

# Conduction abnormalities following device closure of membranous VSD

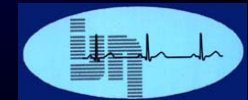
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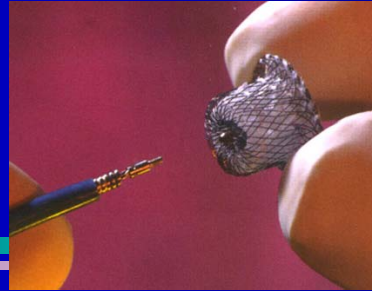
**Institut Jantung Negara**

**(National Heart Institute)**

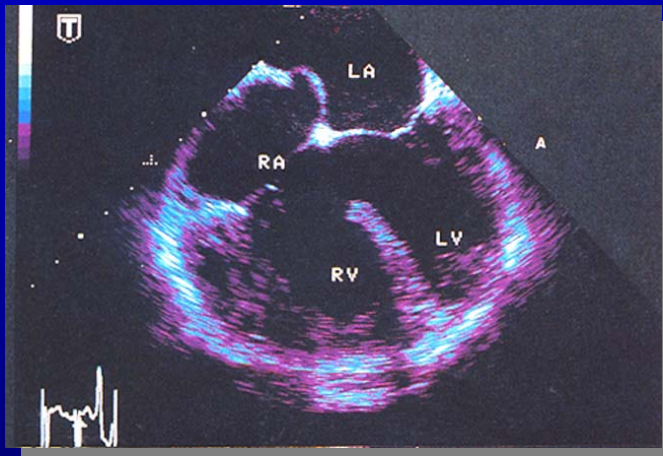
**Kuala Lumpur, Malaysia**



## DEVICE CLOSURE



- Remarkable success in ASD and PDA closure



**VSD is the commonest CHD, perimembranous VSD >75%**

**Commonest surgical procedure performed**

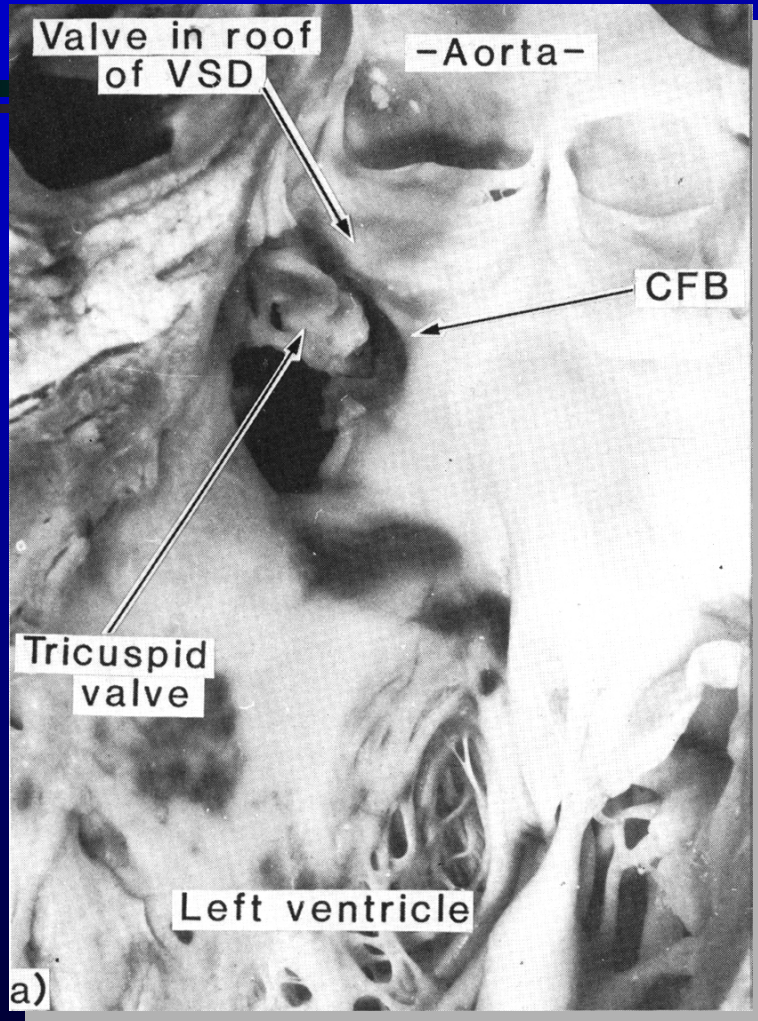
**Desirability of device closure as complete alternative to open heart surgery**



