Valvular Heart Disease

Medical Evaluation and Management

- Mitral Valve
- Aortic Valve
- Tricuspid Valve
- Pulmonic Valve

Surgical Indications

Surgical Options

Percutaneous Options

Mitral Valve Disease

Mitral Regurgitation

Causes

- Primary (degenerative)
  - Mitral valve prolapse
  - Rheumatic heart disease
  - Infective endocarditis
  - Collagen Vascular Diseases

- Secondary (functional)
  - Ischemic heart disease
  - Nonischemic cardiomyopathy

Mitral Valve Disease

Mitral Regurgitation

Mitral Valve Prolapse

- Classic mitral valve prolapse refers to the superior displacement of the mitral leaflets of more than 2 mm during systole with a maximal leaflet thickness of at least 5 mm during diastasis.

- Non classic prolapse refers to the displacement of more than 2 mm with a maximal thickness of less than 5 mm.

Mitral Valve Disease

Mitral Regurgitation

Mitral Valve Prolapse

- With myxomatous billowing leaflets has a likelihood of progression in 7-10% to severe MR
- With normal appearing leaflets has no significant progression of disease
- No need for antibiotic prophylaxis

Individuals with mitral valve prolapse usually develop a chronic compensated state

Decompensation may occur as a result of progression ventricular dilation and decrease in forward cardiac output or acute chordal rupture

The average interval from time of diagnosis to onset of symptoms is 16 years

60 years is the average age at which severe symptoms develop
Mitral Valve Disease
Mitral Regurgitation
Rheumatic Mitral Disease
- The mitral leaflets become thickened and chordal retraction occurs as a result of an inflammatory process
- A classic hockey stick appearance of the anterior leaflet develops

Mitral Valve Disease
Mitral Regurgitation
Infective Endocarditis
- Infective endocarditis can lead to valvular vegetations, valvular destruction and valvular abscesses
- Mitral regurgitation usually results from valvular destruction but can occur through a perivalvular abscess
- In-hospital mortality 15-20%. 1 year mortality approaches 40%
- Common organisms:
  - Streptococci 50-70%
  - Enterococci 10%
  - Staphylococci 25%

Mitral Valve Disease
Mitral Regurgitation
Ischemic/Nonischemic Cardiomyopathy
- The mitral valve relies heavily on the adjacent supporting structures for normal function
- If the mitral annulus dilates as a result of left ventricular enlargement poor central leaflet coaptation develops and results in a central jet of mitral regurgitation

Mitral Valve Disease
Mitral Regurgitation
Ischemic/Nonischemic Cardiomyopathy
- If the left ventricle dilates due to a myopathic process or ischemic disease, the papillary muscles are displaced inferiorly and causes downward traction on the chordal elements leading to a central jet of mitral regurgitation

Mitral Valve Disease
Mitral Regurgitation
Ischemic Heart Disease
- If papillary ischemia or rupture occurs the chordal elements malfunction and severe acute mitral regurgitation occurs with an eccentric jet of mitral regurgitation

General Principles of Therapy
Mitral Regurgitation
Primary
- No medical option for valve
- Surgery for symptoms or LV dysfunction
- Asymptomatic if repairable and low risk

Secondary
- Medical therapy first
- Consider CRT
- Surgery only in highly selected patients with HF
Mitral Valve Disease
Mitral Regurgitation

**Indications for Surgery**

*Acute severe mitral regurgitation*
- Chordal rupture
- Ischemic heart disease
- Infective endocarditis

Mitral Valve Disease
Primary Mitral Regurgitation

**Indications for Surgery**

-Chronic severe mitral regurgitation
  - NYHA class II or greater symptoms
  - Ejection Fraction < .6
  - End systolic dimension > 40mm
  - Atrial fibrillation
  - Pulmonary artery pressure (>60 mm Hg with exercise or > 50 mm Hg at rest
  - MitraClip may be considered in NYHA Class III/IV pts with a reasonable life expectancy but prohibitive surgical risk due to severe comorbidities

Mitral Valve Disease
Mitral Stenosis

**Causes**
- Rheumatic fever
- 25% pure mitral stenosis
- 40% combined MS/MR
- 2/3 Female
- Congenital mitral stenosis

**Rheumatic Mitral Stenosis**

- 20-40 years may elapse between the occurrence of rheumatic fever and the onset of symptoms of mitral stenosis
- Symptoms may not be disabling for another 10 years
- Once symptoms become limiting the 10 year survival drops to 10-15%

