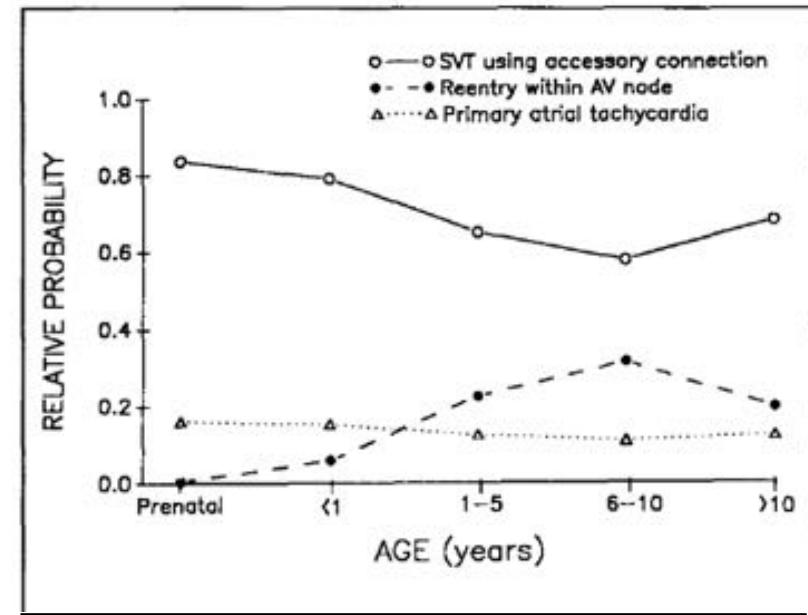


Tachycardie supra ventriculaire

Alice Maltret



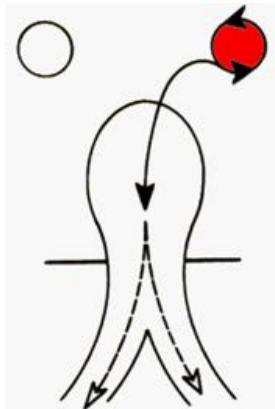
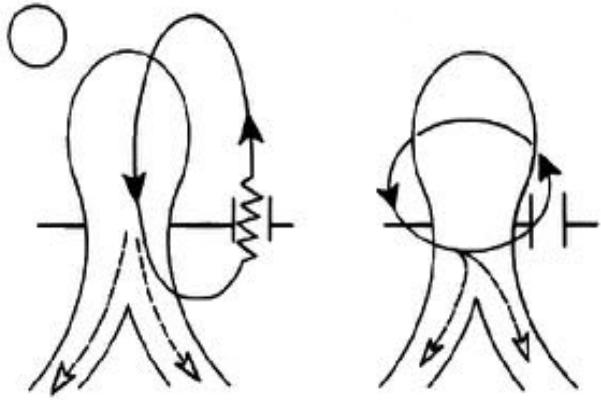
- Pédiatrie = spécialité d'âge
- Même mécanisme que les arythmies de l'adulte
- Histoire naturelle ≠
- Mode de révélation ≠
- **3 périodes à risque**
 - Anténatal → 1 an
 - Après 5 ans
 - Post-opératoire de CHD
 - Post-op immédiat (JET)
 - Post-op tardif (TV, Flutter, ...)



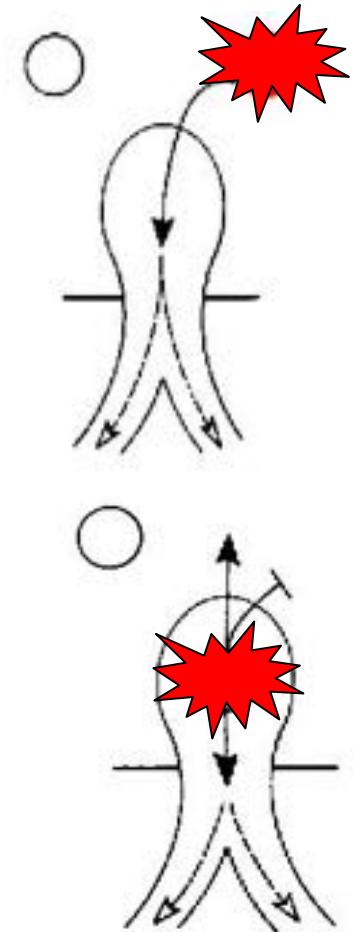
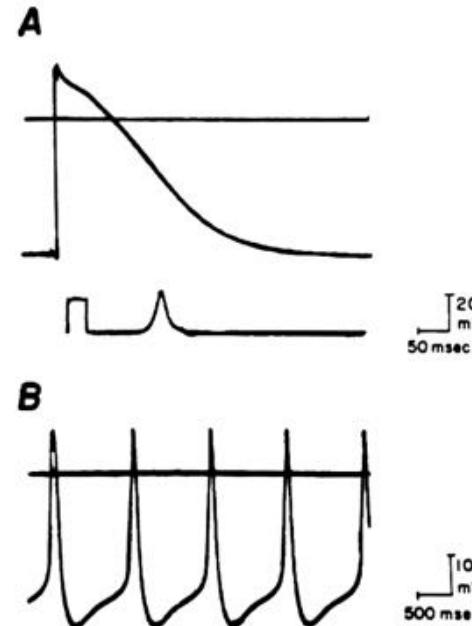
Ko et al Am J Cardiol 1992

Mécanismes électrophysiologiques des TSV

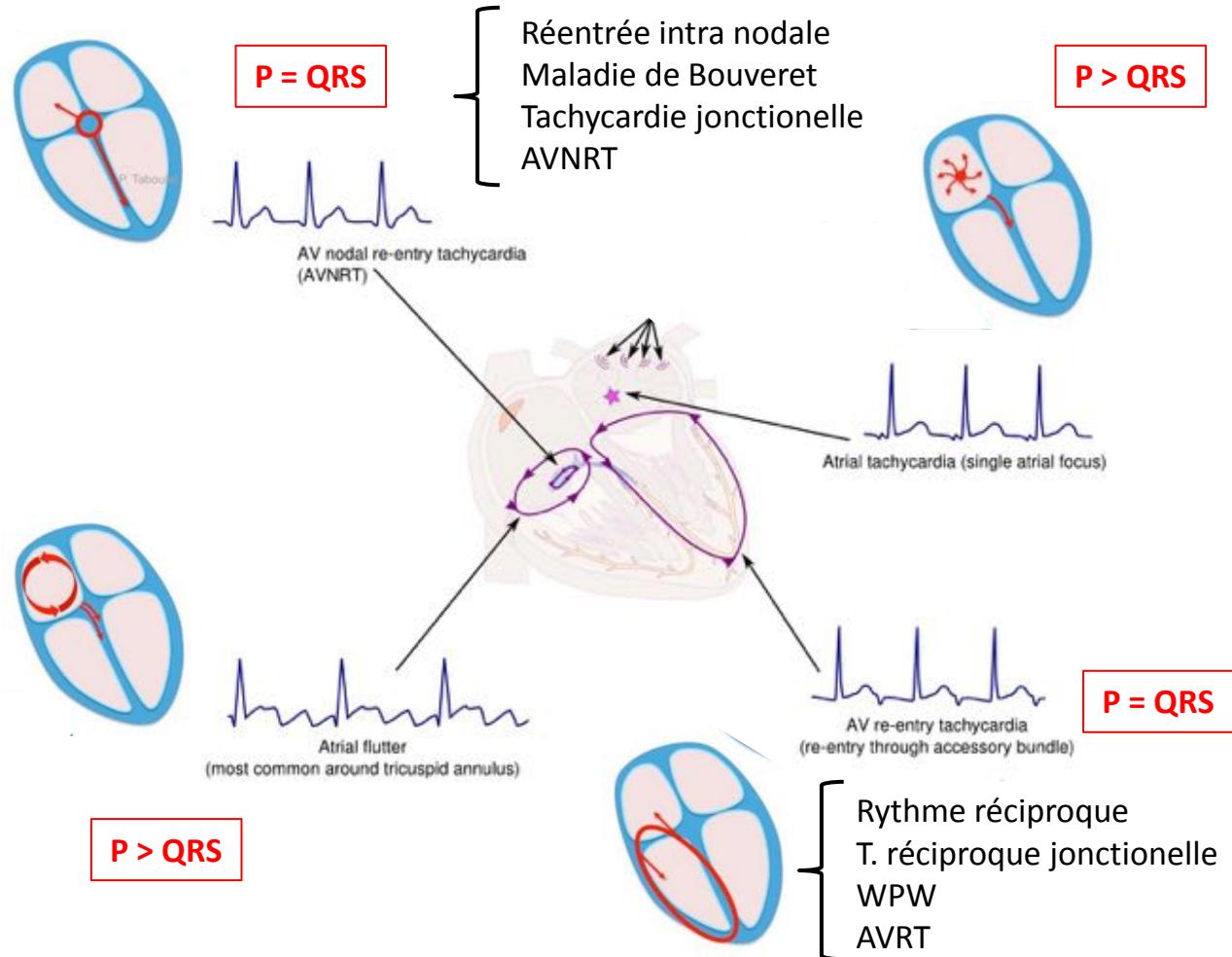
- Réentrée

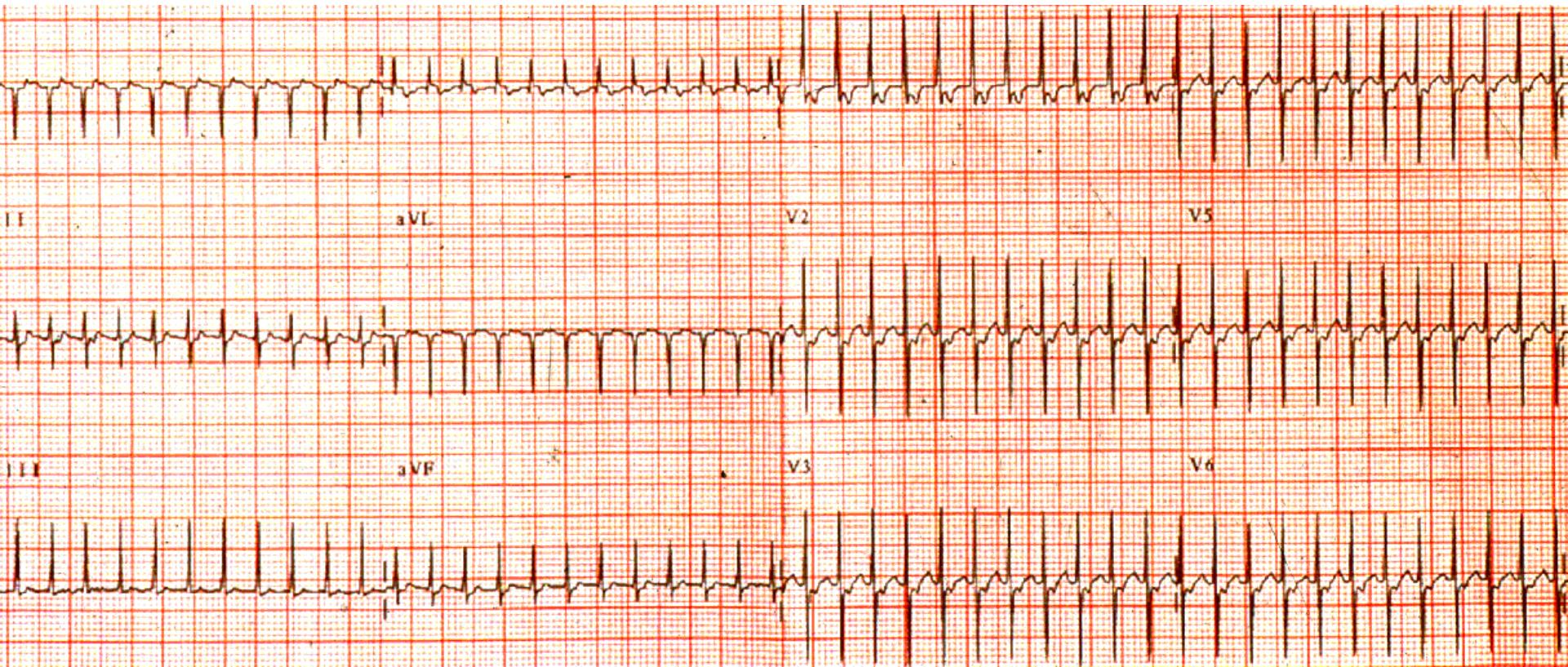


- Automatisme anormal



Tachycardie Supra-Ventriculaire





Origine/Mécanisme de la TSV



Analyse du rapport QRS/P

QRS=P

ou P non visible

QRS>P

+/- dissociation QRS/P

P>QRS

Origine/Mécanisme de la TSV



Analyse du rapport QRS/P

QRS>P

QRS=P
ou P non visible

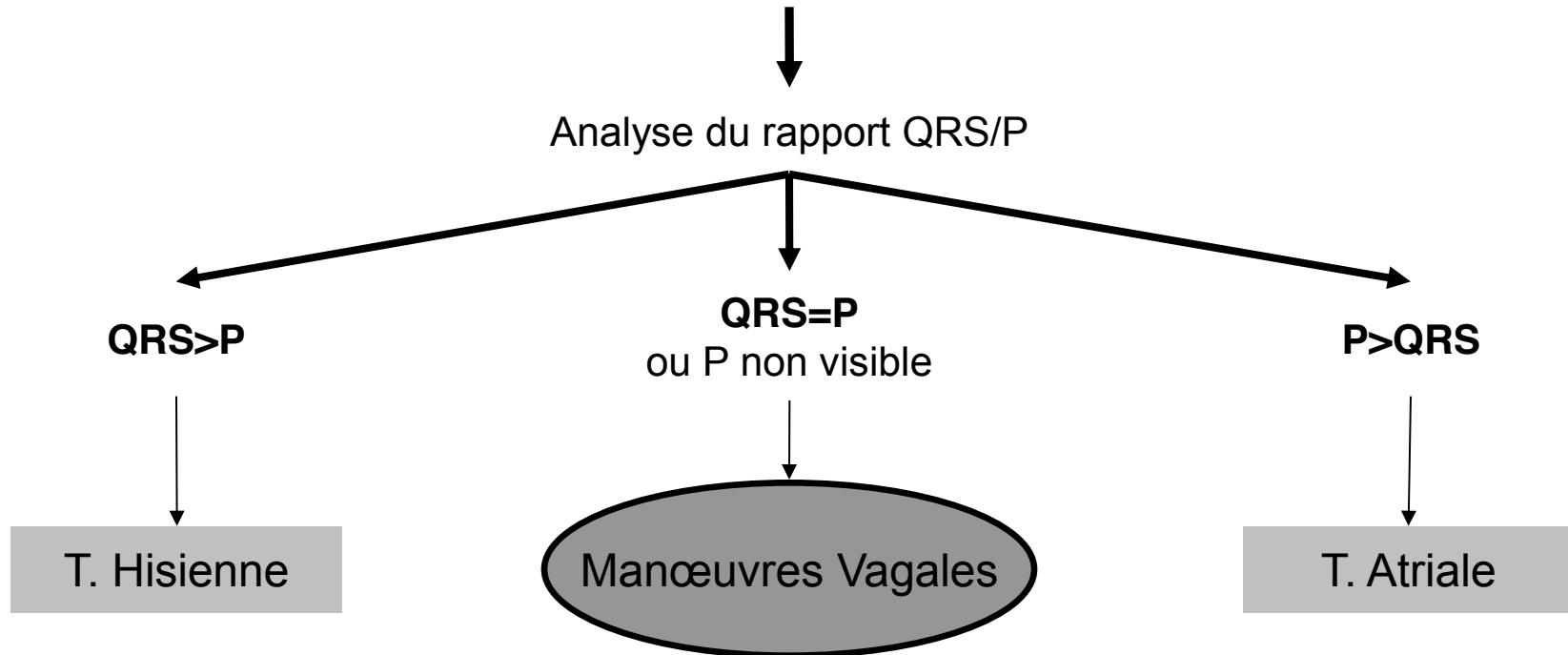
P>QRS

T. Hisienne ou JET

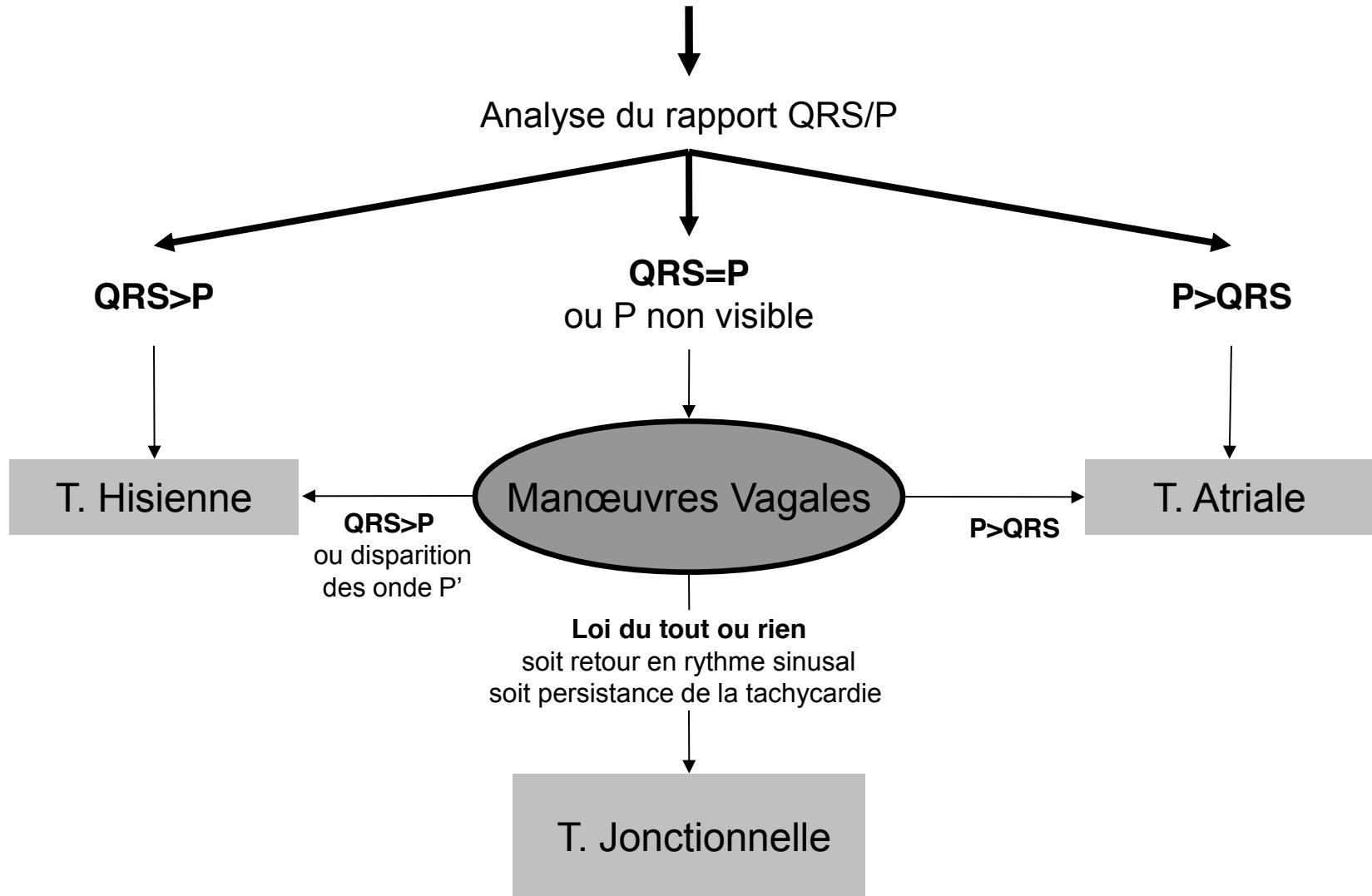
T. Atriale

Macro-réentrée
Foyer ectopique

Origine/Mécanisme de la TSV



Origine/Mécanisme de la TSV



Manoeuvres vagales en enregistrant l'ECG

- Pour ralentir la conduction entre oreillettes et ventricules
- Vessie de glace maintenue 2 à 3 secondes après réduction ou 10 secondes au total
- Pose de sonde naso-gastrique ou aspiration endotrachéale
- Valsalva
- massage carotides, compression oculaire... BOF
- Si échec, test à l'Adénosine

Adénosine en pratique

L'appareil d'ECG doit être branché pour enregistrer la réduction

Le médecin est dans la chambre de l'enfant et le chariot d'urgence à proximité

L'ensemble du matériel de réanimation est vérifié avant l'injection.
La première dose IV flash est de 0,1 mg/kg

Cette injection peut être renouvelée en cas d'échec et la dose augmentée à 0.3 mg/kg IV flash

Adénosine en pratique

Effets secondaires

Flush et rougeur diffuse

Nausées

Sensation de malaise intense

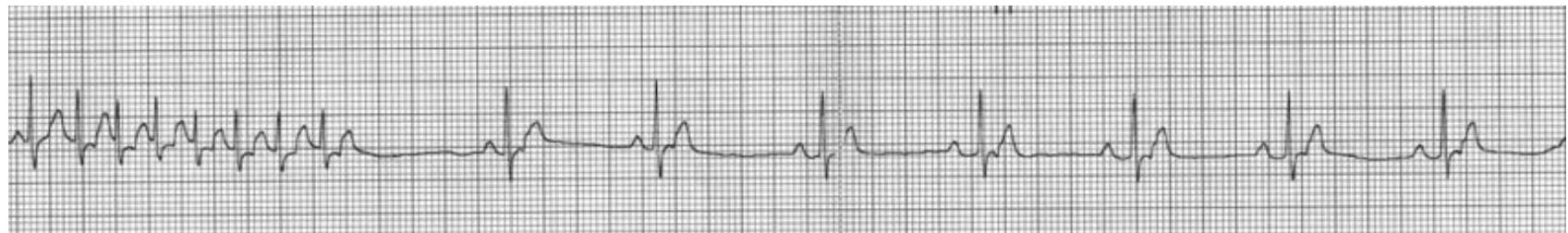
Bradycardie (injecter l'ATROPINE)

Ces effets secondaires sont l'équivalent d'un malaise vagal

Ils cèdent très rapidement car la demi-vie de la Striadyne est très courte (quelques secondes)

Attention si asthmatique! Bronchospasme

Pendant l'injection, un tracé ECG est enregistré et on note en haut de l'ECG le moment de l'injection de Striadyne



