Point of care ultrasound – save time, save lives

Annual Update in Emergency Medicine, February 2012, Whistler, B.C.

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Description:

The utility of point of care ultrasound has been well established in the emergency department setting. Although the published studies often show impressive results, this modality is always operator dependent. Finding ways to incorporate ultrasound into practice has the potential to improve care and, with a structured approach, save time.

Most practicing emergency physicians are familiar with the "basic" indications of point of care ultrasound: assessing for pericardial effusion, abdominal free fluid, abdominal aortic aneurysm, and intra-uterine pregnancy. There are several other indications which can directly impact practice with varying degrees of time to acquire skills. This workshop will focus on three.

Objectives:

1. Understand the indications for ultrasound in the assessment of volume status (using IVC diameter), retinal detachment (ocular ultrasound), and in central venous catheterization.
2. Describe the technique for ultrasound examination of the areas described.
3. Identify the normal findings on ultrasound for each area and be able to distinguish from abnormal findings.

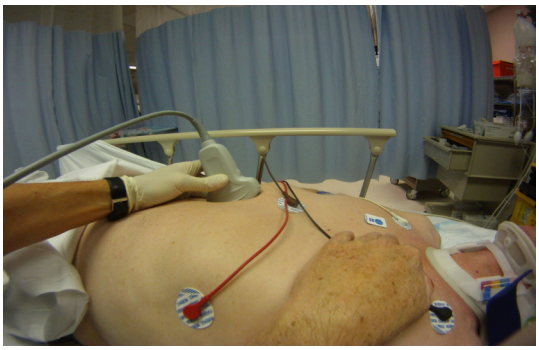
IVC Ultrasound

Setting:

Clinical measurement of volume status is a challenge. Bedside assessment of JVP, for example, has very poor inter-observer reliability. Ultrasound measurement of the IVC diameter is a quick, non-invasive method to guide both initial and ongoing resuscitation.

Technique:

1. Low frequency (abdominal) probe, patient positioning as per AAA scanning
2. Find landmarks in the epigastrium (Spine, aorta, IVC)
3. Identify the IVC (thin walled, to right of spine, respiratory variability)
4. Rotate to longitudinal position
5. Measure A-P diameter mid – liver (2cm distal to intersection of IVC and hepatic veins) at expiration (at its largest)



Interpretation:

Normal anterior-posterior IVC diameter is less than or equal to 2cm. Hypovolemia = 1cm or less, or >50% collapsibility during respiration.

Tips for IVC diameter assessment:

- Don't press so hard that you compress the vein.
- Aim caudally – the IVC can be seen draining into the right atrium.
- Use the "freeze" button and scroll to find the best view if measuring. Gross estimation/relative changes may be as valuable clinically.
- False positive/inconclusive: increased intra-abdominal pressure, intubated patient, increased right-sided pressure.

Selected articles:

Dipti A et al. Role of inferior vena cava diameter in assessment of volume status: a meta-analysis. Am J Emerg Med January 2011;0(0):1

Nagdev A et al. Emergency department bedside ultrasonographic measurement of the caval index for noninvasive determination of low central venous pressure. Ann Emerg Med 2010; 55(3):290-295

Weekes A et al. Comparison of serial qualitative and quantitative assessments of caval index and left ventricular systolic function during early fluid resuscitation of hypotensive emergency department patients. Acad Emerg Med 2011; 18(9):912-921

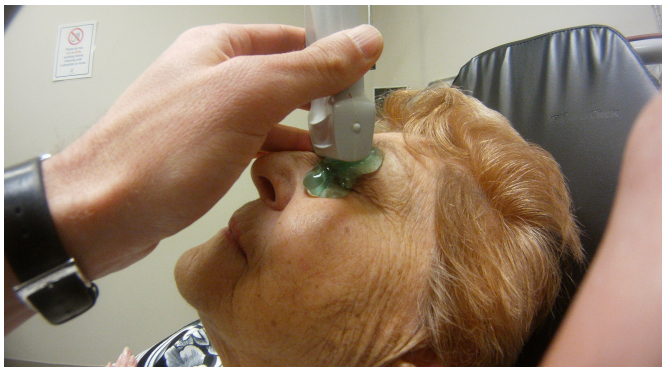
Ocular Ultrasound

Setting:

The presence or absence of retinal detachment can be difficult to distinguish based on history or non-dilated fundoscopic examination. Point of care ultrasound offers the ability to distinguish posterior chamber diagnoses quickly and with confidence.

