Expert recommendations on education, training and certification in perioperative Point-of-Care Ultrasound in Belgium (BePOCUS)

P. Van de Putte[1], L. Vernieuwe[2], S. Bouchez[3], J. Deen[4], G. Schols[1], B. Calle[1], M. Van de Velde[5], S. Rex[5]

[1]Department of Anesthesia, Imeldaziekenhuis, Imeldalaan 9, 2820 Bonheiden; [2]Department of Anesthesia, Algemeen Ziekenhuis Klina, Augustijnslei 100, 2930 Brasschaat; [3]Department of Anesthesia, Onze -Lieve-Vrouw Ziekenhuis, Moorselbaan 164, 9300 Aalst; [4]Department of Anesthesia, ZNA Jan Palfijn, Lange Bremstraat 70, 2170 Merksem, Belgium; [5]Department of Anesthesia, UZ Leuven campus Gasthuisberg, Herestraat 49, 3000 Leuven.

Corresponding author: Peter Van de Putte, Department of Anesthesia, Imeldaziekenhuis, Imeldalaan 9, 2820 Bonheiden. E-mail: doktervdputte@gmail.com

Abstract

Point-of care ultrasound (PoCUS) is a diagnostic paradigm, instrumental in the evolving anaesthesiologist's role towards a perioperative physician. The purpose of this article is to propose expert suggestions for a national standard towards official certification in perioperative PoCUS. Previously published recommendations in this journal constituted a first move towards a structured PoCUS pathway for Belgian anaesthesia residents[1]. This article defines in detail a pathway towards obtaining competency in airway ultrasound, lung ultrasound, gastric ultrasound, hemodynamic volume assessment, basic transthoracic and transesophageal echocardiography. An updated overview of the international literature on the education of perioperative PoCUS serves as a scientific backbone.

Keywords: **Ultrasound, point-of-care, residency, education, curriculum, anaesthesia.**

Introduction

Point-of-care ultrasound (PoCUS) is a new clinical diagnostic paradigm considered to be the 21st century extension of the physical exam[2]. In 2020, four of the authors of the following manuscript published an article in the Acta Anesthesiologica Belgica on the integration of PoCUS into residency and clinical practice[1]. It examined relevant PoCUS applications for the anaesthesiologist, presented an overview of existing international guidelines for education and training and reflected on the need for specialty-wide standards. It also proposed a framework towards a structured PoCUS pathway for anaesthesia residents that could adapted for incorporation into national anaesthesia practice. The authors also concluded there were few approved didactic requirements or guidelines to incorporate such curriculum and that no general consensus existed on what constitutes perioperative PoCUS education, although many referred authors recognized the benefit of POCUS and supported the development of international standards.

The purpose of this follow-up article is to define in detail a national Belgian pathway towards obtaining certification in perioperative PoCUS. An updated overview of the international literature on the education of perioperative PoCUS serves as a scientific backbone.

Updated existing guidelines for PoCUS education and training

A PubMed search was performed in May 2022 using the mesh words "point of care ultrasound" and "curriculum". Exclusion criteria were languages other than English and articles that focused on pediatric patients. The search period was limited to the period between May 2019 which was the concluding search date of the original 2020 publication and May 2022. Ninety-eight articles were retained of which 15 were eliminated based on the title. Of the 83 remaining articles, 21 focused on critical care and the emergency setting, 42 were specific for POCUS education during medical training and 7 focused on the radiological,

palliative and other surgical disciplines. Thirteen publications specifically related to anaesthesia. Four recent (4/13) publications were of high interest to the purpose of this article since they specifically address its purpose[3-8].

1. The American Society of Anesthesiology (ASA) Ad Hoc committee on PoCUS recently provided recommendations on this topic and introduced a diagnostic POCUS certification with three primary applications (cardiac, lung, and abdominal ultrasound) and six secondary applications (airway, musculoskeletal/soft tissue, ocular, renal/genitourinary, transcranial Doppler, and deep venous thrombosis)[3-5]. It is a five part-program: performance improvement (action plan), evidence of prior diagnostic PoCUS training via certificates, image interpretation training through online case-based modules, image acquisition training via a portfolio of performed PoCUS studies with the use of a local mentor or ASA faculty and a final exam.

