Overview of Aortic Regurgitation in the Operated Adult with Congenital Heart Disease .

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RABIN MEDICAL CENTER
BEILINSON • HASHARON

Previous operations and catheter interventions for -

- aortic valve disease - previous surgical/balloon valvotomy, aortic valve repair
- previous aortic valve replacement - mechanical, stented xenograft, stentless valve, homograft and pulmonary autograft
- valve sparing procedures - replacement of ascending aorta

Previous congenital interventions other than aortic valve

- subaortic stenosis surgery
- aortic coarctation surgery/cath.
- VSD closure - surgery/cath
- ASD closure - surgery/cath
- Fallot's tetralogy and other cono-truncal malformations
- transposition complex and other complex congenital heart disease

causes of aortic regurgitation in the operated patient - 1

- degenaration of a previously repaired valve
- degeneration of biological valve substitutes
- failure of mechanical valves - thrombus, pannus
- peri-prosthetic valve leak

causes of aortic regurgitation in the operated patient - 2

- infective endocarditis
- distortion of LVOT anatomy by surgical VSD patch or VSD device
- natural history of the disease with late occurrence of aortic regurgitation (not related to the original surgical intervention)
- deliberate avoidance of aortic valve repair/replacement during surgery

Assessment of aortic regurgitation

- Physical examination first!!
- Chronic aortic regurgitation has quite easily recognizable findings
- If you have to stretch your ears to hear a murmur or search for the apical impulse for five minutes, or you don't find a hyperdynamic/collapsing pulse with a high pulse pressure - don't let the echo mislead you!! cross check your findings!!

The Ross operation

- in general - very good long term results - need for reoperation in the range of 10% in 10 years, very low surgical and late mortality
- major concerns regarding the aortic autograft are aortic root dilatation and important aortic regurgitation
- pulmonary allograft deterioration - stenosis or regurgitation
- early (2 years) regurgitation and/or root dilatation are predictors of need for re-intervention. There is a steady increase in root size over the years

The Ross operation

J Heart Valve Dis. 2006 Jul;15(4):531-9.

An evaluation of the Ross operation in adults.

Yacoub et. al

Ann Thorac Surg. 2004 Sep;78(3):773-81; discussion 773-81.

The Ross procedure: long-term clinical and echocardiographic follow-up.

Kouchoukos et. al

J Heart Valve Dis. 2007 Jul;16(4):394-7.

The Ross operation for aortic valve disease: previous sternotomy results in improved long-term outcome.

Knott-Craig et al.

Circulation. 2009 Sep 15;120(11 Suppl):S146-54.

Autograft reinforcement to preserve autograft function after the ross procedure: a report from the german-dutch ross registry. (1335 pts.)

Charitos et al.

Ann Thorac Surg. 2009 Jan;87(1):95-102.

Ross operation in the adult: long-term outcomes after root replacement and inclusion techniques.

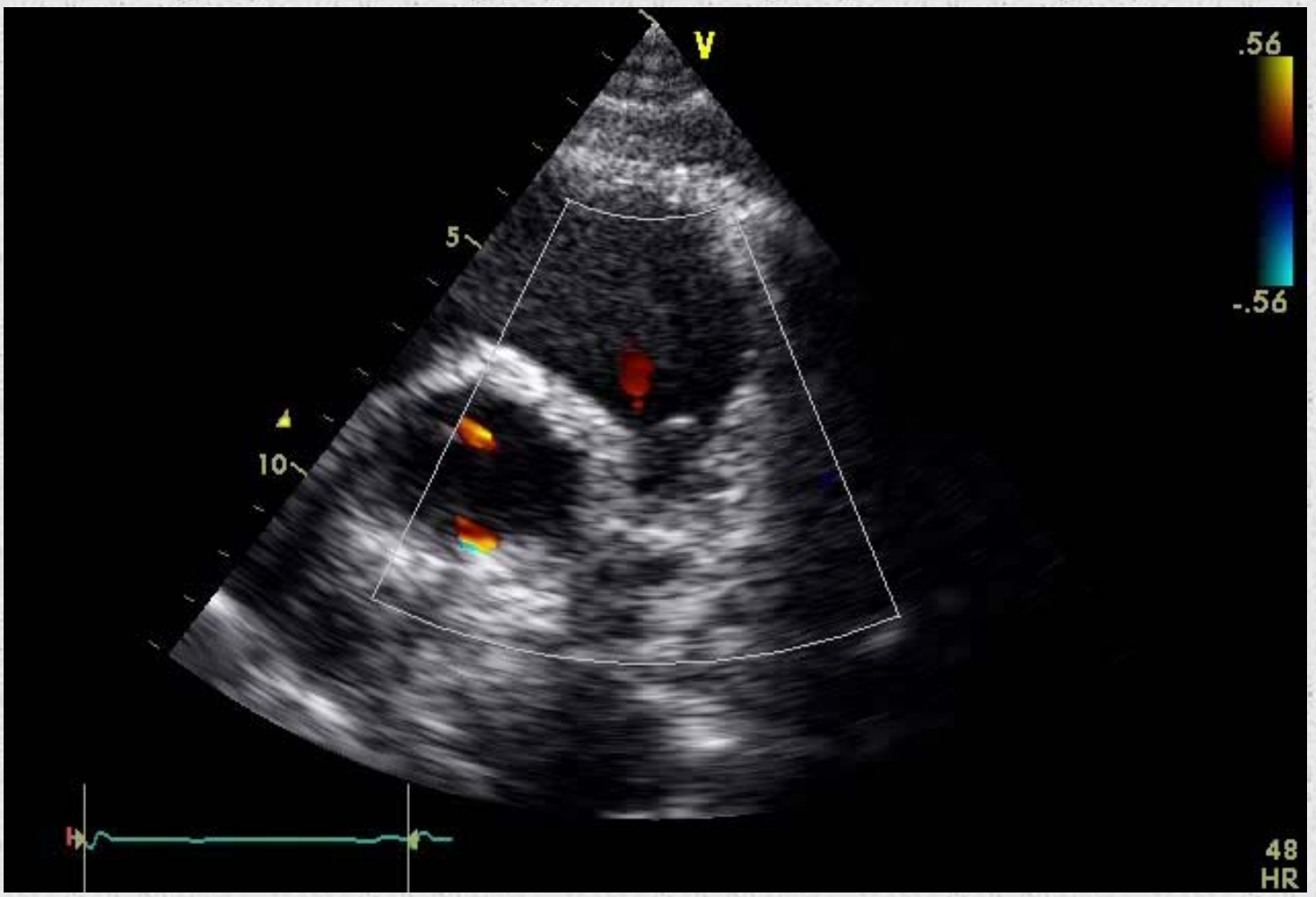
de Kerchove L et al.

Ann Thorac Surg. 2008 Aug;86(2):482-9.

The Ross procedure in adults: long-term follow-up and echocardiographic changes leading to pulmonary autograft reoperation.

