



## A STUDY OF CORRELATION OF PREOPERATIVE RADIOLOGICAL DIAGNOSIS WITH OPERATIVE FINDINGS IN BLUNT INJURY ABDOMEN

<b>Dr. V. Manmadha Rao</b>	Professor, Department of Surgery, Andhra Medical College.
<b>Dr. B. K. Mahalakshmi</b>	Assistant Professor, Department of Surgery, Andhra Medical College.
<b>Dr. U. Kodanda Ramu</b>	Assistant Professor, Department of Surgery, Andhra Medical College.
<b>Dr. K. Janardhana Rao*</b>	Associate Professor, Department of Surgery, Andhra Medical College. *Corresponding Author
<b>Dr. G. Siri</b>	Postgraduate, Department of Surgery, Andhra Medical College.
<b>Dr. J. Yaswanth Sai</b>	Postgraduate, Department of Surgery, Andhra Medical College.
<b>Dr. V. Nikitha</b>	Postgraduate, Department of Surgery, Andhra Medical College.
<b>Dr. M. Chandra Deepika</b>	Postgraduate, Department of Surgery, Andhra Medical College.

### ABSTRACT

**Introduction:** Trauma has been called the neglected disease of modern society, despite its close companionship with man<sup>1</sup>. Abdominal trauma caused by blunt force is a common presentation in the emergency room seen in adults and children. They are usually an outcome of road traffic accidents, fall from heights or fall on any blunt objects or due to assaults<sup>2</sup>. They are associated with a high morbidity and mortality which can be avoided with early diagnosis and management. **Objective:** To study the correlation of preoperative diagnosis made by radiological evaluation with the intraoperative findings in cases of blunt abdominal trauma. **Materials and methods:** The present study was conducted on 60 clinically suspected patients of blunt abdominal trauma presenting to the Emergency Department, King George Hospital, Visakhapatnam. The study was conducted after prior approval by the Institutional Ethics Committee and informed and written consent from the patient. 60 patients with clinical suspicion of blunt abdominal trauma were selected. After thorough clinical examination, the patients were subjected to X-ray chest and abdomen, Ultrasonography (USG) and Computed Tomography (CT) imaging. After arriving at a pre-operative diagnosis, these patients were followed up and correlation of this diagnosis was done with the intra-operative findings and the results were evaluated. The data entry was done using M.S.Excel and statistical analysis was done using Statistical package for social sciences (SPSS version 16) for M.S.Windows. Fischers exact test was used. p-value less than 0.05 was considered to be statistically significant. **Results:** It was observed that preoperative diagnosis made with CT had a higher degree of correlation with the intraoperative findings when compared to Ultrasonography. **Conclusion:** It can be concluded that CT is a better tool for preoperative evaluation when compared to USG in cases of blunt abdominal trauma.

**KEYWORDS :** blunt abdominal trauma, Computed Tomography, Ultrasonography.

### INTRODUCTION:

Trauma has been called the neglected disease of modern society, despite its close companionship with man<sup>1</sup>. Trauma is the leading cause of death and disability in developing countries and the most common cause of death under 45 years of age<sup>2</sup>. 85% of abdominal traumas are of blunt character<sup>4</sup>. Abdominal trauma caused by blunt force is a common presentation in the emergency room seen in adults and children. They are usually an outcome of road traffic accidents, fall from heights or fall on any blunt objects or due to assaults<sup>2</sup>. They are associated with a high morbidity and mortality which can be avoided with early diagnosis and management.

The spleen and liver are the most commonly injured organs as a result of blunt trauma. The kidney is also commonly injured<sup>3</sup>. Prior to advances in radiological assessment, invasive procedures such as Diagnostic Peritoneal Lavage (DPL) and exploratory laparotomy were commonly utilized to diagnose intraabdominal injury<sup>5</sup>. Currently, nonoperative management (NOM) is the most common management strategy in hemodynamically stable patients<sup>3</sup>. Hence, imaging modalities like Focussed Assessment with Sonography in Trauma (FAST) and Computed Tomography (CT), invasive procedures like DPL have become obsolete.

Computed Tomography is the most widely used investigative modality in abdominal injuries and for the detection of hemoperitoneum secondary to blunt abdominal trauma in the hemodynamically stable patients nowadays<sup>6,7</sup>. CT can offer a fast and precise assessment of the abdominal solid organs, the retroperitoneum as well as the abdominal

wall<sup>8</sup>. CT can further reveal concomitant thoracic injuries and other fractures in cases of polytrauma<sup>9</sup>.

The present study was conducted to assess the role of FAST and CT in the hemodynamically stable patients and to correlate the pre-operative radiological diagnosis with that of the operative findings in cases of blunt abdominal trauma.

