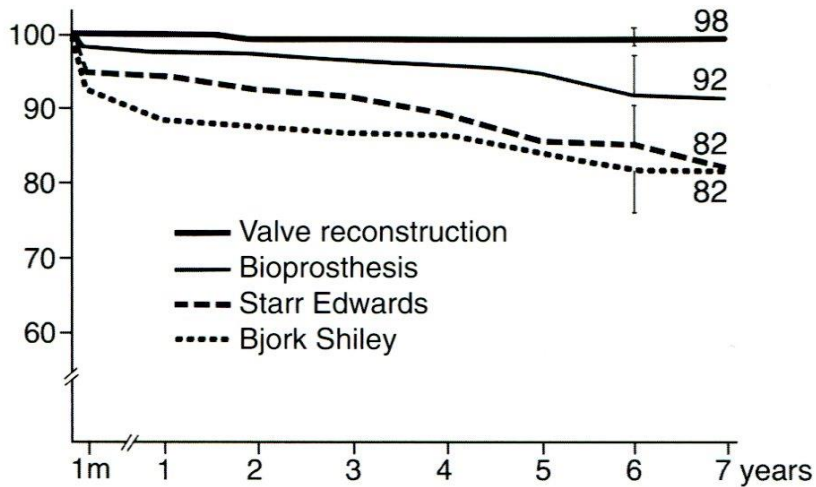


Valve Repair

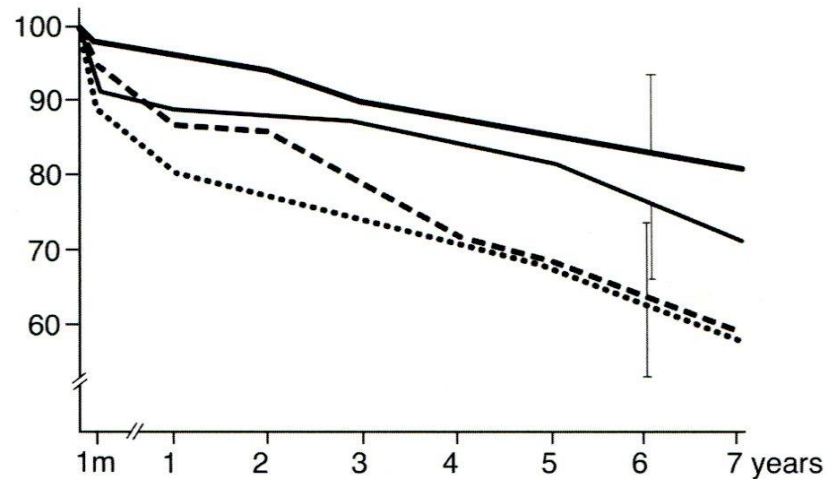
경북대학교병원
김근직

Introduction

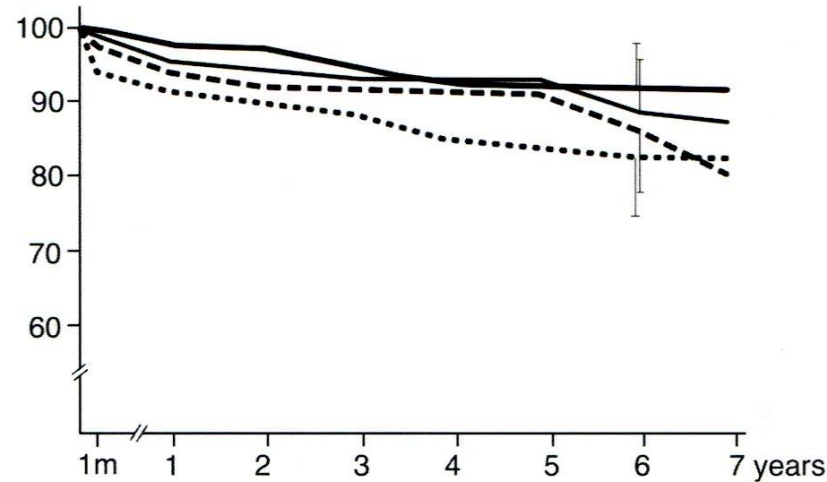
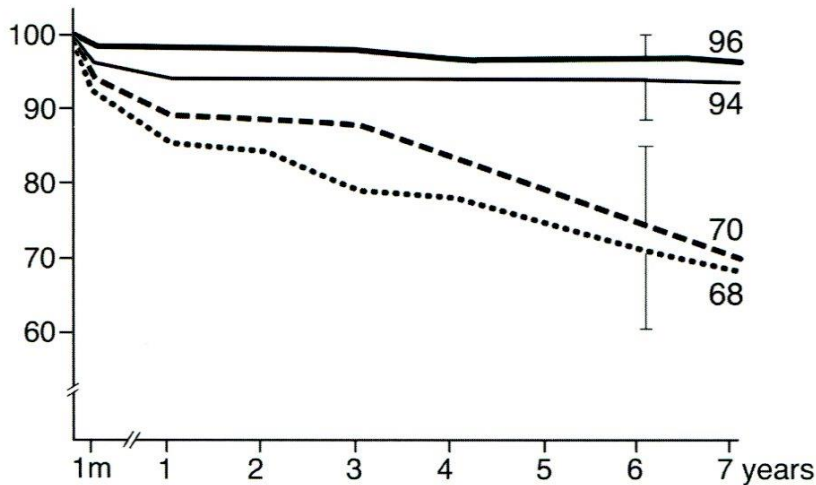
- 1960s **Congenital malformation**
Rheumatic valvular disease
→ Palliative valve **repair**/valve **replacement**
- 1970s **Rheumatic valvular disease**
→ Valve **replacement**(Mechanical, Tissue) / **Repair**
- 1980s **Degenerative valvular disease**(Echocardiography)
→ Functional valve analysis
Reconstructive valve surgery
- 1990s **Ischemic/cardiomyopathy**
(Atrial fibrillation : Maze operation)
→ Nonthrombogenic valve surgery



a Actuarial curves for patients free of valve-related death



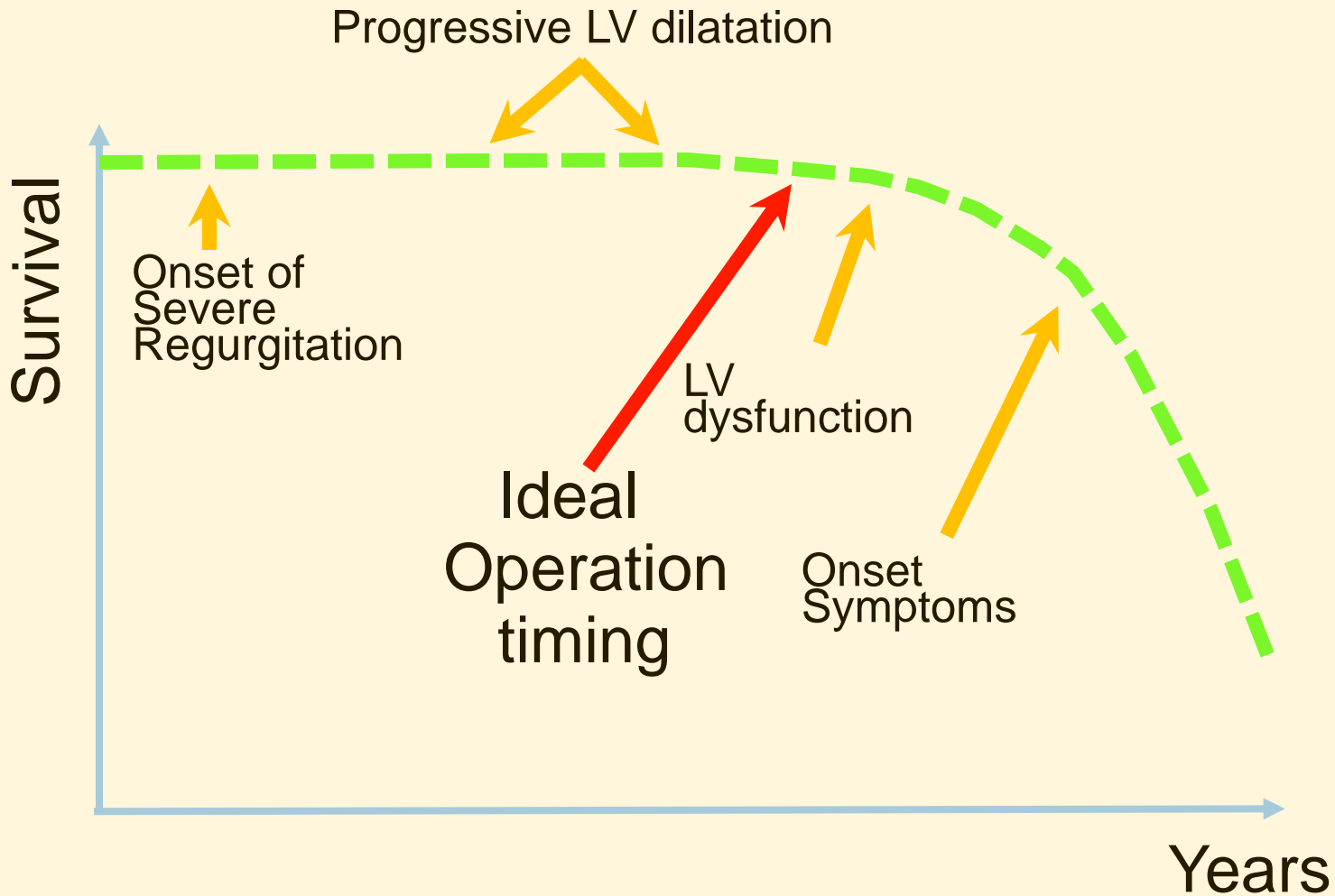
b Percentage of patients free from procedure related morbidity and mortality



Natural course of MR

- Annual mortality of asymptomatic MR
 - 6.3%/yr
 - After 10yr : 90% died
- Occult LV dysfunction
 - : frequently predates symptoms in severe MR
- Medical Tx can produce
 - Congestive heart failure
 - Atrial fibrillation

Natural History





Replacement

The diagram features two blue arrows pointing towards each other, meeting at a central point. The left arrow is labeled 'Replacement' and the right arrow is labeled 'Repair'. The entire graphic is set against a light yellow background.

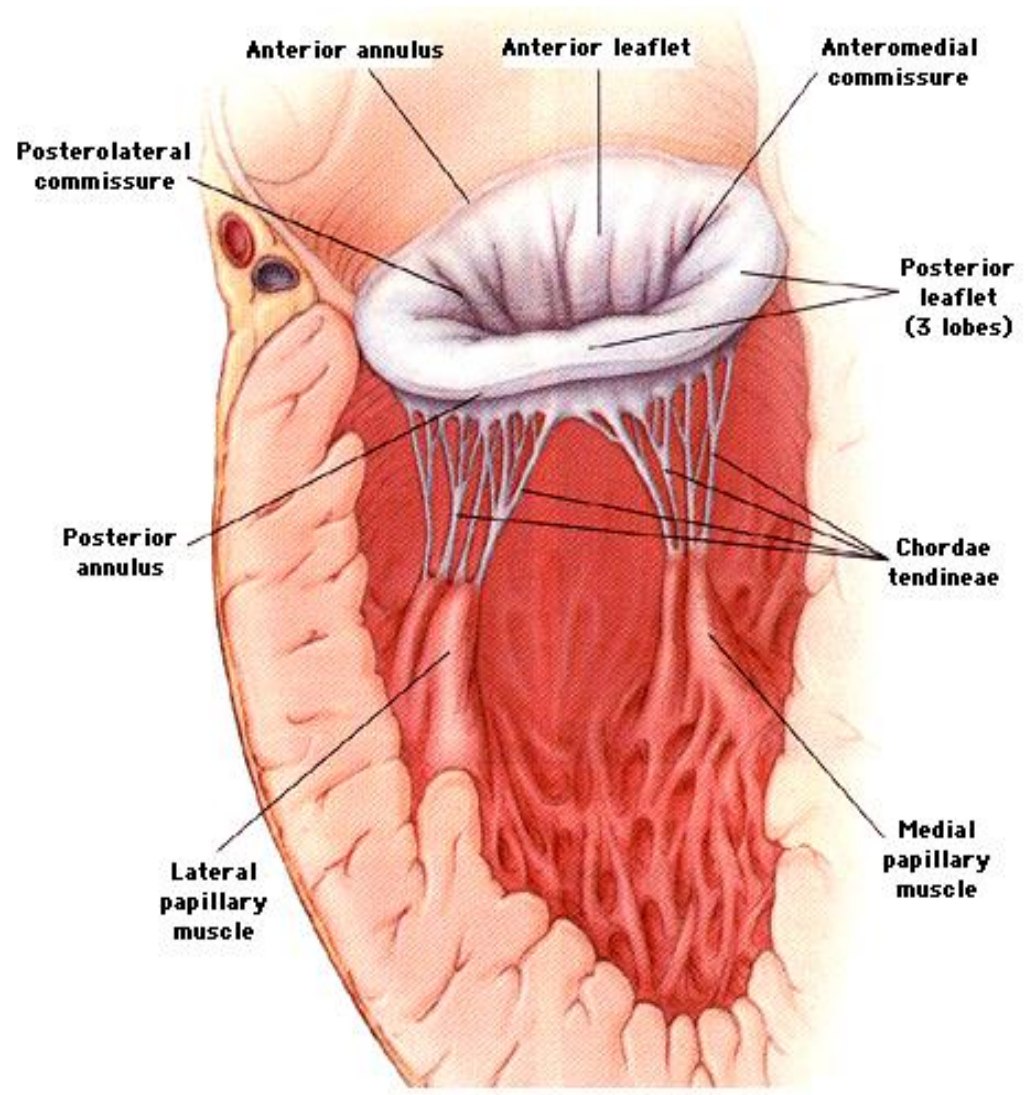
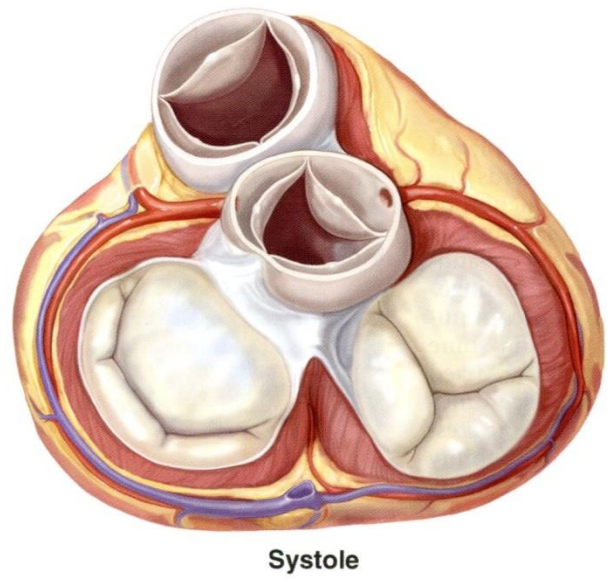
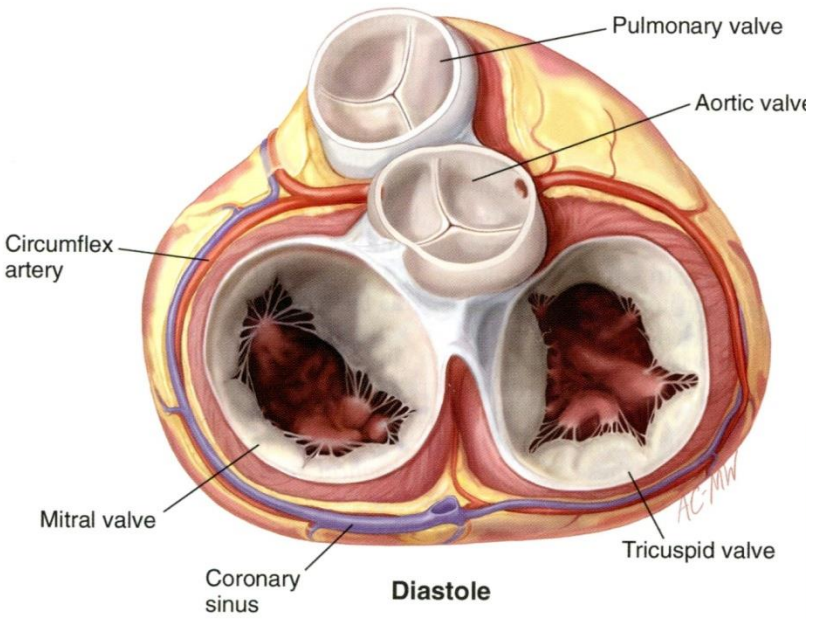
Repair

