

Point of Care Ultrasound (POCUS) in Emergency Medicine

Dr Meehar Shah

Consultant in Emergency Medicine

Dr Shashank Patil

Consultant Department of Emergency
Medicine

Chelsea & Westminster Hospital

Shashank Patil
Consultant

Introduction

In this discussion on the role of POCUS in the Emergency Department in the year 2021, it is useful to briefly chart its history, from a special interest amongst a few enlightened and persevering Emergency Physicians to now, where POCUS has become a core skill in the curriculum for trainees in Emergency Medicine and increasingly other acute specialities, such as Intensive Care and Acute Medicine.

Much credit must be given in the early evolution of POCUS in Emergency Medicine to American, Canadian and Australasian Physicians, who embraced new technology quickly and adapted their training curriculums accordingly. Progress in the UK was slower, where gaining competence in this area was felt to be more the domain of Radiologists and Sonographers, and we are arguably still behind our Antipodean and American colleagues. The Focused Abdominal Assessment in Trauma (FAST) scan protocol, introduced in the late 2000's, was the most frequent indication for POCUS in early ED practice however it was quickly adapted to other indications where the presence of free intra-abdominal fluid was important, such as ruptured ectopic pregnancy. Hence the familiar phrase of "can you do a FAST scan on my patient", heard by many a POCUS practitioner from a junior doctor or nurse, and often where the indication is not even trauma related!

Ultrasound guided vascular access was another important early adoption by POCUS practitioners, which has become one of the most useful applications in the Emergency Department. The vascular imaging techniques learnt from this have also lent themselves to the assessment of Abdominal Aortic Aneurysms (AAA). Echocardiography was increasingly utilised, initially with curvilinear abdominal probes and basic examinations in the context of Acute Life Support, to more sophisticated protocols including the assessment of cardiac output. The four Level 1 Ultrasound indications that are required for UK ED trainees are e-FAST, Vascular Access, Echocardiography in Life Support and AAA; in here lies the early history of POCUS, but what is really exciting is the real and wide expansion in the range of ultrasound examinations and skills shared amongst POCUS practitioners globally, over the last decade. Level 2 Ultrasound is a term used in the UK for the advanced applications of ultrasound, however this terminology is difficult to utilise in areas as diverse as Musculoskeletal Ultrasound or Echocardiography, areas in which POCUS practitioners are increasingly gaining expertise. POCUS has really come a long way from the early days of a few intrepid Emergency Physicians, viewed with suspicion by Radiologists and practising in isolation, to the current large and global POCUS community whose size is evidenced by the number and variety of journals, blogs and social media posts on this clinical topic.

Ultrasound Technology

The pace of change in Ultrasound machine technology over the last 15 years has been quite remarkable and follows the general

evolution in smaller and more sophisticated devices. Whilst some ED physicians will have had the early benefit of large ultrasound machines, no longer wanted by the Radiology department, the advent of cart-based models with smaller footprints at the turn of the century can be justifiably sign-posted as the dawn of POCUS. Much of the credit in this early phase of POCUS, especially in Emergency Medicine, can be given to the company Sonosite whose range of laptop style machines, including the Micromaxx and M-Turbo, broadened the diagnostic capabilities available to the trained ED physician. These early models are to be commended for their robust build, quick start-up and ease of use, as well as the quality of settings such as colour or spectral doppler. A major issue amongst all these technological advances has been the cost of such equipment, making the early history of POCUS largely the reserve of wealthier national healthcare systems.

In the last 5 years however, we have seen a widening in the market with many more competitors emerging in challenge to the established companies such as GE and Sonosite, with large cost reductions being offered for near equivalent machine specifications, by manufacturers such as Mindray or Chison, both based in China. For the POCUS community to become truly global, these changes in the market are to be welcomed, and with the Butterfly Iq, using silicone chip-based technology rather than piezo-electric crystals in the transducer head, a major advancement has been made. With further refinement of this technology, further cost reductions and hence increased availability of POCUS in less resourced healthcare systems, are surely to follow.

Training

The rapid technological changes that have been made have somewhat outrun the equivalent training up of POCUS practitioners. The early 2000s were certainly slow in most UK practices, with America at the forefront of POCUS education and training in Emergency Medicine at this time, through the activities of ACEP. The last decade, in contrast, has seen education and training finally catch-up with the functional capabilities of POCUS machines across the globe, with the help of FOAMed.



In ED training curriculums in most Western countries, a basic level of point of care ultrasound skills are required to achieve specialist qualification and as mentioned previously in the UK this equates to Level 1 ultrasound. Competence in the domains of Vascular Access, AAA, e-FAST and Echocardiography in Life Support are achieved by first attending a 1-day course, of which there are a plentiful supply nationally, and supervised practice on the “shop floor” which is recorded in a logbook. For those that show an interest in ultrasound and wish to progress beyond this, the road becomes somewhat muddier, with various options available, each with their own merits and pitfalls. Whether one chooses to do a Level 2 course on Biliary and Renal ultrasound, MSK or Vascular, the key will be access to a trained supervisor, generally either Radiologists, Sonographers or Cardiologists.

