Original Article

10.37821/ruhsjhs.4.4.2019.190-194

Role of Multidetector Computed Tomography in Evaluation of Blunt Abdominal Trauma

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ABSTRACT

Introduction: Abdominal injury constitutes a significant portion of all blunt and penetrating body injuries. Computed tomography gives rapid information on the type of abdominal injury and helps in management of the patient accordingly. The present study was undertaken to evaluate the usefulness of Multidetector Computed Tomography (MDCT) in detection of intraabdominal injury in patients with blunt abdominal trauma and to provide information that could accurately determine choice of management (non- operative versus operative), also to correlate the computed tomography (CT) findings with either clinical observation, follow up CT scan (if required), or surgical findings (wherever applicable).

Methodology: Patients admitted to various emergency departments of Government Medical College and associated hospitals with history of abdominal trauma during the period of January 2018 to October 2018 were taken for the study. A total of 50 patients with abdominal trauma who underwent computed tomography (CT) examination were included. CT findings were compared with surgical findings in operated cases, and in the rest CT findings were compared by clinical outcome.

Results: Among the 50 cases studied, all 50 had positive CT findings of abdominal trauma, out of which 24 patients underwent surgery and the remaining were managed conservatively. The age group of the patients was ranging from 8 to 66 years. In this study, the commonest organs affected were liver and spleen accounting for 48% and 44%, respectively.

Conclusion: The MDCT was an excellent tool for detection, evaluation, and deciding the management of the cases (operative or nonoperative). It helps in grading of the type of injury and accordingly deciding the management of patient.

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 presentation.[1] Computed tomography (CT) has become increasingly valuable and is extensively used in early clinical management of blunt abdominal trauma.[2,3] It is a widely available imaging technique in clinical practice.[2] Now a days, the multidetector computed tomography (MDCT) scanning with intravenous contrast is the gold standard diagnostic modality in hemodynamically stable patients with intraabdominal fluid. MDCT scanning with intravenous contrast has numerous advantages. The detection of injuries related to solid organs can be reliably determined, with a sensitivity of 90-100%. MDCT readily detects direct and indirect features of bowel and mesenteric injuries; an important advancement given that unrecognized bowel and mesenteric injuries may result in high morbidity and mortality.[4]

Though USG and direct peritoneal lavage (DPL) examinations can be a valuable initial investigation in abdominal injuries. However sometimes, many retro-peritoneal injuries go unnoticed with Direct Pertioneal Lavage (DPL) and Focused assessment with sonography for trauma (FAST) examinations and USG can miss crucial injuries of these organs and may lead to inappropriate management in some patients. Focused assessment with sonography for trauma and direct peritoneal lavage examinations have the capability to determine the source of haemorrhage. CT scan provides excellent imaging especially of the pancreas, duodenum, and genitourinary system. Compromised results of USG may be due to overlying bowel shadow, surgical emphysema, and empty bladder. Hence, it is imperative that all USG positive cases should be followed by CT.

Similarly, CT must also be performed in symptomatic patients with negative USG scans and with suboptimal USG scans. Plain radiographs have a limited role in patient with blunt abdominal trauma. The presence of rib and vertebral fractures can be assessed. They are incapable to make a diagnosis of hemoperitoneum. Even patients with a hollow visceral injury often have normal radiographs. Occasionally, a chest radiograph will show free air under diaphragm. Though, plain films are standard for the evaluation procedure of blunt abdominal trauma patients.

Patients with pelvic fractures have a high energy mechanism. This mandates rapid abdominal evaluation to avoid confusing retro-peritoneal bleeding common with intraabdominal blood loss. Multidetector CT technology offers unprecedented imaging capabilities that can be readily applied for optimal evaluation for polytrauma patient. With the decline in the use of diagnostic peritoneal lavage and the current preference for conservative nonsurgical management for all but the most severe injuries affecting the solid abdominal viscera, diagnosis is heavily reliant on the findings of CT. The use of CT in the initial and follow-up evaluations of trauma victims has played a pivotal role in decreasing the rate of unnecessary exploratory laparotomies and increasing conservative non-operative management of abdominal injuries.[5]

METHODS

Among all the patients who reported with a history of blunt abdomen trauma, 50 patients who were admitted and referred for CT scan of abdomen to the Department of Radiodiagnosis at Government Medical College, Rajasthan, were selected using purposive sampling technique. The study period was from January 2018 to October 2018. All scans were done on 128-slice MDCT (Siemens Somatom) Scanner.

