

Ultrasound in emergency medicine: a tool within the reach of the emergency physicians

RAMON NOGUÉ BOU

Emergency Medicine. Medical School. Universidad de Lleida, Spain.

Ultrasound is very useful as a diagnostic procedure. Its use is widespread in several healthcare fields and it is a quasi-essential diagnostic tool in many specialties. The performance of ultrasounds has progressively increased in every specialty and with greater or fewer problems and this situation is currently accepted as something normal and desirable. This "superspecialisation" has facilitated the finding of new indications, the changing of procedures and techniques and, particularly, placing clinical and ultrasonographic information into the same hands, with the consequent increase in diagnostic effectiveness.

Emergency Medicine should not be the exception to the rule in relation to the remaining specialties. In fact, the idea of emergency physicians performing ultrasounds is almost as old as the specialty. In 1988, Mayron et al¹ recommended the introduction of training programmes in echocardiography for Emergency Departments in the United States. Rozycki et al (1995) coined the term FAST (Focused Assessment with Sonography in Trauma)², extending its use and recommending its introduction in the training curriculum for resident doctors specialising in surgery and emergency medicine. In addition to its advantages and disadvantages, the success of the FAST protocol can be attributed on one hand, to having validated a rapid, reproducible, low-cost method that is also concomitant with resuscitation in the assessment of trauma patients. On the other hand, the protocol made physicians in emergency and resuscitation units become familiarised with ultrasound techniques and progressively develop new indications and applications in several issues related to emergency care. What is probably the most important manifestation of all this will take place

in Porto Alegre, Brazil, next March at the 4th World Conference on Ultrasound in Emergency and Critical Care Medicine³ (not yet held at the time this editorial was written). We expect Spain's participation to be more relevant than in previous editions.

The relatively easy access of different specialties to ultrasound equipment which have been replaced by better equipment that is perfectly valid for our initial needs, together with the technological advances available in ultrasound diagnosis, allow the assumption that the availability of ultrasound for emergency physicians (EP), once they have acquired appropriate and adapted training, will provide the necessary competence to respond to specific diagnostic needs, without having to direct their training to that specialty.

Ultrasound in emergency departments is justified to allow EPs to find rapid answers to key questions to direct their patients in the best possible manner. In the hospital setting this means observation versus emergency surgery or hospitalisation versus outpatient follow-up. In pre-hospital emergency services, having a portable ultrasound machine is aimed to help diagnosis facilitating the best possible direction towards a hospital resource, a department or a certain specialist.

In our setting, there are probably several criteria for assessing the viability of the regular performance of ultrasounds by physicians in emergency departments (ED). In the first place, brevity. The time required to perform an ultrasound exploration may be incompatible with the availability that is expected of EPs, who normally manage high numbers of patients that require quick responses. In the second place, the simplicity in previous anatomical knowledge and in the

CORRESPONDENCE: Ramón Nogué Bou. Emergency Medicine. Medical School. Universidad de Lleida. Av. Rovira Roure, n.º 80. 25198 Lleida, Spain.

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ultrasound semiology that is sought. Thirdly, easy performance is required. Fourthly, portability, as the exploration should preferably be performed with portable ultrasound machines without sophisticated requirements and with simple image acquisition and storing techniques that facilitate their subsequent review. In the fifth place, adaptability, since the ultrasounds will probably not be performed with adequate lighting to facilitate optimal image analysis. Finally, there is quality. Given all of these criteria, indications should also be limited in number and related to pathologies with highly sensitive and specific ultrasound results. Ultrasonographies should be carried out after a short training period and under the assumption that a progressive practice will take place, increasing diagnostic confidence with time in order to provide results that are highly safe and with adequate quality.

