The Diagnostic Value of Ultrasonography in Patients with Blunt Abdominal Trauma

Künt Batın Travmalı Hastalarda Ultrasonografinin Tanısal Değeri

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Abstract

Objective: To evaluate the diagnostic value of ultrasonography (US) in detecting intraabdominal injuries in patients presenting with blunt abdominal trauma.
Materials and Methods: All patients admitted to the emergency department with blunt abdominal trauma in 2009 were retrospectively evaluated. Records of clinical examinations, US reports and computed tomography (CT) findings were evaluated. Sensitivity, specificity, positive and negative predictive values for detecting abdominal free fluid and/or intraabdominal solid organ injury with US were determined.
Results: A total of 110 patients with blunt abdominal trauma who underwent both US and CT were included in the study. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of US in detecting abdominal free fluid were 100%, 85.4%, 50%, 100% and 87.3%, respectively. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of US in detecting intraabdominal solid organ injury were 15.6%, 0.00%, 41.2%, 0.00% and 12.7%, respectively.
Conclusion: When screening patients with blunt abdominal trauma, US has a high diagnostic performance after clinical evaluation, particularly for determining abdominal free fluid. However, it is not sufficiently successful in detecting intraabdominal solid organ injury. *(JAEM 2011; 10: 5-7)*
Key words: Blunt trauma, abdominal free fluid, solid organ injury, ultrasonography, computed tomography

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Özet

Amaç: Kün batın travmasıyla başvuran hastalarda intraabdominal yaralanmaları tesbit etmede ultrasonografinin tanısal değerini değerlendirmek.
Gereç ve Yöntemler: Acil servise künt batın travmasıyla 2009 yılında başvuran tüm hastalar retrospektif olarak değerlendirildi. Klinik muayene kayıtları, ultrasonografi raporları ve bilgisayarlı tomografi bulguları incelendi. Ultrasonografi ile intraabdominal serbest sıvı ve/veya solid organ yaralanmasını tanımada sensitivite, spesifite, pozitif ve negatif prediktif değerler belirlendi.
Bulgular: Çalışmaya hem ultrasonografi hem de bilgisayarlı tomografi yapılmış olan künt batın travmalı toplam 110 hasta alındı. İntraabdominal serbest sıvıyı tesbit etmede ultrasonografinin sensitivite, spesifite, pozitif prediktif değer, negatif prediktif değer ve doğruluğu sırasıyla; %100, %85.4, %50, %100 ve %87.3 olarak bulundu. İntraabdominal solid organ yaralanmasını tesbit etmede ultrasonografinin sensitivite, spesifite, positif prediktif değer, negatif prediktif değer ve doğruluğu sırasıyla; %15.6, %0.00, %41.2, %0.00 ve %12.7 olarak bulundu.
Sonuç: Künt batın travmalı hastalar incelendiğinde ultrasonografinin özellikle intraabdominal serbest sıvıyı tesbit etmede yüksek tanısal performansa sahip olduğu görülmüştür. Oysaki intraabdominal solid organ yaralanmasını tesbit etmede yeterince başarılı değildir. *(JAEM 2011; 10: 5-7)*
Anahtar kelimeler: Künt travma, serbest sıvı, solid organ yaralanması, ultrasonografi, bilgisayarlı tomografi

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Introduction

Trauma patients are one of the major groups of patients presenting to the emergency department and they require immediate evaluation for complications that may present an immediate threat to life. Physical examination alone is not adequate for evaluating the extent of abdominal injuries, especially in cases of severe trauma, and a reliable, easy to perform diagnostic tool is required. Computed tomography (CT), commonly regarded as the gold standard imaging tool, has the advantage of detecting minor injuries, but it involves ionizing radiation and intravenous contrast administration may be required at times, also the patient has to be transported to a less monitorised radiology unit (1).

On the other hand, ultrasonography (US) is an easy to perform study, can easily be repeated and is without complications. Emergency abdominal US is commonly utilised in the initial evaluation of patients with trauma (2-4). US may be regarded as a safer diagnostic tool. It uses sound waves. It can rapidly be performed at

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the bedside, even without interrupting resuscitation (1, 5). In the trauma victim, US is commonly confined to detection of abdominal free fluid (an indirect sign of organ injury), intraabdominal parenchymal contusion, hematoma and laceration (direct signs of injury). Patients positive for these findings are evaluated for immediate laparotomy (6, 7).

US is commonly reported to be accurate for major injuries but has limitations for detecting minor injuries. Hence, it is commonly regarded as an effective tool for screening patients. However, since major traumatic injuries needs prompt evaluation with CT, US is suggested as an initial diagnostic tool during resuscitation of major trauma victims in the emergency department and to screen minor/stable trauma patients for major injuries. CT could then be performed on better stabilised patients when screening US findings are positive but an emergency laparotomy is not mandatory; and when, despite negative US, lesions are suspected based on clinical predictors (2).

