Percutaneous Balloon Mitral Valvuloplasty

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Also known as …

• Mitral valvuloplasty

• PTMV
  • Percutaneous transvenous mitral valvuloplasty

• PTMC
  • Percutaneous transvenous mitral commissurotomy
Mitral stenosis

• Rheumatic > 95%

• Collagen vascular disease
  • Eg. Lupus

• Mitral annular calcification

• Endocarditis

• Congenital inflow disease

• Etc.

Possible treatment options

• Medical

• Surgical
  – Open commissurotomy
  – Closed commissurotomy
  – Mitral valve replacement

• Percutaneous
Superior view

Normal MVA = 4 - 5cm$^2$
Rheumatic mitral stenosis

- Pathological process
  - leaflet thickening and calcification,
  - commissural fusion,
  - chordal fusion, or
  - combination of these processes
- Result is a funnel-shaped mitral apparatus

- Interchordal fusion obliterates the secondary orifices
- Commissural fusion narrows the principal orifice
Presentation

- Diastolic filling period is related to HR
- Tachycardia decreases DFP

- Early symptoms with MS (often dyspnea)
  - Exercise
  - Emotional stress
  - Infection
  - Atrial fibrillation
  - Pregnancy
Severity of mitral stenosis

<table>
<thead>
<tr>
<th>Degree</th>
<th>Mean gradient</th>
<th>Valve area</th>
<th>RVSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>&lt; 5 mmHg</td>
<td>&gt; 1.5 cm²</td>
<td>&lt; 30 mmHg</td>
</tr>
<tr>
<td>Moderate</td>
<td>5 – 10 mmHg</td>
<td>1.0 – 1.5 cm²</td>
<td>30 – 50 mmHg</td>
</tr>
<tr>
<td>Severe</td>
<td>&gt; 10 mmHg</td>
<td>&lt; 1.0 cm²</td>
<td>&gt; 50 mmHg</td>
</tr>
</tbody>
</table>

Natural history

- Often a latency between initial rheumatic fever and cardiac presentation
  - Up to 40 years in developed worlds

- Possibly less of a latency in underdeveloped world due to repeated infections
Natural history

• 10-year survival of untreated patients is 50% to 60%

   Dependents on symptoms | Survival at 10 years
Asymptomatic or minimally symptomatic (60% of patients having no progression of symptoms) | >80%
Significant limiting symptoms | 0% to 15%
Severe pulmonary hypertension | Mean < 3 years

• Mortality is due to:
  – Progressive pulmonary and systemic congestion in 60% to 70%
  – Systemic embolism in 20% to 30%
  – Pulmonary embolism in 10%
  – Infection in 1% to 5%

ACC/AHA indications for PBMV

• Class I
  – NYHA II – IV with moderate or severe MS and favorable valve
  – Asymptomatic with moderate or severe MS and pulmonary HTN
    • >50mmHg at rest and >60mmHg with exercise

• Class IIa
  – Patients with moderate or severe MS, nonpliable calcified valve, NYHA III – IV and are not great for surgery

• Class IIb
  – Asymptomatic with moderate or severe MS and new onset AF
  – NYHA II – IV with mild MS but evidence of hemodynamic significance
    • PA >60mmHg, PAW ≥25mmHg, or mean MV gradient >15mmHg with exercise
  – As an alternative to surgery with nonpliable, calcified valve and NYHA III – IV

Need to have no LA thrombus and < 2+MR
Work-up

- History
- Physical examination
- ECG
- TTE with doppler
  - Appearance and mobility of the MV apparatus and commissures
  - Transmitral gradient
  - MV area
  - Pulmonary artery pressure

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<table>
<thead>
<tr>
<th>Grade</th>
<th>Mobility</th>
<th>Subvalvular Thickening</th>
<th>Thickness</th>
<th>Calcification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Highly mobile valve with only leaflet tips restricted</td>
<td>Minimal thickening just below the mitral leaflets</td>
<td>Leaflets near normal in thickness (4 to 5 mm)</td>
<td>A single area of increased echo brightness</td>
</tr>
<tr>
<td>2</td>
<td>Leaflet mid and base portions have normal mobility</td>
<td>Thickening of chordal structures extending up to one third of the chordal length</td>
<td>Middleaflets normal, considerable thickening of margins (5 to 8 mm)</td>
<td>Scattered areas of brightness confined to leaflet margins</td>
</tr>
<tr>
<td>3</td>
<td>Valve contracts to move forward in diastole, mainly from the base</td>
<td>Thickening extending to the distal third of the chords</td>
<td>Thickening extending through the entire leaflet (5 to 8 mm)</td>
<td>Brightness extending into the midportion of the leaflets</td>
</tr>
<tr>
<td>4</td>
<td>No or minimal forward movement of the leaflets in diastole</td>
<td>Extensive thickening and shortening of all chordal structures extending down to the papillary muscles</td>
<td>Considerable thickening of all leaflet tissue (greater than 8 to 10 mm)</td>
<td>Extensive brightness throughout much of the leaflet tissue</td>
</tr>
</tbody>
</table>

PBMV

- Mean valve area usually doubles
  - From 1.0 to 2.0 cm²
  - 50% to 60% reduction in trans-mitral gradient

- 80% to 95% of patients have a successful procedure
  - MVA > 1.5 cm²
  - ↓ LAP < 18 mmHg
  - No complications

