Complete transposition: Echo preop and arterial switch

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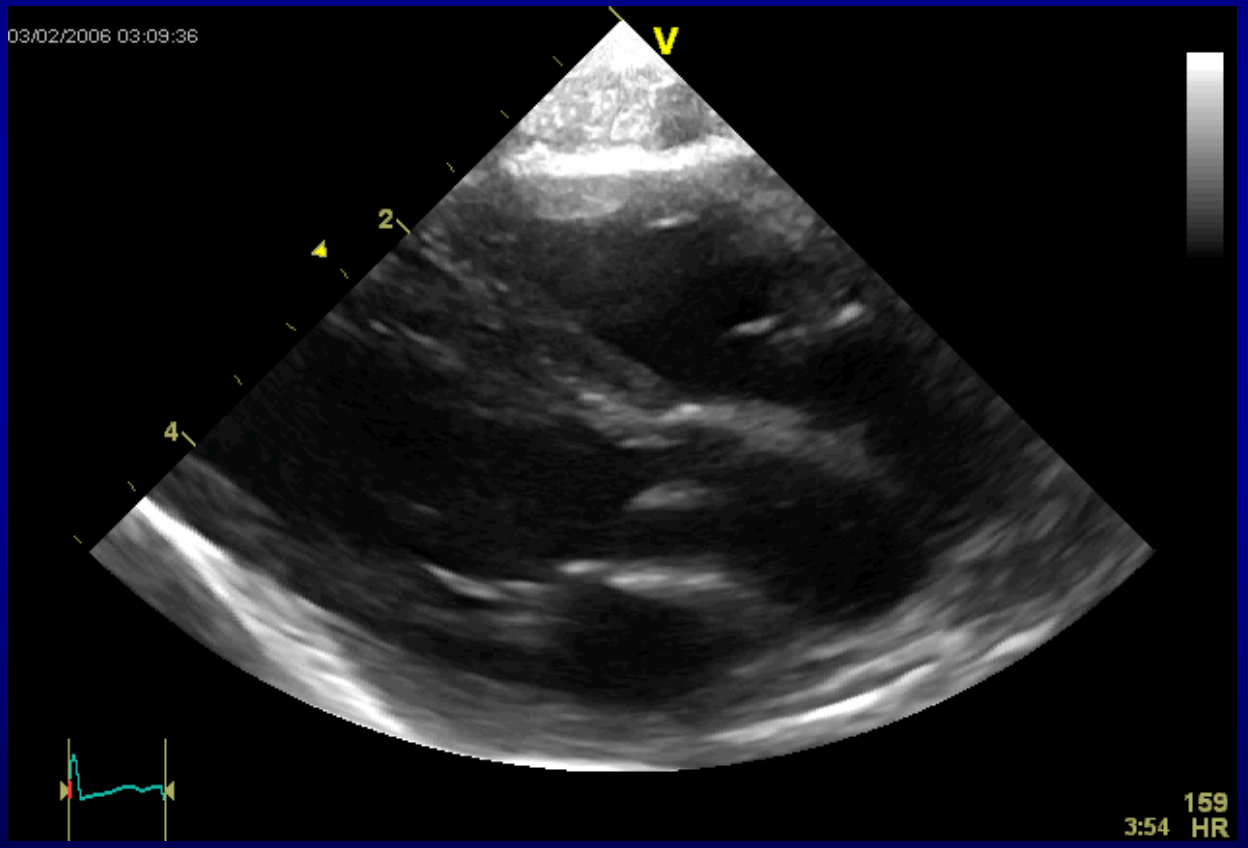
Aims of examination

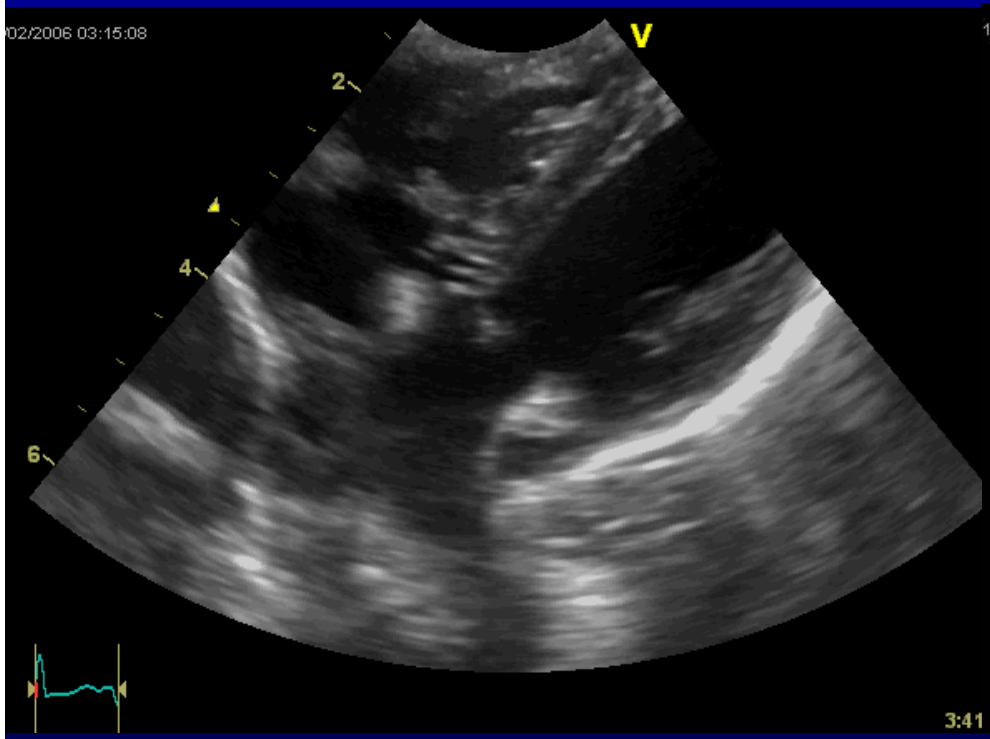
- Establish diagnosis: VA-discordance
- Parallel circuits: evaluation of mixing
- Describe aortic position + coronary patterns
- Associated lesions:
  - VSD, Co-A, LVOTO

