

# A Comparative Study of Chest X-ray and Chest High-resolution Computed Tomography in Blunt Trauma Chest Patients

Sharad Kumar Sahu<sup>1</sup>, Ashish Singh<sup>2</sup>, Atul K Singh<sup>3</sup>, Lal Mani Singh<sup>3</sup>, Mahendra Veljibhai Khanpara<sup>1</sup>, Mayank Jeswani<sup>1</sup>, K Sureshkumar<sup>1</sup>

<sup>1</sup>RSO, Department of General Surgery, Shyam Shah Medical College, Rewa, Madhya Pradesh, India, <sup>2</sup>Senior Resident, Department of General Surgery, Shyam Shah Medical College, Rewa, Madhya Pradesh, India, <sup>3</sup>Associate Professor, Department of General Surgery, Shyam Shah Medical College, Rewa, Madhya Pradesh, India

## Abstract

**Introduction:** Computed tomography (CT) scan is an accurate tool for the detection of injuries in a trauma setting and is able to find the injuries that were occult in chest X-ray (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. The study aimed to compare the efficacy of CXR and chest CT scans in patients with chest trauma.

**Materials and Methods:** The present study was conducted in the Department of Surgery of Medical Institute. For the study, we prospectively view the previous medical records of the patients who were admitted in our surgical ward for blunt chest trauma and received both CXR and high resolution CT chest scans. A total of 95 patients were included in the study. Data regarding the study were collected.

**Results:** Out of 95 patients, 79 were males and 16 females. The mean age of the patients was 32.42 years ranging from 2 to 90 years. The most common cause for blunt trauma to the chest according to our results was a road traffic accident. We observed that CT scan is more accurate as compared to CXR in the detection of certain cases such as sternum fracture, rib fracture, scapula fracture, lung contusion, hemothorax, and pneumothorax.

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

**Key words:** Blunt trauma, Chest computed tomography scan, Chest X-ray, Rib fracture

## INTRODUCTION

Blunt trauma is physical trauma by a non-penetrating impact through a blunt object or surface to a body part. Blunt trauma is the primary trauma, which develops more specific types such as contusions, abrasions, lacerations, and/or fractures. Traumatic injury is the leading cause of death under the age of 45 worldwide. Approximately

5.8 million people die each year as a result of injuries. This accounts for 10% of the world's deaths, more than the number of fatalities from malaria, tuberculosis, and HIV/AIDS combined. In India, every 1.9 min, trauma-related death occurs. Approximately 1 million people die and 20 million are hospitalized every year due to injuries.<sup>[1]</sup>

Chest trauma is one of the most serious injuries of the chest and also a common cause of significant disability and mortality. Chest trauma is the leading cause of death from physical trauma after head and spinal cord injury. Thoracic injuries are primary or a contributing cause of about one-fourth of all trauma-related deaths. The mortality rate in these cases is about 10%. Thoracic injuries account for approximately 20–25% of deaths due to trauma, 16,000 deaths occur per year in India alone as a result of chest

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Month of Submission : 11-2019  
Month of Peer Review : 12-2019  
Month of Acceptance : 12-2019  
Month of Publishing : 01-2020

**Corresponding Author:** Dr. Ashish Singh, Department of General Surgery, Shyam Shah Medical College, Rewa - 486 001, Madhya Pradesh, India.

trauma. Blunt trauma chest contributes to major accidental injuries in India, due to increased incidence of road traffic accidents (6% of global vehicular accidents) due to increased road traffic, availability of new high-speed vehicles and less awareness regarding traffic rules. A very few studies had been conducted to analyze its magnitude and management in Indian scenario.<sup>[2]</sup>

This study is carried out to determine the epidemiology and mechanism of chest trauma along with analyzing the management scheme and to note the prognosis and improvement of the management of chest injuries.