Frigiola A et al

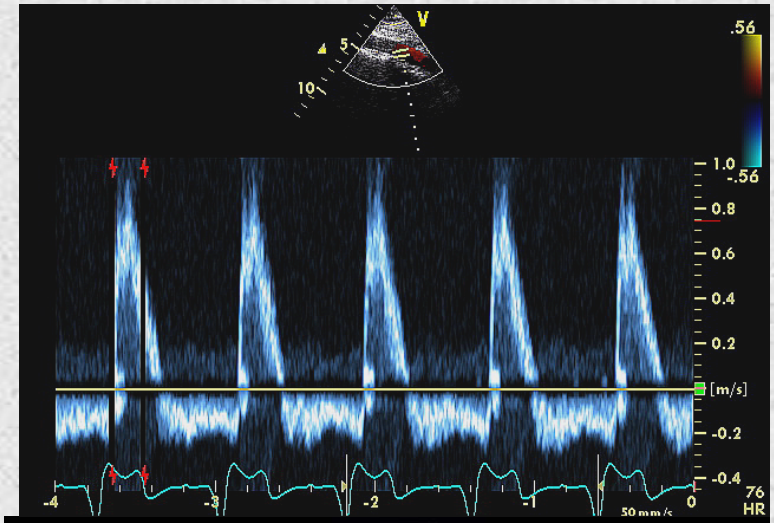
Recent Ross operation

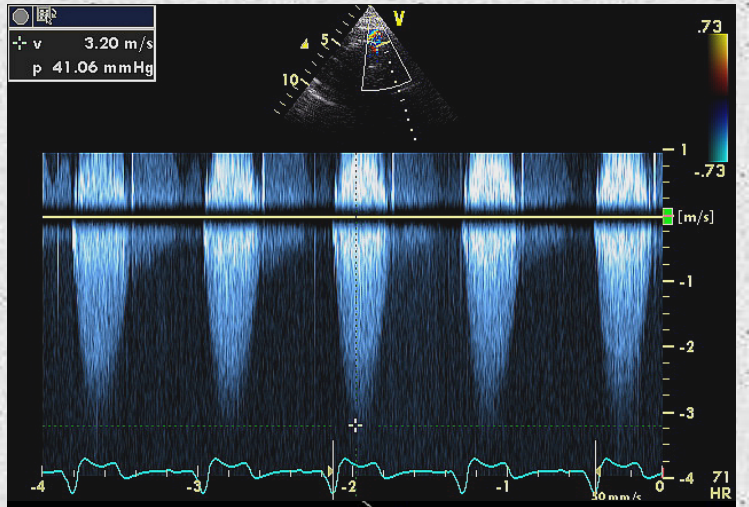


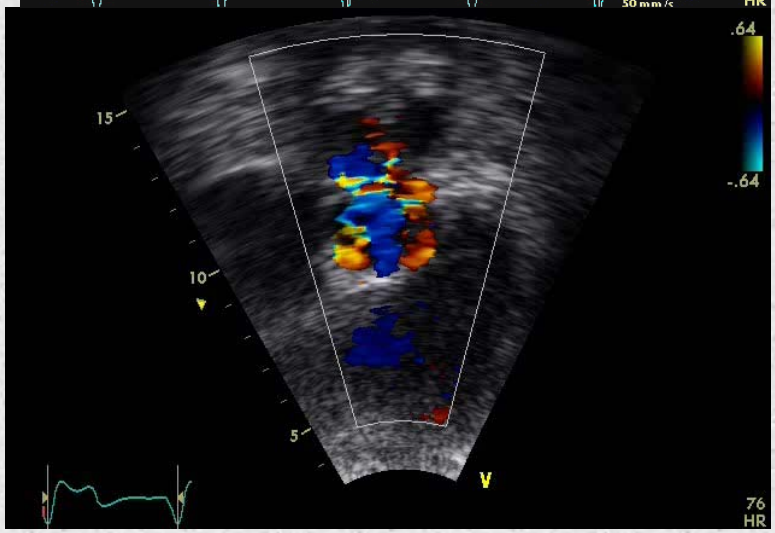
Discrete sub-aortic stenosis

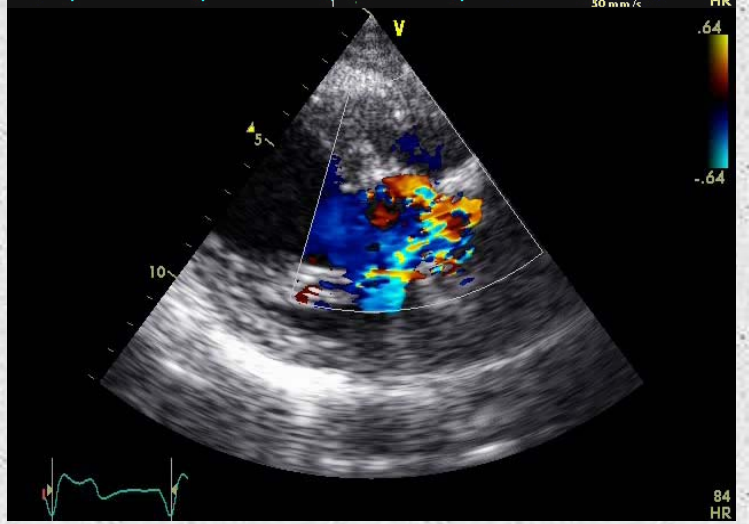
- aortic regurgitation is common but usually not severe and not progressive
- preventing worsening aortic regurgitation should not be a major consideration in decisions regarding surgery
- in adults with severe long standing DSS or DSS recurrence, the aortic valve is often covered by the abnormal fibrous tissue
- peeling of the tissue from the valve may result in paper thin leaflets but in many cases the valve is still functional (awaits long term results)

Konno age 16 years resulting in 2 homografts, permanent PM and accelerated AR with LV dilatation 13 years post op.







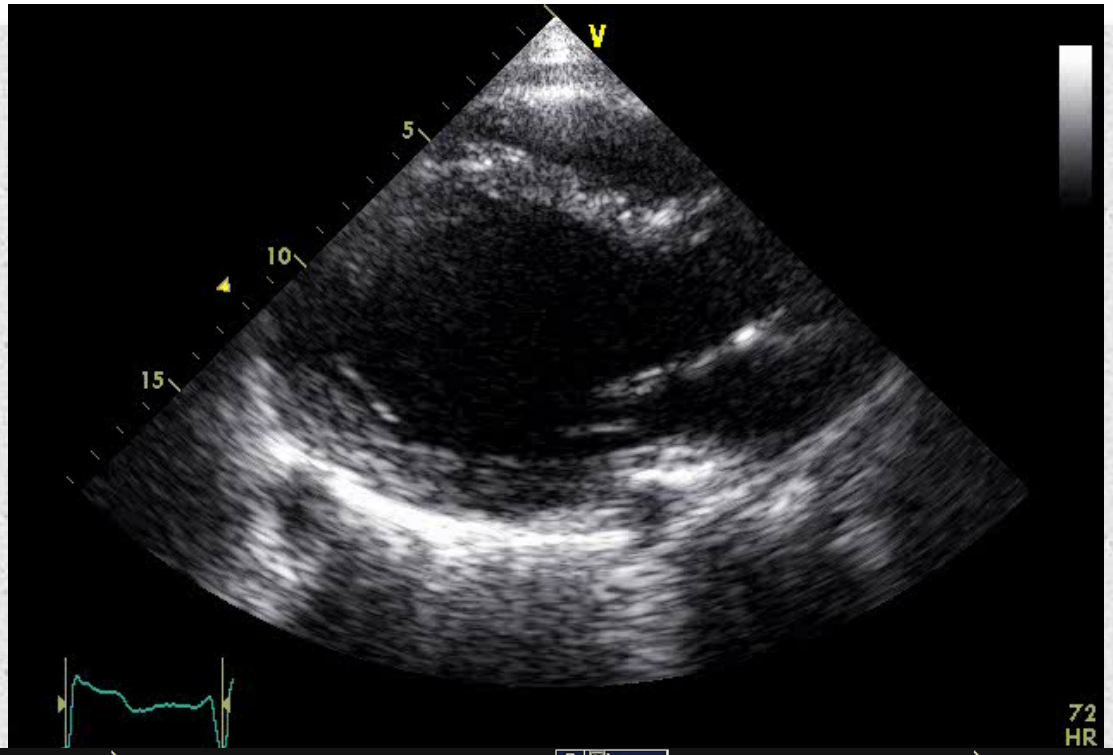


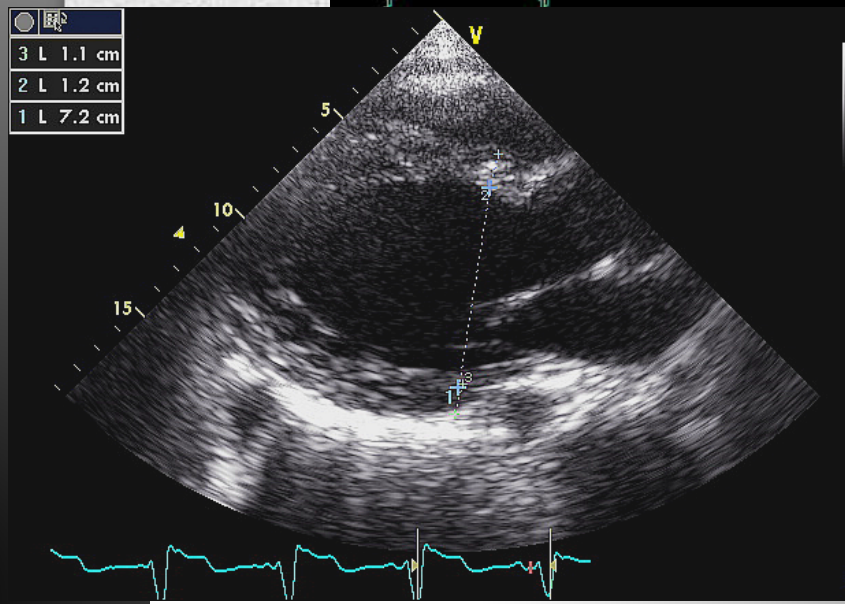
Fallot's tetralogy

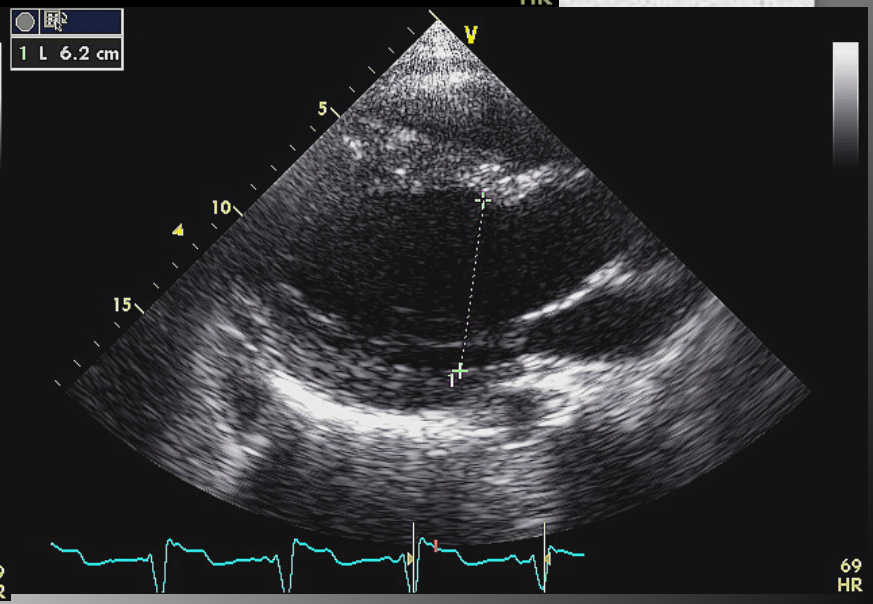
- Dilatation of the aortic root and some aortic regurgitation is common
- Clinically important dilatation and regurgitation are rare
- AR more common in subarterial VSDs, Fallot with pulmonary atresia
- The enlarged root was thought to be part of the asymmetrical development of the arterial trunk but now there is evidence of intrinsic arterial wall vasculopathy

