Chest Injury Outcomes due to Road Traffic Accidents – an Institutional Experience

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Abstract

Background -Thoracic trauma is one of the leading causes of mortality and morbidity in developing world countries. Complications in chest trauma develop secondary to rib fractures and subsequently leading to pain, inadequate ventilation as well as direct injury to lung parenchyma due to fractured rib segments.

Methods - In this study, we present our 2 year experience (August 2017 to August 2019) in the management and clinical outcome of 236 chest trauma cases as a result of road traffic accidents. Patients were divided into three groups based on the presence of rib fractures. The groups were evaluated to demonstrate the relationship between the numbers of rib fractured and associated injuries.

Results – Mean hospitalization time was 7.5 days. Mortality rate was 1 % for the patients with only blunt chest trauma, 4 % in patients with more than two rib fractures and 20 % for those with flail chest. We found that there is significant association between the mortality rate and the number of ribs fractured, the patient's age as well time since the accident.

Conclusion – Risk of increased morbidity and mortality was associated with presence of more than two rib fractures, age over 60 years and delayed hospitalization after the injury.

Keywords – *Rib Fractures, Chest Injury, Blunt trauma*

Background

Blunt chest trauma is associated with a high risk of morbidity and mortality [1]. Rib fracture constitutes a major part of blunt chest trauma and each additional rib fracture is associated with an increasing likelihood of developing complications [2, 3]. Each additional rib fracture in the elderly population increases the chances of mortality by 19% and developing pneumonia by 27% [3, 4]. Respiratory complications develop more with the rib fractures as due to severe pain there is inadequate ventilation [5]. Even a single rib fracture is associated with significant morbidity and consequences particularly in the elderly population [6, 7]. This causes decreased lung volume, atelectasis and can even progress to pneumonia, prolonged ventilation and mortality [8].

Patients and methods – This is a retrospective analysis of all blunt chest trauma patients secondary to road traffic accident. Over a 2 year period, between august 2017 to august 2019, 236 patients with chest injuries following road traffic accidents were admitted to emergency and trauma centre , Uttar Pradesh University of Medical Sciences , Saifai (UPUMS). Patients who died at the scene or were declared dead on arrival were excluded because of incomplete data.

This trauma centre caters both adult as well paediatric population , since it is an superspeciality

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institution and various department work together for the management of trauma patients. Many patients with road traffic accidents are referred to our centre after first management at nearby hospitals.

Patient's physical condition on presentation, number of ribs fractured, patient's age were the main factors affecting our decision for hospitalization. All patients not requiring hospitalization were given symptomatic treatment and called back for follow up visits at 24 hour, at the end of the first week of injury and on regular intervals till 2 months if there were no complications.

Patients were divided into three major groups based on the presence of rib fractures. Group I consisted of patients without rib fractures; Group II consisted of patients with one or two rib fractures; Group III consisted of patients with more than two rib fractures. The groups were evaluated to demonstrate the relationship between the number of rib fractures and associated injuries.

Results - There were 192 male (81.4%), and 44 female (18.6%) patients. Mean age was 45 years, ranging from 6 to 87 years. Of 236 patients, 154 (65.3%) were hospitalized and the remaining 82 (34.7%) patients were followed without hospitalization. Mean hospitalization time was 7.5 days, ranging from 3 to 22 days.

Chest pain and dyspnea were the most common symptoms at presentation whereas sensitivity over the chest wall, bone crepitation and subcutaneous emphysema were the most common findings on physical examination. All patients with chest discomfort with minimal findings on physical examination were followed up without hospitalization. Soft tissue trauma and rib fractures were the most common problems observed following blunt thoracic traumas. Rib fractures were detected in 146 patients, and all were hospitalized.

Rib fractures were associated with subcutaneous emphysema in 37 patients (25.3%). Total 122 patients presented with Hemo/pneumothorax , in which 112 patients were with rib fractures(76.7%) and in 10 patients without rib fractures.

