Implementing New Technology

PP16 Imaging Conference
Bicol Hospital, Legaspi City, Philippines
July 2016

David Adams, ACS, RCS, RDCS, FASE
Duke University Medical Center
Scary Evolution
Echo Technology

New Technology Requires New Questions
1st – What we are NOT Covering
More why than how!
Questions

• Who routinely does 3D?
• Who does strain imaging?
Question

• Why should you care?
The Goal of Echo?

- Gives you a job
- Makes money for the lab
- Makes money for IAC
- To make a diagnosis
- To get the pt to therapy
Todays Talk

• Speckle Strain
Echo Technology

My Interpretation
“It takes a strong man to make a tender chicken”

Frank Perdue
“It takes an aroused man to make a chicken affectionate”

Spanish translation
History of Echo

• One Slide
Questions for any New Technology

- Does it help you get thru the day?
- It is reproducible?
- Is it the same across Vendors?
  - EF is
  - Longitudinal strain is (kind of)
  - Others not
Strain Case

- 32 y/o F
- Breast CA dx 2012
- Older Sister dx’d 2010
- Started on chemotherapy – adriamycin
- Concern = cardiotoxicity
Chemo pt
Strain #1 during chemo
Strain #2 post change
Chemo pt – Strain #1 vs 2

GS = -11%

GS = -20%
We will come back to this patient.
Strain’s Bottom Line

- Strain changes before EF changes
- Serial studies – tracking small changes over time
Strain – pattern recognition

Good

Bad
Strain

• Not for sissies
• Confusing
• Strains the brain
• My Goal – simplify
• Echo’s goal – get the pt to therapy
• Strain is just another tool
Some New Terms

- Parametric imaging
  - Measuring things the eye can’t see
  - Requires special software
Parametric displays

Good

Bad
Some New Terms

• Parametric imaging
  – Measuring things the eye can’t see
  – Requires special software

• Speckle
Speckle

- Acoustic signature within tissue
- Myocardium = lots of speckles
- A “kernel” is a defined area of speckle
Some New Terms

• Parametric imaging
  – Measuring things the eye can’t see
  – Requires special software
• Speckle
• Speckle-Tracking (STE)
Variability of Global Left Ventricular Deformation Analysis Using Vendor Dependent and Independent Two-Dimensional Speckle-Tracking Software in Adults

Niels Risum, MD, Sophia Ali, MD, Niels T. Olsen, MD, PhD, Christian Jons, MD, PhD, Michel G. Khouri, MD, Trine K. Lauridsen, MD, Zainab Samad, MD, Eric J. Velazquez, MD, Peter Sogaard, MD, DMSc, and Joseph Kisslo, MD, Durham, North Carolina; Gentofte, Denmark
Speckle tracking

- Acoustic signature within tissue
- Myocardium = lots of speckles
- A “kernel” is a defined area of speckle
Strain software

• Identifies, tracks and displays speckle patterns (kernels) in the myocardium

• Why should you care (besides having a new toy)

• Helps clinically:
  – Chemo pts – more sensitive than EF
  – HCM / amyloid
  – CRT
  – CAD & Valvular Disease
Strain

- Deformation dealing with shape and volume change
- Distance between speckle kernels changes
Strain

- During contraction (systole) in the long axis speckle gets closer (negative) – longitudinal strain
Strain

• During contraction (systole) in the long axis speckle gets closer (negative)
• In the short axis the speckle moves away (positive) – radial strain
3 Types of Strain

Radial

Circumferential

Longitudinal
Longitudinal Strain

- Negative
- Unitless (percentage)
- Normal (-19 or 20%)
Getting started

• 2D Images Required:
  – Apical 4 chamber
  – Apical 2 chamber
  – Apical Long
Examples: 2D images
How to perform a Speckle-Tracking Strain Echocardiogram

• 2D Images Required:
  – Apical 4 chamber
  – Apical 2 chamber
  – Apical Long

• Doppler images Required (for AoV closure timing):
  – CW through AoV
  – PW of LVOT
Example: Spectral Doppler

Measure on the valve clicks (for CW or PW as applicable)
Why do we care about AoV closure?

Contraction after AoV closure is wasted energy.
Why do we care about frame rate?

- Frame rate of 60-90Hz
- < 60 Hz kernels move too much
- > 90 Hz kernels don’t move enough
Analysis

• Check the waveforms!
• Do they make sense?
• What do they mean?
• What are the other things shown in the analysis?
Good tracking
Bad tracking (stupid)
Waveforms trace the regional strain throughout the cardiac cycle.
Waveforms & colors
Analysis continued: M-Mode

Colors represent the movement of the speckles throughout the cardiac cycle.
Normal LS?

GS = -19%
Example: End Products

Average Global Peak Longitudinal Strain:

-20.1% (normal)
Chemo pt
Chemo pt – Strain #1
Chemo pt – Strain #2
Chemo pt – Strain #1 vs 2

GS = -11%

GS = -20%
Clinical Balancing Act

- Strain improved but was chemo Rx effective?
- Not all cardiac toxicity is irreversible.
- Pick your poison?
Amyloid pt?
Amyloid pt - Strain
Amyloid pt - Strain
Other Strain Applications

- Cardiomyopathies (in general)
- Hypertrophic Cardiomyopathies (HCM)
- Athlete’s Heart
- Sarcoidosis, Lupus
- Amyloidosis
- Myocardial Infarction
- Aortic Stenosis
- And the list is growing!
1989 MV Anatomy

Dr. Bob Levine, et al at MGH

4 Chamber Long Axis
No MVP from Apical 4-Ch
Thanks to the Duke Echo Lab
The End