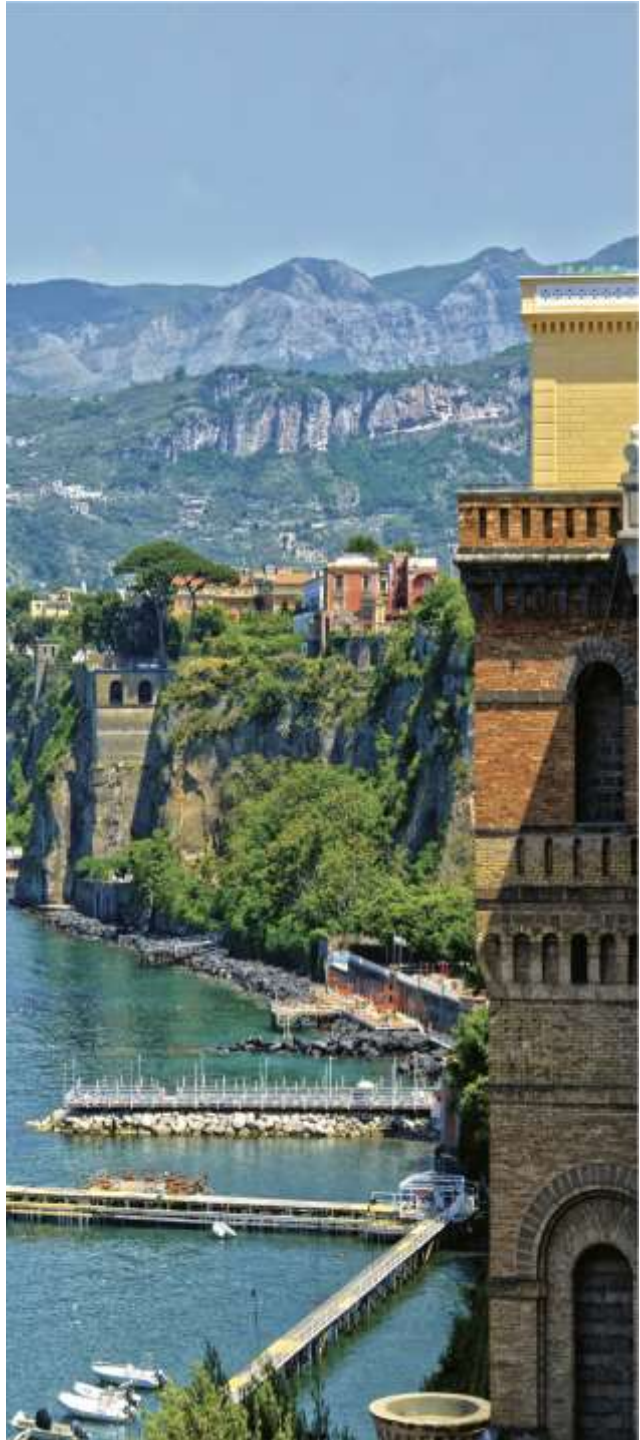
ANCE
Cardiologia Italiana del Territorio

CARDIOCHIRURGIA OGGI, UP TO DATE: QUANDO E COME

Mauro Del Giglio



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Introduction

Aortic valve

Aorta

Mitral valve

Coronary disease

Closing remarks

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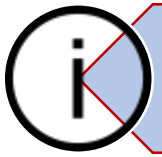

Introduction

Aortic valve

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Closing remarks

L’orizzonte della «chirurgia del futuro» è più vicino di quanto possa sembrare

È la «chirurgia moderna» che viene troppo poco eseguita

TRADIZIONE «VS» INNOVAZIONE

- Volume di pazienti
- Fatturato
- Produttività
- DRG

- Preparazione
- Qualità
- Etica
- consapevolezza

QUANDO ?

GUIDA

LINEE

Coronaropatia stabile

Quando intervenire

Indications for revascularization in patients with stable angina or silent ischaemia

Extent of CAD (anatomical and/or functional)		Class[a]	Level[b]
For prognosis	Left main disease with stenosis >50%.[c] [68–71]	I	A
	Proximal LAD stenosis >50%.[c] [62,68,70,72]	I	A
	Two- or three-vessel disease with stenosis >50% with impaired LV function (LVEF ≤35%).[c] [61,62,68,70,73–83]	I	A
	Large area of ischaemia detected by functional testing (>10% LV) or abnormal invasive FFR.[d] [24,59,84–90]	I	B
	Single remaining patent coronary artery with stenosis >50%.[c]	I	C
For symptoms	Haemodynamically significant coronary stenosis[c] in the presence of limiting angina or angina equivalent, with insufficient response to optimized medical therapy.[e] [24,63,91–97]	I	A

Neumann, F.-J. *et al.* 2018 ESC/EACTS Guidelines on myocardial revascularization. *Eur. Heart J.* **34,** 2949–96 (2018).

Corona

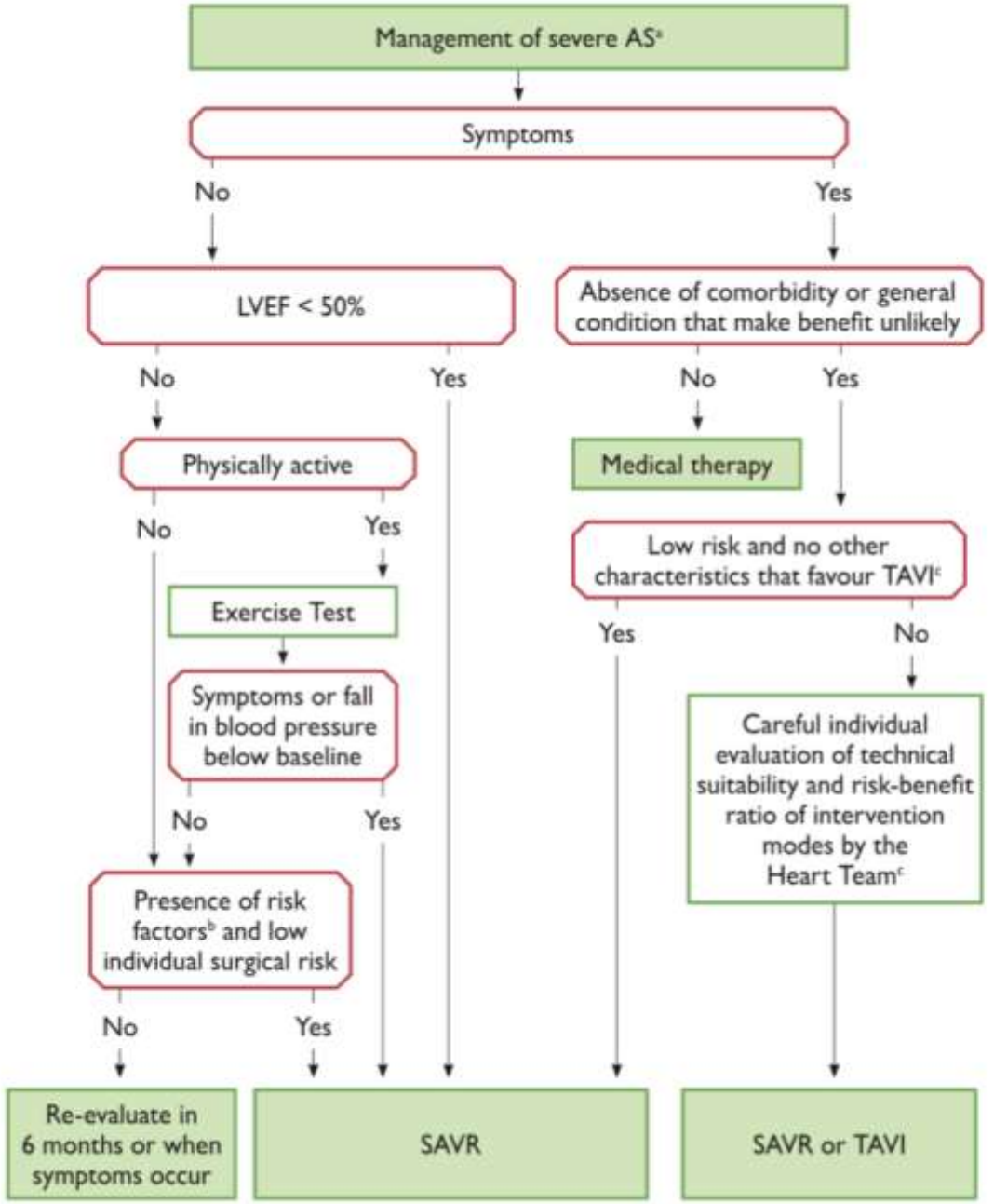
Come inter

Recommendation for the type of revascularization in patients with stable coronary artery disease with suitable coronary anatomy for both procedures and low predicted surgical mortality[d]

Recommendations according to extent of CAD	CABG		PCI	
	Class[a]	Level[b]	Class[a]	Level[b]
One-vessel CAD				
Without proximal LAD stenosis.	IIb	C	I	C
With proximal LAD stenosis.[68,101,139–144]	I	A	I	A
Two-vessel CAD				
Without proximal LAD stenosis.	IIb	C	I	C
With proximal LAD stenosis.[68,70,73]	I	B	I	C
Left main CAD				
Left main disease with low SYNTAX score (0 - 22).[69,121,122,124,145–148]	I	A	I	A
Left main disease with intermediate SYNTAX score (23 - 32).[69,121,122,124,145–148]	I	A	IIa	A
Left main disease with high SYNTAX score (≥33).[c 69,121,122,124,146–148]	I	A	III	B
Three-vessel CAD without diabetes mellitus				
Three-vessel disease with low SYNTAX score (0 - 22).[102,105,121,123,124,135,149]	I	A	I	A
Three-vessel disease with intermediate or high SYNTAX score (>22).[c 102,105,121,123,124,135,149]	I	A	III	A
Three-vessel CAD with diabetes mellitus				
Three-vessel disease with low SYNTAX score 0–22.[102,105,121,123,124,135,150–157]	I	A	IIb	A
Three-vessel disease with intermediate or high SYNTAX score (>22).[c 102,105,121,123,124,135,150–157]	I	A	III	A

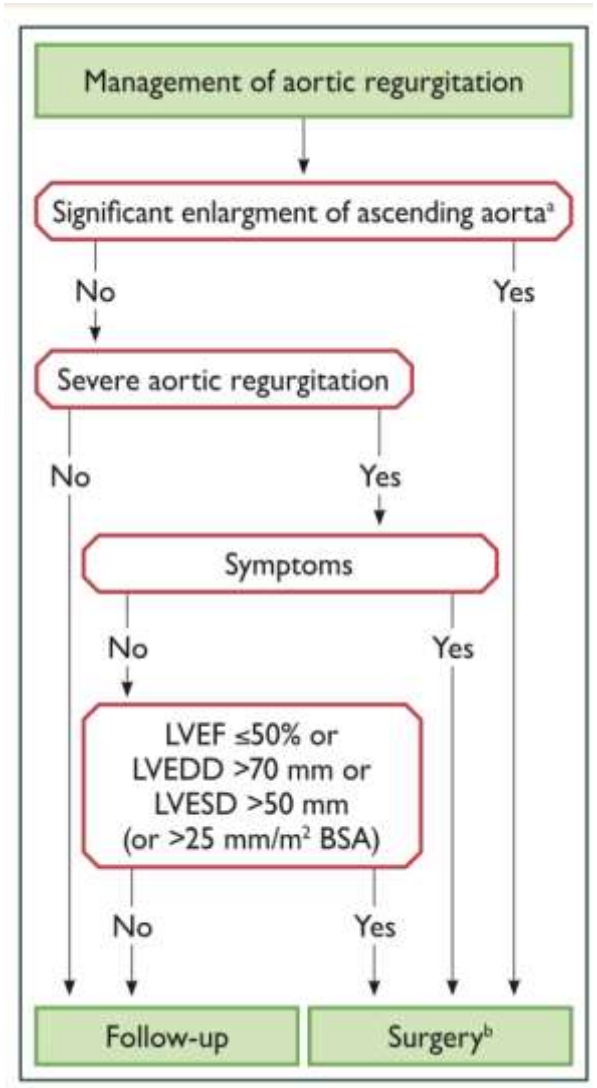
Neumann, F.-J. *et al.* 2018 ESC/EACTS Guidelines on myocardial revascularization. *Eur. Heart J.* **34,** 2949–96 (2018).

Stenosi aortica



Baumgartner, H. *et al.* 2017 ESC/EACTS Guidelines for the management of valvular heart disease. *Eur. Heart J.* 1–53 (2017)

Insufficienza aortica



Indications for surgery	Class[a]	Level[b]
A. Severe aortic regurgitation		
Surgery is indicated in symptomatic patients.[57,58,64,67]	I	B
Surgery is indicated in asymptomatic patients with resting LVEF ≤50%.[57,58]	I	B
Surgery is indicated in patients undergoing CABG or surgery of the ascending aorta or of another valve.	I	C
Heart Team discussion is recommended in selected patients[c] in whom aortic valve repair may be a feasible alternative to valve replacement.	I	C
Surgery should be considered in asymptomatic patients with resting ejection fraction >50% with severe LV dilatation: LVEDD >70 mm or LVESD >50 mm (or LVESD >25 mm/m² BSA in patients with small body size).[58,66]	IIa	B
B. Aortic root or tubular ascending aortic aneurysm[d] (irrespective of the severity of aortic regurgitation)		
Aortic valve repair, using the reimplantation or remodelling with aortic annuloplasty technique, is recommended in young patients with aortic root dilation and tricuspid aortic valves, when performed by experienced surgeons.	I	C
Surgery is indicated in patients with Marfan syndrome who have aortic root disease with a maximal ascending aortic diameter ≥50 mm.	I	C
Surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter:	IIa	C
• ≥45 mm in the presence of Marfan syndrome and additional risk factors[e] or patients with a *TGFBR1* or *TGFBR2* mutation (including Loeys–Dietz syndrome).[f]	IIa	C
• ≥50 mm in the presence of a bicuspid valve with additional risk factors[e] or coarctation.	IIa	C
• ≥55 mm for all other patients.	IIa	C
When surgery is primarily indicated for the aortic valve, replacement of the aortic root or tubular ascending aorta should be considered when ≥45 mm, particularly in the presence of a bicuspid valve.[g]	IIa	C

Baumgartner, H. *et al.* 2017 ESC/EACTS Guidelines for the management of valvular heart disease. *Eur. Heart J.* 1–53 (2017)

Stenosi aortica

Quando intervenire pazienti asintomatici

C) Asymptomatic patients with severe aortic stenosis (refers only to patients eligible for surgical valve replacement)		
SAVR is indicated in asymptomatic patients with severe aortic stenosis and systolic LV dysfunction (LVEF <50%) not due to another cause.	I	C
SAVR is indicated in asymptomatic patients with severe aortic stenosis and an abnormal exercise test showing symptoms on exercise clearly related to aortic stenosis.	I	C
SAVR should be considered in asymptomatic patients with severe aortic stenosis and an abnormal exercise test showing a decrease in blood pressure below baseline.	IIa	C
SAVR should be considered in asymptomatic patients with normal ejection fraction and none of the above-mentioned exercise test abnormalities if the surgical risk is low and one of the following findings is present: ● Very severe aortic stenosis defined by a V_{max} >5.5 m/s ● Severe valve calcification and a rate of V_{max} progression ≥0.3 m/s/year ● Markedly elevated BNP levels (>threefold age- and sex-corrected normal range) confirmed by repeated measurements without other explanations ● Severe pulmonary hypertension (systolic pulmonary artery pressure at rest >60 mmHg confirmed by invasive measurement) without other explanation.	IIa	C

Se il paziente non ha sintomi, la chirurgia è l'unica opzione

Baumgartner, H. *et al.* 2017 ESC/EACTS Guidelines for the management of valvular heart disease. *Eur. Heart J.* 1–53 (2017)

Stenosi aortica

TAVI o chirurgia: come scegliere?

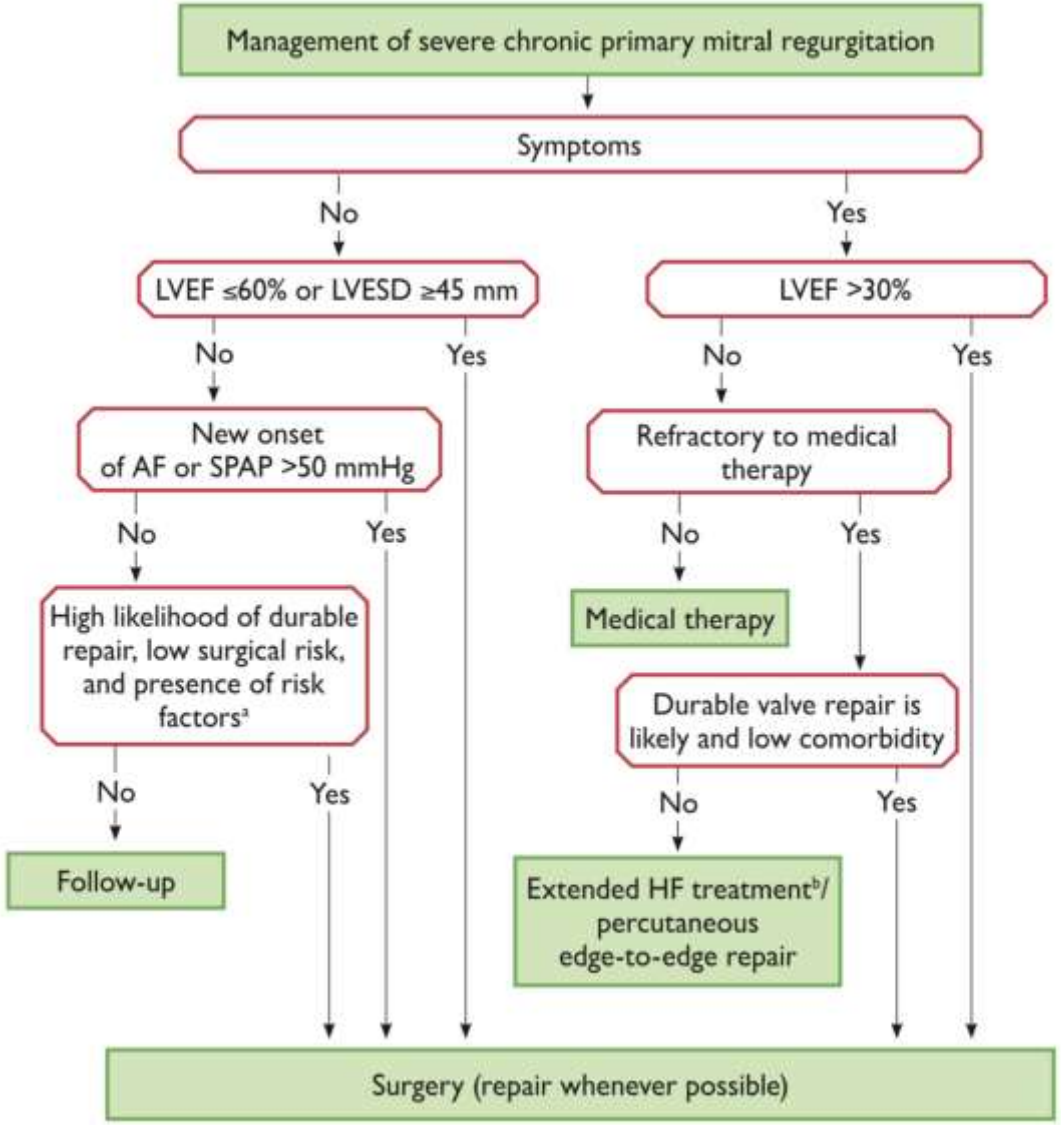
	Favours TAVI	Favours SAVR
Anatomical and technical aspects		
Favourable access for transfemoral TAVI	+	
Unfavourable access (any) for TAVI		+
Sequelae of chest radiation	+	
Porcelain aorta	+	
Presence of intact coronary bypass grafts at risk when sternotomy is performed	+	
Expected patient–prosthesis mismatch	+	
Severe chest deformation or scoliosis	+	
Short distance between coronary ostia and aortic valve annulus		+
Size of aortic valve annulus out of range for TAVI		+
Aortic root morphology unfavourable for TAVI		+
Valve morphology (bicuspid, degree of calcification, calcification pattern) unfavourable for TAVI		+
Presence of thrombi in aorta or LV		+

	Favours TAVI	Favours SAVR
Clinical characteristics		
STS/EuroSCORE II <4% (logistic EuroSCORE I <10%)[a]		+
STS/EuroSCORE II ≥4% (logistic EuroSCORE I ≥10%)[a]	+	
Presence of severe comorbidity (not adequately reflected by scores)	+	
Age <75 years		+
Age ≥75 years	+	
Previous cardiac surgery	+	
Frailty[b]	+	
Restricted mobility and conditions that may affect the rehabilitation process after the procedure	+	
Suspicion of endocarditis		+

	Favours TAVI	Favours SAVR
Cardiac conditions in addition to aortic stenosis that require consideration for concomitant intervention		
Severe CAD requiring revascularization by CABG		+
Severe primary mitral valve disease, which could be treated surgically		+
Severe tricuspid valve disease		+
Aneurysm of the ascending aorta		+
Septal hypertrophy requiring myectomy		+

Baumgartner, H. *et al.* 2017 ESC/EACTS Guidelines for the management of valvular heart disease. *Eur. Heart J.* 1–53 (2017)

Insufficienza mitralica primitiva



Recommendations	Class[a]	Level[b]
Mitral valve repair should be the preferred technique when the results are expected to be durable.	I	C
Surgery is indicated in symptomatic patients with LVEF >30%.[121,131,132]	I	B
Surgery is indicated in asymptomatic patients with LV dysfunction (LVESD ≥45 mm[c] and/or LVEF ≤60%).[122,131]	I	B
Surgery should be considered in asymptomatic patients with preserved LV function (LVESD <45 mm and LVEF >60%) and atrial fibrillation secondary to mitral regurgitation or pulmonary hypertension[d] (systolic pulmonary pressure at rest >50 mmHg).[123,124]	IIa	B
Surgery should be considered in asymptomatic patients with preserved LVEF (>60%) and LVESD 40–44 mm[c] when a durable repair is likely, surgical risk is low, the repair is performed in a heart valve centre and at least one of the following findings is present: • flail leaflet or • presence of significant LA dilatation (volume index ≥60 mL/m^2 BSA) in sinus rhythm.	IIa	C
Mitral valve repair should be considered in symptomatic patients with severe LV dysfunction (LVEF <30% and/or LVESD >55 mm) refractory to medical therapy when the likelihood of successful repair is high and comorbidity low.	IIa	C
Mitral valve replacement may be considered in symptomatic patients with severe LV dysfunction (LVEF <30% and/or LVESD >55 mm) refractory to medical therapy when the likelihood of successful repair is low and comorbidity low.	IIb	C
Percutaneous edge-to-edge procedure may be considered in patients with symptomatic severe primary mitral regurgitation who fulfil the echocardiographic criteria of eligibility and are judged inoperable or at high surgical risk by the Heart Team, avoiding futility.	IIb	C

Baumgartner, H. *et al.* 2017 ESC/EACTS Guidelines for the management of valvular heart disease. *Eur. Heart J.* 1–53 (2017)

Insufficienza mitralica primitiva…asintomatica?

Long-term clinical outcome of mitral valve repair in asymptomatic severe mitral regurgitation☆,☆☆

Scopo: valutare la sopravvivenza a lungo termine, l'incidenza di complicanze cardiache e i fattori che predicono l'esito in pazienti asintomatici con grave rigurgito mitralico degenerativo (MR) sottoposti a riparazione della valvola mitrale.

- 143 pazienti asintomatici con IM severa degenerativa
- Follow-up medio di 8 anni
- Popolazione suddivisa in pazienti con **disfunzione ventricolare e/o dilatazione** (n=18), pazienti con **fibrillazione atriale e/o ipertensione polmonare** (n=44) e pazienti **senza complicanze preoperatorie correlate alla IM severa** (n=81)

Chenot, F. *et al.* Long-term clinical outcome of mitral valve repair in asymptomatic severe mitral regurgitation☆☆☆. *European Journal of Cardio-Thoracic Surgery* **36,** 539–545 (2009).

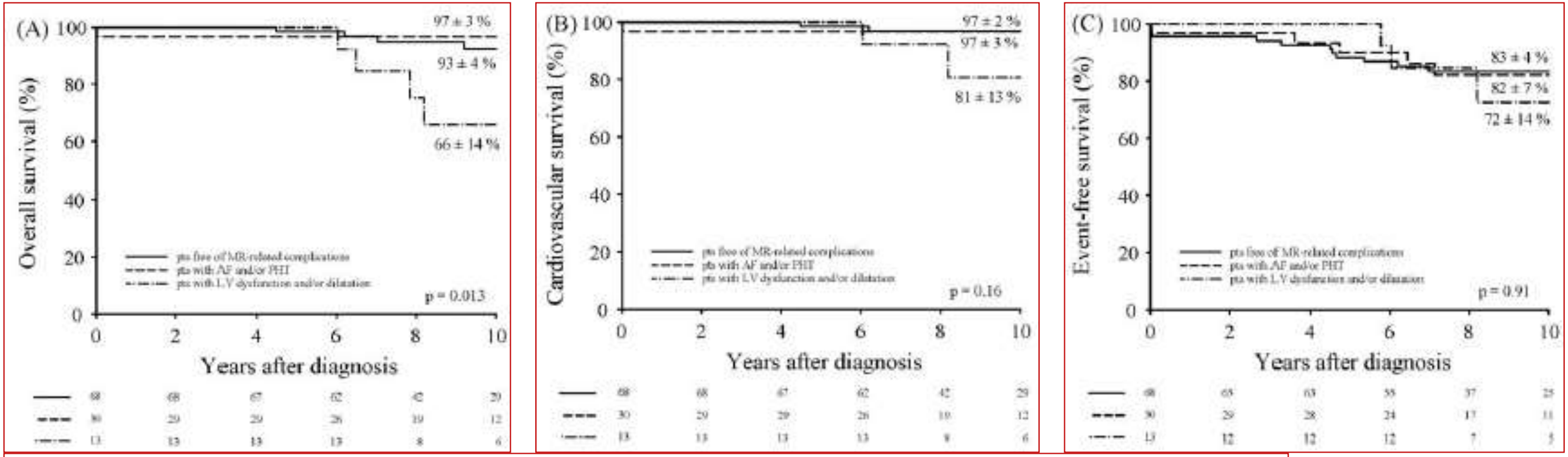


Fig. 3. Kaplan–Meier curves for overall (panel A), cardiovascular (panel B) and event-free (panel C) survival for asymptomatic patients without any MR-related complications (solid line), patients with preoperative atrial fibrillation or pulmonary hypertension (dashed line) and patients with preoperative LV dysfunction or dilation (dashed-dotted line) after exclusion of concomitant CABG pts. Numbers at bottom indicate patients at risk.

la riparazione della valvola mitrale in pazienti asintomatici con IM degenerativa severa è generalmente associata a una prognosi eccellente, tranne in presenza di complicanze preoperatorie correlate alla IM.

Ciò suggerisce che la riparazione della valvola mitrale dovrebbe essere eseguita prima dello sviluppo di eventuali complicanze correlate alla MR.

Insufficienza mitralica primitiva…meno che severa?

Management of less-than-severe mitral regurgitation: should guidelines recommend earlier surgical intervention?☆

Obiettivo: è noto che i pazienti con grave rigurgito mitralico (MR) beneficino della riparazione della valvola mitrale; tuttavia, la gestione di coloro che hanno insufficienza meno che severa è controversa. Il follow-up è spesso ritenuto l'atteggiamento più sicuro, ma il rischio di sviluppare disfunzione ventricolare sinistra (LV) non è noto.

Metodi: Utilizzando un database di studio su scala nazionale si sono analizzati gli ecocardiogrammi durante il follow-up clinico e la gestione medica di 204 pazienti con prolasso della valvola mitrale e IM non grave. La disfunzione LV è stata definita secondo le linee guida dell'American Heart Association come una frazione di eiezione (EF) <60% o LVESD> 40 mm.

Suri, R. M. *et al.* Management of less-than-severe mitral regurgitation: should guidelines recommend earlier surgical intervention?☆. *European Journal of Cardio-Thoracic Surgery* 1–7 (2011).

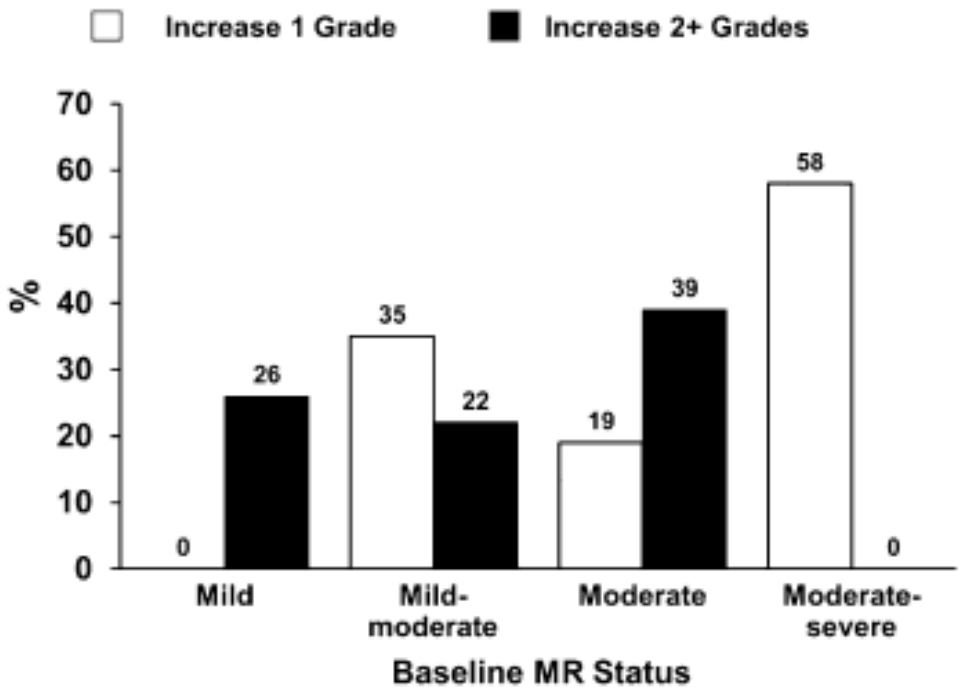


Fig. 1. Progression of MR as a function of baseline MR status. Patients with greater baseline MR were more likely to experience greater MR progression with time (mild/mild-moderate 44/124 (31%) vs moderate/moderate-severe 35/60 (58%) $P = 0.0008$).

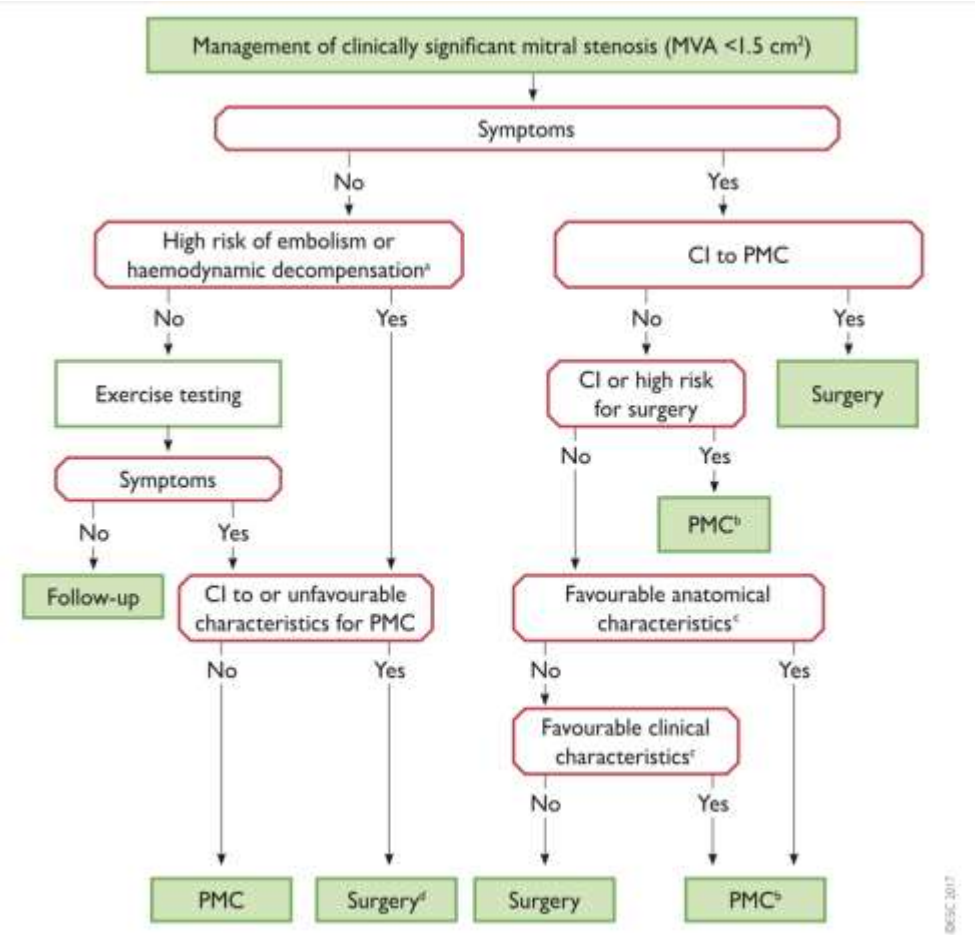
Il grado di IM basale non è stato predittivo del successivo cambiamento nelle misurazioni ecocardiografiche tra valutazioni basali e follow-up.

Oltre la **metà** dei pazienti con **IM degenerativa meno-che-severa persistente,** hanno sviluppato disfunzione del ventricolo sinistro o peggioramento del rigurgito nonostante una gestione medica ottimale.

Il deterioramento della funzione sistolica sinistra può verificarsi anche in assenza di progressione della IM.

Perché negare ai pazienti il trattamento precoce, senza attendere gli effetti deleteri dell'insufficienza mitralica?

Stenosi mitralica



Recommendations	Class[a]	Level[b]
PMC is indicated in symptomatic patients without unfavourable characteristics[c] for PMC.[144,146,148]	I	B
PMC is indicated in any symptomatic patients with a contraindication or a high risk for surgery.	I	C
Mitral valve surgery is indicated in symptomatic patients who are not suitable for PMC.	I	C
PMC should be considered as initial treatment in symptomatic patients with suboptimal anatomy but no unfavourable clinical characteristics for PMC.[c]	IIa	C
PMC should be considered in asymptomatic patients without unfavourable clinical and anatomical characteristics[c] for PMC and: • high thromboembolic risk (history of systemic embolism, dense spontaneous contrast in the LA, new-onset or paroxysmal atrial fibrillation), and/or • high risk of haemodynamic decompensation (systolic pulmonary pressure >50 mmHg at rest, need for major non-cardiac surgery, desire for pregnancy).	IIa	C

Baumgartner, H. *et al.* 2017 ESC/EACTS Guidelines for the management of valvular heart disease. *Eur. Heart J.* 1–53 (2017)

ANEURISMI AORTICI

Recommendations	Class[a]	Level[b]
When an aortic aneurysm is identified at any location, assessment of the entire aorta and aortic valve is recommended at baseline and during follow-up.	I	C
In cases of aneurysm of the abdominal aorta, duplex ultrasound for screening of peripheral artery disease and peripheral aneurysms should be considered.	IIa	C
Patients with aortic aneurysm are at increased risk of cardiovascular disease: general principles of cardiovascular prevention should be considered.	IIa	C

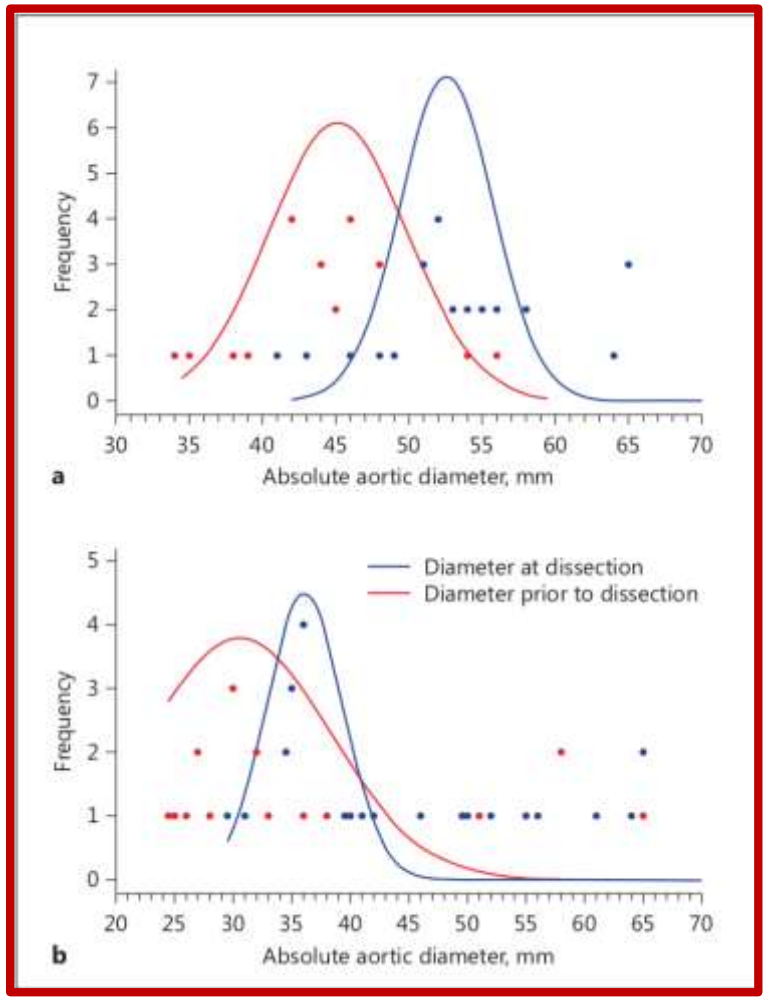
Recommendations	Class[a]	Level[b]
Surgery is indicated in patients who have aortic root aneurysm, with maximal aortic diameter[c] ≥50 mm for patients with Marfan syndrome.	I	C
Surgery should be considered in patients who have aortic root aneurysm, with maximal ascending aortic diameters: • ≥45 mm for patients with Marfan syndrome with risk factors.[d] • ≥50 mm for patients with bicuspid valve with risk factors.[e,f] • ≥55 mm for other patients with no elastopathy.[g,h]	IIa	C
Lower thresholds for intervention may be considered according to body surface area in patients of small stature or in the case of rapid progression, aortic valve regurgitation, planned pregnancy, and patient's preference.	IIb	C
Interventions on aortic arch aneurysms		
Surgery should be considered in patients who have isolated aortic arch aneurysm with maximal diameter ≥55 mm.	IIa	C
Aortic arch repair may be considered in patients with aortic arch aneurysm who already have an indication for surgery of an adjacent aneurysm located in the ascending or descending aorta.	IIb	C

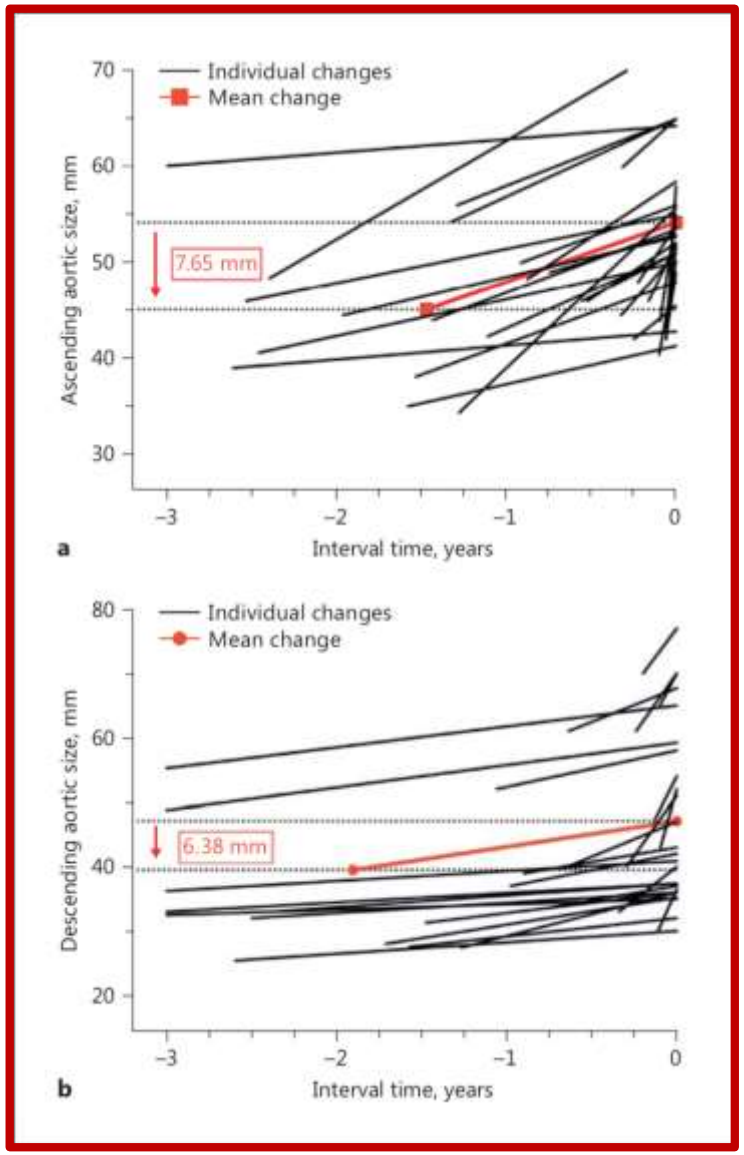
Erbel, R. *et al.* 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: Document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult. *European heart journal* **35,** 2873–2926 (2014).

I DIAMETRI AORTICI NON SPIEGANO TUTTO…

Il diametro dell'aorta aumenta sostanzialmente a causa della dissezione stessa. La dissezione insorge quindi a **diametri significativamente inferiori rispetto al cut-off di 55 mm**.

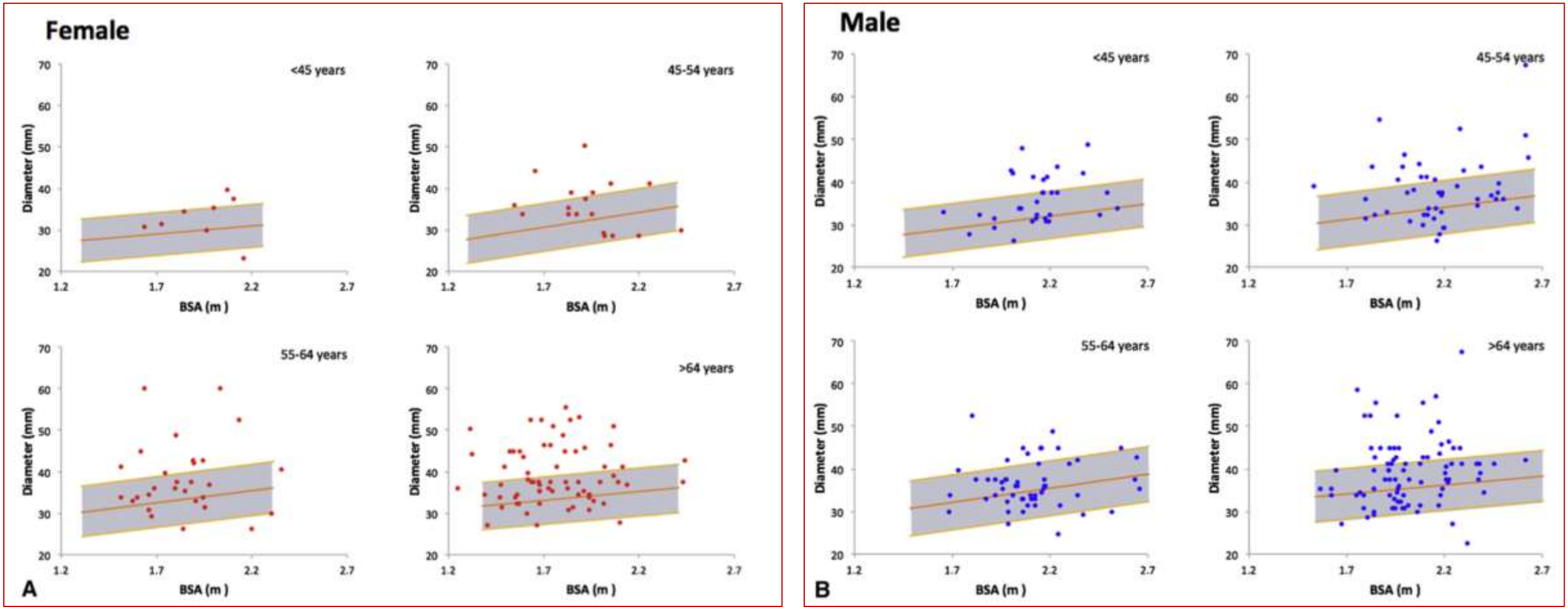
Questi risultati hanno implicazioni importanti per quanto riguarda la **dimensione** con cui aumenta il **rischio di dissezione**.





Mansour, A. M. *et al.* Prevention of Aortic Dissection Suggests a Diameter Shift to a Lower Aortic Size Threshold for Intervention. *Cardiology* **139,** 139–146 (2018).

I DIAMETRI AORTICI NON SPIEGANO TUTTO…



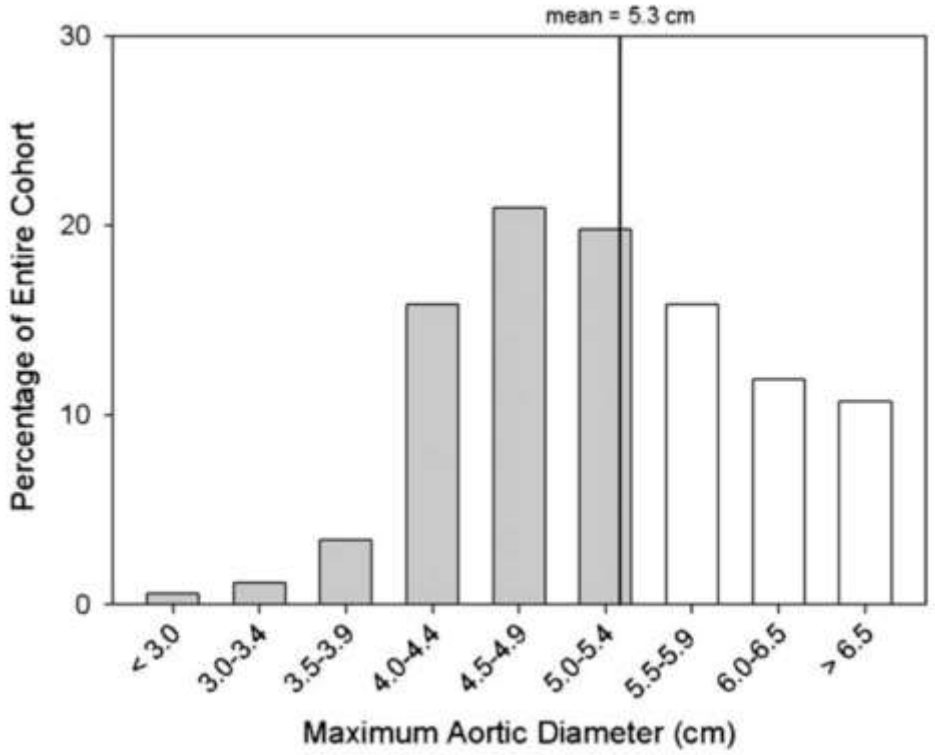
Diametri aortici pre-dissezione nei due sessi ed in 4 fasce di età

B. Rylski *et al.* Modeling of predissection aortic size in acute type A dissection: More than 90% fail to meet the guidelines for elective ascending replacement. *The Journal of Thoracic and Cardiovascular Surgery* **148,** 944–948.e1 (2014).

I DIAMETRI AORTICI NON SPIEGANO TUTTO…

Aortic size in acute type A dissection: implications for preventive ascending aortic replacement☆

Landi M. Parish[a,c], Joseph H. Gorman III[a,c], Sophia Kahn[c], Theodore Plappert[b], Martin G. St. John-Sutton[b], Joseph E. Bavaria[a], Robert C. Gorman[a,c,*]



La maggior parte dei pazienti con dissezione aortica acuta di tipo A presente con diametri aortici <5,5 cm, **non rientrando nelle attuali linee guida** per la sostituzione aortica ascendente elettiva.

È necessaria una gestione medica aggressiva dei pazienti con diametro dell'aorta ascendente superiore a 4 cm.

La **sostituzione preventiva dell'aorta ascendente a 4,5 cm** deve essere presa in considerazione soprattutto nei centri di chirurgia aortica ad alto volume e nei pazienti sottoposti a cardiochirurgia per altre indicazioni.

Parish, L. M. *et al.* Aortic size in acute type A dissection: implications for preventive ascending aortic replacement. *European Journal of Cardio-Thoracic Surgery* **35,** 941–946 (2009).

