The 3rd Congress of Congenital heart disease
Ventricular Septal Defect from A-Z
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Follow-up after VSD closure- what to look for?

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Follow- up after VSD closure
Major Complications

- Complete AV block
- Aortic-/ Tricuspid valve dysfunction
- Malposition/embolization of device
- Residual defect (severe)
- Severe hemolysis

Carminati M et al.European H J 2007, 28: 2361
Kenny D et al: Catheter Cardiovasc Interv 2009, 73:568-75

Follow- up after VSD closure
Minor complications

- Transient arrythmias
- Residual defect (small)
- Transient hemolysis
- Inguinal hematoma and fistula

Carminati M et al.European H J 2007, 28: 2361
Kenny D et al: Catheter Cardiovasc Interv 2009, 73:568-75

Follow- up after VSD closure

- **The day after the procedure**:
  - ECG
  - TTE
  - Chest X-ray

- **Discharged on**:
  - ASS 100 mg/die
  - Prophylaxis against infective endocarditis (IE)

Follow- up after VSD closure

- 1, 6, 12, 24 months, then every 2nd year
- Symptoms?
  - dizziness, syncope, dyspnea, hemolytic anemia ...
- Murmurs?
- ECG- abnormalities?
- TTE (TEE if required):

➢ Residual defect? Tricuspid valve dysfuntion?
AR? RVOT/LVOT obstruction?Device malposition?
Development of discrete subaortic stenosis/DCRV

Adverse events after device closure of perimembranous VSDs (n = 100 procedures)

Procedure related complications	29/100 (29)[a]
■ Mortality	0/100 (0)
■ Arrhythmia/conduction anomalies	13/100 (13)
○ CHB requiring pacemaker	2/100 (2)
○ Transient CHB	1/100 (1)
○ Transient 1st DG HB	1/100 (1)
○ Transient 2nd DG HB	2/100 (2)
○ Transient LBBB	2/100 (2)
○ Transient junctional rhythm	3/100 (3)
○ RBBB	5/100 (5)
■ New/Increased AR	9/97 (9.2)
○ AR at last F/U > mild	1 Patient
■ New/Increased TR	9/97 (9.2)
○ TR at last F/U > mild	1 Patient
■ Tricuspid stenosis	1/100 (1)
■ Device embolization	2/100 (2)
■ Bradycardia/hypotension	3/100 (3)
■ Hemolysis	2/100 (2)
■ Mitral regurgitation	2/100 (2)
■ Other complications	2/100 (2)

[a]Values in parentheses are in percentages.

Holzer et al., Catheterization and Cardiovascular Interventions 2006; 68: 620-628

Follow- up after VSD closure Complications

- 430 pts
- Median FU 24- 38.5 mo
- Technical success rate: 95.3%
- Early complications: 55 (12.7%)
  - 1 death (0.2%) during the procedure
  - Complete AV block early 12 (2.8%)
  - Complete AV block late 4 (at 4, 7, ,12,18 mo)

➢ **Complete AV block 16 (3.7%)**

Carminati M, et al. EHJ 2007; 28: 2361-68

Follow- up after VSD closure Complications

- AR: no pts had more than mild
- TR: 1 case required surgery 3 mo later
- Hemolysis 5 (1.2%)
  - 1 retrieval of device
  - 2 pts needed blood transfusions
  - 2pts transient and self limited
  - Device realted infection 2 (0.5%)

Carminati M, et al. EHJ 2007; 28: 2361-68

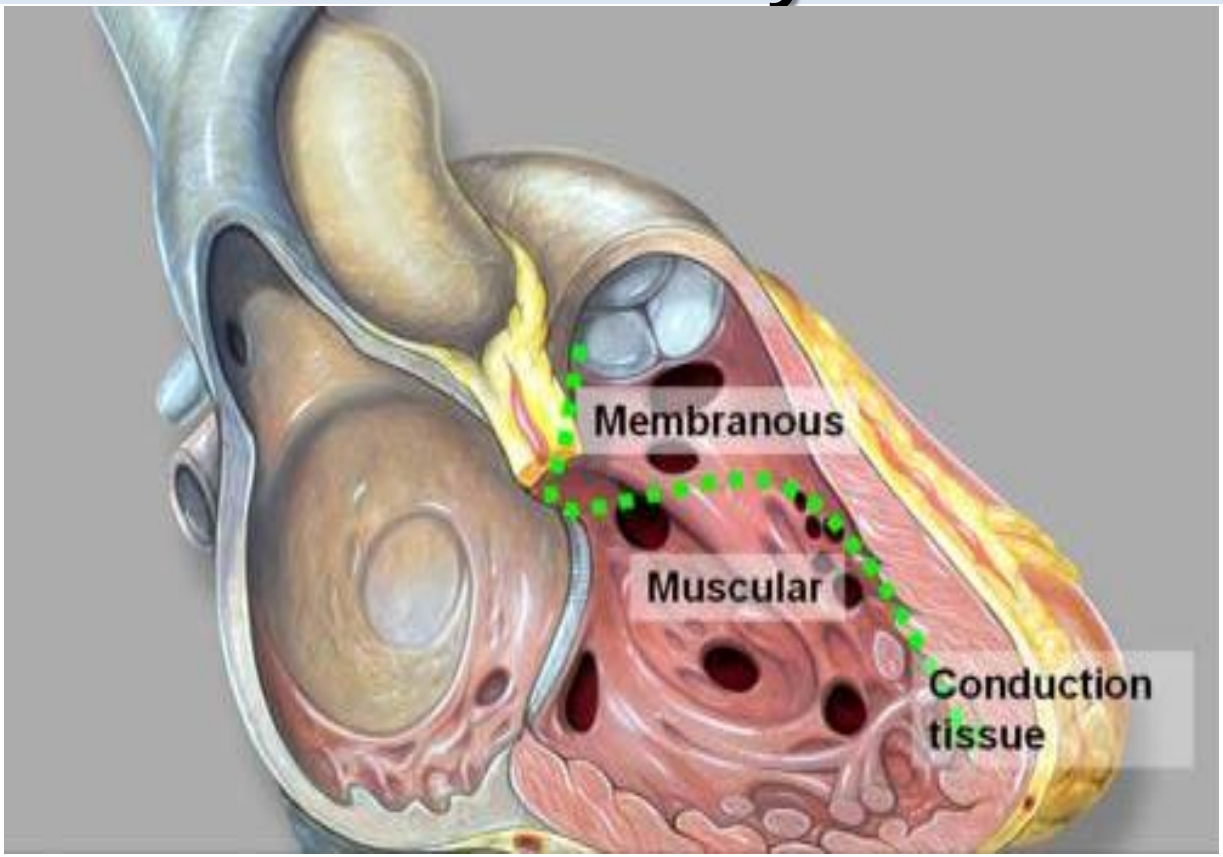
Follow-up after VSD closure
Complications

- Late complications > 1 mo
  - 1 death 6 weeks after the procedure
  - Complete AV block 4 (at 4, 7,12 and 18 mo)
    - 2pts→ syncope
    - 2pts were asymptomatic

Carminati M, et al. EHJ 2007; 28: 2361-68
Butera G et al. J Am Coll Cardiol 2007; 50: 1189-95

Major early and late complications
→ mainly complete AV block!