Chest radiograph is obtained for every blunt trauma chest patient after the stabilization of the patient. The diagnosis is generally obvious with standard chest radiography but more subtle sign requires careful analysis with computed tomography (CT) chest. High-resolution CT (HRCT) is the most important imaging method in this field. Its advantages occur especially because of high speed and high geometric resolution in any plane. Because of its advantages, HRCT has become the first-choice method in high-energy trauma. Diagnostic imaging with HRCT plays a key role in the management of high-energy chest trauma. HRCT is the most important imaging method in this kind of injury, as detailed information can be acquired in a short time.

## MATERIALS AND METHODS

A study of cases of chest trauma admitted at Sanjay Gandhi Memorial Hospital, from June 1, 2018, to May 31, 2019, had been carried out. The study was pertaining to blunt chest trauma. Information was obtained directly from the patient whenever possible and from other witnesses of an accident if available.

No. of patients – 95.

### Inclusion Criteria

All patients with blunt trauma chest in HRCT chest done were included in the study.

### Exclusion Criteria

The following criteria were excluded from the study:

- Penetrating chest injury
- Patients who absconded or left against medical advice.

### Methodology

The study was conducted over the patients admitted from casualty, Outpatient Department and those who transferred from other wards. After eliciting the proper history and mode of trauma, vitals were regarded, and initial airway, breathing, circulation, and deformities were assessed without any delay. After stabilizing the vitals, the patients who were diagnosed

as blunt trauma chest were assessed properly and sent for lab investigations and X-ray was done. The patients were then shifted to ward and sent for HRCT chest. The reports of X-ray chest and CT chest were analyzed and recorded in pro forma. All these data were recorded meticulously in pro forma and master chart after that systematic tabulation, observation, and analysis done. Summary and conclusion were drawn after discussion with review of the literature.

## RESULTS

In the present study, a total of 95 patients participated, out of 95 patients, 79 were males and 16 females. The mean age of the patients was 32.42 years ranging from 2 to 90 years.

The most common cause for blunt trauma to the chest according to our results was road traffic accidents with number of patients affected to be 65. Table 1 and Graph 1 shows the comparison of positive radiological findings in chest X-ray (CXR) and CT scan. We observed that CT scan is more accurate as compared to CXR in reporting the lesion. Statistically, significant difference was seen in cases of sternum fracture, rib fracture, scapula fracture, hemothorax, and pneumothorax.

## DISCUSSION

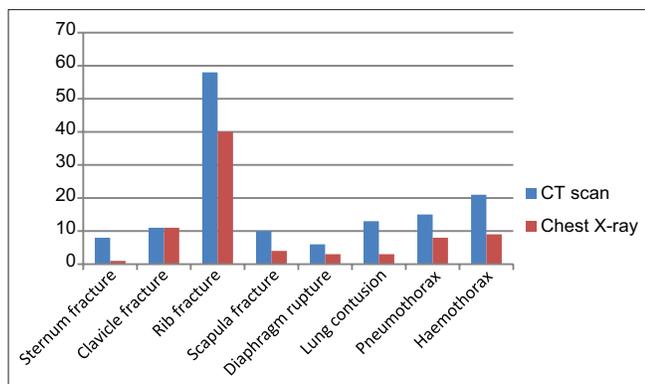
The present study entitled “A comparative study of chest x-ray and chest high-resolution computed tomography in blunt trauma chest patients” was carried out in patients of blunt trauma chest admitted to the Department of Surgery of S. S. Medical College and associated Sanjay Gandhi Memorial Hospital Rewa (Madhya Pradesh) during the period from June 1, 2018, to May 31, 2019.

Chest trauma is one of the most serious injuries of the chest and is a common cause of significant disability and mortality. It is the leading cause for death following physical trauma after head and spinal cord injury. Thoracic injuries are found to be the primary or contributing cause for about 25% of all trauma-related deaths.

