October
17-18
NICE

RHYTHM

Ablation in children with low weight

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Necker-M3C
ICPS-Massy

Disclosure

Speaker name:

Alice Maltret

I do not have any potential conflict of interest

What is the lower threshold ?

1992

Radiofrequency Catheter Ablation of Incessant, Medically Resistant Supraventricular Tachycardia in Infants and Small Children

CHRISTOPHER L. CASE, MD, PAUL C. GILLETTE, MD, FACC, PAUL C. OSLIZLOK, MD, BARBARA J. KNICK, LPN, HENRY L. BLAIR, C-CPT

Charleston, South Carolina

7 pts

3.4 to 13kg

1999

Radiofrequency catheter ablation in a haemodynamically compromised premature neonate with hydrops fetalis

DA OSBORN,[1] KC LAU,[2] JB UTHER,[3] H COUGHTREY[4] and MJ ROCHEFORT[5]

35 WG

3.7kg

2001

Radiofrequency Catheter Ablation in Infants ≤18 Months Old

When Is It Done and How Do They Fare?

Short-Term Data From the Pediatric Ablation Registry

Andrew D. Blaufox, MD; Gary L. Felix, BS; J. Philip Saul, MD; and Participating Members of the Pediatric Catheter Ablation Registry*

137 pts

1.9 to 13.7kg

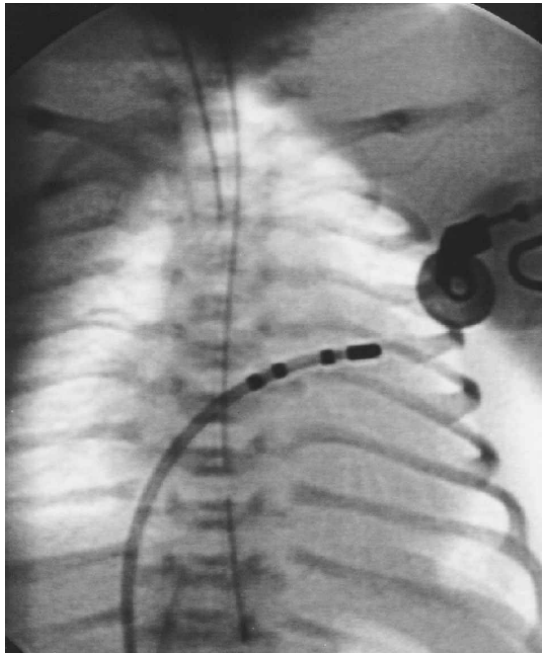
2002

Radiofrequency Catheter Ablation of an Incessant Supraventricular Tachycardia in a Premature Neonate

JOSEP BRUGADA,* RICARDO CLOSAS,† AUGUSTO ORDÓNEZ,* MAGED MABROK,‡ MIHAELA GRECU,* JORDI MERCÉ,§ and CARLOS MORTERA‖

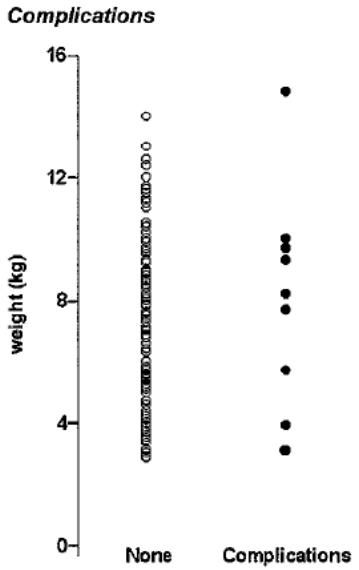
31 WG

1840g



Higher Complication rate

- Higher immediate complication rate and severity
  - #10% before 2000
  - Less nowadays



- 4.6% major complication/infant
  2.9%/non infant (NS)

Blaufox et al, Circ. 2001

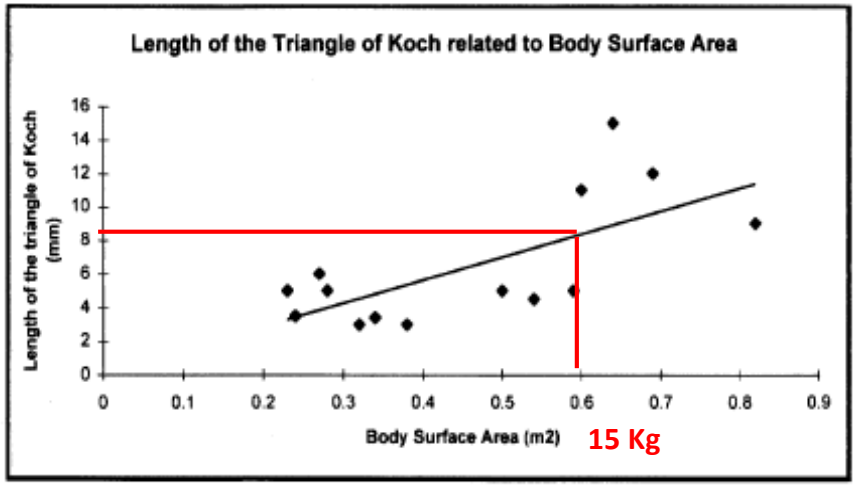
	Complications/Attempts		
	Late Era		
Pathway/Mechanism	All Ages	< 5 Years	5–21 Years
Left free wall	32/1,074 (3%)	5/58 (9%)	27/1,016 (3%)
Right free wall	8/410 (2%)	3/32 (9%)	5/378 (1%)
Anterior septal	15/322 (5%)	3/29 (10%)	12/293 (4%)
Posterior septal	9/431 (2%)	3/49 (6%)	6/382 (2%)
AV nodal reentry	29/977 (3%)	2/11 (18%)	27/966 (3%)
Atrial ectopic tachycardia	7/194 (4%)	2/26 (8%)	5/168 (3%)
Total	100/3,407 (3%)	18/205 (9%)	82/3,202 (3%)

Kugler et al, JCE 2002

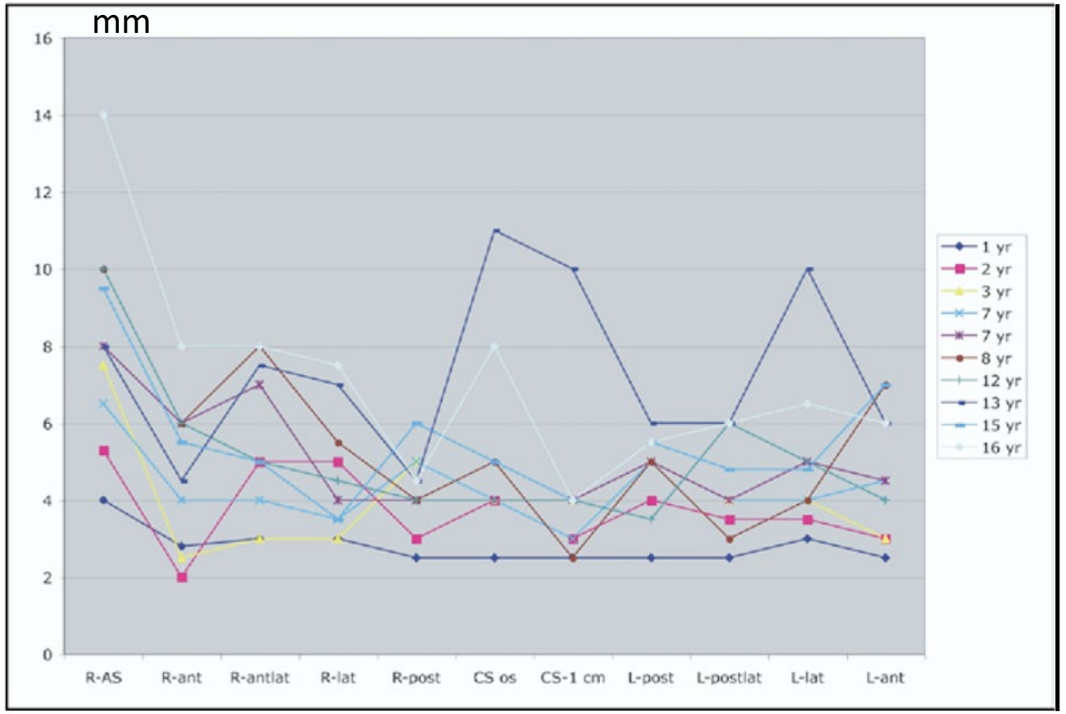
- Mortality rate: 0.12%

Heart Dimension and limited vascular access

- Myocardium thickness
- Proximity Coronary A/Endocardium
- Vascular adverse event: 3.8%
  (pediatric cardiac catheterization)
- Triangle of Koch dimension



