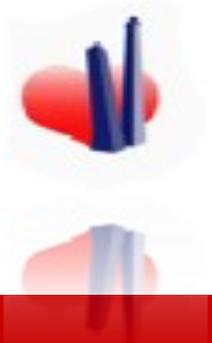




ANEURISMA DELL'AORTA TORACICA

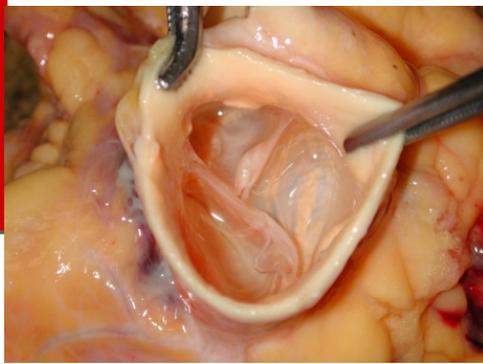


PROF. ROBERTO DI BARTOLOMEO

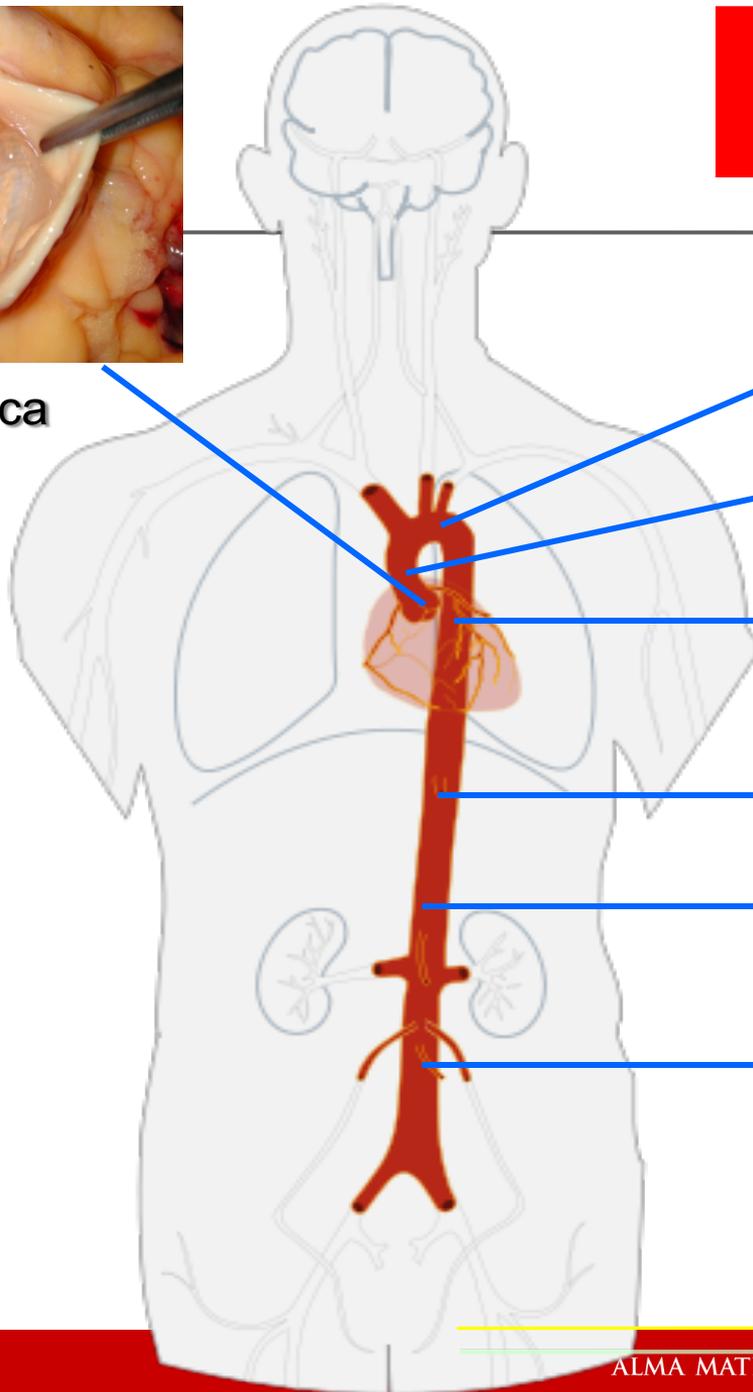
UNIVERSITY OF BOLOGNA



AORTA TORACICA ANATOMIA



Valvola aortica



Arco aortico

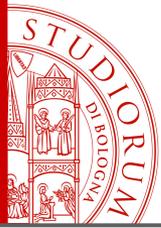
Aorta ascendente

Arco toracica discendente

Aorta toracoaddominale

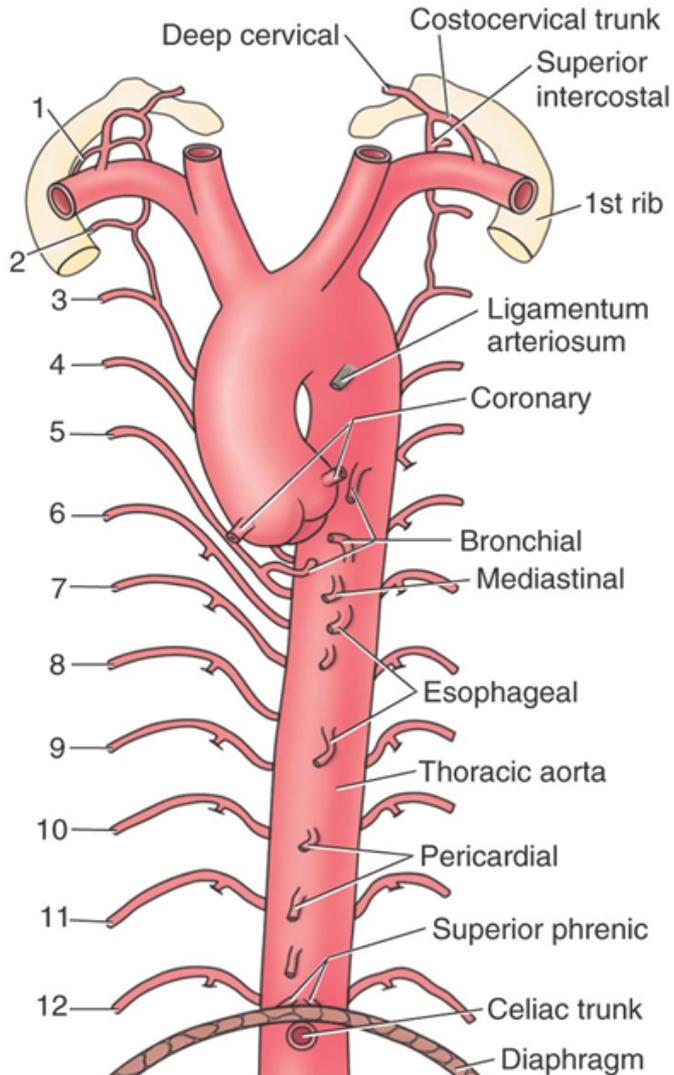
Aorta addominale soprarenale

Aorta addominale sottorenale

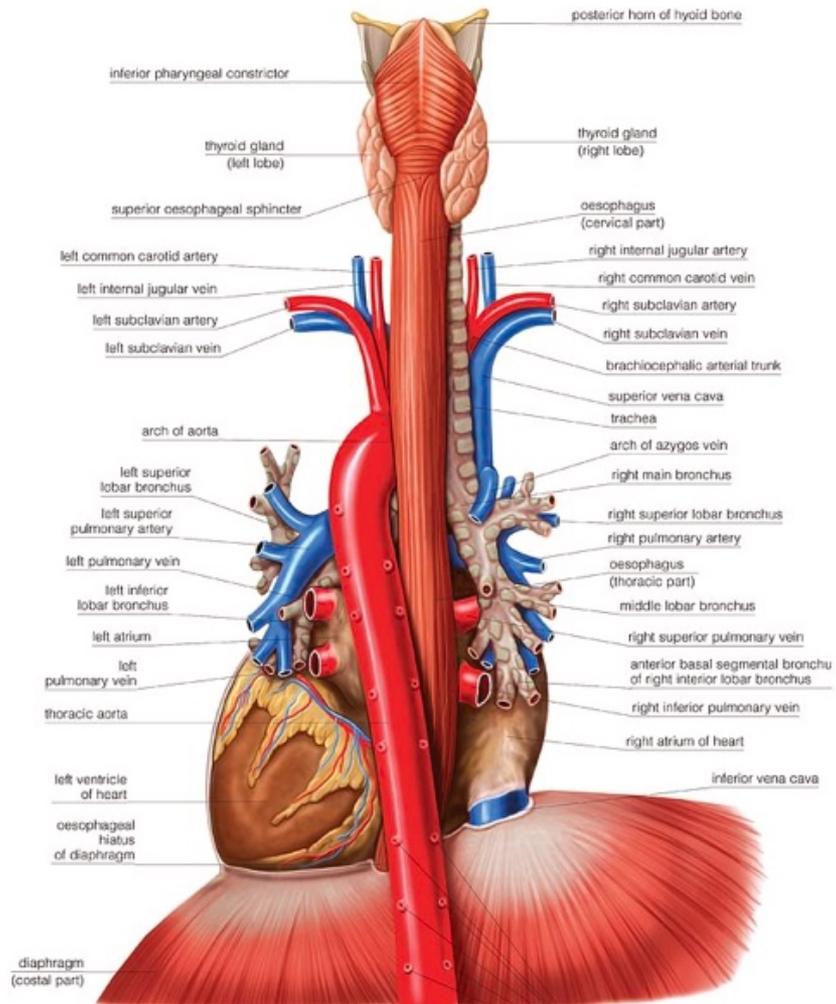


AORTA TORACICA

ANATOMIA



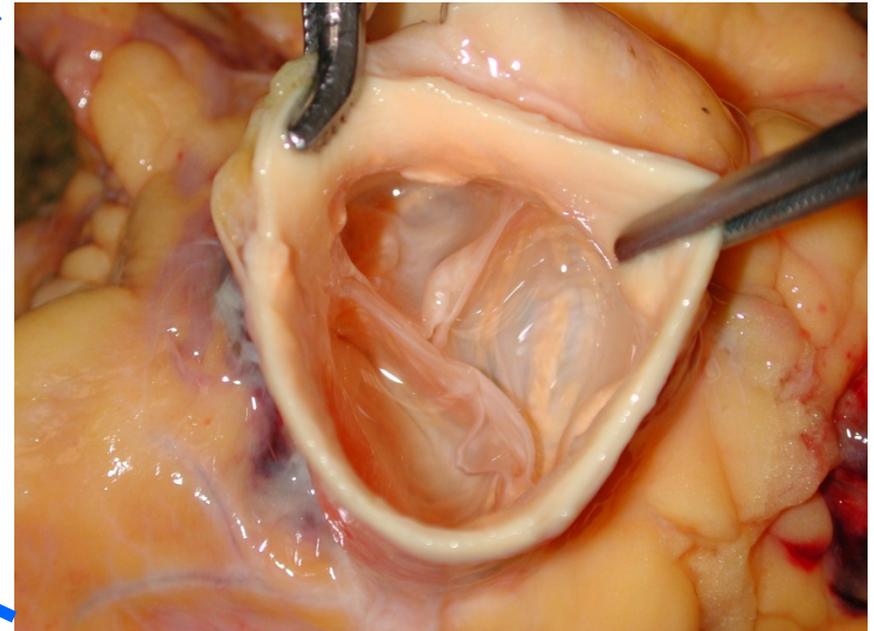
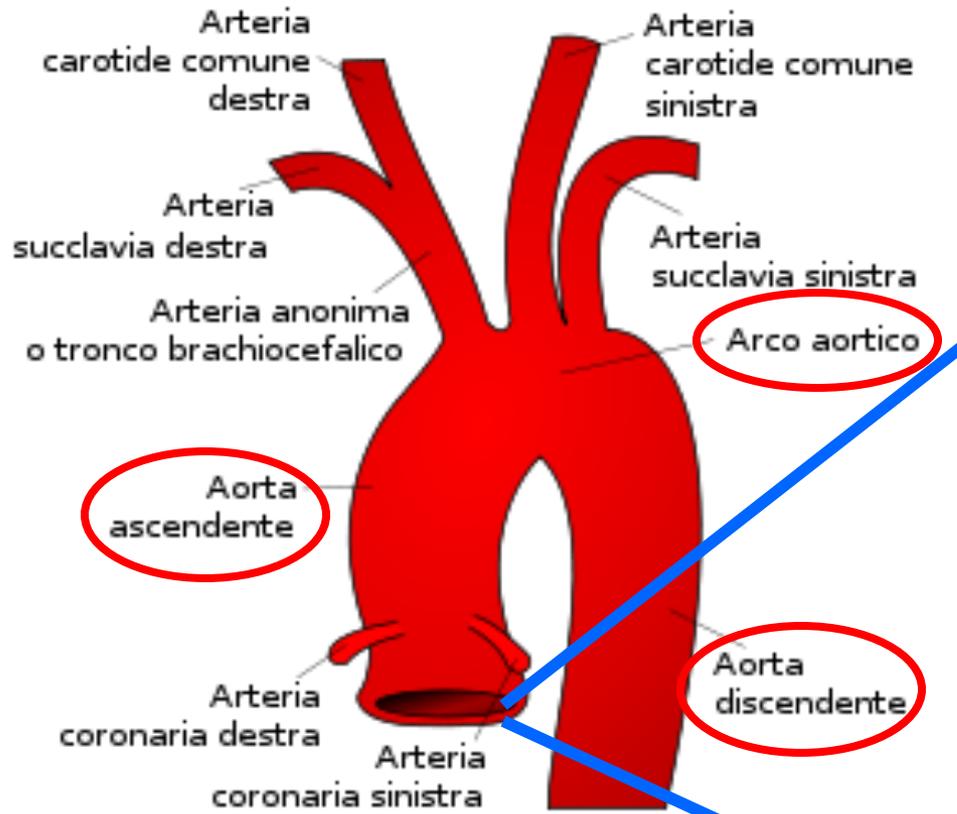
ANTERIORE



