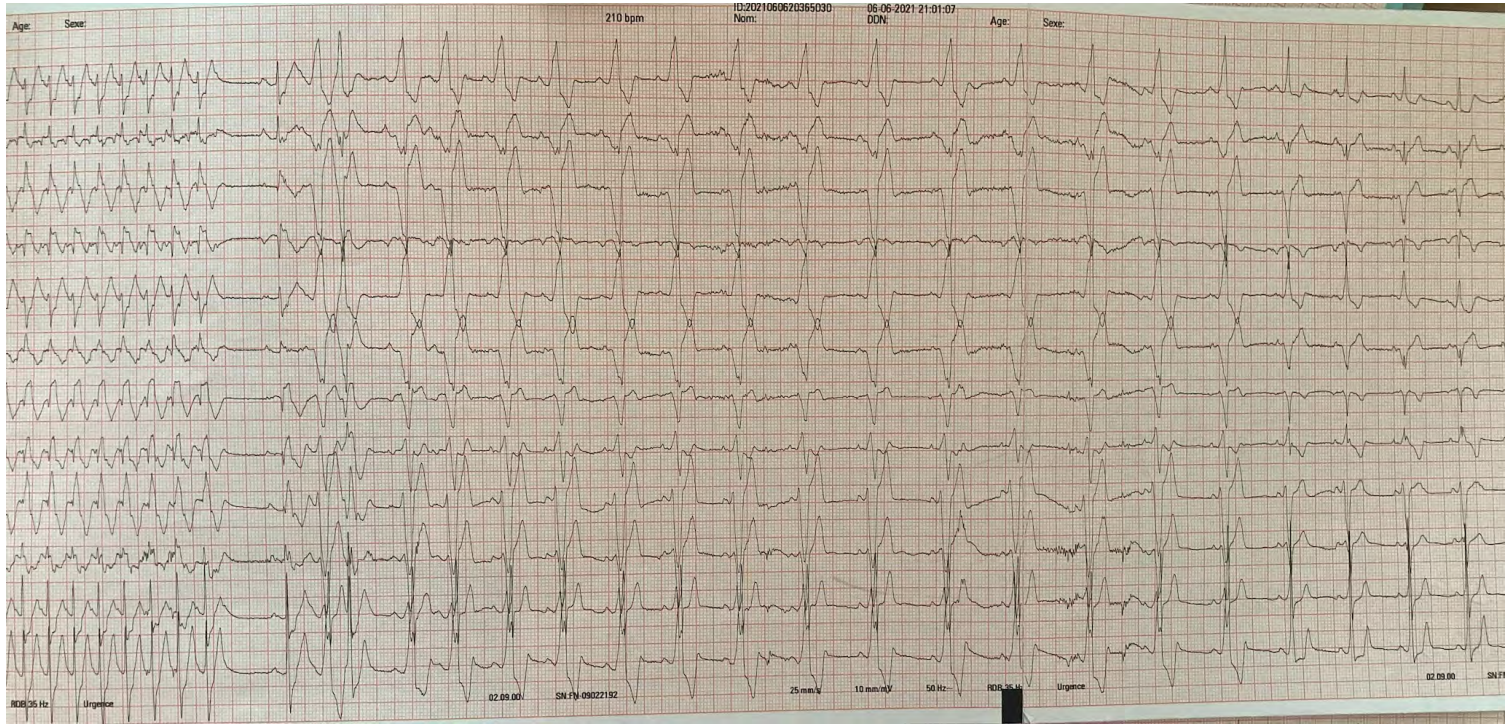
Arythmies en Pédiatrie et Cardiologie Congénitale

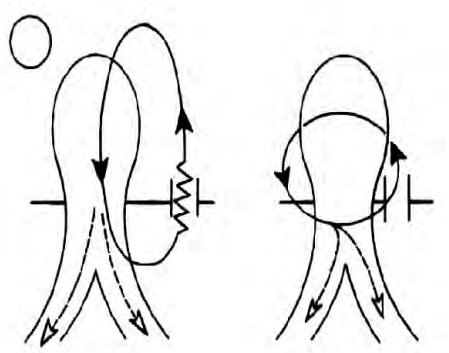


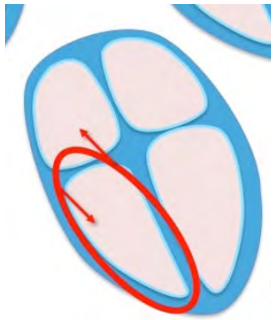
Victor WALDMANN

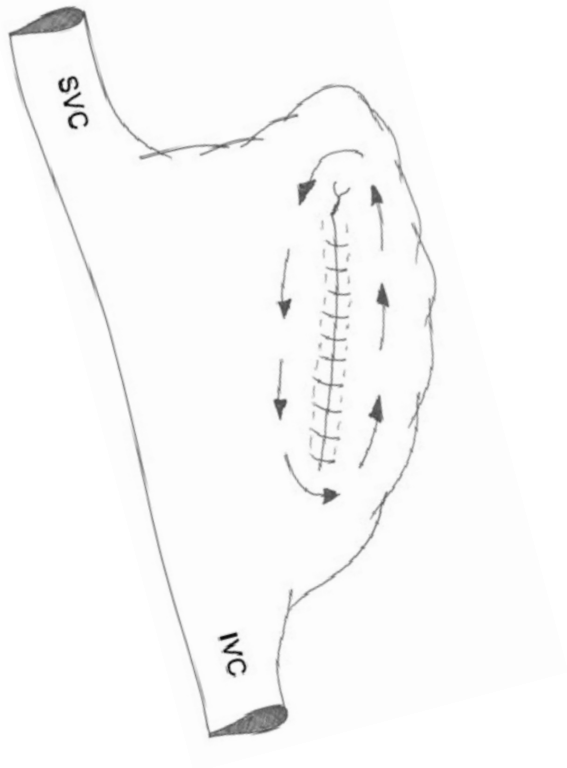
Hôpital Européen Georges Pompidou — Hôpital Necker

MÉCANISMES

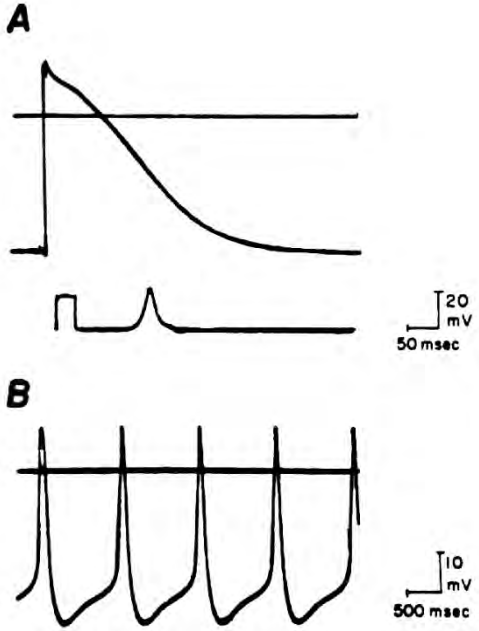
Réentrées ++

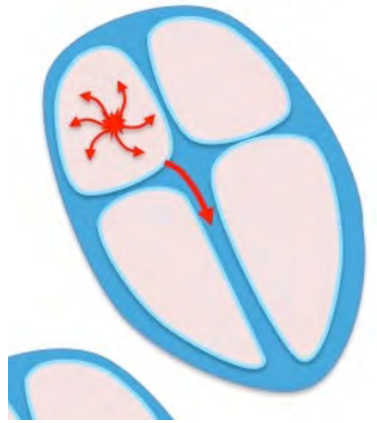




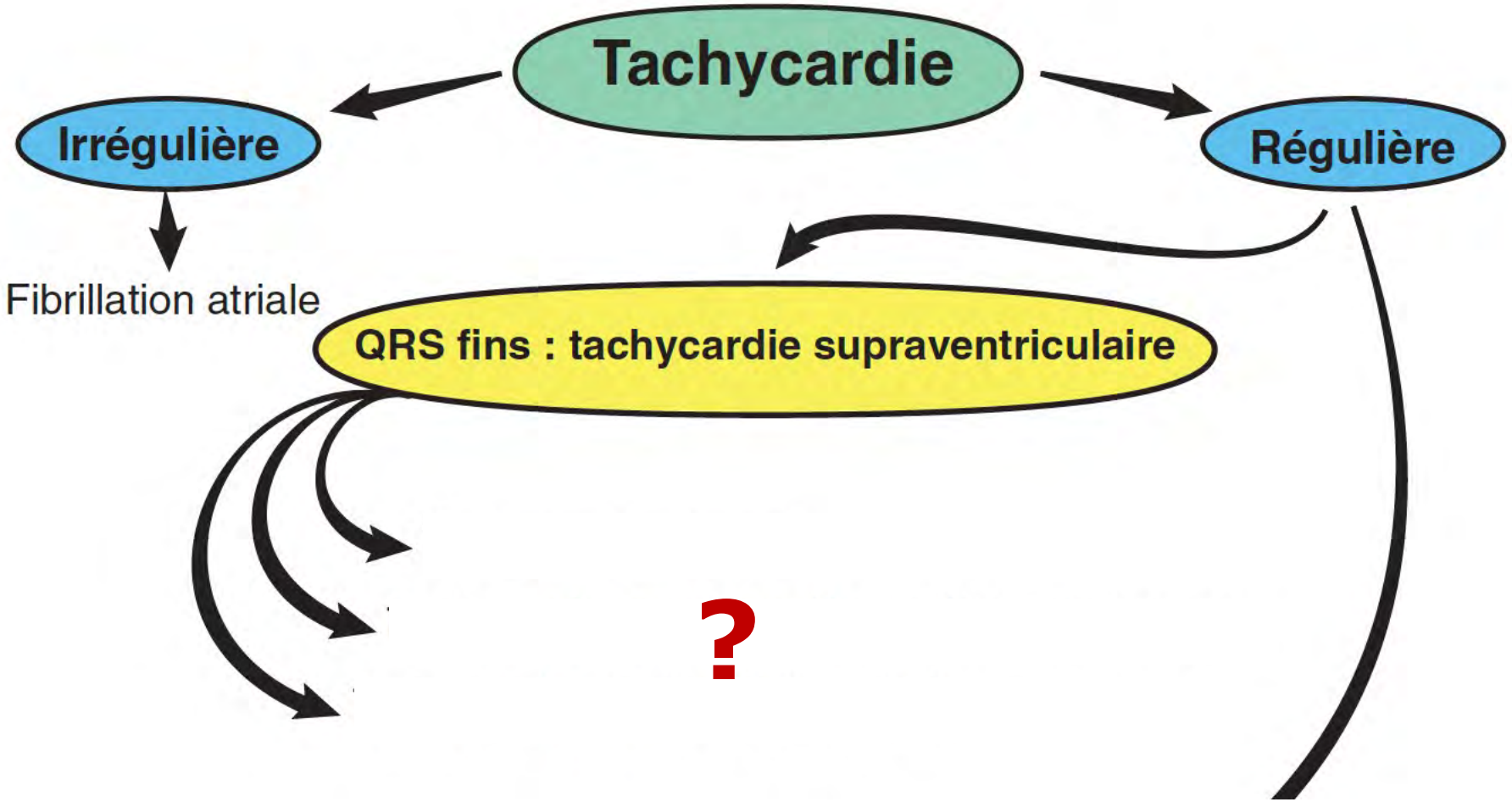


Automatisme anormal

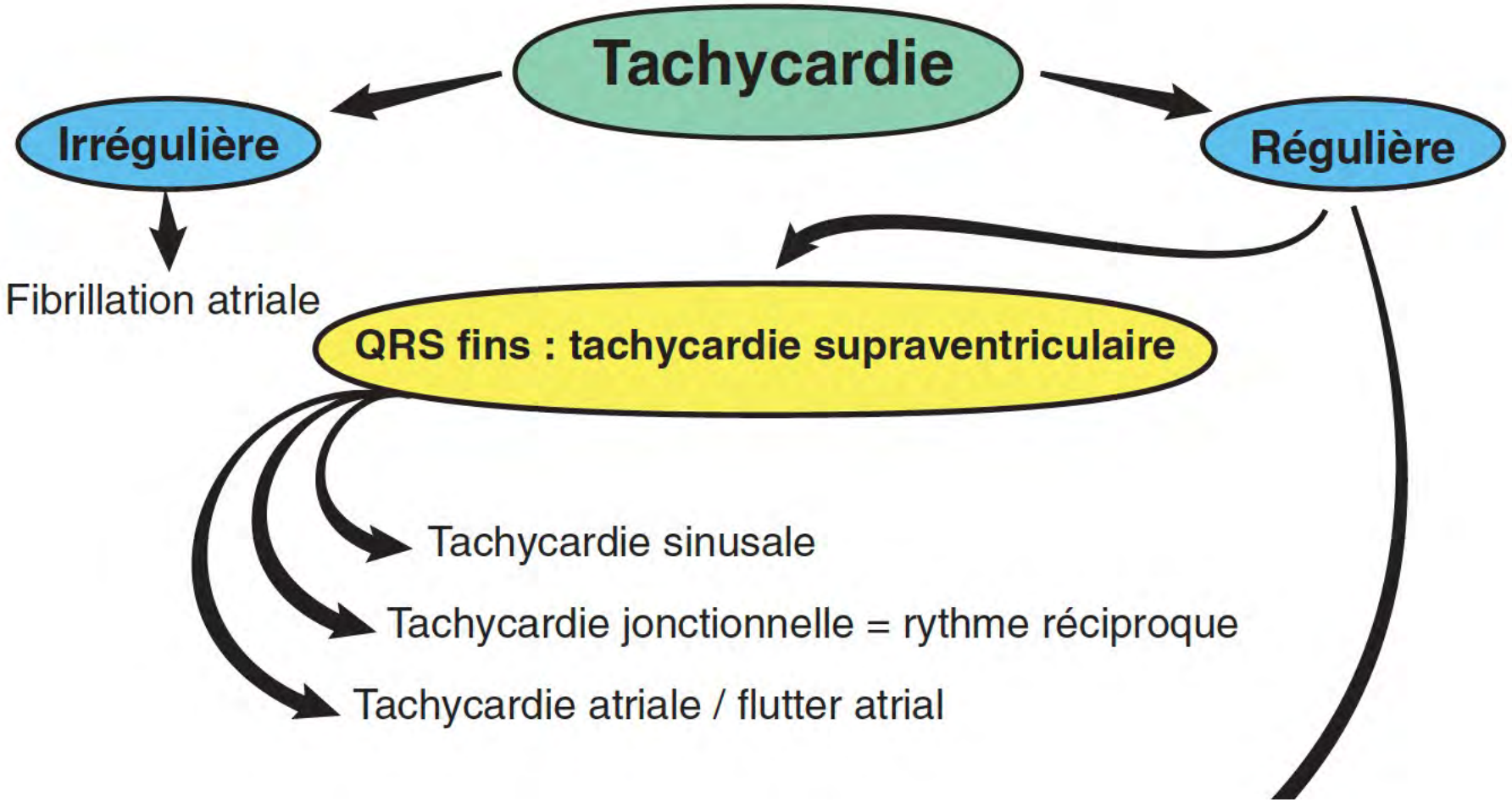




Spectre des Diagnostics

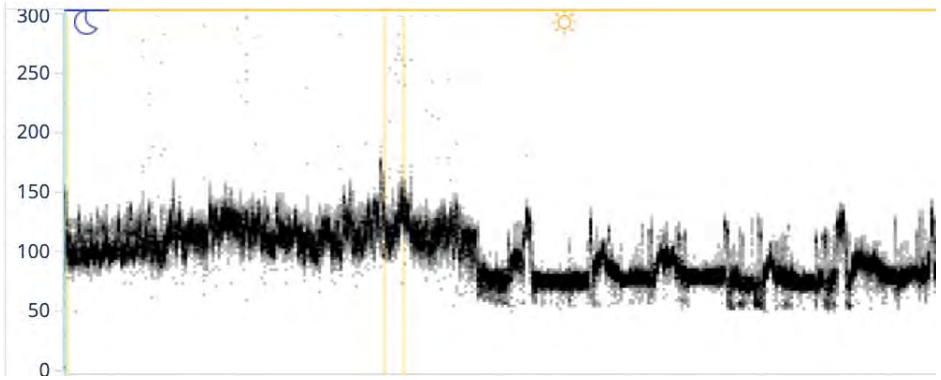


Spectre des Diagnostics



TACHYCARDIE SINUSALE

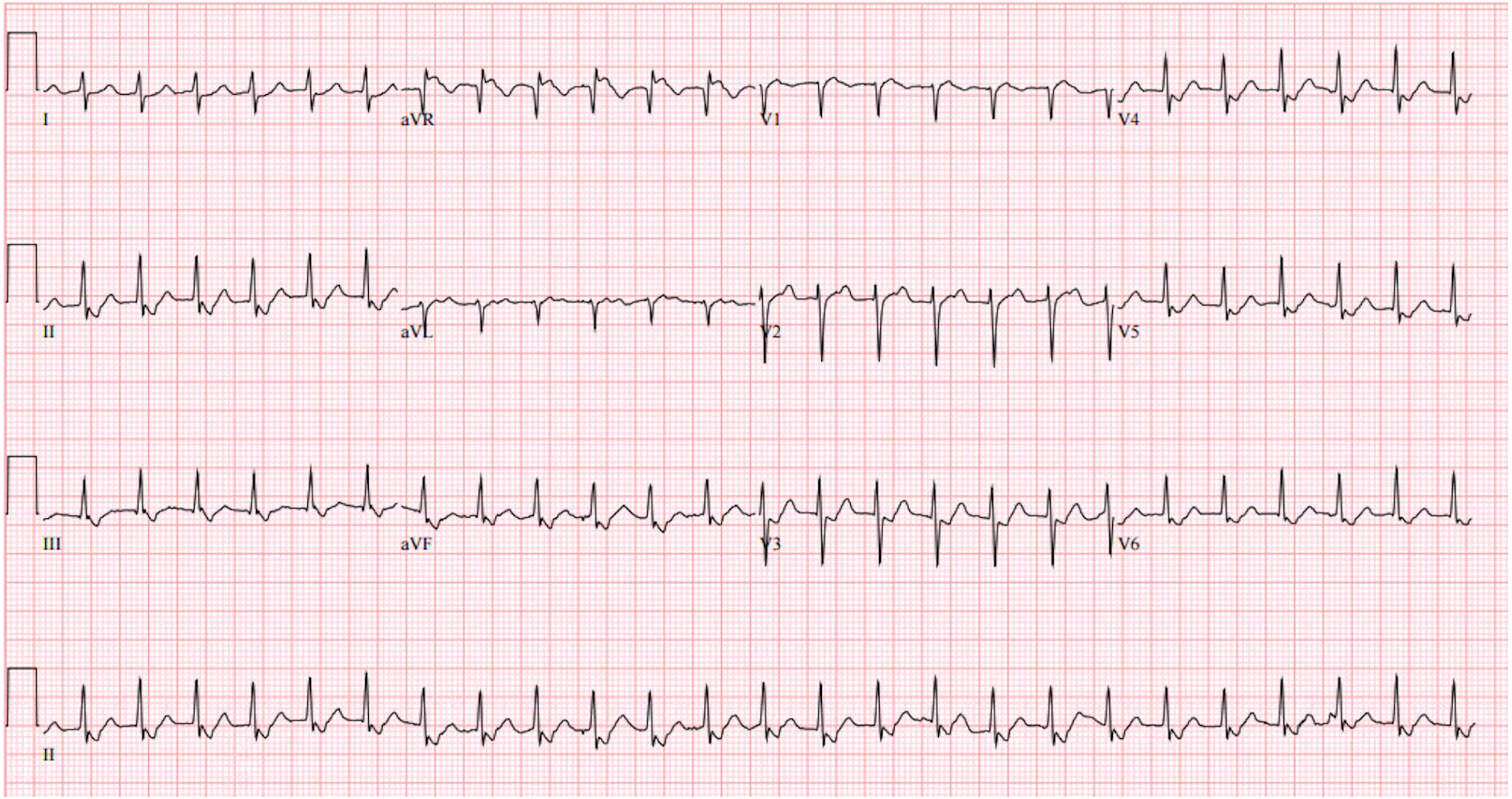
- **Début et fin progressifs (intérêt d'enregistrements prolongés ou monitoring continu) avec fluctuation de la fréquence cardiaque,**



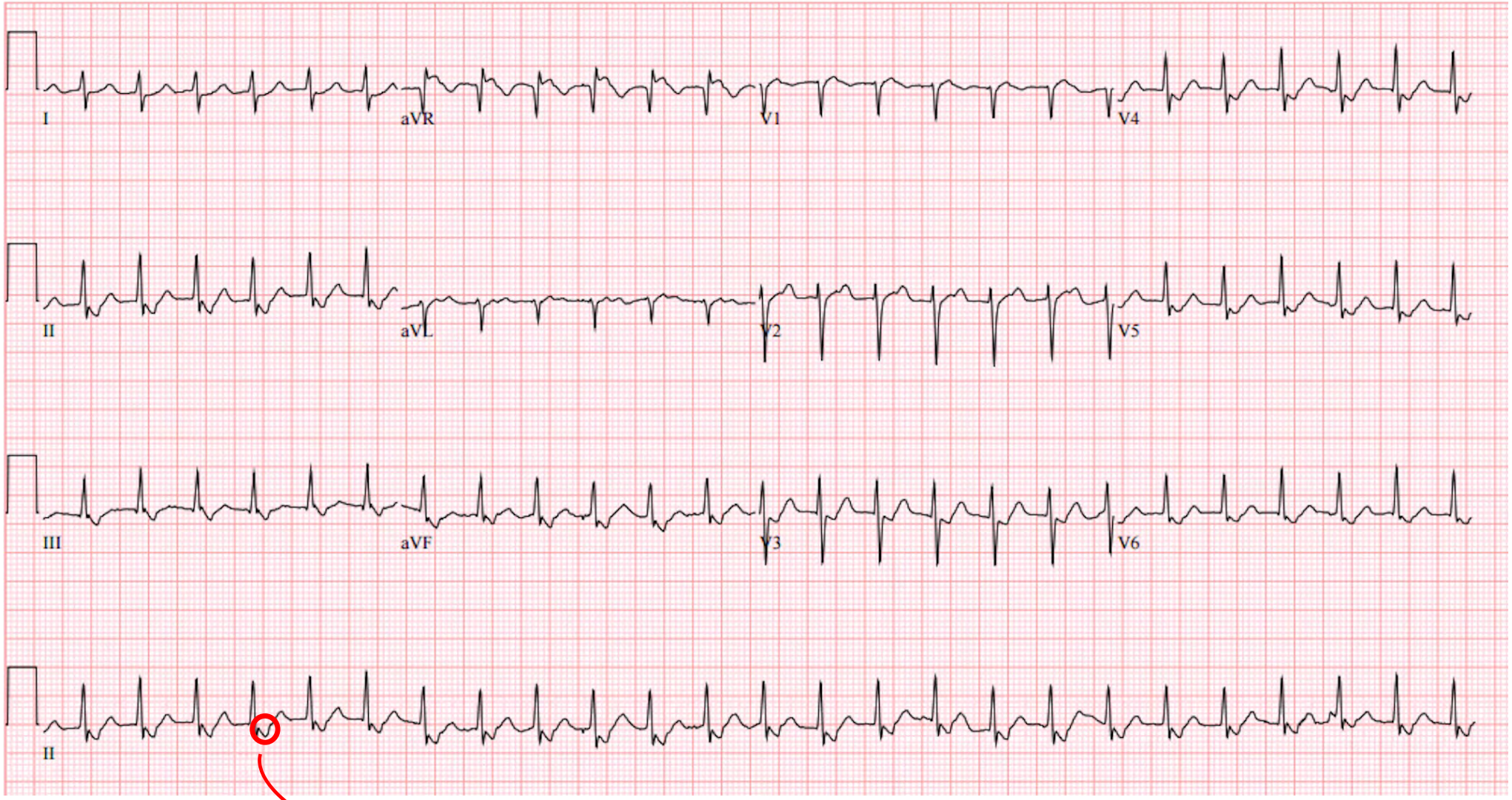
- **Tachycardie sinusale en réponse à un facteur déclenchant ou cause sous-jacente (effort physique, stress, sepsis, hypovolémie, anémie, embolie pulmonaire etc…),**

- **Morphologie de l'onde P en faveur d'une origine du nœud sinusal :**
  - **Positive dans les dérivations inférieures, en DI, et de V3 à V6,**
  - **Négative en avR,**
  - **Souvent biphasique en V1 (parfois en V2)**

???

