Отделение по
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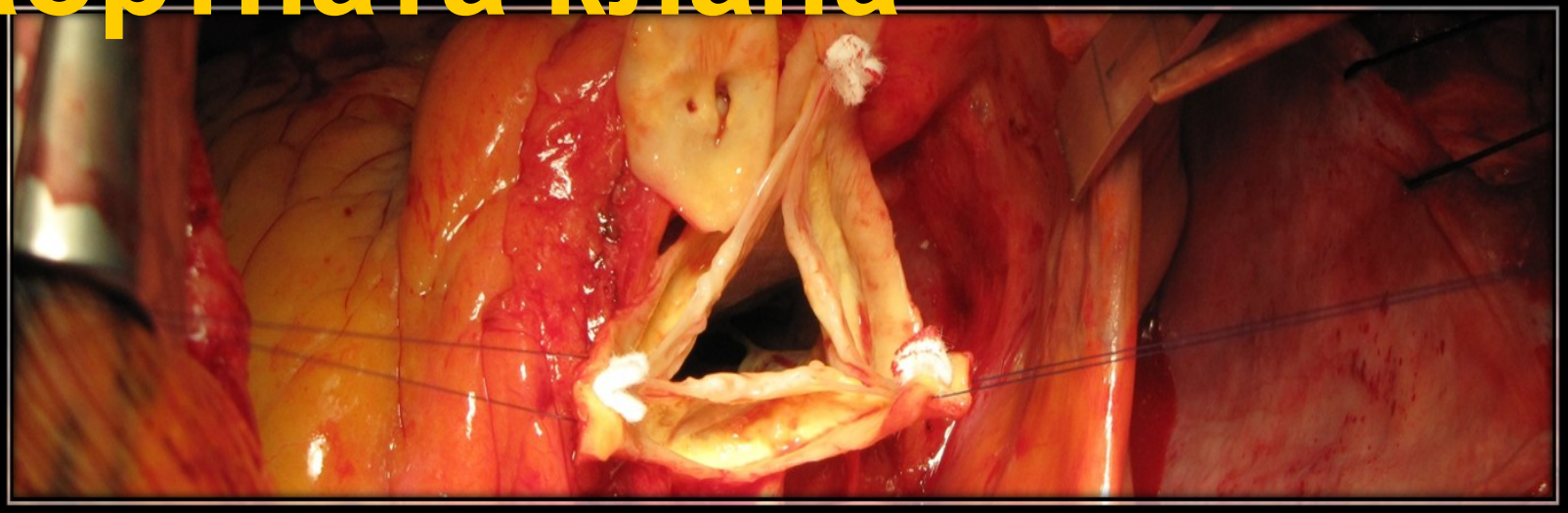
Варна, България

Заболявания на аортната клапа



Гледната точка на хирурга

амен Панайотов, FETCS
ение по Кардиохирургия
„Света Марина”
, България

“If there is any one secret of success, it lies in the ability to get the other person’s point of view and see things from that person’s angle as well as from your own.”

Henry Ford
1863 - 1947

Анатомия

Отделение по
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Surgical Anatomy of the Heart Valves

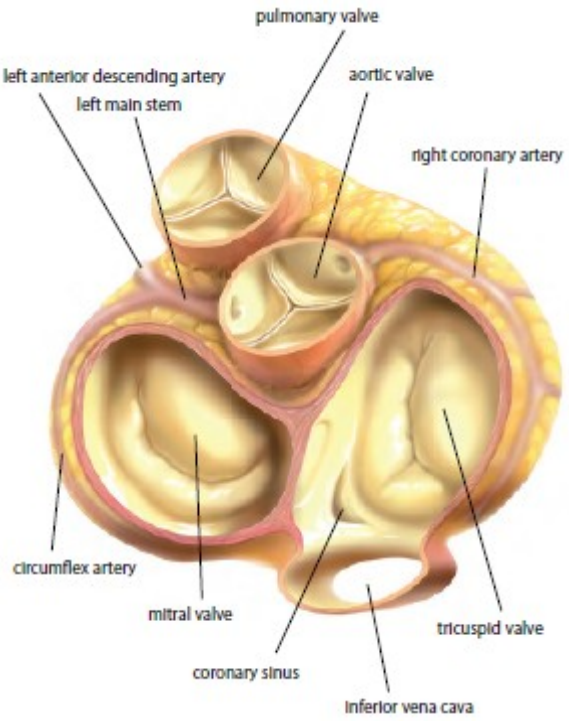

Fig. 2.1 Topographic interrelations of the heart valves

Surgical Anatomy of the Heart Valves

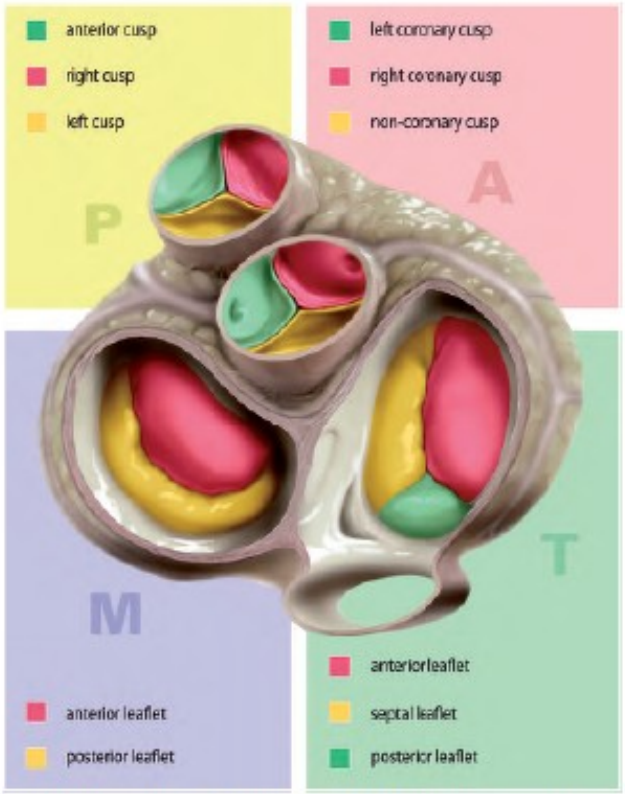

Fig. 2.2 Terminology of the valve cusps and leaflets. *P* pulmonary, *A* aortic, *M* mitral, *T* tricuspid

Анатомия

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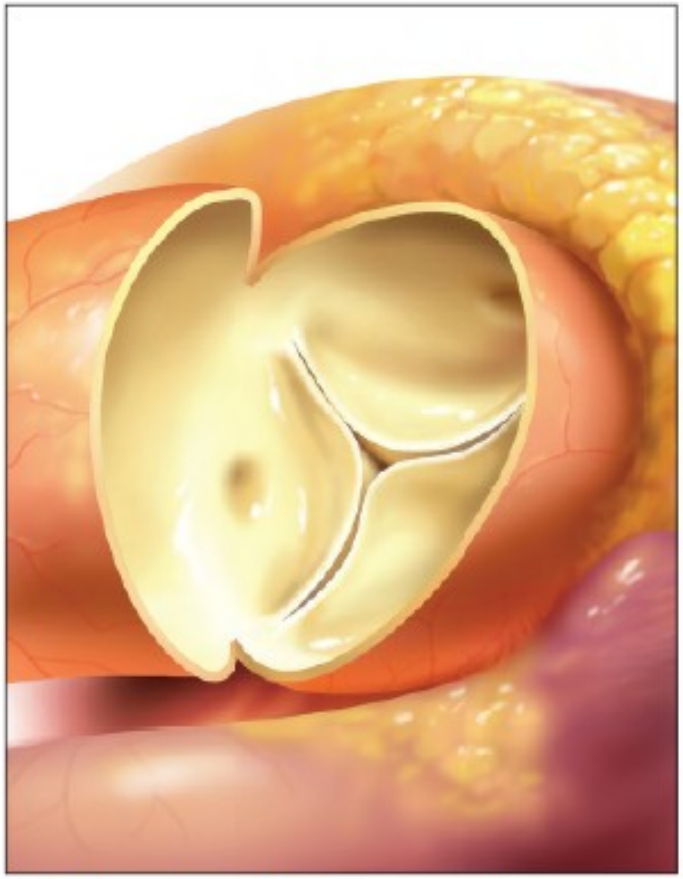

Fig. 2.3 Aortic valve viewed from transverse aortotomy

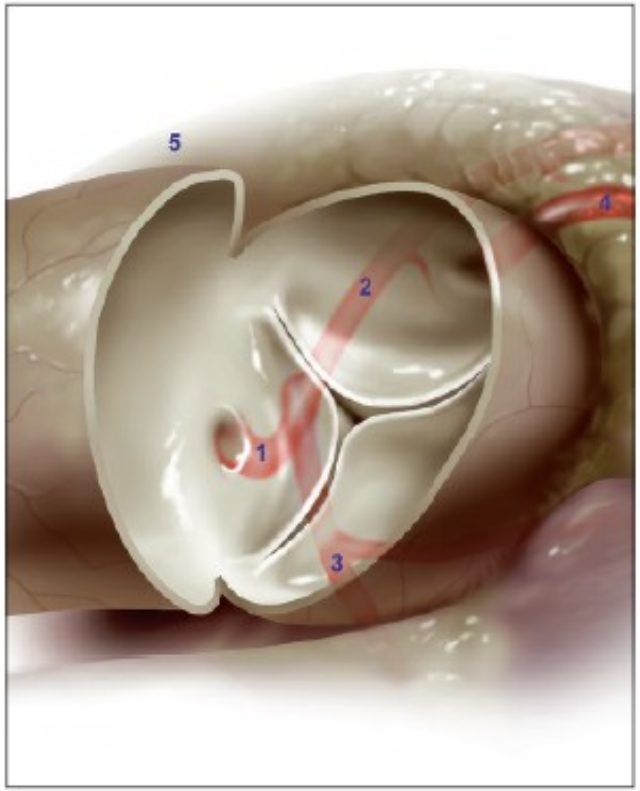

Fig. 2.4 Relation of the aortic valve to the coronary ostia. *1* Left main stem, *2* left anterior descending artery, *3* circumflex artery, *4* right coronary artery, *5* pulmonary artery trunk

Анатомия

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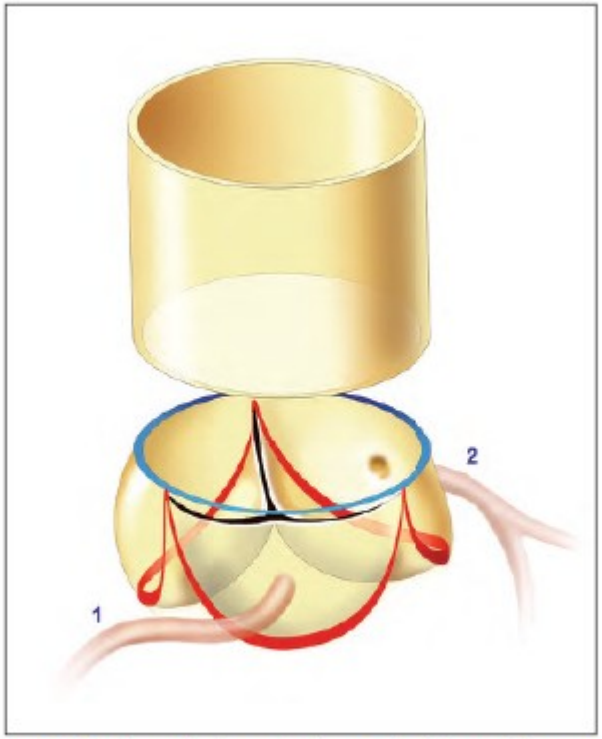

Fig. 2.5 Aortic root. *Red curve* attachment of aortic cusps, *blue curve* sinotubular junction, *1* right coronary artery, *2* left coronary artery

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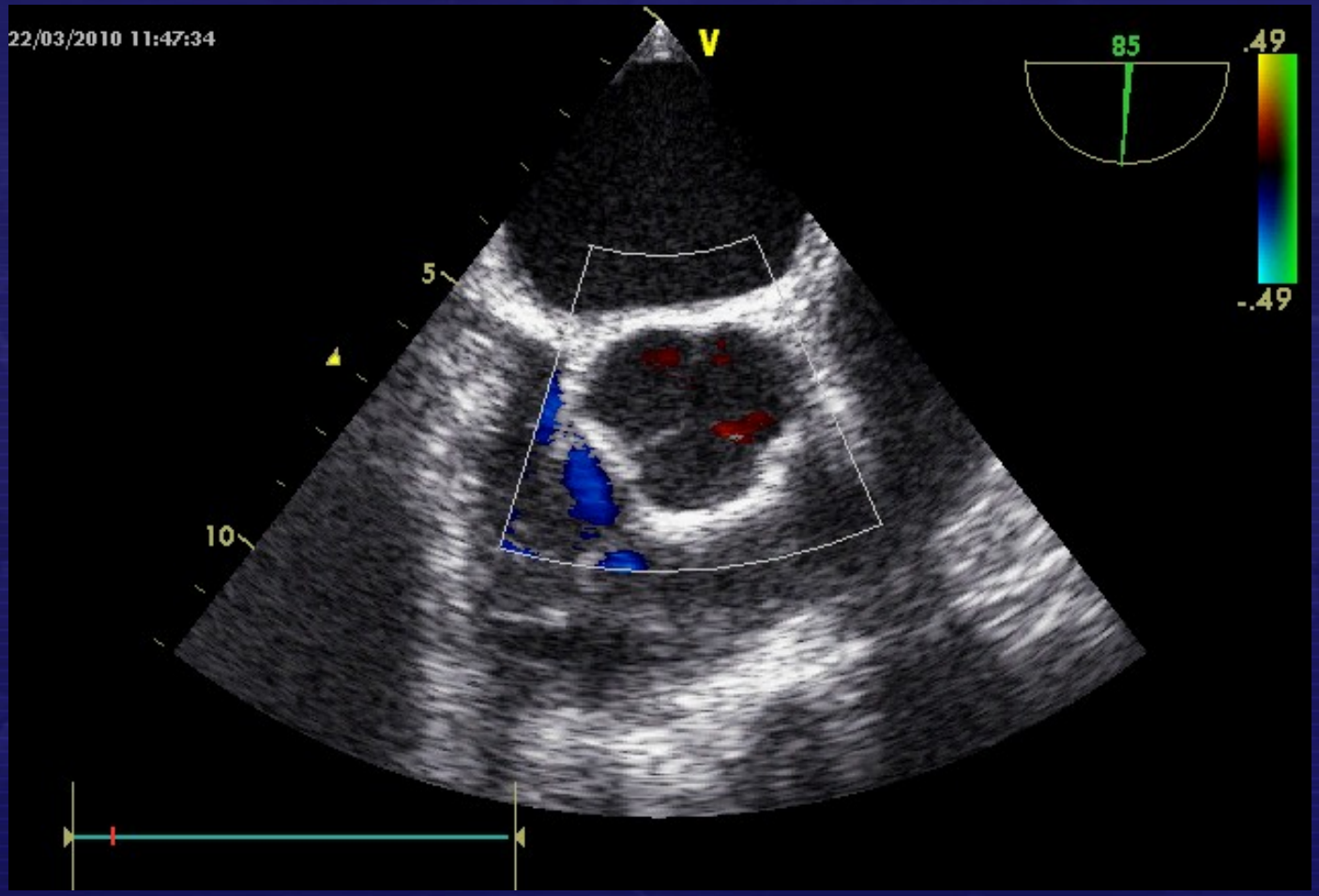
Ехографско изображение на нормална трикуспидна аортна клапа



Предоперативна оценка
Какво трябва да знае хирургът?

- Платна – брой, конфигурация (ако не е трикуспидна), пролапс? перфорация? калцификати?
- Клапен отвор (анулус) – размери, уравнението за продължителноста, калцификати?
- Аортен корен – размери, причина за AR, необходимост от реконструкция на аортния корен, калцификати?
- Възходяща аорта – размери, налага ли се протезиране, калцификати?

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Предоперативна оценка
Какво трябва да знае хирургът?

- LVOT (left ventricular outflow tract) – подклапна стеноза? необходимост от миектомия?
- LV – размери, ФИ %, хипертрофия, стеноза тип low-flow, low-gradient
- Увеличени скорости на кръвотока през аортната клапа

Образна диагностика

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- Цел – пълно и подробно уточняване на определена патология
- TTE – ключов метод за поставяне на диагноза, определяне степен/тежест и прогноза
- TEE – когато TTE е неубедителна или когато се подозира тромбоза, протезна дисфункция или ендокардит
- CT, MRI

Нормални размери на аортата във различните сегменти

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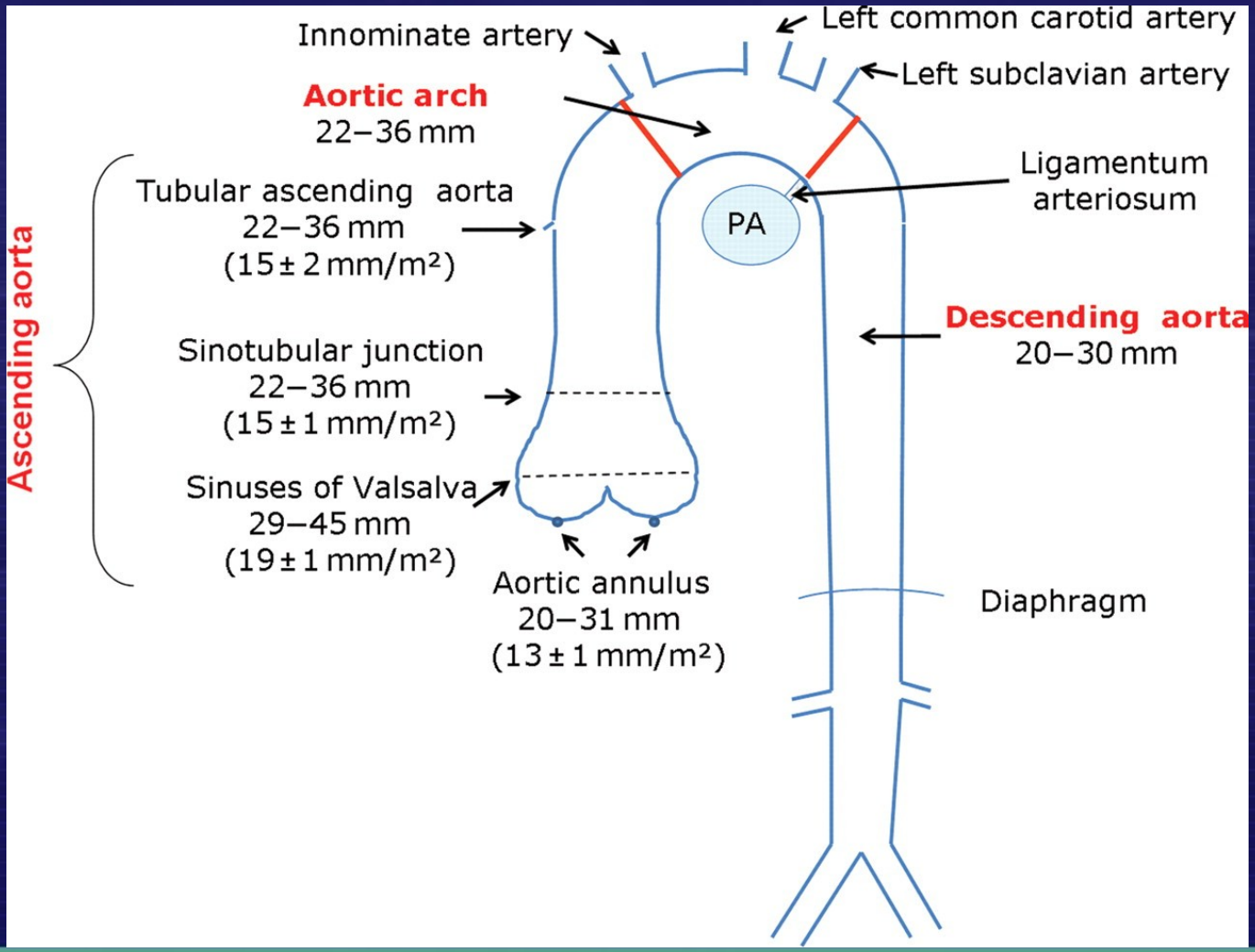

European Journal of Echocardiography

Нормални размери на структурите на аортния корен (Feigenbaum), представени ехографски (Schafers)

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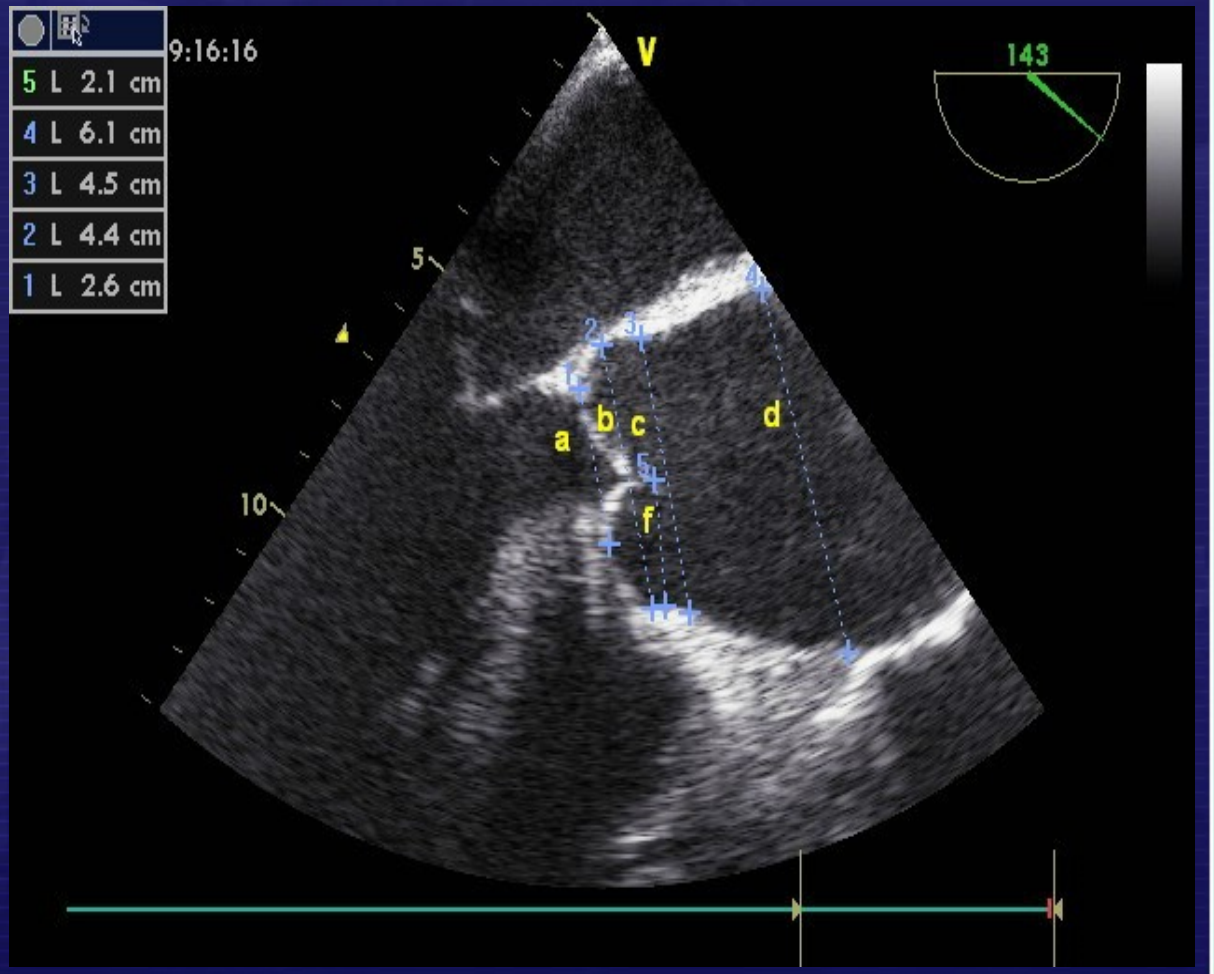
	TEE	Size (mm) / Schafers' indexes
a	AV junction/ Ao annulus	20 – 31 mm / ≤ 16 mm/m²
b	Sinuses of Valsalva	29 – 45 mm / ≤ 21mm/m²
c	Sinutubular junction	22 – 36 mm / ≤ 19 mm/m²
d	Ascending Ao	22 – 36 mm / 15 ±2 mm/m²
e	Sinuses of Valsalva height	22,4 ± 4.2 mm
f	Coaptation line-to-aortic wall	Служи за сравнение на симетричността на SV



Нормални размери на структурите на аортния корен (Feigenbaum), представени ехографски (Schafers)

Отделение по Кардиохирургия
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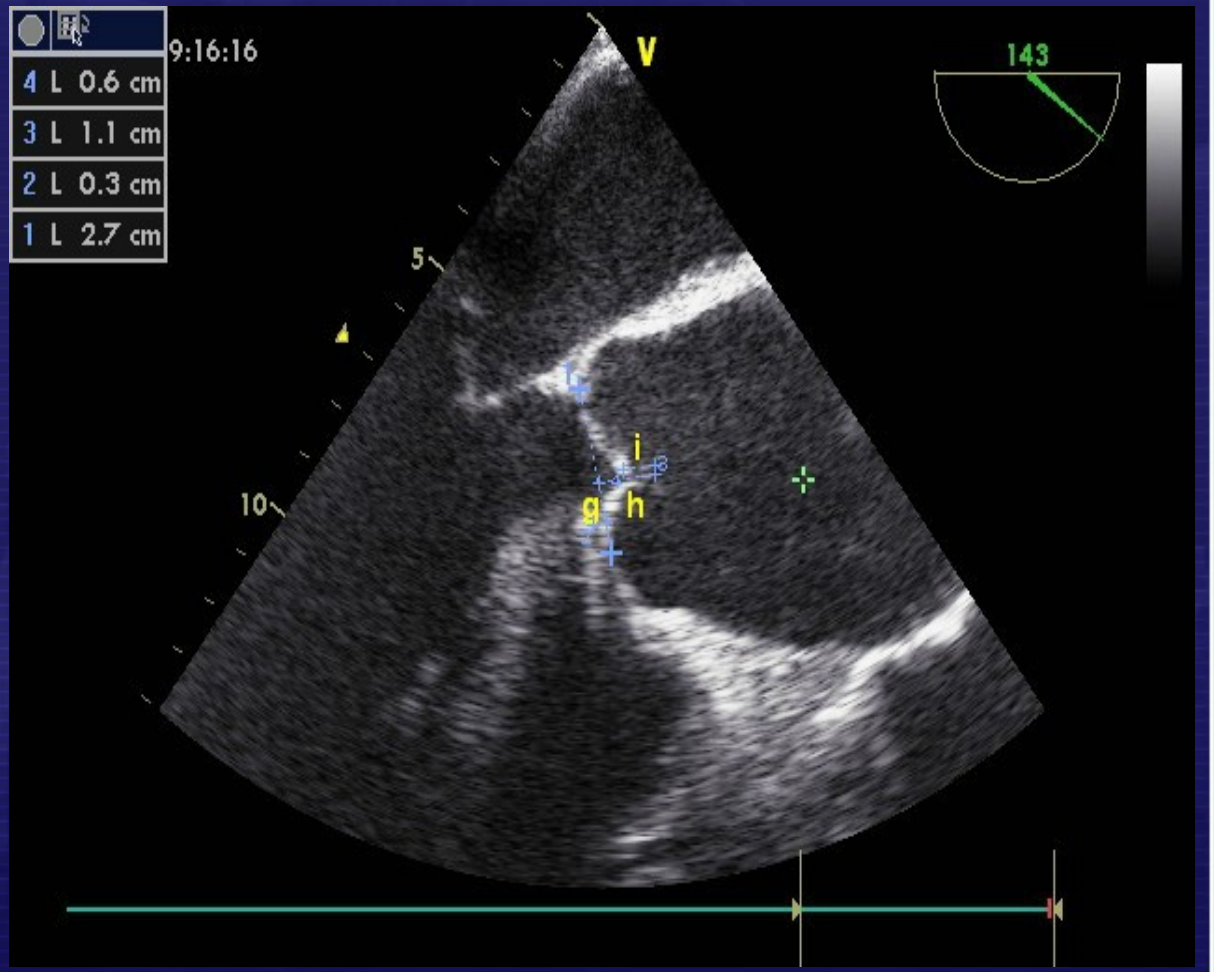
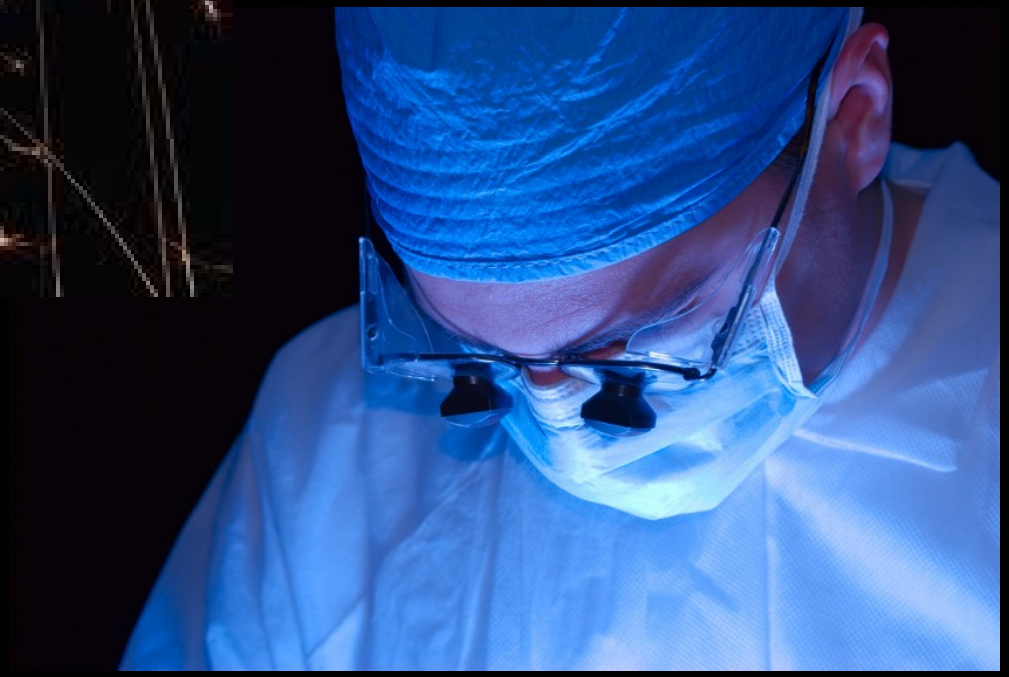
	TEE	Size (mm) / Schafers' indexes
g	Prolapsing part of lowest prolapsing leaflet	Normally 0
h	eH (Effective hight)	7 – 12 mm / 9 – 10 mm/m2
i	Coaptation length	4 – 5 mm
Additional criteria:		
	VC (vena contracta)	0
	Excentric regurgitation jet	Defined by the α angle





① Има ли показания за клапна хирургия?