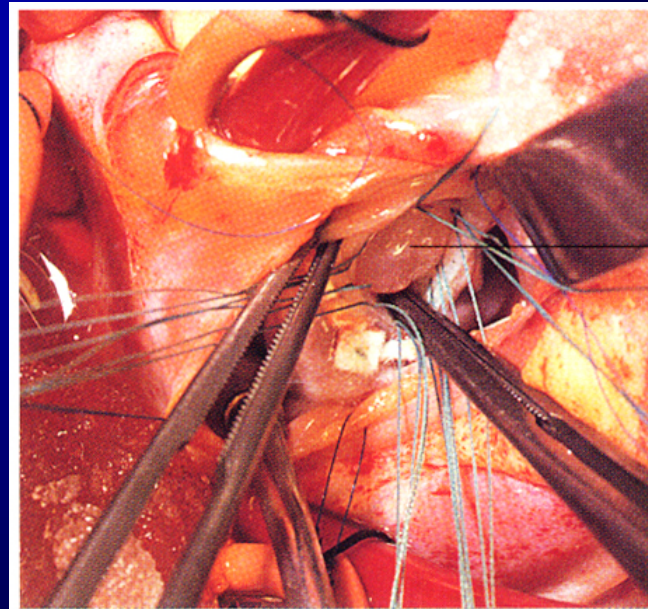
- Technical difficulty – small infants with large defects, large defects, large shunt, PHT
- Proximity of valve and tricuspid valve conduction tissue

**Principle – Stenting of defect by Device, retention disc**

# Perimembranous VSD

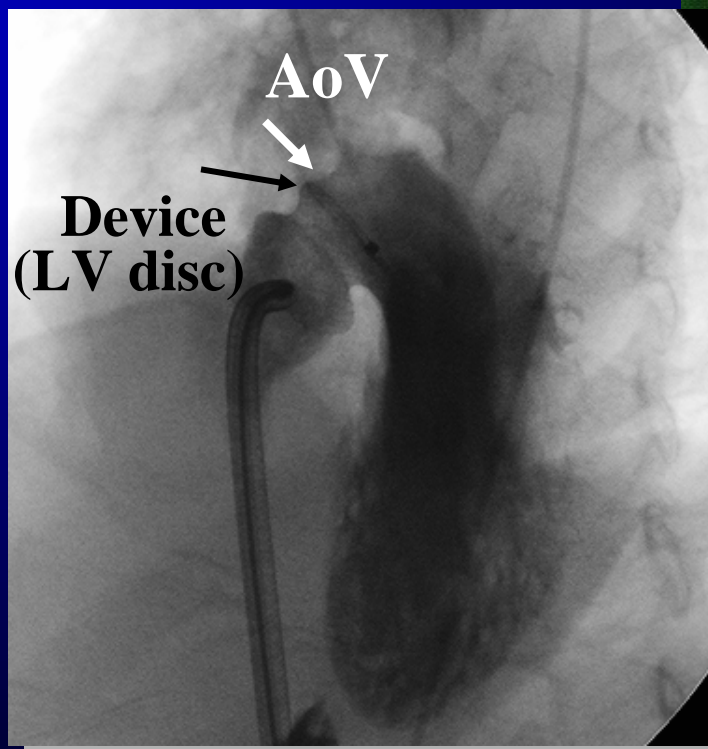
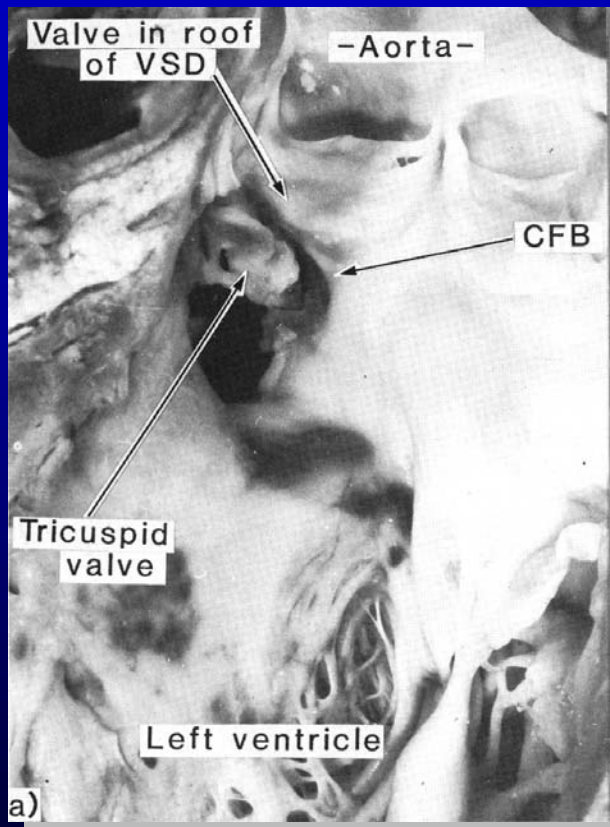