Extremity fractures were found to be the most commonly associated extrathoracic injuries in patients with rib fractures (Table 1)

Table 1: Associated injuries in patients with chest injuries

	Group I(Patients without rib fractures) n= 90		**Group II (Patients with one or two rib fractures) n=135**		**Group III (Patients with more than two rib fractures) n=11**	
Extremity/pelvis	4	4.4	5	3.7	-	
Intra-abdominal / retroperitoneal	1	1.1	1	0.7	2	18.1
Facial trauma	1	1.1	2	1.5	2	18.1
Cranial trauma	2	2.2	2	1.5	2	18.1
Spinal/vertebral trauma	-		1	0.7	3	27.3
Clavicular fracture	3	3.3	2	1.5	1	9.1
Diaphragmatic injury	-		-		3	27.3
Hemothorax/ Pneumothorax	10	11.1	104	77	8	72.7

Chest tube drainage was performed in 116 patients with pneumothorax, hemothorax or hemopneumothorax. Tube thoracostomy was performed successfully in all, but 5 of these patients required thoracotomy as they were having ongoing blood loss. 11 patients presented with flail chest. All patients with flail chest were followed in the Intensive Care Unit. The management of these patients were based on the trend of serial measurements for arterial blood gases. In all patients with flail chest, analgesia was provided through administration of parenteral analgesics and epidural analgesics. In two of these patients, tracheotomy was performed aiming suctioning of secretions and giving oxygen to the patients more effectively. Of all patients with flail chest, three patients died. Mean hospitalization time for these patients was 17.8 days. Primary bronchial anastomosis was performed in two patients, removal of intrathoracic hematoma and control of bleeding in two patients, removal of empyema and decortication in one patient, and thoracic wall stabilization and control of bleeding in one patient. Three patients underwent thoracotomy with laparatomy due to diaphragmatic rupture. One patient undergoing diaphragmatic repairing died postoperatively.

In total, no deaths in Group I, one death in Group II and 3 deaths in Group III were observed (Table 2).

Age (years)	Group I (n=90)		Group II (n=135)			Group III (n=11)			Total		
	Patients	Mortality	Patients	Mortality	%	Patients	Mortality	%	Patients	Mortality	%
0-14	07	-	6	-	-	1	-		14	-	-
14-59	78	-	118	-	-	8	2	25	204	2	0.1
>60	05	-	11	1	9.1	2	1	50	18	2	11..1
Total	90	Nil	135	1	0.7	11	3	27.2	236	4	1.7

The difference was statistically significant for Group II versus Group III , but mortality was not significantly greater in Group II compared to Group I . Mortality rate was 1.7% for all patients with rib fractures.

Discussion

Non-penetrating chest injuries are seen very frequently in civil populations. The major reasons for blunt chest injuries are traffic accidents with an incidence of 70–80% [9]. Rib fractures are reported as the most common pathologies associated with chest trauma (35–40%) [10]. In our series, the incidence of rib fractures was 57.2% (patient with one or 2 rib fracture) and 4.6% (patients with more than 2 rib fractures) and all were hospitalized. Although some authors have suggested that patients with rib fractures require hospitalization not only for their associated injuries but also for pain control and pulmonary complications [11], there is not an immediate indication for hospitalization for the patients with rib fractures. According our opinion, the majority of patients with 'simple' thoracic injuries can safely be treated at the level of the primary health care center or as outpatients at the district hospitals as previously reported [12]. It is recommended that all rib fractures should be

re-evaluated at 48 to 72 h after injury because of the frequent late appearance of pulmonary complications [13].

