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Comparative analysis of diagnostic efficacy of chest X-ray and chest CT scan in patients with blunt chest trauma at a tertiary hospital

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Abstract

Background: Victims of chest trauma are increasing worldwide as the overall incidence of poly trauma is on the rise. Different imaging techniques exist to diagnose thoracic trauma injuries such as CXR, CT-scan and ultrasonography. Present study was aimed to compare diagnostic efficacy of chest X-ray and chest CT scan in patients with blunt chest trauma at a tertiary hospital. **Material and Methods:** Present study was single-center, comparative study, conducted in patients admitted with blunt trauma chest, underwent chest X ray followed by CT scan. **Results:** During study period, 58 patients were considered for present study. Majority were from 30-39years age group (36.21%) &20-29years age group (25.86%), mean age was 48.28 ± 12.35years. Majority were male (74.14%) & male to female ratio was 3.3:1. Common mode of injury was motor vehicle accident (41.38%) followed by motor cycle accident (29.31%), pedestrian injury (15.52 %) &fall injury (13.79%).In present study, chest CT scan was superior to diagnose rib fracture, sternum fracture, lung contusion, diaphragm rupture & pneumothorax than chest X ray, difference was statistically significant. While hemothorax, clavicle fracture & scapula fracture were comparably diagnosed on chest CT scan as well as chest X ray, difference was not statistically significant. **Conclusion:** Chest radiograph serves as the principle screening test for immediate assessment of the thorax after blunt chest trauma, while CT chest helps to detect more intra thoracic injuries than the chest X-ray.

Keywords: Blunt chest trauma, road traffic injuries, chestCT scan, chest X-ray.

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Introduction

Victims of chest trauma are increasing worldwide as the overall incidence of polytrauma is on the rise. It is frequently associated with other injuries such as flail chest, pulmonary contusion, pneumothorax and hemothorax.[1]In the trimodal distribution of trauma deaths (immediate, hours, and weeks following injury), chest injuries are responsible for the majority of deaths occurring at the scene of trauma (immediate deaths) and many of those occurring within few hours (early deaths). Early deaths are usually due to airway obstruction, tension pneumothorax (t-PTx), hemorrhage, or cardiac tamponade.[2]

Outcome of a victim of chest trauma depends on various factors such as age of the patient, force and location of trauma.[3] Delay in diagnosis and treatment and respiratory complications

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increase the mortality. Early recognition and management of associated injuries and complications is of paramount importance in reducing the morbidity and mortality.
Different imaging techniques exist to diagnose thoracic trauma injuries such as CXR, CT-scan and ultrasonography. According to ATLS, it is necessary to obtain chest radiographic images in patients with multiple traumas and injury severity score (ISS) levels of higher than 15 or in patients at levels 3 or 4 in triages.[4]Present study was aimed to compare diagnostic efficacy of chest X-ray and chest CT scan in patients with blunt chest trauma at a tertiary hospital.

Material And Methods

Present study was single-center, comparative study, conducted in department of radio-diagnosis with help from surgery department, at Government Sivagangai Medical College and Hospital, Sivagangai, Tamilnadu, India. Study duration was of one year (January 2021 to December 2021). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- All patients admitted with blunt trauma chest, underwent chest X ray followed by CT scan, willing to participate in present study

Exclusion criteria

- Penetrating chest injury
- Chest X ray or CT scan reports not available.

Study was explained to patients in local language & written consent was taken for participation & study. Patients admitted from casualty, Outpatient Department or transferred from other wards in view of blunt chest trauma. Demographic characteristics, history, mode of trauma, examination findings were noted in proforma. After stabilizing the vitals, the patients underwent bedside chest X-ray & if feasible HRCT chest. The reports of X-ray chest and CT chest were analyzed and recorded in pro forma.
Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

Results

During study period, 58 patients were considered for present study. Majority were from 30-39 years age group (36.21%) & 20-29 years age group (25.86%), mean age was 48.28 ± 12.35 years. Majority were male (74.14%) & male to female ratio was 3.3:1. Common mode of injury was motor vehicle accident (41.38%) followed by motor cycle accident (29.31%), pedestrian injury (15.52 %) & fall injury (13.79%).

