Introduction:

Introduction of portable USG has been a paradigm shift not only in performing nerve block anesthesia in various regional anesthesia techniques but also a promising diagnosing and treating tool for critically ill patients in ICU.

Previously we are doing all invasive procedures in Operating room and ICU by BLIND anatomical landmark technique. Sometimes these blind invasive procedures are difficult because of abnormal anatomy [1,2] or accumulation of excessive fat and connective tissue (particularly true in today's world) and sometimes inciting complications and subsequently increasing morbidity to the patients.

Gone are the days of those BLIND invasive procedures. Today we scan the desired landmark area by USG and able to do the invasive procedures under real time imaging and thus increasing the safety and success rates of all invasive procedures.

Happy to share you all that WE as rural practitioner in Sibsagar,Assam slowly replacing our BLIND invasive procedures by USG and at the same time WE are trying our best to scan every patients in ICU and thereby increasing the patient care of critically ill patients.

WHY ULTRASOUND IS A MUST FOR ANAESTHETIST AND ICU PHYSICIAN?

- Real time imaging of nerve and vessels.
- Direct clinical correlation to the signs and symptoms of the patients.
- Easily repeatable in critically ill patients in bedside if patient condition deteriorates.

REGIONAL ANAESTHESIA (RA)

We all know the advantages of regional anaesthesia over general anaesthesia in day-to-day surgery. In regional anaesthesia technique we numb the operating area only and thus decreasing the side effects of General anaesthetics. Patients are awake during the surgery where it becomes easier to monitor patients and vital parameters. It is no doubt that RA has tremendous safety margins if performed meticulously.

Regional anaesthesia technique may be central neuraxial block (CNB) like spinal and epidural or peripheral nerve block (PNB) like brachial plexus block where the operating area will be numbed or anaesthetized.

Initially PNB were performed by BLIND anatomical technique. Then there was a surge of using peripheral nerve stimulator (PNS) to locate the nerves.

But now Ultrasound guidance is rapidly becoming the gold standard for regional anaesthesia. There is lots of evidence of benefits of ultrasound over nerve stimulation and blind loss of resistance technique. Most importantly USG is increasing the success rates tremendously.

Advantages of USG in Regional anaesthesia:

- Direct observation of nerves [3,4] and surrounding structures [5]
- Direct observation of LA deposition and spread [6]
- Decrease in complications [4,5,6]
- Faster onset of nerve block [7]
- Improve in block quality [8,9]
- Reduction of total dose of LA [8,9]
- Identification of interspinous space for spinal and epidural anaesthesia [10-14].

CRITICAL CARE MEDICINE AND ICU:

Interest in USG is gaining popularity and now no ICU can think of without a portable USG.***The Royal College of Radiologists published 'Ultrasound training recommendations for medical and surgical specialties' [15].*** This publication describes the guidelines how to give USG training for non-radiologists. *One thing I want declare here that we are not going to replace radiologists in future.*

The College of emergency medicine using these guidelines is developing their own curriculum and now USG training is part of the core curriculum for all Emergency Medicine Trainees. The Association of Anaesthetist of Great Britain & Ireland, the Royal College of Anaesthetist, and the Intensive Care Society in November 2010[16] described USG training as inevitable in anaesthesia curriculum.

WE in Sibsagar believe in EMPOWERMENT of patients and patients' relatives by showing them the LIVE USG pictures of their loved one, at the same time WE compare and show relatives' LIVE pictures with their patients. This protocol not only increased our point of care services BUT also increasing the BONDING between health care workers and relatives.

Thus USG helped us in INVOLVING patients' relatives in patient care.

Thoracic USG

Old belief was that air is not a good transducer of sound waves; therefore USG of the normal aerated lung gives an image distorted by arti-facts. Recent research demonstrating that presence or absence of these artifacts may correlate pathology of lung.

X ray chest sometimes miss a pleural effusion or sometimes misdiagnosing as consolidation. USG assessment of a pleural effusion can easily reveal a characteristic echo-free space between visceral and parietal layers.

Similarly pneumothorax in a supine critically ill patients or ventilated patients may be difficult to identify with conventional supine chest x-ray, as in supine patients air lies anteriorly and it is very difficult to see [17]. Diagnosis of pneumo- thorax on USG is made when normal lung artifacts are absent and the normal movement of the visceral pleura with respiration is lost.

