

EDITORIAL VIEW

PERIOPERATIVE MEDICINE

POCUS: the anesthetist's emerging stethoscope

Leena Ayub¹, Shahid Rasool Dar², Waqas Ashraf Chaudhary³

Author affiliation:

1. Leena Ayub, Professor & HoD, Department of Anesthesiology, Pain Management & Intensive Care, Lahore Medical & Dental College / Ghurki Trust Teaching Hospital, Lahore, Pakistan; E-mail: leenayub@gmail.com
2. Shahid Rasool Dar, Assistant Professor, Department of Anesthesiology, Pain Management & Intensive Care, Lahore Medical & Dental College / Ghurki Trust Teaching Hospital, Lahore, Pakistan; E-mail: idrdr@gmail.com
3. Waqas Ashraf, MD, MSc (Pain Management); Consultant Pain Medicine, Department of Anesthesiology, Pain Management & Intensive Care, Lahore Medical & Dental College / Ghurki Trust Teaching Hospital, Lahore, Pakistan; E-mail: waqas.alrai@gmail.com

Correspondence: Professor Leena Ayub, E-mail: leenayub@gmail.com; Phone: +92 321 8423597

Summary: The development of clinical ultrasound was perhaps the greatest revolution in the medical profession during the last half century. The rapid evolution allowed novel uses of US in almost every field of medical practice. Its best use, probably has been in the hands of the anesthetists, who employ it in the operating room, in the pain clinic as well as in the emergency room and in the intensive care units. *Apicare Journal* has strived to introduce this novel modality in this part of the world by editorials and research papers. This invited editorial has been written by one of the best US and POCUS teams in Pakistan, at Ghurki Trust Teaching Hospital, Lahore, Pakistan. It offers a brief introduction to some of the countless options in which it can be used. The authors stress on the availability of US facility and the training to all clinicians.

Key words: POCUS (Point of Care Ultrasound); FAST Scan; eFAST Scan; Pain; Pain Management; Anesthetist; Stethoscope; Gastroparesis; Airway

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Ultrasound is a bedside non-irradiating tool and is now easily available in hand-held devices; it allows integrative head-to-toe clinical assessment as well as guidance for invasive procedures. For these reasons, ultrasound has become ever more and more used tool in the hands of the anesthesia and critical care physicians.¹ Ultrasound skills of the anesthesiologists and the intensivists started with intraoperative transesophageal echocardiography,² but rapidly spread to vascular access and regional anesthesia. In critical care, the last few decades showed an increased use in point-of-care ultrasound (POCUS) for hemodynamic, respiratory and neurologic assessment. POCUS has also become helpful for assessing trauma patients, making a differential diagnosis in acute respiratory failure, redirecting treatment and replacing traditional imaging.

POCUS has been claimed to be the stethoscope and scalpel of future; hence mandatory to learn and acquire expertise of this modality at all levels of medical teachings, especially by the anesthetists. It guides you towards spot diagnosis and safety as innumerable studies have revealed that POCUS improves diagnosis and procedural safety. In the perioperative zones, we can easily calculate the volume of stomach contents, which

helps us in the condition like emergency surgery and gastroparesis etc. Moreover, I/V line placement has now become possible³ without multiple pricks. Accidental esophageal intubation has been one of the nightmares for any anesthetist, which can now be effectively and quickly identified and taken care of. If a patient land into hemodynamic instability, cardiac status can be assessed with US, and it will also help in identification and treatment of the different causes like valvular heart disease, valvular function, volume status and cardiac ischemic. Early detection of acute ischemia is possible even when ECG shows no changes.⁴ A life threatening condition, e.g., pneumothorax, is immediately diagnosed especially during intraoperative period. During emergency and trauma POCUS can be used as Focused Assessment with Sonography in Trauma (FAST) and Extended Focused Assessment with Sonography in Trauma (E-FAST) scan. It is one of the easy and non-invasive method to measure the intra cranial pressure. Last but not the least, it is very helpful in the regional nerve blocks for intra as well as postoperative pain relief.

Being an anesthetist, quick identification and prompt management of a rapidly deteriorating life-threatening complication is our goal; and POCUS will be at our

service if we know how and when to use it effectively. Without relying or shifting the patient to some

Table 1: POCUS in anesthesia care

Diagnostic	Interventional
Airway Lungs Abdominal Assesments	Regional & Neuroaxial Nerve Blocks
(TTE) Transthoracic Echocardiography	Central & Peripheral Vascular Access
Transesophageal (TEE) Echocardiograph	Arterial Access
Definitive Airway Management	Acute & Chronic Pain Management Interventional Procedures
Bladder Scan	Urgent cardiac tempnade decompression
Skull and joint scan for hematoma diagnosis	Needle decompression for Pneumothorax

investigation booth, which could be hazardous, life threatening and logistically impossible most of the time particularly in emergency rooms, POCUS can help us identify and manage some of the threats to the life of the

POCUS is defined as ultrasonography transported to the patient and performed by provider in real time. It allows to compare real time images with signs and symptoms of the patient. It is safe, and cost effective; prompt diagnosis (superior diagnostic sensitivity) is its hallmark. POCUS has a head-to-toe application in diagnosing condition such as acute abdomen, cardiopulmonary function, musculoskeletal, vascular pathologies and inflammatory and infectious conditions. It also helps in therapeutic interventions such as difficult spinal, regional blocks, CVP and difficult vascular access. patient.