POSTERIORE

AORTA TORACICA

ANATOMIA





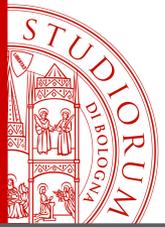
Definizione di aneurisma

Def. anatomica

Dilatazione permanente e localizzata di un'arteria con un aumento del diametro trasverso di oltre il 50% rispetto al diametro normale previsto

Pseudoaneurisma:

**secondario a chirurgia , trauma, ulcere penetranti;
le sue pareti non sono costituite da tutti e tre gli strati del vaso**



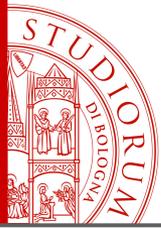
Morfologia dell' aneurisma

Aneurismi fusiformi:
dilatazione
dell'intera circonferenza
di un tratto dell'aorta
toracica



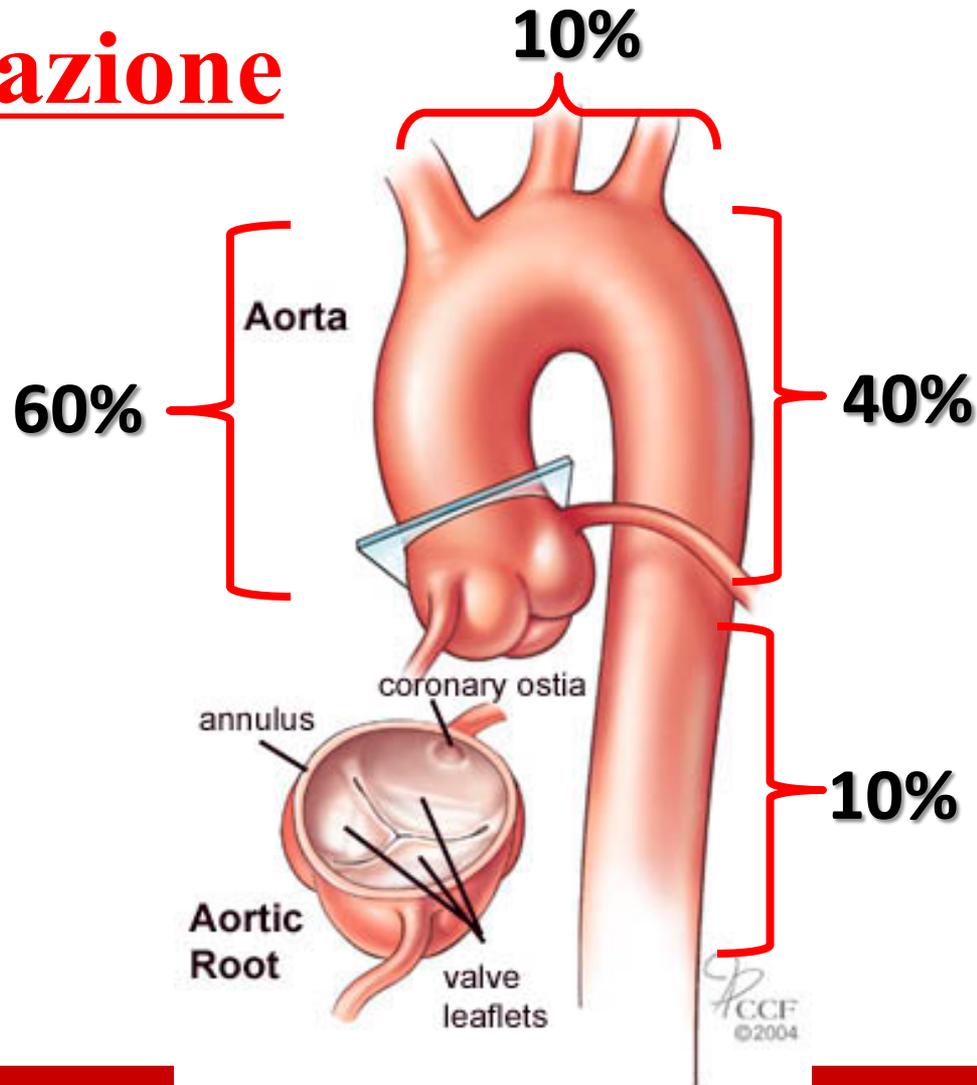
Aneurismi sacciformi:
estroflessione di una parte
della circonferenza
dell'aorta toracica

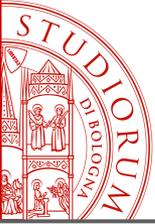




ANEURISMI DELL'AORTA TORACICA

Localizzazione

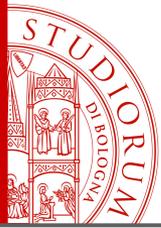




Aneurismi dell'Aorta toracica

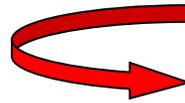
INCIDENZA

- **10.4/100.000 pazienti/anno** (Rochester Epidemiology Project)
- **età 65 (maschi) 77 (femmine)**
- **rapporto M:F da 1.1:1 a 1.7:1**

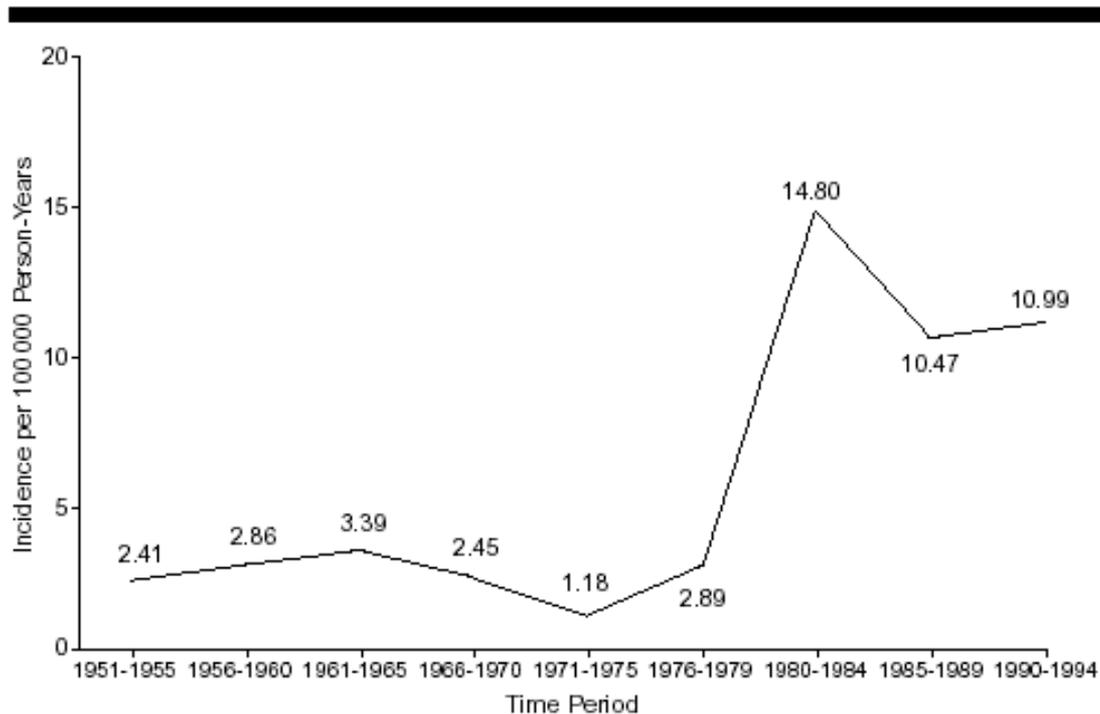


INCIDENZA

Miglioramento tecniche diagnostiche



Incidenza in continuo aumento



JAMA[®]

Online article and related content
available at www.jama.com

Improved Prognosis of Thoracic Aortic Aneurysms: A Population-Based Study

William Darrin Clouse; John W. Hallett, Jr; Hartzell V. Schaff; et al.

JAMA. 1998;280(22):1926-1929 (doi:10.1001/jama.280.22.1926)

QUAL'E' LA CAUSA DEGLI ANEURISMI DELL'AORTA TORACICA?

Patogenesi

- Aterosclerosi
- Fattori anatomici
- Fattori emodinamici
- Fattori biochimici
- Fattori genetici
- **FAMILIARITA'**

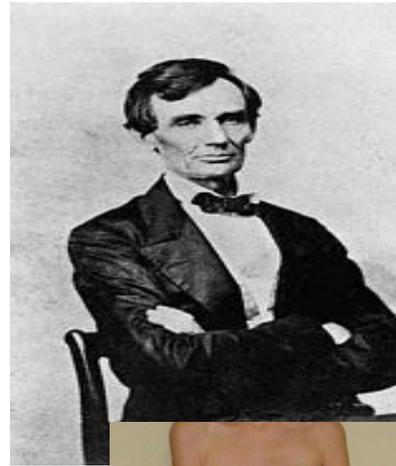


*Patogenesi
multifattoriale*



EZIOLOGIA

- Aterosclerosi
- Disordini tess.connettivo
- Malattie infiammatorie
- Sifilide
- Dissezione aortica
- Trauma aortico
- Infezioni
- Gravidanza

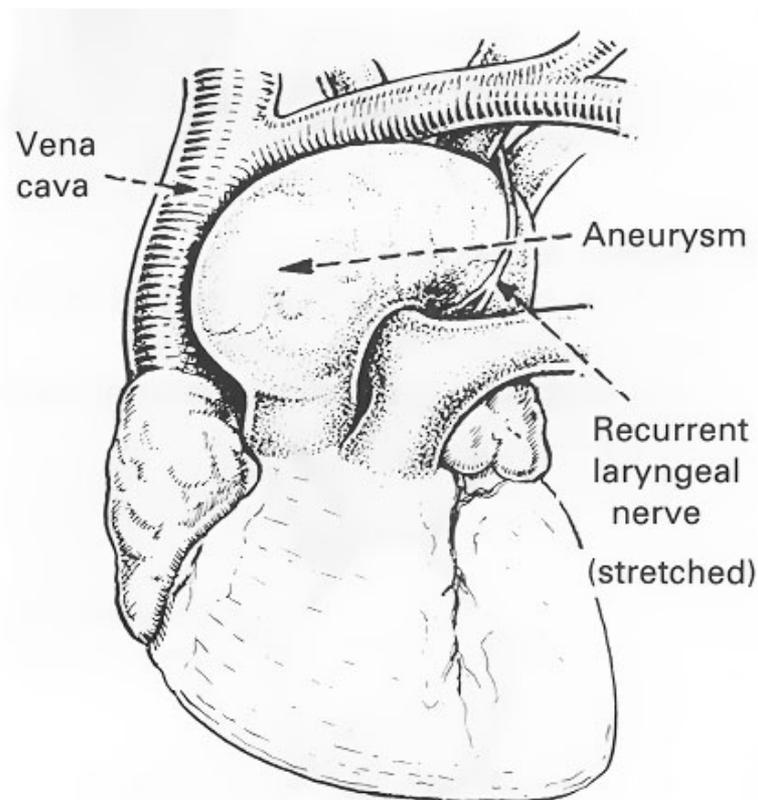


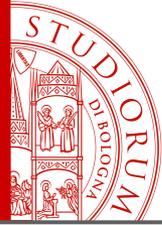
IL 90% degli aneurismi è
asintomatico



SINTOMI

- **90% ASINTOMATICI**
- ***SINTOMI*** più comuni:
 - dolore toracico/dorsale
 - disfonia
 - disfagia
 - tosse, dispnea
 - angina
 - pletora e edema
 - ictus, ischemie delle estremità, infarti renali, ischemia mesenterica

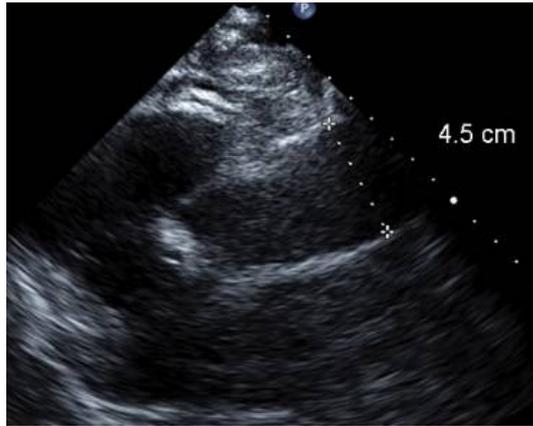




DIAGNOSTICA PER IMMAGINI

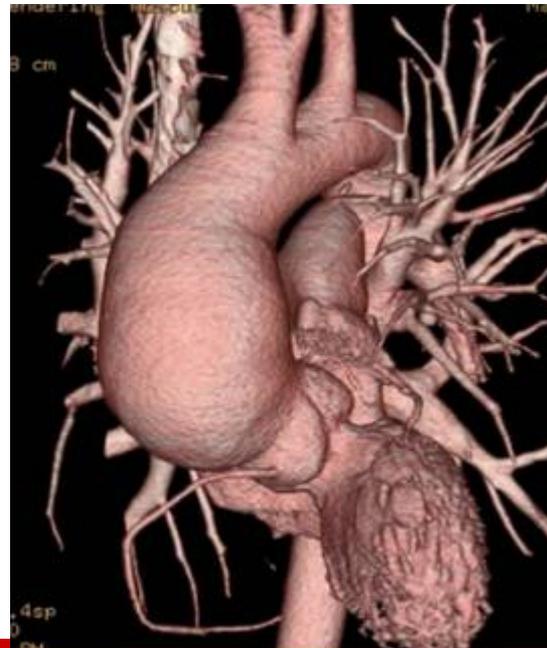
- RX Torace
- Tomografia computerizzata (angio-TC)
- Aortografia
- Risonanza Magnetica (angio-RMN)
- Ecocardiografia transtoracica
- Ecocardiografia transesofagea

