THE EMERGENCY ULTRASOUND IN POLYTRAUMA PATIENTS: PELVIC-ABDOMINAL AND CHEST BLUNT TRAUMA

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Abstract: *Despite advances in trauma care, significant morbidity and mortality exist, which could be reduced if all injuries are immediately identified. The hypovolemia and hypoxia are two treatable factors in abdomen and chest bleeding. The aim of this study is to clarify the role of ultrasonography in the identification of the intraabdominal injuries that require surgical treatment. 1454 patients were retrospectively examined by ultrasound in our hospital with suspicion of blunt abdominal injury between January 2002 and December 2013. Hemoperitoneum and abdominal visceral injury were positively detected with 88% sensitivity and 96,8% specificity. Ultrasound is a useful instrument for identification of intraperitoneal free air (IPFA) in blunt trauma and acute abdominal pain. Abdominal ultrasound can replace CT as the diagnostic modality of choice in initial survey of most patients with blunt abdominal trauma.*

INTRODUCTION

Advances in trauma care continue to improve outcomes in patients following injuries. Yet, despite even the best efforts, major or multisystem trauma still carries significant morbidity and mortablity.(1) Unfortunately, the most rapid assessment tool, the clinical examination, can be very limited. It is said that a pneumo or haemothorax can be diagnosed with a thorough physical examination and in many situations this may be possible.(2) The detection of free peritoneal fluid or injury of abdominal solid viscera in blunt trauma remains a challenge for the clinician. In the management of multiply injured patients, the introduction of computed tomography (CT) resulted in a revolution in the management of multiply injured patients.

The CT is a sensitive and specific test in blunt abdominal and thorax trauma, but CT scan is contraindicated in hemodynamically unstable patients with blunt abdominal trauma (BAT) in need of urgent laparotomy.(3) The US examination offers several advantages as a diagnostic method, with high sensitivity for detecting intraperitoneal fluid which accumulates in dependent areas in patients in the supine position, indicating a BAT.(4,5) The US cannot differentiate between blood, urine, bile or ascites, but the presence of the abdominal fluid in hemodynamically unstable patients indicates the need for urgent laparotomy without any further diagnostics.(6,7)

In polytrauma patients, hypoxia and hypovolemia have many possible causes; two common causes are hemorrhage into the chest and abdomen. Early identification and effective management of hemorrhage or pneumothorax improve survival and reduce morbidity.(8,9,10)

AIM

The aim of this study is to clarify the role of ultrasonography to identify the intraabdominal injuries that require surgical treatment.

MATERIALS AND METHODS

1454 patients were retrospectively examined by ultrasound in our hospital with suspicion of blunt abdominal injury between January 2002 and December 2013 with the aim to evaluate the ability of ultrasonography to detect the patients with intraabdominal injury who needed emergency surgery and to compare US results with intraoperative findings.

The examination provides a quick standardized overview of the intraperitoneal cavity (Morison's pouch, Coller's pouch (splenorenal fossa), pouch of Douglas).

The examination was labelled as positive in the case of free peritoneal fluid or obvious parenchimal injury of solid intraabdominal viscera, negative when the above signs were absent and unclear when equivocal signs or technical limitation (obesity, intestinal gas, subcutaneous emphysema) were present.

We compared all of the findings with the results of the physical examination and the patient's general condition.

After examination, the patients were managed with emergency laparotomy, further evaluation by computed tomography (CT) or diagnostic peritoneal lavage (DPL), or conservative treatment.

In presence of hemodynamic instability and a positive US, the treatment strategy was surgery. The patients with a negative US test and stable were followed up by observation.

If the patients remained hemodynamically stable in the following hours, without instability and without peritoneal irritation signs, the evaluation of the abdomen was considered complete. In cases with unstable hemodynamically status, whose instability could not be attributed to comorbidities outside the abdomen, and the US was unclear or negative, the method of choice was DPL.

RESULTS

Table no. 1 shows the results of abdominal US in 1454 patients.

In 239 cases (16,34%) the US was positive, with 223 patients hemodynamically stable. In these cases, the CT confirmed the US diagnosis. In 7 patients with DPL, 4 were positive and 3 negative. In 5 cases from 1454 (0,34%) a US scan

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was classified as indeterminate. In these cases 3 of them were classified as such because obesity and subcutaneous emphysema. The results of present study shows the ability of US to detect intrabdominal injury in blunt abdominal trauma (table no. 2).

Table no. 1. Abdominal US in 1462 patients

True positives	239
False positives	42
True negative	1146
False negative	34
Excluded	1
Total	1454

Table no. 2. The value of US (%)

Specificity	96
Sensibility	88
Positive diagnostic value	85
Negative diagnostic value	97

The use of US to find intraperitoneal free air shows the presence of FIPA (figures no. 1,2,3).