We aimed to evaluate the diagnostic accuracy of US as the initial screening tool for patients with blunt abdominal trauma presenting at our center.

Materials and Methods

We retrospectively analysed all patients admitted to the emergency department of our hospital with blunt abdominal trauma who underwent abdominal US (Siemens Sonoline G40) and abdominal CT (Siemens CT Somatom) during the initial trauma assessment between January 2009 and December 2009. The same 2-5 MHz probe was used in all cases and US was performed by a radiologist.

Victims of motor vehicle accidents and victims of falls from heights were included in the study. Patient age, sex and trauma types were recorded. Records of clinical examinations, US reports and CT findings were evaluated and findings of intraabdominal free fluid and intraabdominal solid organ injury were recorded. The patients who were not screened with both US and CT were excluded. Additionally, pediatric trauma patients were not included in this study since our emergency department does not have pediatrics and pediatrics surgery clinics. Therefore, pediatric multiple trauma patients are transferred.

Statistics

Sensitivity, specificity, positive predictive values and negative predictive values for detecting abdominal free fluid and /or intraabdominal solid organ injury were calculated to assess the value of CT and US in blunt abdominal trauma.

Results

A total of 110 patients were included in the study. Mean age of the patients was 40.19±15.64 years and 71.8% of the patients were male. Causes of trauma were as follows: motor vehicle accidents (inside vehicle), motor vehicle accidents (hit by a vehicle) and fall from a height (65.5%, 27.3% and 6.4% of the patients, respectively). The mean length of stay in the emergency department was 9.08±8.28 h.

All patients with blunt abdominal trauma who underwent both US and CT were included in the study. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of US in detecting abdominal free fluid were 100%, 85.4%, 50%, 100% and 87.3%, respectively. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of US in detecting intraabdominal injury were 15.6%, 0.00%, 41.2%, 0.00% and 12.7%, respectively.

Discussion

In this study, it was shown that US has high sensitivity, specificity, negative predictive value and accuracy in detecting abdominal free fluid. On the other hand it is unsufficient in detecting intraabdominal solid organ injury. These results are compatible with literature (1, 8).

In today's world, it is an important political and economic issue that the management of the trauma patient is one of the major problems (9).

In the primary evaluation of trauma patients in emergency department, applying US is a common practice (5, 10).

The sensitivity and specificity of US in detecting intraabdominal fluid are 97-100% and 80-90%, respectively. To reach optimal results, adequate education and technical skills are very important. Clinical experiences prove that standardized US must be part of polytrauma management and should be added to advanced trauma life support courses. However, ultrasound does not replace CT for analyzing highly complicated clinical conditions in multiple injured patients. Unexpected diagnoses are found by CT scans in the majority of patients. In haemodynamically stable patients, the diagnostic modality of choice is CT with intravenous contrast (11-13).

CT is the gold standard technique in the assessment of trauma patients because it is panoramic and highly sensitive compared with US 81, 8). According to previous studies, when it is available, it can be performed easily, is repeatable in short intervals, nonirradiating, inexpensive, noninvasive and able to provide rapid information, while US has low sensitivity in detection of solid organ injuries and overlooks significant damage (1, 9, 11, 14).

When compared to CT, US has limitations, depending on operator skill and technique. Also morbid obesity or extensive subcutaneous gas limits visual quality. By adequate training of the sonographer and applying appropriate trauma ultrasound protocol, the success of US can be enhanced (10). However, CT is recommended as the initial investigation of choice in hemodynamically stable patients with blunt abdominal trauma (15) since it is very useful in predicting the grade of injury in order to select the appropriate management of trauma patients.

If USG and CT are applied properly, many patients with solid organ injuries due to blunt trauma can be managed nonoperatively. Thus, unnecessary laparotomies can be prevented (16).

In addition, in patients with contraindications to CT contrast agents (e.g. due to renal failure or severe allergy), radiation exposure and in hemodynamically compromised patients, US is a favourable choice (12).

Based on the literature, it can be said that US is highly sensitive for the detection of free intraperitoneal fluid but not sensitive for the identification of organ injuries (17). Similarly, our study showed that USG is an accurate technique for evaluating detection of free fluid but has very limited capacity in determining solid abdominal organ injuries.

Conclusion

In conclusion, both US and CT are recommended in the management of trauma patients in the emergency department according to patient characteristics and the properties of these diagnostic modalities.

Limitations

The retrospective and single center design characters are limitations of the study.

Conflict of Interest

No conflict of interest is declared by the authors.

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