I DIAMETRI AORTICI NON SPIEGANO TUTTO…

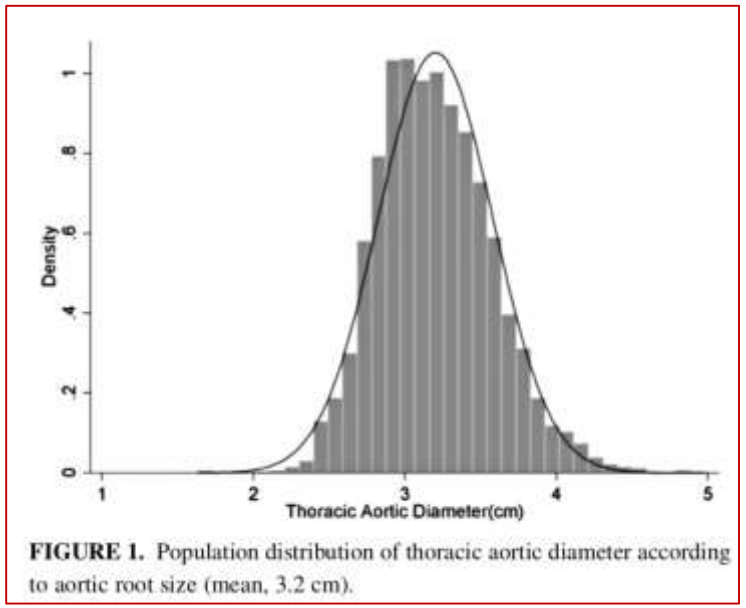
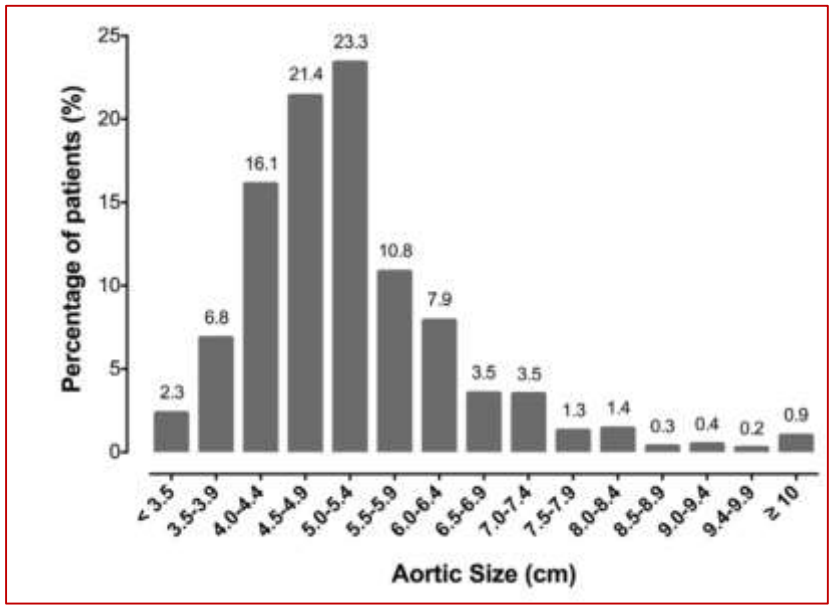
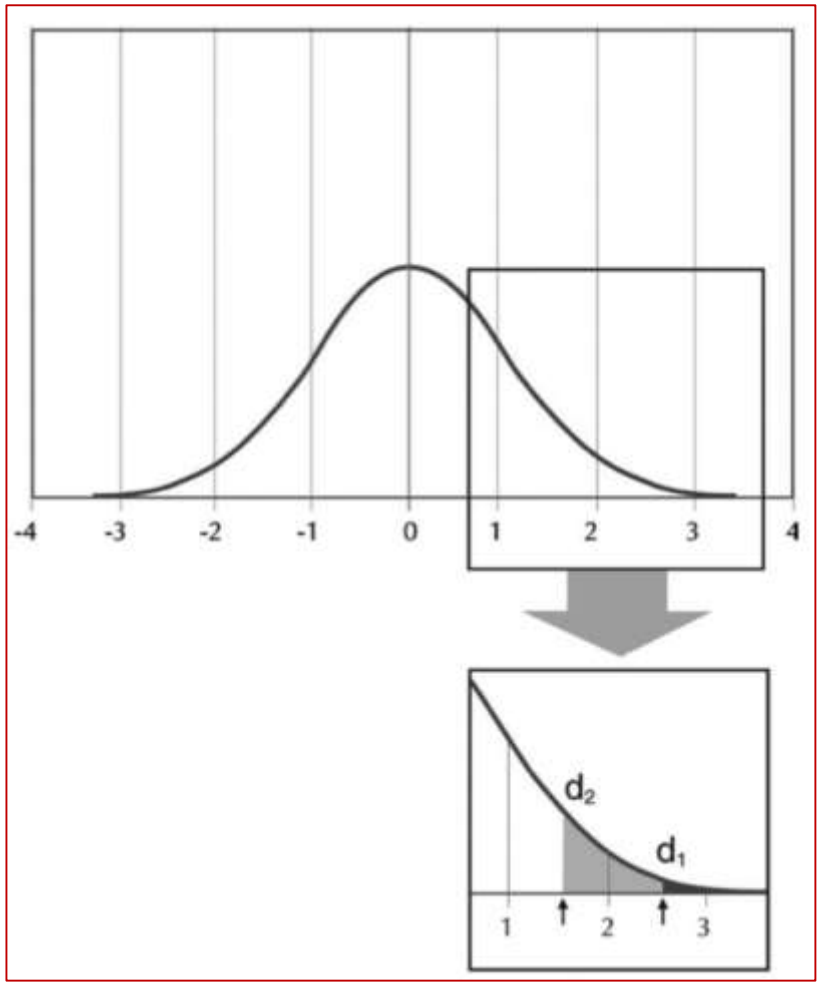


FIGURE 1. Population distribution of thoracic aortic diameter according to aortic root size (mean, 3.2 cm).





il paradosso dimensionale per la dissezione aortica sta nel fatto che ci sono enormemente più pazienti con diametri inferiori alla soglia di 5.5 com, in modo che, pur essendo la dissezione rara a queste dimensioni, tali eventi sono effettivamente abbastanza frequenti da essere osservati clinicamente.

Elefteriades, J. A. *et al.* Indications and imaging for aortic surgery: size and other matters. *The Journal of Thoracic and Cardiovascular Surgery* **149,** S10–3 (2015).

Agenda

Introduction

Aortic valve

Aorta

Mitral valve

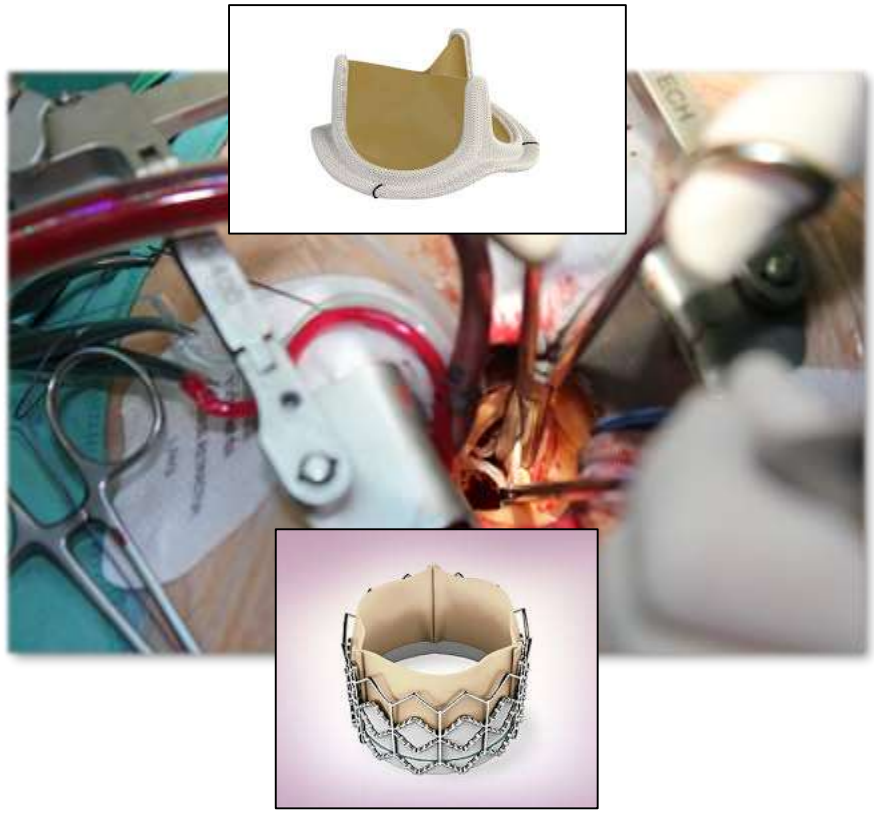
Coronary disease

Some data - Our team experience

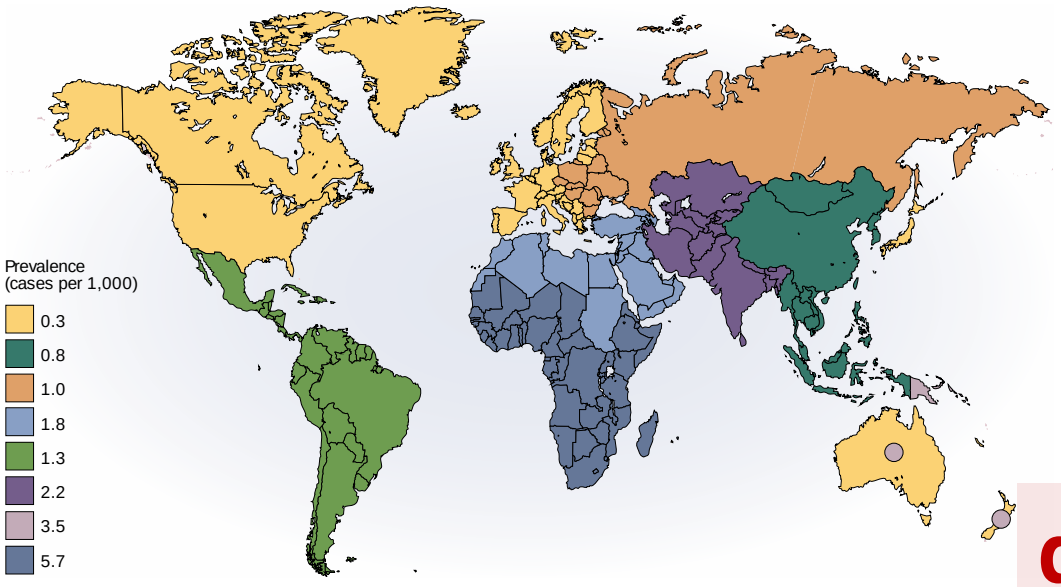
we must live in the past

Waiting for the future

(Or could we face the present?)

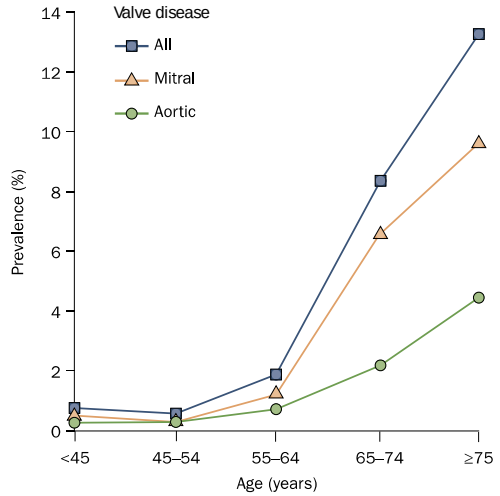


Iung, B. & Vahanian, A. *Nat. Rev. Cardiol.* 8, 162–172 (2011); published online 25 January 2011; doi:10.1038/ nrcardio.2010.202



reumatic in young

diagnosis is increasing



western world: degenerative in ancients

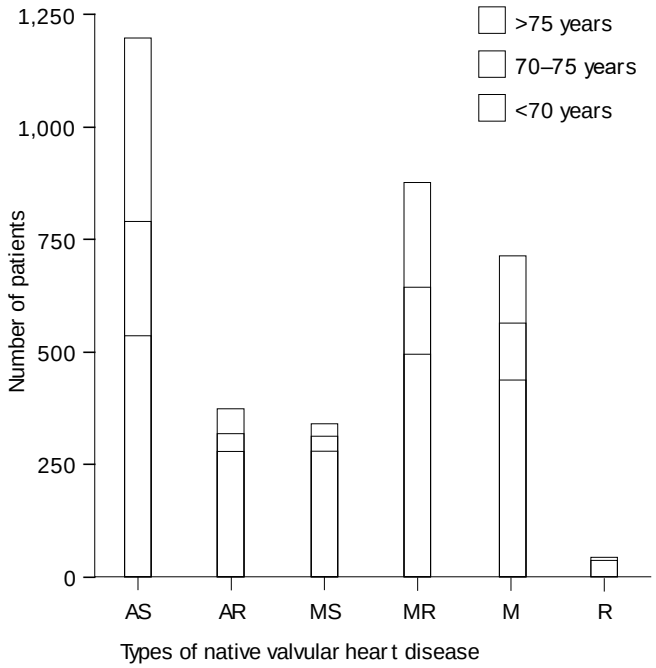


Table 1 | Characteristics of left-sided valve disease in the Euro Heart Survey[10,11]

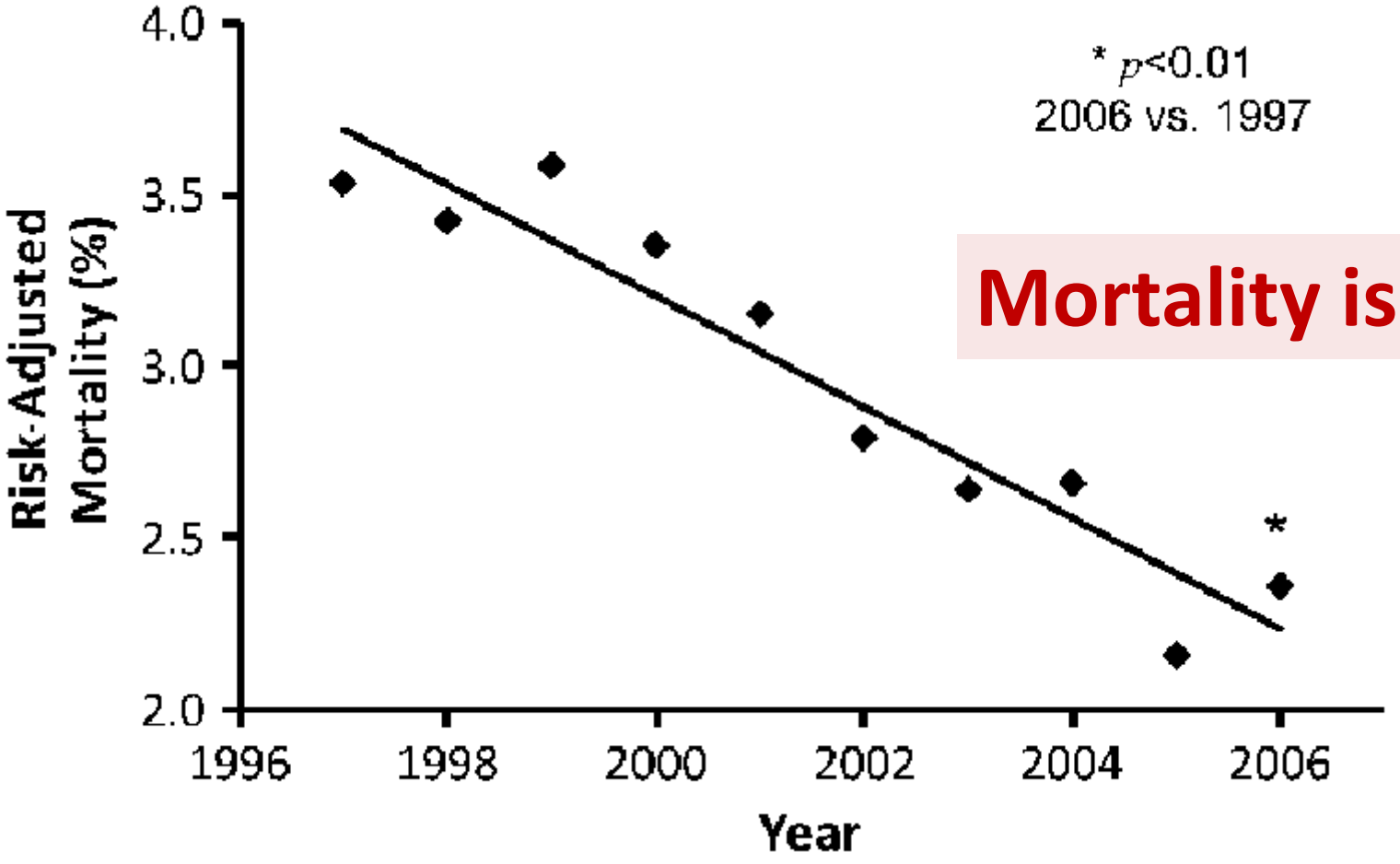
Variables	Aortic stenosis *n* = 1,197	Aortic regurgitation *n* = 369	Mitral stenosis *n* = 336	Mitral regurgitation *n* = 877
Demographic characteristics				
Mean age (years)	69 ± 12	58 ± 16	58 ± 13	65 ± 14
Age >70 years (%)	56	25	18	44
Male (%)	57	74	19	52
Etiology				
Degenerative (%)	81.9	50.3	12.5	61.3
Rheumatic (%)	11.2	15.2	85.4	14.2
Endocarditis (%)	0.8	7.5	0.6	3.5
Inf ammatory (%)	0.1	4.1	0	0.8
Congenital (%)	5.4	15.2	0.6	4.8
Ischemic (%)	0	0	0	7.3
Other (%)	0.6	7.7	0.9	8.1

Iung, B. & Vahanian, A. *Nat. Rev. Cardiol.* 8, 162–172 (2011); published online 25 January 2011; doi:10.1038/ nrcardio.2010.202

The patients' age is increasing

EURO HEARTH SURVEY: aortic stenosis in 8th decade

Also mortality for AVR is significantly decresing with time



Mortality is decreasing

M Brown, J. *et al.* Isolated aortic valve replacement in North America comprising 108,687 patients in 10 years: Changes in risks, valve types, and outcomes in the Society of Thoracic Surgeons National Database. *The Journal of Thoracic and Cardiovascular Surgery* **137,** 82–90 (2009).

«Gold standard»

Two aspects are going under debate in our comunity

Choise of the prosthesis

Choise of the approach

mechanical or biologic prostheses?

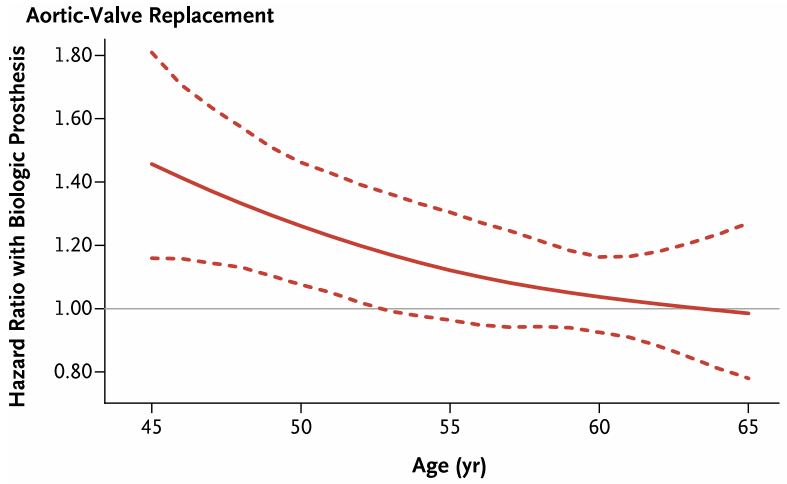
9800 pts

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Mechanical or Biologic Prostheses for Aortic-Valve and Mitral-Valve Replacement

Andrew B. Goldstone, M.D., Ph.D., Peter Chiu, M.D., Michael Baiocchi, Ph.D., Bharathi Lingala, Ph.D., William L. Patrick, M.D., Michael P. Fischbein, M.D., Ph.D., and Y. Joseph Woo, M.D.



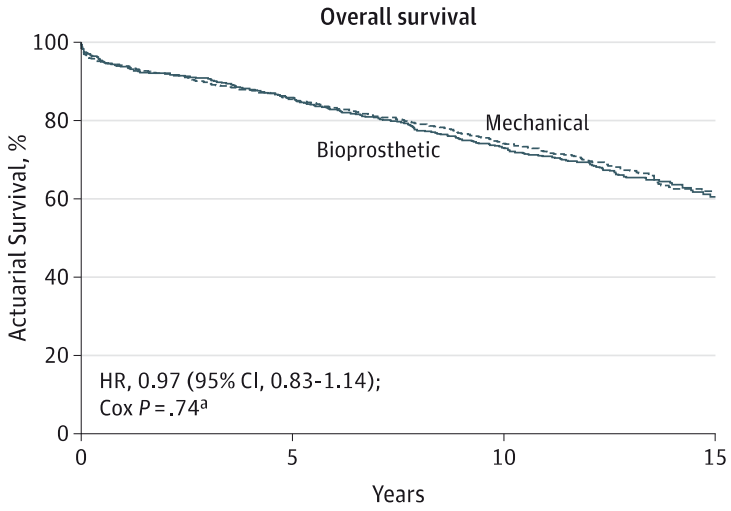
administrative data base

4253 pts

Original Investigation

Survival and Long-term Outcomes Following Bioprosthetic vs Mechanical Aortic Valve Replacement in Patients Aged 50 to 69 Years

Yuting P. Chiang, BA; Joanna Chikwe, MD; Alan J. Moskowitz, MD; Shinobu Itagaki, MD; David H. Adams, MD; Natalia N. Egorova, PhD



clinical data base

The choise of prostheses is determined by balancing the risks of anticoagulation and reoperation

- **Data from (surgery of) the past don’t confirm the superiority of mechanical prosthesis in fifth or sixth decades**

Nowadays the «biologic choise» is preferred by patients and followed by physicians.

- High durability expected of new prostheses
- TAVI «valve in valve»
- Physical activity in middleage

sAVR: a changing scenario

More than 200,000 surgical aortic valve replacements (SAVRs) are performed yearly worldwide .

This treatment has significantly evolved over the last 15 years, with a considerable increase in the use of aortic bioprostheses relative to mechanical prostheses.

This trend may be explained:

- the aging target population,
- the quest to avoid systemic anticoagulation treatment
- the improved hemodynamic performance of aortic bio prostheses

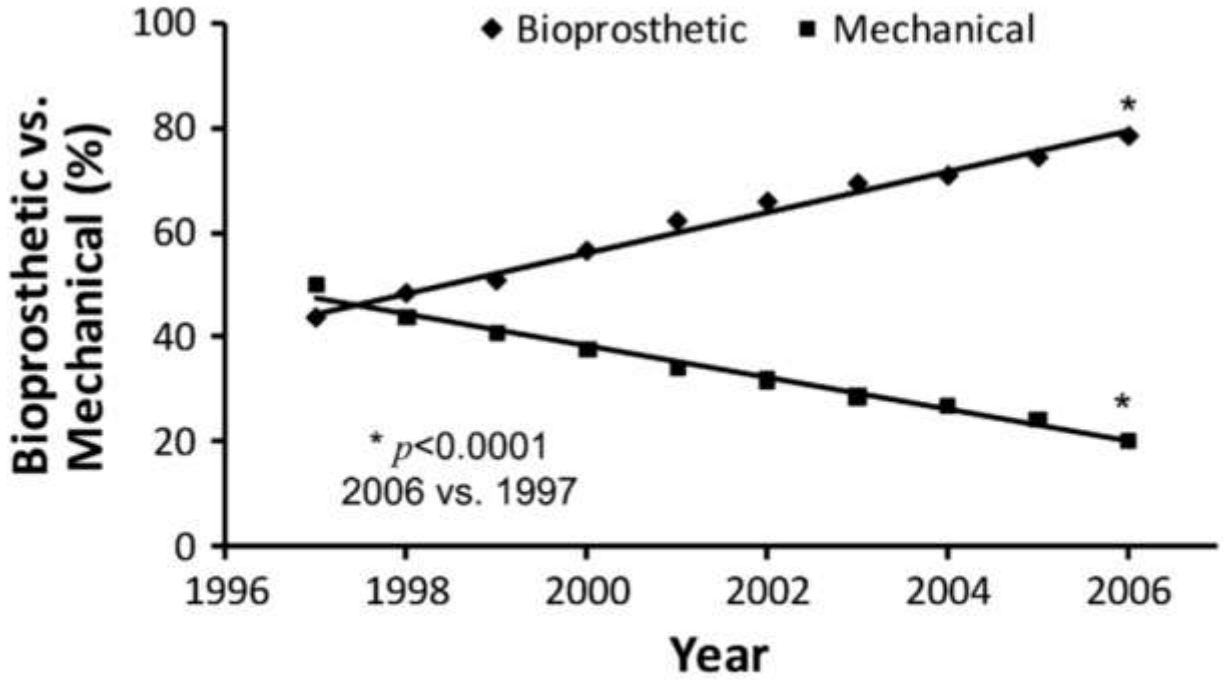


FIGURE 1. Percentage use of bioprosthetic valves relative to mechanical valves from 1997 through 2006. Bioprosthetic valve use increased progressively during 10 years. *Asterisk* indicates $P < .000001$.

M Brown, J. *et al.* Isolated aortic valve replacement in North America comprising 108,687 patients in 10 years: Changes in risks, valve types, and outcomes in the Society of Thoracic Surgeons National Database. *The Journal of Thoracic and Cardiovascular Surgery* **137,** 82–90 (2009).

«2014 the ACC/AHA guideline: a mechanical prosthesis is reasonable for VR in patients <60y»

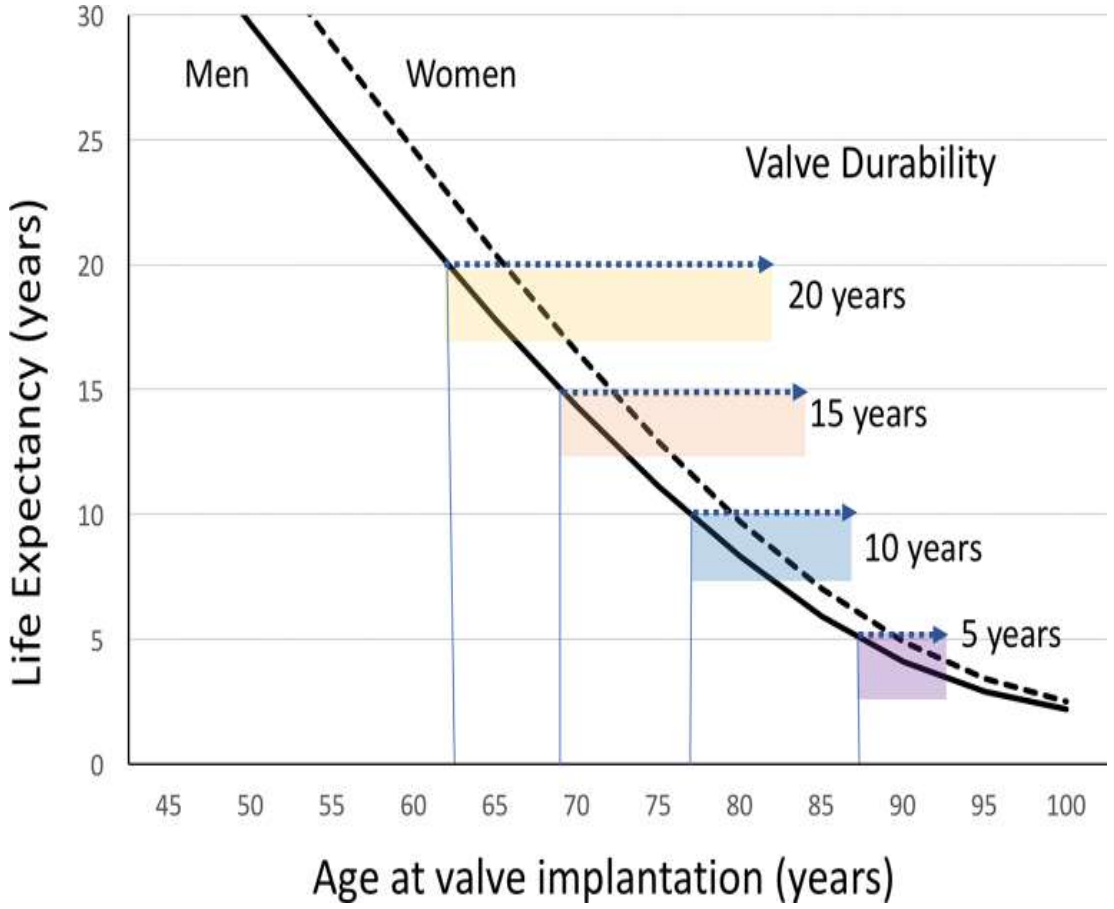


Table 3. Cumulative Risk of Reoperation Because of Structural Valve Deterioration by Age Group: Competing Risk Estimates[a]

Probability	20 y	25 y	30 y	35 y	40 y	45 y	50 y	55 y	60 y
5%	6.9	6.9	7.0	7.5	7.8	8.3	8.7	9.1	9.2
10%	7.8	8.4	9.0	9.2	9.6	9.9	10.3	11.1	11.6
15%	9.1	9.2	9.9	10.0	10.7	11.4	13.1	14.0	14.8
20%	9.9	10.0	10.7	11.4	13.1	14.0	14.8	15.1	16.3
25%	10.4	11.1	12.5	13.9	14.2	14.9	15.5	16.7	17.8
30%	11.2	13.1	14.0	14.8	15.1	16.3	16.9	17.9	18.6
35%	13.1	14.0	14.8	15.3	16.3	17.3	18.0	18.6	21.2
40%	14.0	14.8	15.3	16.3	17.3	18.0	18.6	21.2	23.4
45%	14.8	15.3	16.3	17.3	18.0	18.6	21.2	23.4	…
50%	15.1	16.3	16.9	17.9	18.6	21.0	23.4	…	…

[a] Results are the number of years a patient could expect to be free from reoperation for structural valve deterioration depending on age at implantation. For example, a 50-year-old patient has a 35% probability of being operated on again because of structural valve deterioration after 18 years.

Real world

Our team experience

2010-2016

2871

Aortic valve replacement (isolated or not)

375	**2496**
mechanical	**biologic**
13%	**87%**

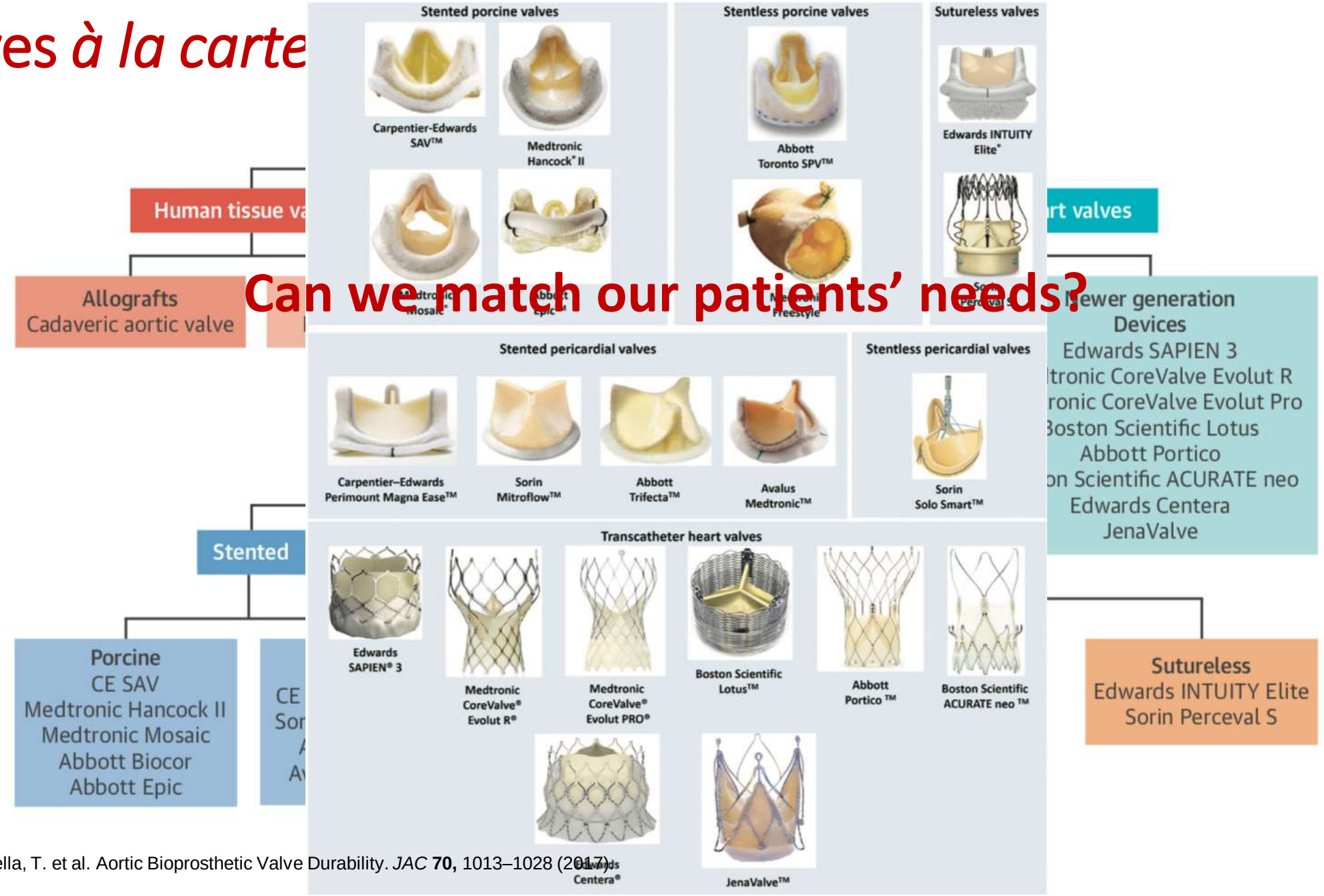
Real world

“per AGE”

	total n° **2871**	biologic n° **2496**	mechanical n° **375**
age ≤ 65	568 (20%)	333 (13%) **(58,62%)**	235 (63%)
age ≤ 60	347 (12%)	164 (7%) **(47,26%)**	183 (49%)

333 BIOPROST. / 568 PTS. ‹ 65 years (58,62%)
164 BIOPROST. / 347 PTS. ‹ 60 years (47,26%)
18 BIOPROST. / 5 PTS. ‹ 40 years (34,61%)

Valves *à la carte*



Can we match our patients' needs?

Rodriguez-Gabella, T. et al. Aortic Bioprosthetic Valve Durability. *JAC* **70,** 1013–1028 (2017).

What should a cardiac surgeon keep in mind during the first surgical aortic valve replacement

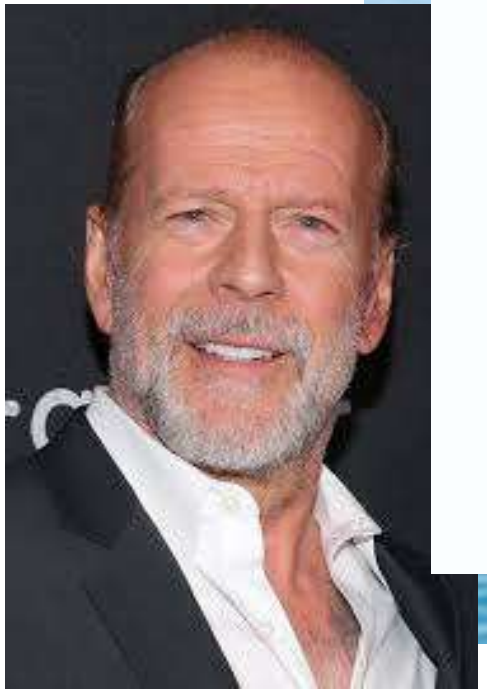
- Avoid PPM, implanting an adequate size
- Do not prefer that certain prosthesis with leaflets outside the stent
- Insert markers for fluoroscopy

for ViV

- Use the mini approaches
- Suture the pericardium
- Adopt a synthetic hydrogel

for redo

Our co a cult of youth



Indications & Contraindications: Patients who would benefit

Patients who benefit from MICS

Published Experience

Minimally invasive aortic valve replacement: how does this perform in high-risk patients?

Jan D Schmitto; Friedrich W Mohr; Lawrence H Cohn
Current Opinion in Cardiology. 26(2):118–122, MAR 2011

Abstract

Purpose of review

Minimally invasive techniques are increasingly important in aortic valve surgery. The aim of this publication is to review our experience and recent literature to assess and present the current 'state-of-the-art'-role of minimally invasive aortic valve operations for high-risk patients.

Recent findings

Minimally invasive aortic valve operation for high-risk patients (e.g. patients with left ventricular dysfunction, reoperation, elderly, multimorbid patients, etc.) can be performed with an operative mortality similar to standard sternotomy approach. Less postoperative bleeding, fewer blood transfusions, better cosmesis, lower ICU and in-hospital stays as well as the absence of sternal wound infection are the main advantages of this technique.

Summary

Minimally invasive aortic valve surgery has evolved into a well tolerated, efficient surgical treatment option in experienced centers, providing greater patient satisfaction and lower complication rates in high-risk patients.

- **Elderly Patients:**
  - Lower operative mortality
  - Lower incidence of sepsis
  - Lower wound complications
  - Shorter hospital stay
  - Faster rehabilitation and discharge

Indications & Contraindications: Patients who would benefit

Patients who benefit from MICS

Published Experience

Minimally invasive aortic valve replacement: how does this perform in high-risk patients?

Jan D Schmitto; Friedrich W Mohr; Lawrence H Cohn
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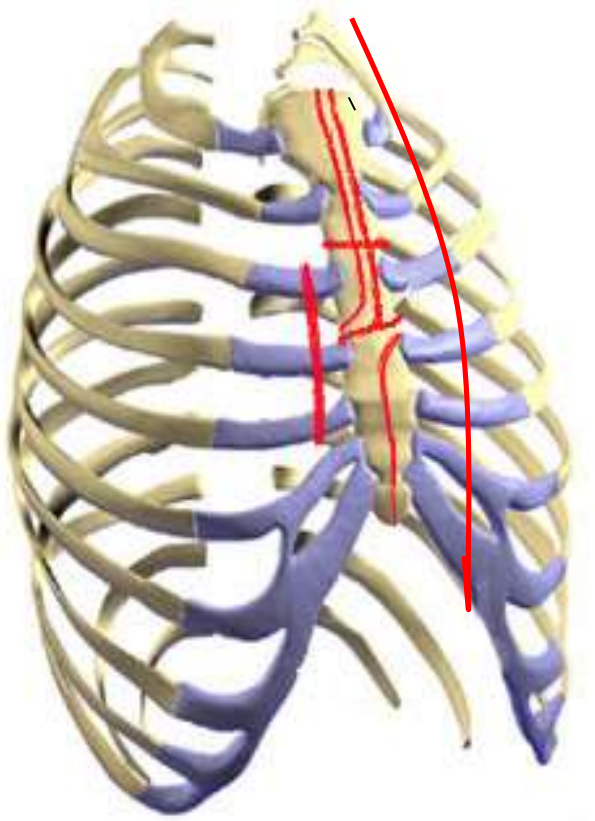
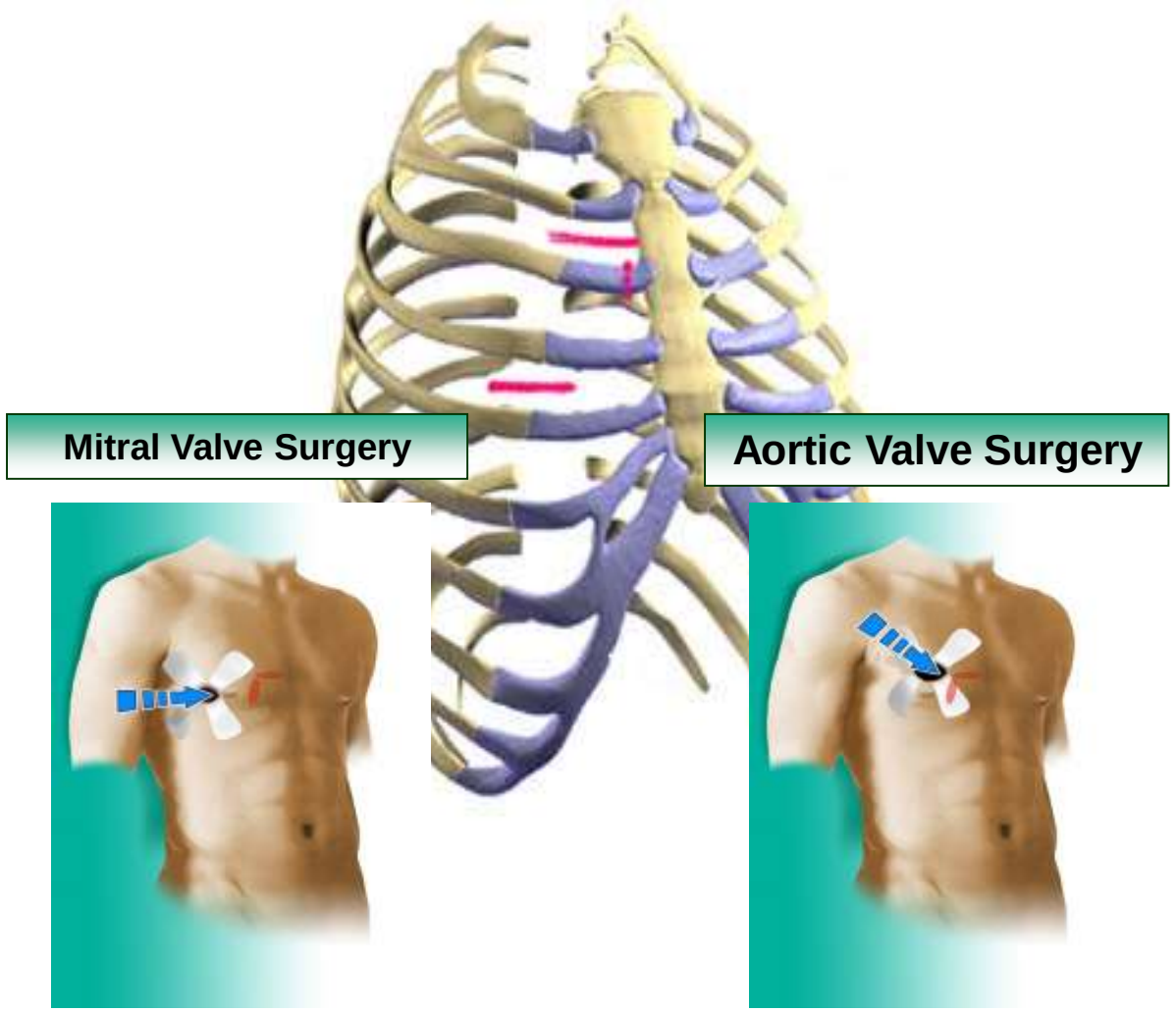
Summary

Minimally invasive aortic valve surgery has evolved into a well tolerated, efficient surgical treatment option in experienced centers, providing greater patient satisfaction and lower complication rates in high-risk patients.

- **Re-op Patients:**
  - Less bleeding
  - Fewer transfusions

Conventional and minimally invasive incisions





Upper “J” mini-sternotomy

2003

Right Minithoracotomy vs Full Sternotomy

Table 2. Clinical Outcome of Propensity Matched Patients

Variables	CAVR (n = 182)	MIAVR (n = 182)	*p* Value
CPB time, minutes	104.1 ± 34.6	117.5 ± 41.9	<0.0001
Aortic cross-clamping time, minutes	71.3 ± 27.5	83.8 ± 28.5	<0.0001
In-hospital mortality	3 (1.6)	3 (1.6)	1.0
Assisted ventilation time, hours[a]	8 (6–11)	7 (6–9)	0.022
Assisted ventilation longer than 12 hours	33 (18.1)	23 (12.6)	0.2
Assisted ventilation longer than 24 hours	9 (4.9)	4 (2.2)	0.27
Low cardiac output syndrome	1 (0.5)	2 (1.1)	0.26
New onset of AF	57 (31.3)	39 (21.4)	0.043
Third degree atrioventricular block	2 (1.1)	2 (1.1)	1.0
Permanent CVA (stroke)	4 (2.2)	2 (1.1)	0.69
Transient CVA	1 (0.5)	1 (0.5)	1.0
Hemodialysis	2 (1.1)	3 (1.6)	0.41
Infective complications	5 (2.7)	4 (2.2)	0.28
Pulmonary complications	8 (4.4)	10 (5.5)	0.58
Pleural effusion requested drainage	5 (2.7)	10 (5.5)	0.19
Reexploration for bleeding	11 (6.0)	8 (4.4)	0.63
Revision for other reasons	2 (1.1)	5 (2.7)	0.45
Blood transfusion pack per patient, unit[a]	2 (0–3)	1 (0–2)	0.046
Postoperative in-hospital length of stay, days[a]	6 (5–7)	5 (5–6)	0.43
Postoperative length of stay more than 6 days	53 (29.1)	48 (26.4)	0.62

[a] Median value (25th to 75th percentile).

Values are expressed as n (%) unless otherwise specified.

AF = atrial fibrillation; CAVR = conventional aortic valve replacement; CPB = cardiopulmonary bypass; CVA = cerebrovascular accident; MIAVR = minimally invasive aortic valve replacement.

Ann Thorac Surg
2013;96:837–43

Indications & Contraindications: Patients who would benefit

Published Experience

Aortic Cross-Clamp Time, New Prostheses, and Outcome in Aortic Valve Replacement

Marco Ranucci[1], Alessandro Frigiola[2], Lorenzo Menicanti[2], Serenella Castelvecchio[1], Carlo de Vincentiis[2], Valeria Pistuddi[1], for the Surgical and Clinical Outcome Research (SCORE) Group

Departments of [1]Cardiothoracic and Vascular Anesthesia and Intensive Care and [2]Cardiac Surgery, IRCCS Policlinico San Donato, Milan, Italy

The Journal of Heart Valve Disease 2012;21:732-739

Results: **The AXCT was an independent predictor of severe cardiovascular morbidity, with an increased risk of 1.4% per 1 min increase. Patients with a left ventricular ejection fraction ≤40%, and also diabetic patients, showed the most relevant clinical benefits induced by a reduction in AXCT.**

Indications & Contraindications: Patients who would benefit

Patients who benefit from shorter procedures

Published Experience

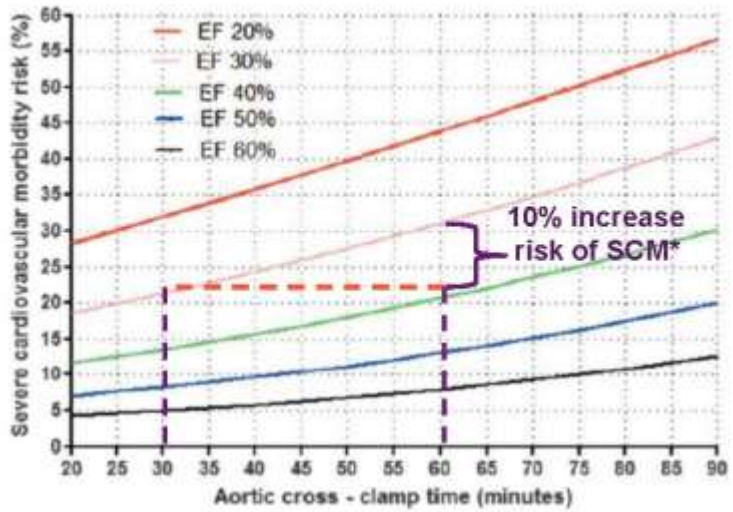


Figure 4: Changes in aortic-cross clamp time dependency for severe cardiovascular morbidity risk at different values of left ventricular ejection fraction.

- **Patients with Low Ejection Fraction**
  LEVF < 40% would benefit from a X clamp time reduction to reduce the risk of:
  - Operative mortality
  - Acute kidney injury
  - Stroke
  - Low post-op Cardiac Output

* SCM defined as presence of operative mortality, acute kidney injury, stroke, low cardiac output.

Ranucci et al. - The Journal of Heart Valve Disease 2012;21:732-739

Indications & Contraindications: Patients who would benefit

Patients who benefit from shorter procedures

Published Experience

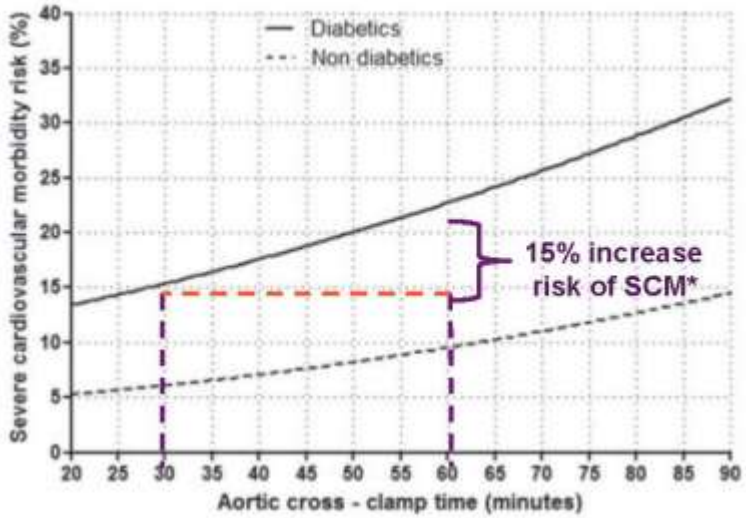


Figure 3: Changes in aortic-cross clamp time dependency for severe cardiovascular morbidity risk in diabetic and non-diabetic patients.

- **Patient with Diabetes** would benefit from a X clamp time reduction to reduce the risk of:
  - Operative mortality
  - Acute kidney injury
  - Stroke
  - Low post-op Cardiac Output

* SCM defined as presence of operative mortality, acute kidney injury, stroke, low cardiac output.

