BEDSIDE CARDIAC ULTRASOUND

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Overview

• Why, Who, What, How of ED Ultrasound...
• How to of Focused Cardiac Examination
• Difficulties & Troubleshooting
• Cases demonstrating pathology
• Literature (briefly!)

Why? - Indications

• Unexplained Dyspnea
• Chest Trauma
• Chest Pain
• Cardiac Arrest
• Unexplained Hypotension
• Procedures

Who? - ED Physicians

• Limited Examination - yes/no questions
• Integrated Bedside Assessment
• Code Management
• Facilitate Interventions/Procedures
What? - to look for

- Pericardial Fluid
- Pericardial Tamponade
- Global Cardiac Function
- Cardiac Activity
- Hyperdynamic/Hypovolemia
- Needle location, capture, success

How? - Technique

Probe Selection:
- Microconvex or phased array probe
- 3-5 MHz probe

Cardiac Setting

How? - Cardiac Views

1. Subxiphoid/Subcostal
2. Parasternal Long Axis
3. Parasternal Short Axis
4. Apical Four Chamber
How? - Cardiac Views

- Subxiphoid/Subcostal
- Parasternal Long Axis
- Parasternal Short Axis
- Apical Four Chamber

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Subxiphoid
Subxiphoid

- "FAST" view
- Probe under ribs
- Indicator to pt RIGHT shoulder
- Use liver as acoustic window
Parasternal Long Axis

- Probe at Left Sternal Border
- 3rd - 5th intercostal space
- Indicator to RIGHT shoulder
- Long axis view of heart

Parasternal Long

- PS views best for estimating EF
- Visualize mitral & aortic valves

Parasternal Short

PSSA

Parasternal Short
Parasternal Short Axis

- Left sternal border
- 90° counterclockwise to Long Axis view
- Indicator to RIGHT HIP
- PS views best for estimating LVEF
PSSA - Aortic Valve

- Aortic valve near base
- Mitral valve at annulus
- LV toward apex

Apical 4 approach

At PMI
5th ICS under nipple marker R

Apical 4 chamber
Apical 4
- From Apex to the base
- Visualizes all 4 chambers side-by-side
- relative chamber size
- Best septal view

Troubleshooting
- Pulmonary Hyperinflation - COPD, Ventilation
- Poor Parasternal windows
- Favor Apical & Subxiphoid
- Obese, Pregnant, Abd Pain
- Favor Parasternal windows
CASE of Dyspnea

• 42 yo female presents to the ED with 2 weeks of increasing shortness of breath.
• Vital signs are BP 118/82, P 104, RR 24, T 37.6, SaO2 97%RA.
• CXR shows:

[Image of chest X-ray]
Pericardial Effusion

- Reduced time to diagnosis
- Suggested by CXR finding of enlarged cardiac silhouette
- Traumatic, Uremic, Malignant, Infectious
- Fake out of epicardial fat
- Ranges from benign to tamponade

Pericardial Effusion

- Dark stripe between pericardium & myocardium
- Dependent area more sensitive & specific

short-axis: effusion

- Doughnut Shaped
- Anechoic Stripe

Table 2.
Overall echocardiographic performance.

<table>
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<th>Predicted</th>
<th>Positive</th>
<th>Negative</th>
<th>Total</th>
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<tr>
<td>Total</td>
<td>24</td>
<td>395</td>
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Sensitivity: 96.8% (95% CI 96.4% to 98.1%)
Specificity: 98.6% (95% CI 98.1% to 99.1%)
Positive predictive value: 81.3% (95% CI 78.8% to 83.8%)
Negative predictive value: 98.9% (95% CI 98.7% to 99.1%)
Accuracy: 97.5% (95% CI 97.1% to 97.9%)

PITFALLS & fakeouts:

- Fakeouts of Pleural or Abdominal cavity fluid
- Fat will move together with heart
- Beware non-dependent collections
- Beware of clotted blood/loculations
- Myocardial reflections

short-axis: effusion

Text
Case of Blunt Trauma

27 yo male BIB medics as trauma S/P running his car into a tree in a suicide attempt. Pt's mental status deteriorates in the trauma bay and goes into PEA.

Bedside ultrasound shows:

Pericardial Tamponade

Pericardial Tamponade

- Acute Chest Trauma
- Large Chronic Effusion
- Expanding Effusion
Tamponade
Systolic collapse of RA, Diastolic collapse RV

Penetrating Chest
Standstill

Trauma Resuscitation

• Yes/No - Cardiac Activity
• Yes/No - Effusion/Tamponade
• Reduce time to OR or intervention

CASE of chest pain

• 62 yo female presents to the ED with chest pain for 6 hours. She is becoming nauseous and diaphoretic.
• Vital signs are BP 89/46, HR 109, RR 16, T 36.9. CXR shows:
Ejection Fraction

- 115 patients ED vs. Formal echo
- Poor <30%, Moderate 30-55%, Normal >55%
- Concordance 86%


EF- Normal
Ejection Fraction

- Parasternal Short Axis View
- How well does the heart move?

Code Management

- Yes/No - Cardiac Activity?
- Yes/No - Continue Resuscitation?
- PEA, No motion = 100% PPV Death
- May Elucidate Reversible Causes
- Effusion/Tamponade
- Evidence of PE/RV collapse

*Blaivas M, Fox JC. Outcome in Cardiac Arrest Patients Found to Have Cardiac Standstill on the Bedside Emergency Department Echocardiogram. Acad Emerg Med. 2001; 8: 616-621.*
Standstill/Effusion

Hypotension Management

• Is patient dry?
• Assess IVC for volume status
• Hyperdynamic heart may indicate hypovolemia, sepsis

Finding IVC
CASE of Hypotension

- 36 yo male with h/o nephrotic syndrome presents to the ED with chest pain & SOB. He is anxious nauseous and diaphoretic.
- Vital signs are BP 92/60, HR 118, RR 28, T 36.9, O2 Sat 95%.
- CXR shows:
Pulmonary Embolus

- PE & Shock = Thrombolytics
- Best view = Apical 4 chamber
- RV dilatation
- IVC Plethora
- Abnormal Septum
Interventions

- Pericardiocentesis
- Transvenous Pacer Insertion
- Transcutaneous & Transvenous Pacer Capture

Summary

- Why? Remember Clinical Indications
- Why? Case Management, Facilitate Interventions & Procedures
- Who? ED docs
- What? Yes/No Questions
- How? 4 Views
Exam

- Subxyphoid
- Parasternal long axis
- Parasternal short axis
- Apical 4 chamber view

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Questions

References

- Blaivas M, Fox JC. Outcomes in Cardiac Arrest Patients Found to Have Cardiac Standstill on the Bedside Emergency Department Echocardiogram. Acad Emerg Med. 2001; 8: 616-621.