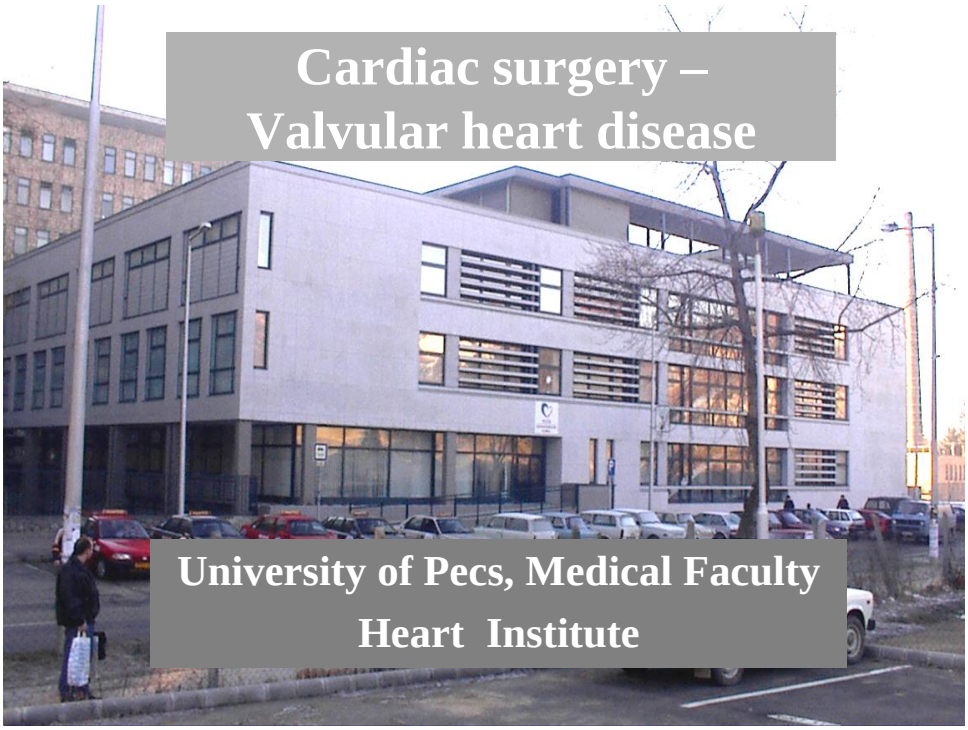


Cardiac surgery – Valvular heart disease

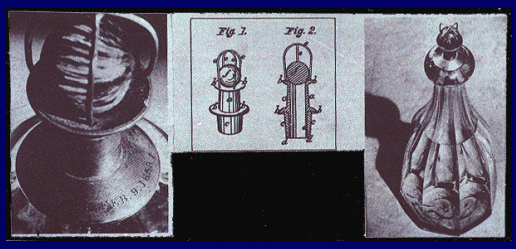
University of Pecs, Medical Faculty
Heart Institute

A brief history of valvular surgery

1925. Souttar – closed mitral commissurotomy
1960. McGoon – plasty for mitral regurgitation
1961. Starr és Edwards – ball valve

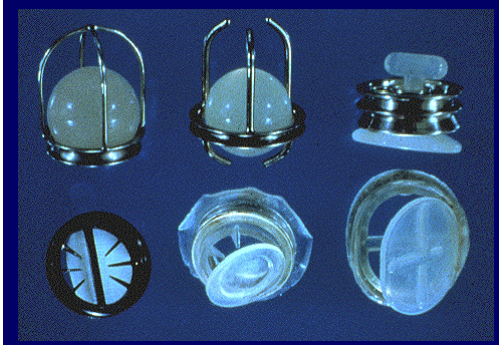
Commissurotom

Artificial valves, history



Modern valves:

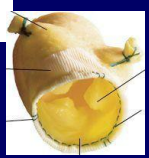
- *slight flow resistance*
- *minimal turbulence*
- *less energy dissipation*
- *faster opening and closing*
- *less hemolysis*



high (near 90°) opening angle

Artificial valves

biograft ***bi-leaflet*** ***mono-leaflet***



Medtronic Freestyle

Toronto SPV stentless

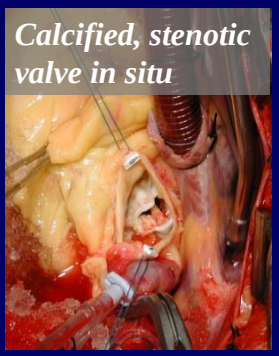
The ideal artificial valve

- safe operation for several years (corrosion, wear)
- minimal turbulence
- do not damage blood cells
- non-allergenic
- non-immunogenic
- non-thrombogenic
- microorganisms do not colonize
- silent operation

Diagnostic procedures

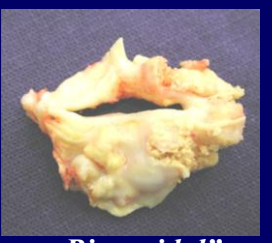
- echocardiography: doppler, calculation of pressure gradient, orifice area, calcification, EF, chamber sizes
- ventriculography, aortography
- invasive pressure measurements
- transoesophageal echo: more accuracy
- above 40 years or suspicion for CAD: coronarography!

Diseases of the aortic valve

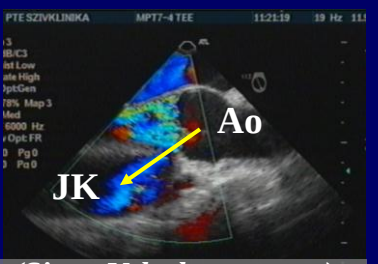


Calcified, stenotic valve in situ

Excised degenerated cusps



„Bicuspidal" aortic valve



Perforated non-coronary sinus (Sinus Valsalva rupture).