Ranucci et al. - The Journal of Heart Valve Disease 2012;21:732-739

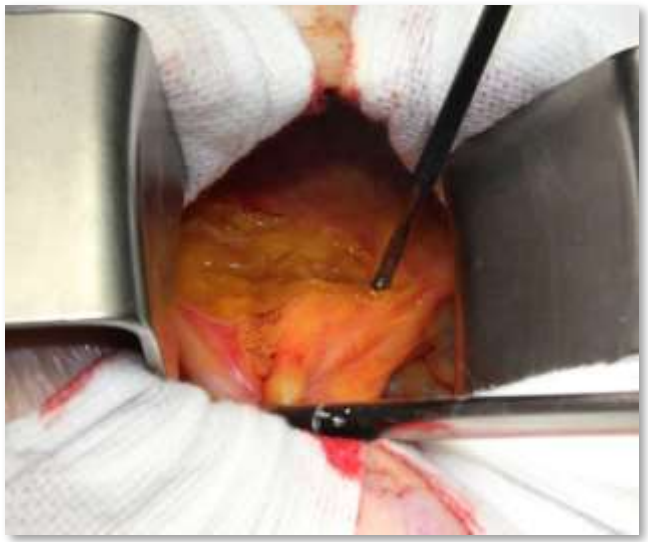
Mini-Thoracotomy Aortic Valve Replacement

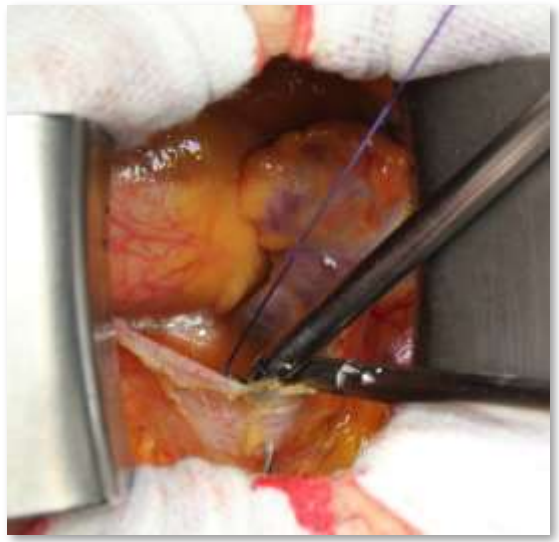
2010

Mini-Thoracotomy Aortic Valve Replacement

PATIENT POSITIONING

Mini-Thoracotomy Aortic Valve Replacement

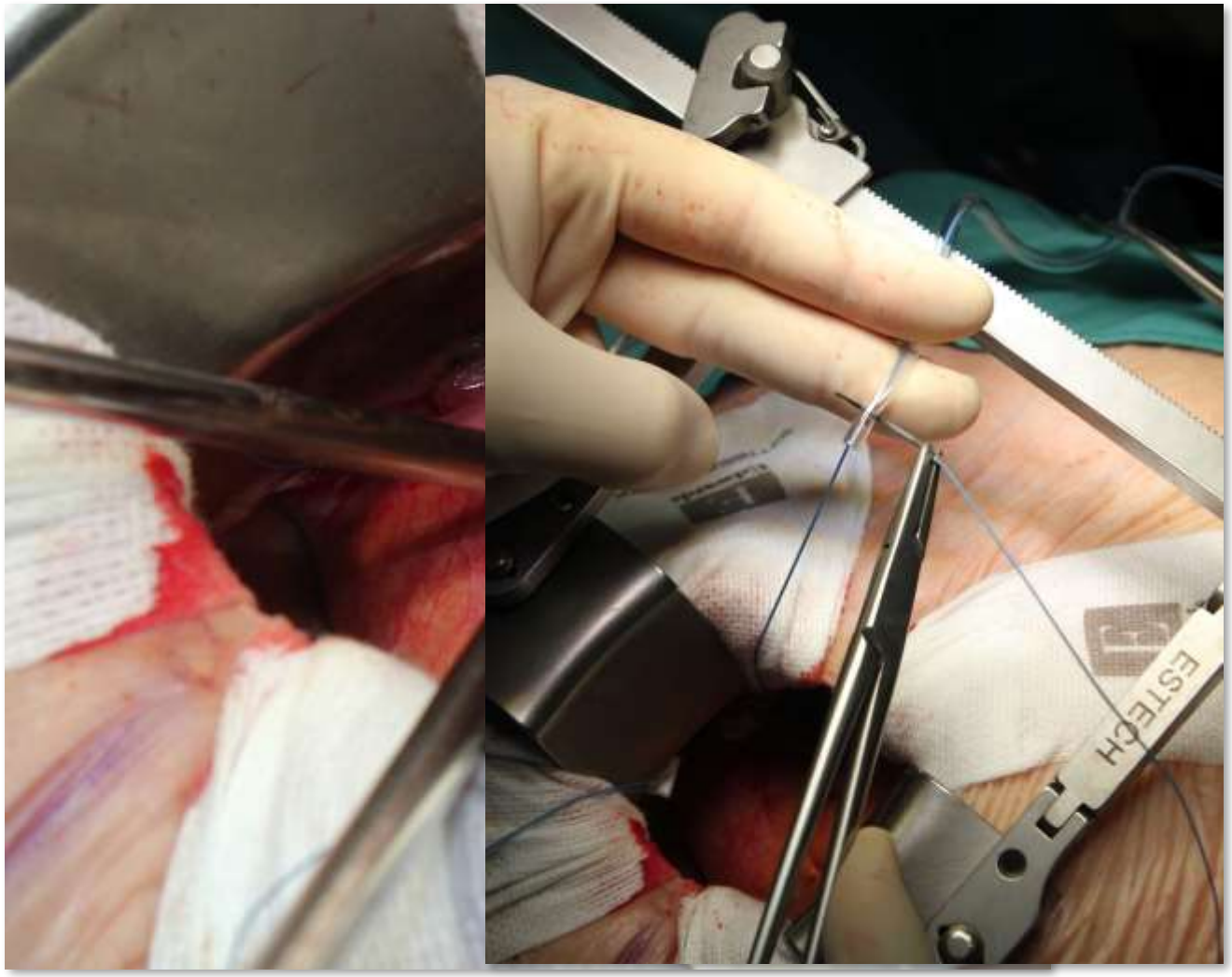




PERICARDIAL STITCHES

Mini-Thoracotomy Aortic Valve Replacement

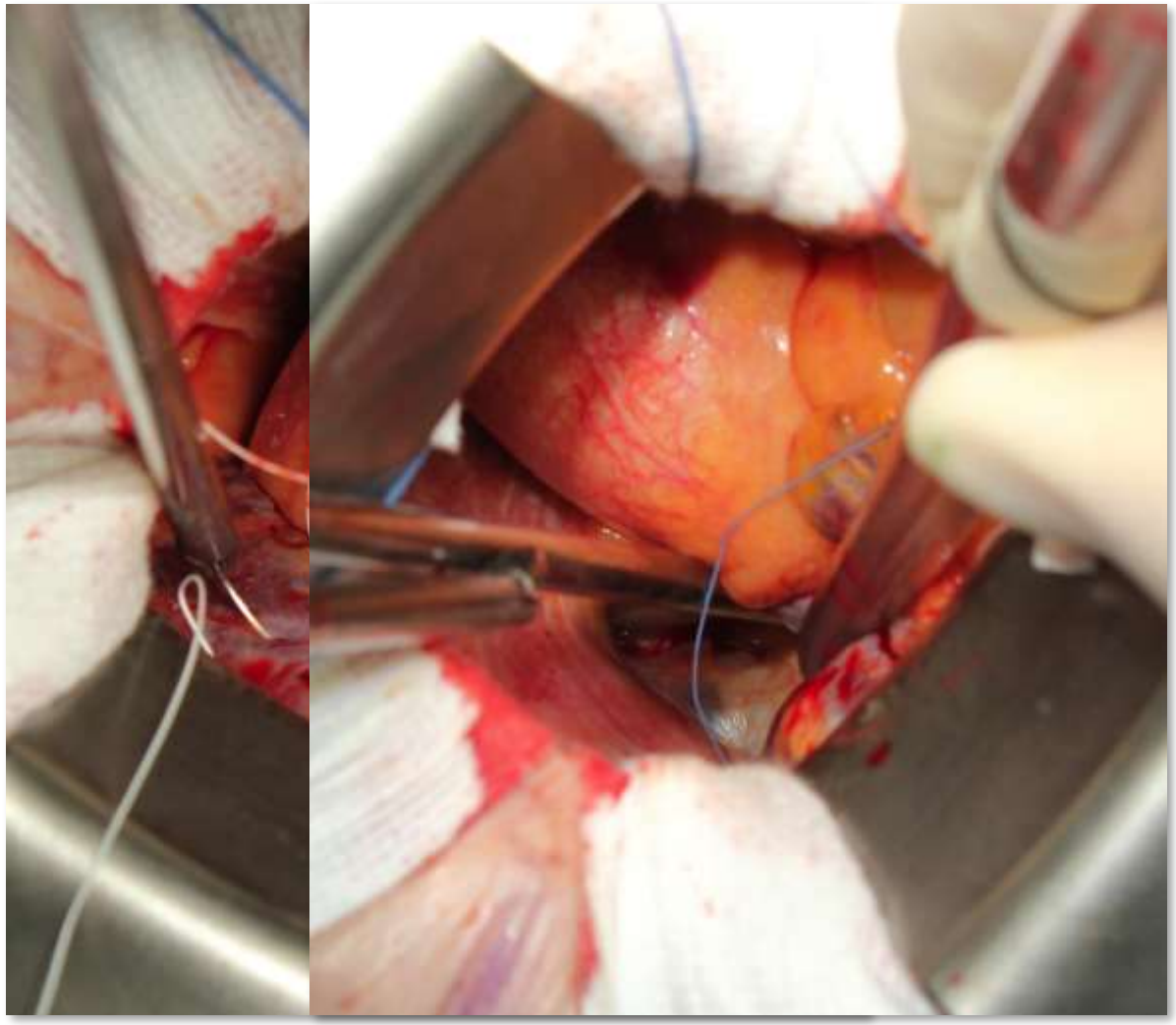
AORTIC PURSE STRINGS



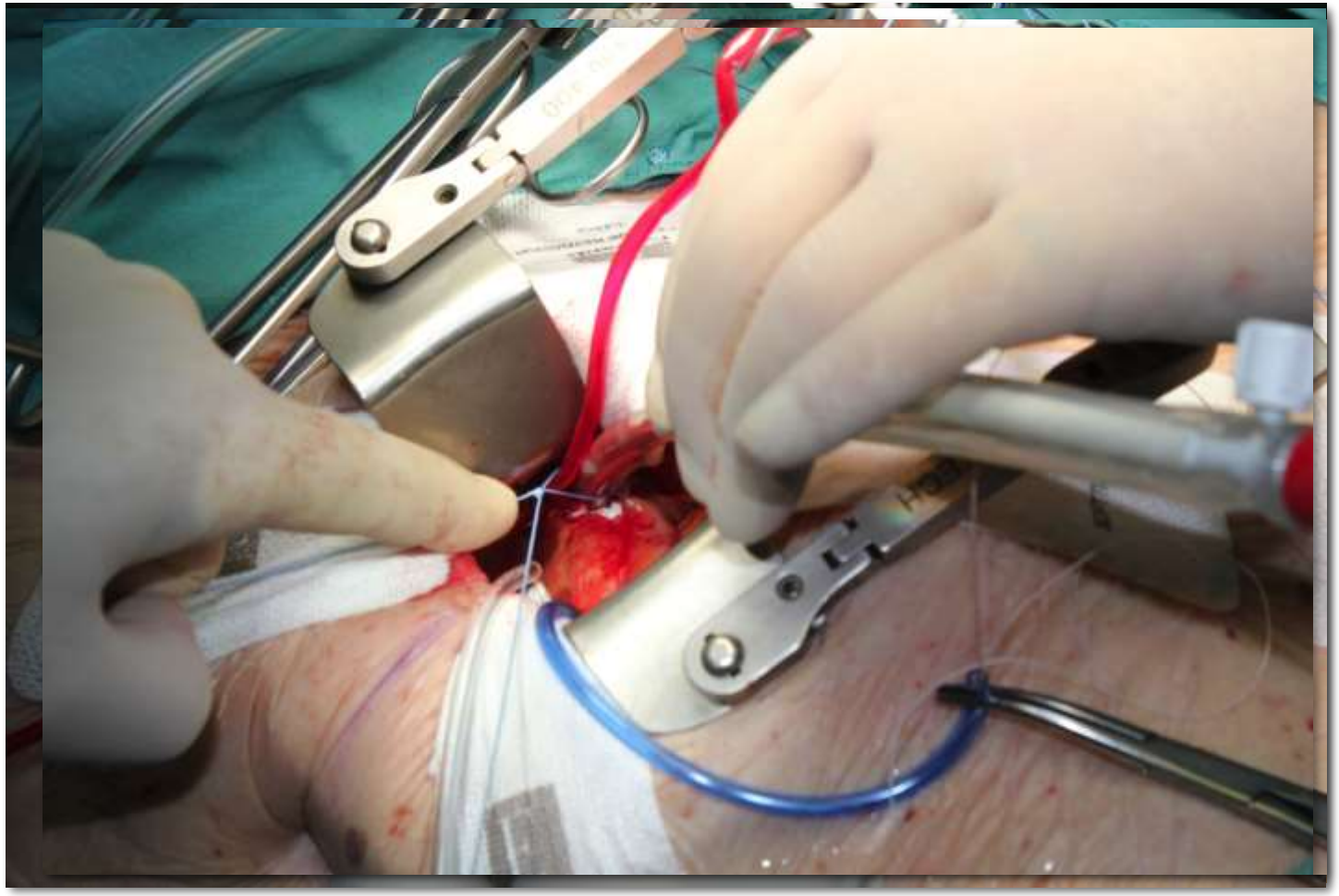
Mini-Thoracotomy Aortic Valve Replacement

RIGHT ATRIUM

SUPERIOR PULMONARY VEIN



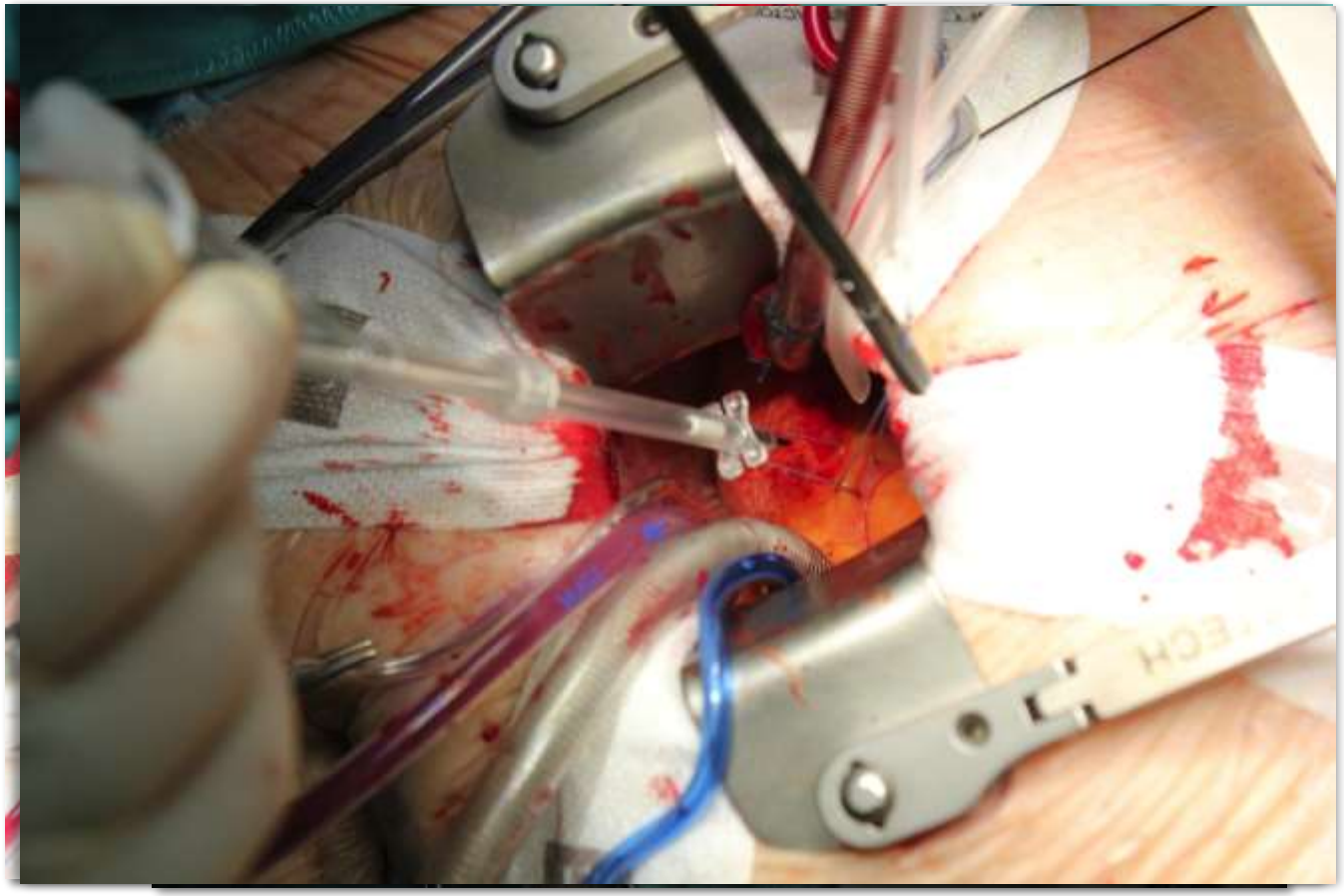
Mini-Thoracotomy Aortic Valve Replacement



AORTIC CANNULATION

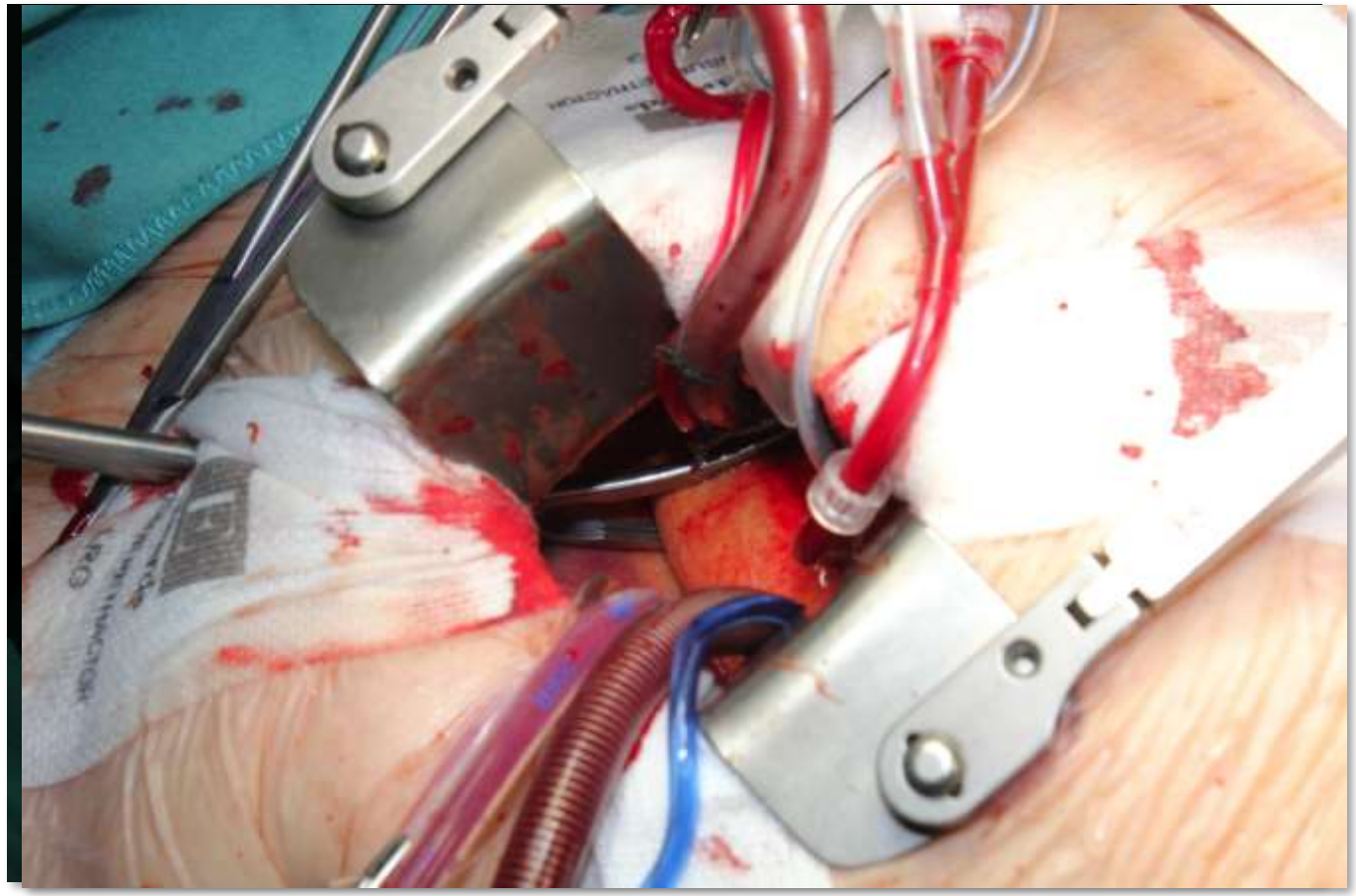
Mini-Thoracotomy Aortic Valve Replacement

RIGHT ATRIUM CANNULATION



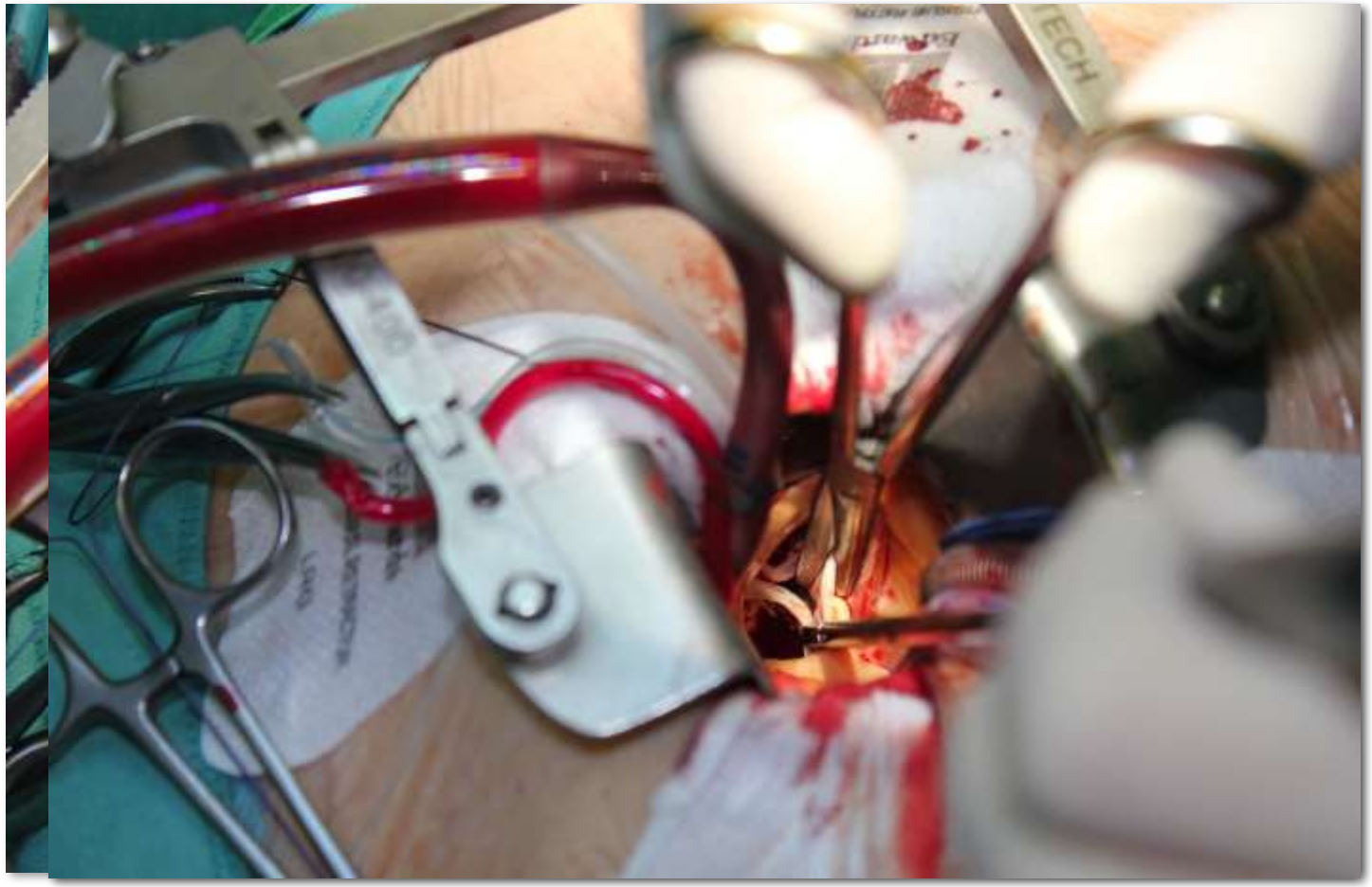
Mini-Thoracotomy Aortic Valve Replacement

AORTIC CROSS CLAMPING



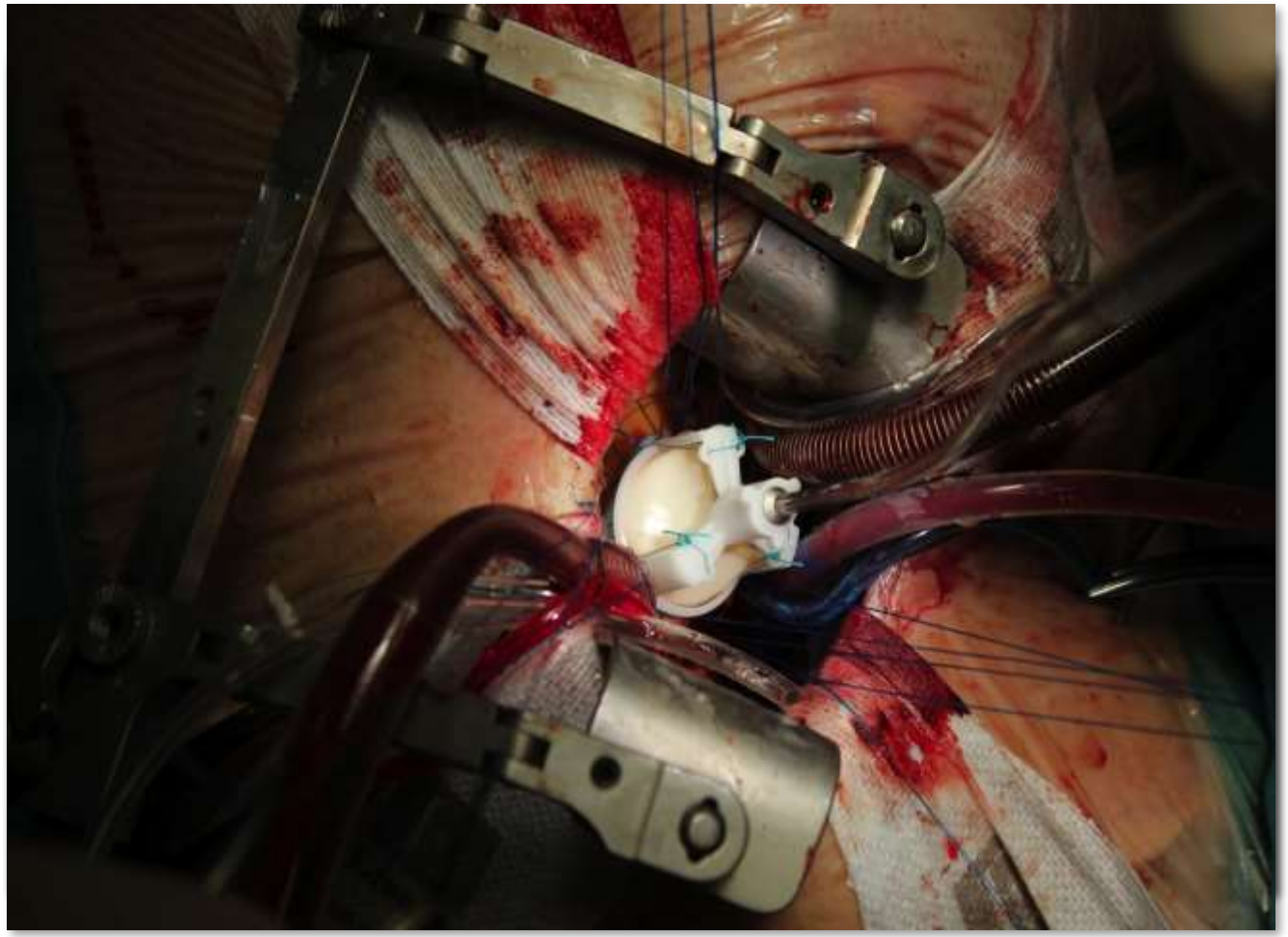
Mini-Thoracotomy Aortic Valve Replacement

DISEASED VALVE REMOVING



Mini-Thoracotomy Aortic Valve Replacement

PROSTHESIS IMPLANTATION



Mini-Thoracotomy Aortic Valve Replacement

FINAL RESULT

Perceval

How we can make it accessible for everyone

RAT - Critiques to the technique…

1. ~~RIB AVULSION~~
2. ~~RIMA DAM~~
3. ~~LONG~~
4. ~~F~~

~~EEDED~~

~~L CANNULATION~~

~~REPRODUCIBILITY"~~

~~ROSTHESIS UNDERSIZING~~

WHY NOT?

How we can make it accessible for everyone

Great number – great outcome

Few devices

Few contraindications

ASSISTANTS MUST «START» FROM THIS APPROACH

NO INTERNAL TEAM COMPETITION

Table 4 . Outcome ♣

Characteristics	Peripheral Cannulation (N=42)	Central Cannulation (N=164)	Total (N=206)
Ventilation time (h)			
Mean ± SD	8 ± 6	9 ± 12	9 ± 11
Median (min - max)	6 (0-30)	6 (0-120)	6 (0 - 120)
ICU stay (h) ♦			
Mean ± SD	56 ± 89	61 ± 109	60 ± 105
Median (min - max)	40 (15 – 598)	40 (13-1258)	40 (13-1258)
Discharged alive (%)	42 (100)	161 (98.2)	203 (98.5)
Discharged to (%)			
Home	22 (52.4)	77 (47)	99 (48.1)
Rehabilitation	18 (42.9)	81 (49.4)	99 (48.1)
Other	2 (4.8)	6 (3.6)	8 (3.9)
Hospital stay (days)			
Mean ± SD	14.4 ± 24.4	11.7 ± 8.2	12.3 ± 13.2
Median (min - max)	9 (5 – 164)	10 (5-59)	9 (5-164)

♣ Values display total number of patients reported as mean ± standard deviation and as median (range).

♦ ICU= intensive care unit;

Ann Thorac Surg. 2015 Mar;99(3):826-30

Aortic valve replacement via right mini-thoracotomy: is it really biologically minimally invasive?

Elisa Mikus MD[1], Simone Turci MD[2] , Simone Calvi MD[1], Massimo Ricci MD[2], Luca Dozza MS,[3] Mauro Del Giglio MD, PhD[1, 2],

Ann Thorac Surg. 2018 Dec;106(6):1782-1788..
Full Sternotomy, Hemisternotomy, and Minithoracotomy for Aortic Valve Surgery: Is There a Difference?
Mikus E[1], Calvi S[2], Campo G[3], Pavasini R[3], Paris M[4], Raviola E[2], Panzavolta M[2], Tripodi A[2], Ferrari R[5], Del Giglio M[4].

Cardiac | Abstract | Minimally invasive aortic valve replacements

Full sternotomy, partial sternotomy and right anterior mini-thoracotomy for aortic valve replacement: is there any difference? A propensity matched analysis

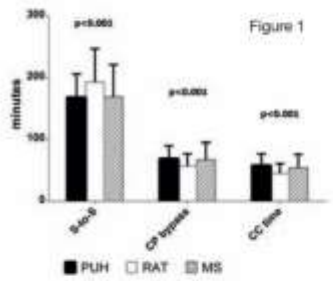
Elisa Mikus[1], Simone Calvi[1], Gianluca Campo[2], Marco Paris[1], Eliana Raviola[1], Marco Panzavolta[1], Rita Pavasini[2], Roberto Ferrari[1,2], Mauro Del Giglio[1]
1. Cardiothoracic and Vascular Department, Maria Cecilia Hospital, GVM Care & Research, Cotignola (RA), Italy; 2. Cardiovascular Institute, Azienda Ospedaliero-Universitaria di Ferrara, Cona (FE), Italy.

In the last decades, the number of patients affected by aortic valve disease (AVD) requiring invasive treatment are increasing. Despite new percutaneous transcatheter aortic valve implantation (TAVI) technique, surgical aortic valve replacement (AVR) performed through median sternotomy remains the gold standard. Minimally invasive approaches for AVR, such as partial upper hemisternotomy (PUH) and right minithoracotomy (RAT) have been described and encouraging results reported. On the other hand, there is a lack of data about clinical benefits in comparing different minimally invasive techniques. This study compares perioperative results and mortality rates of different techniques to perform AVR and describes possible predictors favouring one approach over the others.

Between January 2010 and March 2017, 1907 patients underwent isolated aortic valve replacement though a ministernotomy (N = 820), a minithoracotomy (N = 488) or a sternotomy (N = 599). After propensity score matching, we obtained three groups composed by 377 patients, homogeneous for baseline characteristics. In the three surgical approaches the same surgical technologies were used to perform aortic valve replacement, such as the technique for extracorporeal circulation, total central cannulation and cardioplegia (with the exception for the double lumen intubation used for RAT).

Regarding intraoperative variables, we observed significant differences between groups. Skin to skin time was significantly higher in the RAT group (193±54 minutes vs 168±34 minutes in PUH, p = 0.001 and vs 169±52 minutes in MS, p = 0.001, respectively; Figure 1). On the contrary, cardiopulmonary bypass and cross-clamp times were lower in the RAT group (57±20 minutes vs 69±21 minutes in PUH, p = 0.009 and vs 67±28 minutes in MS, p = 0.01; 45±16 minutes vs 58±19 minutes in PUH, p = 0.01 and vs 54±22 minutes in MS, p = 0.03, respectively). In-hospital mortality did not differ between groups (p = 0.9). Overall, only renal failure (OR 5.4; 95%CI 2.3-11.4; p < 0.0001), extra-cardiac arteriopathy (OR 2.9; 95%CI 1.1-6.7; p = 0.017) and left ventricular ejection fraction (OR 0.96; 95%CI 0.93-0.99; p = 0.009) emerged as independent predictor of in-hospital mortality. We did not observe any significant difference in secondary outcomes. The only exception was the occurrence of wound infection, which was significantly higher in the MS group (p = 0.01).

Figure 1

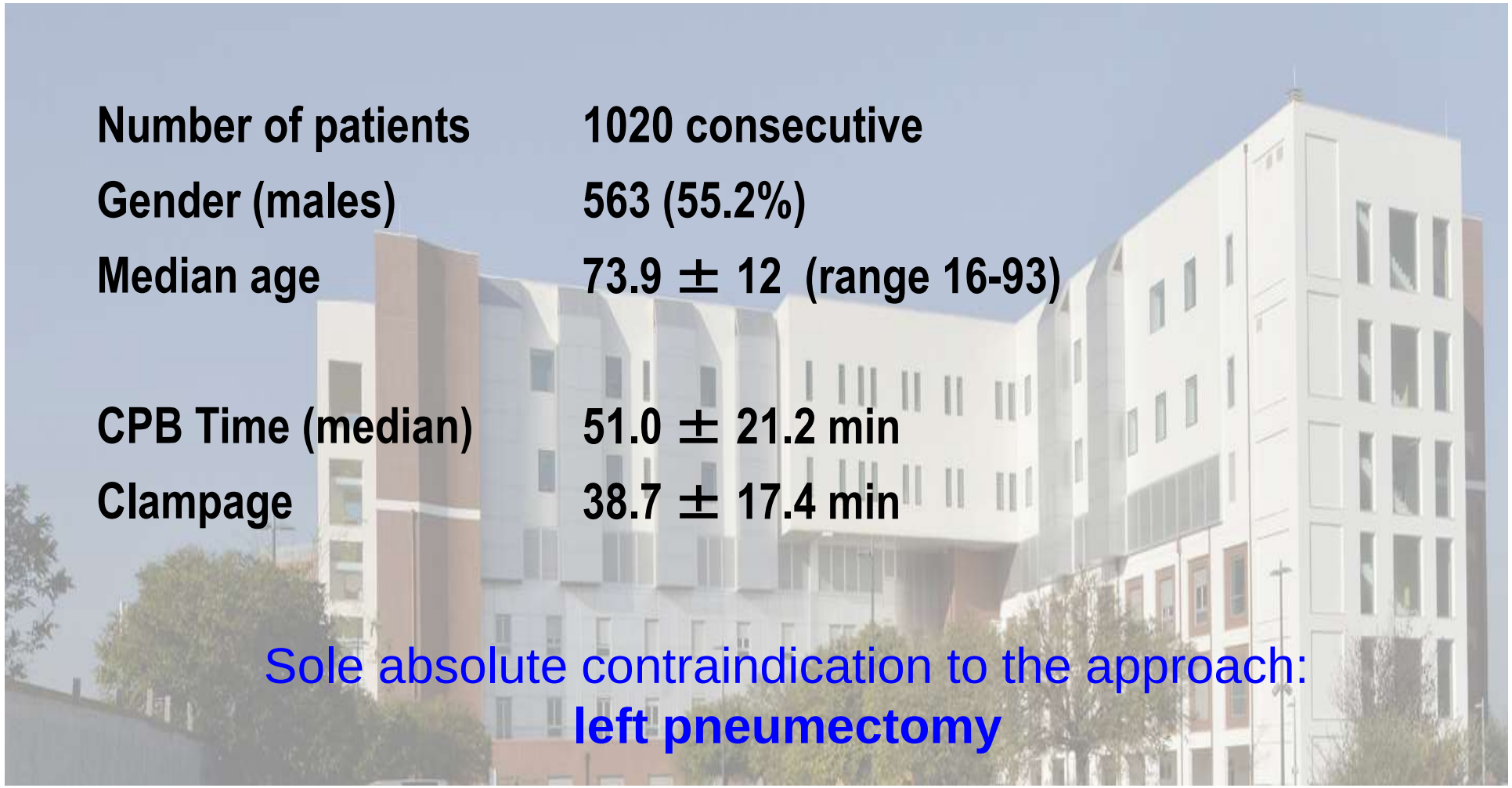


To the best of our knowledge, this is the biggest study database, using a propensity score analysis, comparing different standardised and reproducible surgical approaches for AVR. Contrary to previous reports, our data show that RAT required a higher skin to skin time but a lower cardiopulmonary bypass and cross-clamp times than MS suggesting that a careful planning of surgery significantly reduces the length of the most critical phases of surgery. Our policy is to follow a standard protocol for the management of patients independently by the surgical technique used. Thus, our results are fully comparable. Furthermore, this is probably the reason why we did not find (as others did) differences in ventilations, ICU and hospital stay between groups.

This study shows that minimally invasive AVR is a reproducible, safe and effective procedure with similar outcomes without longer operative times compared to conventional sternotomy. Therefore, considering the proven non-inferiority of RAT versus MS in terms of i) in-hospital mortality, ii) post-operative complications and iii) better psychological acceptance of the surgery, RAT might represent the best option for patients needing AVR.

Right Minithoracotomy

Our team experience 02/2010 – 12/2018



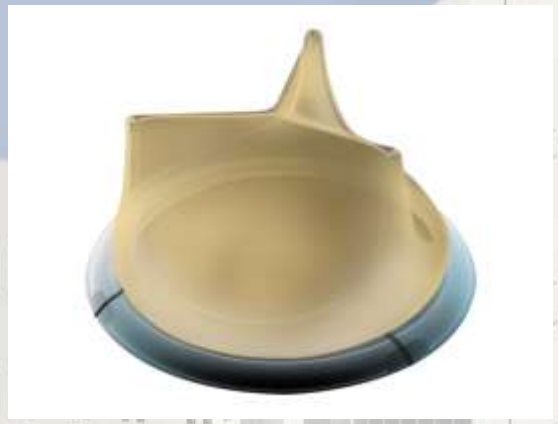
Number of patients	**1020 consecutive**
Gender (males)	**563 (55.2%)**
Median age	**73.9 ± 12 (range 16-93)**
CPB Time (median)	**51.0 ± 21.2 min**
Clampage	**38.7 ± 17.4 min**

Sole absolute contraindication to the approach:
left pneumectomy

Right Minithoracotomy

Our team experience 02/2010 – 12/2018

size	pts
19	5
21	101
23	410
25	432
27	72

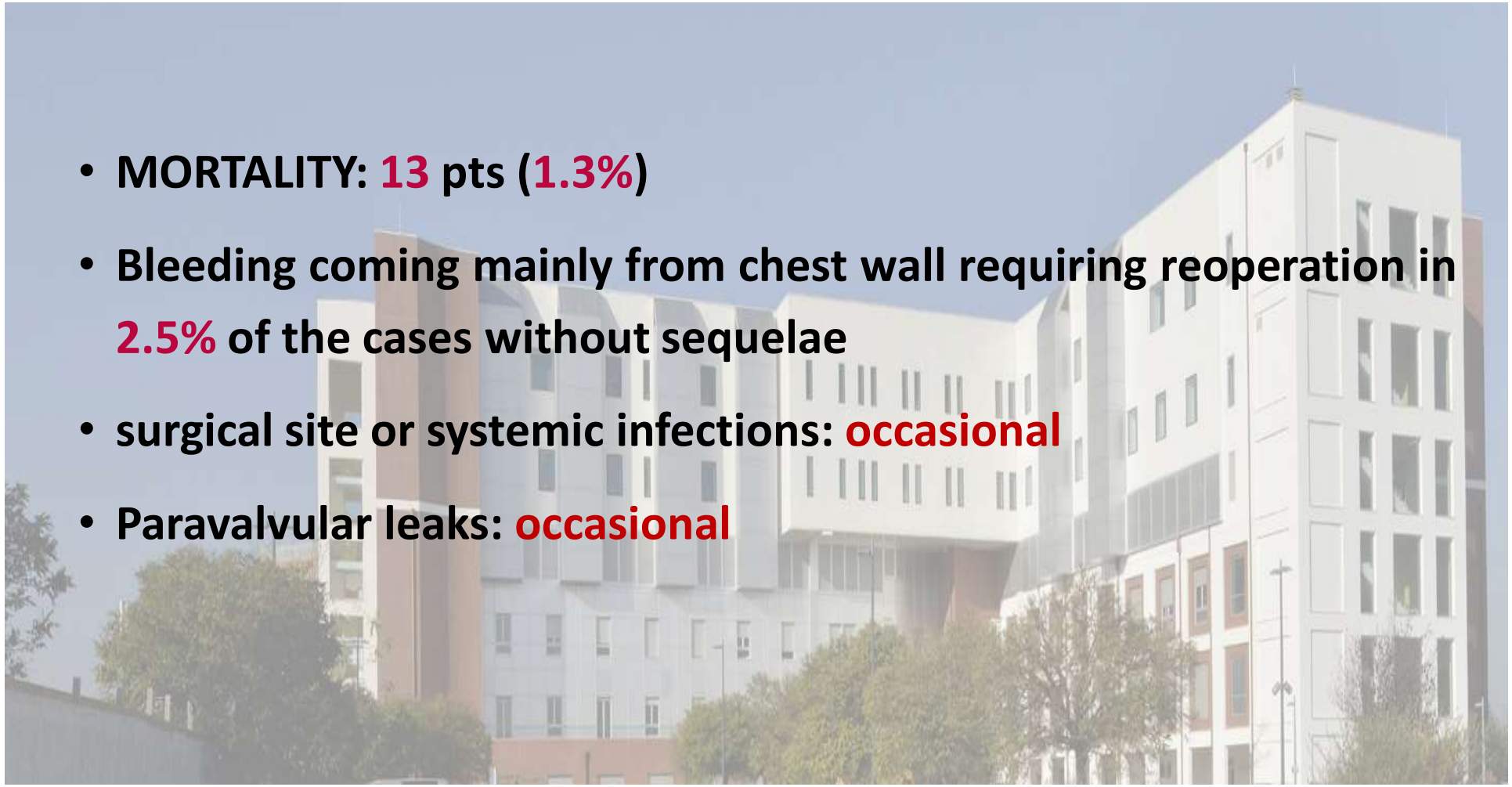


Mean size 23,9 ± 1.7

Biological prosthesis in 95.6% of patients

Right Minithoracotomy

Our team experience 02/2010 – 12/2018



- **MORTALITY: 13 pts (1.3%)**
- **Bleeding coming mainly from chest wall requiring reoperation in 2.5% of the cases without sequelae**
- **surgical site or systemic infections: occasional**
- **Paravalvular leaks: occasional**

First option for AVR during the last 9 years

Redo procedure in the last 5 years

Performed in several town

Cotignola	Moscow
Bologna	Almetevsk
Firenze	Hannover
Rapallo	Tokyo
Torino	Paris
Brescia	Beirut
Milano	Dammam
Napoli	Shanghay
Roma	Delhi
Lecce	L’Habana

In our team this is the new gold standard

RAT - Our team experience

PERCEVAL - Old Patients 2016-2018

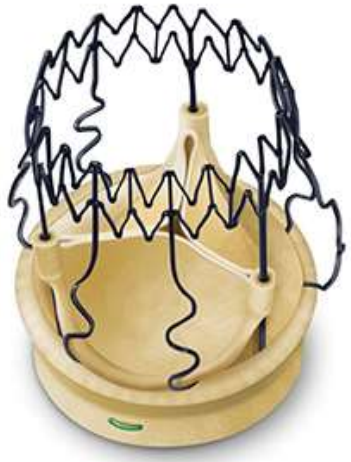
SUTURELESS and MINI-THORACOTOMY

OUR FIRST EXPERIENCE with

FAST IMPLANT PROGRAM

>= 80 y

82 patients



Age: **83.1**

Extracorporeal circulation: **33.1 min**

Cross clamping time: **16.7 min**

VAM: **8.6 hours**

Atrial Fibrillation: **11.9%**

Pacemaker implantation: **2,7%**

Agenda

Introduction

Aortic valve

Aorta

Mitral valve

Coronary disease

Some data - Our team experience

TAADs Syndromes

- Familial Thoracic aorta aneurysms and dissections (TAADs) syndromes are autosomal dominant (probability of early diagnosis is at least 50%)
- Genetic screening to identify familily members who are at risk
- In recents study more than 90% of pts have early osteoarthritis
- Association with saccular intracranial aneurysm

Risk of aortic dissection

- **Aortic diameters**
- **Disease gene and mutation**
- **Family history of dissection**
- **Rate of progression of the aneurysm**
- **Cardiac risk factors (hypertension…)**

the rules and regulations applicable to drugs and devices at the time of prescription.

2. Introduction

In addition to coronary and peripheral artery diseases, aortic diseases

Recently, the Global Burden Disease 2010 project demonstrated that the overall global death rate from aortic aneurysms and AD increased from 2.49 per 100 000 to 2.78 per 100 000 inhabitants between 1990 and 2010, with higher rates for men.[1,2]

ities including the coarctation of the aorta (CoA).

Similarly to other arterial diseases, aortic diseases may be diagnosed after a long period of subclinical development or they may have an acute presentation. Acute aortic syndrome is often the first sign of the disease, which needs rapid diagnosis and decision-making to reduce the extremely poor prognosis.

Recently, the Global Burden Disease 2010 project demonstrated that the overall global death rate from aortic aneurysms and AD increased from 2.49 per 100 000 to 2.78 per 100 000 inhabitants between 1990 and 2010, with higher rates for men.[1,2] On the other hand the prevalence and incidence of abdominal aortic

cult—but very important, because treatment of these emergency situations is very different. Thoracic- and abdominal aortic aneurysms (TAA and AAA, respectively) are often incidental findings, but screening programmes for AAA in primary care are progressively being implemented in Europe. As survival rates after an acute aortic event improve steadily, a specific section is dedicated for chronic AD and follow-up of patients after the acute phase of AAS. Special emphasis is put on genetic and congenital aortic diseases, because preventive measures play an important role in avoiding sub-

Importantly, this document highlights the value of a holistic approach, viewing the aorta as a 'whole organ'; indeed, in many cases (e.g. genetic disorders) tandem lesions of the aorta may exist, as illustrated by the increased probability of TAA in the case of AAA, making an arbitrary distinction between the two regions—with TAAs managed in the past by 'cardiovascular surgeons' and AAAs by 'vascular surgeons'—although this differentiation may exist in academic terms.

These Guidelines are the result of a close collaboration between physicians from many different areas of expertise: cardiology, radiology, cardiac and vascular surgery, and genetics. We have worked

Recommendations on interventions on ascending aortic aneurysms

Recommendations	Class[a]	Level[b]
Surgery is indicated in patients who have aortic root aneurysm, with maximal aortic diameter[c] ≥50 mm for patients with Marfan syndrome.	I	C
Surgery should be considered in patients who have aortic root aneurysm, with maximal ascending aortic diameters: • ≥45 mm for patients with Marfan syndrome with risk factors.[d] • ≥50 mm for patients with bicuspid valve with risk factors.[e,f] • ≥55 mm for other patients with no elastopathy.[g,h]	IIa	C
Lower thresholds for intervention may be considered according to body surface area in patients of small stature or in the case of rapid progression, aortic valve regurgitation, planned pregnancy, and patient's preference.	IIb	C
Interventions on aortic arch aneurysms		
Surgery should be considered in patients who have isolated aortic arch aneurysm with maximal diameter ≥55 mm.	IIa	C
Aortic arch repair may be considered in patients with aortic arch aneurysm who already have an indication for surgery of an adjacent aneurysm located in the ascending or descending aorta.	IIb	C
Interventions on descending aortic aneurysms		
TEVAR should be considered, rather than surgery, when anatomy is suitable.	IIa	C
TEVAR should be considered in patients who have descending aortic aneurysm with maximal diameter ≥55 mm.	IIa	C
When TEVAR is not technically possible, surgery should be considered in patients who have descending aortic aneurysm with maximal diameter ≥60 mm.	IIa	C
When intervention is indicated, in cases of Marfan syndrome or other elastopathies, surgery should be indicated rather than TEVAR.	IIa	C

Recommendations for surgical techniques in aortic disease

Recommendations	Class[a]	Level[b]	Ref.[c]
Cerebrospinal fluid drainage is recommended in surgery of the thoraco-abdominal aorta, to reduce the risk of paraplegia.	I	B	126–127
Aortic valve repair, using the re-implantation technique or remodelling with aortic annuloplasty, is recommended in young patients with aortic root dilation and tricuspid aortic valves.	I	C	
For repair of acute Type A AD, an open distal anastomotic technique avoiding aortic clamping (hemiarch/complete arch) is recommended.	I	C	
In patients with connective tissue disorders[d] requiring aortic surgery, the replacement of aortic sinuses is indicated.	I	C	
Selective antegrade cerebral perfusion should be considered in aortic arch surgery, to reduce the risk of stroke.	IIa	B	139,131, 134,141
The axillary artery should be considered as first choice for cannulation for surgery of the aortic arch and in aortic dissection.	IIa	C	
Left heart bypass should be considered during repair of the descending aorta or the thoraco-abdominal aorta, to ensure distal organ perfusion.	IIa	C	

Recommendation for (thoracic) endovascular aortic repair ((T)EVAR)

Recommendations	Class[a]	Level[b]
It is recommended that the indication for TEVAR or EVAR be decided on an individual basis, according to anatomy, pathology, comorbidity and anticipated durability, of any repair, using a multidisciplinary approach.	I	C
A sufficient proximal and distal landing zone of at least 2 cm is recommended for the safe deployment and durable fixation of TEVAR.	I	C
In case of aortic aneurysm, it is recommended to select a stent-graft with a diameter exceeding the diameter of the landing zones by at least 10–15% of the reference aorta.	I	C
During stent graft placement, invasive blood pressure monitoring and control (either pharmacologically or by rapid pacing) is recommended.	I	C
Preventive cerebrospinal fluid (CSF) drainage should be considered in high-risk patients.	IIa	C

EDITORIAL COMMENT

Extra-Aortic Identifiers to Guide Genetic Testing in Familial Thoracic Aortic Aneurysms and Dissections Syndromes

It Is All About the Company One Keeps*

Eloisa Arbustini, MD, Nupoor Narula, BS

Pavia, Italy

Journal of the American College of Cardiology

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Extra-aortic identifiers to guide genetic testing in familial thoracic aortic aneurysms and dissections syndromes: it is all about the company one keeps.

