

Aortic Root Surgery

Jae Hang Lee, MD, PhD.

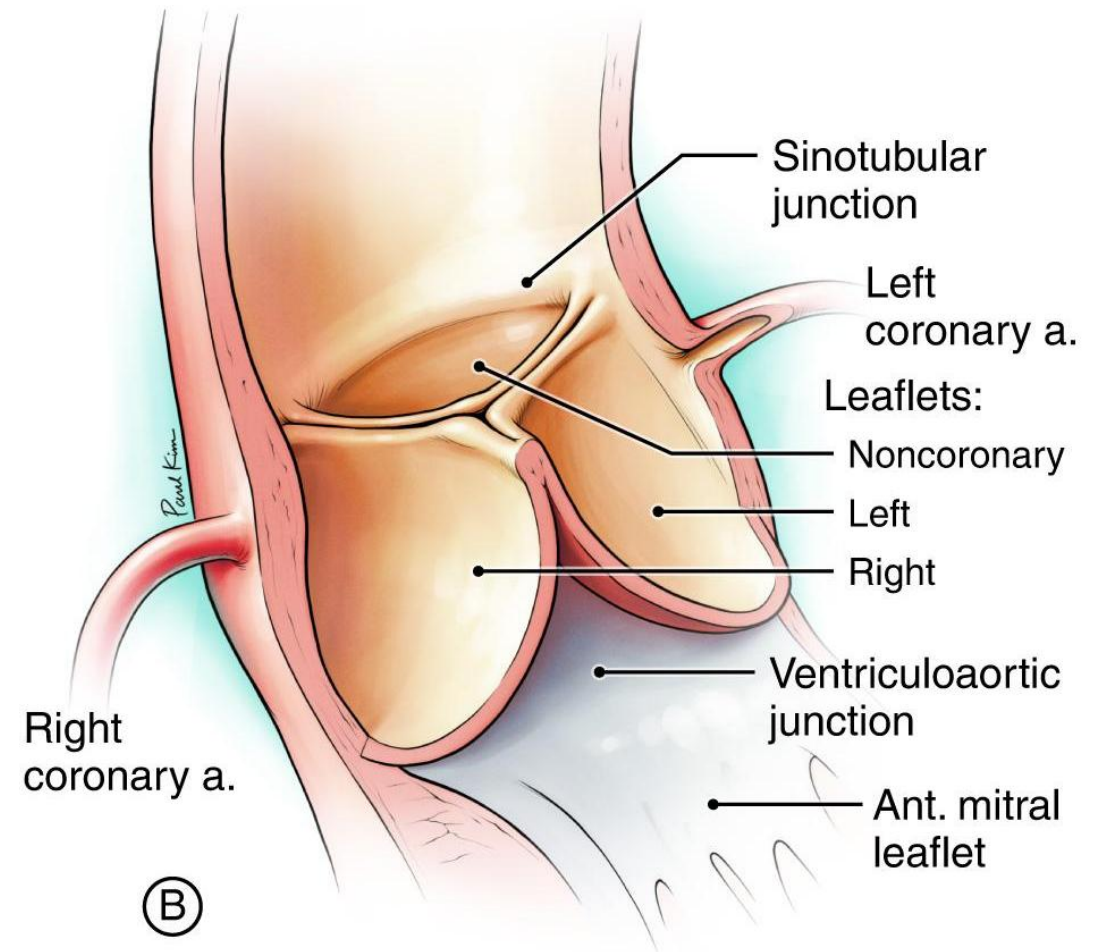
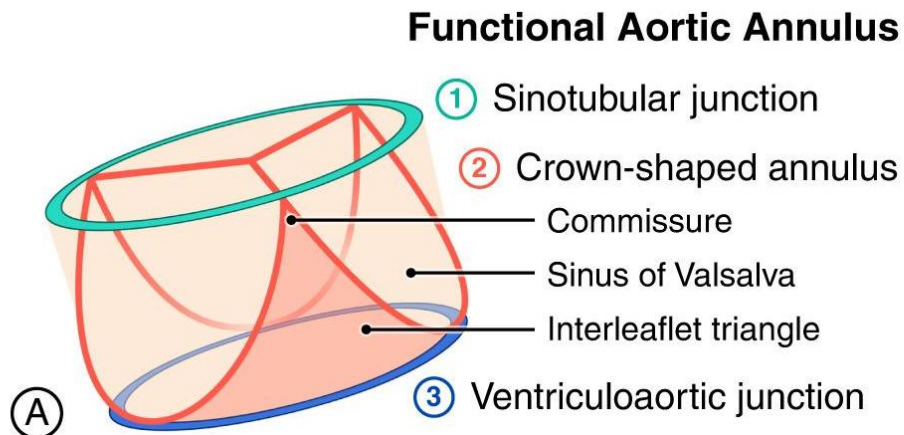
Professor

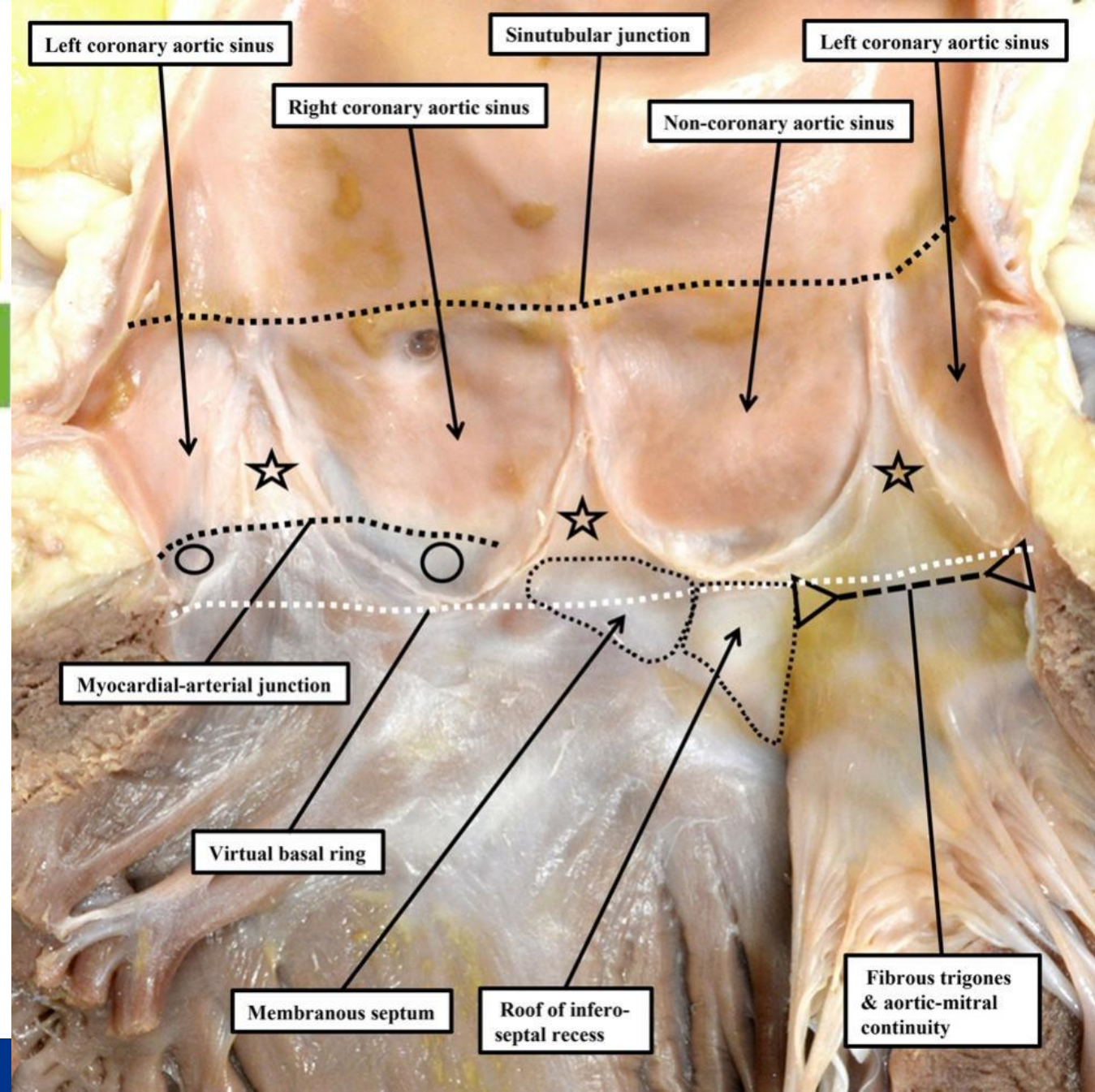
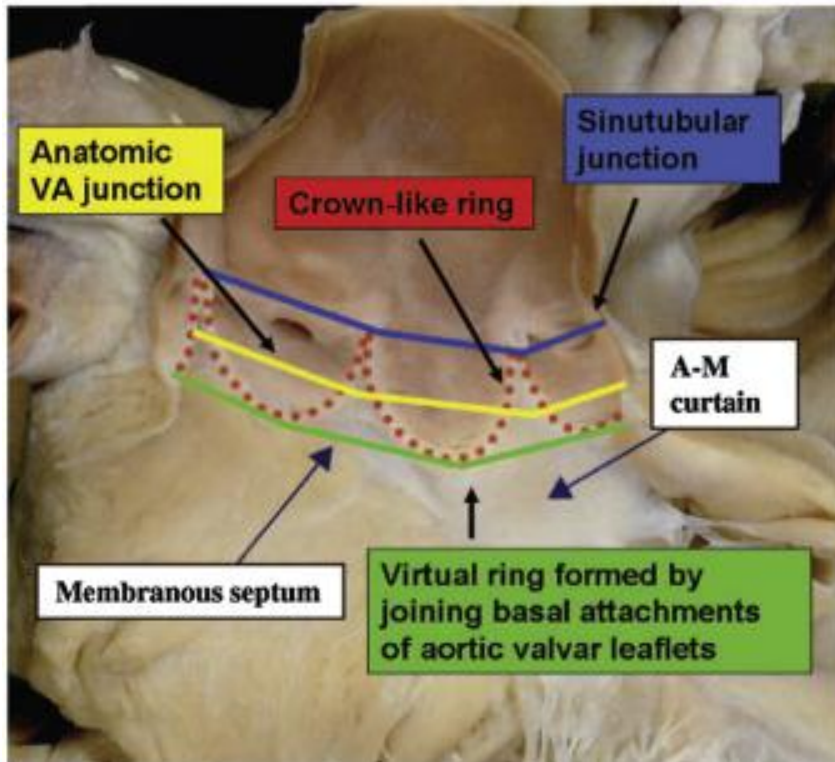
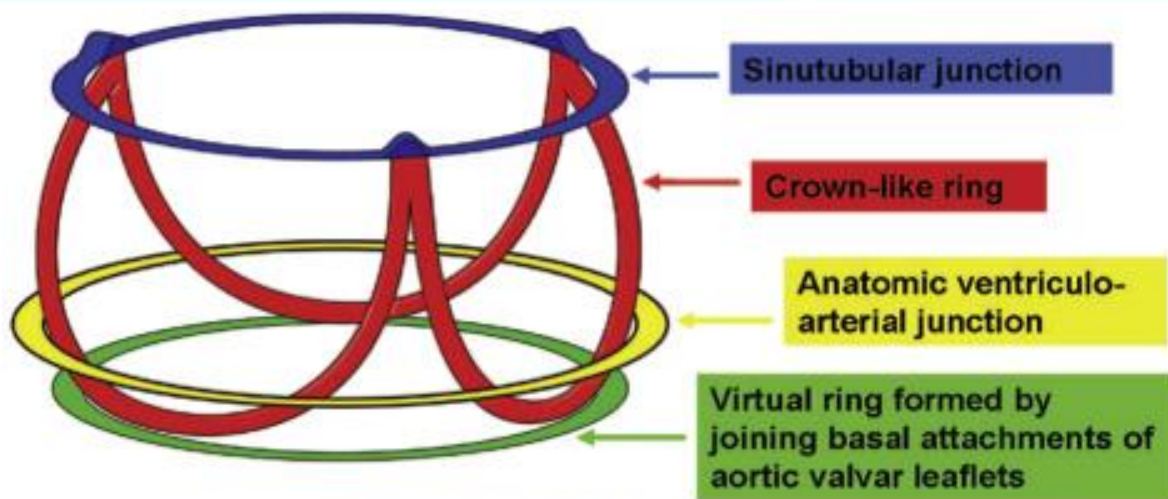
Department of Thoracic & Cardiovascular Surgery