Establish diagnosis

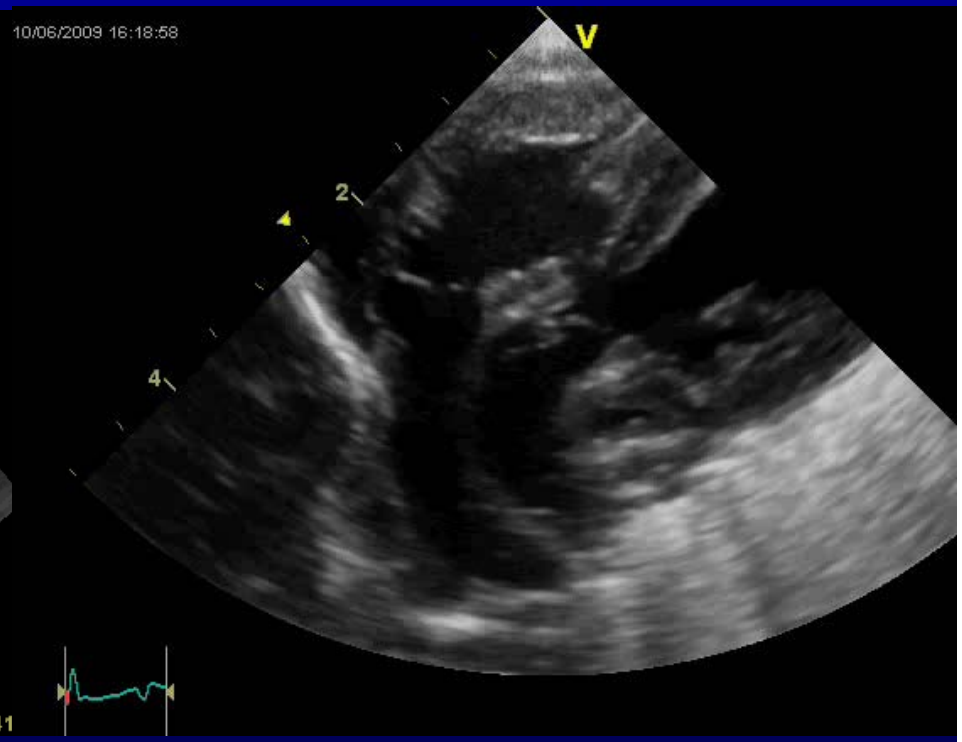


Parasternal long axis

Establish diagnosis

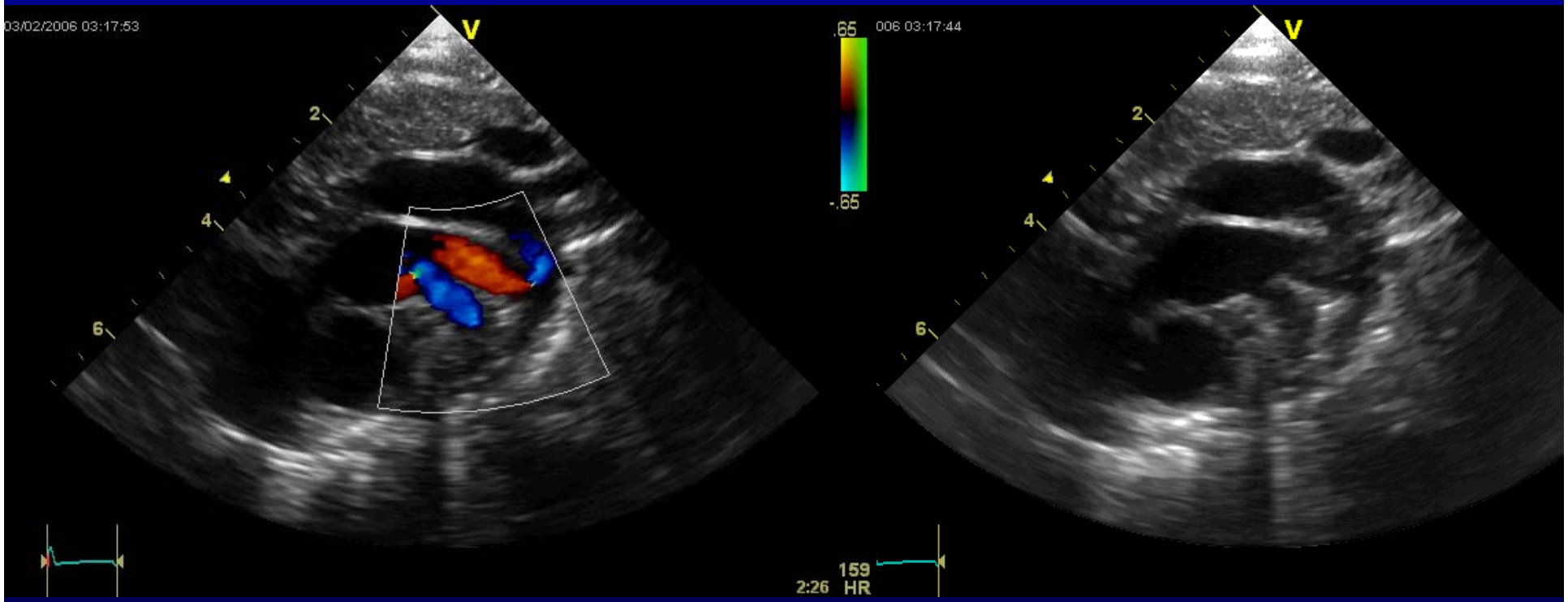


LV-PA



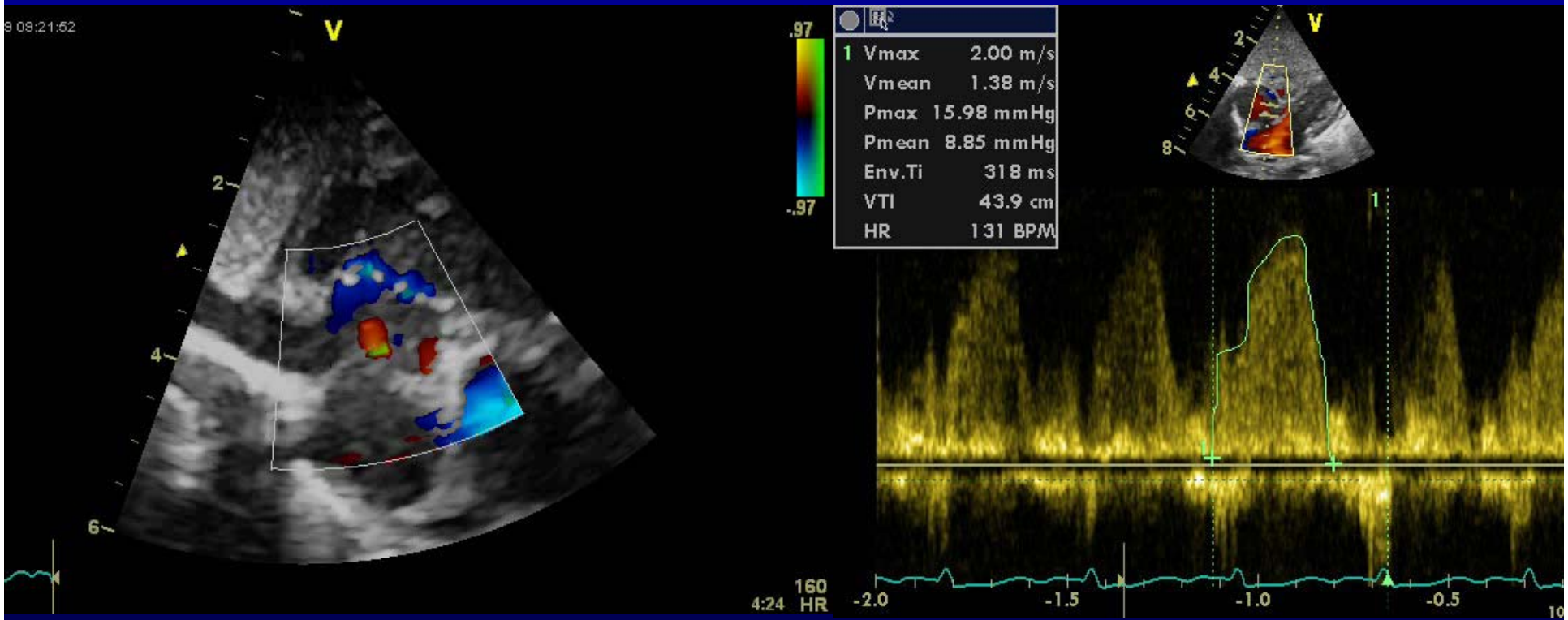
RV-Ao

Evaluation of mixing



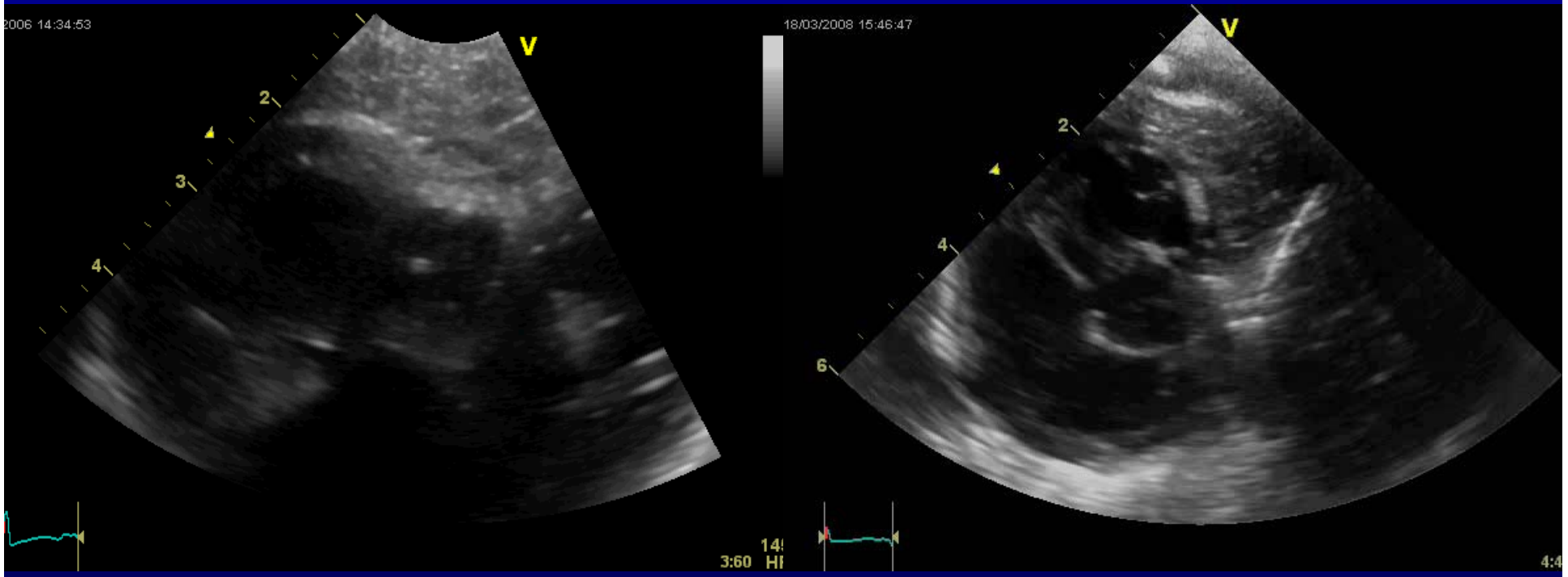
Mixing on arterial level

Evaluation of mixing



Mixing on atrial level

