

ORIGINAL ARTICLE

MORBIDITY AND MORTALITY AMONG PATIENTS SUSTAINING CHEST INJURY DUE TO BLUNT FORCE – THE DIFFERENCE BETWEEN YOUNG AND ELDERLY

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Background: Blunt Chest trauma (BCT) is caused by road traffic accidents (RTAs), falls, assaults, or occupational injuries. Age has been hypothesized to be a predictor of complications and adverse outcomes in the elderly. This study aimed to compare morbidity and mortality in young and elderly patients with BCT. **Methods:** This prospective two-arm study was conducted in Jinnah Postgraduate Medical Center, Karachi from July 1st till 31st December 2019 after approval from the Institutional review board. All hemodynamically stable patients with BCT presenting in the emergency were stratified in two groups. Group A included patients age 12–45 years; Group B were of age ≥ 65 years. Their clinical characteristics, complications, and in-hospital outcomes were compared. Data was analysed using SPSS version 16.0. **Result:** There were 39 (55.7%) patients in group A and 31 (44.3%) in group B. RTAs were a significant cause of BCT in Group A ($p=0.01$) and falls in Group B ($p=0.003$). Lacerations, open wound, and flail chest were significantly more common in Group A ($p\leq 0.05$). Complications of BCT including pneumonia and acute respiratory distress syndrome (ARDS) were significantly higher in Group B ($p\leq 0.05$). Group B required mechanical ventilation more often (45.2% vs. 12.8%; $p=0.003$). There were seven deaths in Group B ($p=0.002$) and none in Group A. **Conclusion:** Commonest cause of BCT in the elderly is falling. Similarly, the elderly are more prone to develop pneumonia, ARDS, and the need for ventilatory support. Early intervention to control pain, improve ventilation, and chest physiotherapy reduce the risk of morbidity and mortality.

Keywords: Blunt trauma; Blunt chest trauma; Age difference; Young; Elderly; Outcomes

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INTRODUCTION

As many as 35% trauma-related deaths in the United States (US) account for the burden of thoracic trauma. Thoracic injuries encompass a variety of non-life threatening to critical injuries with a significant burden of morbidity as well as mortality.¹ Thoracic trauma may be penetrating or blunt. Blunt chest trauma (BCT) is usually a result of road traffic accidents (RTAs) in up to 80% cases. Unintentional fall is also a major cause of BCT.² In Pakistan, 88% of chest trauma was due to blunt injuries, and only 12% due to penetrating injuries.³ Although age plays a crucial role in determining the outcome of trauma, very little data is available regarding age as a predictor of morbidity and mortality. In this two-arm comparative prospective study, we compared the incidence of morbidity and mortality in BCT patients categorized as young and elderly. The purpose of this study is to identify the factors increasing the risk of morbidity and mortality in the studied population and prioritize at risk patients for early intervention to reduce morbidity and mortality

MATERIAL AND METHODS

This prospective two-arm study was conducted at the Department of Thoracic Surgery in collaboration with the Emergency Department (ED) in Jinnah Postgraduate Medical Center, Karachi. The study duration was from 1st July 2019 to 31st December 2019. Institutional review board approval was obtained before starting the study. All patients were included after informed consent.

All patients presenting to the ED with thoracic trauma due to any blunt force (such as RTAs, fall from a height, occupational injuries, and assault) were made part of two age groups. Group A comprised of the younger age group patients age 12–45 years. Group B included elderly patients age 65 years or more. Hemodynamically unstable patients, patients with a head injury, and patients between 46–64 years were excluded.

Patients received in ED, fulfilling the inclusion criteria, were assessed and managed according to Advanced Trauma Life Support (ATLS) protocol. Radiological investigations were carried out. Data was collected using a semi-structured

questionnaire. It included socio-demographic data, mode of blunt trauma, primary and associated thoracic injuries, associated non-thoracic injuries, procedures performed for management, and complications. Data was entered and analysed using SPSS version 16.0. All data was presented in the form of frequencies and percentages. Chi-square was applied to determine the statistical correlation after data stratification. p -value ≤ 0.05 was taken as significant.

RESULTS

Out of 70 patients in this study, 57 (81.4%) were males, and 13 (18.6%) females. There were 39 (55.7%) patients in group A and 31 (44.3%) in group B. In group A, there were six (15.4%) females and 33 (84.6%) males. In group B, there were seven (22.6%) females and 24 (77.4%) males.

RTA was the commonest cause of BCT in both groups: A (n=35; 89.7%), Group B (n=20; 64.5%). Fall was more common in Group B as compared to Group A (35.5% vs. 7.7%). RTAs were statistically significant for the younger age group (A) and falls were significant for the elderly group (B) ($p \leq 0.05$). Among primary thoracic injuries, hemopneumothorax (n=15; 38.5%) and pulmonary contusions (n=12; 30.8%) were common in group A and hemopneumothorax (n=12; 38.7%) and pneumothorax (n=11; 35.2%) were common in group B. Among associated chest wall injuries, lacerations (49% vs. 16%; $p=0.004$) and open

wounds (15% vs. 0; $p=0.02$) were significantly more common in the younger group (A) which may be due to the higher proportion of RTAs in this age group. Flail chest (20% vs. 3%; $p=0.03$) was also more common in the younger age group which may be due to the higher severity of injury in this group. All clinical characteristics of both age groups are compared in table-1.

