



## Role of Multidetector Computed Tomography in Evaluation of Blunt Abdominal Trauma

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### Abstract

**Introduction:** CT is the technique of choice for initial examination of hemodynamically stable patients after blunt abdominal trauma. It is highly sensitive, specific, and accurate for use in detecting the presence or absence of injury and defining its extent.

**Material and Method:** This Prospective Study is carried out in patients admitted to Sardar Patel Medical College & Associate Group of Hospitals, Bikaner with history of blunt abdominal trauma during the period of March 2016 to Nov 2016. 100 patients with blunt abdominal trauma who underwent CT examination were included in this study. using PHILLIPS BRILLIANS 64 SLICE MDCT SCAN.

**Results:** Out of 100 patients in our study, 70% were positive for abdominal injury and 30% were negative. Out of the 70 patients who were positive for Intra-abdominal injury, 72.85% patients had hemoperitoneum with solid organ injury and 15.71% had visceral injury without hemoperitoneum and 11.43% had isolated hemoperitoneum. In this study we had 70 visceral injuries. Majority 38.57% of patients with visceral injury had splenic injury followed by 28.57% patients of Hepatic injury & 20% renal injuries. Bowel and bladder injury contributed to almost 10% injuries. Injuries to GBS & pancreas contributed to only 1.43% each. Majority of the visceral Injuries were Grade III injuries. There were no grade VI injuries (complete devascularization following transaction at hilum) in this study. All the visceral injuries which were operated upon belonged to Grade V. None of the Injuries graded I to III required surgery.

**Conclusion:** CT is an important imaging technique for diagnosis of organ injuries in patients with abdominal trauma. It helps in grading of the type of injury and deciding the management of patient. It is a highly sensitive imaging modality for the diagnosis of abdominal injuries.

**Keywords:** Multidetector Computed Tomography; Multiple Trauma; Screening.

## Introduction

CT is the technique of choice for initial examination of hemodynamically stable patients after blunt abdominal trauma. It is highly sensitive, specific, and accurate for use in detecting the presence or absence of injury and defining its extent. Non-operative management of many posttraumatic injuries, particularly in the liver, spleen, and kidney, is possible due to because of the diagnostic usefulness of CT. CT can be used effectively to visualize the progression of liver and spleen injuries in those patients chosen for conservative management. CT helps in treatment decisions in patients with renal injury by defining the character and extent and distinguishing minor from severe renal trauma. Posttraumatic injuries to the pancreas, bowel, and mesentery can be detected with CT. In these areas, however, signs may be subtle, and a significant injury may be missed on an initial examination.

Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups. Blunt injury occurs most frequently with motor vehicle collisions. Road traffic crash kill 1.2 million people annually around the world (3242 people a day), 90% of these deaths are in low or middle income countries. It is predicted to become the third largest contributor to the global burden of disease by 2020.

Many of these patients have multi system injuries resulting from high velocity mechanisms. Identification of serious intra-abdominal pathology is often challenging. When assessing the status of an abdominal trauma patient upon arrival to the emergency department, clinical history and physical examination are often unreliable and even misleading. Clinical diagnosis can be challenging due to the lack of specific physical findings in many patients. Neurological impairment due to the traumatic ventilator for to concomitant factors such as in toxication or inebriation markedly limits the usefulness of the clinical examination. In addition, the presence of associated injuries may mask overt clinical manifestations or divert the attention of the

admitting physician away from potentially life-threatening intra-abdominal bleeding. Many injuries may not manifest during the initial assessment and treatment period.<sup>3</sup> After initial evaluation and resuscitation, subsequent management depends heavily on the hemodynamic stability of the patient. Patients who remain hypotensive, with clinically obvious continued intra-abdominal bleeding, may go directly to the operating room.

The rapid identification of life-threatening injuries and prompt initiation of appropriate care may increase the chance of survival for patients with trauma. However, it is often difficult to accurately clinically evaluate blunt abdominal injuries, which may be masked by other more obvious external injuries. CT imaging is the diagnostic tool of choice for the evaluation of abdominal injury due to blunt trauma in haemodynamically-stable patients<sup>4</sup>. CT scans can provide a rapid and accurate appraisal of the abdominal viscera, retroperitoneum and abdominal wall<sup>5</sup>. In addition, an abdominal CT scan can assist in the evaluation of coexisting abdominal injuries such as thoracic injuries<sup>6</sup> and unsuspected pelvic and spinal fractures. The ability of CT to perform and produce fast-processing images, such as multiplanar reconstruction (MPR), is important for the accurate interpretation of abnormalities.

