E-FOCUS
Extended Focused Cardiac Ultrasound
Assessment of Valves

My patient has a murmur...

Dr. Paul Atkinson
Dalhousie University
OBJECTIVES

• Indications for Echo in...
  • Suspected valvular disease

• Technique

• Pathology
FoCUS

- FoCUS: Focused Cardiac Ultrasound
  - Goal-directed
  - Problem oriented
  - Limited in scope
  - Simplified
  - Time sensitive and repeatable
  - Qualitative or semiquantitative
  - Performed at the point of care
ASSESSMENT FOR PATHOLOGY

- FLUID?
  - PERICARDIAL EFFUSION?

- FORM
  - SIZE & SHAPE

- FUNCTION
  - WALL THICKENING
  - CHAMBER CONTRACTING
  - VALVE MOVEMENTS

- FLOW
  - VALVE MOVEMENTS
  - COLOUR FLOW DOPPLER

© www.emergencyultrasound.ca
Emergency valvular assessment

• what do i need to know?

• “eye-ball” assessment vs “accurate” measurement
Assessment of Valves

- **Aortic valve**
  - Aortic stenosis
  - Aortic regurgitation

- **mitral valve**
  - mitral stenosis
  - mitral regurgitation

- **tricuspid valve**
  - Tricuspid regurgitation

- pulmonary valve
Evaluation of Murmurs

- **Systolic Murmur**
  - **Aortic Stenosis** *(Degenerative calcific aortic stenosis, rheumatic, calcific aortic valve)*
  - **Mitral Regurgitation** *(Acutely: myocardial infarction & infective endocarditis. Chronically: Degenerative calcific aortic stenosis, congenital bicuspid aortic valve, rheumatic)*
  - **Mitral Valve Prolapse** *(Commonest heart lesion in the community)*
Evaluation of Murmurs

- diastolic murmurs
  - Mitral stenosis (RHEUMATIC)
  - aortic regurgitation
CASES

1. A 75 yr male presents with recurrent syncope on exertion - you detect a systolic murmur - is he safe to go home?

2. A 65 yr female presents with recurrent A Fib requiring repeated cardioversion - does she have mitral valve disease?

3. A 24 year old girl presents with exertion syncope. Exam and ECG are normal. Could she have AI?
Assessment of Valves

- appearance
- mobility
- assessment of LV and/or RV
- Colour map
- spectral doppler measurements
Aortic Valve

• Composed of 3 cusps of equal size
• When viewed from a conventional TTE short-axis projection, the closure lines of the 3 cusps forms a 'Y' shape.
• Behind each cusp is a sinus of Valsalva.
• The left and right coronary arteries arise from the left and right sinuses, respectively, and are associated with the left and right cusps.

Normal aortic valve area: > 2 cm² (2.5 - 3.5 cm²)
Aortic Stenosis

- Normal area of the aortic valve is > 2cm²
- Significant narrowing restricts LV outflow imposing a pressure load on the LV
- Leads to Hypertrophy of the LV

**Symptoms:** Exertional angina
Dyspnoea
Exertional syncope
Aortic Stenosis

**Appearance**

- Degree and distribution of thickening
- How many cusps
- Is the closure line central or eccentric *(Bicuspid)*
Aortic valve
Aortic Valve
Aortic Stenosis

**Mobility**

- **Is it normal or reduced?**
- **Is there systolic bowing?** *(Bicuspid, Rheumatic)*
- Is there diastolic prolapse *(Floppy valve, tear, bicuspid)*
AORTIC VALVE
aortic valve
aortic valve
Aortic Stenosis

A

B

RV

LV

LA

RV

LA
Aortic Stenosis

Severe Aortic Stenosis
Aortic Stenosis

Severe Aortic Stenosis
Aortic Stenosis

Mild Aortic Stenosis
Aortic Stenosis

Mild Aortic Stenosis
Severe Aortic Stenosis
Severe Aortic Stenosis
Assessment of the LV in Aortic Stenosis

• Look for hypertrophy of the LV which suggests (but **DOES NOT PROVE**) severe stenosis
  (IVS / Posterior wall >11mm in Diastole)

• If the LV function is impaired, the transaortic pressure difference may underestimate the severity of the stenosis
Aortic Stenosis

Aortic Stenosis with Severe LV Dysfunction
Aortic Stenosis with Severe LV Dysfunction
Aortic Insufficiency (in brief)

- Volume overload
- Decreased exercise tolerance
PLAX with CFD
PLAX with CFD
Mitral Valve

- Chordae Tendencae
- Papillary Muscle
- Anterior Mitral Leaflet
- Posterior Mitral Leaflet

