3rd International Meeting on Aortic Diseases

New insights into an old problem

CHU Liège, FAD, APF

Surgical Treatment of Ascending Aortic Aneurysms

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Surgery on the Ascending Aorta

1. When to operate?
2. Fundamental anatomic patterns.
3. Options for replacing the aortic root.
4. Brain protection

    (Entertaining video)

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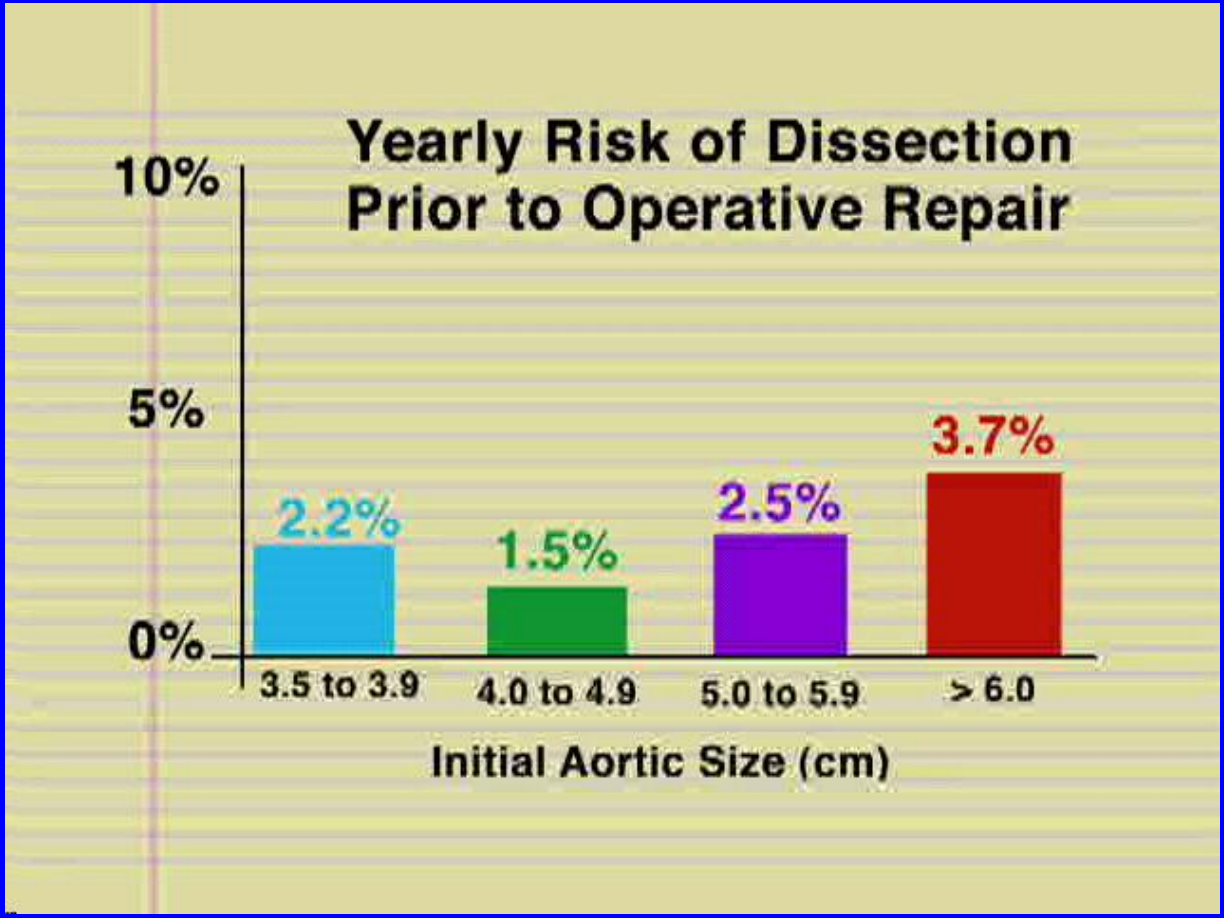
Increased Risk of Complication

Yearly risk of dissection prior to operative repair



- This analysis strongly supports the advisability of elective, preemptive surgical intervention for the lethal condition of large thoracic aortic aneurysms

Table 5. Risk of Complications by Aortic Diameter and Body Surface Area With Aortic Size Index Given Within Chart

	Aortic Size (cm)									
	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0
BSA										
1.30	2.69	3.08	3.46	3.85	4.23	4.62	5.00	5.38	5.77	6.15
1.40	2.50	2.86	3.21	3.57	3.93	4.29	4.64	5.00		
1.50	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67		
1.60	2.19	2.50	2.80	3.13	3.44	3.75	4.06	4.38		
1.70	2.05	2.35	2.65	2.94	3.24	3.53	3.82	4.12	4.41	4.71
1.80	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17	4.44
1.90	1.84	2.11	2.37	2.63	2.89	3.		.68	3.95	4.22
2.00	1.75	2.00	2.25	2.50	2.75	3.		.50	3.75	4.00
2.10	1.67	1.90	2.14	2.38	2.62	2.86	3.10	3.33	3.57	3.80
2.20	1.59	1.82	2.05	2.27	2.50	2.72	2.95	3.18	3.41	3.64
2.30	1.52	1.74	1.96	2.17	2.39	2.61	2.83	3.04	3.26	3.48
2.40	1.46	1.67	1.88	2.08	2.29	2.50	2.71	2.92	3.13	3.33
2.50	1.40	1.60	1.80	2.00	2.20	2.40	2.60	2.80	3.00	3.20

~20%/year

~8%/year

= low risk (~1% per yr); = moderate risk (~8% per yr); = severe risk (~20% per yr).

White area indicates low risk, light gray area indicates moderate risk, and dark gray area indicates severe risk.

BSA = body surface area.

Davies RR, Gallo A, Coady MA, Tellides G, Botta DM, Burke B, Coe MP, Kopf GS, Elefteriades JA.
A novel measurement of relative aortic size predicts rupture of thoracic aortic aneurysms.
Ann Thorac Surg. 81(1): 169-77, 2006.

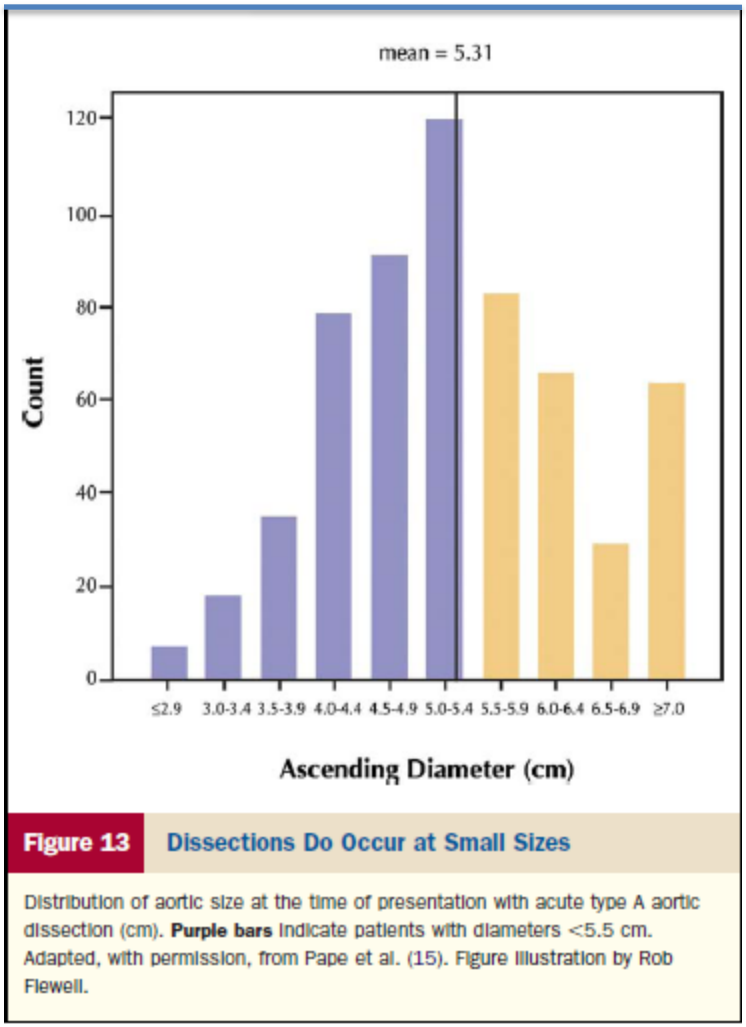


Figure 13 **Dissections Do Occur at Small Sizes**

Distribution of aortic size at the time of presentation with acute type A aortic dissection (cm). **Purple bars** indicate patients with diameters <5.5 cm. Adapted, with permission, from Pape et al. (15). Figure illustration by Rob Flewell.

