Role of Multi-Detector Computed Tomography in Patients with Blunt Abdominal Trauma

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Abstract

Background: Multi-detector Computed Tomography (MDCT) is the imaging modality of choice to evaluate hemodynamically stable patients suffering blunt abdominal trauma. MDCT presents a large impact on diagnosis and management of patients with lesions from blunt traumas. CT findings may help the clinician to take the right decision whether conservatively or surgically.

Aim of Work: To evaluate the prognostic role of MDCT in patients with blunt abdominal trauma in order to improve the therapeutic approaches and outcome of those patients.

Patients and Methods: This study was conducted as a prospective observational study to evaluate the prognostic role of Multi-detector computed tomography in Egyptian patients with blunt abdominal trauma.

Results: This study was conducted as a prospective observational study to evaluate the prognostic role of MDCT on thirty five Egyptian patients with blunt abdominal trauma where MDCT findings were compared to operative findings.

Conclusion: MDCT with its high spatial resolution, 3D application and multiplanar reformations (MPR) has greatly improved the ability to detect subtle findings in abdominal trauma scans especially in difficult cases.

Key Words: MDCT – multi-detector computed tomography – BAT – Blunt abdominal trauma.

Introduction

TRAUMA is a significant public health problem, representing the third leading cause of death in the United States. Trauma is also the leading cause of mortality in patients under the age of 40 years. With the widespread availability of multi-detector computed tomography (MDCT) in trauma centers, the traditional workup of trauma patients has changed. Blunt chest injuries are now frequently studied with MDCT to evaluate the aorta, and workup of the blunt trauma victim with abdominal injury is evolving with MDCT [1-3].

MDCT now allows not only the detection of injuries but provides new information on the severity of injuries with improved detection of vascular injury manifested by "active extra-vasation". Today, MDCT is often performed in patients with blunt trauma in order to best identify vascular injuries prior to surgical intervention [2].

A trauma surgeon can be provided definitive information concerning aortic injuries almost immediately with MDCT without the additional contrast load and invasiveness of traditional angiography [4].

Evaluation of the abdomen and pelvis with MDCT is currently performed differently in different institutions. Some studies advocate the use of a “whole-body” CT in the trauma patient. They utilize a continuous scanning technique through the areas to be scanned, such as abdomen, and pelvis. Others continue to perform separate MDCT data acquisitions for each type of CT, facilitating the optimization of contrast enhancement timing and radiation dose. Sequential rather than continuous scanning makes possible the use of different types of reconstruction algorithms for different anatomical segments [5-7].

Aim of work: To evaluate the prognostic role of MDCT in patients with blunt abdominal trauma in order to improve the therapeutic approaches and outcome of those patients.

Patients and Methods

This study was conducted as a prospective observational study during the period from February to September 2016 to evaluate the prognostic role of MDCT in Egyptian patients with blunt abdominal trauma and the mean age of the studied sample was 31.49±13.98 years, with the majority of the sample lying in the age group between 21 and 40 years. 74.3% of the sample were males. The mean
length of hospital stay was 8.89±4.68 days, with 48.6% of cases spending between 3 and 7 days in the hospital.

This study included thirty five Egyptian patients with blunt abdominal trauma attending the Emergency Department in Suez Canal University Hospital in Ismailia.

All patients were subjected to the following:
- Demographic and complete medical history.
- Patients referred to radiology department from emergency department examined clinically for Heart rate (HR) (rate/minute), Blood pressure (mmHg), Respiratory rate (rate/minute), Temperature (°c), Cardiopulmonary, neurological and abdominal examination, Level of consciousness and kidney function.
- Pelvi-abdominal ultrasound: Fast ultrasound was performed if available for patient suspected to have internal abdominal injuries following blunt trauma.
- MDCT examination: 16-detector-row MDCT examinations were carried-out with standard abdominal trauma protocol using intravenous non-ionic contrast media. Protocol included plain study, followed by intravenous contrast study (2ml/kg with flow rate of 2-3ml/second) in arterial phase and venous phase (70-80 seconds delay) with delayed full bladder scan were performed when required.