### MATERIALS:

The present study is a hospital based observational study which was conducted on 60 clinically suspected patients of blunt abdominal trauma presenting to the Emergency Department, King George Hospital, Visakhapatnam. The study was conducted from June 2021 to November 2022. It was conducted after prior approval from Institutional Ethics Committee and also informed and written consent from the patients.

### Inclusion Criteria:

- Patients presenting to the Emergency Department with blunt abdominal trauma aged above 18 years.
- Poly-trauma cases with clinical suspicion of blunt abdominal trauma.
- Hemodynamically stable patients.
- Patients giving informed and written consent.

### Exclusion Criteria:

- Hemodynamically unstable patients.
- Polytrauma cases with no clinical suspicion of blunt abdominal trauma.

- Patients not giving informed and written consent.
- Patients below the age of 18 years.

**Methods:**

The study was conducted after prior approval by the Institutional Ethics Committee and informed and written consent from the patient. 60 patients with clinical suspicion of blunt abdominal trauma were selected. After thorough clinical examination, the patients were subjected to X-ray chest and abdomen, Ultrasonography (USG) and CT imaging.

USG was done with a 3.5-5.0 MHz convex transducer. Five quadrant examination which included pericardial view, right flank view, left flank view, pelvic view and anterior pleural view, was done.

CT imaging was done with a GE 16 slice CT scanner. Dual phase CT imaging was used which included both arterial and venous phases. These patients received a bolus of 100 ml. (Iohexol – 350mg iodine per ml.) at a rate of 4ml/sec, followed by normal saline.

After arriving at a pre-operative diagnosis, these patients were followed up and correlation of this diagnosis was done with the intra-operative findings and the results were evaluated.

**Statistical Analysis:**

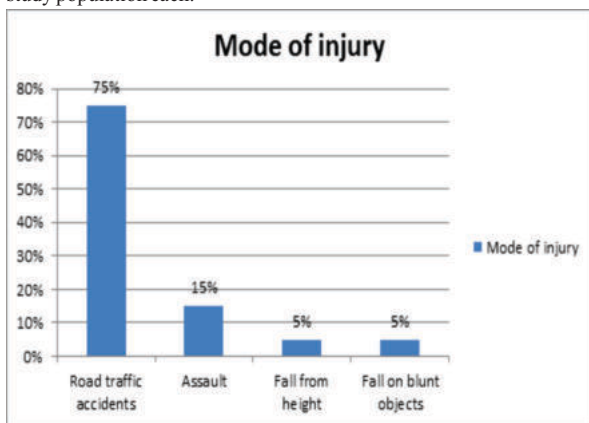
The data entry was done using M.S.Excel and statistical analysis was done using Statistical package for social sciences (SPSS version 16) for M.S.Windows. Fishers exact test was used. p-value less than 0.05 was considered to be statistically significant.

**RESULTS:**

In our study, the most common age group involved in blunt abdominal trauma is 21-40 years, accounting for 36 out of 60 patients (60% of the study population). It is followed by the age group of 41-60 years which involved 12 patients (20% of study population). The patients belonging to the age group of 18-20 years included 9 patients which is about 15% of the study population. The least commonly involved age group is above 60 years of age which had 3 patients, that is only 5% of the study population.

In the current study, out of the study population of 60 patients, males accounted for 80% (48) of the patients and females were 20% (12 patients).

In this study, the most common cause of blunt abdominal trauma was road traffic accidents (RTA), which accounted for almost 75% (45) of the study population. This was followed by assaults which was the cause in 15% (9) of the patients. The other cause of blunt abdominal trauma in the present study were fall from height and fall on blunt objects which were equal in incidence accounting for 5% (3) of the study population each.



**Figure 1:** Distribution According To Mode Of Injury

The most commonly involved organ in the current study was the spleen which was seen in 33 out of 60 patients i.e., 55% of the study population. This was followed by the bowel/ mesenteric injury which was noted in 12 patients (20%), liver injury was seen in 9 patients (15%). The other organs involved in blunt abdominal trauma were kidney, seen in 2 patients (3%) and the urinary bladder in 1 patient (2%).

**Table 1:** distribution Of Study Population Based On The Organs Involved

Organ involved	Frequency (n)	Percentage (%)
Spleen	33	55%
Liver	9	15%
Bowel/mesentery	12	20%
Bladder	1	2%
Kidney	2	3%

In some of the patients, the blunt abdominal trauma was associated with other injuries, especially in victims of road traffic accidents. The most common associated injury in the present study was rib fractures which was noted in 9 out of 60 patients (15%). This was followed by pneumothorax which was observed in 6 patients (10%). The other associated injuries were hemothorax (5%), head injuries (5%) and pelvic bone injuries (5%).