But—What about numerator and denominator? x/y

Numerator	Acute Patients
Denominator	Entire Population

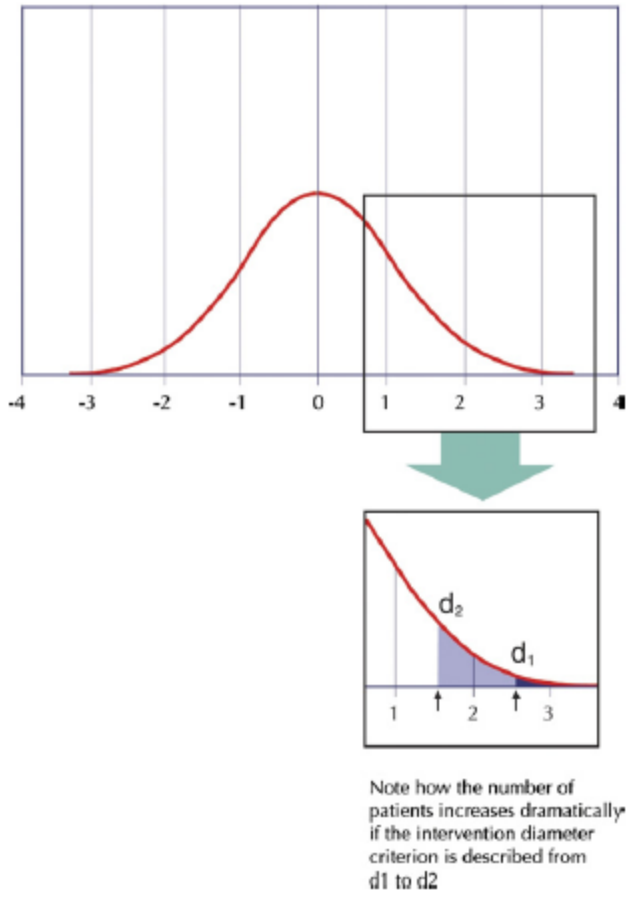
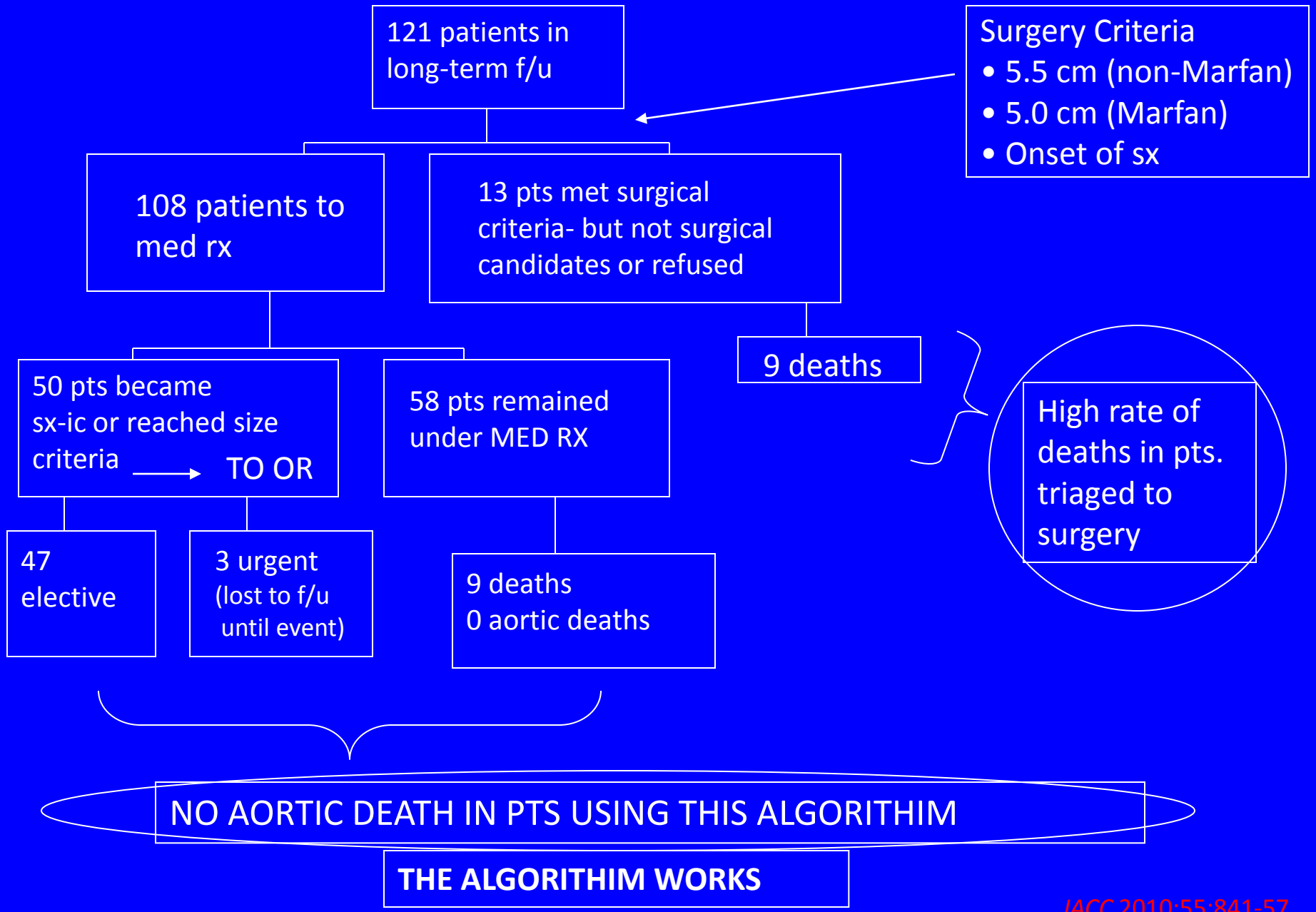
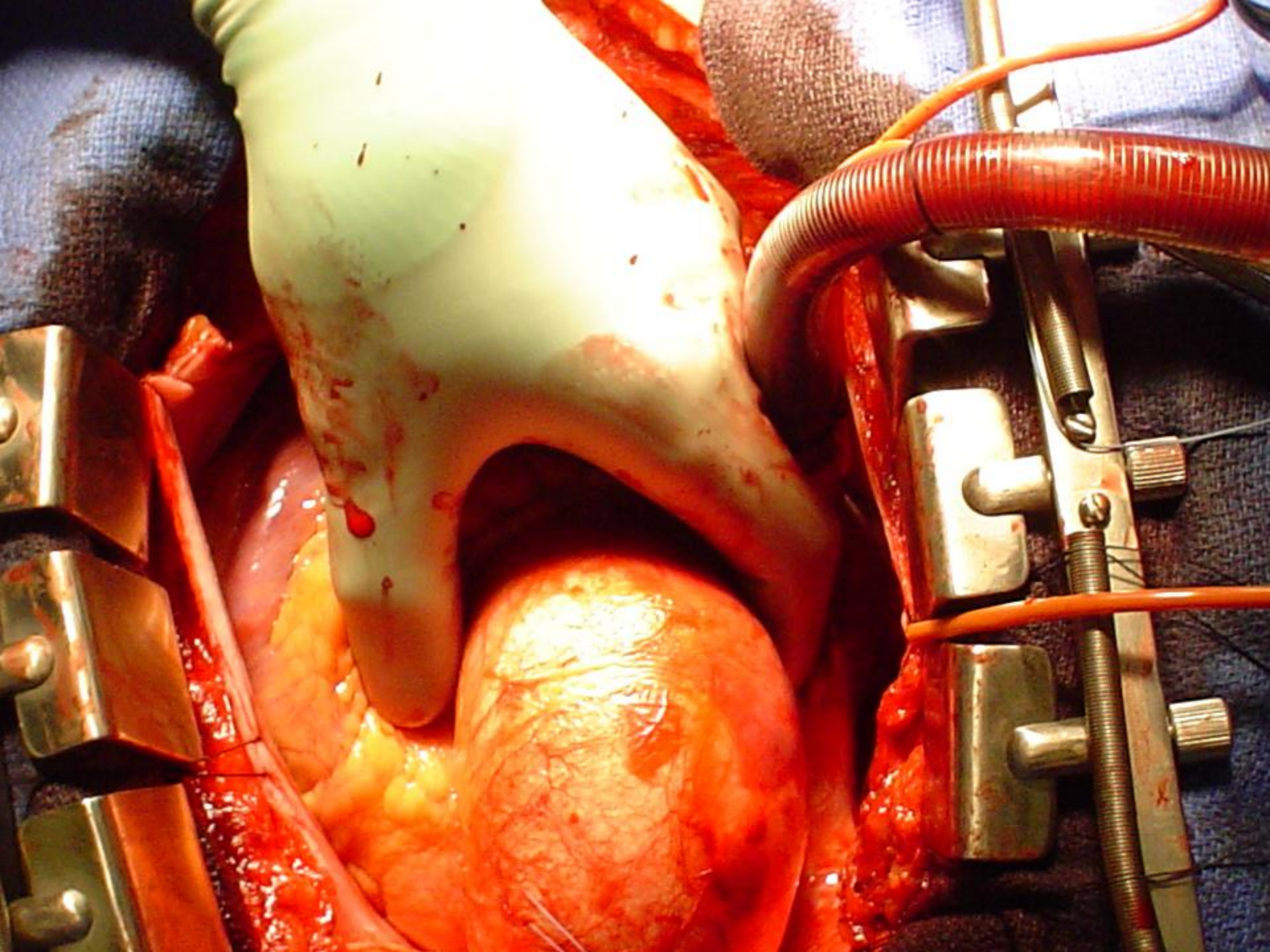


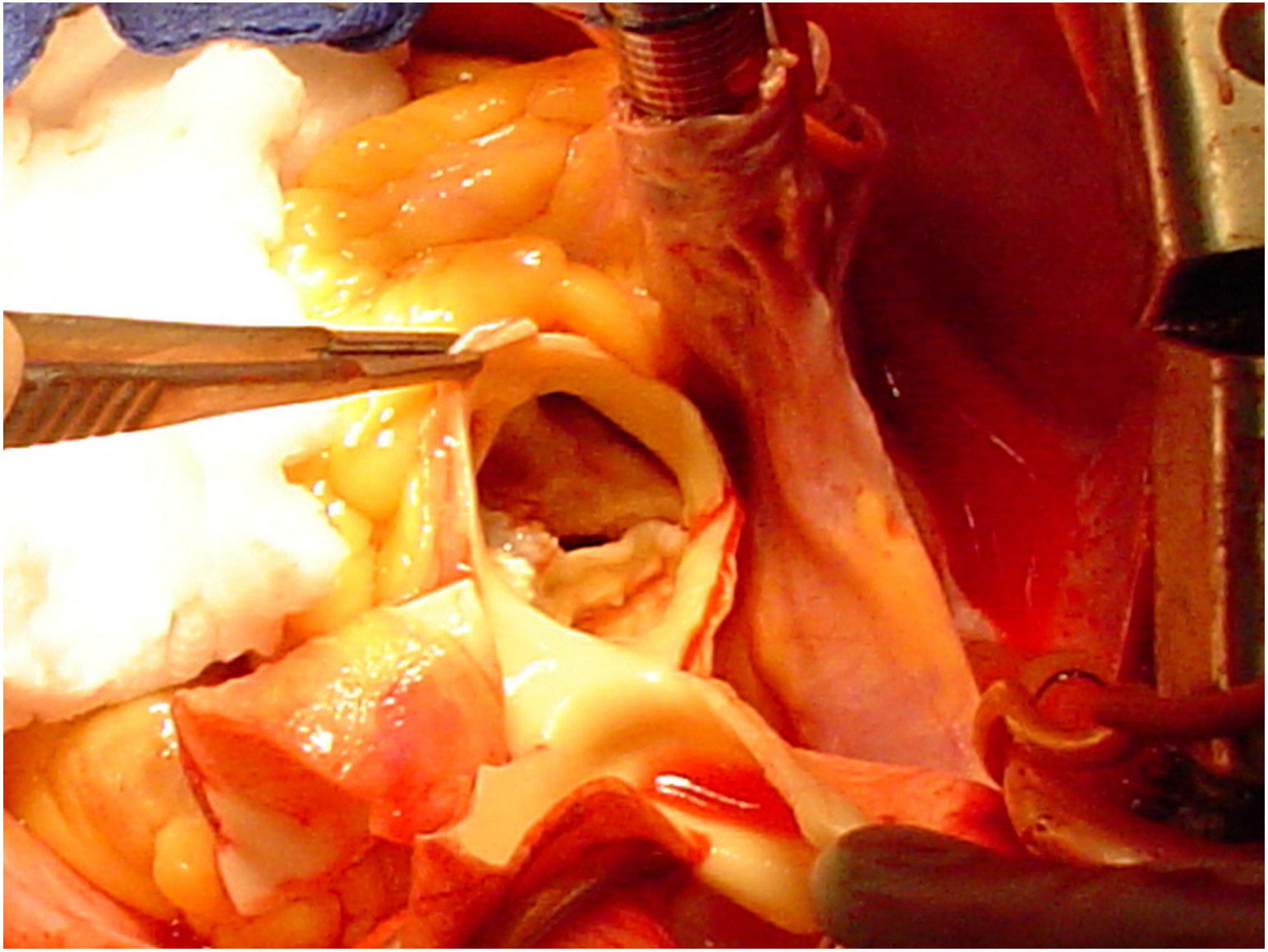
Figure 14 **Huge General Population at Risk Explains the Occurrence of Some Dissections at Small Sizes**

Depiction of a normal distribution curve of aortic size (marked in SDs). Note how small the "tails" of such a curve are. Large aneurysms would reside far out in the tails. While dissections do occur at small dimensions, note how rapidly the at-risk group increases in number as the putative criterion diameter goes from d1 to d2. We anticipate that millions of Americans harbor small thoracic aortic aneurysms, making for a very large denominator of vulnerable patients, and a correspondingly low likelihood of dissection at small sizes. See the "Dissections Can and Do Occasionally Occur at Small Aortic Sizes" section for details. Figure illustration by Rob Flewell.



