

ECG

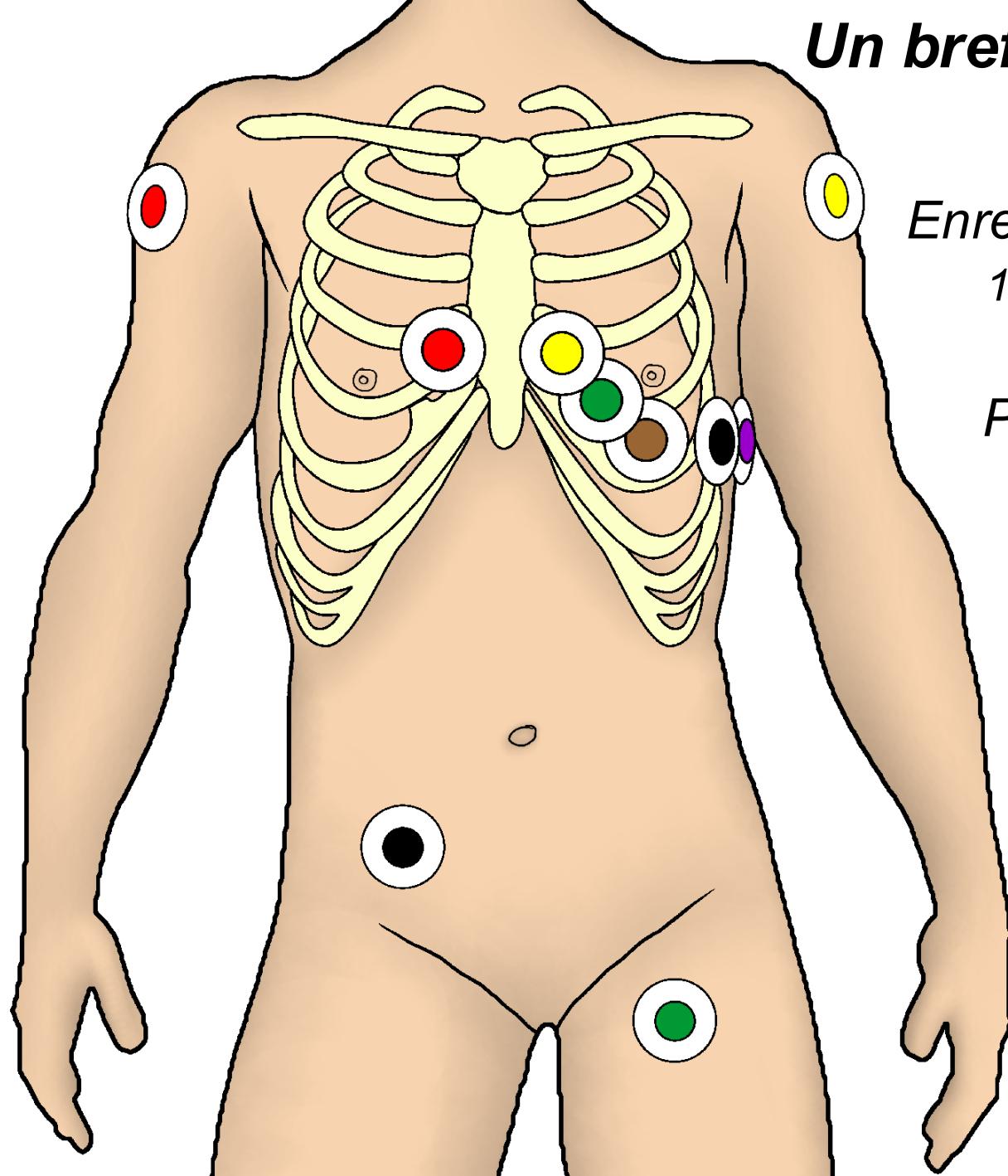
Vendredi 6 février 2026
DIU Réanimation cardio-pédiatrique

Dr TIXIER Romain

Service d'électrophysiologie et stimulation cardiaque

CHU BORDEAUX & IHU LIRYC

Un bref rappel concernant la position des électrodes



Enregistrement standard :
10 électrodes = 12 dérivations

Plan FRONTAL

3 électrodes :

- **R** — M. S. Droit
- **L** — M.S. Gauche
- **F** — M. I. Gauche

1 électrode neutre (*stabilisation de l'enregistrement*)

- **N** — M. I. Droit habituellement

Plan HORIZONTAL (précordial)

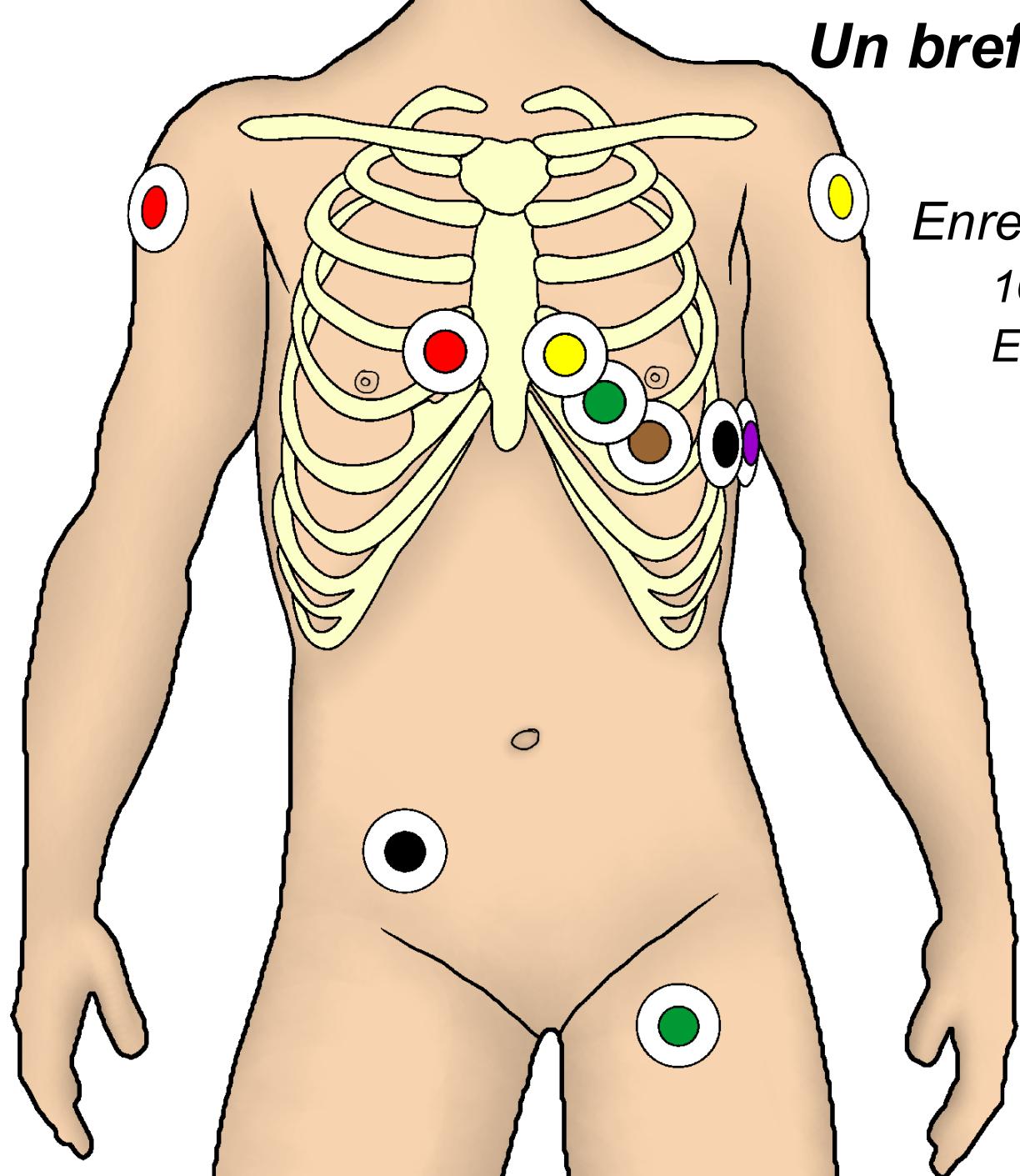
6 électrodes

V1 IV^e EI D ; **V2** IV^e EI G

V3 **V4** V^e EI mid-claviculaire

V5 **V6** mid-axillaire, au même niveau que V4

Un bref rappel concernant la position des électrodes



Enregistrement 18 dérivations :

16 électrodes = 18 dérivations

Enregistrement en 2 temps

*Dérivations **DROITES** :*

V3R et V4R : symétriques de V3 et V4

V_E : au niveau épigastre

*Dérivations **POSTÉRIEURES** :*

V7, V8, V9 : prolongement de V6 vers le dos.

INTRODUCTION : LES REGLES D'OR

1. ECG sans artefact

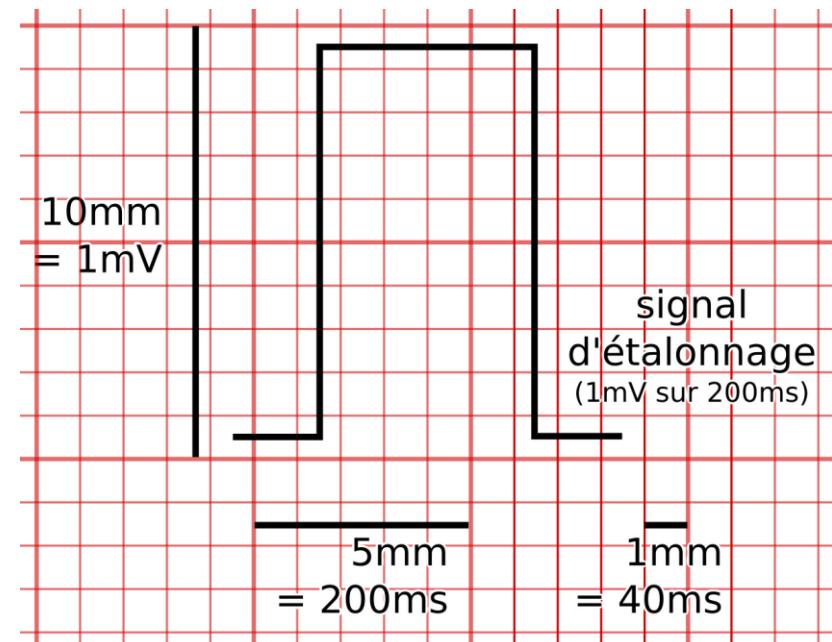
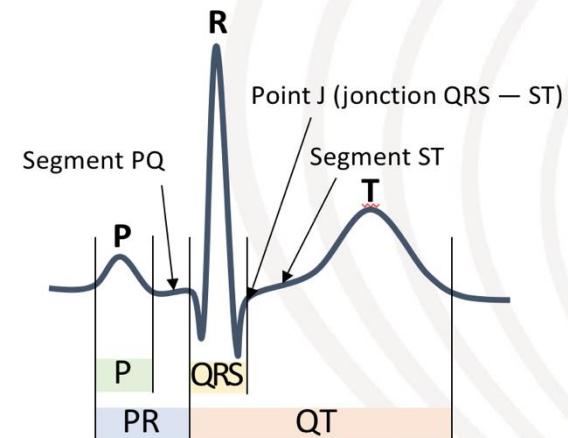
2. Vérification de la **vitesse** de défilement, de l'**amplitude** et des filtres

- vitesse de défilement = 25mm/s = 200ms GC = 40ms PC
- amplitude = 10mm/mV
- filtrage idéalement 0.05-150Hz + 50Hz

3. Ne pas hésiter à faire des **ECG long**

4. Douleur thoracique = **18 dérivations**

5. Eviter **d'écrire** sur les tracés



INTRODUCTION : LES REGLES D'OR

REUSSIR A AVOIR UN ECG DE BONNE QUALITE

SCOPE ≠ ECG

TOUTE MANŒUVRE OU TEST MEDICAMENTEUX = ECG 12D CONTINU

NE PAS HESITER A AVOIR DES ECG LONGS +++

NE PAS GRIBOUILLER SUR LES ECG !

NE PAS CROIRE TOUT CE QUE LA MACHINE VOUS DIT

INTRODUCTION : POINT SUR LES PM & LES DAI

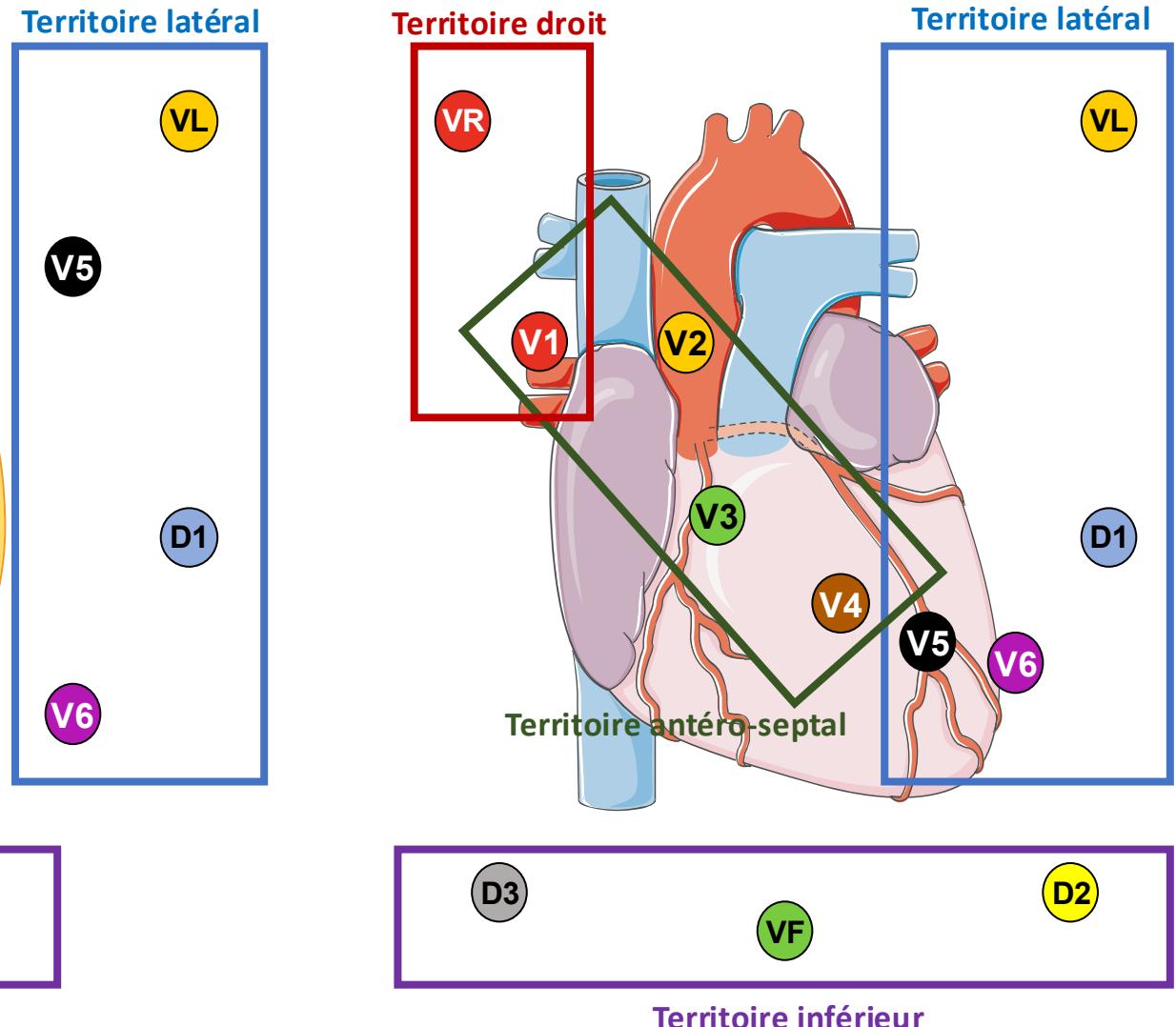
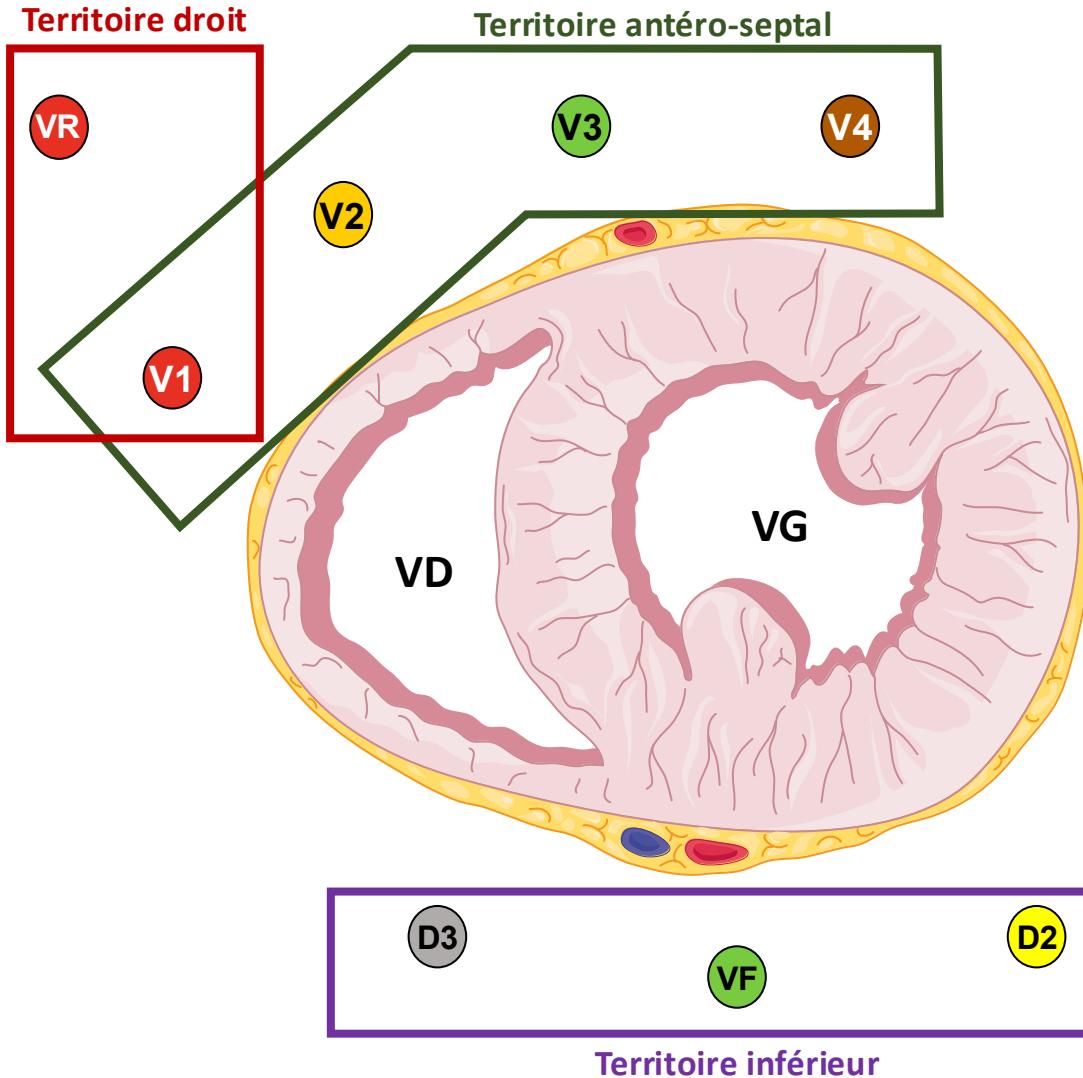
AU DÉPART LES CHOSES ÉTAIENT SIMPLES :

- Boitier de stimulateur **facilement senti sous la peau** et présence d'une **cicatrice**
- Stimulateurs cardiaque réglés en stimulation unipolaire = **artéfacts de stimulations toujours présents**
- **Patients toujours stimulés** (mode unique de stimulation)
- Stimulation dans le VD = **QRS larges et retard gauche** (ie. presque un BBG)
- Un défibrillateur = un stimulateur cardiaque + une fonction de défibrillation

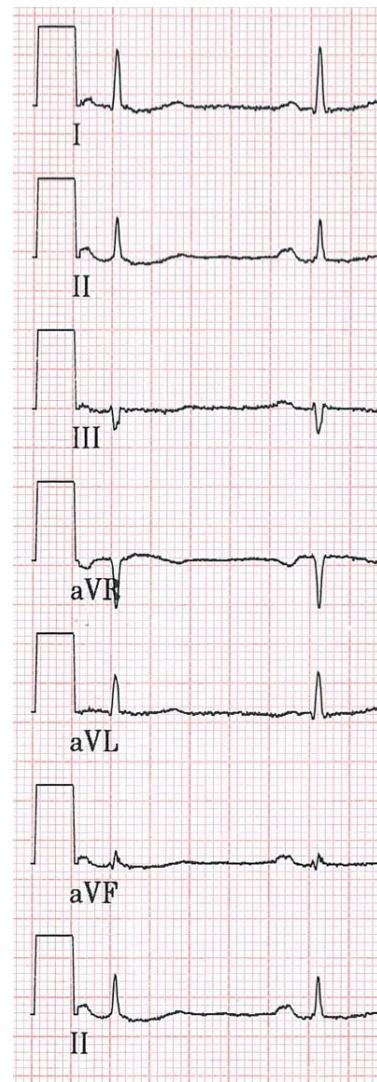
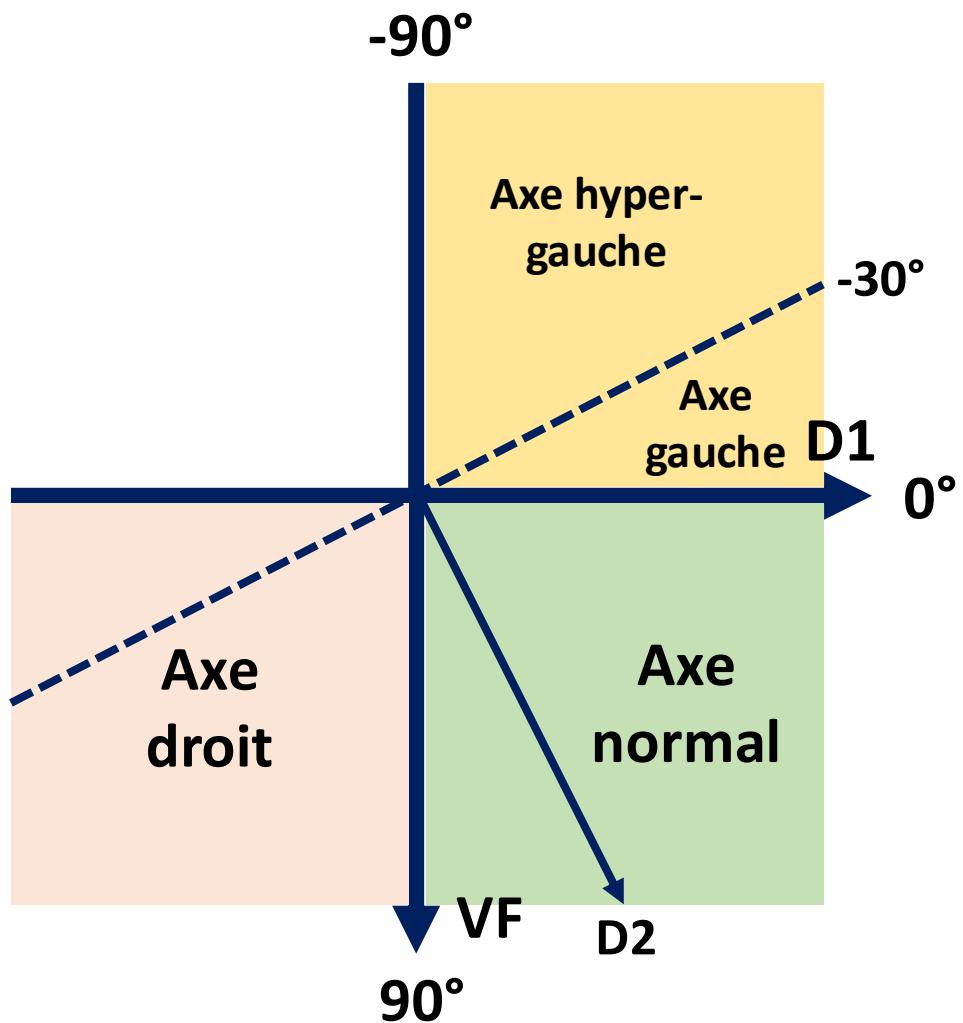
MAIS ...

- Stimulateurs cardiaques maintenant souvent réglés en bipolaire = **peu voire pas d'artefact de stimulation**
- Modes de stimulation évitant de trop stimuler le VD = **patients pas toujours stimulés**
- Apparition de la resynchronisation cardiaque = **QRS moins larges**
- Apparition de la stimulation de branche gauche = **QRS fins**
- Stimulateurs cardiaques sans sondes (capsule intra-VD) = **pas de cicatrice et pas de boitier sous la peau**
- Défibrillateurs sous cutanés = **pas de fonction de stimulation possible**

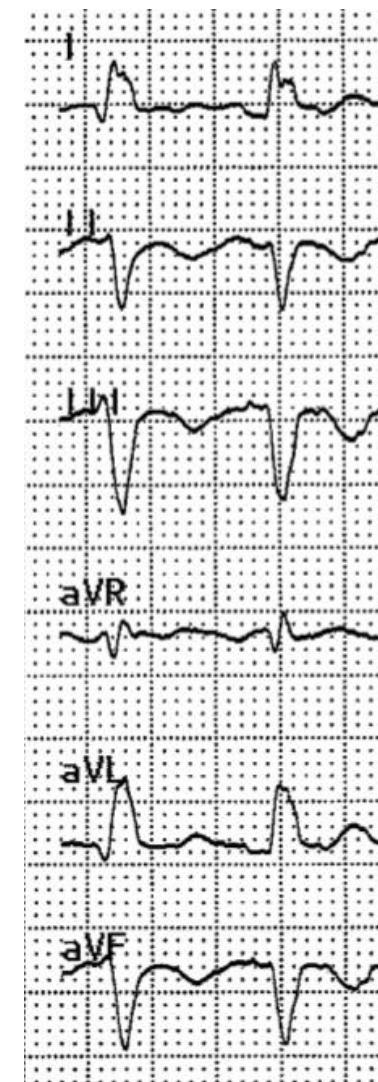
INTRODUCTION : TERRITOIRES ECG



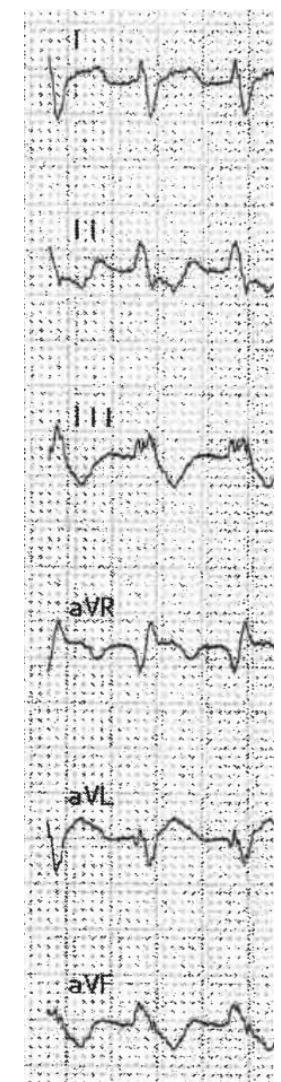
INTRODUCTION : AXE ELECTRIQUE DU COEUR



Axe normal

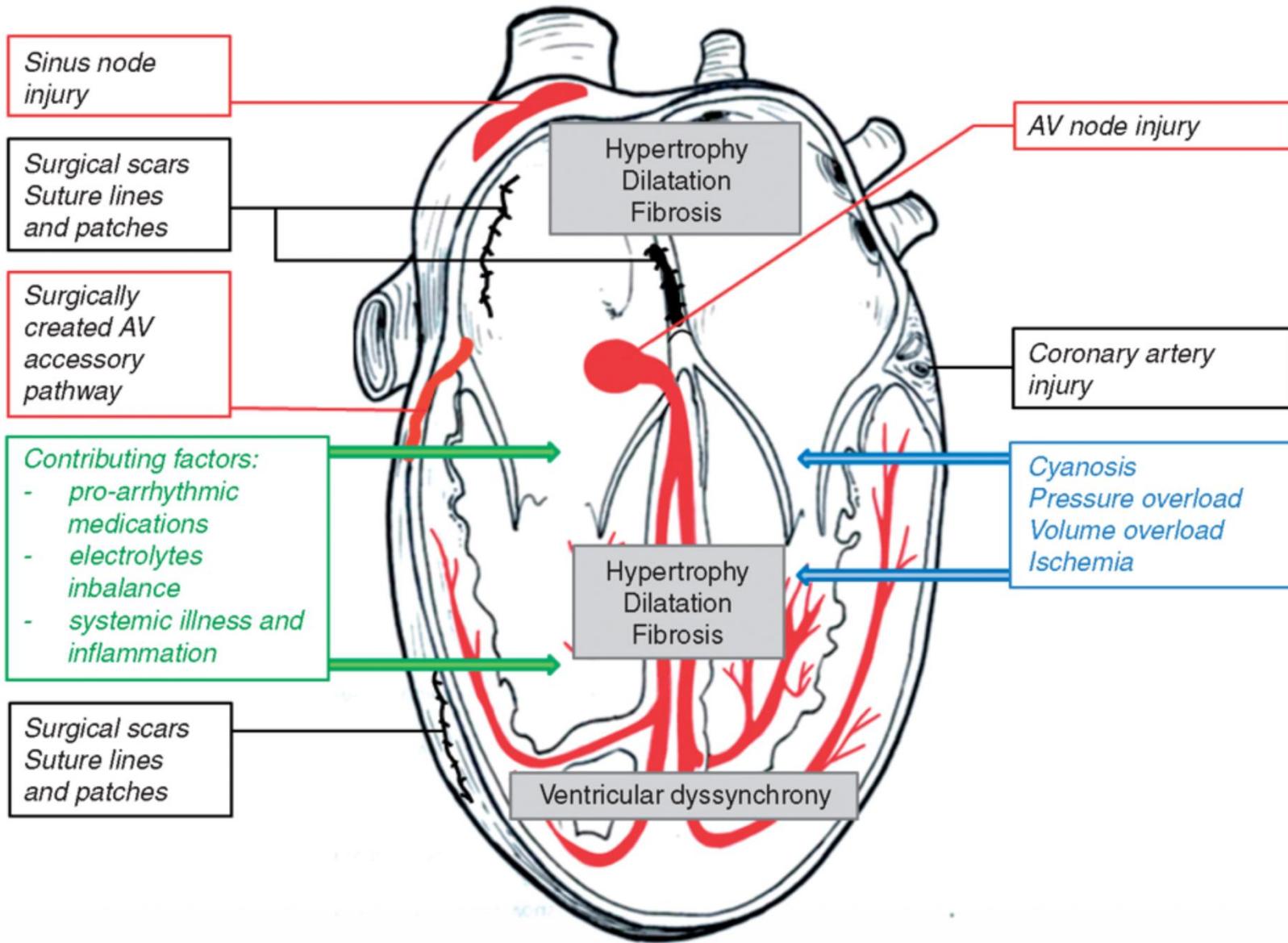


Axe hyper-G

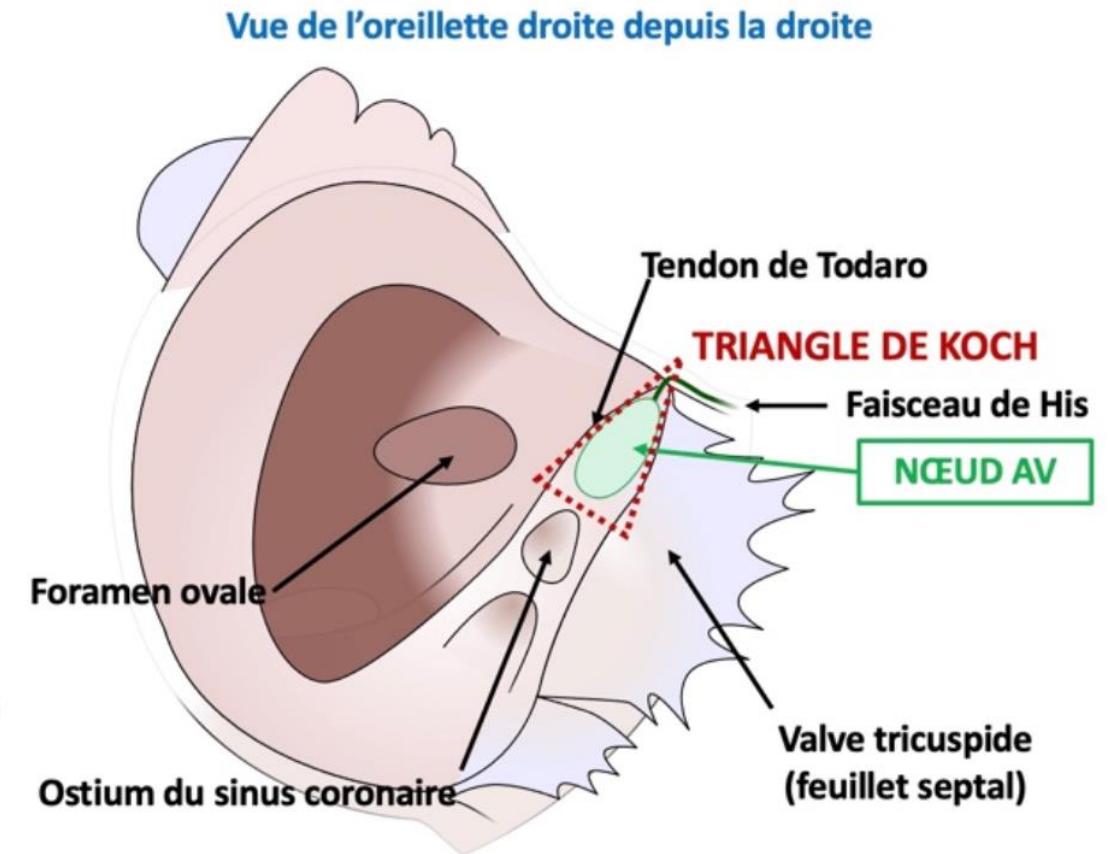
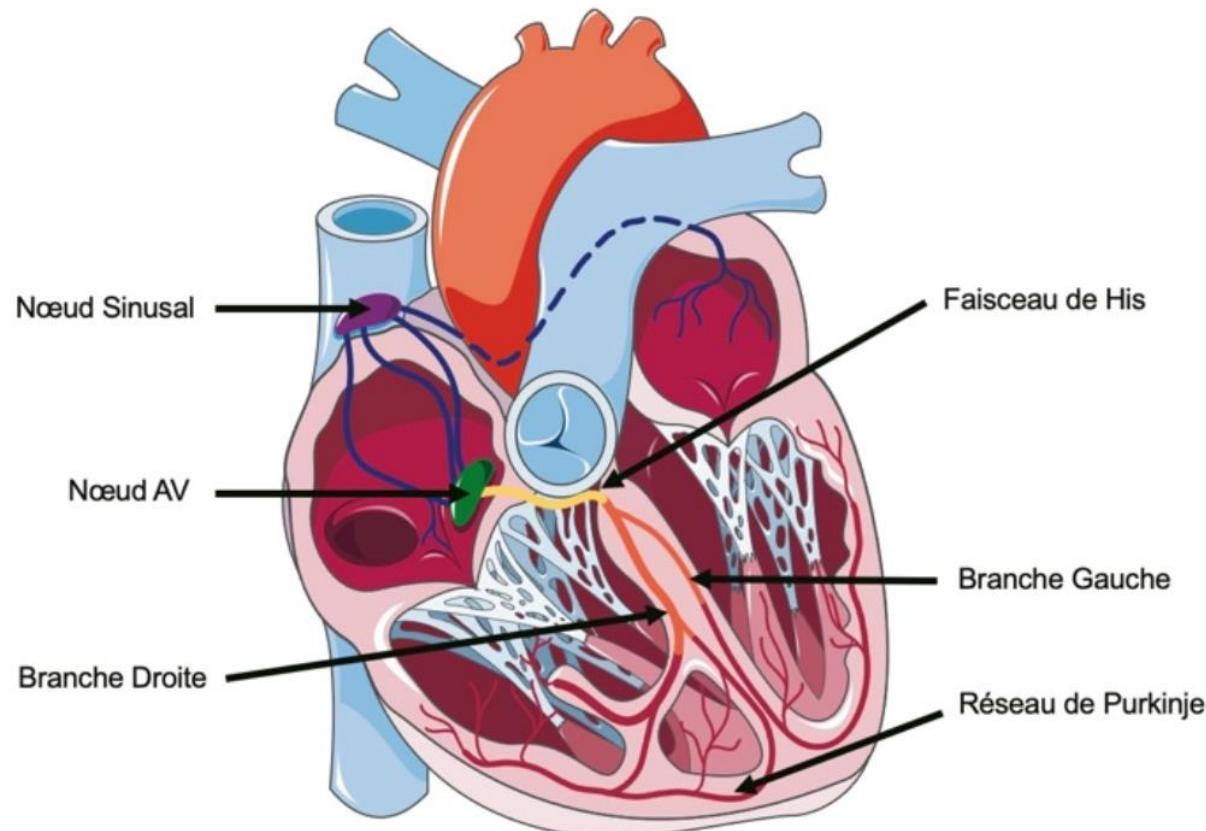


Axe droit

INTRODUCTION : PHYSIOPATHOLOGIE

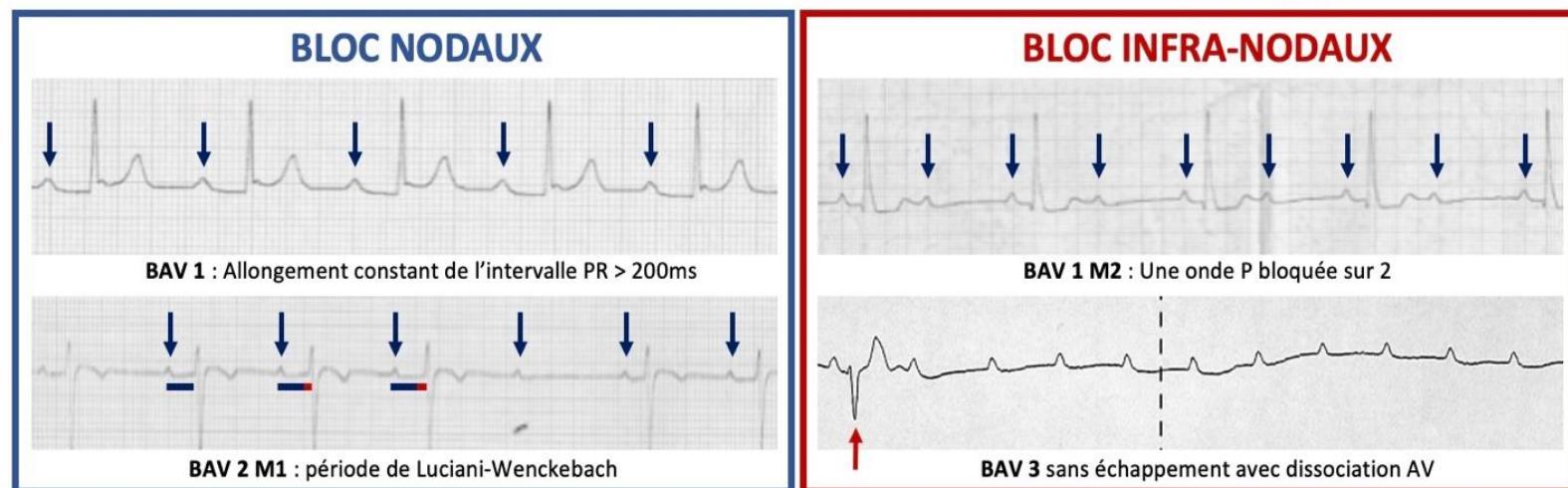


TROUBLES CONDUCTIFS : ANATOMIE

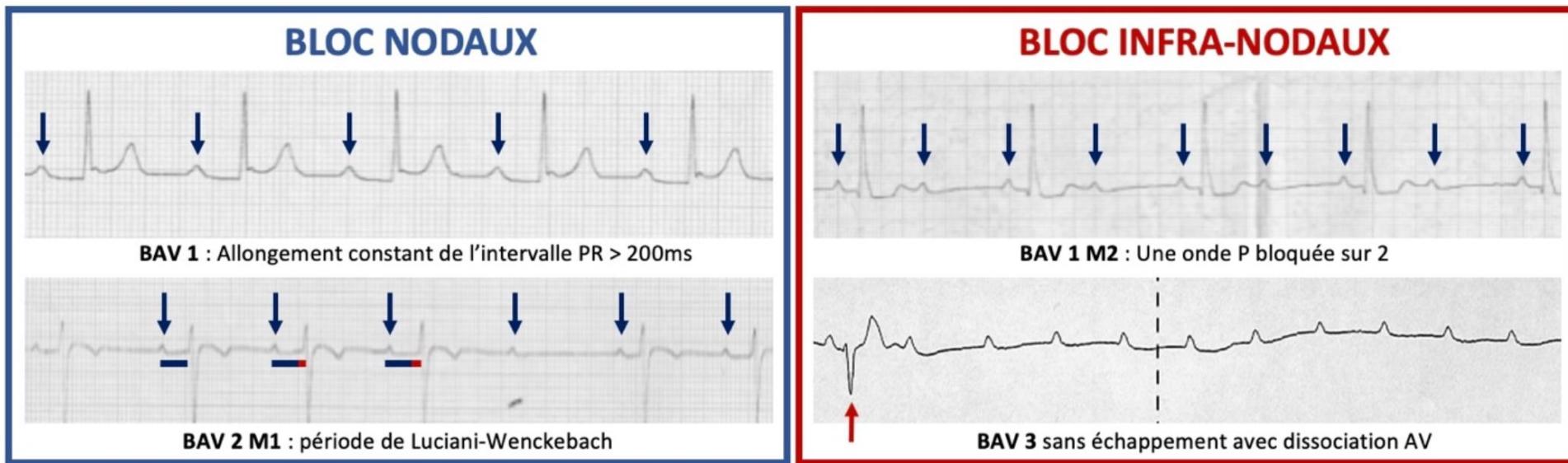


TROUBLES CONDUCTIFS : LE RESUME

Normal	BAV 1	BAV 2		BAV 3	
		Mobitz 1	Mobitz 2		
PR \leq 200 P/QRS = 1	PR > 200 P/QRS = 1	Allongement progressif PR (Séquences de Luciani-Wenckebach) P/QRS > 1	2 p pour 1 QRS Forme frontière P/QRS = 2	Perte de conduction sans allongement préalable P/QRS > 1	Aucun lien entre ondes p et QRS P/QRS > 1



TROUBLES CONDUCTIFS : LA PRISE EN CHARGE



INDICATIONS PM

- BAV complet > 10 jours
- BAV complet intermittent avec symptôme type syncope > 10 jours
- BAV intermittent avec alternance BBG et BBD

NB : signalétiques des PM

S : cavité / 0

D : cavité / 0

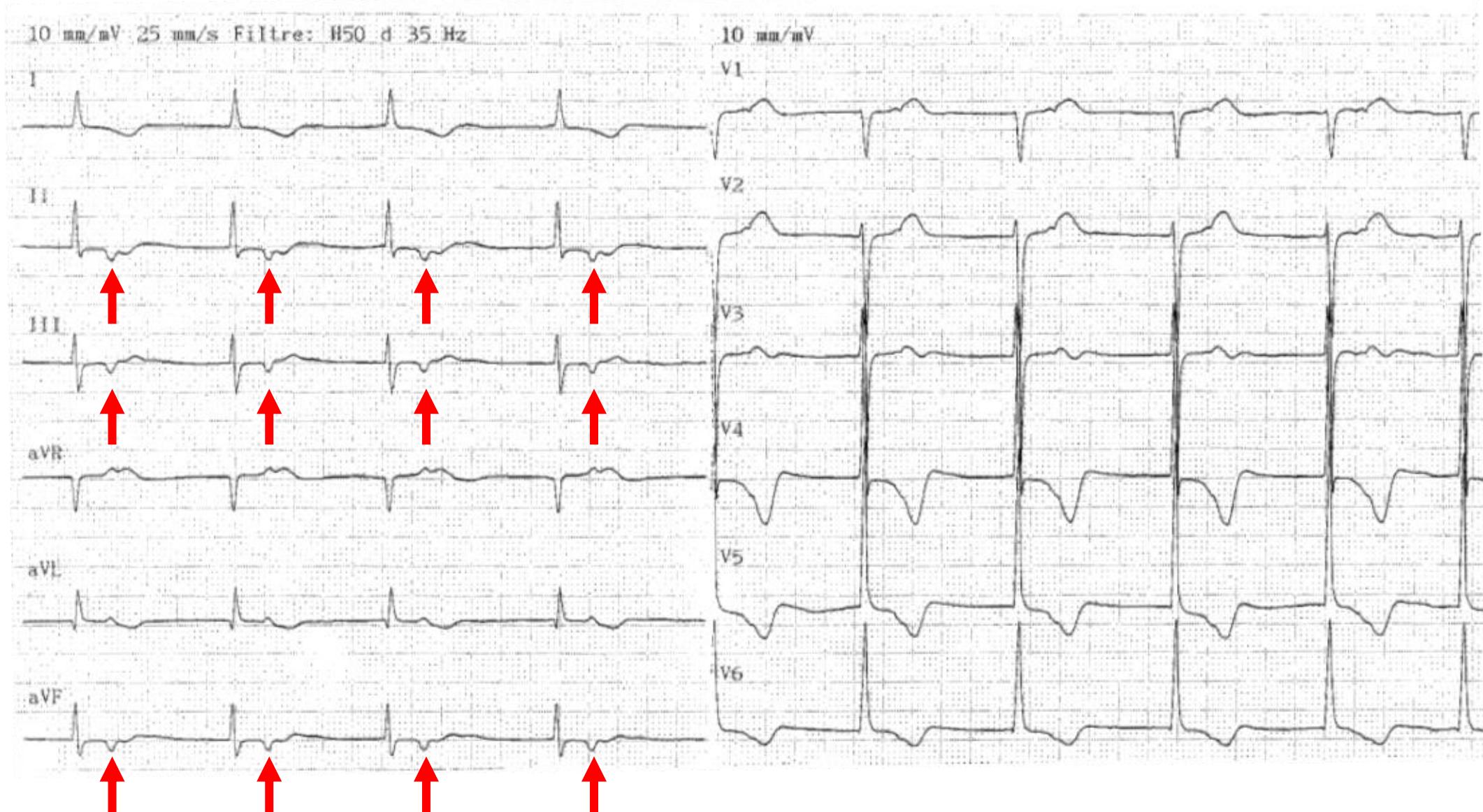
F : T - I - D - 0

Exemples : DDD / VVI / AAI

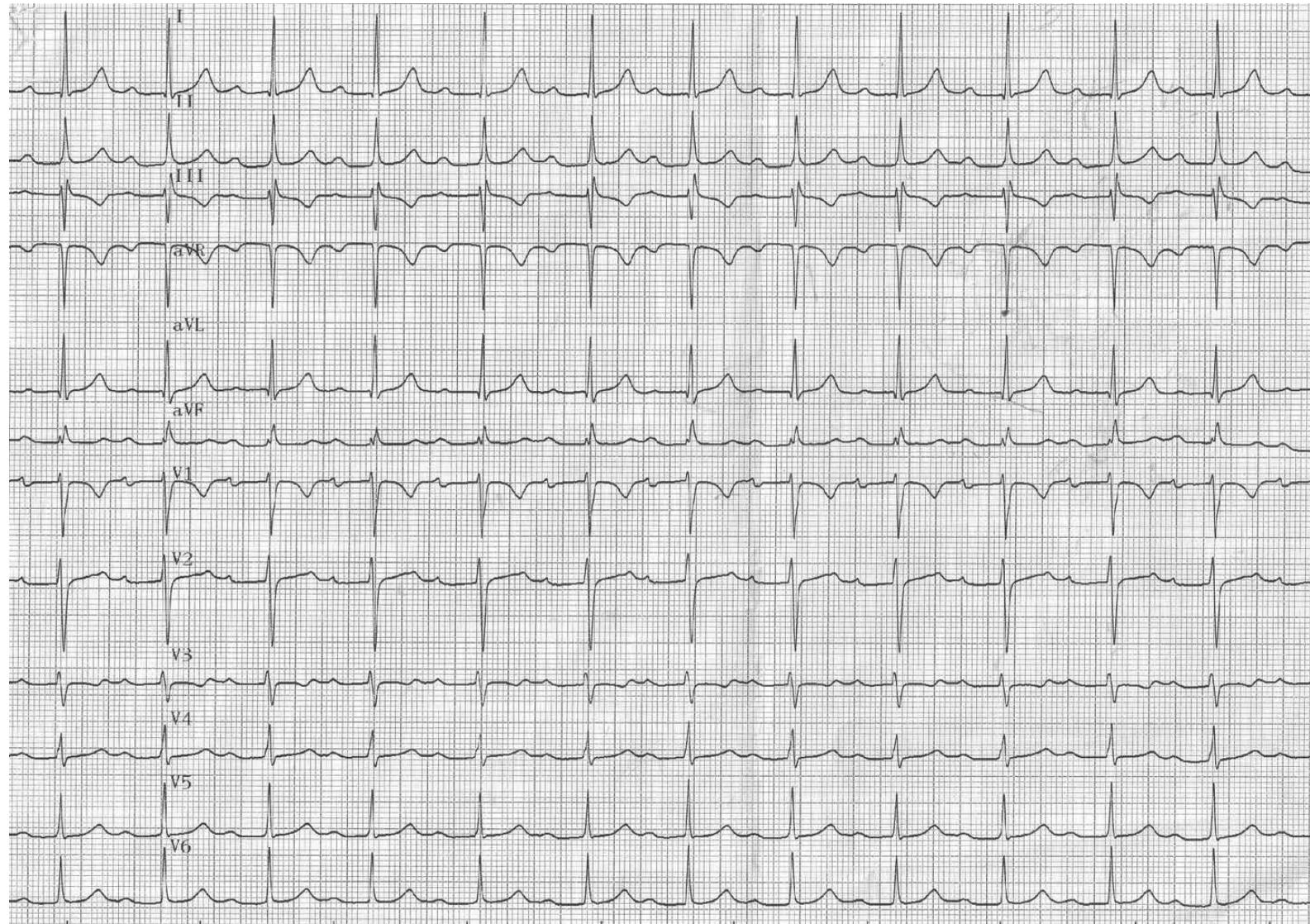
NON INDICATION PM

- BAV < 48h
- BAV < 10 jours avec échappement QRS fins

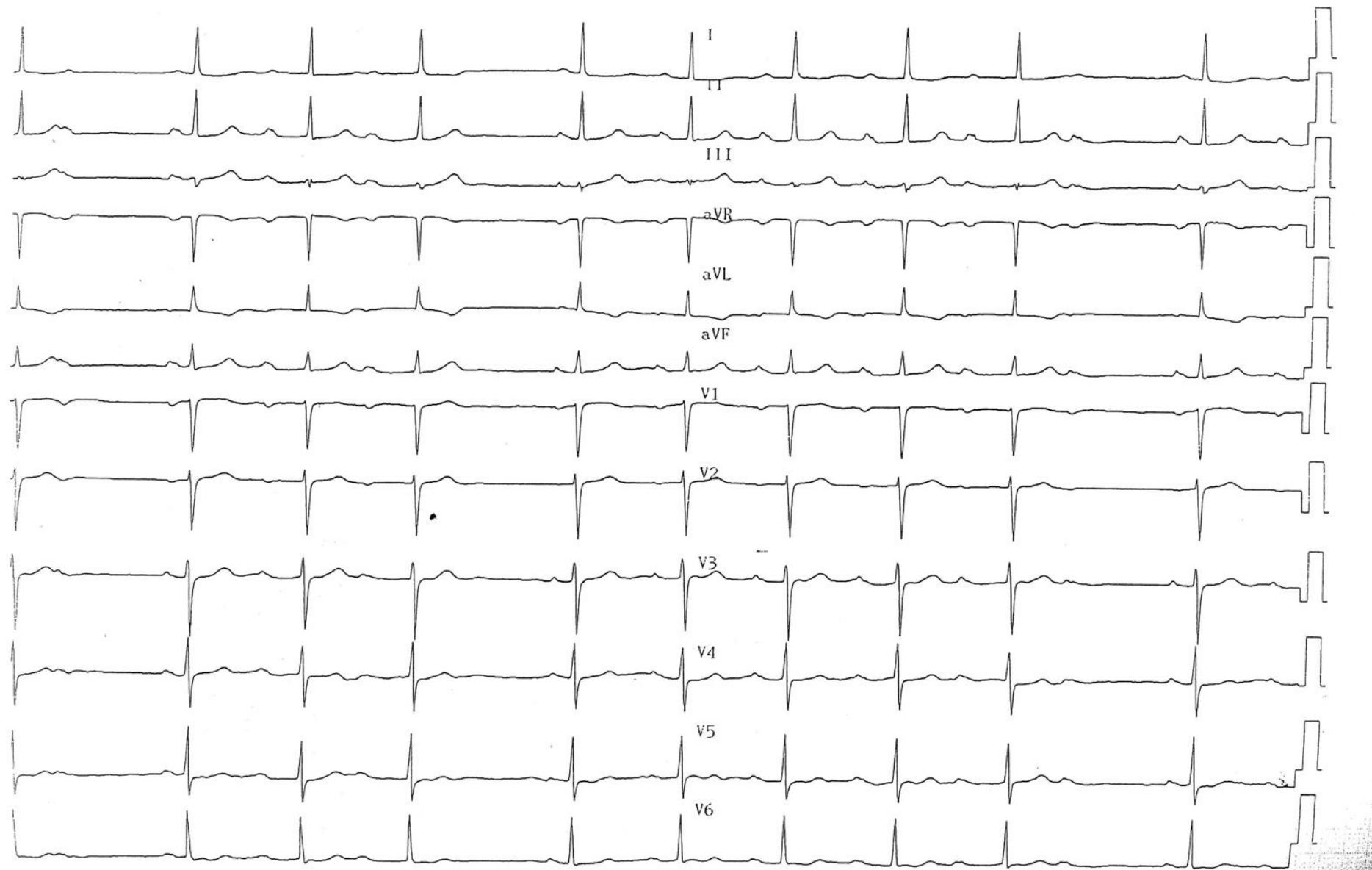
TROUBLES CONDUCTIFS : DYSFONCTION SINUSALE