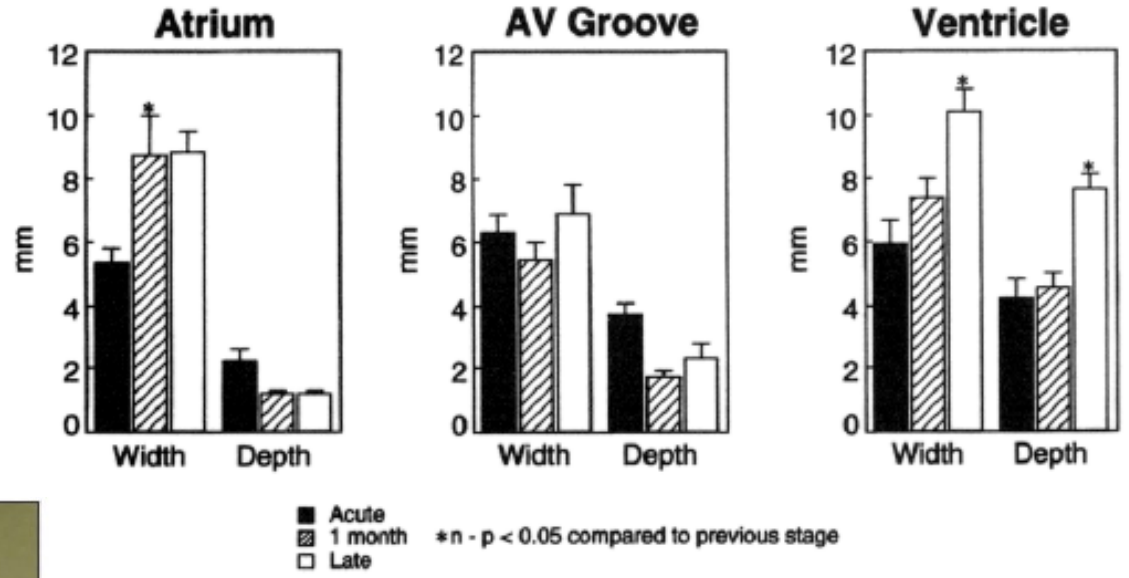
Goldberg et al, Am J Cardiology. 1999



Al Ammouri. Am J Cardiol 2006

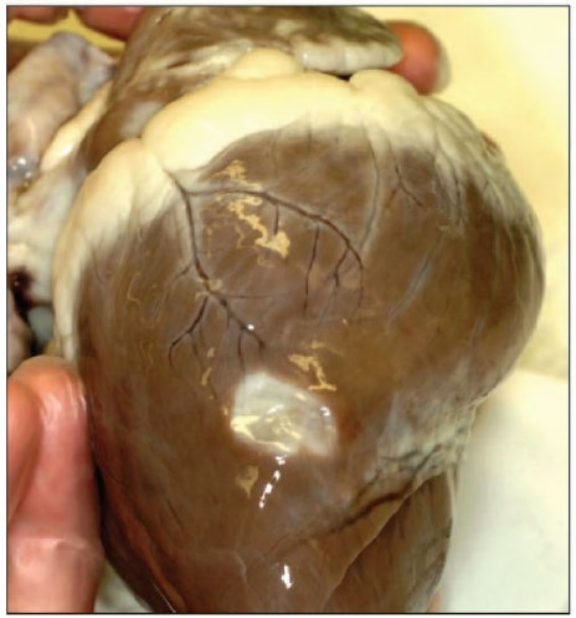
Immature myocardium

- Long-term lesion growth and invasion of scar tissue into the surrounding myocardium



Saul et al, Circ. 1994

RF



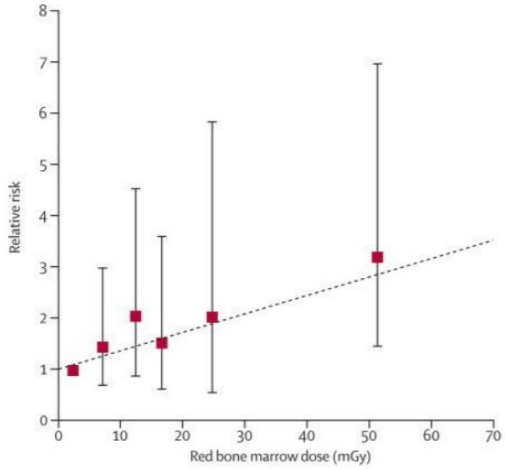
Cryo

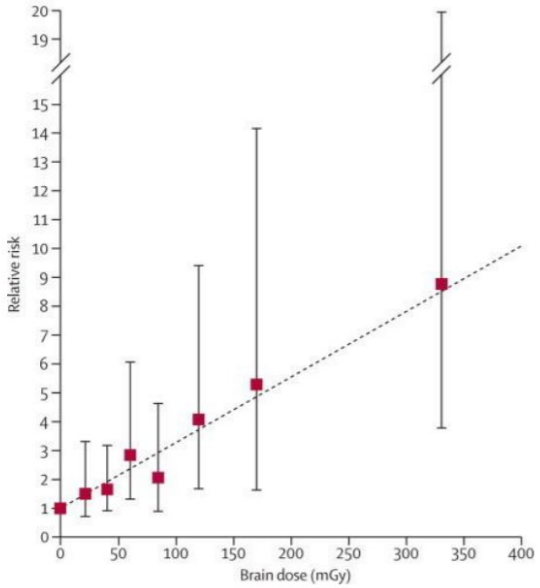
- No significant lesion growth on AV groove with either energy