JACC 2010;55:841-57





How Do You Handle….

Operating For….

	Aorta	Valve
Aorta	STD CRITERIA	
Valve		STD CRITERIA

How Do You Handle….

Operating For….

	Aorta	Valve
Aorta		?
Valve	?	

How Do You Handle….

Operating For….

	Aorta	Valve
Aorta		Replace if will not give >10y normal service.
Valve	Replace @ 4.5 cm.	

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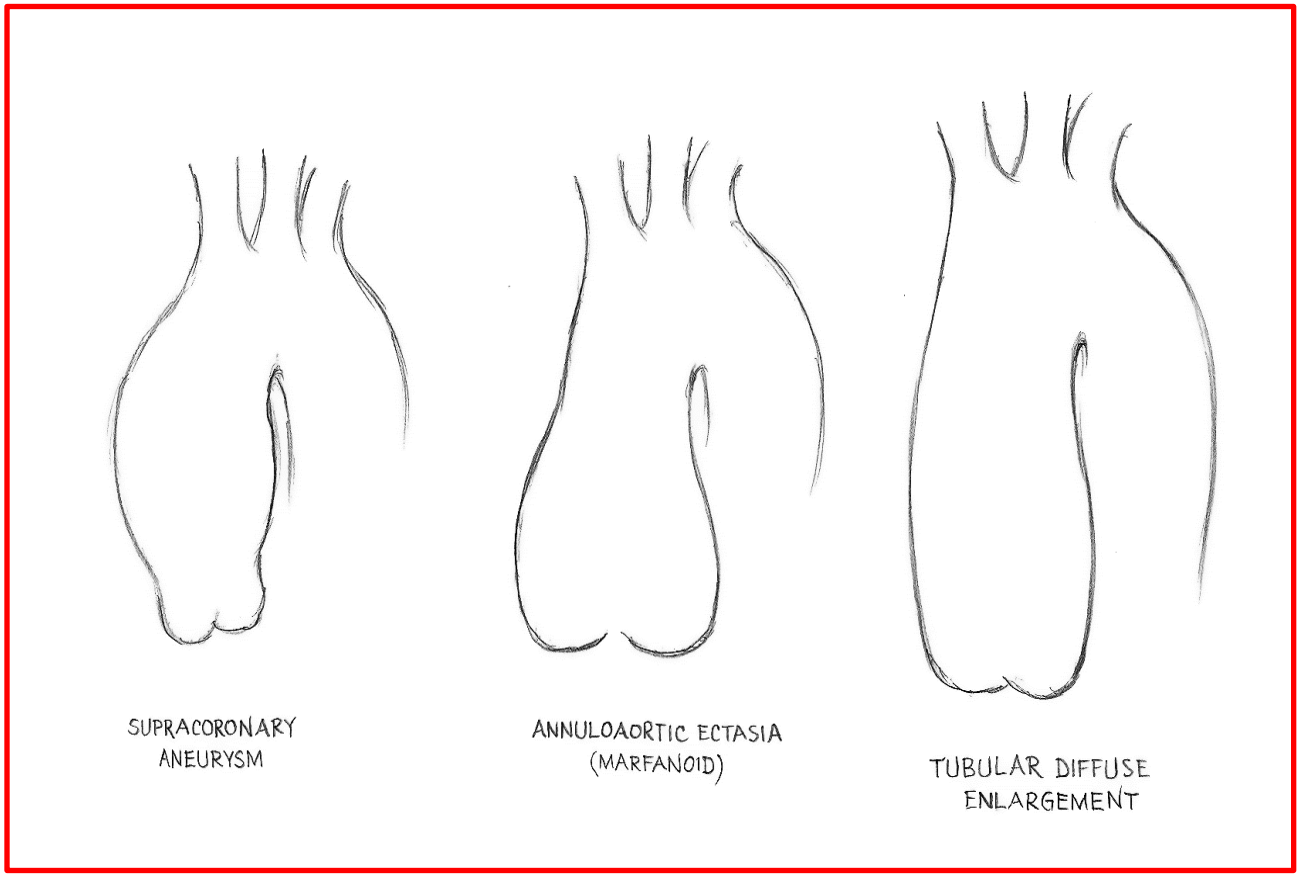
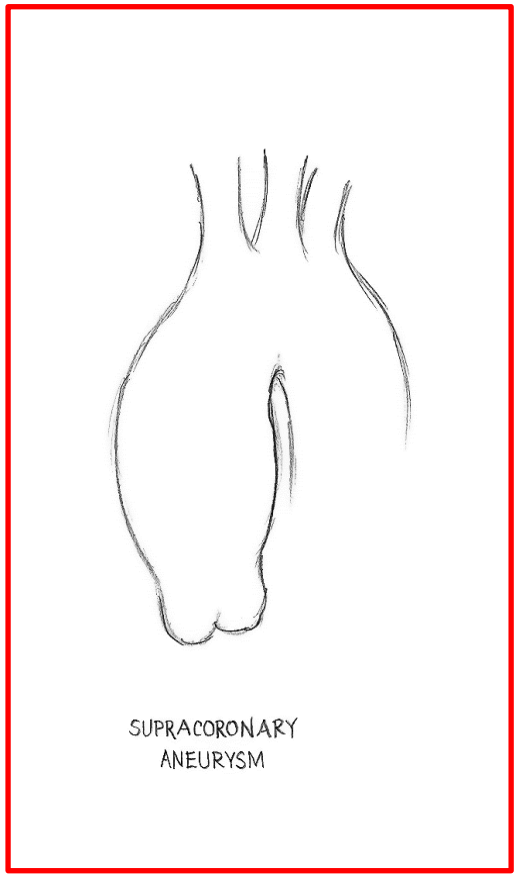
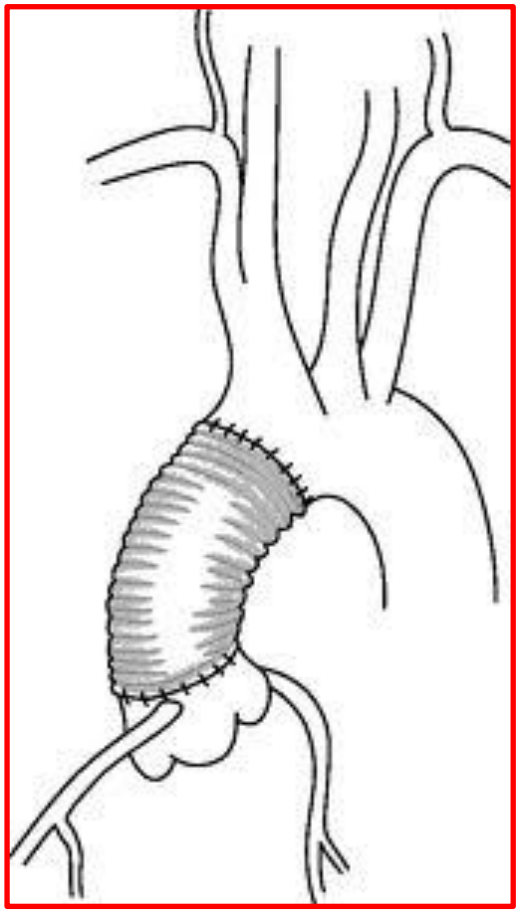
    (Entertaining video)

Three morphologies of the aortic root and ascending aorta.





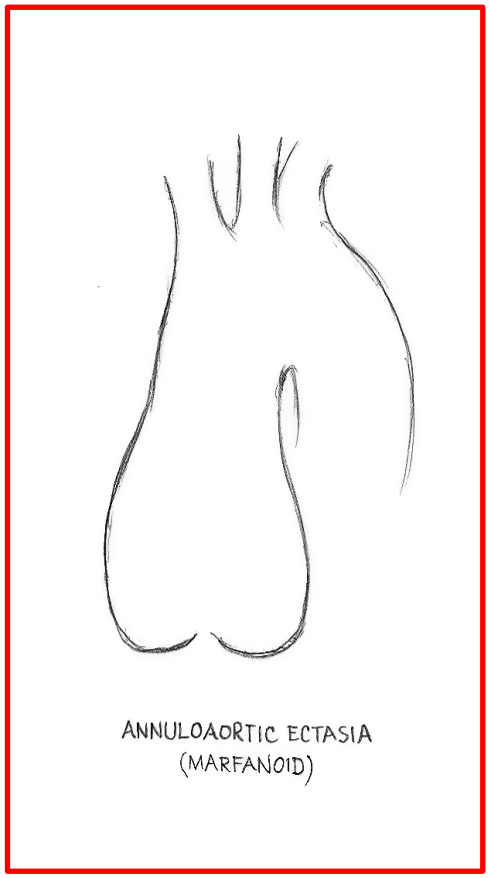


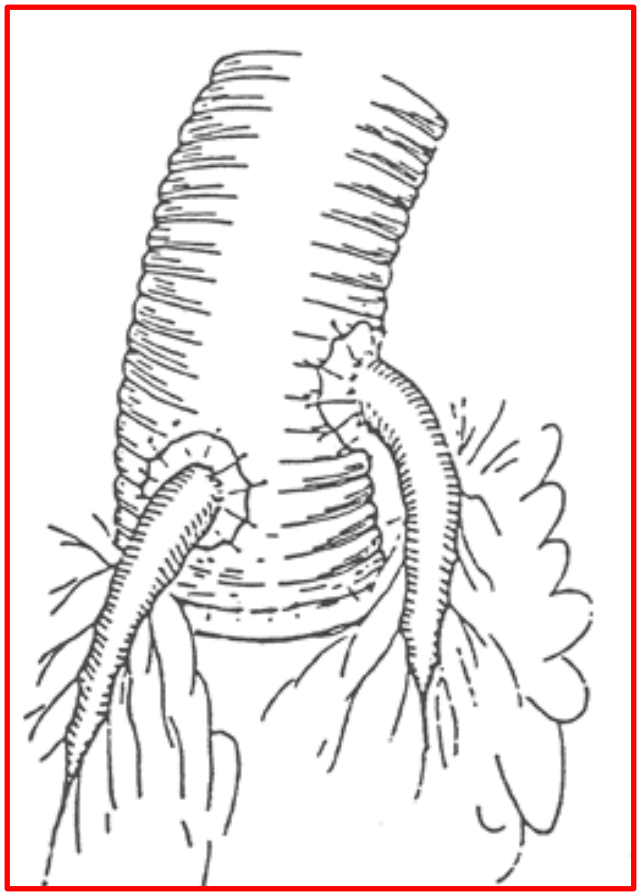
Note: normal-sized proximal aortic root does not dilate later, even in long-term follow-up.

Supra-aortic tube graft

No need to replace more.