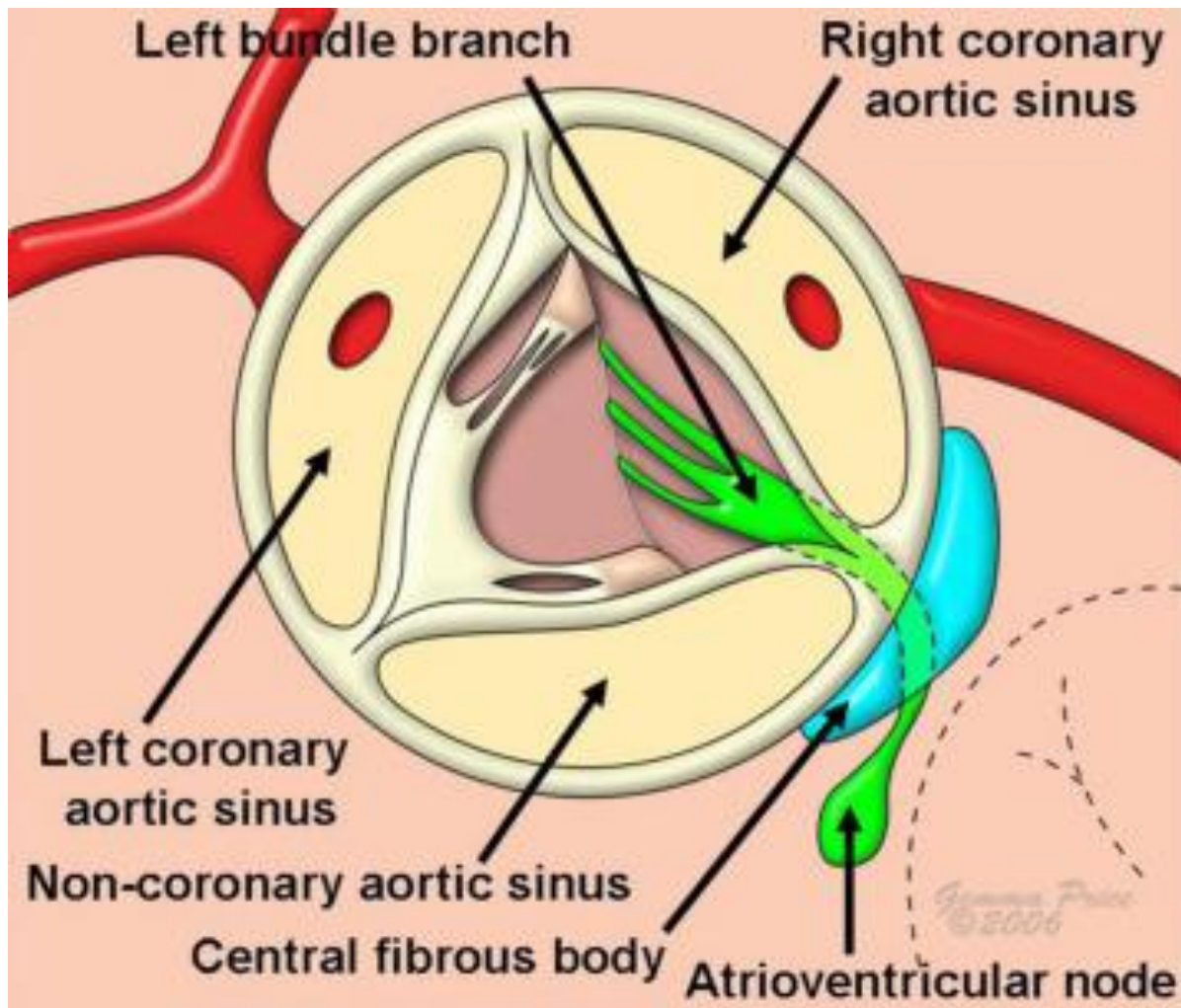
Seoul National University Bundang Hospital

Aortic root components

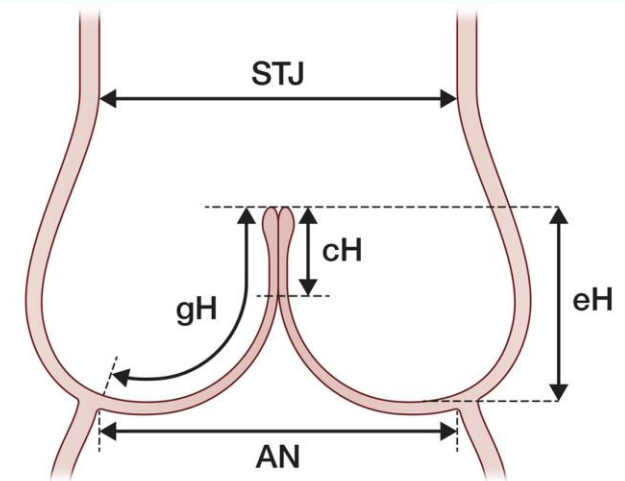
- Aortic valve leaflets
 - LCC, RCC, NCC
- Aortic annulus
- Sinus of Valsalva
- Inter-leaflet triangles
- Sinotubular junction (STJ)





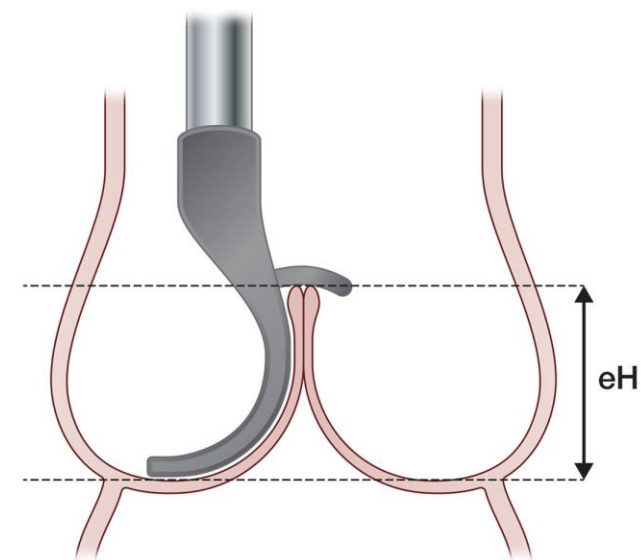


A



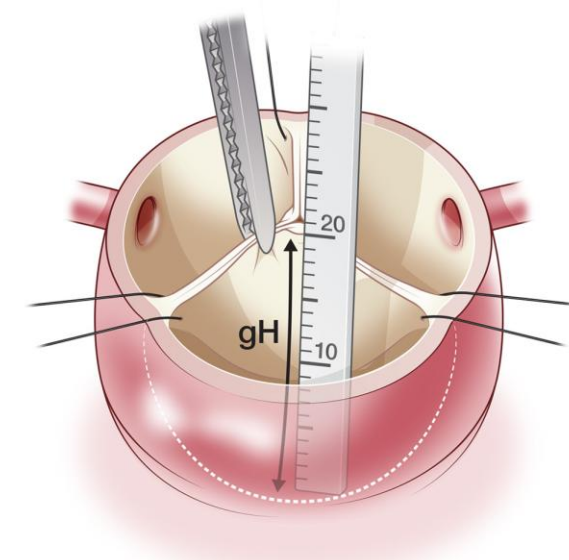
Anatomical measurements

B



Effective height measurement

C



Geometric height measurement

- Indication of aortic root surgery
- Aortic root aneurysm
 - Annulo-Aortic Ectasia
- Aortic root abscess
- Type A aortic dissection
- Small aortic root

Surgical intervention thresholds for aortic root & ascending aorta in patients with...

Sporadic and BAV aneurysms*:

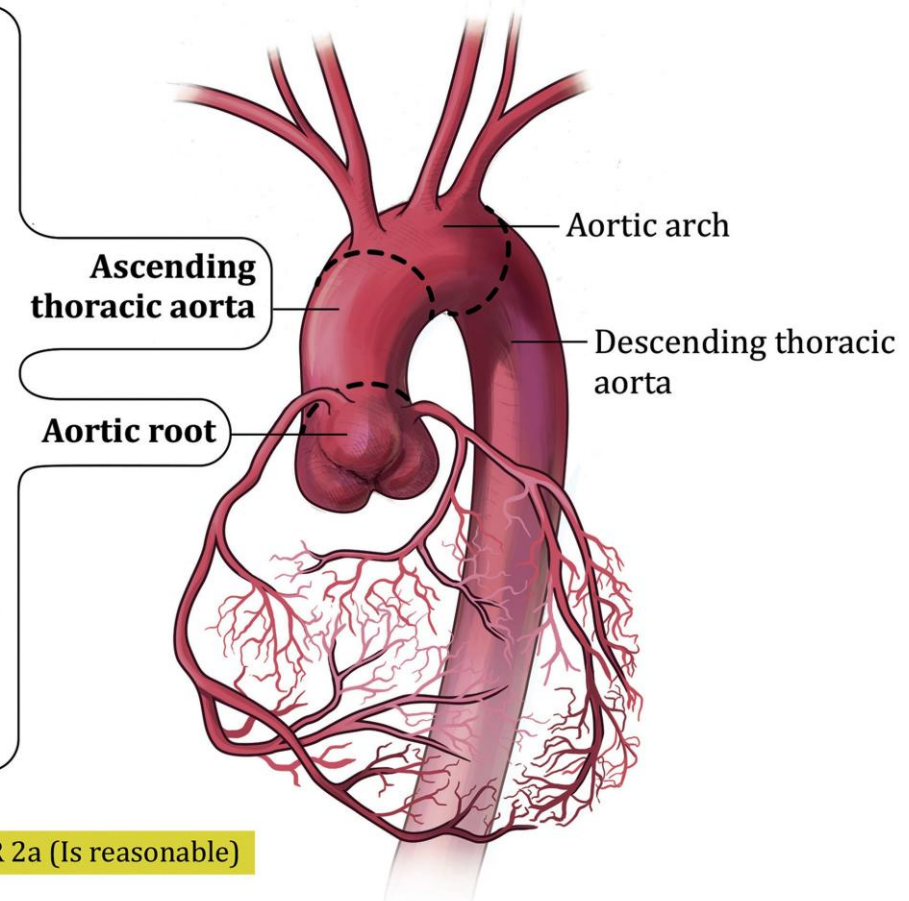
5.5 cm (COR 1)

5.0 cm by experienced surgeons in a Multidisciplinary Aortic Team (COR 2a)

Marfan syndrome#:

