

## Original Research Article

# Comparison of efficacy of CT scan and ultrasound in patients with blunt abdominal trauma

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### ABSTRACT

**Background:** Trauma has become one of the most common cause of hospitalization. The main reason for imaging and screening the patients is to identify the life-threatening injuries as soon as possible so that appropriate treatment can be given immediately. In the past few years, both USG and CT have been widely used to detect the abdominal trauma and have replaced the older methods. This study was undertaken to compare the efficacy of CT scans and Ultrasound in the patients with blunt abdominal trauma.

**Methods:** Patients who had come to our hospital with blunt abdominal trauma and who were stable enough to undergo both USG and CT scans were included into the study. Apart from routine tests, both USG and CT scans were performed for all the patients.

**Results:** The most common cause of trauma was road or vehicular accidents (58.9%) followed by fall from heights (32.1%). Of the organs which were affected, the most one was liver (73.2%), followed by spleen (51.8%), 46.4% of kidneys and 12.5% of the pancreas. Hemoperitoneum was identified in all the 56 patients with CT scan while the same was identified only in 47 cases (83.9%) with USG.

**Conclusions:** CT scan is a superior diagnostic tool for the detection of Blunt abdominal trauma compared to USG. However, the patient needs to be hemodynamically stable for CT to be performed.

**Keywords:** Blunt abdominal trauma, CT Scans, Hemoperitoneum, Ultrasonography

### INTRODUCTION

Trauma has become one of the most common cause of hospitalization especially due to the increase in speed and less adherence to traffic regulations, not to mention, one of the leading causes of death among the younger population, especially in those under 50 years of age. Hence it becomes imperative for improvement in trauma care, especially faster hospitalization, better organization of the trauma centres and well advanced treatments apart from being cost effective.<sup>1</sup> One of the advances in the trauma care is the need for non-invasive diagnosis, so that rapid detection of the patients in need for surgeries and

those with unstable hemodynamics can be given proper lifesaving treatment. For other patients, conservative treatment can be given, thereby avoiding the unnecessary invasive procedures and their accompanying complications.<sup>2</sup>

The incidence of blunt abdominal trauma is reported to be as high as 12-15%, with vehicular accidents being the leading cause in about 80% of the cases.<sup>3</sup>

Ultrasonography, for a long time has been considered to be the first imaging method to be employed in the screening of patients with blunt abdominal traumas a

number of pathologies such as hematomas, contusions, lacerations and hemoperitoneum can be observed.<sup>3</sup> However, it has been reported that ultrasound is not a reliable method for diagnosing trauma in hemodynamically unstable patients as the absence of a free intraperitoneal fluid in the images does not necessarily mean absence of serious organ injuries.<sup>4-8</sup> Diagnostic peritoneal lavage was a method commonly used earlier to diagnose the patients with BAT, however, now a days it is not a preferred option since it required invasive laparotomy.

Computed tomography is one of the better methods for the detection of blunt abdominal injuries, especially when it involves solid organs. CT scan of the abdomen can reveal other associated injuries such as those of vertebral and pelvic fractures or the injuries of the thoracic cavity. Injuries which can be easily identifiable by the CT are that is spleen, liver, diaphragm, colon, bladder, kidneys etc.<sup>9</sup> Unlike direct peritoneal lavage (DPL) and focused assessment with sonography for trauma (FAST) the retroperitoneal injuries do not go unnoticed. CT scans provide very accurate imaging of the internal organs and can help to quantify the amount of blood in the abdomen.<sup>10</sup> The accuracy of the CT is said to be very high with 92-97.6% sensitivity and 98.7% specificity.<sup>11</sup>

This study was undertaken to compare the efficacy of CT scans and ultrasound in the patients with blunt abdominal trauma.

**METHODS**

This prospective study was conducted by the department of Radiology at Mediciti Institute of Medical sciences over a period of 2 years.

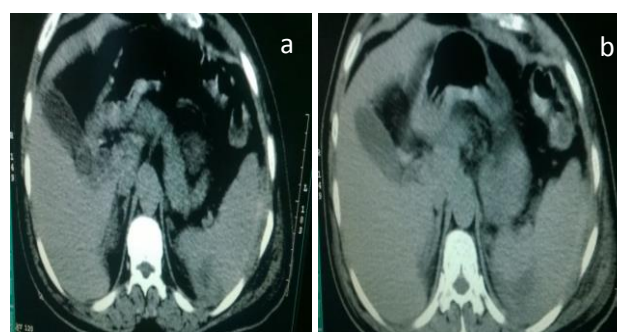
Patients who had come to our hospital with blunt abdominal trauma and who were stable enough to undergo both USG and CT scans were included into the study if any one of the scans had come positive. Informed consent was taken for all the patients. Most of the time, USG was done first followed by CT scan with a time gap so as to include in the study. All the patients for whom both the scans had come negative and those who could not withstand both the tests or who were discharged within a short period after being under observation were excluded from the study.