TROUBLES CONDUCTIFS : BAV 1



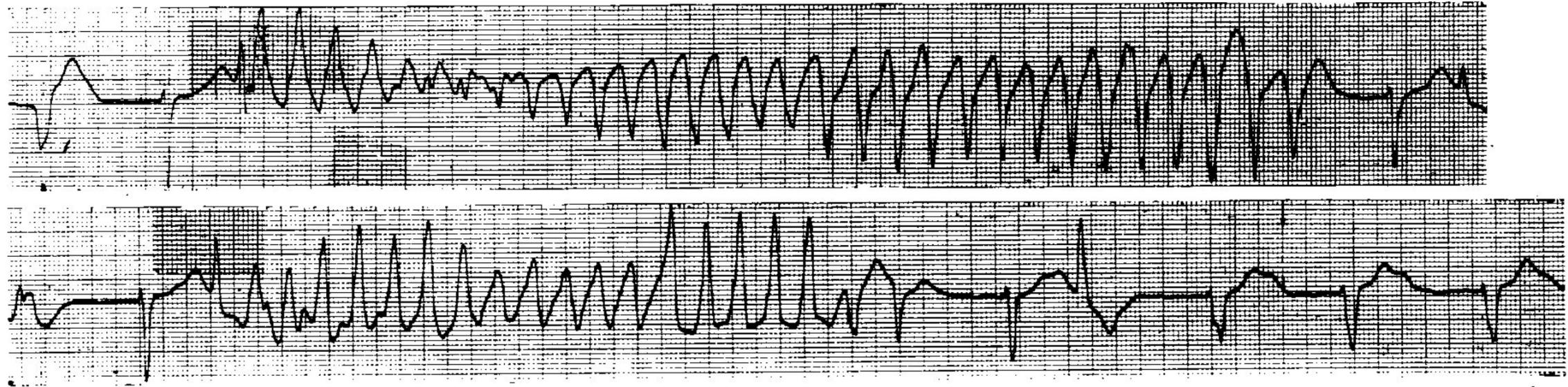
TROUBLES CONDUCTIFS : BAV 2 M1



TROUBLES CONDUCTIFS : BAV 3



TROUBLES CONDUCTIFS : BAV 3



Attention au QT et à la K+

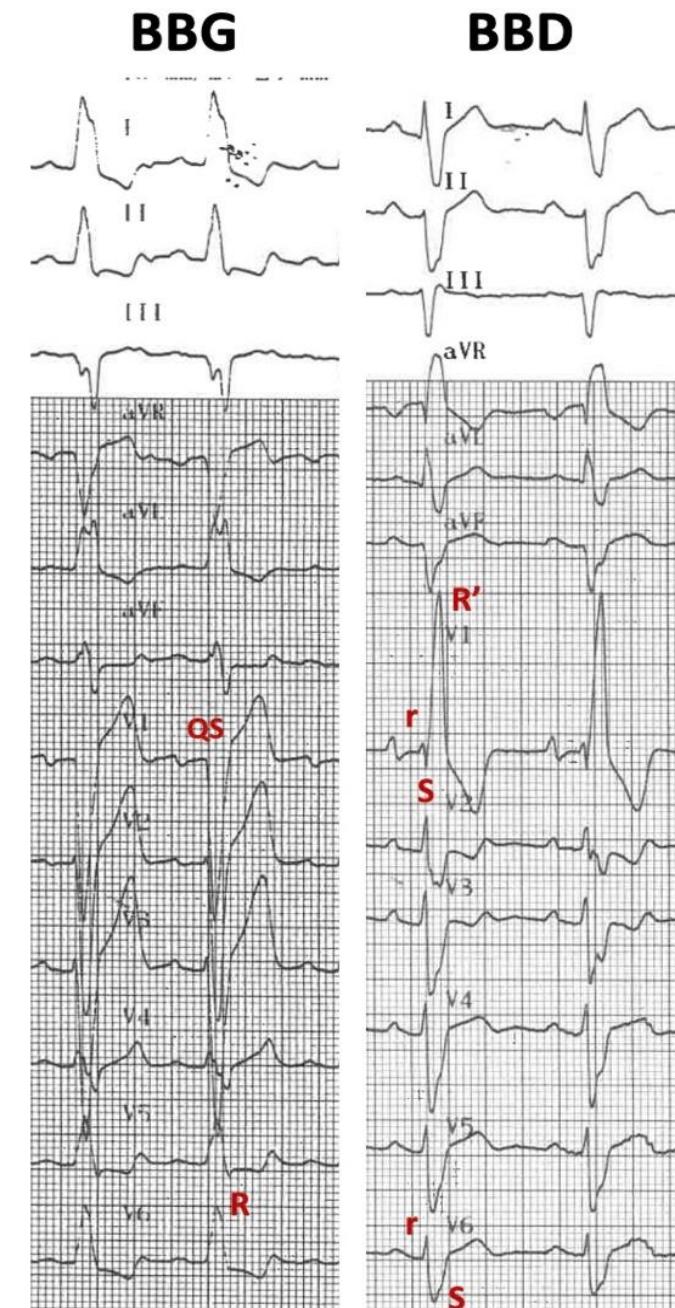
TROUBLES CONDUCTIFS : BLOC DE BRANCHE

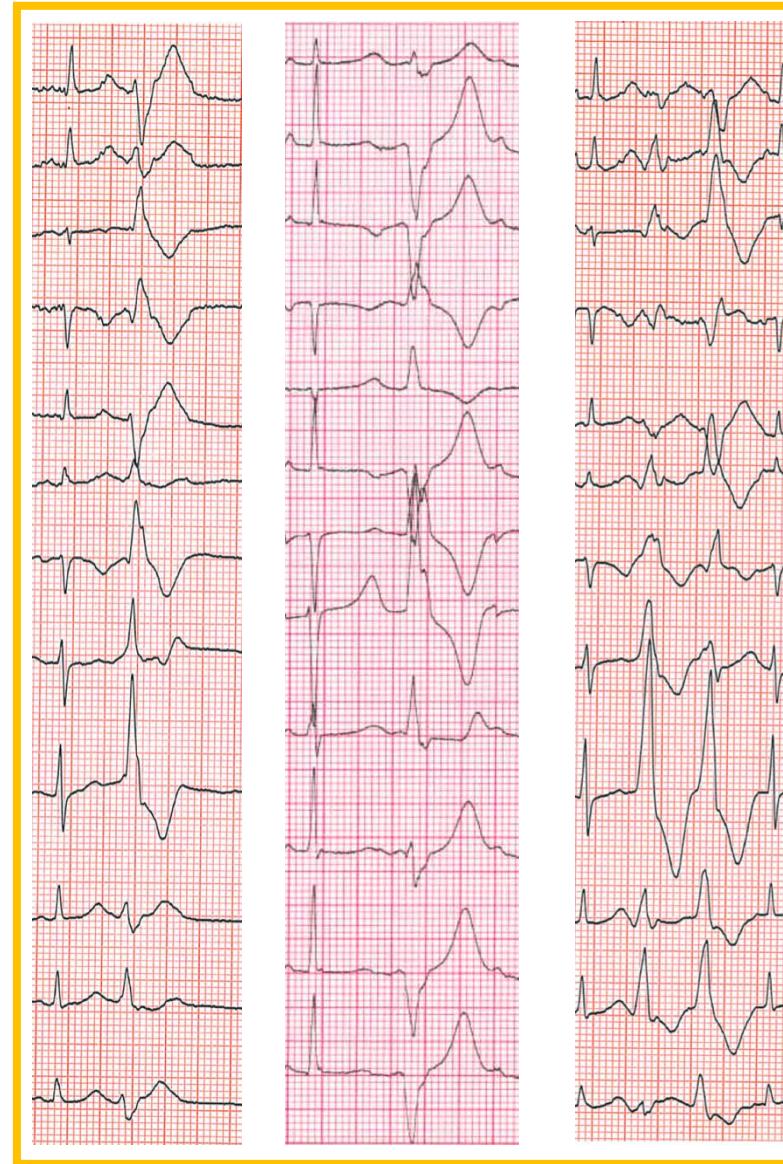
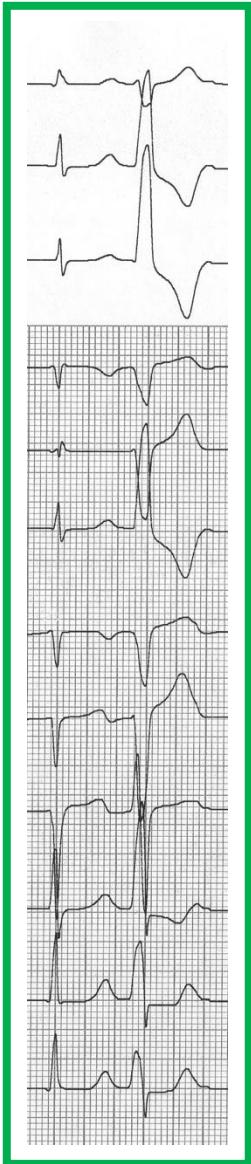
DURÉE DU QRS

- $80\text{ms} < \text{QRS} < 120\text{ms}$ = BB incomplet
- $\text{QRS} > 120\text{ms}$ = BB complet

MORPHOLOGIE DU QRS

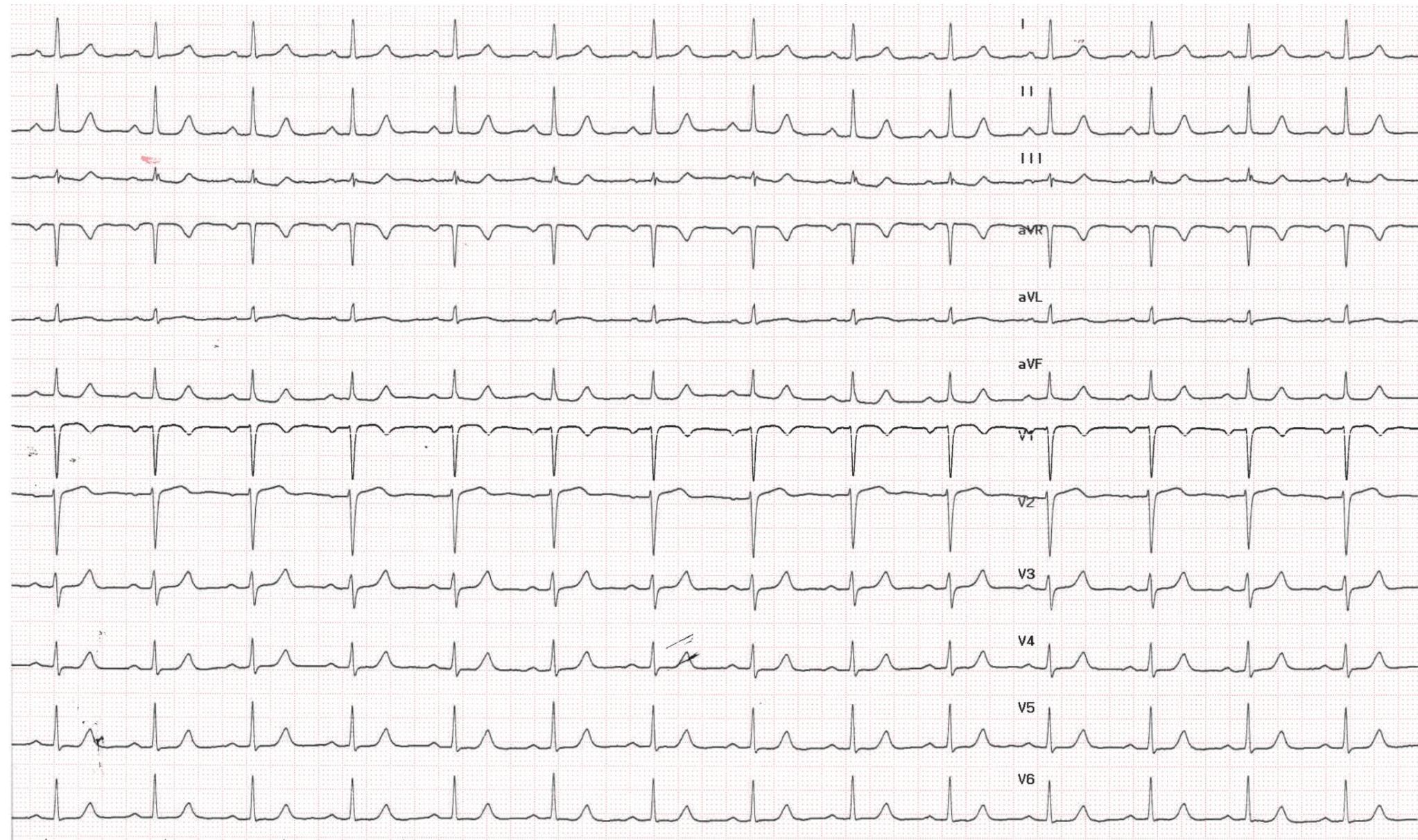
- Bloc de **branche droit**
 - Aspect rSR' en V1 et rS en V6/D1
 - Si BBD + Axe Gauche = BBD + HBAG
- Bloc de **branche gauche**
 - Aspect R exclusif en V6 et QS en V1
 - Axe gauche



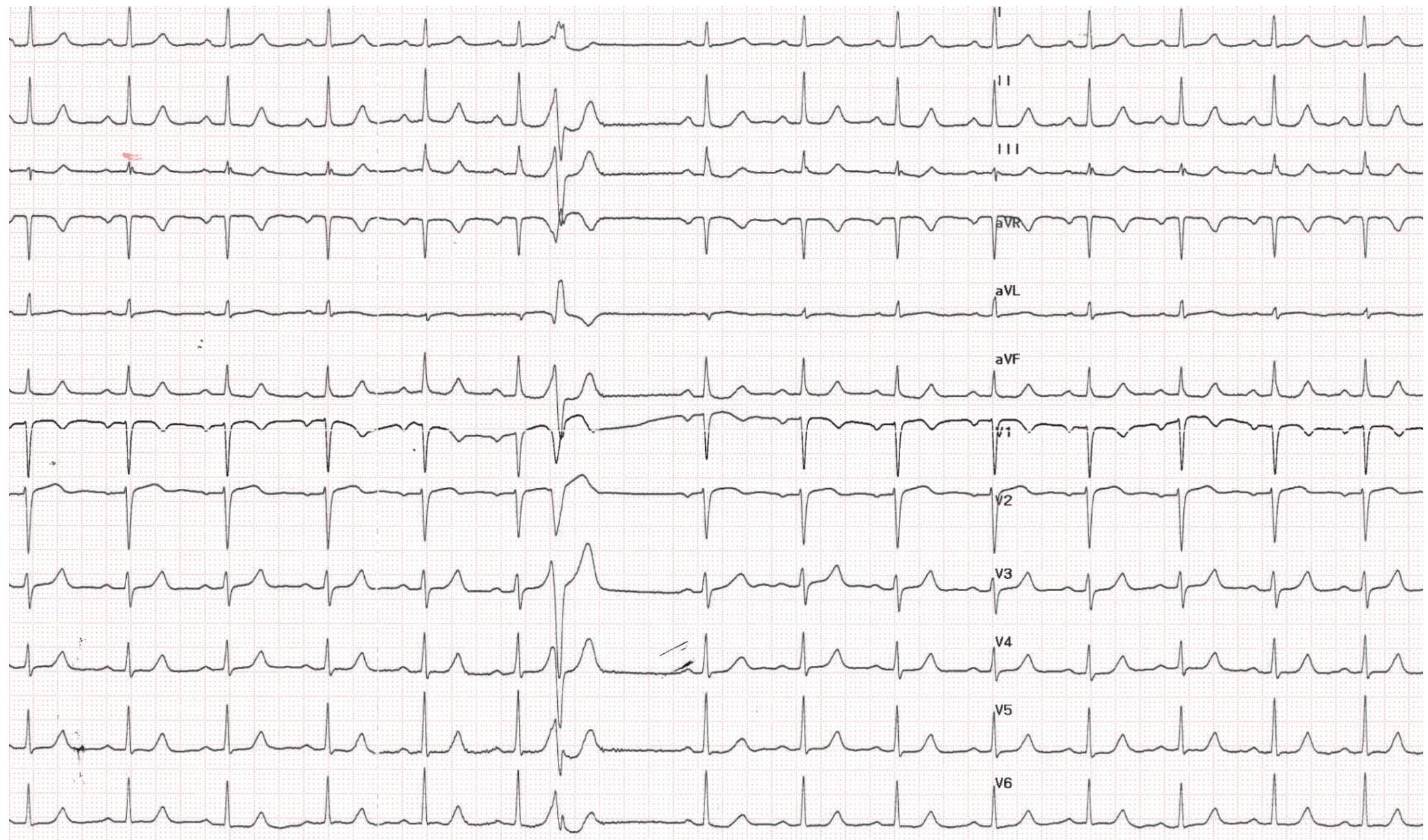


PATIENT #19

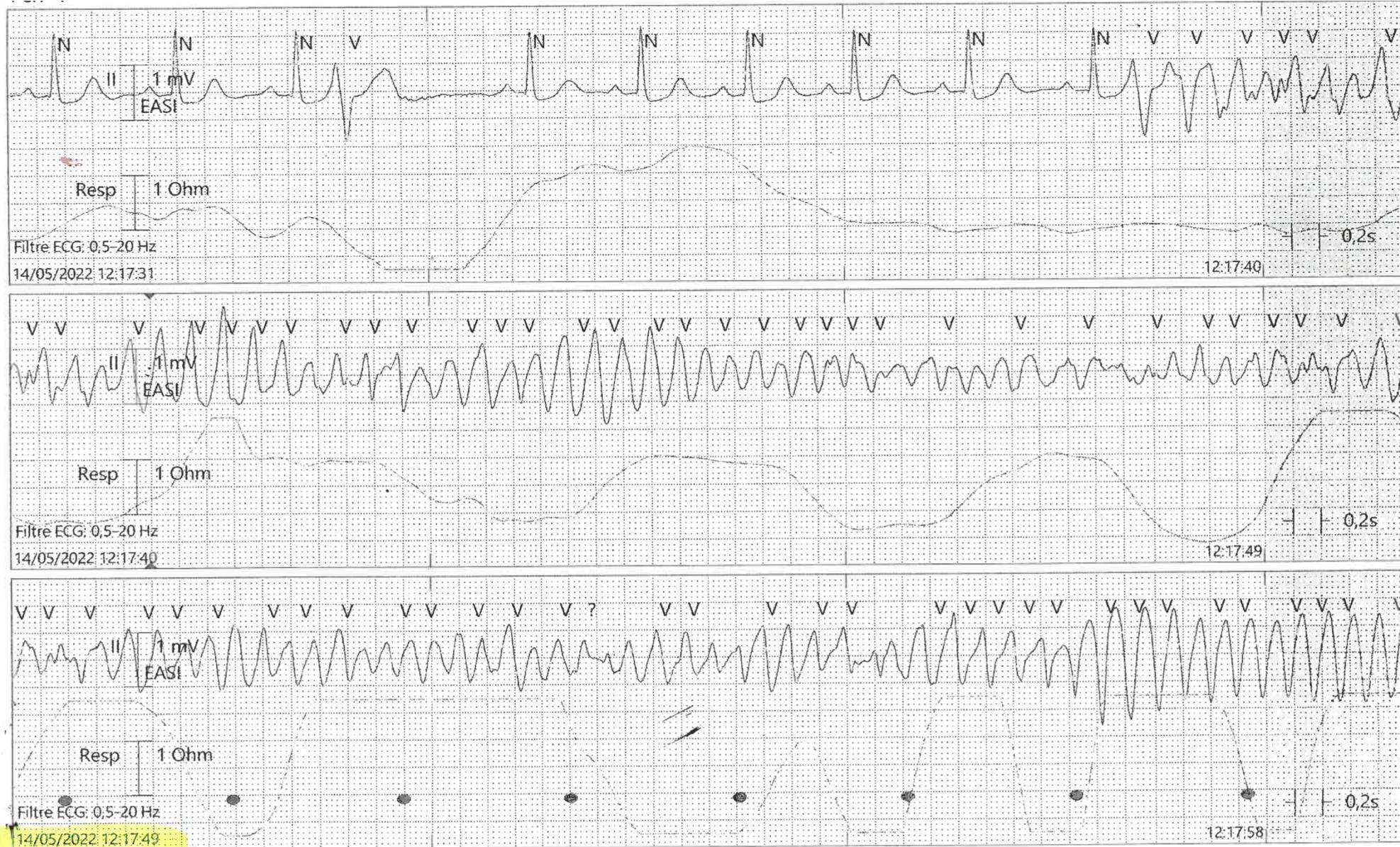
SYNCOPES MULTIPLES



PATIENT #19

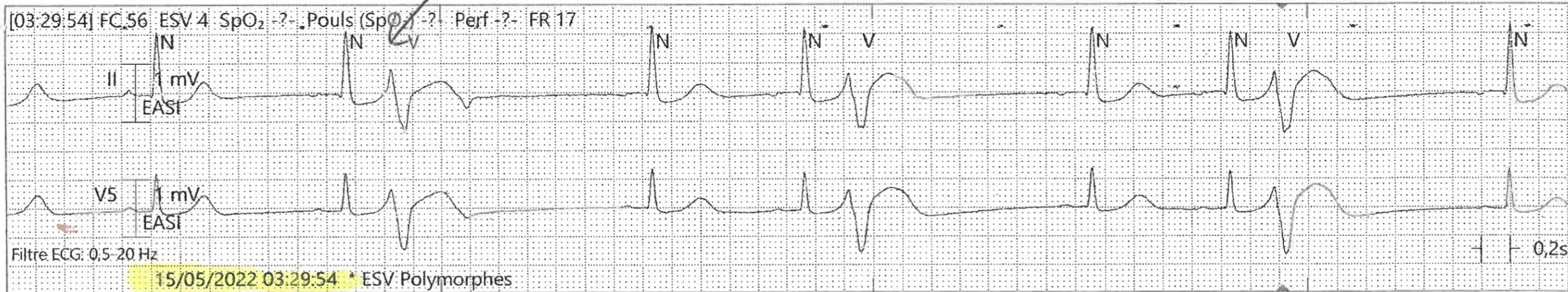


PATIENT #19



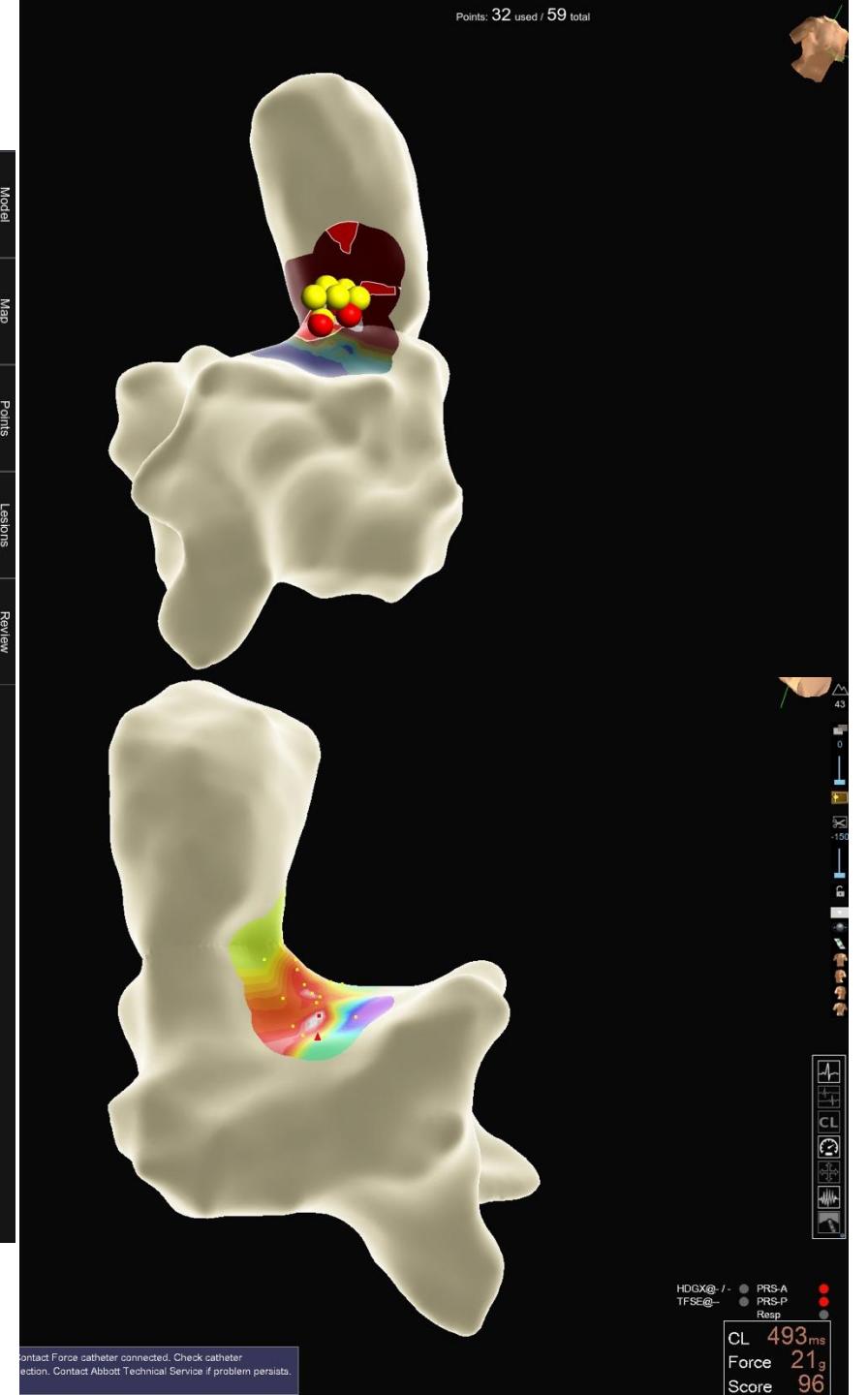
PATIENT #19

Source ECG: MUN3

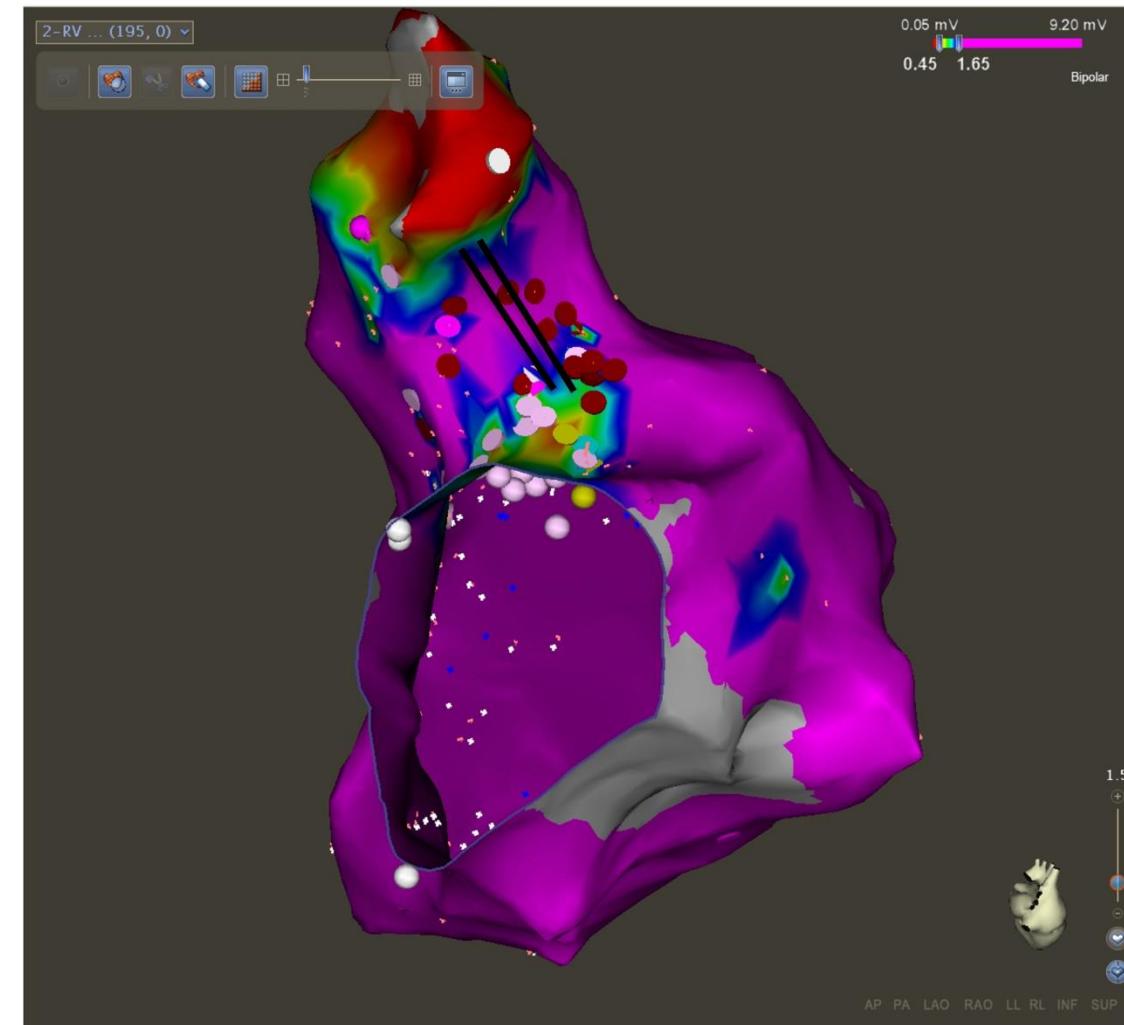
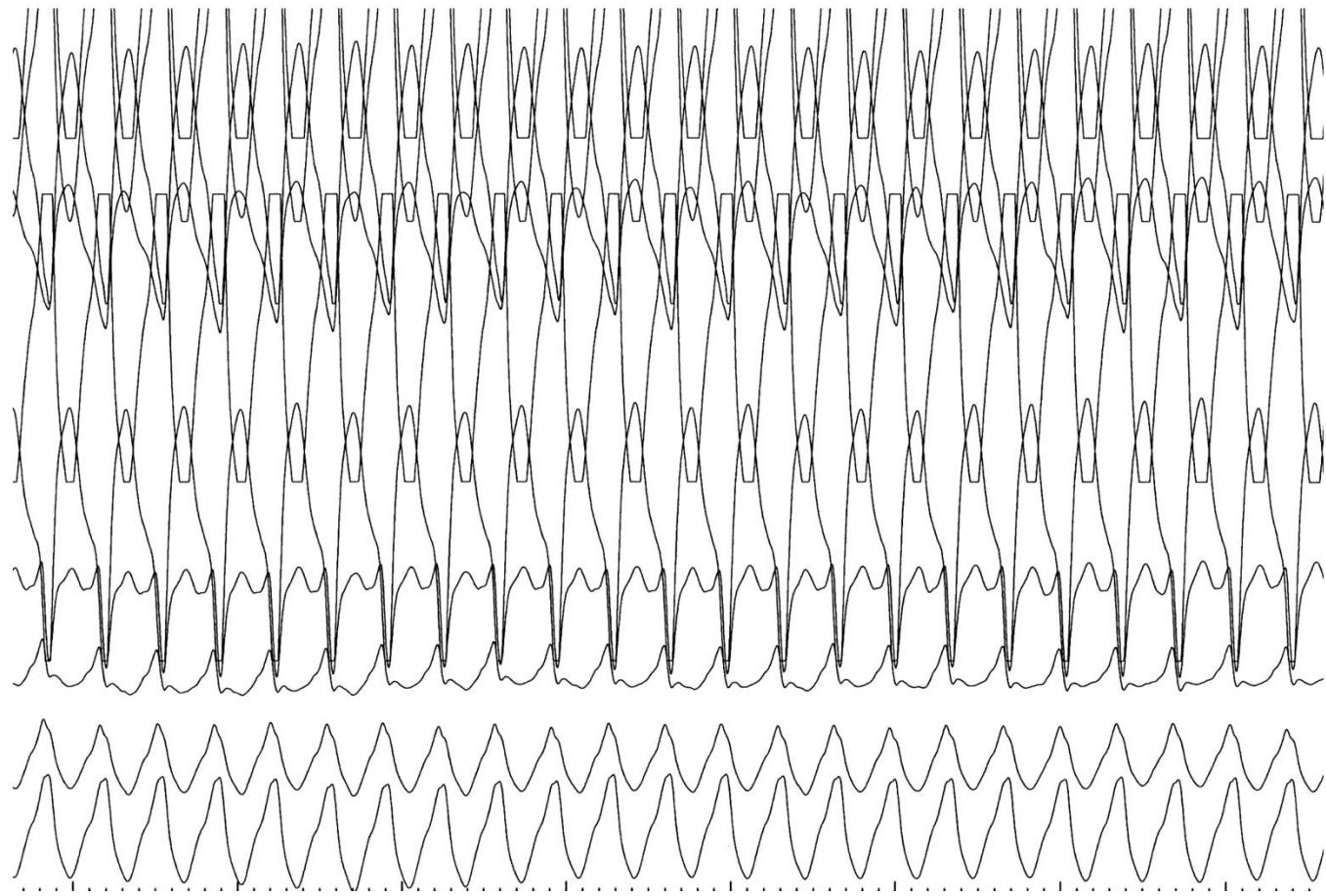




ESV FALLOT



TV FALLOT



P > QRS : tachycardie atriale

Flutter :
-rythme régulier
-fréquence A : 300/min
-fréquence V : 220-230/min
-P' en dent de scie

Tachy atriale ectopique :
-rythme régulier
-fréquence A : 150-250/min
-fréquence V : 150-200/min
-P' d'aspect non sinusal

FA:
-rythme irrégulier
-fréquence A : 180-500/min
-fréquence V : 50-250/min
-P' ≥ 3 morphologies

Traitements

En cas de mauvaise tolérance : cardioversion 1-2 joules / kg

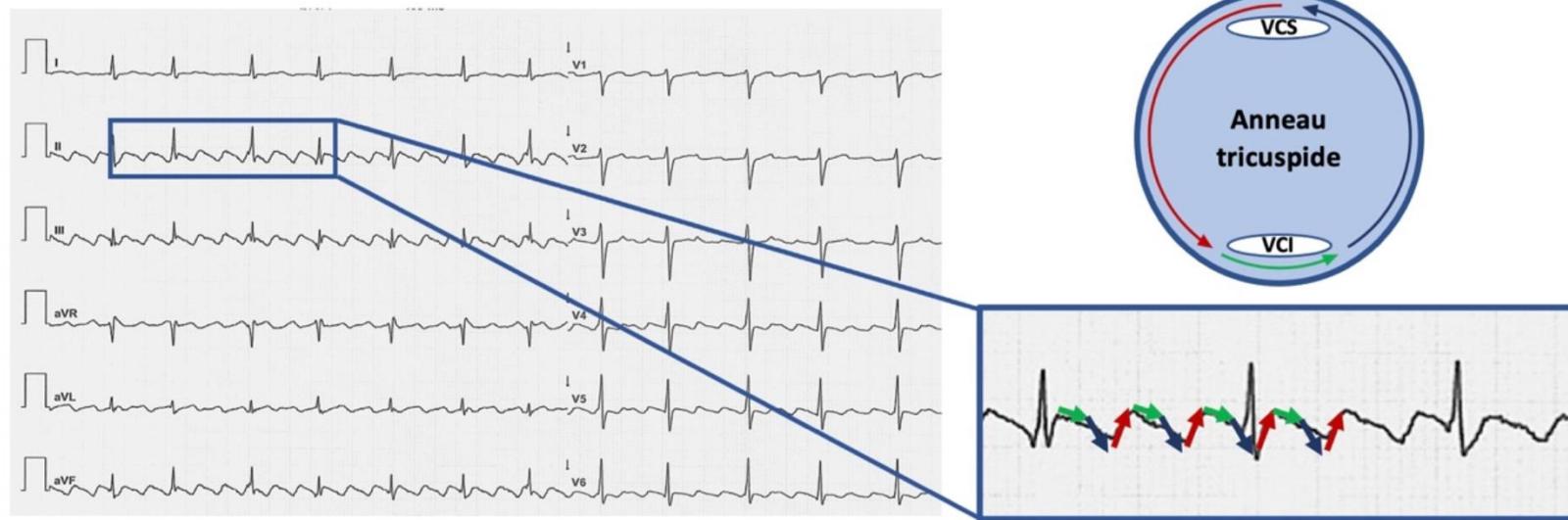
Cordarone dose de charge ou overdriving atrial ectopique :
Entretien : cordarone ou rien

EVITER FLECAINE

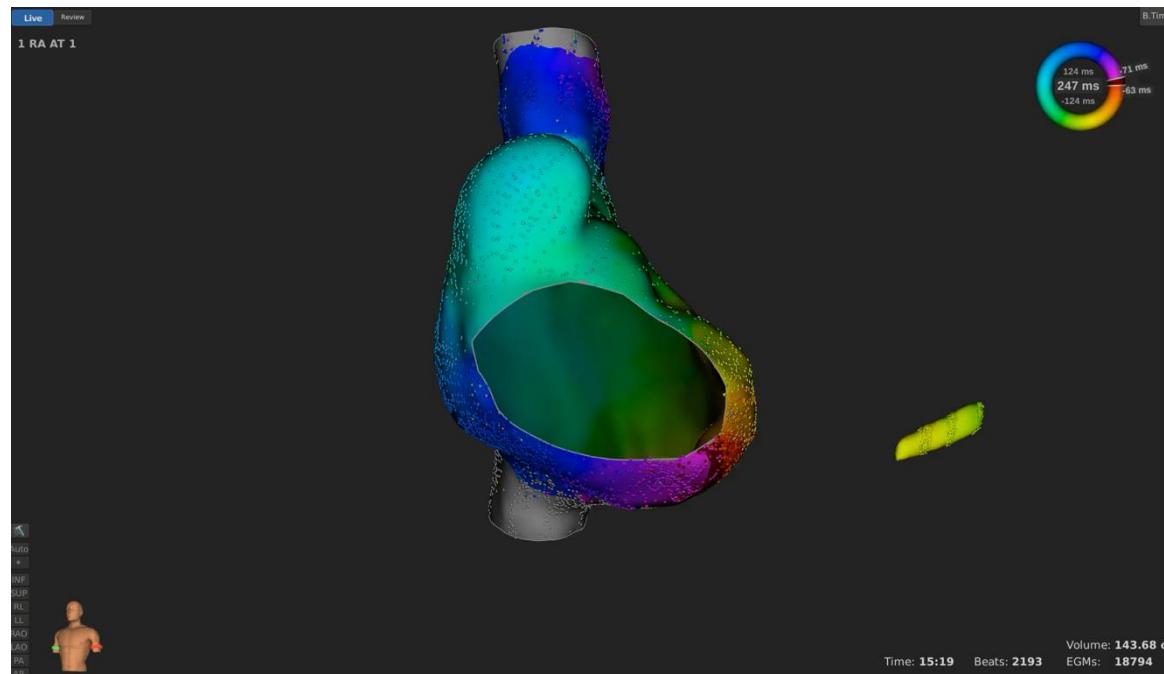
sotalex / flécaïne.
Cordarone si échec
Entretien=TTT efficace pour la réduction

- sotalex / flécaïne.
-Cordarone si échec
Entretien=TTT efficace pour la réduction

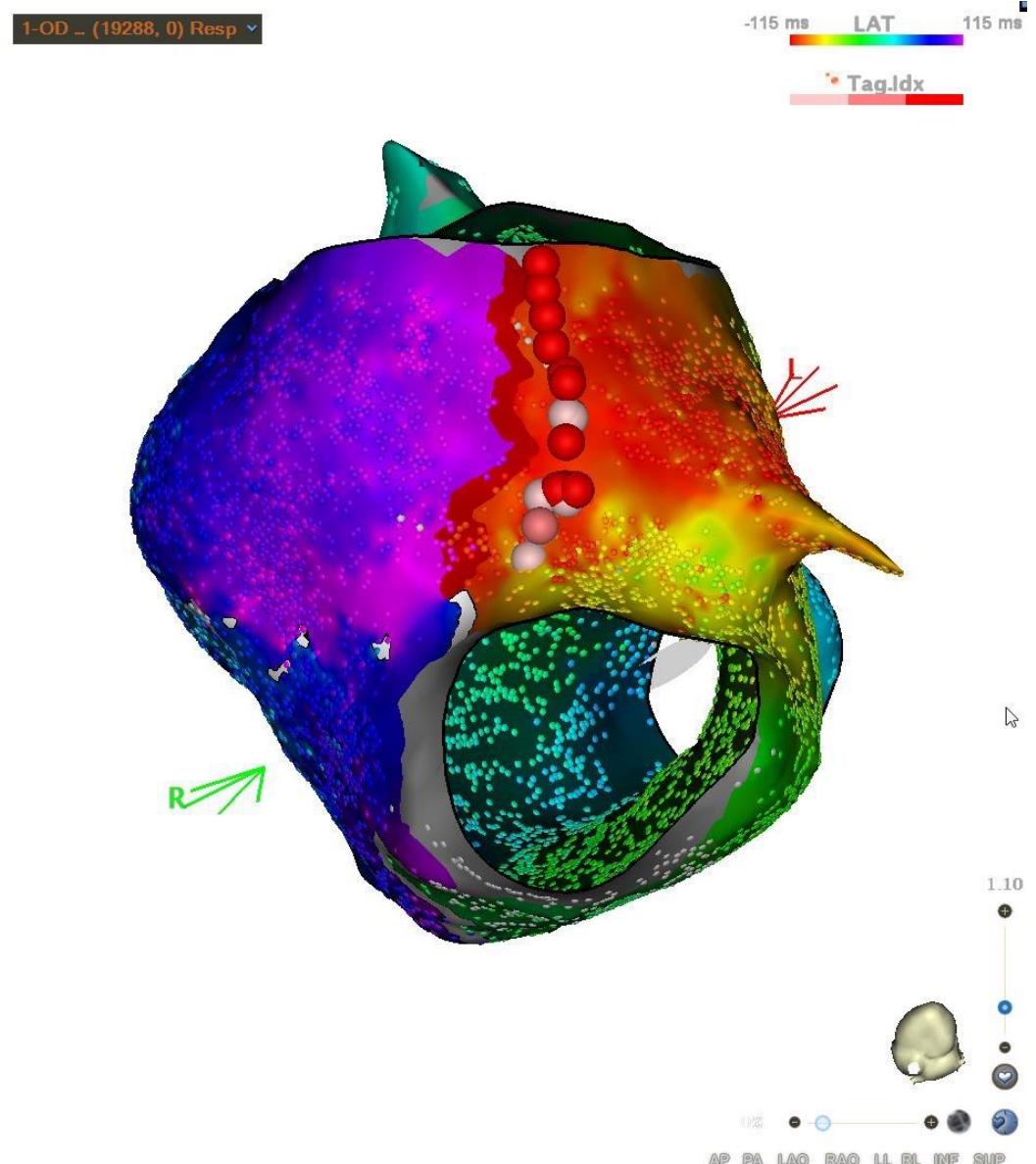
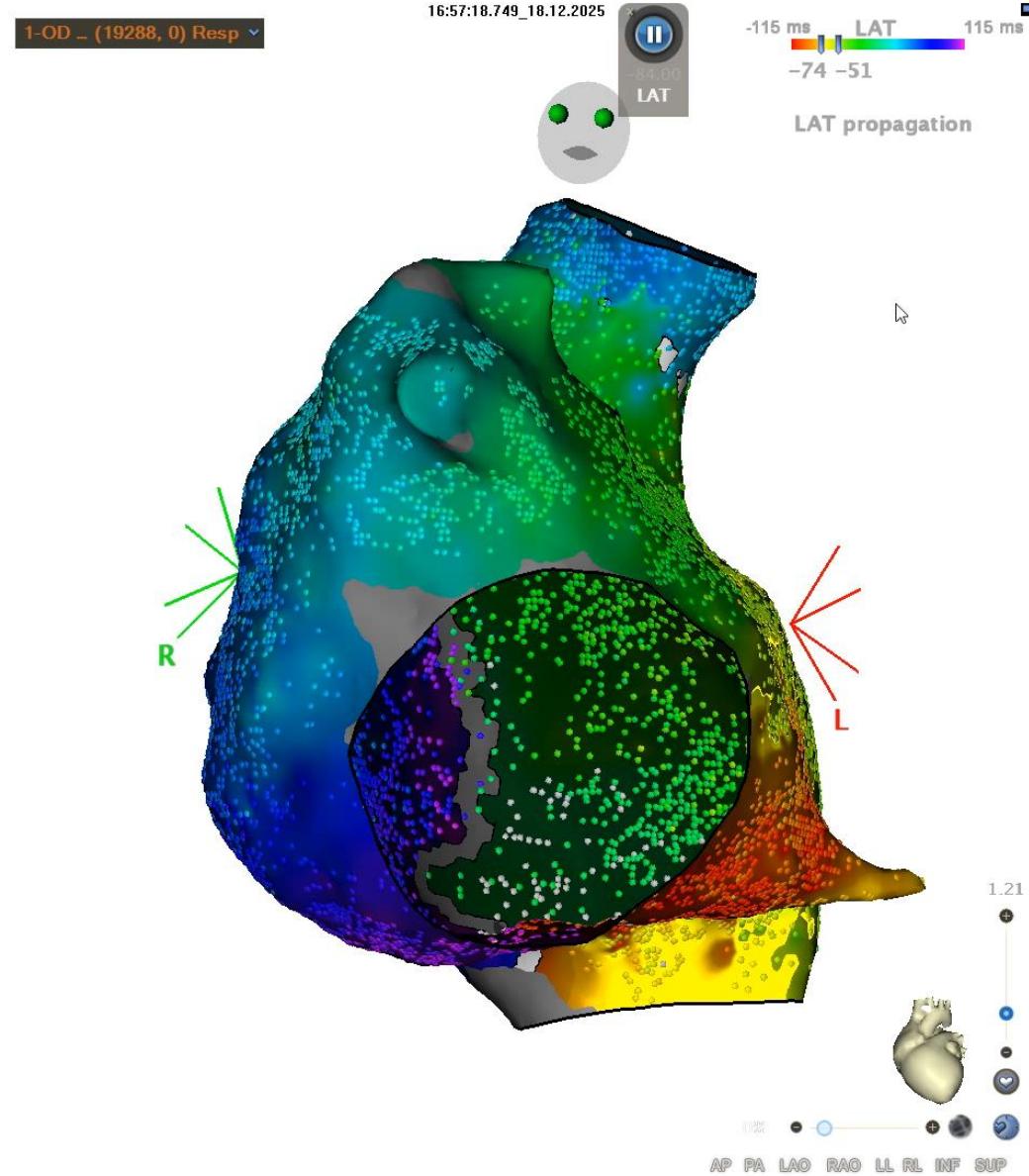
FLUTTER COMMUN



Flutter commun : circuit autour de l'anneau tricuspid dans l'oreillette droite



FLUTTER COMMUN



FLUTTER COMMUN + CICATRICE D'ATRIOTOMIE

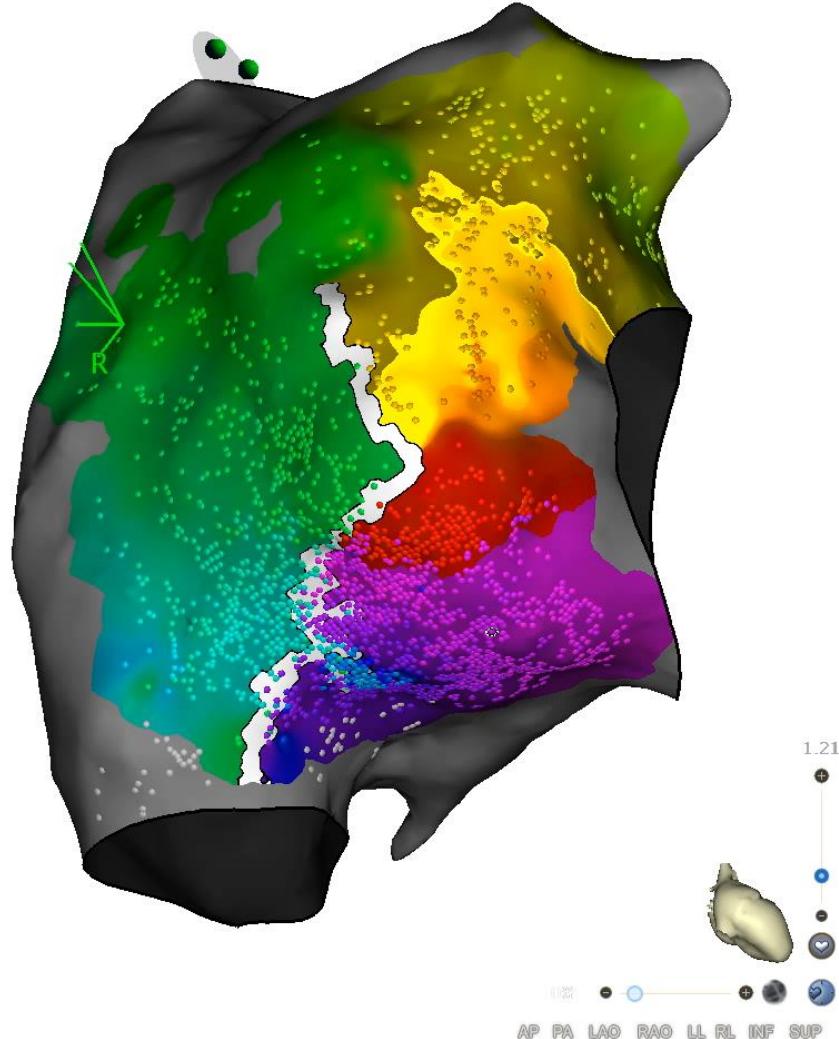
1-1-R_ (4474, 0) Resp

17:00:56.212_18.12.2025



-180 ms LAT 180 ms
-152 -116

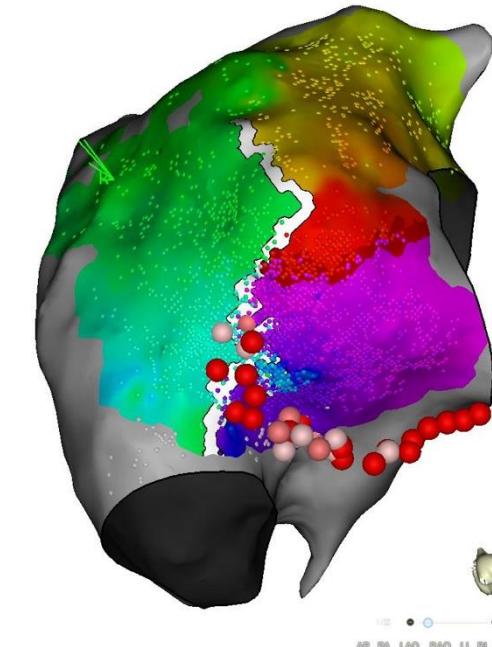
LAT propagation



1-1-R_ (4474, 0) Resp

-180 ms LAT 180 ms

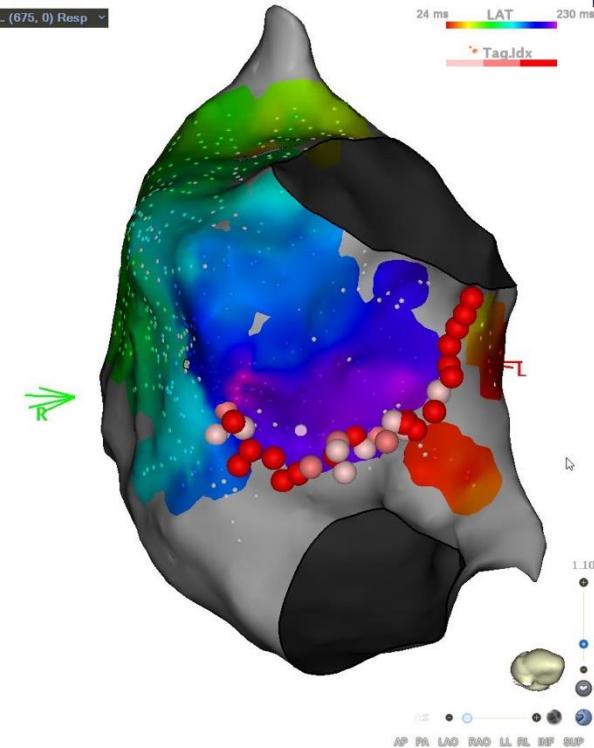
Tag.Idx



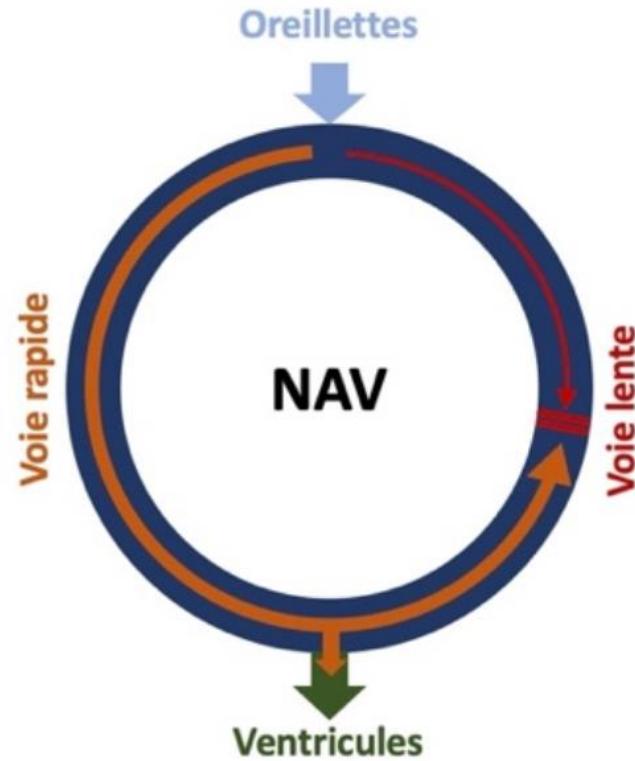
1-2-E_ (675, 0) Resp

24 ms LAT 230 ms

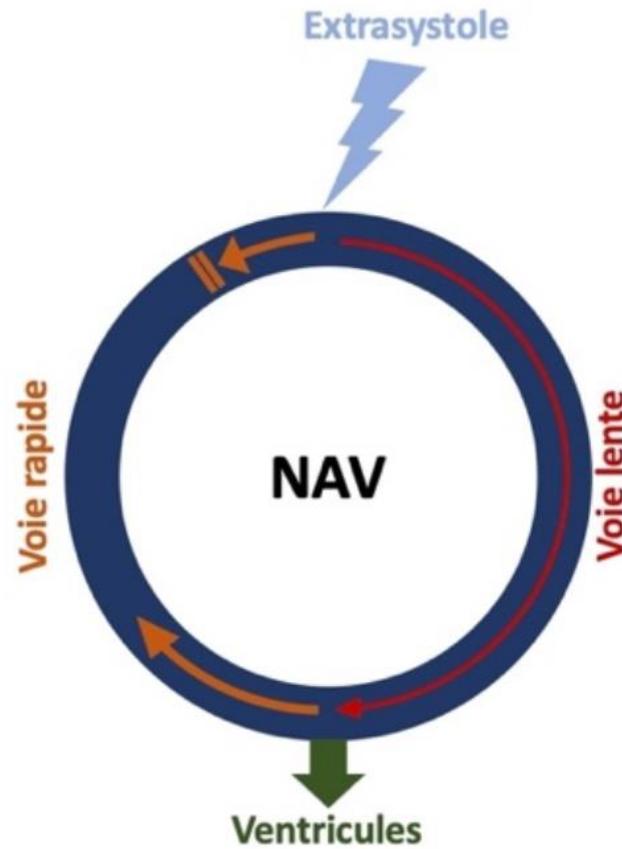
Tag.Idx



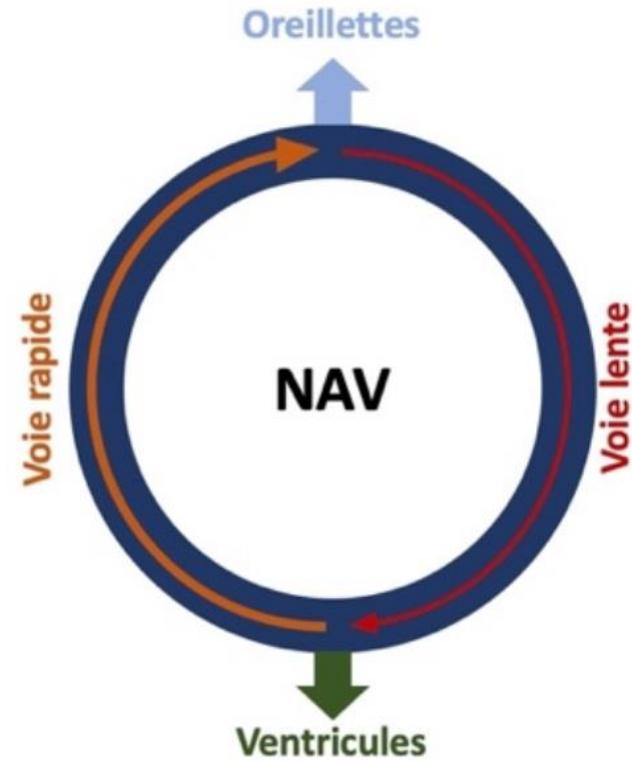
REENTREE INTRA NODALE



RYTHME SINUSAL



INITIATION D'UNE RIN
(extrasystole atriale)



