

Volume Responsiveness
Using Ultrasound evaluation of the Internal Jugular Vein

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Disclosures

- None

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Objectives

- Understand basic principles of volume resuscitation practices
- Understand how to apply ultrasound visualization of the internal jugular vein and inferior vena cava
- Utilize measurements of venous system to guide fluid resuscitation

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A repeat assessment of volume status and tissue perfusion is required for patients with septic shock

CMS Sepsis Bundle

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CMS Sepsis Bundle

- For patient's presenting with septic shock
 - Within 3 hours of presentation:
 - Lactic Acid
 - Blood Cultures
 - Antibiotics
 - Resuscitation with 30mL/kg of crystalloid

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CMS Sepsis Bundle

- For patient's presenting with septic shock
 - Within 6 hours of presentation:
 - Volume status assessment
 - Tissue perfusion assessment
 - Vasopressor administration

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Volume Resuscitation

Overload is possible

- Not every patient will tolerate 30mL/kg of crystalloid infusion
 - ESRD
 - CHF
 - Pulmonary Hypertension
- Must also take into account volume of fluid with antibiotic administration

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Inferior Vena Cava

- One of the first surrogates for measuring CVP non invasively
- Fairly easy to obtain with a slight modification of the subxyphoid cardiac view
- Original studies were in the ICU setting with patient's who were mechanically ventilated

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Inferior Vena Cava

Pitfalls

- Studies have looked at non ventilated patient's
 - Evidence is not as strong
- Can be technically difficult in certain patient populations
 - Large habitus
 - Hyperventilation

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Inferior Vena Cava

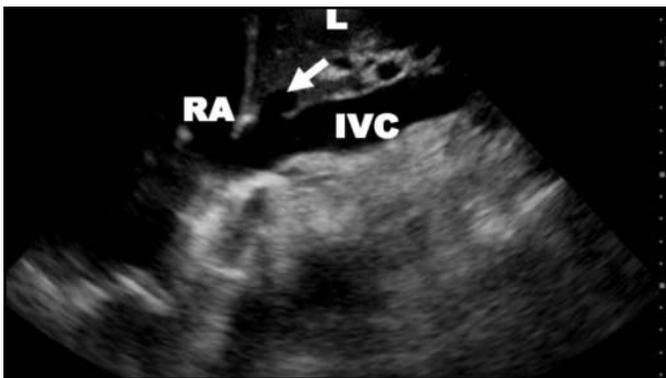
Technique

- Typically you will use your phased array or curvilinear probe
- Subxyphoid view, then rotate 90 degrees or fan to see IVC draining into the atrium
- Measure 2cm from the IVC/RA junction or 1cm from the IVC/hepatic vein junction
- Visualize the IVC in the long axis
- May utilize M-mode to measure collapsibility between respirations

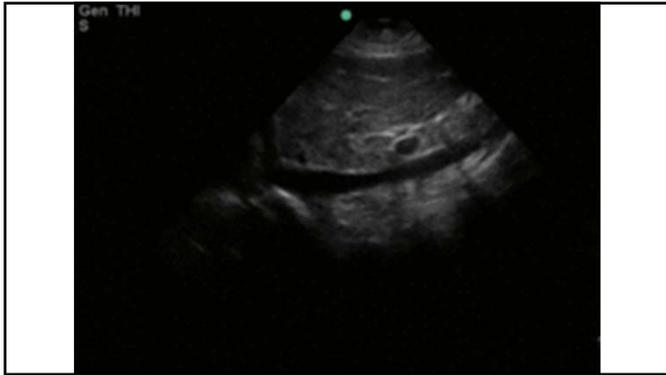
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IVC (cm)	Respiratory Change	CVP (cm H ₂ O)
<1.5	Total collapse	5-5
1.5-2.5	<50% collapse	6-10
1.0-2.5	<50% collapse	11-15
>2.5	<50% collapse	16-20
>2.5	No change	>20

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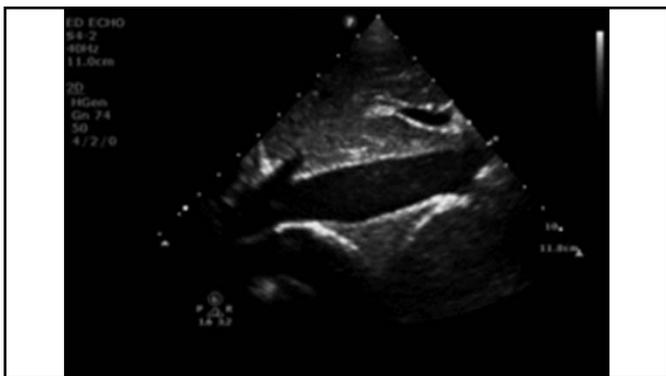
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Can we only use the IVC?

