

Research Article

Evaluation of ultrasound performance on abdominal trauma: A prospective study

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Abstract: Background: Abdominal trauma is a common reason for presentation to the emergency department (ED). Abdominal trauma is classified as either blunt or penetrating. Penetrating abdominal trauma is easily diagnosed, while blunt trauma complications can be missed if the clinical signs are not evident. Ultrasound in the evaluation of abdominal trauma has evolved over the past 30 years. This study aims to assess the role of focused sonography in early diagnosis of abdominal injuries following blunt abdominal trauma and follow up in patients with intra-abdominal injury for early diagnosis of complications. **Material and Methods:** This is a prospective and observational study conducted in the Department of Radiology at Dr. VRK Women's Medical College over a period of 6 months. Including all patients with age ≥ 18 years of either gender with a history of blunt trauma abdomen (BTA) presenting to the Emergency Department. Patients with overt/obvious signs of peritonitis were excluded. Abdominal ultrasonography was performed in the emergency department during initial evaluation and resuscitation. Ultrasonography was performed by sonographers who were trained in trauma ultrasonography and were registered diagnostic medical sonographers. The sonographers used either an Acuson XP 10-128 or Acoustic Imaging 5200S ultrasound with 3.5-MHz and 5.0-MHz probes. **Result:** In the present study, a total of 90 patients were included out of which 64 (71.1%) were males and 26 (28.8%) were females. In our study, most of the patients were 21-30 years i.e., 31 out of 90 (34.4%), followed by 31-40 years, i.e., 23 out of 90 (25.5%). In our study, 32.2% patients had sustained abdominal trauma due to RTA (vehicle to vehicle or vehicle to pedestrian). 26.6% had a history of fall from height, 22.2% patients had industrial accidents, 18.8% had a history Sport Injuries. Out of the 90 patients with abdominal injury, 30 patients had small bowel injury, 21 patients had liver injury, 16 patients had Pancreas injury, 11 patients had splenic injury, 7 patients had large bowel injury, 4 patients had mesenteric injury, 2 patients had renal injury. **Conclusion:** Ultrasonography is very useful in follow up of patients with intra-abdominal injury and decreases use of CT which has the disadvantages of being expensive, high dose radiation and also due to restricted use of modern amenities such as CT-scan in tertiary care in India. Repeated ultrasonography in patients of blunt abdominal trauma and close clinical observation increases the sensitivity of ultrasonography for intra-abdominal bleeding to nearly 100%.

Keywords: Ultrasonography, Abdominal trauma, Blunt trauma.

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INTRODUCTION

Trauma is one of the common causes of death, and is a major economic and health problem. The abdomen is the third most common injured region, in 25% of cases who require surgical interference [1]. Abdominal trauma is classified as either blunt or penetrating. Penetrating abdominal trauma is easily diagnosed, while blunt trauma complications can be missed if the clinical signs are not evident [2].

Abdominal trauma is a common reason for presentation to the emergency department (ED).

Unfortunately, patient history and physical examination often lack the necessary sensitivity and specificity to diagnose acute traumatic pathology accurately [3]. Diagnostic peritoneal lavage (DPL) was historically used to determine which patients needed exploratory laparotomy, but DPL is difficult to perform in pregnant patients, cannot be used for serial assessment, and is overly sensitive, which leads to a high negative laparotomy rate [4].

Ultrasound in the evaluation of abdominal trauma has evolved over the past 30 years. Ultrasound technology was improving with regard to price, portability, and resolution, allowing its use during

resuscitation [5]. At the same time, there was continuing reliance on diagnostic peritoneal lavage (DPL) and CT and much less interest in sonography for abdominal trauma [6]. This all changed when emergency physicians and surgeons in the United States began to publish their experience with ultrasound [7]. The term Focused Assessment with Sonography for Trauma (FAST) was coined by Rozycki et al in 1996 and has persisted as the accepted acronym for the trauma ultrasound evaluation [8]. The basic four-view examination (perihepatic, perisplenic, pelvic, and pericardial views) has become the foundation of the FAST examination. The rapid, noninvasive, and practical nature of ultrasound for bedside evaluation of critically injured patients has changed the evaluation of blunt abdominal trauma [9].