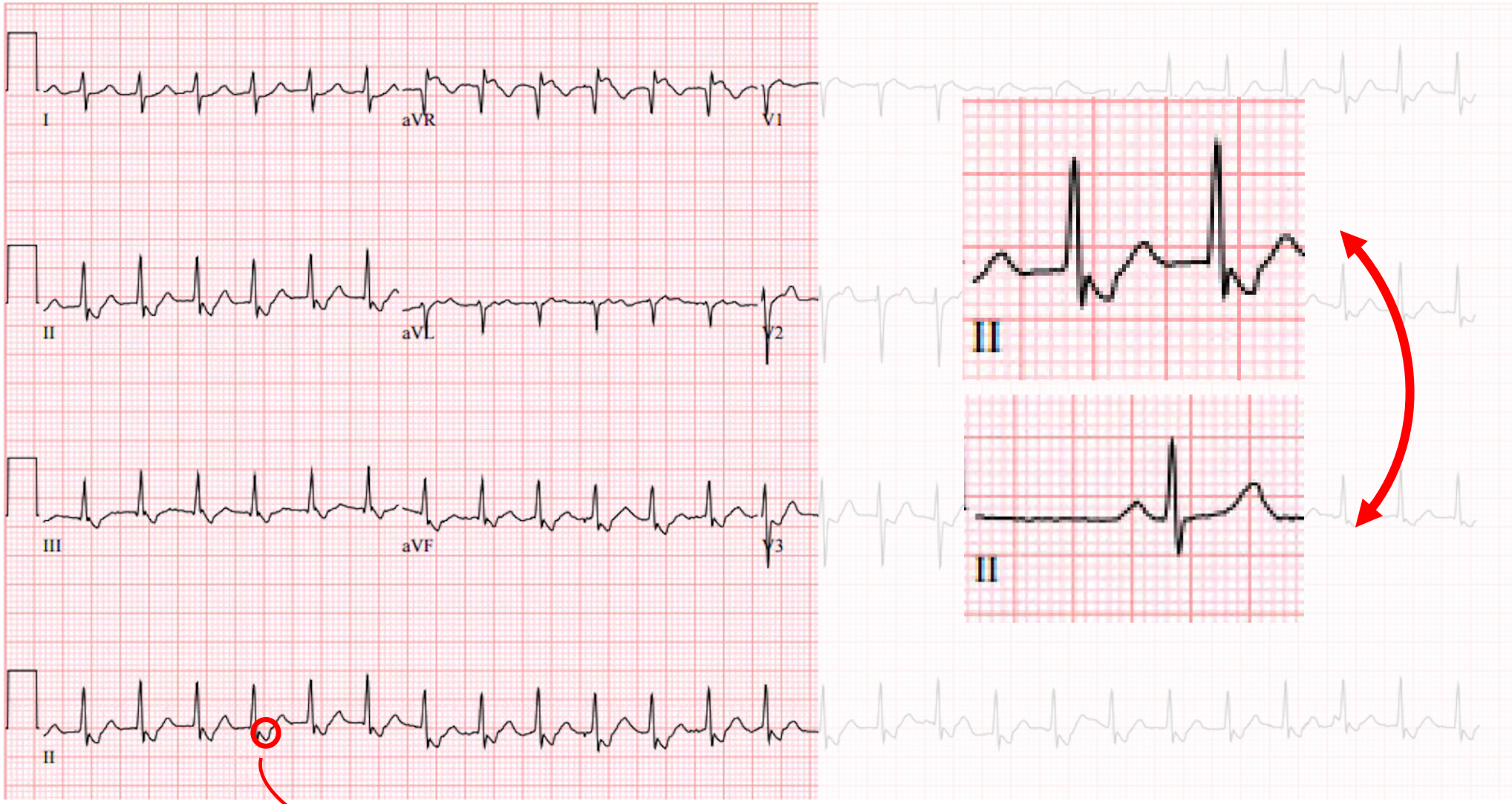

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

Tachycardies Jonctionnelles



- Pas d'ondes P devant les QRS
- Ondes P « cachés » dans les QRS (rétrograde = négative en inférieur)

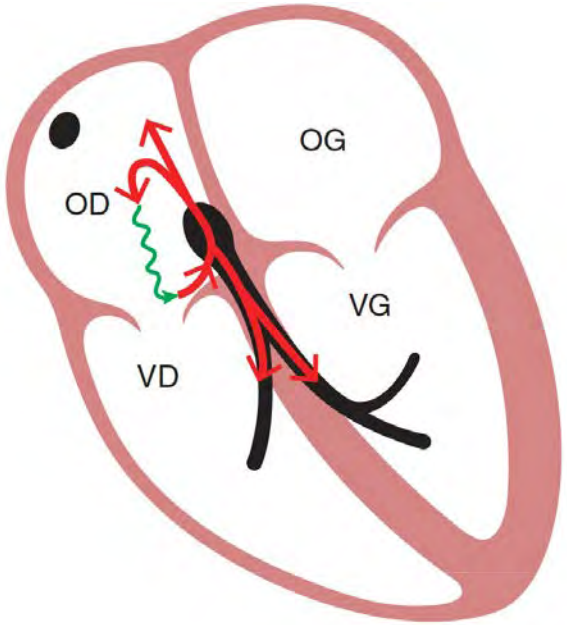
Tachycardies Jonctionnelles

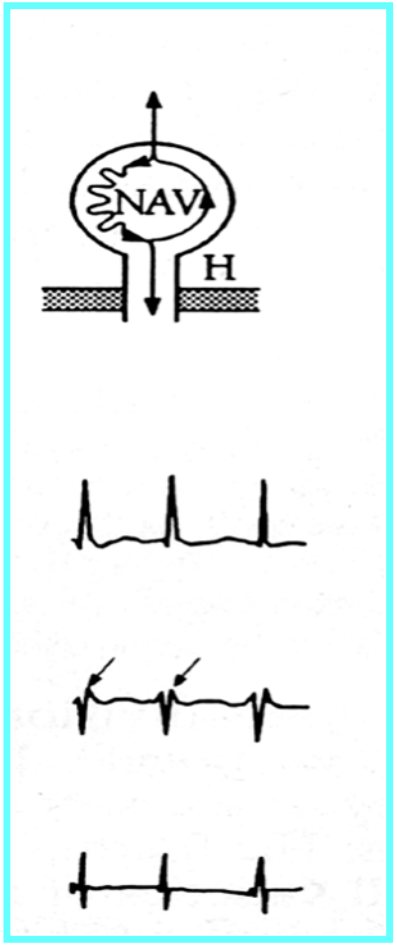


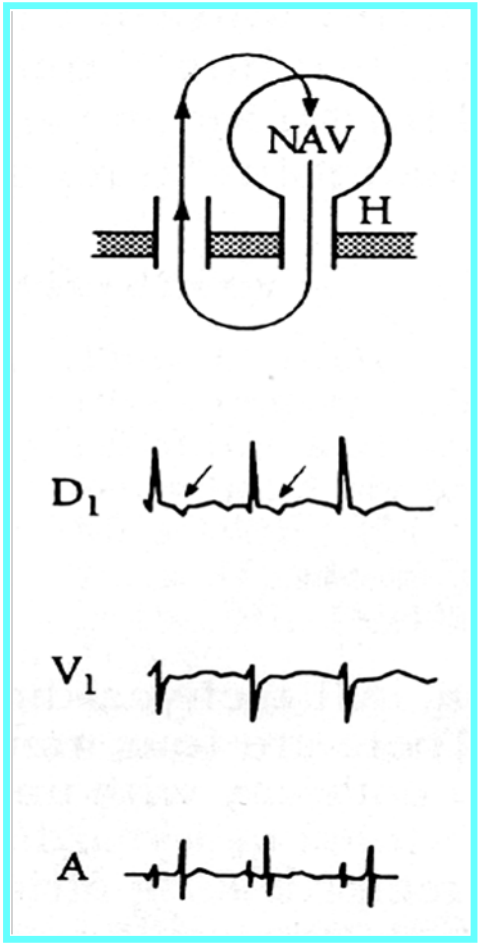
- Pas d'ondes P devant les QRS
- Ondes P « cachés » dans les QRS (rétrograde = négative en inférieur)

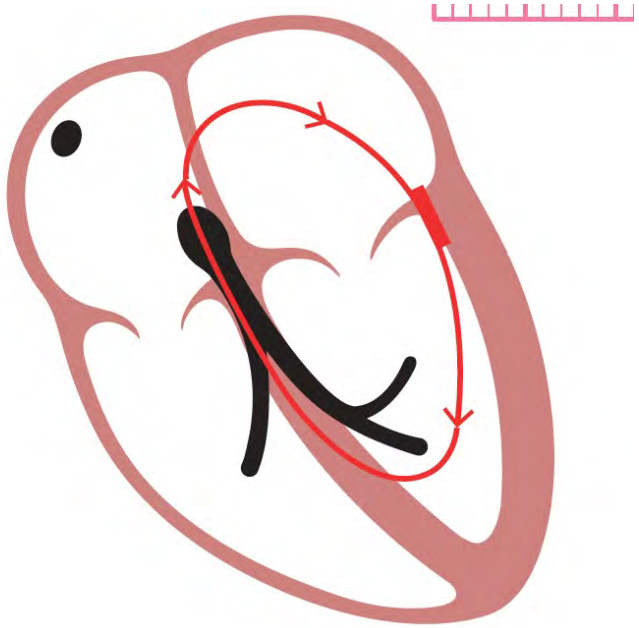
Tachycardies Jonctionnelles

A = V ++





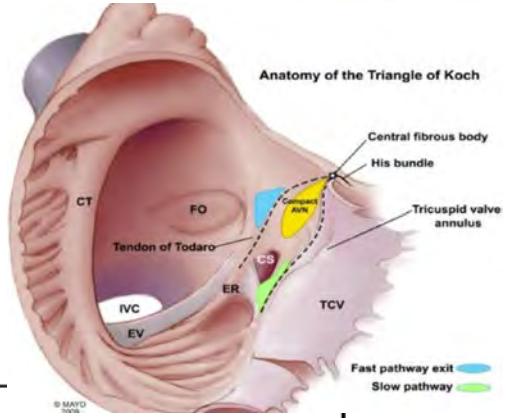




Réentrée intra-nodale

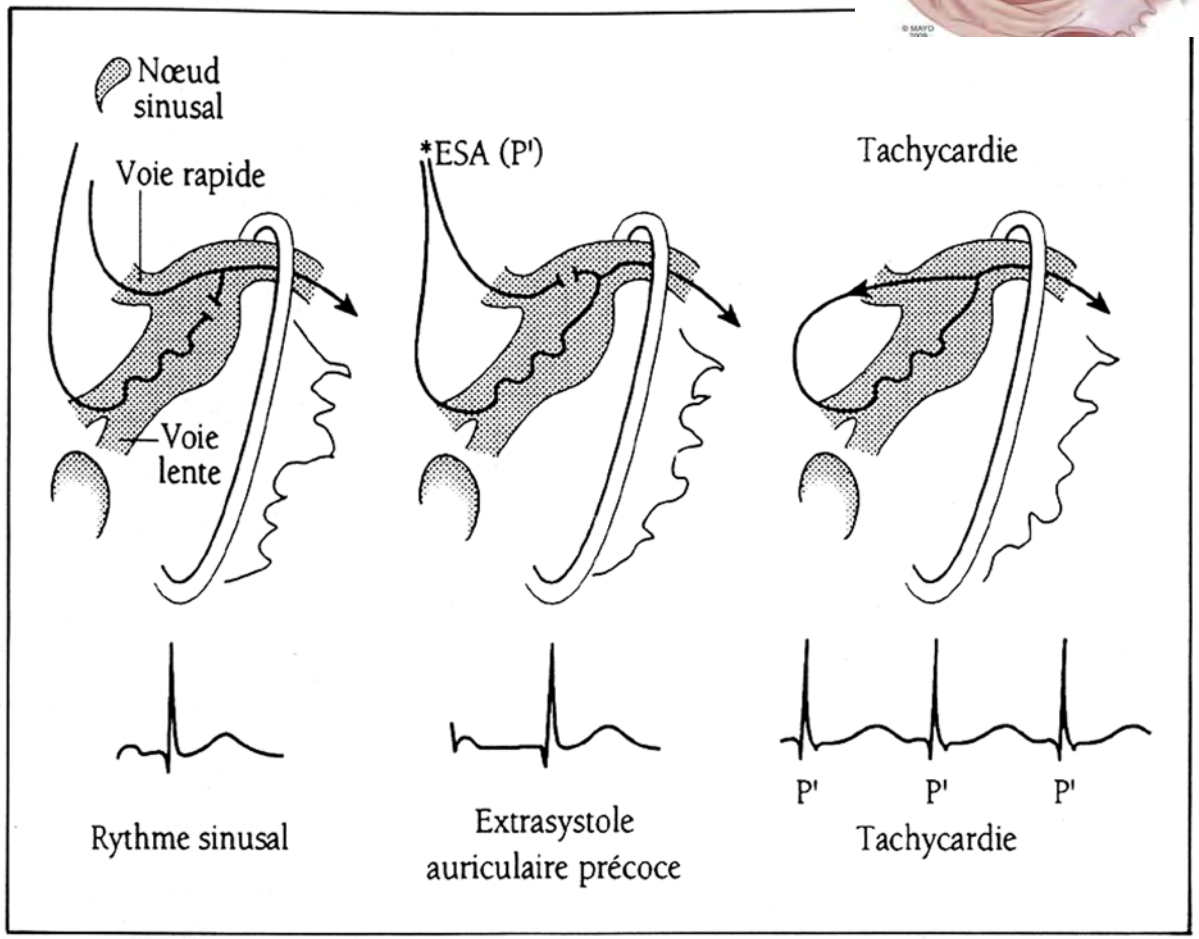
Voie accessoire (Kent = WPW)

TACHYCARDIES JONCTIONNELLES



Réentrée intra-nodale

- **Aussi appelée maladie de Bouveret,**
- **Circuit de réentrée localisé dans le NAV lié à la présence d'une voie rapide et d'une voie lente,**
- **Ondes P' rétrogrades « collées » au QRS (parfois non visibles)**
- **Surtout après 10 ans ++**

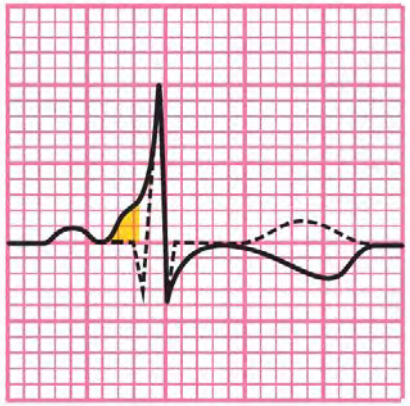


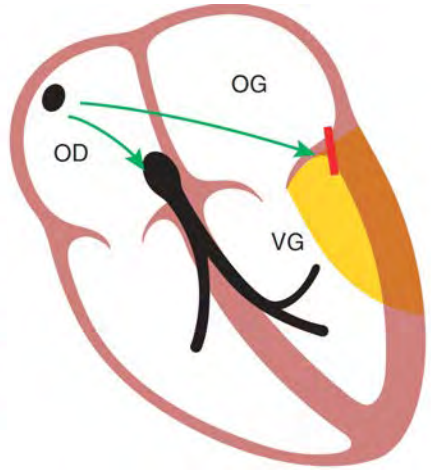
TACHYCARDIES JONCTIONNELLES

Wolff Parkinson White

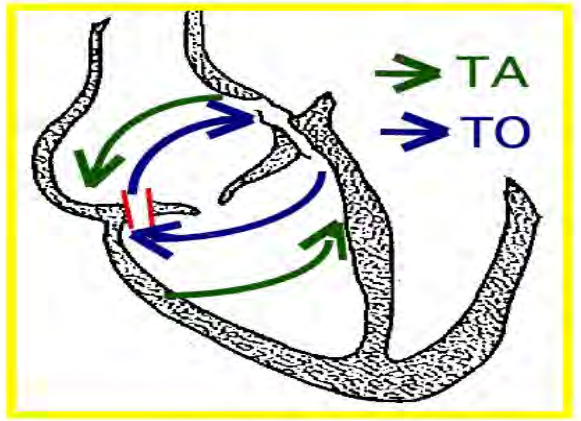
- **Circuit qui descend par le NAV et remonte par une voie accessoire (le plus fréquent, QRS fins, tachycardie orthodromique) *ou* circuit qui descend par une voie accessoire et remonte par le NAV (QRS larges, tachycardie antidromique),**
- **Ondes P' plus à distance du QRS (>80 ms)**
- **Quasi toutes les TJ avant 10 ans**
- **Rémission fréquente 12-18 mois**
- **Récurrences 40-60% après 9 ans ++**

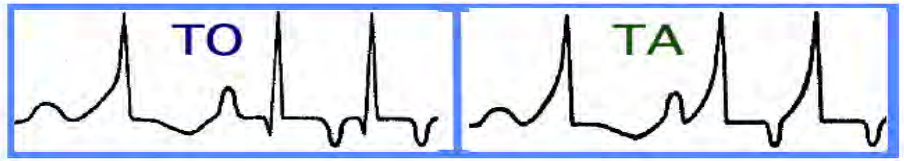
Rythme sinusal
PR court + delta





Tachy ortho/antidromique





TACHYCARDIES JONCTIONNELLES

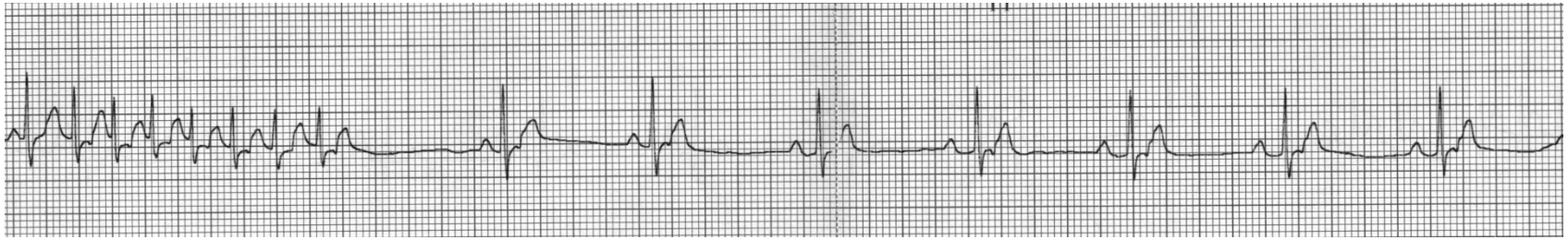
Prise en charge ???

TACHYCARDIES JONCTIONNELLES

Prise en charge — Aigue

- **Manœuvres vagales**
  - **Valsalva**
  - **Verre d'eau froid**
  - **Vessie de glace**
  - **Vomissement, aspirations…**

- **Adénosine (Striadyne / Krenosin)**
  - **0.1 à 0.3 mg/kg IV flash +++**
  - **Chariot d'urgence**
  - **Vérifier papier ECG**



TACHYCARDIES JONCTIONNELLES

Prise en charge — Aigue

Le Test à l'adénosine (Striadyne® ou Krenosin®)

Quand ? Doute diagnostique après échec des manœuvres vagales

Comment ? Injection en bolus très rapide (avec rinçage par un soluté isotonique) de ½ ampoule, voire 1 ou 2 ampoules en cas d'échec, enregistrement d'un tracé ECG long pendant l'injection, matériel de réanimation à proximité

Contre indication ? Asthme car risque de bronchospasme

ECG A

ECG B

Interprétation :

Tachycardies à QRS fins (donc supraventriculaires) = l'injection d'adénosine réduira les tachycardies jonctionnelles (ECG A) et ne fera que ralentir la conduction ventriculaire au cours d'un flutter ou d'une fibrillation atriale, permettant de mieux visualiser l'activité de l'oreillette (ECG B).

Tachycardies à QRS larges = les mêmes diagnostics sont envisageables (avec bloc de branche ou pré excitation ventriculaire), auxquels il faut ajouter la tachycardie ventriculaire. L'injection d'adénosine n'aura pas d'effet sur une TV.

TACHYCARDIES JONCTIONNELLES

Prise en charge — Aigue

Table I Recommendations for acute treatment of haemodynamically stable regular narrow QRS tachycardia in infants and children

Drug/intervention	Dosage (iv)	Class	Level
Vagal manoeuvres	Ice immersion, gastric tube insertion in infants, Valsalva, and head stand in older children	I	B
Transoesophageal atrial overdrive pacing[a]		I	B
Adenosine	Rapid bolus starting dosages:		B
	For infants: 0.15 mg/kg.	I	
	For >1 year of age: 0.1 mg/kg	I	
	Increasing dosage up to 0.3 mg/kg.		
Verapamil[b,c]	0.1 mg/kg slowly over 2 min	I	B
Flecainide[b]	1.5–2 mg/kg over 5 min	IIa	B
Propafenone[b]	Loading: 2 mg/kg over 2 h Maintenance: 4–7 μg/kg/min	IIa	B
Amiodarone	Loading: 5–10 mg/kg over 60 min. Maintenance infusion:5–15 μg/kg/min	IIb	B

iv, intravenously; Class, recommendation class; Level, level of evidence.
[a]Most effective if AV reentrant tachycardias or atrial flutter.
[b]Myocardial depressant effect.
[c]Contraindicated in infants <1 year of age.

