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Original Research Article

Role of multidetector computed tomography in evaluation of abdominal trauma in Sothern Rajasthan, India

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ABSTRACT

Background: Abdominal injury constitutes a significant portion of all blunt and penetrating body injuries. Computed tomography is an important and fast technique which gives rapid information on the type of abdominal injury and helps in management of the patient accordingly. The aim of the present study was to evaluate the usefulness of Multidetector Computed Tomography (MDCT) in detection of intra-abdominal injury in patients with blunt abdominal trauma and to provide information that could accurately determine choice of management (non- operative versus operative). And to correlate the computed tomography (CT) findings with either clinical observation, follow up CT scan (if required) or surgical findings (wherever applicable).
Methods: 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 with male predominance. In this study the commonest organs affected were liver and spleen accounting for 48% and 44% respectively.
Conclusions: Computed tomography is an important and highly sensitive imaging modality for diagnosis of organ injuries in patients with abdominal trauma and accordingly deciding the management of patient.

Keywords: Abdominal trauma, Computed tomography, Detection, Evaluation, Management

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 are encounter because of varied presentation.[1]

CT has become increasingly valuable and is extensively used in early clinical management of blunt abdominal trauma.[2,3] Computed tomography 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 intra-abdominal 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 advance 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. Focused assessment with sonography for Trauma (FAST) and direct peritoneal lavage (DPL) examinations, have the capability to determine the source of haemorrhage. Though sometimes, many retroperitoneal injuries go unnoticed with DPL and FAST examinations. CT scan provide excellent imaging especially of the pancreas, duodenum and genitourinary system. However, USG can miss crucial injuries of these organs and may lead to inappropriate management in some patients. Compromised results of USG may be due to overlying bowel shadow, surgical emphysema, 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. Plan 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 making 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 proceed of blunt abdominal trauma patients.

Patients with pelvic fractures have a high-energy mechanism. This mandates rapid abdominal evaluation to avoid confusing reotro-peritoneal bleeding common with intra-abdominal 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 CTs. 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 had come with a history of blunt abdomen trauma, 50 patients who were admitted and referred for CT scan of abdomen, to the department of radio diagnosis at RNT Medical College and attached Hospital Udaipur, were selected using purposive sampling technique, during the study period January 2018 to October 2018 were included in the study. All scan was done on 128-slice MDCT (Siemens Somatom) Scanner.

Inclusion criteria

- Clinical suspicion of intra-abdominal injury.
- Haemodynamically stable patient.
- Multi-trauma patient.

Exclusion criteria

- All haemodynamically unstable patients with obvious peritoneal signs and progressive abdominal distenstion-will be taken up for surgery immediately and will be excluded from the study.
- Patients who did not have a follow up were excluded.

Technique

Risk of contrast administration had been explained to the patients and consent was obtained prior to the contrast study.

CT was carried out on 128-slice MDCT (Siemens Somatom) Scanners. Axial sections of 5 mm thickness were taken from the level of lung bases to the level of ischial tuberosities. Varying parameters (120-140 kVp, 200-250 m. As for an average-sized patient {increased values for an oversized patient} Pitch:1.5, field of view:240-350 mm: collimation:2.5 mm, Time for scan:4-5 seconds) was used.

Various artifact reduction techniques were used like

- Decompressing stomach with a nasogastric tube to prevent air-fluid artefact.
- By removing electrocardiographic leads from the scan field.
- By raising the patient's arm (if tolerated) out of the scan field.
- By using a large field of view scan technique.
- Post study reconstruction was done at 2.5mm. Saggital and coronal reconstruction were made wherever necessary.

RESULTS

An analysis of data obtained from 50 patients with abdominal trauma admitted to various indoor, outdoor and emergency departments of RNT Medical College and attached hospitals Udaipur, for a period January 2018 to October 2018 was done, using 128-slice MDCT (Siemens Somatom) Scanner. All data was observed and tabulated on various parameters.

Of the 50 cases, 56 percent (28 cases) were below 30 years with distribution of below 10 years, 11-20 years and 21-30 years age group being 6 percent (3 patients), 22 percent (11 patients) and 28 percent (14 patients) respectively. 20 percent (10 cases) of the population belonged to the age group 31 to 40 constituting a second major age group involved in abdominal trauma. Of the age group involved in abdominal trauma the age group 41 to 50 years and above 50 years constituted 14 (7 cases) and 10 percent (5 cases) respectively (Table 1).

Table 1: Age distribution of patients studied.

Age (years)	No. of patients	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

Table 2: Sex distribution of patients.

