CARDIAC SURGERY

- valve diseases
- aortic diseases
- atrial fibrillation

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Valve diseases - history

1950 - Bailey – closed aortic valvulotomy

1952 - Hufnagel – descending thoratic aortic valve

1956 - Murray – descending thoratic aortic homograft

end of 50th – Hurley, Kirklin – open valvulotomy

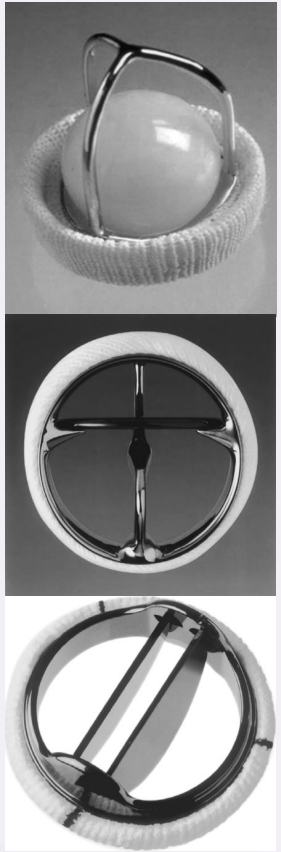
1960 - Harken, Starr – AVR with aortic ball valve

1962 - Barratt-Boyes – AVR with homograft

1965 - Binet – AVR with bioprothesis

1967 – Ross procedure

1991 - David, Yacoub – aortic valve sparing surgery



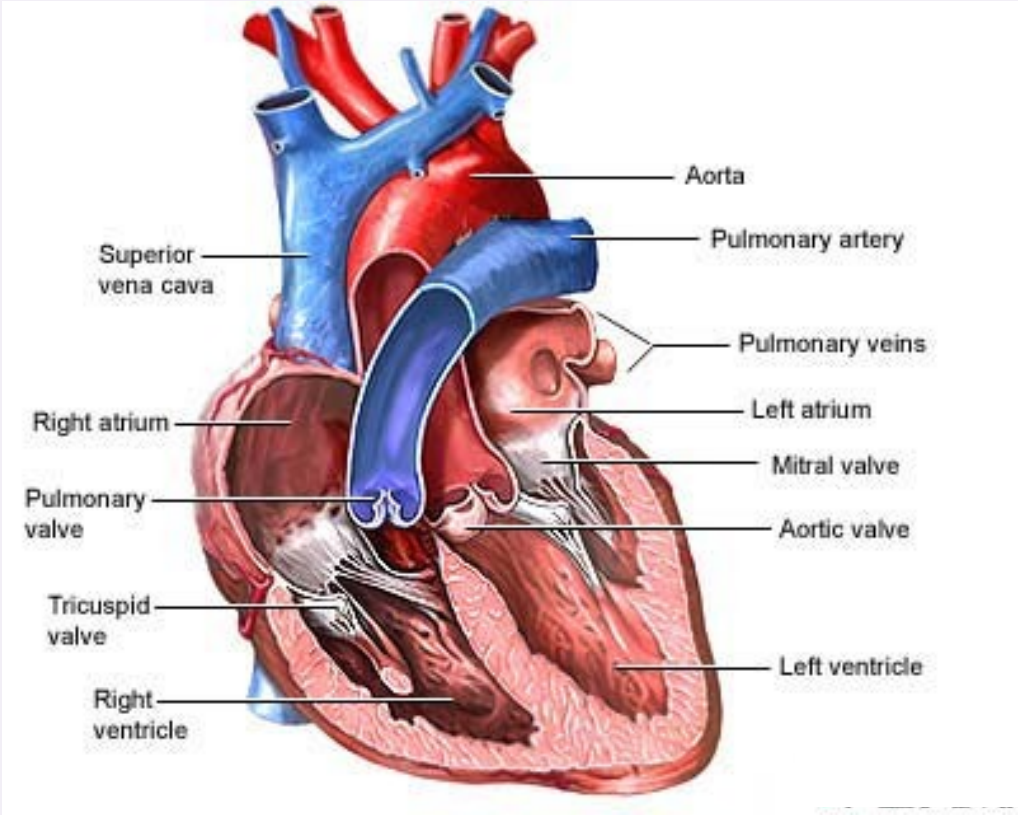
Anatomy of heart valves

Atrio-ventricular valves (Mi,Tri)

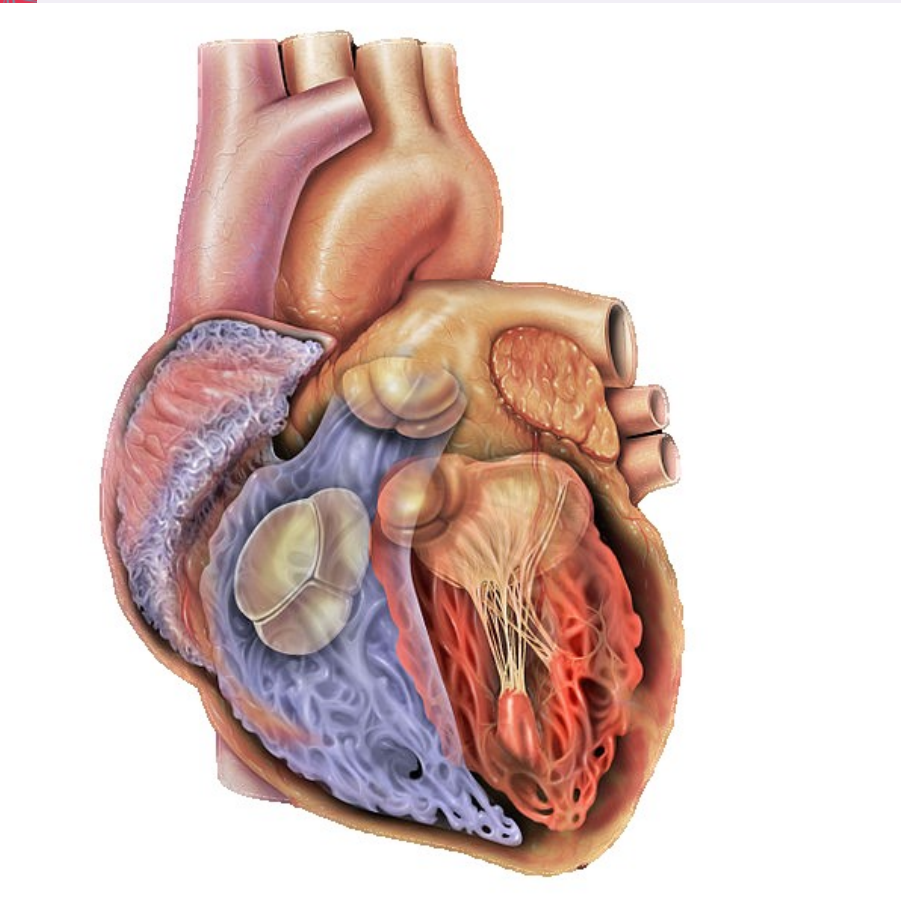
- leaflets
- anulus
- chords
- papillary muscles
- left /right ventricle

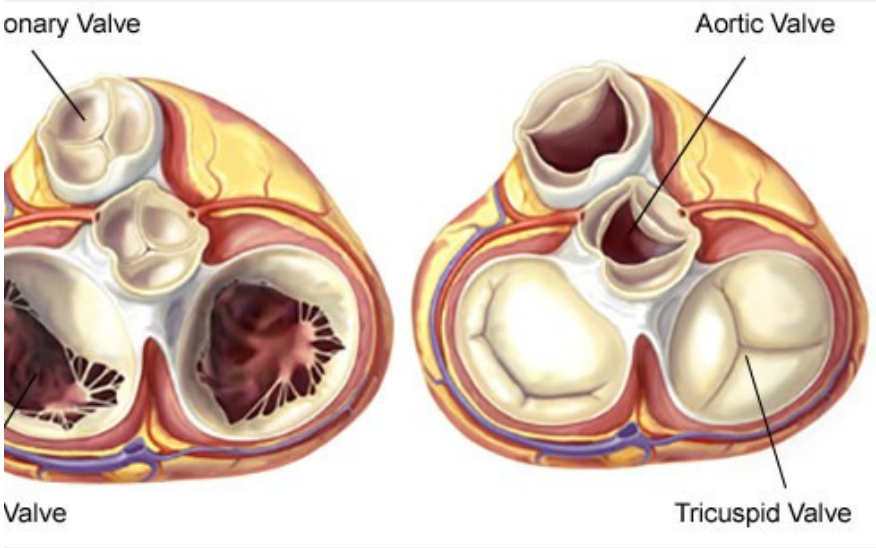
Ventriculo-arterial valves

- leaflets
- anulus
- root
- ST junction



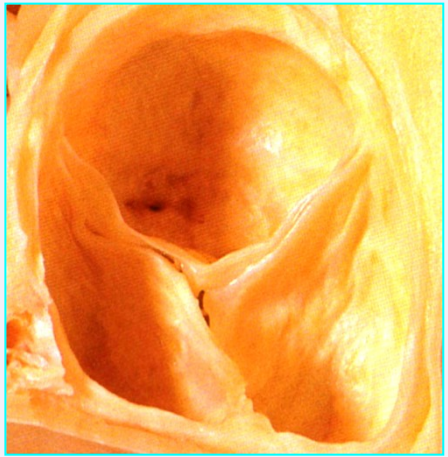
Anatomy of heart valves - localization





Aortic valve disease - stenosis

Etiology - degenerative
- congenital
- post-rheumatic



most often
AS risk factors

bicuspid - 2%
turbulent flow
aortic root dilatation!

+ Mi valve

Aortic valve disease – stenosis – indication for surgery (AVR)

aortic valve stenosis (on ECHO)

symptoms (chest pain, dyspnea, syncope)

⇨ **surgery**

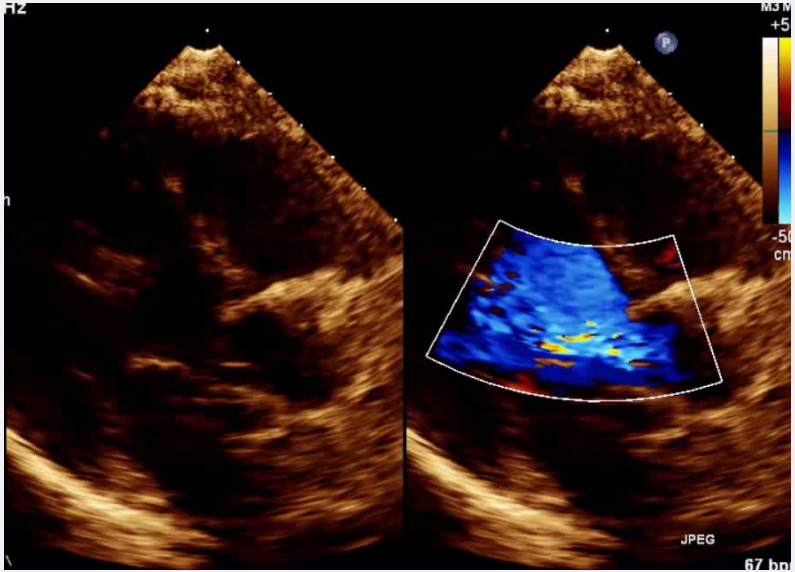
symptoms …. LV function? (↓EF, LV dilatation)

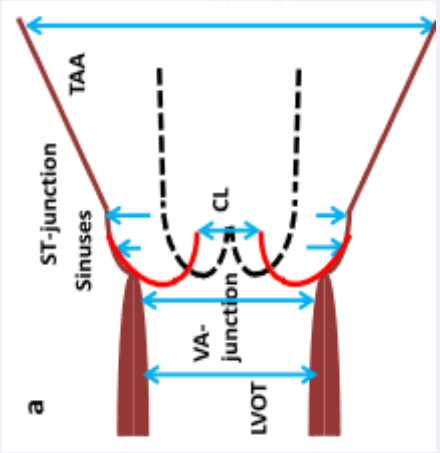
⇨ **surgery**

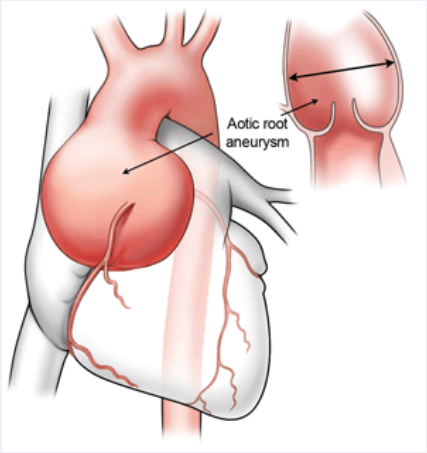
Aortic valve disease - regurgitation

acute x chronic

Etiology
- post-rheumatic
- endocarditis
- congenital
- degenerative
- annulus/root/STJ dilatation







Mitral valve diseases

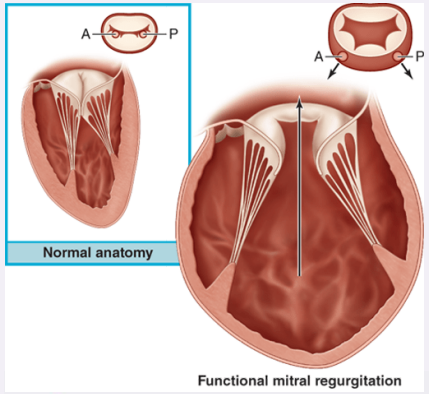
Stenosis **Etiology** - post-rheumatic
- degeneration (calcification)

Indication for surgery - symptoms (dyspnoa)
- MV ≤ 1,5cm^2
- atrial fibrilation
- pulmonary hypertension

Regurgitation (acute, chronic)

Etiology - myxomatous degeneration (leaflet prolaps, chords rupture…)
- post-rheumatic
- endocarditis
- ischemic (MI, LV dysfunction)