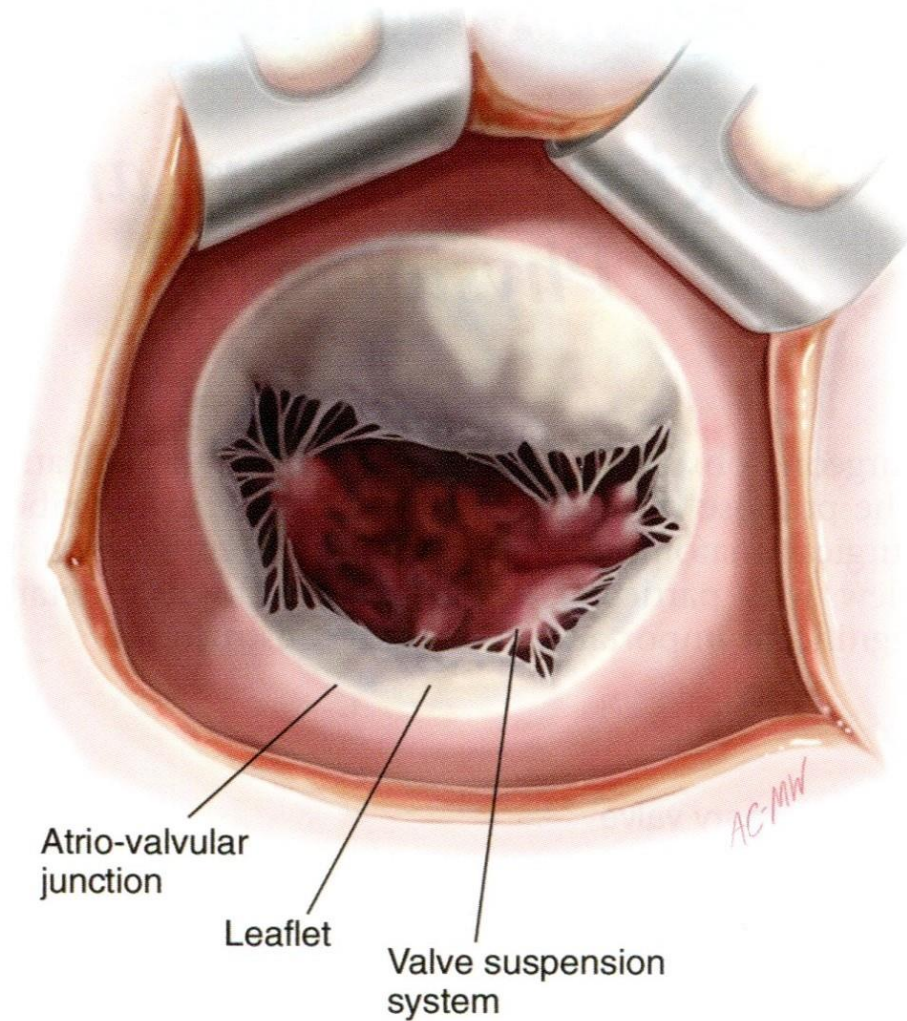
Benefits of MV repair

- Preservation of **own valve within heart**
- No need of **anticoagulation**
- Lower risk of prosthetic **infection**
- Lower risk of **LV rupture**
 - : fatal complication of MV replacement
 - Resection of subvalvular structure during MVR

Mitral valve repair

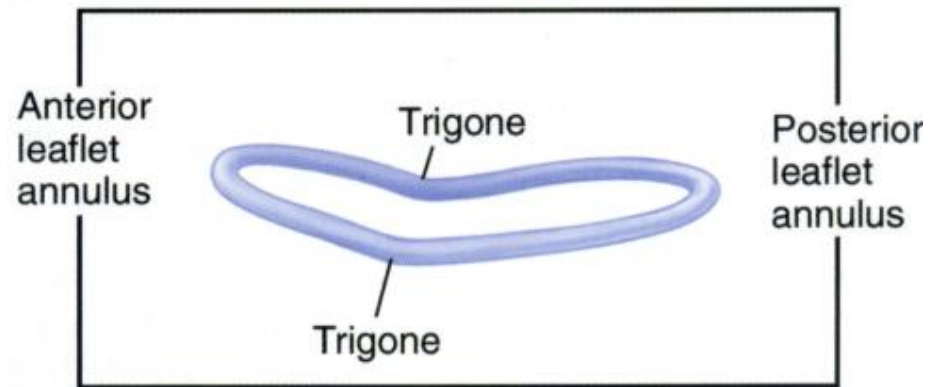
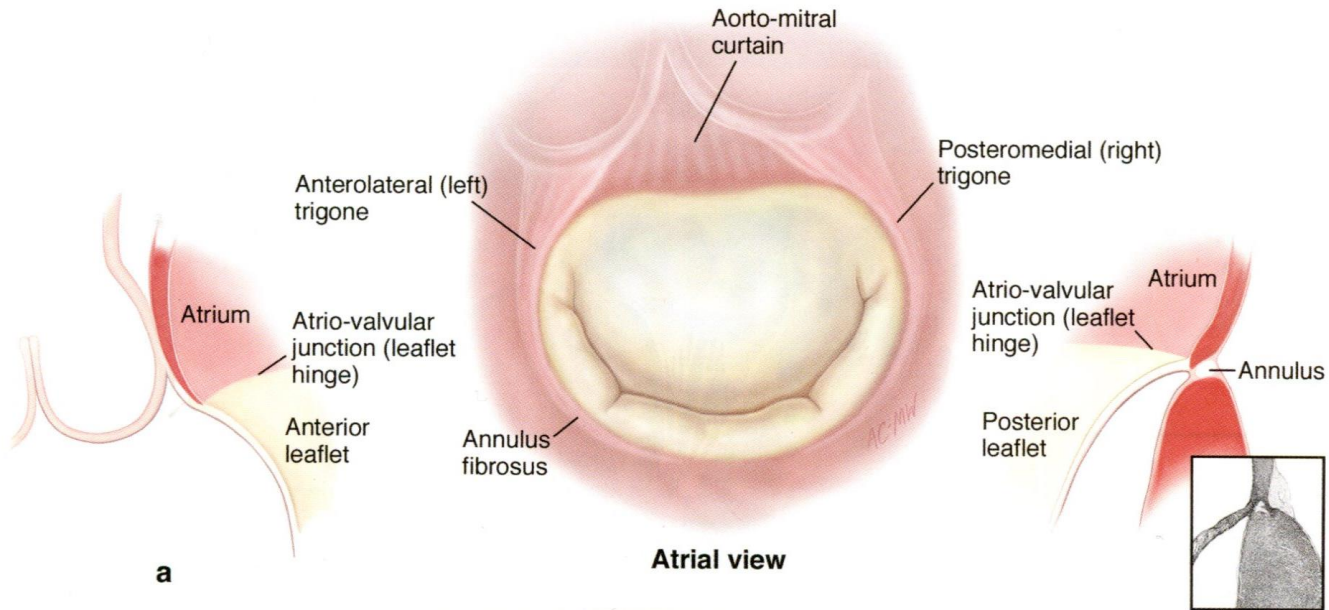
Anatomy of Mitral valve

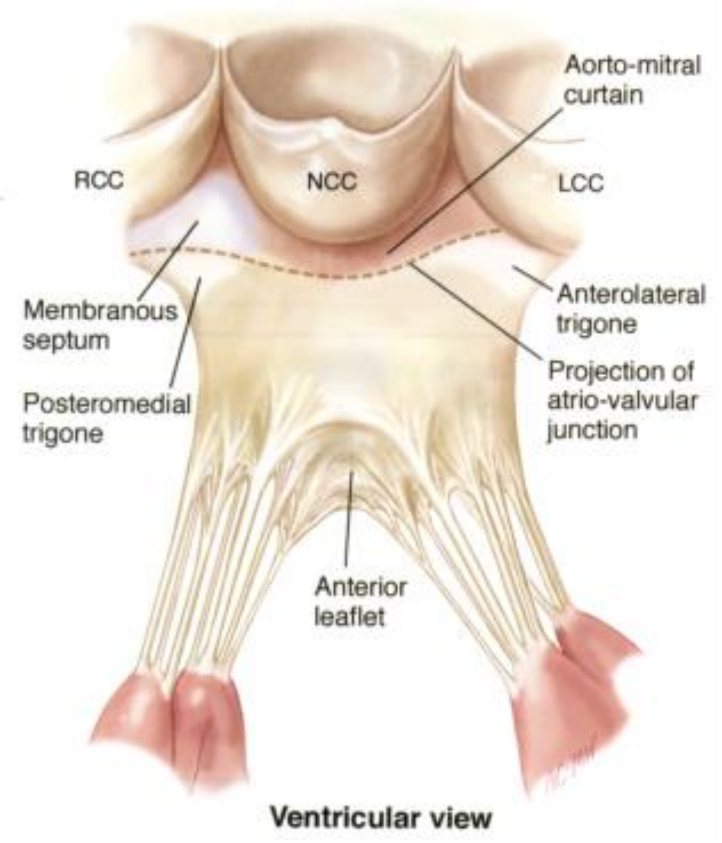
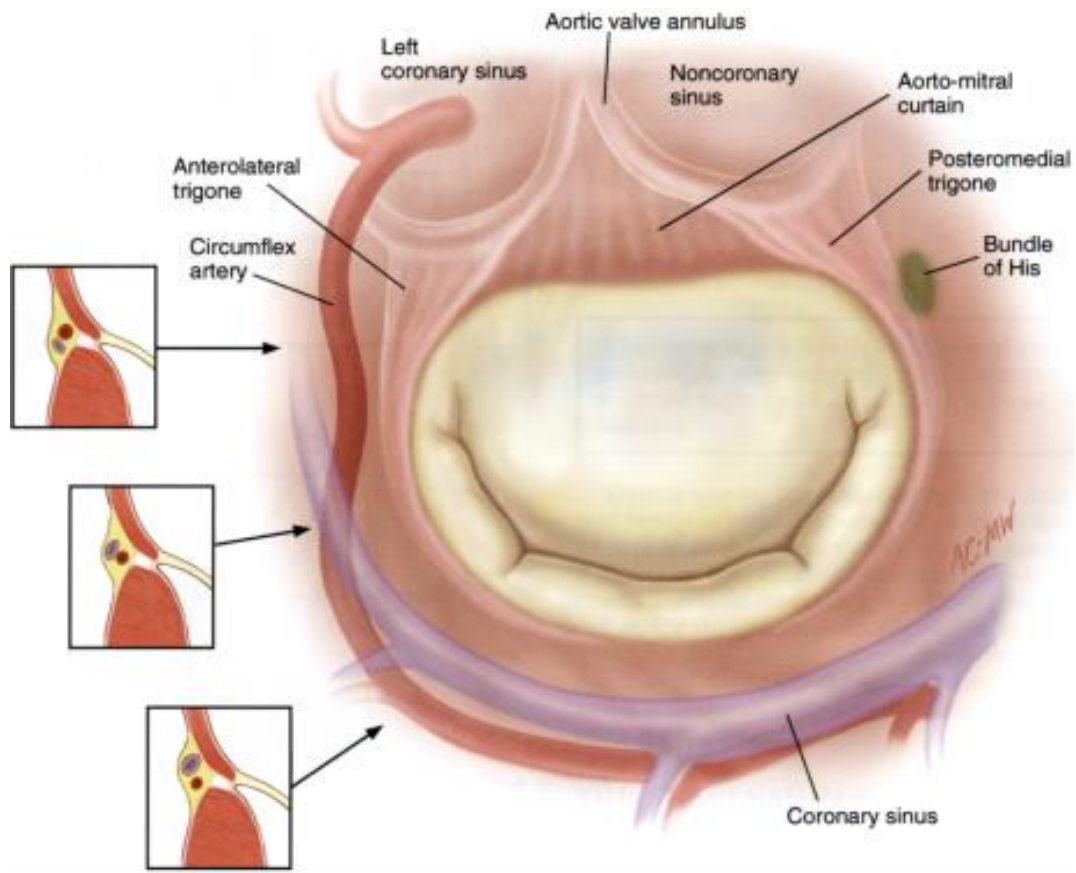




- **Atrio-valvular junction**
- **Leaflet**
- **Suspension system**
 - Chordae
 - Papillary muscle

Annulus

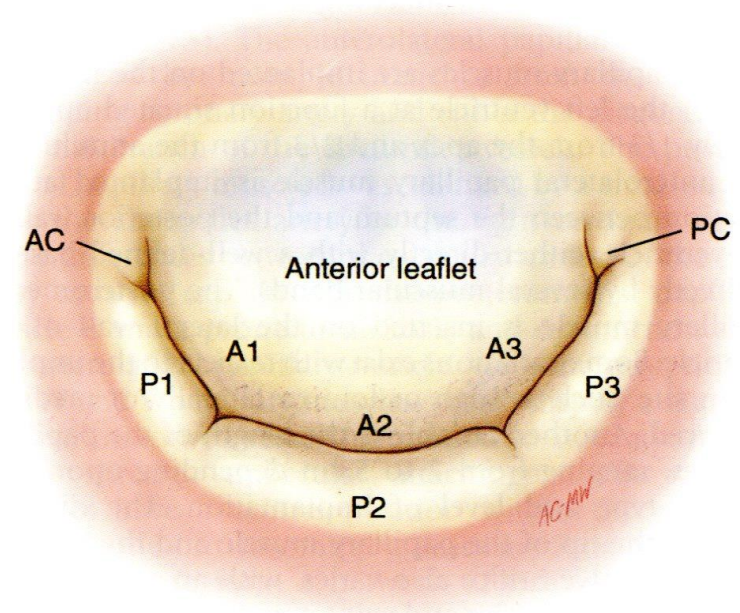




Leaflet

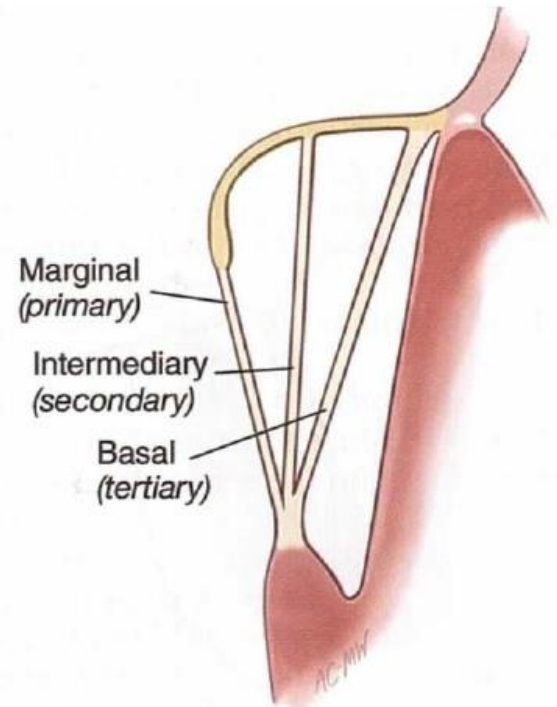
- **Anterior leaflet** : triangular – A1, A2, A3
- **Posterior leaflet**(indentation)
 - P1, P2, P3

- AL commissure
- PM commissure



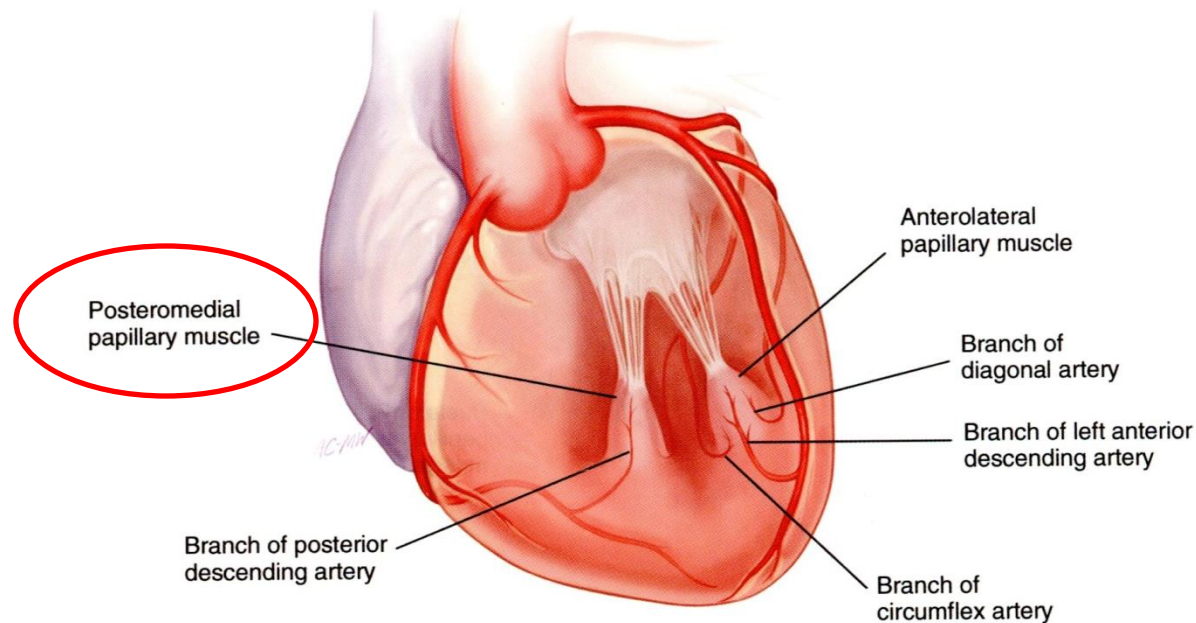
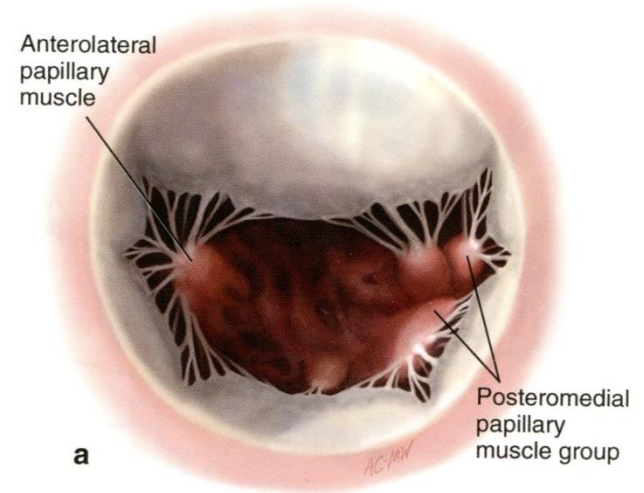
Chordae

- **Marginal(primary)**
: prevent eversion
- **Intermediary(secondary)**
: prevent doming
- **Basal(tertiary)**
: maintain geometry



