International Journal of Innovation Sciences and Research
Vol.4, No, 12, pp.565-567, December- 2015
Available online at
http://www.ijisr.com

RESEARCH ARTICLE

COMPUTED TOMOGRAPHY SCAN AS A FIRST LINE INVESTIGATION IN BLUNT ABDOMINAL TRAUMA

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Accepted 28th November, 2015; Published Online 30th December, 2015

ABSTRACT

Introduction: CT is the imaging method of choice in the evaluation of abdominal and pelvic injuries after blunt trauma. CT scan is a one stop shop as it detects solid organ injury, hollow viscus injury, vascular injury and bony injury. Intravenous (IV) contrast material is necessary because solid viscus laceration or hematoma may be relatively isodense to unenhanced or poorly enhanced solid viscera.
Materials and Methods: This study was undertaken to study the role of computed tomography in abdominal organ injury detection in patients with blunt abdominal trauma where USG findings are equivocal, inconclusive or where USG has no role. Thirty patients of blunt abdominal trauma underwent MD CT scan prior to surgical intervention in our hospital.
Results: The spectrum of CT findings included liver injury in 10(33.33%) patients followed by splenic injury in 4 patients (13.33%). Out of 30, 20 (66.66%) patients underwent surgical intervention on the basis of radiological findings.
Conclusions: MDCT has now come of age in the detection and demonstration of blunt traumatic abdominal injuries and real boon for the referring surgeon.

KEY WORDS: Computed tomography, Blunt trauma, Liver injury.

INTRODUCTION

CT is the imaging method of choice in the evaluation of abdominal and pelvic injuries after blunt trauma. (Federle *et al*., 1981) However, hemodynamically unstable patients need to be stabilized before CT or to proceed directly to surgery. Bedside ultrasound is an alternative in unstable patients. In cases of technical limitations like patient with pneumoperitoneum, subcutaneous emphysema and thick abdominal wall, CT is the answer. (Shuman, 1997) CT scan is a one stop shop as it detects solid organ injury, hollow viscus injury, vascular injury and bony injury. Intravenous (IV) contrast material is necessary because solid viscus laceration or hematoma may be relatively isodense to unenhanced or poorly enhanced solid viscera. (Rhea, 1989) In addition, the use of IV contrast material allows the detection of active haemorrhage. Scanning of the pelvis should be delayed by several minutes after IV contrast injection to optimize bladder distension by IV contrast material. (Hoff *et al*., 2002) If a renal parenchymal injury is noted at initial scanning, delayed scanning through the kidneys is also helpful in the detection of renal collecting system injury. (Ferrada *et al*., 2009) This study was undertaken to study the role of computed tomography in abdominal organ injury detection in patients with blunt abdominal trauma where USG findings are equivocal, inconclusive or where USG has no role.

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MATERIALS AND METHODS

Thirty patients of blunt abdominal trauma underwent MD CT scan prior to surgical intervention in our hospital. In retrospective study, the accuracy of the CT was evaluated on the basis of the final radiology reports which were compared with either surgical follow up and at follow up imaging if managed conservatively. The IV contrast material was given by rapid bolus injection to maximize opacification of solid viscera and ensure adequate injury detection. We administered 2 mL/kg with a maximum amount of 120 mL. CT scan was done on GE 1.5T HDx signa scanner with body flex coil. Hemodynamically stable patients with ultrasound detected free fluid in abdomen but no definite evidence of major organ injury were included in the study.

Also, patients with sonographically detected multi organ injury requiring detailed examination were taken up in the study. Patients with multiple raw areas over abdominal wall were taken directly to CT without prior USG examination. MDCT imaging was performed using sub millimetre thin contiguous axial scan of abdomen. Pre intravenous contrast images were taken after giving oral and rectal contrast in some cases. After giving intravenous contrast, arterial phase was taken by arterial bolus tracking method (20 sec after contrast injection). Portal venous phase was taken 60 seconds after beginning of bolus administration. Delayed images were taken as and when required. Coronal and sagittal reformatted images were obtained.

