Welcome, Intro & Goals

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

David Adams, ACS, RCS, RDCS, FASE
Duke University Medical Center
Echocardiography

The Anatomy Lesson of Dr. Tulp by Rembrandt
This SMEE will be an educational collaboration between the Navy, American Society of Echo Foundation (ASEF) and the Philippine Society of Echocardiography (PSE) at the Bicol Hospital.

Navy Cardiologist CDR David Krause

The ASEF approved this as one of three 2016 global health initiatives.
- Team Leader: David Adams, Duke Cardiac Sonographer
- ASEF Staff: Andrea Van Hoever, VP of Research
- additional ASE cardiologists & sonographers

PSE President Dr. Edwin Tucay and Dr. Thad Ciocson from Bicol Hospital

Format: 2 day seminar with lectures on current updates in echo and hands on training of echo techniques scanning patients provided by Dr. Ciocson. The emphasis will be on screening for congenital and rheumatic heart disease.
Countries in PP16
PP16 in Legazpi

- **MON 27 JUN**
  - ARRIVE IN LEGAZPI FROM TML
- **TUE 28 JUN – SAT 09 JUL**
  - MEDICAL/DENTAL/NURSING SMEEs
    - ZIGA MEMORIAL HOSPITAL (TABACO CITY)
    - JOSEFINA DURAN HOSPITAL (LIGAO)
    - BICOL REGIONAL TEACHING AND TRAINING HOSPITAL (BRTTH) (LEGAZPI CITY)
  - SURGICAL CARE ONBOARD MERCY
- **TUE 28 JUN – THU 07 JUL**
  - CHE AND SMEE IN TABACO CITY, LIGAO, AND DARAGA
- **THU 30 JUN**
  - DISASTER SYMPOSIUM AT BRTTH
- **SAT 09 JUL**
  - CULMINATING DISASTER DRILL
- **MON 11 JUL**
  - DEPART LEGAZPI FOR DA NANG, VIETNAM
A long, long time ago
Goals

• Learn from each other
Friday, July 1

08:45-09:00: Welcome, Introduction and Goals
09:00-09:30: Optimizing Echo / Hemodynamics - David Adams
09:30-10:00: Echo Assessment of Stenotic Lesions – Melissa Cundangan, MD
10:00-12:00: “Patient Scanning” with ASE / Navy / PSE team
10:00-10:30: Patient Prostheses Mismatch (PPM) – Myla Supe, MD
10:30-10:45: Break
10:45-11:15: Echo Assessment of Valvular Regurgitation – Gregg Pressman, MD
11:15-12:00: Echocardiography and Endocarditis – Gregg Pressman, MD
12:00-13:00: Lunch
13:00-14:00: Echocardiography Cases—Aurora Gamponia, Jonnie Bote-Nunez, David Adams & CDR Krause
14:00-16:00: “Patient Scanning” with ASE / Navy / PSE team
Saturday, July 2

09:00-09:30: RV Size and Function – Edwin Tucay, MD
09:30-10:00: CHD: A Segmental Approach – Aurora Gamponia / Jonnie Bote-Nunez, MDs

10:00-12:00: “Patient Scanning” with ASE / Navy / PSE team
10:00-10:30: 2015 ASE Guidelines for Chamber Quantification – Jose Magno, MD
10:30-10:45: Break
10:45-11:15: Restrictive vs Constrictive Disease – Lucy Safi, MD
11:15-12:00: Implementing New Technology – David Adams
12:00-13:00: Lunch
13:00-14:00: Echocardiography Cases—David Adams & CDR Krause, MD

14:00-16:00: “Patient Scanning” with ASE / Navy / PSE team
16:15-16:30: Wrap up / Comments / Feedback
Goals

• Learn from each other
• Ask questions
• Be flexible
• Take care of our patients
• Questions?
Optimizing Echo / Hidden Things in the Heart

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Duke University Medical Center
Today's Talk