Arbustini E., Narula N.

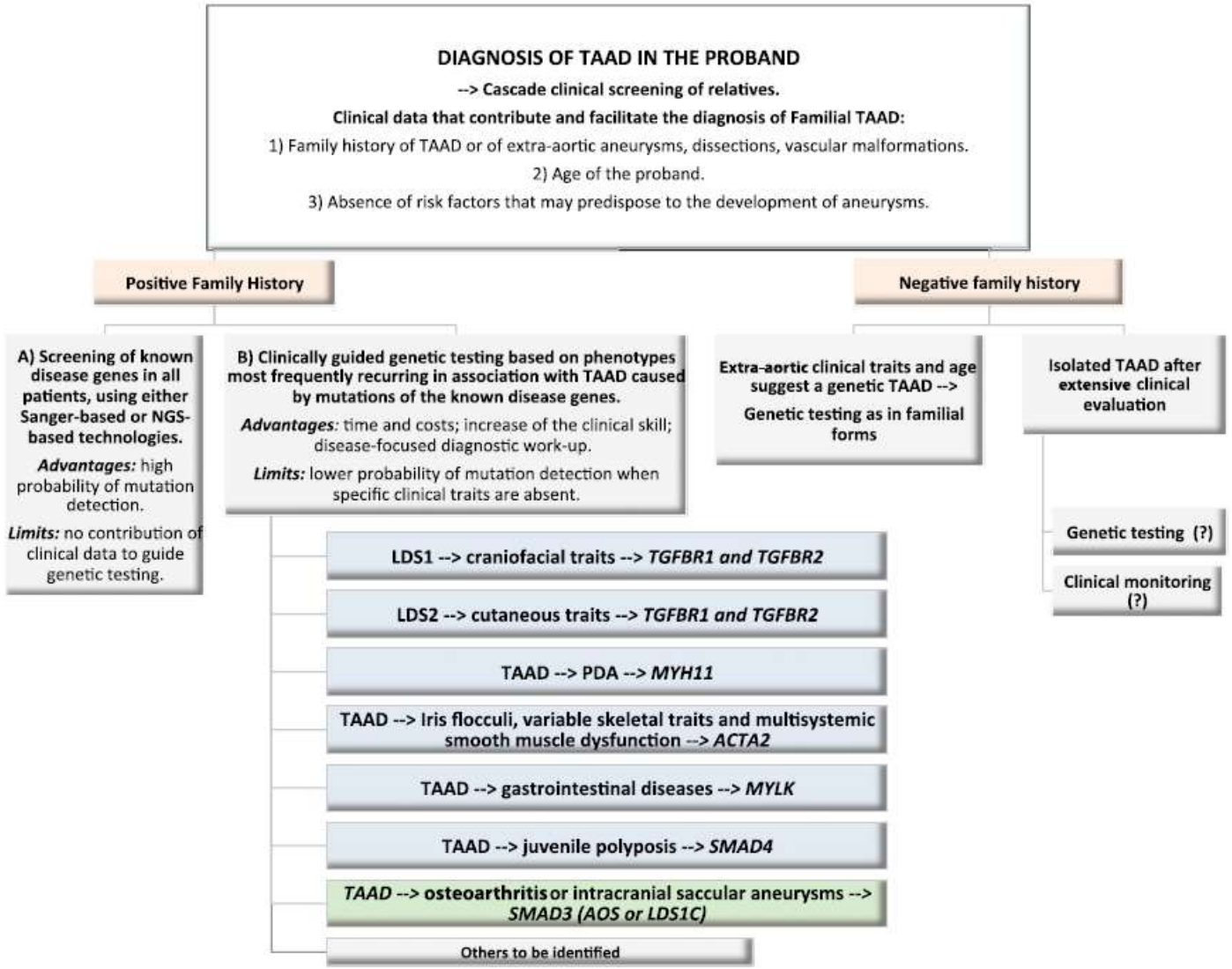

Figure 1 Flow Chart Illustrating the Diagnostic Workup for Clinical and Genetic Evaluation of TAADs

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Cotignola 24 Agosto 2010

Galasso Giovanni
Nato 14/11/1958
Consulenza e valutazione genetica

Indicazioni cliniche

Il Sig. Galasso Giovanni giunge alla consulenza genetica per aneurisma e dissecazione dell'aorta toracica (TAAD), familiarità materna positiva per ictus e morte improvvisa.
Il consultando acconsente a che i clinici di riferimento siano presenti alla consulenza genetica.
Buona conoscenza della situazione parentale materna e paterna.

Informazioni sulla patologia sospettata

Che cosa è la Sindrome da Dissecazione Aortica Aneurismatica (TAAD)?
La Sindrome di Dissecazione Aortica Aneurismatica (TAAD) definisce un gruppo di malattie genetiche rare che si trasmettono con modalita' autosomica dominante nelle forme familiari. La TAAD colpisce il tessuto connettivo e causa disorganizzazione e frammentazione delle fibre elastiche e danno delle cellule muscolari lisce della tonaca media, in particolare dei vasi arteriosi. Poichè il fenotipo è pressochè esclusivamente vascolare, la diagnosi è spesso difficile in quanto non sono presenti dismorfismi rilevabili dall'esame obiettivo.
La TAAD familiare si trasmette con modalità autosomica dominante, di genitore in figlio, con rischio 50% per ogni nuova gravidanza. La patologia si manifesta nell'età adulta o giovane adulta; non sono noti casi pediatrici. E' causata da geni che sono deputati alla formazione di proteine attive nelle cellule delle pareti vascolari, aortica in particolare, noti come MYH11 e ACTA2. Tra le cause genetiche devono essere considerate anche quelle correlate a mutazioni di due geni, il transforming growth factor beta receptor 1 (TGFBR1) e transforming growth factor beta receptor 2 (TGFBR2), le cui mutazioni causano le Sindromi di Loeys-Dietz di tipo I e II. La Sindrome di Loeys-Dietz di tipo II può non essere facilmente riconoscibile con una visita clinica; i pazienti posssono presentare quesi esclusivamente aneurismi aortici o arteriosi di altri distretti. La variante II può quindi essere confusa con TAAD.
E' importante sottolineare che la gravita' delle manifestazioni cliniche delle TAAD varia da persona a persona (anche nell'ambito della stessa famiglia): alcuni individui presentano sintomi lievi, mentre altri possono avere disturbi piu' importanti che devono essere presi in corretta considerazione per il monitoraggio e l'eventuale trattamento.

Famiglia

Il Sig. Galasso Giovanni è figlio terzogenito di genitori riferiti non consanguinei.
E' padre di due figli in abs, Girolamo di 26 anni e Angelo di 21 anni.
Fratria
Quattro germani:

- Antonia di 56 anni in abs, madre di due figli in abs;
- Carmela di 54 anni, con Ca mammario e miopia, madre di due figli in abs;
- Salvatore di 48 anni in abs, con miopia.
- Paolo di 42 anni presenta fenotipo caratterizzato da iperstaturalità (198 cm), scoliosi e cifosi, piede piatto, aracnodattilia, varici agli arti inferiori. Non ha mai eseguito controlli ecocardiografici

Famiglia materna
La madre, Sig.ra Lucia, di 78 è affetta da ipertensione arteriosa; all'età di 50 anni: ictus. 12

germani di cui 2 deceduti in seguito ad ictus, 2 con ictus deceduti improvvisamente, 6 deceduti in età avanzata per cause non note al consultando e due viventi in abs. Non informazioni sui nonni materni.
Famiglia paterna
Il padre è deceduto all'età di 70 anni in seguito a Ca polmonare; 4 germani paterni deceduti attorno ai 60 anni. La nonna è deceduta a 70 improvisamente. Il nonno è deceduto a più di 70 anni.

Data anamnestici del consultando

Anamnesi patologica remota
A 50 anni, dolori retrosternali sospetti per angina: coronarografia negativa.
Terapia con cardioaspirina.
Trauma ad un piede. Terapia steroidea.
Anamnesi recente
Il 6 Agosto 2010, alle 6.45 comparsa di violento dolore toracico. Riscontro di disecazione aortica di tipo A. Intervento di sostituzione della radice ed aortca ascendente (David I).

Valutazione fenotipica

Normotipo
Apparato scheletrico
Non tratti fenotipici sospetti per MFS o LDS.

Apparato oculare
Non altri problemi oculari
Non sclere blu.

Fenotipo craniofaciale
Non evidenti difetti della linea mediana
Non Ipertelorismo

Apparanto integumentale
Non strie cutanee significative
Non lassità cutanea
Non easy bruising
Non ernie.

Non Ipoacusia

Apparato cardiovascolare
Esiti di intervento secondo David I.

Non eseguita RM lombosacrale; manca quindi il dato relativo all'eventuale presenza di ectasia durale. Non sintomi sospetti per ectasia durale o cisti radicolari.

Conclusioni

L'insieme dei dati clinici-anamnestici del probado suggeriscono l'ipotesi clinica di un TAAD il cui carattere familiare non appare accertabile. Sulla base del fenotipo, non vengono raggiunti I criteri di Ghent per la diagnosi clinica di Sindrome di Marfan. Non sono presenti tratti fenotipici suggestivi per sindromi di Loeys-Dietz ed EDS IV.

L'ipotesi di test genetico comprende in prima istanza la valutazione di due geni associati a TAAD (MYH11 e ACTA2). Non appare appropriato il test genetico per FBN1. Circa I geni TGFBR1 e TGFBR2, la possibilità di una loro valutazione sarà presa in considerazione dopo il primi due test in caso di negatività. Questo alla luce di recenti segnalazioni di associazione tra TAAD e mutazioni di TGFBR1 e TGFBR2.

Eloisa Arbustini

Table 28. Genetic Syndromes Associated With Aortic Aneurysms

Disease entity	Responsible genes	Mode of inheritance	Accompanying signs and symptoms
Frequently associated with aortic aneurysms			
Marfan syndrome	*FBN1*	Autosomal dominant	Skeletal features: Arachnodactyly, scoliosis, thoracic deformity
			Lens subluxation
Loeys-Dietz syndrome	*TGFBR1, TGFBR2*	Autosomal dominant	Ocular hypertelorism
			Cleft palate/bifid uvula
			Arterial tortuosity
			Marfanoid habitus
			Craniosynostosis
			Aneurysms of medium- and small-sized arteries including cerebral arteries
Vascular Ehlers-Danlos syndrome	*COL3A1*	Autosomal dominant	Translucent skin
			Easy bleeding
			Tissue fragility: Intestinal rupture, Uterine rupture, Blood vessel rupture
Turner syndrome	X chromosome monosomy	Chromosomal defect	Gonadal dysgenesis
			Bicuspid aortic valve
			Aortic coarctation
			Characteristic habitus: Short stature, webbed neck, shield chest
Occasionally associated with aortic aneurysms			
Polycystic kidney disease	*PKD1, PKD2*	Autosomal dominant	Polycystic kidney
			Cerebral aneurysm
Noonan syndrome	*PTPN11, KRAS, RAF1, SOS1*	Autosomal dominant	Characteristic facial features
			Congenital cardiac anomaly
			Webbed neck
Alagille syndrome	*JAG1, NOTCH2*	Autosomal dominant	Hepatic dysfunction
			Pulmonary artery stenosis
			Vertebral body defect
			Ocular abnormalities (posterior embrotoxon)
Arterial tortuosity syndrome	*SLC2A10*	Autosomal recessive	Generalized tortuous arteries
			Joint hypermobility
			Hyperextensible skin
			Characteristic facial features
Cutis laxa	*ELN, FBLN4*	Autosomal dominant, Autosomal recessive	Loose skin

More than 18 Syndromes

Marfan Syndrome

GHENT CRITERIA

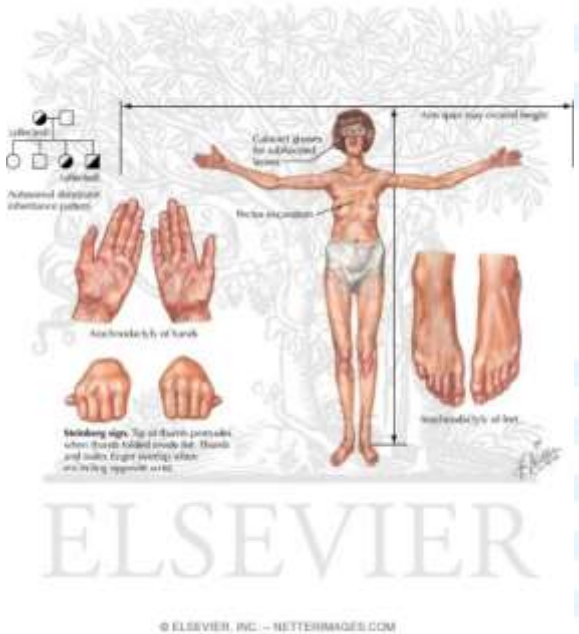


Table 24. Revised Ghent Criteria for Diagnosis of Marfan Syndrome and Marfan-Like Disorders

In the absence of family history:

(1) Aortic root lesions[1] (Z ≥2) and ectopia lentis → "Marfan syndrome"*

(2) Aortic root lesions (Z ≥2) and an *FBN1* mutation[2] → "Marfan syndrome"

(3) Aortic root lesions (Z ≥2) and systemic features (≥7 points) → "Marfan syndrome"*

(4) Ectopia lentis and an *FBN1* mutation associated with aortic lesions[3] → "Marfan syndrome"

- When there is no *FBN1* mutation associated with aortic lesions even in the presence of ectopia lentis, it is diagnosed as "ectopia lentis syndrome" regardless of systemic features.
- When aortic root lesions are mild (Z <2 at the Valsalva sinus) with systemic features (≥5 points plus skeletal features) but without ectopia lentis, it is diagnosed as "MASS".[4]
- When aortic root lesions are mild (Z <2 at the Valsalva sinus) with mitral valve prolapse but without either systemic features (<5 points) or ectopia lentis, it is diagnosed as "mitral valve prolapse syndrome".

In the presence of family history:[5]

(5) Ectopia lentis and family history → "Marfan syndrome"

(6) Systemic features (≥7 points) and family history → "Marfan syndrome"*

(7) Aortic root lesion (Z ≥2 in patients aged 20 or older and Z ≥3 in patients aged less than 20) and family history → "Marfan syndrome" *

*Diagnosis in these cases requires differentiation from Shprintzen-Goldberg syndrome, Loeys-Dietz syndrome, and vascular Ehlers-Danlos syndrome, which resemble Marfan syndrome, and after *TGFBR1/TGFBR 2*, *COL3A1* testing, collagen biochemistry, if indicated. Other conditions or genes will emerge with time.

[1]Aortic root lesions: Enlargement of the aortic diameter at the Valsalva sinus (determined by Z scores) or aortic root dissection

[2]*FBN1* mutation: Defined in a separate table (details not included)

[3]*FBN1* mutation associated with aortic lesions: *FBN1* mutation that has been identified in patients with aortic lesions

[4]MASS: A combination of myopia, mitral valve prolapse, borderline aortic root dilatation (Z <2 at the Valsalva sinus), skin striae, and skeletal phenotypes

[5]Family history: Positive family history with a proband independently diagnosed using criteria (1) to (4) above

Scores of systemic features (Maximum 20 points, positive when points are 7 or more.)

- Wrist and thumb sign: 3 points (wrist or thumb sign: 1 point)
- Pectus carinatum: 2 points (pectus excavatum or chest asymmetry: 1 point)
- Hindfoot deformity: 2 points (pes planus only: 1 point)
- Pneumothorax: 2 points
- Dural ectasia: 2 point
- Protrusio acetabuli: 2 points
- Reduced upper segment/lower segment ratio and increased arm span/height ratio without severe scoliosis: 1 point
- Scoliosis or thoracolumbar kyphosis: 1 point
- Reduced elbow extension: 1 point
- Facial features (3/5) (dolichocephaly, enophthalmos, downslanting palpebral fissures, malar hypoplasia, retrognathia): 1 point
- Skin striae: 1 point
- Myopia (>3 diopters): 1 point
- Mitral valve prolapse: 1 point

Marfan Syndrome

Table 23. Characteristic Features of Marfan Syndrome	
Skeletal:	Tall stature, long extremities, arachnodactyly, scoliosis, pectus excavatum, pectus carinatum, joint hyperextension
Cardiovascular:	Mitral valve prolapse, aortic valve insufficiency, aortic aneurysm, aortic dissection
Ocular:	Myopia, ectopia lentis, lens subluxation, retinal detachment
Others:	Dural ectasia, spontaneous pneumothorax

Table 25. Treatment for Cardiovascular Lesions in Marfan Syndrome

Class I
1. Regular cardiovascular assessment by imaging (Level of Evidence: C)
2. Use of β-blockers to prevent enlargement of the aortic diameter (Level of Evidence: C)
3. Consider exercise limitation (Level of Evidence: C)

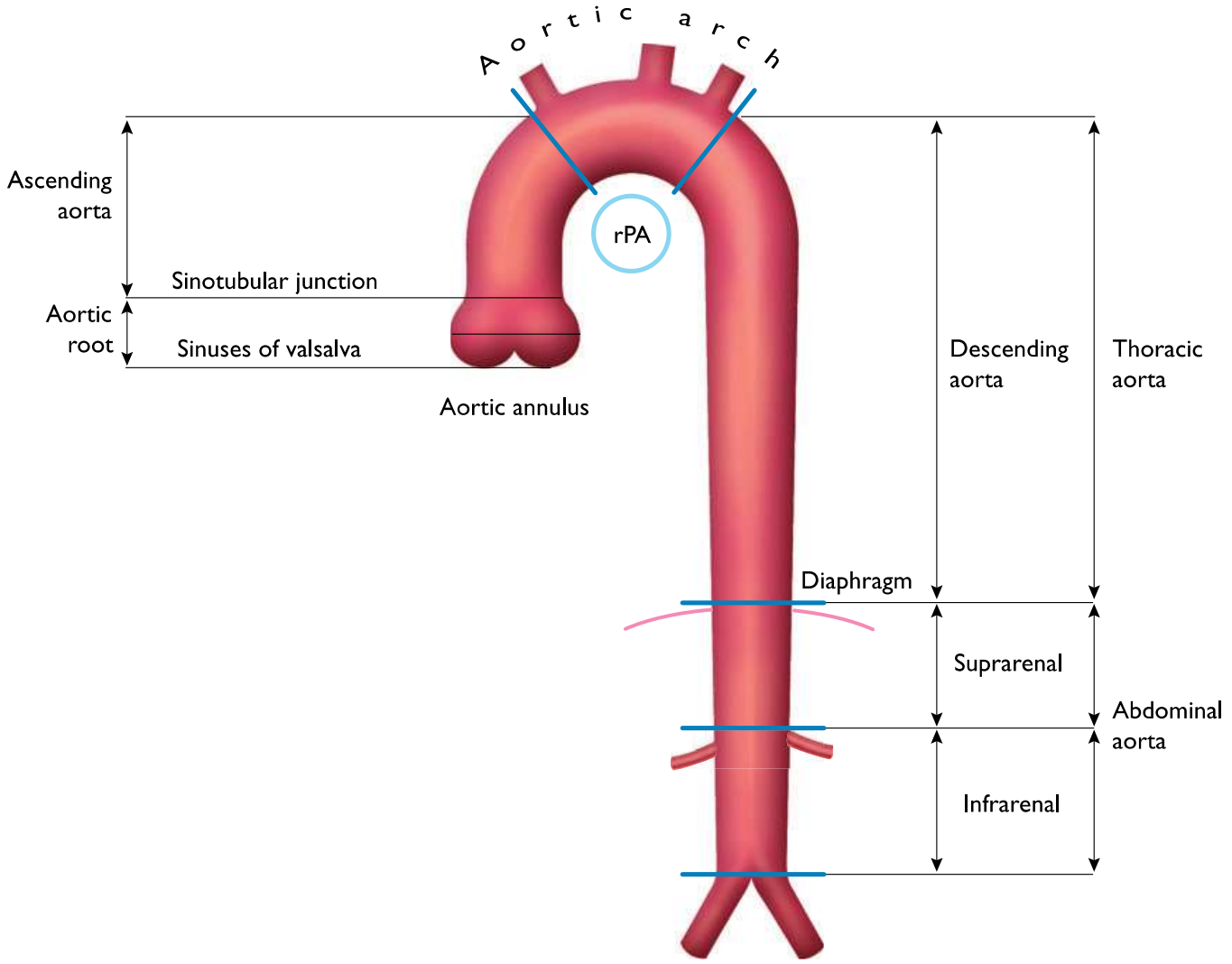
Class IIa
1. Use of β-blockers to prevent aortic dissection (Level of Evidence: C)
2. Use of antibiotics in procedures such as tooth extraction in the presence of valvular disease (Level of Evidence: C)
3. Aortic root replacement when aortic root diameter exceeds 45 mm (Level of Evidence: C)
4. Aortic root replacement in an individual with a history or family history of dissection when aortic root diameter is 40 mm or greater (Level of Evidence: C)
5. Aortic root replacement in women contemplating pregnancy when aortic root diameter is 40 mm or greater (Level of Evidence: C)

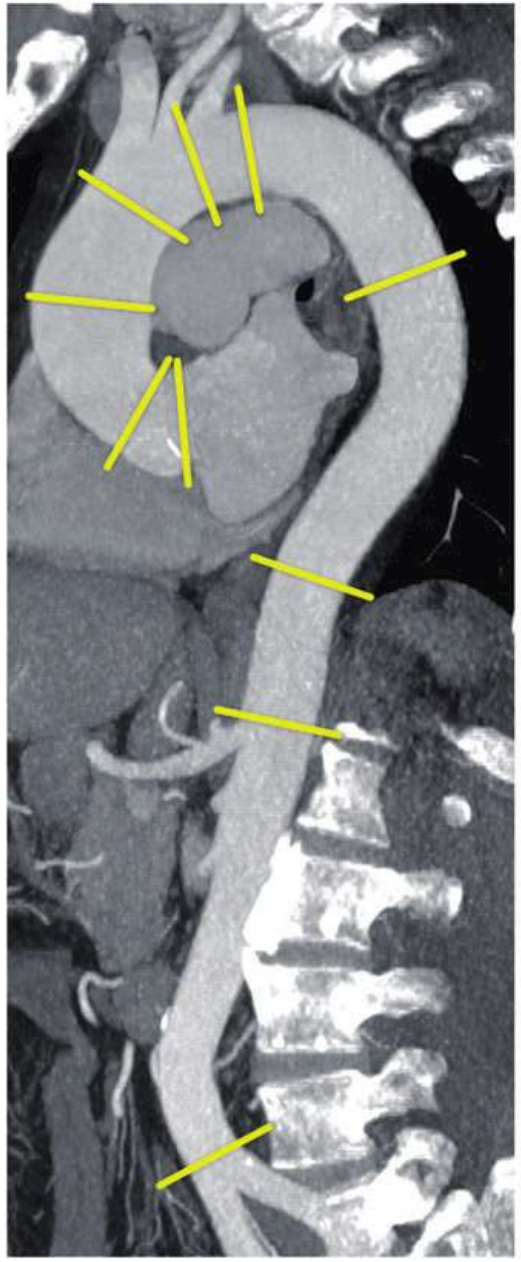
Loeys-Dietz Syndrome

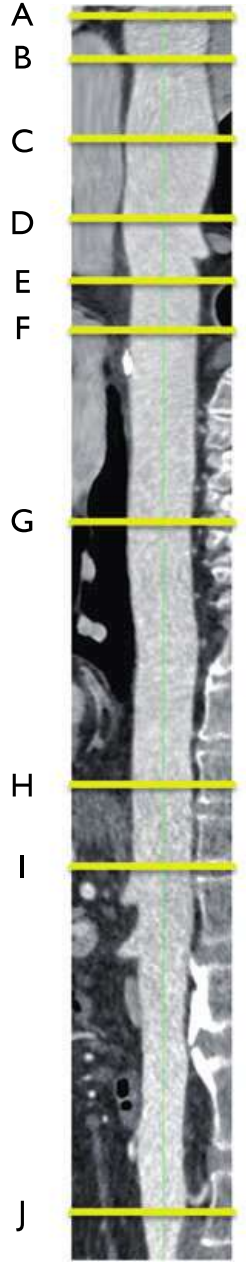
- Tortuous lesions of systemic arteries (aortic aneurysm in 98% of patients)
- Compare to Marfan patients are younger and arterial dissection occurs with smaller vascular diameter
- Diagnosis made by gene analysis

Ehlers-Danlos Syndrome

- Easy bleeding, dissection or rupture of large and small arteries because of severe tissue frialty
- Gastrointestinal perforation and organ rupture
- Delayed wound healing


Aortic arch
Ascending aorta
rPA
Sinotubular junction
Aortic root
Sinuses of valsalva
Aortic annulus
Descending aorta
Thoracic aorta
Diaphragm
Suprarenal
Abdominal aorta
Infrarenal

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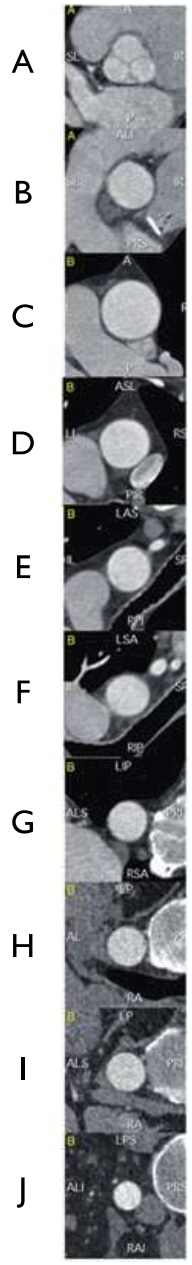
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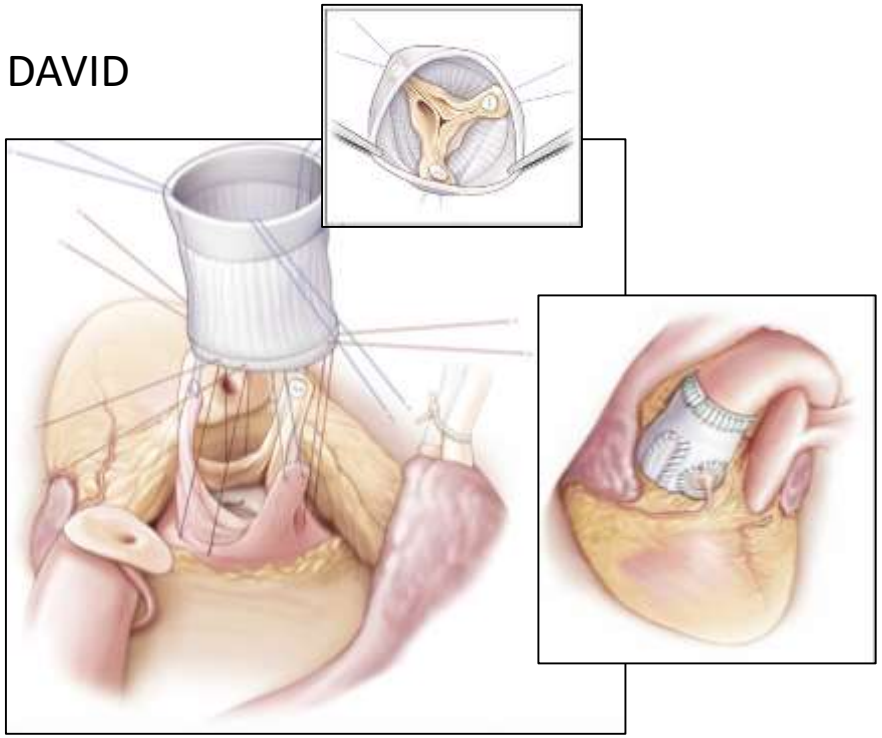
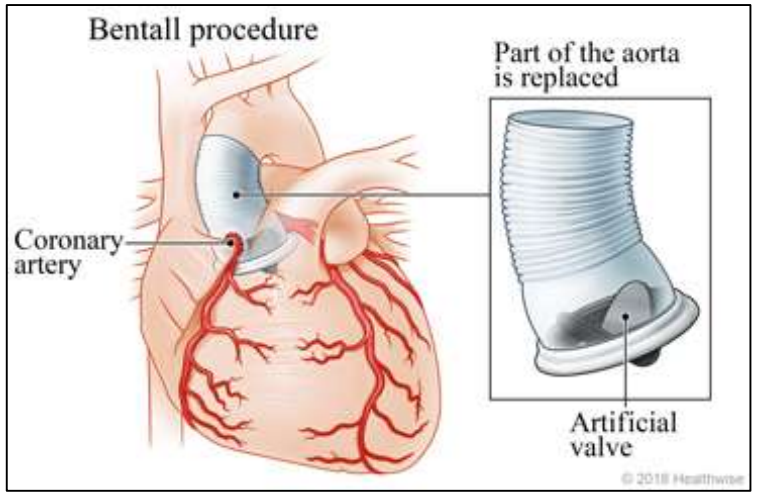
La chirurgia negli aneurismi aortici: differenti approcci per differenti patologie

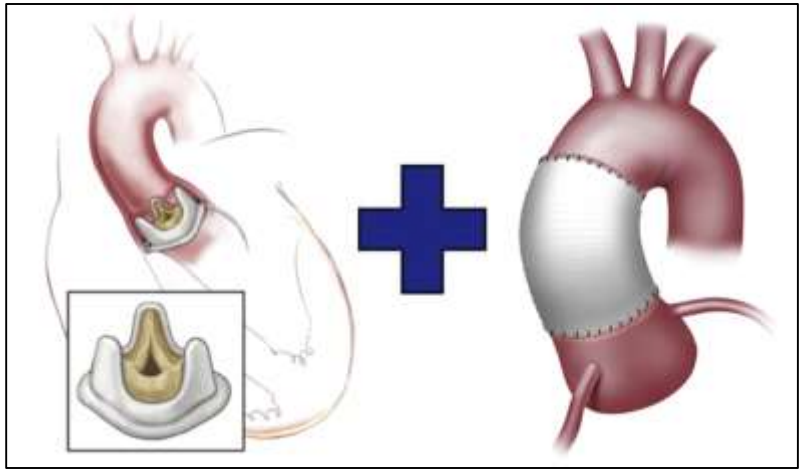
DAVID



BENTALL



WHEAT



Surgical Treatment

EDITORIAL COMMENT

Extra-Aortic Identifiers to Guide Genetic Testing in Familial Thoracic Aortic Aneurysms and Dissections Syndromes

It Is All About the Company One Keeps*

Eloisa Arbustini, MD, Nupoor Narula, BS

Pavia, Italy

surgery. While waiting for evidence-based clinical data, the authors recommend the application of surgical recommendations for LDS (22), with valve-sparing aortic root replacement as the intervention of choice (23). As discussed above,

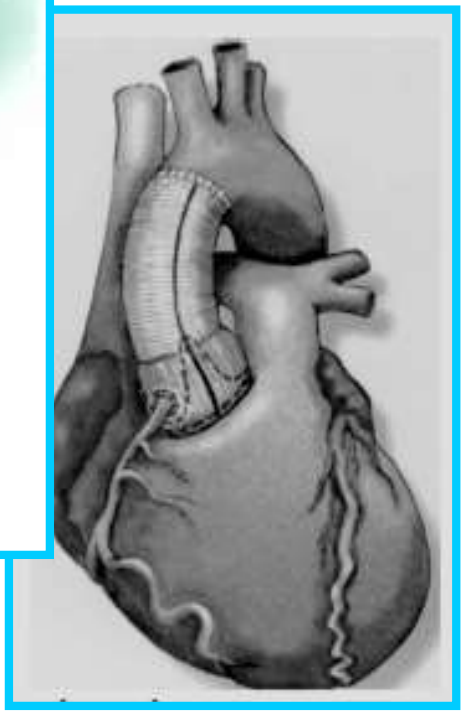
22. Hiratzka LF, Bakris GL, Beckman JA, et al. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM guidelines for the diagnosis and management of patients with thoracic aortic disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine. J Am Coll Cardiol 2010;55: e27–129.

23. Patel ND, Arnaoutakis GJ, George TJ, et al.Valve-sparing aortic root replacement in Loeys-Dietz syndrome. Ann Thorac Surg 2011;92: 556–60.

“replacement” (BENTALL)

TUBO VALVOLATO MECCANICO

Protesi stented



TUBO VALVOLATO BIOLOGICO

Valve Sparing Operation

Introduced by

T E David in 1992

Aortic Valve Repair: The Functional Approach to Leaflet Prolapse and Valve-Sparing Surgery

Hugues Jeanmart, MD, Laurent de Kerchove, MD, David Glineur, MD, Jean-Michel Goffinet, MD, Ishan Rougui, MD, Michel Van Dyck, MD, Philippe Noirhomme, MD, and Gebrin El Khoury, MD

Type I. Normal appearing cusps with FAA dilation.

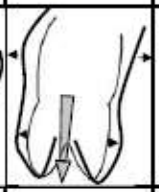
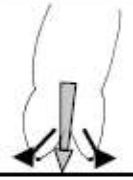
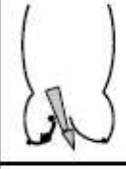
Ia: Ascending aorta dilation (starting at the sinotubular junction)
Ib: Valsalva sinuses and sinotubular junction dilation
Ic: FAA dilatation
Id: Cusp perforation

Type II. Cusp prolapse: excess of cusp tissue, or commissural disruption
Type III. Cusp retraction and thickening

(Ann Thorac Surg 2007;83:S746–51)

Introduced by

El Khoury in 2005

AI Class	Type I Normal cusp motion with FAA dilatation or cusp perforation				Type II Cusp Prolapse	Type III Cusp Restriction
	Ia	Ib	Ic	Id		
Mechanism						
Repair Techniques (Primary)	STJ remodeling *Ascending aortic graft*	Aortic Valve sparing: *Reimplantation or Remodeling with SCA*	SCA	Patch Repair *Autologous or bovine pericardium*	Prolapse Repair *Plication Triangular resection Free margin Resuspension Patch*	Leaflet Repair *Shaving Decalcificatio Patch*
(Secondary)	SCA		STJ Annuloplasty	SCA	SCA	SCA

Repair-oriented classification of aortic insufficiency: Impact on surgical techniques and clinical outcomes

Munir Boodhwani, MD, MMSc, Laurent de Kerchove, MD, David Glineur, MD, Alain Poncelet, MD, Jean Rubay, MD, Parla Astarci, MD, Robert Verhelst, MD, Philippe Noirhomme, MD, and Gébrine El Khoury, MD

The Journal of Thoracic and Cardiovascular Surgery • February 2009

Valve-sparing Operations

David TE, 1992 JTCS

DAVID I

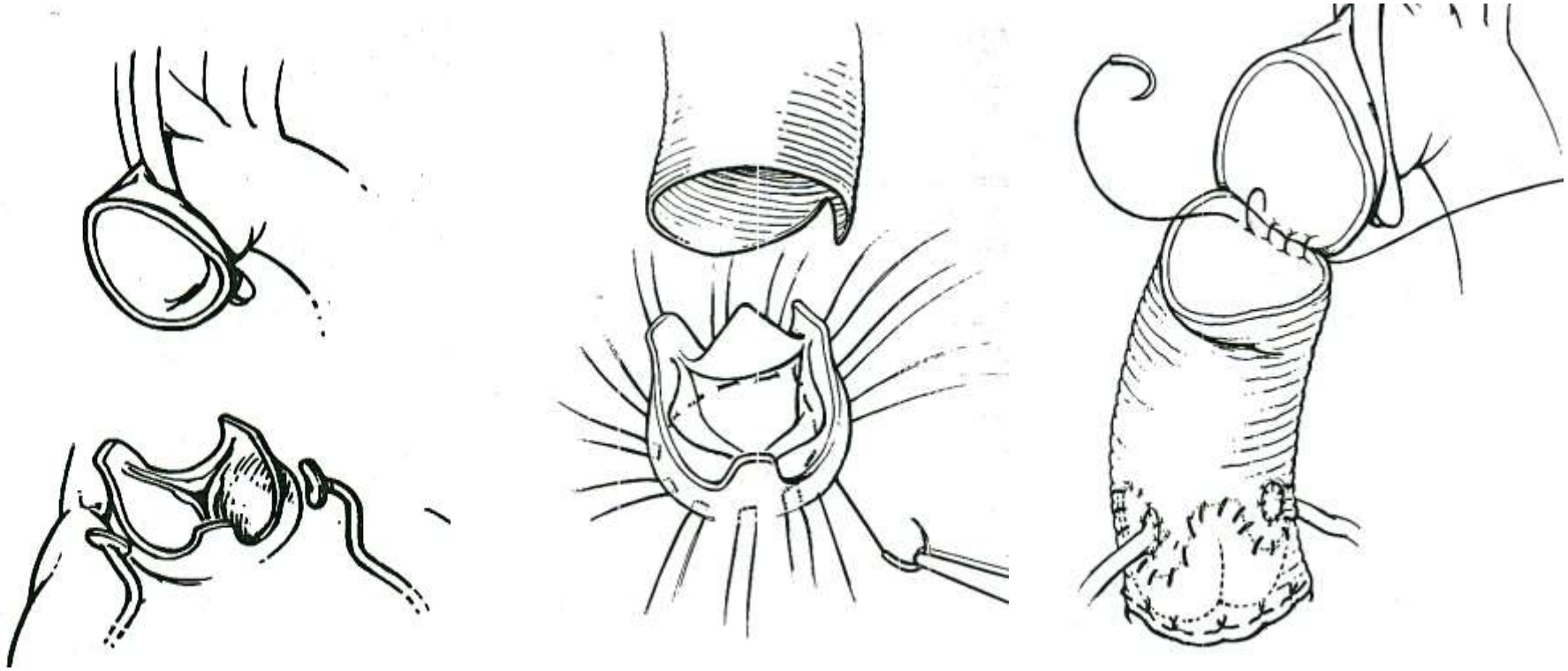
DAVID II

DAVID III

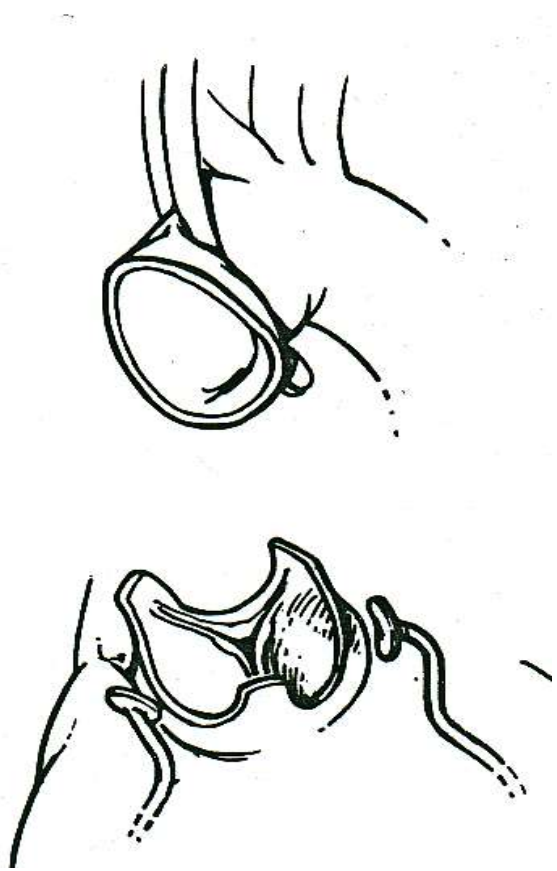
DAVID IV

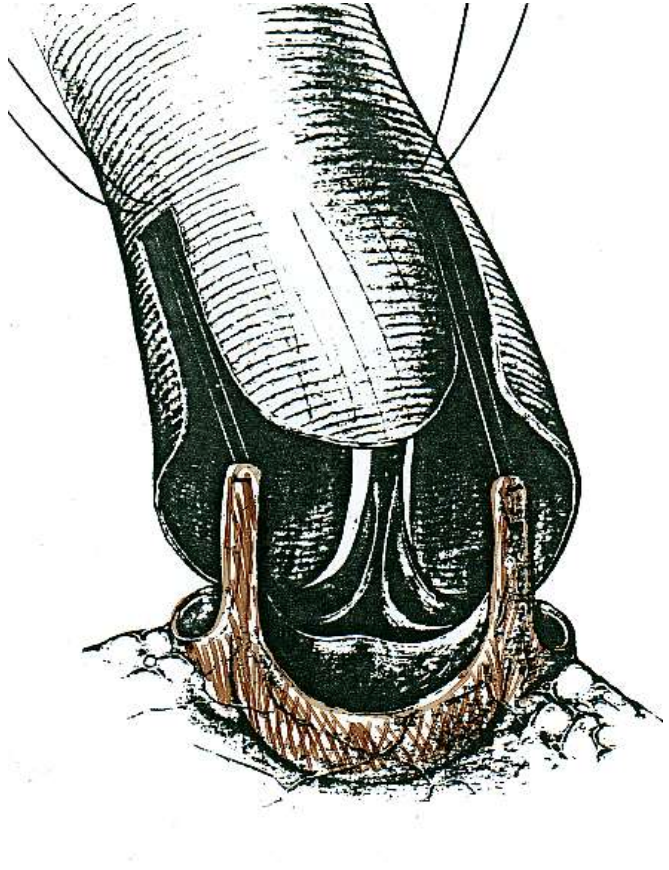
DAVID V

Valve-sparing operation
Reimplantation (David I, 1992)



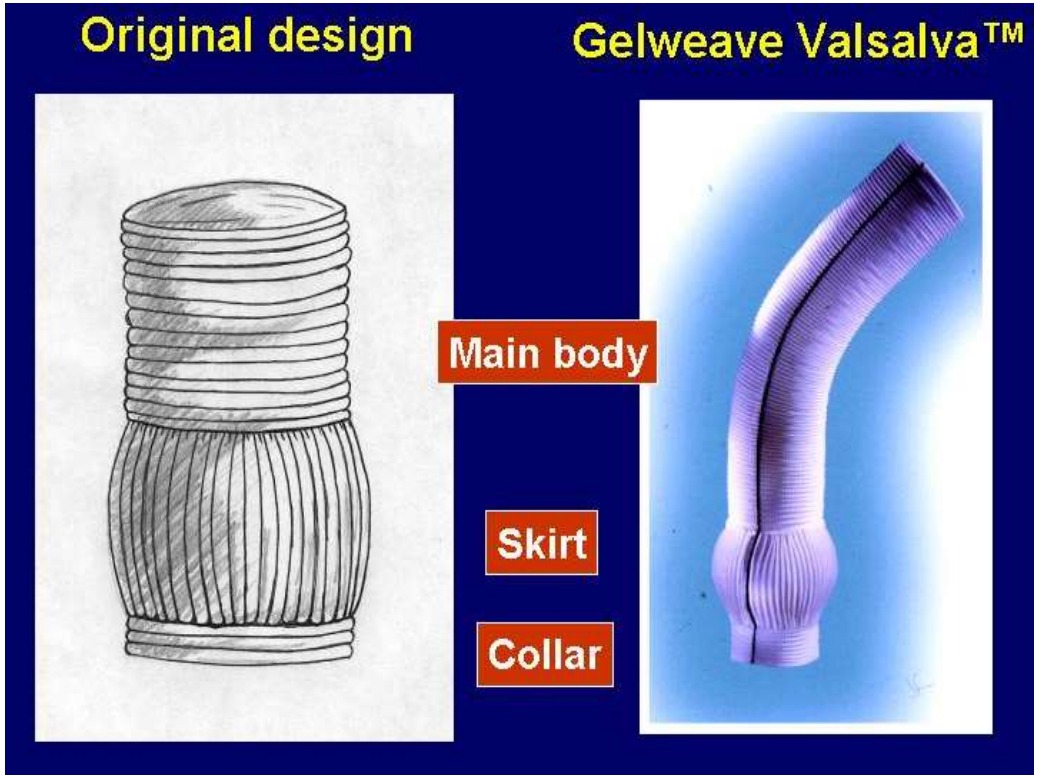
Valve-sparing operation
Remodeling – David II
(Yacoub, 1979)





