Introduction to Basic Echocardiography
Dana Sajed, MD
MGH Emergency Medicine

Learning Echo...
• Indications
• Standard Views
• Interpreting your echo

Indications
• Unexplained Hypotension
• Unexplained Dyspnea
• Chest Pain
• Cardiac Arrest/PEA
• Thoracic trauma

What Does it Tell Us?
• Cardiac activity
• Estimate ejection fraction
• Assess for pericardial effusion/tamponade
• Estimate RV/LV chamber size, septal wall motion/focal wall motion abnormality
• Procedure guidance – pericardiocentesis, TV pacer

First
A word about probe orientation...
• What cardiologists see...
• What we see...

A Word About Probe Orientation...
The Views

- Parasternal
  - Long axis
  - Short axis
- Subxiphoid
- Apical

Standard Cardiac Views

Parasternal Views

Parasternal Long Axis

- Probe adjacent to sternum
- 3rd or 4th left intercostal space (approx. level of nipple)
- Probe placed along long axis of L ventricle
- Rotate enough to elongate cardiac chambers
The “Ideal” Parasternal Long...

- Should not visualize the apex of LV
- Should see:
  - Ao root
  - Mitral valve
  - LA
  - Descending thoracic Ao
- An almost horizontal septum

Parasternal Long Axis

- Estimating EF
- Look for cardiac motion
- Assess for effusion

- Poor visualization of R side of heart
- Not good for estimating RV size or assessing R heart function

Parasternal Views

Parasternal Short Axis

- Obtained by 90° rotation of the probe from PSL
- Provides cross section view of LV
- Sweep the beam from base to apex for different cross sectional views

1 – Base of heart/Ao valve
2 – Mitral valve
3- Mid-LV (papillary muscles)
1 – Base of heart/Ao valve
2 – Mitral valve
3 – Mid-LV (papillary muscles)

The “Ideal” Parasternal Short...

- LV should be round shaped and symmetric
- LV should be in the middle of the screen
- Focus at level of papillary muscles (mid-LV)

Parasternal Short Axis

- Estimating EF
- Effusion
- Septal Wall Motion - ↑ RV pressure
- With more experience, regional wall motion abnormalities

Subxiphoid

- Need to increase depth to obtain image
- Probe marker immediately under the xiphoid process, in a transverse orientation
- Looking through the liver (acoustic window) at the heart

Subxiphoid View
Subxiphoid
- Look for cardiac motion (cardiac arrest)
- Assess for effusion (can see ant and post pericardium)
- Because the view may be oblique, often not ideal for chamber size estimation
- Difficult if stomach is full! (After lunch)

Apical View
- Feel for PMI or place probe under the nipple
- Probe marker horizontal; slightly rotate probe to optimize image
- Aim probe towards R shoulder (Beam through the apex of the heart)

The “Ideal” Apical View...
- Visualizes 4 chambers
- Septum is vertical
- Tricuspid/Mitral valves are seen

Apical View
- Best view for comparing RV/LV chamber size
- Look for effusions laterally
- Septal wall motion
- Having the patient lie in L lateral decub will aid imaging
INTERPRETING YOUR FINDINGS…

Bedside Echo for:
- EF Estimation
- Pericardial Effusion/Tamponade
- RV Enlargement

Assessing Ejection Fraction
- QUALITATIVE assessment of LV function
- 2 easy ways to estimate EF:
  - Contraction of LV
  - Opening/Movement of anterior mitral valve leaflet

Evaluating LV Function
- Classification LV systolic function:
  - Normal = >50%
  - Decreased = 30-50%
  - Severely Reduced = < 30%
- Visual estimation of EF, even after a limited training, has been proven to be reasonably accurate* and comparable to track ball estimates

Estimating LV Function
- 2 markers:
  - LV wall contraction (1)
  - Mitral valve movement towards septum (2)

Estimating LV Function
- Poor EF:
  - LV doesn’t collapse well
  - Mitral valve doesn’t open much

Is There A Pericardial Effusion?

- Look for circumferential fluid around the heart, in multiple views
  - PSL, PSS, SX: Fluid anterior and posterior
  - AP4: Look lateral

Is There A Pericardial Effusion?

- Effusions are graded by size - largest pocket of fluid in diastole
  - <0.5 cm = small
  - 0.5-1 cm = moderate
  - >1 cm = large

- Quantity of pericardial fluid not as important as the rate of accumulation of fluid!

Is it Pleural or Pericardial?
Is it Pleural or Pericardial?

Pleural or Pericardial?

Is There A Pericardial Effusion?

- Pitfalls/Differential:
  - Physiologic fluid
  - Epicardial fat pad
  - Clotted blood
  - Pleural effusion

Is it Tamponade?

- Clinical diagnosis, but usually preceded by a few echo findings…
  - RA inversion during systole
  - RV collapse during diastole
- IVC:
  - Large
  - Non-collapsible

Is it Tamponade?

- RA inversion during systole
- RV collapse during diastole
- RV collapse - 92% sensitive and 100% specific*
- RA collapse - 64% sensitive and 100% specific*

*Singh et al. Circulation 1984
IVC in Tamponade
• Lack of variation through respiratory cycle:

RV/LV Comparison
• Typically best done in the AP4, as this allows you to compare size of RV/LV from apex to base
• Can use other views (PSS) to assess RV enlargement or pressure (septal wall bowing)

RV/LV Comparison
• RV is usually 2/3 size of LV
• When there is RV Enlargement:
  • RV loses triangular shape and becomes more oval
  • Severe RV enlargement- RV apex may extend beyond LV apex

RV Enlargement/Elevated Pressure
• May see abnormal septal motion due to elevated R sided pressure – “D sign”

RV/LV Comparison
• RV Enlargement seen in acute conditions:
  – MI
  – PE
• Can often be chronic (Pulm HTN, COPD, congenital defects)
• Subject to error: Depends on angle of probe vs RV
A FEW CASES...

Case 1
- “I haven’t been to a doctor in years…”
- Presents with DOE…
- VSS, EKG OK(ish)
- What tests to do?
  - CXR
  - Labs, Troponin
  - Bedside Echo!

Case 2
- Blunt thoracic trauma…
- Pt complains of chest pain…
- BP low…
- XR Negative…
Case 3

- Cancer patient comes in with chest pain, shortness of breath…
- Bedside Echo!
Case 4
- Cancer patient comes in with chest pain, shortness of breath…
- Bedside Echo!

Case 5
- “I fainted a few times today…”

Case 6
- “I’m having chest pain…”
- Alas, the EKG machine is broken (or stolen)…
- Bedside Echo!

We divide the heart into various regions based on vascular distribution:
- RCA
- LAD
- LCX
- RCA/LCX
- LCX/LAD
Vascular Distribution in PSS

Vascular Distribution in AP4

Questions?
THANK YOU!