International Journal of Radiology and Diagnostic Imaging

E-ISSN: 2664-4444
P-ISSN: 2664-4436
www.radiologypaper.com
IJRDI 2021; 4(3): 98-100
Received: 10-04-2021
Accepted: 20-06-2021

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Assessment of blunt abdominal injury using computed tomography scan: A cross-sectional study

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DOI: http://dx.doi.org/10.33545/26644436.2021.v4.i3b.224

Abstract
Background and Aim: Assessment of hemodynamic stability is the most important initial concern in the evaluation of a patient with blunt abdominal trauma. Computed tomography is also the modality of choice for diagnosing injuries to the diaphragm, which may result in major morbidity and mortality if undetected and may not present until many years after the event. Hence, the present study was conducted to study computed tomography evaluation of blunt abdominal injury.
Material and Methods: abdomen CT scan reports of 80 patients with BAT, who were stable enough to undergo radiological investigation were used for this study. All CT scans were obtained with a 16 slice MDCT Scanner (Siemens). All patients received intravenous bolus of iodinated contrast agents. Individual organ injuries were graded according to the American Association for the Surgery of Trauma (AAST-OIS) injury scoring scale. The overall imaging findings were analysed for their role in guiding the therapeutic options, whether conservative or surgical.
Results: The mean age of patients was 42.05 years. Number of male patients was 55 and number of female patients was 25. It was observed that OIS grade II patients were 14, OIS grade III patients were 24, OIS grade IV patients were 7 and OIS grade V patients were 5. The highest proportions of conservatively managed patients were seen in OIS grade II patients. However, highest proportion of operated patients was seen in OIS grade III patients.
Conclusion: CT scan for blunt abdominal injury is a reliable and accurate method for diagnosis. It has all the qualities to make it a gold standard for initial investigation of choice for blunt abdominal injury patients.

Keywords: Blunt abdominal trauma, computed tomography, hemodynamic stability, organ injuries

Introduction

Unlike penetrating abdominal trauma, where management is largely determined clinically, the diagnosis of blunt abdominal injury by clinical examination is unreliable, particularly in patients with a decreased level of consciousness [1, 2]. The challenge in the imaging of abdominal trauma is to accurately identify injuries that require early exploration and at the same time avoid unnecessary operative intervention in cases that can be managed conservatively. Blunt trauma in this series, as elsewhere in the world was found to be affecting the relatively younger age group 20-40(68%) years, much more common in the male population (90%). A direct abdominal hit or run over accidents are more likely to cause serious internal damage. In patients with severe polytrauma, substantial resources are used in the evaluation of the abdomen and pelvis for possible injuries. The main reason is that many injuries that affect organs and structures of the abdomen and/or pelvis are treatable, and patients may recover without squeal. Thus, a prompt and accurate diagnosis is critical, and the radiologist plays a pivotal role in the decision-making process.

Diagnosis of blunt abdominal injury is based on clinical examination, X-ray abdomen, diagnostic peritoneal lavage (DPL), ultrasonography (USG), focused assessment with sonography for trauma (FAST), and computed tomography (CT) scan. Assessment of hemodynamic stability is the most important initial concern in the evaluation of a patient with blunt abdominal trauma. In the hemodynamically unstable patient, a rapid evaluation for hemoperitoneum can be accomplished by means of DPL or the FAST. DPL has proven sensitive in ascertaining the presence of intraperitoneal hemorrhage and bowel perforation. However, it is unable to evaluate the retroperitoneum and is an invasive procedure with possibility of serious complications such as injury to major vessels, bowel or bladder.

Plain abdominal radiography has limited role in the assessment of blunt abdominal trauma, although some authorities continue to advocate its use. Plain abdominal radiography does not visualise abdominal viscera or detect free fluid, so it cannot provide direct evidence of organ injury or indirect evidence of haemorrhage [3].

CT scan is most reliable investigation to diagnose hollow/ solid organ injury. Its advantages include superior definition of injury, leading to grading of the injury and sometimes the confidence to avoid or postpone surgery. Its disadvantages include the time taken to acquire image so cannot be used to evaluate unstable patients and financial consideration limits its use in all cases. The accuracy of CT in hemodynamically stable blunt trauma patients has been well established. Sensitivity between 92% and 97.6% and specificity as high as 98.7% have been reported in patients subjected to emergency. Hence, the current study is carried out to assess the role of CT scan in a prospective, observational manner. CT scan's main advantage is the ability to detect arterial contrast extravasation, uncontained or as a pseudoaneurysm, which predicts the need for surgery or angioembolization. Computed tomography can be used to evaluate retroperitoneal injury, whereas DPL and ultrasound are less sensitive. Computed tomography is also the modality of choice for diagnosing injuries to the diaphragm, which may result in major morbidity and mortality if undetected and may not present until many years after the event [4].

Hence, the present study was conducted to study computed tomography evaluation of blunt abdominal injury.

Material and Methods

The present study was conducted in the Department of Radiology at the tertiary care institute of Gujarat. Ethical approval was taken from the institutional ethical committee and written informed consent was taken from all the participants.