Khairy et al, Circ Arrhyth Electrophysiol 2011

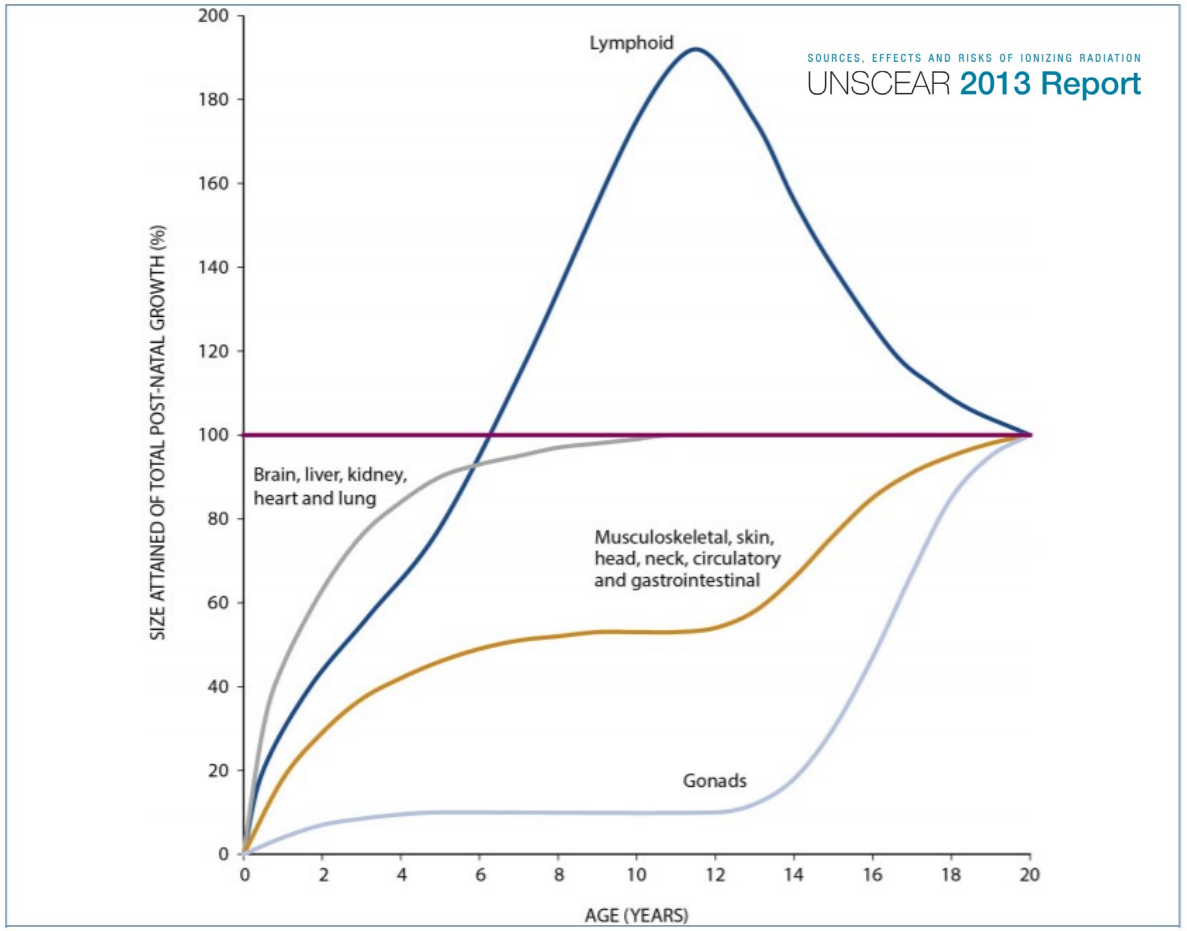
Radiation Exposure

- Risk of Leukaemia X3 for cumulative radiation dose > 30mGy
- Risk of Brain Tumor X2 for cumulative radiation dose > 60mGy





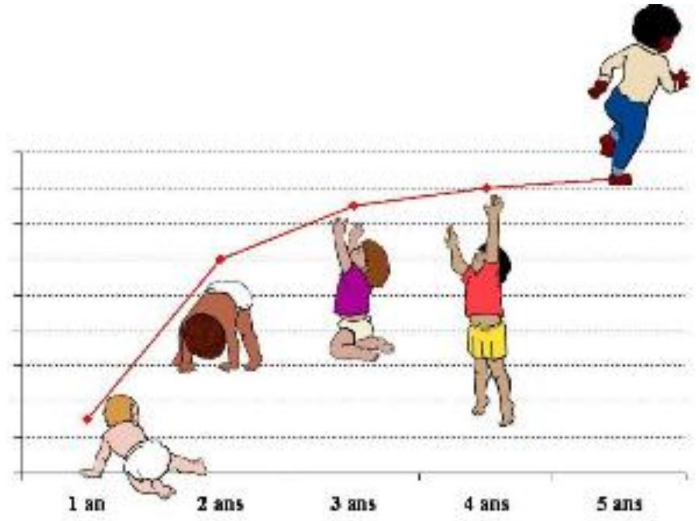
Pearce et al, Lancet 2012



What is a low weight children ?

Pharmacological and non-pharmacological therapy for arrhythmias in the pediatric population: EHRA and AEPC-Arrhythmia Working Group joint consensus statement

Europace, 2013



under 5 years of age

PACES/HRS expert consensus statement on the use of catheter ablation in children and patients with congenital heart disease

HR, 2016

under 15 kg of weight

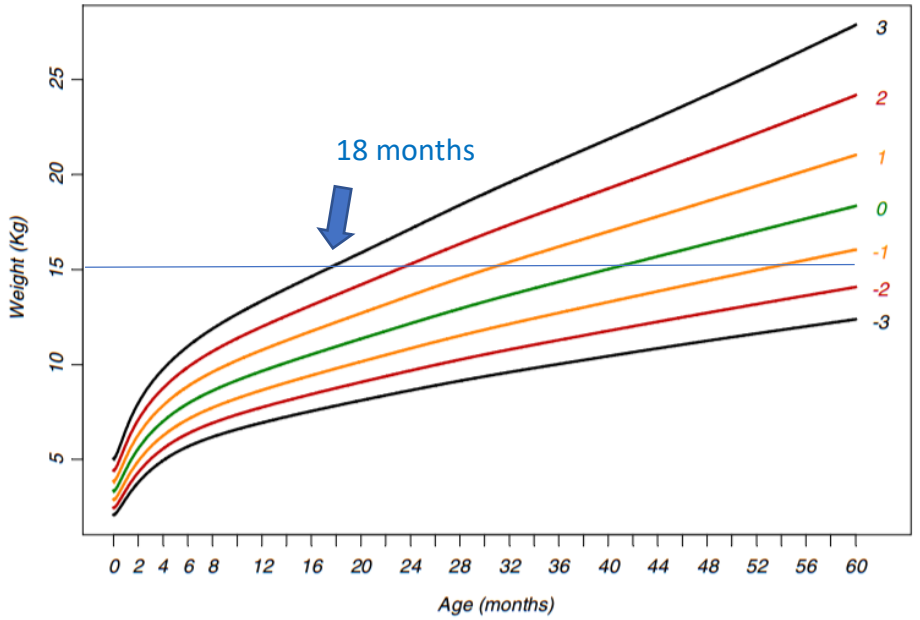


Figure 43 WHO weight-for-age z-scores for boys from birth to 60 months

Pharmacological and non-pharmacological therapy for arrhythmias in the pediatric population: EHRA and AEPC-Arrhythmia Working Group joint consensus statement

Europace, 2013

Any age	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
	Recurrent monomorphic VT with haemodynamic compromise and amenable to catheter ablation	Catheter ablation	I	C
Age < 5 years	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	I	C
		Sotalol	IIa	
		Catheter ablation	IIb	
	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 > 5 years	WPW syndrome and recurrent and/or symptomatic SVT and age >5 years	Catheter ablation	I	C
		Flecainide, propafenone	I	
		Sotalol	I	
		Amiodarone	IIb	

PACES/HRS expert consensus statement on the use of catheter ablation in children and patients with congenital heart disease

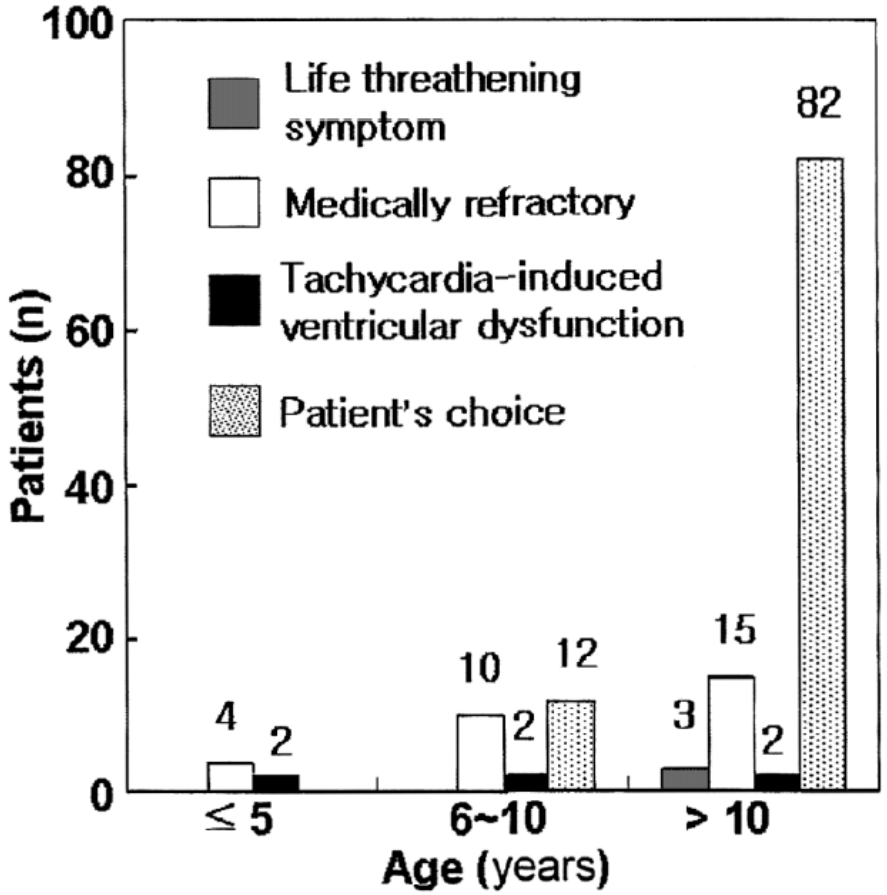
HR, 2016

Infants and Small Children

Class I Ablation is recommended for the following:

1. Documented SVT, recurrent[#] or persistent[^], when medical therapy is either not effective or associated with intolerable adverse effects (LOE: C).
2. WPW pattern following resuscitated cardiac arrest (LOE: B).
3. WPW pattern with syncope when there are predictors of high risk for cardiac arrest[§] (LOE: B).
4. Persistent[^] or recurrent[#] idiopathic JET, or congenital JET associated with ventricular dysfunction, when medical therapy is either not effective or associated with intolerable adverse effects[+] (LOE: C).
5. Ventricular ectopy or tachycardia with ventricular dysfunction, when medical therapy is either not effective or associated with intolerable adverse effects (LOE: C).
6. Recurrent[#] or persistent[^] SVT related to accessory AV connections or twin AV nodes in patients with CHD when medical therapy is either not effective or associated with intolerable adverse effects (LOE: B).
7. Ablation is effective for recurrent symptomatic atrial tachycardia occurring outside the early postoperative phase (less than three to six months) in patients with CHD, when medical therapy is either not effective or associated with intolerable adverse effects (LOE: B).
8. Pediatric cardiovascular surgical support should be available in-house during ablation procedures for smaller patients[*] (LOE: E).

- **Life threatening arrhythmia**
  - Ventricular dysfunction
  - Aborted cardiac arrest or high risk of cardiac arrest
- **Failure of medical therapy**
  - Not effective
  - Intolerable side effect
- **Restriction of access**
  - Vascular or to chamber
  - To medical care…

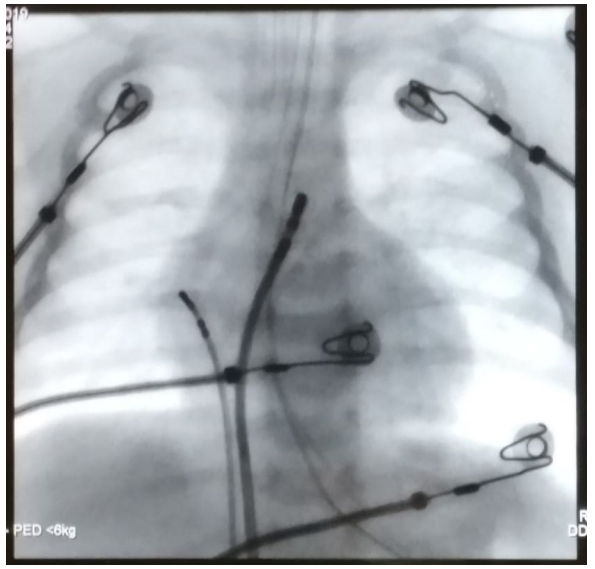


Kantoch et al. Can J Cardiol 2011

Young et al. Circ J 2006

How to perform CA under 15kg ?

- General anesthesia, apnea during RF application
- Fewer mapping catheters
- Small tip catheter-not irrigated
- 10 to 30W
- 50 to 55°C
- 10 to 30s
- Less RF application
- Minimize pulsed fluoroscopy duration, collimation
- Consider coronary angiogram
- Anticoagulant therapy



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JUST BECAUSE WE CAN, DOESN'T MEAN WE SHOULD

What is drug refractoriness ?

- Failure of ≥ 4 medication *Erikson et al, Am J Cardiol 1994*
- Unresponsiveness to amiodarone *Van Hare et al, JCE 1997*
- Amiodarone or Sotalol not effective *Friedman et al, PACE 2002*
- Class I and III AA medication not effective *Brugada et al, EUROPACE 2013*
- Medical Therapy not effective *Saul et al, HR 2016*

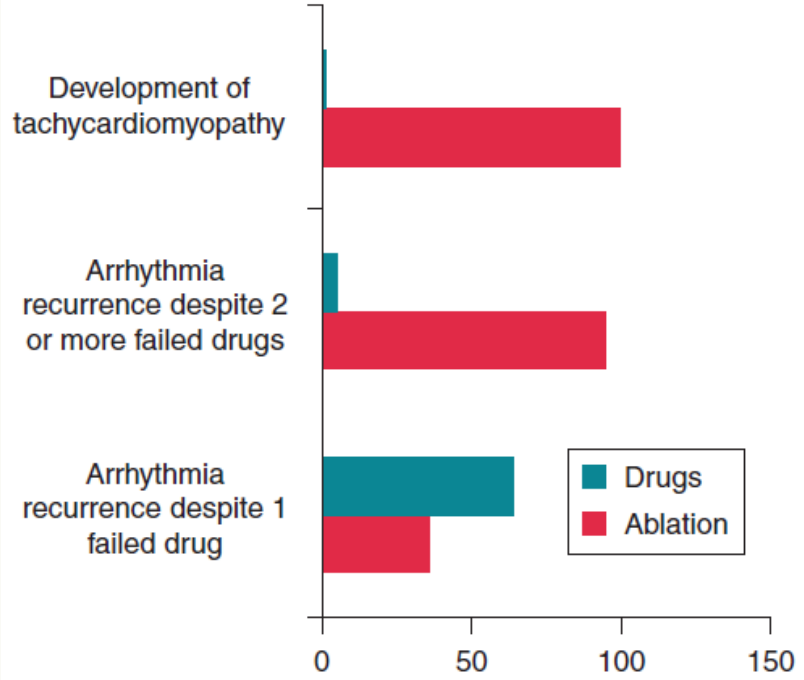
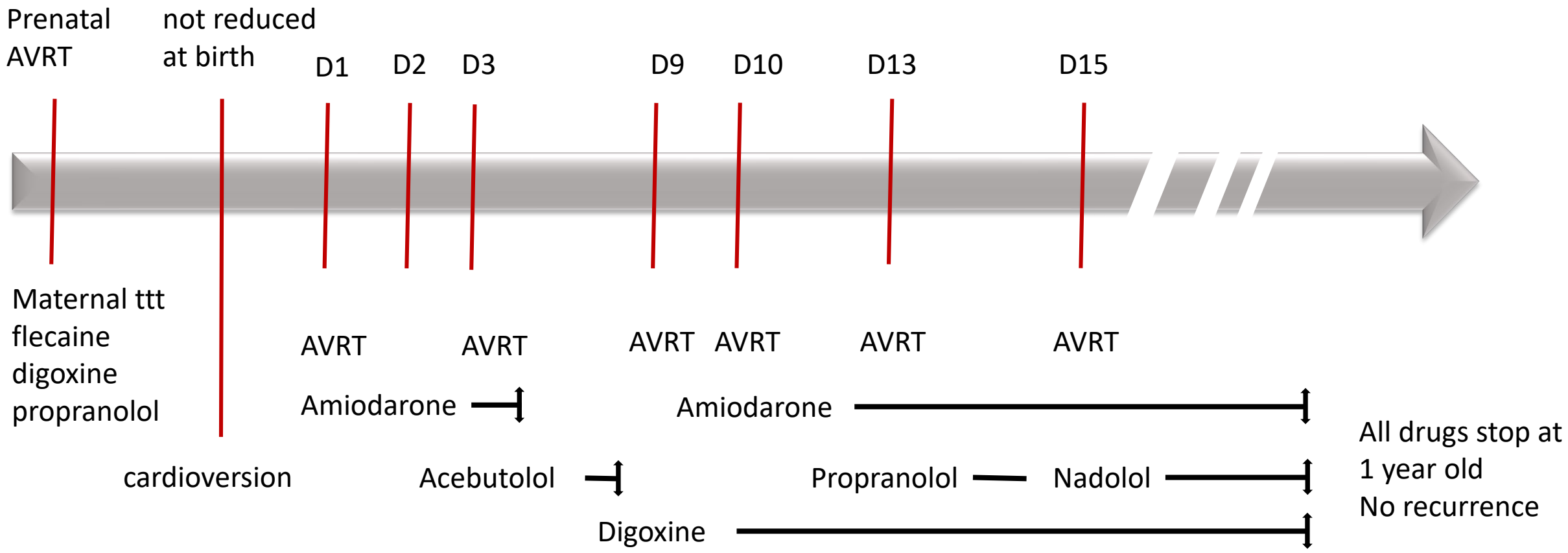


Figure 1 Selection of treatment with catheter ablation or antiarrhythmic drugs for the management of supraventricular tachycardia in children under 5 years.

