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MULTIDETECTOR COMPUTED TOMOGRAPHY APPLICATIONS OF CHEST TRAUMA IN OUR RADIOLOGY UNIT AND PATIENT OUTCOMES

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ABSTRACT

Trauma is the leading cause of death in young people. Radiologic evaluation of chest injuries in patients begins usually with a simple chest X-ray at the admission time. Unfortunately, chest X-ray has limited sensitivity in detecting thoracic injuries. Many thoracic injuries such as contusions, diaphragmatic injuries, pneumothorax and hemothorax are missed on chest X-ray. Computerized Tomography (CT) scan is gaining more importance in the initial management of trauma patients. The aim of this study was to assess the routine chest CT outcomes in patients who admitted to our radiology department with chest trauma. The study was designed as a retrospective investigation. The study group consisted of patients with chest trauma admitted to the Department of Radiology of the Bilecik State Hospital, in the period from May 2015 to January 2016. 297 patients with chest trauma were enrolled in the study. We assessed injuries according to age,gender, accident type, distribution of injuries and made attention on preferring CT imaging in detecting thoracic injuries. MDCT has clearly established itself as the principal imaging method for the patient group with chest trauma, owing to its wide availability, rapid access, quick implementation and the possibility of generating multiplanar and three-dimensional reconstructions. The information provided by MDCT may lead to critical changes in patients' management.

KEYWORDS: Computerized Tomography (CT), MDCT, Radiologic evaluation.

INTRODUCTİON

Trauma is the leading cause of death in young people. Radiologic evaluation of chest injuries in patients begins usually with a simple chest X-ray at the admission time. Unfortunately, chest X-ray has limited sensitivity in detecting thoracic injuries. Many thoracic injuries such as contusions, diaphragmatic injuries, pneumothoraces and hemothoraces are missed on chest X-ray.[1] Computerized Tomography (CT) scan is gaining more importance in the initial management of trauma patients. The aim of this study was to assess the routine chest CT outcomes in patients who admitted to our radiology department with chest trauma.

MATERİAL AND METHODS

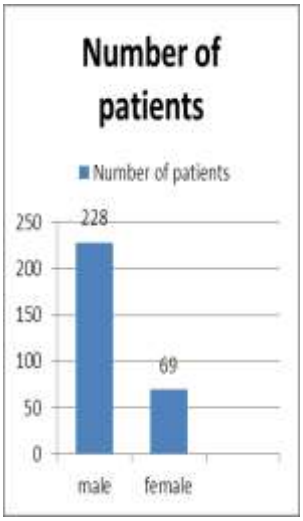
The study was designed as a retrospective investigation. The study group consisted of patients with chest trauma admitted to the Department of Radiology of the Bilecik State Hospital, in the period from May 2015 to January 2016. In our study individuals were subdivided into 3 groups according to age (0-29, 30-49 and over 50), into 2 groups according to gender and into 4 groups according to accident type (motor vehicle accident, falls from a height, direct hit to the thorax and industrial injury).

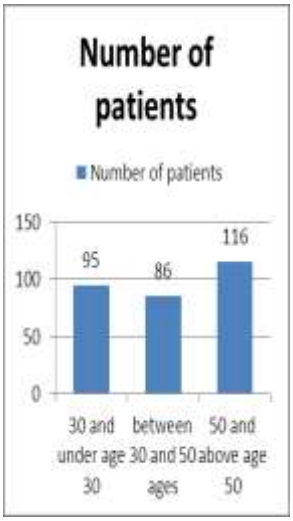
Individual traumatic chest injuries visible at MDCT were determined. Toshiba-Alexion CT (16-slice) in Bilecik State Hospital Radiology Department was used. The slice thickness was 5 mm and collimation was 1.25 mm. Tube voltage was 120 kVp. We assessed injury of thoracic aorta, injury of other vessels, lung contusion, lung laceration, other parenchymal changes (atelectasis), pneumothorax, haemothorax, mediastinal emphysema, haematomediastinum, tracheal and bronchial injury, oesophageal injury, pericardial hematoma, myocardial injury, diaphragm injury, thoracic spine fracture, subcutaneous emphysema, chest wall hematoma, rib fractures, shoulder girdle fractures and sternum fracture.