For the study, we used abdomen CT scan reports of 80 patients with BAT, who were stable enough to undergo radiological investigation. The patients included 55 males and 25 females. The age range was 15-75 years. Diagnostic peritoneal tapping was not performed in any of them. Patients with a normal CT scan and patients who either did not require admission, or who were discharged after a short, uneventful observation period without any further investigation, were excluded from the study. All CT scans were obtained with a 16 slice MDCT Scanner (Siemens). All patients received intravenous bolus of iodinated contrast agents. Following completion of the examination, the CT images were immediately reviewed by two specialist radiologists. Individual organ injuries were graded according to the American Association for the Surgery of Trauma (AAST OIS) injury scoring scale. The OIS classification scheme is fundamentally an anatomic description, scaled from 1 to 5, representing the least to the most severe injury, i.e. from simple organic contusion to vascularization of one organ. CT findings were compared with operative findings, and with the clinical outcome and follow-up. The results were analysed with respect to hemoperitoneum quantification and OIS grades.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

Table 1 shows demographic variables of the participants. Total number of patients included in the study was 80. The mean age of patients was 42.05 years. Number of male patients was 55 and number of female patients was 25. For the mode of injury, other miscellaneous causes were most common in our study group followed by road traffic accidents. Table 2 shows CT-OIS grading and management in 50 patients with solid organ injuries. It was observed that OIS grade II patients were 14, OIS grade III patients were 24, OIS grade IV patients were 7 and OIS grade V patients were 5. The highest proportions of conservatively managed patients were seen in OIS grade II patients. However, highest proportion of operated patients was seen in OIS grade III patients.

Table 1: Demographic variables of the participants

Variables	Number
Total number of patients	80
Mean Age (Years)	42.05
Number of Males	55
Number of Females	25
Road traffic Accident	26
Fall from height	22
Other miscellaneous causes	32

Table 2: CT-OIS grading and management in patients with solid organ injuries

OIS grade	Total number of patients	Number of conservatively managed patients	Number of operated patients
I	14	13	1
II	24	19	5
III	7	2	5
IV	5	1	4

Discussion

The evaluation of the patient with blunt trauma is one of the most difficult assessments in surgery. CT has become increasingly valuable and is extensively used in early clinical management of blunt injury abdomen patient which is highly sensitive and specific method for detection of abdominal injuries. CT allows for complete scanning in a single breath hold and faster scanning speed and narrow collimation increase contrast opacification in mesenteric, retroperitoneal, and portal vessel, as well as parenchymal organ; this improves identification of organ injury and additionally sites of active bleeding. CT is now best established as an accurate non-invasive technique for the detection of entire spectrum of various abdominal injuries help decide on management, especially on decision whether to treat conservatively [5-8].

The most common cause of blunt trauma injury Table 1: Demographic variables of the participants Demographic

variables Values Total number of patients 80 Mean age (years) 42.05 Number of males 55 Number of females 25. Road traffic accident 26, Fall from height 22, other miscellaneous causes 32. CT-OIS grading and management in patients with solid organ injuries in our study was miscellaneous injury followed by road traffic accidents. Bell C *et al*., studied two procedures, diagnostic peritoneal lavage (DPL) and computed tomography (CT scan) to evaluate patients with possible intra-abdominal injuries after blunt trauma [9]. There are advantages and disadvantages of both procedures, however, present evidence suggests that the clinician should not rely on the results of the CT scan. They concluded that the DPL, on the other hand is a sensitive and specific modality in evaluating the patient with blunt abdominal trauma [9]. Hamidi MI *et al*., [10]. determined the utility of the computed tomography (CT) scan in blunt abdominal trauma and to compare it with operative findings or clinical outcomes. They graded organ injuries using the OIS (Organ Injury Scale) guidelines, similar to our study. They concluded that CT was reliable in the evaluation of blunt abdominal trauma in a selected group of patients, with overall sensitivity of 97% and specificity of about 95%, Positive predictive value 82% and negative predictive value 100%. A comparison of the CT findings with the intraoperative findings according to the CT scale (I-V) revealed identical parenchymal injury grades in four cases, whereas the injuries were underestimated on CT scans in four patients and overestimated on CT scans in six patients. Ten patients had scores below 2.5; 8 patients were successfully treated conservatively and 1 patients needed delayed surgery. Twenty-five patients had scores of 2.5 or higher; four patients underwent early laparotomy, 16 patients were successfully treated conservatively, and two patients needed delayed surgery. Mehta N *et al*., [11] evaluated 71 cases of BAT with stress on early diagnosis and management, increase use of non-operative management and time of presentation of patients. A retrospective analysis of 71 patients of BAT within a span of 18 months was done. Demographic data, mechanism of trauma, management and outcomes were studied. Motor vehicle accident (53%) was the most common mechanism of injury. Spleen (53%) was the commonest organ injured and the most common surgery performed was splenectomy (30%). Smith *et al*., [12] found that 220 out of 969 (22.7%) cases with blunt abdominal trauma had hepatic injuries. Gupta *et al*., [13] reported that most common occupation group of RTA victim was of students (36.07%) followed by laborer (25.41%) and farmers (20.49%). The students, laborers and farmers are the most mobile group of the society. Students are active group meet with an accident while going to education institution/tuitions and outdoor work. Most common extra abdominal injury was rib fracture in 20%. Mortality rate was 4%. Wound sepsis (13%) was the commonest complication. Meyer DM *et al*., [14] determined the sensitivity, specificity, and accuracy of CT in pediatric patients with blunt trauma. Sixty children sustaining blunt abdominal trauma were included in the study. CT scans with both oral and IV contrast were performed before open lavage and positive results were confirmed by operation in 18 patients. CT had a sensitivity of 67%, however, only 60% of the actual organ injuries were identified by the scan.

Conclusion

CT scan of the abdomen has largely replaced other imaging modalities in the evaluation of the hemodynamically stable patients of blunt injury abdomen. It is performed in patients where abdomen cannot be evaluated adequately by clinical examination because of altered mental status in those patients where the finding of clinical examination is equivocal; and in those patients with significant pelvic fracture. CT scan for blunt abdominal injury is a reliable and accurate method for diagnosis. It has all the qualities to make it a gold standard for initial investigation of choice for blunt abdominal injury patients.

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