Indication for surgery - symptoms
- RV > 40ml, RF > 40%,



Tricuspid valve disease

Stenosis

Etiology - post-rheumatic
- carcinoid syndrom

Indication for surgery - gradient > 2-3mmHg

Regurgitation

Etiology - relative…annulus dilatation
- endocarditis

Indication for surgery - TriR grade III-IV

Heart valve surgery

1. Valve sparing – if it‘s possible

    X risk of failure valve sparing surgery → redo surgery

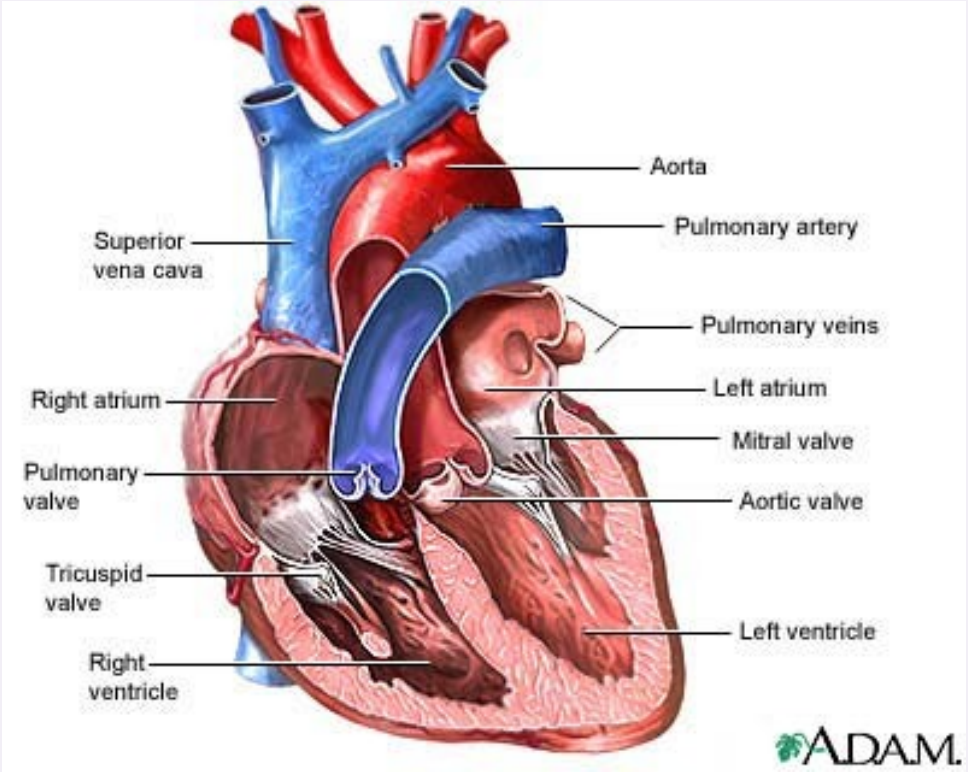
2. Valve replacement

    X risk of valve prosthesis

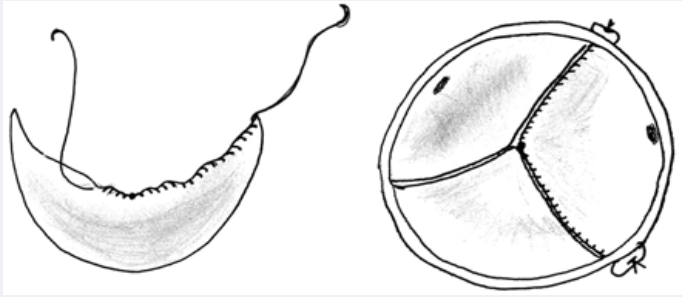
Anatomy of heart valves

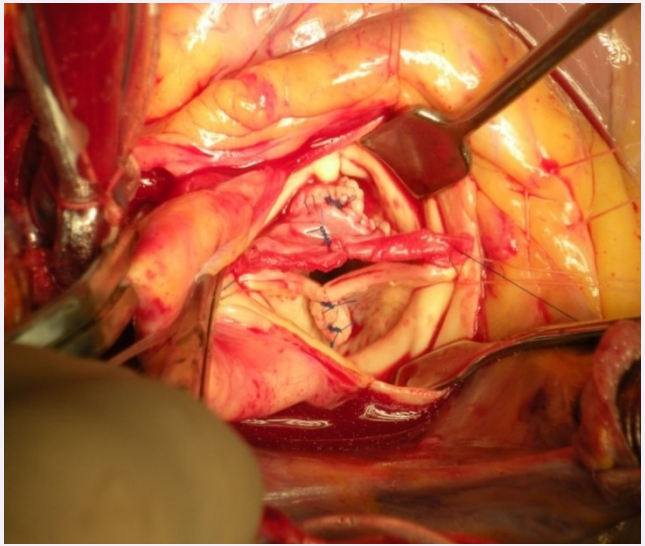
Ventriculo-arterial valves

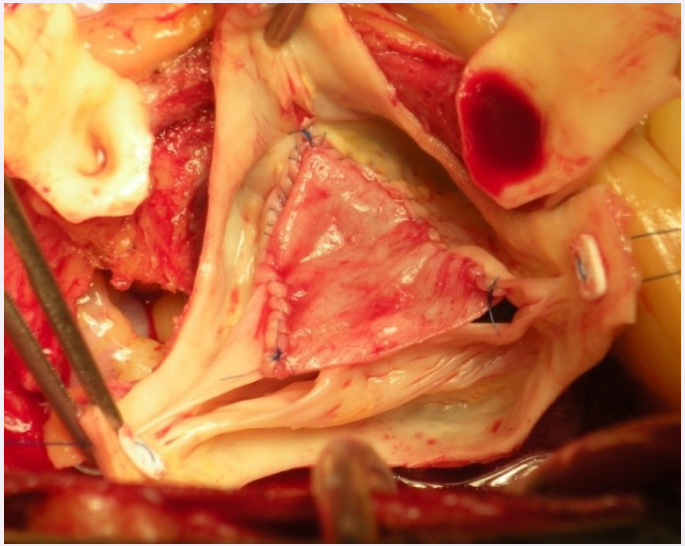
- leaflets
- anulus
- root
- STJ



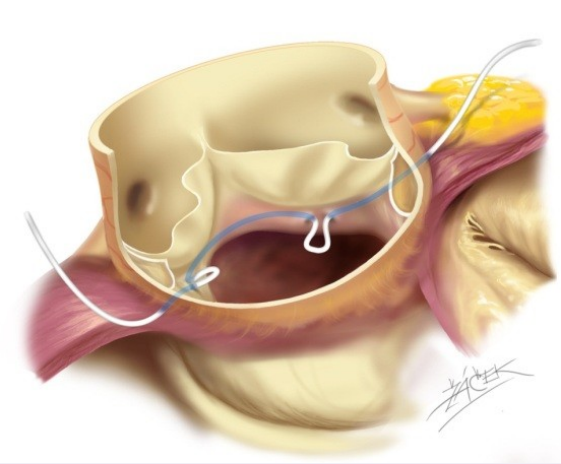
Aortic valve sparing surgery - leaflets

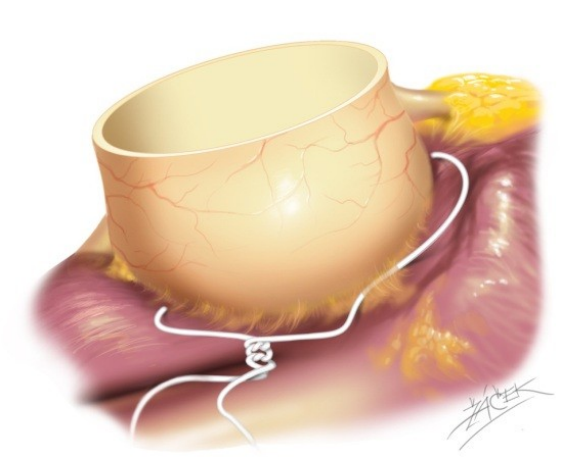


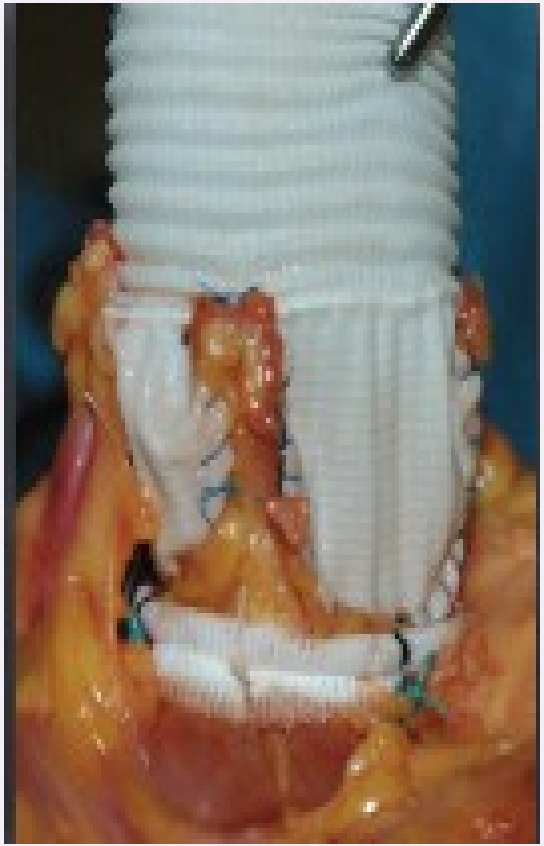




Aortic valve sparing surgery - annulus







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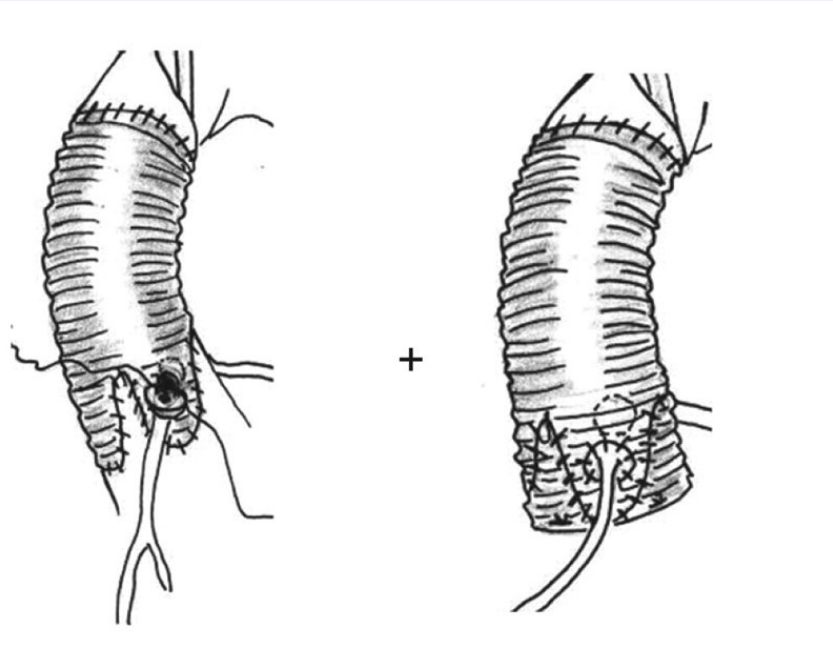
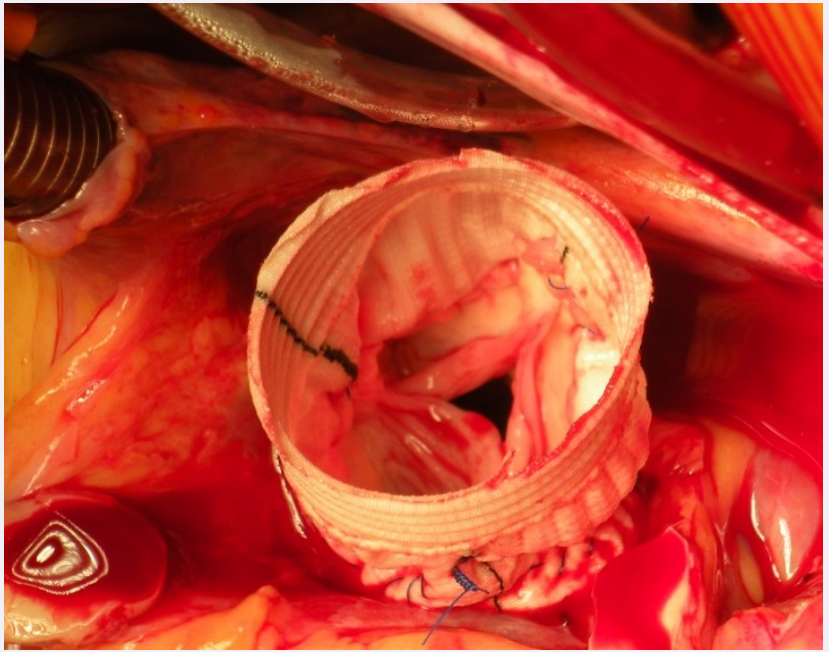
Aortic valve sparing surgery

Root

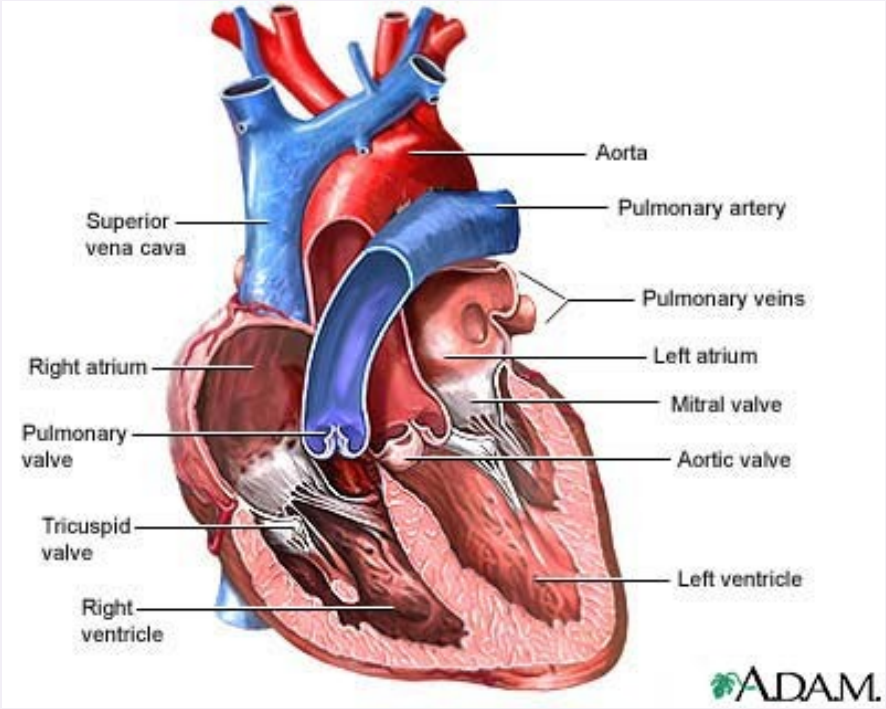




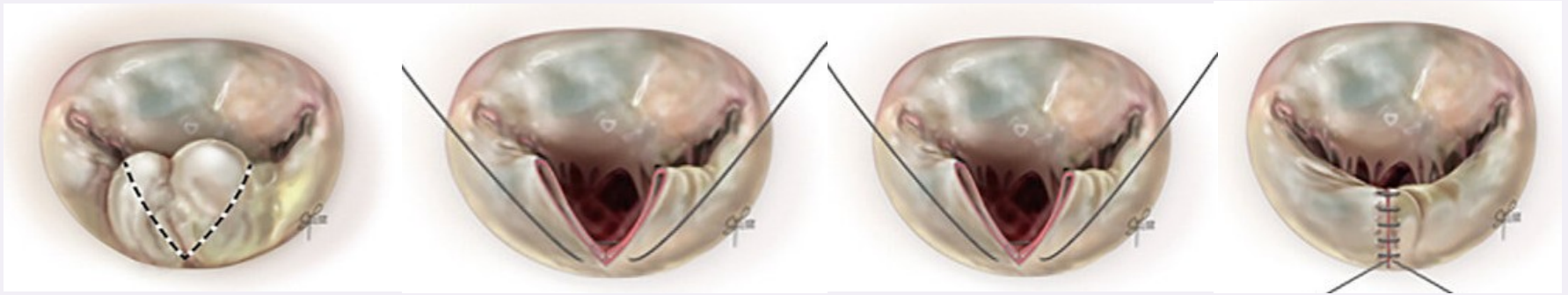
Anatomy of heart valves - localization

Atrio-ventricular valves (Mi,Tri)

