How to Grade Mitral Stenosis

- Routine evaluation of MS severity should combine:
  - Mean Gradient and Valve area using Planimetry and Pressure 1/2t methods.
  - In case of discrepancy the result of planimetry is the reference measurement, except with poor acoustic windows.
  - Continuity equation or PISA not recommended for routine use but may be useful in certain patients when standard measurements are inconclusive.
Quantification Methods

- Valve Area
- Planimetry
- Pressure Half Time (PHT)
- Continuity Equation
- Proximal Isovelocity Surface Area (PISA)
- Mean Gradient

Recommended Recordings

Mitral Stenosis

- Apical window
- CW Doppler
- PW Doppler
  - Leaflet tips
  - Use Color Doppler to line up with MV inflow jet
  - Parallel to Flow
  - Parasternal short-axis MV level / long-axis

Mitral Stenosis: Game Plan

Normal Sinus Rhythm and Rapid Atrial Fibrillation

Echocardiographic Quantification

Pathophysiology of MS
Case #1

49 year old female

History significant for rheumatic fever

Vitals

- 72 bpm
- Sinus rhythm
- BP 132/80
- Grade 1/6 diastolic rumble
Planimetry

Area = 1.8 cm$^2$

Mitral Stenosis
Severity Guidelines

<table>
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<tr>
<th>Severity</th>
<th>Mean Gradient</th>
<th>MVA (cm$^2$)</th>
<th>PHT (msec)</th>
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Pressure Half Time

Time for the pressure to drop in half

Velocity

$V_{PHT}$, $T_{PHT}$, $0.7V_{max}$
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Continuity Equation

$$MVA = \frac{LVOT_{SV}}{MV_{TVI}}$$

Continuity Equation

**LVOT** = 2.1 cm

**MV Peak** = 1.5 m/s

**MV TVI** = 52 cm
Continuity Equation

\[ \frac{2 \times 0.785 \times V_{LVOT}^2}{V_{TVI} \times 0.785} = 1.7 \text{cm}^2 \]

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PISA

\[ \text{MVA} = 6.28 \times r^2 \times \text{Aliasing velocity} \times \frac{\theta}{180} \]

Rifkin RD et al. JACC 1995

PISA
Mitral Stenosis Severity Guidelines

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PISA

\[ MVA = 6.28 \times (1.1\text{cm})^2 \times (39\text{cm/s}) \times \frac{150}{180} = 1.6\text{cm}^2 \]
Case #1

Quantification
- Planimetry
  - MVA: 1.8 cm²
- PHT
  - MVA: 1.8 cm²
- Continuity Equation
  - MVA: 1.8 cm²

Mild MS

PISA
- MVA: 1.6 cm²

Mean Gradient
- MVA: 1.6 cm²

Case #2

69 year old female

History significant for Rheumatic fever

Vitals
- 110 bpm
- Atrial fibrillation
- BP 140/84

Planimetry
Planimetry

Minimum Diameter = 0.85 cm

Area = 1.2 cm²

Pressure Half Time

Pressure Half Time

Pressure Half Time

Pressure Half Time

MV₁ PV₁ = 2.4 m/s

PHT₁ = 188 ms

MVA₁ = 1.2 cm

MV₂ PV₂ = 2.2 m/s

PHT₂ = 177 ms

MVA₂ = 1.2 cm

MV₃ PV₃ = 2.2 m/s

PHT₃ = 196 ms

MVA₃ = 1.1 cm

MV₄ PV₄ = 2.6 m/s

PHT₄ = 186 ms

MVA₄ = 1.2 cm

MV₅ PV₅ = 2.6 m/s

PHT₅ = 185 ms

MVA₅ = 1.2 cm

Average MVA² = 1.2 cm²

Average PHT = 1.2 cm²

LVOT Diameter = 1.9 cm

Continuity Equation

Continuity Equation

Continuity Equation

Continuity Equation

PV₁ = 1.3 m/s

TVI₁ = 20 cm

PV₂ = 1.2 m/s

TVI₂ = 18 cm

Average TVI = 19 cm
Continuity Equation

\[ \frac{MVA}{(1.9\text{cm})^2 \times .785 \times 19}{56\text{cm}} = .96\text{cm}^2 \]

\[ \theta = 165^\circ \]
**PISA**

\[
PISA = 6.28 \times (1.1\text{cm})^2 \times (34\text{cm/s}) \times \frac{165}{180}
\]

\[= .99\text{cm}^2\]

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**Mean Pressure Gradient**

Average Mean Gradient = 13mmHg

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**Mitral Stenosis Severity Guidelines**

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NOTE:

Heart rate dependent!

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**Case# 2**

- **Quantification**
  - **Planimetry**
    - MVA=1.2cm\(^2\)
    - Moderate MS
  - **PHT**
    - MVA=1.2cm\(^2\)
    - Moderate MS
  - **Mean Gradient**
    - MVA=1.2cm\(^2\)
    - Severe MS
  - **Quantification**
    - MVA=9cm\(^2\)
    - Severe MS

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Indicators

- LA Volume (ml/m²)
- RVSP
- RV Size
- RV Function

Average TR Velocity = 3.4 m/s

Take Home Points

- Use all tools in your toolbox, Mean Gradient, MVA; P1/2 time, Planimetry
- Know your limitations of MS
- Always record the HR when reporting the mean pressure gradient
- Measure a minimum of 5 beats when atrial fibrillation is present
- Incorporate the supportive indicators when determining the severity of stenosis