Clinical examination and focused abdominal ultrasonography comprise the standard initial abdominal evaluation in post trauma patients. Clinical observation following BAT is a common procedure in all hospitals; however, the required period for observation remains controversial, some suggested that 24 h is sufficient, while others reported minimum of an 8-h observation as a sufficient time to identify injuries among hemodynamically stable patients [10].

This study aims to assess the role of focused sonography in early diagnosis of abdominal injuries following blunt abdominal trauma and follow up in patients with intra-abdominal injury for early diagnosis of complications.

MATERIAL AND METHODS

This is a prospective and observational study conducted in the Department of Radiology at Dr. VRK Women's Medical College over a period of 6 months.

Inclusion criteria

Including all patients with age ≥ 18 years of either gender with a history of blunt trauma abdomen (BTA) presenting to the Emergency Department.

Exclusion criteria

Patients with overt/obvious signs of peritonitis were excluded.

Demographic and historical data, physical examination, and surgical and radiographic findings

were abstracted and recorded into a central database in a structured pattern. Abstractors determined the abdominal ultrasonography results before determination of the presence or absence of intra-abdominal injury and laparotomy results. Discrepancies between the 2 abstractors were reviewed for a third time and resolved on the basis of this third review.

Abdominal ultrasonography was performed in the emergency department during initial evaluation and resuscitation. Ultrasonography was performed by sonographers who were trained in trauma ultrasonography and were registered diagnostic medical sonographers. The sonographers used either an Acuson XP 10-128 or Acoustic Imaging 5200S ultrasound with 3.5-MHz and 5.0-MHz probes.

The trauma abdominal ultrasonography protocol at the study site included views of the right upper quadrant (Morison's pouch), left upper quadrant (splenorenal fossa), bilateral paracolic gutters, and the pelvis. The protocol did not include dedicated imaging of the abdominal organs. Initial abdominal ultrasonography interpretations as determined by the sonographers and the bedside clinicians were used for study purposes. Ultrasonographic examinations were considered positive if intraperitoneal fluid was identified in any location.

Examinations considered probable for intraperitoneal fluid were also considered positive for study purposes. The location of intraperitoneal fluid was identified, but no attempt was made to grade the amount of intraperitoneal fluid in positive cases. Ultrasonographic examinations were considered negative if intraperitoneal fluid was not identified. Examinations documented as "questionable" or "possible" for intraperitoneal fluid, or listed as "equivocal" were considered negative.

Result

In the present study, a total of 90 patients were included out of which 64 (71.1%) were males and 26 (28.8%) were females (table-1). In our study, most of the patients were 21-30 years i.e., 31 out of 90 (34.4%), followed by 31-40 years, i.e., 23 out of 90 (25.5%) in table 2.

Table 1: Distribution of Gender

Sex	No. of patients	Percentage
Male	64	71.1
Female	26	28.8
Total	90	100

Table 2: Distribution of the number of patients according to age group

Age group	No. of patients	Percentage
18-20 years	16	7.7
21-30 years	31	34.4
31-40 years	23	25.5
41-50 years	11	12.2
51-60 years	9	10
Total	90	100

Table 3: Distribution of Cause of trauma of patients

Trauma	No. of patients	Percentage
Road traffic accidents	29	32.2
Fall from heights	24	26.6
Industrial accidents	20	22.2
Sport Injuries	17	18.8

In our study, maximum patients, i.e., 48.5% (n = 34) were having Apgar score of 4-6 followed by ≤ 3 score were 32.8% and least were > 7 score were 18.5% in table 3.

Table 4: Distribution of MRI changes in study population with stage2 HIE

Type of injuries	No. of patients	Percentage
Small bowel injury	27	30.0
Liver injury	21	23.3
Pancreas injury	16	17.7
Splenic injury	11	12.2
Large bowel injury	7	7.7
Mesenteric injury	4	4.4
Kidney injury	4	4.4
Total	90	100

Out of the 90 patients with abdominal injury, 30 patients had small bowel injury, 21 patients had liver injury, 16 patients had Pancreas injury, 11 patients had splenic injury, 7 patients had large bowel injury, 4 patients had mesenteric injury, 2 patients had renal injury in table 4.