RESULTS

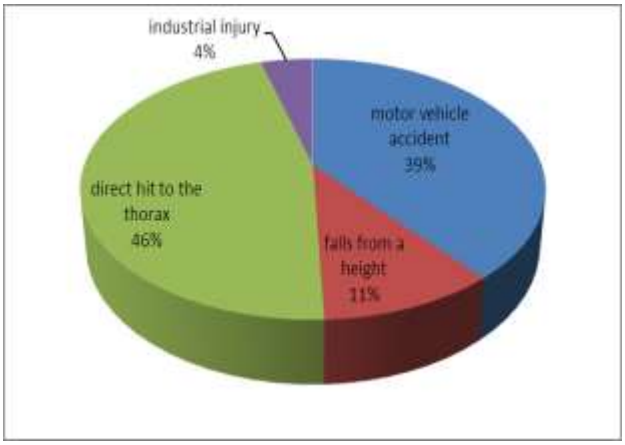
297 patients with chest trauma were enrolled in the study. The mechanism of trauma was motor vehicle accident in 112 patients, falls from a height in 29, direct hit to the thorax in 148 and industrial injury in 10. In our study the majority of patients undergoing chest trauma were male and were over the age of 50. In male patients motor vehicle accident and in females direct hit to the thorax were the most chest injury types. Chest injury was detected in 130 patients.The most detected injury type was rib fracture. Mostly 5 th rib fracture was detected.

7 hemothorax and 22 pneumothorax were identified, leading to chest tube insertion. Results of analysis of traumatic chest injuries are presented in graphics (a,b,c,d,e,f,g,h).

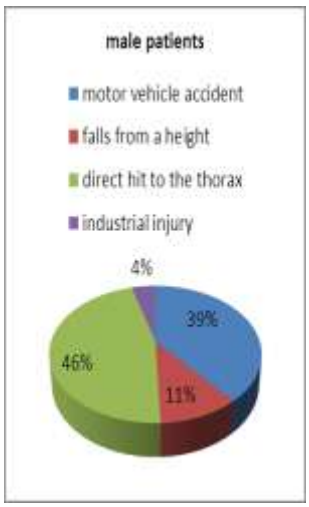


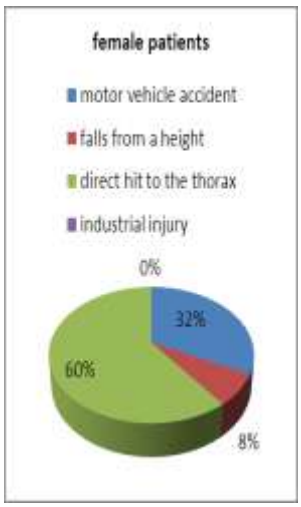


Graphic a and Graphic b shows the percent of patients according to gender and age.

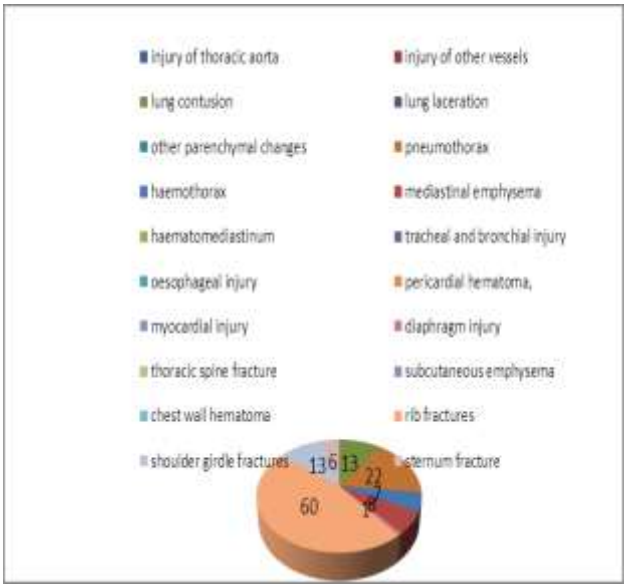


Graphic c shows the percent of patients according to accident type.

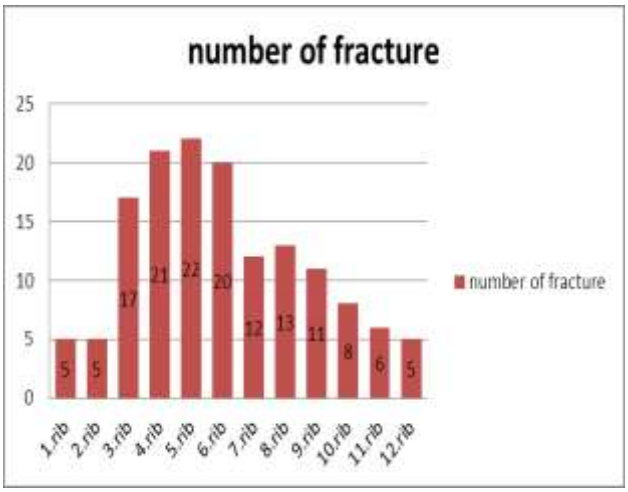




Graphic d and Graphic f shows the percent of patients according to gender and accident type.