Procedural complications

- Severe MR 2% to 10%
- Residual large atrial septal defect < 5%
- Perforation of the left ventricle 0.5% to 4.0%
- Embolic events 0.5% to 3%
- Myocardial infarction 0.3% to 0.5%

- Mortality < 1 to 2%
### Success rates (at five years)

<table>
<thead>
<tr>
<th>Age group</th>
<th>NYHA I or II</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40</td>
<td>87%</td>
</tr>
<tr>
<td>40 – 54</td>
<td>63%</td>
</tr>
<tr>
<td>55 – 69</td>
<td>36%</td>
</tr>
<tr>
<td>≥70</td>
<td>19%</td>
</tr>
</tbody>
</table>


### Technicalities and preparation
Preparing for the procedure

• At least three months of anti-coagulation
  • INR 2.0 – 3.0 (some advocate 2.5 – 3.5)
• TTE to identify the mitral apparatus
• Coronary angiogram in those with risk factors
  • Or over age 35
  • Guidelines do NOT recommend it though
• Right heart cath is not necessary unless discrepancy between symptoms and TTE

Preparation, cont’d

• Stop anti-coagulation 5 days prior to procedure
  • Bridge with LMWH

• Admit the previous day for TEE (rule out LA clot and reassess MR)

• Teaching
  • What to expect during and afterwards
Nursing preparation (floor)

- On admission
  - CBC, lytes, BUN, creatinine, INR
  - Baseline ECG
  - IV access

- Day of procedure
  - Shave and prep both groins
    - RFV and LFA (+/- LFV) access
  - IV NS at 100 – 125cc/hr

Nursing preparation (lab)

- Two transducers
- 8F sheath RFV
- 6F arterial sheath LFA
  - +/- 7F sheath LFV (for PA catheter)
- 2g of IV cefazolin at start of case
  - 1g of vancomycin if penicillin allergic
- 500cc normal saline once all sheaths in
- 5000u IV heparin after successful transseptal
The INOUE balloon kit
Inoue method for transseptal access

**Right Atriogram (systole)**

**Left Atriogram**

“mid-line”

LA

TM = LM

RA

<table>
<thead>
<tr>
<th>Order Number</th>
<th>Size</th>
<th>Sheath Length</th>
<th>Dilator Length</th>
<th>Wire Size Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP008391</td>
<td>8 Fr with hemostasis valve</td>
<td>59 cm</td>
<td>67 cm</td>
<td>.032 in</td>
</tr>
<tr>
<td>EP008552</td>
<td>8 Fr</td>
<td>59 cm</td>
<td>67 cm</td>
<td>.032 in</td>
</tr>
</tbody>
</table>

**Order Number**

| EP003994     | 18 gauge shaft, 21 gauge tip | 71 cm |

**Medtronic**

When Life Depends on Medical Technology
Always do an initial LVA
Right atrial angiogram and holding the pedal for the levo-phase

Crossing the septum
Passing Inoue balloon

First Inflation
Final LVG

Pictures (for patients)
Nursing care (Pre and Post)

- Monitor and oxygen (2 – 3L NP)
- ECG
- LFA sheath removal (usual protocol)
  - RFV sheath removed in lab
- Sandbags on each site
- Vital signs q15 minutes initially

Nursing care (floor)

- Monitor for 24 hours
- Vital signs q2h for 4 hours, then q4-6h
  - Including cardiac auscultation (new murmurs)
- Bed rest according to post-coronary care

- Next day
  - CBC, lytes, BUN, Creatinine
  - Home after seen by physician
Post-valvuloplasty care

- TTE afterwards (typically after 3 days)
  - Baseline measurement of postoperative hemodynamics
  - Exclude significant complications
    - MR, LV dysfunction, or atrial septal defect

- Patients with severe MR or a large atrial septal defect should be considered for early surgery
  - Majority of small left-to-right shunts close spontaneously over the course of 6 months

- Warfarin should be restarted 1 to 2 days after the procedure.

Post-valvuloplasty

- Symptomatic instant improvement

- Objective delayed improvement
  - Eg. Oxygen consumption
  - Gradual regression of pulmonary hypertension
    - Assuming not due to other causes as well
Follow-up

• Yearly
  – History
  – Physical
  – Chest x-ray
  – Ecg
  – +/- TTE

• Prophylaxis against rheumatic fever recurrence as appropriate

Secondary prophylaxis

<table>
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<tr>
<th>Category</th>
<th>Duration</th>
</tr>
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<tbody>
<tr>
<td>Rheumatic fever with carditis and residual heart disease (persistent valvular disease)</td>
<td>10 y or greater since last episode and at least until age 40 y; sometimes lifelong prophylaxis</td>
</tr>
<tr>
<td>Rheumatic fever with carditis but no residual heart disease (no valvular disease)</td>
<td>10 y or well into adulthood, whichever is longer</td>
</tr>
<tr>
<td>Rheumatic fever without carditis</td>
<td>5 y or until age 21 y, whichever is longer</td>
</tr>
</tbody>
</table>
Post-PBMV

• Recurrence of symptoms occurs in up to 60% of patients after surgical commissurotomy at 9 years
  – <20% due to re-stenosis
    • Progressive MR
    • Coronary problems
    • Other valvular disease

That’s it, simple 😊