② Коя е най-подходящата интервенция?

European Heart Journal (2012) 33, 2451–2496
doi:10.1093/eurheartj/ehs109

ESC/EACTS GUIDELINES

EUROPEAN SOCIETY OF CARDIOLOGY®

2012

Guidelines on the management of valvular heart disease (version 2012)

The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

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Ехокардиографски критерии за дефиниране на тежка клапна стеноза

Отделение по
Кардиохирургия
МБАЛ „Света Марина”
Варна, България

Table 4 Echocardiographic criteria for the definition of severe valve stenosis: an integrative approach

	Aortic stenosis	Mitral stenosis	Tricuspid stenosis
Valve area (cm^2)	<1.0	<1.0	–
Indexed valve area (cm^2/m^2 BSA)	<0.6	–	–
Mean gradient (mmHg)	>40[a]	>10[b]	≥5
Maximum jet velocity (m/s)	>4.0[a]	–	–
Velocity ratio	<0.25	–	–

BSA = body surface area.
[a]In patients with normal cardiac output/transvalvular flow.
[b]Useful in patients in sinus rhythm, to be interpreted according to heart rate.
Adapted from Baumgartner *et al.*[15]

Ехокардиографски критерии за дефиниране на тежка клапна инс

Table 5 Echocardiographic criteria for the definition of severe valve regurgitation: an integrative approach

	Aortic regurgitation	Mitral regurgitation		Tricuspid regurgitation
Qualitative				
Valve morphology	Abnormal/flail/large coaptation defect	Flail leaflet/ruptured papillary muscle/ large coaptation defect		Abnormal/flail/large coaptation defect
Colour flow regurgitant jet	Large in central jets, variable in eccentric jets[a]	Very large central jet or eccentric jet adhering, swirling, and reaching the posterior wall of the left atrium		Very large central jet or eccentric wall impinging jet[a]
CW signal of regurgitant jet	Dense	Dense/triangular		Dense/triangular with early peaking (peak <2 m/s in massive TR)
Other	Holodiastolic flow reversal in descending aorta (EDV >20 cm/s)	Large flow convergence zone[a]		–
Semiquantitative				
Vena contracta width (mm)	>6	≥7 (>8 for biplane)[b]		≥7[a]
Upstream vein flow[c]	–	Systolic pulmonary vein flow reversal		Systolic hepatic vein flow reversal
Inflow	–	E-wave dominant ≥1.5 m/s[d]		E-wave dominant ≥1 m/s[e]
Other	Pressure half-time <200 ms[f]	TVI mitral/TVI aortic >1.4		PISA radius >9 mm[g]
Quantitative		Primary	Secondary[h]	
EROA (mm²)	≥30	≥40	≥20	≥40
R Vol (ml/beat)	≥60	≥60	≥30	≥45
+ enlargement of cardiac chambers/vessels	LV	LV, LA		RV, RA, inferior vena cava

CW = continuous wave; EDV = end-diastolic velocity; EROA = effective regurgitant orifice area; LA = left atrium; LV = left ventricle; PISA = proximal isovelocity surface area; RA = right atrium; RV = right ventricle; R Vol = regurgitant volume; TR = tricuspid regurgitation; TVI = time–velocity integral.

[a]At a Nyquist limit of 50–60 cm/s.

[b]For average between apical four- and two-chamber views.

[c]Unless other reasons for systolic blunting (atrial fibrillation, elevated atrial pressure).

[d]In the absence of other causes of elevated left atrial pressure and of mitral stenosis.

[e]In the absence of other causes of elevated right atrial pressure.

[f]Pressure half-time is shortened with increasing left ventricular diastolic pressure, vasodilator therapy, and in patients with a dilated compliant aorta, or lengthened in chronic aortic regurgitation.

[g]Baseline Nyquist limit shift of 28 cm/s.

[h]Different thresholds are used in secondary MR where an EROA >20mm² and regurgitant volume >30 ml identify a subset of patients at increased risk of cardiac events.

Adapted from Lancellotti *et al.*[16,17]

При оценка на един пациент за клапна операция е необходимо да отговорим на следните въпроси

Table 3 Essential questions in the evaluation of a patient for valvular intervention

• Is valvular heart disease severe?
• Does the patient have symptoms?
• Are symptoms related to valvular disease?
• What are patient life expectancy[a] and expected quality of life?
• Do the expected benefits of intervention (vs. spontaneous outcome) outweigh its risks?
• What are the patient's wishes?
• Are local resources optimal for planned intervention?

[a]Life expectancy should be estimated according to age, gender, comorbidities and country-specific life expectancy.

- Каква е тежестта на клапната патология?
- Дали пациентът има симптоми (оплаквания)?
- Оплакванията свързани ли са с клапната патология?
- Каква е очакваната продължителност на живота и очакваното качество на живот на пациента?
- Отношение полза/риск от самата операция?
- Какво е желанието на пациента?
- Самооценка на собствения ни опит и възможности

Table 8 Indications for surgery in (A) severe aortic regurgitation and (B) aortic root disease (whatever the severity of aortic regurgitation)

	Class [a]	Level [b]	Ref [c]
A. Indications for surgery in severe aortic regurgitation			
Surgery is indicated in symptomatic patients.	I	B	59
Surgery is indicated in asymptomatic patients with resting LVEF ≤50%.	I	B	71
Surgery is indicated in patients undergoing CABG or surgery of ascending aorta, or on another valve.	I	C	
Surgery should be considered in asymptomatic patients with resting EF >50% with severe LV dilatation: LVEDD >70 mm, or LVESD >50 mm or LVESD >25 mm/m^2 BSA.[d]	IIa	C	
B. Indications for surgery in aortic root disease (whatever the severity of AR)			
Surgery is indicated in patients who have aortic root disease with maximal ascending aortic diameter[e] ≥50 mm for patients with Marfan syndrome.	I	C	
Surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter: ≥45 mm for patients with Marfan syndrome with risk factors[f] ≥50 mm for patients with bicuspid valve with risk factors[g] ≥55 mm for other patients	IIa	C	

AR = aortic regurgitation; BSA = body surface area; CABG = coronary artery bypass grafting; EF = ejection fraction; LV = left ventricular; LVEDD = left ventricular end-diastolic diameter; LVESD = left ventricular end-systolic diameter.

[a]Class of recommendation.

[b]Level of evidence.

[c]Reference(s) supporting class I (A + B) and IIa + IIb (A + B) recommendations.

[d]Changes in sequential measurements should be taken into account.

[e]Decision should also take into account the shape of the different parts of the aorta. Lower thresholds can be used for combining surgery on the ascending aorta for patients who have an indication for surgery on the aortic valve.

[f]Family history of aortic dissection and/or aortic size increase >2 mm/year (on repeated measurements using the same imaging technique, measured at the same aorta level with side-by-side comparison and confirmed by another technique), severe AR or mitral regurgitation, desire of pregnancy.

[g]Coarctation of the aorta, systemic hypertension, family history of dissection or increase in aortic diameter >2 mm/year (on repeated measurements using the same imaging technique, measured at the same aorta level with side-by-side comparison and confirmed by another technique).

Отделение по
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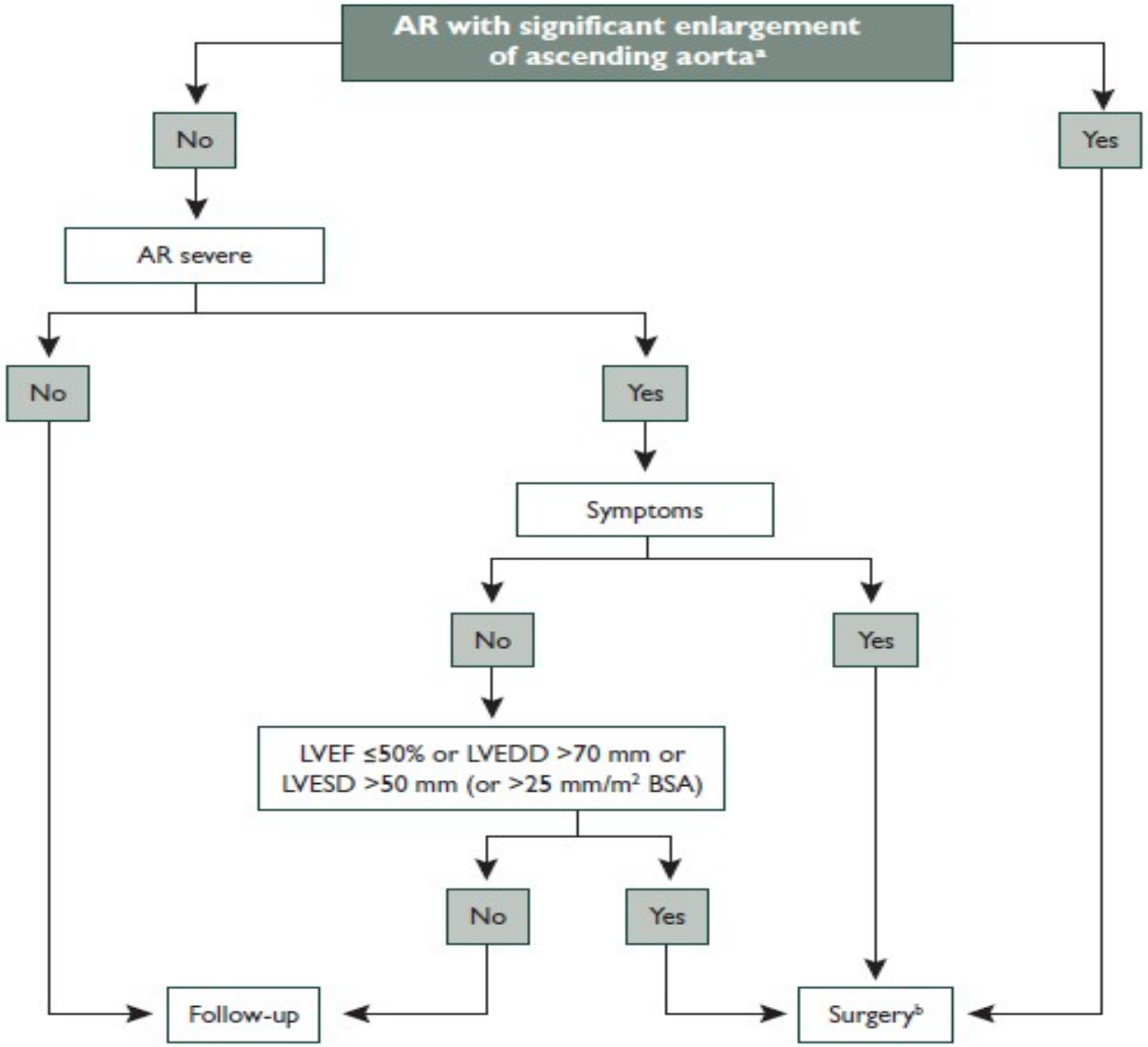
Показания за оперативно лечение при тежка аортна регургитация:

	Клас	Ниво
A. Показания за операция при тежка аортна регургитация		
Операцията е показана при симптомни пациенти.	I	B
Операцията е показана при асимптомни пациенти с LVEF ≤ 50%	I	B
Операцията е показана при пациенти на които им предстои CABG или хирургия на възходяща аорта, или на друга клапа.	I	C
Операция трябва да се обмисли при безсимптомни пациенти с LVEF > 50% и изразена ЛК дилатация LVEDD > 70mm, или LVESD > 50mm или LVESD > 25 mm/m² BSA.	IIa	C
B. Показания за операция при заболявания на аортния корен (без значение степента на АР)		
Операцията е показана при пациенти със заболяване на аортния корен с максимален диаметър на възходящата аорта ≥ 50мм при синдром на Марфан	I	C
Операция трябва да се обмисли при пациенти със заболяване на аортния корен с максимален диаметър на възходящата аорта: ≥ 45mm при болни със синдром на Марфан и други рискови фактори ≥ 50mm при пациенти с бикуспидна клапа и други рискови фактори ≥ 55mm за останалите пациенти	IIa	C



AR = aortic regurgitation; BSA = body surface area; LVEDD = left ventricular end-diastolic diameter; LVEF = left ventricular ejection fraction; LVESD = left ventricular end-systolic diameter.

[a]See *Table 8* for definition.

[b]Surgery must also be considered if significant changes in LV or aortic size occur during follow-up.

Figure 1 Management of aortic regurgitation.

Table 9 Indications for aortic valve replacement in aortic stenosis

	Class[a]	Level[b]	Ref[c]
AVR is indicated in patients with severe AS and any symptoms related to AS.	I	B	12, 89, 94
AVR is indicated in patients with severe AS undergoing CABG, surgery of the ascending aorta or another valve.	I	C	
AVR is indicated in asymptomatic patients with severe AS and systolic LV dysfunction (LVEF <50%) not due to another cause.	I	C	
AVR is indicated in asymptomatic patients with severe AS and abnormal exercise test showing symptoms on exercise clearly related to AS.	I	C	
AVR should be considered in high risk patients with severe symptomatic AS who are suitable for TAVI, but in whom surgery is favoured by a 'heart team' based on the individual risk profile and anatomic suitability.	IIa	B	97
AVR should be considered in asymptomatic patients with severe AS and abnormal exercise test showing fall in blood pressure below baseline.	IIa	C	
AVR should be considered in patients with moderate AS[d] undergoing CABG, surgery of the ascending aorta or another valve.	IIa	C	
AVR should be considered in symptomatic patients with low flow, low gradient (<40 mmHg) AS with normal EF only after careful confirmation of severe AS.[e]	IIa	C	
AVR should be considered in symptomatic patients with severe AS, low flow, low gradient with reduced EF, and evidence of flow reserve.[f]	IIa	C	
AVR should be considered in asymptomatic patients, with normal EF and none of the above mentioned exercise test abnormalities, if the surgical risk is low, and one or more of the following findings is present: • Very severe AS defined by a peak transvalvular velocity >5.5 m/s or, • Severe valve calcification and a rate of peak transvalvular velocity progression ≥0.3 m/s per year.	IIa	C	
AVR may be considered in symptomatic patients with severe AS low flow, low gradient, and LV dysfunction without flow reserve.[f]	IIb	C	
AVR may be considered in asymptomatic patients with severe AS, normal EF and none of the above mentioned exercise test abnormalities, if surgical risk is low, and one or more of the following findings is present: • Markedly elevated natriuretic peptide levels confirmed by repeated measurements and without other explanations • Increase of mean pressure gradient with exercise by >20 mmHg • Excessive LV hypertrophy in the absence of hypertension.	IIb	C	

AS = aortic stenosis; AVR = aortic valve replacement; BSA = body surface area; CABG = coronary artery bypass graft surgery; EF = ejection fraction; LV = left ventricular; LVEF = left ventricular ejection fraction; TAVI = transcatheter aortic valve implantation.

[a]Class of recommendation.

[b]Level of evidence.

[c]Reference(s) supporting class I (A + B) and IIa + IIb (A + B) recommendations.

[d]Moderate AS is defined as valve area 1.0–1.5 cm^2 (0.6 cm^2/m^2 to 0.9 cm^2/m^2 BSA) or mean aortic gradient 25–40 mmHg in the presence of normal flow conditions. However, clinical judgement is required.

[e]In patients with a small valve area but low gradient despite preserved LVEF, explanations for this finding (other than the presence of severe AS) are frequent and must be carefully excluded. See text (evaluation of AS).

[f]Also termed contractile reserve.

Тежест на аортната стеноза

Отделение по
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Варна, България

	Mild		Moderate		Severe	
	ESC	AHA	ESC	AHA	ESC	AHA
Valve area	>1.5 cm2 > 0.9 cm2/m2	>1.5 cm2	1.0 – 1.5 cm2 0.6 – 0.9 cm2/m2	1.0 – 1.5 cm2	< 1.0 cm2 < 0.6 cm2/m2	< 1.0 cm2
Mean gradient	< 30 mm Hg	< 25 mm Hg	30 – 40 mmHg	25 – 40 mm Hg	> 40 mm Hg	> 40 mm Hg

Отделение по
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Варна, България

Показания за смяна на аортната клапа (AVR) при тежка аортна стеноза

	Клас	Ниво
AVR е показана при тежка аортна стеноза която е симптоматична (оплаквания свързани със самото заболяване)	I	B
Операцията е показана при пациенти с тежка аортна стеноза на които им предстои CABG или хирургия на възходяща аорта, или на друга клапа.	I	C
Операцията е показана при асимптомни пациенти с тежка аортна стеноза и систолна левокамерна дисфункция LVEF ≤ 50%, която не е свързана с друга причина.	I	C
Операция е показана при пациенти с тежка аортна стеноза и абнормален тест с натоварване които показват симптоми при натоварване ясно свързани с аортната стеноза.	I	C
AVR трябва да се обмисля при високорискови пациенти с тежка аортна, подходящи за TAVI, при които обаче оперативното лечение се предпочита от “сърдечния екип” въз основа на оценка на индивидуалния риск и анатомични особености.	IIa	B
AVR трябва да се обмися при асимптомни пациенти с тежка аортна стеноза и абнормален тест с натоварване които при натоварване показват спадане на кръвното налягане под изходното ниво.	IIa	C
AVR трябва да се обмисля при пациенти с умерена аортна стеноза на на които им предстои CABG или хирургия на възходяща аорта, или на друга клапа.	IIa	C

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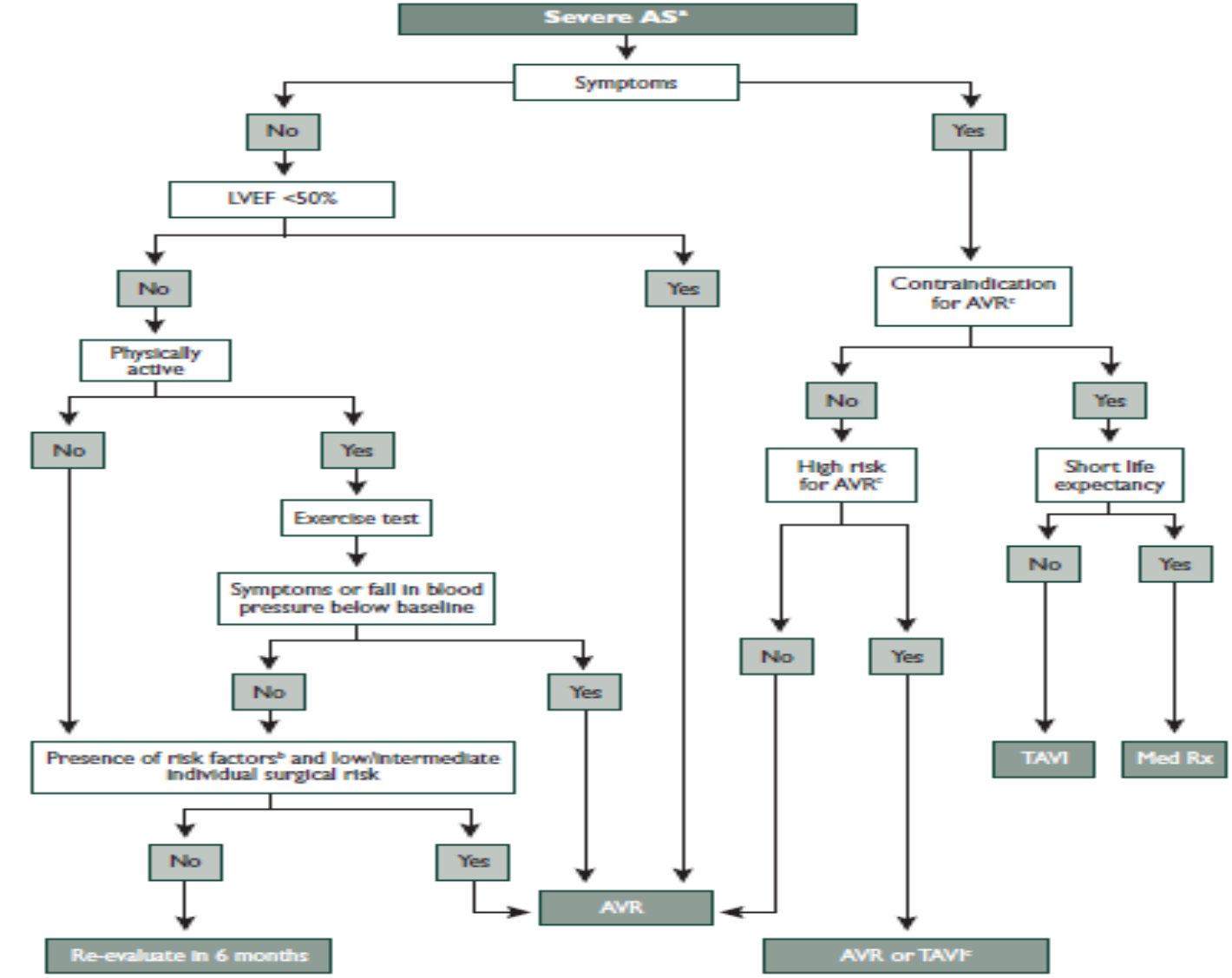
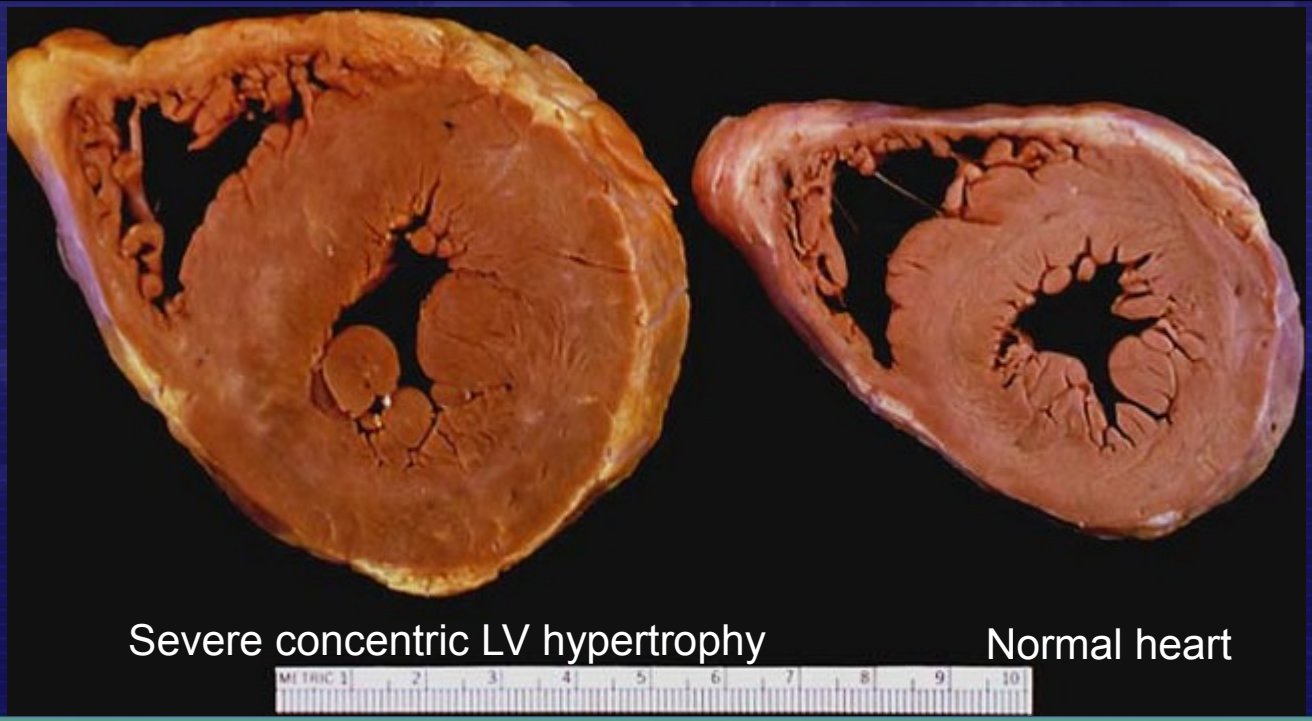
Показания за смяна на аортната клапа (AVR) при тежка аортна стеноза:

AVR трябва да се обмисля при симптомни пациенти с аортна стеноза тип low flow, low gradient(<40mmHg) и нормална фракция на изтласкване само след внимателно потвърждение на тежката аортна стеноза	IIa	C
AVR трябва да се обмисля при симптомни пациенти с тежка аортна стеноза тип low flow, low gradient и потисната фракция на изтласкване, със запазен контрактилен резерв.	IIa	C
AVR трябва да се обмисля при асимптомни пациенти със запазена фракция на изтласкване ако не са налични нито едно от отклоненията при теста с натоварване, споменати по-горе, ако оперативния риск е много нисък и е налично поне едно от следните условия: · Много тежка аортна стеноза, изразена чрез peak transvalvular velocity >5,5m/s, или · Силно изразена калциноза на клапата и прогресия на peak transvalvular velocity >0.3m/s за година.	IIa	C
AVR може да се обмисля при симптомни пациенти с тежка аортна стеноза тип low flow, low gradient и ЛК дисфункция, без функционален резерв.	IIb	C
AVR може да се обмисля при асимптомни пациенти със тежка аортна стеноза и запазена фракция на изтласкване ако не са налични нито едно от отклоненията при теста с натоварване, споменати по-горе, ако оперативния риск е много нисък и при наличие на поне едно от следните условия: • Увеличаване на нивата на атриалния натриуретичен пептид, установено чрез многократни изследвания и липса на друго обяснение за увеличаването им • Увеличаване на средния клапен градиент при натоварване с >20mmHg • Силно изразена ЛК хипертрофия при липса на хипертония	IIb	C



AS = aortic stenosis; AVR = aortic valve replacement; BSA = body surface area; LVEF = left ventricular ejection fraction; Med Rx = medical therapy; TAVI = transcatheter aortic valve implantation.
[a]See *Table 4* for definition of severe AS.
[b]Surgery should be considered (IIaC) if one of the following is present: peak velocity >5.5 m/s; severe valve calcification + peak velocity progression ≥0.3 m/s/year. Surgery may be considered (IIbC) if one of the following is present: markedly elevated natriuretic peptide levels; mean gradient increases with exercise >20 mmHg; excessive LV hypertrophy.
[c]The decision should be made by the 'heart team' according to individual clinical characteristics and anatomy.

Figure 2 Management of severe aortic stenosis. The management of patients with low gradient and low ejection fraction is detailed in the text.