Diseases of the aortic valve

Stenosis:

Grade	Orifice area
Normal	3.0-4.0 cm^2
Mild	1.5 – 3.0 cm^2
Medium	**1.0 – 1.5 cm^2**
Serious	**<1.0 cm^2**

Average transvalvular pressure gradient >50Hgmm

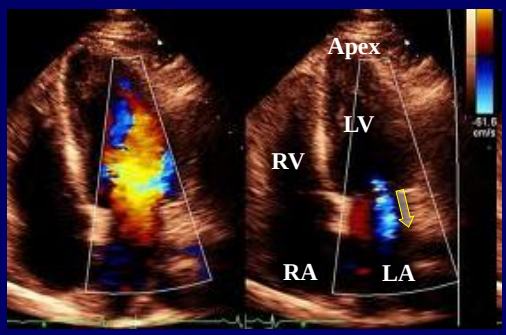
Regurgitation:

Grade I-IV (size of jet)

Indications for op.:

- **complaints**
- **signs of heart failure**
- **significant stenosis and/or regurgitation**
- **decreasing EF**
- **progressive LV dilation**

Diseases of the mitral valve



Mitral regurgitation (color doppler)

Shrunken mitral apparatus with fusion of chordae tendineae

Diseases of the mitral valve

Stenosis:

Average transvalvular pressure gradient >10Hgmm
Area<1.5cm^2 (n: 4.0-5.0 cm^2)

Regurgitation:
Grade I-IV (size of jet)

Indications for op.:

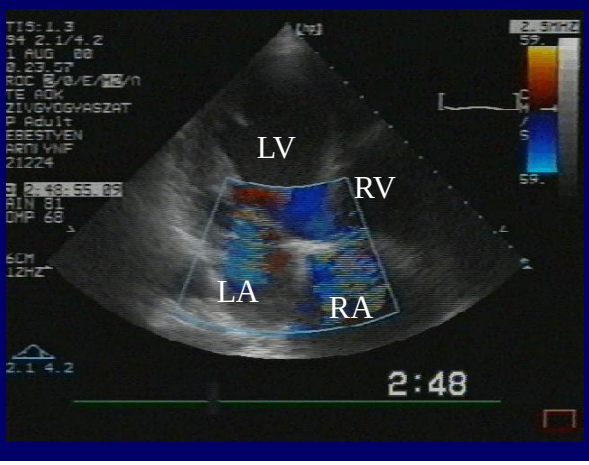
- **complaints**
- **signs of heart failure**
- **significant stenosis and/or regurgitation**
- **decreasing EF**
- **progressive LV dilation**
- **pulmonary hypertension? (systolic > 60Hgmm)**

CABG can improve mild or moderate MR

Diseases of the tricuspid valve

regurgitation: generally concomitant to mitral insuff., a result of annulus-dilation in CAD

IV. drug abusers: right sided endocarditis



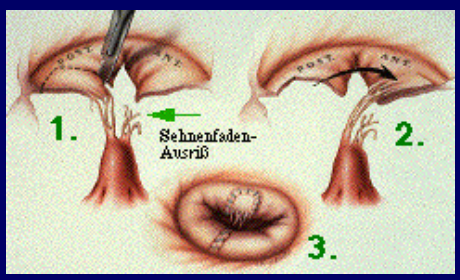
Valvuloplasty

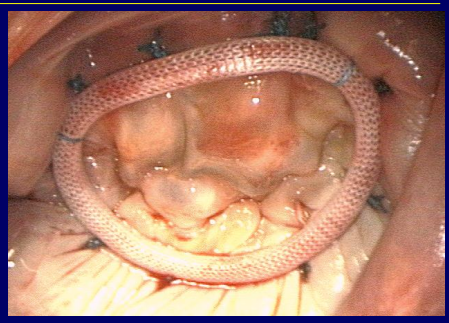
Bad results on the aortic valve – not performed widely

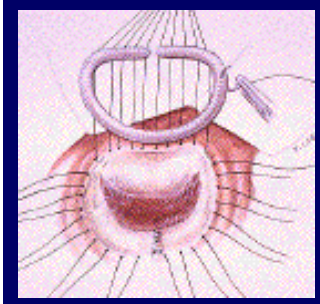
On the mitral and tricuspid valves:
- **tightening the annulus by a *ring* (Carpentier) or a double C-shaped annular suture (DeVega)**
- **excision of the part of leaflet with ruptured chordae**
- **sharp dissection of coadhered commissures**

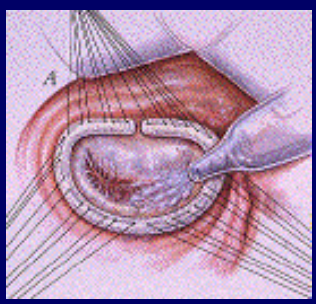
benefits: only transient anticoagulation is needed
own valve, better flow-characteristics
disadvantages: higher rate of recidive
surgeon-dependent results

