

A Prospective Evaluation of Surgeon Performed Sonography as a Screening Test in Blunt Abdominal Trauma

E Foo,*^{MBBS, FRCS}, J W Su,**^{MBBS}, D Menon,**^{MBBS}, D Tan,***^{MBBS, FRCS}, S T F Chan,****^{FAMS, FRCS, FRACS}

Abstract

Introduction: Sonography has found a role in the evaluation of patients with abdominal injury. However, the accuracy of sonography as performed by non-radiologists remains controversial. This study aims to determine the accuracy of focused abdominal sonography for trauma when performed by surgeons. **Materials and Method:** Over a 1-year period, 48 patients with abdominal injury were initially evaluated for free intraperitoneal fluid by sonography. These tests were performed by 2 surgeons who had received instructions and performed a minimum of 30 examinations. Sonographic findings were then compared with other diagnostic modalities including computed tomography (CT) scan, diagnostic peritoneal lavage and exploratory laparotomy. **Results:** The sensitivity, specificity, positive predictive value, negative predictive value and accuracy for sonography were found to be 0.86, 0.92, 0.89, 0.90 and 0.89, respectively. Although not specifically sought for, 2 cases of solid organ injury and 1 haemothorax, which were missed in initial examinations and X-rays, were detected on sonography. **Conclusion:** In conclusion, our initial experience suggests that local surgeons can perform a focused sonographic examination for trauma with acceptable accuracy. Although sonography lacks the sensitivity of diagnostic peritoneal lavage and the accuracy of CT scan, the diagnostic algorithm for abdominal trauma should include sonography as a screening test.

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Key words: Blunt abdominal injury, Computed tomography, Diagnostic peritoneal lavage, Focussed abdominal sonography for trauma

Introduction

Over the past decade, sonography as a screening tool in the evaluation of abdominal trauma has been thoroughly investigated. This modality was first used by the Japanese and German surgeons.^{1,2} The American surgeons adapted later to the technology but today, it has found a place in their treatment algorithm. In some instances, it has replaced the time-honoured modalities like diagnostic peritoneal lavage (DPL) and computed tomography (CT).³⁻⁶

In most hospitals, limited radiographical resources do not allow a certified radiologist to be present in every abdominal trauma examination. Therefore, one problematic area has been the accuracy of sonography as performed by non-radiologists. An important differentiation has to be made between a limited focussed ultrasound examination (FAST) to detect free intraperitoneal fluid (FIF) and an extensive ultrasound examination to detect organ specific injury. The latter requires considerably more skill. The aim of this study was to determine the accuracy

of sonography in detecting FIF in blunt abdominal trauma.⁶⁻⁸

Materials and Methods

Between July 1997 and August 1999, all patients admitted to the Department of Surgery for blunt abdominal trauma were initially evaluated for free peritoneal fluid. These tests were performed by 2 surgeons who had received 6 hours of instructions and performed at least 30 ultrasound examinations. All sonographies were performed with an ultrasound machine (Toshiba linear array probe 3.5 MHz). Sonographic findings were then compared with other diagnostic modalities including CT scan, DPL and exploratory laparotomy.

Sonographic examinations were done to elicit free fluid in the peritoneal cavity and the pericardial space. The pericardial space was assessed via a subxiphoid transducer placement. For the abdomen, the transducer was placed at the right flank, left flank and suprapubic positions to elicit

* Consultant

** Medical Officer

*** Head

Department of Surgery

Alexandra Hospital

**** Associate Professor

Department of Surgery

National University Hospital

Address for Reprints: Dr Edward Foo, Department of Surgery, Alexandra Hospital, 379 Alexandra Road, Singapore 159964.

fluid in the Morrison's pouch, the left subdiaphragmatic and suprarenal recess and the pouch of Douglas, respectively (Fig. 1). A true positive study was defined as the demonstration of free fluid by ultrasound and another modality. A true negative study was defined as the absence of fluid by ultrasound and confirmed by another modality. A false positive study was defined as an ultrasound examination showing the fluid that was not subsequently confirmed by another diagnostic modality. A false negative study was defined as an ultrasound study showing no free fluid but a later diagnostic modality had revealed fluid. The sensitivity, specificity, positive predictive value and negative predictive value for ultrasound examinations were then determined. The time taken to perform the sonographic examinations were noted. After completing the basic examination, an attempt was made to identify organ specific injuries and haemothoraces. This part of the examination was not timed.