Technique:

1. High frequency probe, lots of gel on the closed lid, turn up gain
2. Visualize the entire retina. Have the patient look to one side then the other, along the direction of the probe (e.g. left and right for a transverse probe).
3. Interrogate or "sweep" both the transverse and longitudinal planes to visualize the whole retina.



Interpretation:

Retinal detachment will be fixed at the optic nerve, less mobile, visible with gain lowered. Vitreous detachment will be thinner, more mobile, visible with gain turned up

Tips for ocular ultrasound:

- The probe doesn't need to touch the eyelid, just the gel
- Don't use Doppler mode
- Compare to the other eye if you aren't sure of what you are seeing

Selected articles:

Blaivas M et al. A study of bedside ocular ultrasonography in the emergency department. Acad Emerg Med 2002;9(8):791-799.

Shinar Z Use of ocular ultrasound for the evaluation of retinal detachment. J Emerg Med 2011;41(1):53-57

Yoonessi R Bedside ocular ultrasound for the detection of retinal detachment in the emergency department. Acad Emerg Med 2010;17(9):913-917.

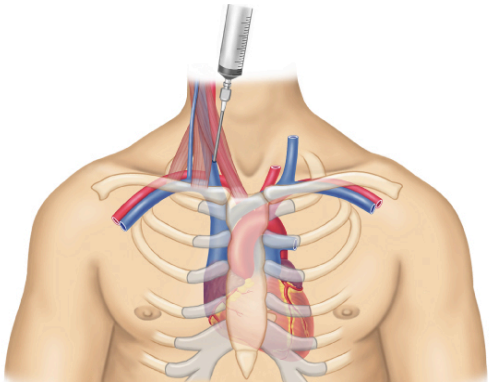
Central Venous Access

Setting:

Ultrasound guidance has been well documented to increase safety while decreasing the number of attempts. Although accidental carotid puncture is generally well tolerated, accidental dilation of the artery can lead to significant morbidity and/or mortality. Point of care ultrasound is increasingly being portrayed as a standard of practice for non-urgent placement of central lines.

Static Technique (Internal Jugular Vein):

1. High frequency probe
2. Trendelenburg position, head rotated approx. 30 degrees (do not over rotate)
3. Start in transverse view, just lateral to SCM
4. Use as little pressure as possible – the vein will collapse very easily under pressure
5. Mark the course of the vein on the skin. Also note the depth relative to the skin.



Optional confirmation:

1. Proceed with usual setup for central line placement using aseptic technique
2. Place sterile probe cover on machine
3. Proceed with initial puncture and guidewire placement
4. Confirm wire location in vein prior to dilation, catheter placement

Dynamic visualization:

1. Ensure comfort with needle visualization, practice prior to attempting
2. Proceed with usual setup including sterile probe cover
3. Visualize needle tip in plane at all times

Interpretation:

Veins are thin-walled and should be easily compressible relative to arteries. If the course seems unusual or compression seems equivocal, compare to other side or consider another site altogether.

Tips for central venous access:

- Use as little compression as possible initially – veins will collapse easily especially if superficial.
- Ensure that you visualize the entire course of the vessel in the area you intend to catheterize (lymph nodes are more or less spherical).
- Dynamic visualization takes practice.
    - Recipe for US phantom: Kendall J CJEM 2007;9(5):371-373
- Visualization of a guidewire which is stuck may identify the problem, avoiding another puncture.

Selected articles:

Balls A et al. Ultrasound guidance for central venous catheter placement: results from the Central Line Emergency Access Registry Database. Am J Emerg Med 2010;28:561-567.

Beaudoin F et al. Bedside ultrasonography detects significant femoral vessel overlap: implications for central venous cannalation. CJEM 2011;13(4):245-250.

Karakitsos D Real-time ultrasound-guided catheterisation of the internal jugular vein: a prospective comparison with the landmark technique in critical care patients. Cri Care 2006; 10(6): R162

Leung J et al. Real-time ultrasonongraphically-guided internal jugular catheterization in the emergency department increases success rates and reduces complications: A randomized, prospective study. Ann Emerg Med 2006; 48(5):540-547.

Troianos et al. Guidelines for Performing Ultrasound Guided Vascular Cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. J Am Soc Echocardiogr 2011;24:1291-318.

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