



IV CONGRESSO NAZIONALE DI ECOCARDIO CHIRURGIA

MILANO 10-12 MARZO 2010

Con il patrocinio di: SIEC - ANMCO - SICCH - SIC

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Sono stati assegnati
n. 15 crediti ECM



**AORTIC
VALVE
REPAIR**



La plastica dell'apparato valvolare aortico sottocommissurale.

*Una tecnica difficile nella quale è
possibile ottenere buoni risultati.*

Carlo Antona

**Professor of Cardiac Surgery
Head Cardio-Nephro-Vascular Department
Head Division of Cardiovascular Surgery
"L. Sacco" University Hospital
Milan, Italy**



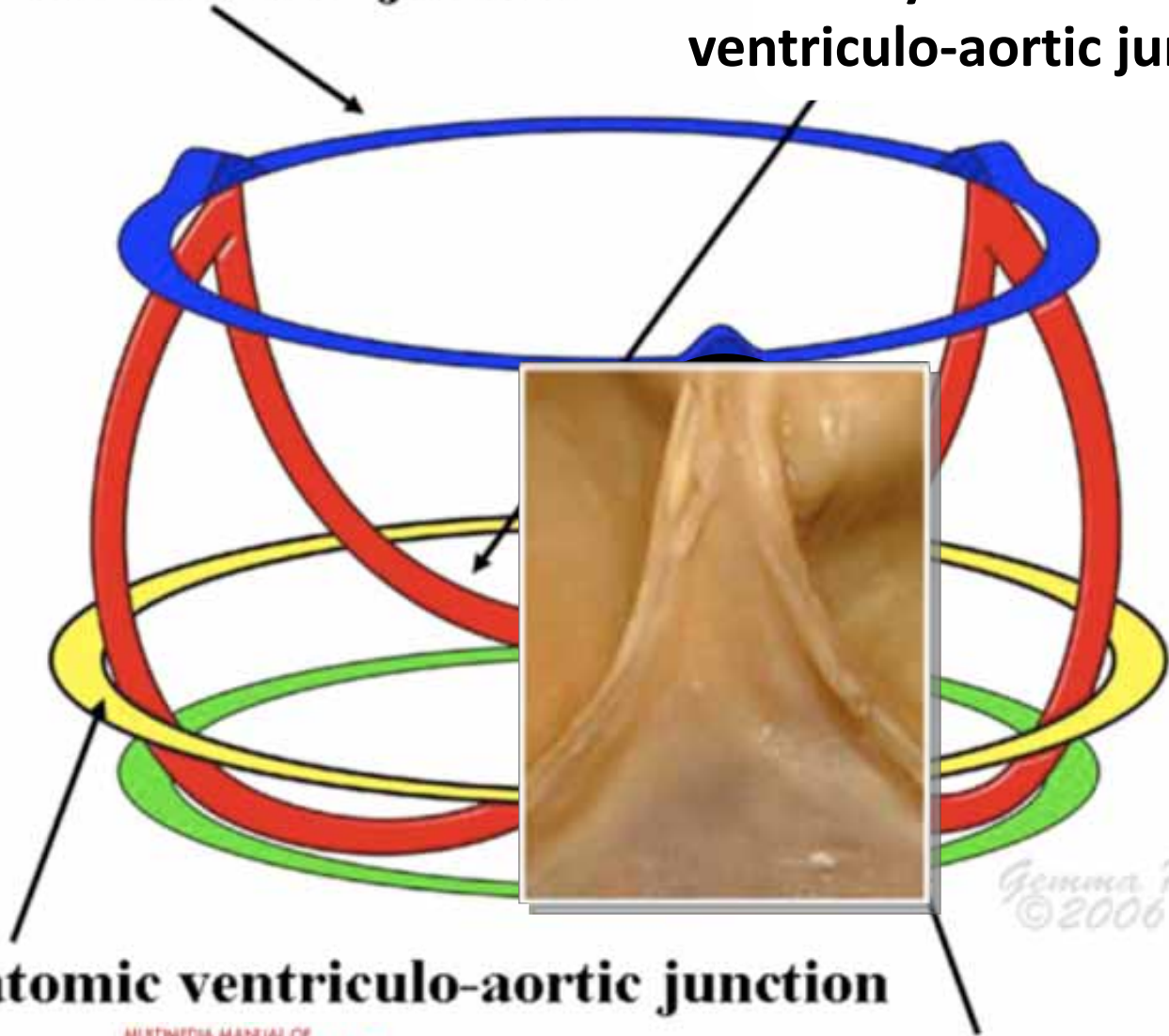
Leonardo da Vinci 1452-1519

Handwritten text in Leonardo's mirror script, likely describing the anatomical structures shown in the sketches below.



Sinutubular junction

**Haemodynamic
ventriculo-aortic junction**



Gemma Price
©2006

Anatomic ventriculo-aortic junction

Virtual basal ring

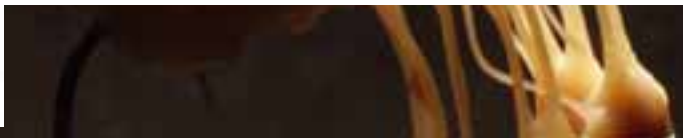
ISSN 1351-9606/2006/000202

MULTIMEDIA MANUAL OF
CARDIO THORACIC
SURGERY

The surgical anatomy of the aortic root

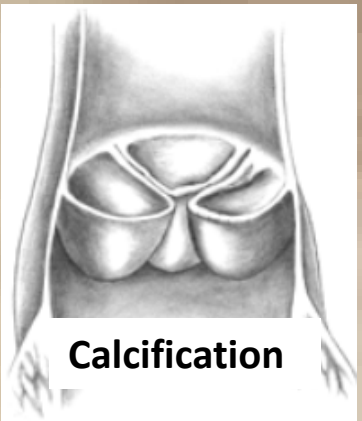
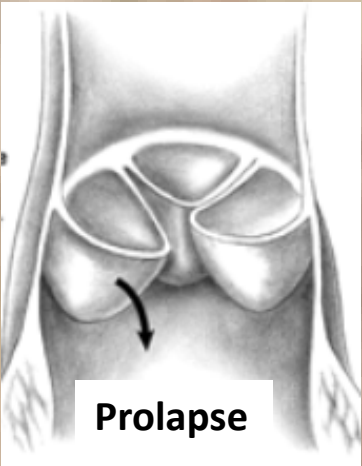
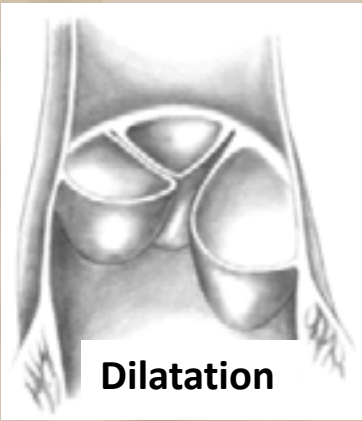
Robert H. Anderson

Cardiac Unit, Institute of Child Health, University College, 30 Guilford Street, London WC1N 1EH, UK



**AORTIC
VALVE
REPAIR**





Aortic Valve

Disease

INCOMPETENCE

STENOSIS

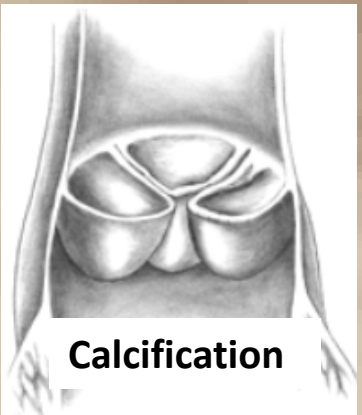
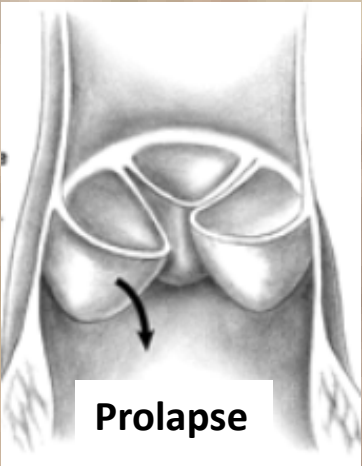
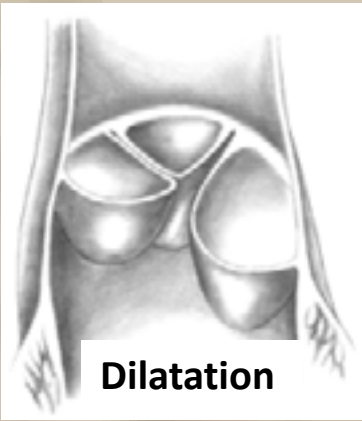
- Ascending Aorta Dilatation →
- Aortic Root Dilatation →
- Aortic Annulus Dilatation ↙

Replacement of the Ascending Aorta by a woven Dacron graft

BENTALL PROCEDURE

Aortic Valve Replacement





Aortic Valve

Disease

INCOMPETENCE

STENOSIS

- Ascending Aorta Dilatation →
- Aortic Root Dilatation →
- Aortic Annulus Dilatation ↙

Replacement of the Ascending Aorta by a woven Dacron graft

Sparing Technique
Reimplantation
Remodelling

Aortic Valve Repair



Aortic Valve Replacement



Successful Approach

- Recognition of the exact lesions responsible for the regurgitation
- Selection of the adequate operative maneuvers to correct abnormalities

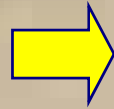


Cooperation



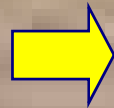
Surgical Flow-Chart for Aortic Regurgitation

**Echo
Valve Analysis**



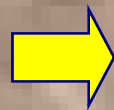
To analyse regurgitation mechanisms

**Surgical
Valve Analysis**



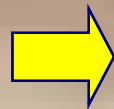
To confirm repair feasibility and
to analyse tissue characteristic

**Functional Unit
Repair**



To repair regurgitation mechanisms

**Functional Unit
Stabilization**



To regain F.U. continuity
and to rearrange hemodynamic stresses





AVR is not always possible



What the surgeon want to know from the ECHO?

PRE-OP.

- The Anatomy of the Aortic Valve Functional Unit
- The measures of the Aortic Valve Functional Unit
- The Aortic Valve pre-op. incompetence grade
- The incompetence mechanism

POST-OP.

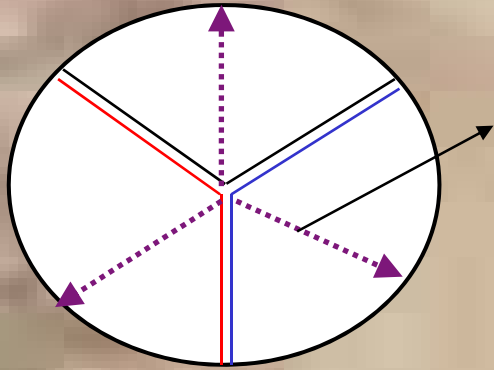
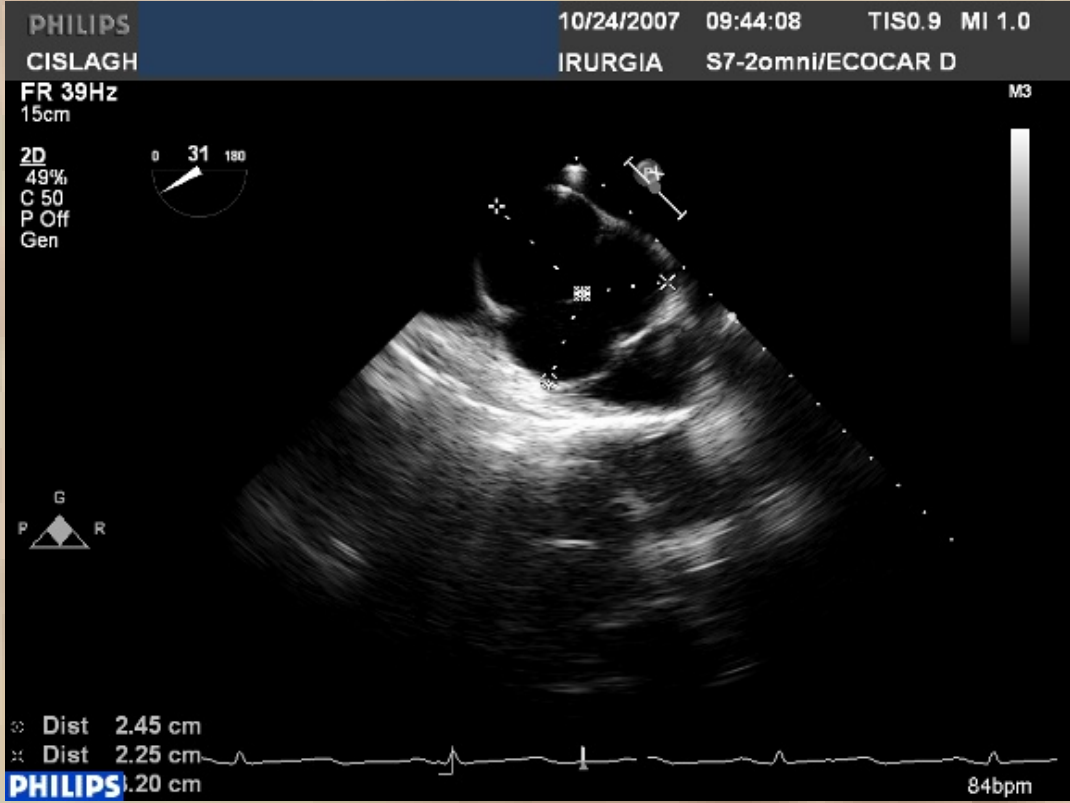
- The post-operative measures
- The residual incompetence grade
- The mechanism of the residual incomptence