Table 1: General characteristics

Characteristics	No. of patients	Percentage
Age groups (in years)		
<20	2	3.45%
20-29	15	25.86%
30-39	21	36.21%
40-49	12	20.69%
50-59	4	6.90%
60-69	3	5.17%

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70-79	1	1.72%
Mean age (mean ± SD)	48.28 ± 12.35	
Gender		
Male	43	74.14%
Female	13	22.41%
Mode of trauma		0.00%
Motor vehicle accident	24	41.38%
Motorcycle accident	17	29.31%
Pedestrian injury	9	15.52%
Fall injury	8	13.79%

In present study, chest CT scan was superior to diagnose rib fracture, sternum fracture, lung contusion, diaphragm rupture & pneumothorax than chest X ray, difference was statistically significant. While hemothorax, clavicle fracture & scapula fracture were comparably diagnosed on chest CT scan as well as chest X ray, difference was not statistically significant.

Table 2: Comparison of positive radiological findings in chest CT and chest X-ray

Radiological finding	**CT scan**	**Chest X-ray**	***P* value**
Rib fracture	43	30	<0.001
Hemothorax	19	14	0.092
Pneumothorax	18	10	<0.001
Clavicle fracture	16	15	0.72
Scapula fracture	11	7	0.068
Sternum fracture	9	0	<0.001
Lung contusion	8	2	<0.001
Diaphragm rupture	5	1	0.032

Discussion

Chest trauma is classified as blunt or penetrating, with blunt trauma being the cause of most thoracic injuries (90%).[5] Blunt thoracic injuries are the third most common injury in poly trauma patients following head and extremities injuries.[6]Management option of blunt chest trauma depends on type of chest injury and clinical presentation of the patients. Patients with pneumothorax, haemothorax or both would improve on tube thoracostomy. Other patients would require mechanical ventilation, appropriate analgesics management, supportive therapy and critical care observation.[7]

Portable chest radiography / Static Chest radiography is the initial imaging method used at the emergency workup of the poly trauma patient, and it is useful for detecting serious life-threatening conditions, such as a tension pneumothorax or haemothorax, mediastinal haematoma, flail chest or mal-positioned tubes. While CT scan is generally considered in high risk cases, affording patients or patients developed complications of blunt chest trauma.

M. Mohta et al.,[8] reported 49.55% patients in their study of 105 in the same age group (21-40 years). Massaga et al.[9] had 43.75% patients from age group of 30 to 49 years. Similar findings were noted in present study. Young males are more prone to chest trauma because of the greater exposure to external environmental forces in their daily activities. The highest incidence in this age group can be attributed to the active lifestyle with exposure to factors like use of automobiles, working with machinery, assaults and contact sports.

In study by Sahu SK et al.,[10] out of 95 patients, 79 were males and 16 females. The mean age of the patients was 32.42 years, most common cause for blunt trauma to the chest according

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to our results was a road traffic accident. 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.

Pinki Kumari[11] noted that, out of 120 patients, 90 were males, mean age was 49.6 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.

Yazkan R et al.,[12] studied 83 patients with blunt chest trauma, on the CT scan, the number of rib fractures was 3.75±2.35 whereas on chest X-ray, the number of rib fractures was 2.15±2.12. Authors observed statistically significant difference between CT scan and chest X-ray. Chest CT scan should be employed as compared to Chest X-ray as CT scan is more sensitive and reliable.

CT has been shown to be useful for the evaluation of vascular, pulmonary, airway, skeletal and diaphragmatic injuries as well. CT has overall greater sensitivity than radiography in the detection of pulmonary lacerations and pneumothoraces. In addition, it may be indicated in cases of suspected trachea-bronchial injury.[13]

Computer tomography was found to reveal otherwise underestimated or overlooked injuries in the multiple injured, positively influence decision making in regard to operative strategies (i.e. chest tube, thoracostomy), and guide intensive care procedures (i.e. mechanical ventilation concepts) were reported to increase patient outcome.[14]

Multi-detector computed tomography (MDCT) is the preferred imaging modality for the evaluation of poly-trauma patients. It offers multi-planar and three-dimensional reconstructions and is generally more sensitive and specific than chest radiography. It has been shown to change patient management in up to 20% of patients with abnormal initial chest radiography.[15]CT is far more effective than chest radiography in detecting pulmonary contusion, thoracic aortic injury and osseous trauma, especially at the cervico-thoracic spine.[16]Evidence-based interventions are required to improve road safety, enhance the involvement of the health system to deal with road injuries and improve availability of quality actionable data.[17]

Conclusion

Blunt chest trauma was noted commonly in young male patients, road traffic injuries being the commonest cause. Chest CT scan was superior to diagnose rib fracture, sternum fracture, lung contusion, diaphragm rupture & pneumothorax than chest X ray. Chest radiograph serves as the principle screening test for immediate assessment of the thorax after blunt chest trauma, while CT chest helps to detect more intra thoracic injuries than the chest X-ray.

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