

Aortendissektion

Was sind Warnhinweise?

Wie sieht die Therapie prähospital und insbesondere intrahospital aus?

Martin Misfeld

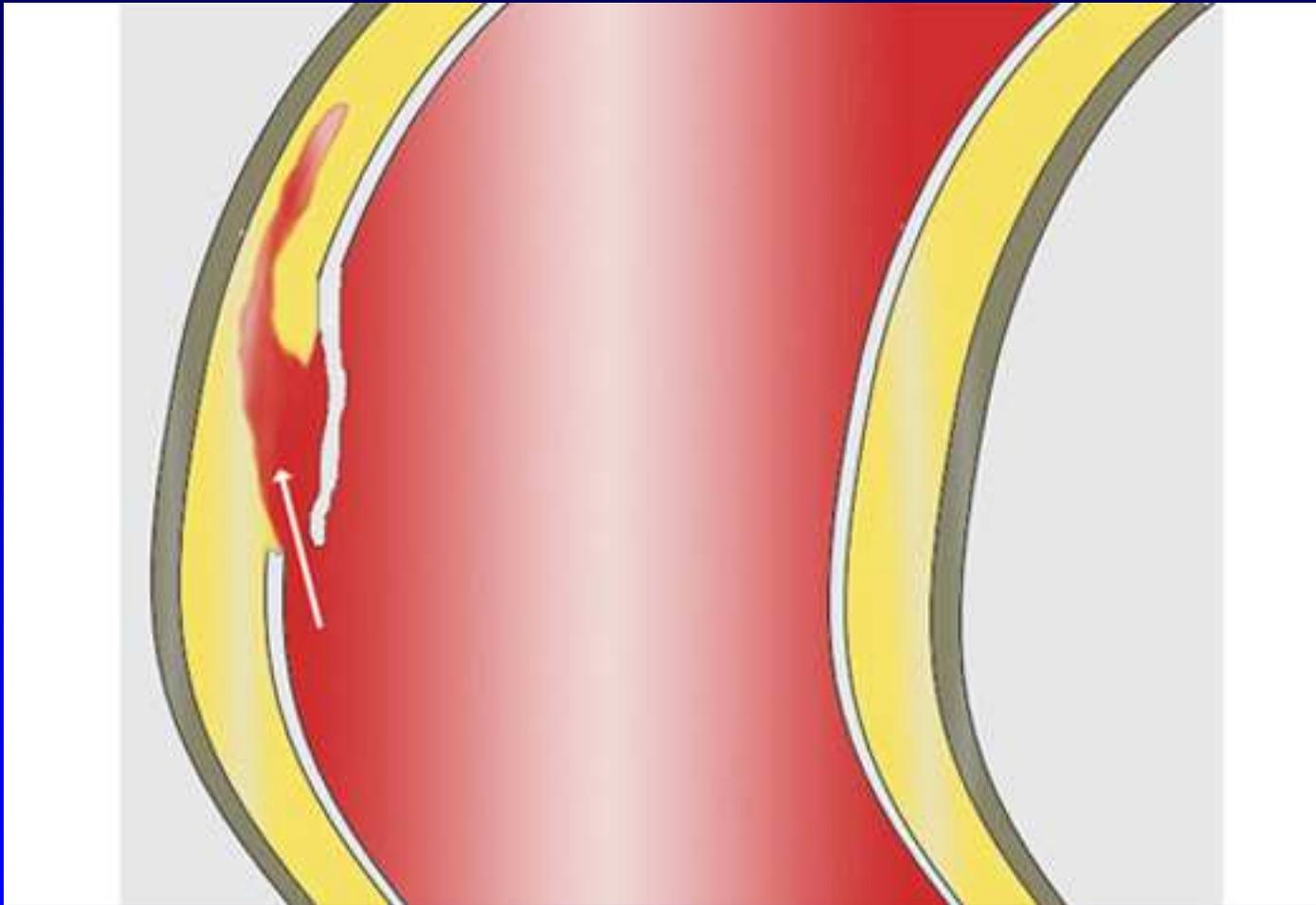


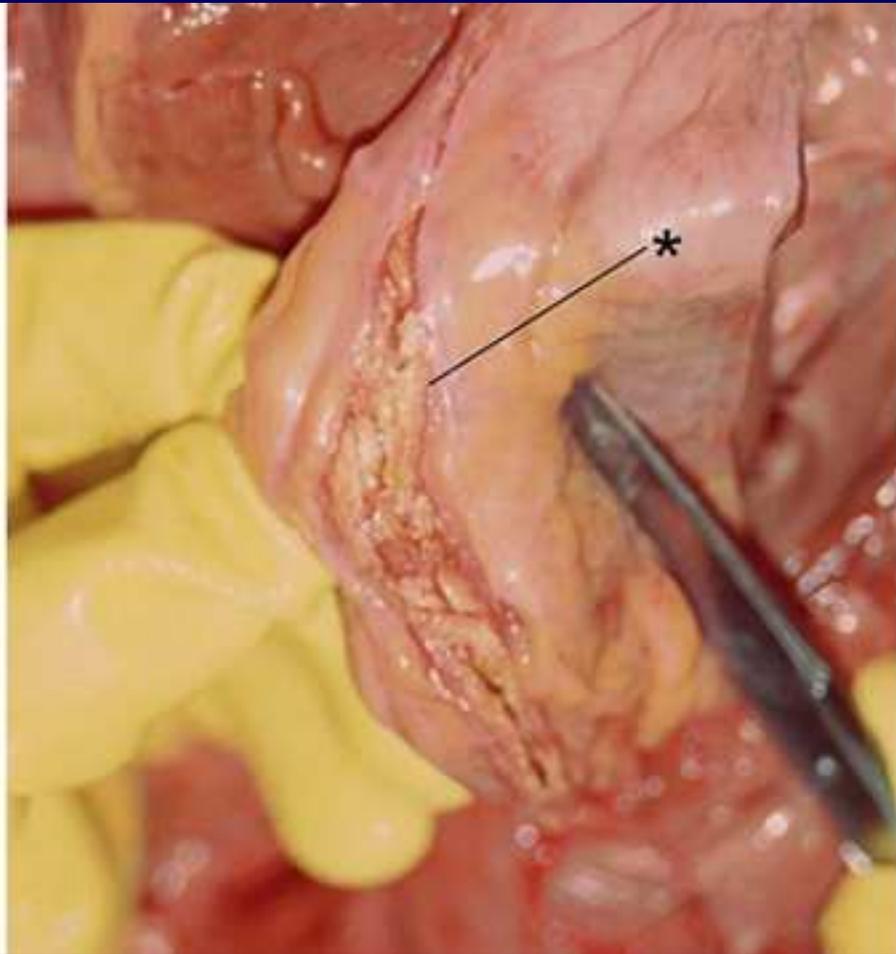
Direktor: Prof. Dr. Friedrich W. Mohr

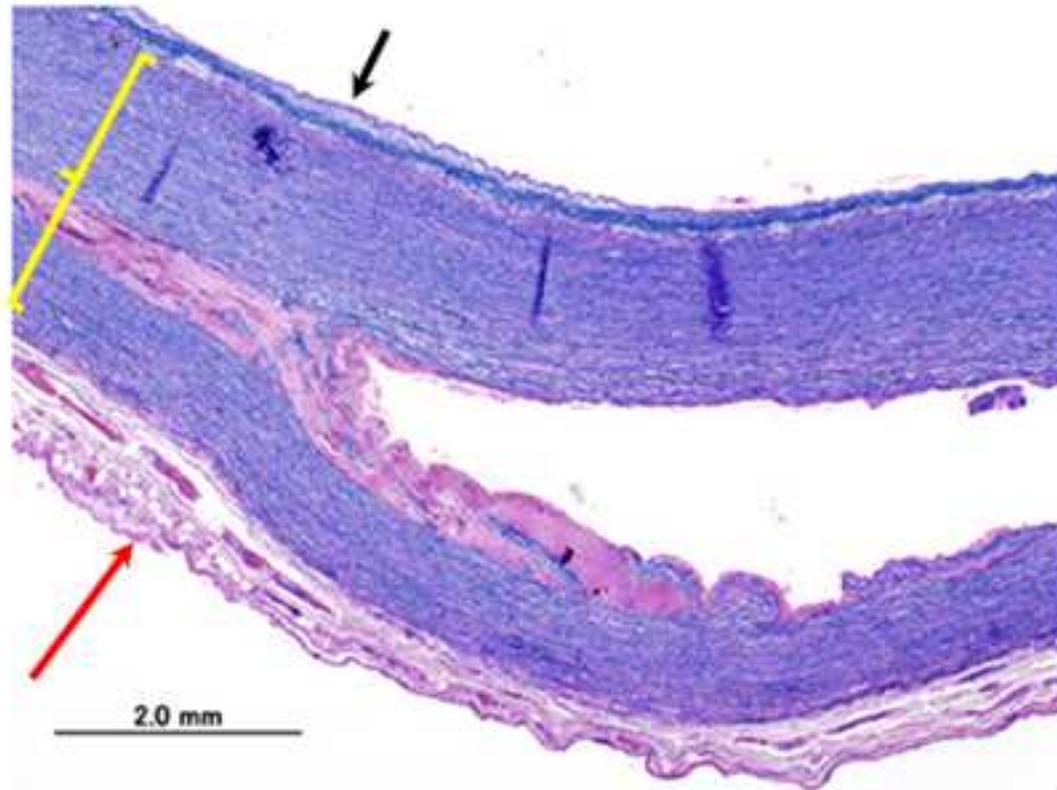
King George II (30.10.1683 - 25.10.1760)



“...the pericardium was found distended with a quantity of coagulated blood, nearly a pint...; the whole heart was so compressed as to prevent any blood contained in the veins from being forced into the auricles; therefore the ventricles were found absolutely void of blood...; and in the trunk of the aorta we found on a transverse fissure its inner side, about an inch and a half long, through which some blood had recently passed under its external coat and formed an elevated ecchymosis.”









John Ritter



Dr. Michael Ellis DeBakey



Prinzessin
Diana

Aortendissektion

Inzidenz:

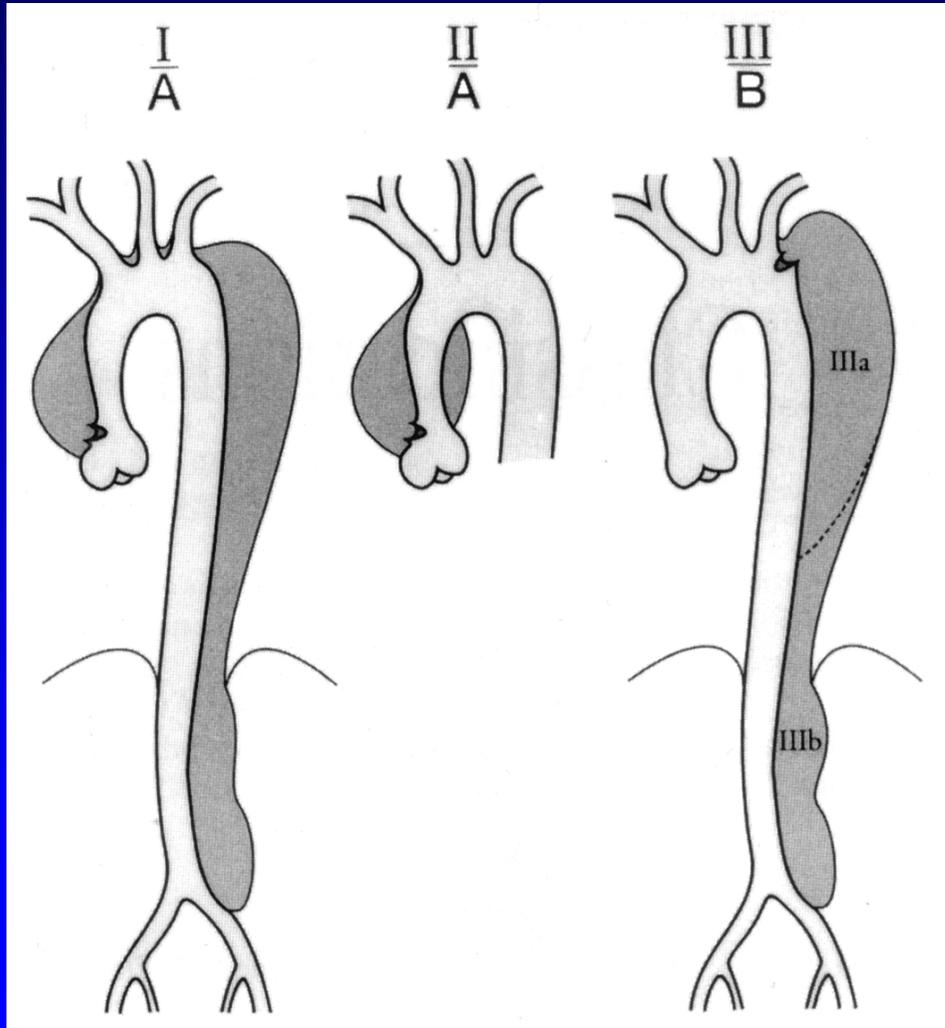
~ 2000 / y in den USA

-- 400-500 / y in Deutschland

Lokalisation des Einrisses:

- Aorta ascendens	65%
- Aorta descendens	20%
- Aortenbogen	10%
- Aorta abdominalis	5%
- kein entry	3-13%

Klassifikationen



Stanford

Typ A = Aorta asc. +/- desc.

Typ B = nur Aorta desc.

DeBakey

Typ I = Aorta asc. + desc.

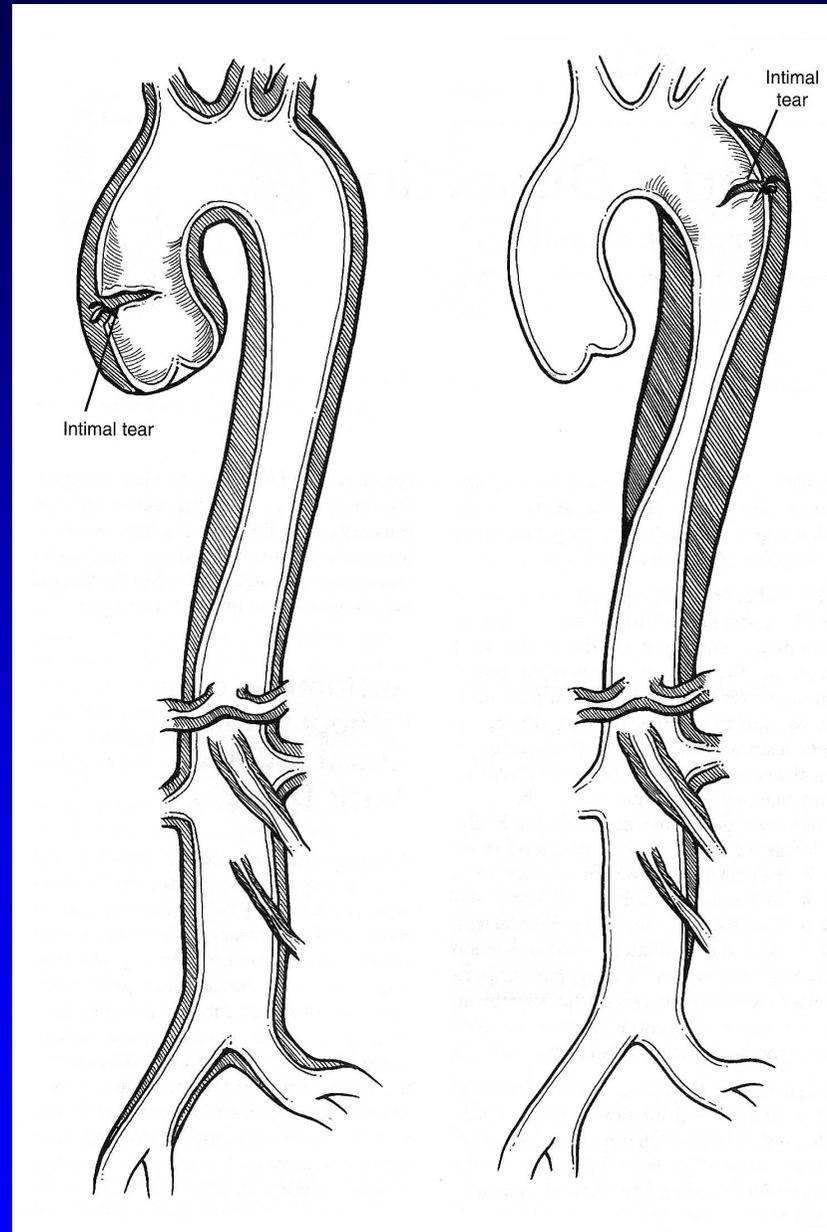
Typ II = nur Aorta asc.

Typ III = nur Aorta desc.

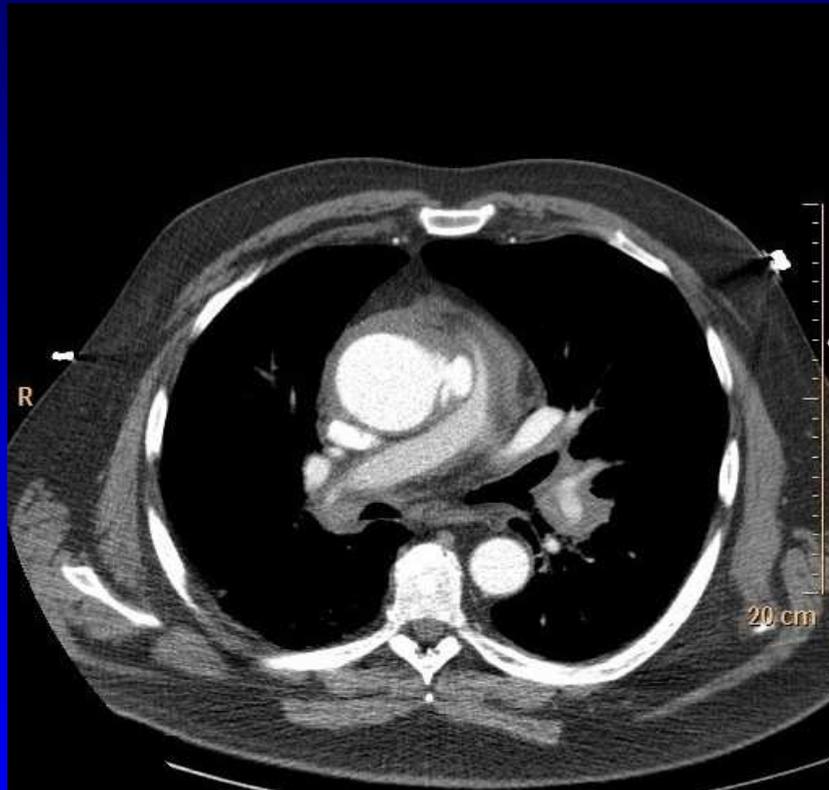
IIIa = bis Diaphragma

IIIb = unterhalb Diaphr.