CIRCUIT D'UNE RIN TYPIQUE

REENTREE INTRA NODALE



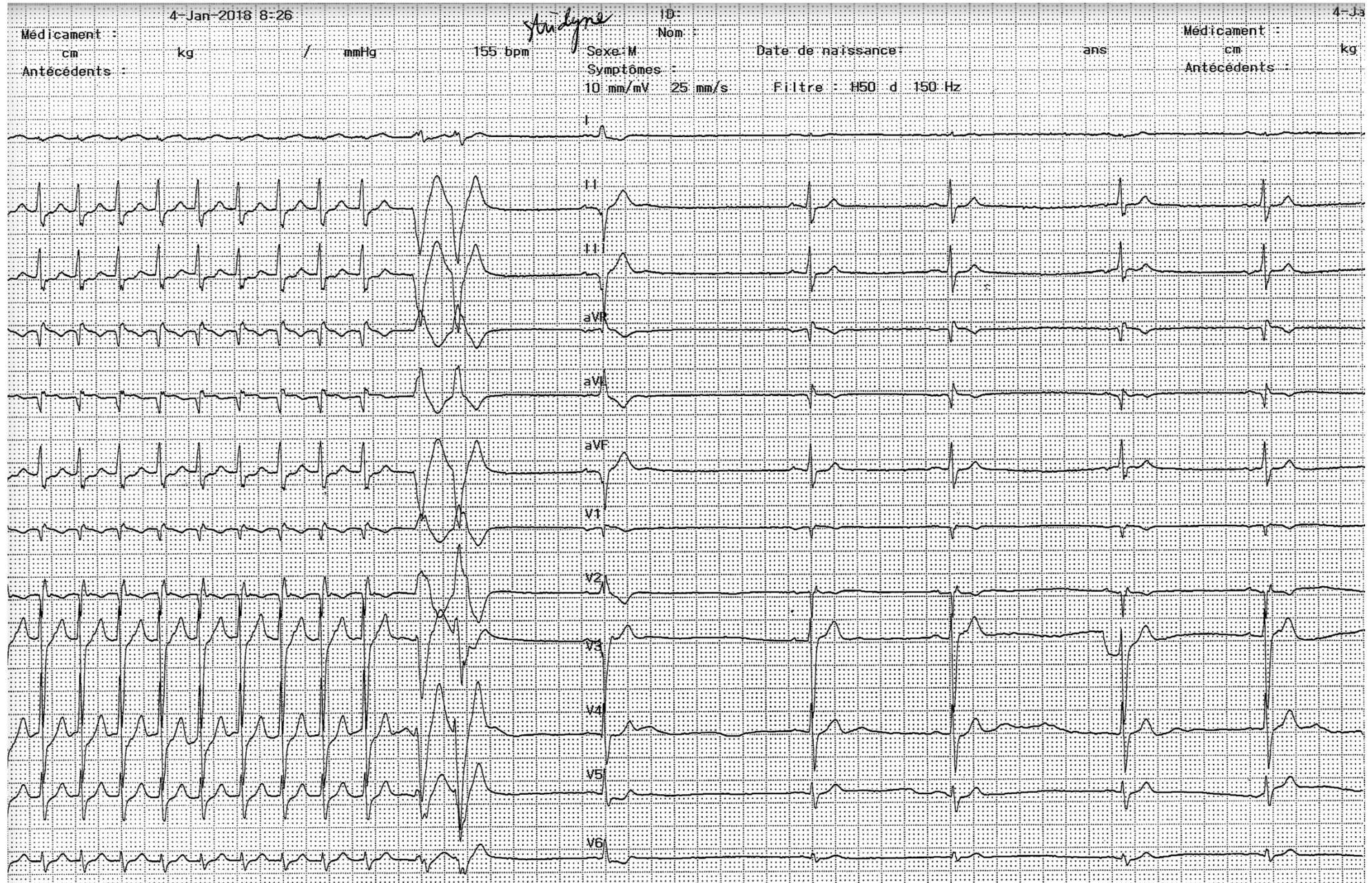
Réentrée intranodale

(activité atriale rétrograde négative en inférieur bien visible juste après le QRS cf. flèches rouges)

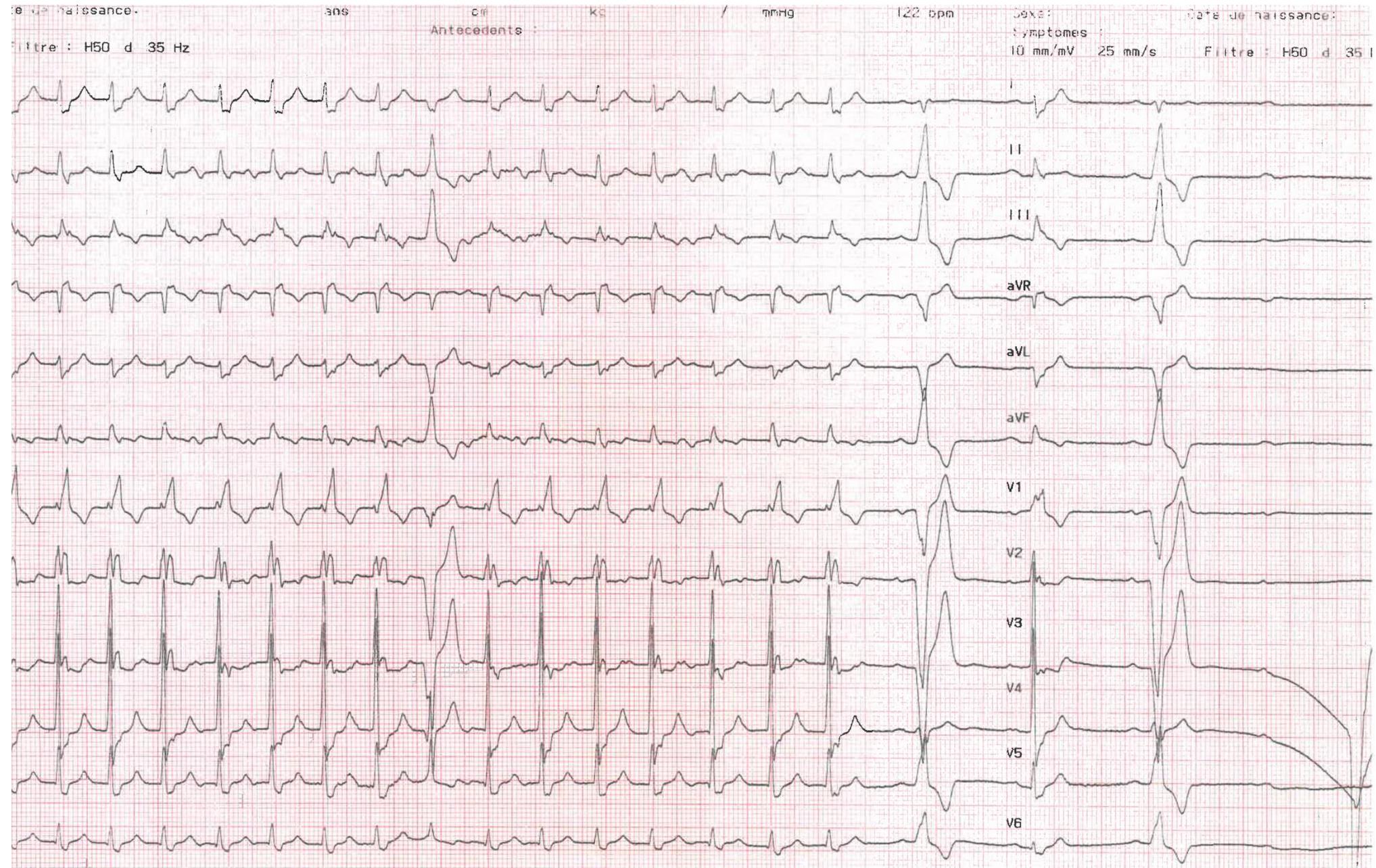
REENTRANCE INTRANODAL



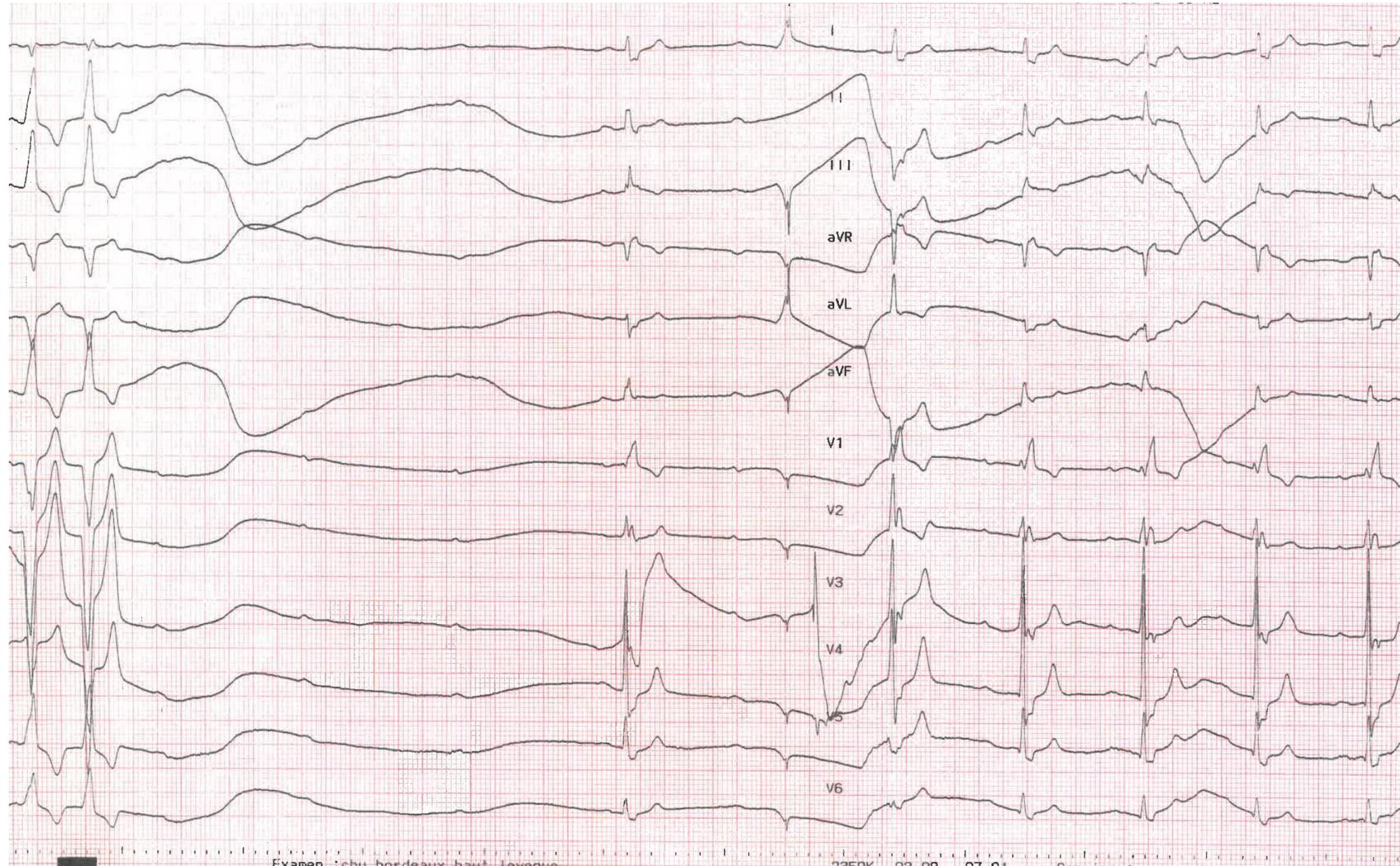
REENTREE INTRA NODALE



REENTREE INTRA NODALE

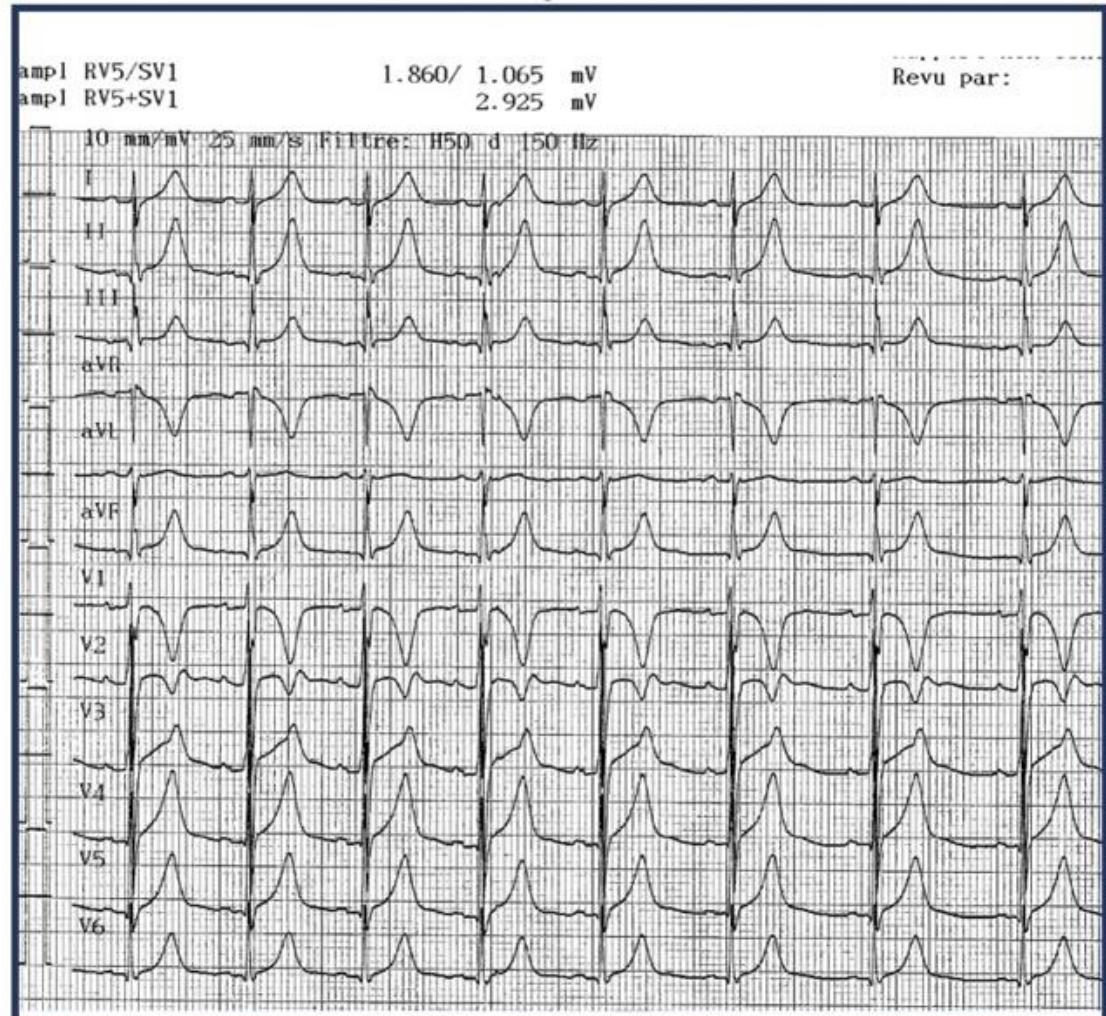


REENTRANCE INTRANODAL

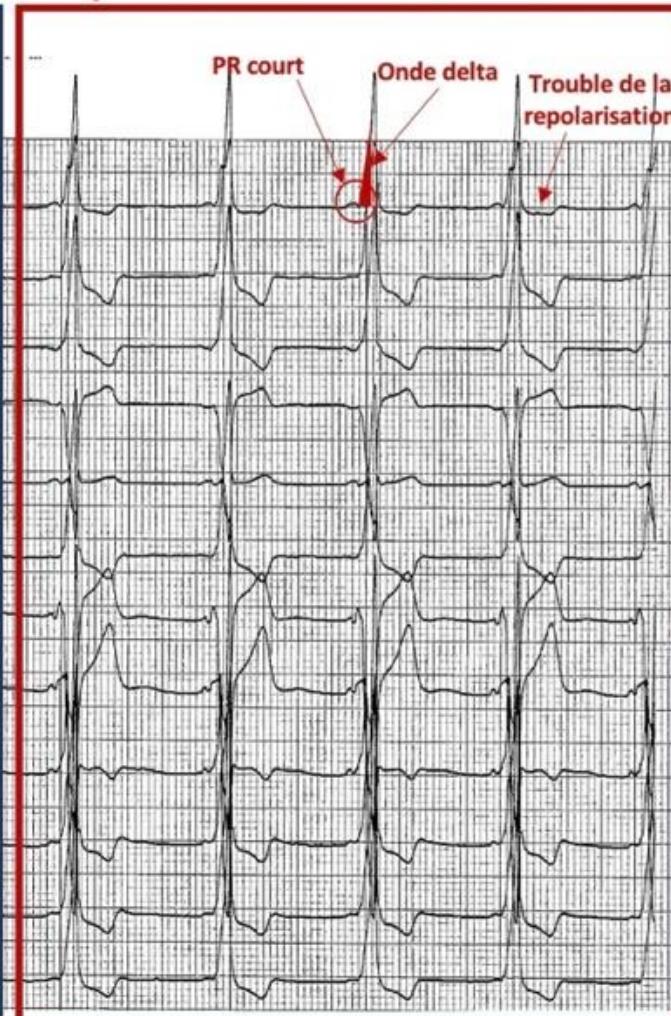


VOIES ACCESSOIRES

Absence de pré-excitation



pré-excitation ventriculaire

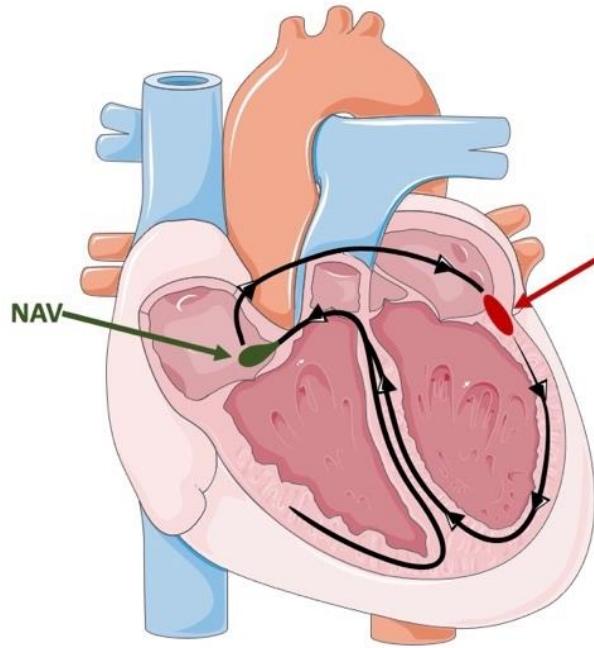


Pré-excitation ventriculaire intermittente sur un même tracé ECG (rythme sinusal)

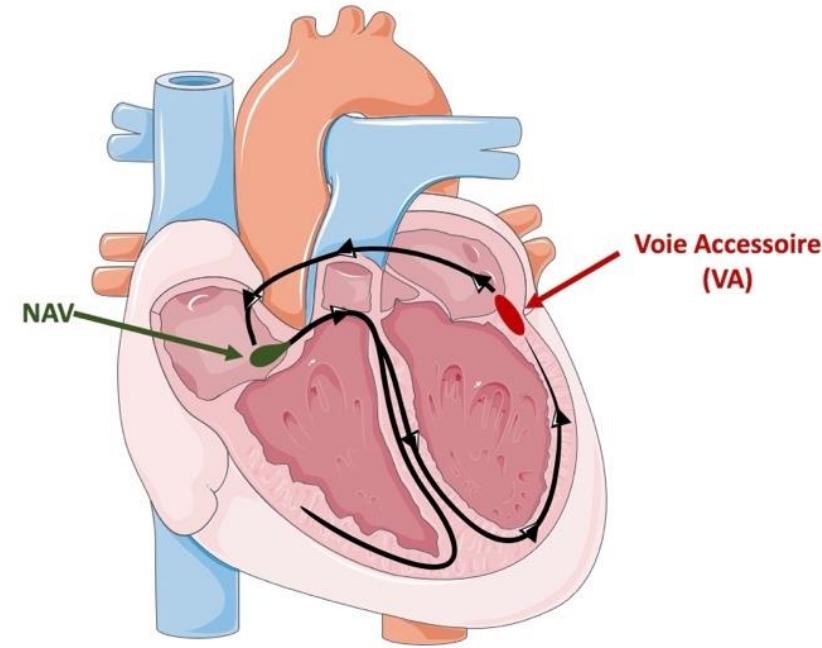
VOIES ACCESSOIRES

- **VISIBLE**
 - Différents degrés de pré-excitation
 - Intermittence ?
- **MASQUÉE**
 - = conduction antérograde présente mais non visible
- **CACHÉE**
 - = pas de conduction antérograde

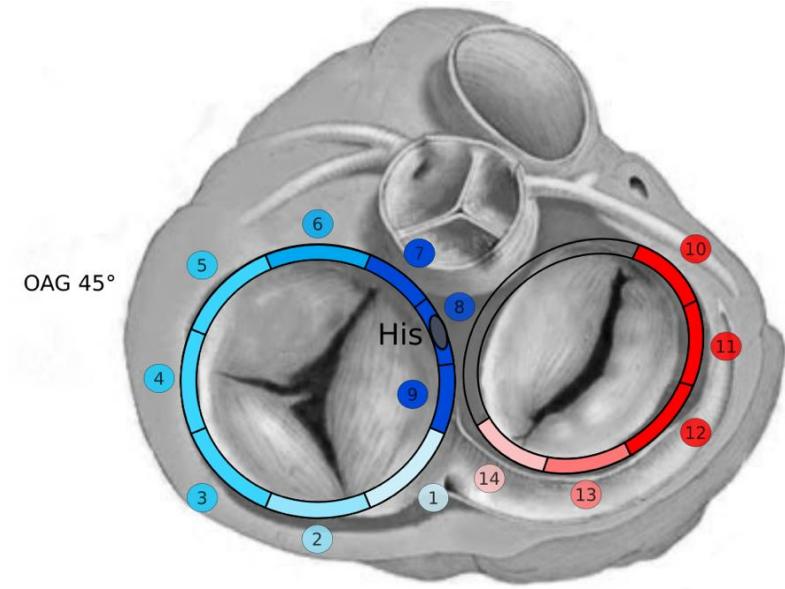
VOIES ACCESSOIRES



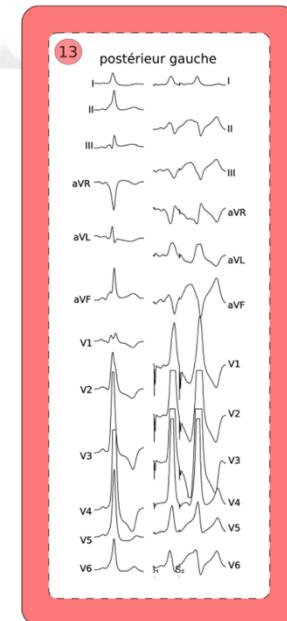
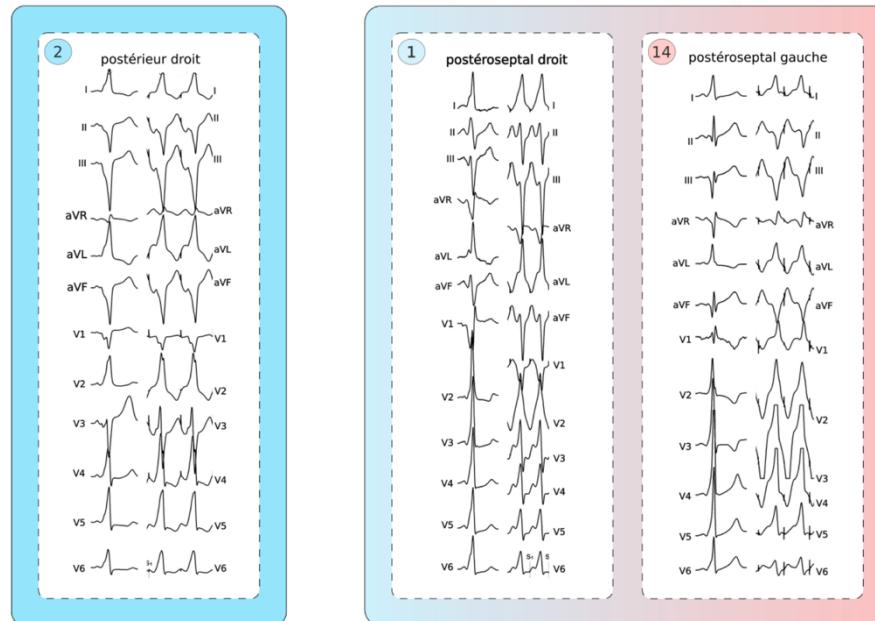
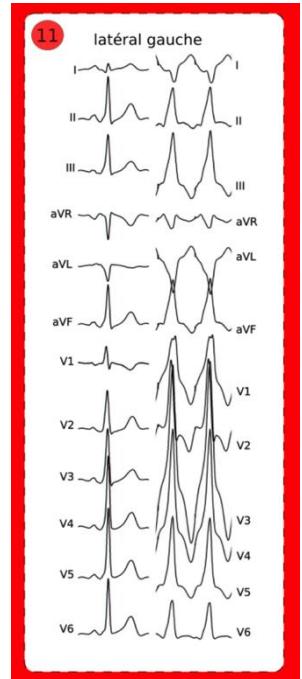
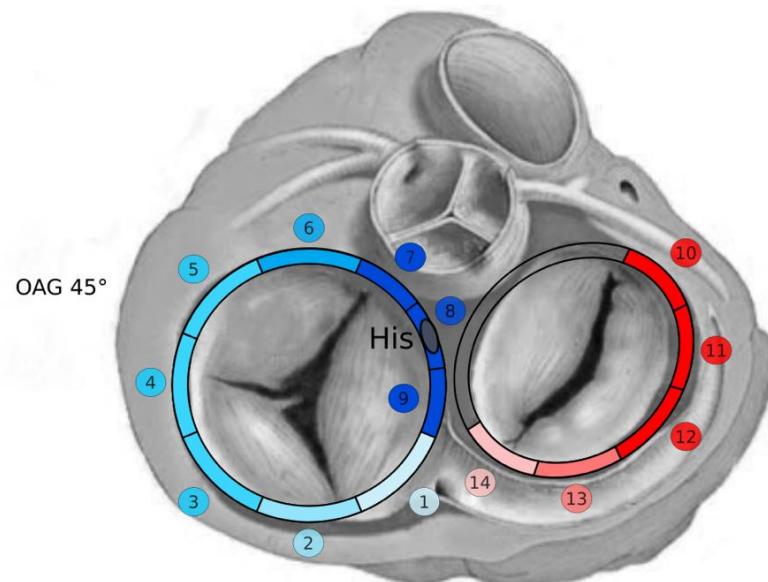
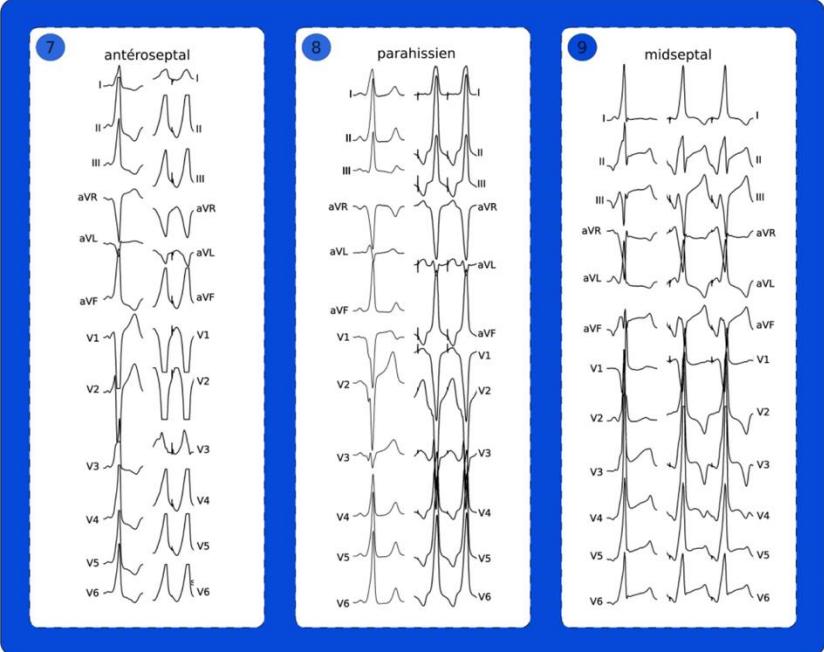
TJ sur VA ANTIDROMIQUE (5%)



TJ sur VA ORTHODROMIQUE (95%)



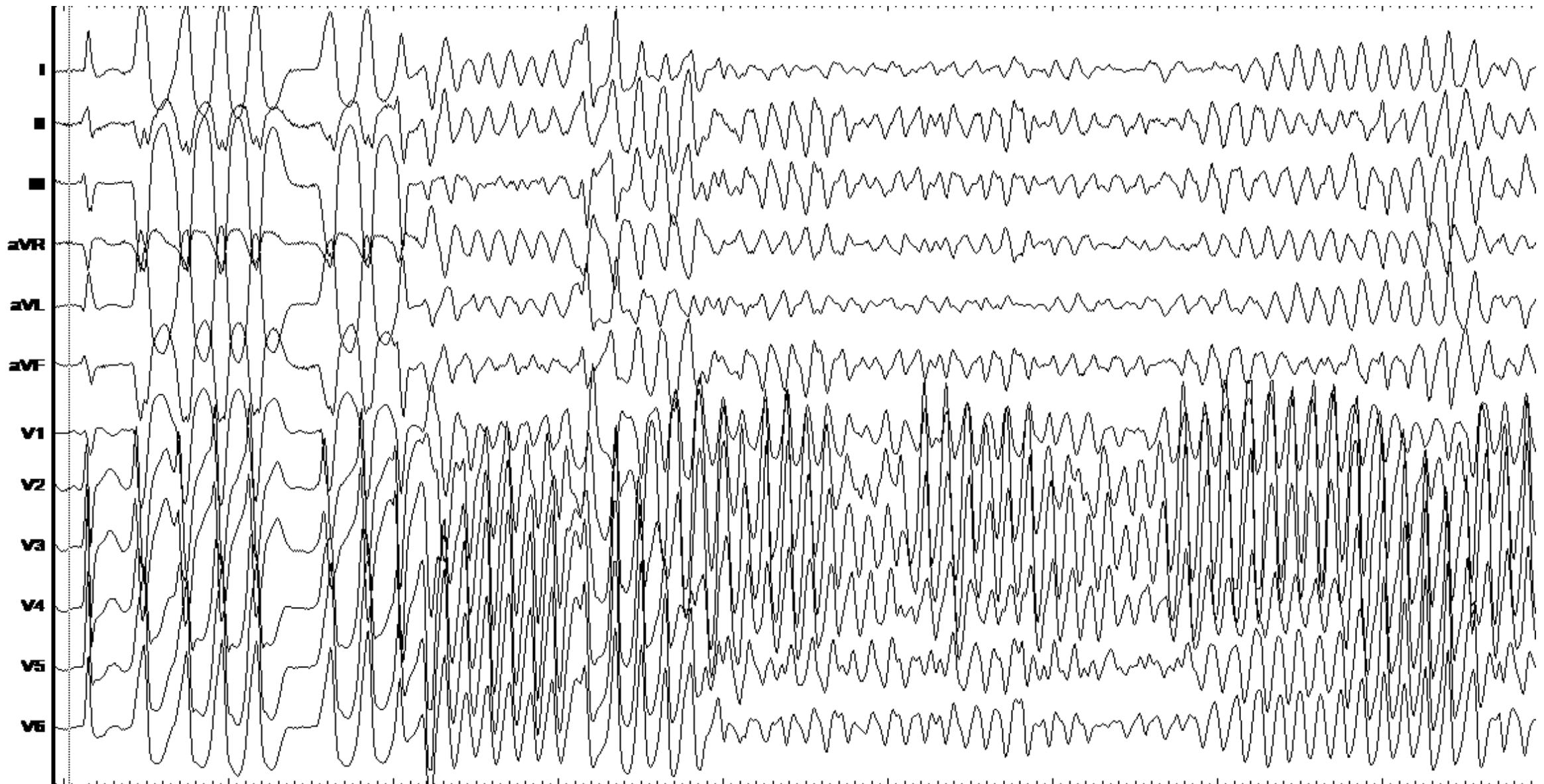
VOIES ACCESSOIRES : LOCALISATIONS



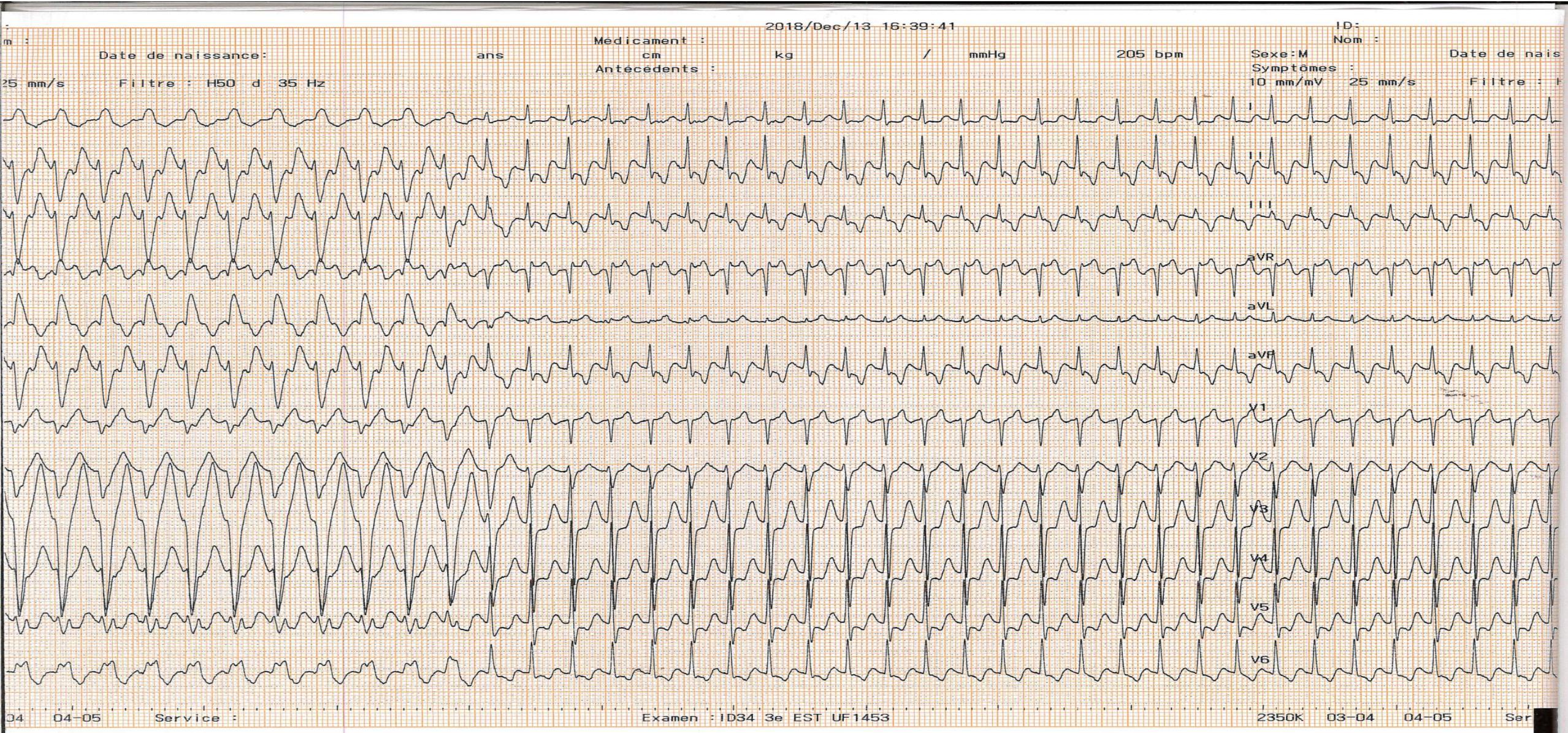
MANŒUVRES EP : Evaluation de la PRA des VA



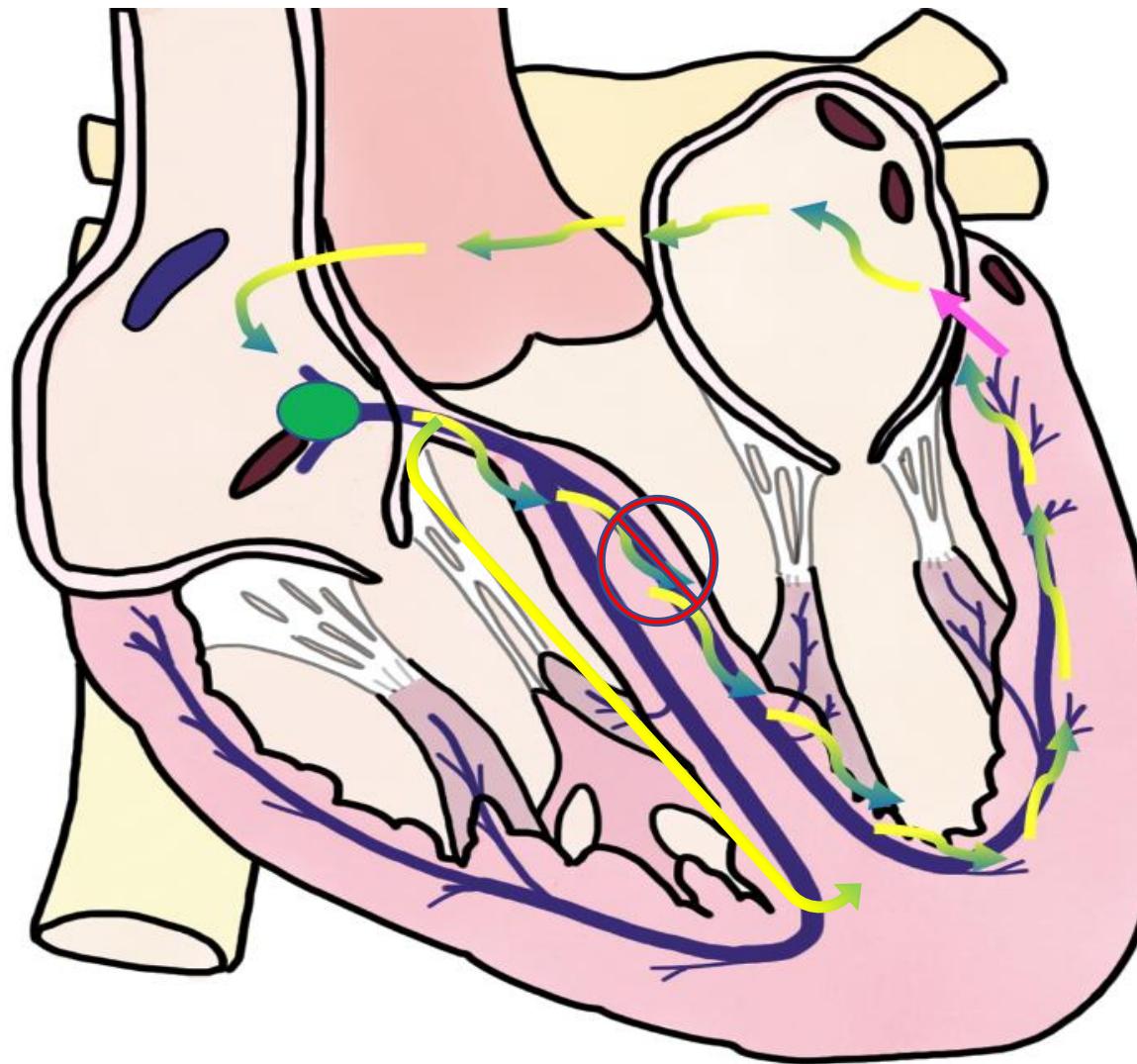
MANŒUVRES EP : Evaluation de la PRA des VA



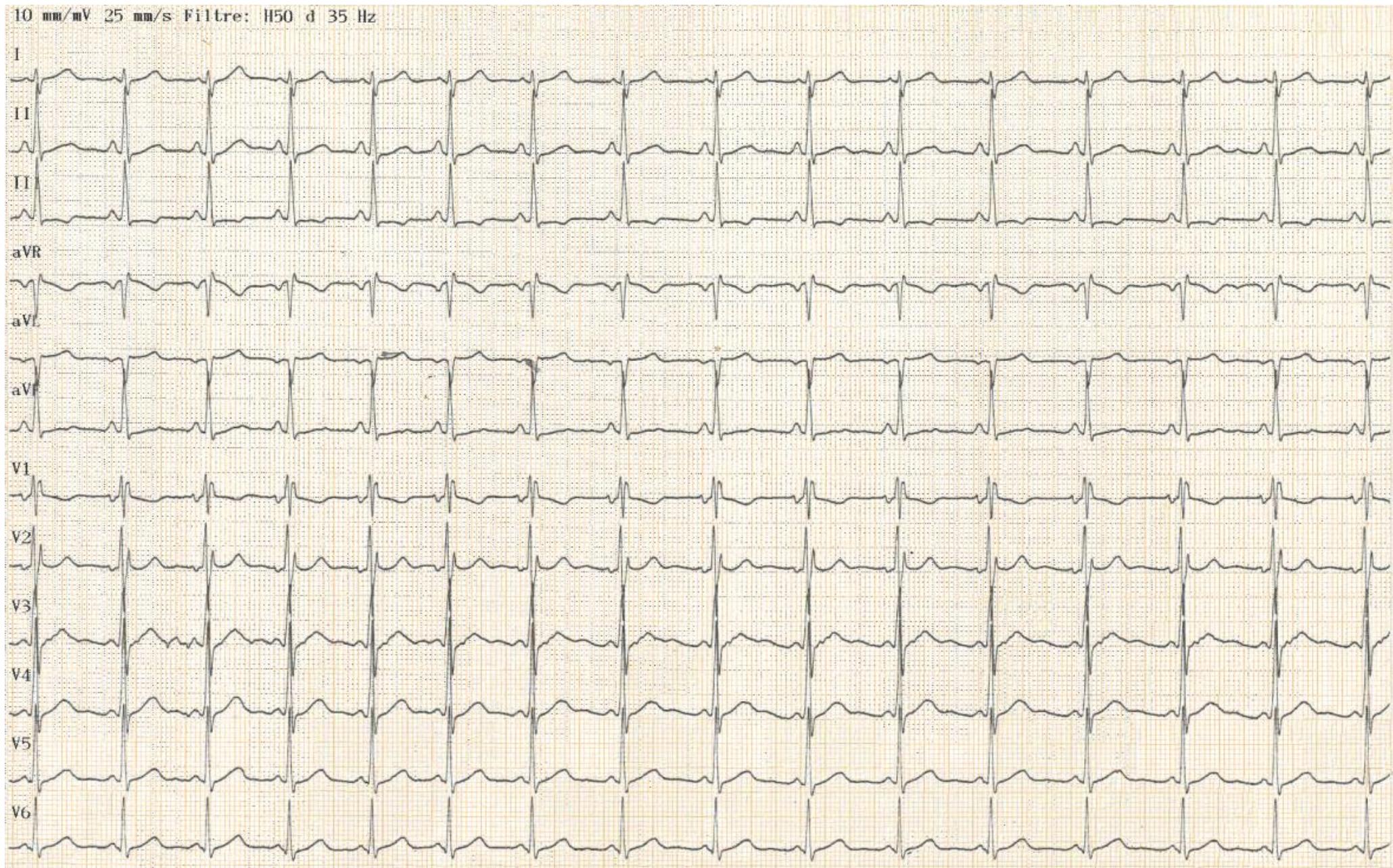
MANŒUVRES EP : Bloc de branche ralentisseur