- The Aortic Valve Functional Reserve



Short axis view

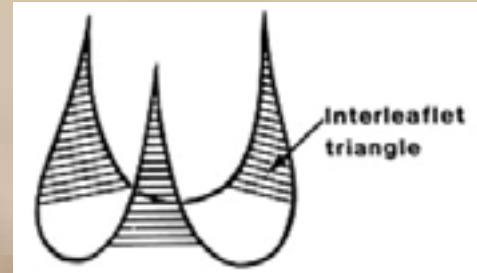


Normal valve

to measure Asymmetrical Sinuses



AORTIC FUNCTIONAL ANNULUS



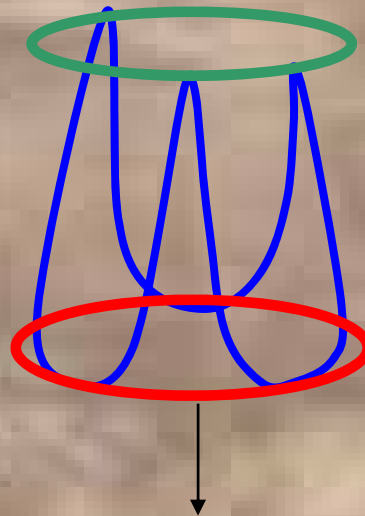
Sino-Tubular Junction



Ventriculo-Arterial Junction



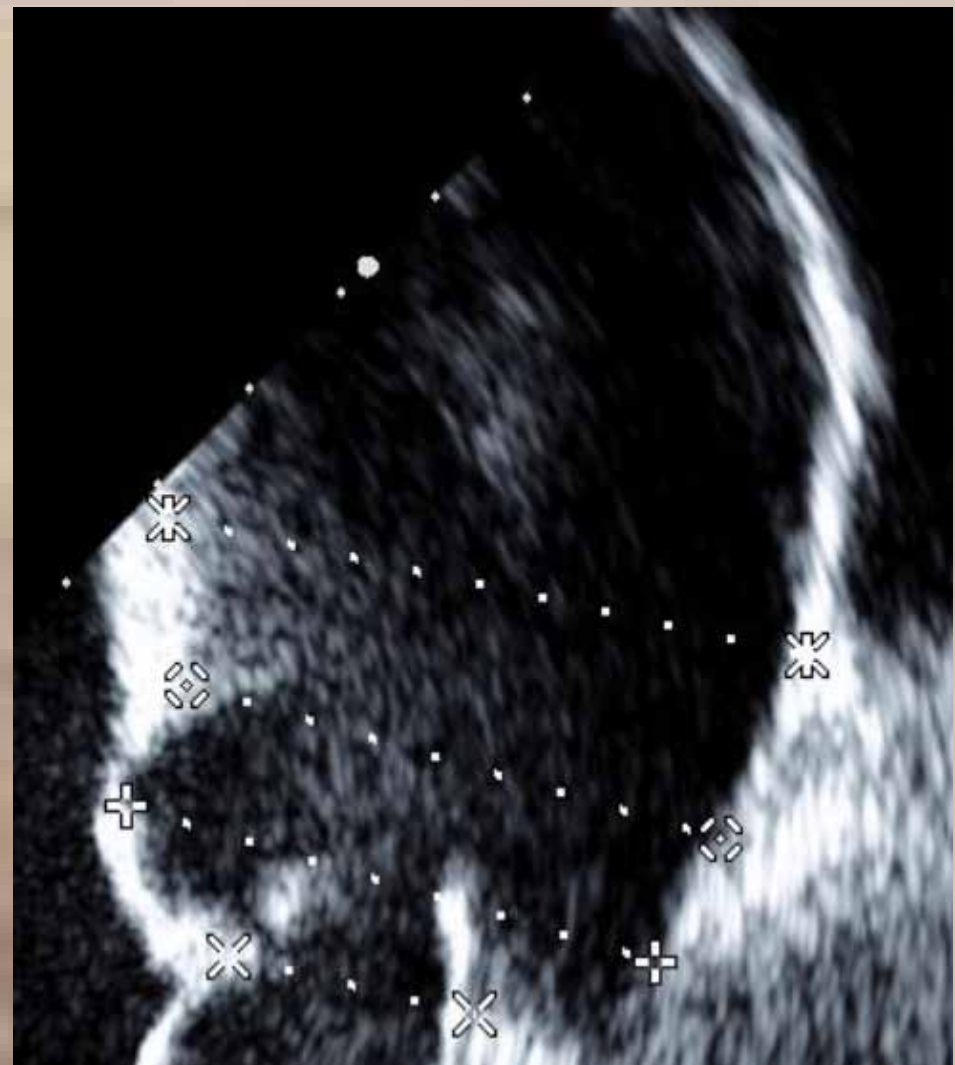
AORTIC FUNCTIONAL ANNULUS



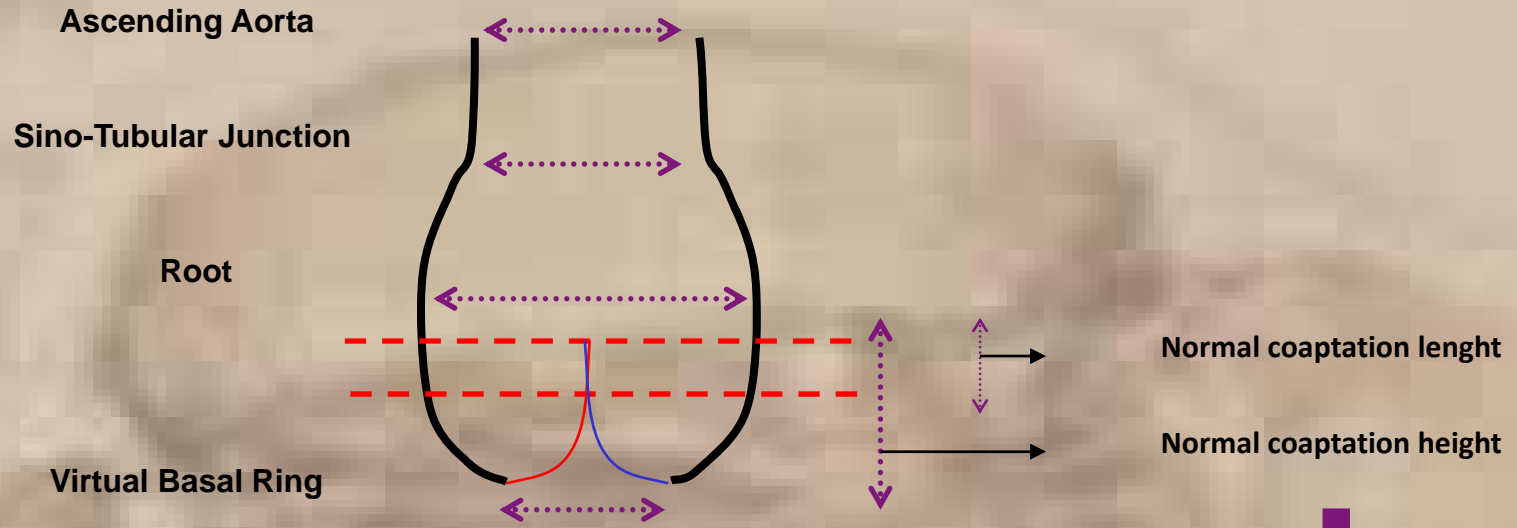
ECO-annulus



Long axis view



Long axis view

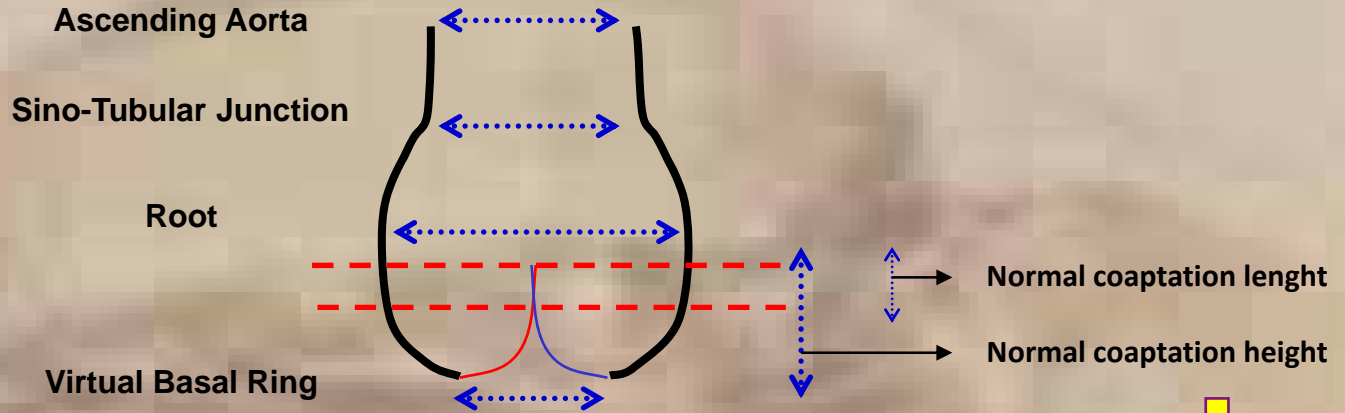


FUNCTIONAL RESERVE

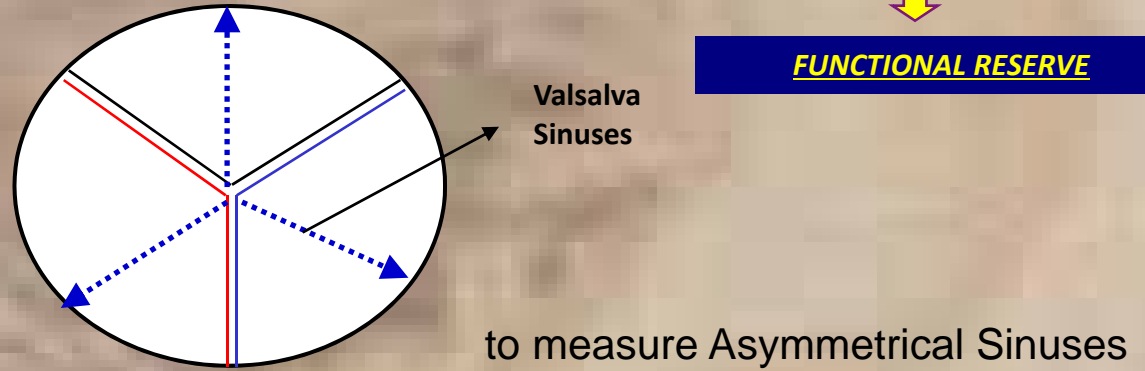


TEE Measures

Long axis view



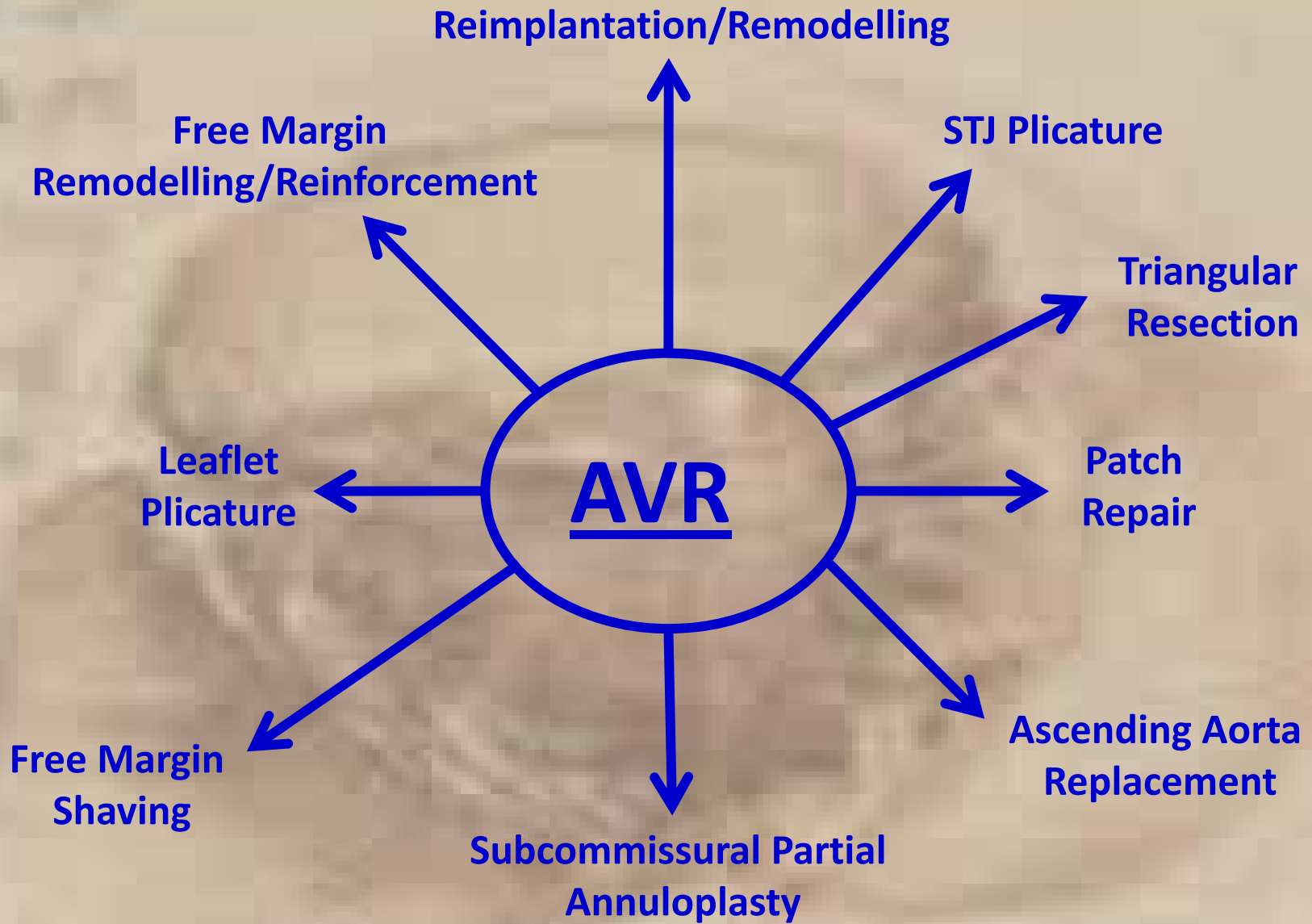
Short axis view



Normal valve

FUNCTIONAL RESERVE





FAA

- STJ Plicature
- Subcommissural Partial Annuloplasty

AORTIC ROOT

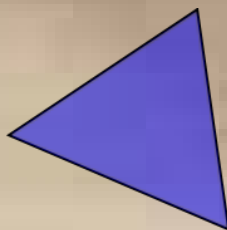
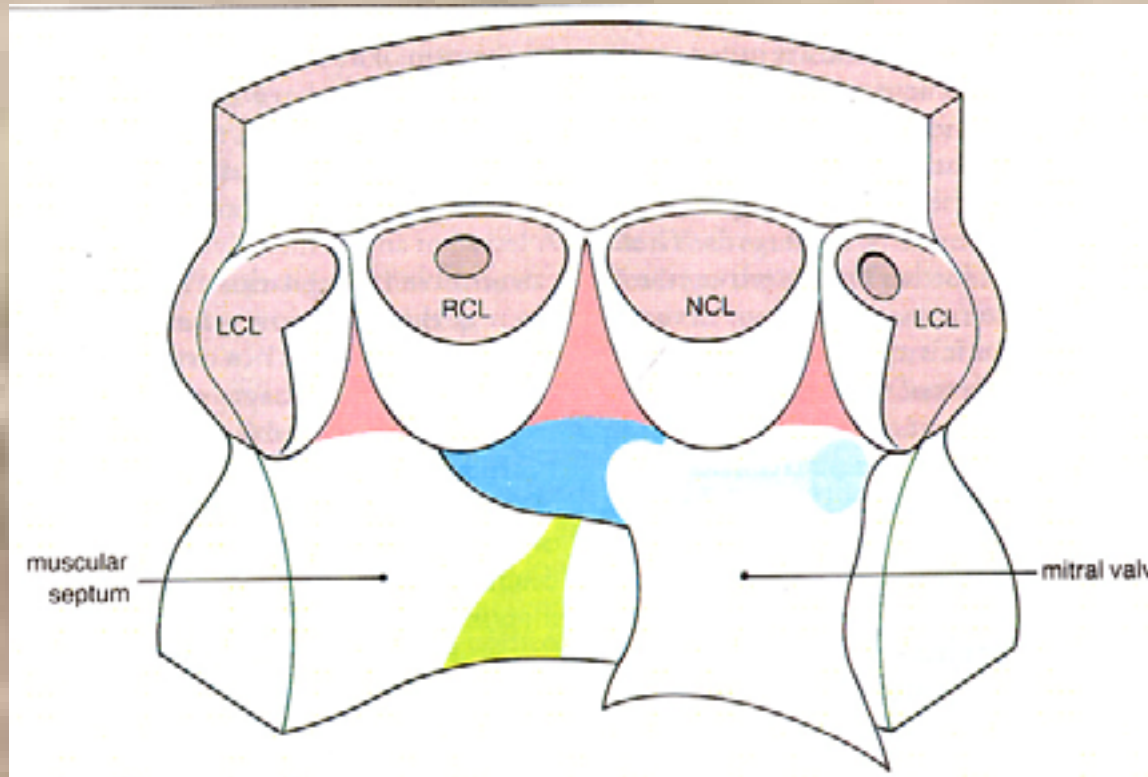
- Ascending Aorta Replacement
- Reimplantation
- Remodelling

LEAFLETS

- Leaflet Plicature
- Free Margin Shaving
- Free Margin Reinforcement
- Free margin Remodelling
- Triangular Resection
- Patch Repair



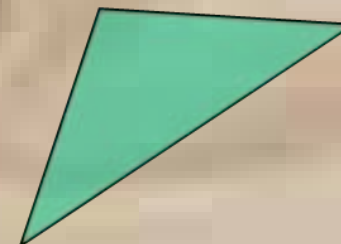
Interleaflet Triangle Analysis



Mild Dilation



Normal



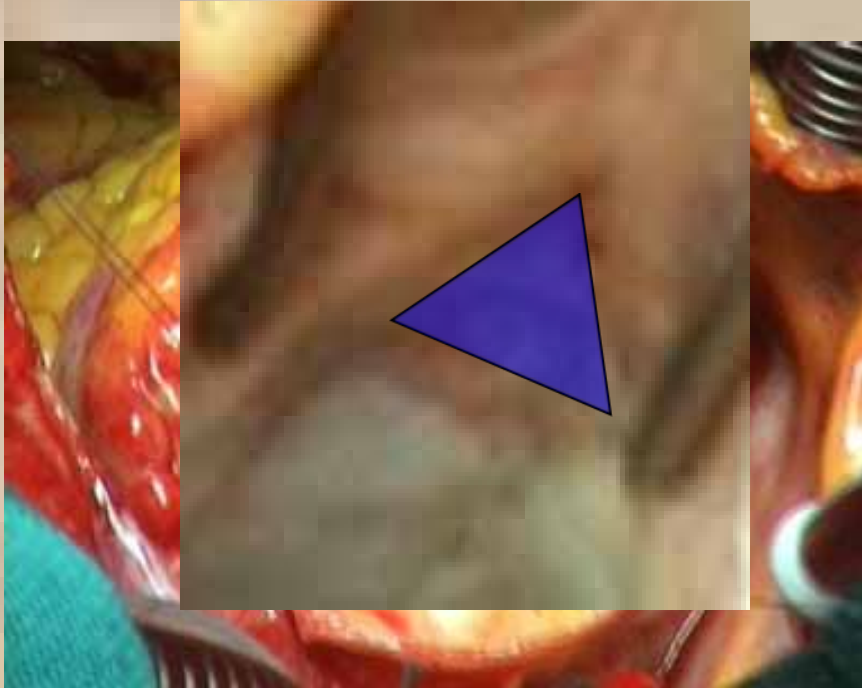
Severe Dilation



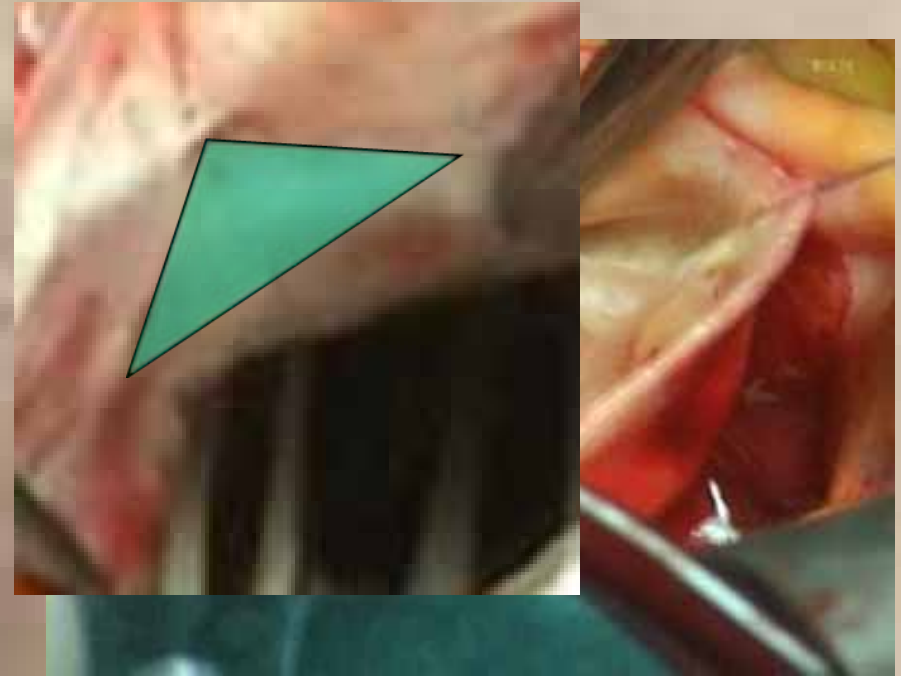
**AORTIC
VALVE
REPAIR**



Pathologic Interleaflet Triangle



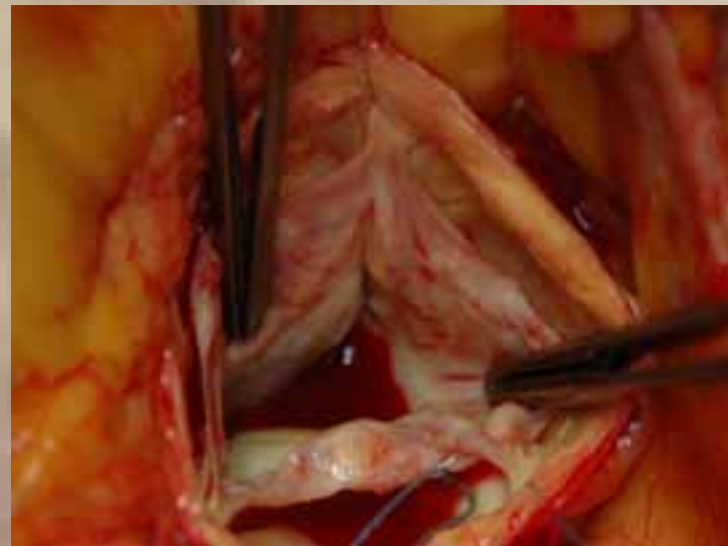
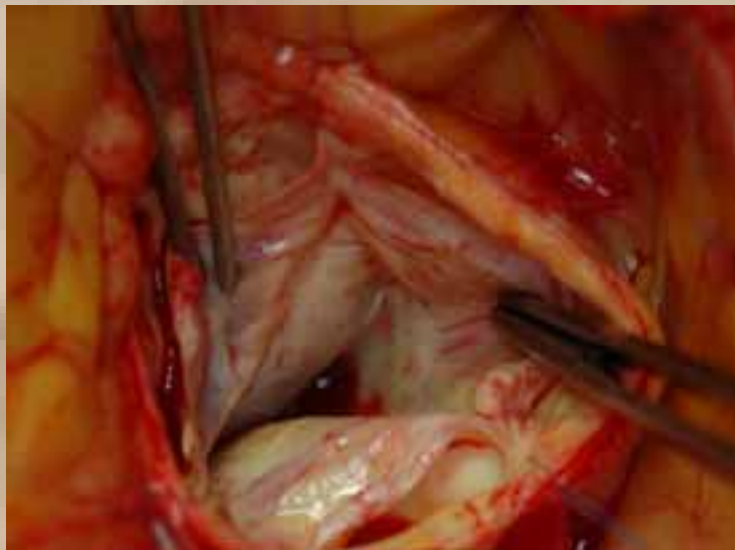
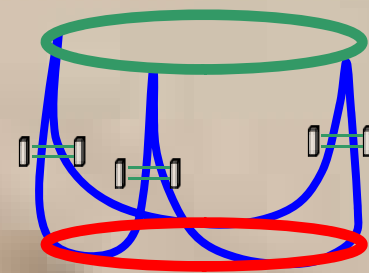
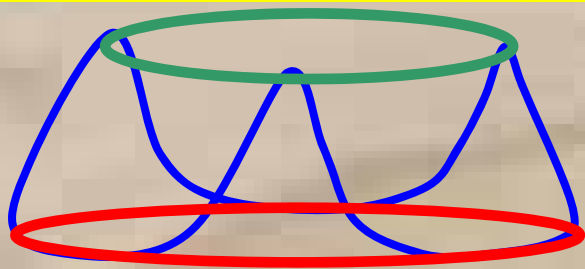
Mild Dilation