33 y.o with repaired TOF

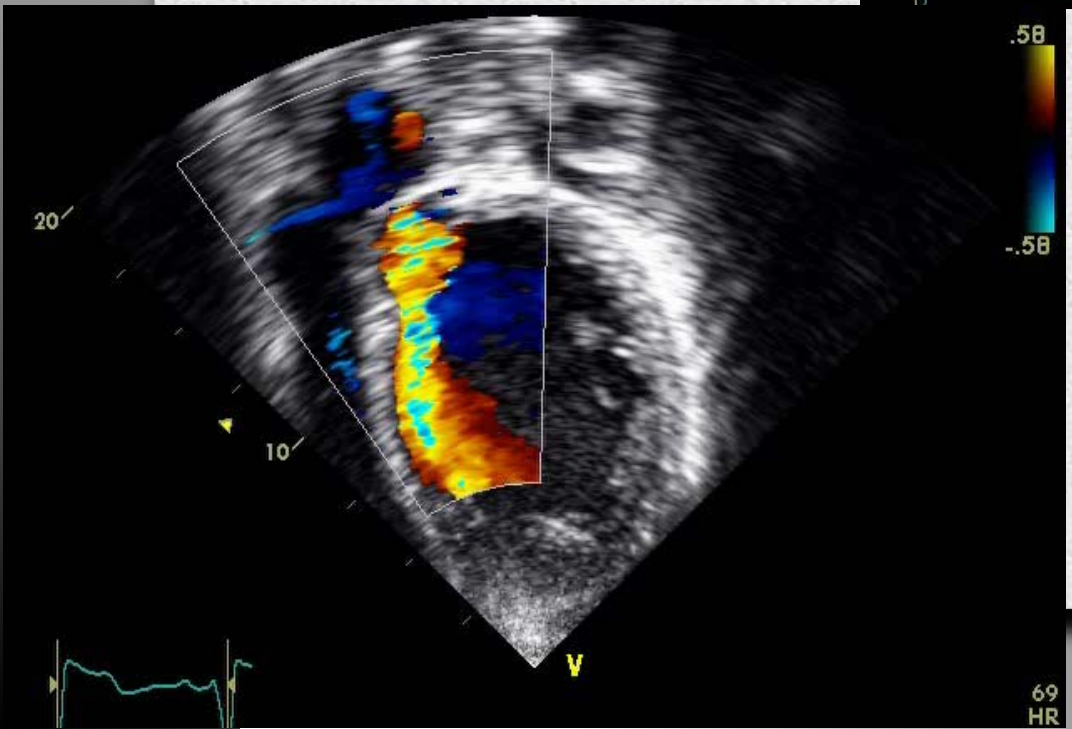
- very good initial repair of TOF, age 3 years.
- At 12 years - m/p endocarditis.
- Cath age 14 years - "will need AVR in the future"
- Not followed up for many years.
- Returns because of very poor FC