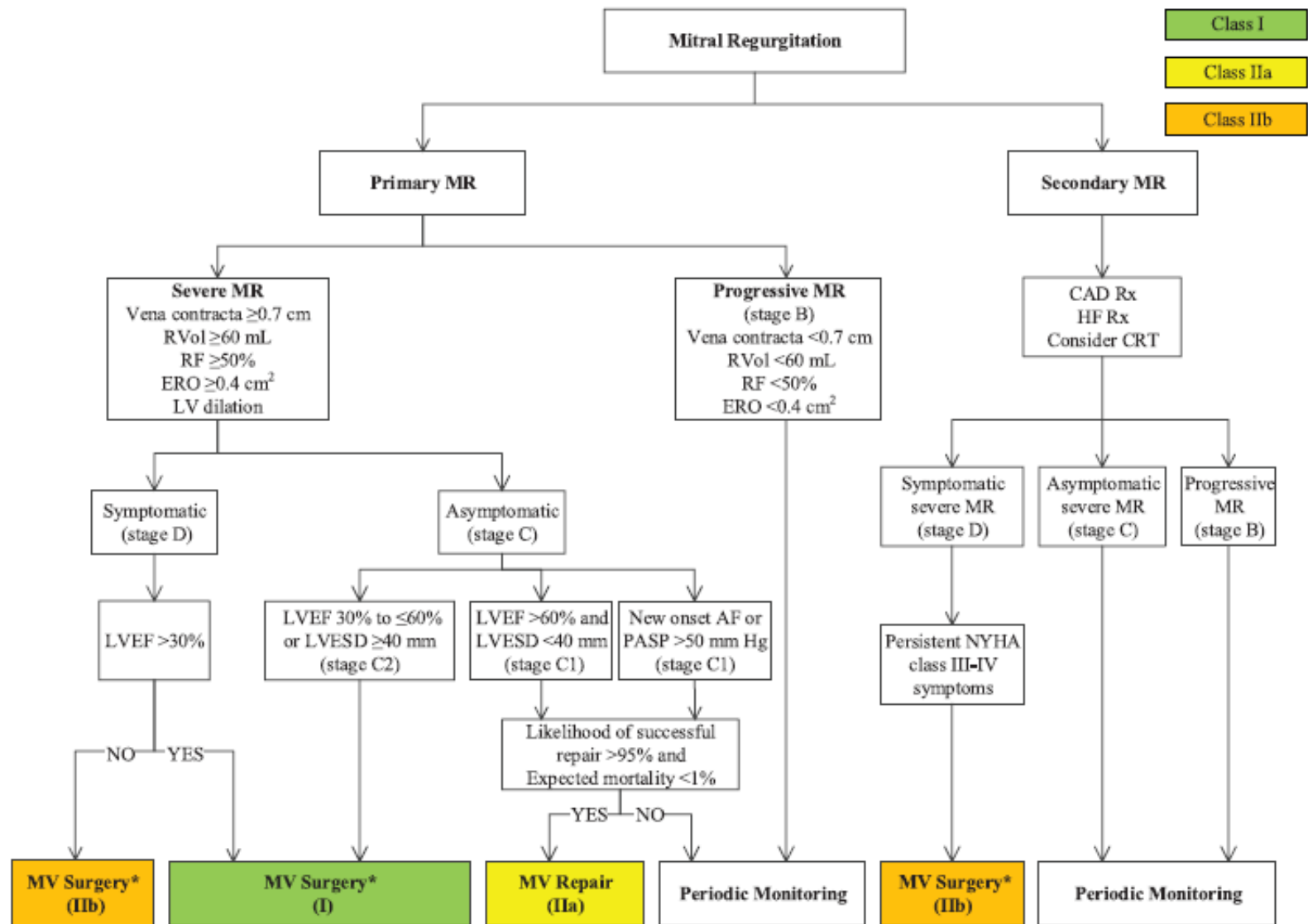
Papillary muscle

- Anterolateral PM
- Posteromedial PM

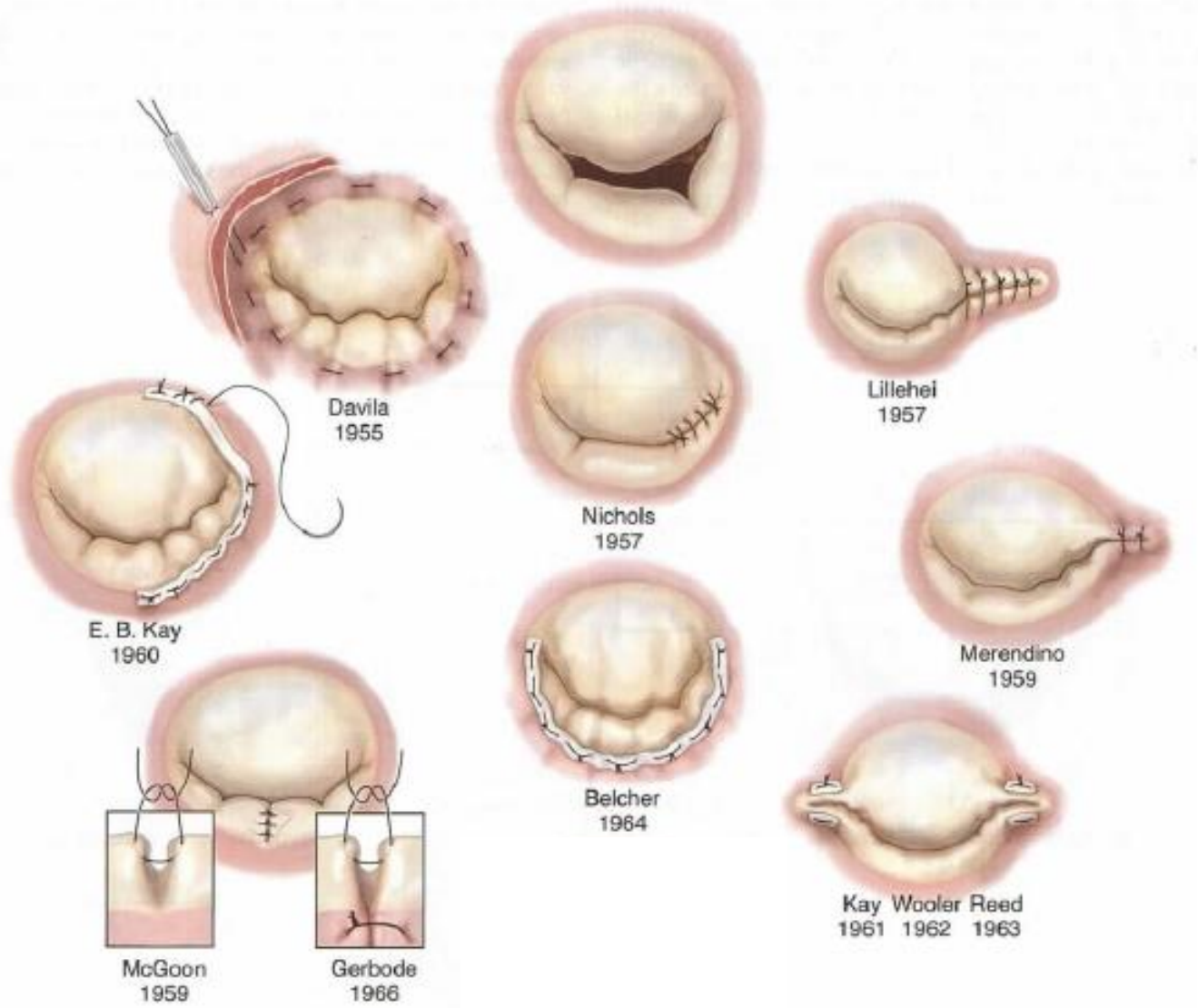


Mitral regurgitation

ACC/AHA 2014 guideline



1957-1968 Palliative Techniques



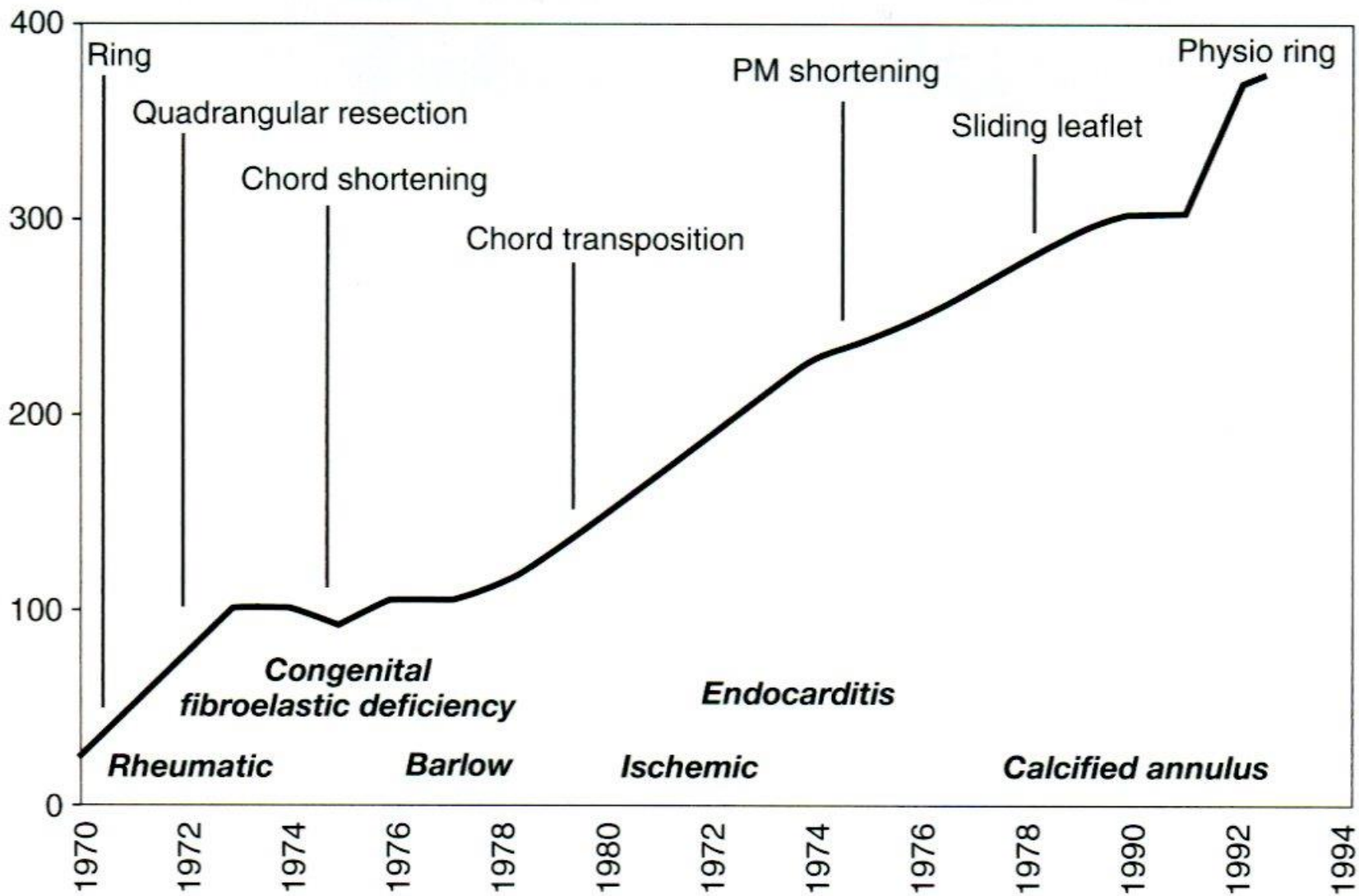
Etiology

- **Primary MR**
 - Degenerative
 - Fibroelastic deficiency(FED)
 - Barlow ds(billowing valve)
 - Marfan syndrome
 - Endocarditis
 - Rheumatic
 - Calcified valve
- **Secondary MR** : problem of LV
 - Ischemic
 - DCMP

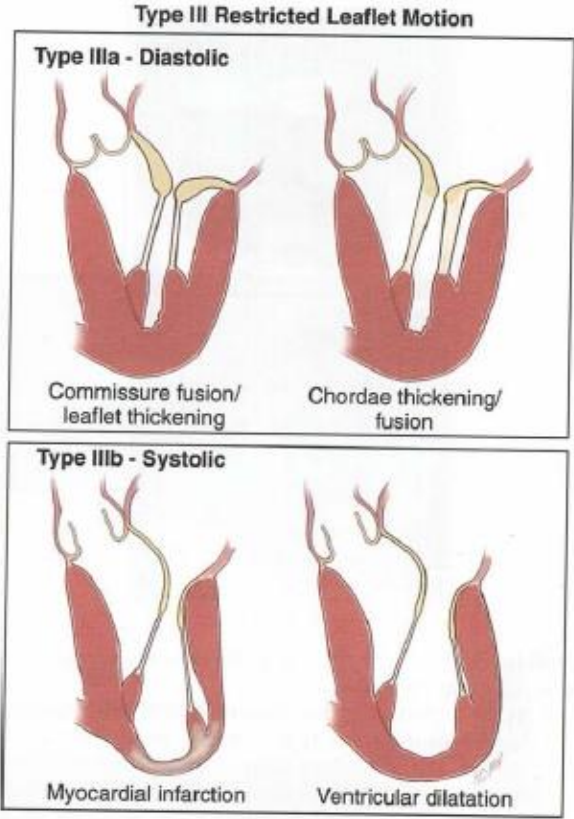
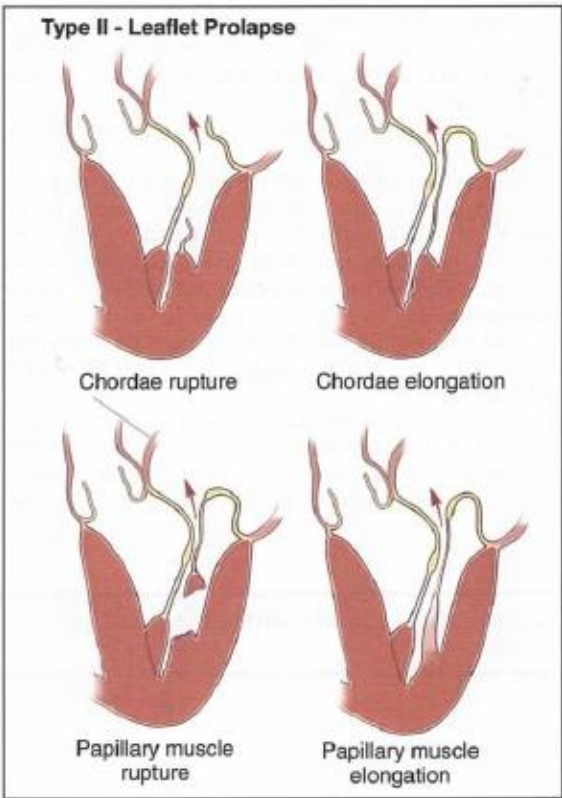
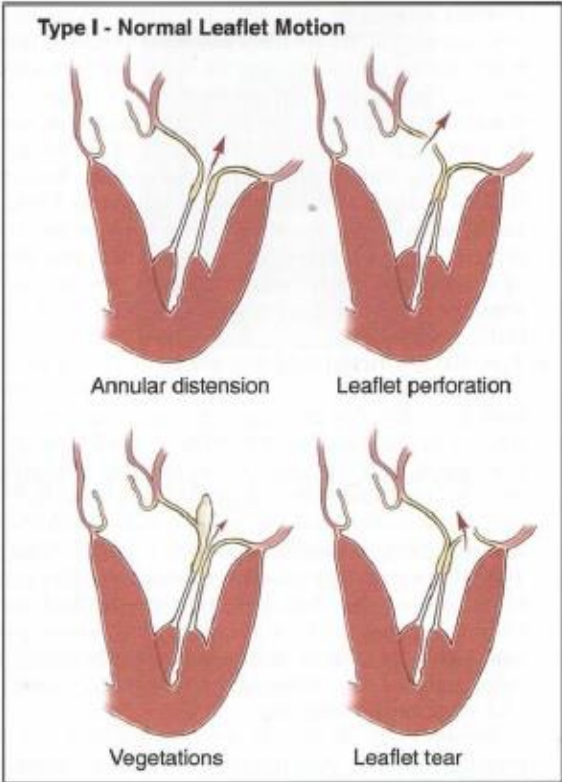
Reconstructive Valve Surgery

Three Fundamental Principles

1. Preserve or restore **full leaflet motion**
2. Create **large surface of coaptation**
3. **Remodel the annulus**



Carpentier's Classification

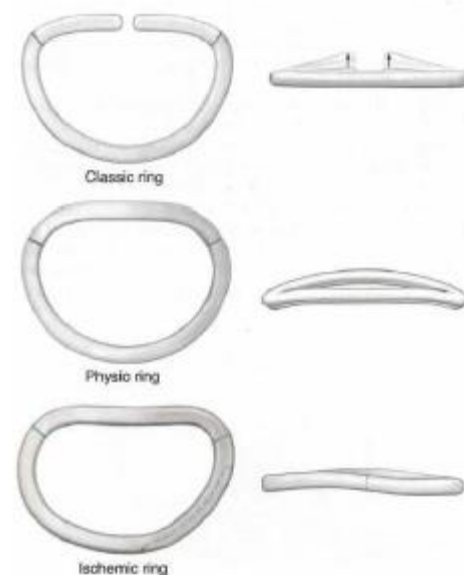


Remodeling prosthetic ring

The remodeling ring restores the **normal systolic shape** and **size of the annulus**, a condition needed for **optimal leaflet coaptation**. It also prevents further deformation

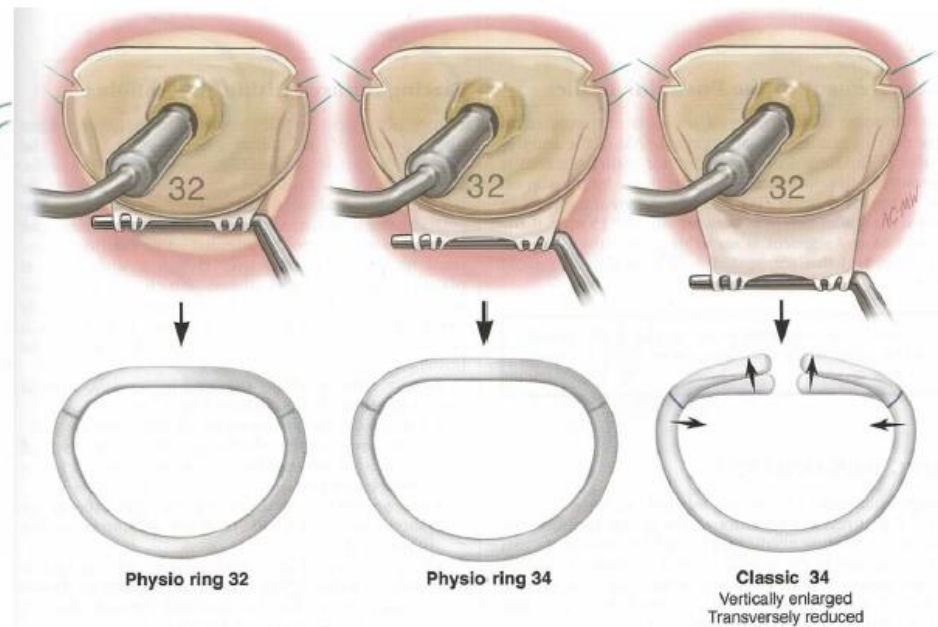
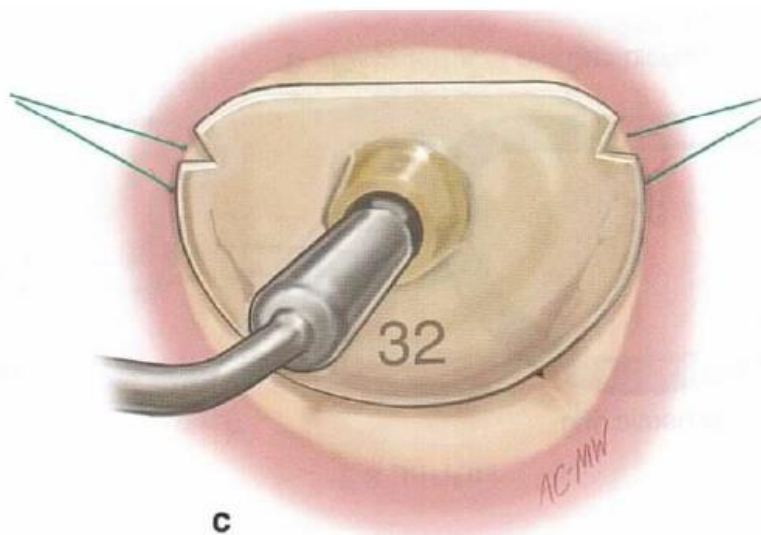
Annuloplasty ring