2. The perioperative section of the Canadian Anesthesiologists' Society published a consensus statement of Canadian academic centres on the recommendations for training and performance in basic perioperative PoCUS[6]. It is a document with 56 statements that defines the scope, practice and training requirements for perioperative PoCUS. They describe a national standard on which curricula may be further developed. Basic PoCUS training should include introductory training, portfolio completion, competency assessment and quality assurance.

3. The American Society of Regional Anesthesia and Pain Medicine (ASRA) published a two-part series with expert panel indications, recommendations on PoCUS education and training directed at regional anaesthesiologists and pain physicians[7,8]. The second part of the series by Haskins et al. presents learning goals and objectives for achieving competency in the use of PoCUS for airway, lung, gastric, cardiac and trauma, all based on the Indication, Acquisition, Interpretation, Medical decision-making framework (I-AIM)[8]. The authors also discuss barriers to education and offer a list of educational resources.

Our literature search learned that though until recently individual specialties had their own guidelines and single PoCUS applications were sustained by international recommendations, none fully described the integrated use of perioperative PoCUS application[6]. However, significant progress concerning training and certification in PoCUS has been made the last two years, especially in North America.

Mandatory PoCUS applications

In line with international programs, we believe the main PoCUS applications taught to residents should include: (1) airway, (2) lung, (3) hemodynamic volume assessment, (4) heart, (5) abdomen. The applications are divided into basic/advanced and diagnostic/therapeutic applications. Every resident must be able to perform these basic skills to obtain the certificate of competence. A detailed list of the skills per application can be found in Table I.

An essential element of the perioperative PoCUS definition is that the ultrasound exam answers a well-defined clinical diagnostic question: does the patient have a pneumothorax, is there a pericardial tamponade present, is the patient fasted or not? This question is answered in a binary fashion, being yes/no or present/absent and must lead to a change in management. We chose to adhere to the true definition of perioperative PoCUS and therefore excluded ultrasound-guided locoregional blocks and vascular access. The focused assessment with sonography in trauma (commonly abbreviated as FAST) forms strictly speaking no part of the perioperative event. Yet the anaesthesiology resident will encounter this examination frequently during the obligatory emergency department rotation and it is therefore included.

A structured pathway for Belgian anaesthesia residents

The goal of implementing a national curriculum for perioperative point-of-care ultrasound is to allow consistent and qualitative training for Belgian anaesthesiologists in this increasingly impactful skill. The first goal is to implement this curriculum in the actual resident training program. Once this has been established, anaesthesia consultants must also be able to join the program and get certification.

The pathway (Table II) we propose consists of 4 steps: *1.* introduction to PoCUS, *2.* obtaining clinical competence, *3.* building a portfolio, *4.* assessment of competency. Recertification is a fifth step that needs further defining in the nearby future. The philosophy of the abovementioned I-AIM framework is followed throughout the entire curriculum, e.g. the e-learning material, face-to-face "masterclass" and mannequin-based basic skills teaching[9]. This framework is already clinically applied for FAST, gastric and lung ultrasound[9-11]. Recently published expert panel recommendations by the ASRA have also provided examples of I-AIM frameworks that could be utilized for airway, lung, and gastric ultrasound, as well as FAST and FoCUS[8].

Table I. — Skills per PoCUS application.