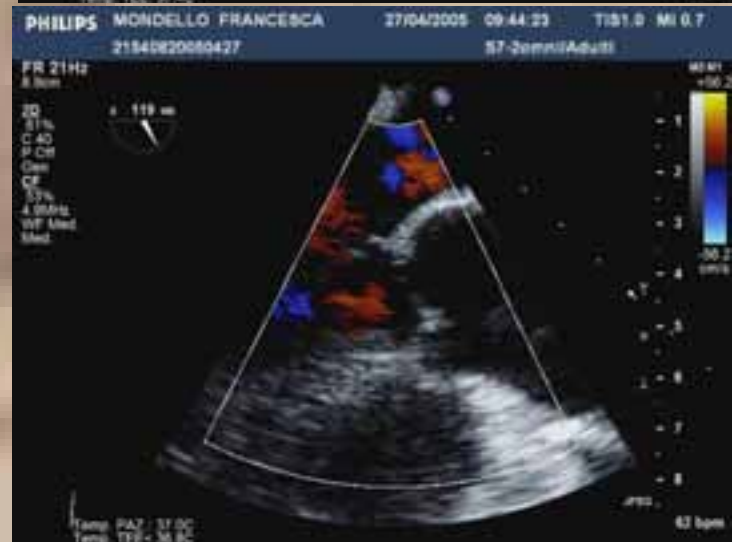
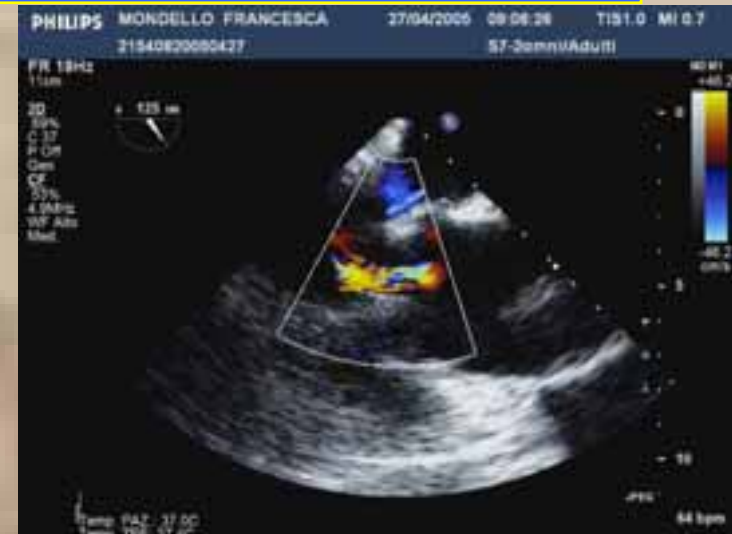
Severe Dilation



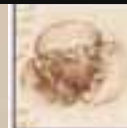
FAA Repair



STJ Diameter Importance



**Ascending Aortic Aneurysm
Severe AVR**



**AORTIC
VALVE
REPAIR**



FR 39Hz
8.1cm

M3

2D
64%
C 50
P Off
APen

⊕ Diam. Ao ascend.	4.9 cm
⊙ Diam. STJ	3.3 cm
⊗ Diam S Valsalva	2.9 cm
PHILIPS /	1.9 cm

55bpm

Asc Ao=4.9 cm
STJ=3.3 cm
SoV=2.9 cm
Ao anulus=1.9 cm



Moderate AR

F, 75 y (L.A.)

Ascending aorta dilatation

Tricuspid aortic valve → moderate AR



PHILIPS

22/12/2009 09:25:13 TIS1.3 MI 0.7
S7-2omni/AdultI

FR 23Hz
12cm
2D
53%
C 50
P Off
Gen
CF
70%
4.9MHz
WF Alto
Med.



PHILIPS

STJ dilatation



NO COAPTATION

22/12/2009 09:17:01 TIS0.7 MI 1.2
S7-2omni/AdultI

JPEG

58 bpm

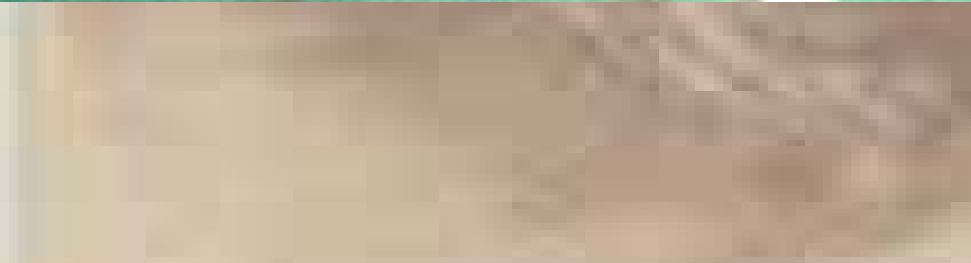


PHILIPS



AORTIC
VALVE
REPAIR





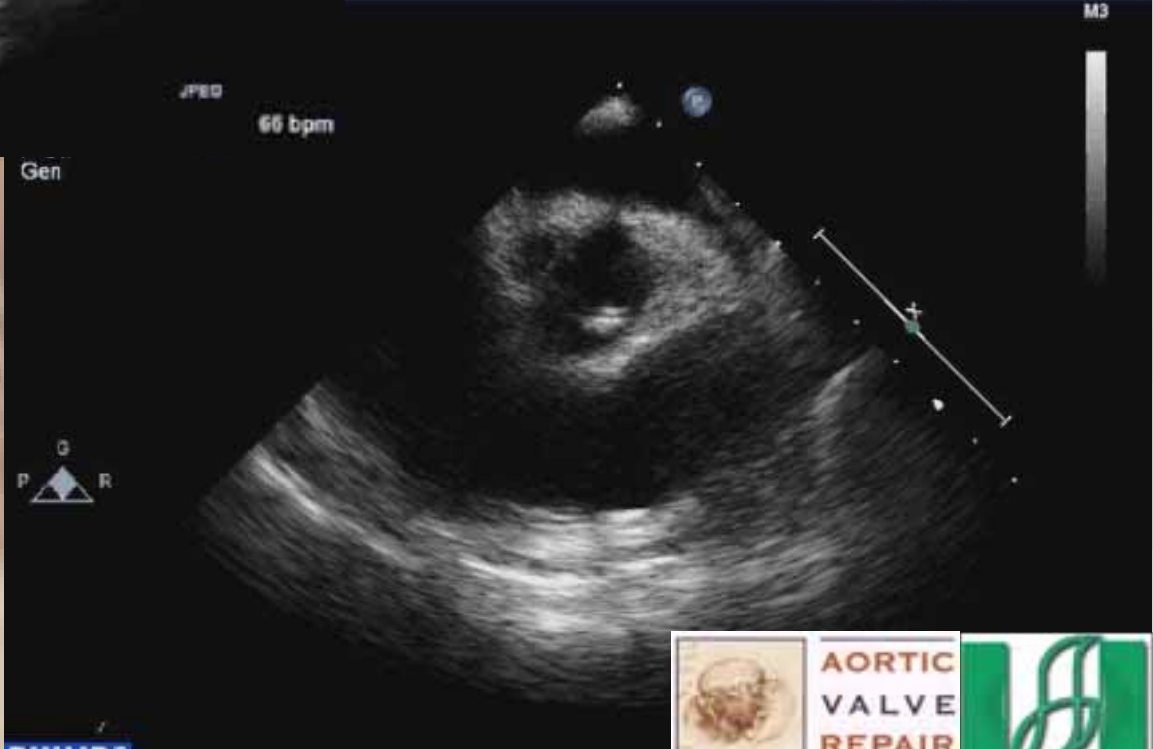
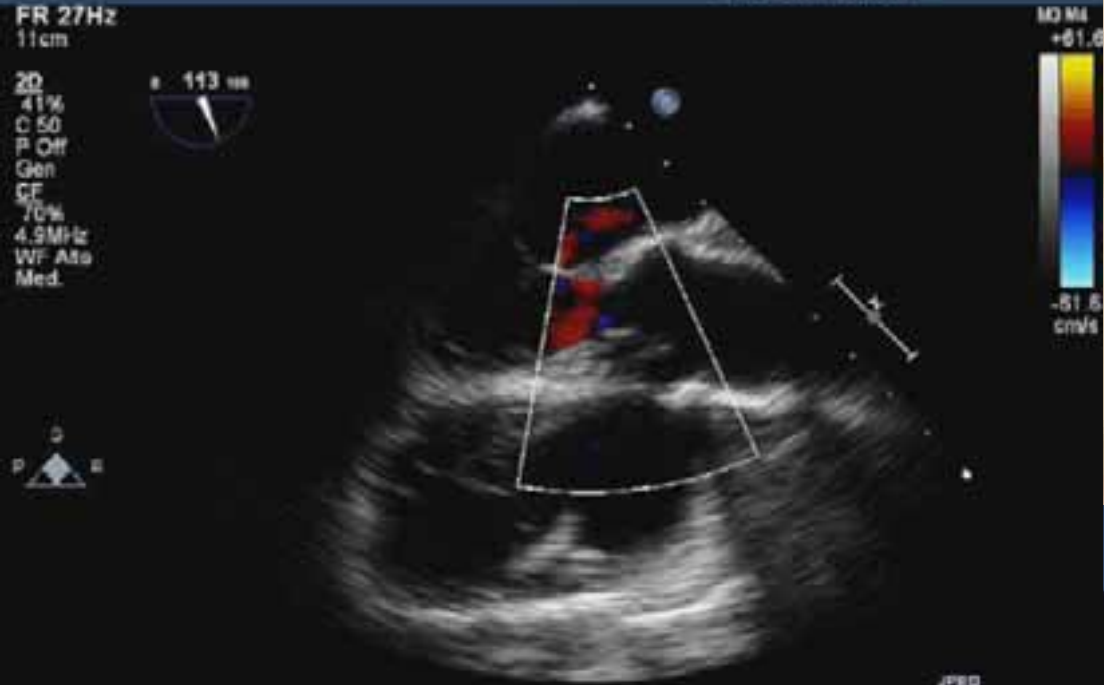
**AORTIC
VALVE
REPAIR**





**Ascending aorta replacement
Partial subcommissural annuloplasty**





AORTIC VALVE REPAIR



F, 63 y (F.A.)
Bicuspid aortic valve → moderate AR
Ascending aorta and NCS dilatation

21/12/2009 09:10:38 TIS1.2 MI 0.6
S7-2omni/Adult1

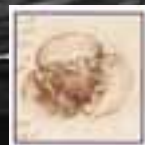
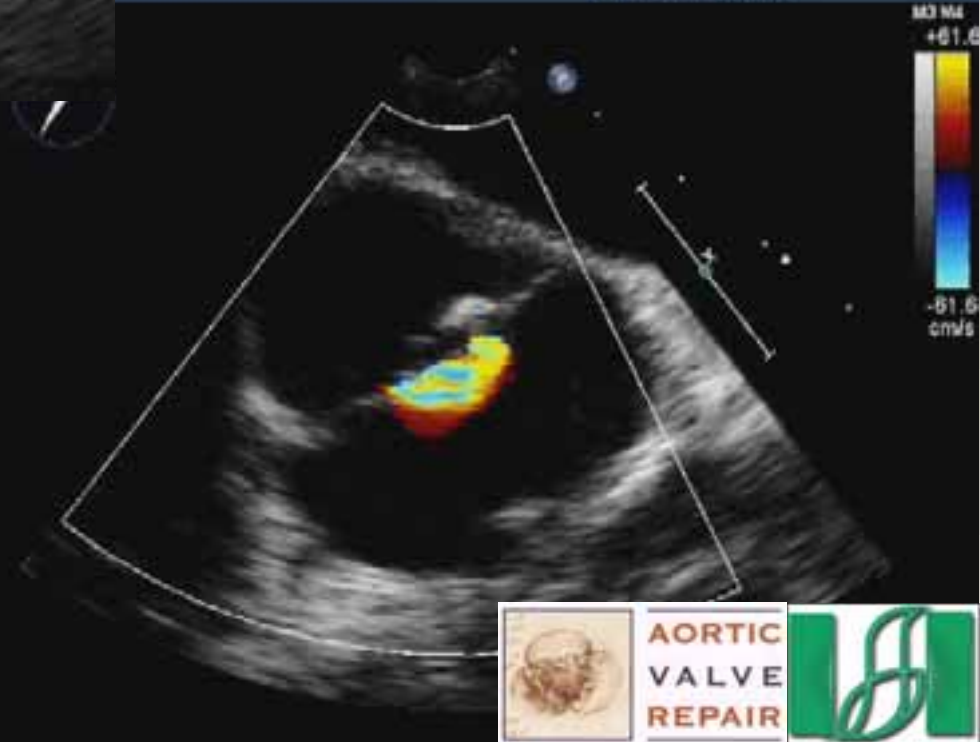
PHILIPS



20 70
C 50
P Off
Gen
CF
70%
4.9MHz
WF Ato
Med.



PHILIPS

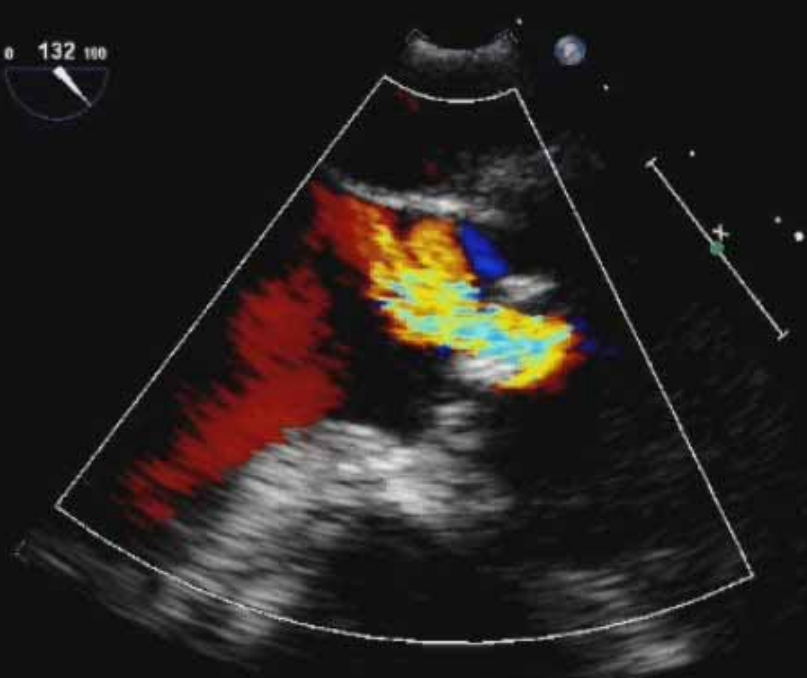


**AORTIC
VALVE
REPAIR**



FR 17Hz
8.6cm

2D
55%
C 50
P Off
Gen
CF
70%
4.9MHz
WF Alto
Med.