„Entry“
„Reentry“

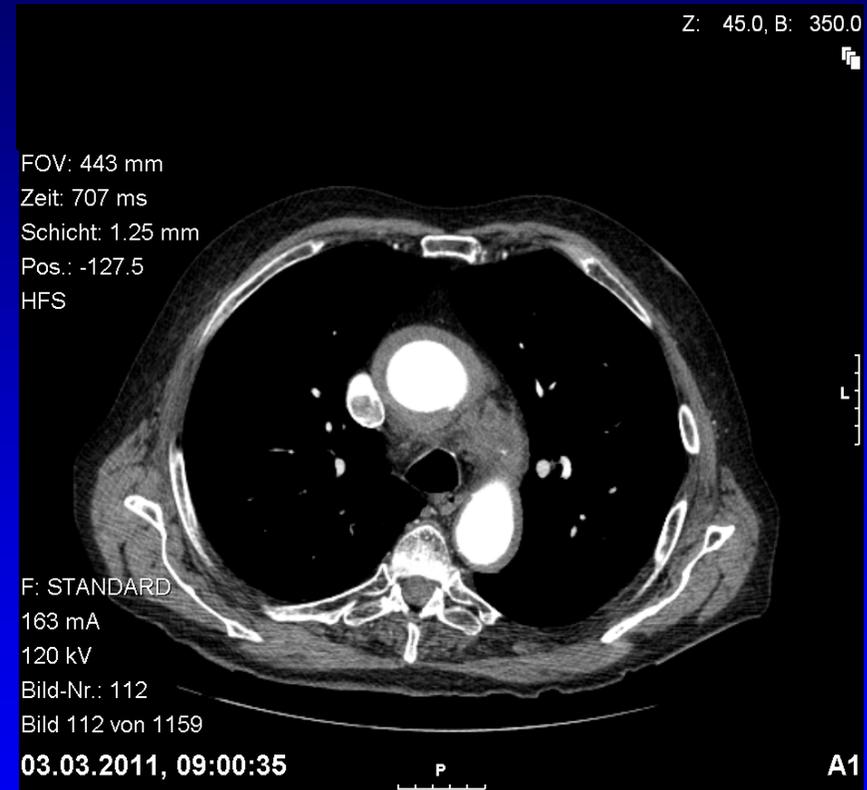


„Sonderformen“



PAU

penetrating atherosclerotic ulcer



IMH

intramural hematoma

TABLE 1. RISK FACTORS FOR ACUTE TYPE A DISSECTION

Vascular trauma

Intrinsic

- Hypertension
- Atherosclerosis
- Intramural hematoma/Penetrating aortic ulcer
- Excess hemodynamic stress (eg. pregnancy, cocaine abuse)

Extrinsic (Iatrogenic)

Antegrade

- Coronary catheterization/Angioplasty
- Aortic cannulation for cardiopulmonary bypass (CPB)
- Aortic cross-clamp
- Coronary artery bypass graft proximal anastomosis
- Antegrade needle vent site
- Aortic valve replacement
- Transapical aortic valve replacement

Retrograde

- Femoral cannulation for CPB
- Transfemoral thoracic stent grafting
- Transfemoral aortic valve replacement

Substrate Deficiency

Connective tissue disorders

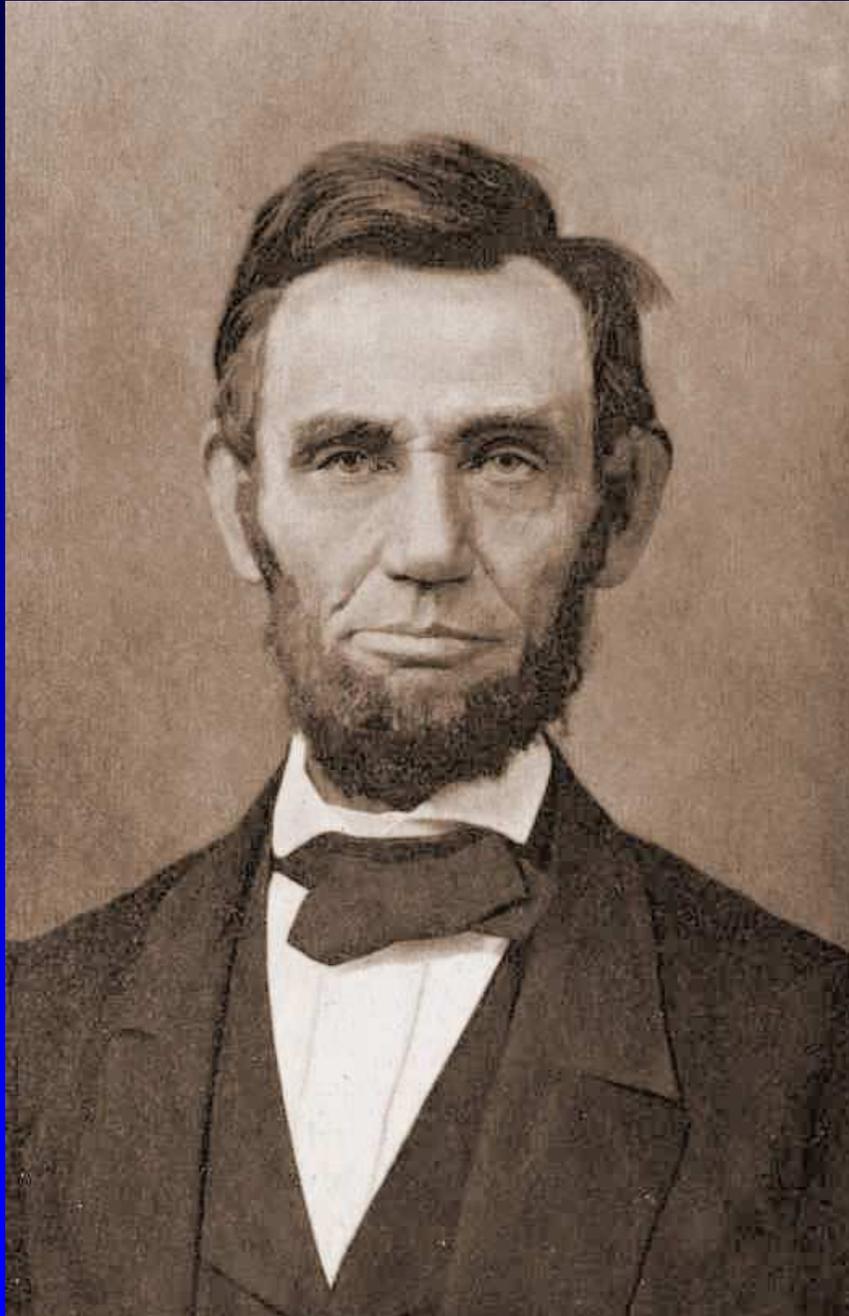
- Marfan Syndrome
- Ehlers-Danlos Syndrome
- Loeys-Dietz Syndrome
- Turner Syndrome

Aortopathy

- Bicuspid aortic valve
- Unicuspid aortic valve
- Thoracic aortic aneurysm

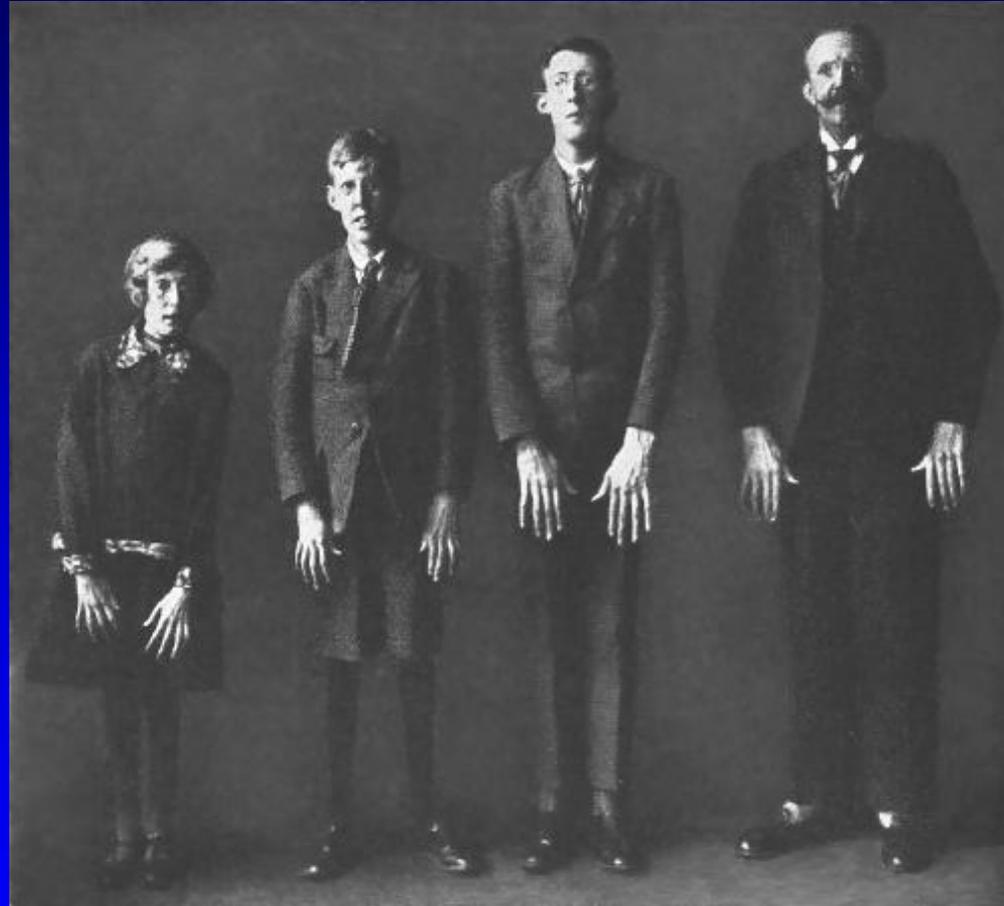
Patienten

- Bekanntes Aortenaneurysma
- KHK
- arterieller Hypertonus
- familiäre Häufung
- Bindegewebsanomalien
- Aortenklappenfehler (bikuspide AK)



Abraham Lincoln
12.2.1809 – 15.4.1865

Marfan Syndrom



Ehlers-Danlos Syndrom
Loeys-Dietz Syndrom

Marfan Syndrom

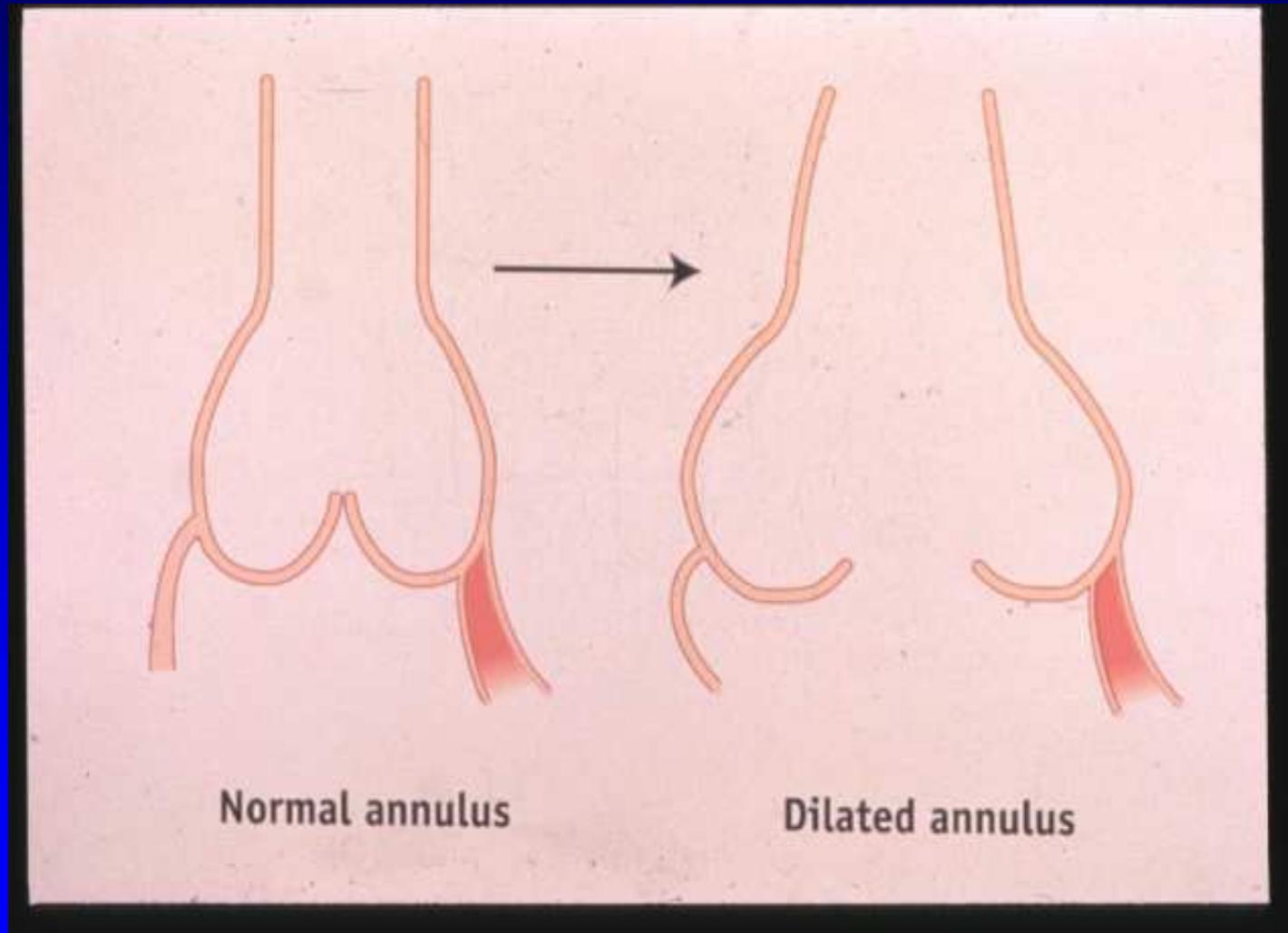
- autosomal-dominant vererbte Bindegewebserkrankung
- Fibrillin-1 (FBN1) Abnormalität
- Inzidenz: 1/5.000 to 1/10.000
- 25% spontane Mutationen
- Verschiedene Organsysteme sind betroffen: z.B. kardiovaskuläres System, Skelettapparat, Augenlinse, Dura

Marfan Syndrom

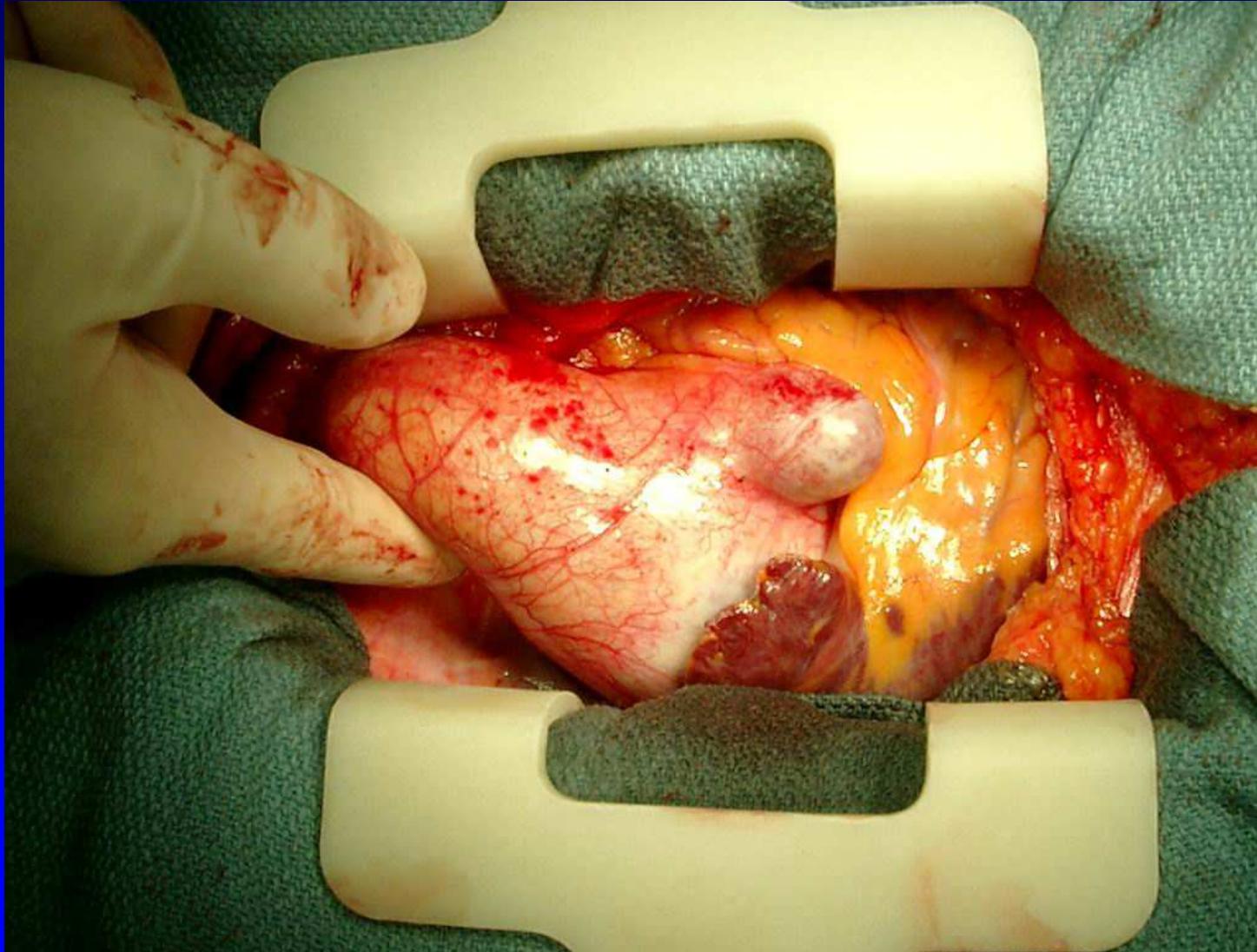
- kardiovaskuläre Beteiligung -

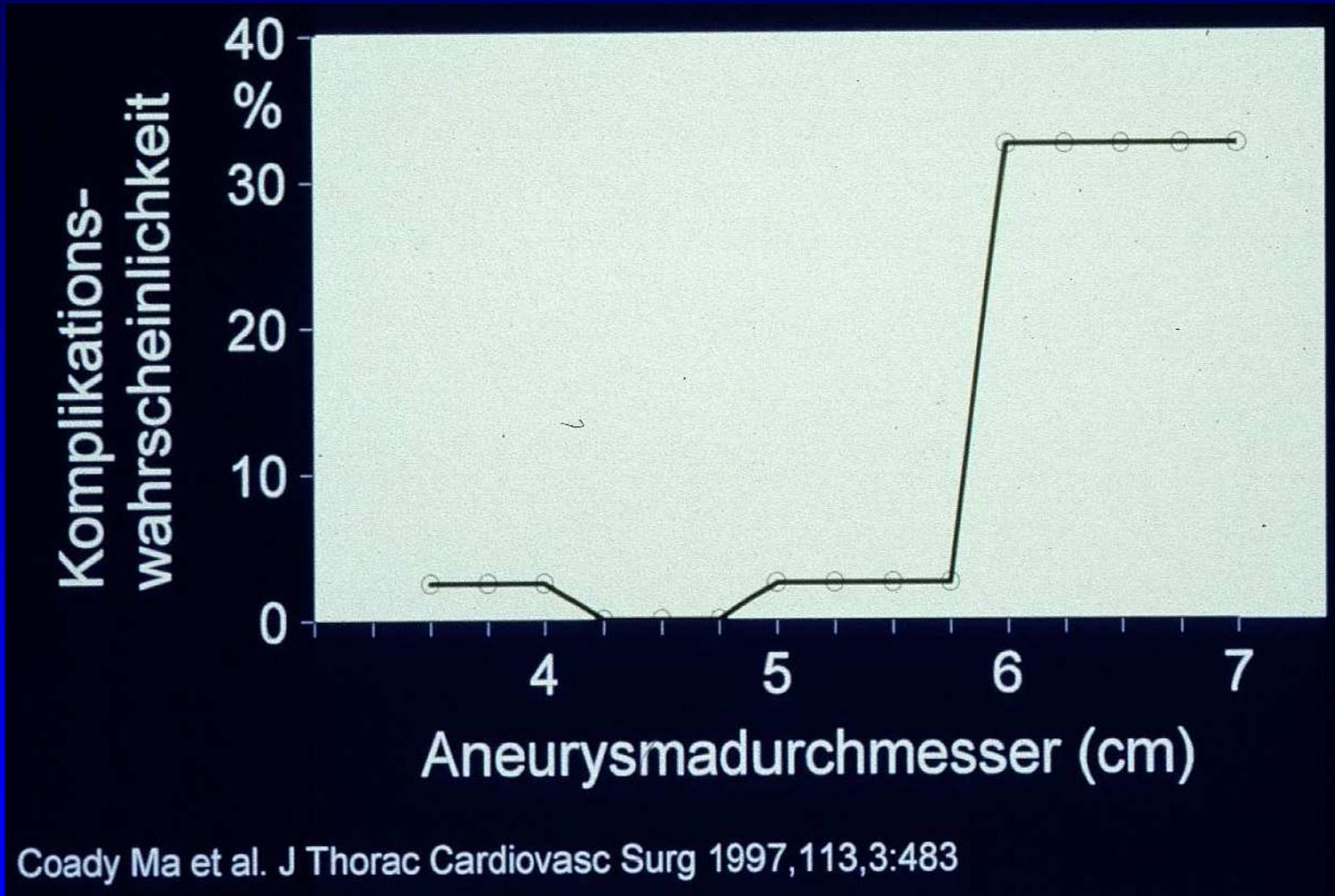
- Aorta (Aortenwurzel > Aorta ascendens > Aorta descendens)
- Aortenklappe (Insuffizienz)
- Mitralklappe (Prolaps)

Dilatation der Aortenwurzel



Intraoperatives Bild





Coady Ma et al. J Thorac Cardiovasc Surg 1997,113,3:483

Symptome

- plötzlich einsetzender Vernichtungsschmerz
- typisch zwischen den Schulterblättern
- **IRAD** (=International Registry of acute Aortic Dissection)
 - 85 % „schlimmste Schmerz“
 - 73 % thorakaler Schmerz
 - 64% „eher scharf / spitz“ als „reißend“
- Zeichen der Malperfusion

>>>>> „daran denken“

Spontaner Verlauf

- Risiko ist abhängig vom Aortendurchmesser
- Akutmortalität: 40%
- 1-2 % / h in der Folgezeit

>>> chirurgischer Notfall!