Gender	No. of patients	Percentage
Female	4	8
Male	46	92
Total	50	100

Sex distribution involved in abdominal trauma According to our study 92 percent of total cases i.e. 46 out of 50 were males and only 4 patients (8%) were females (Table 2).

Table 3: Mode of injury.

Mode of injury	No. of patients	Percentage
Road traffic accidents	27	54
Fall from height	19	38
Fall of heavy object	1	2
Miscellaneous	1	2
Sports injury	1	2
Assault	1	2
Total	50	100

The data of our study suggested that road traffic accidents (27of 50 cases) constituted majority of the cases, followed by fall from height being the second most common cause for abdominal injuries with 19 of 50 patients. Sports injury, assault, heavy object fall constituted the rest modes of injury with 1 patient each. One patient was gored by a bull (Table 3).

The distribution of organ involvement in abdominal trauma showed that, liver was the most common organ involved in organ injury constituting 24 of 50 patients in the study. This was followed by involvement of the spleen with 22 patients showing splenic injury. The kidney was involved in 7 patients with adrenal and rectum involved in 1 patient each. Multiple organs were involved in 5 patients (Table 4).

In the present study, among the 24 patients who got operated, intra-operative grading was correlating with computed tomography grading in 21 cases constituting 87.5 percent (Table 5 and 6).

Table 4: Organ involvement.

Organ	No. of patients	Percentage
Kidney	7	13
Liver	24	43
Spleen	22	40
Adrenal	1	2
Rectum	1	2
Total	55	100

Table 5: Intra-operative grading correlation.

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

In present study, of total 50 patients with abdominal injuries, multiple injuries were present in 5 patients (10 percent) and isolated organ injury was present in 45 patients (90 percent) (Table 7).

In present study of 22 cases of splenic injury, there were 22 cases of splenic laceration. Splenic haematoma was also found in all 22 cases and splenic vascular pedicle injury in 1 case (Table 8).

In the present study of 24 cases of liver injury, there were 15 cases of liver haematoma. Laceration of liver was seen in all 24 cases (Table 9).

In the present study of 7 cases of renal injury, there were 2 cases of renal contusion and renal haematoma in 5 cases. Renal laceration was seen in 5 cases (Table 10). 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 percent cases and 52 percent of cases were treated respectively (Table 11).

Out of the 50 patients in the present study, 12 patients (24 percent) out of total 50 patients sustained rib fractures while 38 patients (76 percent) had no rib fractures (Table 12).

Out of the 50 patients in the present study, 18 patients (36 percent) out of total 50 patients had pleural effusion while 32 patients (64 percent) had no pleural effusion (Table 13).

Of the 50 patients included in our study, 48 patients (96 percent) were successfully treated and their condition improved after treatment with advice of follow up. Mortality in the present study was in 2 patients (4 percent) (Table 14).

Table 6: A Comparison table regarding the intra-operative and pre operative grading.

Grade of injury		Intra-operative grading					Total
		Grade I	Grade II	Grade III	Grade IV	Grade V	
Grade I	Frequency	1	0	0	0	0	1
	%within grade of injury	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	%within intra-op grading	100.0%	0.0%	0.0%	0.0%	0.0%	4.2%
Grade II	Frequency	0	4	2	0	0	6
	%within grade of injury	0.0%	66.7%	33.3%	0.0%	0.0%	100.0%
	%within intra-op grading	0.0%	100.0%	25.0%	0.0%	0.0%	25.0%
Grade III	Frequency	0	0	6	0	0	6
	%within grade of injury	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
	%within intra-op grading	0.0%	0.0%	75.0%	0.0%	0.0%	25.0%
Grade IV	Frequency	0	0	0	8	1	9
	%within grade of injury	0.0%	0.0%	0.0%	88.9%	11.1%	100.0%
	%within intra-op grading	0.0%	0.0%	0.0%	100.0%	33.3%	37.5%
Grade V	Frequency	0	0	0	0	2	2
	%within grade of injury	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	%within intra-op grading	0.0%	0.0%	0.0%	0.0%	66.7%	8.3%
Total	Frequency	1	4	8	8	3	24
	%within grade of injury	4.2%	16.7%	33.3%	33.3%	12.5%	100.0%
	%within intra-op grading	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 7: Number of organs involved.

Number of organs	No. of patients	Percentage
Single organ involved	45	90
Multiple organs involved	5	10
Total cases	50	100

Table 8: Type of splenic injury (n=22).

	No. of patients	Percentage
Haematoma	22	100
Laceration	22	100
Pedicle injury	1	4.5

Table 9: Type of liver injury (n=24).

	No. of cases	Percentage
Haematoma	15	62.5
Laceration	24	100

Table 10: Type of renal injury (n=7).