5.0 cm (COR 1)

≥4.5 cm in those with an increased risk of aortic dissection when performed by experienced surgeons in a Multidisciplinary Aortic Team (COR 2a)



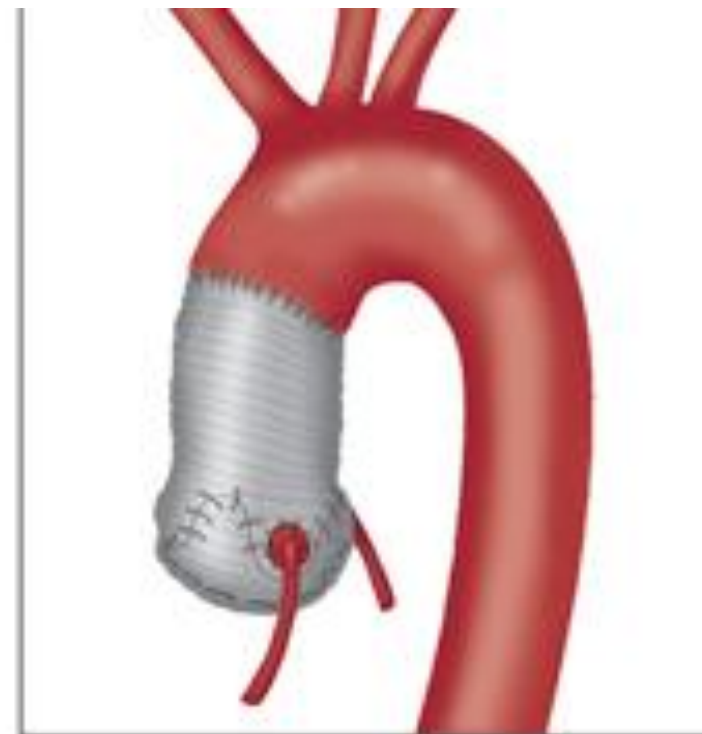
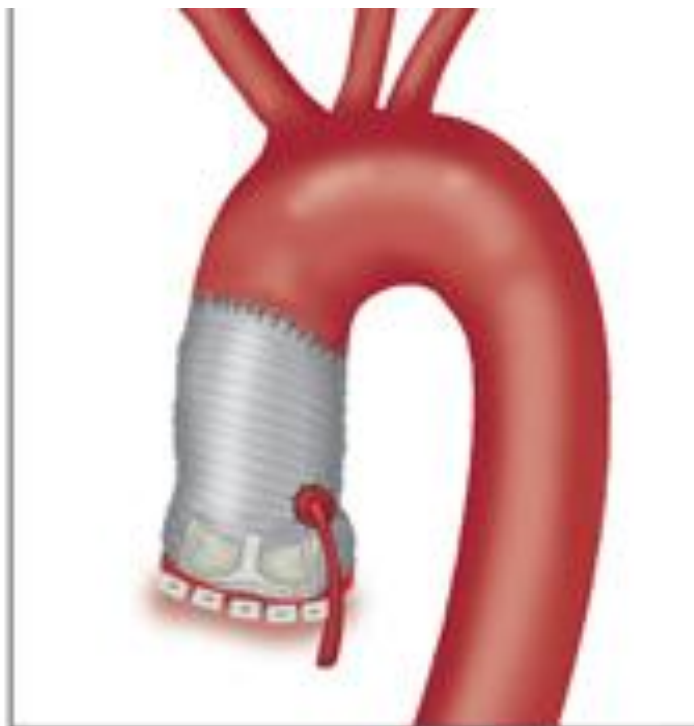
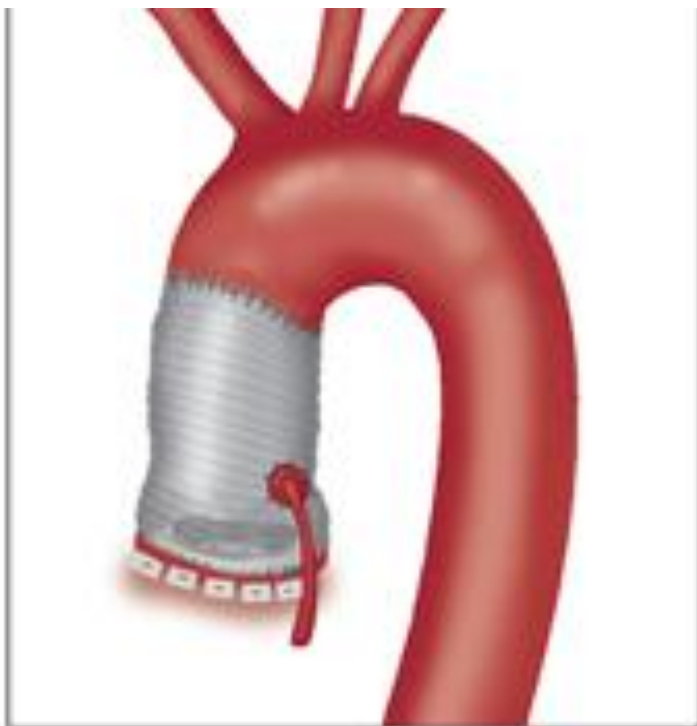
COR 1 (Is recommended)

COR 2a (Is reasonable)

*Surgical thresholds may be adjusted based on patient genetics, rapid aortic growth rate, cross-sectional aortic area/height ratio $\geq 10 \text{ cm}^2/\text{m}$, aortic size index of $\geq 3.08 \text{ cm}/\text{m}^2$, or aortic height index of $\geq 3.21 \text{ cm}/\text{m}$.

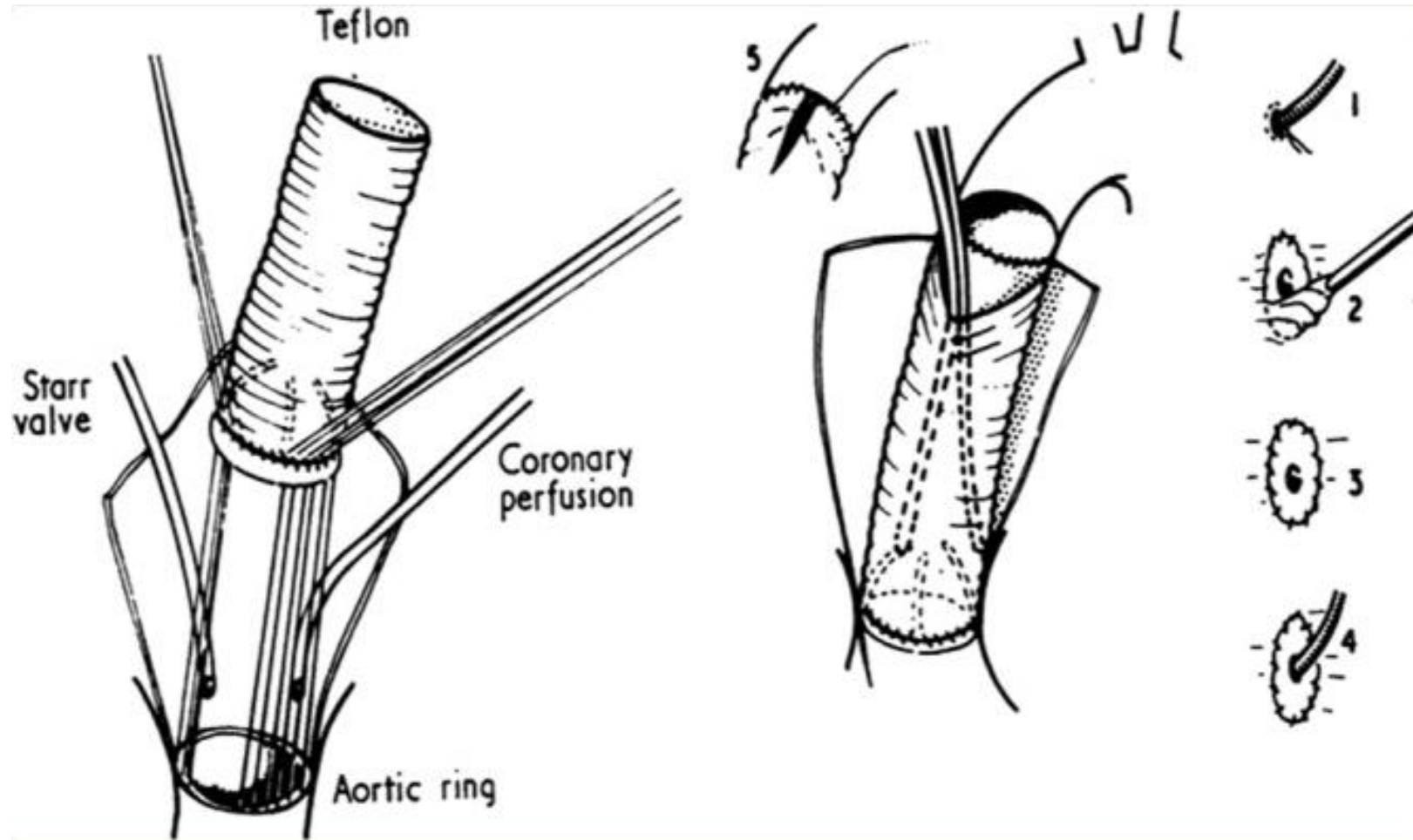
#For more on rapid aortic growth rate and patients with nonsyndromic heritable thoracic aortic aneurysms or with genetic aortopathies other than Marfan syndrome (e.g., Loeys-Dietz syndrome), please see the 2022 ACC/AHA Guideline for the Diagnosis & Management of Aortic Disease.

Aortic root surgery (replacement)