Severe concentric LV hypertrophy
Normal heart

Уникуспидна клапа

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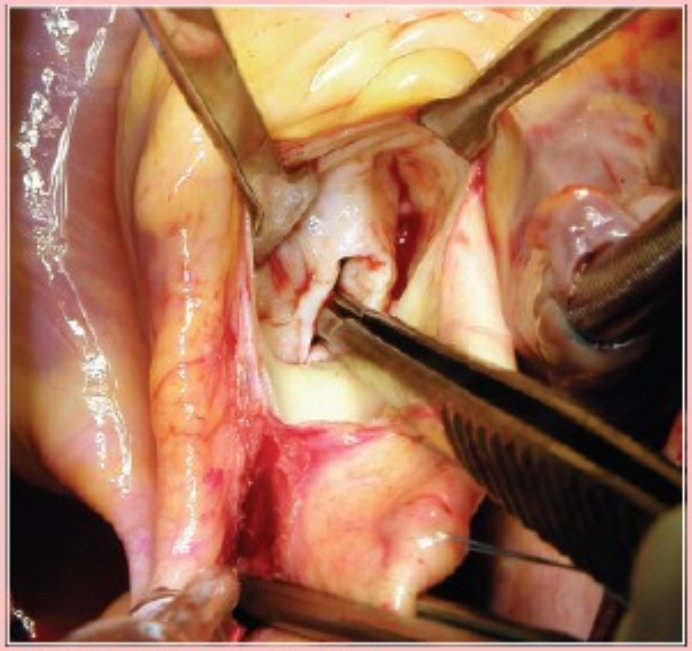

Fig. 5.1 Congenital unicuspid aortic valve

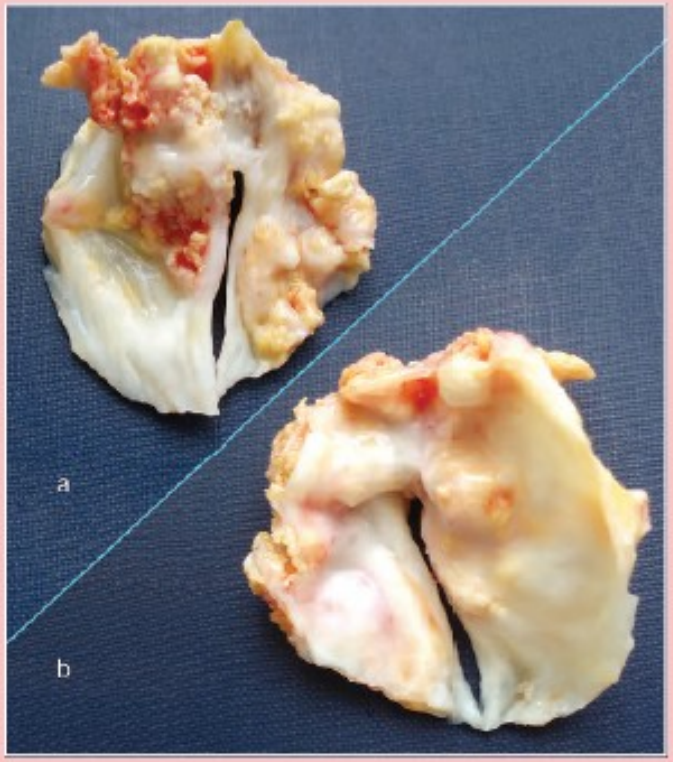

Fig. 5.2 Unicuspid unicommissural congenital aortic stenosis. Stenotic slit-like orifice and cusps penetrated by calcifications. **a** View from aorta. **b** View from left ventricle

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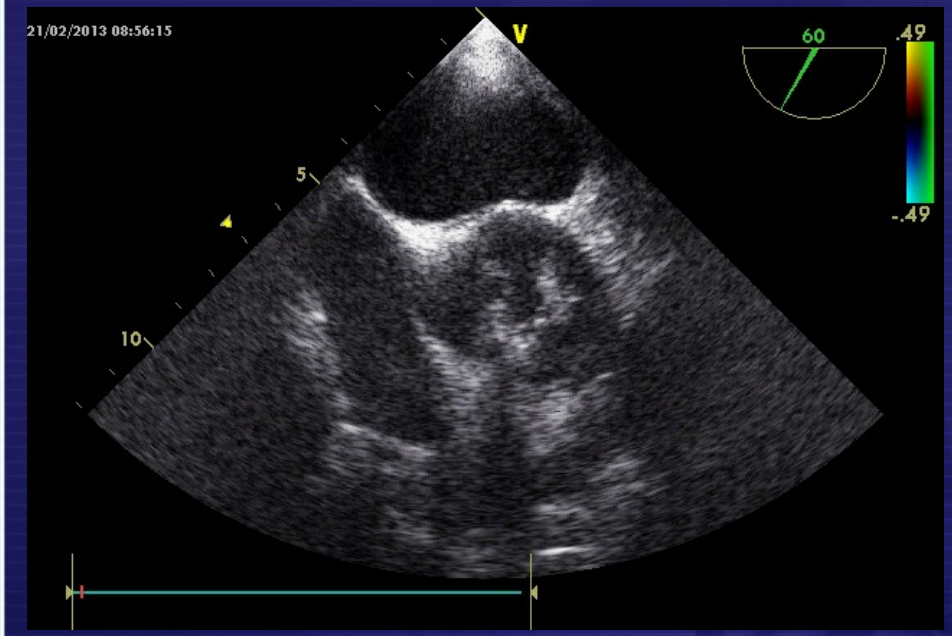
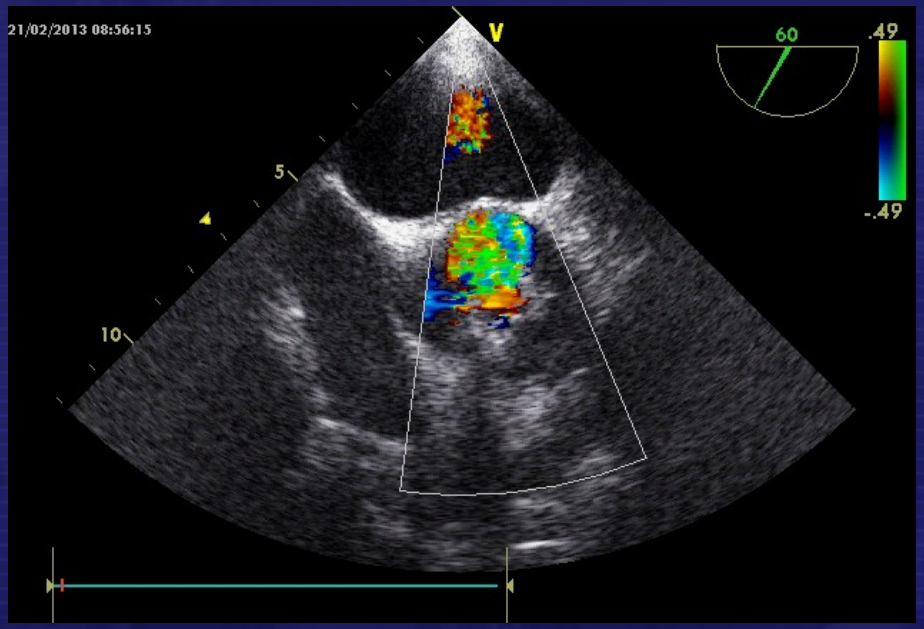
Ехографски образ на уникуспидна аортна клапа





Бикуспидна клапа

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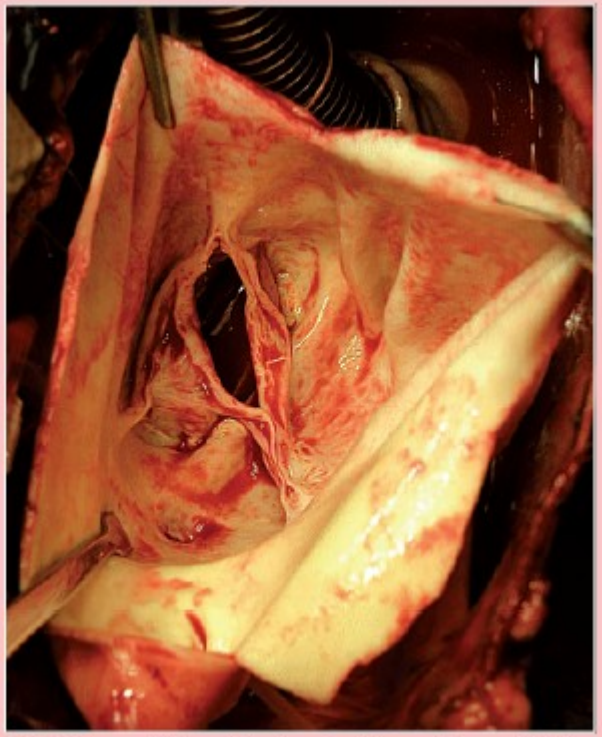

Fig. 5.3 Congenital bicuspid aortic valve with ascending aortic dilation

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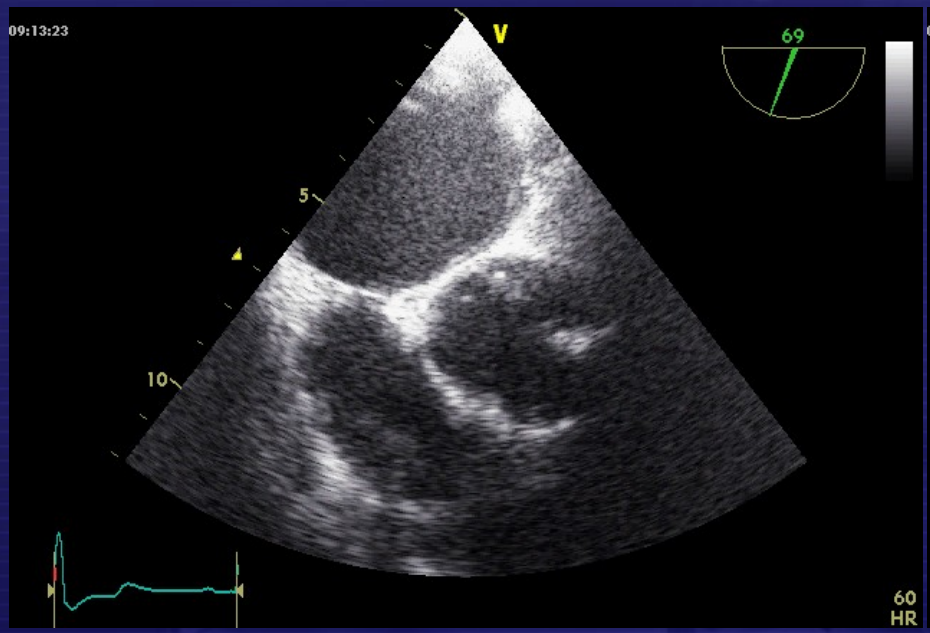
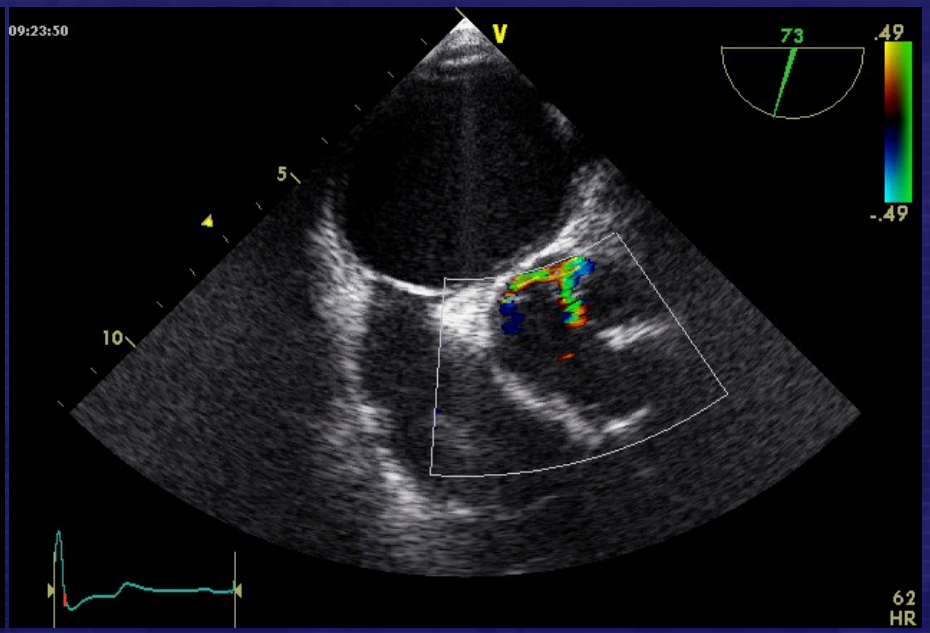
Ехографски образ на бикуспидна аортна клапа





Аортна клапа с калциноза

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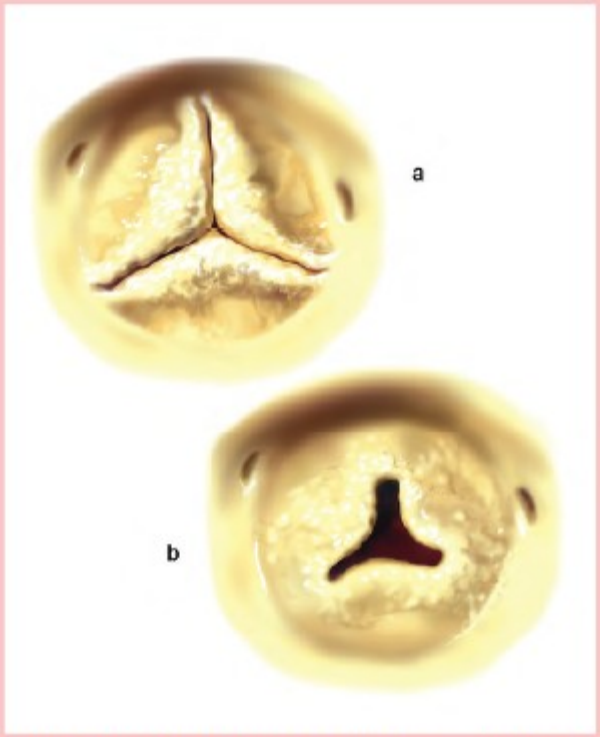

Fig. 5.4 Calcified aortic stenosis. **a** Degenerative etiology. **b** Rheumatic etiology

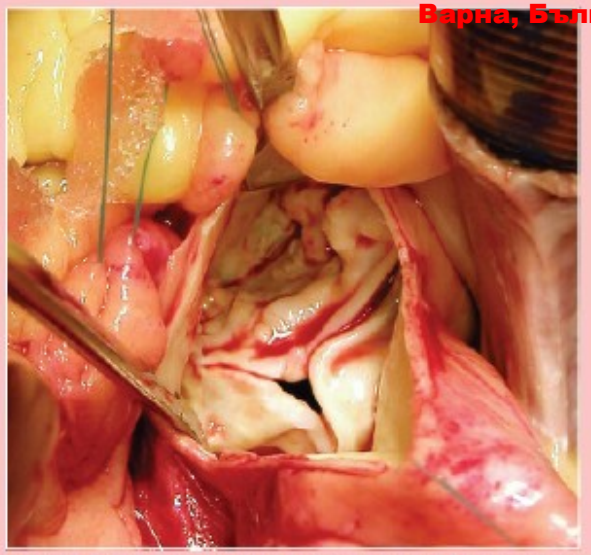

Fig. 5.5 Senile degenerative calcified aortic stenosis. Cusps penetrated by calcifications and commissures are not fused

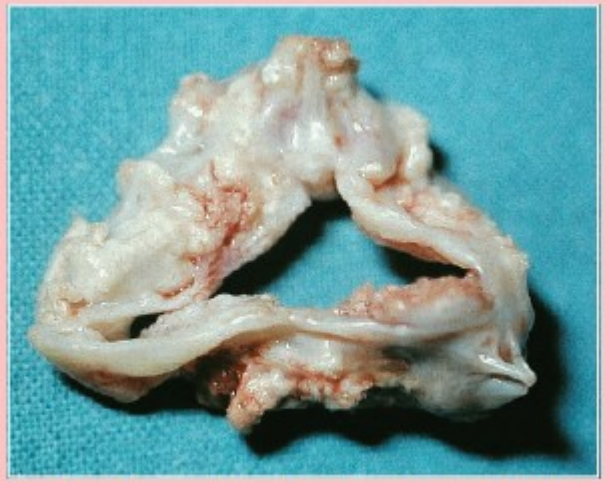

Fig. 5.6 Aortic valve excised for extensive calcifications in all cusps (degenerative etiology). Combined valve disease (stenosis and regurgitation)

Аортна клапа с калциноза

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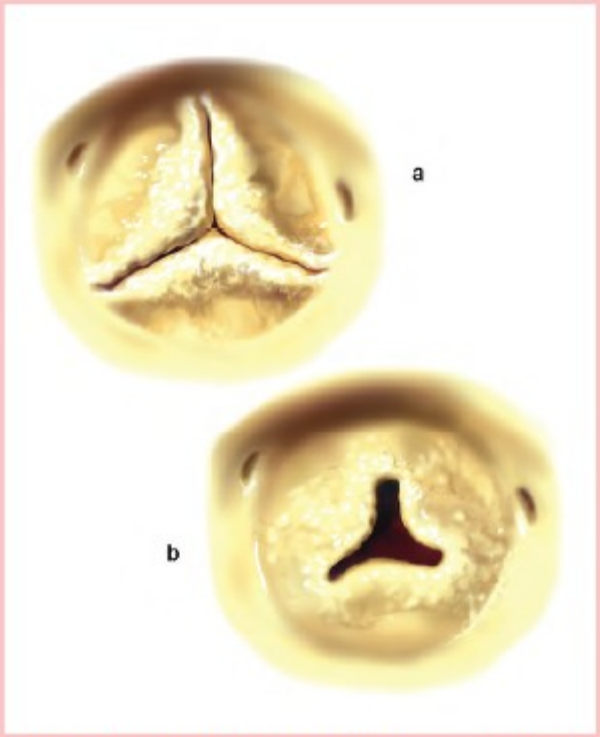

Fig. 5.4 Calcified aortic stenosis. **a** Degenerative etiology. **b** Rheumatic etiology

Fig. 5.7 Rheumatic aortic stenosis

Fig. 5.8 Aortic valve excised for rheumatic aortic valve disease. Dominance of stenosis and concomitant regurgitation through a narrow rigid orifice. Calcified cusps and fused commissures

Видове клапни протези

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I. Механични:
I.1Caged-ball

Fig. 3.4 Caged-ball valve Starr–Edwards (aortic model 1260)

Fig. 3.5 Caged-ball valve Smeloff–Cutter

Fig. 3.6 Cloth-covered caged-ball valve Braunwald–Cutter

Видове клапни протези

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I. Механични:
I.2 Disc valves (tilting-disc, monodisc)

Fig. 3.8 Non-tilting disc valves **a** Beall and **b** Starr–Edwards

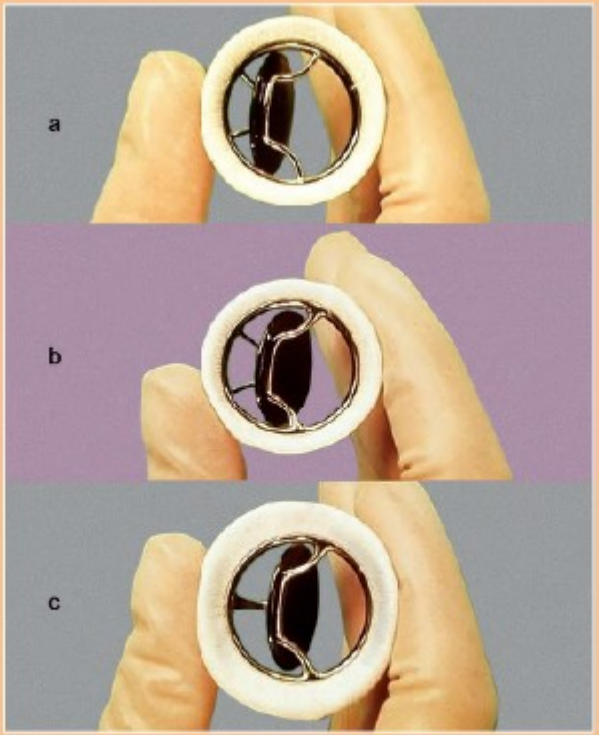

Fig. 3.9 Disc valve Björk–Shiley. **a** Standard type with flat disc. **b** Convex–concave type. **c** Monostrut

Видове клапни протези

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I. Механични:

I.3 Bileaflet valves

Fig. 3.12 Disc valve Medtronic–Hall

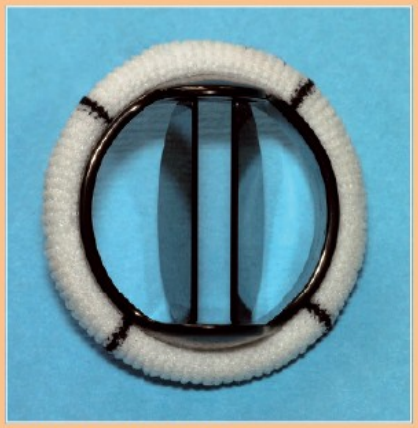

Fig. 3.13 Bileaflet valve St. Jude Medical

Fig. 3.14 Bileaflet valve Sorin–Bicarbon. **a** Slimline. **b** Overline

Видове клапни протези

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II. Биологични:
II.1 Stented

Fig. 3.18 Bioprosthesis Edwards–Perimount Magna

Fig. 3.16 Bioprosthesis St. Jude Medical–Epic

Fig. 3.15 Stents for bioprostheses

Видове клапни протези

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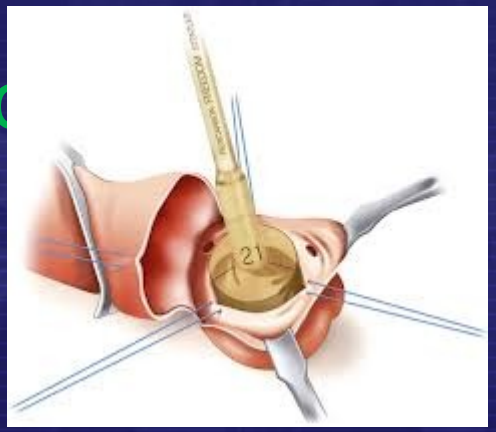
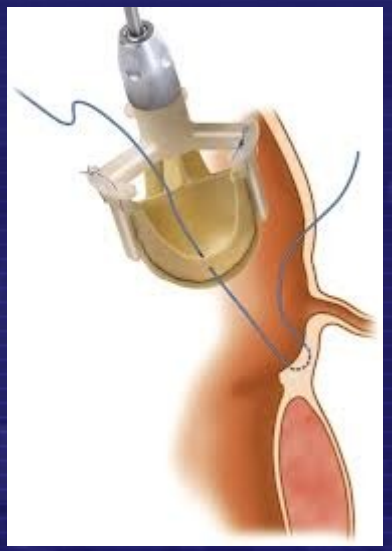
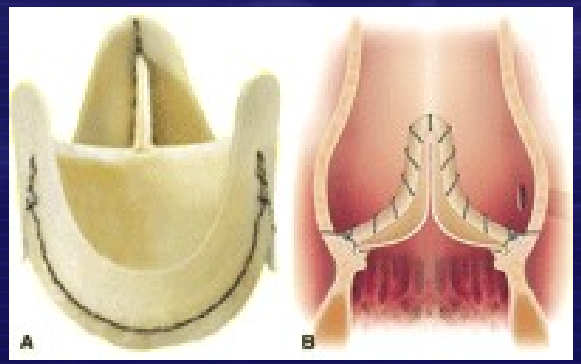
II. Биологични:

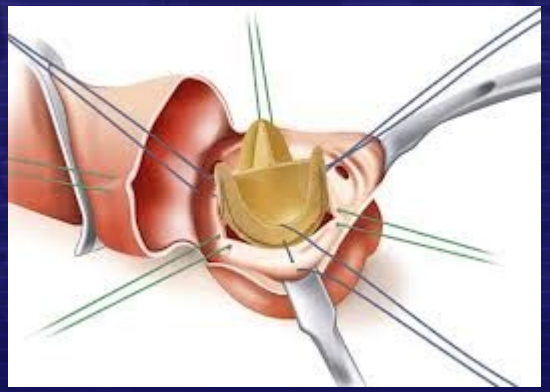
II.2 Stentless

Freedom Solo









Видове клапни протези

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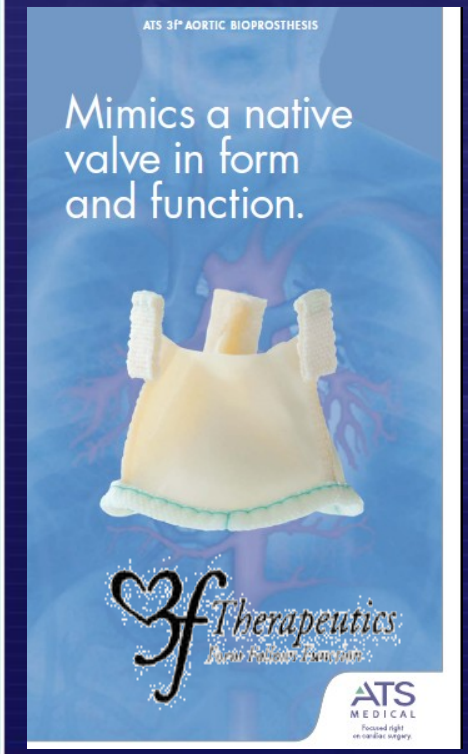
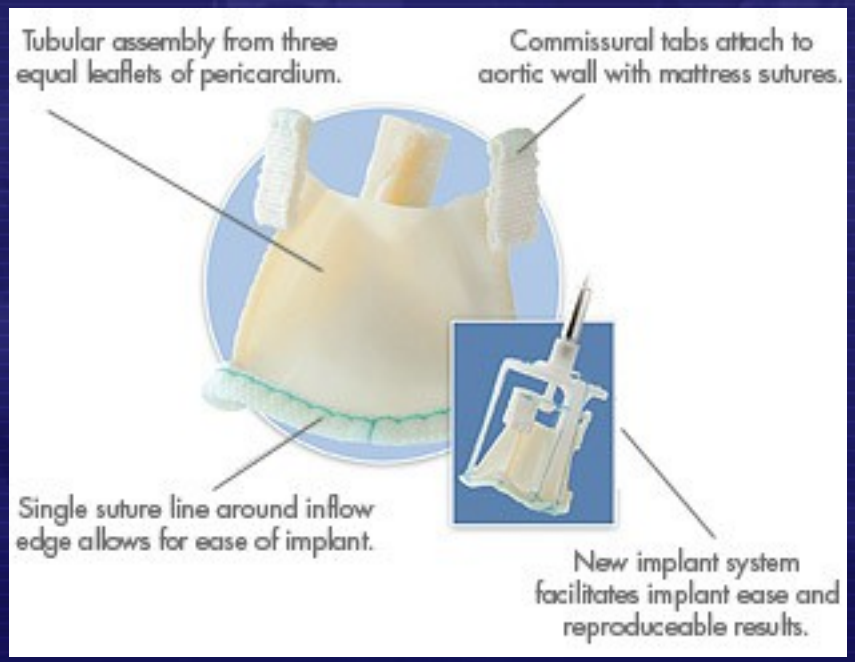
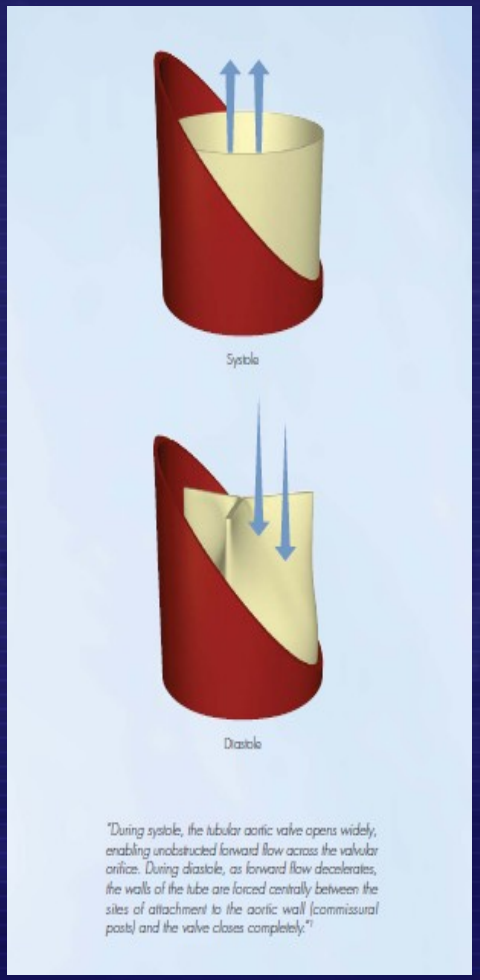
II. Биологични:

II.2 Stentless

3F







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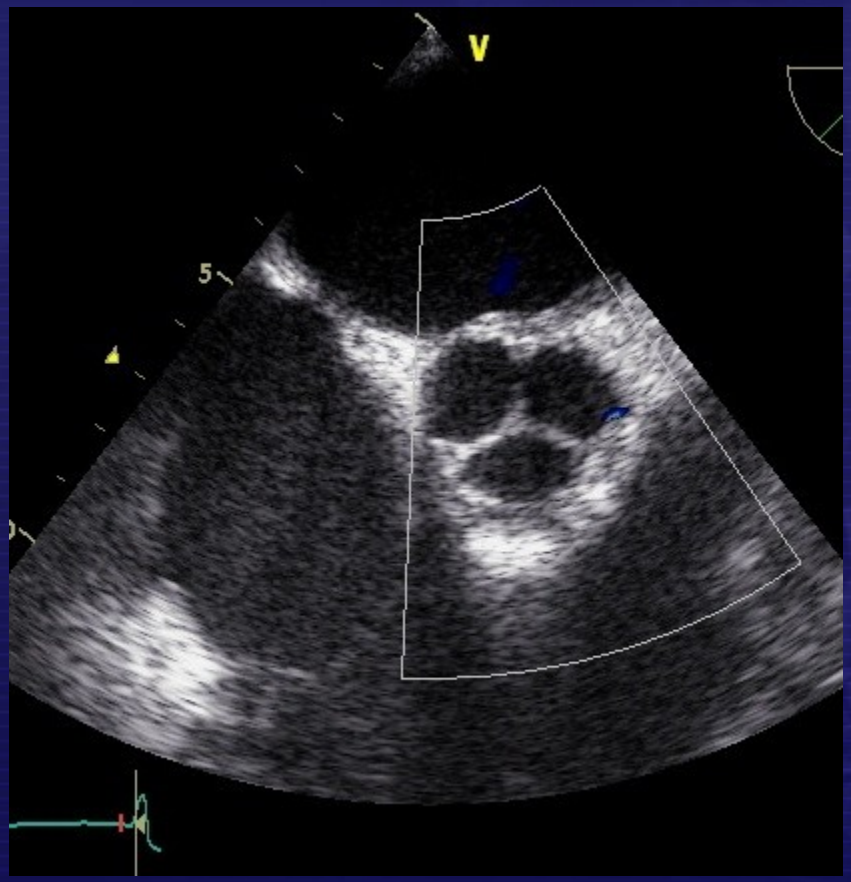
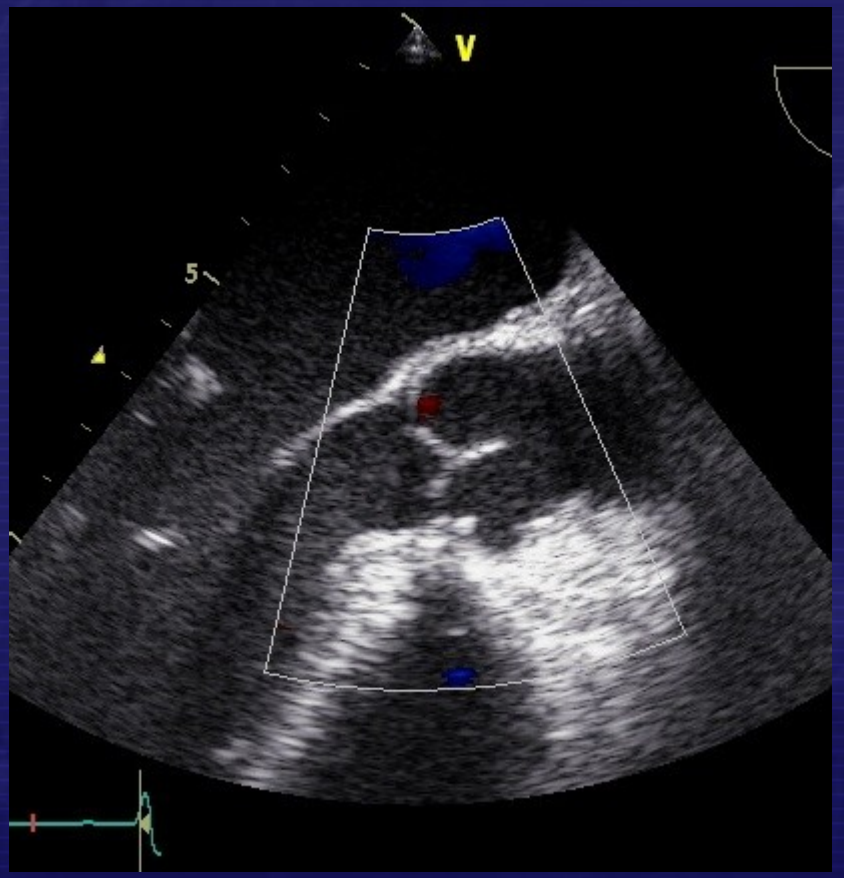
TEE по къса и по дълга ос на stentless биологична аортна клапна