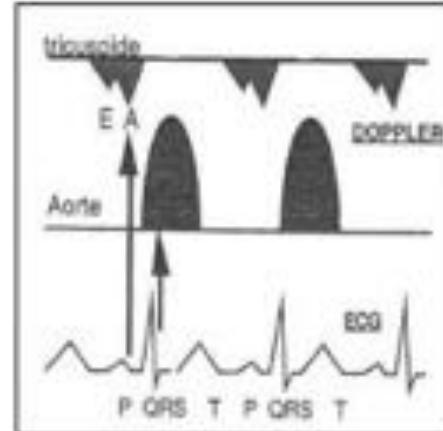
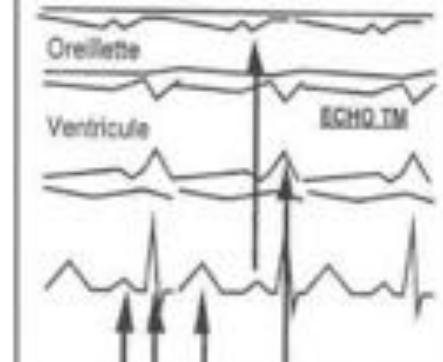
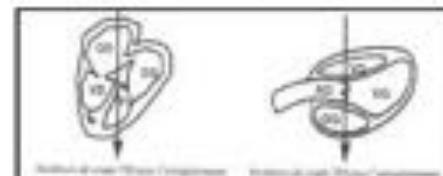
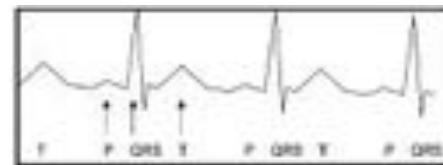
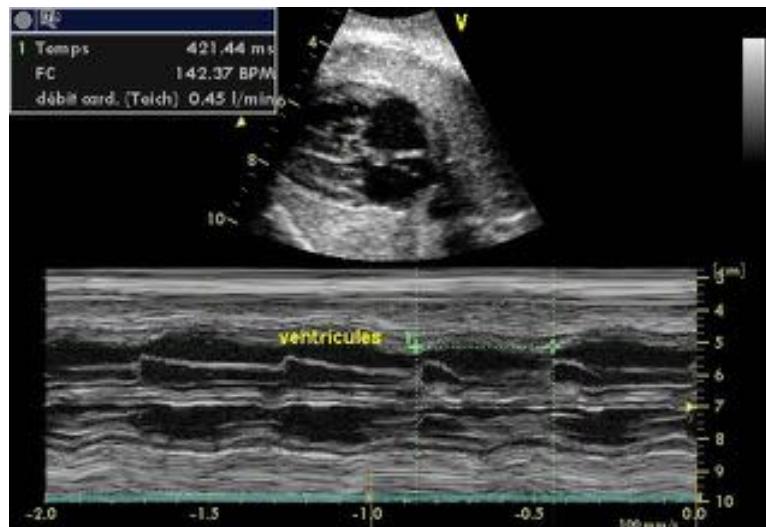
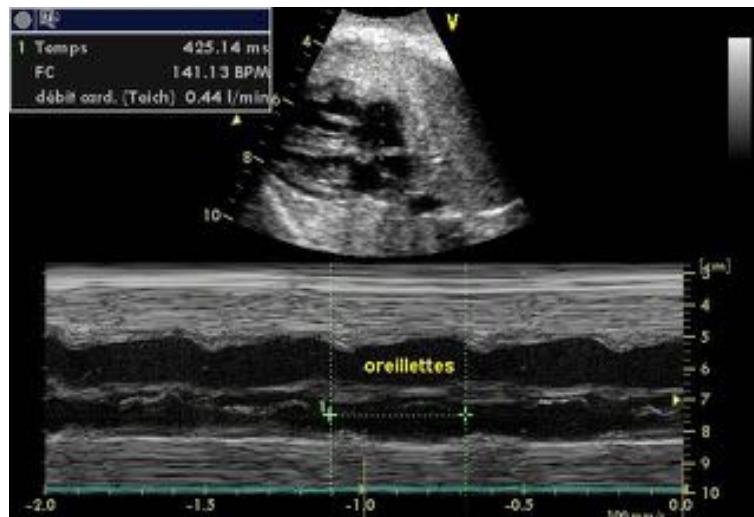
Arythmies de l'enfant

AVANT 1 AN

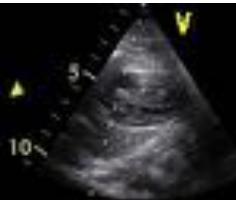
Diagnostic de tachycardie fœtale

- Fc fœtal
 - Normal: 100-180 (150)
 - Tachycardie > 180-200
- Diagnostic possible dès 20 SA
- Echographie cardiaque Fœtal
 - TM et BD sur paroi auriculaire et ventriculaire
 - Doppler: flux de remplissage ventriculaire et flux transvalvulaire pulmonaire ou aortique

Rythme sinusal normal

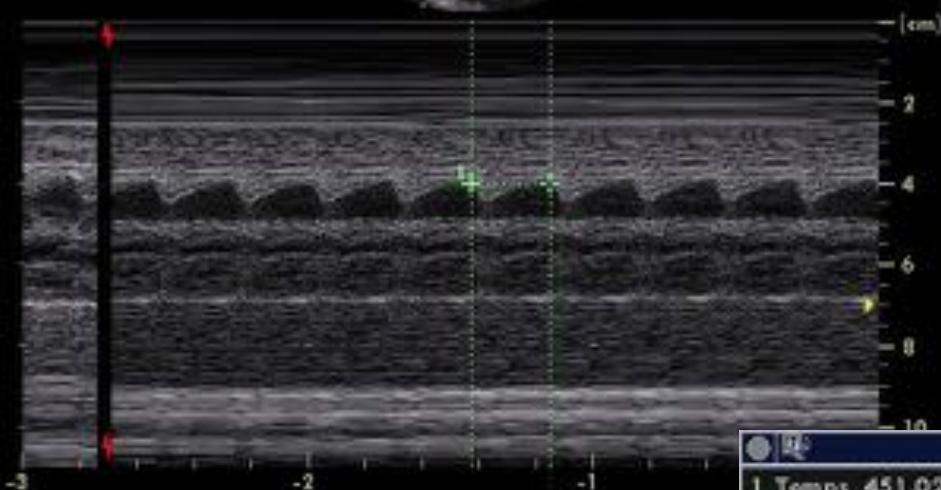


1 Temps: 277.26 ms
FC 216.40 BPM



[cm]

10



1 Temps: 451.02 ms
FC 133.03 BPM



V

74

1.0

0.5

-0.5

-1.0

0.0

100 ms/s

-2.0

-1.5

-1.0

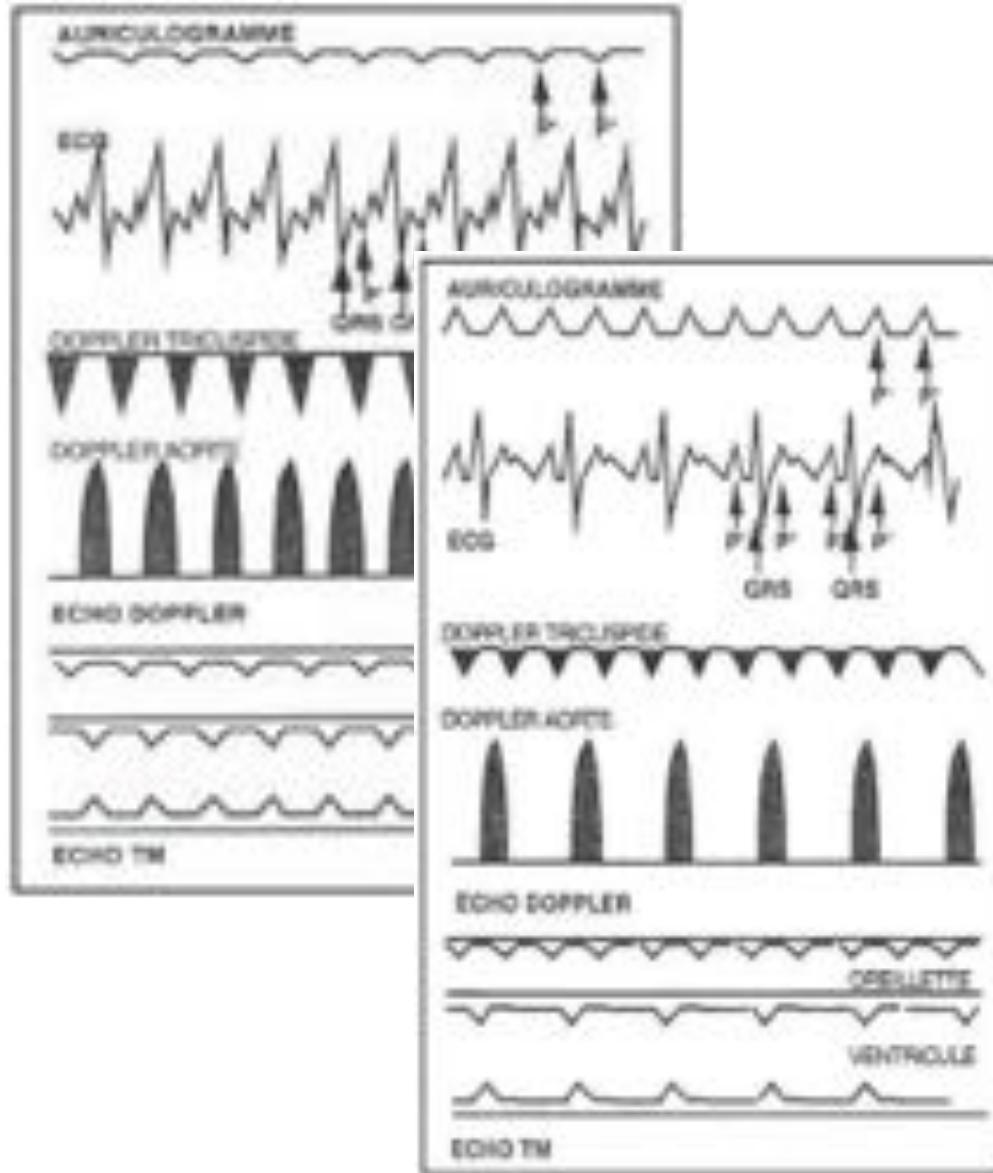
-0.5

0.0

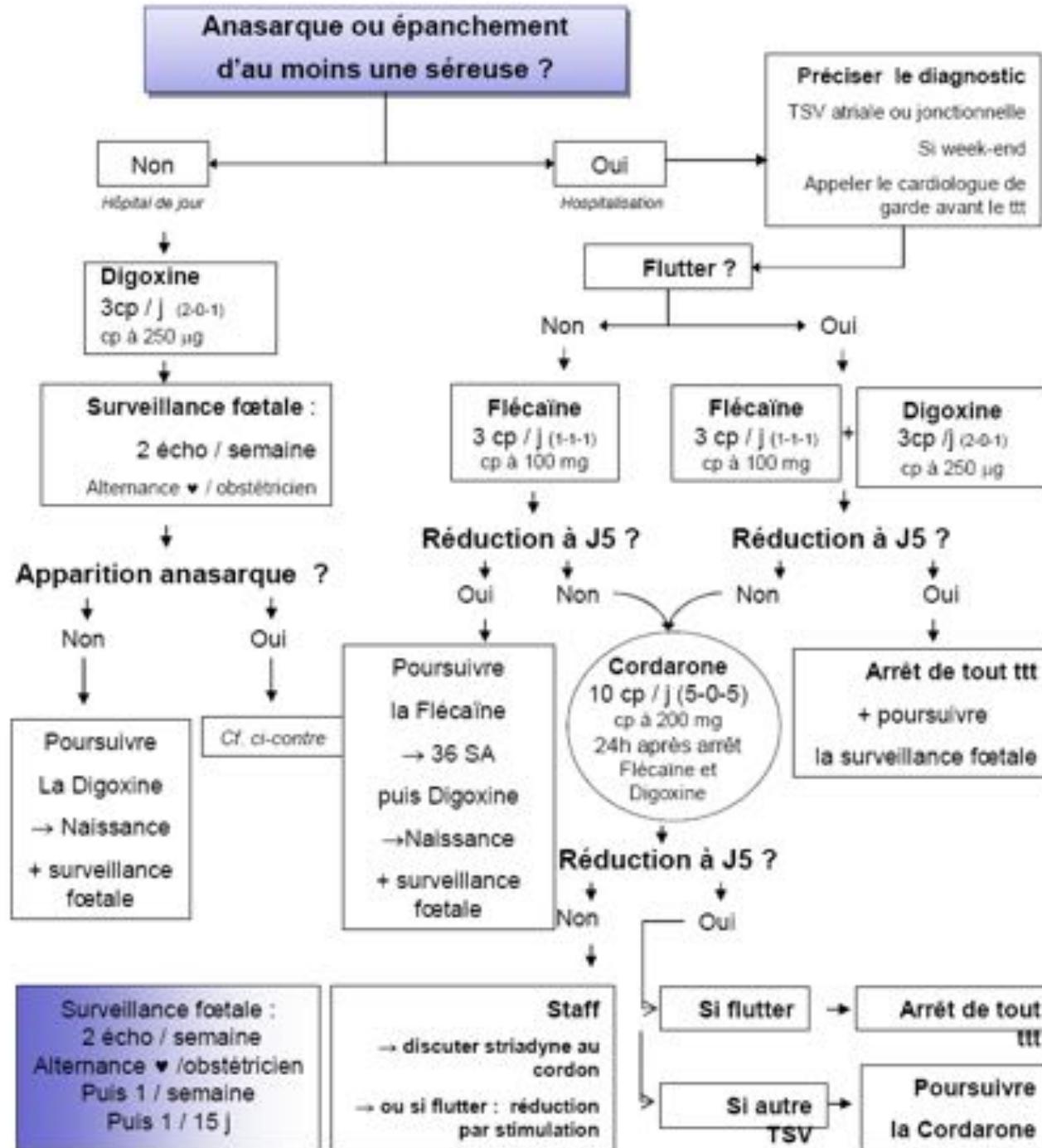
100 ms/s

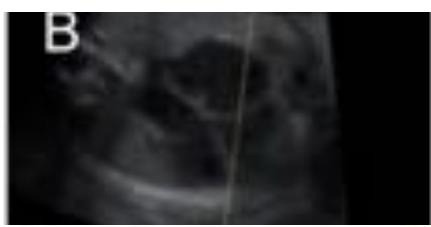
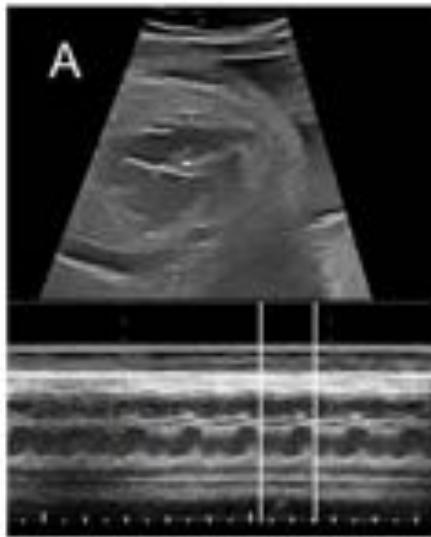
Diagnostic de l'arythmie fœtale

- Fréquence atriale et ventriculaire
- Rapport entre les contractions atriales (A) et les contractions ventriculaires (V)
- 2 mécanismes principaux
 - TJ/RR ($A = V$)
 - Flutter ($A > V$ – A: 300 à 400 bpm)

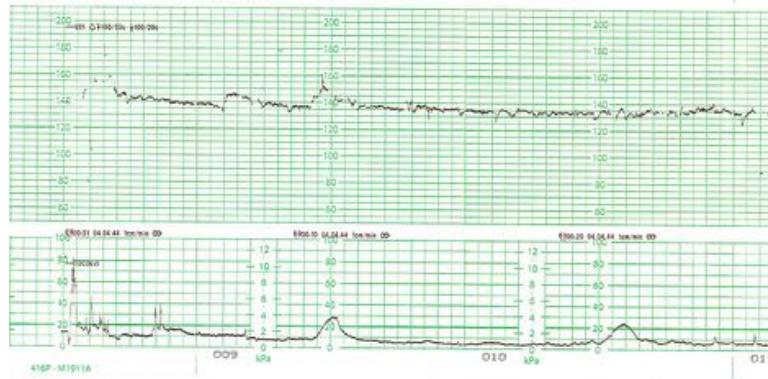


Protocole Necker
d'après JM Jouannic





Necker
CHU Paris
AP-HP
UNIVERSITÉ PARIS DIDEROT



Diagnostic post-natal

- Epidémio
 - 2.25/1000 avant 19 ans
 - H>>F
- Cardiopathie associée
 - 10 à 15% (WPW)
- Mécanismes : **90%/réentrée**
- Mode de révélation (Dg svt retardé)
 - difficulté alimentaire → défaillance cardiaque
- Mortalité
 - 0.25 à 1%
 - 10%/PJRT NN et NRS (Necker)



*Vos et al, Acta Paediatrica. 2003
Schlechte et al, J Ped HC. 2008*

Tachycardie prolongée

↗ métabolisme secondaire à la tachycardie

↘ de la diastole

Dette énergétique (ATP)

Anomalie mitochondriale

Stress oxydatif

Ischémie

Altération de la fonction systolique et diastolique

↗ PTDVG

perte de contractilité
(Starling)

Recapture incomplète du
Calcium par le RE et
Sarcolemme

défaut de
relaxation du
myocyte

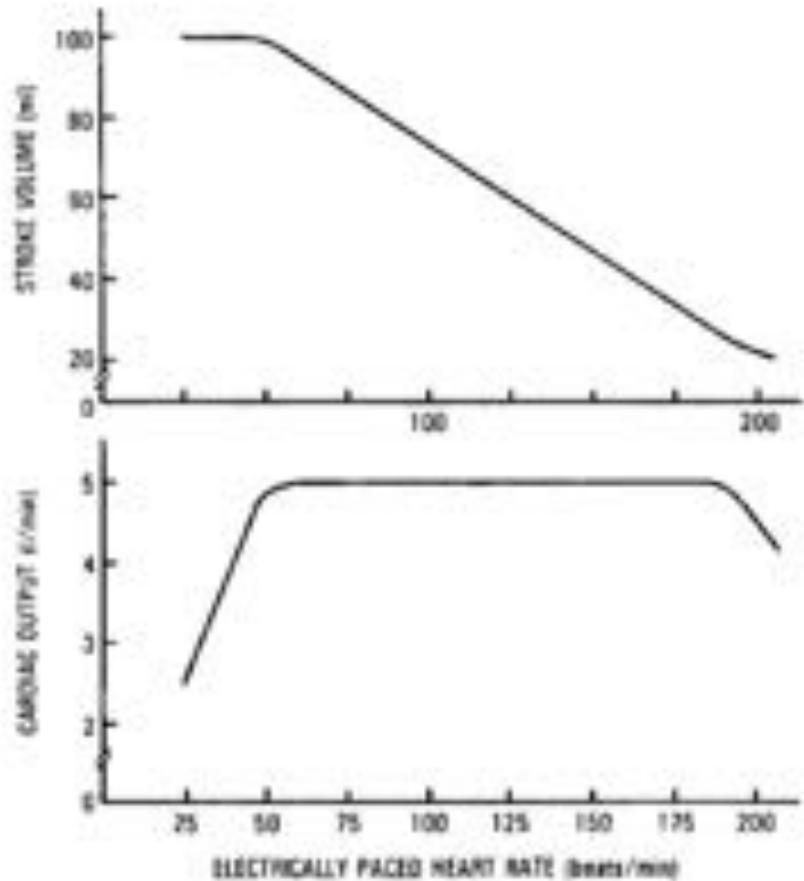
diminution de la
précharge

↘ perfusion coronaire

Physiopathologie de la CM Rythmique....

•

$$Qc = SVol \times HR$$



Paroxysmic Tachy

= ↘ ↗

=> reduction

= ↗ ↘

TM-DMC

↘ ↗ ↗

=> reduction

↖ ↖ ↖ ↖ ↘ ↘

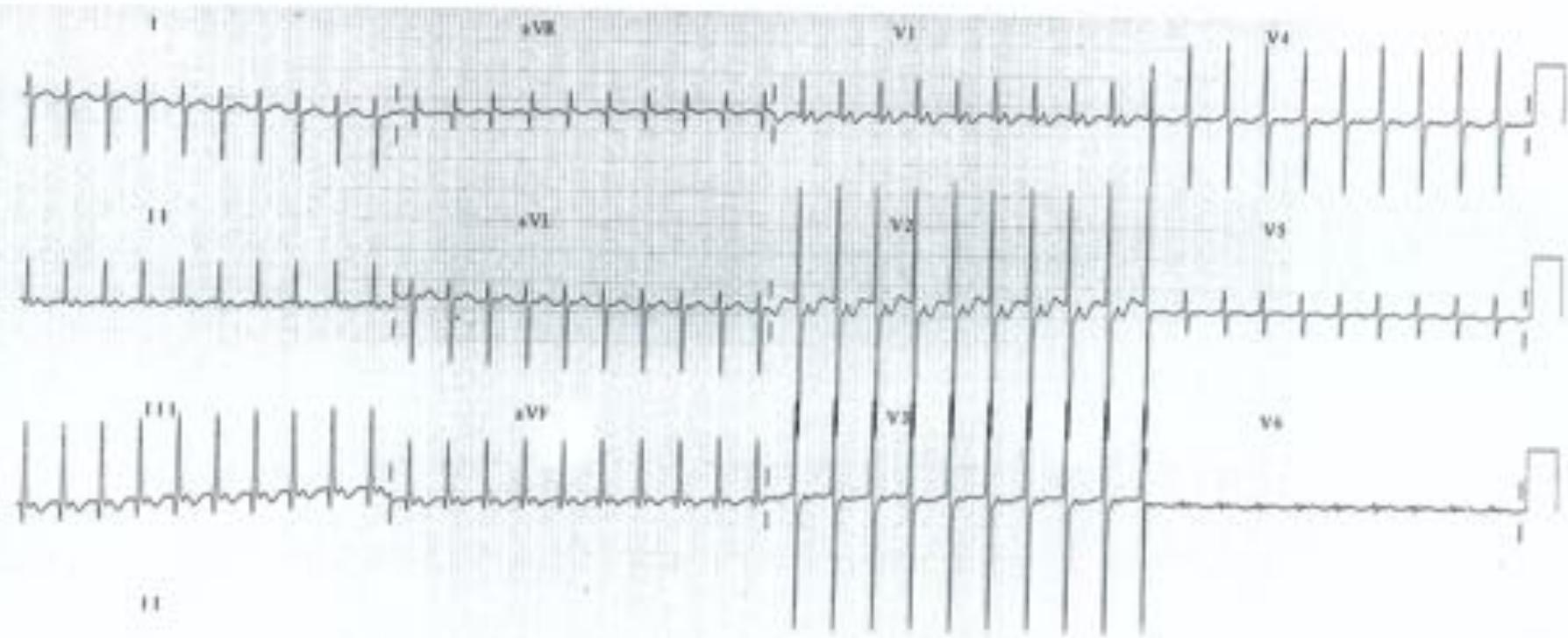
Haemodynamic collapse

Shebani et al. Europace 2015

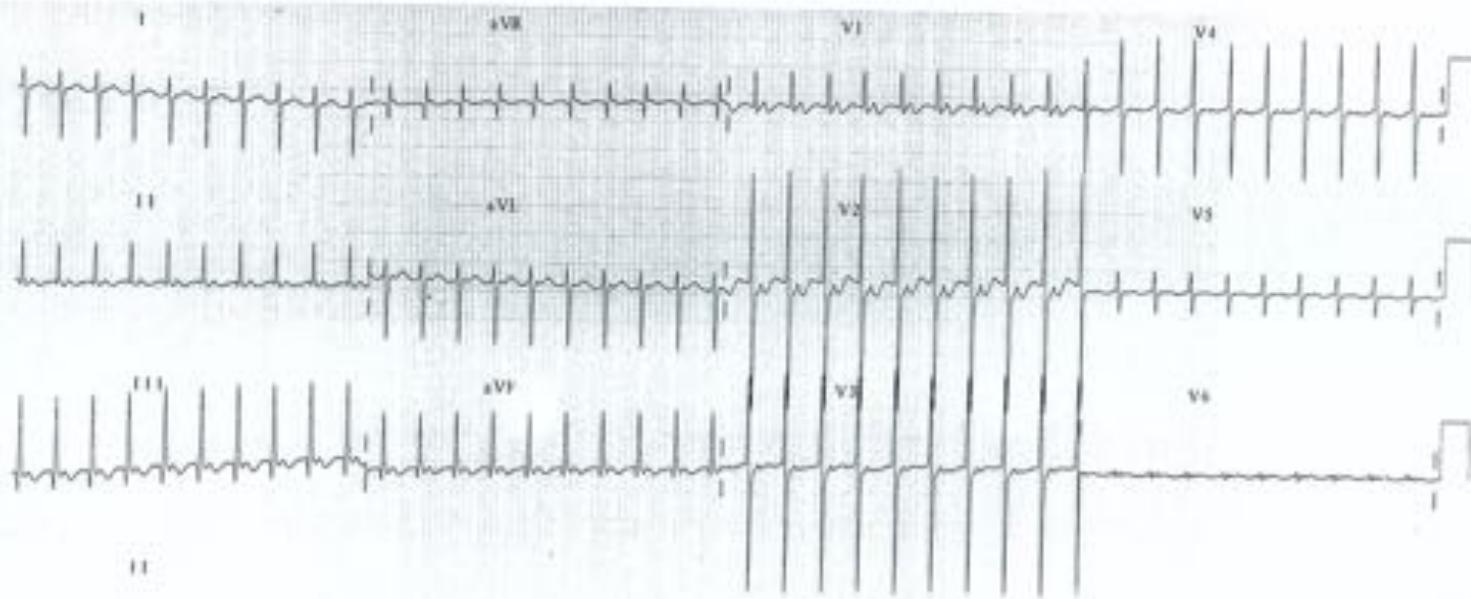
TSV - CAT initiale

- Choc décompensé
 - ⇒ CEC
 - 1 à 2 joules/kg
- Bonne tolérance
 - ⇒ Manoeuvres Vagales
 - Réduction et/ou diagnostic du mécanisme
- Choc compensé
 - ⇒ Ralentir plutôt que réduire
 - ⇒ ECMO

