



MEDICAL EDUCATION: PART II

TEACHING BEDSIDE PHYSICAL EXAMINATION WITH ULTRASOUND: AN OPPORTUNITY TO RE-ENGAGE AND INVIGORATE LEARNERS

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The bedside physical examination is an integral component of the clinical encounter. However, with decreased time spent teaching at the bedside,¹ there has been a notable decline in physical exam skills among medical trainees. In the past decade, there has been increasing literature supporting the use of point-of-care ultrasound (POCUS) to augment the physical exam to better guide physicians with clinical decision making.² In this article, we describe a strategy to teach bedside physical examination skills by incorporating POCUS, which provides immediate visual feedback to the learners. More specifically, we will highlight how POCUS can be incorporated into two prototypical physical examinations: the examination for pleural effusion and the jugular venous pulse (JVP) examination. Pedagogical concepts discussed can be readily applied to other physical examinations.

Pleural effusion commonly occurs in patients with congestive heart failure, pneumonia and malignancy. The presence and absence of pleural effusion can help narrow differential diagnosis and/or guide management in patients presenting with dyspnea. For example, patients with congestive heart failure with pleural effusions may need intensified diuretic therapy. New pleural effusion in a patient with lung cancer may have prognostic implications (e.g., potential for stage IV disease). A careful physical examination is essential for the detection of pleural effusion. Specific findings such as asymmetrical chest expansion, diminished vocal fremitus and dullness to percussion have positive likelihood ratios that may significantly change the post-test probability of detecting pleural effusion. Conversely, normal breath sounds and conventional percussive sounds strongly argues against

pleural effusion.³ However, accuracy of the examination is limited by patient characteristics and size of the effusions. POCUS offers direct visualization of the pleural effusion, confirming not only of its presence, but also allows for a visual estimation of its size. Bedside rounds is an excellent way to illustrate ultrasound augmented physical examination to learners. As the patient is sitting upright, learners are asked to determine if pleural effusion is present or absent by the traditional physical exam on both hemithoraces. A mark is made at the first area of dullness that either represents the diaphragm or top of the pleural effusion. Using a low-frequency transducer, the posterolateral chest is scanned from the level of the liver or spleen and moved cephalad. For the presence of pleural effusion, an anechoic space between the visceral and parietal pleura can be easily recognized. Real-time confirmation and feedback can then be provided to the learners.

In a similar fashion, POCUS can assist in teaching the JVP exam. Examination of the neck veins provides an estimate of the patient's central venous pressure, and abnormalities in its waveforms can provide additional information on cardiac abnormalities.³ Despite the importance of this examination, skepticism abounds regarding trainees' ability to learn this skill.⁴ POCUS provides learners with immediate visual feedback on the location of the top of the internal jugular vein by visualizing where it tapers in the longitudinal view, using a linear high-frequency transducer, with the transducer marker pointing towards the patient's head (see photo). Visualization of internal jugular vein can also be confirmed in the transverse view. For educational purposes, additional features

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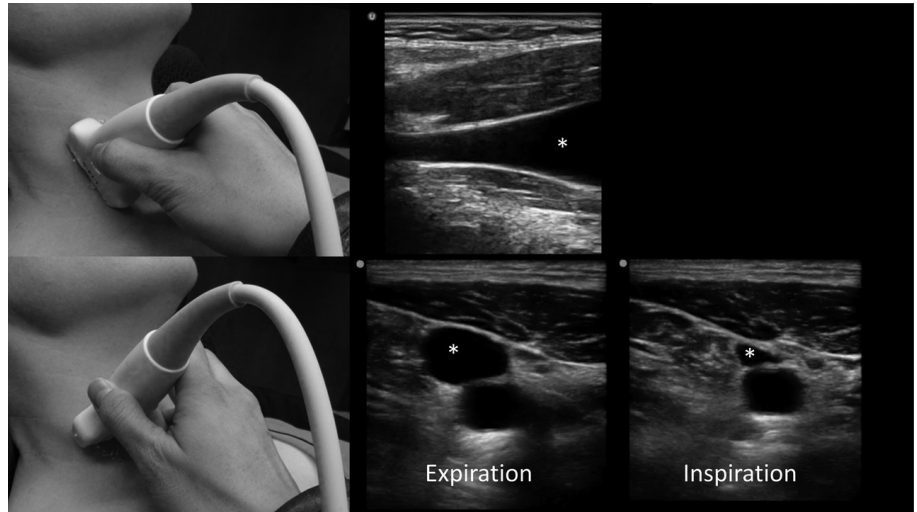
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of the JVP exam that can be visually demonstrated with ultrasound at the bedside include the following:

1. its location between the two heads of the sternocleidomastoid muscles;
2. changes with respirations, where the size of the internal jugular vein can be seen to decrease upon inspiration (see photo);
3. changes with positioning of the angle of the head of the bed;
4. compressibility;
5. double waveform;
6. changes with abdominojugular test.

The non-palpability of the vein can also be demonstrated to the learners by having learners palpate where the transducer is centered over the internal jugular vein, compared to palpating where it is centered over the carotid artery.

The bedside physical examination remains a cornerstone of clinical medicine. POCUS-augmented physical examination offers several distinct advantages for learners and educators. From a learner's perspective, it provides immediate feedback of their physical examination skills. As a result, this increases learner confidence and opportunities to seek improvement. For clinician educators, POCUS augmented physical



(Longitudinal [top] and transverse [bottom] imaging of the internal jugular vein [asterisk] demonstrating top of the vein and respiratory variations, respectively.)

examination offers the opportunity to reinforce existing examination techniques while role-modeling examination-related skills such as exemplifying physician-patient communication. From our experience, POCUS augmented physical exam re-engages and reinvigorates our learners about bedside medicine.

References

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