Left Heart Valve Replacement; Surgical Technique, Choice of the Valve, Postoperative Management, and Long Term Results

Young Hwan Park, M.D.
Yonsei Cardiovascular Center
Yonsei University College of Medicine

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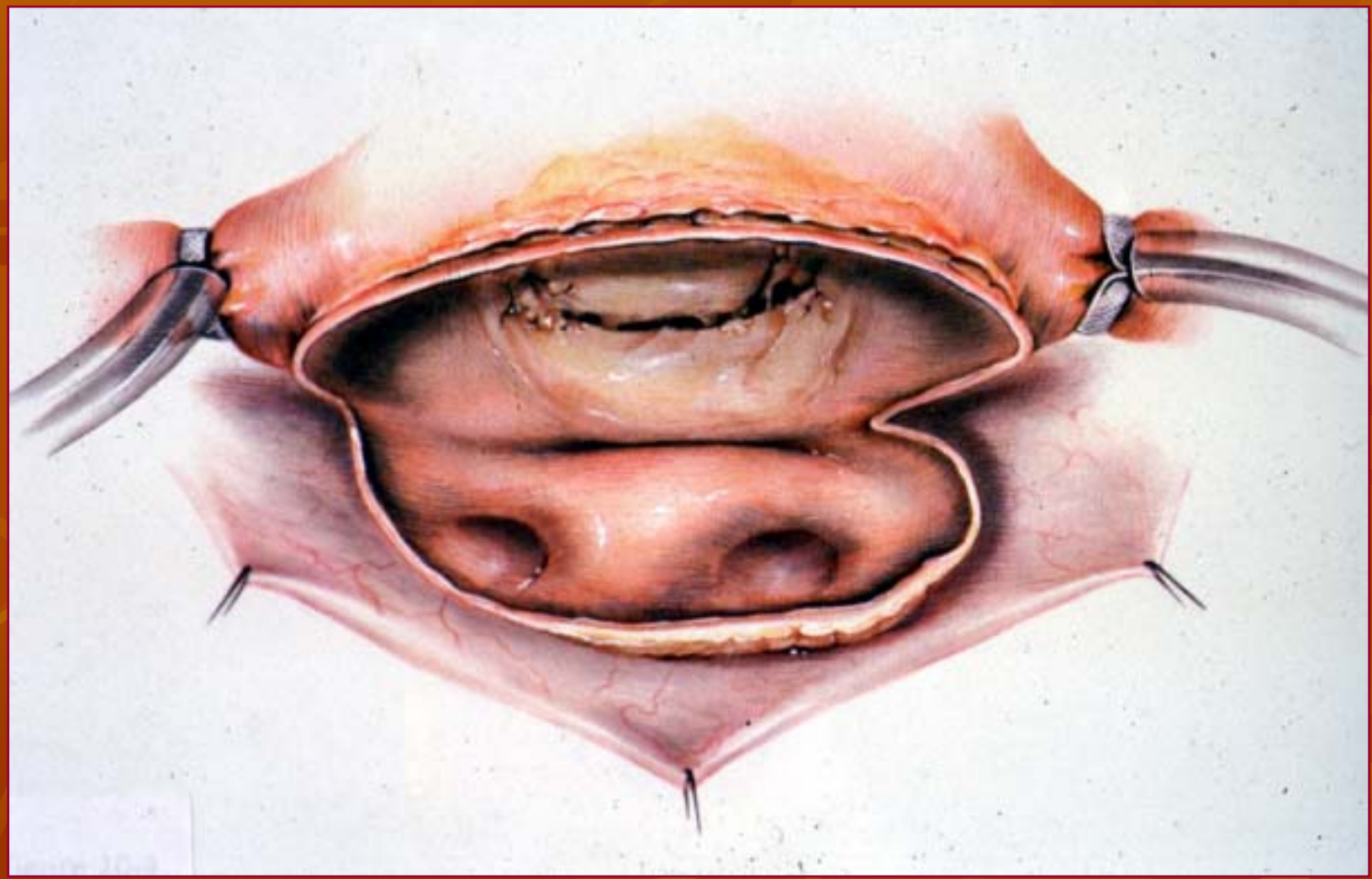
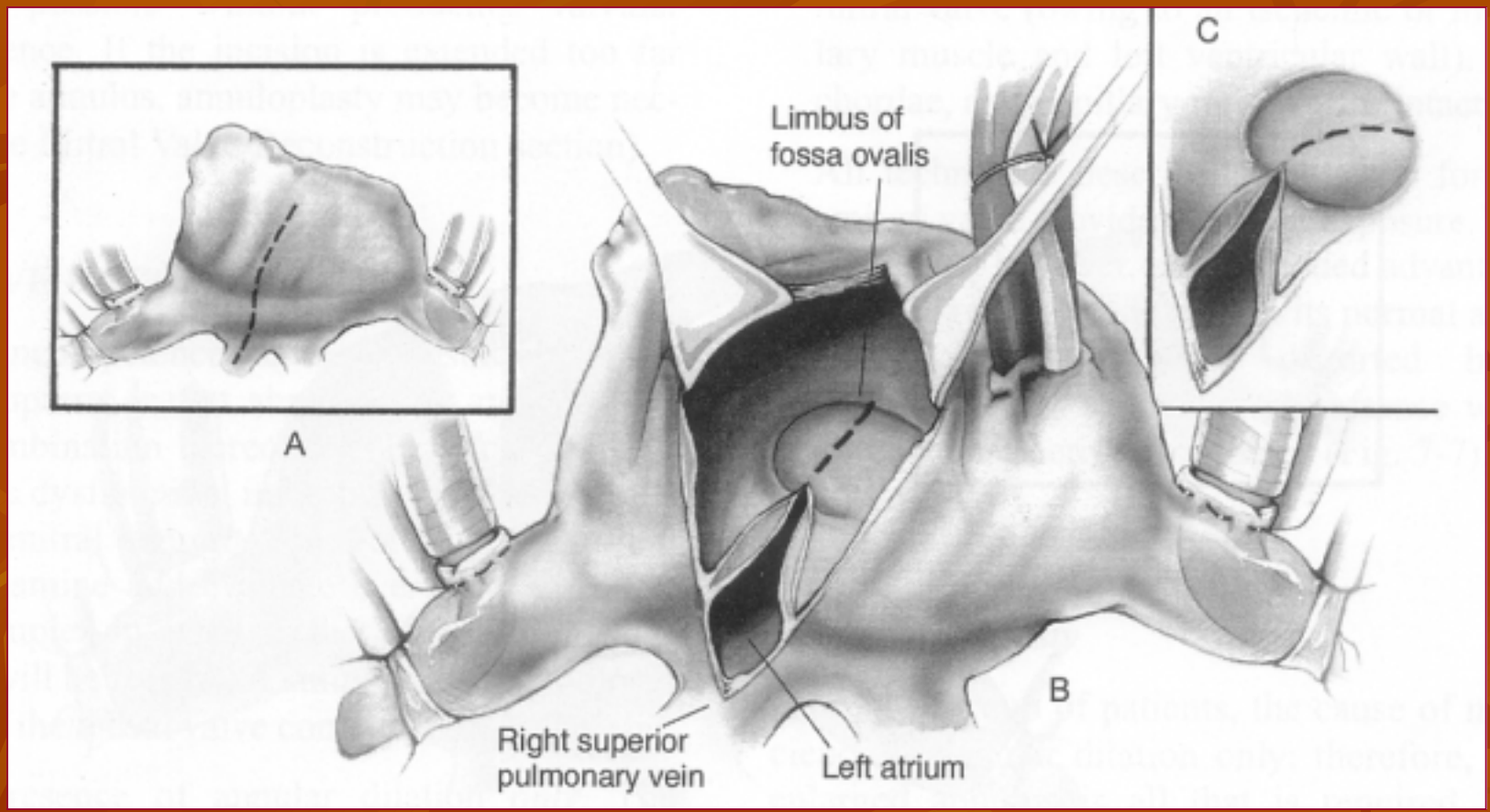
Problems Related with Left Side Valve Replacement in Children

- Small size (the mitral annulus, left atrium, left ventricle, aortic root)
- Great variability in valve anomalies
- Other cardiovascular anomalies
- Growth Potential
- Anticoagulation