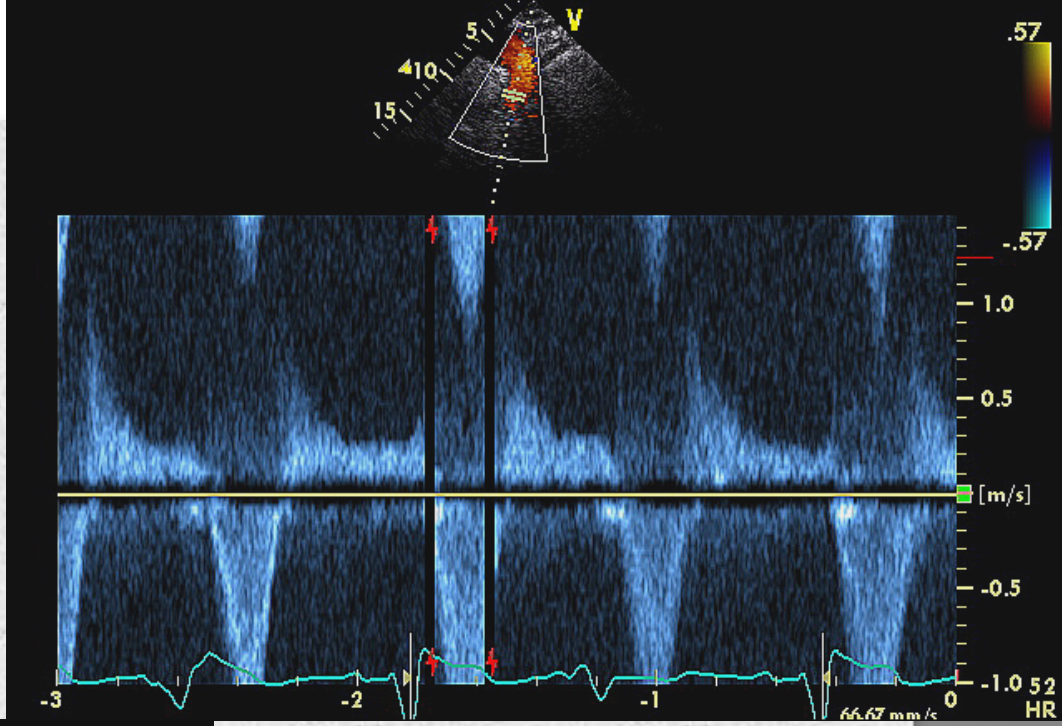

V
5
10
15
72
HR

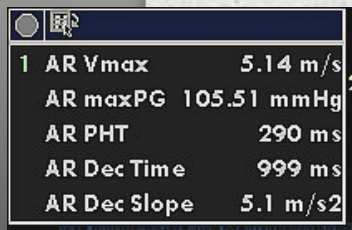

3 L 1.1 cm
2 L 1.2 cm
1 L 7.2 cm
V
5
10
15
69
HR

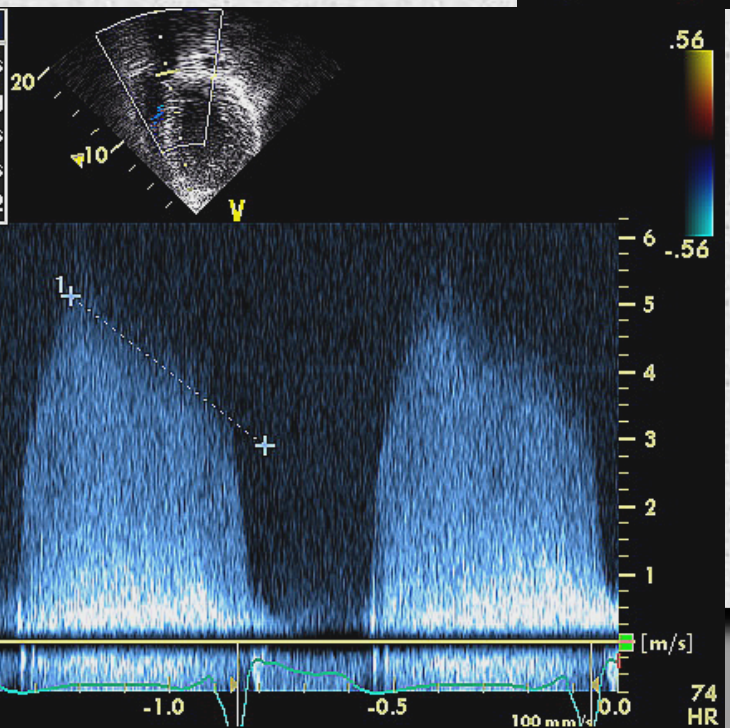

1 L 6.2 cm
V
5
10
15
69
HR


20
10
V
61
HR


.58
-.58
20
10
V
69
HR


5
10
15
V
.57
-.57
1.0
0.5
[m/s]
-0.5
-1.0
52
HR
-3
-2
-1
0

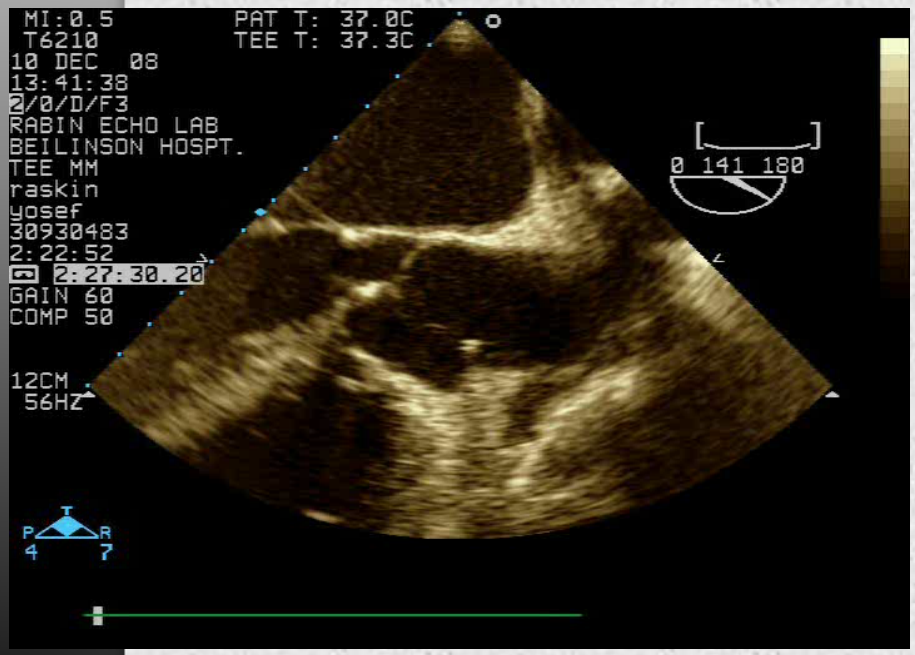

1 AR Vmax 5.14 m/s
AR maxPG 105.51 mmHg
AR PHT 290 ms
AR Dec Time 999 ms
AR Dec Slope 5.1 m/s2

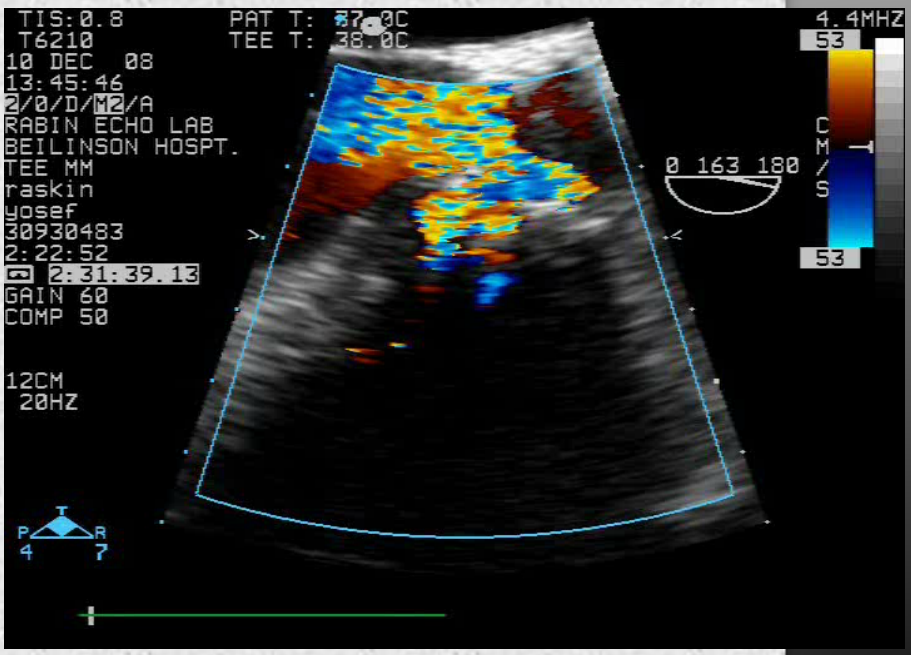

20
10
V
.56
-.56
1
6
5
4
3
2
1
[m/s]
74
HR
-2.0
-1.5
-1.0
-0.5
0.0

Repair of VSD with prolapsing aortic valve

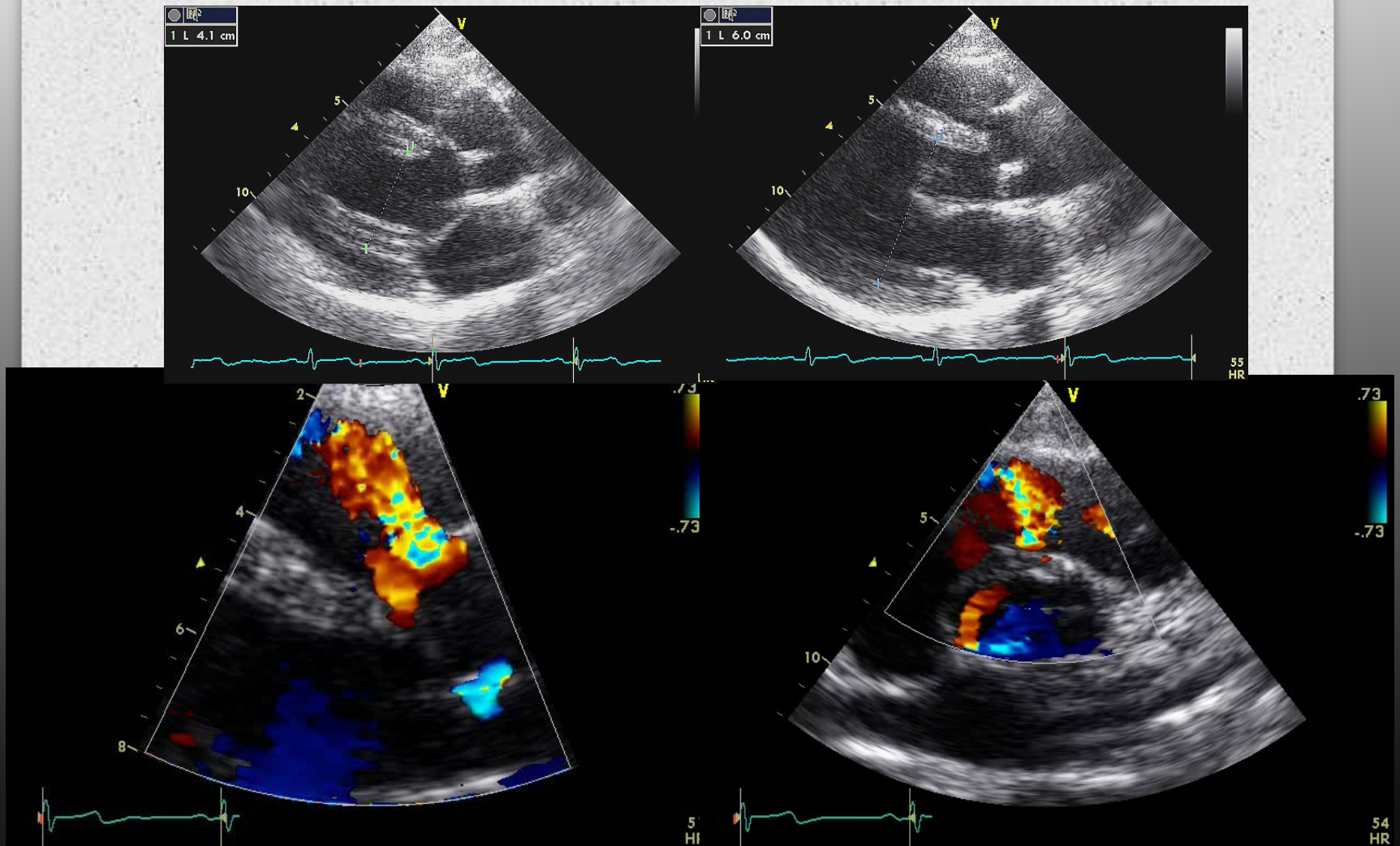
- In children surgical plication of the commissures involved in aortic valve prolapse has a good long-term outcome
- The best predictor of late aortic regurgitation is the success of initial repair
- When foreign material is used for aortic valve repair, immediate results may seem promising but early recurrence of regurgitation is common