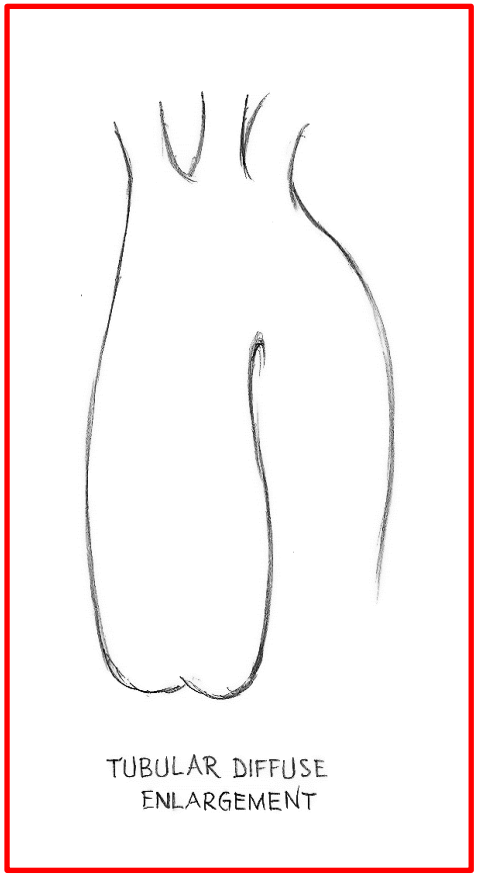
NO NEED TO DO VALVE-SPARING IN THIS SETTING. RATHER, “ROOT-SPARING”



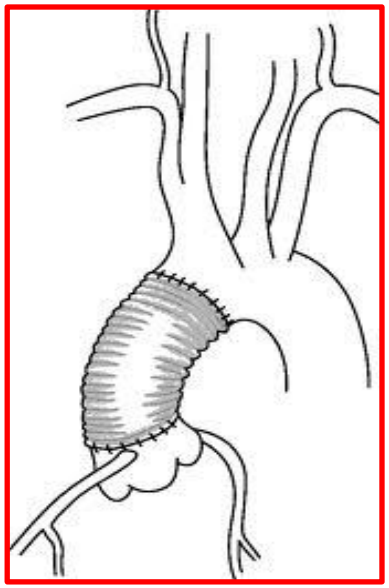


Cannot leave dilated root behind: will enlarge, dissect, or rupture.

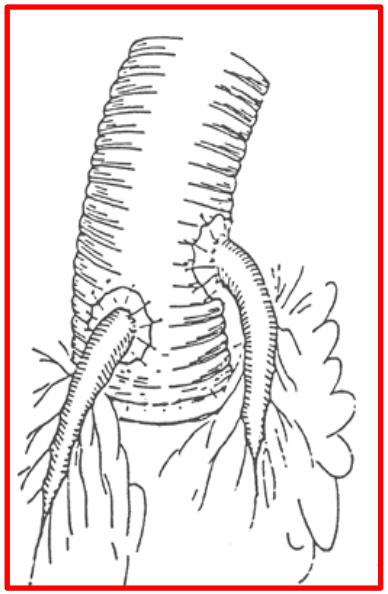
Root replacement (or alternate)



Tube



Composite



Can go either way: tube or composite, depending on age, condition:

Old, frail:	Tube
Young, strong:	Composite

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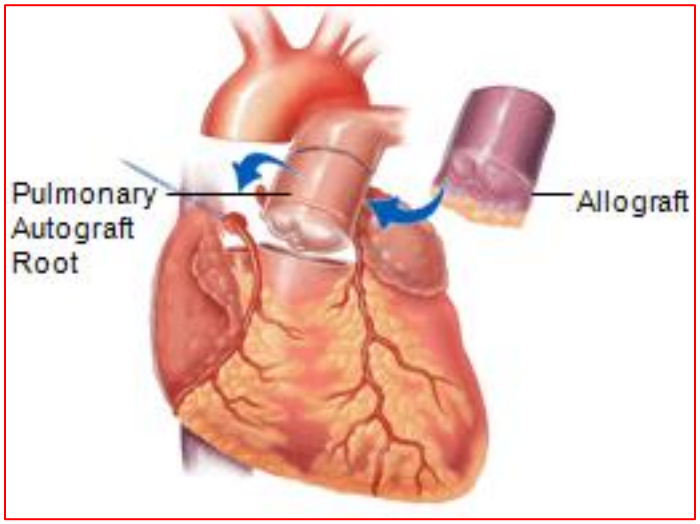
Key Questions in Choice of Procedure

- With what do we replace the resected tissue?

Key Questions in Choice of Procedure

- How much to we resect?
- With what do we replace the resected tissue?
  - Ross Procedure
  - Homograft
  - Allograft (Medtronic FreeStyle)
  - Composite graft
    - Mechanical
    - Biological
  - Valve-sparing procedure

Ross Procedure



- "Loosing steam" due to
  - Complexity
  - Late problems
    - AI
    - PI
    - Homograft calcification
  - Increasing reoperations
    - These are tough reoperations!

Reserve for special situations: Patient or environment

Circulation. 2010;122:1153-1158.

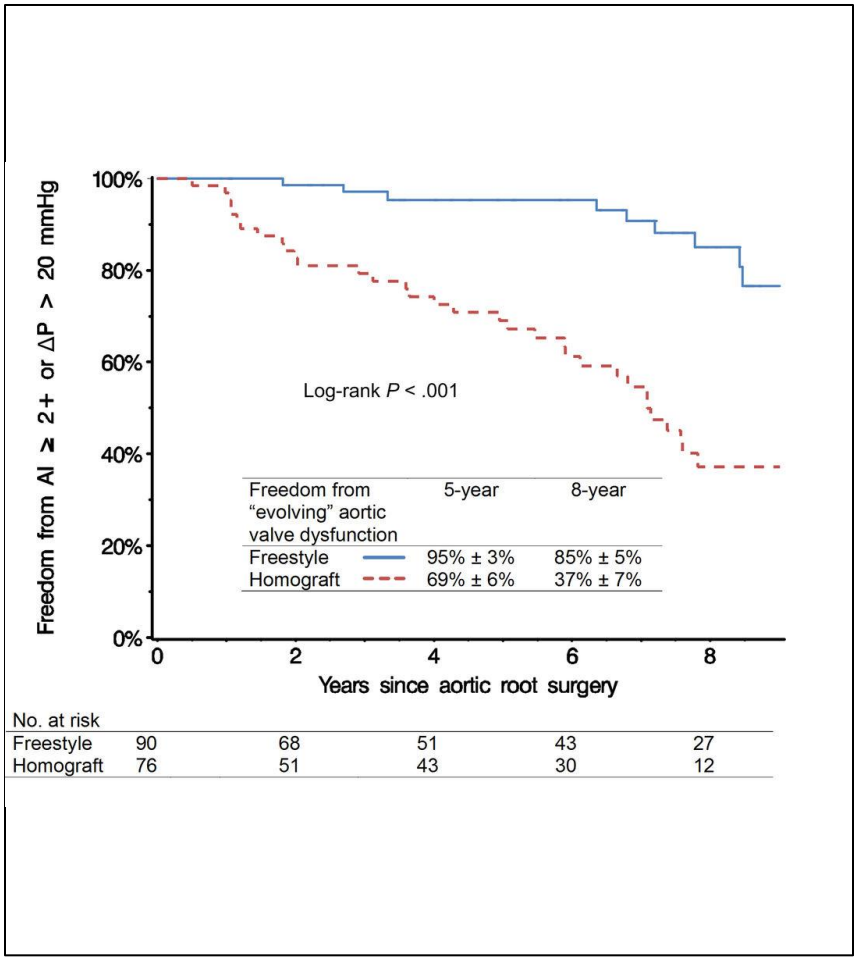
Homograft

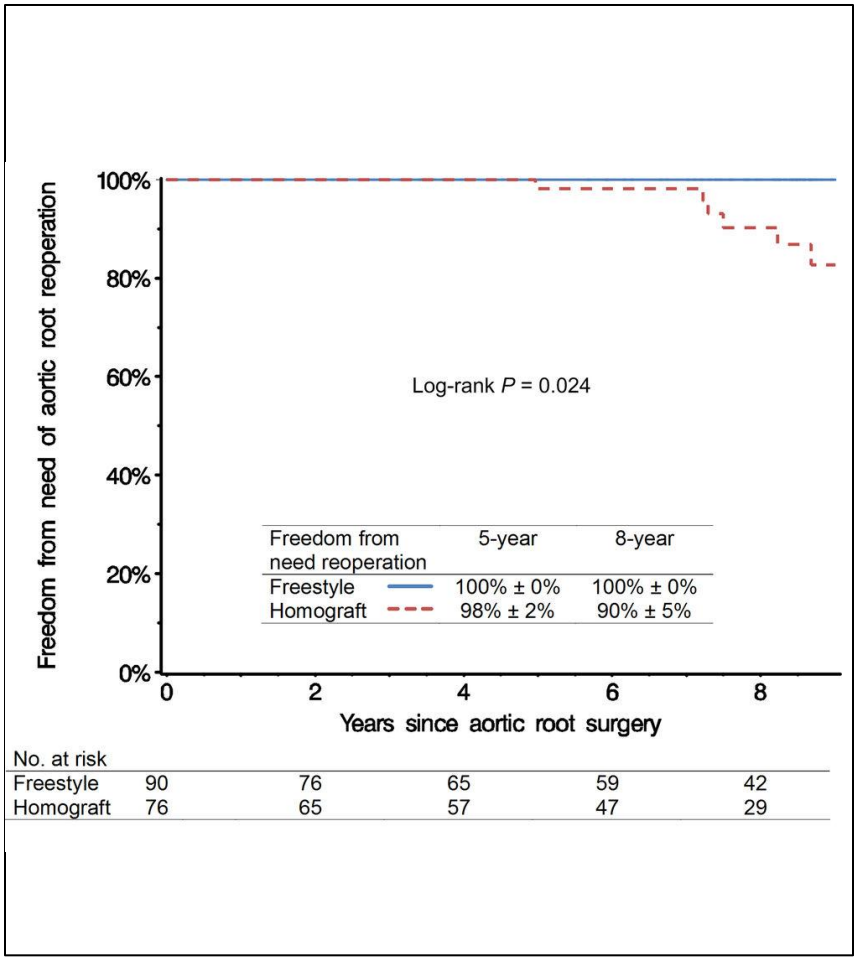
- Preservation, sterility issues.
- Latest information from Prof. Yacoub indicates suboptimal performance in mid-term: persistent immunologic antigenicity.
- Best reserved for infection cases.

Yacoub MH, et al. Long-term outcomes after autograft versus homograft aortic root replacement in adults with aortic valve disease: a randomized controlled trial. Lancet 201;376:524-31.

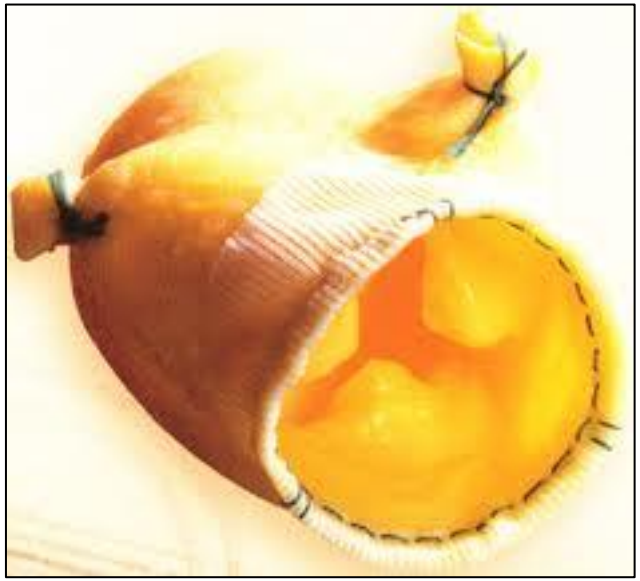
Elefteriades JA. Should we abandon homografts? J Am Coll Cardiol. 2010 26;55:377-8.