EHRA consensus paper 2013

TACHYCARDIES JONCTIONNELLES

Prise en charge — Chronique

- **TJ <1 an récidivante:**
  - **Souvent amiodarone**
  - **Tentative sevrage 6-12 mois**

- **TJ > 1 an:**
  - **Flecaine ++ si pre excitation ventriculaire**
  - **Si pas de pre excitation: BB, Calciques, Sotalol, Amiodarone…**

- **Ablation ?**
  - **Traitement de 1ère intention après 25-30 kg**
  - **Avant si échec du traitement médical**

TACHYCARDIES JONCTIONNELLES

Prise en charge — Chronique

Amiodarone 500 mg/m2 en charge 5 jr puis 250 mg/m2

Necker

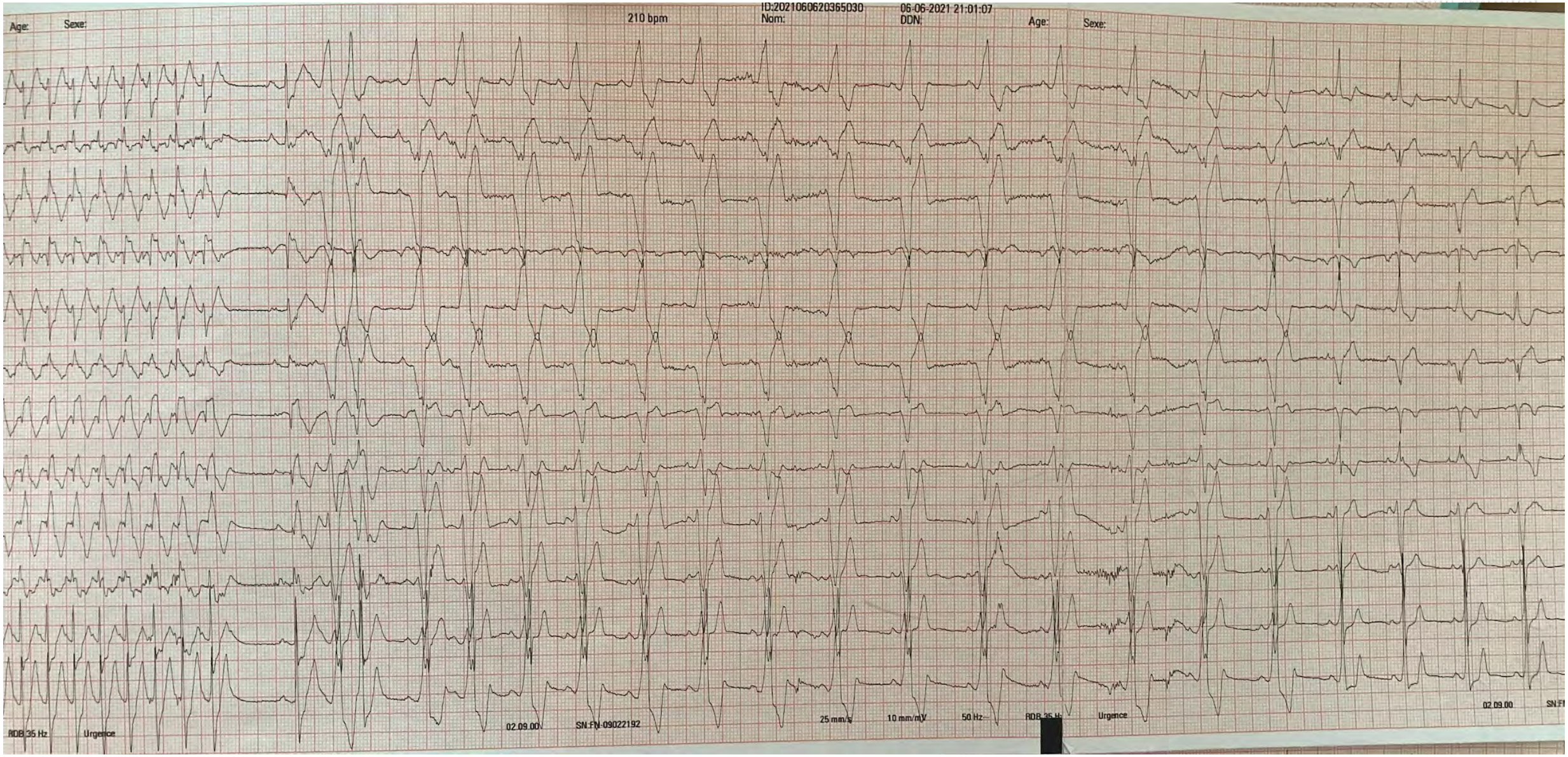
Table 3 Suggested doses and main side effects/precautions for commonly used oral prophylactic antiarrhythmic drugs for SVT and VT in infants and children

Drug	Total daily dosage per body weight divided in × doses	Main contraindications and precautions	Features prompting lower dose or discontinuation	AV nodal slowing
Digoxine			Bradycardia	Moderate
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 digitoxin/digoxin should be reduced.	QT interval >500 ms	Slight

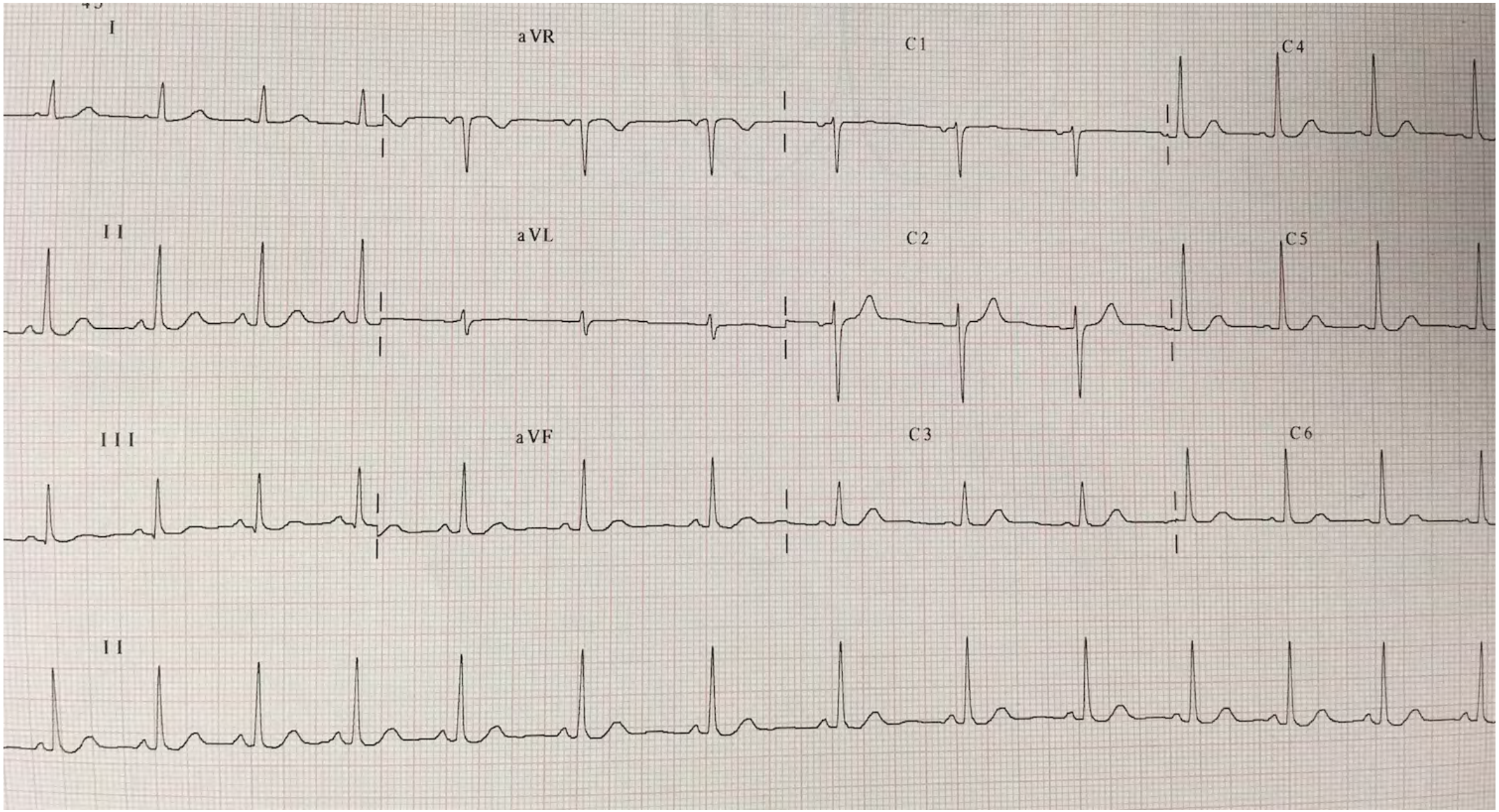
LVEF, left ventricular ejection fraction; HF, heart failure.

EHRA consensus paper 2013

Tachycardies Jonctionnelles

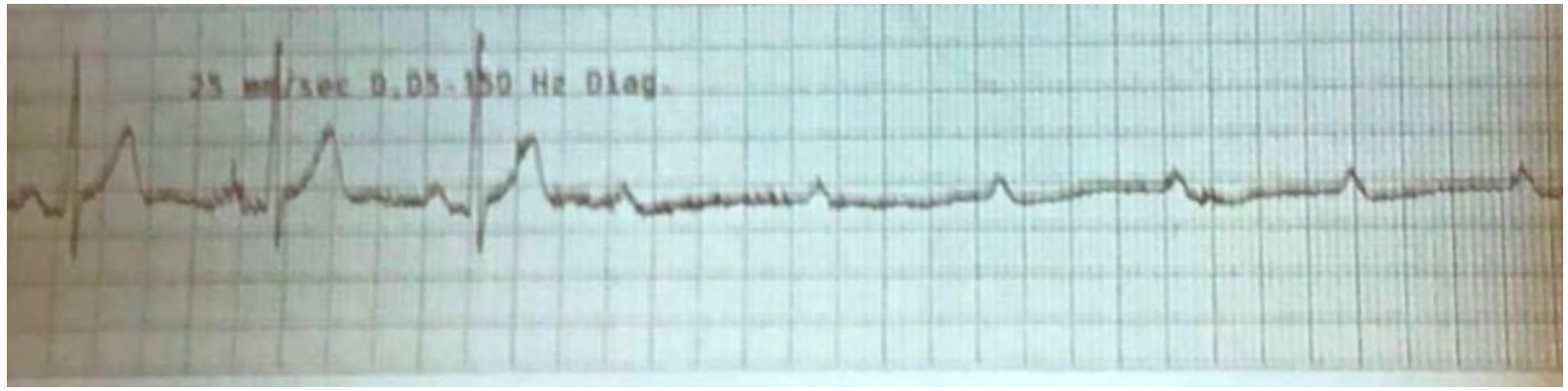


Voie Accessoire Possible ?



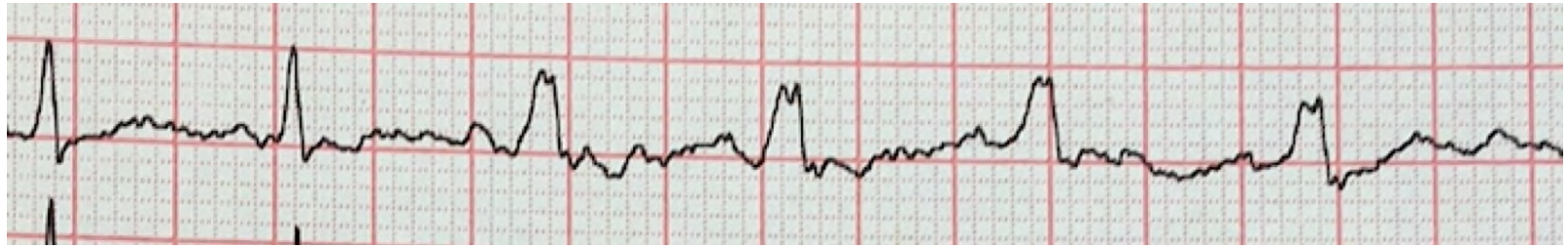
Voie Accessoire Possible ?

Pas de VA = BAV



VA antéro =
pas de BAV + pré excitation

= Kent Masqué



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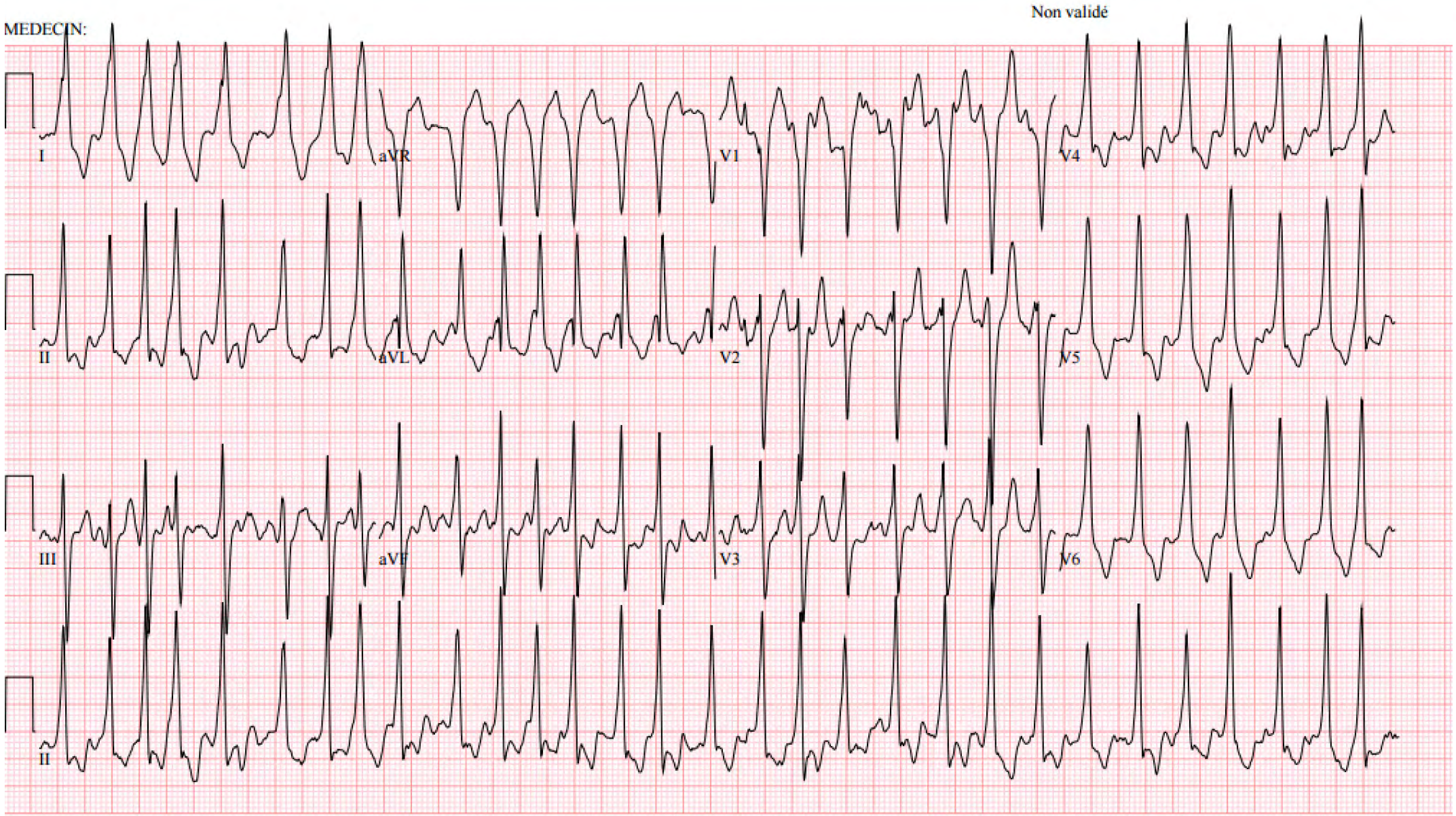
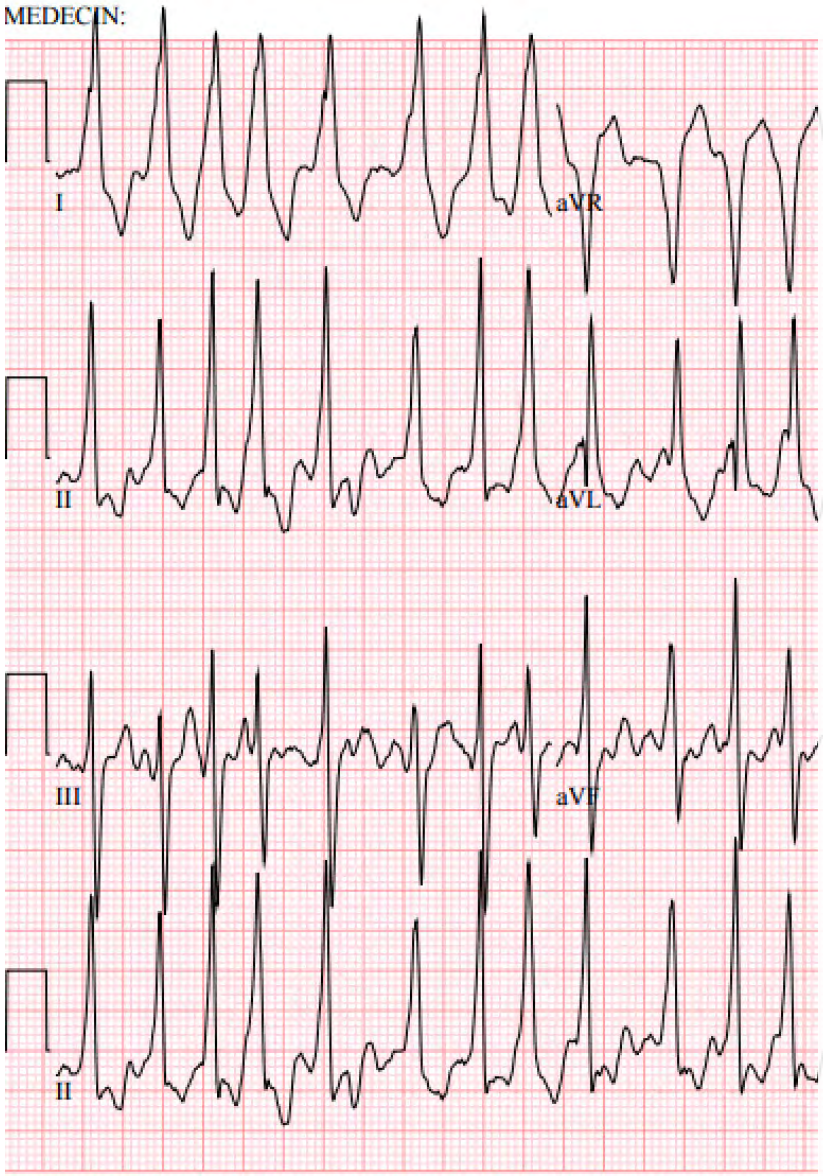
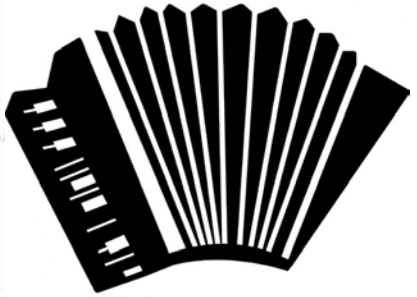
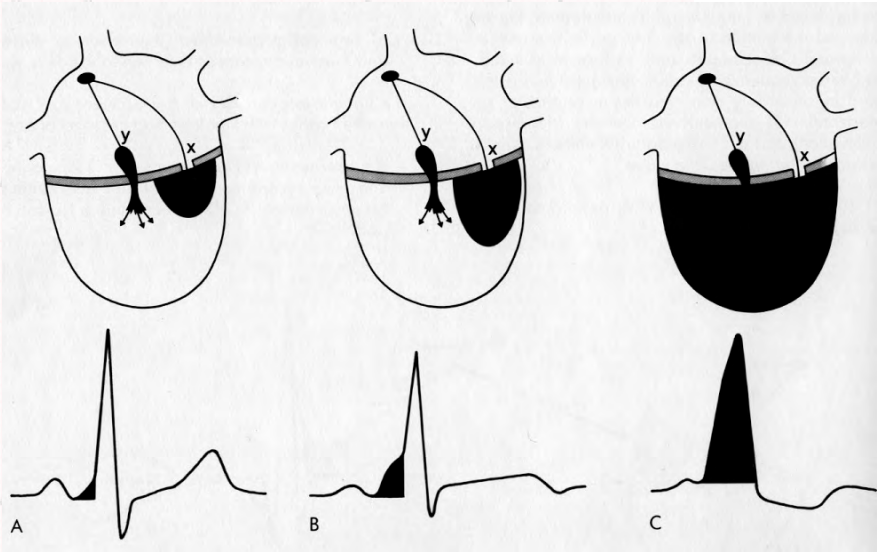

Non validé
MEDECIN:
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

SUPER-WPW



- **Rythme irrégulier**
- **QRS en accordéon**
- **Risque de FV**
- **CEE en urgence**
- **Ablation**





Pre excitation Asymptomatique

ESC European Society of Cardiology
European Heart Journal (2019) **00**, 1–65
doi:10.1093/eurheartj/ehz467

ESC GUIDELINES

2019 ESC Guidelines for the management of patients with supraventricular tachycardia

The Task Force for the management of patients with supraventricular tachycardia of the European Society of Cardiology (ESC)

