

Profile of thoracic injury at College of Medical Sciences Teaching Hospital

D Chapagain,¹ D Jayapal Reddy,² S Shah,³ K G Shrestha.³

¹Lecturer, ² Professor and HOD, ³M.ch.residents, Department of Cardiothoracic and Vascular Surgery, College of Medical Sciences, Teaching Hospital, Bharatpur, Chitwan Nepal.

Abstract

Objectives

Thoracic injury is a challenge to the thoracic surgeon practicing in developing countries. This prospective study was conducted to see the mode of injury, injury types and overall outcome of thoracic injury in our settings.

Materials and methods

This prospective study was conducted in 100 thoracic injury patients between December 2011 to June 2012. The demographic features, type of the trauma, radiological assessment, associated organ injuries, management of the injury, surgical interventions, morbidity, mortality, length of hospital stay were analysed.

Results

In this study the ages ranged from 7 to 84 years. There were 73 (73%) males and 27 (27%) females. The majority of patients (83%) were injured during the evening and night time. The majority of patients 92(92%) sustained blunt chest injuries. The mechanism of injury was not significantly associated with length of hospital stay ($P > 0.05$) and mortality ($P > 0.05$). Road traffic accident was the most common cause of injuries affecting 68(68%) of patients followed by fall injury of 19(19%). Rib fractures, haemothorax, pneumothorax and lung contusion were the most common type of injuries accounting for 83.0%, 57%, 34% and 33% respectively. Associated extra-thoracic injuries were noted in 64.0% of patients. 45(45%) of the cases of haemothorax, pneumothorax and haemopneumothorax were treated by tube thoracotomy. Four patients (04%) had undergone thoracotomy. There were 09(09%) patients of flail chest and treated conservatively. Fourty six patients (46%) were admitted in the ICU. Eleven (11%) patients were treated with ventilator support. Seventeen (17%) patients had complication. The overall length of hospital stay ranged from 0 to 25 days.

Conclusion

Road traffic accidents and fall from height are the major public health problems. Preventive measures at reducing road traffic accidents and timely management with closed tube thoracotomy are the main factors to be considered in the thoracic injury.

Key words: Thoracic injury, road traffic accident, tube thoracotomy, thoracotomy.

Introduction

Trauma is recognised as a serious public health problem. It is the leading cause of death and disability in the first four decades of life and is the third most common cause of death overall. Modern trauma care system consists of three primary components: pre-hospital care, hospital care and rehabilitation. From an historical viewpoint, it is accepted that trauma care and trauma systems are evolved from war. There was significance improvement in the thoracic injury patients between World War I and World War II. This was partly because of better statistical reporting, but mainly because of major contributions of patient care, including the introduction of anesthesia.

Material and methods

This study was done between December 2011 and June 2012. Patient who presented to emergency department with thoracic injury were evaluated. Patients presenting with hypotension, massive blood loss, or disabling dyspnoea were evaluated immediately and resuscitated accordingly. Relevant investigations, chest X-ray, ultrasonography and CT imaging were carried out and their findings recorded. Chest-tube insertion was performed in patients with pleural complications and in those with extensive subcutaneous emphysema and prominent dyspnoea, even if there was no evidence of pneumothorax in the chest X-ray as this could be life saving procedure. Thoracotomy was performed if there was evidence of continuous bleeding and persistence air leak. Other surgical interventions were also recorded. Patients were followed up for 1 month to see for any complication. All data obtained from this study were analyzed statistically using appropriate statistical tools and the level of significance of the study hypothesis was determined conventionally

(i.e. $P \leq 0.05$). The enumerated data were analyzed using the SPSS computer program for statistical analysis. Fisher's X^2 test was used for determining statistical significance.

Results

A total number of 100 patients of thoracic injury were studied. Their ages ranged from 7 to 84 years with a mean of 38.92 years and standard deviation of 17.45. The median and the mode were 35.00 and 22.00 years respectively. (Table1)

Table 1: Descriptive Statistics of age of the patients

Total no. of patients	100
Mean	38.92
Median	35.00
Mode	22
Std. Deviation	17.457
Range	77
Minimum	7
Maximum	84

In the group distribution of patients, the most common age group of presentation was between 20-40 years of age with peak age incidence was 21-30 years (Table 2)

Table 2: Age group distribution of the patients.