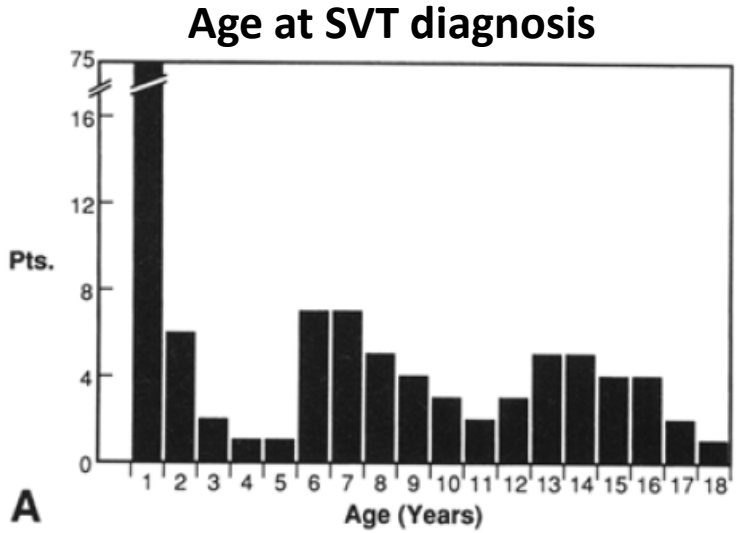
Hernandez-Madrid et al, EUROPACE 2014

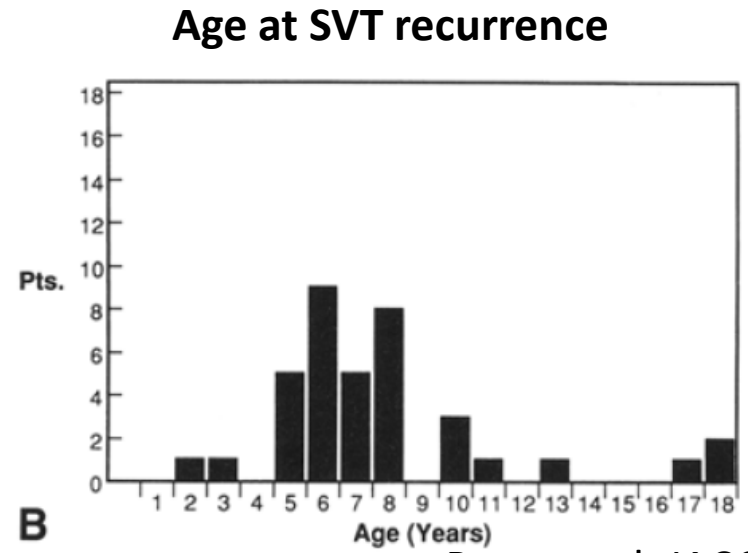

Prenatal AVRT
not reduced at birth
D1
D2
D3
D9
D10
D13
D15
Maternal ttt
flecaine
digoxine
propranolol
cardioversion
AVRT
AVRT
AVRT
AVRT
AVRT
AVRT
Amiodarone
Amiodarone
Acebutolol
Propranolol
Nadolol
Digoxine
All drugs stop at
1 year old
No recurrence

Natural history is good…

- 90% of AVRT that begins during infancy will resolve at 1 year
- 30 to 50% will recur in latter childhood
- If AVRT is present at 5 years old, it persists in > 75%

- 78% of AET diagnosed before 3 years old will resolve

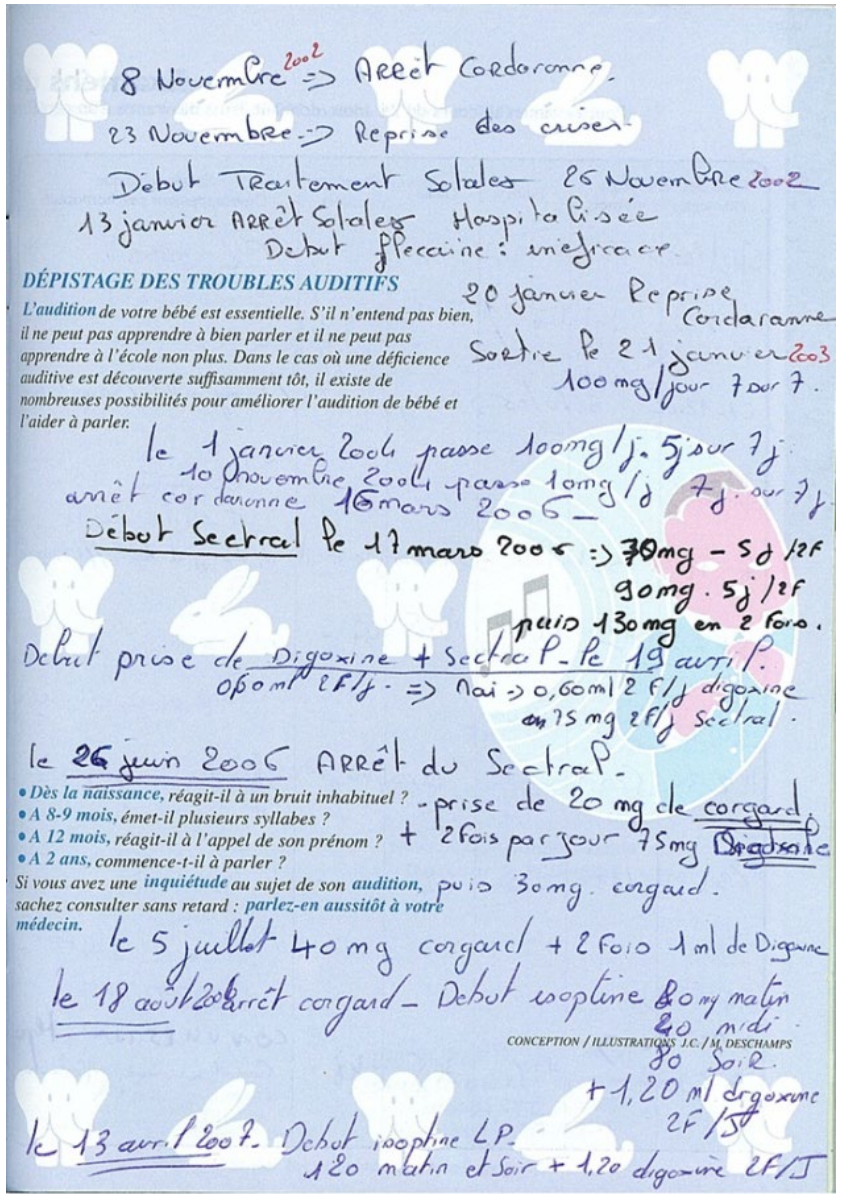




Perry et al, JACC 1990

Conclusion

- Infant and < 1 year old
  - Risk of Tachycardia-Induced DCM
  - **AA therapy +++**
- 5 to 10 years old
  - **AA therapy # CA ablation**
  - According to subtrat, symptom, AA tolerance, patient and family's choice, sport participation…
- Teenagers > 10 years old
  - **CA >>> AA therapy**
  - EP study mandatory for WPW