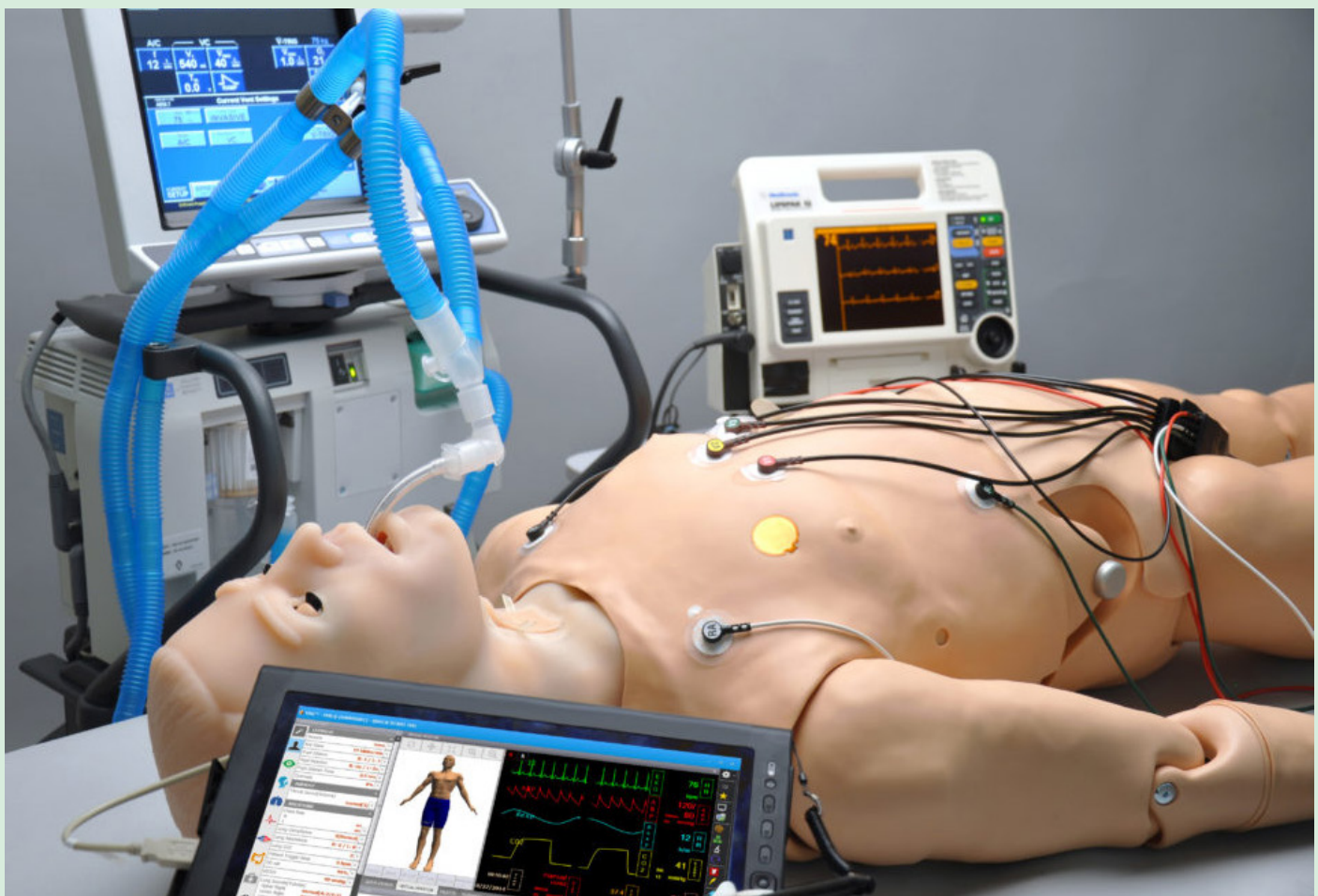
Increasingly, ED and ICU physicians are fulfilling this role, as trainers in FICE for example, allowing more trainees to benefit from these useful skills. In the UK, many choose to enrol in a university delivered PGCERT, PGDip or MSc as another route to gaining expertise, but requires a commitment that can prove challenging when coupled with a busy clinical role. The importance of supervision when training in POCUS cannot be over-emphasised, to both educate the trainee but also avoid harm to patients from mis-interpreted scans. For the trainee, there is a great benefit in discussing and reflecting on their practice with a more experienced supervisor, and more so if time can be formally dedicated to this. Local Ultrasound faculty groups can also be an excellent resource for education and training, but can

certainly be challenging to organise in large departments. The more widespread use of video conferencing platforms such as Zoom or Microsoft Teams in healthcare during the COVID-19 pandemic has at least allowed for attendance to be broadened for such meetings.

A significant step in wider education and training in POCUS has been made through the FOAMed movement and the excellent online resources that are now available and widespread. Social media has played a big role and a simple search of, for example, “POCUS ultrasound” on Youtube will lead to hundreds of links to videos, which although varying in their quality, allow the inquisitive POCUS practitioner to gain knowledge applicable to their practice. Although not a substitute for supervised scanning practice, videos of ultrasound scans on patients with pathology or undergoing procedures, widely available in the last 10 years, are a powerful educational tool for the both the trainee and the POCUS practitioner alike.