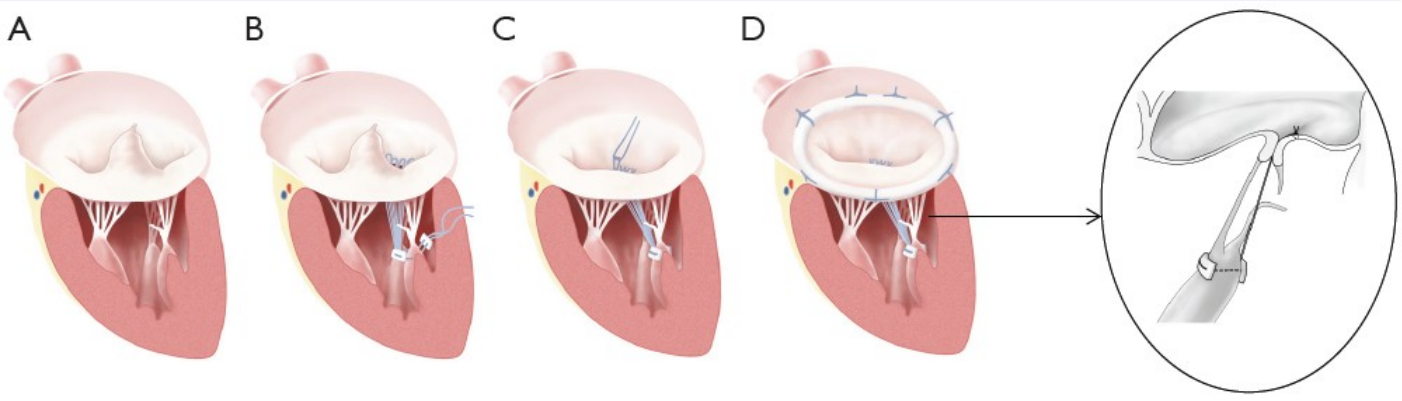
- leaflets
- anulus
- chords
- papillary muscles - *limited*
- left/right ventricle - *limited*



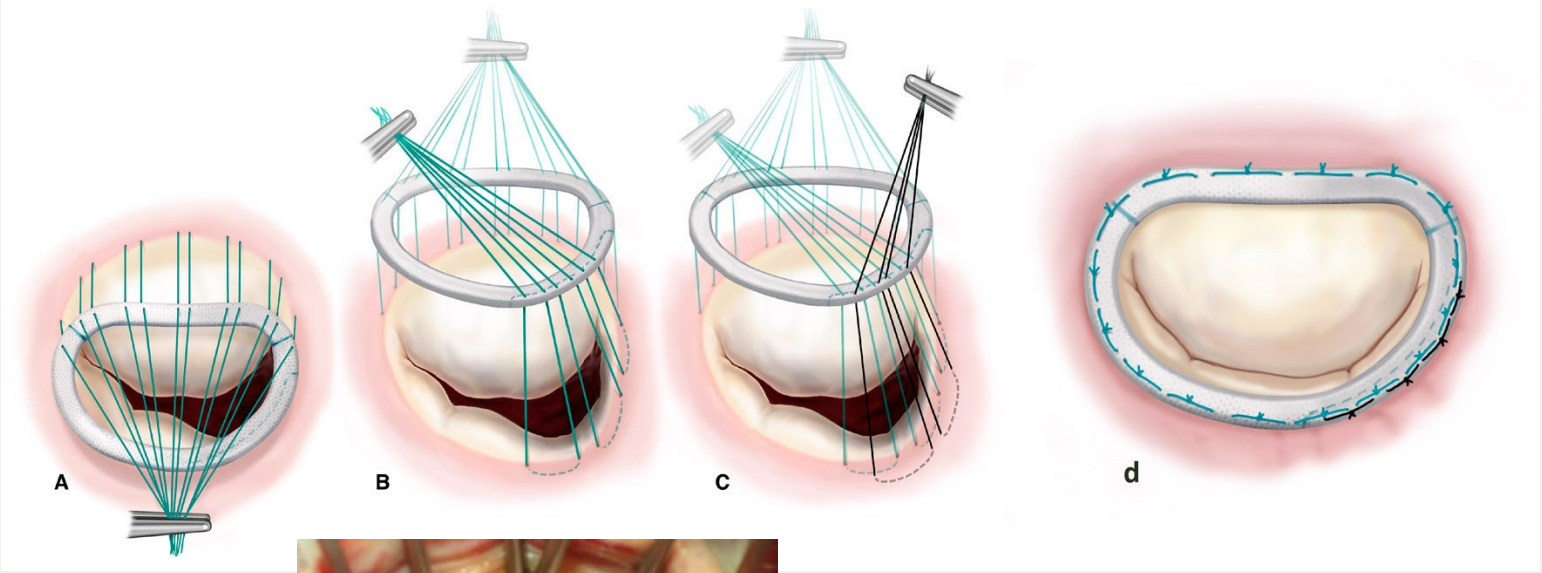
Mitral valve reconstruction surgery - leaflets

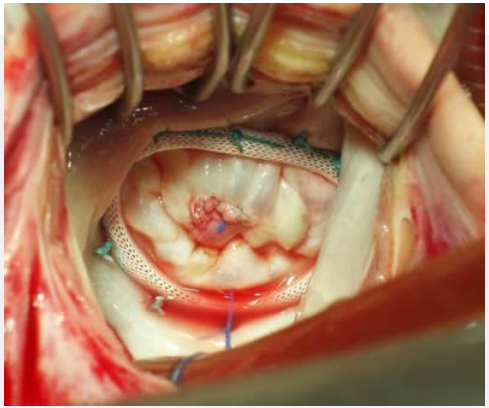


Mitral valve reconstruction surgery - chords

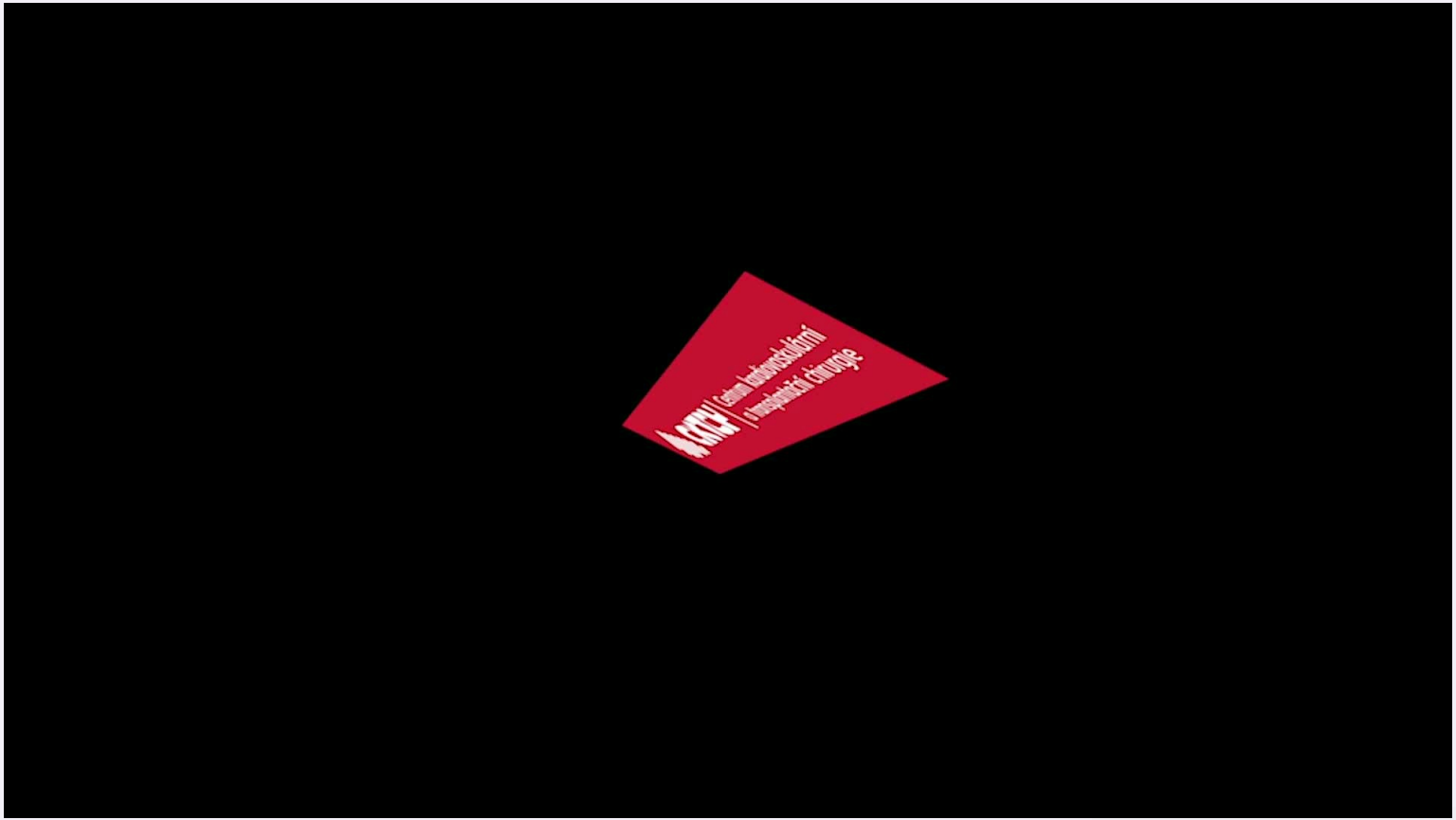


Mitral valve reconstruction surgery - annulus





Minimaly invasive mitral valve reconstruction

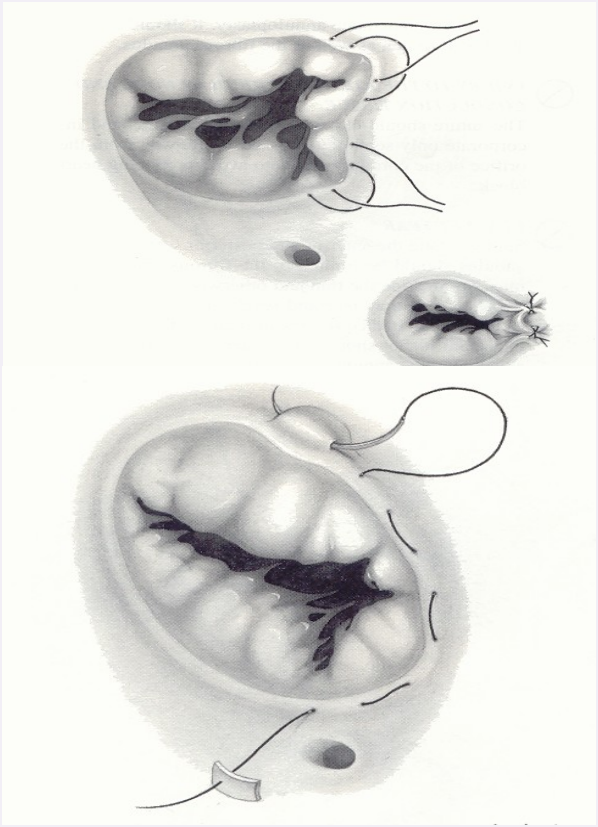


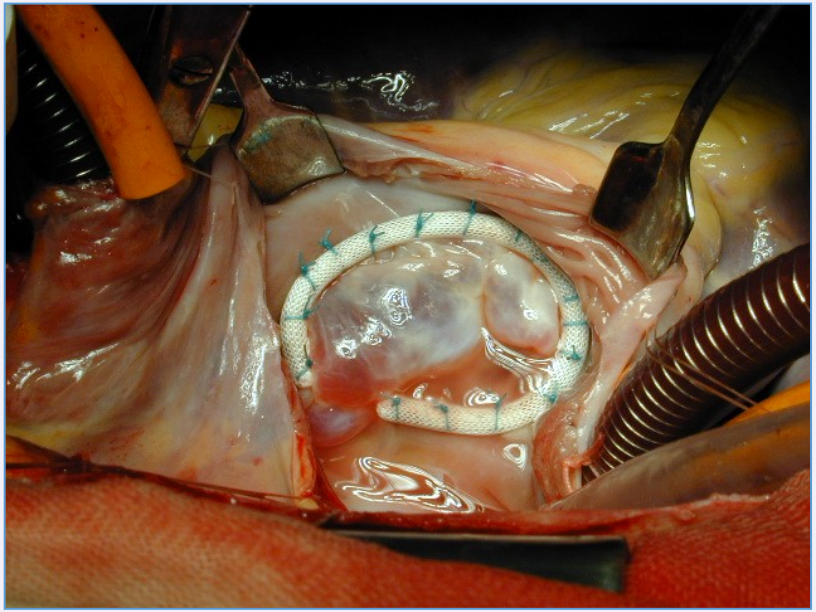
Tricuspid valve reconstruction surgery

Annulus

Leaflets

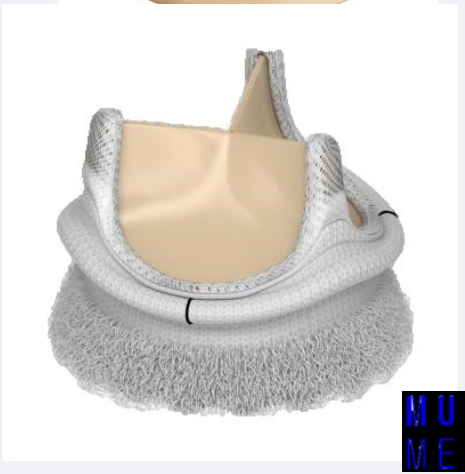
(chords)





Valve replacement - mechanical

Valve replacement - biological



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Aortic valve replacement - video

