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ORIGINAL ARTICLE

Role of multislice computed tomography in assessment of non-solid organ injury in patients with blunt abdominal trauma

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KEYWORDS

Multislice CT;
Abdominal trauma;
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Abstract *Objective:* Blunt abdominal trauma is a leading cause of morbidity and mortality. Multidetector computed tomography (MDCT) scanning with intravenous contrast is the gold standard diagnostic modality in hemodynamically stable patients. The aim of this work was to highlight the role of MDCT in patients with blunt abdominal trauma for diagnosis and staging of non-solid organ injury.

Materials and methods: Thirty injured patients were enrolled into the study, including 28 males and 2 females, with a mean age of 38. They were referred from the surgical department after stabilization of their general condition. Multi-detector CT was conducted including non-contrast MDCT of the abdomen and pelvis followed by contrast enhanced MDCT.

Results: Five patients had diaphragmatic rupture, five patients were diagnosed bowel perforation, and two patients were diagnosed traumatic rectovesical fistula. Three patients were diagnosed by MDCT had mesenteric injury. Four had vascular injury diagnosed by MDCT. Five patients had traumatic urinary bladder injury. Four patients had spine injury. Two patients had rectus sheath hematoma.

Conclusions: CT is the imaging modality of choice to evaluate non-solid organ injury in patients with blunt abdominal trauma.

1. Introduction

Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups. It is one of the most challenging conditions in emergency department that physicians encounter because of varied presentations (1).

Blunt abdominal trauma usually results from motor vehicle collisions, recreational accidents, or falls. Men tend to be affected slightly more often than women. The most commonly injured organs are the spleen, liver, retro peritoneum, small bowel, kidneys, bladder, colorectal, diaphragm, and pancreas (2).

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The management of blunt abdominal injury has changed considerably (3). Computed tomography (CT) is currently a widely available imaging technique in clinical practice (4). Currently, multidetector computed tomography (MDCT) scanning with intravenous contrast is the gold standard diagnostic modality in hemodynamically stable patients with intra-abdominal fluid. MDCT scanning with intravenous contrast has numerous advantages. First, the detection of injuries related to solid organs can be reliably determined, with a sensitivity of 90–100%. Second, active bleeding (a contrast blush), can be diagnosed, and the MDCT scan plays a decisive part in the order of treatment if more than one injury is present (3).

MDCT readily detects direct and indirect features of bowel and/or mesenteric injury an important advance given that unrecognized bowel and mesenteric injuries may result in high morbidity and mortality (5).

Multidetector CT offers significantly faster scanning times and improved image resolution due to thinner collimation and reduced partial volume and motion artifacts (6).

The ability of CT to perform and produce fast-processing images, such as multiplanar reconstruction (MPR), is important for accurate interpretation of abnormalities (7).

The aim of this study was to highlight the role of MDCT in patients with blunt abdominal trauma for diagnosis and staging of non-solid organ injury.

2. Materials and methods

2.1. Patients

Thirty critically injured patients were enrolled into the study, including 28 males and 2 females, aged 2–74, with a mean age of 38. They were referred from the surgical department. There was a detailed trauma request, emphasizing the type of injury, indication of the study to tailor the imaging protocol. Patients were refereed after stabilization of their general condition. All patients were subjected to portable Plain X-ray and portable ultrasound before requesting CT scan.

16 patients were managed conservatively and 14 patients managed operatively. The operated patients were correlated with the CT findings, and most of the conservative patients were followed up before hospital discharge. The patients were evaluated with Multidetector Computed Tomography and various injuries were graded according to American Association for the Surgery of Trauma (AAST). This study was approved by the ethics committee of our institution.

2.2. Patients' handling and preparation

The patients were handled with care, immobilized in a vacuum mattress which rendered moderate artifact; patients with injured cervical spine were immobilized in a collar.

Oral contrast was given only if an adequate visualization of gastrointestinal tract was required, 500–600 Ml of diluted (2–5%) water-soluble oral contrast material administered orally or through a nasogastric tube. The urinary bladder catheter was clamped prior to leaving emergency department (ED) especially if there is pelvic trauma. Serum creatinine was checked for all patients. The radio-opaque objects were removed.

An expert radiologist, expert radiographer and nursing staff were available.

2.3. MDCT imaging protocol

All examinations were performed with a GE Light Speed VCT 16 slice combined with Advantage Workstation 4.4; parameters included a tube voltage of 120 kV, a tube current of 300 mA, FOV large/36 cm, pitch/speed 0.984:1/ 39.37, and a rotation time (s), 0.4 gantry tilt: 0, slice thickness 5 mm at 5 mm interval, patient position: supine, patient orientation: feet first. And the scan range extends from lower chest domes of the diaphragm to the iliac crests.

The patients were scanned in the supine position with the arms elevated whenever possible above his head. Patient orientation was feet first. Patient motion should be avoided during study.

Multi-detector CT including non-contrast MDCT of the abdomen and pelvis to exclude hemorrhage and plan for the contrast study, contrast enhanced MDCT of the abdomen (arterial, portal venous phases), delayed phase in selected cases.

Nonionic contrast was injected intravenous through 18 or 20-gauge cannula in an antecubital vein. All patients received a single bolus of contrast calculated according to the body weight 1 ml/1 kg especially in children. Patients were injected at the rate of 3–4 mL/s. followed by 30 ml of 0.9% saline solution at the same rate. The contrast-enhanced scans were obtained in arterial phase by smart prep. Portal venous phase was acquired 70 s after the onset of contrast material injection. Delayed Images after 5–10 min were acquired in selected cases according to the radiologist opinion. The radiologist read the examination on the monitor, immediately conveying the results to the trauma surgeon.

2.4. Images interpretation

Axial images in all phases were reviewed and analyzed; high quality post-processing 2D coronal and sagittal reformatted images with thin cuts 1.25 mm thickness were routinely obtained using the multiplanar reconstruction (MPR) technique from volumetric and isotropic axial CT data. Images obtained were sent to the work station. The Maximum Intensity Projection (MIP) and 3-D volume reconstruction could be obtained as needed.

The abdomen and pelvis were scanned in lung window for the detection of free intraperitoneal air, air adjacent to bowel loops, and retroperitoneal air. Soft tissue window was used to detect hemoperitoneum, retroperitoneal hematoma or extra peritoneal fluid, searching for arterial extravasations (contrast blush) and localizing the anatomical sites of injury. Assessment of diaphragm integrity, muscle injury and bone fractures was done via bone window.

3. Results

A total of 30 patients with blunt abdominal and pelvic trauma were submitted for Multidetector CT examination.

28 males and 2 females were included, aged 2–74, with a mean age of 38. Five (16.6%) patients had diaphragmatic rup-