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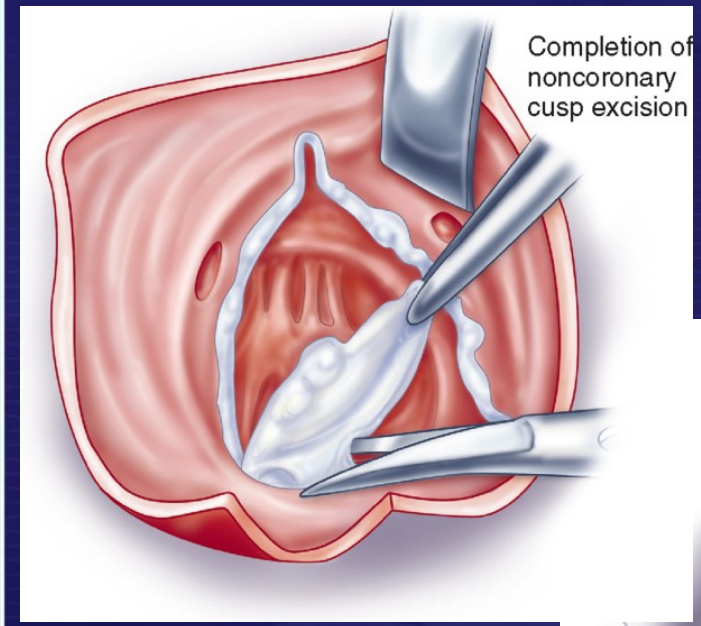
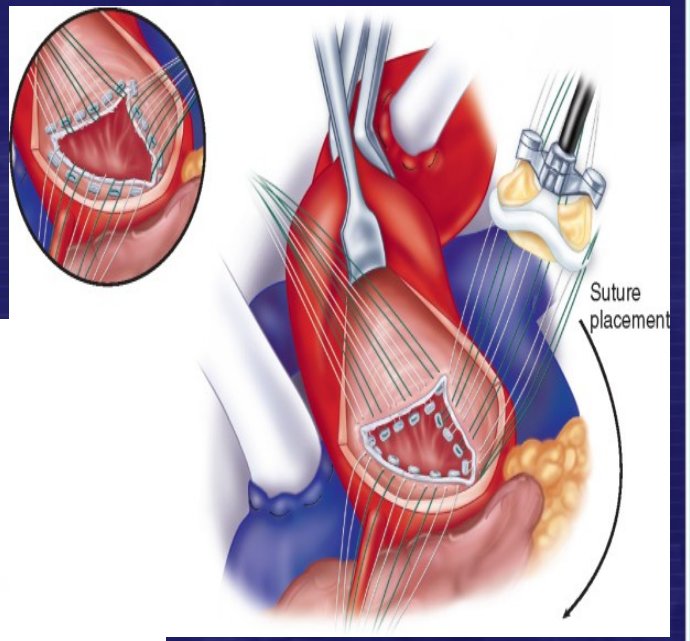
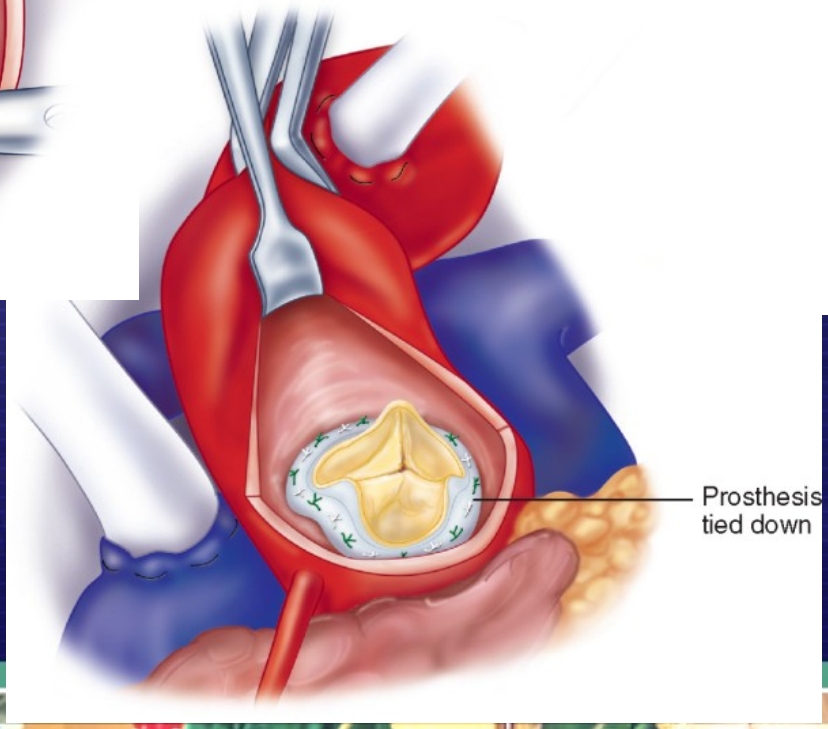
Смяна на аортна клапа (Aortic valve replacement)







Смяна на аортна клапа

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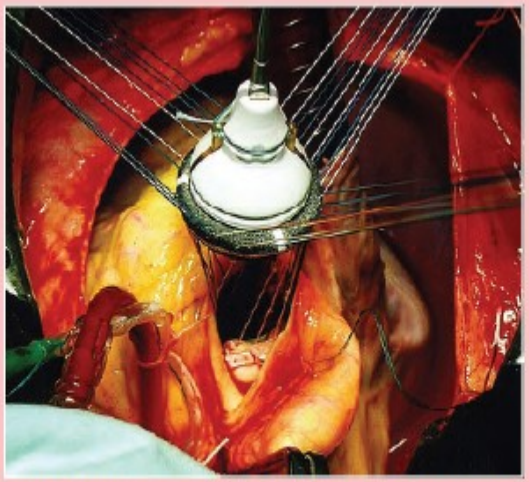

Fig. 5.15 Aortic valve prosthesis after placement of all sutures before running down into the aortic annulus

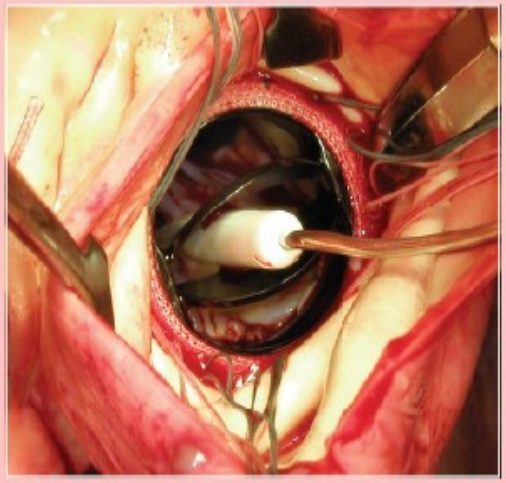

Fig. 5.16 Control of free mobility of semilunar leaflets of implanted bi-leaflet valve Sorin–Bicarbon

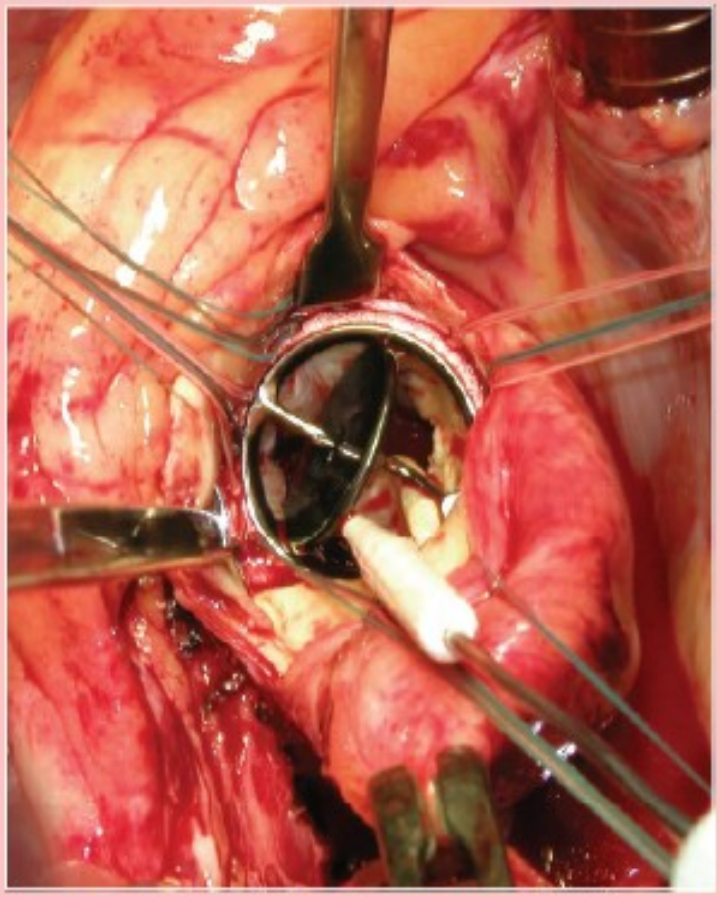

Fig. 5.17 Disc valve Medtronic–Hall implanted into aortic orifice: control of free mobility of the tilting disc

Смяна на аортна клапа

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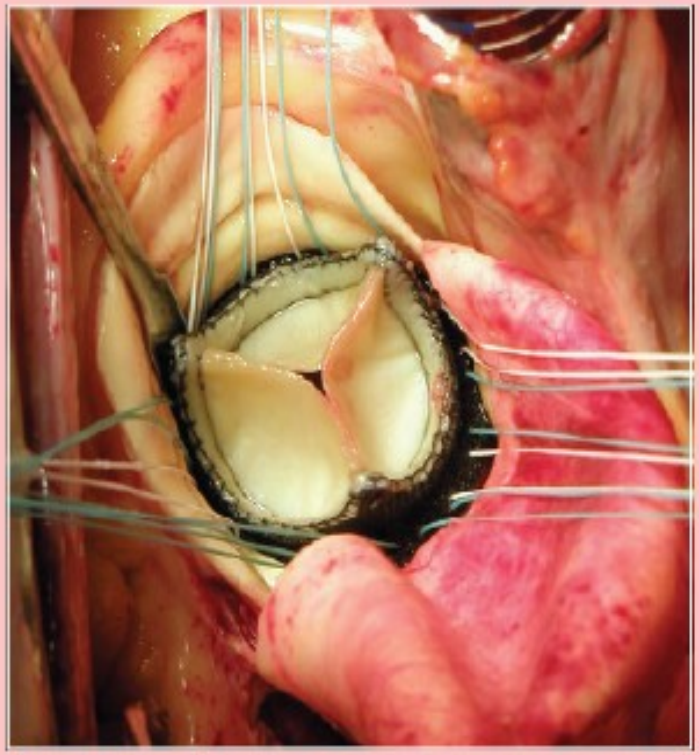

Fig. 5.18 Bioprosthesis Sorin–Soprano implanted into aortic orifice

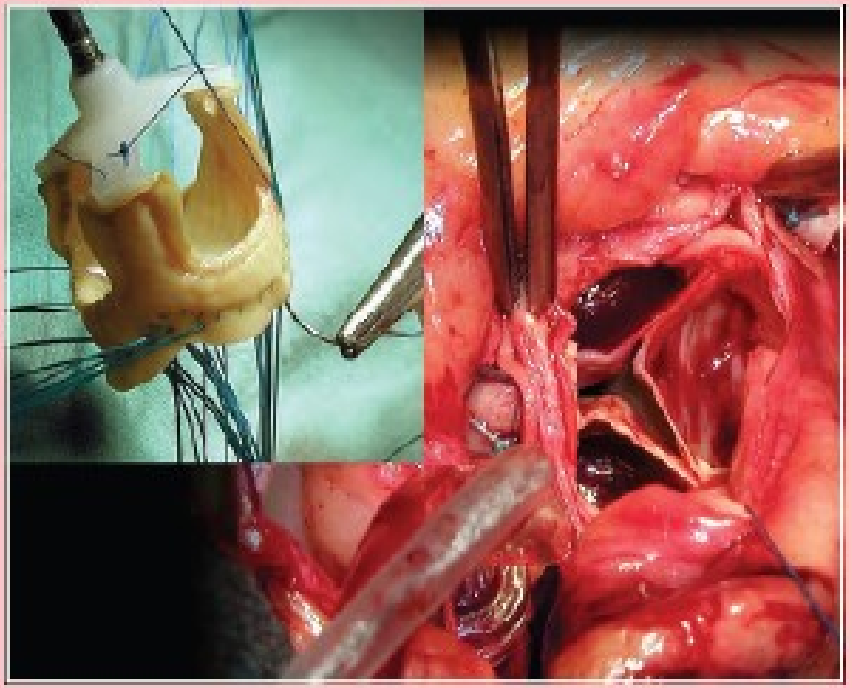

Fig. 5.26 Implantation of stentless bioprosthesis. *Inset* shows placement of sutures into the annulus of bioprosthesis

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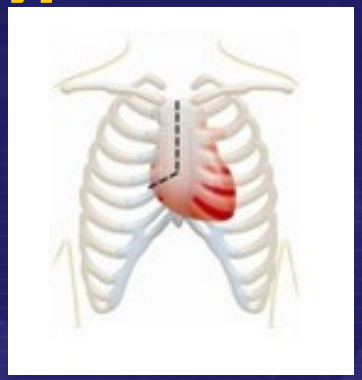
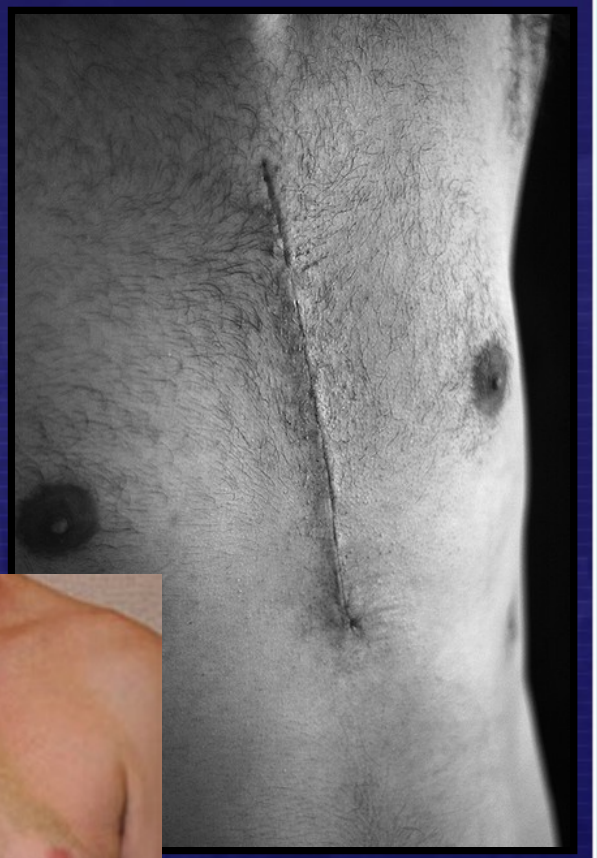
По-малко травматични хирургични достъпи





Министернотомия

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Варна, България

Защо не бива да се бавим ?

Подходящият момент за операция за AS

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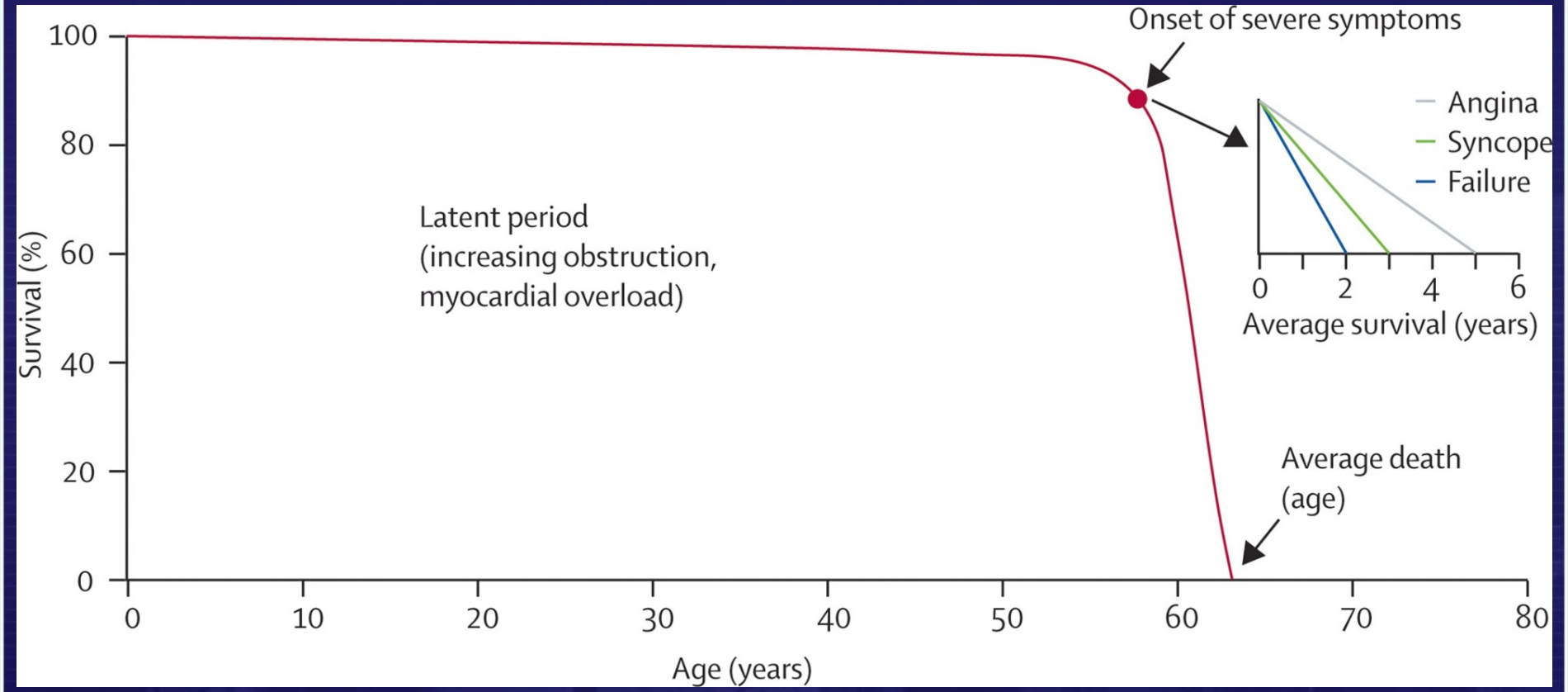

Aortic Stenosis, John Ross, JR. and Eugene Braunwald, Circulation, Jul 1968; 38: V-61 - V-67

- Лоша прогноза след начало на оплакванията - половината от пациентите екзитират в рамките на 2-3 години без операция

Полза от AVR за симптоматична AS

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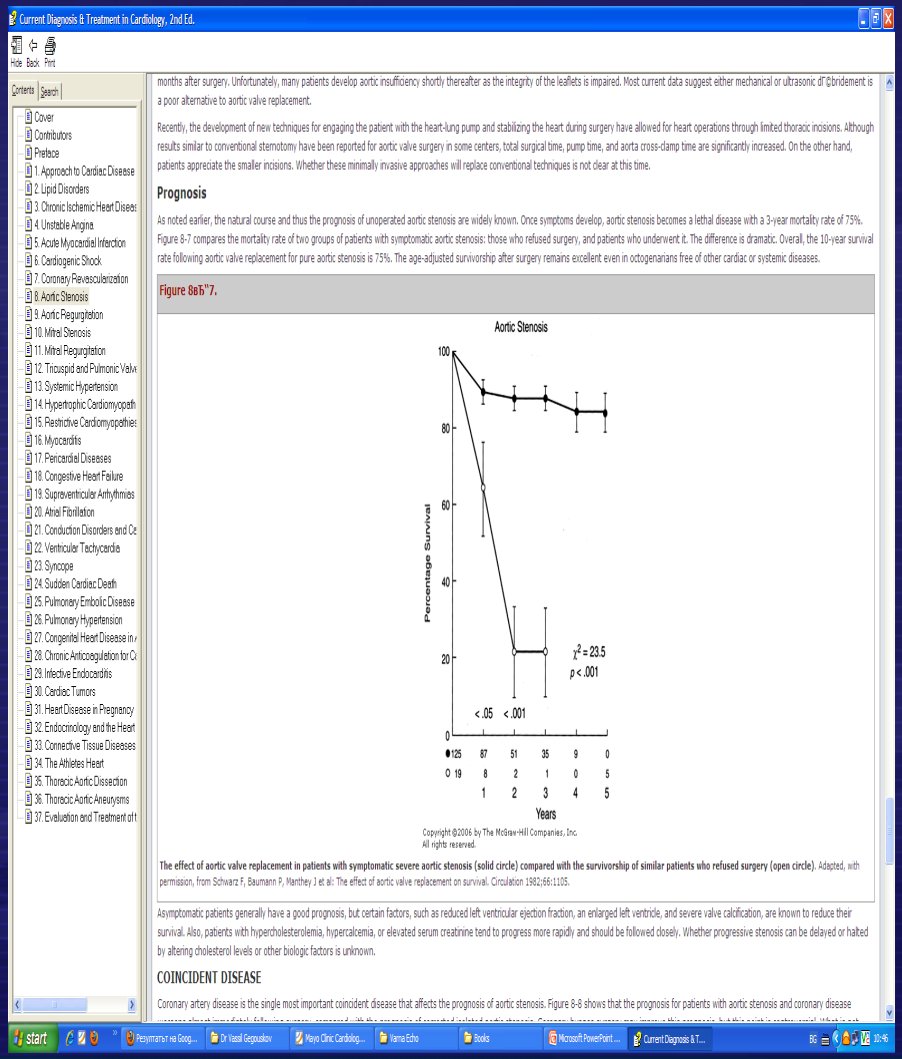
- 5-годишна преживяемост при симптоматични пациенти и AVR (solid circles, •),
- Сравнено с пациенти отказали оперативно лечение (open circles, ○)



Schwarz F, Baumann P, Manthey J et al:
The effect of aortic valve replacement on survival.
Circulation 1982;66:1105

Препоръки за антикоагулация при клапни операции

Table 13.3 • Recommended Anticoagulation Regimens for Prosthetic Heart Valves

	Warfarin	Antiplatelet Drugs
AVR – tissue	INR 2.0–3.0 for 3 months if risk factors (ACC/AHA)	Aspirin 75–100 mg alone if no risk factors
AVR – mechanical	INR 2.0–3.0 indefinitely	Aspirin 75–100 mg
AVR-MVR – tissue	INR 2.0–3.0 for 3 months	Aspirin 325 mg after 3 months
AVR-MVR – mechanical	INR 3.0–4.5 indefinitely	Aspirin 75–100 mg
Atrial fibrillation with any of above	Continue warfarin indefinitely	

Risk factors: hypercoagulable state, history of systemic thromboembolism, ejection fraction <35%, history of anteroapical infarction, atrial fibrillation.

ACCP, American College of Chest Physicians recommendations 2008;[65] ACC/AHA, American College of Cardiology/American Heart Association recommendations 2008.[66]

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Антитромботична терапия след клапна хирургия

Table 20 Target international normalized ratio (INR) for mechanical prostheses

Prosthesis thrombogenicity[a]	Patient-related risk factors[b]	
	No risk factor	Risk factor ≥1
Low	2.5	3.0
Medium	3.0	3.5
High	3.5	4.0

[a]Prosthesis thrombogenicity: Low = Carbomedics, Medtronic Hall, St Jude Medical, ON-X; Medium = other bileaflet valves; High = Lillehei-Kaster, Omniscience, Starr-Edwards, Bjork-Shiley and other tilting-disc valves.
[b]Patient-related risk factors: mitral or tricuspid valve replacement; previous thromboembolism; atrial fibrillation; mitral stenosis of any degree; left ventricular ejection fraction <35%.

Table 19 Indications for antithrombotic therapy after valvular surgery

	Class[a]	Level[b]	Ref[c]
Oral anticoagulation is recommended lifelong for all patients with a mechanical prosthesis.	I	B	213
Oral anticoagulation is recommended lifelong for patients with bioprostheses who have other indications for anticoagulation.[d]	I	C	
The addition of low-dose aspirin should be considered in patients with a mechanical prosthesis and concomitant atherosclerotic disease.	IIa	C	
The addition of low-dose aspirin should be considered in patients with a mechanical prosthesis after thromboembolism despite adequate INR.	IIa	C	
Oral anticoagulation should be considered for the first three months after implantation of a mitral- or tricuspid bioprosthesis.	IIa	C	
Oral anticoagulation should be considered for the first three months after mitral valve repair.	IIa	C	
Low-dose aspirin should be considered for the first three months after implantation of an aortic bioprosthesis.	IIa	C	
Oral anticoagulation may be considered for the first three months after implantation of an aortic bioprosthesis.	IIb	C	

INR = international normalized ratio.
[a]Class of recommendation.
[b]Level of evidence.
[c]Reference(s) supporting class I (A + B) and IIa + IIb (A + B) recommendations.
[d]Atrial fibrillation, venous thromboembolism, hypercoagulable state, or with a lesser degree of evidence, severely impaired left ventricular dysfunction (ejection fraction <35%).

Why bother?