ESAMI DIAGNOSTICI

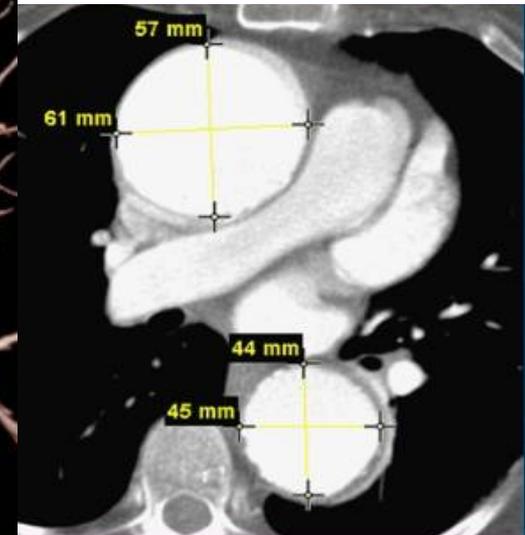


Ecografia: Ottima per la radice. Raramente si vede la aorta ascendente

MRI: non richiede contrasto

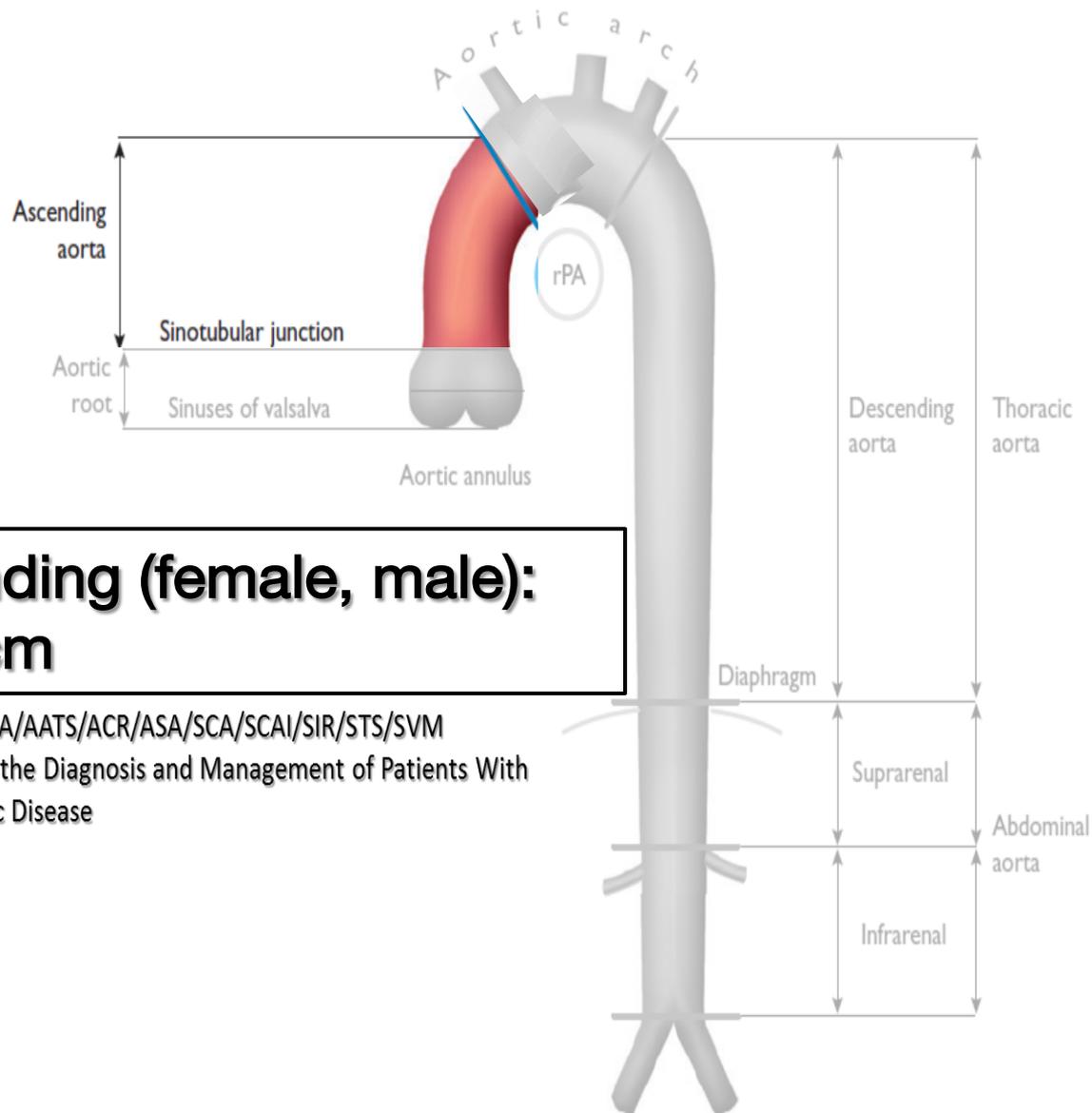


ANGIO-TC: GOLD STANDARD, vede tutto



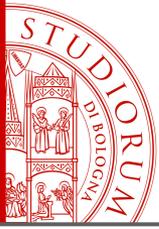
A QUALE DIMENSIONE L'AORTA TORACICA SI ROMPE O SI DISSECA?

The normal aorta



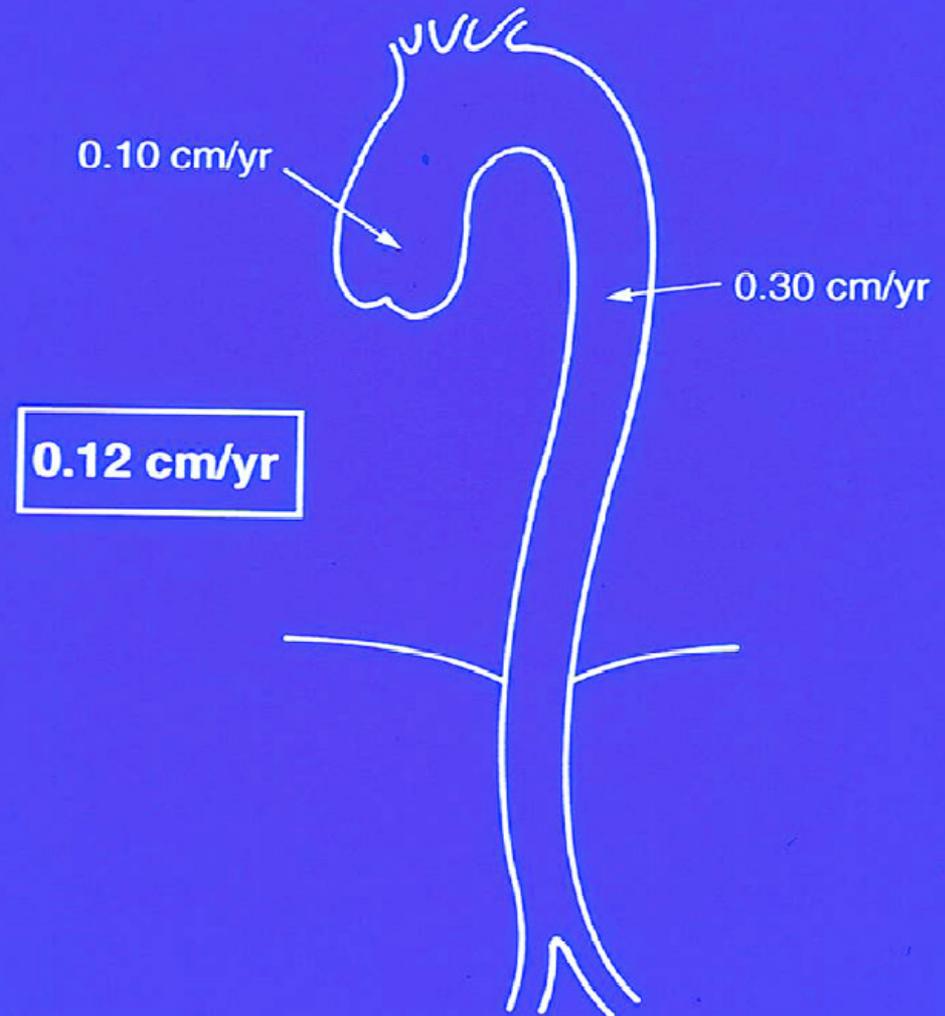
**Ascending (female, male):
2.86 cm**

2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM
Guidelines for the Diagnosis and Management of Patients With
Thoracic Aortic Disease



Quanto velocemente cresce l'aorta?

Annual Growth Rates of Thoracic Aortic Aneurysms



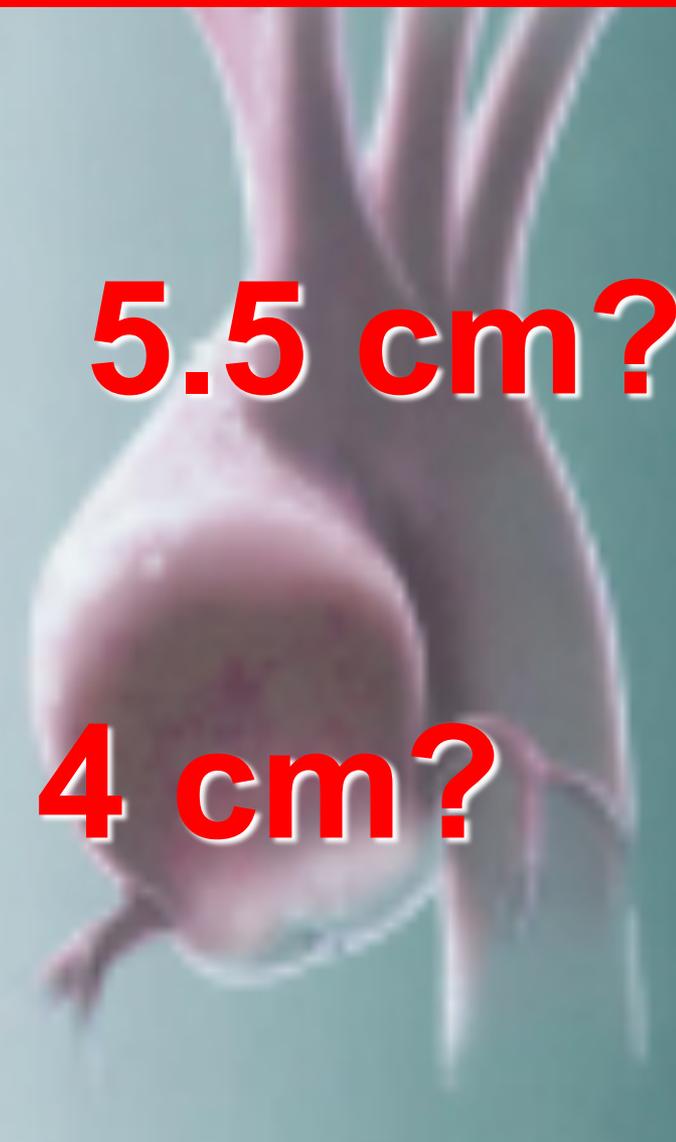
QUANDO DEVE ESSERE OPERATO UN ANEURISMA DELL'AORTA ASCENDENTE ?

5 cm?

5.5 cm?

4.5 cm?

4 cm?



Tasso di complicanze in base ai diametri aortici

| | Aortic Size | | | |
|------------------|-------------|-------|-------|-------|
| Yearly risk | >3.5 cm | >4 cm | >5 cm | >6 cm |
| Rupture | 0.0% | 0.3% | 1.7% | 3.6% |
| Dissection | 2.2% | 1.5% | 2.5% | 3.7% |
| Death | 5.9% | 4.6% | 4.8% | 10.8% |
| Any of the above | 7.2% | 5.3% | 6.5% | 14.1% |

John A. Elefteriades, MD

(Ann Thorac Surg 2002;74:S1877-80)



QUANDO INTERVENIRE...

Indicazioni alla chirurgia

- Diametro massimo
- Tasso di crescita annua
- Età del paziente
- Condizioni di comorbidità
- Presenza di patologia aneurismatica aortica in altro tratto
- Rischi chirurgici (Marfan: alto rischio rottura e dissezione)



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

The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC)

Authors/Task Force members: Raimund Erbel* (Chairperson) (Germany), Victor Aboyans* (Chairperson) (France), Catherine Boileau (France), Eduardo Bossone (Italy), **Roberto Di Bartolomeo (Italy), Holger Eggebrecht (Germany), Arturo Evangelista (Spain), Volkmar Falk (Switzerland), Herbert Frank (Austria), Oliver Gaemperli (Switzerland), Martin Grabenwöger (Austria), Axel Haverich (Germany), Bernard Jung (France), Athanasios John Manolis (Greece), Folkert Meijboom (Netherlands), Christoph A. Nienaber (Germany), Marco Roffi (Switzerland), Hervé Rousseau (France), Udo Sechtem (Germany), Per Anton Sirnes (Norway), Regula S. von Allmen (Switzerland), Christiaan J.M. Vrints (Belgium).**

INDICAZIONI CHIRURGICHE

**SIZE
MATTERS**



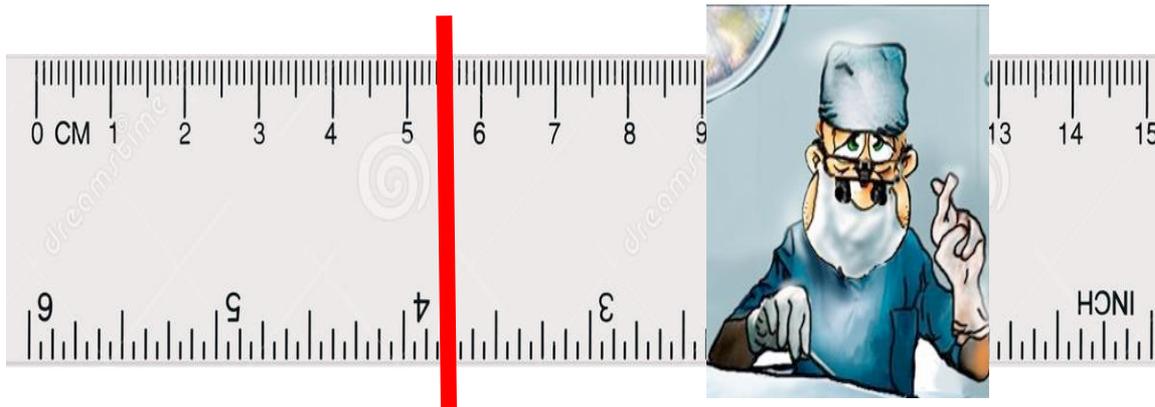
AORTIC SIZE

Ascending aorta



Diameter \geq 55 mm

Diameter \geq 50 mm (HBP, Familiar History, Aortic CoA, Increase $>$ 3 mm/y)



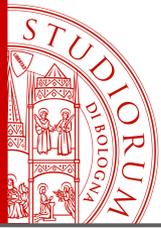
ESC 2014

ACC/AHA 2010

| | | | | | | | |
|---|-----|-----|-----|---|-----|-----|-----|
| I | IIa | IIb | III | I | IIa | IIb | III |
| | C | | | C | | | |

Level of evidence C

Consensus of opinion of the experts and/or small studies, retrospective studies, registries.



