

BLUNT CHEST TRAUMA AT A REGIONAL TAY NGUYEN HOSPITAL: FREQUENT PLEUROPULMONARY INJURIES AND THE SIGNIFICANCE OF FOLLOW-UP AFTER TUBE THORACOSTOMY

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ABSTRACT

Background: Chest trauma is a common surgical emergency with diverse presentations and a high mortality rate. The Tay Nguyen region has distinctive characteristics in terms of terrain, transportation, and delayed access to healthcare, which may affect diagnosis, management, and treatment outcomes. However, data on this condition in the region remain limited.

Objective: To investigate the clinical and paraclinical characteristics of chest trauma and evaluate treatment outcomes at Tay Nguyen Regional General Hospital.

Materials and methods: A retrospective, descriptive analytical study was conducted on 55 patients with thoracic trauma diagnosed and treated at Tay Nguyen Regional General Hospital between January 2024 and June 2025.

Results and discussion: Males were 81.8%, the mean age was 52.78. Road traffic accidents were the leading cause (85.4%). The chest pain symptom was 100% and dyspnea was 56.36%. Rib fracture was the most common injury (94.5%). Pleuropulmonary injuries were identified in 74.5%. Tube thoracostomy was the most common initial treatment modality (63.6%), conservative management was 36.4%. The treatment success rate was 95.0% in the conservative group and 74.3% in the tube thoracostomy group ($p = 0.075$). Complications occurred in 18.2%, and no in-hospital mortality was recorded. The mean hospital stay was 9.8 days; patients with complications had a significantly longer hospital stay than those without complications (15.2 ± 7.3 vs. 8.6 ± 4.1 days; $p = 0.006$).

Conclusion: Chest trauma at Tay Nguyen Regional General Hospital was more common in working-age males, with road traffic accidents being the predominant cause. Rib fractures and pleuropulmonary injuries were the most prominent findings. Tube thoracostomy was the main treatment modality. Although no in-hospital mortality was observed, complications still occurred at a considerable rate and were associated with prolonged hospitalization, highlighting the need for close monitoring after initial treatment, especially in patients with pleural space injuries.

Keywords: Blunt chest trauma; tube thoracostomy; in-hospital complications.

1. BACKGROUND

Chest trauma is a common surgical emergency. Although substantial advances have been made in its medical management, mortality remains high. According to the current literature, chest trauma accounts for approximately 10–15% of all trauma-related hospital admissions, while it may contribute to up to 20–25% of trauma-related deaths.

To date, specialized studies on chest trauma have mainly been conducted and reported by major hospitals in urban areas. This may be partly because severe and polytrauma cases are more likely to be referred to specialized centers, and partly because densely populated urban areas are associated with a higher burden of traffic-related injuries. In contrast, the Central Highlands region has several distinct characteristics, including mountainous terrain, a dispersed population, a high incidence of traffic and occupational accidents, delayed access to healthcare, and limited resuscitation and diagnostic imaging resources. These factors may directly influence diagnostic strategies, management approaches, and treatment outcomes. However, systematic descriptive studies on the epidemiological, clinical, and paraclinical characteristics, as well as the management burden of chest trauma at regional hospitals in the Central Highlands, remain limited. Such data are needed to guide clinical management and improve the quality of care.

Therefore, we conducted this study with the following objectives:

1. To describe the epidemiological, clinical, and paraclinical characteristics of patients with chest trauma treated at Tay Nguyen Regional General Hospital.

2. To evaluate the treatment outcomes of these patients.

2. MATERIALS AND METHODS

2.1. Study population

All patients diagnosed with chest trauma and admitted for treatment at Tay Nguyen Regional General Hospital between January 2024 and June 2025 were included in the study.

Inclusion criteria: Patients diagnosed with chest trauma at admission and treated at Tay Nguyen Regional General Hospital.

Exclusion criteria: Patients with chest trauma who were transferred to another hospital during treatment, or whose medical records lacked essential data.

Study design: This was a retrospective, descriptive analytical study.

Sampling method: A convenience sampling method was used. All patients who met the inclusion criteria were enrolled. A total of 55 cases were included in this study.

2.2. Diagnostic and therapeutic assessment

Chest trauma was diagnosed in patients admitted with thoracic injury. All patients underwent chest radiography, including posteroanterior and lateral views. Contrast-enhanced chest computed tomography was performed when abnormalities were detected on chest radiographs. The imaging results were used to identify injuries of the chest wall or intrathoracic organs.