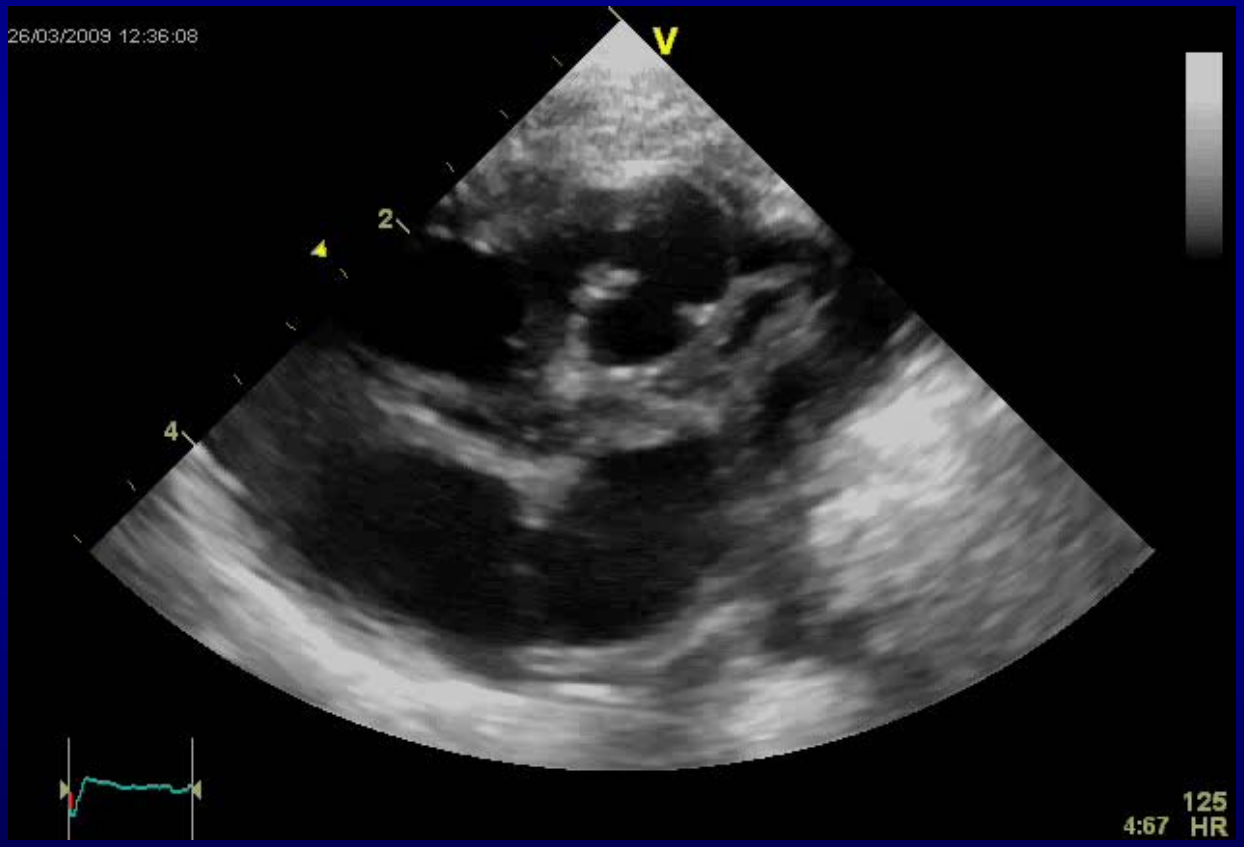
Position of aorta



Aorta to the right – D-TGA

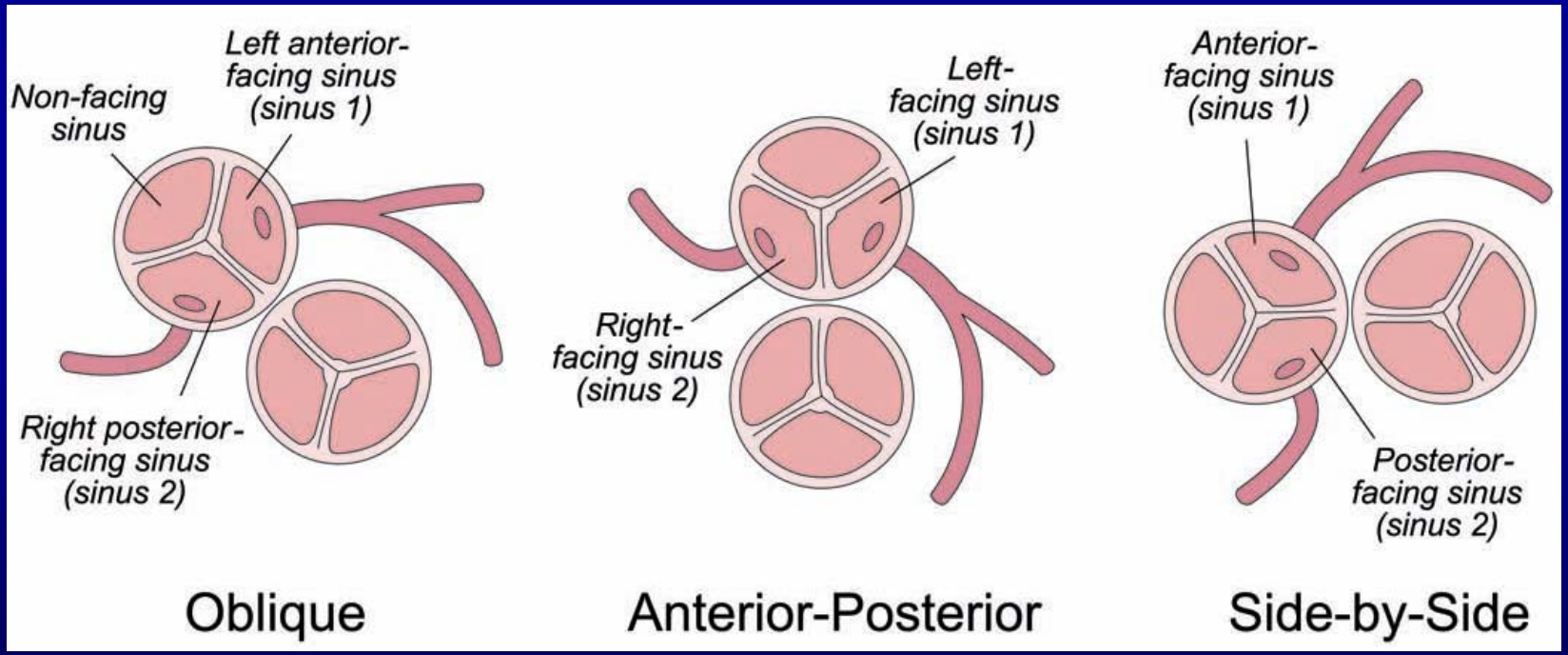
Aorta anterior – AP-TGA

Position of aorta

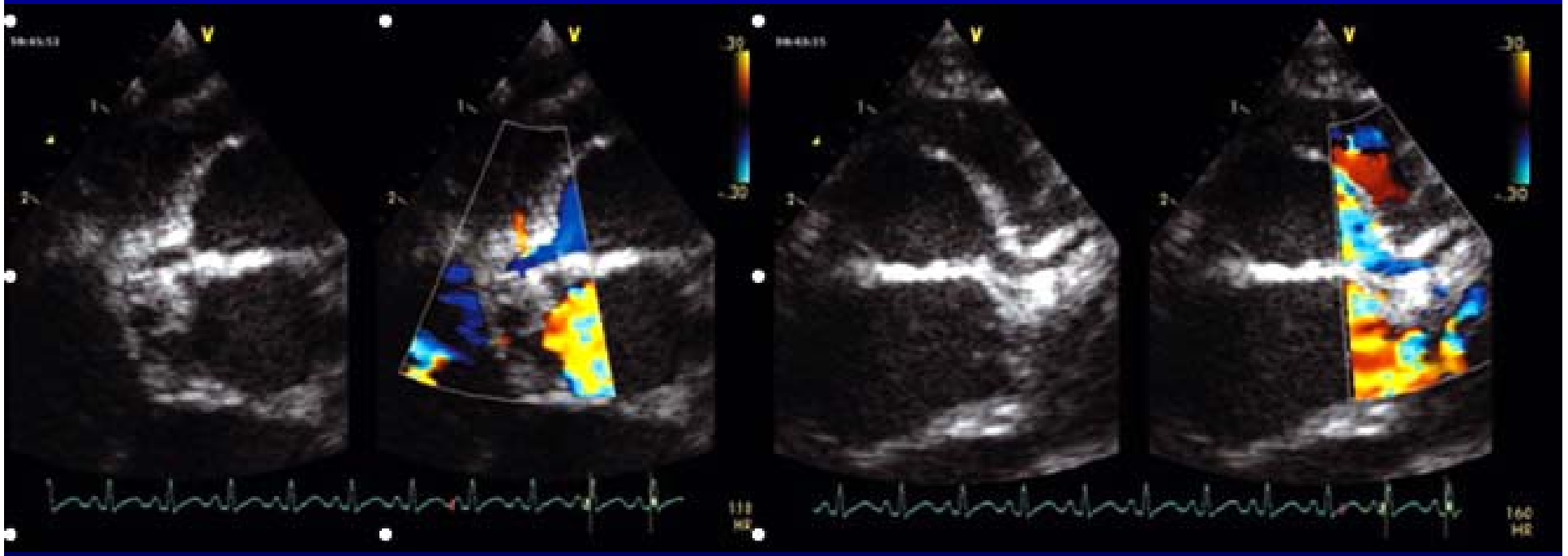


Aorta side by side

Position of aorta - coronaries



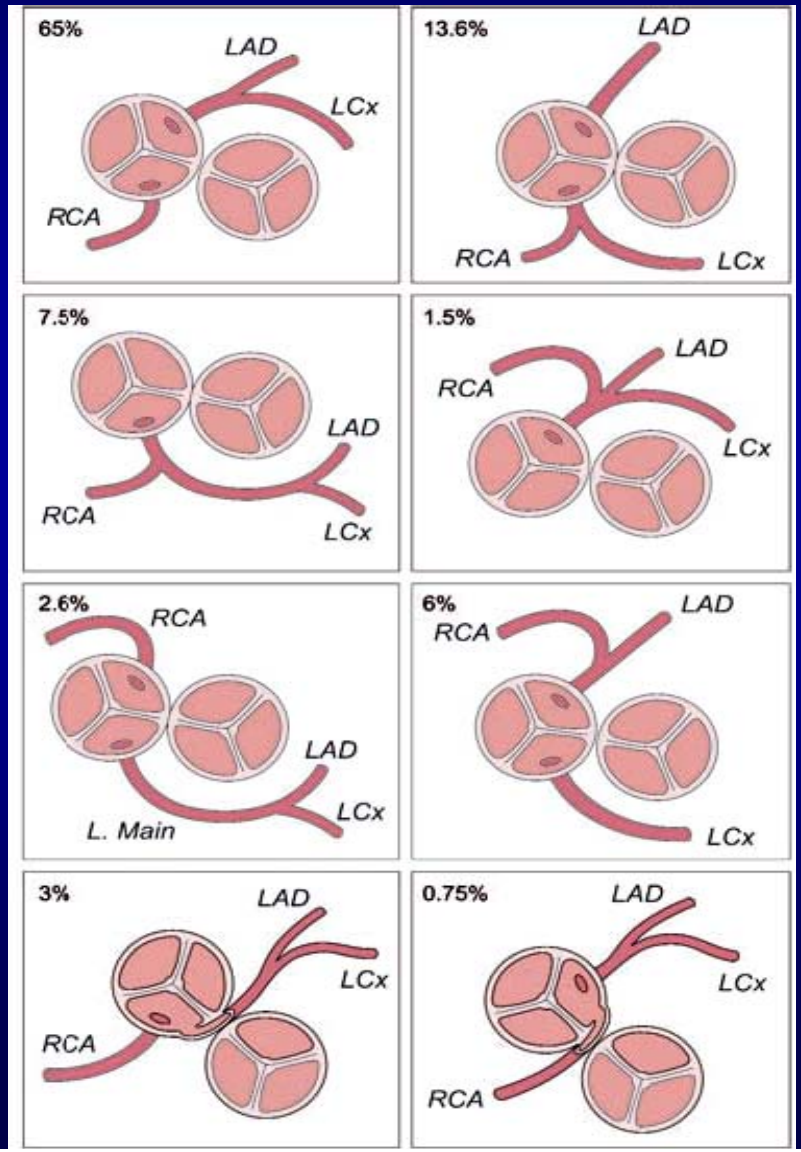
Position of aorta - coronaries