PRINCIPALES ARYTHMIES DE LA PREMIÈRE ANNÉE DE VIE



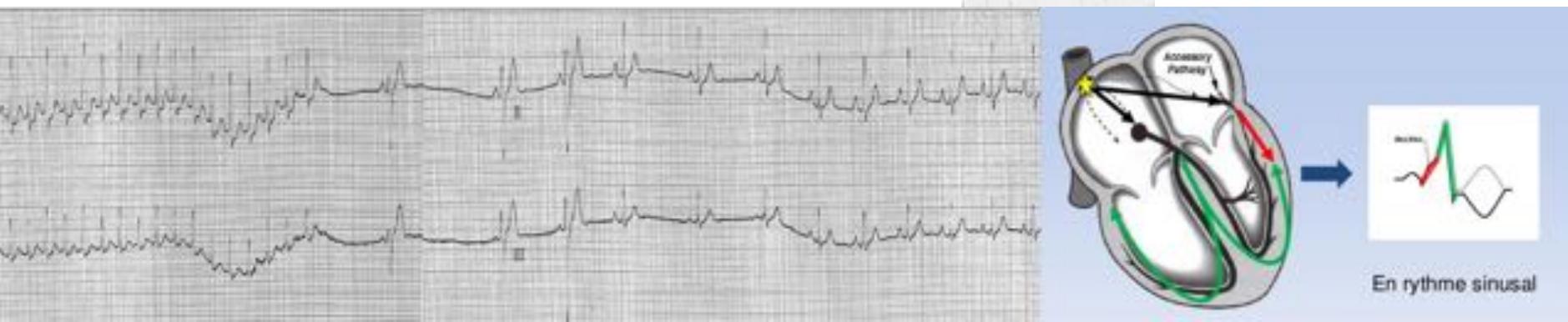
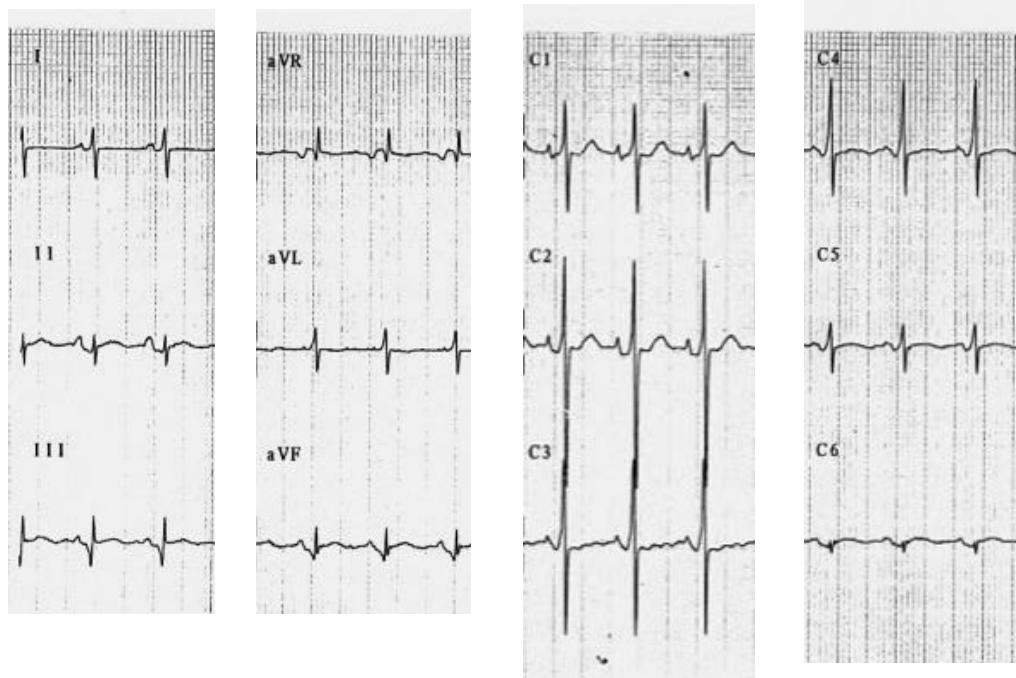
AVRT



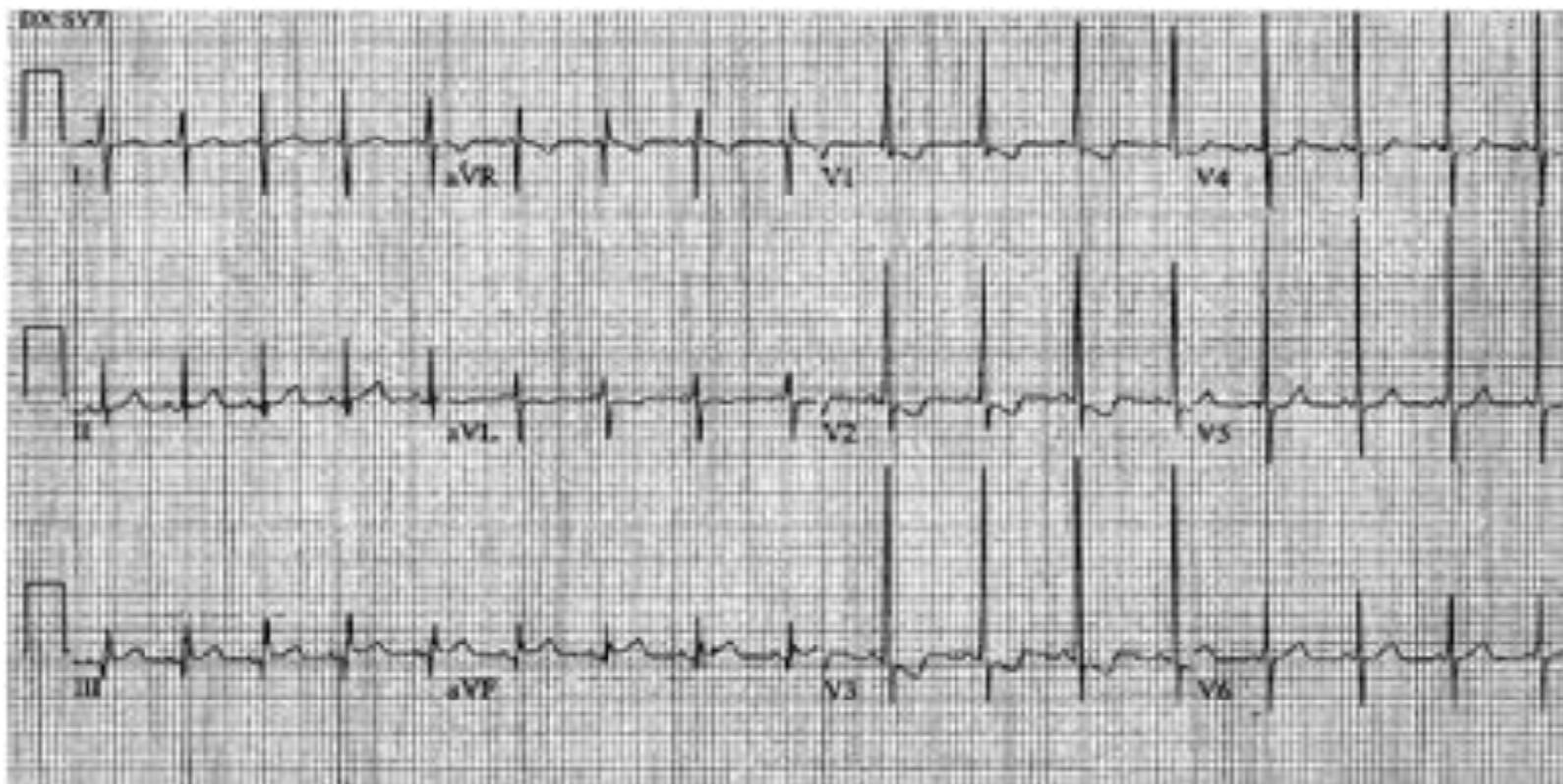
- Adénosine: 0.1 à 0.3 mg/kg

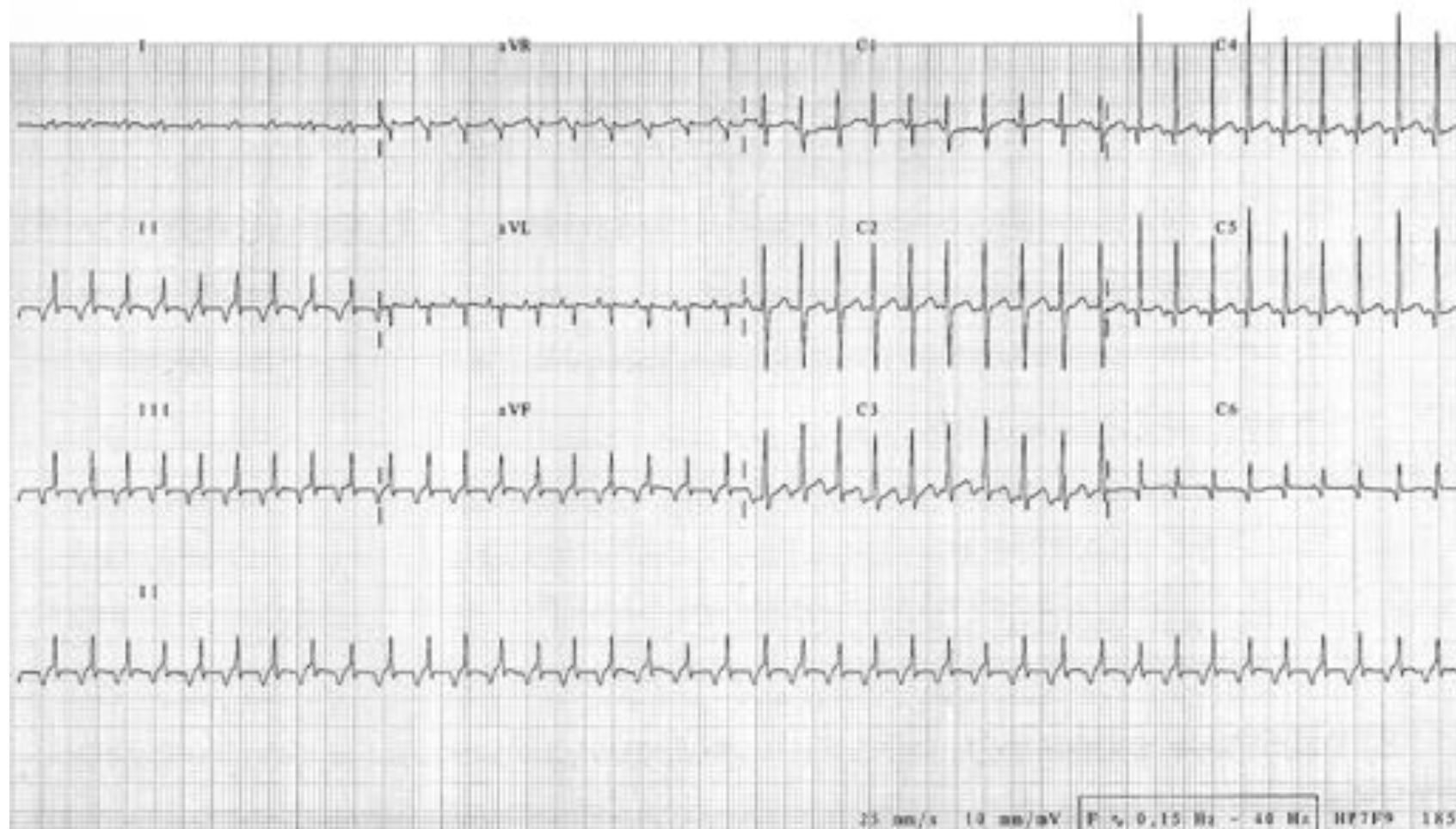


WPW – Nouveau- Né

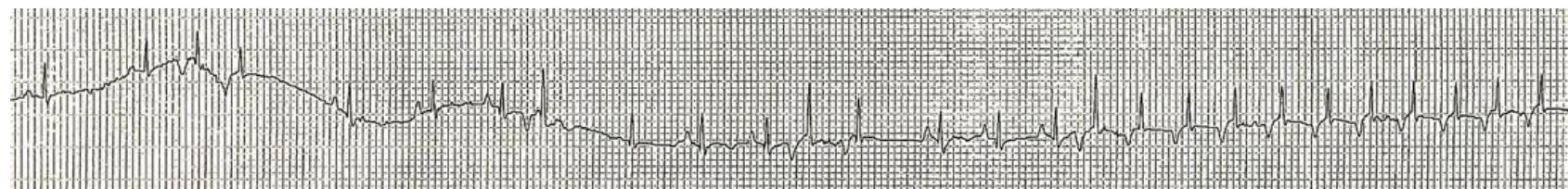


WPW – Nouveau-Né

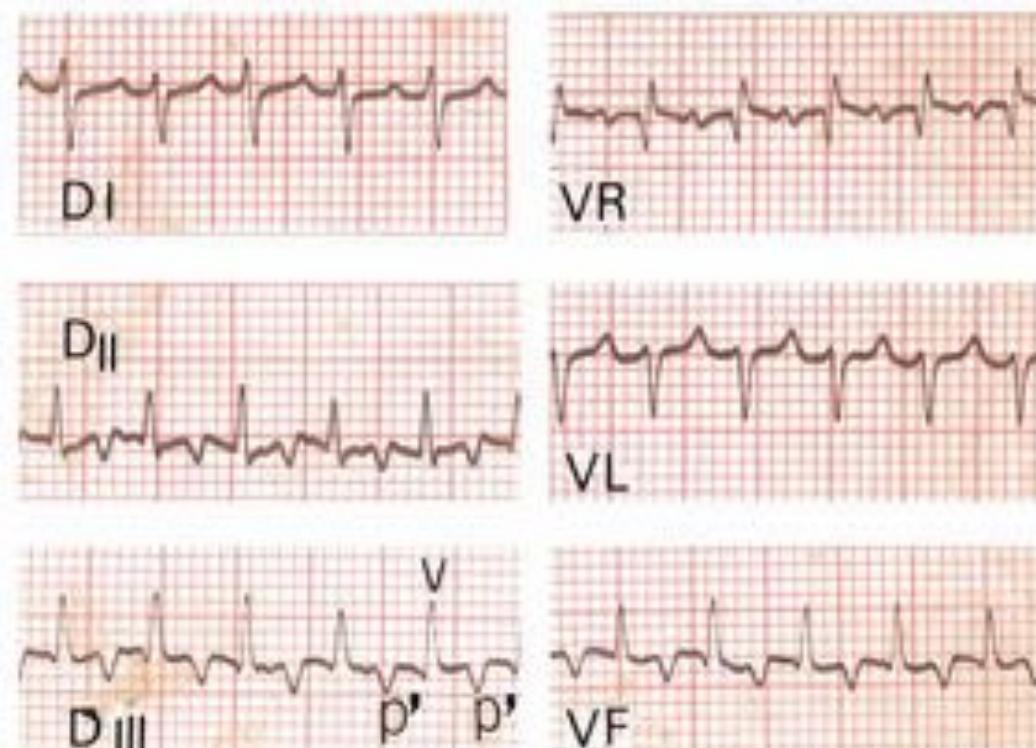




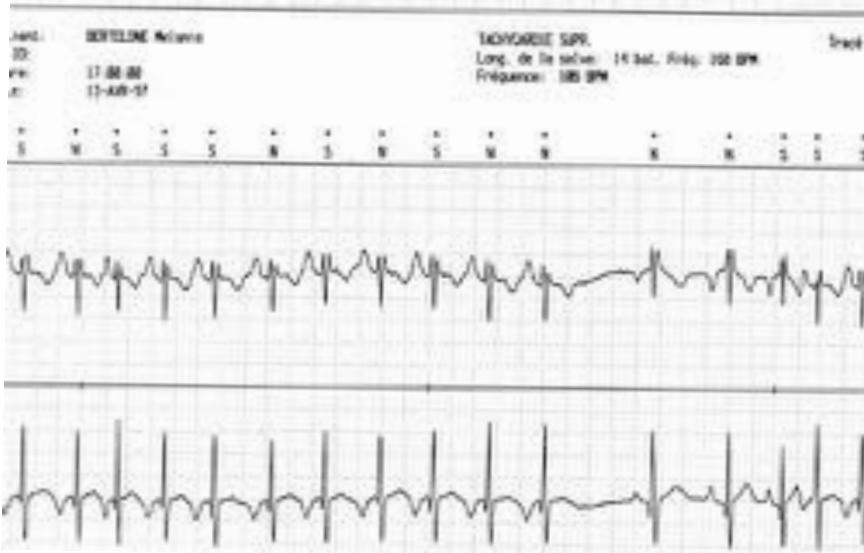
25 mm/s 10 mm/mV IP ~ 0,15 ms - 40 ms HF7E9 185