MANŒUVRES EP : Bloc de branche ralentisseur

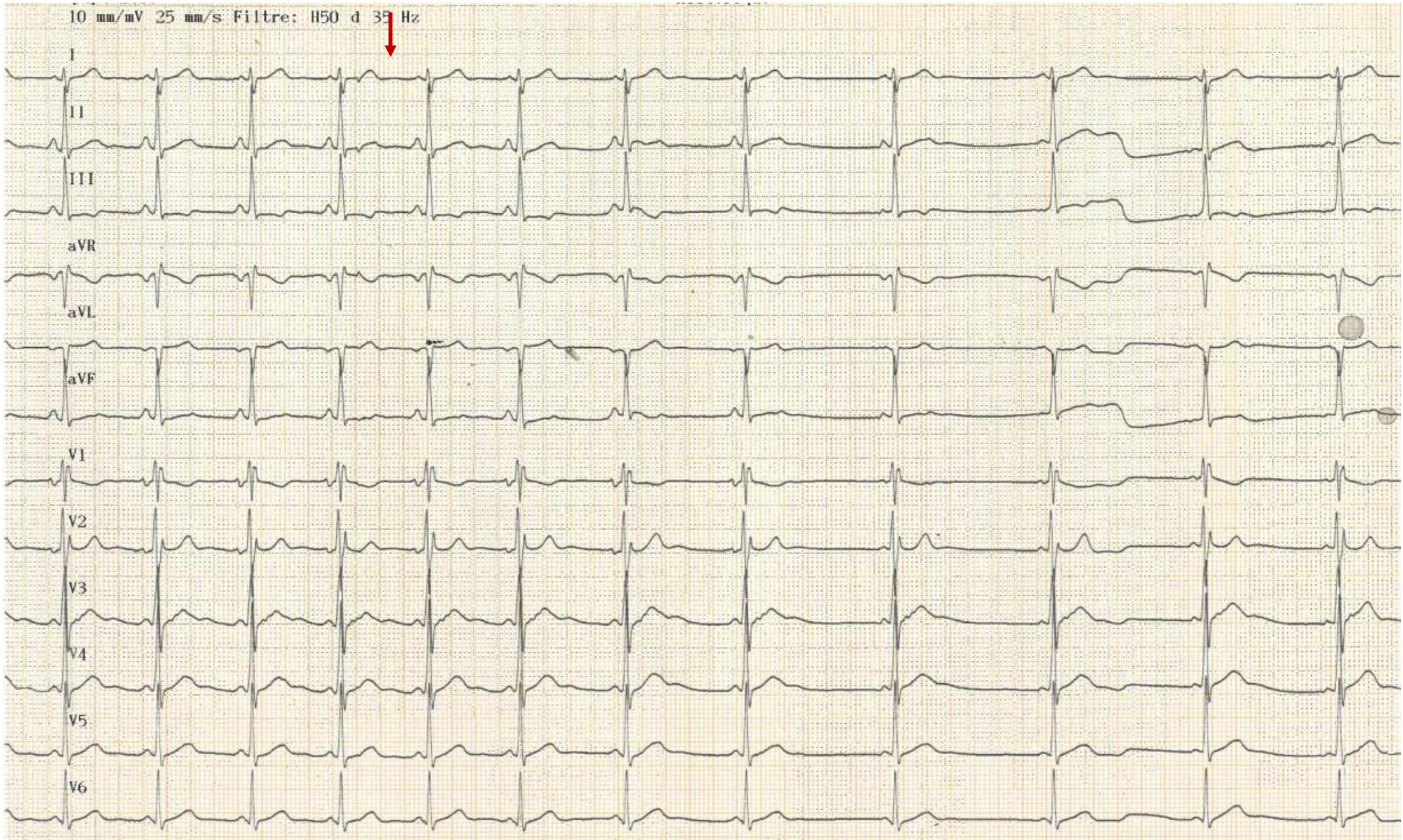


PATIENT #13 ter

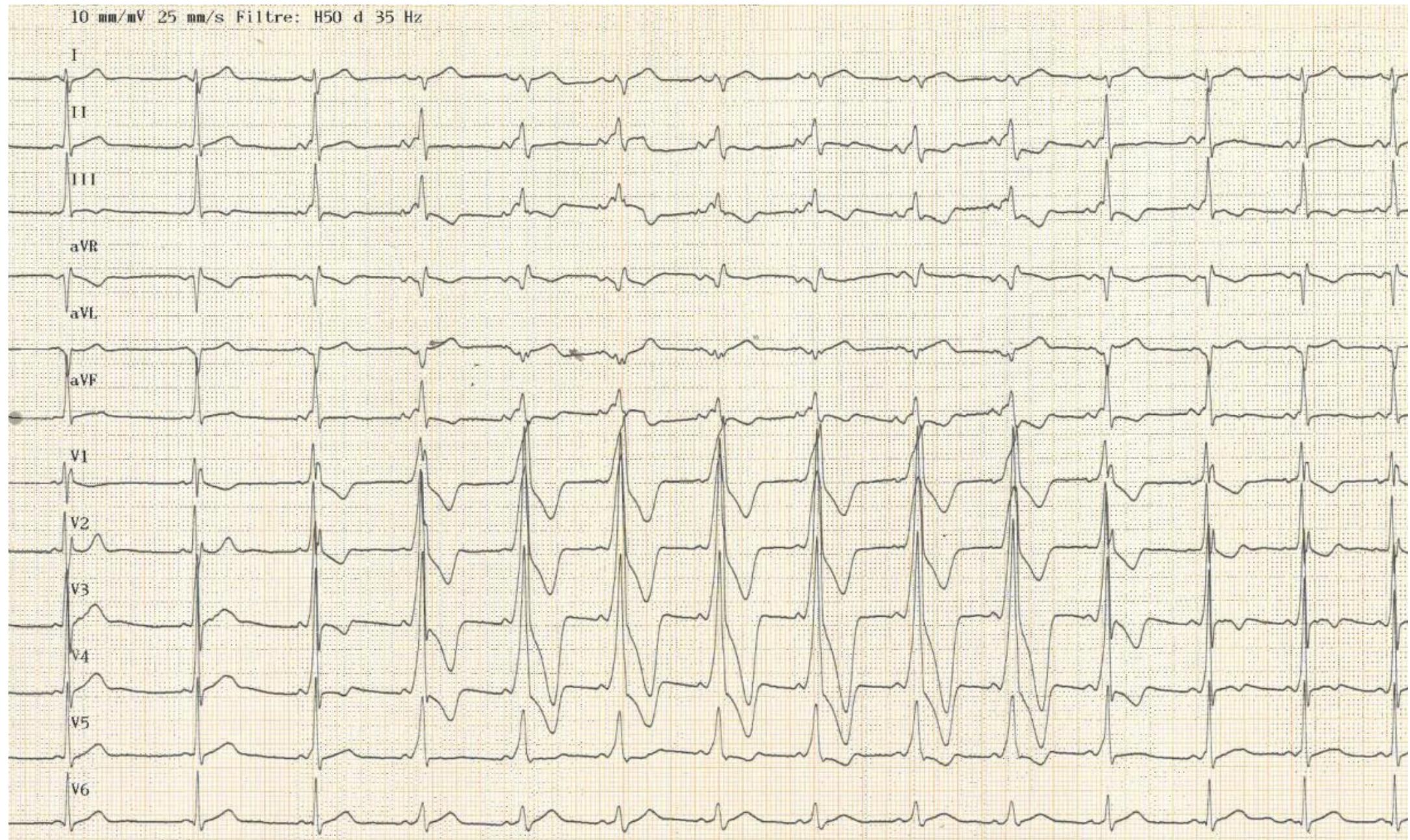


PATIENT #13 ter

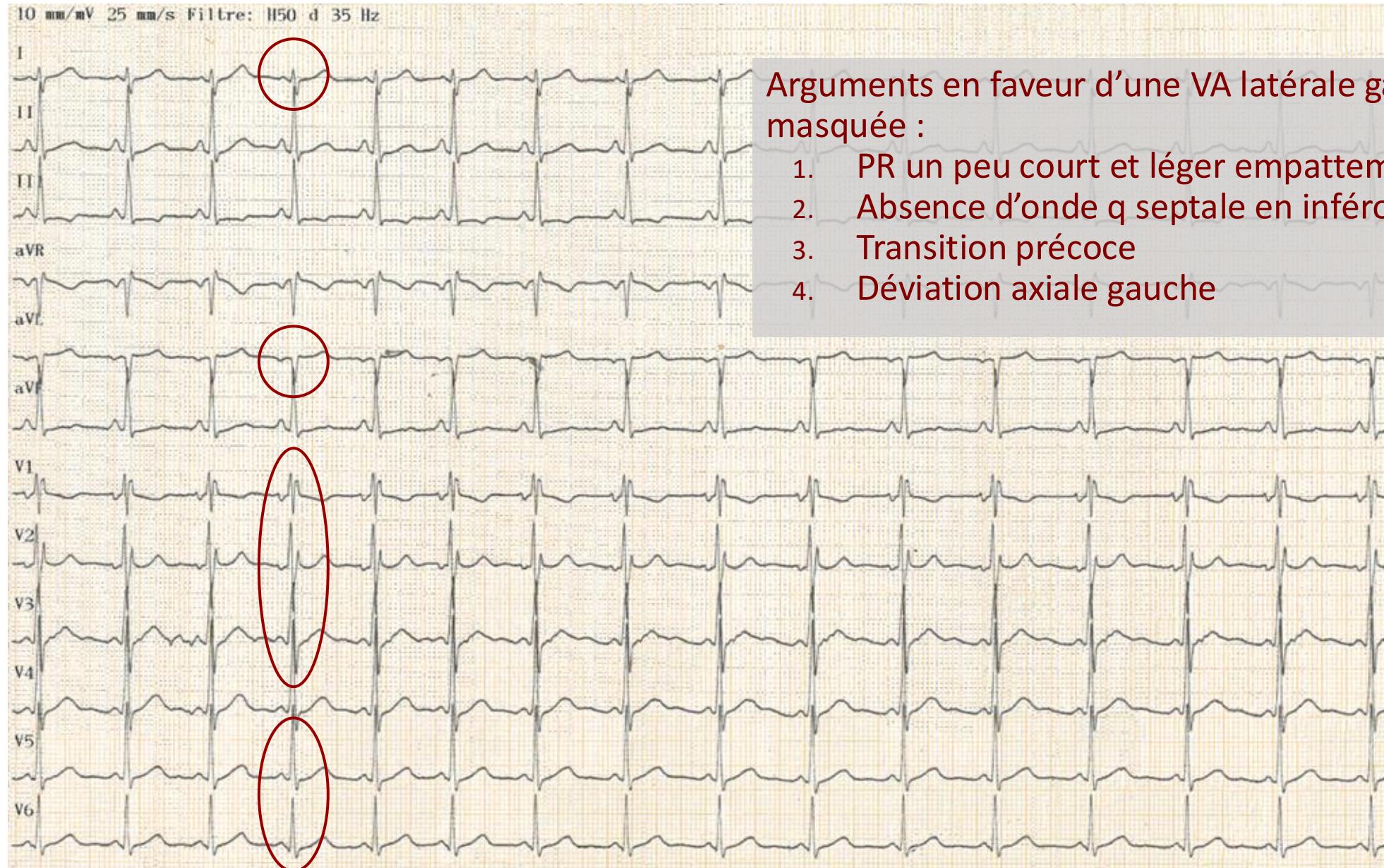
STRIADYNE



PATIENT #13 ter



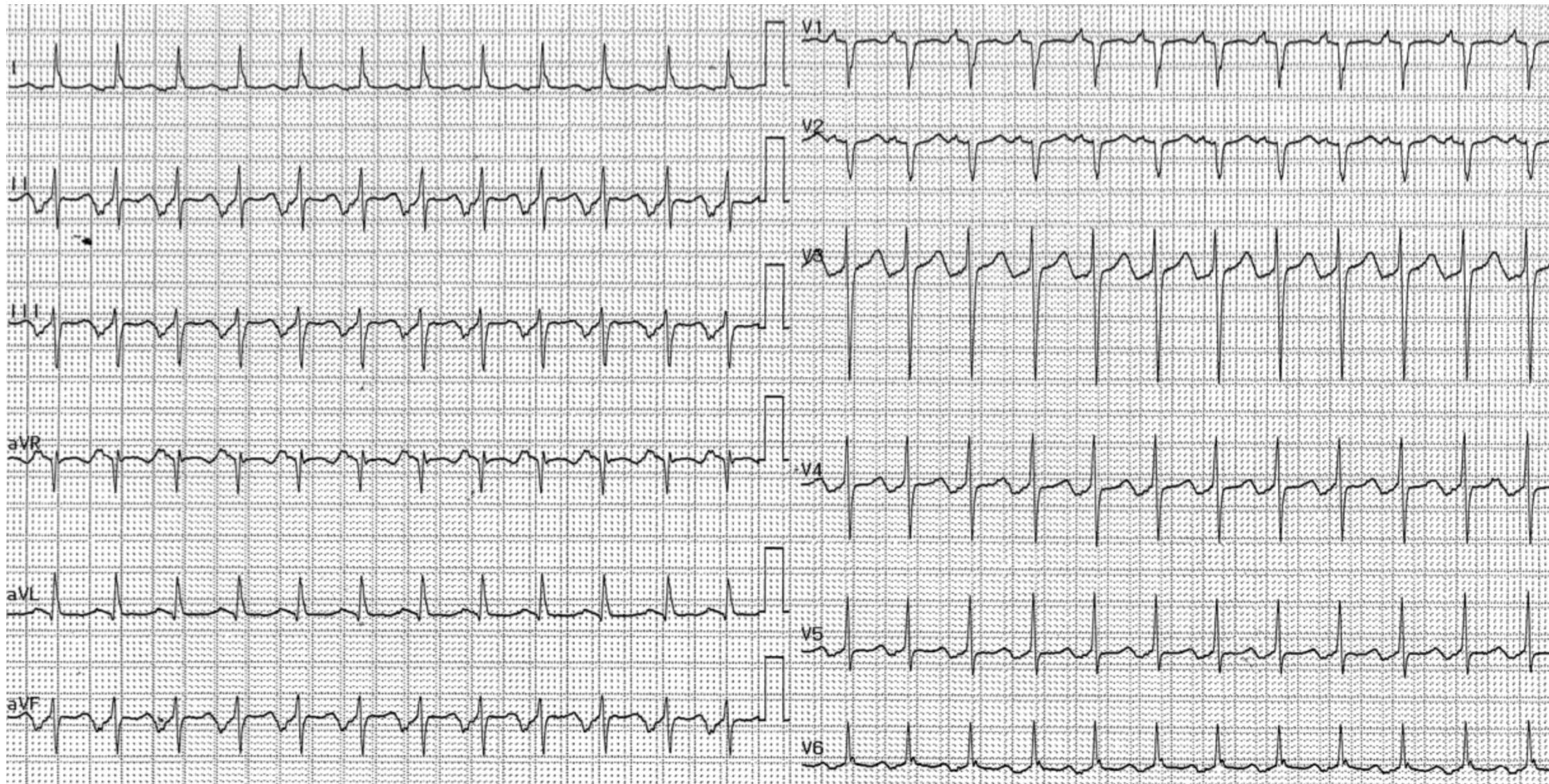
PATIENT #13 ter



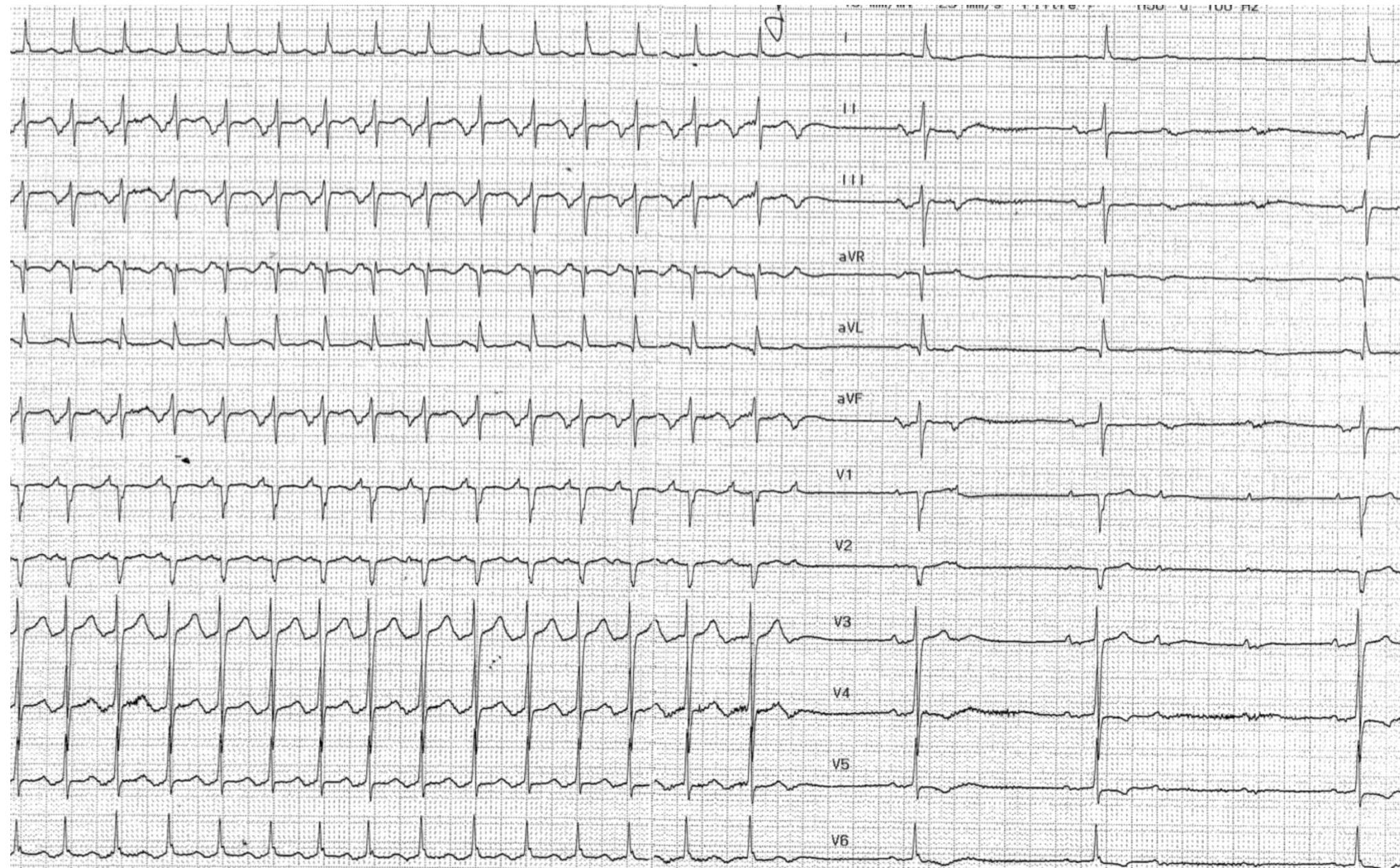
Arguments en faveur d'une VA latérale gauche masquée :

1. PR un peu court et léger empattement du QRS
2. Absence d'onde q septale en inféro-latéral
3. Transition précoce
4. Déviation axiale gauche

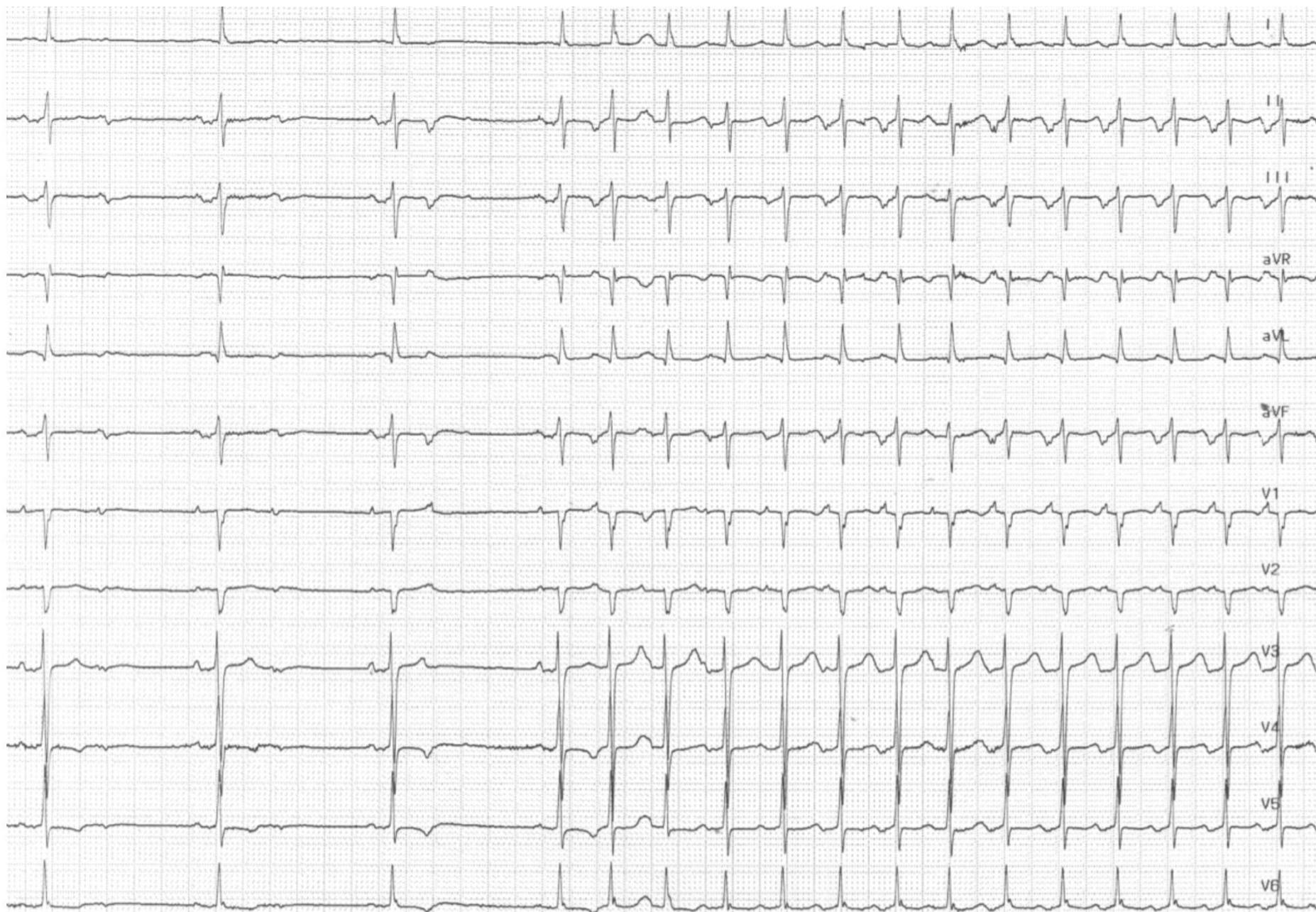
PJRT / Coumel = VA décrémentielle rétrograde exclusive



PJRT / Coumel = VA décrémentielle rétrograde exclusive



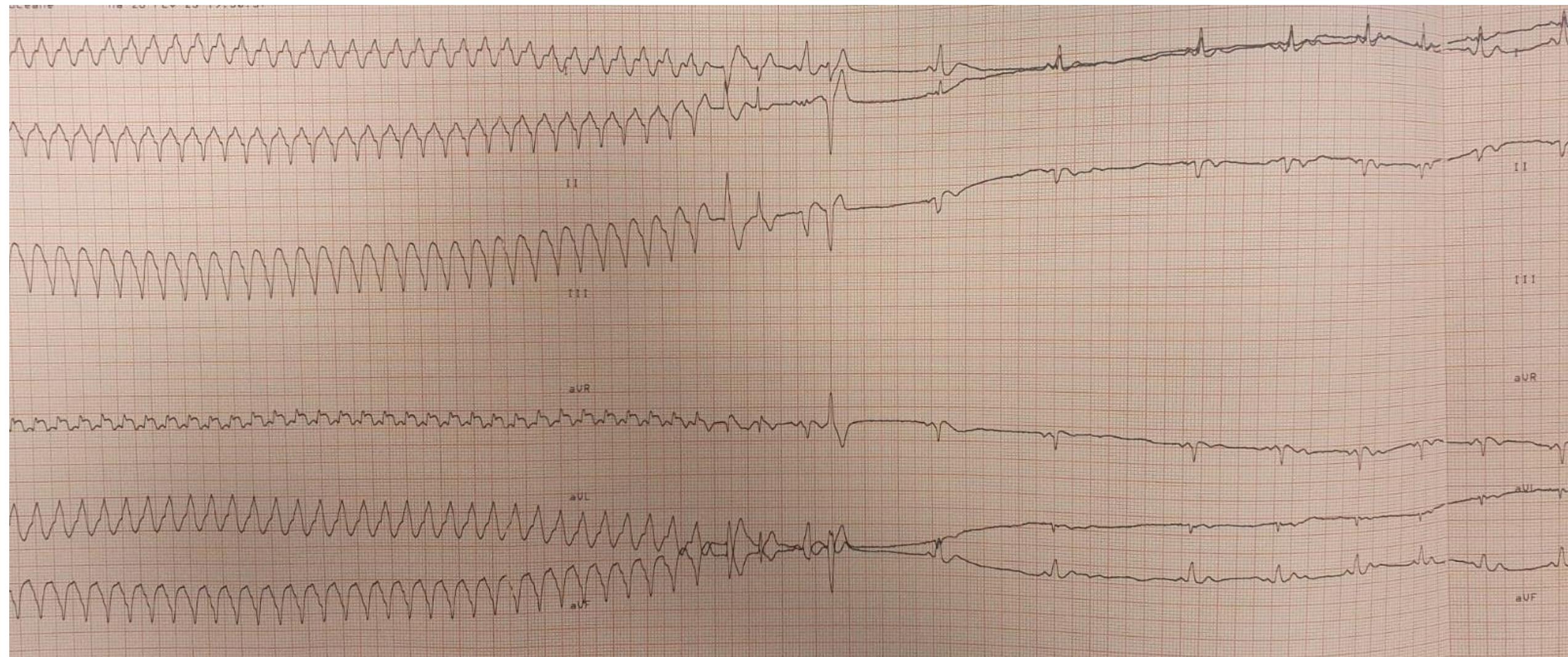
PJRT / Coumel = VA décrémentielle rétrograde exclusive



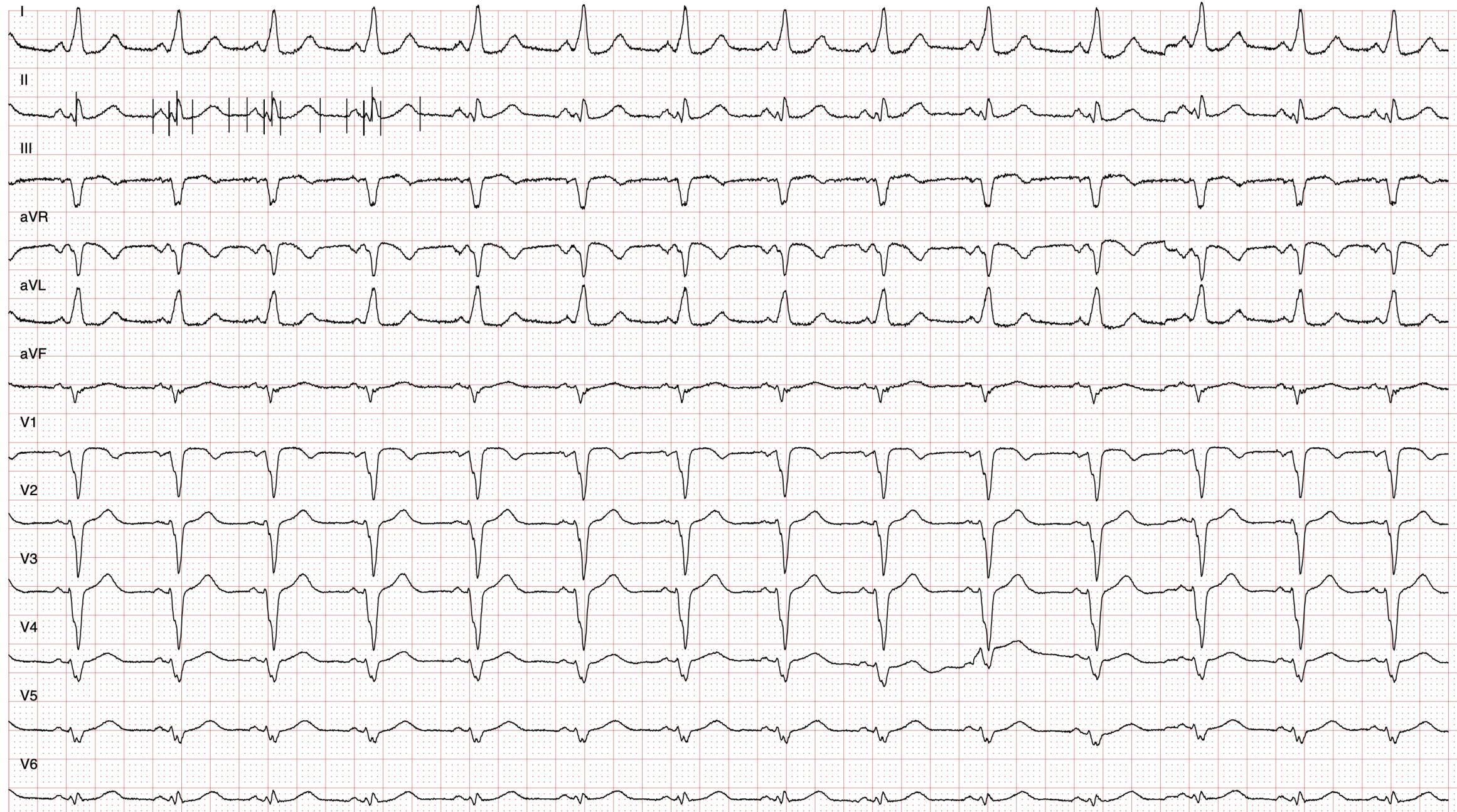
ENCORE UNE VA ?



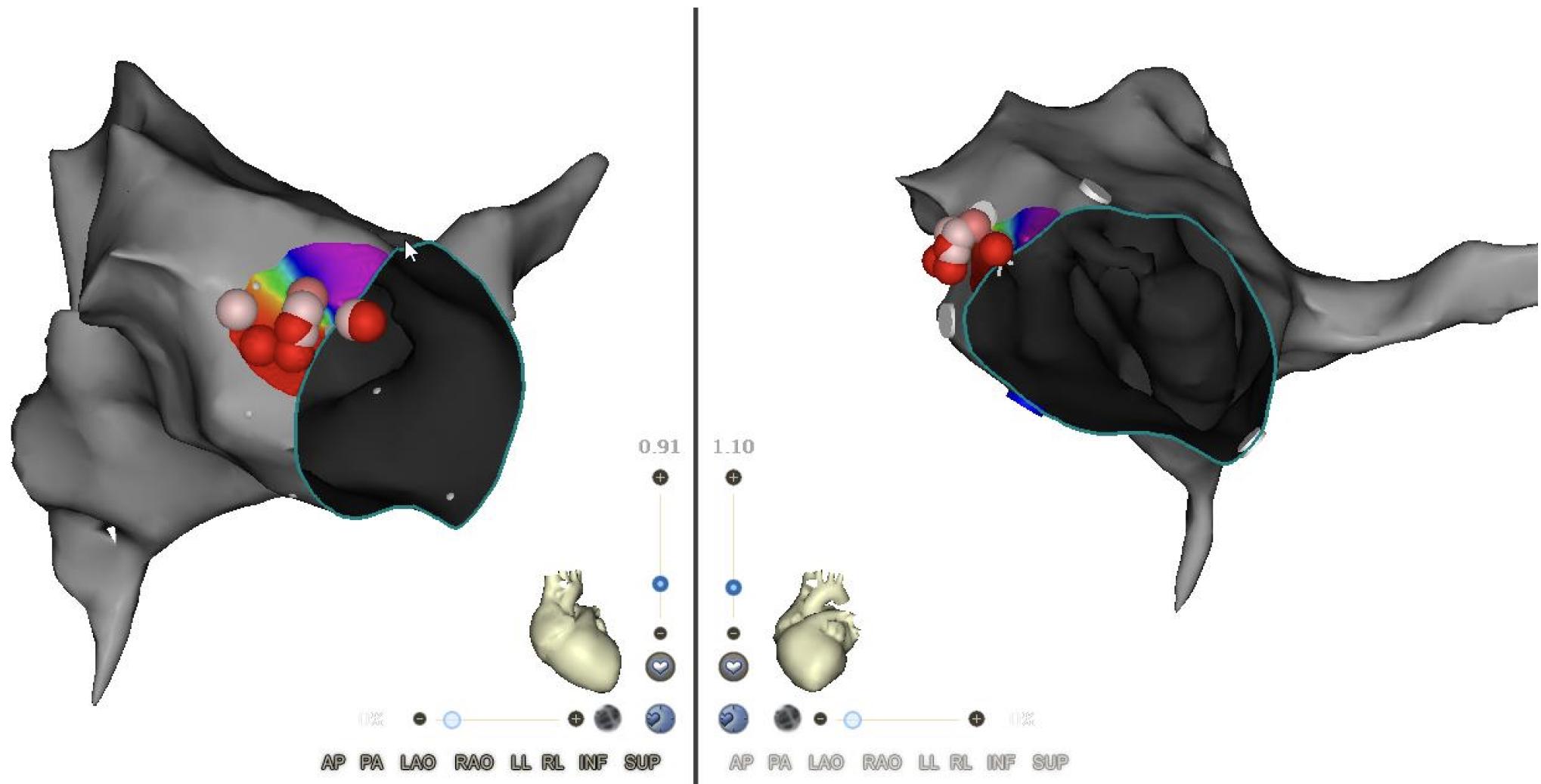
ENCORE UNE VA ?



ENCORE UNE VA ?



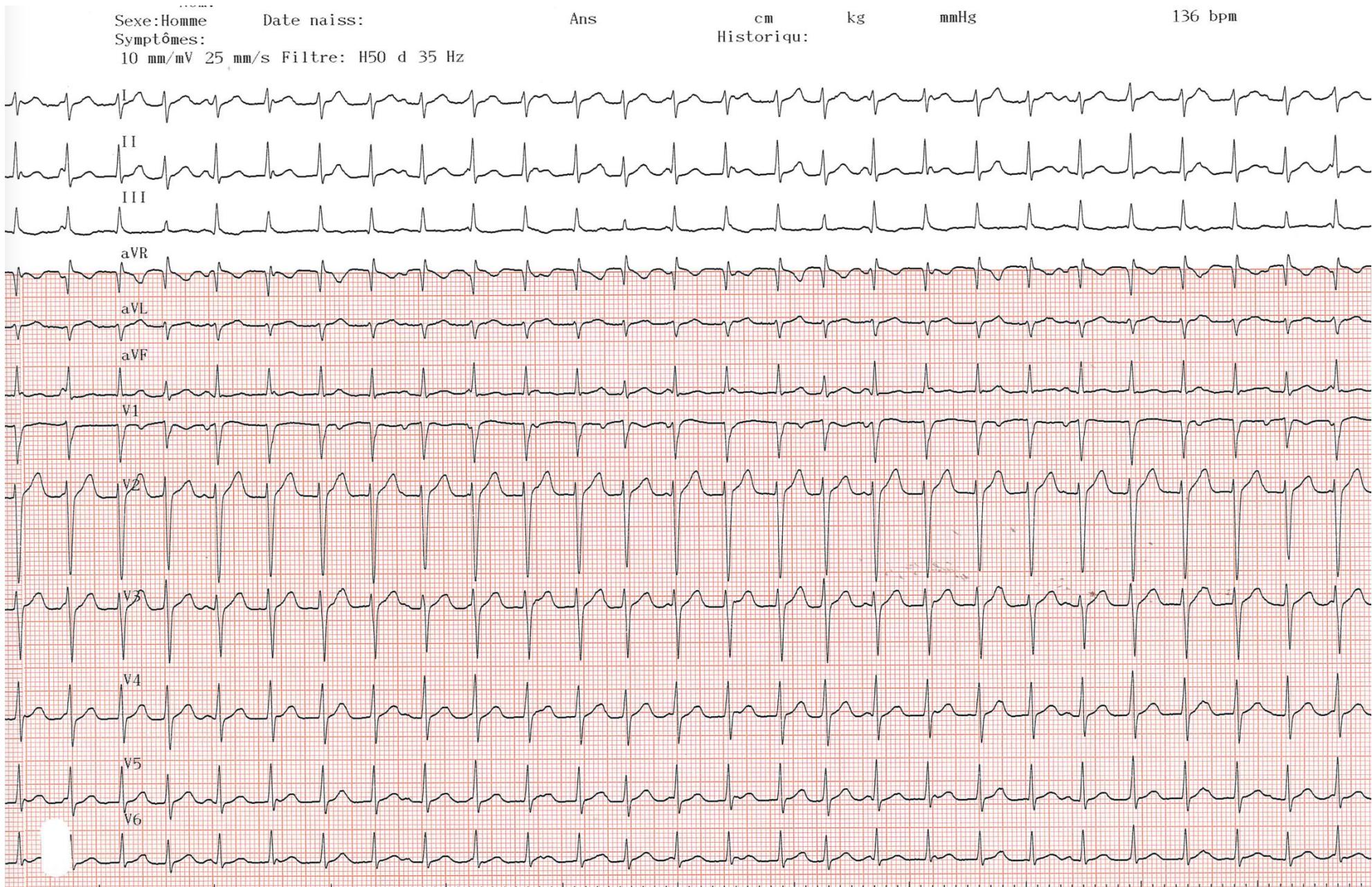
ENCORE UNE VA ?



ENCORE UNE VA ?



JET : Junctional Ectopic Tachycardia



JET : Junctional Ectopic Tachycardia

Sexe:Homme Date naiss:

Ans

cm
Historiqu:

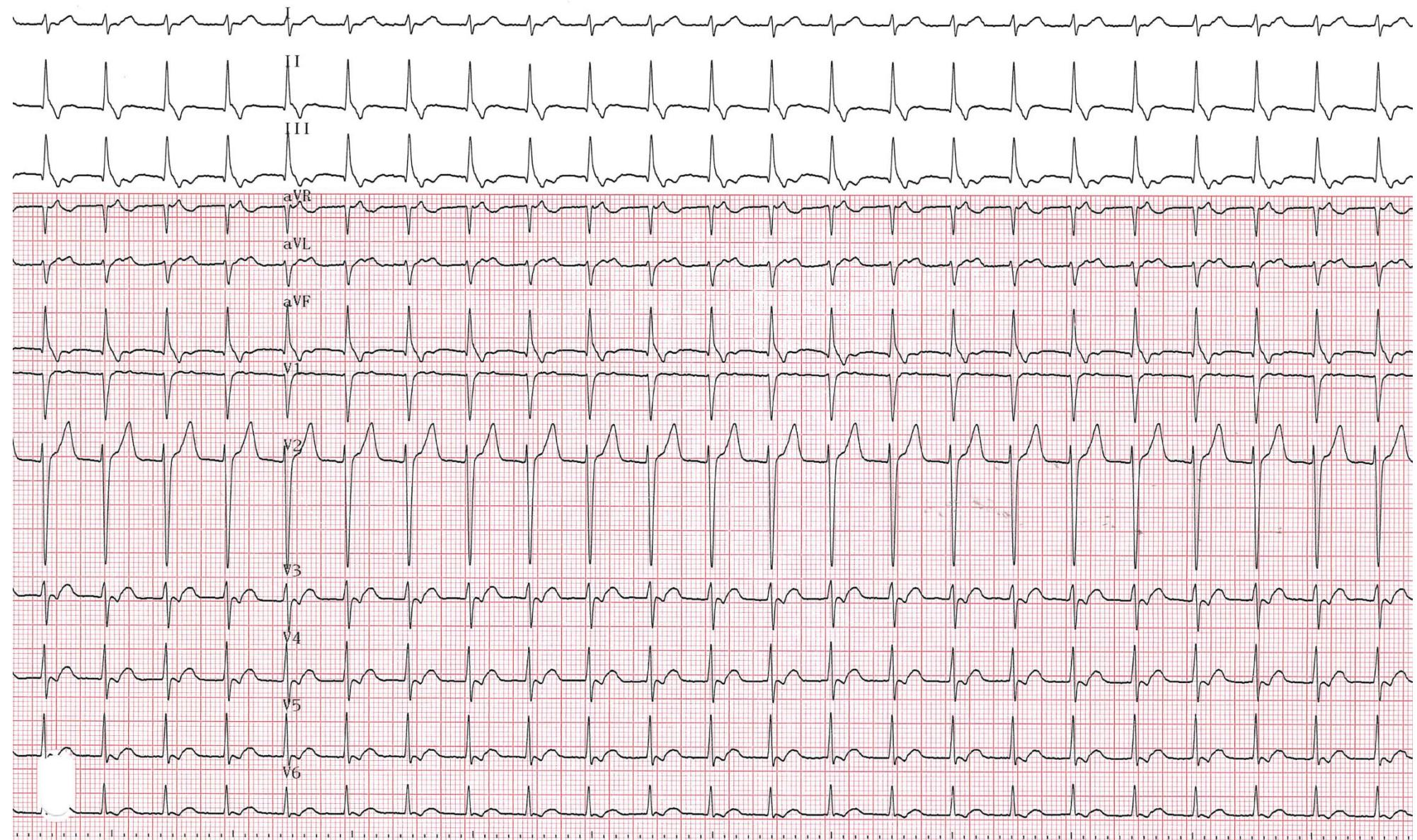
kg

mmHg

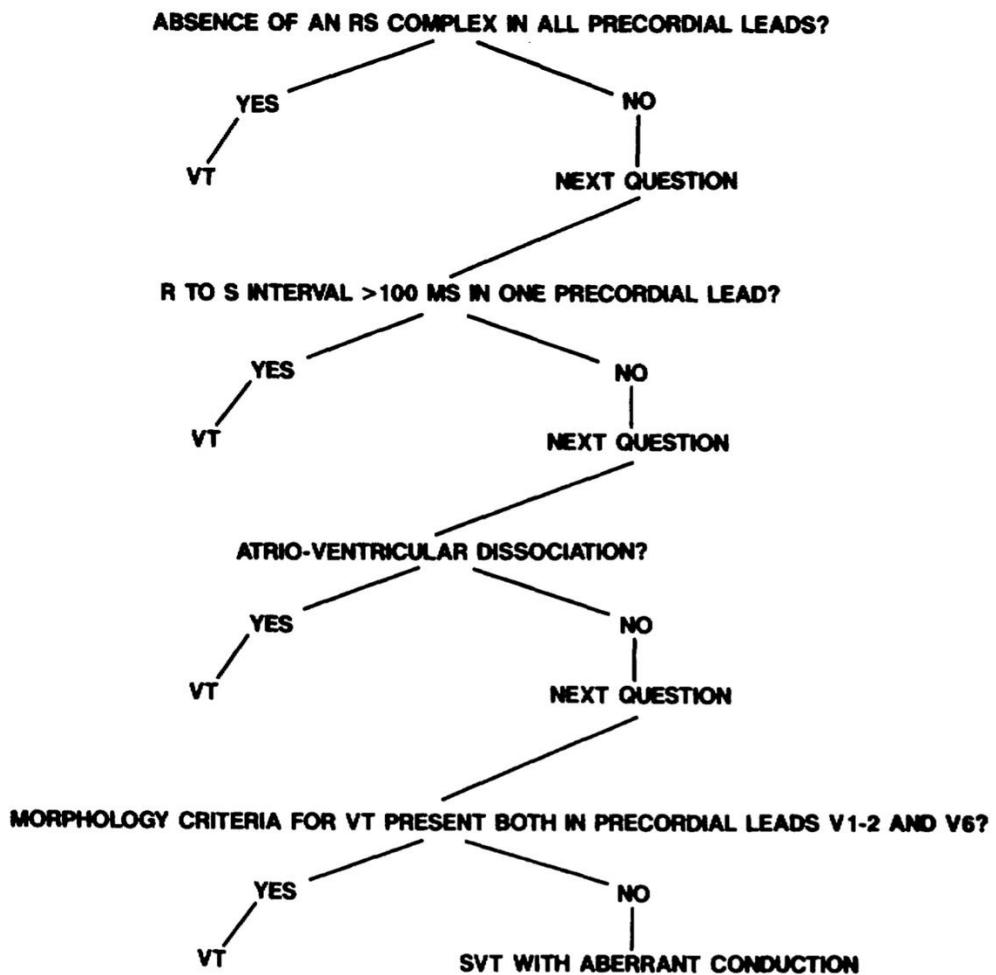
119 |

Symptômes:

10 mm/mV 25 mm/s Filtre: H50 d 35 Hz



TV vs. TSV : ALGORITHMES DE DISCRIMINATION



Brugada 1991

Table 9 Summary of key electrocardiographic criteria that suggest ventricular tachycardia rather than supraventricular tachycardia in wide complex tachycardia

AV dissociation	Ventricular rate > atrial rate
Fusion/capture beats	Different QRS morphology from that of tachycardia
Chest lead negative concordance	All precordial chest leads negative
RS in precordial leads	<ul style="list-style-type: none"> - Absence of RS in precordial leads - RS >100 ms in any lead^a
QRS complex in aVR	<ul style="list-style-type: none"> ● Initial R wave ● Initial R or Q wave >40 ms ● Presence of a notch of a predominantly negative complex
QRS axis –90 to ±180°	Both in the presence of RBBB and LBBB morphology
R wave peak time in lead II	R wave peak time ≥50 ms
RBBB morphology	<p>Lead V1: Monophasic R, Rsr', biphasic qR complex, broad R (>40 ms), and a double-peaked R wave with the left peak taller than the right (the so-called 'rabbit ear' sign)</p> <p>Lead V6: R:S ratio <1 (rS, QS patterns)</p>
LBBB morphology	<p>Lead V1: Broad R wave, slurred or notched-down stroke of the S wave, and delayed nadir of S wave</p> <p>Lead V6: Q or QS wave</p>

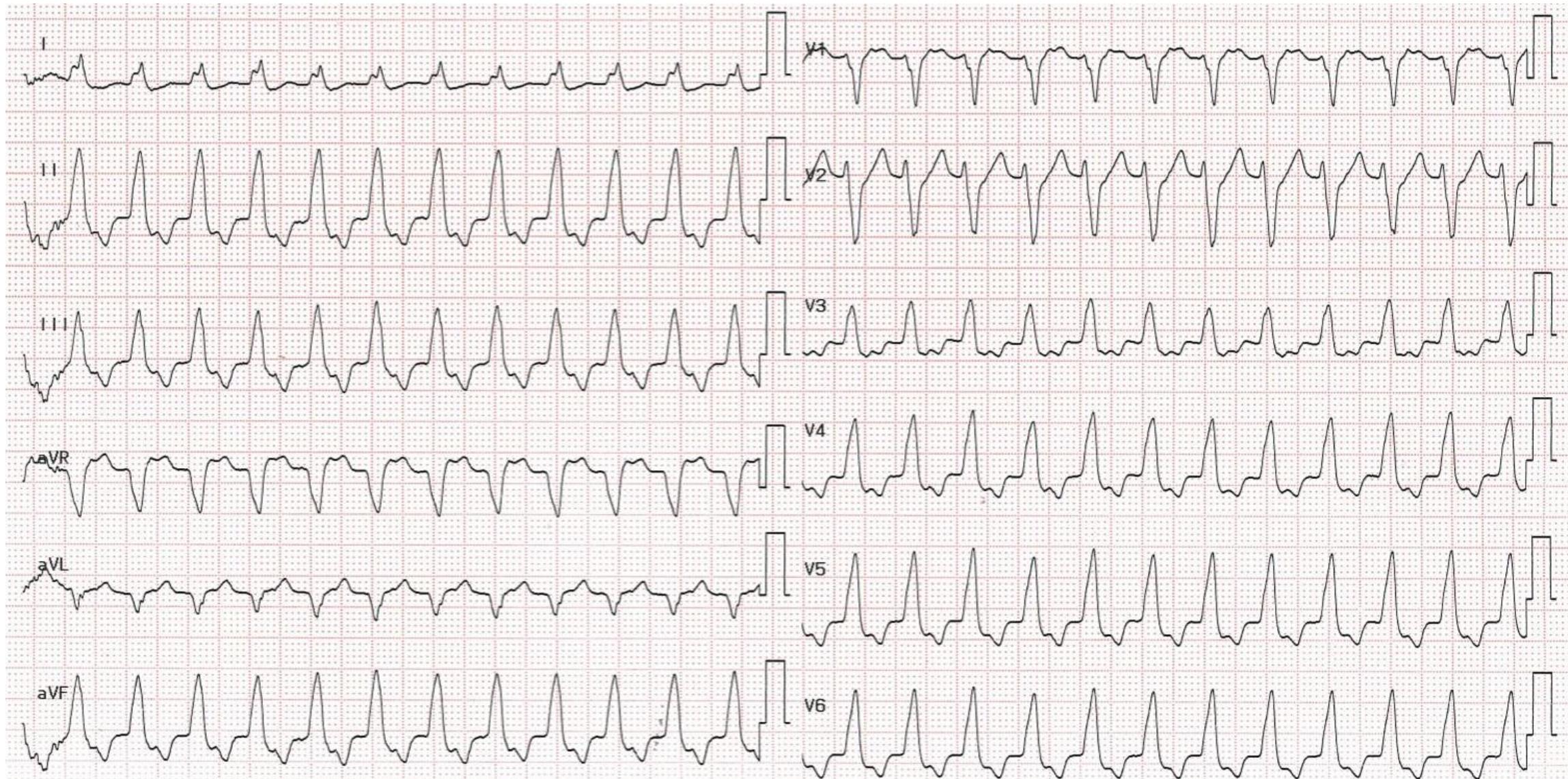
PATIENT #1

CLINIQUE

- Homme de 65 ans
- Consulte aux urgences pour palpitations
- Depuis 3 heures
- Premier épisode
- Pas d'ATCD particulier.