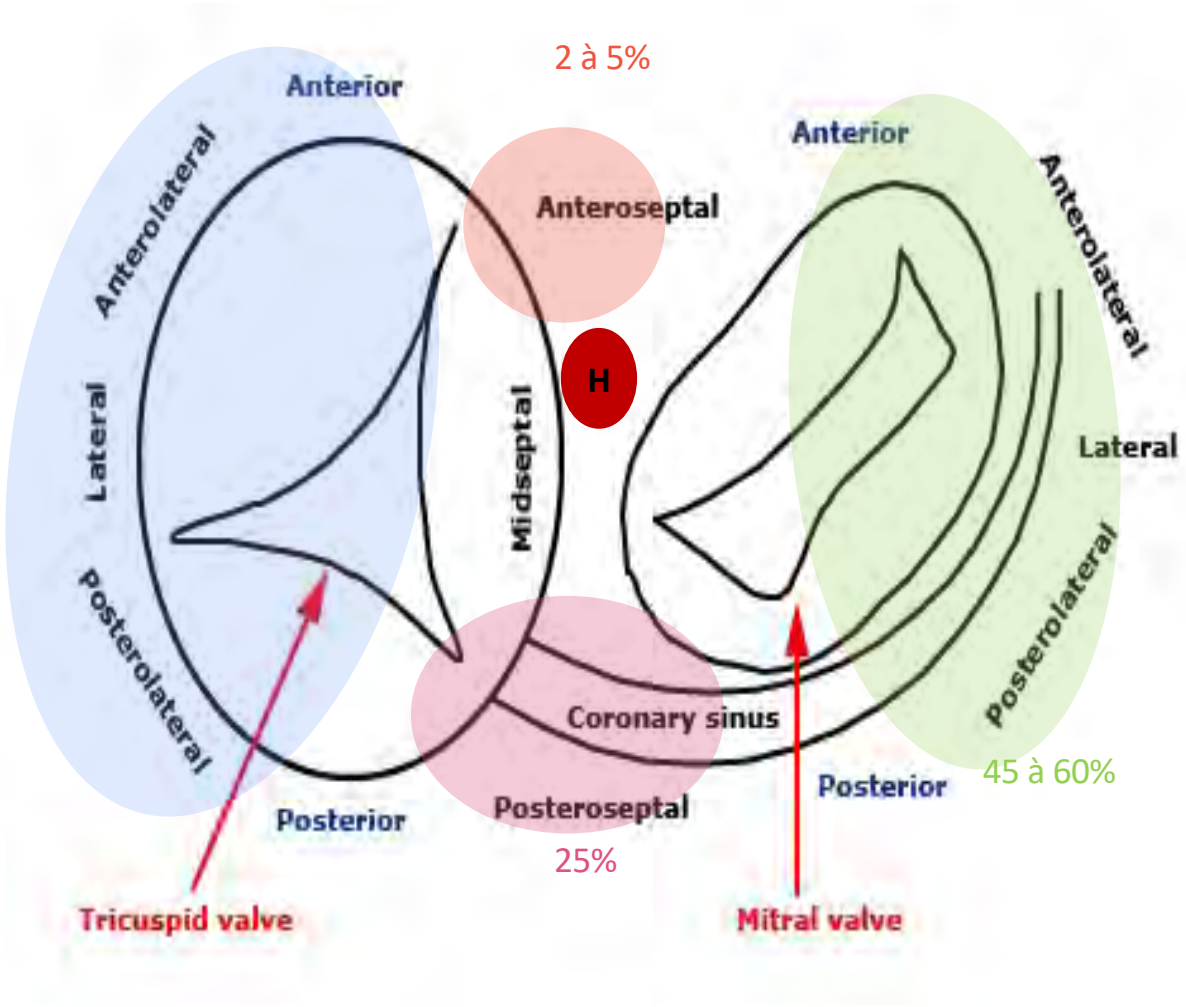
Developed in collaboration with the Association for European Paediatric and Congenital Cardiology (AEPC)

Recommendation	Class[a]	Level[b]
Performance of an EPS, with the use of isoprenaline, is recommended to risk stratify individuals with asymptomatic pre-excitation who have high-risk occupations/hobbies,[c] and those who participate in competitive athletics.[439,450–452,454–460]	I	B
Catheter ablation is recommended in asymptomatic patients in whom electrophysiology testing with the use of isoprenaline identifies high-risk properties, such as SPERRI ≤250 ms, AP ERP ≤250 ms, multiple APs, and an inducible AP-mediated tachycardia.[439,450,452,454–460]	I	B
Performance of an EPS to risk stratify individuals with asymptomatic pre-excitation should be considered.[439,450–452,454–460]	IIa	B
Non-invasive evaluation of the conducting properties of the AP in individuals with asymptomatic pre-excitation may be considered.[459,461–463,465–469]	IIb	B
Invasive risk stratification with an EPS is recommended in patients without 'low-risk' characteristics at non-invasive risk stratification.[462,463,465–469,477]	I	C

Pre excitation Asymptomatique

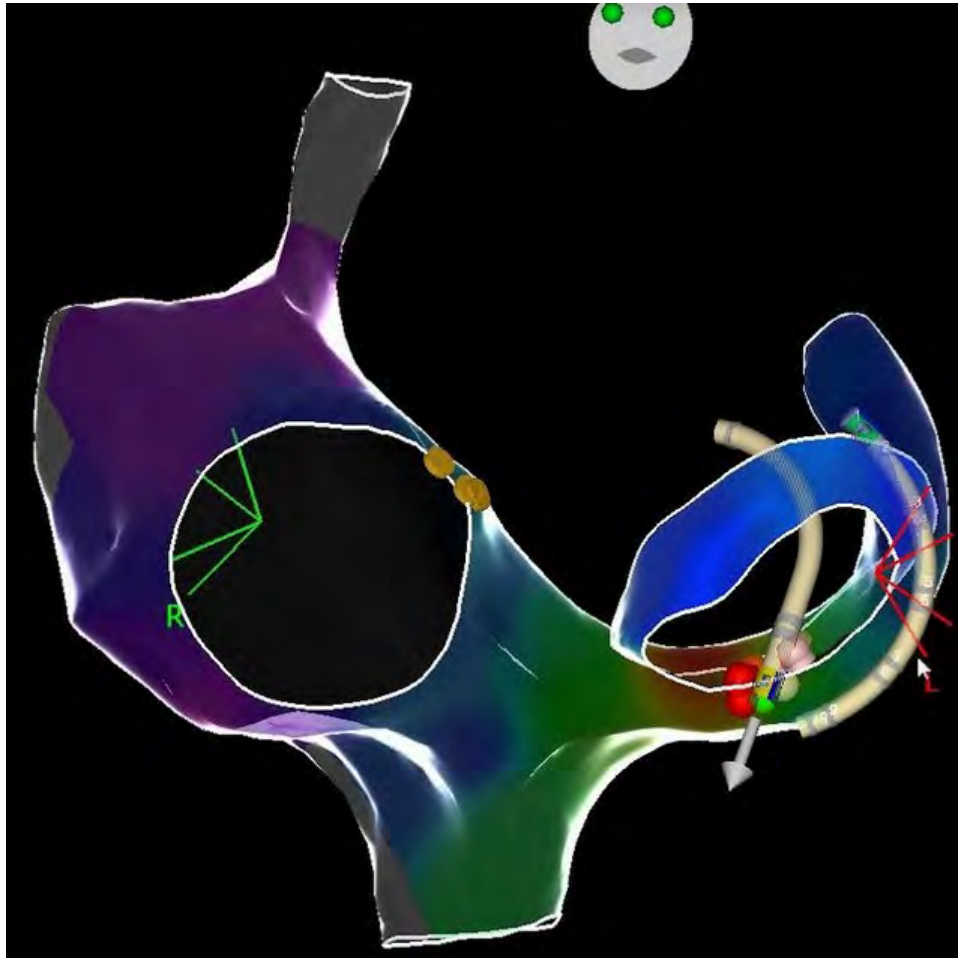
2 à 5%

13 à 21%



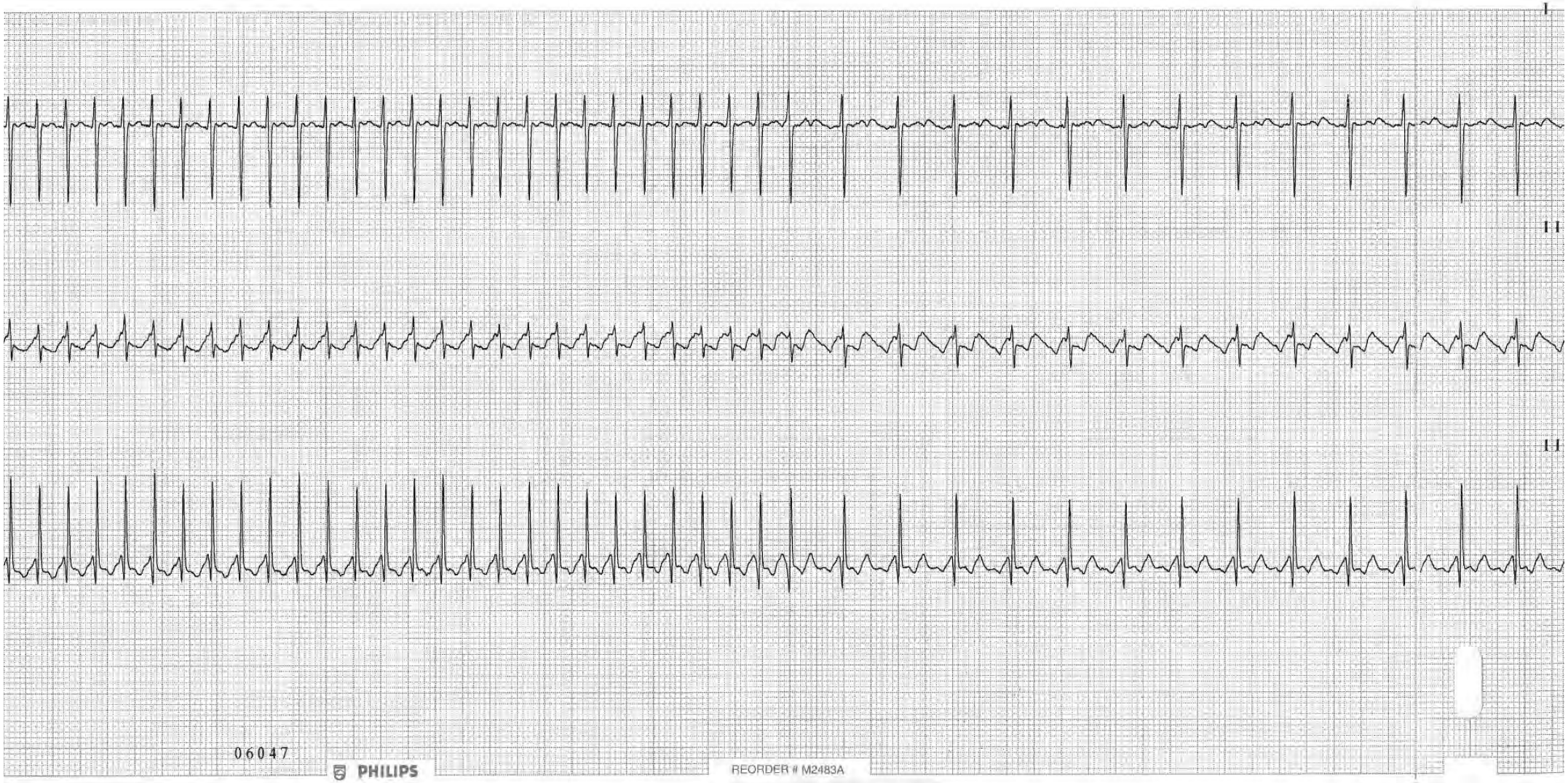
45 à 60%

25%

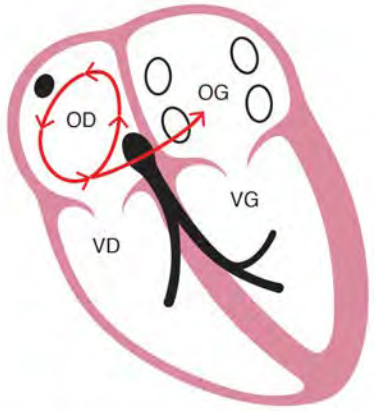


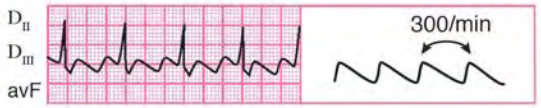
M3C

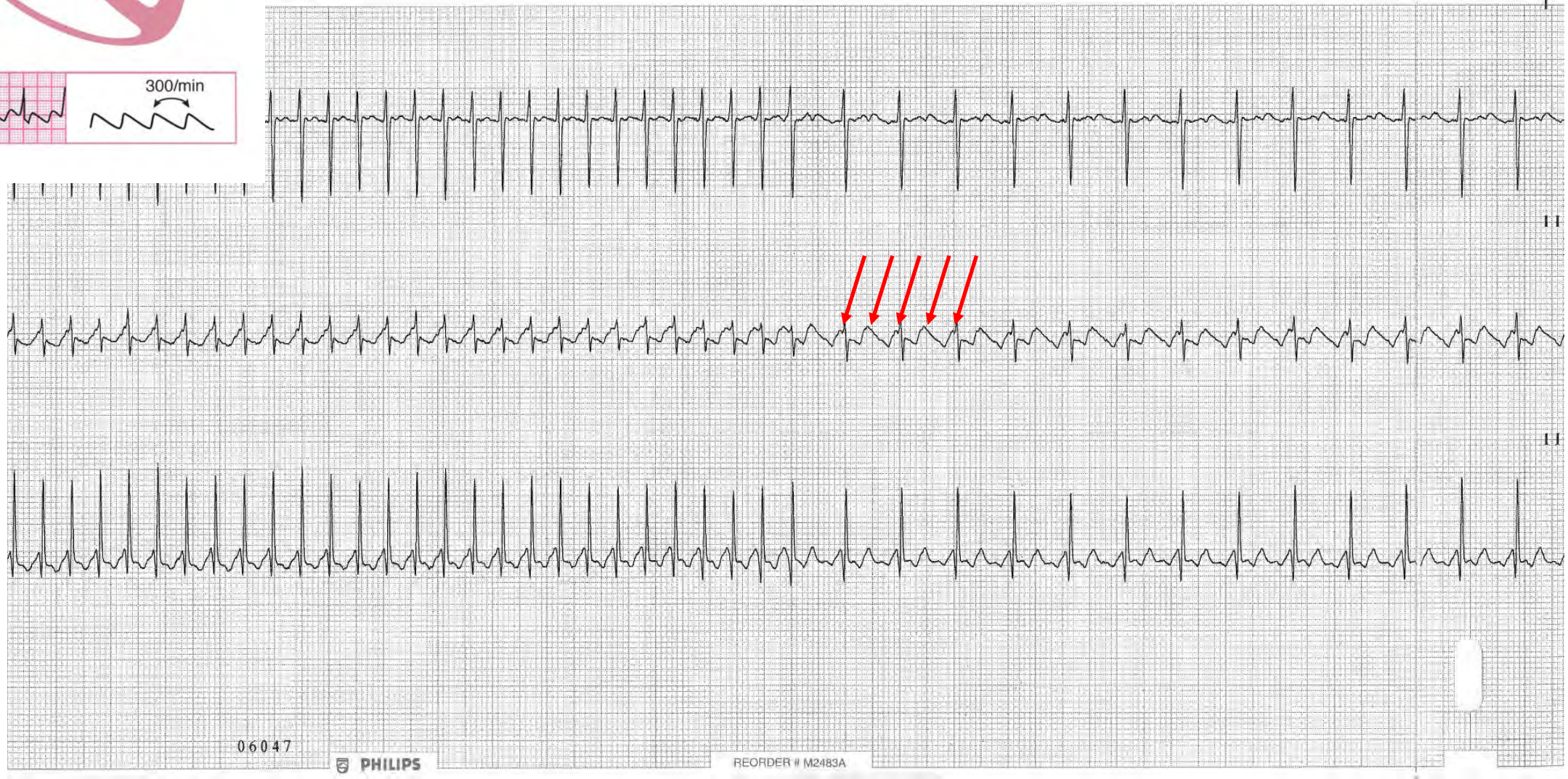
???



FLUTTER 1/1 → 2/1



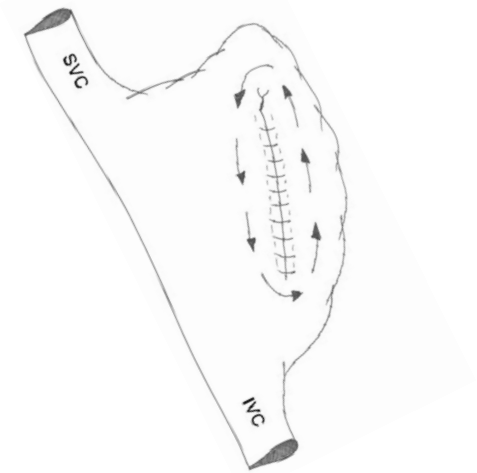


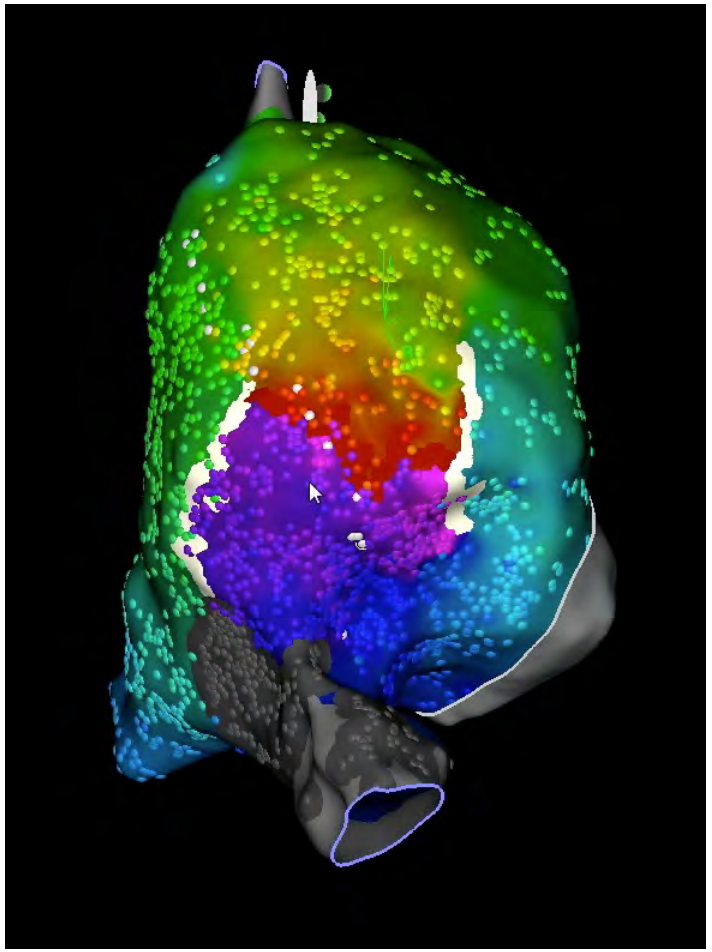


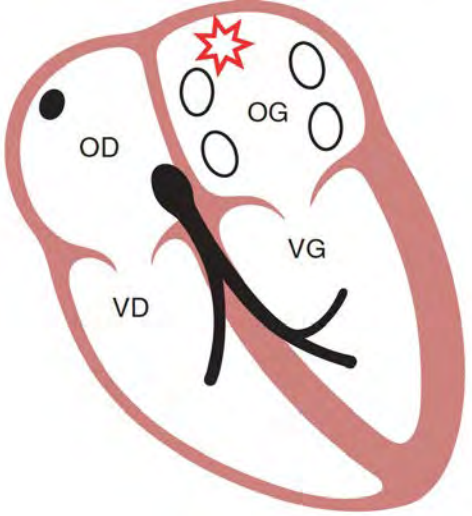
FLUTTER

A > V ++ ou A = V

- **Néonatal sur cœur sain souvent très rapide en 1/1:**
  - **Réduction par CEE ou antiarythmique**
  - **Récidives rares, pronostic excellent**
- **Cardiopathies congénitales opérées:**
  - **Favorisé par les cicatrices chirurgicales**
  - **Ablation en 1ère intention en fonction du gabarit**

