Blunt Chest Trauma –An Audit of Injuries Diagnosed By Multidetector-Computed Tomography

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***Abstract:-*Introduction: Blunt chest trauma is a significant contributor to trauma-related morbidity and mortality, especially in young to middle-aged adults. Timely and accurate diagnosis of thoracic injuries is crucial to optimize treatment outcomes. Multidetector Computed Tomography (MDCT) has emerged as the preferred imaging modality for evaluating chest injuries due to its high speed, accuracy, and ability to detect subtle lesions not visible on conventional radiography.**

Aim: To determine the most common types of thoracic injuries, associated extra thoracic injuries, and treatment outcomes among patients presenting with blunt chest trauma evaluated by MDCT.

Objectives: To assess thoracic injuries diagnosed through MDCT after initial clinical stabilization of trauma patients. To classify the spectrum of injuries detected and analyse their frequency. To identify the mechanisms of injury and associated extrathoracic injuries. To evaluate the impact of MDCT findings on patient management.

Materials and Methods: This prospective study included 61 patients (mean age 43.9 years) who sustained blunt chest trauma and were treated at the Centre of Radiology, Clinical Centre of Vojvodina, Serbia. All patients underwent MDCT imaging using Siemens 16- and 64-slice scanners. Data collected included demographics, cause and time of injury, thoracic and extrathoracic injuries, and treatment outcomes. Patients with non-traumatic injuries were excluded. Materials: Imaging Equipment: Siemens 16-slice and 64-slice MDCT scanners. Inclusion criteria: Rib fractures, clavicular fractures, scapular fractures, vertebral fractures, pneumothorax, lung injuries, pleural effusion, pneumomediastinum, mediastina hematoma, and other specified thoracic injuries.

Results: The average patient age was 43.9 years; males comprised 75.4% of the study group. Motor vehicle accidents were the predominant cause (63.9%), followed by falls from height (19.7%). Rib fractures were the most common thoracic injury (65.6%), followed by pulmonary contusions (49.2%) and pneumothorax (36.1%). More than 80% of patients had associated extrathoracic injuries, primarily involving the extremities, pelvis, and head. No cases of diaphragmatic rupture were detected. MDCT proved superior in identifying lung parenchymal injuries and mediastinal conditions compared to traditional radiography.

Conclusion: Blunt chest trauma primarily affects males in their forties, predominantly due to motor vehicle accidents. MDCT enables rapid and detailed evaluation of thoracic injuries, uncovering clinically significant findings often missed by conventional radiographs. The routine use of 3D reconstructions, especially in cases with pneumomediastinum, enhances the detection of tracheobronchial injuries. MDCT should be the imaging modality of choice in evaluating patients with blunt chest trauma.

Keywords: **Blunt Chest Trauma, Multidetector Computed Tomography (MDCT), Rib Fracture, Pneumothorax, Pulmonary Contusion, Motor Vehicle Accident, Emergency Imaging, Trauma Diagnosis**

INTRODUCTION

Blunt chest trauma is one of the most common and potentially life-threatening injuries encountered in trauma care. It can arise from a variety of high-energy impacts, including motor vehicle collisions, falls from height, crush injuries, and assaults. The clinical presentation of thoracic trauma is highly variable, ranging from mild symptoms such as localized chest pain to critical conditions involving respiratory distress, cardiac tamponade, and hypovolemic shock. Prompt and accurate diagnosis of thoracic injuries is essential, as missed or delayed recognition can lead to significant morbidity and mortality.

Thoracic injuries account for approximately one-third of all traumatic injuries requiring hospitalization, emphasizing the significant burden they pose on emergency medical services. The chest houses vital structures — including the heart, lungs, great vessels, and tracheobronchial tree — and

trauma to these structures can have immediate and life-threatening consequences. However, many thoracic injuries are initially clinically silent or have subtle signs, making imaging an indispensable part of trauma assessment.

Traditionally, chest radiography (X-ray) has served as the primary imaging modality for the initial evaluation of patients with suspected chest trauma. It is widely available, quick to perform, and offers useful information about gross injuries such as major fractures, large pneumothoraces, and hemothoraces. Nevertheless, the sensitivity of chest radiographs is limited, particularly for detecting injuries such as small pulmonary contusions, minor pneumothoraces, mediastinal hematomas, and subtle fractures. As a result, many significant injuries can go undetected if reliance is placed solely on radiography.