Poor long-term performance of homografts (Yacoub)





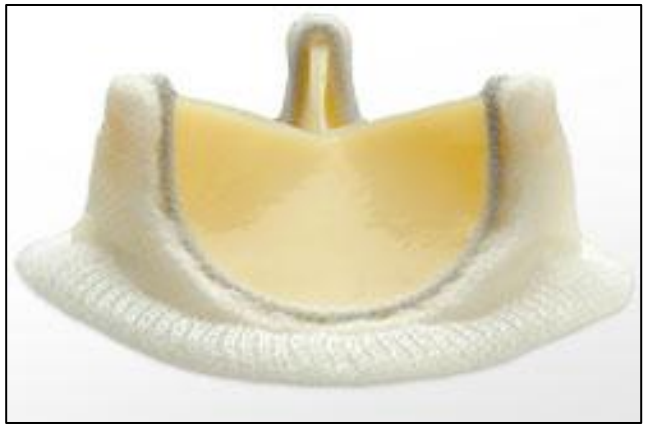
Allograft (Medtronic FreeStyle)

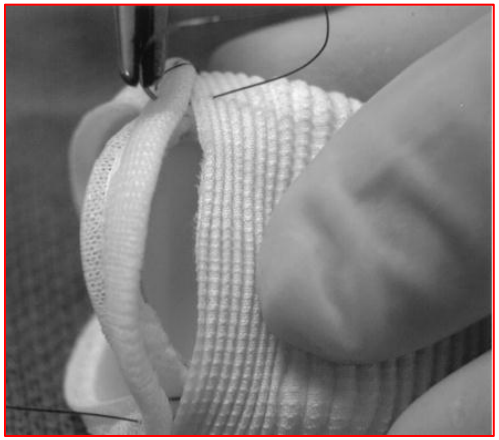


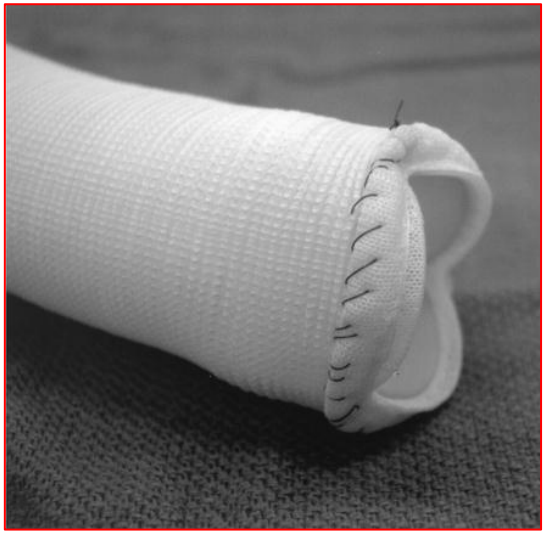
- Good performance
- None of preservation issues of homografts
- Non-antigenic
- Sewing ring delicate—perhaps would be better if bulkier

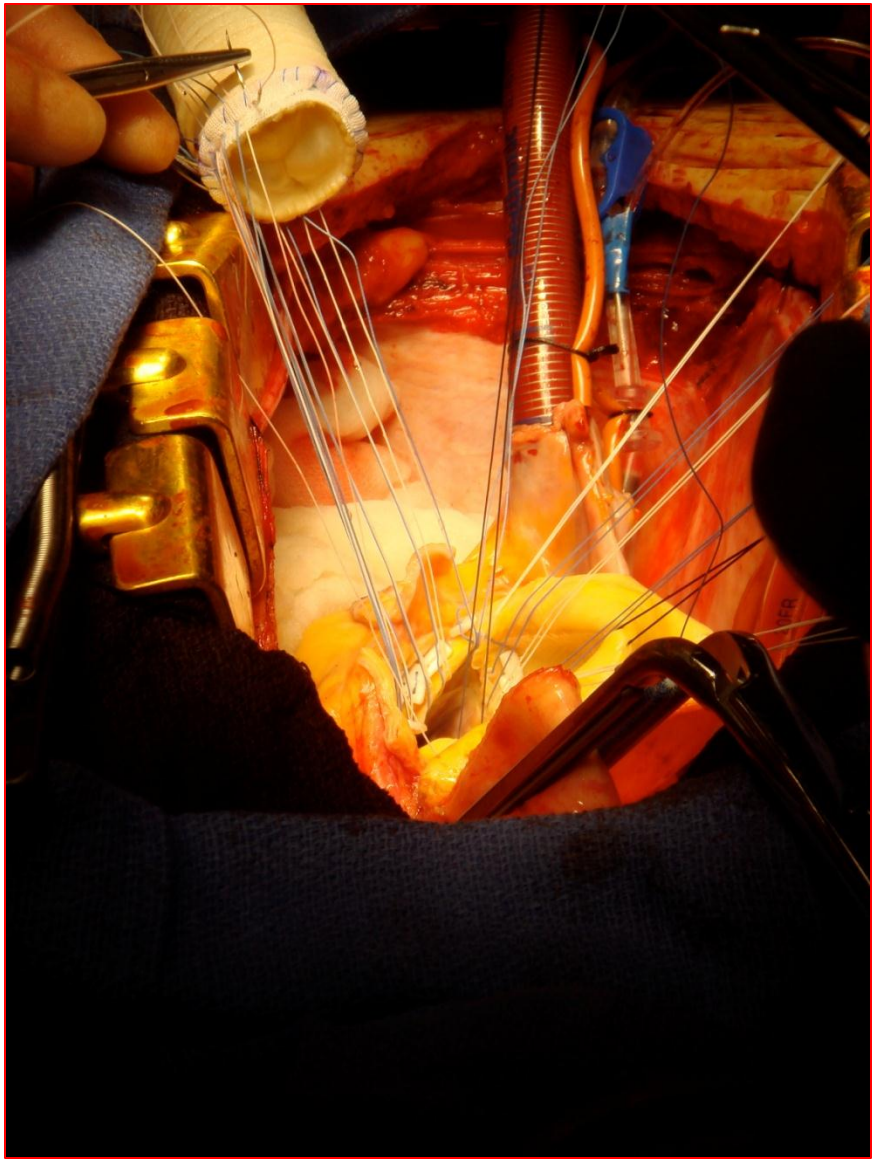
Biological valved conduits

(No prefabricated versions available in US.)

