

Indications for catheter ablation in children

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Guidelines for catheter ablation in children



Tachycardias in children



Tachycardias in children

Structurally normal hearts

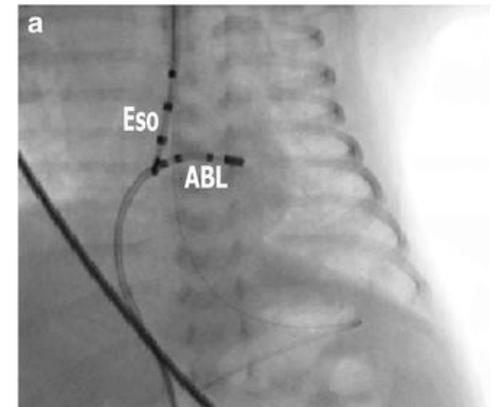
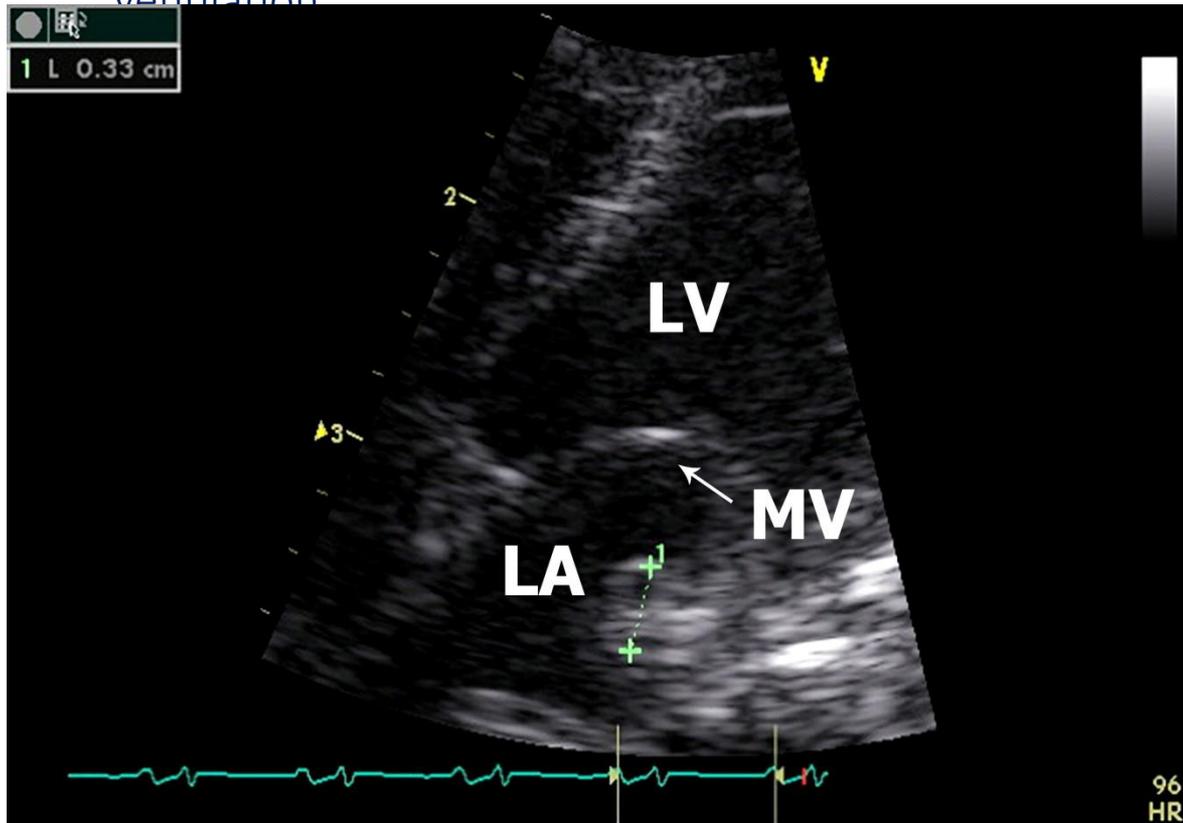
- Majority is supraventricular tachycardia
 - **AV re-entrant tachycardias**
 - WPW syndrome, concealed bypass
 - Permanent Junctional Reciprocating Tachycardia
 - **AV nodal re-entrant tachycardia**
 - Focal atrial tachycardia
 - Others
- Ventricular arrhythmias
 - Frequent PVCs, nonsustained VT
 - Outflowtract tachycardias (RVOT/LVOT/aorta cusps)
 - Idiopathic Left Ventricular Tachycardias (ILVT)
 - Others

Catheter ablation in young children

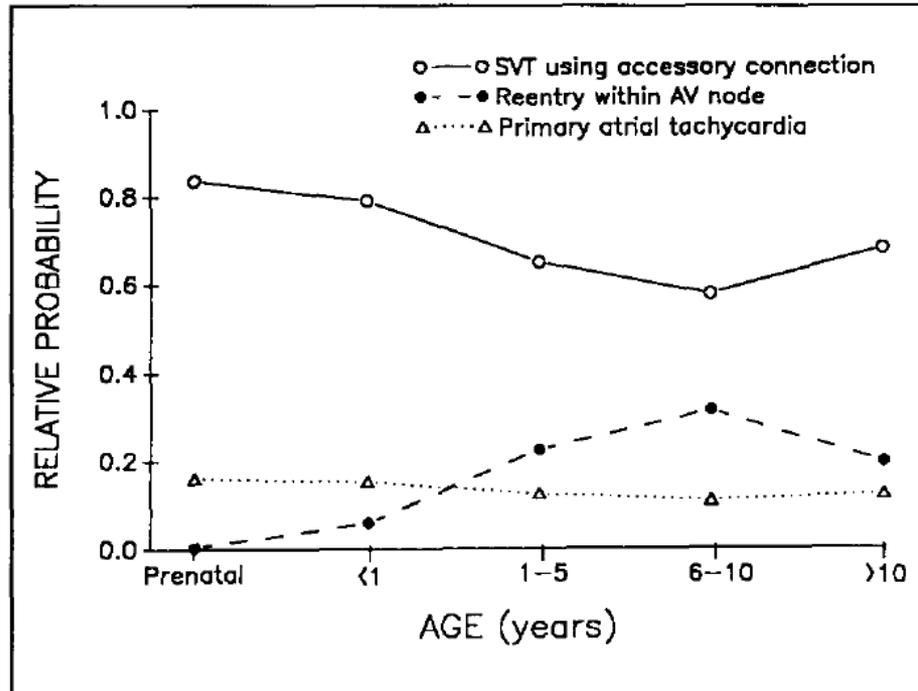
- 60% of tachycardias present during infancy
- Only 2-3 % of all pediatric ablations are performed in children < 18 months and only 6% <15 kg
- Why ?
 - Many tachycardias during infancy are self-limiting or have a benign clinical course
 - Increased risk of major complications
 - Complications like AV block , valve damage, CA lesion have major impact in a young child
 - Concern about growth of lesions
 - Difficult technical aspects
 - **Is it feasible :Yes**

Indications for infant catheter ablation

- Incessant AVRT pre- and postnatally
- Prenatal therapy included direct fetal amio therapy
- Born at 32 weeks, 1,7 kg with hydrops and incessant AVRT despite amiodarone /flecainide
- 3 weeks 1.9 kg : IRDS, 100% fiO2, edema, mechanical ventilation



SVT mechanism and age distribution in children



- AVRT most common mechanism (neonates/infants 80-85%, in teenagers 60%)
- AVNRT: > 10 yrs of age (40-50%), rare in 1st year of life
- More rare chronic forms:
- Focal atrial tachycardia :
- PJRT: young children
- congenital JET: very rare

AVRT in infants: prognosis

- Can be life-threatening or lethal
- Majority structurally normal hearts, associated with CHD (M.Ebstein, others)
- 25% WPW syndrome, 75% concealed
- Aggressive drug therapies can be necessary, rarely drug-refractory
- 60% symptom free without drugs > 1 yr
- WPW patients: 30% recurrence of symptoms after 8 yrs of age
- Chronic management
 - 1st line: (digoxin) , beta-blockers
 - 2nd line: sotalol, propafenon/flecainide
 - 3rd line: amiodarone
 - 4th line: combinations amiodarone/ flecainide or sotalol/flecainide

Kugler JD et al. J Pediatr. 1996 , Perry et al JACC 1990

Paul et al Pediatric Drugs 2000, Wong et al Pediatr Cardiol 2006,



Recurrence of AVRT in infants +/- WPW

- 150 infants with AVRT, 41 WPW , 109 nonWPW
- First line therapy digoxin +/- beta-blocker effective in 77% of pts: 17% had WPW
- Second line therapy (additional drugs) necessary in 23% of pts: 62% had WPW
- Recurrence > 1 yr (early or late) : 88% WPW versus 17% nonWPW

Natural history of WPW diagnosed in childhood.