Maßnahmen

- RR-Kontrolle (β -Blocker)
- Verlegung in ein herzchirurgisches Zentrum

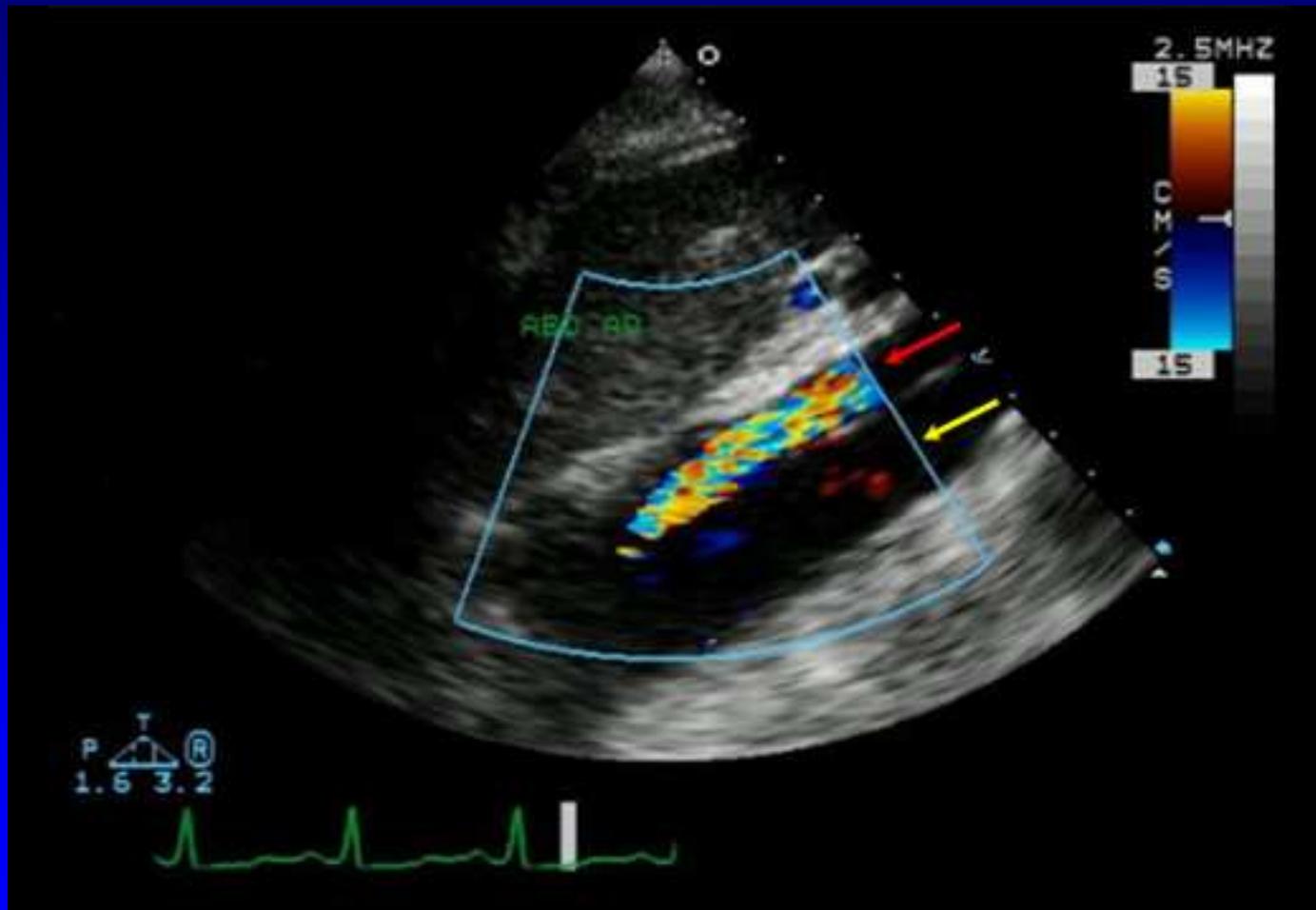
Diagnostik

➤ Echo

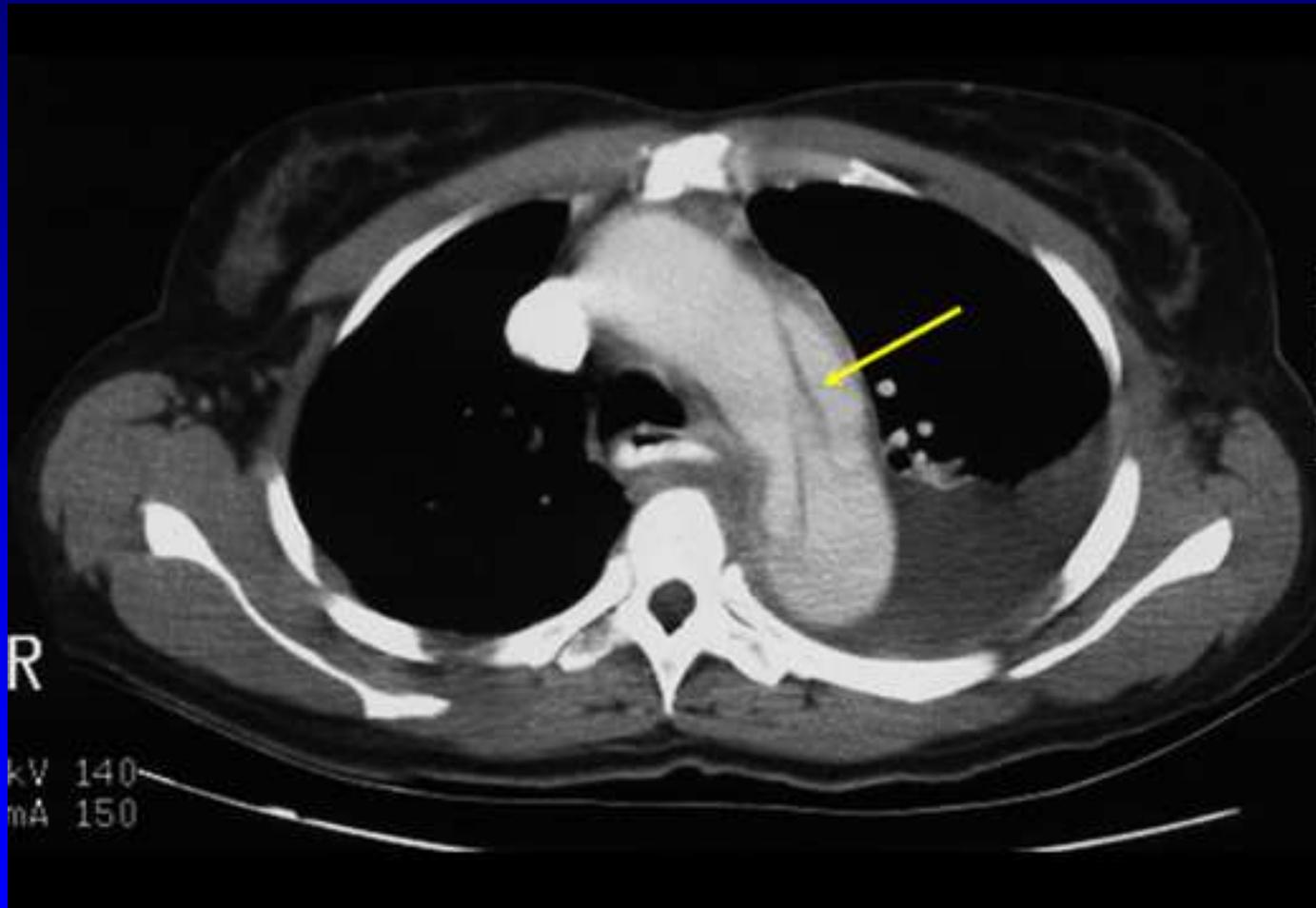
➤ CT / MRT

➤ Herzkatheter

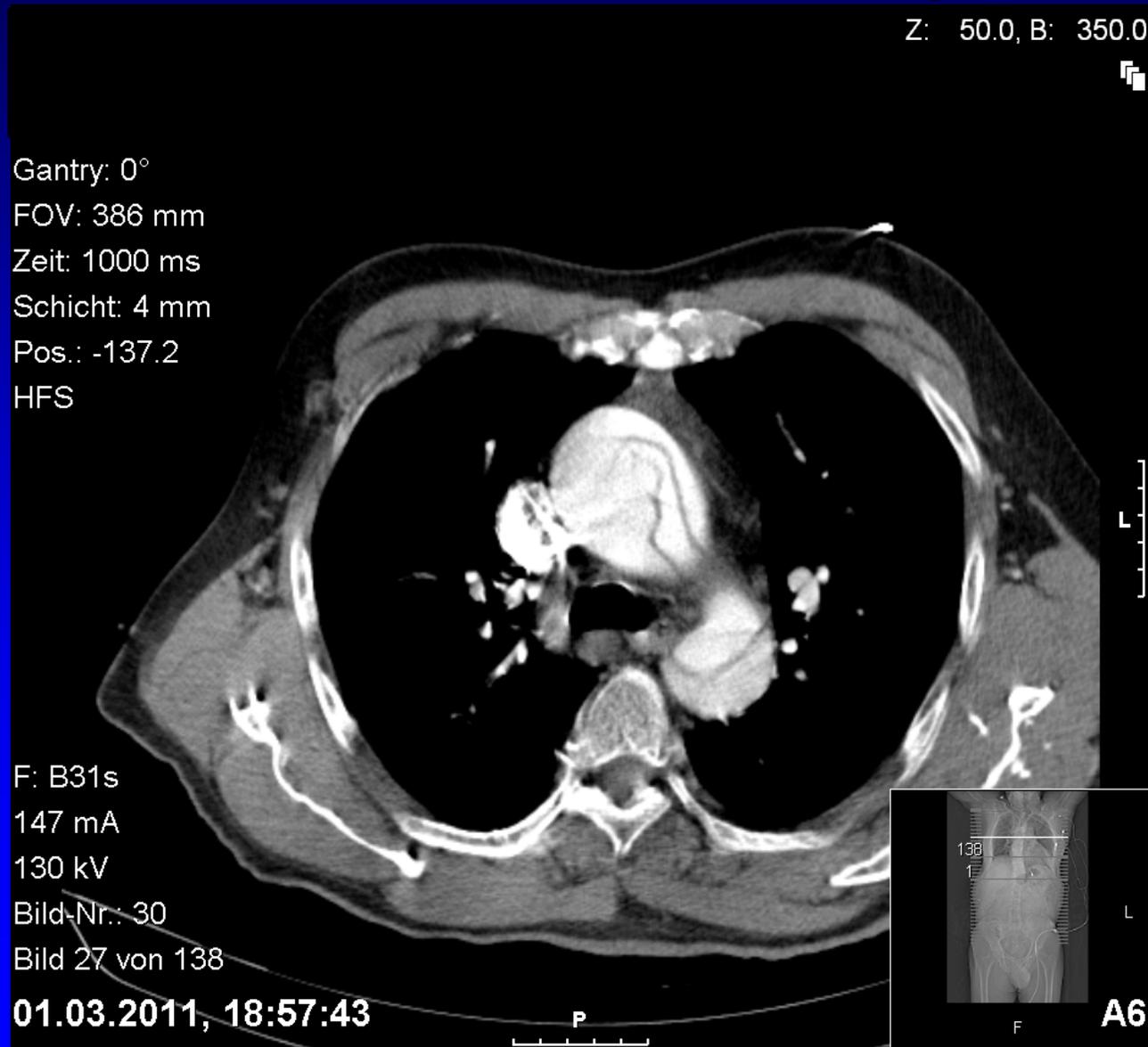
Aortendissektion Typ A



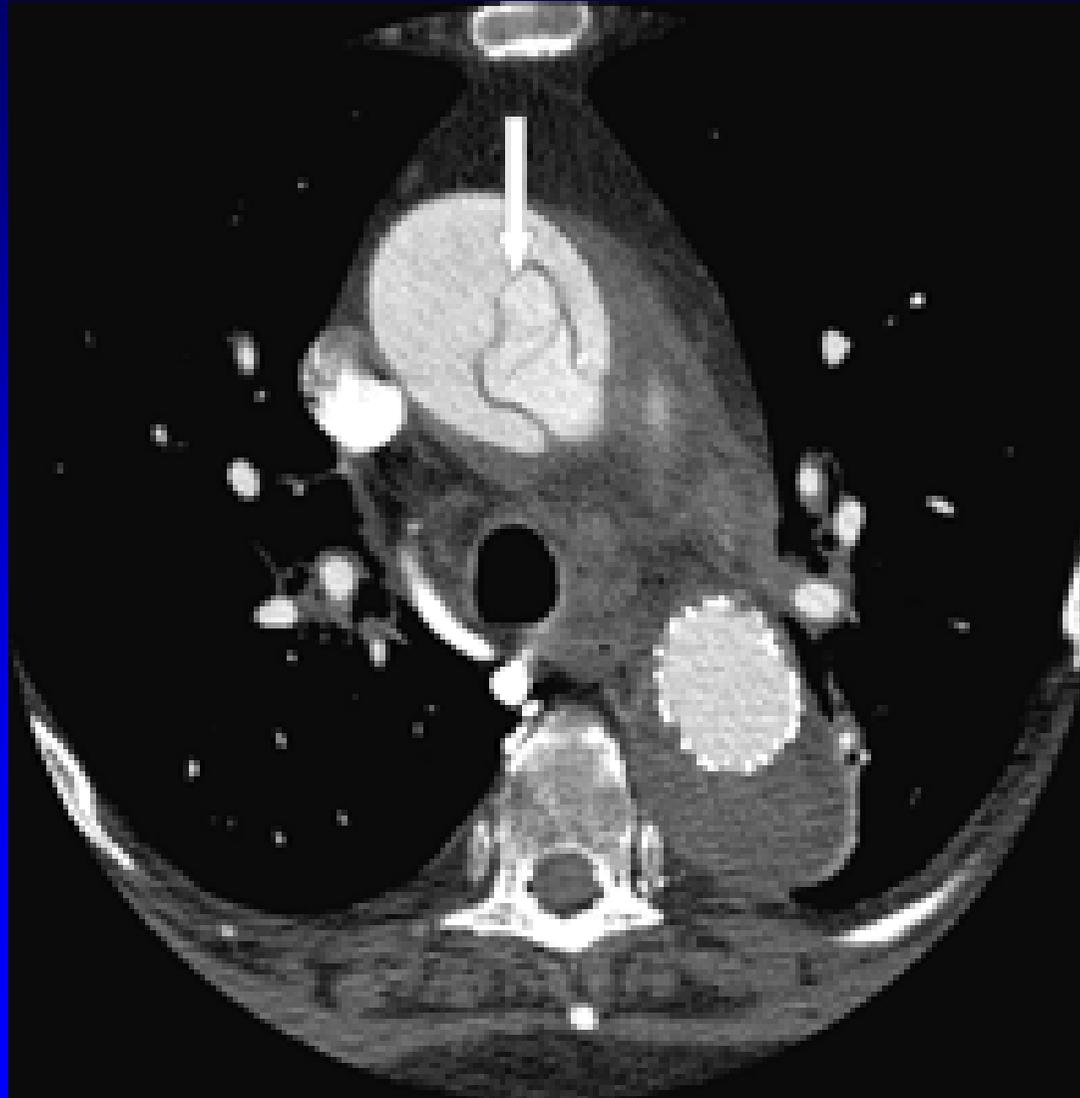
Aortendissektion Typ A



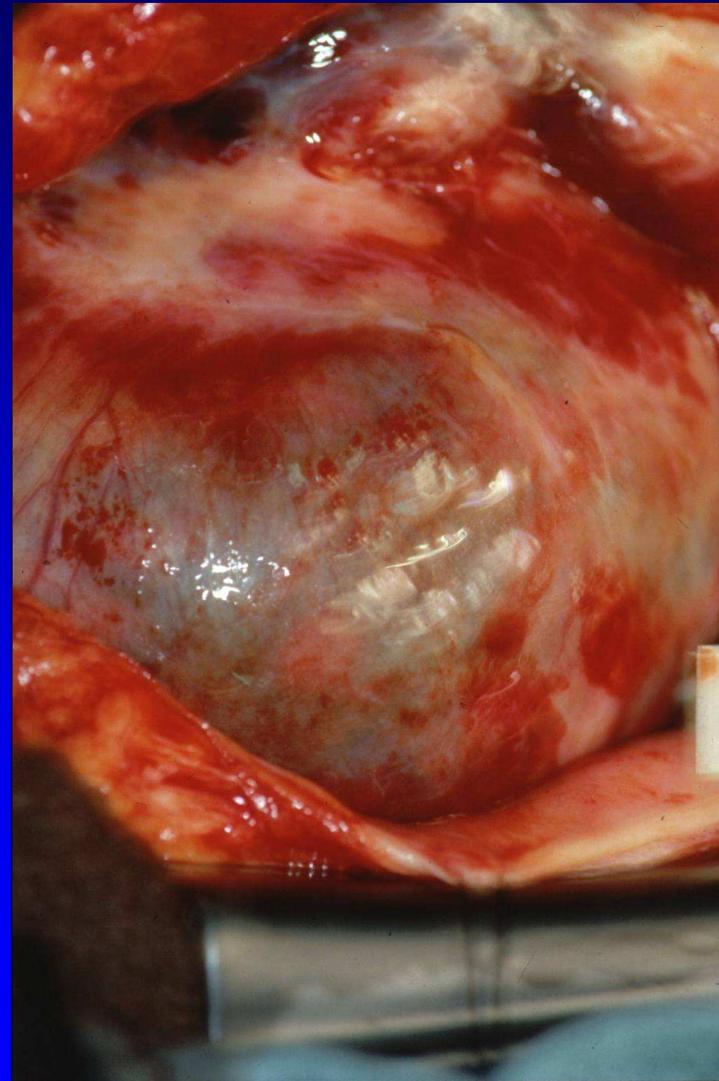
Aortendissektion Typ A



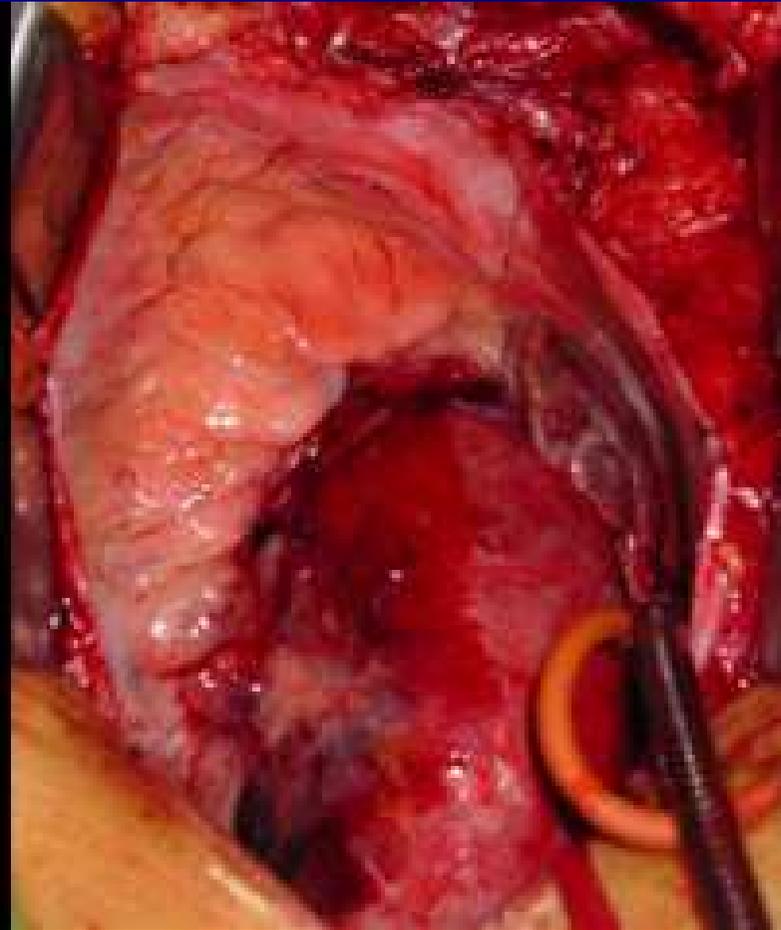
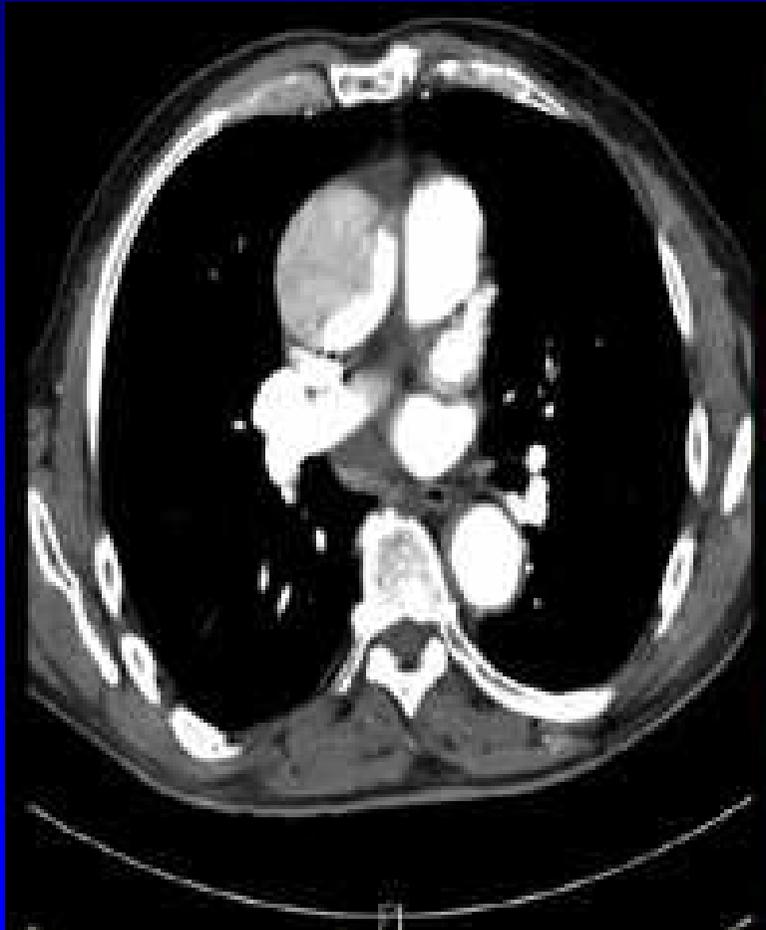
Aortendissektion Typ A



