

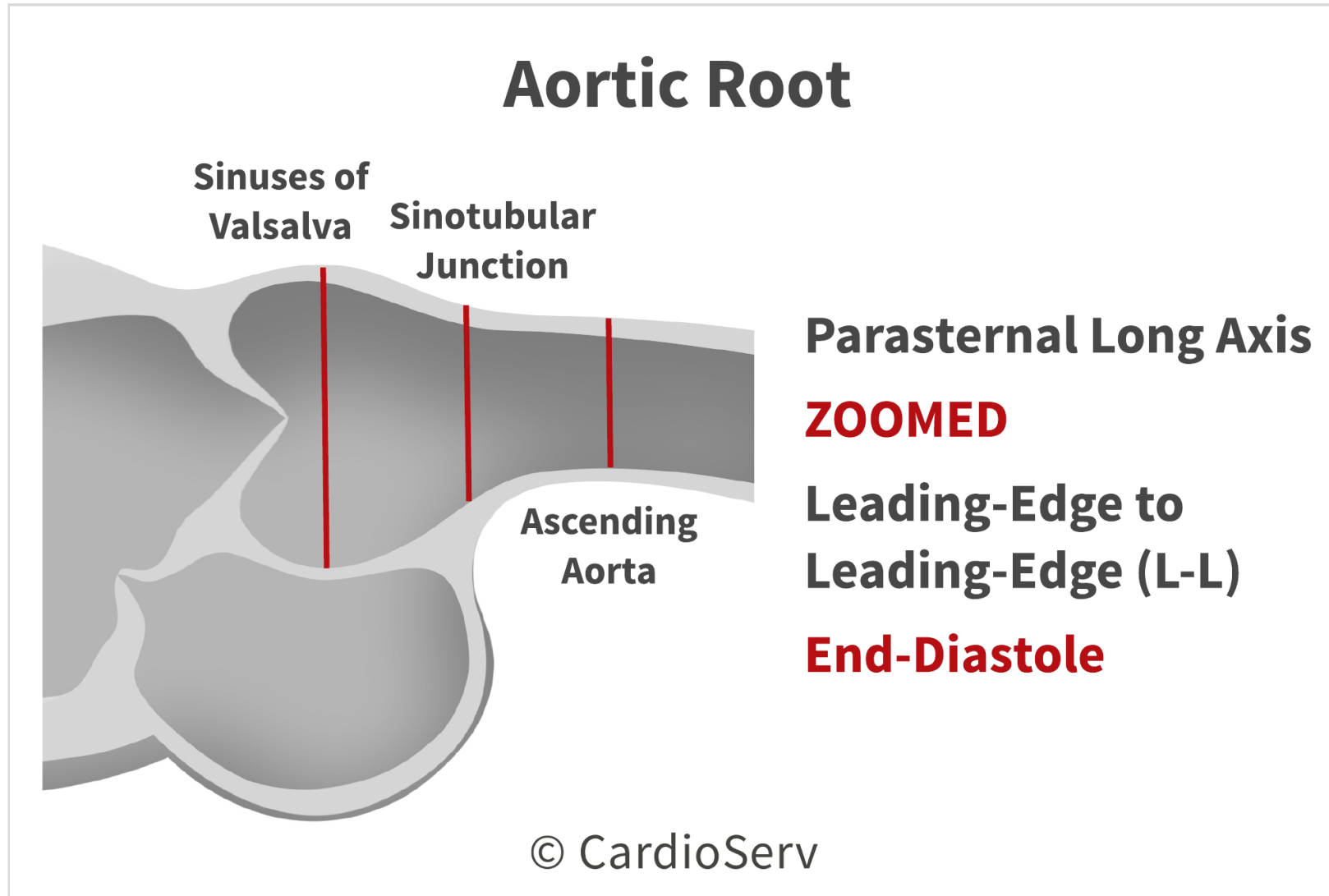
Aortic valve surgery

김정환

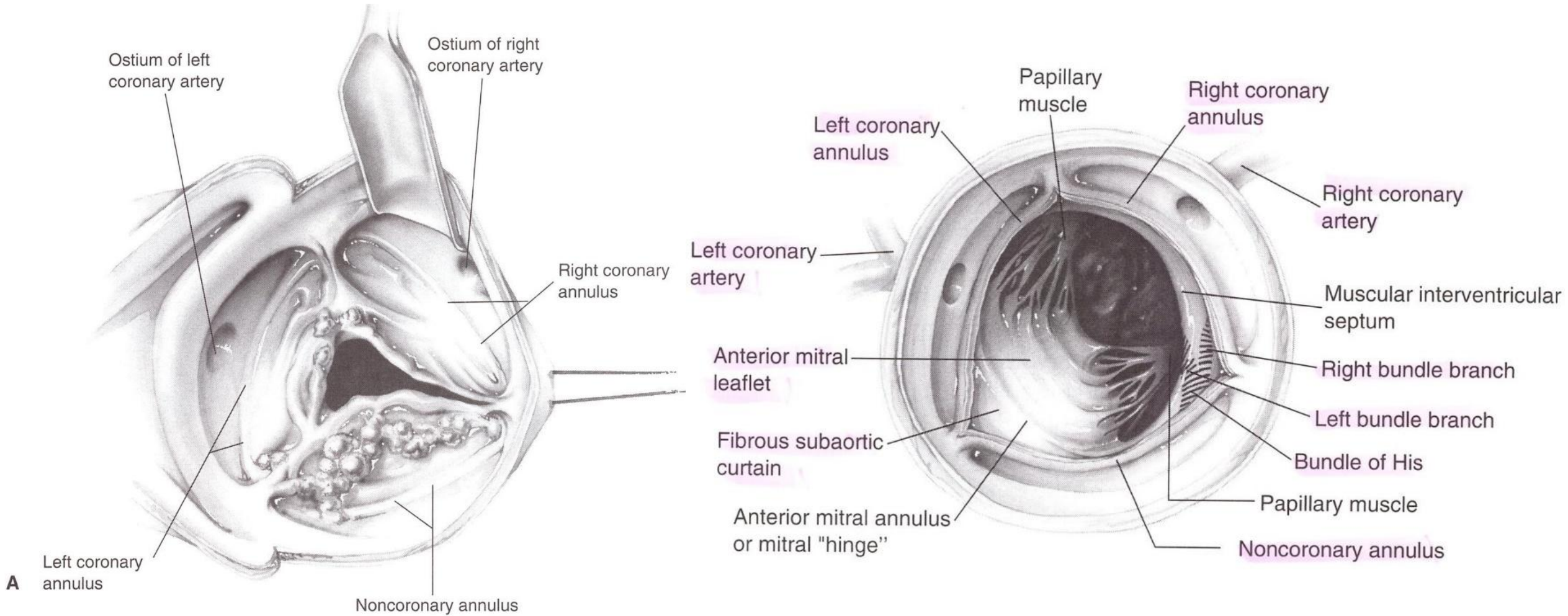
연세대학교

Severance

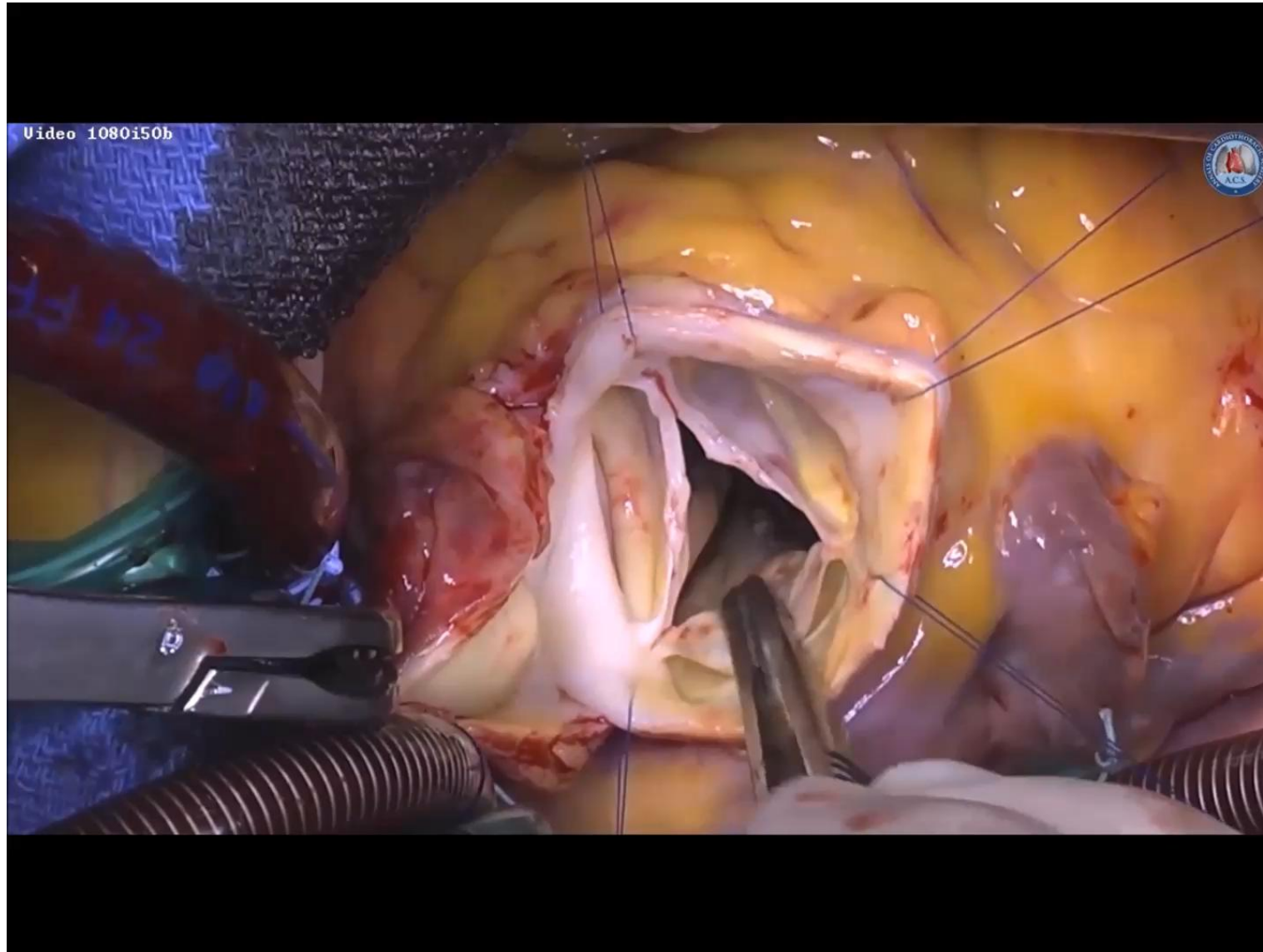
Aortic valve anatomy



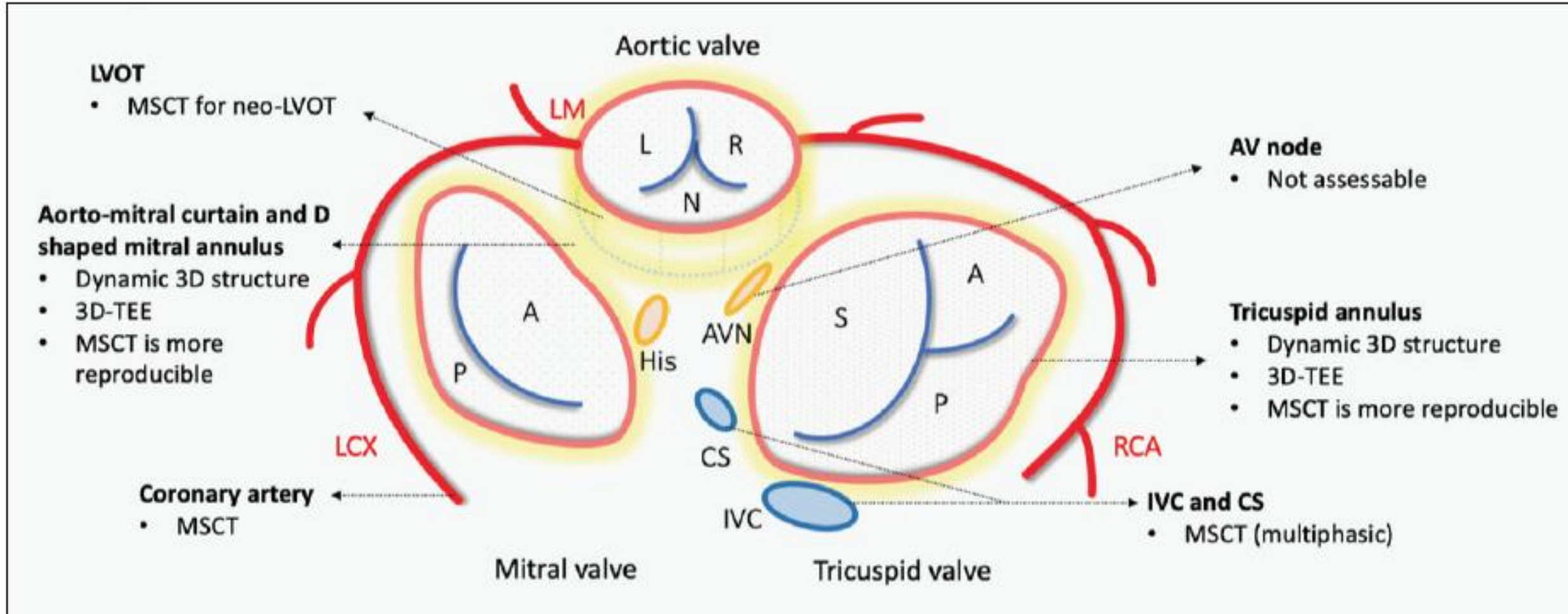
Aortic valve anatomy



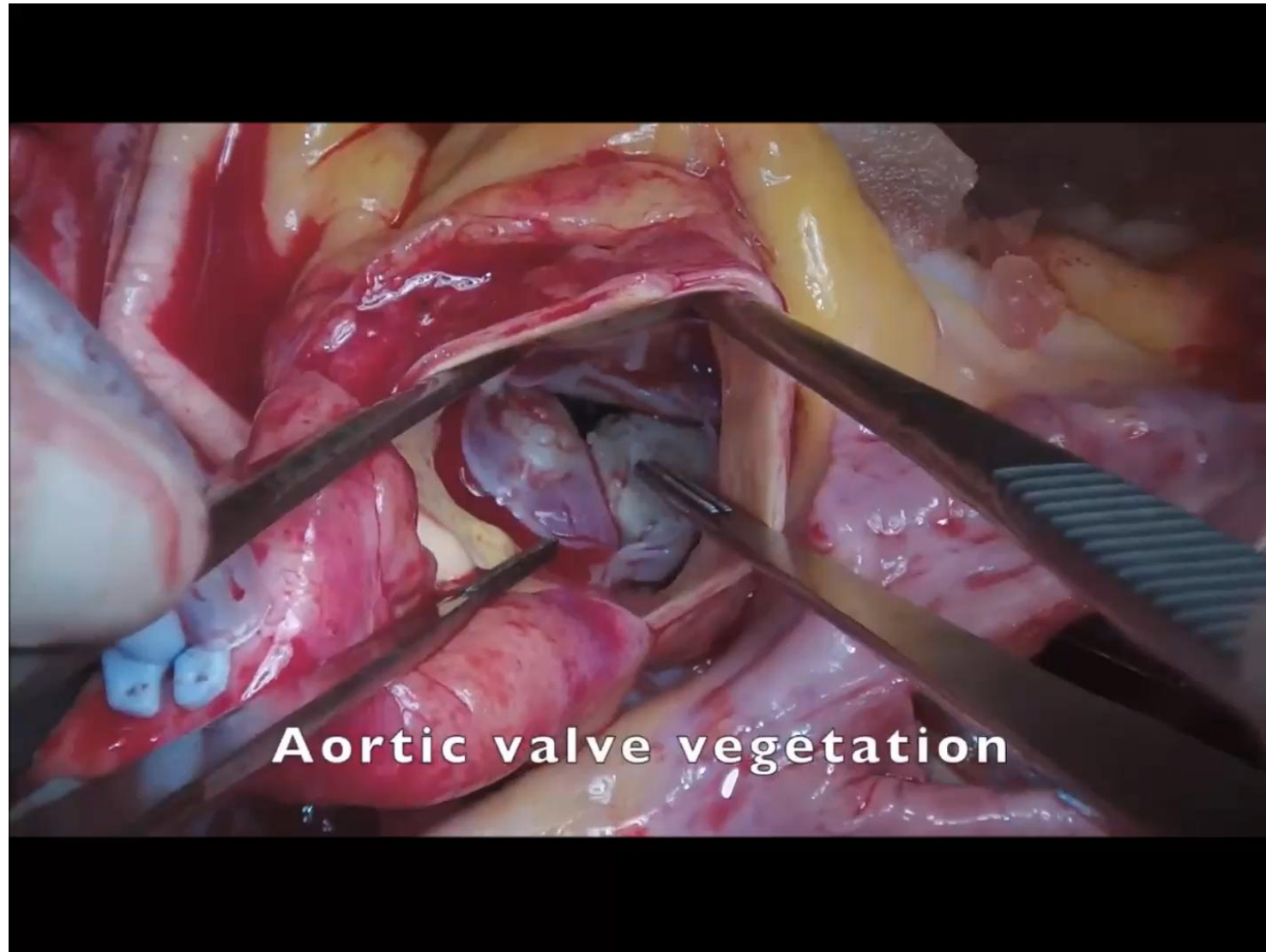
Aortic valve anatomy



Relationship between three valves



Relationship between three valves



Aortic stenosis

Table 13. Stages of AS

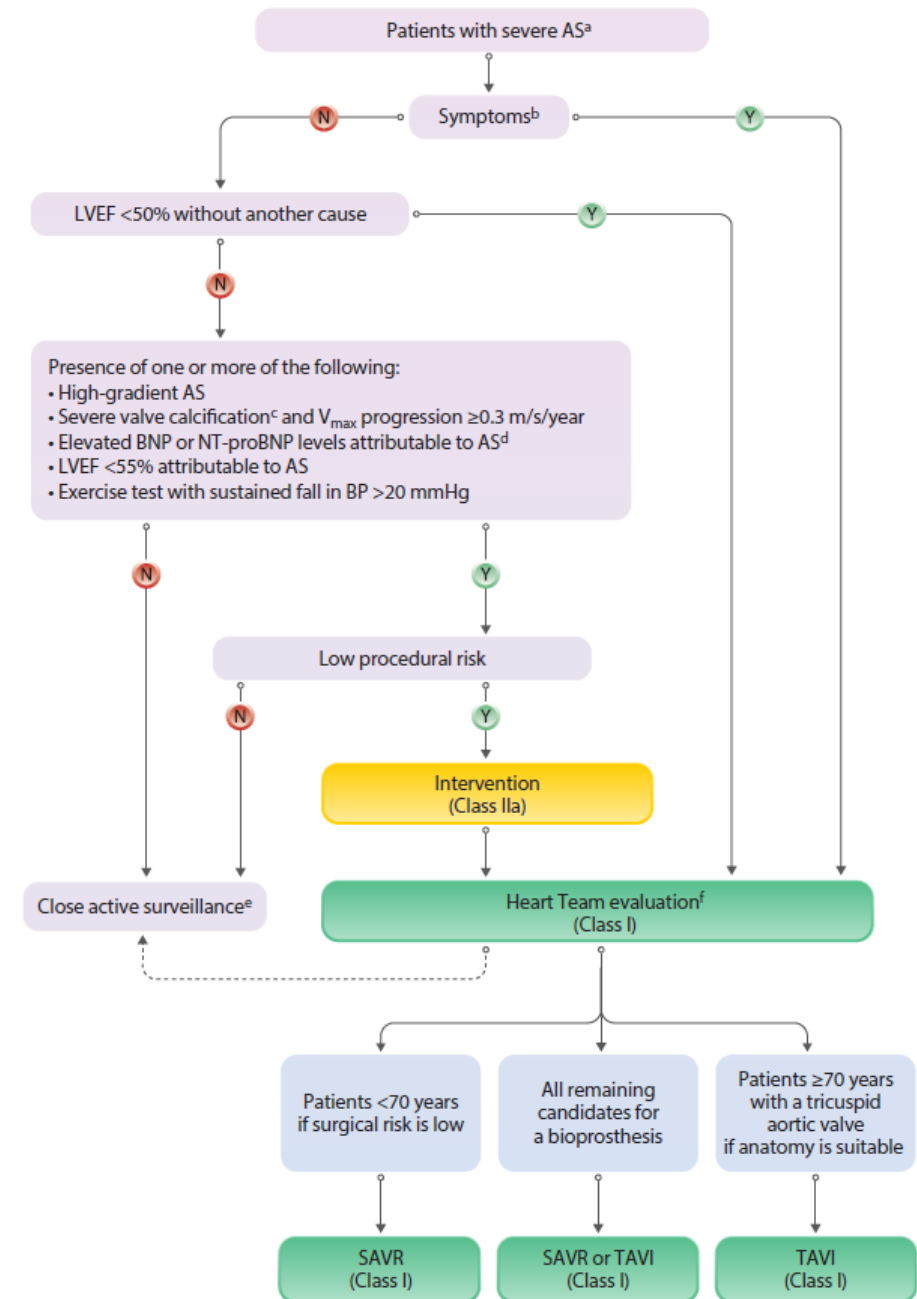
Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
A	At risk of AS	BAV (or other congenital valve anomaly) Aortic valve sclerosis	Aortic $V_{\max} < 2$ m/s with normal leaflet motion	None	None
B	Progressive AS	Mild to moderate leaflet calcification/fibrosis of a bicuspid or trileaflet valve with some reduction in systolic motion or Rheumatic valve changes with commissural fusion	Mild AS: aortic $V_{\max}$ 2.0–2.9 m/s or mean $\Delta P < 20$ mm Hg Moderate AS: aortic $V_{\max}$ 3.0–3.9 m/s or mean ΔP 20–39 mm Hg	Early LV diastolic dysfunction may be present Normal LVEF	None
C: Asymptomatic severe AS					
C1	Asymptomatic severe AS	Severe leaflet calcification/fibrosis or congenital stenosis with severely reduced leaflet opening	Aortic $V_{\max} \geq 4$ m/s or mean $\Delta P \geq 40$ mm Hg AVA typically is ≤ 1.0 cm ² (or AVAi 0.6 cm ² /m ²) but not required to define severe AS Very severe AS is an aortic $V_{\max} \geq 5$ m/s or mean $P \geq 60$ mm Hg	LV diastolic dysfunction Mild LV hypertrophy Normal LVEF	None Exercise testing is reasonable to confirm symptom status
C2	Asymptomatic severe AS with LV systolic dysfunction	Severe leaflet calcification/fibrosis or congenital stenosis with severely reduced leaflet opening	Aortic $V_{\max} \geq 4$ m/s or mean $\Delta P \geq 40$ mm Hg AVA typically ≤ 1.0 cm ² (or AVAi 0.6 cm ² /m ²) but not required to define severe AS	LVEF $< 50\%$	None