Detailed demographic data was collected from all the patients either directly or from the relatives. After a thorough physical and clinical examination, blood was sent to the central laboratory for routine examinations such as random blood sugar, complete blood picture, haemoglobin levels, total and direct count, blood grouping, total blood urea and creatinine levels. Urine was sent doe routine and microscopic evaluation. Chest and abdominal X-rays were also taken for all the patients. Ultrasound and CT scans were done for all the patients to

compare the outcomes, even if the USG readings were abnormal.

Ultrasound was performed giving attention for the detection of free fluid in the abdomen and pelvis apart from the assessment of the individual organs. In the gall bladder and the urinary bladder, distension and the intraluminal echoes were looked for.

The stomach was decompressed with a nasogastric tube to prevent the air fluid artifact and consequently withdrawn. Any other leads which may interfere with the scan are removed. Contrasts were given orally and intravenously to the patients. CT sections were performed at 30 seconds for arterial and for 60-90 seconds for venous phases. In case of suspected renal trauma, delayed scanning was done (Figure 1a and b).



**Figure 1: CT section of spleen in BAT patient.**

The patients with hemoperitoneum or abdominal visceral injury or both were considered as positive. When they had neither, it was considered as negative.

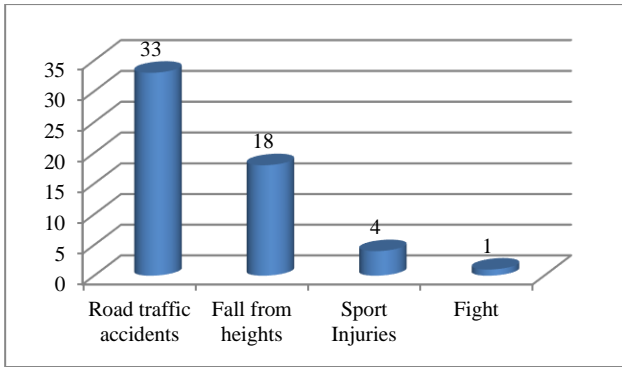
**RESULTS**

Out of the 56 patients, 44 were males and 12 were females with the male to female ratio being 3.67:1. The Most common age group affected was 18-40 years. This was probably due to the fact that it is this age group that usually is involved in speeding leading to accidents (Table 1).

**Table 1: Age wise distribution of patients.**

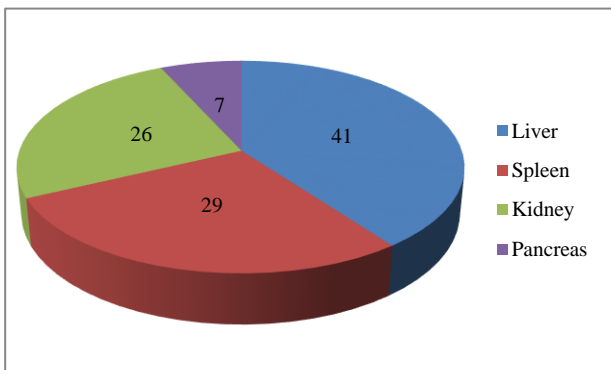
Age group	Males	Females	Total
4-17	3	0	3
18-25	17	2	19
25-40	15	3	18
>40	9	7	16

The most common cause of trauma was road or vehicular accidents (58.9%) followed by fall from heights (32.1%). Other causes of injury were due to some sporting accidents (7.1%) or in 1 case (0.18%), due to physical violence. Among the fall from heights, many were women, probably due to domestic violence (Figure 2).



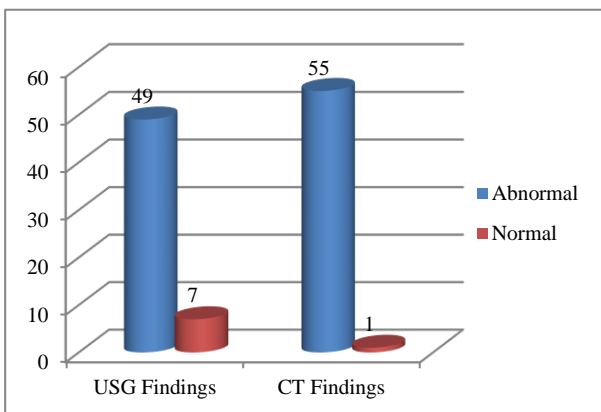
**Figure 2: Causes of trauma.**

The most common organ which was found to be affected was liver (73.2%), followed by spleen (51.8%). 46.4% of kidneys and 12.5% of the pancreas were also affected (Figure 3).