Relationship between VSD and conduction system



The conduction tissue is primarily placed postero-inferiorly with reference to membraneous VSDs, while it is placed antero-superiorly in most of the muscular VSDs

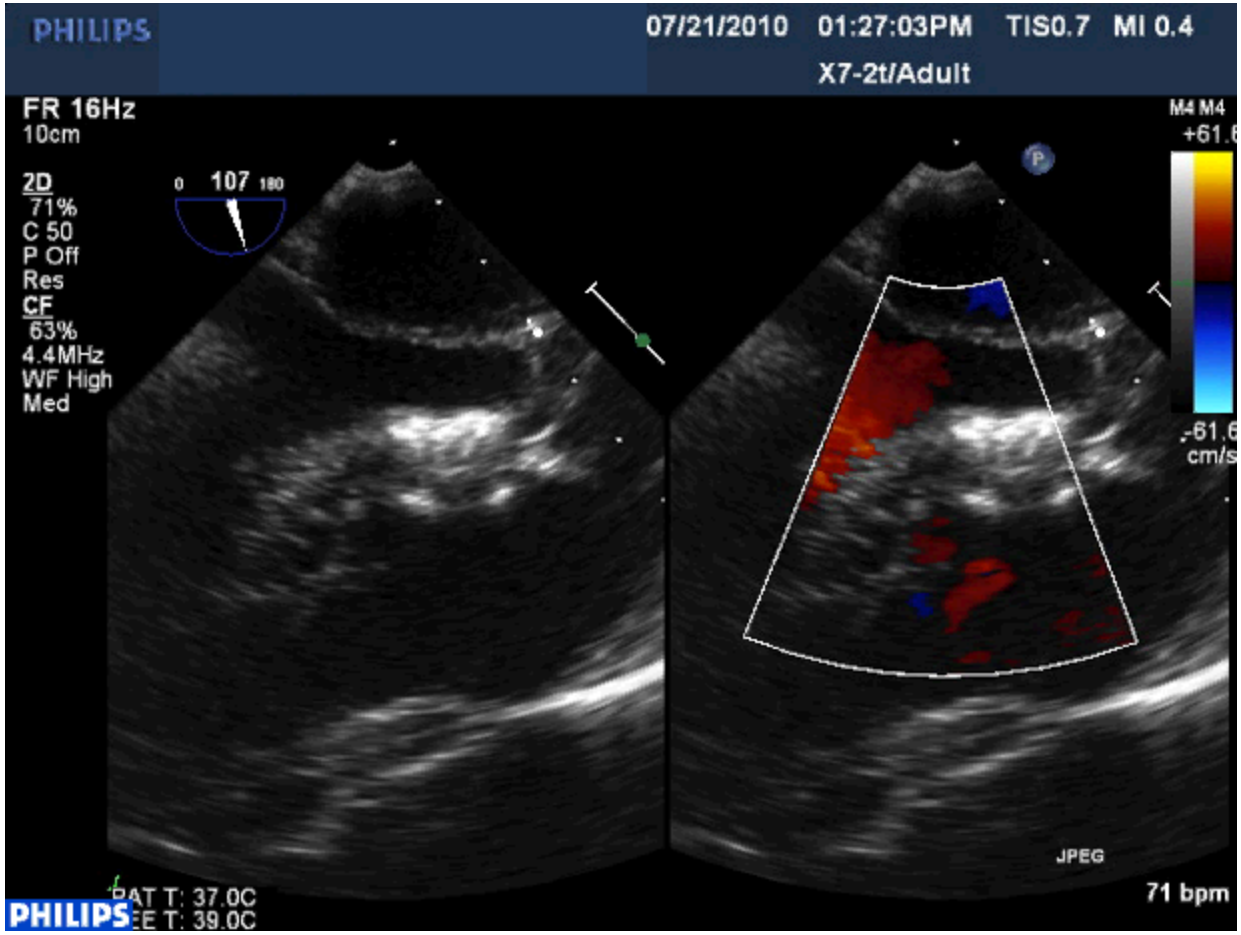
Lynch PJ. C Carl Jaffe Yale University

Follow-up after VSD closure
Risk factors for AV block

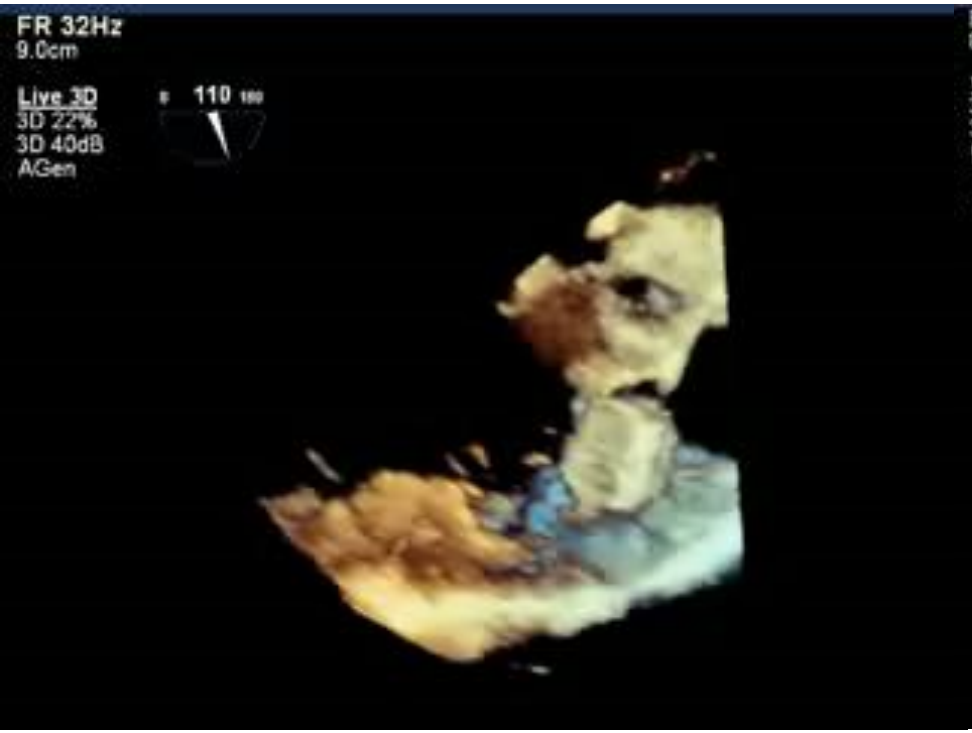
- **Young age**: (2.7 + 1 vs 14.7 + 15.6
´ (p < 0.0001)
- **Low weight** (15.8 + 5.7 vs 36.2 + 23.3 (p < 0.0001))
- **Device d / pt weight** (0.66 + 31 vs 0.39 + 0.20 (p < 0.03)