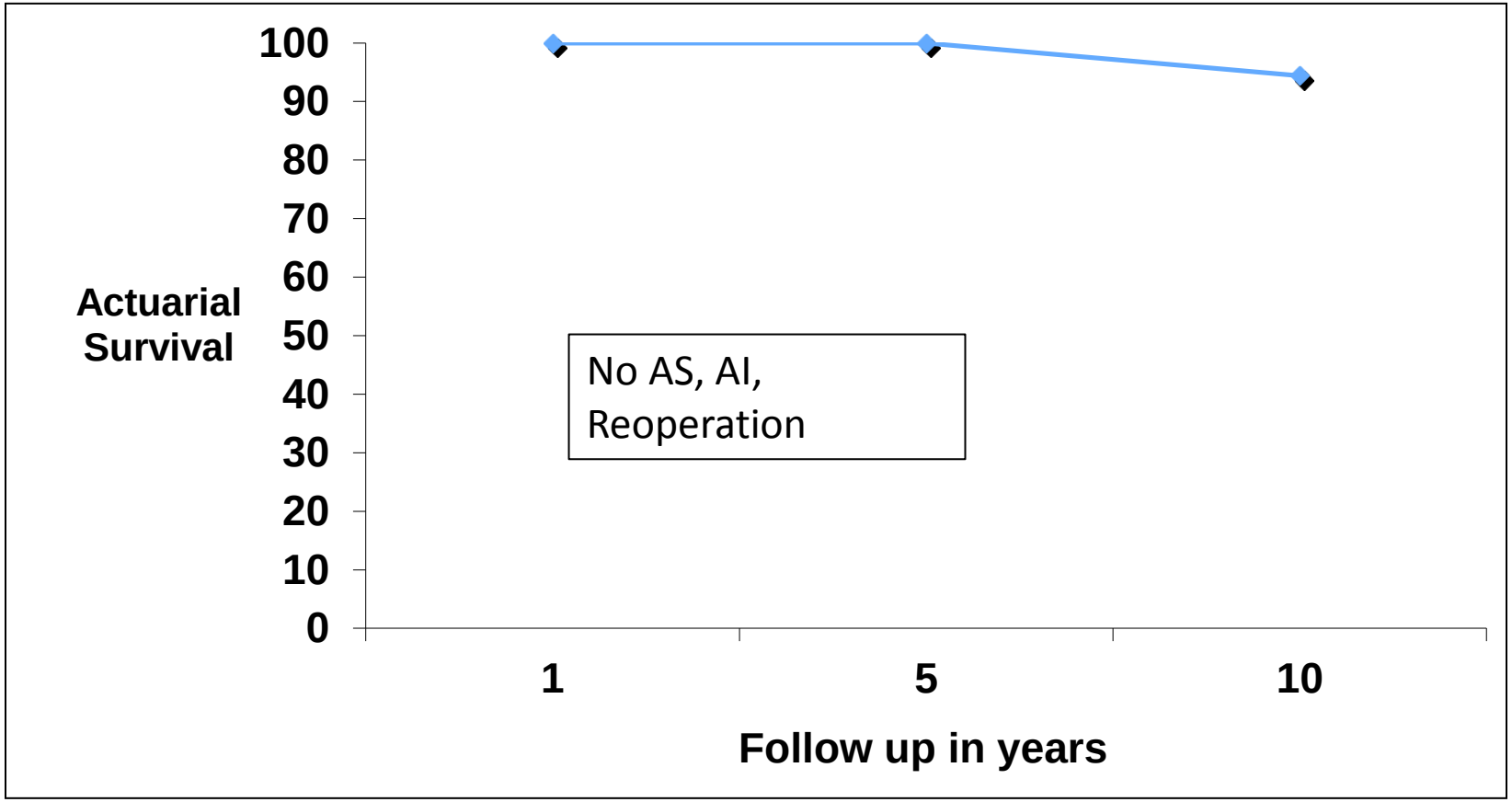




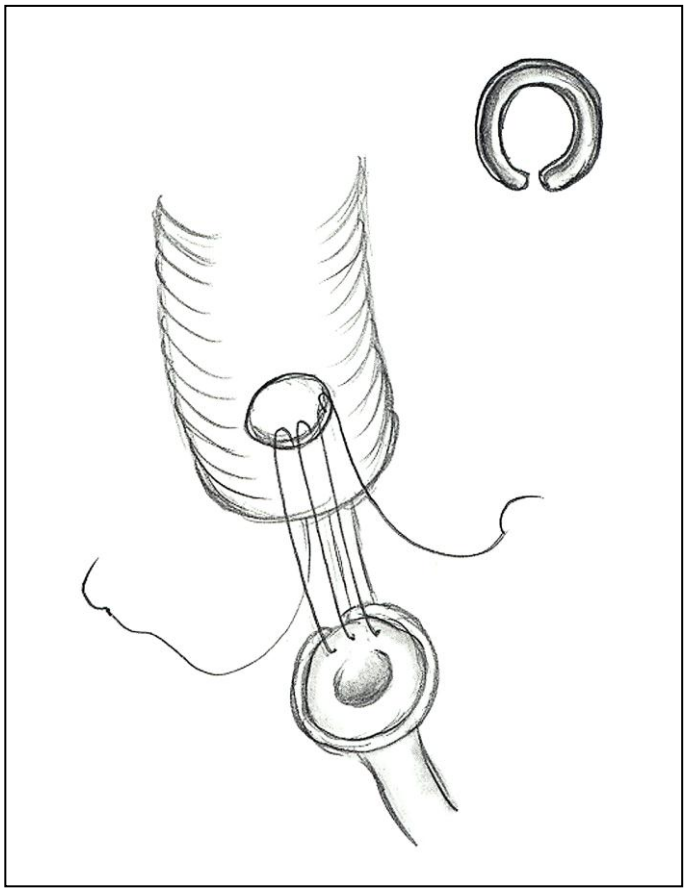




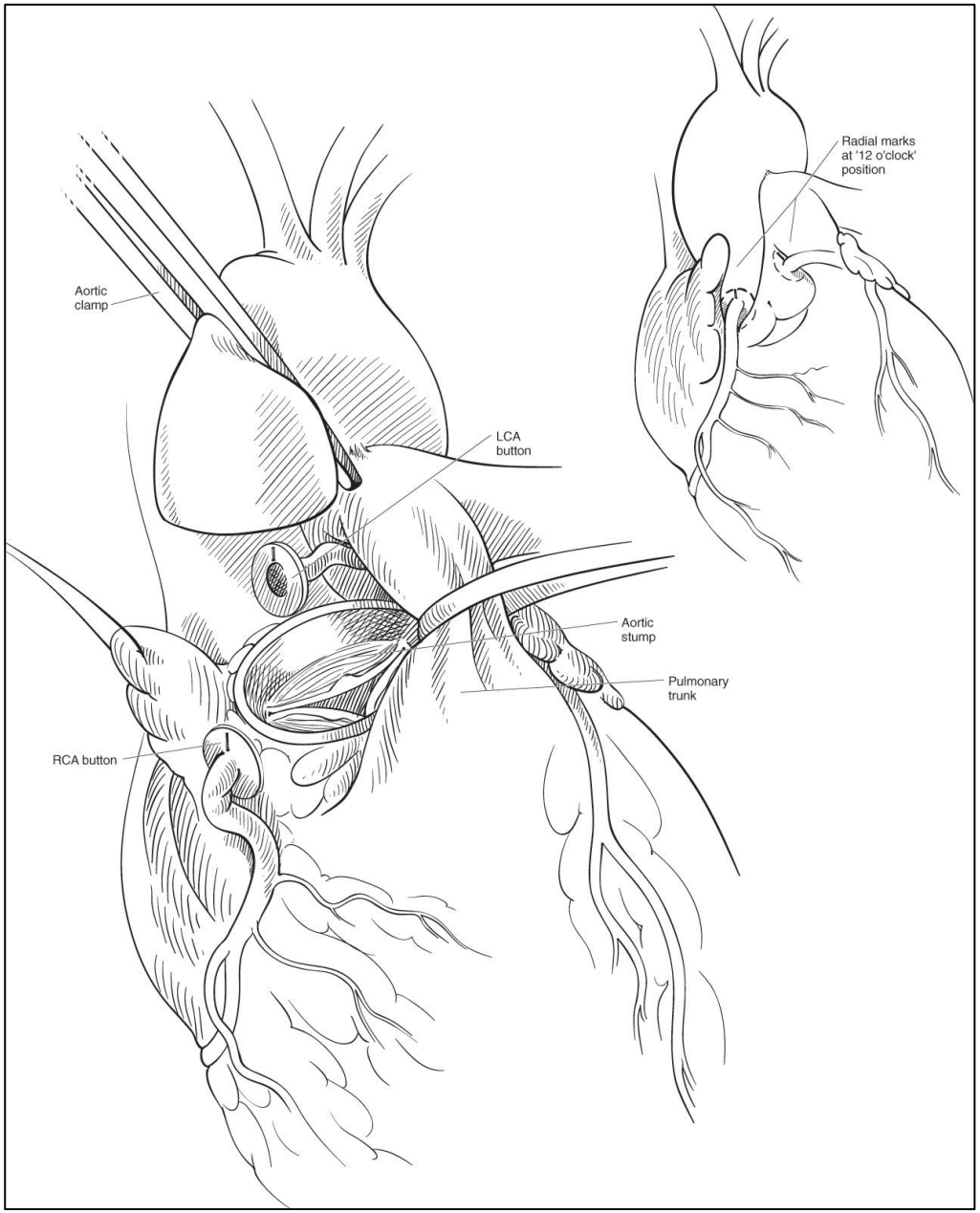
Biological Valved Conduit Actuarial Survival

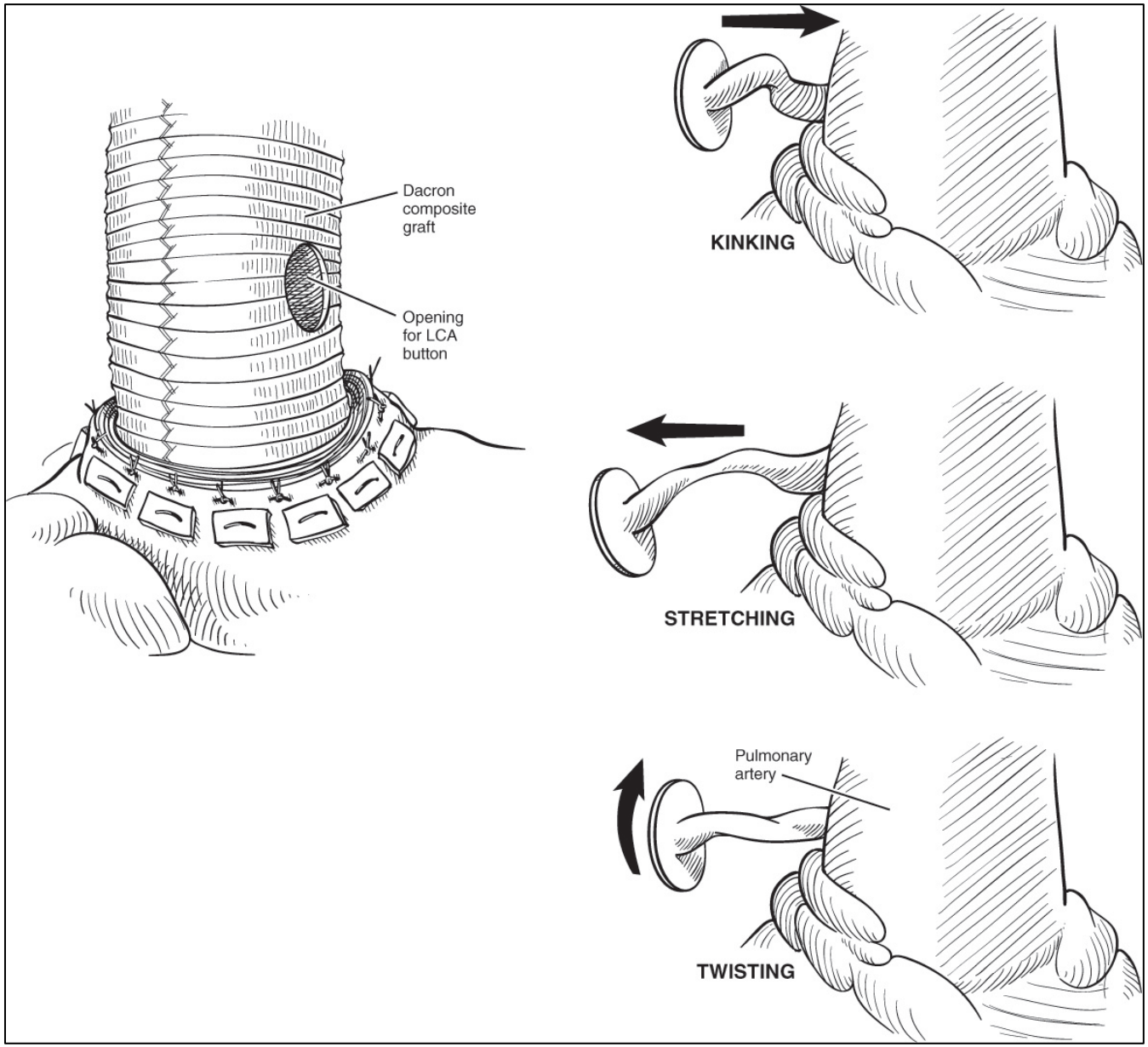


Mechanical valved conduit: Technical Tips



- Reinforce coronary buttons with Teflon “washers”
- L button is inaccessible after completion


Radial marks at '12 o'clock' position
Aortic clamp
LCA button
Aortic stump
Pulmonary trunk
RCA button

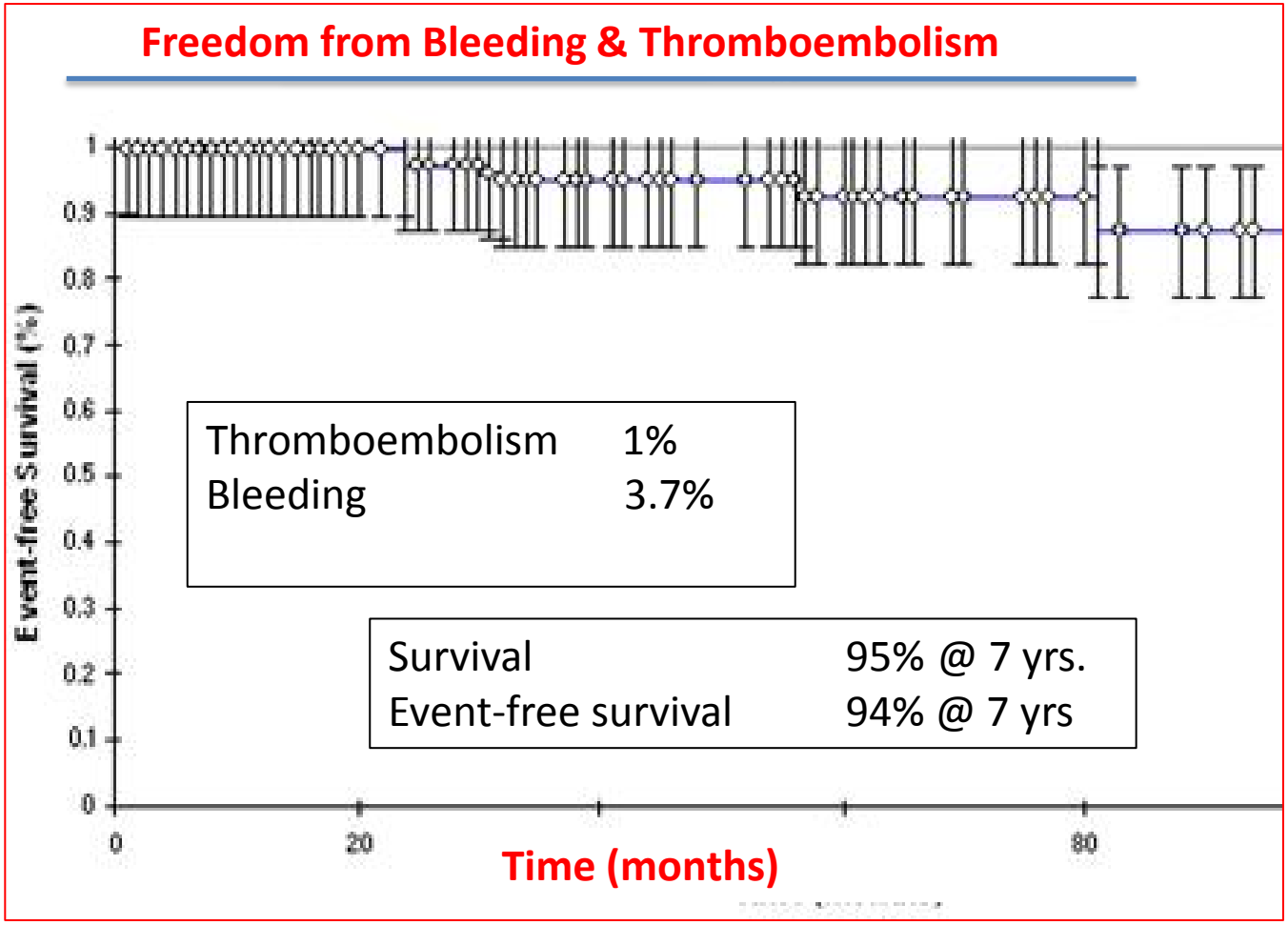

Dacron composite graft
Opening for LCA button
KINKING
STRETCHING
Pulmonary artery
TWISTING

Rescue Coronary Artery Bypass Grafting (CABG) after Aortic Composite Graft Replacement

Ali Shahriari, M.D., Michael Eng, M.D., Maryann Tranquilli, R.N., and John A. Elefteriades, M.D.