POCUS will soon be the future of perioperative care.⁵ It will be an integral part of physical examination in pre-op assessment, important monitoring tool intra and post-operative period. Soon hand-held portable ultrasound probes rather than the stethoscopes will be the norm for the anesthesiologists and emergency physicians.

Difficult airway especially in airway surgery, previous radiation therapy, obese patient, vocal cord palsy and other pathologies, ETT placement and confirmation, assessment of ETT depth and one lung ventilation confirmation can easily be done using POCUS.

USG probe is the 6th sense for the anesthetist in the situation where no capnography is available, low end-tidal CO₂ i.e cardiac arrest, etc. It can readily be used to identify the cricothyroid membrane for emergency airways. In these conditions POCUS achieves higher success rate than the traditional palpation method.

POCUS helps in real time bedside identification of root cause of hemodynamic unstable patients like valvular diseases, ventricular function, volume status and cardiac ischemia. It is more sensitive than ECG in diagnosis of acute ischemia leading to hypotension, ventricle wall hypokinesia and akinesia validating ischemia. Presence of cardiac POCUS specialist can have better outcome of tertiary care operating rooms, and POCUS has outperformed physical examination by the cardiologist and perioperative physician. Different cardiac POCUS views are;

- The parasternal long axis view (PLAX) for ejection fraction and ventricular size, aortic stenosis, hypertrophic obstructive cardiomyopathy (HOCM), CCF,
- The parasternal short-axis view (PSAX) for volume status, RV overload and coronary ischemia.
- Apical 4 chamber view for pericardial effusion, RV tricuspid valve.

Patients' volume status can be assessed by visualizing inferior vena cava (IVC) diameter and collapsibility.

POCUS is helpful in diagnosis of the causes of hypoxia i.e. pleural effusion, pneumothorax, pulmonary edema, atelectasis etc.; and is equal in sensitivity and specificity to chest X-ray and CT chest. Most common intraoperative application is diagnosis of pneumothorax which may be due to CVP line insertion, chest trauma, unilateral breath sounds etc. What we will see on pulmonary POCUS in pneumothorax; absence of lung sliding on effected side, which appears to be as 'Barcode Sign'. Other cause of absence lung sliding is endobronchial intubation, breath holding and pleural adhesion. Moreover, POCUS is also helpful in pulmonary effusion and thoracentesis.

POCUS helps us to assess volume and content (solid liquid, empty); hence fast and easy way to evaluate and mitigate aspiration Risk which is 9% cause of anesthesia related deaths. Gastric POCUS come where fasting guidelines fails i.e. Emergency Cases, altered GCS patients, Gastroparesis and Diabetes Mellitus, as POCUS measures cross sectional area of gastric antrum hence measuring gastric volume.

Vascular access is a benchmark for anesthesiologist, i.e. insertion of I/V lines, CVP lines, arterial lines and PICC lines.⁶ POCUS is helpful in difficult situations such as morbidly obese, babies, chronic medical conditions and

i/v drug abusers. One must know the difference b/w arterial and venous sono-anatomy especially when scanning deep veins. Compressibility and the flow appearance on the color doppler are the hallmarks. POCUS also facilitates in diagnosis of DVT.

POCUS is highly effective and facilitates regional peripheral nerve blocks. It reduces the complication rate, the dose to be used, the rate of arterial punctures, and nerve injuries. It also helps in difficult neuraxial blocks in difficult scenarios such as scoliosis and obese patients or even at the remote places.

It can be used for ICP assessment by optic nerve diameter in eclampsia, head trauma and in neurology patients.

Newer handheld devices have rapidly emerged as a vital diagnostic and therapeutic aid, and the clinicians have readily adopted these. Currently POCUS devices range from hand-held devices that connect to phone and tablet or laptop screen to save and manipulation of images. As the size of these devices is gradually reduced, and their functions improved, these are going to replace the stethoscope as every doctor's toy.

POCUS is not without limitations. Misdiagnosis can occur in even an experienced hand. Image recording, documentation, secondary review and timely expert feedback might prevent the pitfalls.

POCUS is a powerful tool of anesthesiologists in perioperative care for timely diagnosis and management. It is safe and relatively inexpensive. POCUS must be included in the postgraduate training of residents, especially in the specialties of anesthesiology, pain management, intensive care, emergency medicine, general medicine, surgery and many others. We must remove barriers and facilitate POCUS learning and interdepartmental harmony for better and prompt management of patient. Major barriers are lack of prioritization at the administrative end, relative resource scarcity, lack of training, biased outlook by the seniors and a long learning curve. Ultrasound machines must be made available in operating rooms, pre- and post-operative bays, emergency rooms and intensive care units. With advent of POCUS; quick effective medical intervention is made possible by decreasing the load on

laboratories, radiological suits and ERs in particular. Such interventions result in shortening of hospital stay and which would ultimately impact on the national economy as well.

Conflict of interest

None declared by the authors.

Author contribution

All authors took part in the literature search and manuscript writing, editing and final approval.

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