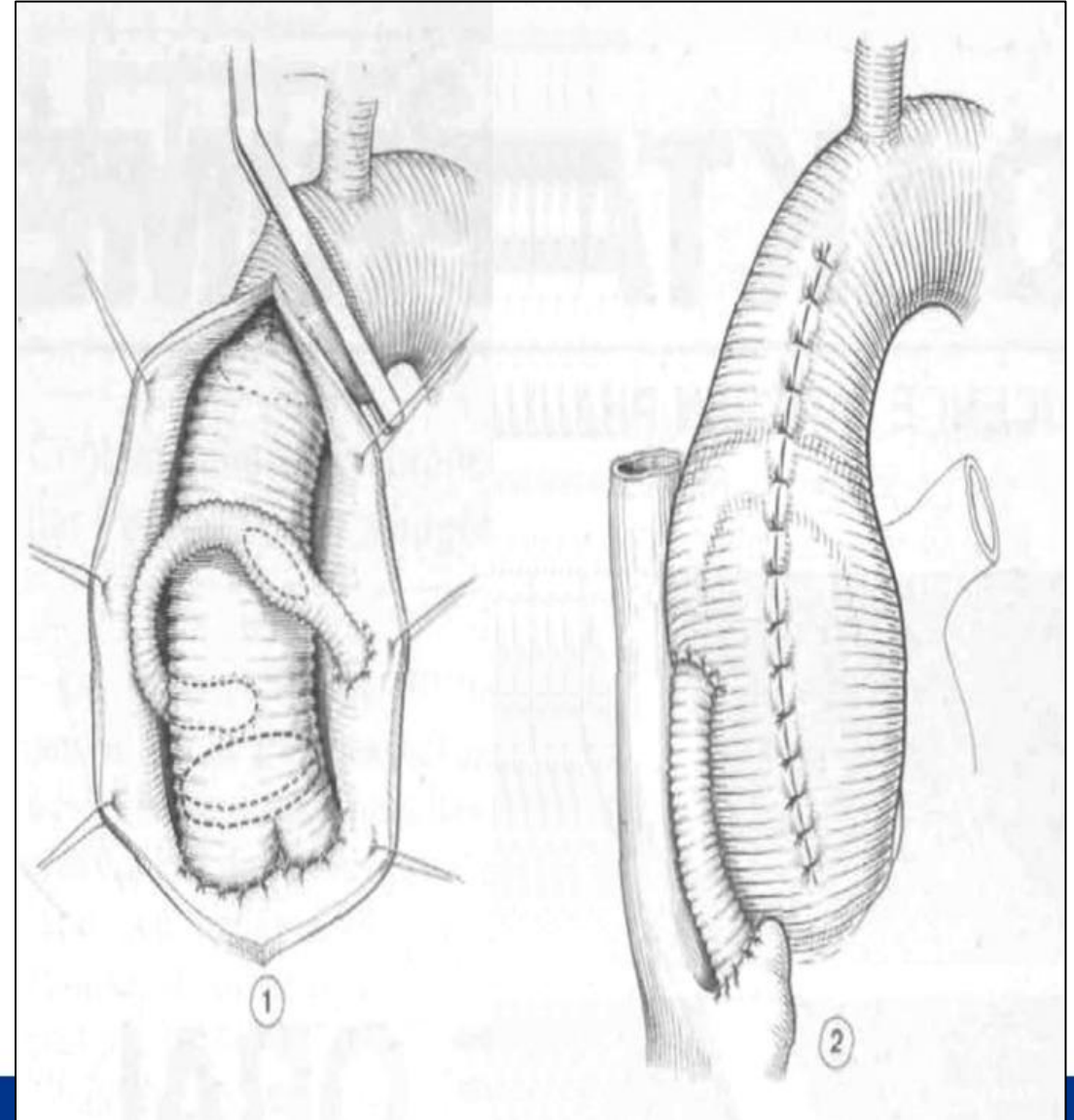
Bentall operation (1968)

- By Hugh Bentall & Anthony de Bono
- Include replacement of the aortic valve, root and ascending aorta

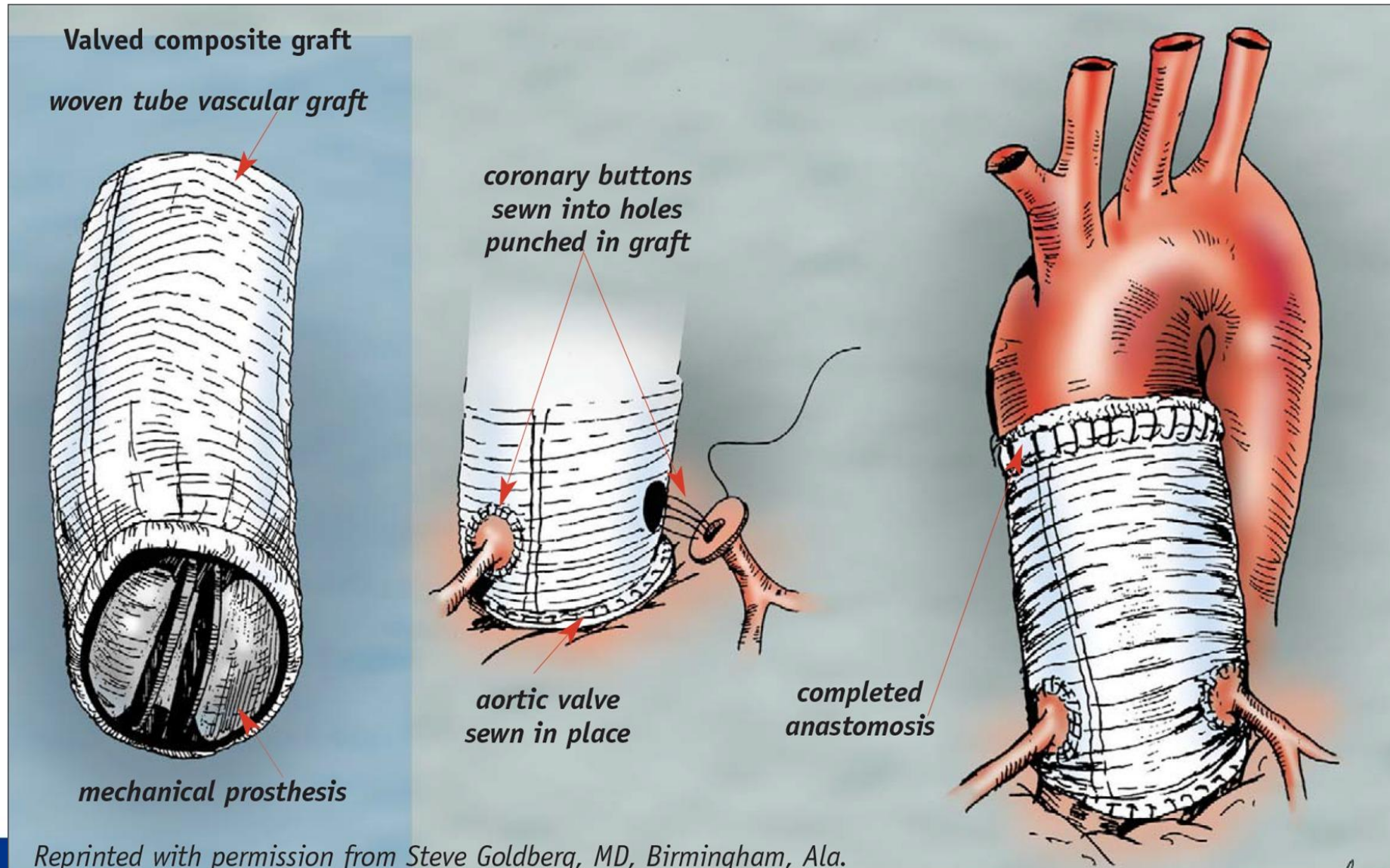


Cabrol operation / shunt (1981)

- Limitation of classic Bentall op
 - Pseudoaneurysm of coronary buttons
 - Lead to tear-off the coronary ostia
- Cabrol op
 - Use of 8mm Dacron graft
 - Oval 1.5cm side-to-side anastomosis
 - Native aortic wall wrapping & shunt to RA appendage
 - Risk of graft thrombosis & stenosis

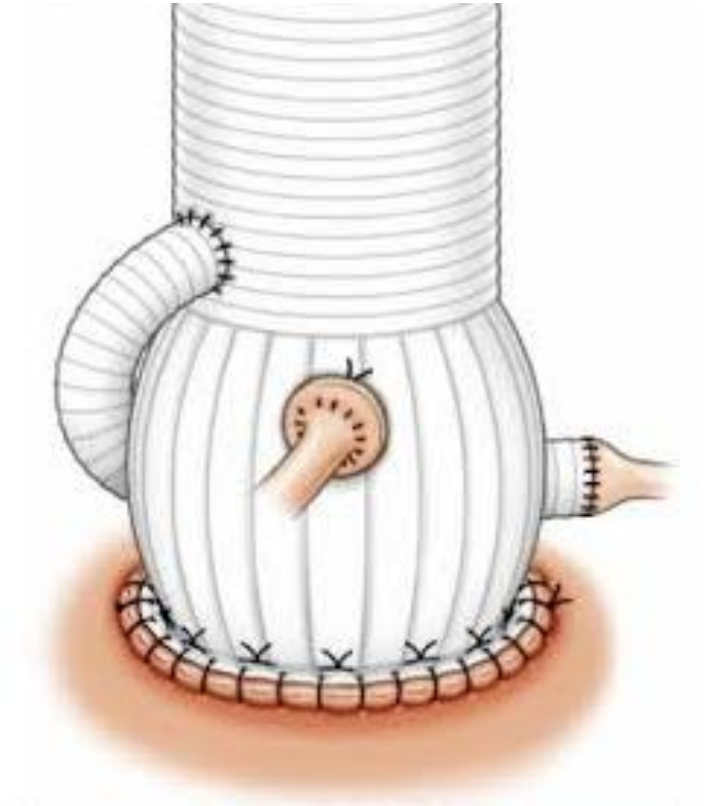


Modified Bentall procedure (1981 / 1991)



Modification of Cabrol procedure

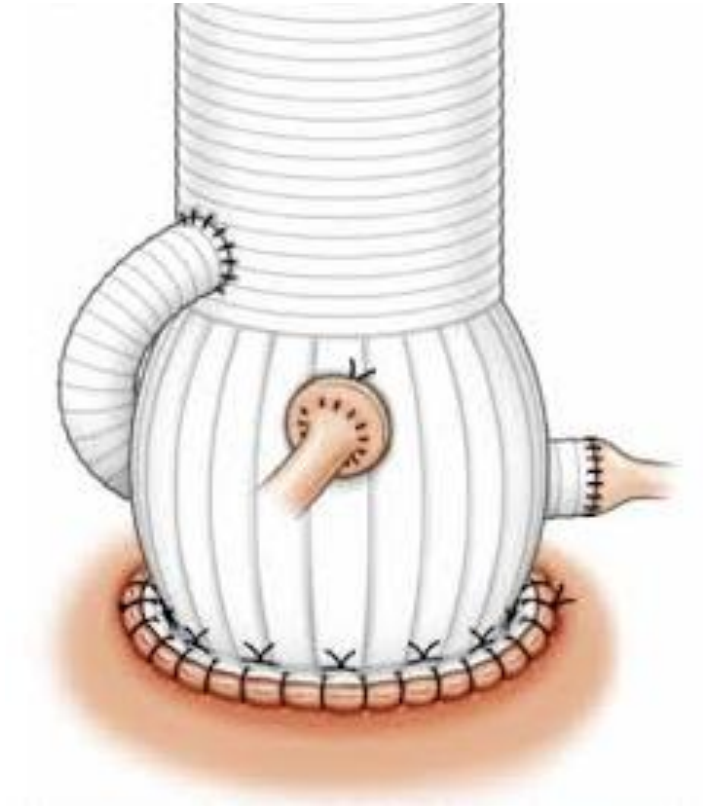
- Redo aortic root surgery
 - Dense adhesions limit coronary mobilization
- Dissection involving the coronary ostia
- Markedly displaced or anomalous coronary origins
- Friable ostial tissue
 - Infection, root abscess, or previous surgery compromises tissue integrity