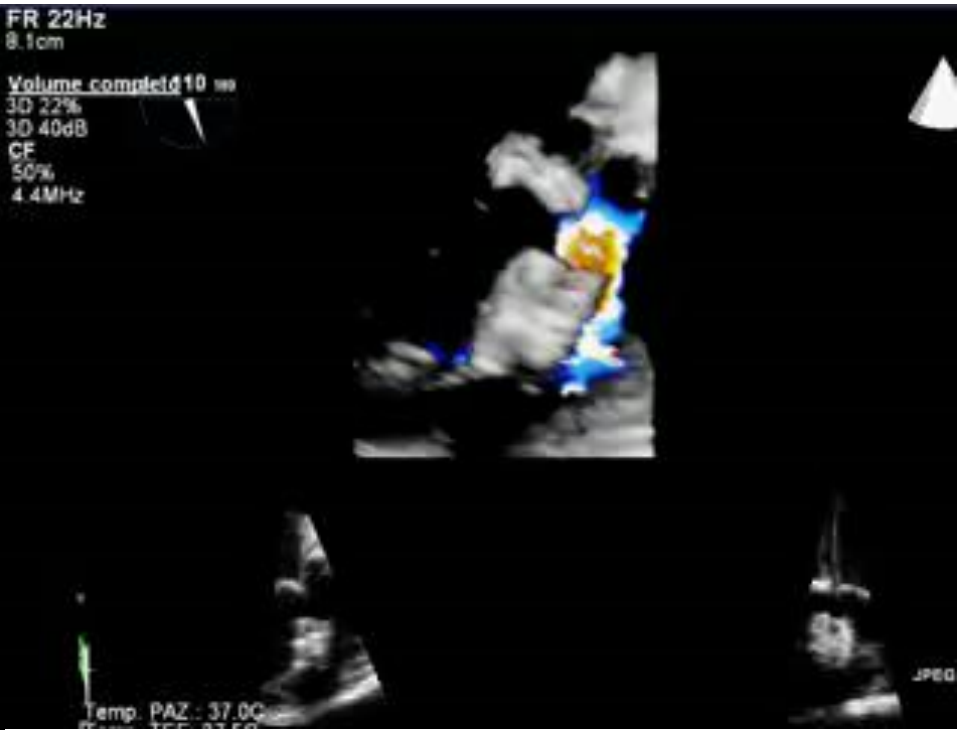
Butera G et al J Am Coll Cardiol 2007, 50: 1189--95

Follow-up after VSD closure
pmVSD-2D TEE

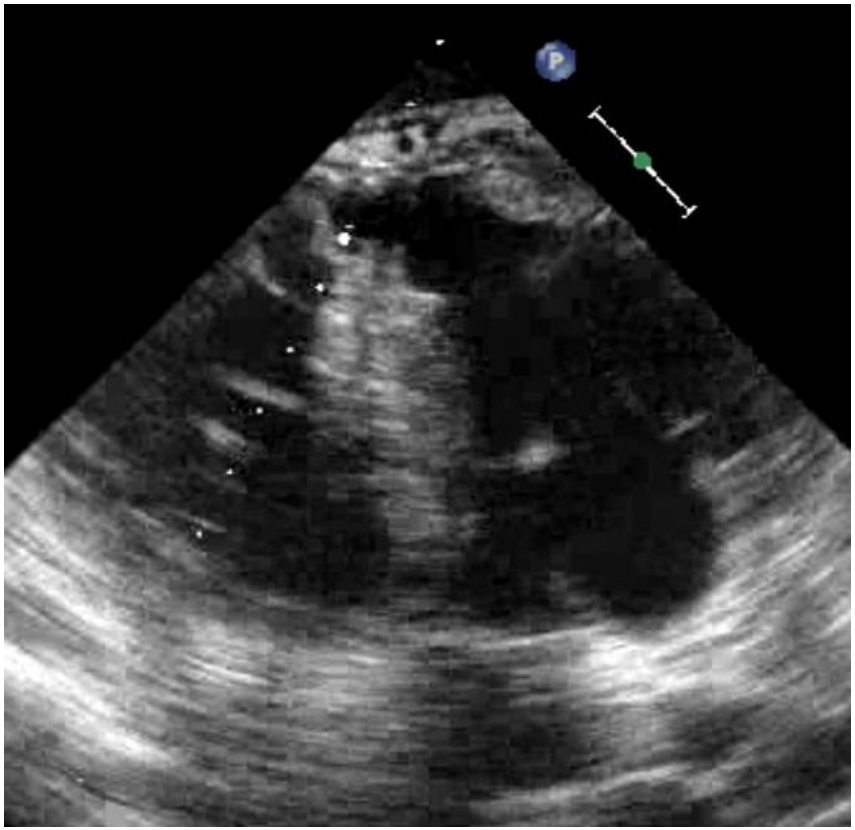


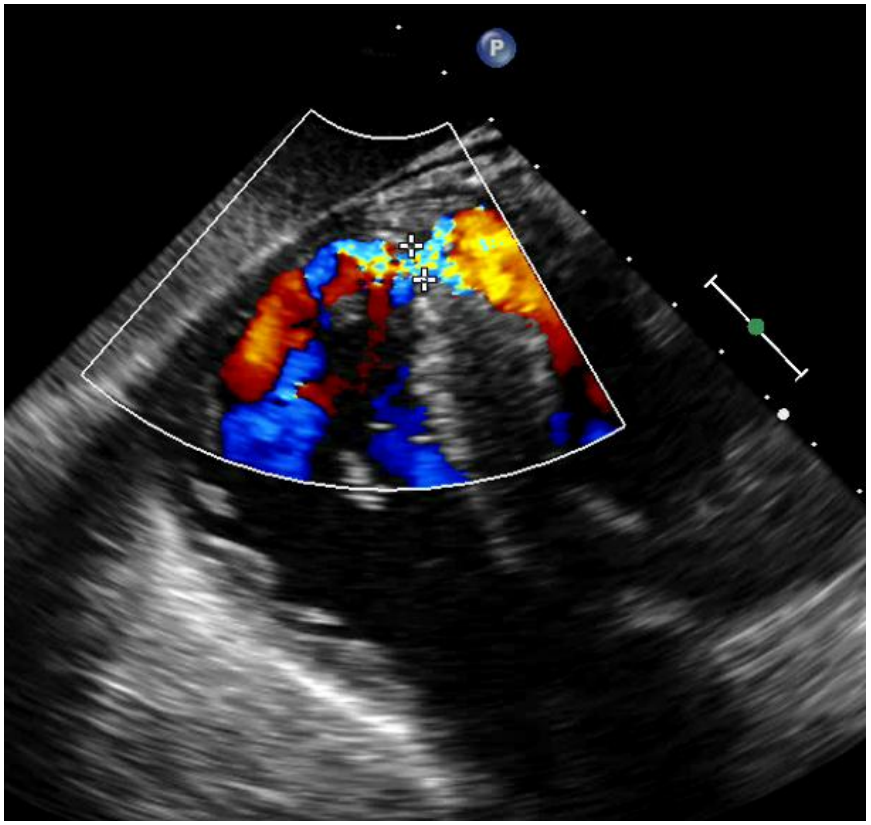
Follow-up after VSD closure
pmVSD- 3D TEE