One-piece designed prosthesis

GETINGE CARDIOROOT

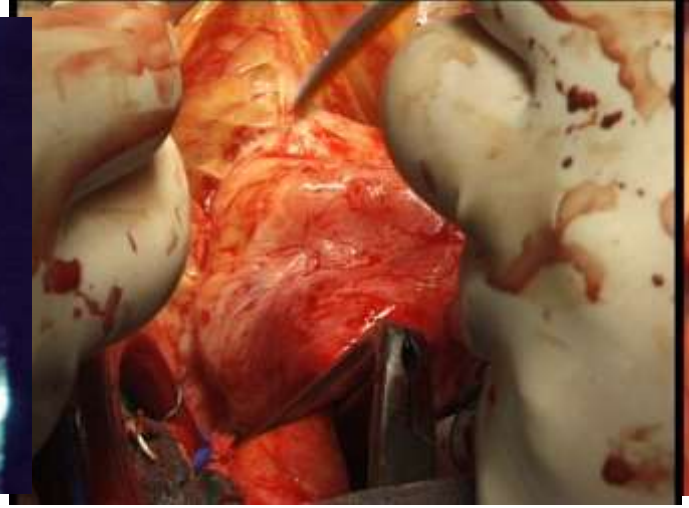


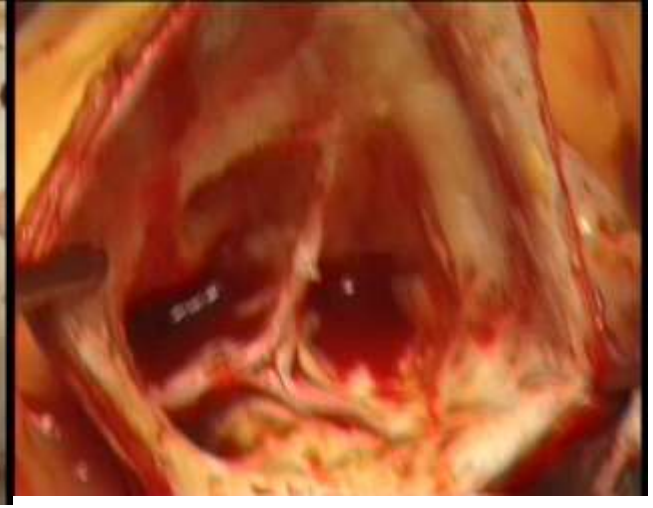
Concepts of aortic valve surgical repair

a logic connection

lesion → dysfunction

Lesion correction → dysfunction correction





dysfunction

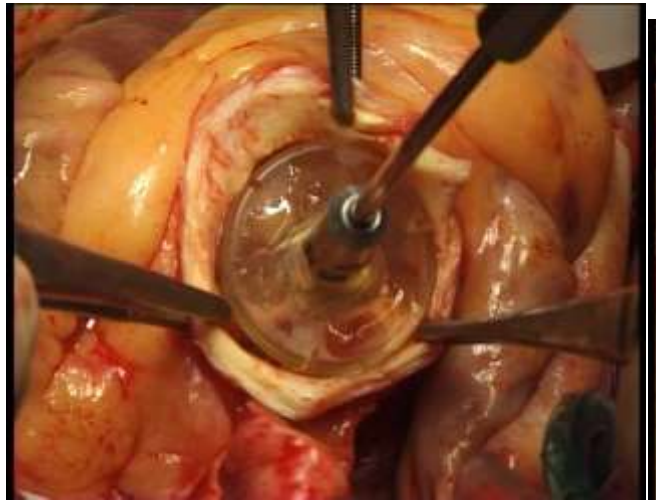
lesion

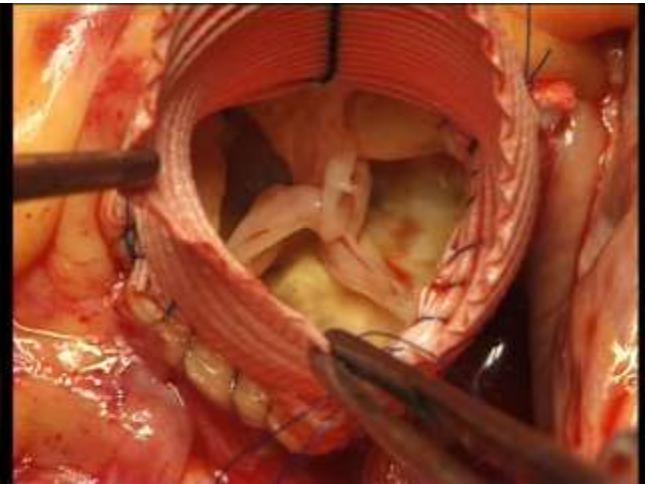
surgery

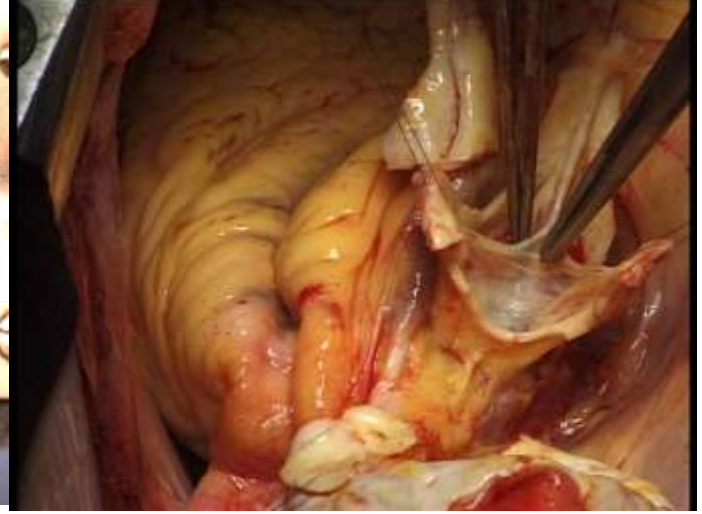
I a

STJ dilatation

David IV







disfunction

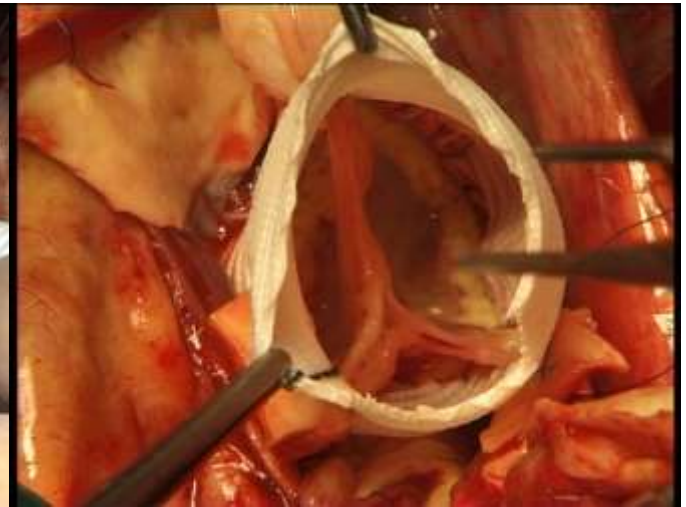
lesion

surgery

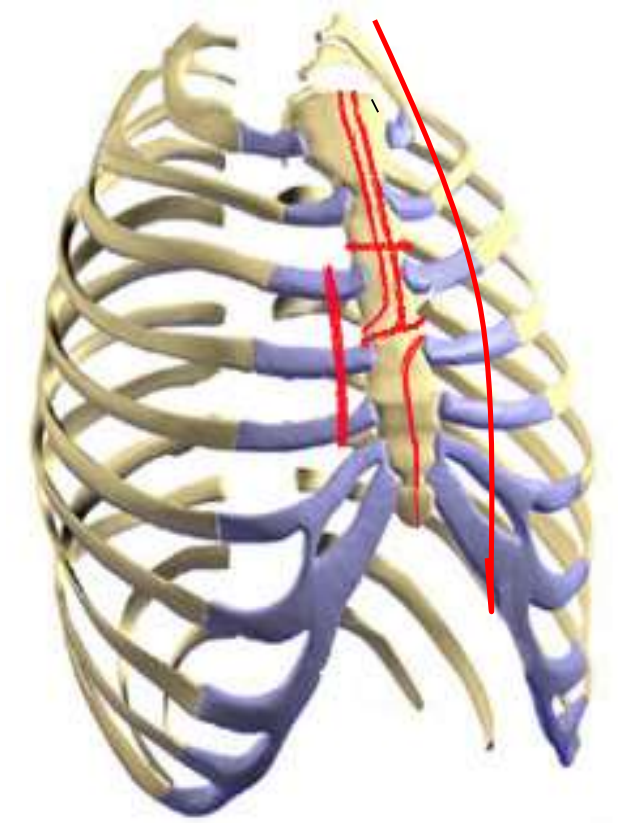
I b

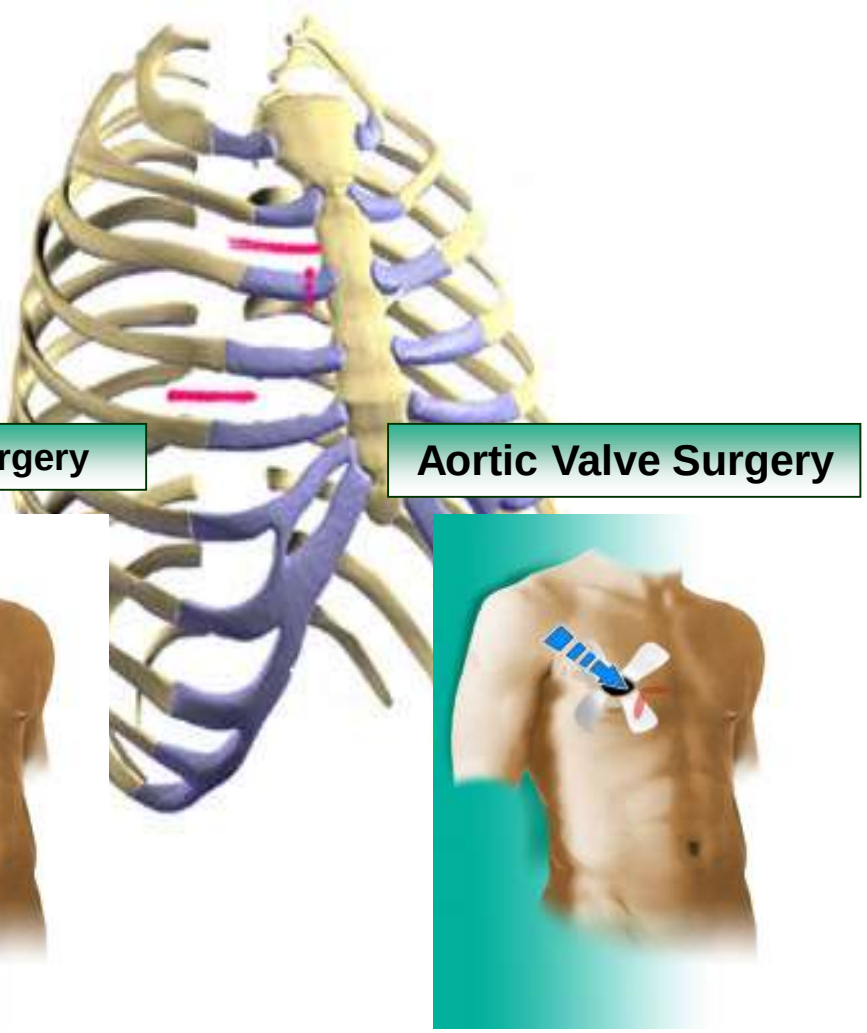
Sinuses Aneurism

David II



Conventional and minimally invasive incisions





AORTIC ROOT MINI-STERNOTOMY

State-of-the-art - Cardiac general

Ministernotomy approach for surgery of the aortic root and ascending aorta

Sossio Perrotta[a,*], Salvatore Lentini[b]

[a]Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, 413 45, Gothenburg, Sweden
[b]Department of Cardiac Surgery, University Hospital 'G Martino', Messina, Italy

Received 30 March 2009; received in revised form 30 June 2009; accepted 15 July 2009

Interactive CardioVascular and Thoracic Surgery 9 (2009) 849-858

1141 Medline articles
186 Cochrane articles
514 CINAHL database articles

50 articles with the following cases:
*Tabata: 79
*Byrne: 44
*Perrotta: 40 (Bentall)
*Sun: 16
*Svensson: 69 + 54

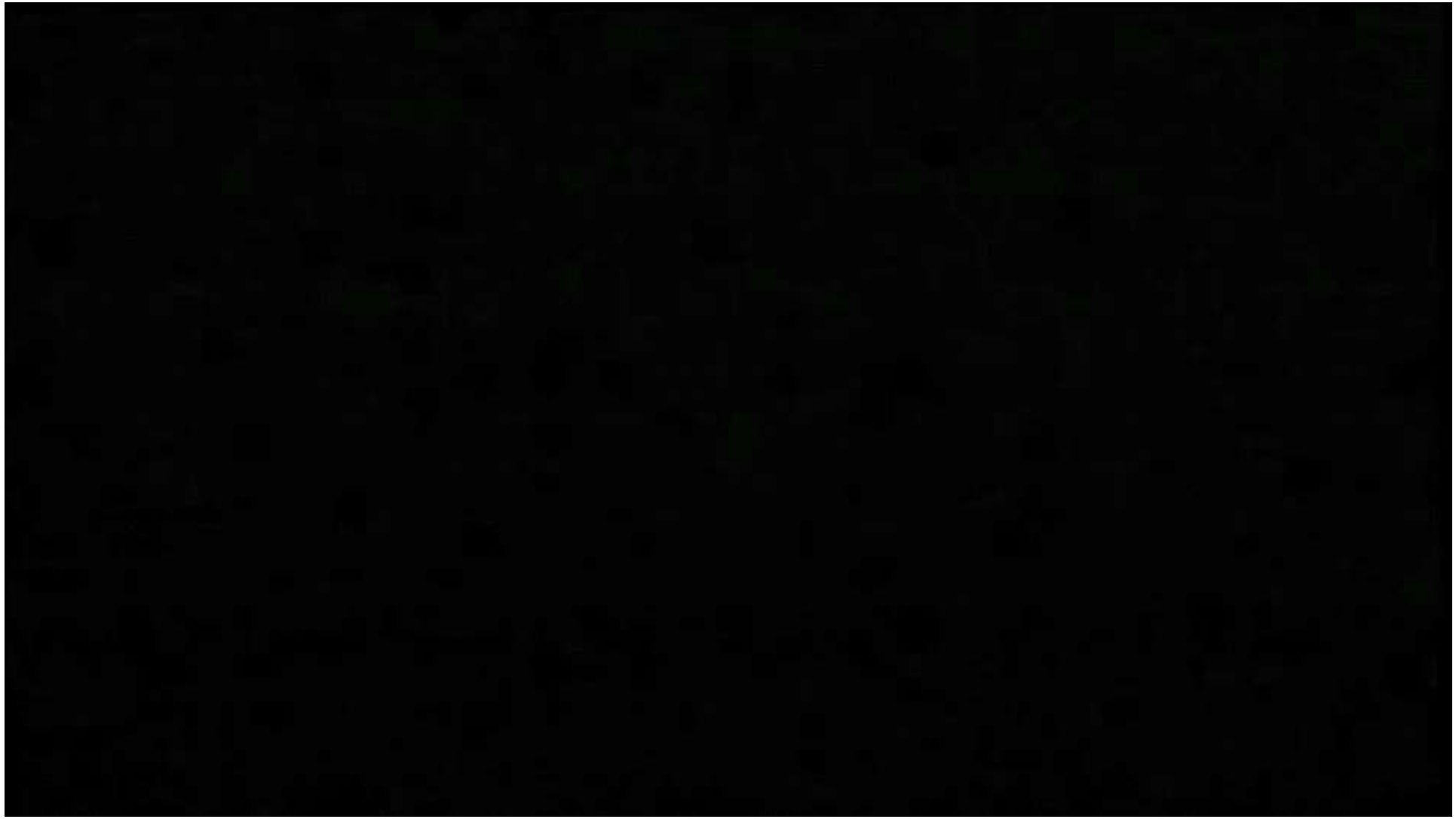
- Surgery of the aortic root via mini-sternotomy is SAFE, however there are not enough studies comparing minimally invasive access and conventional sternotomy
- Few reports in literature on ROOT REMODELING or REIMPLANTATION through mini-sternotomy


METRIC INCHES
Devon OR Products & Safety Solutions
Measurement device is not calibrated. Use for approx. measurement only.
MADE IN U.S.A.


CM
1
2
3
4
5
6
7
8
INCHES
1
2
3
MEDLINE

AORTIC ROOT REIMPLANTATION (DAVID I)

via MINI-STERNOTOMY



2010

CONCLUSIONS

Each patient with TAADs of unknown cause should be potentially affected by other syndromes (es aneurysm-osteoarthritis): the simple clinical evaluation may reinforce the clinical suspicion and

ADDRESSES GENETIC TESTING

CONCLUSIONS

Relatives should undergo clinical screening.

When the causative mutation is identified, cascade GENETIC TESTING IS INDICATED IN FAMILIES

CONCLUSIONS

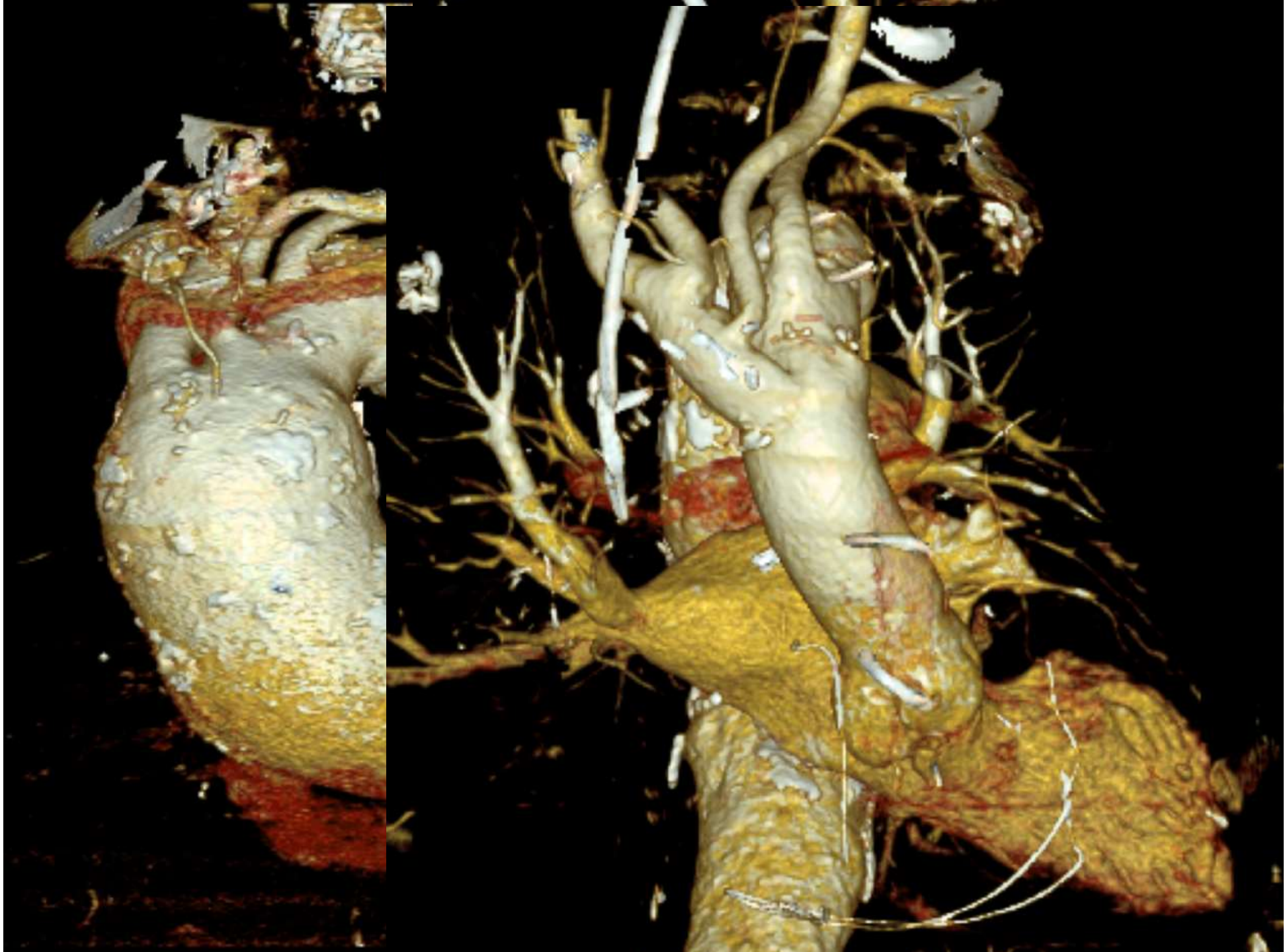
(although waiting for evidence-based data) the transforming growth factor (TGF) antagonists could be useful for delaying the progression of aortic dilatation:

ANGIOTENSIN RECEPTOR BLOCKERS

CONCLUSIONS

Our data confirms that MIC is a safe alternative for patients requiring isolated aortic valve replacement or aortic root surgery

THORACOSCOPY

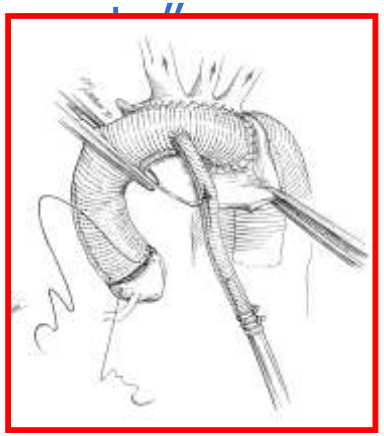


H. BORST

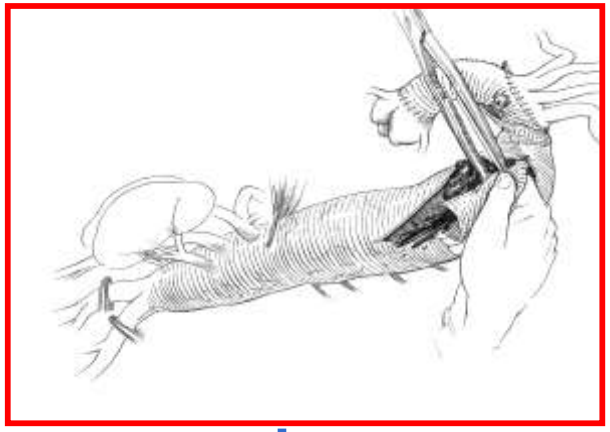
1982 – THE BIRTH OF THE ELEPHANT TRUNK

Reflections of Borst

- ✓ The problem: 2 patients with mega-aorta syndrome
- ✓ Solution: "Decided to replace the aortic arch with a long graft, whose free ' 'elephant trunk' ' extension was to be suspended freely in the distal



1 st stage

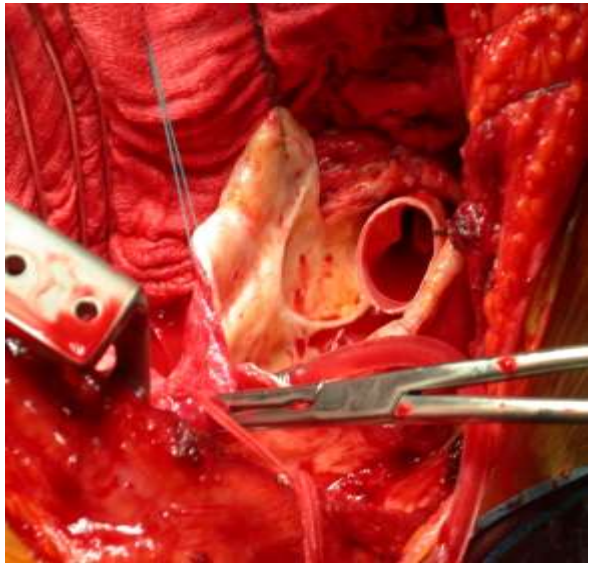


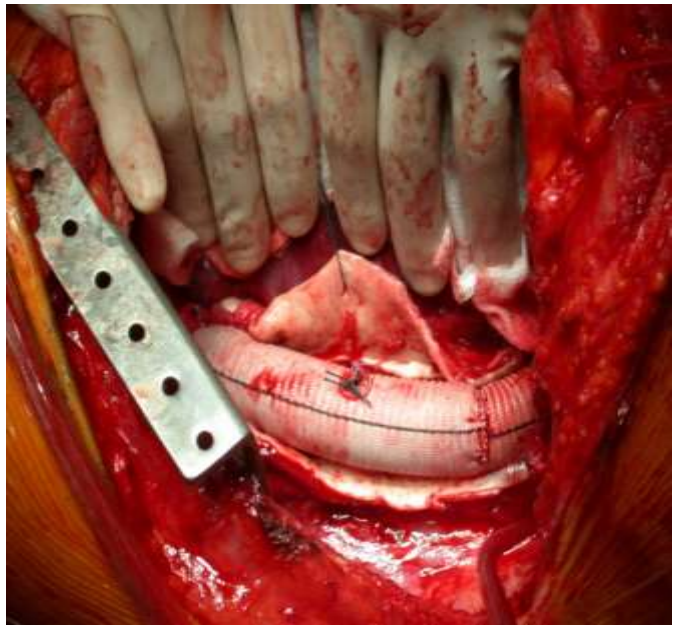
2 nd stage

Elephant Trunk Technique

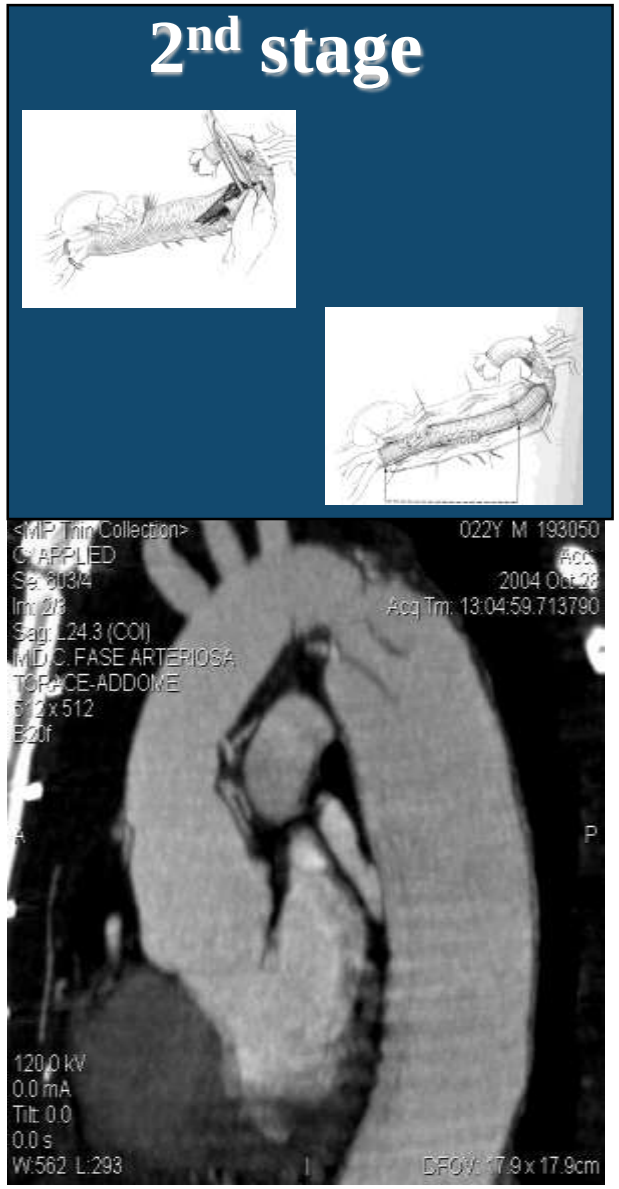
2nd stage

During the 2° stage it avoids hazardous dissection of the distal aortic arch and facilitates the prosthesis-to-prosthesis anastomosis





Elephant Trunk Technique



A development of the classic elephant trunk technique is the combination of an endovascular stent graft with a conventional surgical graft for hybrid procedures of the entire thoracic aorta. This new option was termed:

Frozen elephant trunk

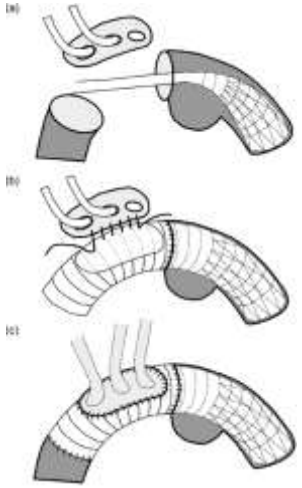
Kark M,Haverich A, et al. *The frozen elephant trunk technique: a new treatment for thoracic aortic aneurysms*. J Thorac Cardiovasc Surg 2003; 125:1550-3

THE TRUNK EVOLUTION

1982

Birth of ET

1992
ET modified distal suture
Crawford-Svensson



2003
Birth of FET
Chavan-Haverich

Today

2007
FET Hybrid graft

2012
Branched FET

Key-points

Aortic anatomy assessment

Organ protection

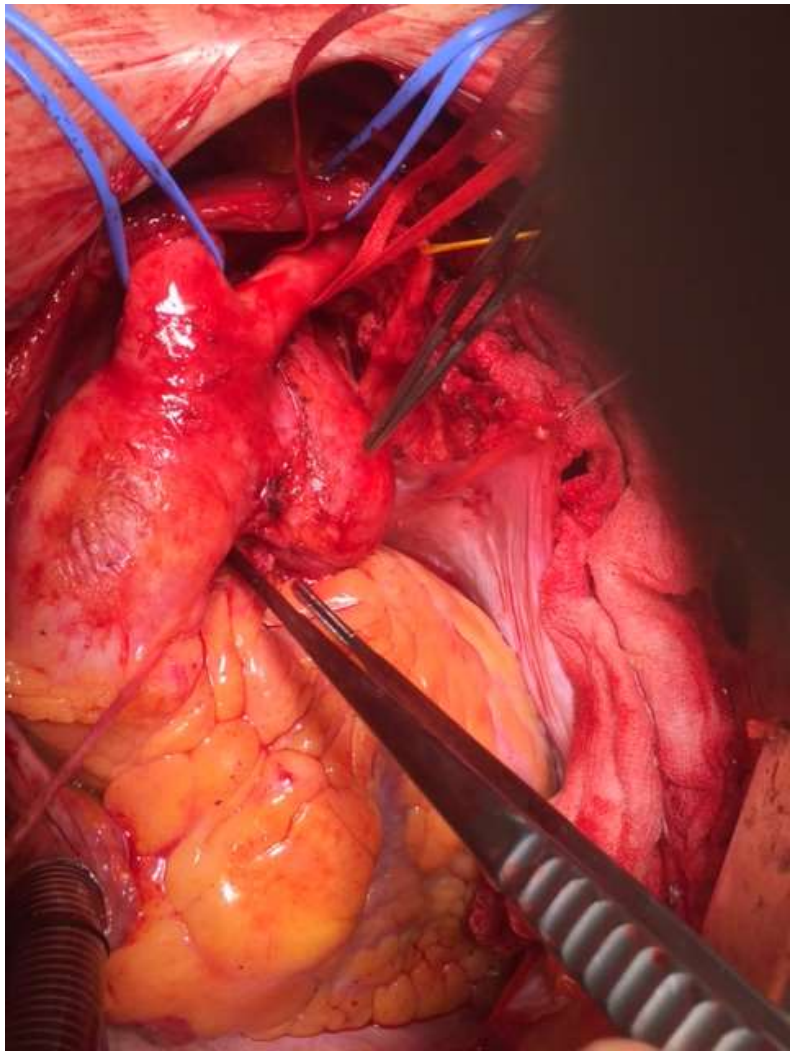
Myocardial

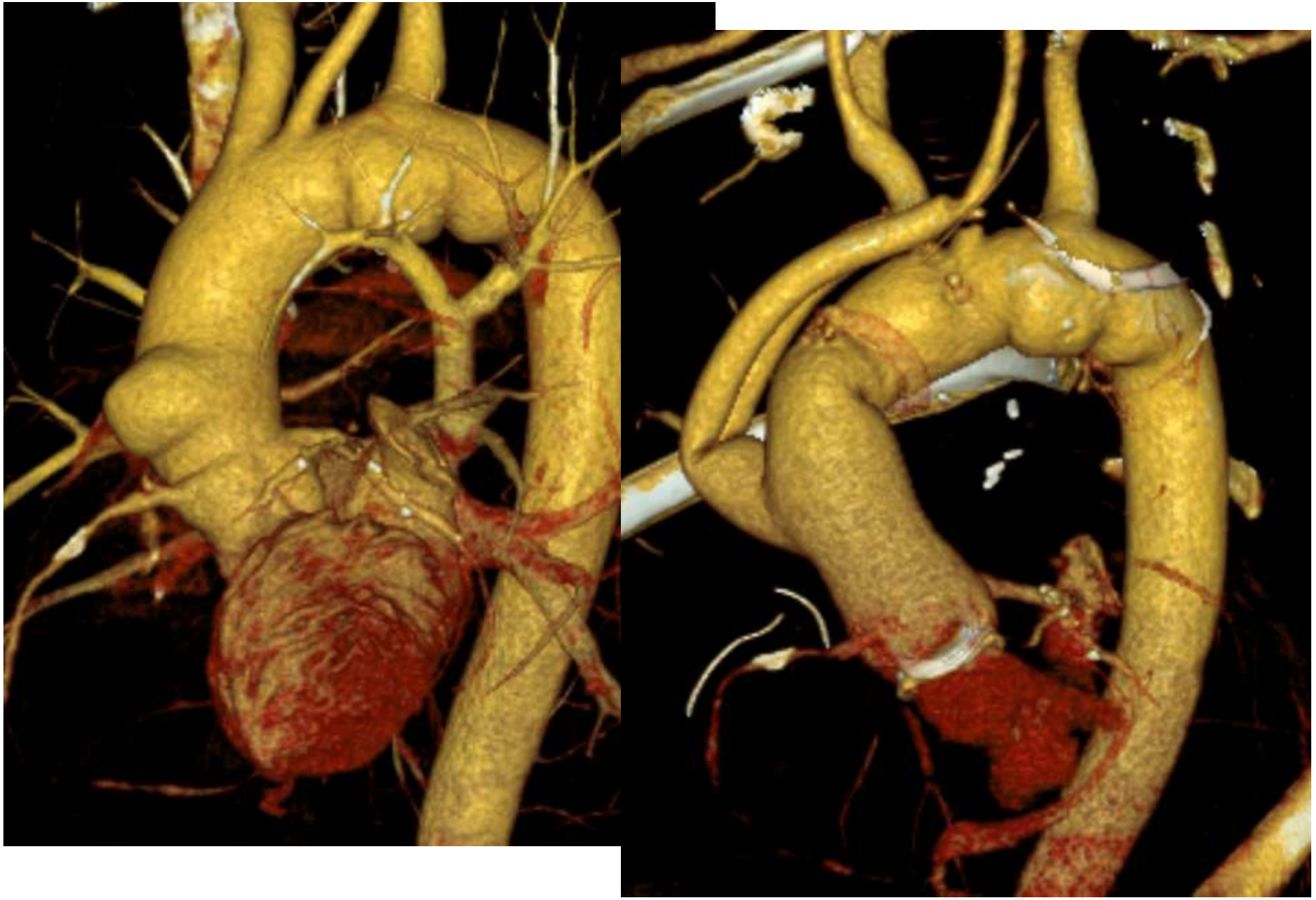
Cerebral

Visceral

Surgical technique/strategy

DEBRANCHING





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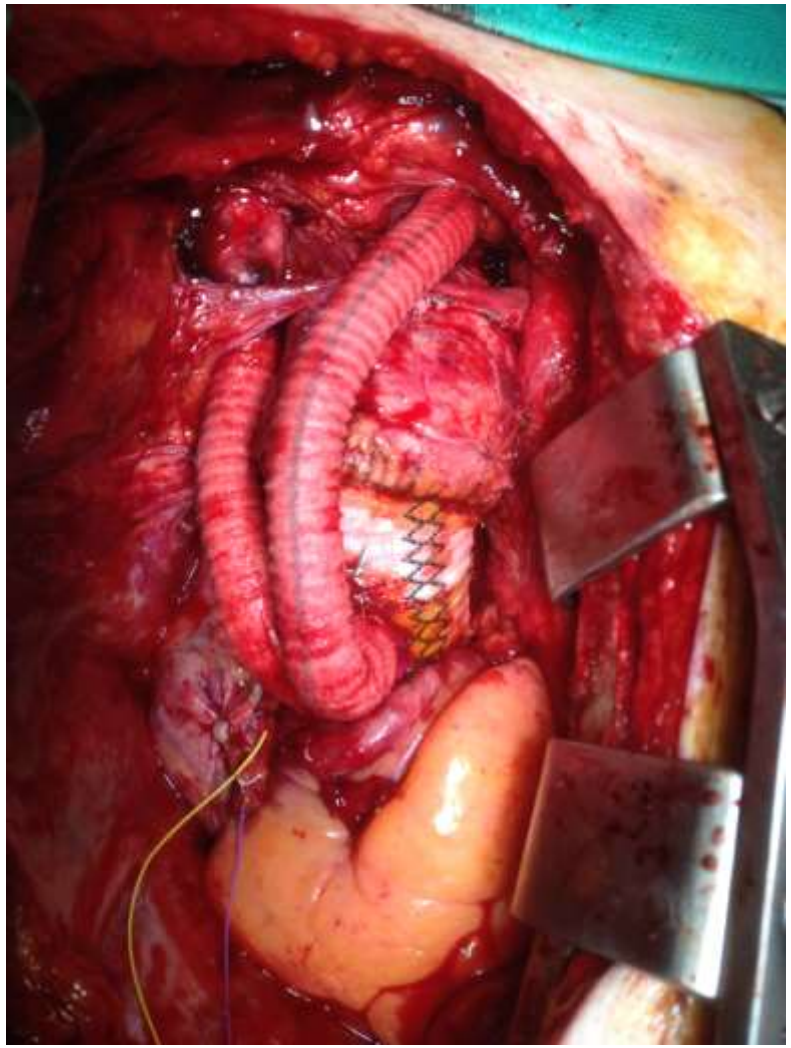

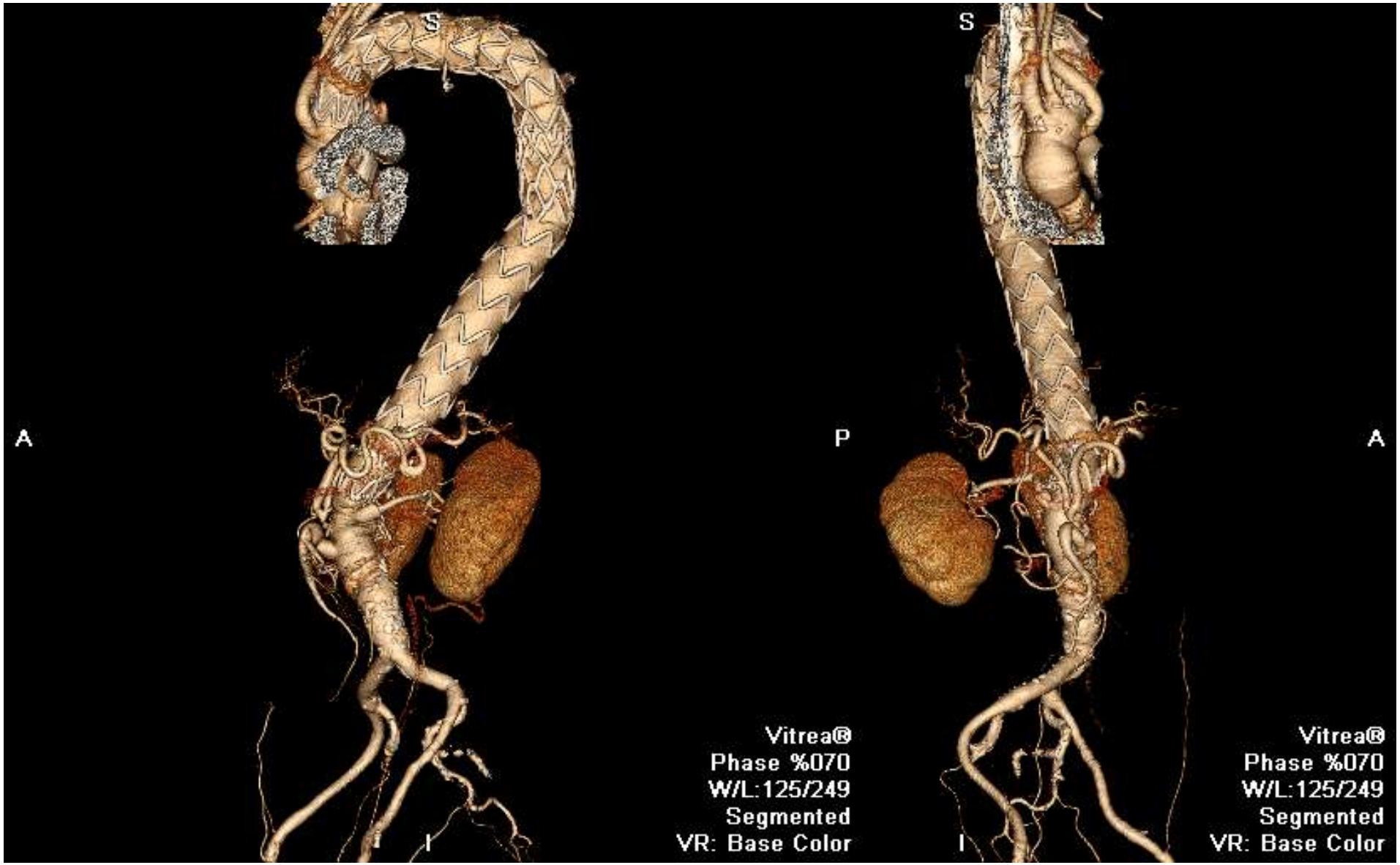
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W/L:125/249
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VR: Base Color
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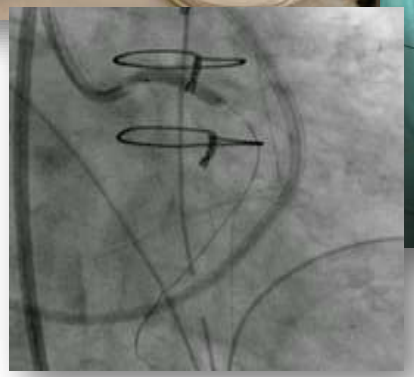
VR: Base Color

HYBRID OR

HYBRID OR

INTERVENTIONAL THEATRE

Hybrid Coronary Revascularization



Maria Cecilia Hospital
Cotignola

GVM
CARE & RESEARCH

Hybrid Suite

↓

LIMA on LAD

DES PCI

↓

ICU

“Single team experience”

- From January 2010 to January 2017

1138 patients underwent thoracic aorta surgery

- Mean age 65.7±12.2 yy

- 807 (70.9%) male

“Single team experience”

Extent of aortic arch replacement	N 118 (%)
Ascending + aortic arch	69 (58.5%)
Isolated aortic arch	23 (19.5%)
Bentall + aortic arch/hemiarch	22 (18.6%)
David + aortic arch/hemiarch	4 (3.4%)

“Single team experience”

Other	
Ascending aorta	583
Bentall	321
David	126

Surgical Experience 2010-2015

Aortic dissection: n° 154

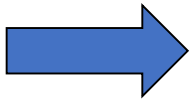
- Age 63.3± 12.9
- Redo 12/141 (8.5%)
- CPB time 114 (IQR 88-146)
- Clamp time 87 (IQR 63-111)
- Hospital Mortality 7%

Aortic Arch and Emiarch procedure: n° 105

- Age 67.1±10.1
- CPB time 198.54 ± 82.07
- Clamp time 124.55 ± 56.8
- Hospital Mortality 11/75(4.6%)

Ascending aorta replacement: n° 436

- Age 64.9 ±10.9
- CPB time 110.02 ± 49.9.6
- Clamp time 82.75 ± 28.81

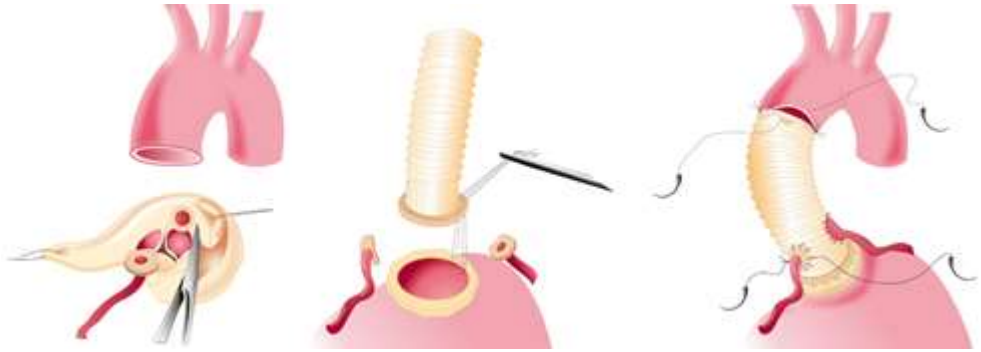


Mini-aortic root replacement: n° 106

Bentall Procedure n° 270

Elective Bentall procedure: n° 218

- Age 63.24 ± 12.5
- Redo 29/218 (13.3%)
- CPB time 117.2±54.2
- Clamp time 95.17 ± 38.3
- Hospital Mortality 10/218 (**4.59%**)



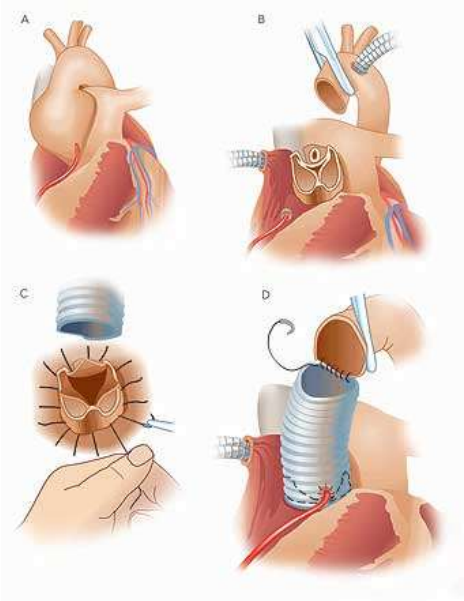
Mini-Bentall procedure: n° 58

- Age 61.55 ± 13.66
- Redo 0%
- CPB time 95.46 ± 35.37
- Clamp time 81.21±30.14
- Hospital Mortality **0%**

David Procedure n° 113

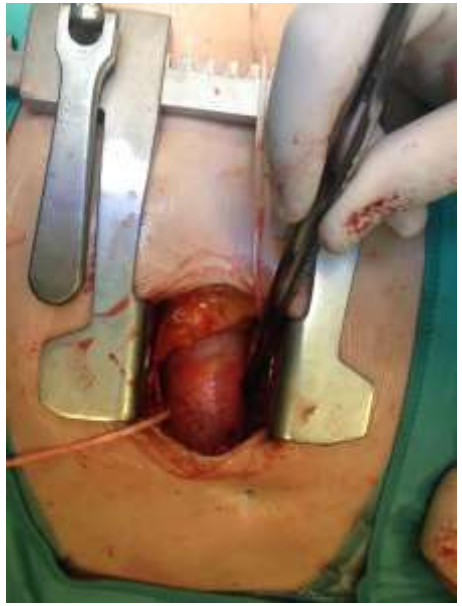
David procedure: n° 65

- Age 54.2 ± 14.8
- CPB time 156.9±50.2
- Clamp time 134.5±32.6
- Hospital Mortality 2/65 (3.%)

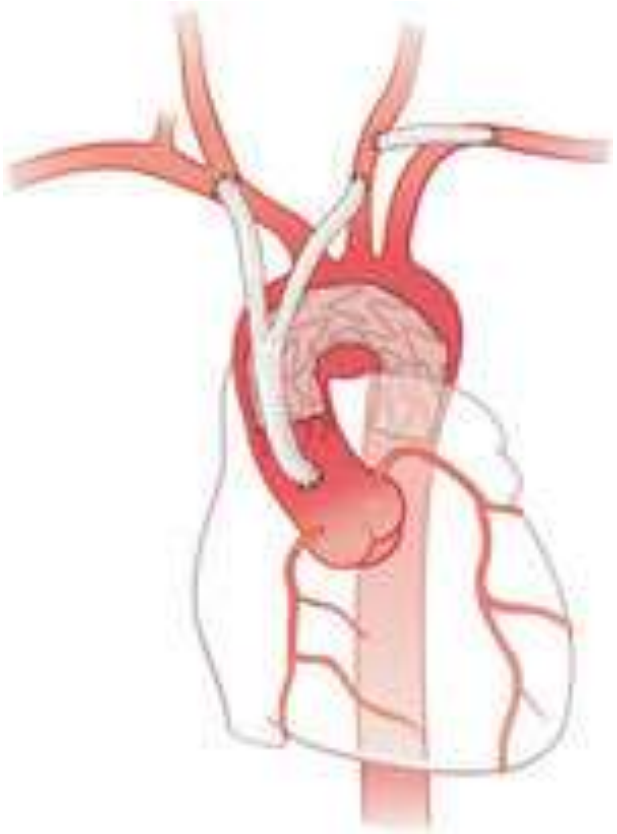


Mini-David procedure: n° 48

- Age 49.1±14.4
- CPB time149.3±33.1
- Clamp time 130.8±22.7
- Hospital Mortality 2/37 (5.4%)



DEBRANCHING



Number of Patients	**21**
Mortality 30 days In-hospital	(1pt) 4,7 % 4,7%
Permanent neurol. events Cerebral Spinal cord	 0 % 0 %

Agenda

Introduction

Aortic valve

Aorta

Mitral valve

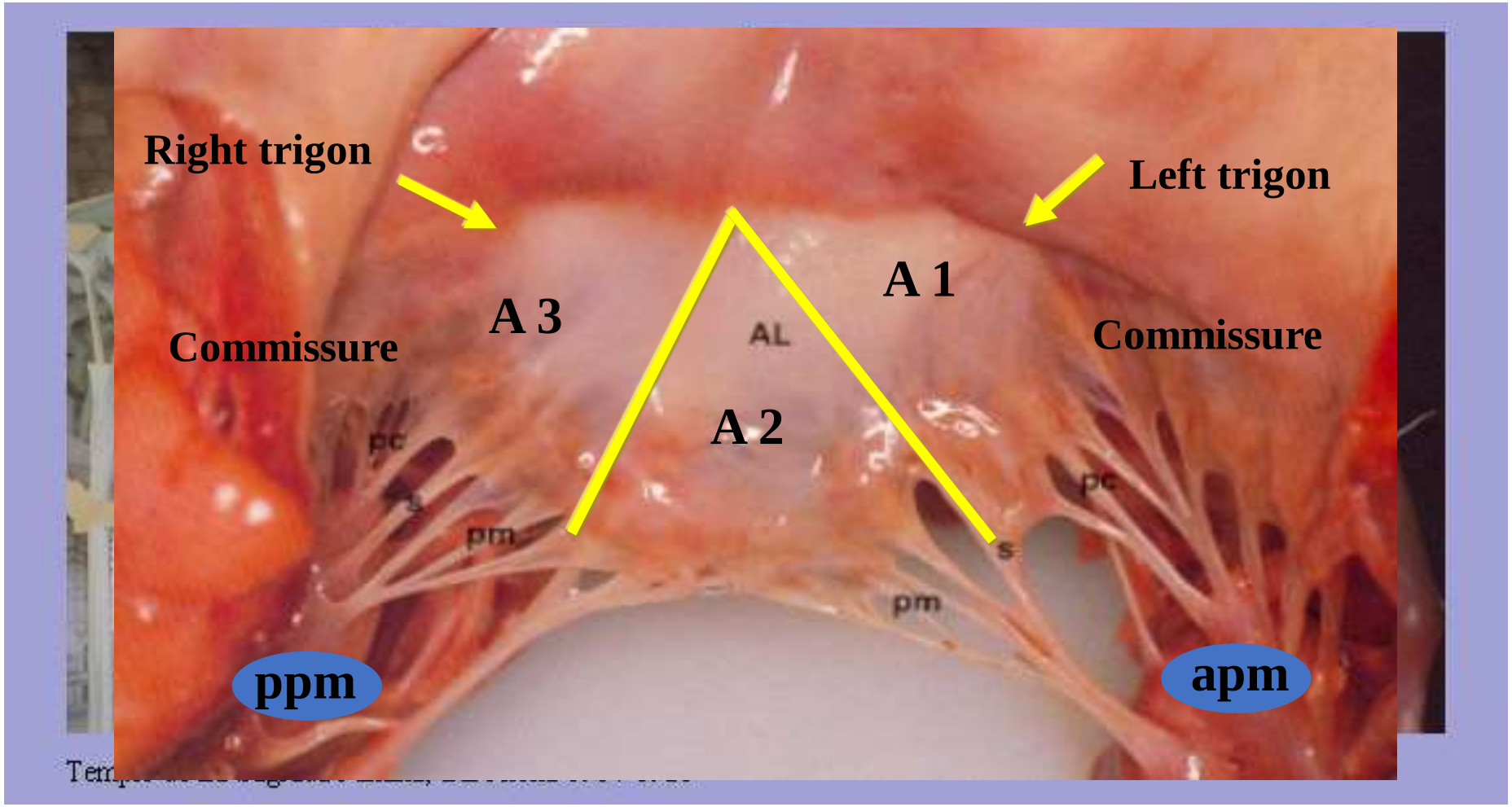
Coronary disease

Closing remarks

Mitral surgery: keeping up with a tradition

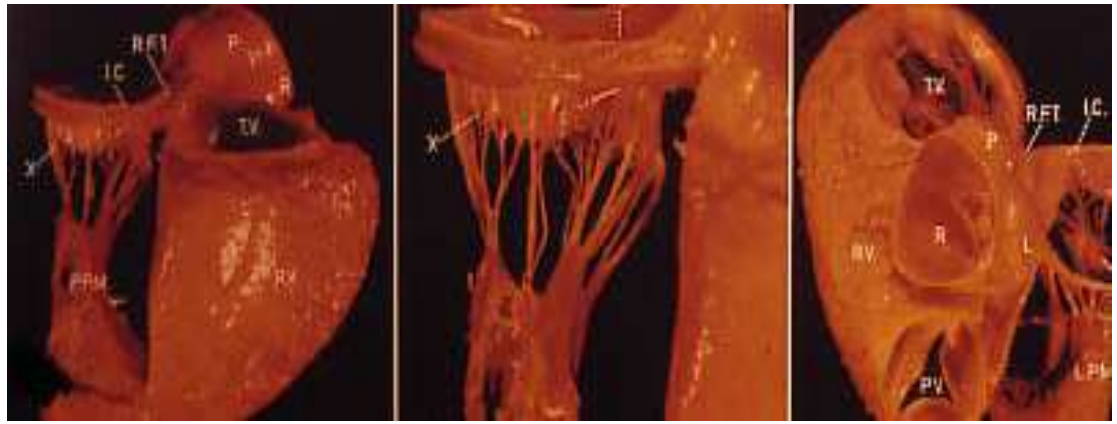
SURGICAL ANATOMY, FISIOPATHOLOGY and APPROACH