adult with aortic valve prolapse VSD - LV dysfunction

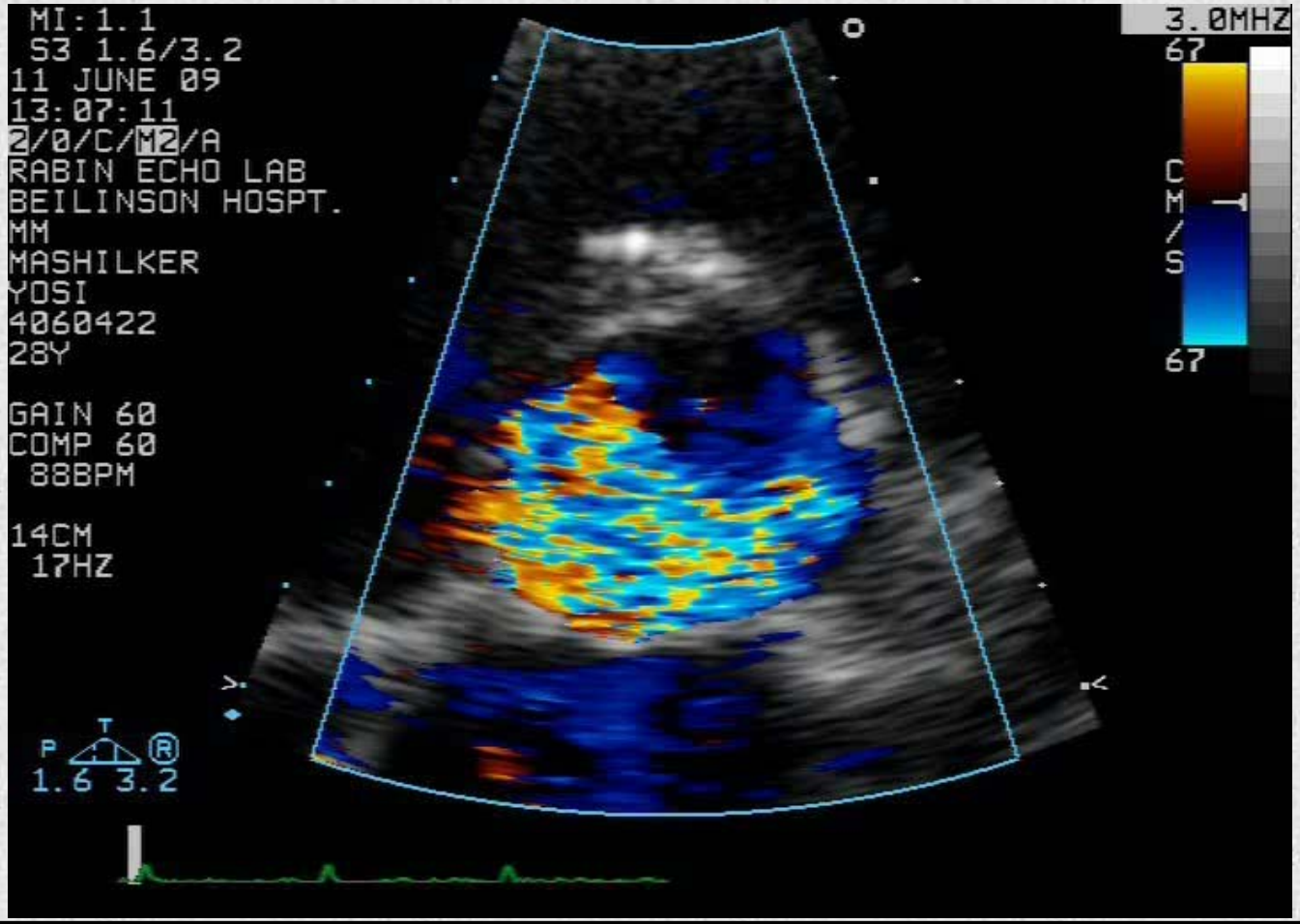


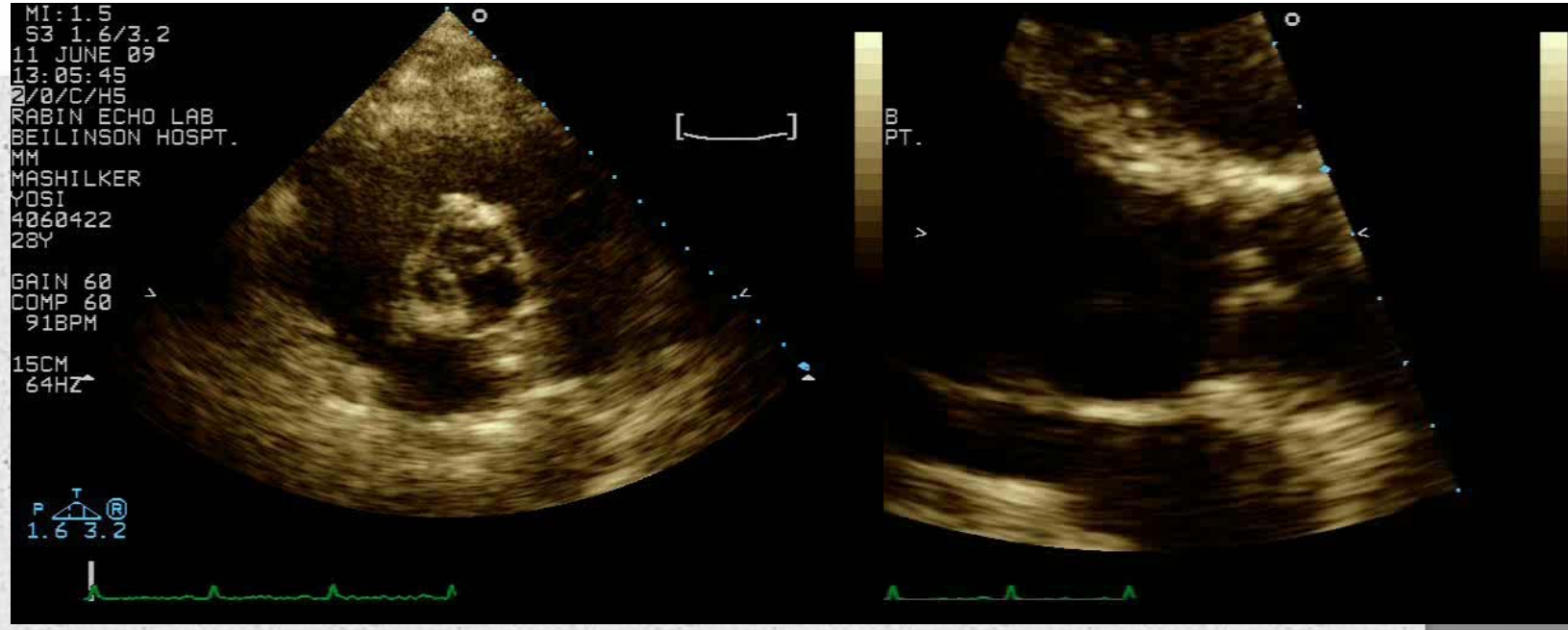


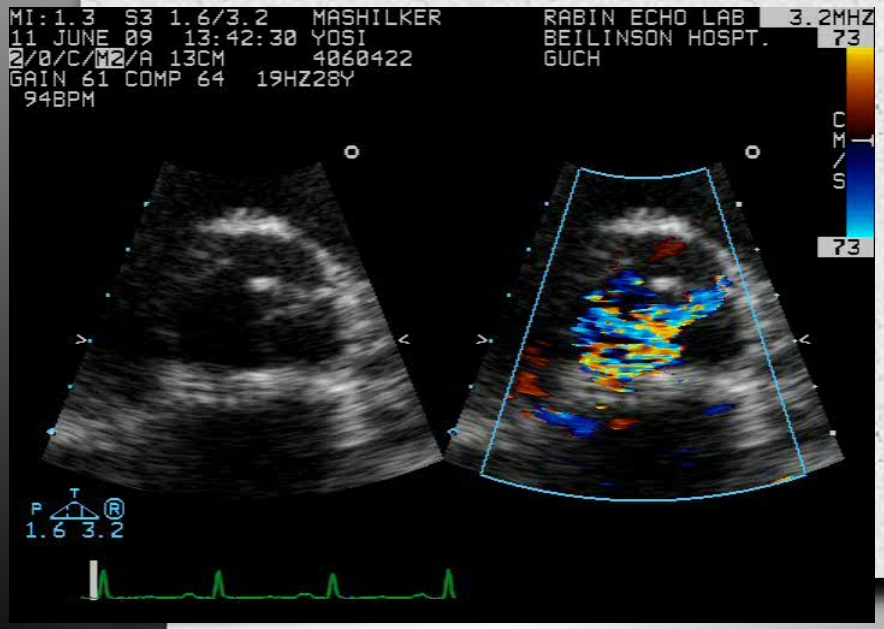
28 y.o gentleman, lt. heart volume overload from significant leak through a hole in aortic sinus of Valsalva, small VSD, mild-mod aortic regurgitation



post surgery - AR




MI:1.5
S3 1.6/3.2
11 JUNE 09
13:05:45
2/0/C/H5
RABIN ECHO LAB
BEILINSON HOSPT.
MM
MASHILKER
YOSI
4060422
28Y
GAIN 60
COMP 60
91BPM
15CM
64HZ
1.6 3.2
PT.