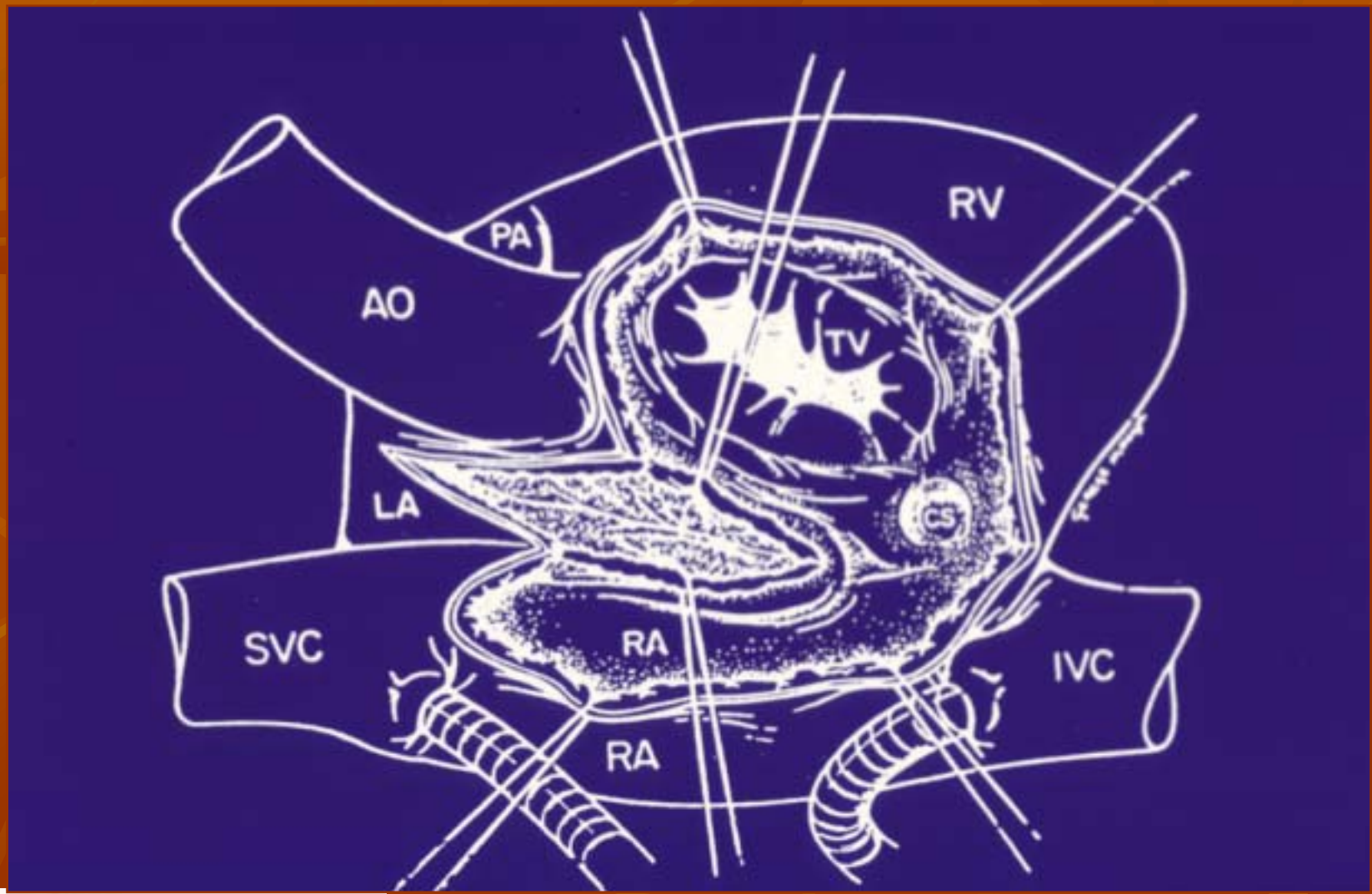
Standard Exposure Method



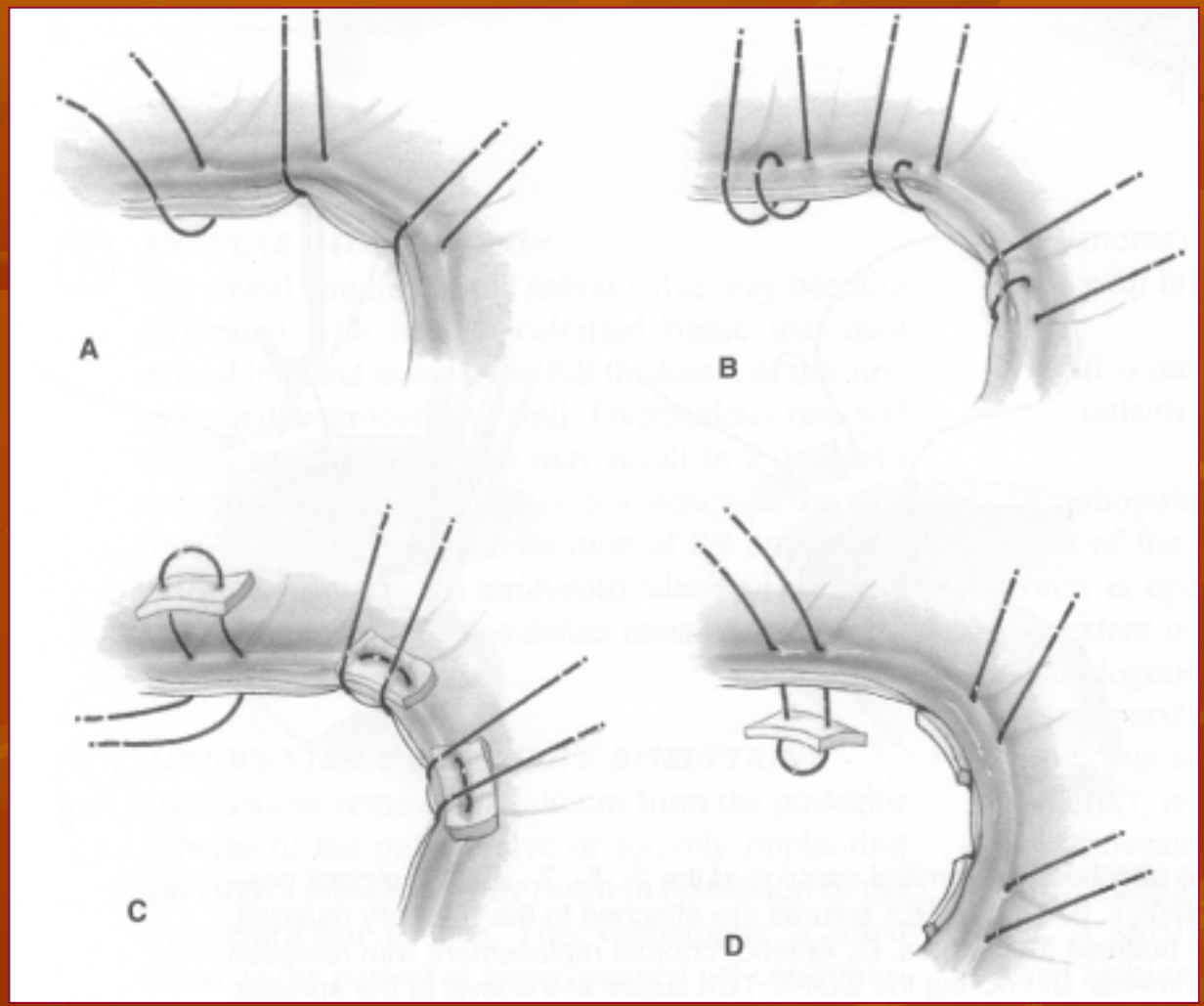
Transverse Transseptal Approach



Extended Transeptal Approach

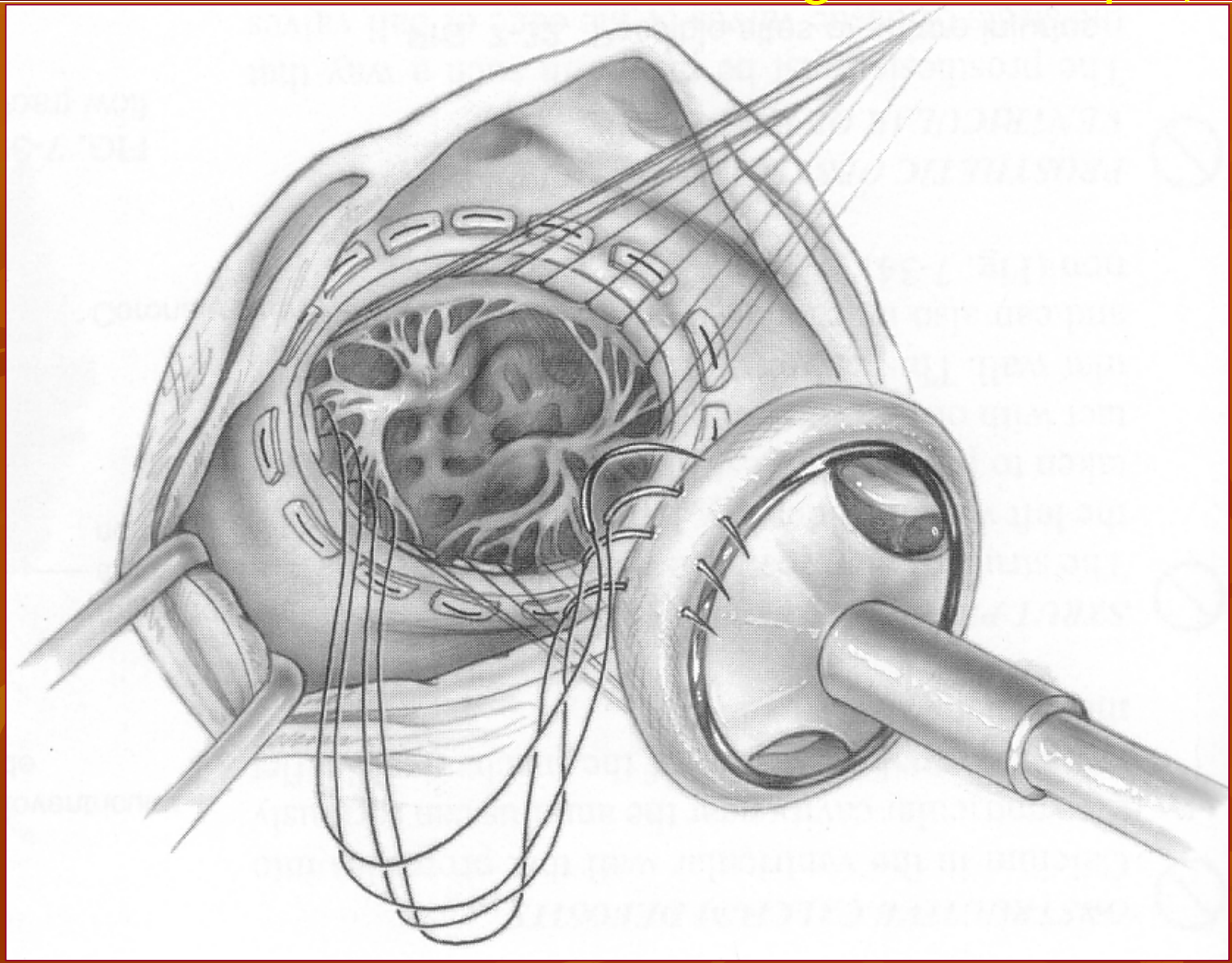


Valve Suture Technique



A. Simple Suture
B. Figure of eight
C. Everting Mattress
D. Inverting Mattress

Surgical Technique(Mitral)



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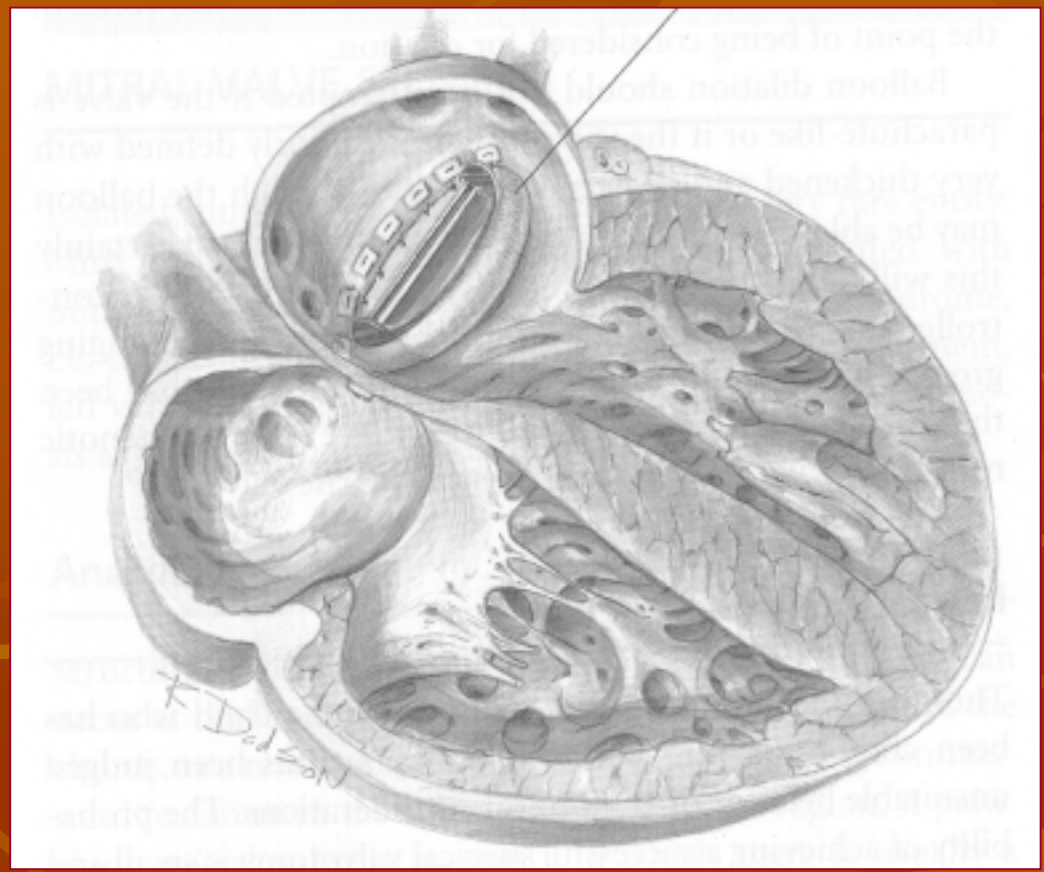
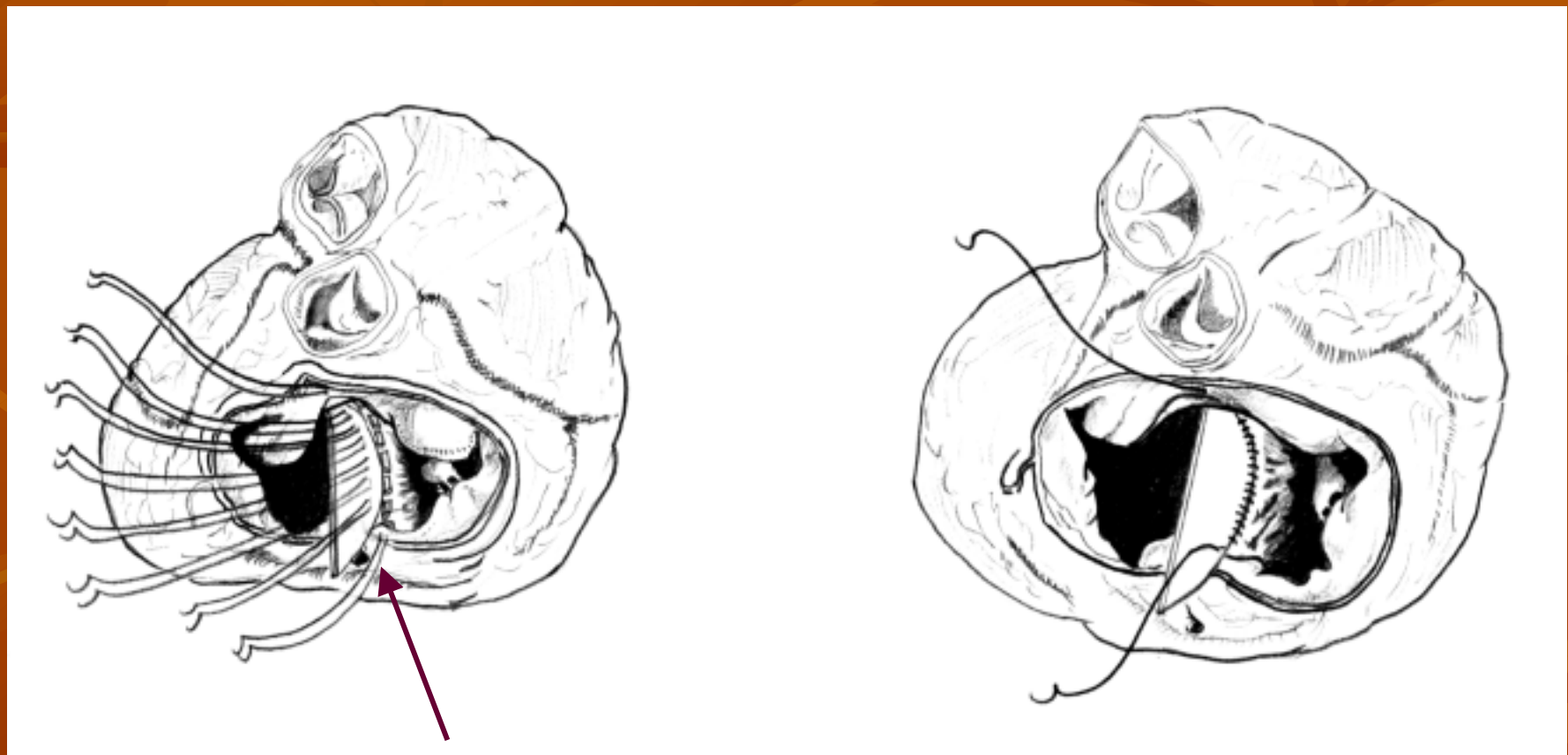
Supra-annular Mitral Valve Replacement



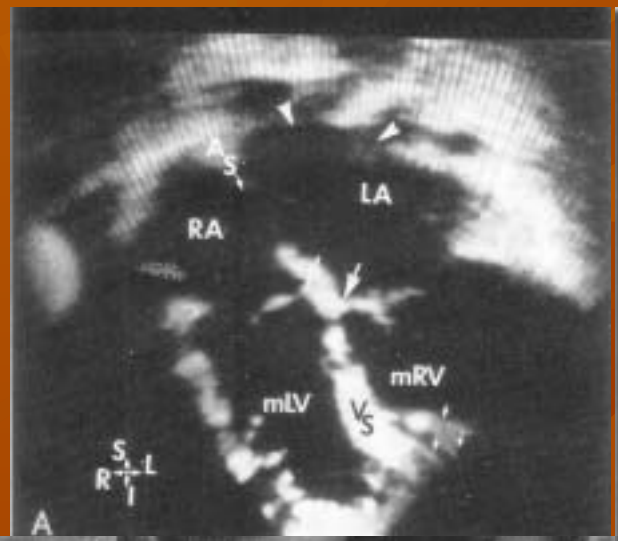
Supraannular position
- posterior: annulus and Left pulmonary vein
- lateral: annulus and LA appendage
- anterior: atrial septal

