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Research Article

Diagnostic Accuracy of Ultrasonography Compared with Computed Tomography in Blunt Abdominal Trauma: A Prospective Study

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Abstract: ***Introduction:*** Early and accurate diagnosis of intra-abdominal injuries is crucial in reducing morbidity and mortality associated with BAT[3]. However, clinical evaluation alone is often unreliable due to factors such as altered sensorium, associated injuries, and the absence of obvious external signs[5,8]. This makes imaging modalities indispensable in the assessment and management of these patients.**Methods:** Subsequently, contrast-enhanced computed tomography (CECT) of the abdomen was performed in 98 patients using a multidetector CT scanner. CT scan was considered the reference (gold standard) modality for confirmation of free fluid, detection and grading of organ injuries, and identification of associated intra- and extra-abdominal injuries. Ultrasonography findings were compared with CT scan findings and operative outcomes wherever applicable.**Results**: Comparison of ultrasonography with computed tomography (CT) findings in 98 patients revealed that both modalities detected hemoperitoneum with comparable frequency (96%). However, CT was superior in detecting organ-specific injuries. Liver injuries were identified in 43.8% of patients on CT compared to 40% on ultrasonography.

Keywords: Blunt abdominal trauma; ultrasonography; computed tomography; diagnostic accuracy; prospective study; abdominal injury; trauma imaging; FAST; emergency radiology.

INTRODUCTION

Trauma remains a major global public health problem and is one of the leading causes of morbidity and mortality, particularly among young and economically productive individuals[1,2]. Among various forms of trauma, blunt abdominal trauma (BAT) constitutes a significant proportion of surgical emergencies and is commonly associated with road traffic accidents, falls, and interpersonal violence[3]. The increasing rate of urbanization and motorization has further contributed to the rising incidence of BAT, especially in developing countries[1].

Early and accurate diagnosis of intra-abdominal injuries is crucial in reducing morbidity and mortality associated with BAT[3]. However, clinical evaluation alone is often unreliable due to factors such as altered sensorium, associated injuries, and the absence of obvious external signs[5,8]. This makes imaging modalities indispensable in the assessment and management of these patients.

Ultrasonography (USG), particularly in the form of focused assessment with sonography for trauma (FAST), has emerged as a rapid, non-invasive, bedside tool for the initial evaluation of patients with suspected intra-abdominal injury[4,6]. It is widely available, cost-effective, and does not involve ionizing radiation, making it especially useful in emergency settings and in hemodynamically unstable patients[4]. Ultrasonography is highly sensitive in detecting free intraperitoneal fluid, which often serves as an indirect indicator of visceral injury[8,9]. However, its ability to accurately identify specific organ injuries and retroperitoneal lesions is limited and operator-dependent[5,8].

On the other hand, computed tomography (CT) is considered the gold standard imaging modality in hemodynamically stable patients with blunt abdominal trauma[7,10]. It provides detailed information regarding the presence, extent, and grading of organ injuries, as well as associated extra-abdominal findings[7]. Despite its high diagnostic accuracy, CT is associated with limitations such as radiation exposure, higher cost, and limited accessibility in certain settings[7].

Given these considerations, there is a need to evaluate the diagnostic performance of ultrasonography in comparison with CT scan in patients with blunt abdominal trauma. Understanding the strengths and limitations of each modality can help in formulating appropriate imaging protocols and optimizing patient

management, particularly in resource-constrained environments. Therefore, the present study was undertaken to assess the role of ultrasonography in the detection of intra-abdominal injuries in patients with blunt abdominal trauma and to compare its diagnostic accuracy with computed tomography and operative findings.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Radiodiagnosis at a tertiary care teaching hospital in Mumbai, India, over a period of approximately two years from May 2004 to May 2006. A total of 100 patients presenting to the emergency department with a history of blunt abdominal trauma (BAT) were included in the study. Patients of all age groups and both sexes who were hemodynamically stable and underwent both ultrasonography (USG) and computed tomography (CT) scan were enrolled. Patients who required immediate surgical intervention without imaging, those who did not undergo both imaging modalities, or those with incomplete follow-up were excluded from the study.