From LV



From RV

# Device for closure of PM VSD



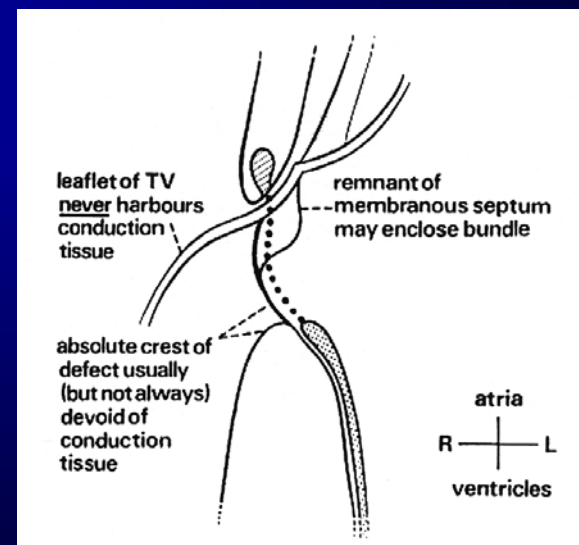
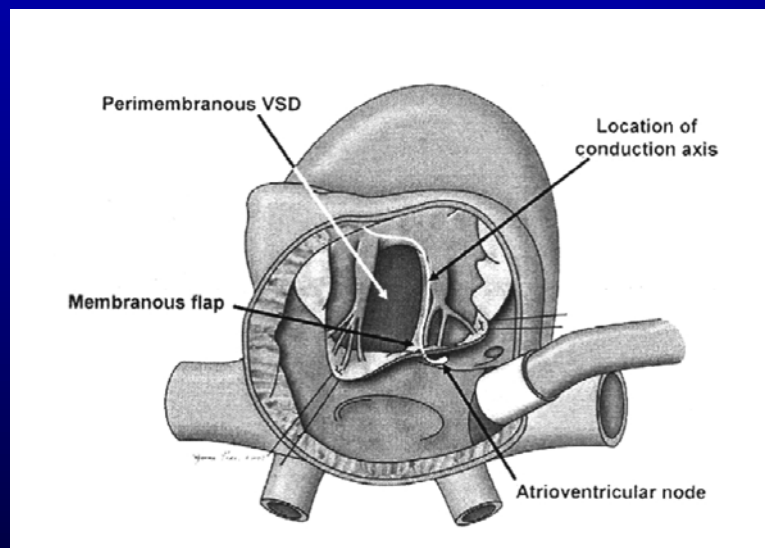