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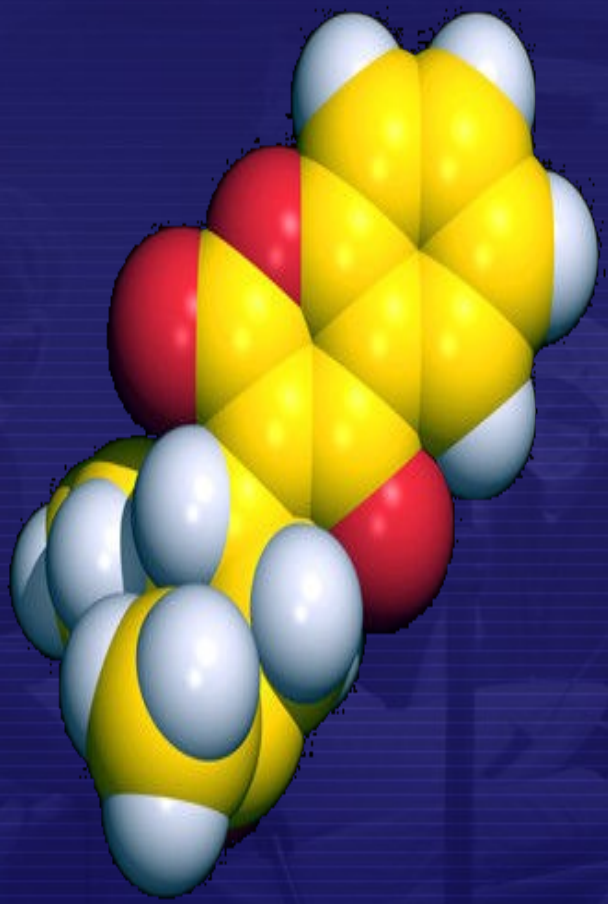
WARFARIN



Gives life
&
kills

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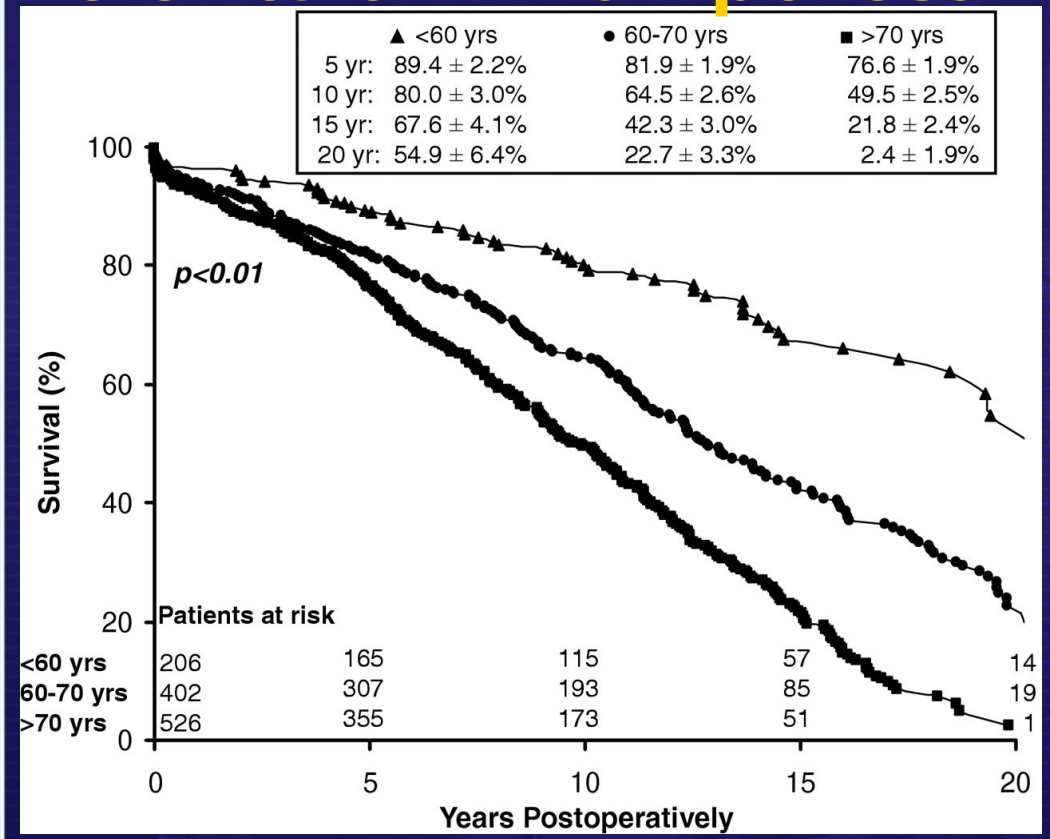
Преживяемост след AVR с биологична протеза



- Преживяемост след AVR със биологична протеза Hancock II според възраста (Kaplan-Meier):
- < 60 години (▲)
- 60 - 70 години (●)
- > 70 години (■)

vid T. E. et al.;
n Thorac Surg 2010;90:775-781

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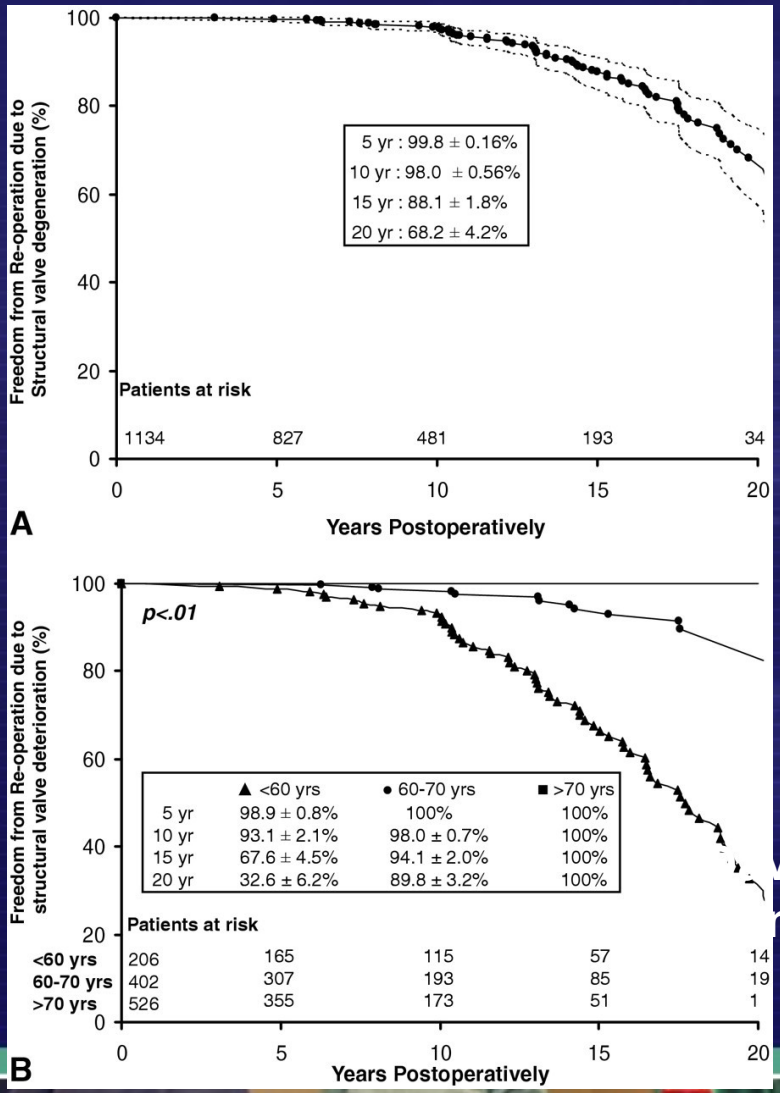
Значими структурни промени



- Години, изминали без нужда от реоперация поради значими струкрурни промени на клапата за:
- (A) всички пациенти (dotted lines on either side of solid line represent upper and lower 95% confidence interval)
- и (B) според възрастовата група

vid T. E. et al.;
n Thorac Surg 2010;90:775-781

Механична vs биологична протеза

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The Journal of
Thoracic and Cardiovascular Surgery

Patient outcome after aortic valve replacement with a mechanical or biological prosthesis: Weighing lifetime anticoagulant-related event risk against reoperation risk

Martijn W.A. van Geldorp, W.R. Eric Jamieson, A. Pieter Kappetein, Jian Ye, Guy J. Fradet, Marinus J.C. Eijkemans, Gary L. Grunkemeier, Ad J.J.C. Bogers and Johanna J.M. Takkenberg

J Thorac Cardiovasc Surg 2009;137:881-886
DOI: 10.1016/j.jtcvs.2008.09.028

The Journal of
Thoracic and Cardiovascular Surgery

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J Thorac Cardiovasc Surg 2009;137:881-886
DOI: 10.1016/j.jtcvs.2008.09.028

- 3934 patients; 73 % biological and 27 % mechanical prostheses
- 26 467 patient-years follow-up

Механична vs биологична протеза

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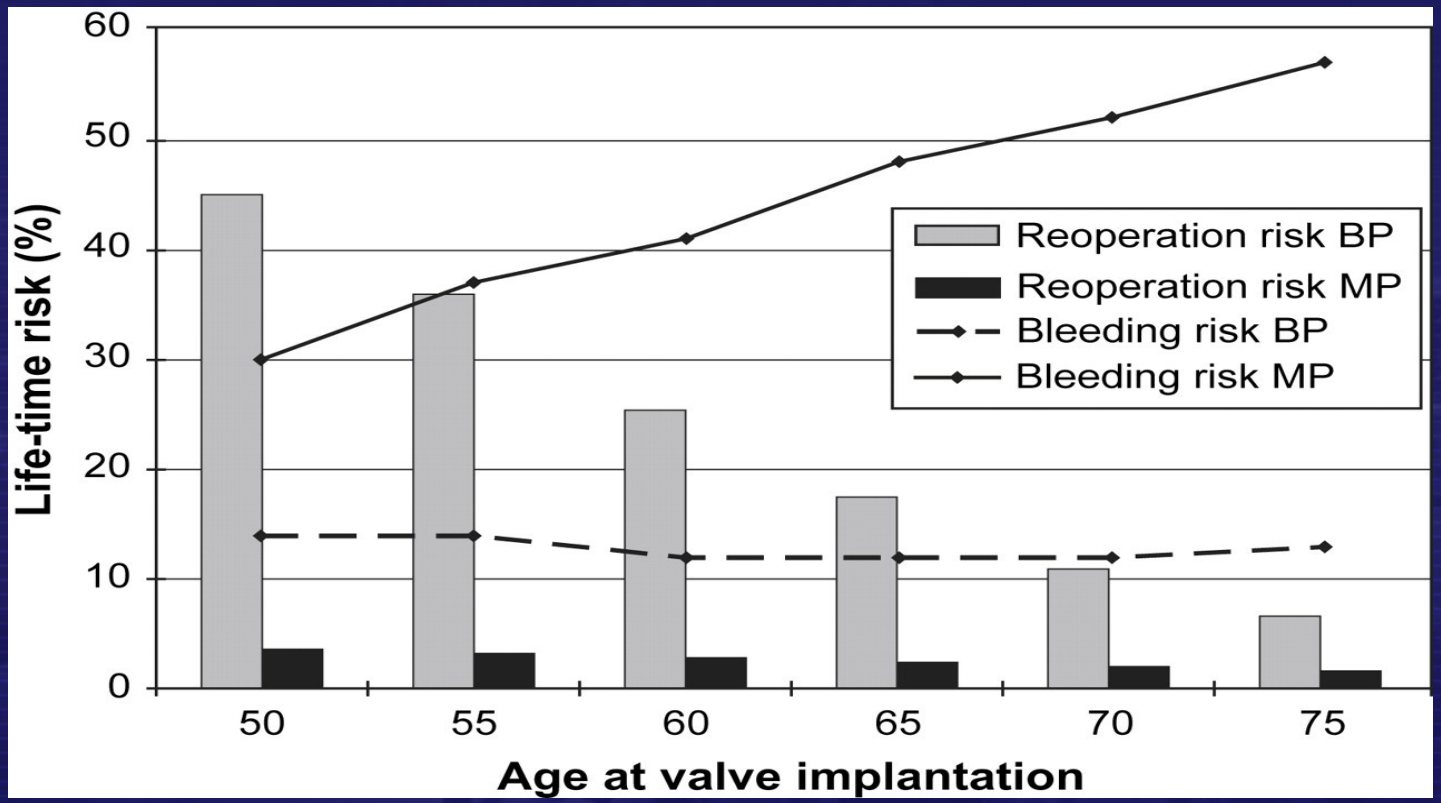

Риск от реоперация и кървене след AVR с механична и биологична;
BP – биологична протеза; MP – механична протеза

Conclusion: Even for patients aged 60 years, event-free life expectancy is better with a bioprosthesis. Although the chance of reoperation is higher, the lifetime risk of bleeding is lower compared with a mechanical prosthesis. Comparing lifetime event risks between different types of valve prostheses provides more insight into patient outcome after aortic valve replacement and aids patient selection and counseling.

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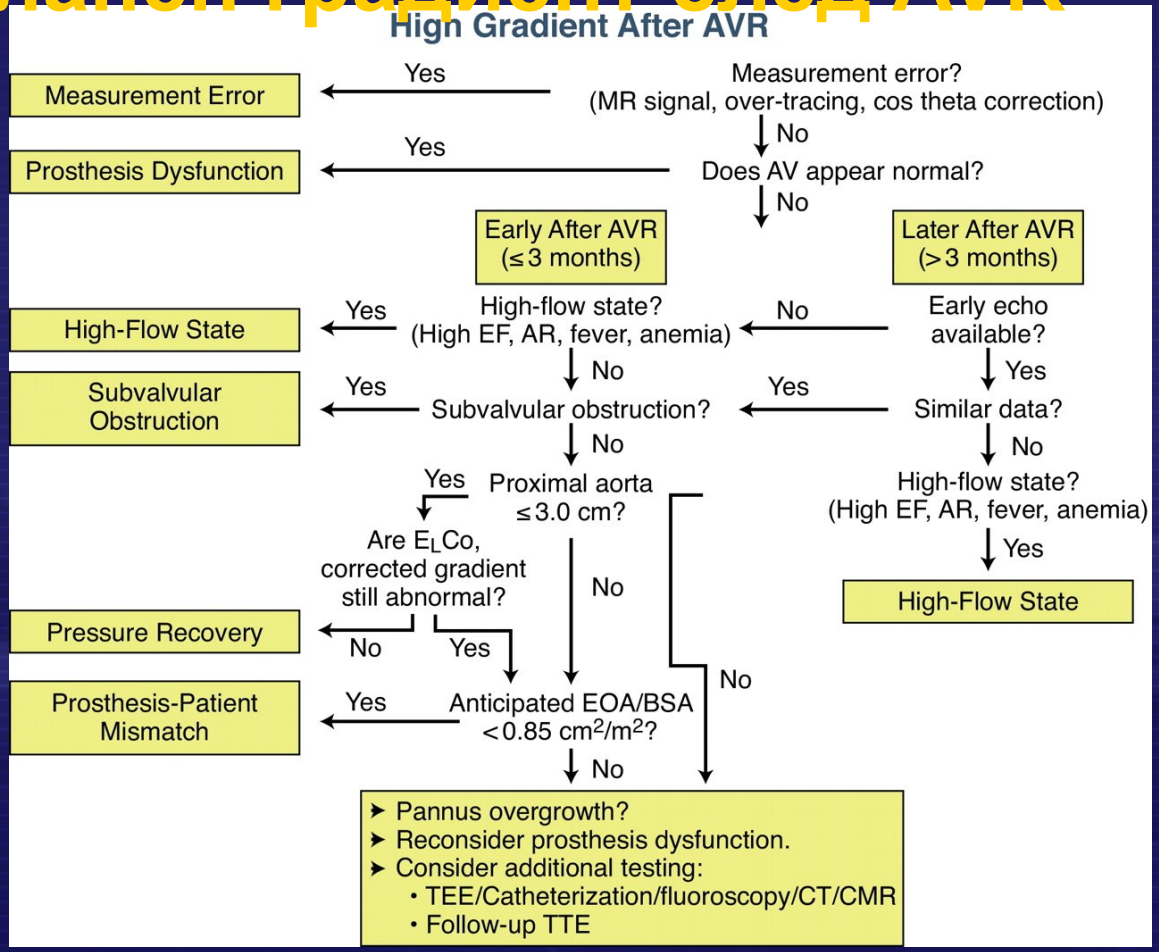
Алгоритъм за оценка на висок трансклапен градиент след AVR



Bach, D. S. J Am Coll Cardiol Img 2010;3:296-304

JACC cardiovascular Imaging

Реконструкция и ремоделиране на аортната клапа (Aortic Valve Repair)

- 1. Пластика на перфорация на платно с перикарден пач
- 2. Удължаване на платно с перикарден пач
- 3. Плисиране на платно при пролапс, дължащ се на елонгация
- 4. Пластика с продължителен обвивен шев при стрес фенестрации по свободния ръб на платната
- 5. Реконструкция на инсуфициентна бикуспидна клапа

Аортна клапна реконструкция

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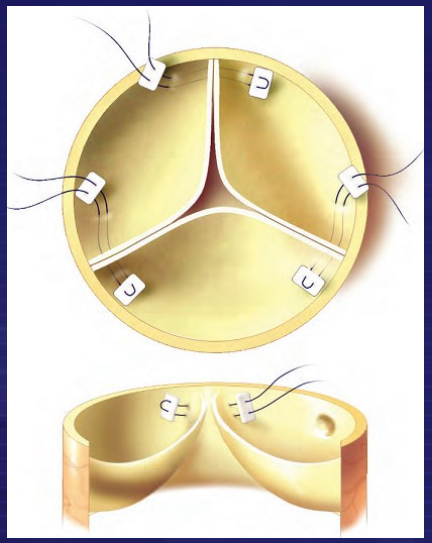
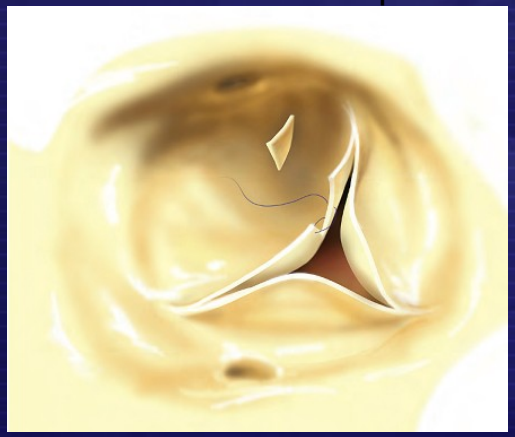


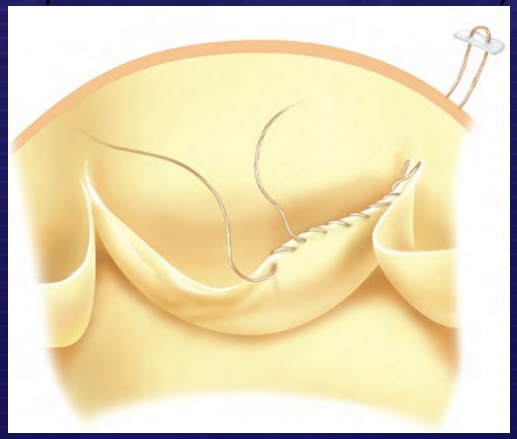
Subcommisural repair

Trusler repair (shortening of prolapsing aortic cusp by its plication at the commissure)

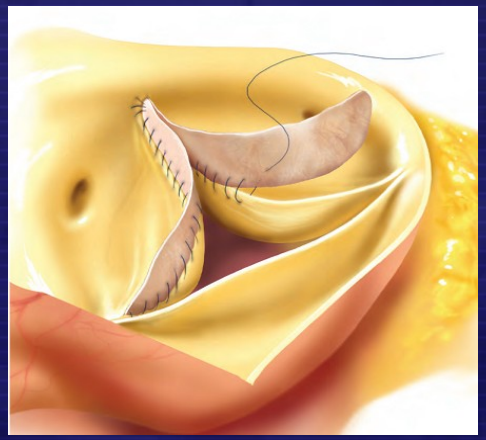
Shortening of prolapsing aortic cusp by its central plication



Shortening of prolapsing aortic cusp by triangular resection



Reduction of prolapsing aortic cusp edge by its plication with two running sutures



Aortic leaflet extension by autologous pericardium fixated by glutaraldehyde

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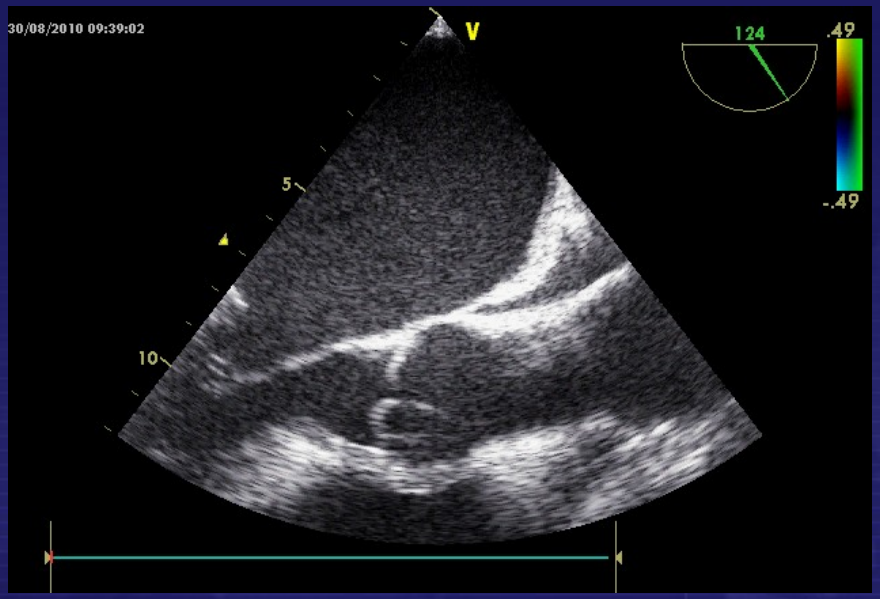
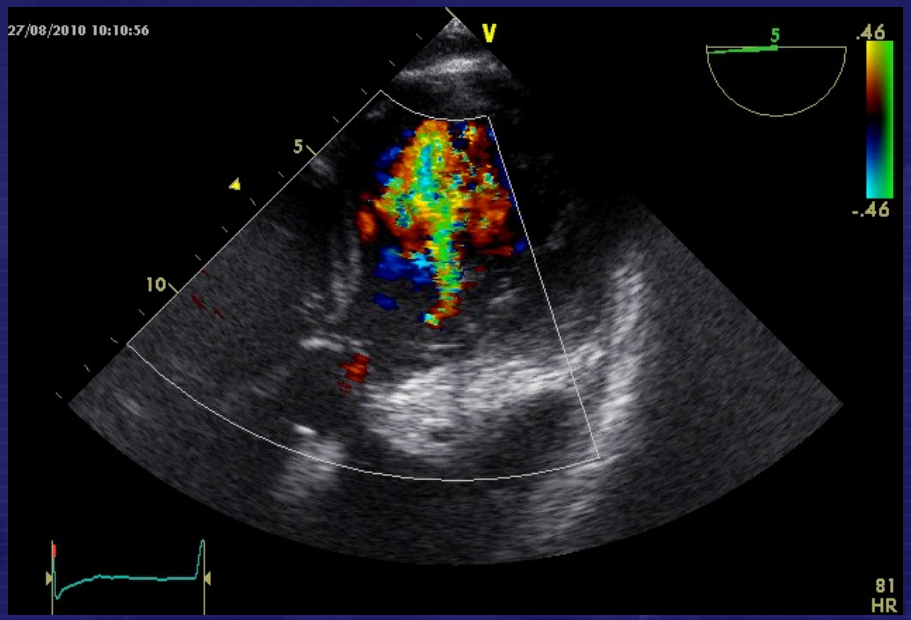
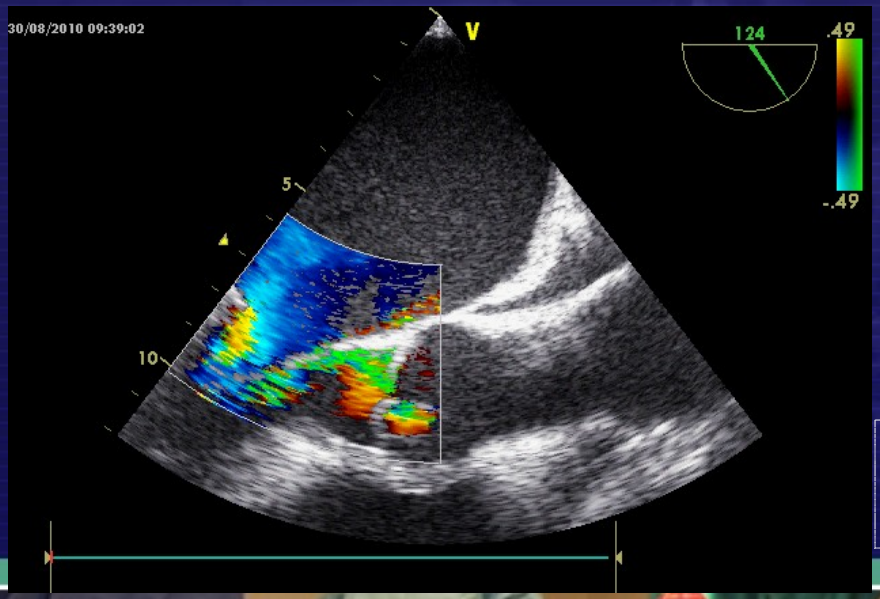


Предоперативна TEE на пациент с AR и пролапс на AV платно, подложен на триклапна операция



Предоперативна дълбока трансгастрална TEE на същия пациент



Предоперативна TEE на пациент с AR и пролапс на AV платно (colour), подложен на триклапна операция

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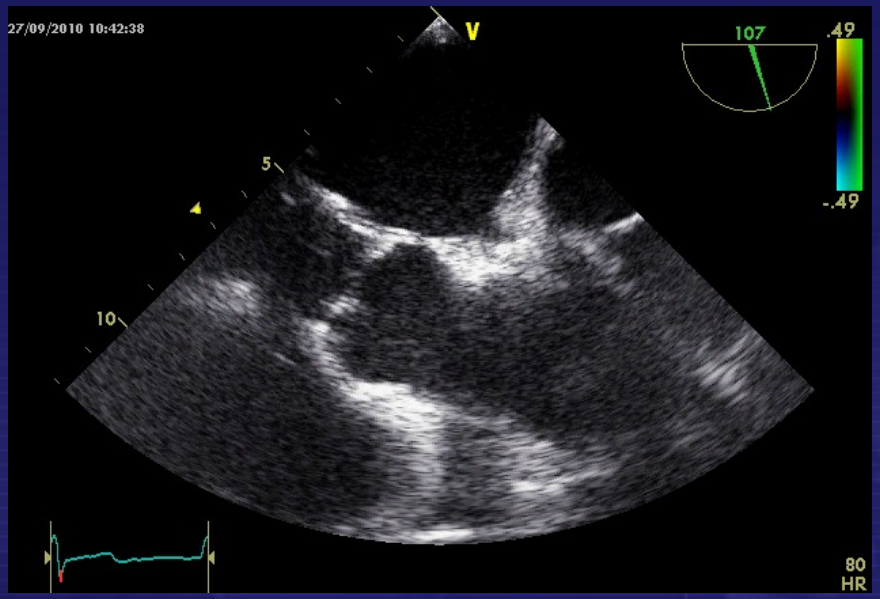
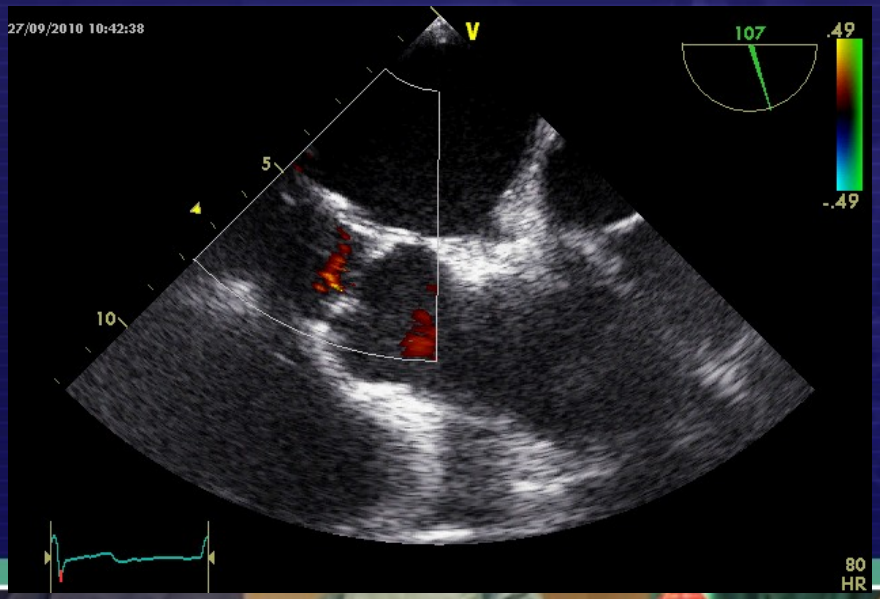


Постоперативна TEE на пациент с AR и пролапс на AV платно



Постоперативна TEE на пациент с AR и пролапс на AV платно (colour)

Малък аортен корен – риск за PPM (Patient prosthesis mismatch)

- PPM - Когато имплантираната протеза е относително малка за телесната повърхност, тя предизвиква необичайно високи трансклапни градиенти = превръщаме високостепенната AS във умерена
- EOA / BSA < 0.85 cm2/m2; високостеп
- По-висок NYHA клас следоперативно
- По-лоша дългосрочна преживяемост

Какво следва?

Малък аортен корен – алтернативи

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Протеза с оптимална хемодинамика

Заместване на аортния корен (stentless bioprostheses)

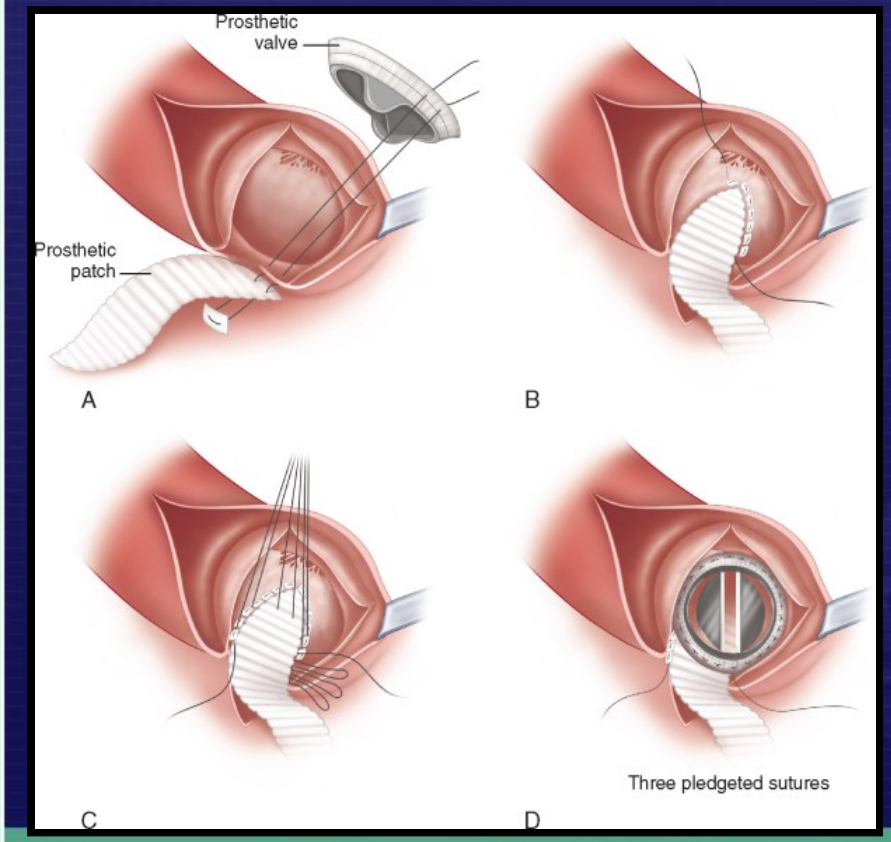
Разширяване на аортния корен

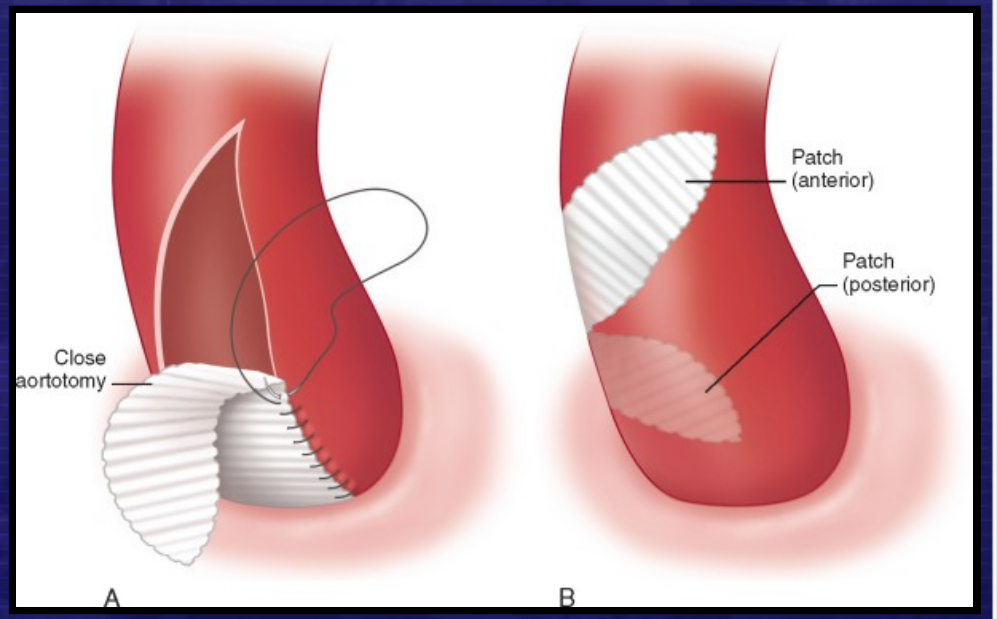
Супраануларна имплантация (upsizing)

Какво следва?