Age Group	Frequency	Percent
0-10 years	1	1.0%
11-20 years	9	9.0%
21-30 years	27	27.0%
31-40years	20	20.0%
41-50years	14	14.0%
51-60years	18	18.0%
61-70years	7	7.0%
>71years	4	4.0%
Total	100	100.0%

There were 73 (73%) males and 27 (27%) females with the male to female ratio of 2.7:1 with a male predominance in each age group (Table 3).

Table 3: Sex of the patient

Sex	Frequency	Percent
Male	73	73.0
Female	27	27.0
Total	100	100.0

The majority of patients (83%) were injured during the evening and night time. Ninety seven patients (97%) were attended within 24 hours of the injury and three patients presented (3%) after 24 hours since the injury occurred. (Table 4)

Table 4: Time of presentation since the time of events

Time	Frequency	Percent
< 24 hours of events	97	97.0
> 24 hours of events	3	3.0
Total	100	100.0

Table 5: Mortality and time of presentation since the time of event

Mortality	Time of presentation since from events		Total
	< 24 hours of events	> 24 hours of events	
Yes	3	0	3
No	94	3	97
Total	97	3	100

Pearson Chi-square - 0.757(insignificant)

Timing in seeking medical care did not significantly influence the mortality.

The majority of patients 92(92%) sustained blunt injuries. The remaining 8 (8%) patients had either penetrating injuries or combined (blunt and penetrating) injuries. (Table 6)

Table 6: Mode of injury

Injury Type	Frequency	Percent
RTA	68	68.0%
Fall injury	19	19.0%
Physical assault	3	3.0%
Penetrating injury	6	6.0%
Bullet injury	1	1.0%
Animal attack	3	3.0%
Total	100	100.0%

Table 7: Mode of injury and mortality cross tabulation

Mode of injury	Mortality		
	Yes	No	Total
RTA	3	65	68
Fall injury	0	19	19
Physical assault	0	3	3
Penetrating injury	0	6	6
Bullet injury	0	1	1
Animal attack	0	3	3
Total	3	97	100

Pearson Chi-square - 0.918(Insigificant)

The mechanism of injury was not significantly associated with length of hospital stay ($P > 0.05$) and mortality ($P > 0.05$). Road traffic accident was the most common cause of injuries affecting 68(68%) of patients followed by fall injury of 19 (19%). (Table-8)

In this study, the cause of injury did not significantly affect the outcome of thoracic injury patients in terms

of either length of hospital stay ($P > 0.05$) or mortality ($P > 0.05$). Rib fractures, haemothorax, pneumothorax and lung contusion were the most common type of injuries accounting for 83.0%, 57%, 34% and 33% respectively. The type of injury; (pneumothorax and

rib fractures,) significantly influenced the length of hospital stay ($P < 0.05$) but haemothorax and mortality did not significantly influence the length of hospital stay ($P > 0.05$).

Table 8: Mode of injury and length of hospital stay

Mode of injury	Length of hospital stay					No admission	Total
	1-5 days	6-10 days	11-15 days	16-20 days	>20 days		
RTA	16	21	16	8	6	1	68
Fall injury	8	7	1	2	0	1	19
Physical assault	2	0	0	0	0	1	3
Penetrating injury	0	4	1	1	0	0	6
Bullet injury	0	0	1	0	0	0	1
Animal attack	1	1	0	0	1	0	3
Total	27	33	19	11	7	3	100

Pearson Chi-square - 0.130(Insignificant)

Associated extra-thoracic injuries were noted in 64.0% of patients, out of which head/neck (13%), musculoskeletal injuries (35%), abdominal injury (08%), upper and lower limb fracture (15%) were commonly seen.