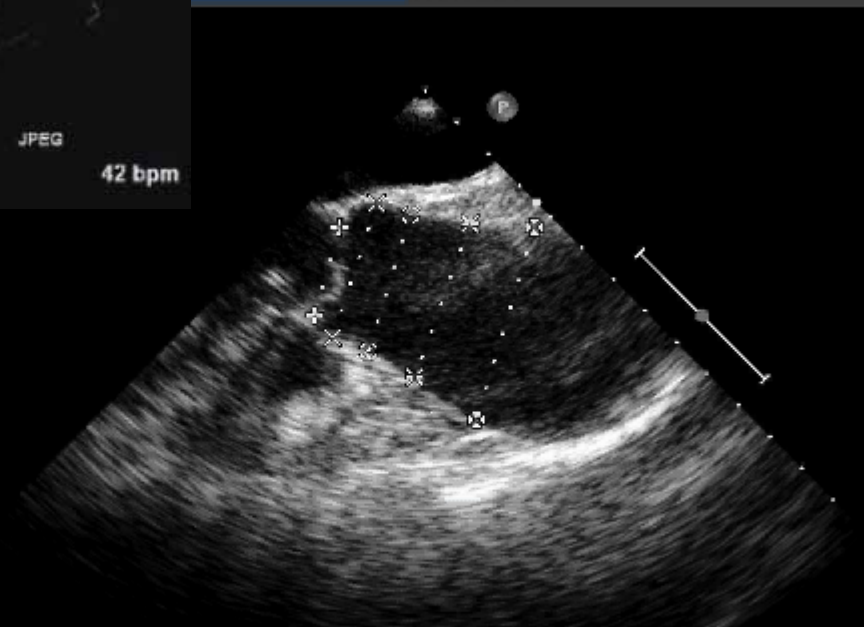


JPEG

42 bpm

Asc Ao=4.5 cm
STJ=3.7 cm
SoV=3.2 cm
Anulus=2 cm

M3



- * Dist 4.53 cm
- ** Dist 3.67 cm
- o Dist 3.21 cm
- x Dist 3.18 cm



AORTIC VALVE REPAIR

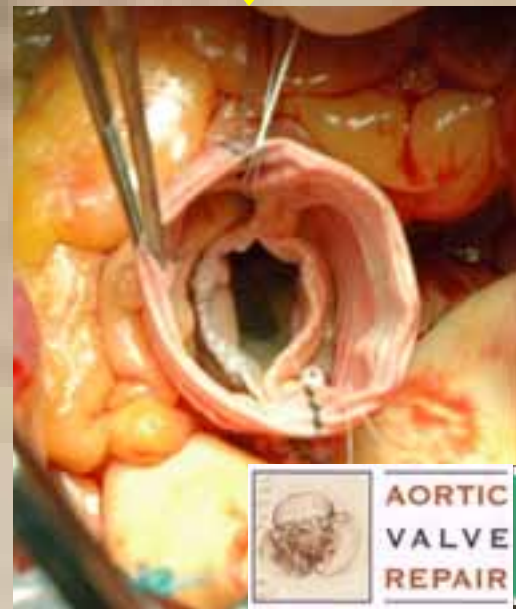




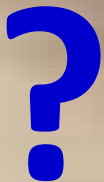
Raphe resection and patch repair



Wolfe procedure



Free margin shaving and reinforcement



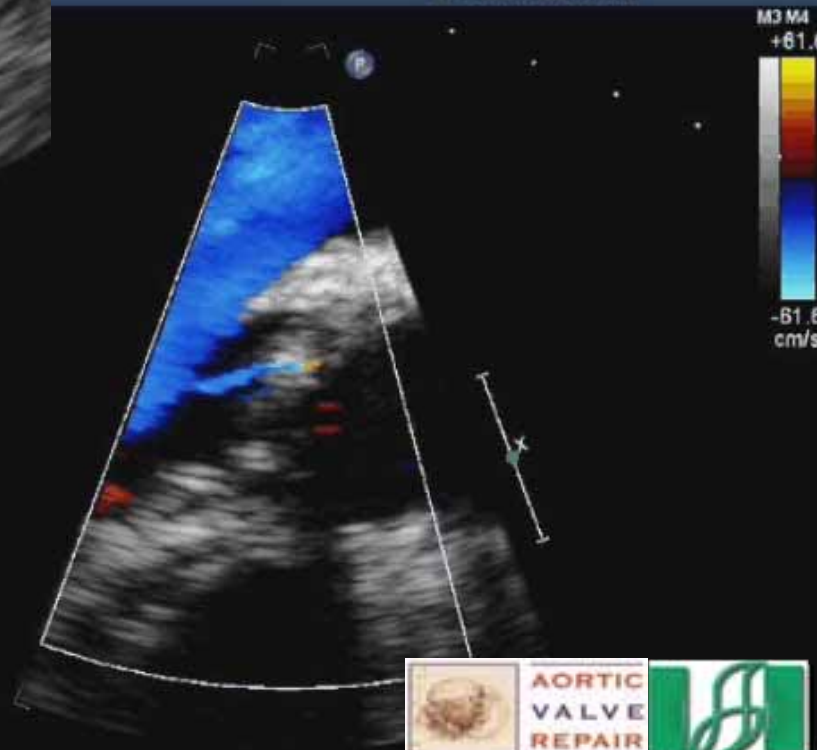


PHILIPS



21/12/2009 12:37:21 TIS1.1 MI 0.7

S7-2omni/Adultl

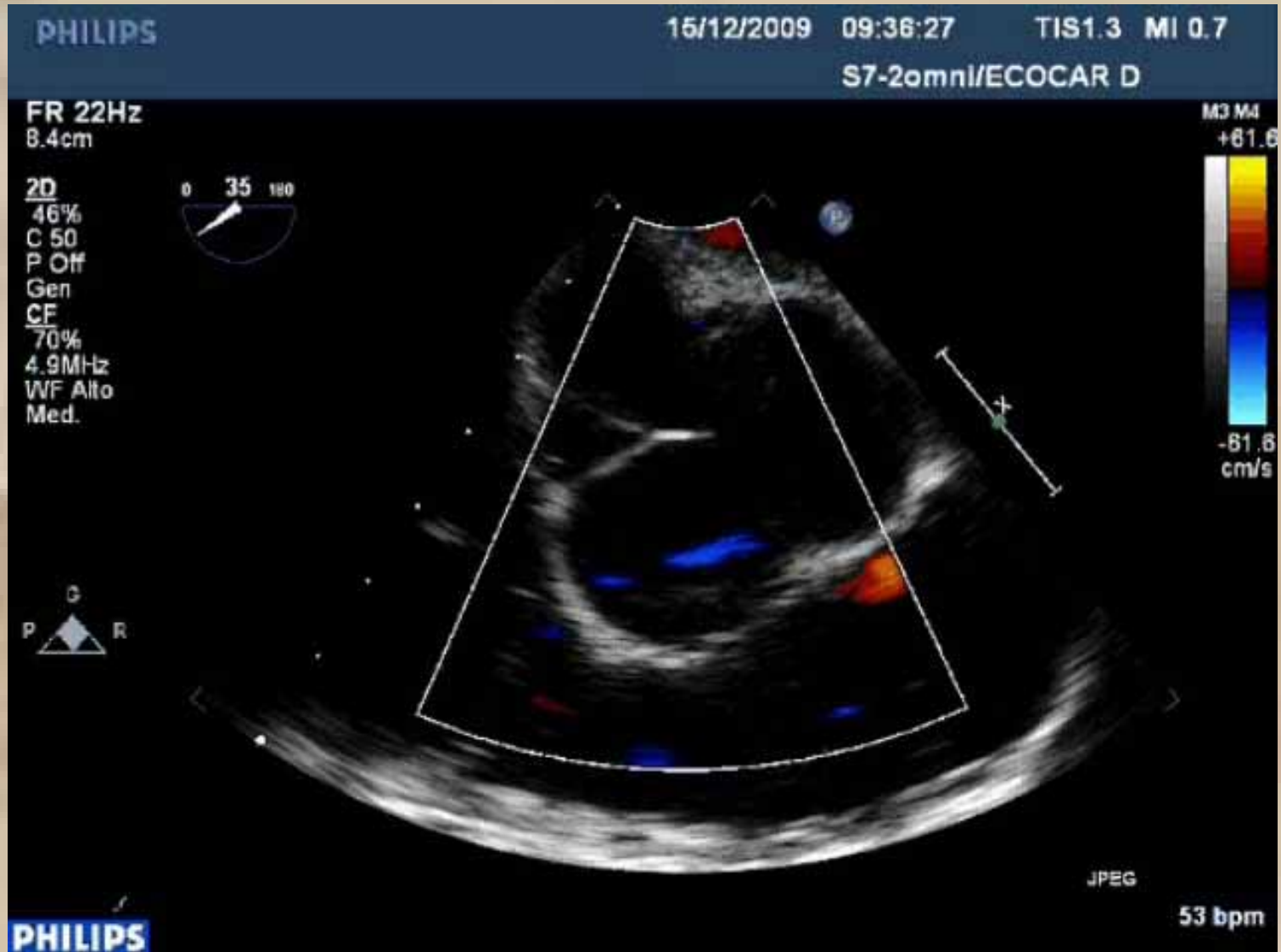


CL
70%
4.9MHz
WF Alto
Med.



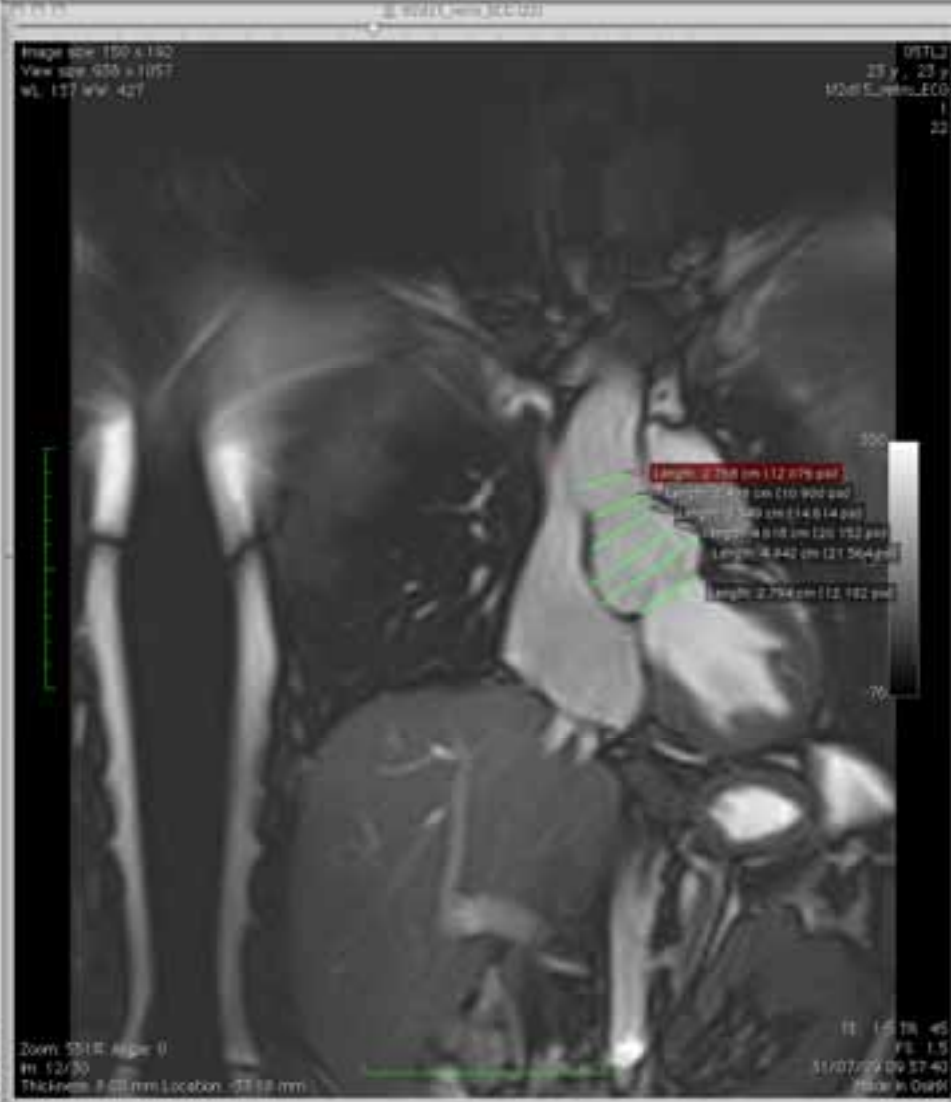
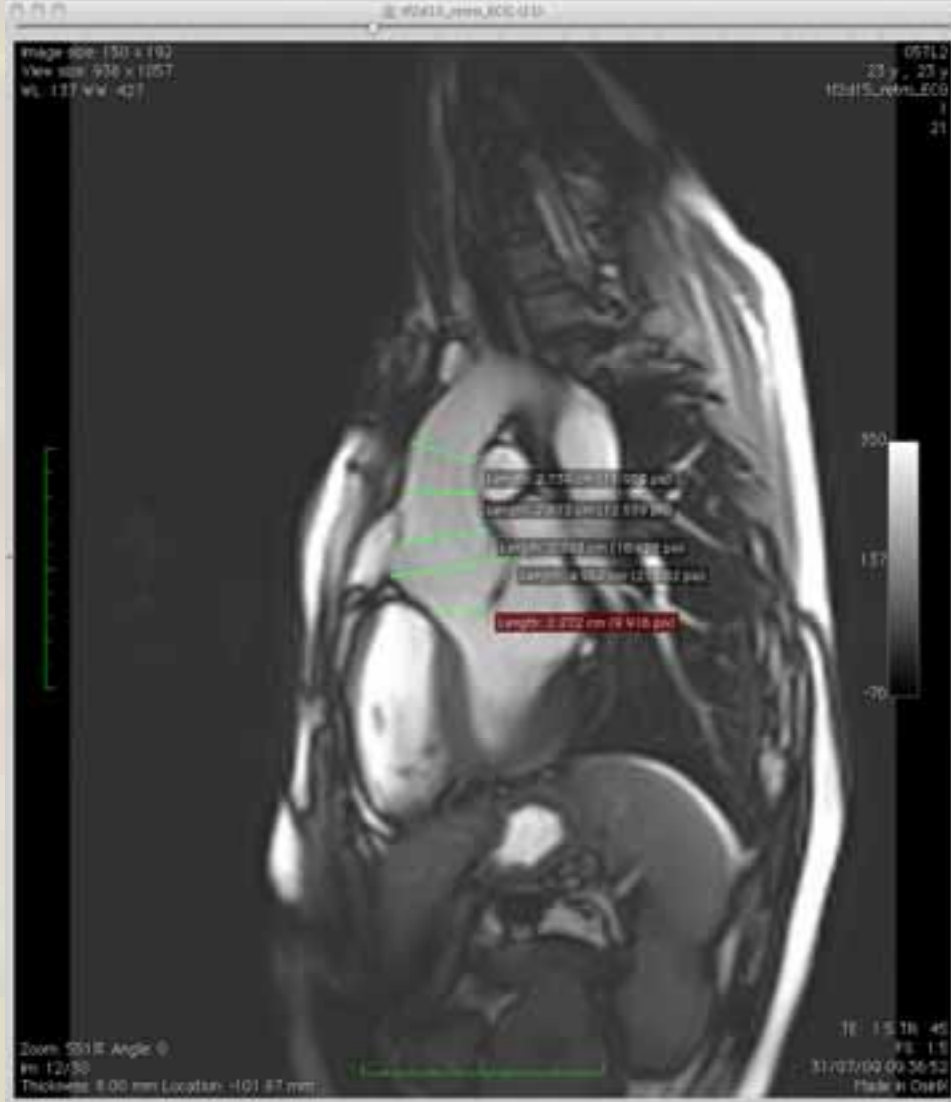
PHILIPS





