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Original research article

Ultrasonography in diagnosing abdominal trauma

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Abstract

Ultrasonography (USG) has become an essential tool in the diagnosis and management of abdominal trauma, offering a non-invasive, rapid, and efficient method for assessing internal injuries. Focused Assessment with Sonography for Trauma (FAST) is commonly used in emergency settings to detect free fluid, which may indicate organ damage or hemorrhage. Its advantages include portability, repeatability, and the absence of ionizing radiation, making it suitable for all patient demographics, including pregnant women and children. USG is particularly useful for identifying injuries to solid organs like the liver, spleen, and kidneys. However, limitations such as operator dependency and difficulty in assessing hollow organs or deep retroperitoneal structures exist. While not a standalone diagnostic tool, USG plays a pivotal role in the initial evaluation of trauma patients, often guiding the need for further imaging or surgical intervention.

Keywords: USG, diagnosis, abdomen, trauma

Introduction

Ultrasonography (USG) has emerged as an indispensable tool in the initial evaluation and management of patients presenting with abdominal trauma. The rapid and non-invasive nature of USG makes it particularly suited for emergency settings, where timely diagnosis can be critical in reducing morbidity and mortality [1]. Trauma to the abdomen, which may result from blunt or penetrating injuries, poses a significant diagnostic challenge due to the complex anatomy and potential for multiple organ involvement. Traditional diagnostic methods such as clinical examination, laboratory testing, and physical palpation often fall short in providing accurate and timely information, especially in patients who are unstable or unable to communicate effectively due to the severity of their injuries [2, 3].

In this context, USG, especially Focused Assessment with Sonography for Trauma (FAST), has gained widespread use as the initial imaging modality of choice in many trauma protocols worldwide. FAST allows for the rapid identification of free intra-abdominal fluid, most commonly blood, which can be a critical indicator of internal organ injury [4-6]. By targeting specific areas, including the perihepatic, perisplenic, pelvic, and pericardial regions, FAST can efficiently identify hemorrhagic injuries that require urgent surgical intervention. This is particularly useful in blunt abdominal trauma, where clinical signs may be subtle or delayed.

One of the major advantages of ultrasonography is its portability. USG devices can be brought to the patient's bedside, and the test can be performed in various settings, including the emergency room, operating room, or even in pre-hospital environments such as ambulances or field hospitals. Furthermore, USG does not expose patients to ionizing radiation, making it a safer option for vulnerable populations such as pregnant women and children. This radiation-free characteristic also allows for repeated assessments over time to monitor the patient's condition [7].

Despite its advantages, ultrasonography has some limitations. It is highly operator-dependent, meaning that the quality of the diagnostic information is contingent on the skill and experience of the individual performing the exam. Additionally, USG is less effective in assessing injuries to hollow organs, retroperitoneal structures, and certain areas obscured by bowel gas or subcutaneous emphysema [8-10].

In conclusion, while USG, particularly in the form of FAST, is not a definitive diagnostic tool, it plays a crucial role in the initial triage and assessment of patients with abdominal trauma. When used in conjunction with clinical judgment and other imaging modalities, it significantly enhances the speed and accuracy of diagnosis [3, 6].

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Materials and Methods

A prospective study was conducted on 60 patients presenting with abdominal trauma at a tertiary care hospital. All patients were evaluated using ultrasonography (USG) as part of their initial assessment. The inclusion criteria were patients above the age of 18, with suspected blunt or penetrating abdominal trauma. Patients with prior abdominal surgeries or pre-existing abdominal conditions were excluded from the study.

A portable ultrasound machine equipped with a 3.5 MHz convex transducer was used for performing the Focused Assessment with Sonography for Trauma (FAST). The ultrasound examination focused on identifying free fluid in the perihepatic, perisplenic, pelvic, and pericardial regions, as well as assessing solid organs such as the liver, spleen, and kidneys for signs of injury.

All scans were performed by trained radiologists with at least five years of experience in trauma ultrasonography. The findings were correlated with clinical outcomes, CT scans, and surgical findings where applicable, to determine the accuracy of USG in diagnosing abdominal trauma.