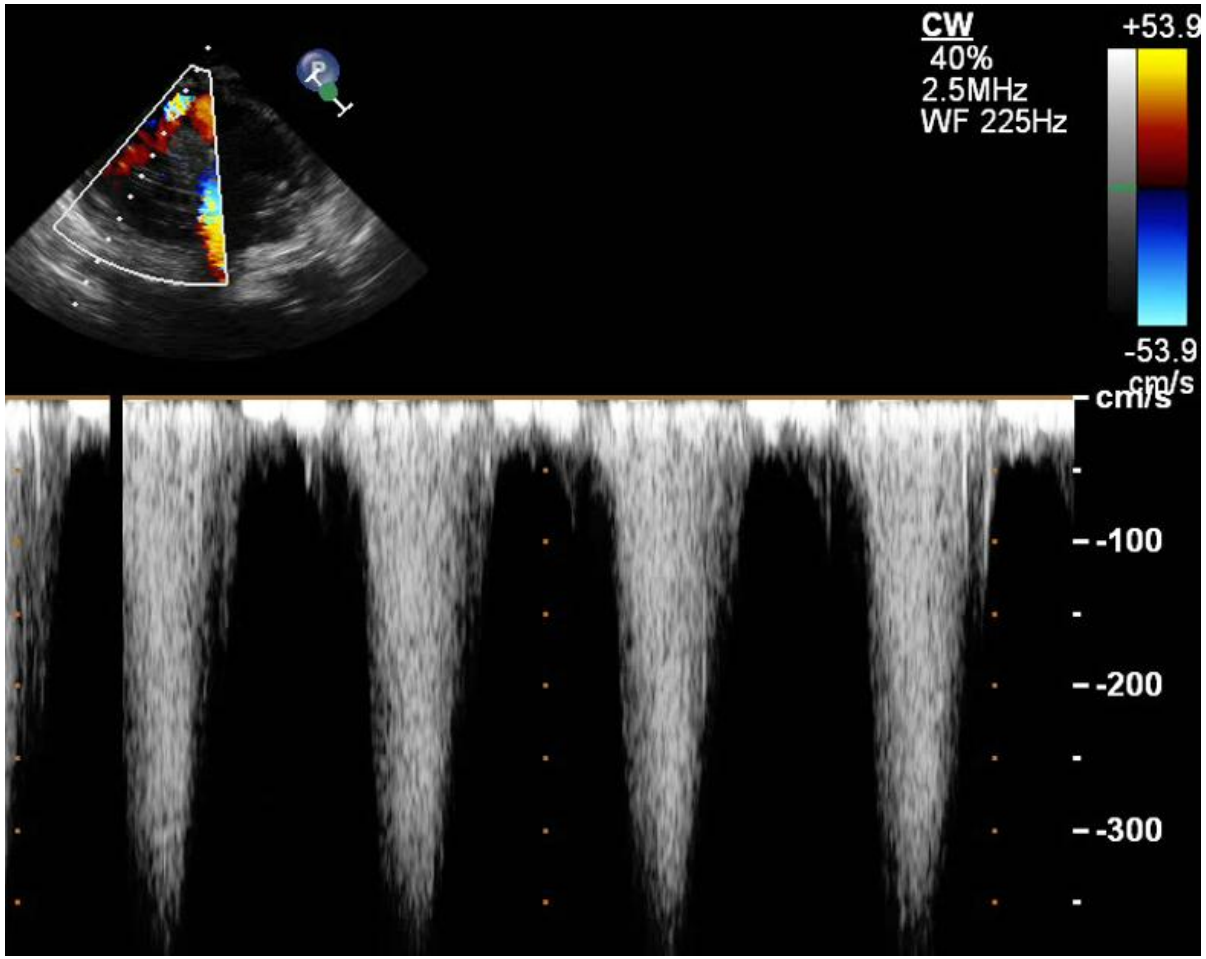
Follow-up after VSD closure
Residual shunt





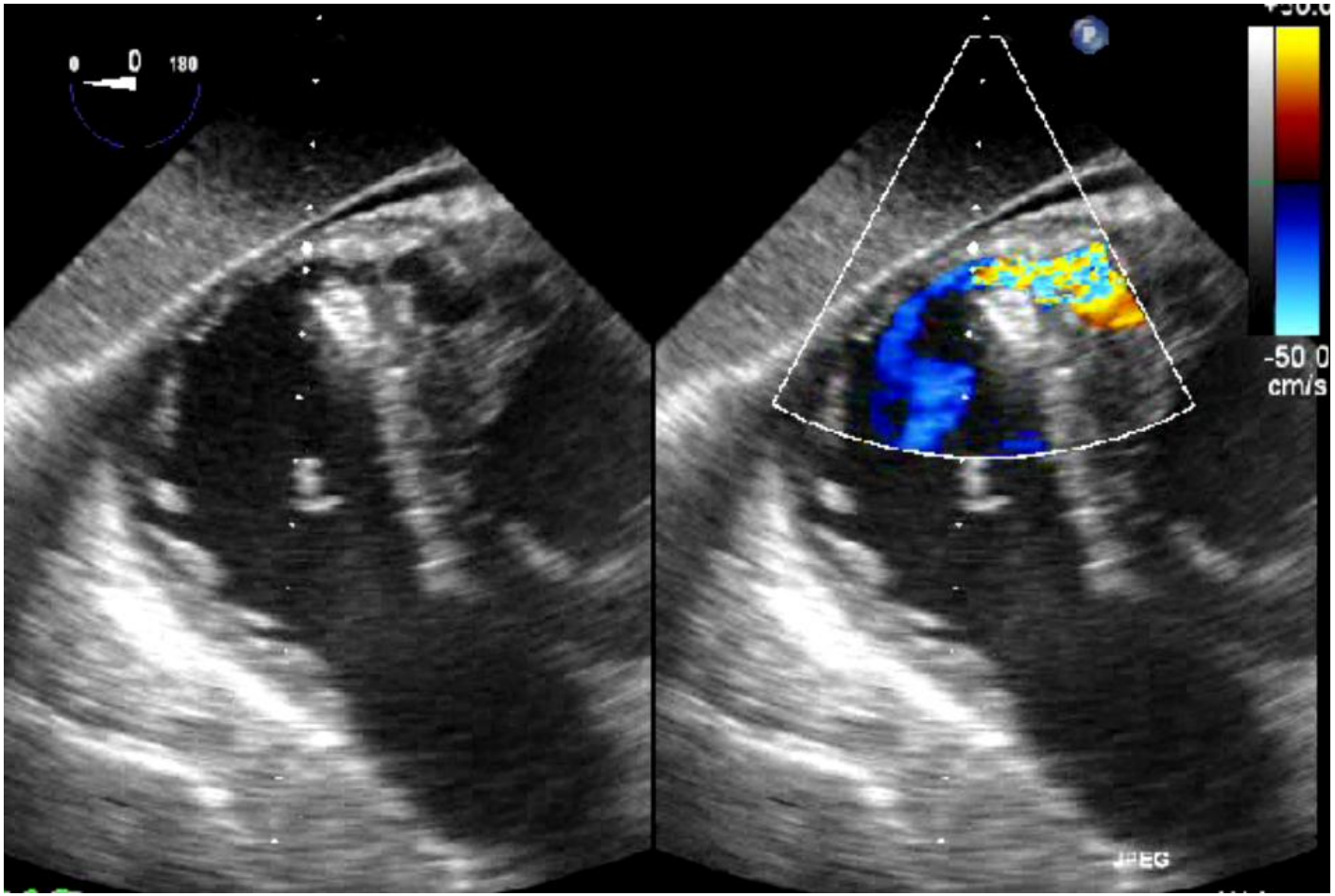
TTE: apical VSD without and with color Doppler