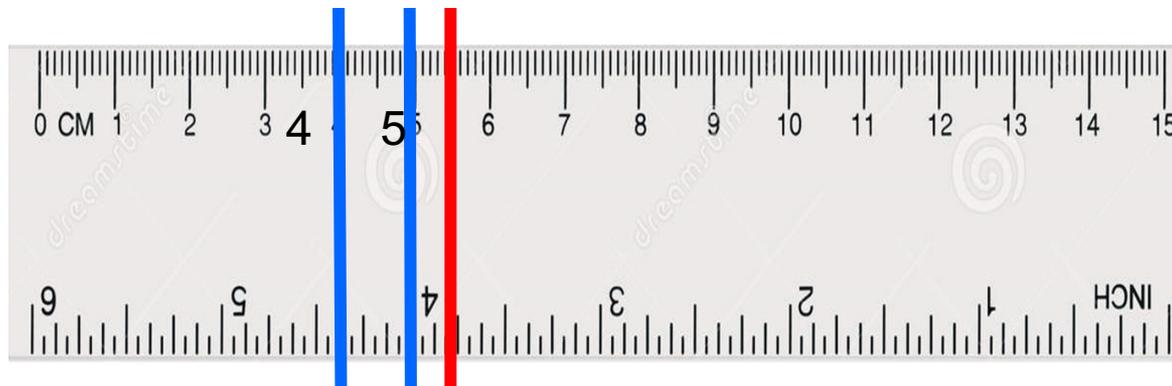
BICUSPID AORTIC VALVE

Whitout Risk Factors

Diameter ≥ 55 mm

Diameter ≥ 45 mm (in case of aortic valve surgery)

Diameter from 40 to 50 mm



ESC 2014

ACC/AHA 2010

| | | | | | | | |
|---|-----|-----|-----|---|-----|-----|-----|
| I | IIa | IIb | III | I | IIa | IIb | III |
| | c | | | c | c | | |

Level of evidence C

Consensus of opinion of the experts and/or small studies, retrospective studies, registries.



GENETIC DISEASES

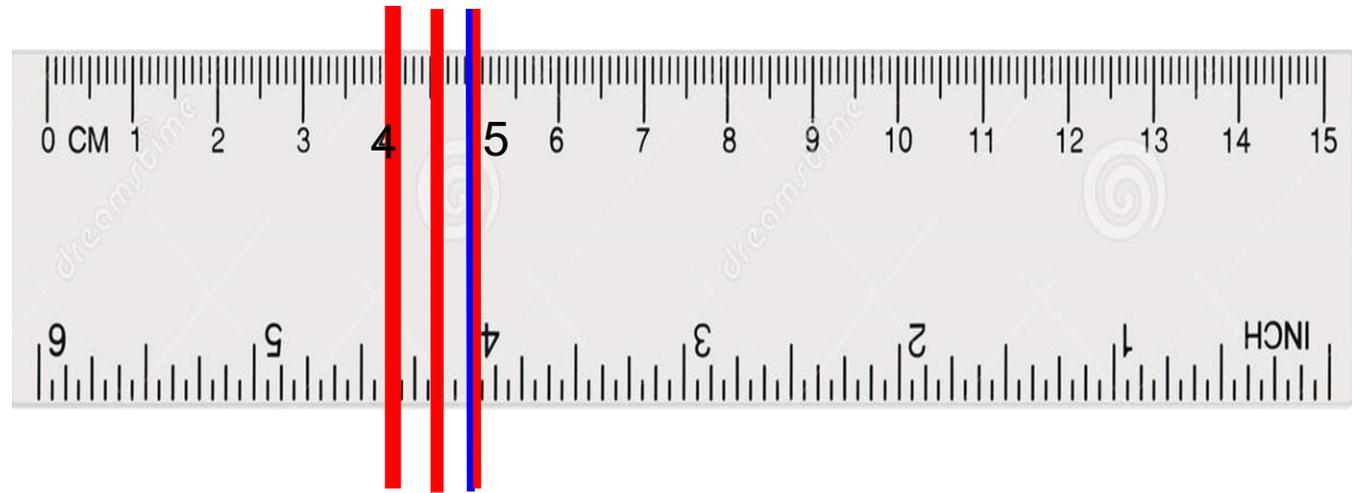
Marfan: ≥ 50 mm; Marfan: 40 to 50 mm

Marfan with risk factors*: ≥ 45 mm

Loeys-Dietz: 42 mm (Echo) 44-46 mm (CT-MRI) (ESC:NOT rec.)

Ehlers-Danlos: No Data

***History of Ao D. incr. $>$ 3mm/y, Severe AR, Desire for pregnancy**



ESC 2014

ACC/AHA 2010

| | | | | | | | |
|---|-----|-----|-----|---|-----|-----|-----|
| I | IIa | IIb | III | I | IIa | IIb | III |
| c | c | | | c | c | | |

| | |
|---------------------|--|
| Level of evidence C | Consensus of opinion of the experts and/or small studies, retrospective studies, registries. |
|---------------------|--|

buonsenso [buon-sèn-so] o
buon senso, s.m.(solo sing.)

Capacità naturale e istintiva
dell'individuo di valutare e distinguere
il logico dall'illogico, l'opportuno
dall'inopportuno, e di comportarsi
in modo giusto, saggio ed equilibrato,
in funzione dei risultati pratici
da conseguire.

BUONSENSO...

The Frozen Elephant Trunk Technique: European Association
for Cardio-Thoracic Surgery Position and Bologna Experience

Luca Di Marco, M.D., Ph.D., Antonio Pantaleo, M.D., Alessandro Leone, M.D.,

Di Marco et al

Acquired

**Composite valve graft implantation for the treatment of aortic valve
and root disease: Results in 1045 patients**

Luca Di Marco, MD, PhD, Davide Pacini, MD, PhD, Antonio Pantaleo, MD, Alessandro Leone, MD,
Giuseppe Barberio, MD, Giuseppe Marinelli, MD, and Roberto Di Bartolomeo, MD

Di Bartolomeo et al

Aortic Symposium 2010

**Complex thoracic aortic disease: Single-stage procedure with the
frozen elephant trunk technique**

Roberto Di Bartolomeo, MD, Davide Pacini, MD, Carlo Savini, MD, Emanuele Pilato, MD,
Sofia Martin-Suarez, MD, PhD, Luca Di Marco, MD, and Marco Di Eusanio, MD, PhD

ESPERIENZA...



LINEE GUIDA...

PRACTICE GUIDELINE: EXECUTIVE SUMMARY

**2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM
Guidelines for the Diagnosis and Management of Patients
With Thoracic Aortic Disease: Executive Summary**

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

Endorsed by the North American Society for Cardiovascular Imaging



ESC GUIDELINES

**2014 ESC Guidelines on the diagnosis and
treatment of aortic diseases**

Document covering acute and chronic aortic diseases of the thoracic
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The Task Force for the Diagnosis and Treatment of Aortic Diseases
of the European Society of Cardiology (ESC)

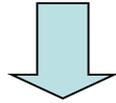


L'INDICAZIONE CHIRURGICA VA ADATTATA AL PAZIENTE....



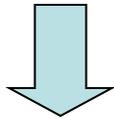
TRATTAMENTO

- **FARMACOLOGICO**



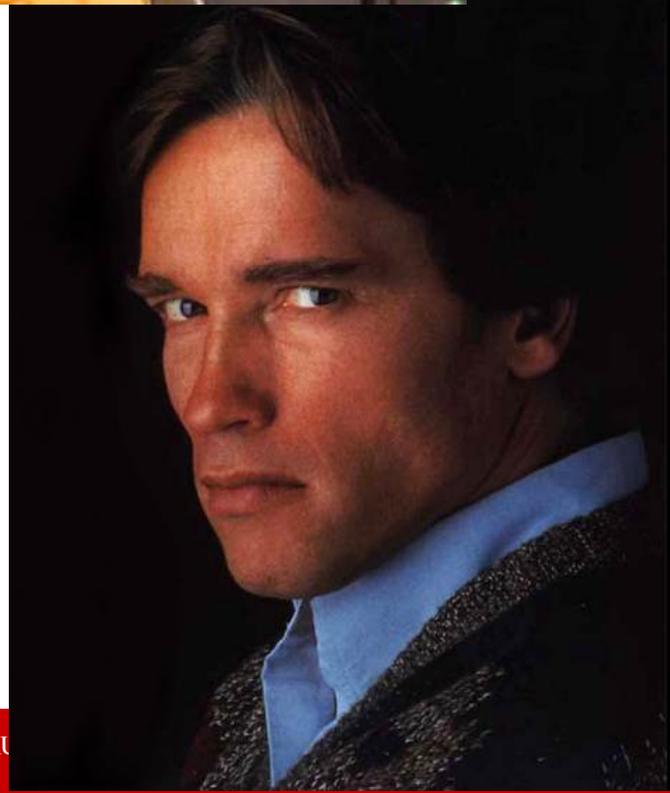
BETA-BLOCCANTI – SARTANICI (irbesartan)

- **CHIRURGICO**



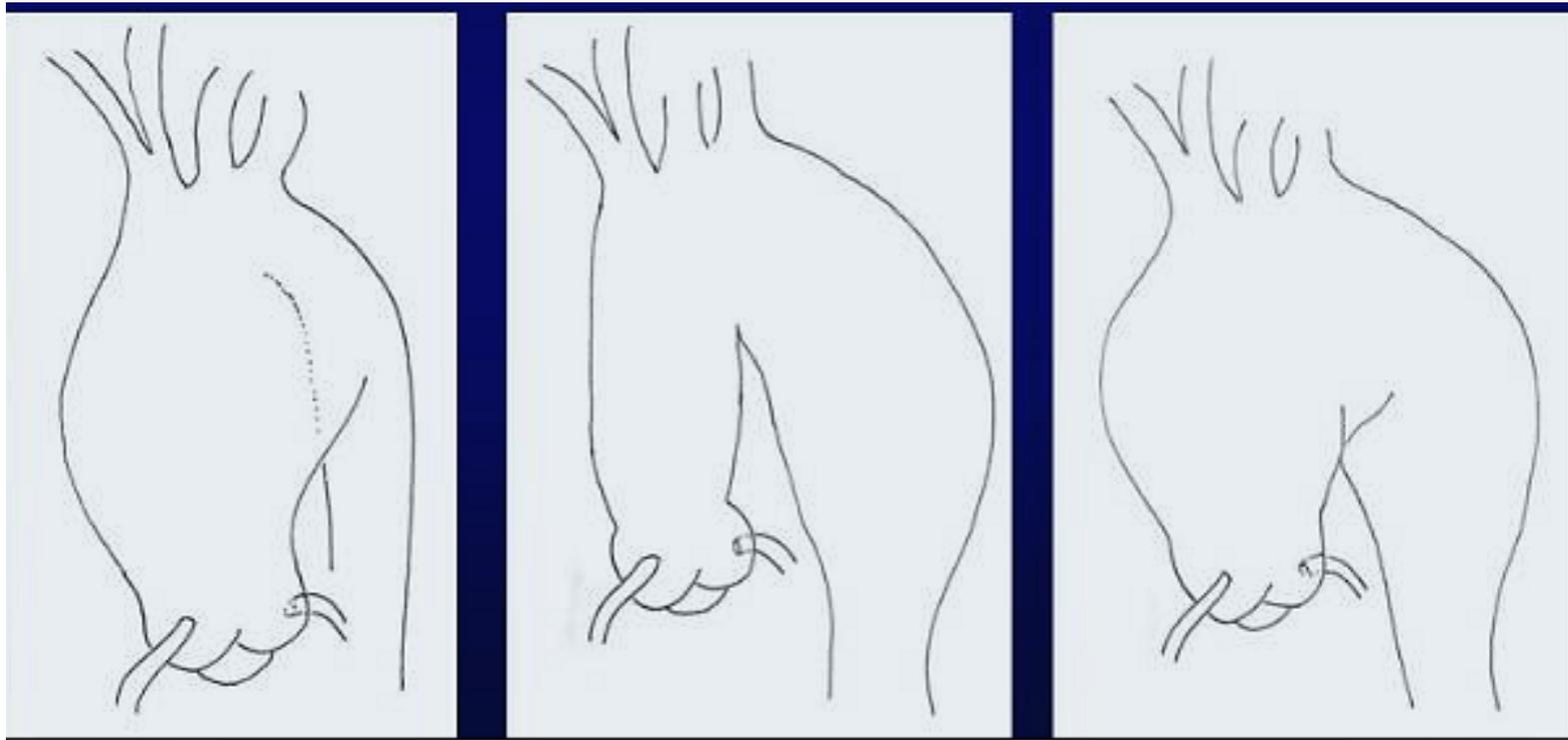
sostituzione con ***PROTESI SINTETICHE***