Aortic valve replacement – sutureless bioprosthesis

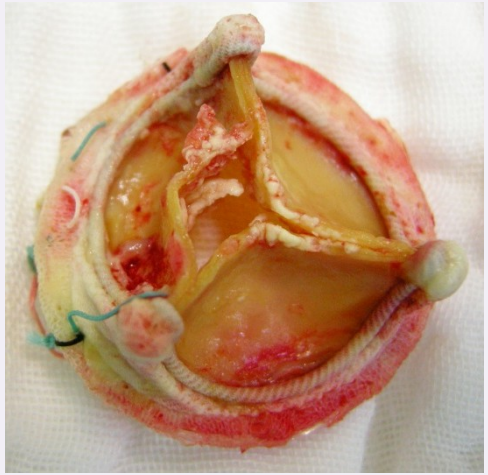
Mechanical vs. biological valves

Mechanical

- advantages - long-term durability
- disadvantages - need of anticoagulation

Biological

- advantages - no anticoagulation
- disadvantages - limited durability



Complications after valve replacement

- thrombembolism

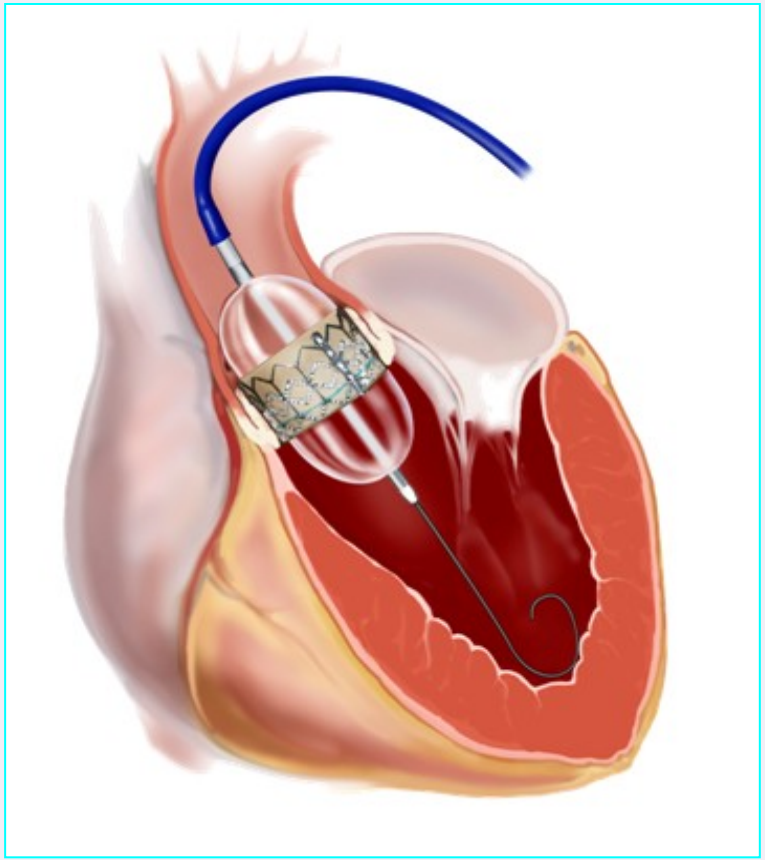
- bleeding

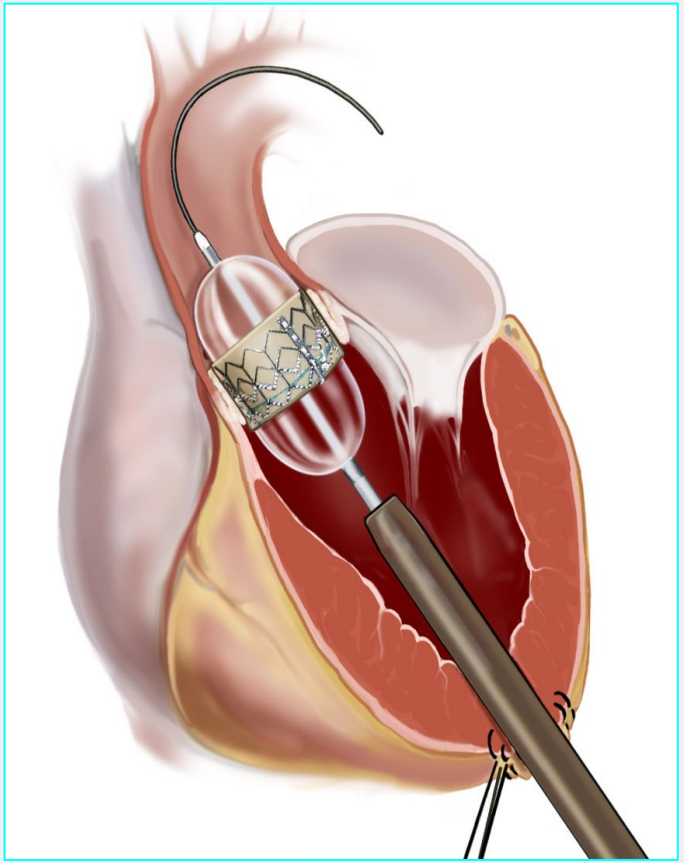
- valve dysfunction (pannus, thrombus)

- prosthetic endocarditis

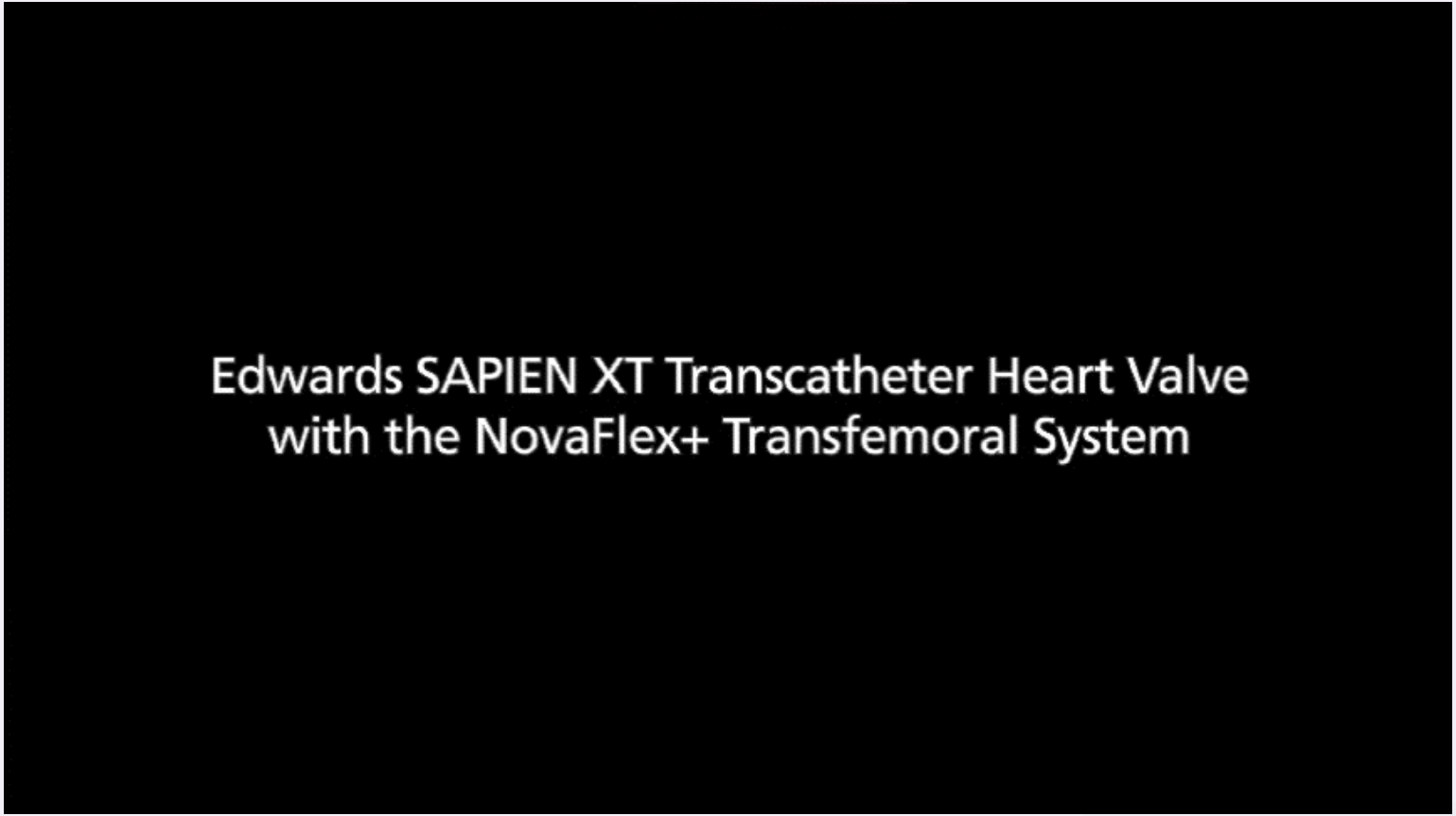
2 - 4% per year
mortality 1% per year

TAVI – transcatheter aortic valve implantation





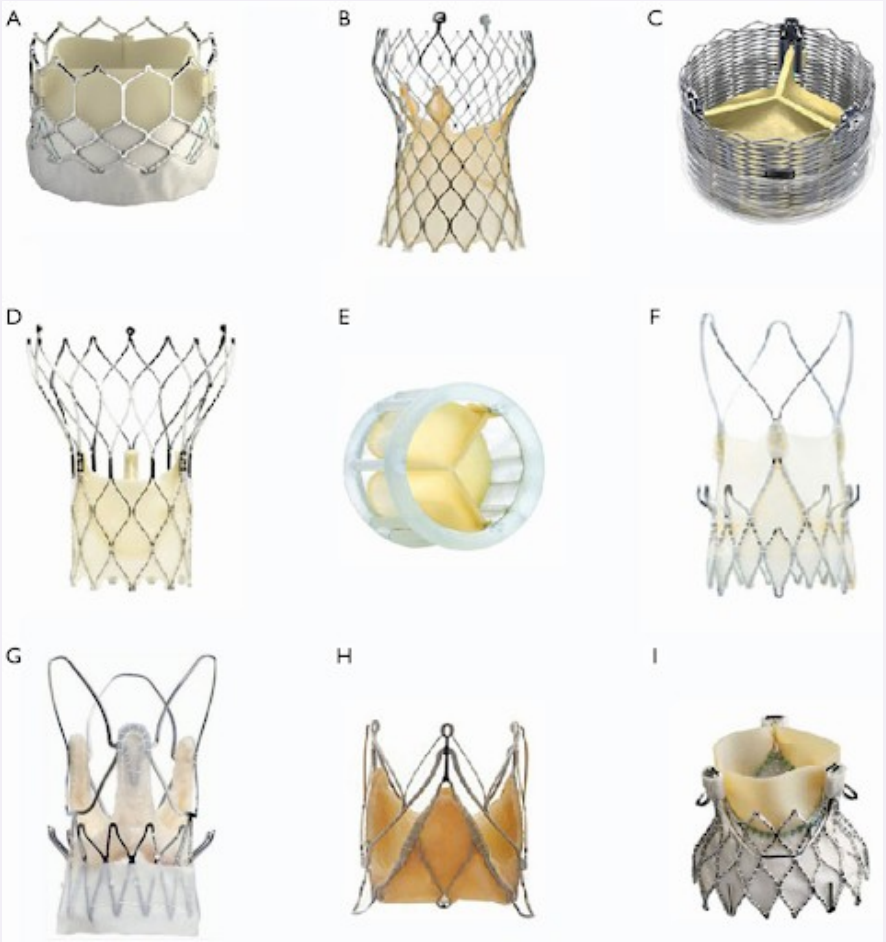
TAVI - transfemoral

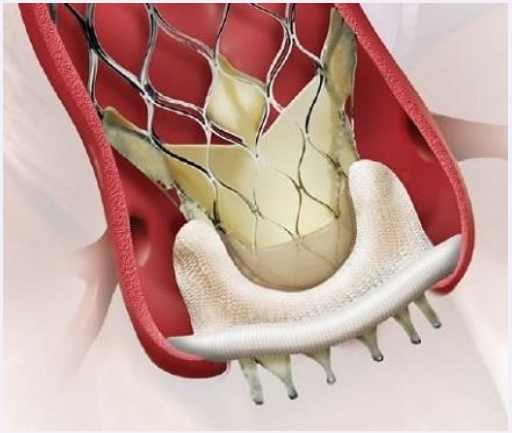


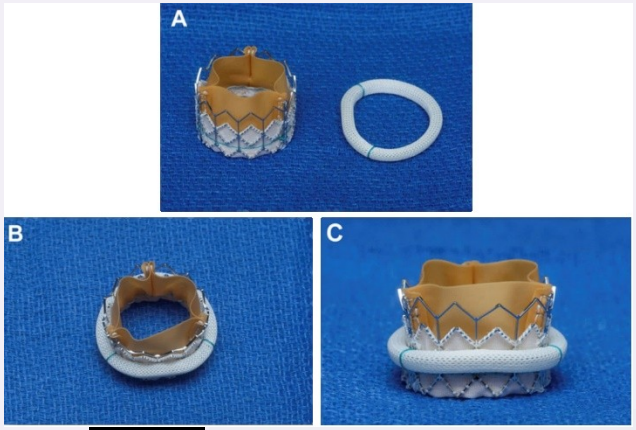
TAVI - transapical

TAVI - transapical

TAVI – transcatheter valve implantation







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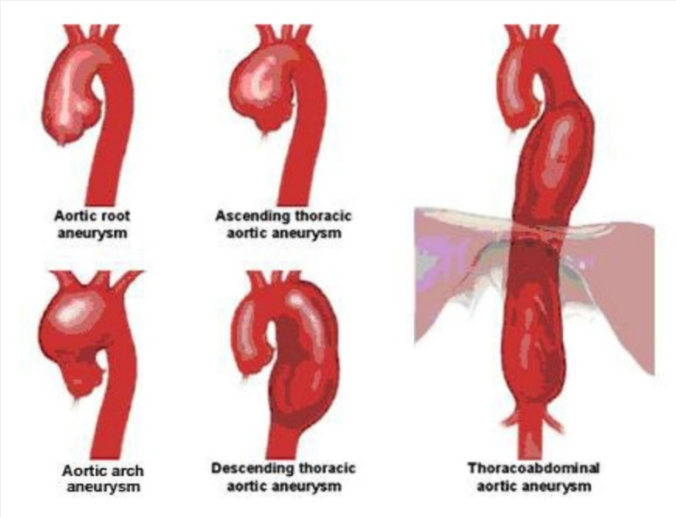
Aortic diseases – aortic aneurysm

ascending, arch, descending, thoracoabdominal
≥ 55mm



risk factors - hypertension, bicuspid valve, Marfan syndrom, Ehlers-Danlos syndrom, Loeys-Dietz syndrom, inflammatory aortic disease (aortitis)

symptoms – no symptoms OR chest pain, hoarseness, cough, shortness of breath

Dg - ECHO, CT, MRI

therapy – prevention of rupture/dissection
aortic replacement with vascular prosthesis, TEVAR (thoracic endovascular aortic repair)

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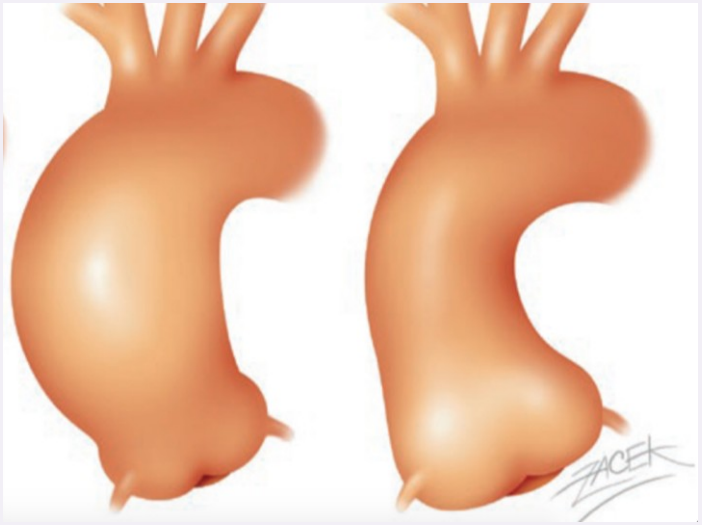
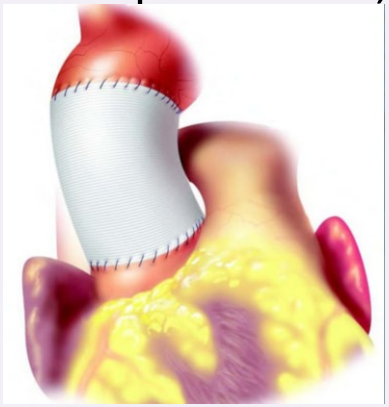
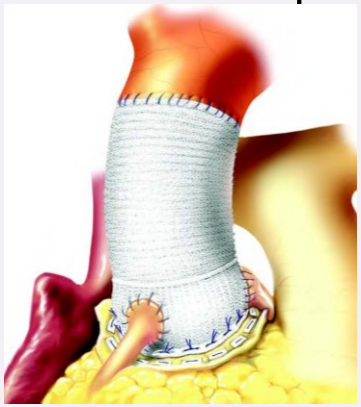
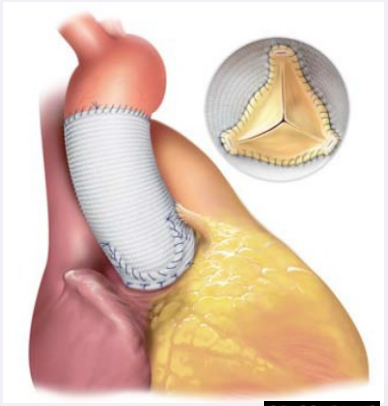
Ascending aorta aneurysm