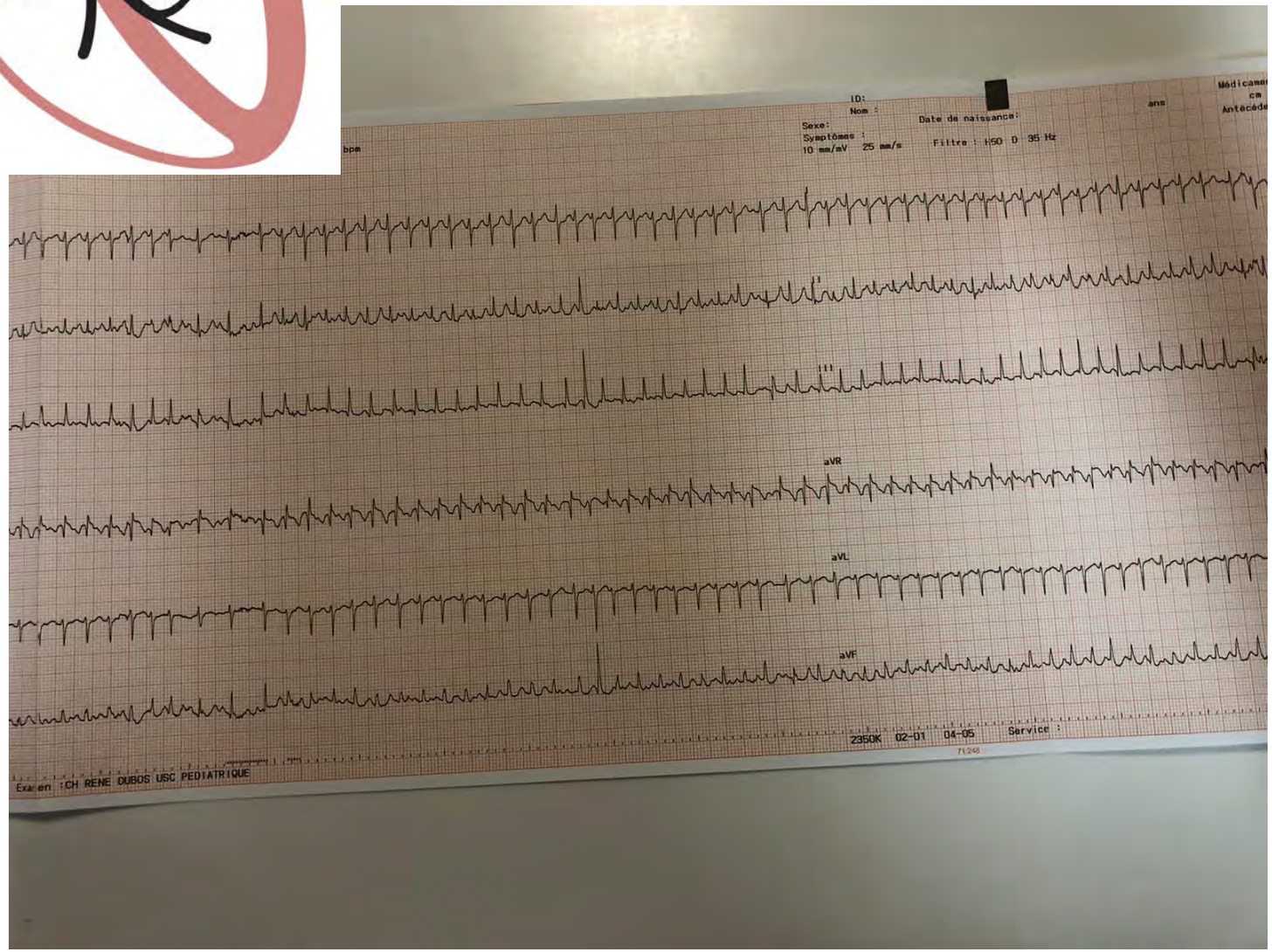


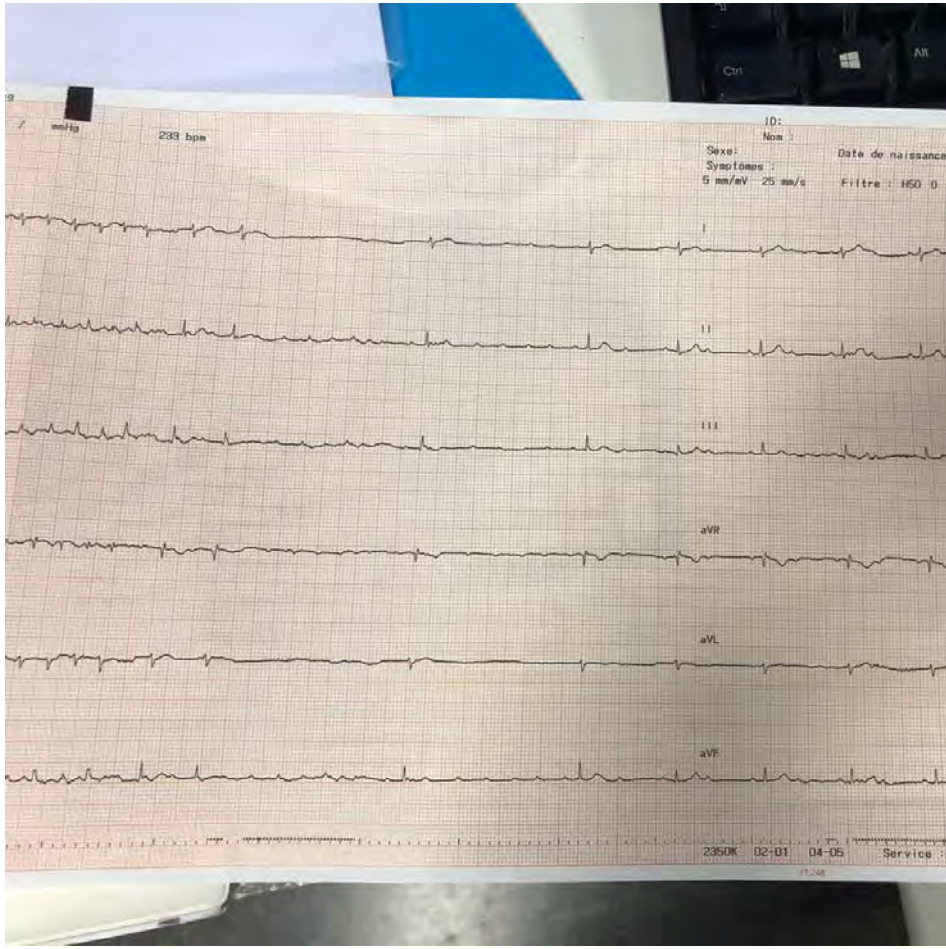




TACHYCARDIE ATRIALE

A > V ++ ou A = V



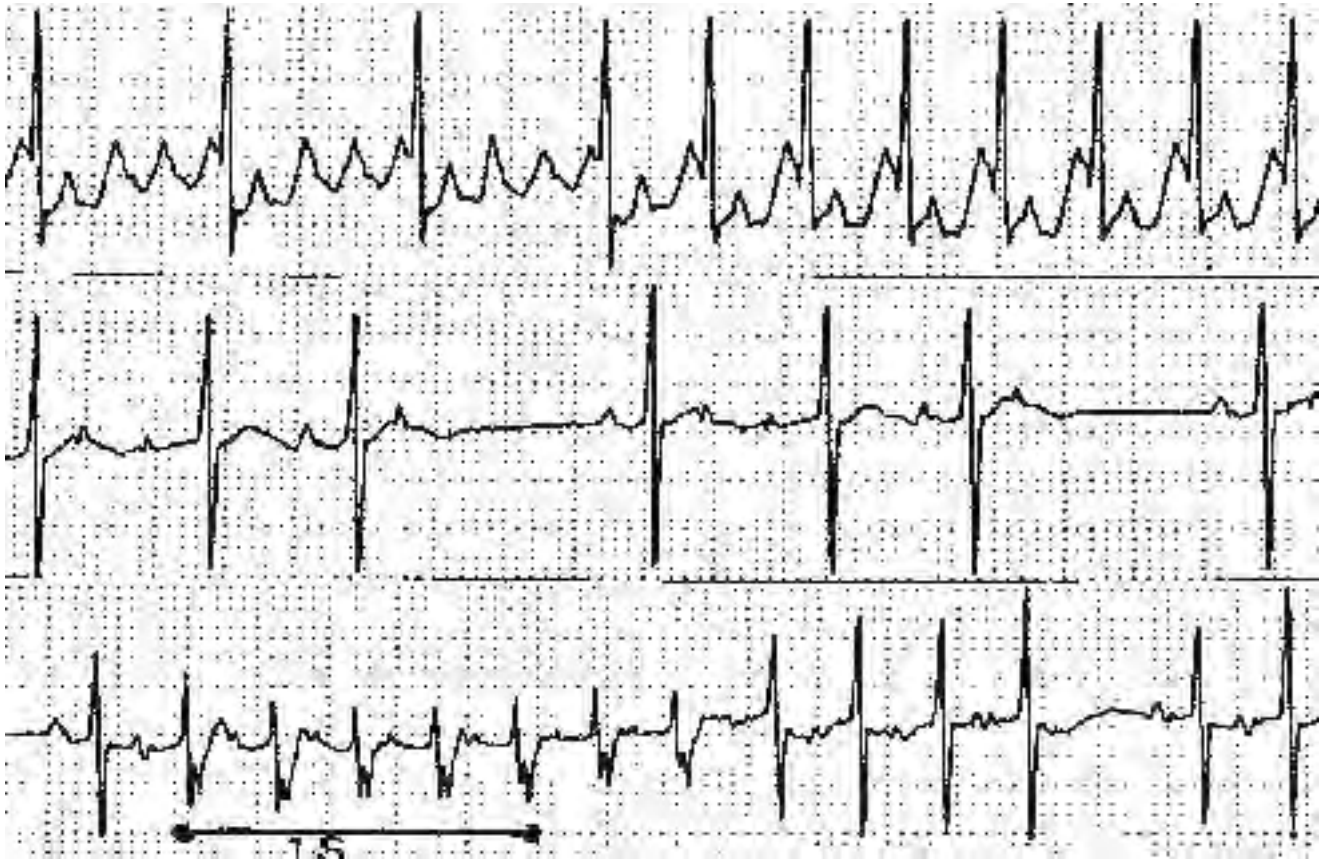


Striadyne

Tachycardie Atriale Chaotique

A > V ++ ou A = V

- Co existence d'au moins 3 ondes P différentes
- Intervalles P-P irréguliers
- Passages en FA et/ou flutter
- Traitement antiarythmique
- Bon pronostic



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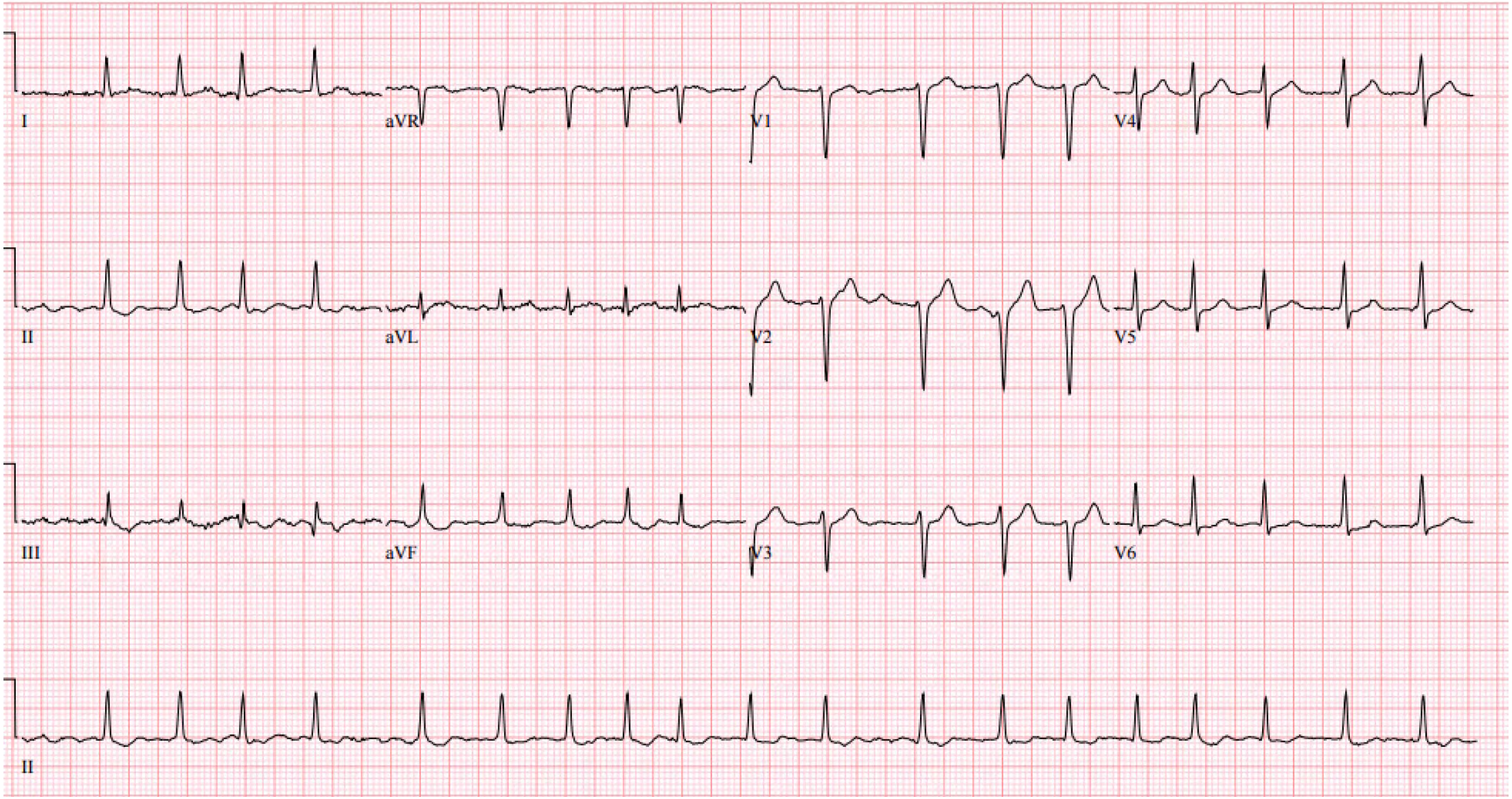
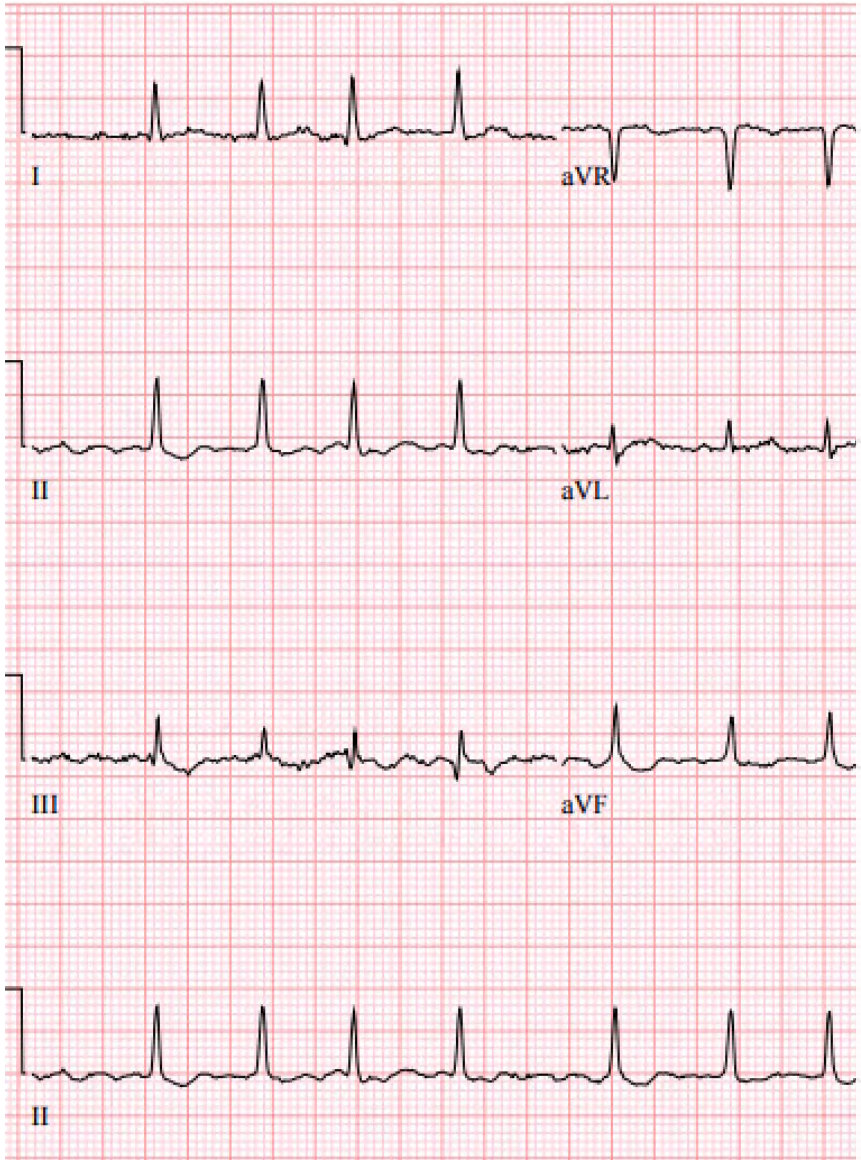

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

Fibrillation Atriale



- **Rythme irrégulier**
- **Trémulation ligne de base, pas d'onde P**
- **> 30 secondes**
- **QRS fins ++**
- **QRS larges:**
  - **Bloc de branche**
  - **Aberration de conduction**
  - **Pré-excitation ventriculaire (WPW)**

Fibrillation Atriale

- **Rare chez l'enfant**
- **Postop de chirurgie cardiaque**
- **Cardiopathies congénitales, certaines canalopathies**
- **Traitement antiarythmique, peu de données sur l'ablation chez les enfants**

Fibrillation Atriale

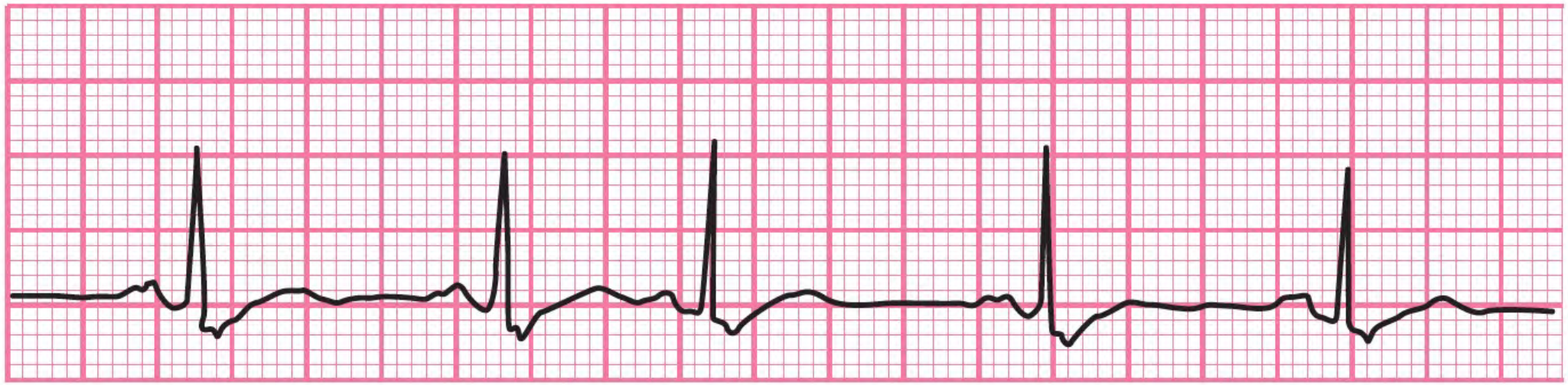
ECG - pièges

- **ESA**
  - Ondes P visibles

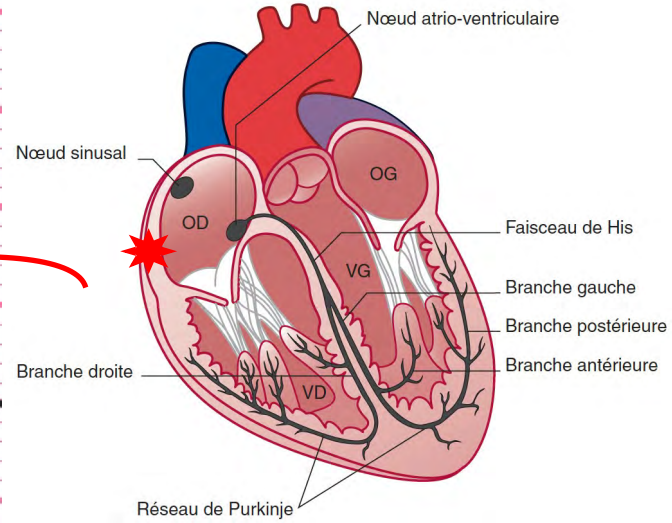
- **FA régulières**
  - BAV complet + échappement
  - Stimulateur cardiaque
  - Bitachycardie: FA + TV

- **QRS larges**
  - Pré-excitation ventriculaire
  - Bloc de branche

???

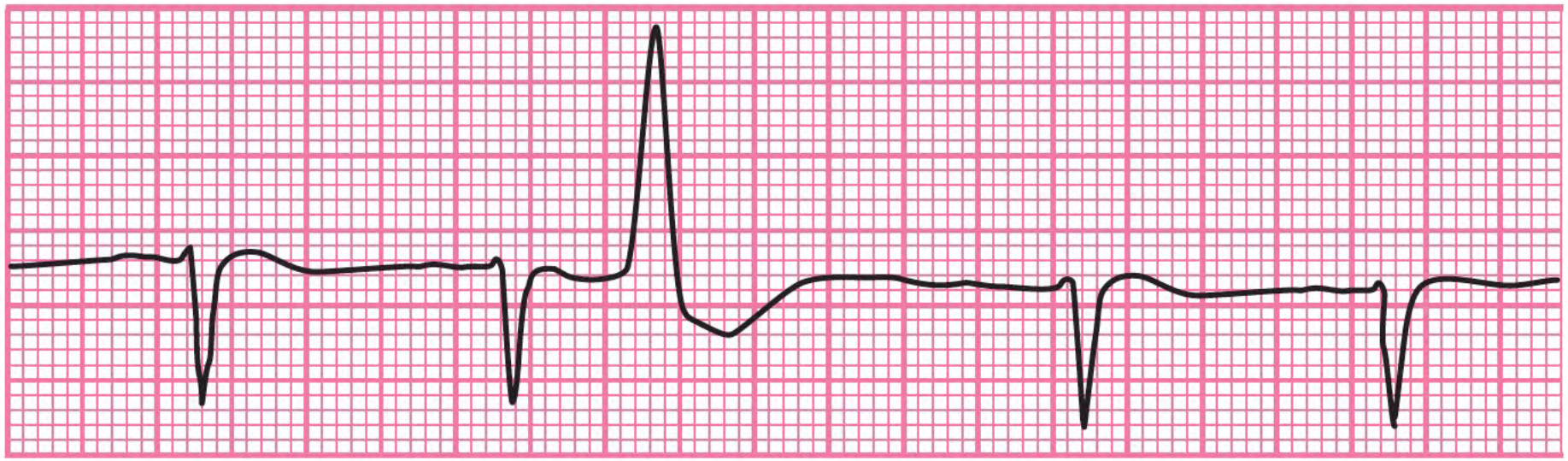


Extrasystoles Atriales

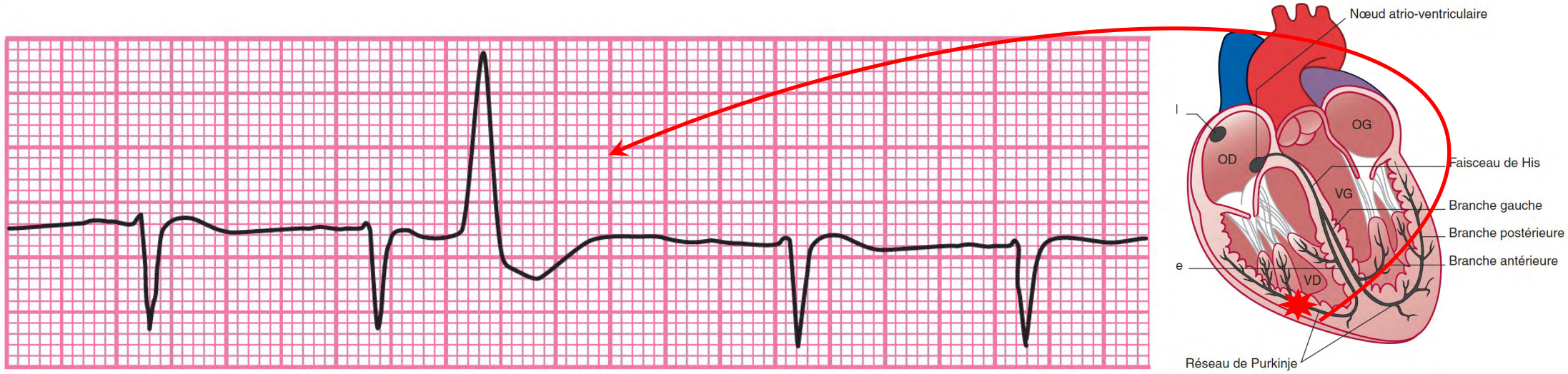


- **Banales chez les nouveaux nés, immaturité**
- **Eliminer cardiopathie si charge importante (% sur 24h)**
- **Traitement uniquement si symptômes ou retentissement sur fonction ventriculaire**

???