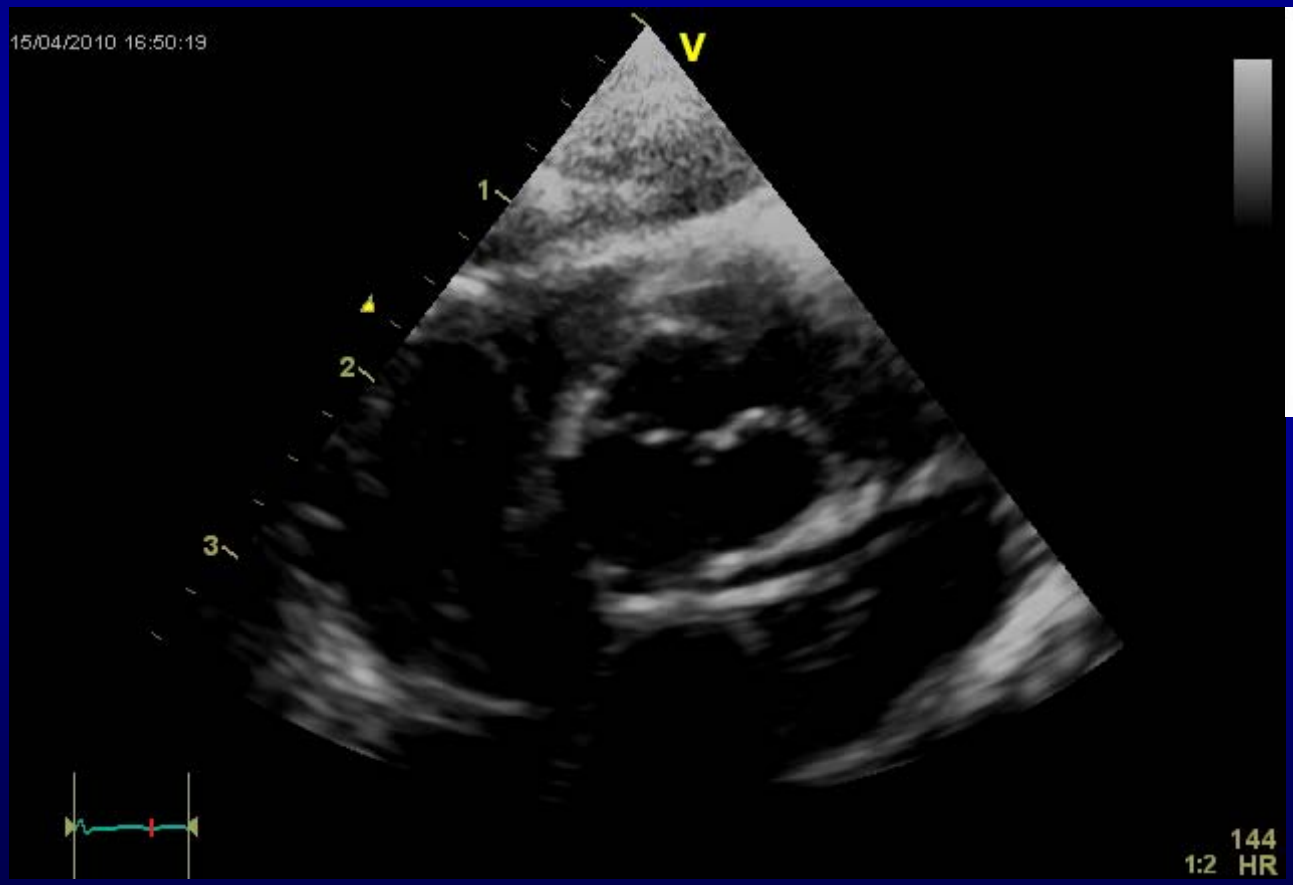
RCA – Sinus 2

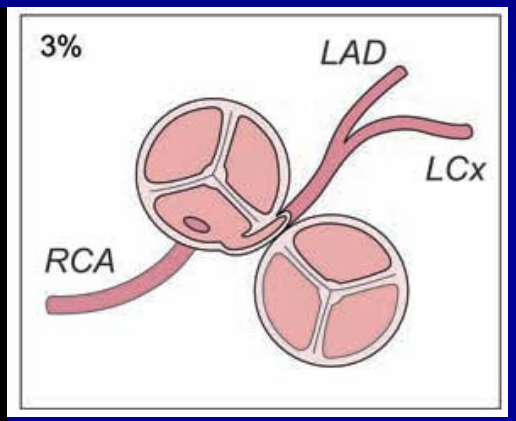
LCA – Sinus 1

Coronary patterns

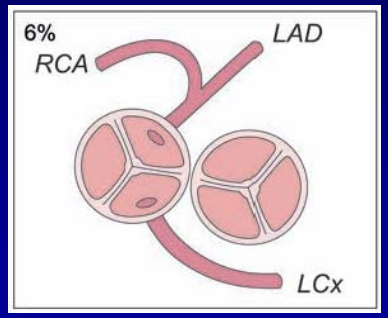


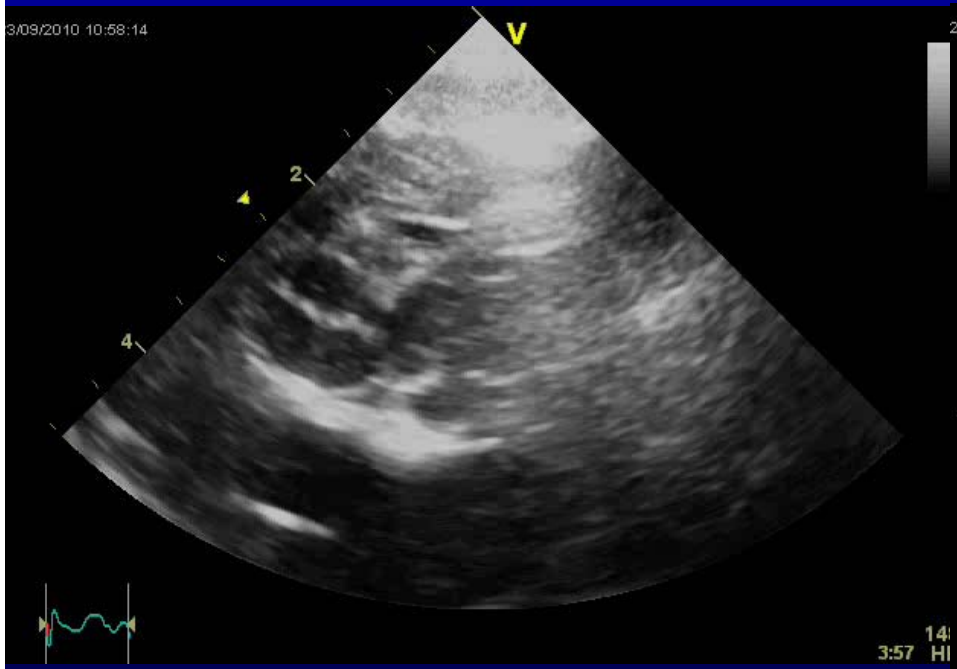
Coronary pattern: intramural

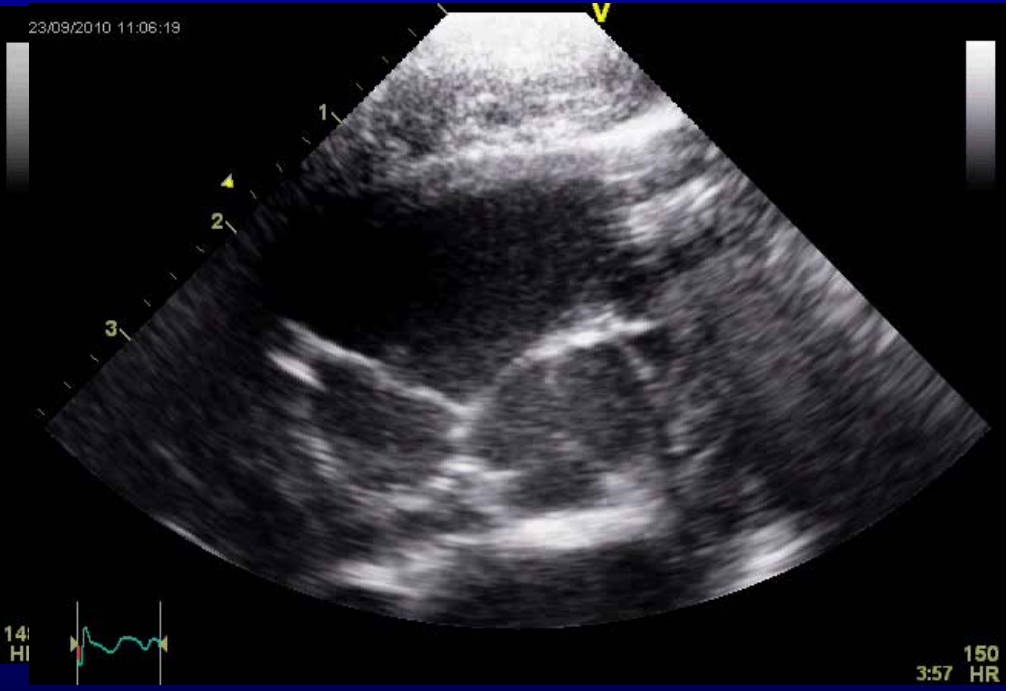




Coronary pattern







LCx – Sinus 2

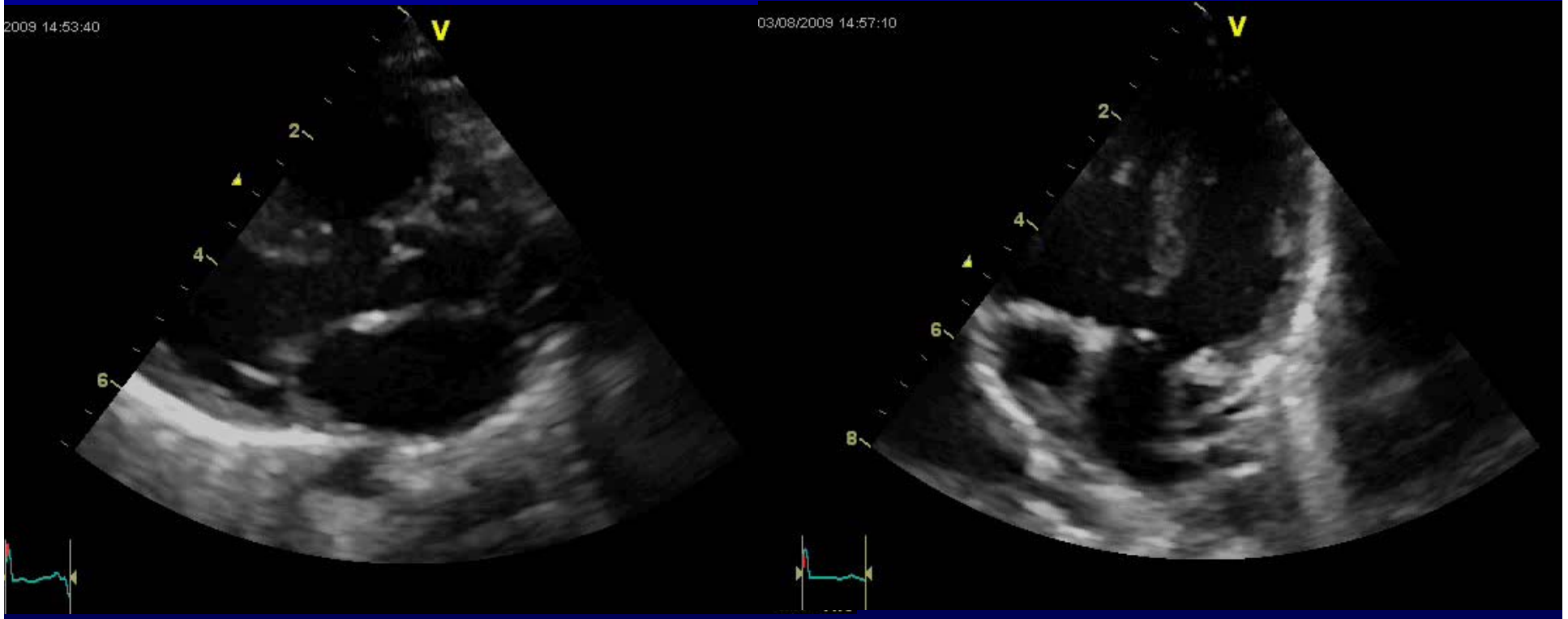