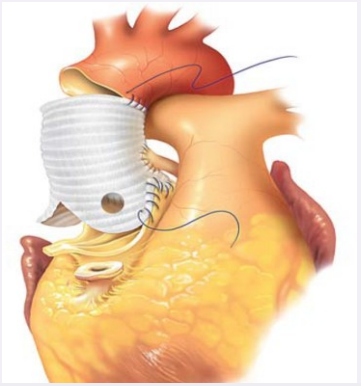
graft replacement– W/, W/O aortic valve replacement , aortic valve sparing procedures







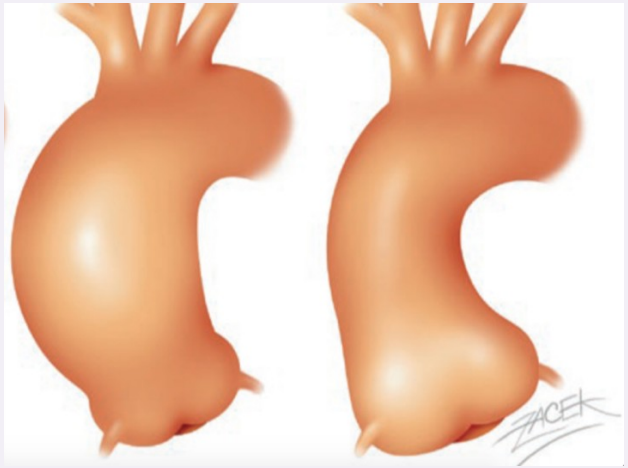


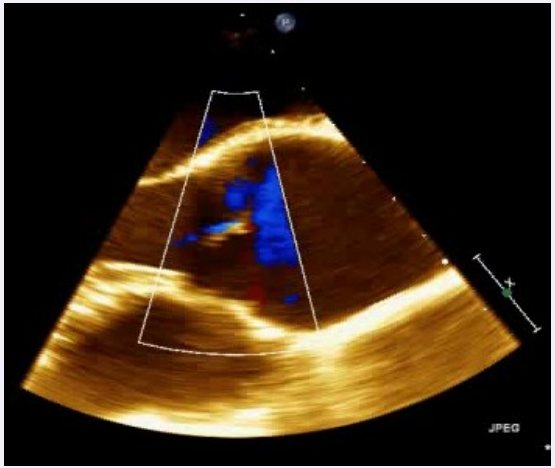


Ascending aorta aneurysm

PEARS (personalised external aortic root support)

- prophylactic surgery on the aortic root and AA to prevent further growth in aortic aneurysms





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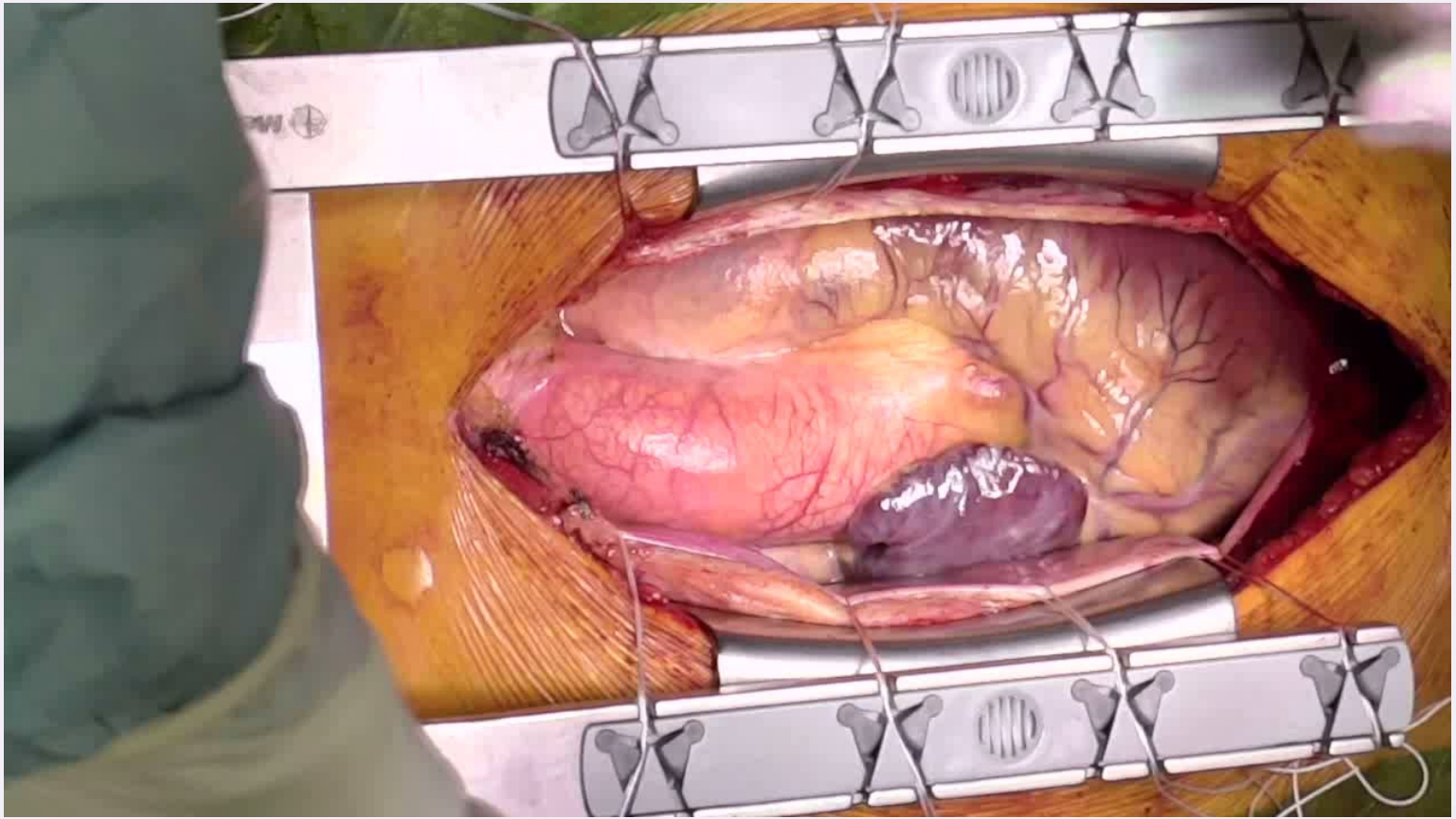
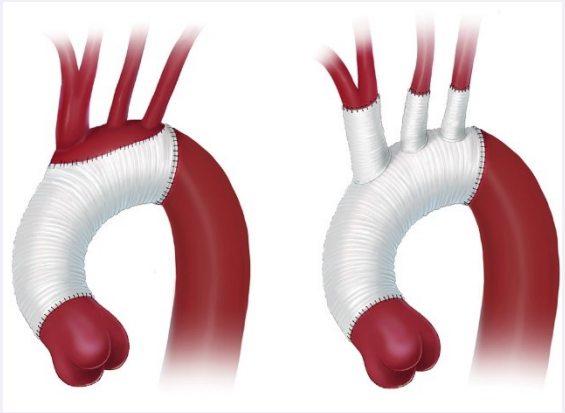
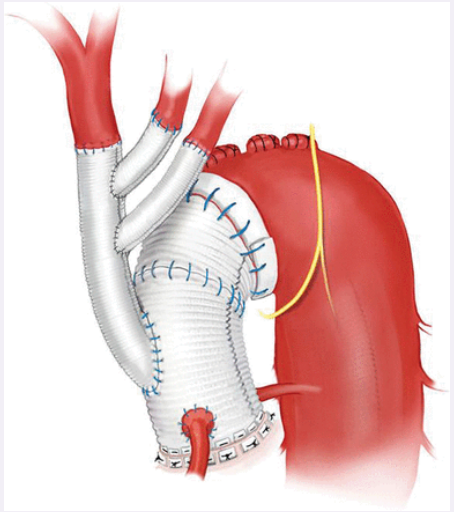
Ascending aorta aneurysm - PEARS

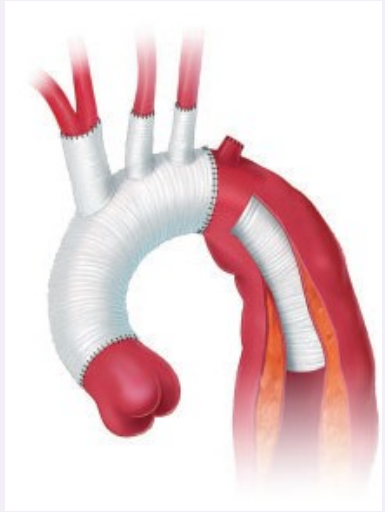


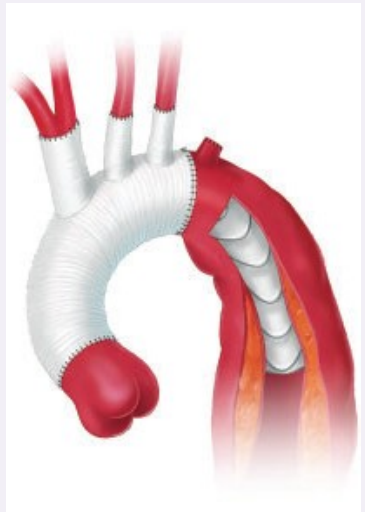
Aortic arch aneurysm

arch replacement - technically demanding, hypothermia, brain protection









Czerny M, et al. European Journal of Vascular end Endovascular Surgery 2019; 57, 165-198. doi.org/10.1016/j.ejvs.2018.09.016

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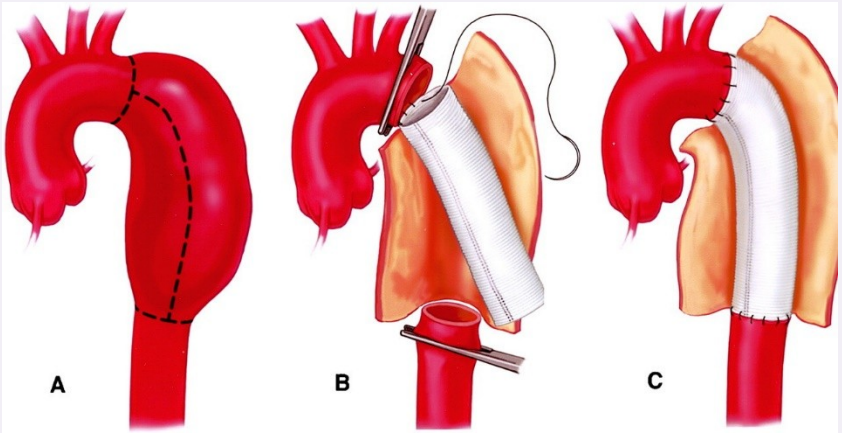
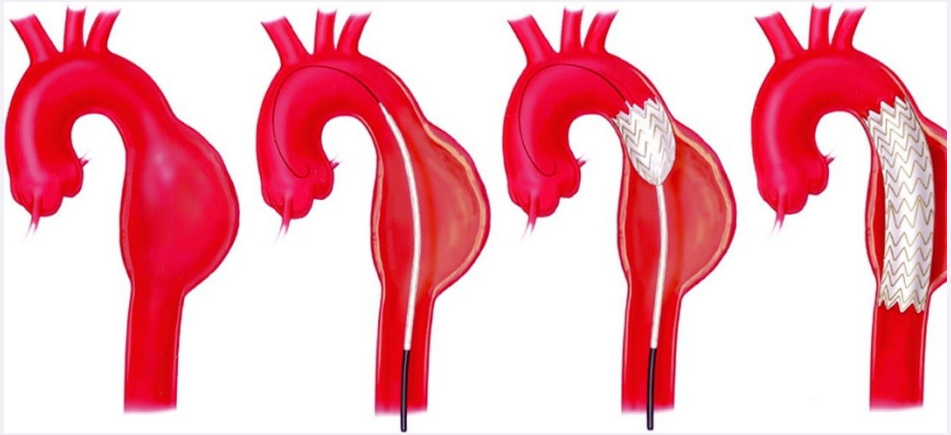
Descending aorta aneurysm

vascular graft replacement
- thoracotomy

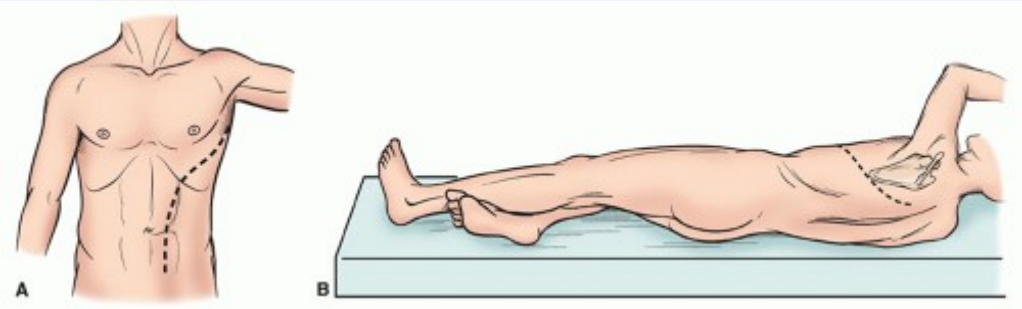
TEVAR
- thoracic endovascular aortic repair

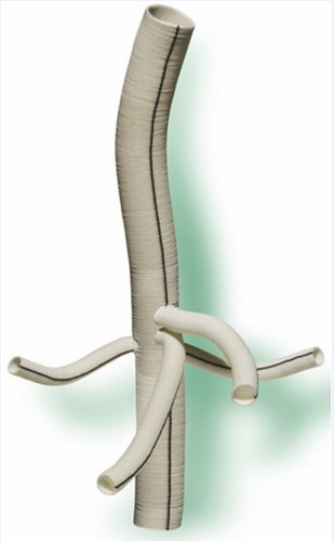


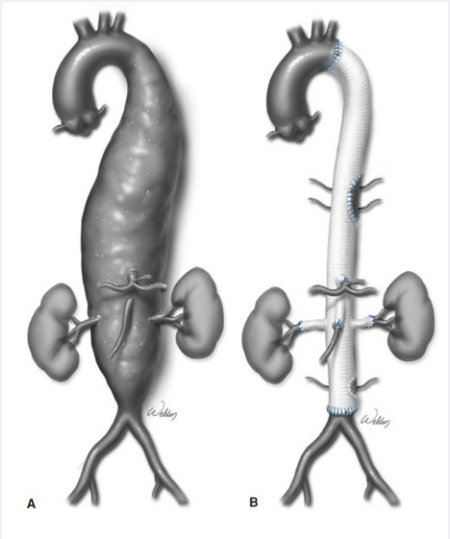


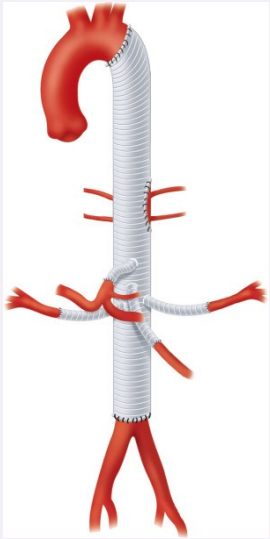
Isselbacher, Eric M. Thoracic and abdominal aortic aneurysms. Circulation, 2005, 111.6: 816-828.