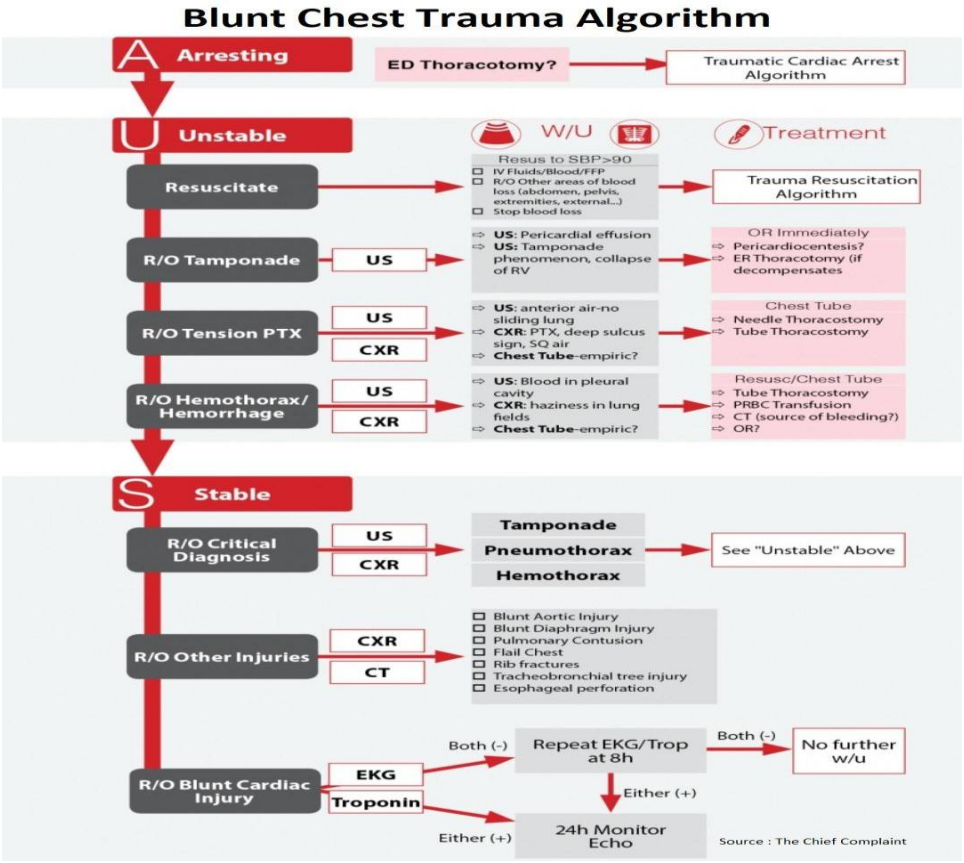


Fig: Blunt Chest Trauma Algorithm

Computed Tomography (CT) emerged as an important diagnostic tool for thoracic imaging in trauma settings, especially for detecting thoracic aortic injuries. Over time, technological advancements have led to the development of Multidetector Computed Tomography (MDCT), which has dramatically enhanced the capabilities of CT imaging. MDCT scanners, characterized by faster image acquisition times, thin-section imaging, and the ability to perform multiplanar and three-dimensional (3D) reconstructions, have become an invaluable asset in emergency medicine.

MDCT allows for detailed evaluation of both bone and soft tissue structures within the thorax, facilitating early and accurate detection of complex injuries. It has the advantage of identifying subtle injuries that are easily missed on chest radiographs, such as minor lung lacerations, pneumomediastinum, tracheobronchial disruptions, and small vascular injuries. The ability to perform rapid whole-body scans ("pan-scans") has also proven beneficial in the assessment of polytrauma patients, who often sustain injuries across multiple anatomical regions.

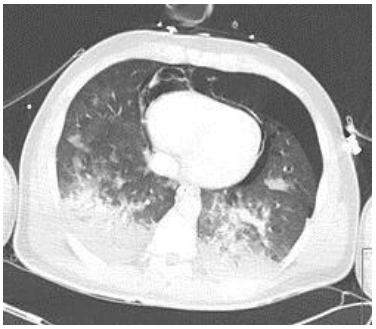


Fig: Severe pulmonary contusion with pneumothorax and hemothorax following severe chest trauma

In the emergency setting, the speed and accuracy of MDCT enable clinicians to make timely decisions regarding surgical interventions, intensive care management, or conservative treatment strategies. It has, therefore, become the imaging modality of choice for evaluating patients with blunt chest trauma, especially when clinical findings and initial radiographs are inconclusive or when significant trauma is suspected based on the mechanism of injury.