M, 23 y (T.M.)
Marfan, aortic root dilatation



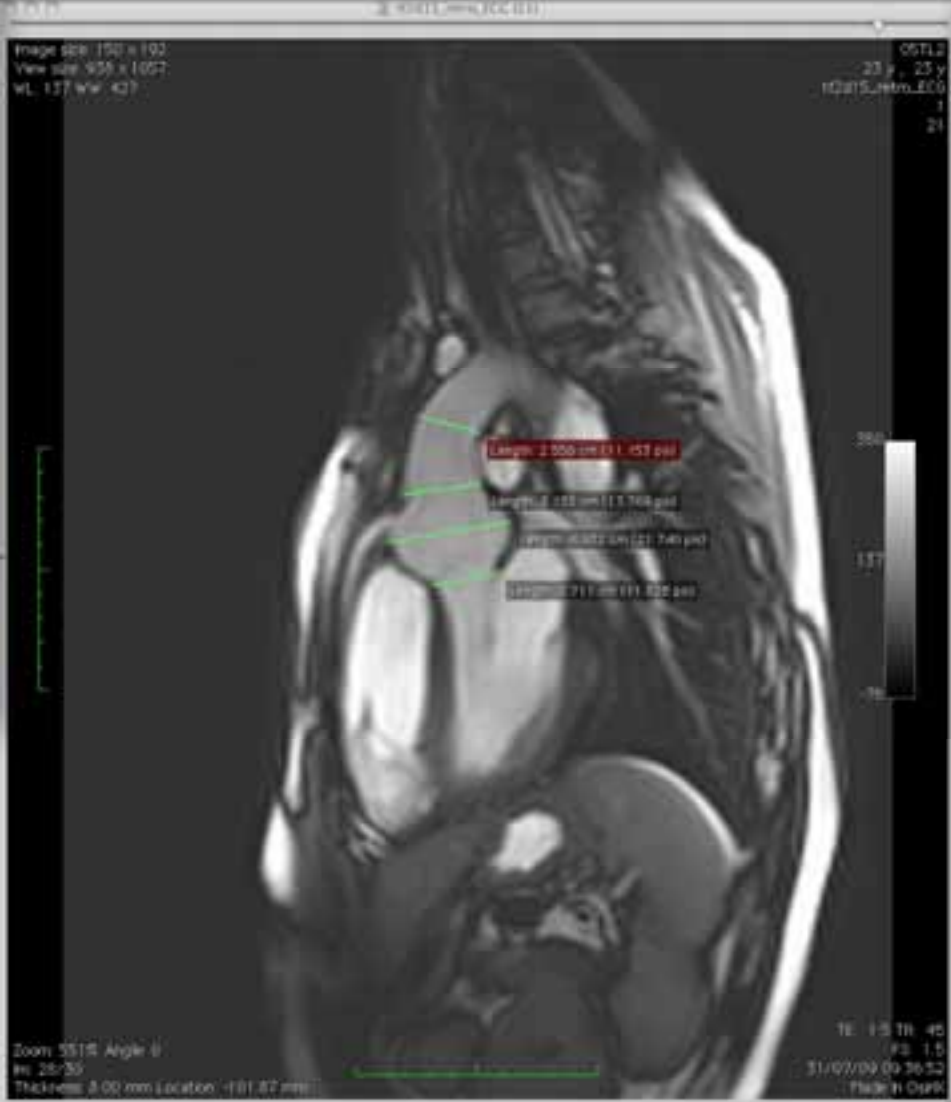


Anulus=2.2
Root=4.9
STJ=3.7
Asc Ao=2.8

END-SYSTOLE

Anulus=2.7
Root=4.9
STJ=2.4
Asc Ao=2.7





Anulus=2.7

Root=4.9

STJ=3.1

Asc Ao=2.5

END-DIASTOLE

Anulus=2.8

Root=4.6

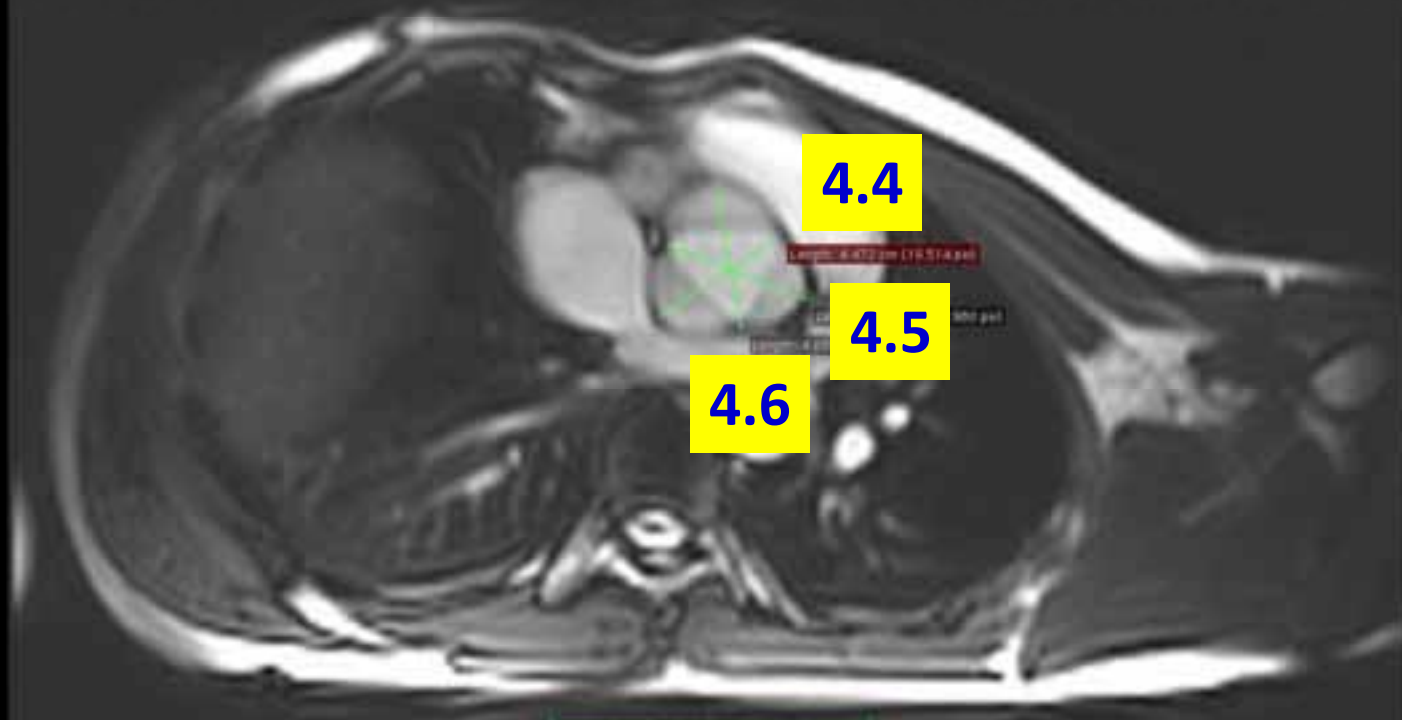
STJ=3.1

Asc Ao=2.8



Image size: 192 x 150
View size: 1898 x 1057
WL: 137 Wv: 427

05TL2
23 y, 23 y
t2d15_retro_ECG
1
23



Zoom: 728% Angle: 0
In: 4/30
Thickness: 5.00 mm Localiz: -412.19 mm

TE: 1.5 Tr: 45
FS: 1.5
31/07/09 09:58:19
Made in Ours!

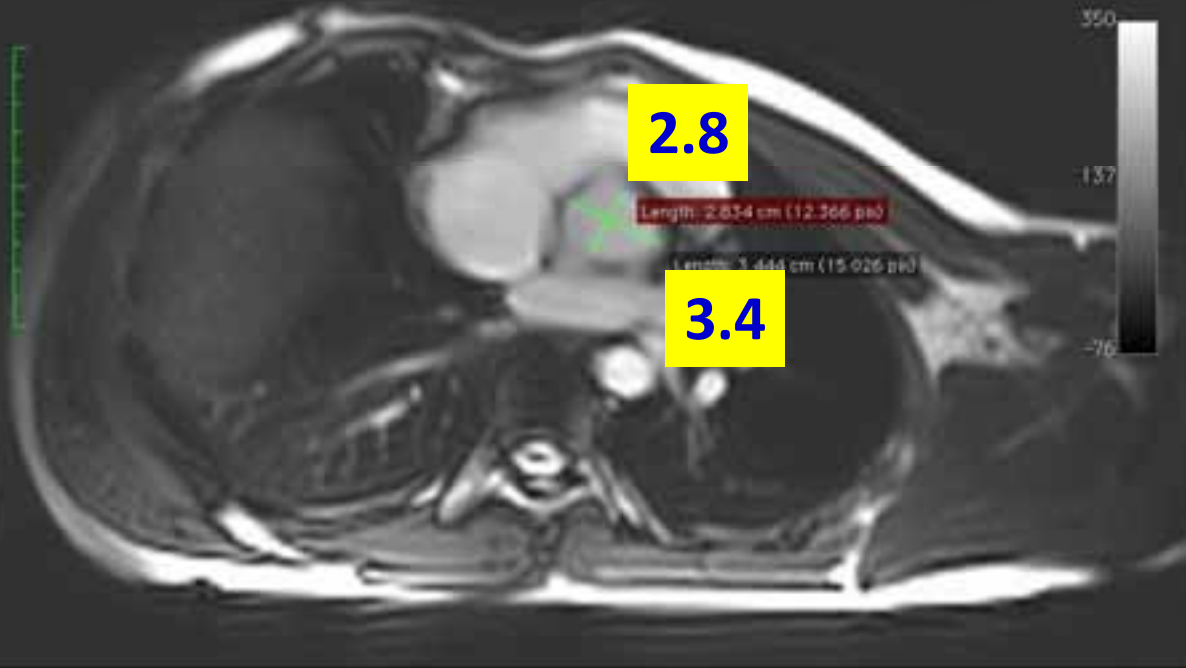
VALSALVA SINUSES



Image size: 192 x 150
View size: 938 x 1057
WL: 137 WW: 427

05TL2
23 y, 23 y
tf2d15_retro_ECG
1
23

VENTRICULO-AORTIC JUNCTION



2.8

Length: 2.834 cm (12.366 px)

3.4

Length: 3.444 cm (15.026 px)



ation: -112.19 mm

TE: 1.5 TR: 45
FS: 1.5
31/07/09 09:38:20
Made in OMRK



AORTIC
VALVE
REPAIR





Remodeling

+

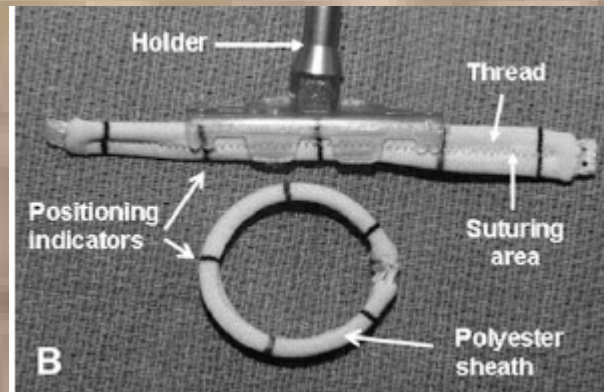


Reimplantation

=



Remodeling +
Subvalvular aortic annuloplasty



An expansible aortic ring for a physiological approach to conservative aortic valve surgery

Emmanuel Lansac, MD, PhD,^{a,b} Isabelle Di Centa, MD,^c François Raoux, MD,^d Neil Bulman-Fleming,^e Adrian Ranga,^e Aicha Abed, MSc,^{a,f} Maguette Ba, MD,^g Anthony Paolitto,^e Didier Letourneur, PhD,^{a,f} and Anne Meddahi-Pellé, MD, PhD^{a,g}

The Journal of Thoracic and Cardiovascular Surgery • September 2009





PHILIPS

15/12/2009

12:04:27

TIS1.1 MI 0.8

S7-2omni/ECOCAR D

FR 39Hz
11cm

M3

2D
46%
C 50
P Off
Gen



POSTCEC

JPEG

53 bpm

PHILIPS



FR 22Hz
13cm

2D
60%
C 50
P Off
APen
CF
70%
4.9MHz
WF Alto
Med.



M, 43 y (C.M.)
 Bicuspid aortic valve, moderate
 regurgitation
 Ascending Aorta dilatation (47mm)
 Aortic root 43 mm



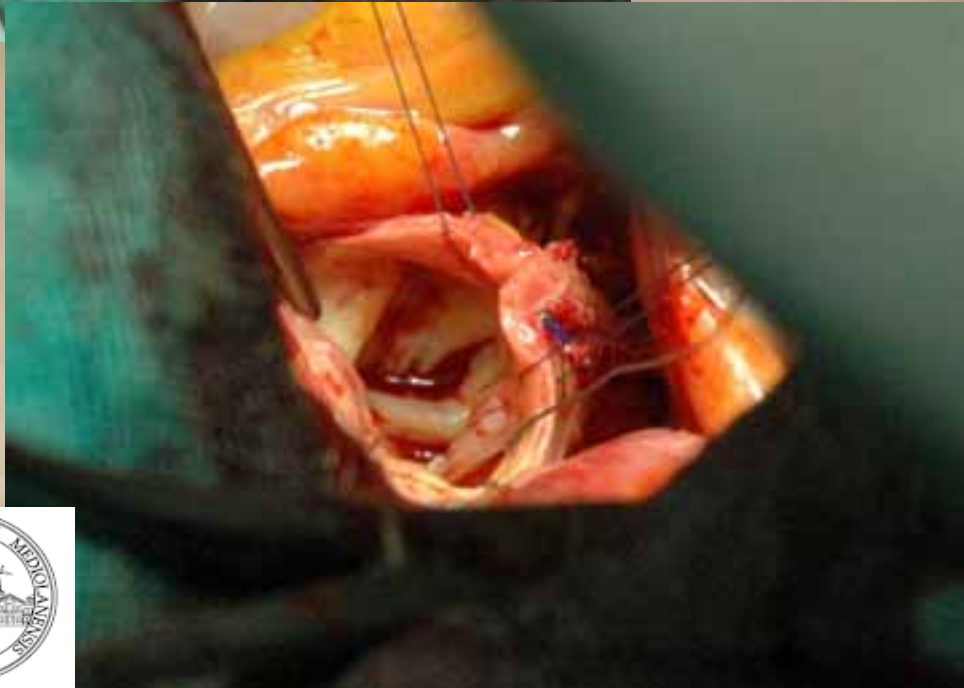
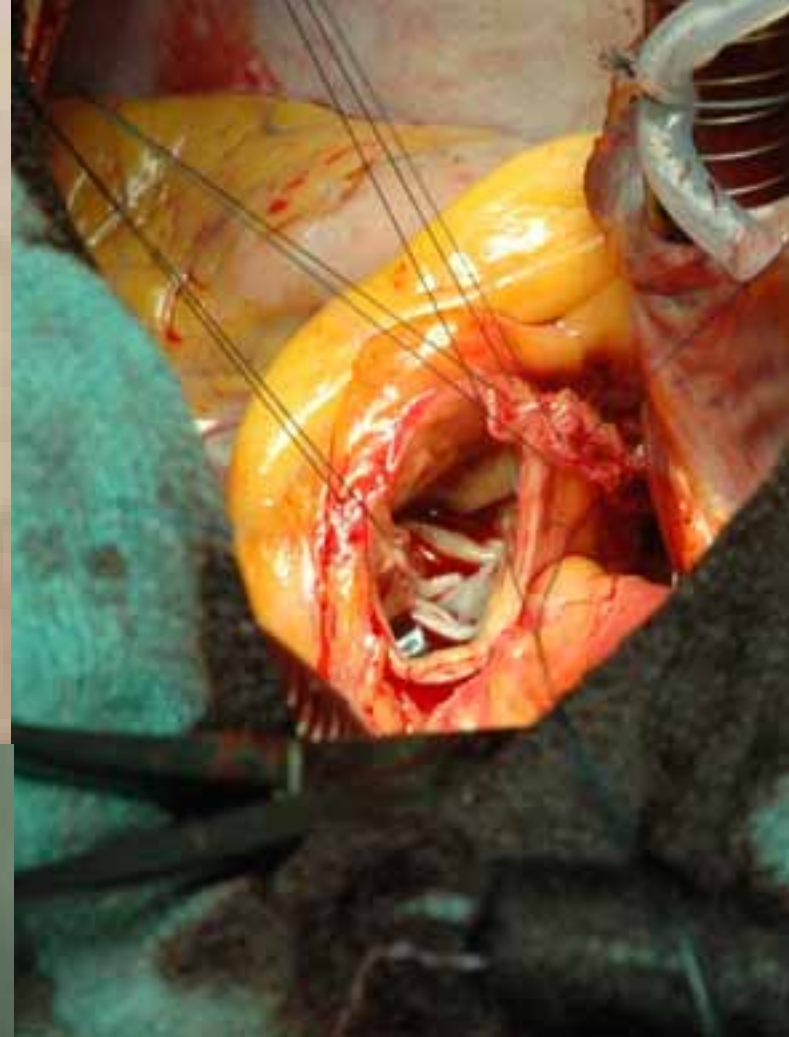
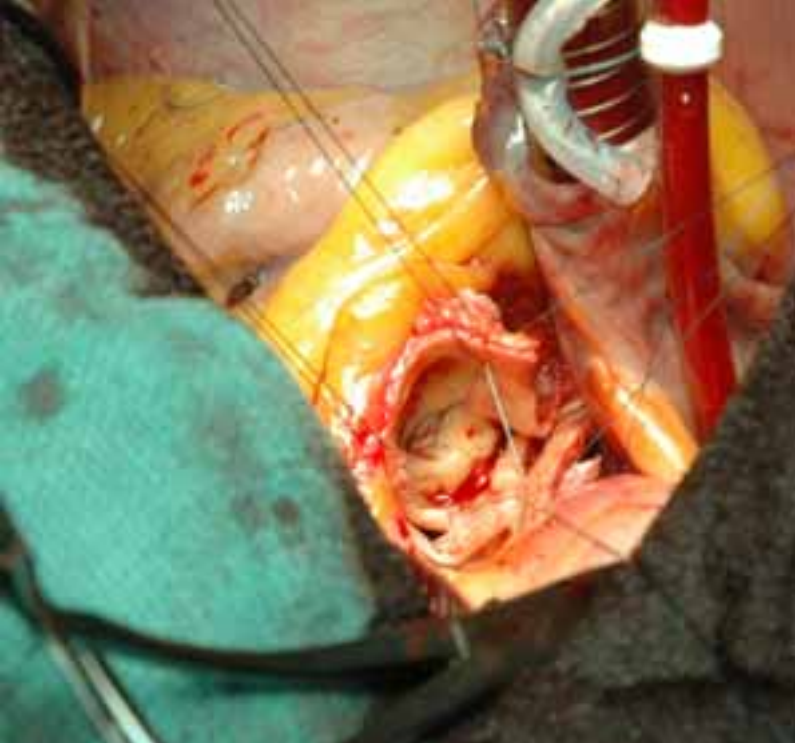
JPEG

77 bpm

CF
70%
4.9MHz
WF Alto
Med.



AORTIC
VALVE
REPAIR



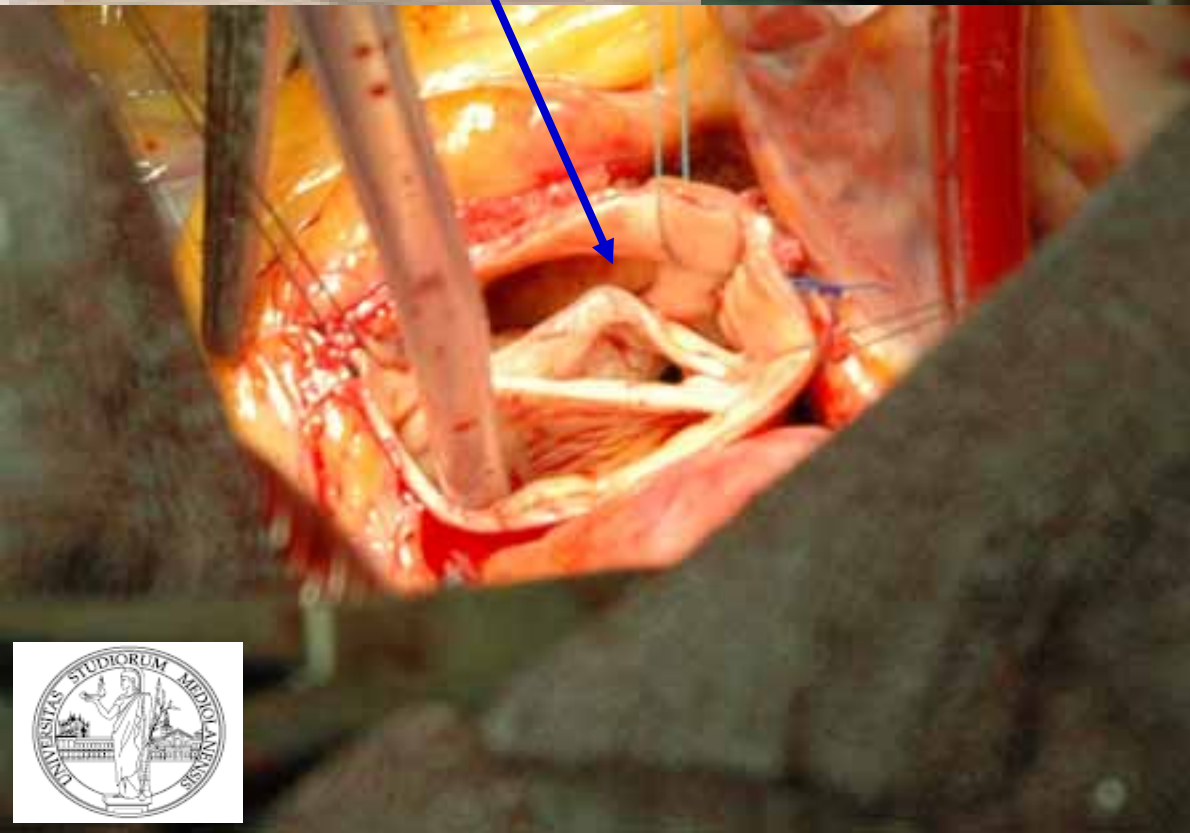
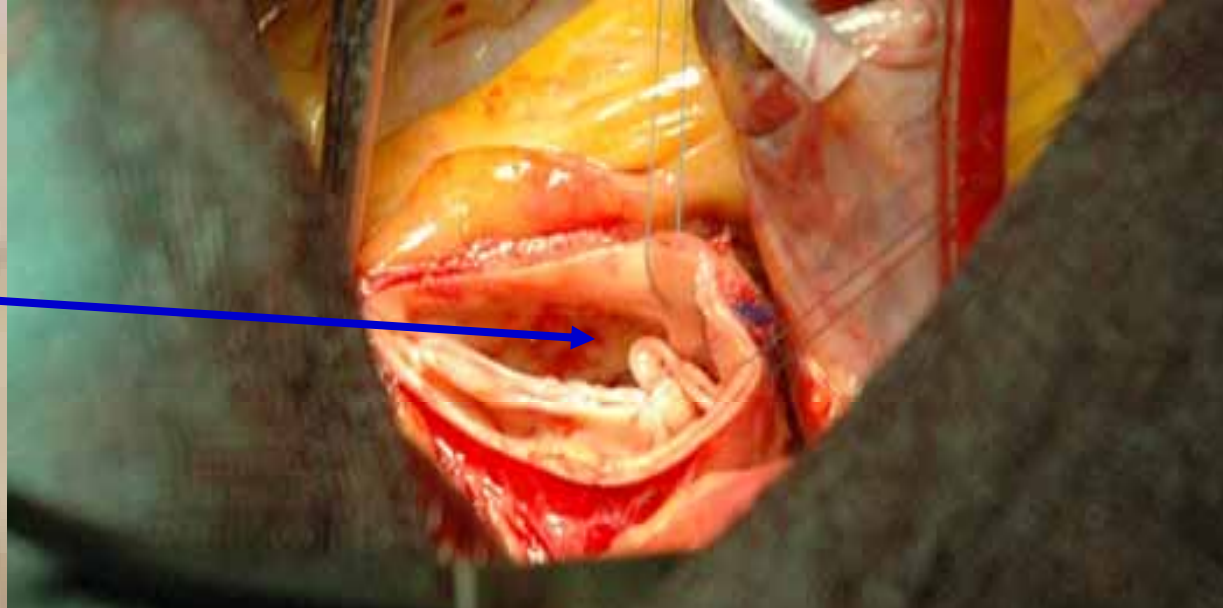
NC SINUS REDUCTION