	Acquisition	Interpretation
US Modality		
GENERAL	ergonomics	limitations
	probe selection (frequency)	risks
	image generation	difficulties
	image optimisation	problem-solving
TTE	parasternal short axis	LV (RV) size, systolic function, shape of interventricular septum, LV hypertrophy
	parasternal long axis	LV size and systolic function, mitral and aortic valve assessment, left atrial size
	subcostal 4 chamber	pericardial fluid and/or tamponade, LV (RV) size and function, MV/TV assessment
	apical 4 chamber	LV and RV size and function, major valvular problems, atrial size
	subcostal inferior vena cava long axis	size and respiratory variation of IVC diameter
TEE	4 chamber view	LV size, systolic function, hypertrophy
	transgastric short axis	RV size, systolic function
	midesophageal long axis view	pericardial tamponade
		major valvular problems
		aorta ascendens/descendens
LUNG	identify lungs	pneumothorax
	identify pleura	interstitial syndrome
	identify ribs	pleural effusion
	identify diaphragm	paralysis diaphragm
AIRWAY	identify cricothyroid membrane	oesophageal intubation
	identify cricoid, thyroid cartilage	oro/nasogastric tube placement
	identify tracheal rings	
	identify esophagus	
GASTRIC	identify antrum	identify stomach at-risk for aspiration
	identify different gastric contents	
	estimate total gastric fluid volume	
VOLUME ASSESSMENT	identify IVC and liver	size and respiratory-induced variation (collapsibility) of IVC diameter
	identify transition IVC - right atrium	estimation of central venous pressure
	differentiate between IVC and aorta	

IVC: inferior vena cava; RV: right ventricle; LV: left ventricle; MV: mitral valve; TV: tricuspid valve.