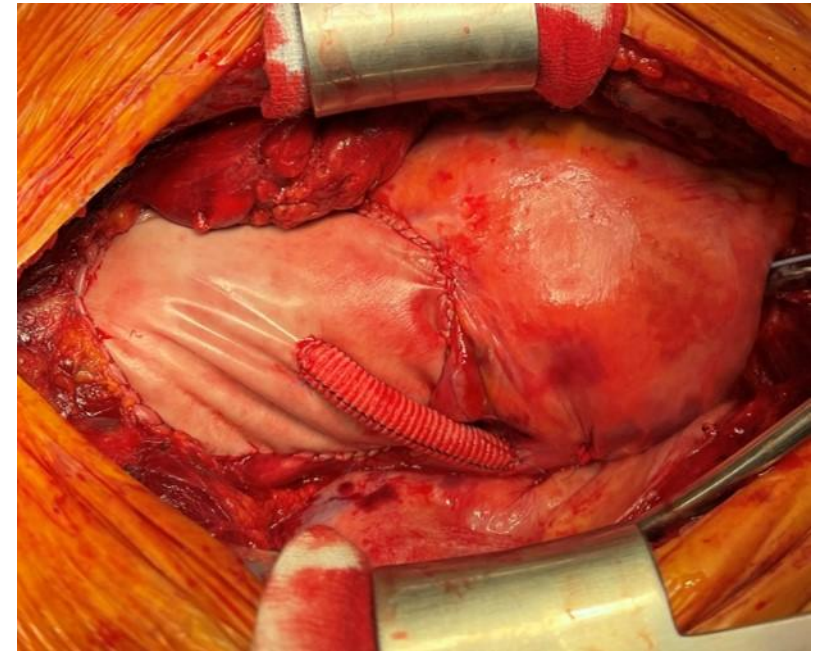
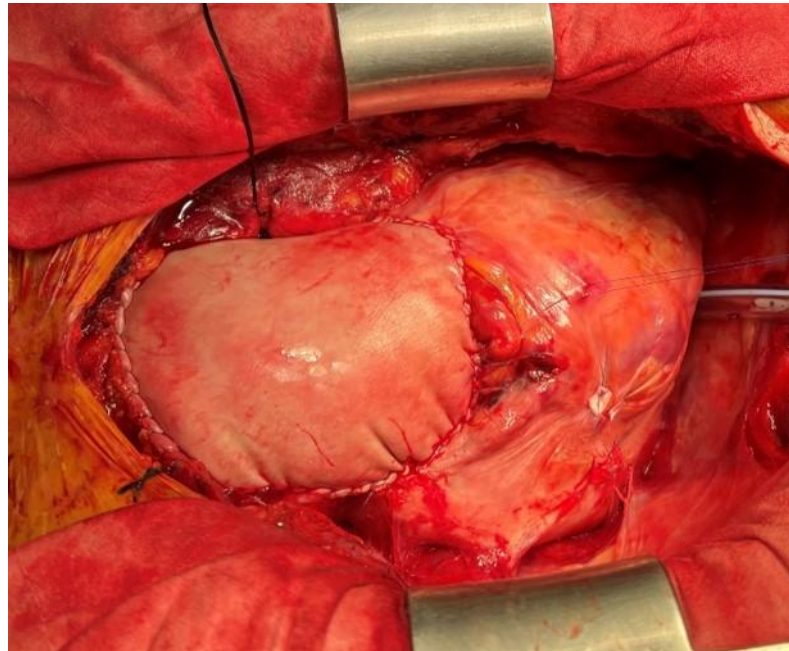
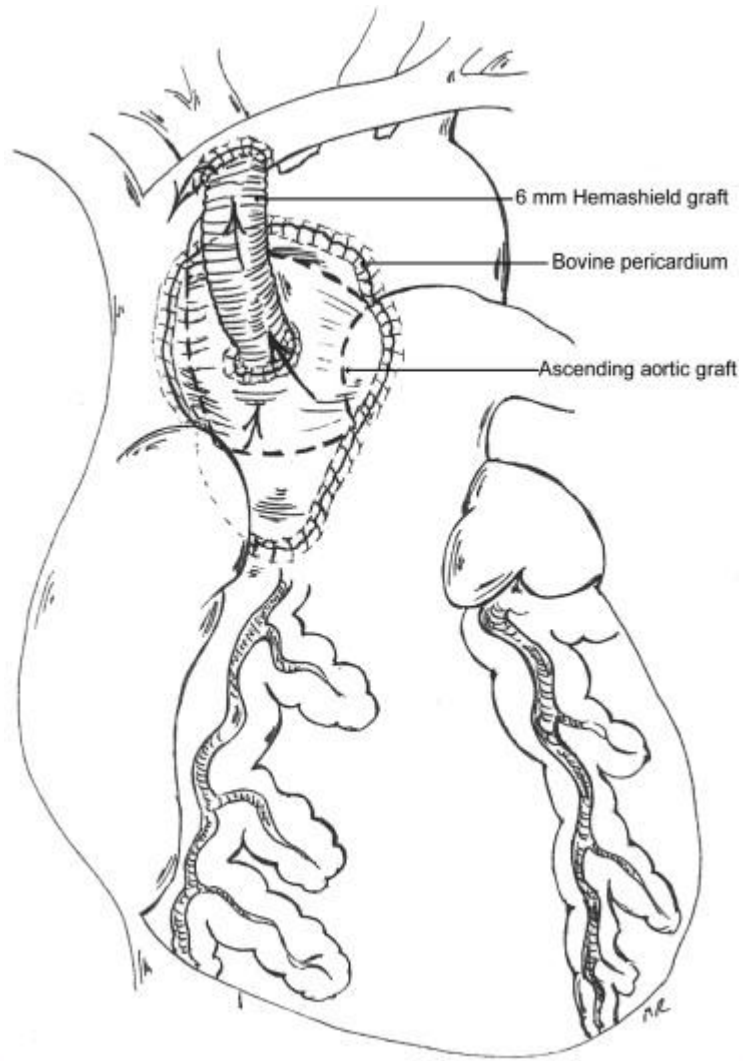
Modification of Cabrol procedure



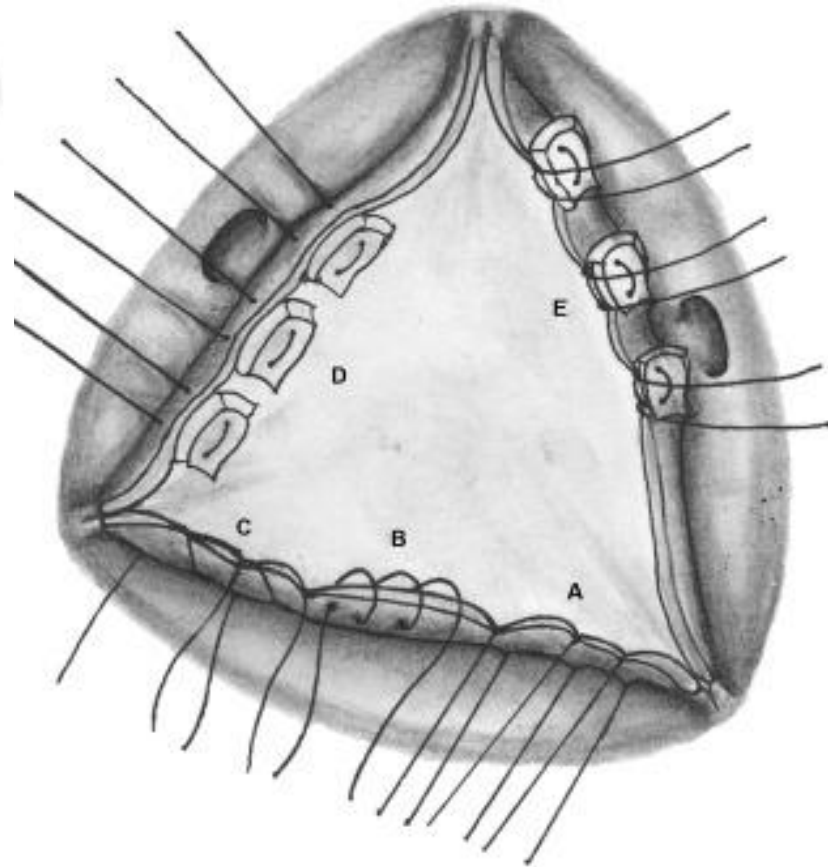
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Modification of Cabrol shunt (patch)