DISCUSSION

Assessment of the abdomen for possible intra-abdominal injury due to trauma is a common clinical challenge for surgeons and emergency medicine physicians. The true problem with torso trauma is not to determine the presence of an organ lesion, but to identify clinically significant intra-abdominal injuries [11]. Physical findings may be unreliable because of altered patient consciousness, neurological deficit associated with head injury or spinal injury, medication, or other associated injuries [12].

The advantage of USG was that it can be performed immediately at the patients bedside and is highly sensitive to the free peritoneal fluid [13]. In the present study, the age group was consistent, with a higher prevalence of trauma among male individuals. In our study, most of the patients were 21-30 years i.e., 31 out of 90 (34.4%), followed by 31-40 years, i.e., 23 out of 90 (25.5%). In a study done by Fleming et al., a total of 100 patients were included out of which 62% of the patients were male and the mean age of participants was 41 years which is comparable to our study [14]. In another study done by Farahmand et al., 60% of the patients were males and the mean age of participants was 45 years [15].

This higher number could be attributable to more number of males driving vehicles on the road or being the major part of workforce, making them more prone to injuries as compared to the female gender in both the situations. In our study, 32.2% patients had sustained abdominal trauma due to RTA (vehicle to vehicle or vehicle to pedestrian). 26.6% had a history of fall from height, 22.2% patients had industrial accidents, 18.8% had a history Sport Injuries. In a study done by Kornezos et al., 78% of the total cases were motor vehicle accidents, 17% sustained falls from a height, and 5% assault or other causes, which is comparable to our study [16].

The most common organ to be affected during the abdominal trauma in present study was the small bowel injury followed by liver, pancreas, spleen, large bowel injury, mesenteric injury and kidney. Similar results were obtained in another study by Sato and Yoshii in 2004 [17]. In a study by Vadodariya et al, similar results were observed where the authors reported USG scan to be a better diagnostic tool for abdominal trauma [18]. In a study by Abu- Zidan et al, in New Zealand, lesions in 7 patients were missed by USG [19].

Patients with small splenic or hepatic injuries who were hemodynamically stable do not need further

investigations and are treated conservatively. Patients with major splenic or hepatic injuries and who are hemodynamically stable could perform CT abdomen for accurate characterization of their injuries. Jalli et al, suggested that CT scan is the modality of choice in hemodynamically stable patients who have major suspicions for renal injuries [20]. In cases of renal trauma, the exact extent of injury should be assessed for accurate therapy choice. Tears that expand into or through the pelvi-calyceal system (grade IV and higher) and ureteric injuries are not very obvious on sonography if there is no significant urinary leakage. Delayed contrast-enhanced CT performed 10 min after contrast injection can easily show extravasation from the pelvi-calyceal system or the ureters and, thus, delineate the location and extent of damage [21].

In our study, 2 cases of renal injury were reported, those cases were hemodynamically stable, one of them had subcapsular hematoma while the other had perinephric hematoma and renal laceration; however, ultrasonography could not detect the exact extension of the injury and could not exclude injury of collecting system, CECT was performed during follow-up period, and the case of subcapsular hematoma was treated conservatively. In a study done by Sato and Yoshii, they reported that ultrasonography was found to detect and classify parenchymal injuries efficiently, when done by experienced examiners despite disadvantages in detecting superficial and vascular injuries [17].

CONCLUSION

Abdominal Trauma is one of the important causes of morbidity and mortality in relatively young individuals. Most common mode of injury is road traffic accidents. Early diagnosis of the extent of injury by appropriate imaging (X-ray, Ultrasound or CT abdomen) and appropriate interventions, aggressive fluid resuscitation, blood transfusion, and operative interventions are crucial in management. Associated injuries like head injury, abdomino-thoracic injuries and fractures influence the outcome. Hemodynamically stable patients with suspected blunt injury abdomen should undergo routine CT scanning preferably contrast enhanced because of its high sensitivity and specificity.

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