Considering the points mentioned above, the use of ultrasound by EPs should provide multiple advantages. For patients, there would probably be a shorter waiting time, as the circuits of complementary tests that resort to other specialists (which are, on the other hand, frequently far or in other cases simply localised at their homes) are always long or very long if also combined with transport times, staff availability (porters, reception staff, radiologists, etc.) and the length of the test. For EDs, the advantage would be a reduction in overall attention times. For radiology units, which are very often have an overflow of emergency requests and also have a lack of staff, this previous selection

should limit the number of tests and allow better patient management. Following the directions of the ACEP (American College of Emergency Physicians)⁴ and Neri et al⁵, the potential indications combining pertinence, viability and limited ultrasound complexity, without wanting to be exhaustive, could include those shown in Table 1.

There are several reasons why patients in Emergency Medicine might need an ultrasound. The classical definition of demand is that of a polyvalent ultrasound, which must respond to often complex questions about very diverse anatomical regions.

The previous defence of the performance of ultrasounds by EPs does not aim to question the indications, in the context of emergency care, of classic ultrasounds that require a high professional qualification, that must be performed by an expert ultrasound specialist and that entail the use of upmarket equipment. Therefore, the search for cholecystitis, appendicitis, extrauterine pregnancy, cardiac segmental hypocontractility or an aortic dissection, for example, requires expert hands with specialised training.

The two studies on the use of ultrasound published in this issue, illustrate the two types of practice that have been described above. The clinical case of García et al⁶ is based on the early use of ultrasound by EPs that resulted in a quick and accurate diagnosis of a pericardial tamponade, the infectious origin of which was later confirmed. This diagnostic attitude provided rapid orientation which would otherwise have probably

Table 1. Indications proposed for the use of emergency ultrasound by emergency physicians⁶⁻¹¹

Cardiac assessment	<ul style="list-style-type: none"> • Assessment of essential data on contractility. • Identification of liquid in the pericardium. • Severe valvulopathies, to define the cardiogenic or non-cardiogenic mechanism of a state of shock of undetermined origin. <p>The recently described FATE⁸⁻⁹ protocol (Focus Assessed Transthoracic Echocardiography) would respond to these needs.</p>
Assessment of thorax	<ul style="list-style-type: none"> • Free intra-abdominal fluid (FAST). • Abdominal aortic aneurism. • Pyelocalyceal dilatation. • Acute urinary retention. • Gallstones and/or cholecystitis. • Intrauterine pregnancy. • Confirmation of clinical suspicion of hepatosplenomegaly. • Non-invasive measurement of central venous pressure¹¹. • Localisation of pleural effusions. • Pneumothorax, with high reliability¹².
Vascular assessment	<ul style="list-style-type: none"> • Search for venous thrombosis or arterial ischaemia.
Facilitation of techniques	<ul style="list-style-type: none"> • Localisation of vessels for puncture. • Search for foreign body in soft tissues. • Puncture of collections (abscesses, cysts, etc.). • Perineural puncture for tamponades. • Puncture of pleural effusion. • Checking correct evacuation of pneumothorax.
Other	<ul style="list-style-type: none"> • Detached retina. • Control of airway.

been delayed. It should be highlighted that in order to observe a pericardial effusion with ultrasonography it is necessary to have basic information which is within the reach of any EP with a minimum of interest. The study by Pintado et al⁷ on the use of ultrasound in the suspicion of acute appendicitis reinforces the acceptable overall performance of this technique but, as the authors point out, the exploration is an independent factor which is a fact that justifies, in part, the false negatives and positives of the test and supports the undertaking of this procedure by radiologists with the previous clinical criteria from EPs.

One risk to avoid would be prioritising an ultrasound in settings in which the consensus tends to support direct access to computerised tomography (CT). Performing two tests requires more time and may result in the patient missing opportunities such as for example the assessment of a multiple trauma patient that is haemodynamically stable or stabilised and requiring a rapid complete and reliable diagnosis.