• Optimizing the Echo Images
• Ultrasound Machine Controls
  – Why it’s important
  – Good vs Bad
Why its important

• Operator dependent technique
• Image quality varies between pts
• Quality affects measurements
• And diagnosis
The Challenge

Fig 2-17

Suprasternal approach

Parasternal approach

Subcostal approach

Apical approach
Knobology

• The science of which knob or control to adjust and what it does to an ultrasound image.
Goals

• When to use what controls
• Optimizing the 2D images
Controls: 2D Images

- Depth
- Sector size
- Gain
- TGC
- Frequency
- Harmonics
- Gray scale
2 Common Mistakes

• Over gaining
  – destroys resolution
Important controls
2D Gain

Too Low

Too High
2D Gain

Just Right
**Color Doppler Gain**

![Ultrasound Images]

**Good**

**Too High**

UNCLASSIFIED

PACIFIC PARTNERSHIP 2016
• Time Gain Control (Compensation)
• Evens out the overall image brightness
• Suppresses the strong near field echoes
• Boosts the weaker far field echoes
Bad TGC Settings
Image Quality

• Resolution
• Target acquisition
• Display (gray scale)
Transducer frequency

- Lower frequency
  - better penetration (targets)
  - worse resolution
- Higher frequency
  - worse penetration (targets)
  - better resolution
Resolution

2.5 MHz

4.0 MHz
Harmonics

• Fundamental
  – Transmit & receive at the same frequency

• Harmonics
  – Transmit & receive at different frequencies
Fundamental Imaging
Harmonic Imaging
Harmonics

- Why is it important?
- Harmonics causes the leaflets to be thicker.
- For RHD and measuring the leaflets – turn Harmonics off!!
Harmonics
2 Common Mistakes

• Over gaining
• Foreshortened LV
Foreshortened
Apical Four - Chamber

- Image true apex
- Maximize RV dimension
- No aorta
- No coronary sinus
Systematic Approach

- Optimal gray scale
- Adjust the monitor
- Image in view / depth
- TGC – even gray throughout
- Overall gain – do not over gain!!!
• Optimizing the Echo Images
• Ultrasound Machine Controls
  – Why it’s important
  – Good vs Bad
• Hidden Things in the Heart
The Heart

- 4 chambers & 4 valves (hopefully)
- Other things we see:
  - Catheters / devices
  - Clots / cysts
  - Vegetation's
  - Tumors
  - Bullets / knives
  - Artifacts
  - Normal Variants
The Problem

- Normal Variants can be confusing
- Mistaken for pathology
- Can lead to unnecessary tests or even cardiac surgery

The Solution

- Know detailed anatomy
- Common things are common!
Normal Variants

Eustachian valve  Crista terminalis
Ligament of Marshall  Trabeculations
Dumbell IAS  Q-tip sign
Coumadin ridge  Valve excrescences
Atrial septal aneurysms  Moderator Band
Pectinate muscles  False chords / tendons
Lipomatous Hypertrophy  Thebesian Valve
Chiari network  Eustachian ridge
Confusing!!!!!!

Eustachian tube
Crouzon's
Ligament of Marshall
Dumbell IAS
Pectinate muscle
Atrial septal aneurysm
Chiari network
Eustachian ridge
Eustachian tubes / tendons
Thebesian Valve
Q-tip sign
Crista terminalis
Trabeculations
Valve excrescences
Modige
False chordae
Tetralogy of Fallot
Lipomatous plate
Goals for Today

- Review normal anatomy
- Review normal variants
- Show examples
- Become less confused
- The more you see the more you know
Right Atrium

• Crista Terminalis
• Eustachian Valve
• Thebesian Valve
• Chiari Network
• IAS Lipomatous Hypertrophy
• IAS Aneurysm
– Ridge between the smooth & trabeculated RA walls
– When prominent it may be mistaken for a RA mass

