LA STENOSI VALVOLARE AORTICA

LE COMPLICANZE DELLE TECNICHE INTERVENTISTICHE E DELLA CARDIOCHIRURGIA

LE DIFFICOLTÀ PROCEDURALI
ACCENNO ALLA CHIRURGIA MINI-INVASIVA
RIMEDI DELLA PROCEDURA CARDIOCHIRURGICA

Enrico Citterio
U.O. Cardiochirurgia

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LA STENOSI VALVOLARE AORTICA: COMPLICANZE DELLE PROCEDURE CARDIOCHIRURGICHE

La chirurgia cardiaca è una chirurgia maggiore, complessa, che comporta necessariamente il possibile insorgere di complicanze durante lo svolgimento

Negli anni si è assistito ad una progressivo incremento dell'indice di complessità dei pazienti sottoposti ad intervento cardiochirurgico

Tuttavia, l'incidenza delle complicanze tecniche legate strettamente alla procedura chirurgica, rappresenta percentualmente la causa meno frequente di mortalità

L'outcome dei pazienti cardiochirurgici risulta maggiormente condizionato dalla complessità della condizione pre-operatoria del paziente, dal suo profilo di rischio, dalla fragilità, che non da specifiche complicanze della procedura chirurgica

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DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

European Journal of Cardio-Thoracic Surgery 47 (2015) 341–345
doi:10.1093/ejcts/ezu380 Advance Access publication 29 October 2014

ORIGINAL ARTICLE

Cite this article as: Westaby S, De Silva R, Petrou M, Bond S, Taggart D. Surgeon-specific mortality data disguise wider failings in delivery of safe surgical services. Eur J Cardiothorac Surg 2015;47:341–5.

Surgeon-specific mortality data disguise wider failings in delivery of safe surgical services

Stephen Westaby[a,*], Ravi De Silva[b], Mario Petrou[a], Simon Bond[c,d] and David Taggart[a]

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…In the public eye surgeon mortality data implies that only one individual has the scope to determine patient outcome…

…collective team experience and multidisciplinary input have considerably more influence on outcome

Deaths are triggered by a seminal event, which is the catalyst of a cascade of processes that culminate in death

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METHODS: Using POCMA and FTR analysis, we studied hospital deaths in 1558 cardiac surgical patients between 2009 and 2013. Comorbidity and urgency status were used to calculate modified logistic EuroSCORE (MLE). The circumstances of death were critically reviewed by a panel of four experienced surgeons. Death certificate information and autopsy were taken into account. Deaths were then classified: Class 1 surgeon dependent, Class 2 FTR or Class 3 where multiple factors conspired to cause death.

RESULTS: There were 51 deaths providing 3.3% mortality, as predicted by MLE. In the 86% who underwent autopsy, no surgical error was identified. Most deaths in each group were related to high-risk status, age, frailty, comorbidity and urgency. FTR was the predominant factor occurring in 45%. Though difficult operations were implicated in 37%, no deaths occurred in the operating theatre. Some FTR deaths occurred in low-risk patients. Scrutiny of FTR deaths provided important information that could be used for quality improvement.

Class 1 surgeon dependent: mortality directly related to the surgical procedure, where inappropriate patient selection, a *de novo* intraoperative event, a technical error or postoperative bleeding initiated the pathway to death.

Class 2 failure to rescue: mortality following an uneventful operation where a new potentially treatable and retrievable postoperative complication not present on hospital admission caused death.

Class 3 multifactorial: mortality where multiple factors including frailty, comorbidity, critical preoperative state or surgical complexity, contributed to death despite an uneventful and effective surgical procedure.

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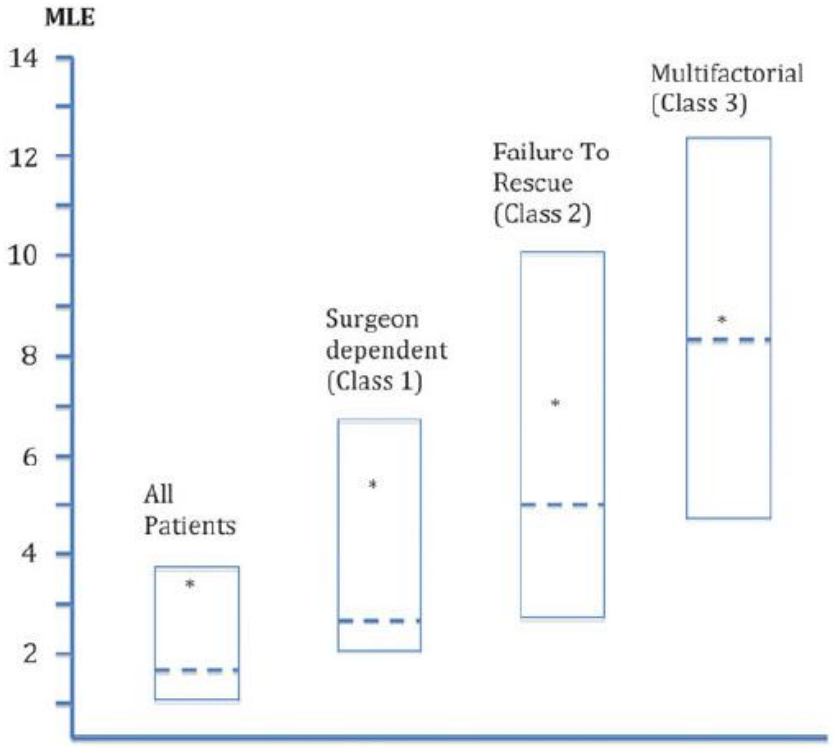

Figure 1: Box chart showing modified logistic EuroSCORE (MLE) between the different patient groups by median MLE (dashed line), mean MLE (asterix) and interquartile range (box).