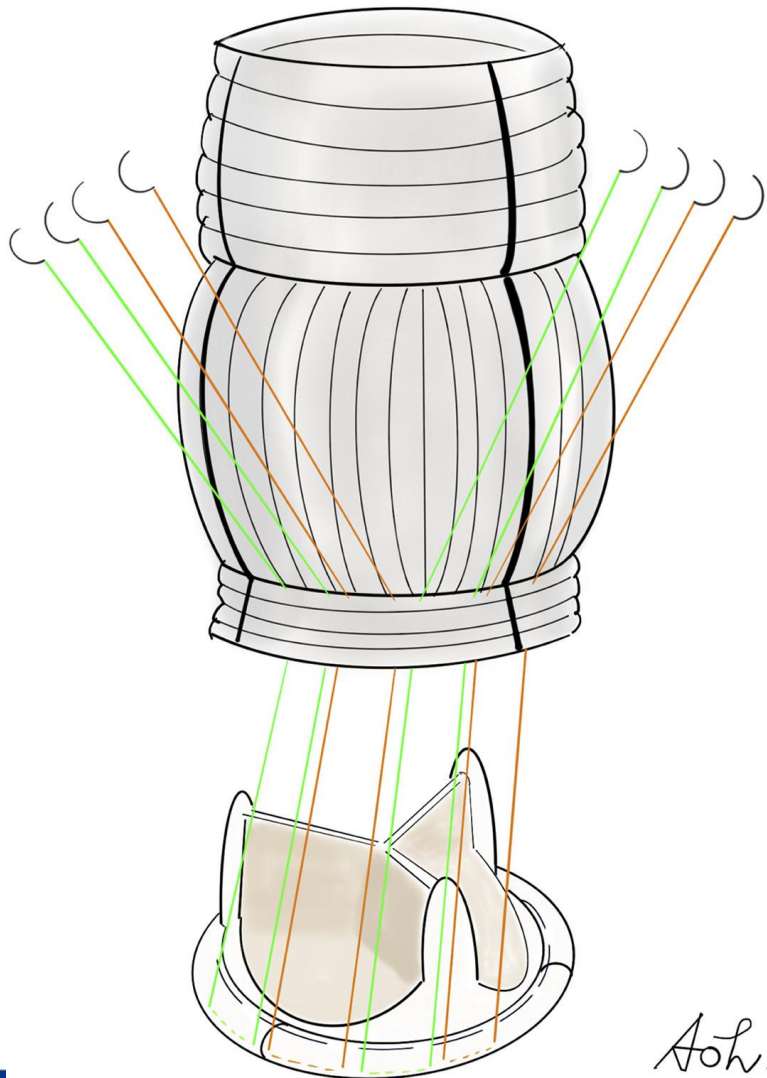
Bentall operation w/ mechanical valve



Various suture techniques

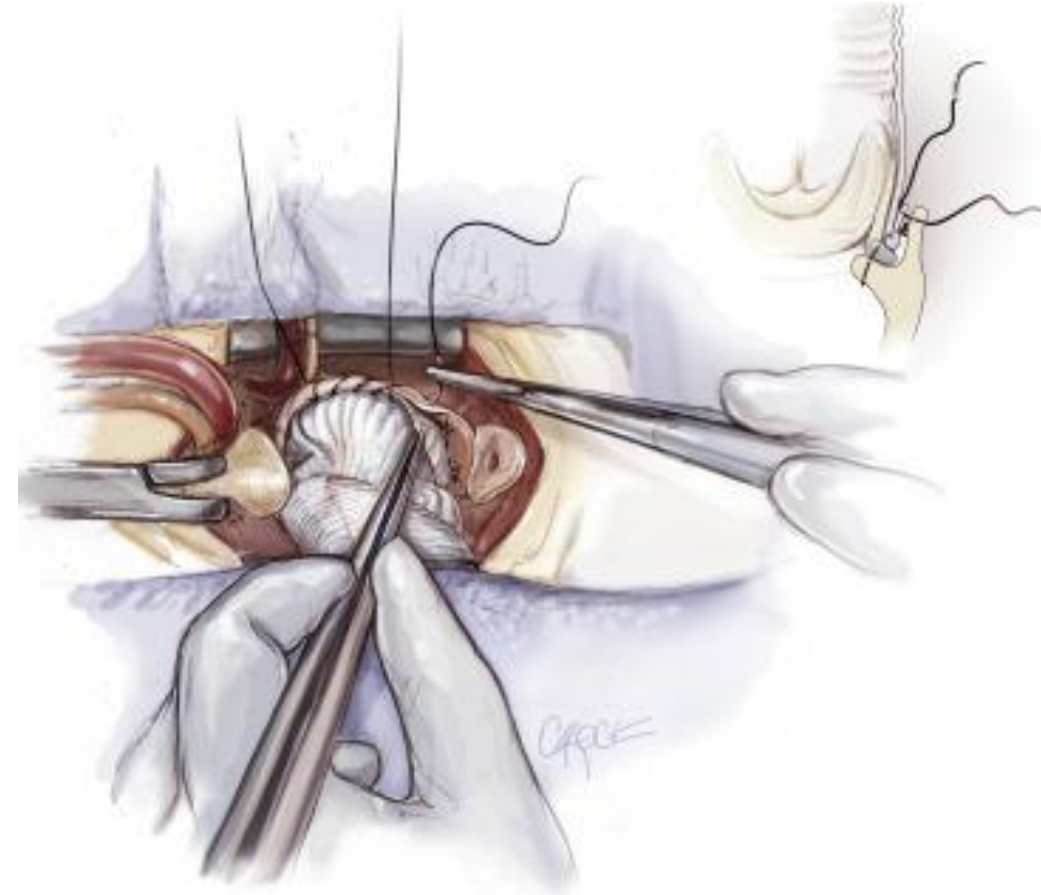
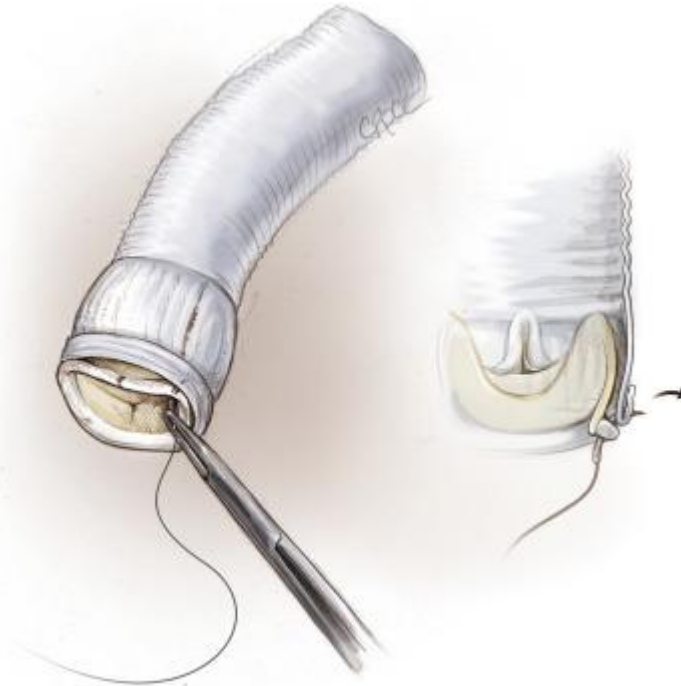
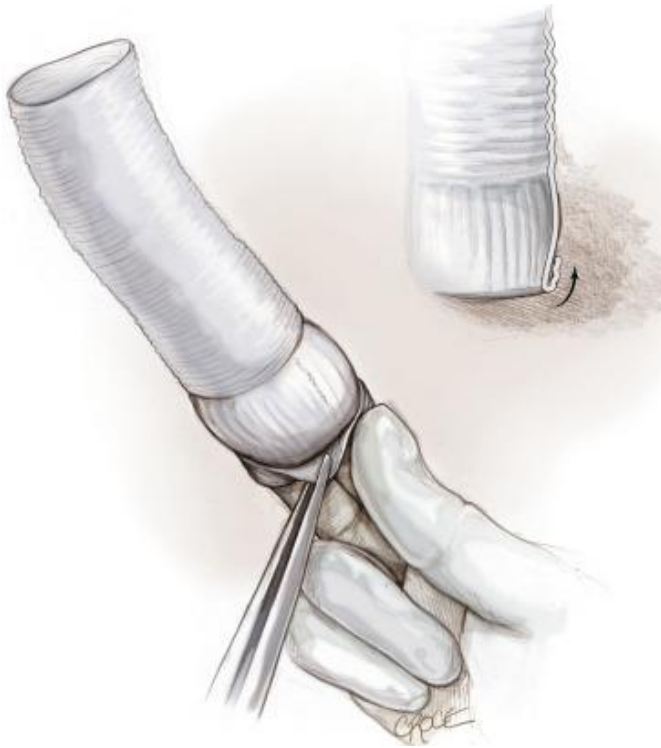
Technique	Typical configuration	Advantages	Disadvantages / precautions
Everting mattress	Pledgets on the aortic side ; generally favors intra-annular seating	Easier visualization of sutures from the aortic side; avoids ventricular-side pledgets	May limit prosthesis size in a small annulus ; excessive tightening can distort the annulus
Non-everting mattress	Pledgets on the ventricular side ; facilitates supra-annular seating	Distributes tension through pledgets; may accommodate a larger prosthesis ; allows individual adjustment of each stitch	Ventricular-side pledgets and tissue may encroach on the LVOT; multiple sutures and knots increase implantation time
Continuous running	One or several running suture segments	Fewer knots; potentially faster ; less foreign material when pledgets are omitted	Uneven tension may cause a purse-string effect, tissue cut-through , or gaps; localized revision can be more difficult

Bentall operation w/ bioprosthetic valve



Bentall operation w/ bioprosthetic valve

- French cuff techniques



Intraoperative Considerations for Bio-Bentall Surgery

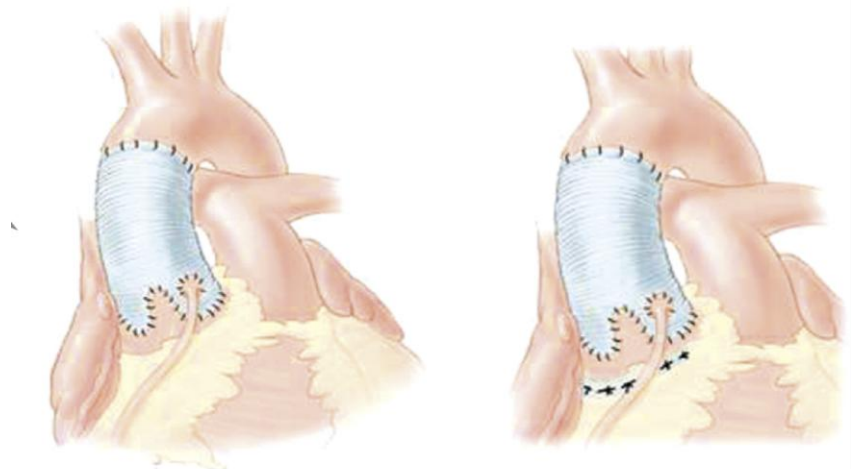
- **Avoid leaflet injury** from needles, instruments, cautery, or sutures.
- **Consider potential valve-in-valve treatment** when selecting valve size and root geometry
- **Preserve adequate coronary clearance** where feasible, without compromising the current reconstruction.
- Use TEE to **assess leaflet motion, transvalvular gradients**, transvalvular and paravalvular regurgitation

Valve sparing aortic root replacement (VSRR) ★

- Option for children and young adults with aortic root +/- ascending aneurysm
- Preserve and restore valve competence
- Avoids problems of prostheses

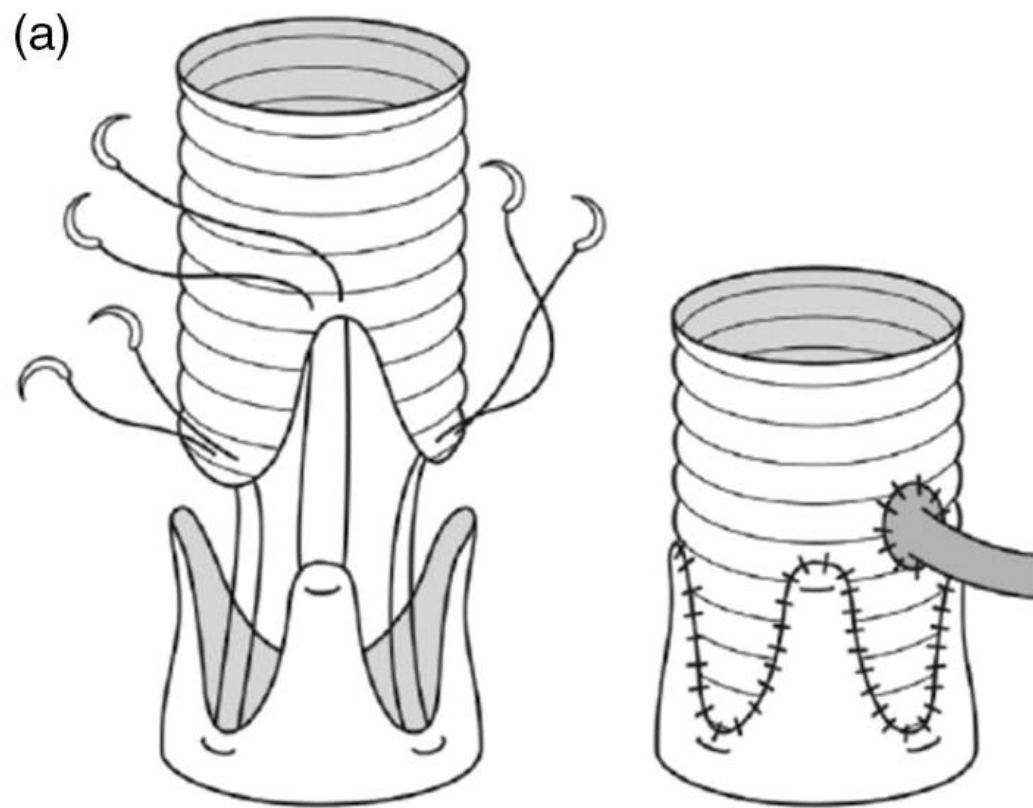


Reimplantation of the aortic valve

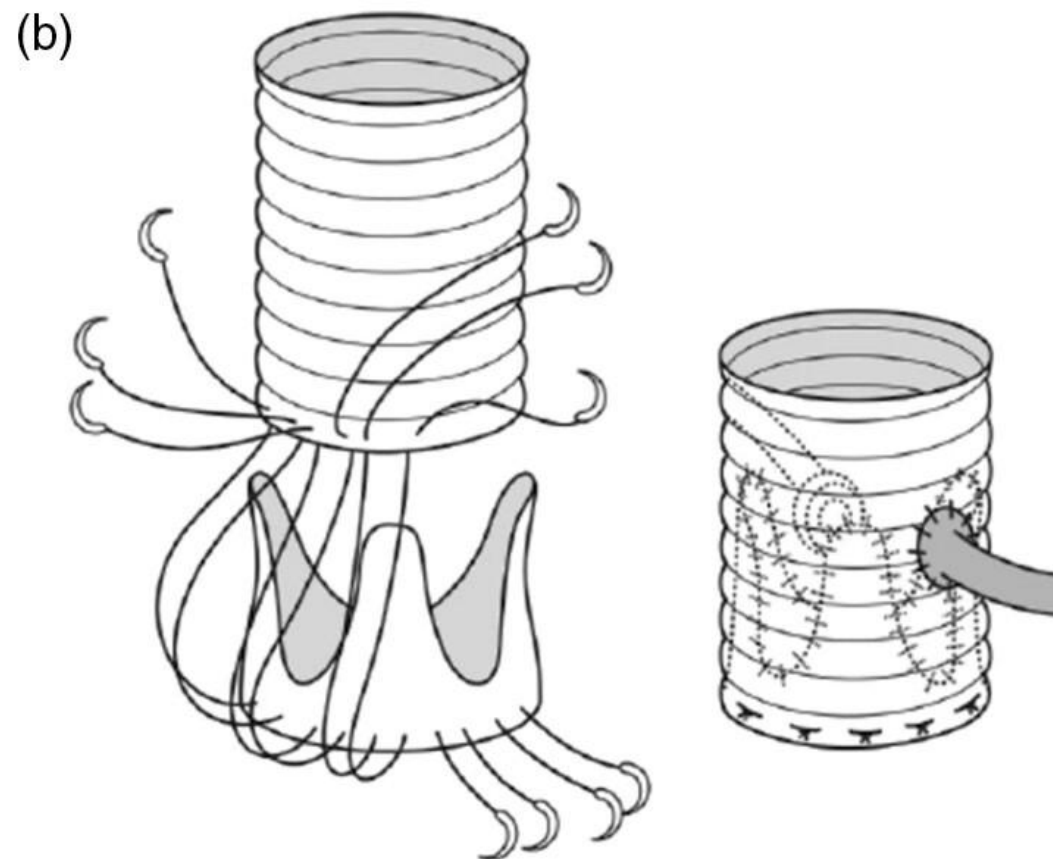


Remodeling of the aortic root

Valve sparing aortic root replacement (VSRR)