Aortendissektion Typ A



Aortendissektion Typ A



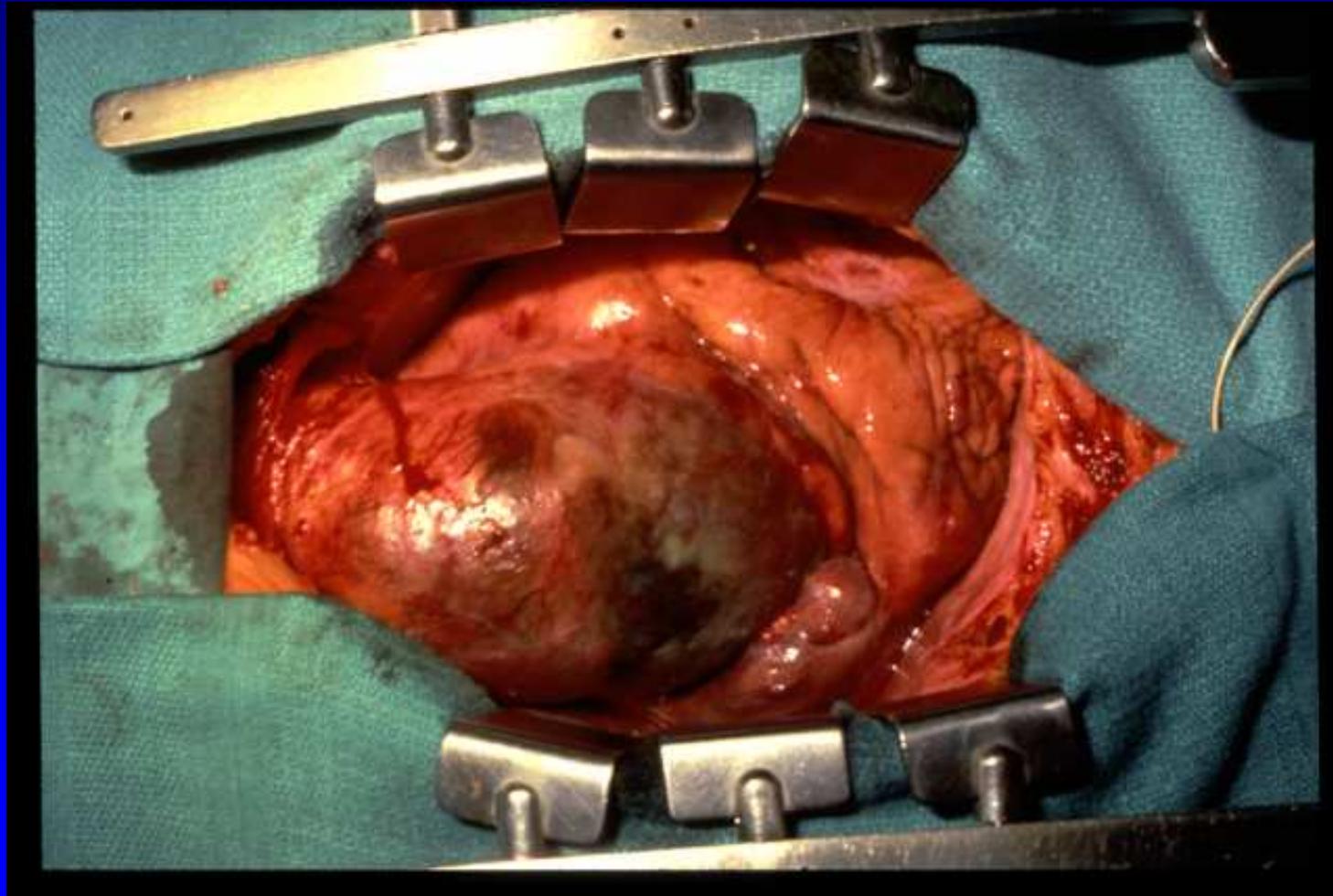
Dr. Michael DeBakey 1960



Aortenwurzelaneurysma



Aortenwurzelaaneurysma mit akuter Typ A Dissektion



Operationsstrategien

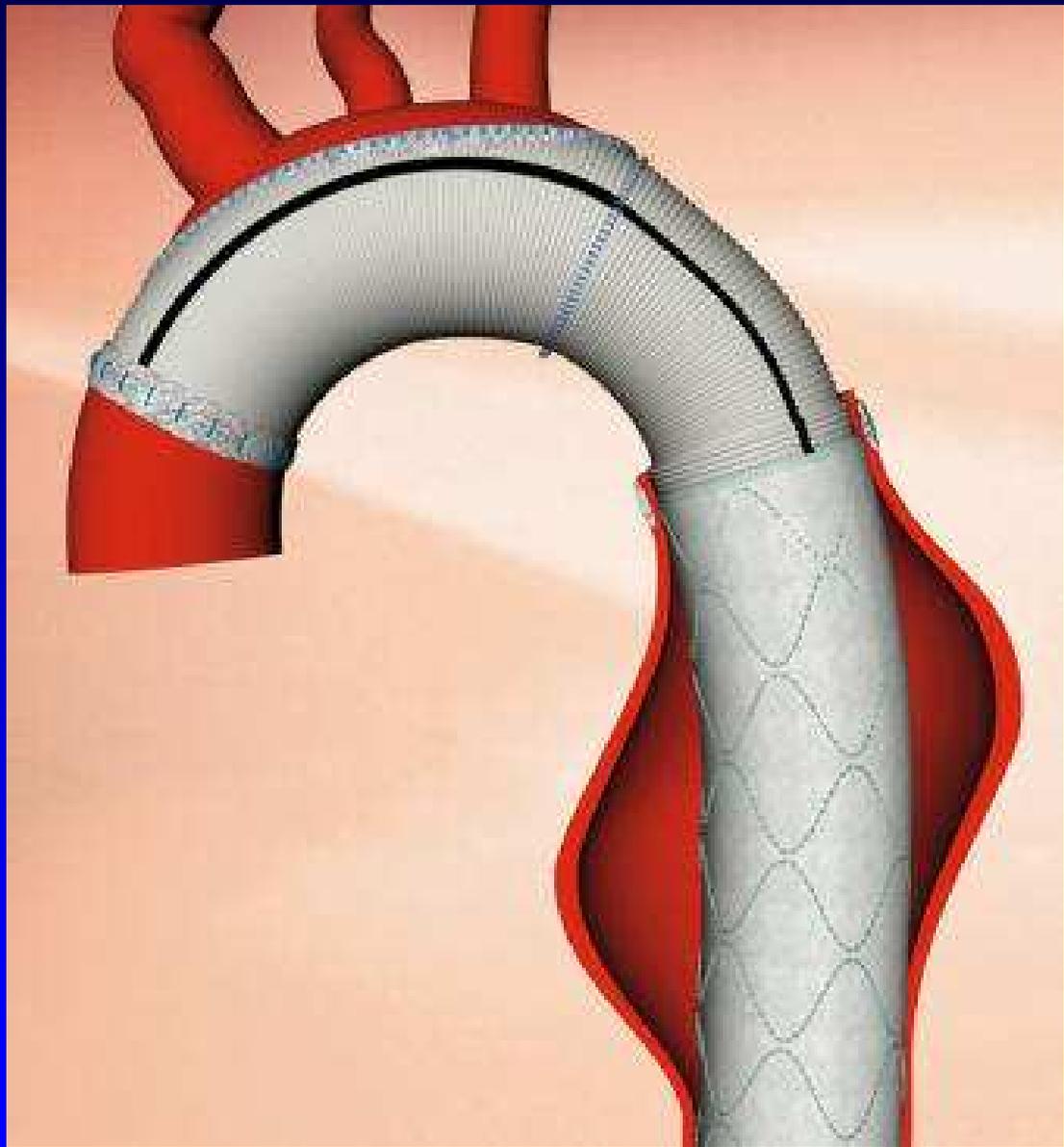
I. Behandlung der Aortenwurzel

- suprakommissuraler Aortenersatz
- Aortenklappenrekonstruktion
- Aortenklappenersatz

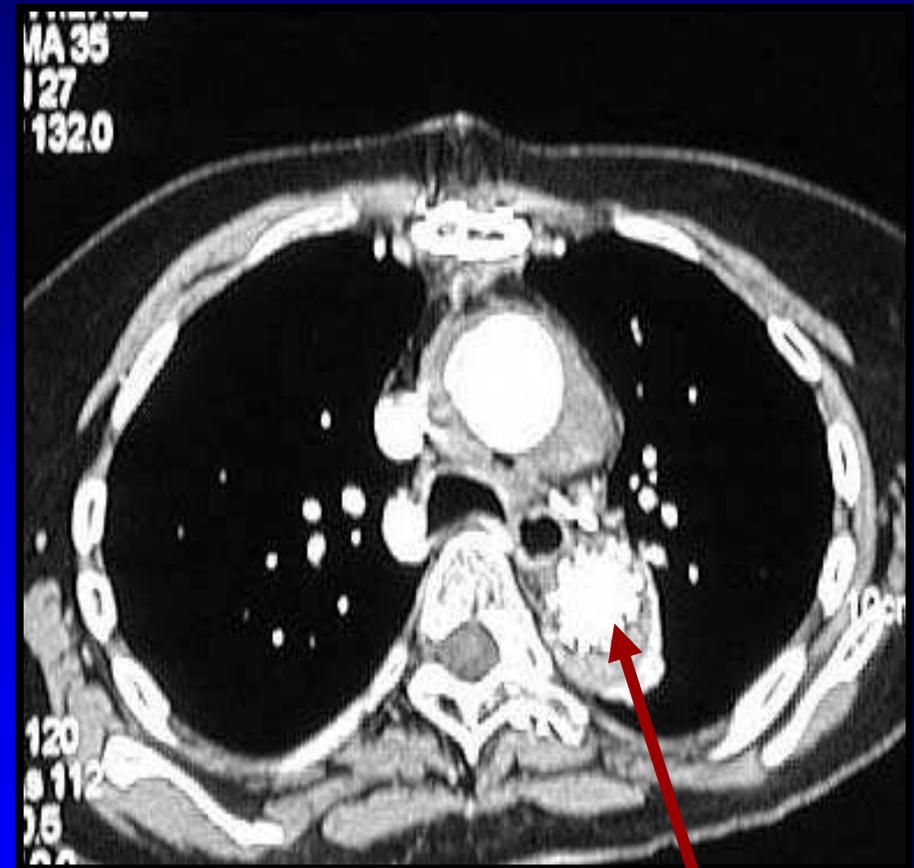
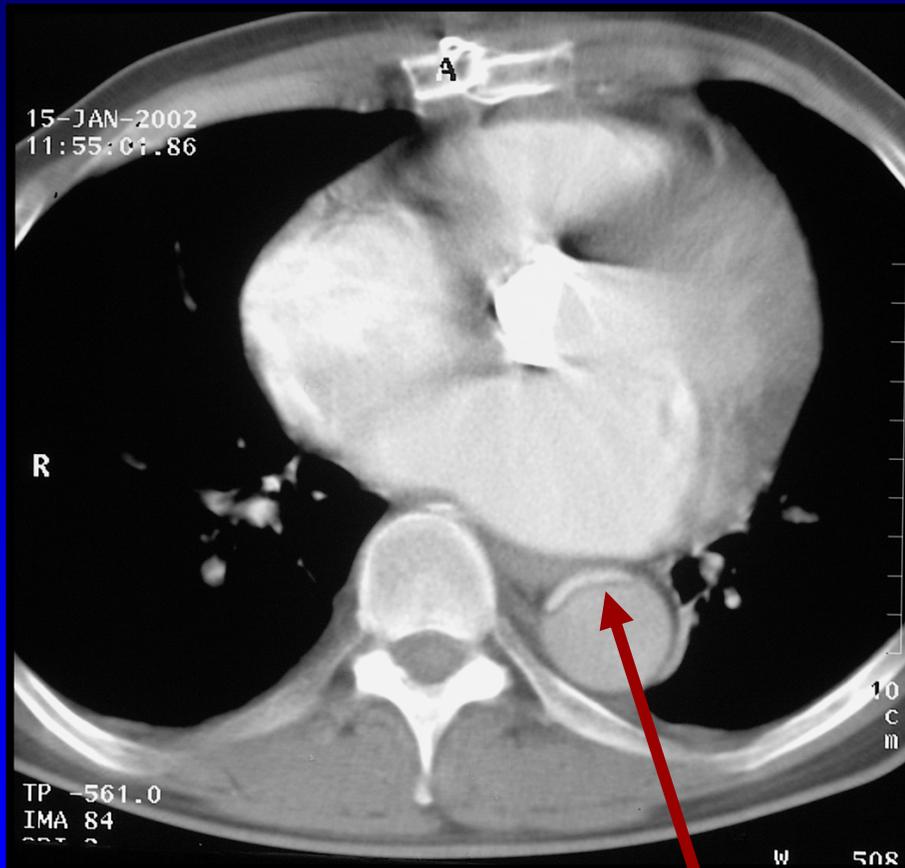
II. Behandlung des Aortenbogens

- Rekonstruktion der Wandschichten
- partieller Bogenersatz
- Aortenbogenersatz +/- „elefant trunk“
+/- Ersatz der supraaortalen Äste

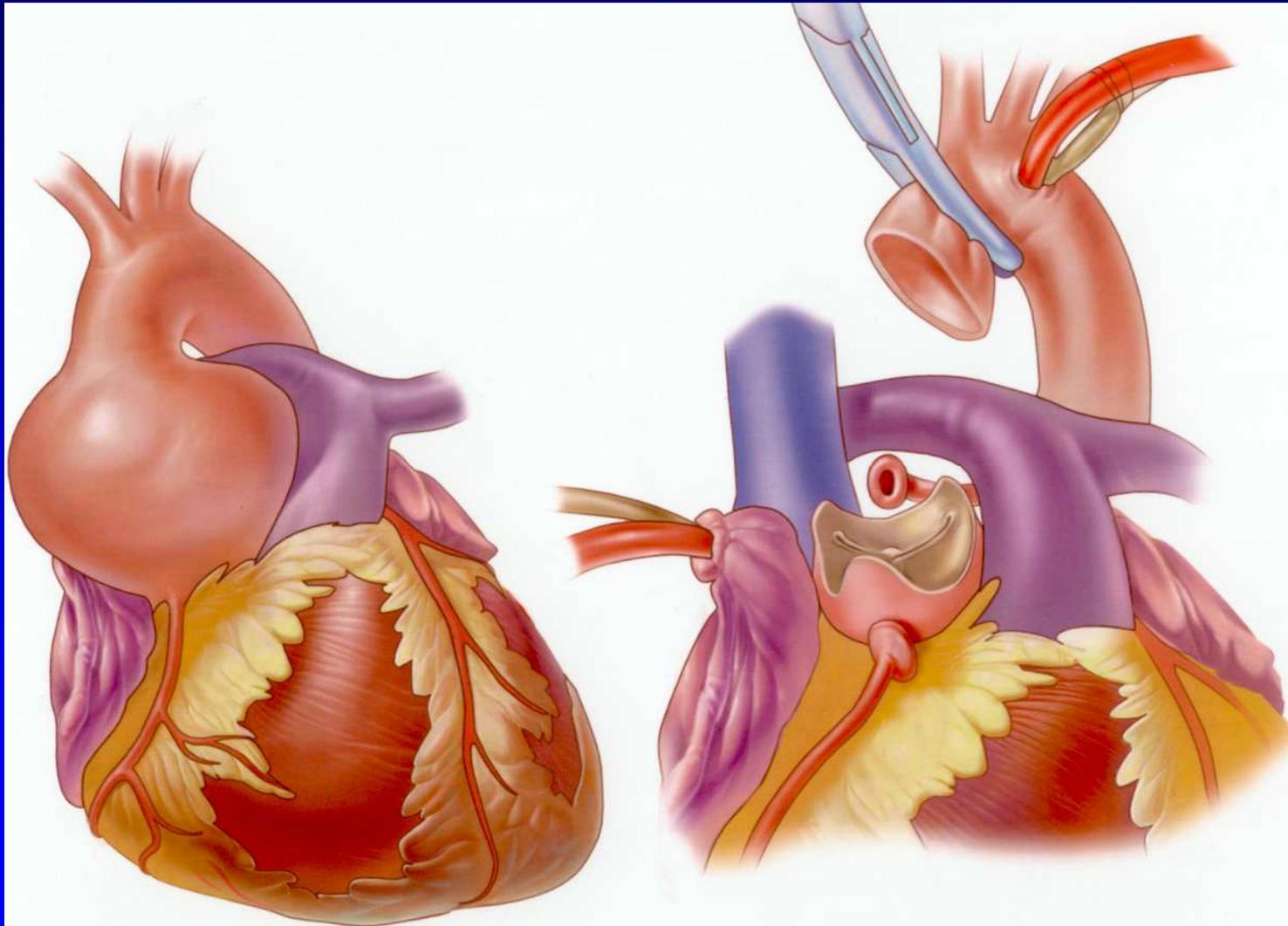




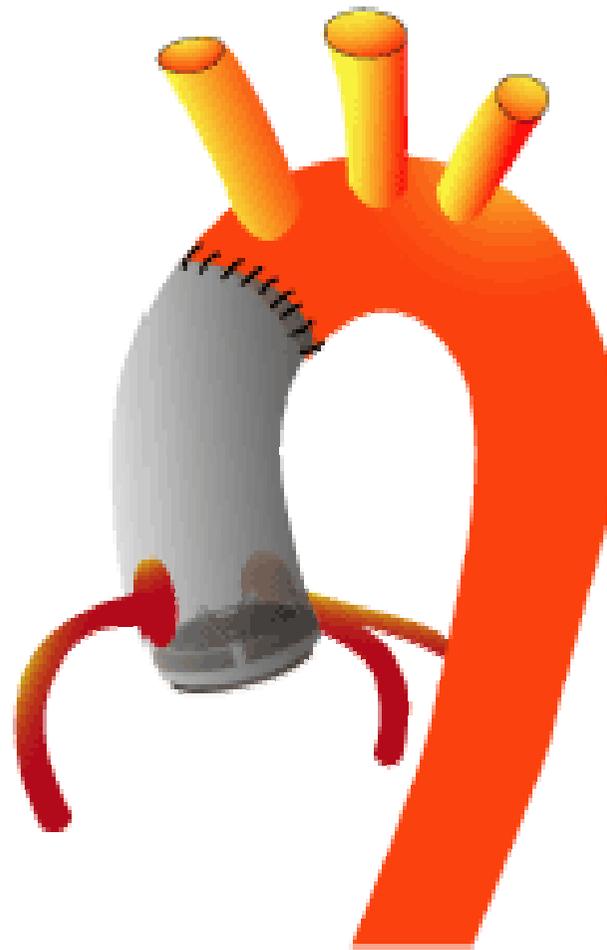
CT nach Typ A Dissektion mit OP und Aortenstenting



Resektion der Aortenwurzel



Bentall-Operation



Bentall-Operation

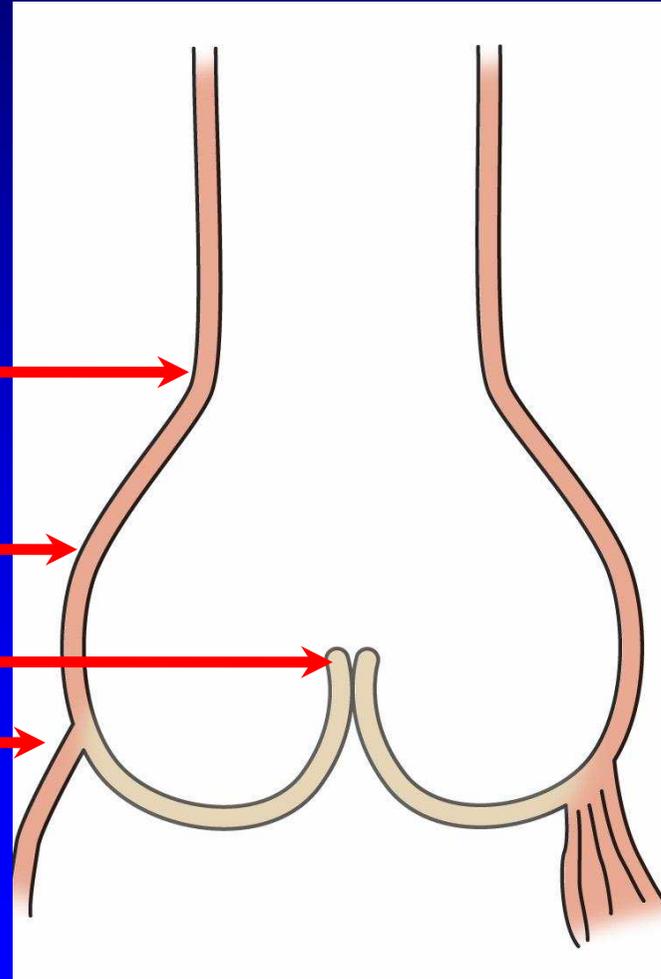


Aortenklappenprothesen

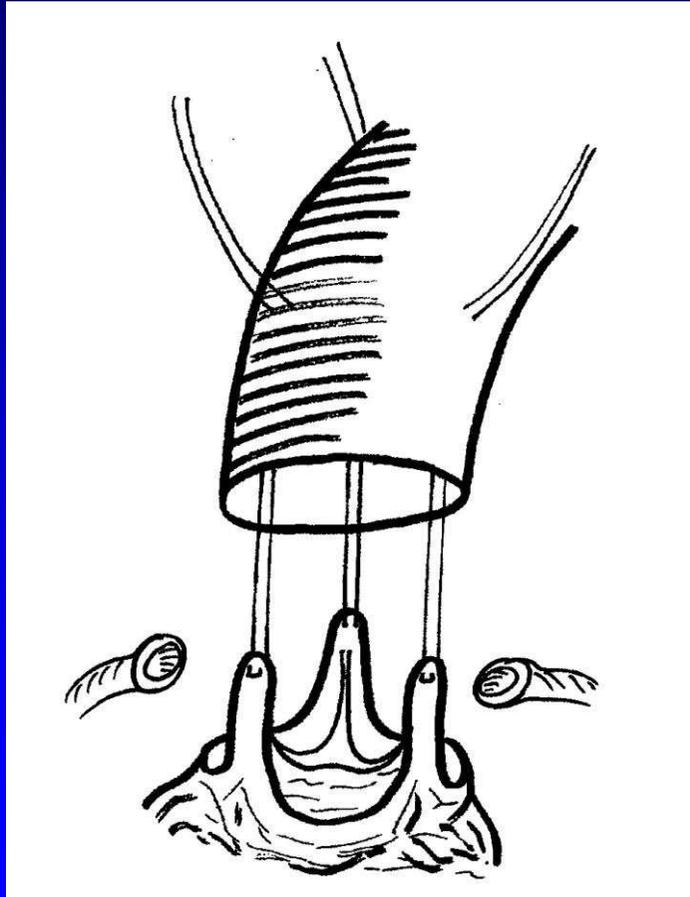


AK-erhaltender Aortenwurzelsersatz: Anatomische Komponenten der Aortenwurzel

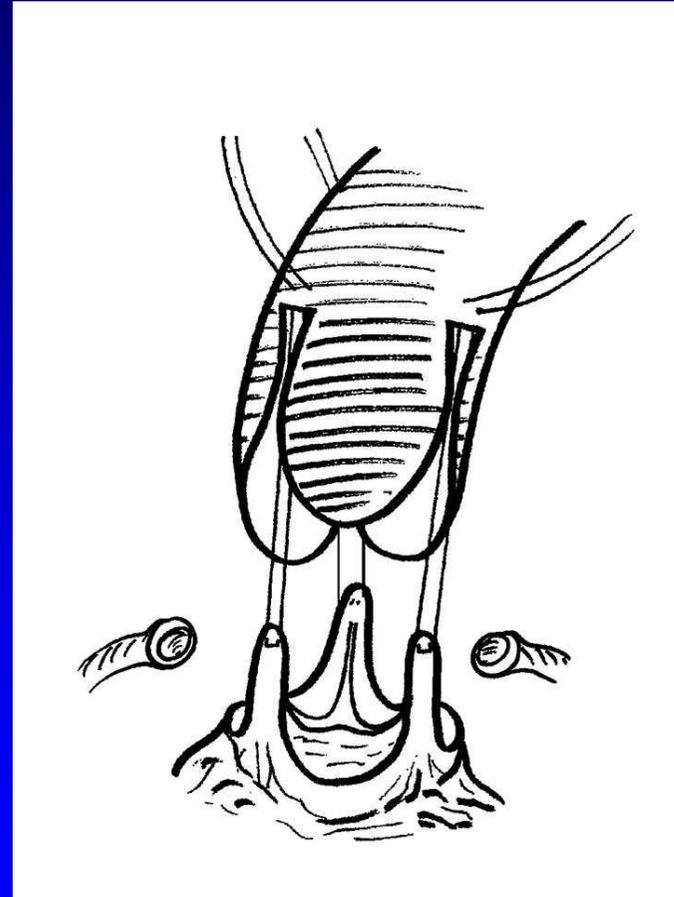
- *sinotubulärer Übergang*
- *Sinus von Valsalvae*
- *Taschenklappen*
- *Annulus*