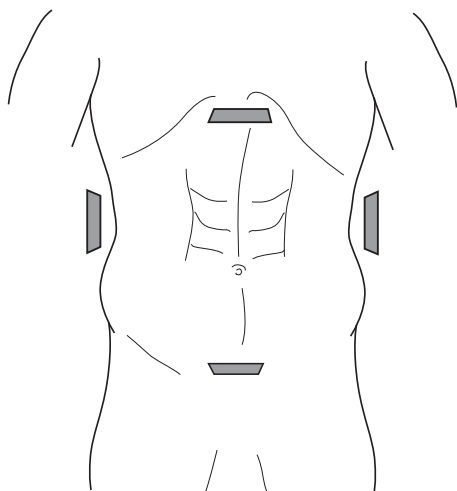


Fig. 1. Scanner positions for sonographic evaluation of patients with blunt abdominal injury.

Results

There were 48 patients aged between 19 and 38 years admitted for blunt abdominal trauma. The mean age was 30.2 years and the male to female ratio was 7:1.

Of the 48 patients, 35 had CT scan, 12 patients had DPL and 12 patients had exploratory laparotomy. There were 2 deaths which occurred within 30 days of injury.

The sensitivity, specificity, accuracy, positive predictive value and negative value for sonography were 0.86, 0.92, 0.89, 0.90 and 0.89, respectively (Table I). There were three false positive and three false negative studies. The average time to complete the basic ultrasound examination for the first 20 patients was 3.9 minutes and for the other 28 patients was 2.2 minutes.

TABLE I: PRESENCE OF FREE INTRAPERITONEAL FLUID DETECTED BY DIFFERENT MODALITIES

		Other modality findings		
		Positive	Negative	Total
Ultrasound findings	Positive	19	2	21
	Negative	3	24	27
	Total	22	26	48

Three patients (2 with small liver lacerations and 1 with splenic laceration) with free fluid seen on CT scan were not detected on ultrasound. Two patients had small haemothoraces (less than 200 mL) which were not seen on initial chest X-rays but were detected on ultrasound examination. Two false positive results occurred relatively early in our experience and was attributed to a tendency to over-read for fear of missing injuries.

Discussion

Evaluation of the patient with blunt abdominal trauma can be difficult especially if there is altered sensorium. Diagnostic peritoneal lavage, first described in 1965, is extremely sensitive. However, its disadvantages are that it is invasive and contraindicated in patients with previous surgery, pregnancy or coagulopathy. It is also associated with a high proportion of non-therapeutic laparotomies as it is so sensitive and fails to identify organ specific injuries, for example hepatic lacerations. CT scan later gained popularity even though it was not as sensitive as DPL, as it provided information on organ specific injuries and therefore avoided some unnecessary laparotomies. Its disadvantages were its cost and its unsuitability for unstable patients because of the length of time required for the necessary transport to the scan room and the actual scanning procedure.

Ultrasound has an advantage of being a bedside procedure and is therefore repeatable. While not as sensitive as DPL, its sensitivity for detecting intraperitoneal fluid is high (84% to 98%).^{3,9-12} However, the sensitivity for identifying specific organ injury has a wide range, and to some extent, is operator dependent.¹³

In a cost-conscious era, duplicity of investigations should be kept to a minimum. Ultrasound is complementary to DPL and CT scan. It probably would not completely replace either of the other two modalities. The experience in Europe has seen the use of DPL restricted to haemodynamically unstable patients with equivocal focussed abdominal sonography for trauma.⁵ A clinical pathway which allowed for rapid, safe and cost-conscious evaluation of blunt abdominal trauma was described (Fig. 2). The use of focussed abdominal sonography for trauma based algorithms has reduced the use of DPL and CT scan in their