Complications were related with associated extrathoracic injury. All the patients had chest radiographs done; the commonest abnormal findings were rib fractures 83(83%), hemothorax 57 (57%) and pneumothorax 37(37%). Radiographs of upper and lower limb detected fractures in 15 patients (15.0%). Abdominal ultrasound was done in 97 patients and abnormal findings were detected in 8 patients (splenic rupture in 2 patients, 2 liver injury and haemoperitoneum alone in 4 patient). CT scan of the

skull and brain was done in 30 patients (30%) and detected abnormality in 13 patients (13%). (Table-9).

Table 9: Associated other injury with complication

Associated other injury	Complication		
	Yes	No	Total
Head injury	2	11	13
Abdominal injury	6	2	8
Upper & lower limb fracture	4	11	15
External soft tissue injury	2	18	20
Spinal injury	0	3	3
No other injury	4	32	36
>2 system involvement	1	4	5
Total	19	81	100

Pearson Chi-square - 0.003(significant)

Out of 100 patients, 45(45%) of the cases of haemothorax, pneumothorax and haemopneumothorax were treated by tube thoracotomy and the average duration of drainage was 2.3 days. Four patients (04%) had undergone thoracotomy. In 03(03%) patients thoracotomy was done for massive haemothorax and in 01(01%) patient thoracotomy was done for big sucking wound of the chest because of rhino attack. External soft tissue wounds were managed by suturing in 08(08%) patients. Thirtseven(37%) patients had undergone surgical management for extrathoracic injury like head injury, abdominal injury, upper and lower limb fracture. Six patients(06%) were treated conservatively without any surgical intervention, out of which 03(03%) patients were treated in OPD basis because these patients had presented 24 hours after trauma and had minor injuries as shown in Table-10

Table 10: Management of the patients

Management of the patients	Frequency	Percent
Tube thoracotomy	45	45.0
Thoracotomy	4	4.0
Other thoracic procedure	8	8.0
Other than thoracic intervention	37	37.0
No intervention	6	6.0
Total	100	100.0

There were 09(09%) patients with flail chest. Six patients 06(06%) were treated by keeping them in the ventilator with IPPV (intermittent positive pressure ventilation) and other three patients 03(03%) were treated with oxygen support without invasive ventilation as shown in Table-11.

Table 11: Flail chest management

Management	Frequency	Percent
Only external O2 support	3	3.0
Ventillatory support with IPPV	6	6.0
No flail chest	91	91.0
Total	100	100.0

There were 04(04%) patients of myocardial injury. 03(03%) patients myocardial trauma and 01(01%) had minimal pericardial effusion. Both were treated conservatively. 03(03%) had also sternal fracture. There is association of sternal fracture with myocardial injury –Table12

Table 12: Sternal fracture and myocardial injury

Sternal fracture	Myocardial injury			Total
	Contusion	Effusion	No injury	
Yes	2	0	1	3
No	1	1	95	97
Total	3	1	96	100

$P < .05$

Fourty six patients (46%) were admitted in the ICU. The mean length ICU stay is 2.7 days.

The need for ICU admission was found to be significantly associated with mortality ($P < 0.05$)-Table13

Table 13: Length of ICU stay

ICU stay	Frequency	Percent
No stay	54	54.0
1-3 days	11	11.0
4-6 days	17	17.0
7-9 days	12	12.0
10-12 days	6	6
Total	100	100.0

11 (11%) patients were treated with ventilator support. 08 (08%) patients were treated in ventilator for 4-6 days. 03(03%) patients died of head injury, were also treated on ventilator. The need for ICU admission was found to be significantly associated with mortality (P < 0.05)-Table 14

Table 14: Ventilator support

Ventilator support	Frequency	Percent
No stay	89	89.0
1-3 days	3	3.0
4-6 days	8	8.0
Total	100	100.0

There were 17(17%) patients having complication. Nine patients (9%) had pleural fluid collection but one patient 01 (01%) developed empyema which was drained by tube thoracotomy. Three patients had undergone reinsertion of the chest tube with drainage of serous type of fluid. Six patients 06 (06%) had decreased lung expansion which was improved with incentive spirometry. One patient 01 (01%) developed chest wall deformity. Another 01 (01%) patient developed left phrenic nerve injury-Table 15