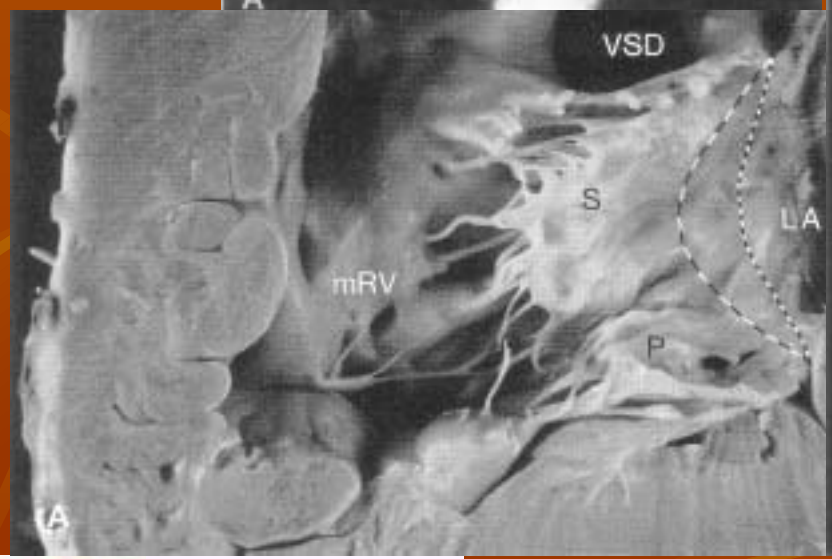
Mitral Valve Replacement in AVSD

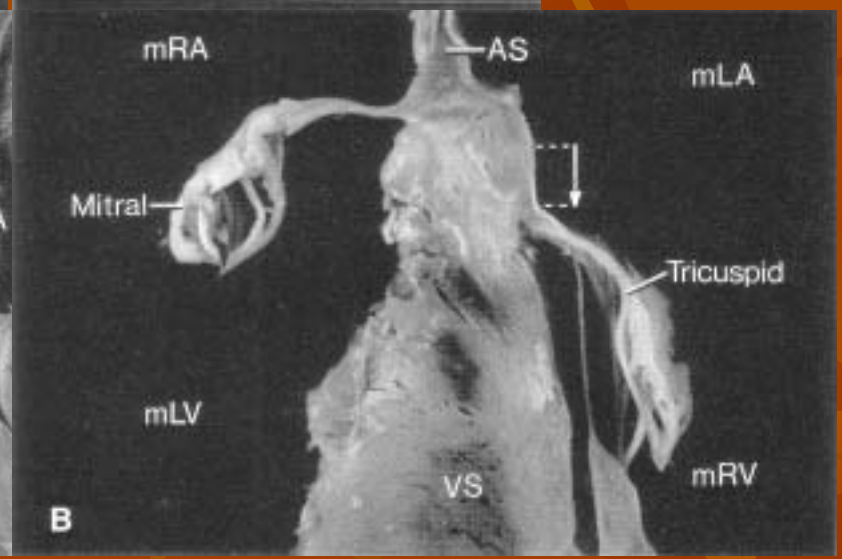


Single Ventricle: Common AV valve Replacement

Systemic Atrioventricular Valve in Corrected Transposition







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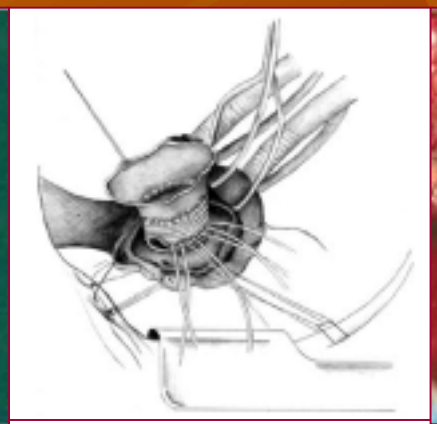
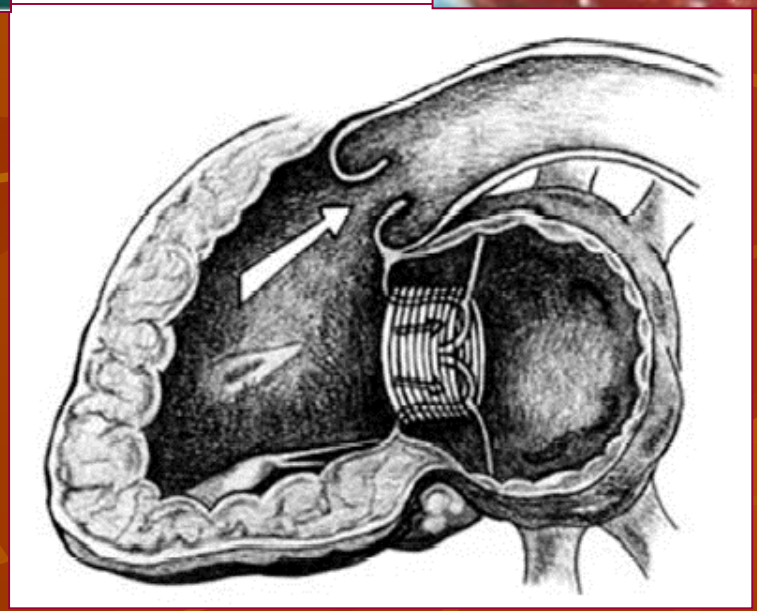
Mitral Pulmonary Autograft





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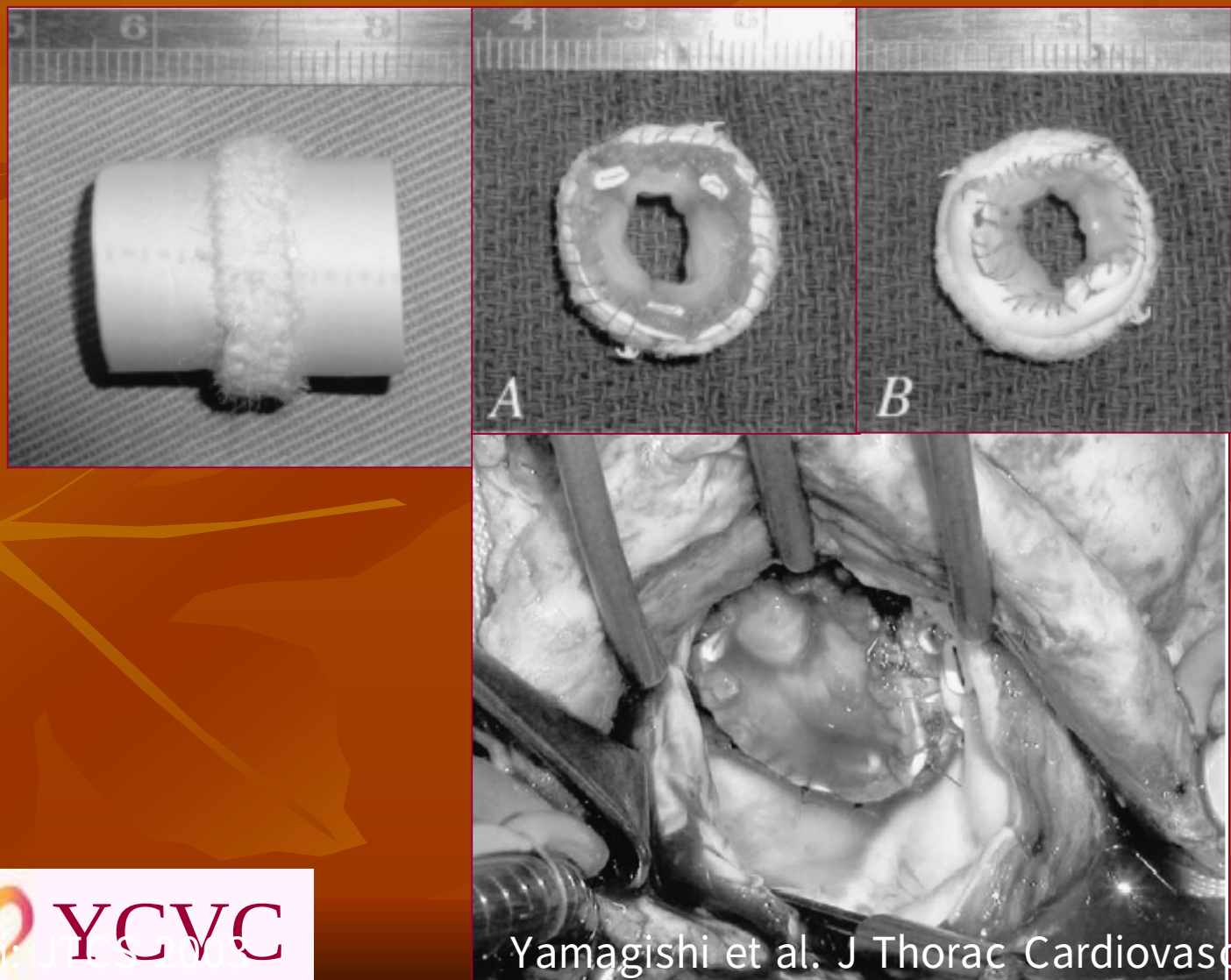
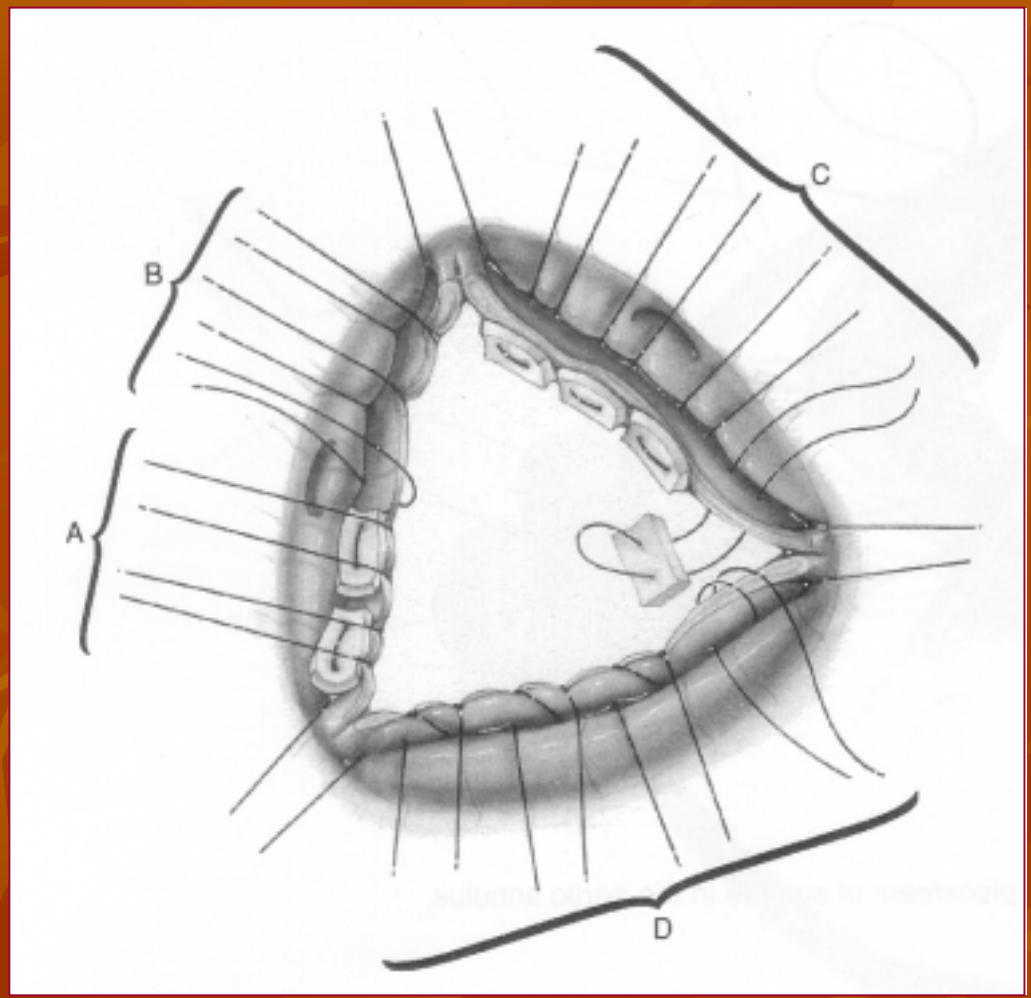
Kabbani et al. Ann Thorac Surg 2004

Goretex Reinforced Mitral Pulmonary Autograft

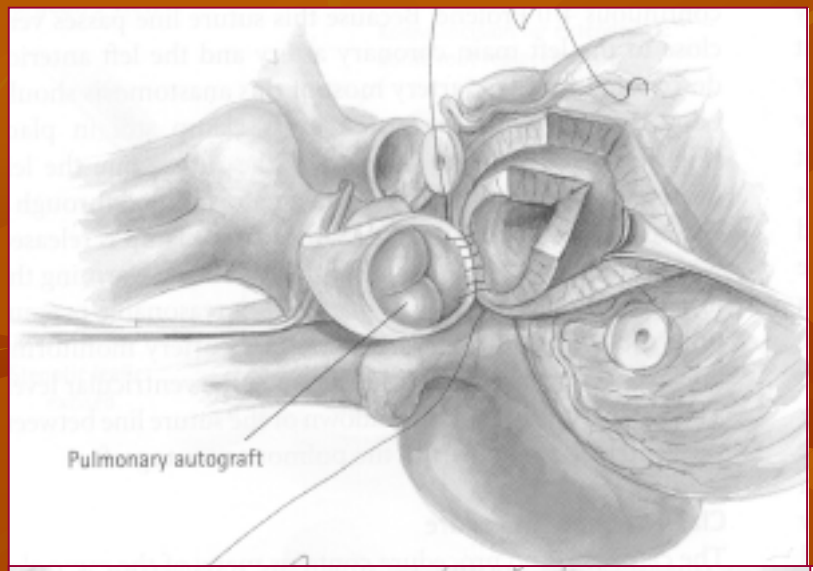


Yamagishi et al. J Thorac Cardiovasc Surg 2004

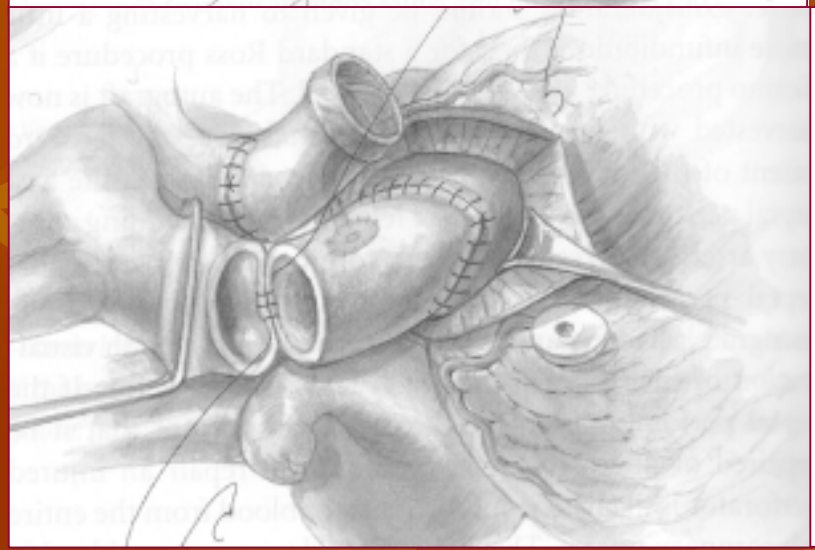
Valve Suture Technique (Aortic Valve)