### Is Complete Heart Block After Surgical Closure of Ventricular Septum Defects Still an Issue?

Henrik Ø. Andersen, Marc R. de Leval, Victor T. Tsang, Martin J. Elliott, Robert H.  
Anderson and Andrew C. Cook

*Ann Thorac Surg* 2006;82:948-956

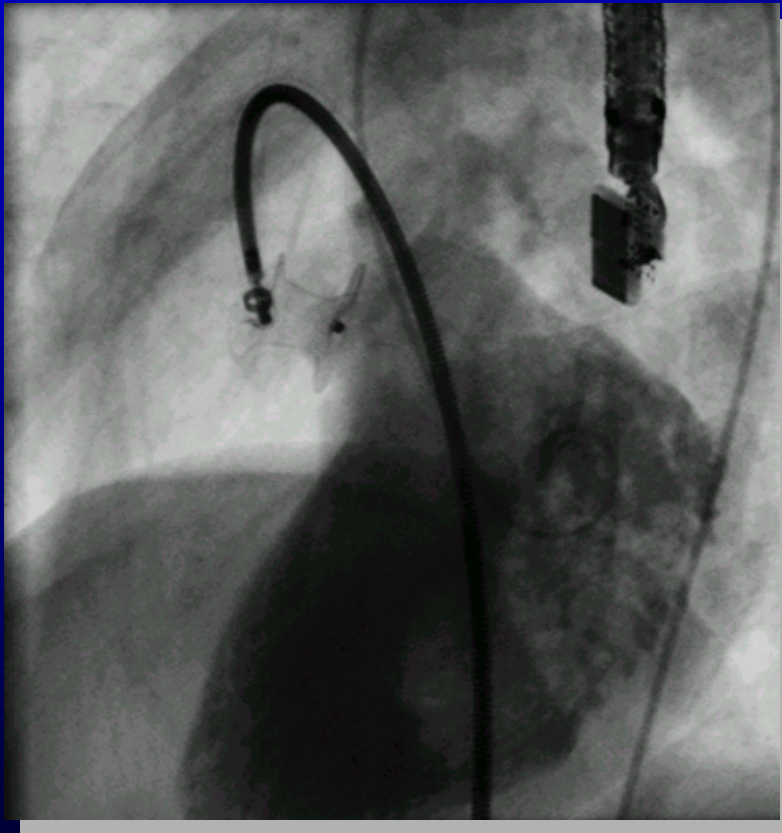
DOI: 10.1016/j.athoracsur.2006.04.030



- **CHB – well known complication of surgical closure**
- **Very low incidence in the modern era**
- **Much improved morbidity and mortality even in small infants with large defects**

# **Device closure of VSD**

## **Complication: Complete heart block**



- **Muscular inlet/  
perimembranous VSD**
- **Developed complete  
heart block 3 days after  
closure**
- **Supported with  
temporary pacemaker  
for a few days, sinus  
rhythm restored**

# Complete AVB

- **Acute intraprocedural cAVB – mechanical trauma/compression by delivery system or device restore sinus rhythm by discontinuation of procedure or removal of device**
- **Late onset**
  - ✓ **Progressive device flattening of originally oversized device**
  - ✓ **Chronic inflammation or fibrosis**

