis of 214 cases of rib fractures. Clinics (Sao Paulo) 2011; 66(3):449-451.
20. Srmal M, Türüt H, Topçu S, Gülhan E, Yazc Ü, Kaya S, et al. A comprehensive analysis of traumatic rib fractures: morbidity, mortality and management. *Eur J Cardiothorac Surg* 2003; 24(1):133-138.
21. Parreira JG, Rasslan S, Utiyama EM. Controversies in the management of asymptomatic patients sustaining penetrating thoracoabdominal wounds. *Clinics* (Sao Paulo) 2008; 63(5):695-700.
22. Freeman RK, Al-Dossari G, Hutcheson KA, Huber L, Jessen ME, Meyer DM, et al. Indications for using video-assisted thoracoscopic surgery to diagnose diaphragmatic injuries after penetrating chest trauma. *Ann Thorac Surg* 2001; 72(2):342-347.
23. Kiser AC, O'Brien SM, Detterbeck FC. Blunt tracheobronchial injuries: treatment and outcomes. *Ann Thorac Surg* 2001; 71(6):2059-2065.
24. Göz M, Cakir O, Eren MN. Penetrating cardiac injuries: analysis of the mortality predictors. *Ulus Travma Acil Cerrahi Derg* 2009; 15(4):362-366.
25. Rodrigues AJ, Furlanetti LL, Faidiga GB, Scarpelini S, Barbosa Evora PR, de Andrade Vicente WV. Penetrating cardiac injuries: a 13-year retrospective evaluation from a Brazilian trauma center. *Interact Cardiovasc Thorac Surg* 2005; 4(3):212-215.