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Table 2: Summary of observed patient deaths, subdivided into procedure and 'class' of death

Procedure	All deaths	Surgeon dependent	Failure to rescue	Multifactorial
CABG	22 (43.1%)	8	11	3
AVR	4 (7.8%)	0	2	2
AVR + CABG	7 (13.7%)	0	4	3
MV surgery	0	0	0	0
MV + CABG	1 (2.0%)	1	0	0
Other surgery	17 (33.3%)	10	6	1
Total	51	19 (37.3%)	23 (45.1%)	9 (17.6%)
Median MLE	4.6	2.9	4.7	7.0
Median age	79	71	75	80

Blue Book Online

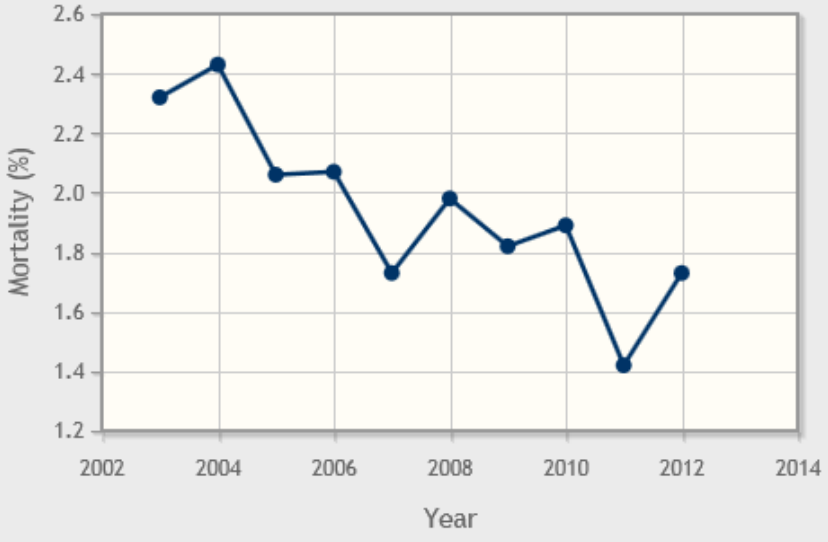
The Society for Cardiothoracic Surgery in Great Britain & Ireland

What are the actual outcomes of the operations?

Heart surgery is major surgery. There has been a lot of attention paid to the mortality rates after surgery in recent years, which has encouraged service improvements and driven the overall risk of surgery down. When we talk about 'mortality rates' in this section, we are talking about the percentage of patients who died in hospital (before they were discharged) after having a heart operation. The mortality varies for different operation groups; for example the risk of isolated first time coronary artery surgery is lower than for the more complex combined aortic valve and coronary artery surgery. The mortality rate each year is given in the following table and graph – the particular operation group can be selected from the drop-down menu.

Isolated first-time AVR

Year	Mortality (%)
2003	2.32
2004	2.43
2005	2.06
2006	2.07
2007	1.73
2008	1.98
2009	1.82
2010	1.89
2011	1.42
2012	1.73



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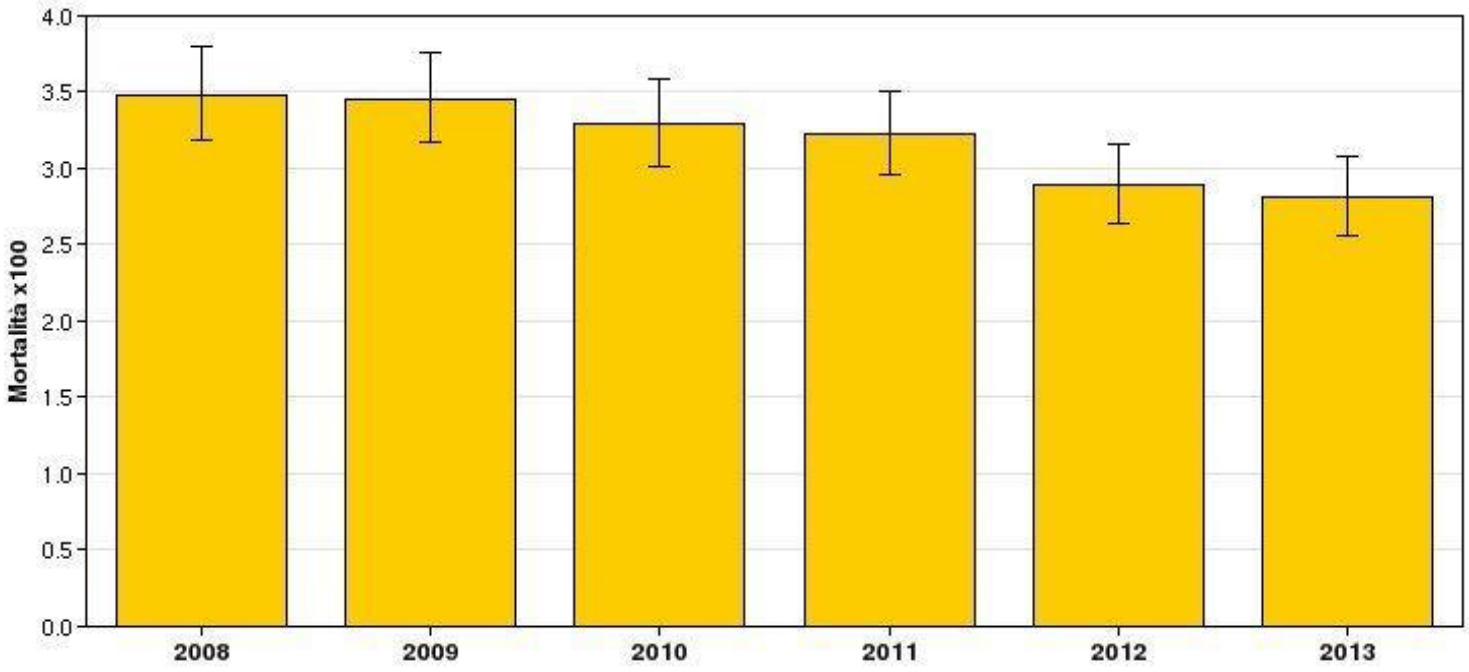
Valvuloplastica o sostituzione di valvole cardiache: mortalità a 30 giorni.



DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

- Difficoltà legate a condizioni anatomo-patologiche

  Patologia della parete aortica
  - Calcificazioni della parete aortica
  - Dilatazione della radice aortica
  - Bicuspidia della valvola aortica

  Patologia dell'anulus valvolare aortico
  - Severa calcificazione anulare
  - Anulus di piccole dimensioni
  - Lesioni da endocardite dell'anulus valvolare

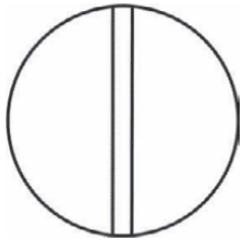
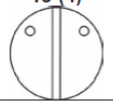
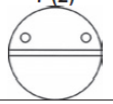
- Difficoltà legate al tipo di approccio chirurgico

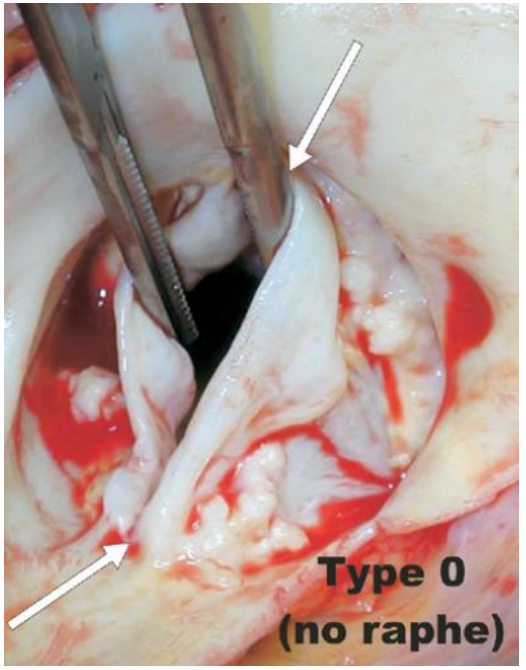
  Sternotomia mediana
  Mini-sternotomia in III o IV spazio intercostale
  Mini-toracotomia destra in II spazio intercostale

DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

Aorta bicuspide

- Parete aortica più fragile e sottile
- Dominanza coronarica sinistra più frequente (dal 27% al 57% delle BAV)
- Tronco comune della coronaria sinistra del 50% più corto rispetto alla tricuspide (TC di lunghezza < a 5 mm)
- Protezione miocardica (cardioplegia) più difficoltosa

main category: number of raphes	0 raphe - Type 0		1 raphe - Type 1			2 raphes - Type 2
	 21 (7)		 269 (88)			 14 (5)
1. subcategory: spatial position of cusps in Type 0 and raphes in Types 1 and 2	lat 13 (4) 	ap 7 (2) 	L – R 216 (71) 	R – N 45 (15) 	N – L 8 (3) 	L – R / R – N 14 (5) 
2. subcategory:						
VALVULAR FUNCTION I	6 (2)	1 (0.3)	79 (26)	22 (7)	3 (1)	6 (2)
VALVULAR FUNCTION S	7 (2)	5 (2)	119 (39)	15 (5)	3 (1)	6 (2)
VALVULAR FUNCTION B (I + S)		1 (0.3)	15 (5)	7 (2)	2 (1)	2 (1)
VALVULAR FUNCTION No			3 (1)	1 (0.3)		



DIFFICOLTA’ PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

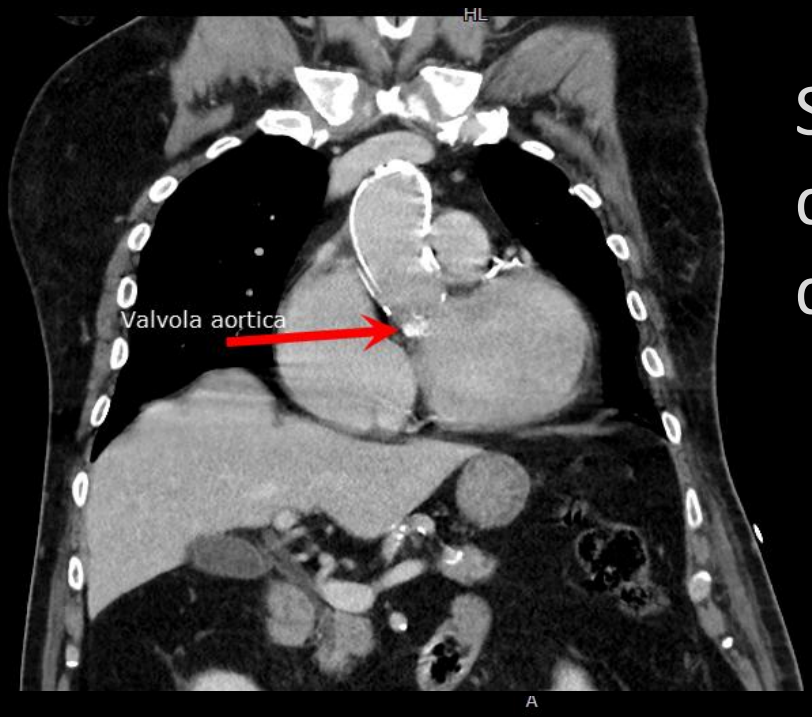
Calcificazione dell’aorta ascendente

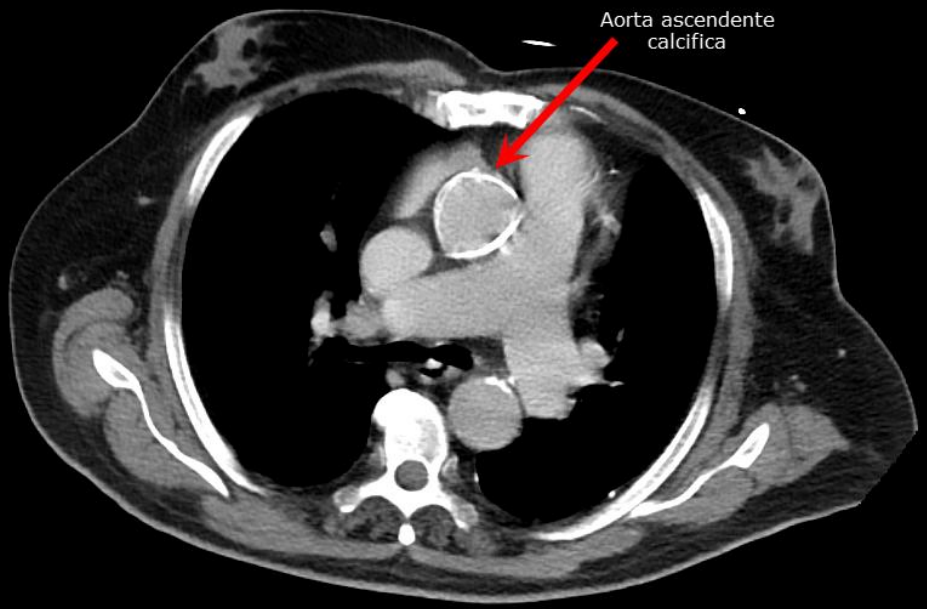
- Clampaggio aortico difficoltoso o impossibile
- Mobilizzazione di frammenti di calcio
- Rottura o dissezione
- Aortotomia complessa
- Difficile ricostruzione della parete