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Internal Jugular Vein
An Emerging surrogate for CVP

- Not as limited with body habitus
- Studies have shown that it correlates well, even in non mechanically ventilated patients
- Can be easier to monitor while performing a straight leg raise or raising the head of the bed

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Internal Jugular Vein
Pitfalls

- Not as well studied as IVC measurement, some previous meta analyses showed that the IVC correlated better with CVP
- More recent studies have shown that the IJV provides just as robust PPV, but these studies have been underpowered
- As with IVC, there may be difficulty distinguishing from the carotid in inexperienced users

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Internal Jugular Vein

Technique for measurement

- Linear probe
- Short axis view of the IJV approximately 2 cm above the clavicle
- Distinguish from the carotid artery, which is thicker walled and pulsatile

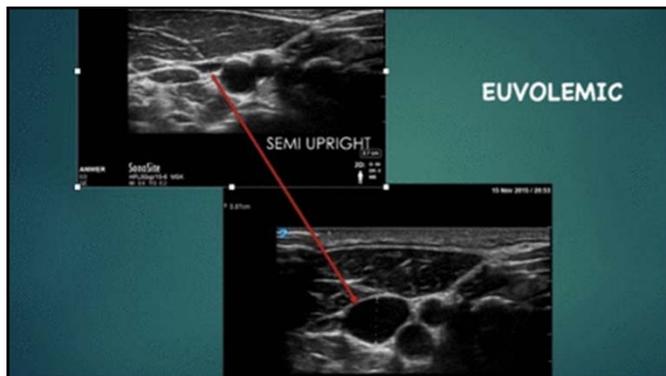
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Internal Jugular Vein

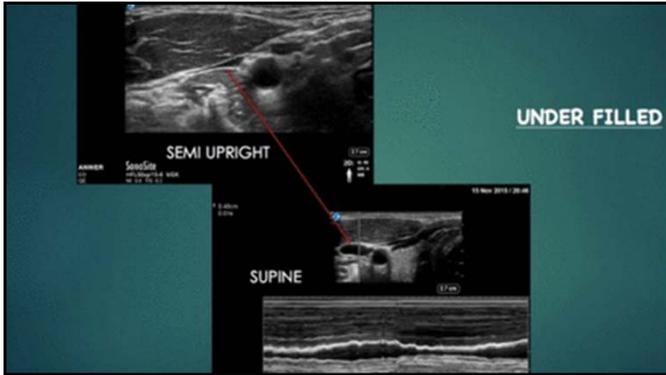
Changes in volume status

- Studies have correlated the change in diameter of the IJV with CVP
- You can also compression, straight leg raise, or raising the head of the bed to watch dynamic changes
- You don't necessarily need to measure the diameter
 - Flat IJV to begin with will likely indicate that the patient will be volume responsive
 - Conversely, if you have a large IJV which has minimal change with compression or change in position, the patient may not need additional volume

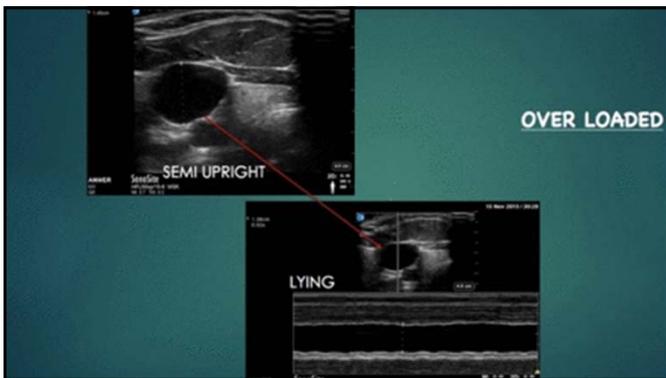
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Measuring Volume Responsiveness

Take away points

- In patients with undifferentiated shock/sepsis, blind fluid administration may not be beneficial for the patient
- Ultrasound can give real time feedback on whether the patient can be volume responsive or has been adequately resuscitated
 - Re evaluation is part of CMS sepsis bundle
- IVC is a commonly used surrogate for CVP, well studied in ventilated patients
- IJV is an easily accessible option which can be visualized in many patients

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Thank you!

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