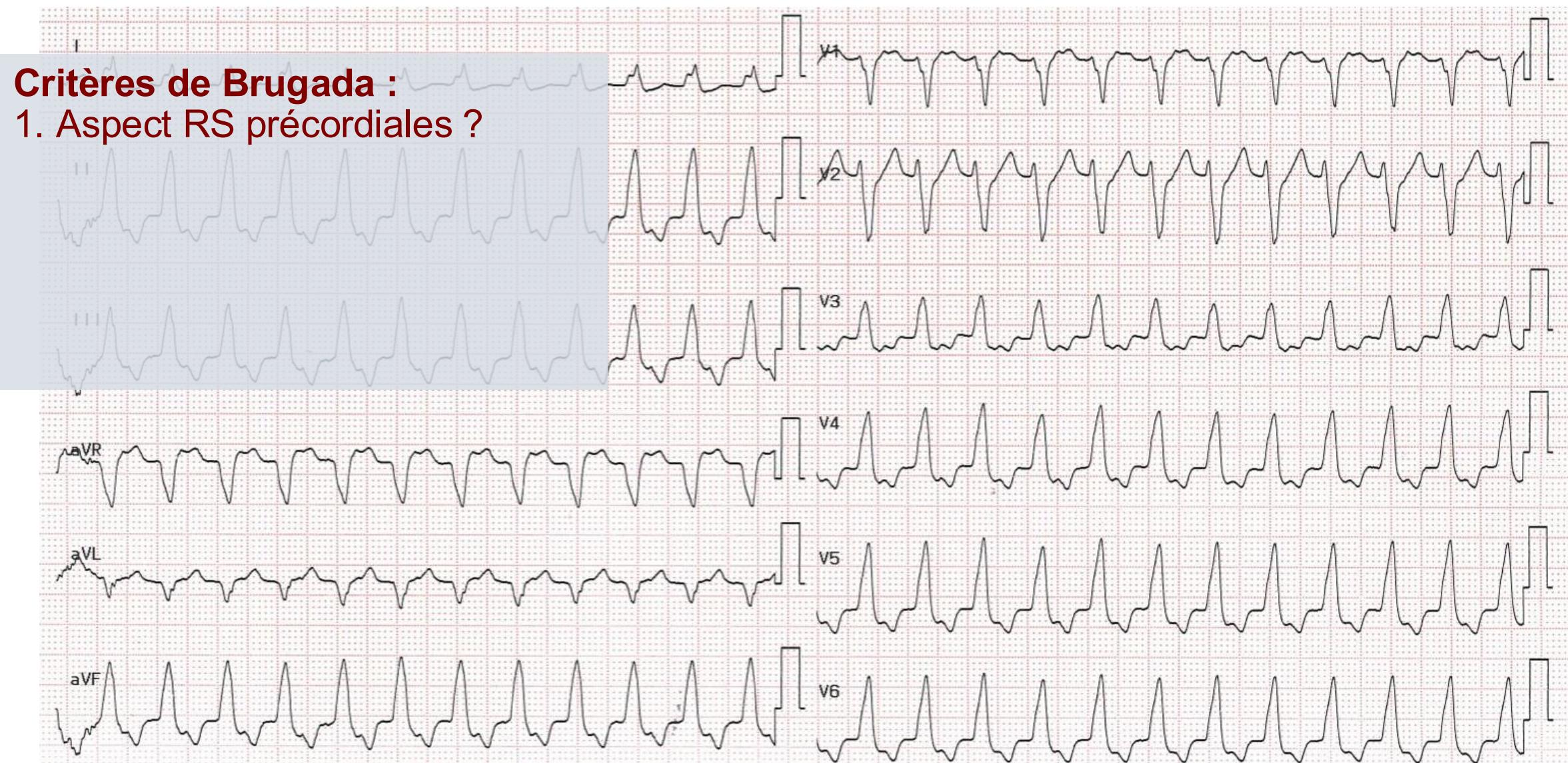
PATIENT #1

ECG ENTRÉE



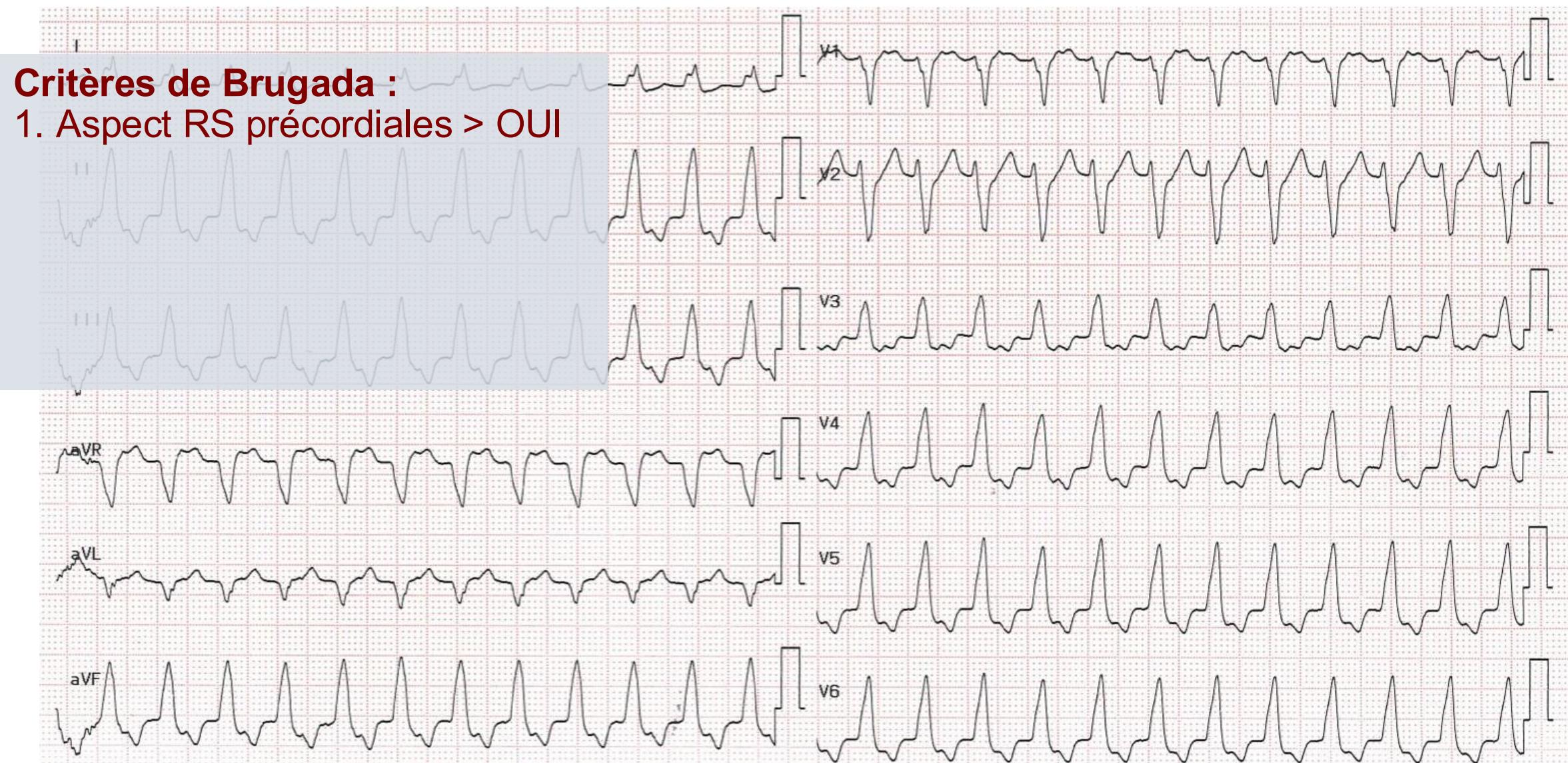
PATIENT #1

ECG ENTREE



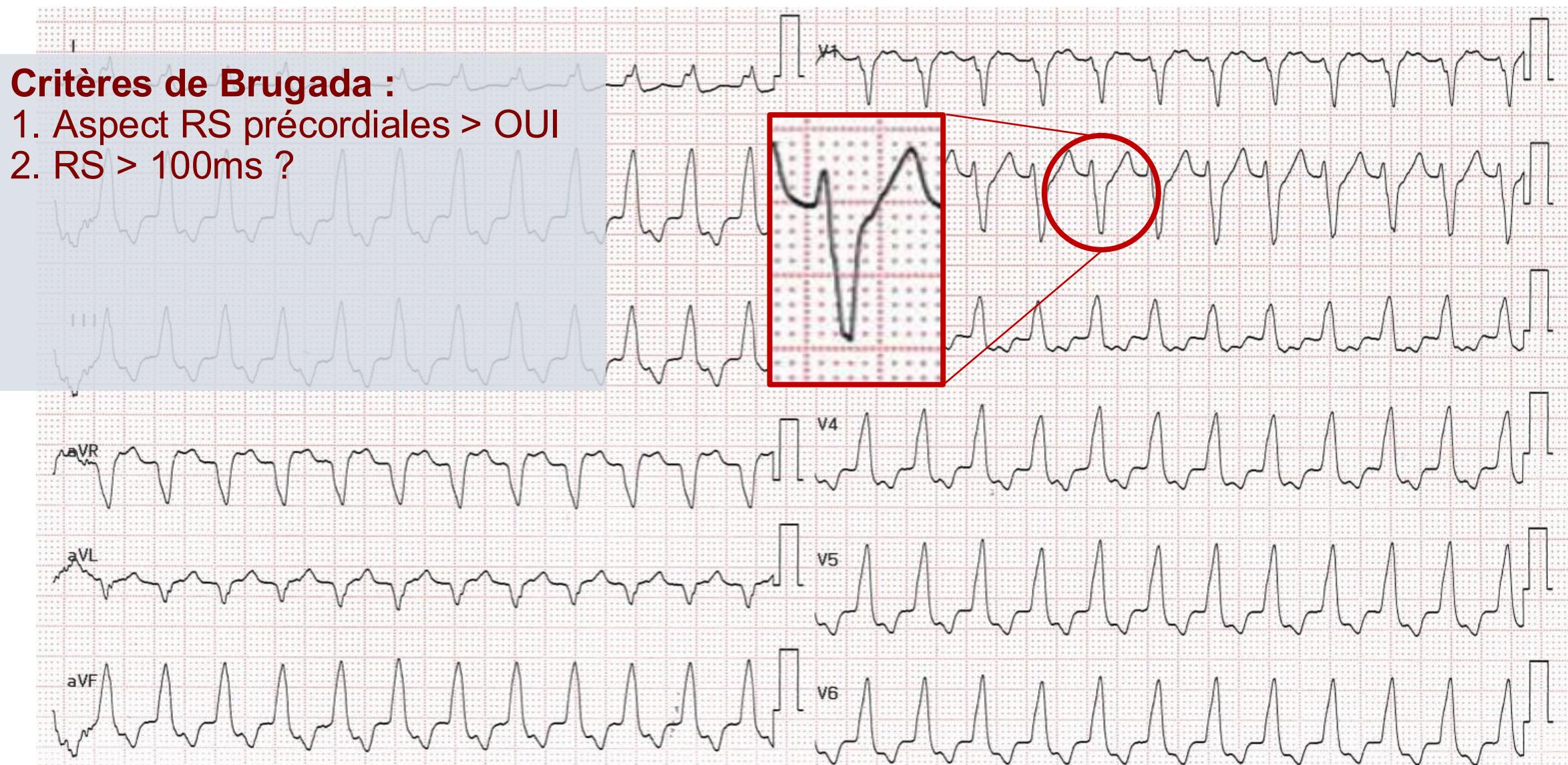
PATIENT #1

ECG ENTRÉE



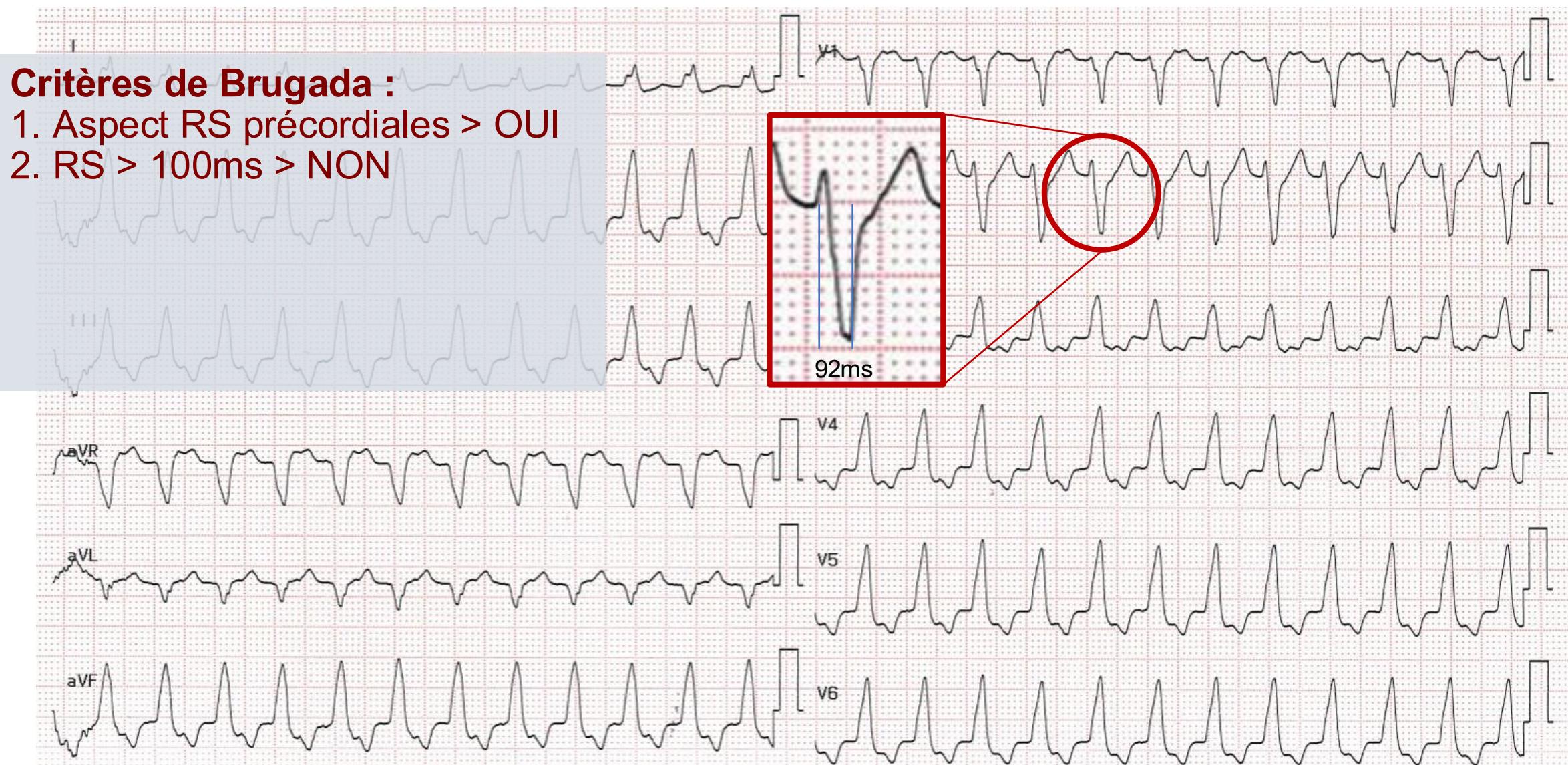
PATIENT #1

ECG ENTRÉE



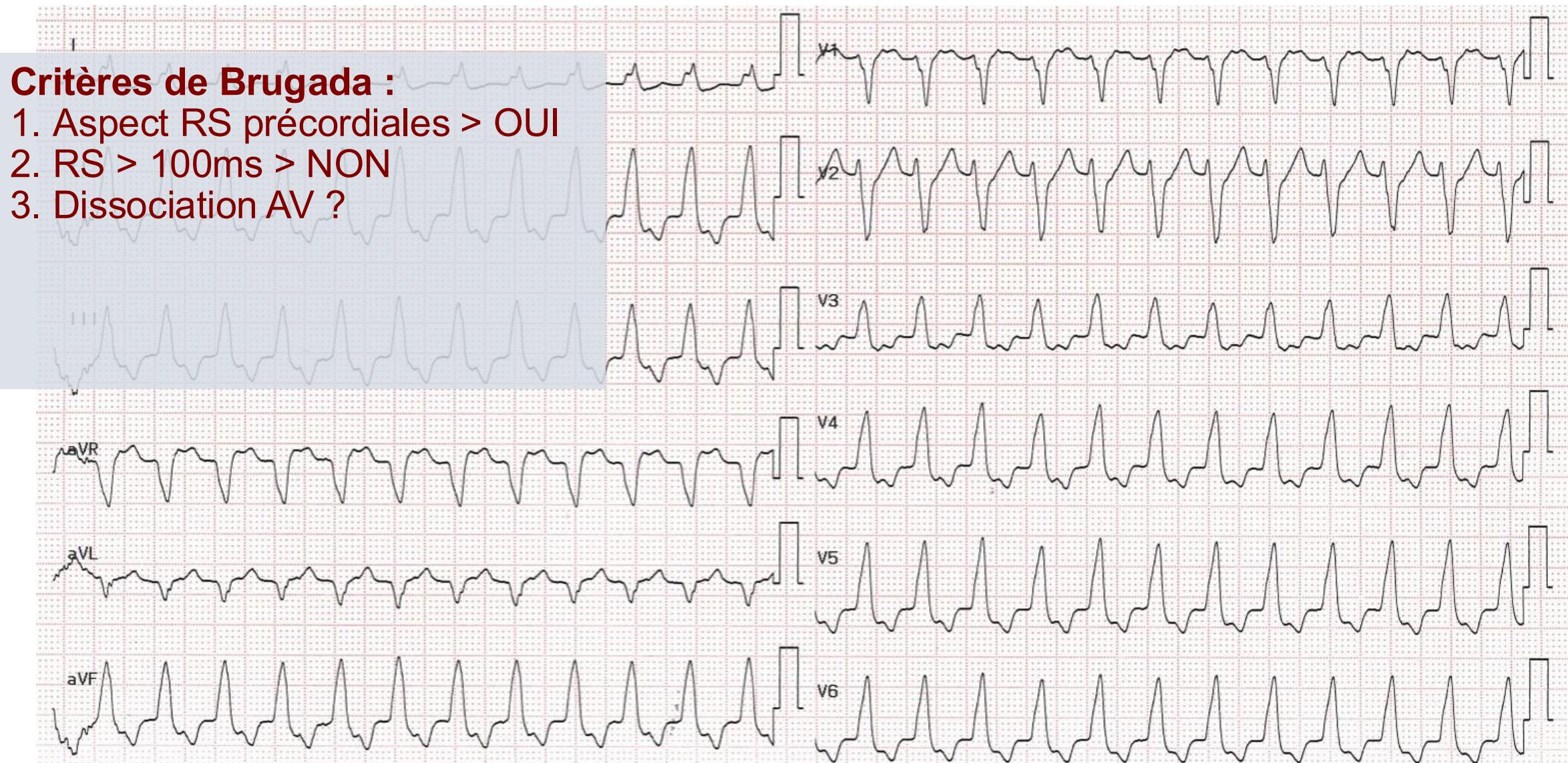
PATIENT #1

ECG ENTRÉE



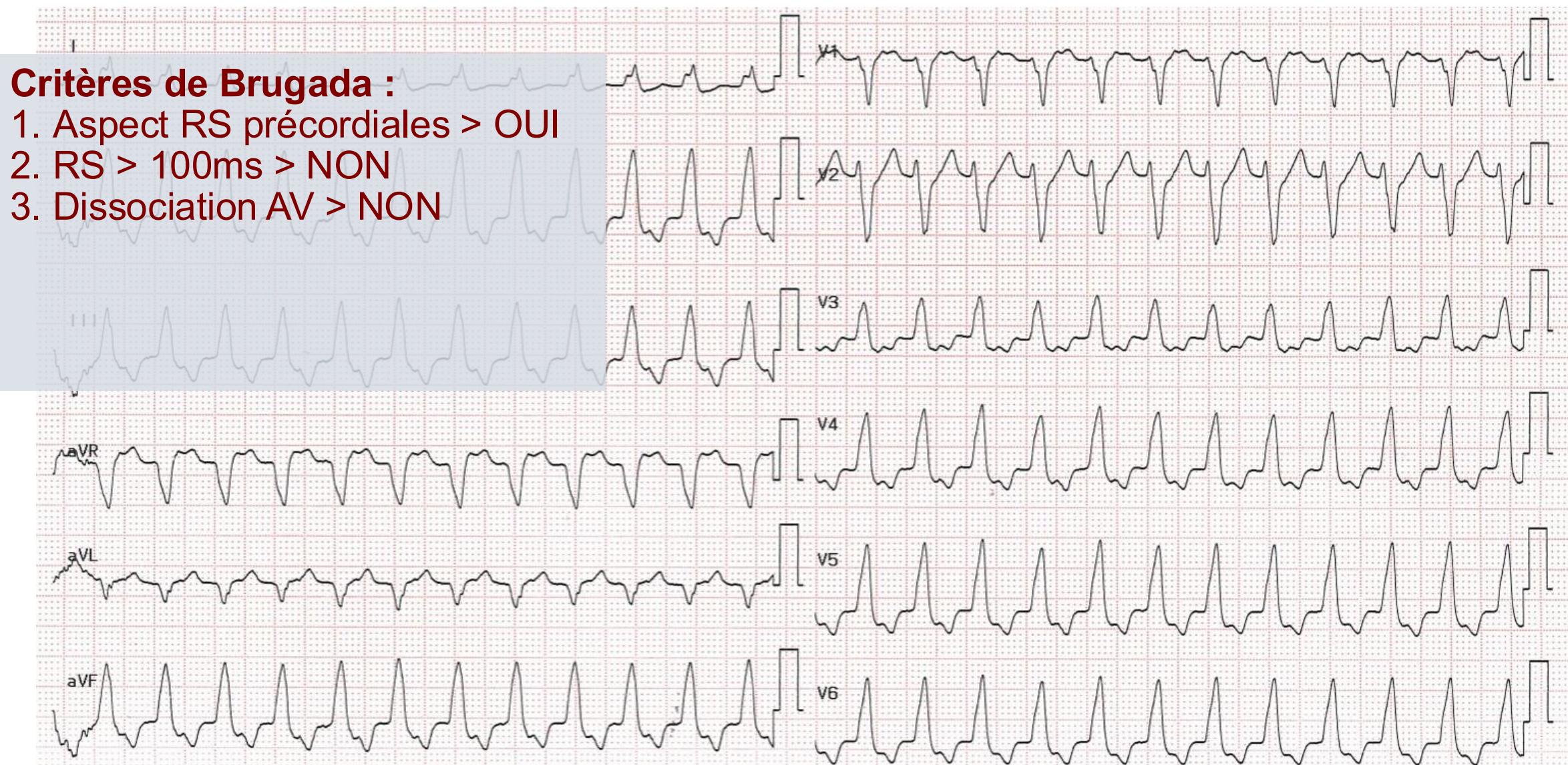
PATIENT #1

ECG ENTRÉE



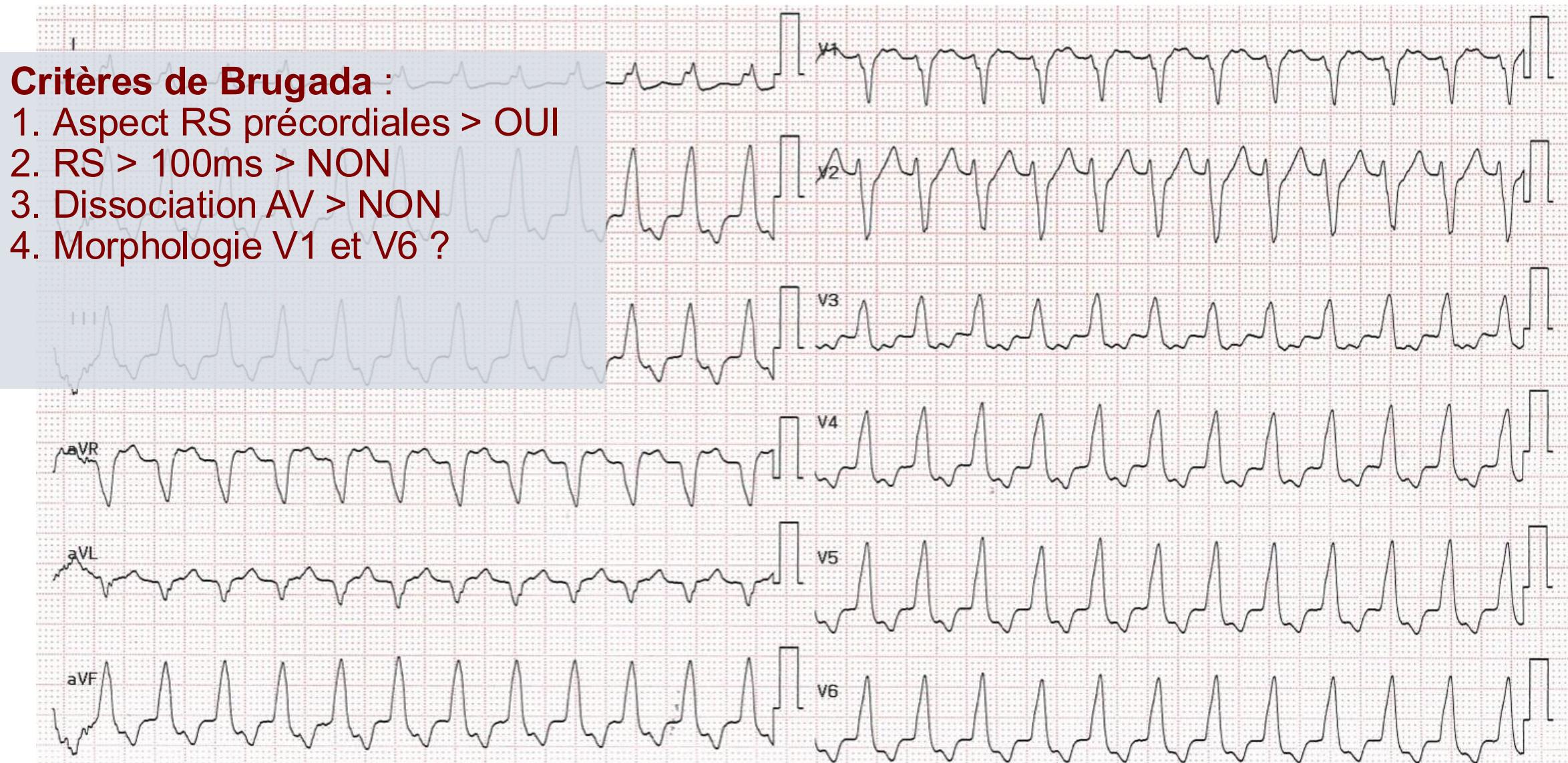
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ECG ENTRÉE



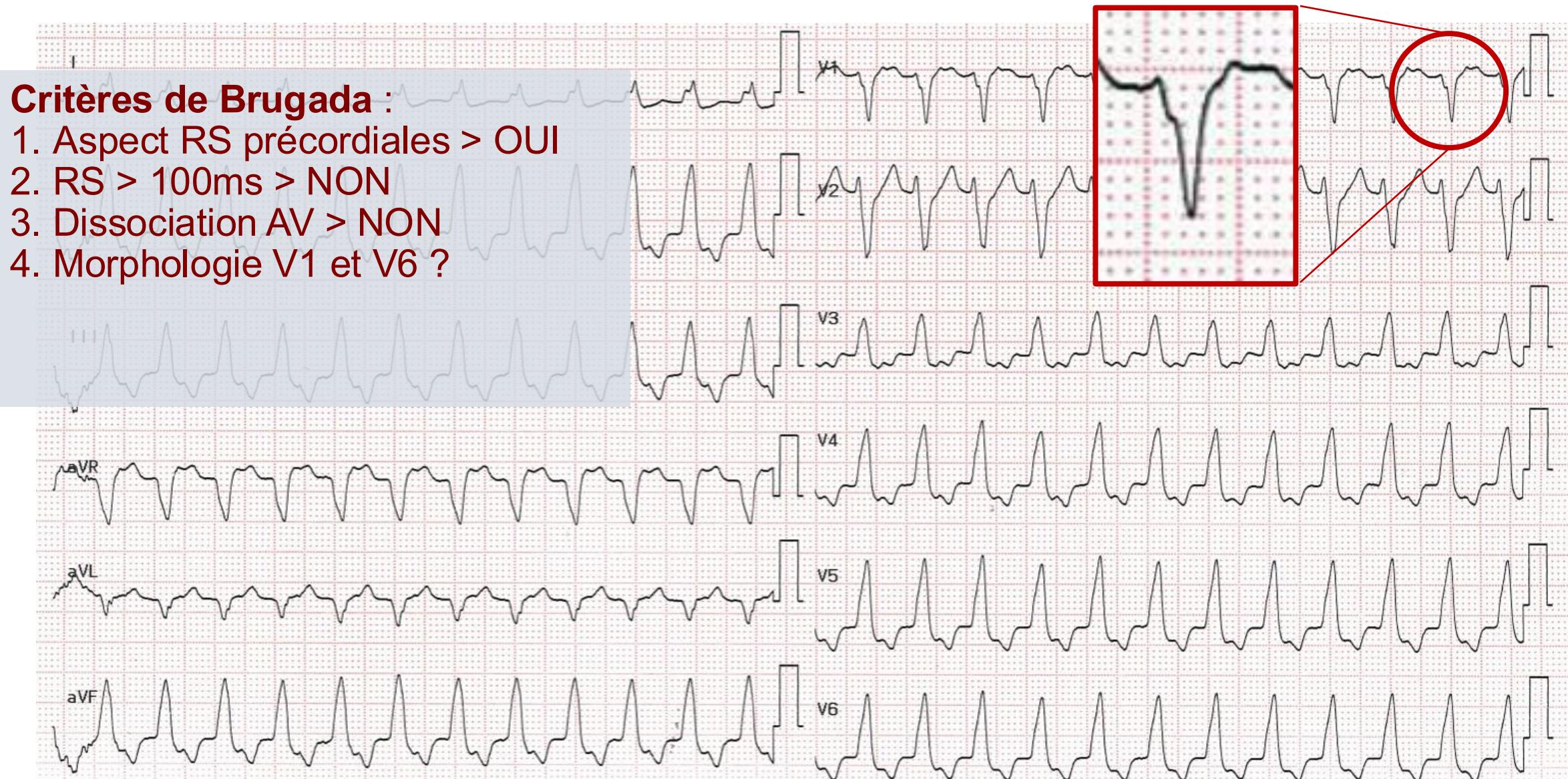
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ECG ENTREE



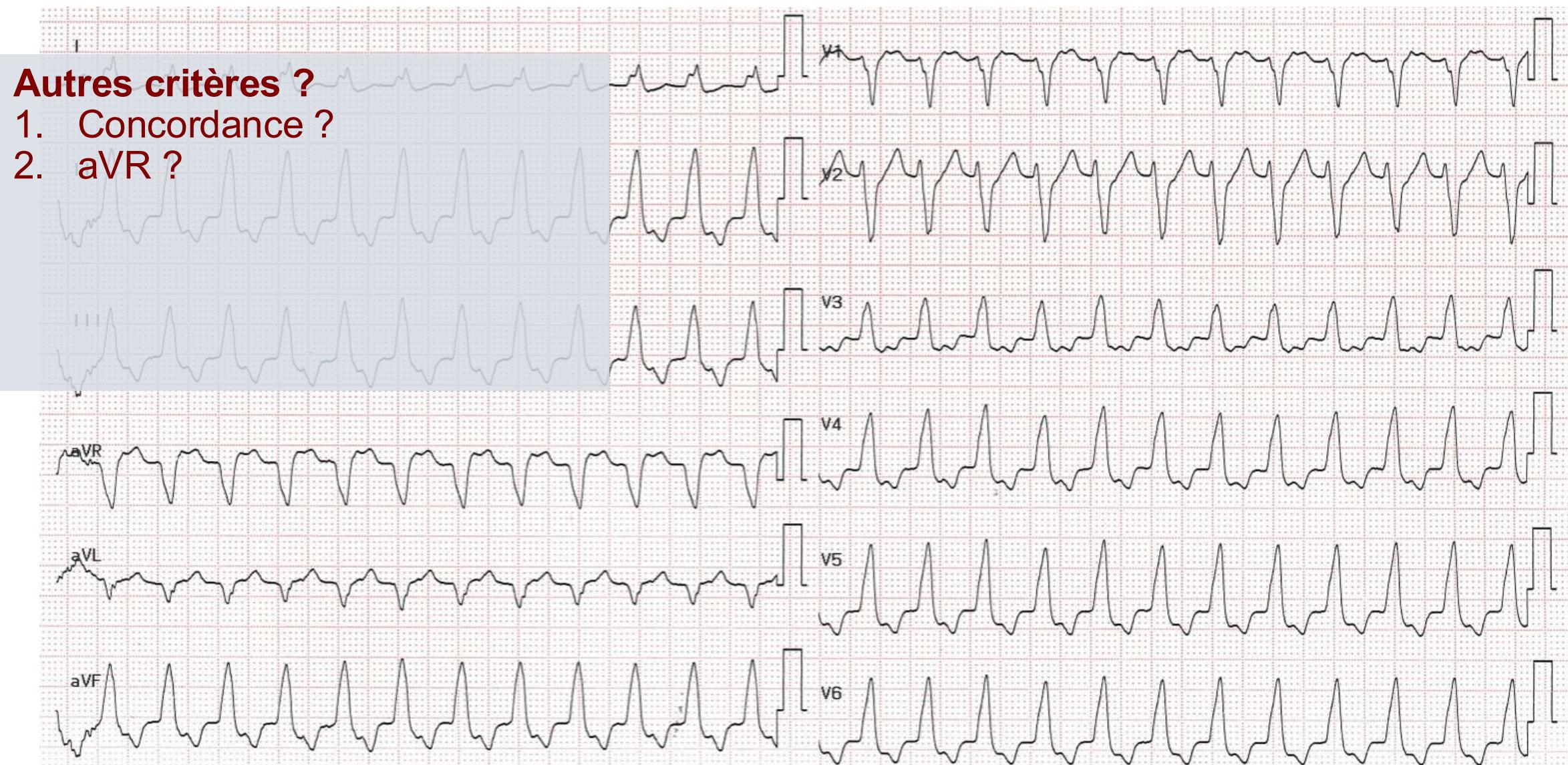
PATIENT #1

ECG ENTREE



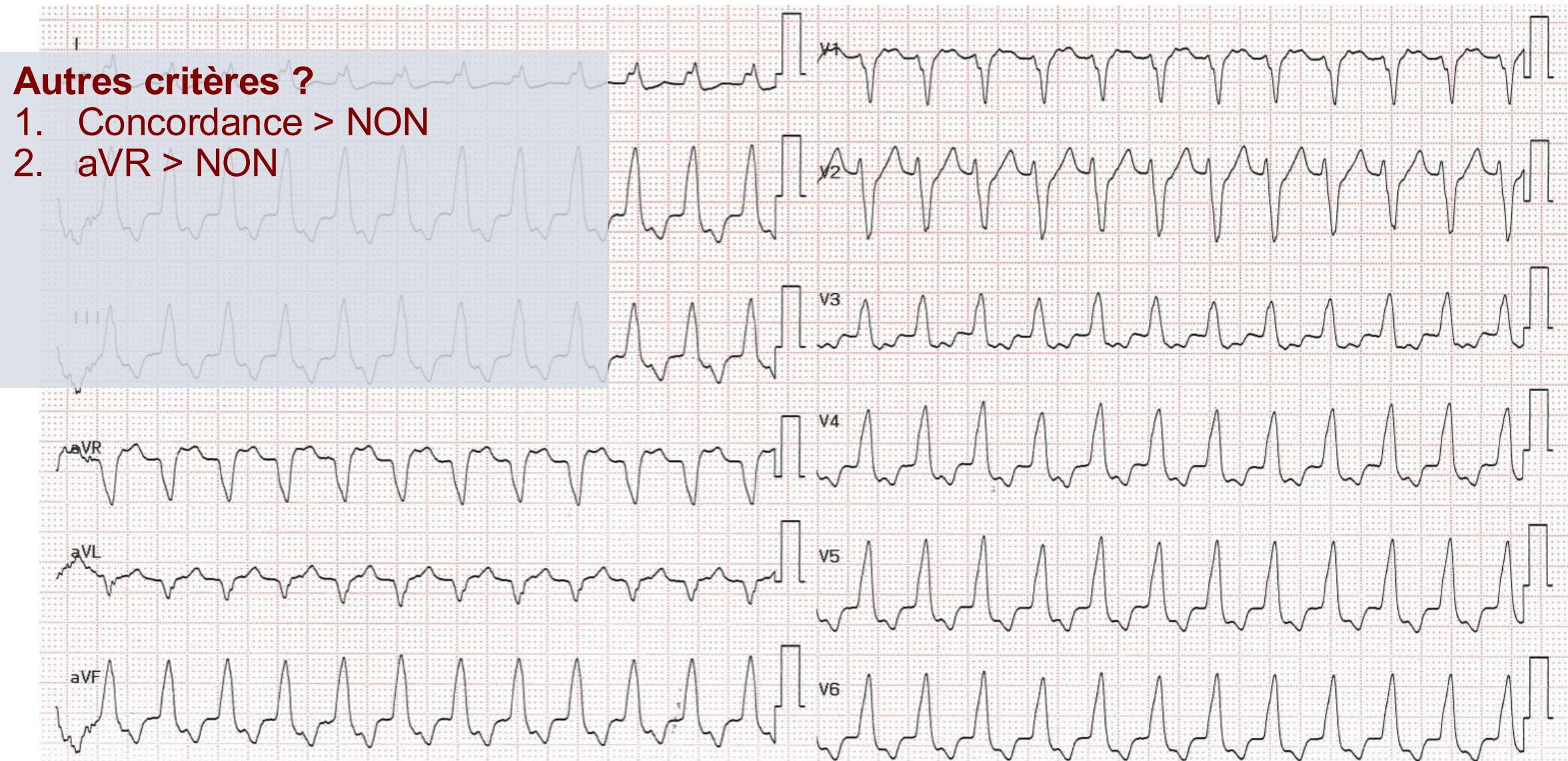
PATIENT #1

ECG ENTRÉE



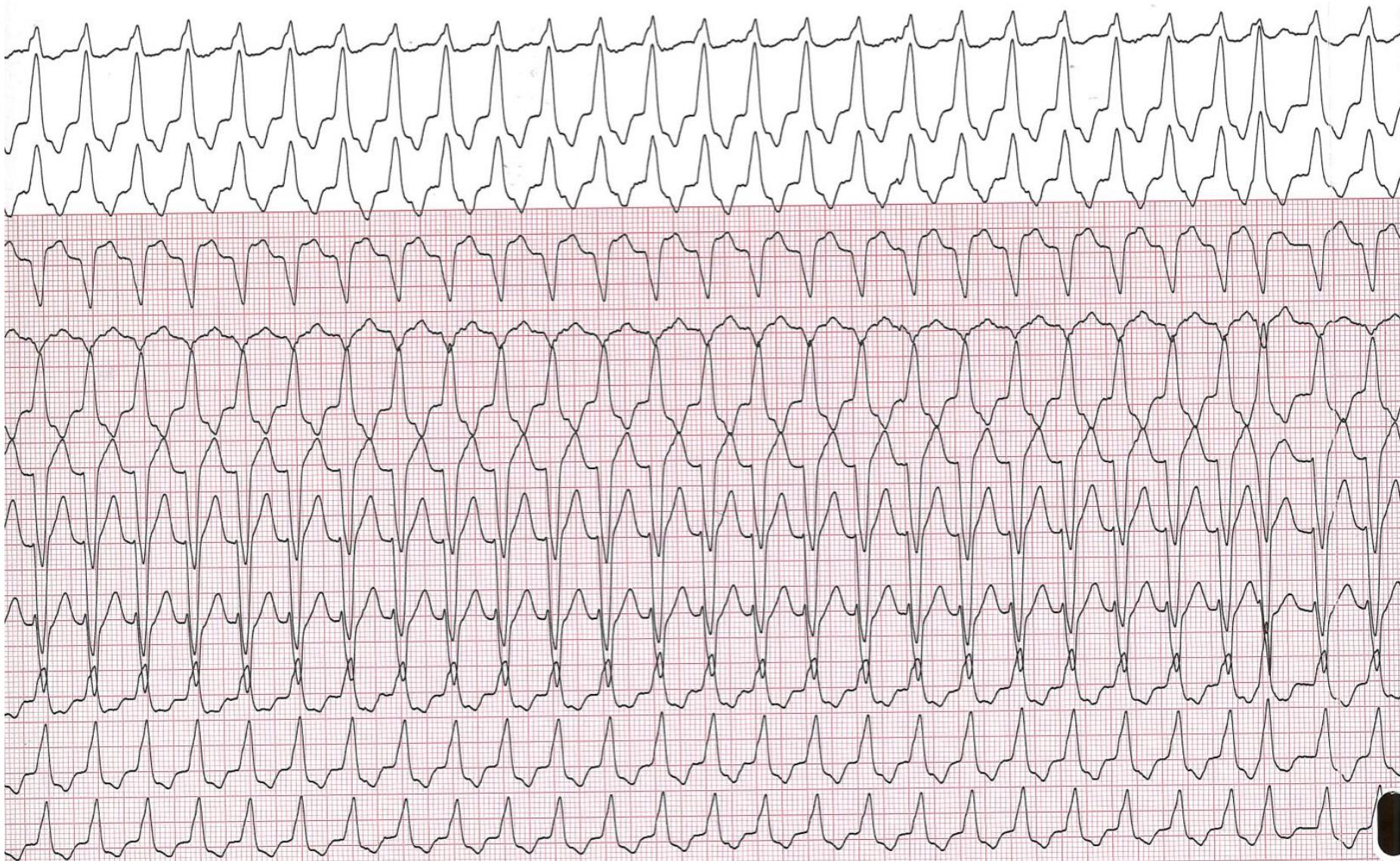
PATIENT #1

ECG ENTRÉE



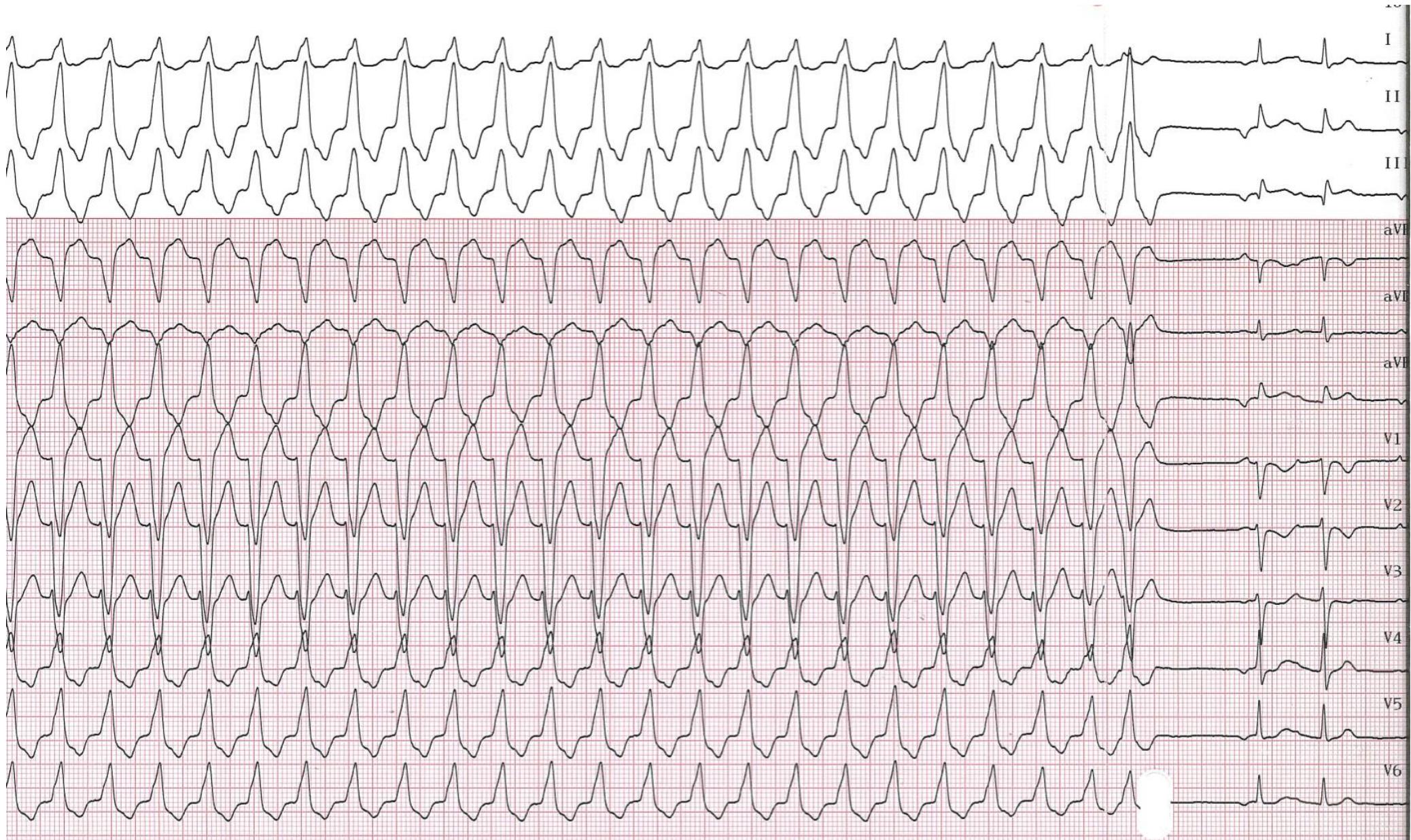
PATIENT #1

2 ampoules de STRIADYNE



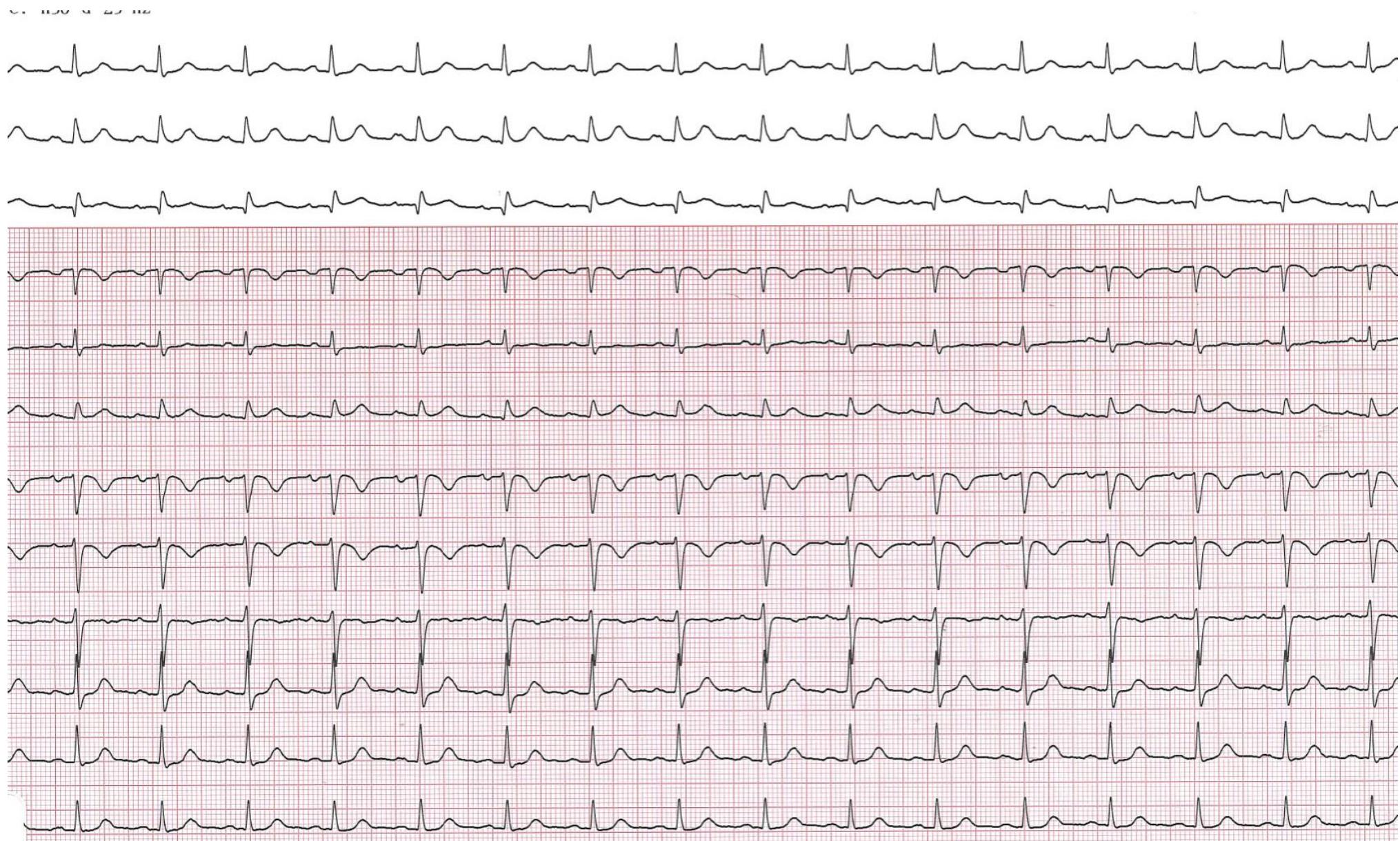
PATIENT #1

2 ampoules de VERAPAMIL

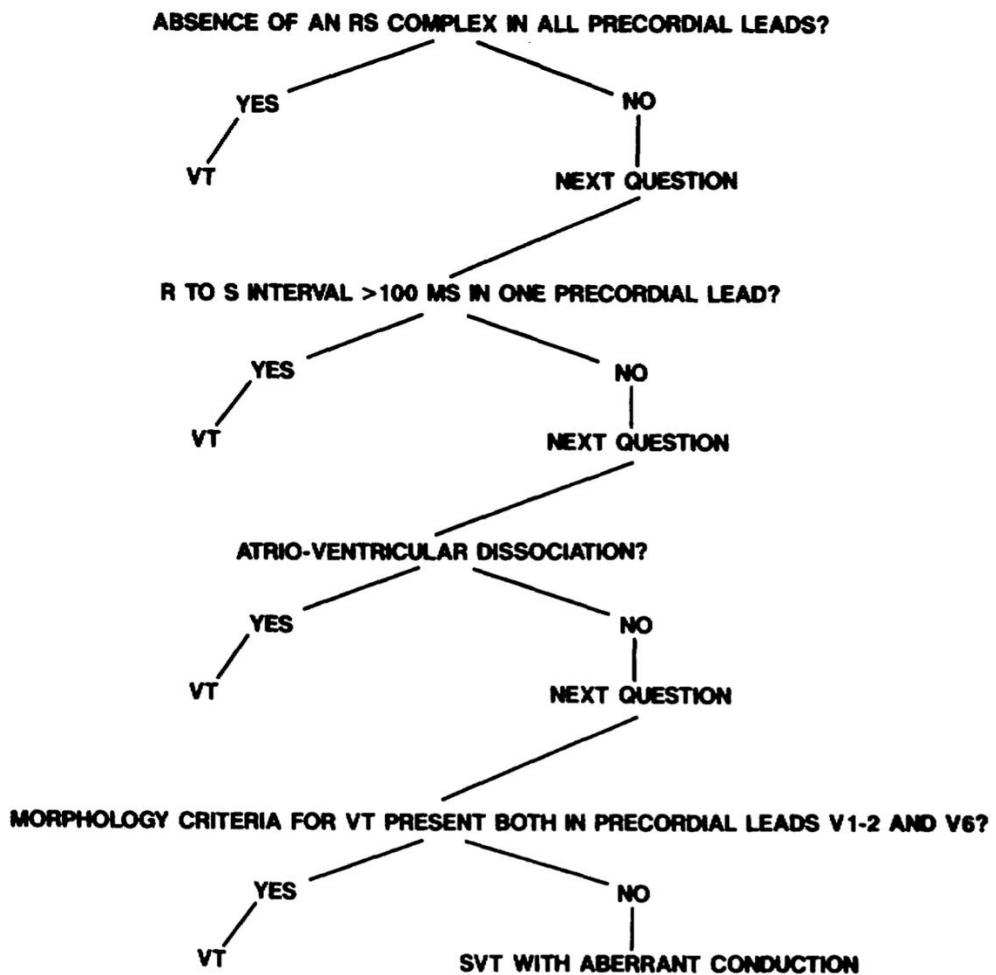


PATIENT #1

ECG POST REDUCTION



TV vs. TSV : ALGORITHMES DE DISCRIMINATION



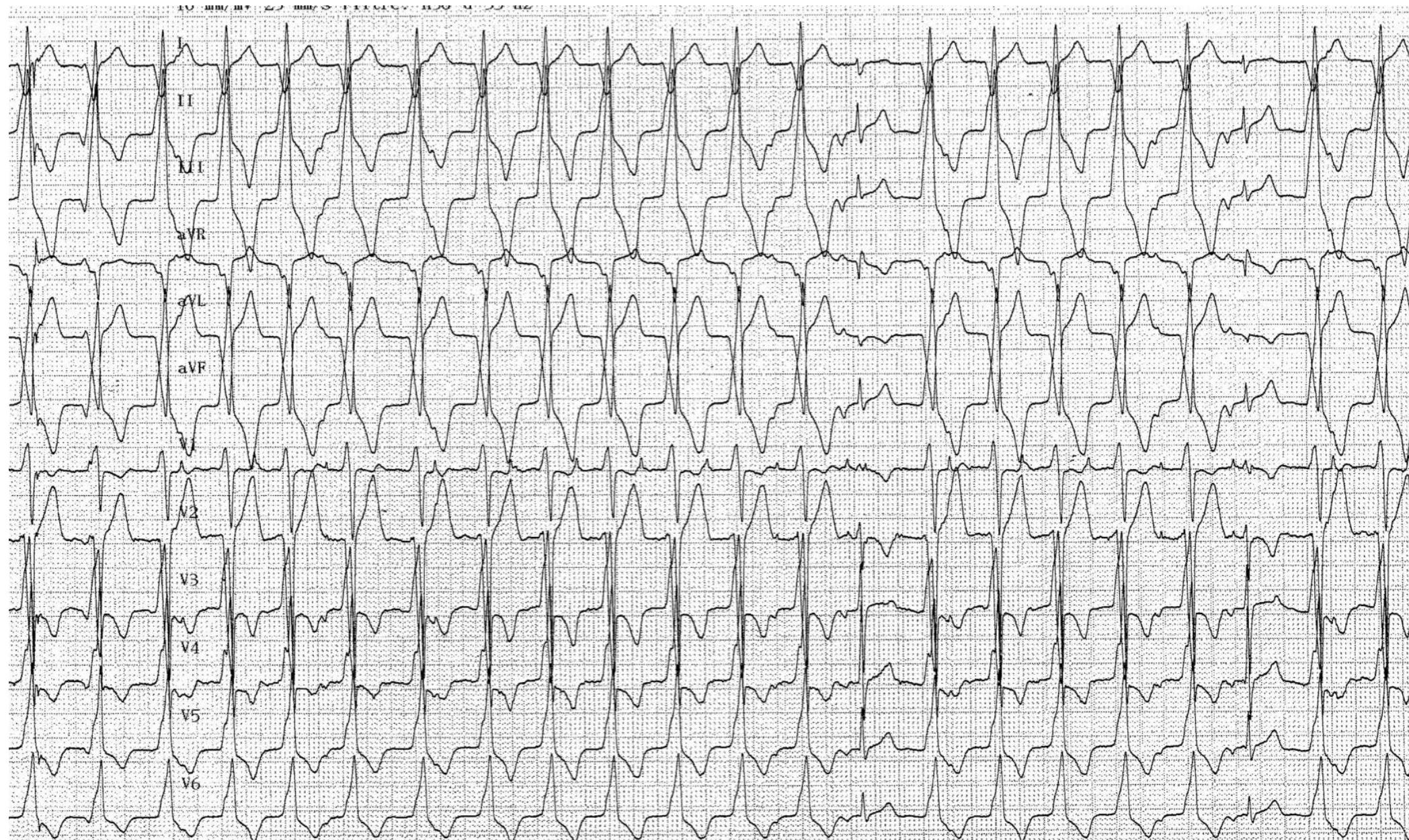
Brugada 1991

Table 9 Summary of key electrocardiographic criteria that suggest ventricular tachycardia rather than supraventricular tachycardia in wide complex tachycardia

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QRS axis –90 to $\pm 180^\circ$	Both in the presence of RBBB and LBBB morphology
R wave peak time in lead II	R wave peak time ≥ 50 ms
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LBBB morphology	<p>Lead V1: Broad R wave, slurred or notched-down stroke of the S wave, and delayed nadir of S wave</p> <p>Lead V6: Q or QS wave</p>

ESC 2019

PATIENT #2 : ECG d'entrée



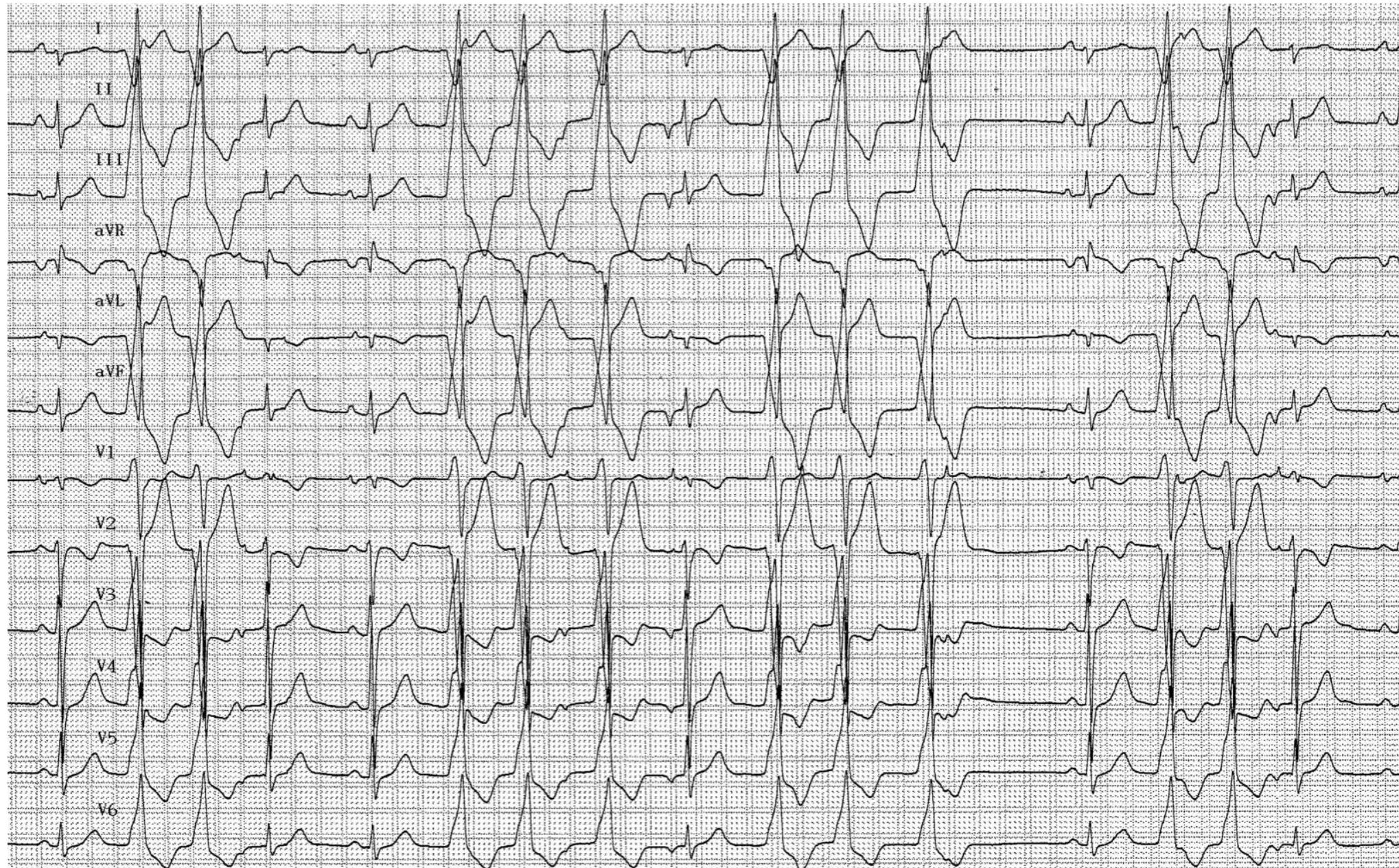
PATIENT #2 : Test ISUPREL



PATIENT #2 : Test ISUPREL



PATIENT #2 : Test FLECAINE



PATIENT #2 : Test FLECAINE



PATIENT #3

Monsieur A. 68 ans

- Antécédents : STEMI inférieur avec stent actif CD il y a 1 mois, Fibrillation auriculaire persistante, insuffisance rénale chronique, diabète type 2
- Traitements : Xarelto 15, Plavix 75, Kardegec 75, Bisoce 7,5, Lercan 20, Januvia 50, Inexium 20.
- Anamnèse : nouvelle douleur thoracique depuis 48h, moins marquée que lors de l'infarctus
- Bilan réalisé : ETT: VG non dilaté, VG 35-40% avec hypokinésie inférieur, inféro septale et latérale. PRVG élevées

