

## Ultrasound in the emergency department

### Emergency department ultrasound for the assessment of abdominal trauma: an overview

John Ross, MD

**D**iagnostic ultrasound (U/S) has been used in medicine for over 40 years,<sup>1</sup> and reports describing the use of abdominal U/S in trauma date back to 1971.<sup>2</sup> Recently, however, trauma ultrasonography has become a controversial issue in Canada.

U/S provides the speed and accuracy we associate with diagnostic peritoneal lavage (DPL) in a noninvasive format. It is safe, inexpensive, repeatable, accessible at the bedside, and requires little patient preparation. U/S is now the initial test for the assessment of blunt abdominal trauma in most European and Australasian centres.<sup>3</sup> More recently U/S has become common in US trauma centres.

A focused abdominal sonogram in trauma (FAST)<sup>4</sup> exam takes 5 minutes or less. The FAST scan examines the right upper quadrant, left upper quadrant, subxiphoid area, pelvis

at the pouch of Douglas, and, in some cases, the paracolic gutters.<sup>3</sup> But can FAST scans tell us which patients require surgery?

English-language publications document trauma U/S data from over 10,000 patients. These data suggest that U/S is 80–100% sensitive and 88–100% specific for detecting hemoperitoneum in adult, pediatric, blunt or penetrating abdominal trauma.<sup>3</sup> Serial scanning over minutes to hours increases both sensitivity and specificity. Several studies have compared U/S, either single or serial, with DPL and CT. The figures presented in Table 1<sup>5</sup> are typical of the results of these studies.

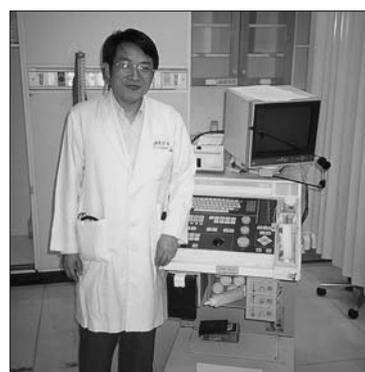
Although sensitive for hemoperitoneum, U/S, like CT, has poor sensitivity (in the range of 50–60%) for hollow viscus and pancreatic injuries. Most studies report U/S

**Dear Dr. Innes**

*It is my great honor to have this picture of me standing with our ultrasound machine published in your article. Indeed, we endured some conflicts with other departments (Cardiovascular, GI) several years ago, but our superintendent made the decision that "Ultrasound is like a stethoscope" to resolve all problems.*

*Thank you very much for your kindness in sharing with us your new journal.*

**Shiumn-Jen Liaw**  
T'aoyüan Hsien, Taiwan



**Dr. Shiumn-Jen Liaw, Chang Gung Memorial Hospital, with the ED ultrasound machine**

specificities in the range of 94%;<sup>3</sup> however, unlike CT, U/S provides little organ-specific injury detail.

The algorithm in Figure 1 has been proposed as one way to incorporate FAST exams in the assessment of blunt abdominal trauma patients.<sup>3</sup> This type of algorithm is used in many centres to guide initial and serial U/S examinations. One large North American trauma centre has decreased CT use from 26% to 11%, and DPL use from 38% to 10%<sup>6</sup> by adding emergency department U/S as an initial screening test.

Some centres also use the size of fluid collections to guide therapy in trauma. Investigators at two centres have used scoring systems to determine the likelihood that trauma patients with varying free-fluid volumes will require laparotomy.<sup>7,8</sup> These systems will require validation in other centres.

**Who should perform ED ultrasound?**

There is little doubt that U/S has a role in abdominal trauma.