Aortic stenosis

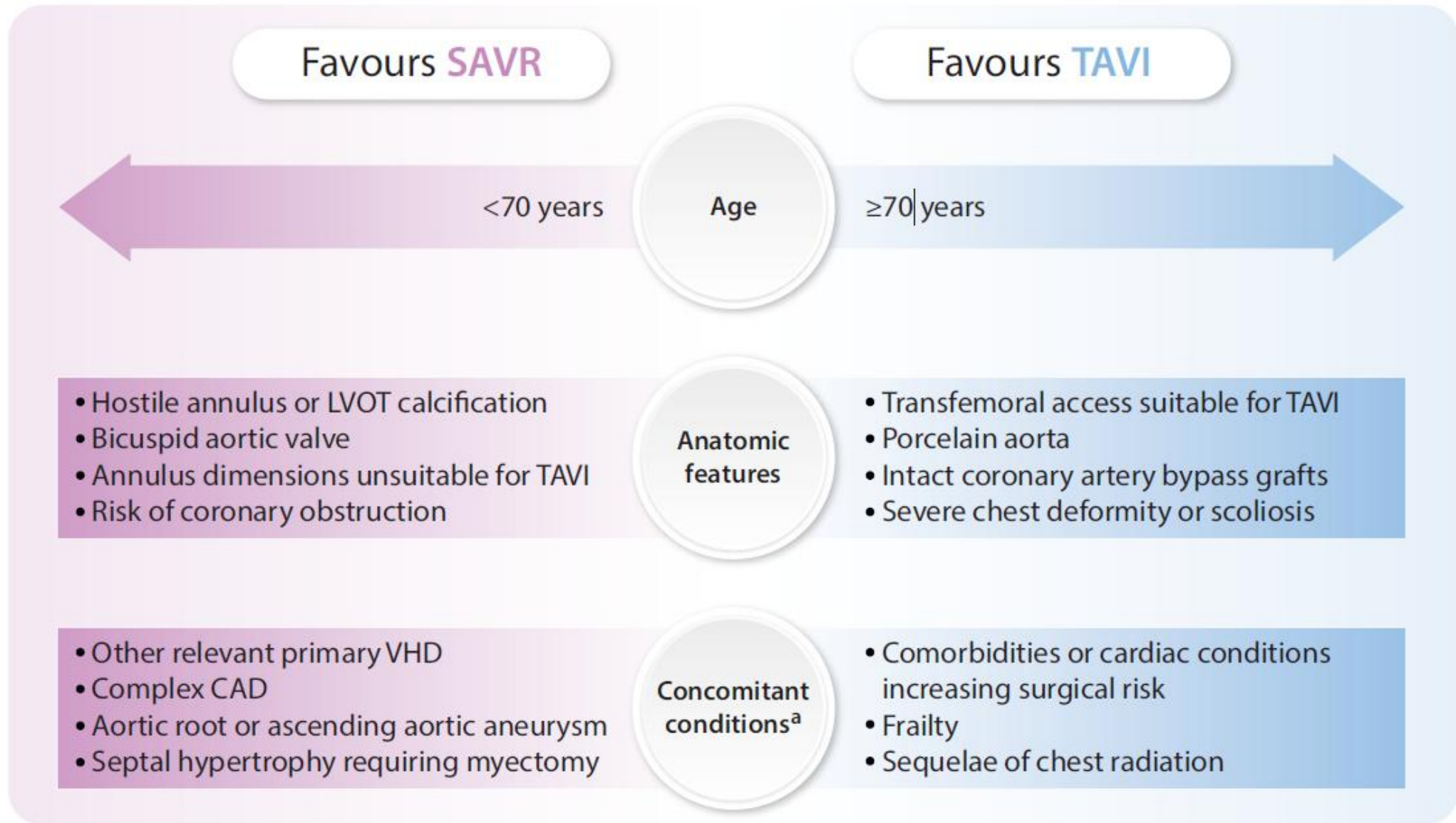
D: Symptomatic severe AS					
D1	Symptomatic severe high-gradient AS	Severe leaflet calcification/fibrosis or congenital stenosis with severely reduced leaflet opening	Aortic $V_{\max} \geq 4$ m/s or mean $\Delta P \geq 40$ mm Hg AVA typically ≤ 1.0 cm ² (or AVAi ≤ 0.6 cm ² /m ²) but may be larger with mixed AS/AR	LV diastolic dysfunction LV hypertrophy Pulmonary hypertension may be present	Exertional dyspnea, decreased exercise tolerance, or HF Exertional angina Exertional syncope or presyncope
D2	Symptomatic severe low-flow, low-gradient AS with reduced LVEF	Severe leaflet calcification/fibrosis with severely reduced leaflet motion	AVA ≤ 1.0 cm ² with resting aortic $V_{\max} < 4$ m/s or mean $\Delta P < 40$ mm Hg Dobutamine stress echocardiography shows AVA < 1.0 cm ² with $V_{\max} \geq 4$ m/s at any flow rate	LV diastolic dysfunction LV hypertrophy LVEF $< 50\%$	HF Angina Syncope or presyncope
D3	Symptomatic severe low-gradient AS with normal LVEF or paradoxical low-flow severe AS	Severe leaflet calcification/fibrosis with severely reduced leaflet motion	AVA ≤ 1.0 cm ² (indexed AVA ≤ 0.6 cm ² /m ²) with an aortic $V_{\max} < 4$ m/s or mean $\Delta P < 40$ mm Hg AND Stroke volume index < 35 mL/m ² Measured when patient is normotensive (systolic blood pressure < 140 mm Hg)	Increased LV relative wall thickness Small LV chamber with low stroke volume Restrictive diastolic filling LVEF $\geq 50\%$	HF Angina Syncope or presyncope

Aortic stenosis

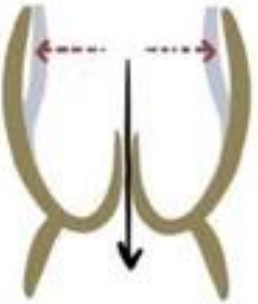
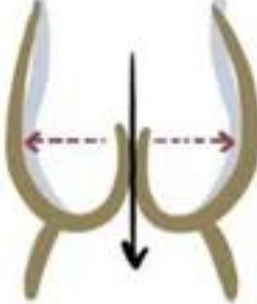
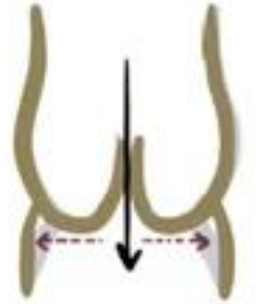
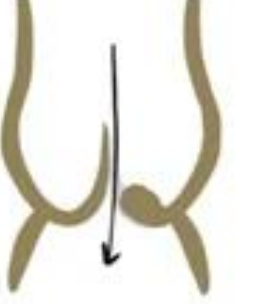
- ✓ Symptomatic severe AS
- ✓ Asymptomatic severe AS with heart failure



Aortic stenosis



Aortic regurgitation

Types of AR	Type I				Type II	Type III
	1a	1b	1c	1d		
						
Valve Cusp Pathology	Normal	Normal	Normal	Cusp Perforation/Fenestration	Excessive Cusp Prolapse Cusp Commissural Disruption	Cusp Retraction Cusp Restriction
Aortic Pathology	Dilation of STJ	Dilation of Sinus of Valsava	Dilation of Aortic Annulus	Dilation of Aortic Annulus	Normal	Normal
Repair Technique	STJ remodeling	Aortic Valve Sparing	Subcommissural Annuloplasty	Patch Repair	Prolapse Repair	Cusp Repair

Aortic regurgitation

Table 15. Stages of Chronic AR

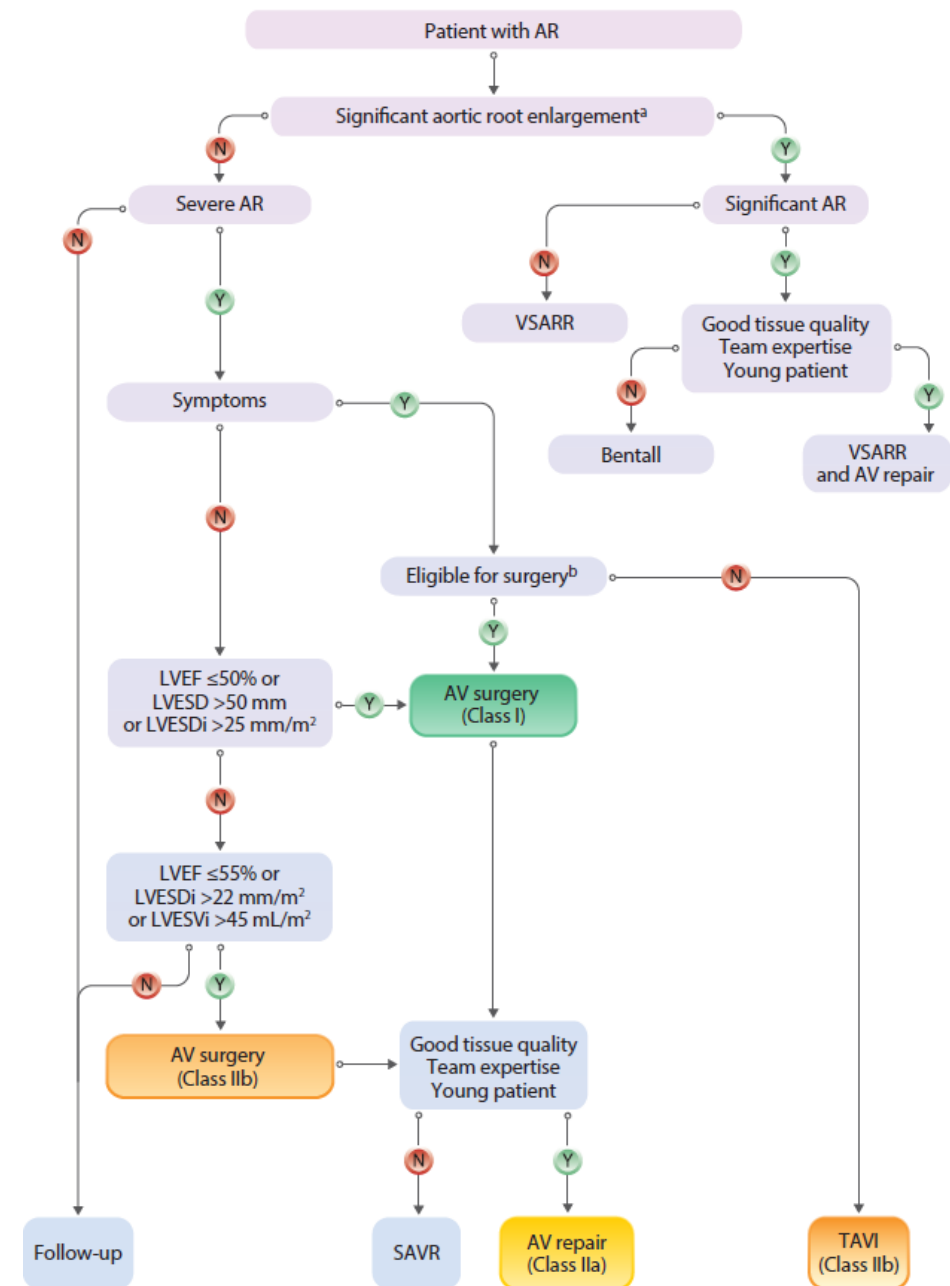
Stage	Definition	Valve Anatomy	Valve Hemodynamics	Hemodynamic Consequences	Symptoms
A	At risk of AR	BAV (or other congenital valve anomaly) Aortic valve sclerosis Diseases of the aortic sinuses or ascending aorta History of rheumatic fever or known rheumatic heart disease IE	AR severity: none or trace	None	None
B	Progressive AR	Mild to moderate calcification of a trileaflet valve BAV (or other congenital valve anomaly) Dilated aortic sinuses Rheumatic valve changes Previous IE	Mild AR: Jet width <25% of LVOT Vena contracta <0.3 cm Regurgitant volume <30 mL/beat Regurgitant fraction <30% ERO <0.10 cm ² Angiography grade 1 Moderate AR: Jet width 25%–64% of LVOT Vena contracta 0.3–0.6 cm Regurgitant volume 30–59 mL/beat Regurgitant fraction 30% to 49% ERO 0.10–0.29 cm ² Angiography grade 2	Normal LV systolic function Normal LV volume or mild LV dilation	None

Aortic regurgitation

C	Asymptomatic severe AR	Calcific aortic valve disease Bicuspid valve (or other congenital abnormality) Dilated aortic sinuses or ascending aorta Rheumatic valve changes IE with abnormal leaflet closure or perforation	Severe AR: Jet width $\geq 65\%$ of LVOT Vena contracta > 0.6 cm Holodiastolic flow reversal in the proximal abdominal aorta Regurgitant volume ≥ 60 mL/beat Regurgitant fraction $\geq 50\%$ ERO ≥ 0.3 cm² Angiography grade 3 to 4 In addition, diagnosis of chronic severe AR requires evidence of LV dilation	C1: Normal LVEF ($> 55\%$) and mild to moderate LV dilation (LVESD < 50 mm) C2: Abnormal LV systolic function with depressed LVEF ($\leq 55\%$) or severe LV dilation (LVESD > 50 mm or indexed LVESD > 25 mm/m²)	None; exercise testing is reasonable to confirm symptom status
D	Symptomatic severe AR	Calcific valve disease Bicuspid valve (or other congenital abnormality) Dilated aortic sinuses or ascending aorta Rheumatic valve changes Previous IE with abnormal leaflet closure or perforation	Severe AR: Doppler jet width $\geq 65\%$ of LVOT Vena contracta > 0.6 cm Holodiastolic flow reversal in the proximal abdominal aorta Regurgitant volume ≥ 60 mL/beat Regurgitant fraction $\geq 50\%$ ERO ≥ 0.3 cm² Angiography grade 3 to 4 In addition, diagnosis of chronic severe AR requires evidence of LV dilation	Symptomatic severe AR may occur with normal systolic function (LVEF $> 55\%$), mild to moderate LV dysfunction (LVEF 40% to 55%), or severe LV dysfunction (LVEF $< 40\%$) Moderate to severe LV dilation is present	Exertional dyspnea or angina or more severe HF symptoms

Aortic regurgitation

- ✓ Root aneurysm
- ✓ Symptomatic severe AR
- ✓ Asymptomatic severe AR with heart failure



