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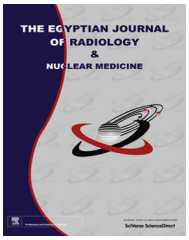

ORIGINAL ARTICLE

Multi-detector computed tomography imaging of blunt chest trauma

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KEYWORDS

MDCT;
Chest;
Blunt trauma;
Chest X-ray

Abstract *Background and purpose:* Chest trauma is a significant cause of mortality and morbidity, especially in the younger population. The purpose of this study was to evaluate the role of multi-detector computed tomography (MDCT) in the assessment of patients with blunt chest trauma.
Patients and methods: A prospective study was conducted on thirty (30) patients with blunt chest trauma (21 males and 9 females, aged from 6 to 62 years) and 29 control patients presented with any trauma other than blunt chest trauma (23 males and 6 females, aged from 10 to 68 years) at the Emergency Department, Tanta University Hospital, from January 2013 to February 2014. Cases were subjected to clinical evaluation and radiological assessment of the chest using conventional chest X-ray (CXR) and multi-detector computed tomography.
Results: The most common mode of injury was motor vehicle accidents (56.7%). On MDCT scan, the frequency of chest injuries were; chest wall injuries (86.7%), pleural injuries (80%), parenchymal injuries (56.7%), mediastinal injuries (30%) and finally the dorsal spine injuries (16.7%). MDCT is more sensitive, specific, and accurate than CXR in the assessment of blunt chest trauma and management of patients.
Conclusion: MDCT is the modality of choice for rapid assessment of emergency chest trauma patients, when chest X-ray was inconclusive.
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1. Introduction

Chest trauma is a significant cause of mortality and morbidity, especially in the younger population (1).

Injuries to the thorax are the third most common injuries in trauma patients, next to injuries to the head and extremities. Thoracic trauma has an overall fatality rate of 15–25%, which is the highest in patients with cardiac or tracheobronchial-esophageal

Abbreviations: MDCT, multi-detector computed tomography; CXR, chest X-ray; *x*, mean; SD, standard deviation; MPR, multiplanar reformation; PPV, positive predictive value; NPV, negative predictive value; ATLS, Advanced Trauma Life Support.

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injuries. Furthermore, the presence of thoracic injuries in the setting of multi-systemic trauma can significantly increase patient mortality. Injuries such as flail chest, lung contusion, hemothorax, and pneumothorax can complicate overall case management (2,3).

More than two-thirds of cases of blunt thoracic trauma in developed countries are caused by motor vehicle collisions. The remaining cases are the result of falls from height or of blows from blunt objects (4).

Imaging plays an important role in the diagnosis of blunt thoracic trauma. The conventional radiography remains the initial study for assessing patients sustaining blunt trauma to the chest, however, in severely injured patients. The ideal upright, full inspiratory PA chest radiography cannot be obtained. Portable supine radiographs are suffering from poor positioning, poor inspiration, or artifact from an underlying backboard or overlying monitoring equipment and many injuries may be difficult to detect in these suboptimal studies (5).

Multidetector-row CT (MDCT) has been recognized and accepted as an effective and fast imaging tool in severely injured trauma patients (6).

MDCT scanners are available in almost all trauma centers. The fast scanning time of MDCT allows for single breath-hold scanning, fewer motion artifacts, and improved contrast bolus imaging. Additionally, thinner collimation provides isotropic voxels, allowing multi-planar reformations while maintaining spatial resolution (5).

Studies have shown that MDCT may demonstrate significant injury (e.g., thoracic aortic injury) in patients with normal initial radiographs (7). Furthermore, MDCT has been credited with changing management in up to 20% of chest trauma patients with abnormal initial radiographs (8).

MDCT is more accurate than radiography for the evaluation of pulmonary contusion, thereby allowing early prediction of respiratory compromise (9). It is also valuable in the diagnosis of fractures of the thoracic spine, especially at the cervico-thoracic junction, which is difficult to evaluate with conventional radiography. In addition, MDCT has helped to exclude thoracic aortic injury, thereby limiting the number of catheter aortographic examinations (10).

2. Aim of the work

The aim of this study was to evaluate the role of multi-detector computed tomography in the assessment of patients with blunt chest trauma.

3. Patients and methods

3.1. Participants

This study was conducted according to the guidelines of the ethics committee of our university and was approved by our institutional review board. Informed written consents were obtained from relatives of all participants in this study.

A prospective study was conducted on 30 blunt chest trauma patients (21 males and 9 females, aged from 6 to 62 years with mean of 32.7 ± 14.3 years) and 29 control trauma patients presented with any trauma other than blunt chest trauma (23 males and 6 females, aged from 10 to 68 years with mean of 34.3 ± 13.2 years) at the Emergency Department of Tanta University hospital, over a period of one year starting from January 2013 to February 2014 with the following inclusion & exclusion criteria:

- **Inclusion criteria:** All cases with blunt chest trauma either as a sole presentation or as a part of poly-traumatic insults were included in the study as patients.
  While cases with any trauma other than blunt chest trauma were included as controls. No age predilection.
- **Exclusion criteria:** The following groups of patients were excluded:
  1. Patients in need of emergency transfer to surgery.
  2. Patients who were hemodynamically unstable.
  3. Lactating and pregnant females.
  4. Patients known to had sensitivity to the contrast medium.

3.2. Methodology

In this prospective study, all participants were subjected to:

3.2.1. History taking & clinical assessment

3.2.2. Plain chest X-ray

AP (supine) views were taken for 23 patients, five of them with portable radiograph & PA (standing) views could be done for 7 patients.

3.2.3. Multi-detector CT of the chest

All patients underwent MDCT of chest on Siemens Emotion 6 MDCT.

Patients are examined in the supine position and the field of view was adjusted to obtain complete anatomical imaging of the chest.

Thin axial section images (1.25 mm slice thickness). On multi-detector CT (MDCT) scanners volumetric acquisition of high-resolution CT datasets was acquired in the cranio-caudal direction from the base of the neck to the level of the renal arteries.

Intravenous contrast media injection: volume (80 ml), concentration (350–400 mg/ml), rate (2.5–3 ml/s) and scanning delay (30–40 s).

3.2.4. Virtual bronchoscopy

Three dimensional reconstruction based on surface and volume rendering, was done for three patients & was used as a gold standard for those patients.

3.2.5. Operative & interventional findings

Operative & interventional findings relevant to chest trauma were obtained & used as a gold standard with clinical findings & follow up in cases underwent conservative treatment.

3.3. Data analysis

The collected data were tabulated and statistically analyzed using SPSS (statistical package for social science) version 16 on Personal Computer. The level of significance was adopted at $P < 0.05$. Two types of statistics were done: (a) *Descriptive statistics* included percentage (%), mean (x) and standard devi-

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