Figure no. 1. US image: A. Intraperitoneal free air on the surface of the liver

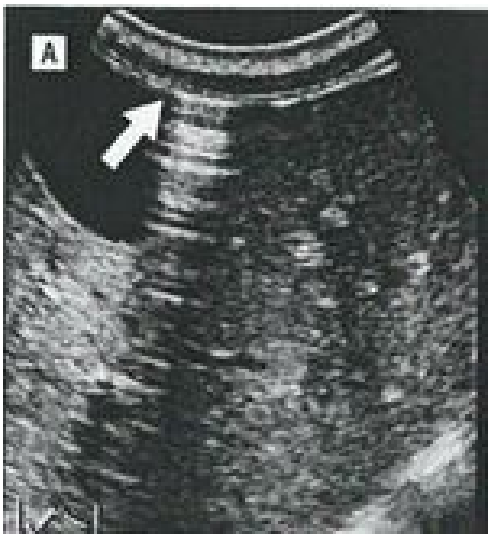


Figure no. 2. In cases with negative US findings because of small bubbles, the CT image is suggestive (CT)

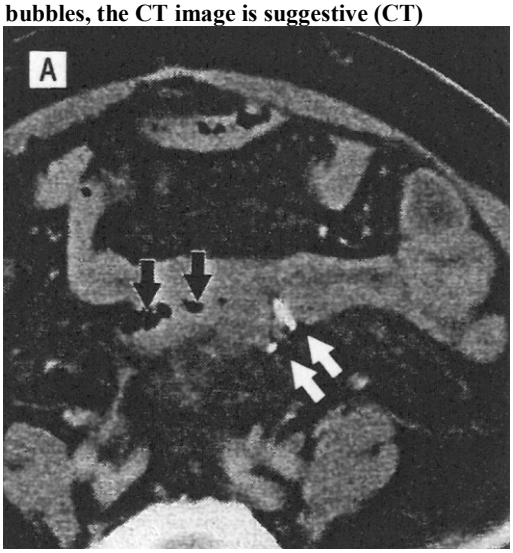
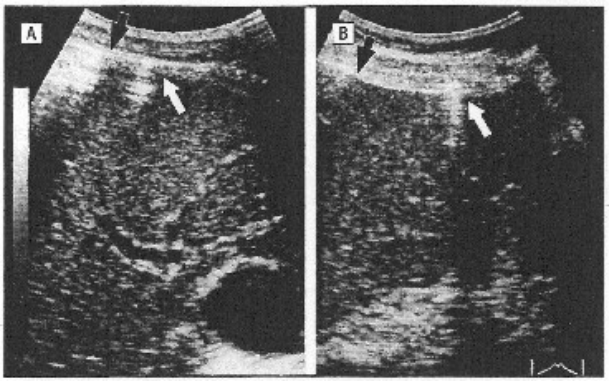


Figure no. 3. Ultrasonography findings showing subcutaneous emphysema (A) and intermuscular emphysema (B) mimicking intraperitoneal free air (IPFA) (white arrows in both A and B), witch can be differentiated from IPFA by the origin of the shadow in the peritoneal wall or immovability in response to compression of the probe



DISCUSSIONS

One of the most important issues in a blunt abdominal trauma patient is the indication for the exploratory laparotomy, and for this reason, the abdominal US scan seems to be the initial diagnostic modality because it is a non-invasive method.(11,12,13,14)

Pneumothorax, hemothorax and abdominal bleeding frequently accompany significant blunt or penetrating injuries of the chest and abdomen, and are usually detected clinically with chest X-ray or US scan. In 2-5% of cases, there has been reported the presence of occult injuries (15,16,17,18), which can be very serious in trauma patients, especially if they contribute to hypoxia or hypovolemia. In several studies about trauma, a small occult pneumothorax, if undetected, may rapidly become life-threatening after the administration of general anesthesia or intubation.(19,20) In most studies, in the USA, Europe and Asia, it has been shown that US is reliable in both the detection of free peritoneal fluid and parenchimal injuries.(21) In recent studies the accuracy in detection of parenchymal trauma has the sensitivity and specificity range from 62%(370 to 97%(38), and from 84% (39) to 100% (40) respectively .

In our experience, DPL is a fast and accurate method for detecting intraperitoneal injuries in hypotensive patients or in those with an altered sensorium without a clear indication for surgery. DPL is a very sensitive method for detecting intraperitoneal blood, but its specificity is low.(22,23)

The most important issue in the present study involving US is the accuracy of the interpretation of the US findings.

CT scan is the most frequently used method for the evaluation of hemodynamically stable patients in thoraco-abdominal trauma, with accuracy ranges between 92%and 98%, with relative small number of false positive and false negative results.(24,25,26)

In our experience, US use has increased in the last years due to its noninvasive character, rapidness and its diagnostic accuracy, being comparable with DPL and CT.

In our hospital, the abdominal US evaluation is the initial diagnostic method for patients with a high risk of intraabdominal injury in blunt trauma.

The results of our study and experience with polytrauma patients showed that the majority of patients can be diagnosed with US, and CT is very useful in patients with suspected retroperitoneal injury.

CONCLUSION

In most patients with blunt abdominal trauma US scan is reliable in primary diagnosis and can replace CT, DPL.

US is useful for the diagnosis of IPFA indicating visceral perforation in polytrauma patients.

In small pnemo or hemothorax, CT scan detect otherwise undiagnosed injures, including air or blood in the pleural space and the lung parenchymal contusions.

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