Extrasystoles Ventriculaires

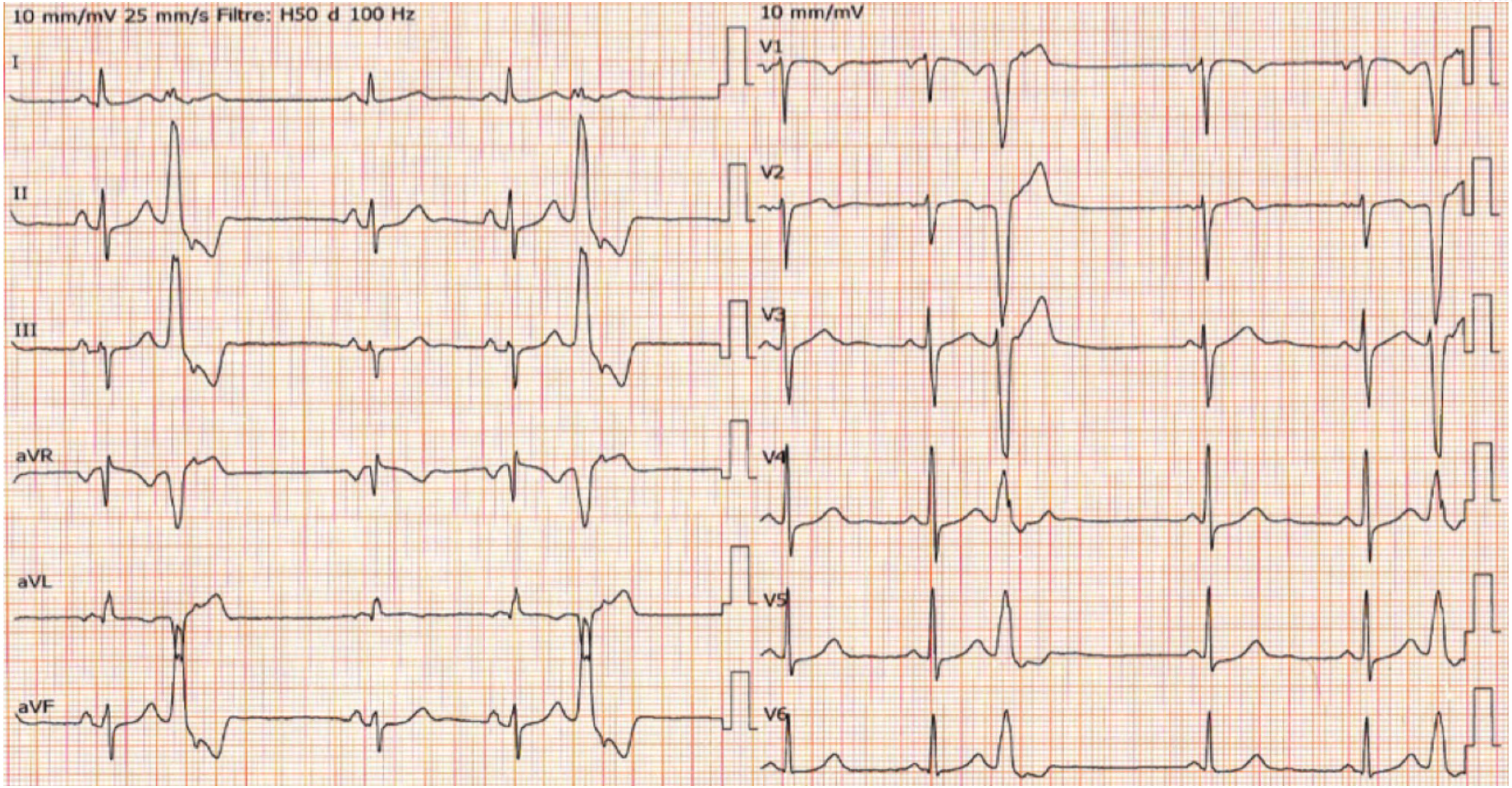


- **Eliminer cardiopathie, le plus souvent bénignes sur cœur sain**

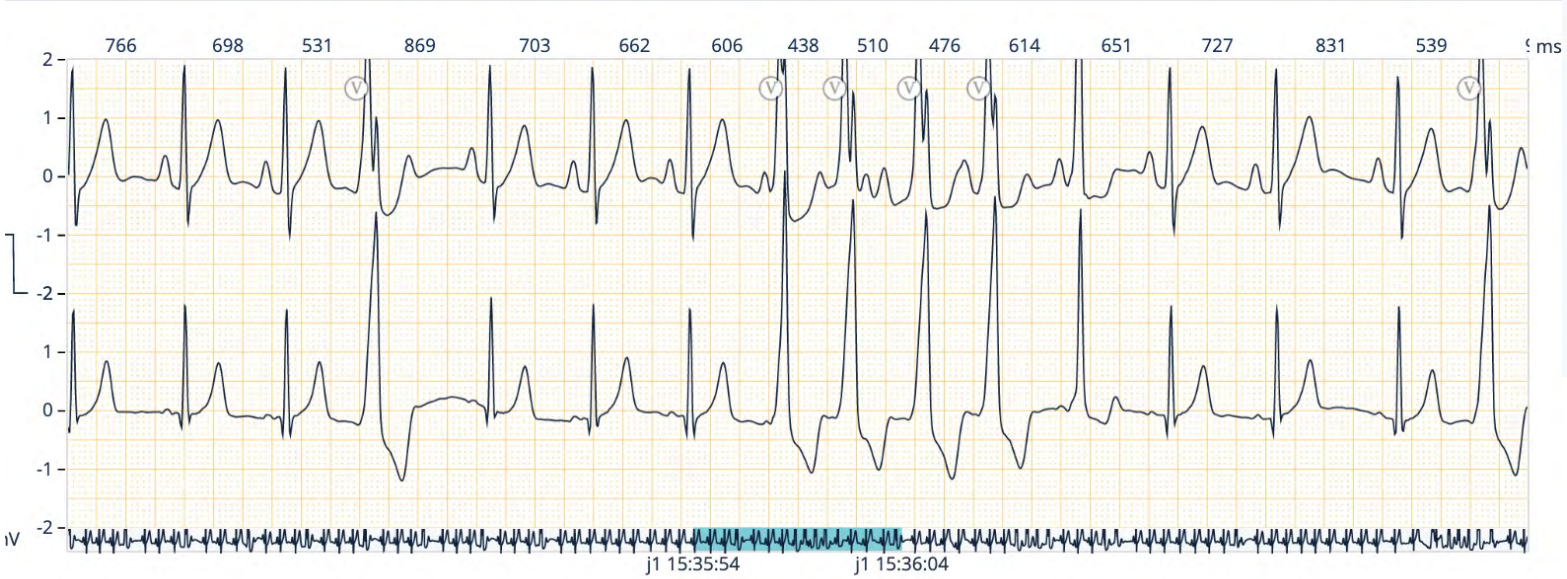
- **Bilan =**
  - **ETT**
  - **Epreuve d'effort (disparition à l'effort ?)**
  - **Holter (charge sur 24h, monomorphe vs. polymorphe, recherche de TV)**

- **Traitement uniquement si symptômes ou retentissement sur fonction ventriculaire**

ESV Benignes



Extrasystoles Ventriculaires



Extrasystoles Ventriculaires

Nombre d'ESV : 15288 (15.5 %)

Nombre de morphologies : 1

Nombre de doublets : 247 (0.5 %)

Nombre de bigéminées : --

Nombre de trigéminées : 3 (< 0.01 %)

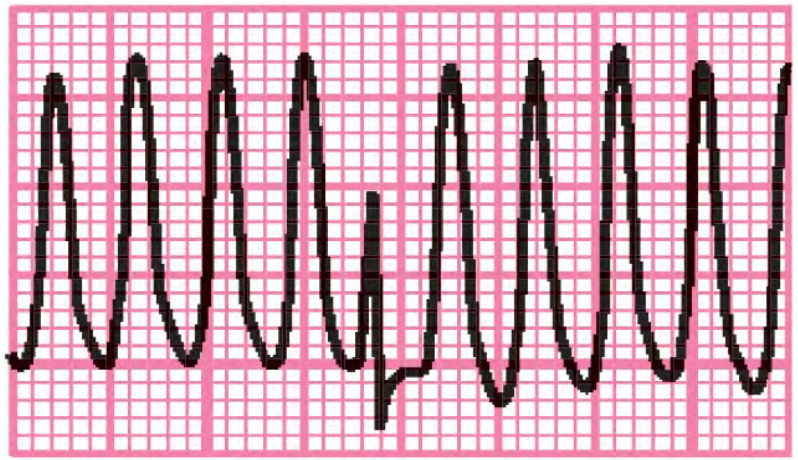
???

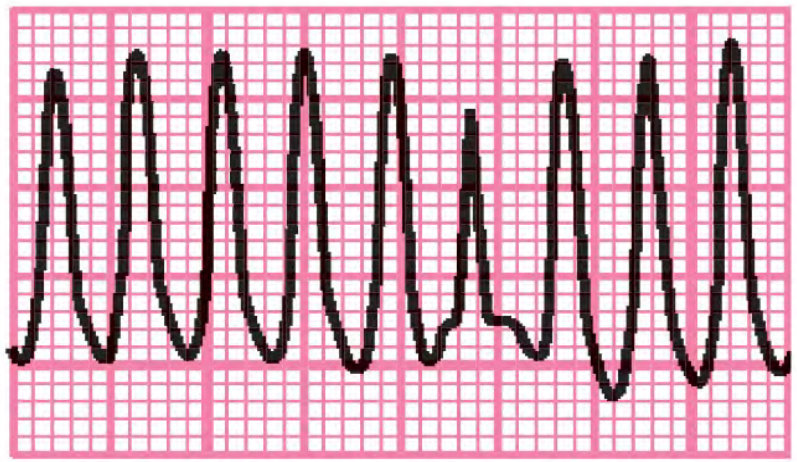

V1

Tachycardie Ventriculaire

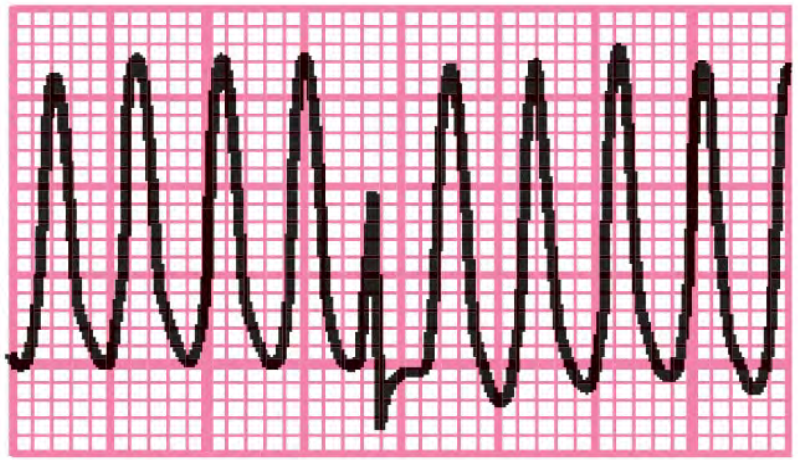
Dissociation atrio-ventriculaire
V > A = TV !

???

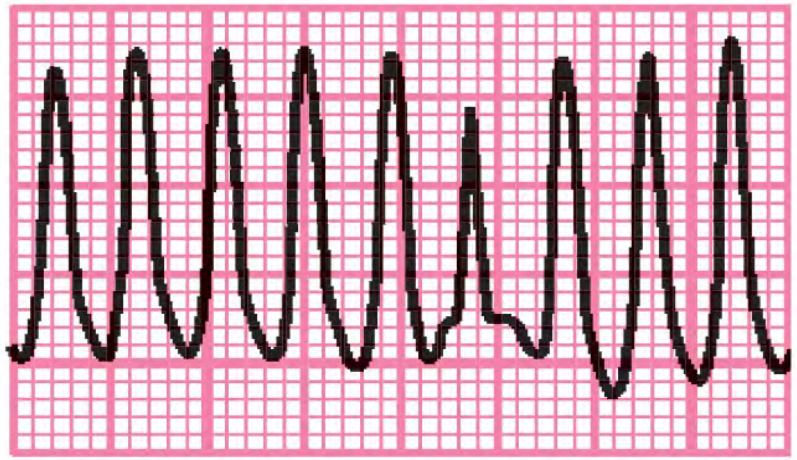




Tachycardie Ventriculaire



f



c

Complexes de fusion (f) et de capture (c)

- **Complexe de capture = QRS fins en rapport avec une onde P qui conduit aux ventricules au cours d'une tachycardie ventriculaire**

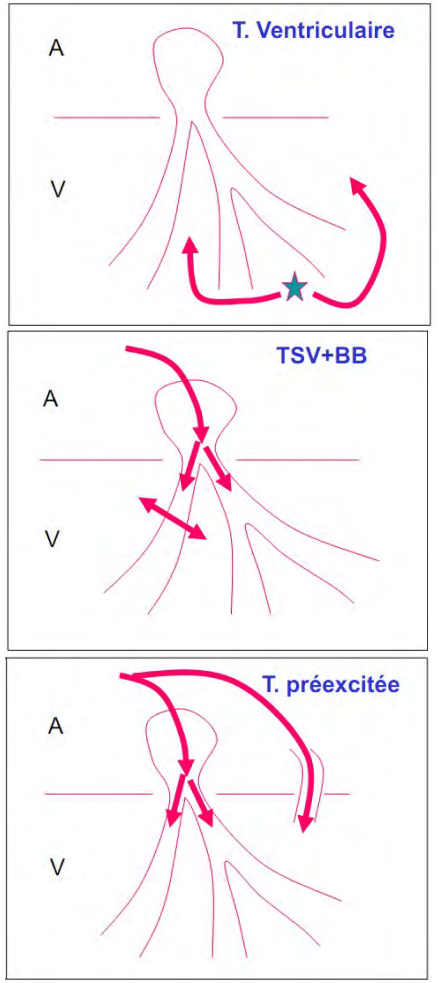
- **Complexe de fusion = fusion entre un QRS fins qui résulte d'une conduction d'une onde P aux ventricules et du complexe QRS large de tachycardie ventriculaire avec donc une largeur intermédiaire**

Tachycardie Ventriculaire

Toute Tachy à QRS larges est une TV jusqu'à preuve du contraire

2 signes pathognomoniques = dissociation AV et complexes capture/fusion

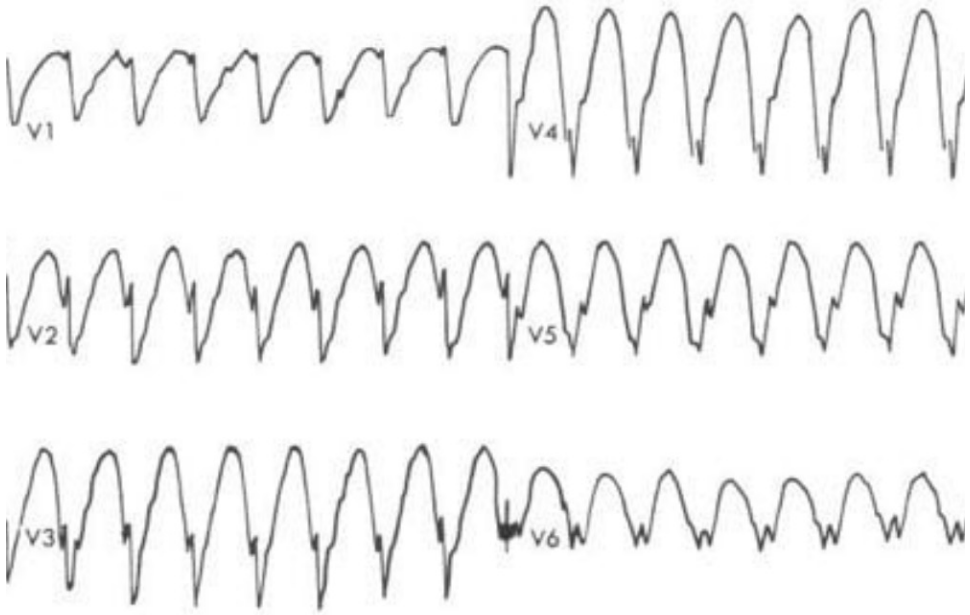
Autres signes en faveur d'une TV ?



TACHYCARDIE VENTRICULAIRE

Autres signes en faveur d'une TV ?

- **QRS > 160 ms,**
- **Onde R exclusive en aVR,**
- **Concordance positive (R exclusif) ou négative (aspect QS) dans les dérivations précord**



TACHYCARDIE VENTRICULAIRE

Prise en charge

- **Mauvaise tolérance = CEE en urgence ++**
- **Bilan étiologique:**
  - **Cardiopathie ? (congénitale, CMD, CMH…)**
  - **Myocardite**
  - **Canalopathie**
  - **…**
  - **TV sur cœur sain = diagnostic d'élimination**
- **Traitement antiarythmique +/- ablation +/- DAI (cf cours sur DAI)**

???


V1

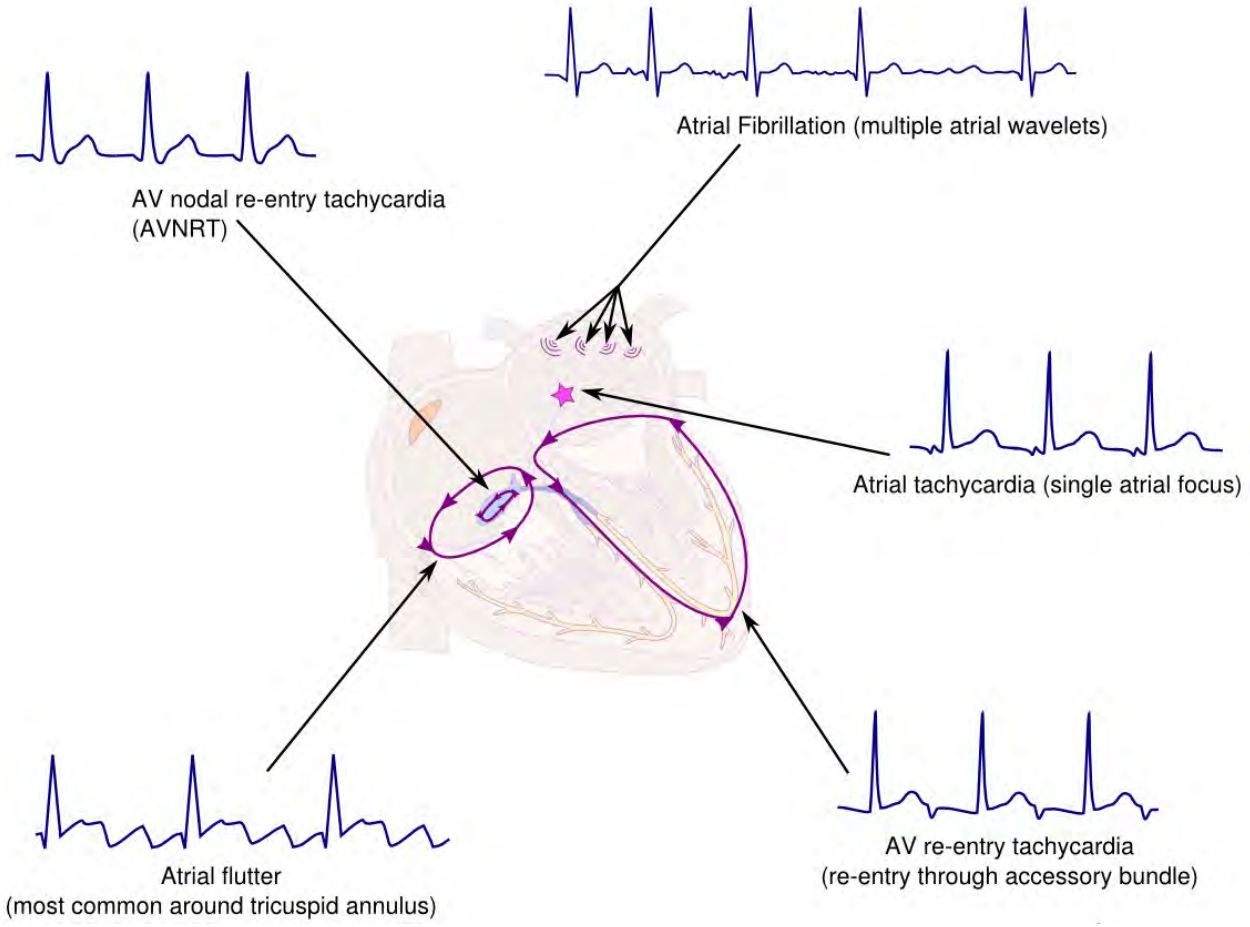
Fibrillation Ventriculaire

FV = CEE

0.5-2 J/kg

Algorithme Diagnostique

A=V ?