Governance

The increased use of POCUS in the Emergency Department over the last 20 years must also come with the systems to ensure safe practice, and much has been achieved in this area. Some of the key aspects of good Governance in POCUS are for the individual to be aware of the limitations of their practice, possess a deep understanding of the indications and pitfalls of different examinations and be clear with their patients on how the test influences their patient journey. Involvement in



Source: The Robot Report : Gaumard gives simulated patients realistic symptoms for medical training

reflective practice, regular attendance at educational meetings and case discussions will also allow the clinician to contribute towards the local Governance systems that are in place to protect patients and improve clinical care.

Documentation of scans is an important and sometimes weak area of POCUS, certainly in early UK practice although this has been recently improving. Whilst in the USA scans are generally billed and hence will usually be accompanied by stored images and a formal report, quality is likely to be high to resist scrutiny by an insurance company. In the UK, documentation for Level 1 scans such as e-FAST will be quite straightforward, however becomes more complicated for more advanced scanning practice such as in whole leg DVT ultrasound or Echocardiography.

A key point here is that if an individual is unable to write a comprehensive and consistent report on the scan being performed, they probably shouldn't be doing the scan in the first place. Accurately documenting more advanced POCUS examinations, to the level of Sonographers or Radiologists, ensures good practice, but the storage of associated videos or images can be more problematic in the UK. Few UK Emergency Departments will have their ultrasound machines connected to Hospital image transfer and storage software such as DICOM or Radpoint, preventing a key, if not essential, method of patient documentation. Hence the importance of accurate and detailed written scan reports, which should be learnt through the training process, to clearly record positive and negative findings. The increased sophistication of electronic patient records and improved wireless technology should hopefully in the future increase access to image storage for POCUS practitioners and reduce the often-unnecessary duplication of ultrasound examinations purely for the purpose of storing images on the patient record.

The Governance structures in place at our institution consist of an Ultrasound Lead, responsible for the Equipment and issues such as Infection Control, for training and education, ensuring patient safety and involvement in regular Clinical Governance and Local Faculty meetings. The Ultrasound Lead also has the responsibility of liaising and partnering with relevant speciality colleagues, such as Radiology, Gynaecology and Cardiology. Ensuring "buy-in" from speciality colleagues is a central component to a successful POCUS programme and although this been harder to gain in the UK compared to the USA or Australasia, things are certainly improving. Whilst this Governance model will vary according to the size and needs of an individual Emergency Department, these should be considered a minimum for an ED where POCUS is used regularly.

Common Pitfalls

What are the common pitfalls when performing POCUS examinations? Rather than discussing a lengthy list in each specific examination area, here are a few general and personal observations from my practice over the last decade.

Knowing your own limitations is important, especially when starting out. It is certainly an exciting journey, when beginning in POCUS, to use such a powerful diagnostic tool that opens up a lot of possibilities. This enthusiasm should be tempered with respect for the real and present danger of over or under diagnosis, from a lack of experience. Initially, resist the urge to let your scans change your overall patient management, as you improve

and begin to "rule-in" certain pathologies, with more training and experience can come the method of "ruling-out" pathology by POCUS, generally achieved in the UK through Post-graduate clinical education such as a PGCert.

It is important to allow yourself sufficient time free from distraction when performing a POCUS examination or procedure, such that you can follow a consistent scanning protocol for each patient and not miss pathology. A "quick look" is to be discouraged in this regard, aim to be methodical with each examination you perform. Allow time to think the case through properly and consider whether the ultrasound findings are relevant or incidental to your overall clinical picture.

Poor infection control is an all too regularly observed problem with POCUS machines, with remnants of blood on a high-frequency linear probe from a vascular access procedure, a common incident. It should be the norm in every department for every practitioner to participate in decontaminating the probe before and after a patient interaction, and ensure adequate precautions are taken with invasive procedures. This needs regular re-enforcement though the ever-changing medical staffing in the Emergency Department, to ensure standards are maintained.

The Future

POCUS has come far, as evidenced by Clinicians outside of the Radiology department, in specialities such as Emergency Medicine and Intensive Care Medicine, who have expertise in areas as diverse as focused Echocardiography, MSK, Vascular and Lung ultrasound. In discussing the future of POCUS, we could again touch on some of the areas already discussed, the exciting technological advancements and increasing access to educational resources for instance. However, what I feel most exciting is the opportunity to link with colleagues in specialities over POCUS examinations, interactions that continue to increase the validity of this important and powerful diagnostic tool. There is a paradox with POCUS, high quality evidence on the merit of POCUS in the literature is relatively weak, however few Clinicians would deny, for example, the utility of performing bedside Echocardiography in the shocked patient. If, as a minimum, we regard POCUS as a profound extension of the traditional physical examination, and with signs of ultrasound being increasingly incorporated into medical school curriculums, then the future is certainly bright for POCUS.

