

## ORIGINAL ARTICLE

## Emergency department ultrasound (EDU): clinical adjunct or plaything?

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*Emerg Med J* 2005;22:333–335. doi: 10.1136/emj.2004.014241

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Accepted 1 April 2004

**Background:** Emergency department ultrasound (EDU) is a physician performed ultrasound service aimed at improving patient flow and diagnosis in the emergency department.**Methods:** This paper describes the initial phase of the introduction of EDU with three illustrative case reports and a discussion on the pitfalls and benefits of EDU.**Results and discussion:** In three cases discussed here, the use of EDU facilitated treatment and reduced the need for formal radiological scanning. While there are drawbacks to EDU, we believe these are far outweighed by the advantages, and in a recent survey of emergency medicine consultants throughout Ireland, the vast majority were in favour of its introduction.**Conclusion:** EDU has become a routine part of our clinical practice, and although we are still on a learning curve with regard to its use, we have experienced significant benefits in patient care. With technological advances (such as improved image resolution and teleradiology) the potential for EDU will continue to expand, but training, practice, accreditation, and audit are essential.

In the UK and Ireland, ultrasound investigation is largely the responsibility of radiologists. However, clinical specialities such as obstetrics use ultrasound to complement their clinical practice. The concept of emergency department ultrasound (EDU) is taking hold in emergency medicine within the UK and Ireland, but few departments have actually established a practice. This is quite different to emergency departments (EDs) in North America and Australasia.<sup>1–3</sup>

The potential benefits of EDU include improved patient flow and early detection of conditions such as haemoperitoneum, abdominal aortic aneurysm (AAA), deep vein thrombosis, paediatric hip effusion, and soft tissue foreign body.<sup>4–8</sup> Coupling clinical assessment with EDU, the clinician explores a binary (yes or no) option as to the presence of a specific condition.

The purpose of this paper is to describe the process, pitfalls, and benefits of introducing an EDU service.

## METHODS

The ED in the Ulster Hospital, Belfast receives approximately 70 000 attendances/year, and treats a wide spectrum of adult and paediatric disease, including major trauma. In July 2003, a pilot EDU service was introduced to the ED. The radiology department of the Ulster Hospital agreed to co-operate in its implementation, and to provide ongoing quality assurance. Five ED doctors attended a 1 day ultrasound scanning course that provided an introduction to its use and showcased some of the available scanners. This course was facilitated by a consultant emergency physician accredited in the use of EDU, and consisted of didactic lectures and practical ultrasound sessions with patients and healthy volunteers. The main objectives of this course were to introduce participants to the basics of ultrasound technology and its applications, including aortic aneurysm and free abdominal fluid. Funding was obtained, and a scanner that offered a balance between cost, portability, and image quality was chosen. After an initial trial period of 3 months, a scanner was purchased.

A logbook was devised and assessed regularly by two consultant radiologists, who (with their sonographers) provided ongoing training. The training required was

individually tailored to suit the learners' needs. For example, a specialist registrar wishing to develop a number of applications such as aortic aneurysm, free abdominal fluid, hip effusion, and deep vein thrombosis was seconded to the radiology department for 3 months. In contrast, a consultant simply wishing to detect paediatric hip effusions was producing diagnostic quality images after performing 20 examinations supervised by a radiologist. In the absence of agreed UK accreditation guidelines, the American College of Emergency Physicians (ACEP) guidelines were followed: 25 examinations for the first application and then a further 25 for any new application required by the EDU practitioner.<sup>1</sup> Departmental guidelines were introduced, covering indications, techniques, and acceptable views for EDU. The principles of quality assurance were firmly laid down within the department, and no doctor was allowed to perform EDU unless they had attended the 1 day course and were enrolled in the quality assurance process. This ongoing process includes a fortnightly meeting between the emergency and radiology departments whereby all ultrasound images are reviewed, and feedback is provided to the EDU practitioners. Currently the ED has five doctors enrolled in the EDU process, and diagnostic images are regularly produced for a number of applications as demonstrated by the following cases.

## Case studies

### Case 1

A 70 year old normotensive man presented with severe back pain and rigid abdomen. EDU demonstrated an 8 cm AAA (fig 1A). He was immediately referred to a consultant vascular surgeon and taken directly to theatre for successful AAA repair without recourse to CT scan, which would have delayed surgery.