Table 15 : Complication

Complication	Frequency	Percent
Effusion	9	9.0
Chest deformity	1	1.0
No complication	80	80.0
Decrease lung expansion	6	6.0
Expired	3	3.0
Lt. phrenic nerve injury	1	1.0
Total	100	100.0

The overall length of hospital stay ranged from 0 day to 25 days (mean =9.68 days). Three 03(03%) were not admitted-Table 16

Table 16: Descriptive statistics of duration of hospital stay

Total Cases	100
Mean	9.63
Median	8.0
Mode	5.0
Std. Deviation	5.947
Range	25.00
Minimum	0.00
Maximum	25.00

There were 33(33%) patients with lung contusion mostly presented with haemothorax. Seven patients 07(07%) had scapular fracture. Eleven patients 11(11%) had surgical emphysema. Three patients 03(03%) had left sided branchial plexus injury. Clavicular fractures were seen in 25(25%) patients-Table 17

Table 17: Types of chest injury

Types of chest injury	No. of cases	Percentage
Rib fractures	83	83%
Haemothorax	57	57%
Chest contusions, bruise and abrasions	46	46%
Pneumothorax	34	34%
Haemopneumothorax	34	34%
Lung contusion	33	33%
Clavicular fractures	25	25%
Surgical emphysema	11	11%
Flial chest	09	09%
Scapular fractures	07	07%
Branchial plexus injury	03	03%

Myocardial injury	03	03%
Sternal fractures	03	03%
Open sucking chest wound	01	01%
Diaphragmatic paralysis (Left phrenic nerve injury)	01	01%

Discussion

Trauma is a major public health problem. It is the leading cause of death and disability in the first four decades of life and is the third most common cause of death overall.

In organized trauma centre, the outcome of the injury is much better.¹

In this study of demographic observation, most of patients were in younger age group in between the ages of 20-40 years of age. The most dominant age group was 21-30 years of age. So the most vulnerable group is younger population. The incidence was higher in male population.²

Similar demographic observation was also reported by other authors.³ The reason for male predominance among chest injury patients in this age group is probably that males are more mobile and relatively males are taking outdoor activities.

Time is a important factor in trauma patient for prevention strategies and an impact on the outcome. We noted that the majority of patients were arrived during evening and night hours were not related with poor outcome.⁴ This can be explained by the fact that senior consultants and senior post graduates residents are present round the clock in the emergency, the timely care of the chest trauma patients. Monafisha

K.Lema et al mentioned that timely care and adequacy of staffs are key factor for the outcome of the patients.⁵

The timing of medical care did not significantly affect the outcome of our patients in term of length of hospital stay and mortality, but we still believe that delay in seeking medical care still contributes significantly to high morbidity and mortality among chest injury patients. Early recognition and treatment of these injuries appear to reduce mortality and morbidity associated with the disease.

Most patients in this study sustained blunt chest injuries mostly related with road traffic accident and fall injury, which is comparable with other studies.^{6,7,8} But in contrast with a Nigerian study^{5,6} in which penetrating chest injuries was the most common mechanism of injury.⁹ The high incidence of blunt chest injuries in this study is explained by the fact that those patients who had blunt injuries were mostly involved in road traffic accidents and fall from height because of hilly geographic region and driving recklessly over the poor quality road of this region.

The management of patients with chest injuries has several important factors at various level like timely pre-hospital care, maintaining basic management during transport ,in-hospital multidisciplinary care and rehabilitation. The prehospital care plays a key role in determining the final outcome of treatment when done appropriately and contributes significantly to reducing morbidity and mortality.¹⁰ In this series, prehospital treatment was reported in very few number of cases of thoracic injury which is against the agreement with a study that was done in Ethiopia. In this study there was

complete lack of pre hospital care, fortunately we did not have increased number of mortality and morbidity. The common type of injuries were rib fractures, haemothorax, pneumothorax, haemopneumothorax and lung contusion. These types of injury is comparable with other studies.¹¹ In the present study, the type of injury was insignificant with the length of hospital stay and mortality. This finding reflects the low mortality rate among thoracic injury patients.¹²

In this paper, the presence of extrathoracic injury greatly affected the mortality. There were three mortality which was associated with head injury. This pattern of associated extra-thoracic injuries in this study is in agreement with findings from other studies.¹³ The presence of associated injuries is an important determinant of the outcome of chest injury patients. Associated injuries increase the risk of complications in patients with chest injuries.¹⁴ Early recognition and treatment of associated extra-thoracic injuries is important in order to reduce mortality and morbidity associated with thoracic injuries .