**Incidence 0 – 20%**

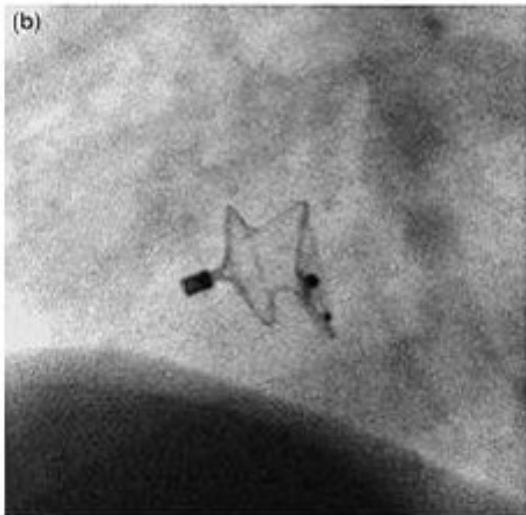
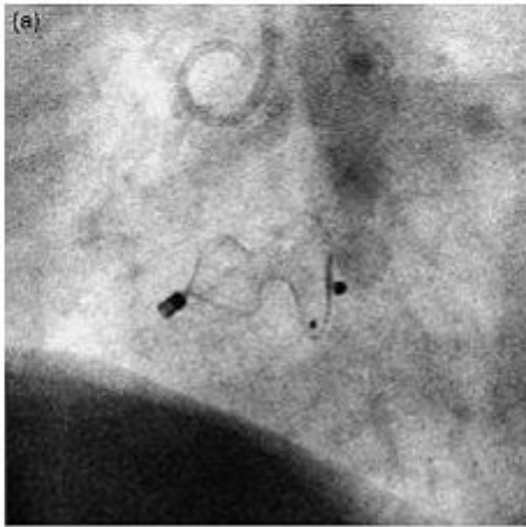


Figure 2.

*The long axial oblique projection immediately after placement of an 8 millimetres occluder in a perimembranous ventricular septal defect (a) shows a compressed central waist and bulging of the right ventricular disc of the occluder. The same projection after development of Mobitz II second-degree atrioventricular block 6 months after implantation (b) shows a good position of the occluder, with full expansion of the waist and flattening of the right ventricular disc.*

## **Progressive flattening of device not observed in all patients with CHG Not significantly in patients with or without CHB**

*Predescu et al. JTCVS 2008;  
136:1223-8*

*Fischer et al. Cardiol Young 2007;  
17:499-504*



# Complete AV Block

**100/104 patients – successful implants (1999 – 2006)**

**cAVB :**

***Early:***

- 2 – intraprocedural, procedure aborted
- 2 – cAVB developed soon after device release (1 transient, 1 returned to SR after surgical removal)
- 1 – 24 hours post procedure (permanent pacemaker, SR returned)
- 1 – 5 days post (steroids – resolved)
- 1 – 7 days post (permanent pacemaker)

***Late:***

- 4 – all required permanent pacemaker

**Incidence of AVB            8.7%**

**Permanent pacemaker 5.7%**

*Butera et al, JACC 2007; 50:1189-95*

**20 patients successful  
implantation**

**18/20 – considered large  
shunt (Qp/Qs >2) or  
mean PA pressure > 20  
mmHg**

**4 – developed CAVB at  
17 days, 4.2 months, 8.8  
months, all received  
permanent pacemaker**

**Other conduction  
abnormalities**

**1° HB, RBBB, LBBB,  
bifascicular block**

**TABLE 2. Comparison between non-CHB and CHB groups  
(n = 18)**

	Non-CHB group (n = 14)		CHB group (n = 4)		P value
Age (y)	1.6	(0.5–16.2)	1.3	(0.9–1.5)	.22
Weight (kg)	9.1	(6.2–43)	9.1	(8.1–10.3)	.79
Qp/Qs ratio	2	(1.0–3.4)	1.8	(1.4–2.3)	.45
Mean PAP (mm Hg)	33	(16–59)	39	(26–55)	.91
VSD size (mm)	10	(6–17)	9.5	(7–12)	.71
VSD/BSA	22.1	(8.2–27.5)	20.7	(16.3–28)	.79
Device size (mm)	12	(8–18)	12	(8–14)	.74
Device/VSD	1.2	(1.0–1.3)	1.2	(1.1–1.3)	.87
"New device"/device	0.9	(0.7–1.1)	0.9	(0.8–1.0)	.91
Trisomy 21	4		3		.24

Values are presented as medians (ranges). *CHB*, Complete heart block; *PAP*, pulmonary artery pressure; *VSD*, ventricular septal defect; *BSA*, body surface area; "New device"/device, device size by the new formula to used device ratio.