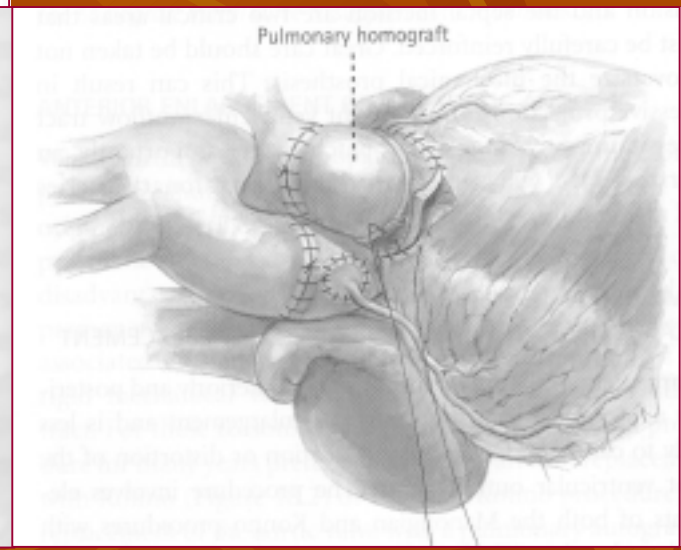


A. Everting Mattress Suture
B. Simple Suture
C. Inverting Mattress Suture
D. Figure of 8 Suture

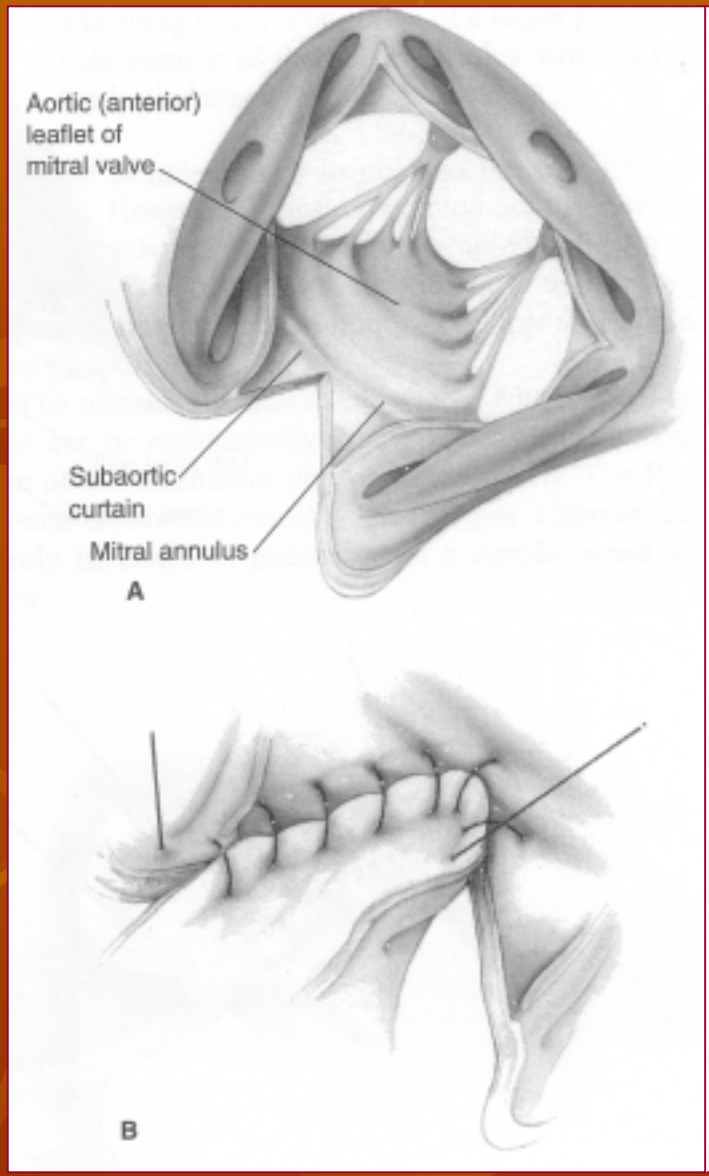


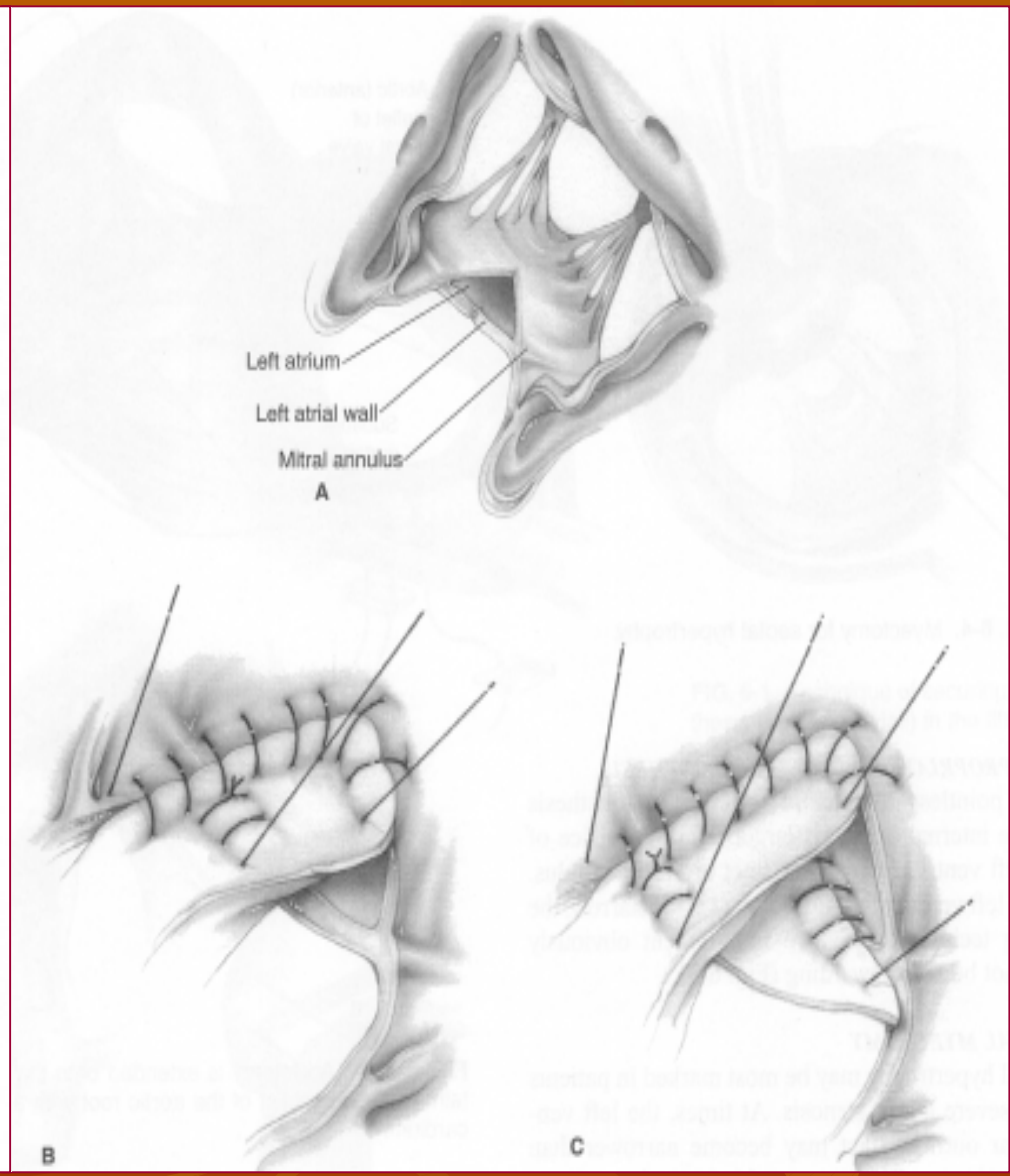
Ross/Konno procedure





Surgical Technique(Aortic)





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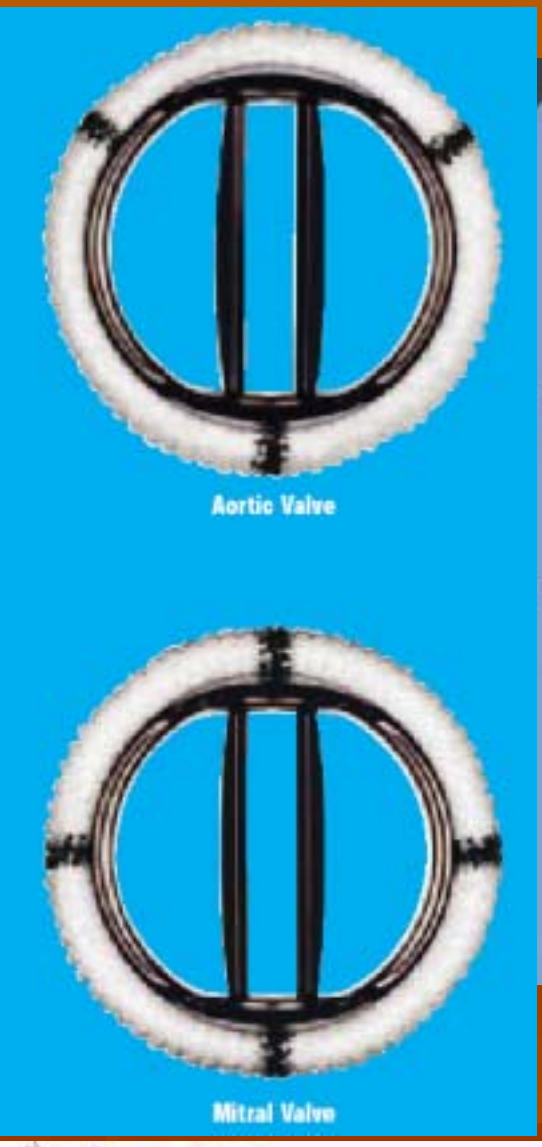
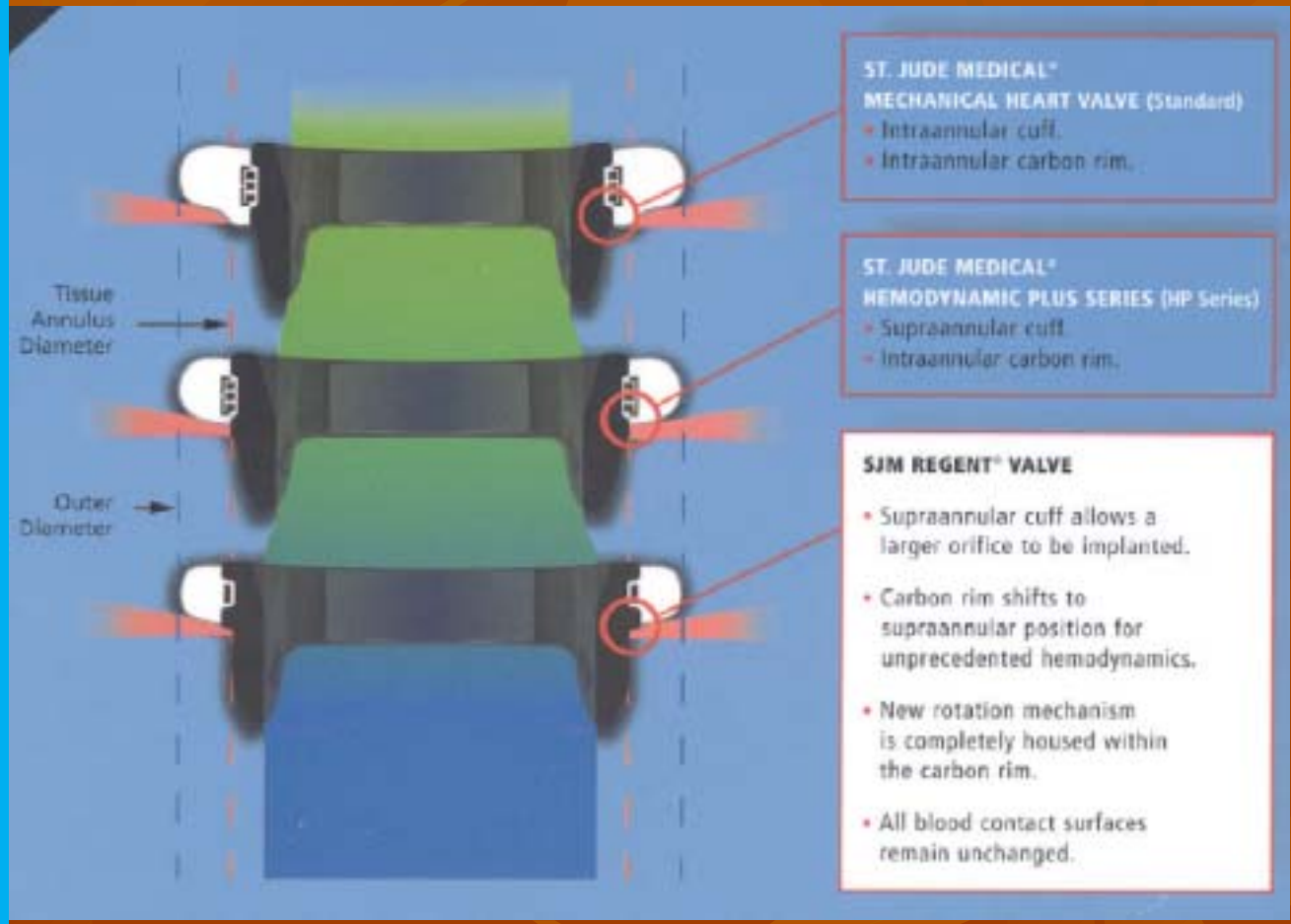
Choice of the Valve

- Choice of Valve Type
  - Mechanical Valve: Caged Ball
    - Medtronic Hall
    - Bjork-Shiley
    - St. Jude, ATS, Carbomedic
  - Tissue Valve: Carpentier-Edward
    - Hancock
    - Medtronic Intact

Choice of Valve





St. Jude Vavle: Standard, Hemodynamic Plus, Reagent

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Choice of Valve

CarboMedics

Standard

Reduced Series

TopHat: Aortic

ATS Medical Valve

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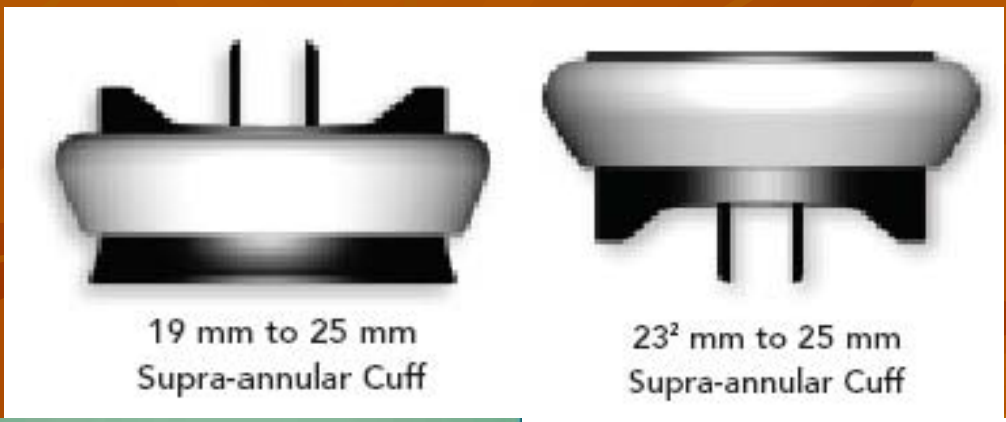
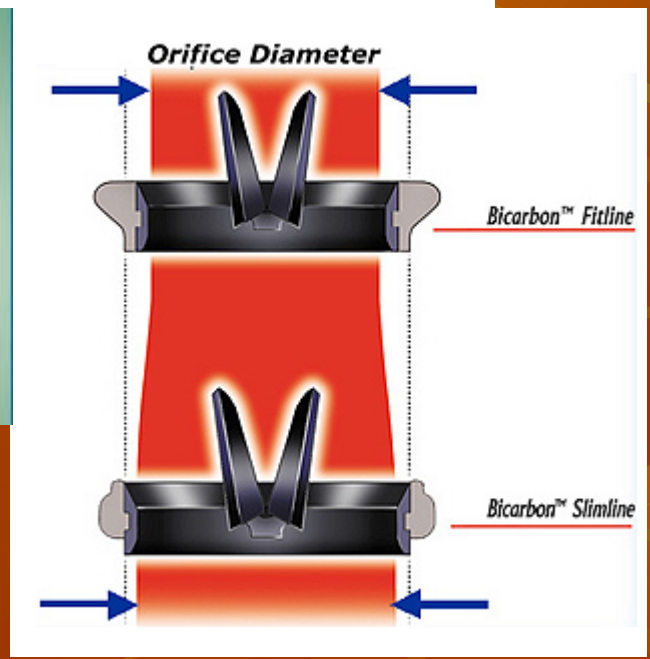
Choice of Valve