Conservative treatment was indicated for stable blunt chest trauma, mainly presenting with chest pain and/or rib fractures, with minor

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or non-progressive pleural injury and without respiratory or hemodynamic compromise [4,6,7]. Tube thoracostomy was indicated in cases of pneumothorax, hemothorax, hemopneumothorax, or increased air/blood volume in the pleural cavity during conservative follow-up [4,6]. Emergency thoracotomy was indicated for hemothorax requiring surgical hemostasis, hemopericardium, or retained pleural collections/pleural space complications that could not be resolved by tube drainage alone [11]. Video-assisted thoracoscopic surgery for clot evacuation was indicated in cases of retained hemothorax or post-traumatic pleural collections, inadequate drainage, incomplete lung re-expansion, or early pleural space complications [1,4,11].

Treatment outcomes were evaluated according to the initial treatment modality during hospitalization. Effective treatment was defined as successful control of the injury using the initial treatment modality, clinical improvement, no need for conversion to another intervention, and no complications[4,9]. Ineffective treatment was defined as the need to switch to another treatment modality or the occurrence of complications[4,9]. Complications were defined as adverse events arising during hospitalization that were related to the thoracic injury or the treatment modality[11]. The protocols for diagnosis, treatment, and outcome assessment were based on the clinical guidelines of Tay Nguyen Regional General Hospital.

2.3. Study variables

The study variables included general characteristics of the patients, including age, sex, comorbidities, and mechanism of injury; clinical characteristics, including chest pain, dyspnea, hemoptysis, subcutaneous emphysema, reduced breath sounds, Galliard's triad, Beck's triad, chest wall deformity, and flail chest; injury characteristics, including side of injury, lung and pleural injuries, rib fractures, and associated extra-thoracic injuries; paraclinical characteristics on chest radiography

and computed tomography; treatment modalities, including conservative medical treatment, tube thoracostomy, thoracotomy, and thoracoscopic surgery; treatment outcomes, including effective treatment, ineffective treatment, mortality, complications, conversion to another treatment modality; and hospitalization.

2.4. Statistical analysis

Data were analyzed using Stata version 17.0. Qualitative variables were presented as frequencies and percentages, and comparisons were performed using the Chi-square test or Fisher's exact test when appropriate. Quantitative variables were presented as mean $\pm$ standard deviation, and comparisons were performed using the independent-samples t-test or the Mann-Whitney/Wilcoxon rank-sum test depending on data distribution. Statistical significance was defined as $p < 0.05$.

Ethical considerations: All data were collected from archived medical records. Patient information was randomly coded, kept strictly confidential, and used solely for research purposes.

3. RESULTS

3.1. Characteristics of the study population

Table 1. General characteristics of the study population (n = 55)

Study characteristics		n	%
Sex	Male	45	81.8
	Female	10	18.2
Mean age (mean $\pm$ SD)		52.78 $\pm$ 15.94	
Comorbidities	Hypertension	14	25.4
	Diabetes mellitus	05	09.1
	Cardiovascular disease	01	01.8
	Chronic lung disease	01	01.8

Study characteristics		n	%
Comorbidities	Chronic kidney disease	0	0
	Other diseases	05	09.1
Mechanism of injury	Road traffic accident	47	85.4
	Domestic accident	04	07.2
	Occupational accident	03	05.4
	Social violence	01	01.8

Among the 55 patients with chest trauma treated at Tay Nguyen Regional General Hospital, males predominated, accounting for 45 cases (81.8%), while females accounted for 10 cases (18.2%). The mean age of the study population was 52.78 ± 15.94 years (min:17, max:90). Regarding comorbidities, hypertension was the most common, observed in 14 cases (25.4%), followed by diabetes mellitus in 5 cases (9.1%). Cardiovascular disease and chronic lung disease were each recorded in 1 case (1.8%). No cases of chronic kidney disease were recorded, while other diseases accounted for 9.1%. The leading mechanism of injury was road traffic accident, with 47 cases (85.4%), followed by domestic accidents in 4 cases (7.2%), occupational accidents in 3 cases (5.4%), and social violence in 1 case (1.8%).

