

# Comparative Analysis of Efficacy of Chest X-ray and Chest CT Scan in Patients with Chest Trauma: A Retrospective Study

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## A B S T R A C T

**Introduction:** CT scan is an accurate tool for detection of injuries in trauma setting and is able to find the injuries that were occult in CXR. In past years the utility of CT scan was limited to severe trauma injuries but now is used in less severely injured trauma patients. Study aimed to compare the efficacy of Chest X-ray and Chest CT scan in patients with chest trauma.

**Material and Methods:** The present study was conducted in the Department of Radiology of medical institute. For study, we retrospectively viewed the previous medical records of the patients who were treated in level 1 trauma centre for blunt chest trauma and received both Chest X-ray and CT chest scan. A total of 120 patients were included in the study. Data regarding the study was collected from the records.

**Results:** Out of 120 patients, 90 were males. The mean age of the patients was 49.6 years ranging from 18-75 years. The most common cause for blunt trauma to chest according to our results was motor vehicle crash. We observed that CT scan is more accurate as compared to chest X-ray in detection of the certain cases such as sternum fracture, rib fracture, scapula fracture, lung contusion and pneumothorax.

**Conclusion:** Chest CT scan is highly sensitive in detection of thoracic injuries following blunt chest trauma. In day to day practice, CT scan is better in visualizing sternum fracture, rib fracture, scapula fracture, lung contusion and pneumothorax.

**Keywords:** Blunt Trauma, Chest X-ray, Chest CT Scan, Rib Fracture

## INTRODUCTION

Chest traumas constitute 10-15% of all traumas and are the cause of death in 25% of all fatalities due to trauma.<sup>1,2</sup> Blunt chest trauma accounts for 81% of thoracic injuries in children and 78% in the elderly, and minor blunt chest trauma is the most common form of blunt chest trauma.<sup>3</sup> Motor vehicle accidents is the most predominant reason for,<sup>4</sup> and rib fractures are the most common (25%) injuries resulting from, blunt chest trauma.<sup>5</sup> Minor blunt chest trauma comprises more than half of the rib fractures without any complications such as pneumothorax, hemothorax or pulmonary contusion, and is often treated on an outpatient basis.<sup>3</sup> Significant injury detection with CXR ranges between 6.3% and 12.4%.<sup>8</sup> CXR can show a severe pneumothorax, a large hemothorax, tube and line malpositioning, but some of injuries such as pulmonary contusion, occult pneumothorax and small to moderate hemothorax can be missed during initial evaluation.<sup>9</sup> Chest CT scan is the gold standard imaging tool in emergency room.<sup>5</sup> Nowadays there is a marked increase in use of chest CT scan as the initial evaluation for patients with

chest trauma.<sup>5,9,10</sup> CT scan is an accurate tool for detection of injuries in trauma setting and is able to find the injuries that were occult in CXR.<sup>11,12</sup> In past years the utility of CT scan was limited to severe trauma injuries but now is used in less severely injured trauma patients.<sup>13</sup> The aim of this study was to compare the efficacy of Chest X-ray and Chest CT scan in patients with chest trauma.

## MATERIAL AND METHODS

The present study was conducted in the Department of Radiology of medical institute. Before starting the study, the protocol of the study was approved from the ethical committee of the institute. For study, we retrospectively viewed the previous medical records of the patients who were treated in level 1 trauma centre for blunt chest trauma and received both Chest X-ray and CT chest scan. Identification of the patients was done from the hospital's registry. Inclusion criteria for the study were:

- Injury severity score (ISS) more than 15
- Admission to Intensive Care Unit (ICU)
- Hospital stay more than 3 days
- Death in hospital

So, a total of 120 patients were included in the study. Data regarding the study was collected from the records. The collected data included vital signs at the admission, ISS, clinical findings like bruising or tenderness, emphysema, laboratory findings including hemoglobin, arterial blood gas results, therapeutic interventions and outcomes. Abnormal findings on chest X-ray and CT scan were identified using written report from radiologist. The results were recorded and analyzed.

## STATISTICAL ANALYSIS

The statistical analysis of the data was done using SPSS program version 20.0 for windows. The significance of the data was checked using Chi-square test and Student's t-test. P value less than 0.05 was predetermined as statistically significant.

## RESULTS

In the present study, a total of 120 patients participated. Out of 120 patients, 90 were males. The mean age of the patients was 49.6 years ranging from 18-75 years. We observed 4 major causes of blunt trauma to chest, motor vehicle crash; motorcycle crash; pedestrian injury; and fall injury. The most common cause for blunt trauma to chest according to our results was motor vehicle crash with number of patients affected to be 45. The mean Injury severity score (ISS) for the study group was 26 ranging from 3-59 (Table 1). Table 2 shows the comparison of Positive Radiological findings in Chest X-ray and CT scan. We observed that CT scan is more accurate as compared to chest X-ray in reporting the lesion. Statistically significant difference was seen in cases of sternum fracture, rib fracture, scapula fracture, lung contusion and pneumothorax.