Incidence 6%

RCA/LAD – Sinus 1

Associated lesions: VSD

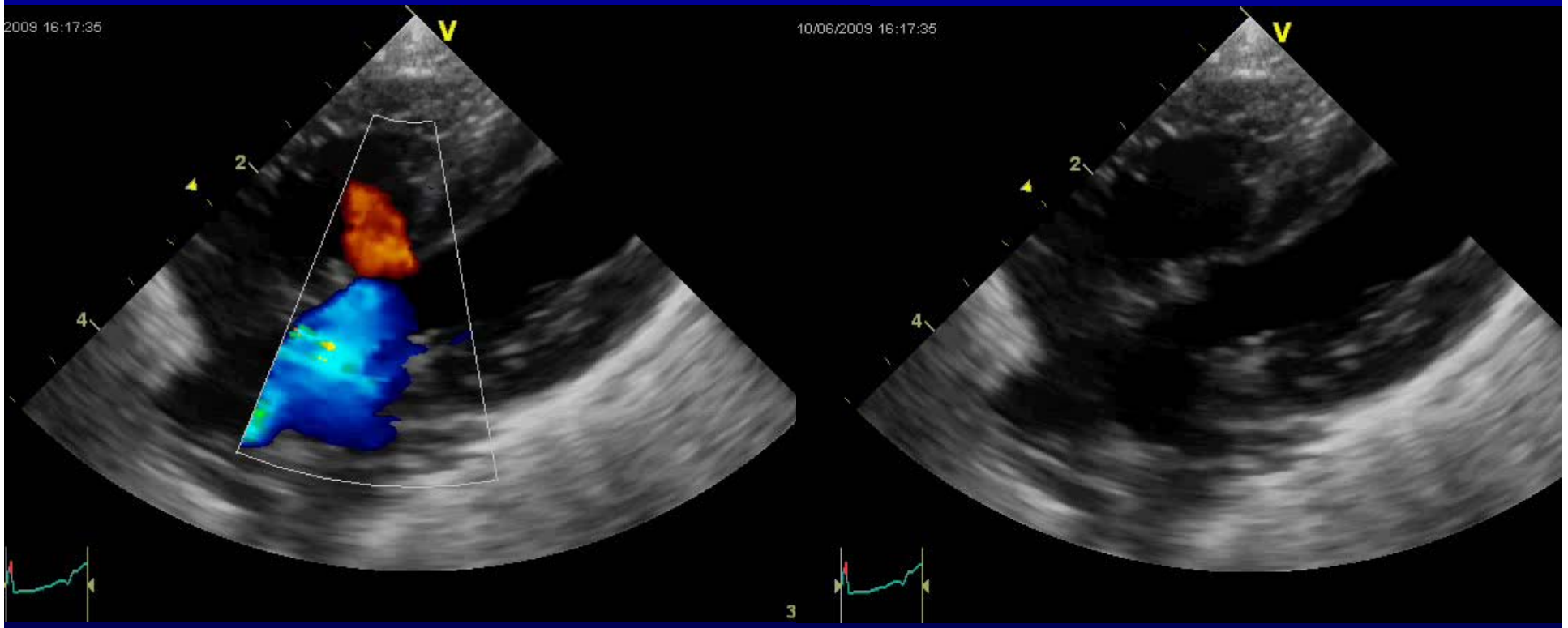
- Description is not different to VSD concordant VA-connection
- Important information on VSD
  - Type of VSD: perimem. or muscular
  - Localisation: inlet – outlet – midventricular
  - Number of defects
  - Association to cardiac structures