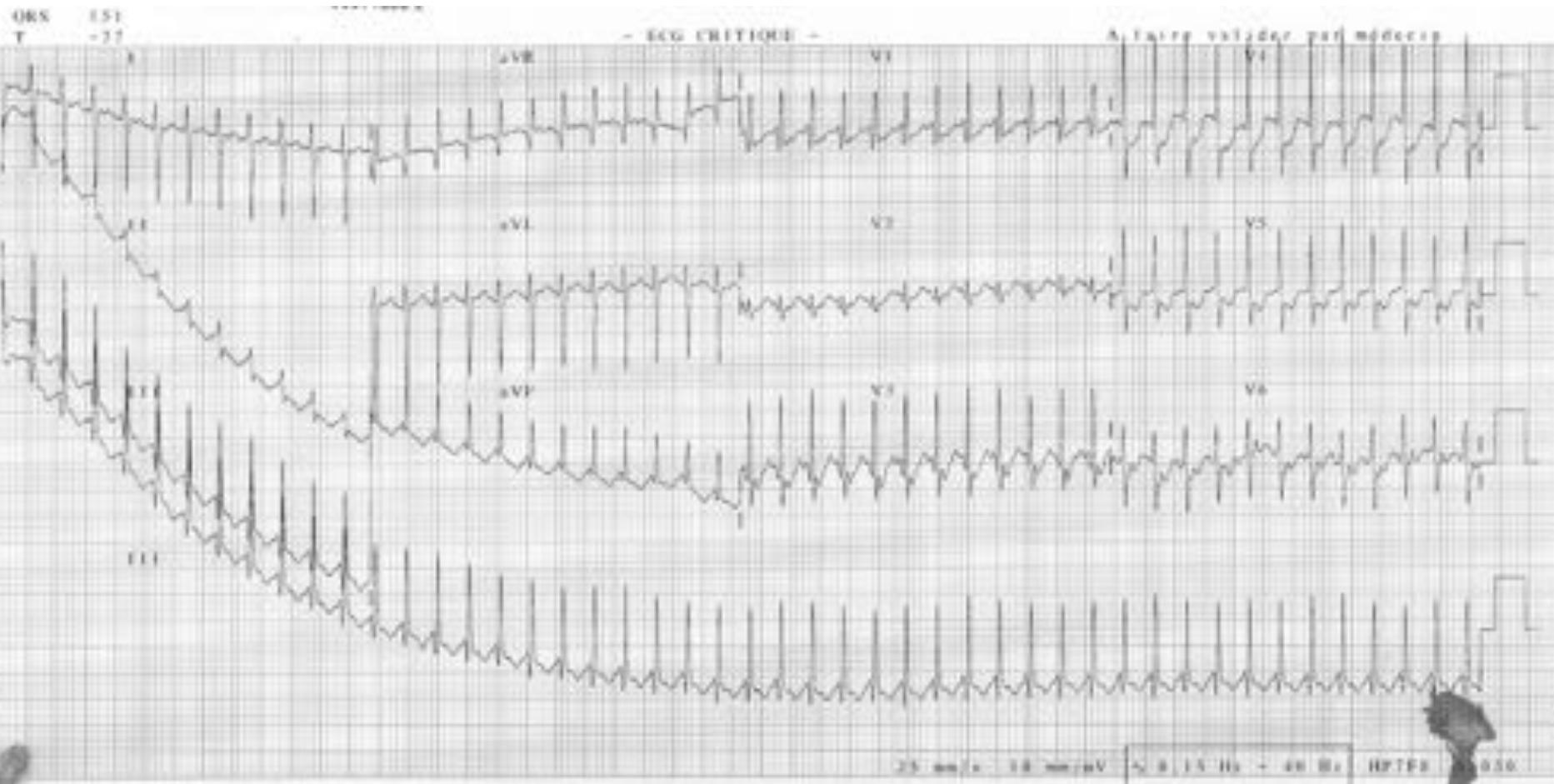


PJRT < 1 an

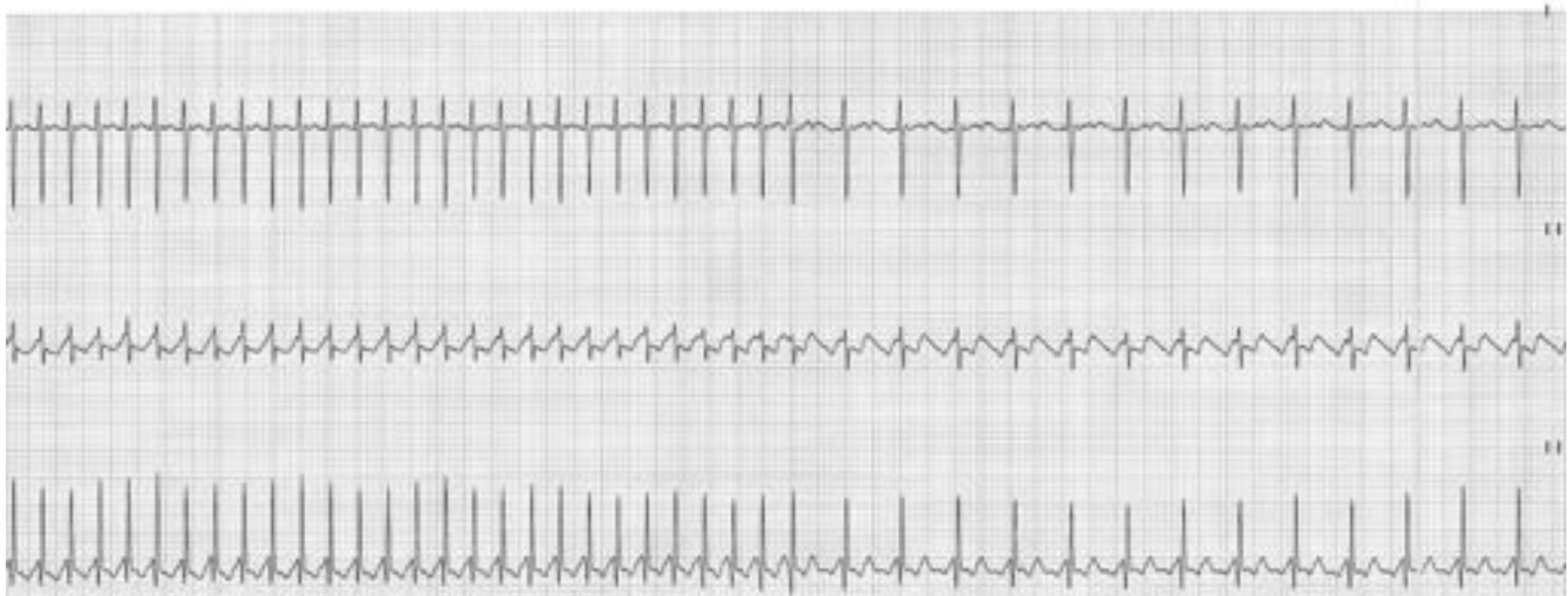


- P' négatif DII ,DIII,VF
- QRS-P' long

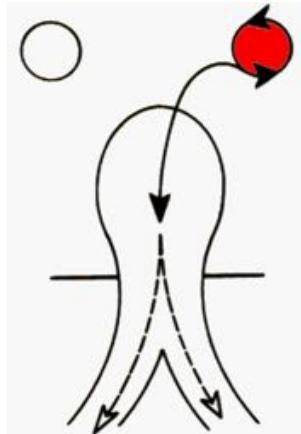
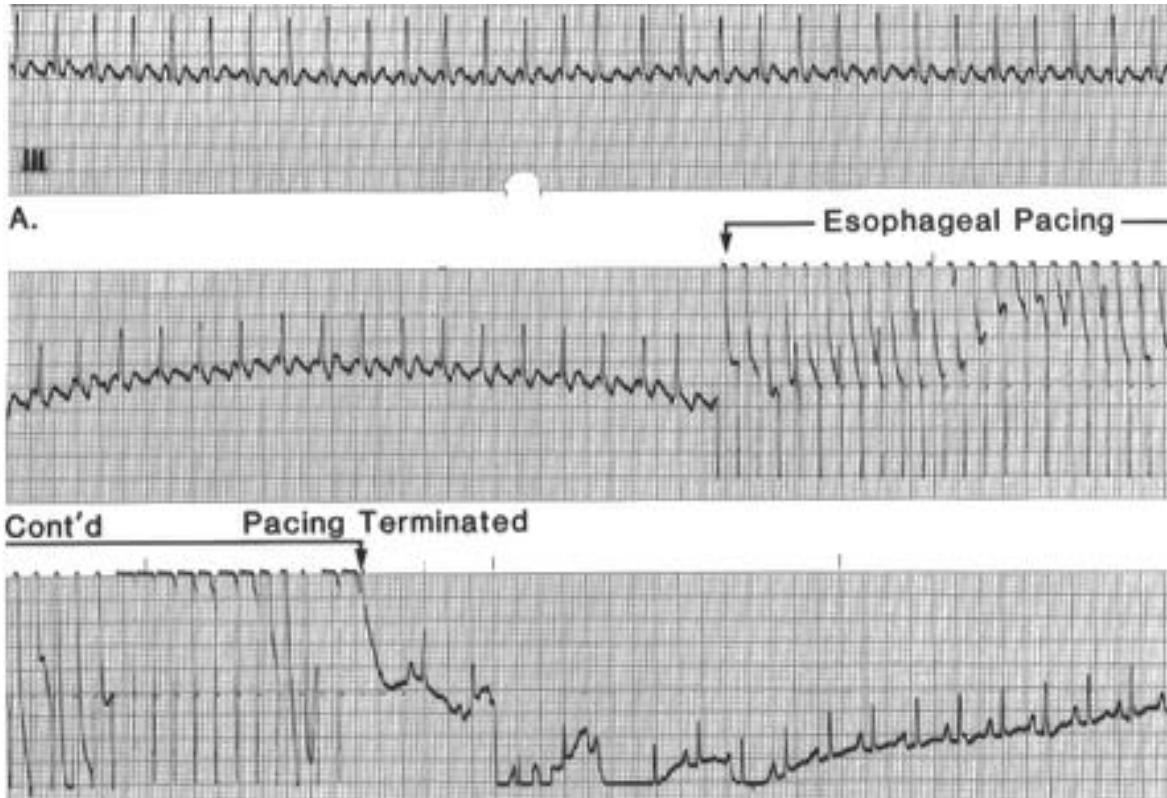




Stio 8



Flutter atrial



- Reduction:
Stimulation atriale
Amiodarone
Choc
- Pronostic: excellent
- Echo cœur: éliminer anomalie d'Ebstein



107

Nom:

Sexe:Homme

Date naiss:

Ann:

Médicament:

cm

kg

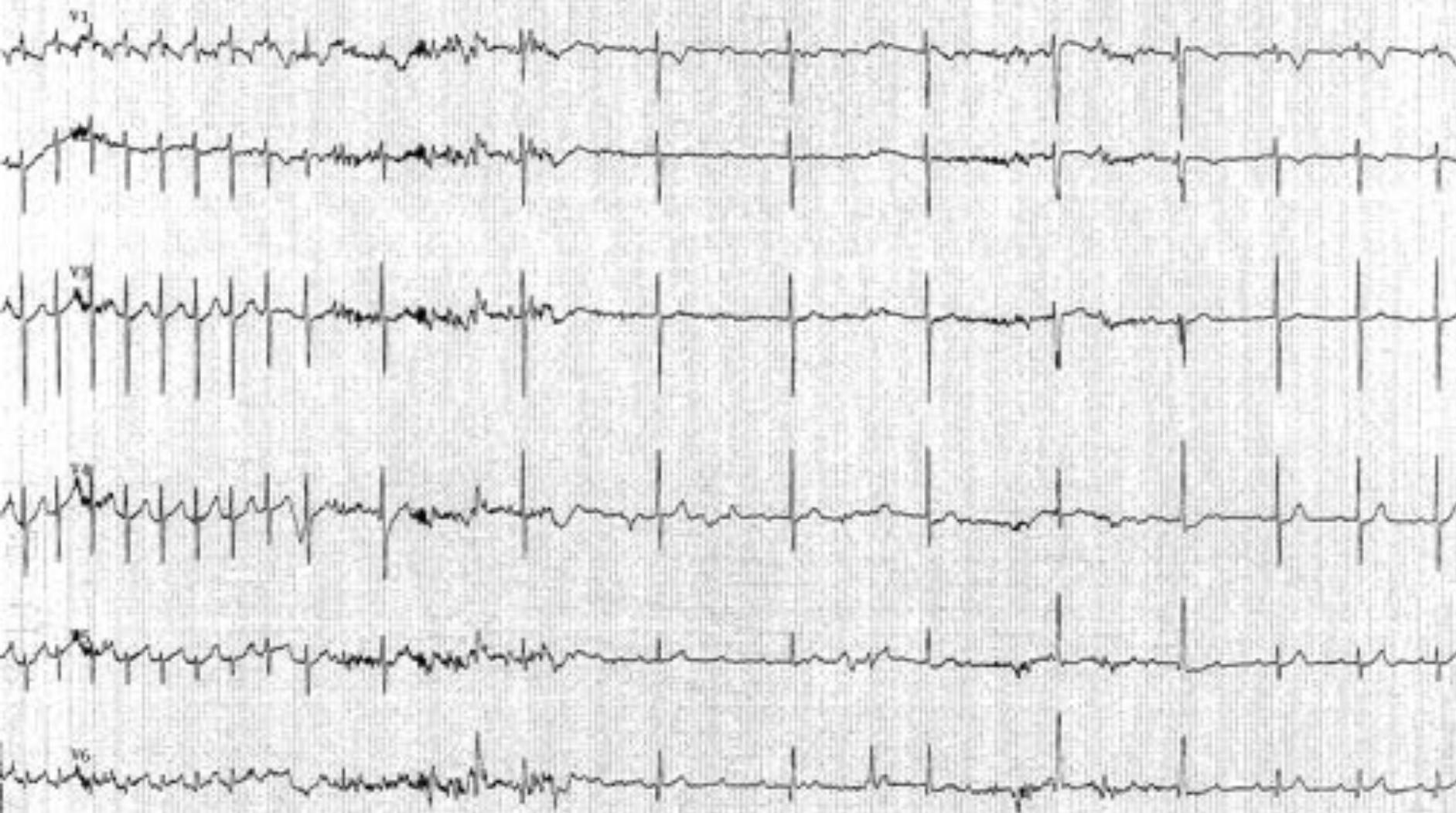
mellg

ECG-NF-DREC-11

Symptômes:

10 mm/mV 25 mm/s Filtre: R50 d 100 Hz

57 bps



L.M.

Nom:

Sexe: Homme

Date naiss.:

Age:

Médicament:

LE ANTICARDIUS

Symptômes:

CB

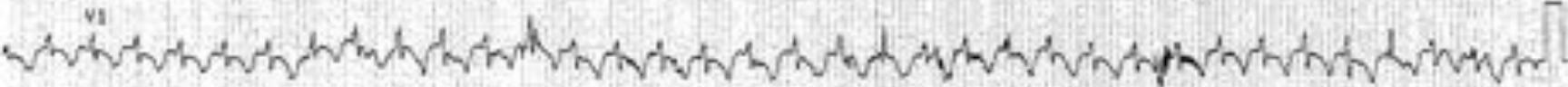
kg

mHz

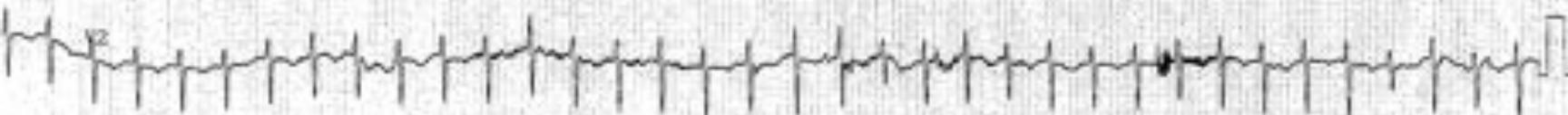
174 bpm

10 mm/mV 25 mm/s Filtre: H50 à 100 Hz

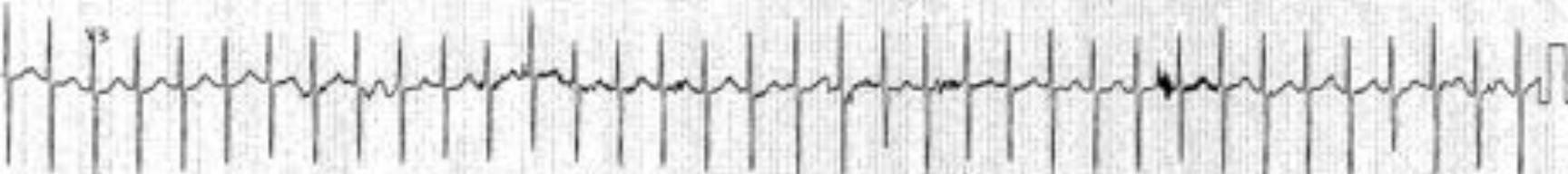
V1



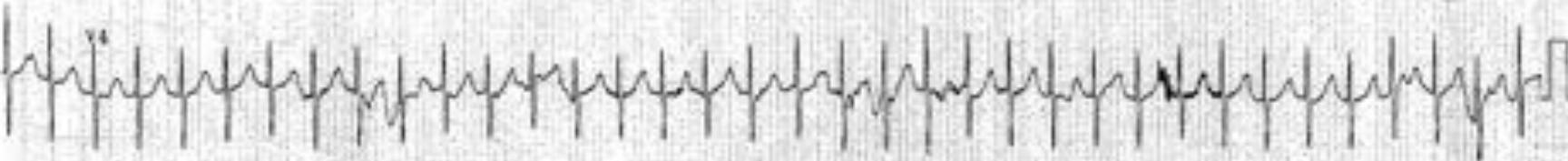
V2



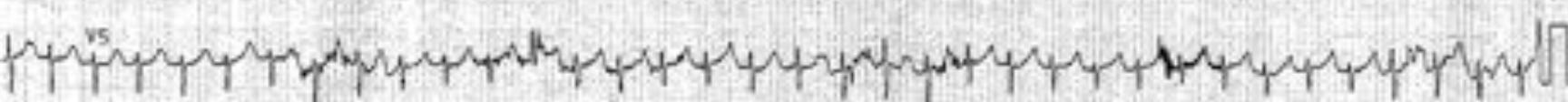
V3



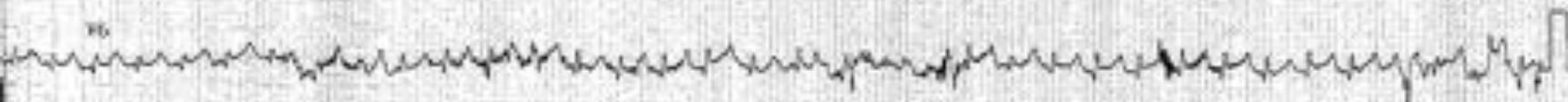
V4

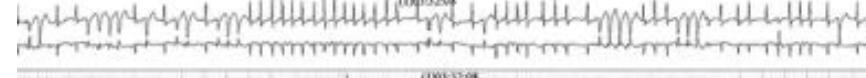
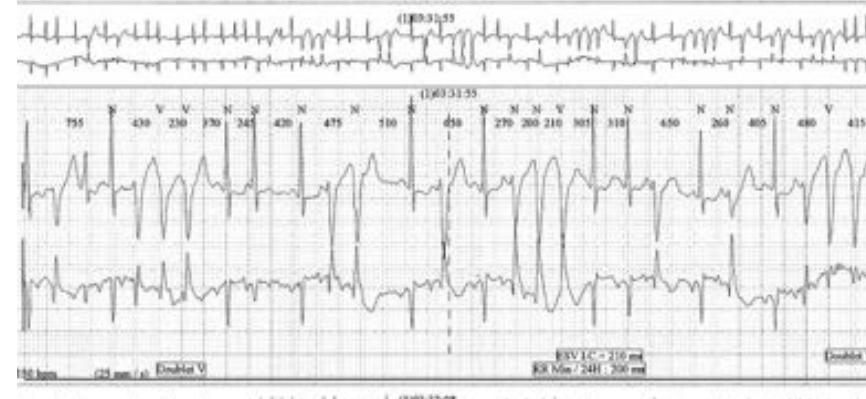
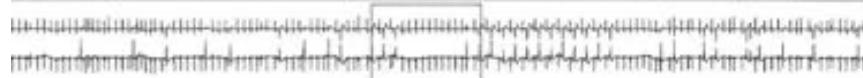
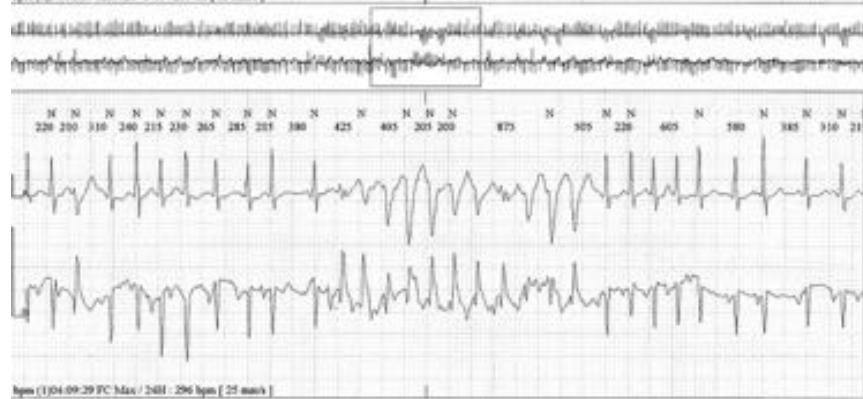
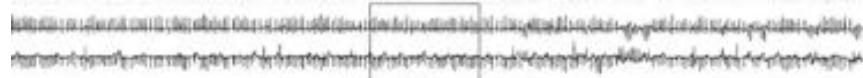


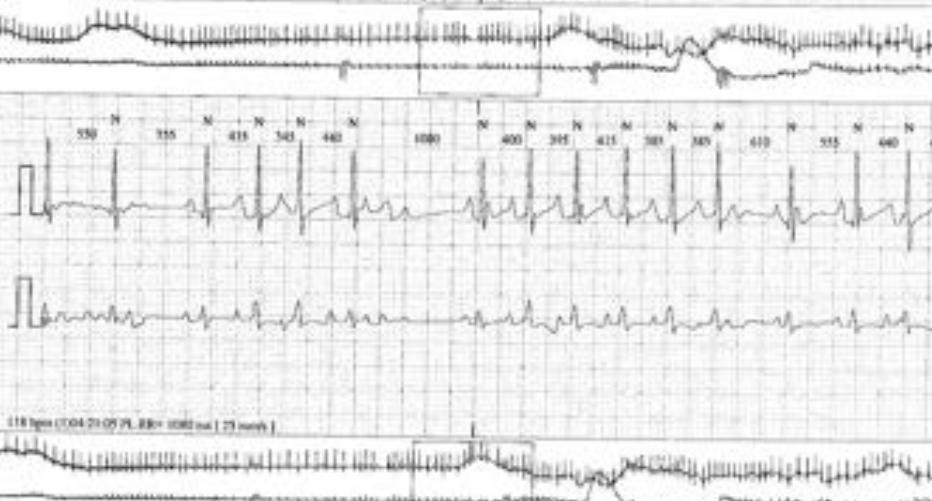
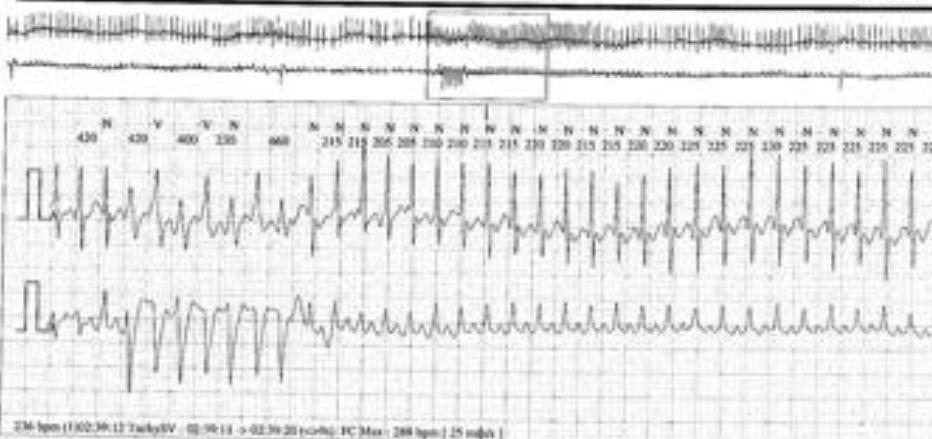
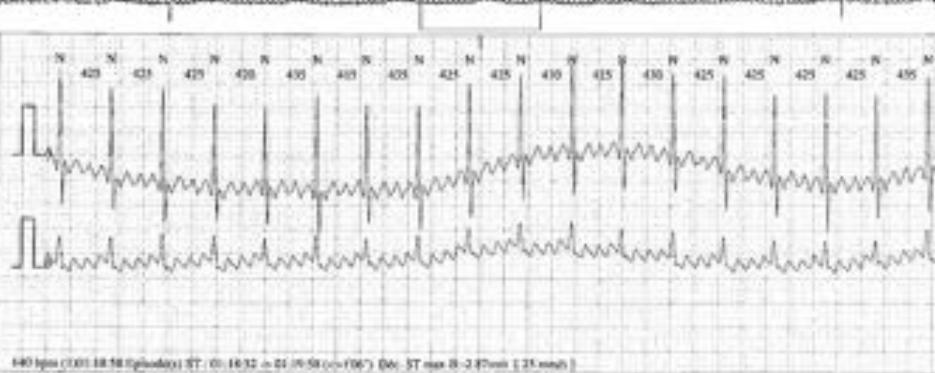
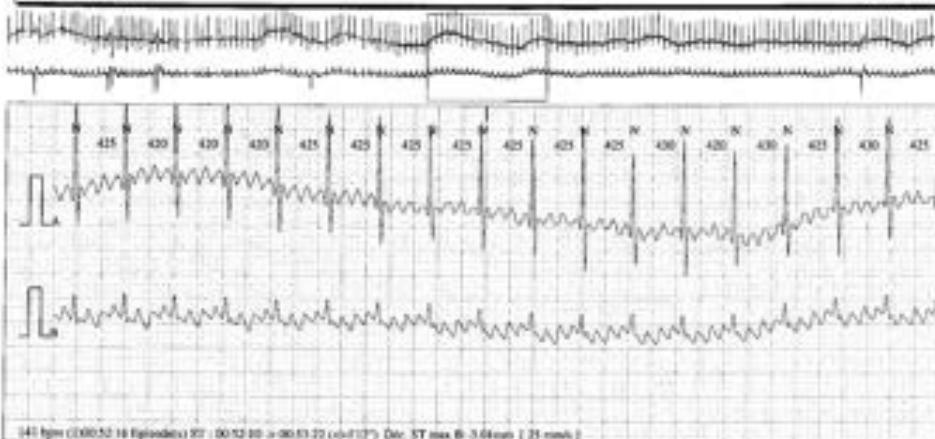
V5