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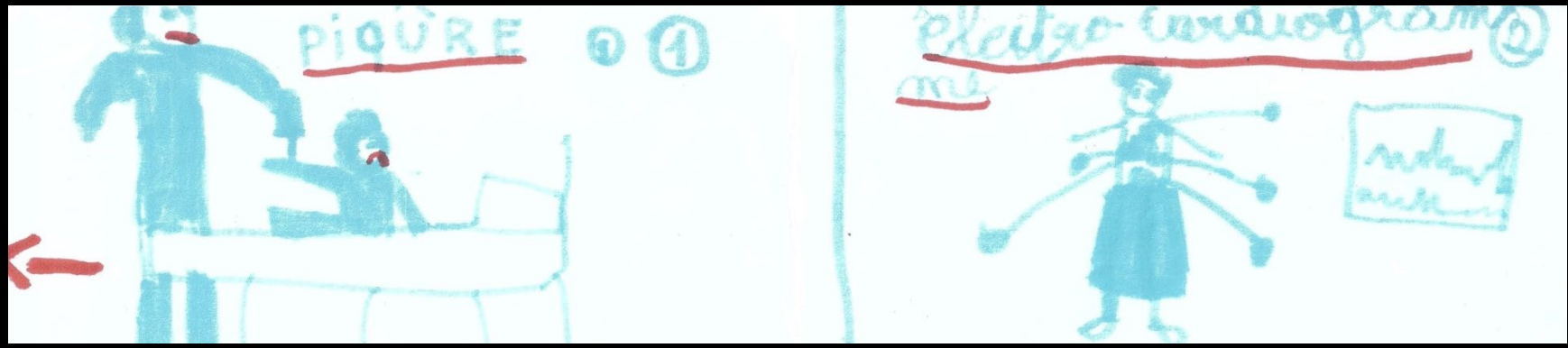
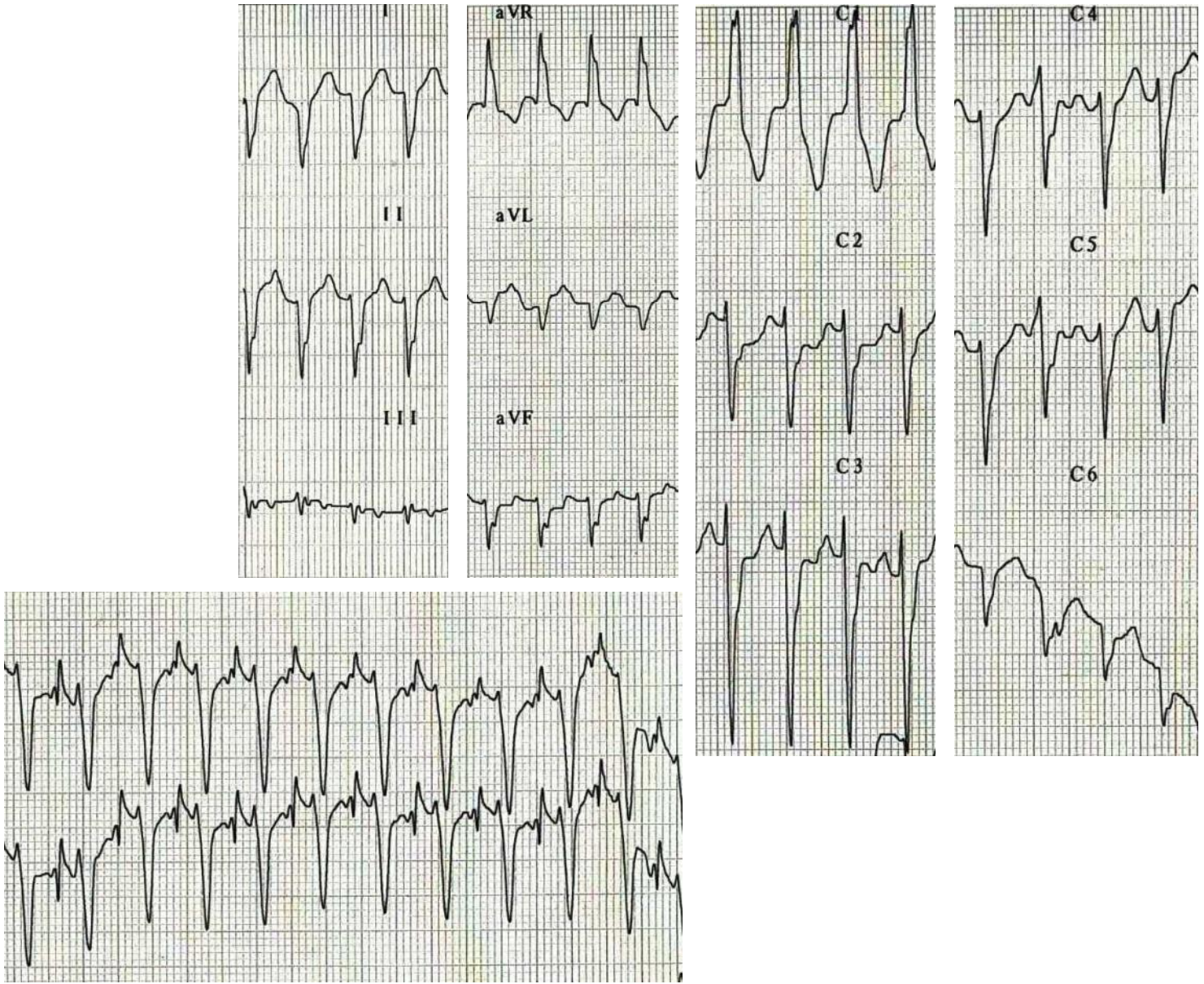
