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Left Ventricular Systolic Function

Disclosures

- I have no financial disclosures

Goals

- Clinical case
- LV systolic Function
- Cardiac Output monitoring

Confusing Case

- 36 y/o female
- CC: Severe lactic acidosis
- Transferred from Wyoming community hospital
- PMH:
  - open gastric bypass 6 years ago
  - Initially lost weight
    - Then subsequent complications
  - Chronic pain (abdominal/headaches)

Confusing Case

- Referring Hospital course
- Admitted for severe abdominal pain with weight loss
- Severe Headaches
- CT scan of abdomen on admission unremarkable
- Abdominal pain progressed after two days of PCA analgesia
- Lactic acid 8

Confusing Case

- General Surgeon suspects dead bowel
- Emergent Ex-lap:
- Bowel Pink and viable
- Aggressive Goal directed therapy
- Fascia Left open
  - Difficult to close the belly
  - Surgeon concerned for abdominal hypertension
  - Transferred to SICU at CU Denver

Confusing case

- Intubated, Awake
- On Norepinephrine 0.6mcg/kg/min
- Vasopressin 0.04 units/min
- MAP 45
- CVP 18 (femoral venous line)
- Open Abdomen
  - PEEP 10
- WBC 0.8
- Anuric

Looks like sepsis

- Start the fluids…
- Or could we get more information first
- Echo tech wont get to the ICU for another two hours, cardiology fellow can get there…
- Anybody want to put a TEE in this patient?
  - Gastric Bypass with unknown anatomy?

Bedside Echo

- Immediate information
- Repeated study
- What is the risk of study to patient
- Misinterpreting data

Diagnosis?

- Stress induced (Takotsubo) cardiomyopathy
- Treatment for this patient
  - Supportive care
    - Beta blockers
    - Not inotropic medications
  - Mechanical Support
  - IABP vs Percutaneous VAD (Impella, Tandem Heart)

Difficult/Impossible to diagnose

- Without echocardiography
  - **Systolic anterior motion**
  - **Stress induced cardiomyopath**y
  - **Acute Right heart dysfunction**
  - **Depressed LV systolic function**

Old and new devices…

- PA catheters?
- Non-invasive cardiac output
  - **LIDCO**
  - **PICO**
  - **FLOTRAC**
  - **ESOPHAGEAL DOPPLER**

Filling Pressures

- Can be misleading
- Do not tell you:
  - **Blood volume**
  - **Cardiac Function**
  - **Valve dysfunction**
  - **Fluid responsiveness**

Qualitative assessment of LV function

- Quick exam with high yield material
- If you have good windows you should be able to:
  - Quickly assess:
    - Fluids vs. Inotropes
- If you cannot see anything there was no harm done

Who do I echo in the ICU?

- Everyone and anyone I can
- What do I look at:
  - Left Ventricular systolic function
  - Right Ventricular systolic function
  - Assess Valves for major pathology
    - Aortic
    - Mitral
    - Tricuspid
    - Pulmonic

Melamed R et al " Assessment of Left Ventricular Function by Intensivists Usind Hand-Held Echocardiography" Chest 2009 Feb 18

- 2hrs of lectures
- 4 hours hands on
- Global assessment
  - Normal
  - Mild to moderately decreased
  - Severely decreased
- 82% of the time intensivist assessment matched board formal TTE

Left Ventricular function

- **Preload**
  - Volume status
  - Restrictive valves (tricuspid/mitral)
  - Large pericardial effusion
- **Afterload**
  - Restrictive valves (pulmonic/aortic/aortic dissection)
  - Systolic Anterior motion of mitral valve
- **Contractility**
  - Qualitative assessment
  - Would this patient benefit from inotropes

Add Clinical meaning…

- Figure out what normal looks like…
- Point of care Echo
  - Needs a clinical context