Aortic valve replacement : Aortotomy

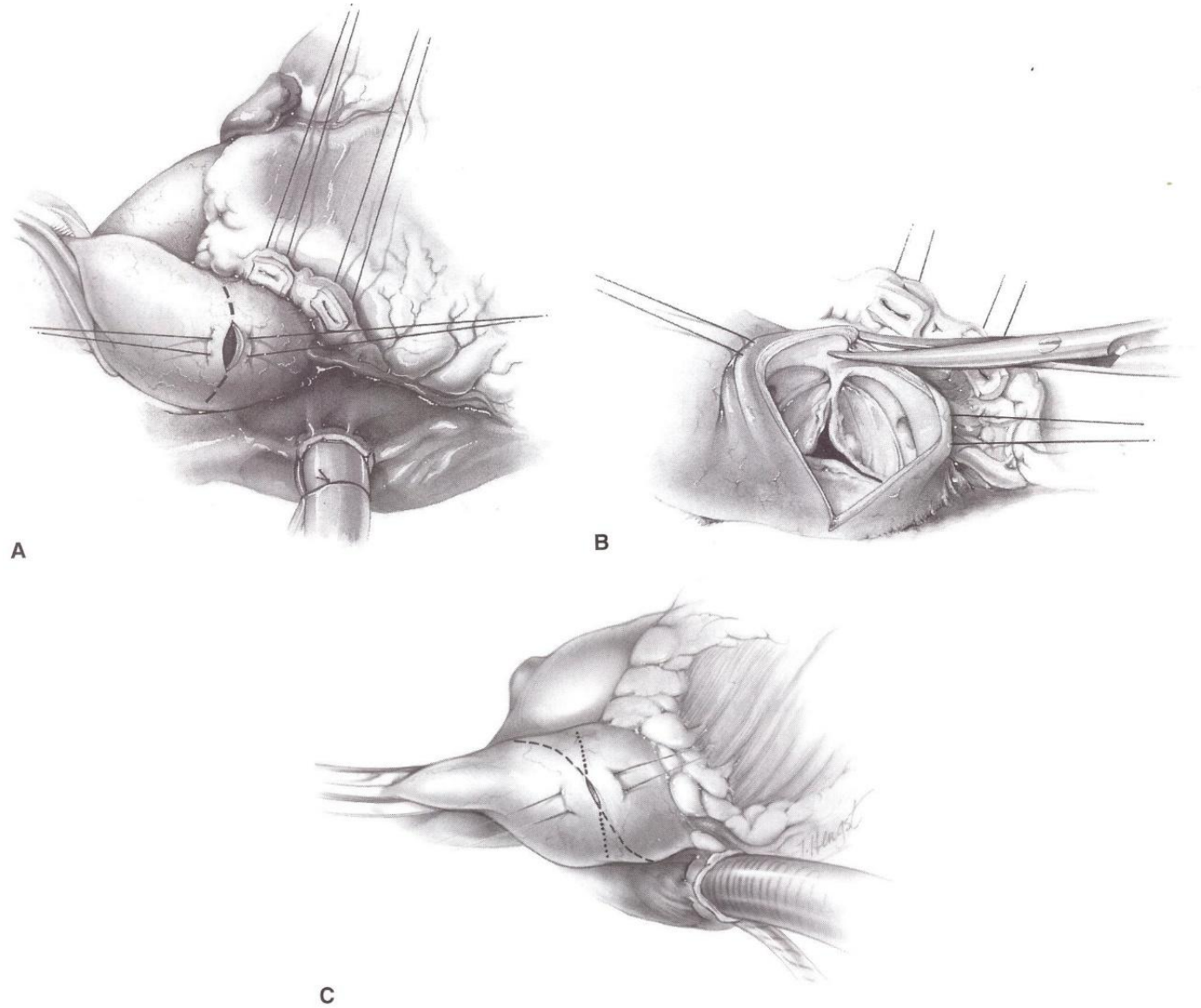


FIG 5-2. **A:** A low transverse incision to expose the aortic valve. **B:** Extension of transverse incision. **C:** Initial small transverse aortotomy may be extended transversely or obliquely.

Aortic valve replacement : Aortotomy

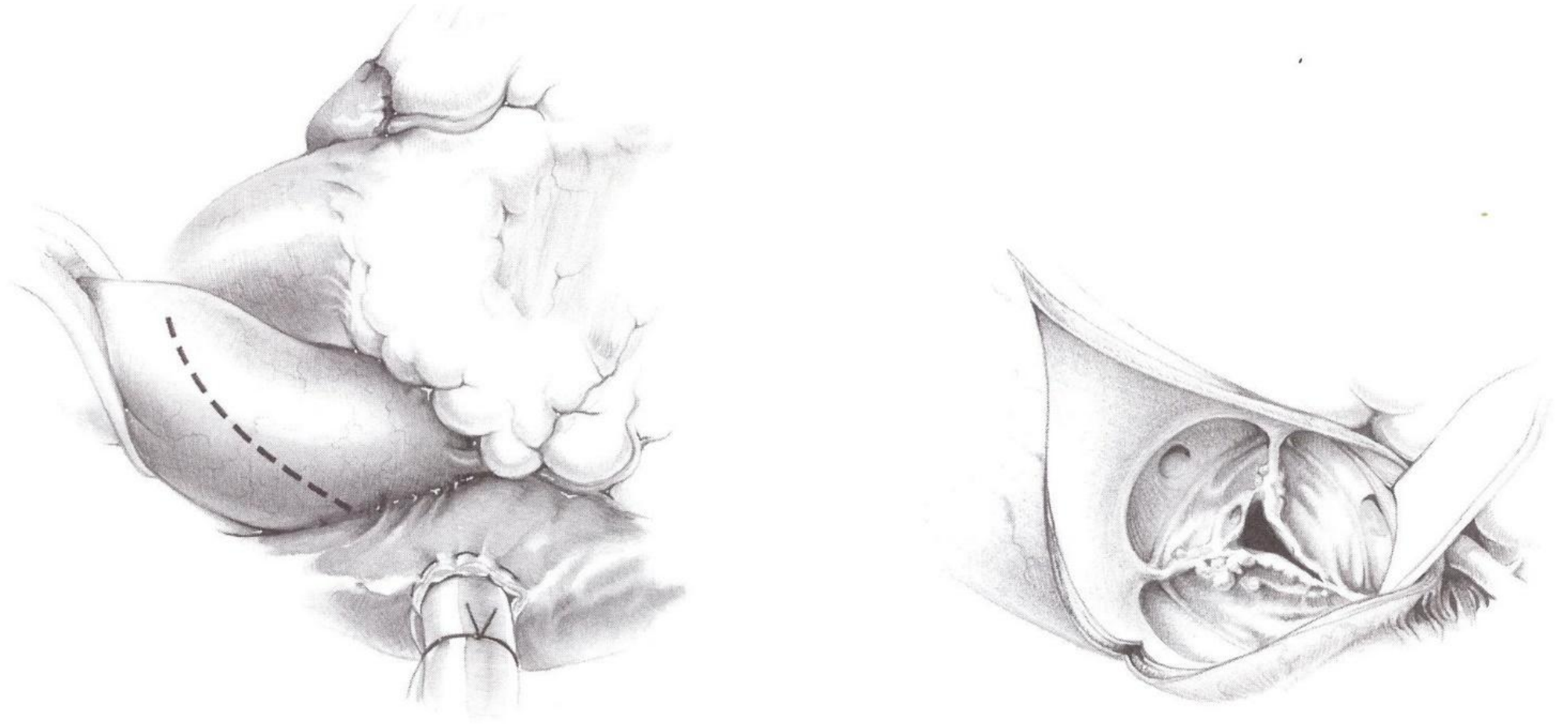


FIG 5-4. Oblique incision to expose the aortic valve.

Aortic valve replacement : Leaflets resection

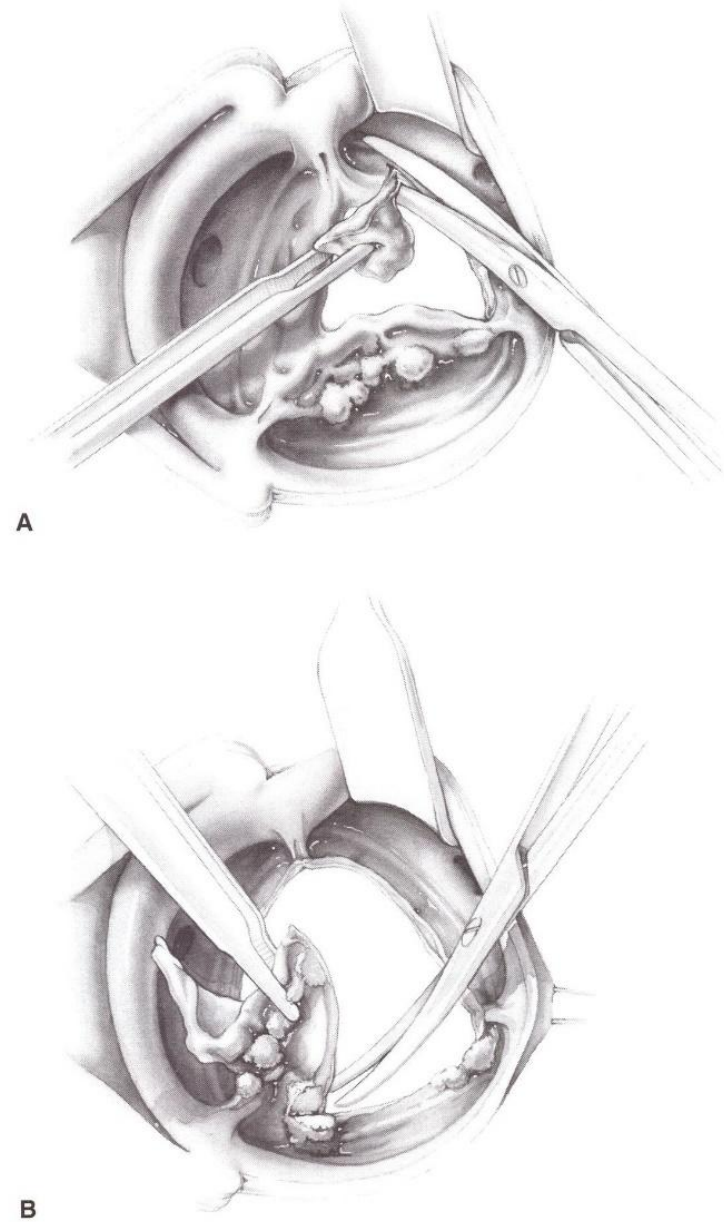


FIG 5-5. Excising the diseased aortic valve. **A:** Right coronary leaflet. **B:** Noncoronary leaflet.

Aortic valve replacement

: Annular stitches

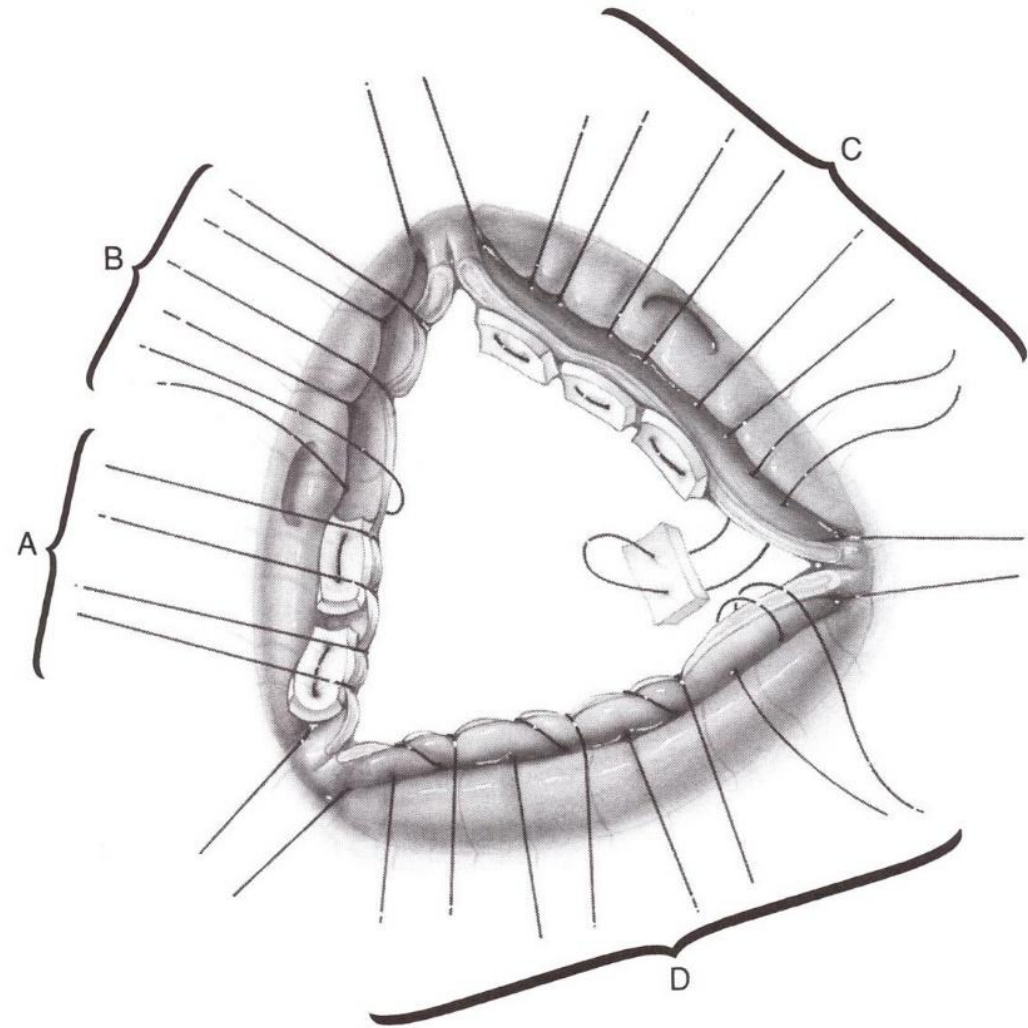


FIG 5-16. **A:** Inserting the sutures in an everted manner, with the pledgets lying above the annulus in the aorta. **B:** Simple sutures. **C:** Inserting the sutures from below allows the pledgets to remain subannular. **D:** Figure-of-eight sutures.