TGA and VSD



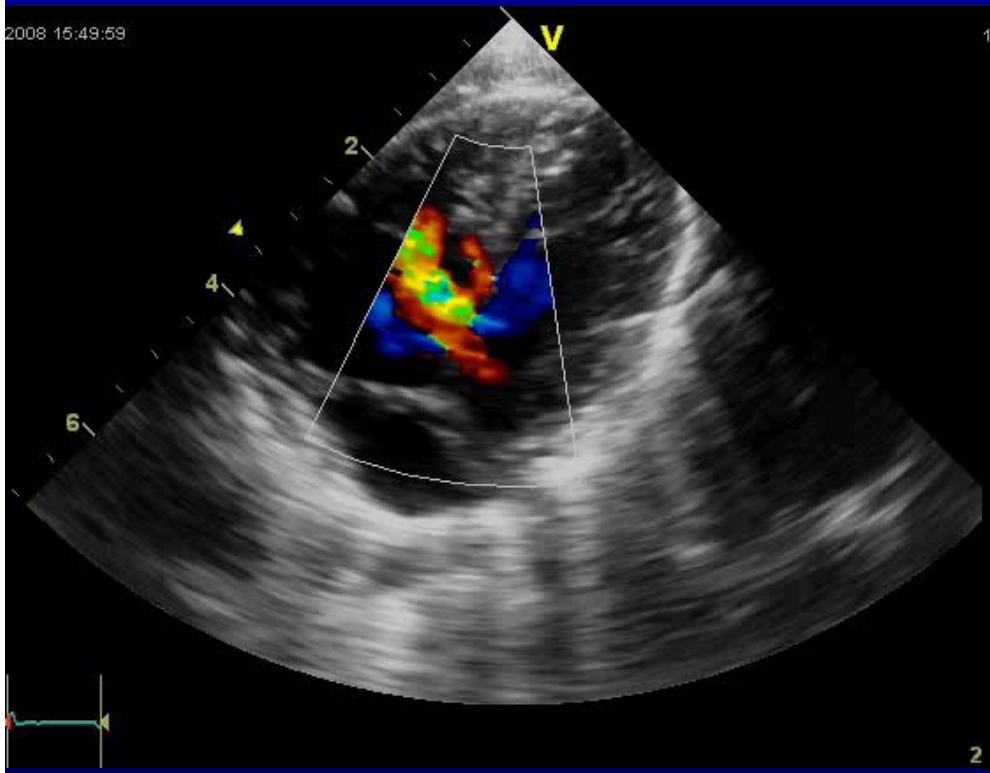
Perimem. VSD subpulmonary outlet

TGA and VSD

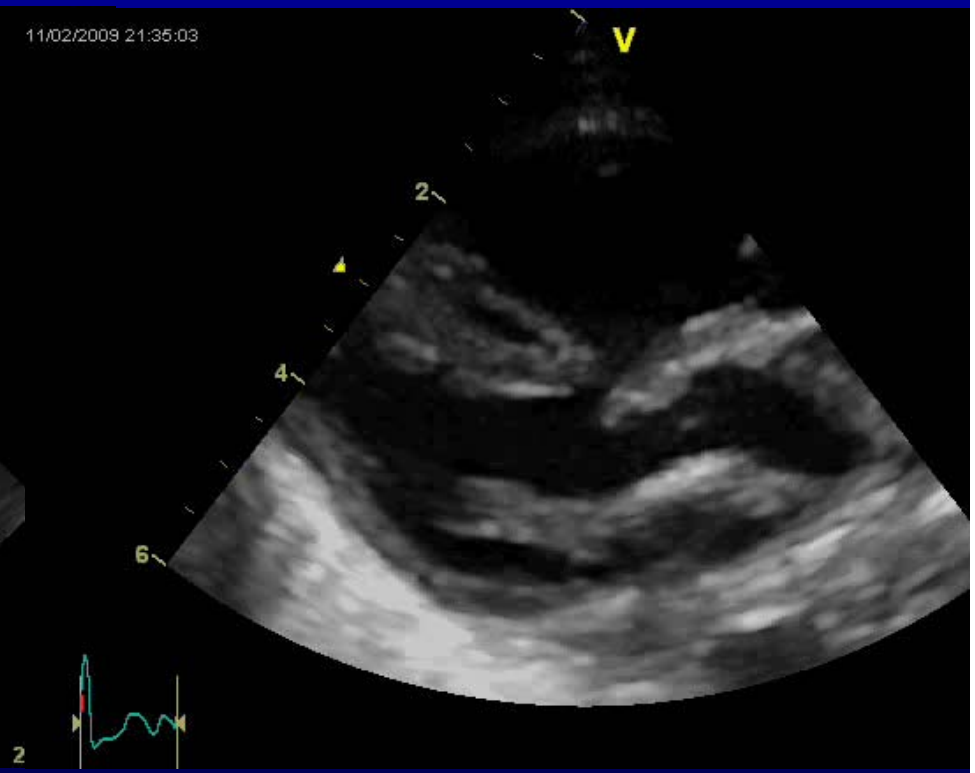


Perimem. VSD subpulmonary outlet

TGA and VSD

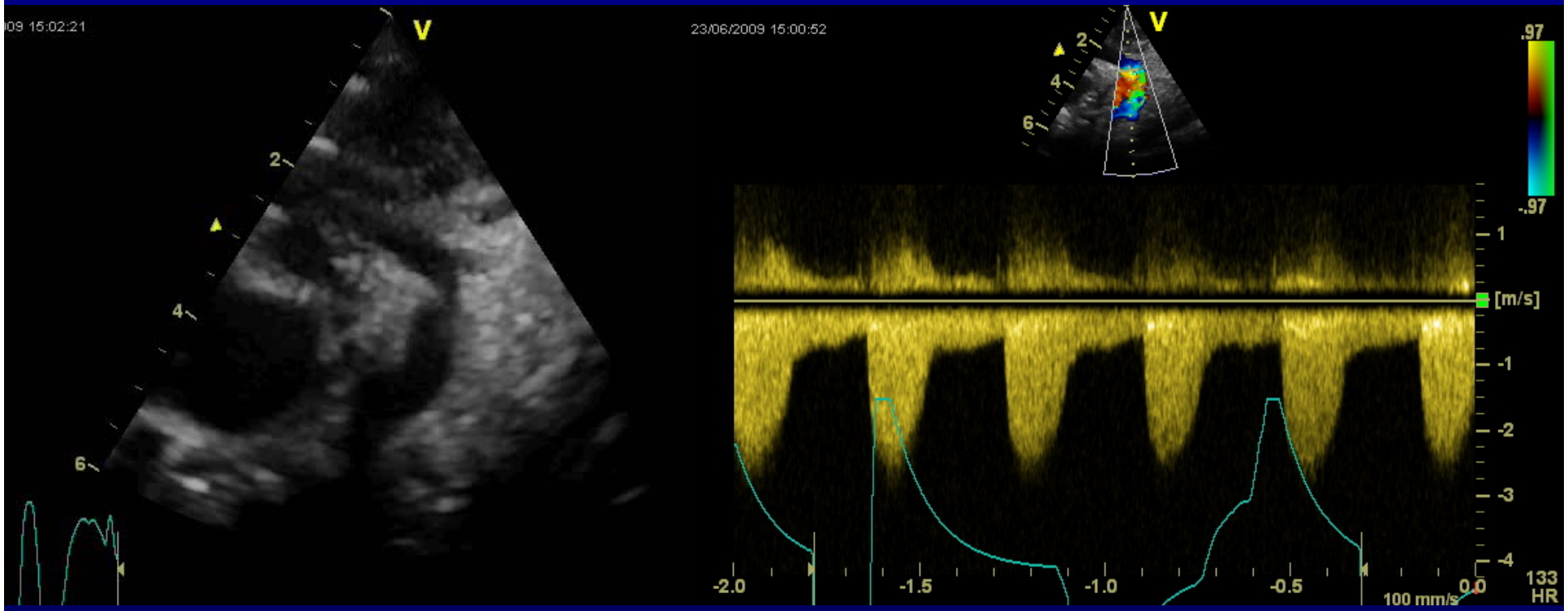


Musc. inlet VSD



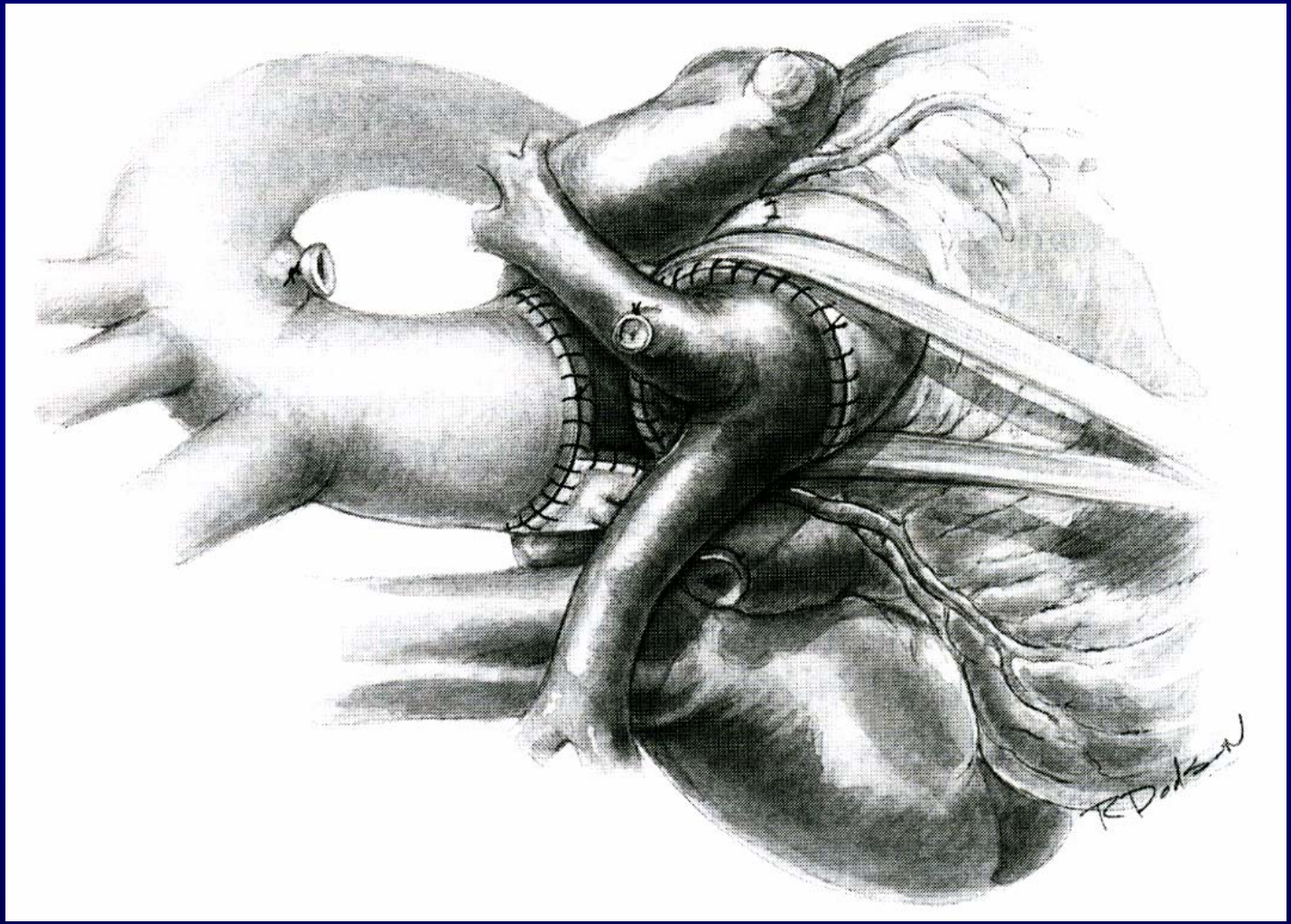
Musc. outlet VSD + LVOTO

TGA + VSD + Co-A



Preductal Coarctation + TGA+VSD

The surgical procedure

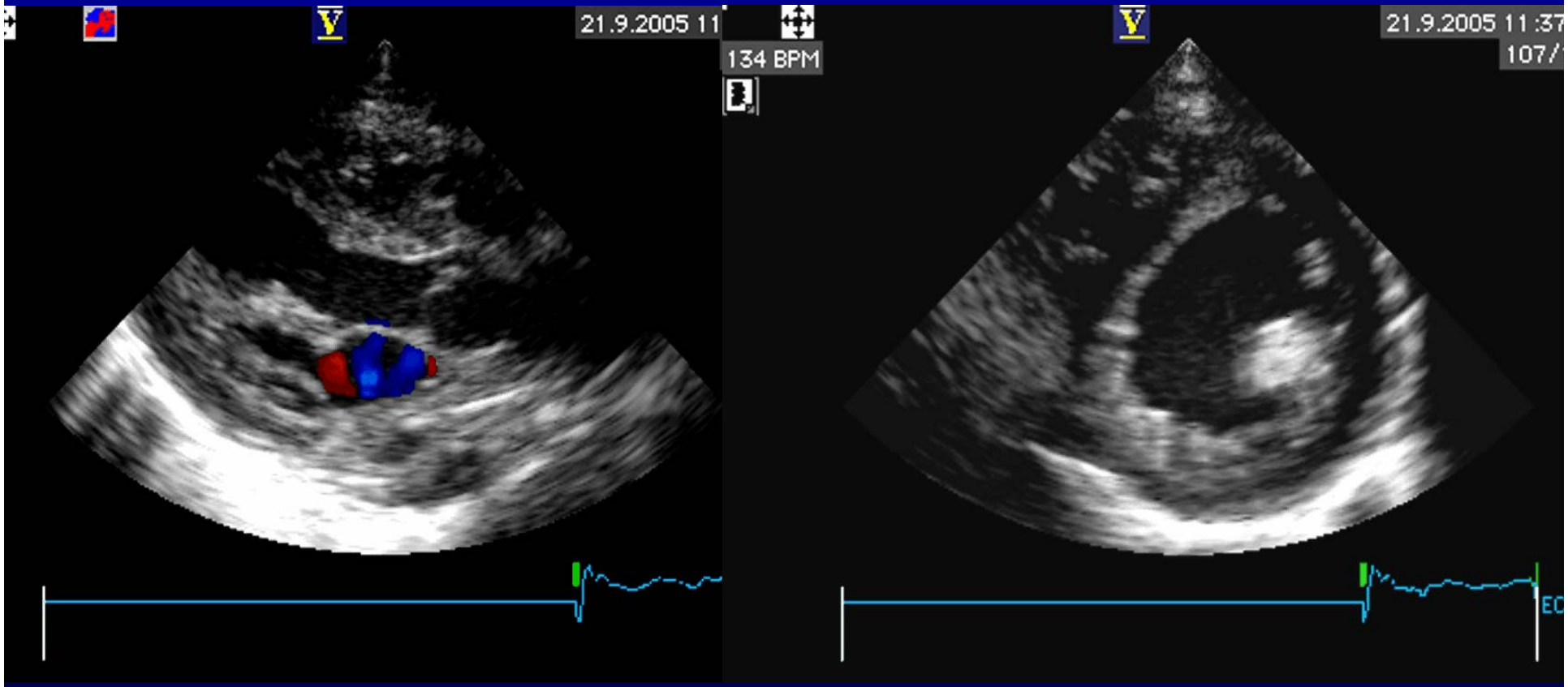


Jonas, Surgical management Arnold/London 2004:265-8

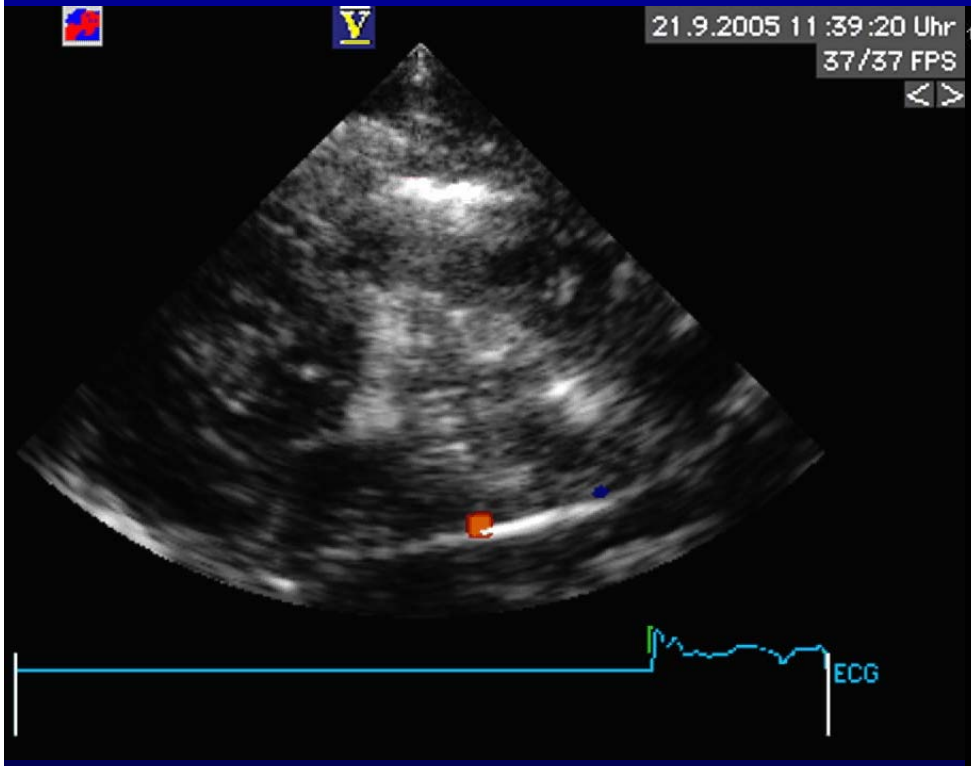
Echo-information post-OP

- Myokardial function – result of coronary blood flow
- Monitoring of RVOT – stenosis?
- Monitoring of LVOT - adequate growth of neo-aorta? Regurgitation? Dilatation of bulbus?
- Immediate – long term follow-up