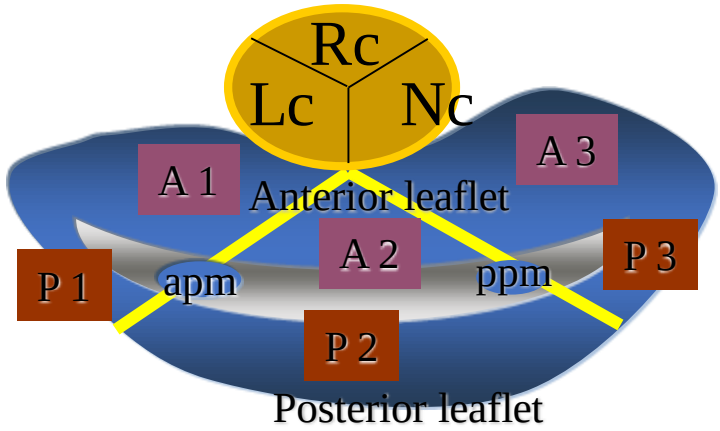
SURGICAL ANATOMY



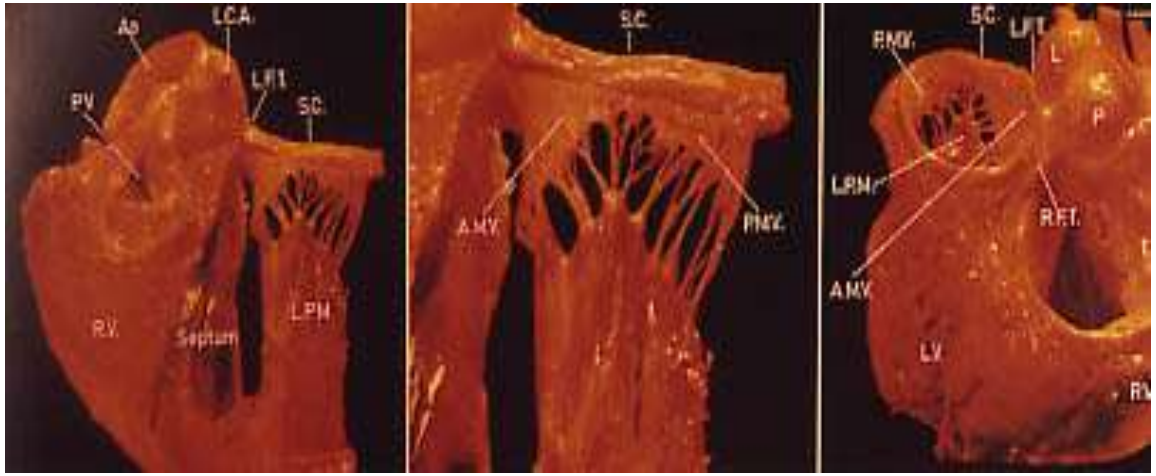
SURGICAL ANATOMY

ANATOMIC-FUNCTIONAL UNIT





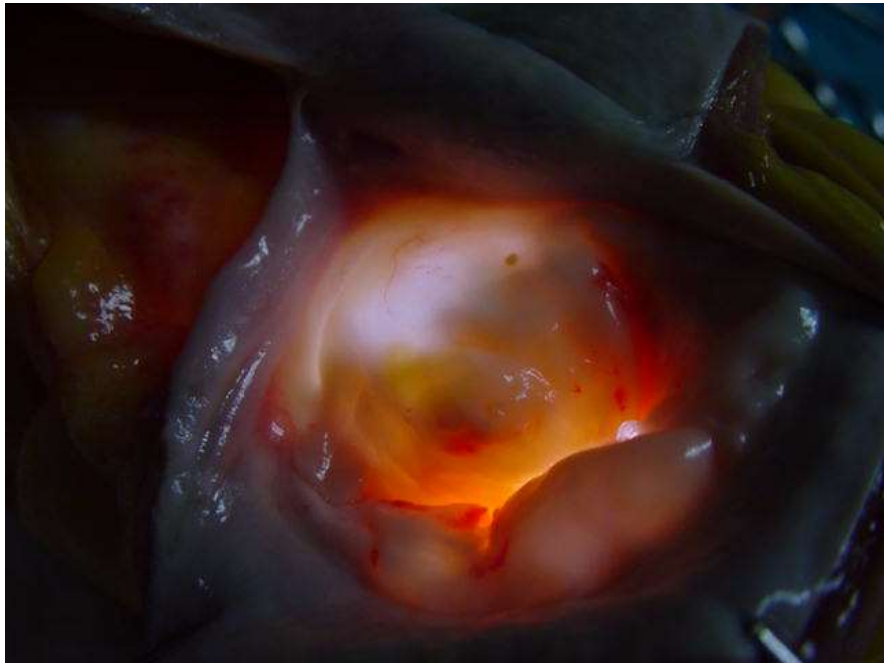
- Left atrium
- Annulus
- Leaflets
- Chordae
- Papillary muscles
- Left ventricle

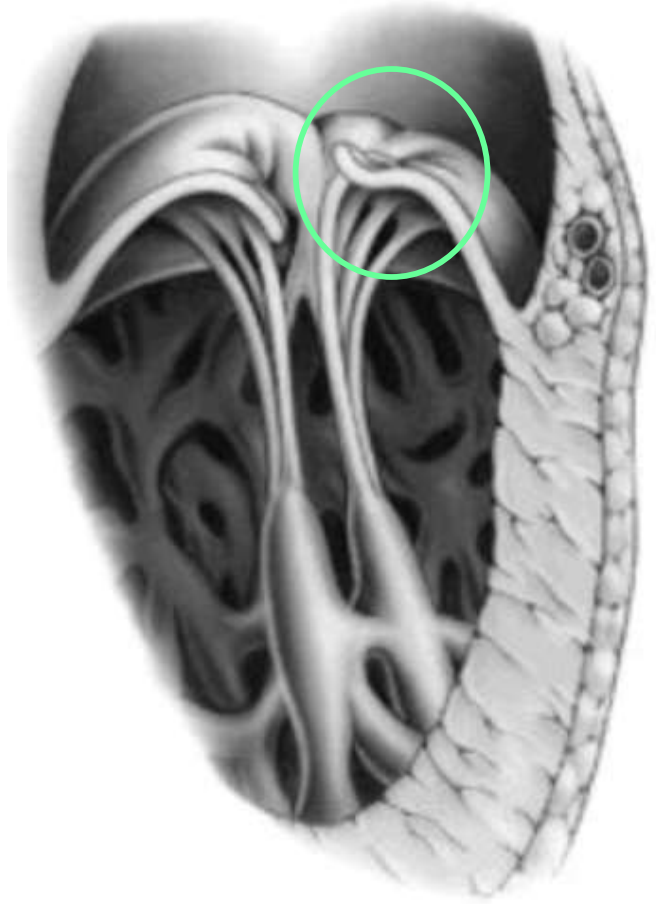


Coaptation

Coaptation factors:

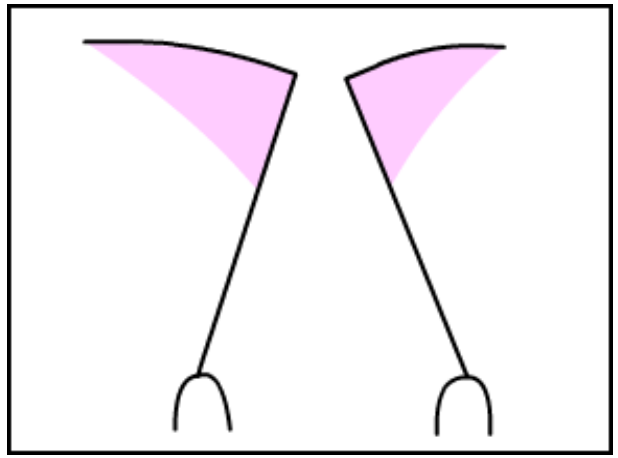
- Extension and quality of leaflets
- Chordae integrity
- Papillary muscles function
- Left ventricle structure



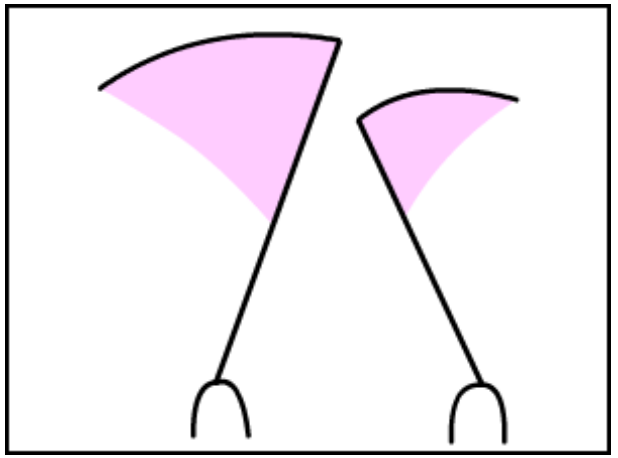


FISIOPATHOLOGY

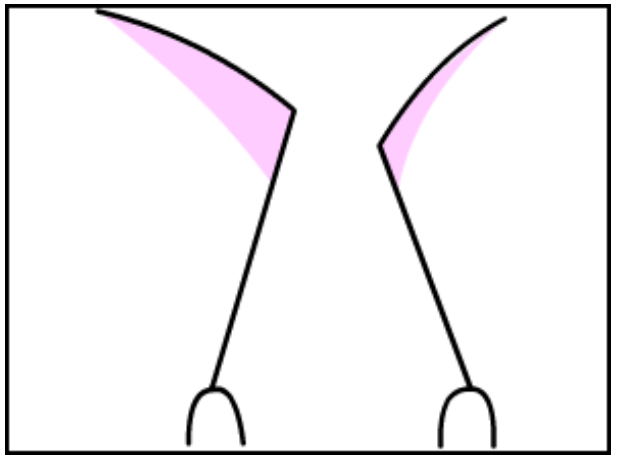
CARPENTIER CLASSIFICATION



Type I:
Normal leaflets movement



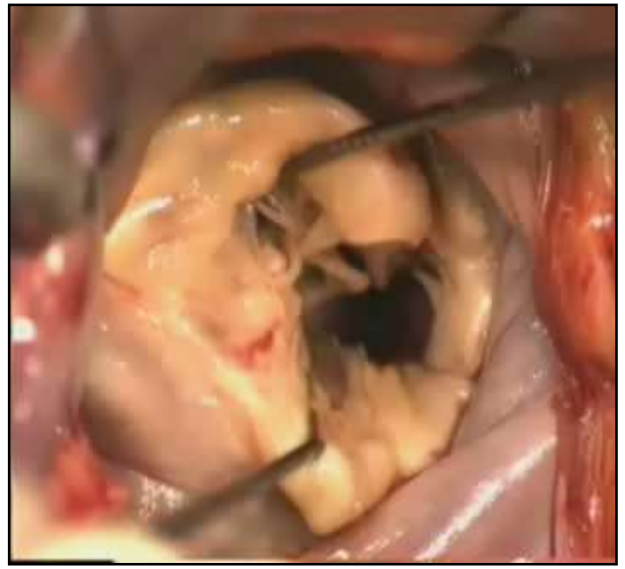
Type II:
Excessive leaflets dislocation

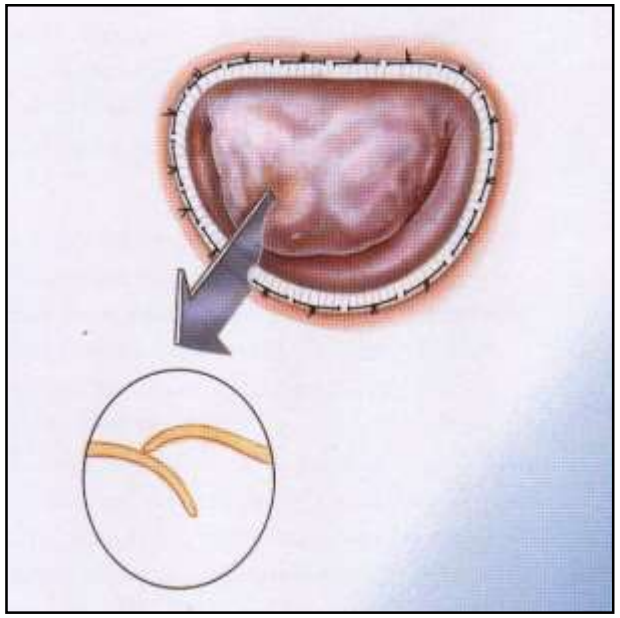


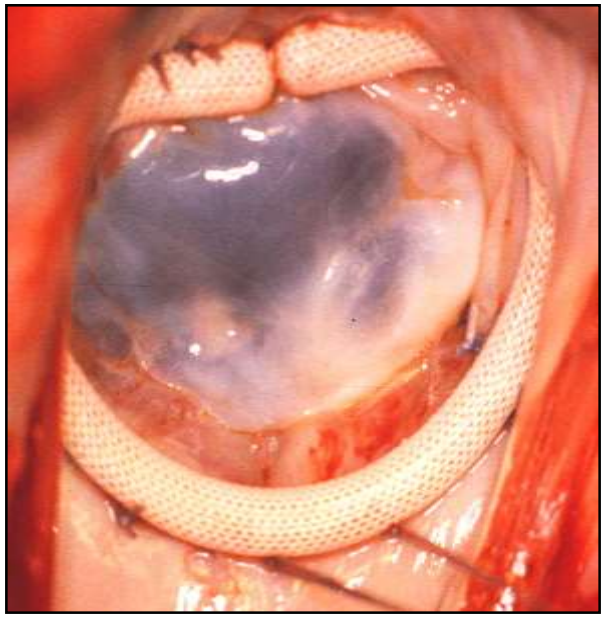
Type III:
Restrictive movement

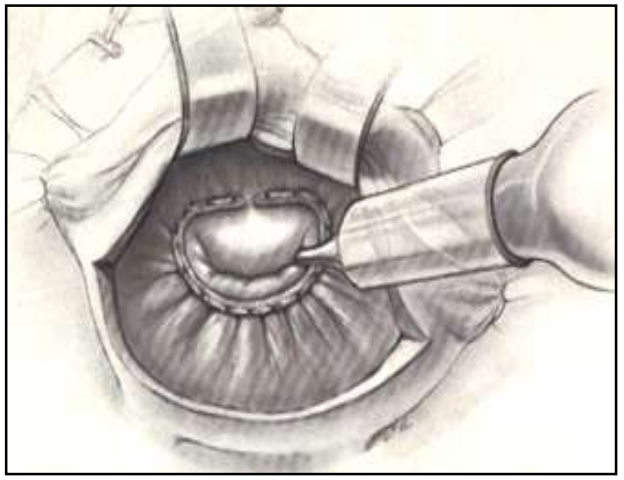
SURGEON DECISION MAKING…

1) Valve analysis
2) Identification of the valve lesions
3) Choice of the right technique
4) Ensure the coaptation
5) Check the final result







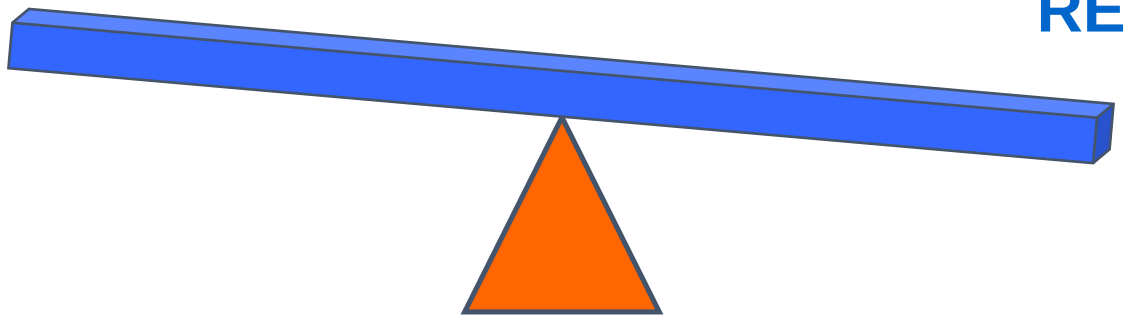


SURGICAL OPTIONS

- VALVE REPLACEMENT
  - BIOLOGICAL
  - MECHANICAL
- REPAIR TECHNIQUES

SURGICAL OPTIONS

REPLACEMENT



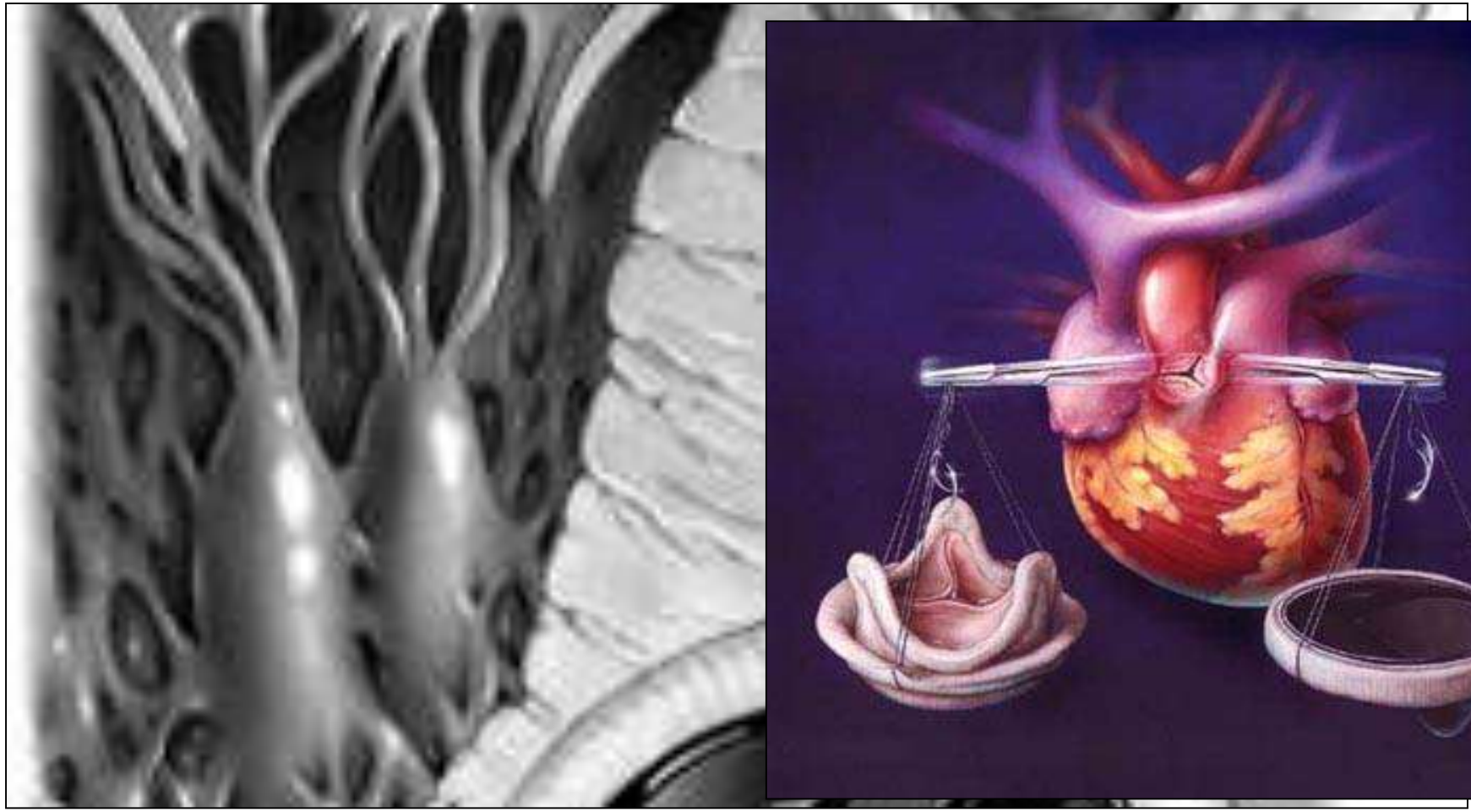
REPAIR

- Excellent MR reduction
- Faster
- Requires less training
- Bioprostheses: limited longevity
- Mechanical: anticoagulation

- Maintains LV geometry
- Improved patient survival
- No anticoagulation
- Reduced risk of thrombo-embolism, endocarditis

VALVE REPLACEMENT

BIOLOGICAL v/s MECHANICAL



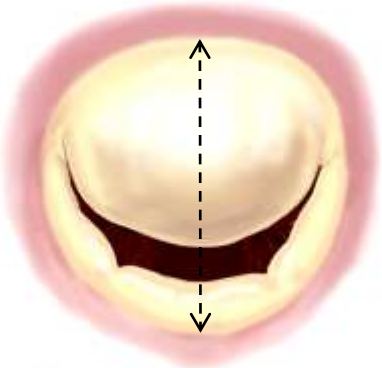
REPAIR TECHNIQUES

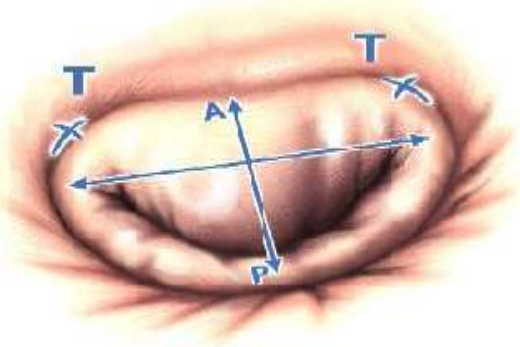
- Anatomical REPAIR (70%)
  - Annulus
  - Leaflets
  - Chordae
  - Papillary muscles
- Functional REPAIR (30%)
  - Ischemic (20%)
  - Non-ischemic (10%)

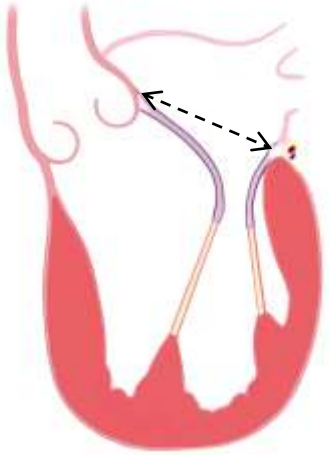
ANNULUS

- Annulus dilatation
- Annulus stabilization

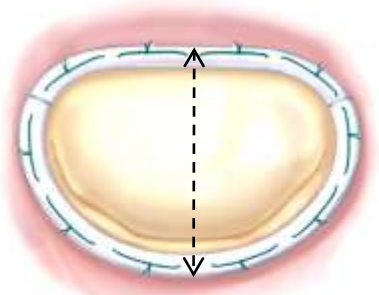
→ **Prosthetic or pericardial ring**



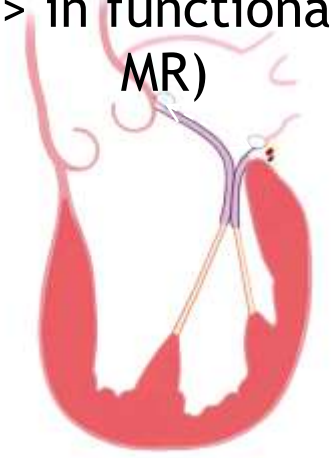




Open ring

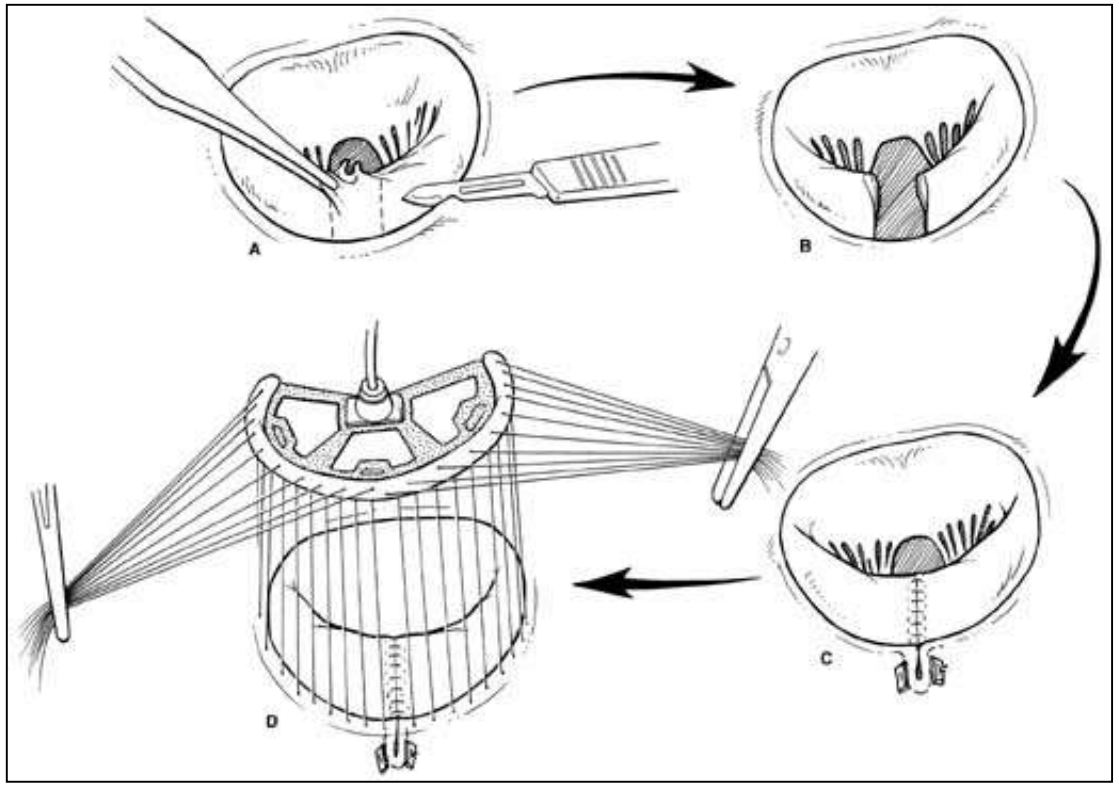


Closed ring
(> in functional MR)



LEAFLETS

- mono- or bi-leaflet prolapse → **Quadrangular or triangular resection**



QUADRANGULAR resection:
- If large prolapse is present
- Not for anterior leaflet
- Risk of SAM

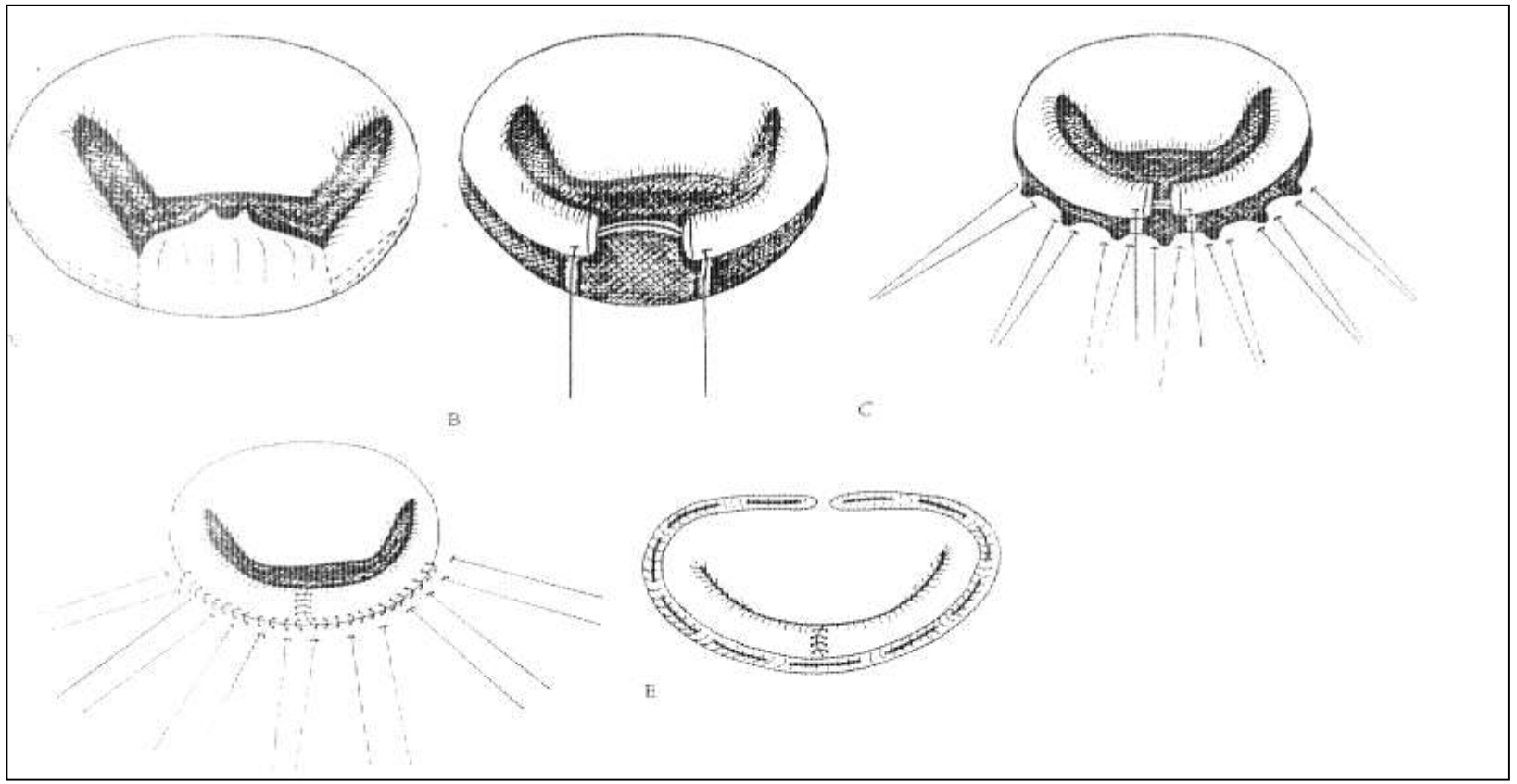
v/s

TRIANGULAR resection:
- Only for small prolapse
- Also for anterior leaflet
- less risk of SAM
- « valve-sparing »

LEAFLETS

- Large quadrangular resection
- Marked annulus dilatation
- High risk of SAM

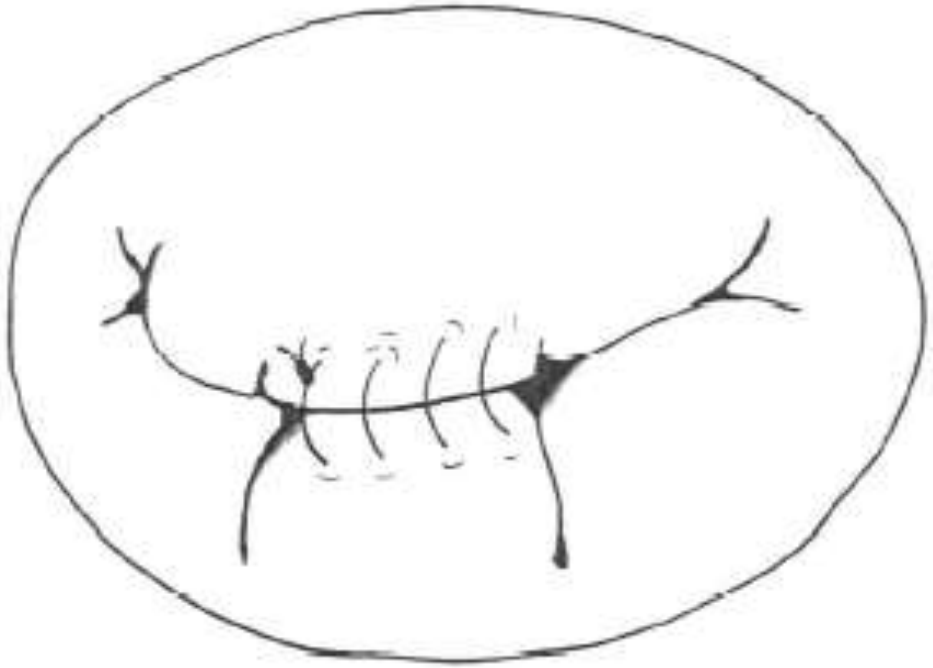
→ **SLIDING and/or FOLDING Of the posterior leaflet**



LEAFLETS

- Large bi-leaflet prolapse
- Barlow disease (floppy valve)
- Risk of (or correction of) SAM

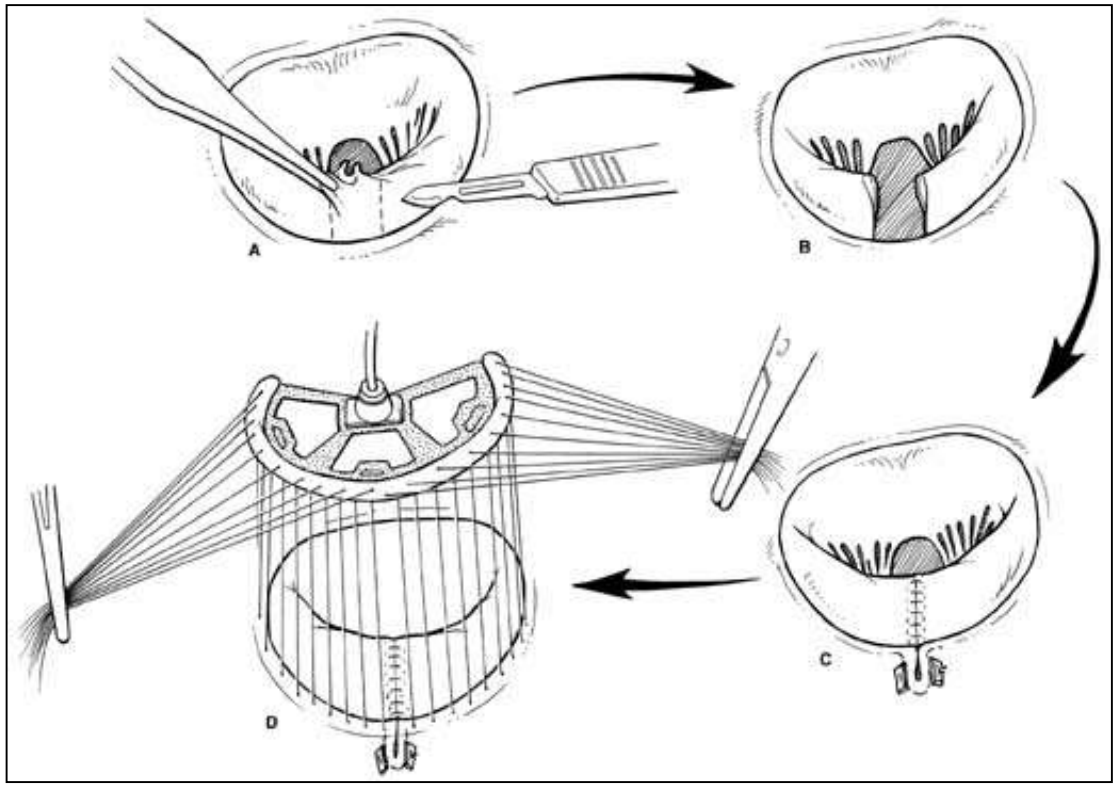
→ **EDGE-TO-EDGE (ALFIERI STITCH)**



CHORDAE

- Chordal rupture
- Chordae elongation

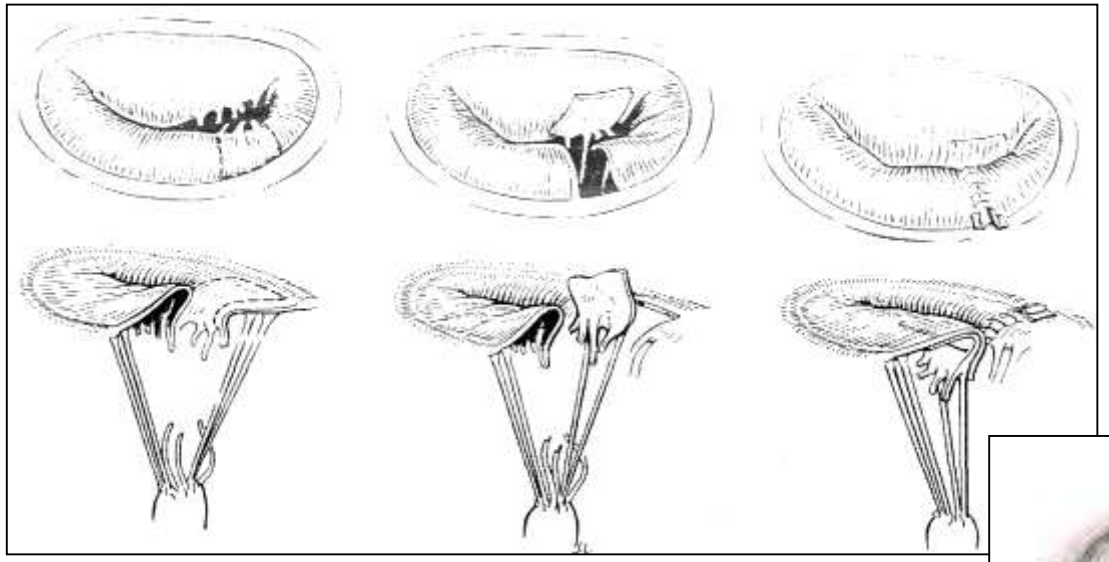
→ **QUADRANGULAR or TRIANGULAR RESECTION**



CHORDAE

- Anterior or bi-leaflet prolapse

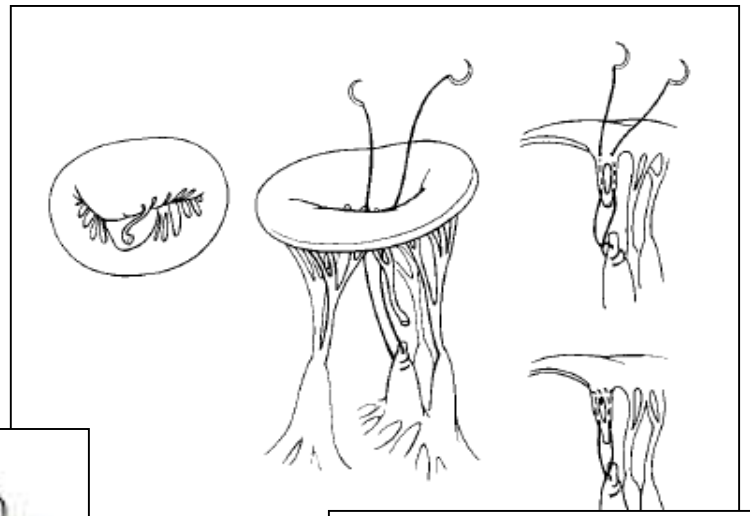
Chordal transpositioning
POSTERIOR -> ANTERIOR



CHORDAE

- Leaflet prolapse
- Chordae rupture
- Elongation/shortening
- Chordae degeneration
- Barlow
- .....

Artificial chordae (PTFE)



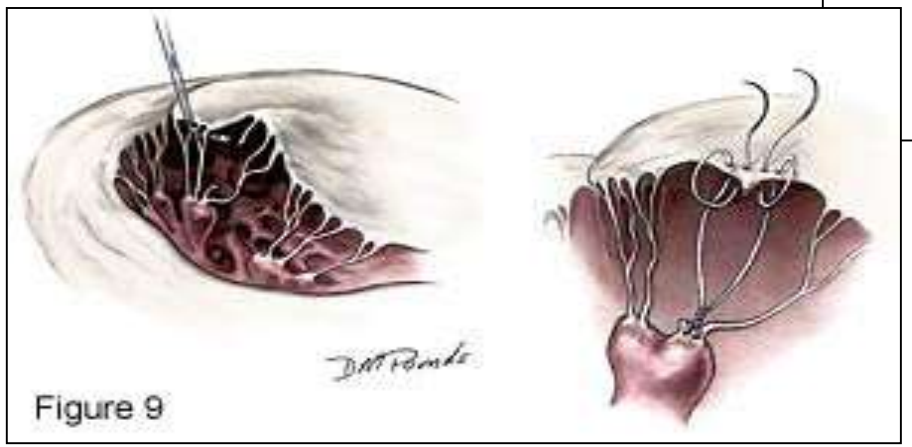


Figure 9

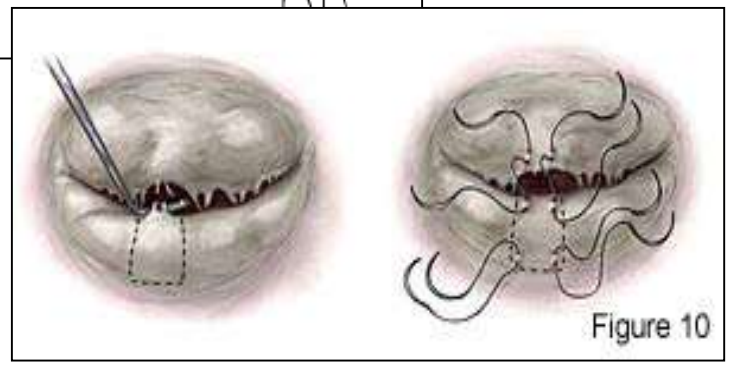


Figure 10

FUNCTIONAL MITRAL REGURGITATION

REPAIR v/s REPLACEMENT

✓ Limited survival after operation

✓ Long term survival and results are better with REPAIR, in patients with functional MV regurgitation at low risk

✓ REPAIR = less morbidity and mortality than REPLACEMENT in patients with non-ischemic MR

✓ **but… REPAIR is associated with HIGH RISK OF RELAPSE!**

FUNCTIONAL MITRAL REGURGITATION

REPAIR v/s REPLACEMENT

- ✓ REPLACEMENT recommended in case of:
  - ✓ ACUTE functional MR (almost always ischemic)
  - ✓ High risk patients
  - ✓ Severe leaflets tethering

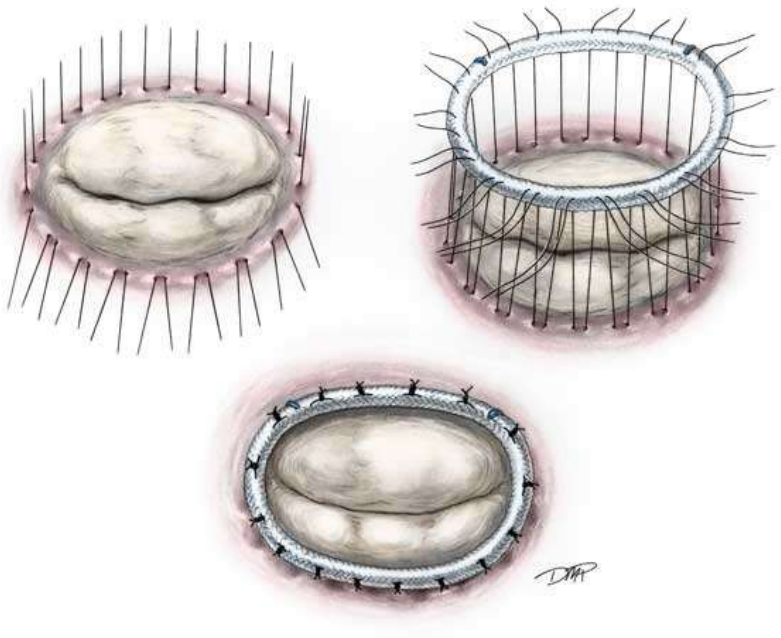
- ✓ If REPLACEMENT: better a biological prosthesis, with preservation of the sub-valvular apparatus

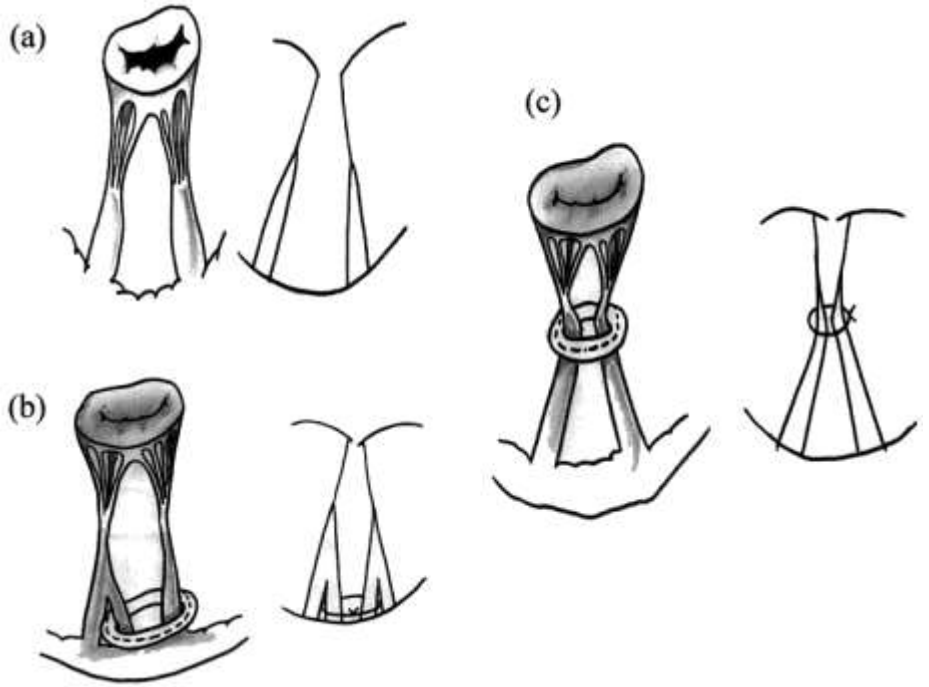
- ✓ Advanced techniques (eg. chordal-cutting?) could favour repair

FUNCTIONAL MITRAL REGURGITATION

REPAIR: treatment of choice

Undersized annuloplasty + Papillary muscles sling





FUNCTIONAL MITRAL REGURGITATION

- 10% of patients with CAD
- Ischemic cardiomiopathy cause 70% of heart failures in U.S., and 50% are associated with MITRAL REGURGITATION
- 1.6-2.8 millions U.S. people
- Associated with low long term survival in post-MI and post-revascularization patients

NON-ISCHEMIC FUNCTIONAL MITRAL REGURGITATION

DILATED CARDIOMIOPATHY
Mechanisms of mitral regurgitation

- Reduction of the closure forces of leaflets caused by lowered left ventricle ejection fraction
- Increased tethering forces caused by left ventricular remodeling with papillary muscles dislocation
- Annulus dilatation caused by left ventricle dilatation

NON-ISCHEMIC FUNCTIONAL MITRAL REGURGITATION

DILATED CARDIOMIOPATHY

Mitral surgery

- **Mitral repair is a valid option in selected patients with dilative cardiomiopathy**
- **Mitral repair is not alternative to heart transplant**
- **Selection criteria must be yet identified**

NON-ISCHEMIC FUNCTIONAL MITRAL REGURGITATION

DILATED CARDIOMIOPATHY

Surgical strategy

- **REPAIR is preferable to REPLACEMENT**
- **REPAIR through correction of leaflets tethering**
- **REPAIR through increase of leaflets coaptation**

MINIMALLY INVASIVE MITRAL VALVE SURGERY

A PRACTICAL APPROACH

MINIMALLY INVASIVE MITRAL SURGERY

LITERATURE REVIEW

Systematic Review

A meta-analysis of minimally invasive versus conventional mitral valve repair for patients with degenerative mitral disease

Christopher Cao[1], Sunil Gupta[1], David Chandrakumar[1], Thomas A. Nienaber[1], Praveen Indraratna[1], Su C. Ang[1], Kevin Phan[1,2], Tristan D. Yan[1,2]

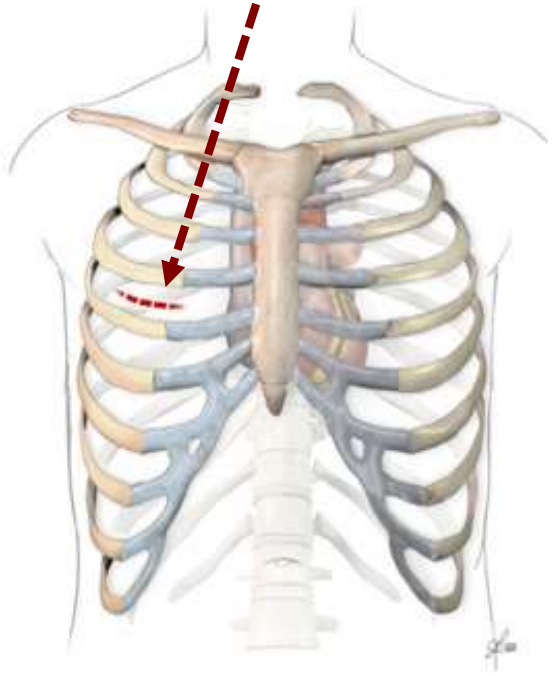
[1]The Collaborative Research (CORE) Group, Macquarie University, Sydney, Australia; [2]The Royal Prince Alfred Hospital, Sydney University, Sydney, Australia

Conclusions: The existing literature has limited data on comparative outcomes after MIMVR versus conventional mitral valve repair for patients with degenerative disease. From the available evidence, there are no significant differences between the two surgical techniques in regards to clinical outcomes. Patients who underwent MIMVR required longer cardiopulmonary bypass and cross clamp times, but the duration of stay in the ICU was significantly shorter than conventional mitral valve repair.