Aortic valve replacement

: Valve stitches

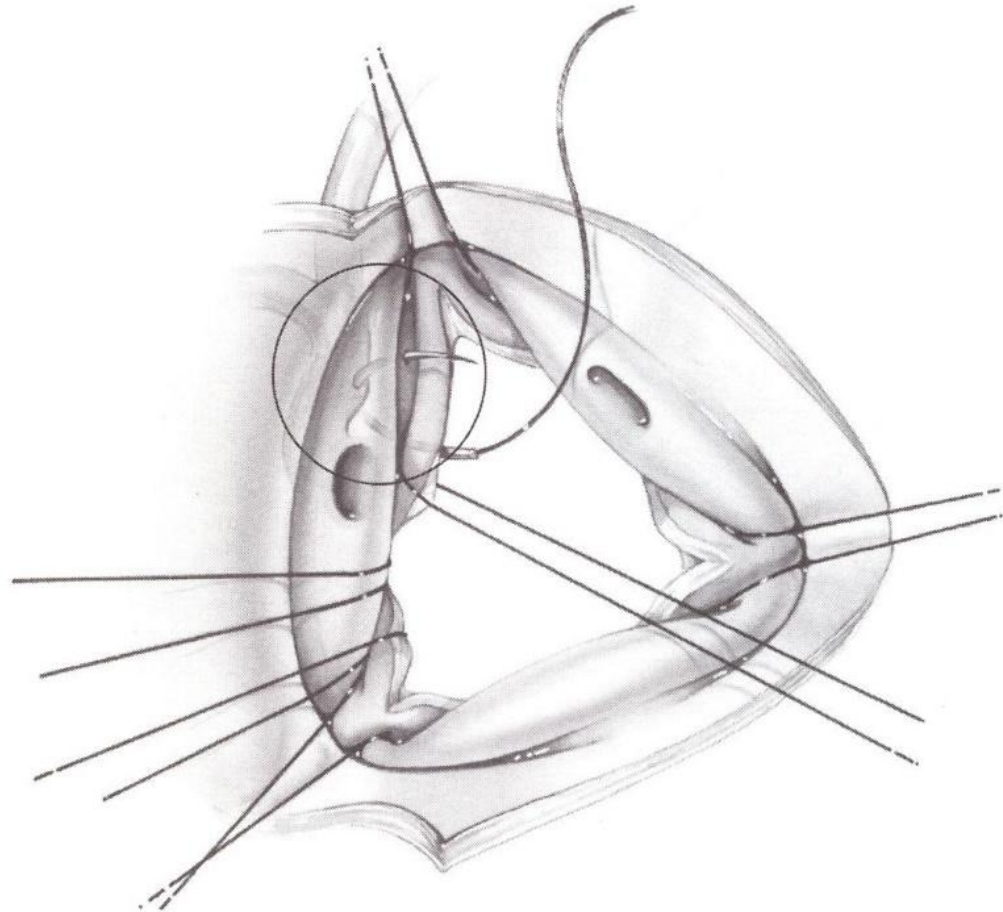


FIG 5-19. Left main coronary artery punctured by a deep suture near the left coronary annulus.

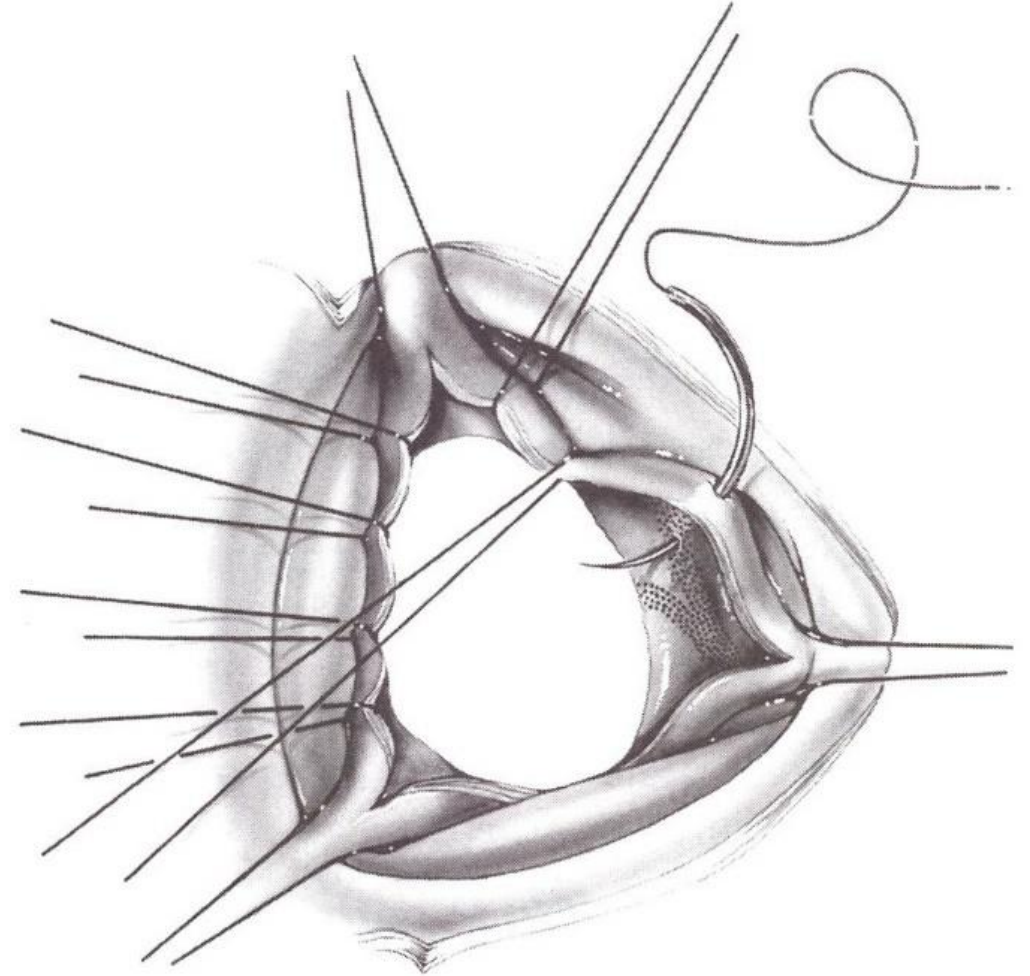


FIG 5-18. Injury to the conduction tissues caused by deeply placed sutures.

Aortic valve replacement

: Valve implantation

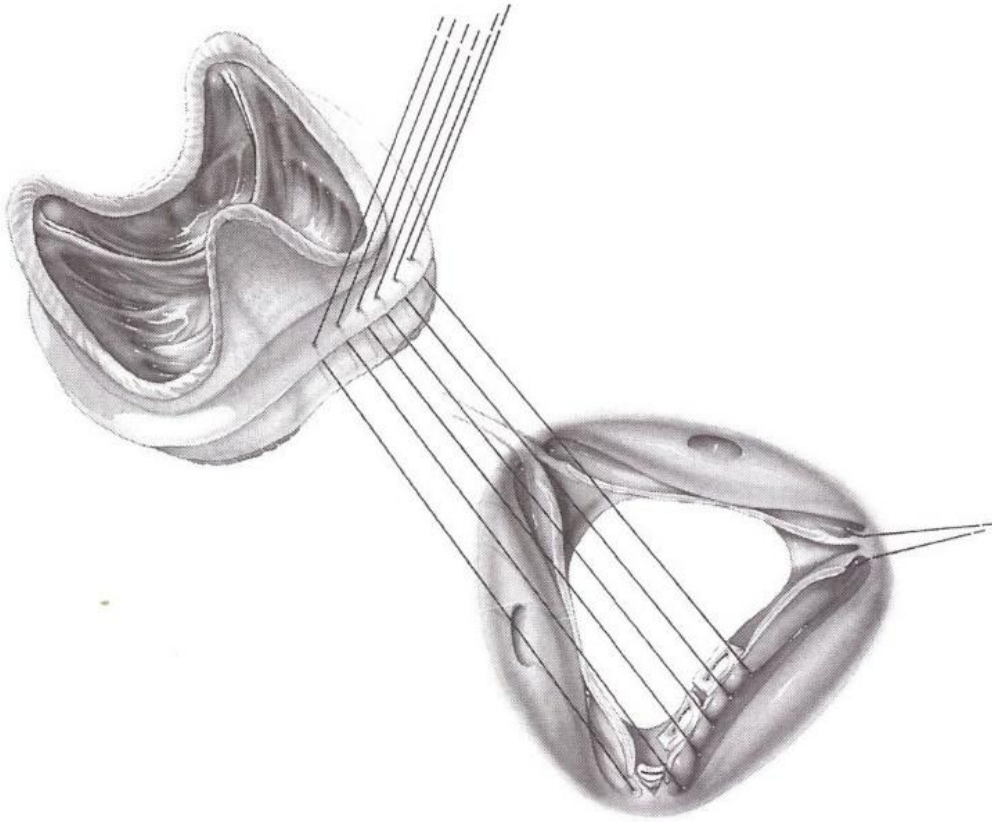


FIG 5-17. Horizontal mattress sutures, with pledgets below the annuli, placed in a horizontal mattress fashion in the prosthetic ring.

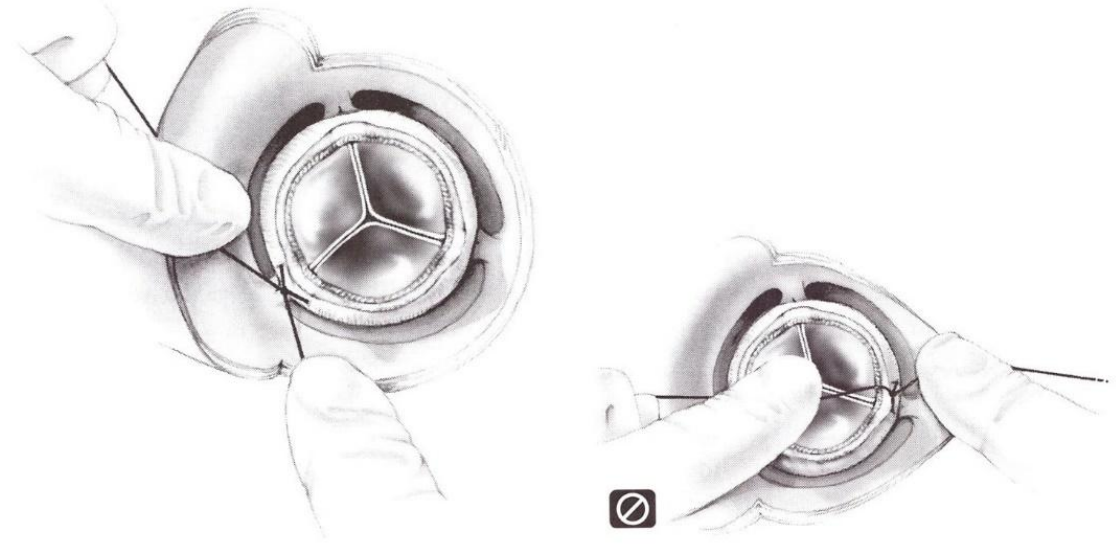


FIG 5-22. Tying sutures down parallel with the direction of the sewing ring (A), not across the prosthetic leaflets (B).