Inclusion criteria:
- Adult patients with blunt abdominal trauma and clinically suspected having internal abdominal injuries after blunt trauma.
- Both genders.

Exclusion criteria:
- Patients with sharp trauma.

Fig. (1): CT shows a fairly defined irregular hypodense laceration injury is seen traversing the hepatic parenchyma reaching its capsule yet not reaching the portahepatis with no sizable subcapsular hematoma in keeping with (Grade III hepatic injury).

Fig. (2A,B): CT shows an ill defined large hypodense area of splenic laceration seen traversing the splenic parenchyma (covering more than 50% of the splenic surface) with perisplenic collection (red arrow in the right image in Fig. (2A). Mild hepato-renal free collection is also noted. No pelvic collection is noted associated with subcapsular hemotoma and perisplenic collection with sparing of the hilar vessels in keeping with (Grade III splenic injury).

Fig. (3A,B): Hypodense area of laceration is seen traversing the splenic parenchyma and reaching its capsule associated with perisplenic collection. Patchy hypodense area is seen involving the left renal parenchyma reaching the renal pelvis (Grade IV injury). Hypodense area is seen at the posterior segment of right hepatic lobe reaching its capsule.
Data assessment and interpretation:

Personal data of patient (name, gender, age, contact information and medical history) were collected upon permission of the patient conserving its privacy. Previous radiological imaging and laboratory investigations were recorded. MDCT findings were recorded. Data will be managed using Statistical Package of Social Sciences (SPSS) version 20.0. Descriptive statistics will be presented as (mean ± standard deviation) for quantitative variables and as (%) for qualitative variables. Personal, clinical and radiological data will be collected and relationship between different factors will be done then the results of management will be represented in tables and graphs.

Results

This study was conducted as a prospective observational study to evaluate the prognostic role of MDCT on thirty five Egyptian patients with blunt abdominal trauma where MDCT findings were compared to operative findings.

The studied sample had 42.9% multiple organ injury. The most common isolated injury was splenic injury (37.1%) followed by liver injury (11.4%).

Splenic involvement was the most common finding, present in 77.1% of cases. Regarding liver involvement, it was found in 40% of cases, with grade 1 injury being the most common (28.6%). Bowel injury and bladder injury were found in 5.7% of cases.

Table (1) shows that the most common splenic involvement was grade 3 injury found in 37.1%. Regarding liver involvement, it was found in 40% of cases, with grade 1 injury being the most common (28.6%). Bowel injury and bladder injury were found in 5.7% of cases.

Grade 1 liver involvement was the most common involvement found in 31.4% of cases, while grade 3 was the most common splenic involvement found in 34.3% of cases.

Discussion

Blunt abdominal trauma in isolation represents 5% of the trauma mortality and further contributes 15% to mortality as part of poly-trauma [8].

Abdominal injuries rank third as a cause of traumatic death just after head and chest injuries. Unrecognized abdominal injuries are frequently the cause of preventable death, which constitutes a significant diagnostic challenge. In the past, we relied on clinical signs that have relatively low diagnostic accuracy (47% to 87%), especially when the patient had a decreased consciousness level, neurological deficit, other associated injuries, or was under the influence of drugs or medications. The introduction of bedside ultrasonography provides another non-invasive, readily available, and time-saving option for patients with blunt abdominal trauma [9].

Imaging in abdominal trauma has seen a quantum leap with Multi Detector CT Scan (MDCT) with its three-dimensional reconstruction, angiography techniques and scanning times being progressively decreased and image resolution has increased reducing motion artifacts. High resolution ultrasound being cost effective can detect the solid organ injury and free fluid but had limitation in evaluating injuries to pancreas, bowel, kidney, adrenal, mesentery, diaphragm, vascular and spine injury. While MDCT detect these injuries better and also detects lower thoracic injury [10].