## Materials and Methods

**Study Area:** Department of Radiodiagnosis, Sardar Patel Medical College & Associate Group of Hospitals, Bikaner.

**Study Design:** Prospective Study

**Study Duration:** 9 months (March 2016- Nov 2016)

**Source of Data:** Data for the study were collected from patients with blunt abdominal trauma attending/referred to the PBM Hospital, Sardar Patel Medical College, Bikaner.

**Sampling Technique:** Convenience sampling

**Sample Size:** All blunt abdominal trauma patients, eligible as per inclusion criteria,

reporting to Department of Radio-diagnosis within study duration.

**Method of Collection of Data**

A descriptive correlational study was conducted on all patients with blunt abdominal trauma. They were evaluated with Multidetector Computed Tomography (PHILLIPS BRILLIANS 64 SLICE MDCT SCAN) and findings were correlated with clinical findings wherever applicable.

A complete clinical history of the each patient was taken, which included, age sex, type of injury and principal presenting complaints. The type of trauma was further classified into Road traffic accidents, falls, Assaults and miscellaneous; followed by general physical examination and detailed examination of the whole abdomen.

**Results**

**Table-1:** Mode of blunt injury abdomen with respect to Sex

Mode of injury	Male		Female		Total	
	No.	%	No.	%	No.	%
MVA / RA	56	80.0	14	20.0	70	100.0
Fall from height	12	63.15	7	36.85	19	100.0
Assault	5	45.45	6	54.55	11	100.0
Total	73	73.0	27	27.0	100	100

Table 1 shows distribution of modes of blunt injury to abdomen according to sex of study population. Motor vehicle injuries and falls from

Free fluid quantification was done according to the system devised by Federle and Jeffrey<sup>4</sup>, and was graded as small, moderate or large. Individual organ injuries were graded according to the OIS system and injury severity grades given by Mirvis et al<sup>7</sup>, and Moore E.E. et al.<sup>8</sup>

**Inclusion Criteria**

- Clinical suspicion of intra-abdominal injury.
- Hemodynamically stable patient.
- Multi-trauma patient.
- A positive ultrasonography study

**Exclusion Criteria**

All hemodynamically unstable patients with obvious peritoneal signs and progressive abdominal distension were excluded from the study.

height were more among males whereas assault cases were reported more among females.

**Table: 2.** Distribution of cases according to presence of Intra-abdominal Injury

Patients with BAT	Number of cases	%
Positive for intra-abdominal Injury	70	70
Negative for intra-abdominal Injury	30	30
Total	100	100

The patients with hemoperitoneum or abdominal visceral injury or both were considered as positive for intra-abdominal injury. The patients with neither visceral injury nor hemoperitoneum were

considered as negative for intra abdominal injury. Out of 100 patients in our study, 70% were positive for abdominal injury and 30% were negative.

**Table: 3.** Distribution of Cases according to Positive Intra – abdominal injuries

Positive Intra – abdominal injuries	No. of cases	%
Solid organ injury associated with hemoperitoneum	51	72.85
Visceral injuries without hemoperitoneum	11	15.71
Isolated Hemoperitoneum	8	11.43
Total	70	100

Out of the 70 patients who were positive for Intra-abdominal injury, 72.85% patients had hemoperitoneum with solid organ injury and

15.71% had visceral injury without hemoperitoneum and 11.43% had isolated hemoperitoneum.

**Table: 4.** CT Quantification of Cases according to presence of hemoperitoneum

CT quantification Hemoperitoneum	Number of cases		a)Number of patients managed conservatively		b)Number of operated patients	
	No.	%	No.	%	No.	%
Small	15	25.42	13	26.0	4	44.45
Moderate	32	54.24	30	60.0	0	0
Large	12	20.34	7	14.0	5	55.55
Total	59	100.0	50	100.0	9	100

CT quantification of hemoperitoneum was done as devised by Federle and Jeffrey and they were classified as having mild, moderate or large hemoperitoneum. This quantification was used as an indicator for the need for laparotomy in patients with hemoperitoneum. In our study, cases of hemoperitoneum showed a density of about 45 to 65 Hounsfield units.

All the CT findings of hemoperitoneum and/or solid organ injury were confirmed in the 9 cases taken up for surgery in this study, however, bowel injury was additionally noted in 3 cases of isolated hemoperitoneum and one case of renal injury was upgraded from grade II to III. CT was 100% sensitive in detecting hemoperitoneum.

**Table :5** Distribution of Cases according to visceral injuries

Abdominal viscera involved	Number of Injuries	%
Liver	20	28.57
Gall bladder	1	1.43
Biliary system	1	1.43
Spleen	27	38.57
Pancreas	1	1.43
Renal	14	20
Bowel/Mesentery	3	4.29
Bladder	3	4.29
Total	70	100

In this study we had 70 visceral injuries. Majority 38.57% of patients with visceral injury had splenic injury followed by 28.57% patients of Hepatic injury & 20% renal injuries. Bowel and bladder

injury contributed to almost 10% injuries. Injuries to GBS & pancreas contributed to only 1.43% each.