- Uso di **ENDOPROTESI (STENT)**

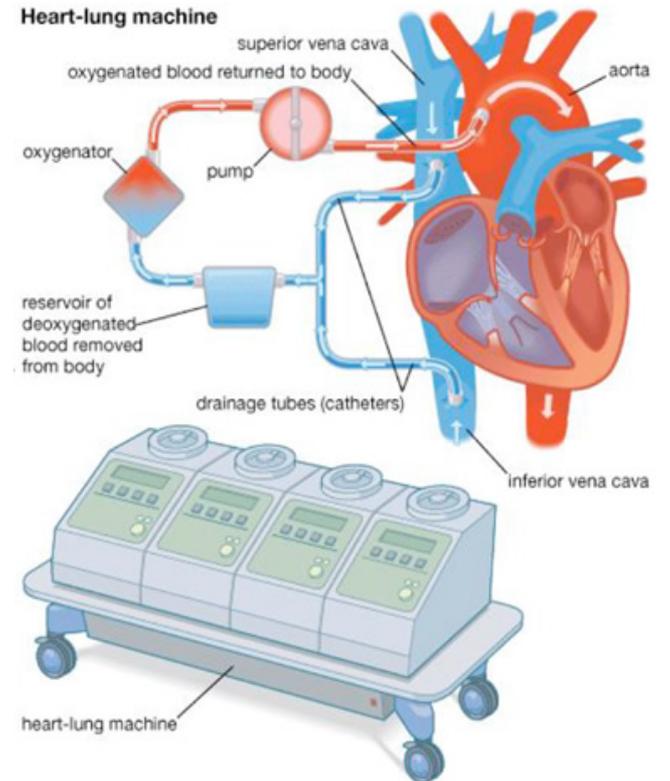
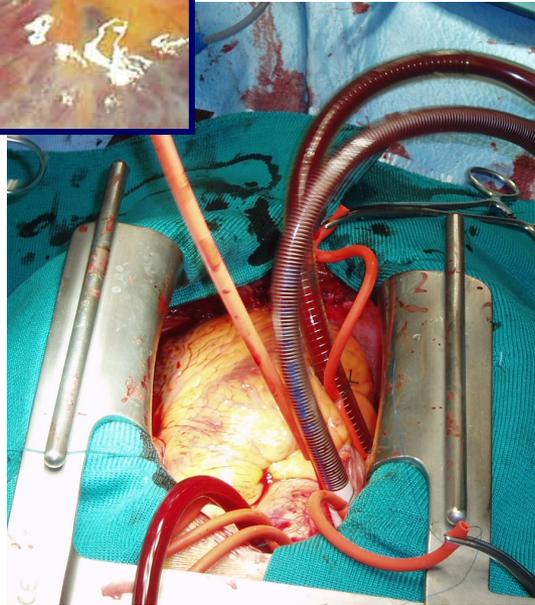
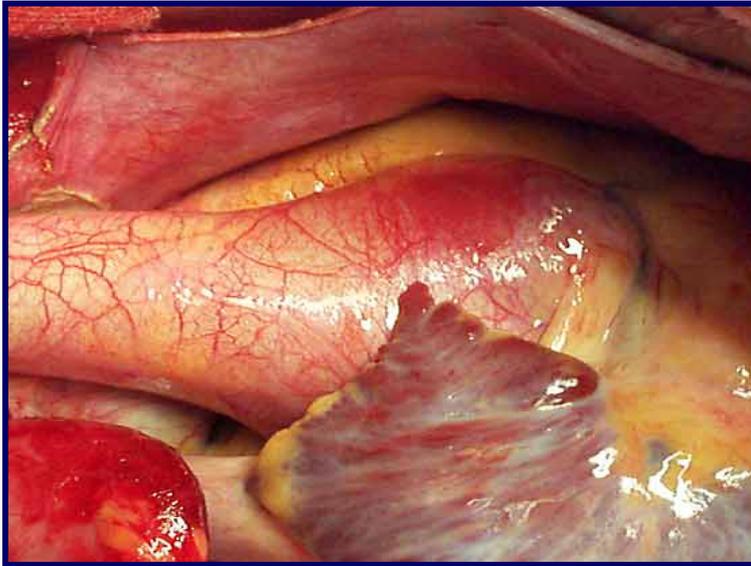


Tecnica operatoria

E' raro che l'aneurisma aortico sia isolato, più spesso coinvolge aree concomitanti della aorta ascendente, arco e discendente e ciò comporta scelte tecniche diverse



Trattamento chirurgico convenzionale



PROTESI IN DACRON

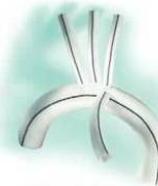


- Biocompatibile
- Strutturalmente duratura
- Facile da sterilizzare e conservare
- Disponibile in differenti dimensioni
- Facile da impiantare e da suturare
- Impermeabile al sangue

polietilene tereftalato



Ante-Flo



4 Branch Plexus



Siena™



Valsalva™



Trifurcate Arch Graft

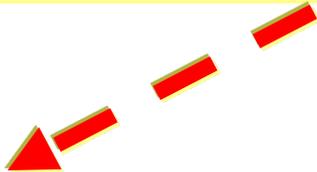


Thoracoabdominal Trifurcate



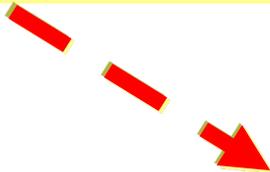
Coselli

PATOLOGIA DELL'AORTA ASCENDENTE + DISFUNZIONE DELLA VALVOLA AORTICA



Riparazione

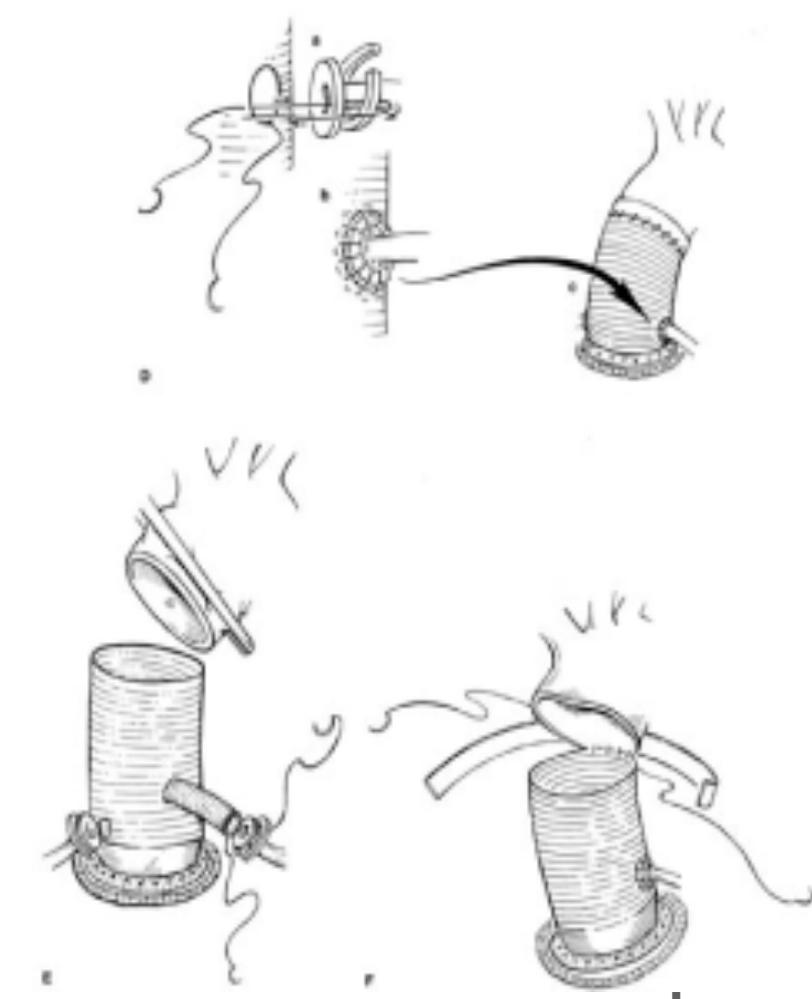
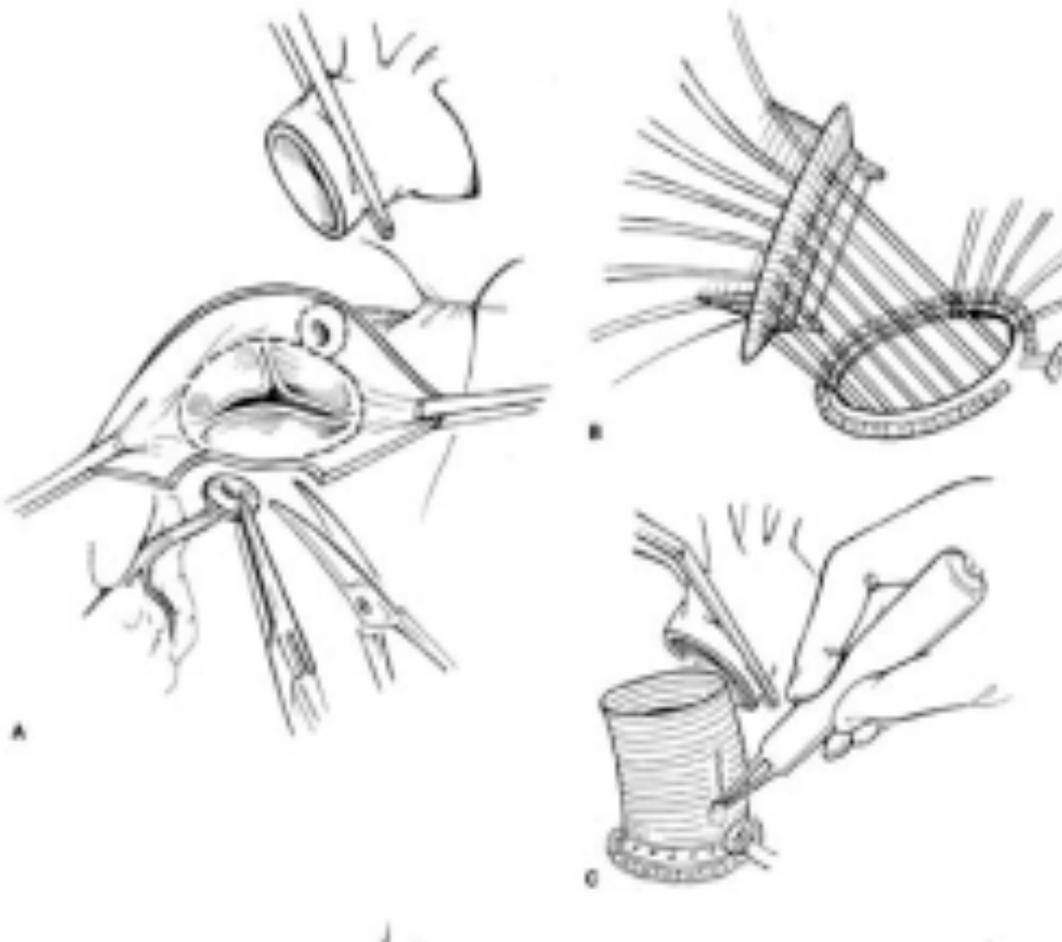
- Reimplantation (David);
- remodeling S.T.J (David)
- remodeling (Yacoub)



Sostituzione

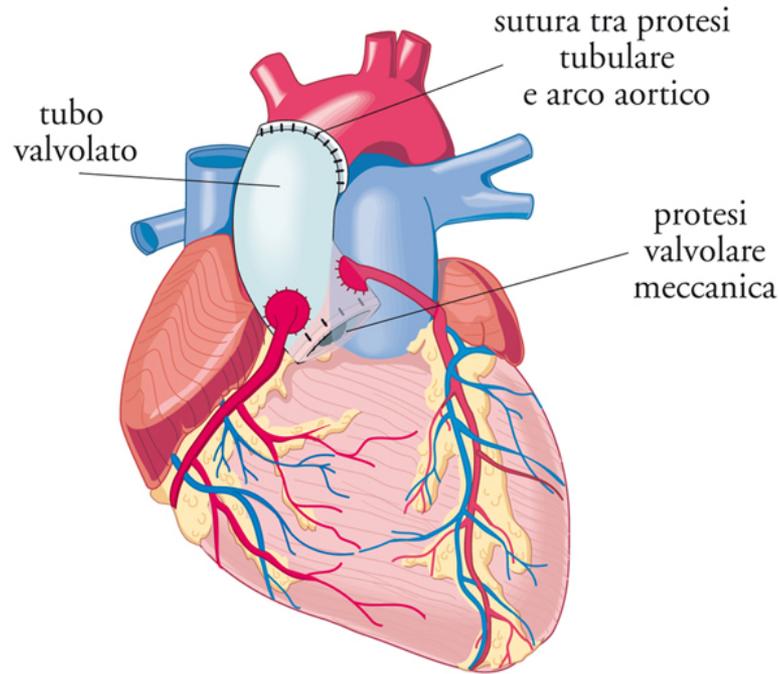
- Bentall procedure (mechanical and biological valved conduit);
- Homograft;
- Ross operation;
- stentless porcine root....