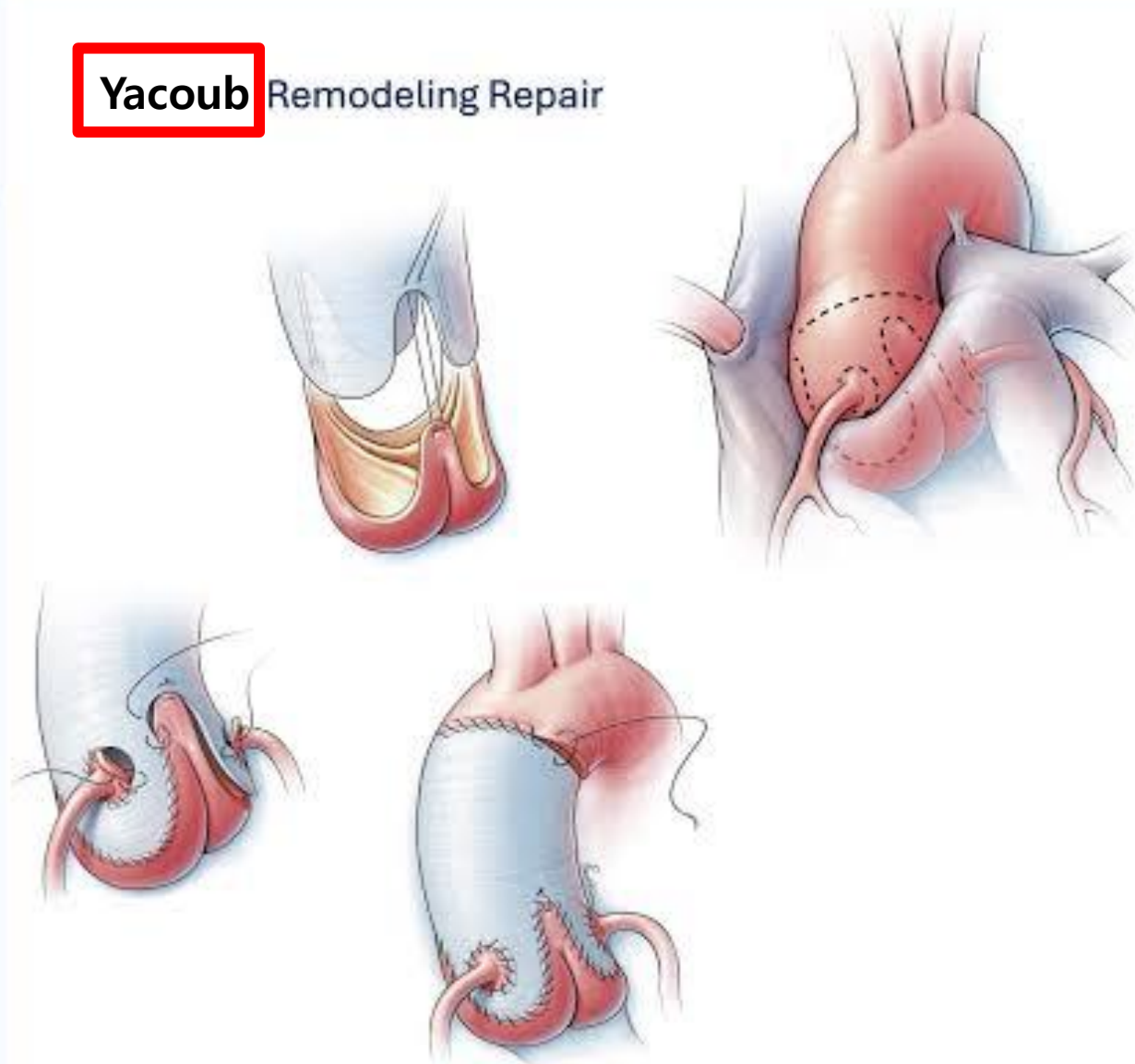


Aortic root remodeling

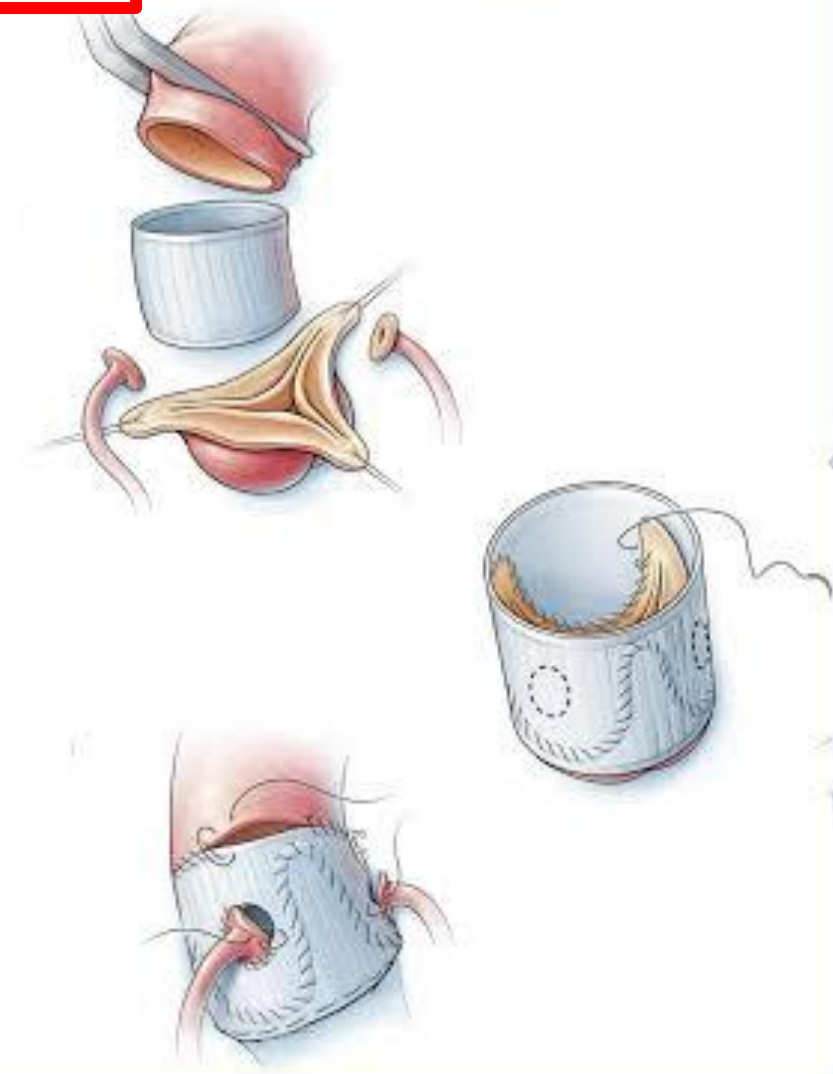


Aortic valve reimplantation

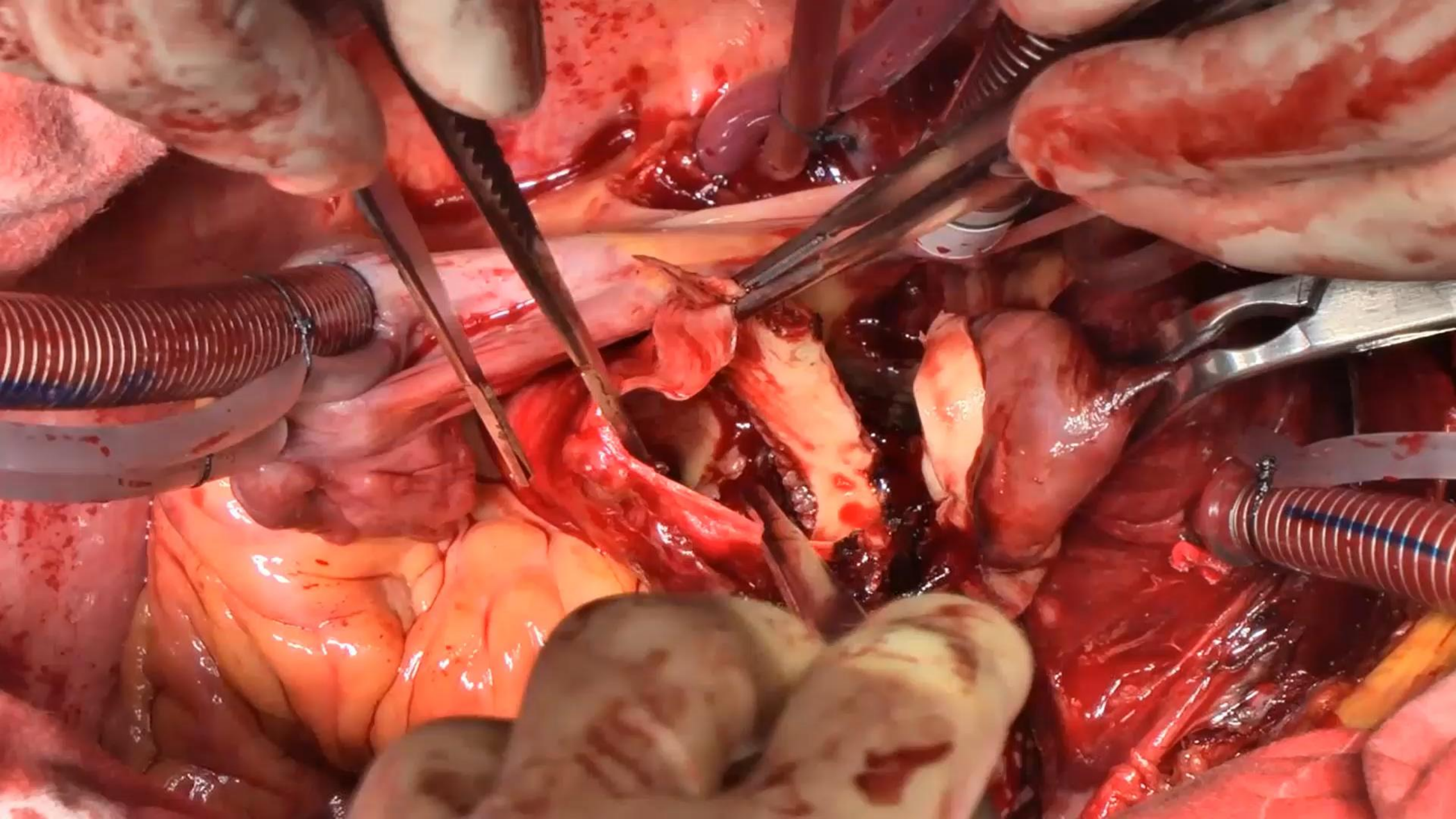
Yacoub Remodeling Repair



David Reimplantation Repair

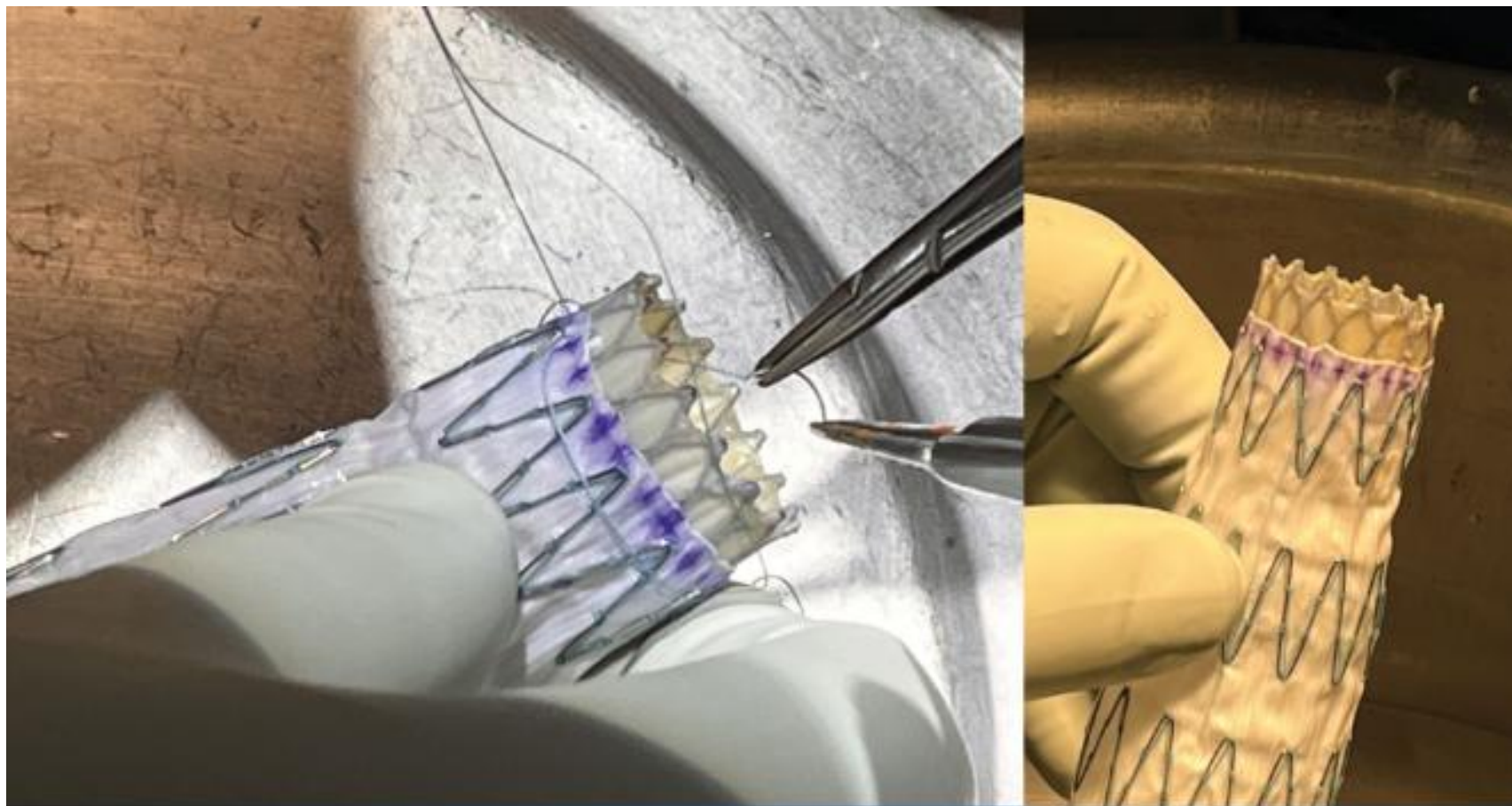


Feature	Yacoub procedure — Remodeling	David procedure — Reimplantation
Annular stabilization	Absent in the original technique; requires additional annuloplasty when indicated	Inherent to the technique, providing basal-ring stabilization
Root dynamics	Better preserves native annular and interleaflet-triangle mobility	Restricts native root expansion; modern sinus-containing grafts help recreate sinus geometry
Main advantages	Preserves root mobility; avoids the circumferential subannular fixation required for reimplantation	Stabilizes both the annulus and STJ; protects against progressive annular dilatation