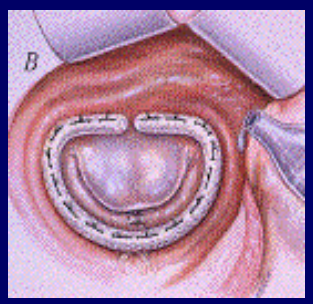
Valvuloplasty



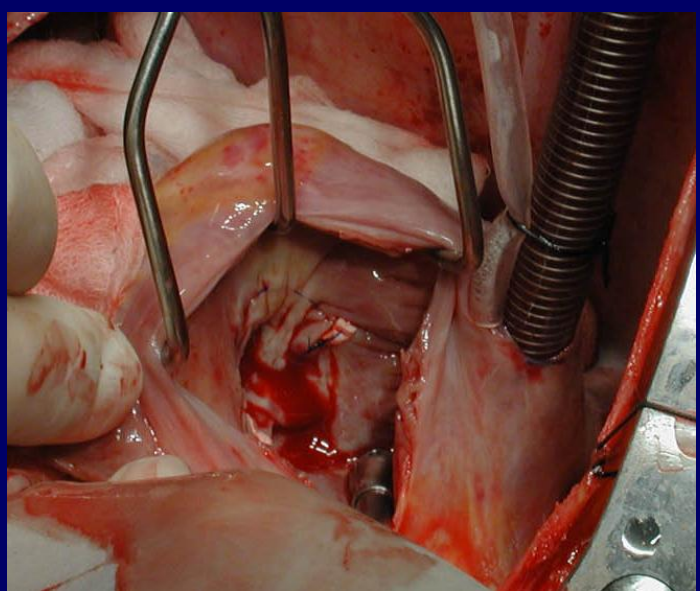




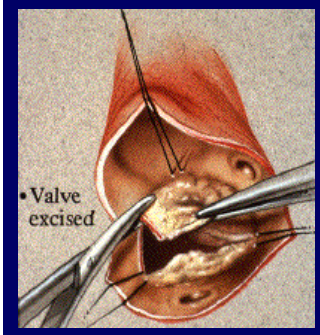




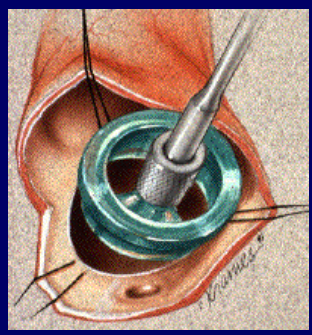
Tricuspidal plasty sec. DeVega



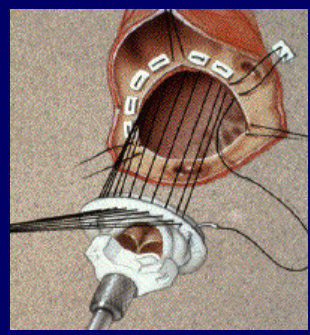
Technique of valve replacement



Excision of the diseased valve



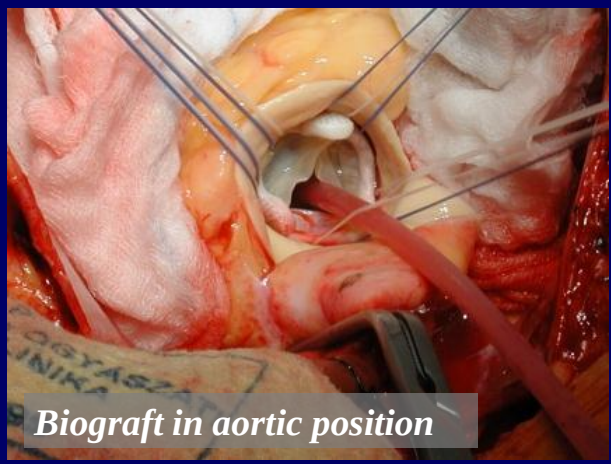
Measuring the annulus



Suturing the valve with teflon-pledgeted stitches

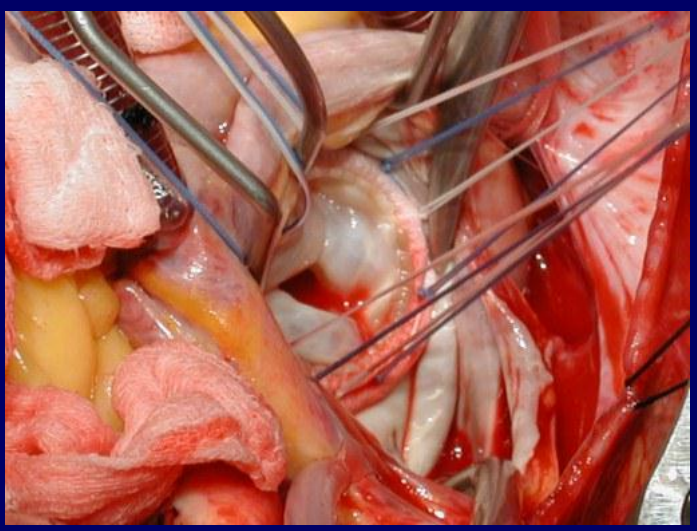
Valve replacement - biograft

- **only transient anticoagulation (3-6 months)**
- **degeneration after 10-12 years (increasing…)**