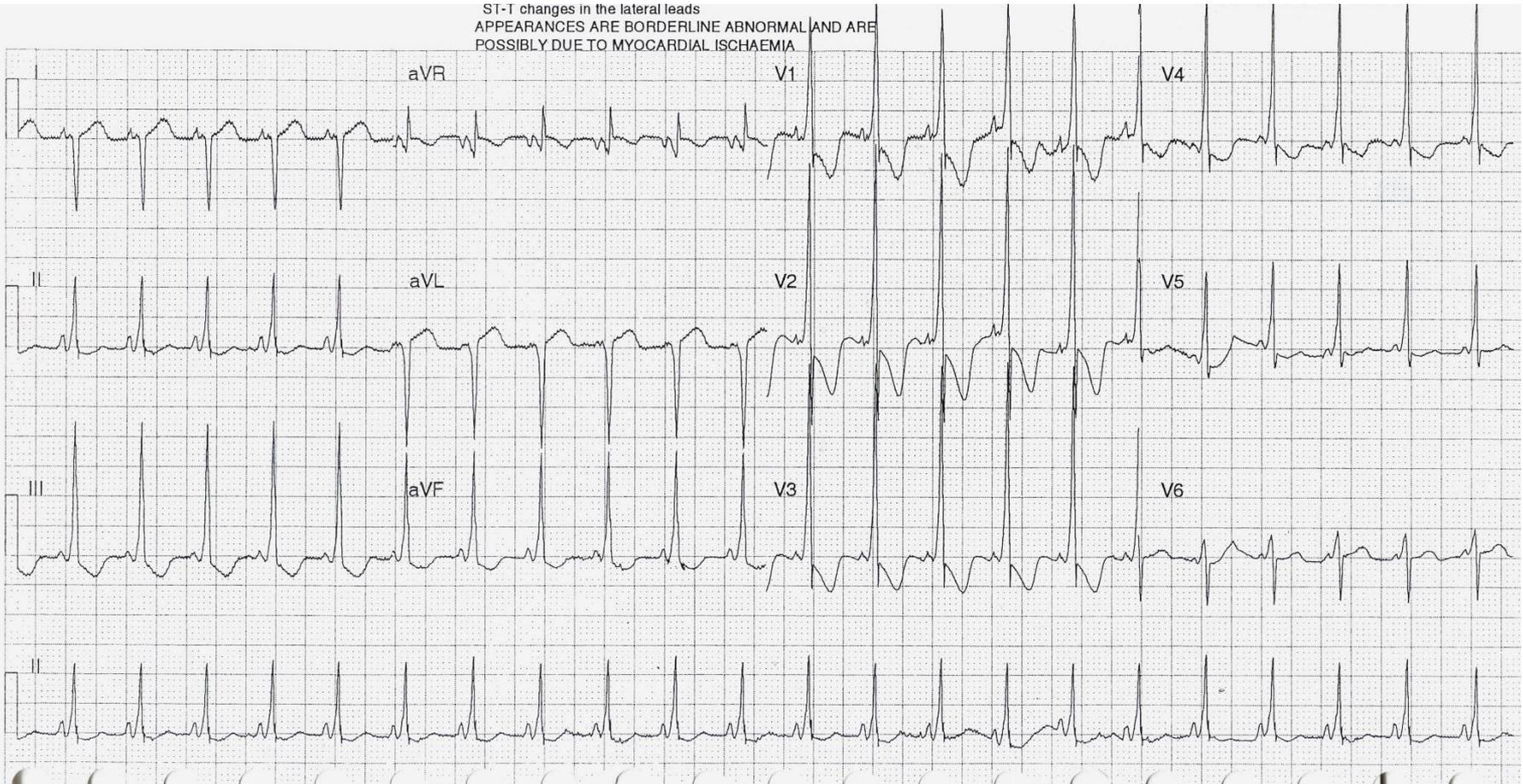
- 446 WPW pts, median age at diagnosis 7 yrs, 60% male
- Presentation: SVT (38%), palpitations (22%), chest pain (5%), **syncope (4%), Afib (0.4%), SCD (0.2%),** incidental finding (26%)
- During FU : 54% had SVTs , 7 pts (1.6%) Afib
- Disappearance deltawave: 35% in pts presented ≤ 3 months, 6 % in patients presented > 3 months (can reappear later on)
- 6 SCD (1.3%) : incidence 2.8 per 1,000 pt-yrs
 - 2/6 pts structurally normal hearts (in 1.1 per 1,000 pt-yrs).
 - **4/6 heart disease (incidence 27 per 1,000 pt-yrs)**