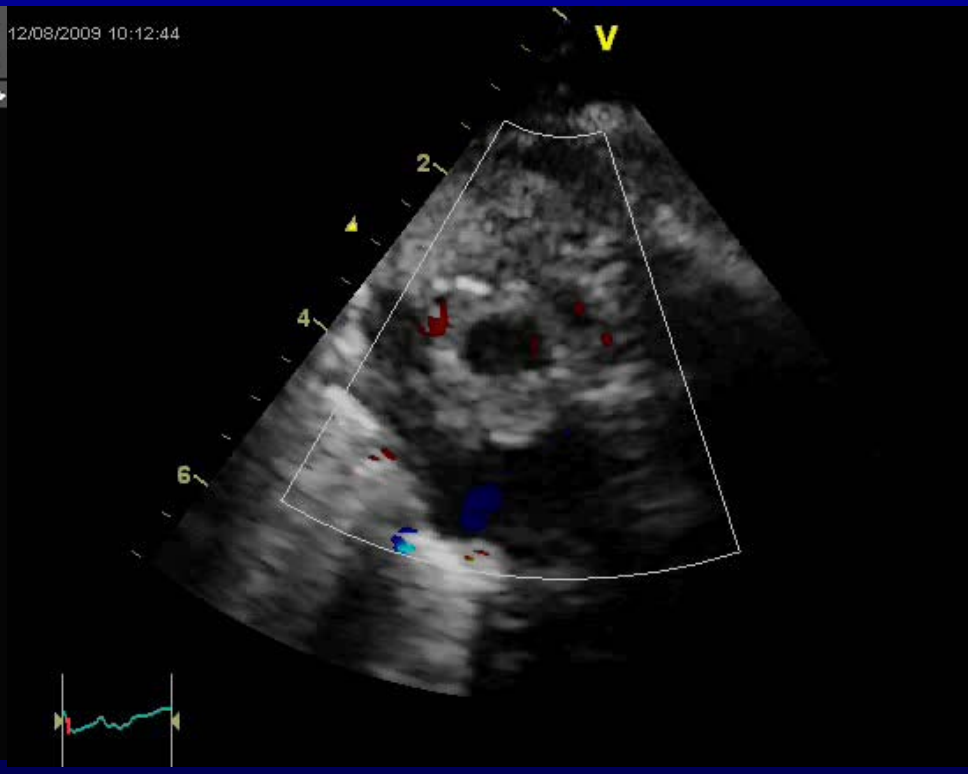
Early post-OP evaluation – myocardial function



Early post-OP evaluation – RVOT

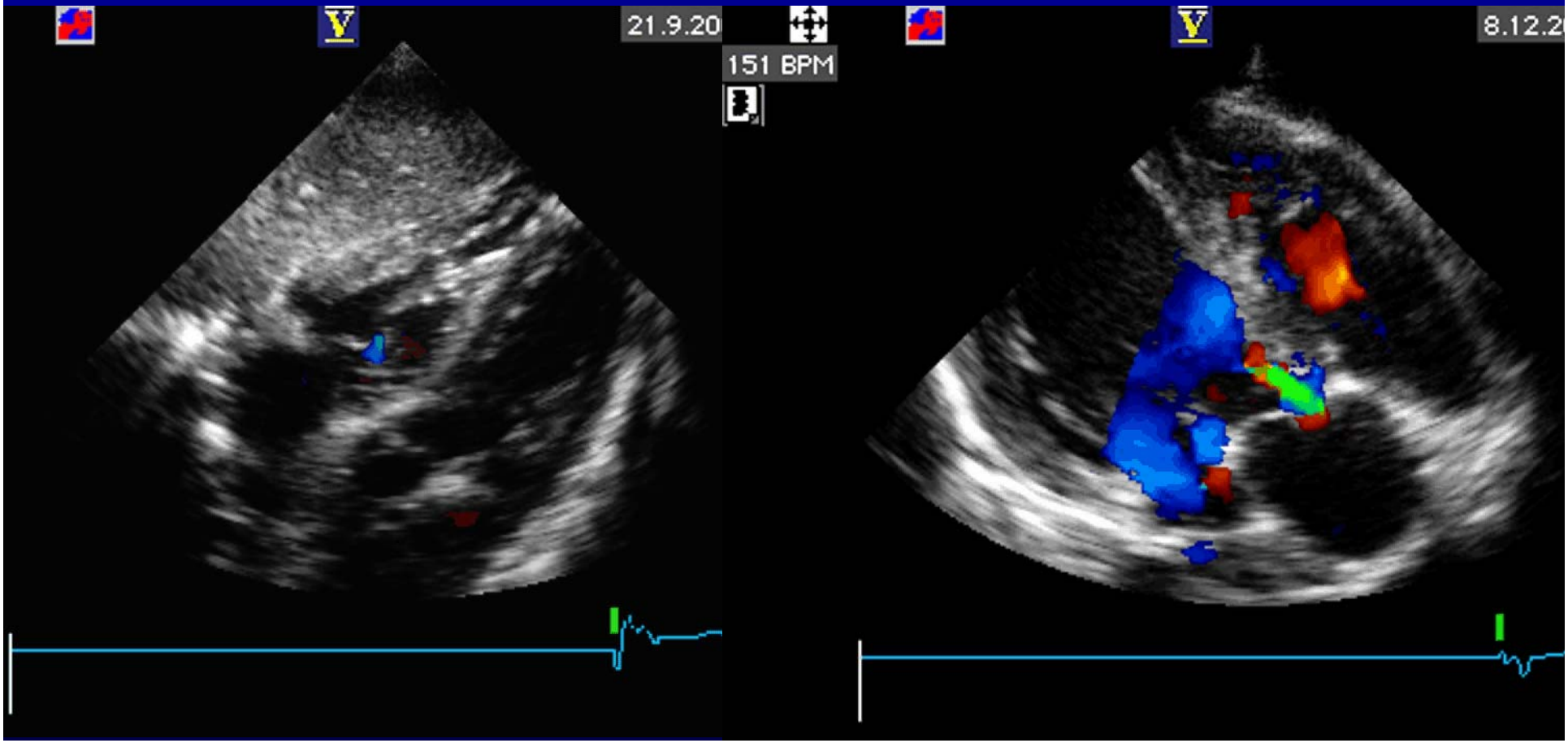


Mod. long axis



High coronary view

Early post-OP evaluation – LVOT



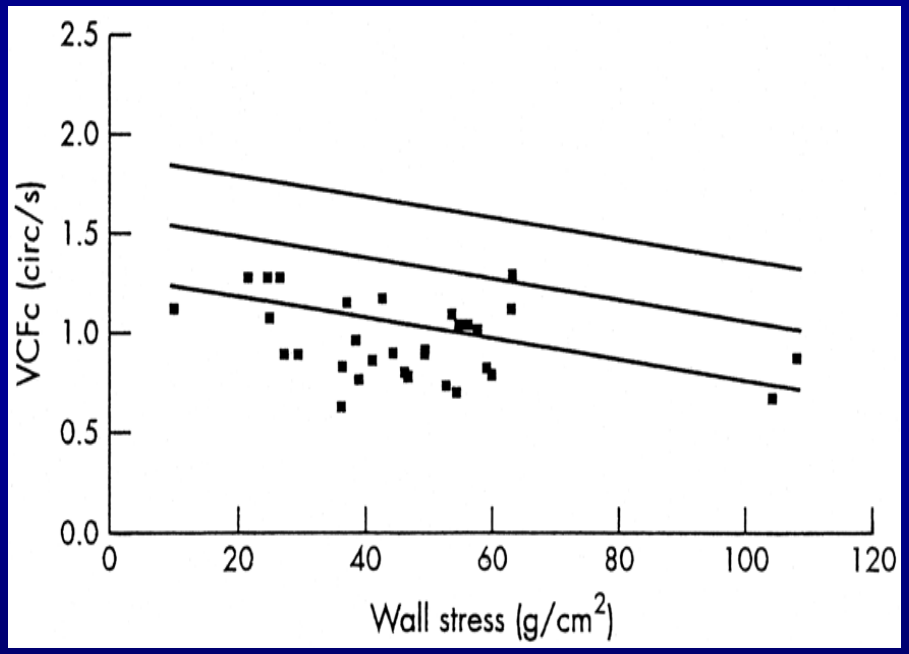
Long term follow-up: myocardial function

Echocardiographic Findings After Neonatal Arterial Switch Operation: Longitudinal Course

	Follow-up 5.3 (1.6) years		Follow-up 10.5 (1.6) years		
	n	%	n	%	p^a
Left ventricular end-diastolic diameter					
Normal	55	91.7	60	100.0	NS
< 3rd percentile	1	1.7	0	0	
> 97th percentile	4	6.7	0	0	
Shortening fraction					
Normal (28% to 2%)	56	93.3	53	88.3	NS
Reduced (< 28%)	1	1.7	1	1.7	
Not measurable	3	5.0	6	10.0	

Hövels-Gürich et al. Ann Thorac Surg 2003;75:935-43

Long term follow-up: stress echocardiography



Comparison of baseline left ventricular echocardiographic indexes between patient and control groups

Variable	Patients (n=31)	Controls (n=20)	p Value
HR (beats/min)	81(14)	78(13)	0.46
FS (%)	0.33(0.05)	0.41(0.05)	<0.001*
EF (%)	0.70(0.06)	0.80(0.06)	<0.001*
VCFc (circ/s)	0.97(0.18)	1.23(0.21)	<0.001*
LVSD (cm)	2.43(0.48)	2.47(0.36)	0.74
LVPWS (cm)	1.28(0.29)	1.11(0.17)	0.01*

Stress-velocity index

74% stress induced wall abnormalities

Hui L. et al. Heart 2005;91:68-72

Long term follow-up: coronary blood flow

Quantitative and Qualitative PET Results With N-13 Ammonia

	ASO	Normals
n	21	10
Age, y	12.3±2.2	25.6±5.4
Time since operation, y	11.2±2.9	
Heart rate, bpm		
At rest	66±11	66±12
With adenosine	105±16*	107±15*
RPP, mm Hg · min^{-1}		
At rest	7.113±1.458	7.821±1.147
With adenosine	12.119±3.065*	12.961±2.442*
MBF, mL · 100 g^{-1} · min^{-1}		
At rest normalized	112.2±27.7*	77.4±16.4*
With adenosine	263.2±44.1*	310.3±75.4*
CFR	2.54±0.61	4.09±0.95
Perfusion defects (stress-induced), n	5	0

Values are mean±SD. RPP indicates rate-pressure product.
*$P<0.05$ vs at rest.