Graphic g shows distribution of injuries with chest trauma.



Graphic h shows the number of rib fractures with chest trauma.

DİSCUSSİON

Chest injuries occur in about 20 % of all trauma patients. In up to 80 % of cases they are associated with injuries of other body parts such as the head (69 %), abdomen and pelvis (43 %) and extremities (52 %).[2, 3]

Chest traumas are divided into two groups: blunt and penetrating. Blunt traumas are caused predominantly by road traffic accidents, the second most frequent cause are falls from height. Penetrating chest traumas are almost exclusively caused by sharp tools and firearms.

Four main mechanisms of injury are responsible for chest trauma: direct impact to the chest, thoracic compression, rapid acceleration/deceleration and blast injury. Injuries from a direct impact are usually less dangerous and affect mainly the soft tissues of the chest wall (haematomas, rubbings). Occasionally, a localised injury to the osseous part of the chest wall can occur (rib

fracture, sternal fracture and sternoclavicular dislocation) or, rarely, direct impact forces may be transmitted through the chest wall to the deeper organs, causing serious injury to the heart, lung or large mediastinal vessels. In thoracic compression injuries intrathoracic structures strike a fixed anatomical structure causing organ contusion or rupture. Thoracic compression may cause contusion or laceration of the lung parenchyma, pneumothorax or haemothorax, tracheobronchial fractures as well as rupture of the diaphragm. In decelaration injuries the production of shearing forces causes direct compression against fixed points. This type is the most common and potentially lethal injury, and may cause major tracheobronchial disruption, cardiac contusions, aortic and diaphragmatic rupture.[4] Finally, with the increasing use of improvised explosive devices blast injuries are occurring at an increasing rate. Explosion results from the instantaneous conversion of a solid or liquid material into gas after detonation of an explosive material. The blast pressure wave that is created exerts forces and pressure differentials mainly at air-tissue interfaces within the body, mostly affecting the pulmonary, gastrointestinal and auditory systems .Secondary blast injuries result from objects propelled by the explosion, impacting the individual, while tertiary injuries follow when the individual is being propelled by the explosion.[5, 6]

Among patients with blunt chest trauma, the most frequent severe injuries are pneumothorax, haemothorax and lung contusion, haemothorax and diaphragm rupture. In the group of blunt traumas the most frequent injuries are rib polyfractures. The most frequent injuries in the group of penetrating traumas are haemothorax and pneumothorax with subcutaneous emphysema and chest wall hematomas.

Imaging studies are an essential part of thoracic trauma care once the patient is stabilized.[7] A chest radiograph is usually performed initially in the acute setting. Findings on a chest radiograph include pneumothorax, pneumomediastinum, airspace shadowing (resulting from pulmonary contusion), and pleural hematoma. CT is better for assessing most of these lesions. Advancements in CT imaging have changed the management of blunt lung trauma and permitted the detection of blood in bronchi and interstitial air or blood with greater accuracy.[8] Many centers now screen patients with chest trauma for aortic injuries by using contrast-enhanced CT. CT scans (see the images below) also demonstrate injuries to the lung, pleura, mediastinum, and chest wall better than plain radiographs do. Many serious thoracic injuries may be overlooked on initial chest radiographs; these include tracheobronchial tears, diaphragmatic rupture, esophageal tears, thoracic spine injuries, chest wall and seat-belt injuries, lung contusion, cardiac injuries, pneumothorax, hemothorax, and chest tube complications.[9]

It is important to remember that multiple types of injury in a single patient may coexist, and radiologists should not be disorientated by depicting one type of trauma and neglect other coexisting or associated types of injury. Therefore, systematic exclusion after thorough investigation of all sites of possible injury in the thorax is warranted.

CT images demonstrate fractures of the vertebral bodies with great accuracy and readily show the relationship of fractured fragments and displaced disk material to the cord. Sagittal and coronal reconstructions may provide further exquisite detail.

Because of a dramatic reduction in motion and beam-hardening artifacts and significant improvement of spatial resolution, especially along the z-axis, helical and multisection CT scanning allows better demonstration of the most subtle signs of thoracic trauma.

Multidetector CT can quickly and accurately help diagnose a variety of thoracic injuries in trauma patients. These injuries can be clearly displayed with multiplanar and volumetric reformation.

CONCLUSİON

MDCT has clearly established itself as the principal imaging method for the patient group with chest trauma, owing to its wide availability, rapid access, quick implementation and the possibility of generating multiplanar and three-dimensional reconstructions. The information provided by MDCT may lead to critical changes in patients' management.

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