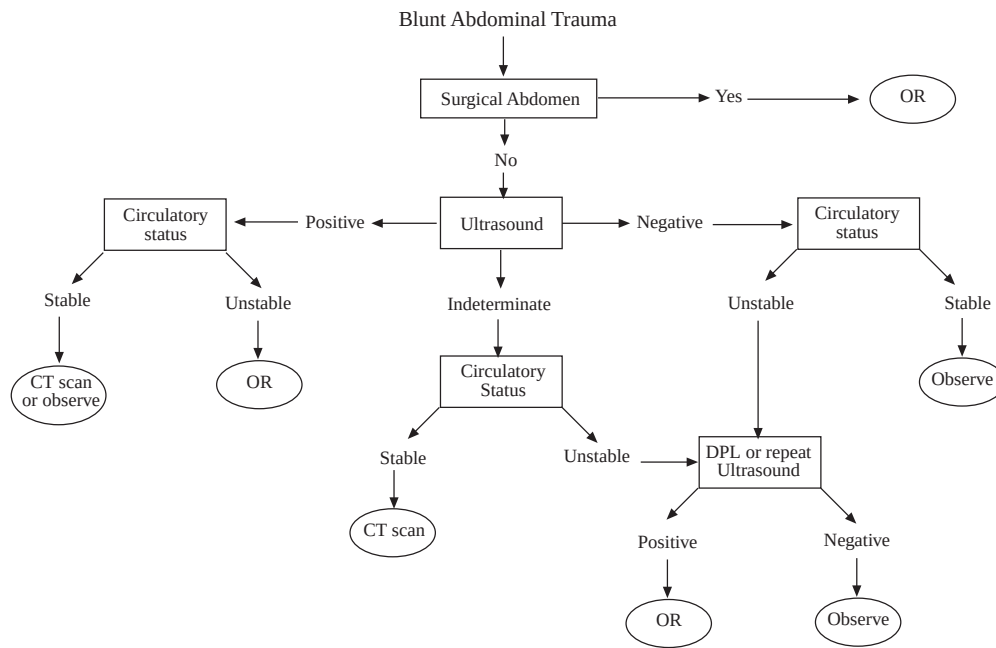


Fig. 2. Blunt abdominal trauma.

DPL: Diagnostic peritoneal lavage; OR: Operating room

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trauma centre. In fact, more than 65% of patients may only require ultrasound as their only imaging modality.

Our experience suggests that surgeons and other non-radiologists can perform focussed abdominal sonography or trauma with acceptable accuracy. A distinction should be made between detecting only free fluid versus solid organ injuries which require extensive experience and would probably remain within the domain of trained radiologists.^{12,14} Although very small haemothoraces, otherwise missed by chest X-rays, can be detected by ultrasound, their clinical significance remains uncertain.¹¹ The appropriate level of training and the required number of practical examination before non-radiologists are allowed to use ultrasound independently remain controversial.^{7,8} We believe that trauma sonography is a valuable clinical tool and attempts to restrict its usage are unjustified.

Missed abdominal injuries remains a concern with focussed abdominal sonography for trauma.¹⁵ Three such injuries were missed in our study (small liver and splenic lacerations). However, these patients did not require laparotomy. Goletti et al¹² suggested that the amount of free fluid may be a prognostic indicator for surgical management. Therefore, the potential morbidity of an injury missed by sonography may not be as severe as feared. This morbidity is further reduced if consideration is given to examination findings and the practice of repeated sonography.¹²

Conclusion

In conclusion, focussed abdominal sonography for trauma performed by experienced surgeons is a valuable tool in assessing intra-abdominal injuries in the setting of blunt abdominal injuries. The use of trauma sonography as part of the diagnostic algorithm for abdominal trauma should be included.

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