WPW syndrome in 3 month old girl

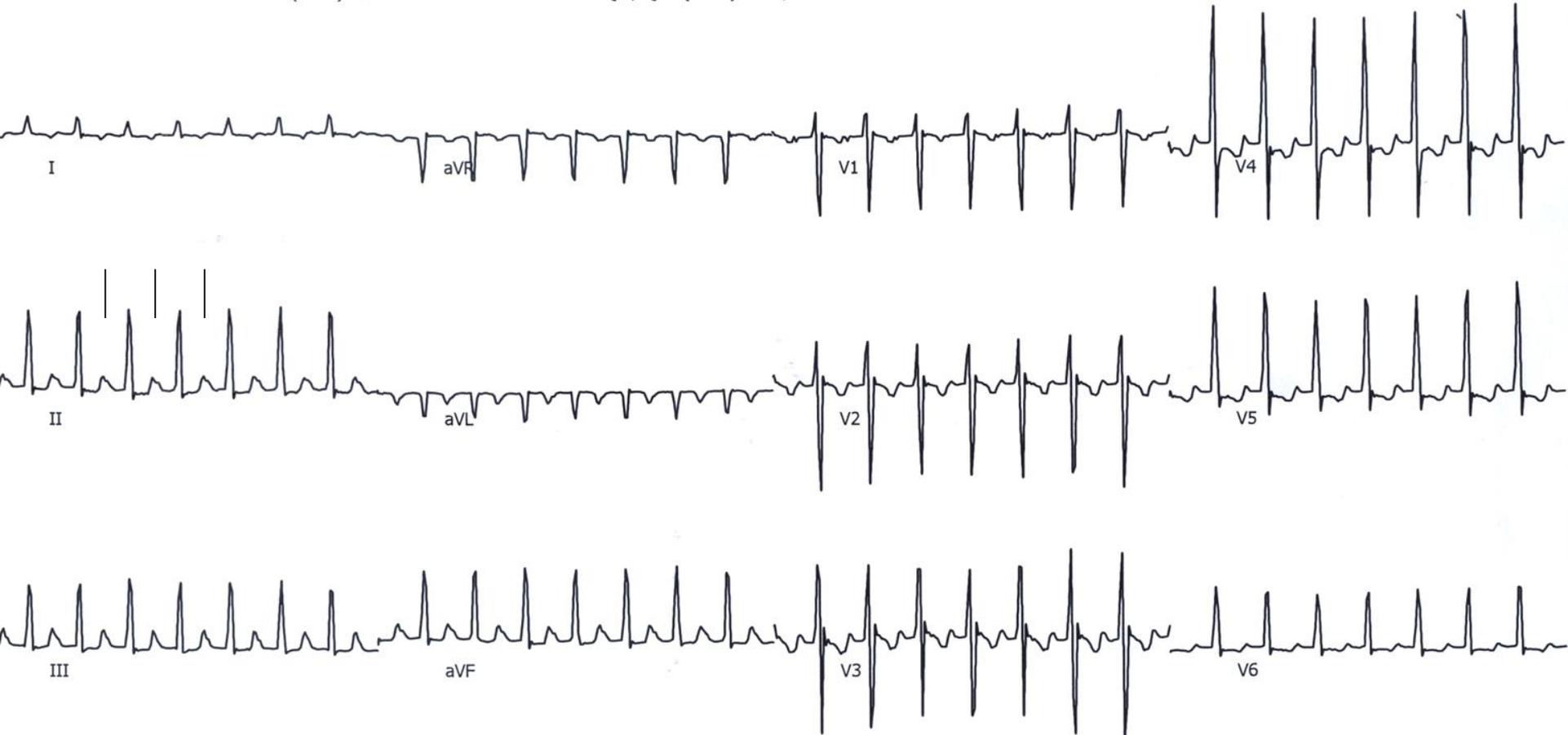
very frequent SVT

rhabdomyoma left AV groove

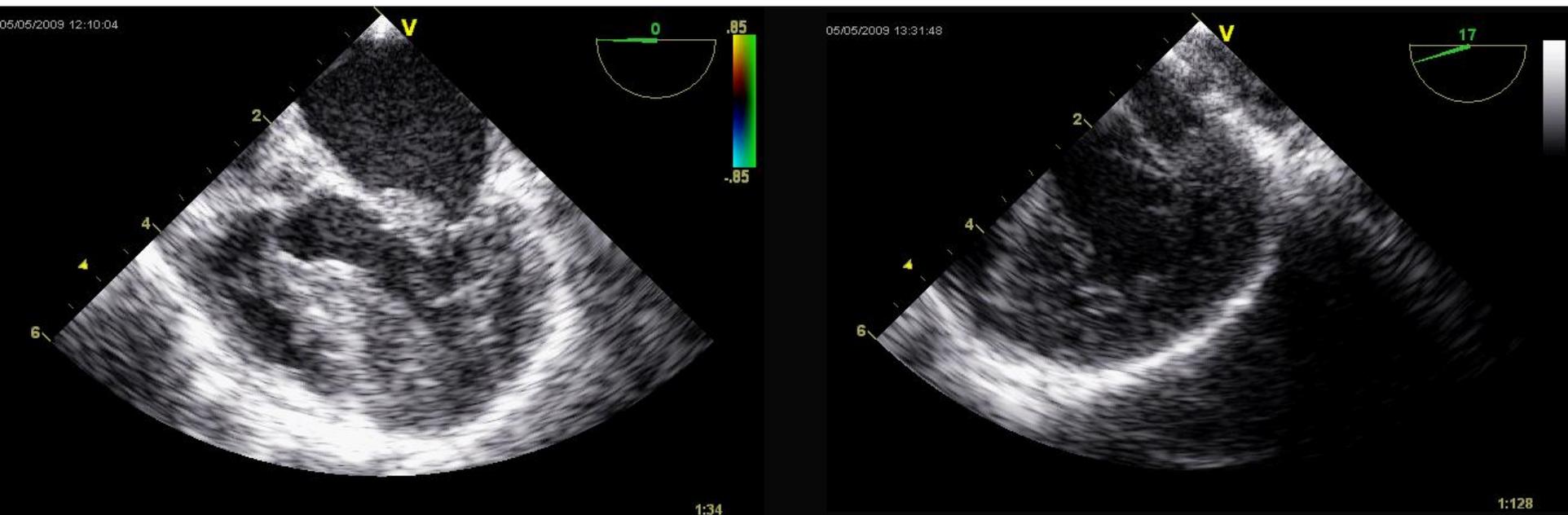
ST-T changes in the lateral leads
APPEARANCES ARE BORDERLINE ABNORMAL AND ARE
POSSIBLY DUE TO MYOCARDIAL ISCHAEMIA



- At 7 months frequent SVTs (every two weeks) under flecainide and amiodarone
- Always conversion with adenosine
- Still good LV function
- What would you do ???



Echo/TEE: cardiac tumor (rhabdomyoma) left anterior wall

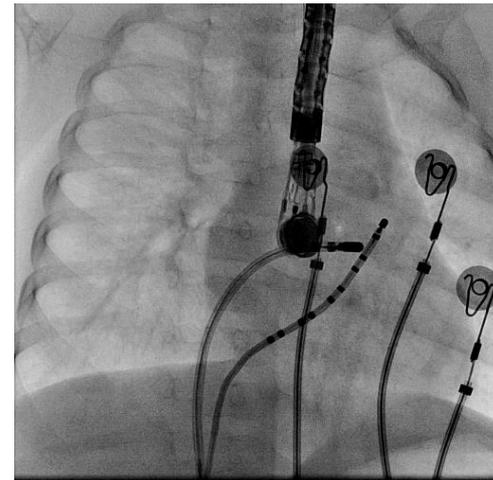
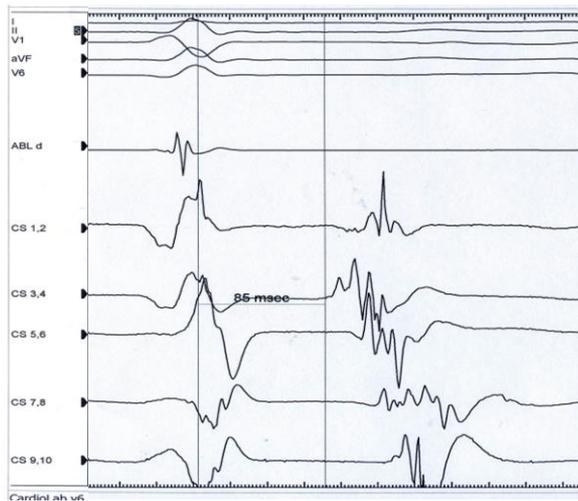
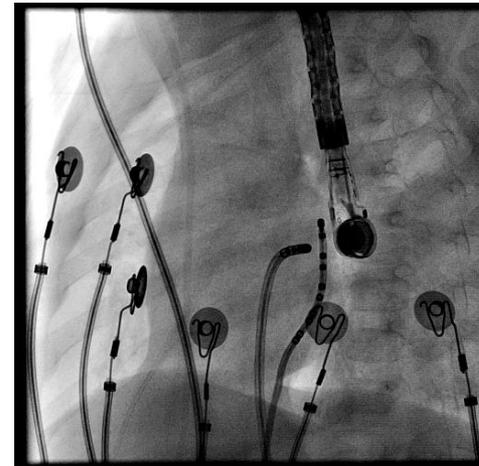
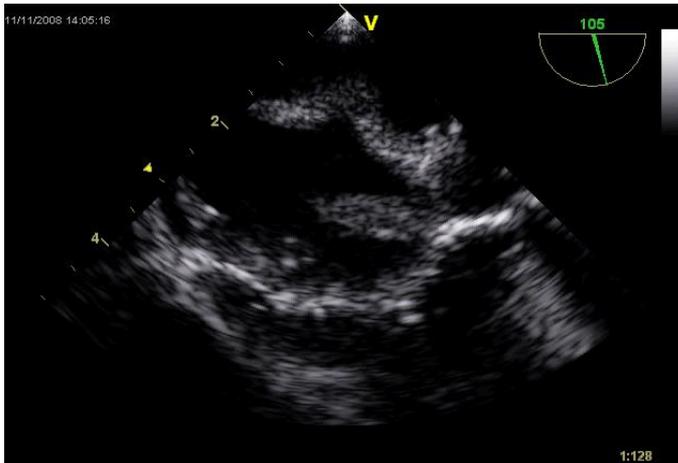


RFCA during incessant AVRT

Decapolar CS catheter

Transseptal puncture (TEE)

7 Fr ablation catheter



What do the guidelines say?

Table 4 Indications for catheter ablation and oral prophylactic antiarrhythmic drugs for recurrent SVT o

| Clinical situation | Recommendation | Class | Level |
|---|---|------------------------|-------|
| WPW syndrome and episode of aborted SCD | Catheter ablation | I | C |
| WPW syndrome and syncope combined with preexcited RR interval during AF <250 ms or antegrade APERP during PES <250 ms | Catheter ablation | I | C |
| Incessant or recurrent SVT associated with ventricular dysfunction | Catheter ablation | I | C |
| WPW syndrome and recurrent and/or symptomatic SVT and age >5 years | Catheter ablation Flecainide, propafenone Sotalol Amiodarone | I I I IIb | C |
| SVT, age <5 years (including infants), when AA medications, including Classes I and III are not effective or associated with intolerable side effects | Catheter ablation | IIa | C |
| WPW syndrome and recurrent and/or symptomatic SVT and age <5 years | Flecainide, propafenone Sotalol Catheter ablation Amiodarone | I IIa IIb IIb | C |

What do the guidelines say?

What would you do ?