Mitral Valve Disease
Mitral Stenosis

**Indications for Surgery**

- NYHA Class II symptoms with MVA < 1.5 cm² or mean gradient ≥ 5mm may be considered for balloon valvotomy (Normal MVA is 4-6 cm²)
- NYHA Class III or IV and severe mitral stenosis (MVA < 1 cm², mean gradient > 10 mmHg) require balloon valvotomy or surgery

Mitral Valve Disease
Mitral Stenosis

**Nonsurgical Options**

- Balloon valvotomy
  - Leaflet mobility
  - Valvular thickening
  - Subvalvular calcification
- Valve Score < 8 good candidate
**Mitral Valve Disease**

**Mitral Stenosis**

**Surgical Options**

- **Open Commissurotomy**
- **Mitral valve replacement**
  - Less time consuming than MV repair (repair may not be an option)
  - Less dependent on individual surgeon’s expertise than MV repair
  - Preservation of the subvalvular apparatus whenever possible
  - Operative risk 3-5%

**Mitral Valve Disease**

**Combined MS/MR**

**Mitral Valve Replacement**

**Tissue Valves**

- Low thrombogenicity
- Shorter life span in the mitral position
- Leaflets tear or calcification of leaflets most common cause of failure

**Mitral Valve Disease**

**Combined MS / MR**

**Mitral Valve Replacement**

**Mechanical Valves**

- Bileaflet
- Tilting disc
- Ball in cage

- More thrombogenic than tissue valves
- Need for chronic coumadin therapy
- Longer lifespan the tissue valves

**Mitral Valve Disease**

**Combined MS / MR**

**Surgical Options**

- **Mitral valve replacement**
  - Paravalvular leak
  - Infective endocarditis
  - Pannus formation
  - Thromboembolic events

**Benefits of mitral valve repair:**

- No risk of prosthesis degeneration/pannus formation
- Reduced risk of thrombogenicity
- Reduced risk of infection
- No risk of reduced left ventricular function
- Minimal operative risk
Mitral Valve Disease
Combined MS / MR

Surgical Options

Mitral valve repair

- For mitral valve prolapse repair of both anterior and posterior leaflets is possible
- Gortex chordal elements or chordal transfer may be used
- For central jets of mitral regurgitation an annular ring can be enable appropriate leaflet edge coaptation

Aortic Valve Disease
Aortic Stenosis

Causes

- Unicuspid aortic valve
- Bicuspid aortic valve; 2% of live male births
- Calcific aortic stenosis, most common
- Acquired valvular lesion; 1-2% of persons over age 65

Aortic Valve Disease
Aortic Stenosis

Left Ventricular Compensation

- Concentric hypertrophy develops due to pressure overload
- Diastolic dysfunction develops due to hypertrophy due to increased wall thickness and collagen content
- Systolic dysfunction develops due to excess afterload and decreased contractility

Aortic Valve Disease
Aortic Stenosis

Symptoms

- Normal aortic valve area is 3-4 cm²
- Symptoms occur with valve areas less than 1.2-1.5 cm²
  - Angina – 50% mortality at 5 years – due to decreased coronary flow and increased myocardial oxygen demand
  - Syncope – 50% mortality at 3 years – decrease in peripheral resistance combined with fixed left ventricular outflow
  - Congestive heart failure – 50% mortality at 2 years

Aortic Valve Disease
Aortic Stenosis

Asymptomatic

Identification of higher risk patients

- Peak echo gradient of 64 mm Hg or greater (70% chance of developing symptoms in 2 years)
- Exercise testing to evaluate exercise induced hemodynamic compromise
- Symptomatic patients with gradient < 30 mmHg due to depressed left ventricular function benefit from evaluation with dobutamine stress echo
- An increased gradient with inotropic stimulation suggest benefit from AVR