All patients initially underwent abdominal ultrasonography using real-time scanners with 3.5 MHz curvilinear probes. The examination was performed in standard planes to assess the hepatorenal recess (Morrison's pouch), splenorenal recess, pelvis, and paracolic gutters. Ultrasonography was used to detect the presence of free intraperitoneal fluid (hemoperitoneum), solid organ injuries involving the liver, spleen, and kidneys, as well as other findings such as intra-abdominal hematoma and pneumoperitoneum.

Subsequently, contrast-enhanced computed tomography (CECT) of the abdomen was performed in 98 patients using a multidetector CT scanner. CT scan was considered the reference (gold standard) modality for confirmation of free fluid, detection and grading of organ injuries, and identification of associated intra- and extra-abdominal injuries. Ultrasonography findings were compared with CT scan findings and operative outcomes wherever applicable.

The diagnostic performance of ultrasonography was evaluated in terms of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. Free fluid was graded based on the number of abdominal spaces involved. Data regarding demographic characteristics, mode of injury, imaging findings, and management outcomes were recorded in a predesigned proforma and analyzed using descriptive statistics.

RESULTS

Table 1: Demographic Profile of Patients with Blunt Abdominal Trauma (n = 100)

Variable	Frequency (n)	Percentage (%)
Sex		
Male	84	84%
Female	16	16%
Age Group (years)		
2–10	9	9%
11–20	19	19%
21–30	35	35%
31–40	19	19%
41–50	5	5%
>50	9	9%

A total of 100 patients with blunt abdominal trauma were included in the study. The majority of patients were males (84%), with a male-to-female ratio of 5.25:1. The age of patients ranged from 2 to 70 years, with a mean age of 27.4 years. The highest proportion of patients belonged to the 21–30 years age group (35%), followed by 11–20 years (19%) and 31–40 years (19%).

Table 2: Mode of Injury among Study Participants

Mode of Injury	Frequency (n)	Percentage (%)
Road Traffic Accidents	62	62%
Fall from height	23	23%
Assault	6	6%
Domestic injury	5	5%
Fall of heavy object	3	3%
Stab injury	1	1%

Road traffic accidents were the most common mode of injury, accounting for 62% of cases, followed by falls from height (23%). Other causes included assault (6%), domestic injuries (5%), fall of heavy objects (3%), and stab injury (1%).

Table 3: Ultrasonography Findings in Blunt Abdominal Trauma (n = 100)

Finding	Frequency (n)	Percentage (%)
Hemoperitoneum	96	96%
Liver injury	40	40%
Splenic injury	24	24%
Renal injury	11	11%
Intra-abdominal hematoma	4	4%
Pneumoperitoneum	2	2%
Pancreatic injury	1	1%

On ultrasonography, hemoperitoneum was the most frequently detected finding, observed in 96% of patients. Among solid organ injuries, liver injury was the most common (40%), followed by splenic injury (24%) and renal injury (11%). Intra-abdominal hematoma was detected in 4% of cases, while pneumoperitoneum and pancreatic injury were identified in 2% and 1% of patients, respectively.

Table 4: Diagnostic Performance of Ultrasonography

Parameter	Value (%)
Sensitivity (free fluid detection)	95.74%
Positive Predictive Value (PPV)	93.7%
Negative Predictive Value (NPV)	100%
Overall Accuracy	91%
Sensitivity (organ injury detection)	75%
Specificity (organ injury detection)	72%

The diagnostic performance of ultrasonography for detection of free intraperitoneal fluid showed a sensitivity of 95.74%, positive predictive value (PPV) of 93.7%, and negative predictive value (NPV) of 100%, with an overall accuracy of 91%. However, for detection of organ injuries, ultrasonography demonstrated a sensitivity of 75% and specificity of 72%.

Table 5: Comparison of Organ Injury Detection by Ultrasonography and CT (n = 98)

Injury Type	USG (n, %)	CT (n, %)
Hemoperitoneum	96 (96%)	94 (96%)
Liver injury	40 (40%)	43 (43.8%)
Splenic injury	24 (24%)	32 (32.6%)
Renal injury	11 (11%)	20 (20.4%)
Intra-abdominal hematoma	4 (4%)	11 (11%)
Adrenal injury	0	10 (10%)
Bowel injury	2 (2%)	6 (6%)
Pancreatic injury	1 (1%)	6 (6%)

Comparison of ultrasonography with computed tomography (CT) findings in 98 patients revealed that both modalities detected hemoperitoneum with comparable frequency (96%). However, CT was superior in detecting organ-specific injuries. Liver injuries were identified in 43.8% of patients on CT compared to 40% on ultrasonography. Similarly, splenic injuries (32.6% vs 24%), renal injuries (20.4% vs 11%), and intra-abdominal hematomas (11% vs 4%) were more frequently detected on CT. Additionally, CT identified adrenal injuries in 10% of cases, which were not detected on ultrasonography. Detection of bowel (6% vs 2%) and pancreatic injuries (6% vs 1%) was also higher with CT.