MI:1.3 S3 1.6/3.2 MASHILKER
11 JUNE 09 13:42:30 YOSI
2/0/C/M2/A 13CM 4060422
GAIN 61 COMP 64 19HZ28Y
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RABIN ECHO LAB
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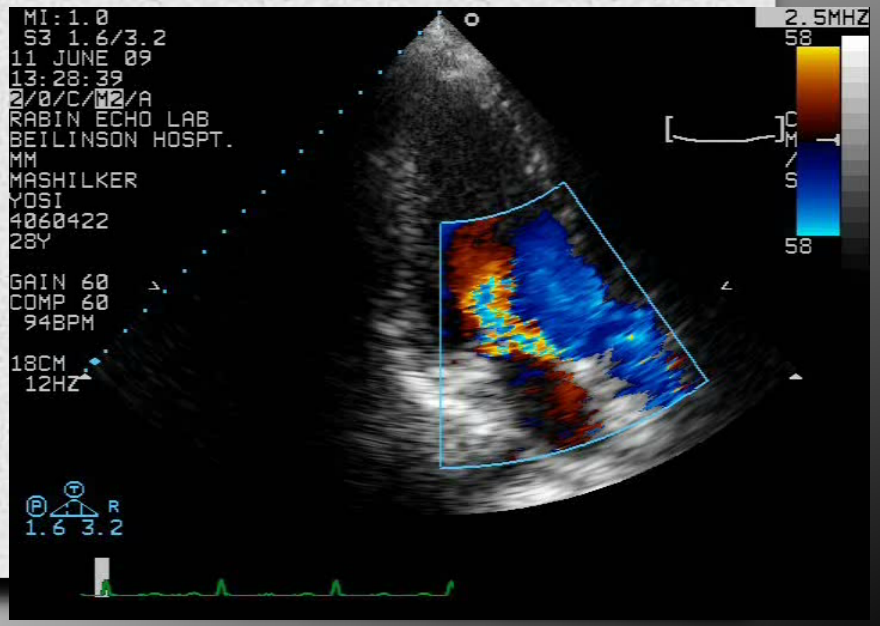
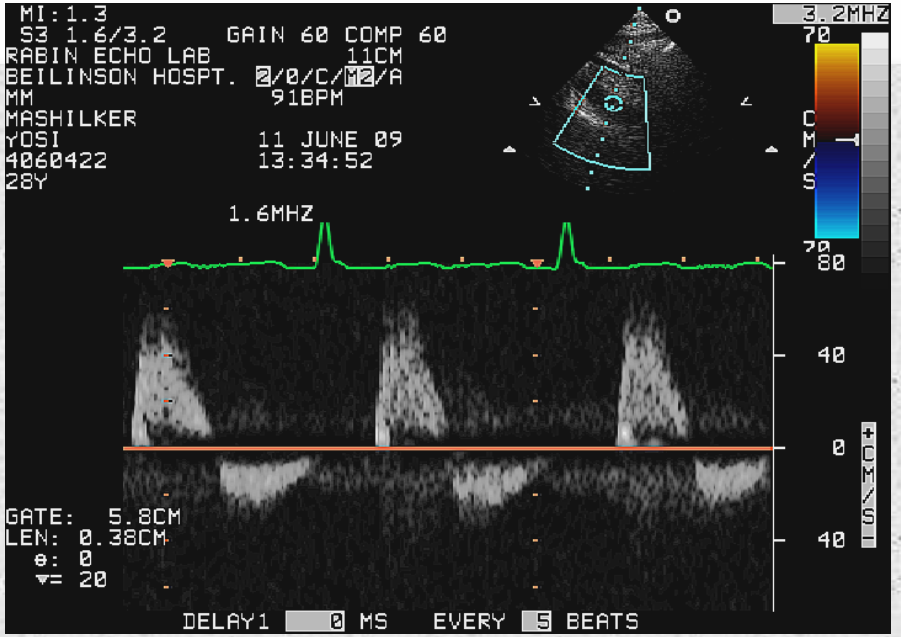

MI:1.0
S3 1.6/3.2
11 JUNE 09
13:28:39
2/0/C/M2/A
RABIN ECHO LAB
BEILINSON HOSPT.
MM
MASHILKER
YOSI
4060422
28Y
GAIN 60
COMP 60
94BPM
18CM
12HZ
2.5MHZ
58
58
1.6 3.2


MI:1.3
S3 1.6/3.2
GAIN 60 COMP 60
RABIN ECHO LAB
11CM
BEILINSON HOSPT.
2/0/C/M2/A
MM
91BPM
MASHILKER
YOSI
11 JUNE 09
4060422
13:34:52
28Y
3.2MHZ
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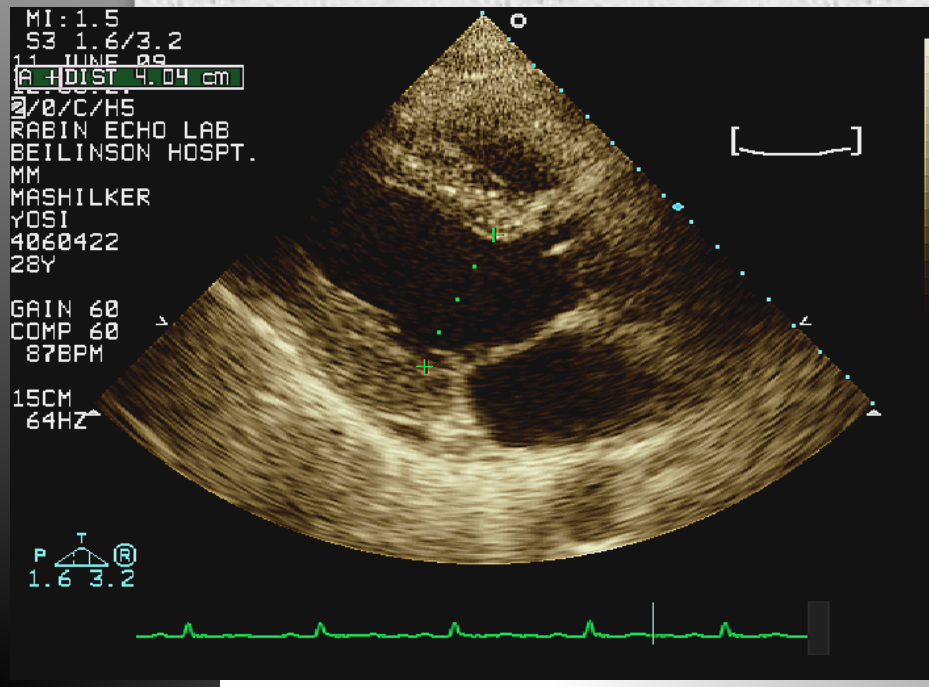
80
40
0
40
GATE: 5.8CM
LEN: 0.38CM
DELAY1 0 MS
EVERY 5 BEATS


MI:1.5
S3 1.6/3.2
A +DIST 4.04 cm
2/0/C/H5
RABIN ECHO LAB
BEILINSON HOSPT.
MM
MASHILKER
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4060422
28Y
GAIN 60
COMP 60
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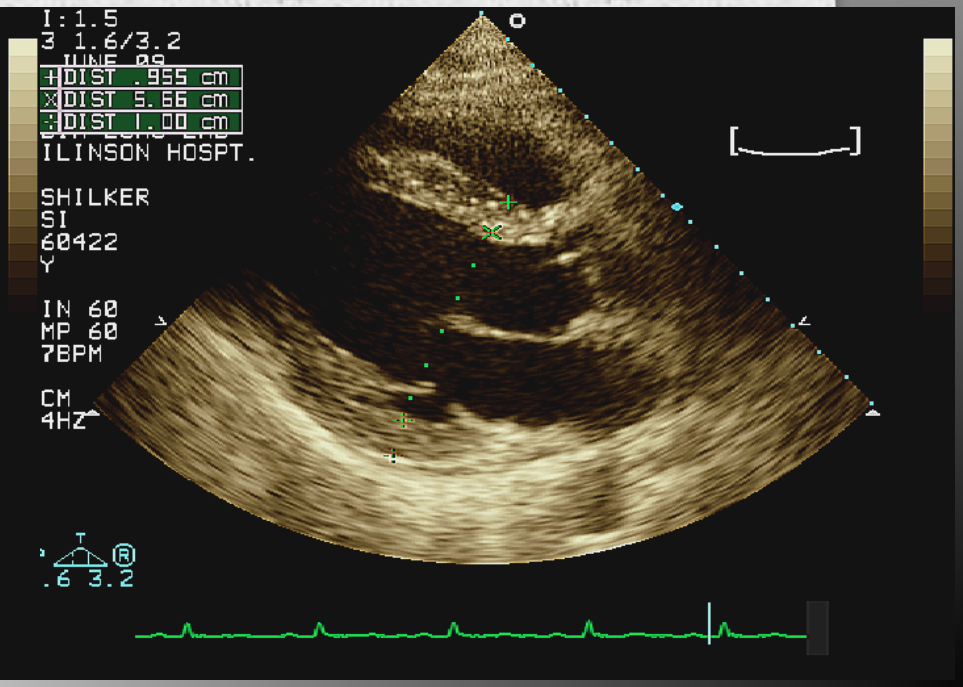
1.6 3.2


I:1.5
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+DIST .955 cm
X DIST 5.66 cm
DIST 1.00 cm
ILINSON HOSPT.
SHILKER
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60422
Y
IN 60
MP 60
7BPM
CM
4HZ
.6 3.2

Transcatheter closure of congenital ventricular septal defects: results of the European Registry.