- **Complete vs incomplete**
 - Incomplete
 - Usually posterior annular dilatation
 - Leaflet repair itself reduce annular circumference
 - Difficult visualization of anterior annulus
 - Complete
 - Functional MR(to reduce annular circumference)
- **Rigid, Semi-rigid, Flexible**
 - Flexible ring
 - Physiologic movement of MV annulus
 - Valve distortion or orifice narrowing
 - Rigid ring : more prone to produce SAM
- **Adjustable vs fixed**



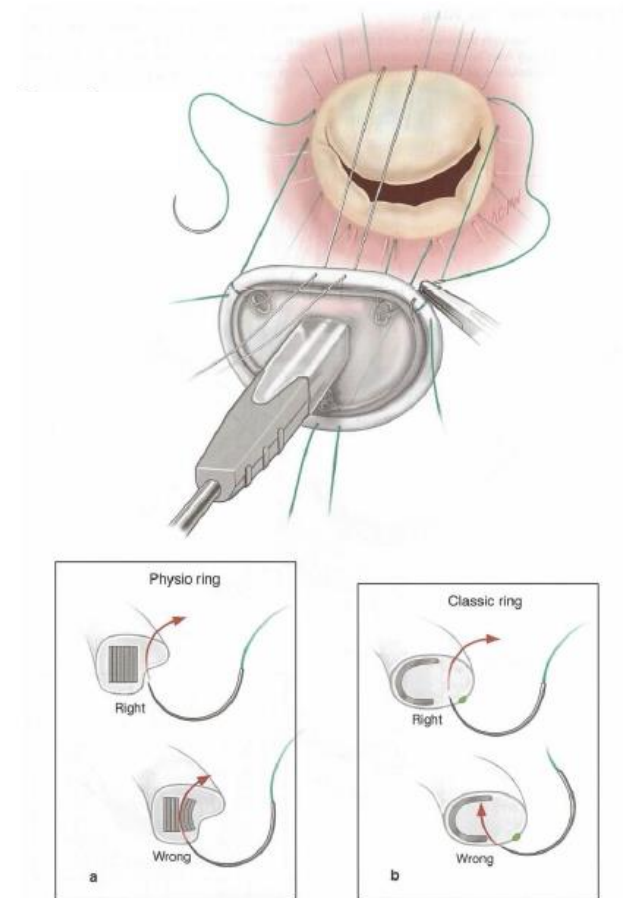
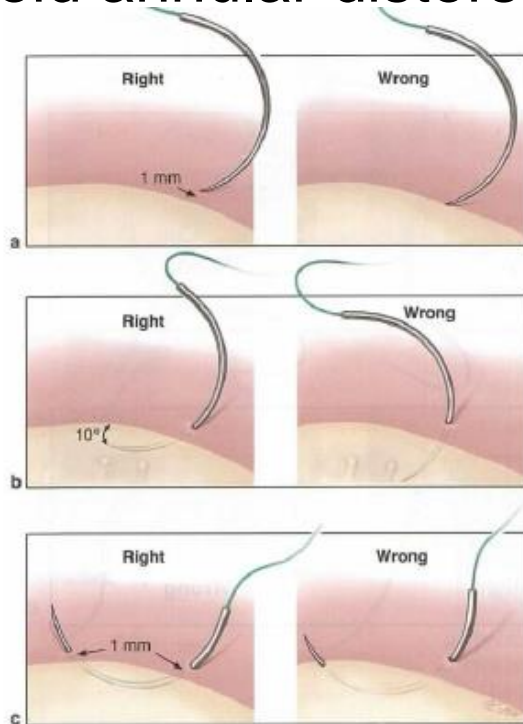
Ring sizing

- Measurement of anterior leaflet
- Commissure to commissure
- Height of anterior leaflet : partial ring?



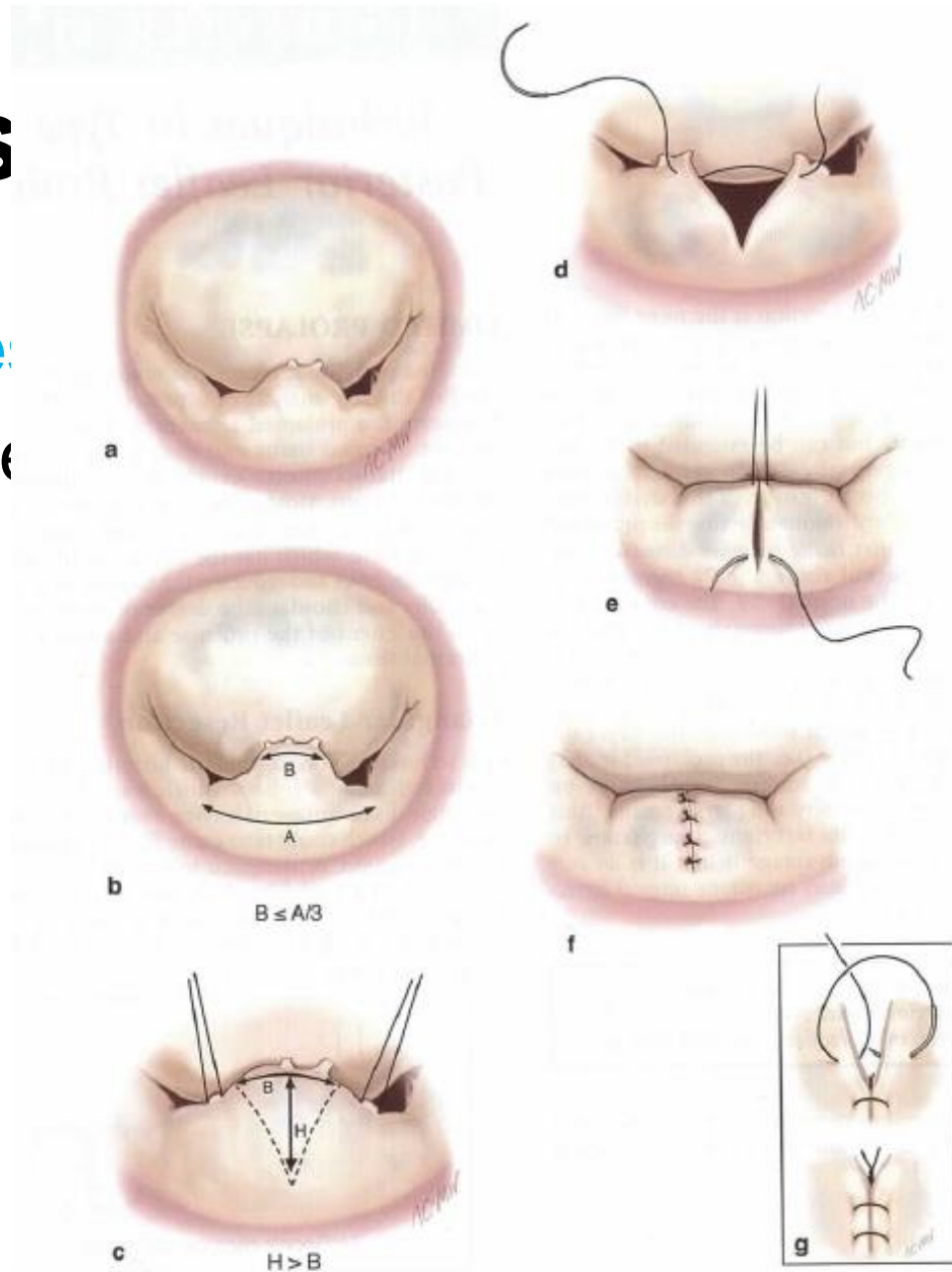
Annuloplasty suture

- Suture within the annulus fibrosus
 - to avoid ring dehiscence
- Not to suture metallic core of ring
 - to avoid annular distortion



Pos

- **Triangular retractor**
: $< 1/3$ of segment

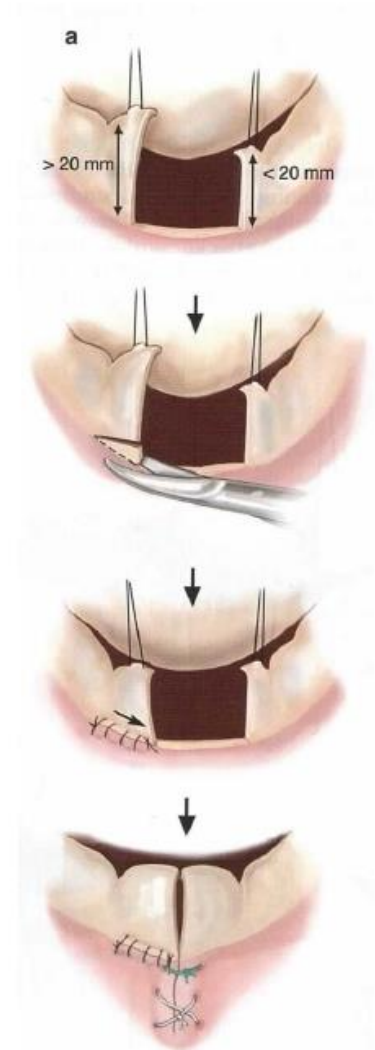
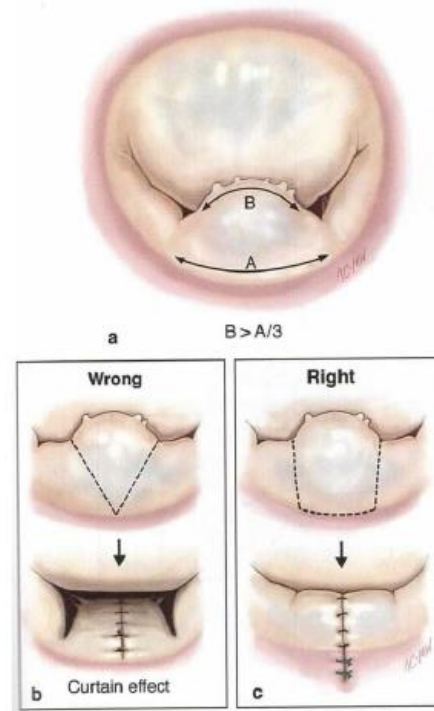


Posterior prolapse

- **Quadrangular resection**

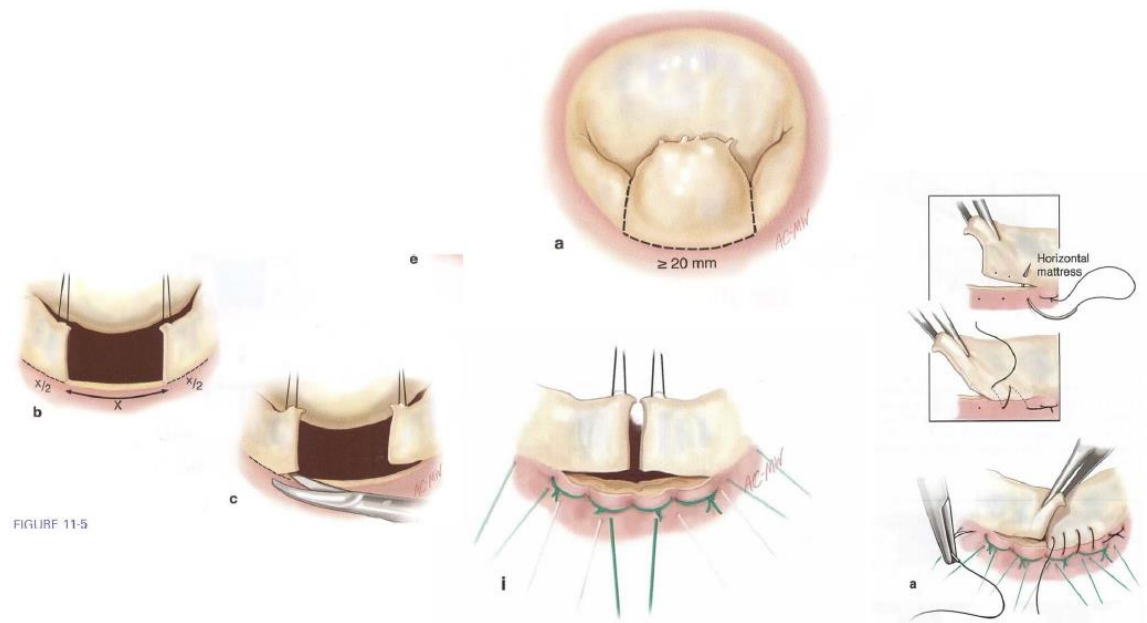
: $>1/3$ of segment

Annular plication



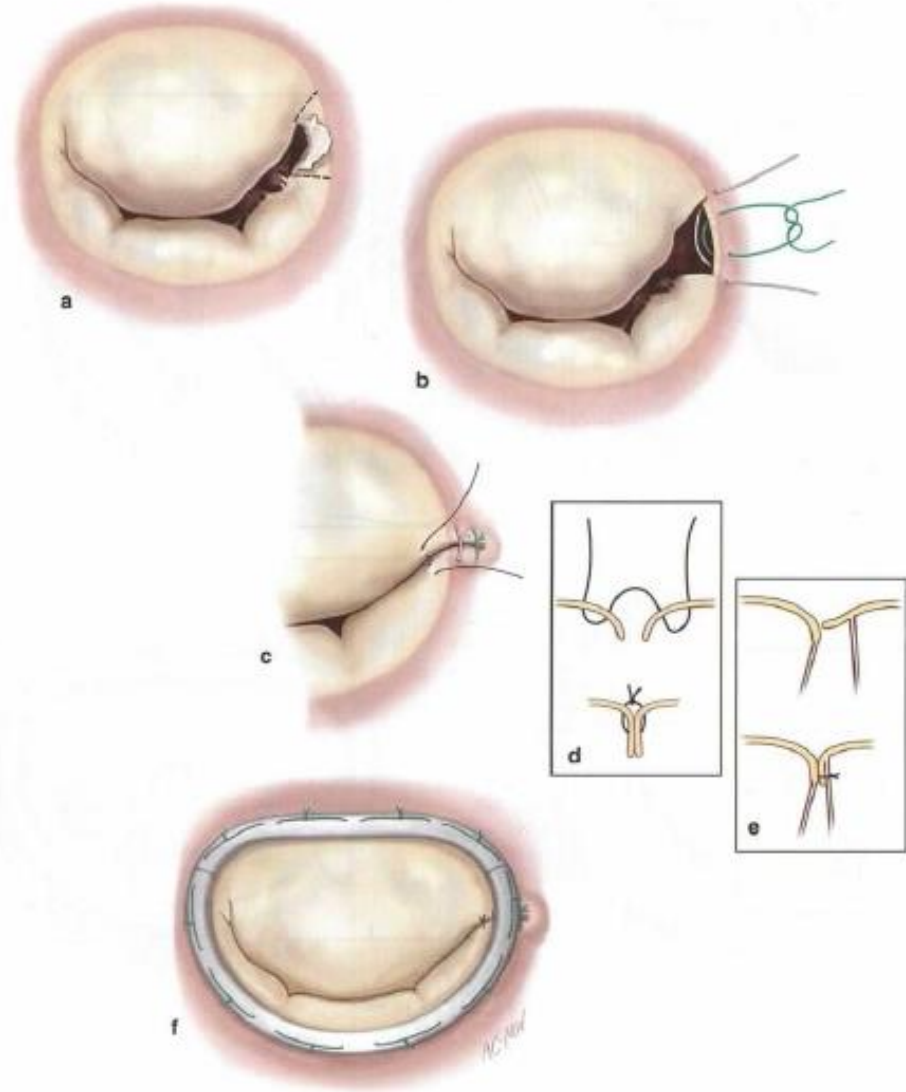
Posterior prolapse

- **Quadrangular resection+sliding annuloplasty**
 - : >30mm
 - Prevent SAM
 - Compression suture



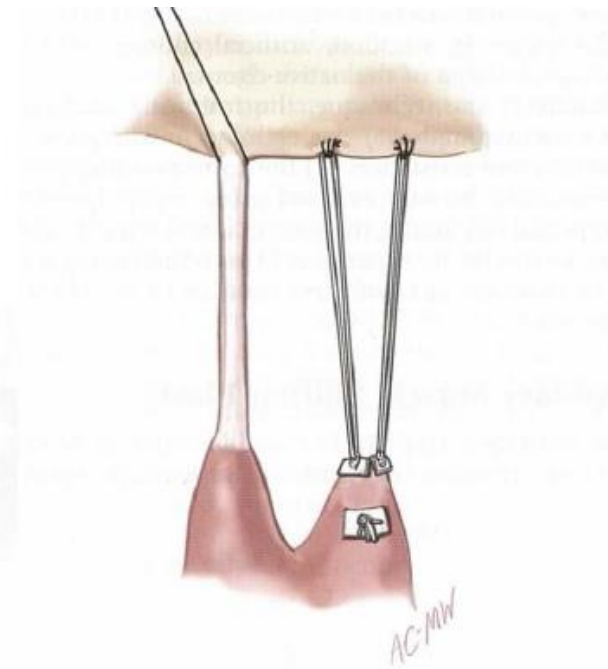
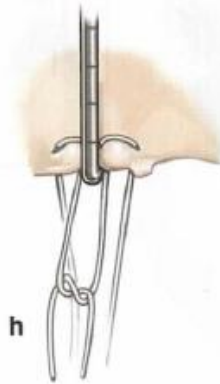
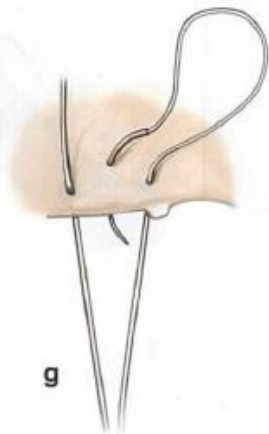
Commissural prolapse