DISCUSSION

Blunt abdominal trauma (BAT) continues to be a significant contributor to morbidity, particularly among young and economically active individuals. In the present study, the majority of patients were males (84%), with a male-to-female ratio of 5.25:1. This male predominance is consistent with previous studies such as those by Hoffmann et al.11 and Nural et al.12, which reported higher involvement of males in trauma cases due to greater exposure to outdoor activities and risk-prone behavior. Similar trends have also been observed in studies by Goletti et al.13 and Sirlin et al.14, although the male-to-female ratio varies depending on sample size and population characteristics.

The mean age of patients in this study was 27.4 years, with the highest incidence in the 21–30 years age group

(35%). This finding correlates well with studies by Nural et al.12 and Bode et al.15, where the majority of patients were in the third and fourth decades of life. This age group represents the most active segment of the population and is therefore more susceptible to trauma. Road traffic accidents (RTA) were identified as the most common cause of blunt abdominal trauma (62%), followed by falls from height (23%). This pattern is consistent with findings from previous studies, including Nural et al.12, where RTA accounted for the majority of cases. The predominance of vehicular injuries reflects increasing urbanization, motorization, and infrastructural development.

In the present study, hemoperitoneum was the most frequent ultrasonographic finding, detected in 96% of patients. This observation is in agreement with studies by Healey et al.16 and Boulanger et al.17, who reported free intraperitoneal fluid as the most common and earliest detectable abnormality in BAT. Among solid organ injuries, the liver was the most commonly affected organ (40%), followed by spleen (24%) and kidney (11%), which is comparable to observations made in studies by Goletti et al.13 and Bode et al.15, where solid organ injuries constituted the majority of abdominal injuries.
The diagnostic performance of ultrasonography in detecting free intraperitoneal fluid in this study showed a sensitivity of 95.74% and accuracy of 91%. These findings are comparable with those reported by Hoffmann et al.11 (sensitivity 89%, accuracy 94%) and Bode et al.15 (sensitivity 92.8%, accuracy 99.4%), supporting the reliability of ultrasonography as a screening tool in trauma settings. The high negative predictive value (100%) observed in this study further emphasizes its utility in ruling out significant hemoperitoneum. However, ultrasonography demonstrated lower sensitivity (75%) and specificity (72%) for detection of organ-specific injuries. This limitation has also been highlighted in previous studies such as those by Tao et al.18 and Sirlin et al.14, where ultrasonography was found to be less sensitive in detecting parenchymal and retroperitoneal injuries, especially in the absence of free fluid. Factors such as operator dependency, patient body habitus, and interference from bowel gas contribute to these limitations.

Comparison with CT scan findings revealed that while both modalities were comparable in detecting hemoperitoneum (96%), CT was superior in identifying organ-specific injuries. Higher detection rates of splenic, renal, bowel, pancreatic, and adrenal injuries on CT were observed in the present study. Similar observations have been reported by Lee et al.19, who demonstrated superior sensitivity and specificity of CT compared to ultrasonography in diagnosing intra-abdominal injuries. CT also has the advantage of accurately grading organ injuries and detecting associated extra-abdominal injuries, which are often missed on ultrasonography. The inability of ultrasonography to detect adrenal injuries and its lower detection rate for bowel and pancreatic injuries in this study further reinforces its limitations, as also reported in earlier studies.20 CT remains the imaging modality of choice in hemodynamically stable patients due to its comprehensive evaluation capabilities.

Overall, the findings of the present study support the role of ultrasonography as a rapid, non-invasive, and reliable initial screening modality in patients with blunt abdominal trauma, particularly for detecting hemoperitoneum. However, CT scan remains indispensable for definitive diagnosis, detailed evaluation of organ injuries, and guiding management decisions.