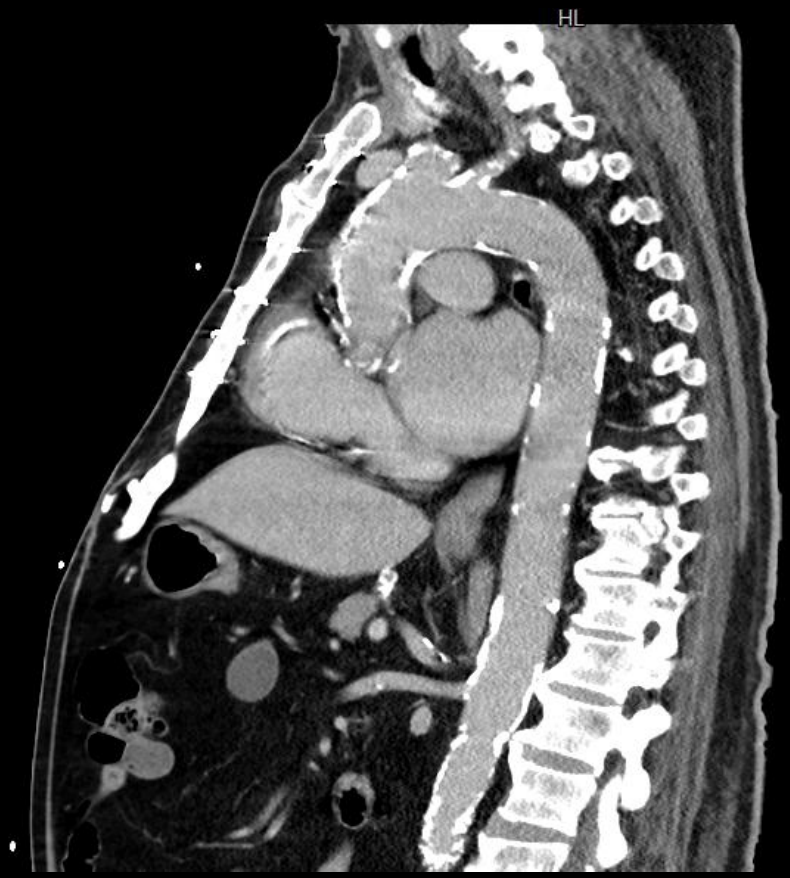
Possibili alternative

- Sostituzione aorta ascendente
- Endoclamp
- TAVI transapicale o trans-vascolare

Severa e diffusa calcificazione dell'aorta toracica ascendente e discendente : Aorta a porcellana







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DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

Patologia dell'anulus valvolare aortico

- **Anulus di calibro ridotto**

  PPM, prosthesis-patient mismatch
  Aumento eventi cardiaci avversi
  Funzione emodinamica deteriorata
  Mancata regressione Ipertrofia VS
  Sopravvivenza ridotta

- **Severa calcificazione anulo-aortica**

  Possibile danneggiamento anulus anatomico
  Blocco A-V
  Maggiore rischio distacco protesico

- **Lesioni endocarditiche, ascessi anulari**

HEART REVIEW

Prosthesis-patient mismatch: definition, clinical impact, and prevention

P Pibarot, J G Dumesnil

Heart 2006;**92**:1022–1029. doi: 10.1136/hrt.2005.067363

Table 1 Theoretical comparison of mean transvalvar pressure gradient in five hypothetical patients receiving the same prosthetic valve but having different body surface areas

	Patient number				
	1	2	3	4	5
Body surface area (m^2)	1.5	1.75	2.0	2.25	2.5
Cardiac output (l/min)	4.5	5.25	6.0	6.75	7.5
Valve EOA (cm^2)	1.3	1.3	1.3	1.3	1.3
Mean pressure gradient (mm Hg)	13	17	22	28	35

For this simulation, mean pressure gradient was calculated assuming a cardiac index of 3 l/min/m^2, a heart rate of 65 beats/min, and a systolic ejection time of 300 ms.
EOA, effective orifice area.
Reproduced and modified from Pibarot and Dumesnil[5] with permission of Remedica Publishing.

$$TPG = Q^2/[k \times EOA^2]$$

(TPG) = Transvalvar Pressure Gradient
(Q) = Transvalvar Flow
EOA = Effective Orifice Area
K = Constant

DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

Il mismatch protesi-paziente condiziona lo sviluppo di eventi cardiaci tardivi che influenzano negativamente la prognosi a lungo termine

