DIASTOLOGY
“DON’T BE SUCH A STIFF”

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Warning: The education found within this presentation is not approved by anyone who does approvals
CASE 1 – ROOM 8

- 74 yo female presents with SOB
  - Hx of COPD, CHF, DM
  - As you walk in the room she is sitting up in bed tripodding and tachypnic.
  - She can only speak in 2-3 word sentences and complains of pleuritic chest pain and difficulty breathing.

- Vitals:
  - HR 104
  - BP 144/86
  - O2: 72% on RA, 94% on NRB
CASE 1

- **PE:**
  - Decreased BS bilaterally
  - Mild Wheezes bilaterally
  - Increased AP diameter
  - Heart sounds difficult to auscultate
  - Mild LE edema
  - +JVD, but you’ve seen worse
CASE 1 – DIFFERENTIAL

• Differential Diagnosis?
  • COPD Exacerbation
  • CHF Exacerbation
  • Pneumothorax
  • Pneumonia
  • Pulmonary Embolus
  • Pericardial Effusion
CASE 1 – WHAT NEXT

• You got this.

• You did your required 150 ultrasound scans in residency……… At least 30 were cardiac.

• You’ve seen multiple ultrasounds of people in heart failure…… you even watched a podcast or 2 about it.
CASE 1 - ULTRASOUND

- Bamm! Diagnosisism
CASE 1 - ULTRASOUND

- DX: CHF – Call Cards, Start Nitro gtt, BiPAP, Lasix, Admit – too easy
CASE 2 - ROOM 9

- 59 yo male presents with SOB
  - Hx of COPD, CHF, DM
  - As you walk in the room he is sitting up in bed tripoding and tachypnic.
  - He can only speak in 2-3 word sentences and complains of pleuritic chest pain and difficulty breathing.

- Vitals:
  - HR 104
  - BP 144/86
  - O2: 72% on RA, 94% on NRB
CASE 2

• **PE:**
  - Decreased BS bilaterally
  - Mild Wheezes bilaterally
  - Increased AP diameter
  - Heart sounds difficult to auscultate
  - Mild LE edema
  - +JVD, but you’ve seen worse
CASE 2 – DIFFERENTIAL

• Differential Diagnosis?
  • COPD Exacerbation
  • CHF Exacerbation
  • Pneumothorax
  • Pneumonia
  • Pulmonary Embolus
  • Pericardial Effusion
CASE 2 – WHAT NEXT?

• Didn’t we just do this, I just proved my Ultrasound dominance.
CASE 2 – WHAT NEXT?

- No Heart failure: must be COPD: pred, nebs, O2, admit
CASE 2 -WHOOPS

• Patient SOB worsens.
• Requires intubation prior to admission.
• Post-intubation X-ray shows bilateral pulmonary interstitial edema and BNP comes back at 2,543.

• What Happened?
• How did US fail you?
DIASTOLIC HEART FAILURE

- Under recognized
- Can occur with normal EF!
- 5 Million Americans with heart Failure
- 50% of acute failure is diastolic only (EF>50%)
PHYSICAL EXAM – GOOD IDEA?

- Your physical exam put to the test
  - Sensitivity of JVD: 30%
  - Sensitivity of S3: 24%

ECHO – GOOD IDEA?
MISPLACED CONFIDENCE

- Cardiac Ultrasound by POC Physicians
- Just because the EF is normal:
  - Does not mean there is not acute failure

"60% of the time, it works EVERY Time."
DIASTOLIC FAILURE

- **RELAXATION**: Ability of the myocardium to relax during Diastole
- **COMPLIANCE**: Ability of the myocardium to accept a volume of blood in Diastole
RELAXATION

• Muscle relaxation in early diastole.
• Descent of base.
• How well do I pull?
COMPLIANCE

- Compliance -
- Myocardial compliance determines pressure required for diastolic filling
- How hard do I have to push?
PUSHING OR PULLING?
DIASTOLIC FAILURE – HOW DOES IT OCCUR

- HTN thickens myocardium and impairs filling
- Decreased Filling = Decreased CO
- Decreased CO = Activation of Renin/ATII
- Renin/ATII = Fluid retention
- Fluid retention = Increased Preload
- Increased Preload = Increased filling pressure
CAN I EVEN DO THIS?
THE PUDDING


- 145 Patients: evaluated by ED docs with Echo for “restrictive” diastolic dysfunction and compared to BNP
- Pulsed Doppler Sensitivity 82%, Specificity 90%
- Performed better than BNP or Boston heart failure criteria
YOU'RE AWESOME
THE QUESTION IS:

- Who is getting admitted for a CHF exacerbation?
QUALITATIVE ASSESSMENT

LA area >20cm²
Very sensitive
MEASURING DIASTOLIC FAILURE

• Mitral inflow – POWER DOPPLER
MEASURING DIASTOLIC FAILURE

• Mitral inflow
MEASURING DIASTOLIC FAILURE

- TISSUE DOPPLER
MEASURING DIASTOLIC FAILURE

- Tissue Doppler

<table>
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<tr>
<th>Normal</th>
<th>Impaired Relax</th>
<th>Pseudonormal</th>
<th>Restrictive</th>
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[ECG] [MVF] [TDI]
FILLING PRESSURE

- $E/e' \approx$ Filling Pressure (LVEDP, PCWP)

- Normal: $E/e' < 8$

- Elevated Filling Pressure: $E/e' > 15$
THE SPECTRUM

Normal | Impaired Relax | Pseudonormal | Restrictive

E/e’ <8  →  E/e’ >15
Clinical Application

- Acute heart failure - Dyspnea
- Volume overload – Monitor response to therapy
- Critical patients requiring massive volume resuscitation
DIASTOLIC FAILURE SUMMARY

- Diastolic Failure can occur with normal Systolic Function ~ 50% of the time
- Systolic Normal Acute Heart Failure- Under diagnosed by ED physicians

- Diastolic Failure: $E/e' > 15$
  - Normal
  - Impaired Relaxation
  - Pseudonormal
  - Restrictive

Diastolic Failure: $E/e' > 15$
DIASTOLIC FAILURE
DIASTOLOGY REFERENCES