**Table 6:** Number of Grade specific Solid Organ Injuries with management of these injuries (Conservative Vs Surgical)

Injury Grade	Liver		Spleen		Kidney		Pancreas	
	CONSERVATIVE MANAGEMENT	OPERATED CASES	CONSERVATIVE MANAGEMENT	OPERATED CASES	CONSERVATIVE MANAGEMENT	OPERATED CASES	CONSERVATIVE MANAGEMENT	OPERATED CASES
I	3	-	4	-	1	-	-	-
II	2	-	6	-	4	-	-	-
III	12	-	17	-	2	-	-	-
IV	2	-	-	-	6	-	-	-
V	1	-	-	-	-	1	1	1
VI	0	-	-	-	-	-	-	-
TOTAL	20	-	27	-	13	1	1	1

Majority of the visceral Injuries were Grade III injuries. There were no grade VI injuries (complete devascularization following transaction athilum) in this study. All the visceral injuries which were operated upon belonged to Grade V. None of the Injuries graded I to III required surgery. Hence, visceral injuries graded I to III can be managed conservatively and only rarely require surgical intervention.

### Discussion

In this study, the youngest patient was 4 years old, and the oldest was aged 78 years. The maximum patients (31%) were in the age range of 21 to 30 years followed by patients in the age range of 31 to 40 years (24%). There were more male patients (73%) with blunt injury abdomen than female patients. Motor vehicle injuries and falls from height were more among males whereas assault cases were reported more among females. In accidents due to MVA, among males, maximum cases (33.33%) belonged to 21-30 years age group whereas among females maximum cases (50.0%) belonged to 31-40 years age group. No female cases were reported in 41-80 years age group. Among blunt abdominal trauma cases due to fall from height, among females equal number of cases were reported in age groups 1-10 & 11-20 years age group (28.57% each) whereas among males 50% cases were from 11-20 years age group followed by 33.33% in 21-30 years age group. Among blunt trauma due to assault cases, all cases were observed to be centred in age span of 21-60 years. Out of 100 patients in our study, 70% were positive for abdominal injury and 30% were negative for it.

Out of the 70% patients who were positive for Intra abdominal injury, 72.85% had hemoperitoneum associated with solid organ injury, 15.71% had visceral injury without hemoperitoneum and 11.4% (8 patients) had isolated hemoperitoneum.

CT quantification was for hemoperitoneum was done as devised by Federle and Jeffrey et al<sup>4</sup>, and they were classified as having mild, moderate or

large hemoperitoneum. This quantification was used as an indicator for the need for surgery in patients with hemoperitoneum. 25.42% patients had small hemoperitoneum, 54.24% had moderate and 20.34% (12 patients) had large hemoperitoneum. Mallik K and Vashisht S et al<sup>9</sup> however, found good correlation of CT quantification of hemoperitoneum with management approach. All patients with small quantity hemoperitoneum were conservatively managed and similarly all patients with large hemoperitoneum required surgical exploration. Approximately half of the patients with moderate fluid were explored in their study. CT was 100% sensitive in detecting hemoperitoneum.

The most commonly injured organ in this study was spleen. 37.14% (27 cases) had splenic injuries. Majority of them, 65.38% (17 out of 27) were grade III injuries. We agree with Becker CD et al<sup>10</sup> who in their study found that, CT findings in splenic trauma cannot be used to determine reliably which patients require surgery and which patients can be treated conservatively. Even patients with splenic parenchymal injuries of CT grade III, IV and V can be successfully treated conservatively if the clinical situation is appropriate, whereas delayed splenic rupture can still develop in patients with low CT grades. The choice between operative and non-operative management of splenic trauma should be mainly based on clinical findings rather than CT findings. In this study we had 28.57% (20 cases) liver injuries in, majority of them, 60% (12 out of 20) were grade III injuries. There was one case of injury to gallbladder which presented as minimal hemorrhage into gallbladder lumen, and one case of injury to intra hepatic biliary ducts which presented as multiple bilomas. We had one case of grade V liver injury and no case of grade VI liver injury. No hepatic injury required operative management. Jeffrey et al<sup>11</sup> states that CT staging of blunt hepatic injuries has little discriminatory value in predicting outcome of stable patients, as nearly all have an excellent prognosis.

**Conclusion**

CT is an important imaging technique for diagnosis of organ injuries in patients with abdominal trauma. It helps in grading of the type of injury and deciding the management of patient. It is a highly sensitive imaging modality for the diagnosis of abdominal injuries.

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