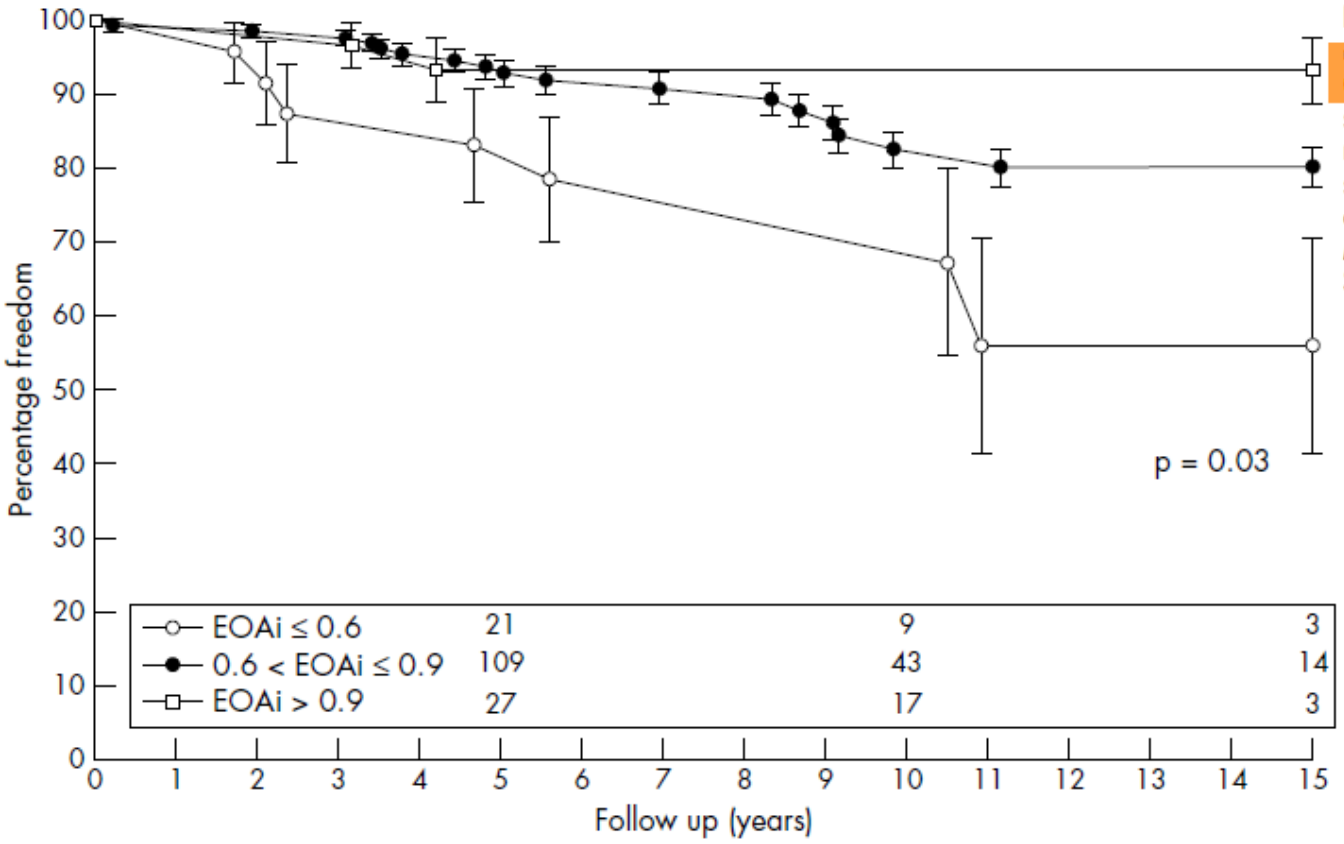

Figure 4 Freedom from late cardiac events in patients with non-significant (indexed EOA (EOAi) >0.9 cm^2/m^2; squares), moderate (EOAi >0.6 cm^2/m^2 and ⩽0.9 cm^2/m^2; solid circles), or severe (EOAi ⩽0.6 cm^2/m^2; open circles) mismatch. Reproduced from Milano *et al*[11] with permission of the Society of Thoracic Surgeons.

DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

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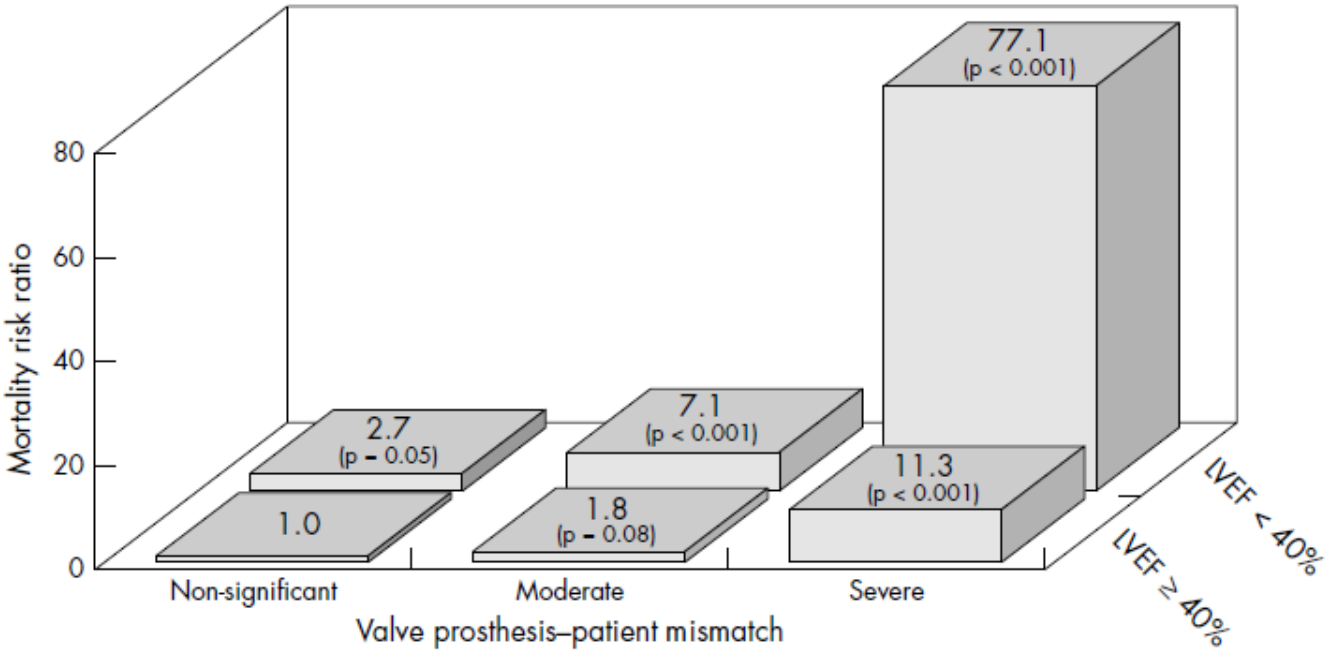


Figure 5 Relative risk ratio for short term mortality according to valve prosthesis-patient mismatch and preoperative left ventricular ejection fraction (LVEF). Numbers above the bars indicate the relative risk ratio for mortality compared with the group with non-significant mismatch and normal LVEF. Reproduced from Blais *et al*[13] with permission from the American Heart Association.

DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

Anulus aortico di calibro ridotto

- Allargamento chirurgico dell'anulus posteriore
  - Nick Technique
  - Monouguian Technique

- Scelta di protesi a basso gradiente
  - Stentless
  - Sutureless
  - Meccanica VS Biologica