Thoracoabdominal aneurysm – surgery









thoracoabdominal aorta
- graft replacement
- thoraco-freno-laparotomy
- arteries reimplantation
  (spinal cord arteries,
  abdominal)

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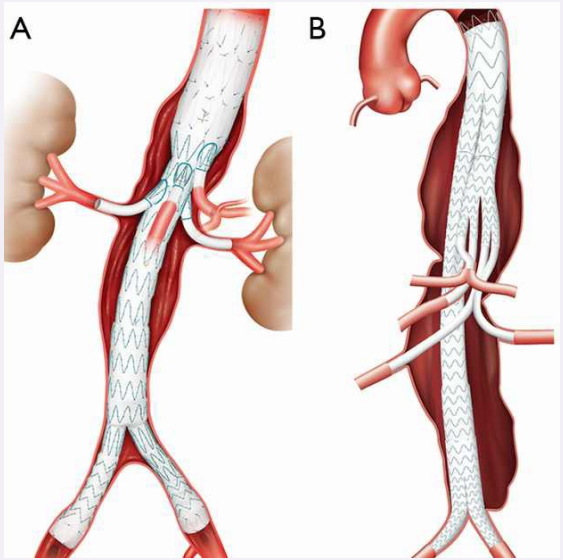
Thoracoabdominal aneurysm – endovascular repair



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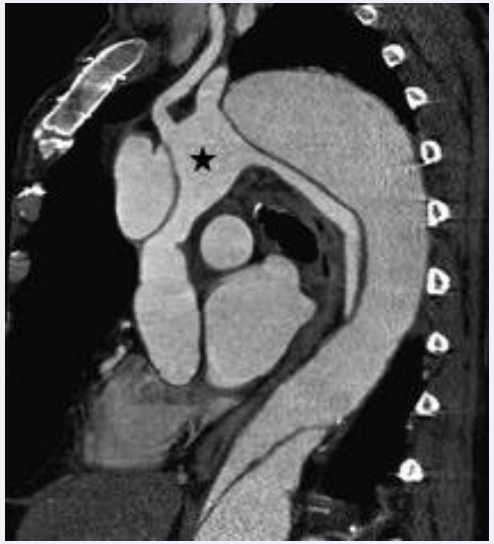
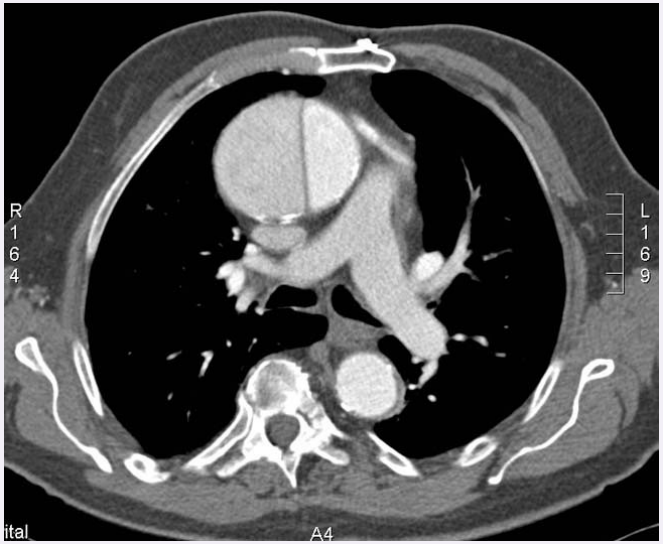
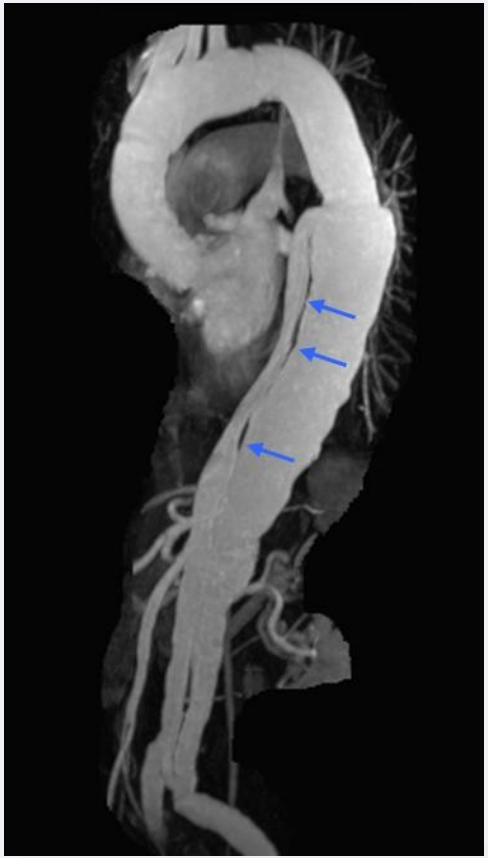
Aortic dissection

tear in the inner wall of the aorta causes
blood to flow between the layers of the
wall of the aorta and force the layers apart
→ true and false lumen
- acute (< 2 weeks) OR chronic







Aortic dissection

Splitting tunica media

⇩

Weakening of the walls of the false lumen
Impaired flow of aortic branches

⇨ **Risk of rupture**

⇩

Tamponade
Malperfusion – brain, myocardial, visceral, extremity

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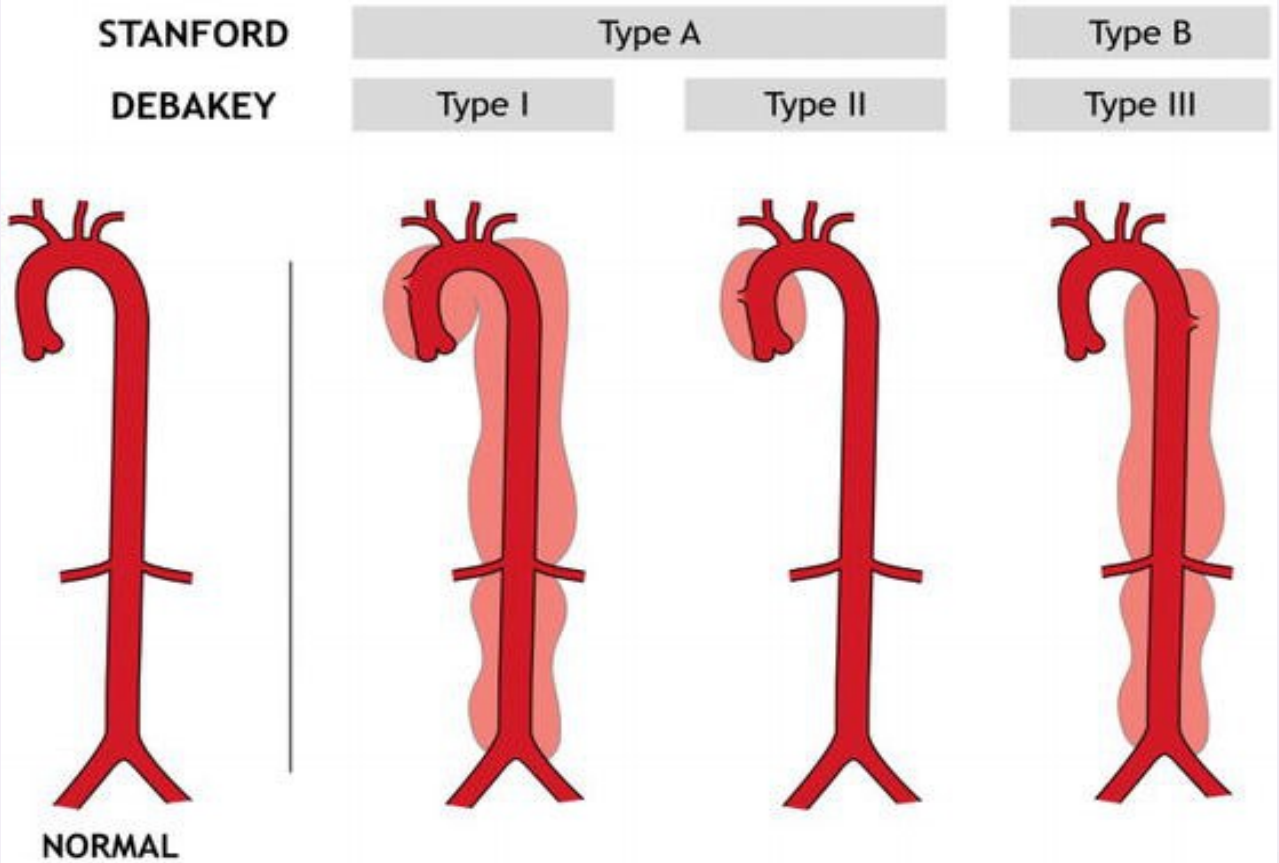
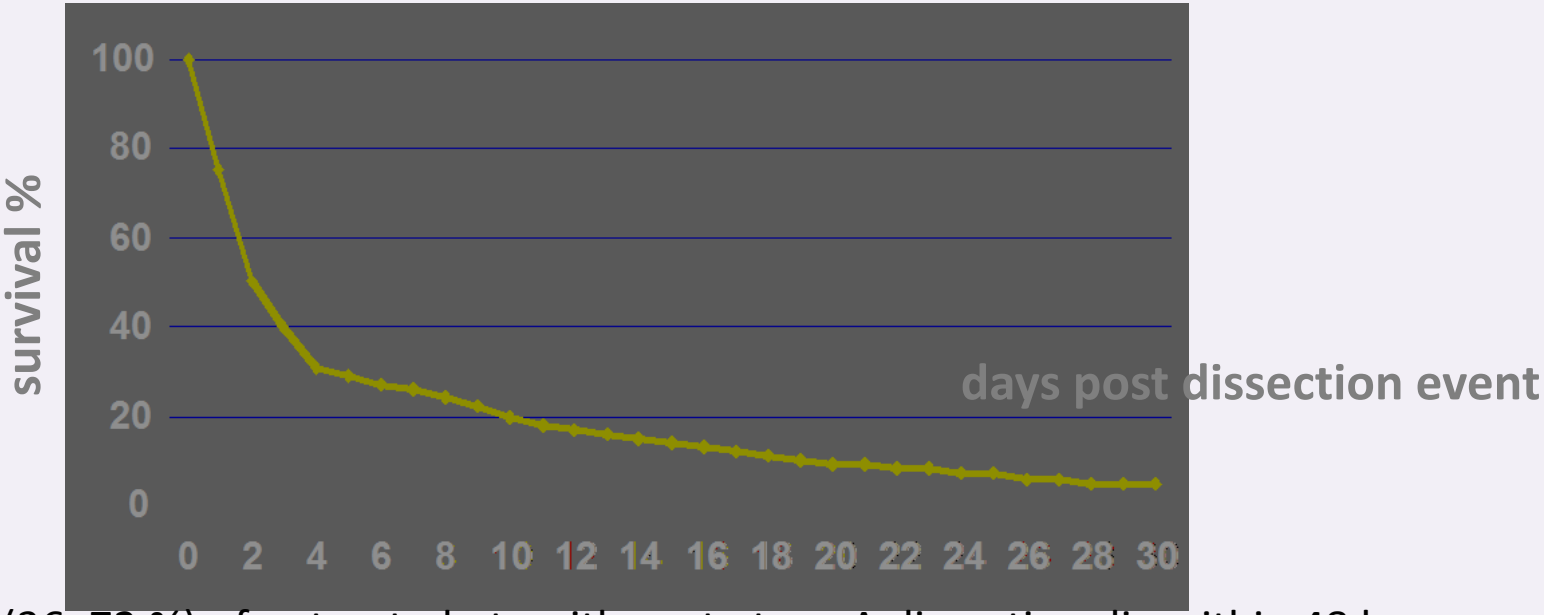
Aortic dissection

- hypertension
- connective tissue disorders (Marfan, Ehlers-Danlos, Turner)
- degenerative or inflamatory disease of aortic wall
- iatrogenic injury
- atherosclerosis
- bicuspid aortic valve
- aortic dilatation
- trauma
- polycystic kidney disease
- coarctation of the aorta
- …

Aortic dissection - classification



Survival of untreated pts with type A aortic dissection



- 50 % (36–72 %) of untreated pts with acute type A dissection die within 48 hours
- mortality rate 1 % / hour
- the survival rate without treatment at 1 month is approximately 5%
- after 3 weeks approx. 90 % †

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Aortic dissection - symptoms

PAIN!!!

- pre-shock symptoms (sweating, hypotension, tachycardia)
- malperfusion (peripheral or splanchnic ischemia)

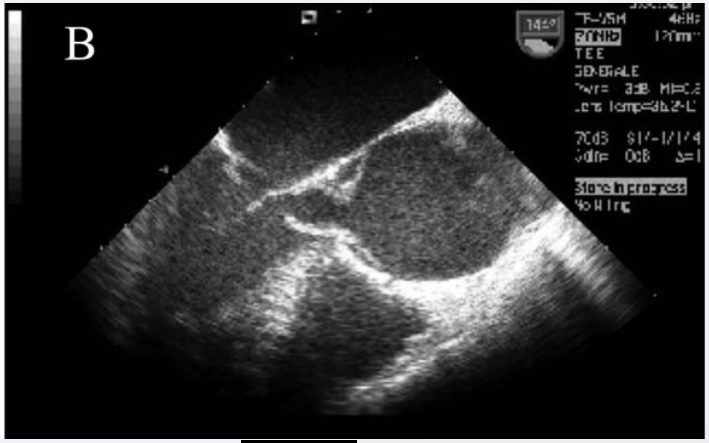
CAVE:
ALWAYS CONSIDER AORTIC DISSECTION IN CASE OF ISCHEMIC EXTREMITY !

- neurological signs (stroke)
- no another symptoms (some patients are only complaining chest pain)

Aortic dissection - diagnosis

WITHOUT DELAY !!!