Follow-up after VSD closure residual shunt



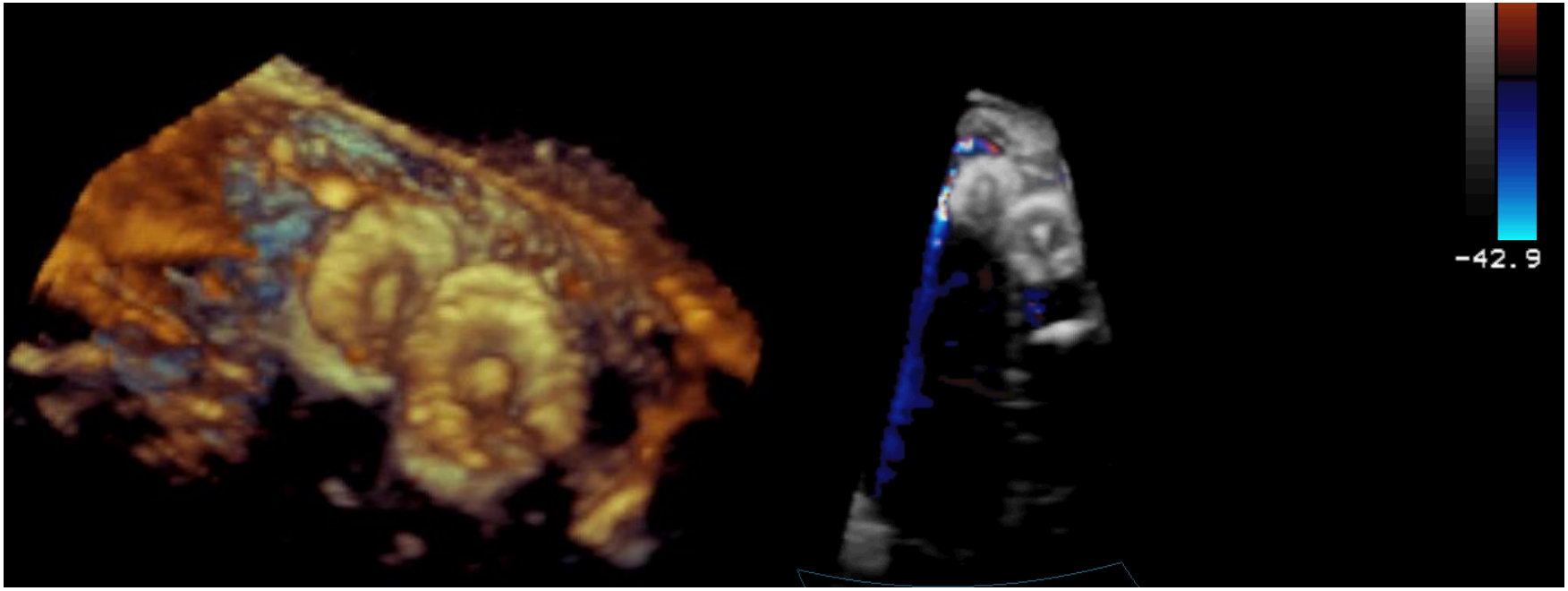
High velocity signal through the defect

Follow-up after VSD closure
Residual shunt



TEE after implantation of a muscular VSD occluder

Follow-up after VSD closure
Residual shunt

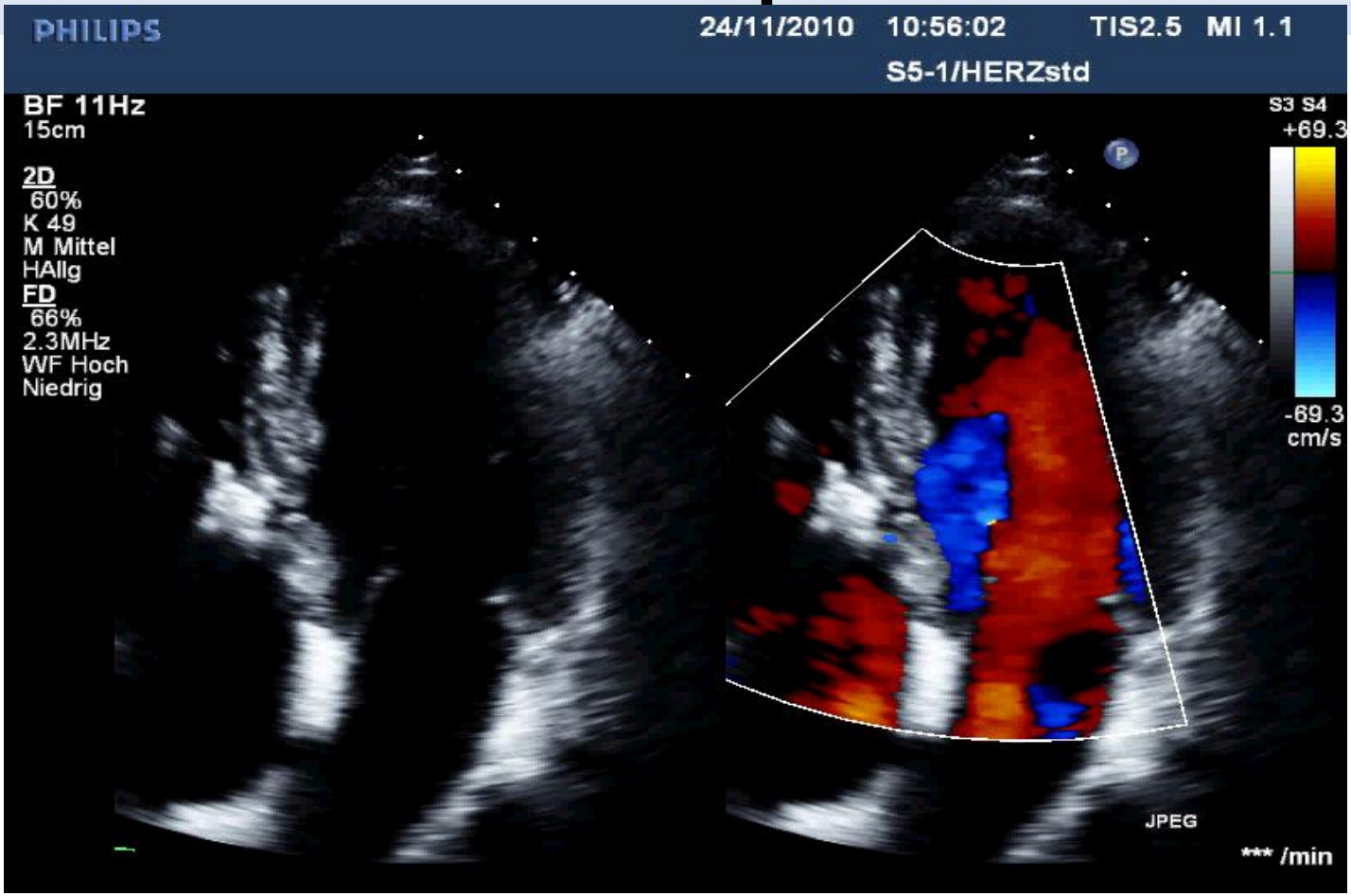