Stentless Bioprosthesis

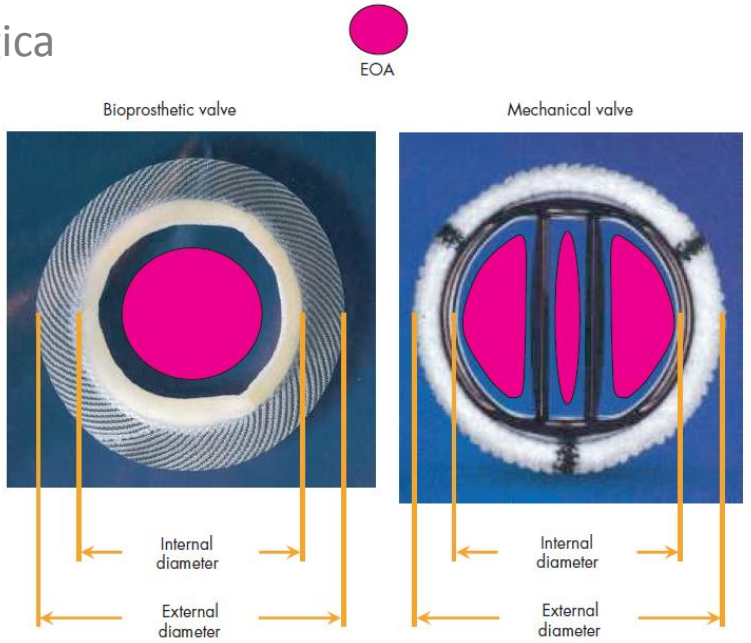
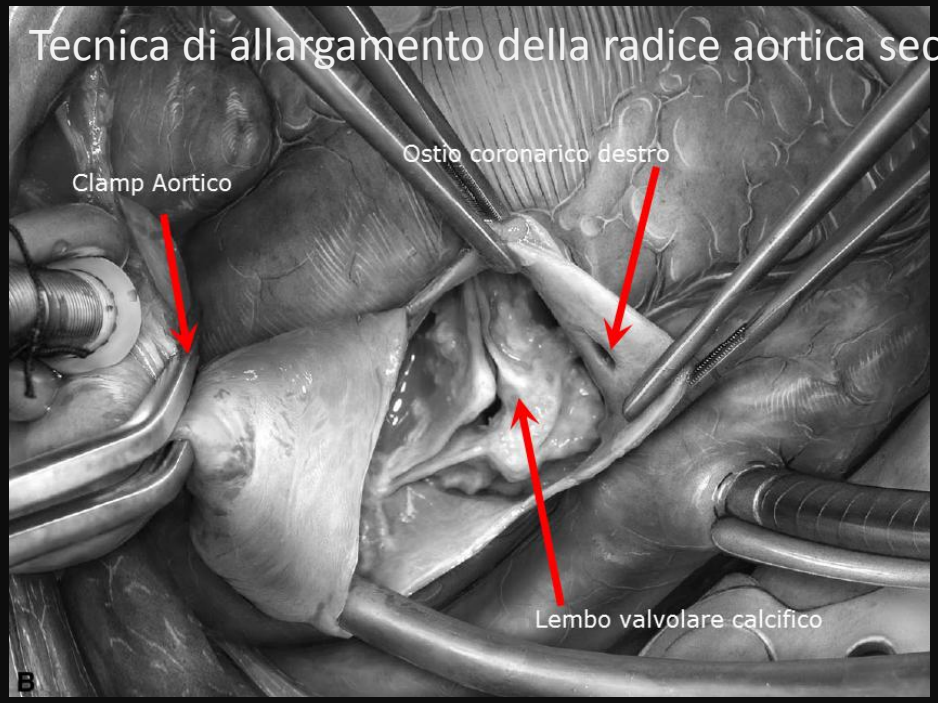
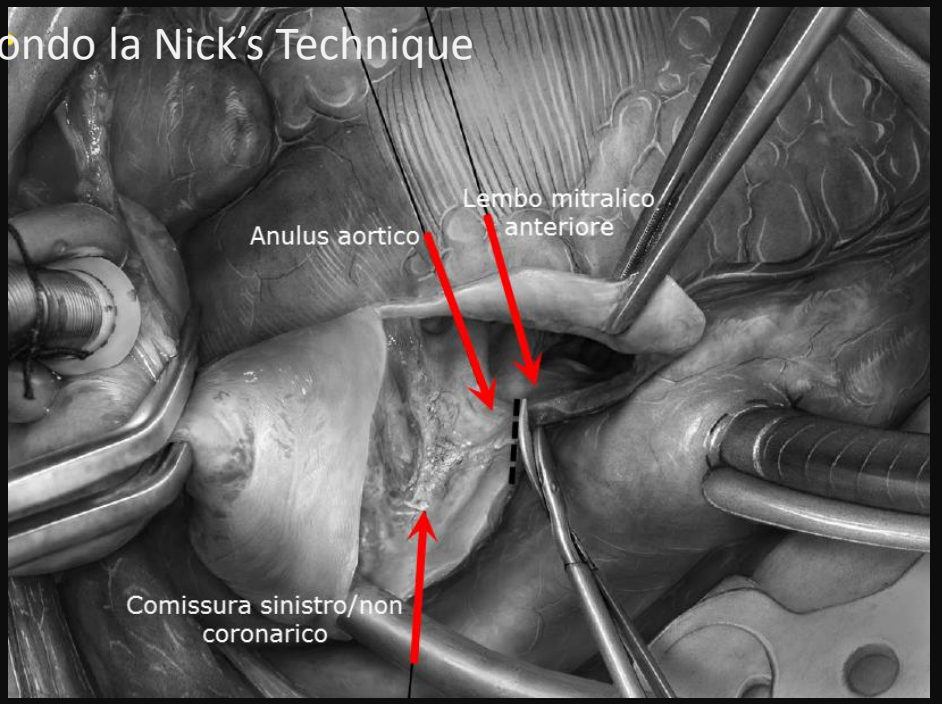
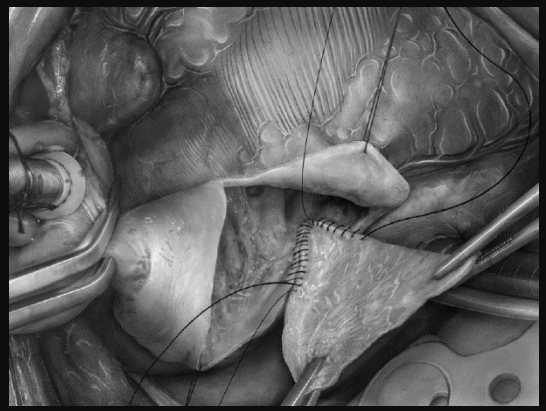


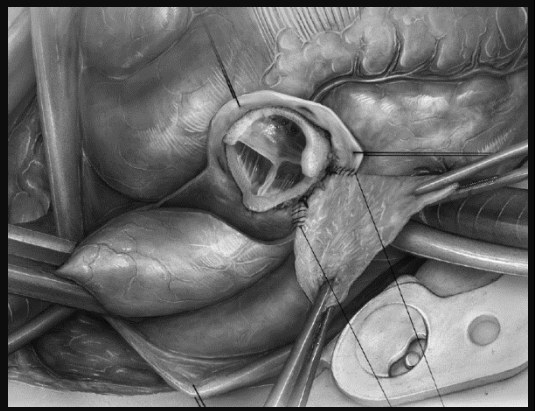
Figure 2 View of a bioprosthesis and a bileaflet mechanical valve with the leaflets in a fully open position. The area highlighted in pink is the effective orifice area (EOA). Reproduced and modified from Pibarot and Dumesnil[5] with permission of Remedica Publishing.