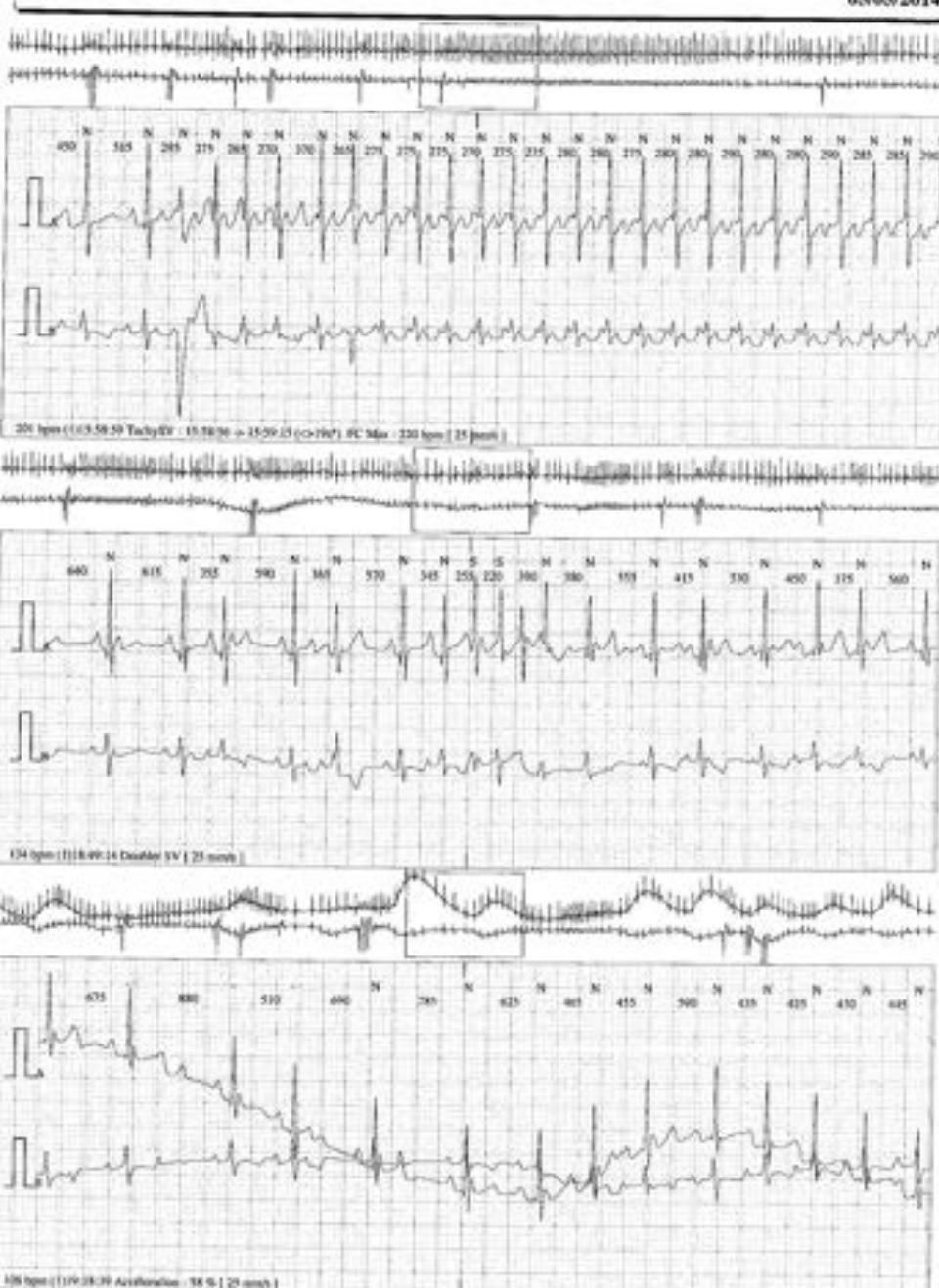


V6



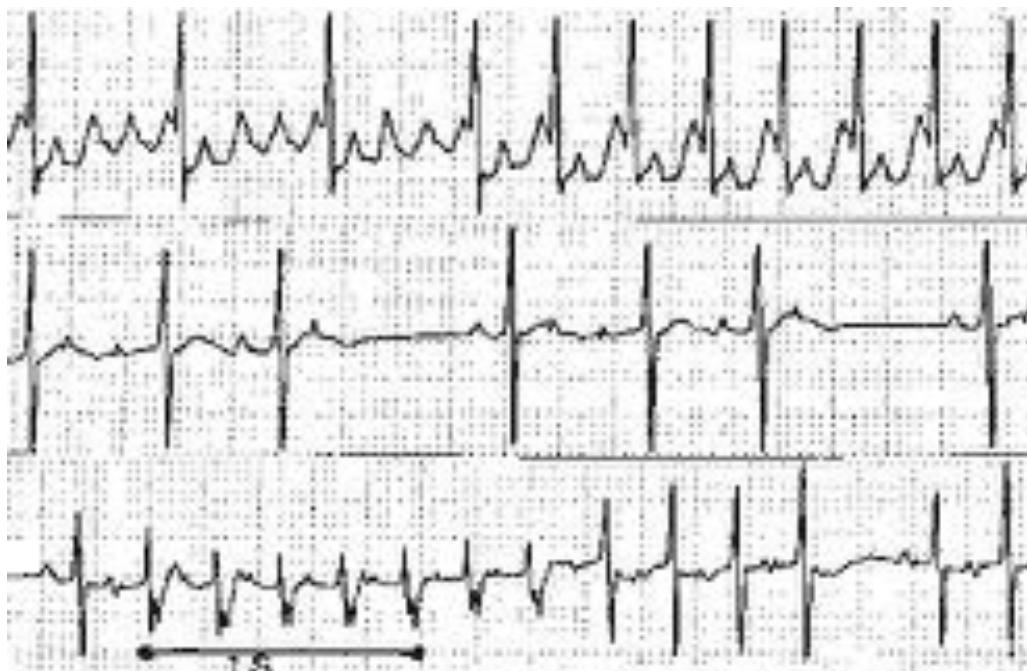








Tachycardie atriale chaotique



- coexistence d'au moins 3 types d'onde P différentes
- intervalles P-P irréguliers
- conduction auriculo-ventriculaire variable, avec rythme ventriculaire accéléré et irrégulier
- aspect de bloc de branche
- passage en FA et Flutter spontanément résolutif

23-AVR-2007 12:00:39

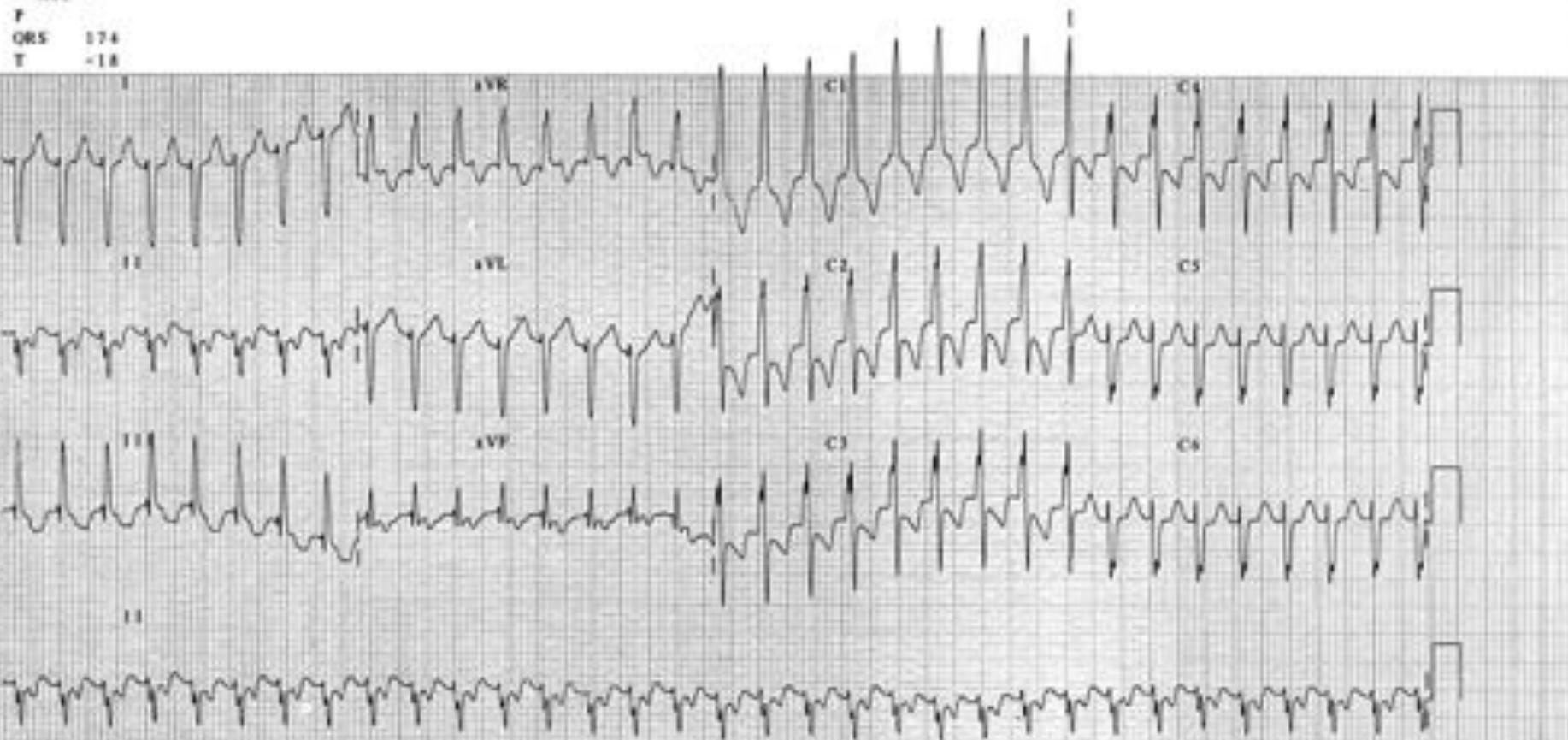
HOPITAL NECKER CARDIO PEDIATRIE

malhot Alexandre

FC 192
PR 8
QRS 96
QT 256
QTc 457

--Axes--

P 0
QRS 174
T -18



23 mm/s 10 mm/mV [F. N. 3, 15 Hz - 40 Hz] RPTF9_14268

0405

23-Avr-2007 16:26:18

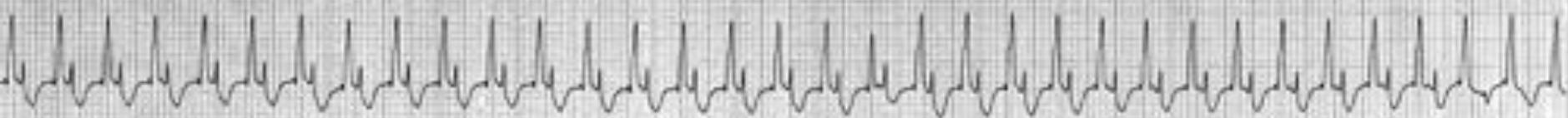
HOPITAL NECKER CARDIO PEDIATRIE

Stridule

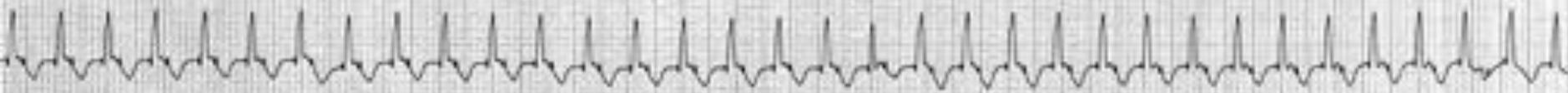
25 mm/s

10 mm/mV HC

C1 N 3.03 Hz - 43.3Hz



C2



C3



34289

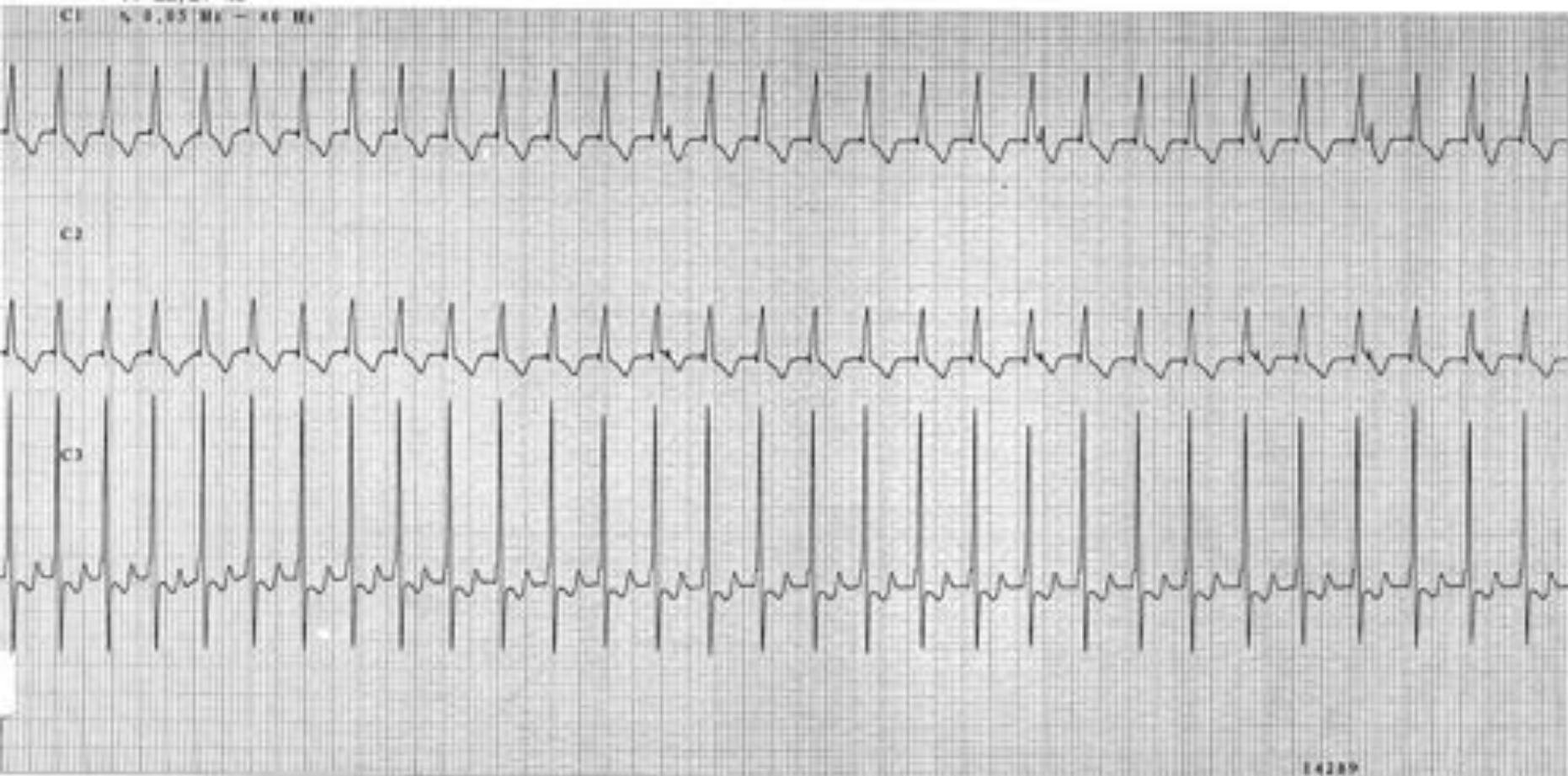
14289

23-Avr-2017 16:26:22

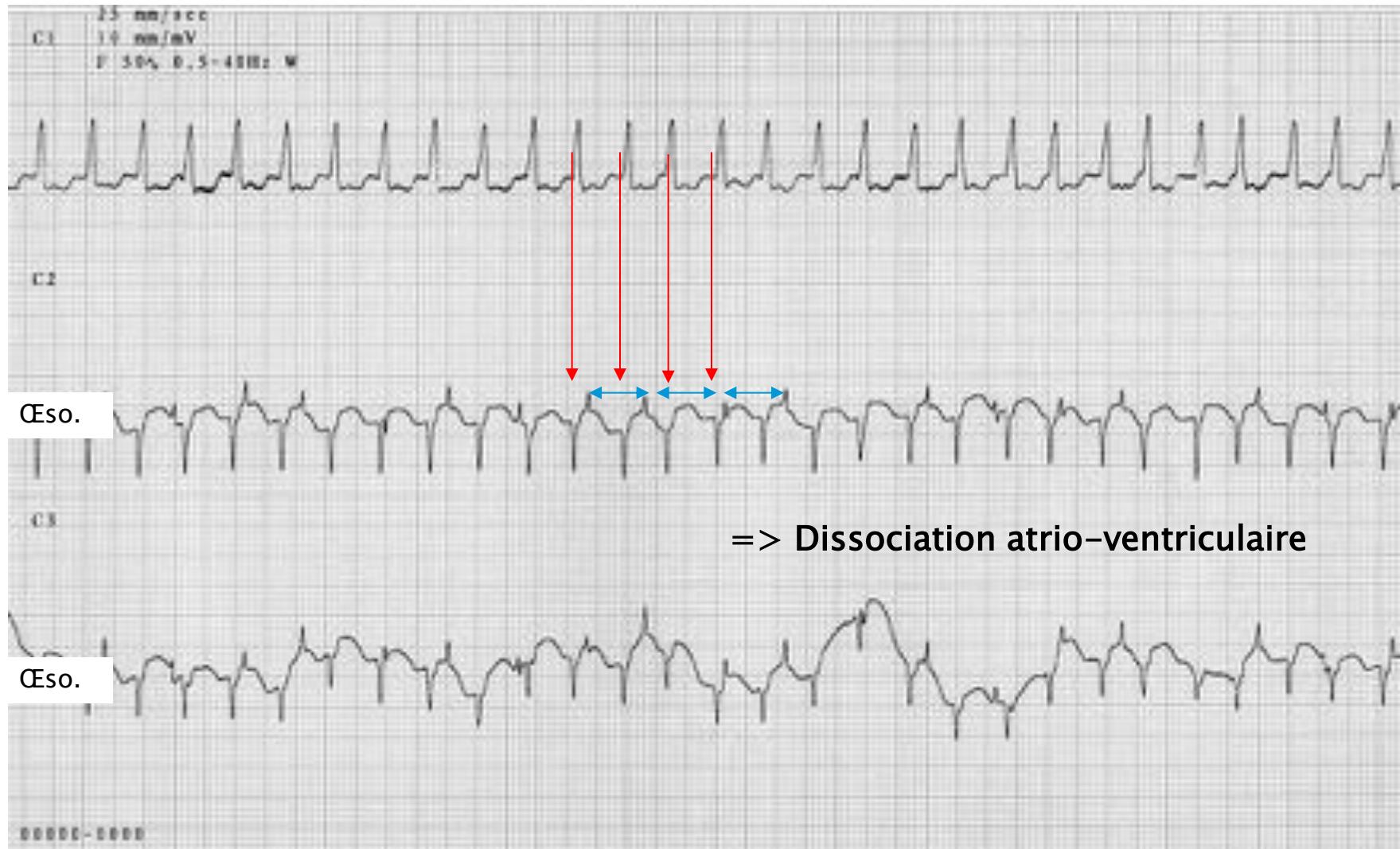
HOPITAL NECKER CARDIO PEDIATRIE

25 mm/s
10 mm/mV NC

CF N° 0,85 MW = 100 Hz



14289



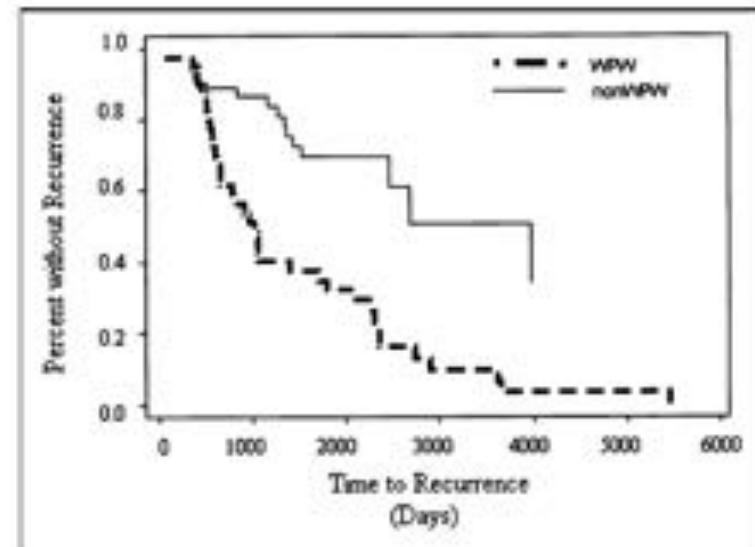
Tachycardie hissienne ou Junctionnal Ectopic Tachycardia



HISTOIRE NATURELLE DES ARYTHMIES DE LA 1^{ER} ANNÉE DE VIE

AVRT

- 90% Rémission à 12/18mois
- 30 à 60% de récurrence après 9 ans
- Facteur de risque de récurrence
 - Age du diagnostic
 - WPW: risque X 29
- « Lune de miel » plutôt que guérison



Tortoriello, et al Am J Cardiol. 2003

Lundberg et al, Pediatrics. 1982

Friedman et al, PACE. 2002

Benson et al, Circ. 1987

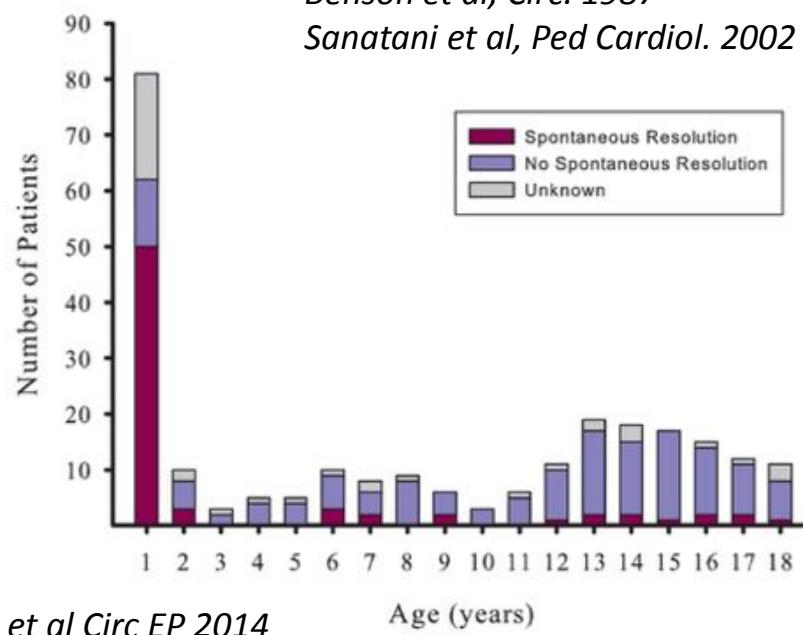
Sanatani et al, Ped Cardiol. 2002

PJRT

- 20% de régression spontanée

TAE

- 78% de régression spontanée si diagnostic avant 3 ans



Kang et al Circ EP 2014

PRISE EN CHARGE DES ARYTHMIES DE LA 1^{ER} ANNÉE DE VIE

- But du TTT: Prévention des récidives (et de la cardiomyopathie rythmique) en attente d'une régression spontanée
- AAR per-os
- Durée du traitement: 6 à 12 mois

Table 3 Suggested doses and main side effects/precautions for commonly used oral prophylactic antiarrhythmic drugs for SVT and VT in infants and children

Drug	Total daily dosage per body weight divided in x doses	Main contraindications and precautions	Features prompting lower dose or discontinuation	AV nodal slowing
Digoxine				
Propranolol	1–3 mg/kg in 3× daily	Asthma bronchiale	Bradycardia	Moderate
Atenolol	0.3–1.3 mg/kg in 1× daily	Asthma bronchiale	Bradycardia	Moderate
Verapamil	4–8 mg/kg in 3× daily	Myocardial depressant effect	Bradycardia	Marked
Flecainide	2–7 mg/kg in 2× daily	Contraindicated if creatinine clearance <50 mg/mL or reduced LVEF. Caution if conduction system disease.	QRS duration increase >25% above baseline	None
Propafenone	200–600 mg/m ² or 10–15 mg/kg in 3× daily	Contraindicated if reduced LVEF. Caution if conduction system disease and renal impairment.	QRS duration increase >25% above baseline	Slight
Sotalol	2–8 mg/kg in 2× daily	Contraindicated if significant LV hypertrophy, systolic HF, pre-existing QT prolongation, hypokalaemia, creatinine clearance <50 mg/mL and asthma bronchiale. Moderate renal dysfunction requires careful adaptation of dose	QT interval >500 ms	Similar to high-dose beta-blockers
Amiodarone	Loading: 10 mg/kg for 10 days. Maintenance: 5 mg/kg in 1× daily	Caution when using concomitant therapy with QT-prolonging drugs, HF. Dose of vitamin K antagonists and of digoxin/digoxin should be reduced.	QT interval >500 ms	Slight

LVEF, left ventricular ejection fraction; HF, heart failure.