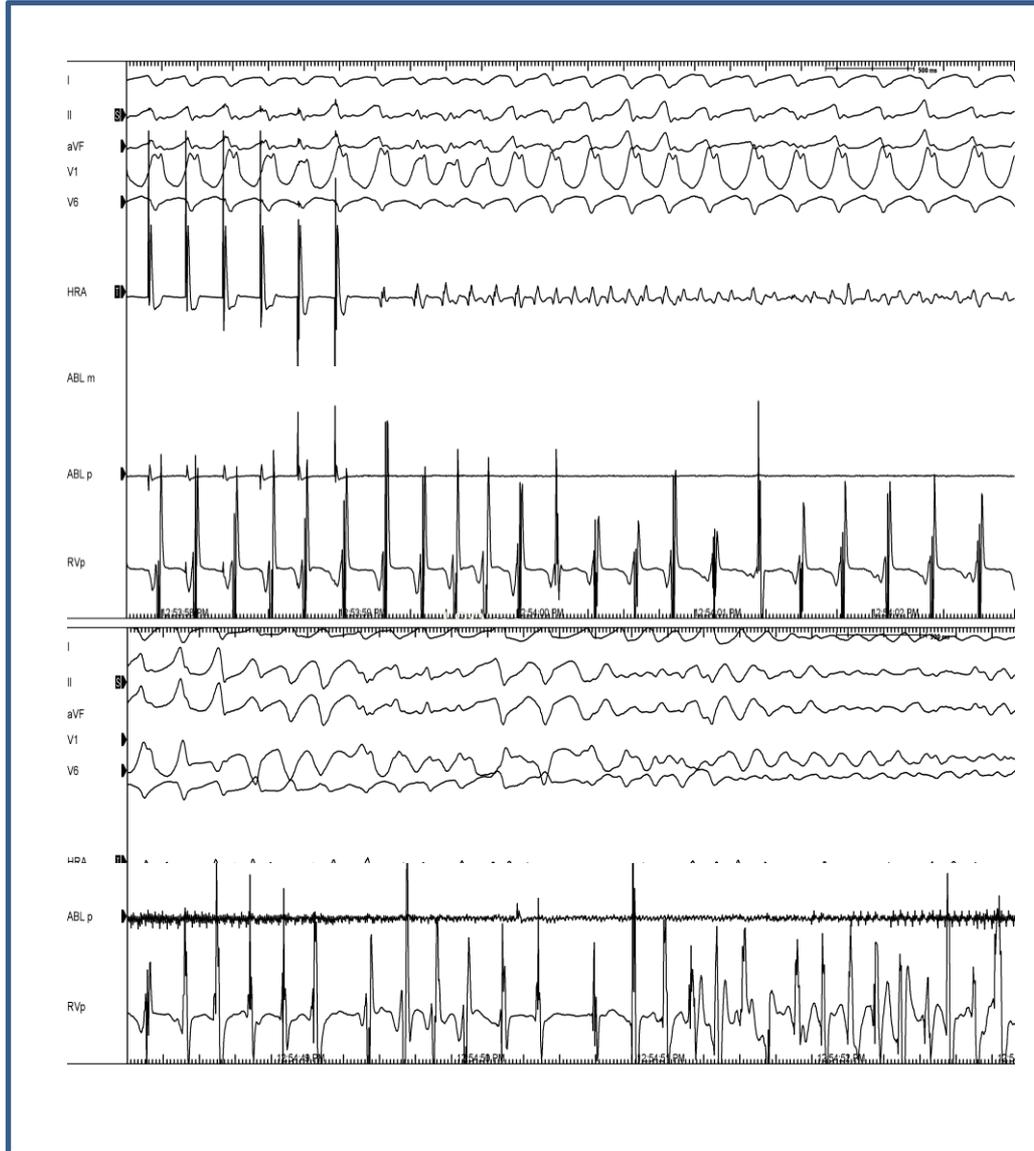
- Child with AVRT /AVNRT of 6 years, 18 kg , SVTs since age 4
- Well controlled with sotalol ,4 times a year short recurrences under sotalol

| | | | |
|---|-------------------------|-----|---|
| WPW syndrome and recurrent and/or symptomatic SVT and age >5 years | Catheter ablation | I | C |
| | Flecainide, propafenone | I | |
| | Sotalol | I | |
| SVT, age >5 years, chronic AA therapy has been effective in control of the arrhythmia | Catheter ablation | IIa | C |
| Asymptomatic preexcitation, age >5 years, no recognized tachycardia, risks and benefits of procedure and arrhythmia clearly explained | Catheter ablation | IIb | C |
| | Any AA drug | III | |
| Asymptomatic preexcitation, age <5 years | Catheter ablation | III | C |
| | Any AA drug | III | |
| SVT controlled with conventional AA medications, age <5 years | Catheter ablation | III | C |

Age and risk SCD in WPW in children

- Risk of Afib in children with WPW under 10-12 yrs of age is very rare
- Anecdotal reported of SCD/aborted SCD in children under 12 yrs
- Own experience of 25 years (grumpy old man) : one child of 8 yrs with WPW and aborted SCD

Asymptomatic boy , 14 yrs old, history of selflimiting neonatal SVT first two months of life (concealed AP), referred for routine ECG now overt preexcitation



Risk Stratification for Arrhythmic Events in Patients With Asymptomatic Pre-Excitation: A Systematic Review for the 2015 ACC/AHA/HRS Guideline for the Management of Adult Patients With Supraventricular Tachycardia: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society

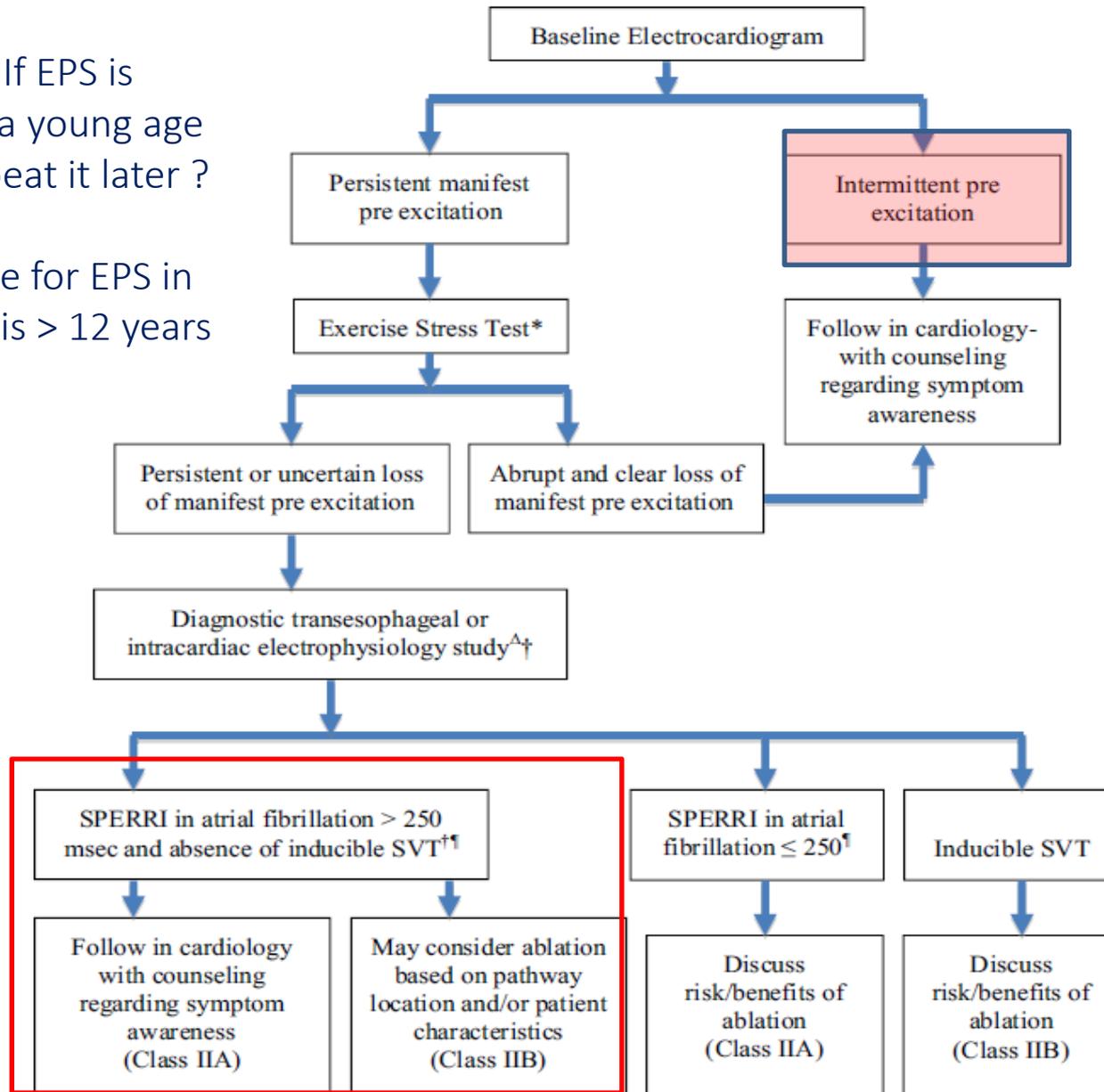
CONCLUSIONS

The existing evidence suggests risk stratification with an electrophysiological study of patients with asymptomatic pre-excitation may be beneficial, along with consideration of accessory-pathway ablation in those deemed to be at high risk of future arrhythmias. Given the limitations of the existing data, well-designed and well-conducted studies are needed.

