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EDITORIAL

Bedside ultrasound in the critically ill paediatric patient☆

Ecografía a pie de cama en el niño crítico

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Female patient aged 7 years, postoperative from thoracic surgery, extubated, with the drains removed 4 hours ago, presents with respiratory distress and need for increased oxygen. Auscultation reveals some hypoventilation in the right hemithorax and percussion proves inconclusive. Thoracic ultrasound is immediately performed by the doctor on call, obtaining the diagnosis of pneumothorax in less than a minute without the need for further radiological examination. This is so-called ''bedside'', ''clinical'' or ''focused'' ultrasound, which is an extension of the physical examination of the patient, performed by the treating doctor at the place where the problem arises, seeking an urgent dichotomous (yes/no) answer and greater assurance when faced with a diagnostic or procedural requirement. It offers assurance, by minimising possible complications from procedures as well as avoiding radiation, efficacy, by facilitating management focused on the patient's specific needs, fairness, because it is a resource available at any time of day or night and in almost any healthcare centre, immediacy, by not delaying diagnosis and treatment, and efficiency, because all the advantages mentioned are achieved at minimal cost after the initial investment.[1]

Its use in paediatrics is less common than that described in the adult population and it is routinely implemented more often in urgent than in critical care areas. A survey conducted in 2015 by the Ultrasound Working Group of the Sociedad Española de Cuidados Intensivos Pediátricos (SECIP: Spanish Paediatric Intensive Care Society) found that 65% of Paediatric Intensive Care Units (PICUs) used it, but only for a few applications. This underuse may be due to the scarcity of publications and evidence in this particular population, but since we know that the differences in image acquisition and interpretation are minimal and that it is harmless when correctly used, this should not be an impediment to implementing it; and the fact is that as regards the applicability of clinical ultrasound to critically ill children it really can be said that the child is the adult writ small.

There is evidence in children of the benefit of clinical ultrasound for vascular access cannulation, reducing the number of attempts and complications in cannulation of the internal jugular vein and even achieving lower figures in femoral and subclavian access as well, but always using it in real time (ultrasound-guided puncture). Subclavian or brachiocephalic vein cannulation from the supraclavicular region is a possibility increasingly used in paediatrics and neonatology with promising results, though it requires a certain amount of experience. Correct estimation of

☆ Please cite this article as: Renter Valdovinos L, Oulego Erroz I, in representation and members of the Working Group of the Spanish Ultrasound Society of Pediatric Intensive Care. Ecografía a pie de cama en el niño crítico. An Pediatr (Barc). 2016;85:117–118.

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ventricular function, pericardial effusion and possible tamponade, and also intravascular volume status, in conjunction with examination of the inferior vena cava, has been shown to be viable after a brief period of training. During cardiopulmonary resuscitation, and especially in the case of pulseless electrical activity, it can be useful in diagnosing the possible causes (hypovolaemia, pneumothorax, tamponade, pulmonary thromboembolism) provided, it does not interfere with chest compressions. Thoracic ultrasound is very useful in the diagnosis and management of pneumothorax, pleural effusion, pulmonary consolidations, acute respiratory distress syndrome and acute pulmonary oedema, where, moreover, it produces quantification of the artefacts, and is related to intrapulmonary extravascular fluid and pulmonary artery wedge pressure. It also makes it possible to verify various degrees of lung aeration, helping to monitor progress and response to various treatments, such as diuretics and haemodiafiltration or increasing the pressures in the respirator, and estimating probabilities of success during a trial extubation or on initiating non-invasive ventilation. In patients with multiple trauma the FAST (Focused Assessment Sonography for Trauma) protocol is very specific for detecting free fluid and quite sensitive in the case of intra-abdominal lesions requiring intervention or transfusion. In addition, it provides a means of alerting to the presence of intracranial hypertension in patients with traumatic brain injury, both by using pulsed Doppler and colour (duplex) to assess the behaviour of cerebral flows in the arteries and by measuring optic nerve sheath diameter. It can also help in checking for correct endotracheal tube and vascular access placement, visualising the pupillary light reflex, fractures, ascites, diaphragm movement, performance of paracentesis, thoracocentesis and lumbar puncture.[2] Bedside ultrasound really comes into its own in carrying out protocols that seek to determine the causes of various types of conditions by using the various applications mentioned in a systematic and integrated way, such as RUSH (Rapid Ultrasound for Shock and Hypotension) for shock, BLUE (Bedside Lung Ultrasound in Emergency) for respiratory distress, FEEL (Focused Echo Evaluation in Life support) for cardiorespiratory arrest, and others.

The usefulness of bedside ultrasound in PICUs is reflected in the possibility of modifying or confirming the diagnosis at the moment when the need arises, with the consequent optimisation of medical management and reduction in performing other diagnostic tests and consulting other specialists, as well as a reduction in complications resulting from certain procedures.[3]

However, ultrasound also has its drawbacks, and the most important of these is the risk that misinterpretation may lead to faulty patient management, which is linked to the experience of the examiner. To minimise this risk we must ensure that proper training is given through implementation programmes, designed not only for new intensive care specialists but also for those who are unfamiliar with the technique. The training objectives must be based on recommendations from existing experts on bedside ultrasound in adult critical patients[4] and in paediatric emergencies, given the current lack of such experts in paediatric intensive care, but at the same time these recommendations must be adapted to the particular needs of each hospital, depending on the type of patients it treats. Implementation programmes must begin with a phase of training in the technique, seeking to teach skills not only in acquiring images but also interpreting them and incorporating them into the care process, and in addition, the minimum knowledge an intensive care specialist has to achieve must also be determined. Being too ambitious with certain kinds of examination, trying to obtain measurements or images that are the province of cardiologists or radiologists, may overcomplicate the technique and demotivate clinicians from learning and subsequently using it, as well as increasing the likelihood of erroneous interpretations. Training should ideally be followed by a phase of practice supervised by expert staff, until the person is qualified to make clinical decisions. This period can vary widely according to whether the applications require a greater or lesser number of supervised examinations.[5]

In view of the clear benefit this technique offers for paediatric critical patients, and in order to assist in the dissemination and implementation of this new tool, as well as providing unified definitions, protocols for its use and standardised minimum training, the Ultrasound Working Group (Grupo de Trabajo de Ecografía) was set up in 2015 at the SECIP National Conference held in Toledo. It is a platform seeking to promote correct use of bedside ultrasound and improve the current evidence through studies such as RECANVA, on vascular access cannulation in children admitted to Intensive Care Units (ICUs), which is already underway.

Ultrasound in critical patients is changing our day-to-day work. It is not just another machine to add to the range of PICU equipment but functions as an extension of our own senses, enabling us to see inside the patient autonomously and immediately, offering the possibility of greater diagnostic precision, a way of monitoring the response to certain treatments and greater security in procedures. Knowing not only all its possibilities and how to use them but also, and above all, its limitations will enable us to obtain the maximum benefit from a technique which undoubtedly improves the day-to-day management of our patients.

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