

## POCUS as part of the medical curriculum – is this the year?

EW Turton,<sup>1</sup>  M Gibbs,<sup>2</sup>  E Neethling,<sup>3</sup>  J Swanevelder<sup>2</sup> 

<sup>1</sup>Department of Anaesthesiology, University of the Free State, South Africa

<sup>2</sup>Department of Anaesthesia and Perioperative Medicine, University of Cape Town, South Africa

<sup>3</sup>Department of Anesthesiology and Pain Medicine, University of Toronto, Canada

**Corresponding author, email:** [TurtonEW@ufs.ac.za](mailto:TurtonEW@ufs.ac.za)

Echocardiography allows real-time examination of cardiac function and structure. The information obtained includes diagnosing patient pathology, guiding clinical management, and monitoring treatment results. A detailed diagnostic echocardiography examination on a stable patient is usually performed during working hours by an echosonographer in the echocardiography suite. Given the available resources, it is however impractical to expect cardiologists to provide a reliable point-of-care (POC) transthoracic echocardiography (TTE) service at all hours.

Over the past 40 years, it has become clear that there is value in taking the echocardiography machine and this expertise to the bedside of an unstable patient.<sup>1</sup> This enables the busy clinician to answer specific questions about the patient's condition out of hours and integrate this information into decision-making. Important POC clinical decisions can therefore be made timeously to improve patient outcomes. Reviews of the literature suggest that echocardiography by non-cardiologists is now commonplace and of an adequate standard to be clinically relevant, with potential prognostic impact.<sup>2</sup>

Focused echocardiographic examinations allow quick diagnostic screening during clinical emergency situations and act as an invaluable monitor in the haemodynamically unstable patient.<sup>3</sup> In the critical care setting, a focused scan enables the intensivist to answer frequent questions that arise in the care of their critically ill patients.<sup>4,6</sup> Besides haemodynamic assessment, critical care physicians should also be able to perform basic lung and pleura and interventional vascular ultrasound.<sup>2</sup> Evidence suggests that answering these questions may change the patient's management in up to 51% of cases.

In the preoperative assessment clinic, point-of-care ultrasound (POCUS) has also proved to be valuable. One study showed that in patients older than 65 years or patients with possible heart disease, preoperative echocardiography examination resulted in a change of management in 54 out of 100 patients.<sup>7</sup> A similar study showed that in patients with known or suspected cardiac disease admitted for emergency surgery, focused assessed transthoracic echocardiography (FATE) changed the cardiac diagnosis in 67% of patients and the management plan in 44% of patients.<sup>3</sup> Perioperative POCUS may also be extended to the operating theatre to assist with vascular access and

regional blocks, detect endotracheal intubation and estimate intracranial pressure.<sup>2</sup> The same applies for perioperative transoesophageal echocardiography (TOE), which is practised in limited specialised institutions, but has an important impact on patient outcomes.<sup>8-11</sup>

POCUS can make a huge difference to patient outcomes in the complex obstetric patient presenting for anaesthesia and critical care.<sup>12</sup> The haemodynamic changes in preeclampsia, eclampsia and peripartum cardiac disease is a leading cause of maternal death and may be accurately diagnosed with echocardiography. The Rapid Obstetric Screening Echocardiography (ROSE) scan may be used as a tool to assess peripartum cardiac failure and hypotension.<sup>13</sup>

Lack of expertise and certified training among anaesthetists remains a barrier.<sup>14-16</sup> Education in the basic principles of medical ultrasound has proven beneficial and feasible, early on at both undergraduate and postgraduate levels. The aim would be to produce clinicians with entry-level echocardiography skills, certainly as registrars, but also during their primary medical training. Presently there is a paucity of data in the developing world relating to the current state of training in POC echocardiography.

Anaesthetists need a goal-directed approach to better equip specialists-in-training with the skills they need to efficiently diagnose and manage their patients.<sup>17</sup> POCUS theoretical knowledge and practical skills of trainee anaesthetists at academic institutions in general have been identified as inadequate, as reported by the authors in this specific edition of SAJAA.<sup>18</sup> This finding is by no means unique to the university in question but is far more ubiquitous. This specific anaesthesia department is to be commended for identifying the gap in knowledge among their trainees. The universities in South Africa that offer medical specialist training each deal with their own challenges, and the implementation of a new POCUS programme undoubtedly poses a human resource and financial obstacle to all.