On-X valve

Sorin: Overline



Sorin: Slimline

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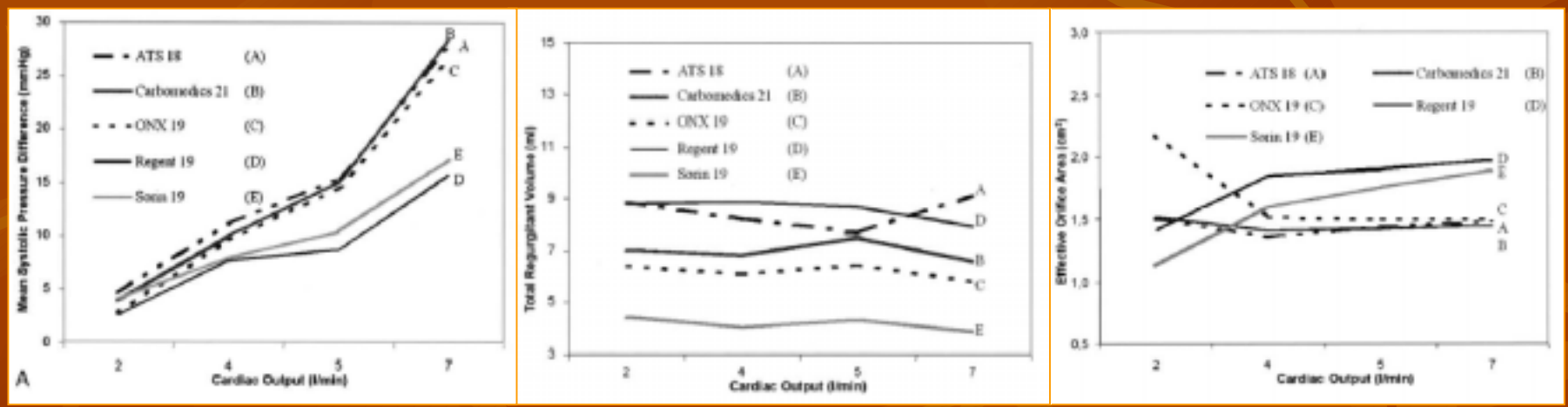
5 commercially available bileaflet mechanical valve for small aortic annulus

TABLE 1. Geometrics of the tested valves and mean value of EOA calculated over all tests performed for each valve

Model	External diameter (mm)	Internal diameter (mm)	Height (mm)	Excursion angle (°)	Opening angle (°)	Geometric orifice area (cm^2)	Clear valve area (cm^2)	EOA (cm^2)
ATS	18.2	16.8	8.8	60	85	2.02	–	1.44
Carbomedics Top Hat	21.8	16.7	10.3	53	78	2.07	1.46	1.45
On-X	20.1	17.4	10.8	47	90	2.22	2.00	1.80
SJM Regent	19	17.8	9.07	60	85	2.39	1.96	1.78
Sorin Slimline	19.2	17.22	10.5	60	70	2.27	–	1.59

EOA, Effective orifice area.



Bottio et al : JTCS, 2004

Advantages and Disadvantages of Tissue Valves

- No Anticoagulation
- No Thromboembolic event
- No Teratogenic effect
- Early degeneration and calcifications
- Relatively smaller orifice and larger profile
- No pregnancy over 10 yrs after AVR

Advantages and Disadvantages of Mechanical Valves

- Require Anticoagulation

  Thromboembolic event: 0.3-0.7%/patient-year
- Pannus in-growth, paravalvular leak
- Relatively larger orifice and lower profile
- Heparin switch during pregnancy

  (6주-12주, term) 4.1% of Embryopathy?

Anticoagulation in Children

- Different intrinsic coagulation system
- Hemodynamic difference
  - Higher resting heart rate,
  - Lower incidence of arrhythmia,
  - Atrial enlargement and depressed ventricular function
- Difficult to keep daily medication and to maintain coumadin level.
- Strict prophylatic antibiotics (infective endocarditis)

Multiple Procedure due to Outgrowth & Complication

- Small size of valve is commercially not available.

  St. Jude # 17,19, 21,23, ATS # 16, 18, 20

  Carbomedics # 16, 18, - - 25

- Bigger size of valve may be harmful to ventricular function.
- Risk of redosurgery is less than 1%.
- Goretex membrane protection

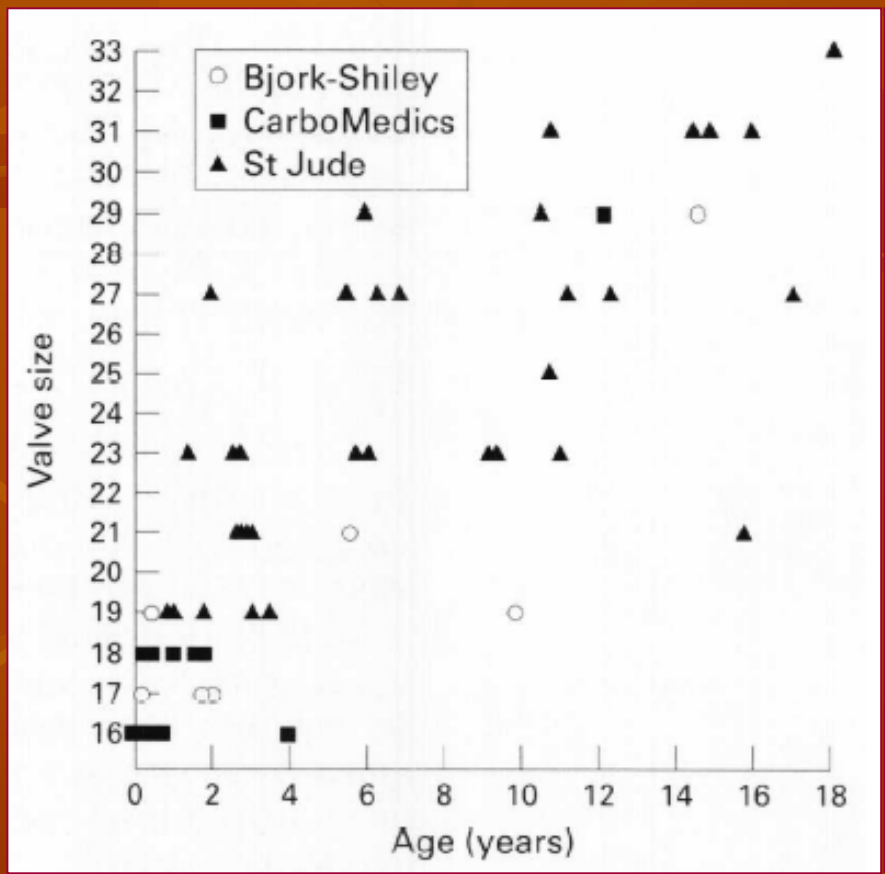
Post-operative Care (Mitral Valve)

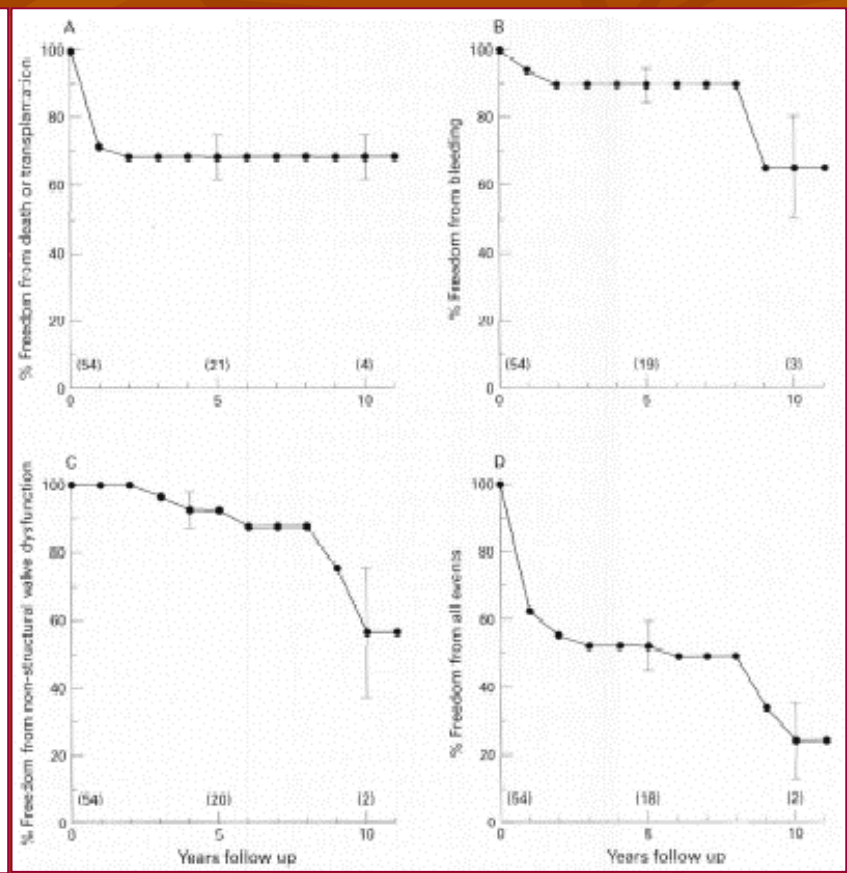
- Left atrial pressure monitoring
- Atrioventricular sequential pacing
- Mixed venous oxygen saturation
- Inotropics
- Vasodilators

Post-operative Care (Aortic Valve)

- Left atrial pressure monitoring
- Atrioventricular sequential pacing
- Volume infusion and Beta blocker in LV hypertrophy
- Inotropics if profound peripheral vasodilation often seen in patients with aortic insufficiency

MVR in Children: hemodynamic status





(n=54, MVR=59)

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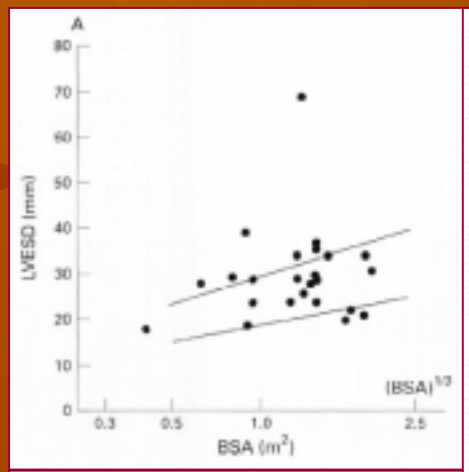
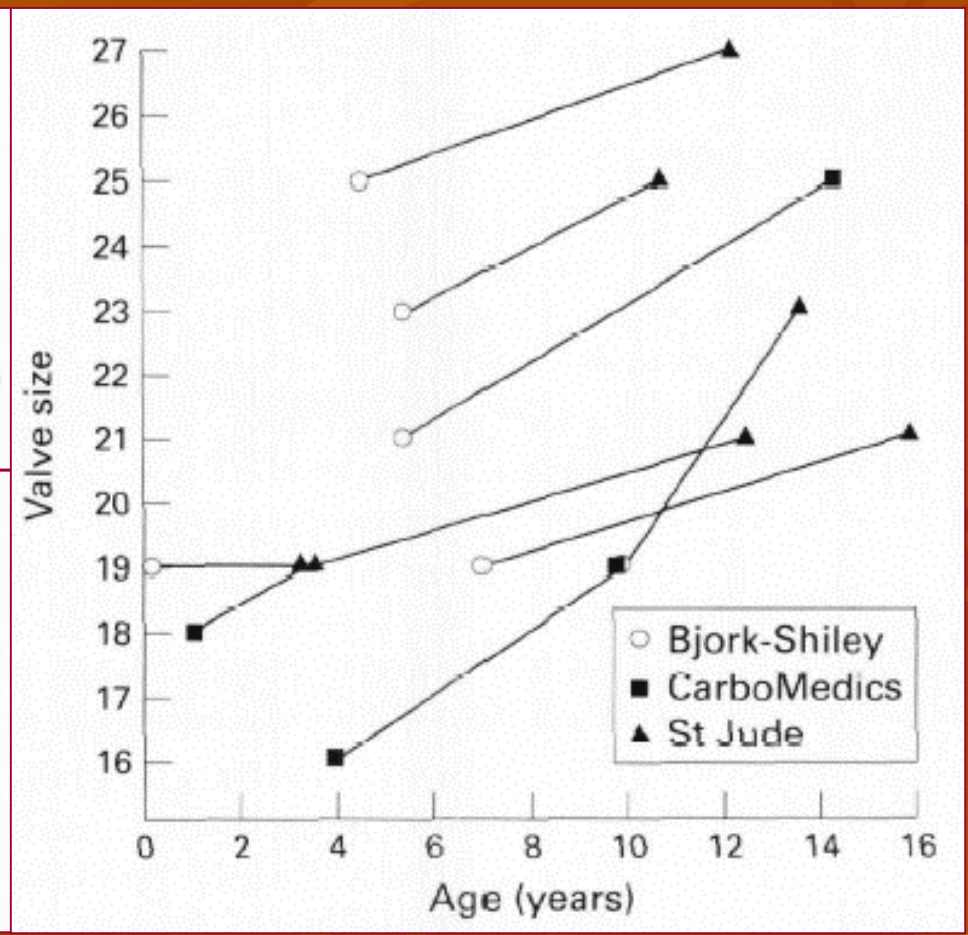
Van Doorn: Heart 2000