Table 2. Clinical and paraclinical characteristics (n = 55)

Variables		n	%
Main symptoms	Chest pain	55	100
	Dyspnea	31	56.36
	Hemoptysis	01	01.8
Physical signs	Subcutaneous emphysema	04	07.3
	Reduced breath sounds	21	38.2
	Galliard's triad	14	25.4

Variables		n	%
Physical signs	Chest wall deformity	0	0
	Flail chest	0	0
	Beck's triad	0	0
Side of injury	Right side	21	38.2
	Left side	29	52.7
	Bilateral	03	05.4
Injury patterns	Rib fracture	52	94.5
	Hemothorax	33	60.0
	Pneumothorax	19	34.5
	Hemopneumothorax	11	20.0
	Subcutaneous emphysema	10	18.2
	Pulmonary contusion	10	18.2
	Pleuropulmonary injury	41	74.5
Associated injuries	Traumatic brain injury	04	07.3
	Abdominal–pelvic trauma	07	12.7
	Clavicle fracture	17	30.9
	Scapular fracture	06	10.9
	Upper limb trauma	01	01.8
	Lower limb trauma	02	03.6
	Maxillofacial trauma	02	03.6

Chest pain was recorded in all patients. Dyspnea was also common, occurring in 31 cases (56.4%), while hemoptysis was observed in only 1 case. The most frequent physical sign was reduced

breath sounds, accounting for 38.18%, followed by Galliard's triad in 25.4%. Subcutaneous emphysema was less common, observed in 7.3% of cases. Left-sided injuries were more frequent, accounting for 52.73%, while right-sided injuries accounted for 38.18%; bilateral injuries were uncommon, accounting for only 5.45%.

Rib fracture was the most common injury pattern, observed in 94.5% of patients. Pleuropulmonary injuries accounted for 74.5%, with hemothorax being particularly frequent, occurring in 60.0% of cases. Pneumothorax and hemopneumothorax were recorded in 34.5% and 20.0% of cases, respectively. Among associated injuries, clavicle fracture was the most common, accounting for 30.9%. Other associated injuries included abdominal–pelvic trauma (12.7%), scapular fracture (10.9%), and traumatic brain injury (7.3%). Other injuries were less frequent.

Anteroposterior chest radiography was routinely performed for all patients with chest trauma. Chest computed tomography (CT Scan) was indicated when there was clinical suspicion of occult pleuropulmonary injuries, multiple or multi-level rib fractures, post-traumatic complications, or ambiguous findings on chest radiographs. These procedures followed the standard guidelines of Tay Nguyen Regional General Hospital. Regarding diagnostic imaging, 100% of patients (n=55) underwent chest radiography, which initially detected rib fractures in 51 cases (92.7%). Among these, 22 cases were classified as having ≤ 3 rib fractures and 29 cases as having >3 rib fractures. Chest CT Scan was performed in 24 patients (43.6%), revealing 4 cases with ≤ 3 rib fractures and 20 cases with >3 rib fractures. Chest CT Scan demonstrated higher accuracy in the classification of rib fractures and pleuropulmonary injuries.

The mean hospital stay was 11.63 ± 8.47 days in patients with associated injuries and 8.11 ± 2.75 days in those without associated injuries. The Wilcoxon rank-sum test, also known as

the Mann–Whitney test, showed a statistically significant difference in length of hospital stay between these two groups, with $p = 0.04$.

3.2. Treatment outcomes

Table 3. Treatment outcomes

Treatment outcomes		Value	p-value
Initial treatment modality (n, %)	Conservative medical treatment	20 (36.4)	
	Tube thoracostomy	35 (63.6)	
Treatment outcome according to initial modality (n, %)	Effective conservative treatment	19/20 (95.0)	0.075 Fisher's exact test
	Ineffective conservative treatment	1/20 (5.0)	
	Effective tube thoracostomy	26/35 (74.3)	
	Ineffective tube thoracostomy	9/35 (25.7)	
Additional intervention / conversion to another treatment modality (n, %)	Thoracoscopic evacuation of retained hemothorax	6 (10.9)	
	Open surgery for pleural space debridement	1 (1.8)	
In-hospital complications (n, %)	Retained hemothorax after tube thoracostomy	6 (10.9)	
	Atelectasis	2 (3.6)	
	Post-traumatic pneumonia	2 (3.6)	
	Prolonged air leak (>5 days)	1 (1.8)	
	Empyema	1 (1.8)	

Treatment outcomes		Value	p-value
In-hospital complications (n, %)	At least one complication	10 (18.2)	
	Mortality	0	
Length of hospital stay, days, mean $\pm$ SD	Overall study population	9.8 $\pm$ 6.4	0.006 Mann–Whitney test
	Patients without complications (n = 45)	8.6 $\pm$ 4.1	
	Patients with complications (n = 10)	15.2 $\pm$ 7.3	

The main initial treatment modality was tube thoracostomy, performed in 35 cases (63.6%), whereas conservative medical treatment was applied in 20 cases (36.4%). According to the initial treatment outcome assessment, effective treatment was achieved in 19 of 20 patients in the conservative treatment group (95.0%), which was higher than that in the tube thoracostomy group, where 26 of 35 patients achieved effective treatment (74.3%). However, this difference did not reach statistical significance according to Fisher's exact test, with $p = 0.075$.