3D TEE, showing double closure devices with a small residual shunt

Follow-up after VSD closure
Device malposition
Case example

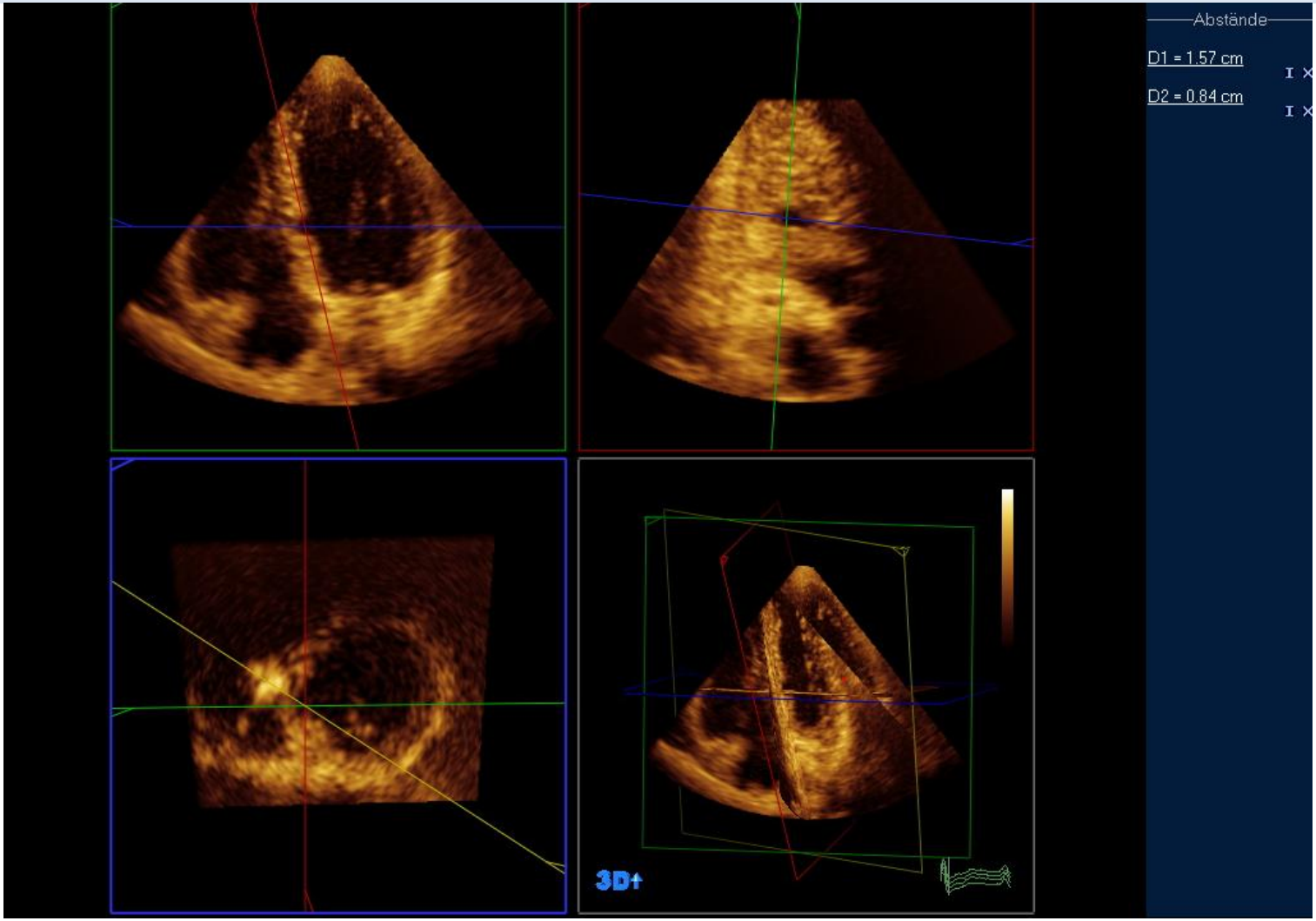
- 44 y old man
- Pre-diagnosed muscular VSD- Measurements: 6mm
- 11/2010 implantation of a 6mm muscular VSD occluder