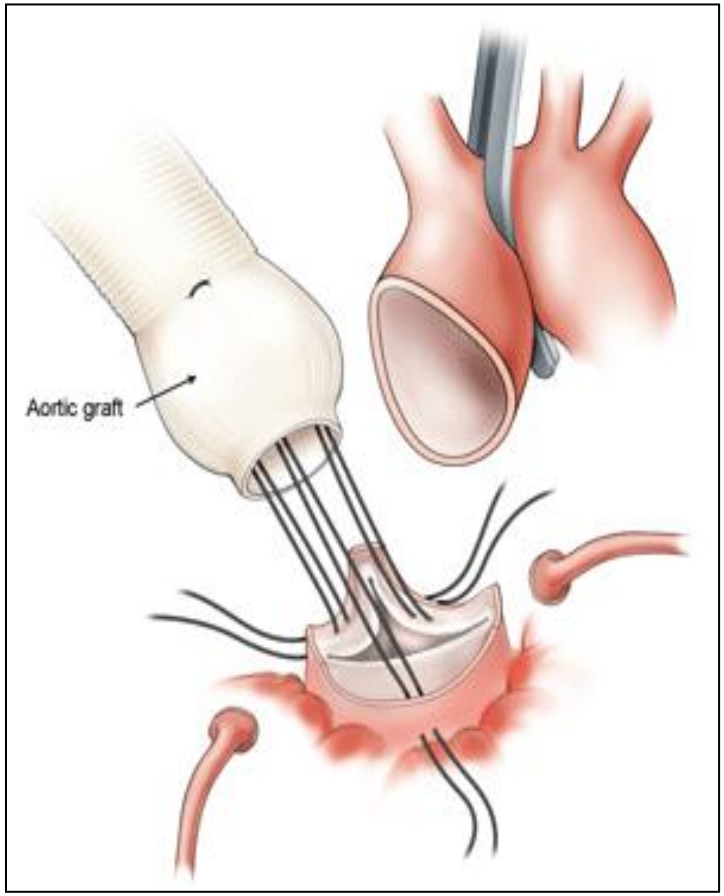
Section of Cardiac Surgery, Yale University School of Medicine, New Haven, Connecticut

Composite Graft: Superb Long-Term Performance



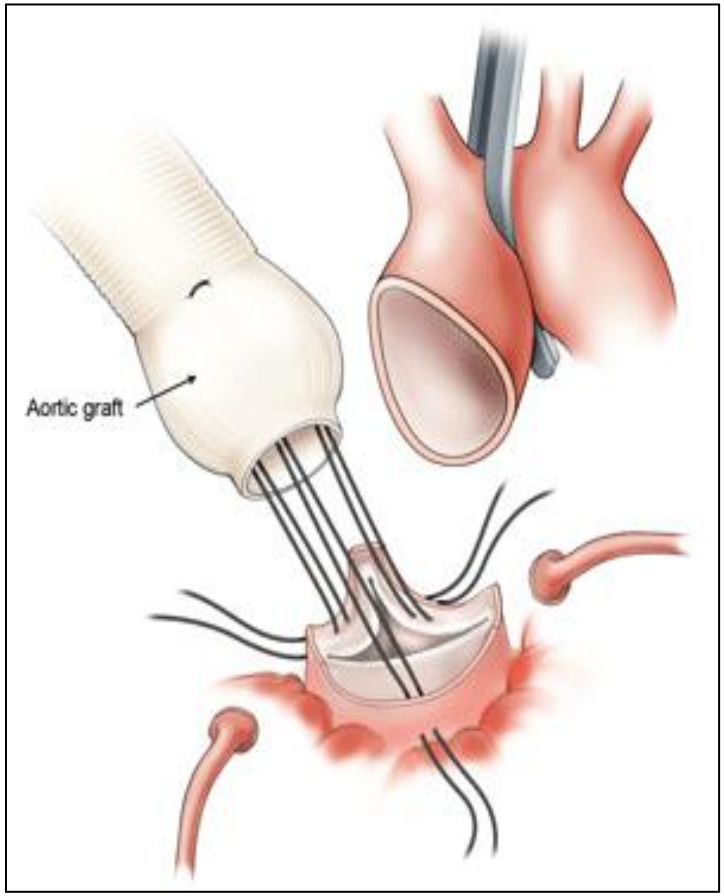
Ann Thorac Surg 2012;94:734-43

Valve-Sparing Operation



- Gaining popularity
- Gaining positive f/u
- Technical expertise building
- Remodeling vs. Reimplantation?

Valve-Sparing Operation



Cautions

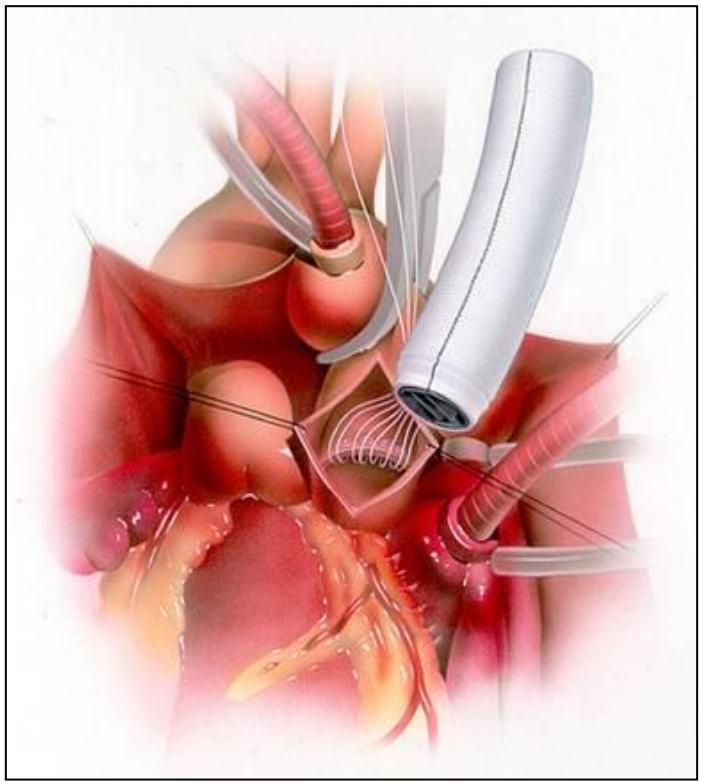
- Don't need for supracoronary aneurysm
- Care in
  - AS (NO!)
  - Endocarditis (NO)
  - Valve perforations (NO)
  - Associated AI (only ≤ mod)
  - Marfan disease (et al)
  - Bicuspid valve
  - Children
  - Acute Type A dissection
  - p-Failed Ross

Ann Thorac Surg 2000;70:1460-1465.
Circulation 2002;106:I-229-233.

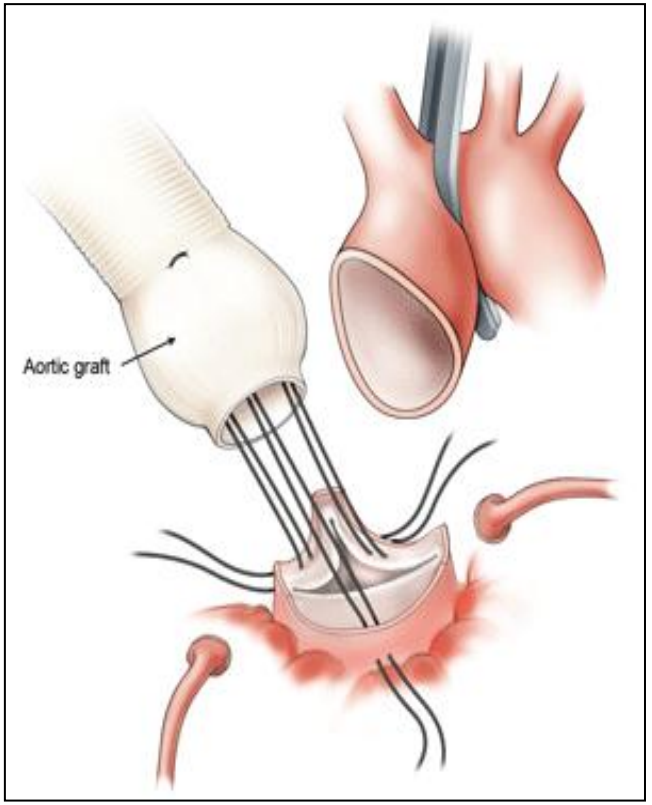
Composite graft vs. Valve-sparing

COMPOSITE: Durable, but requires anticoagulation.

VALVE-SPARING: No anticoagulation, but does it leave AI and is it durable?



VS.



Freedom from Reoperation

	Follow-up (yrs)	Composite	Valve-sparing	*p* value
Zehr (2004) n=203	5	96%	63%	<0.001
Karck (2004) n=119	5	92%	84%	0.31
Patel (2008) n=140	8	96%	86%	0.1

Note: Remember, AI is very well tolerated and reoperation is unappealing, so reoperation means the patient was seriously ill.