Patients with clinical suspicion of intraabdominal injury, stable haemodynamics, and multi-trauma were included in the study. All haemodynamically unstable patients with obvious peritoneal signs and progressive abdominal distenstion taken up for immediate surgery were excluded from the study and patients who did not have a follow up were also excluded.

Risk of contrast administration was explained to the patients and consent was obtained prior to the contrast study. CT was carried out on 128-slice MDCT (Siemens Somatom) scanners. An axial section of 5 mm thickness was taken from the level of lung bases to the level of ischial tuberosities. Varying parameters (120-140 kVp, 200-250 mA for an average-sized patients (increased values for an oversized patient), pitch: 1.5, field of view: 240-350 mm: collimation: 2.5mm, time for scan: 4-5 seconds) were used.

Various artifact reduction techniques were used like decompressing stomach with a nasogastric tube to prevent air-fluid artifact, by removing electrocardiographic leads from the scan field, raising the patient's arm (if tolerated) out of the scan field, and using a large field of view scan technique and post study reconstruction was done at 2.5 mm. Sagittal and coronal reconstructions were made wherever necessary.

RESULT

The age group of the patients ranged from 8 to 66 years. The maximum numbers of cases were in the age group of 21-30 years. Out of total 50 participants, 46 are males and 4 were females. Table 1 shows percent ratio of various age groups involved in abdominal trauma.

Table 1: Age distribution of study population with abdominal trauma

Age (years)	Frequency	Percentage
0-10	3	6
11-20	11	22
21-30	14	28
31-40	10	20
41-50	7	14
>50	5	10
Total	50	100

Road traffic accidents (27 of 50 cases) constituted majority of the cases, followed by fall from height being the second most common cause for abdominal injuries in 19 of 50 patients. Sports injury, assault, and heavy object fall constituted the rest modes of injury with one patient each. One patient was gored by a bull.

Liver was the most common organ involved in organ injury constituting 24 patients, followed by spleen with 22 patients. Kidney was involved in 7 patients followed by adrenal and rectum involvement in one patient.

Out of total 50 patients with abdominal injuries, multiple injuries were present in 5 patients (10%) and isolated organ injury was present in 45 patients (90 %).

There were 22 cases of splenic injury. Splenic haematoma laceration and contusion were found in all 22 cases and splenic vascular pedicle injury in 1 case. This suggests that laceration and contusion being the most common type of injury in splenic trauma and vascular pedicle injury is very rare (4.5 %) in occurrence.

Among 24 cases of liver injury, there were 15 cases of liver haematoma. Liver laceration was found in all 24 cases (100%) suggesting laceration to be the most common type of injury in liver trauma followed by haematoma (62.5%). In the study among 7 cases of renal injury, there were 2 cases of renal contusion. Laceration and haematoma were found in 5 cases (71%) each suggesting laceration and haematoma to be the most common type of injury in renal trauma followed by contusion (28 %).

Out of total 50 patients with abdominal injuries, 26 patients were treated conservatively and 24 patients underwent surgery, thus operative management and conservative management was undertaken in 48% and 52% of cases, respectively. There were 12 patients (24%) out of total 50 patients who sustained rib fractures while 38 patients (76%) had no rib fractures. Among total patients, 18 had pleural effusion. Out of the 50 patients included in our study, 48 patients (96%) were successfully treated and their condition improved after treatment with advice of follow up. Mortality in the present study was in 2 patients (4 %).

Table 2 depicts that 24 patients who got operated, intra-operative grading was correlating with computed tomography grading in 21 cases constituting 87.5 % with p value < 0.01 and kappa value 0.831 which is highly significant.

Table 2: Correlation of intra-operative grading and computed tomography grading in the study population

	Frequency	Percentage
Correlating	21	87.5
Not correlating	3	12.5
Total	24	100

DISCUSSION

In this study, the most common organ affected in abdominal trauma was liver and spleen accounting for 43% and 40% respectively of organ injury, followed by the kidneys (13%), rectum (2%), and adrenal (2%). Hemoperitoneum was observed in all patients accounting for 100%. This study has discussed the CT features of abdominal trauma.