Aortic Valve Disease
Aortic Stenosis

Indications for Surgery

- Symptomatic
  - Aortic valve replacement recommended for angina, syncope, congestive heart failure if gradient > 50 mm Hg and valve area is < 1 cm²
- Asymptomatic
  - Severe AS with an LVEF < 50% and Ao velocity 4.0 m/sec or > or mean gradient 40 mmHg or higher
  - When undergoing cardiac surgery for other indications with Ao velocity 4.0 m/sec or mean gradient 40 mmHg or higher
  - Ao velocity 5.0 m/sec or > and mean pressure gradient 60 mmHg or higher and low surgical risk
**Aortic Valve Disease**

**Aortic Stenosis**

**Indications for Surgery**

- Asymptomatic
  - If BP falls with stress testing and meets criteria for severe AS
  - If LVEF < 50% and dobutamine can generate an Ao velocity of > 4.0 m/sec or mean gradient 40 mmHg or higher.
  - If felt the most likely cause of symptoms in low-flow/low gradient with EF > 50%

**Surgical/Percutaneous Options**

- Mechanical valves
- Tissue valves
- Transcatheter aortic valve replacement (TAVR)

---

**Aortic Valve Disease**

**Aortic Insufficiency**

**Causes**

- **Dilation of the aortic root**
  - Marfan's
  - Syphilis
- **Abnormalities of the aortic leaflets**
  - Prolapse
  - Fenestrations
- **Damage to the aortic leaflets**
  - Rheumatic fever
  - Endocarditis

**Chronic**

- Stroke volume increase
- Pulse pressure increase
- Left ventricular dilation occurs
- Systolic dysfunction results

**Acute**

- Usually secondary to infective endocarditis
- Acute increase in filling pressures leading to pulmonary edema
- Acute decrease in cardiac output
- Reduced coronary blood flow
- Shock

**Indications for Surgery**

- Acute aortic insufficiency – early operation
  - Septic emboli
  - Growing vegetations
  - Hemodynamic instability
- Antibiotic therapy preferred for 6 weeks if acute aortic insufficiency is tolerated
Aortic Valve Disease
Aortic Insufficiency

Indications for Surgery

Chronic severe aortic insufficiency

- LVEF ≤ 50%
- LV systolic dimension of 5.0 cm
- Patients often asymptomatic

Surgical Options

**Aortic Valve Disease**
**Aortic Stenosis / Insufficiency**

**Surgical Options**

**Tissue valves:**
- Autografts (Ross type AVR)
- Homografts
- TAVR
- Xenografts – porcine / bovine
  - Stented / stentless

**Mechanical valves:**
- Bileaflet
- Tilting disc
- Ball in cage

Tissue Valves

- Last longer in the aortic position
- Less thrombogenic
- No need for anticoagulation (usually)
- Homografts have increased longevity and reduced incidence of prosthetic endocarditis

Mechanical values

- Durability of 20-30 years
- Need for anticoagulation
- Higher transvalvular gradient
- Higher risk of infection during first 3 postoperative months but no significant difference at 5 years
Tricuspid Valve Disease

**Causes**

- Stenosis
  - Rheumatic
  - Carcinoid syndrome
  - Endocardial fibroelastosis
  - Endomyocardial fibrosis
  - SLE

- Regurgitation
  - Endocarditis
  - Trauma
  - Prolapse
  - Carcinoid
  - Infarction
  - Ebstein’s

**Surgical Indications**

- Annuloplasty for severe tricuspid regurgitation and pulmonary hypertension in patients requiring mitral valve surgery
- Valve replacement for severe tricuspid regurgitation when annuloplasty or repair not possible
- Valve replacement or annuloplasty for severe tricuspid regurgitation with mean pulmonary artery pressure < 60 mm Hg when symptomatic

Tricuspid Valve Disease

**Surgical Options**

- Annuloplasty
- Homograft
- Bioprosthesis
- St. Jude prosthesis

Pulmonic Valve Disease

**Causes**

- Stenosis
  - Nearly always congenital
  - Rarely rheumatic fever
  - Rarely carcinoid syndrome

- Insufficiency
  - Endocarditis
  - Carcinoid
  - Tuberculosis

Pulmonic Valve Disease

**Pulmonic Stenosis**

**Surgical Indications**

- > 40 mm Hg gradient between PA & RV

**Surgical Options**

- Valvuloplasty

Conclusion

- Patients of any age with dyspnea, palpitations or a murmur should have an echocardiogram.
- Abnormal echo findings warrant routine follow-up.
- Know your surgeons and your valve team.