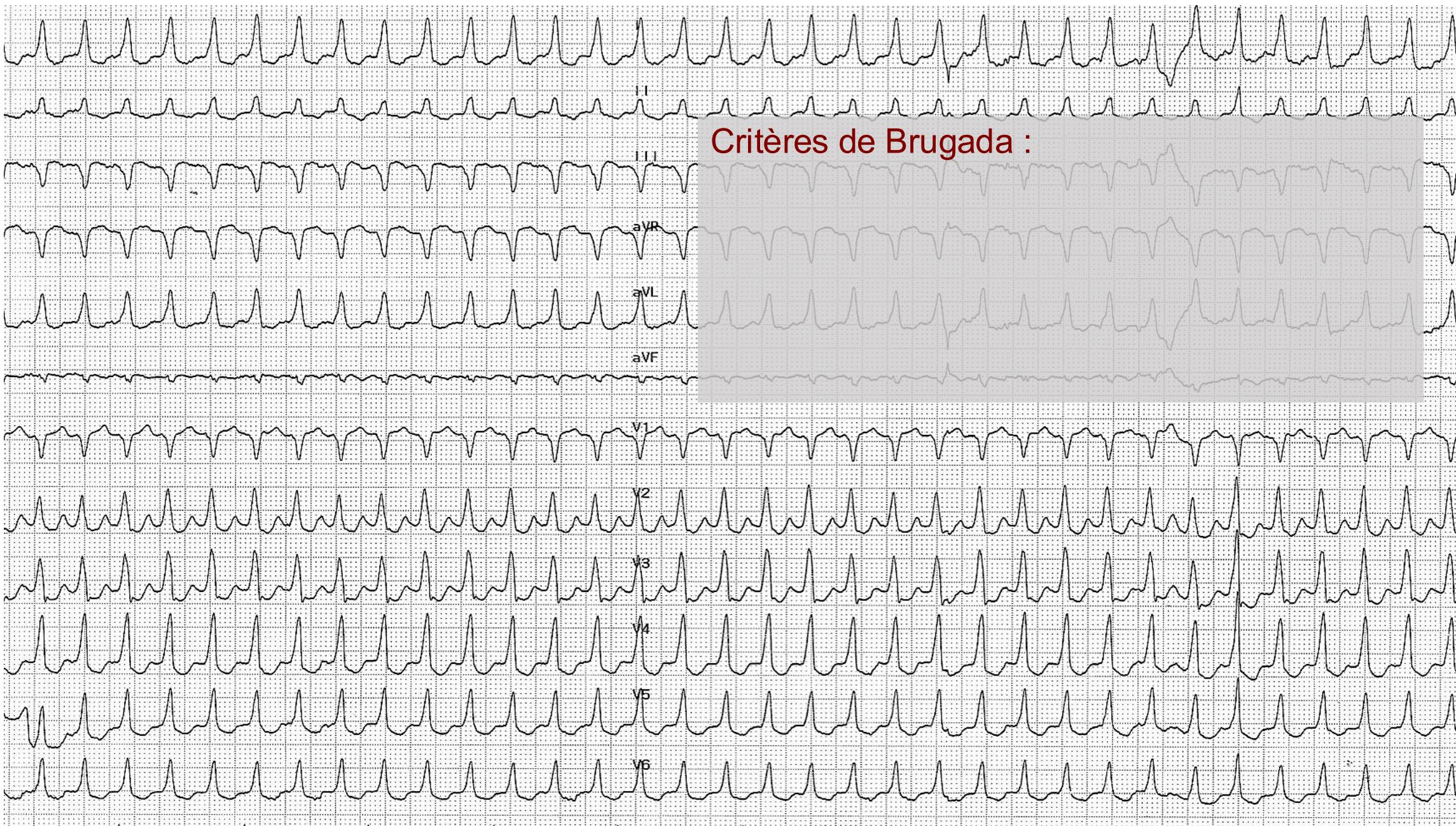
PATIENT #3 : ECG aux urgences



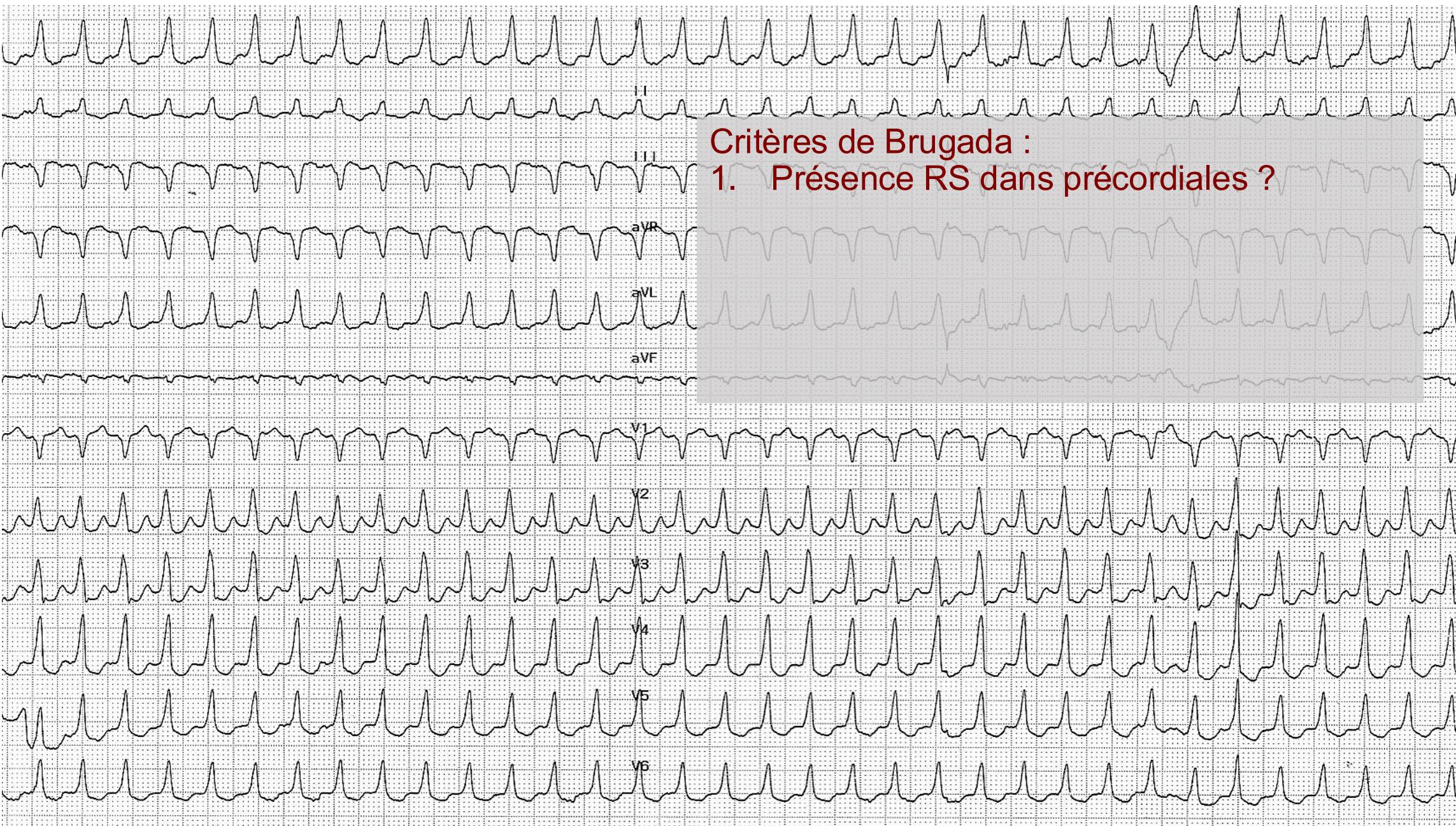
PATIENT #3



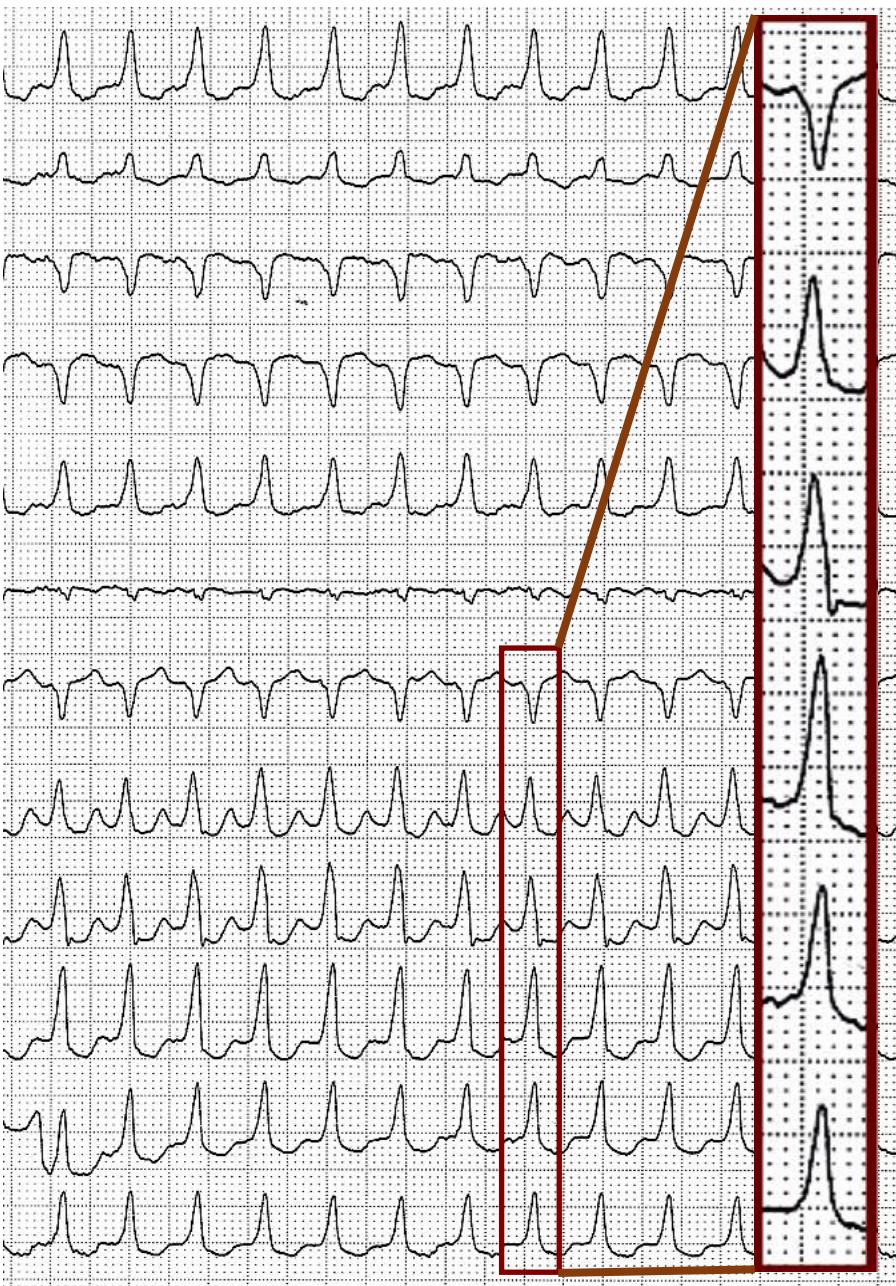
PATIENT #3



PATIENT #3

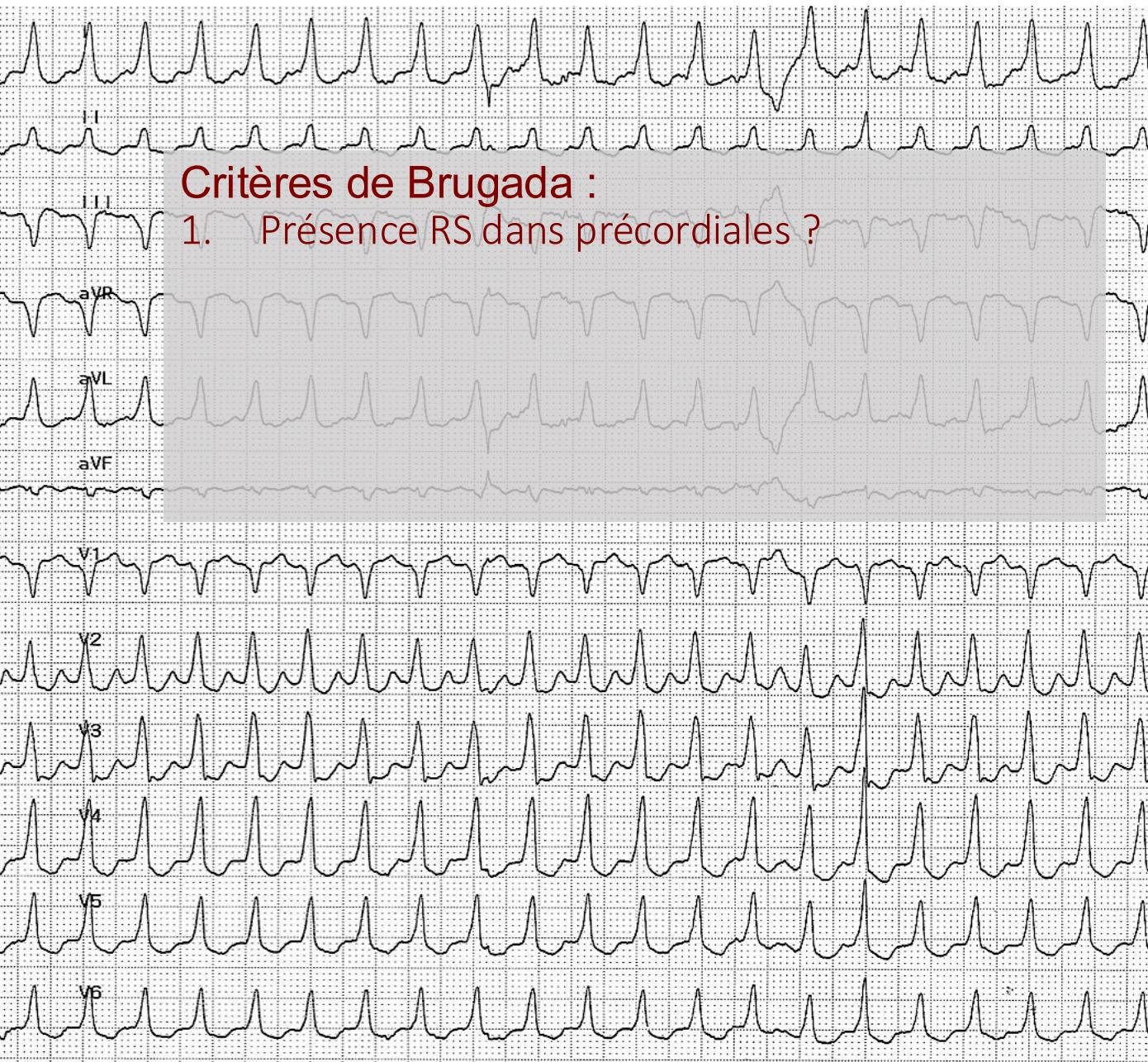


PATIENT #3

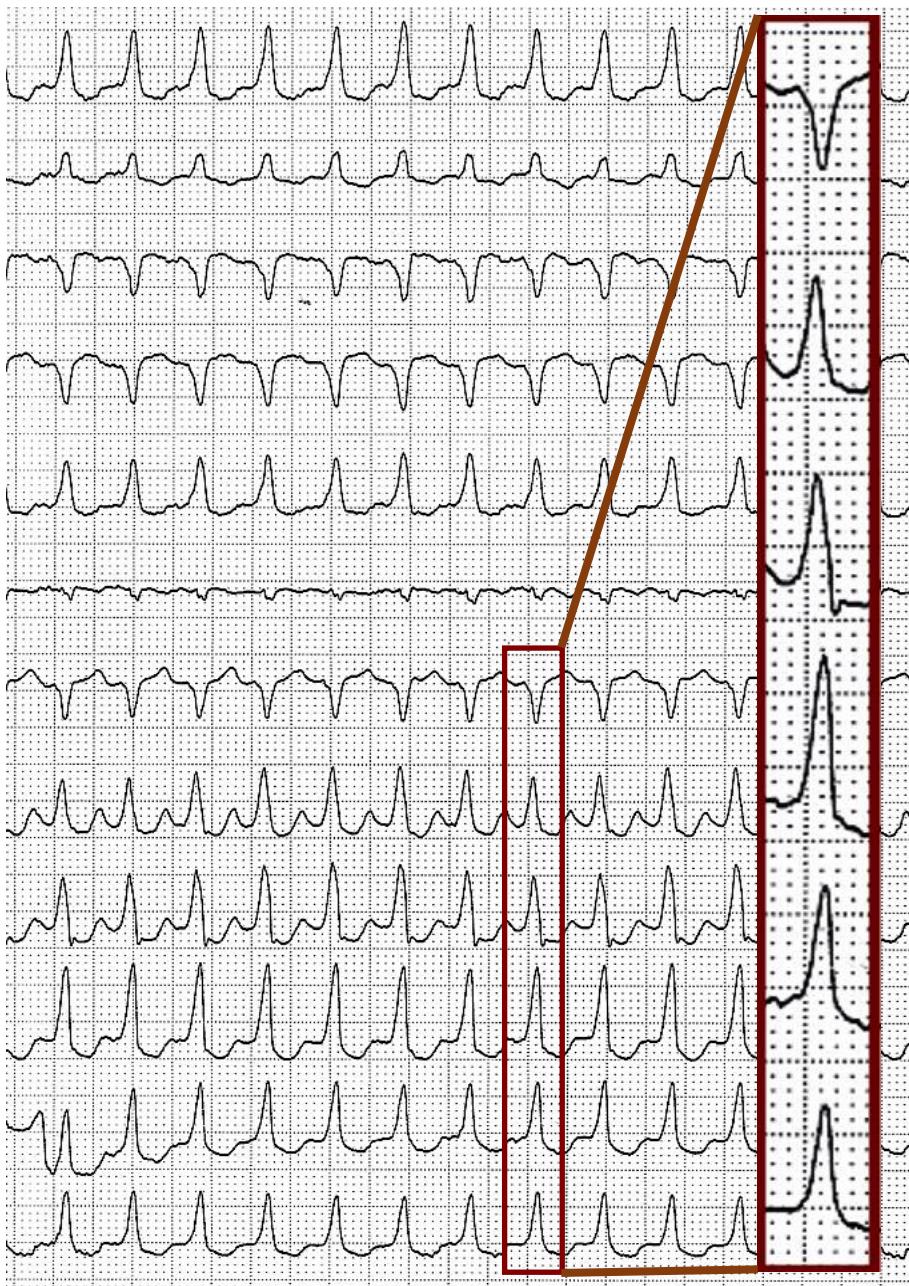


Critères de Brugada :

1. Présence RS dans précordiales ?



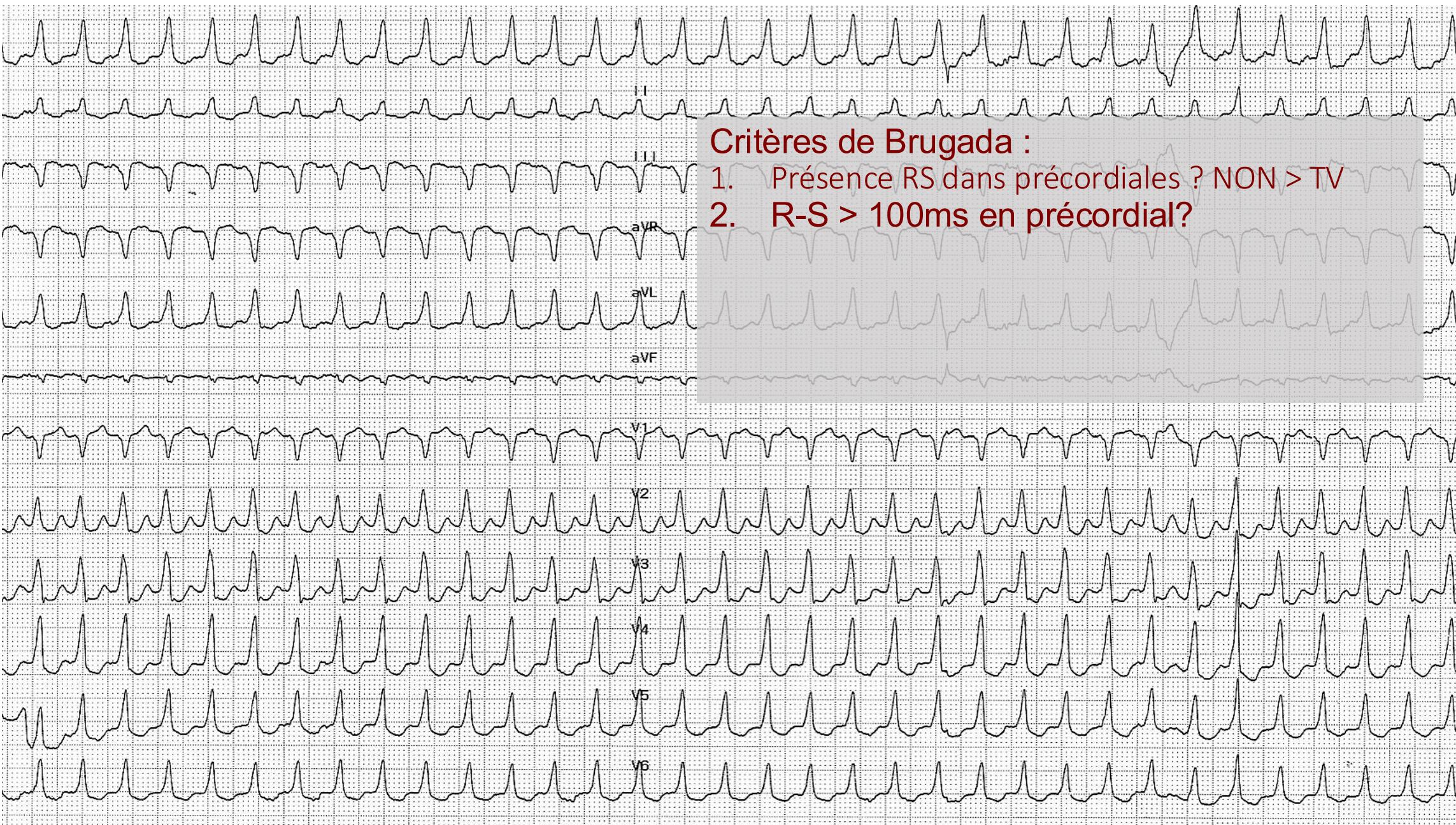
PATIENT #3



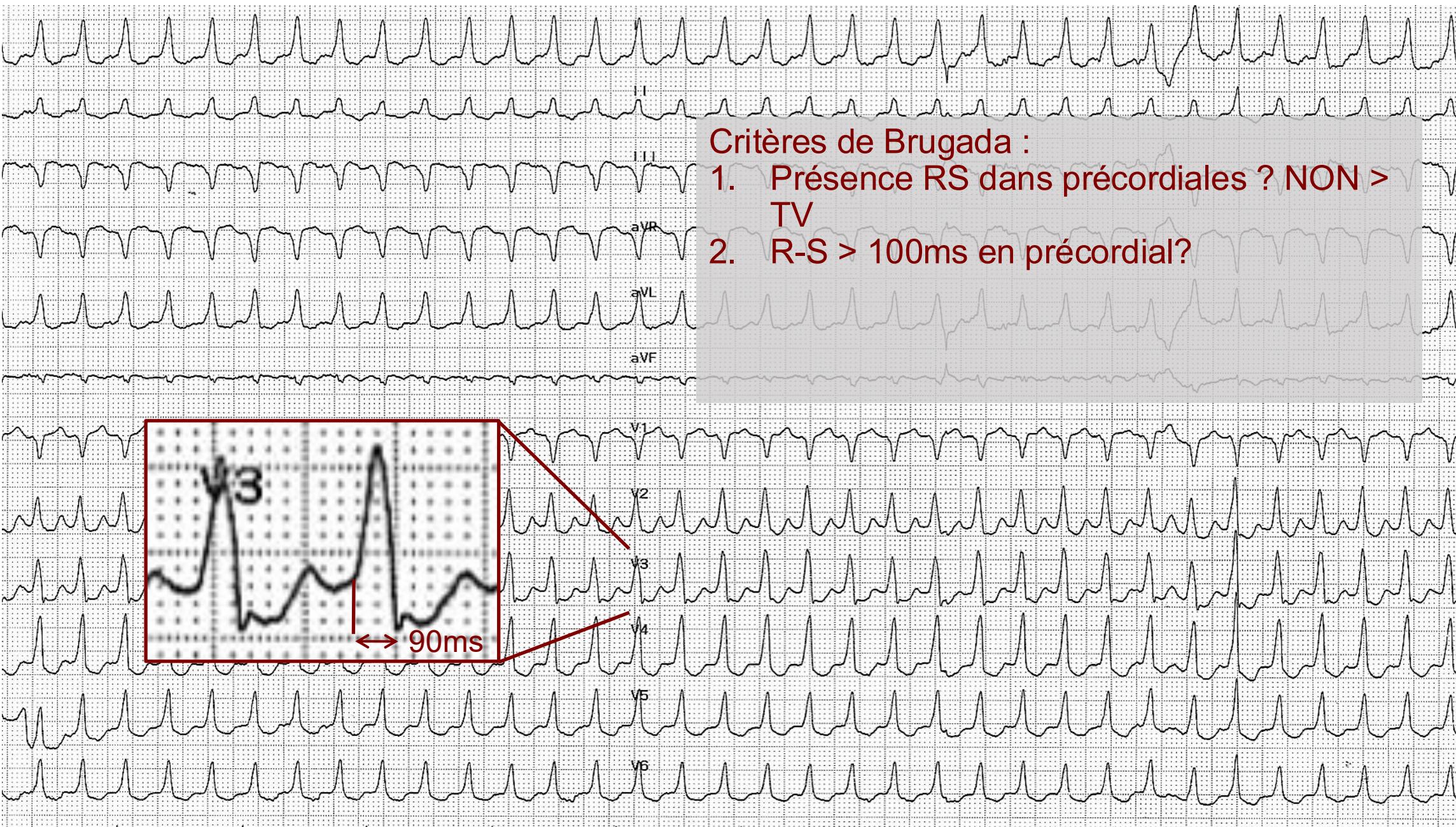
Critères de Brugada :

1. Présence RS dans précordiales ? NON > TV

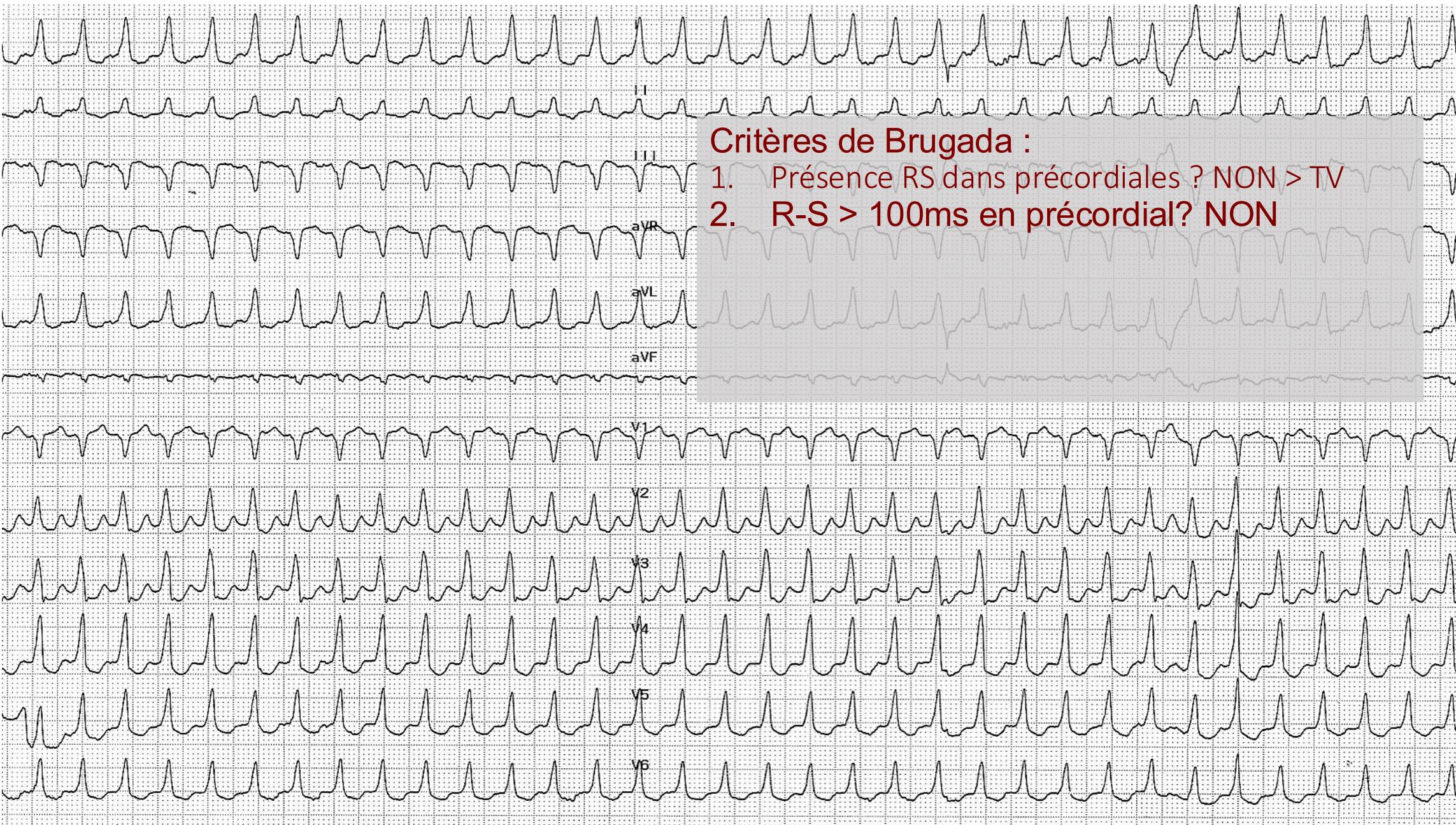
PATIENT #3



PATIENT #3



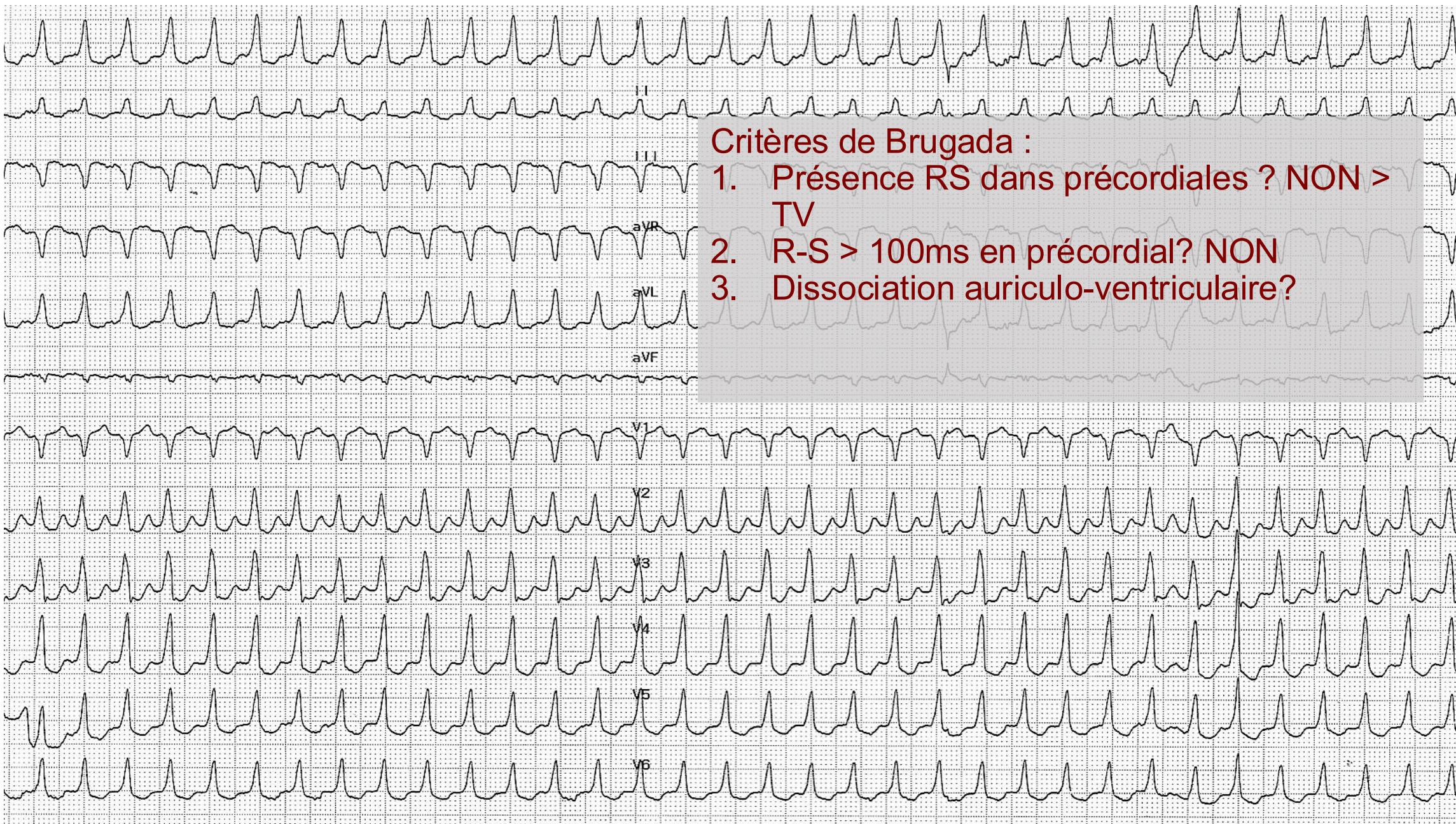
PATIENT #3



Critères de Brugada :

1. Présence RS dans précordiales ? NON > TV
2. R-S > 100ms en précordial? NON

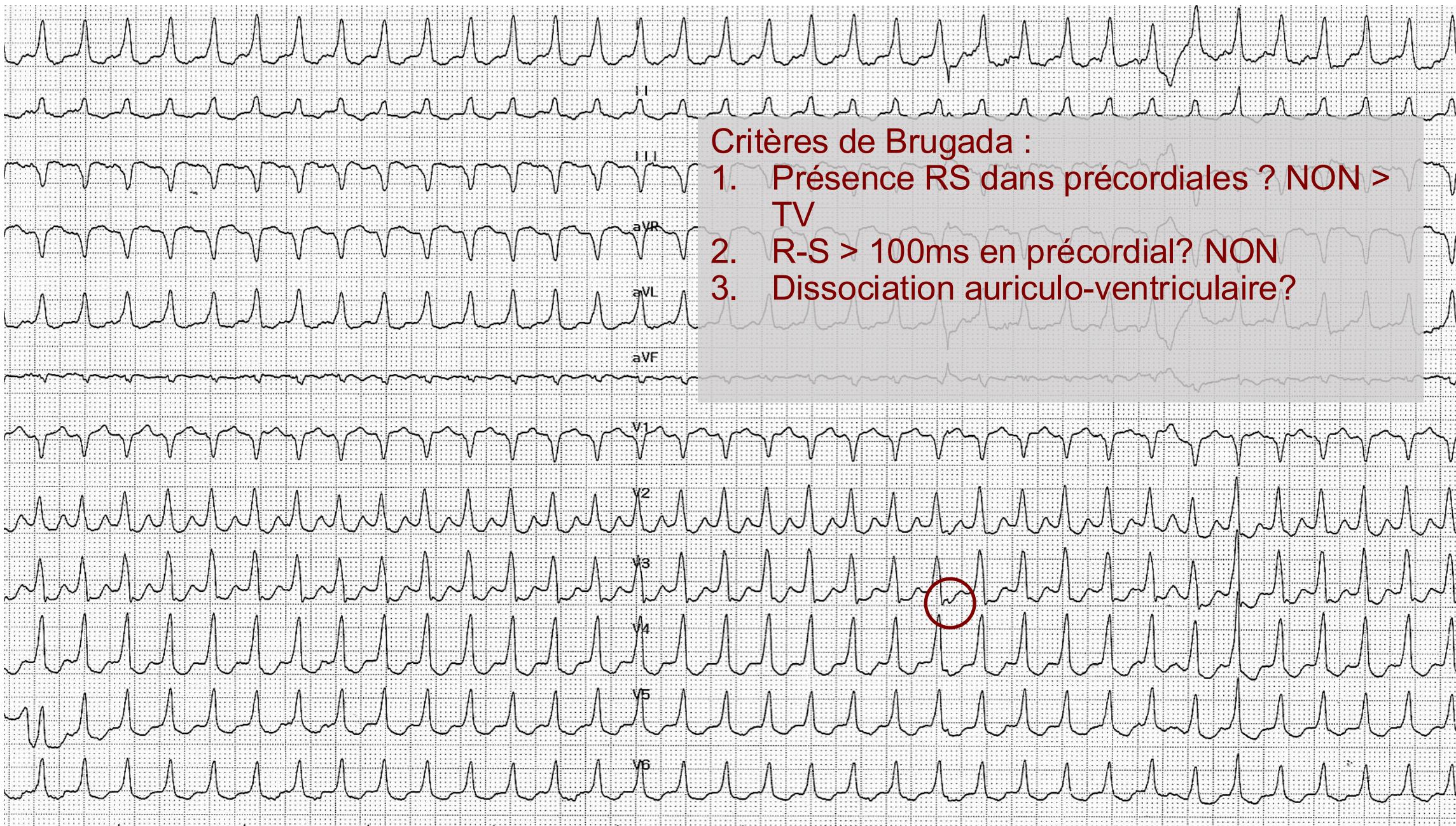
PATIENT #3



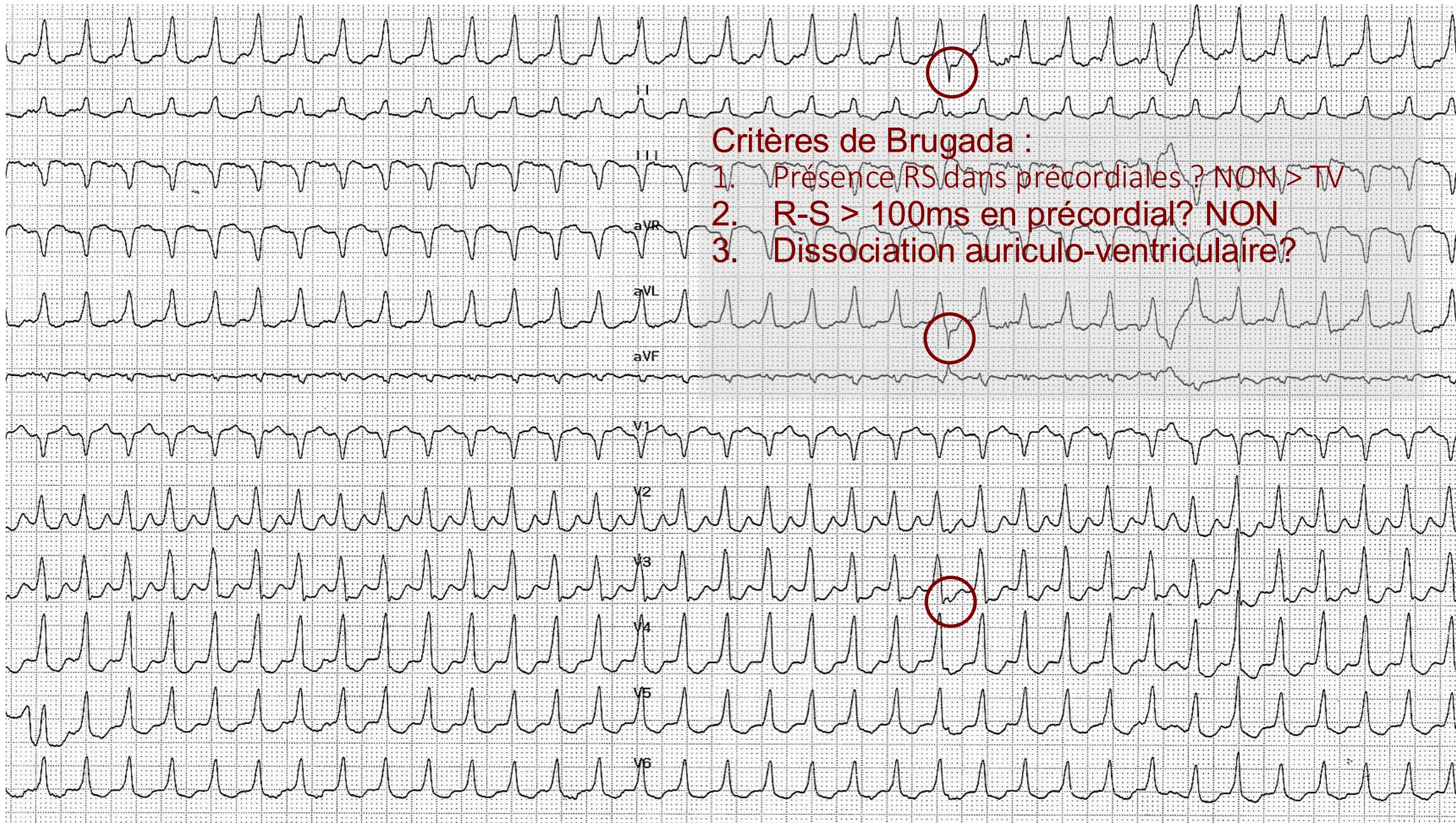
Critères de Brugada :

1. Présence RS dans précordiales ? NON > TV
2. R-S > 100ms en précordial? NON
3. Dissociation auriculo-ventriculaire?

PATIENT #3



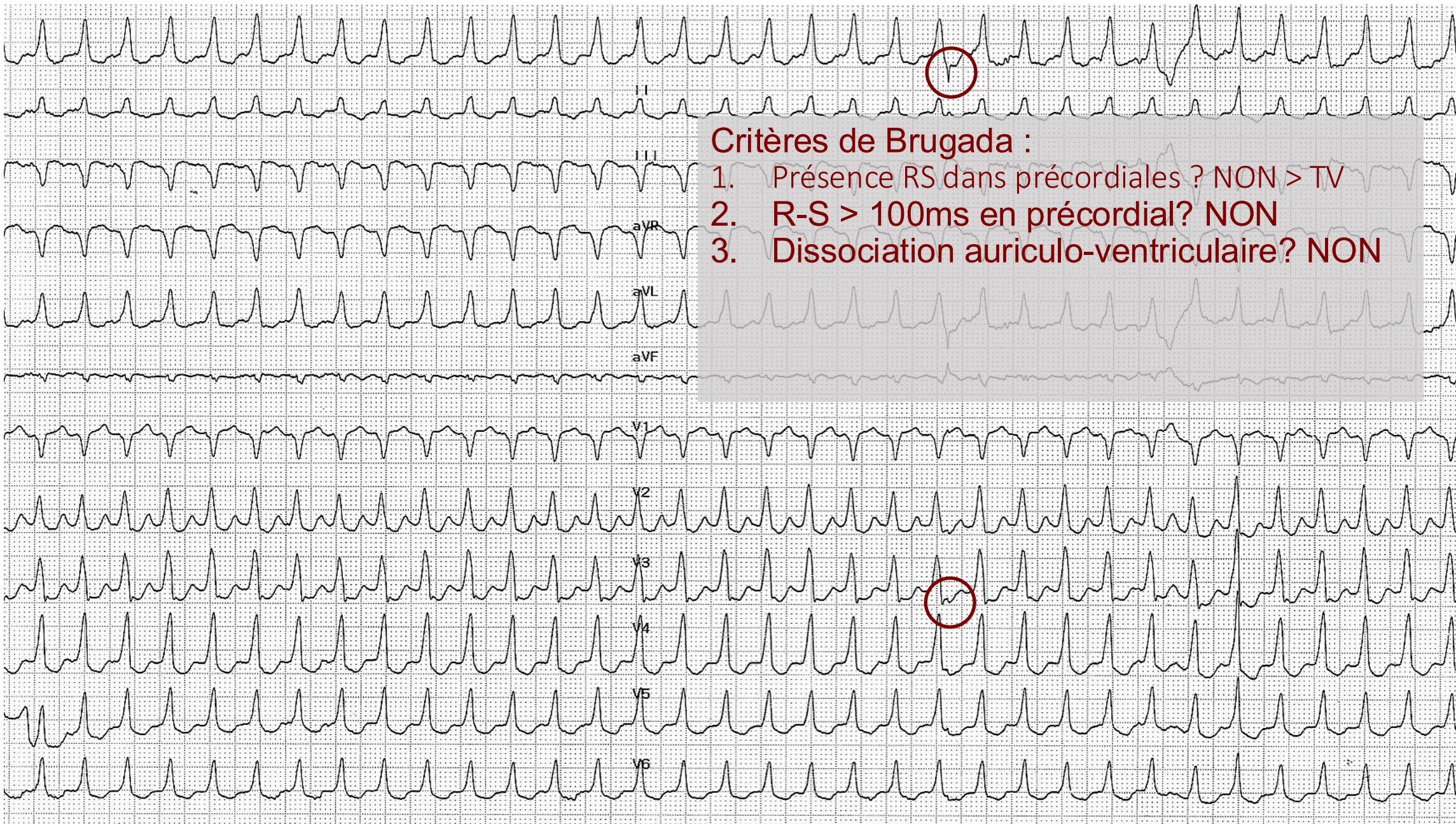
PATIENT #3



Critères de Brugada :

1. Présence RS dans précordiales ? NON > TV
2. R-S > 100ms en précordial? NON
3. Dissociation auriculo-ventriculaire?

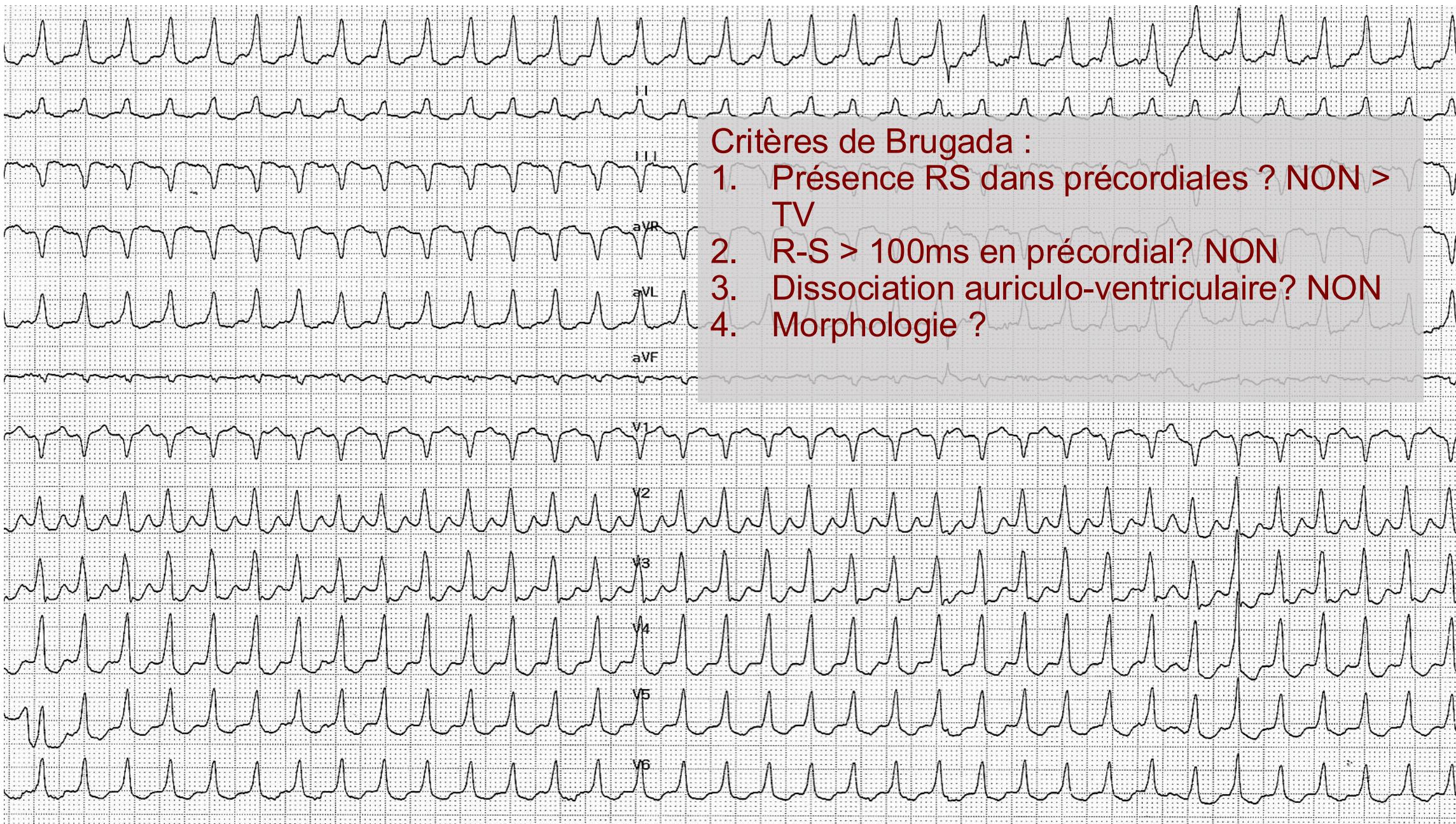
PATIENT #3



Critères de Brugada :

1. Présence RS dans précordiales ? NON > TV
2. R-S > 100ms en précordial? NON
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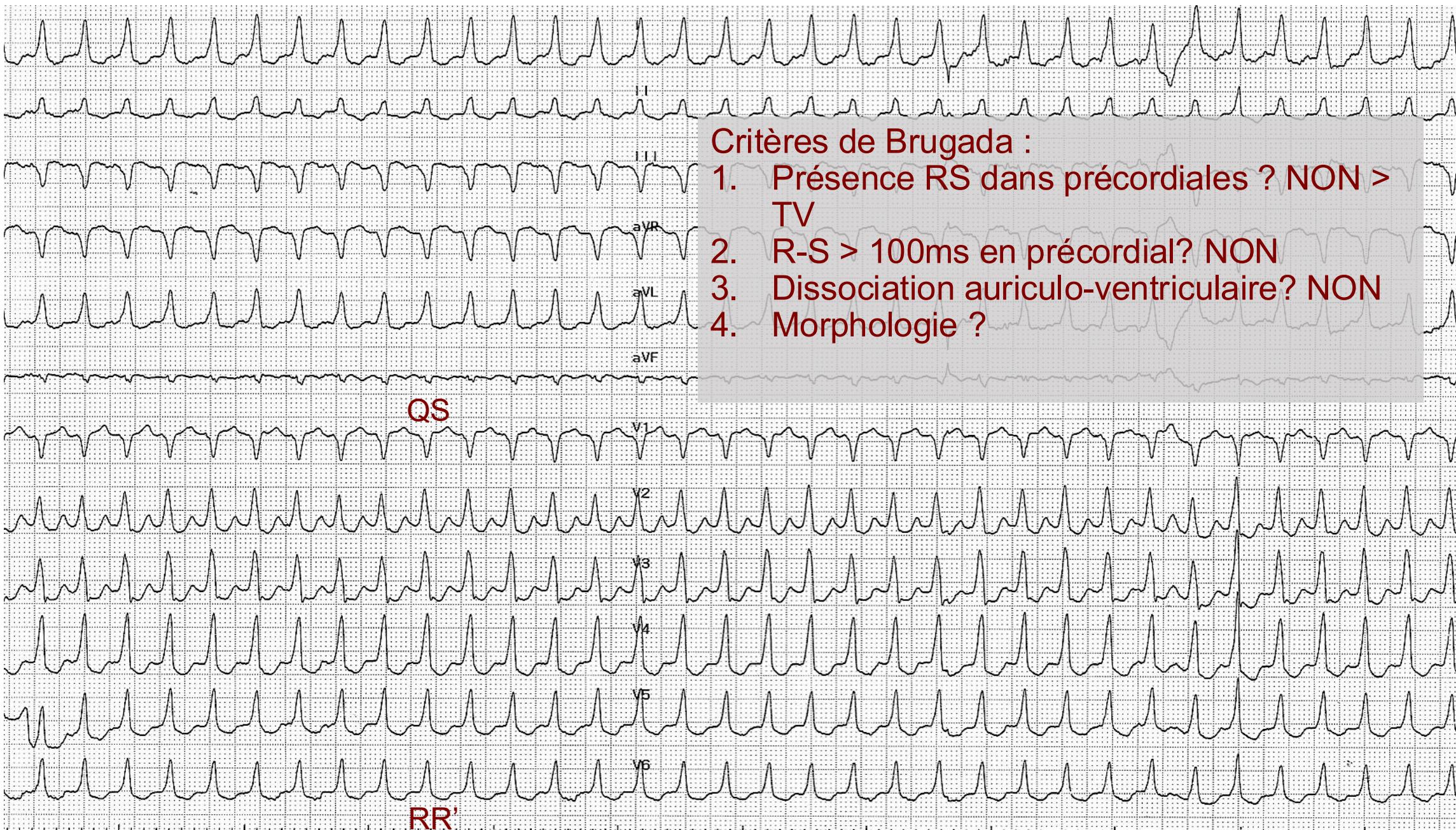
PATIENT #3



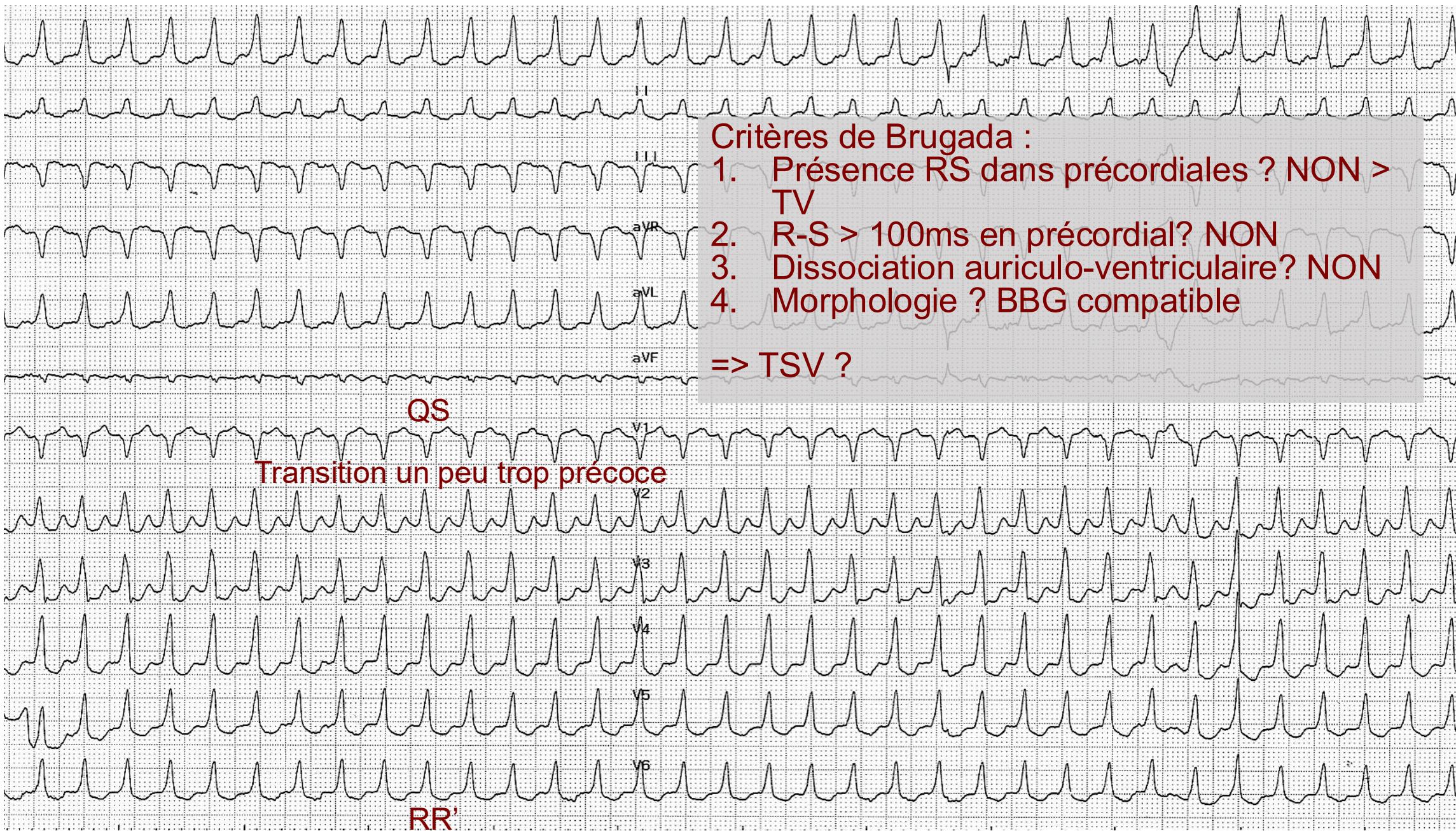
Critères de Brugada :

1. Présence RS dans précordiales ? NON > TV
2. R-S > 100ms en précordial? NON
3. Dissociation auriculo-ventriculaire? NON
4. Morphologie ?