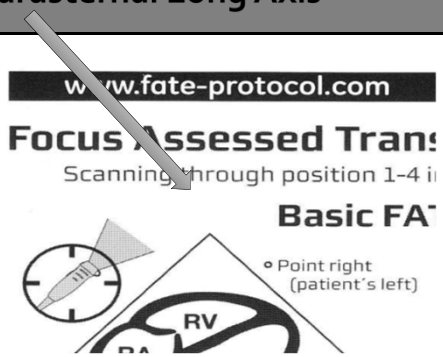
Left Ventricular Systolic function

- **First View**
  - Parasternal Long Axis
  - Patient Laying flat or tilted on their left side
  - Probe is placed to the left of the sternum
  - Start at the 2nd interspace and then slide to 4thor fifth intercostal space
  - Indicator is pointed to the right shoulder at 9 or 10 o'clock

Left Ventricular Systolic function

- Global function
- Focused valve pathology
  - Calcifications
  - Obvious regurgitant jets

Parasternal Long Axis



Parasternal Long axis

- Aortic valve pathology
  - Calcifications
  - Opening and closing
  - Color flow
    - Aortic regurgitation
    - Aortic stenosis
- Left ventricular outflow tract diameter
  - Save this number and use it later

Parasternal Long Axis

- Mitral Valve
  - Opening, closing
    - Degree of opening in early diastole
  - Regurgitation
  - Outflow tract obstruction in systole
    - Systolic Anterior Motion (SAM)
    - With mitral regurgitation and septal hypertrophy

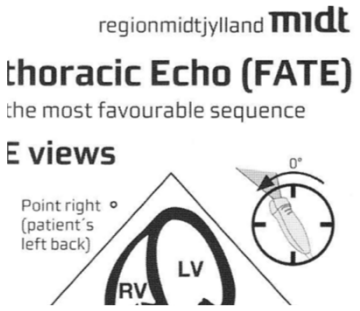
Parasternal Long Axis

- Pericardial effusion
- Remember Tamponade in some situations
  - Clinical diagnosis
  - **Not** always an echo diagnosis
    - Trauma
    - Post Cardiac surgery

Parasternal Short Axis

- Patient supine
- Probe is rotated the indicator is pointed towards the left shoulder
- By tilting the probe cephalad or caudad you will image the base or apex of the LV

Parasternal Short Axis



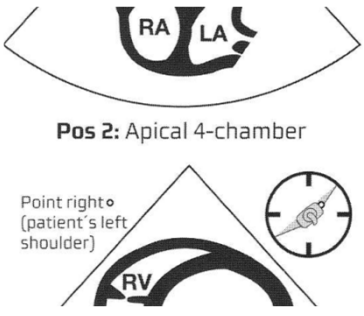
Parasternal Short Axis

- Contractility of the LV
- Regional wall motion abnormalities
- Movement of the septum
  - D shaped septum
  - In systole= pressure overload
  - In diastole= volume overload

Parasternal Long Axis

- Volume status
- At the midpapillary level
  - Kissing Papillary muscles
  - Low Blood pressure
  - Volume challenge

Apical four chamber



Apical four chamber

- Best view patient should be propped up on their left side
- Feel for the patients PMI
- Place the probe indicator pointed to the right shoulder

Apical four chamber

- Contractility
- Movement of the septum
- Volume status
- Mitral and Aortic valve
- Pulse wave Doppler with the gate in the LVOT

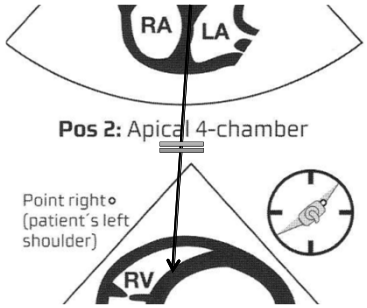
Apical four chamber

- Cardiac output= Stroke volume x heart rate
- Stroke Volume= cross sectional area LVOT x velocity time integral
- CSA= π {(LVOT diameter)/2}^{2}

Apical Four Chamber

- Easy to repeat in response to fluid challenges
- Want to make sure you are increasing cardiac output
- Cardiac Index increase by 15% = volume responsive

Apical four chamber



Summary

- Rapid bedside TTE in the ICU
- Assess LV systolic function
- Assess
  - Preload
  - Afterload
  - Contractility

Summary

- Simple repeated Cardiac output measurement
- LVOT diameter in Parasternal LAX
  - PW doppler LVOT
  - VTI

Thanks