Both groups were compared for the therapeutic procedures performed (Table-1) which showed no statistical significance; Elderly patients however required mechanical ventilation (MV) more frequently as compared to the younger patients (45.2% vs. 12.8%; $p=0.003$). Out of 31 patients of Group B, 10 (32.2%) had both ischemic heart disease (IHD) and chronic obstructive pulmonary disease (COPD) as comorbidities.

Patients were then compared for the incidence of complications during their hospital stay. Pneumonia (26% vs. 5%; $p=0.01$) and acute respiratory distress syndrome (ARDS) (71% vs. 15%; $p=0.000$) were significantly higher in the elderly group (B) compared to the younger group (A). The mortality rate in this study was 10% and all seven deaths were in the elderly group (B) (23% vs. 0%; $p=0.002$). Table-3 shows a comparison of complications and in-hospital outcomes between the two age groups.

Table-1: Comparison of clinical characteristics of the young and the elderly group (n=70)

Clinical characteristics	GROUP A (n=39; 55.7%)	GROUP B (n=31; 44.3%)	p-value
Mode of Injury			
Road traffic accident	35 (89.7%)	20 (64.5%)	0.01
Fall	3 (7.7%)	11 (35.5%)	0.003
Assault	1 (2.5%)	0	0.36
Primary thoracic injury			
Hemothorax	9 (23.1%)	6 (19.4%)	0.70
Pneumothorax	11 (28.2%)	11 (35.2%)	0.51
Tension pneumothorax	4 (10.2%)	2 (6.4%)	0.57
Hemopneumothorax	15 (38.5%)	12 (38.7%)	0.98
Pulmonary contusion	12 (30.8%)	7 (22.6%)	0.44
Associated chest wall injuries			
Lacerations	19 (48.7%)	5 (16.1%)	0.004
Abrasions	6 (15.4%)	4 (12.9%)	0.77
Open wound	6 (15.4%)	0	0.02
Flail chest	8 (20.5%)	1 (3.2%)	0.03
Associated non-thoracic injuries			
Clavicle fracture	6 (15.4%)	10 (32.3%)	0.09
Long bone fracture	14 (35.9%)	10 (32.3%)	0.75
Head injury	10 (25.6%)	6 (19.4%)	0.53
Abdominal injury	6 (15.4%)	3 (9.7%)	0.48

Table-2: Comparison of therapeutic procedures performed in the young and the elderly group (n=70)

Procedure performed	Age \leq 45 years (n=39; 55.7%)	Age \geq 65 years (n=31; 44.3%)	p-value
Epidural for relief	23 (59.0%)	18 (58.1%)	0.94
Bedside bronchoscopy	13 (33.3%)	6 (19.4%)	0.19
Tube thoracostomy	35 (89.7%)	30 (96.8%)	0.26
Thoracotomy	4 (10.2%)	1 (3.2%)	0.09
Mechanical ventilation	5 (12.8%)	14 (45.2%)	0.003

Table-3: Comparison of complications and in-hospital outcome of the young and the elderly group (n=70)

Complications	Group A (n=39; 55.7%)	Group B (n=31; 44.3%)	p-value
Pneumonia	2 (5.1%)	8 (25.8%)	0.01
Acute respiratory distress syndrome	6 (15.4%)	22 (71.0%)	0.000
Pulmonary oedema	1 (2.6%)	2 (6.5%)	0.43
Pulmonary embolism	1 (2.6%)	1 (3.2%)	0.87
Empyema	0	1 (3.2%)	0.26
Mortality	0	7 (22.6%)	0.002

DISCUSSION

This study included six months of data from the largest public tertiary care hospital in South Pakistan. The study found that in elderly patients, BCT due to falls is most common. These patients are also prone to develop pneumonia, need for MV, ARDS, and die during their hospital stay. Age groups studied are based upon the categorization of the young, middle, and elderly described by Shahram.⁴ Literature has limitations for paediatric age group trauma up to 12 years of age.⁵ The study has targeted young and elderly populations in terms of factors, comorbidities, and outcomes of BCT.

RTAs were the most common cause of BCT in both study groups. Elderly patients were more prone to both trauma and fall and young to RTAs. Among Japanese community-dwelling elderly at least 15% experienced one incidence of falls after 60 years of age.⁶ As far as RTAs are concerned, they have been a major public health concern, especially in low-to-middle-income countries. It is reported that every year more than one million deaths are caused by RTAs and the numbers are expected to increase by 65% in twenty years.⁷ In a recent report, 53% of BCT was due to RTA and 20% of cases were due to fall.⁸ When stratified with age, in older adults (≥ 65 years) 60% cases were due to fall and 33% due to RTAs⁹, and in other reports as many as 90% cases of isolated BCT in the elderly were due to fall¹⁰.