*Predescu et al. JTCVS 2008; 136:1223-8*

# **cAVB post perimembranous VSD device closure**

- **High incidence**
- **Late onset in many cases**
- **Lack of strong predictive factors (? Inlet PM VSD, oversized device)**
- **Potentially life-threatening presentation**

**All patients are big children who have no or minimal symptoms**

# **Institut Jantung Negara, Kuala Lumpur**

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***July 04 – June 06***

**65 cases**

**1 transient cAVB, 3 days post implant**

**1 persistent, required pacemaker**

**11 years female**

**Perimembranous VSD, 10 mm**

**2005 – device size 14 mm**

**Short run of SVT during procedure**

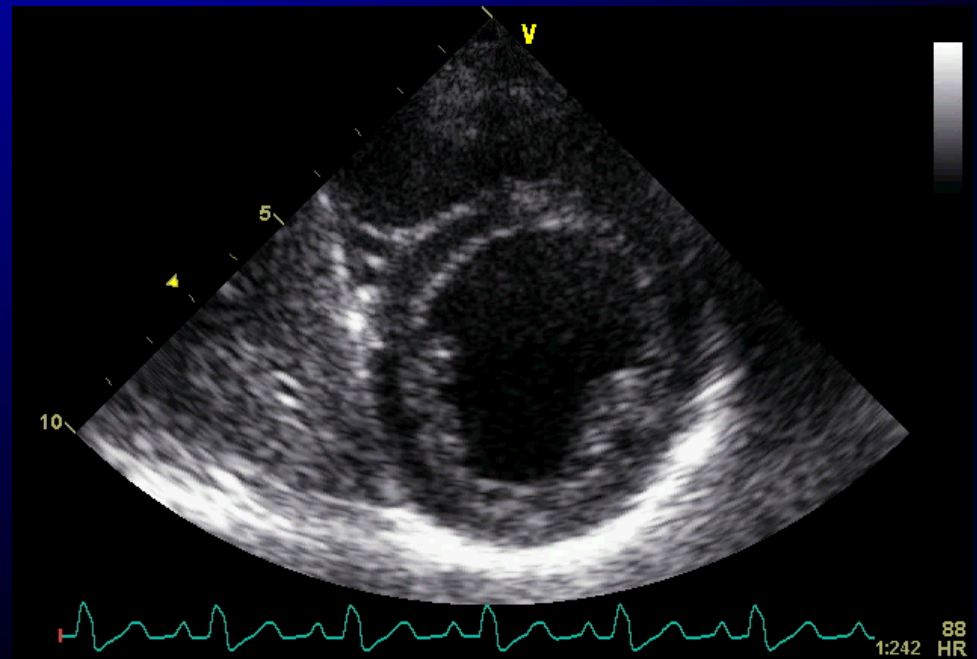
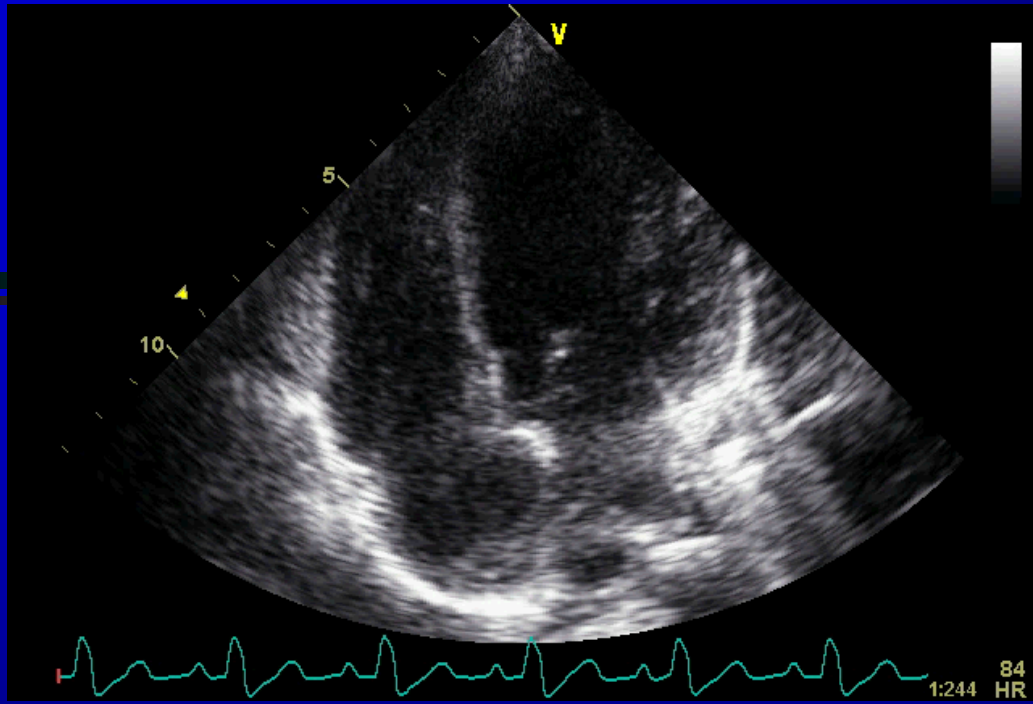
**2007 – new LBBB, LVEF 68%**