## DISCUSSION

In the present study, we compared the efficacy of Chest X-ray and Chest CT scan in patients with chest trauma. We retrospectively viewed the medical records for patients treated in level 1 trauma centre for chest trauma. We observed that motor vehicle crash was the most common reason for chest trauma. Also, the mean injury severity score of the patients was 26. The results showed that CT scan is more sensitive and accurate as compared to chest X-ray for diagnosis of sternum fracture, rib fracture, scapula fracture, lung contusion and pneumothorax. Similar studies conducted by other authors in the past have shown similar results. Chardoli M et al conducted a study to detect the accuracy of CXR versus chest computed tomography (CT) in hemodynamically stable patients with blunt chest trauma. Study was conducted at the emergency department of Sina Hospital from March 2011 to March 2012. Hemodynamically stable patients with at least 16 years of age who had blunt chest trauma were included. All patients underwent the same diagnostic protocol

Variables	Values	P value
Males	90	0.3
Mean age	49.6	0.22
Type of crash		
Motor vehicle crash	45	0.02
Motorcycle crash	10	
Pedestrian injury	33	
Fall injury	32	
Mean ISS	26	0.5

**Table-1:** Characteristic variables for study group

Findings	CT scan	Chest X-ray	P-value
Sternum fracture	8	0	<0.001
Clavicle fracture	11	11	0.2
Rib fracture	58	40	<0.001
Scapula fracture	10	4	0.02
Diaphragm rupture	2	1	0.3
Lung contusion	37	20	<0.01
Pneumothorax	26	8	<0.001
Haemothorax	13	9	0.59

**Table-2:** Comparison of Positive radiological findings in Chest X-ray and CT scan

which consisted of physical examination, CXR and CT scan respectively. Two hundred patients (84% male and 16% female) were included with a mean age of (37.9+/-13.7) years. Rib fracture was the most common finding of CXR (12.5%) and CT scan (25.5%). The sensitivity of CXR for hemothorax, thoracolumbar vertebra fractures and rib fractures were 20%, 49% and 49%, respectively. Pneumothorax, foreign body, emphysema, pulmonary contusion, liver hematoma and sternum fracture were not diagnosed with CXR alone. The authors concluded that applying CT scan as the first-line diagnostic modality in hemodynamically stable patients with blunt chest trauma can detect pathologies which may change management and outcome. Trupka A et al evaluated whether early thoracic computed tomography (TCT) is superior to routine chest x-ray (CXR) in the diagnostic work-up of blunt thoracic trauma and whether the additional information influences subsequent therapeutic decisions on the early management of severely injured patients. In a planned investigation of 103 back to back patients with clinical or radiologic indications of chest injury, starting CXR and TCT were looked at after introductory appraisal in our crisis branch of a Level I injury focus. In 67 patients (65%) TCT distinguished significant chest injury intricacies that have been missed on CXR (lung wound (n = 33), pneumothorax (n = 27), residual pneumothorax (n = 7), hemothorax (n = 21), chest tube displaced (n = 5), rupture in diaphragm (n = 2), rupture in myocardium (n = 1)). In 11 patients just minor extra pathologic (dystelectasis, little pleural emission) were envisioned on TCT, and in 14 patients CXR and TCT demonstrated the same pathologic outcomes. Eleven patients experienced

both CXR and TCT without pathologic discoveries. The TCT examine was fundamentally more compelling than routine CXR in distinguishing lung injuries, pneumothorax, and hemothorax. In 42 patients (41%) the extra TCT discoveries brought about a difference in treatment: chest tube position, chest tube adjustment of pneumothoraces or huge hemothoraces, change in mode of ventilation and respiratory care, influence on the management of fracture stabilization, laparotomy in cases of diaphragmatic lacerations, bronchoscopy for atelectasis, exclusion of aortic rupture, endotracheal intubation, and pericardiocentesis. It was concluded that TCT is highly sensitive in detecting thoracic injuries after blunt chest trauma and is superior to routine CXR in visualizing lung contusions, pneumothorax, and hemothorax.<sup>14,15</sup>

Ebrahimi A et al evaluated the diagnostic accuracy of CUS and chest radiography (CXR) for detection of pneumothorax. Only those articles were selected for the study in which patients were diagnosed with pneumothorax and were advised CT scan. The analysis showed the pooled sensitivity and specificity of CUS were 0.87 and 0.99, respectively and for CXR were 0.46 and 1.0, respectively. The Meta regression showed that the sensitivity and specificity of ultrasound performed by the emergency physician was higher than by non-emergency physician. Non-trauma setting was associated with higher pooled sensitivity and lower specificity. It was concluded by the authors that the diagnostic accuracy of CUS was higher than supine CXR for detection of pneumothorax. Yazkan R et al compared computed tomography and chest X-ray in the diagnosis of rib fractures in patients with blunt chest trauma. A total of 83 patients with blunt chest trauma who were treated in three hospitals between May 2010 and June 2011 and who had received both, chest computed tomography scan and chest X-ray as part of their initial assessment were included in the study. On the CT scan, the number of rib fractures was  $3.75 \pm 2.35$  whereas on chest X-ray, the number of rib fractures was  $2.15 \pm 2.12$ . On comparing the results, the authors observed statistically significant difference between CT scan and chest X-ray. It was concluded by the authors that to detect rib fracture accurately and more positively, Chest CT scan should be employed as compared to Chest X-ray as CT scan is more sensitive and reliable.<sup>16,17</sup>

## CONCLUSION

From the results of present study, we conclude that Chest CT scan is highly sensitive in detection of thoracic injuries following blunt chest trauma. In day to day practice, CT scan is better in visualizing sternum fracture, rib fracture, scapula fracture, lung contusion and pneumothorax.

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