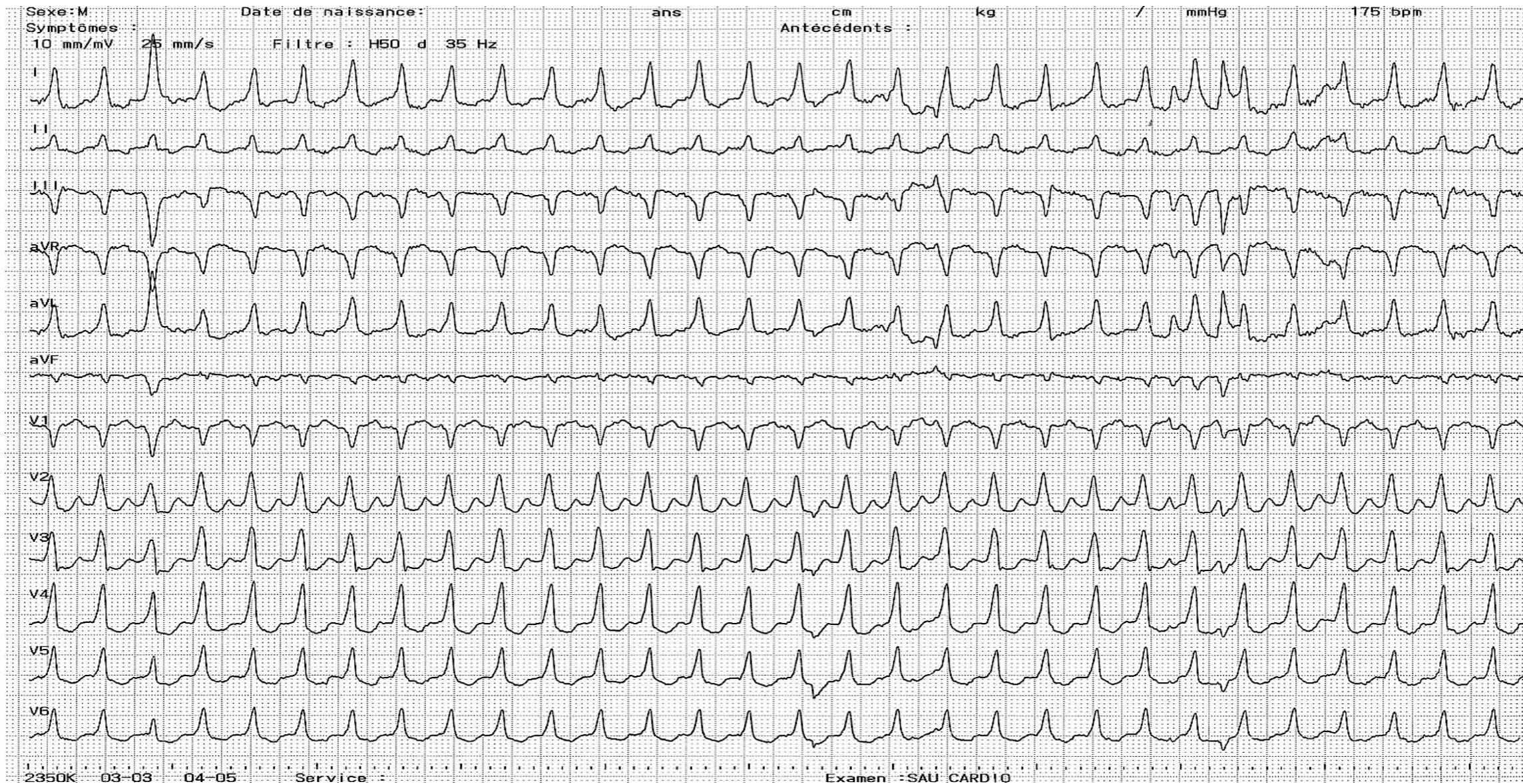
PATIENT #3



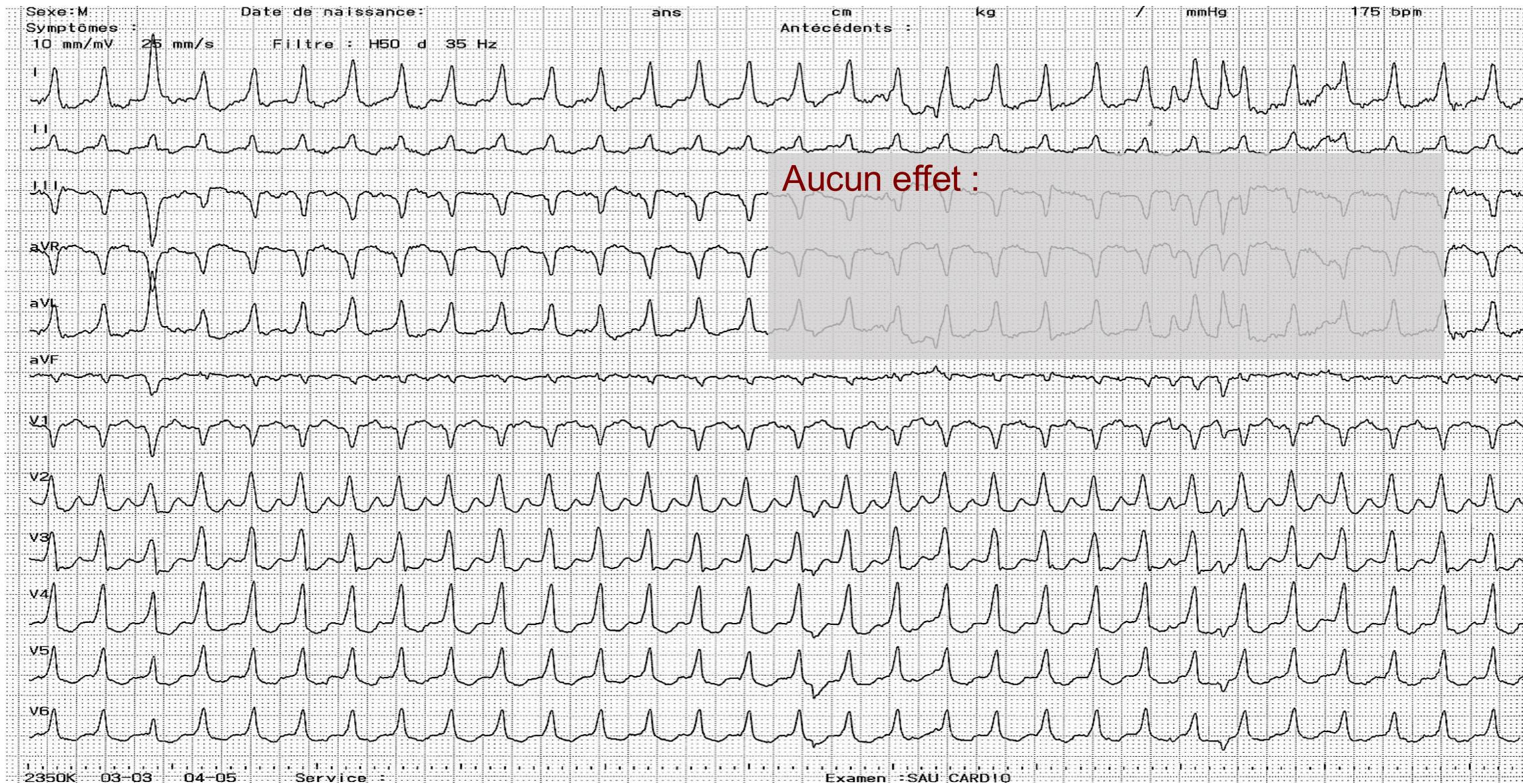
PATIENT #3



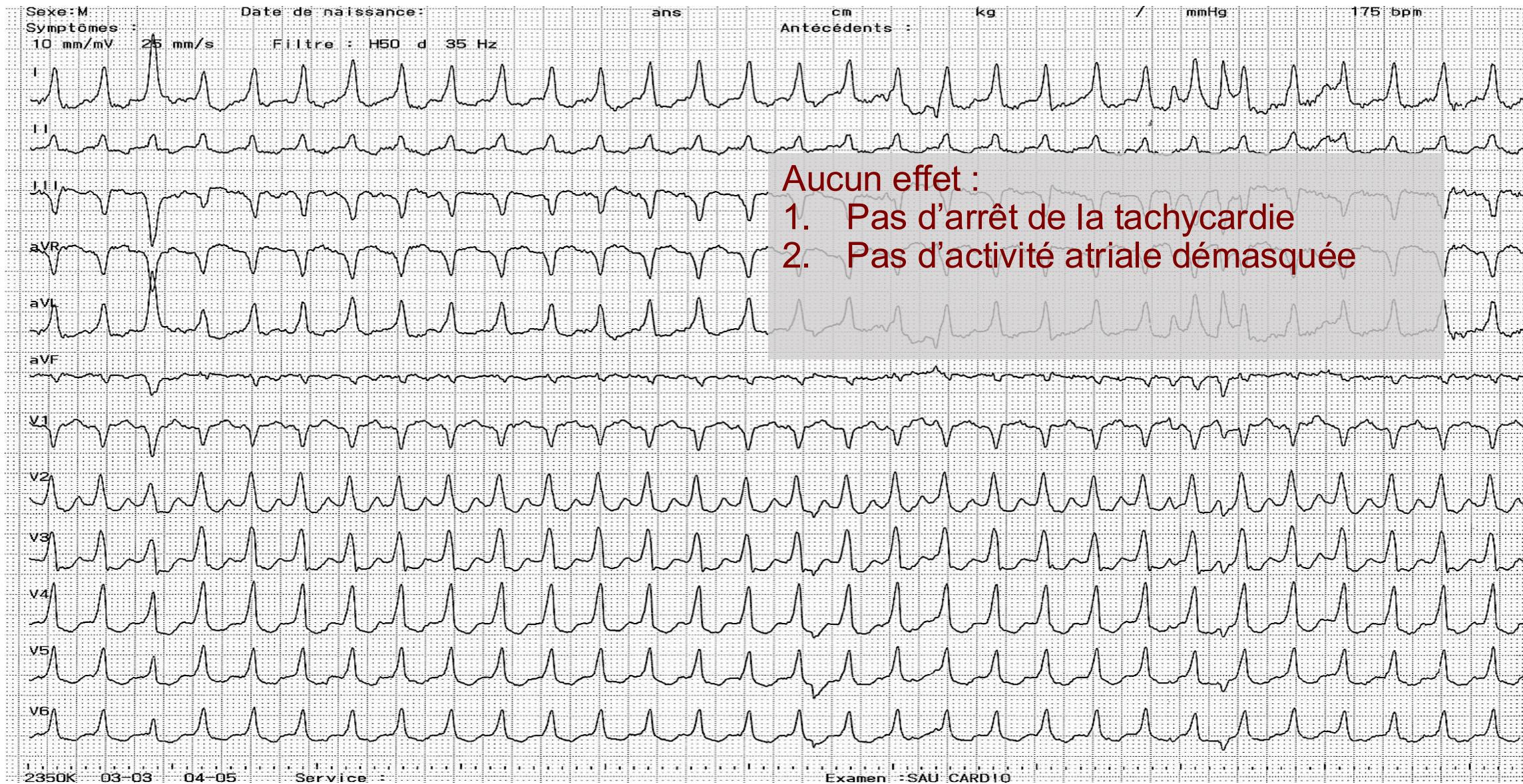
PATIENT #3 : test à la striadyne



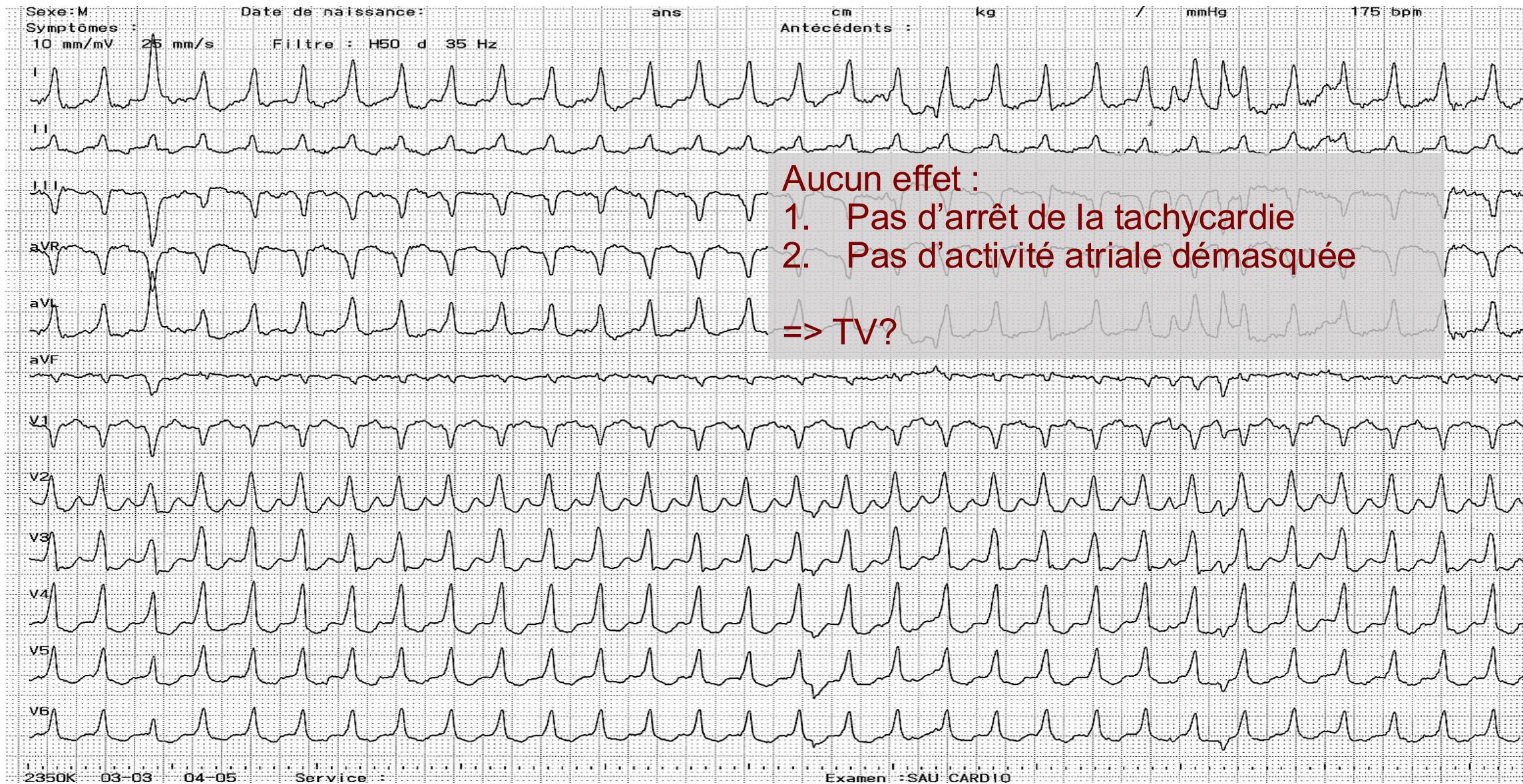
PATIENT #3 : test à la striadyne



PATIENT #3 : test à la striadyne



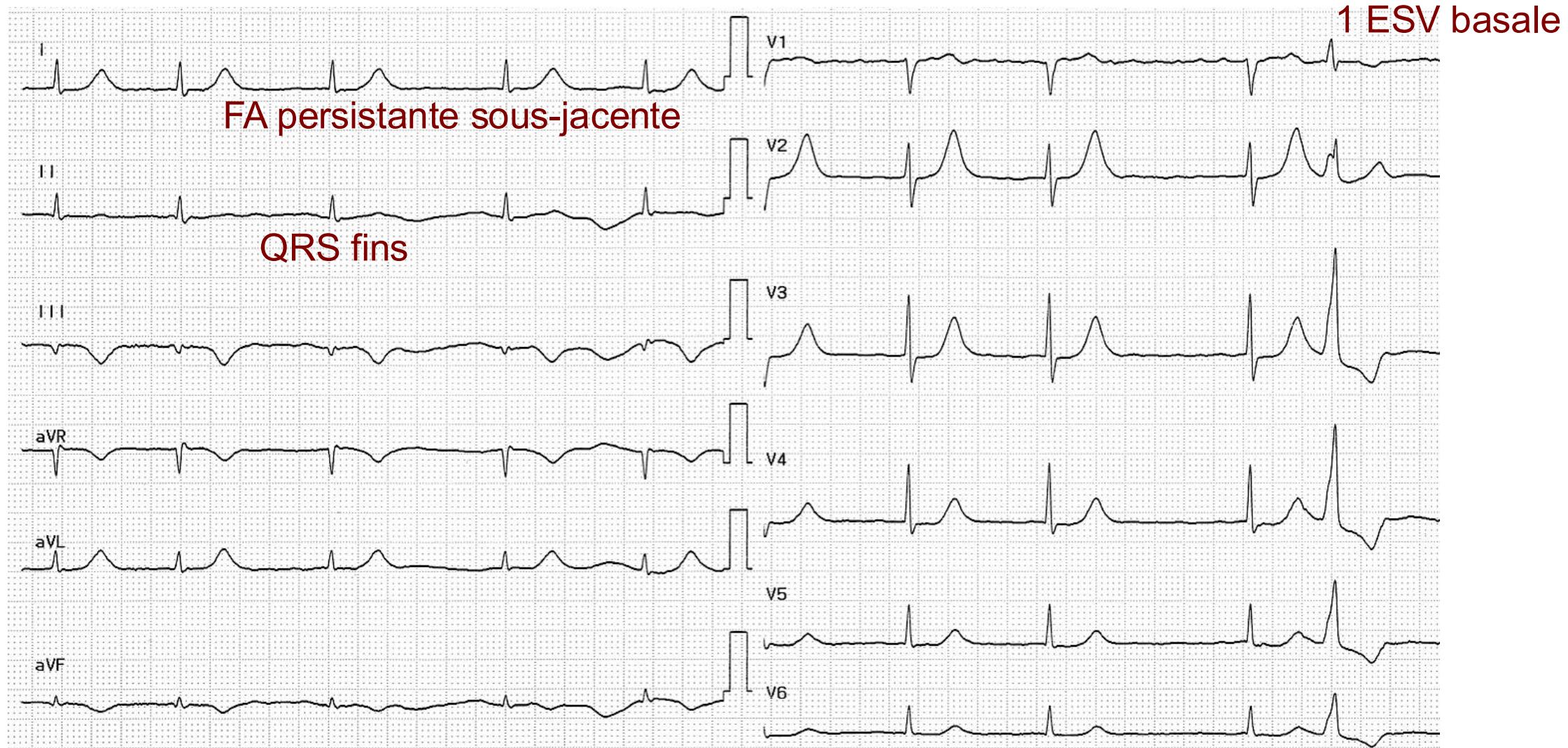
PATIENT #3 : test à la striadyne



PATIENT #3 : post réduction de TV !

TV postéro-septale

IRM myocardique : séquelle inférieure et inféro-septale



PATIENT #8

CLINIQUE

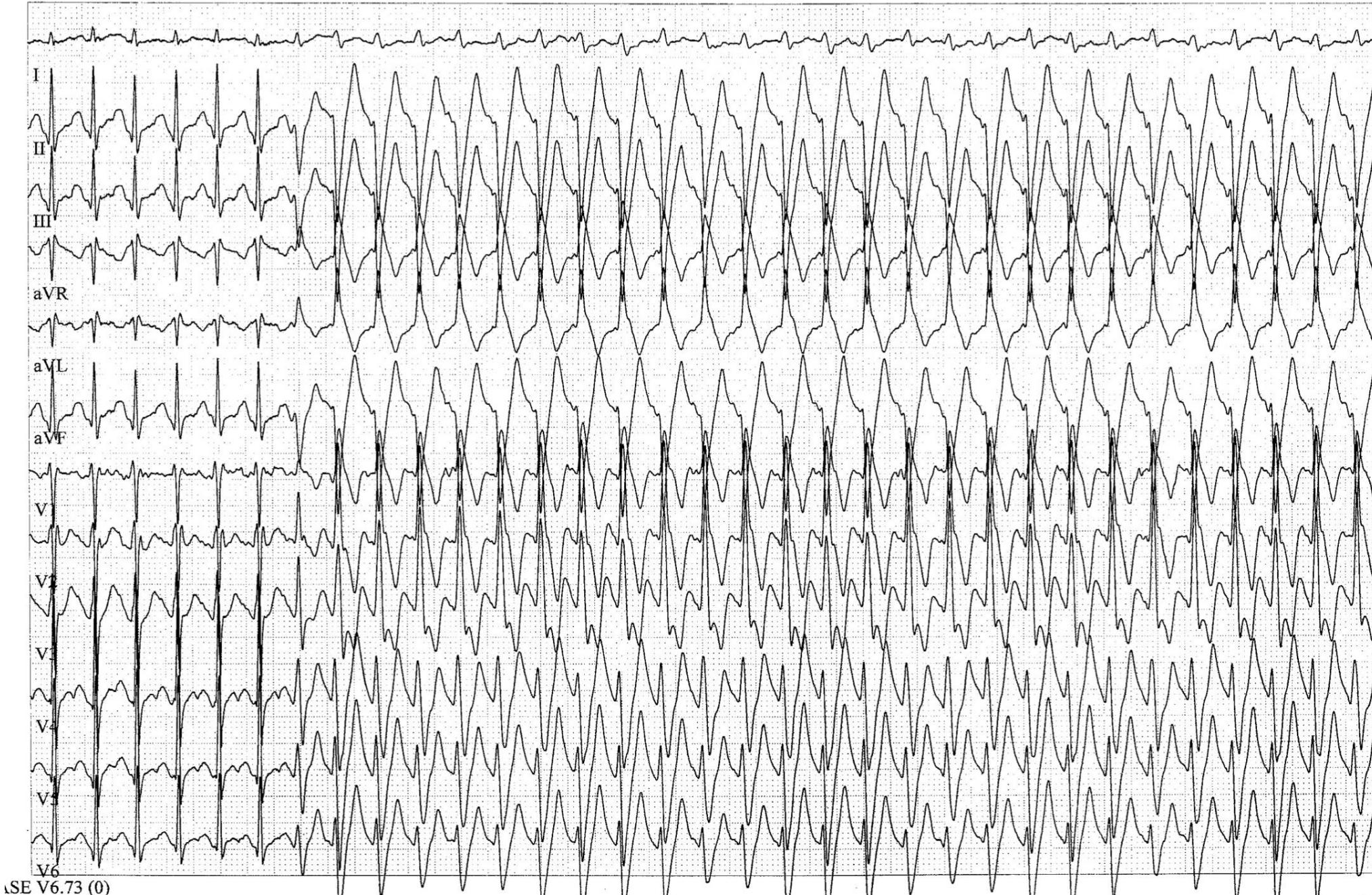
- Patient de 24 ans, sportif amateur (rugby en club, footing régulier)
- Aucun ATCD familial de cardiopathie ou de mort subite
- Aucun ATCD personnel notable
- Présente depuis plusieurs mois aux efforts intenses des épisodes de palpitations bien tolérée hémodynamiquement mais très symptomatiques
- ETT, EE et Holter ECG normaux
- Revient pour deuxième avis avec nouvelle EE

PATIENT #8

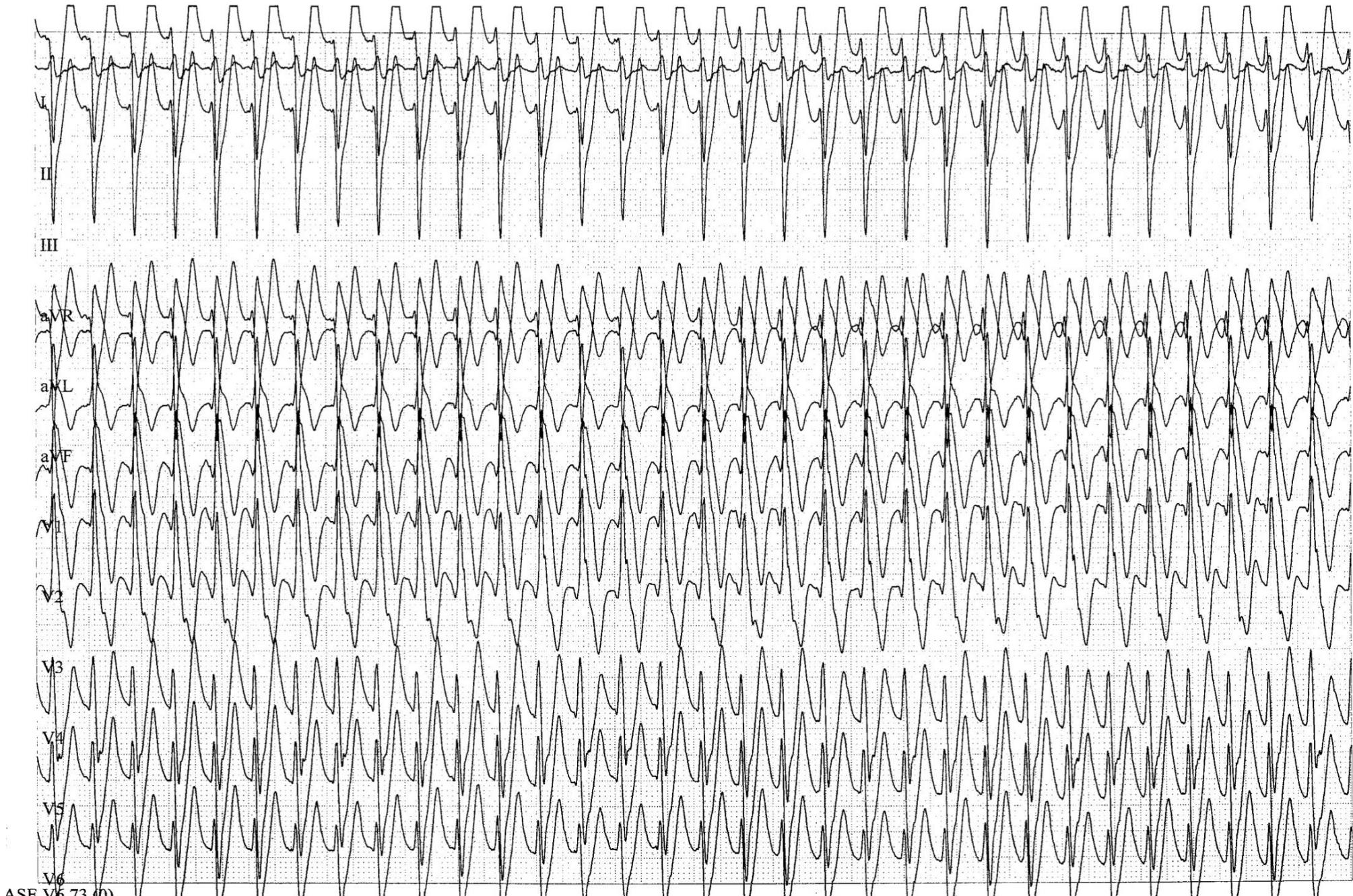


ASE V6.73 (0)

PATIENT #8

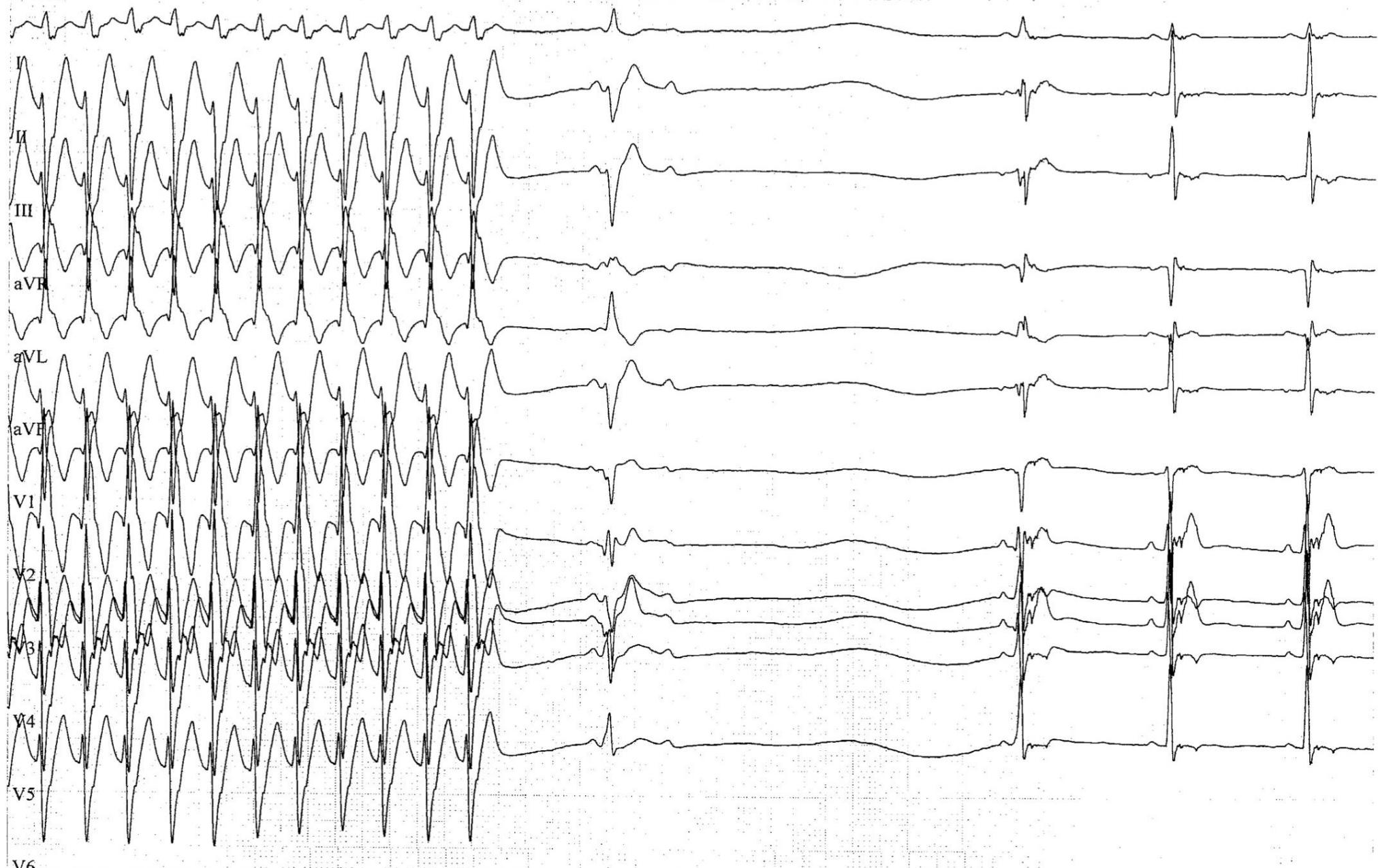


PATIENT #8

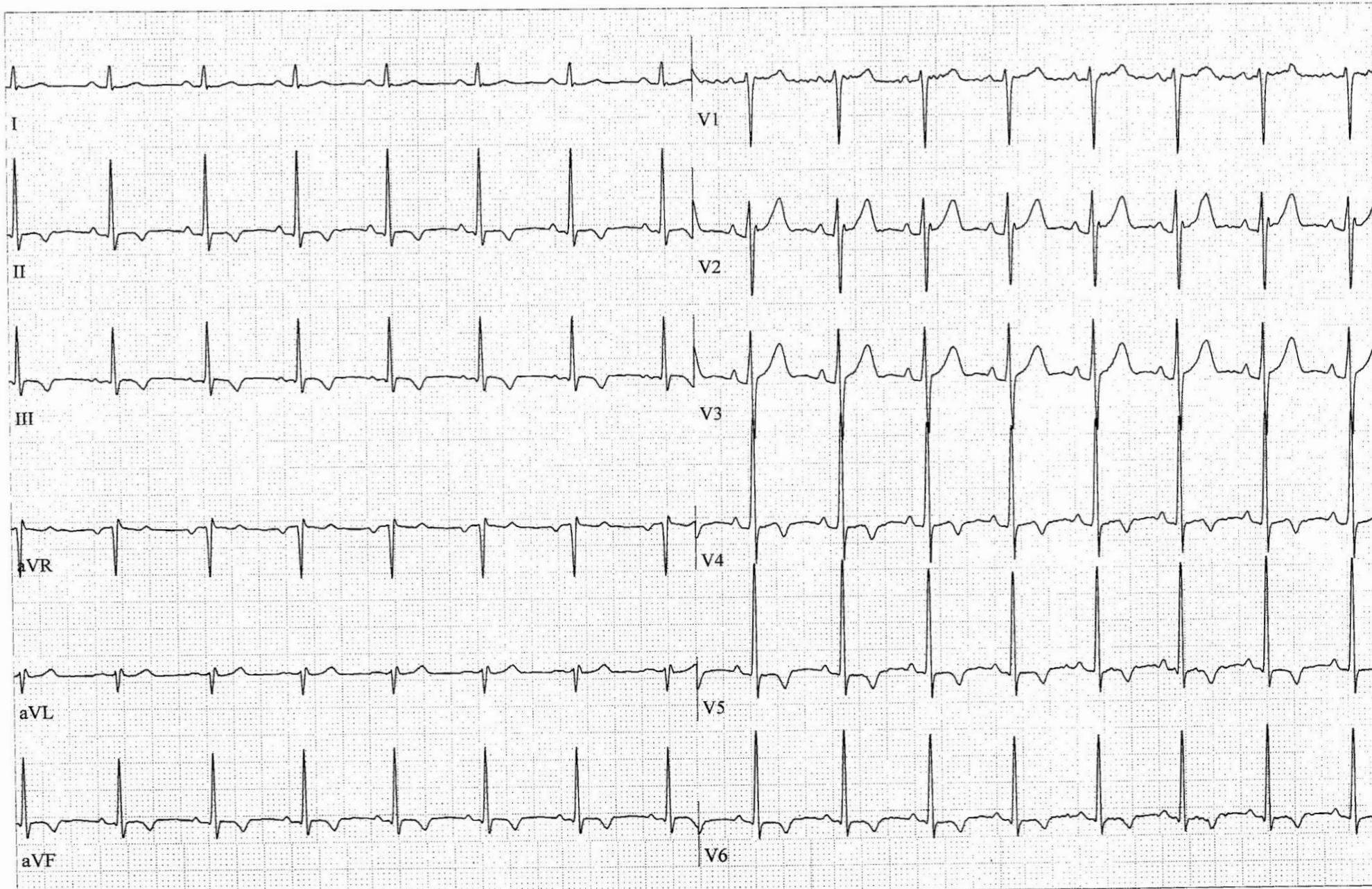


PATIENT #8

14:37 STRIADYNE
13:56 PERFUSE



PATIENT #8



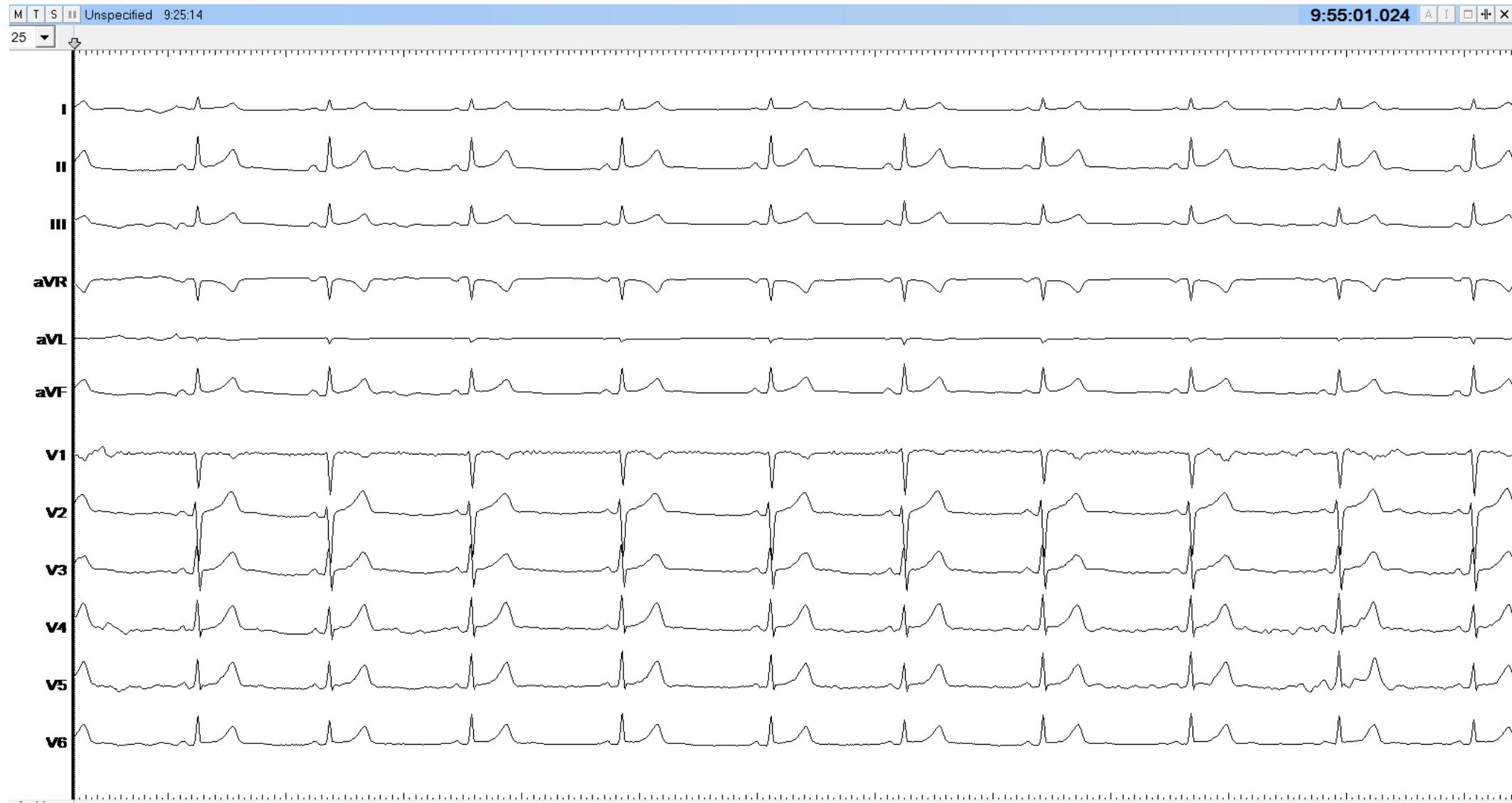
PATIENT #8 bis

CLINIQUE : jeune femme de 18 ans

- No structural heart disease, no other medical history
- Fascicular VT diagnosed in 2021
 - Initially treated with bisoprolol
 - Bisoprolol discontinuation in 10.2022 due to patient preference. Exercise test at the time was normal.
 - Since 05.2025, recurrence of exertional palpitations → exercise test revealed fascicular VT
 - scheduled for ablation

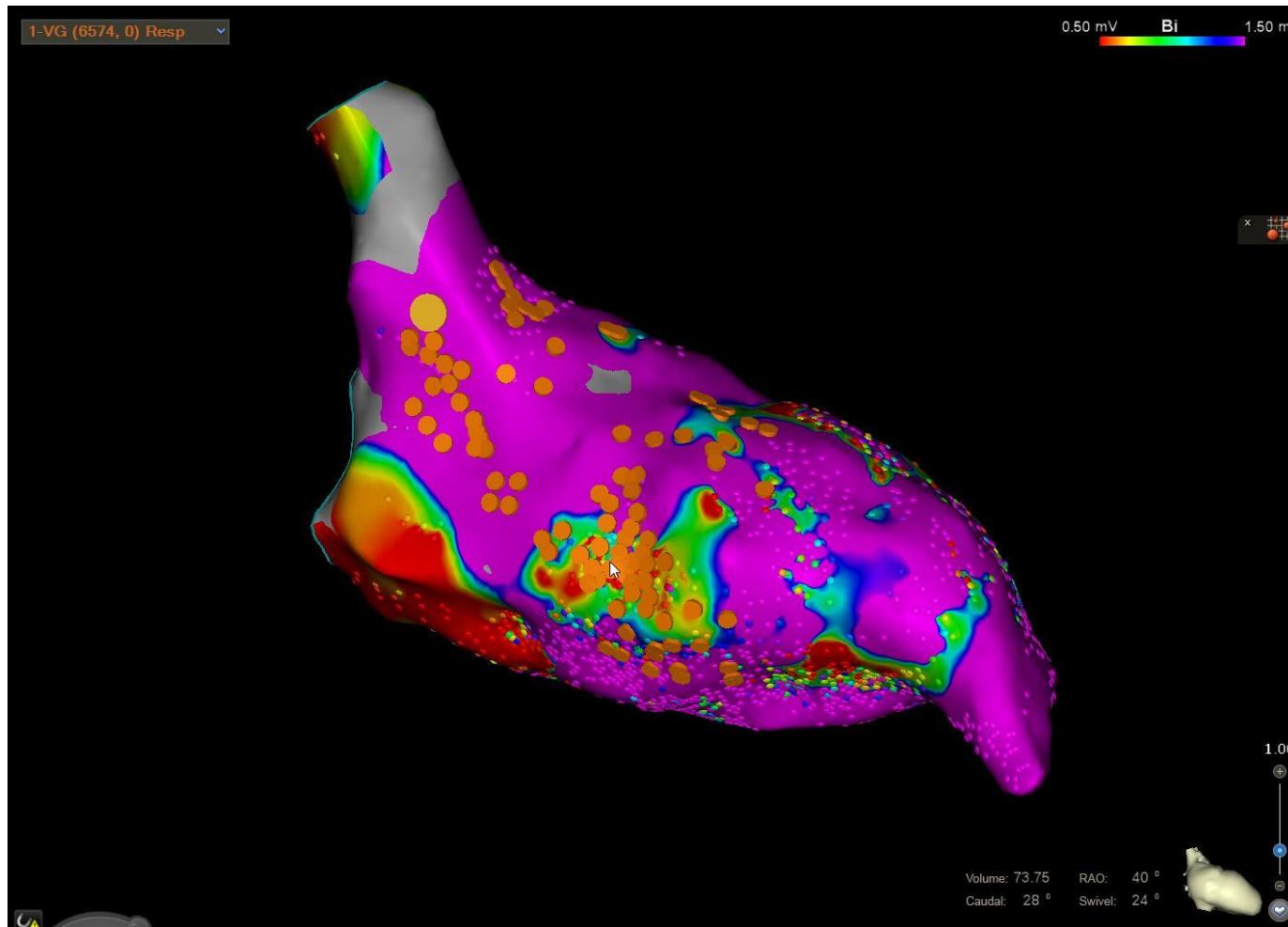
PATIENT #8 bis

Baseline ECG



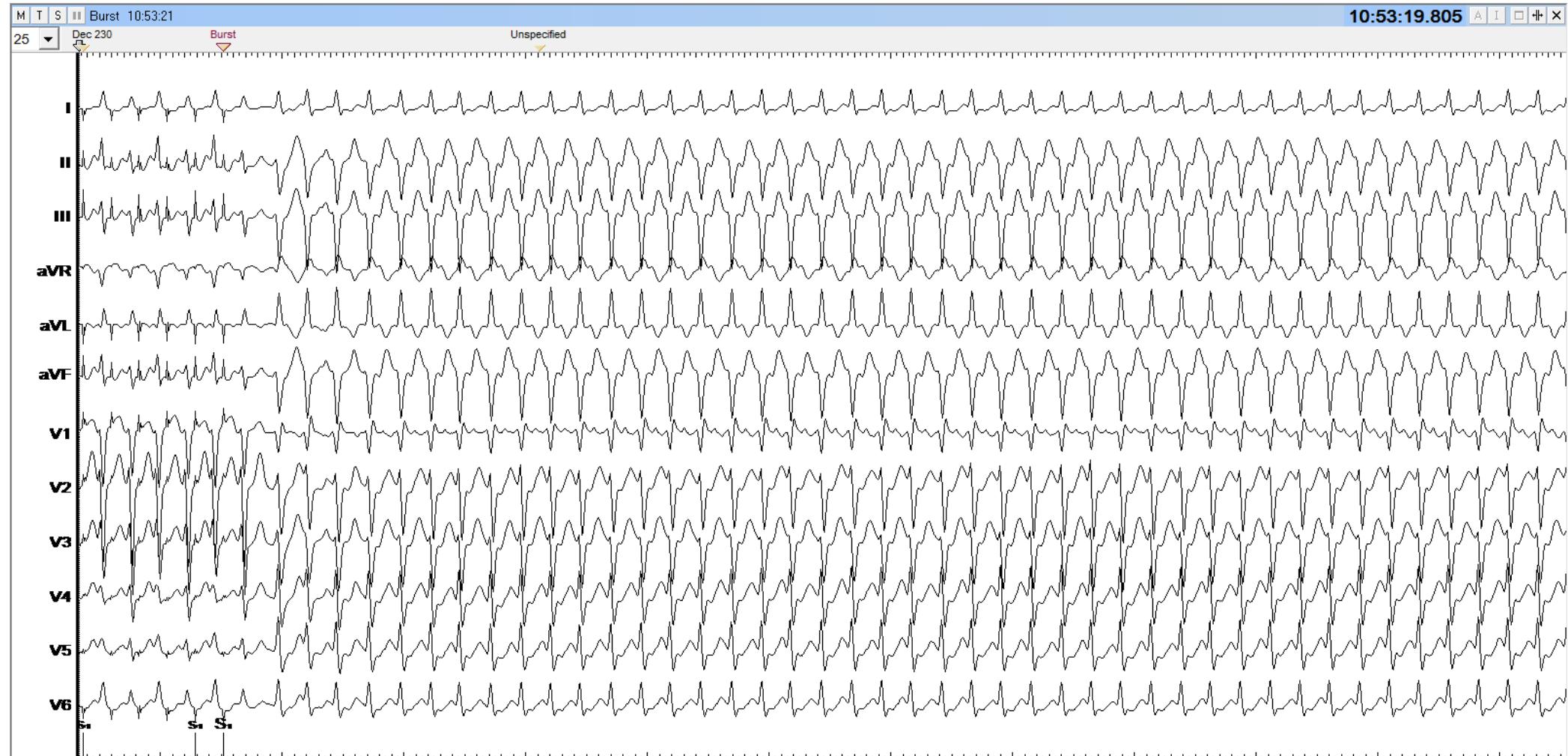
PATIENT #8 bis

Baseline map



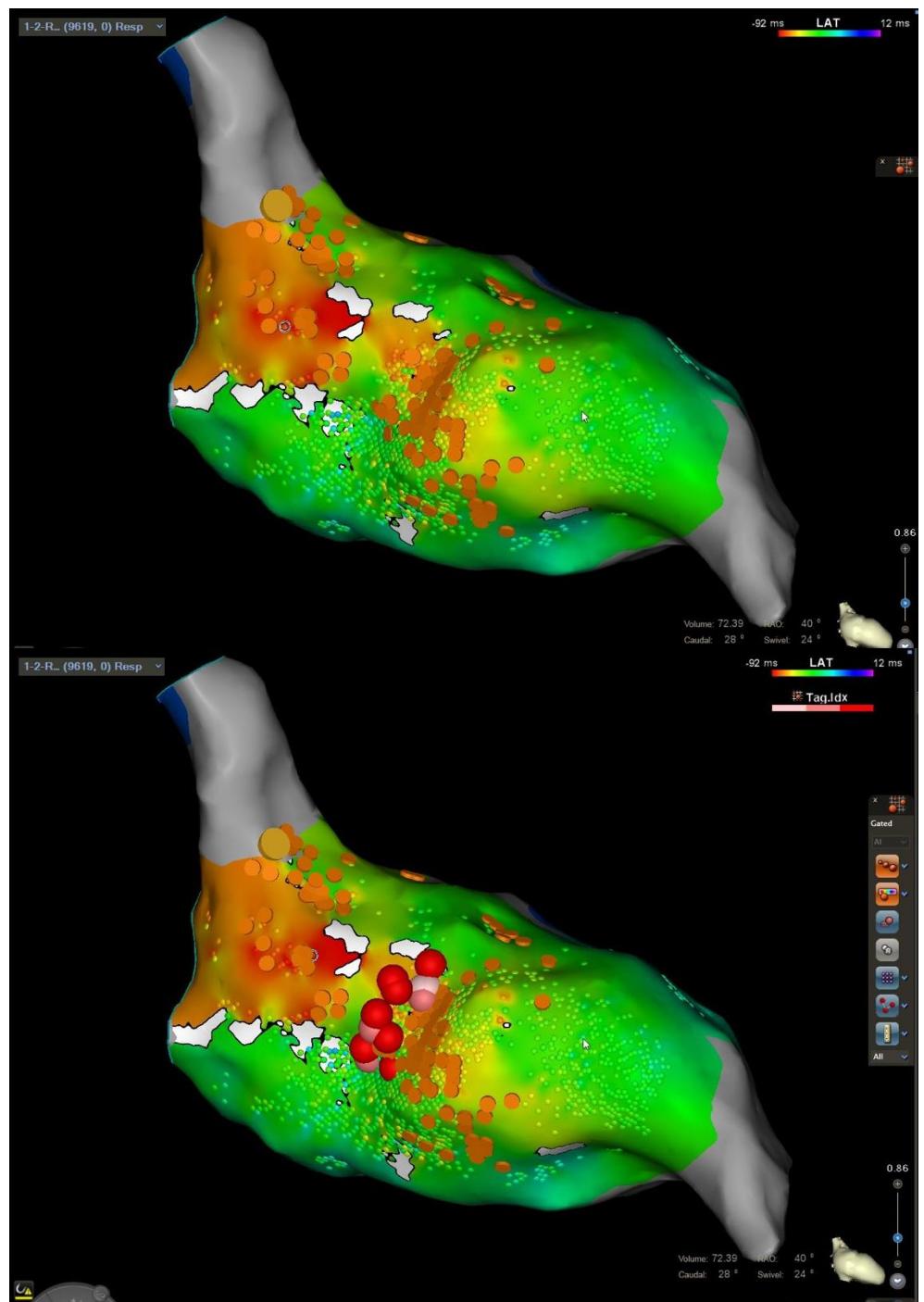
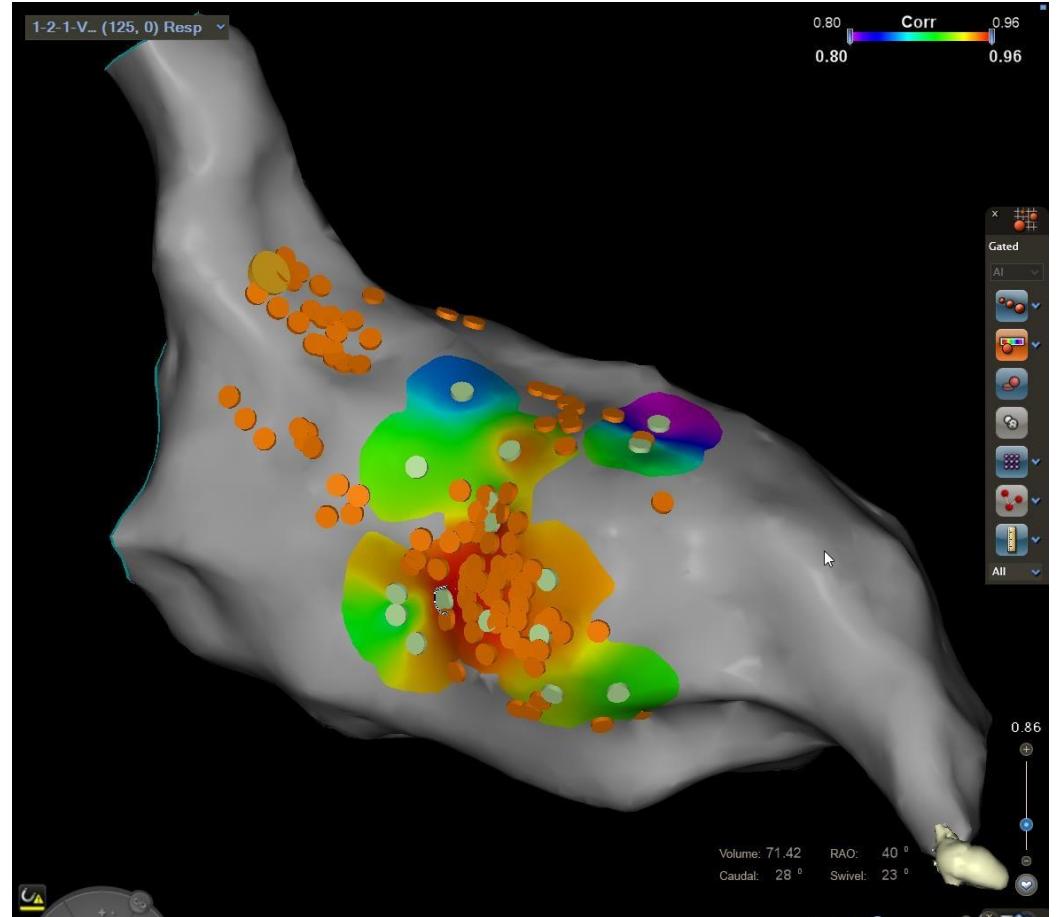
PATIENT #8 bis

VT induction w/ ISO



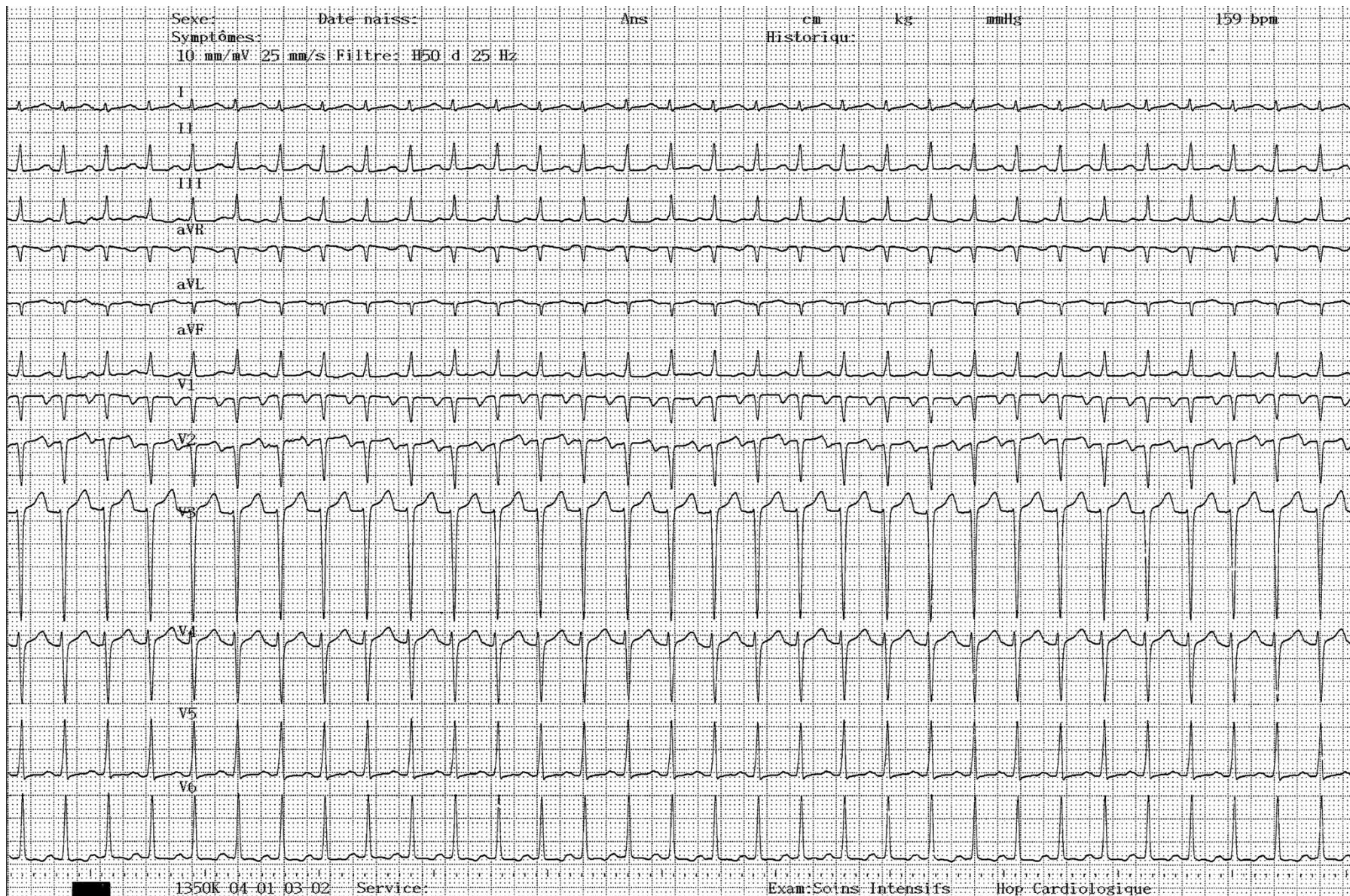
PATIENT #8 bis

VT mapping



PATIENT #8 bis

Post ablation ECG

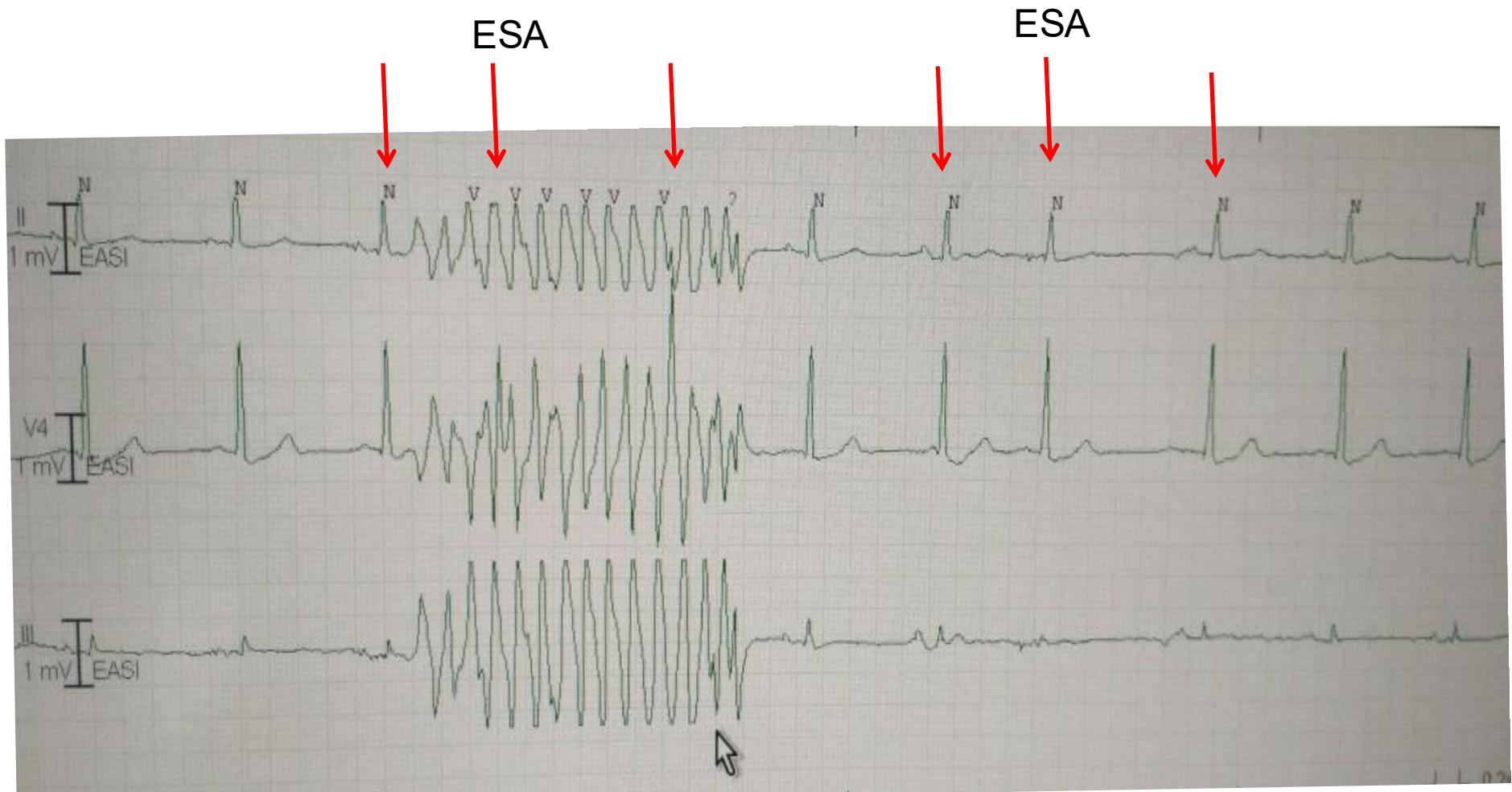


PATIENT #14

Revue 12 dérivations



PATIENT #14



PATIENT #4

Histoire Clinique

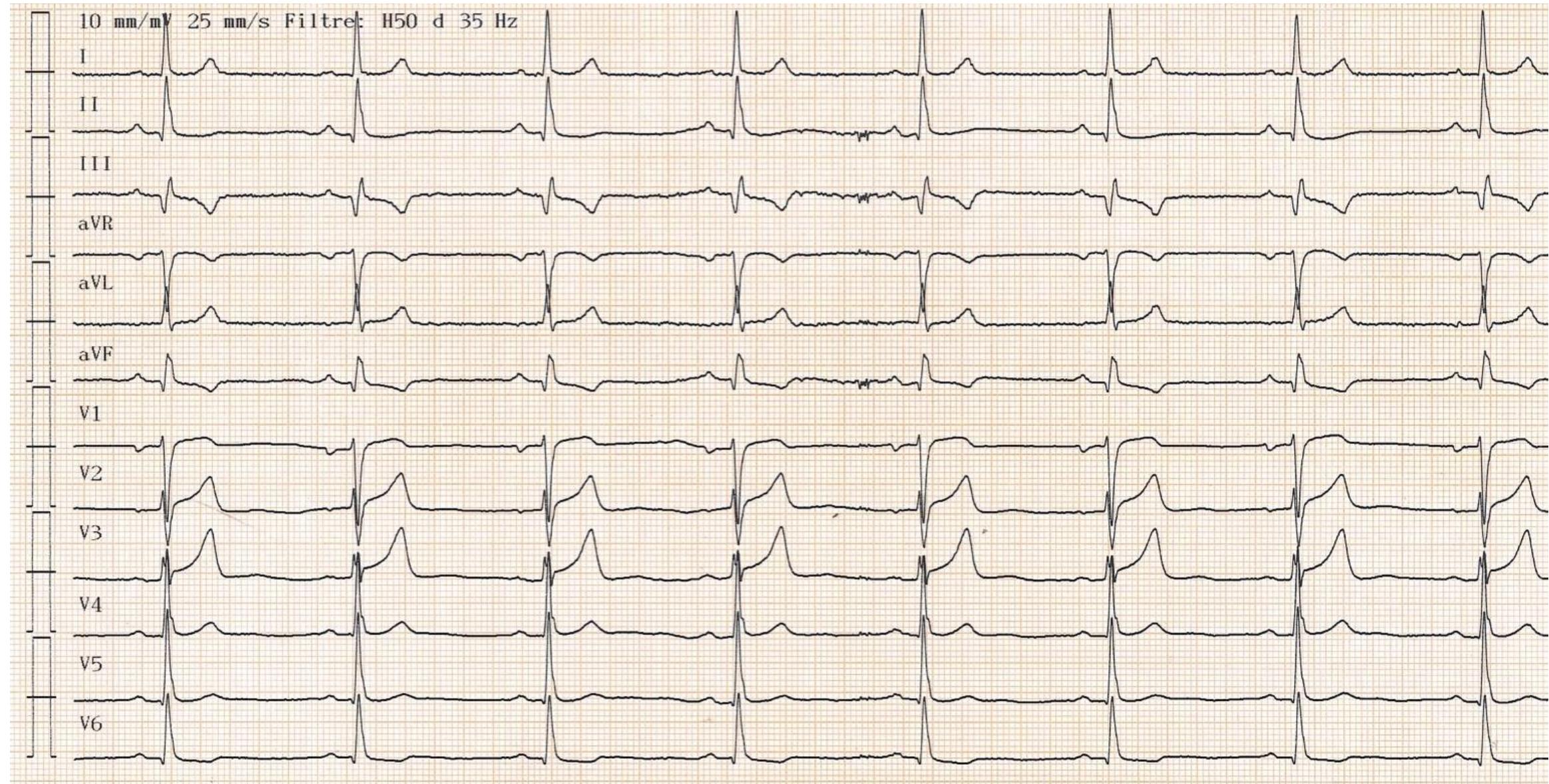
Patient de 67 ans hypertendu et dyslipidémique avec cardiopathie ischémique

- IDM inférieur en 1989 stenté sur CD et Cx
- Nouvel IDM inférieur en 2001 stenté sur CD

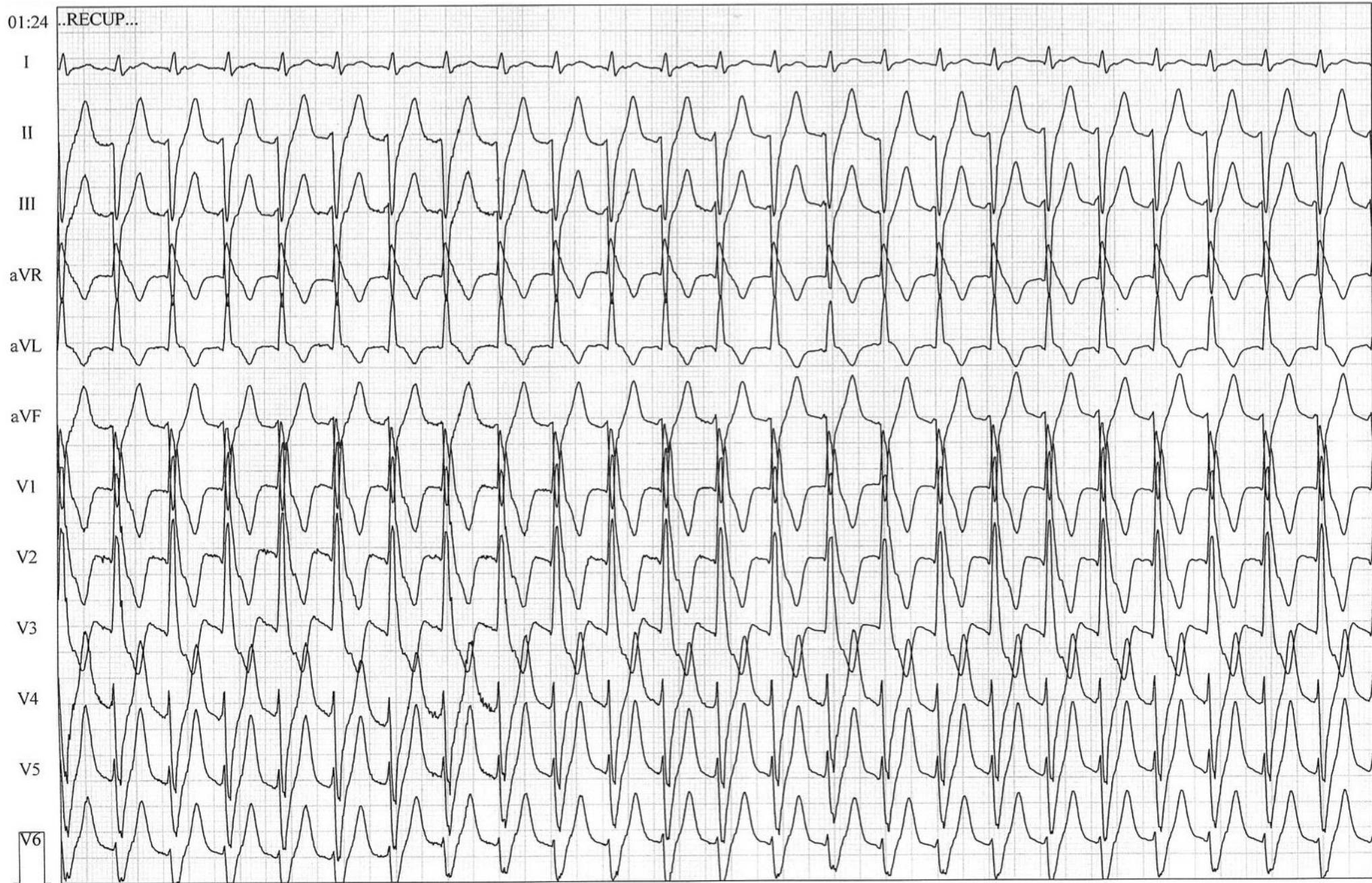
ETT : VG légèrement dilaté, FEVG 60%, Akinésie inferieure et inféro-septale. OG non dilatées, pas de VVP significative. Absence d'HTAP, VCI non dilatée et péricarde sec.