RESULTS

The spectrum of CT findings included liver injury in 10(33.33%) patients, splenic injury 4 (13.33%), renal injury 2(6.6%) patients, adrenal haemorrhage in 1(3.3%)patients, rupture of urinary bladder in 3(10%) patients, vascular injury in 3(10%) patients, pancreatic laceration in 21(3.3%) patients, bowel injury 3(10%), and others 3(10%). Out of 30, 20 (66.66%) patients underwent surgical intervention on the basis of radiological findings. Intra operatively findings included 6 cases of liver injury, 3 cases of splenic injury and 2 cases of renal injury. Three patients had bowel injury and 3 patients had extra peritoneal urinary bladder rupture. Rest of the non-surgical imaging follow-up study well correlated with previous CT reporting.

Table 1. Table showing the spectrum of injuries identified on CT Scan of abdomen in trauma patients

Findings on CT	No. of Patients (n=30)	%
Liver injury	10	33.33
Splenic injury	4	13.33
Urinary bladder injury	3	10
Renal injury	2	6.66
bowel injury	3	10
Adrenal injury	1	3.33
Pancreatic injury	1	3.33
Vascular injury	3	10
Miscelleneous	3	10

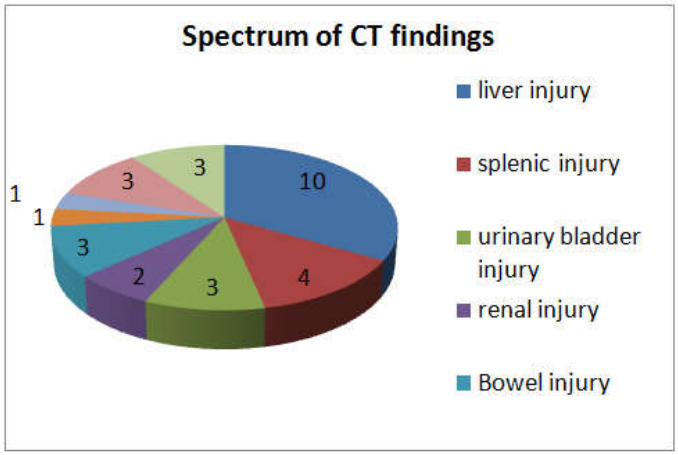

Figure 1. Pie chart showing the spectrum of injuries identified on CT Scan

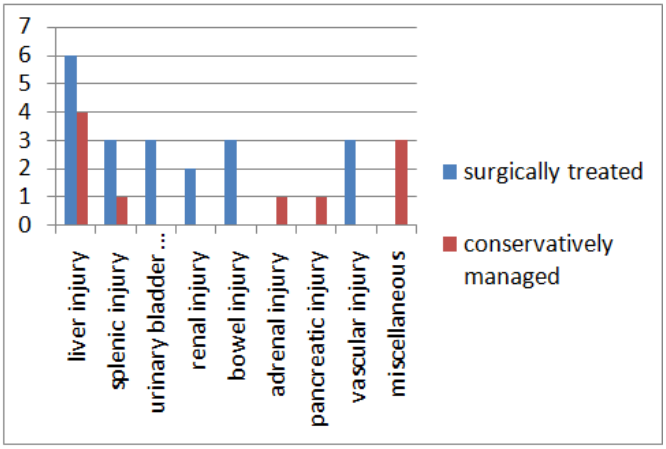

Figure 2. Graph showing the management strategy as against the injury type in trauma patients

Figure 3. CT Scan image showing free fluid in the peritoneal cavity

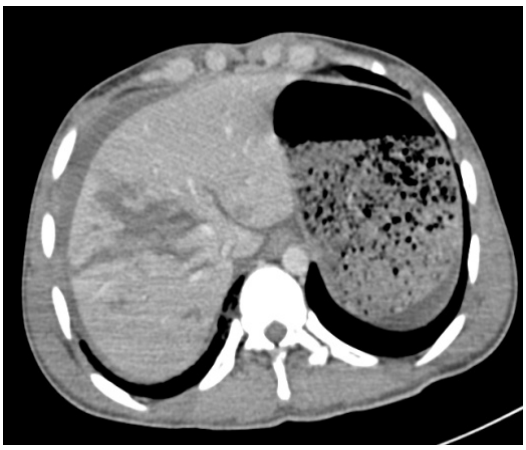

Figure 4. CT Scan image showing free fluid in the peritoneal cavity along with liver parenchymal injury