In a developed country like the United Kingdom, only 8% of cases were due to RTAs; and falls accounted for 85% cases.¹¹ In a German study, RTAs accounted for 66% CT cases and falls only accounted for 27%.¹² In a recent retrospective analysis from Sweden, 59% of elderly patients with chest wall and associated injuries had fallen and 35% had RTAs; in the young adult group, only 14% had experienced fall and the remaining 86% had RTAs or some other form of an accident.¹³

The most common primary thoracic injury, overall and, in both studies, groups was hemopneumothorax for our patients. It was followed by pulmonary contusion in the young and pneumothorax in the elderly. In other studies,

rib fractures (40%), pneumothorax (12.5%), hemopneumothorax (12.5%), and lung collapse (12.5%) remained common pattern of injury.¹⁴ Lung contusions were seen in 48% of CT in a German registry, followed by pneumothorax (39%), rib fractures (35%), and haemothorax (28%).¹² When stratified with age, isolated rib fractures (34%), lung contusions (10%), and parenchymal lung injuries (8%) were common in adults. In the elderly, rib fractures with associated haemothorax, pneumothorax, or hemopneumothorax (72%) were more common.¹⁵ In a three-year observational study, haemothorax (31% vs. 26%) and rib fractures (79% vs. 56%) were more common in the elderly, pneumothorax was more common in young adults (32% vs. 19%).¹⁶ Open chest wounds (15%) and flail chest (20%), in our study, was associated with young age group. In other literature, flail chest has been reported in 84–94% of patients of chest wall trauma.¹³ Lacerations were found to be 48.7% in group A about RTAs as the most common cause.

Among non-thoracic injuries, clavicle and long bone fractures were more common in the elderly whereas head injuries and long bone fractures were common in the young participants. The differences were insignificant. In a three-year observational study, 29% of the elderly had head injuries as compared to 39% in young adults ($p=0.01$).¹⁶ On the other hand, Hanafi *et al.* reported the highest incidence of head injuries in paediatric patients (6.5%), followed by elderly (5.4%), and lowest in adults (4.9%) ($p=0.04$). Similarly, bone fractures were most common in adults (23%), followed by paediatric (20%), and least common among the elderly (7.2%) ($p=0.02$).¹⁵

Associated abdominal injuries were more common in young patients (15%) in our study, contrary to Hanafi *et al.* only 5.4% elderly had associated abdominal injuries as compared to 4.4% in adults.¹⁵ Although, we could not find any Pakistani study that stratified BCT patients according to their ages, in general, associated lower limb fractures (13%) and head injuries (12%) have been commonly reported. Abdominal trauma has been reported in 9% BCT patients.¹⁷ Tube thoracostomy was done for 97% of the

elderly and 90% of young patients. The need for an epidural for pain relief was comparable in both groups (59% vs. 58%). MV was significantly less required for the young group as compared to the elderly group (45% vs. 13%; $p=0.003$). On the other hand, pneumonia, pulmonary oedema and ARDS tend to have occurred in the elderly because pre-existing illness mainly COPD and IHD led to worsening outcomes. Contrary to our results, pneumonia and intubation have been associated with the younger age group. Overall mortality has been reported in 16% of the elderly as compared to 11% of young.¹⁶

In a report from the American College of Surgeons Level I Trauma Center registry; there were 12% patients of ≥ 65 years with BCT who developed pneumonia, 1% developed ARDS; 1% required thoracotomy; and 26% were managed with thoracostomy. There were 4% MV and 2% mortality [18]. In local data, there have been 10% mortalities with BCT; not stratified for age.¹⁷ Predictors of mortality have been reported in the literature. These include multiple/bilateral rib fractures, older age, major chest wall injury, associated intra-abdominal injuries, pulmonary contusion, MV, and admission in the intensive care unit.^{8,19-22}

To the best of our knowledge, this is the first report from Pakistan which highlighted the characteristics of a vulnerable age group in case of blunt thoracic trauma. This study is significant in mapping a path towards further investigations to ensure an improved level of healthcare, reduced complications, and more favourable outcomes in the elderly. The shift towards geriatric care is swift and to enhance their overall healthcare experience it is essential to publish robust scientific evidence. We recommend local thoracic and trauma investigators to study the geriatric population in greater depths and analyse characteristics of predictors specific to them.

CONCLUSION

BCT is a common entity experienced by emergency medicine specialists, trauma specialists, and thoracic surgeons. Its main causes include accidents and unintentional falls. The elderly are a high-risk vulnerable population group are at risk of complications including pneumonia, ARDS, and the possibility of MV. They are prone to higher mortality in cases of BCT. It is mandatory to anticipate complications and take early measures to avoid preventable mortality.

AUTHORS' CONTRIBUTION

AA: Literature search, study design, Questionnaire design, data collection, data analysis, interpretation, drafting. TA: Study design and concept, revising data with critical analysis, final approval. PT: Literature search, drafting, critical analysis of study. SD: Literature search, data collection, revising data. NS: Literature search, data collection and analysis. MM: Questionnaire designing, data collection, drafting.

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