Aortic valve replacement : Aortotomy closure

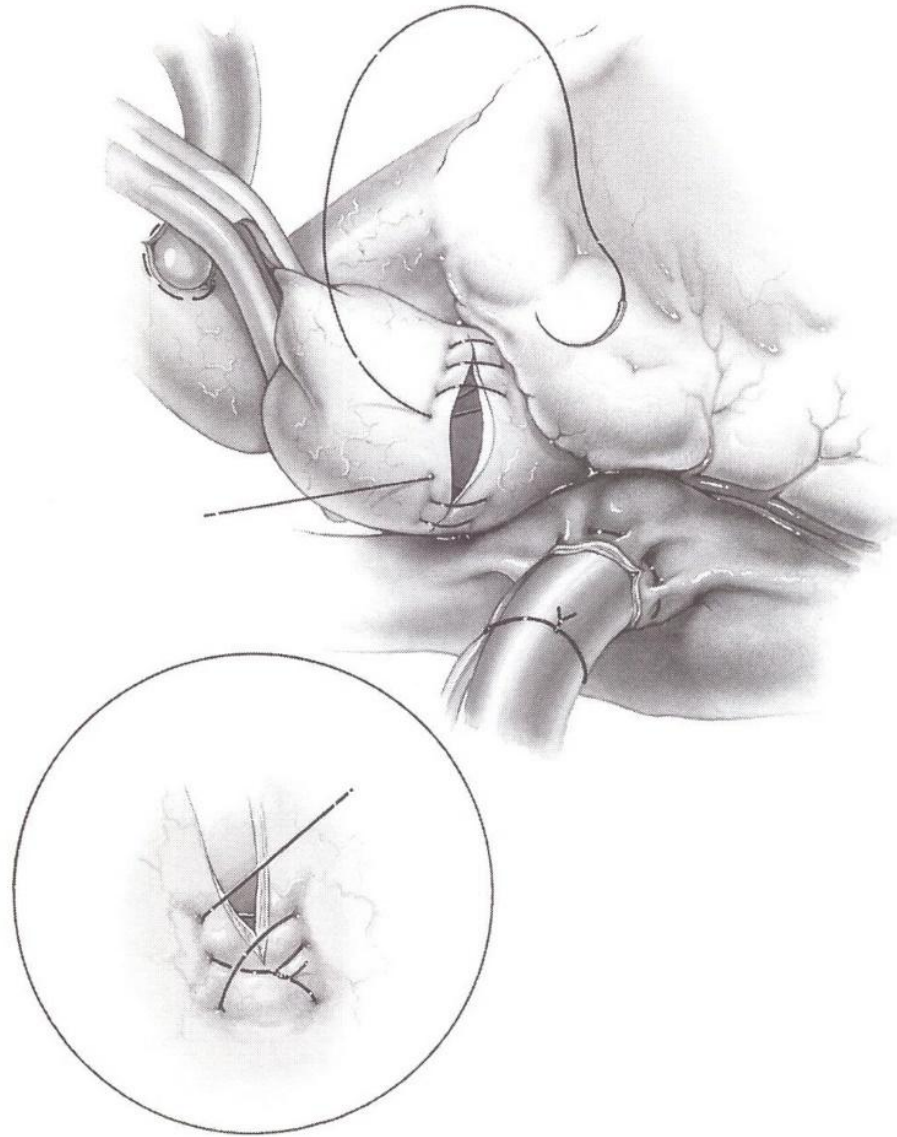
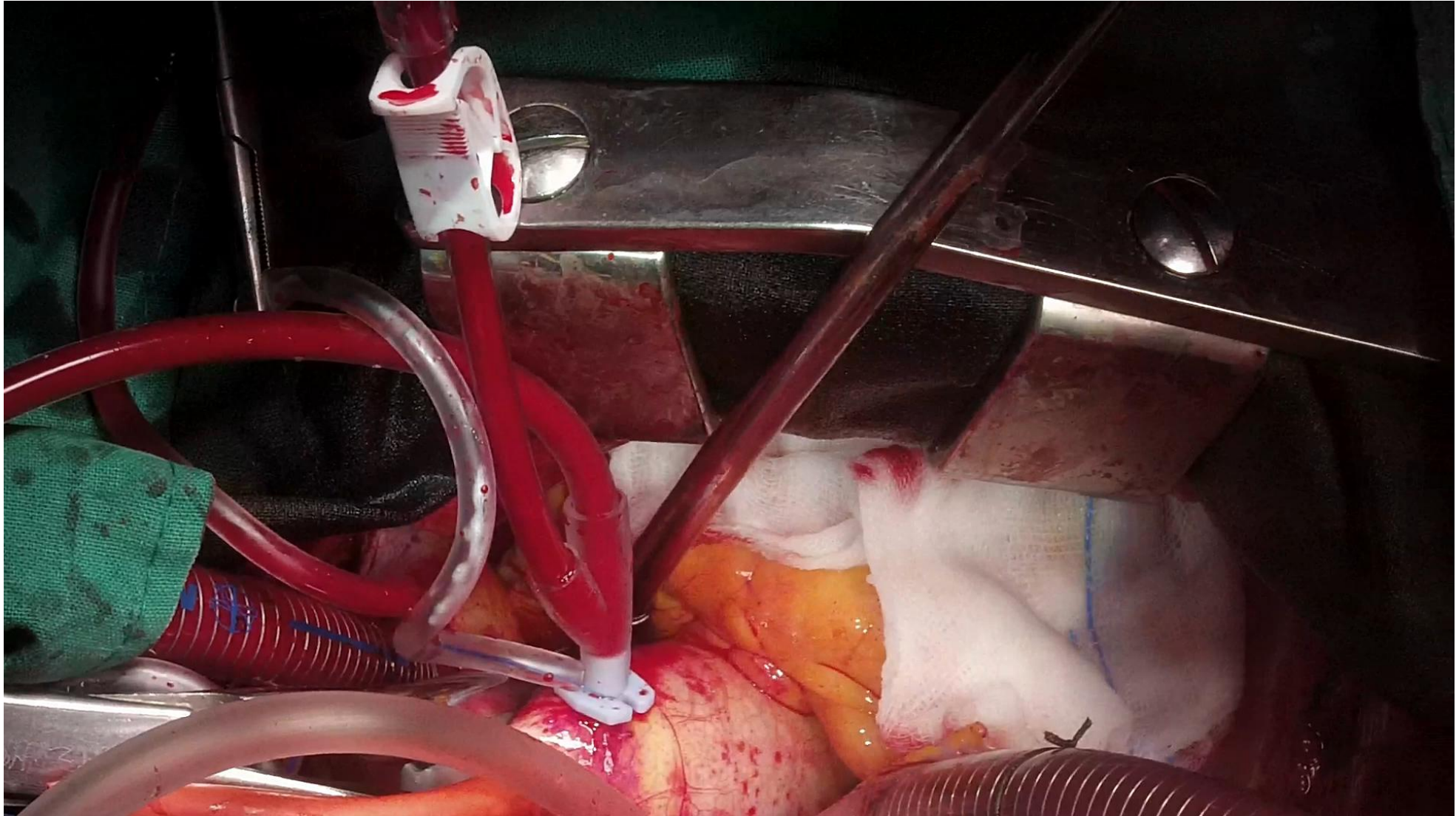


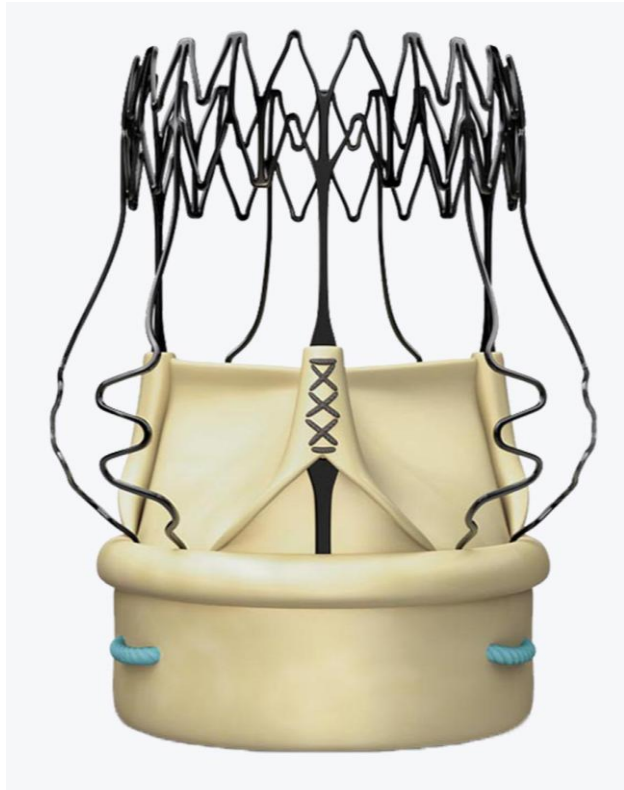
FIG 5-25. Aortotomy closure with a special precaution to prevent bleeding from the ends of the incision.