Biograft in aortic position

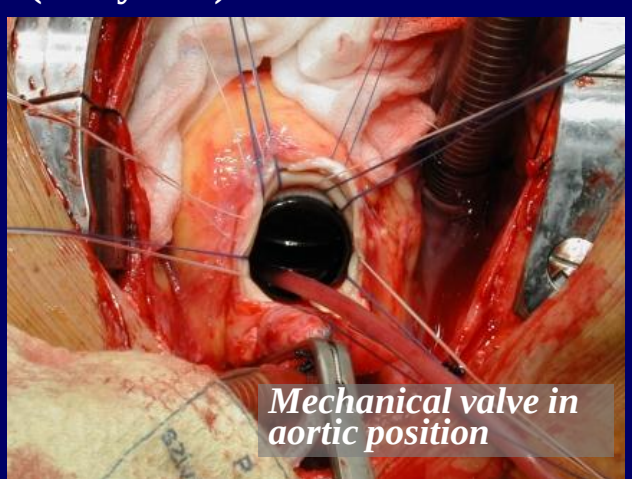
Valve replacement - biograft



Biograft in mitral position

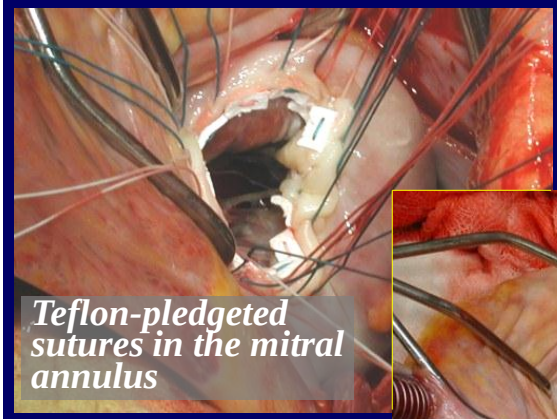
Valve replacement - mechanical

- **life-long anticoagulation**
- **eternal (200 years)**
- **noisy**

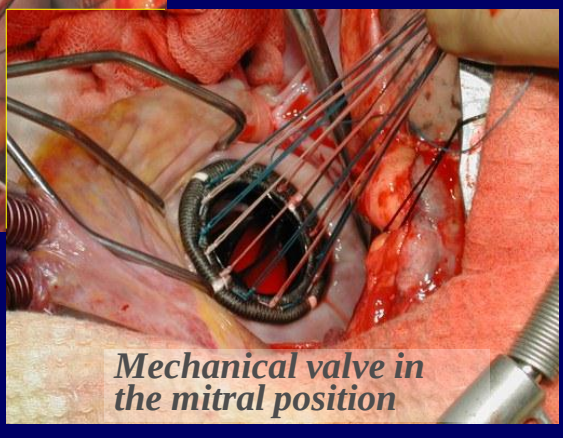


Mechanical valve in aortic position

Valve replacement - mechanical

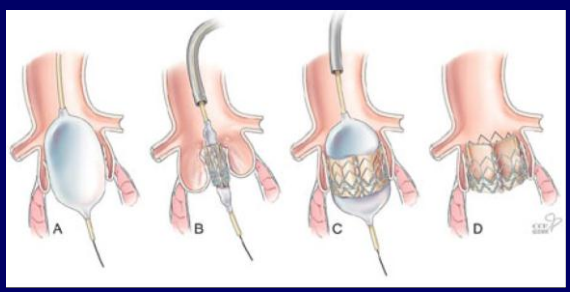


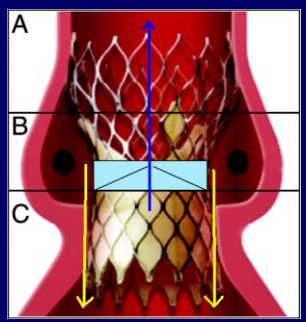
Teflon-pledgeted sutures in the mitral annulus



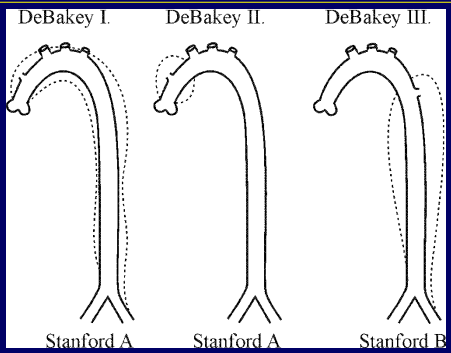
Mechanical valve in the mitral position

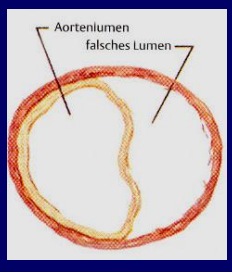
TAVI – transcatheter aortic valve implantation

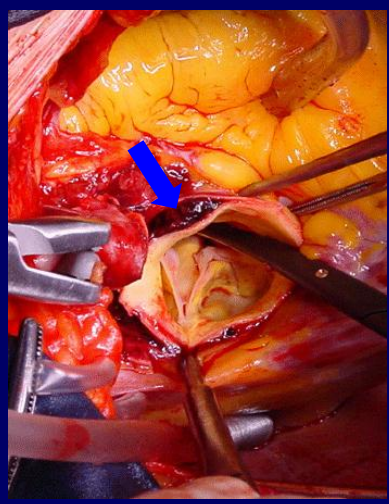




Aortic dissection



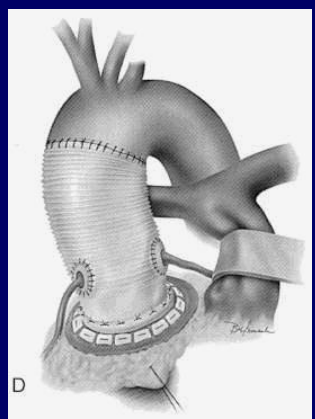




Bentall-procedure

Conduit with valve

Valvular conduit with CABG in situ



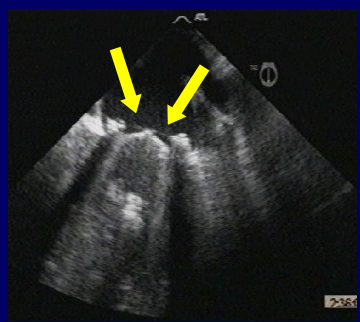
Patient follow-up

Anticoagulation: Syncumar/Cumadine to INR
Biograft: 3 months (INR 2.0-3.0), now: ASA (75-100mg)
Mechanical: life-long (Ao: 2.0-3.0, M: 2.5-3.5)
Tell it before any medical intervention !
1 week before any operation change to heparine (LMWH),
postoperatively LMWH for some days

Endocarditis profilaxis: antibiotics
In case of dental extraction (depuration) or before and after any invasive intervention
amoxicillin+clavulanic acid, erythromycin

Results

- Operative mortality around <5%
- Fast hemodynamic and functional recovery
- Slight regurgitation with Doppler US, because the mechanical valves do not close completely in order to prevent the damage of blood cells (hemolysis)



Mitral bileaflet mechanical valve (TEE)

Possible complications

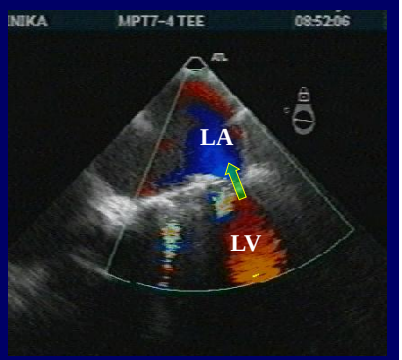
Thromboembolism, artificial valve dysfunction

Bleeding (anticoagulant)