The majority of the patients were managed by simple surgical procedure by tube thoracotomy(45%). This is in agreement with various authors.^{15,16} Very few number of cases (four) had undergone more invasive procedure like thoracotomy for massive haemothorax and lung contusion. In thoracotomy, extensive surgery were not required which is supported by many literatures.¹⁷

This simple procedure can be readily performed in health post level that can be performed by trained medical officer, which is in favour with other studies.¹⁸

We had very few number of penetrating chest injury (08%) which were mostly treated by simple tube thoracotomy. Thoracic surgeons generally agree that most patients with especially penetrating chest injuries could be managed adequately by closed thoracostomy tube drainage alone. Inci *et al* reported the percentage to be between 62.1% and 91.4%.

Sternal fracture can be associated with cardiac and great vessel injury lying below the sternum. In this study we had four patients of myocardial injury associated with sternal fracture. But many authors mentioned less incidence of myocardial injury in sternal fracture.¹⁹ In this study Flail chest were managed by ventilator support (IPPV) and with oxygen support only which is supported by Kalliopi A et al and Pettiford BL. Thompson D stated very low incidence of diaphragmatic injury. In this study we had one patient of diaphragmatic paralysis because of left phrenic nerve injury.

Scapular fracture are less common(1-3)% and associated with visceral injury.²¹ In this study seven patients had scapular fracture which was related with other associated injury like lung contusion ,multiple rib fracture and haemothorax. One fourth of patients had clavicular fracture and mostly treated with conservative management. There is increased risk of brachial plexus injury in fracture clavicle with first and second rib fracture.²²

We had three patients of rhino attack. One patients had open sucking chest wound presented in shock state and managed in emergency department.

The presence of complications has an impact on the final outcome of patients presenting with chest injury. In this study we had 17% of complication which were minor in nature. Most patients had minimal amount of pleural fluid collection out of which one developed empyema and treated by tube thoracotomy.

The overall mean length of hospital stay in this study was lower compared to that reported by Atri *et al* in India and Monafisa K Lema in Tanzania and in the Nigerian study. The long period of hospital stay in our study was noted in patients with blunt chest injuries and those associated with long bone fractures of upper and lower limbs. The length of hospital stay is an important measure of morbidity. Estimates of length of hospital stay are important for financial reasons, and accurate early estimates facilitate better financial planning by the payers.

Nearly half of the patients were treated in ICU out of which eight patients were treated in ventilator with minor air leak in one patient that resolved quickly.

The overall mortality rate in this study was 03% comparable to that found in Nigeria and in other study but relatively lower than that reported in other studies.^{23,24}

The reason for low mortality rate in the present study is that most of the patients were not severely injured except when there was a major associated extrathoracic injury. They responded favorably to measures that were well within the competence of CTVS residents.

Conclusion

Thoracic injury is common injury in patients with RTA and fall from height. Depending upon the mode of

injury, patients can be treated effectively with good outcome. In case of associated extrathoracic injury, multidisciplinary approach is essential for good outcome. More attention should be given to associated head injury patients to reduce mortality. Urgent preventive measures targeting at reducing the occurrence of road traffic accident is necessary to reduce the incidence of chest injuries in this region of Chitwan.