Follow-up after VSD closure
Device malposition

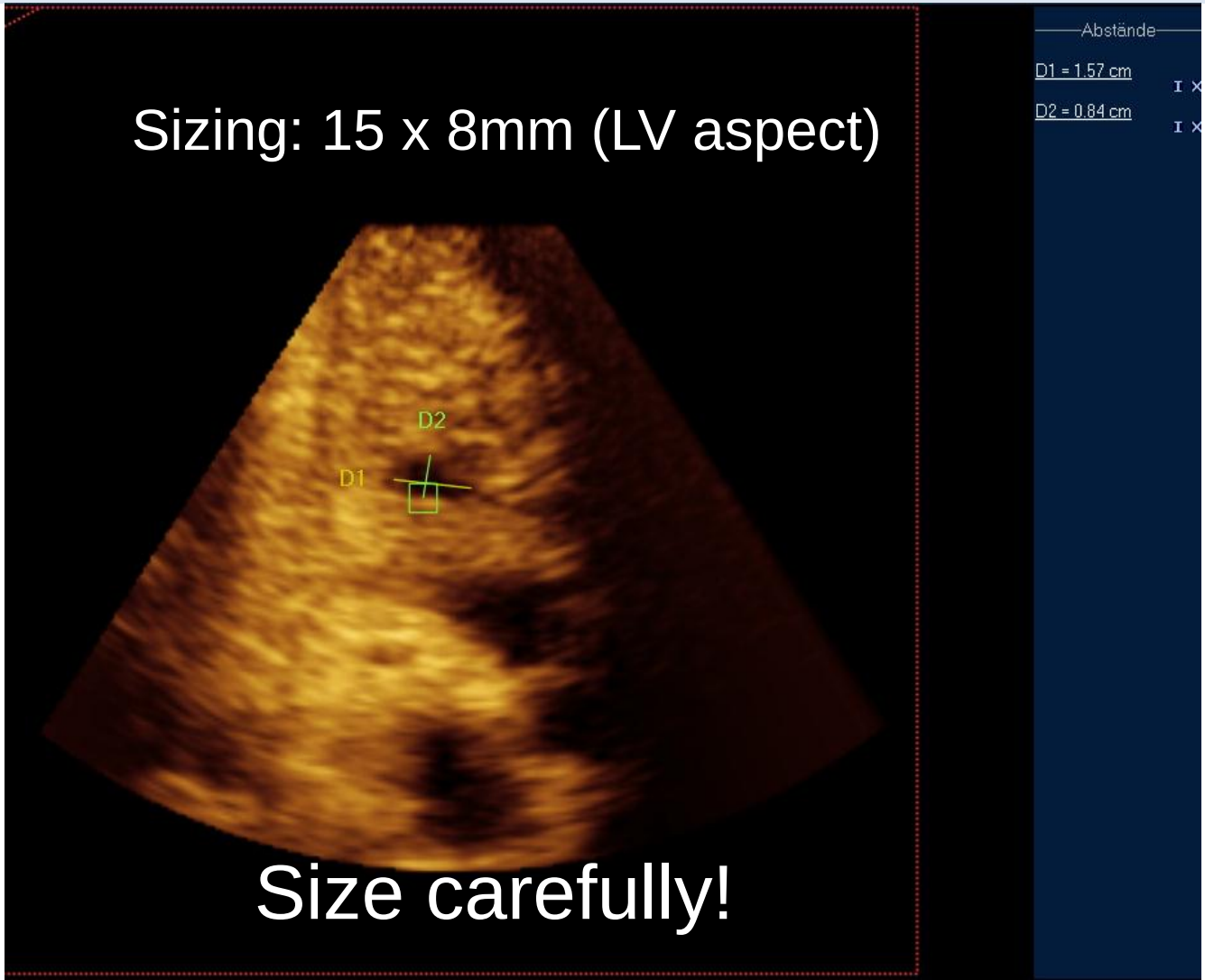


6 mo-FU: Migration of device

Follow-up after VSD closure
Device malposition



Follow-up after VSD closure
Device malposition



Take-home message
Follow-up after VSD closure

- AV block, arrythmias (ECG, holter ECG)
- Residual shunt (echo)
- LV dysfunction (echo)
- Device position (malposition?) (echo/X-ray)
- Aortic-/tricuspid malfunction +PAP (echo)
- Development of DCRV or discrete subaortic stenosis (echo)
- Device related infection (echo, lab test)
- Hemolysis (lab tests)

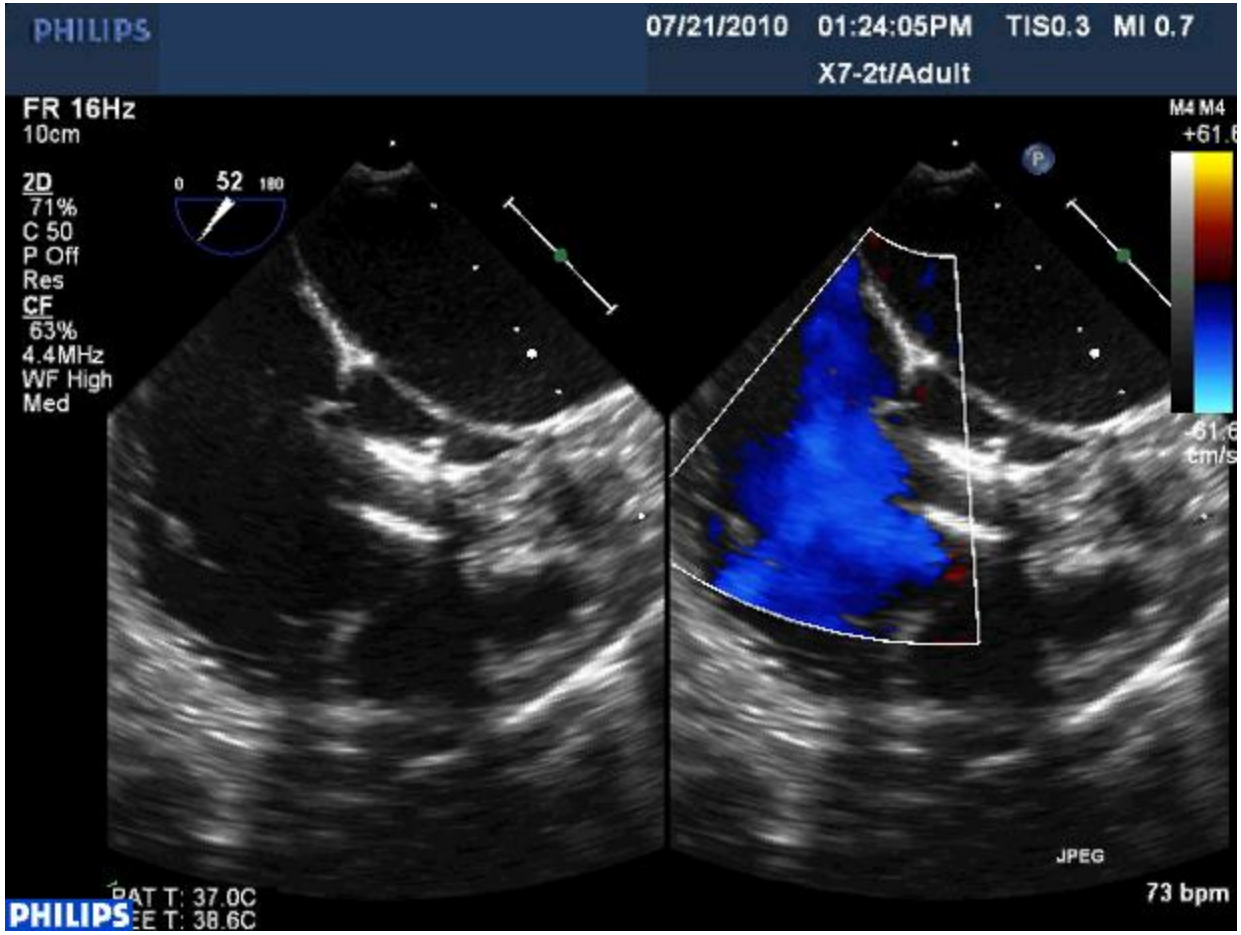
Take-home message
FU intervals

- Pts with LV dysfunction, pulmonary hypertension, aortic regurgitation,LVOT or RVOT obstruction
  - Every year
- Pts with small VSD
  - 3-5 y intervals
- Pts after device closure
  - Regular FU until 2 years, then every 2-4 years depending on the result
- Pts after surgery
  - Follow-ùp`s in 5 year intervals when no residual abnormality is present

ESC guidelines 2010

Thank you!