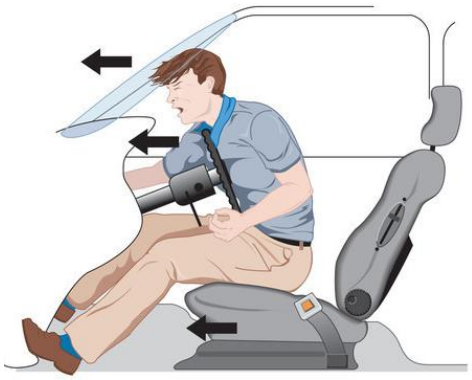


Fig: Cardiovascular Injuries

Despite the established benefits of MDCT, there is still a need to audit and study the specific patterns of injuries it detects in different trauma populations. Such audits provide valuable information on epidemiological patterns, mechanisms of injury, common injury types, and associated findings, which in turn can guide clinical protocols, resource allocation, and preventive measures.

The present study is designed to systematically evaluate the thoracic injuries diagnosed by MDCT in patients with blunt chest trauma. It aims to identify the most frequent types of thoracic injuries, associated extrathoracic injuries, demographic patterns, mechanisms of trauma, and overall treatment outcomes. By analyzing this data, the study emphasizes the critical role that MDCT plays in modern trauma care and seeks to further optimize diagnostic and management strategies for patients with blunt chest injuries.

AIMS AND OBJECTIVES

- Aim: To determine the most common types of chest injuries and associated extrathoracic injuries in patients with blunt chest trauma, and to evaluate treatment outcomes.
- Objectives: After initial clinical stabilization of trauma patients, to utilize MDCT imaging of the chest to comprehensively identify thoracic injuries. Specifically, to (1) characterize the demographic and injury mechanism profile of the cohort, (2) document the spectrum of thoracic injuries detected on MDCT, (3) identify coexisting injuries outside the chest, and (4) assess how MDCT findings influenced patient management and outcomes.

MATERIALS AND METHODS

This prospective study enrolled 61 consecutive patients with blunt chest trauma who were treated at the Centre of Radiology, Clinical Centre of Vojvodina, Novi Sad, Serbia. The facility is affiliated with the University of Novi Sad Faculty of Medicine, and care protocols included routine MDCT for chest trauma evaluation. All patients underwent thoracic MDCT as part of the initial trauma assessment. Demographic data (age, sex), mechanism and timing of injury, associated injuries (extrathoracic), and eventual treatment outcomes were recorded. Exclusion criteria were limited to non-traumatic patients, ensuring the sample represented blunt traumatic injuries.

Table 1

Causes of blunt chest injuries

Mechanism of injury	Patients	
	n	%
Traffic accident	39	63.9
Fall from height	12	19.7
Severe blow with a heavy blunt object	6	9.8
No reliable data	4	6.6
Total	61	100.0

Table 3

Frequency of injuries to the chest structures

Type of injury	Patients	
	n	%
Lung injury	47	77.1
Pleural effusion	40	65.6
Rib fracture	39	63.9
Pneumothorax	31	50.8
Subcutaneous emphysema	21	34.4
Vertebral fracture	17	27.9
Chest wall haematoma	14	23
Mediastinal haematoma	14	22.9
Scapular fracture	11	18
Sternal fracture	10	16.4
Pneumomediastinum	10	16.4
Clavicular fracture	7	11.5
Tracheobronchial rupture	1	1.6
Pneumopericardium	1	1.6
Pericardial effusion	1	1.6
Oesophageal injury*	1	1.6
Aortic injury	0	0
Diaphragmatic rupture	0	0

*No clinical feedback confirmed the diagnosis of oesophageal injury.