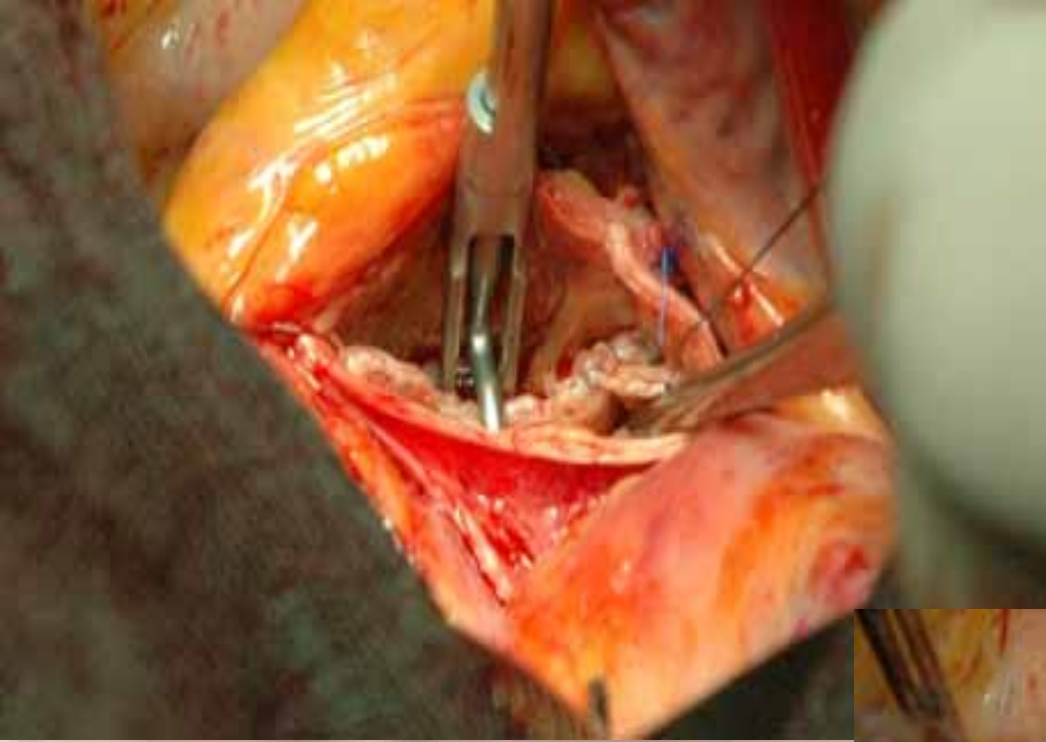


AORTIC
VALVE
REPAIR

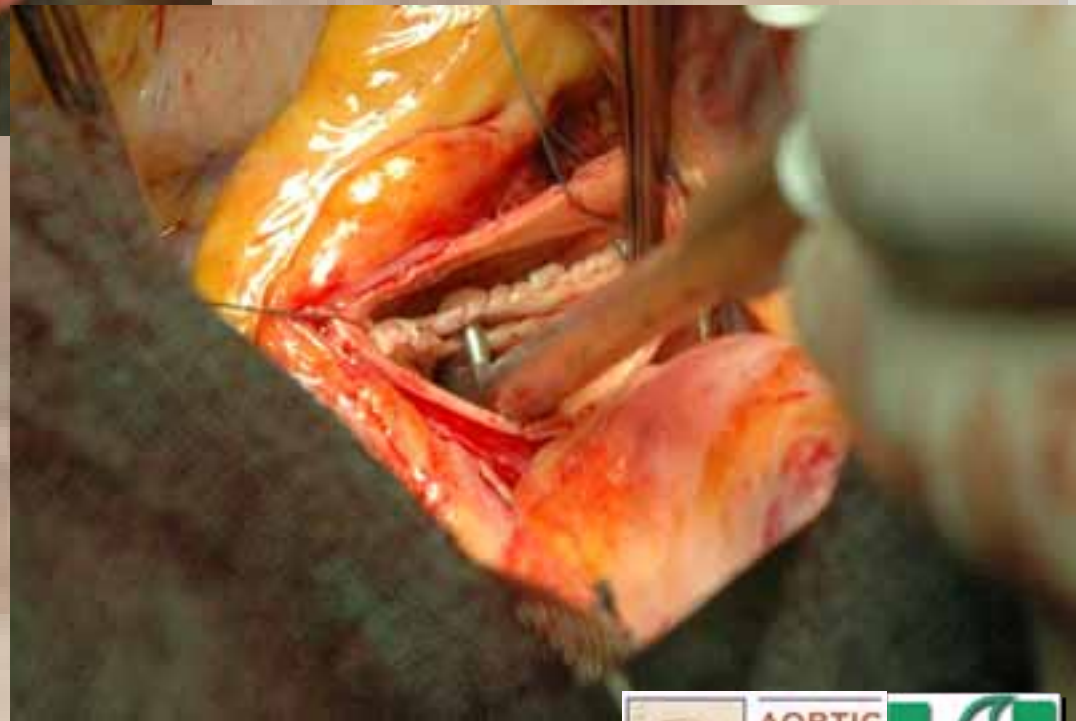


Leaflet prolapse



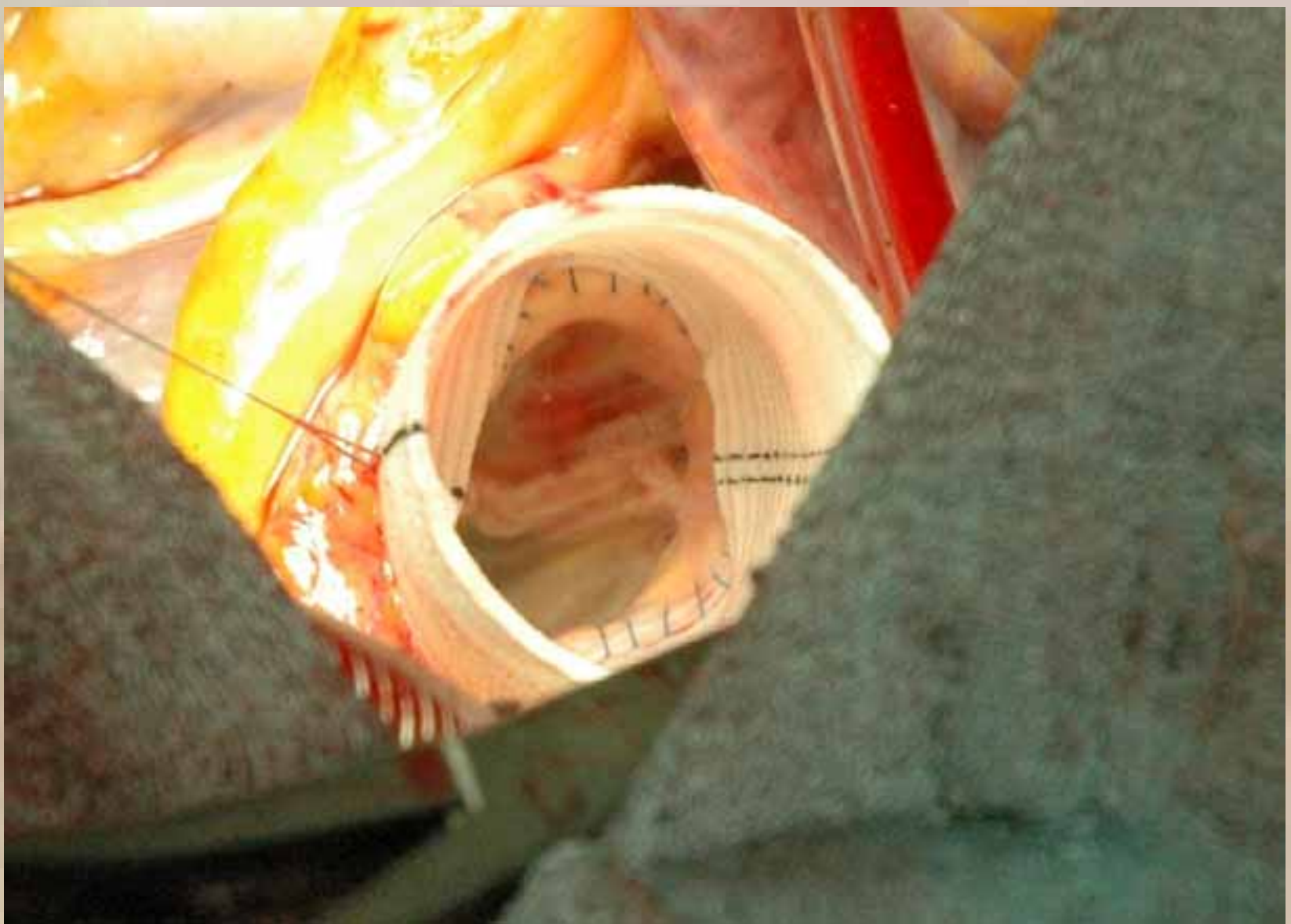


- Leaflet plication
- Subcommissural annuloplasty
- Free margin reinforcement



Coaptation height
measurement





ASCENDING AORTA REPLACEMENT



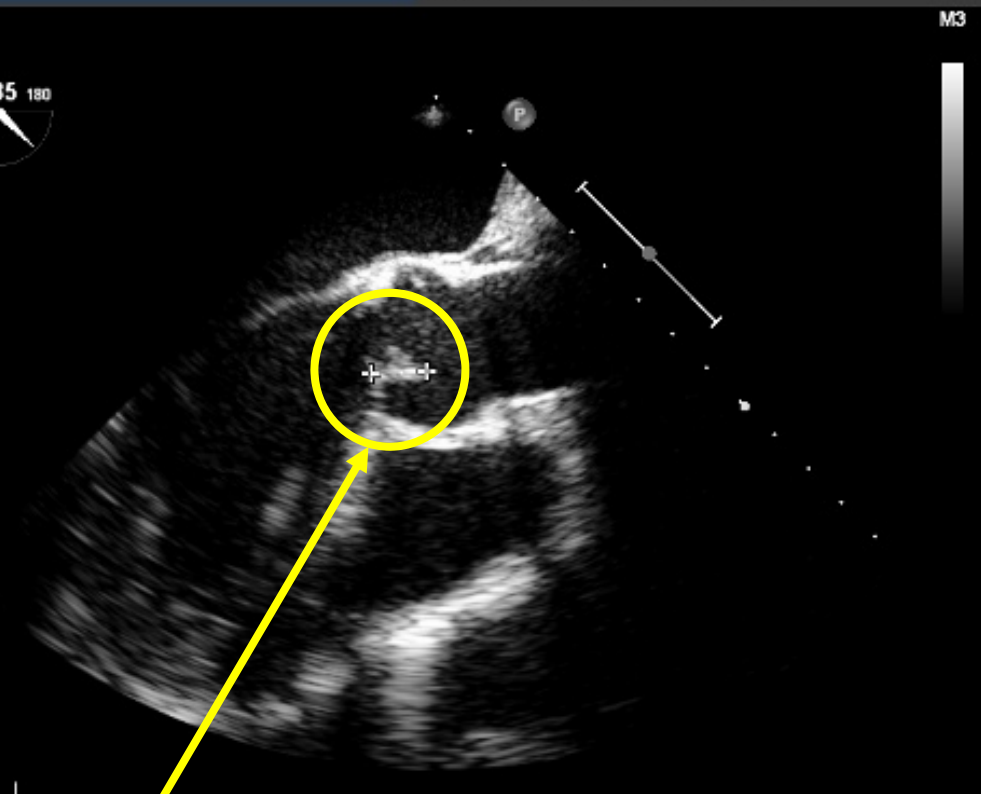
FINAL RESULT



FR 49Hz
14cm

M3

2D
56%
C 50
P Off
APen



Asc Ao=2.55 cm
STJ=2.54 cm
SoV=3.48 cm

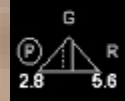
27/01/2010 12:33:01 TIS0.8 MI 1.1
IRURGIA S7-2omni/Adulti

M3

PHILIPS .17 cm

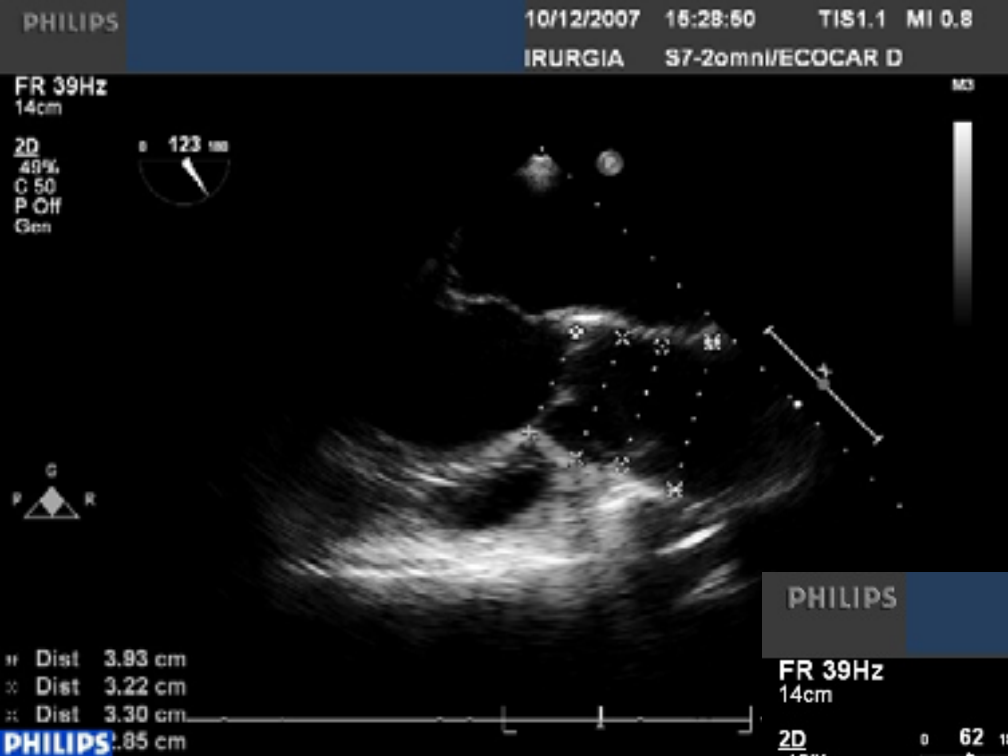
***bpm

CL=1.17 cm

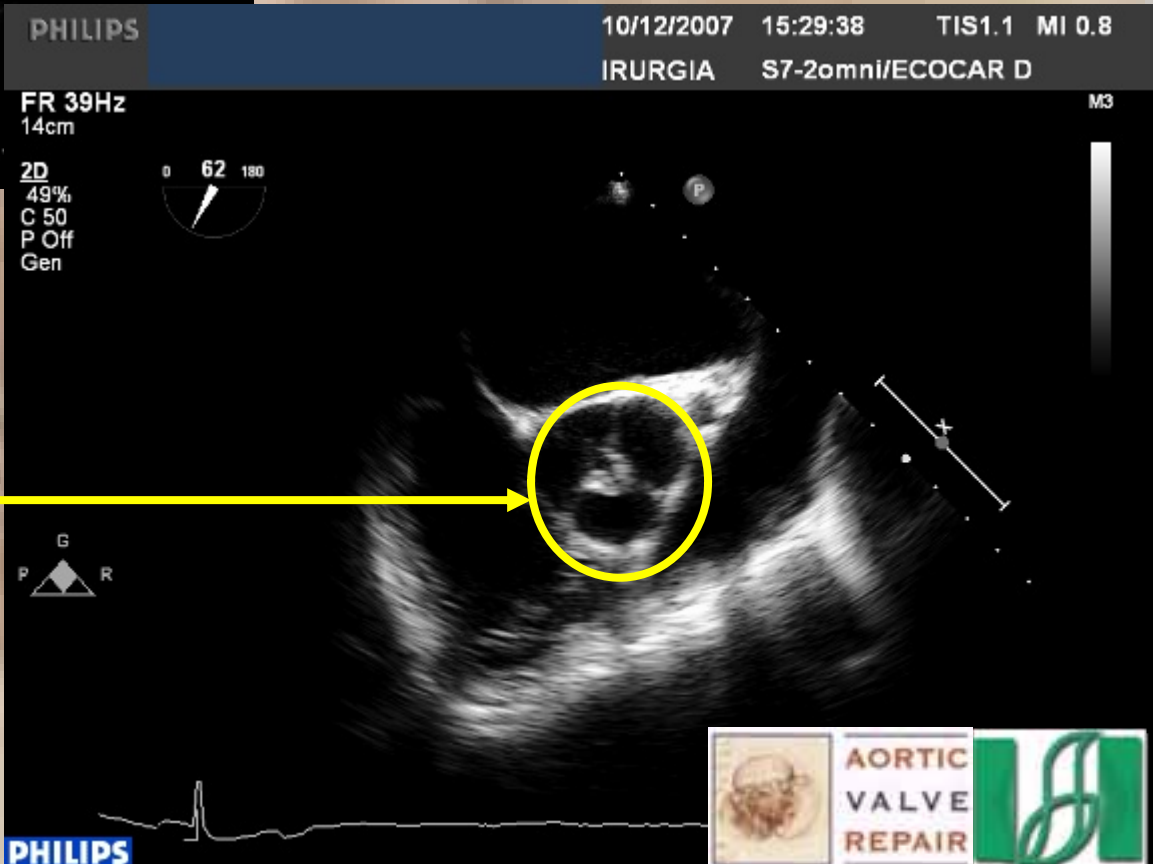


Dist 2.55 cm
Dist 2.54 cm
PHILIPS 3.48 cm





M, 51 y (S.I.)
Bicuspid aortic valve, severe AR.
Ascending Aorta dilatation (45 mm)



PHILIPS

10/12/2007 15:30:03 T1S1.3 MI 0.7
S7-2omni/ECOCAR D

FR 16Hz
14cm

2D
54%
C 50
P Off
Gen
CF
70%
4.9MHz
WF Alto
Med.