ECHO
CT-angio
(MR)



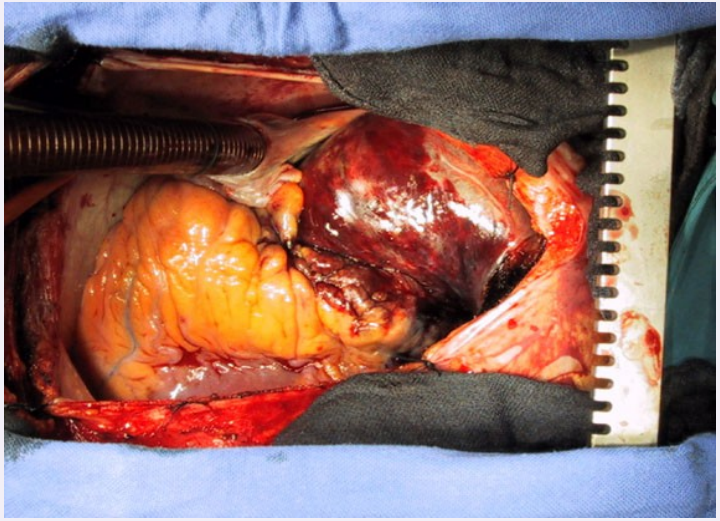
Aortic dissection - therapy

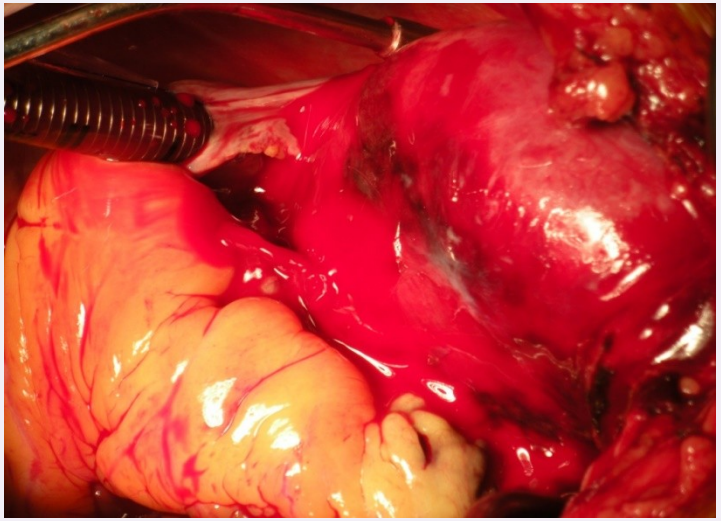
Initial

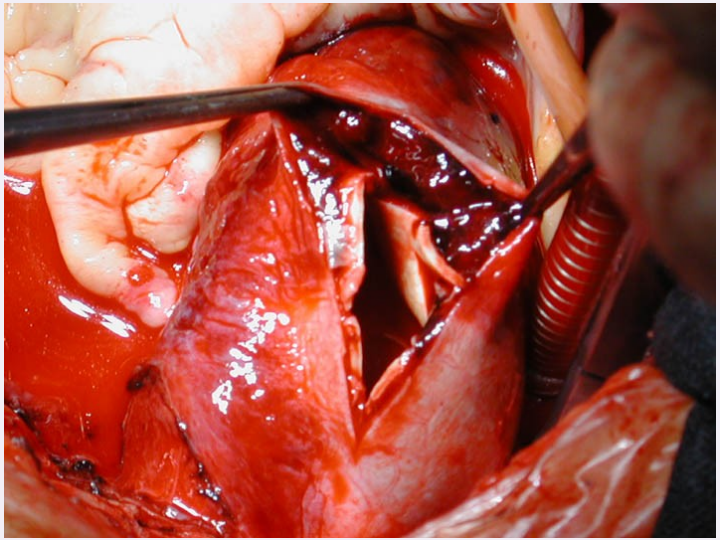
analgetics
ANTIHYPERTENSIVE THERAPY (vasodilatation, betablockers)

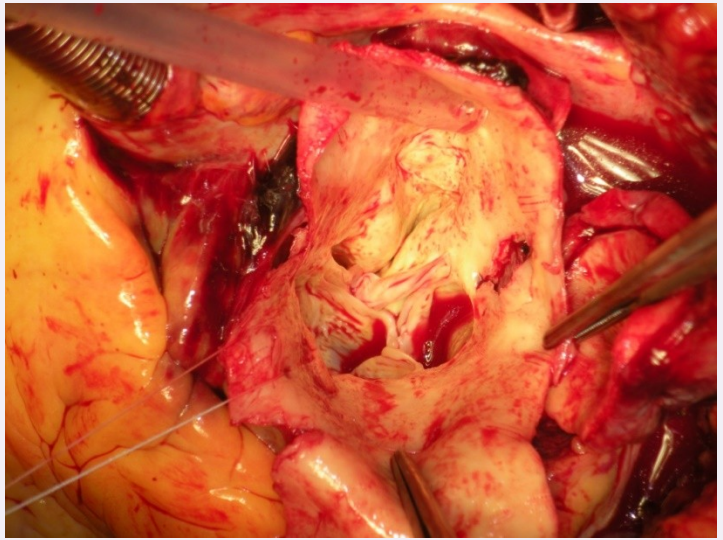
Definitive

type A - surgery !!!
type B - no surgery
- intervention (stentgraft) :
  - rupture
  - malperfusion
  - pain
  - progresive dilatation >10mm/30 days
  - failure of hypertension treatment management