Aortic valve replacement



Sutureless/Rapid-deployment AVR

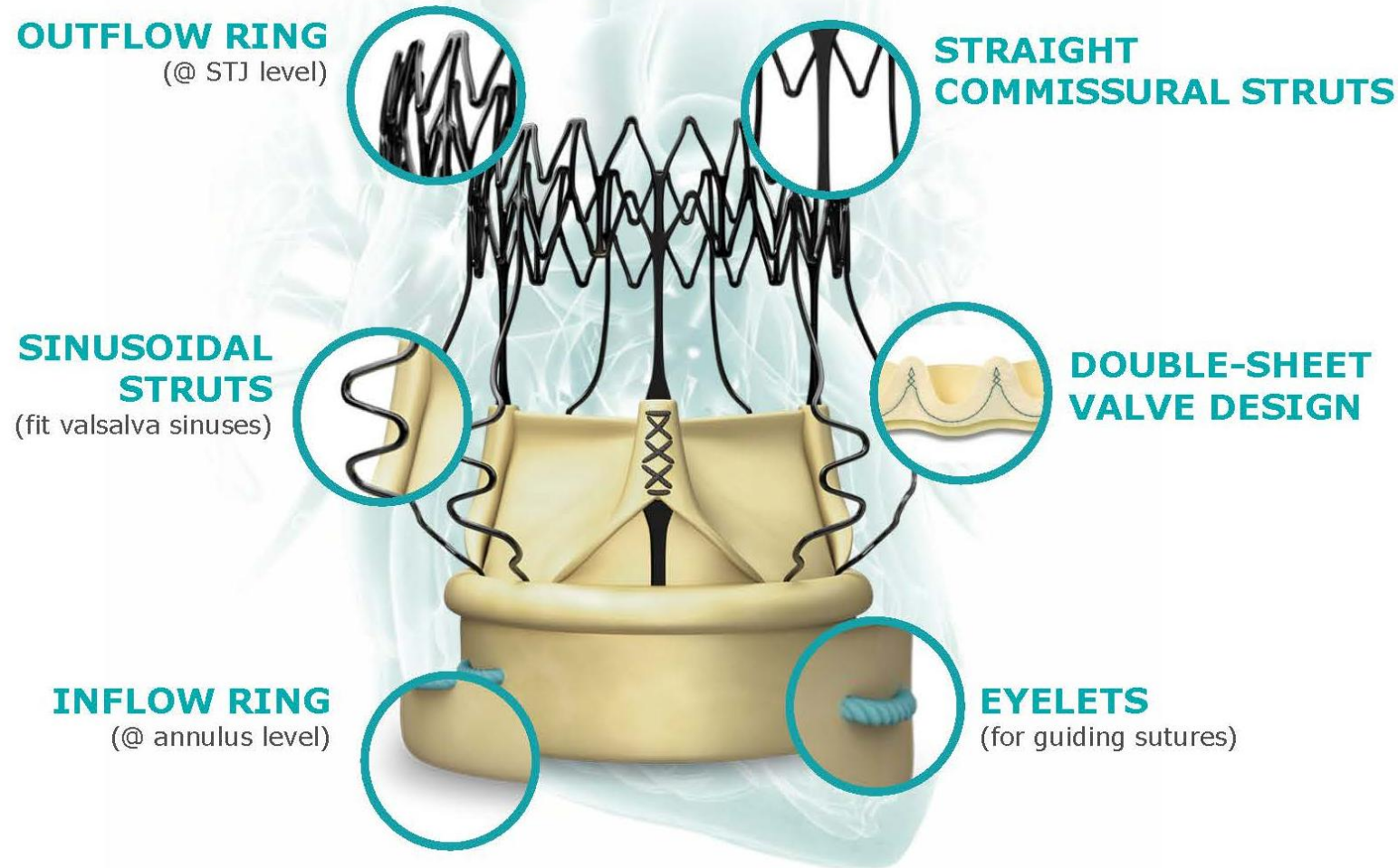
Sutureless , Rapid deployment valve



Rapid deployment valve



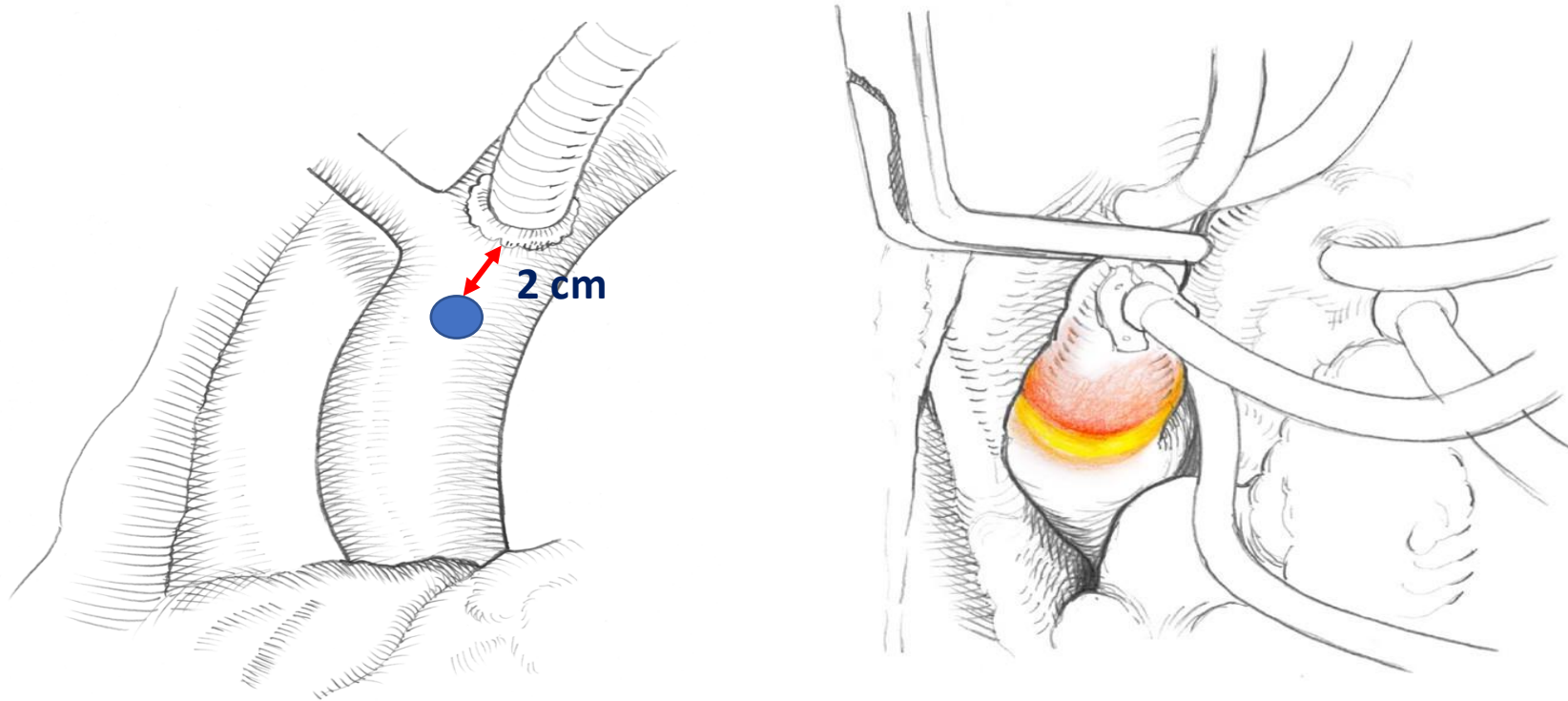
Sutureless/Rapid-deployment AVR



Sutureless/Rapid-deployment AVR

- Ideal candidates
 - Multiple procedures in addition to AVR
 - Minimal invasive surgery
 - Small aortic annulus
- Careful consideration
 - Type 0 BAV (True type)
 - Annular abscess or destruction
 - Root/ascending aorta aneurysm or dissection

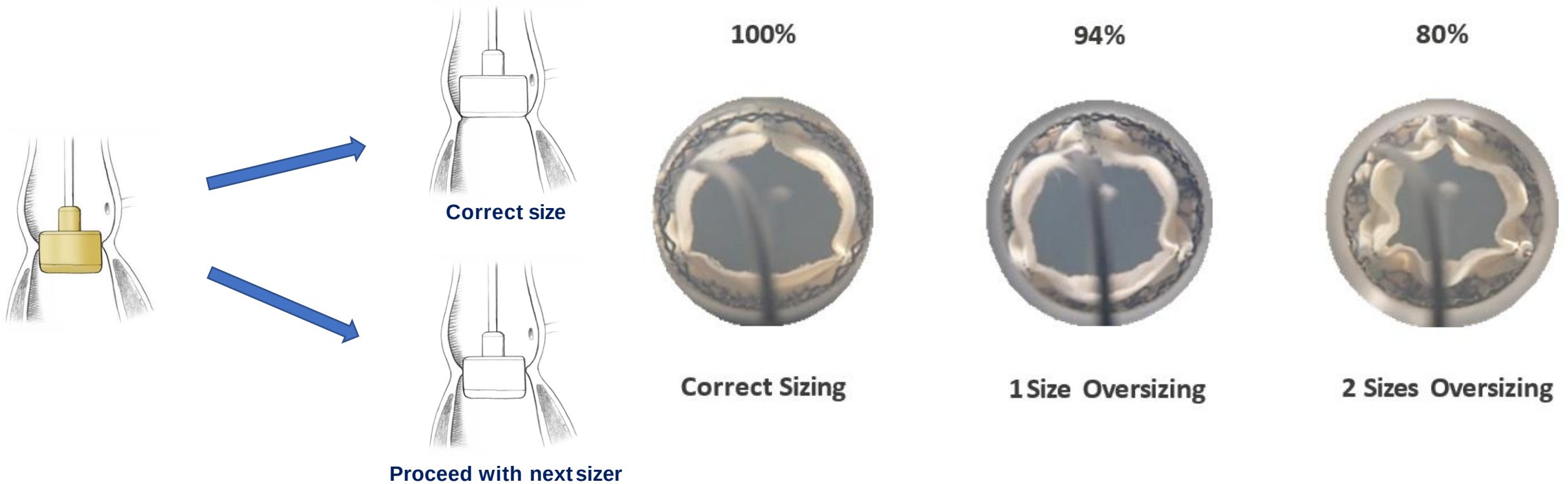
Sutureless/Rapid-deployment AVR



- It is recommendable to perform the aortic cannulation in the arch 2 cm more distally than usual, leaving 2-3 cm between cross clamp and the aortotomy, as shown in the picture. **(Find yellow fat band!!!!)**
- A transverse aortotomy located at **least 3.5 cm above the aortic annulus** or at least 0.5 cm above the STJ is considered optimal.

Sutureless/Rapid-deployment AVR

Sizing is most important



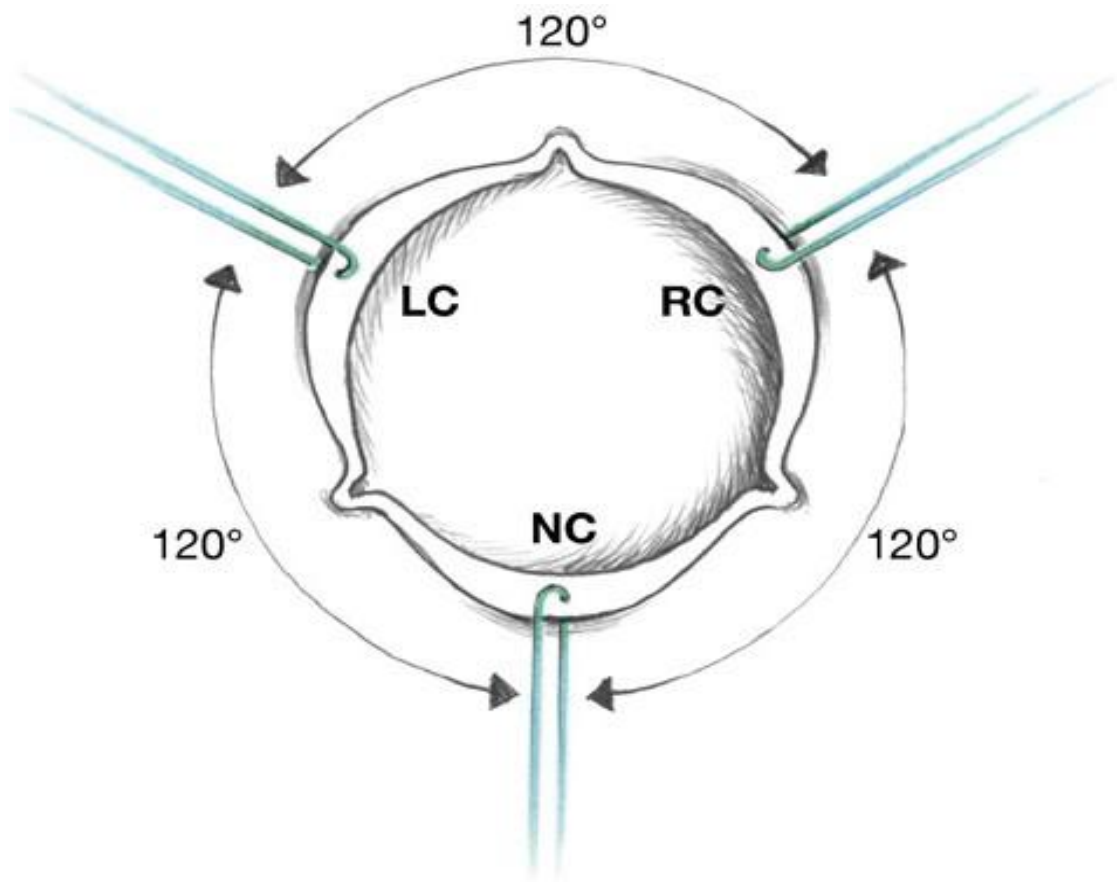
Sutureless/Rapid-deployment AVR

Sizing is most important



Sutureless/Rapid-deployment AVR

: Guiding sutures



- ✓ 3 Nadir position
- ✓ For beginner, sizer is recommended
- ✓ Check MV relationship with AV

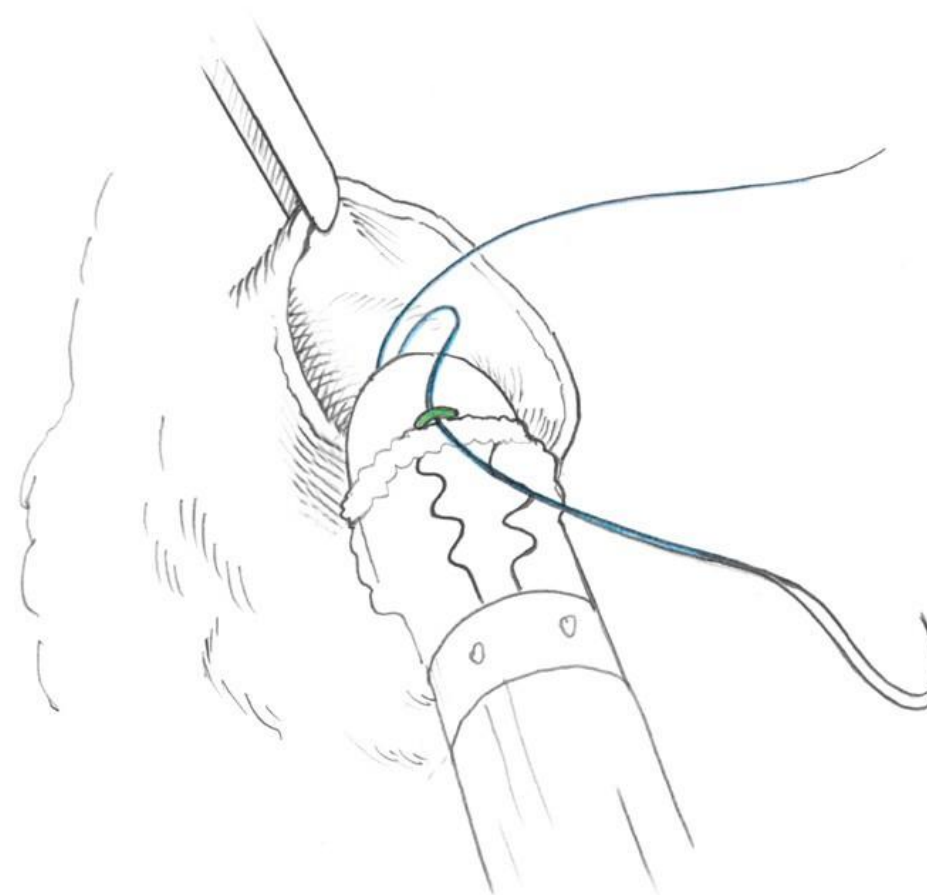
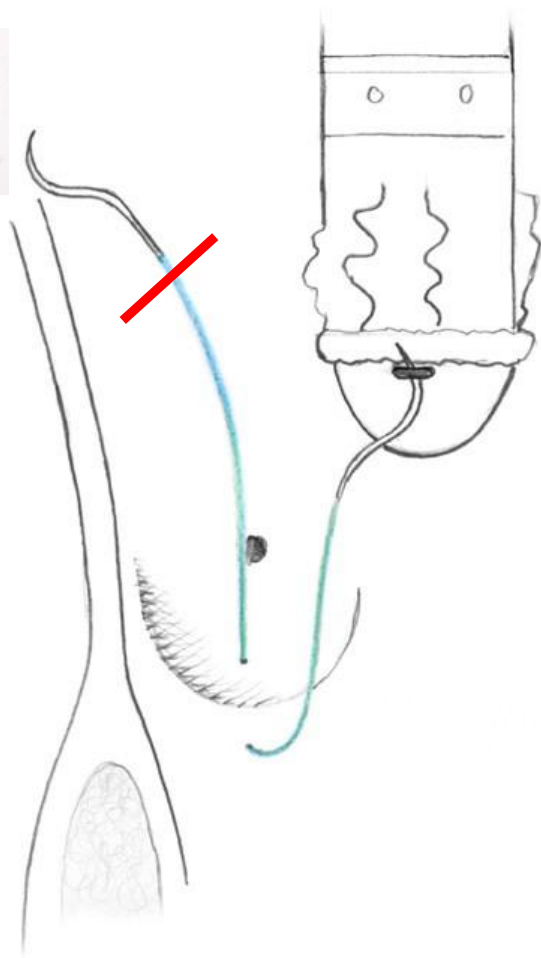
Sutureless/Rapid-deployment AVR