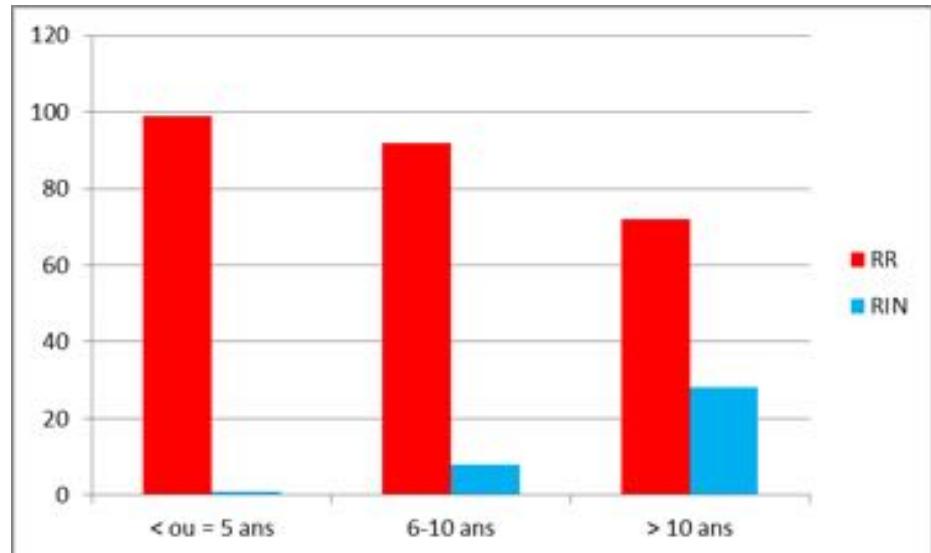
Arythmies de l'enfant

APRÈS 5 ANS

Arythmie après 5 ans

- L'enfant, après 5 ans, décrit des « palpitations »
- ECG inter-critique
 - Pré excitation ou non
- Persistance ou récurrence de TSV néonatale
- Premier épisode
- ECG per-critique +++

*Kugler and Danford, Pediatrics. 1996
Deal et al, JACC. 1995
Joung et al, Circ J. 1997*



TRACÉ PERCRITIQUE

Rapport : Lecture réalisée sous réserve de la clinique

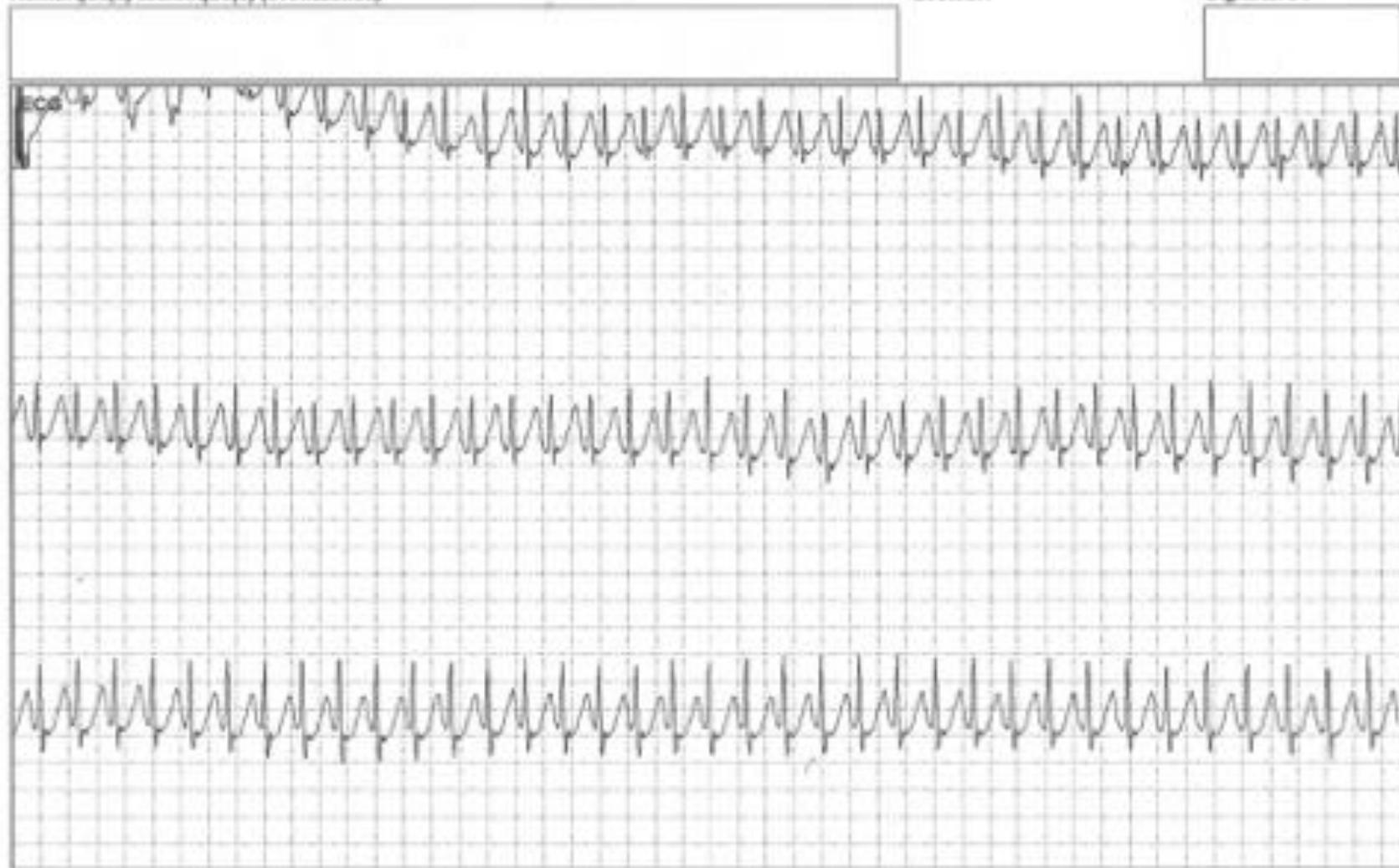
Page: 1 of 2
Event: 1/1

Nom Médecin	Code Médecin	First, Middle, Last Name	Sexe	Age
MALTRETT ALICE	MD0178	LETSYR01042009F LETSYR01042009F	Female	41

Remarque(s) technique(s) (éventuelles)

Lecteur:

Signature :



Résolution: 25mV/sec - 10mm/m

Appel: Moniteur: H1001 CardoMemo

Enregistrement:

Cardio

Reçu le:

14/01/2014 20:21:24

Imprimé: 14/01/2014

[mm] 0 10 20 30 40

[sec] 0 1

[mV] 0 1 2 3 4

ECG inversé.

Patient:
Enregistré:
Fréquence cardiaque:

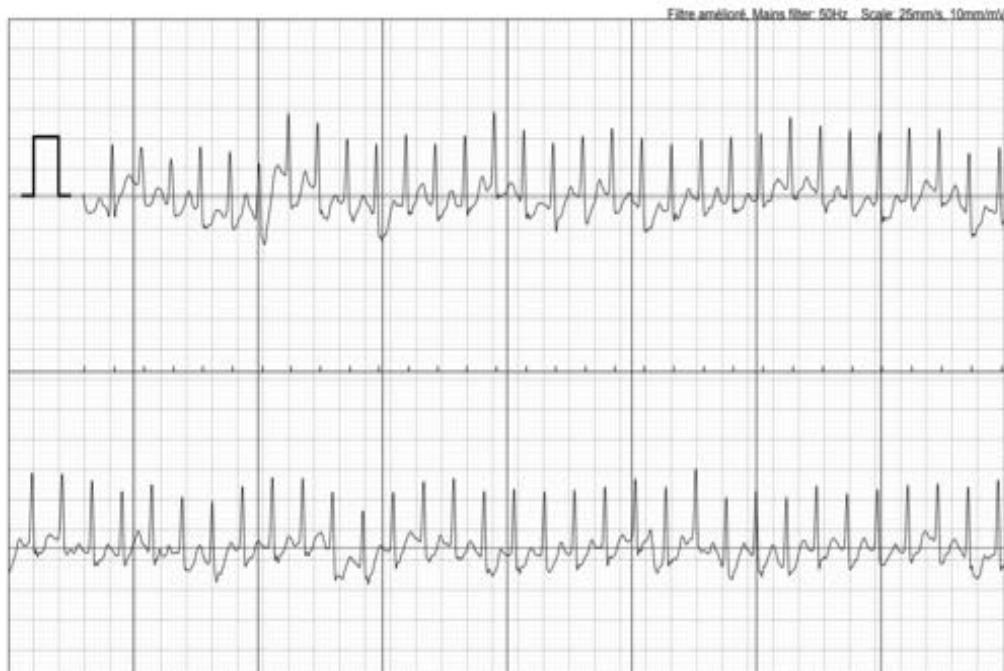
dimanche 4 février 2018 à 16:29:05
227 bpm

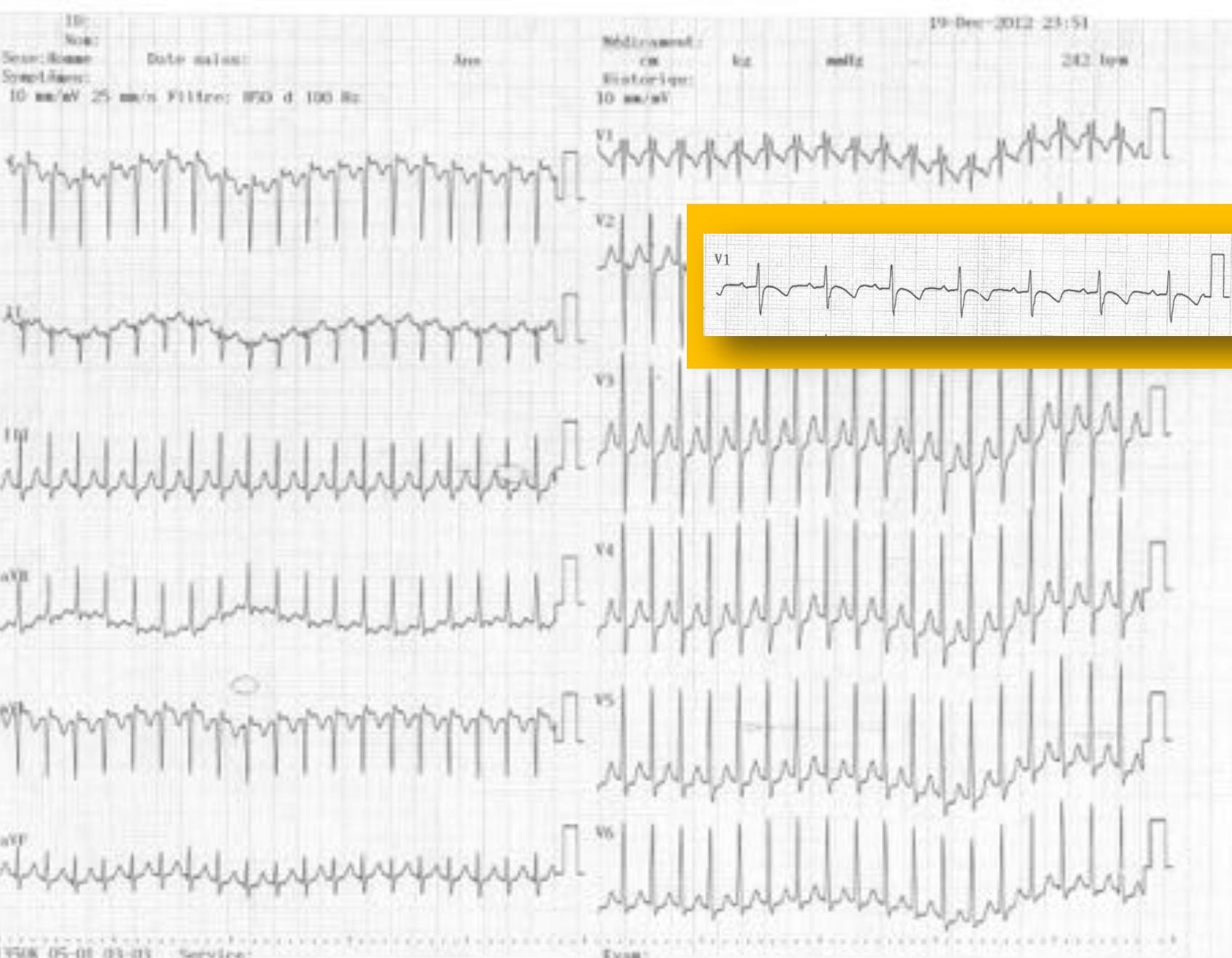
Durée: 1min

Notes:
Finding by
Kardia:

this announ...
Possible atrial
fibrillation

Kardia





13508 05-01-09-09 Service:

Exam:

BORNHOFEN

Warm UP

Copie d'écran

27/11/2017



BORNHOFEN

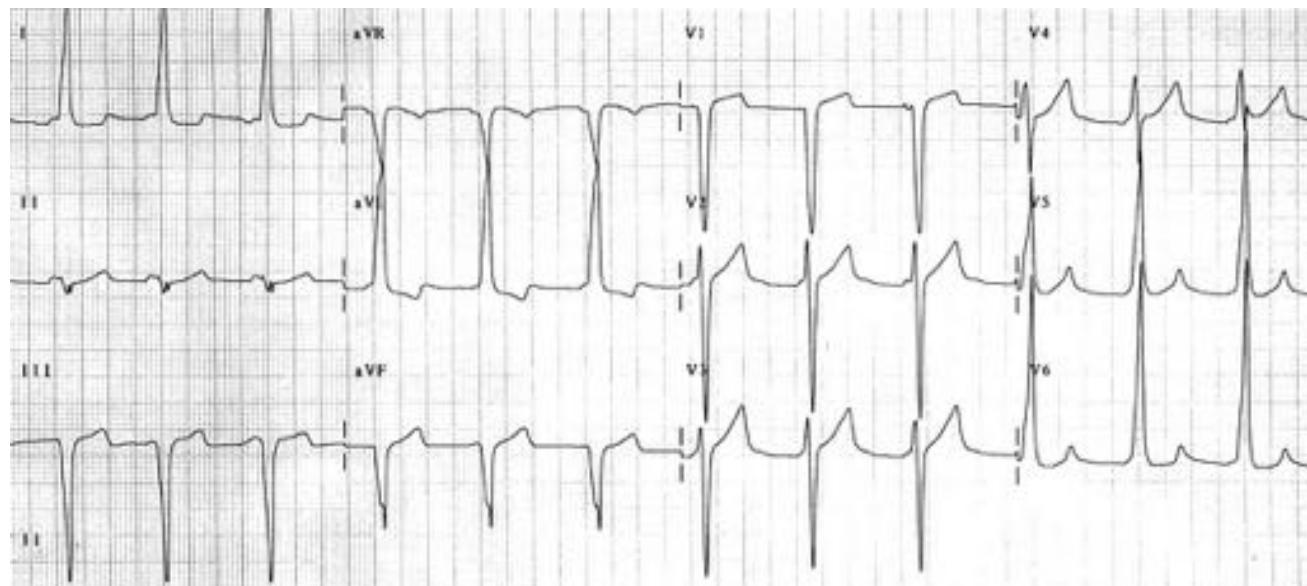
cool Down

Copie d'écran

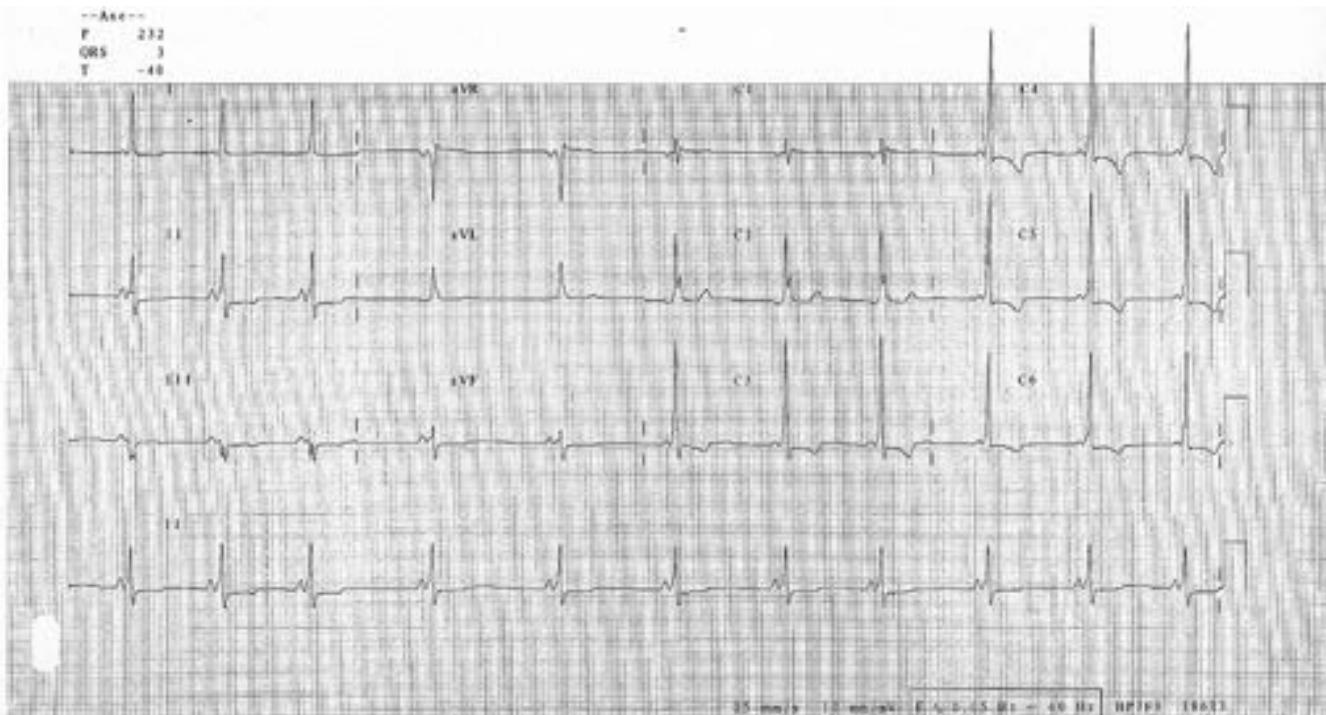
27/11/2017



TRACE INTERCRITIQUE



--Axe--
P = 232
QRS = 3
T = -48



WPW DE L'ENFANT

Prevalence

- 0.1 to 0.3% in adult population
- 0.07% of children under 13 years old (???)
- **Most adolescents (65%) with a WPW pattern on a resting ECG are asymptomatic**