**Table 1. Diagnostic parameters for ultrasound (U/S), computed tomography (CT) and diagnostic peritoneal lavage (DPL) in blunt abdominal trauma**

	U/S, %	CT, %	DPL, %
Sensitivity	91.7	97.2	100
Specificity	94.7	94.7	84.2
Accuracy	92.7	96.4	94.5

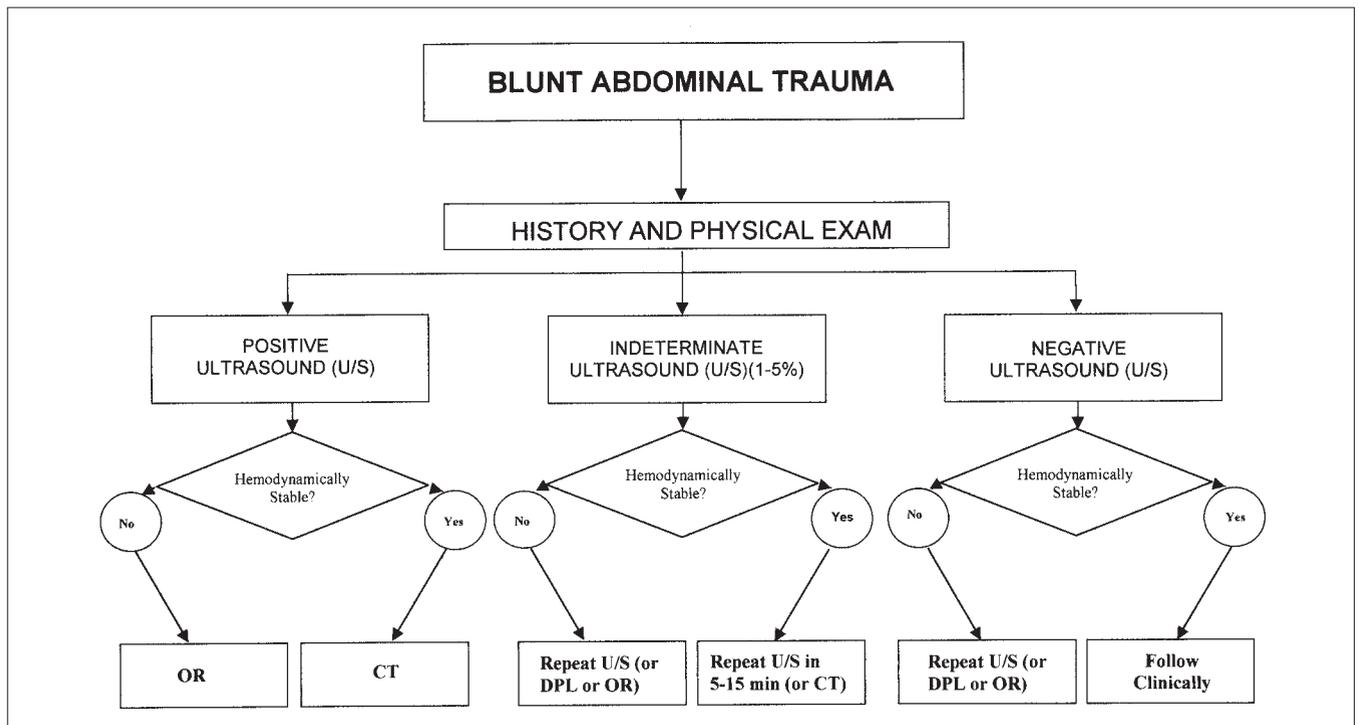
The question is: *Who* will perform the U/S study? Radiologist? Surgeon? Emergency physician (EP)? If a non-radiologist, how will they be trained, who will train them, and what quality assurance mechanisms will be instituted?

Several studies demonstrate that EPs and surgeons can perform U/S safely and accurately. Existing training programs vary in length from 2 to 200 hours, and advocates of ED U/S suggest that a curriculum be designed to teach FAST exams during surgical and emergency residency programs. In 1994, the Society for Academic Emergency Medicine (SAEM) published a comprehensive curriculum for ED U/S training.<sup>9</sup> The SAEM guidelines suggest 40 hours of instruction and 150 U/S examinations, including aorta, gallbladder, kidneys, ectopic pregnancy and pericardium, as well as trauma.

The controversy becomes heated when emergency physicians gain confidence and extend the application of ED U/S to non-trauma. What are reasonable limits for non-radiologists performing U/S and how will these be determined?