Quando la valvola aortica è malata



Intervento di Bentall

Terapia Chirurgica sostitutiva



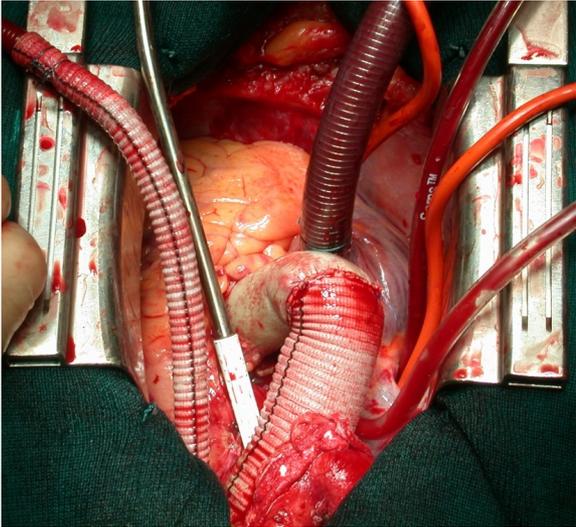
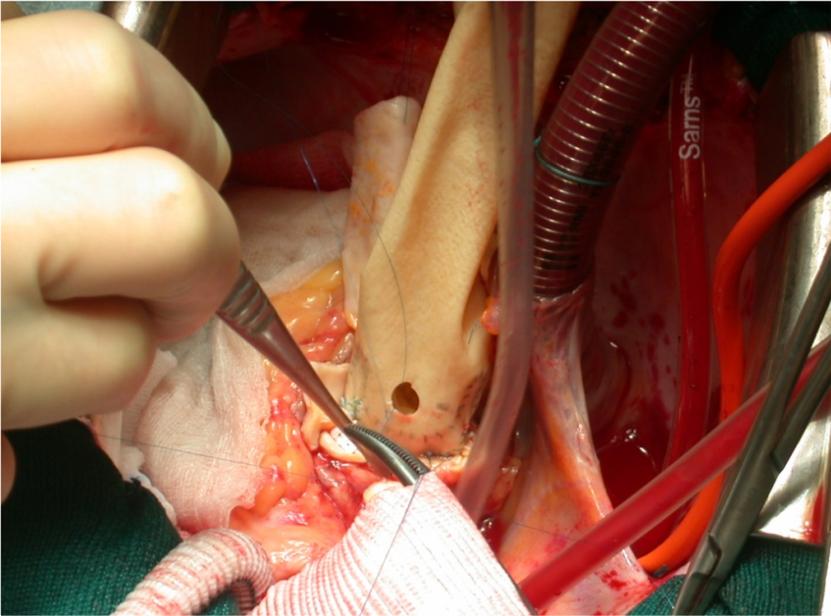
**TUBO VALVOLATO
MECCANICO**



**TUBO VALVOLATO
BIOLOGICO**

Stentless valved conduits

The Bio-integral:
pericardial stentless valve conduit

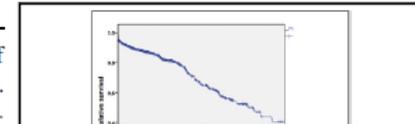




Composite valve graft implantation for the treatment of aortic valve disease: Results in 1045 patients

Luca Di Marco, MD, PhD, Davide Pacini, MD, PhD, Antonio Pantaleo, MD, Alessandro Leone, MD, Giuseppe Barberio, MD, Giuseppe Marinelli, MD, and Roberto Di Bartolomeo, MD

Aortic root replacement using a composite graft is the treatment of choice for a large variety of aortic root conditions with a diseased aortic valve. The objective of the current study was to evaluate the long-term results of this pro-



Di Marco et al

Acquired

Composite valve graft implantation for the treatment of aortic valve and root disease: Results in 1045 patients

Luca Di Marco, MD, PhD, Davide Pacini, MD, PhD, Antonio Pantaleo, MD, Alessandro Leone, MD, Giuseppe Barberio, MD, Giuseppe Marinelli, MD, and Roberto Di Bartolomeo, MD

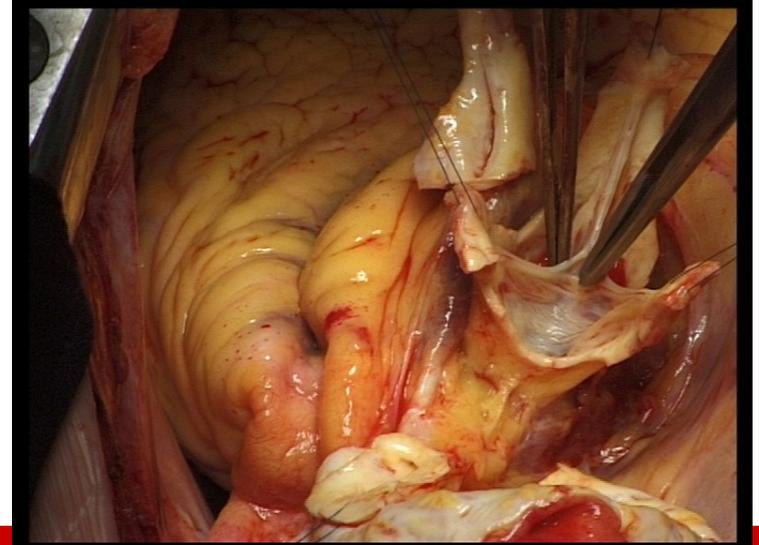
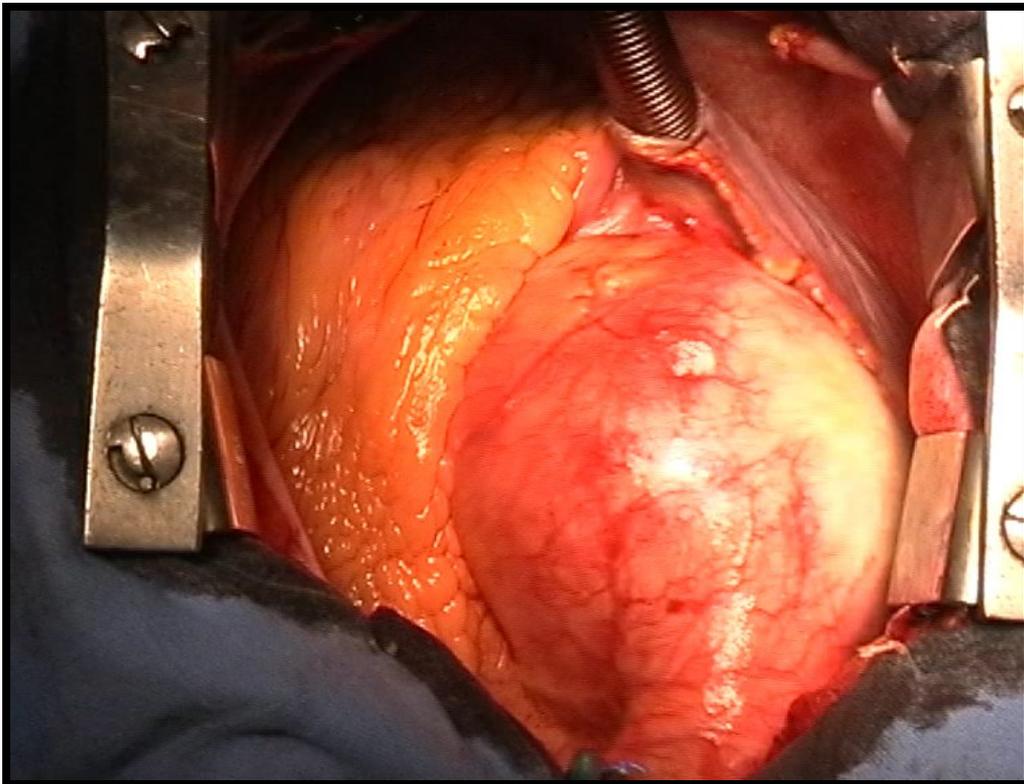
Di Marco L, et al.
JTCVS 2016;152(4):1041-1048

pulmonary disease ($P = .027$; HR, 1.94), aortic dissection ($P = .001$; HR, 2.05), Cabrol technique ($P = .009$; HR, 15.34), and CABG ($P = .016$; HR, 2.02) to be significant predictors of late death, and BAV ($P = .010$; HR, 0.43) to be a significant protective predictor. Freedom from thromboembolism, bleeding complications, and endocarditis was $93.7\% \pm 2.6\%$, $90.3\% \pm 3.1\%$, and $98.4\% \pm 1\%$ at 20 years, respectively. Freedom from aortic reoperation was $91.8\% \pm 2.1\%$ at 20 years and was significantly lower in patients with aortic dissection.

Conclusions: Within the limitations of this retrospective study, we can conclude that aortic root replacement for aortic root aneurysms can be performed with low morbidity and mortality and with satisfactory long-term results. Few late serious complications were related to the need for long-term anticoagulation or a prosthetic valve. Reoperation on the proximal or in the distal aorta was most commonly performed in patients with aortic dissection. (J Thorac Cardiovasc Surg 2016; ■:1-8)

with satisfactory long-term results.

ANEURISMA DELL'AORTA ASCENDENTE CON VALVOLA AORTICA NORMALE

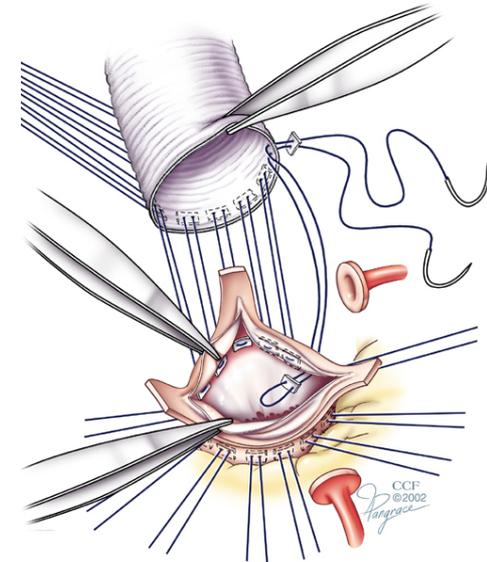
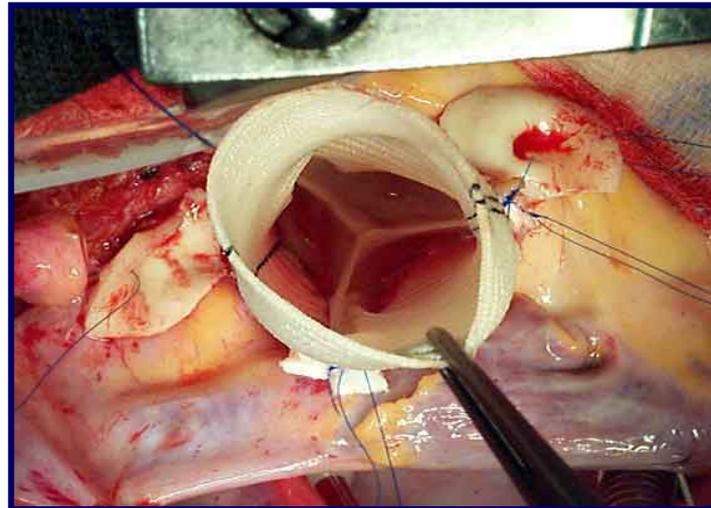
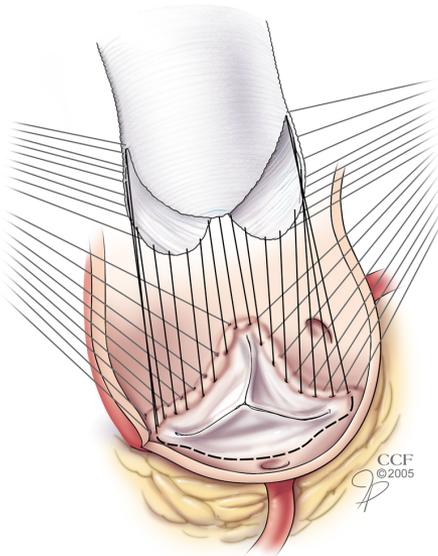


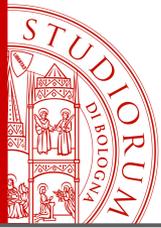
SOSTITUZIONE DELL' ANEURISMA DELL'AORTA ASCENDENTE PRESERVANDO LA VALVOLA AORTICA