Klappenerhaltender Ersatz der Aorta ascendens

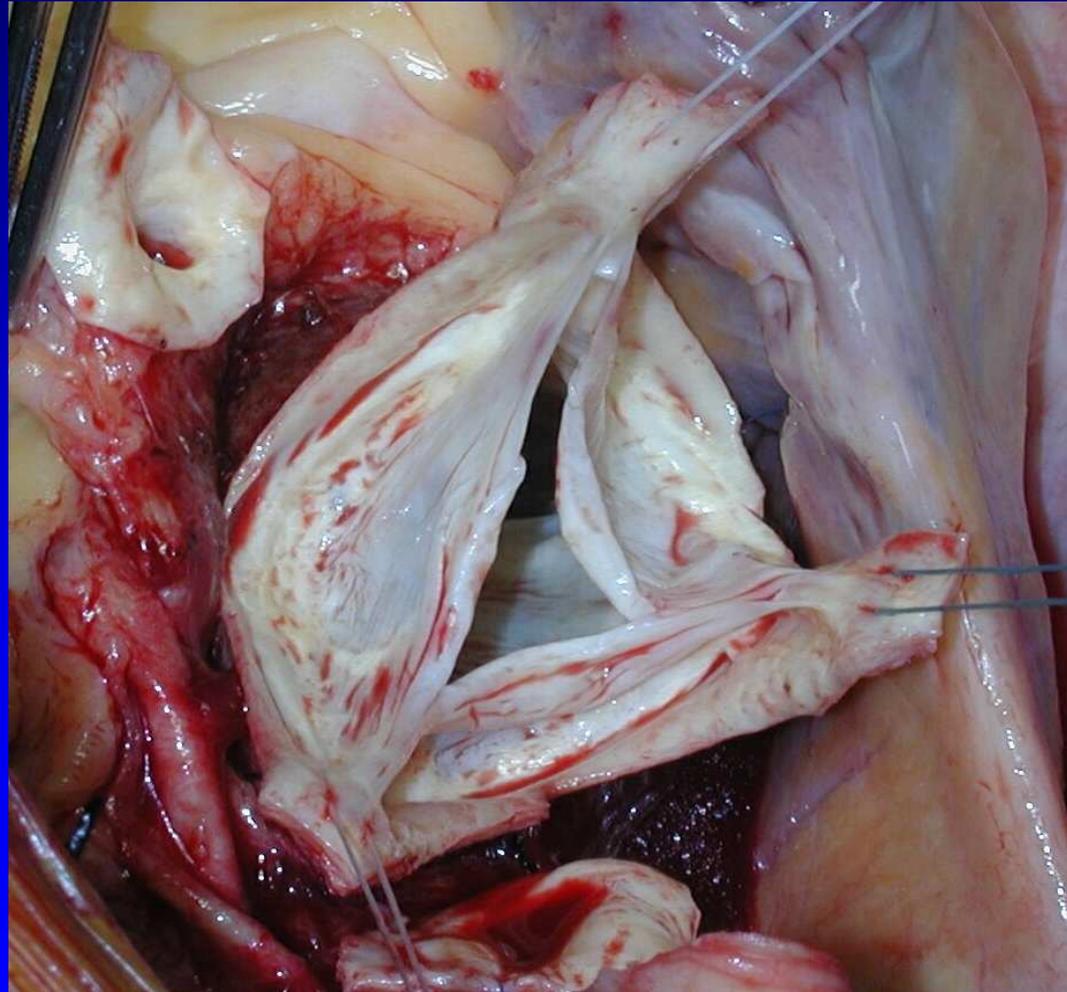


David-Operation
„reimplantation“



Yacoub-Operation
„remodeling“

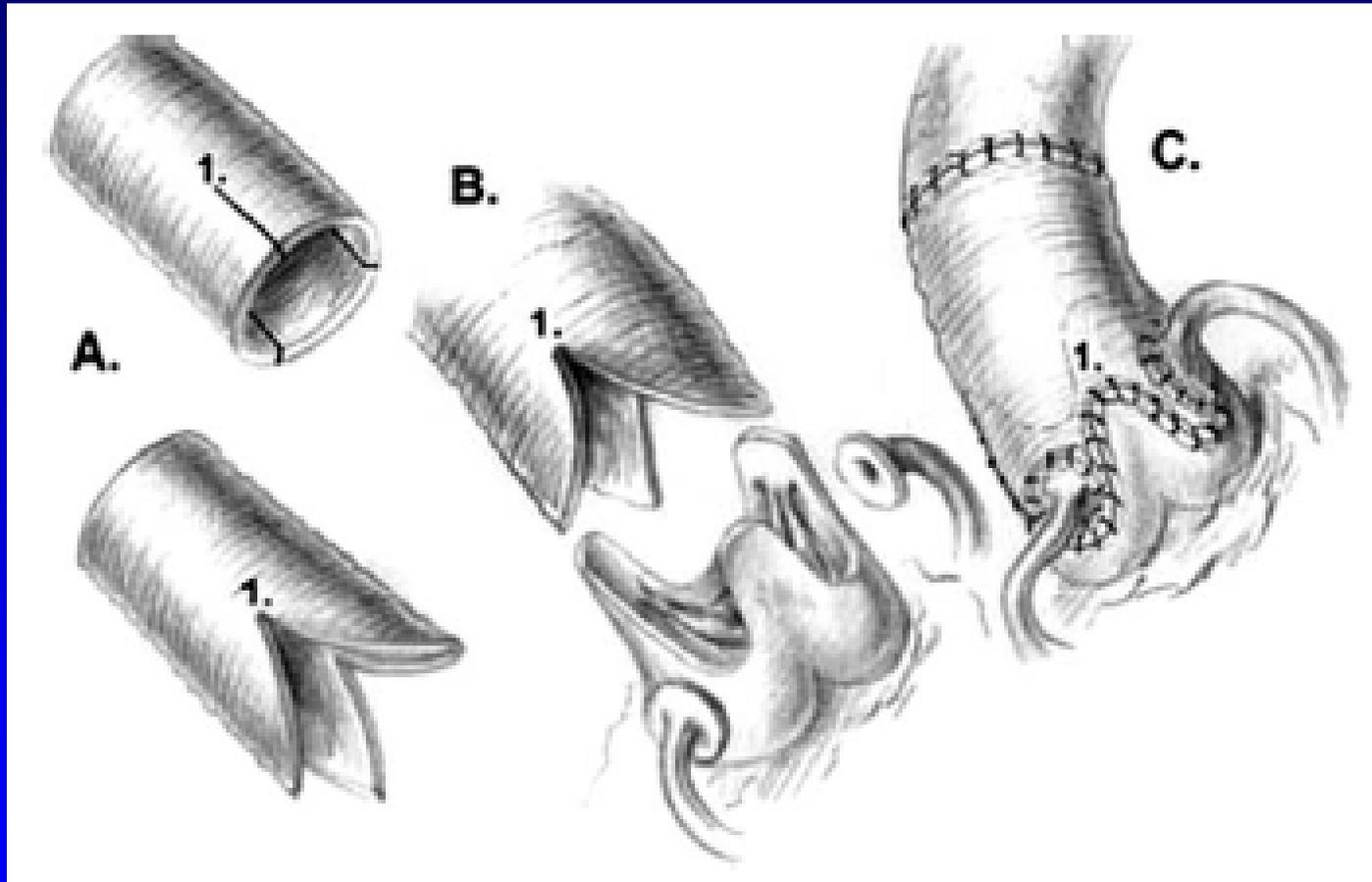
Präparation der Aortenwurzel





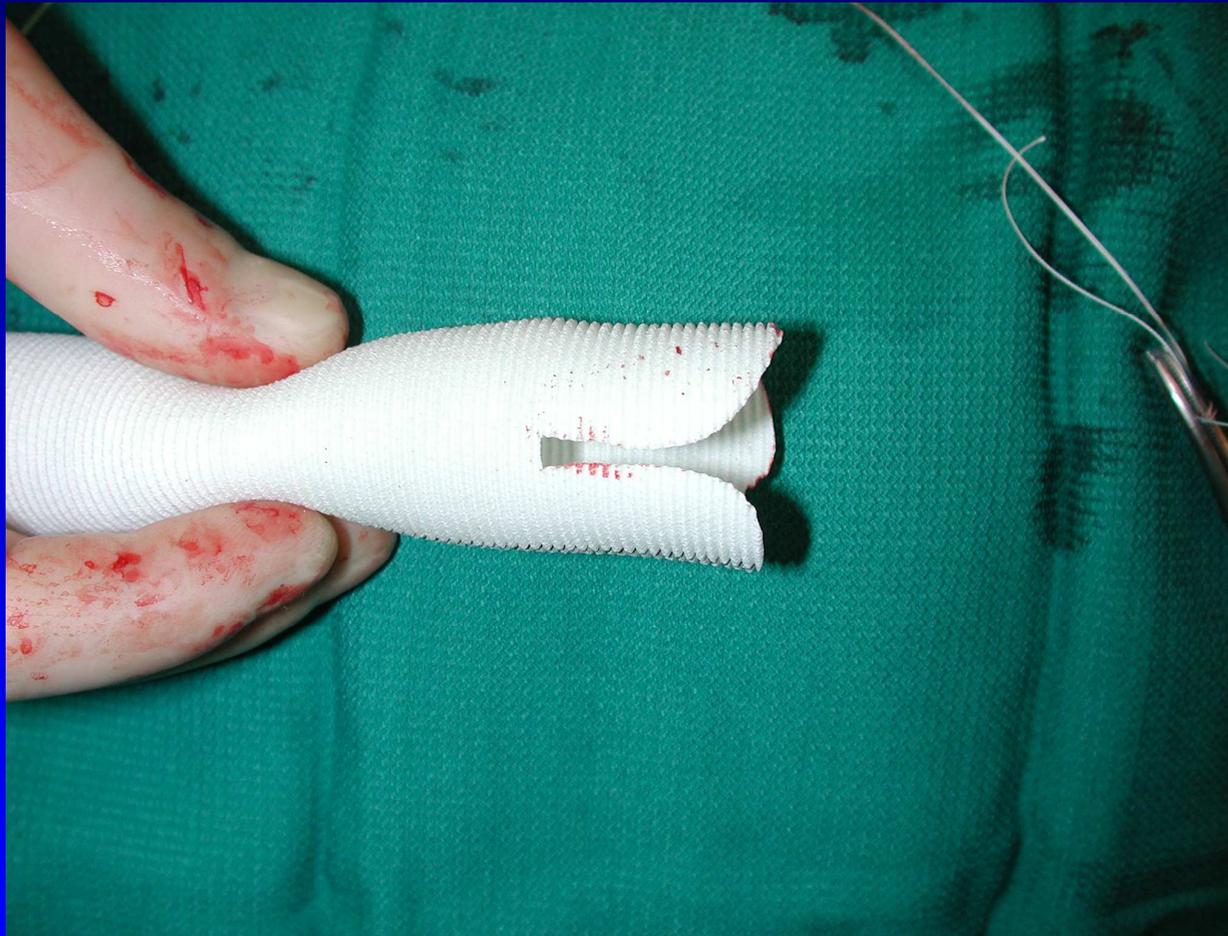
Professor Sir Magdi H. Yacoub

Aortic Valve Sparing- Operation “remodelling-technique”

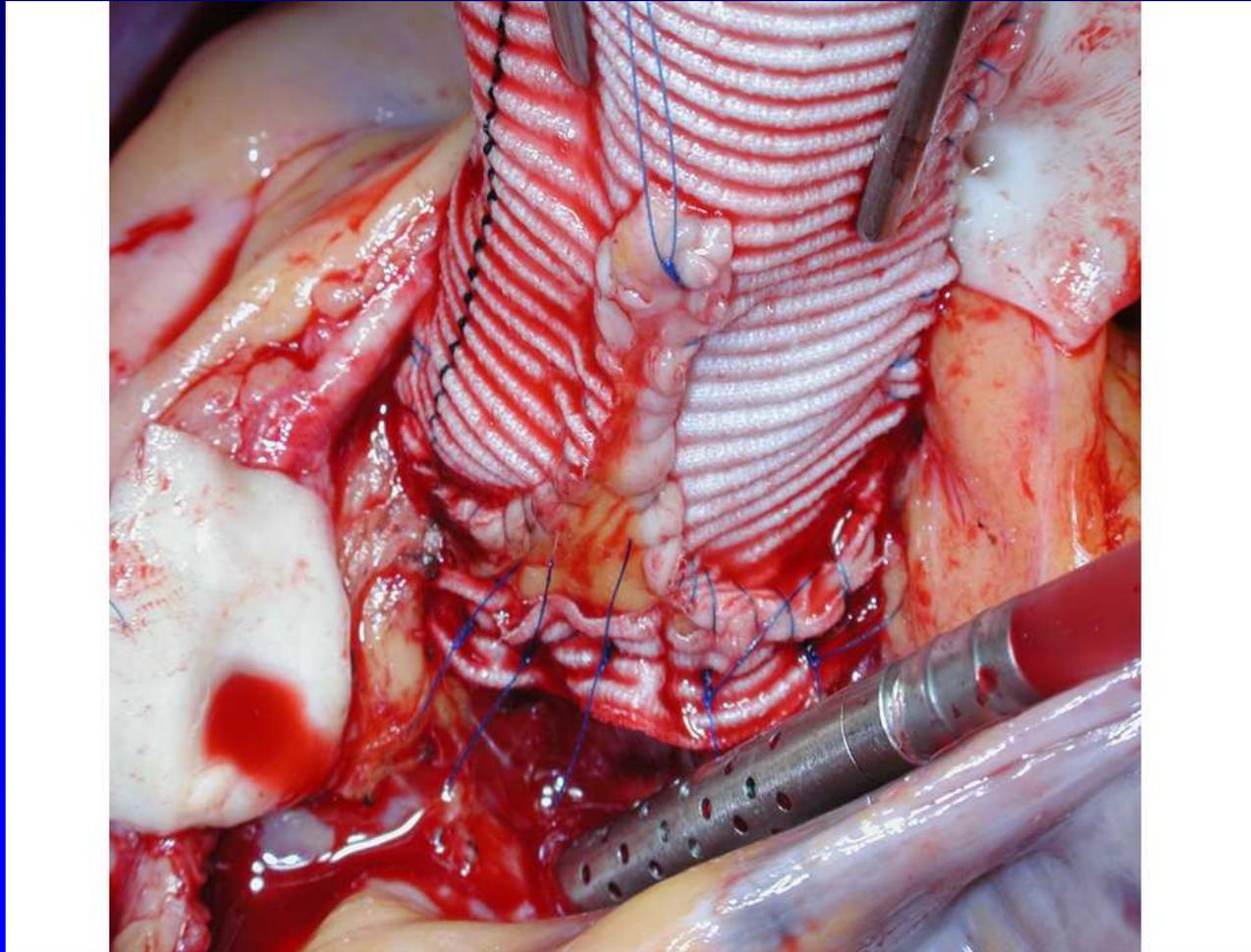


Fagan A et al. Br Heart J 1983;49:302

Yacoub-Operation



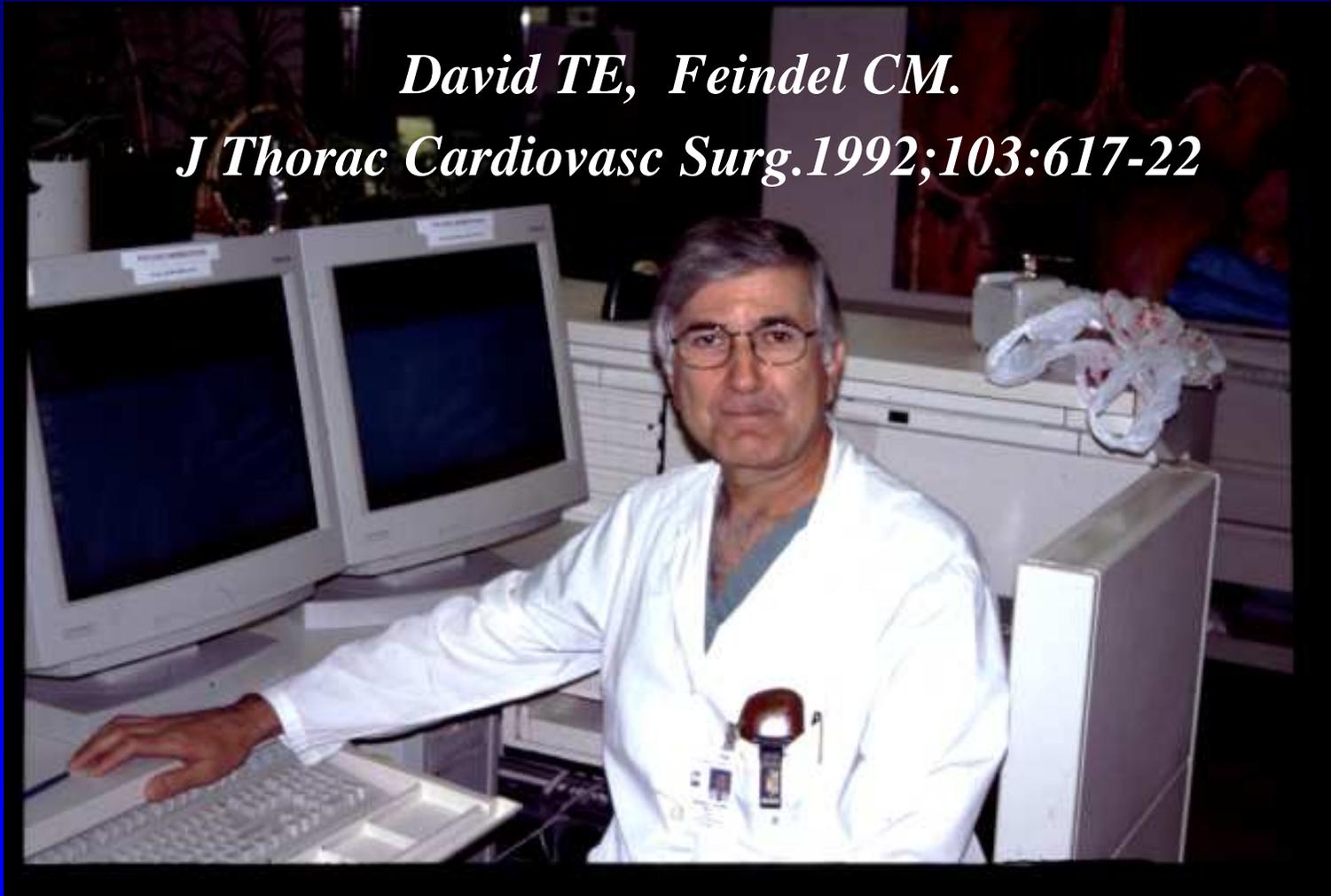
Yacoub-Operation



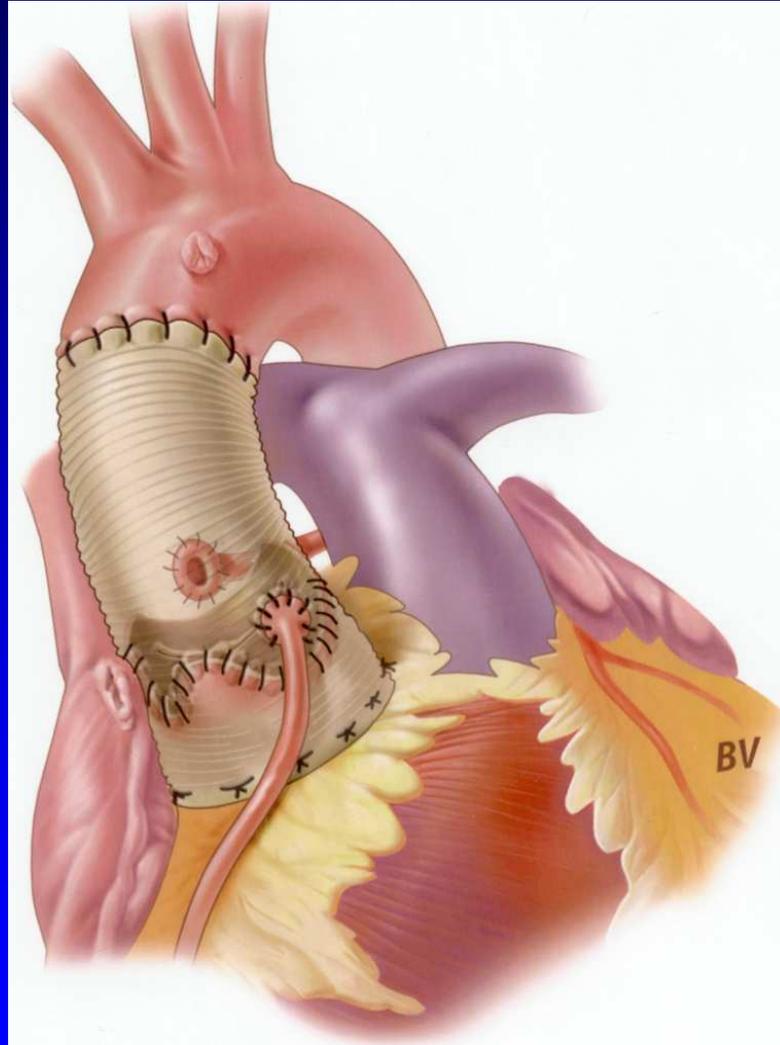
Aortic Valve Sparing- Operation “reimplantation-technique”

David TE, Feindel CM.