Artificial valve endocarditis

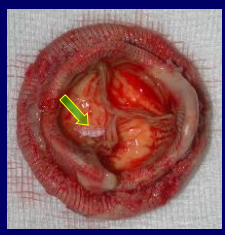
Paravalvular leak

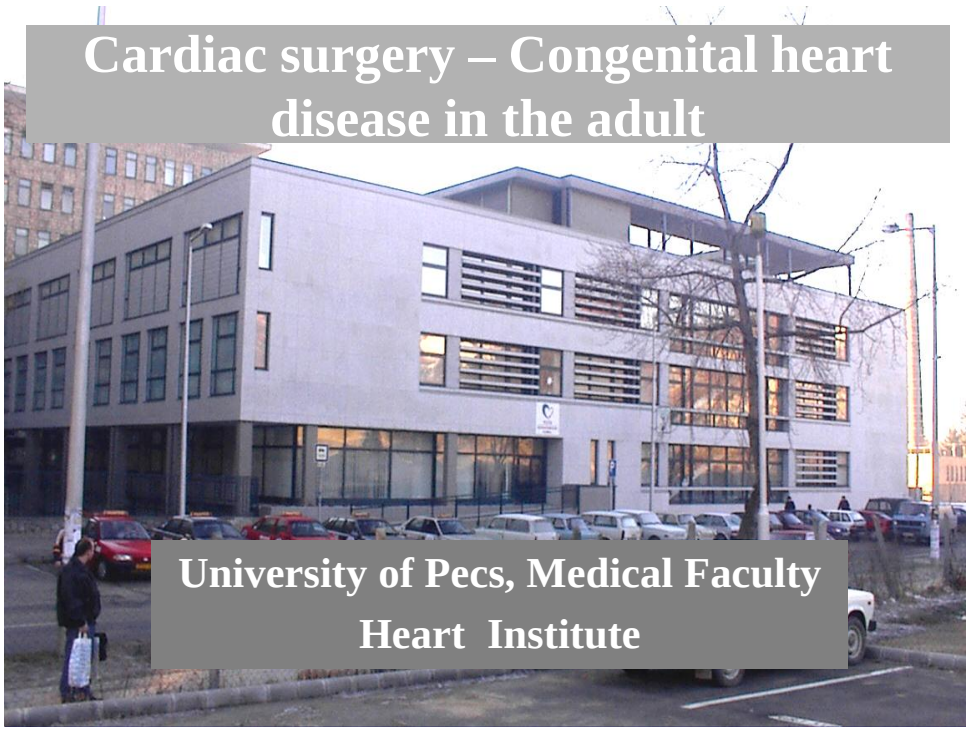
Mitral paravalvular leak (TEE)



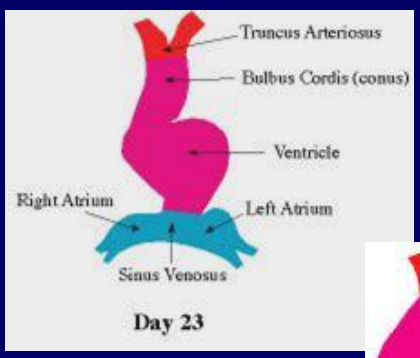
Thrombotized artificial valve

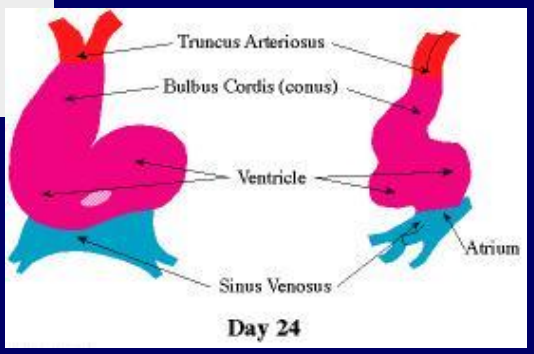
Degenerated biograft with a hole



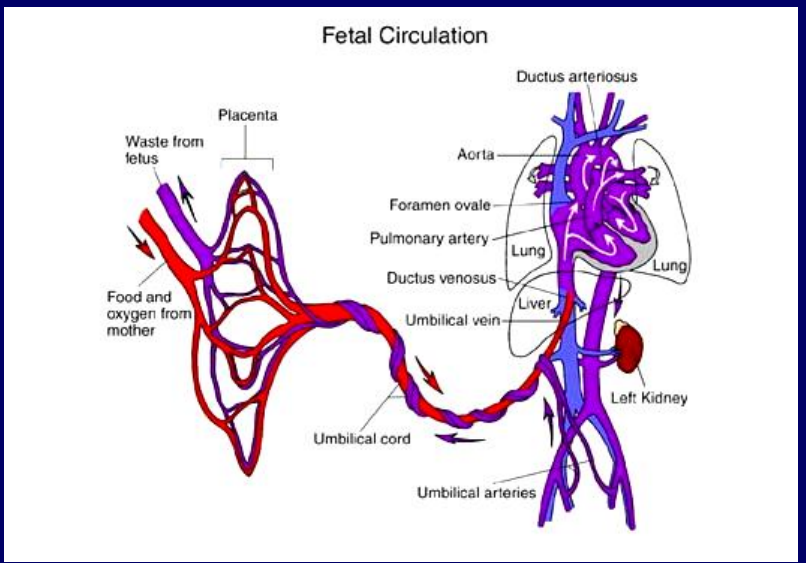


Embryogenesis of the heart

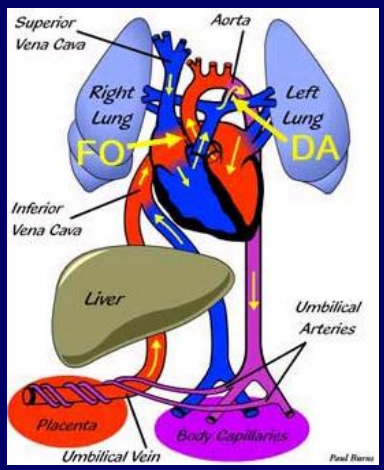


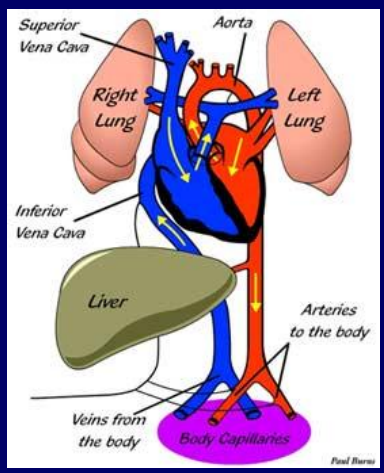


The fetal circulation



Transformation of the fetal circulation





Classification of congenital heart diseases

Left-to-right shunt
- atrial septal defect
- ventricular septal defect
- persistent ductus arteriosus
- atrioventricular septal deffect
- partial transposition of pulmonary veins