Freedom from Aortic Insufficiency

	Follow-up (yrs)	Survival	Mod to Sev AI
Yacoub (1998) n = 158	10	89%	36%
David (2007) n = 103	10	54%	22%

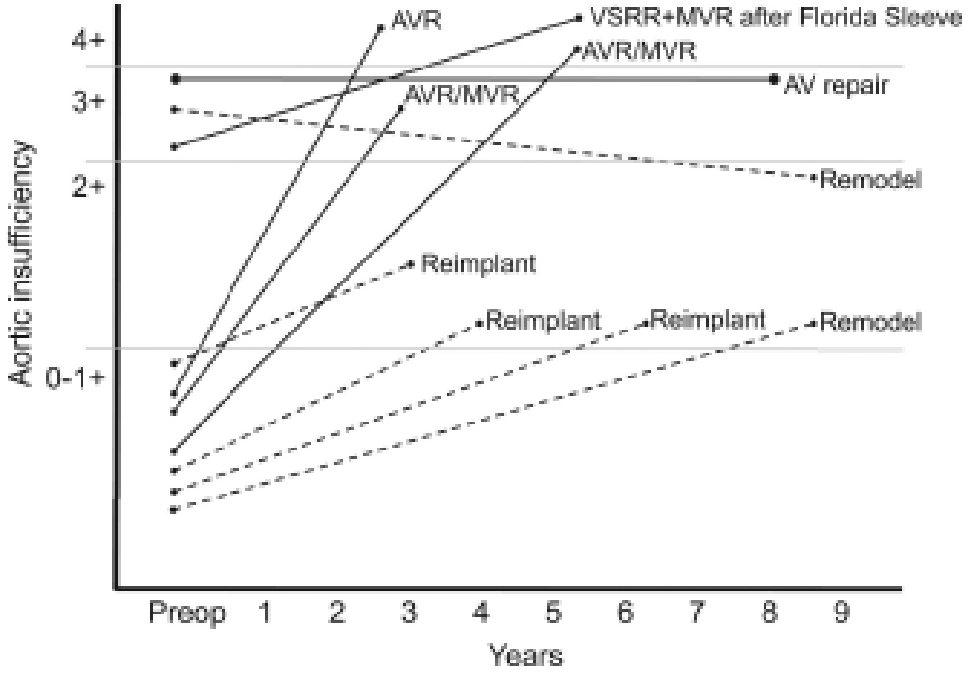


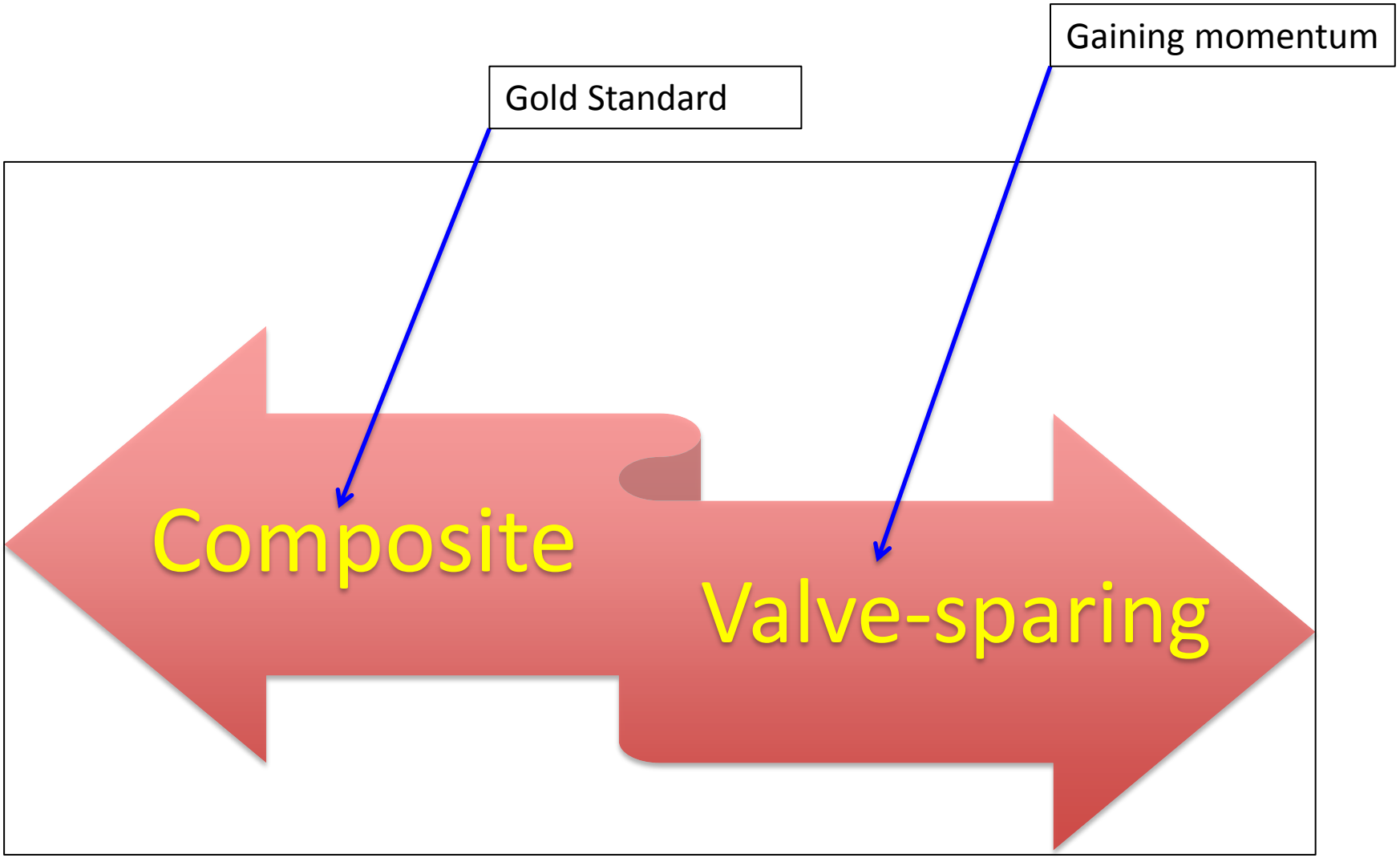
Fig. 2. Progression of aortic insufficiency and need for aortic valve replacement/repair. Solid lines denote patients requiring surgery. Dashed lines reflect patients with progression of aortic insufficiency currently being followed. VSRR, value-sparing root replacement; MVR, mitral valve replacement; AVR, aortic valve replacement; AV, aortic valve; Preop, preoperative.

Interact CardioVasc Thorac Surg 2011;12:415-419.

Choice of conduit

- Many options for materials/technique
  - Homograft
  - Allograft (FreeStyle)
  - Biological conduit
  - Mechanical conduit
  - Valve-sparing procedure (David)
- Replace what needs to be replaced
  - Root-sparing (tube graft) for “supra-aortic” aneurysm
  - Root-replacement (some type) for annuloaortic ectasia
  - Choice for tubular aneurysm

Choice of procedure



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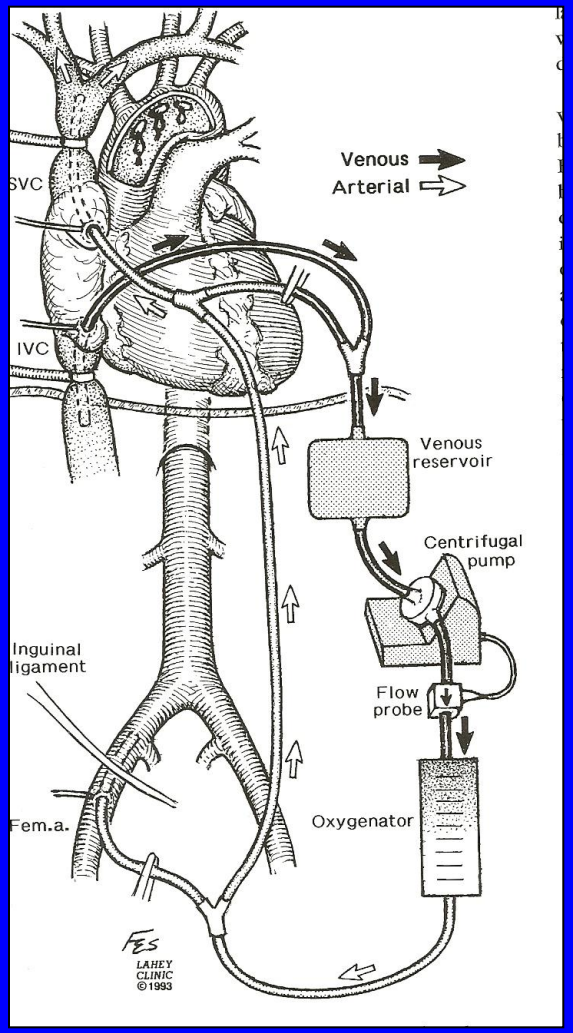
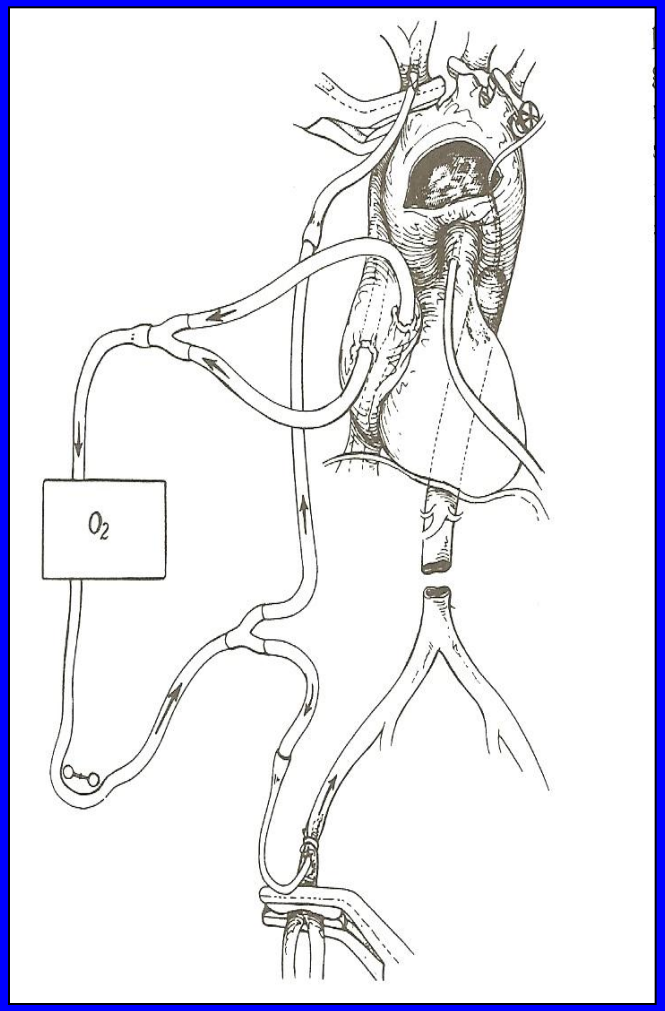
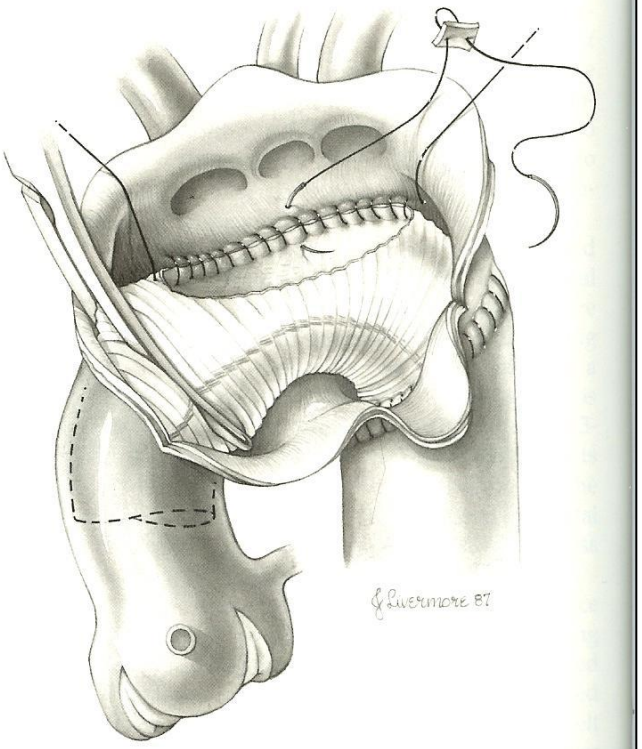
    (Entertaining video)

➢ *Straight DHCA suffices for brain protection.*






J. Livermore 87