During treatment, 6 patients (10.9%) required thoracoscopic evacuation of retained hemothorax, and 1 patient (1.8%) required open surgery for pleural space debridement. In-hospital complications included retained hemothorax after tube thoracostomy in 6 cases (10.9%), atelectasis in 2 cases (3.6%), post-traumatic pneumonia in 2 cases (3.6%), prolonged air leak lasting more than 5 days in 1 case (1.8%), and empyema in 1 case (1.8%). Overall, 10 patients (18.2%) had at least one complication. No deaths were recorded.

The mean length of hospital stay in the overall study population was 9.8 ± 6.4 days. Patients with complications had a significantly longer hospital stay than those without

complications, at 15.2 ± 7.3 days versus 8.6 ± 4.1 days, respectively. This difference was statistically significant according to the Mann–Whitney test, with $p = 0.006$.

4. DISCUSSION

In our study, males accounted for a clear predominance, representing 81.8% (Table 1) of the study population, with a mean age of 52.78 ± 15.94 years (Table 1). This finding reflects the general characteristics of chest trauma reported in previous studies, as men of working age are more frequently involved in traffic activities and physically demanding labor. The proportion of male patients in our study was comparable to those reported by Nguyen The Luc, Nguyen Huu Uoc, and Sikander N, all of whom also found that males constituted the majority of patients with chest trauma [1,2,3]. However, the mean age in our study was lower than that reported in several studies specifically focusing on elderly patients, such as those by Nguyen The Luc and Nguyen Van Nam [1,5], and was closer to the findings of Pham Doan Ngoc Tuan and Kozanlı [4,5]. This suggests that our study population reflects a relatively typical pattern of chest trauma at a regional hospital, not limited to elderly patients but mainly involving physically active age groups. Accordingly, road traffic accidents accounted for as much as 85.4% of cases, contributing to a realistic picture of the local situation in the Central Highlands. This may represent a distinctive epidemiological feature, because unlike major urban surgical centers, the disease and injury pattern in the Central Highlands is strongly influenced by terrain, distance to healthcare access, and inter-district or inter-provincial traffic characteristics.

Clinically, chest pain was present in all patients, while dyspnea was observed in 56.36%, (Table 2) indicating that these remain two highly suggestive symptoms in the initial assessment and management of patients with

chest trauma. The 100% rate of chest pain in our study was consistent with recent domestic studies, whereas the rate of dyspnea was closer to that reported by Nguyen Van Nam than by Nguyen The Anh [5,6]. On physical examination, reduced breath sounds accounted for 38.2% and Galliard's triad for 25.4%, reflecting the substantial burden of pleural space injuries in our study population. In addition, left-sided injuries were more frequent than right-sided injuries, accounting for 52.7% versus 38.2%, a trend also reported in studies by Pham Doan Ngoc Tuan and Nguyen The Anh [3,6]. More importantly, the anatomical injury pattern was notable: rib fractures accounted for 94.5%, (Table 2) hemothorax for 60.0%, pneumothorax for 34.5%, (Table 2) hemopneumothorax for 20.0%, and pulmonary contusion for 18.2% (Table 2). This pattern indicates that chest trauma in our cohort was not limited to isolated chest wall injury; rather, most patients had pleuropulmonary involvement. Compared with domestic studies, the rate of rib fractures in our study was similar to those reported by Nguyen Van Nam, Pham Doan Ngoc Tuan, and Nguyen The Anh [3,5,6]. In contrast, the rate of hemothorax in our study was higher than that in several other case series, suggesting that pleural space injury in this group of patients tended to be more severe.

Another important finding was the frequency of associated injuries. Clavicle fracture was recorded in 30.9% of patients, abdominal–pelvic trauma in 12.7%, scapular fracture in 10.9%, and traumatic brain injury in 7.3% (Table 2). From a mechanistic perspective, chest trauma rarely occurs in isolation, particularly when the mechanism is road traffic accident. Our results indicate that polytrauma or multiple associated injuries were relatively common, consistent with previous observations that chest trauma is often part of a systemic injury pattern rather than a strictly localized thoracic condition [2,8]. Notably, patients with associated injuries had a significantly longer hospital stay than those

without associated injuries, at 11.63 ± 8.47 days versus 8.11 ± 2.75 days, respectively, with $p = 0.04$. This finding suggests that in-hospital prognosis is determined not only by the severity of thoracic injury but also by the burden of extra-thoracic injuries. In other words, comprehensive assessment of associated injuries from the outset may help predict the duration of treatment, the need for multidisciplinary coordination, and the risk of a more complicated clinical course.