Focused echocardiography

Focused echocardiographic examination is significantly shorter in duration than traditional echocardiography. The goal is to supplement the physical examination in critically ill patients, which is increasing the definitive diagnosis and prompt management [18]. However we the practicing ICU physicians are not trained for detailed valvular function and great vessels. ***Our aim is to diagnose and treat effectively yet promptly in a rapidly deteriorating patient in ICU.***

When a healthy human being breathes spontaneously, because of negative intrathoracic pressure venous return to the heart increases and there is collapse of Inferior Vena Cava (IVC) diameter more than 50%. This cyclic change in the vena cava diameter will lost when vessel is dilated, like in cardiac tamponade, pulmonary embolism, and severe right heart failure. But in ventilated patients the cycle changes, because we are providing positive pressure during inspiration causing increase in diameter of IVC.This cyclic respiratory changes in IVC diameter during mechanical ventilation can be seen only with normal or low volume status.

Thus USG of IVC can be used as a noninvasive tool to evaluate the volume loading of the patient. It guides us whether patient is fluid responsive or not? Gone are the days ***of INVASIVE central venous pressure monitoring system. In today's world of Medicine look for the collapsibility of IVC, If collapsible, means we can load more fluid, if not STOP further fluid therapy.*** This ultimately prevents the fluid overloaded state in

critically ill patients.

FAST scan [19]

Focused assessment with Sonography for trauma scan (FAST scan).

We usually get some patients with blunt abdominal trauma with unstable hemodynamics with sinus tachycardia and hypotension and sometimes unresponsive to volume therapy. We have also unfortunately witnessed patients with history of blunt abdominal trauma and dying in front of us because we donot have access to bedside USG to evaluate the abdominal organs injury. Bedside prompt scan of the abdomen almost always rules out the any abdominal organ injury.

FAST scan was developed to aid in the diagnosis of blood or free fluid in abdomen in patients who had suffered blunt abdominal trauma in unstable patients, which guides for therapeutic laparotomies.

Gone are days when surgeon or critical care physician performing 'needle puncture test' in the abdomen to observe and monitor the collected blood or fluid to guide for therapeutic laparotomies, which may be dangerous sometimes. 'Needle puncture test' most of the time gives negative results as blood or bleeding may be inside the liver capsule or bleeding may be in the retroperitoneal structure causing very unstable hemodynamics.

Abdominal aorta

Abdominal aortic aneurysms (AAAs) can present with variety of symptoms like back pain, flank pain, ureteric colic, syncope, abdominal pain, and gastrointestinal bleeding. ***In such symptoms one should not be adamant with his diagnosis. Take the help of USG and look and rule out AAA.***

Deep venous thrombosis (DVT)

Bedside USG of the lower extremity venous system can detect early DVT and subsequently prevent pulmonary embolism.

Ocular [20]

USG is used to measure the optic nerve sheath diameter. From the optic sheath diameter

we can monitor raised intracranial pressure (ICP), which may be reflected through the nerve sheath as in papilledema. ***It has become the great and yet predictive noninvasive tool to monitor the raised ICP in recent days.***

Vascular access

Now a days USG is widely used for central venous cannulation (CVC). We scan the area and in real time imaging insert the needle under direct vision, thus reducing the unwanted complications of CVC.It can also be used for peripheral venous canulation in obese people where accessibility to venous system is poor.

These are some current uses of USG in Anaesthesia and critical care medicine.Now a days USG has been using widely in every aspect of medicine for safe patients care.In this small writings it is very difficult to describe all usages of USG by nonradiologists in patient care.I am just highlighting the importance of USG in point of care [21]and in regional anaesthesia.

C. USE OF USG IN FUTURE MEDICAL PRACTICE

In 2004 the American Institute of Ultrasound in Medicine(AIUM)[22] concluded "the concept of 'Ultrasound Stethoscope' is rapidly moving from the theoretical to reality".***Some Medical schools are now beginning to provide their students with hand held ultrasound equipment during clinical rotations.***

Figure: Newer Echo machines: can be used as STETHOSCOPE in the rounds.

CONCLUSION:

USG is going to be a part and parcel tool for Anaesthesiologist and critical care physician ***if we successfully overcome the cost factor and PCPNDT (Pre conception and Pre Natal Diagnostic techniques) act***. Because these two branch most of time performs blind invasive procedures in patient management. Its widespread use will increase the safety margin and success rates in various invasive procedures. Same time we have to remember that ***a fool with a tool is a biggest fool.*** So we have to develop a structured programme so that we can train future generations and ourselves properly in greater interest of society and safe patient care.