Obstructive
- aorta stenosis
- pulmonary stenosis
- coarctation of aorta

Cyanotic (right-to-left shunt)
- great vessel transposition
- tetralogy of Fallot
- tricuspidal atresia
- pulmonary atresia
- Ebstein-anomaly
- total transposition of pulmonary veins
- persistent truncus arteriosus
- univentricular heart

Operative management

- Why operate? symptoms of circulatory failure, frequent airway infections, retardation in growth, Eisenmenger syndrome
- Earlier: several-stage operations starting with palliation
- Nowadays primary total anatomical reconstruction even in newborns
- Reduced mortality recently
- Less demanding for the society and for the family
- Diagnostics: mainly echocardiography, less angiocardiography (X-ray, contrast agent!), cardiac MRI

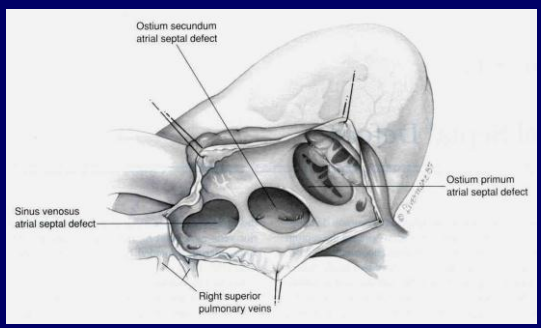
Postoperative follow-up

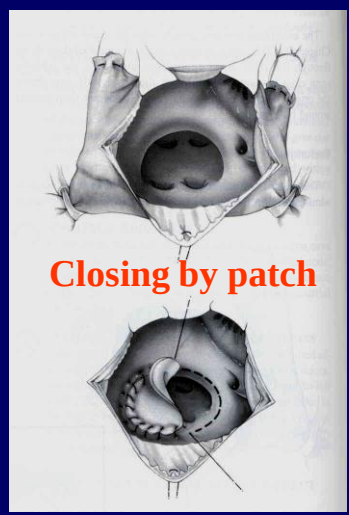
- Regular follow-up is necessary in most cases
- (Elective multistage operations to the strength of the child)
- Redo operations (adhesions!): graft replacement for a bigger one, calcified homograft, late complications
- Endocarditis prophylaxis (in case of residue)
- Physical education/load according to capacity
- Psychological/mental guidance

GUCH (Grown-up congenital heart) disease

- 80-85% of patients born with congenital heart disease survive to adulthood
- Relatively small population, but complex and variable pathology
- Special follow-up: cardiology, intensive care, anesthesia, pregnancy
- 40% simple or cured disease – no specialist, 35-40% – access to expert consultation, 20-25% – life long expert supervision
- Pediatric cardiologist and cardiac surgeon ↔ Adult cardiologst and cardiac surgeon

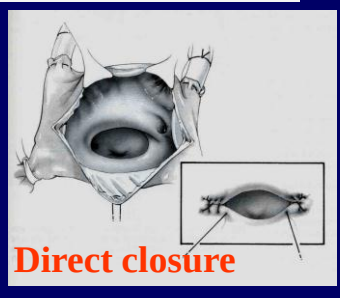
Atrial septal defect (ASD)



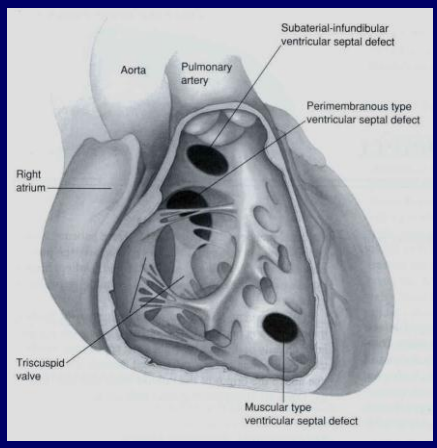


Op.:
Qp/Qs > 2.0

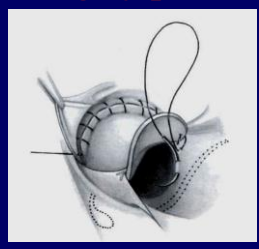
Paradoxic emb.



Ventricular septal defect (VSD)