From *A Sonographer’s Guide* textbook by Bonita Anderson
Crista terminalis
Crista terminalis

- Do sweeps
- Shows connections & the extent of anatomy
Crista terminalis
- Valve of the IVC
- Directs flow to the LA in fetal circulation
- Best seen in the subcostal IVC view
- Can be prominent or undulating

From *A Sonographer’s Guide* textbook by Bonita Anderson
Eustachian Valve

- Can be confused with intracardiac thrombus
- Or complicate IVC cannulation
Thebesian Valve

- Valve of the coronary sinus
- Well known to the EP docs for biV lead placement
- Best seen in the parasternal RVIT view

From A Sonographer’s Guide textbook by Bonita Anderson
Thebesian Valve

- Valve of the coronary sinus
- Well known to the EP docs for BIV lead placement
- Best seen in the parasternal RVIT view
Chiari Network

- Mobile filamentous strands in the RA
- Random motion
- Has been associated with PFO’s & IAS aneurysms
Chiari network
Chiari network
Hyperlipomatous IAS

- Lipomatous hypertrophy of the IAS
  - Benign process
  - “Dumbbell” appearance (Echo term)
  - Fossa ovalis is spared (lack of fat cells)
Hyperlipomatous IAS
Hyperlipomatous IAS
IAS Aneurysm

- Idiopathic or may develop due to high atrial pressures
- Thin and hypermobile movement of the central IAS
- Some say ≥ 15 mm
- Associated with PFOs & may be prone to thrombus formation
IASA Gross Pathology
Left Atrium

- LAA & Pectinate Muscle
- Ligament of Marshall
- Transverse Sinus
LA Appendage

- Contractile
- Trabeculated – pectinate muscles
- Variable anatomy
- 1-5 lobes
Major LAA Types

The **Wind Sock Type** LAA is an anatomy in which one dominant lobe of sufficient length is the primary structure.

The **Chicken Wing Type** LAA is an anatomy whose main feature is a sharp bend in the dominant lobe of the LAA anatomy at some distance from the perceived LAA ostium.

The **Broccoli Type** LAA is an anatomy whose main feature is an LAA that has limited overall length with more complex internal characteristics.

From JAFIB LA Appendage Morphology by Ajay Vallakati
Case Western Reserve University
Ligament of Marshall

- Atrial tissue between the LUPV & LAA
- Also called the Q-tip, Warfarin or Coumadin ridge
- Has been mistaken for thrombus
Transverse sinus

- Potential pericardial space between the LA & AO root
- Could be mistaken for an abscess
Right Ventricle

- Trabeculations
- Moderator Band

From *Atlas of Human Anatomy* by Frank Netter
- The RV is normally more heavily trabeculated than the LV
- Difficult to see small, layered thrombi
Moderator Band

- Septomarginal trabecula
- Helps define the anatomic RV in CHD
Moderator Band

- Septomarginal trabecula
- Helps define the anatomic RV in CHD
- Contains conduction fibers to the anterior pap muscle

From *Diagnostic Atlas of the Heart* by Hurst & Alpert
Left Ventricle

- False Tendons
- Trabeculations
- Lambl’s Excrescences

From Atlas of Human Anatomy by Frank Netter
False Tendons

– Usually towards the LV apex
– Also called accessory chords, LV chords, aberrant bands or “heart strings”
– Known to cause a murmur
– May mimic thrombus or the edge of a tumor
False Tendons (2D & 3D)
LV Chord
LV Chord
LV Trabeculations

– May be more prominent in remodeled ventricles (LVH)
RV & LV Trabeculations
Lambl’s Excrescences

- Small, mobile filamentous strands coming off the AoV leaflets.
- May mimic valvular vegetations so must be put in a clinical context.
Conclusions

• Know cardiac anatomy
  – All of it!!
• Know the echo characteristics
• Remember that ultrasound beams diverge and have width
• Do sweeps to make connections
• Common things are common!
The End