MDCT also allows high quality two-and three-dimensional multi-planar reformatted images to be obtained, which aid in the diagnosis of the complex multisystem traumatic injuries and guiding the management of patients. The primary advantage of MDCT scanning is its high specificity and use for guiding non-operative management of solid organ injuries. In addition, MDCT scan of the abdomen can reveal other associated injuries, notably vertebral and pelvic fractures and injuries in the thoracic cavity [10].

Table (1): Operative findings found in the studied sample.

<table>
<thead>
<tr>
<th>Organ Involved</th>
<th>Total patients (n=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liver Involvement:</strong></td>
<td></td>
</tr>
<tr>
<td>No Liver Involvement</td>
<td>21 (60.0)</td>
</tr>
<tr>
<td>Grade 1 injury</td>
<td>11 (31.4)</td>
</tr>
<tr>
<td>Grade 2 injury</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Grade 3 injury</td>
<td>2 (5.7)</td>
</tr>
<tr>
<td><strong>Spleenic Involvement:</strong></td>
<td></td>
</tr>
<tr>
<td>No Spleenic Involvement</td>
<td>8 (22.9)</td>
</tr>
<tr>
<td>Grade 1 injury</td>
<td>6 (17.1)</td>
</tr>
<tr>
<td>Grade 2 injury</td>
<td>4 (11.4)</td>
</tr>
<tr>
<td>Grade 3 injury</td>
<td>12 (34.3)</td>
</tr>
<tr>
<td>Grade 4 injury</td>
<td>2 (5.7)</td>
</tr>
<tr>
<td>Grade 5 injury</td>
<td>3 (8.6)</td>
</tr>
<tr>
<td><strong>Renal Involvement:</strong></td>
<td></td>
</tr>
<tr>
<td>No Renal Involvement</td>
<td>31 (88.6)</td>
</tr>
<tr>
<td>Grade 1 injury</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Grade 2 injury</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Grade 3 injury</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Grade 4 injury</td>
<td>3 (8.6)</td>
</tr>
<tr>
<td><strong>Bladder Involvement:</strong></td>
<td></td>
</tr>
<tr>
<td>No Bladder Involvement</td>
<td>33 (94.3)</td>
</tr>
<tr>
<td>Bladder Injury</td>
<td>2 (5.7)</td>
</tr>
<tr>
<td><strong>Intestinal Involvement:</strong></td>
<td></td>
</tr>
<tr>
<td>No Intestinal Involvement</td>
<td>32 (91.4)</td>
</tr>
<tr>
<td>Bowel Injury</td>
<td>2 (5.7)</td>
</tr>
<tr>
<td>Abdominal Wall Injury</td>
<td>1 (2.9)</td>
</tr>
</tbody>
</table>
This study was conducted as a prospective observational study to evaluate the prognostic role of MDCT on 35 Egyptian patients with blunt abdominal trauma where MDCT findings were compared to operative findings thus MDCT proves to be a boon for surgeons in the management of the patient whether surgical or conservative is to be undertaken. In cases where operative management is required, it aids in planning the surgery well and vascular surgeon can be informed beforehand if the MDCT findings point towards the need for any vascular intervention.

In our study, abdominal FAST ultrasound examination was performed as the initial imaging modality. MDCT was performed to all patients. Operative results were compared with MDCT findings. Patients with conservative management were regularly followed up with MDCT/FAST [11].

Conclusion:

MDCT with its high spatial resolution, 3D application and multiplanar reformations (MPR) has greatly improved the ability to detect subtle findings in abdominal trauma scans especially in difficult cases. Sensitivity of MDCT in identifying the grade of liver injury was 90.9% for grade 1 injuries and 100% for grades 2 and 3 injuries. Sensitivity of MDCT in identifying the grade of splenic injury varied, being 100% for grades 2, 3, 4 and 5 and 83.3% for grade 1 injuries. The sensitivity of MDCT in detecting renal injury was 75%, since it was not capable of detecting one case of grade 2 injury with non-expanding perirenal hematoma. The sensitivity, specificity and accuracy of MDCT in detecting bladder and bowel injuries were 100%.

References


References