References

1. Juan A. Asensio, Donald D. Trunkey Current therapy of trauma and surgical critical care. Mosby Elsevier. Feb 26, 2008.
2. Cooper C, Militello P. The multiple injured patient: Maryland shock trauma protocol approach. *Thoracic Cardiovasc Surg.* 1992;4:163.
3. Massaga FA, Mchembe M. The pattern and management of chest trauma at Muhimbili National Hospital, Dar Es Salaam. *East and central african journal of surgery.* 2010;15:124-9.
4. Bolukbas S, Ghezel-Ahmadi D, Kwozalla AK et al. Diagnostic assessment and treatment concepts for thoracic trauma. *Chirurg.* 2011 Sep; 82(9): 843-9.
5. Monafisha K Lema, Phillip L Chalya, Joseph B Mabula et al. Outcome of chest injuries at bugando medical centre in northwestern tanzania. *J Cardiothorac Surg.* 2011; 6:7.
6. Ozgen G, Duygulu I, Solak H. Chest Injuries in Civilian Life and Their Treatment. *Chest.* 1984;85:89-92.
7. Chalkiadakis G, Drositis J, Kafetzakis A, Kassotakis G et al. Management of simple

- thoracic injuries at a level trauma centre: Can primary health care system take over? *Injury*. 2000;**31**:669–75.
8. Museru LM, Leshabari MT. Road traffic accidents in tanzania: A 10-year epidemiological appraisal. *East Central Afr. J. Surg.* 2002;**7**:23–6.
 9. Ali N, Gali BM. Pattern And Management Of Chest Injuries in Maiduguri, Nigeria. *Annals Of African Medicine*. 2004;**3**:181–4.
 10. Aylwin CJ, Brohi K, Davies GD et al. Pre-hospital and in-hospital thoracostomy: Indications and complications. *Ann R Coll Surg Engl*. 2008;**90**:54–7.
 11. Atri M, Gurjit S, Arvind K. Chest Trauma in Jammu Region. An Institutional Study. *I.J.Ctvs*. 2006;**22**:219–22.
 12. Blasco E, Borro JM, Caffarena JM JR et al. Blunt chest injuries in 1696 patients. *Eur J Cardio-Thorac. Surg.* 1992;**6**:284.
 13. Ziegler DW, Agarwal NN. The morbidity and mortality of rib fractures. *J Trauma* 1994;**37**:975.
 14. Gracia VF, Gotschall CS, Eichelberger MR et al. Rib fractures in children: A marker of severe trauma. *J. Trauma* 1990;**30**:695.
 15. Graham JM, Mattox KL, Beall AC. Penetrating trauma of the lung. *J Trauma* 1979;**19**:665–9.
 16. Eddy AC, Luna GK, Copass M. Empyema thoracis in patients undergoing emergent closed tube thoracostomy for thoracic trauma. *Am J Surg* 1989;**157**: 494.
 17. Wall MJ, Villavicencio RT, Miller CC et al. Pulmonary tractotomy as an abbreviated thoracotomy technique. *J Trauma* 1998;**45**:1015–23.
 18. Inci I, Ozçelik I, Tacyildiz O et al. Penetrating Chest Injuries: Unusually High Incidence Of High Velocity Gunshot Wounds in Civilian Practice. *World J Surg*. 1998;**22**:438–42.
 19. Buckman R, Trooskin SZ, Flancbaum L et al. The Significance Of Stable Patients With Sternal Fractures. *Surg Gynecol Obstet* .1987;**164**:261.
 20. Rasmussen OV, Brynitz S, Struve et al. Thoracic Injuries. A review of 93 cases. *Scandinavian journal of thoracic and cardiovascular surgery*. 1986;**20(1)**:71-4.
 21. Thompson D, Flynn TC, Miller PW et al. The significance of scapular fractures. *J Trauma* 1985;**25**:974.
 22. Hill JM, Mcguire MH, Crosby LA. Closed treatment of displaced middle third clavicular fractures of the clavicle gives poor results. *J Bone Joint Surg Br* 1997;**79(4)**:537–9.
 23. Richardson JD, Adams I, Flint IM. Selective management of flail chest and pulmonary contusion. *Annals of Surgery* 1982 ; **196(4)**:481-7.
 24. Adem AA, R. Llagoa R, Mekonen E. Chest injuries in Tikur Anbessa Hospital, Addis Ababa, Ethiopia: 3-year experience. *East and Central African Journal of Surgery*. 2009;**6**:11–4.