**2009 – LBBB present, QRS 120 ms**

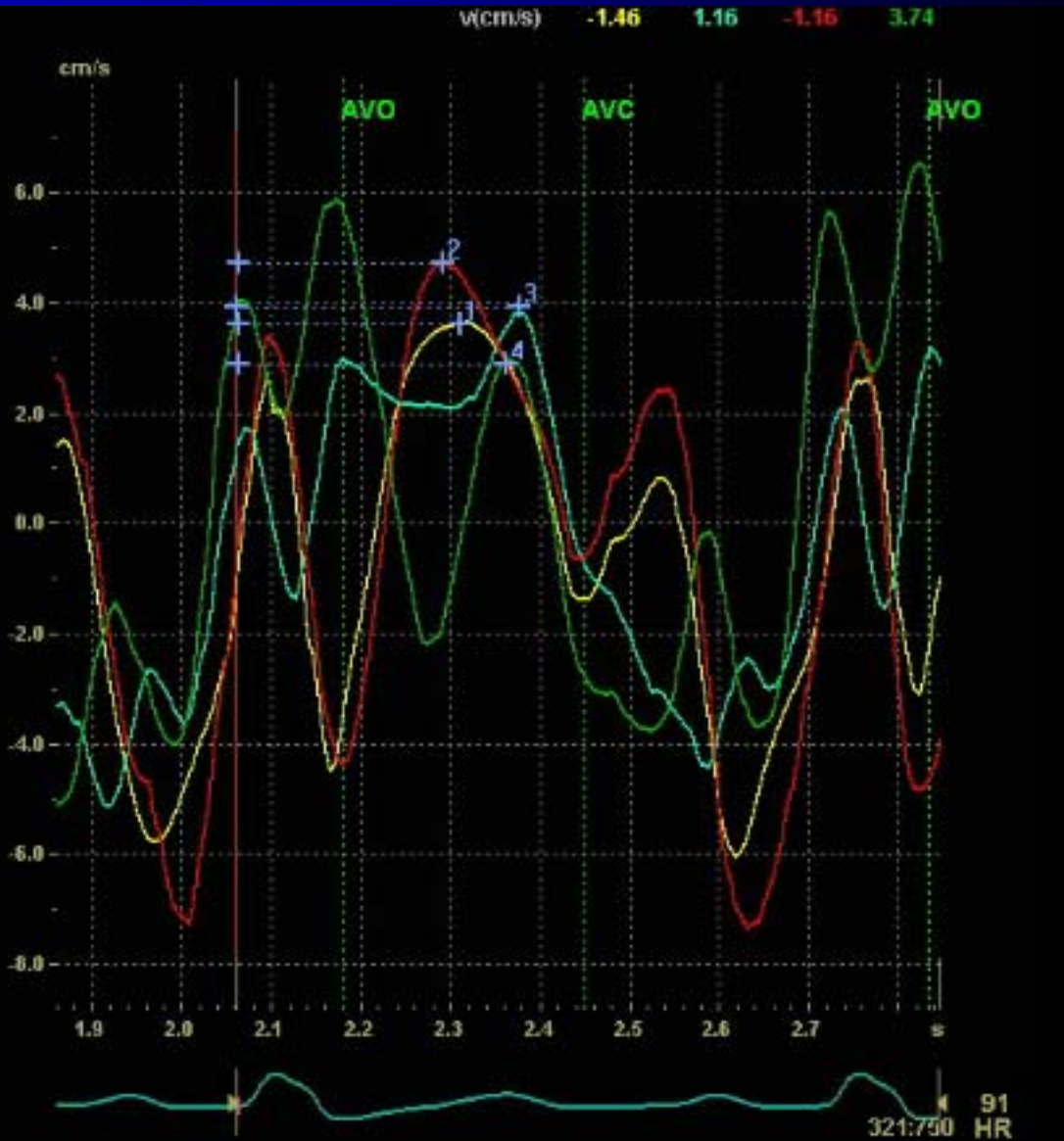
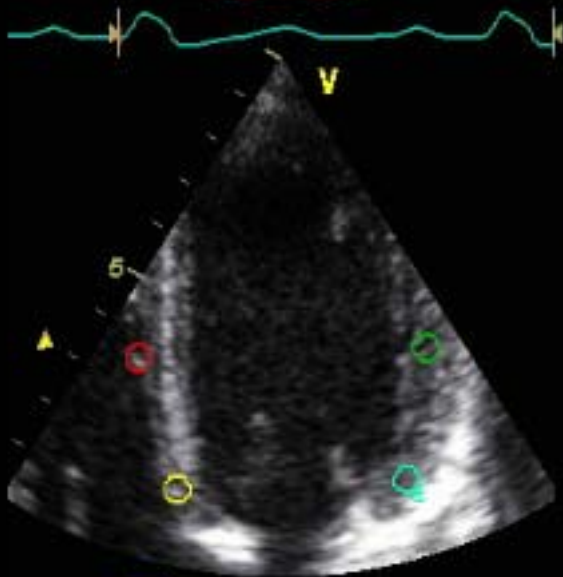
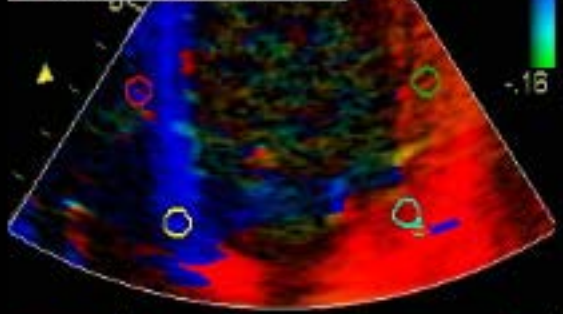
**Impaired LV function, septal dyssynchrony**

**Global hypokinesia**

**LVEF 40%**



4	mid lateral	0.299 s
3	basal lateral	0.316 s
2	mid septum	0.228 s
1	basal septum	0.248 s



# **SUMMARY**

## **Post device closure of perimembranous VSD**

- **High rate of cAVB late onset, absence of predictive factors,  $\pm$  catastrophic presentation**
- **?Dyssynchrony and LV dysfunction from bundle branch block**
- **All patients with device closure must be followed up closely**
- **? Device closure of perimembranous VSD with AMVO should be discontinued**
- **Needs radical changeover of concept for device design**