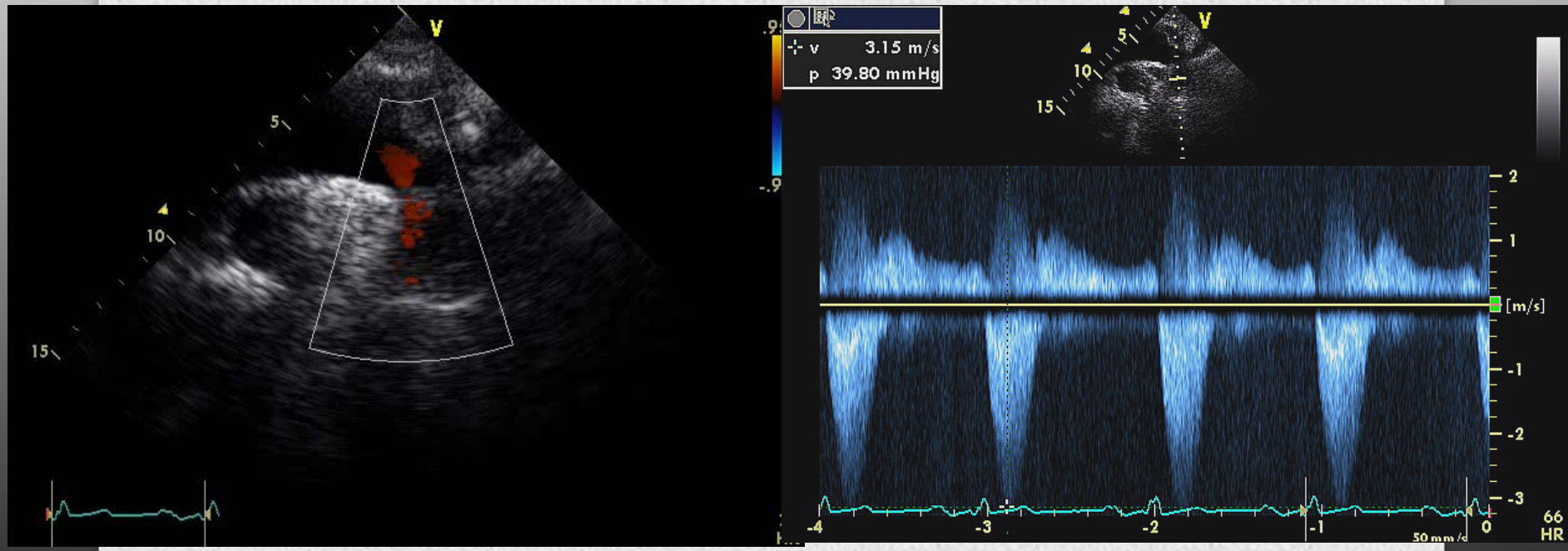
Carminati et al.

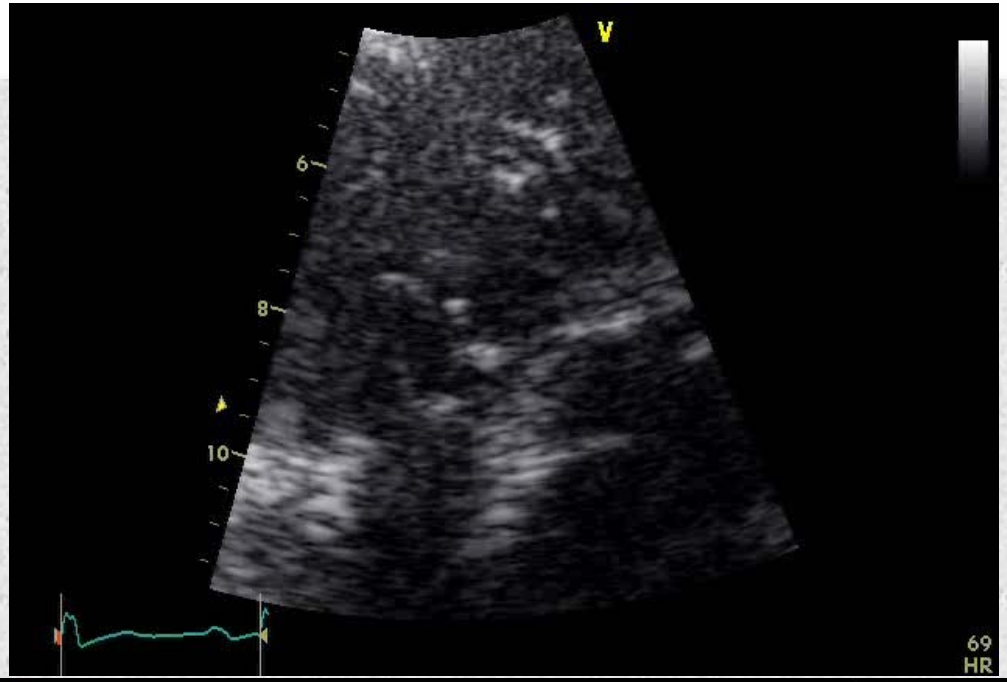
- 23 centers, 430 pts. 119 muscular, 250 perimembranous, 16 multiple, 45 residual post surgery
- 364 Amplatzer devices (musc. or perimem.)
- 14 pts. (3.3%) developped aortic regurgitation
- Immediate surgery was necessary in only 2, aged 4 years

ASD

- There is one report of worsening aortic regurgitation post device ASD/PFO closure in around 10% of pts, mostly not clinically important
- We have not experienced any to date (>700 implants)
- 4 cases of congenitally corrected TGA - no deformation of low pressure pulmonary trunk

54 y.o gentleman. CoAo surgery age 5 years, balloon+stenting age 44. bicuspid aortic valve - long standing aortic regurgitation, two VSDs




V
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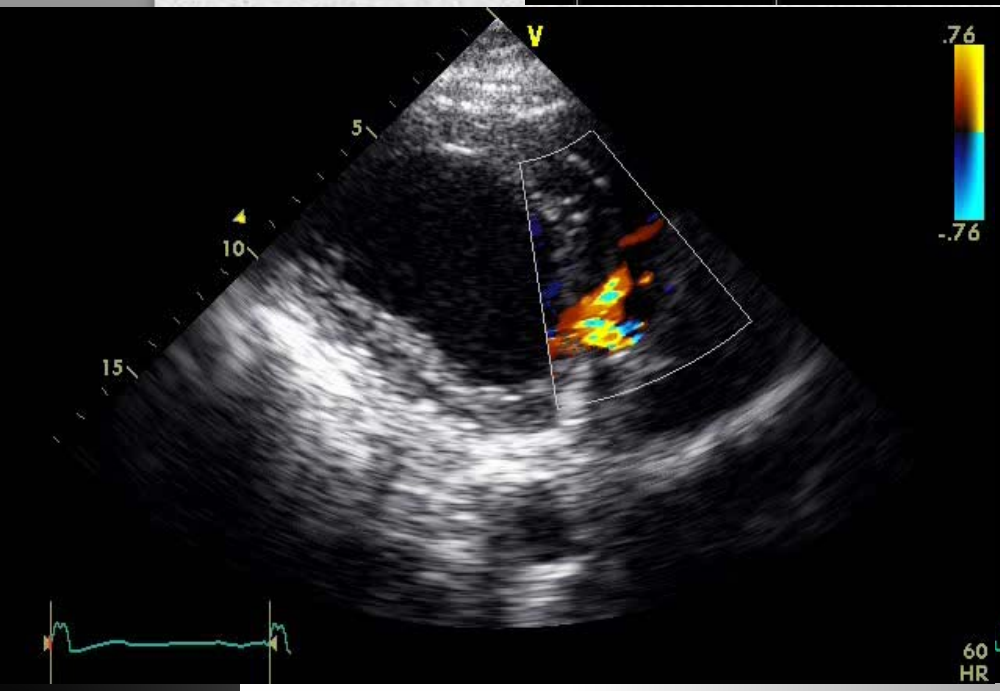
HR