Noninvasive risk assessments SCD in asymptomatic children with WPW

At what age ? If EPS is performed at a young age should we repeat it later ?

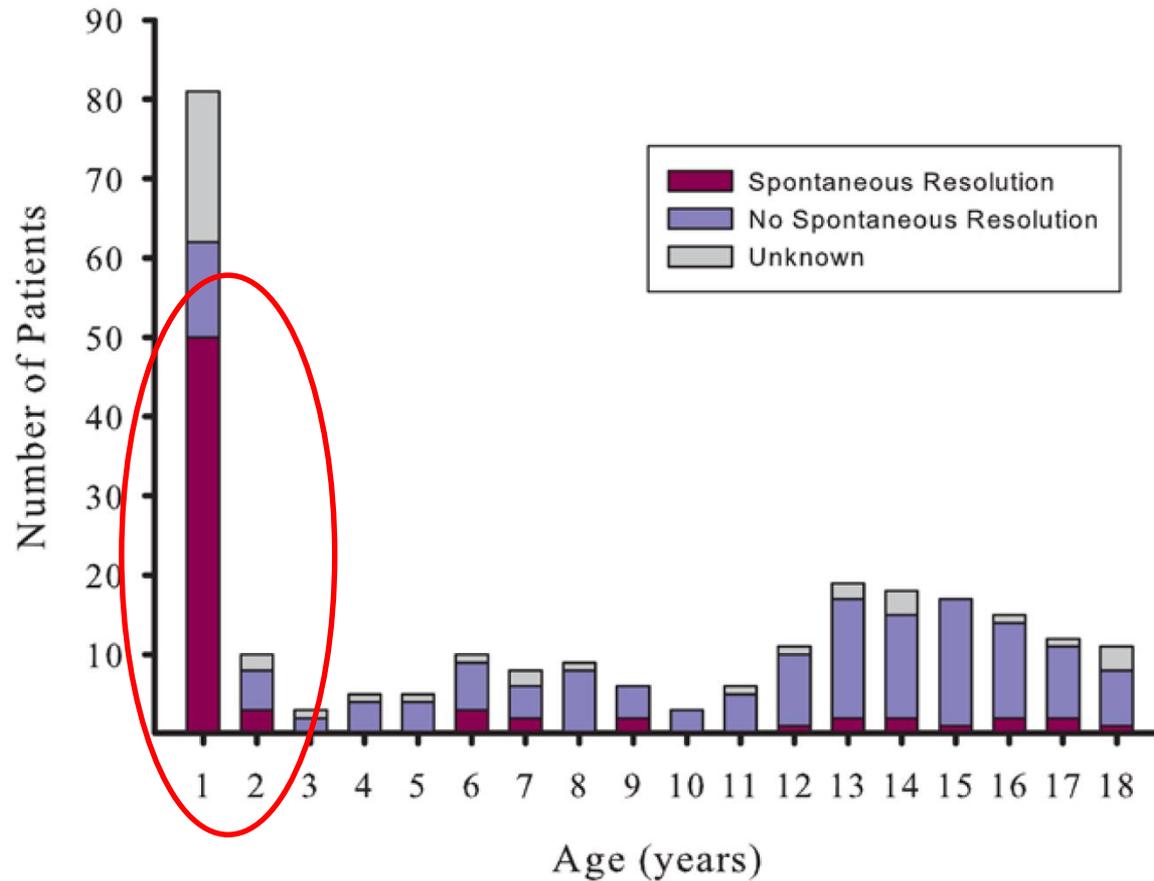
Our preference for EPS in asympt WPW is > 12 years



Focal atrial tachycardia in children when to ablate?

- 249 pts median age at diagnosis 7.2 %
- Cardiomyopathy in 28%
- Spontaneous resolution 34% (especially in the young age group)
- 1st line management by drugs 60% , effective (rate control) in 72%
- BB mostly used (53%) and most effective 42%
- FAT ablation successful in 80%

Age and spontaneous resolution

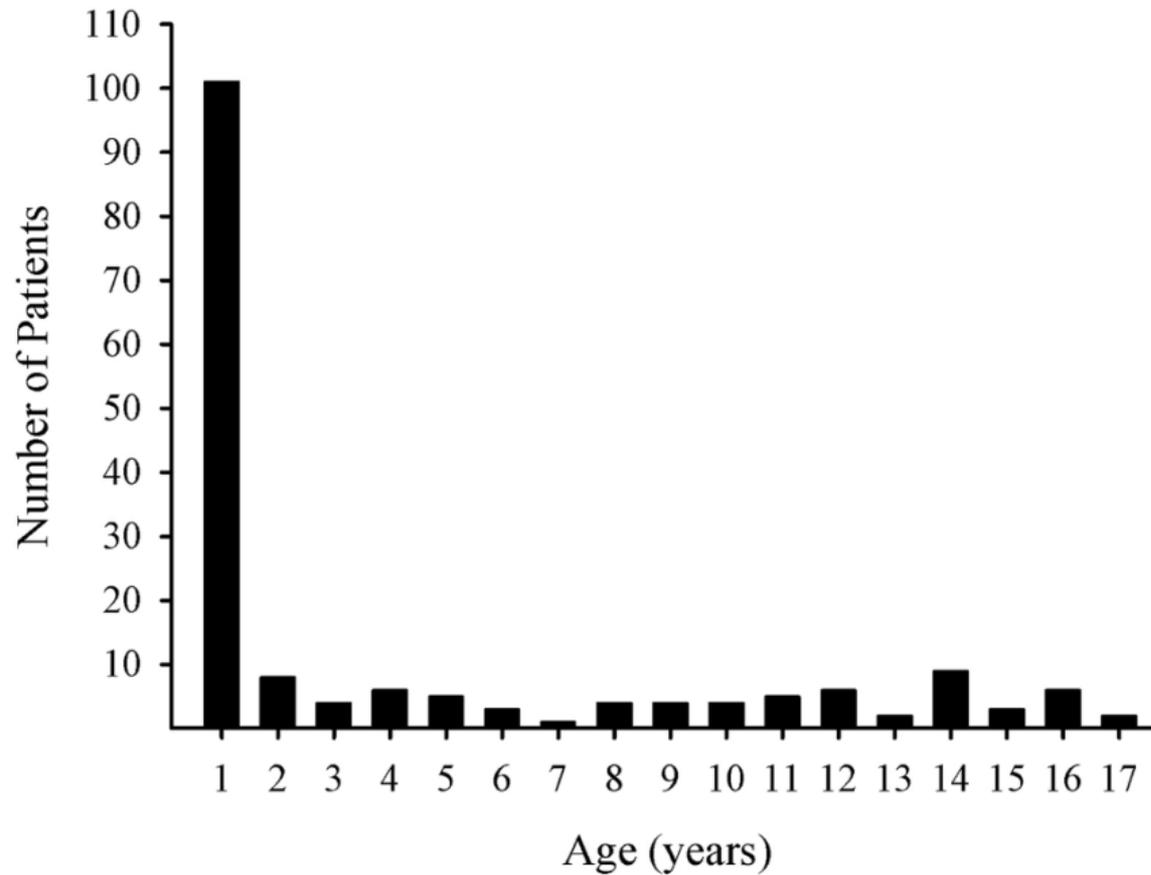


Permanent Junctional Reciprocating Tachycardia (PJRT) in children when to ablate?