Хирургични методи за разширяване на аортния корен (Ao root enlargement)

- По метода на Nicks (a modo Nicks)

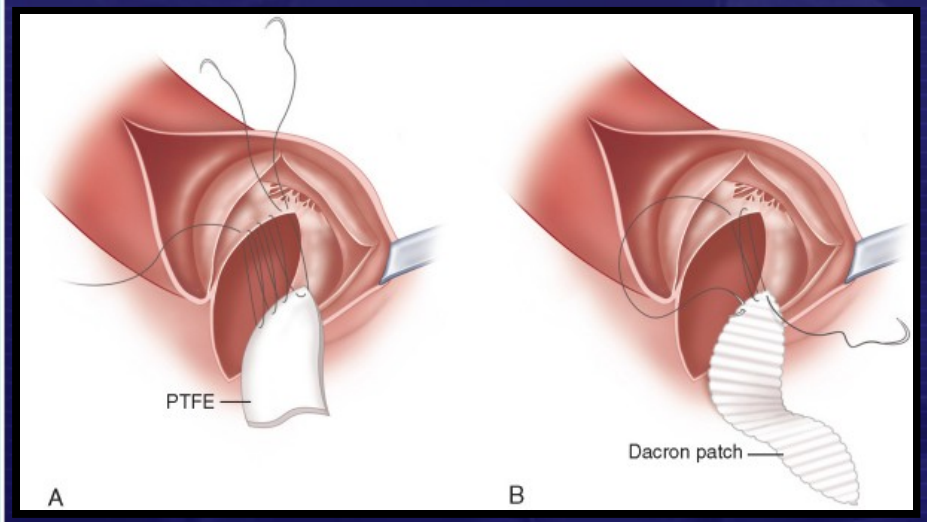


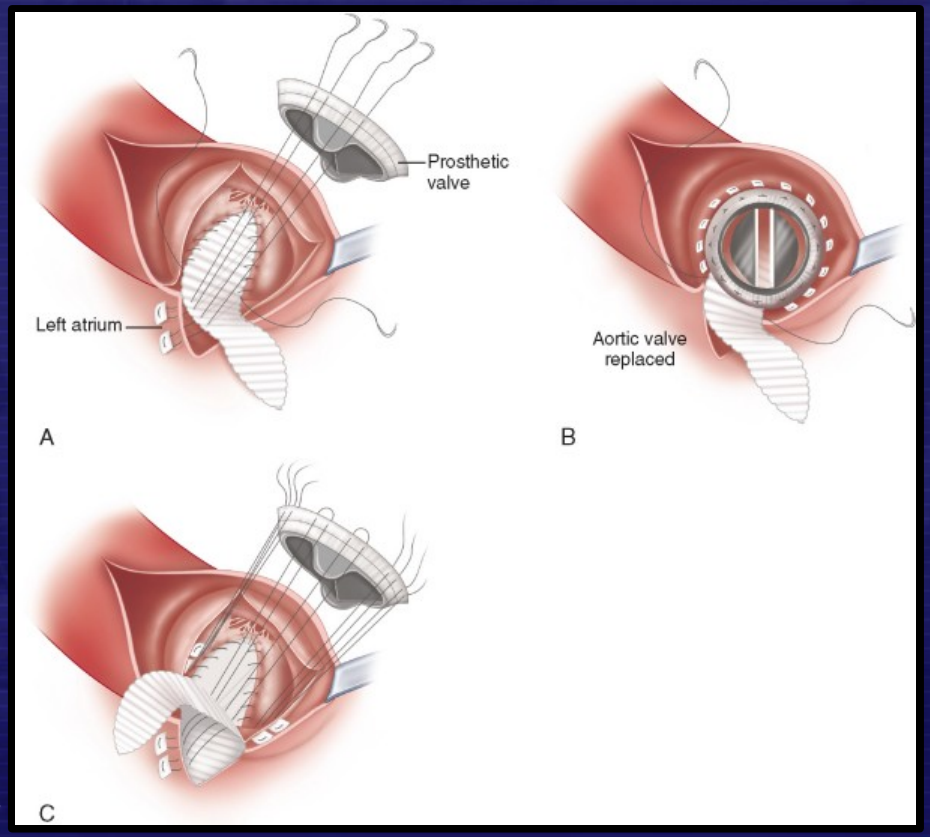


Atlas of Cardiac Surgical Techniques
By Frank Sellke, MD and Marc Ruel, MD, MPH, FRCSC

Хирургични методи за разширяване на аортния корен (Ao root enlargement)

- По метода на Manouguian (a modo Manouguian)





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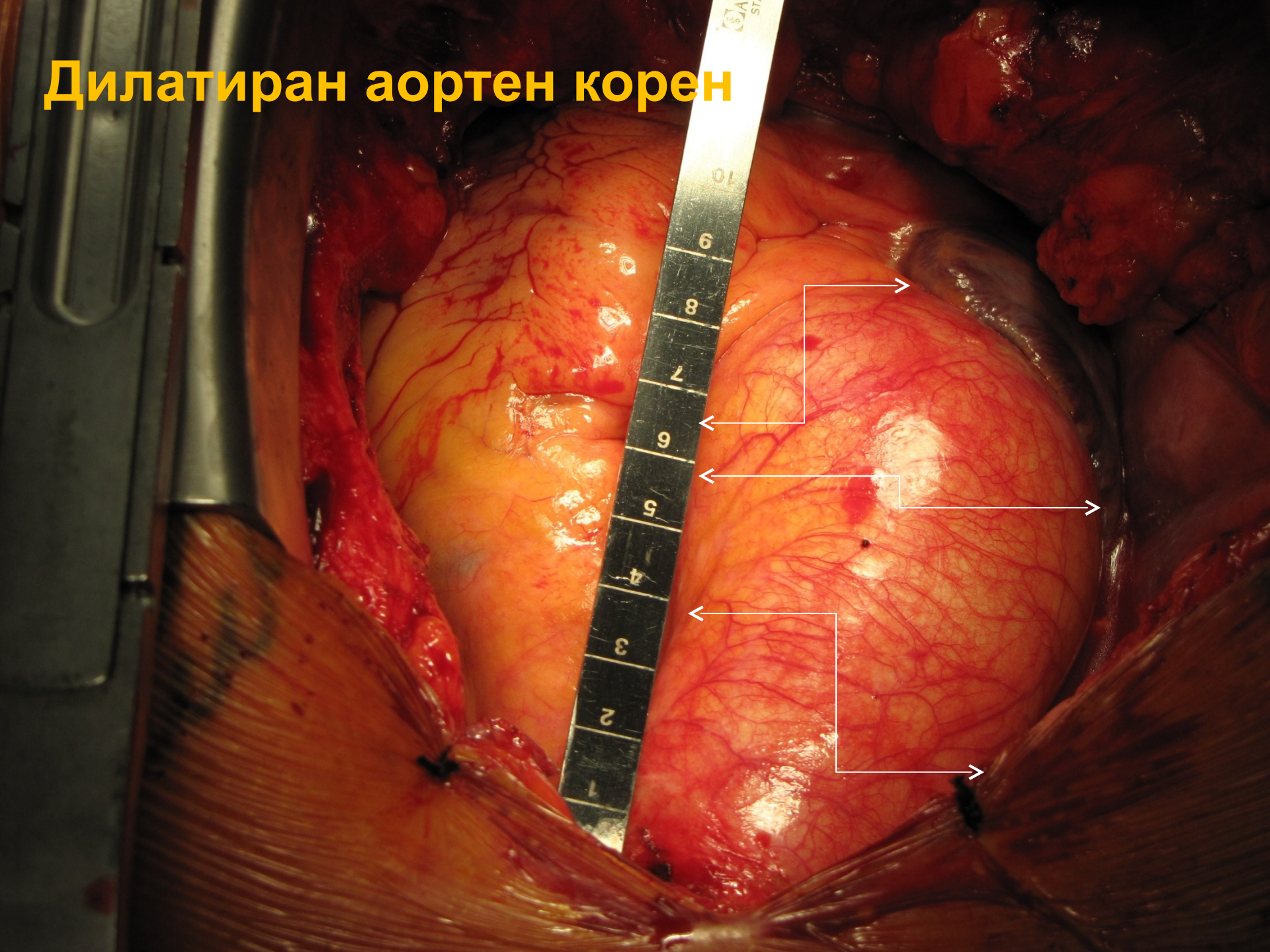
Дилатиран аортен корен



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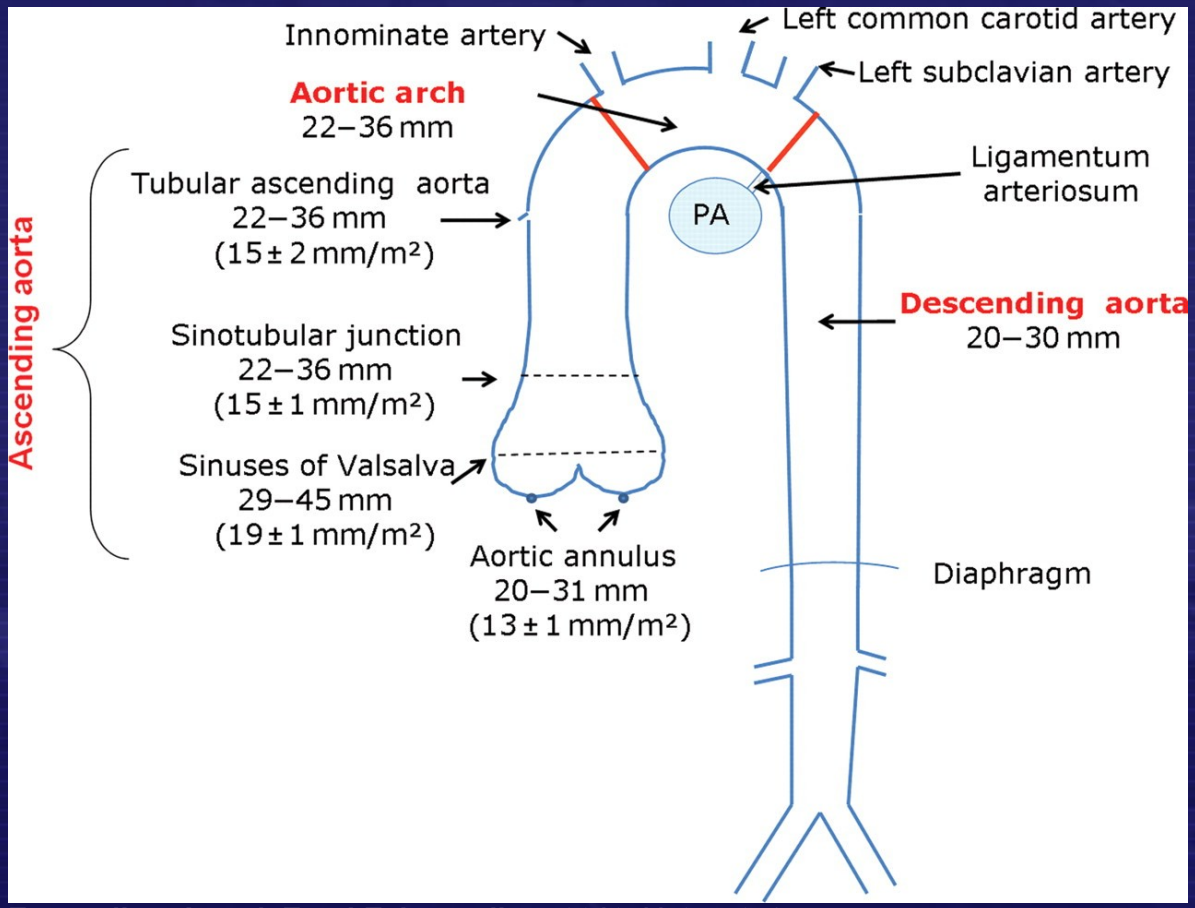
Нормални размери на торакалната аорта в различните сегменти



Evangelista A et al. Eur J Echocardiogr 2010;11:645-658

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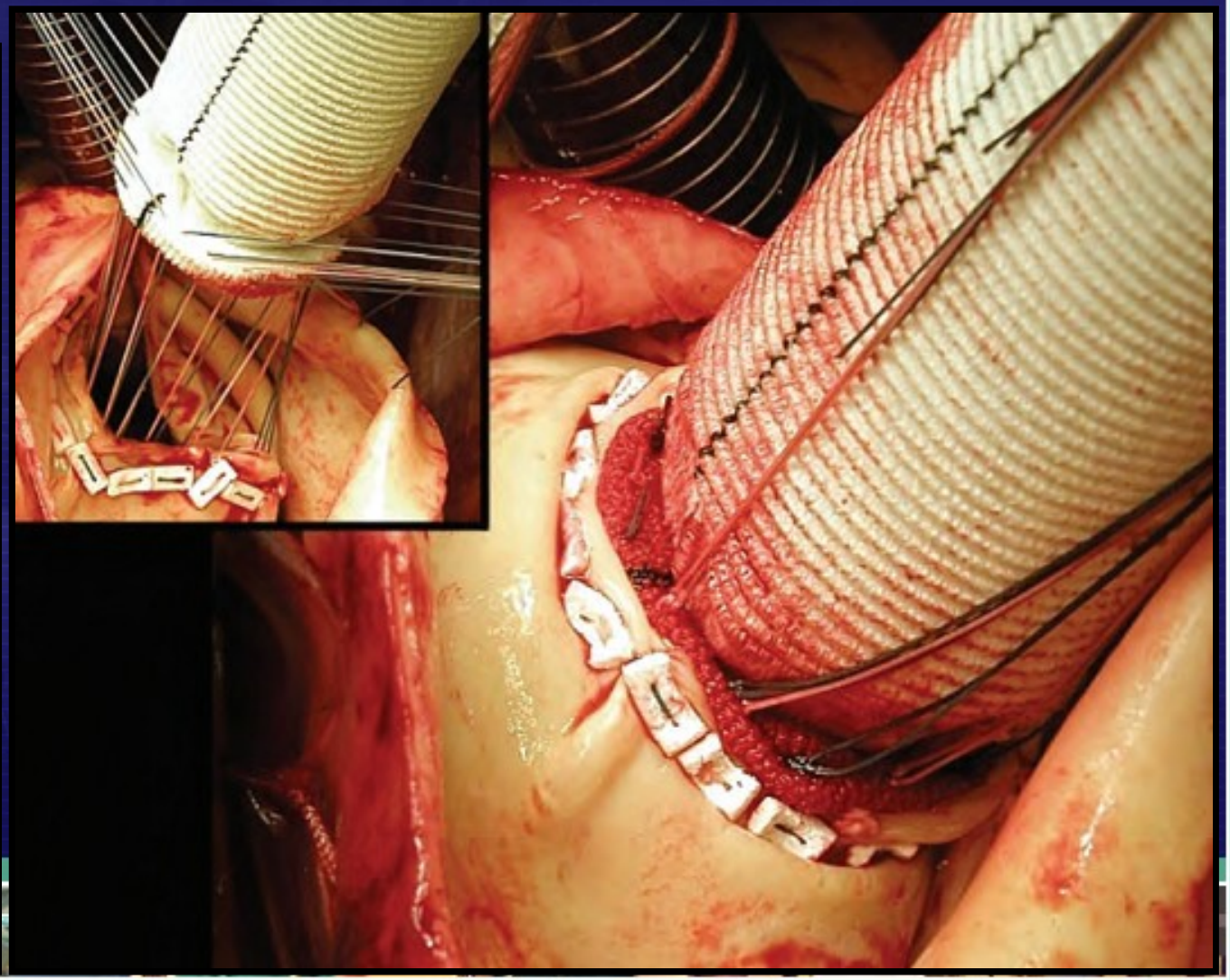
Хирургични техники при разширен аортен корен

Bentall DeBono



VALVE SPARING

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Клапно-съхраняващи операции (Valve sparing procedures)

Индикации

- Дилатация на AV съединение (AV junction) - (20 – 31 mm / ≤ 16 mm/m²)
- Изолирана дилатация на синусите на Valsalva (29 – 45 mm / ≤ 21mm/m²)
- Размер на аортния корен
  - Tricuspid Ao valve – 55 mm
  - Bicuspid Ao valve – 50 mm
  - Marfan syndrome – 45 mm
  - Ao valve surgery indications – 45 mm
  - Ao root enlargement - > 5 mm/y

Без значение от наличието или липсата на аортна регургитация

Нормална морфология на клапните платна е ЗАДЪЛЖИТЕЛНА!!

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Варна, България

Клапно-съхраняващи операции (Valve sparing procedures)

Контраиндикации

- Промени в корена на аортата, когато:
  - Аортна стеноза с калциноза
  - Морфилогични промени по клапните платна непозволяващи корекция

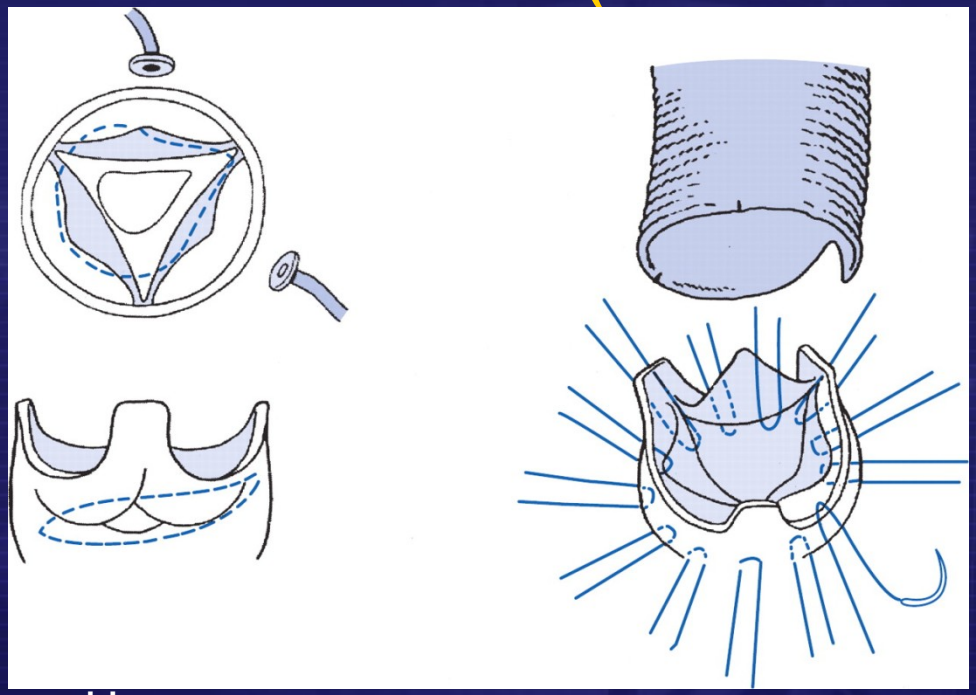
Bentall DeBono

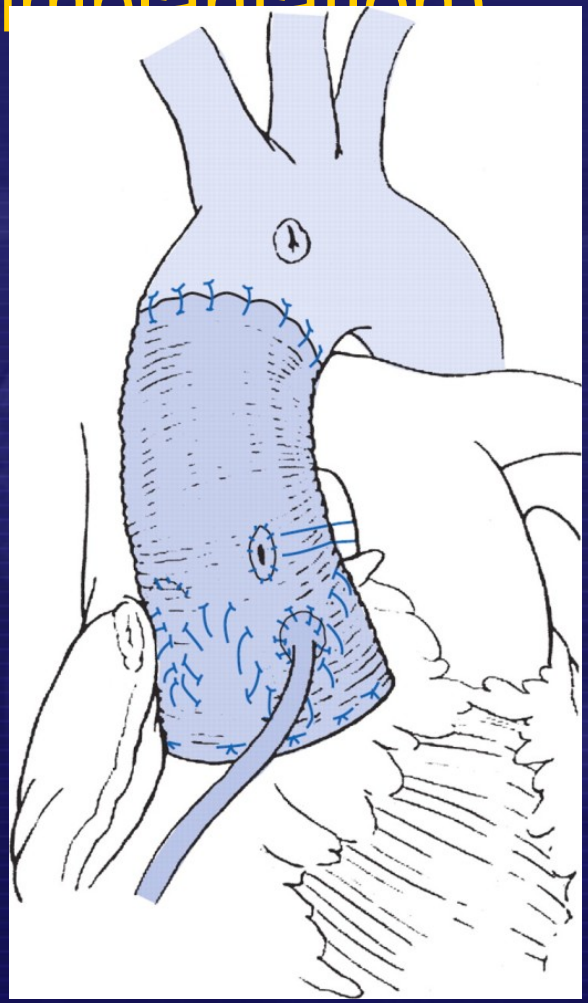
Защо клапно-съхраняващи операции?

- Няма необходимост от доживотен прием на антикоагуланти
- По-нисък риск от ендокардит
- Подобрена хемодинамика
  - Нискостепенна регургитация, ако има изобщо
  - Физиологичен градиент през клапата:
    ≈ 5 mmHg при трикуспидна клапа и
    < 10 mm Hg при бикуспидна клапа (най-физиологичните stentless биопротези са със 7 – 20 mm Hg)
  - Неосинуси – Walsalva-graft

- Функцията на реконструирания аортен корен остава непроменена в >90% от случаите през първите 5 год.

Клапно съхраняващи операции – a modo David (aortic valve reimplantation)





- Цилиндрична реконструкция на синусите (вече със Walsalva graft)
- Реимплантиране на коронарните остиуми
- Оптимално стабилизиране на основата на аортния корен (аортен анулус)

Аневризма на синус на Валсалва

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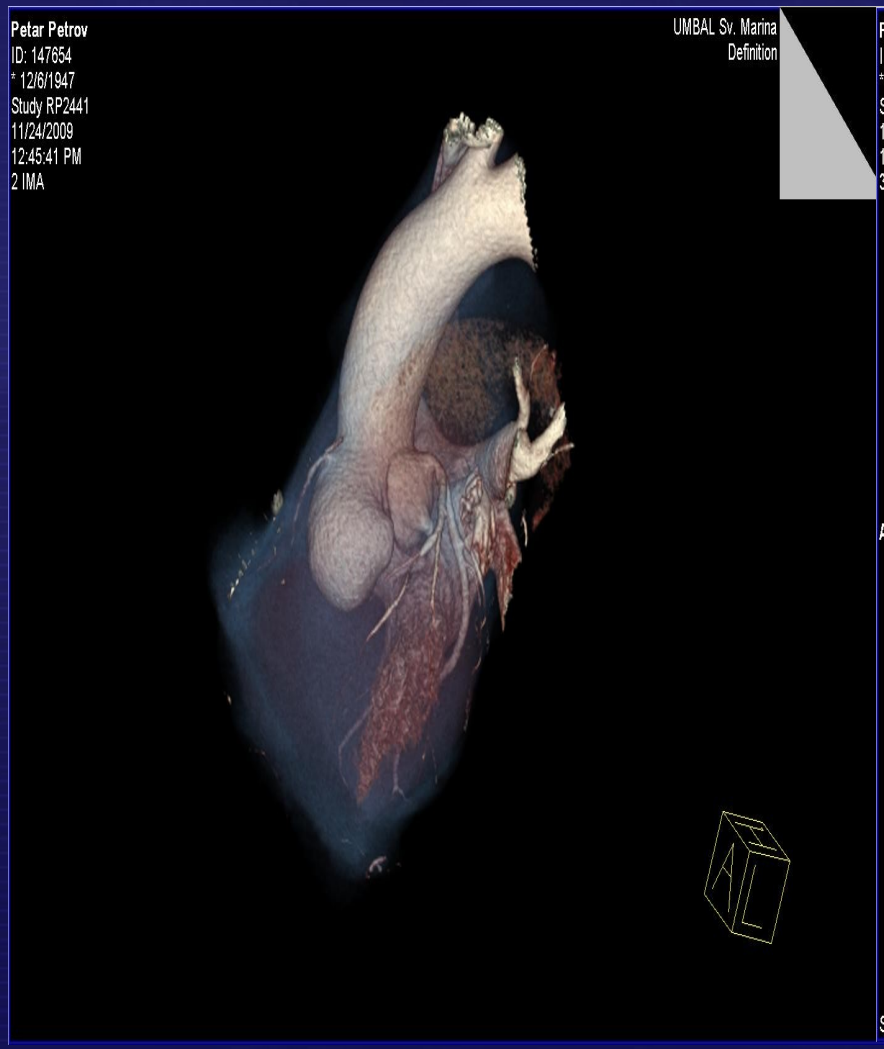

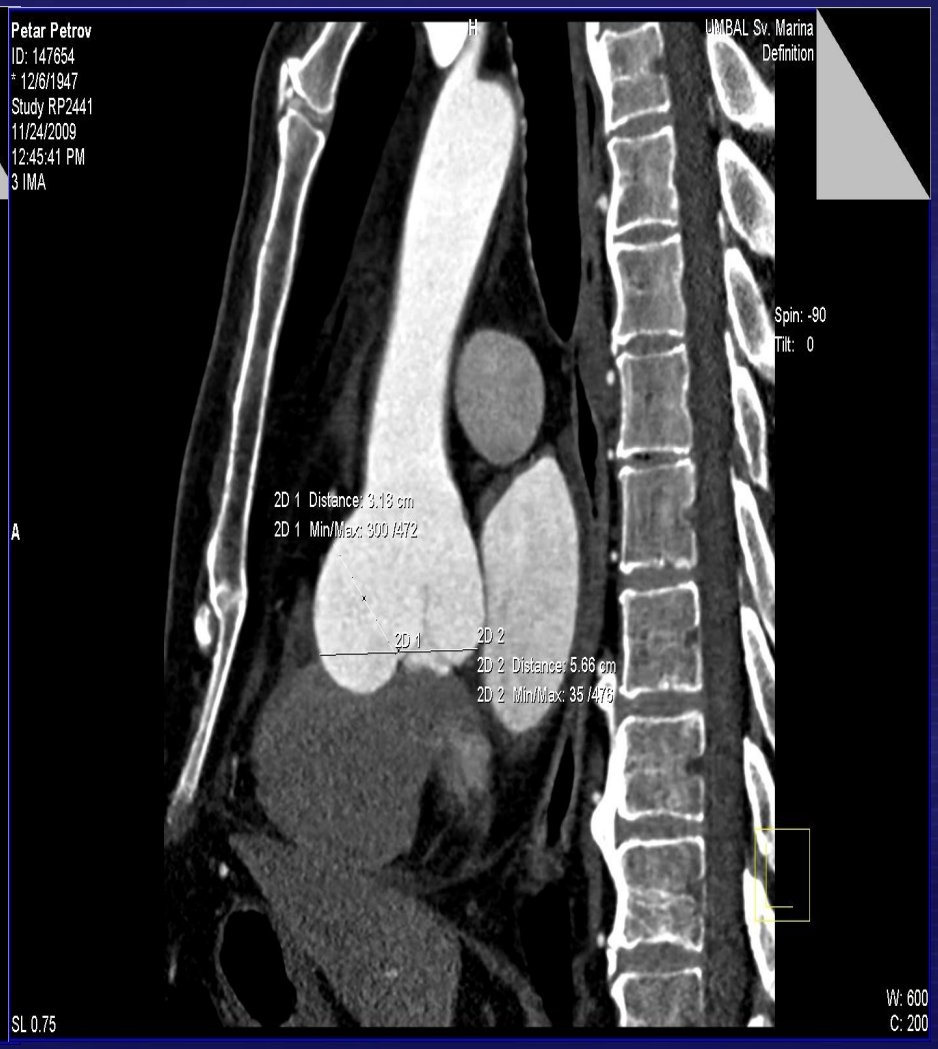

Анулоаортна ектазия – СТ изображение

Отделение по
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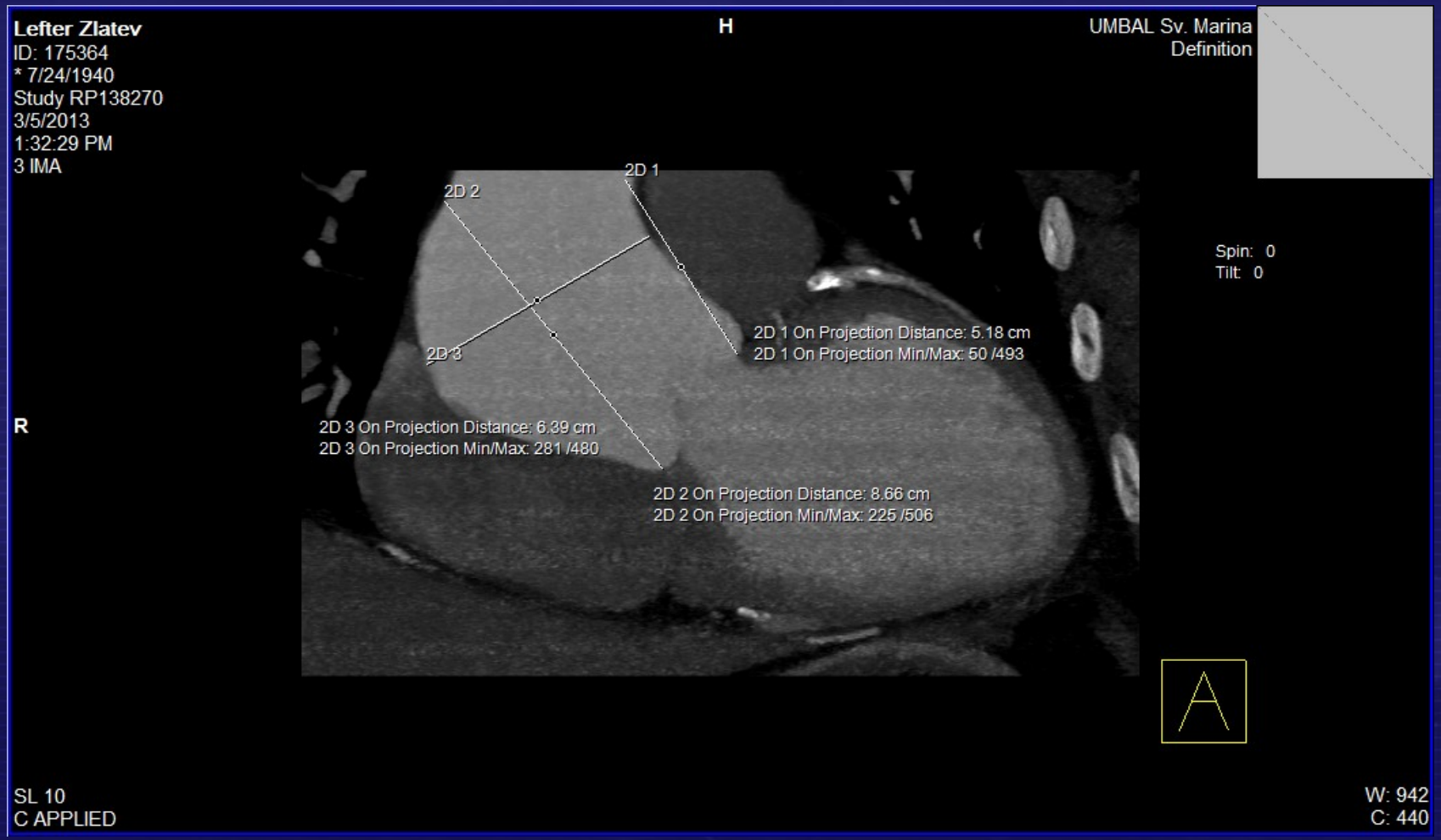
МБАЛ „Света Марина"
Варна, България