J Thorac Cardiovasc Surg.1992;103:617-22

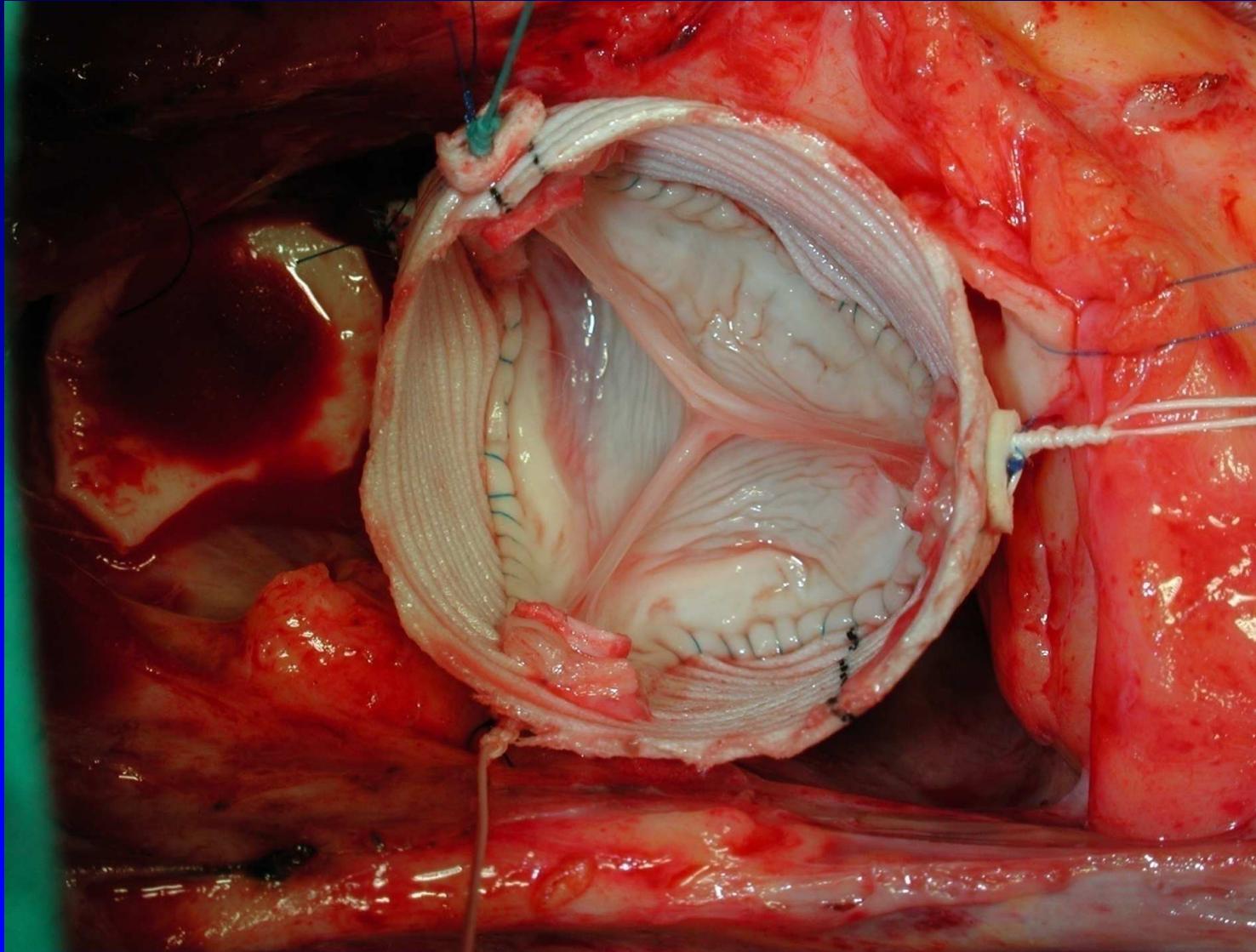


Reimplantations-Operation (David I)

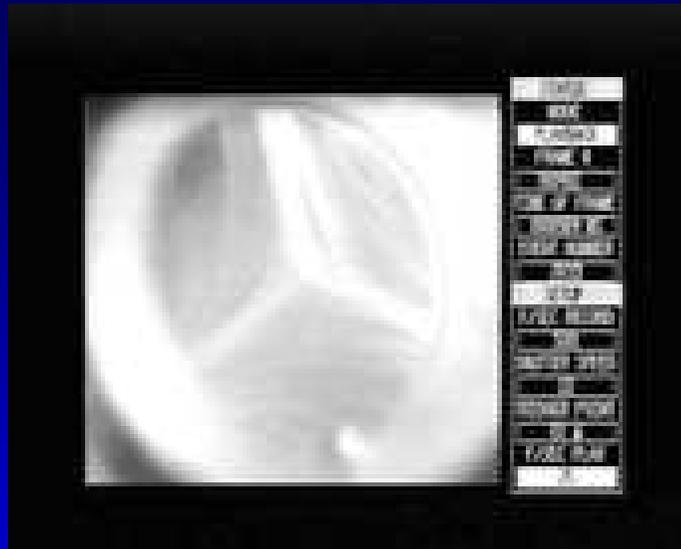


David TE, Feindel CM. J Thorac Cardiovasc Surg 1992;103:617

David-Operation



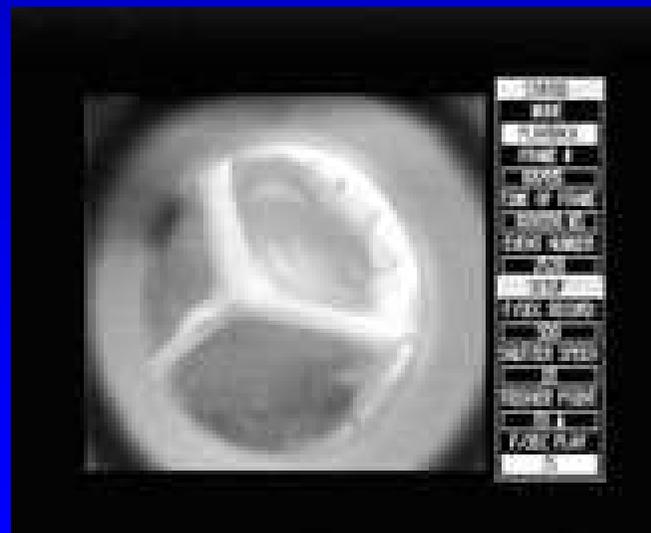
Aortenklappenfunktion



native AK



Yacoub-OP



David-OP

In vitro hydrodynamics, cusp-bending deformation, and root distensibility for different types of aortic valve–sparing operations: Remodeling, sinus prosthesis, and reimplantation

Armin Erasmi, MD, Hans-H. Sievers, MD, Michael Scharfschwerdt, Thorsten Eckel, and Martin Misfeld, MD, PhD

Objective: Preserving aortic valve cusps during operations for aortic root pathology theoretically offers several advantages over alternative prosthetic valve–bearing

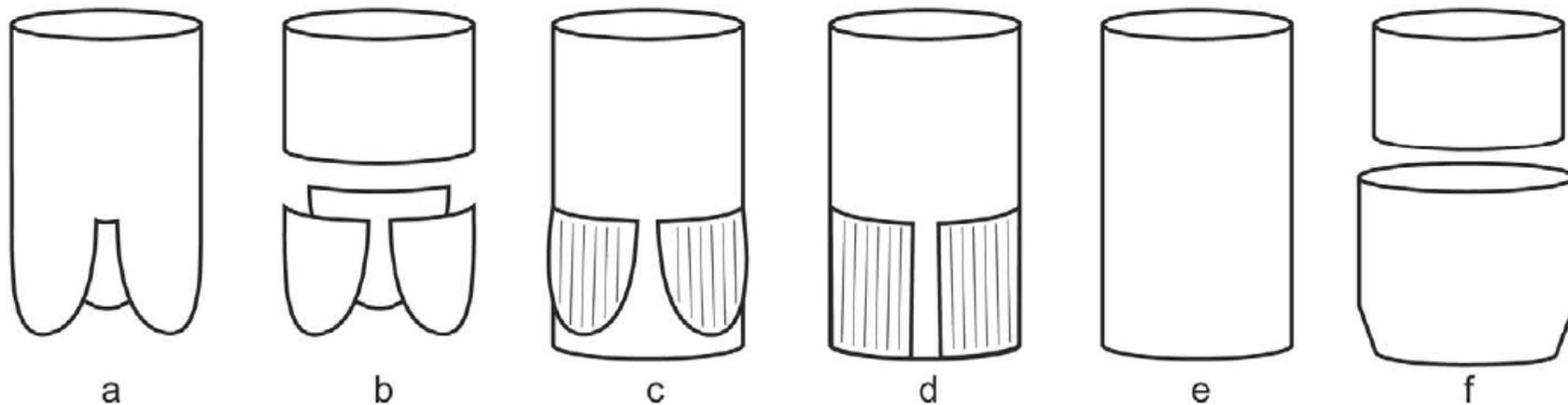


Figure 1. Schematic drawings of the different valve-sparing techniques. Left to right: remodeling, modified remodeling, sinus prosthesis, modified sinus prosthesis, reimplantation, and modified reimplantation.

Received for publication April 19, 2005; revisions received June 3, 2005; accepted for publication June 7, 2005.

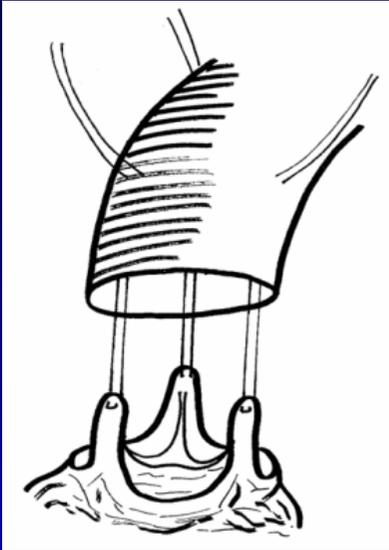
Address for reprints: Hans-H. Sievers, MD, Department of Cardiac Surgery, University Clinic of Schleswig-Holstein, Campus Luebeck, Ratzeburger Allee 160, 23538 Luebeck, Germany (E-mail: herzchir@medinf.mu-luebeck.de).

J Thorac Cardiovasc Surg 2005;130:1044-9
0022-5223/\$30.00

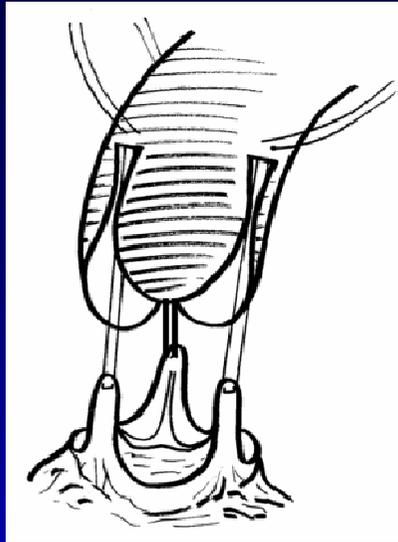
Copyright © 2005 by The American Association for Thoracic Surgery

doi:10.1016/j.jtcvs.2005.06.005

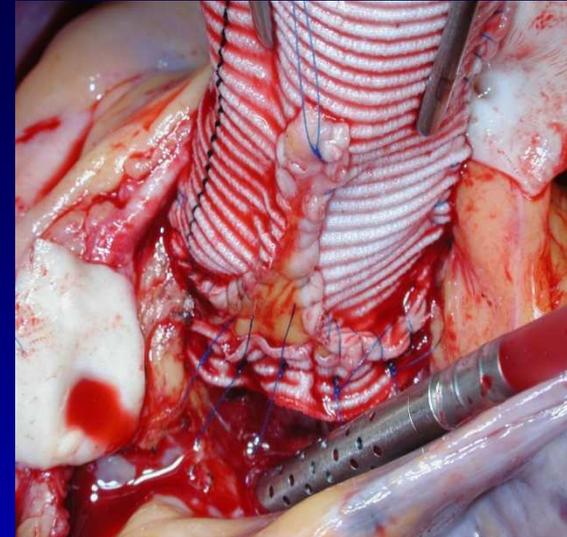
The aortic valve is composed of 3 cusps inserting into the aortic wall in 3 crown-shaped fibrous rings that confine the sinuses of Valsalva downstream and the intervalvular trigones upstream. The commissures, as the top of the adjoining fibrous rings, border on the sinotubular junction, whereas the so-called aortic annulus, which represents the transition area between the left ventricle and the aorta, includes the nadirs of the sinuses, the muscular and the membranous septum, and the aortomitral curtain. All of these functional structures perform very sophisticated cyclic movements, interacting with each other.¹ Their dynamic characteristics are aimed at reducing stress on the cusps and optimizing ventricular-arterial coupling to warrant hemodynamic efficiency without structural deterioration of the cusps throughout life. Aneurysms and dissections involving the aortic root lead to morphologic, geometric, and hemodynamic abnormalities that often leave the cusps macroscopically intact. Valve-sparing surgical techniques have been developed,



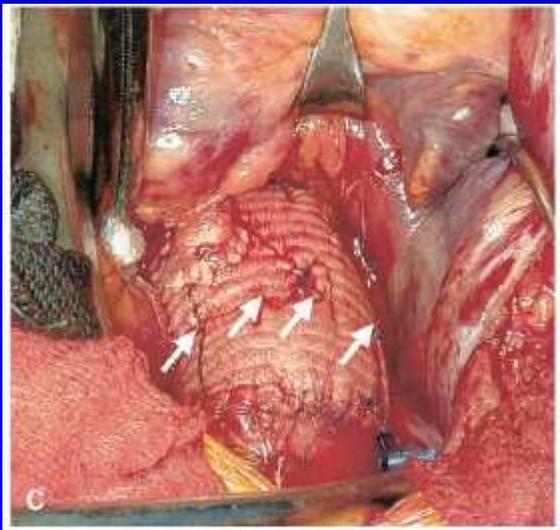
David I



David II = Yacoub



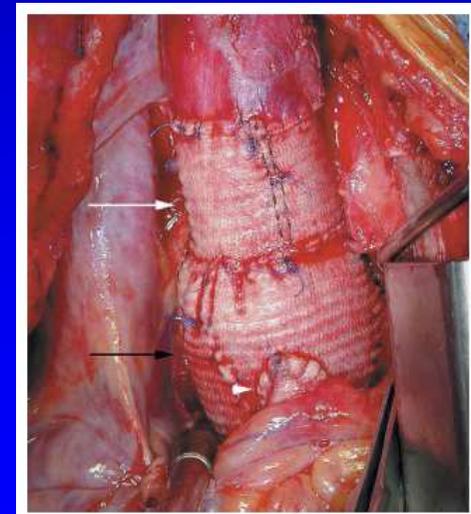
**David III = Yacoub +
annuloplasty**



David IV

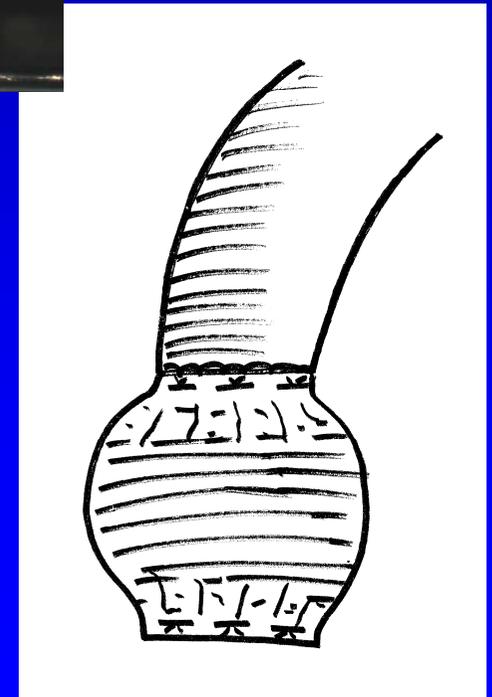
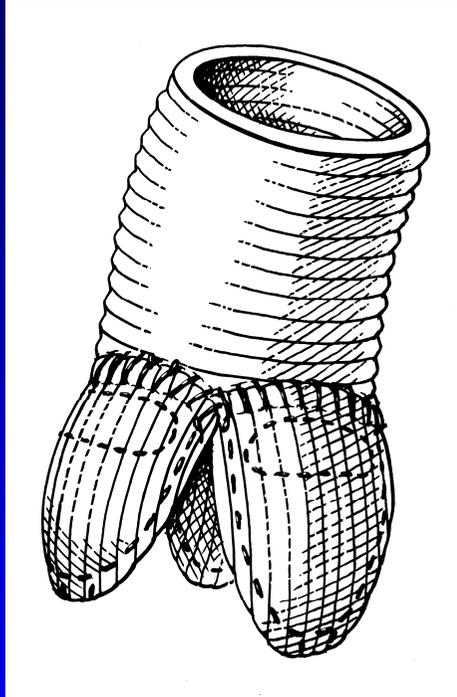


David V



**David IV Stanford
modification**

Gefäßprothesen



Aortic Valve Preservation in Patients With Aortic Root Aneurysm: Results of the Reimplantation Technique

Tirone E. David, MD, Christopher M. Feindel, MD, Gary D. Webb, MD, Jack M. Colman, MD, Susan Armstrong, MSc, and Manjula Maganti, MSc

Divisions of Cardiovascular Surgery and Cardiology of Toronto General Hospital and University of Toronto, Toronto, Ontario, Canada

Background. A study was conducted to determine the long-term results of aortic valve reimplantation to treat aortic root aneurysm.

Methods. Prospective follow-up with clinical assessments and echocardiography was done of 167 consecutive patients who had reimplantation of the aortic valve as treatment of aortic root aneurysm. Their mean age was 45 ± 15 years, 78% were men, 38% had Marfan syndrome, 14% had aortic dissection, and 7% had bicuspid aortic valve. The aortic valve was reimplanted into a straight Dacron (Dupont, Wilmington, DE) tube in 89 patients and in a Dacron tube with creation of neo-aortic sinuses in 78. Aortic cusp repair was performed in 66 patients, and the free margin was reinforced with a fine Gore-Tex suture (W.L. Gore & Assoc, Flagstaff, AZ) in 36. The mean follow-up was 5.1 ± 3.8 years and was 100% complete.