The presence of more than two rib fractures is a marker of severe injury. Eighty-one percent of our patients had hemothorax and/or pneumothorax and most of them presented with associated extra thoracic injuries. Lee reported that mortality doubles (1.8 versus 3.9%) for patients with three or more rib fractures and those with no rib fractures [14]. The presence of fractures of the first or second ribs has also been reported to be indicative of severe trauma. Poole reviewed all series of fractures of first and second ribs and found a 3% risk for aortic injury and a 4.5% risk for injury to a brachiocephalic vessel [15]. In our series, we did not observe any major vascular injury. Subcutaneous emphysema is a clear indication of injury to the respiratory tract. Seventy-six percent of cases were associated with hemothorax and/or pneumothorax in this study. All of the patients with subcutaneous emphysema had fractured ribs, which also led to lung injury. Kalyanaraman et al. reported that lung injury seems to be associated with rib fractures in 74% of cases with subcutaneous emphysema [16]. In most of the cases, subcutaneous emphysema is self-limited and it is essential to identify and treat the underlying cause. Some authors have reported that acute respiratory failure caused by massive subcutaneous emphysema requires decompression of the anterior mediastinum [17–19]. Flail chest is a serious problem in blunt chest trauma practice because of the risk of respiratory insufficiency where stabilization may be required. Although recently surgical procedures have been mentioned to decrease the mortality and morbidity rate by some authors [20, 21], operative fixation has not yet been widely accepted [13]. We prefer performing surgical procedures only when thoracotomy is required for another indication and fixation by mechanical ventilation only in case of respiratory insufficiency. In flail chest, mortality rate is reported between 11 and 40% [22–25]. Our mortality rate for flail chest was 27.2%, comparable to studies by clark GC, Freeland M and Shacford SR et al.

The maintenance of pulmonary and tracheal hygiene, effective eradication of pleural fluid and air played a significant role in minimizing pulmonary complications. If the conservative treatment is not sufficient and intrathoracic organ injuries are detected, early or late thoracotomy should be performed. In the literature there has been a significant decline in the number of operations over recent years [26]. Richardson states that less than 5% of patients sustaining blunt chest trauma have indications for a thoracotomy [27]. In our series, only 05 patients required thoracotomy and the operation rate was 3.4% in hospitalized patients. Rising mortality rates depend on the severity and complexity of the wounds and older age. Hospital mortality rates for isolated chest injuries were reported to range from 4 to 8%, and increased to 13–15% when another organ system was involved and to 30–35% when more than one organ system was involved [28]. Lee et al reported the mortality rate as 1.8% in all patients with blunt chest trauma [14]. This rate was 1% in our series. Most traumas occur between 14 and 60 years of age. Mortality rate significantly increased in overall patients with more than two rib fractures. However, we did not found any correlation between the mortality rate and the number of rib fractures for the elderly patients. It takes a less severe injury to be lethal in this age group. Osteopenic changes and co-existent underlying disease may also play a significant role in this process [21]. The clinical state of the patient, severity of the trauma, age, presence of more than two rib fractures, presence of flail chest, presence of subcutaneous emphysema and possible intrathoracic injury help in making the decision for hospitalization.

Conclusion

Chest trauma is an important public health problem accounting for a substantial proportion of all trauma admission at UPUMS, Saifai. The risk of mortality in chest trauma has been associated with the presence of more than two rib fractures, age older than 60 years and delayed hospitalization after the injury. The ability to identify those patients having significantly higher risk for morbidity and mortality ensures the establishment of treatment priorities and efficient management of existing injuries.

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Ethical Clearance: Institutional Ethical Committee Clearance was taken.