REFERENCES:

1. Wedel DJ. Ultrasonographic findings of the axillary part of the brachial plexus. Regional Anesthesia and Pain Medicine 2001; 92: 1271–5.
2. Perlas A, Niazi A, McCartney C, Chan V, Xu D, Abbas S. The sensitivity of motor response to nerve stimulation and paresthesia for nerve localization as evaluated by ultrasound. Regional Anesthesia and Pain Medicine 2006; 31: 445–50.
3. Greher M, Retzl G, Niel P, Kamholz L, Marhofer P, Kapral S. Ultrasonographic assessment of topographic anatomy in vol- unteers suggest a modification of the infraclavicular vertical brachial block. British Journal of Anaesthesia 2002; 88: 632–6.
4. Marhofer P, Schrogendorfer K, Koinig H, Kapral S, Weinstabl C, Mayer N. Ultrasonographic guidance im- proves sensory block and onset time of three-in-one blocks. Anesthesia & Analgesia 1997; 85: 854–7.
5. Retzl G, Kapral S, Greher M, Mauritz W. Ultrasonographic findings of the axillary part of the brachial plexus. Anesthesia & Analgesia 2001; 92: 1271–5.
6. Sandhu NS, Capal LM. Ultrasound-guided infraclavicular brachial plexus block. British Journal of Anaesthesia 2002; 89: 254–9.
7. Marhofer P, Schrogendorfer K, Wallner T, Koinig H, Mayer N, Kapral S. Ultrasonographic guidance reduces the amount of local anesthetic for 3-in-1 blocks. Regional Anesthesia and Pain Medicine 1998; 23: 584–8.
8. Kapral S, Greher M, Huber G, et al. Ultrasonographic guidance improves the success rate of interscalene brachial plexus blockade. Regional Anesthesia and Pain Medicine 2008; 33: 195–8.
9. Perlas A, Brull R, Chan VW, CMcCartney CJ, Nuica A, Abbas S. Ultrasound guidance improves the success of sciatic nerve block at the popliteal fossa. Regional Anesthesia and Pain Medicine 2008; 33: 259–65.
10. Arzola C, Davies S, Rofaeel A, Carvalho JCA. Ultrasound using the transverse approach

to the lumbar spine provides reliable landmarks for labor epidurals. Anesthesia & Analgesia 2007; 104: 1188–92.
11. Rapp HJ, Grau T. Ultrasound imaging in pediatric regional anesthesia. Canadian Journal of Anesthesia 2004; 51: 277–8.
12. Grau T, Leipold RW, Horter J, Conradi R, Martin E, Motsch J. The lumbar epidural space in pregnancy: visuali- zation by ultrasonography. British Journal of Anaesthesia 2001; 86: 798–804.
13. Furness G, Reilly MP, Kuchi S. An evaluation of ultrasound imaging for identification of lumbar intervertebral level. Anaesthesia 2002; 57: 277–80.
14. Prasad GA, Tumber PS, Lupu CM. Ultrasound guided spinal anesthesia. Canadian Journal of Anesthsia 2008; 55: 277– 80.
15. Board of the Faculty of Clinical Radiology. Ultrasound Training Recommendations for Medical and Surgical Specialities. London: Royal College of Radiologists, 2004
16. Joint working party of the Association of Anaesthetists of Great Britain & Ireland, the Royal College of Anaesthetists and the Intensive Care Society. Ultrasound in Anaesthesia and Intensive Care: A Guide to Training. London: The Association of Anaesthetists of Great Britain & Ireland, The Royal College of Anaesthetists, and The Intensive Care Society, 2010
17. Noble V, Nelson B, Sutingco AN. Manual of Emergency and Critical Care Ultrasound. New York, NY: Cambridge University Press, 2007
18. Beaulieu Y. Specific skill set and goals of focused echocardiography for critical care clinicians. Crit Care Med 2007; 35: S144 – 9
19. Rippey JCR, Royse AG. Ultrasound in trauma. Best Pract Res Clin Anaesthesiol 2009; 23: 343–62
20. Blaivas M, Theodoro D, Sierzenski PR. Elevated intracranial pressure detected by bedside emergency ultrasonography of the optic nerve sheath. Acad Emerg Med 2003; 10: 376–81
21. Moore CL, Copel JA. Point-of-care ultrasonography. *N Engl J Med* 2011; 364:749–757.
22. Greenbaum LD, Benson CB, Nelson LH, Bahner DP, Spitz JL, Platt LD. Proceedings of the Compact Ultrasound Conference sponsored by the American Institute of Ultrasound in Medicine. *J Ultrasound Med* 2004; 23:1249–1254.

Author:

Dr. Surajit Giri

Author

- CCEM Journal

View all posts