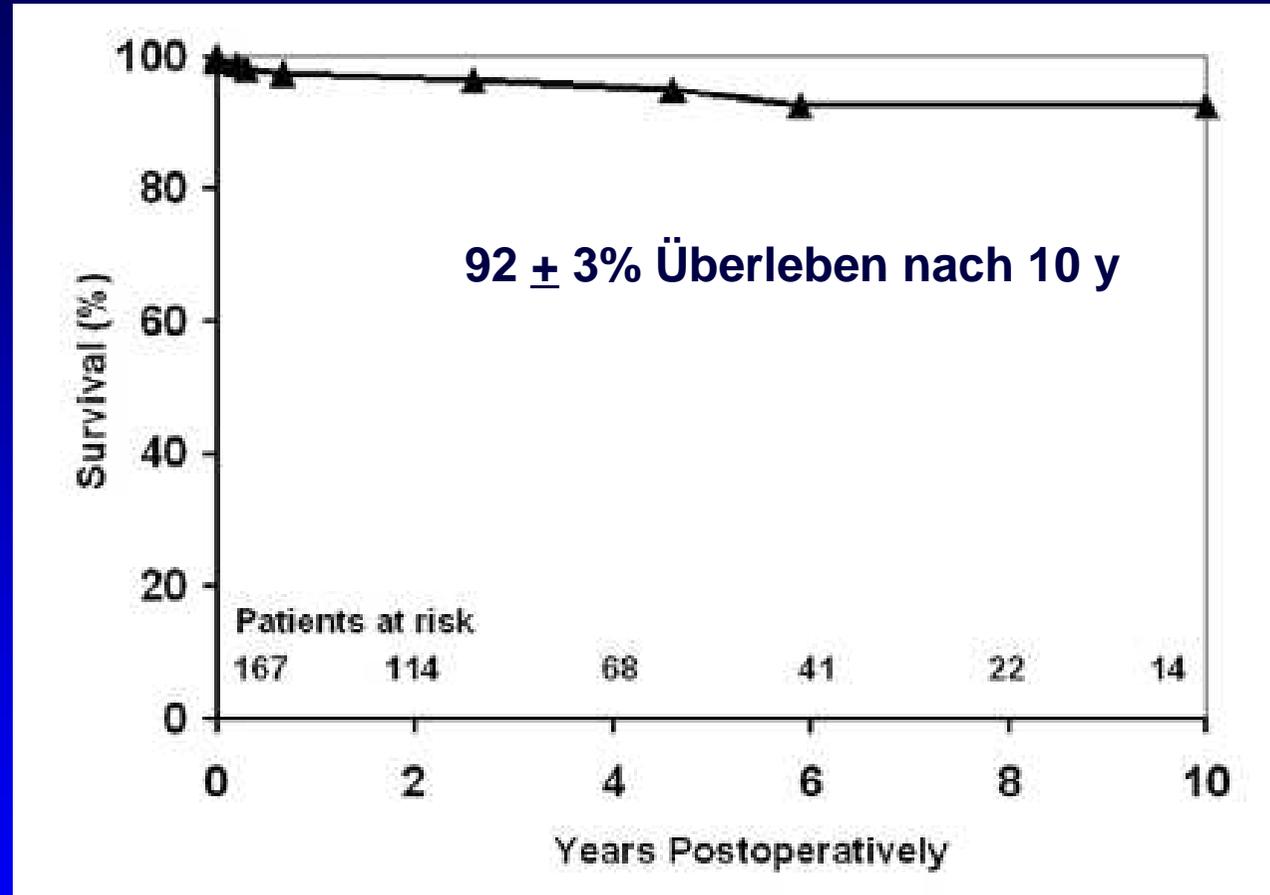
Results. There were two operative and six late deaths. Survival at 10 years was $92\% \pm 3\%$. Moderate aortic insufficiency developed in 3 patients, and severe developed in 2. Freedom from moderate or severe aortic insufficiency was $94\% \pm 4\%$ at 10 years. Two patients required aortic valve replacement. Freedom from aortic valve replacement was $95\% \pm 4\%$ at 10 years. At the latest follow-up, 90% of the patients were in New York Heart Association functional class I and 10% were in class II.

Conclusions. Reimplantation of the aortic valve to treat patients with aortic root aneurysm is associated with excellent long-term survival and low rates of valve-related complications. Reimplantation of the aortic valve is a durable type of aortic valve repair.

(Ann Thorac Surg 2007;83:S732-5)

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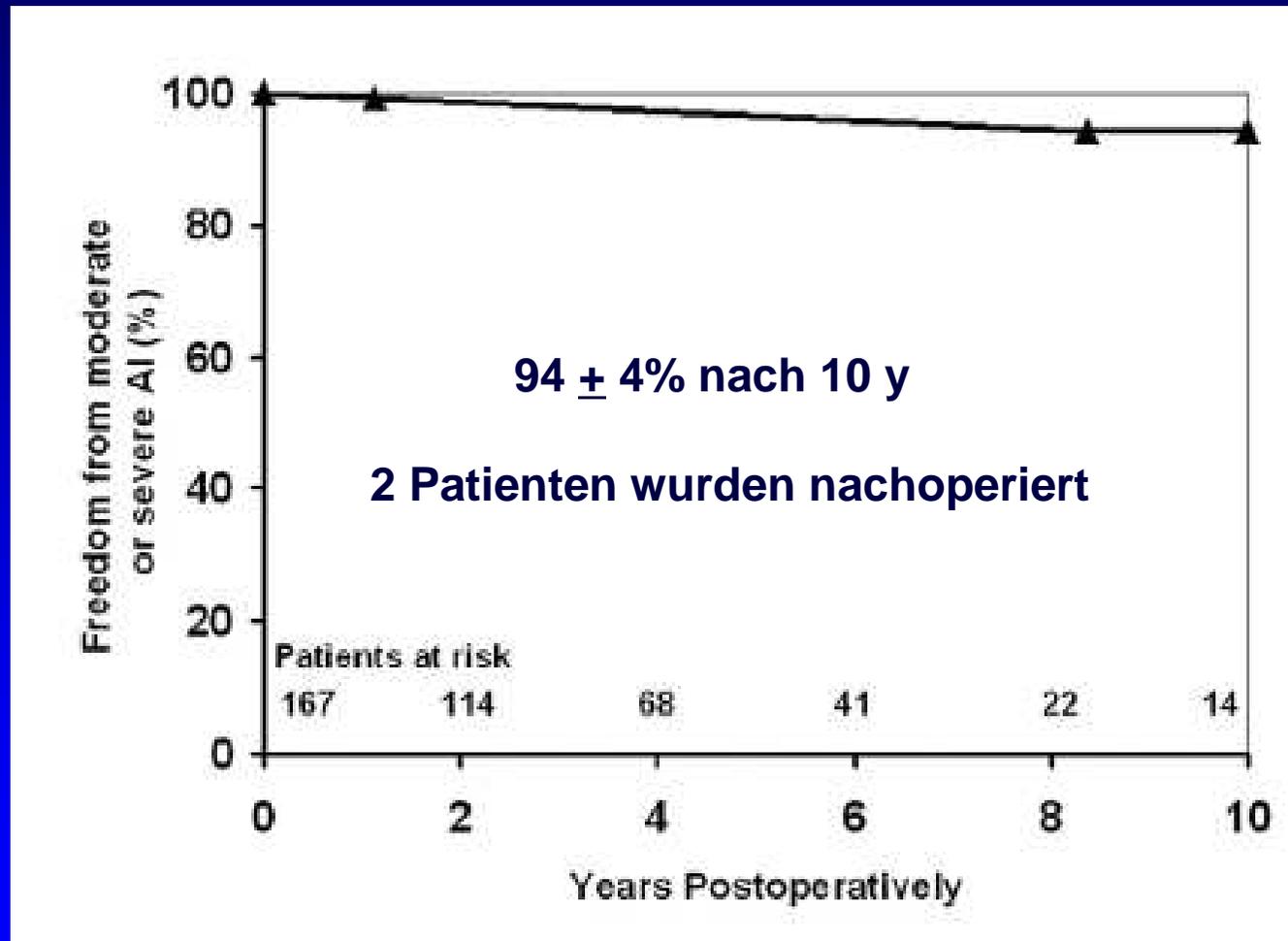
Langzeitdaten



1 Schlaganfall, keine Endokarditis

91% in NYHA class I, 7% in NYHA class II in F/U

Langzeitdaten



David Operation in Marfan Patienten

Long-term results of aortic valve–sparing operations in patients with Marfan syndrome

Tirone E. David, MD, Sue Armstrong, BSc, Manjula Maganti, BSc, Jack Colman, MD, and Timothy J. Bradley, MBChB

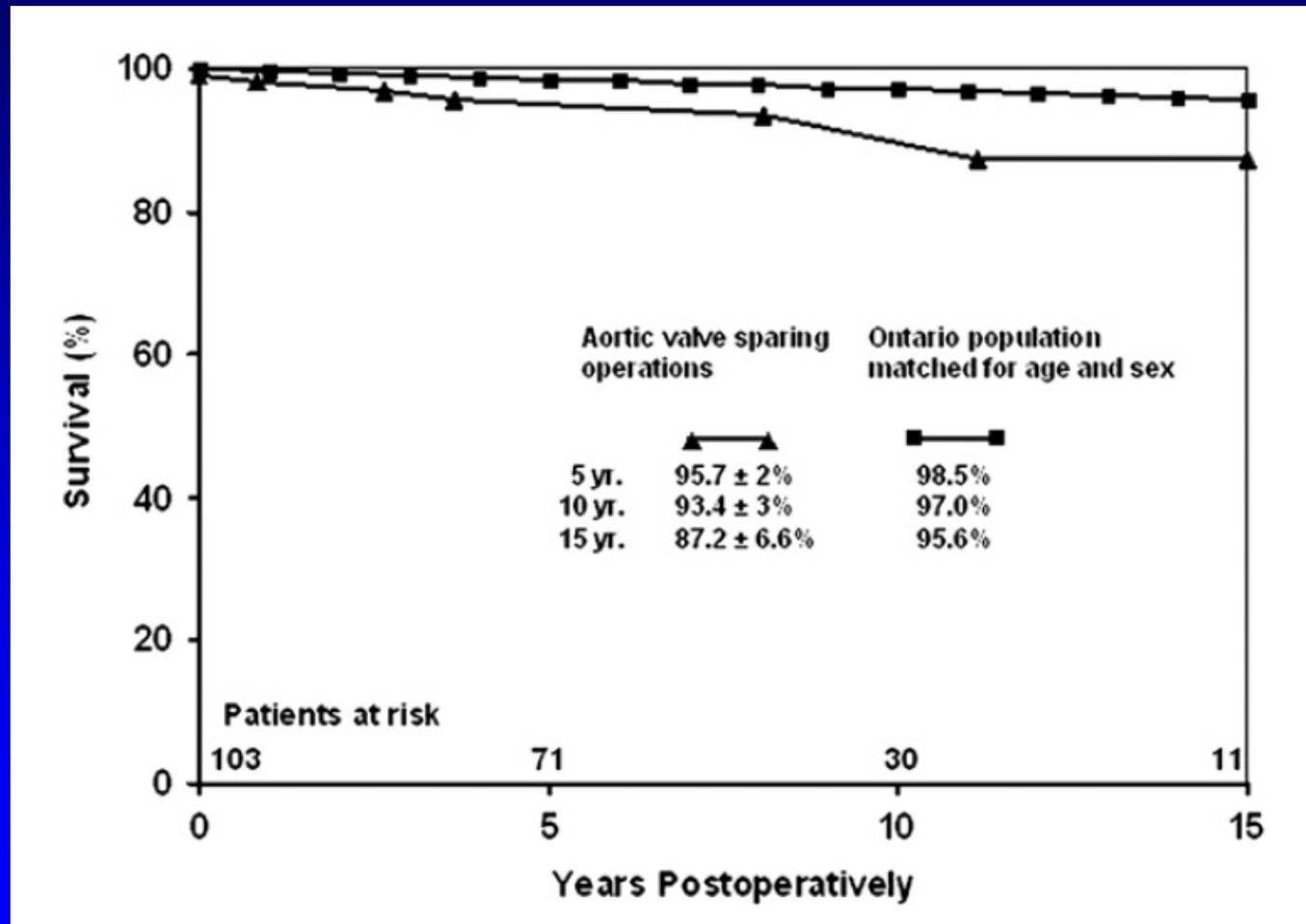
Objective: The appropriateness of aortic valve–sparing operations in patients with Marfan syndrome has been questioned. This study examines the long-term results of these operations in patients with Marfan syndrome.

Methods: From 1988 to 2006, 103 consecutive patients with Marfan syndrome (mean age, 37 ± 12 years) and aortic root aneurysm had aortic valve–sparing operations. Emergency surgery was performed in 11 patients: 8 for acute type A aortic dissection and 3 for unexplained persistent chest pain. Fourteen patients also had mitral valve surgery. The technique of aortic valve reimplantation was used in 77 patients, and aortic root remodeling was used in 26 patients. Patients were followed prospectively and underwent annual echocardiographic studies. The mean follow-up was 7.3 ± 4.2 years and 100% complete.

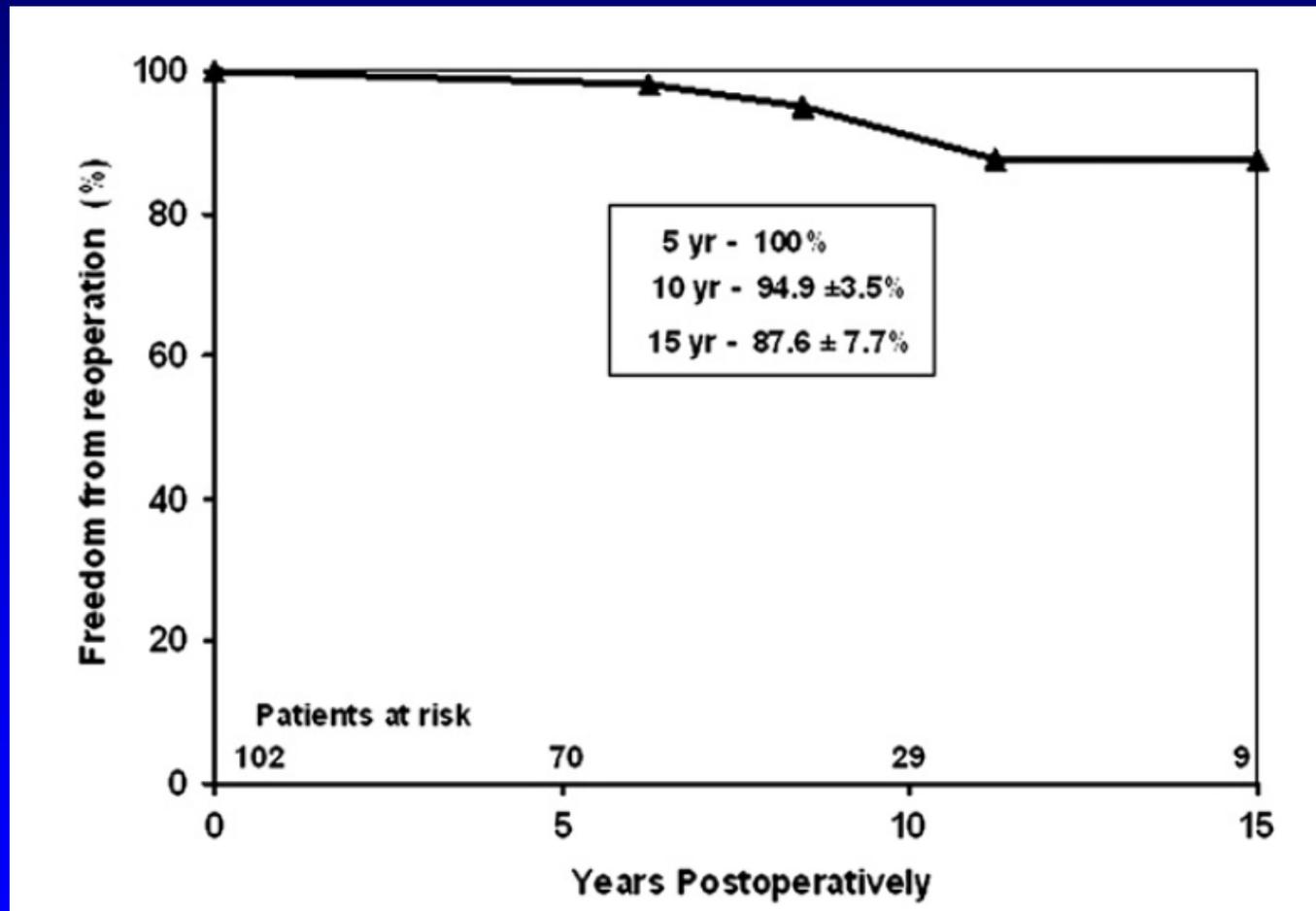
Results: There was 1 operative death and 5 late deaths. Four of the 6 deaths were due to complications of aortic dissections. The patients' survival at 15 years was 87.2% compared with 95.6% for the general population of Ontario matched for age and sex. Seven patients had important aortic insufficiency: 4 mild to moderate, 2 moderate, and 1 moderate to severe. Freedom from greater than mild aortic insufficiency at 15 years was 79.2%. Three patients, all after aortic root remodeling, had aortic valve replacement, 2 for aortic insufficiency and 1 for endocarditis. At the most recent follow-up, 97 patients were alive: 86 were in functional class I, and 11 were in functional class II.

Conclusions: Aortic valve–sparing operations provided excellent clinical outcomes in this series of patients with Marfan syndrome. Postoperatively, complications of aortic dissections were the leading cause of death.

Langzeitdaten



Freiheit von Re-Operation an der Aortenwurzel



David TE et al J Thoracic Cardiovasc Surg 2009;138:859

David versus Yacoub Operation: Welche Operationstechnik ist besser?

Re
Ac
Arm
Tho:
Clinic

Remodeling or Reimplantation for Valve-Sparing Aortic Root Surgery?

Armin W. Erasmi, MD, Hans-H. Sievers, MD, JF Matthias Bechtel, MD, Thorsten Hanke, MD, Ulrich Stierle, MD, and Martin Misfeld, MD, PhD

Clinic of Cardiac Surgery, University Clinic of Schleswig-Holstein, Campus Luebeck, Luebeck, Germany

Background. Valve-sparing operations are gaining increasing acceptance; however, there is an ongoing discussion about the technique-specific indications. We present our experience with a follow-up of 123 months.

Methods. Between July 1993 and July 2005, 164 consecutive patients were operated on using the remodeling (group A, n = 96) or reimplantation technique (group B, n = 68). Fifty-seven patients presented with acute type A dissection. Aortic regurgitation was present in 84%. Follow-up was 54.7 ± 28 in group A and 48.4 ± 37.3 months in group B.

Results. After urgent operations, 4 patients died in each group, but none died after elective surgery. Late mortality was 8% in group A and 4% in group B. Seven patients of group A and 1 in group B required reopera-

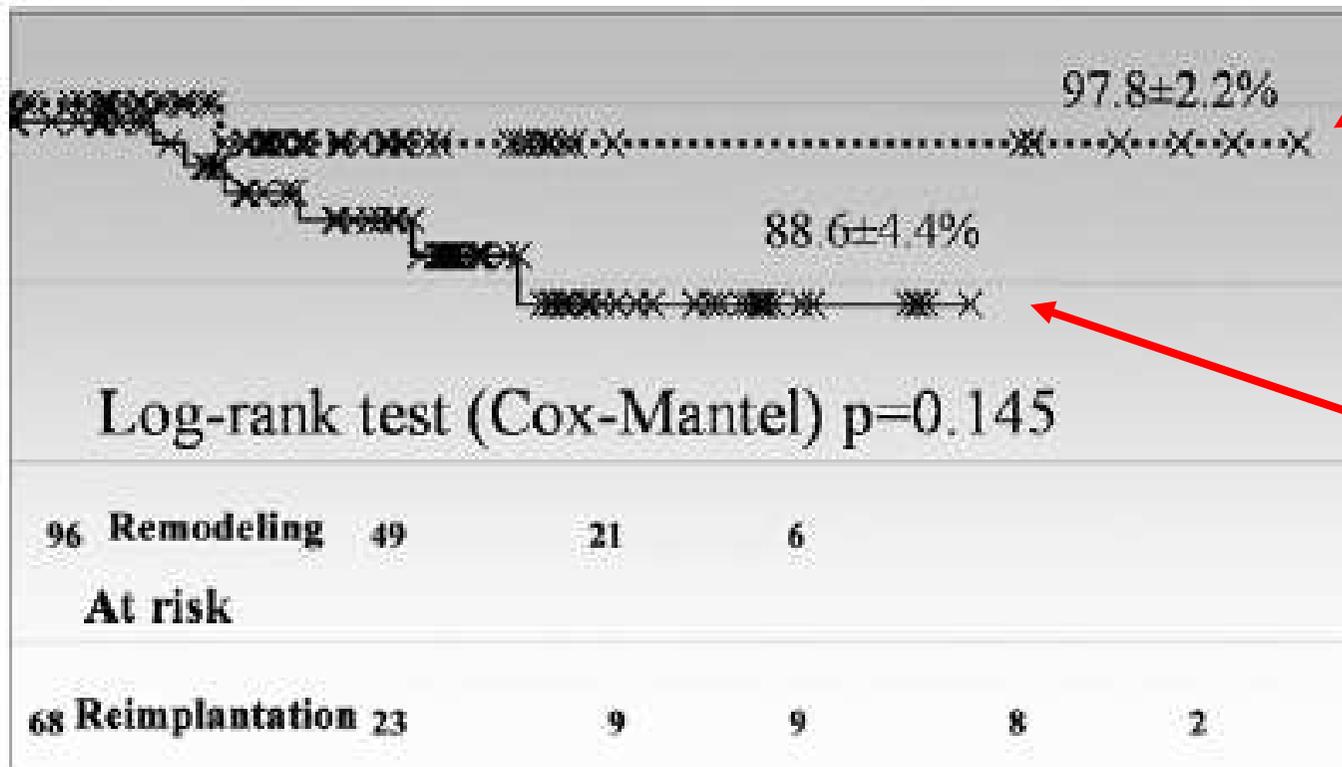
tion. Echocardiographic follow-up of reoperation-free survivors showed that 3 patients (all group A, 1.3%) had aortic regurgitation of more than grade II. Root diameter, valve pressure gradient, and valve orifice area were comparable. No gross thromboembolic or bleeding events occurred.