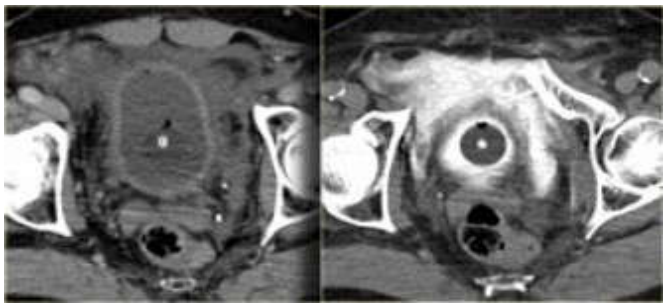

Figure 5. CT scan image showing injury to urinary bladder

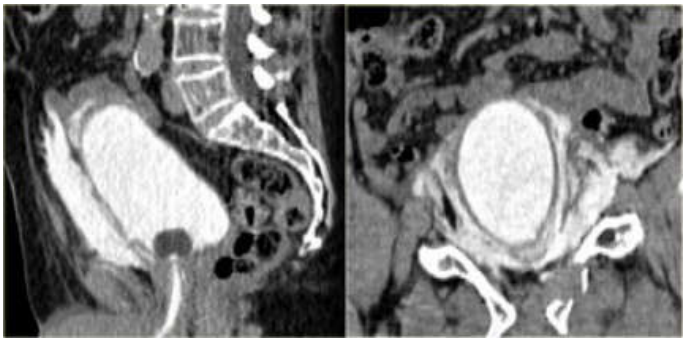

Figure 6. CT scan image showing injury to bowel

DISCUSSION

In our study, we found that CT can be considered the primary technique for the diagnosis of blunt traumatic abdominal injuries, except in unstable patients. In these patients, bedside ultrasonography (USG) is an alternative or patient is directly taken to the surgery. Unstable patients need to be stabilized before CT. CT is the imaging method of choice in pelvic injuries where USG has limited role. (Fang *et al*., 2006) Hemodynamically unstable patients can be examined at the bedside with sonography. Evaluation with CT allows accurate detection and quantification of injury to solid and hollow viscera.

CT also identifies and quantifies intraperitoneal and extraperitoneal fluid and blood and active hemorrhage as fluid (13- 38 HU) and haemorrhage (40- 80 HU) have different HU values. (Badger *et al*., 2009) CT can help prioritize optimal management by diagnosing the major or most life-threatening site of hemorrhage or injury. (Atri *et al*., 2008) CT shows associated bone injury to the ribs, spine, and pelvis. A normal CT examination may prevent unnecessary surgical exploration owing to its ability to provide a comprehensive evaluation of the abdomen and pelvis. (Hawkins and Mirvis, 2003) Further investigation depends upon hemodynamic status of the patients. IV contrast material is necessary because solid viscus laceration or hematoma may be relatively isodense to unenhanced or poorly enhanced solid viscera. In addition, the use of IV contrast material allows the detection of active hemorrhage. Scanning of the pelvis should be delayed by several minutes after IV contrast injection to optimize bladder distension by IV contrast material. (Neish *et al*., 1998) If a renal parenchymal injury is noted at initial scanning, delayed scanning through the kidneys is also helpful in the detection of renal collecting system injury. (Ruess *et al*., 1997; Taviloglu and Yanar, 2009)

The advantages of USG include proven utility, widespread availability, low cost, no radiation hazards and easy acceptability among patients. (Levine *et al*., 1995) The limitations of USG include limited penetration in obese patients, limited penetration in patients with pneumoperitoneum due to hollow viscus perforation, no information about pelvic bone or spinal injuries, limited visualization in patients with subcutaneous emphysema due to chest injuries, small field of view and near field reverberation artifacts. (Lubner *et al*., 2007)

Conclusions

MDCT has now come of age in the detection and demonstration of blunt traumatic abdominal injuries and real boon for the referring surgeon. Sonography has limited utility in the assessment of abdominal trauma. It has been primarily used in the detection of hemoperitoneum in trauma patients. However, the presence of hemoperitoneum in the hemodynamically stable patient typically has limited impact on management decisions. It does not provide any diagnostic information regarding injury to the pelvis or lumbar spine. Sonography cannot be used in the diagnosis of hollow viscus injury. Sonography has been shown to miss approximately one fourth to one third of solid viscus injuries. Nevertheless, sonography has an important role in the assessment of the hemodynamically unstable patient because it can be rapidly performed at the bedside before taking the patient to the operating room. In this role, it can serve as a fast, non-invasive replacement of diagnostic peritoneal lavage.

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