MVR in Children: hemodynamic status





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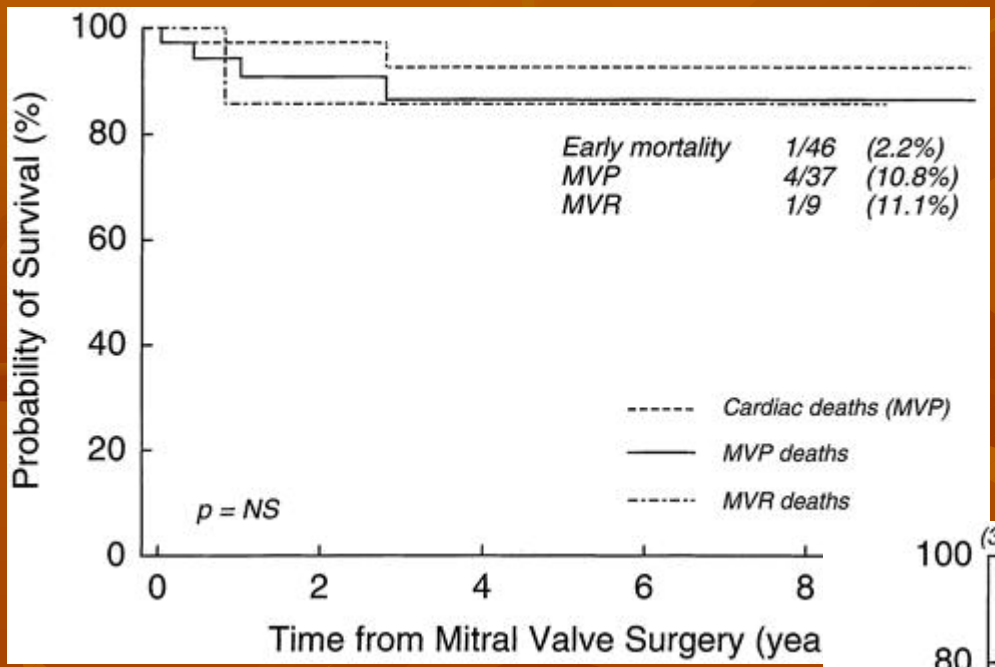
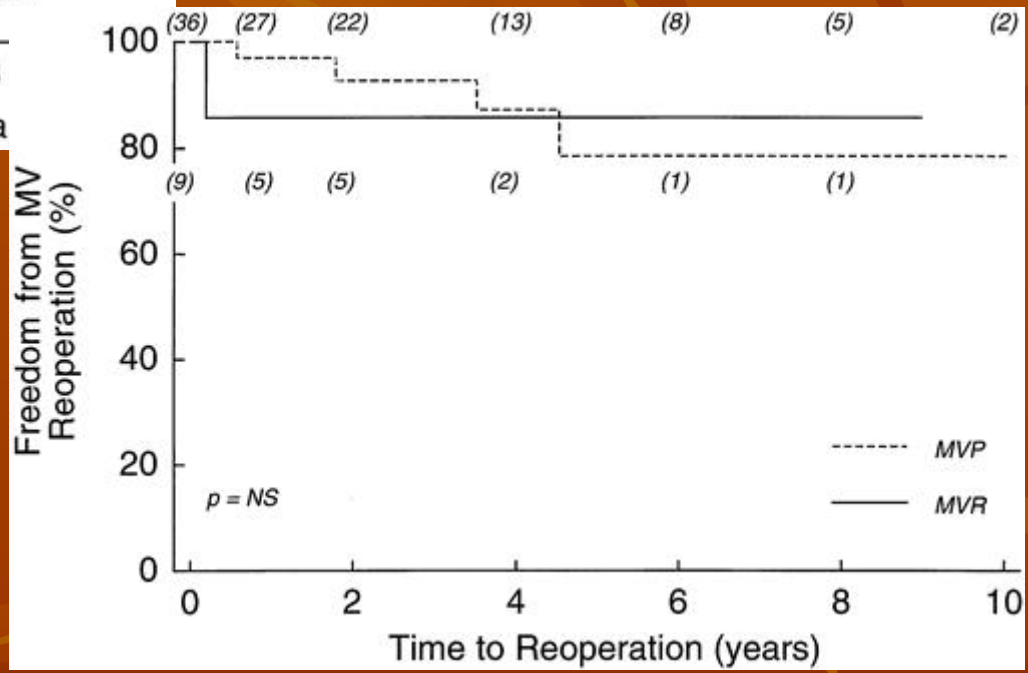
Van Doorn: Heart 2000

Long-term Results(Mitral)



Survival and Reoperation freedom
Of AVSD after MVP or MVR

Complete heart block: 20-30%



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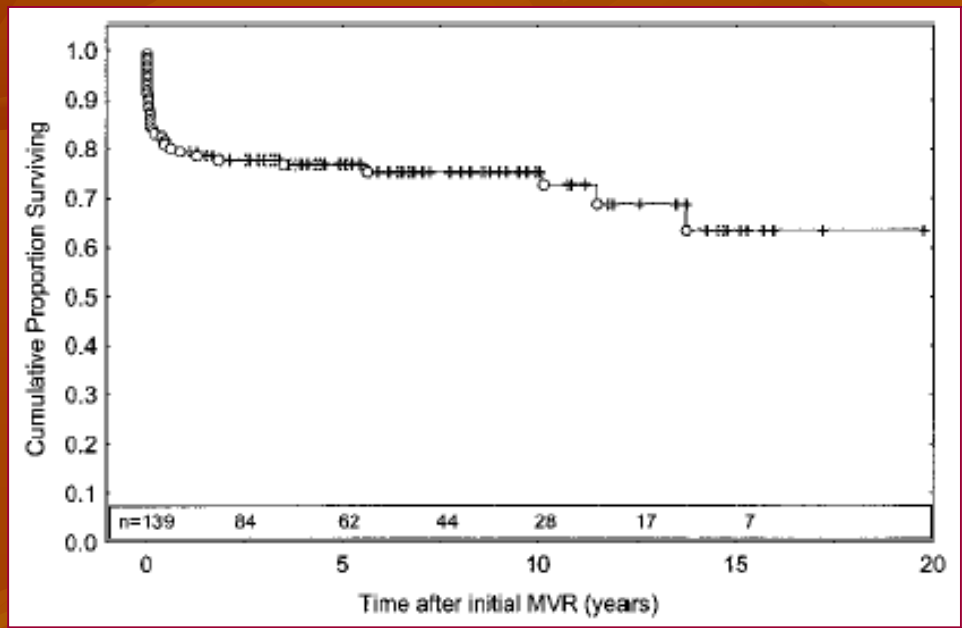
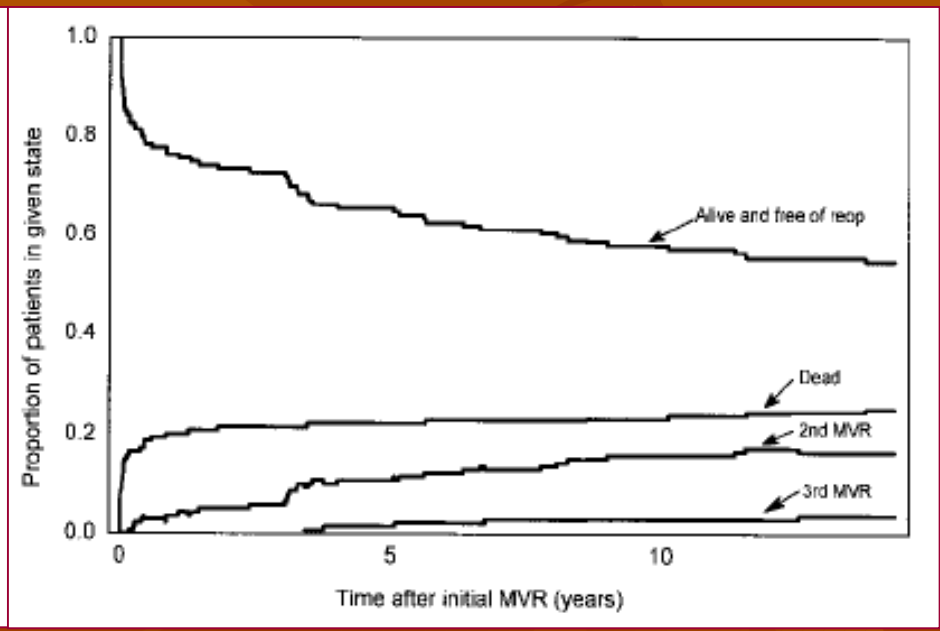
Moran et al: Circulation, 2000

Long-Term Survival after MVR <5years





45 center, 139명, 176 MVR

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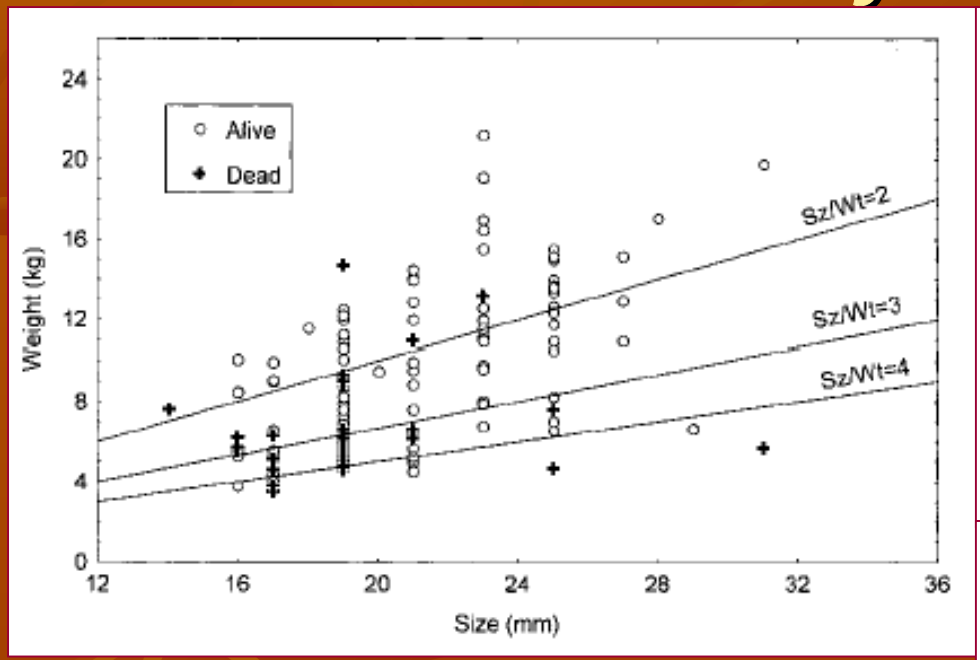
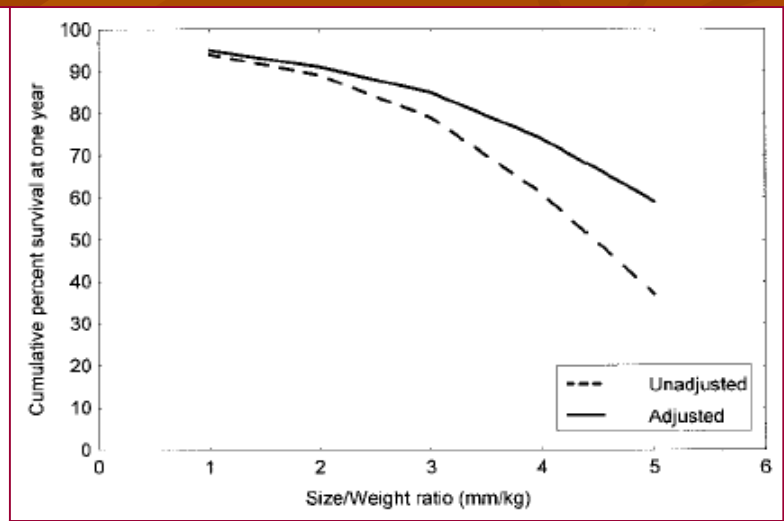
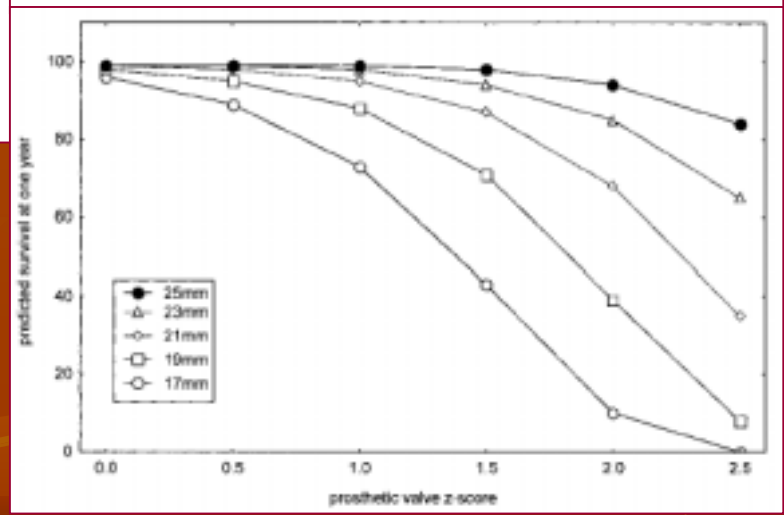
Caldarone: Circulation 2001

Long-Term Survival after MVR <5years







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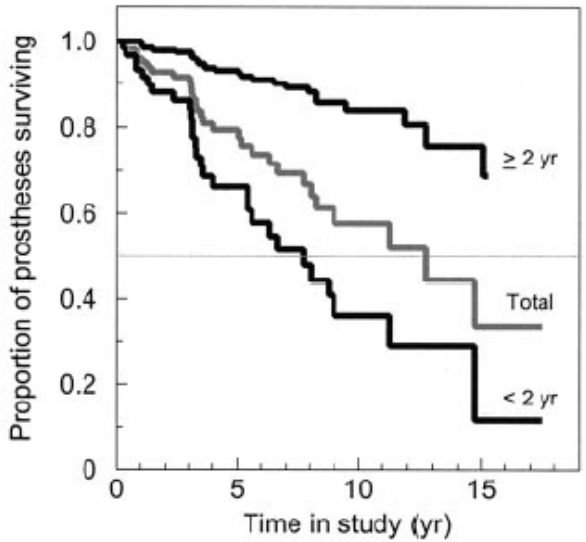
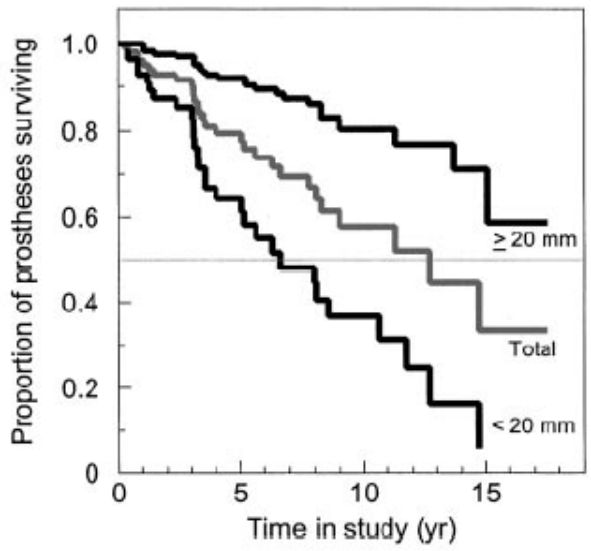
Caldarone: Circulation 2001

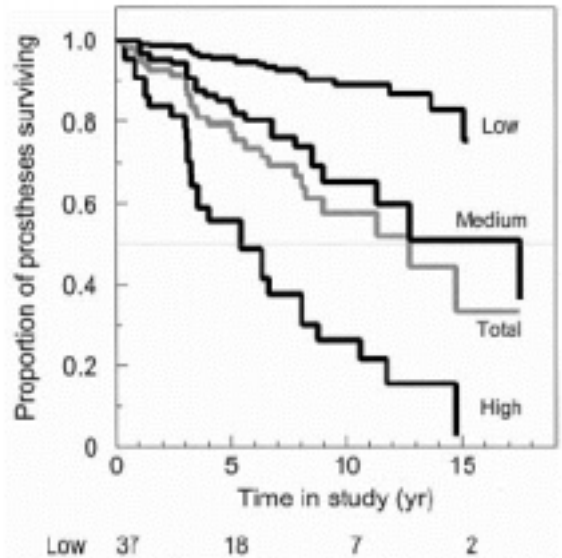
MVR below 5 years of Children



< 2 yr	52	32	16	6
≥ 2 yr	50	26	11	3
Total	102	58	27	9



< 20 mm	45	28	14	5
≥ 20 mm	57	30	13	4
Total	102	58	27	9



Low	37	18	7	2
Medium	33	20	10	3
High	32	20	10	4
Total	102	58	27	9

Low risk: >2yr, >20mm
Medium risk: <2yr, >20mm or
> 2yr, <20mm
High risk: <2yr, <20mm