**Figure 3: Organs affected.**

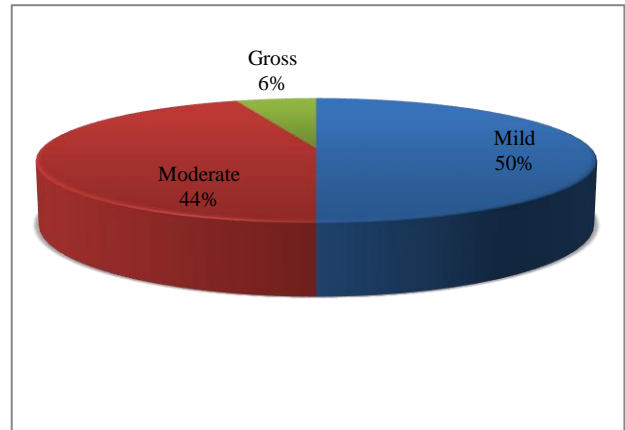
Out of the 56 patients with blunt abdominal trauma, 49 patients (87.5%) were detected by ultrasound and 7 (12.5%) were missed. However, only 1 case (1.8%) was missed by CT scan, thereby having a sensitivity of 98.2% (Figure 4).



**Figure 4: Comparison of USG and CT values.**

Hemoperitoneum was identified in all the 56 patients with CT scan while the same was identified only in 47 cases (83.9%) with USG.

The quantification of the hemoperitoneum was done by CT in accordance to Salomone et al. The hemoperitoneum was divided into 3 categories depending on the location and the amount of fluid identified. If the fluid was seen only in one space, it was categorized as mild, with the quantity of the fluid being 100-200ml. If there was fluid in two or more spaces and on the pelvis, with the quantity being 250-500ml, it was classified as moderate and if there was fluid in all the spaces pelvic fluid superior or anterior to the urinary bladder, with fluid quantity exceeding 500ml, it was classified as gross (Figure 5).



**Figure 5: CT quantification of hemoperitoneum.**

**DISCUSSION**

One of the commonest causes of health problem and death is trauma. Abdomen has been reported to be the third most common region of injury after head and extremities. 25% of these individuals require surgical intervention to save life. Blunt abdominal trauma is difficult to diagnose due to the absence of clinical signs as opposed to the penetrating trauma, which can be seen and easily diagnosed.<sup>11</sup>

The main reason for imaging and screening the patients is to identify the life-threatening injuries as soon as possible so that appropriate treatment can be given immediately. In the past few years, both USG and CT have been widely used to detect the abdominal trauma and have replaced the older methods.

The advantage of USG was that it can be performed immediately at the patients bedside and is highly sensitive to the free peritoneal fluid.<sup>12-14</sup> However, for the parenchymal lesions, USG is not very sensitive as hemoperitoneum is not always present with patients with solid organ injuries. Thus, for exclusion of the abdominal injuries, USG is not a reliable method<sup>15-18</sup>. Taylor et al, in a large cohort study, emphasized the limited importance of peritoneal fluid as a predictor for the need of laparotomy as 37% of the patients with blunt abdominal trauma showed an absence of peritoneal fluid with similar results found by Emery et al.<sup>19,20</sup>

In the present study, the age group which was mostly affected was between 18-40 years. This is probably because this age group normally leads an active life outdoors. People around 50 years have a lesser active life outdoors. However, this age was not a significant aspect for occurrence of abdominal trauma. Neither was the gender. Males are normally active outdoors, and susceptible to accidents compared to the women.

In present study, 49 out of 56 cases of abdominal trauma was detected with USG and 7 cases were missed out, 6 of which were detected by CT scan. The lower sensitivity of USG could be due to the overlying bowel shadow, surgical emphysema, empty bladder. Lack of skilled personnel may also contribute to the lower efficacy of USG.<sup>21</sup> This was in accordance to a similar study by Vadodariya et al wherein CT scan was more sensitive than USG.<sup>21</sup> Mallik et al also reported CT scanning to be superior to Ultrasound.<sup>22</sup>

The most common organ to be affected during the blunt abdominal trauma in present study was the liver, followed by spleen, kidney and pancreas. Similar results were obtained in another study by Sato and Yoshii in 2004. The hemoperitoneum was identified in all the cases with CT scan, while only 47 cases were identified with USG in our study. In a study by Vadodariya et al, similar results were observed where the authors reported CT scan to be a better diagnostic tool for blunt abdominal trauma compared to USG.<sup>21</sup> In a study by Abu- Zidan et al, in New Zealand, lesions in 7 patients were missed by USG, which were identified by CT scan, proving CT to be better concurring present studies.<sup>23</sup>

Although USG and CT scan have replaced most of the older diagnostic procedures for the detection of blunt abdominal trauma, apart from many advantages, both of these procedures have their disadvantages.<sup>24</sup> USG does not detect pancreatic, bowel and mesenteric injuries or the ability to assess the kidneys and frequent interference by gaseous distension and associated bone or soft tissue injuries.<sup>25</sup> CT on the other hand, requires experienced personnel and can be performed only of the patient is hemodynamically stable.<sup>16</sup>

## CONCLUSION

CT scan is a superior diagnostic tool for the detection of Blunt abdominal trauma compared to USG. Although USG is also a very valuable tool, it can miss some of the crucial injuries which need immediate attention for the life of the patient. It is therefore recommended that if the patient is stable, all USG should be followed by CT scans.

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