MARIA CECILIA HOSPITAL experience

2010-2016

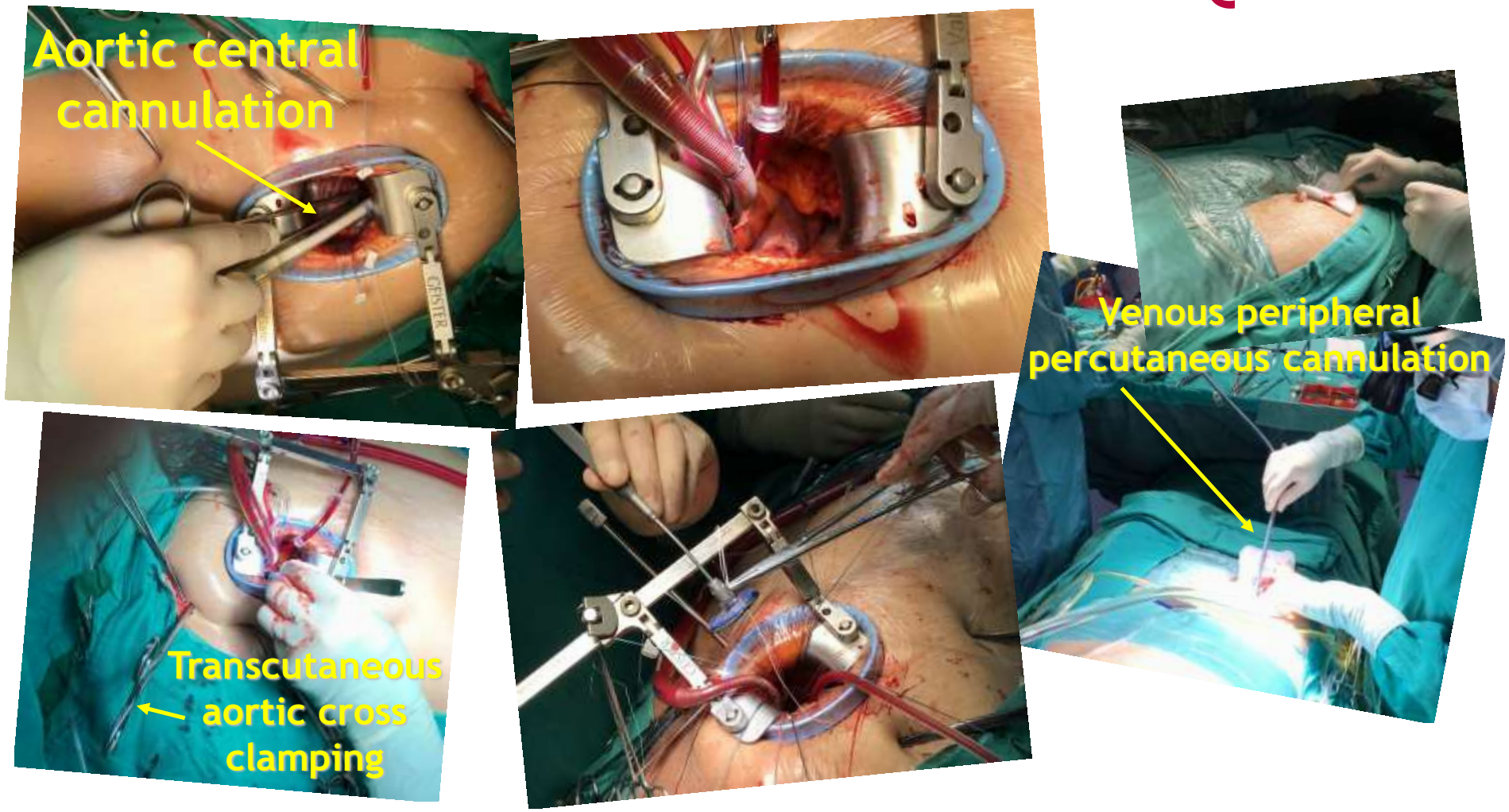
Right minithoracotomy
4° -5° intercostal space



MARIA CECILIA HOSPITAL experience

2010-2016

EASY and REPRODUCIBLE TECHNIQUE



OPERATING THEATRE

MARIA CECILIA HOSPITAL experience 2010-2016

Mitral valve Repair or Replacement

1682

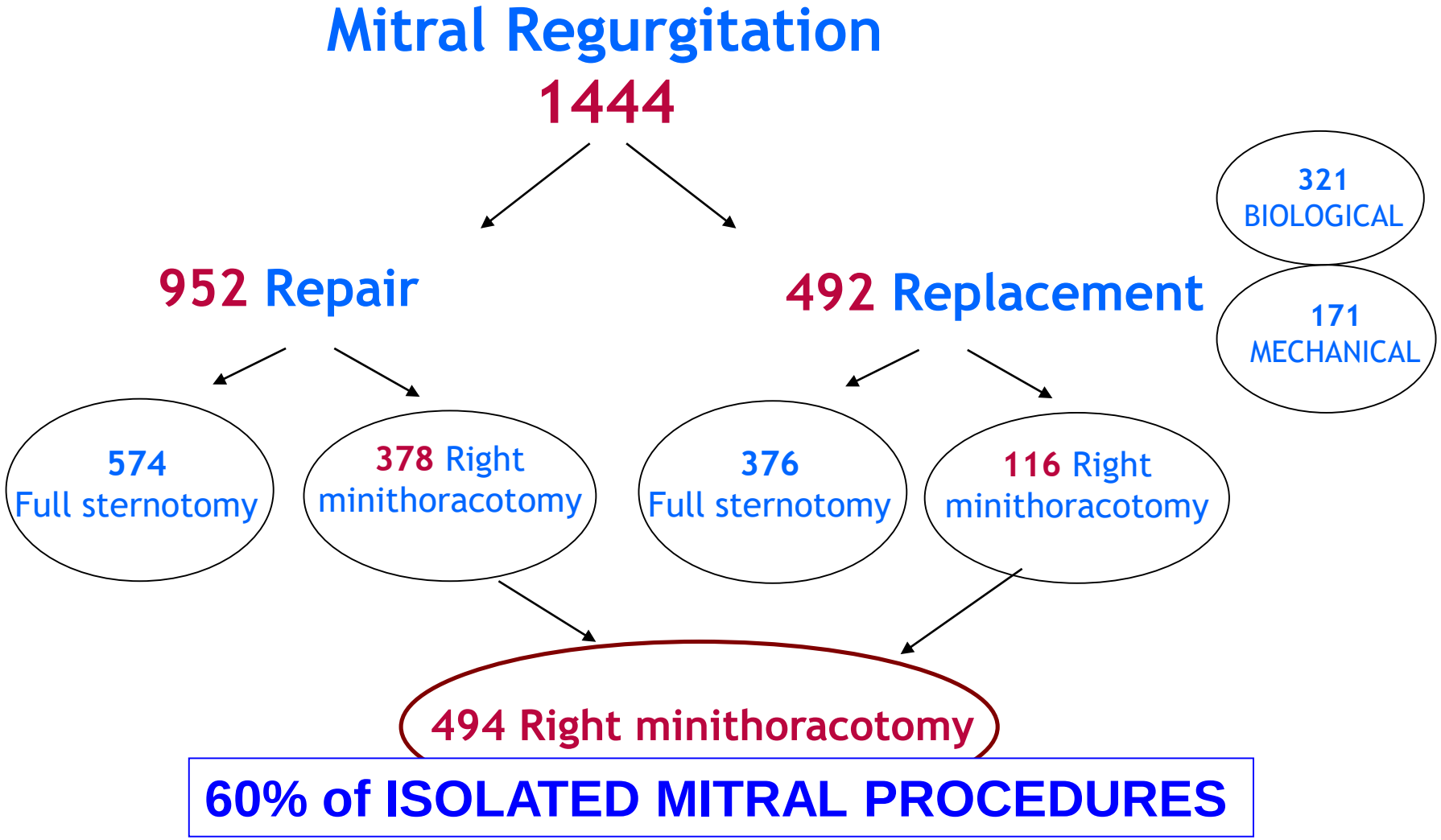
818 Isolated repair or replacement

864 Not Isolated Repair or replacement

1444 Mitral regurgitation

Degenerative (81.1%)
Ischemic - Functional (3.88%)
Rheumatic (9.56%)
Other cause (5.46%) (endocarditis, prosthesis malfunctioning/degeneration, other)

MARIA CECILIA HOSPITAL experience 2010-2016



MARIA CECILIA HOSPITAL experience 2010-2016

494 pts (60.32% males)

Median age 64 ys - Median EF% 65

Right minithoracotomy

Repair: 378 pts

Replacement: 116 pts

REDO: 2.63%

Mean CPB time: 95.08 ± 34.97 min

Mean ACC time: 76.53 ± 27.45 min

Median ICU stay: 1.8 days (43 hours)

Mean hospital stay: 8.39 days

Revision for bleeding: 19 pts (3.85%)

Mortality: 8 pts (1.62%)

MARIA CECILIA HOSPITAL experience 2010-2016

REPAIR techniques in mini-thoracotomy

378 patients

361 prosthetic ring (95.5%)

Quadrangular resection: 43 (11.38%)

Triangular resection: 140 (37.04%)

Sliding or folding: 23 (6,08%)

Cleft obliteration: 93 (24.6%)

Neochordae in Gore-tex: 74 (19.58%)

Edge-to-edge: 93 (24.6%)

MARIA CECILIA HOSPITAL experience 2010-2016

- Easy feasible technique - reproducible

- Feasible with or without thoracoscopic support

- Feasible also in REDO patients

- Allows every kind of technique repair (also complex)

- Low surgical time
(at least comparable with full sternotomy
CPB 95.07 vs 96.42 min - ACC 76.53 vs 77.65 min)

Advantages

- Less morbidity
reduced need for reoperation for bleeding (3.85% vs 6.13%)
lower surgical site infections (0.2% vs 1.12%)
shorter ICU (1.8 vs 2 days) and hospital stay (8.39 vs 11.02 days)
less pain and faster return to preoperative function

- Equivalent outcomes (better in selected patients)

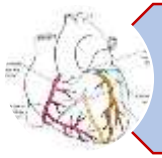
Agenda

Introduction

Aortic valve

Aorta

Mitral valve



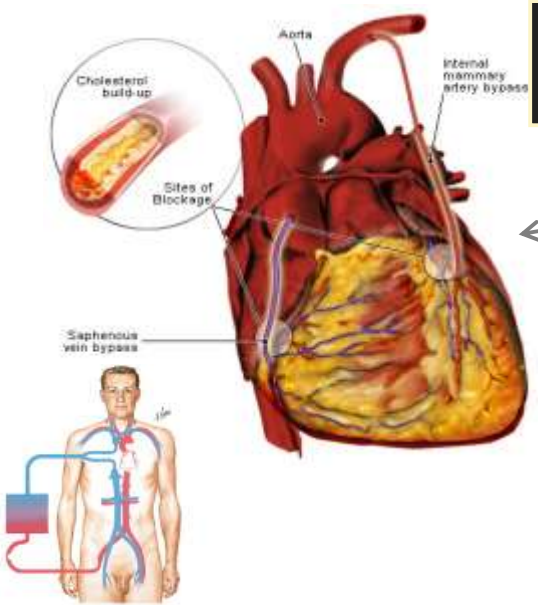
Coronary disease

Closing remarks

Minimally invasive Hybrid coronary revascularization: initial experience at Cotignola

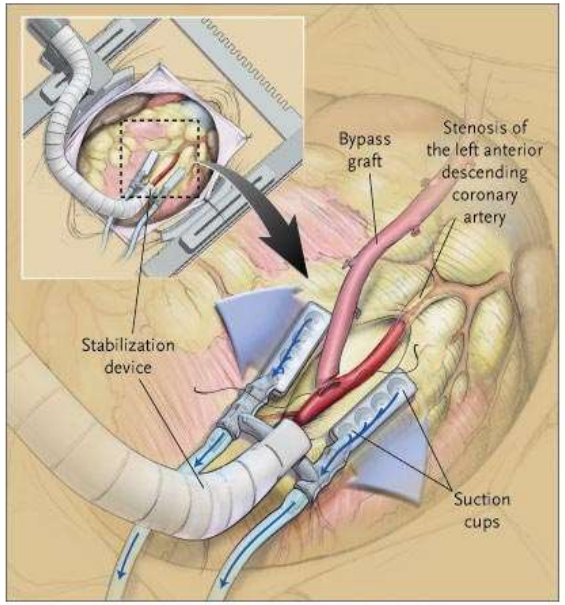
From clinical evaluation to treatment multy-modalities

Options for myocardial revascularization

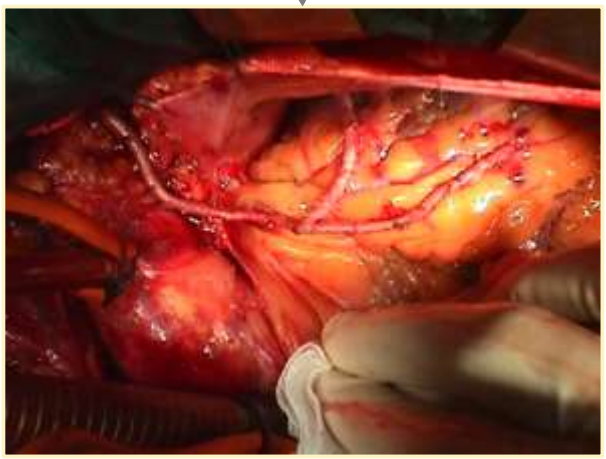


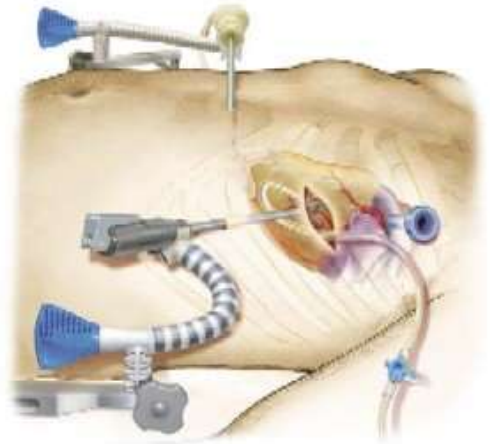
STANDARD CABG
Cardiopulmonary bypass + aortic cross clamp

OPCAB – OFF-PUMP CABG



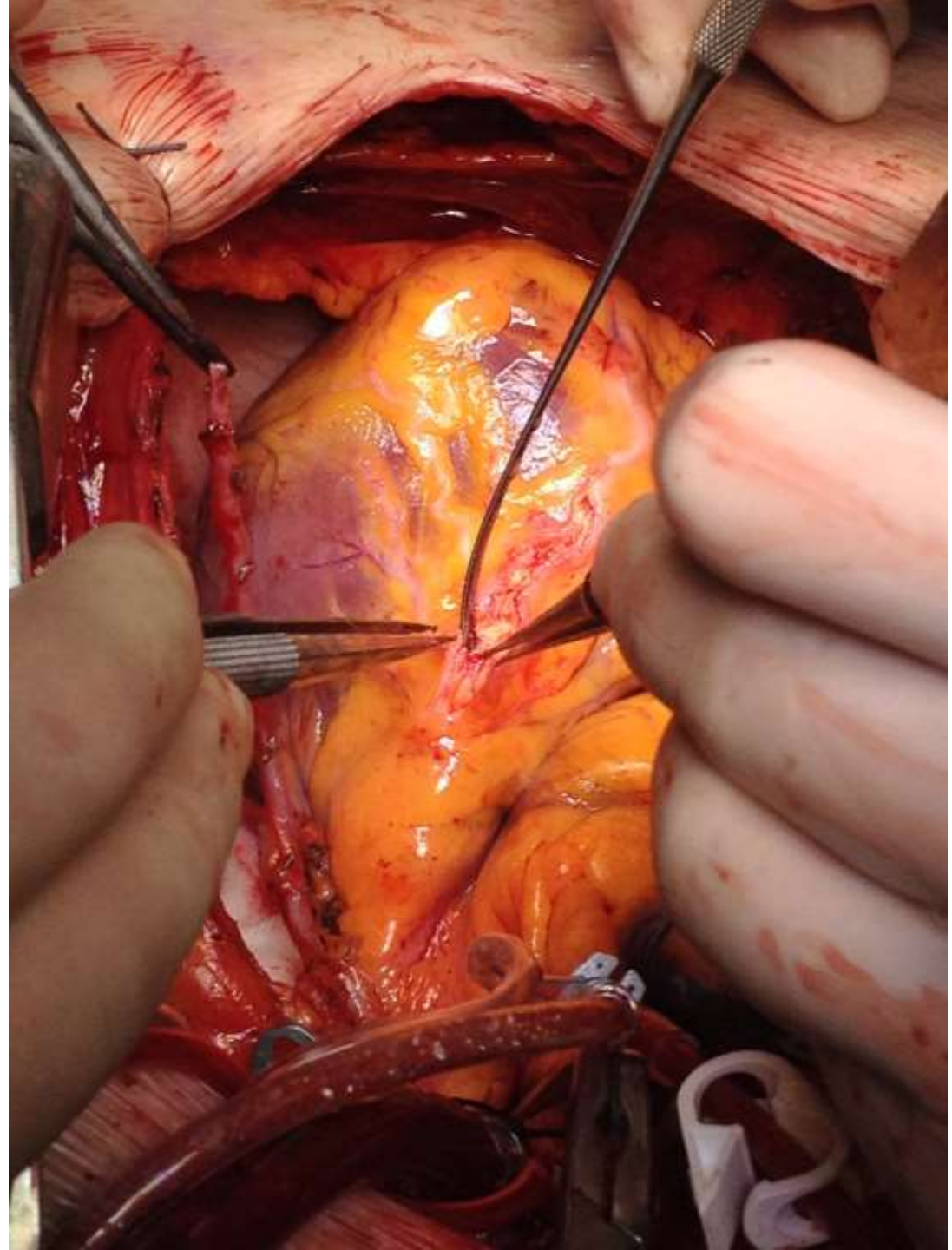
Totally arterial CABG





HYBRID REVASCULARIZATION:
SURGERY + PCI (online or staged)

MICS CABG – MINIMALLY INVASIVE CABG



	Advantages	Disadvantages
CABG	-LIMA to LAD (patency > 90% 10y) survival advantage -CABG better than DES with more extensive disease (SYNTAX Score > 32)	-Relatively high risky procedure -Morbidity of full sternotomy -Saphenous vein grafts early and late attrition (50% occluded 10y) -Extracorporeal circulation
PTCA	-Less invasive intervention -DES better than SVG -Reduced hospital stay -More rapid in acute settings	-Inability in highly complex lesions -Recurrent stenosis -Need for repeat revascularization -Contrast induced nephropaty

ACC/AHA GUIDELINES

1 - Heart team approach for patients with unprotected left main or complex coronary disease (class I)

2 - HCR is reasonable in patients with one or more of the following conditions:

- Calcified proximal aorta
- Poor targets for surgery amenable to pci
- Lack of conduits for grafting
- Unfavorable left anterior descendig anatomy for percutaneous intervention such as chronic total occlusion

(class IIa)

LITERATURE

Review Article

Hybrid Coronary Revascularization as a Safe, Feasible, and Viable Alternative to Conventional Coronary Artery Bypass Grafting: What Is the Current Evidence?

Arjan J. F. P. Verhaegh, Ryan E. Accord, Leen van Garsse, and Jos G. Maessen

5. Conclusions

The large variability in HCR techniques makes it difficult to draw firm conclusions from the currently available evidence, but HCR appears to be a promising and cost-effective alternative for CABG in the treatment of multivessel coronary artery disease in a selected patient population. The HCR procedure was associated with short hospital stays (including ICU stay and intubation time), low MACCE and 30-day mortality rates, low PRBC transfusion requirements and TVR, high postoperative LITA patency rates, and high survival rates.

Holzhey et al. [24]	2008	117	64.6 ± 12.0	21.3	Simultaneous (5) and staged (112)	Open MIDCAB (107); beating-heart TECAB (8); arrested-heart TECAB (8)	DES/BMS
Zhao et al. [25]	2009	112	63 (32–85) (median)	NR	Simultaneous	On-pump (90) or off-pump (22) CABG	DES/BMS
Delhaye et al. [26]	2010	18	62 (55–77) (median)	12.0	Staged	On-pump (13) or off-pump (5) CABG	DES
Halkos et al. [27]	2011	147	64.3 ± 12.8	38.4 (median)	Mainly staged	Thoracoscopic endo-ACAB and robotic endo-ACAB	DES
Hu et al. [28]	2011	104	61.8 ± 10.2	18 ± 7.9	Simultaneous	Reversed J-shaped inferior ministernotomy	PTCA/BMS/DES

Unless otherwise indicated, data are expressed as mean ± standard deviation. *N*: number; PCI: percutaneous coronary intervention; MIDCAB: minimally invasive direct coronary artery bypass; PTCA: percutaneous transluminal coronary angioplasty; BMS: bare metal stent; endo-ACAB: endoscopic atraumatic coronary artery bypass; DES: drug-eluting stent; TECAB: totally endoscopic coronary artery bypass; NR: not reported; CABG: coronary artery bypass grafting; RCA: right coronary artery.

Hindawi Publishing Corporation
Minimally Invasive Surgery
Volume 2013, Article ID 142616, 10 pages
http://dx.doi.org/10.1155/2013/142616

LITERATURE

Table 5. Studies Comparing Outcomes After HCR Versus CABG or PCI in the Drug-Eluting Stent Era

Author, Year (Ref)	No.	CAD	Group(s)	One-Stop	Hospital Stay (Days)	In-Hospital Stroke	Reoperation for Bleeding	In-Hospital Mortality	LIMA Patency	F/U Period	Survival
Studies comparing HCR with CABG											
Bachinsky, 2012 [51]	52	MVD	Robotic HCR (n=25) vs. OPCAB (n=27)	Yes	5.1±2.8 vs 8.2±5.4	0% vs 0%	0% vs 0%	0% vs 4%	96%	30 days	100% vs 96%
Hu, 2012 [29]	40	LMD	MIDCAB HCR (n=20) vs. OPCAB (n=20)	Yes	7.5 (6-14) vs 9 (7-24)	0% vs 0%	0% vs 5%	0% vs 0%	100%	18.5 +/- 9.8 months	100% vs 100%
Lucchs, 2013 [50]	381	MVD	SYNTAX≥33 + EuroSCORE>5 HCR (n=9), CABG (n=27)	Yes	6(1-25) vs 6(4-63)	11% vs 0%	0% vs 0%	22% vs 0%	—	—	—
		MVD	SYNTAX≥33 + EuroSCORE≤5 HCR (n=5), CABG (n=48)	Yes	6.5 (5-32) vs 5 (3-33)	0% vs 2%	0% vs 0%	25% vs 0%	—	—	—
		MVD	SYNTAX<33 + EuroSCORE>5 HCR (n=25), CABG (n=81)	Yes	6(3-19) vs 6(1-32)	4% vs 4%	0% vs 4%	0% vs 5%	—	—	—
		MVD	SYNTAX<33 + EuroSCORE≤5 HCR (n=42), CABG (n=145)	Yes	5(3-97) vs 5 (3-28)	0% vs 0%	7% vs 3%	2% vs 1%	—	—	—
Halkos, 2011 [60]	108	LMD	Endo-ACAB HCR ± robot (n=27) vs OPCAB (n=81)	No	6.6±5.6 vs 5.6±2.0	0.0% vs 0.0%	0% vs 0%	0.0% vs 3.7%	100%	3.2 years	5-year: 86.6% vs 83.4%
Hu, 2011 [28]	208	MVD	MIDCAB HCR (n=104) vs. OPCAB (n=104)	Yes	8.2±2.6 vs 9.5±4.5	0% vs 0%	3.8% vs 1.9%	0% vs 0%	100%	18 (±7.9) months	100% vs 99%
Halkos, 2011 [61]	735	MVD	Endo-ACAB HCR ± robot (n=147) vs. OPCAB (n=588)	No (yes <10)	6.6±6.7 vs 6.1±4.7	0.7% vs 0.7%	—	0.7% vs 0.9%	99.3%	3.2 years	5-year survival 86.8% vs 84.3%
Delhaye, 2010 [46]	36	MVD	HCR (18) vs CABG (18)	No	10 (10-11.2) vs 10.5 (10.0-12.5)	0% vs 0%	0% vs 0%	0% vs 0%	100%	12 mo	100% vs 94.4%
Vassiliades, 2009 [62]	4,266	MVD	HCR (n=91) vs OPCAB (n=4,175)	No	4.2±2.5 (no data OPCAB)	0.0% vs 1.1%	0%	0% vs 1.8%	96%	3 years	3-year 94.0% vs 89.2%
Zhao, 2009 [16]	366	MVD	HCR (n=112, unplanned: 45) or CABG (n=254)	Yes	6 (1-97) vs 5 (1-33)	1.7% vs 1.1%	3% vs 3%	2.6% vs 1.5%	92%	—	—
Kon, 2008 [17]	45	MVD	MIDCAB HCR (n=15) vs OPCAB (n=30)	Yes	3.7 ± 1.4 vs 6.4 ± 2.2	0% vs 3.3%	—	0% vs 0%	100% vs 94% (CTA)	12 mo	100% vs 100%
Reicher, 2008 [31]	39	MVD	HCR (n=13) vs OPCAB (n=26)	Yes	3.6±1.5 vs 6.3±2.3	0% vs 0%	0% vs 0%	0% vs 0%	100% vs 100% (CTA)	6 mo	100% vs 100%
Studies Comparing HCR With PCI (Or CABG)											
Puskas, 2013 [63]	298	MVD	MIDCABG HCR (n=200) vs MV-PCI (n=98)	No (Yes= 24)	—	—	—	—	—	17.6 (± 6.5) mo	1.5% vs 1.0%
Shen, 2013 [64]	423	MVD	MIDCAB HCR (n=141) vs CABG (n=141) vs MV-PCI (n=141)	Yes	—	—	—	—	100%	3 yrs	0.7% vs 2.8% vs 3.5%
Gao, 2010 [65]	43	MVD	MICAB HCR (n=23) vs PCI (n=20)	Yes	—	0% vs 0%	0% vs 0%	0% vs 0%	100%	30 days	0% vs 0%

CABG = coronary artery bypass grafting; CAD = coronary artery disease; CTA = computed tomography angiography; DES = drug-eluting stent; Endo-ACAB = endoscopic atraumatic coronary artery bypass; EuroSCORE = European System for Cardiac Operative Risk Evaluation; F/U = follow-up; HCR = hybrid coronary revascularization; LIMA = left internal mammary artery; LMD = left main disease; MACCE = major adverse cardiac and cerebrovascular events; MICAB = minimally invasive coronary artery bypass; MIDCAB = minimally invasive direct coronary artery bypass; mo = months; MVD = multivessel disease; OPCAB = off pump coronary artery bypass; PCI = percutaneous coronary intervention.

LITERATURE

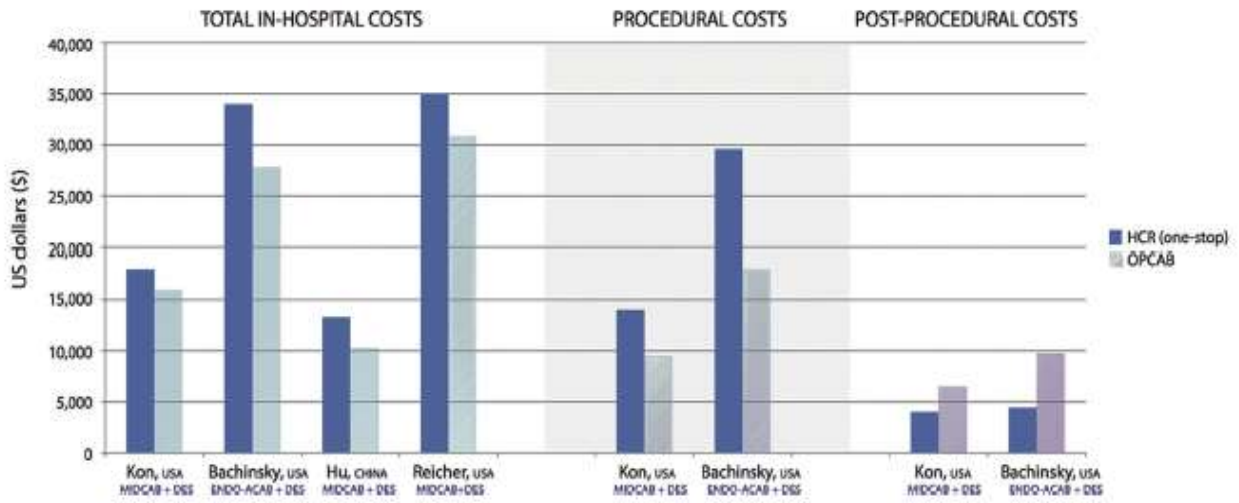


Fig 2. In-hospital cost-specific data of the average patient after 1-stage hybrid coronary revascularization (HCR) versus complete revascularization with off-pump coronary artery bypass graft surgery (OPCAB).

Quality of life assessment was also found to be better in the HCR group (physical score: 32.8 ± 10.4 vs 41.6 ± 10.3, $p = 0.009$, using SF-12) [51]. A number of reasons may contribute to this difference in quality of life and patient satisfaction. Postoperative pain management is of importance for patient satisfaction. Although pain experienced after minimally invasive direct coronary artery bypass is higher compared with other minimally invasive surgical techniques and with sternotomy, the duration for pain to subside is shorter after HCR (10.3 ± 10.9 vs 45.5 ± 33.6 days, $p = 0.004$) [17, 51]. Additionally, the length of intensive care and hospital stay is significantly shorter after HCR compared with CABG or OPCAB, particularly in those who underwent simultaneous or same-day staged HCR (Table 5). After discharge home, patients who underwent HCR returned to work and normal activities much quicker. A study led by Kon

Future Directions

Despite the promising early and mid-term results, recovery parameters and patient satisfaction, HCR still remains relatively limited in its use. A number of factors are accountable. First, there have been no randomized clinical trials that have compared HCR with CABG or multi-vessel PCI to establish an accepted standard of use. In order to demonstrate that HCR is non-inferior or even superior to conventional revascularization strategies in terms of long-term death, myocardial infarction, stroke, and additional revascularization, adequately sized randomized controlled clinical trials are warranted. Apart

Hybrid coronary revascularization is a promising technique that combines the advantages of the LIMA-to-LAD graft with the superior patency of DES compared with SVGs on non-LAD vessels. As such, HCR provides a minimally invasive alternative to conventional CABG and may provide a more durable alternative to multi-vessel PCI. Despite the rapid advances in stent technology and surgical techniques, experience with HCR is currently limited to a little over a thousand cases in a dozen centers around the globe. In order to find a larger and more permanent role for HCR as a mainstream revascularization strategy in the management of patients with multi-vessel disease, further study into the comparative effectiveness of HCR to both conventional and off-pump CABG and multi-vessel PCI is warranted.

LITERATURE

Hybrid coronary artery revascularization: initial experience of a single centre

Elisa Mikus[1]*, Chiara Grattoni[2], Flavio Fiore[3], Massimiliano Conte[4], Roberto Coppola[5], Sergio Chierchia[5], Stefano Bosi[6], Maria Cristina Jori[7], Fausto Castriota[2], and Mauro Del Giglio[1]

Table 1 Preoperative characteristics of patients

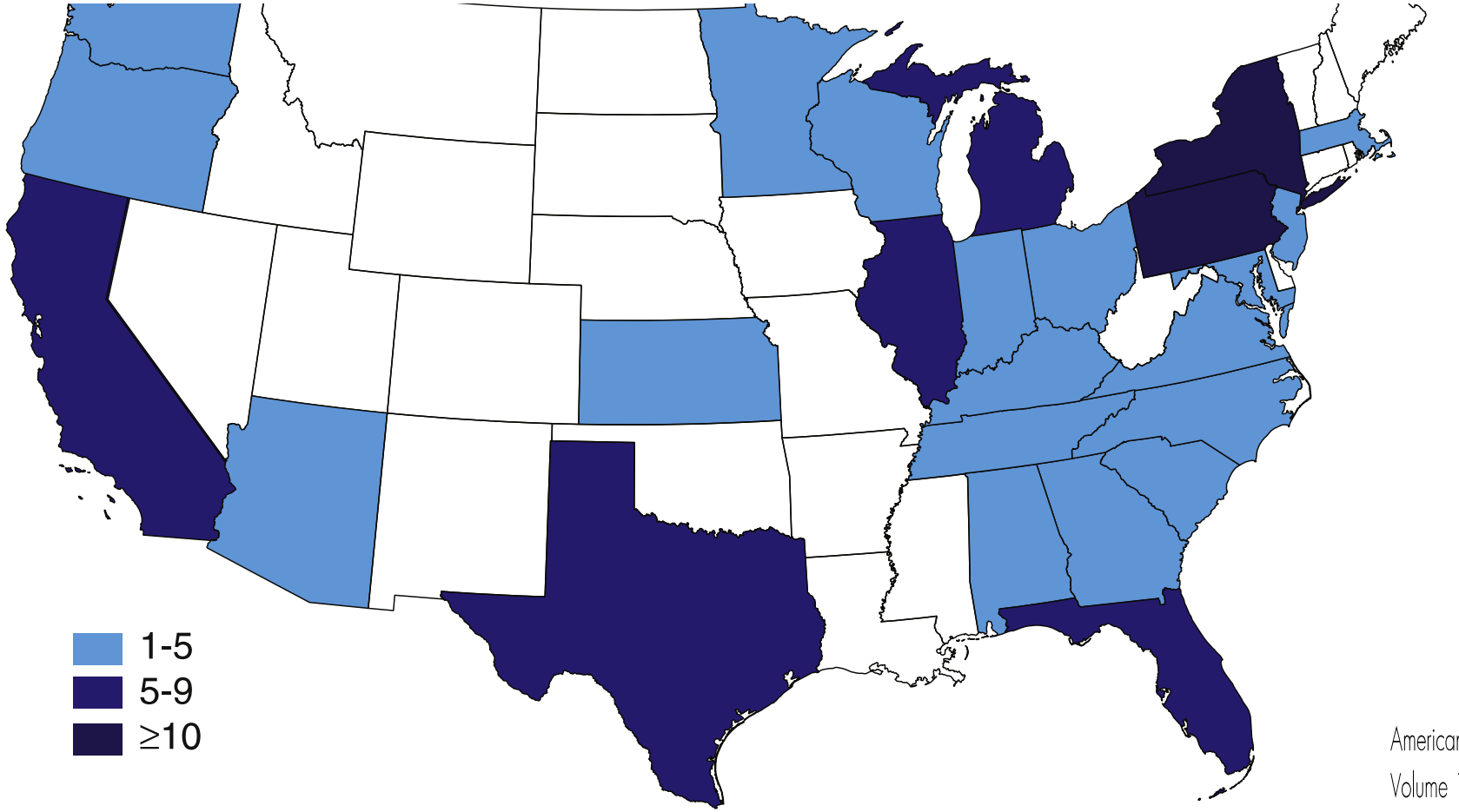
Characteristics	$N = 42$
Age (years)	
Mean ± SD	68.6 ± 10.29
Median (min–max)	70 (53–90)
Male sex (%)	37 (88.1)
Body mass index	
Mean ± SD	27.02 ± 3.78
Median (min–max)	26.24 (21.48–39.79)
Hypertension (%)	30 (71.4)
Diabetes (%)	
Insulin dependent	4 (9.5)
Non-insulin dependent	6 (14.3)
Smoking status (%)	
Current	6 (14.3)
Former	15 (35.7)
Chronic lung disease (%)	2 (4.8)
Renal failure (%) (creatinine >2 mg/dL)	1 (2.4)
Hypercholesterolaemia (%)	27 (64.3)
Peripheral arterial disease (%)	10 (23.8)
Atrial fibrillation (%)	6 (14.3)
Previous PTCA (%)	16 (38.1)
ACEF score (%)	
Mean ± SD	1.21 ± 0.35
Median (min–max)	1.21 (0.77–2.89)
Previous MI (%)	11 (26.2)
Family history of cardiovascular disease (%)	10 (23.8)
CCS classification (%)	
Class 1	6 (14.3)
Class 2	12 (28.6)
Class 3	6 (14.3)
Class 4	1 (2.4)
Cerebrovascular disorder (%)	
Stroke	2 (4.8)
TIA	2 (4.8)
Supra aortic vessel arteriopathy (%)	10 (23.8)

Table 2 Intra- and post-operative data of patients

Characteristics	$N = 42$
Number of vessels treated	
Mean ± SD	1.60 ± 0.63
Median (min–max)	2 (1–3)
Number of lesions treated	
Mean ± SD	1.76 ± 0.79
Median (min–max)	2 (1–4)
Stent type (%)	
Zotarolimus	21 (26.6)
Everolimus	27 (34.2)
Sirolimus	1 (1.3)
BMS	10 (12.6)
Other	14 (17.7)
BVS	6 (7.6)
Periprocedural MI (%)	0 (0)
Tracheotomy (%)	0 (0)
Stroke (%)	0 (0)
Wound dehiscence/infection	1 (2.4)
Hemofiltration	0 (0)
Low-output syndrome IABP (%)	0 (0)
Blood transfusions (%)	6 (14.3)
RBC units	
Mean ± SD	3.67 ± 3.72
Median (min–max)	2(1–11)
Ventilation time (min)	
Mean ± SD	520.79 ± 322.96
Median (min–max)	460 (180–1980)
ICU stay (h)	
Mean ± SD	33.43 ± 25.93
Median (min–max)	21.5 (13–158)
Discharged alive (%)	42 (100)
Discharged to (%)	
Home	16 (38.1)
Rehabilitation centre	21 (50.0)
Other	5 (11.9)
Hospital length of stay (days)	
Mean ± SD	7.67 ± 2.34
Median (min–max)	7 (4–15)

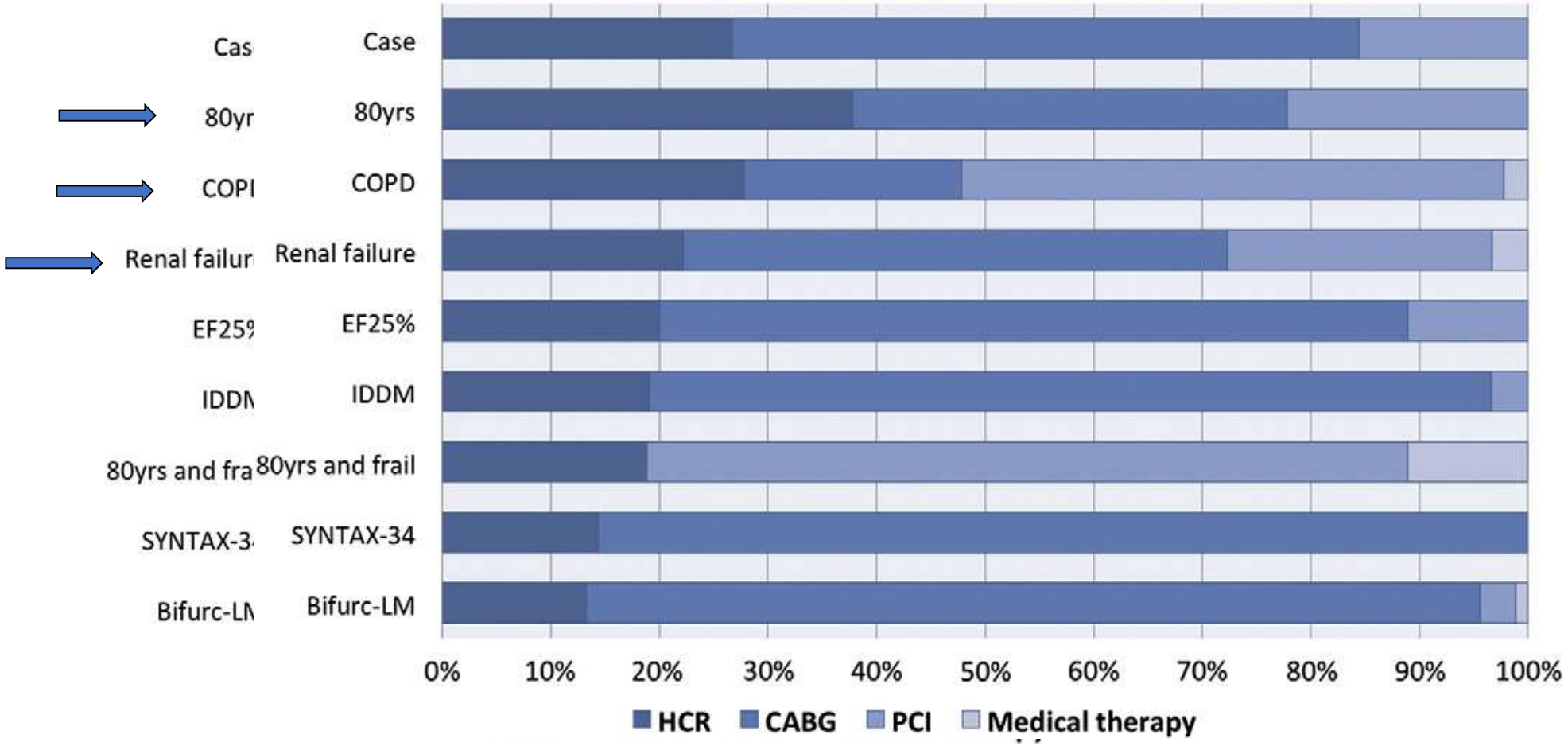
European Heart Journal Supplements (2015) 17 (Supplement A), The Heart of the Mother
doi:10.1093/eurheartj/suv015

A nationwide survey on perception, experience, and expectations of hybrid coronary revascularization among top-ranked US hospitals

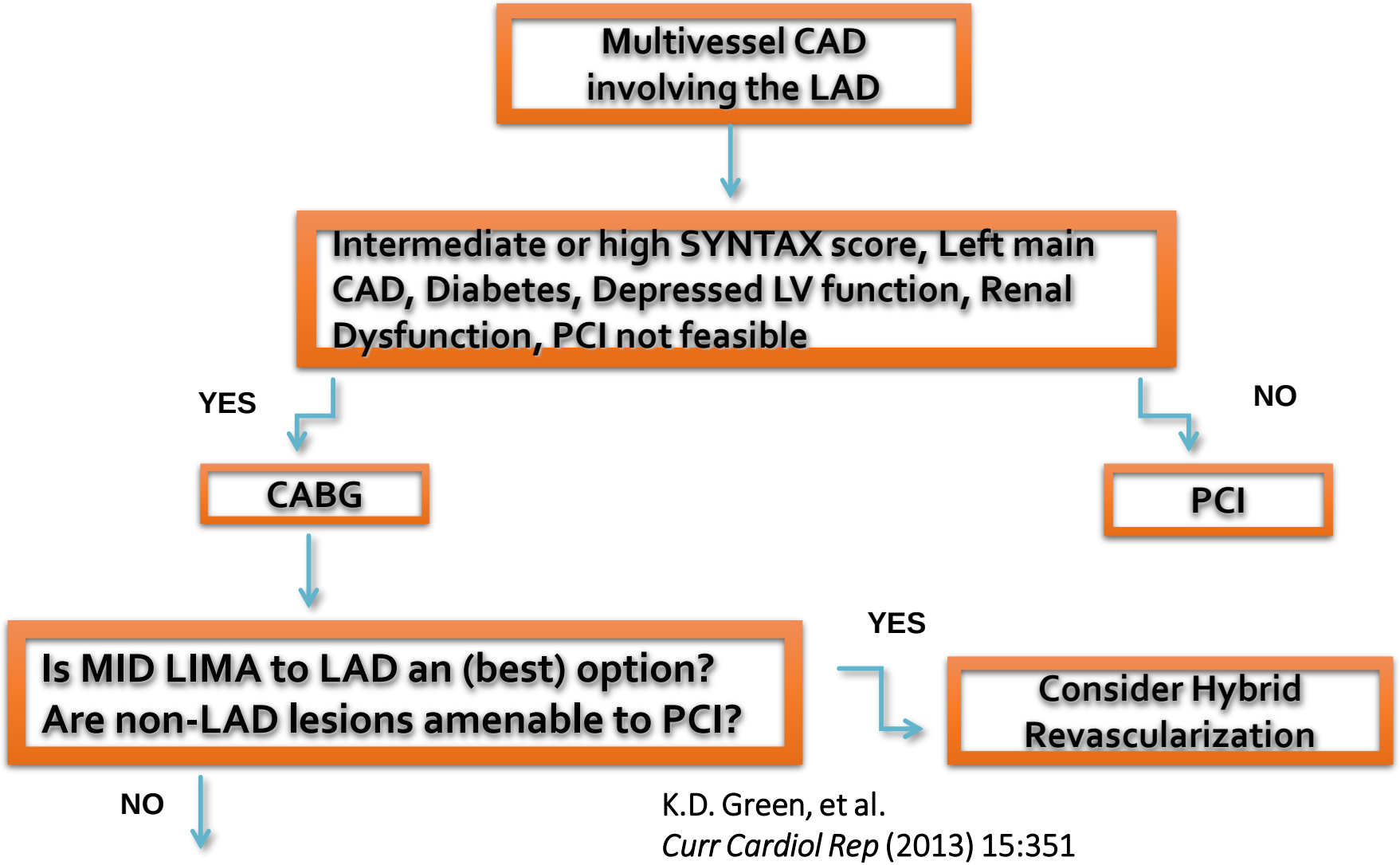


2015
American Heart Journal
Volume 169, Number 4

Preferred management strategy

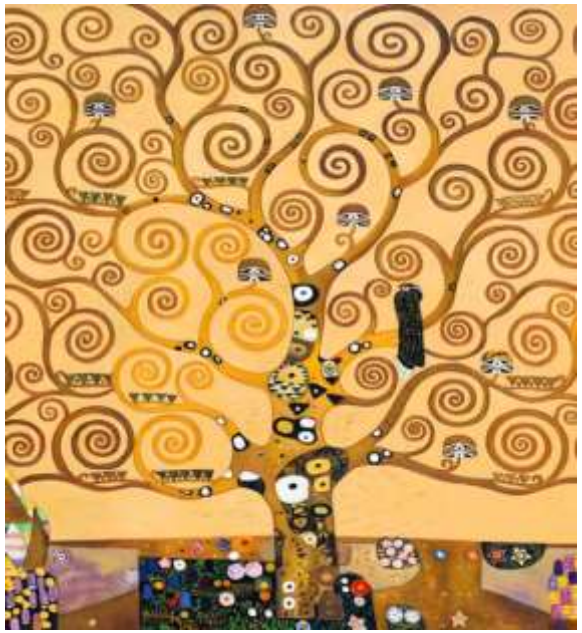


A proposed Algorithm



K.D. Green, et al.
Curr Cardiol Rep (2013) 15:351

La Rivascolarizzazione Chirurgica nel Paziente con Anatomia Coronarica Complessa



CORONAROPATIA “ANATOMICAMENTE COMPLESSA”

1. **NUMERO DEI VASI COINVOLTI**
2. **TIPOLOGIA DELLE LESIONI**
3. **LORO LOCALIZZAZIONE**

SYNTAX SCORE

Boston Scientific

CARDIALYSIS
Clinical Trial Management - Core Laboratories

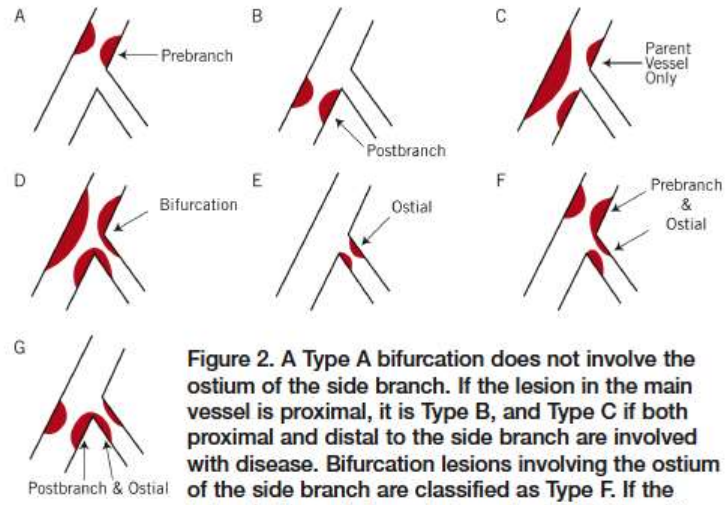


Figure 2. A Type A bifurcation does not involve the ostium of the side branch. If the lesion in the main vessel is proximal, it is Type B, and Type C if both proximal and distal to the side branch are involved with disease. Bifurcation lesions involving the ostium of the side branch are classified as Type F. If the lesion in the main branch is proximal, it is Type G, and Type D if both proximal and distal to the side branch are involved. If only the ostium of the side branch is narrowed, such a lesion is considered Type E.

LA REALTA' E' QUASI SEMPRE MOLTO PIU' DIFFICILE

- ✓**PLURIVASALE NON SEMPRE SIGNIFICA COMPLESSO E MONOVASALE NON SEMPRE SEMPLICE**

- ✓ **LESIONI DI TIPO DIVERSO POSSONO COESISTERE NELLO STESSO PAZIENTE O SULLA STESSA ARTERIA**

- ✓ **IL POTENZIALE EVOUTIVO DI OGNI LESIONE E' DIFFICILE DA INTERPRETARE**

QUANDO LE LESIONI SONO TALMENTE COMPLESSE DA FAR CONSIDERARE IL PAZIENTE “INOPERABILE” ?

DA COMPLESSO A “INOPERABILE”

CHE COSA RENDE “INOPERABILE” ?

UNA SITUAZIONE ANATOMICA CHE NON PERMETTE L’ESECUZIONE DI UN BYPASS A BENEFICIO DELL’IVA IN PRESENZA DI MIOCARDIO ISCHEMICO E VITALE

- **VASI “ESILI”**
- **STENOSI MULTIPLE O DIFFUSE**
- **CALCIFICAZIONI DIFFUSE**
- **OCCLUSIONI COMPLETE SENZA VISUALIZZAZIONE DEL LETTO A VALLE**

DA COMPLESSO A “INOPERABILE”

CHI LO DECRETA “INOPERABILE” ?

DIFFICILE RESPONSABILITA’ DEL CARDIOCHIRURGO

PAZIENTE INOPERABILE

DEFINIRE UN PAZIENTE "ANATOMICAMENTE INOPERABILE" SIGNIFICA EMETTERE UNA SENTENZA CHE LO ESPONE AD UN MAGGIOR RISCHIO DI EVENTI SUCCESSIVI

- ***PER EVOLUZIONE DELLA MALATTIA***

- ***PER LA MESSA IN OPERA DI PROCEDURE POCO EFFICACI, INUTILI O DANNOSE (PER COMPLICAZIONI PROPRIE O PER AUMENTO DEL RISCHIO NEL CASO DI UNA SUCCESSIVA RICOSTRUZIONE CHIRURGICA)***

Quale Strategia adottare nella coronaropatia complessa?

ESC/EACTS GUIDELINES

10.2.1 Coronary vessel

…….. Diffuse CAD is often seen in the presence of insulin-treated diabetes, long-standing and untreated hypertension, PAD, and CKD.

Different technical approaches have been applied to vessels with diffuse pathology such as very long anastomoses, patch reconstruction of the vessel roof with or without grafting to this roof, coronary endarterectomy, and multiple anastomoses on the same vessel, with no evidence of superiority of any one.