In a study by Miller LA et al[6], including 100 cases of abdominal trauma, there was maximum incidence of trauma in age group 21-30 group, which was 35% followed by age group below 20 years. In the present study maximum incidence of trauma was seen in age group 21-30 years which was 28% followed by age group 11-20 years (22%). A study reported that male: female ratio was 13:7 while in the present study male: female ratio was 92:8 suggesting males are more prone to injuries than females.[6]

Siddique MAB et al[7] studied 50 patients of abdominal trauma and concluded stab injuries in 21 patients as leading cause followed by motor accidents in 12 patients, assault in 7 patients, fall from height in 4 patients, and other cause in 6 patients. In this study, vehicular accidents were the major cause of blunt abdominal trauma.

In the present study road traffic accidents (27 out of 50 cases) constituted majority of the cases, followed by fall from height (19 out of 50 cases). Sports injury, stab injury, and heavy object fall constituted the rest modes of injury with one patient each. One patient was gored by a bull. There were maximum of grade III (38%) followed by grade IV (34%), grade II (10%), grade I (5%), and grade V (4%). The reason for grade III and II being more common can be due to more number of cases belonging to major road traffic accidents and fall from height and our hospital being major referral centre for road traffic injuries and fall from height because of its tertiary setup and close proximity to the national highway.

Anderson SW et al[8] studied 68 patients out of which 47 patients underwent computed tomography for the examination of abdominal injuries. Out of these 47 cases, majority of cases belonged to grade II constituting 45% of cases followed by grade III and grade IV with incidence of 21% and 19%, respectively. Grade I and grade V was diagnosed in 6 and 1 case respectively out of 47 cases with incidence of 13% and 9% each.

In the present study, among the renal injury patients (7), grade I and grade III constituted 28% (2 patients each) with rest of the grades with incidence of 14% each. Abdominal trauma can cause injury to a single organ or may involve multiple organs. Clinical sign and symptoms have been identified that are associated with risk of intra-

abdominal injury. They include gross hematuria, abdominal tenderness, abdominal distension, absent to low bowel sounds, dropping hematocrit, pelvic or lower rib fracture.

Liver:- CT assessment of grading of liver trauma was noted to correlate with surgical outcome. In the present study it was noticed that 4 out of total 15 cases of grade IV liver injury were treated by operative management. Trauma of grade III and less were treated conservatively. One patient had both grade III liver trauma and grade II rectal injury. Patient was operated for rectal injury however, liver was treated conservatively. There were no false positives.

Kidney:- CT grading of renal trauma was noted to correlate with clinical outcome. All 7 cases were treated conservatively. There were no false positive.

Spleen:- CT grading of splenic trauma was noted to correlate with intra-operative grading in 18 patients out of 20 patients operated. Two patients had one higher intra-operative grading of splenic trauma compared to the one diagnosed on CT. Two patients with grade I and III were treated conservatively and all other were operatively managed. The reason for under diagnosis of the grading in two cases was due to closely apposed lacerations with large peri-lesional haematoma found intra-operatively which were difficult to image and grade on CT.

Adrenal:- One case of adrenal trauma was detected on CT. It was seen with liver injury in the same patient. Treatment was conservative for both liver and adrenal injury.

Rectum:- One case of rectal injury was diagnosed in a case which also had grade III liver injury. Patient was operated and reported as grade III rectal injury compared to grade II as diagnosed on CT. Liver injury was treated conservatively. The difference in grading between CT and intra-operative findings can be explained due to inability of CT to visualize circumferential tear completely and accurately.

In this study computed tomography grading correlated well with intra-operative grading with p value < 0.01 and kappa value 0.831 and hence, was a good and reliable modality to grade intraabdominal organ injury grading pre-operatively.

There were few limitations in the study as the sample size was small to correctly evaluate role of CT in detection and grading abdominal injuries in trauma having no patients with pancreatic, small bowel and diaphragm injuries. There was only one case of rectal injury and adrenal injury in the study and hence, the role of CT in management of these injuries cannot be inferred from the present study. Only 24 out of 50 patients underwent surgical management and CT grading of organ injury could be correlated only in these cases and there were no conclusive way for confirming the CT grading in the rest of 26 patients who were managed conservatively. Patients were followed up only till time of discharge and long term follow up for clinical outcome was not done in the study.

CONCLUSION

Computed tomography grading correlates well with intra-operative grading, hence, is a good and reliable modality to grade intraabdominal organ injury grading pre-operatively. CT is a very good modality to identify haematoma, contusion, and laceration. MDCT, because of its easy availability, better resolution, better sensitivity, and specificity for organ injures in patients of blunt abdomen trauma is the gold standard modality and modality of choice and has became an important tool in decision making in term of operative v/s conservative management.

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