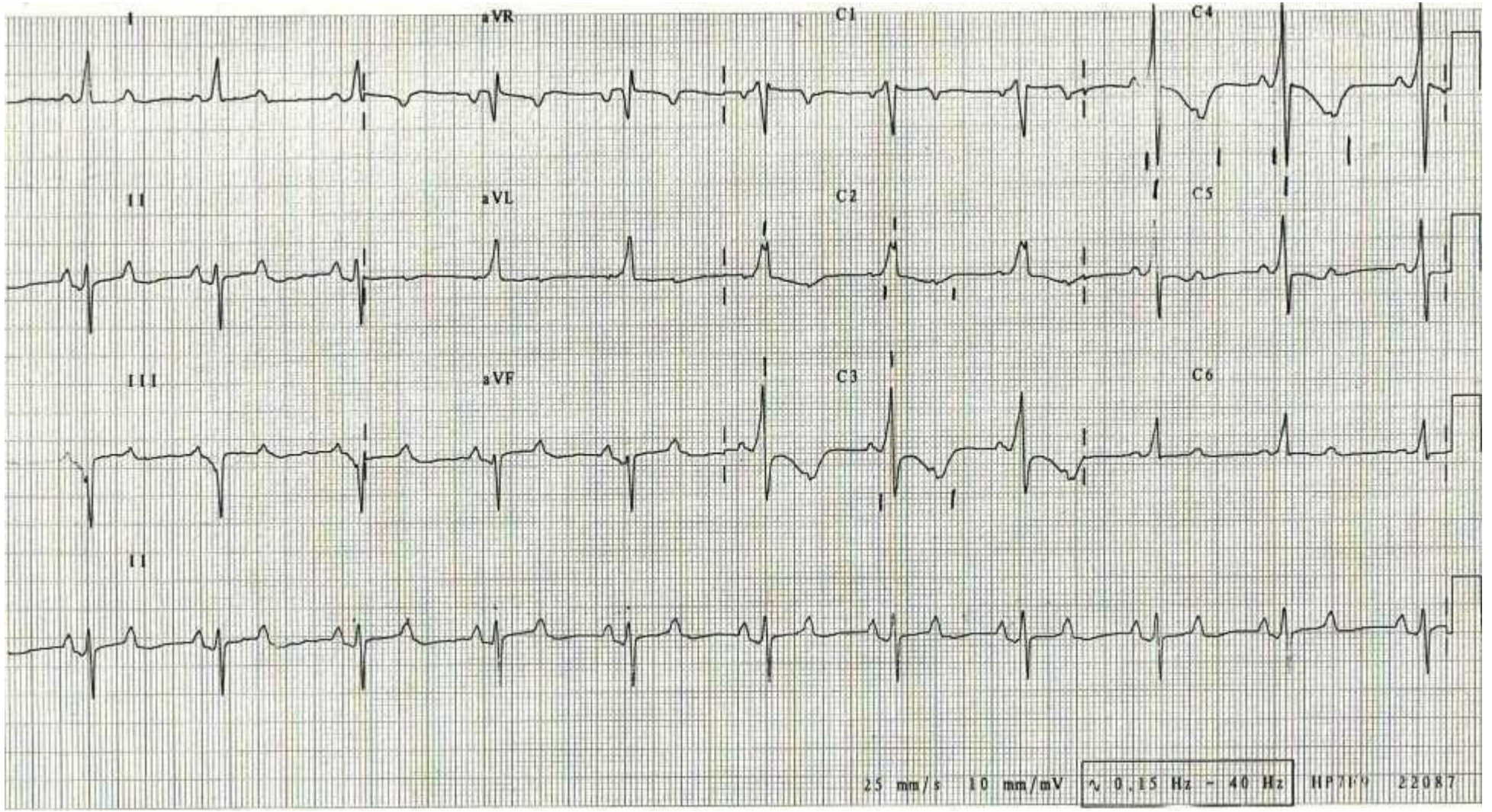
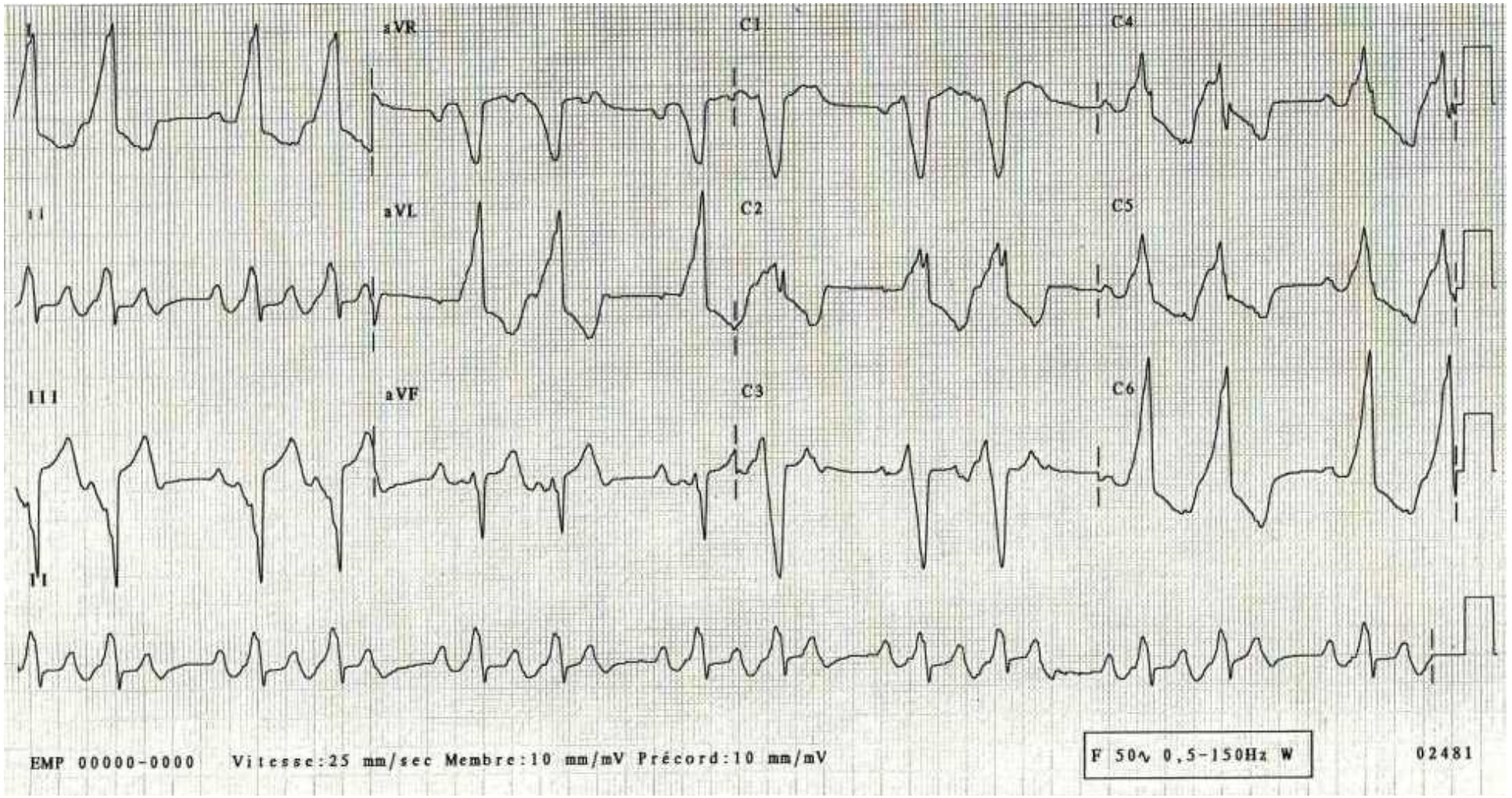
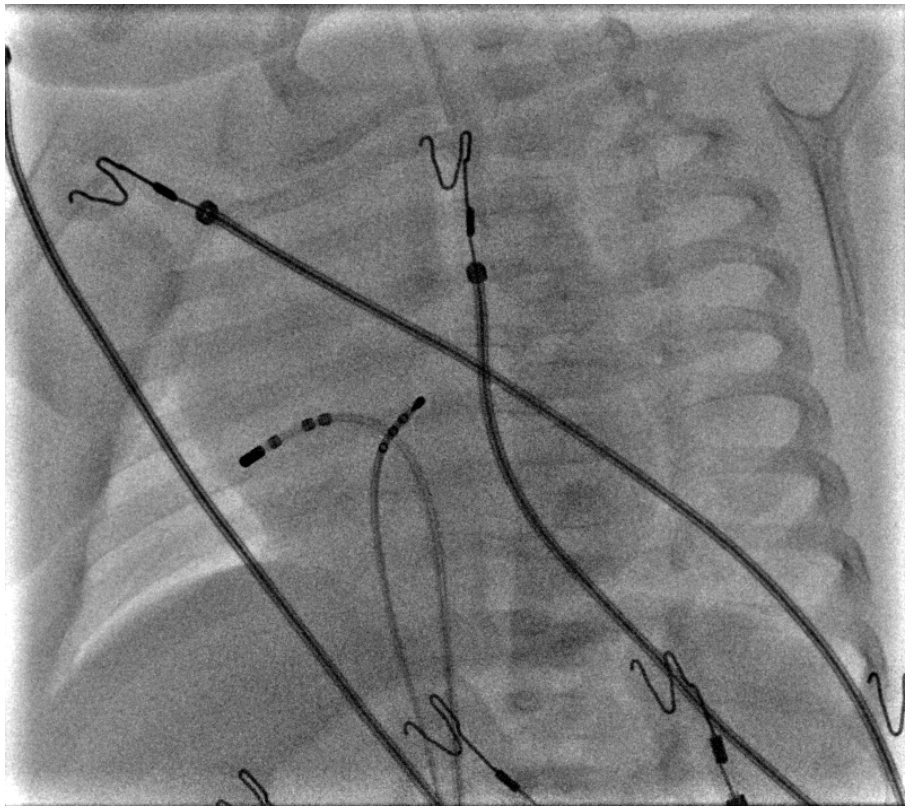