- 194 pts (11 institutions, 2000 – 2010)
- Median age at diagnosis 3.2 mos,
- PJRT incessant in 47%.
- HR infants 210 (187-242)/min, older cohort 164(135-200)/min
- Tachycardia-induced cardiomyopathy in 18%.
- **1st management: antiarrhythmics in 76%, ablation only 10%.**
- Drugs: complete resolution 23% , clinical benefit additional 47% (70% total)
- FU: median of 45.1 months, normal sinus rhythm in 90% at last FU .
- Spontaneous resolution in 12%
- **175 CA in 140 pts. success rate of 90%. Complications in 9%, no major**

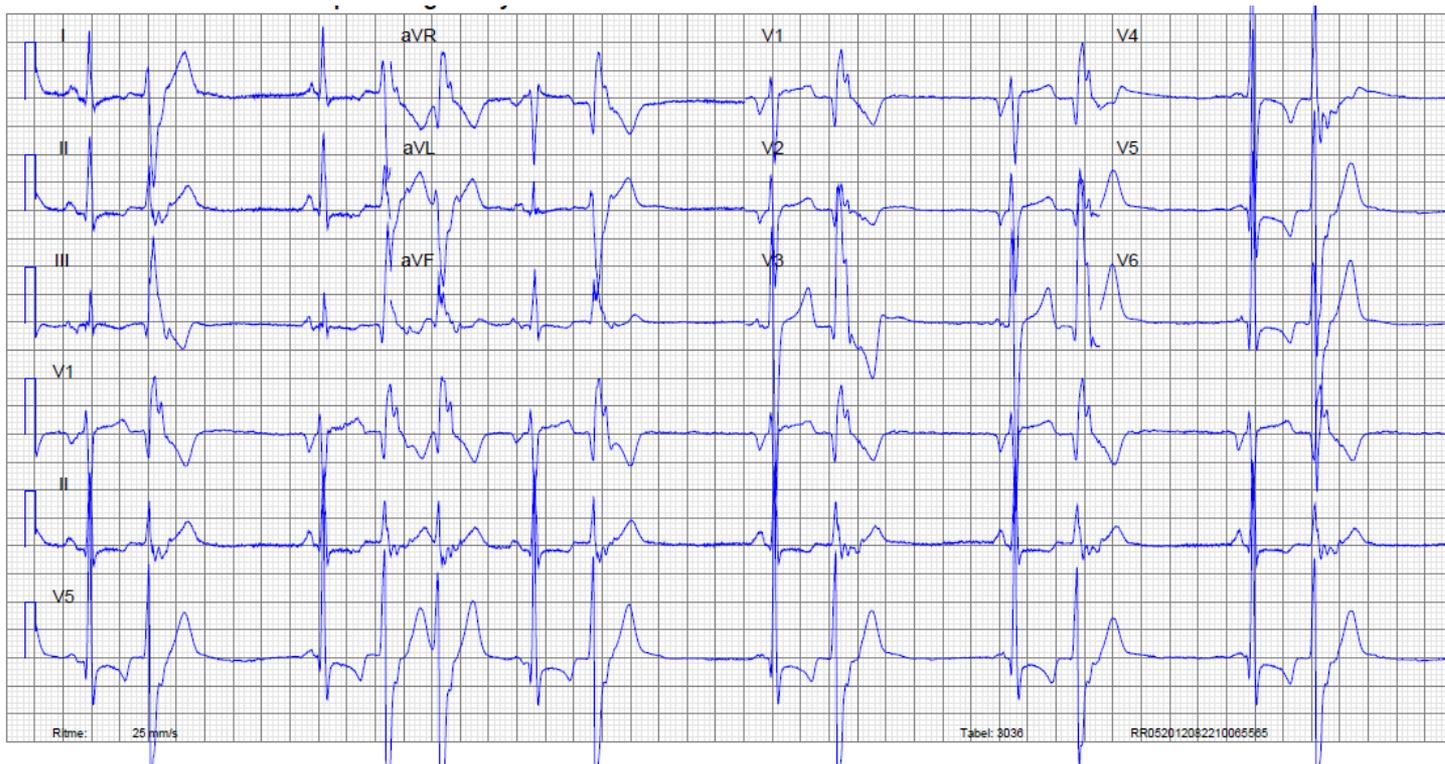
Age at presentation

Age distribution

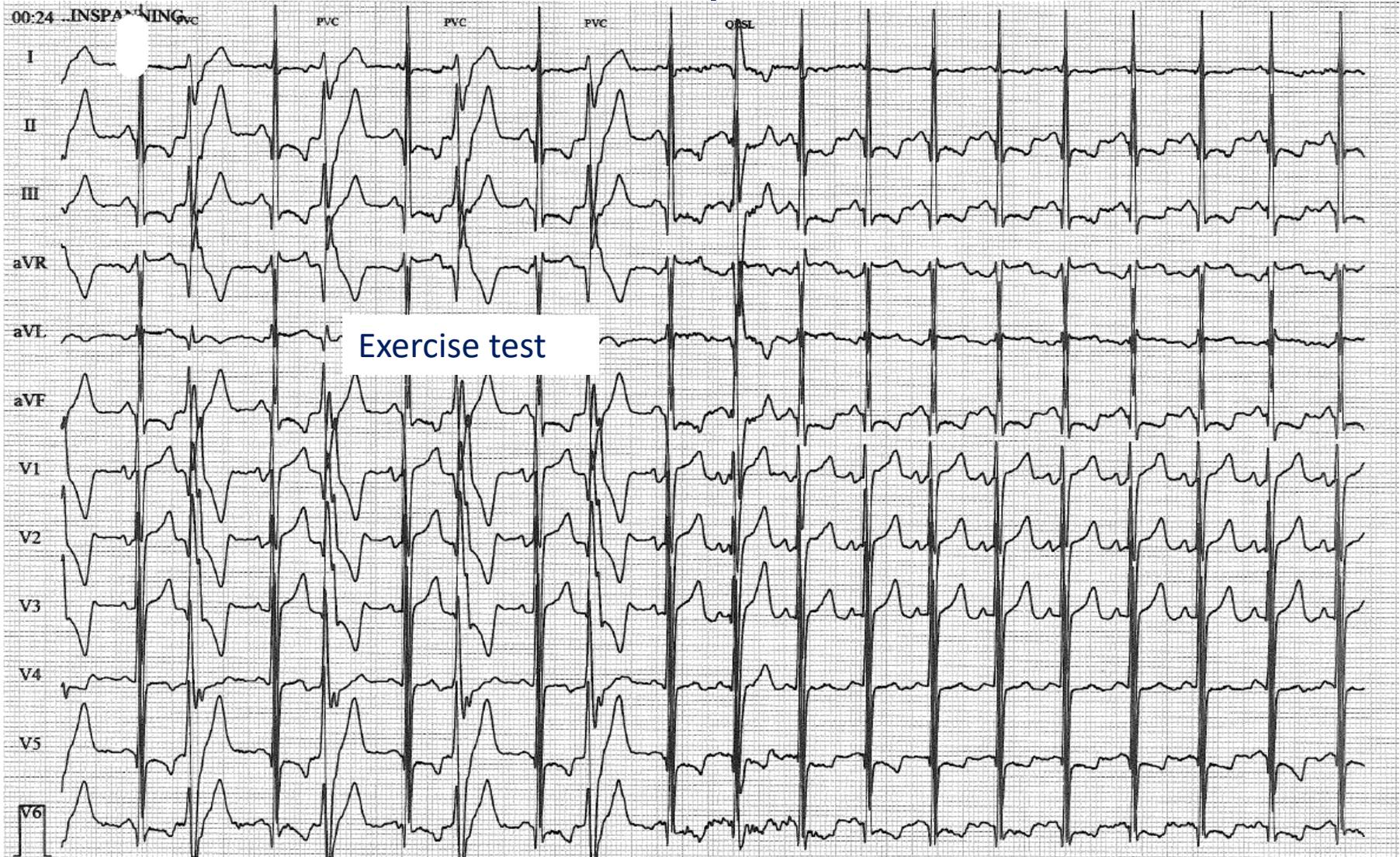


PVCs/nonsustained VT what would you do ?