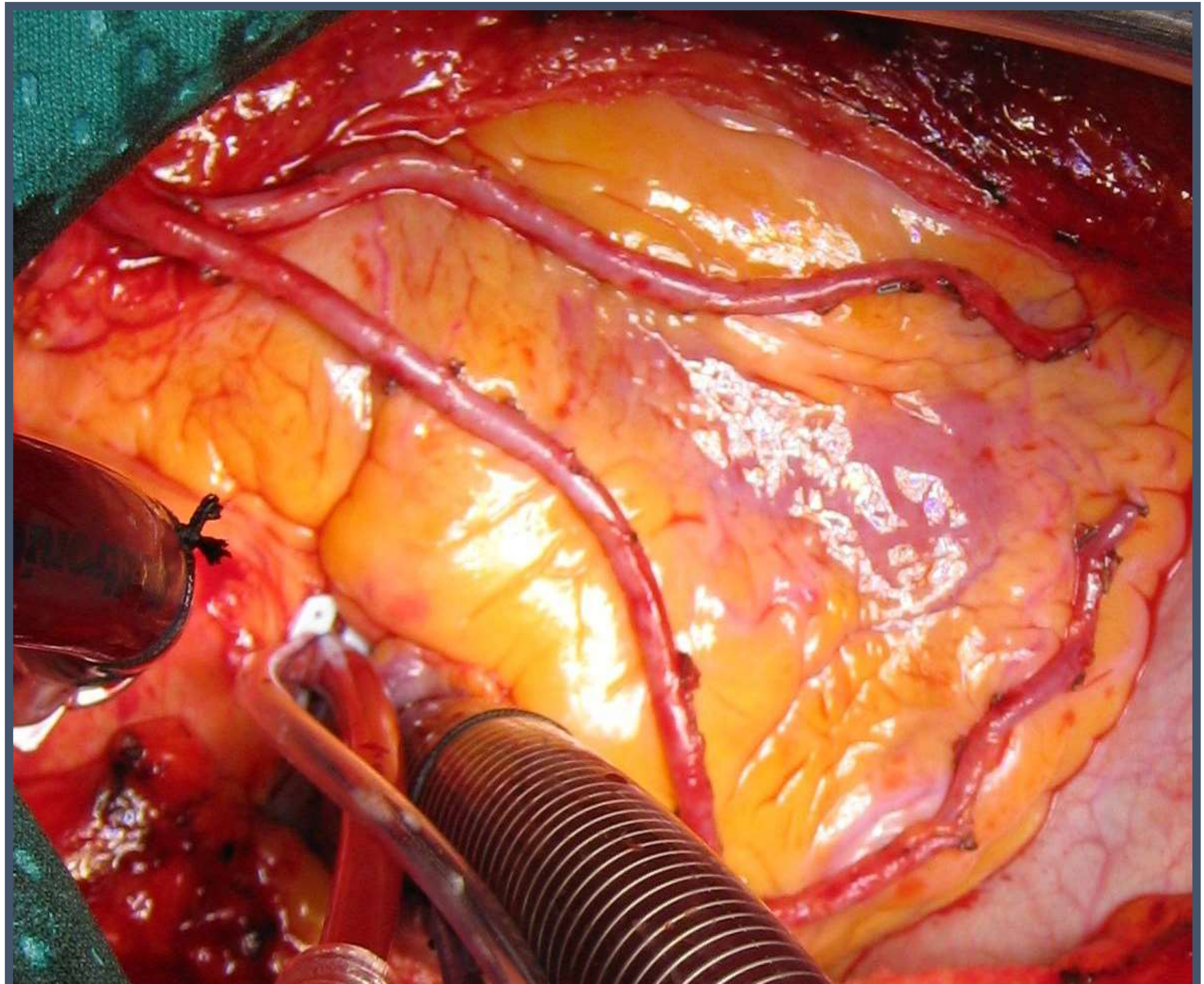
European Heart Journal (2010) 31, 2501–2555
doi:10.1093/eurheartj/ehq277

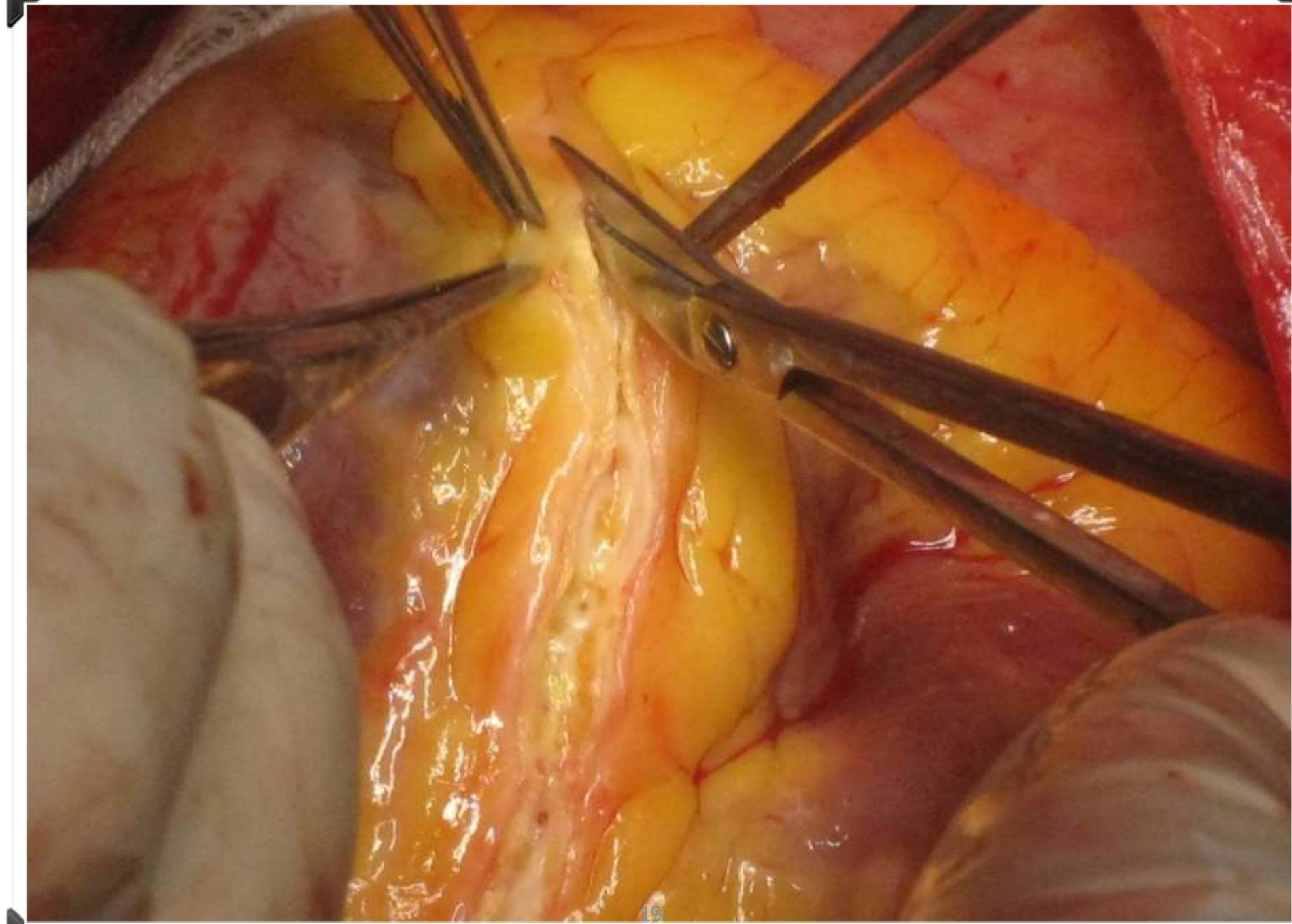
RICHIESTE E NECESSITA’

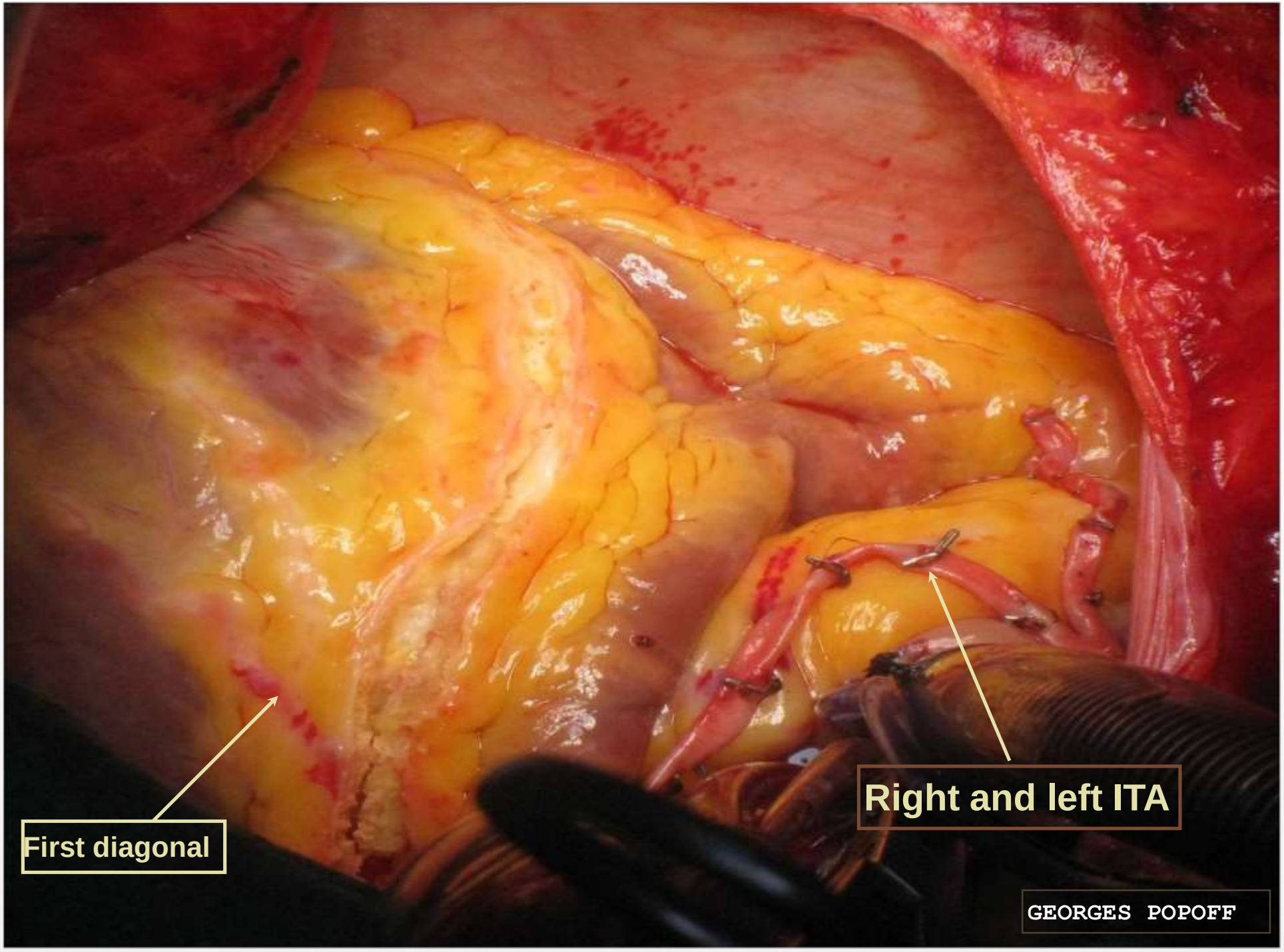
- ✓ **OGNUNO VORREBBE ESSERE TRATTATO NEL MODO MENO INVASIVO POSSIBILE**
- ✓ **MA OGNUNO VORREBBE «GUARIRE»**

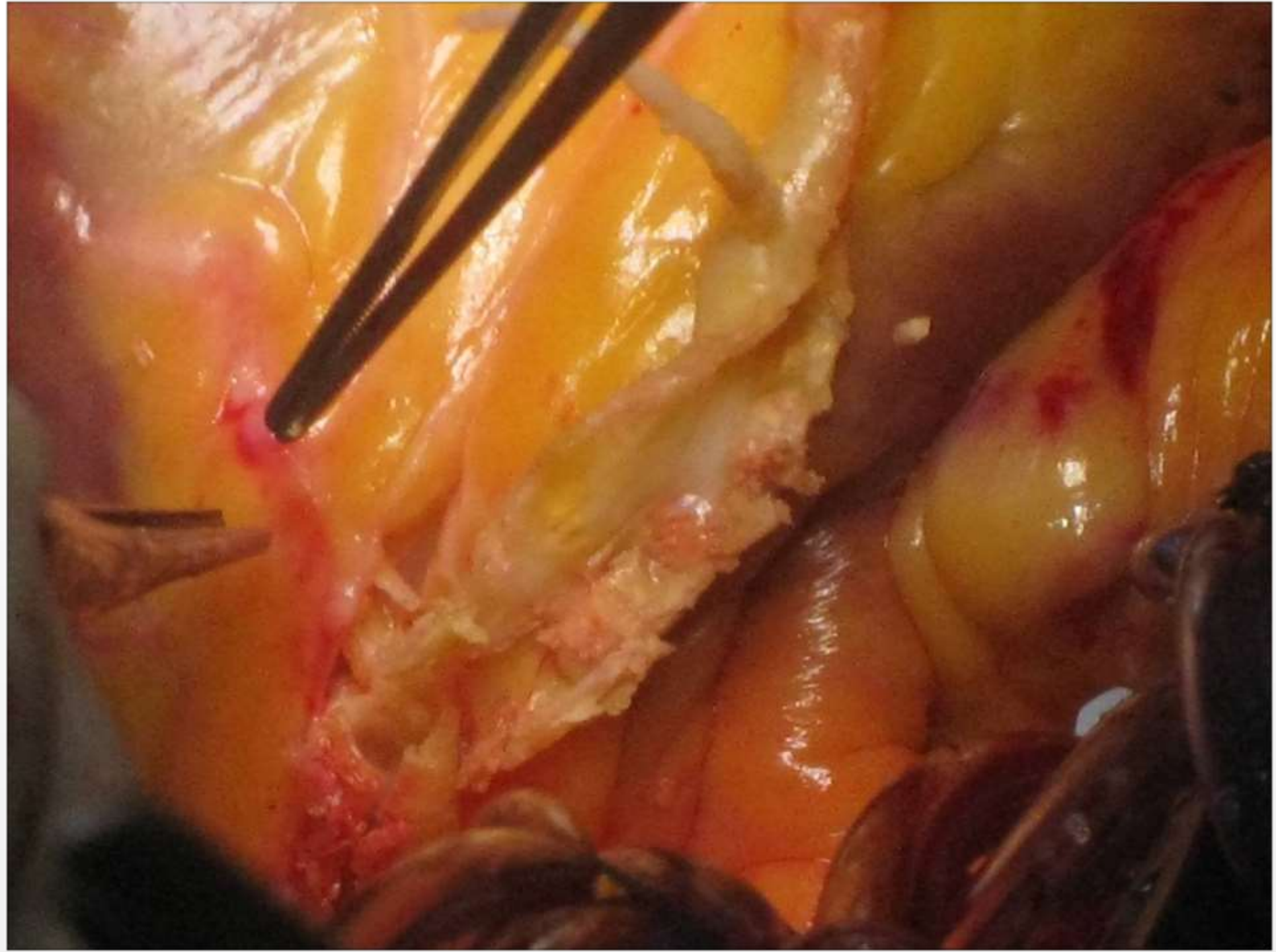
LA RICOSTRUZIONE CORONARICA

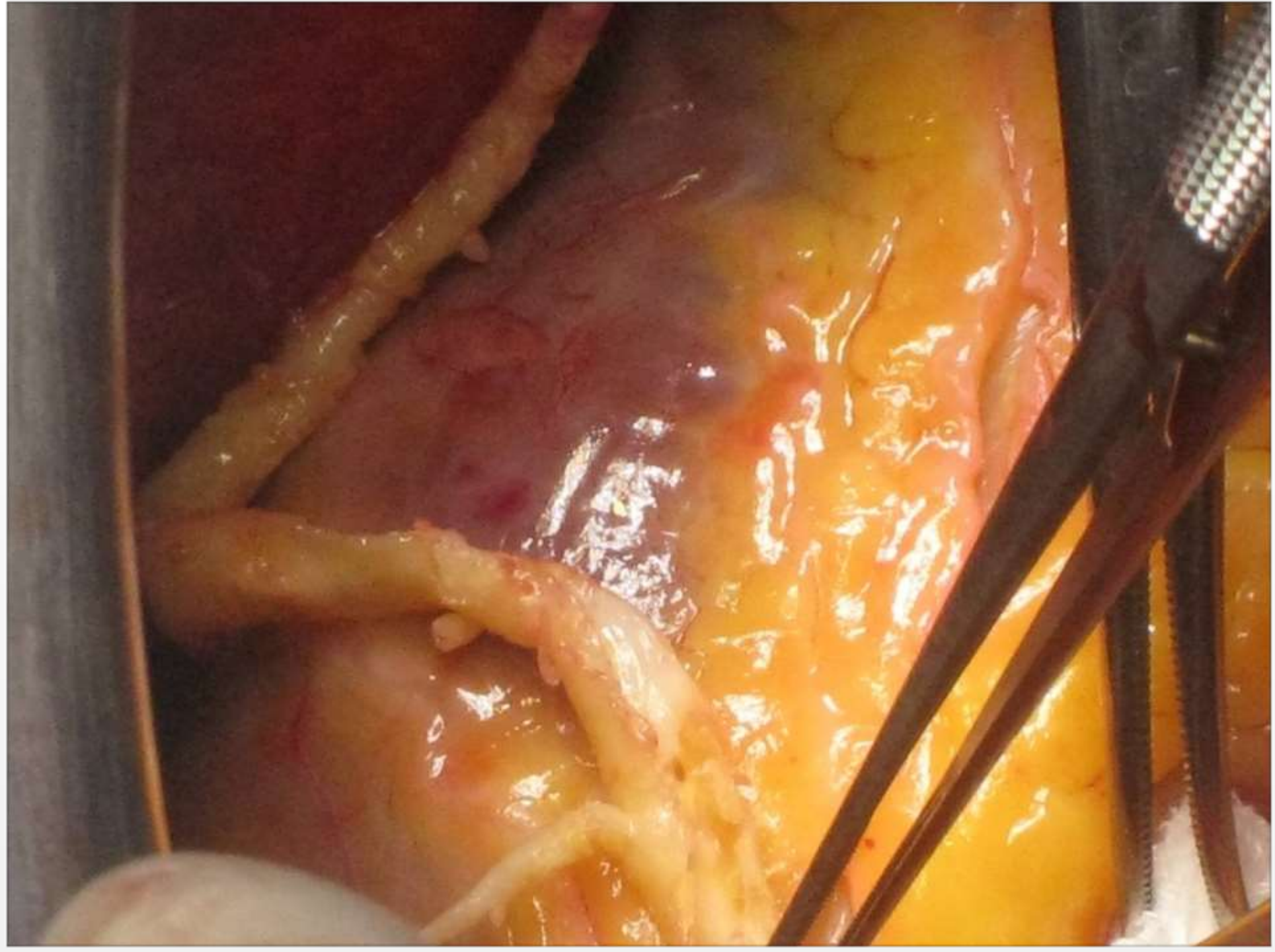
INTERVENTO CHIRURGICO CODIFICATO INDICATO IN FORME PARTICOLARI DI MALATTIA CORONARICA NATURALE O IATROGENA, CARATTERIZZATO DALLA RIMOZIONE DEI MATERIALI PATOLOGICI E LA SOSTITUZIONE DI PARTE DELLA PARETE CORONARICA NATIVA MEDIANTE UN PATCH ENDOTELIALE DI ARTERIA MAMMARIA

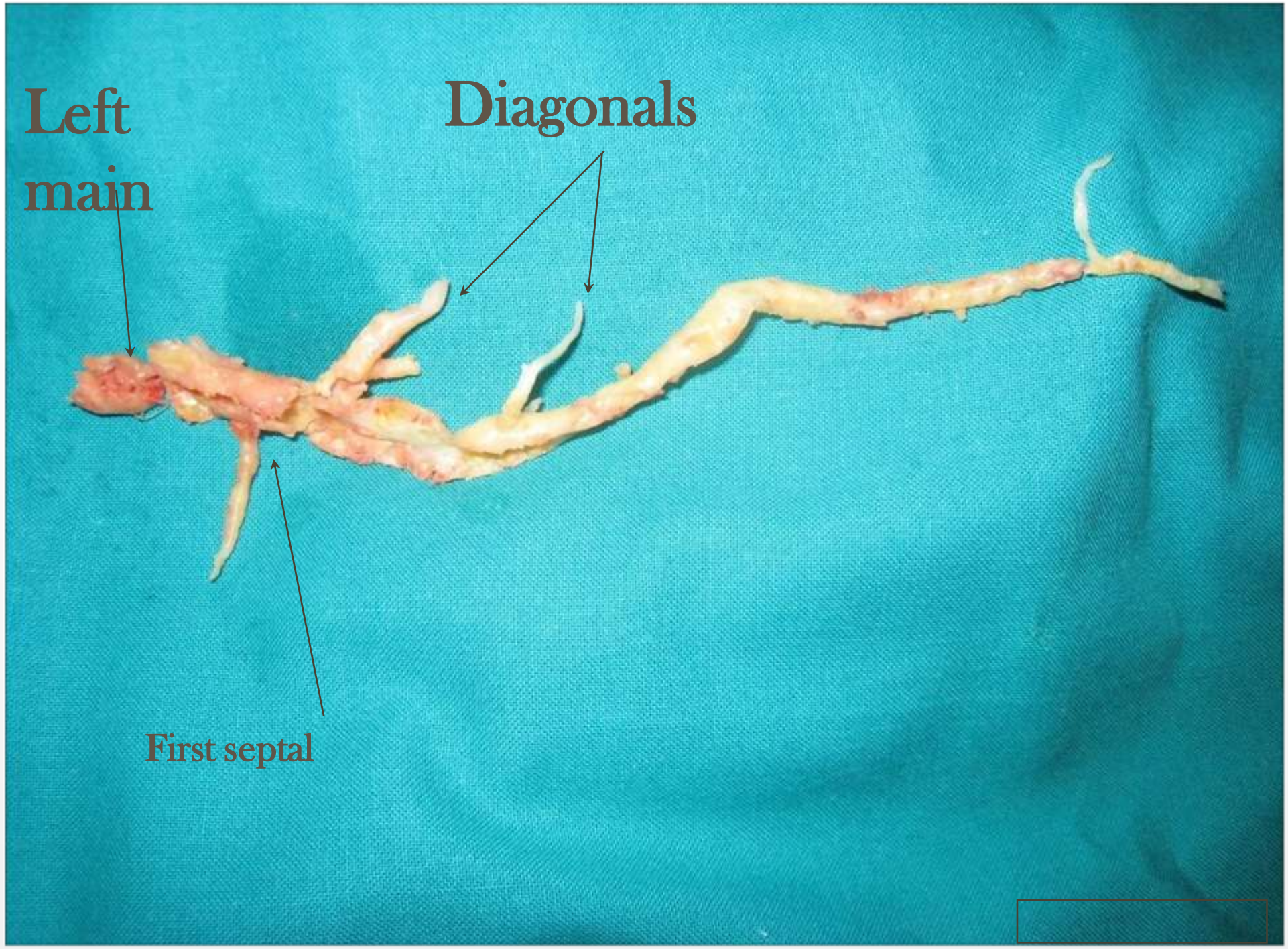


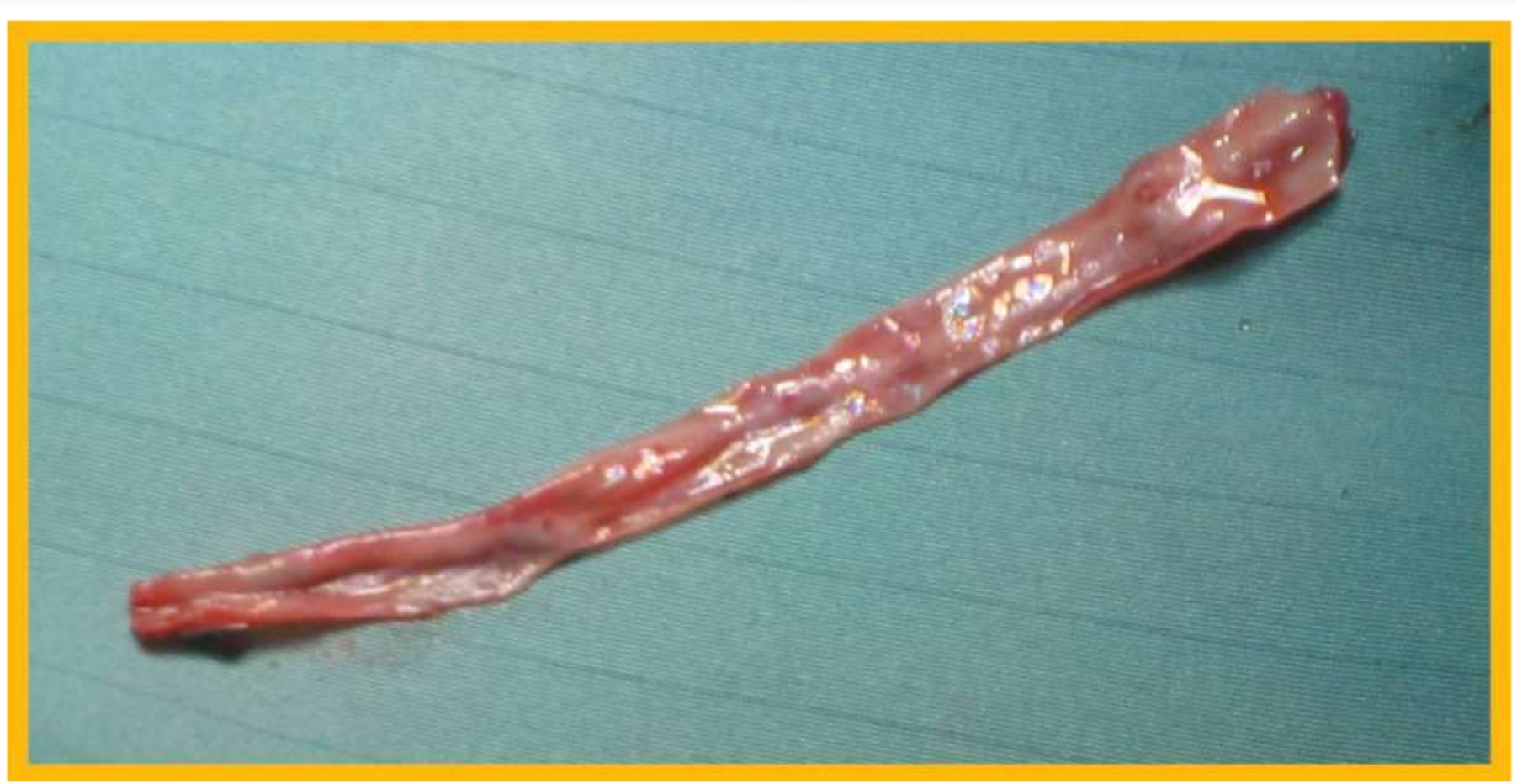


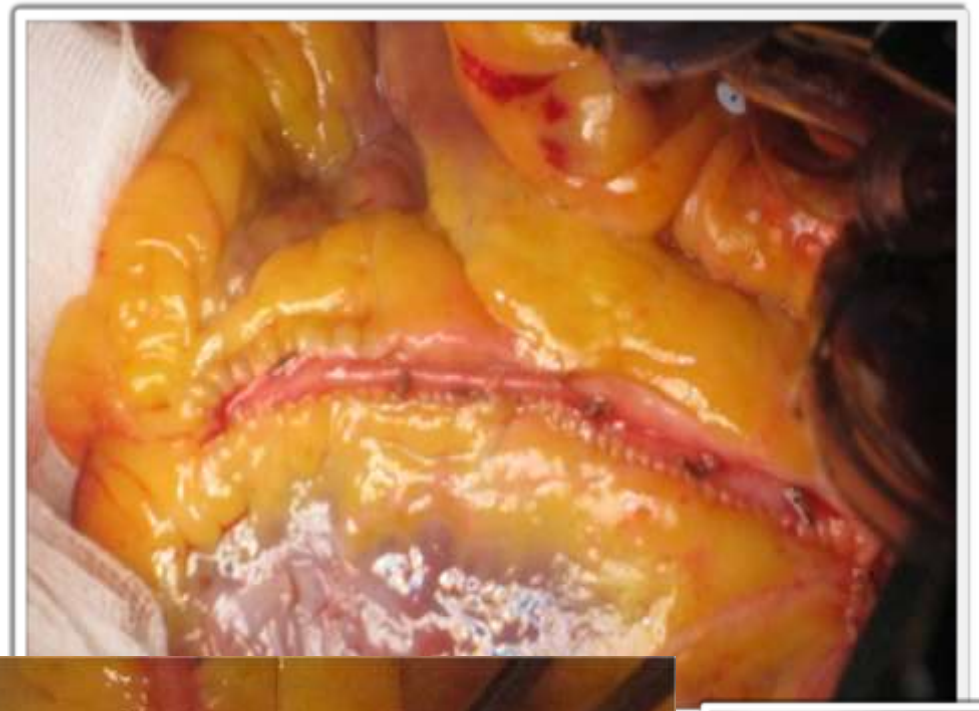

First diagonal
Right and left ITA
GEORGES POPOFF

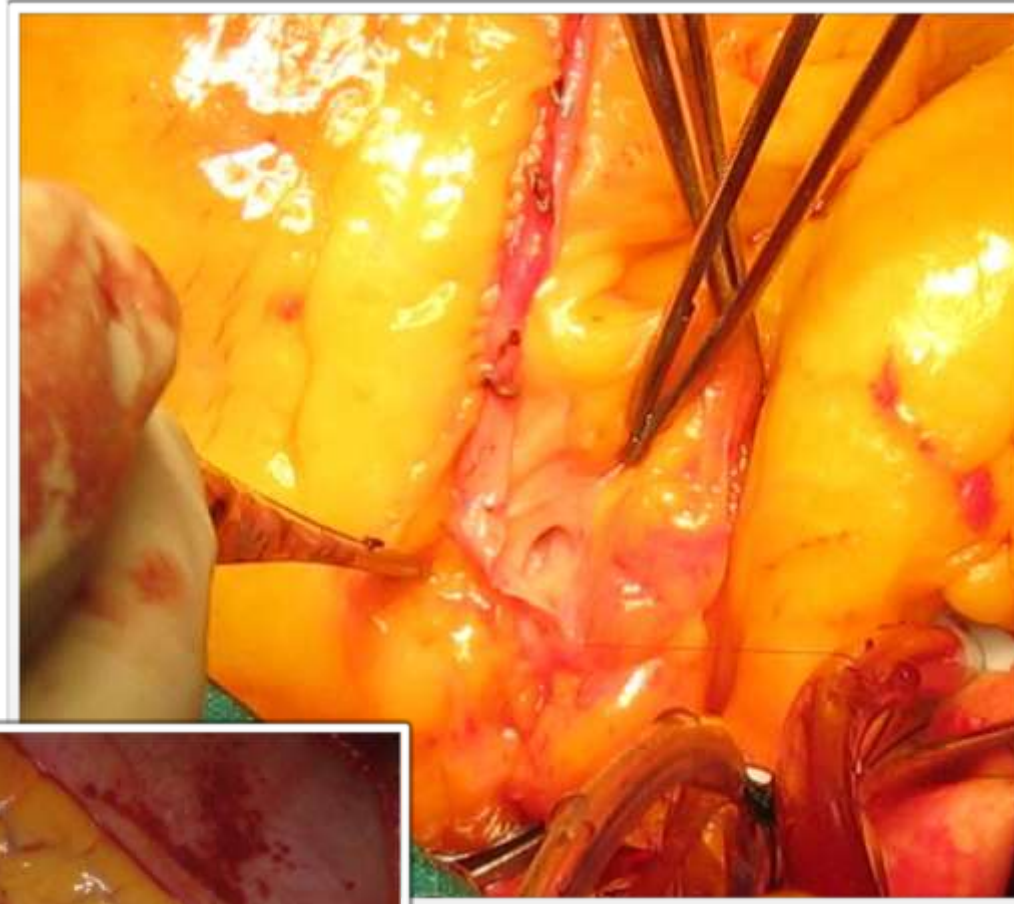


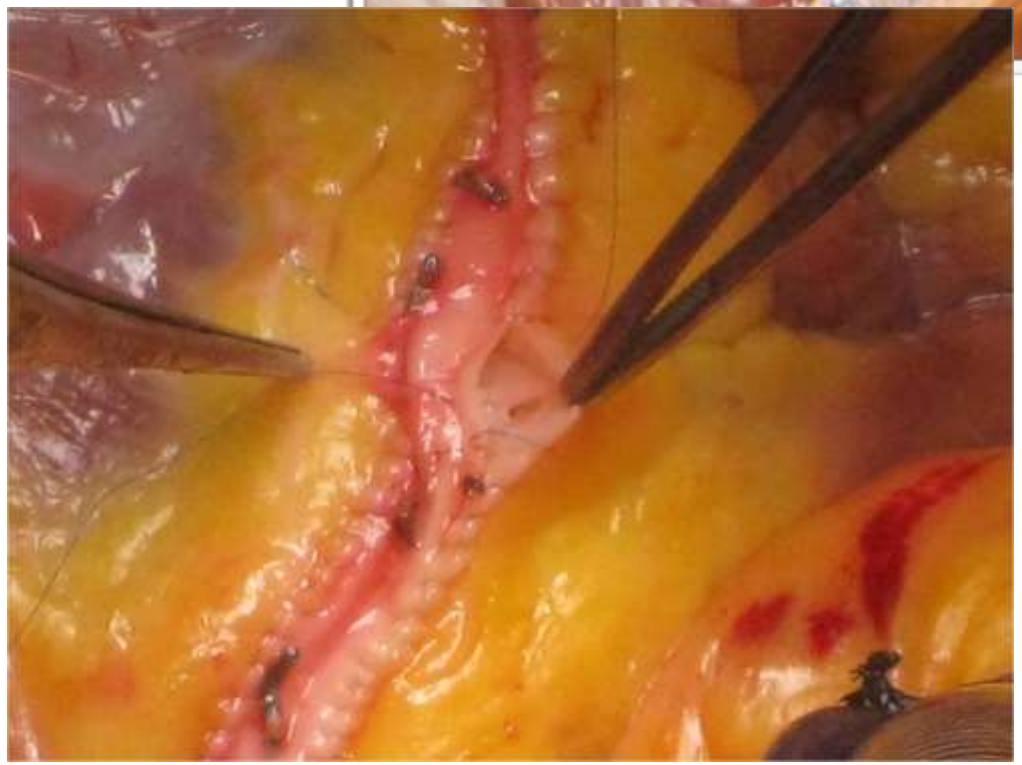



Left main
Diagonals
First septal









INDICAZIONI ALLA RICOSTRUZIONE CORONARICA

1. **MALATTIA DIFFUSA D.A , ANCHE CALCIFICA O IN FORMA OCCLUSIVA, NON O MAL RIVASCOLARIZZABILE MEDIANTE PCI O CABG**

2. **MALATTIA D.A. PROSSIMALE COINVOLGENTE L'OSTIO DI S1 e D1**

3. **PRESENZA DI STENTS STENOSANTI DELLA D.A.**

4. **PRESENZA DI STENTS PERVII MA OSTRUENTI COLLATERALI**

CONTROINDICAZIONI ALLA RICOSTRUZIONE CORONARICA

- **AMI NON DISPONIBILI PER IL PATCH ENDOTELIALE E/O PER IL BYPASS DI PROTEZIONE SUL PATCH**
- **RICOSTRUZIONE ESTESA DI C.D. O CX , SE D.A. DEVE ESSERE RICOSTRUITA**
- **ASSENZA DI VITALITÀ RESIDUA IN TERRITORIO ESTESAMENTE NECROTICO**

GEORGES POPOFF - Firenze

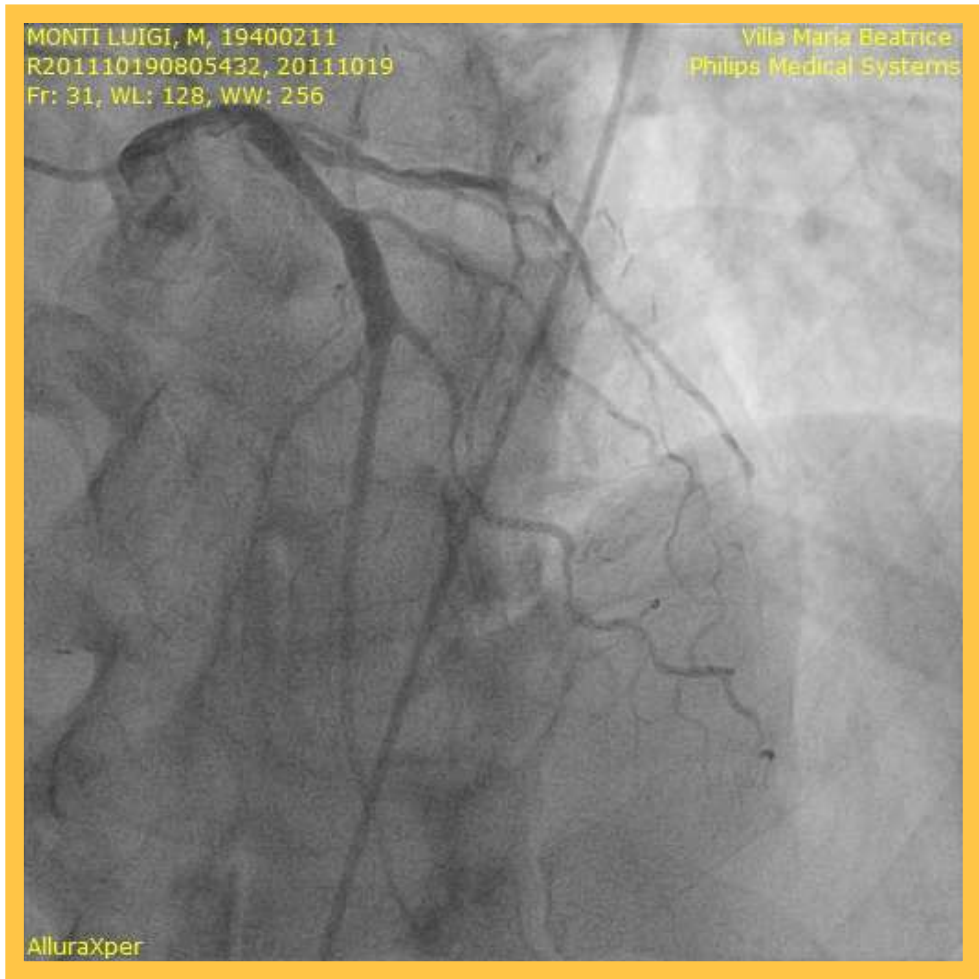
2009-2014

450 PZ. sottoposti a RICOSTRUZIONE:

>80% estese al tratto prossimale di IVA

MORTALITA PERI-OPERATORIA RIC. ISOLATE (ESCLUSI REDO)

1.33%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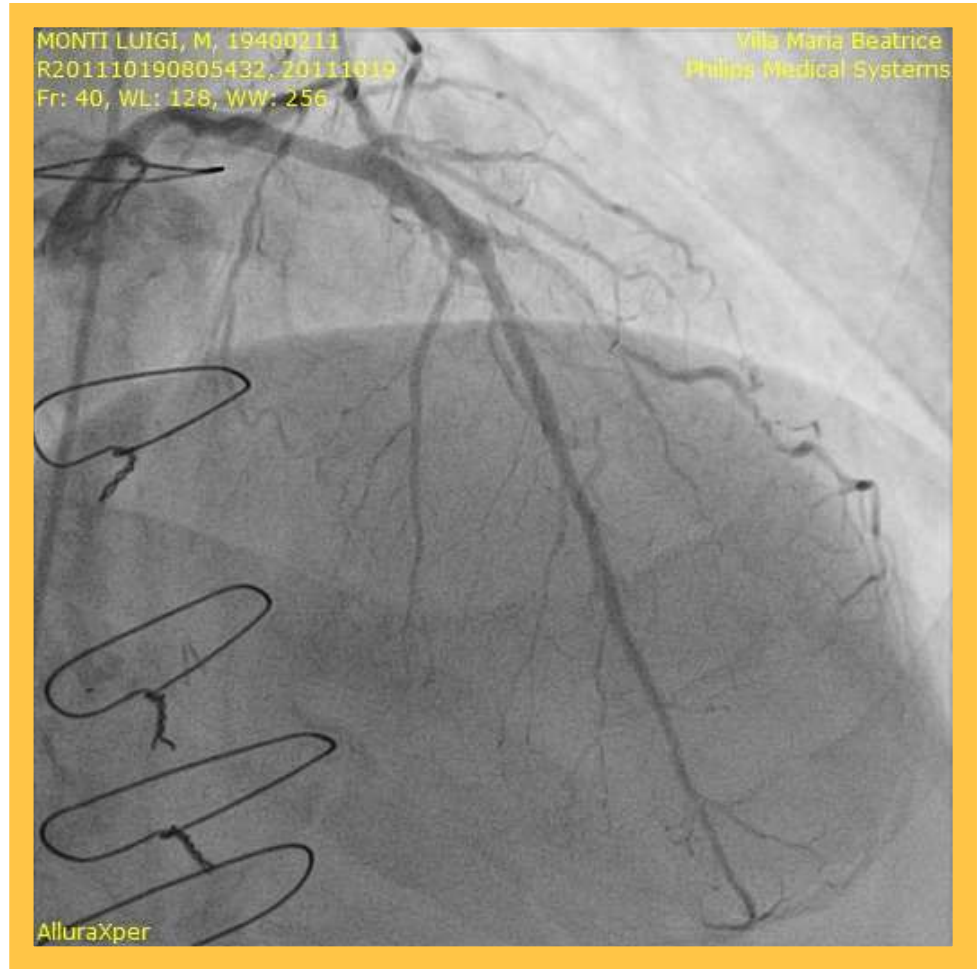
Philips Medical Systems
AlluraXper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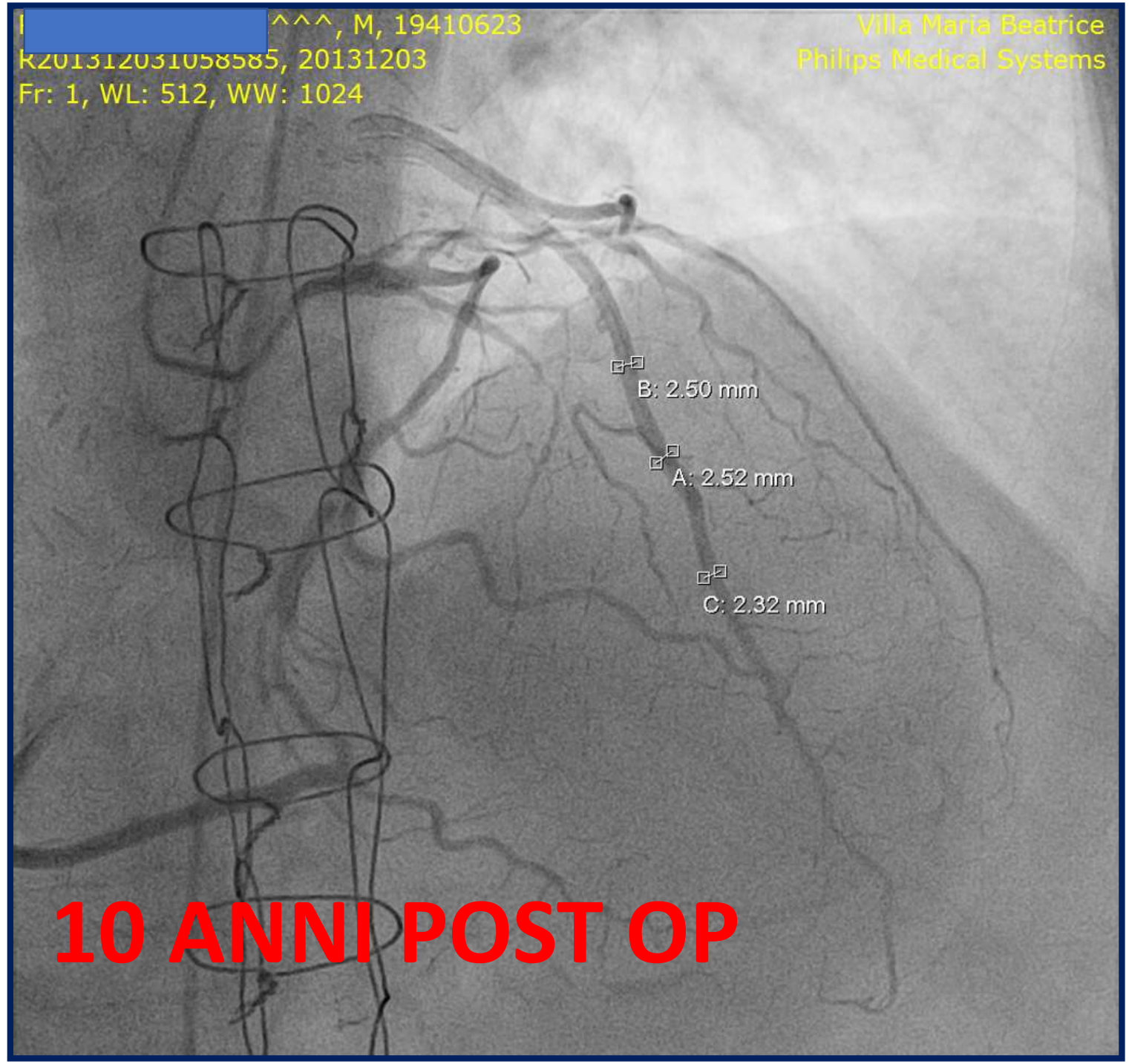
^^^, M, 19410623
Villa Maria Beatrice
Philips Medical Systems
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A: 2.52 mm
C: 2.32 mm
10 ANNI POST OP

CONCLUSIONI

LA RICOSTRUZIONE CORONARICA PUO' ESSERE VISTA COME LA TERZA VIA DI RIVASCOLARIZZAZIONE ED ESSERE PROPOSTA AD UNA POPOLAZIONE DI PAZIENTI POTENZIALMENTE NUMEROSA ALTRIMENTI NON O MAL RIVASCOLARIZZABILE

Agenda

Introduction

Aortic valve

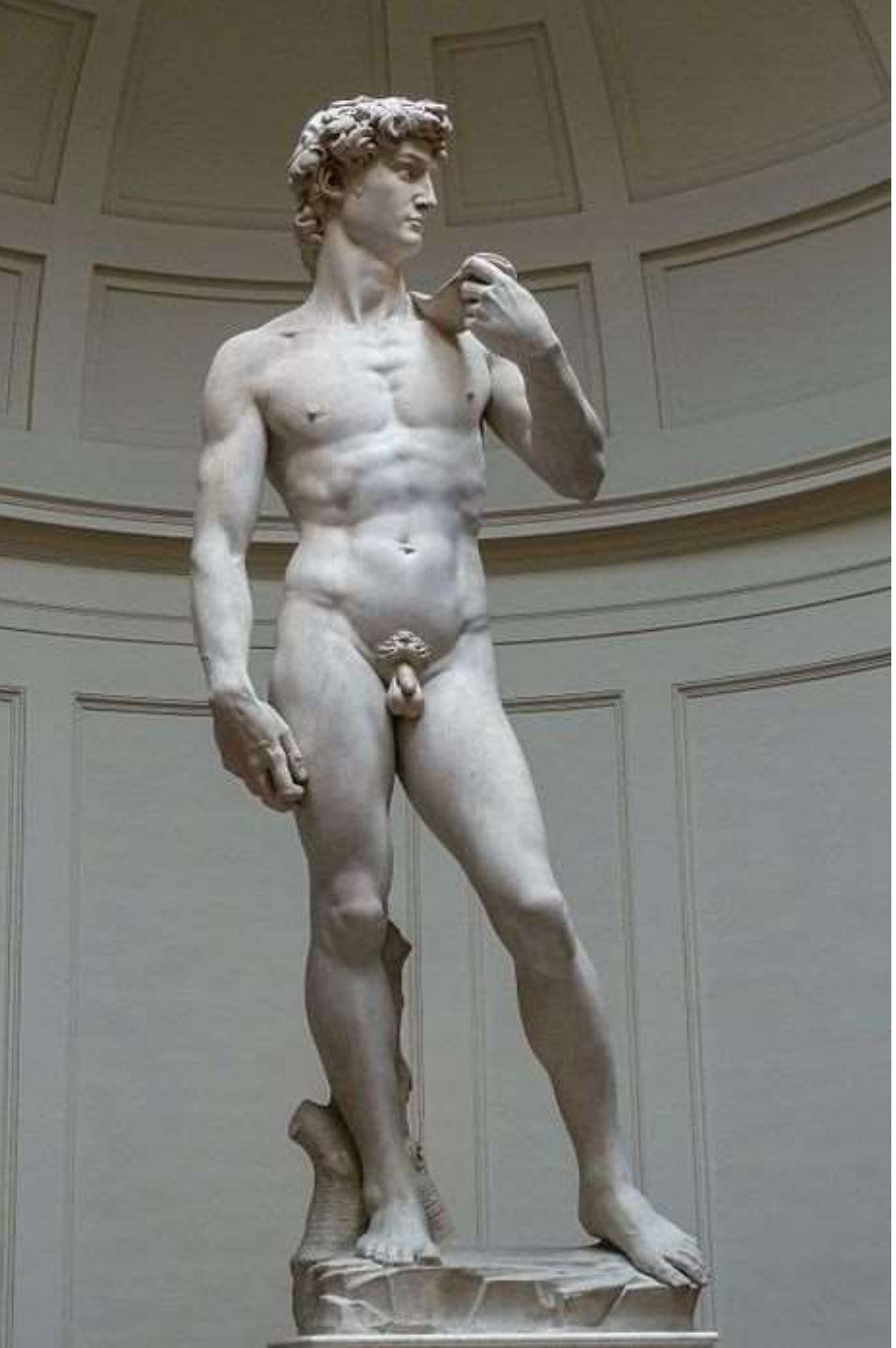
Aorta

Mitral valve

Coronary disease

Closing remarks

- Attenersi alle linee guida
- Anticipare l’indicazione solo per evidenti dati clinici e con chirurghi di alto volume
- Prediligere gli interventi radicali e curativi
- Considerare le nuove protesi biologiche
- Considerare gli approcci meno invasivi



Thank you