Obeyesekere et al, Circ. 2012: 2308

Sano et al, Heart 1998: 374

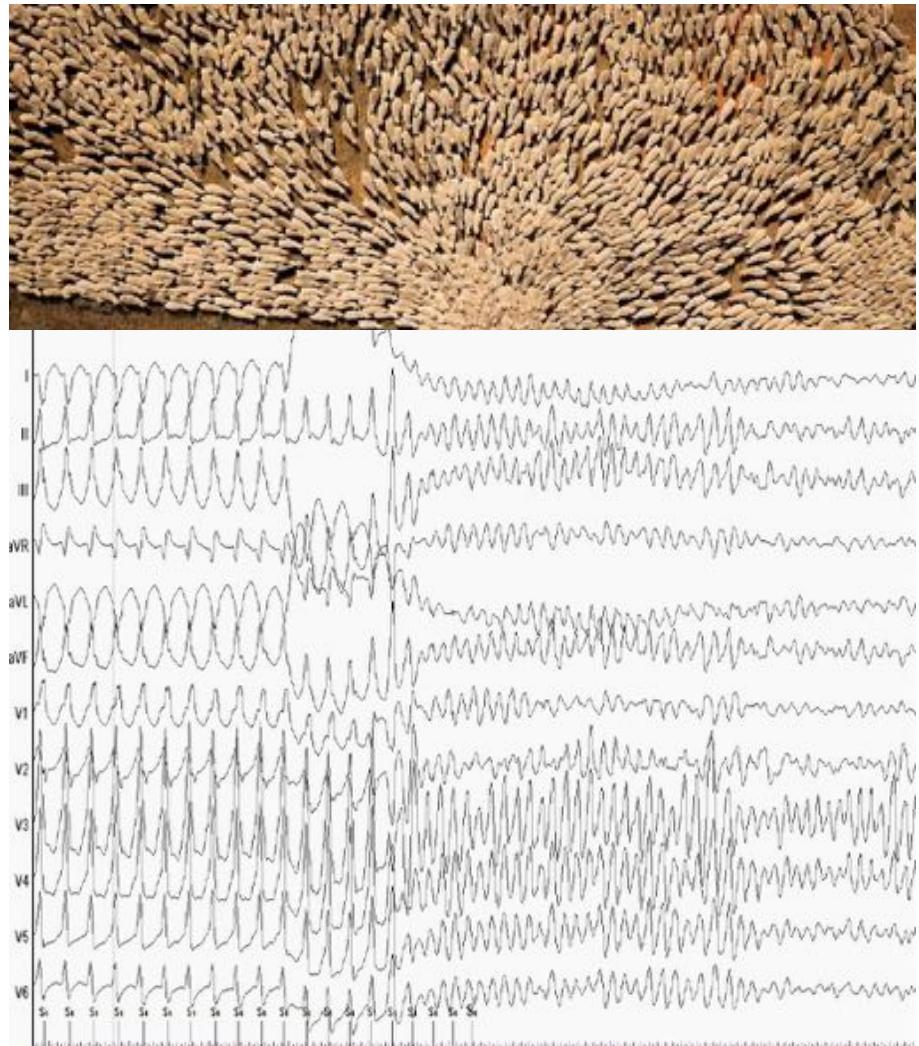
Pappone Card Electrophysiol Clin. 2015: 371

Natural history

- Symptomatic => Asymptomatic
- Regression of the anterograde conduction
 - normal ECG
- Asymptomatic => Symptomatic
 - 70% remain asympto
 - 30% become sympto
 - AVRT (2/3)
 - Life-threatening arrhythmia (1/3)
- **Sudden Cardiac Death can be the first symptom**

Arhythmias and WPW

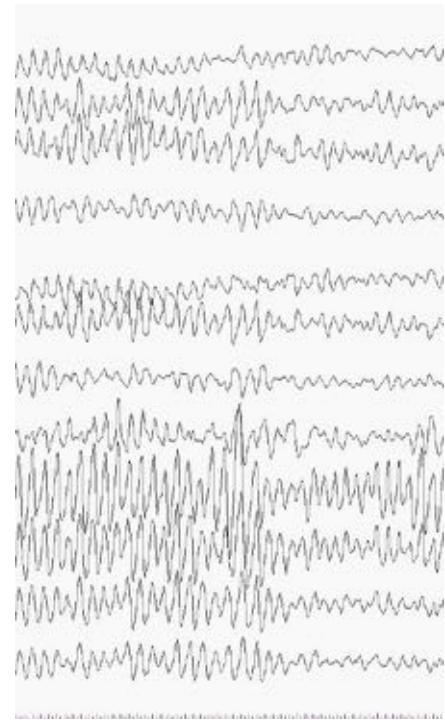
- AVRT



SCD and WPW

- 1.93 (95% CI, 0.57-4.41) for 1000 person-years of FU
 - 0.86 in adult, risk decrease after 30 years old
- **Rapid conduction of AF to the ventricle through the AP leading to VF**
- Depend on
 - Atrial fibrillation occurrence
 - Rare in children with a normal heart, even rarer before 10 years old
 - Intrinsic electrophysiologic properties of the AP

Obeyesekere et al, Circ. 2012: 2308



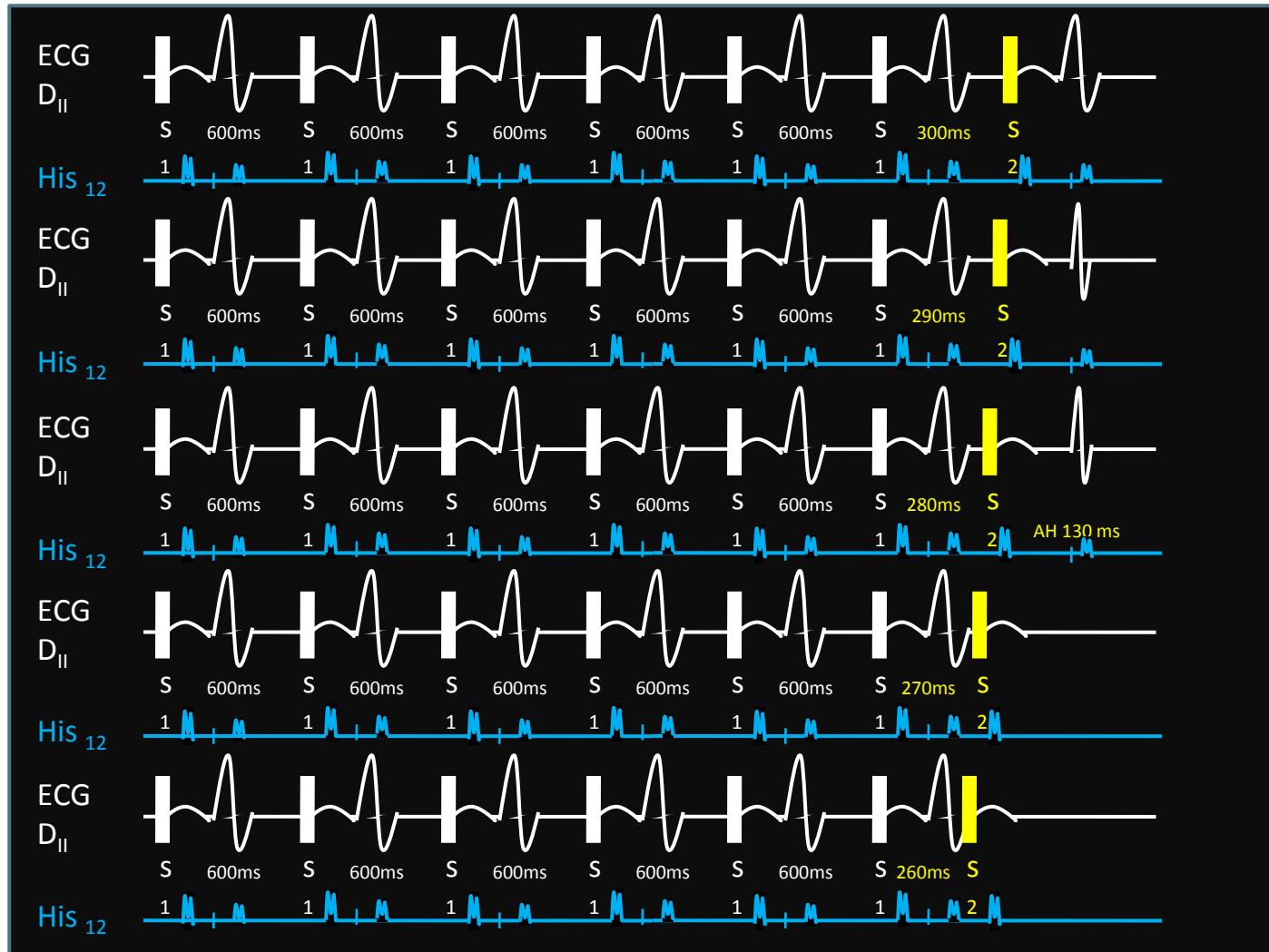
Risk stratification of SCD/WPW

- Non invasive risk factors
 - Age
 - Symptom
 - Intermittent preexcitation
 - Treadmill test
 - CHD/Multiple AP
 - AP location
- (Esophageal stimulation)
- Invasive risk factors/Electro-Physiologic Testing
 - Inducibility
 - Refractory period of the AP

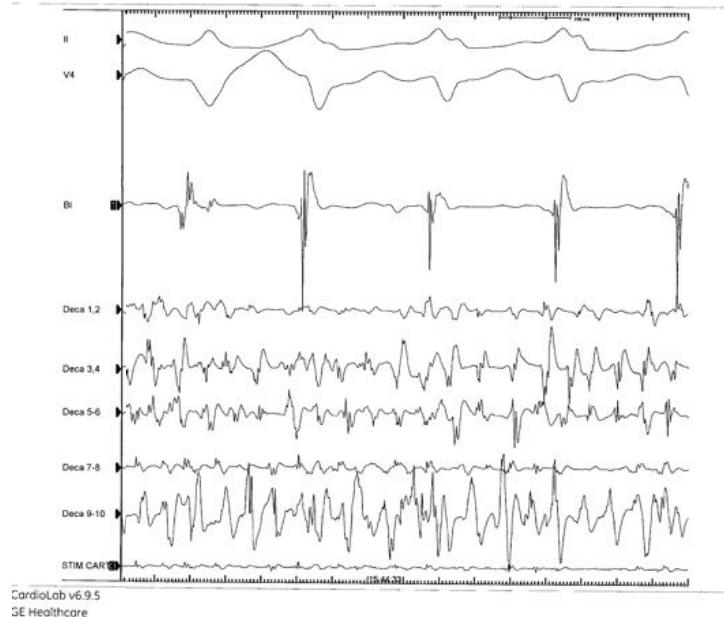
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Pappone et al, Circ. 2014: 811
Santinelli et al, JACC. 2009: 275
Kiger et al, PACE. 2016: 14
Pappone et al, JACC. 2003: 239

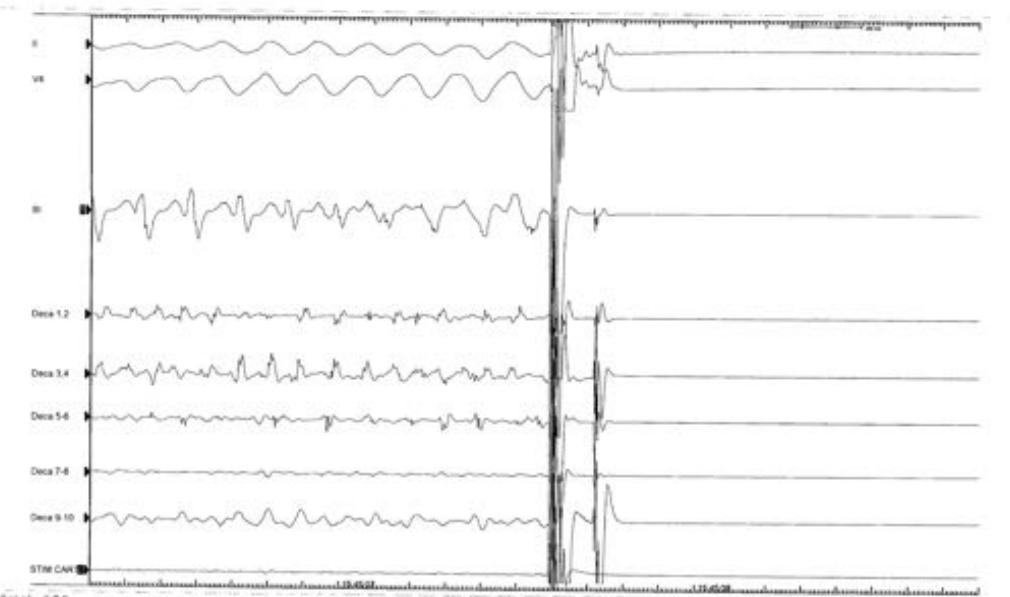


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Cliché Consultation 1



CardioLab v6.9.5
SE Healthcare

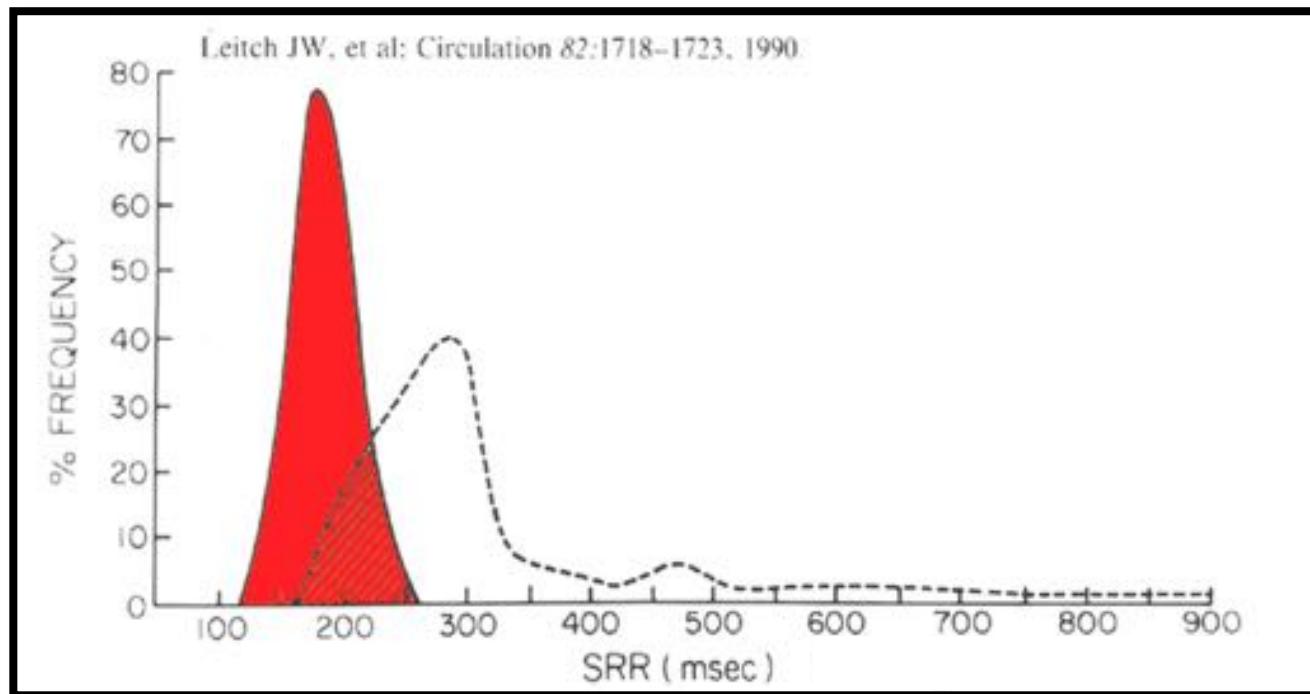
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Cliché Consultation 1: Page 3



CardioLab v6.9.5
SE Healthcare

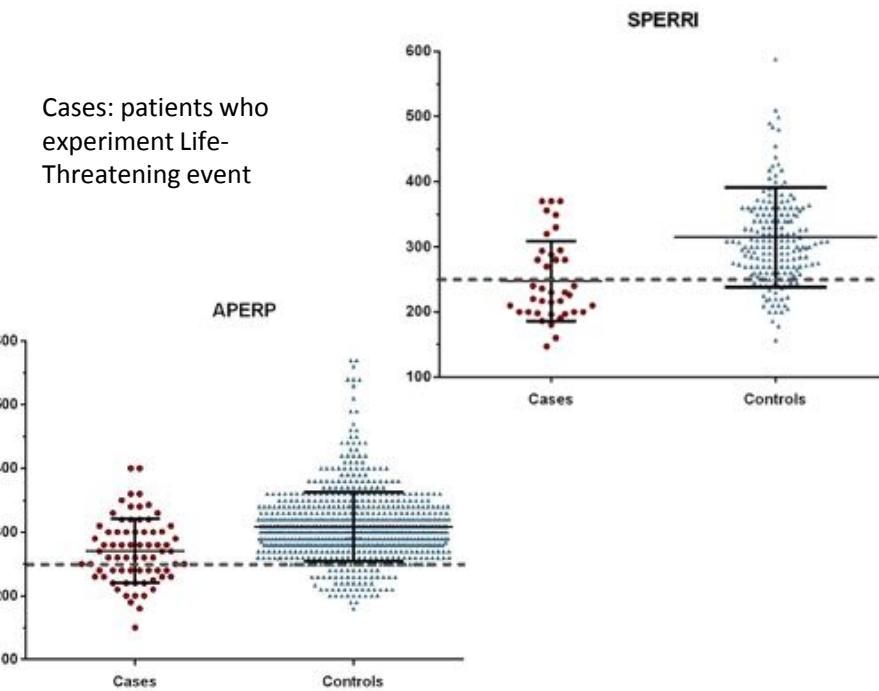
High-Risk Criteria/EPT

- SPERRI: Shortest preexcited RR interval during atrial fibrillation $\leq 250\text{ms}$



- AP effective refractory period (APERP):
 - $\leq 250\text{ms}$ baseline
 - $\leq 200\text{ms}$ after Isoproterenol
- Shortest paced cycle length with preexcitation during atrial pacing (SPPCL)

Life-Threatening Event Risk in Children With Wolff-Parkinson-White Syndrome



Isoproterenol Administration During General Anesthesia for the Evaluation of Children With Ventricular Preexcitation

Jeremy P. Moore, MD; Prince J. Kannankeril, MD, MSci; Frank A. Fish, MD

Circ Arrhythm Electrophysiol February 2011

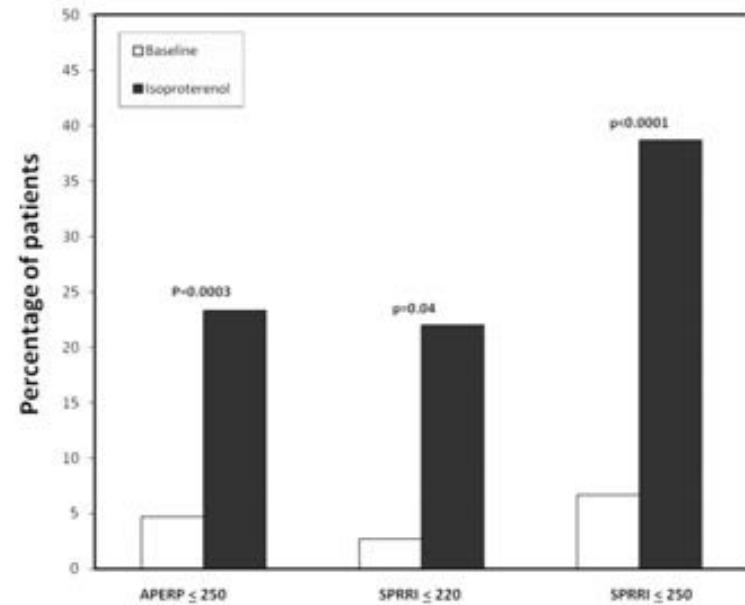


Figure 3. Percentage of patients meeting traditional high-risk criteria at baseline and after the addition of isoproterenol.

Management of WPW in 2018

- Age
- Associated CHD
- Symptom
- AP location
- Family chose

Management of WPW in 2018

- Age
- Associated CHD
- Symptom
- AP location
- Family chose
- Operator experience

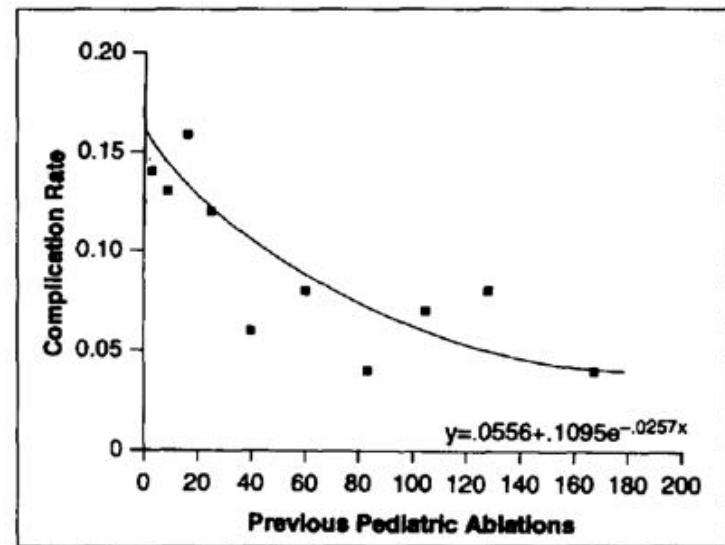
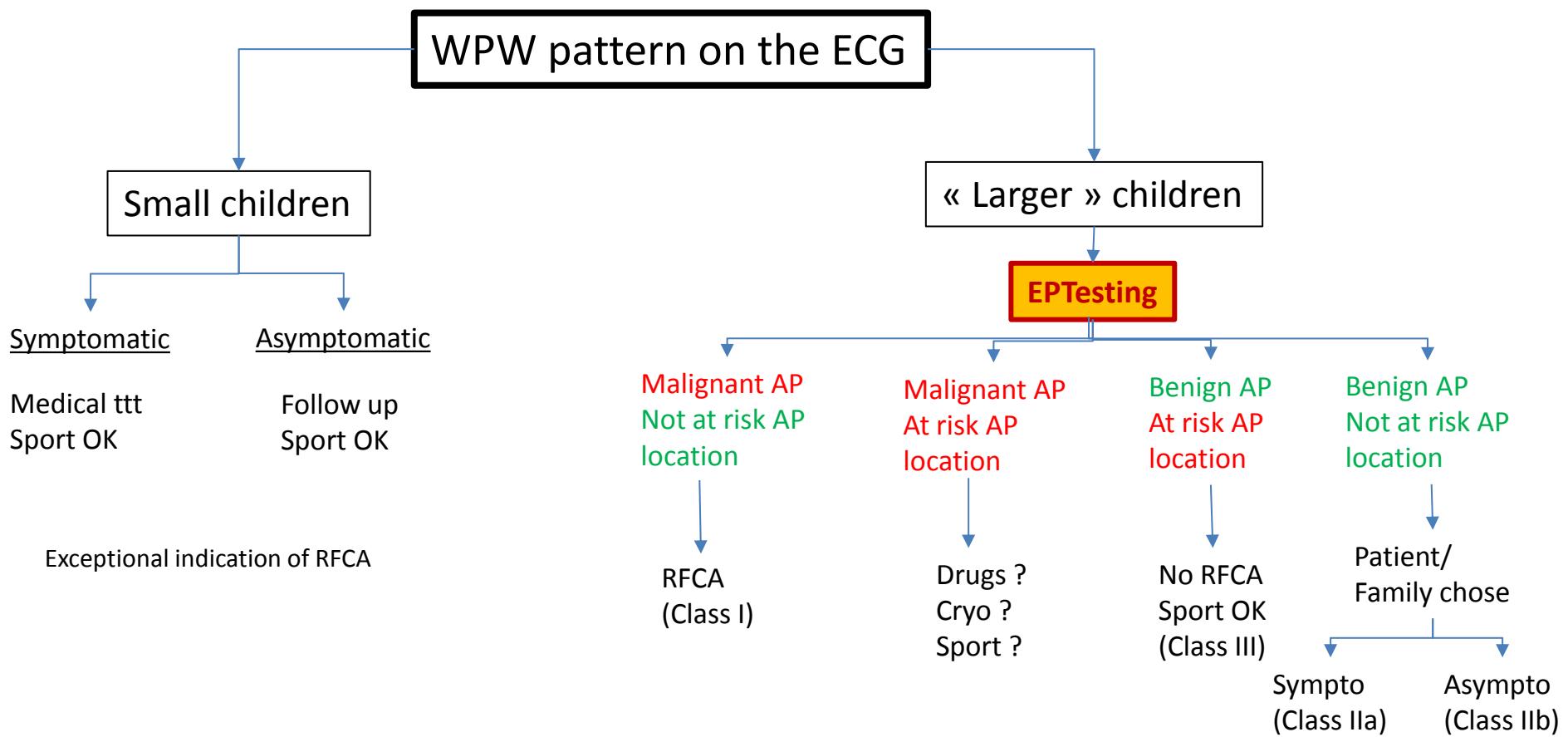


FIGURE 2. The procedural complication rate is shown as a function of number of prior pediatric ablation procedures for the entire sample. Other features as described for Figure 1A.