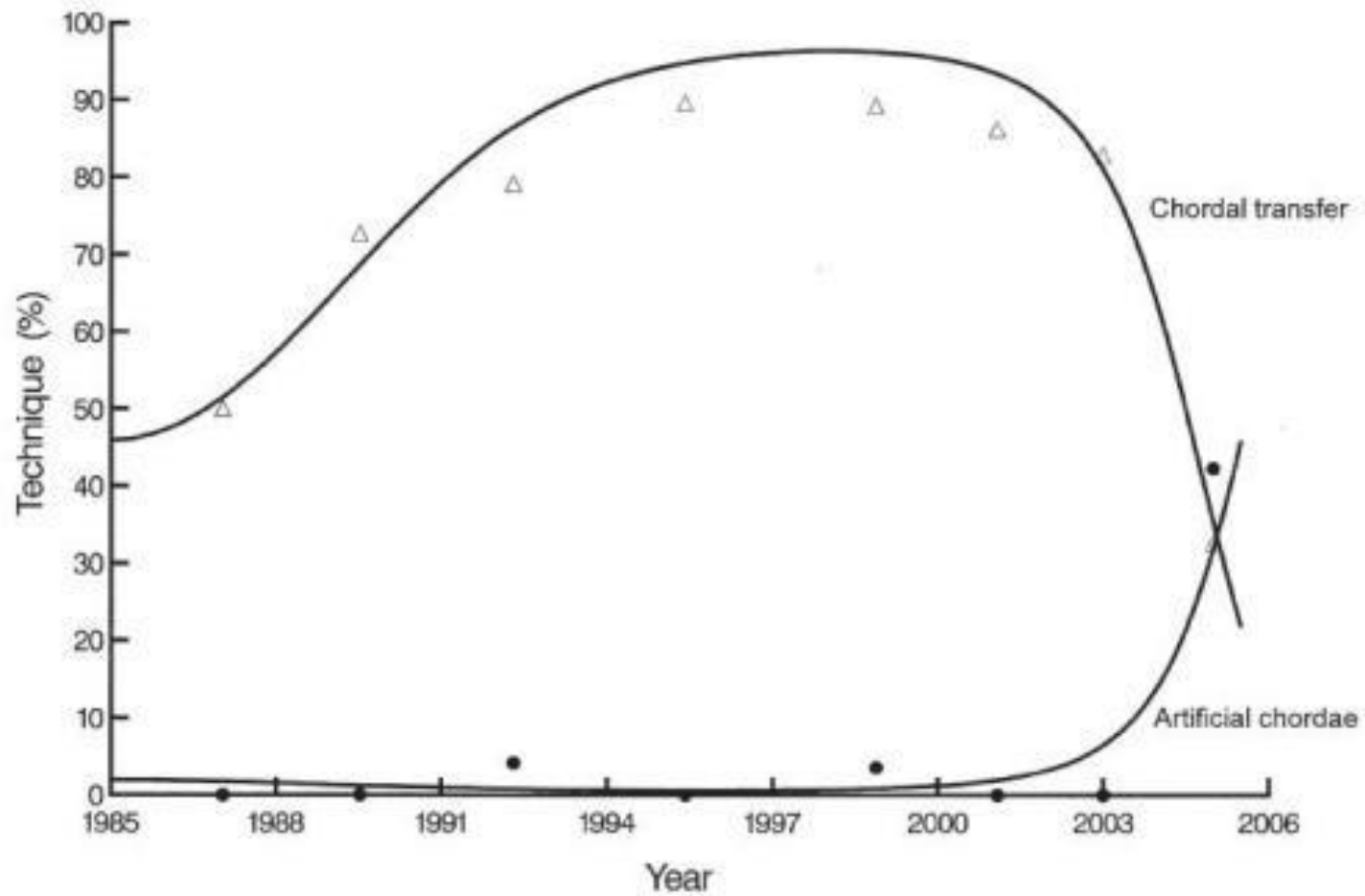
- Commissural plication
- Triangular resection



Anterior prolapse

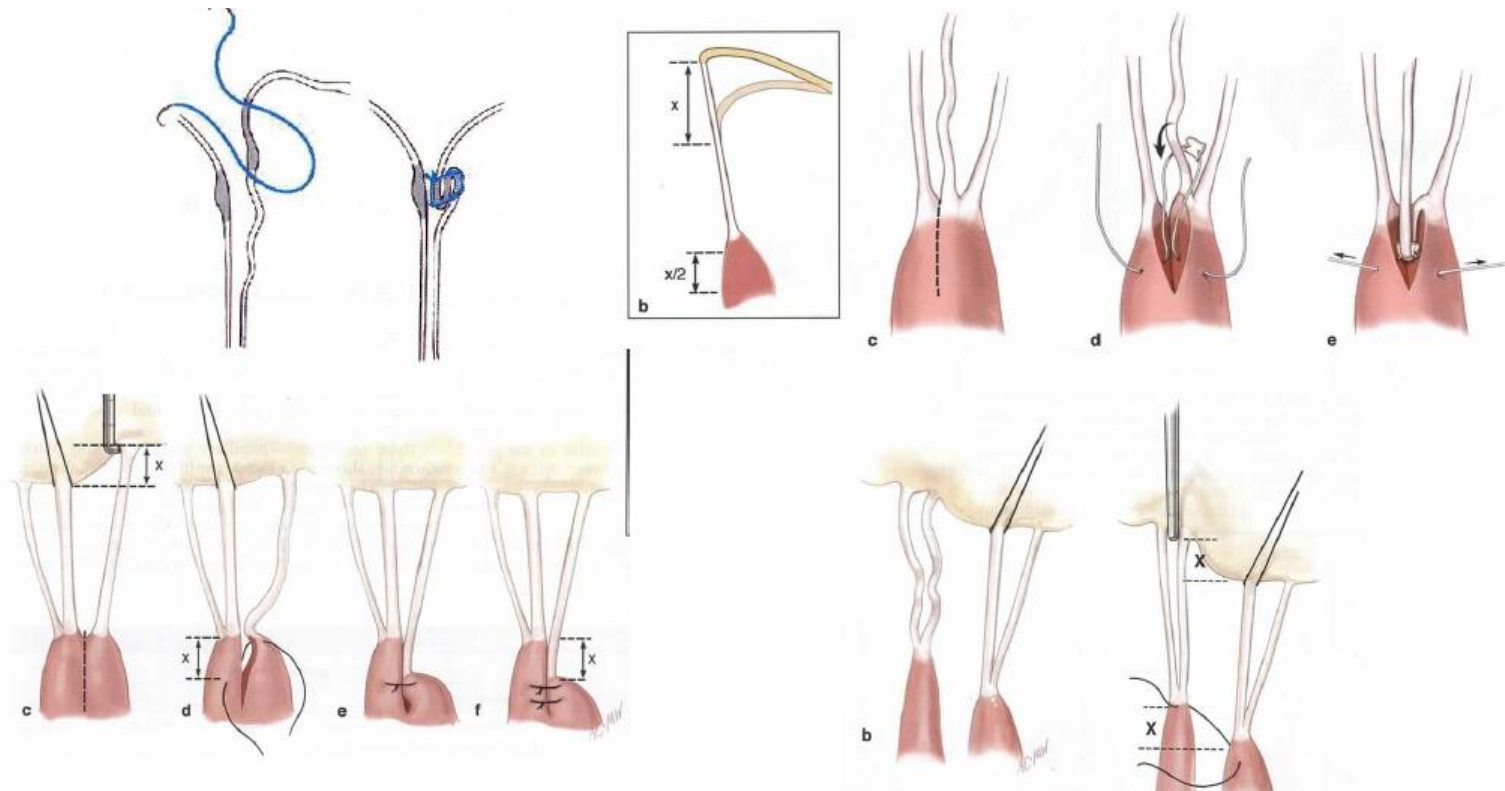
- Long-term results : **posterior**>>anterior
- **Artificial chordae implantation**





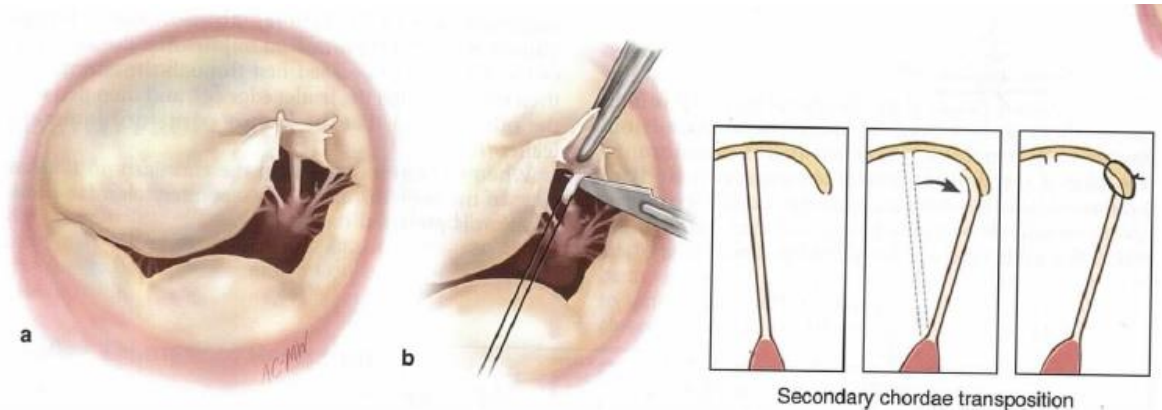
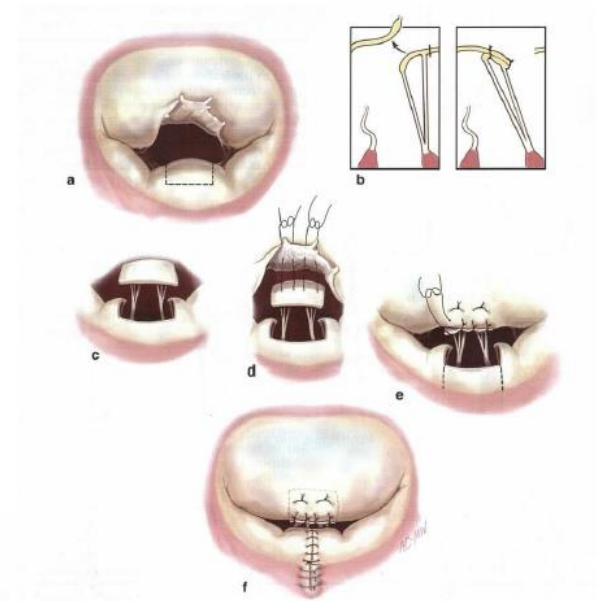
Anterior prolapse

- Chordae shortening
- Papillary muscle sliding plasty



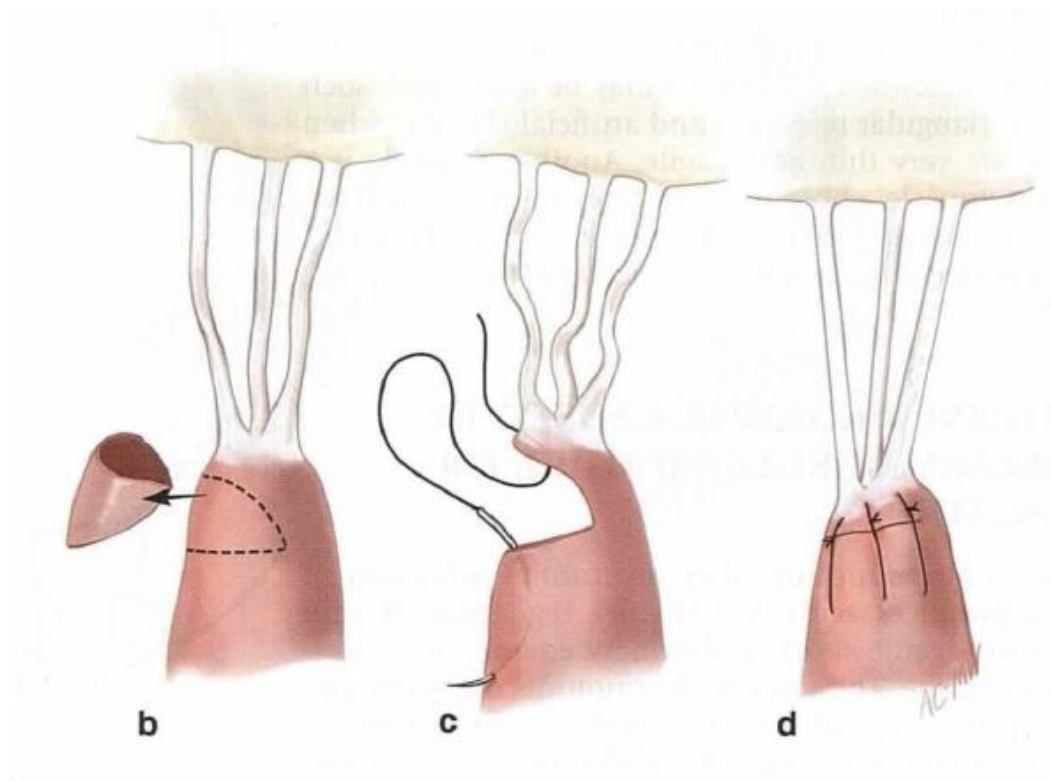
Anterior prolapse

- Chordae transfer
 - 2ndary chordae
 - Posterior chordae



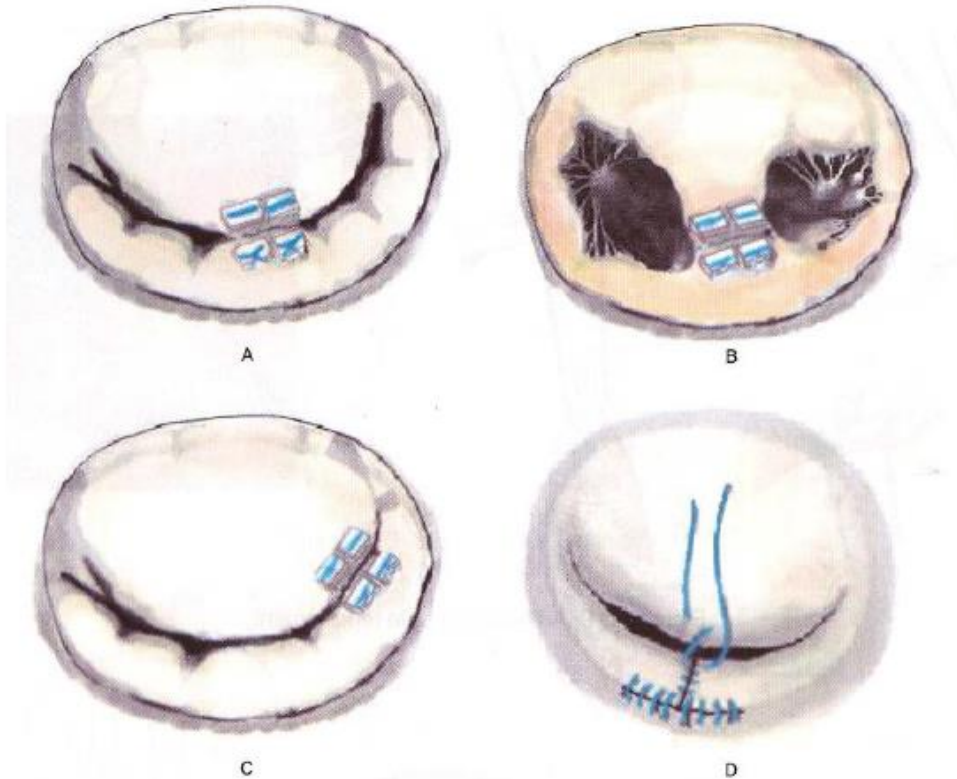
Anterior prolapse

- Papillary muscle shortening



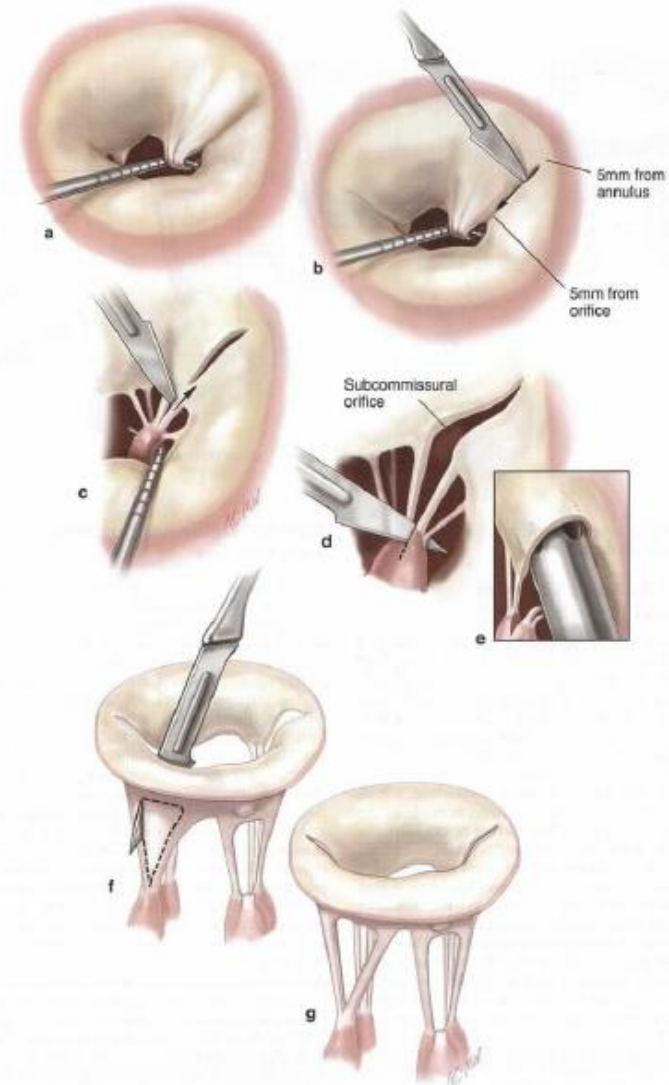
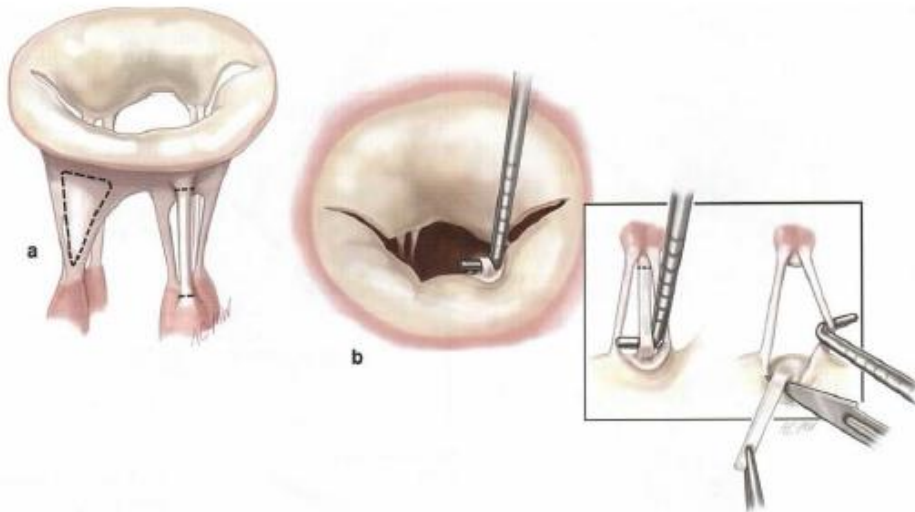
Anterior prolapse