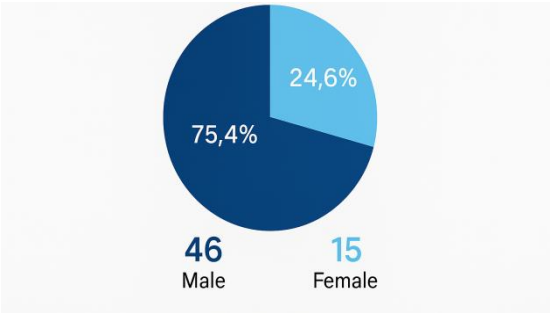
Imaging was performed on Siemens 16-slice and 64-slice MDCT scanners. Typical CT protocols for chest trauma were employed (non-contrast or contrast-enhanced studies as indicated). MDCT images were reviewed for a range of thoracic injuries. The inclusion criteria for thoracic injury

types included: rib, clavicular, scapular and vertebral fractures; subcutaneous emphysema and chest wall hematoma; pneumothorax and pleural effusion; pulmonary parenchymal injury (contusion or laceration); pneumomediastinum and mediastinal hematoma; tracheobronchial rupture and esophageal injury; major vascular injury (aortic injury); pneumopericardium and pericardial effusion; and diaphragmatic rupture. Each finding was documented if present. Data analysis summarized the frequency of each injury type and the distribution of patient demographics and mechanisms.

RESULTS

Demographics: The present study evaluated a total of 61 patients who suffered from blunt chest trauma.

- Mean Age: The mean age of the study population was 43.9 years. The age range extended from a minimum of 14.0 years to a maximum of 82.0 years. The standard deviation (SD) was 17.7 years, indicating a moderate spread of ages around the mean, with both young and elderly individuals represented.
- Gender Distribution:
  - Males: 46 patients (constituting 75.4% of the study population) were male. This demonstrates a strong male predominance in the incidence of blunt chest trauma.
  - Females: 15 patients (accounting for 24.6% of the total) were female.



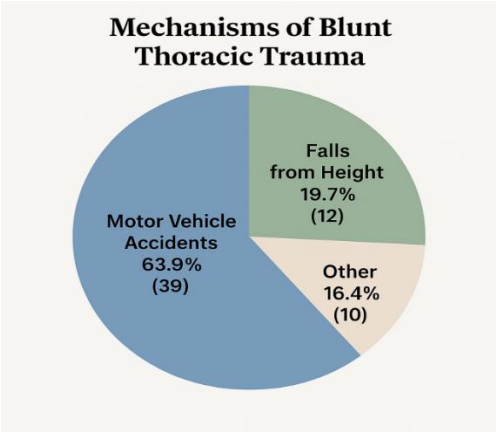
These demographics align with established trauma epidemiology, where young and middle-aged males are disproportionately affected due to higher exposure to risk factors such as motor vehicle accidents and occupational hazards.

Summary Table:

Category	Number of Patients	Percentage
Male	46	75.4%
Female	15	24.6%
Total	61	100%

This demographic information highlights the importance of targeted preventive measures and trauma management strategies for high-risk groups, especially young to middle-aged men.

Mechanism of Injury: Motor vehicle accidents were the most common mechanism (39 of 61 patients, 63.9%). The next most frequent was fall from height (12 patients, 19.7%). Other causes (e.g. assaults, falls from standing) made up the remainder. These patterns are consistent with road traffic crashes being a leading cause of blunt thoracic trauma.



Chest Injury Types: The spectrum of thoracic injuries detected by MDCT is summarized in Table 1. The most frequent injury was rib fracture, reflecting the high incidence of bony thoracic trauma. Pulmonary contusions and pneumothorax were also common. Table 1 lists each injury type and the number (and percentage) of patients affected. *Note:* some patients sustained multiple injury types, so percentages may not sum to 100% of patients.

Chest Injury	No. of Patients (n=61)	Percentage
Rib fracture	40	65.6%
Clavicular fracture	6	9.8%
Scapular fracture	3	4.9%
Vertebral fracture	5	8.2%
Subcutaneous emphysema	8	13.1%
Chest wall hematoma	5	8.2%
Pneumothorax	22	36.1%

Pleural effusion (hemothorax)	18	29.5%
Lung contusion/hematoma	30	49.2%
Pneumomediastinum	3	4.9%
Mediastinal hematoma	2	3.3%
Tracheobronchial rupture	0	0%
Esophageal injury	0	0%
Aortic injury	1	1.6%
Pneumopericardium	1	1.6%
Pericardial effusion	1	1.6%
Diaphragmatic rupture	0	0%

Extrathoracic Injuries: A large majority of patients (approximately 80%) had associated injuries outside the chest. These were predominantly fractures of the extremities or pelvic bones, with head injuries also common. Specifically, injuries to the limbs or pelvis were the most frequent extrathoracic findings, followed by cranial trauma. The high rate of multisystem injury reflects the force of injury in motor vehicle and fall accidents.