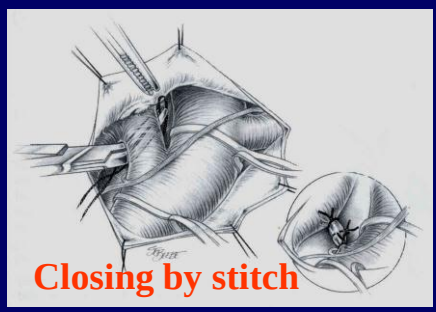


Closing by patch

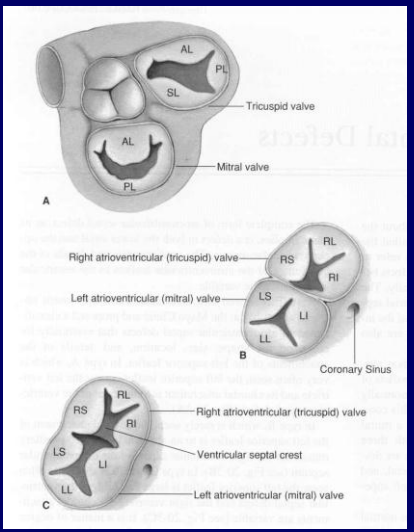


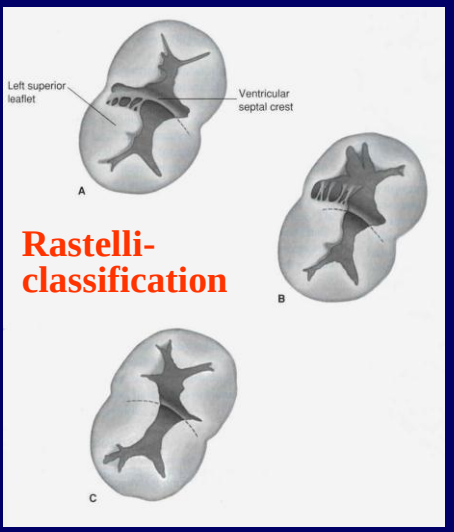
Op.:
Qp/Qs > 2.0

Persistent Ductus Arteriosus (PDA)



Atrioventricular septal deffect, AV-canal, AVSD

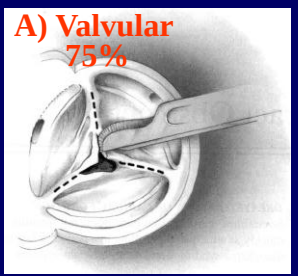




Rastelli-classification

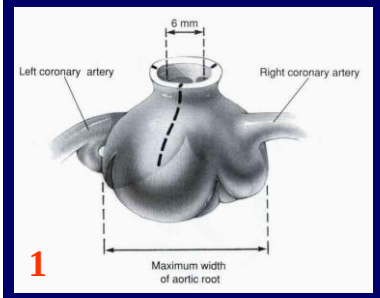
Congenital aortic stenosis

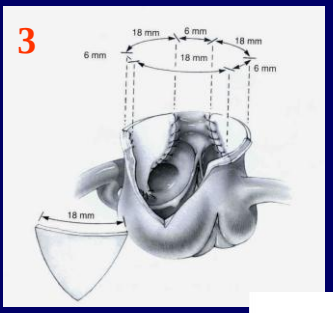
A) Valvular 75%

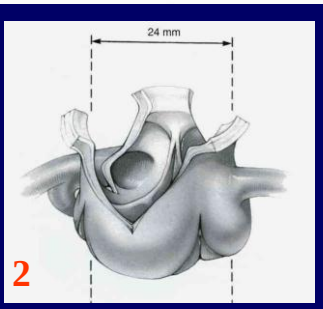


B) subvalvular 20% (membranous ring)