Main disadvantages	Without annuloplasty, late annular dilatation may cause recurrent aortic regurgitation	Requires extensive root dissection and precise graft sizing and commissural positioning
Technical pitfalls	Incorrect scallop geometry or commissural positioning; failure to address annular dilatation	Excessive annular reduction, commissural malposition, or graft mismatch may cause cusp prolapse, restriction, or stenosis



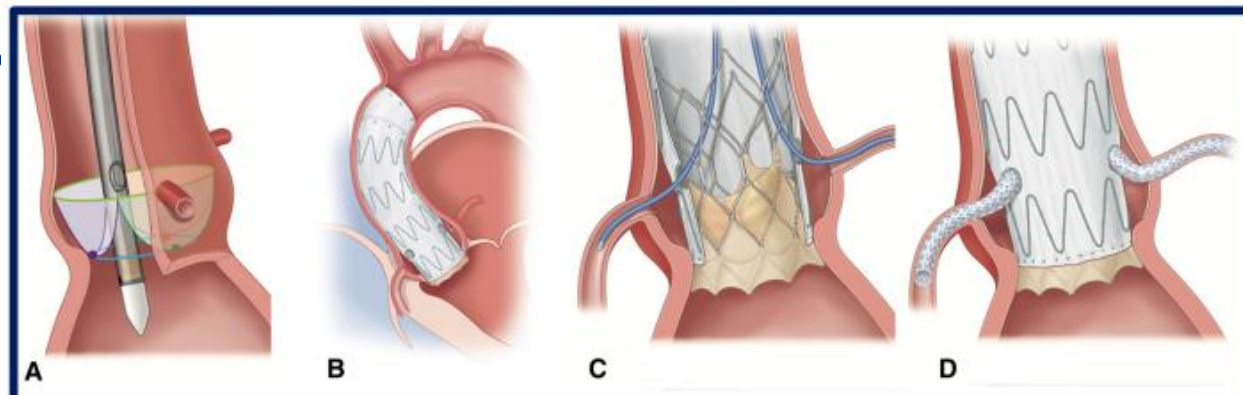
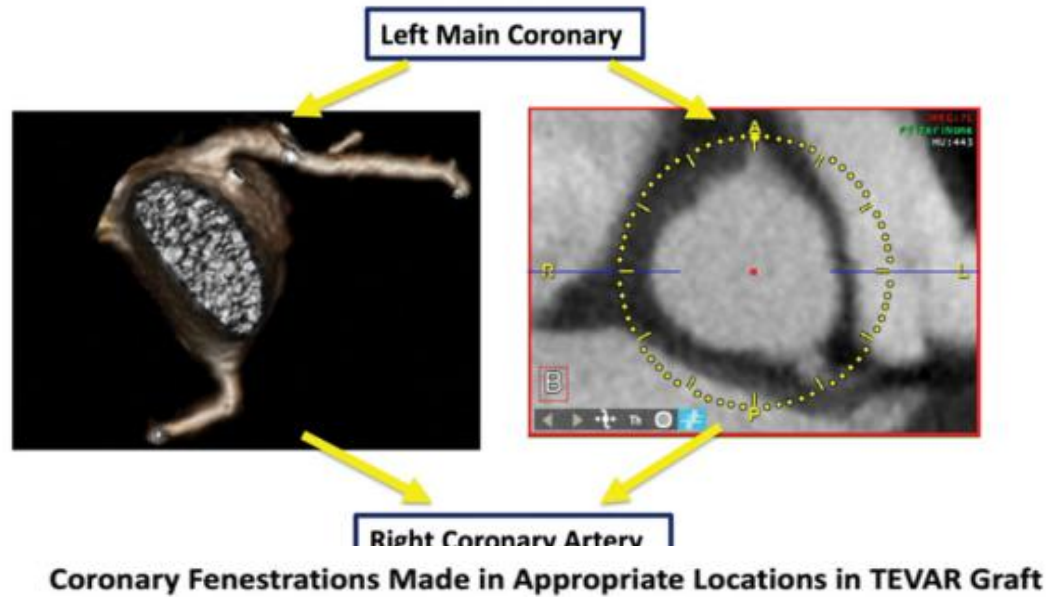
Future....

Endo-Bentall procedure

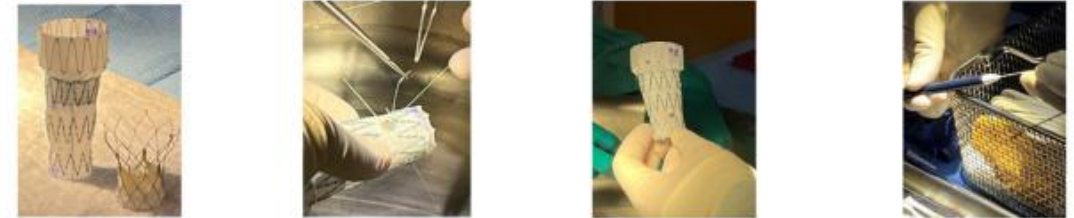


**Hand-sewn Self-Expanding TAVR
Valve Inside Tapered TEVAR Graft**

Endo – Bentall Repair: Location of Coronary Arteries



Physician Constructed Endo-Bentall Device



Coronary Fenestrations



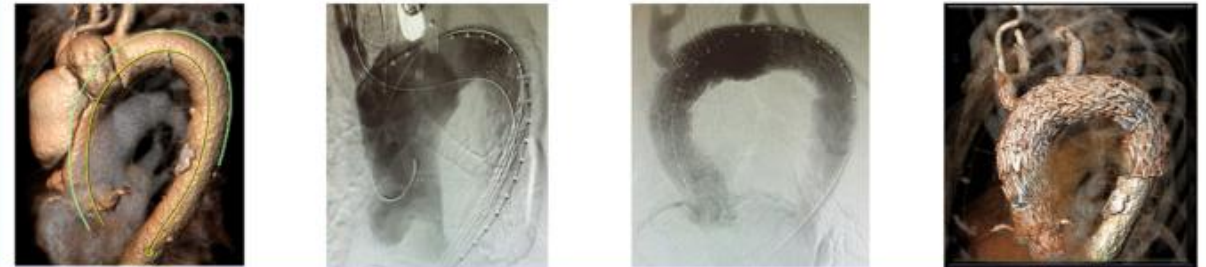
Fenestration Reinforced with Nitinol Wire



Height and Clock Location Confirmed Again



Endo-Bentall Repair for Acute Type A Dissection



Endo-Bentall Repair for Aortic Root and Ascending Aneurysm



Thank you for your attention~!