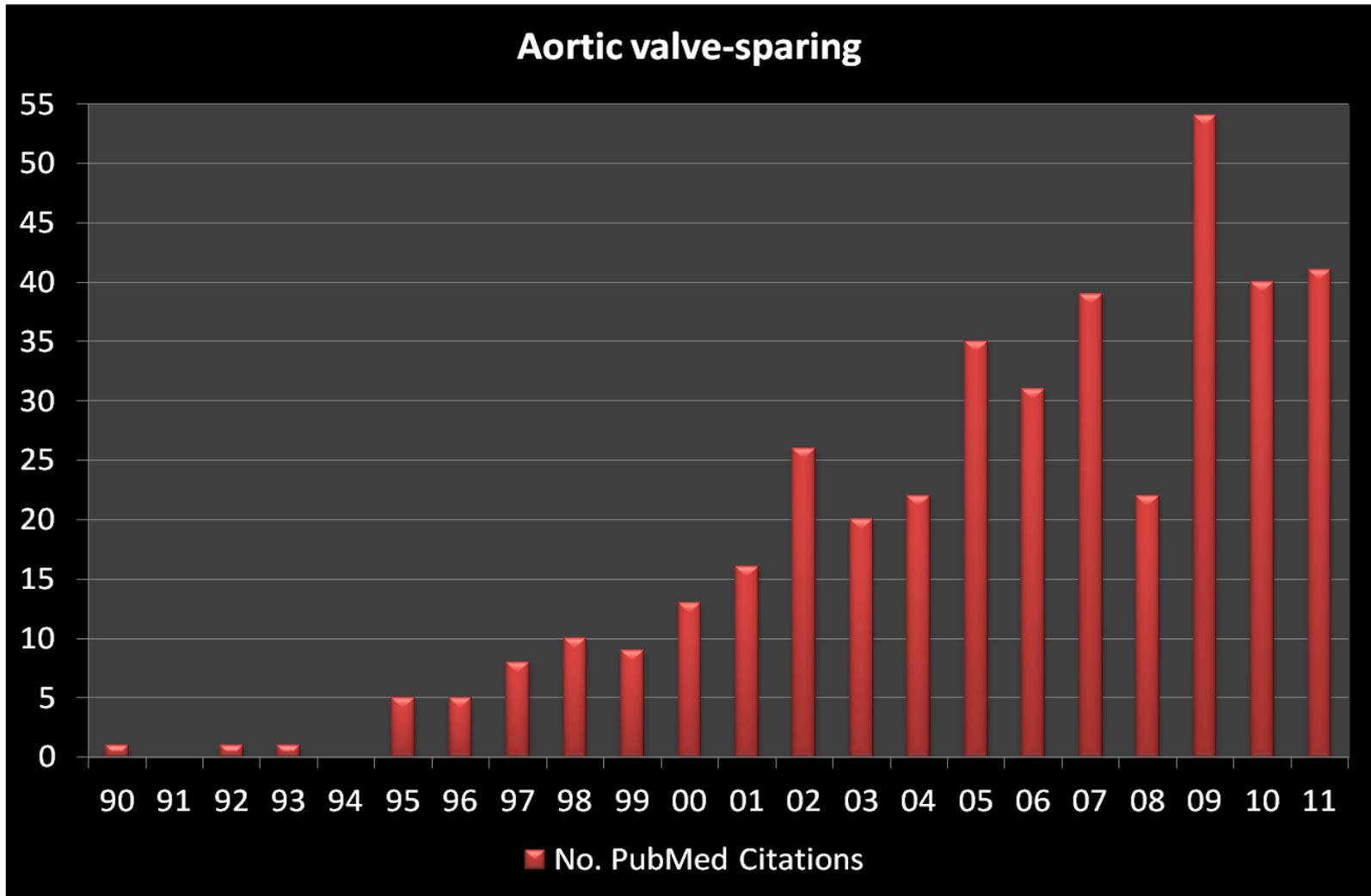
Remodeling
Yacoub

Reimplantation
David I

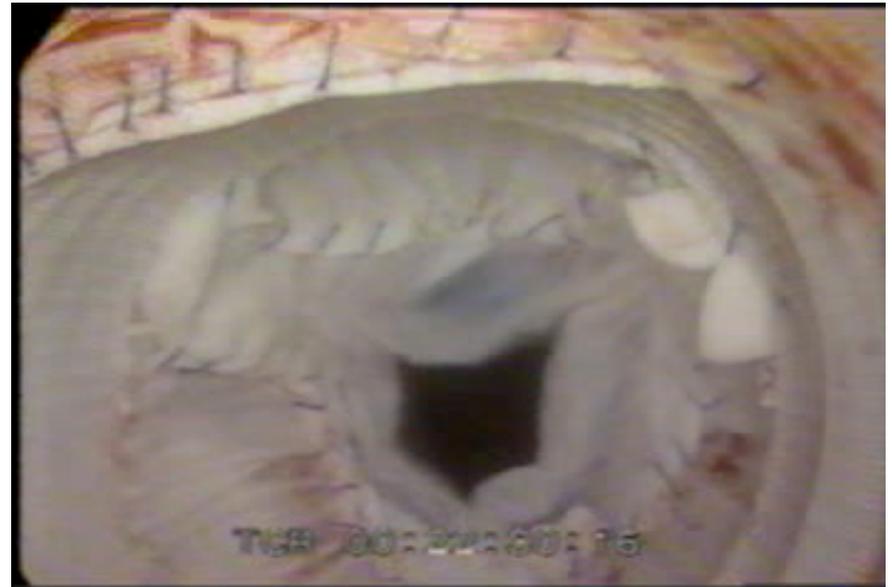




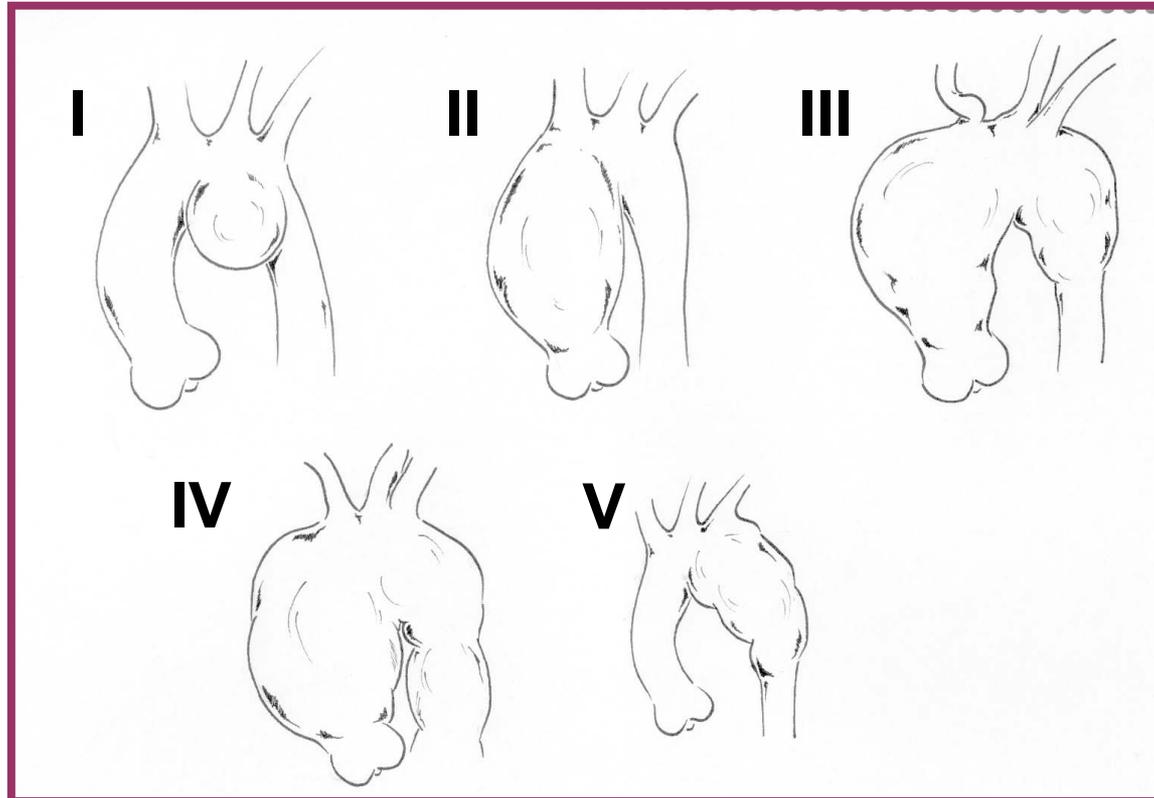
Crescita degli interventi di riparazione della valvola aortica nel mondo



Protesi di Valsalva

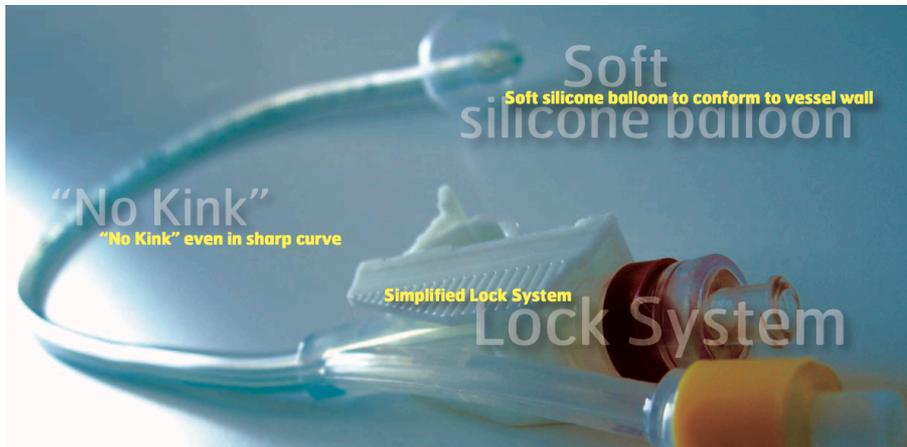


Tipologie di aneurisma dell'arco aortico



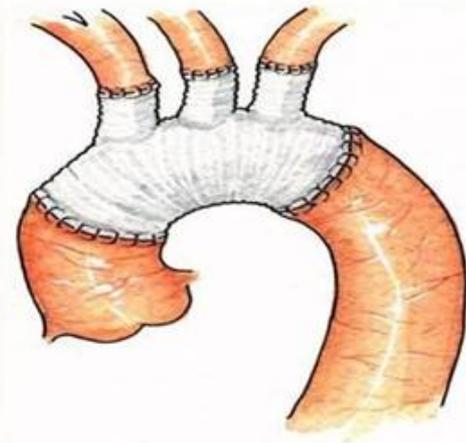
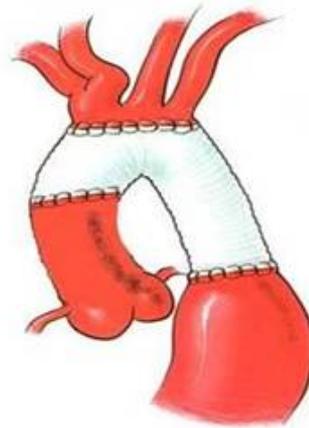
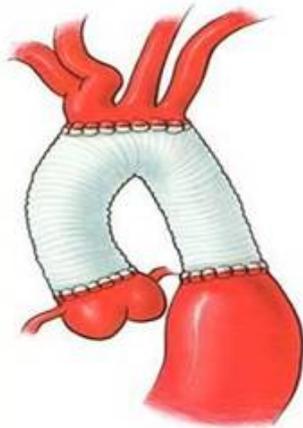
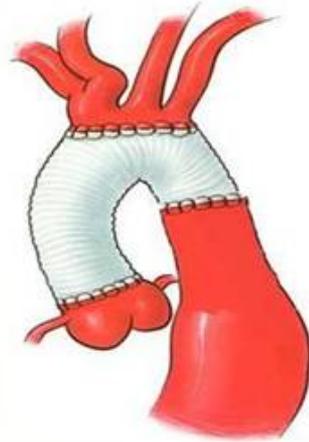
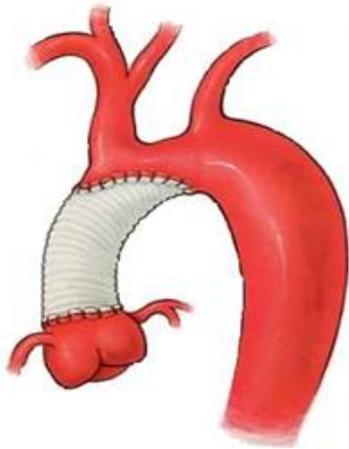
TECNICA DI PROTEZIONE CEREBRALE DURANTE CHIRURGIA DELL'ARCO AORTICO

- **PERFUSIONE CEREBRALE ANTEROGRADA**
- **ARRESTO DI CIRCOLO IN IPOTERMIA MODERATA (26 °C)**



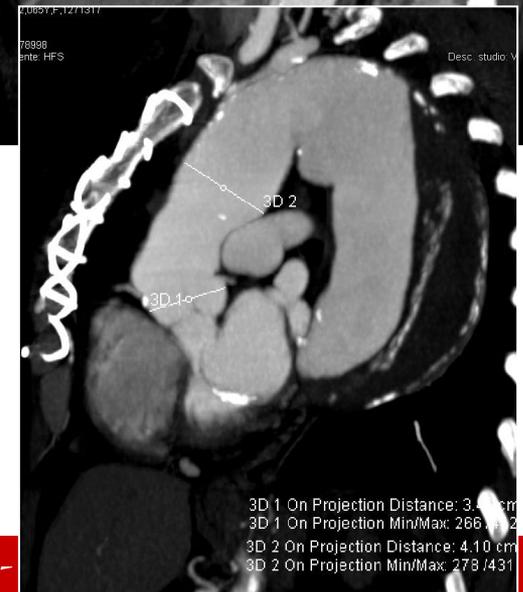
CHIRURGIA DELL'ARCO AORTICO

Opzioni chirurgiche



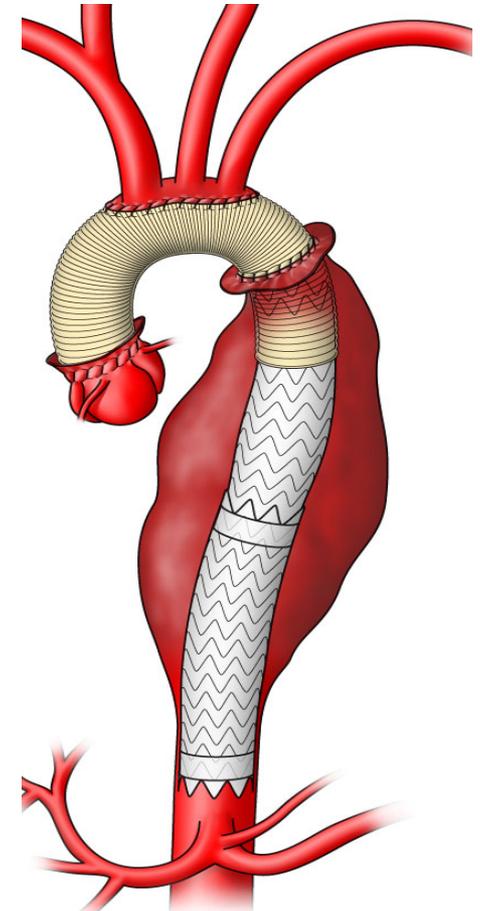
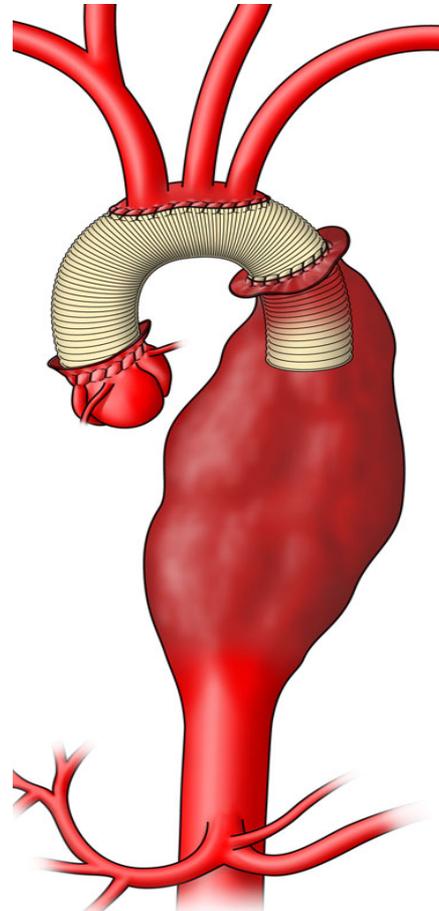