Type of renal injury	No. of cases	Percentage
Contusion	2	28
Haematoma	5	71
Laceration	5	71

Table 11: Mode of treatment.

Mode of treatment	No. of patients	Percentage
Conservative	26	52
Surgical	24	48
Total	50	100

Table 12: Rib fractures.

Rib fractures	No. of patients (n=50)	Percentage
Present	12	24
Absent	38	76
Total	50	100

Table 13: Pleural effusion.

Pleural effusion	No. of patients (n=50)	Percentage
Present	18	36
Absent	32	64
Total	50	100

Table 14: Outcome of patients.

Outcome of patients	No. of patients (n=50)	Percentage
Improved	48	96
Expired	2	4
Total	50	100

DISCUSSION

Among the 50 cases studied, CT findings regarding identifying the organ of injury correlated in all 24 patients. However, grading of injury did not correlate with intra-operative grading in 3 of 24 patients who underwent surgery. Remaining 26 patients were managed conservatively.

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

This study has discussed the CT features of abdominal trauma. These compare well with abnormalities highlighted by other authors. In a study by Miller et al, including 100 cases of abdominal trauma, there was maximum incidence of trauma in age group 21-30 years, which was 35% followed by age group below 20 years.[6]

In 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%).

In a study by Millar et al, including 100 cases of abdominal trauma the male: female ratio was 13:7.[6]

In present study male: female ratio was 92:8 suggesting males are more prone to injuries than females.

Siddique et al, studied 50 patients of abdominal trauma and concludes stab injuries in 21 patients as leading cause followed by motor accidents in 12 patients, assault in 7 patients and fall from height in 4 patients and other causes in 6 patients.[7] In his study vehicular accidents are the major cause of blunt abdominal trauma. In our study road traffic accidents (27of 50 cases) constituted majority of the cases, followed by fall from height with 19 of 50 patients. Sports injury, assault injury, heavy object falls constituted the rest modes of injury with 1 patient each. One patient was gored by a bull.

Since authors' hospital is in close proximity to the national highway and being a tertiary setup, it is a major referral centre for road traffic injuries. Khan et al, studied 100 cases of abdominal trauma and there were maximum of grade I injuries (42.8%) followed by grade II and grade III injuries (22.85%).[8]

Anderson et al, studied 68 patients out of which 47 patients underwent computed tomography for examination of abdominal injuries.[9] 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 present study there were maximum of grade III injuries (38%) followed by grade IV (34%), grade II (10%), grade I (5%) and grade V (4%). The reason for grade III and grade IV injuries 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.

Laal M et al, studied 16,573 patients out of which 106 patients had renal injuries. Out of these 106 cases majority of cases belonged to grade I constituting 62.3% of cases followed by grade II and grade III with incidence of 14% and 10% respectively.[10]

Grade IV and grade V was diagnosed in 8 cases each out of 106 cases with incidence of 7.5% each.

In our study of renal injuries of 7 patients, 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 signs and symptoms have been identified that are associated with risk of intra-abdominal injury. They include gross hematuria, abdominal tenderness, abdominal distension, absent bowel sounds low, dropping hematocrit, pelvic or lower rib fractures.

Biomedical parameters such as raised serum amylase may also be indicative of specific injury. The routine ultrasonographic examination helps, however it is difficult to characterize and grade injury of injury in patients. In this study CT has proved very useful in characterization and grading of injury.

CT grading of splenic trauma was noted to correlate with intra-operative grading in 18 patients out of 20 patients operated Two patients had higher intraoperative grading of splenic trauma compared to the one diagnosed on CT. The reason for under diagnosis of the grading in two cases was due to closely apposed lacerations with large

perilesional haematoma found intra-operatively which were difficult to image and grade on CT.

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.

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 finding can be explained due to inability of CT to visualise circumferential tear completely and accurately.

Limitations of the study were the sample size was small to correctly evaluate role of CT in detection and grading abdominal injuries in trauma. Also, there were no patients with pancreatic, small bowel and diaphragm injuries. There were only 1 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 was no conclusive way for confirming the CT grading in the resr of 26 patients who were managed conservatively. Patients were followed up only till time of discharge and long term follow up forclinical outcome was done in the study.

CONCLUSION

Computed tomography grading correlated well with intra-operative grading p value <0.01 and kappa value 0.831 an hence, is a good and reliable modality to grade intra-abdominal organ injury grading pre-operatively. Computed tomography is a very good modality to identify haematoma, contusion and laceration. It is suggested that 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 became an important tool in decision making in term of operative vs conservative management.

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