Considering the previous example, the diagnosis of a haemoperitoneum in an unstable multiple trauma patient in EDs in which the availability of a proficient ultrasound specialist can be guaranteed and whose reliability is higher a priori, the EP must manage the clinical condition of the patient. However, many other EDs in which radiologists are not rapidly available, ED physicians should have the necessary skills to use the ultrasound equipment properly to thereby answer some key questions and correctly manage the subsequent actions.

Putting such approaches into practice entails reflection upon the organisation of adapted theoretical and practical, initial and continuous training, and also entails reflecting on this orientative ultrasound or the so-called "stethoscope ultrasound" or "ultrascopy". The concept of a "limited" examination is essential. The risk of confusion between an orientative ultrasound and an ultrasound examination is real and potentially dangerous. And there is nothing more harmful than wrongly believing that a good examination was performed. This approach obviously directs towards having ED physicians with experience, continuous training, progressive specialisation, who are aware of their responsibilities and of their high value in the emergency care chain. The learning curve on how to carry out good ultrasound exams can be long and delicate⁸ and that is without con-

sidering that this entails having certain aptitudes of spatial orientation which are not universal.

Ultrasound should be considered as an extension of the hand of an EP. Therefore, in the future it will be necessary to completely integrate ultrasound in the orientation process of medical attention in emergency care similar to the connection of a monitor, the programming of a ventilator or the use of a urine dipstick. Every medical action generates a responsibility for the physician that performs it. Moreover, considering the potentially tragic consequences of a mistake in an emergency care setting, it is essential to establish the limits on competence within the setting of Emergency Medicine. This debate will develop with the increase in the demand and the number of explorations performed and with the definition of the real usefulness of ultrasonography in our setting.

References

- 1 Mayron R, Gaudio FE, Plummer D, Asinger R, Elspenger J. Echocardiography performed by emergency physicians: impact on diagnosis and therapy. *Ann Emerg Med* 1988;17:150-4.
- 2 Rozycki GS. Abdominal ultrasonography in trauma. *Surg Clin North Am* 1995;75:175-91.
- 3 World Interactive Network Focused on Critical UltraSound. <http://www.winfocus.org/>
- 4 Tayal V, Blaivas M, Mandavia D. Emergency Ultrasound Guidelines. *Ann Emerg Med* 2001;38:470-81.
- 5 Neri L, Storti E, Lichtenstein D. Towards an Ultrasound Curriculum for Critical Care Medicine. *Crit Care Med* 2007;35:S290-S304.
- 6 Martín LA, Campo R, Rayo Gutiérrez M. Pericarditis purulenta: diagnóstico ecográfico precoz en el servicio de urgencias. *Emergencias* 2008;20:135-8.
- 7 Pintado R, Moya de la Calle M, Sánchez S, Castro MA, Plaza S, Mendo M. Indicación y utilidad de la ecografía en la sospecha de apendicitis aguda en la urgencia. *Emergencias* 2008;20:81-6.
- 8 Ma OJ, Gaddis G, Norvell JG, Subramanian S. How fast is the focused assessment with sonography for trauma examination learning curve? *Emerg Med Australas* 2007;20:32-7.
- 9 Jensen E, Sloth K, M Larsen, Schmidt. Transthoracic echocardiography for cardiopulmonary monitoring in intensive care. *European Journal of Anaesthesiology* 2004;21:700-707.
- 10 Price S, Nicol E, Gibson DG, Evans TW. Echocardiography in the critically ill: current and potential roles. *Intensive Care Med* 2006;32:48-59.
- 11 Lichtenstein D, Jardin F. Appréciation non invasive de la pression veineuse centrale par la mesure échographique du calibre de la veine cave inférieure en réanimation. *Réanimation Urgences* 1995;3:79-82.
- 12 Blaivas M, Lyon M, Duggal S. A prospective comparison of supine chest radiography and bedside ultrasound for the diagnosis of traumatic pneumothorax. *Acad Emerg Med* 2005;12:844-9.