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Raghuveer Circulation 2003

Improved Risk and Survival of MVR in Children

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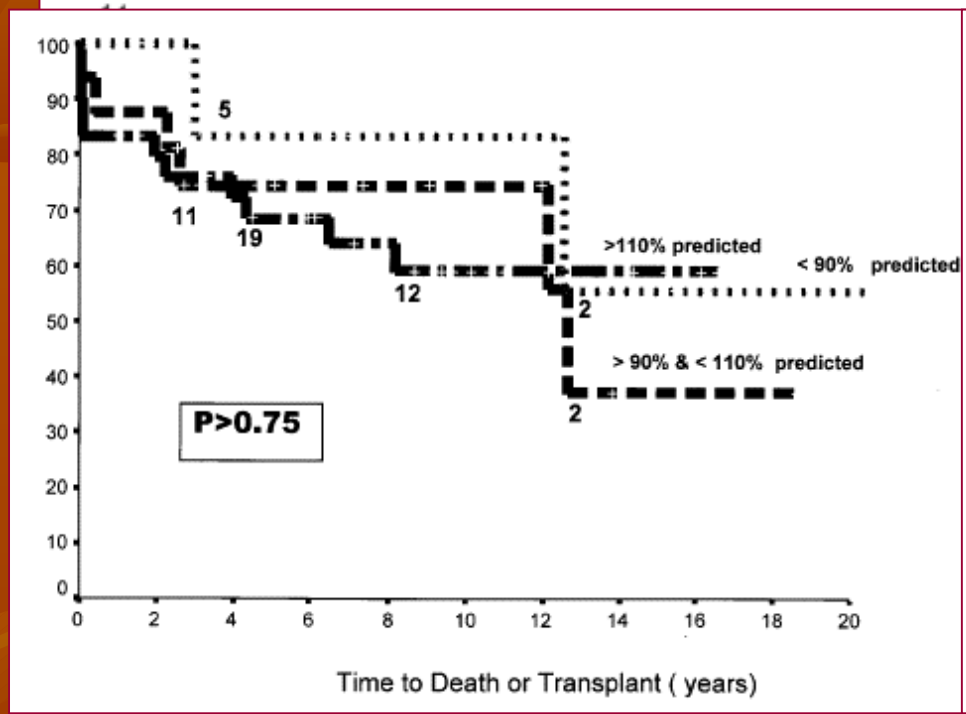
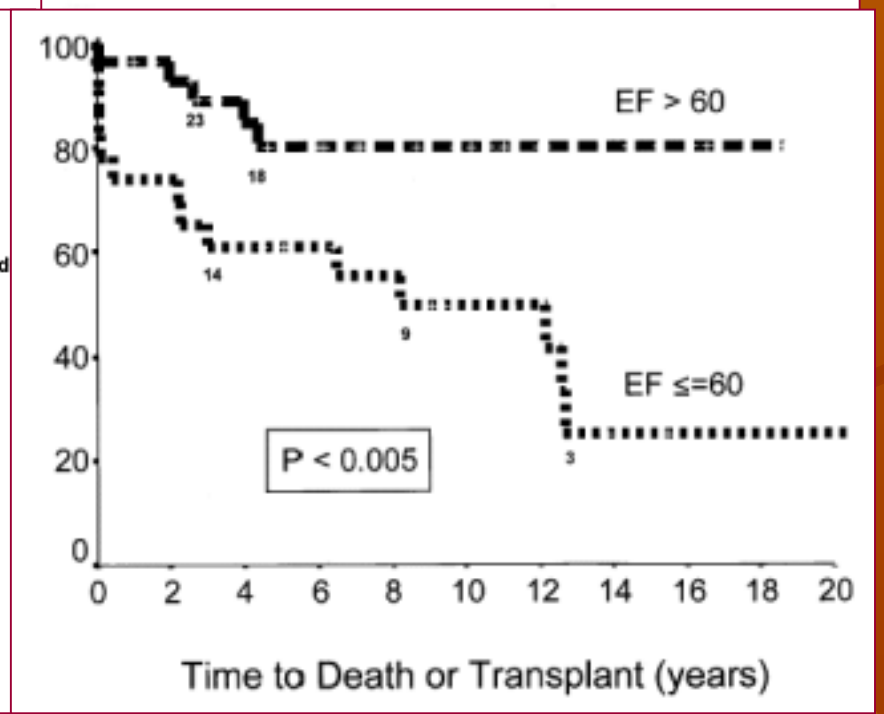
Alexiou: Eur JTCS 2001

MVR in Children: predictors of Long-term Survival





(N=53)

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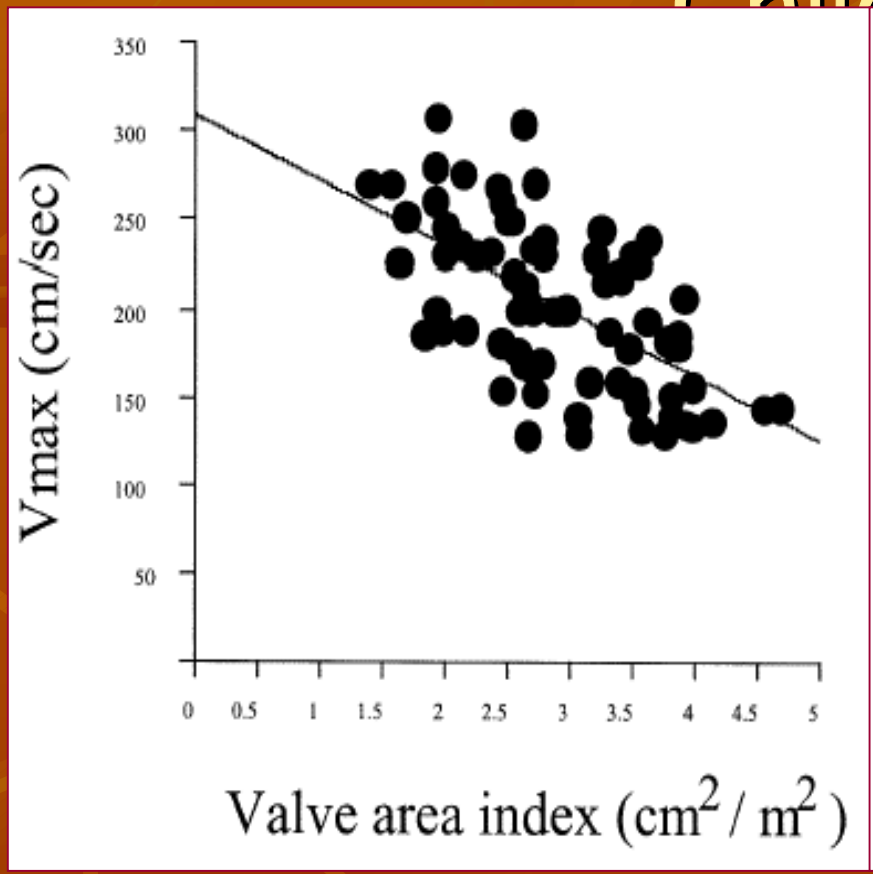
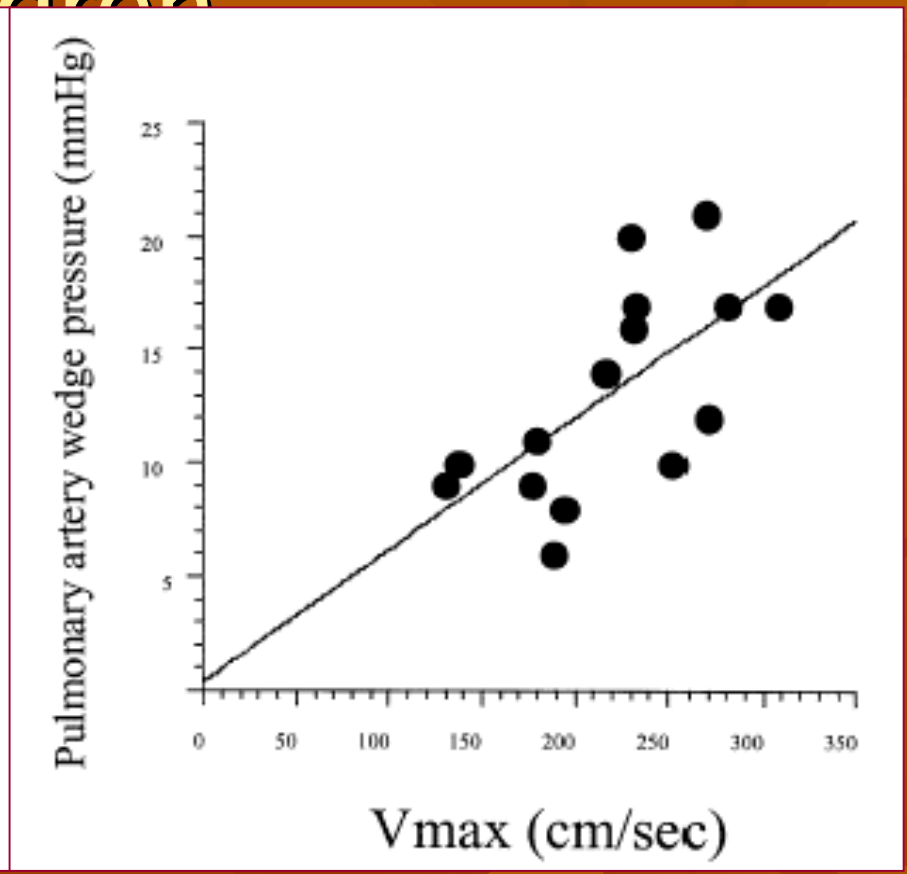
Eble: Ann Thorac Surg 2003

Late Results after MVR in Children





Geomatric vavle area > 1.3 cm^2/m^2 BSA

Prosthesis-Patient Mismatch n=37

Vmax > 270cm/s reoperation

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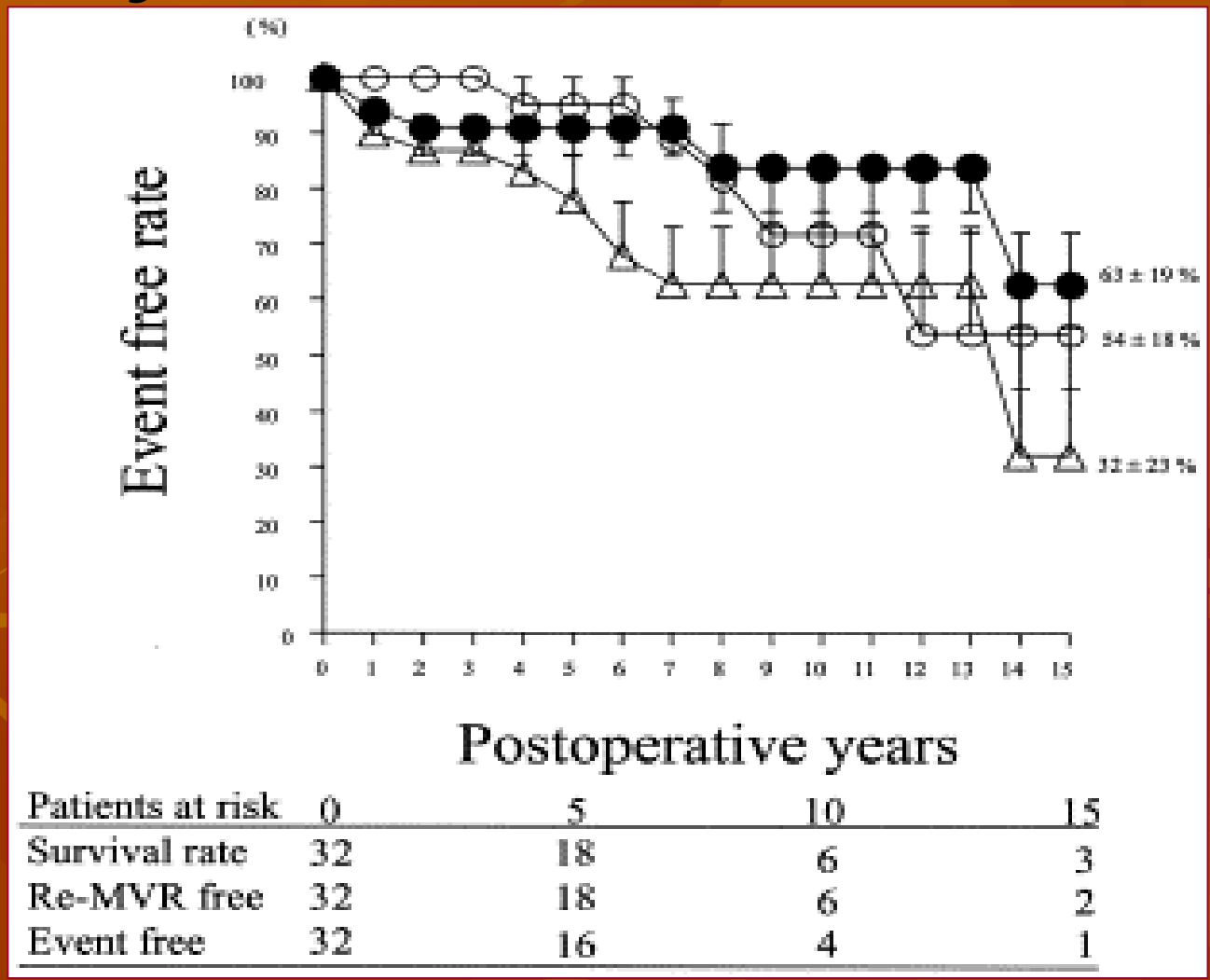
Masuda: Ann Thorac Surg 2004

15 year results after MVR



Patients at risk	0	5	10	15
Survival rate	32	18	6	3
Re-MVR free	32	18	6	2
Event free	32	16	4	1