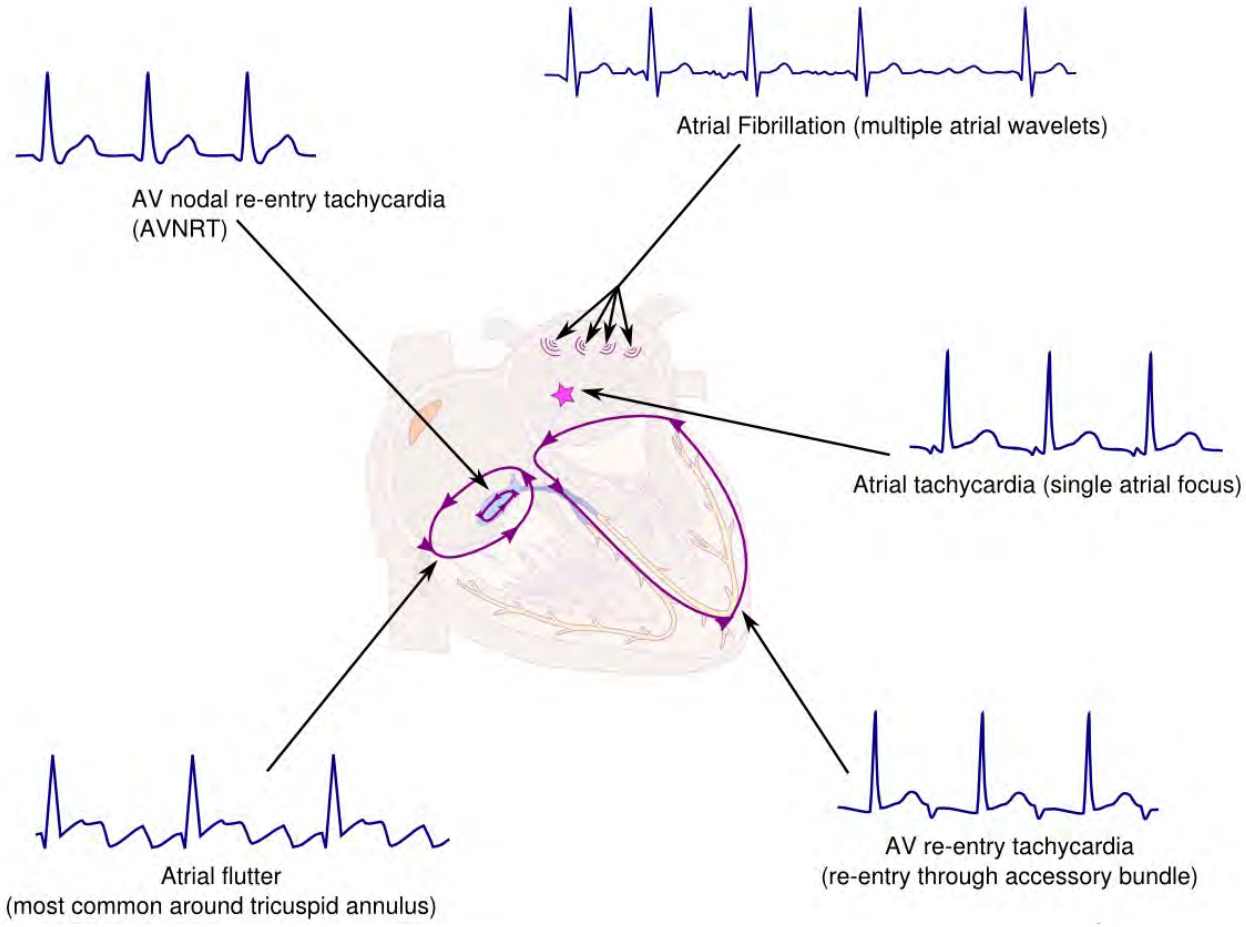


Algorithme Diagnostique

A=V ?

- **TS**
- **TJ (AVRT & AVNRT)**
- **TA**
- **Flutter**
- **TV (A retro)**

A>V ?



Algorithme Diagnostique

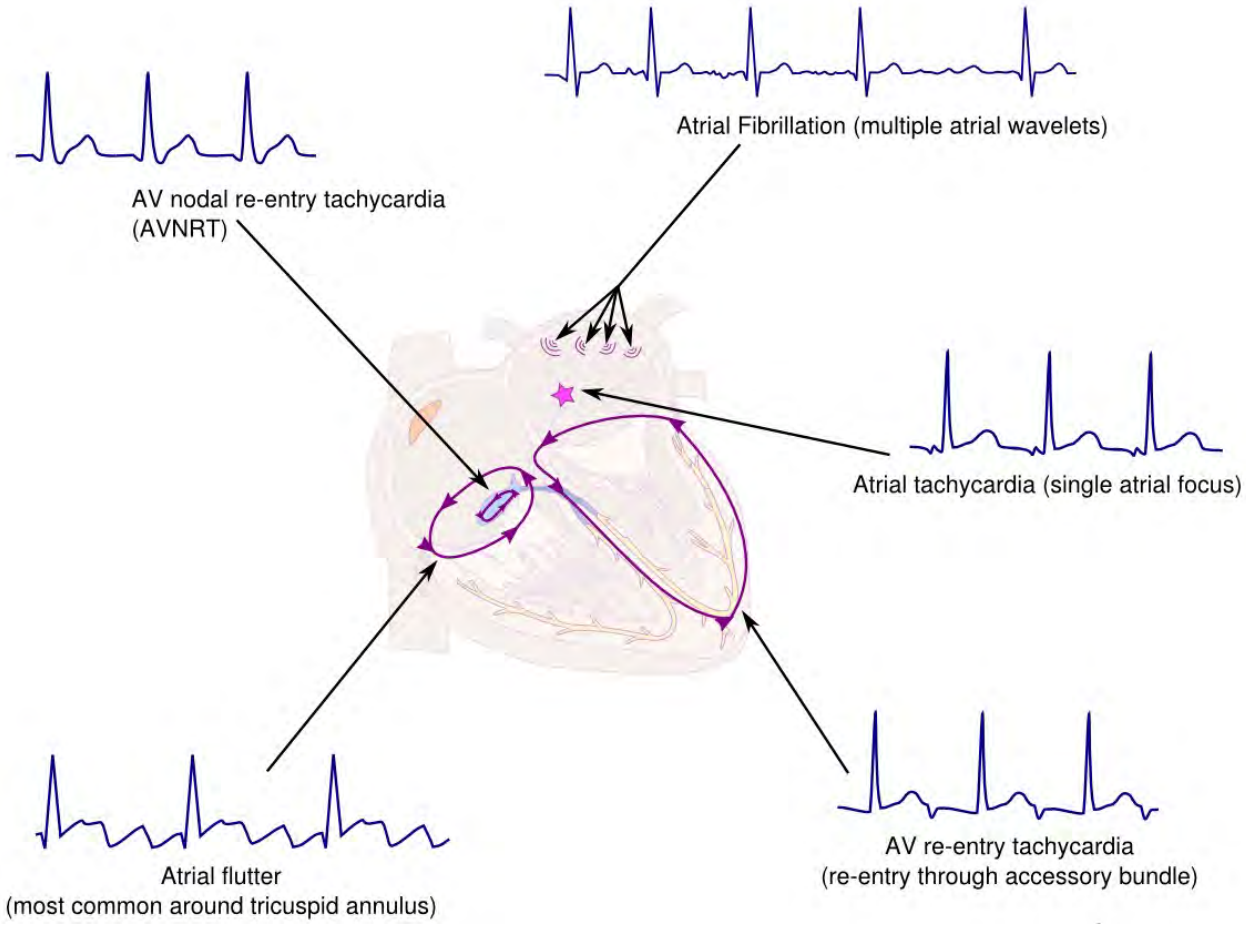
A=V ?

- **TS**
- **TJ (AVRT & AVNRT)**
- **TA**
- **Flutter**
- **TV (A retro)**

A>V ?

- **TA**
- **Flutter**

A<V ?



Algorithme Diagnostique

A=V ?

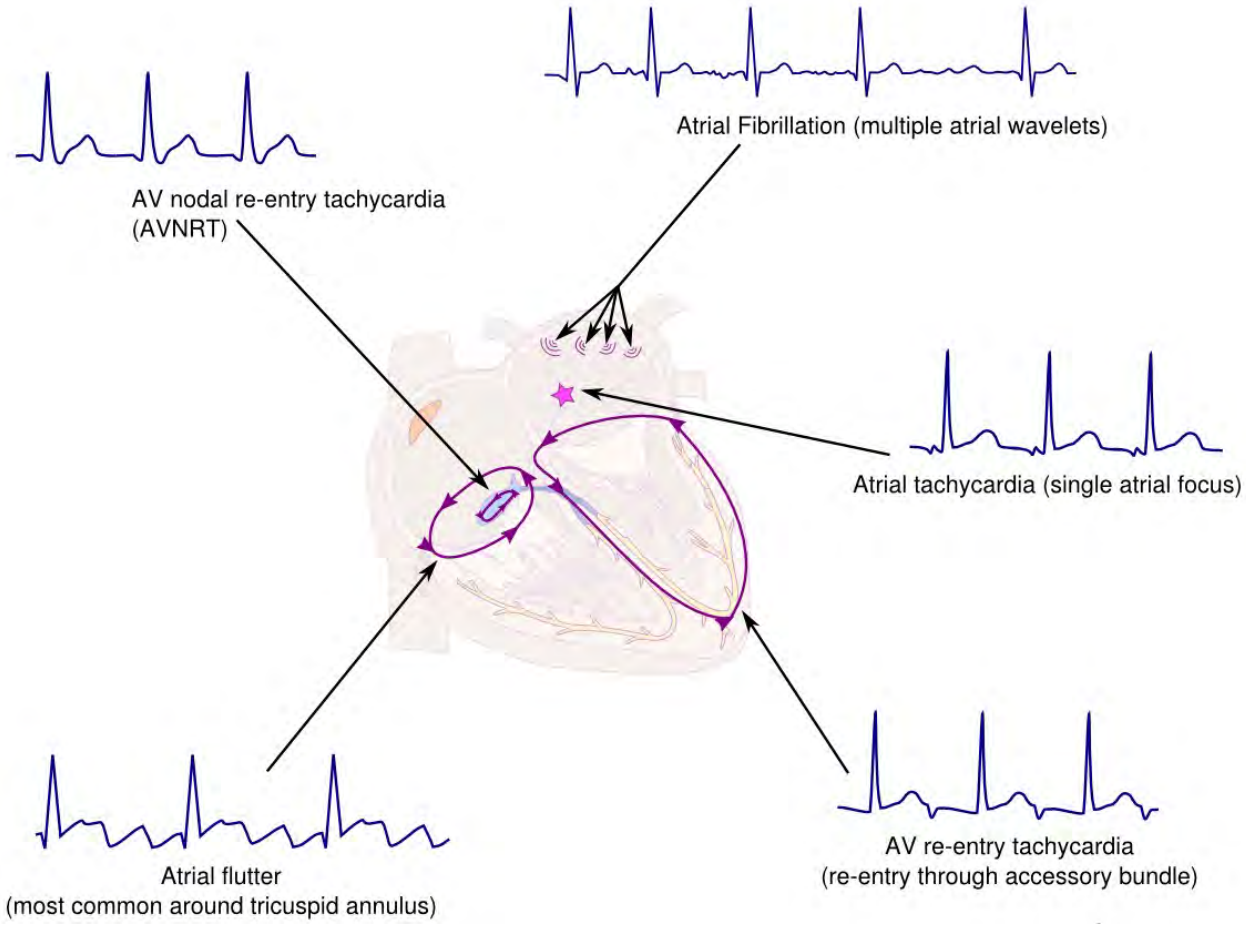
- **TS**
- **TJ (AVRT & AVNRT)**
- **TA**
- **Flutter**
- **TV (A retro)**

A>V ?

- **TA**
- **Flutter**

A<V ?

- **TV**
- **JET**



Algorithme Diagnostique

A=V

Ou P non visible

- **TS**
- **TJ (AVRT & AVNRT)**
- **TA**
- **Flutter**
- **TV (A retro)**

↓

Manœuvres vagales ou Adénosine

Reduction

Algorithme Diagnostique

A=V

Ou P non visible

- **TS**
- **TJ (AVRT & AVNRT)**
- **TA**
- **Flutter**
- **TV (A retro)**

Manœuvres vagales ou Adénosine

A>V

Reduction

TJ
(AVRT & AVNRT)

Algorithme Diagnostique

A=V

Ou P non visible

- TS
- TJ (AVRT & AVNRT)
- TA
- Flutter
- TV (A retro)

Manœuvres vagales ou Adénosine

A>V

- TA
- Flutter

Reduction

TJ
(AVRT & AVNRT)

A<V

ou pas d'effet

Algorithme Diagnostique

A=V

Ou P non visible

- TS
- TJ (AVRT & AVNRT)
- TA
- Flutter
- TV (A retro)

Manœuvres vagales ou Adénosine

A>V

- TA
- Flutter

Reduction

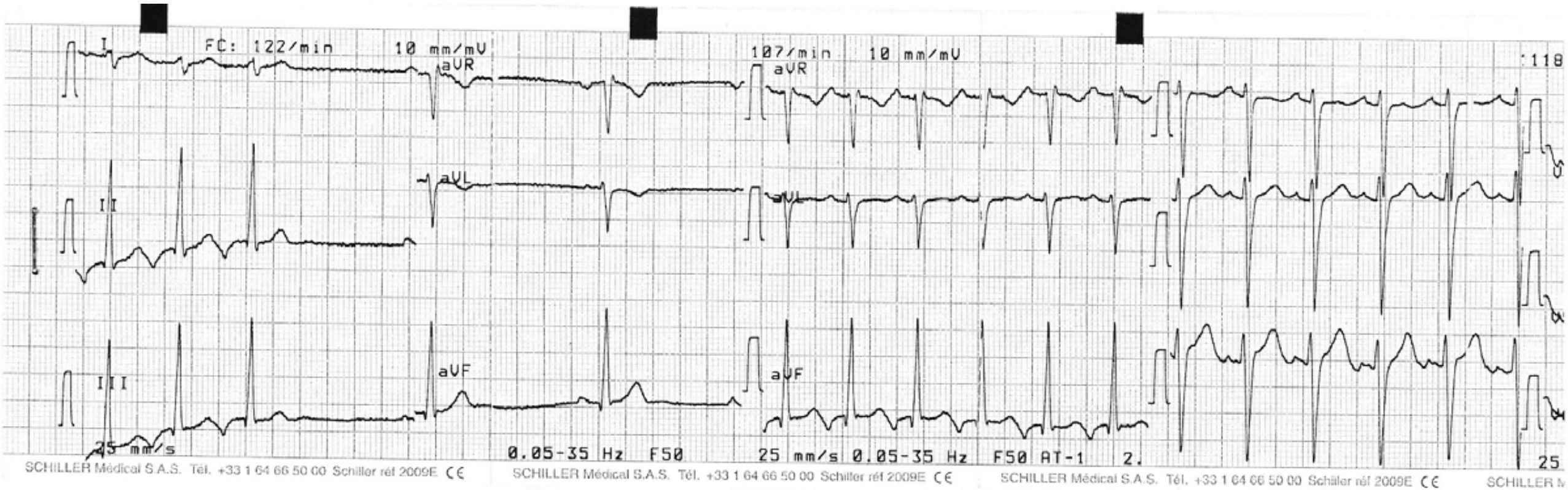
TJ
(AVRT & AVNRT)

A<V

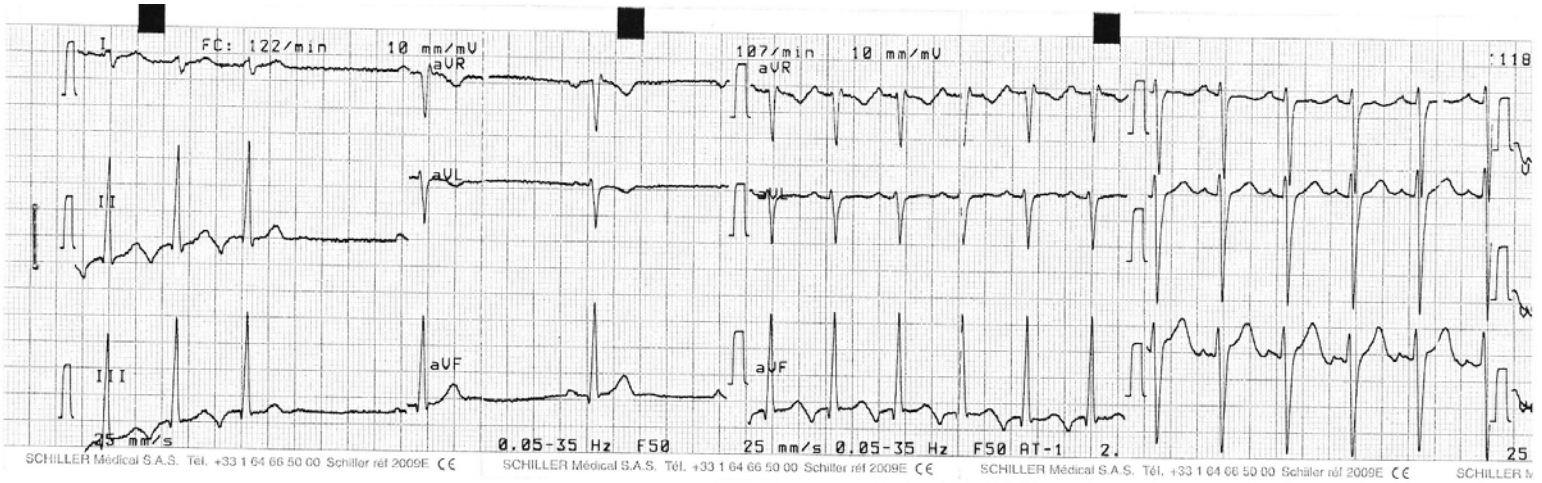
ou pas d'effet

- TV
- JET

???


I
II
III
FC: 122/min
10 mm/mV
aVR
aVL
aVF
25 mm/s
0.05-35 Hz F50
SCHILLER Médical S.A.S. Tél. +33 1 64 66 50 00 Schiller réf 2009E CE
107/min
10 mm/mV
aVR
aVL
aVF
25 mm/s 0.05-35 Hz F50 AT-1 2.
SCHILLER Médical S.A.S. Tél. +33 1 64 66 50 00 Schiller réf 2009E CE
118
25
SCHILLER Médical S.A.S. Tél. +33 1 64 66 50 00 Schiller réf 2009E CE

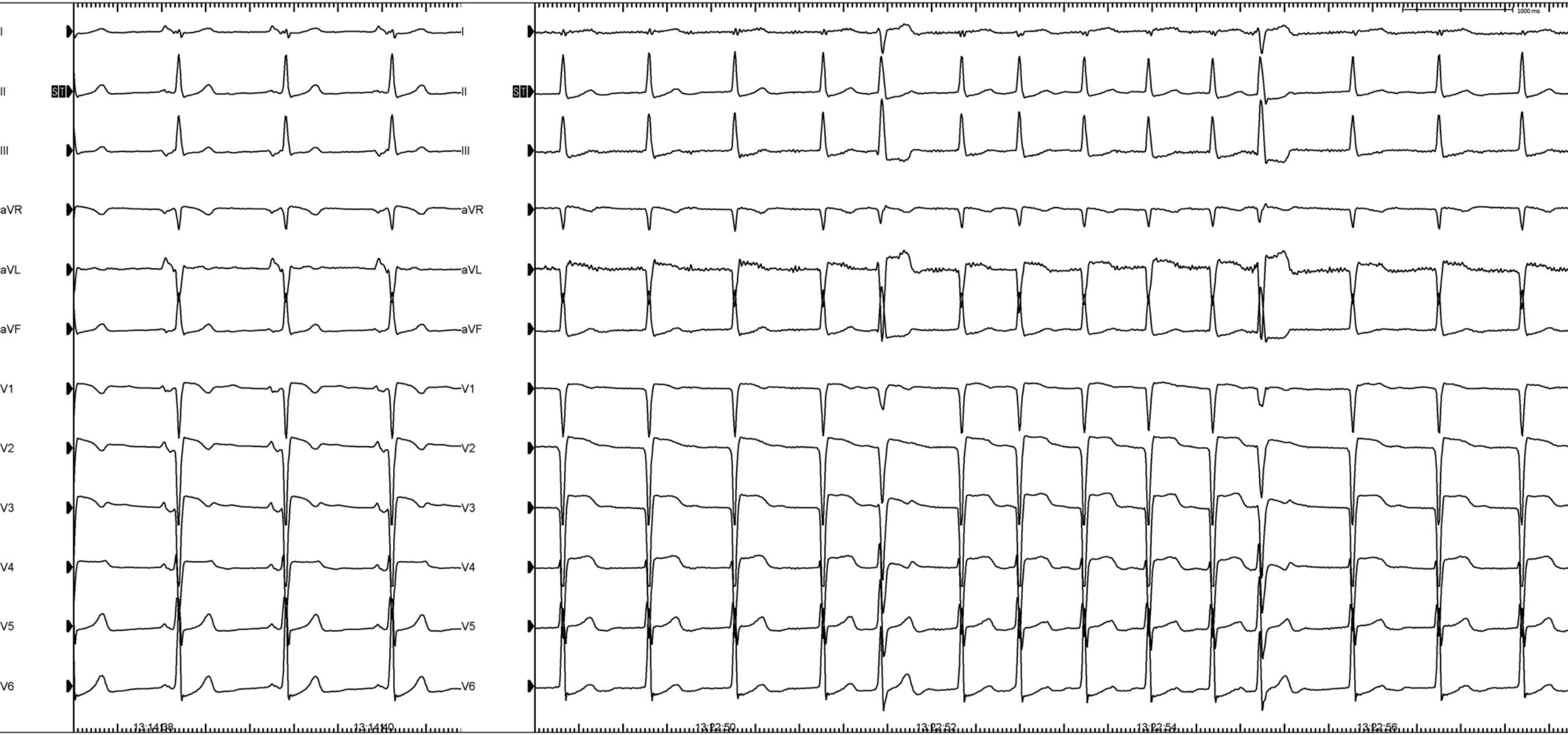
PJRT



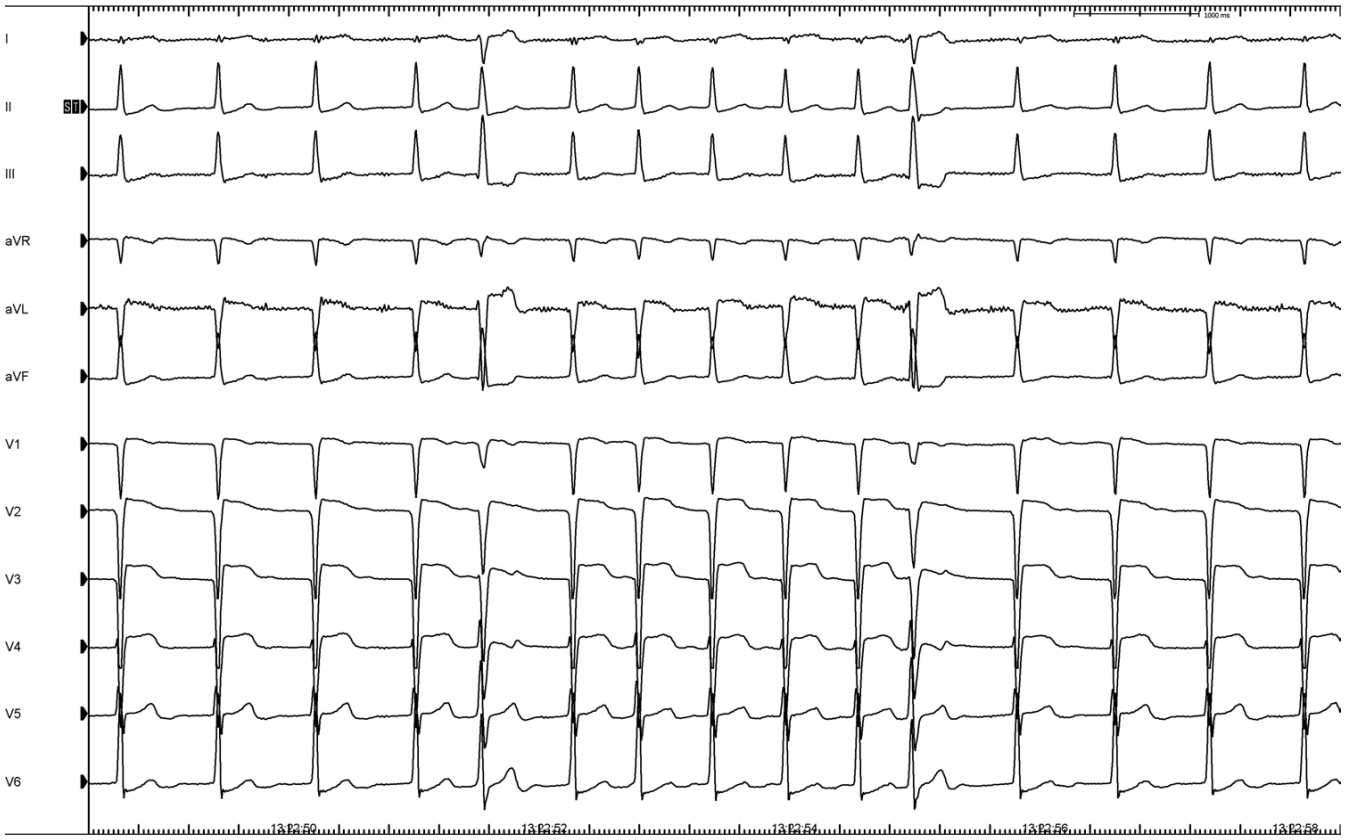
Permanent Junctionnal Reciprocating Tachycardia