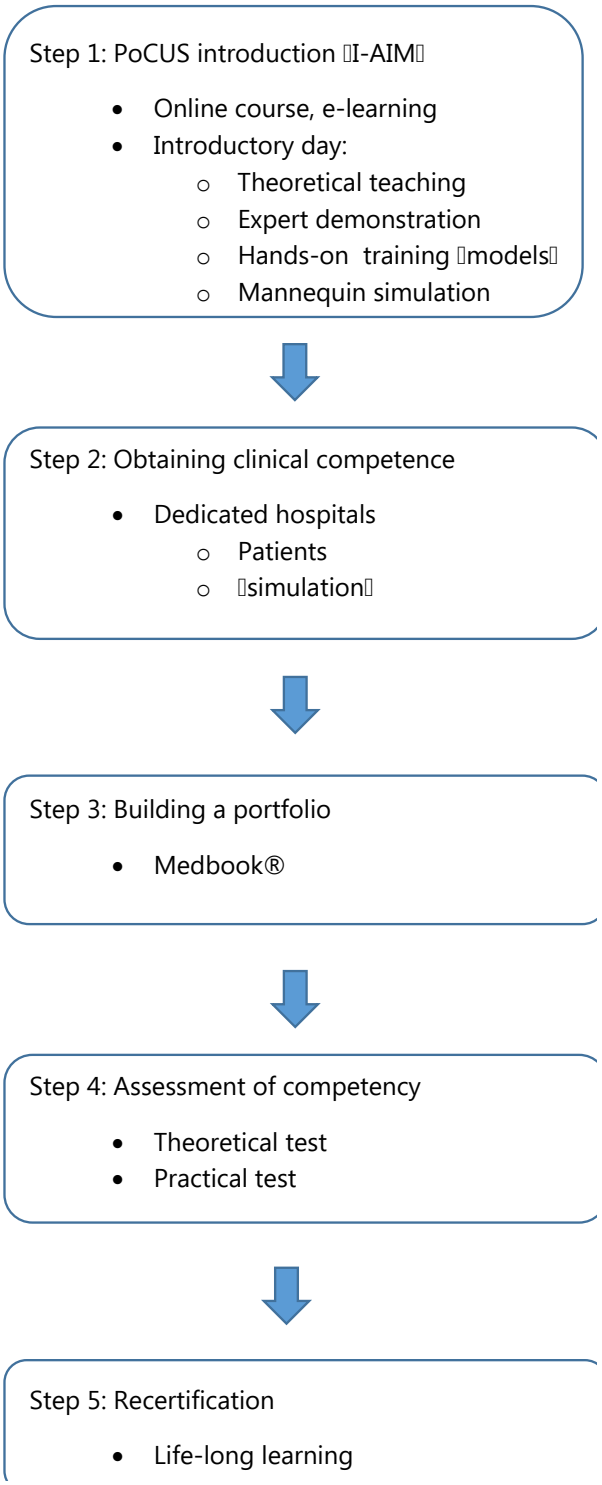
Step 1: Introduction to PoCUS

• This part includes prerecorded theoretical modules, real-life lectures and suggested reading material. The prerecorded modules must be followed before attending the hands-on training and simulation days. Such prerecorded modules have already been made available for gastric ultrasound, transthoracic echocardiography and lung ultrasound for this part of the program (https://www.pocus.education). Modules for basic TEE and airway are under construction. The modules would be made available for every hospital that participates in any part of the official training (step 2). The real-life lectures are presented during the introductory days.

• Hands-on training consists of a whole day of practice on live models. A maximum of 4 attendees per station is strictly maintained.

• Ideally, centres that offer the first step of training have a simulation mannequin at their disposal. This allows time-efficient, focused, uninterrupted, and safe learning, without the impact of interference on clinical practice nor

Table II. — PoCUS certification pathway.



subjecting patients to possible harm. The ASRA recommendations state that ultrasound simulators are potentially useful to teach image interpretation skills especially when pathology is involved but not to teach image acquisition[8]. Experience however, has taught us that both in lung ultrasound, TTE and more especially basic TEE training, the presence of a mannequin simulator is very useful. The combination of scanning on simulator, models and real patients during the hands-on practice day is experienced as very satisfactory by both students and teachers in a post-course questionnaire. Gastric PoCUS is an exception to the rule since every sonographic presentation (empty, clear fluid, solid content) can be safely demonstrated in healthy models. Additionally, contrary to all other perioperative applications, reproduction of its technical and anatomical subtleties is difficult to reproduce technically with simulation and turning a heavy mannequin into the right lateral decubitus which is a prerequisite for correct scanning of the stomach is very difficult[7,8].

- Scanning on real patients in e.g., the intensive care station can also be considered.
- A theoretical test after step 1 must be completed before advancing to step 2.
- The accredited locations where residents can follow the step 1 introduction day will be made available.

Step 2: Obtaining clinical competence

- How to obtain clinical competency is poorly defined. The definition of clinical competency is in fact the ability to perform a clinical task adequately or in other words to be capable to meet the demands. This definition does not fulfill the expectations of many trainees.
- While image interpretation can be taught on simulation mannequins, image acquisition is preferably taught during hands-on sessions on live models or patients, and the introduction to clinical practice should ideally occur in a dedicated POCUS facility guided by a 'certified' expert. Apprentices can devote time to individualized clinical case-based learning and acquire the minimal requirements for their POCUS skills. These requirements should be assessed and supervised by a 'certified' expert at the bedside of the patient. A full range of pathology can be interpreted.
- The list of accredited locations that offer PoCUS teaching facilities, responsible representative(s) and available PoCUS skills will be made available.

Step 3: Building a portfolio

- We propose students should register every executed PoCUS scan in a logbook and build a portfolio. This can be done in Medbook® and the necessary adaptations should be made in the Medbook® software to allow this. The evaluation of the cases, e.g., correct image acquisition and interpretation, must be assessed by the local expert.
- The number of cases necessary to achieve competency in each specific domain, is displayed in Table III. These numbers are based on the best current evidence available[6,8]. Both the ASRA

Table III. — minimal number of cases required to obtain competency.

	Ultrasound modality	Basic TTE	Basic TEE	Lung	Gastric	Airway	FAST	Volume assessment
Acquisition	Minimal number of cases performed in person, and supervised	20	20	15	30	5	20	10
Interpretation	Minimal number of cases interpreted, not necessarily performed in person	20	20	10	20	5	20	10
Total number		40	40	25	50	10	40	20

FAST: focused assessment with sonography in trauma.

expert panel, the ASA Ad hoc Committee and the Canadian anaesthesiology academic centres provided recent recommendations on the minimum number of exams that need to be performed under direct supervision by the learner. The American requirements appear to be stricter than the Canadian numbers and also make a difference between exams performed under direct supervision (image acquisition) and exams interpreted but not necessarily performed (image interpretation). The numbers we propose are based on these documents and assume that the trainee has very limited experience with point-of-care ultrasound and that local experts are available during the portfolio building phase.