A lack of training opportunities in South Africa has been identified as a contributory reason for anaesthetists being unable to perform FATE. A recommendation from the authors to remedy this problem is to include POCUS as part of the postgraduate training curriculum.<sup>18</sup> The authors of this editorial can confirm that the College of Anaesthetists of South Africa (CASA)

curriculum is currently under review. This includes the FCA Part 1 and Part 2 (final) curricula for specialists and the Diploma in Anaesthesia (DA) curriculum. Including POCUS training in these curricula will certainly be beneficial.

In South Africa, ad hoc POCUS teaching of registrars has been the standard approach in most anaesthesia departments. Some departments have implemented a more regular ultrasound training programme and others continue to do this intermittently. Anaesthesia in South Africa and many parts of Africa is indebted to one of the pioneers of POCUS, Eric Sloth, for his generous contribution during regular visits to distribute ultrasound knowledge and skills to non-cardiologists.<sup>1</sup> Some departments conduct his formalised e-module guided FATE workshops (using [www.usabcd.org](http://www.usabcd.org)), where testing of knowledge and skills occur at the end of a one-day (basic or advanced) session. The incorporation of well-defined goals for POCUS knowledge and skills into the training curriculum enables teachers to set reasonable endpoints and timelines when constructing local training programmes. It also guides anaesthesia trainees on what is expected for an efficient clinical service in our developing world. Without this curriculum guidance and a clear goal, it is difficult to achieve competency in the performance of any diagnostic or therapeutic procedure.

POCUS should therefore be formalised as part of the anaesthesia training curriculum. The curriculum should direct and guide didactic lectures and clinical examination techniques. Established guidelines and recommendations should be used to create a dynamic curriculum, keeping up to date with science and practice. Examination skills can be taught on simulation mannikins in a non-threatening environment and by practising echocardiography on healthy volunteers. Most pathology identification and real-life skills development, however, will need to take place in the clinical environment over an extended period of time.

POCUS teaching and training should ideally be introduced at an undergraduate level. Today only a few medical schools have POCUS as an integrated part of their curricula.<sup>19-21</sup> Hoppmann et al. described an ultrasound programme implemented across all 4 years in their Medical School at the University of South Carolina, while others reported on programmes introduced during the students' last year of medical school.<sup>19</sup> Other authors have shown that medical students with no previous ultrasound experience demonstrated a considerable improvement in practical skill after interactive e-learning and 4 hours of hands-on training (HOT).<sup>22</sup> The e-learning course consisted of interactive internet-based modules developed especially for the medical student curriculum. The HOT sessions strongly emphasise the importance of practical teaching, i.e. not spending excessive time showing students a particular technique or procedure but allowing them to practice from the onset under direct supervision. Medical students are relatively quick learners in comparison with senior colleagues. In addition, we believe that clinicians are more likely to incorporate ultrasound into their daily practice if it is introduced at an early stage of their careers.<sup>23</sup>

POCUS training on high-fidelity simulators has been included in some institutions' 3rd- to 4th-year student's curriculum. Literature on the teaching of POCUS to medical students is available, and new recommendations and guidelines are published regularly. This should assist so that scientific material can form the body of knowledge essential for the practising clinician.

Is it any different in North America/Canada? What does the developed world say about training and education of POCUS in their environment? We perceive their clinical environment to be fundamentally different to the one in South Africa, and therefore unique obstacles may be encountered. Or is our struggle in teaching ultrasound skills more universal than we think?

In the USA, POCUS is not yet one of the core competencies of anaesthesia training. However, the OSCE examination of POCUS by the American Board of Anesthesiology started in 2022. The plan is to introduce the full spectrum of POCUS in 2024.<sup>24</sup> One of the attempts made to address this knowledge gap is through the American Society of Anesthesiology (ASA) diagnostic POCUS certification programme. This consists of a five-step pathway to achieve competency in image acquisition and interpretation. The programme has didactic lectures and optionally assigns ASA mentors to help participants achieve their goal. This may also be one of the possible solutions for a department where POCUS-trained consultants are limited.

In Canada, POCUS training has been implemented by curriculum design as a core competency since 2020.<sup>25</sup> This requires registrars to interpret and perform POCUS as part of the entrusted professional activities (EPAs) that must be completed prior to completing their programme. Their current training programme consists of a dedicated lecture series with didactic lectures for 2nd- and 3rd-year residents. Residents then undergo two full-day hands-on training sessions as part of their weekly academic days. In their 4th-year, residents have a one-month rotation in POCUS where they scan patients daily, record images, and review them with a consultant.