Transthoracic

AMVL
PMVL

© www.emergencyultrasound.ca

Reproduced from Feigenbaum's Echocardiography 6th Edition
Parasternal Short-Axis
Parasternal Short-Axis
Mitral Stenosis

• **Causes:**
  - Rheumatic Heart Disease *(only common cause)*
  - Congenital Mitral Stenosis
  - Mitral Annular Calcification
Mitral Stenosis

- valve anatomy, appearance, mobility
- 2D mitral valve area
- mean transmitral pressure gradient
- Pressure Half-Time
- pulmonary artery pressures
- coexisting mitral regurgitation
Valve Anatomy & Mobility

**Assess:**

- the distribution and degree of thickening of each leaflet
- whether there is calcification in the line of commissural fusion
- the mobility of the anterior and posterior leaflets
- The degree of chordal involvement
Rheumatic Mitral Stenosis

Mitral Stenosis

© www.emergencyultrasound.ca
Rheumatic Mitral Stenosis

Mitral Stenosis
Rheumatic Mitral Stenosis
Rheumatic Mitral Stenosis
Parasternal Short-Axis
Rheumatic Mitral Stenosis
Parasternal Short-Axis
Rheumatic Mitral Stenosis
Apical 4-Chamber View
Rheumatic Mitral Stenosis
Apical 4-Chamber View
Rheumatic Mitral Stenosis
RHEUMATIC MITRAL STENOSIS WITH MARKED CHORDAL THICKENING
RHEUMATIC MITRAL STENOSIS WITH MARKED CHORDAL THICKENING
Mitral Valve Area:

- **Normal 2-6 cm²**
- **Mild MS 2-4 cm²**
- **Moderate MS 1-2 cm²**
- **Severe <1 cm²**
Mitral Regurgitation

Aetiology

- Ischaemic:
  - Restricted posterior leaflet prolapse
  - Papillary muscle rupture or dysfunction

- Functional
- Floppy Mitral Valve
- Rheumatic
- Endocarditis
- Other (e.g., SLE)
Mitral Regurgitation

Features of MR

- Acute vs Chronic
- LV volume overload with dilatation
- LA dilatation
Assessment of Mitral Regurgitation

- Appearance & Movement of the valve leaflets
- Colour flow mapping
- Continuous wave Doppler
- Left Ventricular Function
- Pulmonary Artery Pressure
RESTRICTED POSTERIOR MITRAL VALVE LEAFLET
RESTRICTED POSTERIOR MITRAL VALVE LEAFLET
Posteriorly directed MR jet due to restriction of the posterior mitral valve leaflet
Posteriorly directed MR jet due to restriction of the posterior mitral valve leaflet
MR in a patient with dilated cardiomyopathy and apical displacement of the papillary muscles leading to functional mitral regurgitation.
MR in a patient with dilated cardiomyopathy and apical displacement of the papillary muscles leading to functional mitral regurgitation
SEVERE FUNCTIONAL MR ASSOCIATED WITH APICAL DISPLACEMENT OF THE PAPILLARY MUSCLES
Severe functional MR associated with apical displacement of the papillary muscles
Colour Flow Mapping

- Colour Doppler imaging is the primary echocardiographic tool for the DETECTION and QUANTITATION of Mitral regurgitation.
- Assess the width of the base of the jet at the level of the valve.
- Assess the jet area.
Mitral Regurgitation
Mitral Regurgitation
Mitral Regurgitation
Mitral Regurgitation

Mild mitral regurgitation

Severe mitral regurgitation
mitral valve prolapse

- movement of any part of either valve leaflet behind the plane of the annulus in the long-axis view
- movement of the point of coaptation behind the plane of the annulus in the 4-chamber view
- usually, the jet is directed away from the prolapsing leaflet
MITRAL VALVE PROLAPSE
MITRAL VALVE PROLAPSE

© www.emergencyultrasound.ca
MITRAL VALVE PROLAPSE
Mitral Regurgitation: Summary

- Valve anatomy and movement: Aetiology of regurgitation
- Assess severity using colour flow mapping
- Assess for LV dilatation and systolic dysfunction
- Assess for other valve disease
Summary

+ WHAT DO I NEED TO SEE?

+ “Eye-ball” assessment vs “accurate” measurement
  
  · FLUID? (PERICARDIAL EFFUSION?)
  
  · FORM (SIZE & SHAPE)
  
  · FUNCTION
    
    · WALL THICKENING
    
    · CHAMBER CONTRACTING
    
    · VALVE MOVEMENTS
  
  · FLOW
Questions?