LESIONI COMPLESSE DELL'AORTA TORACICA



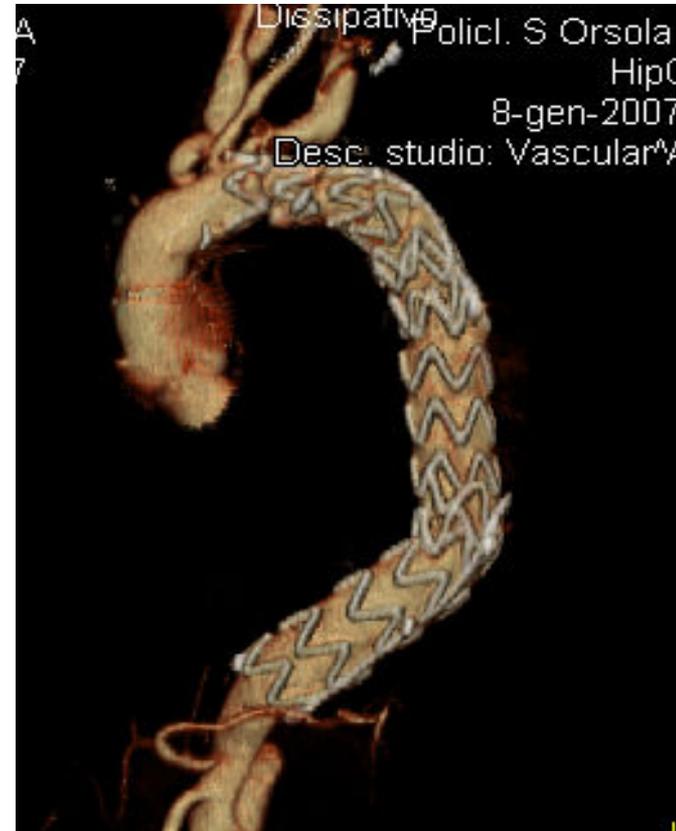
LESIONI COMPLESSE DELL'AORTA TORACICA

Tecnica dell'elephant trunk

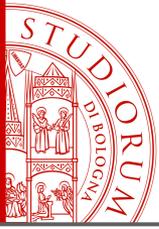


Tecnica dell'elephant trunk + TEVAR

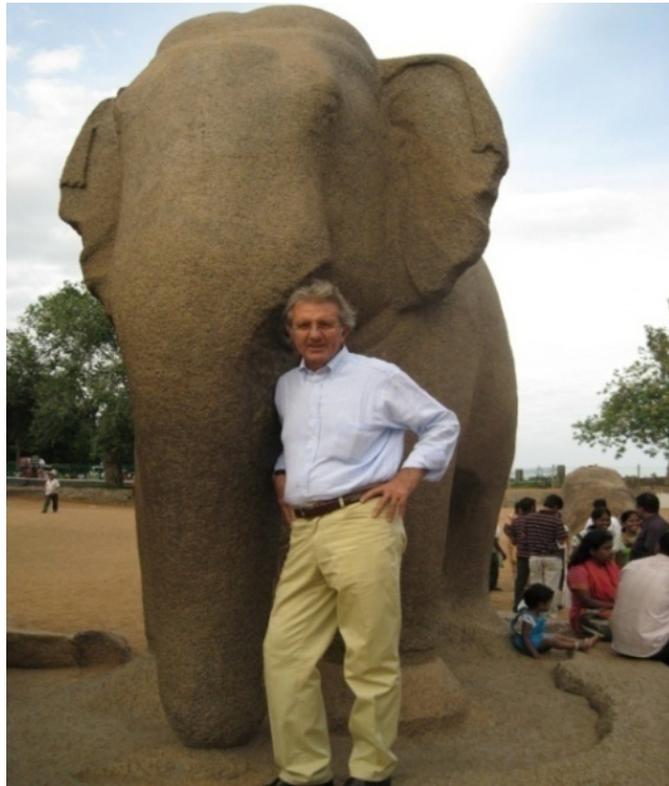
ELEPHANT TRUNK + ENDOVASCULAR STENT GRAFT



Bologna 2004 – 1° caso in Italia



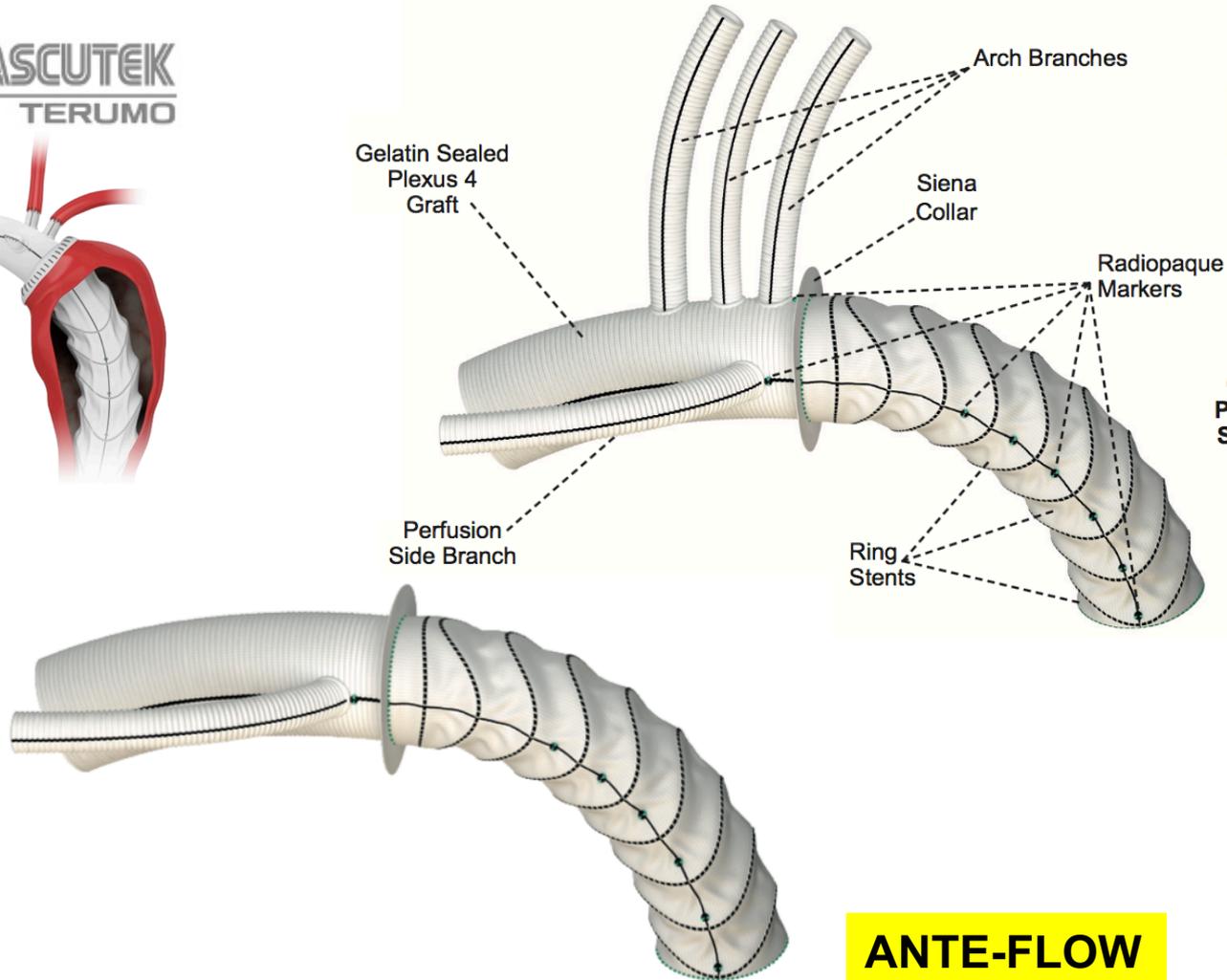
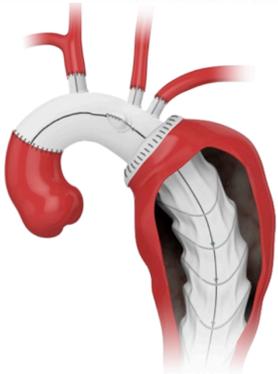
Tecnica ibrida di sostituzione dell'aorta toracica



**FROZEN
ELEPHANT
TRUNK**

Protesi: Thoraflex hybrid branched graft

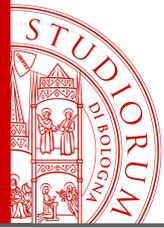
VASCUTEK
TERUMO



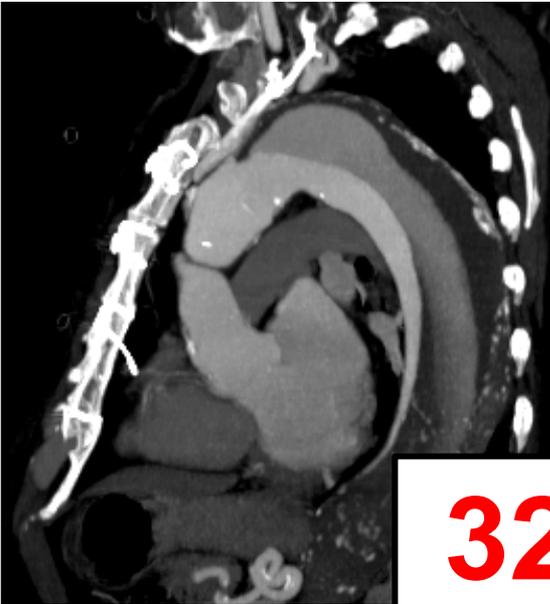
PLEXUS-4

Gelatin Sealed Polyester/Nitinol Supported Graft

ANTE-FLOW



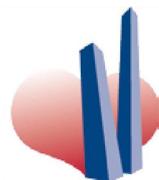
Esperienza Personale nelle lesioni complesse dell'aorta



325 PROCEDURE

Jotec E-vita





BOLOGNA EXPERIENCE

From January **2000** to December **2017**

1004 Open aortic arch procedures (with kazui technique)

FET PROCEDURE: 287

Endovascular aortic arch procedures (since 2010)



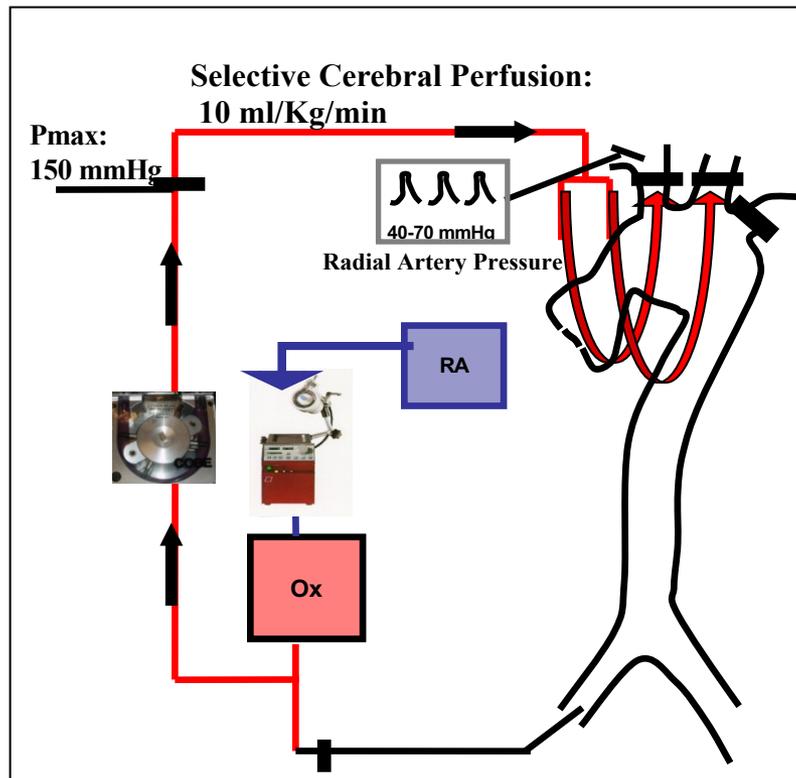
Arch repair in zone I or 2: 114

Arch repair in zone 0: 16

Completely endovascular: 5

Bologna, November 1996

The first case in Italy of ASCP with the Kazui technique



Aneurisma toraco addominale: classificazione di CRAWFORD





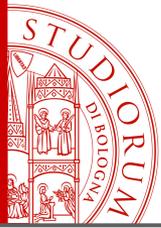
Houston, October 1985



PROF. DI BARTOLOMEO

E.S. Crawford

PROF. PIERANGELI



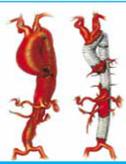
Surgery of the Thoracic Aorta Course



First announcement

Surgery of The Thoracic Aorta

EIGHT POSTGRADUATE COURSE



X COURSE

11-12 November 2019
Bologna, Italy



Course Director:
Roberto Di Bartolomeo

Cardiac Surgery Department
University of Bologna
S. Orsola - Malpighi Hospital
Bologna, Italy





OSSEVAZIONI FINALI

- L'aneurisma dell' aorta toracica è una patologia sempre più frequente che necessita di un adeguato inquadramento clinico per prevenirne le gravi complicanze di rottura o dissecazione.
- I pazienti andrebbero riferiti a chirurghi con particolare esperienza in questa difficile chirurgia (sec. Le linee guida ESC) dove poter ricevere un trattamento adeguato al tipo di lesione.
- I recenti mezzi diagnostici e terapeutici hanno permesso di ottenere ottimi risultati dopo il trattamento.