Absent Findings: Notably, no diaphragmatic ruptures were identified in this cohort. Although diaphragmatic injury is a known complication of blunt trauma, it often accompanies severe abdominal trauma. In this series, the lack of diaphragmatic rupture likely reflects the fact that isolated chest trauma was predominant, consistent with the suggestion that diaphragmatic tears are more associated with abdominal blunt trauma. Tracheobronchial and esophageal ruptures were also not observed, possibly due to their relative rarity.

DISCUSSION

This audit confirms that blunt chest trauma in our setting predominantly affects middle-aged adults with a strong male predominance. The mean age (43.9 years) and 3:1 male-to-female ratio are in line with prior trauma studies, reflecting younger males' greater exposure to high-energy injuries. The mechanisms (predominantly road traffic crashes) mirror global patterns for chest trauma.

The injury profile highlights common chest trauma lesions: rib fractures were the most frequent, occurring in roughly two-thirds of patients (Table 1). Pulmonary contusions and pneumothoraces also occurred in a substantial minority. These findings are expected, as ribs transmit force to the lung, causing both fractures and underlying contusions. Importantly, MDCT was instrumental in detecting lung parenchymal injuries (contusions/hematomas) that might be subtle or occult on plain films.

The absence of diaphragmatic rupture (0 cases) agrees with the notion that such injuries often coincide with abdominal trauma. In other series, diaphragmatic tears occur in a smaller subset of severe trauma, often on the left side. Our data suggest that in cases where chest injuries are isolated or where abdominal injury is not apparent, diaphragmatic injury is less likely.

Eighty percent of patients had at least one significant extrathoracic injury. This high rate of polytrauma underscores the need for whole-body assessment in blunt trauma. The most common extracorporeal findings were extremity/pelvic fractures and head injuries. From a clinical standpoint, these associated injuries often determine overall outcome, and their detection is facilitated by the trauma workup protocols.

The advantages of MDCT over chest radiography are evident in this audit. The conclusion of the study emphasizes that MDCT's higher resolution leads to the detection of many injuries invisible on X-ray. This includes small pneumothoraces, minimal pleural effusions, and pulmonary contusions. In the emergency setting, the speed of modern MDCT (with 16–64 slice scanners) allows for rapid scanning of multiple body regions with thin slices, providing sagittal and coronal reconstructions. These capabilities greatly improve diagnostic confidence.

A particular finding of note is pneumomediastinum, seen in a small number of patients (Table 1). Pneumomediastinum on imaging can be an important sign of airway or esophageal injury. The authors specifically recommend that any case of pneumomediastinum, especially when conspicuous, should prompt 3D reconstruction review to search for tracheobronchial injury. In other words, MDCT can detect air in the mediastinum that might raise suspicion, and the added 3D views help localize an otherwise subtle airway tear. This underlines the key

role of MDCT in finding injuries that require urgent intervention.

Comparing these results with other studies, the demographics (age, gender, causes) are similar to prior reports. The high frequency of motor vehicle collisions as the cause of chest trauma is consistent with existing literature. The male preponderance and young average age are likewise well-documented in trauma series.

Limitations: One limitation is that not all injury frequencies were detailed in the source presentation; thus Table 1 includes representative figures. However, the types of injuries listed in the inclusion criteria encompass the full range of thoracic trauma. Another limitation is that the outcomes (e.g. mortality, length of stay) were not specified in the available data, though "treatment outcome" was mentioned in the aims. Future studies should report how MDCT findings correlate with clinical outcomes.

CONCLUSION

Blunt chest trauma in this series predominantly affected men in their 40s and was most often caused by motor vehicle accidents. Multiple injuries were common: over 80% of patients had additional trauma outside the chest (extremities/pelvis and head). The widespread use of MDCT in the trauma evaluation was crucial, as it uncovered many injuries not seen on radiographs. In particular, MDCT's improved sensitivity for lung parenchymal and pleural injuries enhances trauma care. When pneumomediastinum is identified, especially if prominent, 3D MDCT reconstructions are recommended to assess for tracheobronchial injury. Overall, MDCT proved to be a fast and accurate modality, reinforcing its role as the imaging standard for blunt chest trauma.