**Table 1: Comparison of positive radiological findings in chest CT and chest X-ray**

Findings	CT scan	Chest X-ray	P value
Sternum fracture	8	1	<0.001
Clavicle fracture	11	11	0.2
Rib fracture	58	40	<0.001
Scapula fracture	10	4	0.02
Diaphragm rupture	6	3	0.3
Lung contusion	13	3	<0.01
Pneumothorax	15	8	<0.001
Hemothorax	21	9	0.59

CT: Computed tomography



**Graph 1: Comparison of positive radiological findings in chest computed tomography and chest X-ray**

The results showed that CT scan is more sensitive and accurate as compared to CXR for diagnosis of sternum fracture, rib fracture, scapula fracture, lung contusion, hemothorax, and pneumothorax. Similar studies conducted by other authors in the past have shown similar results.

CXR alone is not effective in the management of the patient and finally CT scan should be used. This finding is complementary to Wicky *et al.*,<sup>[3]</sup> study in which they concluded that CXR is the most efficient modality for all chest trauma patients because of its ability to detect most life-threatening lesions. However, Exadaktylos *et al.*,<sup>[4]</sup> recommended CT scan as the primary diagnostic tool in patients with major chest trauma because they showed that over 50% of patients with abnormal CXR had multiple injuries on the CT scan. In our study, CXR identified hemothorax in 16.4% cases in study sample compare to CT chest which identified 29.5% cases in study sample, ( $P = 0.01846$  [ $<0.05$ ]), CXR identified pneumothorax in 9% cases in study sample compare to CT chest which identified 27.4% cases in study sample, ( $P = 0.00224$  [ $<0.05$ ]), and CXR identified hemopneumothorax in 7.5% cases in study sample compare to CT chest which identified 17.9% cases in study sample, ( $P = 0.036029$  [ $<0.05$ ]). In another study, Traub *et al.* in 2007<sup>[5]</sup> found CXR identified hemothorax in 7% cases, where CT chest found hemothorax in 11.3% cases. The same result also is seen in pneumothorax, where X-ray chest detects 6.4% cases of pneumothorax and CT chest found 22% cases of pneumothorax, and CXR identified hemopneumothorax in 0.7% cases, where CT chest found hemopneumothorax in 11.3% cases. Chardoli *et al.*<sup>[6]</sup> conducted a study to detect the accuracy of CXR versus chest CT in hemodynamically stable patients with blunt chest trauma. The study was conducted at the Emergency Department of Sinai Hospital from March 2011 to March 2012. Hemodynamically stable patients with at least 16 years of age who had blunt chest trauma were included in the study. All patients underwent the same diagnostic protocol 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  $37.9 \pm 13.7$  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 was 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 that may change management and outcome. Trupka *et al.*<sup>[7]</sup> evaluated whether early thoracic CT (TCT) is superior to a routine CXR in the diagnostic workup 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 ( $n = 2$ ), and rupture in myocardium ( $n = 1$ )). In 11 patients, just minor extra pathologic (dystelectasis, and little pleural emission) was 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.

Ebrahimi *et al.*<sup>[8]</sup> evaluated the diagnostic accuracy of chest ultrasonography (CUS) and chest radiography (CXR) for the detection of pneumothorax. Only those articles were selected for the study in which patients were diagnosed with pneumothorax and were advised CT scans. The analysis showed that 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 were higher than by non-emergency physicians. 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 the detection of pneumothorax. Yazkan *et al.*<sup>[9]</sup> compared CT and CXR 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 CT scan and CXR 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 CXR, the number of rib fractures was  $2.15 \pm 2.12$ . On comparing the results, the authors observed a statistically significant difference between CT scan and CXR. It was concluded by the authors that to detect rib fracture accurately and more positively, chest CT scan should be employed as compared to CXR as CT scan is more sensitive and reliable.

## CONCLUSION

From the results of the present study, we conclude that the chest CT scan is highly sensitive in the 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, hemothorax, and pneumothorax.

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**How to cite this article:** Sahu SK, Singh A, Singh AK, Singh LM, Khanpara MV, Jeswani M, Sureshkumar K. A Comparative Study of Chest X-ray and Chest High-resolution Computed Tomography in Blunt Trauma Chest Patients. *Int J Sci Stud* 2020;8(1):31-34.

**Source of Support:** Nil, **Conflicts of Interest:** None declared.