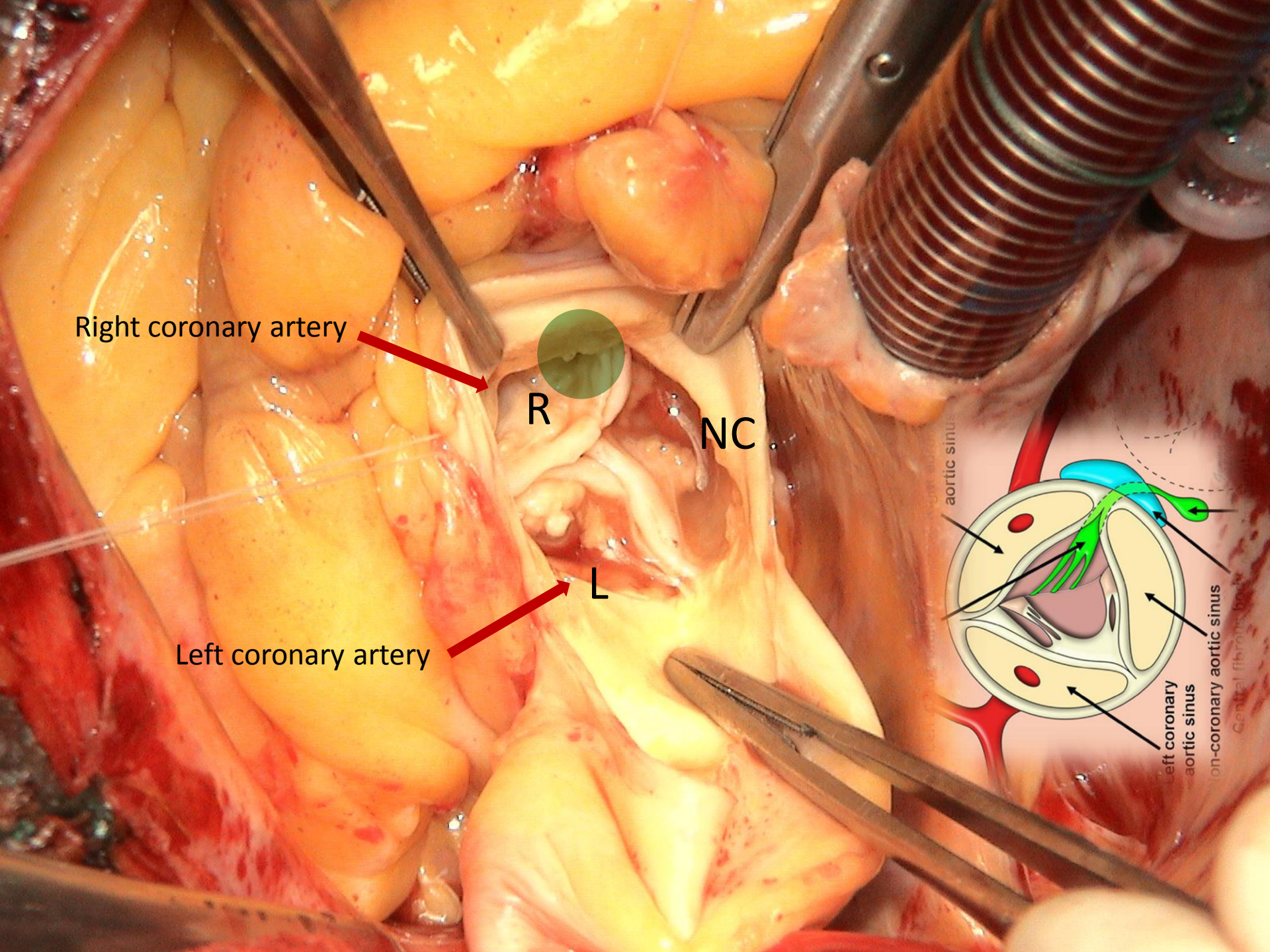
Tecnica di allargamento della radice aortica secondo la Nick's Technique










Right coronary artery
R
NC
L
Left coronary artery
aortic sinus
ft coronary
ortic sinus
n-coronary aortic sinus

DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

Approccio chirurgico mini-invasivo

- Mini-sternotomia (in IV o III spazio intercostale)
- Mini-toracotomia in II spazio intercostale

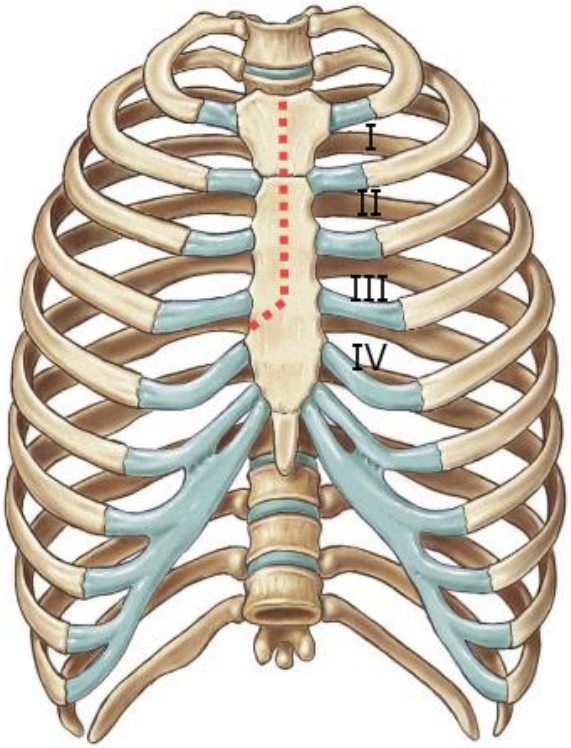
La chirurgia mini-invasiva comporta una riduzione della "porta" chirurgica di accesso, questo determina un vantaggio estetico indubbio ed una riduzione del trauma sulla parete toracica