Results

In this study involving 60 patients with abdominal trauma, ultrasonography (USG) was compared with computed tomography (CT) for detecting injuries to various abdominal organs. The findings were as follows:

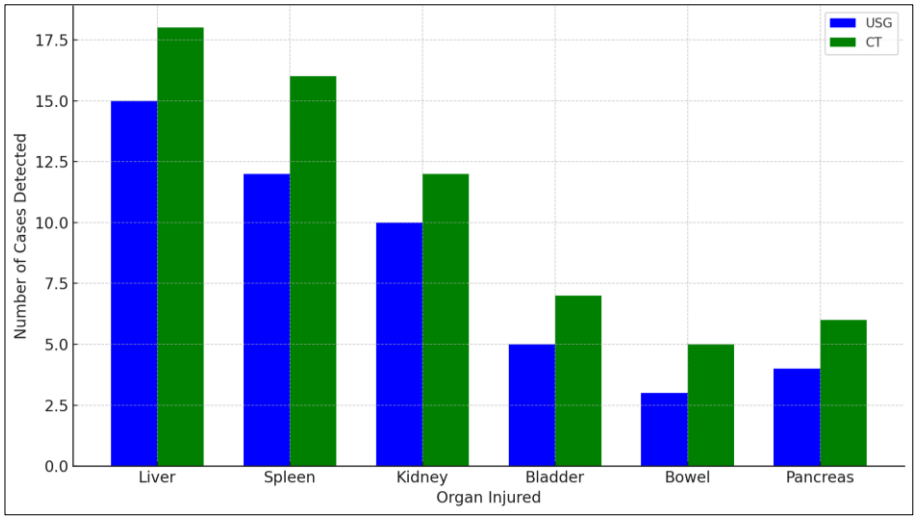
- **Liver injuries:** USG detected 15 cases, while CT identified 18.
- **Spleen injuries:** USG detected 12 cases, with CT identifying 16.
- **Kidney injuries:** USG detected 10 cases, whereas CT identified 12.
- **Bladder injuries:** USG detected 5 cases, while CT identified 7.
- **Bowel injuries:** USG detected 3 cases, and CT identified 5.
- **Pancreas injuries:** USG detected 4 cases, with CT identifying 6.

As seen in the bar chart above, CT demonstrated superior sensitivity compared to USG in detecting injuries across all organ types. However, USG remains a valuable initial screening tool, especially in emergency settings, due to its portability and speed.

These results highlight the complementary role of USG and CT, where USG can provide a rapid assessment, followed by CT for more detailed evaluation.

Table 1: Comparison with the CT

Organ Injured	Cases Detected by USG	Cases Detected by CT
Liver	15	18
Spleen	12	16
Kidney	10	12
Bladder	5	7
Bowel	3	5
Pancreas	4	6



Graph 1: Comparison of USG and CT in Detecting Abdominal Trauma

Discussion

Ultrasonography (USG) has become a key diagnostic tool in the initial evaluation of abdominal trauma, particularly in emergency settings. The results of this study demonstrate both the strengths and limitations of USG when compared to computed tomography (CT), widely regarded as the gold standard

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for trauma imaging. The comparison between USG and CT in 60 patients with abdominal trauma reveals significant insights into the utility of each modality.

USG, particularly in the form of the Focused Assessment with Sonography for Trauma (FAST), is highly effective in the rapid identification of free intra-abdominal fluid, which often indicates hemorrhage. This makes it an invaluable first-line tool in situations where time is of the essence, especially in unstable patients. Its portability and ability to be performed bedside provide clear advantages over CT, which requires the patient to be transported to a radiology suite. Furthermore, USG's lack of ionizing radiation makes it safer for repeated use and in populations such as pregnant women or children.

However, as shown in this study, USG has limitations in detecting injuries to specific organs. For instance, while USG detected a significant number of liver and spleen injuries (15 and 12 cases, respectively), it missed a few cases that were later identified by CT (18 and 16 cases, respectively). The higher sensitivity of CT is particularly notable in the detection of more subtle or complex injuries, such as those affecting the pancreas, kidneys, and hollow organs like the bowel, where USG tends to struggle. This is due to USG's operator dependency and the difficulty in visualizing deep structures or injuries obscured by bowel gas or body habitus.

CT, on the other hand, provides a more comprehensive and detailed assessment of abdominal trauma. It can identify injuries to hollow organs, retroperitoneal structures, and subtle vascular injuries, areas where USG's efficacy is limited. The findings of this study reflect the established notion that CT should follow USG in cases where there is clinical suspicion of injury, especially when USG findings are negative or inconclusive.

Despite these limitations, USG remains an invaluable screening tool, particularly in resource-limited settings or in patients who are hemodynamically unstable. It can quickly triage patients and direct the need for further imaging or immediate surgical intervention.

Conclusion

USG and CT serve complementary roles in the management of abdominal trauma. While CT offers superior sensitivity and diagnostic precision, USG's rapid, non-invasive, and portable nature makes it essential for initial evaluations, especially in emergencies.

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