### Case 2

A 4 year old boy presented with a non-traumatic painful limp and a mild fever. Radiographs were normal, EDU revealed a

**Abbreviations:** AAA, abdominal aortic aneurysm; ED, emergency department; EDU, emergency department ultrasound



**Figure 1** Sagittal view of right hip demonstrating an effusion in a limping child; (B) transverse view of an abdominal aortic aneurysm; (C) transverse view of dorsum right index finger showing foreign body.

large effusion of the right hip (fig 1B). The child was then admitted directly for drainage of his hip effusion without the need for formal radiology department scanning.

### Case 3

A 71 year old man presented with a 3 month history of painful swelling over the dorsum of the proximal interphalangeal joint of his right little finger. Radiographs revealed no abnormality. EDU revealed a foreign body in the soft tissues (fig 1C). The patient was then referred directly for removal.

## DISCUSSION

EDU is an imaging modality with a range of benefits in emergency medicine.<sup>5-7</sup> It is rapid, safe, non-invasive, and repeatable. It requires no contrast media and no special patient preparation. Benefits include earlier identification of life threatening conditions and streamlined patient care. Patients with traumatic haemoperitoneum or abdominal aortic aneurysm may be accurately identified in the ED.<sup>6</sup> Cardiac tamponade can be rapidly diagnosed and treated.<sup>9</sup>

Additional benefits to clinicians such as surgeons and emergency doctors include continuing professional development and the satisfaction of a broadened skills repertoire. Radiology departments may benefit from decreased demand for out of hours emergency imaging.

Drawbacks may be encountered as with any new technology, in particular the recognition of the limitations of this service. EDU can provide answers to specific, binary (yes/no) questions only. For instance, it can demonstrate the presence or absence of free intraabdominal fluid in the patient with blunt trauma, but not reliably reveal the cause.

There is a criticism that EDU is not core work for the emergency physician and should be provided by radiographers or radiologists on a 24 hour basis. However, this is impractical in most institutions, and we consider that the immediate availability of an emergency clinician trained in the use and interpretation of EDU represents a more practical alternative. This is of particular relevance in light of the trends toward increased out of hours clinical work by senior ED clinicians.

Other potential difficulties include inappropriate requests for scans from colleagues, and the risk of misdiagnosis. However, such issues can be addressed through education and quality control. There is international consensus that the benefits of EDU outweigh its disadvantages, and that EDU is a useful adjunct to clinical practice in the ED.<sup>2,3</sup>

We recently surveyed all consultants in emergency medicine on the whole island of Ireland, and found the vast majority to be in favour of the introduction of EDU. Perceived difficulties in its introduction included finance, support by radiologists, and cultural change. Furthermore, there was an

almost unanimous request for national guidelines in EDU practice and accreditation.

Once a need for EDU has been identified, an important initial step is to convince radiology colleagues that EDU complements their current service and does not compete with it. The initial expense of purchasing a machine must be included in the budget, as must the hidden costs, including running expenditure and peripherals such as printers and extra ultrasound transducers. A wide selection of scanners is available. These range from the cheaper, basic models to more expensive "state of the art" scanners. The use of a scanner for a trial period may focus these issues and reveal which is the most suitable for a particular hospital to use.

EDU is observer dependent, and the training requirements (including the minimum number of studies required for independent practice) remain controversial.<sup>1,10</sup> It can be a challenge to strike a balance between training and service provision. Seconding staff to the ultrasound department has been invaluable as a means of providing ongoing training, feedback, and strengthening relationships between both departments.

It is important to remember that EDU represents an adjunct to clinical findings, and the basic principles of clinical medicine should not be forgotten.

## CONCLUSION

EDU has become a routine part of clinical practice in the Ulster Hospital ED. We are still on a learning curve with regard to its use. However, we have experienced significant benefits in patient care.

Potential future directions for EDU include broadening its scope to include conditions such as deep venous thrombosis. For physicians who engage in central venous access, the future use of ultrasound is now a national guideline.<sup>11</sup> With technological advances (such as improved image resolution and teleradiology) the potential for EDU will continue to expand. Finally, for EDU to become a useful clinical adjunct we conclude that training, practice, accreditation, and audit are essential. Without these, it may well remain a plaything.

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Competing interests: none declared

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