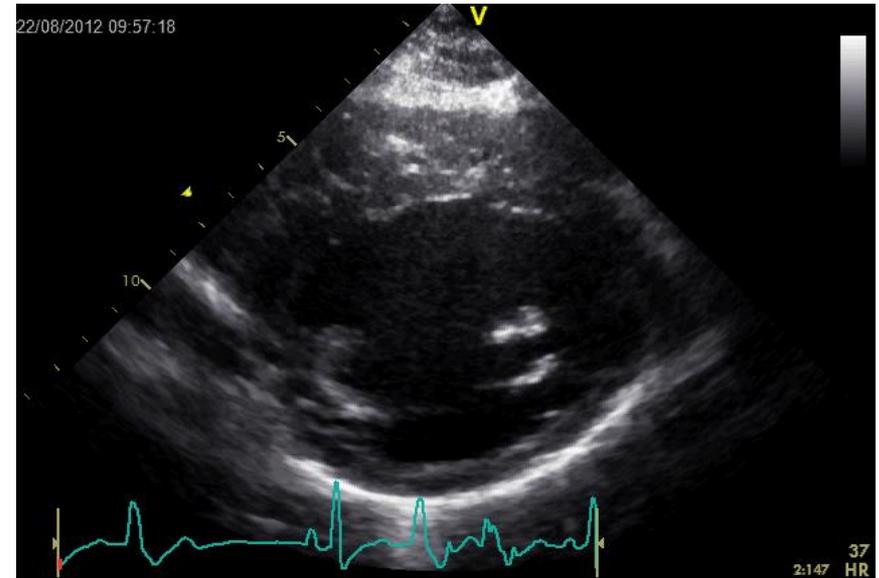
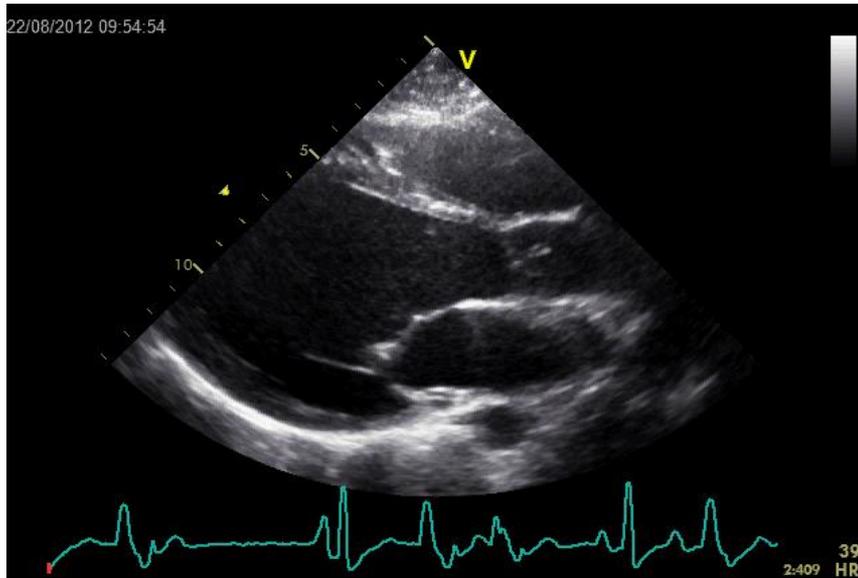
- Boy 13 yrs, asymptomatic PVCs, normal function , Holter 47% PVCs



PVCs/nonsustained VT what would you do ?

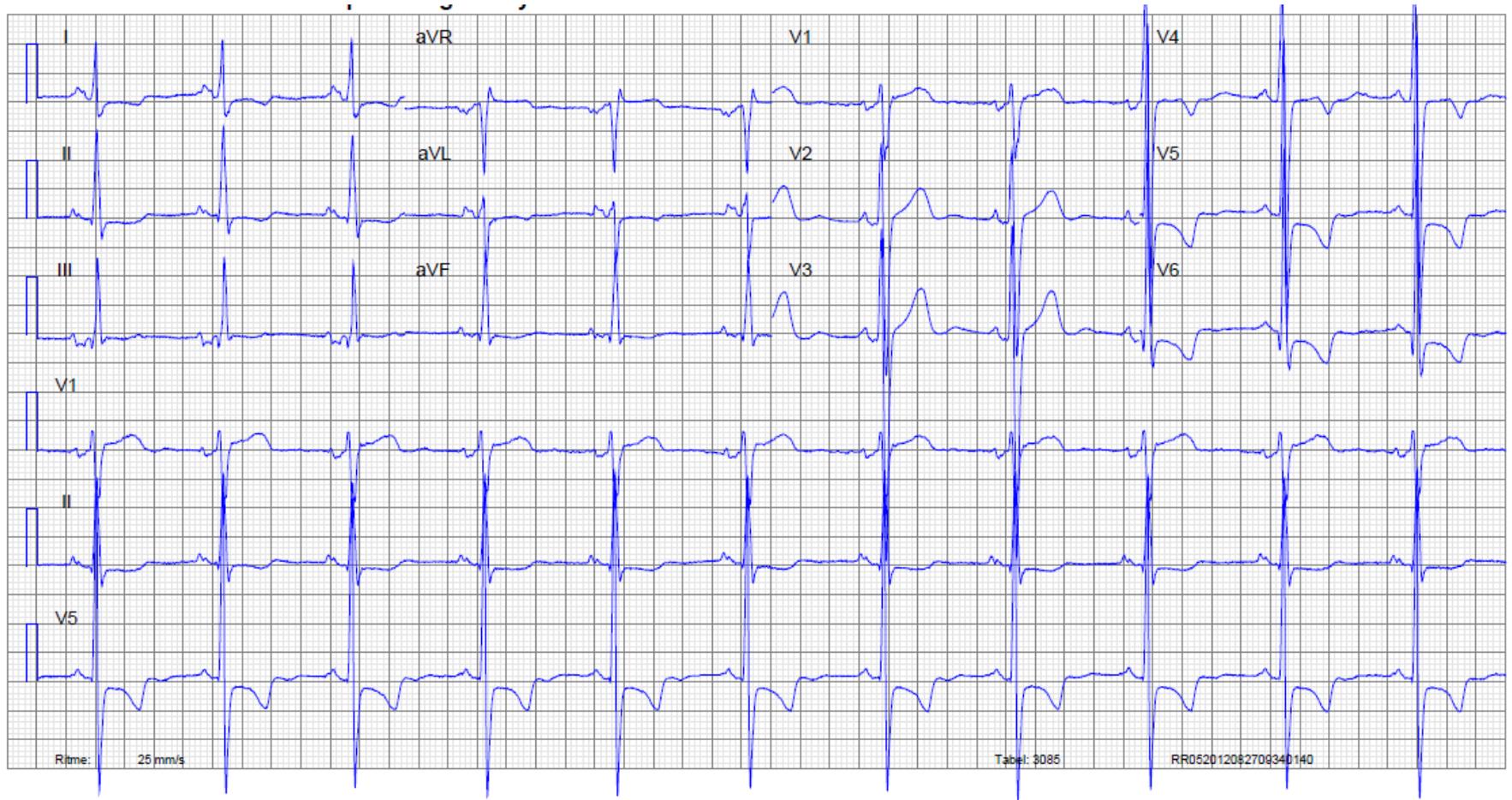


Same story but different echocardiogram What would you do now?