References

1. Bulger EM, Arneson MA, Mock CN, Jurkovich GJ. Rib fractures in the elderly. J Trauma-Injury Infec Crit Care. 2000;48(6):1040–6. discussion 1046–1047.
2. Lee RB, Bass SM, Morris Jr JA, MacKenzie EJ. Three or more rib fractures as an indicator for transfer to a Level I trauma center: a population-based study. J Trauma-Injury Infect Crit Care. 1990; 30(6):689–94.
3. Yeh DD, Kutcher ME, Knudson MM, Tang JF. Epidural analgesia for blunt thoracic injury–which patients benefit most? Injury. 2012; 43(10):1667–71.
4. Wardhan R. Assessment and management of rib fracture pain in geriatric population: an ode to old age. Curr Opin Anaesthesiol. 2013;26(5):626–31.
5. Easter A. Management of patients with multiple rib fractures. Am J Crit Care. 2001; 10(5):320–7.
6. Barnea Y, Kashtan H, Skornick Y, Werbin N. Isolated rib fractures in elderly patients: mortality and morbidity. Can J Surg. 2002;45(1):43–6.
7. Elmistekawy E, Hammad AA. Isolated rib fractures in geriatric patients. Annals of Thoracic Med. 2007; 2(4):166–8.
8. Bayouth L, Safcsak K, Cheatham ML, Smith CP, Birrer KL, Promes JT. Early intravenous ibuprofen decreases narcotic requirement and length of stay after traumatic rib fracture. Am Surg. 2013; 79(11):1207–12.
9. Shorr RM, Crittenden M, Indeck M, Hartunian SL, Rodriguez A. Blunt thoracic trauma: analysis of 515 patients. Ann Surg 1987; 206:200–205.
10. Calhoon JH, Grover FL, Trinkle JK. Chest trauma: approach and management. Clin Chest Med 1992; 13:55–67.
11. Ziegler DW, Agarwal NN. The morbidity and mortality of rib fractures. J Trauma 1994; 37(6):975–979.
12. Sanidas E, Kafetzakis A, Valassiadou K, Kassotakis G, Mihalakis J, Drositis J, Chalkiadakis G, Tsiftsis D. Management of simple thoracic injuries at a level I trauma centre: can primary health care system take over. Injury 2000;31:669–675.
13. Battistella F, Benfield JR. Blunt and penetrating injuries of the chest wall, pleura and lungs. In: Shields TW, editor. General thoracic surgery, Philadelphia, PA: Williams and Wilkins, 1994. pp. 767–783.
14. Lee RB, Bass SM, Morris JA, MacKenzie E. Three or more rib fractures as an indicator for transfer to a level I center: A population-based study. J Trauma 1990;30(6):689–694.
15. Poole GV. Fracture of the upper ribs and injury to the great vessels. Surg Gynecol Surg 1989; 169:275–282.
16. Kalyanaraman R, De Mello WF, Ravishankar M. Management of chest injuries- a 5-year retrospective survey. Injury 1998; 29(6):443– 446.
17. Beck PL, Heitman SJ, Mody CH. Simple construction of a subcutaneous catheter for treatment of severe subcutaneous emphysema. Chest 2002; 121:647–649.
18. Gibney RTN, Finnegan B, FitzGerald MX, Lynch V. Upper airway obstruction caused by massive subcutaneous emphysema. Int Care Med 1984;10:43–44.
19. Conetta R, Barman AA, Iakovou C, Masakayan RJ. Acute ventilatory failure from massive subcutaneous emphysema. Chest 1993; 104:978–980.
20. Ahmed Z, Mohyuddin Z. Management of flail chest injury: internal fixation versus endotracheal intubation and ventilation. J Thorac Cardiovasc Surg 1995;110:1676–1680.
21. Hideharu T, Tetsuo Y, Yoshihiro Y, Syoichiro S, Hideaki G, Hiroharu M, Syuji S. Surgical stabilization of internal pneumatic stabilization? A prospective randomized study of management of severe flail chest patients. J Trauma 2002; 52:727–732.
22. Clark GC, Schecter WP, Trunkey DD. Variables affecting outcome in blunt chest trauma: flail chest vs. pulmonary contusion. J Trauma 1988; 28:298–304.
23. Freedland M, Wilson RF, Bender JS, Levison MA. The management of flail chest injury: factors affecting outcome. J Trauma 1990; 30:1460–1468.
24. Shackford SR, Smith DE, Zarins CK, Rice CL,

Virgilio RW. The management of flail chest: a comparison of ventilatory and nonventilatory treatment. Am J Surg 1976;132:759–762.

25. Thomas AN, Blaisdell FW, Lewis Jr FR, Schlobohm RM. Operative stabilization for flail chest after blunt trauma. J Thorac Cardiovasc Surg 1978;75:793–801.
26. Galan G, Penalver JC, Paris F, Caffarena Jr JM, Blasco E, Borro JM, Garcia-Zarza A, Padilla J, Pastor J, Tarrazona V. Blunt chest injuries in 1696 patients. Eur J Cardiothorac Surg 1992; 6:284–287.
27. Richardson JD. Indications for thoracotomy in thoracic trauma. Curr Surg 1985; 42:361–364.
28. Mayberry JC, Trunkey DD. The fractured rib in chest wall trauma. Chest Surg Clin North Am 1997;7(2):239–261.