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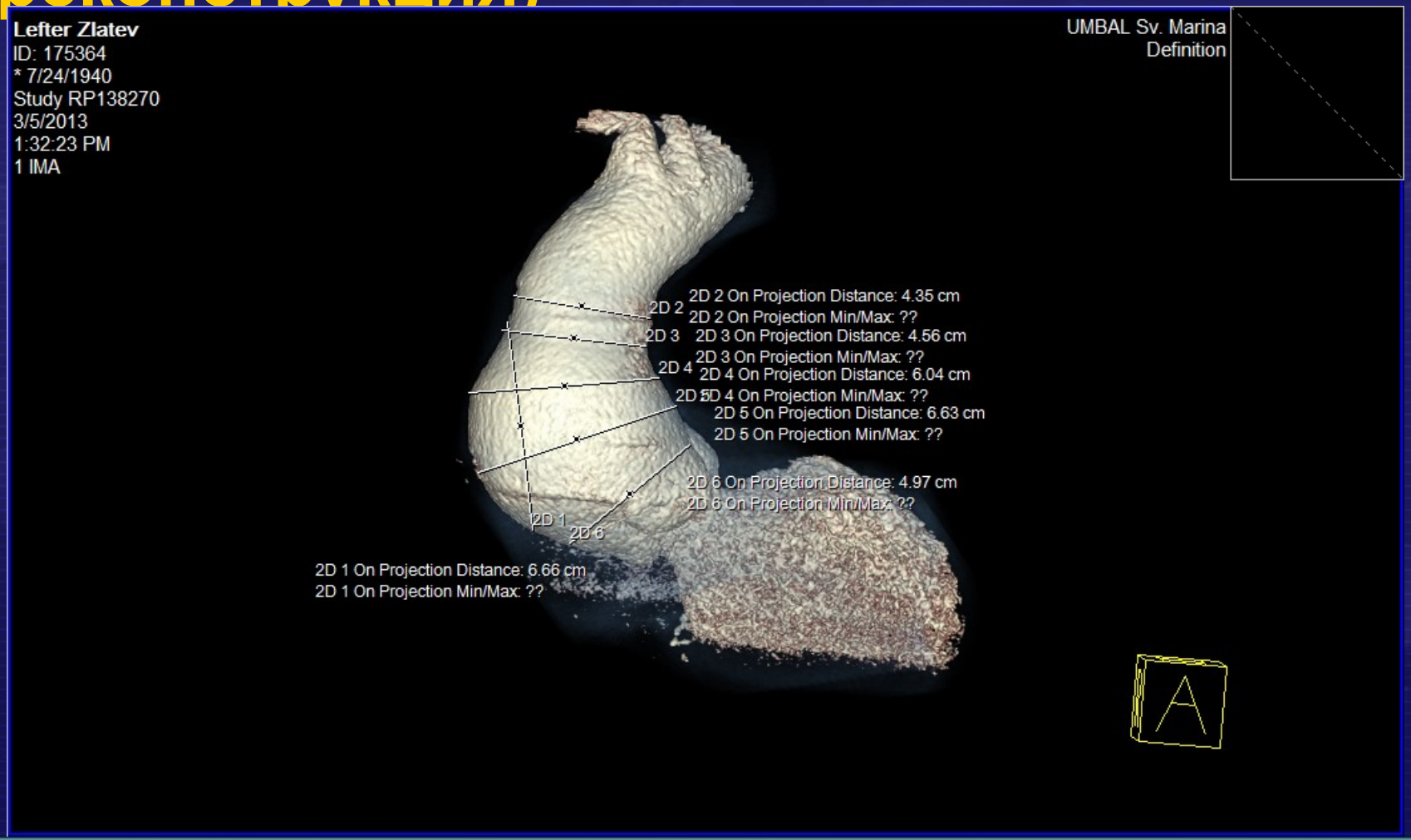
Анулоаортна ектазия – CT изображение (реконструкция)



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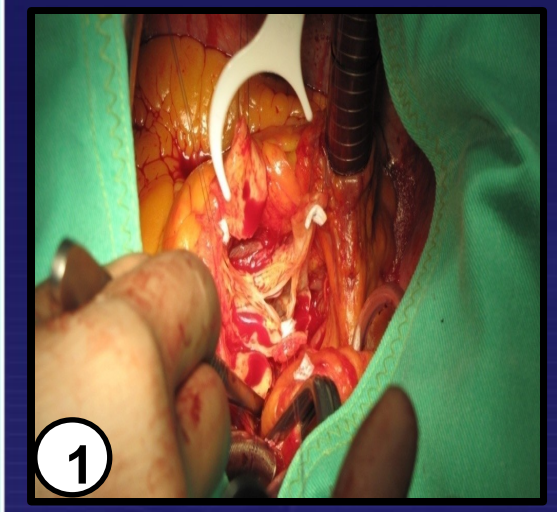

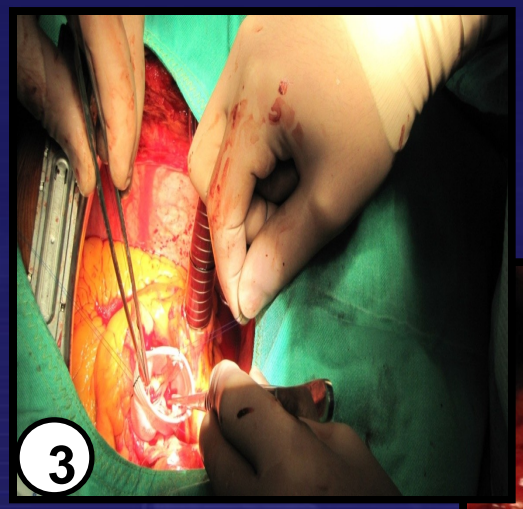

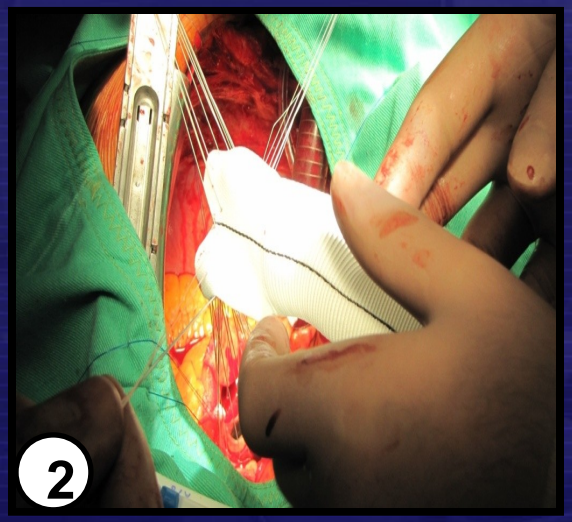

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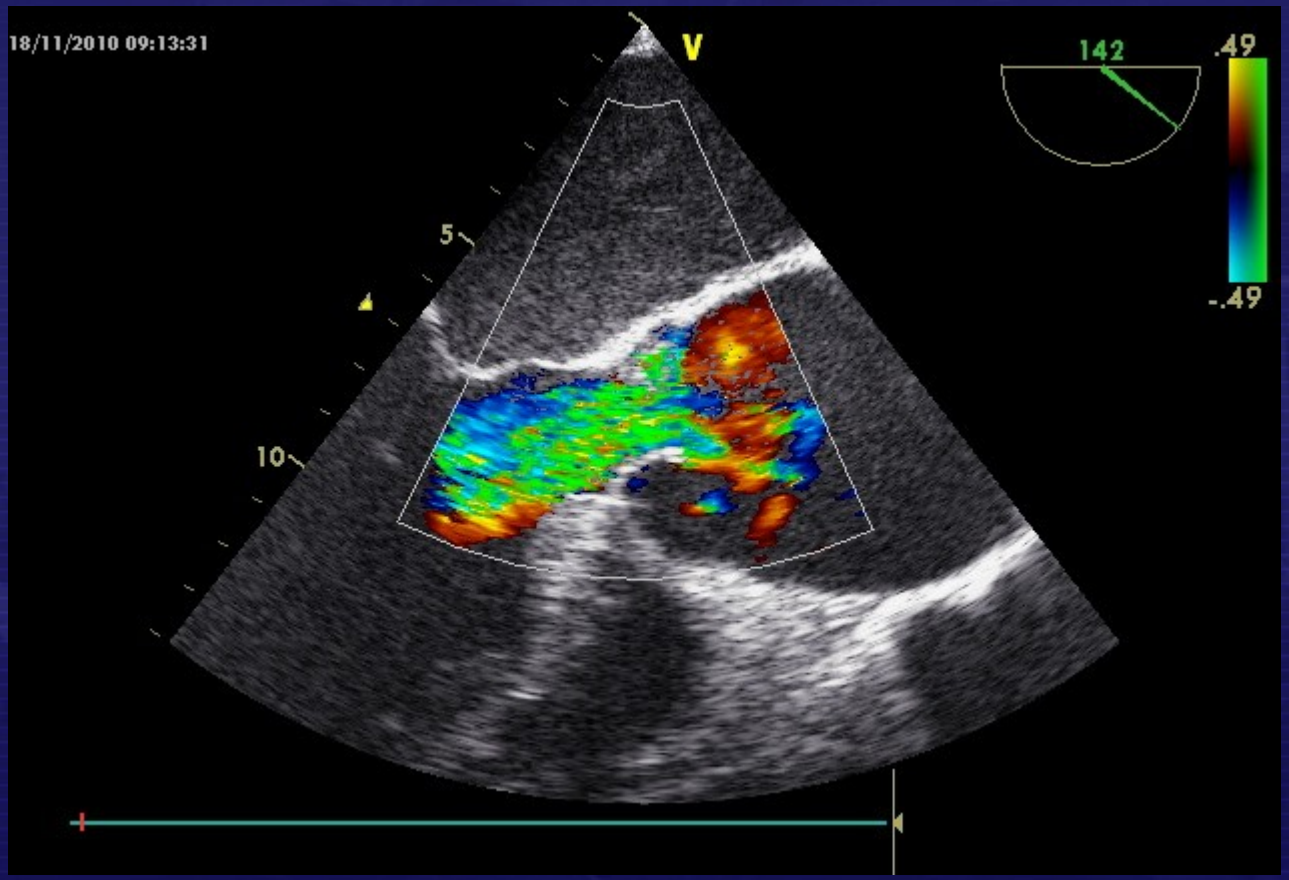
Аортна инсуфициенция при анулоаортна ектазия



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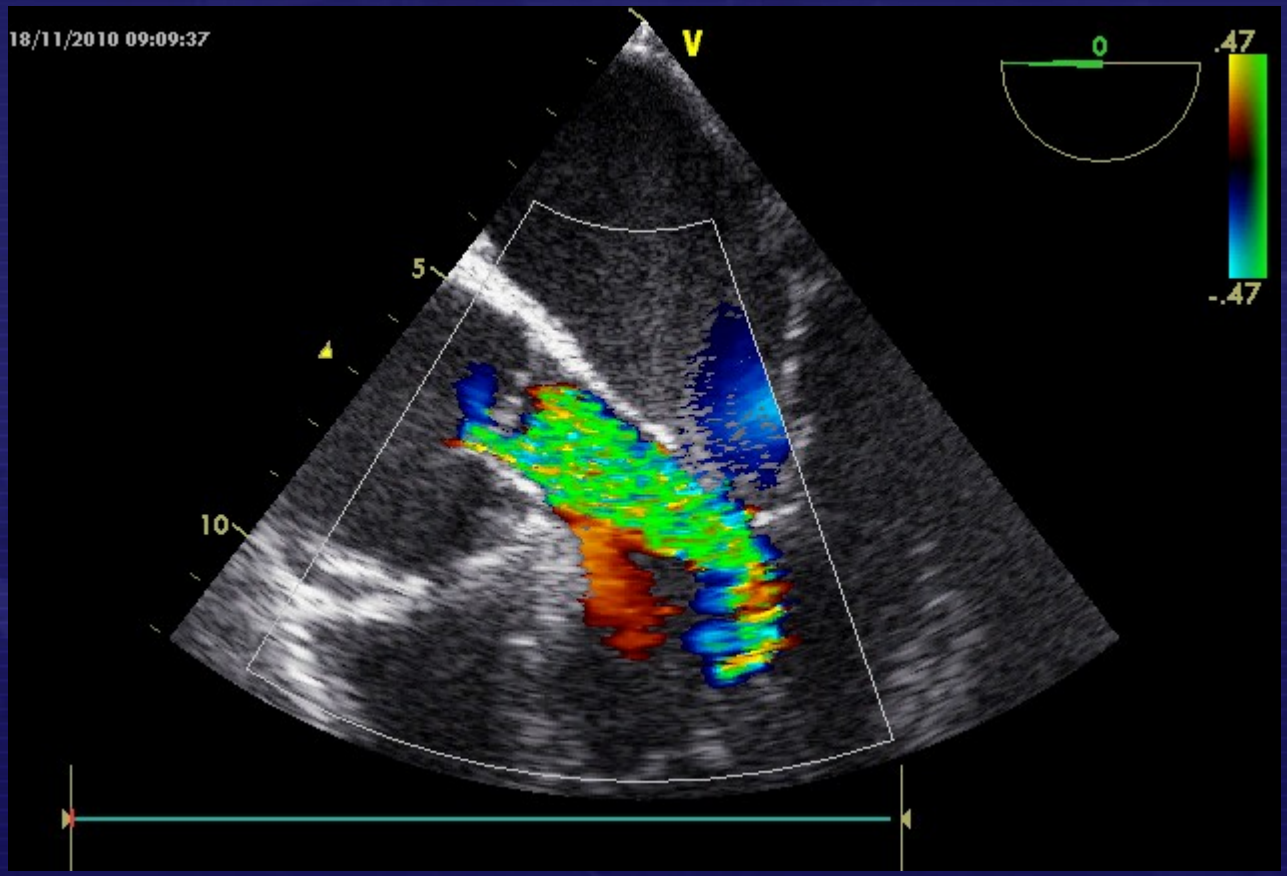
Аортна инсуфициенция при анулоаортна ектазия



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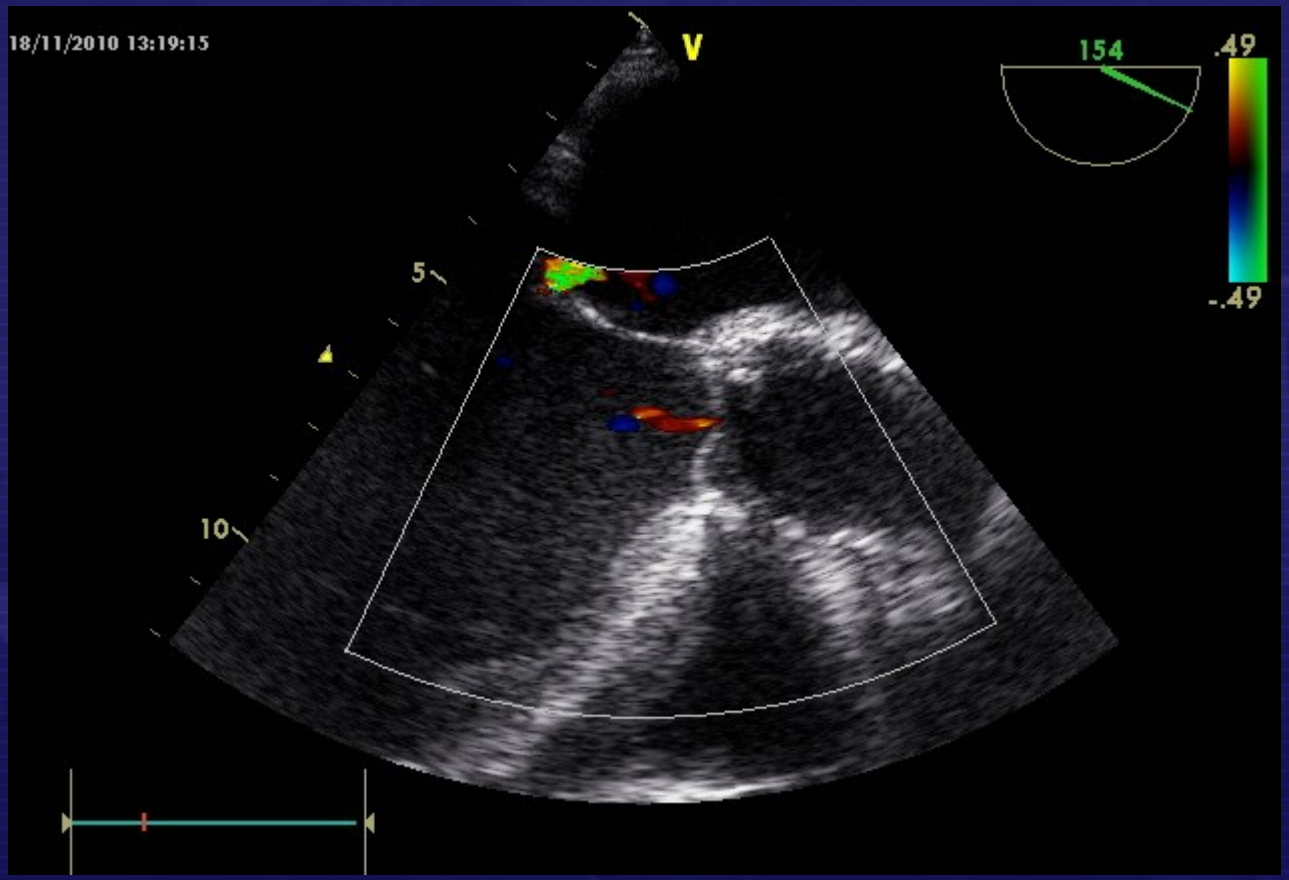
Операция по метода на David по повод на анулоаортна ектазия



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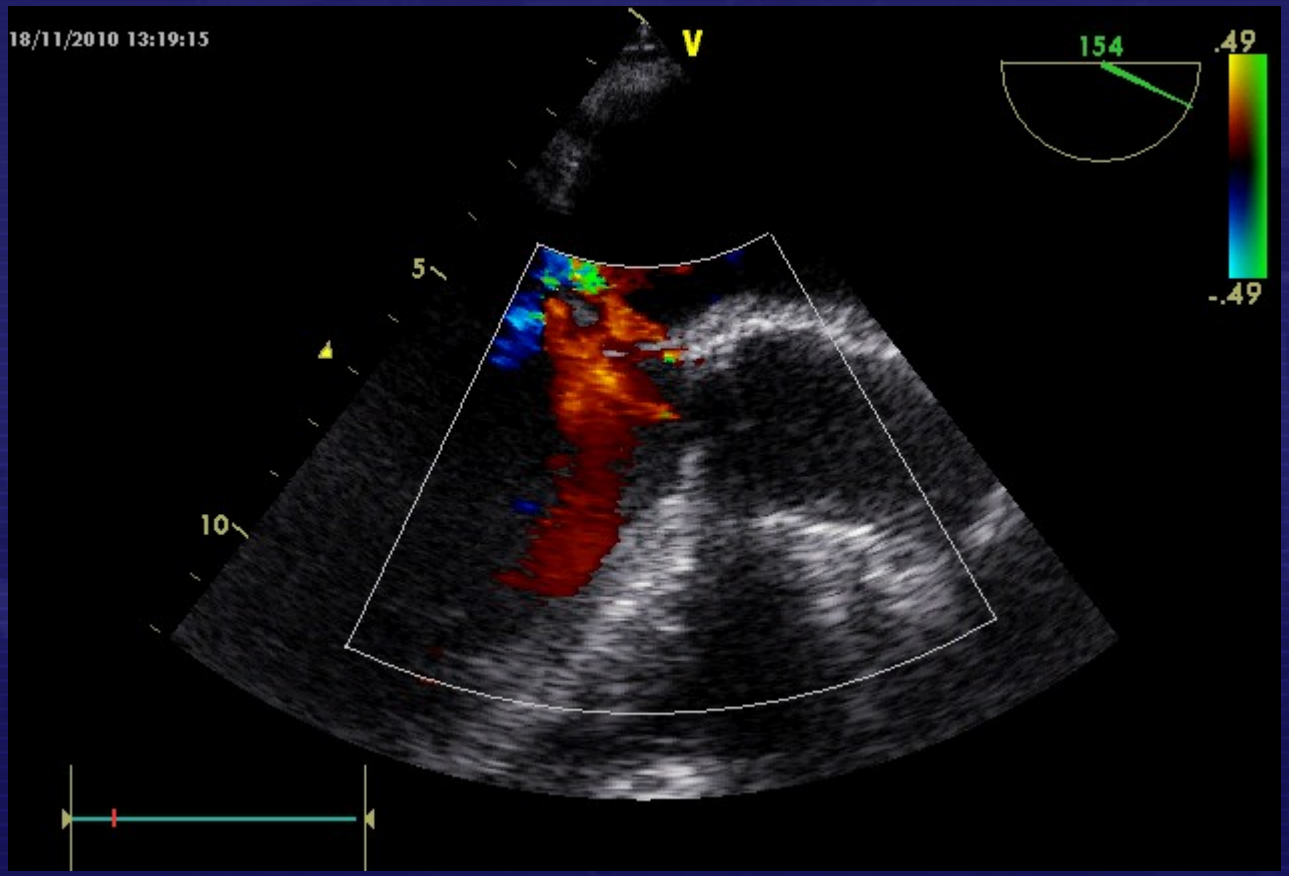
Операция по метода на David по повод на анулоаортна ектазия



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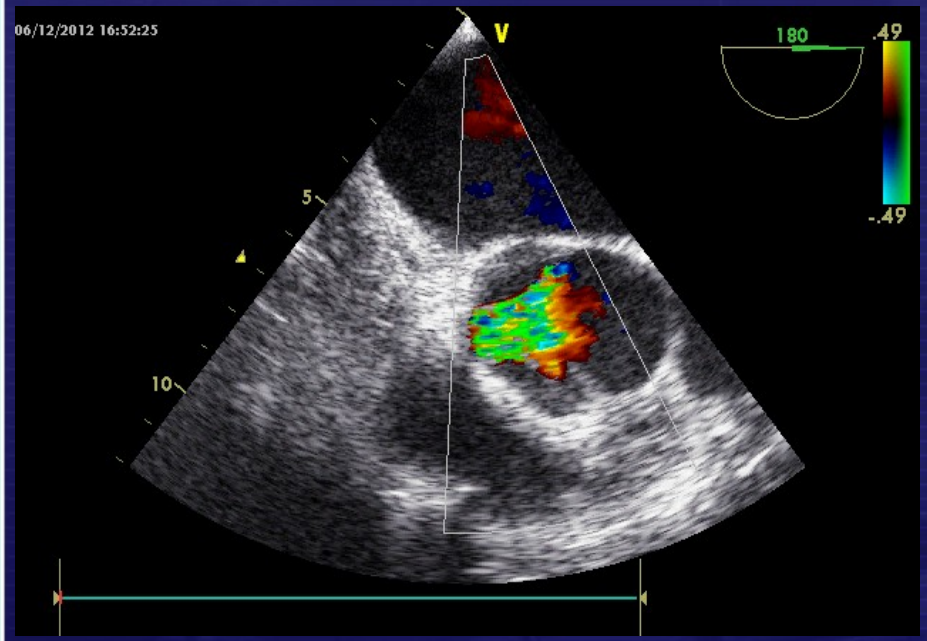
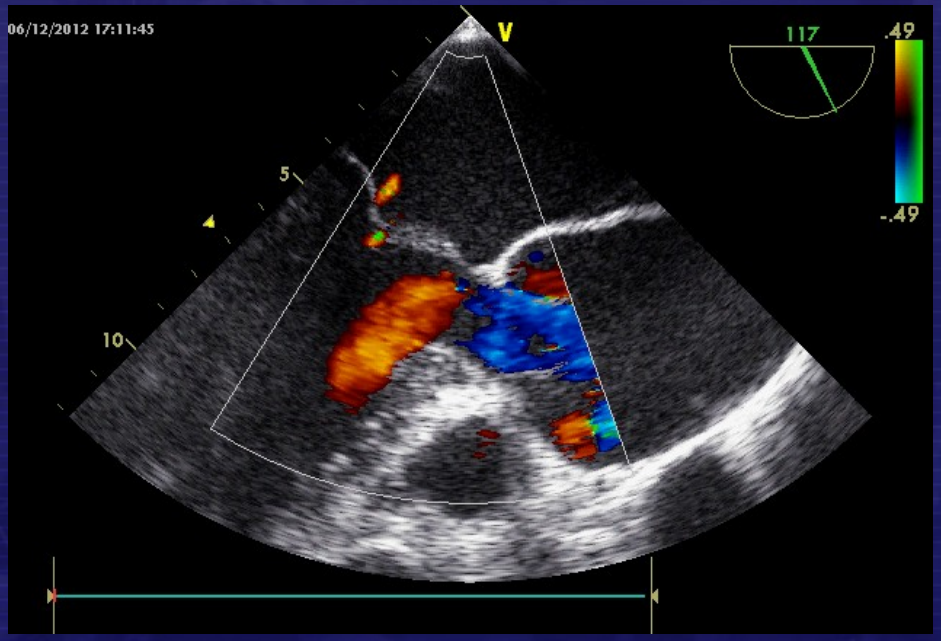
Високостепенна аортна клапна инсуфициенция при дисекация на възходяща аорта