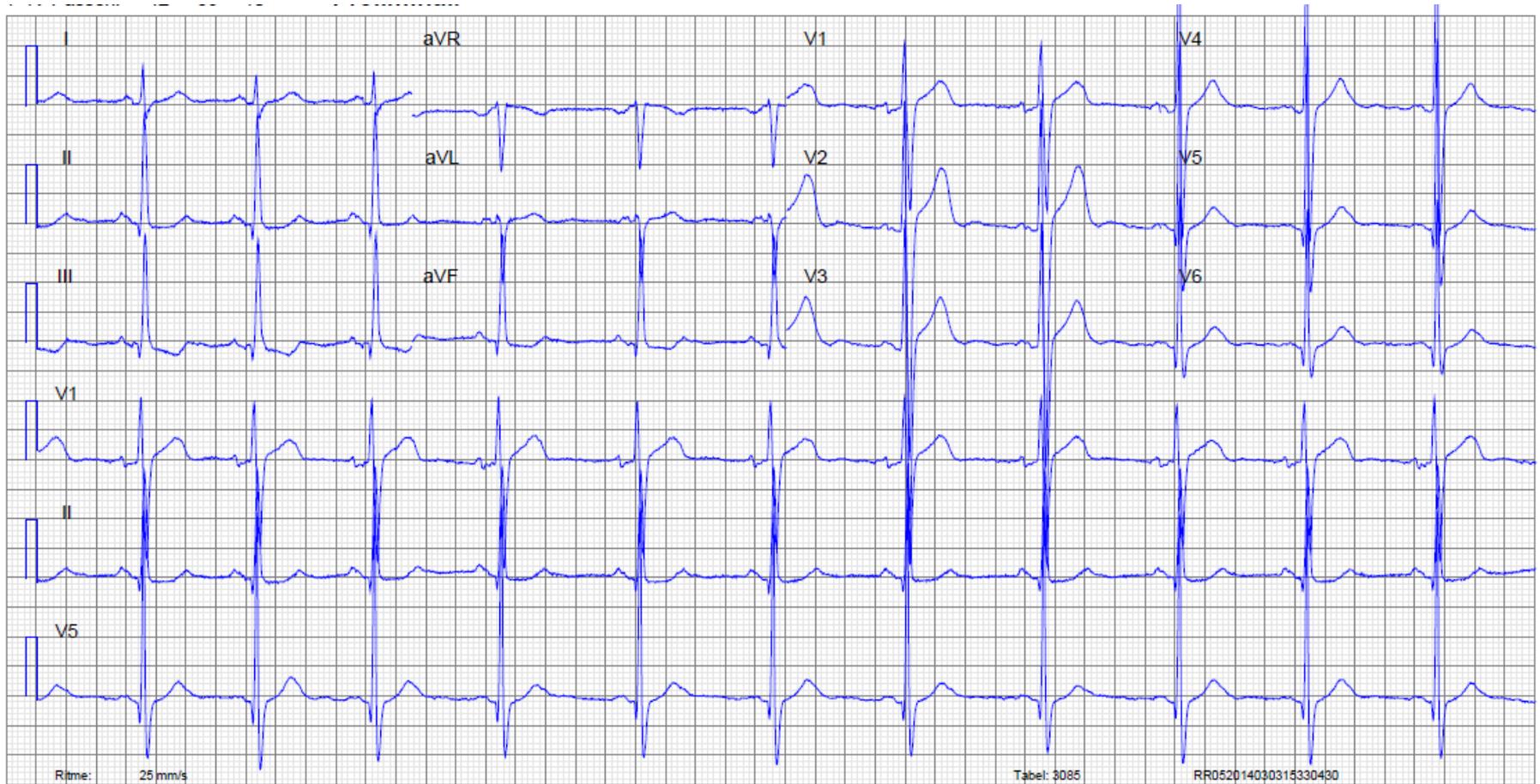


LVED 70 mm, FS 24%
MRI no myocarditis or other infarction

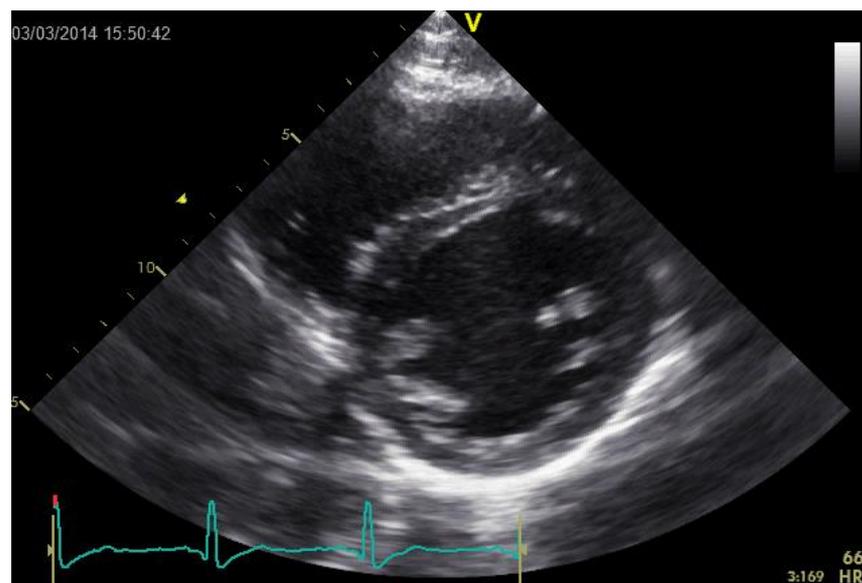
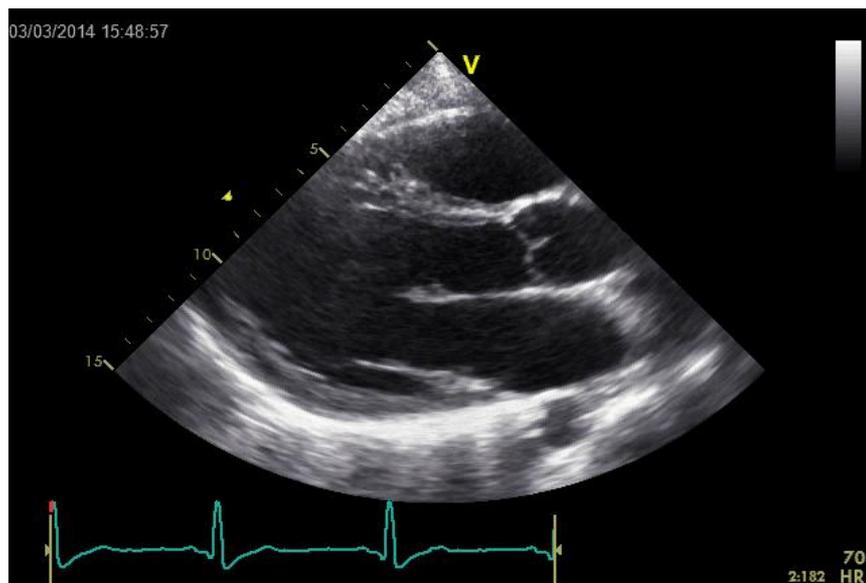
Flecainide 2 d 100 mg



ECG during FU



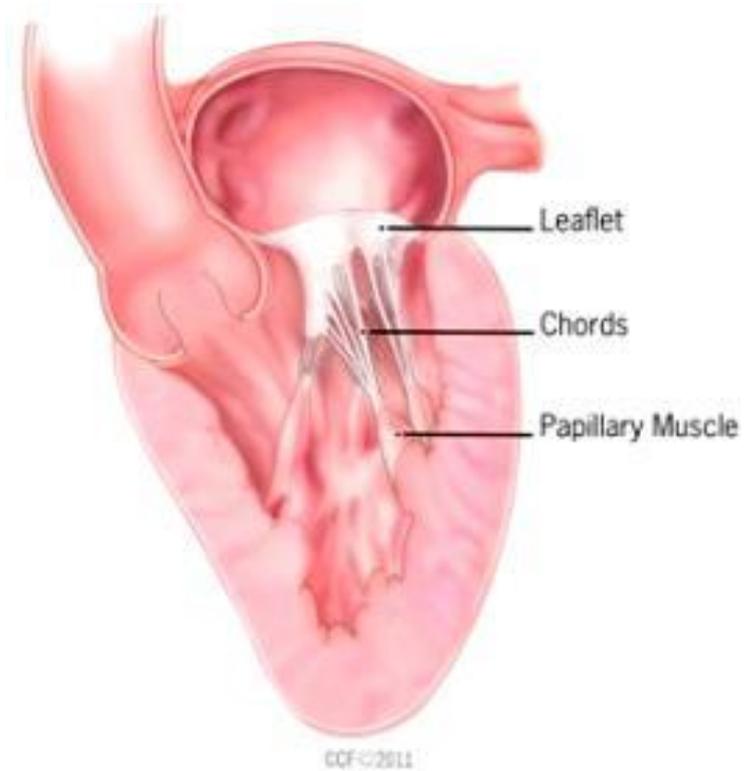
Echocardiogram during FU



LVED 62 mm, FS 30%

EP study

- Focus deep in the base of the anterolateral papillary muscle . No ablation performed because of the location



Management of ventricular arrhythmias in children with a structurally normal heart

| Recommendations | Class ^a | Level ^b | Ref. ^c |
|---|--------------------|--------------------|-----------------------|
| It is recommended that asymptomatic children with frequent isolated PVCs or an accelerated ventricular rhythm and normal ventricular function be followed-up without treatment. | I | B | 469, 470 |
| Medical therapy or catheter ablation is recommended in children with frequent PVCs or VT thought to be causative of ventricular dysfunction. | I | C | This panel of experts |
| Catheter ablation should be considered when medical therapy is either not effective or undesired in symptomatic children with idiopathic RVOT VT/ PVCs or verapamil-sensitive left fascicular VT. | IIa | B | 471–474 |
| Catheter ablation by experienced operators should be considered after failure of medical therapy or as an alternative to chronic medical therapy in symptomatic children with idiopathic LVOT, aortic cusps or epicardial VT/ PVCs. | IIa | B | 473, 474 |
| Sodium channel blockers (class IC agents) should be considered as an alternative to beta-blockers or verapamil in children with outflow tract VT. | IIa | C | 471 |
| Catheter ablation is not recommended in children <5 years of age except when previous medical therapy fails or when VT is not haemodynamically tolerated. | III | B | 475 |
| The use of verapamil is not recommended in children <1 year of age. | III | C | 476 |



Concern regarding growth of lesions (ventricular myocardium)

Risk of coronary lesion : focus from coronary cusp

Take home message

Indications for ablation in children

- Catheter ablation is feasible at any age even in newborns
- There are only very few indications to perform ablation in the very young
- Always think twice before you consider ablation in young children
 - Can we first manage with drugs?
 - What is the natural course of the arrhythmia (can it be self-limiting, what is the risk of cardiomyopathy or life threatening arrhythmia?)
 - What Is the risk of ablation: size of the heart, location of substrate etc
- Timing of catheter ablation in children: usually no harm in waiting