**Controversies, turf, and the Canadian perspective**

This type of controversy is not new to emergency medicine, and emergency physicians tread on the turf of many other “vertical” specialists. We provide acute care to patients whose problems relate to all anatomic regions, and whose diseases are often considered the property of other specialties. It has been a long and painful process to carve



**Fig. 1. Proposed role for ultrasound in blunt abdominal trauma**

out our niche. Until the “time is muscle” concept was accepted, thrombolytics were restricted to the cardiac care unit. Emergency physicians’ use of paralyzing agents still causes spasms in some of our anesthesia colleagues. In recent years, the boundaries of radiology have been threatened by orthopedic surgeons who read their own radiographs, cardiologists who interpret coronary angiograms, and now by EPs who develop diagnostic imaging protocols and demand to perform ultrasounds. Where will it end?

There are many issues to resolve: training, maintenance of skills, availability, indications, “turf,” the need for a “gold standard,” and the critical question: Will ED ultrasound actually improve patient outcomes? In preparing this article, we invited several emergency physicians and one radiologist to comment on the role of U/S in the ED. Their opinions follow.

### References

1. Howry DH, Bliss WR. Ultrasonic visualization of soft tissues of the body. *J Lab Clin Med* 1952;40:579-84.
2. Kristensen JK, Buemann B, Kuhl E. Ultrasound scanning in the diagnosis of splenic hematomas. *Acta Chem Scand* 1971;137: 653-7.
3. Melanson SW, Heller M. The emerging role of bedside ultrasonography in trauma care. *Emerg Med Clin N Am* 1998;16:165-73.
4. Rozycki GS, Shackford SR. Ultrasound: what every trauma surgeon should know. *J Trauma* 1996;40:1-4.
5. Lui M, Lee CH, P’eng FK. Prospective comparison of diagnostic peritoneal lavage, computed tomographic scanning and ultrasonography for the diagnosis of blunt abdominal trauma. *J Trauma* 1993;35:267-70.
6. Healey MA, Simons RK, Winchell RJ, Gosink BB, Casola G, Steel JT, et al. A prospective evaluation of abdominal ultrasound in blunt trauma: Is it useful? *J Trauma* 1996;40:875-83.
7. Akgur FM, Aktug T, Olguner M, Kovanlikaya A, Hakguder G. The place of ultrasound examination in the initial evaluation of children sustaining blunt abdominal trauma. *J Pediatr Surg* 1993;28:78-81.
8. Huang MS, Liu M, Wu JK, Shih HC, Ko TJ, Lee CH. Ultrasonography for the evaluation of hemoperitoneum during resuscitation: a simple scoring system. *J Trauma* 1994;36:173-7.
9. Mateer J, Plummer D, Heller M, Olson D, Jehle D, Overton D, et al. Model curriculum for physicians training in emergency ultrasonography. *Ann Emerg Med* 1994;23:95-102.

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## Ultrasound in emergency medicine

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Although diagnostic imaging is, for the most part, the domain of radiologists, exceptions to this rule have developed. Cardiologists perform cardiac catheterization and echocardiography. Obstetricians have developed expertise in transvaginal ultrasound and fetal assessment. Why have some specialties embraced areas of imaging as theirs, while others — such as orthopedics and medicine — continue to rely on radiology? One reason is that radiologic expertise in these latter specialities is rarely required on a 24-hour basis and it can be provided without taking on an overwhelming workload. ED bedside ultrasonography, on the other hand, must be available 24 hours a day. Conditions requiring immediate (within 15 to 20 minutes) ultrasound (U/S) include expanding or leaking abdominal aneurysm, suspected ectopic pregnancy, and traumatic hemoperitoneum. When patients with these conditions are unstable they require even more rapid imaging — “real imaging” in the operating room.

Emergency physicians (EPs) in many emergency depart-

ments state that they lack rapid access to U/S because of resistance from their radiologists, in effect using the same arguments that other specialists have used. But unlike other specialties, to remedy this situation and make 24-hour U/S immediately available, *all* EPs in *every* department would have to master the technique. Anything less than this would establish a double standard of care in each department, eliminating the argument that immediate U/S is essential for optimal patient management. The appearance would be that EPs want to perform U/S for financial or turf reasons.

What has rapidly available U/S given us? Many US trauma centres are equipped with ED U/S. Despite this, few if any studies demonstrate that trauma outcomes have improved as a result. While U/S rapidly identifies intraperitoneal blood and perhaps decreases invasive peritoneal lavages, it does not identify hollow viscus injuries. A normal U/S does not allow patient discharge; nor does it rule out significant intra-abdominal injury. To date, therefore,

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