- Alfieri(double orifice) technique
: not to make stenosis



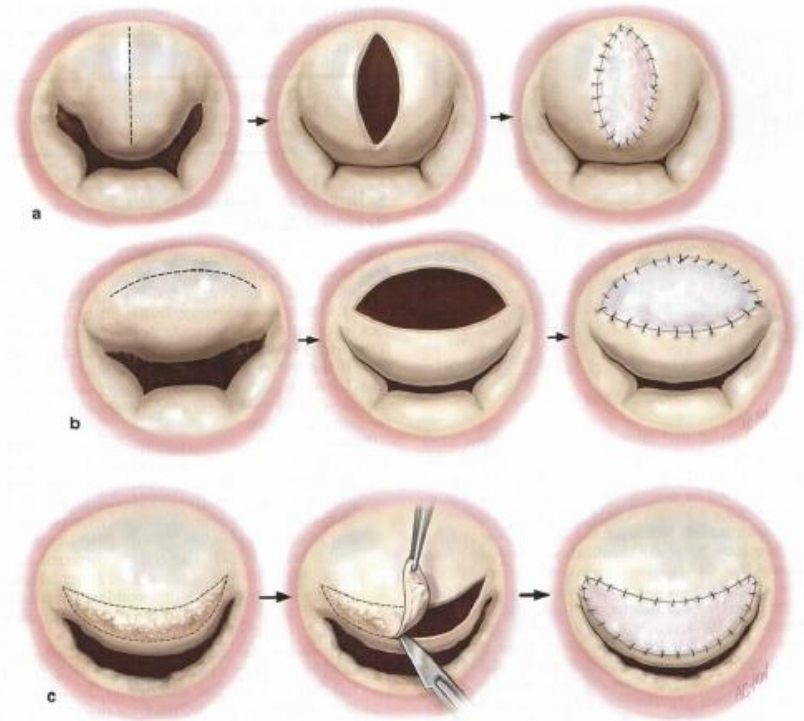
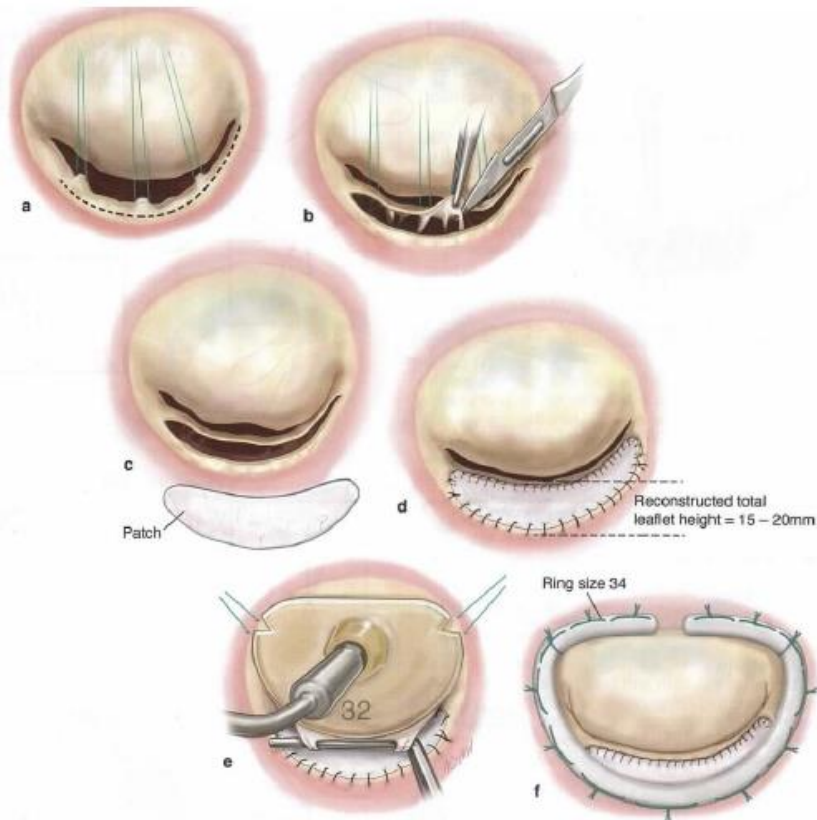
Rheumatic MV disease

- Commissurotomy
- 2ndary chordae resection
- Not good result
in severe deformity valve

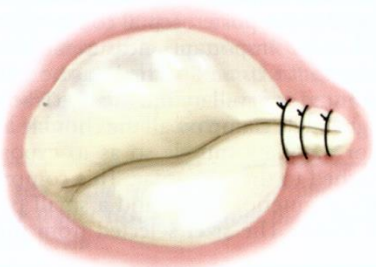


Rheumatic MV disease

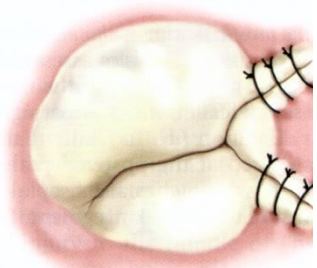
- Leaflet extension : pericardium



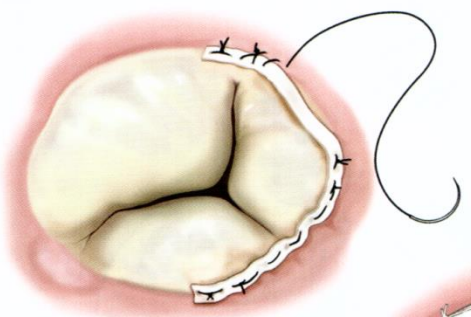
Tricuspid valve repair



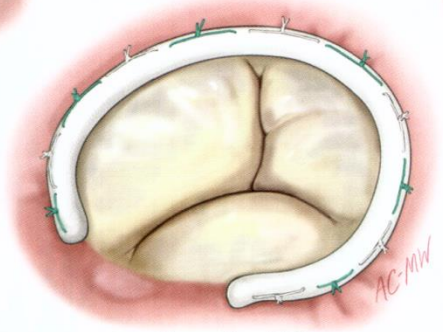
a J. Kay 1965



b Modified Kay



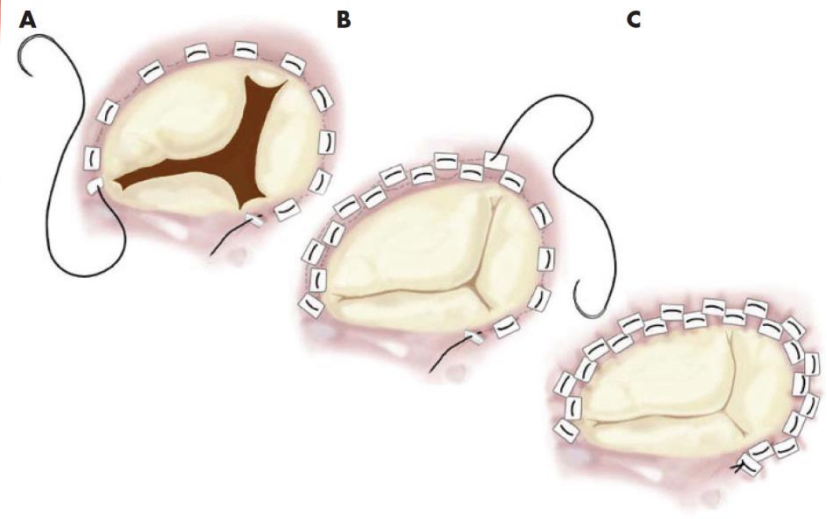
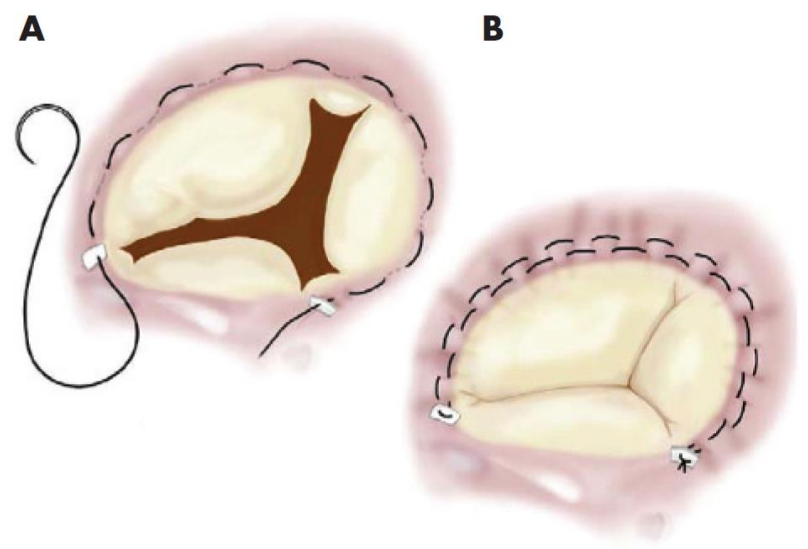
c Dubost 1967



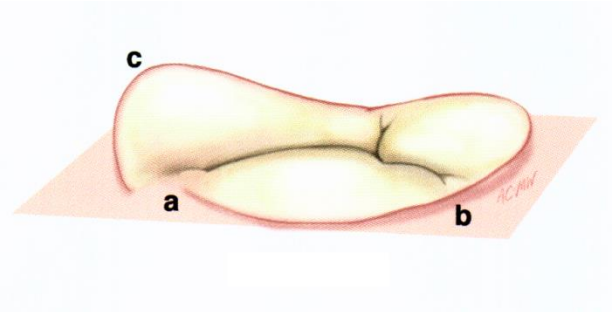
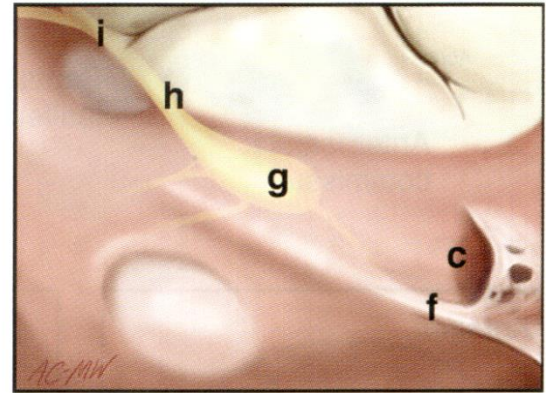
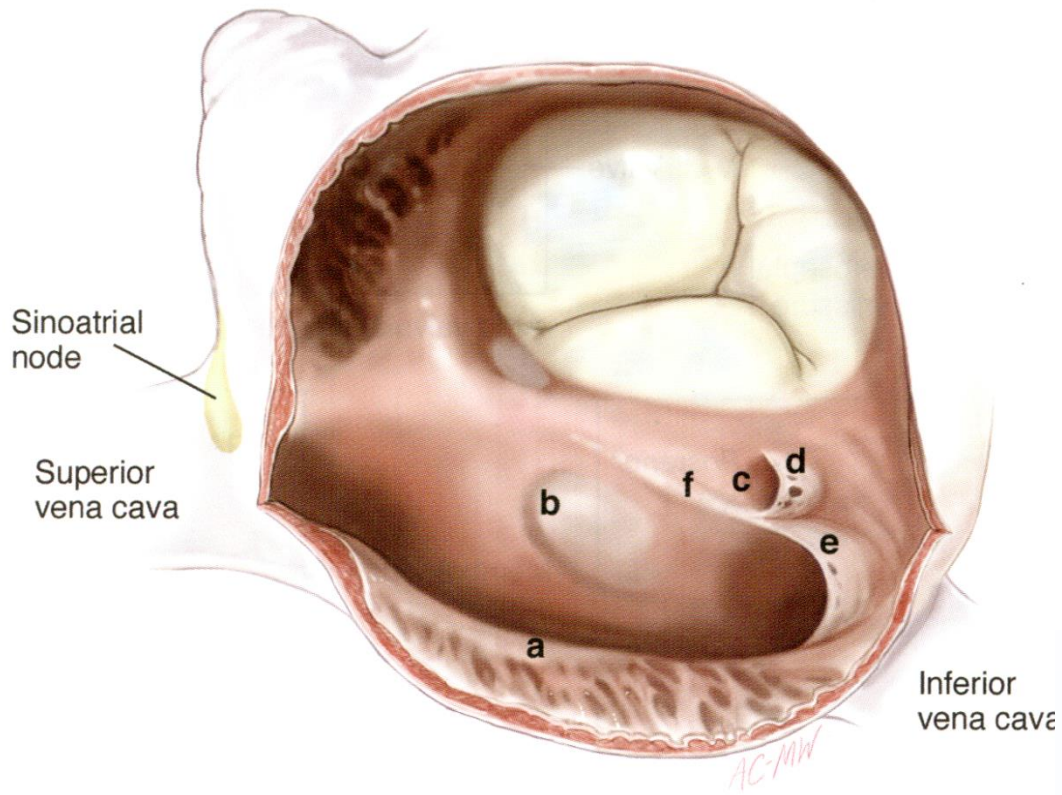
e Carpentier 1971



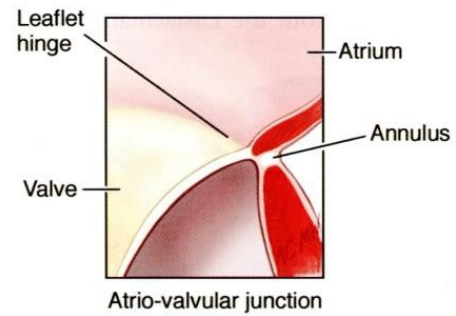
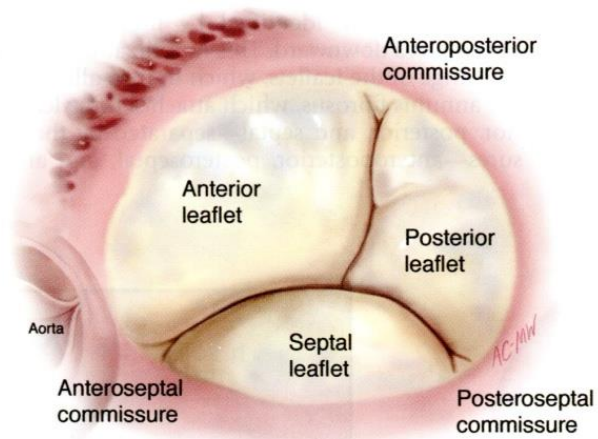
d DeVega 1972



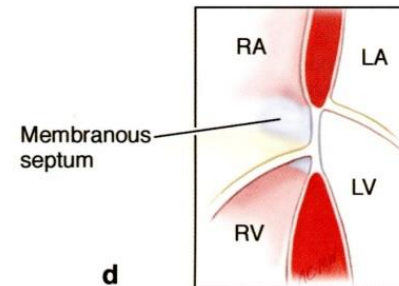
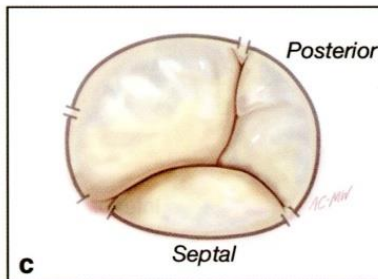
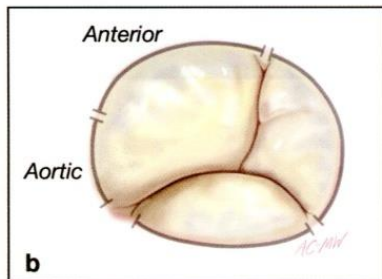
Anatomy of Tricuspid valve