It was observed that the most commonly missed injuries in the preoperative radiological evaluation were bowel and mesenteric injuries. It was noted that only about 16% of bowel and mesenteric injuries were missed on CT evaluation whereas all the bowel and mesenteric injuries were missed on USG evaluation.

On comparison of USG diagnosis with intraoperative findings, it was noted that all of the solid organ injuries were identified on USG whereas the diagnosis was missed in all the cases of bowel and mesenteric injuries.

**Table 2:** Comparison Of USG With Intraoperative Solid Organ And Bowel/ Mesenteric Injuries

USG vs intraoperative solid organ and bowel/ mesenteric injuries	Intraoperative		p value
	Present	Absent	
USG			0.01
Present	45 79%	0 0%	
Absent	12 21%	3 100%	
Total	57 100%	3 100%	

Sensitivity = 79%, Specificity = 100%, Positive Predictive Value (PPV) = 100%, Negative Predictive Value (NPV) = 20%

In the current study, it was observed that all the patients with solid organ injuries could be diagnosed with CT evaluation. In cases of bowel and mesenteric injuries, only 10 out of 12 patients could be diagnosed with CT and the remaining 2 patients could be diagnosed only in the intraoperative period.

**Table 3:** Comparison Of CT With Intraoperative Solid Organ And Bowel/ Mesenteric Injuries

CT vs intraoperative solid organ and bowel/ mesenteric injuries	Intraoperative		p value
	Present	Absent	
CT			0.001
Present	55 96.5%	0 0%	
Absent	2 3.5%	3 100%	
Total	57 100%	3 100%	

Sensitivity = 96.5%, Specificity = 100%, Positive Predictive Value (PPV) = 100%, Negative Predictive Value (NPV) = 60%

**DISCUSSION:**

Trauma is one of the leading causes of morbidity and mortality all over the world. Abdomen has been found to be the third most commonly injured site in trauma following trauma to the head and extremities. The patients of blunt trauma abdomen can have a good prognosis if the presentation to the hospital is early, followed by early evaluation and diagnosis and rapid intervention, if necessary. Blunt abdominal trauma also poses other challenges in the form of vague symptoms which makes the early clinical diagnosis difficult in these patients. These patients are subjected to further evaluation with radiological investigations like ultrasonography (USG) and CT scans.

Ultrasonography (USG) in the hands of an experienced radiologist can help in the assessment of the organ injured, especially the solid organs, the grade of the organ injury, the severity of hemoperitoneum and any other associated injuries like hemothorax and pneumothorax. But the use of USG is limited in cases of bowel and mesenteric injuries, retroperitoneal injuries like pancreatic injuries, duodenal injuries and retroperitoneal hematomas. This is usually due to presence of bowel shadows which obscures the adequate visualization of these organs.

Evaluation of the patient with CT not only establishes the diagnosis made by USG but can also identify any other injuries which were initially missed by USG and to identify other associated injuries like rib fractures and pelvic fractures. CT can not only identify the presence of injuries but can also identify the precise extent of the injury which helps in deciding the further management in the patient. It can help in the better identification of bowel and mesenteric injuries, retroperitoneal injuries which are usually missed on USG evaluation. CT has an added advantage of identifying any ongoing bleeding by contrast enhanced imaging which can be seen as a leakage of contrast into the peritoneal cavity. This helps in the type of intervention needed in these patients.

In the present study, 60 patients presenting to the Emergency Department of King George Hospital, Visakhapatnam with clinical suspicion of blunt abdominal trauma were studied. After prior informed and written consent, these patients were clinically evaluated after a thorough history regarding the mode of injury. Then, they were subjected to radiological evaluation with X-ray chest and abdomen, Ultrasonography (USG) and CT scan.

These findings on imaging were graded by the American Association for the Surgery of Trauma (AAST) grading score<sup>10</sup>. Once a definitive diagnosis was established, these patients were followed up and correlation was done between the pre-operative radiological diagnosis with USG and CT and the intra-operative findings.

#### Age:

In the present study, most of the patients of blunt abdominal trauma belonged to the age group of 21-40 years. Out of the 60 patients, 36 (60%) patients belonged to the age group of 21-40 years. This was followed by the age group of 41-60 years, which included 12 (20%) out of 60 patients. The age group of 18-20 years included 9 (15%) patients and there were 3 (5%) patients in the age group of above 60 years.