2D TEE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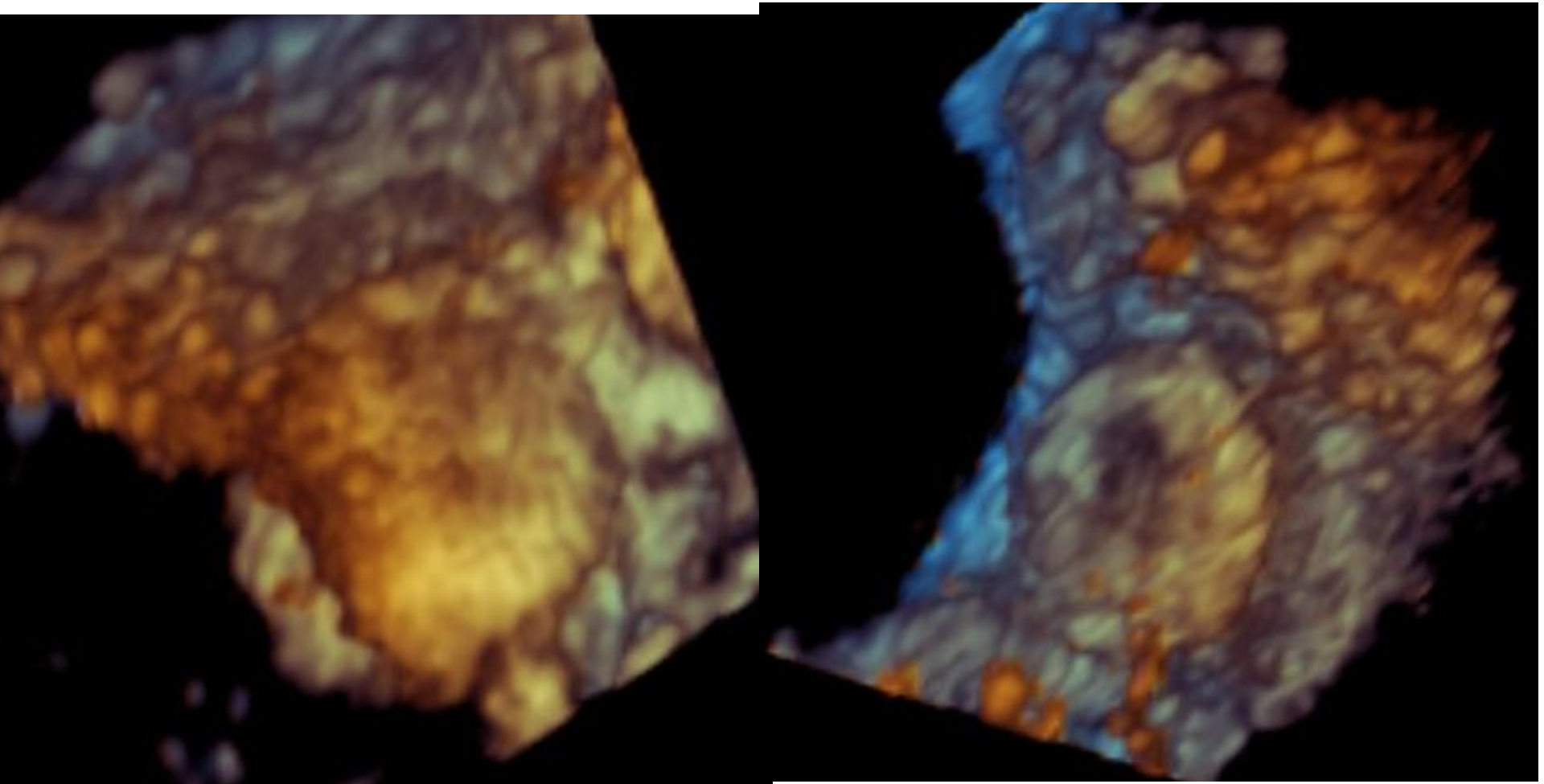
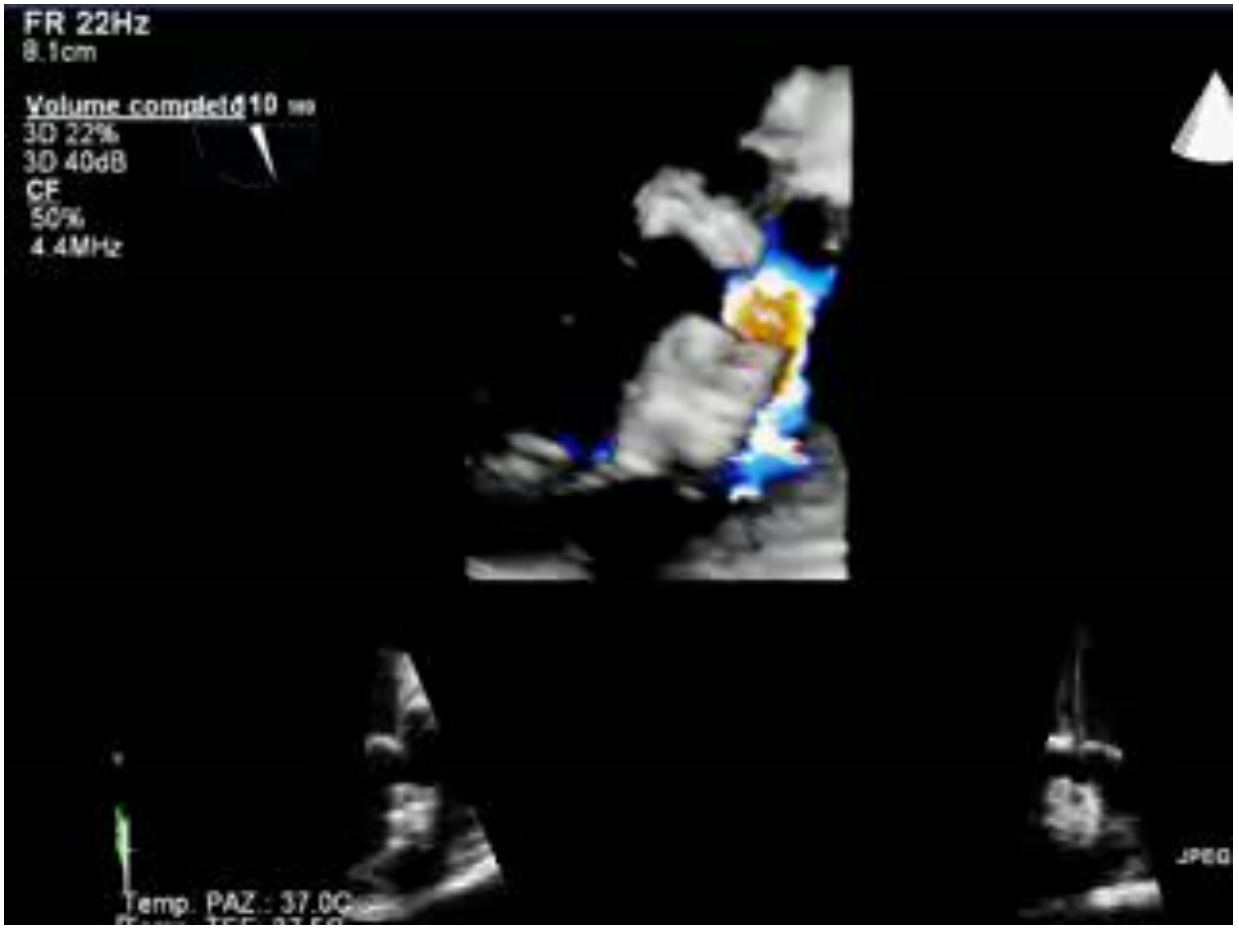
3D TEE

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