Ultrasound machines are available in many operating rooms in large academic institutions in our country.<sup>15</sup> This may not be the case in smaller hospitals. The widespread uptake of POCUS as a diagnostic and clinical management tool is therefore still variable. For example, the use of ultrasound to guide procedures such as central line placement is standard of care, whereas other applications (cardiac/lung/abdominal/gastric) are still not universally used by all.

The challenges encountered in the Canadian system are different. The curriculum includes the assigned EPAs, yet training of specialists to assist and mentor residents during these assigned rotations has not developed in parallel.<sup>25</sup> POCUS may have a bigger impact in under-resourced, developing countries where services are not readily available. In better-resourced countries, adequate access to trained echocardiographers and radiologists to perform diagnostic ultrasound at all hours of the day, also removes the incentive of acute care perioperative clinicians to maintain and practice their skills.


These above may also be challenges that the South African system will face with the implementation of a formal structured programme. Most anaesthetists in academic institutions have attended basic POCUS ultrasound courses. Developing and maintaining these newly-acquired skills through regular practice and image interpretation remains a challenge confounded by the shortage of educated providers to review and critique images.<sup>26</sup>

The implementation of any new technique usually happens over 10 years. It then takes another five years for the acceptance of this technique into general daily practice. POC echocardiography, both transoesophageal and transthoracic, performed by the treating physician, is now widespread and an essential part of evaluation and treatment. POCUS is operator dependent, so it must be reiterated that POC echocardiography should not replace the comprehensive scan that may be performed in an echocardiography clinic by a highly trained echocardiographer. We need a curriculum now to guide our anaesthetists and we need to establish POCUS guidelines and recommendations for South Africa.<sup>17</sup> A commitment to future training and advocacy is imperative, not only to broaden the physician skill set, but also for the sake of our patients. Post-COVID 2023 may just be 'the POCUS year'.