Conclusions. Aortic valve-sparing operations can provide acceptable long-term results in both techniques. Particular care to the annulus in the remodeling technique and different prosthesis designs in the reimplantation technique may overcome the intrinsic problems of each procedure.

(Ann Thorac Surg 2007;83:S752-6)

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Freiheit von Reoperation



David

Yacoub

Factors associated with the development of aortic valve regurgitation over time after two different techniques of valve-sparing aortic root surgery

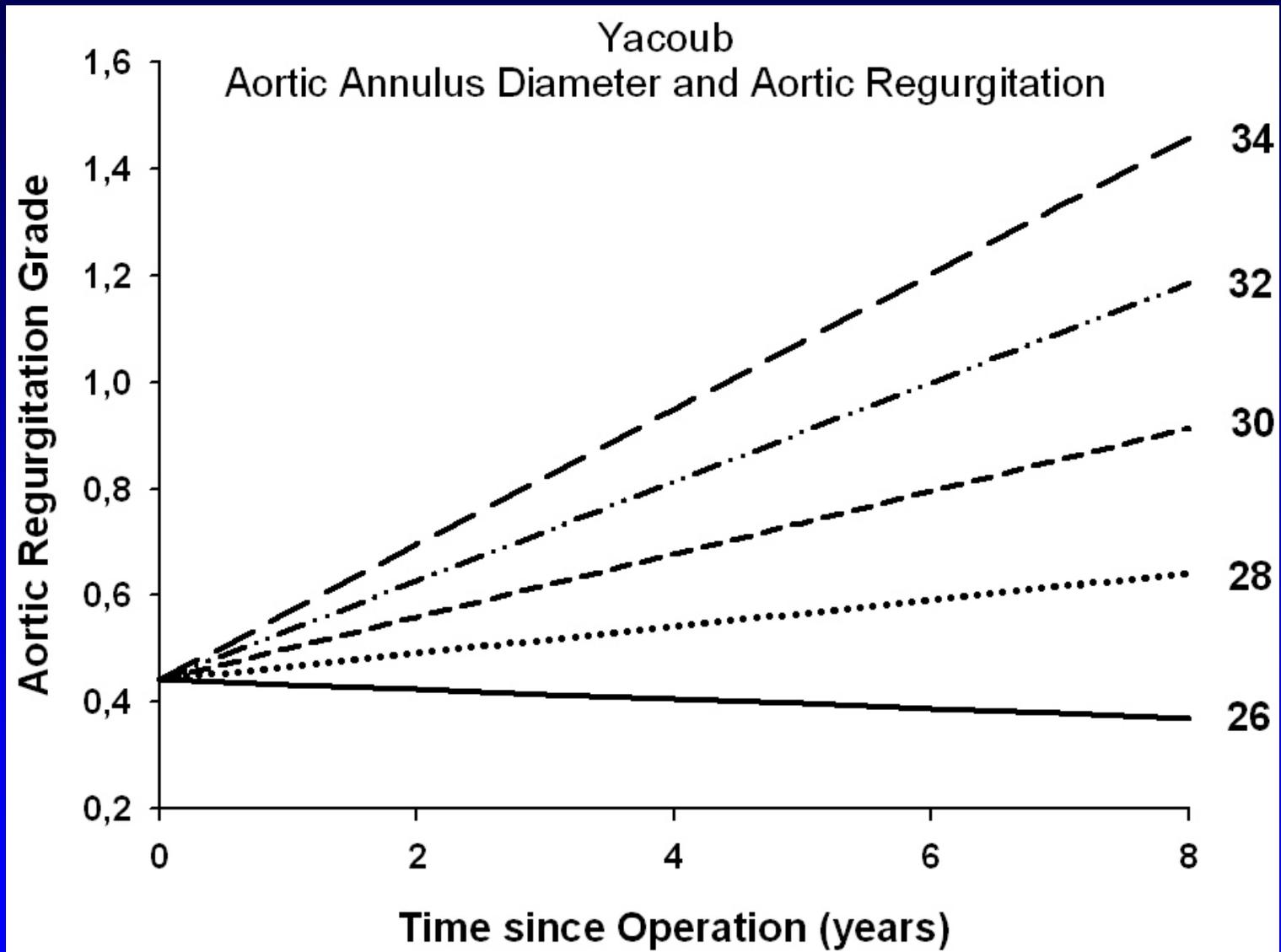
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Objective: Early results after aortic valve-sparing root reconstruction are excellent. Longer-term follow-up, especially with regard to aortic valve function, is required for further judgment of these techniques.

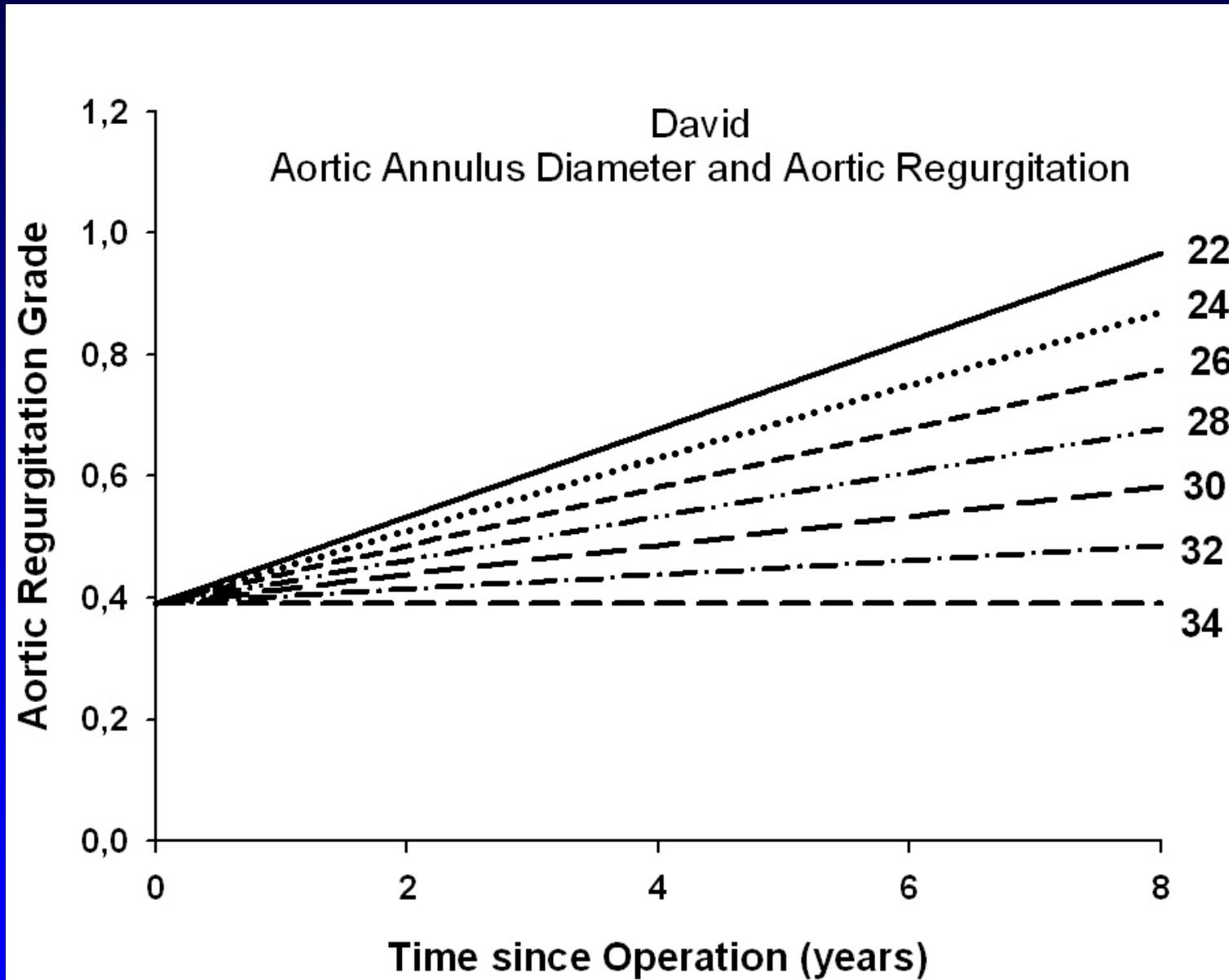
Methods: Between July of 1993 and September of 2006, 108 consecutive patients (mean age 53.0 ± 15.8 years) underwent the Yacoub operation (group Y) and 83 patients underwent the David operation (group D). Innovative multilevel hierarchic modeling methods were used to analyze aortic regurgitation over time.

Results: In general, aortic regurgitation increased with time in both groups. Factors associated with the development of a significant increase in aortic regurgitation were Marfan syndrome, concomitant cusp intervention, and preoperative aortic annulus dimension. In Marfan syndrome, the initial aortic regurgitation was higher in group Y versus group D (0.56 aortic regurgitation vs 0.29 aortic regurgitation, $P = .049$), whereas the mean annual progression rate of aortic regurgitation was marginally higher in group Y (0.132 aortic regurgitation vs 0.075 aortic regurgitation, $P = .1$). Concomitant cusp intervention was associated with a significant aortic regurgitation increase in both groups ($P < .0001$). There was a trend that smaller preoperative aortic annulus diameters in group D and larger diameters in group Y were associated with increased aortic regurgitation over time.

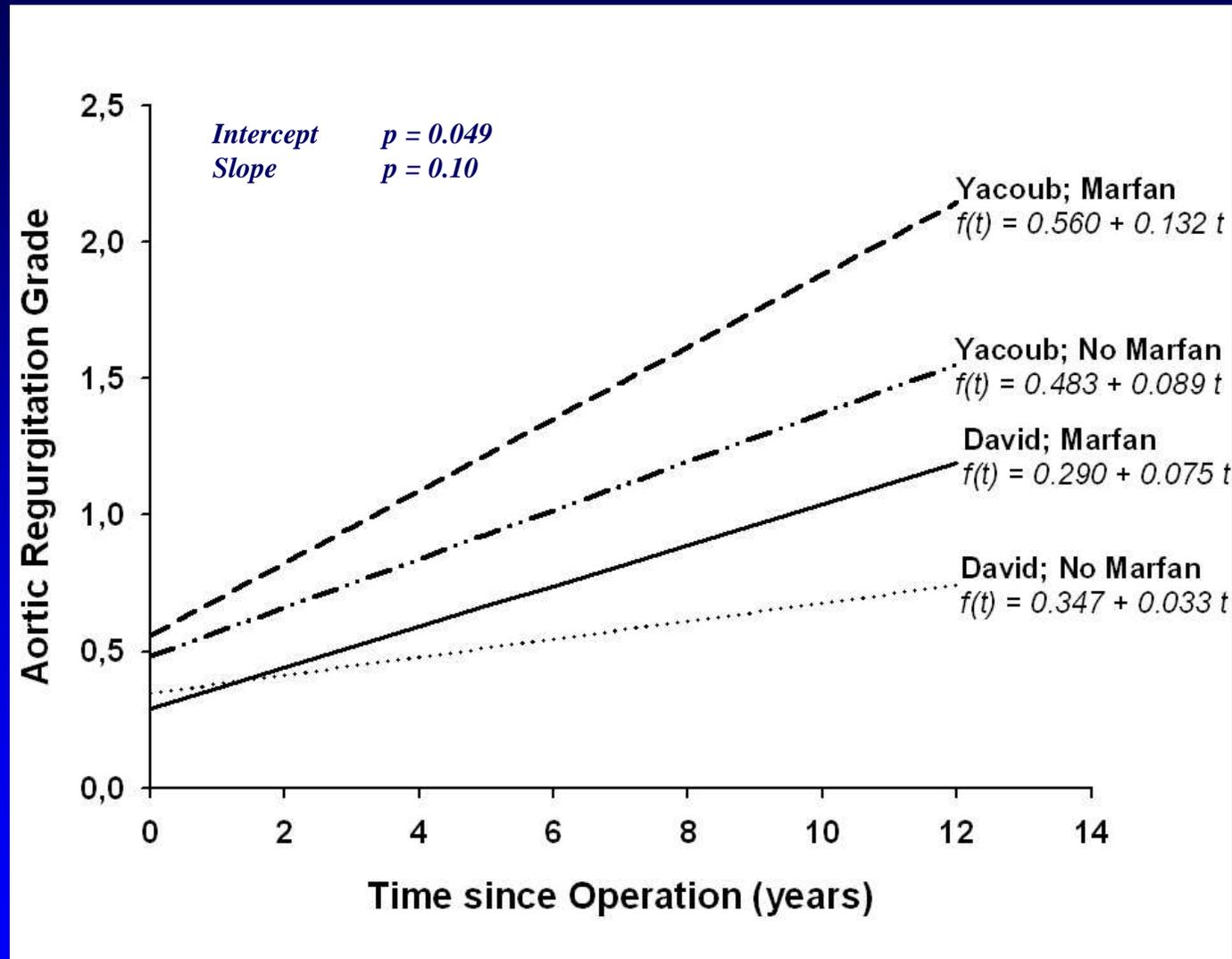
Conclusion: In regard to aortic regurgitation grade over time, patients with Marfan syndrome and a large preoperative aortic annulus diameter were better treated with the reimplantation technique, whereas those with a smaller diameter were better treated with the remodeling technique. Concomitant free-edge plication of prolapsing cusps was disadvantageous in both groups. Considering these factors may serve to improve the aortic valve longevity after valve-sparing aortic root surgery.



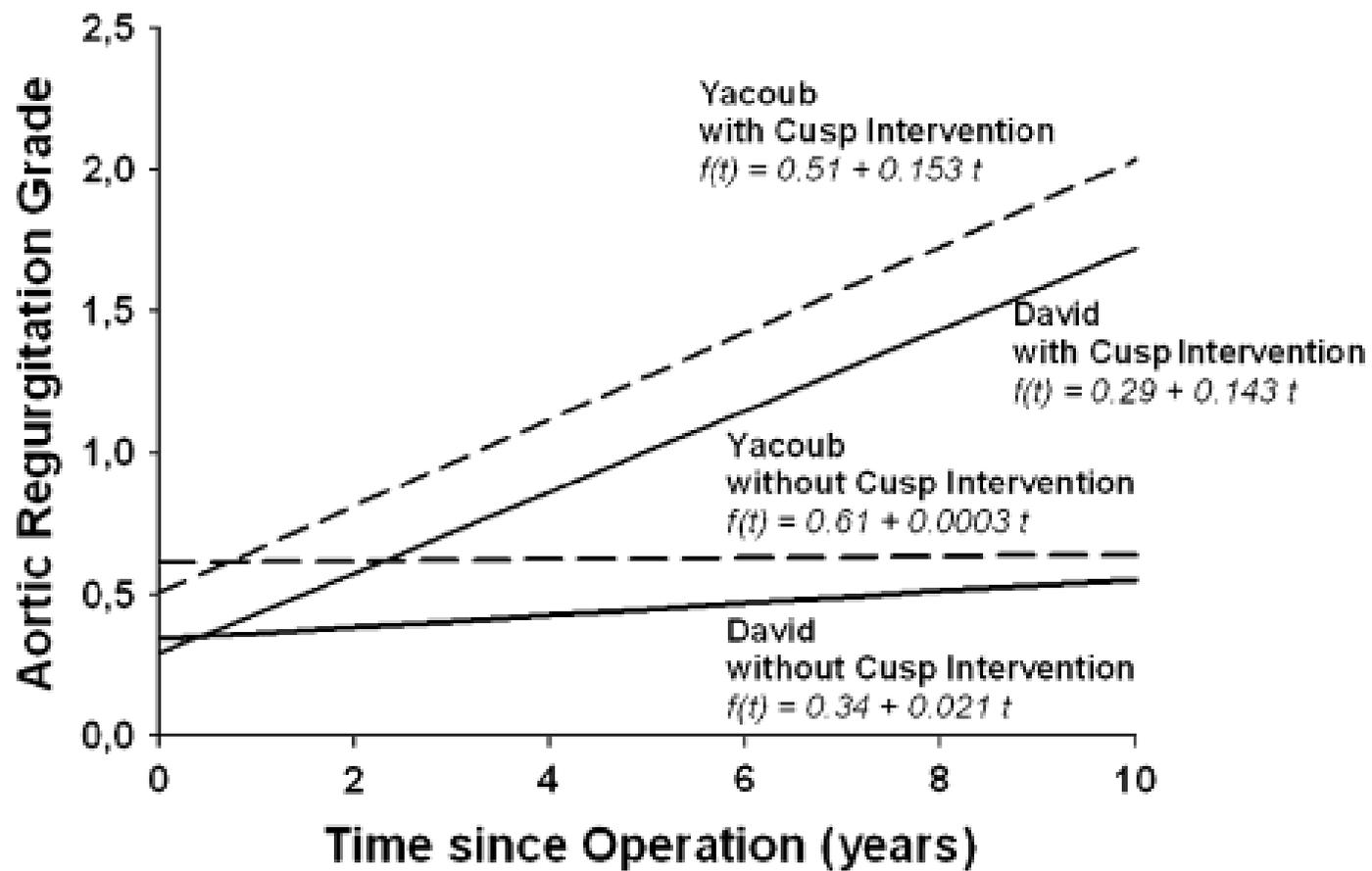
Hanke T et al. J Thorac Cardiovasc Surg 2009;137:314



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David-OP: Herzzentrum Leipzig

Ergebnisse

- 2006 – 2009: n = 93 (David I oder David V)
- perioperative Letalität: 2.2%
 - Typ A Dissektion: 2/18 = 11%
 - andere Patienten: 0/75 = 0%
- AI (Entlassungsecho):
 - none-to-mild AI -- 98%
 - mild-to-moderate AI -- 2%

Was passiert mit der Aorta descendens nach OP einer Typ A Dissektion?

- 80% der Patienten haben ein persistierendes falsches Lumen

Pat. müssen jährlich mit MRT oder CT nachuntersucht werden!

- Dilatation:
 - 17 % mit kontrolliertem arteriellen Hypertonus
 - 45 % mit unkontrolliertem arteriellen Hypertonus

Aortendissektion Typ B

I. konservativ / medikamentös

II. Operation

III. Aortenstenting

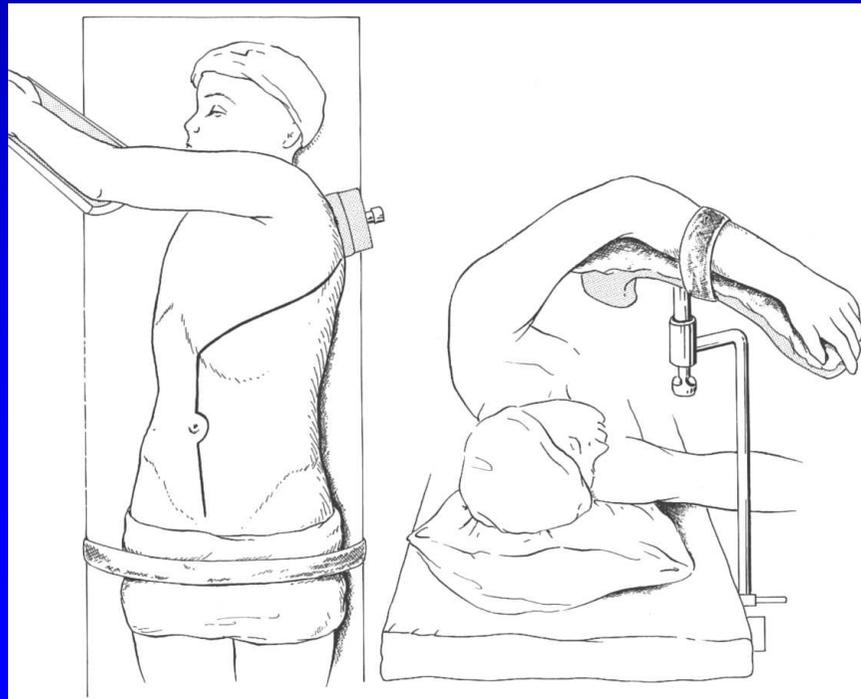
Aortendissektion Typ B





Chirurgie der chronischen Typ B Dissektion

- Hohe Morbidität
- Mortalität 10%, Paraplegie 10%
- Empfohlen für Aortendurchmesser > 5.5 (5.0?) cm



Aortenpathologie und Chirurgie

- Therapie der Wahl ist der prophylaktische Ersatz der Aorta
- OP empfohlen bei einem Durchmesser > 5.0 cm (4.5 cm?) für die Aorta ascendens oder bei einem Durchmesser > 5.5 cm (5.0 cm?) für die Aorta descendens
- geringere Durchmesser mit OP-Indikation bei:
 - zusätzliche kardiale Erkrankung
 - schneller Durchmesseranstieg
 - familiäres Risiko für Ruptur / Dissektion
 - bikuspidale Aortenklappe

Zusammenfassung I

- Aortendissektion >>> “daran denken”
- RR-Kontrolle ist essentiell
- Die Behandlung sollte in speziellen Zentren erfolgen
- Typ A > Notfall-OP
- Typ B > konservativ / Stent
- Bei Aneurysmen sollte die Operation elektiv durchgeführt werden, um das Risiko einer Dissektion zu reduzieren

Zusammenfassung II

- Die David-Operation ist die optimale operative Therapie beim Aneurysma oder einer Dissektion der Aorta ascendens
- Das postoperative Monitoring der Aorta ist extrem wichtig
- Patienten mit Marfan Syndrom sollten in spezialisierten Zentren betreut werden



Vielen Dank !