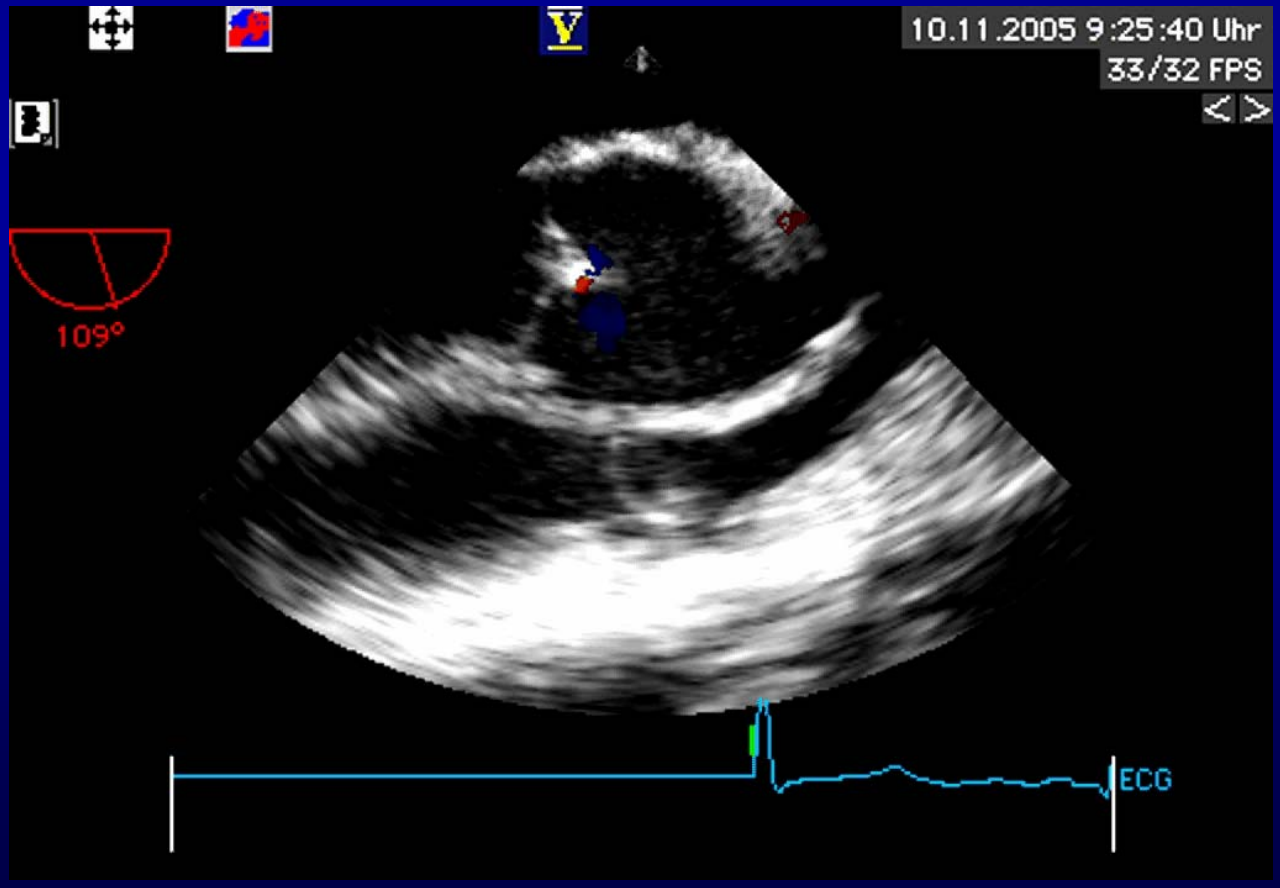
Hauser et al, Circulation 2001;103:1875-1880

Long term follow-up: RVOTO

- Neopulmonary stenosis most frequent complication (30%-5y; 42%-10y)
- RVOTO may increase in severity/number
- Reintervention rate 2.6 - 5% in 10y
  Freedom from reintervention 10 y 95%
- Surgical techniques may influence RVOTO

Hövels-Gürich et al. Ann Thorac Surg 2003;75:935-43
Losay et al. Circulation 2001;104 (suppl I): 121-6

Long term follow-up: RVOTO



Long term follow-up: Neoaorta

- LVOTO is not a problem
- Mild Aortic regurgitation 3 – 12%
- Sign. Aortic regurgitation 3%
- Rate and degree do not increase with age
- Mild regurg. is associated with root dilatation not with valve annulus

Long term follow-up: Neoaorta

P.A. Hutter et al. / European Journal of Cardio-thoracic Surgery 20 (2001) 82–88

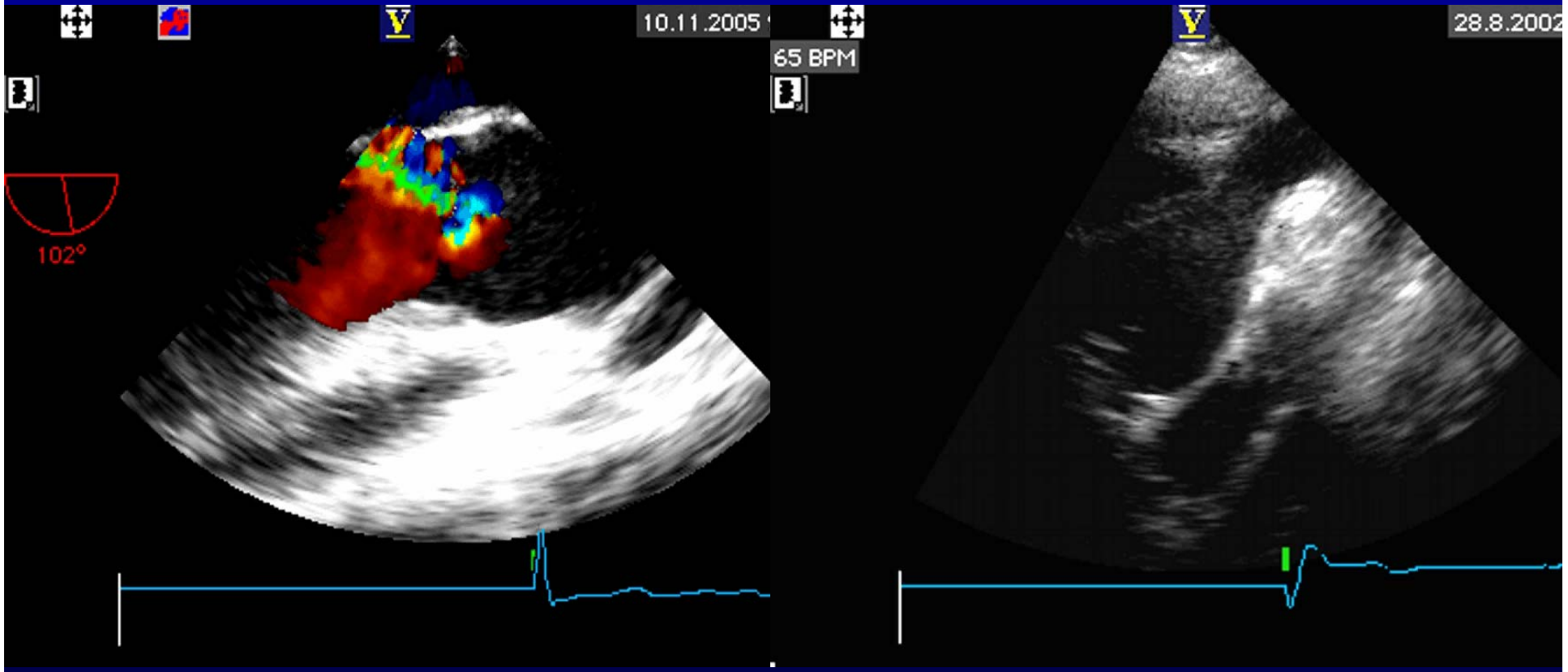
Measurements of z-scores of aortic valve, sinus and anastomosis in different age groups[a]

Age	0–4 months	5–12 months	1–5 years	6–10 years	11–15 years	> 15 years
No. of observations	50	41	98	163	128	28
Aortic valve z-score	0.63 ± 2.20	2.56 ± 2.30	2.40 ± 2.55	1.07 ± 2.14	1.26 ± 2.05	1.29 ± 2.41
Sinus z-score	0.22 ± 0.94	1.76 ± 1.08	2.28 ± 1.11	1.86 ± 1.03	1.53 ± 1.02	0.96 ± 1.22
Anastomosis z-score	− 0.64 ± 0.98	0.83 ± 1.49	1.33 ± 1.35	1.69 ± 1.39	1.63 ± 1.53	2.11 ± 2.54

[a] All three differences between the group 0–4 and 5–12 months are significant at $P < 0.0001$.

Hütter et al. Eur J Cardio-thorac Surg 2001;20:82-88

Long term follow-up: Neoaorta



Conclusion

- Late outcome after neonat. Switch Operation is good
- Myocardial function at rest is normal
- Stress testing may unmask regional wall abnormalities
- RVOTO common complication – Reintervention rate 3-5%
- Neoaortic root dilatation in 1st y of life „normalizes“ within 10 y
- Sign. AI is less common; related to root diameter

Thanks!