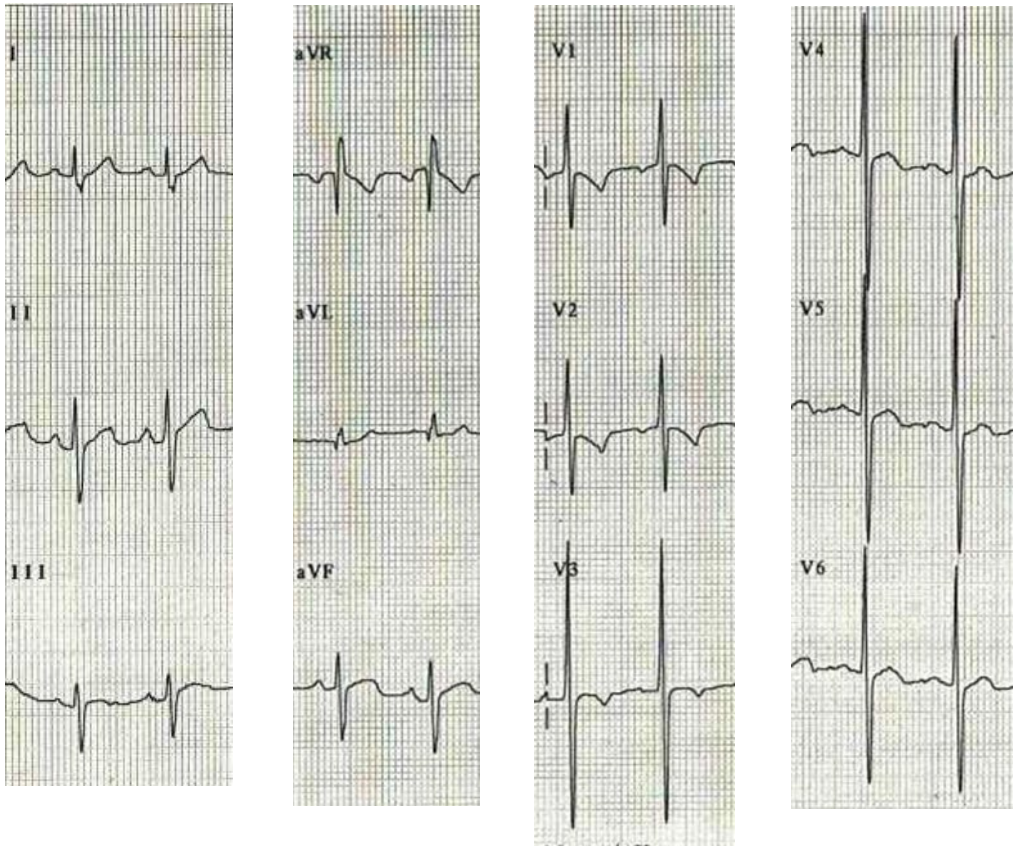
Thank you for your attention

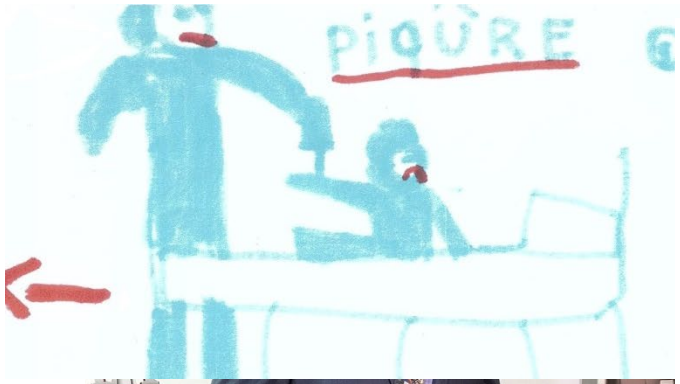

I
II
III
aVR
aVL
aVF
C1
C2
C3
C4
C5
C6

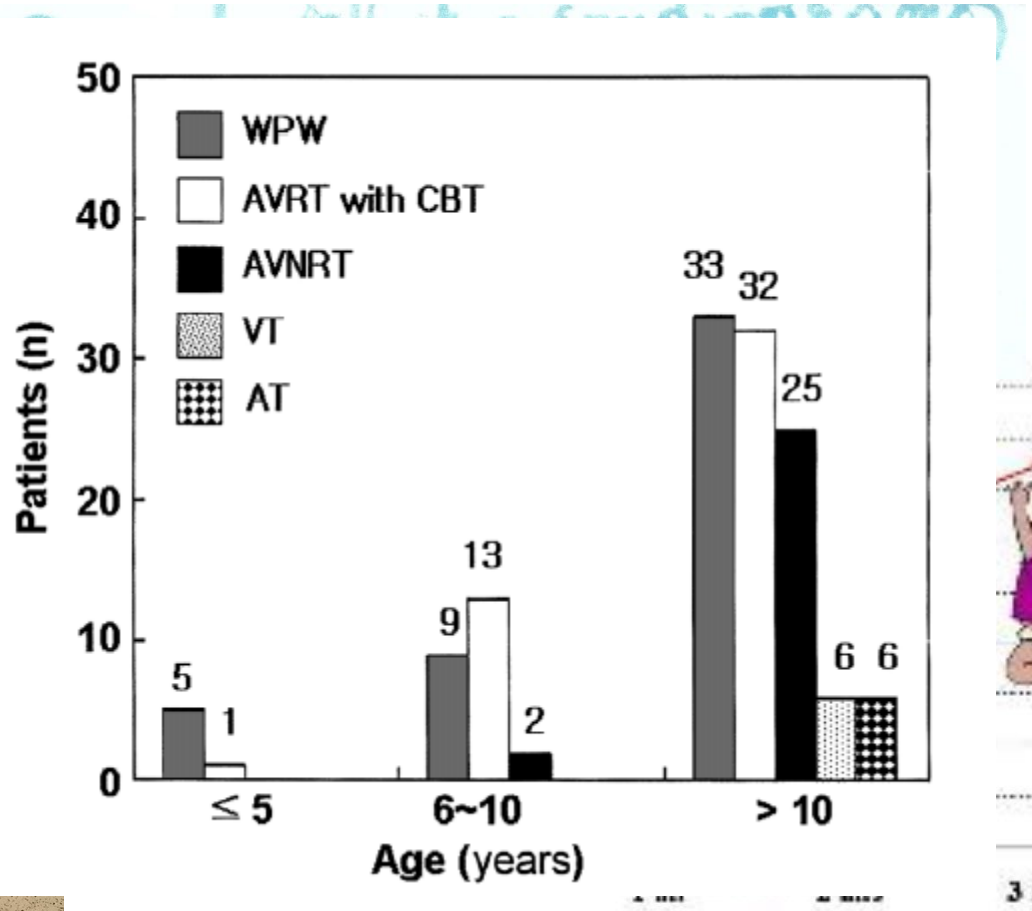

I
aVR
C1
C4
II
aVL
C2
C5
III
aVF
C3
C6
II
25 mm/s 10 mm/mV
0.15 Hz - 40 Hz
22087

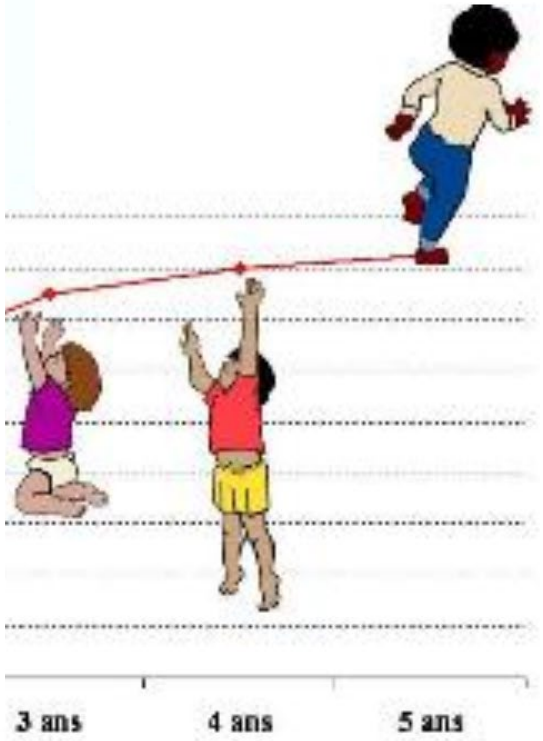

I
aVR
C1
C4
II
aVL
C2
C5
III
aVF
C3
C6
II
EMP 00000-0000
Vitesse:25 mm/sec Membre:10 mm/mV Précord:10 mm/mV
F 50∿ 0,5-150Hz W
02481




I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6


PIQÛRE


50
40
30
20
10
0
Patients (n)
WPW
AVRT with CBT
AVNRT
VT
AT
5
1
9
13
2
33
32
25
6
6
≤ 5
6~10
> 10
Age (years)


3 ans
4 ans
5 ans