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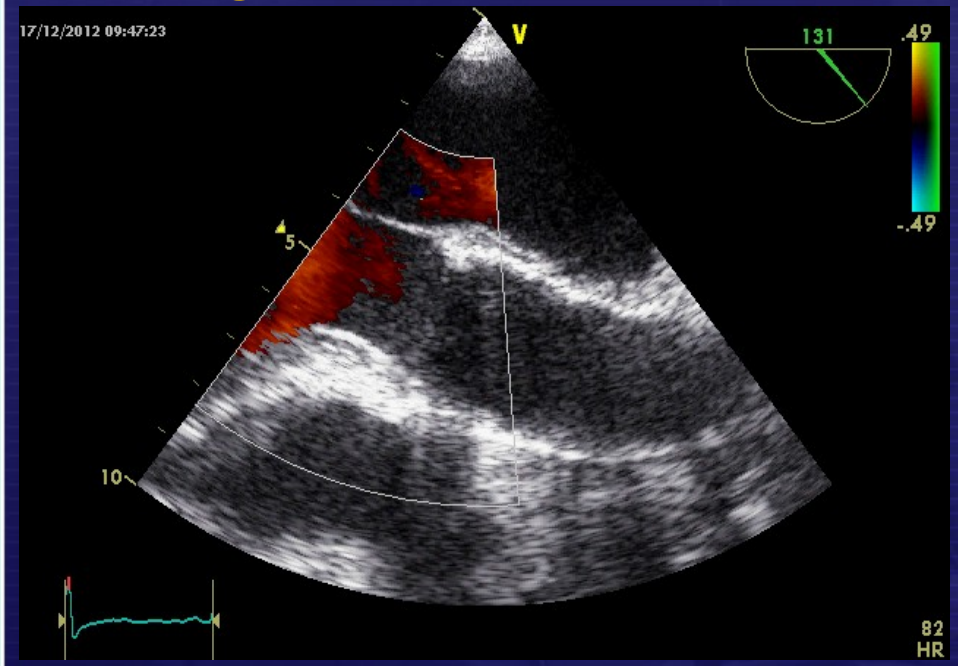
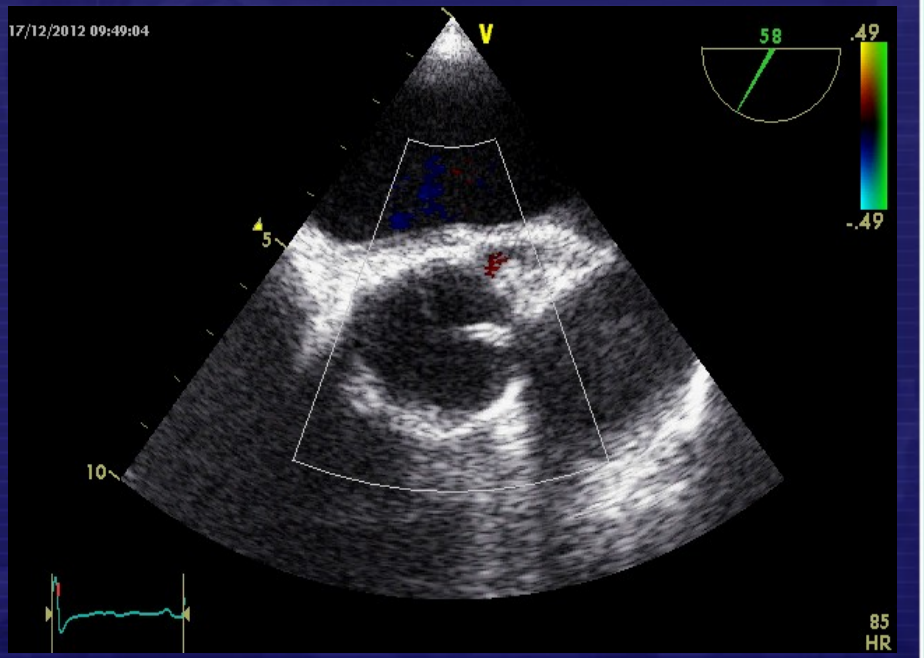
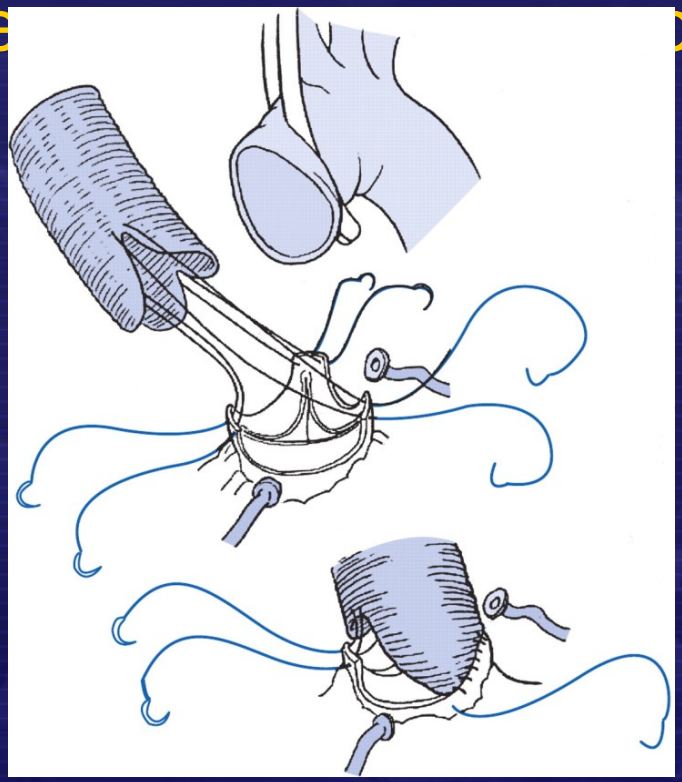
Операция по метода на David по повод на високостепенна аортна клапна инсуфициенция при аортна дисекация

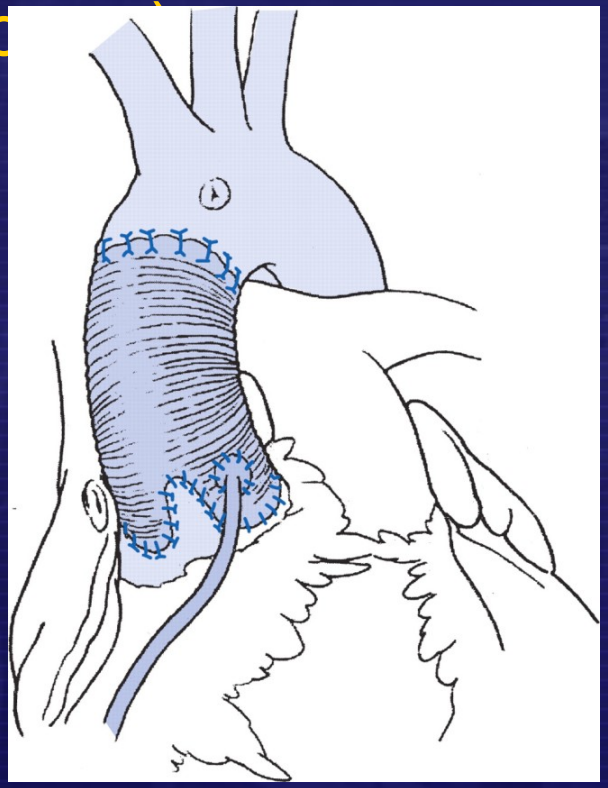




Клапно-съхраняващи операции – a modo Yakoub

(ре ртния ко





- Без стабилизация на аортния анулус
- По-лесна за извършване

David vs Yakoub

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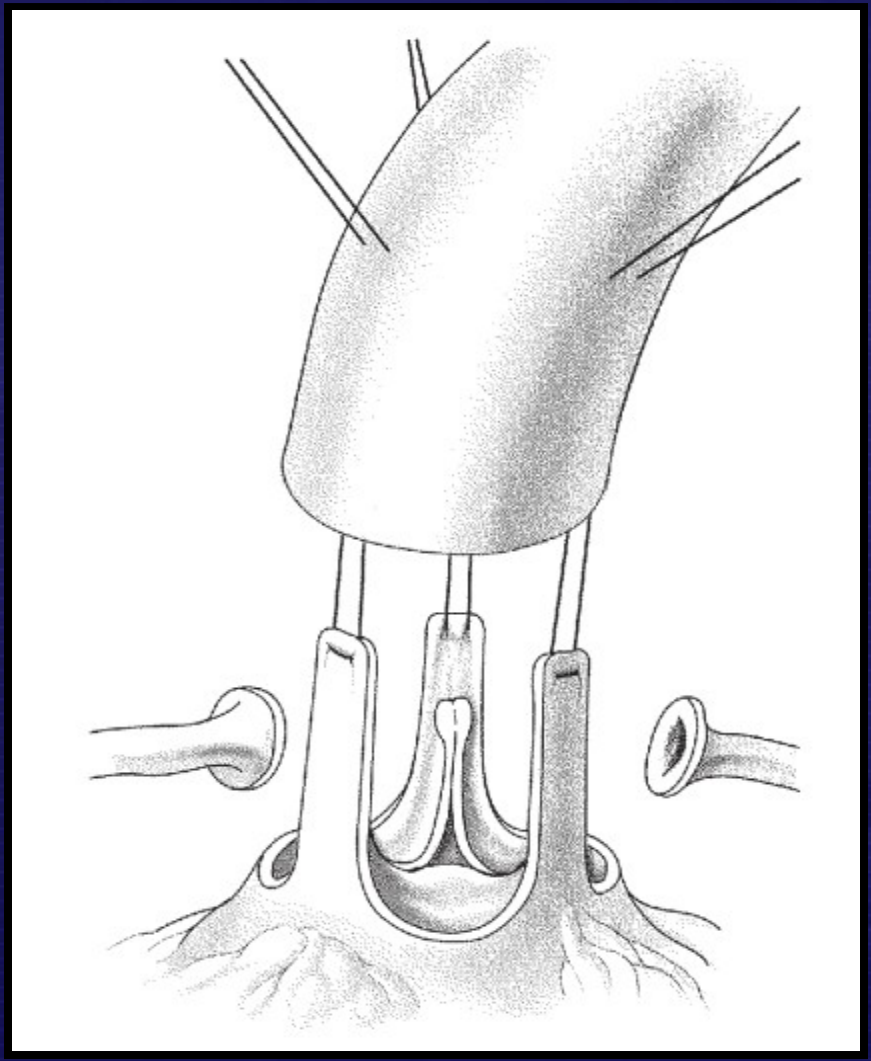

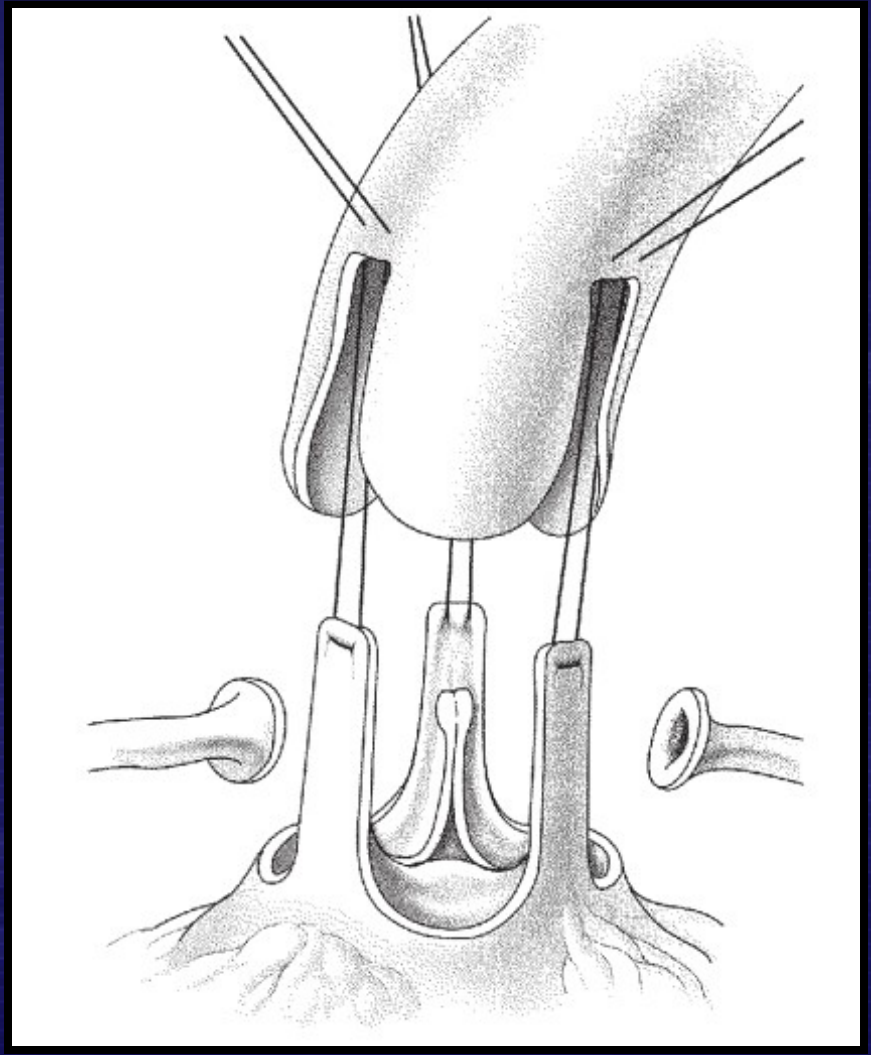

David vs Yakoub

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	Ao root remodelling	Ao valve reimplantation	Bentall-DeBono
Patients (n)	475	700	2453
Bicuspid Ao valve	64 (13.5%)	17 (2.4%)	139
Emergency	37 (8%)	34 (4.8%)	262
Operative mortality	3.9% (2–4.9)	1.67% (0–3.8)	5.3% (0–7.8)
Average follow-up	86 months	30 months	68 months
5 yrs survival	89.8%	94.15%	74.9% (in 10 years!)
Thromboembolic complications	0%	0%	4.2 %
Bleeding complications	0%	0%	20% (in 10 years!)
Reoperation rate	7.1%	4.1%	7.2%
Mean Ao valve gradient (mmHg)	4.3±2.2	4.3	14±9
Mean resudual AR	0.53	0.45	–

Външни анулопластични пръстени

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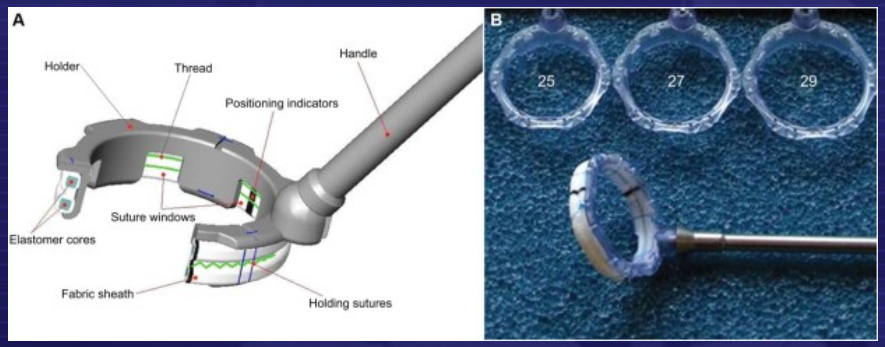
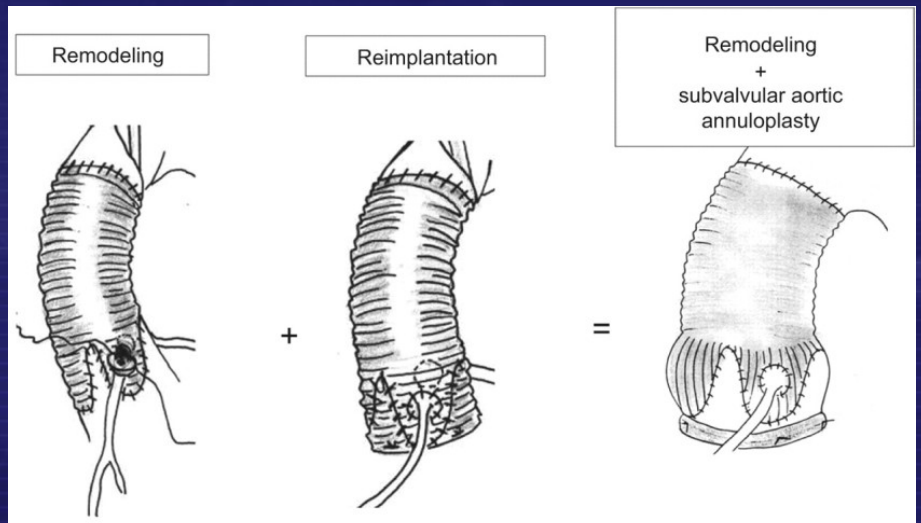


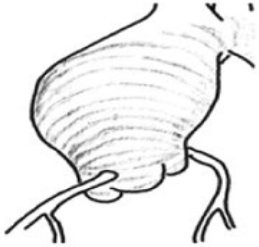


	Remodeling	Reimplantation	Remodeling + subvalvular aortic annuloplasty
Reduction of STJ Ø	+	+	+
Re-creation of sinuses of Valsalva	+	±	+
Root expansibility (interleaflet triangles)	+	-	+
Reduction of annular base Ø	-	+	+

Phenotypes of dystrophic ascending aorta

Aortic root aneurysm

Valsalva ≥45 mm
Annulus ≥25 mm



Supra-coronary aneurysm

Valsalva <40 mm

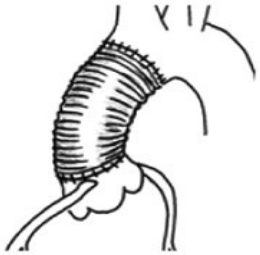
Isolated AI

Valsalva ≥40 mm
Annulus ≥25 mm

Physiological and standardized approach to aortic valve repair

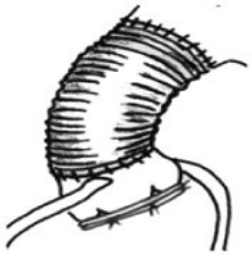
Reconstruction of the aortic root+subvalvular annuloplasty

Remodeling +subvalvular annuloplasty



Supra-coronary graft

\+



Sub-valvular annuloplasty
Annulus ≥25 mm

Sub-valvular annuloplasty

± Aortic valve repair

and/or

Resuspension of cusp effective height

Отделение по
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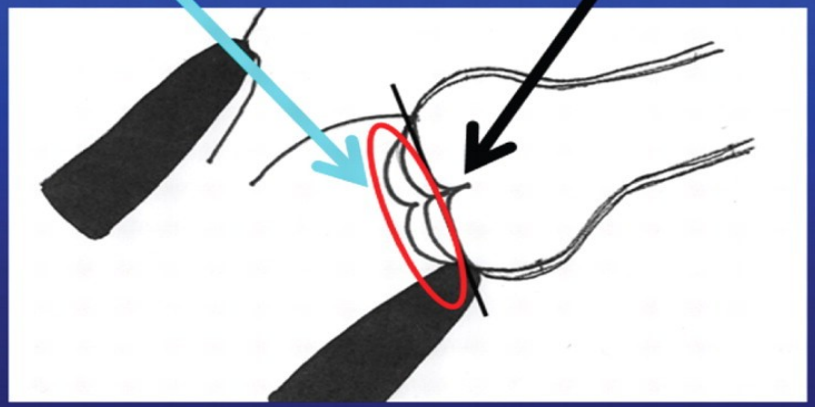
Интраоперативни ТЕЕ критерии за оценка на резултатите след аортна клапна реконструкция

Risk factor for reoperation	Satisfactory results
AL>grade I	AL≤grade I
Eccentric jet	Coaptation height>5 mm
Prolapsing cusps	
Leaflet bellowing	Effective height>9 mm
Tip of coaptation at the level of the aortic annulus or below	Tip of coaptation above the plane of aortic annulus



Отделение по
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Перкутанна имплантация на аортна клапа

- Релативно нов метод, алтернатива за възрастни (над 80 год.), високорискови пациенти, кандидати за смяна на аортна клапа (AVR)

- Трансфеморален / аксиларен или трансапикален достъп

Показания за TAVI

Отделение по
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Table 11 Recommendations for the use of transcatheter aortic valve implantation

Recommendations	Class [a]	Level [b]	Ref [c]
TAVI should only be undertaken with a multidisciplinary 'heart team' including cardiologists and cardiac surgeons and other specialists if necessary.	I	C	
TAVI should only be performed in hospitals with cardiac surgery on-site.	I	C	
TAVI is indicated in patients with severe symptomatic AS who are not suitable for AVR as assessed by a 'heart team' and who are likely to gain improvement in their quality of life and to have a life expectancy of more than 1 year after consideration of their comorbidities.	I	B	99
TAVI should be considered in high-risk patients with severe symptomatic AS who may still be suitable for surgery, but in whom TAVI is favoured by a 'heart team' based on the individual risk profile and anatomic suitability.	IIa	B	97

AS = aortic stenosis; AVR = aortic valve replacement; TAVI = transcatheter aortic valve implantation.
[a]Class of recommendation.
[b]Level of evidence.
[c]Reference(s) supporting class I (A + B) and IIa + IIb (A + B) recommendations.

Показания за TAVI

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Препоръки	Клас	Ниво
Към TAVI трябва да се премине при наличие на мултидисциплинарен “сърдечен екип” който включва кардиолог, кардиохирург и други специалисти при необходимост	I	C
TAVI трябва да се извършва само в болници с разкрито отделение по кардиохирургия	I	C
TAVI е показана при пациенти с тежка, симптоматична AS, които са оценени като непотходящи за AVR от сърдечния екип и при които се очаква подобрение в качеството на живот и очаквана продължителност на живота >1 година, като се вземат в предвид и придружаващите заболявания	I	B
TAVI трябва да се обмисля при високорискови пациенти с тежка, симптоматична AS, които можеби още са потходящи за операция, но TAVI е предпочитана от сърдечния екип въз основа на индивидуалния рисков профил и анатомични особености	IIa	B

Противопоказания за TAVI

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Table 10 Contraindications for transcatheter aortic valve implantation

Absolute contraindications
Absence of a 'heart team' and no cardiac surgery on the site
Appropriateness of TAVI, as an alternative to AVR, not confirmed by a 'heart team'
Clinical
Estimated life expectancy <1 year Improvement of quality of life by TAVI unlikely because of comorbidities Severe primary associated disease of other valves with major contribution to the patient's symptoms, that can be treated only by surgery
Anatomical
Inadequate annulus size (<18 mm, >29 mm[a])
Thrombus in the left ventricle
Active endocarditis
Elevated risk of coronary ostium obstruction (asymmetric valve calcification, short distance between annulus and coronary ostium, small aortic sinuses)
Plaques with mobile thrombi in the ascending aorta, or arch
For transfemoral/subclavian approach: inadequate vascular access (vessel size, calcification, tortuosity)
Relative contraindications
Bicuspid or non-calcified valves
Untreated coronary artery disease requiring revascularization
Haemodynamic instability
LVEF <20%
For transapical approach: severe pulmonary disease, LV apex not accessible

AVR = aortic valve replacement; LV = left ventricle; LVEF = left ventricular ejection fraction; TAVI = transcatheter aortic valve implantation.
[a]Contraindication when using the current devices.

Перкутанна имплантация на аортна клапа

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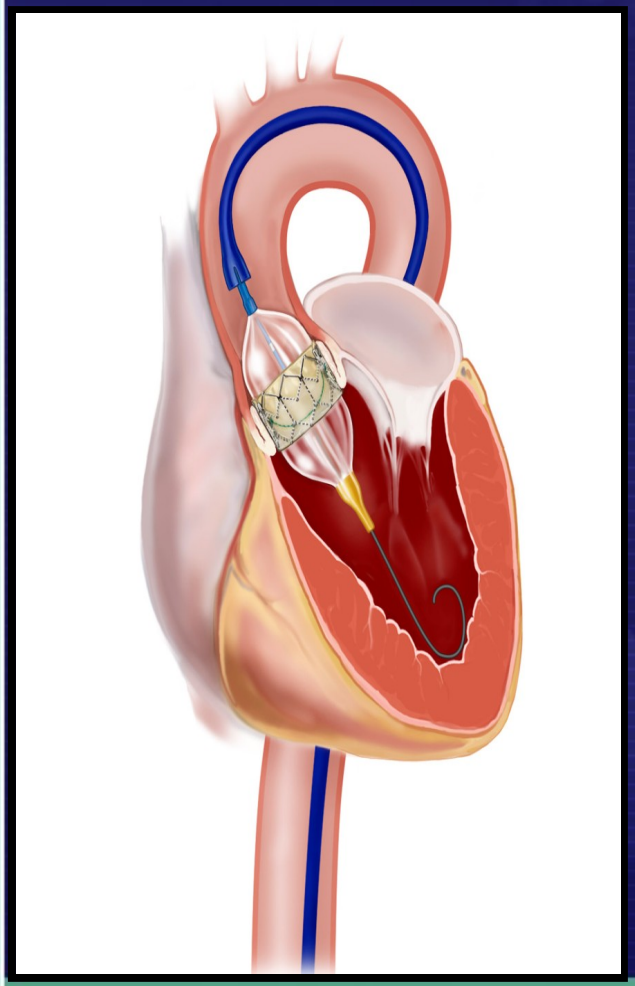

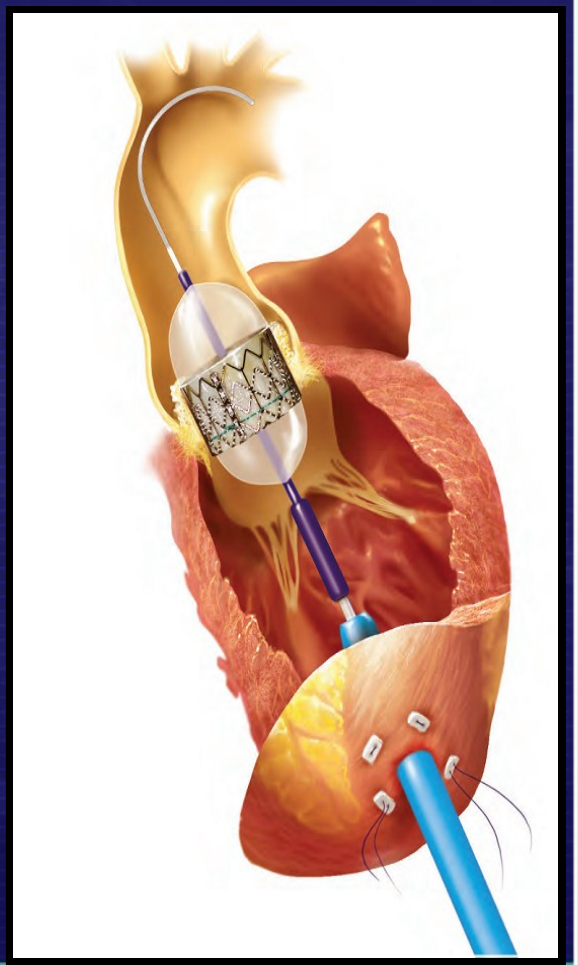

Table 17 Choice of the aortic/mitral prosthesis. In favour of a mechanical prosthesis.

	Class[a]	Level[b]
A mechanical prosthesis is recommended according to the desire of the informed patient and if there are no contraindications for long-term anticoagulation.[c]	I	C
A mechanical prosthesis is recommended in patients at risk of accelerated structural valve deterioration.[d]	I	C
A mechanical prosthesis is recommended in patients already on anticoagulation as a result of having a mechanical prosthesis in another valve position.	I	C
A mechanical prosthesis should be considered in patients aged <60 years for prostheses in the aortic position and <65 years for prostheses in the mitral position.[e]	IIa	C
A mechanical prosthesis should be considered in patients with a reasonable life expectancy,[f] for whom future redo valve surgery would be at high risk.	IIa	C
A mechanical prosthesis may be considered in patients already on long-term anticoagulation due to high risk of thromboembolism.[g]	IIb	C

The decision is based on the integration of several of the following factors
[a]Class of recommendation.
[b]Level of evidence.
[c]Increased bleeding risk because of comorbidities, compliance concerns, geographic, lifestyle and occupational conditions.
[d]Young age (<40 years), hyperparathyroidism.
[e]In patients aged 60–65 years who should receive an aortic prosthesis, and those between 65–70 years in the case of mitral prosthesis, both valves are acceptable and the choice requires careful analysis of other factors than age.
[f]Life expectancy should be estimated >10 years, according to age, gender, comorbidities, and country-specific life expectancy.
[g]Risk factors for thromboembolism are atrial fibrillation, previous thromboembolism, hypercoagulable state, severe left ventricular systolic dysfunction.

Table 18 Choice of the aortic/mitral prosthesis. In favour of a bioprosthesis.

	Class [a]	Level [b]
A bioprosthesis is recommended according to the desire of the informed patient	I	C
A bioprosthesis is recommended when good quality anticoagulation is unlikely (compliance problems; not readily available) or contraindicated because of high bleeding risk (prior major bleed; comorbidities; unwillingness; compliance problems; lifestyle; occupation).	I	C
A bioprosthesis is recommended for reoperation for mechanical valve thrombosis despite good long-term anticoagulant control.	I	C
A bioprosthesis should be considered in patients for whom future redo valve surgery would be at low risk.	IIa	C
A bioprosthesis should be considered in young women contemplating pregnancy.	IIa	C
A bioprosthesis should be considered in patients aged >65 years for prosthesis in aortic position or >70 years in mitral position, or those with life expectancy[c] lower than the presumed durability of the bioprosthesis.[d]	IIa	C

The decision is based on the integration of several of the following factors
[a]Class of recommendation.
[b]Level of evidence.
[c]Life expectancy should be estimated according to age, gender, comorbidities, and country-specific life expectancy.
[d]In patients aged 60–65 years who should receive an aortic prosthesis and those 65–70 years in the case of mitral prosthesis, both valves are acceptable and the choice requires careful analysis of factors other than age.

Table 6 Management of coronary artery disease in patients with valvular heart disease

	Class[a]	Level[b]
Diagnosis of coronary artery disease		
Coronary angiography[c] is recommended before valve surgery in patients with severe valvular heart disease and any of the following: • history of coronary artery disease • suspected myocardial ischaemia[d] • left ventricular systolic dysfunction • in men aged over 40 years and postmenopausal women • ≥1 cardiovascular risk factor.	I	C
Coronary angiography is recommended in the evaluation of secondary mitral regurgitation.	I	C
Indications for myocardial revascularization		
CABG is recommended in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis ≥70%.[e]	I	C
CABG should be considered in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis ≥50–70%.	IIa	C

CABG = coronary artery bypass grafting.
[a]Class of recommendation.
[b]Level of evidence.
[c]Multi-slice computed tomography may be used to exclude coronary artery disease in patients who are at low risk of atherosclerosis.
[d]Chest pain, abnormal non-invasive testing.
[e]≥50% can be considered for left main stenosis.
Adapted from Wijns et al.[20]