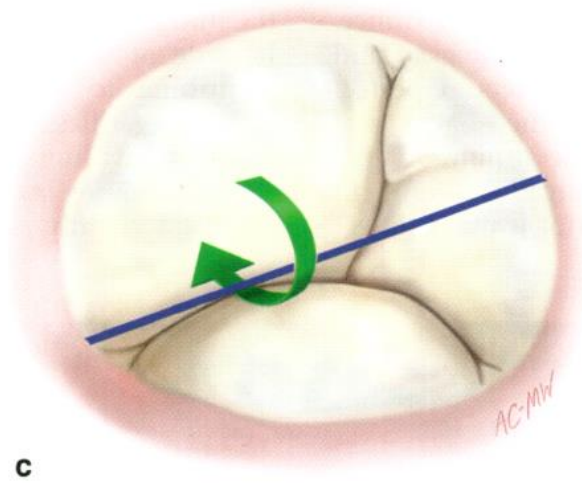
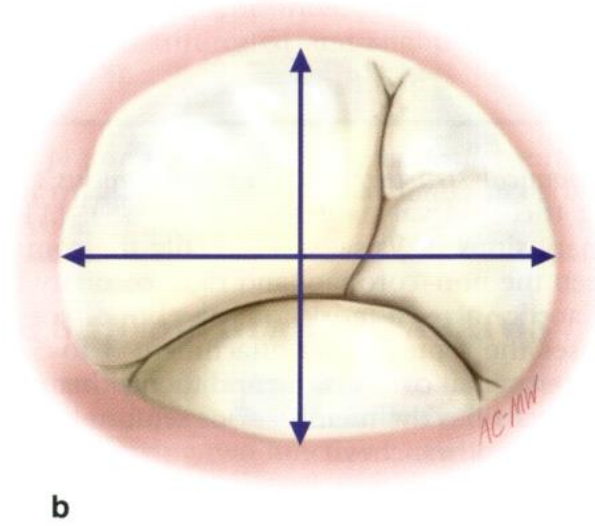
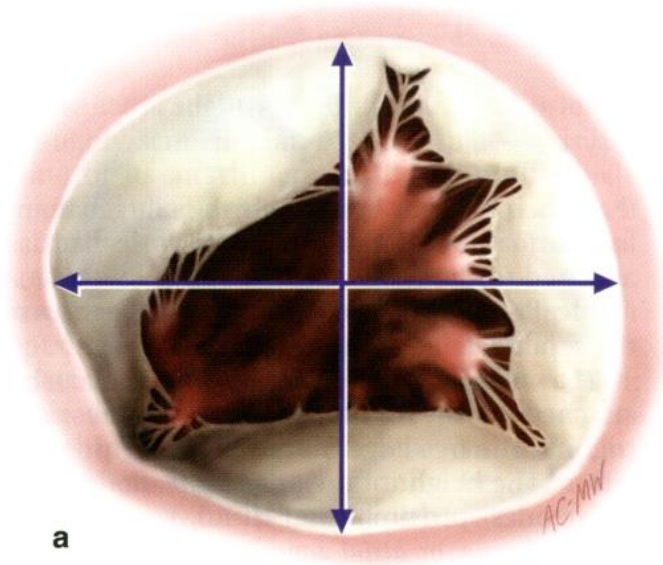
Annulus

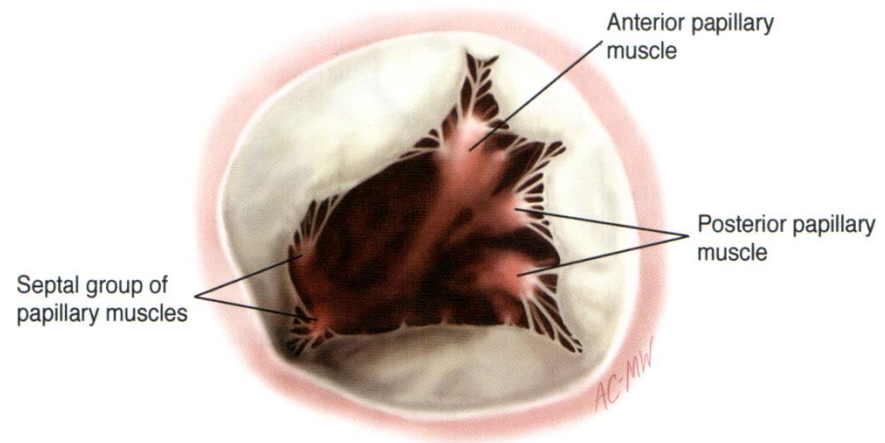
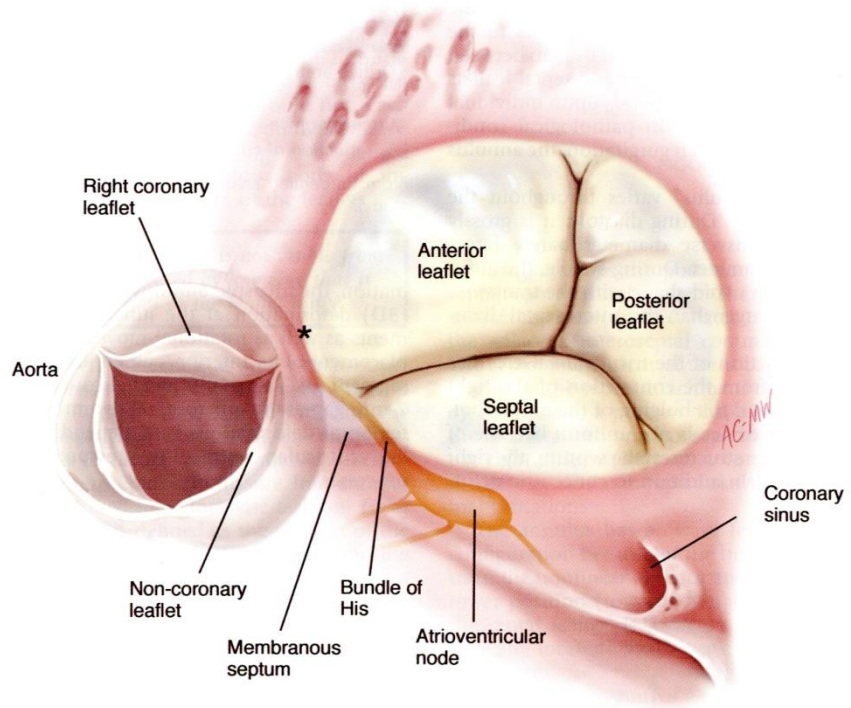


a

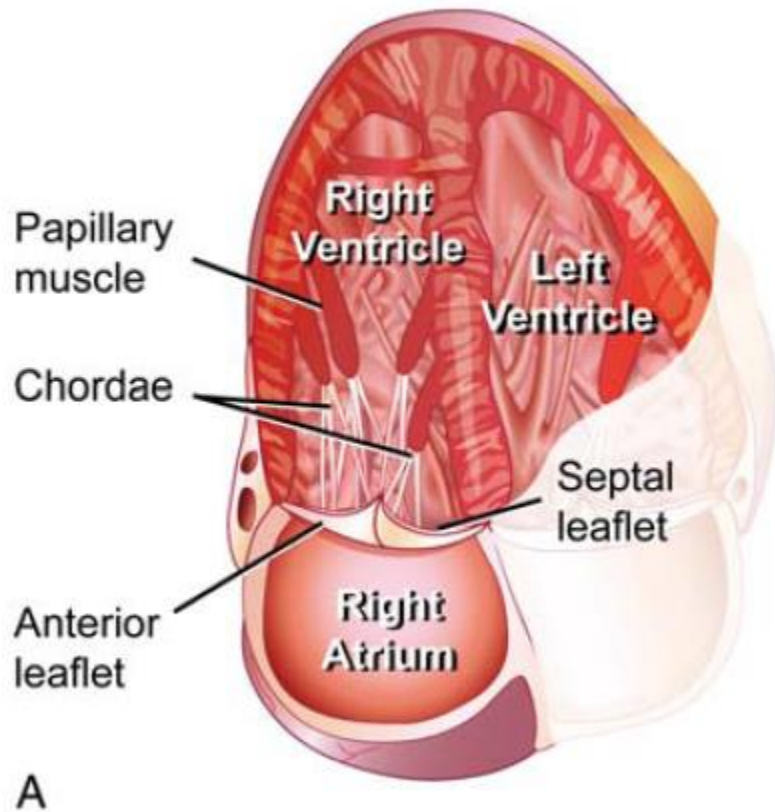


d

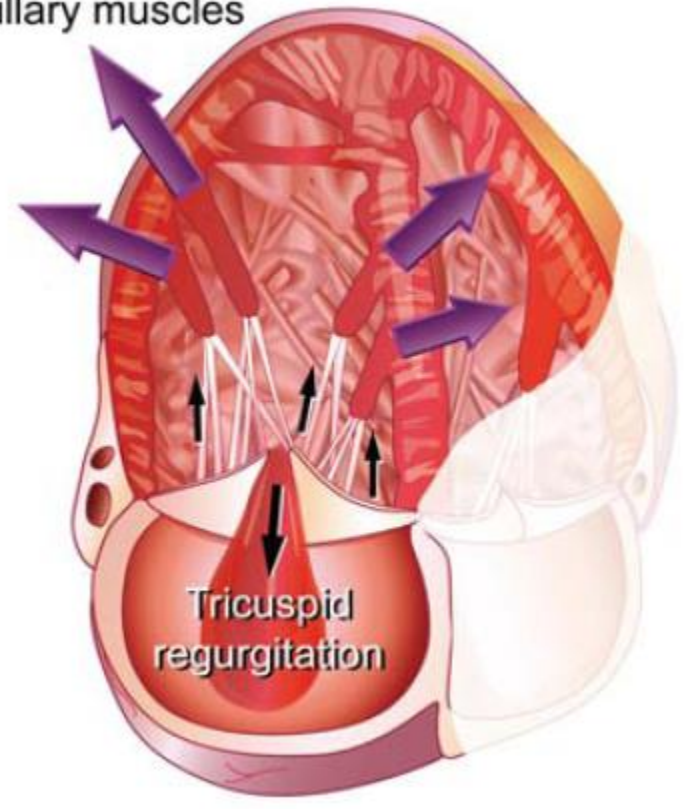




Functional TR

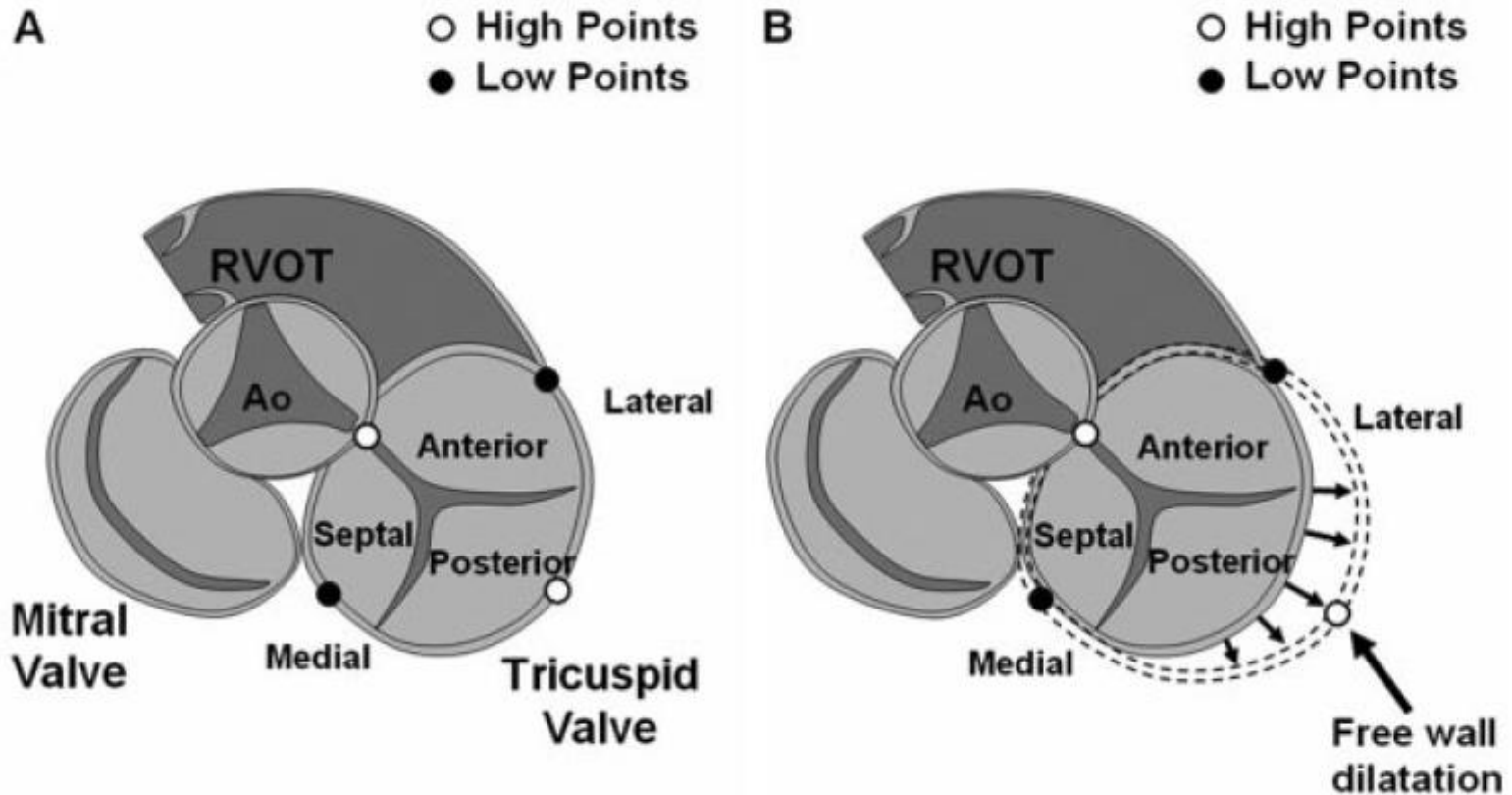


Displacement of the papillary muscles



Mascherbauer J, EHJ;2010;31:2841-2843

Functional TR



Ton-Nu T et al. Circulation. 2006;114:143-9

Ring annuloplasty

- **Differential Annulus Dilatation**

: Dilatation of the annulus does not affect all leaflets the same

- Posterior leaflet can increase up to 80%
- Anterior leaflet can increase up to 40%
- Septal leaflet can increase up to 10%

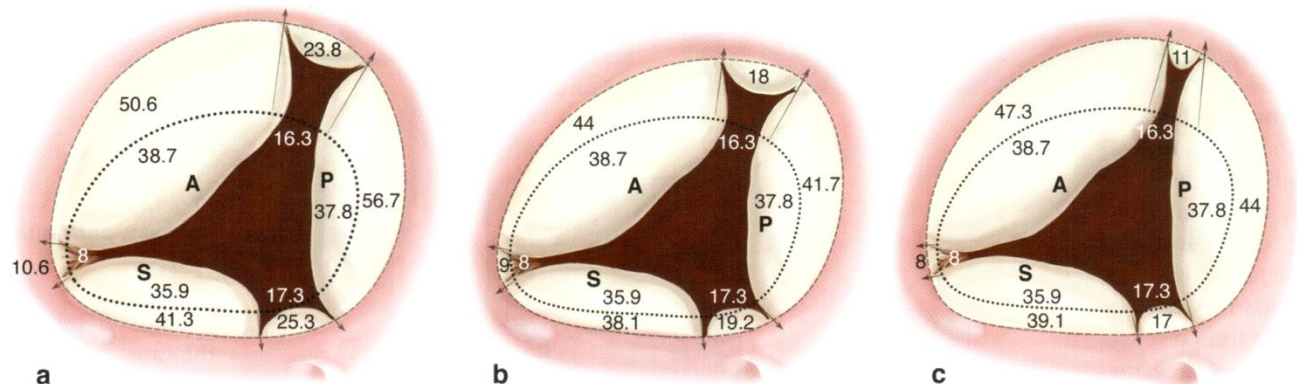


Table 2. Comparison of Selected Annuloplasty Approaches for Functional TR

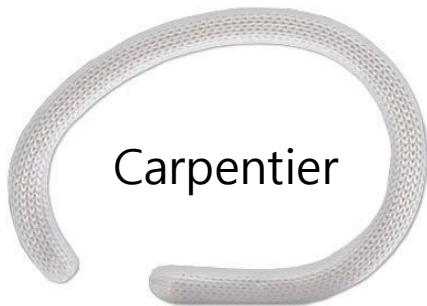
	Bicuspidization	Classic De Vega	Flexible Band	Rigid Ring
Simplicity	Yes	Yes	No	No
Added time	<5 min	<10 min	10-20 min	15-20 min
Reproducibility	Low	Moderate	High	Very high
Annular stabilization	Posterior	Anterior/posterior	Anterior/posterior	Septal/anterior/posterior
Risk of heart block	None	Minimal	Minimal	Low
Residual TR	High	Moderate	Low	Low
Recurrent TR	High	Moderate	Low	Low
Cost	Cheap	Cheap	Expensive	Expensive