- A list of accredited hospitals where residents know they can build a PoCUS portfolio will be made available.

Step 4: Assessment of competency

This should consist of a theoretical exam (multiple-choice questions), which encompasses all aspects of POCUS and is based on the I-AIM framework, and a practical (simulation-based) test.

Step 5: Recertification

This is not common in Belgium but in line with individual (e.g., the TEE recertification by the European Association of Cardiovascular and Thoracic Anesthesiologists) and hospital-oriented recertification pathways (e.g., Joint Commission International) and our opinion is that this should be a requisite on the longer term. ("life-long learning").

Anaesthesiologists will be deemed qualified in a specific POCUS modality if they have completed supervised training (as established by a written endorsement by a certified expert in this field), have a logbook of the required number of cases, and have passed the theoretical and simulation-based exam. The complete certification process, including a final exam and test, is the best way to ensure that those using the technology have the cognitive competency and the clinical skills to perform PoCUS.

The propositions made in this manuscript were also sent to the Belgian Society of Anesthesiology, Resuscitation, Perioperative Medicine and Pain Management (BeSARPP).

Limitations

- 'Certified' instructors: there are currently not only in Belgium but also internationally limitations to the amount of available local experts in PoCUS. The question is what defines someone as a skilled PoCUS instructor. Usually this is a self-proclaimed proficiency based on experience, self-study via PoCUS courses, textbooks and publications and research. The ASA Ad Hoc committee acknowledges it is possible for physicians to develop PoCUS competence through these routes[5]. We suggest in concordance with the ASRA recommendations that participating hospitals designate a curriculum leader who will engage core faculty[8]. This can include not only anaesthesiologists but also cardiologists, radiologists, emergency or intensive care physicians. In accordance with the ASA Ad Hoc committee, we suggest that proof of teaching competence of local trainers should be obtained through 'peer attestation'.
- Time and money: it is clear that setting up a program, whether this consists of organising workshops, buying ultrasound equipment such as a curved low-frequency abdominal probe for gastric PoCUS or extra (handheld) ultrasound machines or the purchase of a high-end simulator, requires money and dedicated time both for instructors and residents. Both factors are seen as the major obstruction to educational efforts[12,13]. It is therefore crucial that hospitals or departments consider collaboration both in terms of faculty and equipment. For example, high-end simulators that can be used hospital-wide between departments such as cardiology, anaesthesiology and the emergency department.
- To create a nationwide program, we believe it is crucial that all teachers, trainers, hospitals

involved in the development of a PoCUS curriculum collaborate very closely through all steps and join efforts to connect and to match programs.

To meet the practical implications of setting up a PoCUS program, we also used the experience gained in setting-up and executing the introductory course that is organized by the Department of Anaesthesiology of the Imeldaziekenhuis Bonheiden (https://www.pocus.education/) and that is part of the postgraduate training of the anaesthesia resident education of a major university. The attendants follow a consecutive didactical set-up with pre-course online tutorials, a full training day with short lectures and intense scanning on models, a simulation mannequin (CAE Vimedix, CAE Healthcare) and real patients in small groups of maximal 3 attendees. Taught at the course are basic TTE and TEE, lung and gastric ultrasound and hemodynamic volume assessment.

Conclusion

Point-of-Care Ultrasound education is crucial in the evolving anaesthesiologist's role towards a perioperative physician. This article defines a national standard for official certification in perioperative PoCUS (airway ultrasound, lung ultrasound, gastric ultrasound, basic transthoracic and transoesophageal echocardiography). An updated overview of the international literature on the education of perioperative PoCUS serves as a scientific backbone.

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