#### ORCID

EW Turton  <https://orcid.org/0000-0001-6916-7691>

M Gibbs  <https://orcid.org/0000-0002-3283-2552>

E Neethling  <https://orcid.org/0000-0002-0236-8808>

J Swanevelder  <https://orcid.org/0000-0001-6986-4470>

#### References

- Holm J, Frederiksen CA, Juhl-Olsen P, Sloth E. Perioperative use of focus assessed transthoracic echocardiography (FATE). *Anaesth Analg*. 2012;115(5):1029-32. <https://doi.org/10.1213/ane.0b013e31826dd867>.
- Neethling E, Roodt F, Beck C, Swanevelder JLC. Point-of-care and lung ultrasound incorporated in daily practice. *S Afr Med J*. 2018;108(5):376-81.
- Canty DJ, Royse CF, Kilpatrick D, et al. The impact of pre-operative focused transthoracic echocardiography in emergency non-cardiac surgery patients with known or risk of cardiac disease. *Anaesthesia*. 2012;67(7):714-20. <https://doi.org/10.1111/j.1365-2044.2012.07118.x>
- Jensen MB, Sloth E, Larsen KM, Schimdt MB. Transthoracic echocardiography for cardiopulmonary monitoring in intensive care. *Eur J Anaesthesiol*. 2004;21(9):700-7. <https://doi.org/10.1017/s0265021504009068>.
- Ahmad F, Ng A, Swanevelder J. Echocardiographic assessment of left ventricular function in the critical care setting. *Int J Int Care*. 2012;Spring:17-25
- Morris C, Bennett S, Swanevelder J, et al. Echocardiography in the intensive care unit: current position, future directions. *J Intensive Care Soc*. 2010;11(2).
- Canty DJ, Royse CF, Kilpatrick D, Bowman L, Royse AG. The impact of focused transthoracic echocardiography in the preoperative clinic. *Anaesthesia* 2012;67(6):618-25. <https://doi.org/10.1111/j.1365-2044.2012.07074.x>.
- Ng A, Swanevelder J. Perioperative echocardiography for non-cardiac surgery. What is its role in routine haemodynamic monitoring? *Br J Anaesth*. 2009;102(6):731-4. <https://doi.org/10.1093/bja/aep100>.
- Ng A, Swanevelder J. Perioperative monitoring of left ventricular function: what is the role of recent developments in echocardiography? *Br J Anaesth*. 2010;104(6):669-72. <https://doi.org/10.1093/bja/aeq115>.
- Swanevelder J, Ng A. The role of perioperative transoesophageal echocardiography. *SA Heart Journal*. 2010;7(2):114-23.
- Kolev N, Brase R, Swanevelder J, et al. The influence of transoesophageal echocardiography on intra-operative decision making. A European multicentre study. *European Perioperative TOE Research Group. Anaesthesia*. 1998;53(8):767-73. <https://doi.org/10.1046/j.1365-2044.1998.00341.x>.
- Ortner CM, Macias P, Neethling E, et al. Ocular sonography in pre-eclampsia: a simple technique to detect raised intracranial pressure? *Int J Obstet Anesth*. 2020;41:1-6. <https://doi.org/10.1016/j.ijoa.2019.09.002>.
- Dennis AT. Transthoracic echocardiography in obstetric anaesthesia and obstetric critical illness. *Int J Obstet Anesth*. 2011;20(2):160-8. <https://doi.org/10.1016/j.ijoa.2010.11.007>.
- Keene AR. Change or be changed; anaesthetist accreditation in echocardiography: is it time? *South Afr J Anaesth Analg*. 2010;16(6):6-7.
- Kathrada MIS, Jagga M, Mzoneli YN, Swanevelder JLC, Gibbs MW. Perioperative ultrasound among South African anaesthetists: a survey of current practice and availability. *South Afr J Anaesth Analg*. 2021;27(6):271-7. <https://doi.org/10.36303/SAJAA.2021.27.6.2636>.
- Turton EW. Point-of-care ultrasound for all – teaching, training and use at every opportunity *South Afr J Anaesth Analg*. 2021;27(6):256-7. <https://doi.org/10.36303/SAJAA.2021.27.6.2752>.
- Keene AR, Fischer S, Swanevelder JLC, et al. The Cardiothoracic Anaesthesia Society of South Africa (CASSA) consensus paper for accreditation of anaesthetists in South Africa in peri-operative echocardiography. *South Afr J Anaesth Analg*. 2012;18(3):139-41.
- Coetzee N, Perrie H, Scribante J, Kleyenstuber T. The transthoracic echocardiographic skills of registrars in a department of anaesthesiology. *South Afr J Anaesth Analg*. 2023;29(1):10-16. <https://doi.org/10.36303/SAJAA.2766>.
- Hoppmann RA, Rao VV, Poston MB, et al. An integrated ultrasound curriculum (iUSC) for medical students: 4-year experience. *Crit Ultrasound J*. 2011;3(1):1-12. <https://doi.org/10.1007/s13089-011-0052-9>.
- Bahner DP, Royall NA. Advanced ultrasound training for fourth-year medical students: a novel training program at The Ohio State University College of Medicine. *Acad Med*. 2013;88:206-13. <https://doi.org/10.1097/acm.0b013e31827c562d>.
- Rao S, Van Holsbeeck L, Musial JL, et al. A pilot study of comprehensive ultrasound education at the Wayne State University School of Medicine: a pioneer year review. *J Ultrasound Med*. 2008;27:745-9. <https://doi.org/10.7863/jum.2008.27.5.745>.
- Heiberg J, Hansen LS, Wemmelund K, et al. Point-of-care clinical ultrasound for medical students. *Ultrasound Int Open*. 2015;1:E58-66. <https://doi.org/10.1055/s-0035-1565173>.
- Hempel C, Turton EW, Hasheminejad E, et al. Impact of simulator-based training on acquisition of transthoracic echocardiography skills in medical students. *Ann Card Anaesth*. 2020;23(3):293-7. [https://doi.org/10.4103/aca.aca\\_51\\_19](https://doi.org/10.4103/aca.aca_51_19).
- American Board of Anesthesiology. Applied exam: objective structured clinical examination (OSCE) content outline 2022. Available from: [https://www.theaba.org/pdfs/OSCE\\_Content\\_Outline.pdf](https://www.theaba.org/pdfs/OSCE_Content_Outline.pdf). Accessed 2 Feb 2023.
- Pellerin H, Raazi DM, Stewart J, Pierce D. National curriculum for Canadian anesthesiology residency. 2020. Ottawa: The Royal College of Physicians and Surgeons of Canada. Available from: <https://www.royalcollege.ca/rcsite/documents/ibd/anesthesiology-national-curriculum-e.pdf>. Accessed 2 Feb 2023.
- Kimura BJ, Sliman SM, Waalen J, Amundson SA, Shaw DJ. Retention of ultrasound skills and training in "point-of-care" cardiac ultrasound. *J Am Soc Echocardiogr*. 2016;29:992-7. <https://doi.org/10.1016/j.jecho.2016.05.013>.