: Guiding sutures

The needle of the LVOT extremity must be inserted in the eyelets

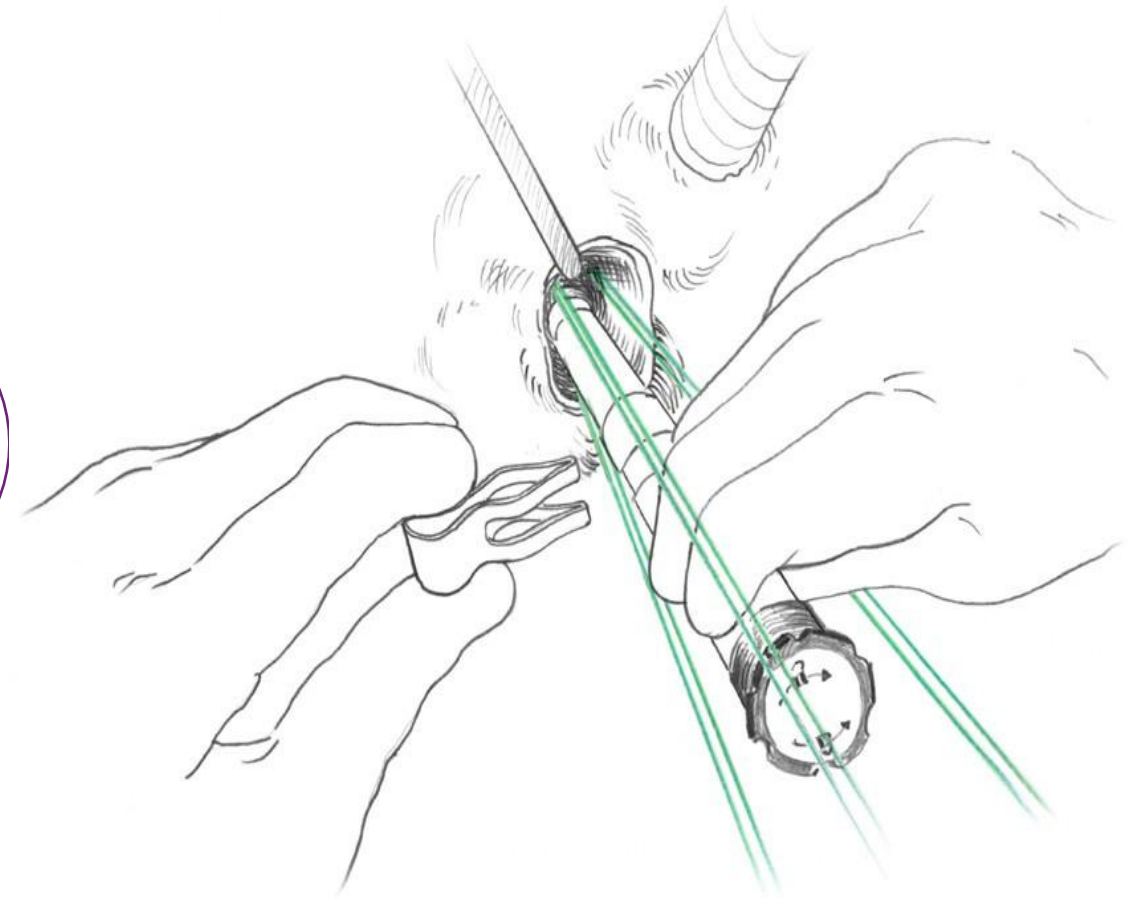
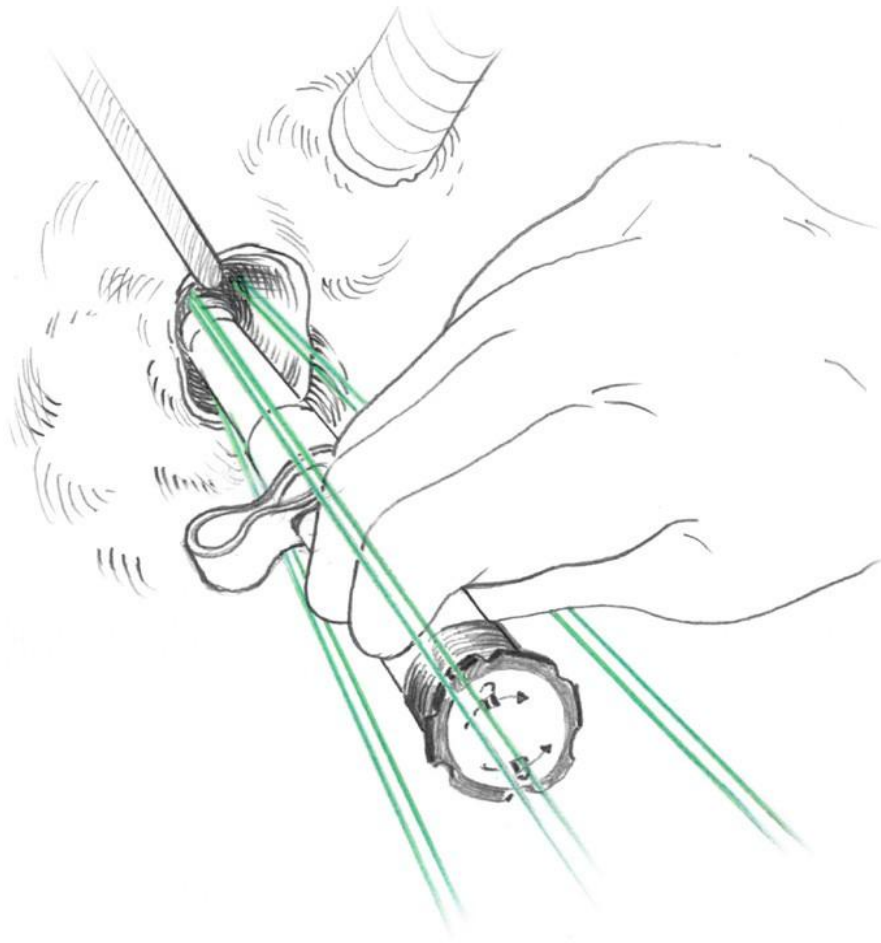


Cut the needle from the aortic extremity of the guiding suture



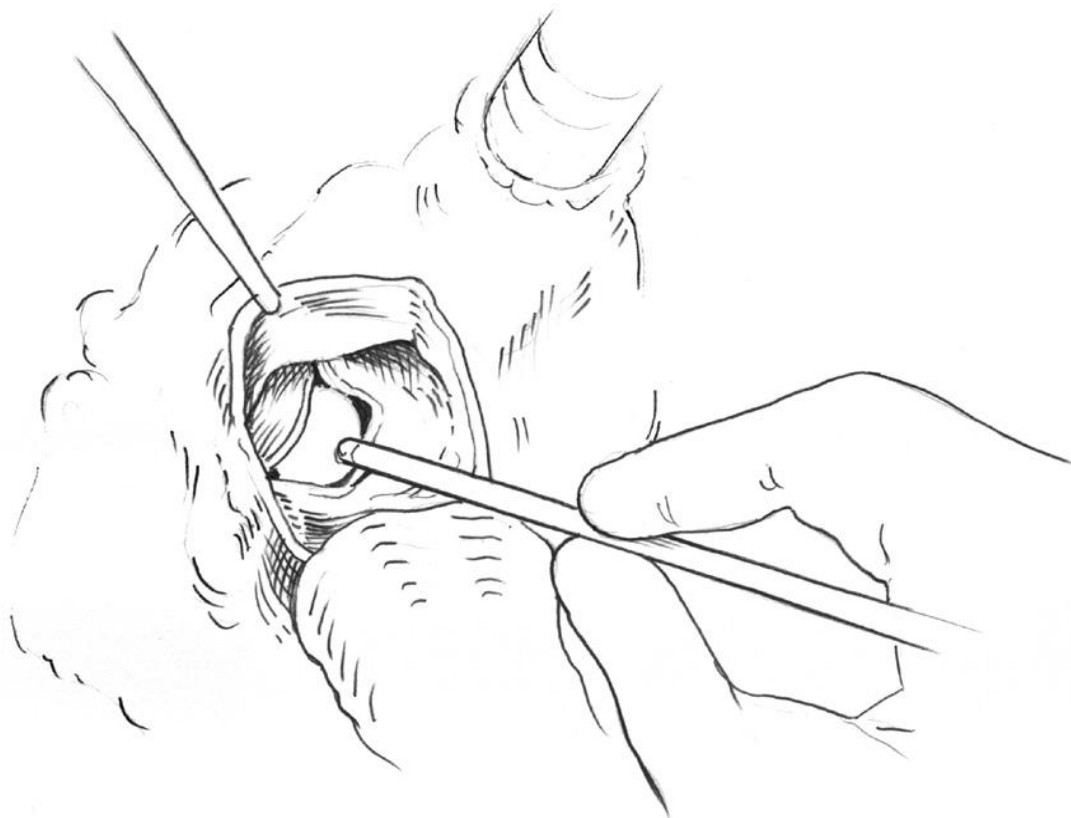
Sutureless/Rapid-deployment AVR

: Valve positioning

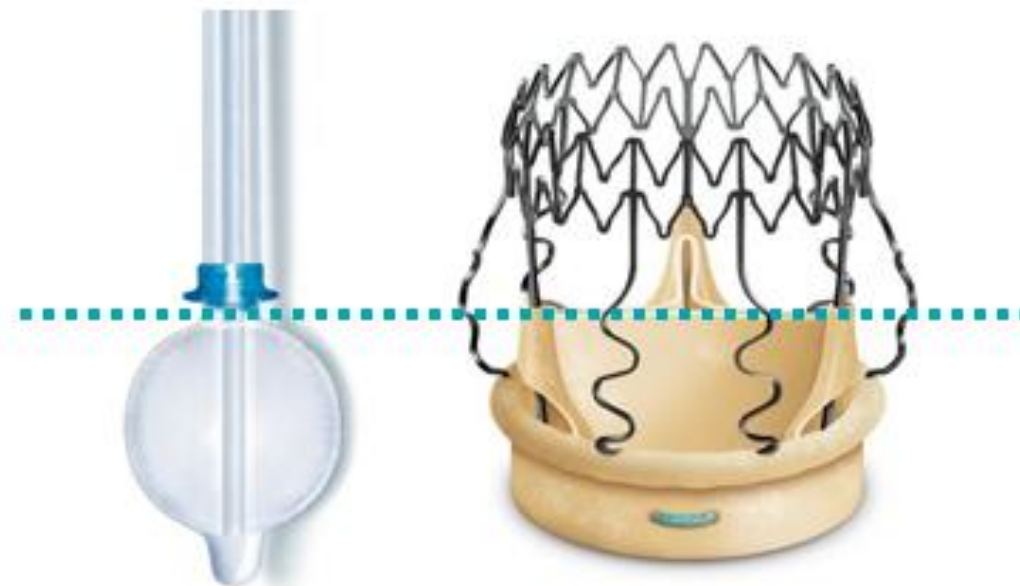


Sutureless/Rapid-deployment AVR

: Balloon



90° to the plane of the annulus



Sutureless/Rapid-deployment AVR





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