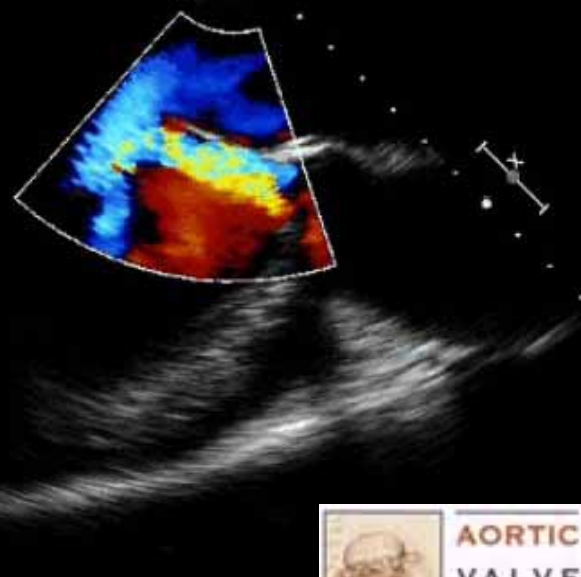


10/12/2007 15:27:34 T1S1.3 MI 0.7
S7-2omni/ECOCAR D

PHILIPS

JPEG
*** bpm

CF
70%
4.9MHz
WF Alto
Med.



 **AORTIC VALVE REPAIR** 

PHILIPS



Raphe resection



Patch repair





Free margin shaving



CV 7 reinforcement

NC leaflet prolapse



Ascending Aorta replacement



PHILIPS

10/12/2007 17:52:15 TIS1.2

S7-2omni/ECOCAR D

FR 53Hz
13cm

2D
54%
C 50
P Off
Gen



G
P R



JPEG

*** bpm



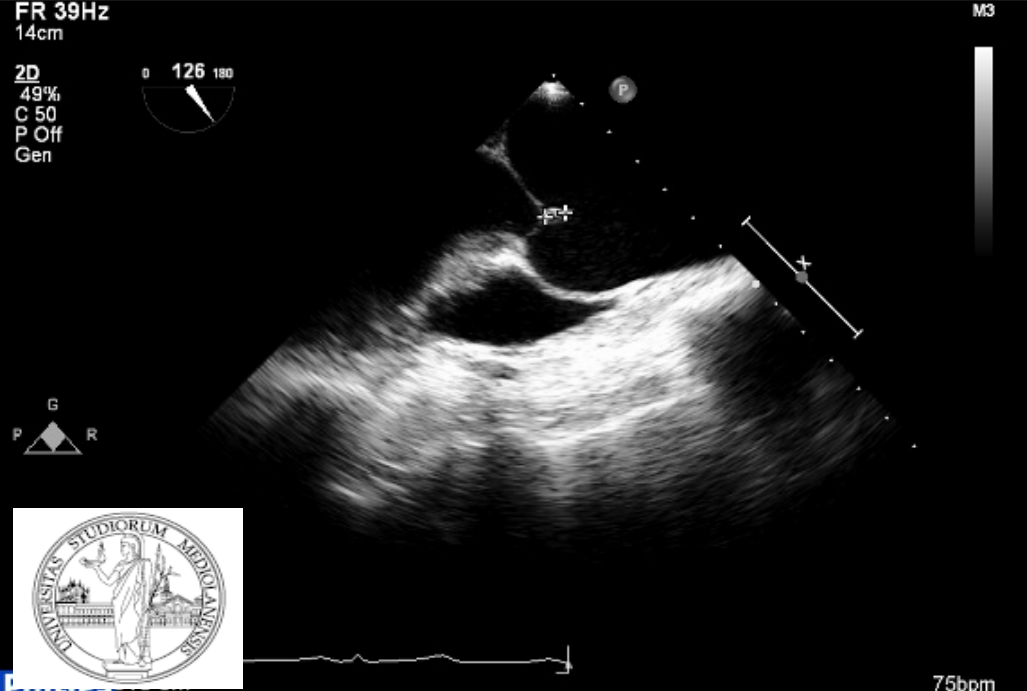
F, 14 y (P.G.)
Marfan, moderate AR
Aortic root dilatation

Asc Ao= 4 cm
STJ=4.7 cm
SoV= 4.9 cm
Anulus= 2.5 cm



PHILIPS
CISLAGH
FR 39Hz
14cm

10/24/2007 09:21:05 TIS1.1 MI 0.8
IRURGIA S7-2omni/ECOCAR D

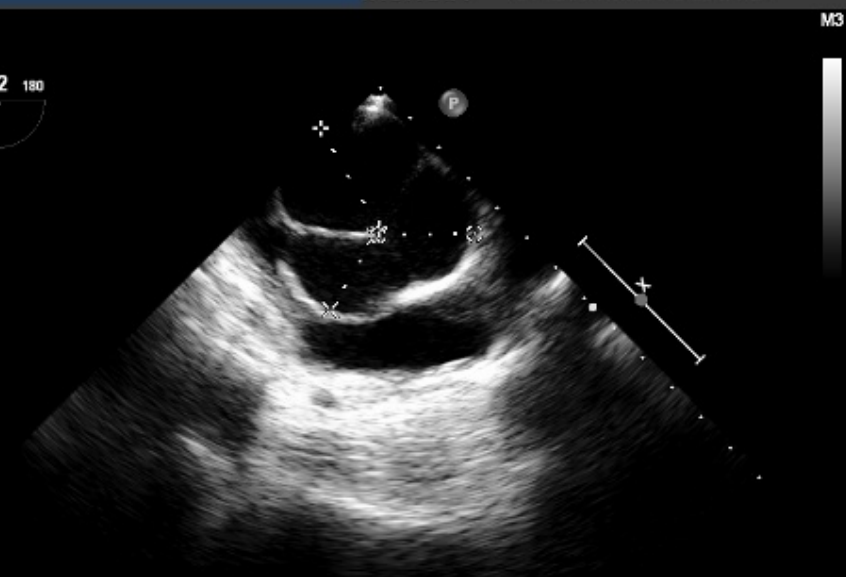


Aortic root:
NC=2.77 cm
LC= 2.31 cm
RC=2.05 cm

FR 39Hz
14cm
2D
49%
C 50
P Off
Gen



G
P R



FR 21Hz
13cm

2D
53%
C 50
P Off
Gen
CF
70%
4.8MHz
WF Allo
Med.



Dist 2.31 cm
Dist 2.05 cm
PHILIPS 2.77 cm



G
P R



212bpm

83 bpm



 **AORTIC VALVE REPAIR** 

FR 39Hz
14cm

2D
49%
C 50
P Off
Gen



10/24/2007 09:18:40 TIS1.4 MI 0.7

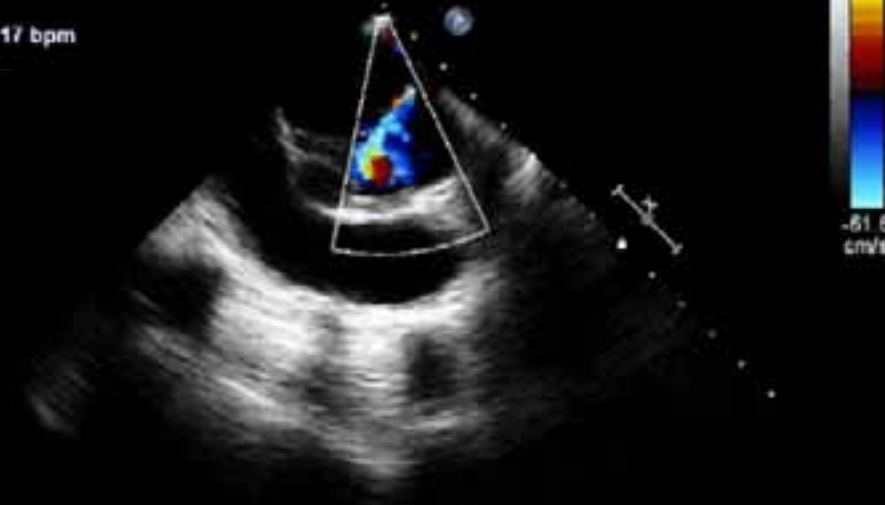
S7-2omni/ECOCAR D



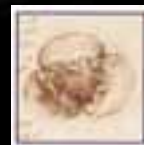
JPEG

117 bpm

Gen
CF
70%
4.9MHz
WF Auto
Med.



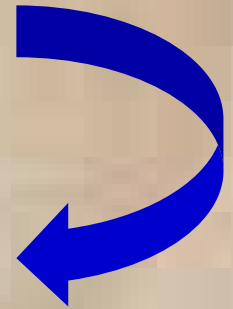
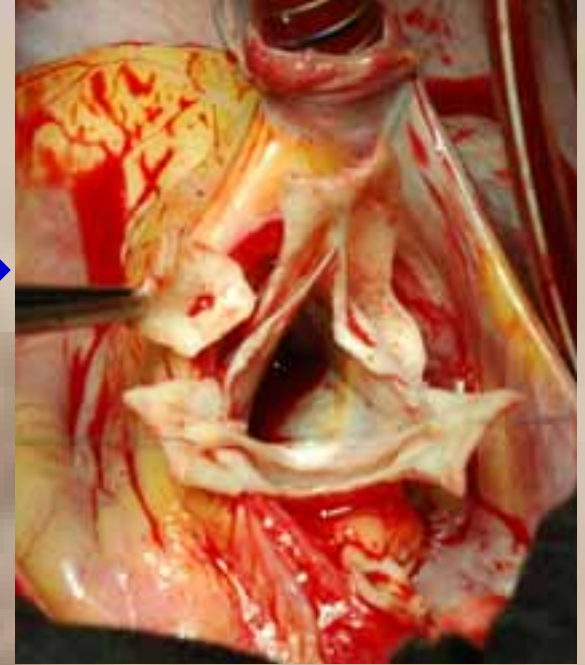
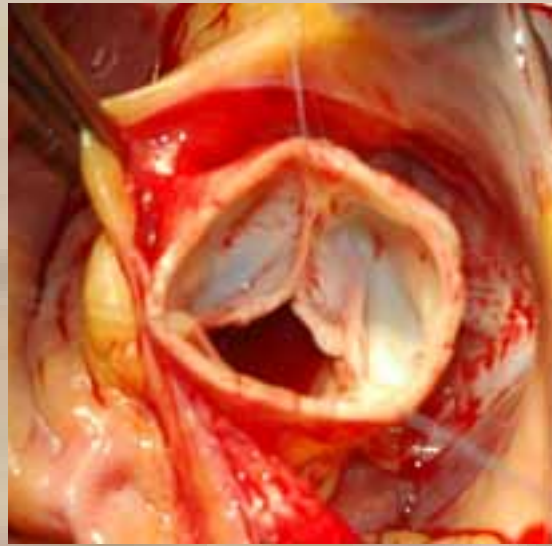
MO M4
+61.6
-61.6
cm/s



AORTIC
VALVE
REPAIR

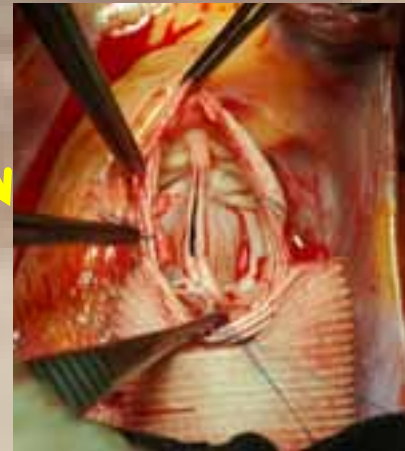
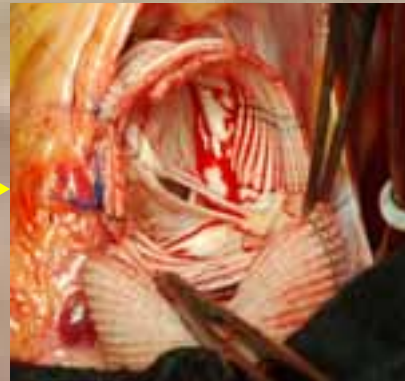
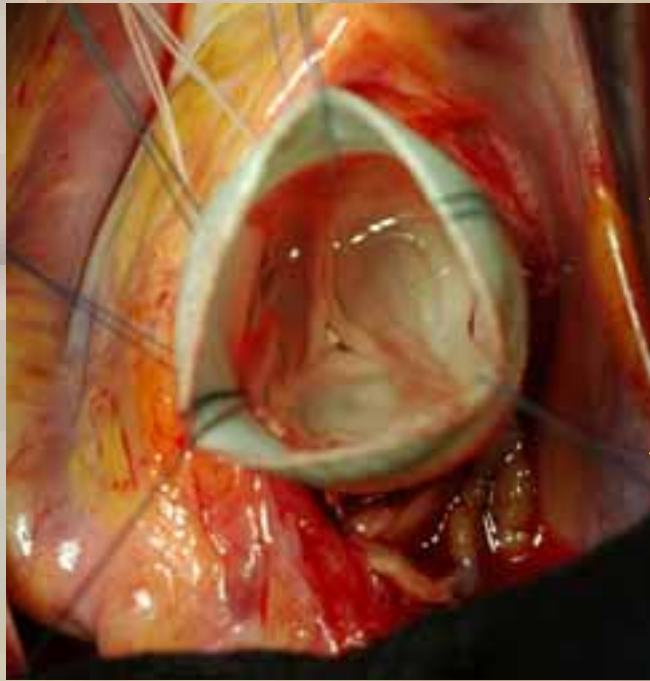


**TD I
procedure**



**AORTIC
VALVE
REPAIR**

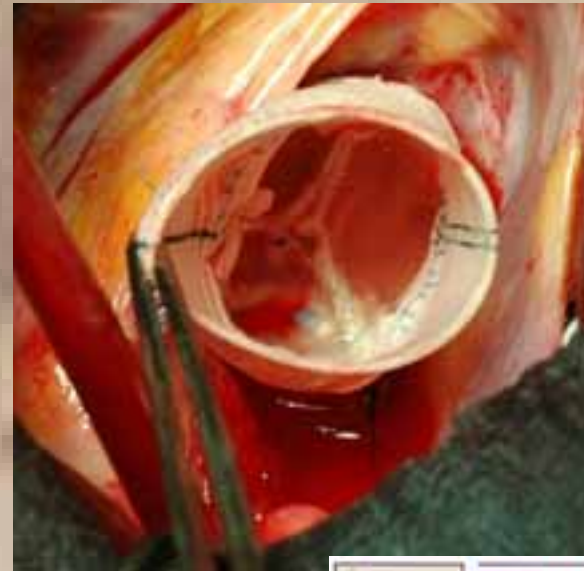
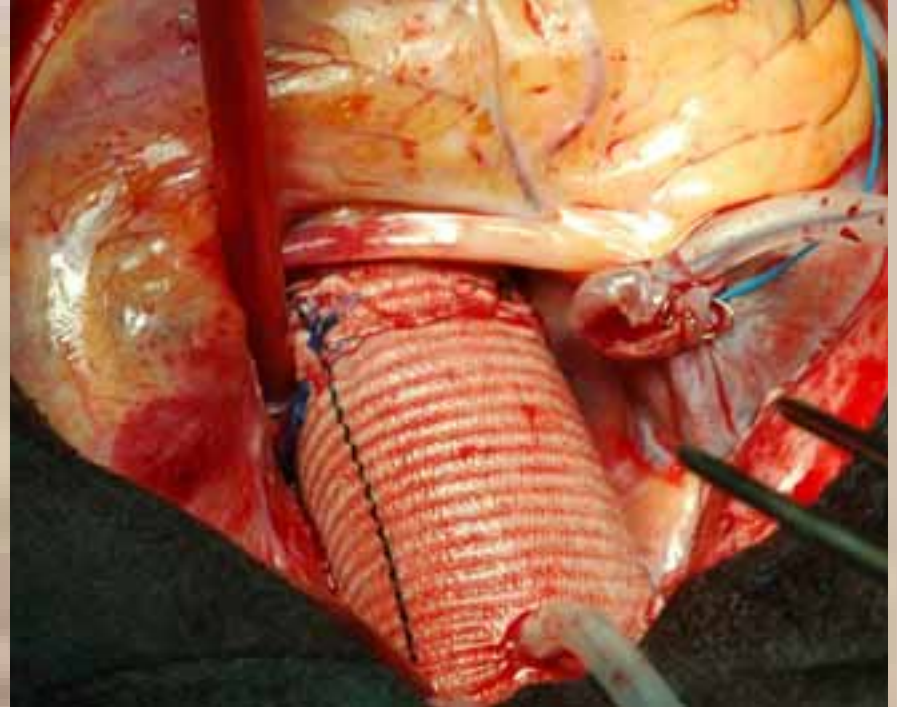