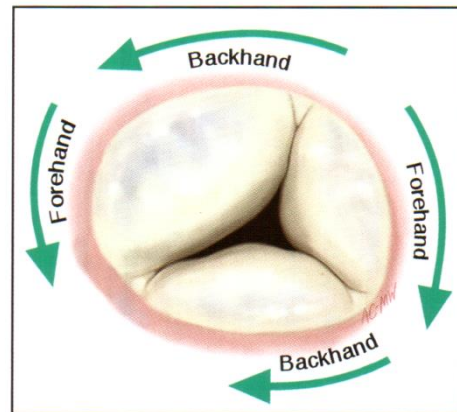
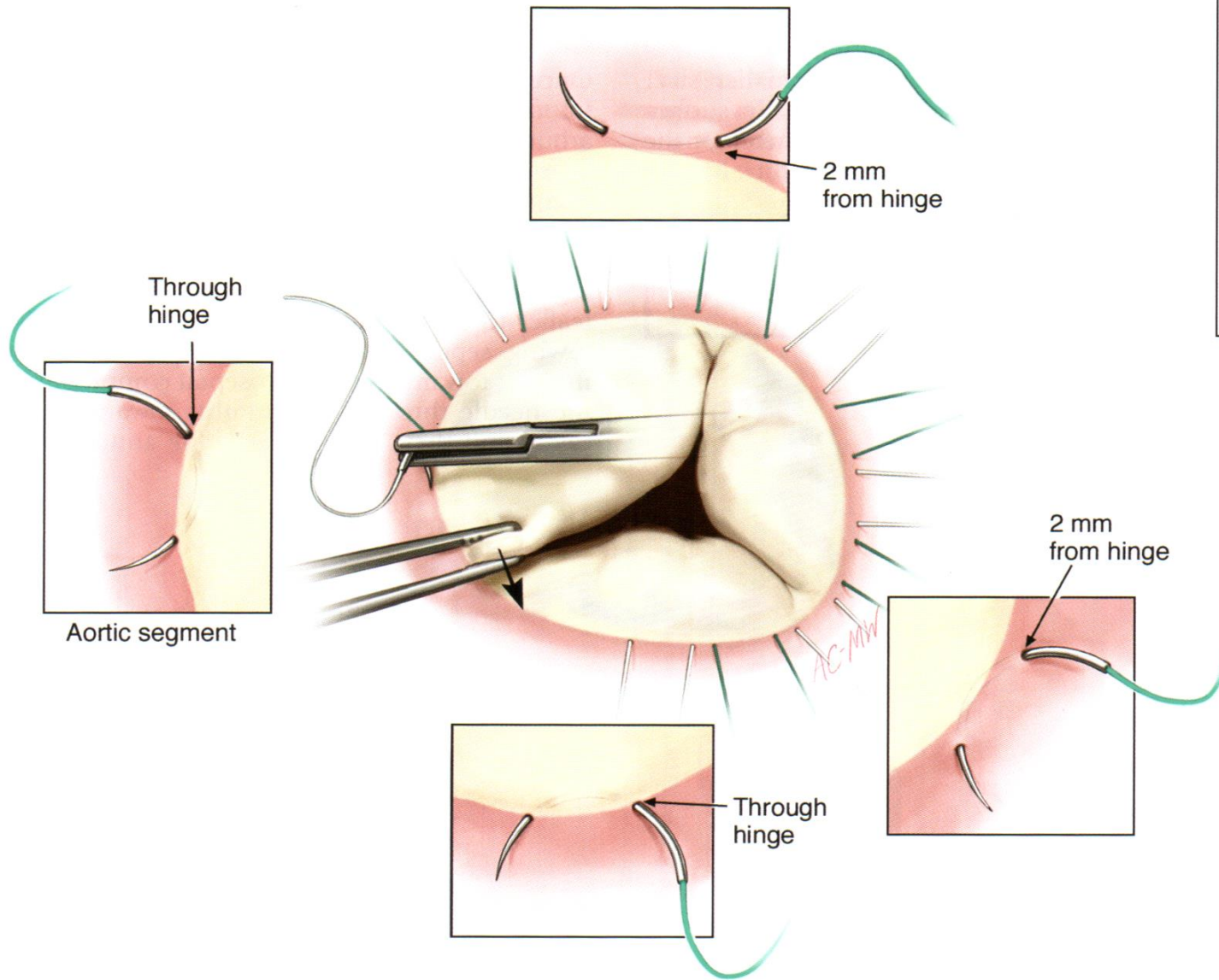
This assumes techniques are applied by general cardiac surgeons without specific expertise in either repair technique. TR, tricuspid regurgitation.

Table 1. Commonly Used Rings and Bands for the Treatment of Functional Tricuspid Regurgitation

Name	Manufacturer	Rigid or Flexible	Size and Shape (Closed or Open)	Comments
Carpentier-Edwards	Edwards Lifesciences	Rigid Ring	26-36 mm open	Dedicated tricuspid, planar
Cosgrove-Edwards	Edwards Lifesciences	Flexible band	26-38 mm open	Mitral or tricuspid
MC3	Edwards Lifesciences	Rigid titanium Ring	26-36 mm open 3D	Dedicated tricuspid, 3D conformation
Duran AnCore	Medtronic	Flexible ring or band	25-35 mm closed or open	Mitral or tricuspid
Tailor	St. Jude Medical	Flexible ring or band	Closed or open	Mitral or tricuspid
Annuloflex	CarboMedics	Flexible ring or band	26-36 mm convertible closed or open	Mitral or tricuspid
Simulus	ATS Medical	Flexible ring or band	23-35 mm closed or open	Mitral or tricuspid

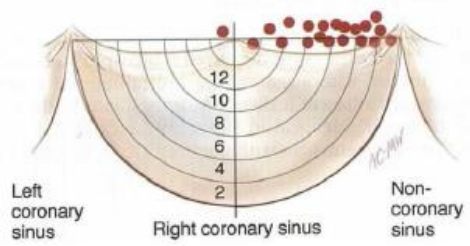
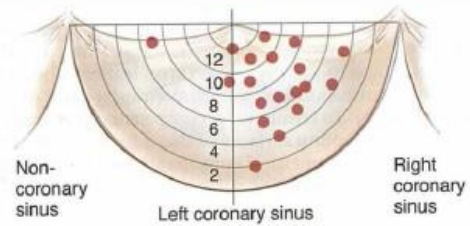
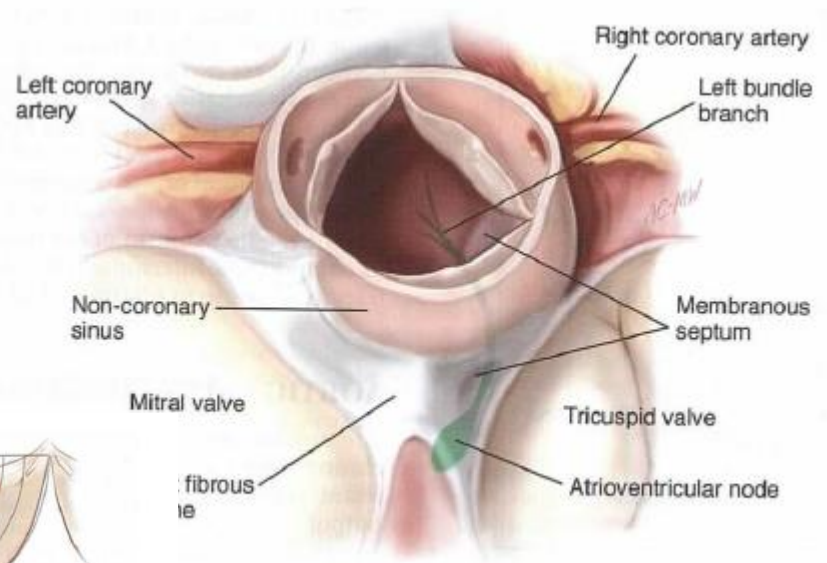
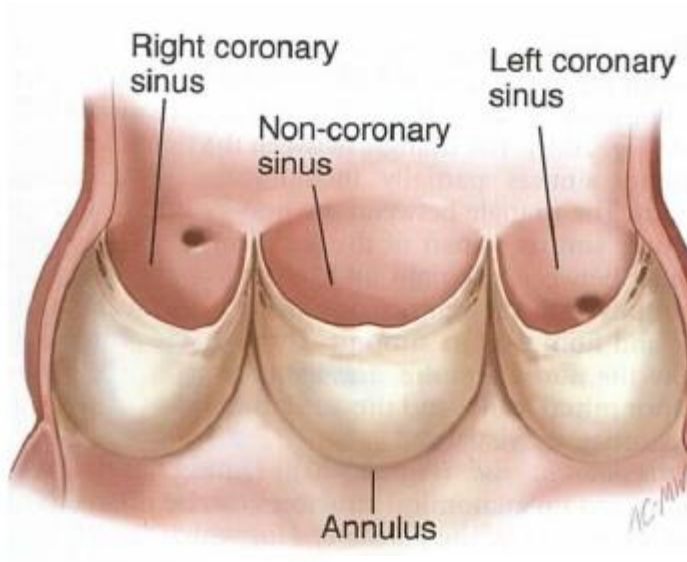
Rogers JH, Bolling SF, et al. Semin Thoracic Surg 22:84-89



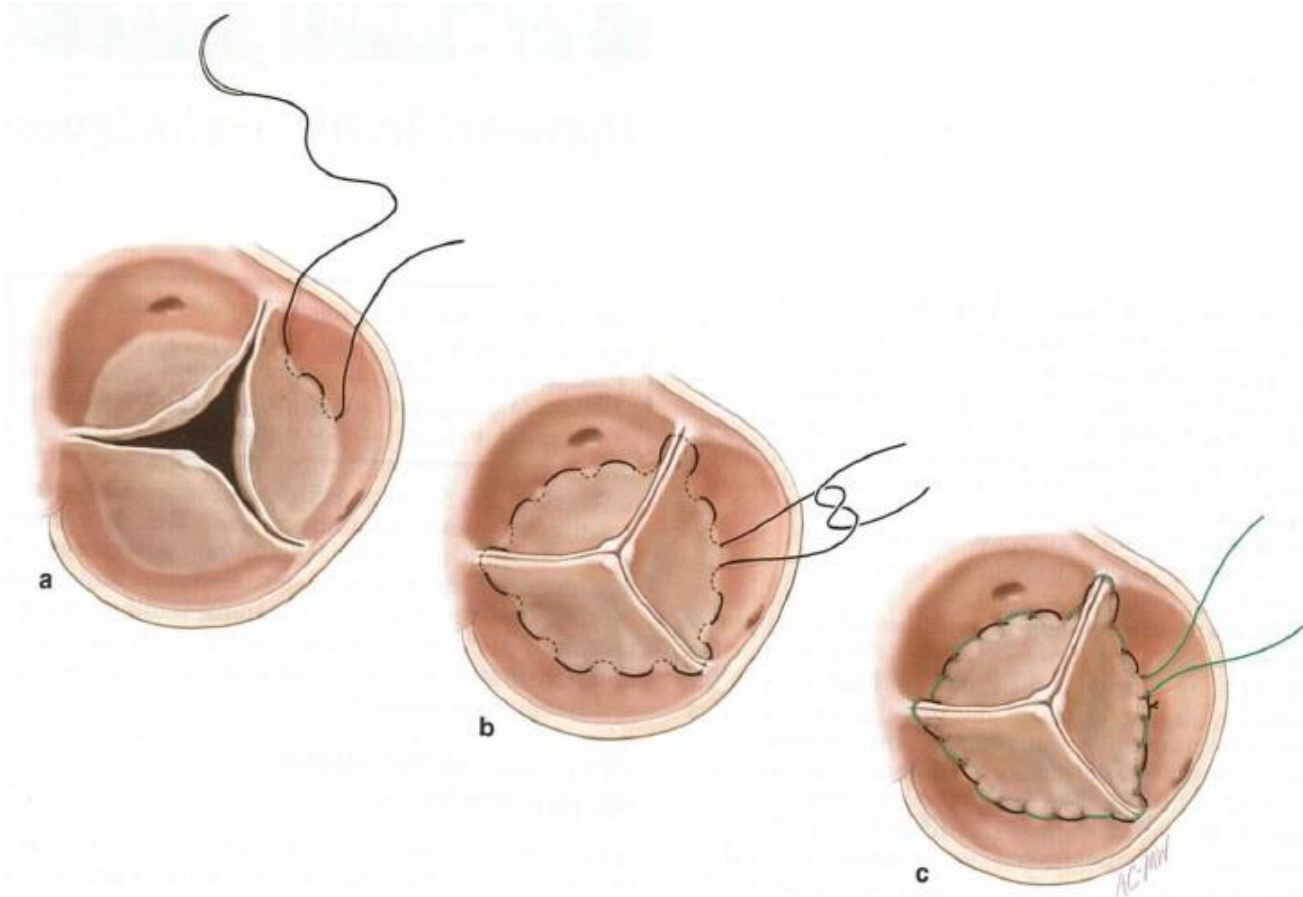


Aortic valve repair

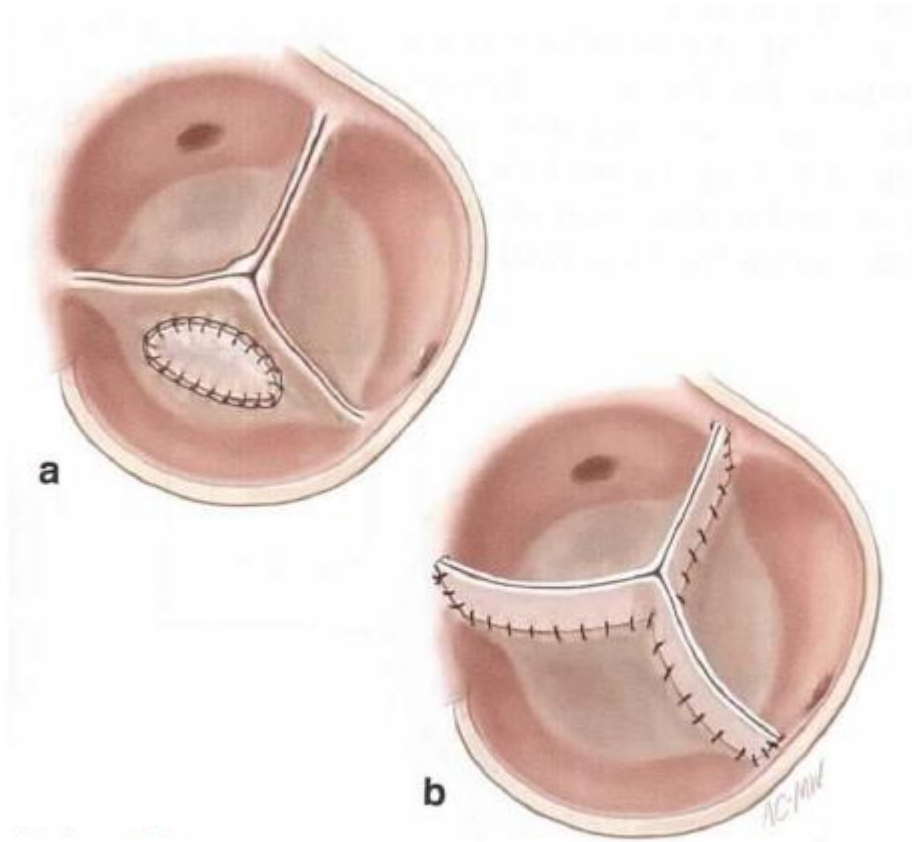
Anatomy of Aortic valve



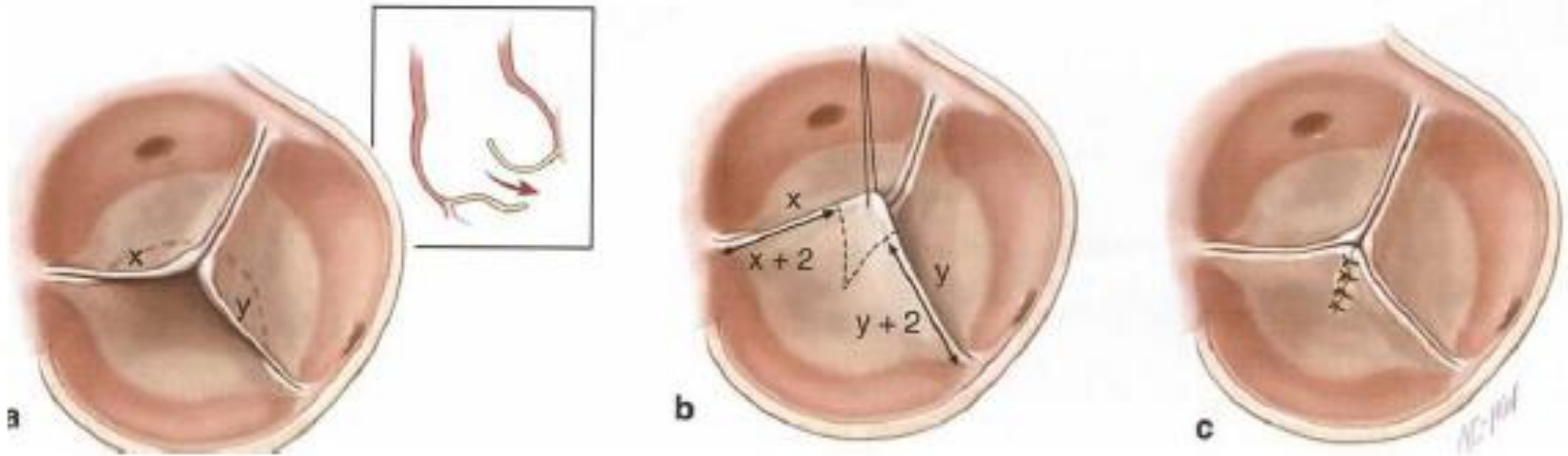
Annular dilatation



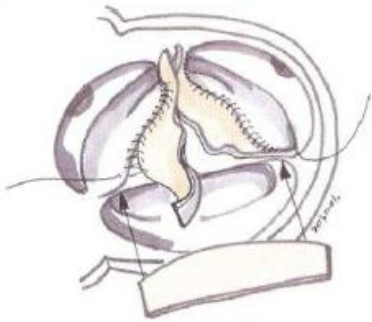
Leaflet perforation



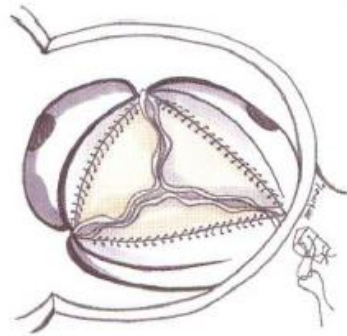
Leaflet Prolapse



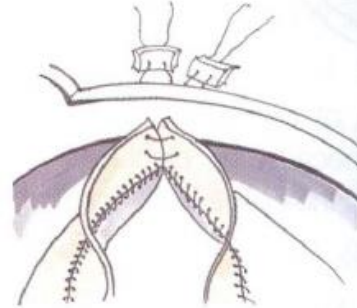
Leaflet extension



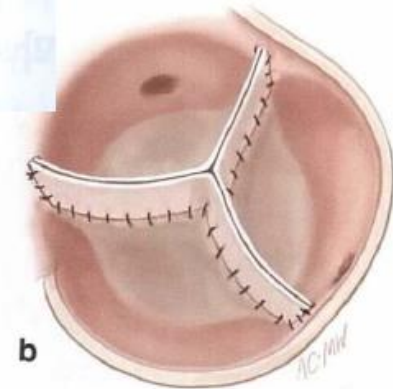
A



B



C



b

Summary

- Adequate knowledge for Valve
- Adequate ring annuloplasty(MV, TV).
- Artificial chordae(MV)
- One lesion one technique principle(MV)