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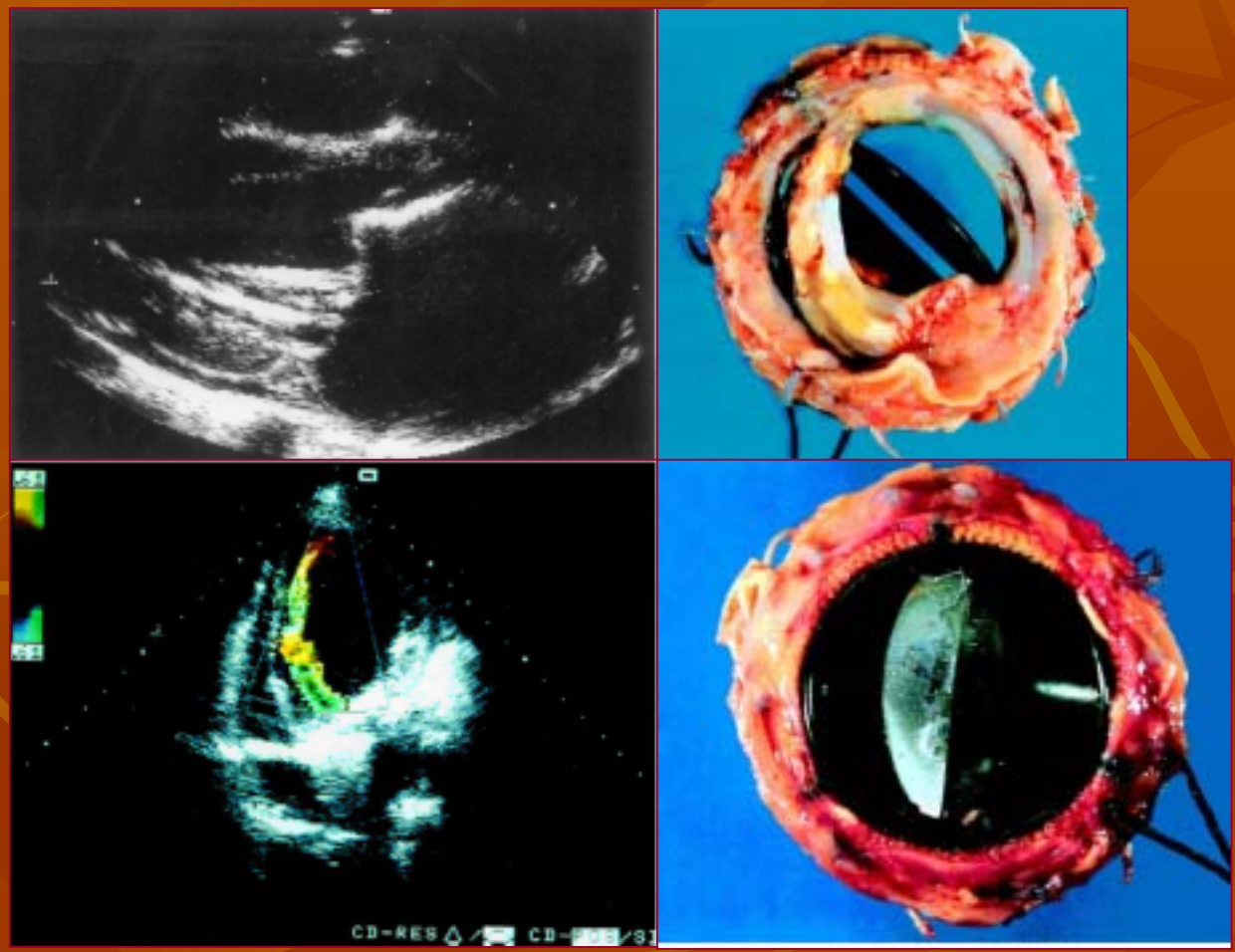
Masuda: Ann Thorac Surg 2004

Formation of Pannus with Pseudoxanthoma Elasticum



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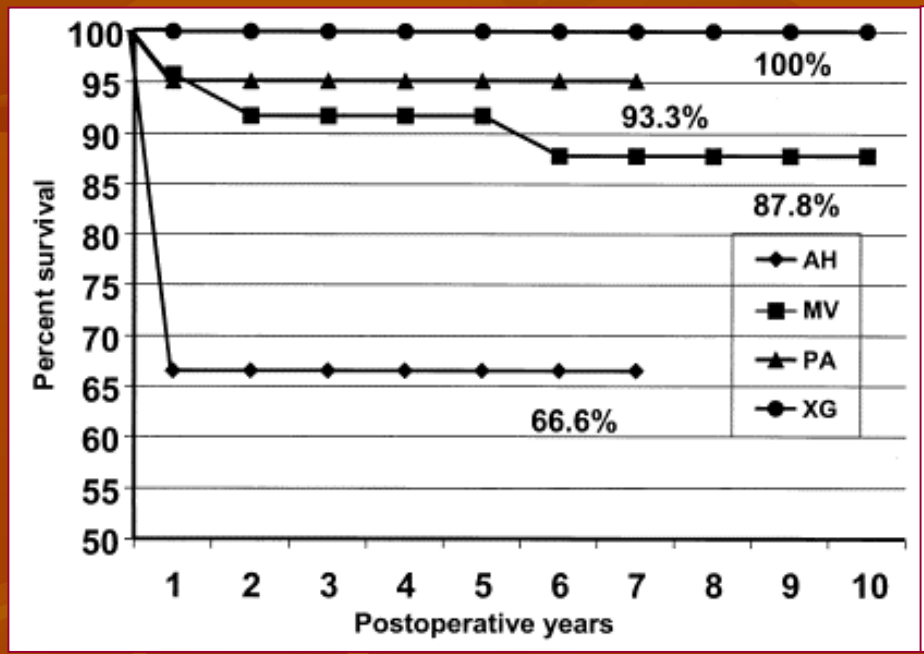
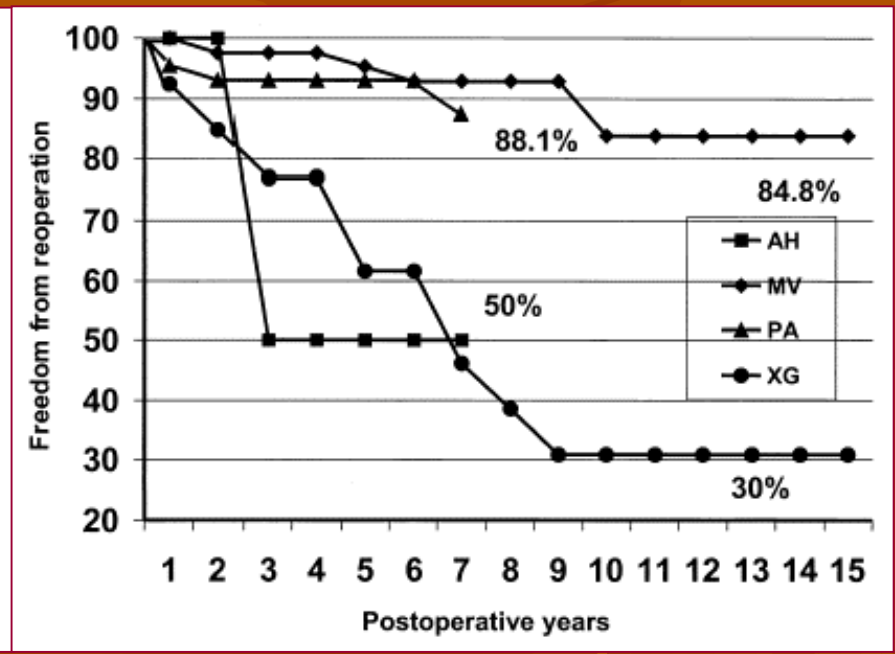
Radford: Cardiol Young 2002

Biological vs. Mechanical AVR in Children



Actuarial Survival



Freedom from Reoperation

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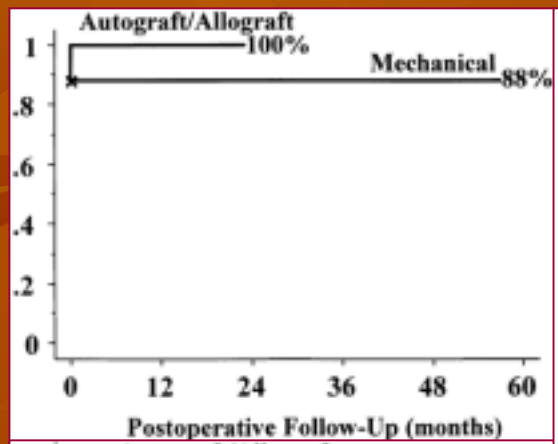
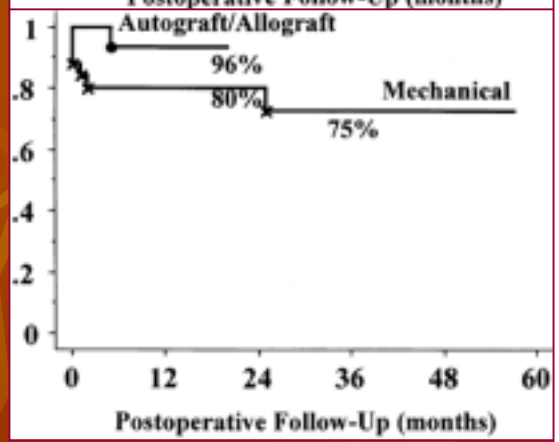
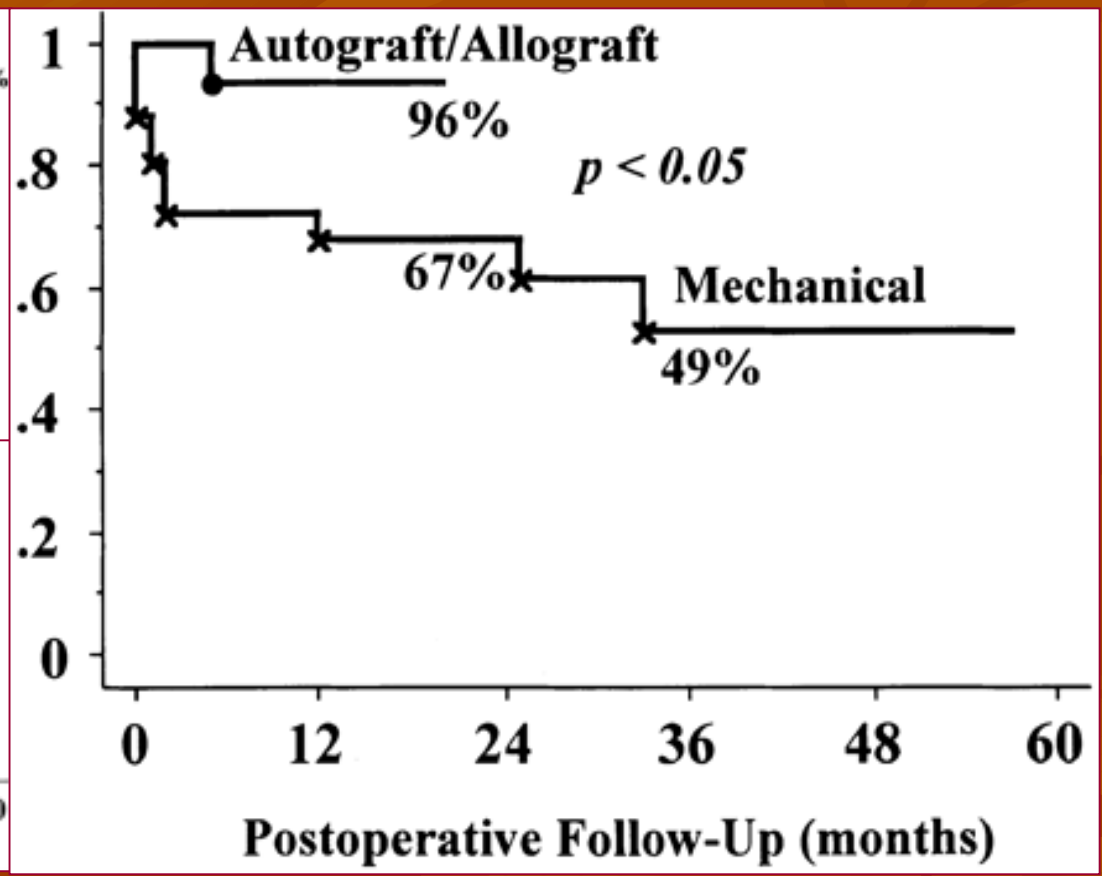
Turrentine et al. Ann Thorac Surg 2001

Human Tissue vs Mechanical Valve

Actuarial Survival







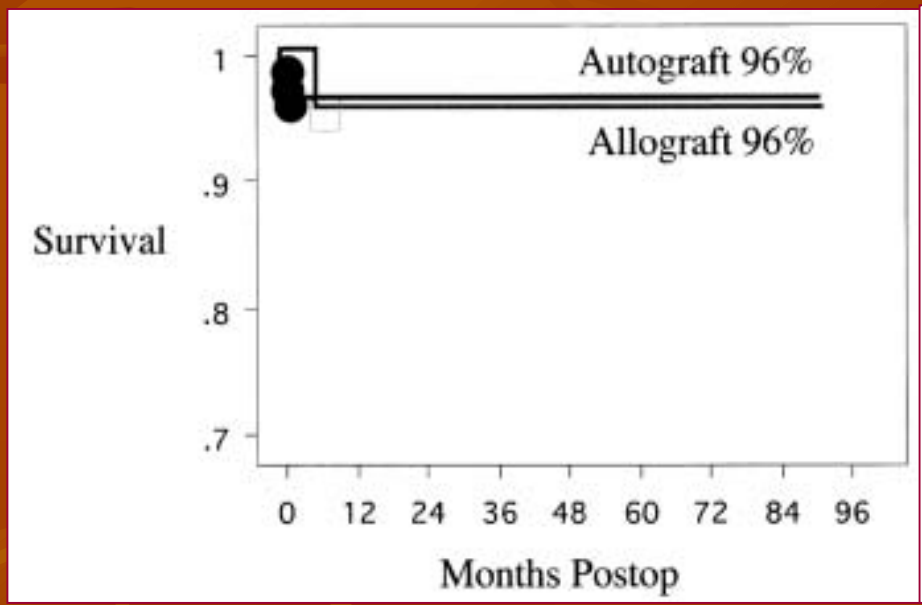
Freedom from Reoperation

Actuarial Survival free of all late complication

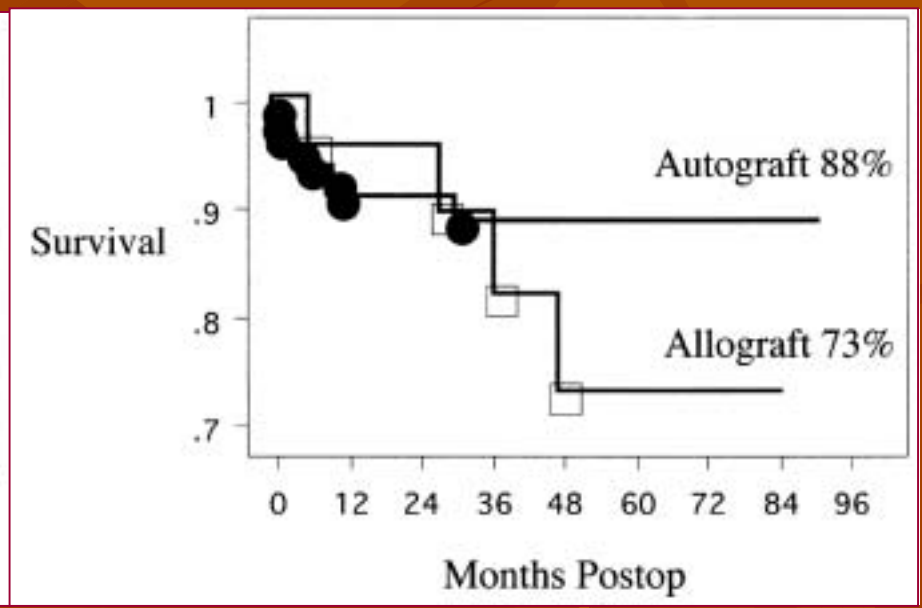
YCVC

Lupinetti et al. Circulation 1997

Autograft vs Allograft



Survival



Reoperation Freedom

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Lupinetti et al. JTCS 2003

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연세대 세브란스 심장혈관병원