Danford et al. AJM 1995



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Table 3. Comparison of Clinical and Electrophysiologic Characteristics of the 162 Asymptomatic WPW Subjects Grouped According to the Occurrence of Arrhythmic Events

	Arrhythmic Events		p Value
	No (n = 129)	Yes (n = 33)	
Age (yrs)	37.1 (13.4)	20.1 (8.6)	< 0.0001*
Males, n (%)	81 (62.8)	24 (72.7)	NS†
Multiple APs, n (%)	1 (0.8)	16 (48.5)	< 0.0001‡
AERP of AP, ms (baseline)	283.6 (29.9)	246.6 (27.5)	< 0.0001*
AERP of AP, ms (follow-up)	337.7 (47.5)	249.1 (32.6)	< 0.0001*
AERP of AP after Is, ms (baseline)	224.9 (28.6)	203.1 (12.6)	< 0.0001*
AERP of AP after Is, ms (follow-up)	237.0 (38.7)	203.0 (14.0)	< 0.0001*

Pappone et al, Circ. 2014: 811

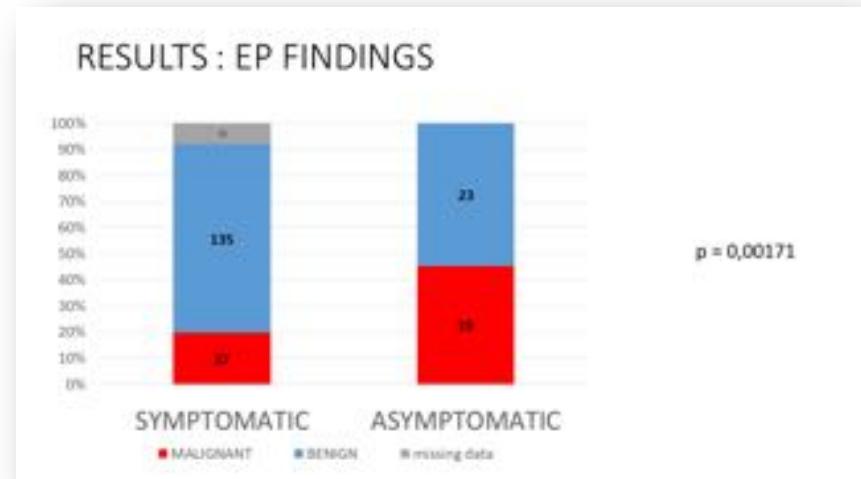
Santinelli et al, JACC. 2009: 275

Kiger et al, PACE. 2016: 14

Pappone et al, JACC. 2003: 239

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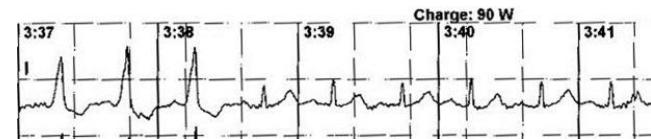
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Spar et al, 2012: 1011

*Pappone et al, Circ. 2014: 811
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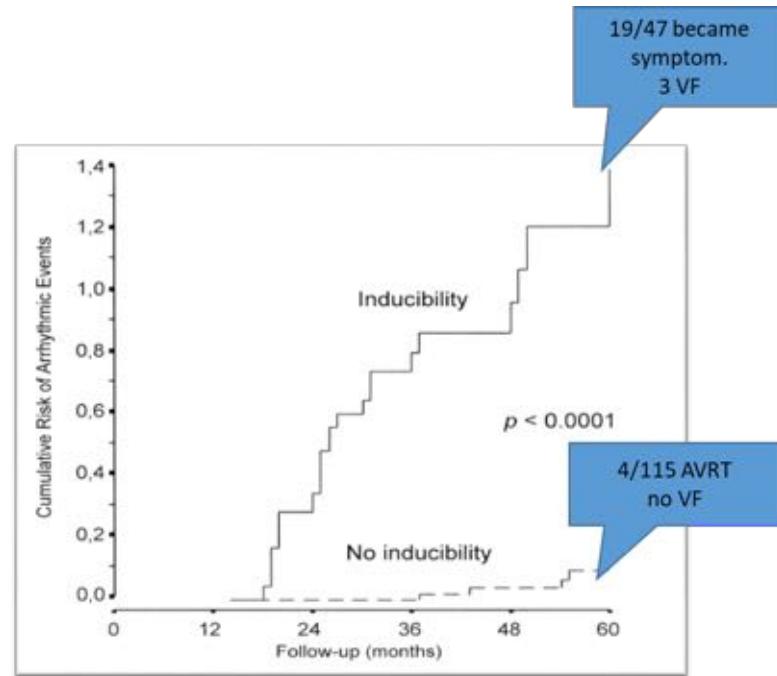
Santinelli et al, JACC. 2009: 275

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Management of WPW in 2018

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
WPW syndrome and recurrent and/or symptomatic SVT and age >5 years	Catheter ablation Flecainide, propafenone Sotalol Amiodarone	I I I IIb	C
WPW syndrome and recurrent and/or symptomatic SVT and age <5 years	Flecainide, propafenone Sotalol Catheter ablation Amiodarone	I Ila IIb IIb	C
WPW syndrome and palpitations with inducible sustained SVT during EP test, age >5 years	Catheter ablation Flecainide, propafenone Sotalol Amiodarone	I I I IIb	C
Asymptomatic preexcitation, age >5 years, no recognized tachycardia, risks and benefits of procedure and arrhythmia clearly explained	Catheter ablation	IIb	C
Asymptomatic preexcitation, age <5 years	Any AA drug Catheter ablation Any AA drug	III III III	C

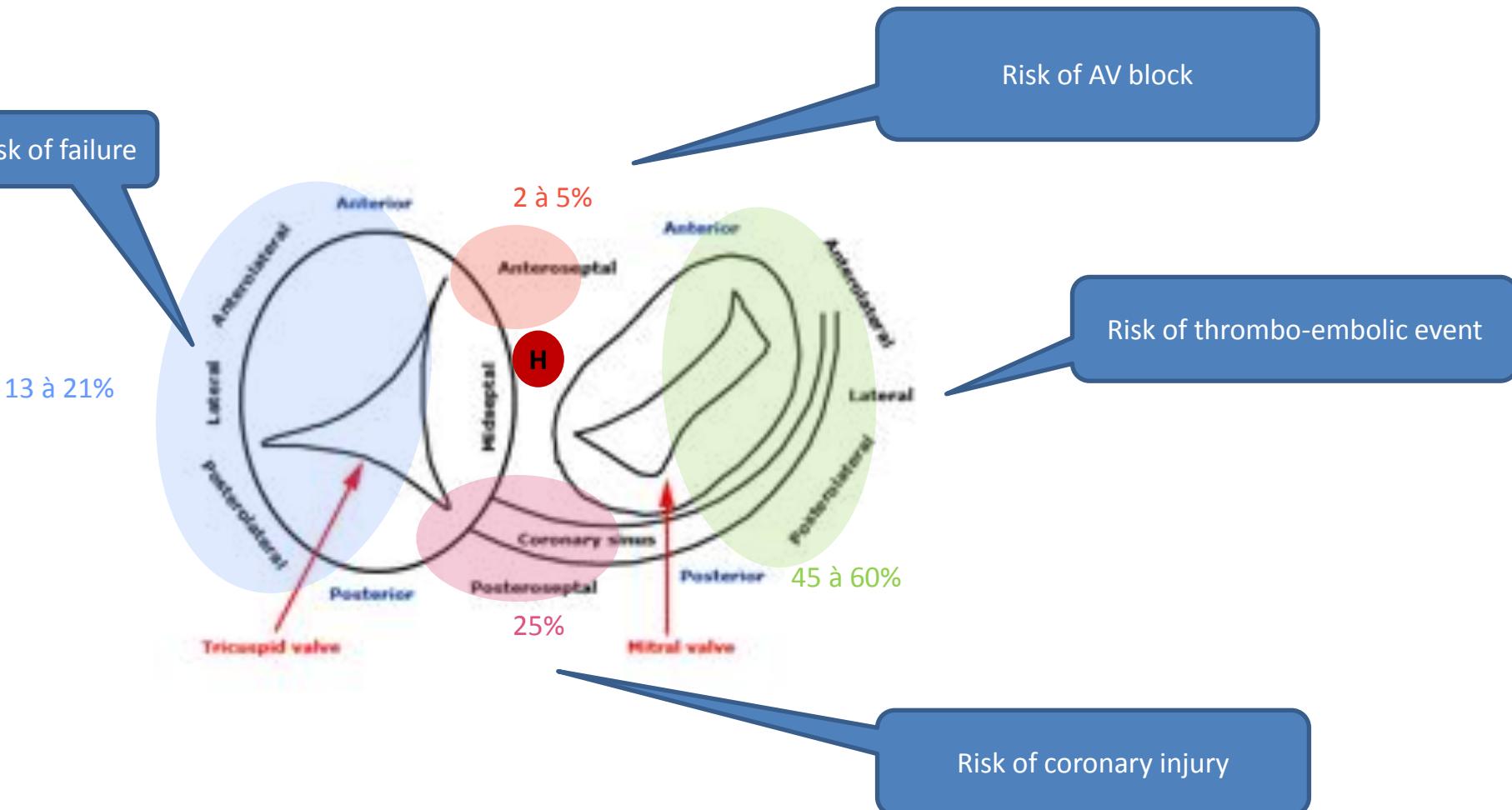
Brugada et al, Europace 2013

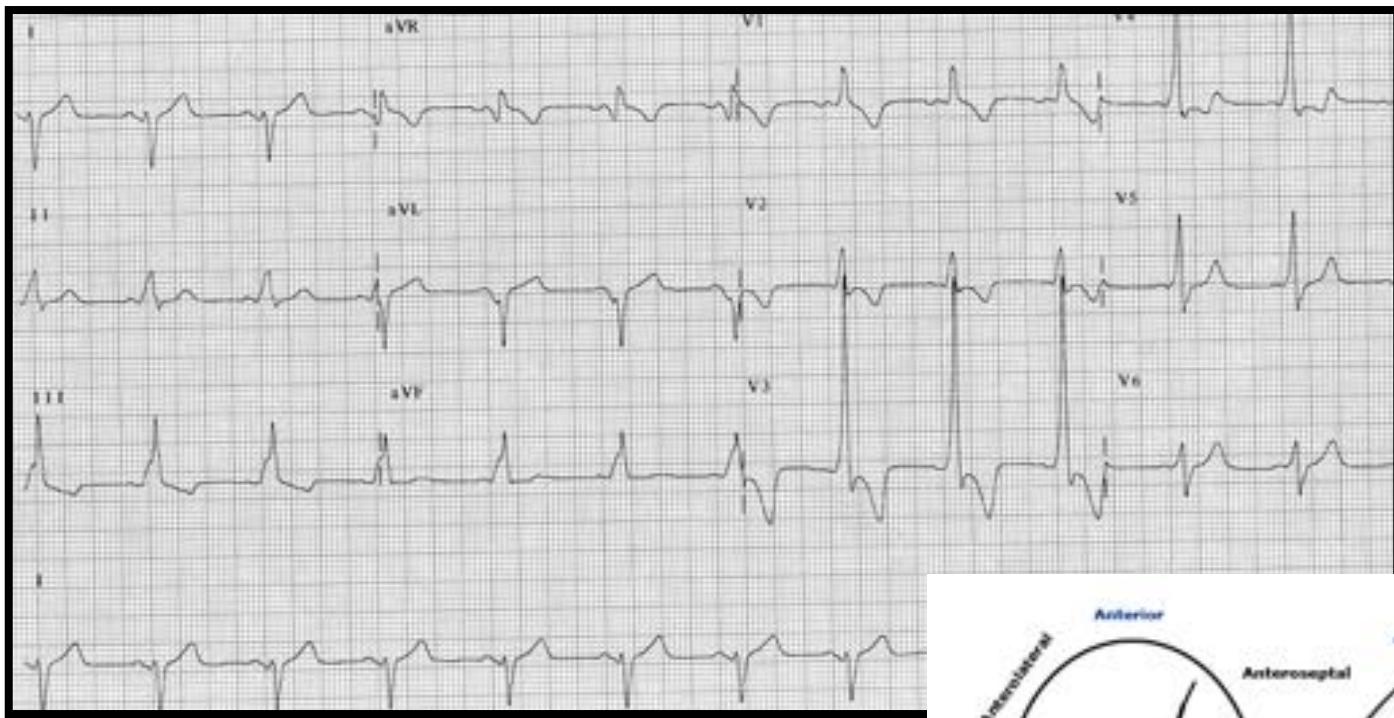
Catheter ablation of AP in children

- Success rate: 95%
- 5 to 10% of recurrence
- Complication rate << 1%
 - Age
 - AP location

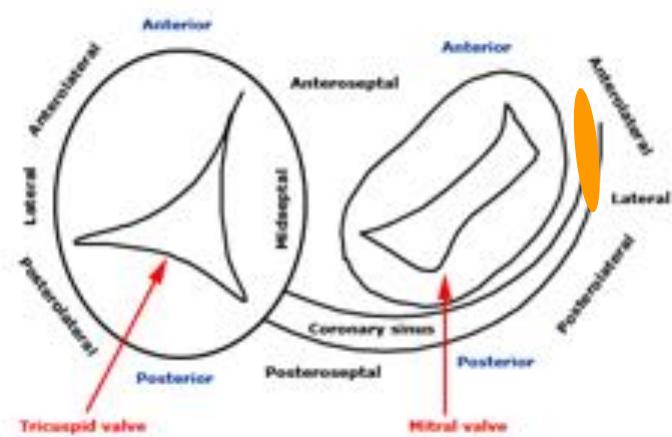
Pathway/Mechanism	Complications/Attempts		
	All Ages	< 5 Years	5–21 Years
Left free wall	32/1,074 (3%)	5/58 (9%)	27/1,016 (3%)
Right free wall	8/410 (2%)	3/32 (9%)	5/378 (1%)
Anterior septal	15/322 (5%)	3/29 (10%)	12/293 (4%)
Posterior septal	9/431 (2%)	3/49 (6%)	6/382 (2%)
Total	100/3,407 (3%)	18/205 (9%)	82/3,202 (3%)

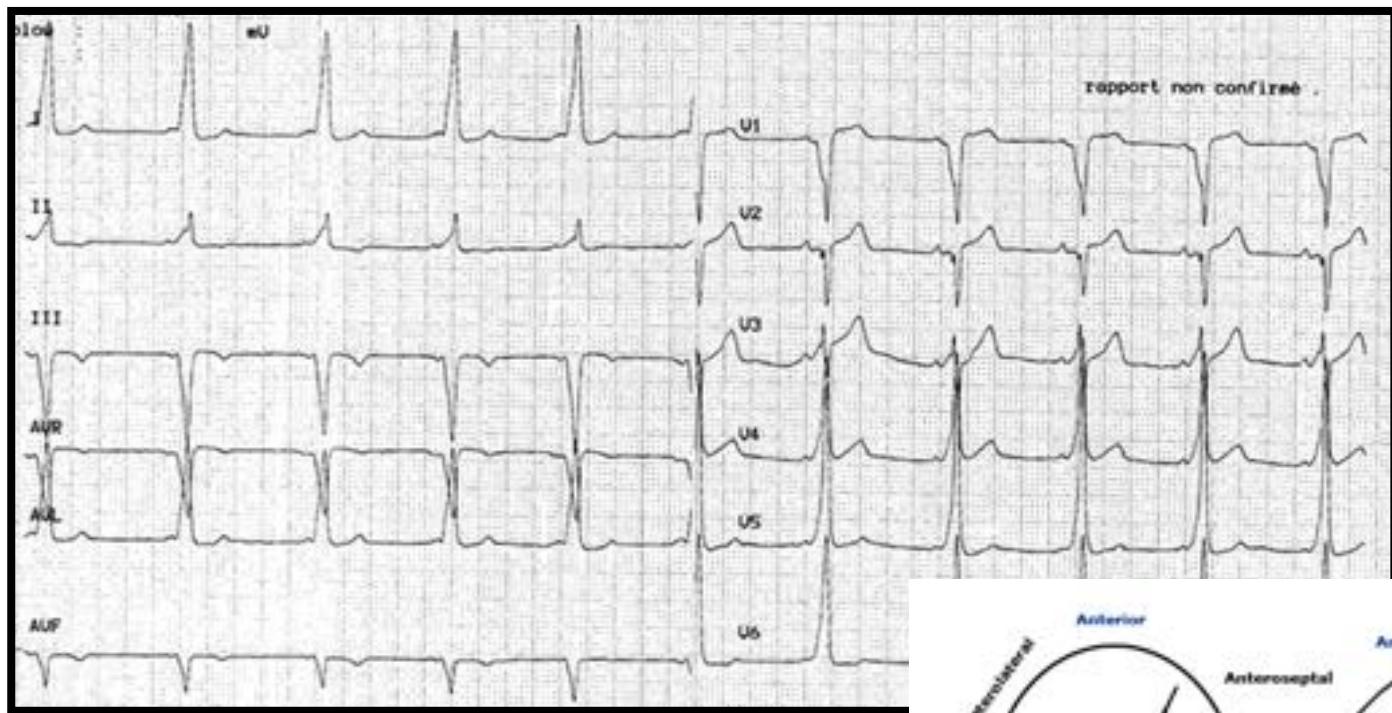
Kugler et al, JCE 2002: 336



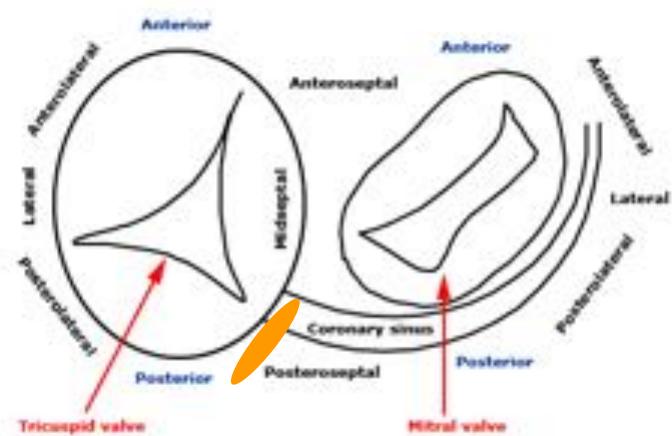


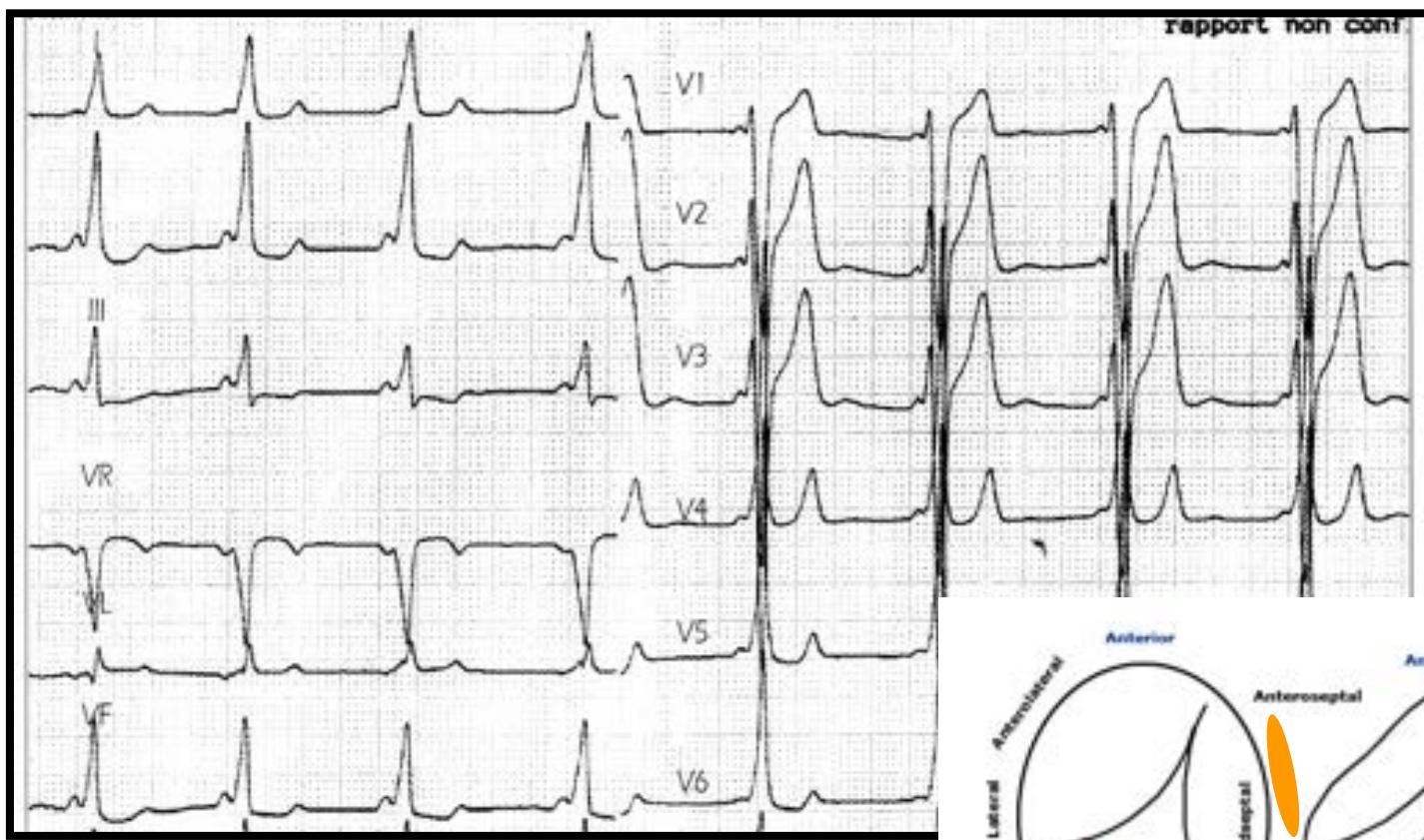
Left lateral





Right posterior





Anteroseptal