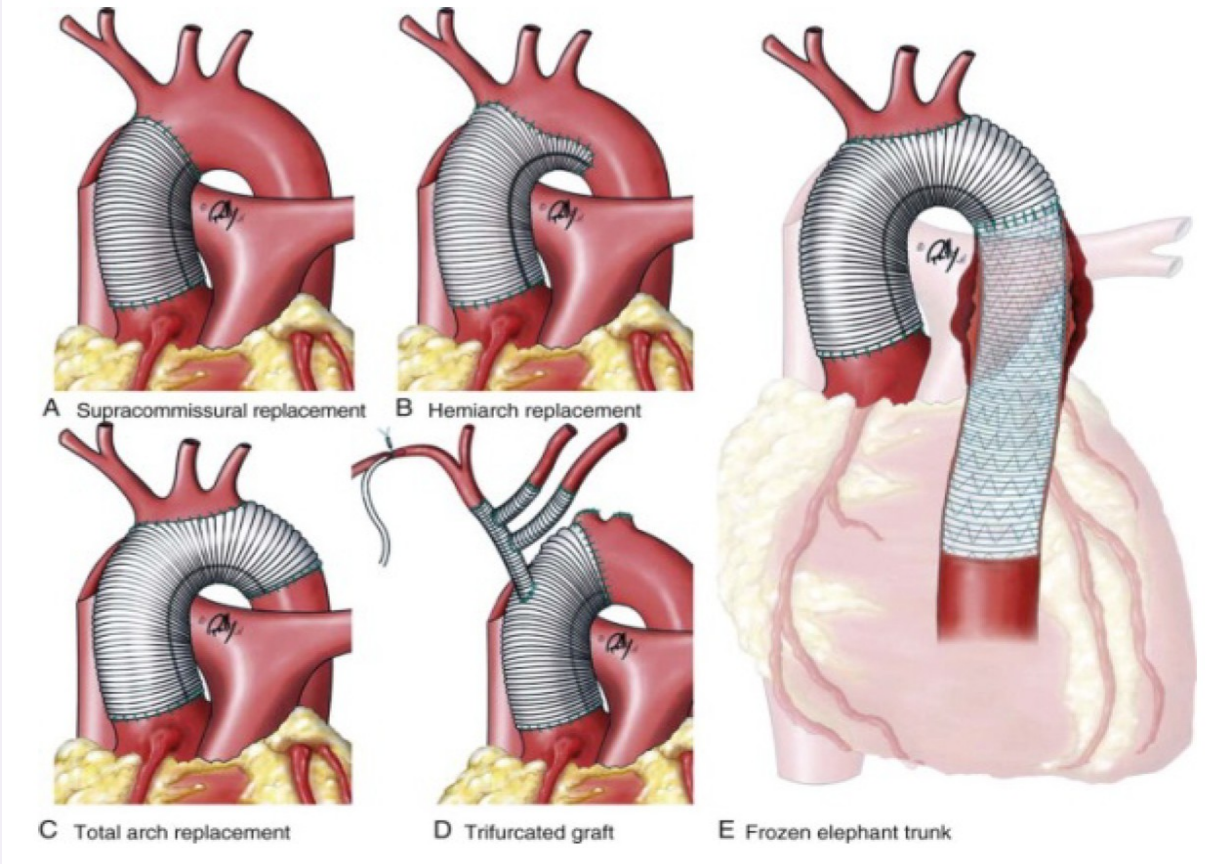




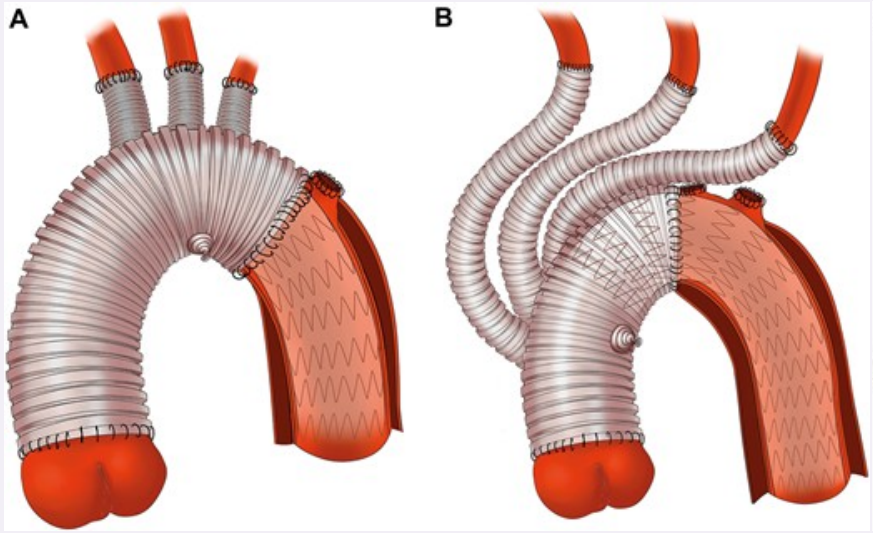


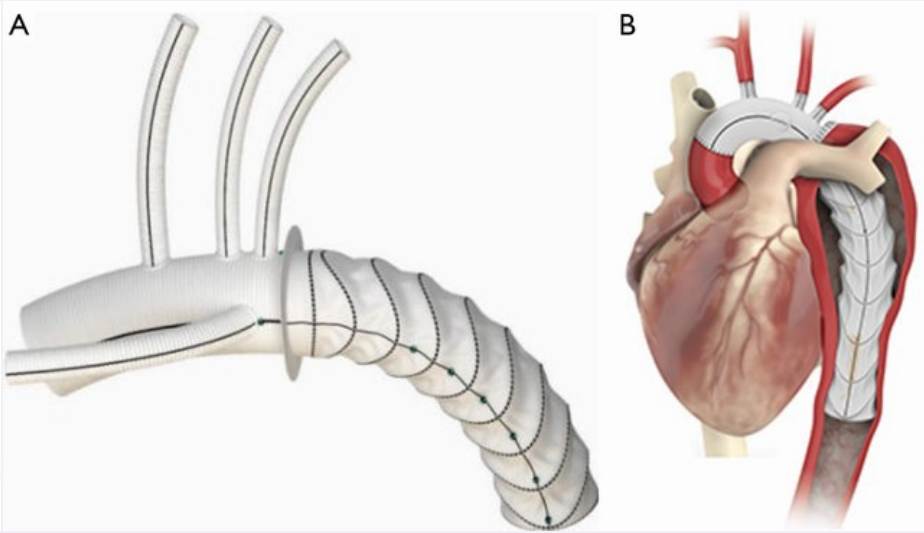


Aortic dissection - surgery

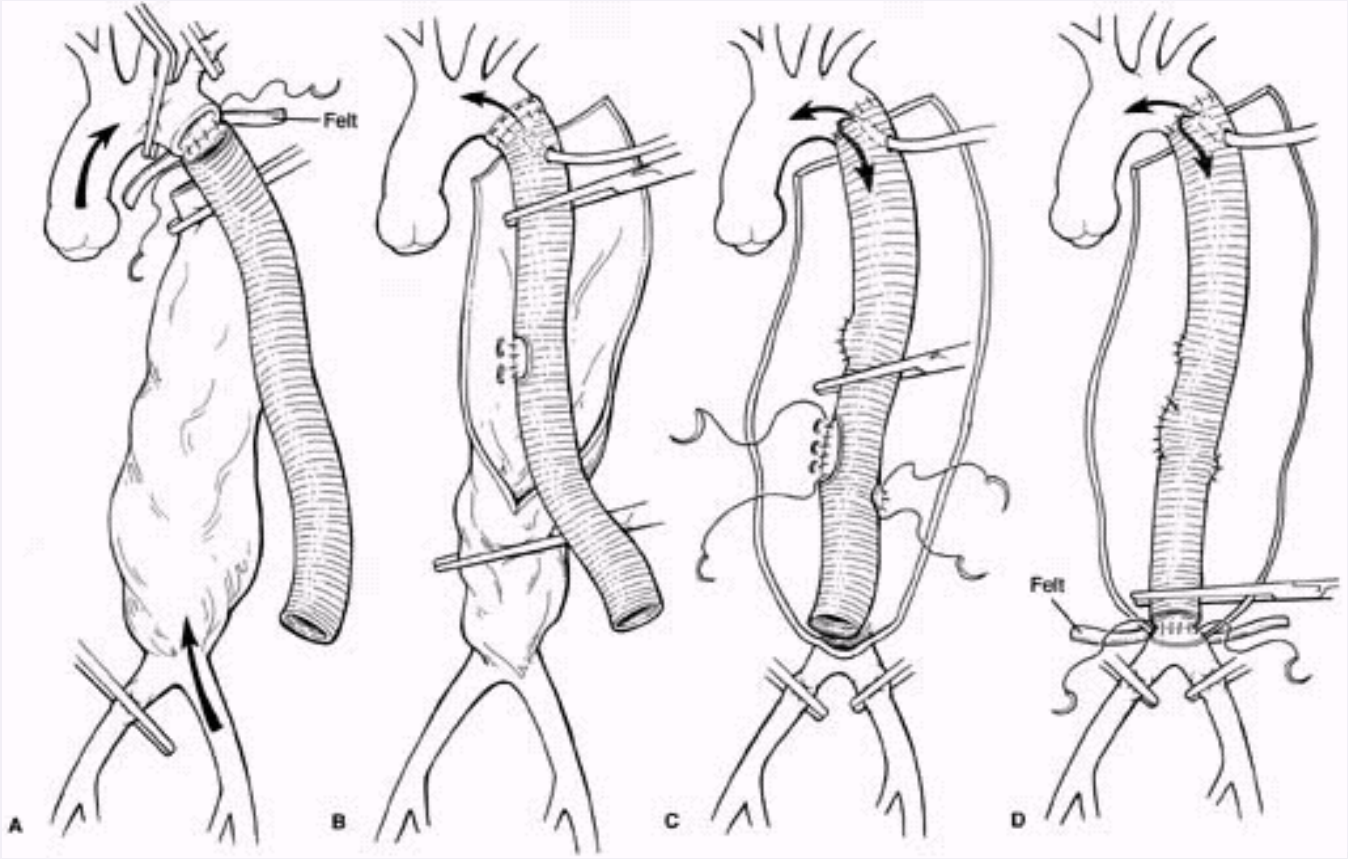


Aortic dissection - surgery

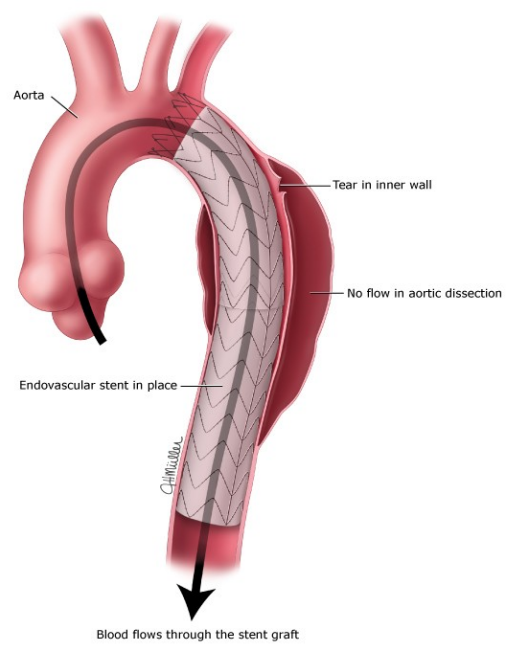


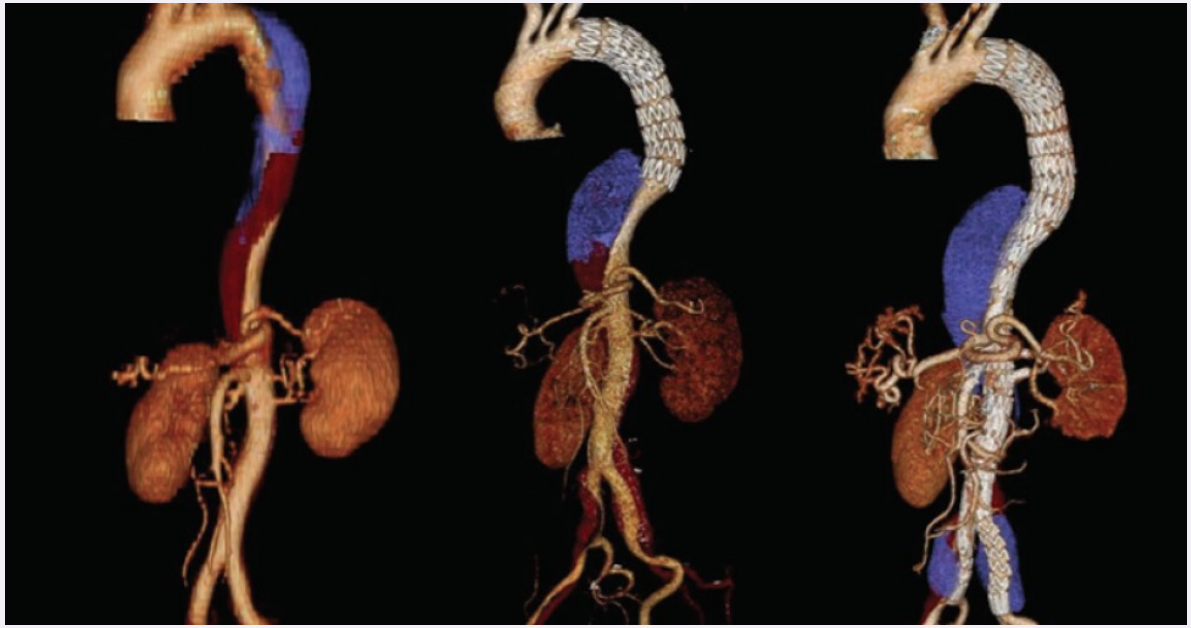


Aortic dissection type B – surgery - limited



Endovascular therapy of aortic type B dissection





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Aortic dissection therapeutic results

Prognosis without surgery

type A - within 48 hours of the event - 50% mortality
- survival rate at 1 month is approximately 5%

Surgery

	early mortality	survival 1 year	survival 5 years
Type A	10-25%	91%	75%
Type B	20-50%	93%	82%
stentgrafts	5-10%		

reason why catheter intervention is prefered

Conservative (no surgery) therapy

Type B 10-20%

Atrial fibrillation

- the most often SV dysrythmias
- prevalence 1-2% - increasing with age
- the most serious consequences (risk of strokes, heart failure and other heart-related complications)

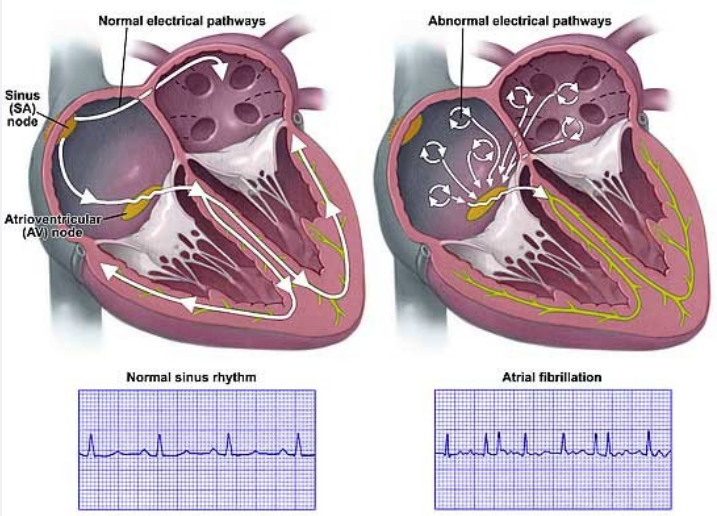
paroxysmal

→ LA remodelation + atrial interstitial fibrosis

→ **persistent**

→ **permanent**

- abnormal heart rhythm can't be restored



Atrial fibrillation

symptoms:

- palpitation, dyspnoea, fatigue, weakness
- low cardiac output
- heart failure
- cardioembolic strokes
- bleeding complications

therapy:

- anti-arrhythmic drugs (sinus rhythm control, hear
- anticoagulants
- valve/ischemic heart disease treatment
- catheter or surgical (MAZE) procedures, LA apper

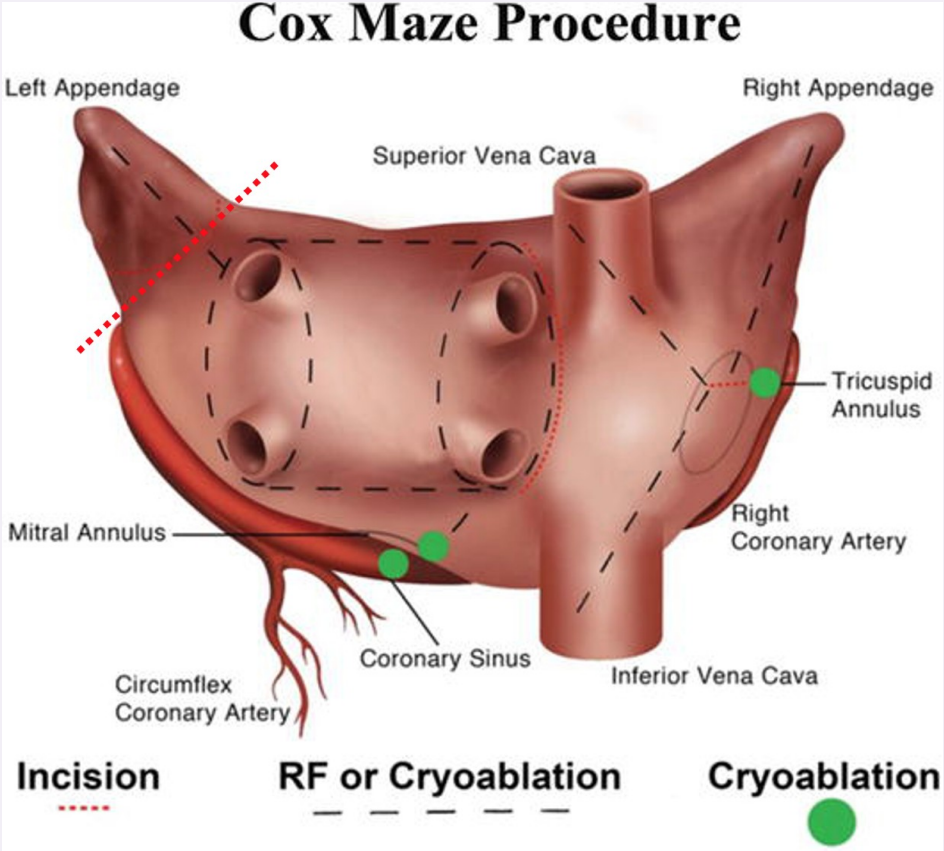
Atrial fibrillation – MAZE procedure

lesions

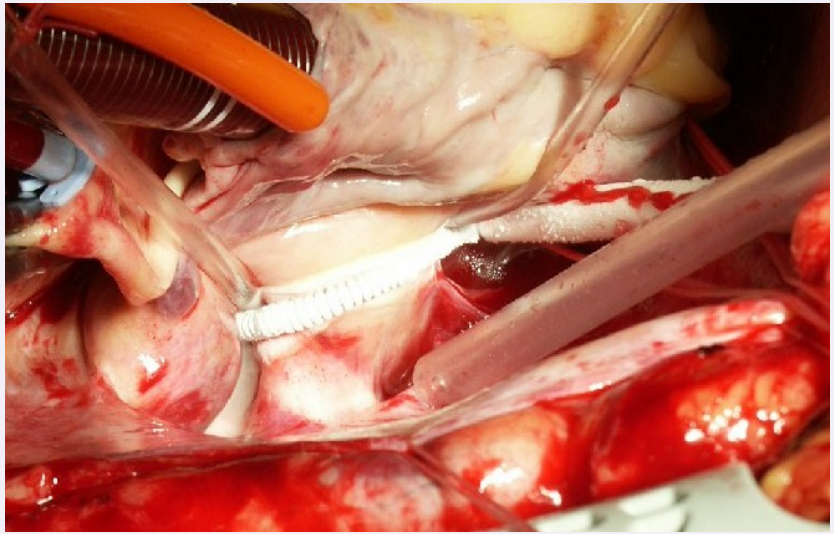
- transmural
- continual

technique

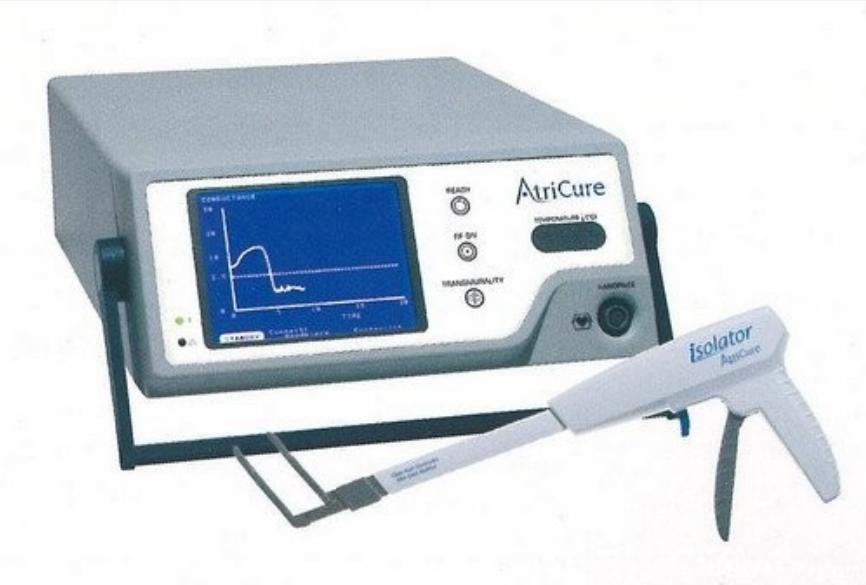
- surgical incision
- cryo energy
- radiofrequency energy



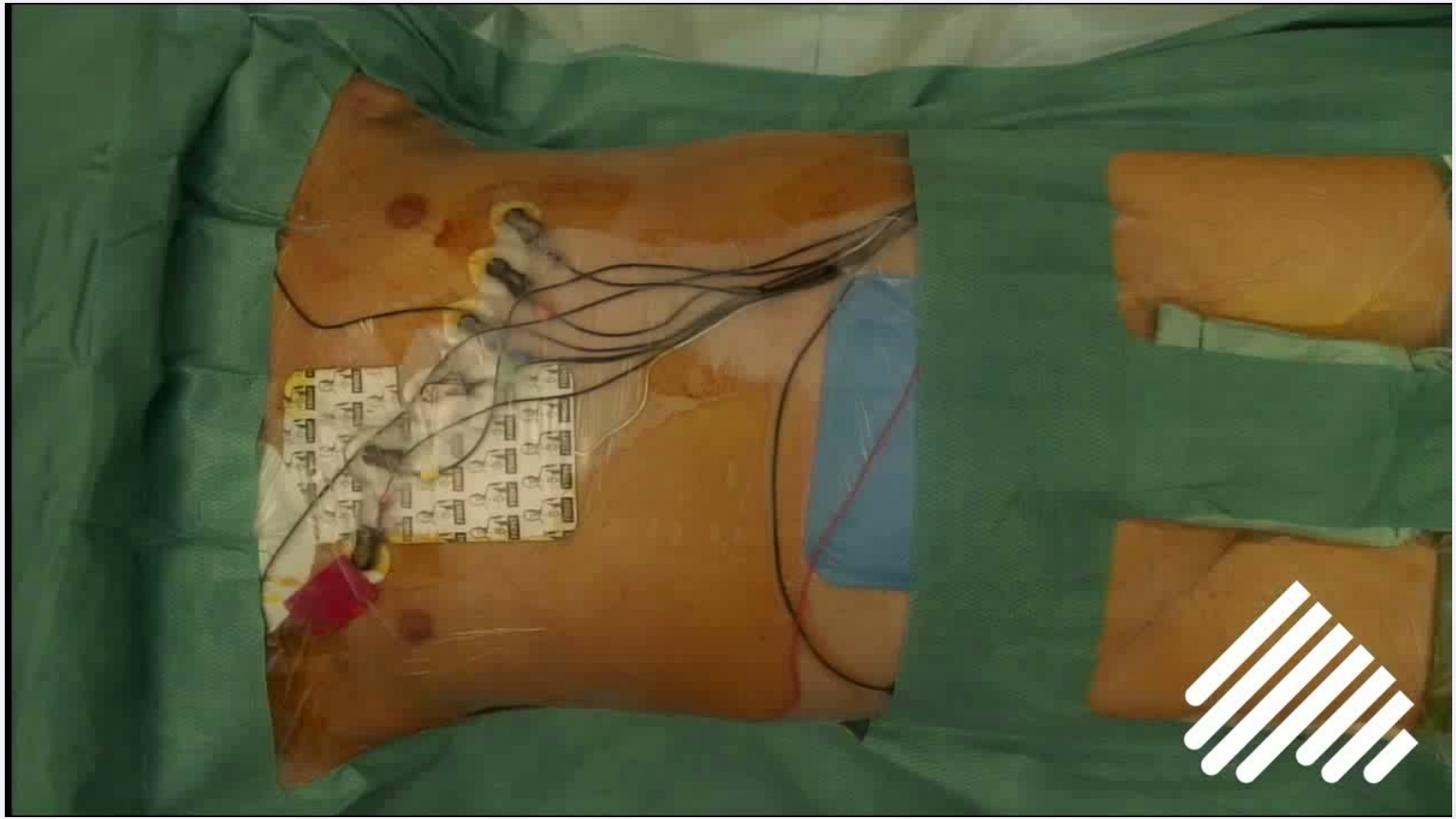
Atrial fibrilation – cryo MAZE



Atrial fibrilation – radiofrequency MAZE



Thoracoscopic MAZE procedure



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