Congenital aortic stenosis

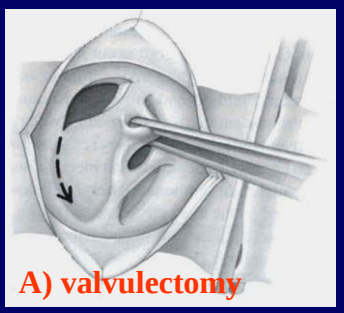






C) supravalvular 5%

Pulmonary stenosis

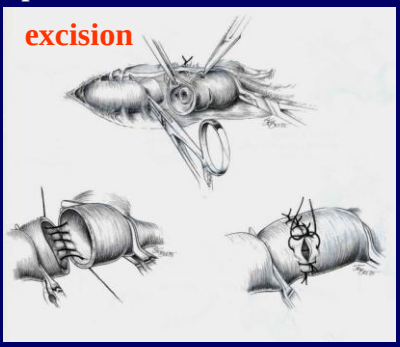


C) Double patch plasy

Coarctation of the aorta

praeductal, postductal type
Op.: sten>50%, RRdiff>20-30Hgmm

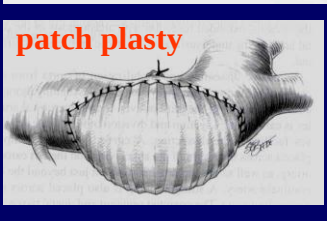
excision

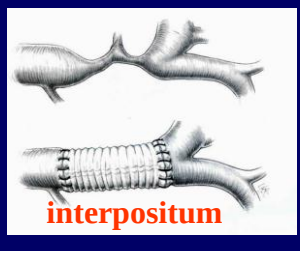


subclavian plasty

bypass

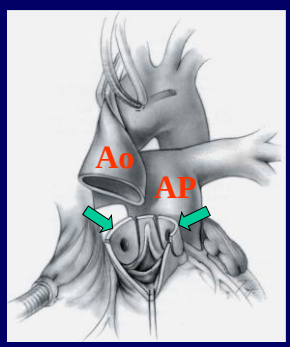
patch plasty

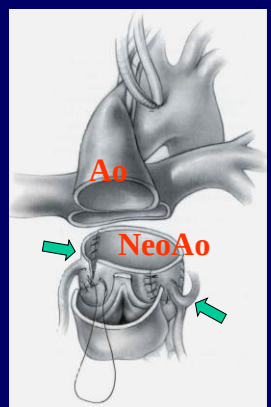


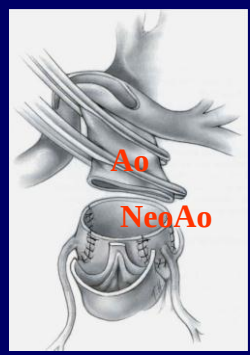


interpositum

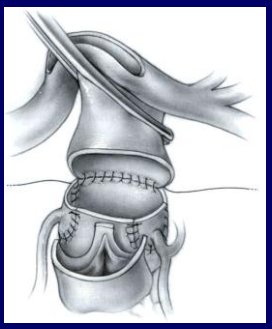
Transposition of the great vessels

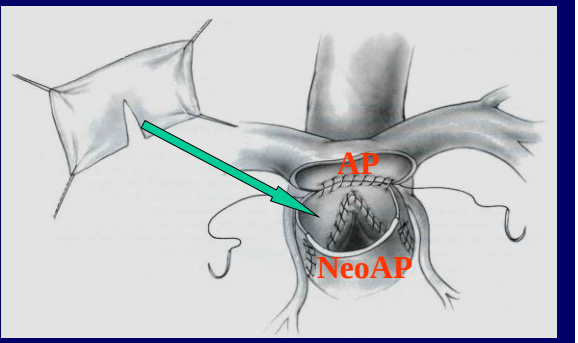






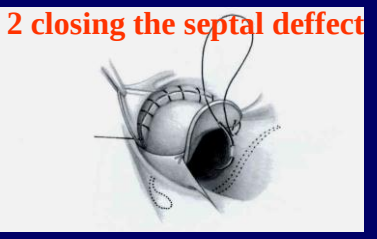
Transposition of the great vessels

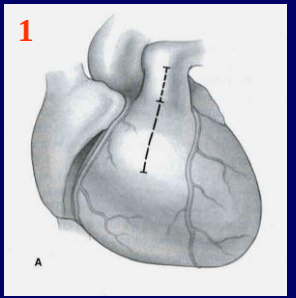


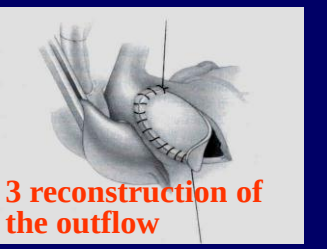


Tetralogy of Fallot

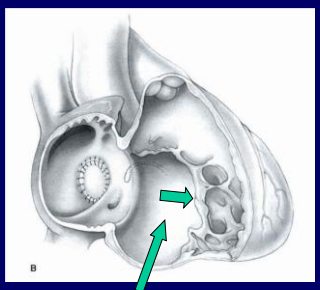
- Pulmonary infundibular stenosis
- VSD
- Overriding aorta
- Right ventricular hypertrophy



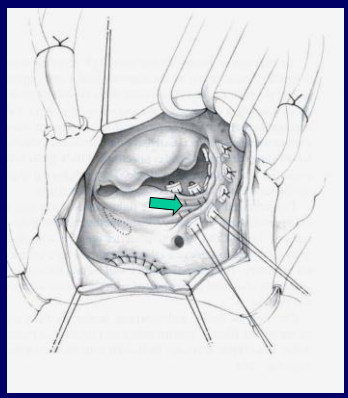




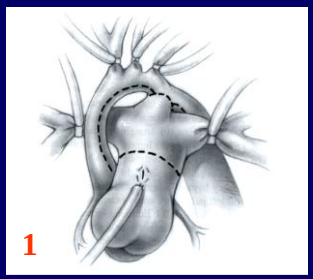
Ebstein-anomaly

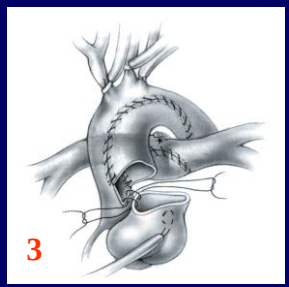


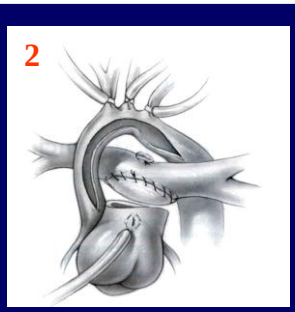
Atrialized right ventricle

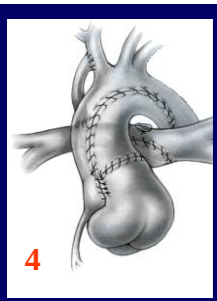


Univentricular heart (<1%)

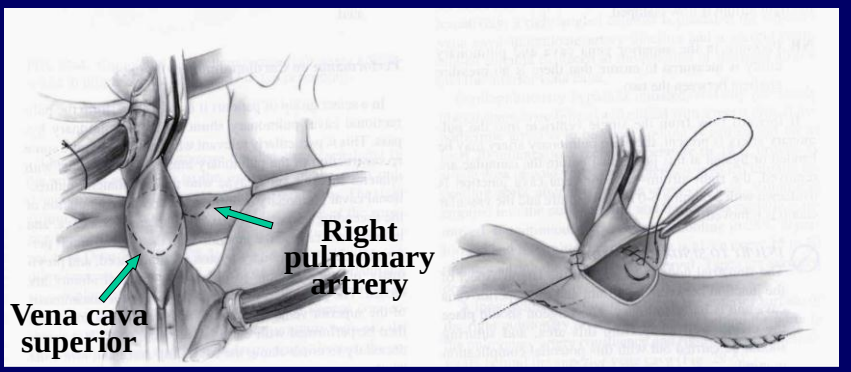




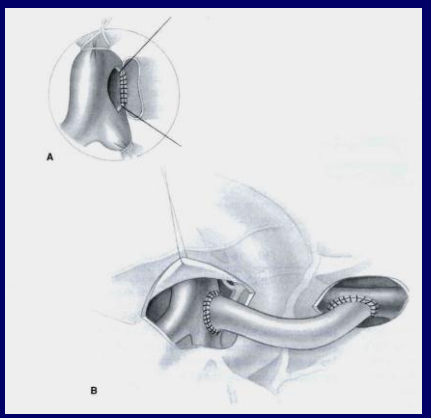


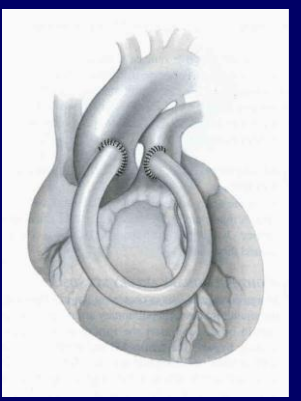


Bidirectional cavopulmonary anastomosis



Aorto-pulmonary shunts





Central shunt

Reducing pulmonary perfusion

pulmonary artery banding
preventing pulmonary hypertension