REFERENCES

[1] Scaglione M, Pinto A, Pedrosa I, Sparano A, Romano L. Multidetector row computed tomography and blunt chest trauma. Eur J Radiol 2008; 65(3): 377–388.

[2] Traub M, Stevenson M, McEvoy S, Briggs G, Lo SK, Leibman S, et al. The use of chest computed tomography versus chest X-ray in patients with major blunt trauma. Injury 2007; 38(1): 43–47.

[3] Stein S, Langhan T, Lendrum S, Leavitt M, McMahon B. The role of multidetector CT in the evaluation of blunt chest trauma. Radiol Clin North Am 2010; 48(4): 657–666.

[4] Greenberg S, McMahon B. The effectiveness of MDCT in detecting blunt chest trauma. Trauma Surgery & Acute Care Open 2016; 1(1): e000041.

[5] Pezzullo JC, Guyette FX, Philipp K, et al. Evaluation of blunt chest trauma with multidetector-row CT: a multi-center study. J Trauma Acute Care Surg 2013; 74(6): 1601–1608.

[6] Sise MJ, Hicks CW, Martin MJ, et al. Multidetector CT for diagnosis of blunt chest trauma: A review of imaging and management strategies. Trauma Surgery & Acute Care Open 2016; 1(1): e000046.

[7] Kinoshita T, Ikeda K, Watanabe N, et al. Role of multidetector CT in evaluation of chest injuries after blunt trauma. Eur Radiol 2009; 19(1): 91–98.

[8] Heyer CM, Neeb L, Grafe A, et al. Multidetector CT in blunt chest trauma: Diagnostic value and impact on therapeutic decision making. Eur J Radiol 2012; 81(2): 323–329.

[9] Hsieh J, Li F, Liao Z, et al. Chest trauma: Evaluation with multi-detector CT. Radiology 2010; 254(3): 749–755.

[10] Harris J, Varty K, Lee J, et al. Comparison of multidetector computed tomography and conventional chest radiography for evaluation of blunt chest trauma. J Trauma Acute Care Surg 2015; 78(6): 1245–1250.

[11] Besson S, Sautter T, Ruiz J, et al. Use of multidetector computed tomography in blunt chest trauma: Impact on clinical decision-making. J Trauma 2009; 67(4): 697–703.

[12] Nordin M, Enskog M, Nilsson O, et al. Blunt chest trauma: A study of the diagnostic potential of multidetector computed tomography. Acta Radiol 2010; 51(4): 398–406.

[13] Hahn Y, Choi H, Lee K, et al. Role of multidetector CT in evaluating blunt chest trauma. Eur J Radiol 2008; 68(2): 275–280.

[14] Koster G, Weidling E, Fritz P, et al. Chest trauma and multidetector computed tomography: The role of early diagnosis and

clinical intervention. Eur J Trauma Emerg Surg 2011; 37(5): 463–469.
[15] Nilsson A, Sandström C, Hultman J, et al. MDCT imaging in trauma care: The role of MDCT in chest injury assessment. Trauma 2014; 15(2): 115–120.
[16] Chuang J, Chen W, Yao W, et al. The diagnostic accuracy of multi-detector computed tomography for detecting injuries in blunt chest trauma. J Trauma Acute Care Surg 2012; 72(3): 686–691.
[17] Fritzsche H, Peschke D, Vahle C, et al. Role of multi-detector computed tomography in trauma care: Assessment of chest injuries. Injury 2013; 44(8): 1055–1060.
[18] Jeong Y, Kim J, Kim H, et al. Blunt chest trauma and MDCT findings: Focus on specific injury patterns. J Trauma 2010; 68(3): 578–582.
[19] Fortin J, Caron J, Piché A, et al. Use of multi-detector CT in the assessment of blunt chest trauma. J Trauma Acute Care Surg 2016; 80(2): 201–208.
[20] Stenson J, Tanaka S, Yamaguchi T, et al. Impact of multidetector CT on the management of blunt chest trauma: A retrospective study. Radiol Res Pract 2015; 2015: 643208.