V
.76
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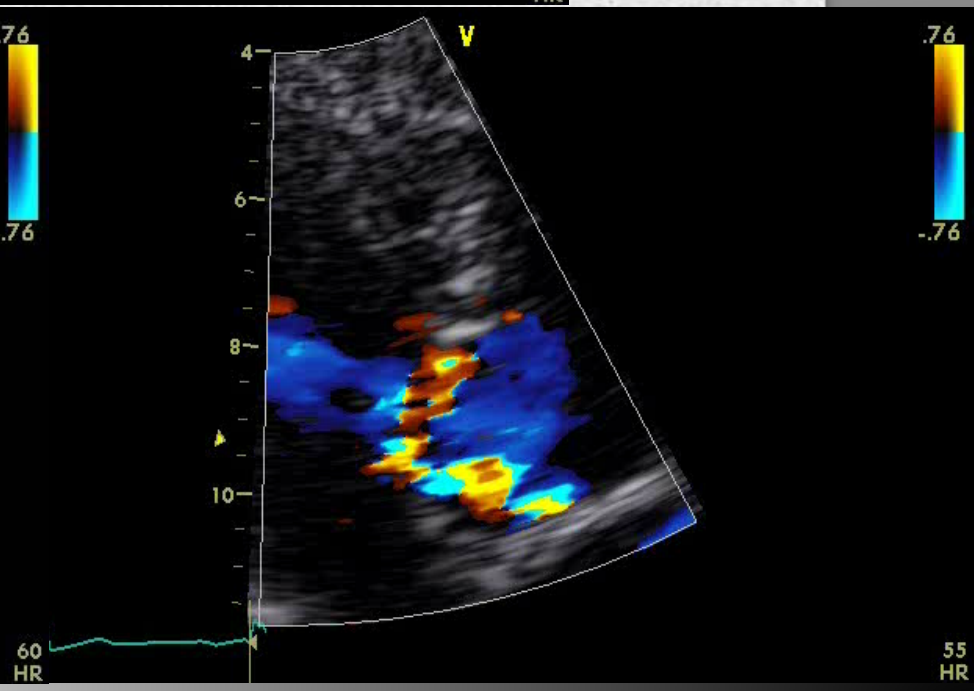
V
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4
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8
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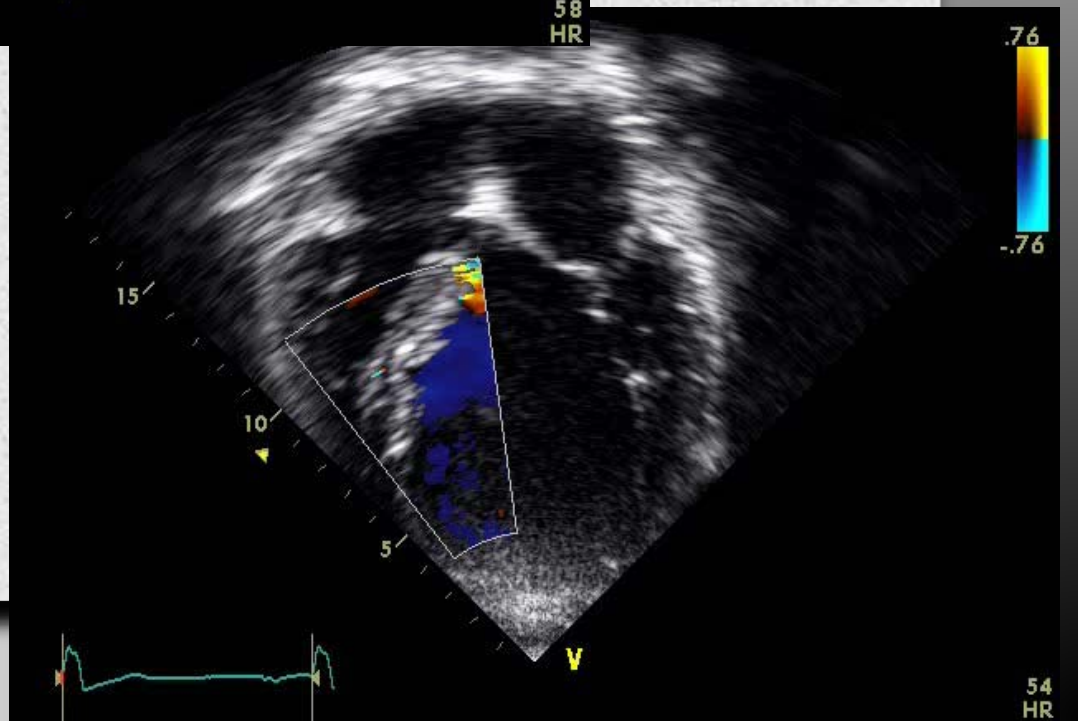
60
HR
55
HR


15
10
5
V
58
HR


.76
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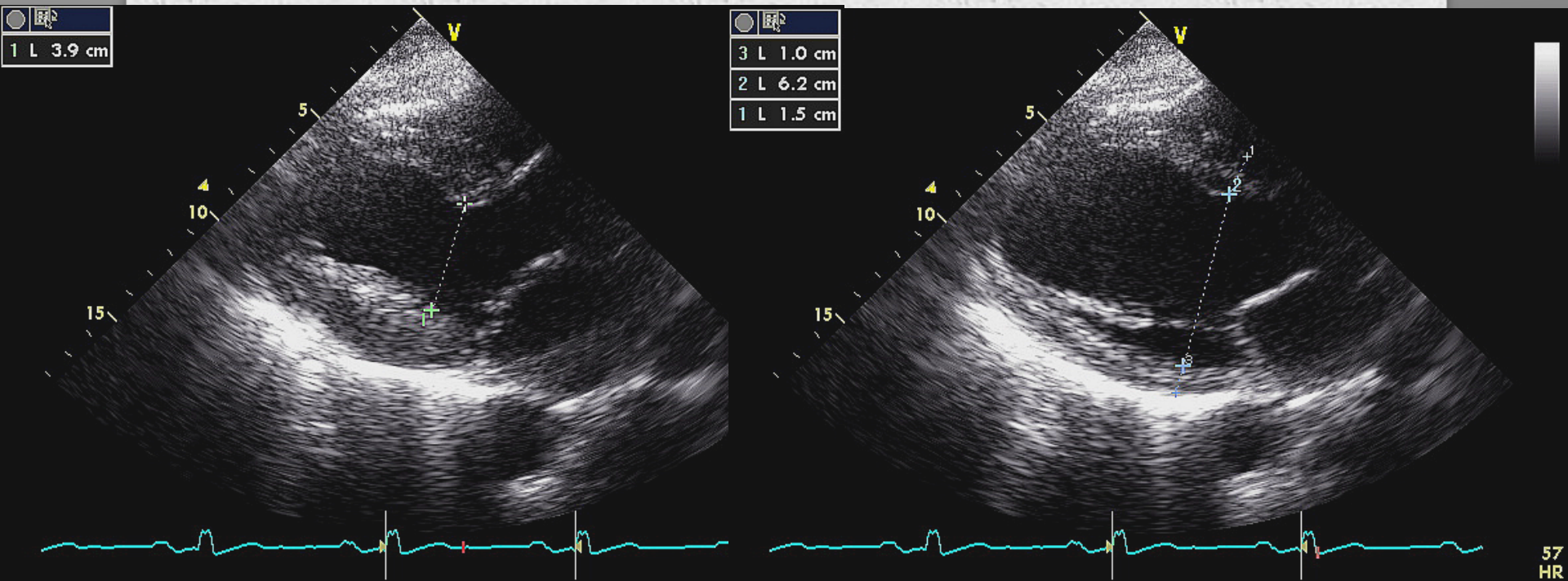
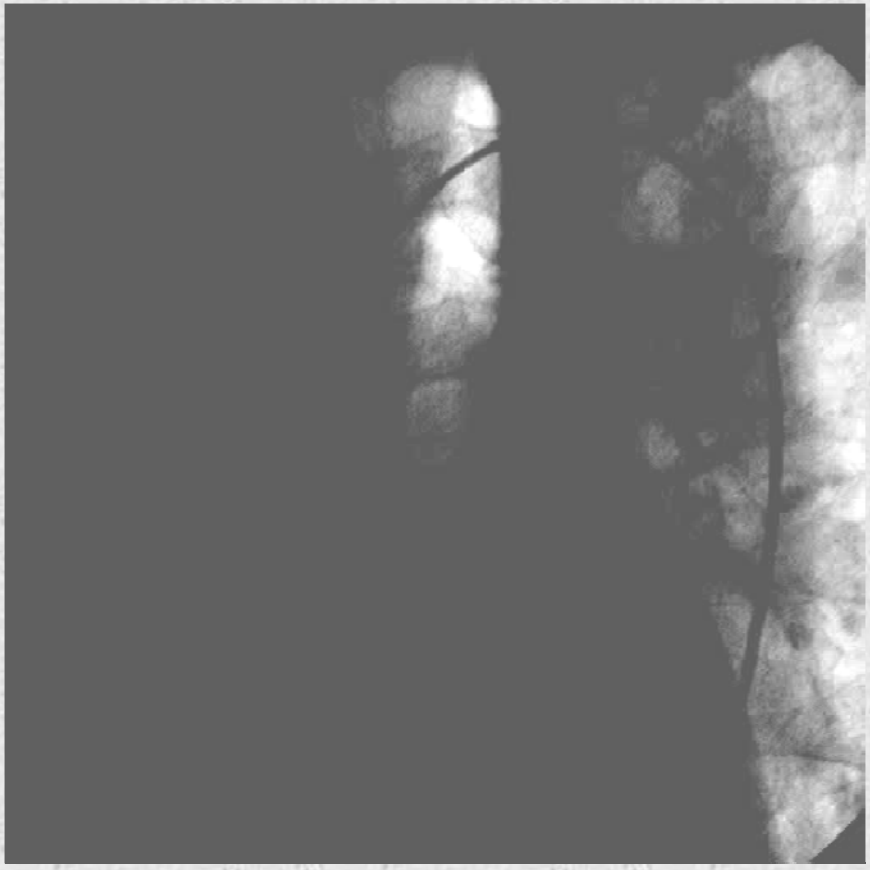
54
HR

Dilated LV - good systolic and diastolic function

Stress echo - 12 minutes Bruce protocol, normal physiologic reduction of LV volume



40 y.o. lady with Turner syndrome - post AoCoarc repair, AVR, aortic root aneurysm, mod. AR, severe TR



arterial switch - 1

- patients are not yet 40 years old
- aortic root dilatation not uncommon - in a study of 335 patients (Schwartz, Boston Children's, Circulation 2004) - almost 50% had root dilatation in 10 years
- Only a small number develop important (≥ moderate) regurgitation

arterial switch - 2

- Previous PA banding was a predictor of dilatation and regurgitation
- Older age at operation & presence of VSD predict aortic regurgitation
- Another study (Agnoletti, Necker, Paris, J Thorac Cardiovasc. Surgery, 2008) showed an acute angulation of the aortic arch to be a predictor of late aortic root dilatation and aortic regurgitation