L'intervento presenta maggiore complessità e difficoltà tecnica

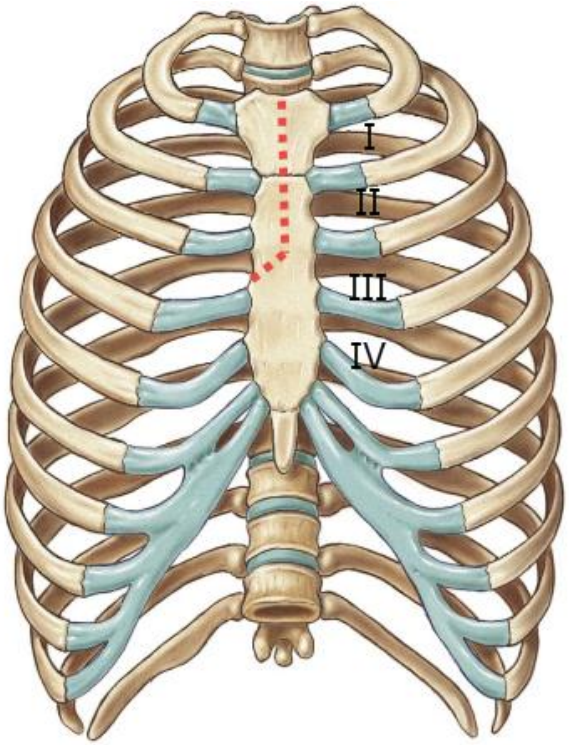
- Learning curve
- Maggiore profilo di rischio
- Tempi operatori spesso più lunghi
- Cannulazione periferica
- De-airing meno efficace
- Minore controllo delle strutture anatomiche

DIFFICOLTA’ PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

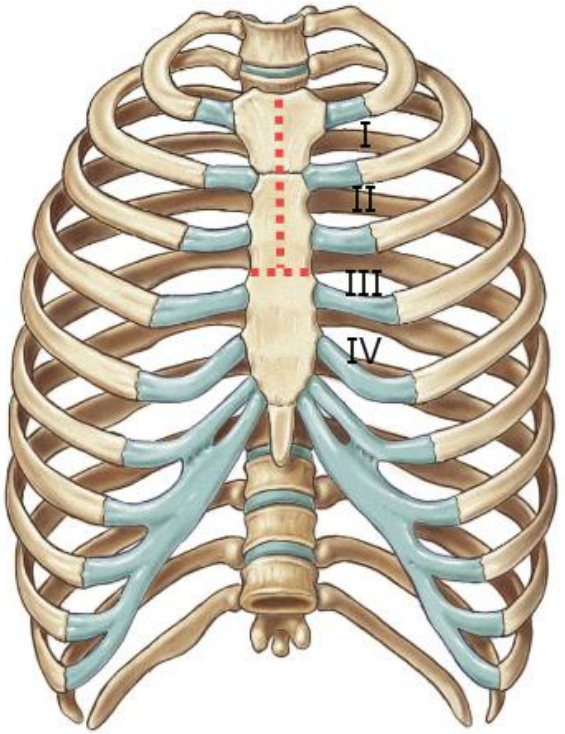
Differenti tipi di approccio chirurgico alla valvola aortica in mini-sternotomia



IV spazio a “J” destra



III spazio a “J” destra



III spazio a T rovesciata

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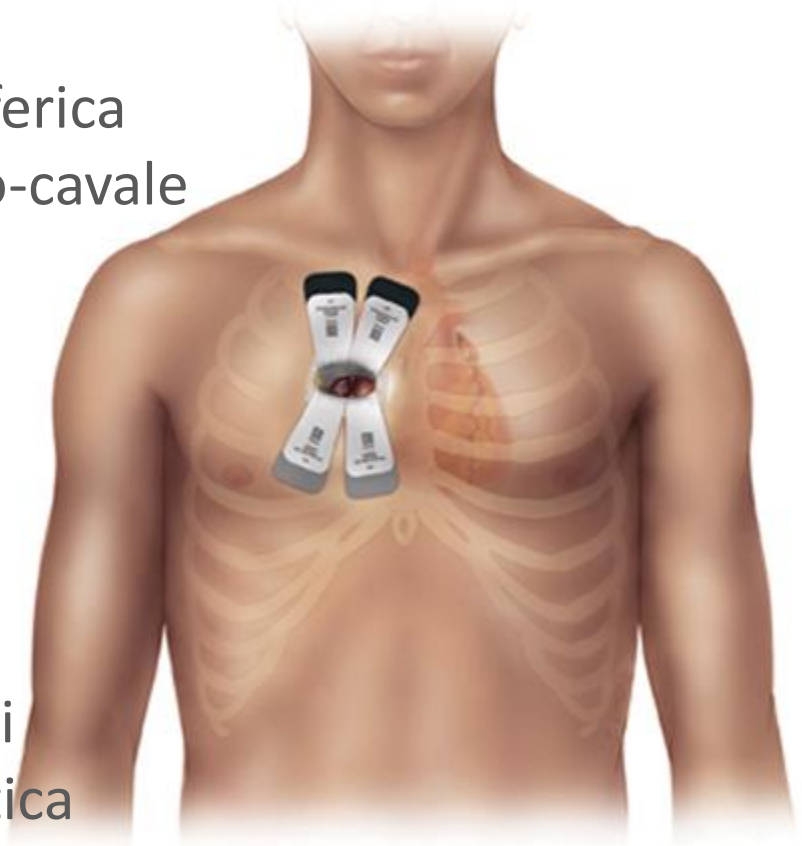
DIFFICOLTA’ PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

MINI – TORACOTOMIA DESTRA IN II SPAZIO INTERCOSTALE

NOTE TECNICHE PRINCIPALI

- Cannula arteriosa: centrale o periferica
- Cannula venosa: periferica femoro-cavale (diretta o percutanea)
- Vent in vena polmonare superiore destra
- Monitoraggio ECO-TE
- Intubazione bronchiale selettiva (opzionale)
- Fattibilità tecnica legata ai rapporti anatomici tra sterno e valvola aortica



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DIFFICOLTA' PROCEDURALI: CHIRUGIA DELLA VALVOLA AORTICA

- La chirurgia della valvola aortica costituisce una procedura cardiochirurgica ormai consolidata da anni
- L'aumento progressivo delle difficoltà procedurali legate alla presenza di pazienti sempre più complessi ha visto svilupparsi nel tempo tecniche sempre più raffinate
- La decisione sulla operabilità e sul calcolo del profilo di rischio deve soprattutto tenere conto della multifattorialità che la complessità del paziente comporta
- E' importante la raccolta accurata di tutte quelle informazioni che concorrono a definire la condizione patologica del paziente
- L'outcome positivo o meno di un intervento dipende dalla cooperazione di tutte le professionalità coinvolte. Onori ed oneri sono proporzionalmente divisi

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