Similar findings were noted in a study conducted by Jitendra T Sankpal et al.<sup>11</sup> on blunt abdominal trauma. They stated that majority of the patients belonged to the age group of 21-40 years accounting for a total of 52% of the cases. These findings were in correlation with the findings observed by Vadodariya et al.<sup>12</sup> which noted that most of the patients belonged to the younger age group especially 20-29 years of age.

#### Gender:

In the current study, most of the patients of blunt abdominal trauma were males. The male patients were 48 (80%) out of the total of 60 patients and the female patients were 12 (20%) out of the 60 patients of blunt abdominal trauma.

These findings were in correlation with an article published by Jitendra T Sankpal et al.<sup>11</sup> where 84% of the study population were male patients. Another study conducted by Vadodariya et al.<sup>12</sup> noted that males contributed to 87% of the patients of blunt abdominal trauma.

#### Mode Of Injury:

In our study population, the most common mode of injury of blunt abdominal trauma was road traffic accidents. They were the cause of trauma in 45 out of 60 patients (75%) in the current study. This was followed by assaults which was the cause in 9 patients (15% of study population). The other causes were fall from heights and fall on blunt objects which contributed to 5% of the injuries each.

These findings were in correlation with a similar study conducted by Kranthikumar et al.<sup>13</sup>, it was noted that road traffic accidents were the most common cause of blunt abdominal trauma contributing to the injuries in 68.7% of the study population.

These findings were also in accordance with an article published by Jitendra T Sankpal et al.<sup>11</sup> which noted that road traffic accidents were

the most common cause of blunt abdominal trauma contributing to injuries in 52% of the study population.

#### Visceral Injury:

In the current study, out of the 60 patients with blunt abdominal trauma and hemoperitoneum, 33 patients (55%) showed splenic injury, which was the most common organ involved in the present study. This was followed by injury to the bowel or mesentery which was noted in 12 patients (20%), followed by liver injury in 9 patients (15%). Renal trauma was noted in 2 patients (3%) and bladder injury was present in 1 patient (2%).

Hence, in the current study it was observed that spleen was the most common organ involved in cases of blunt abdominal trauma. Similar findings were noted in a study conducted by Vadodariya et al.<sup>12</sup> where 43% of the study population had splenic injury which was the most common organ injured.

Studies conducted by Jitendra T Sankpal et al.<sup>11</sup> and Murali Belman et al.<sup>14</sup> also noted that spleen was the most commonly injured organ in cases of blunt abdominal trauma.

CT had a sensitivity of 96.5%, specificity of 100%, positive predictive value (PPV) of 100% and a negative predictive value (NPV) of 60% in the diagnosis of solid visceral and bowel injuries. Ultrasonography (USG) had 79% sensitivity, 100% specificity, 100% positive predictive value (PPV) and 20% negative predictive value (NPV) in the diagnosis of solid organ and bowel/mesenteric injuries.

These findings show that CT scan is more sensitive when compared to Ultrasonography (USG) in the diagnosis of solid organ trauma and bowel/mesenteric injuries secondary to blunt abdominal trauma.

Vadodariya et al.<sup>12</sup> also observed similar findings and stated that CT scan was a better diagnostic tool when compared to Ultrasonography (USG) for the diagnosis of injuries in blunt trauma abdomen. They also noted that the lower sensitivity of USG when compared to CT was mostly due to obscuration by bowel shadow, surgical emphysema and also due to the fact that USG has very less specific findings of bowel injury when compared to the more specific findings in CT scan.

Kranthikumar et al.<sup>13</sup> conducted a similar study in which they noted the sensitivity and specificity of CT scan to be 97.2% and 100%, respectively in the diagnosis of injuries due to blunt abdominal trauma. They noted the sensitivity and specificity of Ultrasonography (USG) were 83.3% and 87.5%, respectively.

**Table 4: Comparison Of Sensitivity And Specificity Of CT With Various Studies<sup>13</sup>**

Name of the study	Sensitivity (%)	Specificity (%)
Present study	96.5%	100%
Kranthikumar et al. <sup>13</sup>	94.7%	100%
Kumar MM et al. <sup>15</sup>	93%	100%
Wing VW et al. <sup>16</sup>	97.2%	94.7%

#### CONCLUSION:

In conclusion, CT scan is a better tool in the diagnosis of blunt abdominal trauma when compared to Ultrasonography (USG). Though USG is a useful tool, it can miss a few critical injuries which may prove to be life-threatening if not diagnosed early.

CT scan can also diagnose other associated injuries which are usually missed in USG. Hence, in hemodynamically stable patients, it is advisable to subject the patients of blunt abdominal trauma to CT scan after USG evaluation.

**Conflict Of Interest:** None.

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