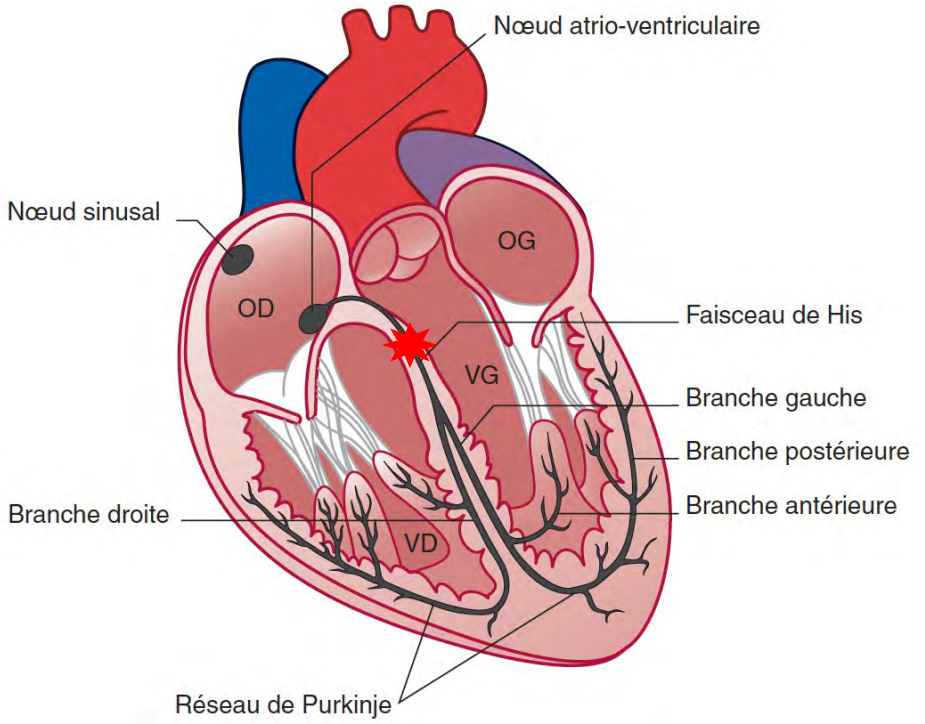
- **RP’ long (VA rétrograde exclusive décrémentielle), accès en salves incessantes**
- **Retentissement possible sur fonction ventriculaire**
- **Anti arythmique pour contrôle du rythme ou de la fréquence**
- **Régression spontanée ~20%**
- **Ablation**

???


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
13:14:38
13:14:40
13:12:50
13:12:52
13:12:54
13:12:56

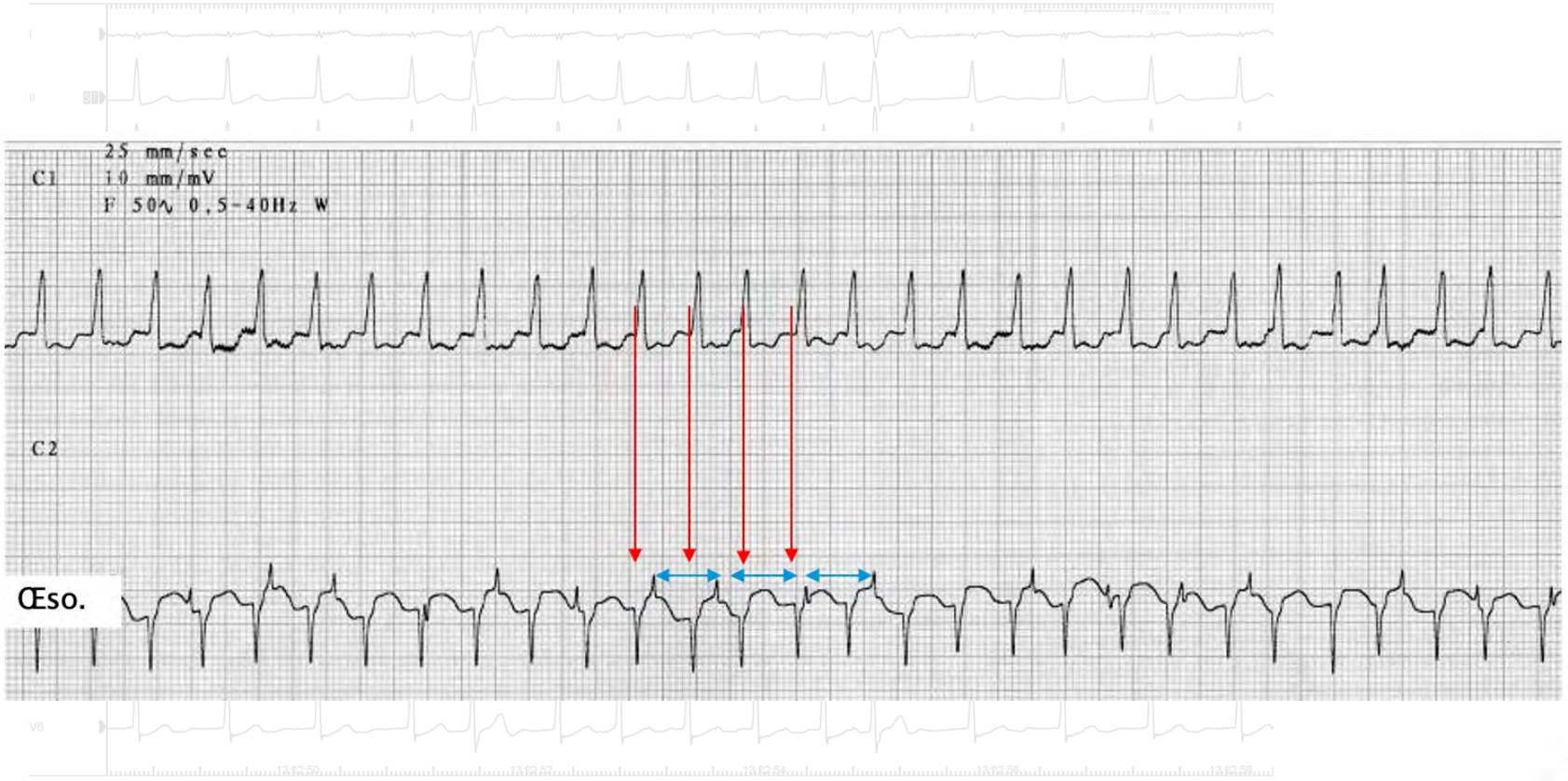
JET

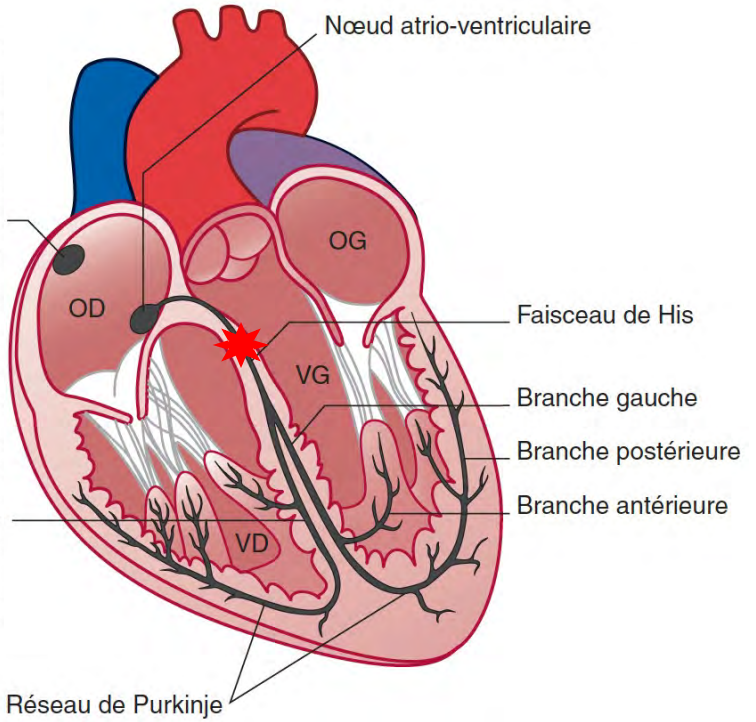




Junctionnal Ectopic Tachycardia

JET





Junctionnal Ectopic Tachycardia

TACHYCARDIES FOETALES

AHA Scientific Statement

Diagnosis and Treatment of Fetal Cardiac Disease

A Scientific Statement From the American Heart Association

Endorsed by the American Society of Echocardiography and Pediatric and Congenital Electrophysiology Society

*The American Institute of Ultrasound in Medicine supports the value and findings of the statement.**

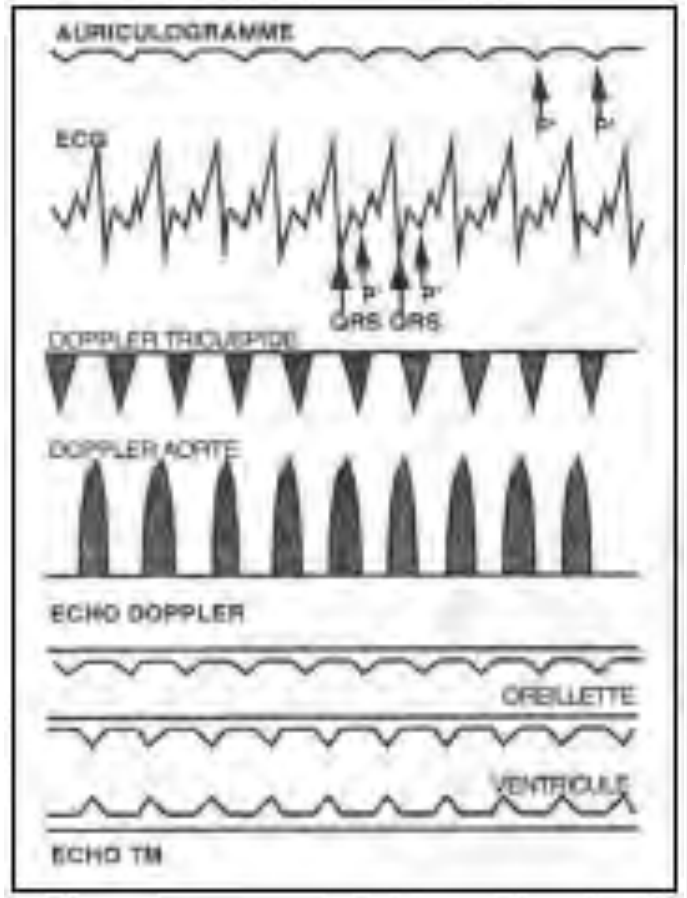
The Society of Maternal Fetal Medicine supports the statement's review of the subject matter and believe it is consistent with its existing clinical guidelines.†

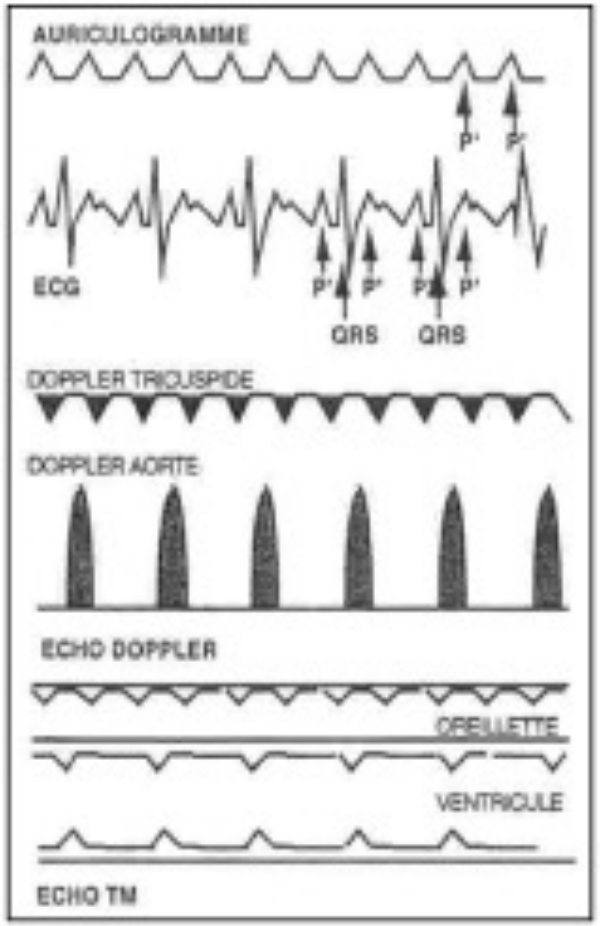
Mary T. Donofrio, MD, Chair; Anita J. Moon-Grady, MD; Lisa K. Hornberger, MD; Joshua A. Copel, MD; Mark S. Sklansky, MD; Alfred Abuhamad, MD; Bettina F. Cuneo, MD; James C. Huhta, MD; Richard A. Jonas, MD; Anita Krishnan, MD; Stephanie Lacey, DO; Wesley Lee, MD; Erik C. Michelfelder, Sr, MD; Gwen R. Rempel, RN; Norman H. Silverman, MD, DSc, FAHA; Thomas L. Spray, MD, FAHA; Janette F. Strasburger, MD; Wayne Tworetzky, MD; Jack Rychik MD; on behalf of the American Heart Association Adults With Congenital Heart Disease Joint Committee of the Council on Cardiovascular Disease in the Young and Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and Council on Cardiovascular and Stroke Nursing

Donofrio et al. Circulation 2014

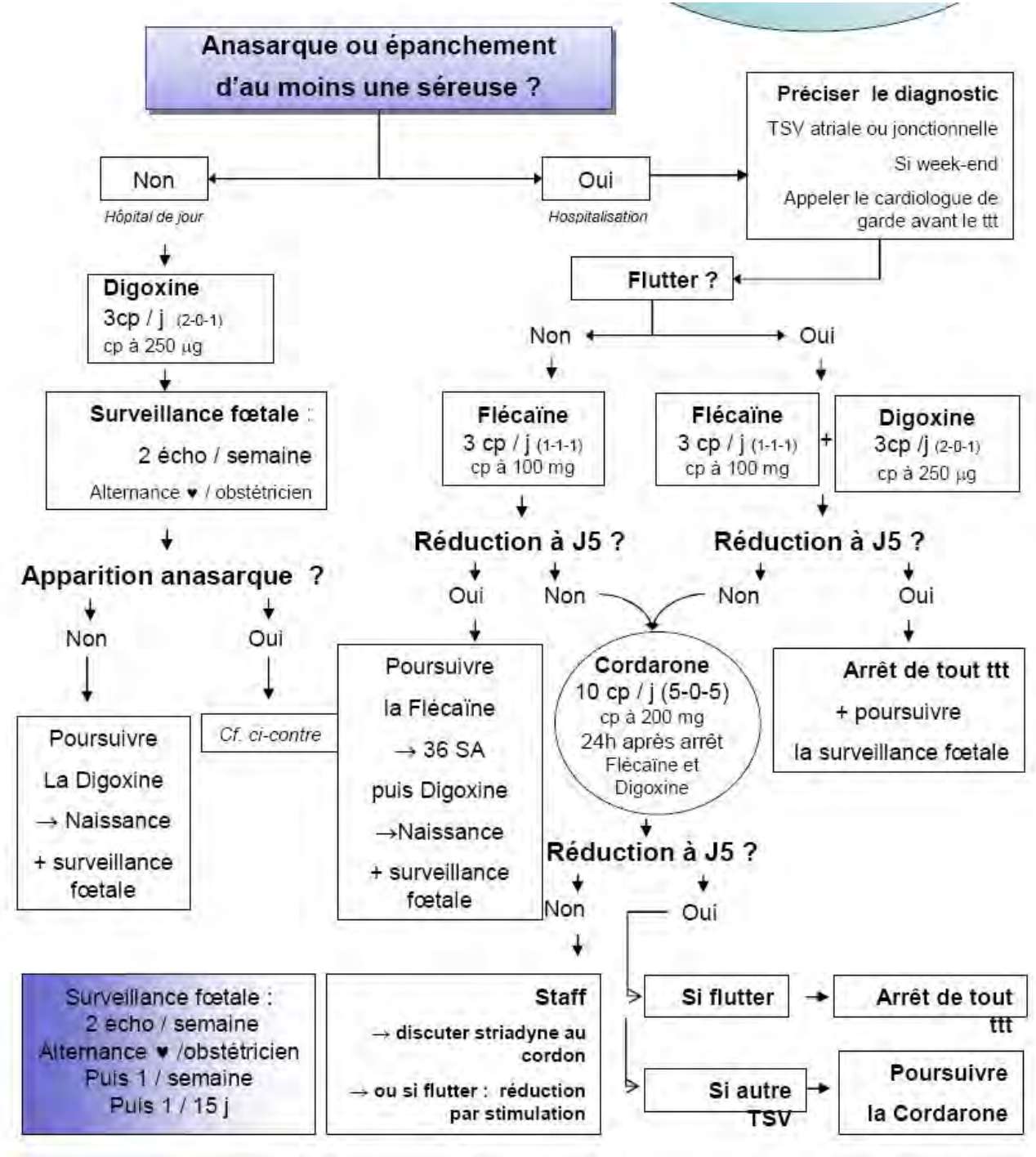
TACHYCARDIES FOETALES

- **FC > 180-200 bpm**
- **Diagn possible dès 20 SA**
- **2 mécanismes principaux:**
  - **TJ (AVRT)** **A = V**
  - **Flutter** **A > V**





Protocole Necker



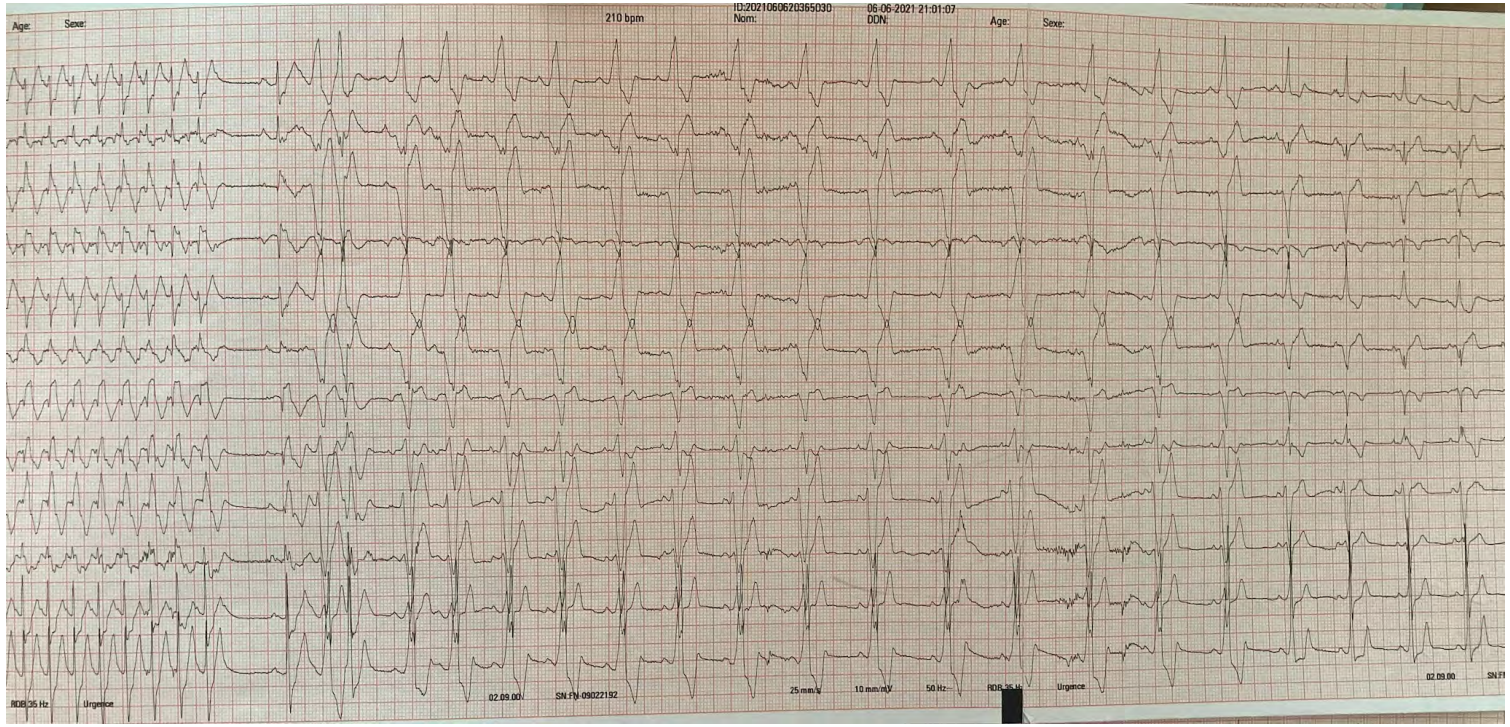
Palpitations Paroxystiques

Alivecor Kardia

Montres Withings

PETIT CŒUR DE BEURRE AU RYTHME DE LA VIE CARDIOPATHIE CONGENITALE

Arythmies en Pédiatrie et Cardiologie Congénitale



Victor WALDMANN

Hôpital Européen Georges Pompidou — Hôpital Necker