NC and LC
leaflets prolapse



- NC leaflet plicature
- LC leaflet plicature
- Partial subcommisural annuloplasty (NC-LC triangle)





PHILIPS POSTCEC (TYRON DAVID I)



PHILIPS POSTCEC (TYRON DAVID I)



AORTIC VALVE REPAIR



Asc Ao=2.8 cm
Aortic root=1,95 cm

FR 39Hz
11cm

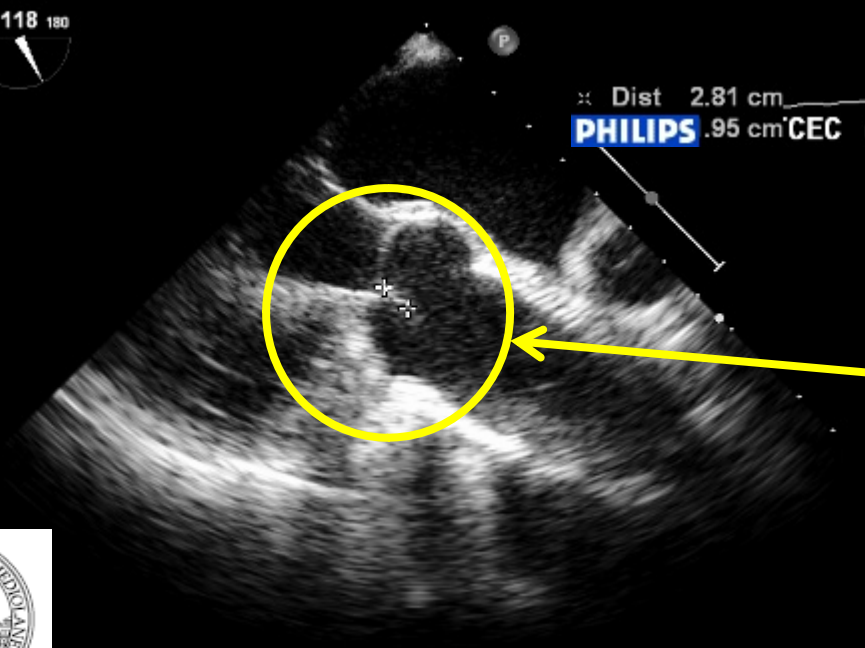
2D
40%
C 53
P Off
Gen



M3

FR 53Hz
13cm

2D
54%
C 50
P Off
Gen



Dist 2.81 cm

PHILIPS .95 cm CEC (TYRON DAVID I)

106bpm

CL=0.83



AORTIC
VALVE
REPAIR



***bpm

CLINICAL FEATUES

	n°	%
n°	166	
Male	107	64,46%
Age	58,49	35,24%
Smoke	22	13,25%
History of familiar CAD	6	3,61%
CAD	26	15,66%
Hypercholesteremia	22	13,25%
Diabetes	3	1,81%
Hyperension	61	36,75%
COPD	10	6,02%
endocarditis	2	1,20%
Periferal vascular disease	10	6,02%
Cerebrovascular disease	11	6,63%
Previous AMI	2	1,20%
History of familiar Marfan Disease	8	4,82%
HIV	3	1,81%



**AORTIC
VALVE
REPAIR**

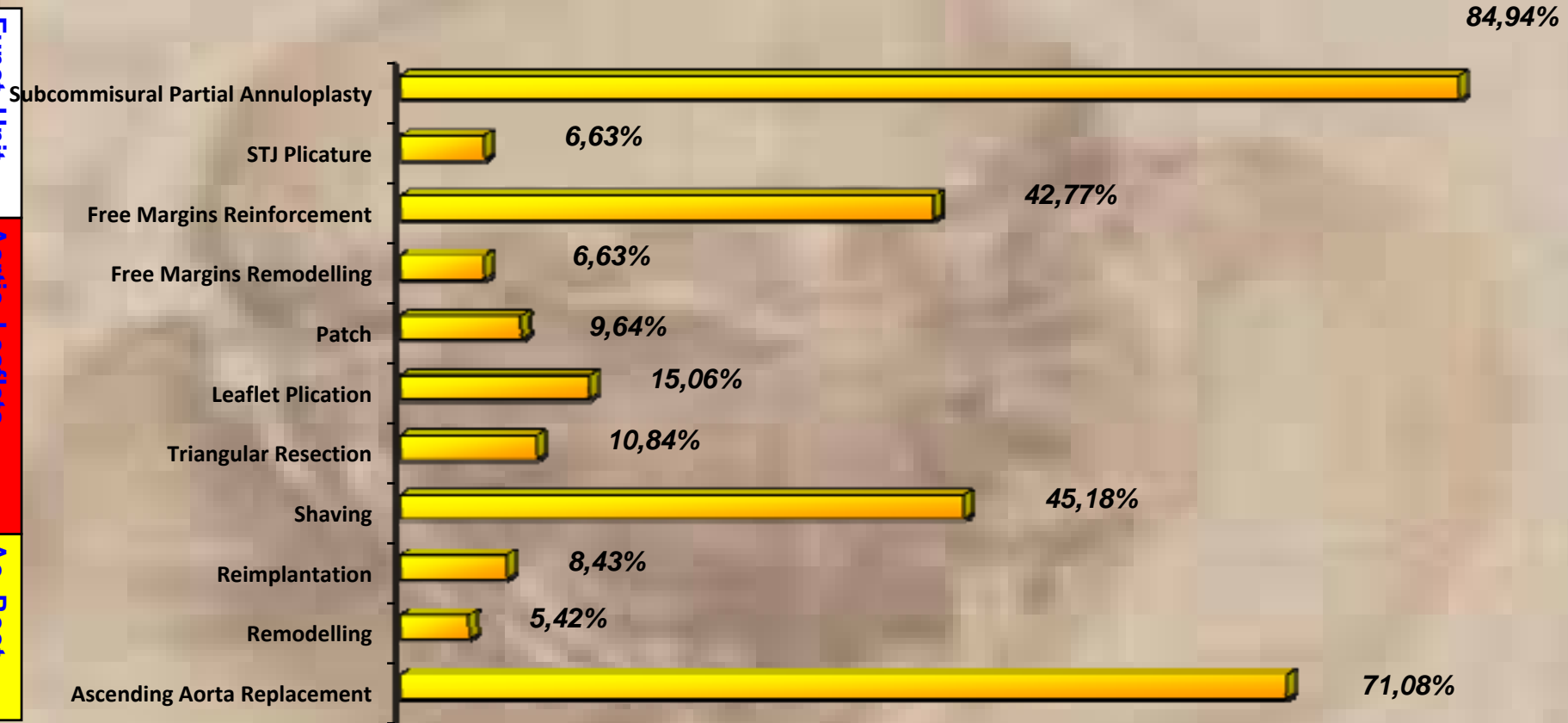


SURGICAL RESULTS

Funct. Unit

Aortic. Leaflets

Ao. Root



PERIOPERATIVE RESULTS

MORTALITY

1/149(0.67%)

INTRAOPERATIVE CONVERSION

2/149(1.34%)

PRE-DISCHARGE REOPERATION

2/149(1.34%)



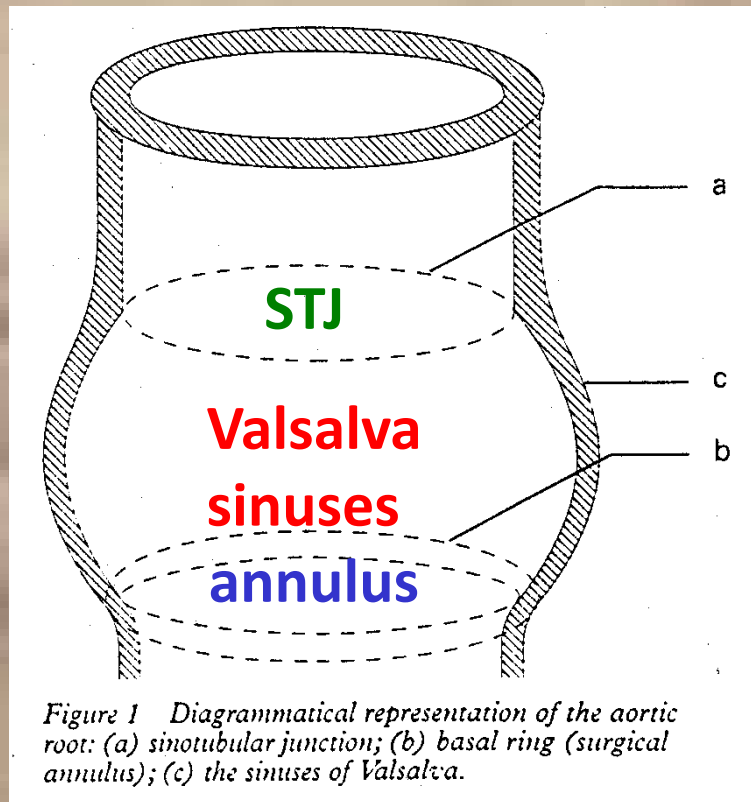
AORTIC FUNCTIONAL UNIT DIAMETERS

PRE-OP.

42.1±7.74

44.4±12.02

24.9±2.32



POST-OP.

34.6±5.53mm ($p \leq 0.01$)

37.4±3.23mm ($p \leq 0.01$)

20.4±0.92mm ($p \leq 0.01$)

BT 211 B

**Aortic root
Long-axis view
Normal diameters**

POST-OP.

34.6±5.53mm

37.4±3.23mm

20.4±0.92mm



26.1±2.7



32.1±3.4



21.3±2.1



**36 MONTHS
Follow-up**

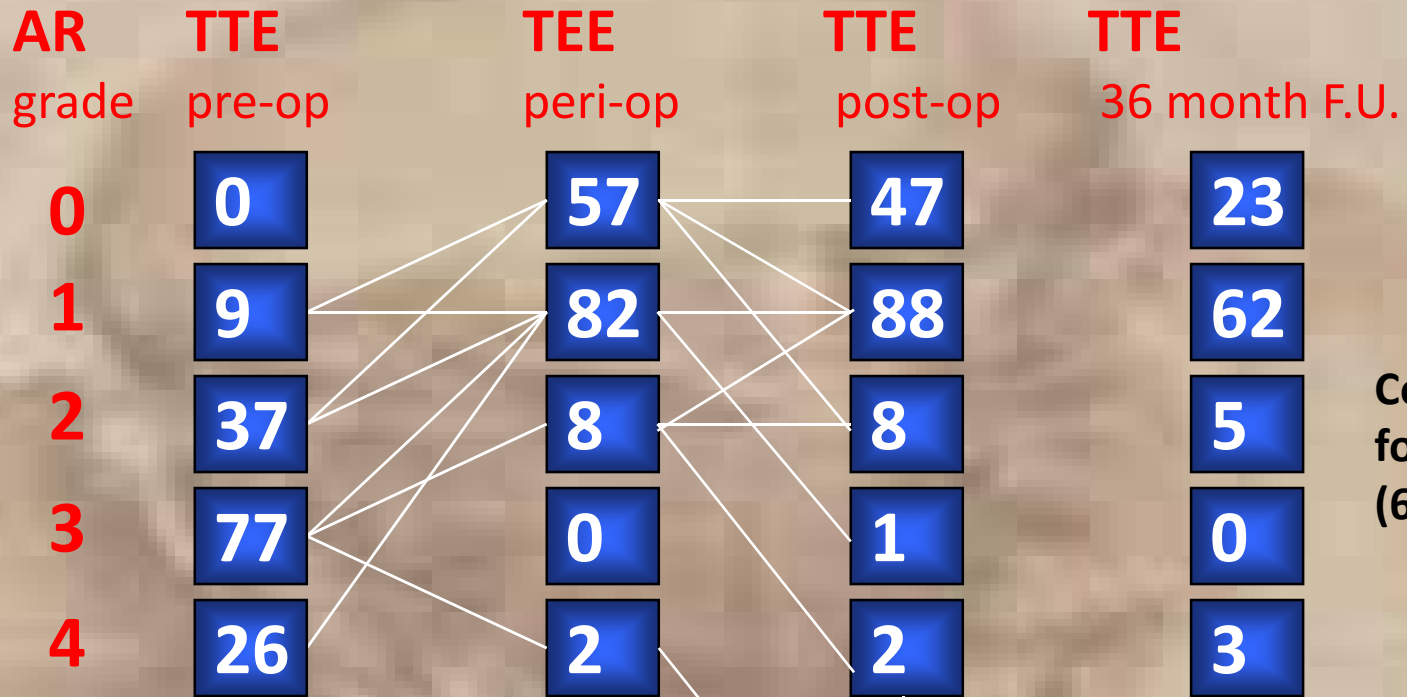
32.4±4.77mm

35.7±4.69mm

22.0±2.95mm



ECHO FOLLOW UP



Completed for 93 pts (62.4%)

INTRAOPERATIVE CONVERSION

PRE-DISCHARGE REOPERATION

Death

AVR

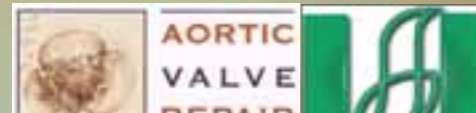
Free margins fibrosis

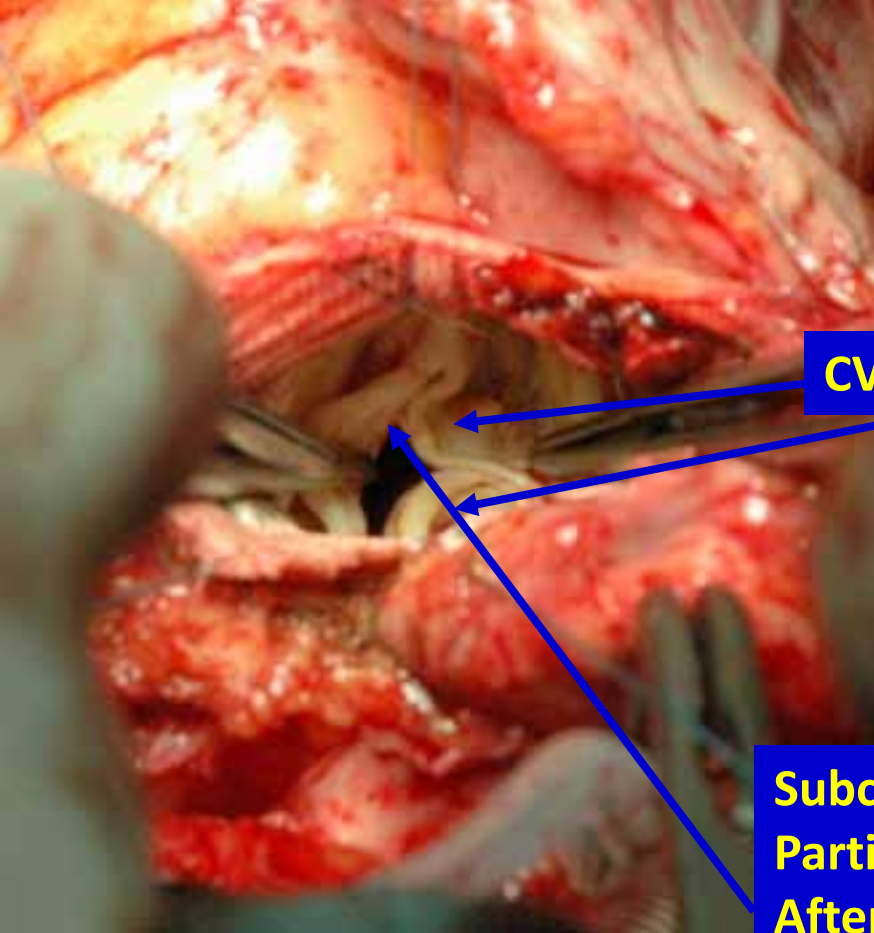
New repair due to suture dehiscence



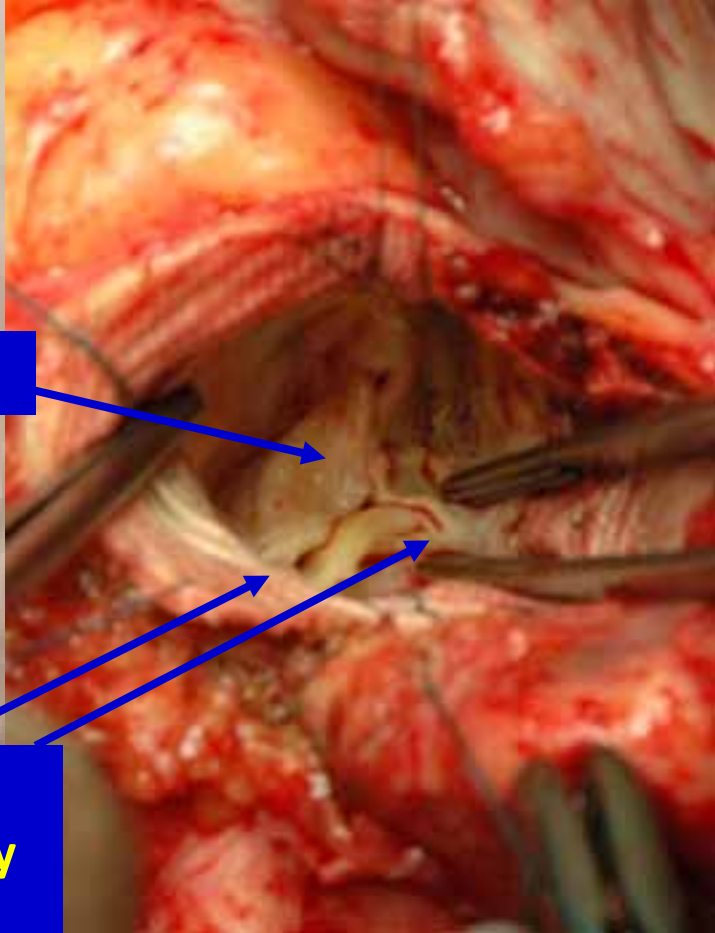
CV-7 after 1year

**Subcommissural
Partial Annuloplasty
After 1 year**





CV-7 after 5 year



**Subcommissural
Partial Annuloplasty
After 5 year**



CONCLUSIONS

Aortic repair solve the cause and effect of Ao regurgitation

Correction and stabilization of FAA

Correction of leaflet pathology

Reduction of dilatation of LV

New approach for surgeons

Functional classification

Learning curve

Knowledge Transfer

New approach for echocardiographist

New criteria for repair evaluation