Regarding management, tube thoracostomy was the predominant initial treatment modality in our study, accounting for 63.6%, whereas conservative medical treatment was applied in 36.4% of patients (Table 3). In our view, this finding reflects the injury characteristics of the study population, as most patients had hemothorax, pneumothorax, or hemopneumothorax. Compared with domestic studies, the rate of tube thoracostomy in our study was lower than those reported by Doan Duy Hung and Nguyen The Hiep [11,12], closer to that reported by Nguyen The Luc [1], but clearly higher than those reported by Nguyen Van Nam and Pham Doan Ngoc Tuan [3,5]. These differences may be related to variations in patient selection across centers, admission criteria, timing of injury detection, and availability of conservative monitoring strategies. In our study, the conservative treatment group achieved an effectiveness rate of 95.0%, higher than the 74.3% observed in the tube thoracostomy group (Table 3); however, this difference did not reach statistical significance, with $p = 0.075$. This result is consistent with the fact that patients selected for conservative treatment were generally more stable, had less progressive injuries, and therefore had a more favorable prognosis from the beginning. Conversely, patients requiring tube thoracostomy had more evident pleural space injuries and greater injury severity, resulting in a higher risk of treatment failure or the need for additional intervention. The lack of statistical significance may be attributable to the small sample size, although the clinical difference

remains relatively apparent.

In terms of in-hospital outcomes, 6 patients with retained hemothorax after tube thoracostomy required thoracoscopic evacuation of clotted blood, and 1 patient with empyema required open surgery for pleural space debridement. In addition, atelectasis was recorded in 2 cases, post-traumatic pneumonia in 2 cases, and prolonged air leak in 1 case; no deaths were recorded. Pathophysiologically, retained hemothorax is a common event after tube thoracostomy in patients with moderate to large hemothorax. Atelectasis, pneumonia, and prolonged air leak are respiratory complications commonly associated with chest pain, hypoventilation, pulmonary contusion, or concomitant lung parenchymal injury [1,3,4]. The absence of in-hospital mortality suggests that the overall treatment outcome in this study was favorable. However, this finding should be interpreted with caution, as patients transferred to other hospitals during treatment were excluded, which may have reduced the number of very severe cases included in the study. Nevertheless, the 12.7% rate of additional intervention and the 18.2% rate of complications indicate that chest trauma at our hospital was not a minor condition and required close follow-up after initial treatment, especially among patients who underwent tube thoracostomy.

Another important finding was that the mean length of hospital stay for the entire study population was 9.8 ± 6.4 days (Table 3). Patients with complications had a markedly longer hospital stay than those without complications, at 15.2 ± 7.3 days versus 8.6 ± 4.1 days (Table 3), respectively, with a statistically significant difference of $p = 0.006$. Although complications did not increase mortality in our study population, events such as retained hemothorax, pneumonia, and empyema substantially prolonged treatment and increased the need for specialized care. Compared with several other studies, such as those by Nguyen Van Nam and Kozanlı, the mean hospital stay in our study was longer [4,5]. This

may reflect two factors: first, the high proportion of pleural space injuries in our study; and second, the local conditions of monitoring, care, and access to outpatient follow-up in the Central Highlands, which may lead clinicians to discharge patients only after both clinical and imaging findings have become stable. These findings suggest that, beyond management of the primary injury, prevention of respiratory complications, adequate pain control, and early detection of retained hemothorax after tube thoracostomy are key factors for shortening hospital stay and improving treatment effectiveness.

Overall, our study shows that chest trauma at Tay Nguyen Regional General Hospital reflects a pattern of road traffic injury predominantly affecting working-age male patients, with rib fractures and pleuropulmonary injuries as prominent findings. Tube thoracostomy was the main treatment modality, but this patient group also had a risk of complicated clinical progression, need for additional intervention, and longer hospitalization when complications occurred. The encouraging aspect of this study lies not only in its description of injury patterns, but also in its demonstration that, at our regional hospital, most patients with chest trauma could be treated effectively without in-hospital mortality, provided that appropriate treatment stratification and close monitoring of post-initial treatment complications were implemented.

5. CONCLUSION

Chest trauma at Tay Nguyen Regional General Hospital is more commonly observed in working-age male patients, with road traffic accidents being the predominant mechanism of injury. Clavicle fracture was the most frequent associated injury, while rib fracture is the most common thoracic injury pattern. Tube thoracostomy is the principal treatment modality. Although no in-hospital mortality is recorded, complications still occur and are

significantly associated with prolonged hospital stay. These findings underscore the need for close follow-up after initial treatment, particularly in patients with pleural space injuries.

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