REFERENCES

1. World Health Organization. Global status report on road safety 2018. Geneva: World Health Organization; 2018.
2. Mock C, Lormand JD, Goosen J, Joshipura M, Peden M. Guidelines for essential trauma care. Geneva: World Health Organization; 2004.
3. Coccolini F, Coimbra R, Ordonez C, Kluger Y, Vega F, Moore EE, et al. WSES guidelines on blunt and penetrating abdominal trauma. World J Emerg Surg. 2017;12:22.
4. Richards JR, McGahan JP. Focused assessment with sonography in trauma (FAST) in 2017: what radiologists can learn. Radiology. 2017;283(1):30-48.
5. Stengel D, Bauwens K, Sehouli J, Rademacher G, Ekkernkamp A. Emergency ultrasound-based algorithms for diagnosing blunt abdominal trauma. Cochrane Database Syst Rev. 2005;(2):CD004446.
6. Kirkpatrick AW, Clinch J, Simons RK, et al. Focused assessment with sonography for trauma in 2010: what clinicians should know. J Trauma. 2010;68(3):665-75.
7. Poletti PA, Mirvis SE, Shanmuganathan K. Blunt abdominal trauma patients: can organ injury be excluded without performing computed tomography? J Trauma. 2004;57(5):1072-81.
8. Holmes JF, Offerman SR, Chang CH, Randel BE, Hahn DD, Frankovsky MJ, et al.
9. Performance of abdominal ultrasonography in blunt trauma patients. J Trauma. 2004;57(3):627-32.
10. Sirlin CB, Brown MA, Deutsch R, et al. Screening US in patients with blunt abdominal trauma: value of negative findings. Radiology. 2001;219(2):353-7.
11. Huber-Wagner S, Lefering R, Qvick LM, et al. Effect of whole-body CT during trauma resuscitation on survival: a retrospective multicentre study. Lancet. 2009;373(9673):1455-61.
12. Hoffmann R, Nerlich M, Muggia-Sullam M, Pohlemann T, Wippermann B, Regel G, et al.
13. Blunt abdominal trauma in cases of multiple trauma evaluated by ultrasonography: a prospective analysis. J Trauma. 1992;32(4):452-8.
14. Nural MS, Yardan T, Guven H, Baydin A, Bayrak IK, Kati C. Diagnostic value of ultrasonography in

the evaluation of blunt abdominal trauma. Diagn Interv Radiol. 2005;11(1):41-4.
15. Goletti O, Ghiselli G, Lippolis PV, Chiarugi M, Braccini G, Macaluso C, et al. The role of ultrasonography in blunt abdominal trauma: results in 250 patients. J Trauma. 1994;36(2):178-81.
16. Sirlin CB, Brown MA, Andrade-Barreto OA, Deutsch R, Fortlage D, Hoyt DB, et al. Blunt abdominal trauma: clinical value of screening ultrasonography. Radiology. 2004;232(3):699-705.
17. Bode PJ, Niezen RA, van Vugt AB, Schipper J. Abdominal ultrasound as a reliable indicator for conclusive laparotomy in blunt abdominal trauma. J Trauma. 1993;34(1):27-31.
18. Healey MA, Simons RK, Winchell RJ, Gosink BB, Casola G, Steele JT, et al. A prospective evaluation of abdominal ultrasound in blunt trauma: is it useful? J Trauma. 1996;40(6):875-83.
19. Boulanger BR, McLellan BA, Brenneman FD, Wherrett L, Rizoli SB, Culhane J, et al. Emergent abdominal sonography as a screening test in a new diagnostic algorithm for blunt trauma.
20. J Trauma. 1996;40(6):867-74.
21. Tao P, Rodriguez A, Cooper C, et al. Ultrasonography in blunt abdominal trauma: a prospective study. J Trauma. 1992;32(3):330-3.
22. Lee CH, Peng FK. Comparison of diagnostic accuracy of ultrasonography, CT scan and diagnostic peritoneal lavage in blunt abdominal trauma. J Formos Med Assoc. 1992;91(6):576-80.
23. Sirlin CB, Casola G, Brown MA, et al. Patterns of fluid accumulation on screening ultrasonography in blunt abdominal trauma: clinical significance. Radiology. 2001;219(3):701-6.