Revient pour épreuve d'effort pour réévaluation de sa cardiopathie

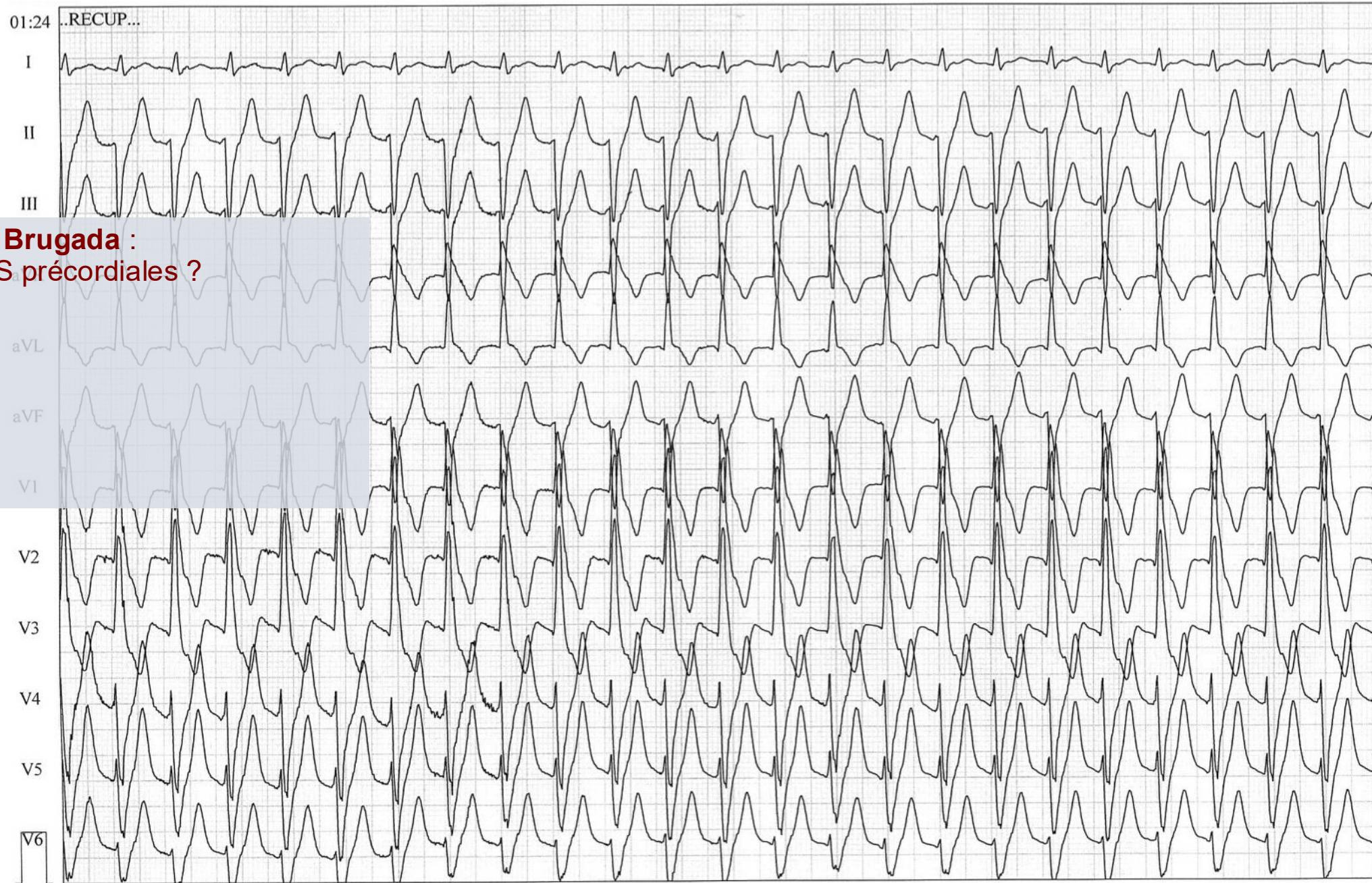
PATIENT #4 : ECG 1



PATIENT #4 : ECG 1



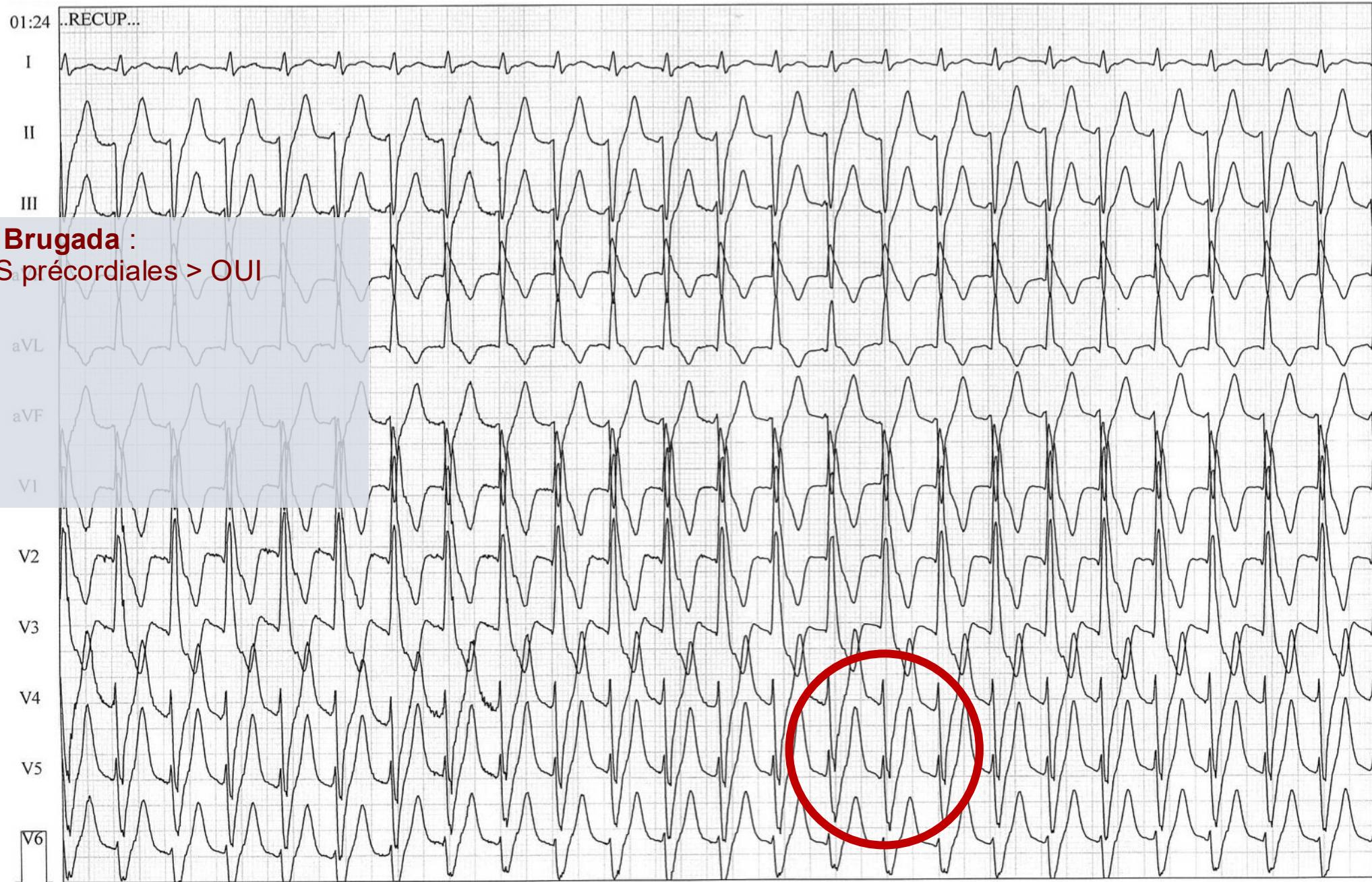
PATIENT #4 : ECG 1



Critères de Brugada :

1. Aspect RS_a précordiales ?

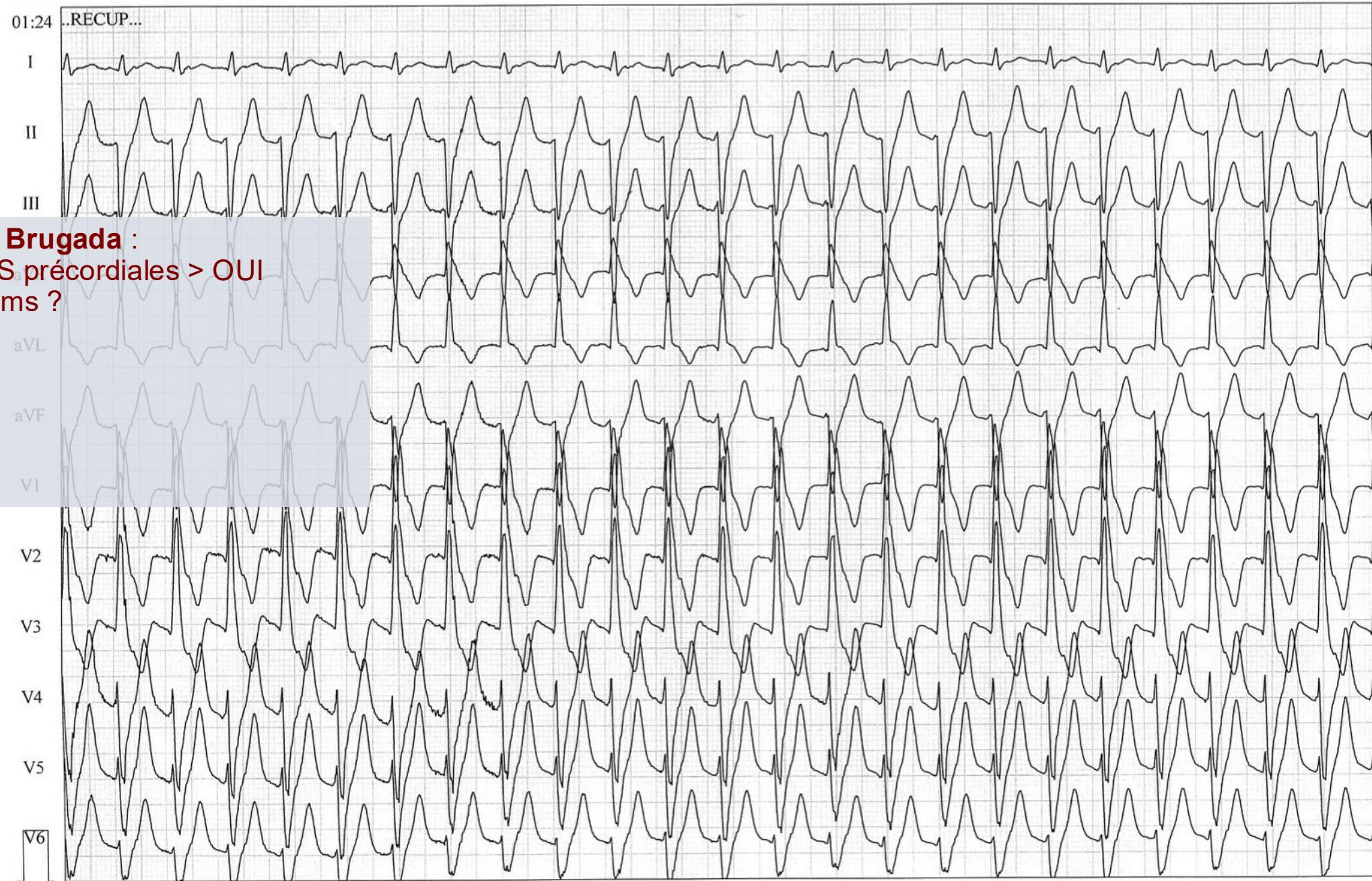
PATIENT #4 : ECG 1



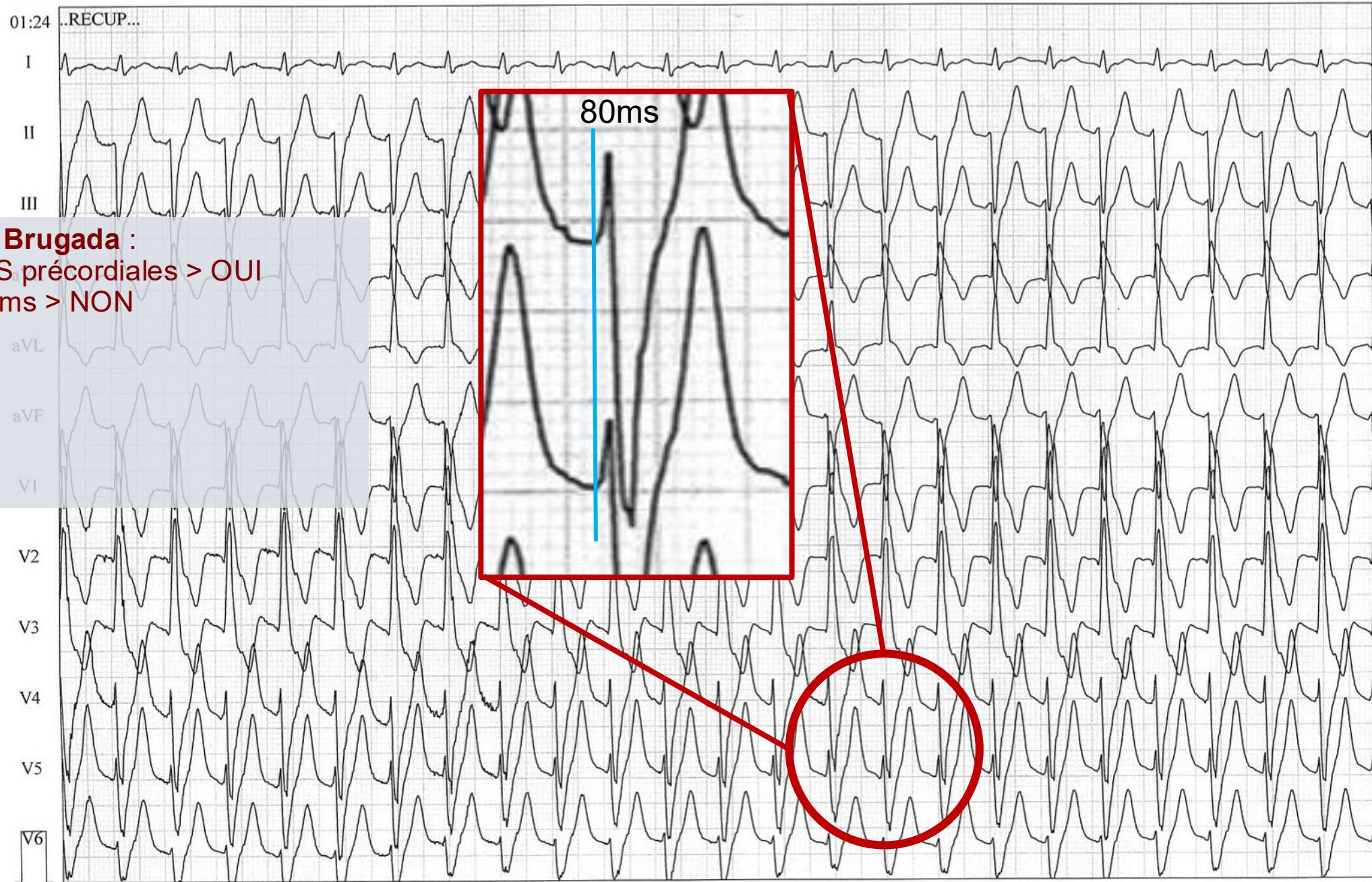
Critères de Brugada :

1. Aspect RS_a précordiales > OUI

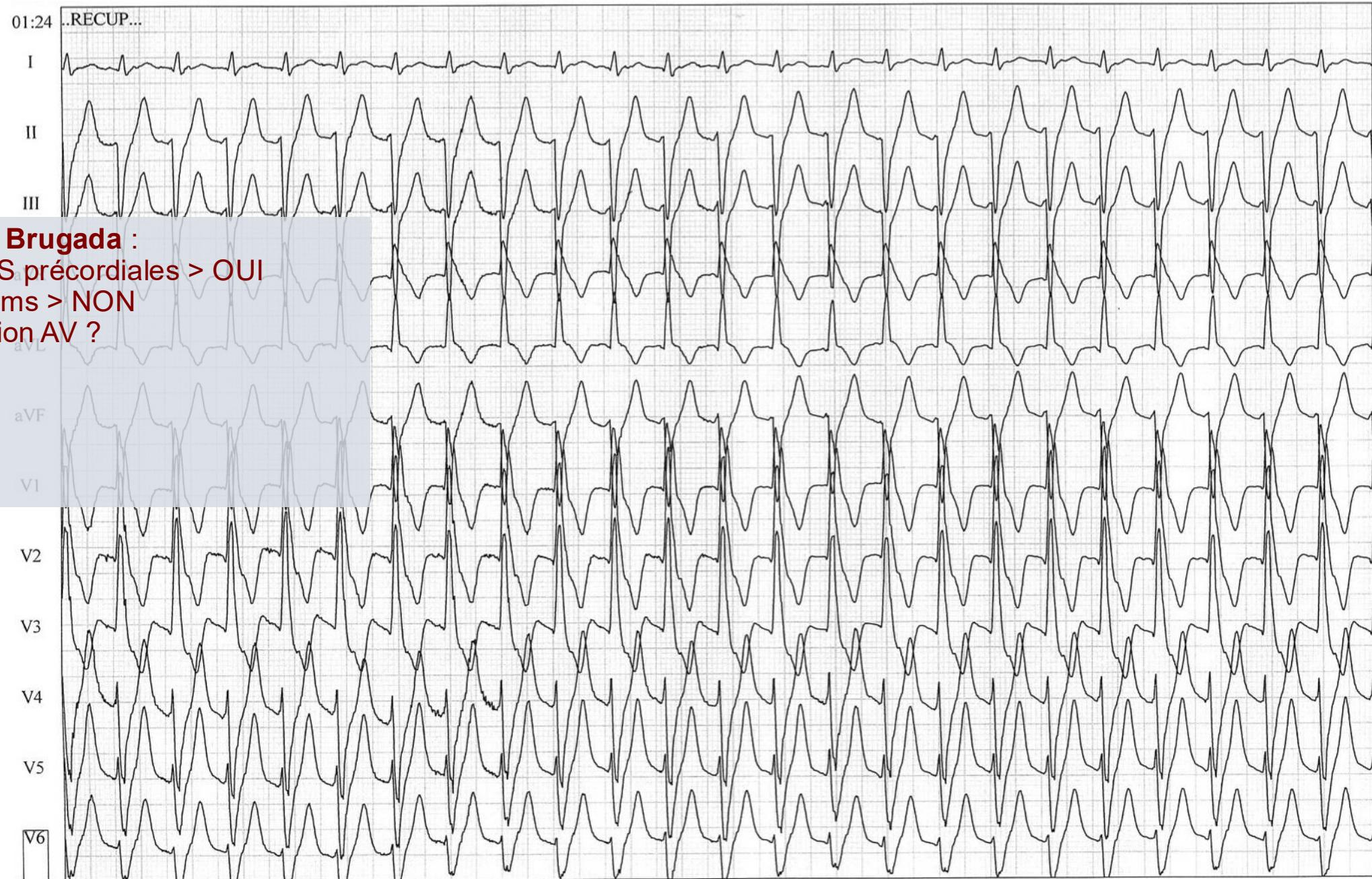
PATIENT #4 : ECG 1



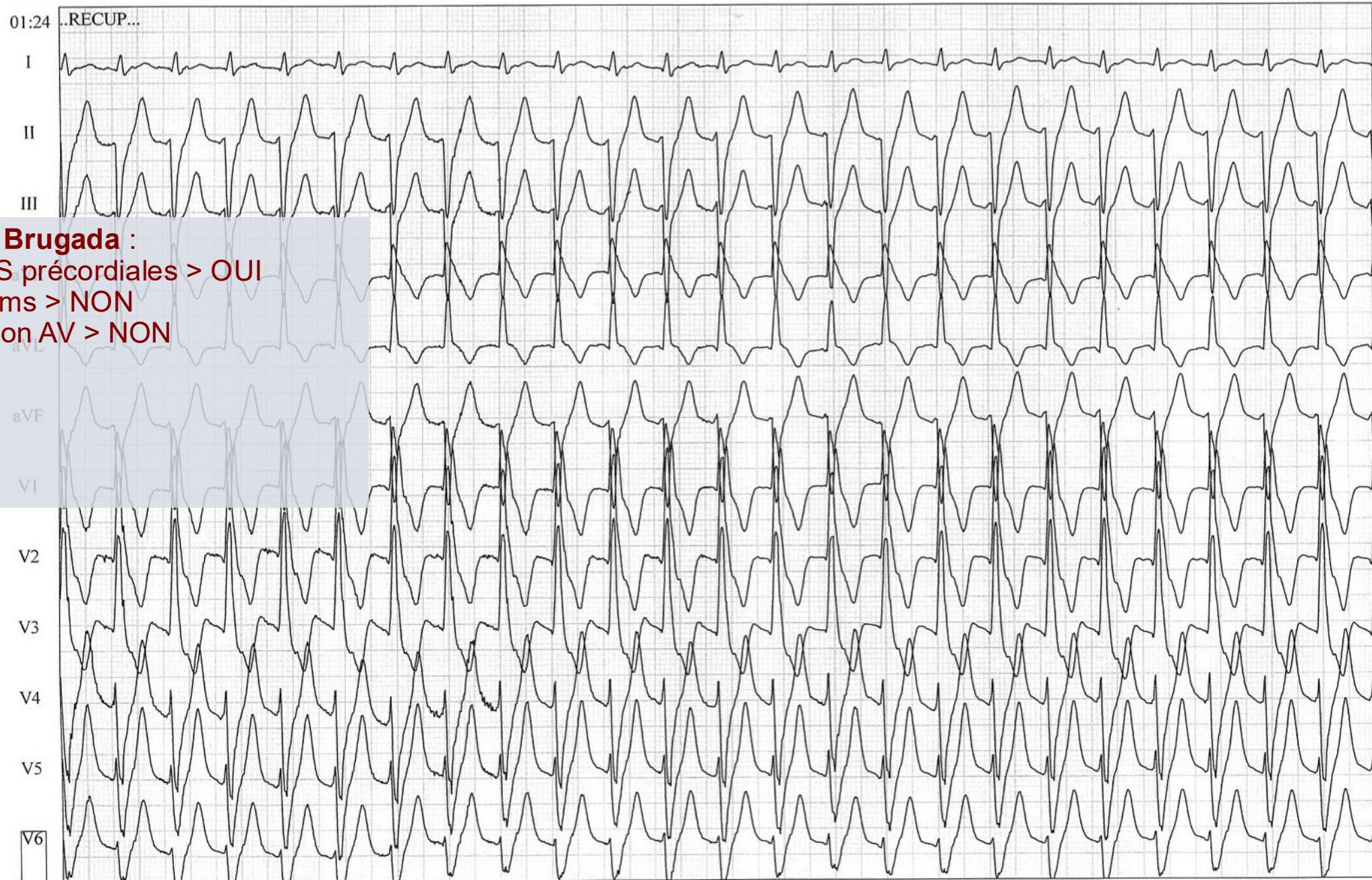
PATIENT #4 : ECG 1



PATIENT #4 : ECG 1



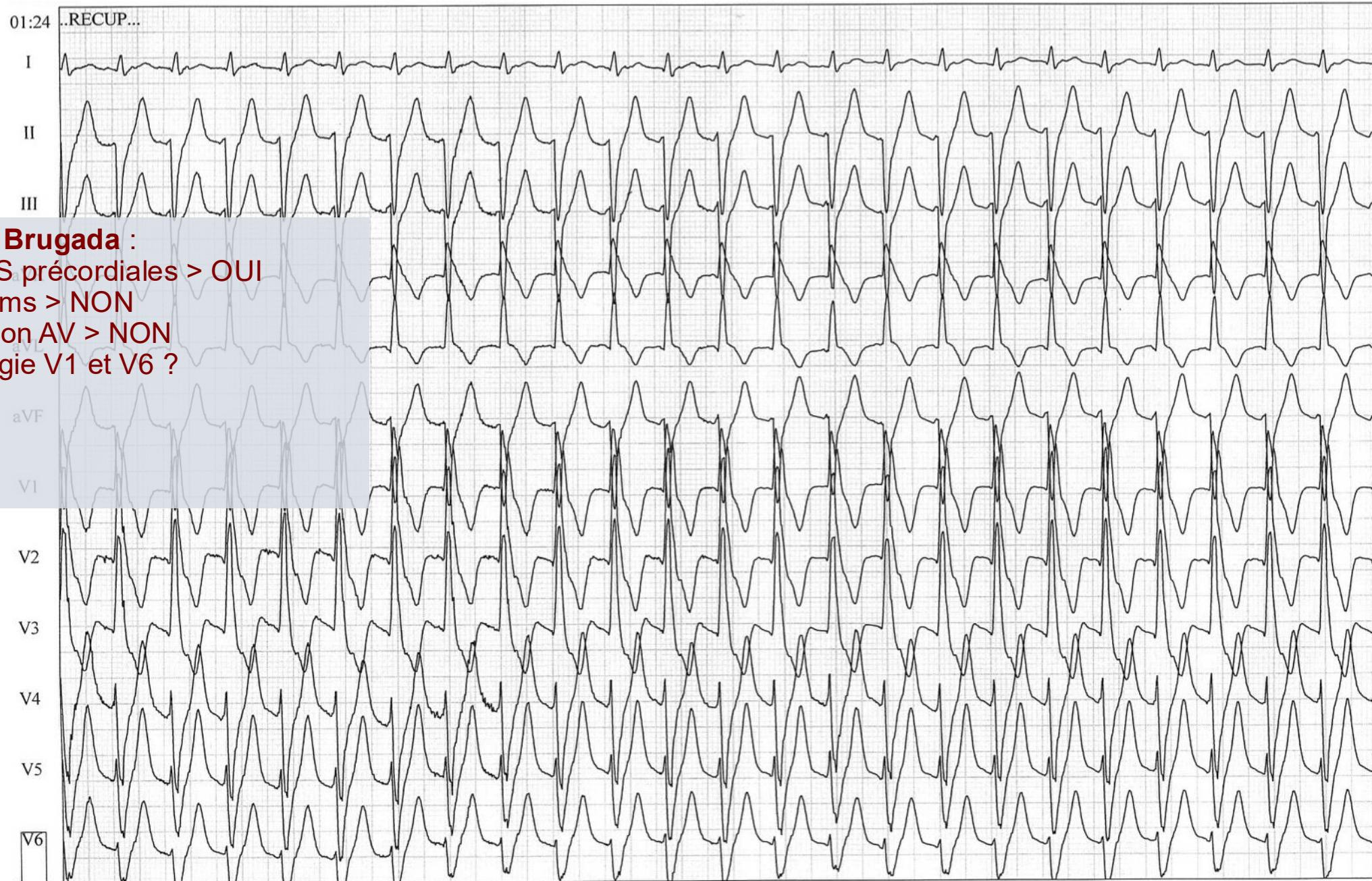
PATIENT #4 : ECG 1



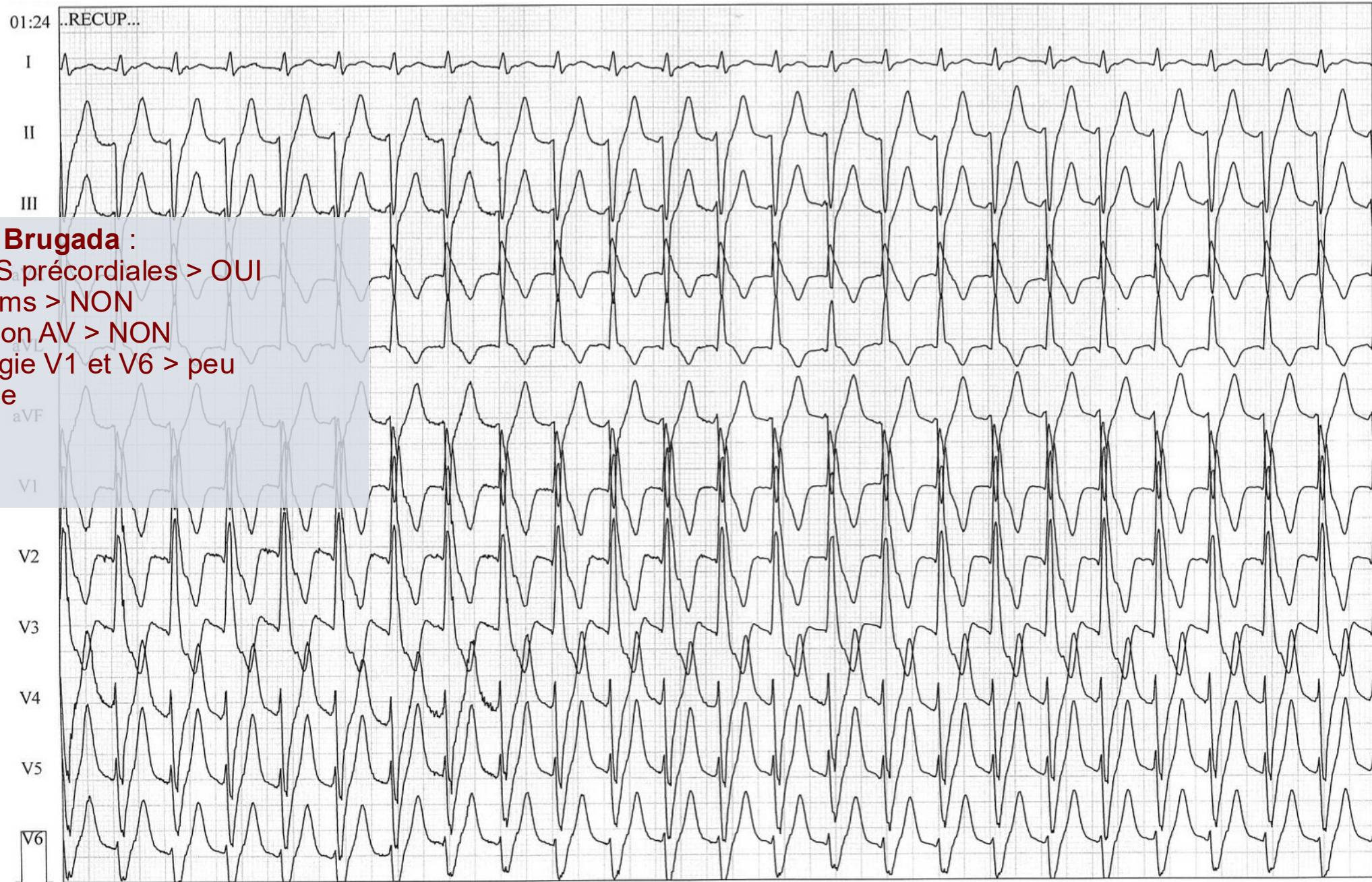
Critères de Brugada :

1. Aspect RS précordiales > OUI
2. RS > 100ms > NON
3. Dissociation AV > NON

PATIENT #4 : ECG 1



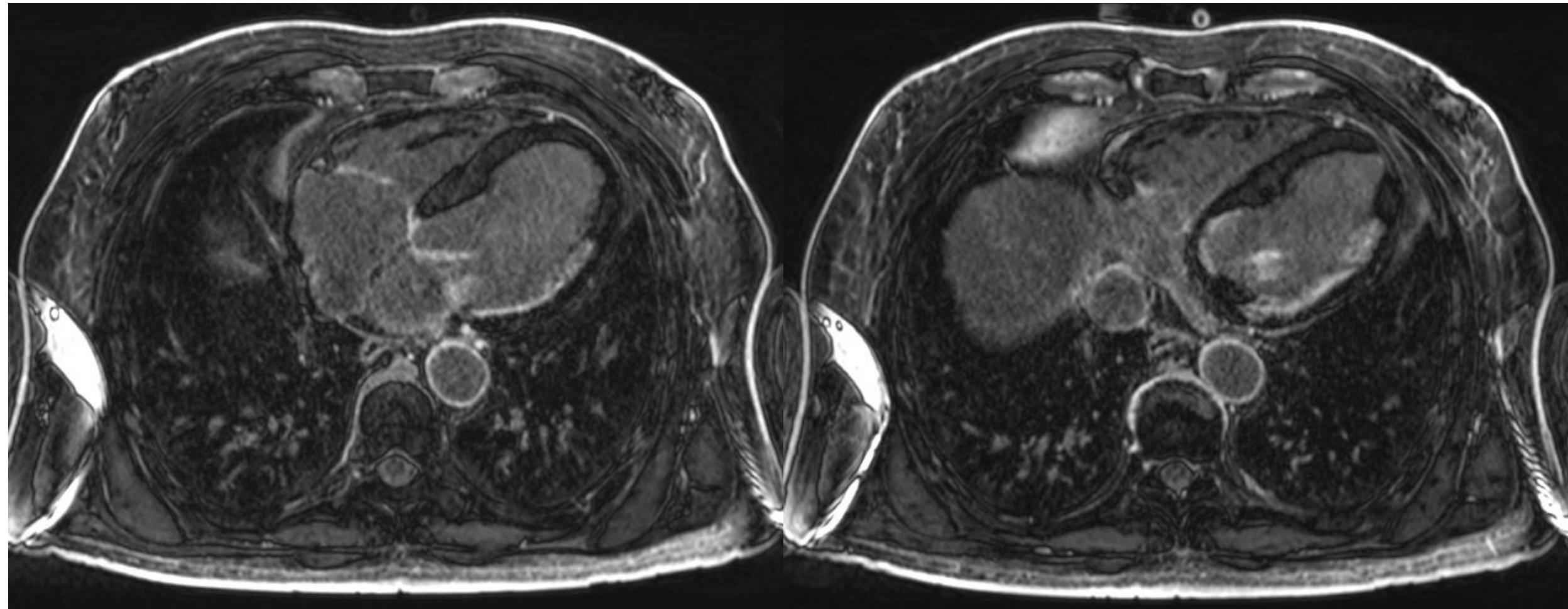
PATIENT #4 : ECG 1



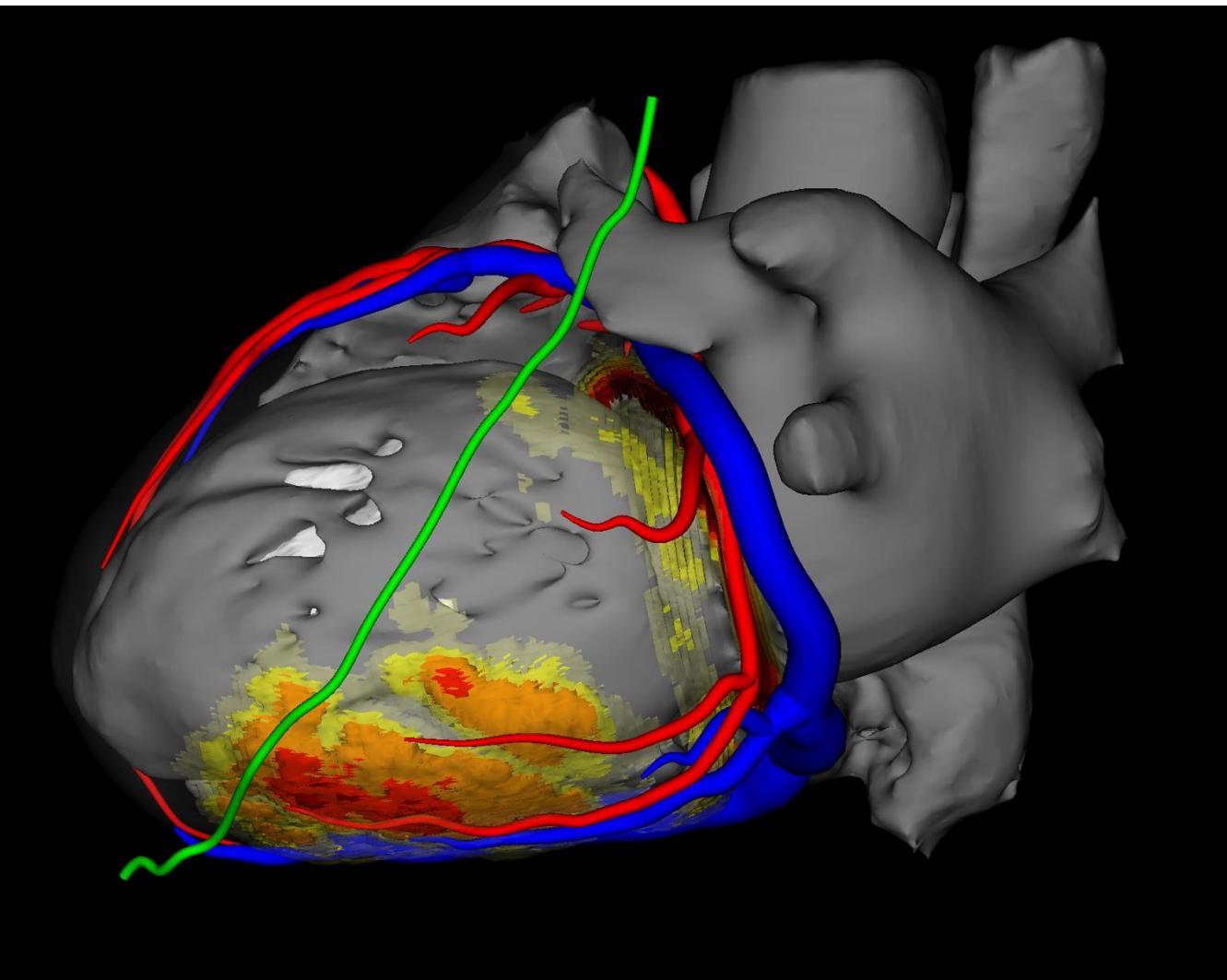
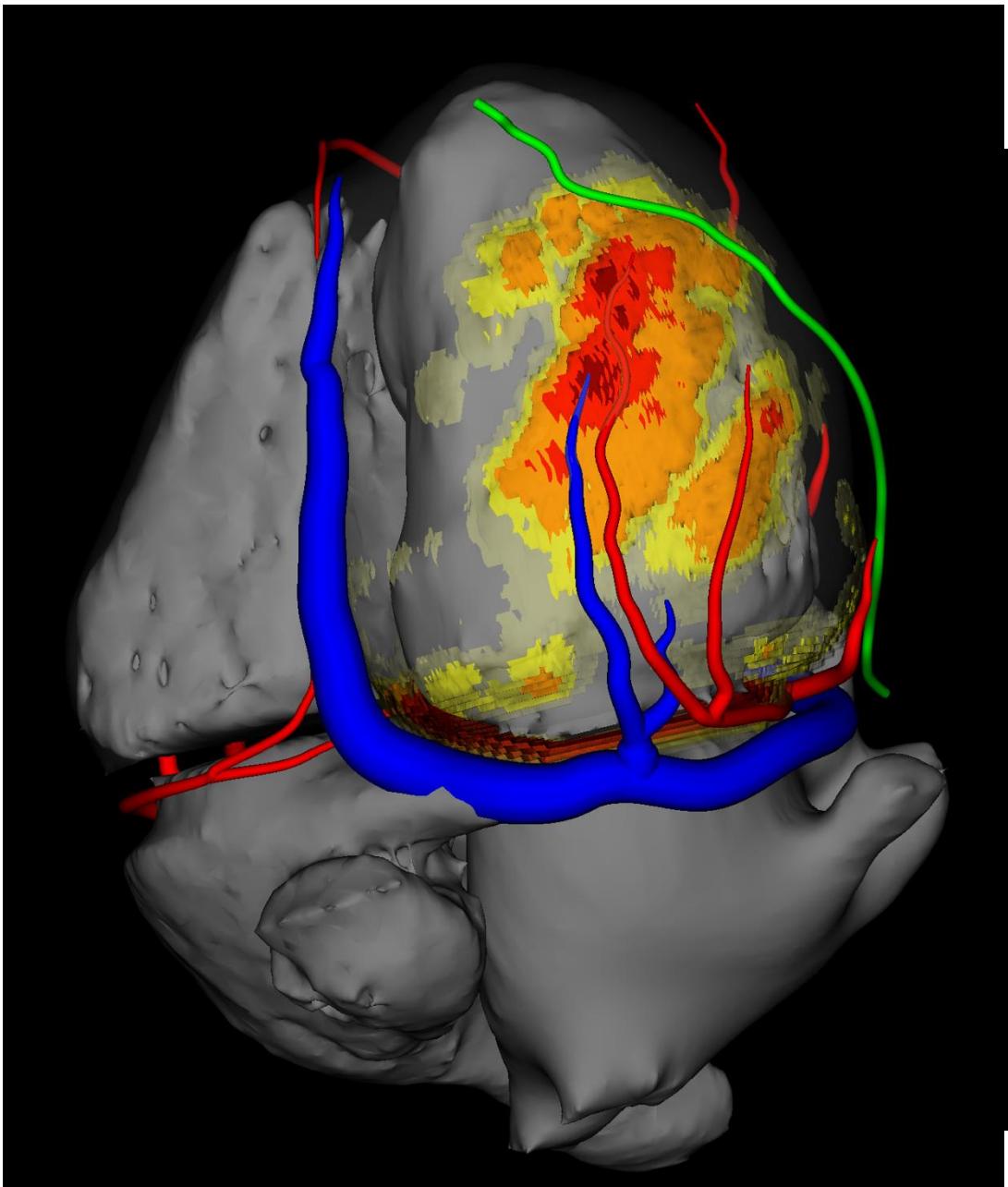
PATIENT #4 : Début de la tachycardie



PATIENT #4 : IRM cardiaque



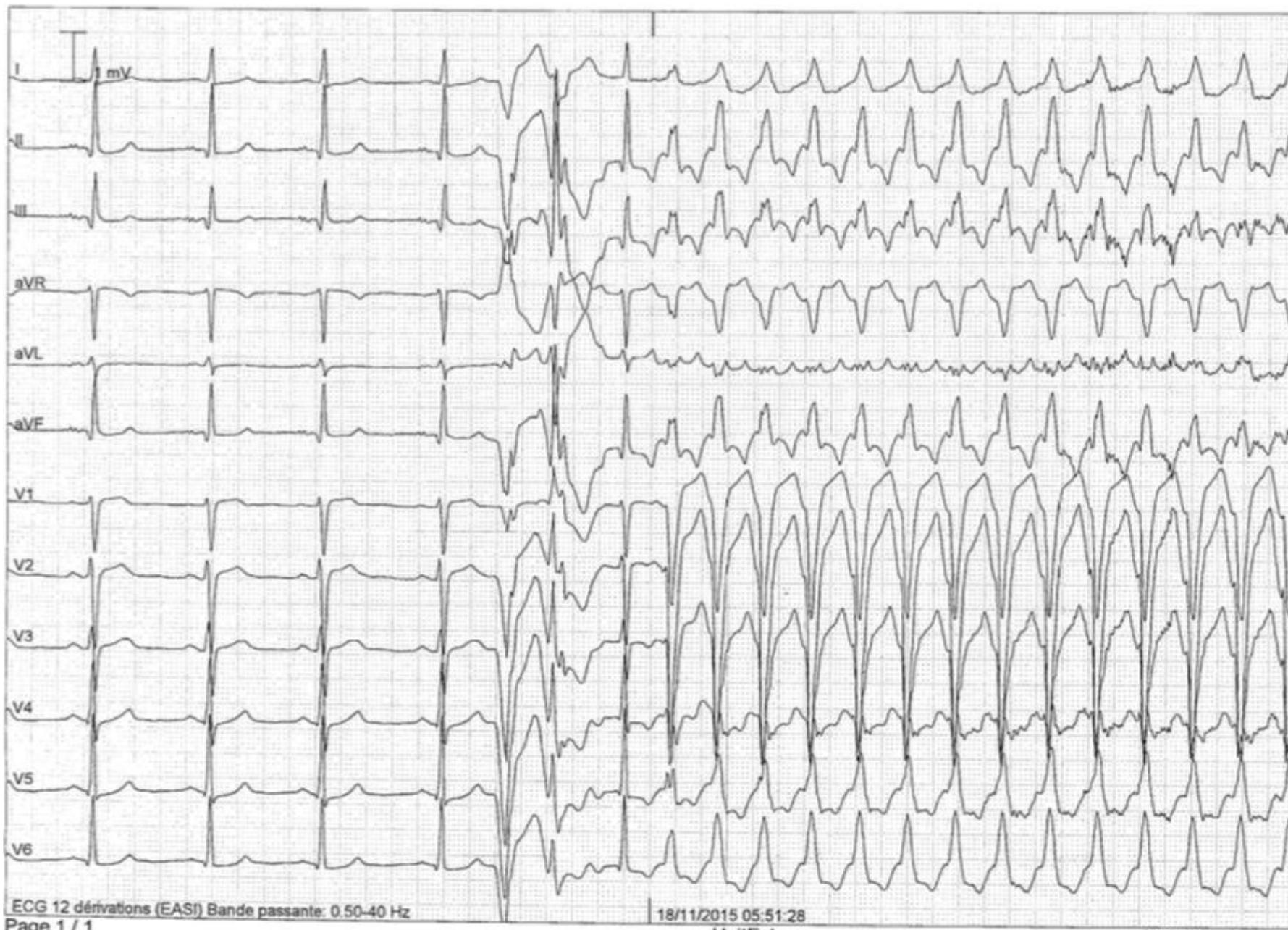
PATIENT #4 : TDM + inHeart



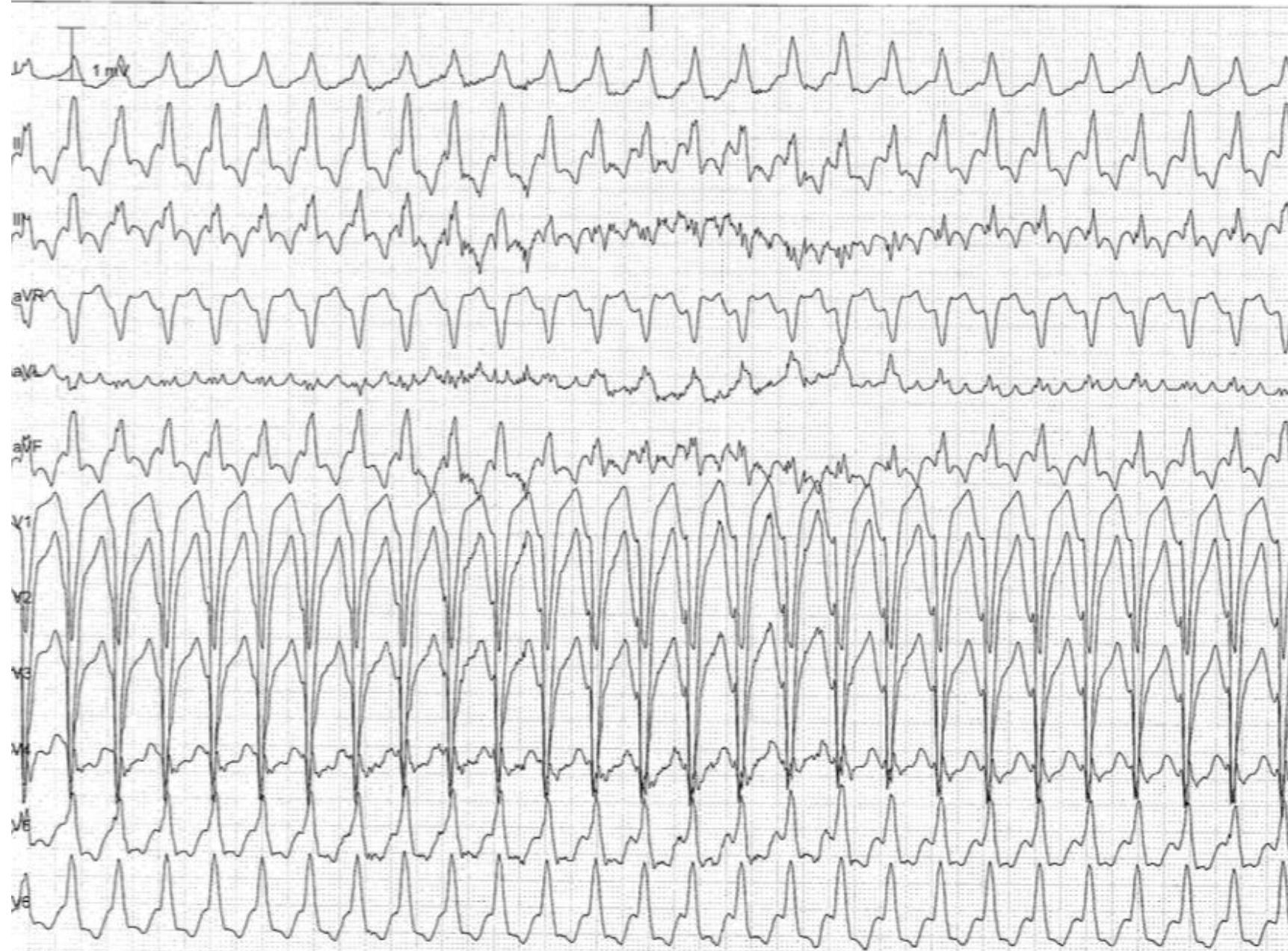
PATIENT #6

- Antécédent d'une crise de palpitation il y a 15 ans, sous ISOPTINE pendant quelques années puis arrêté.
- Crise de palpitation après un effort, quelques minutes avec douleur thoracique, ayant cédé spontanément.
- Bilan biologique normal et ETT : dilatation aorte ascendante 50mm, le reste est normal.
- Télémétrie dans les étages

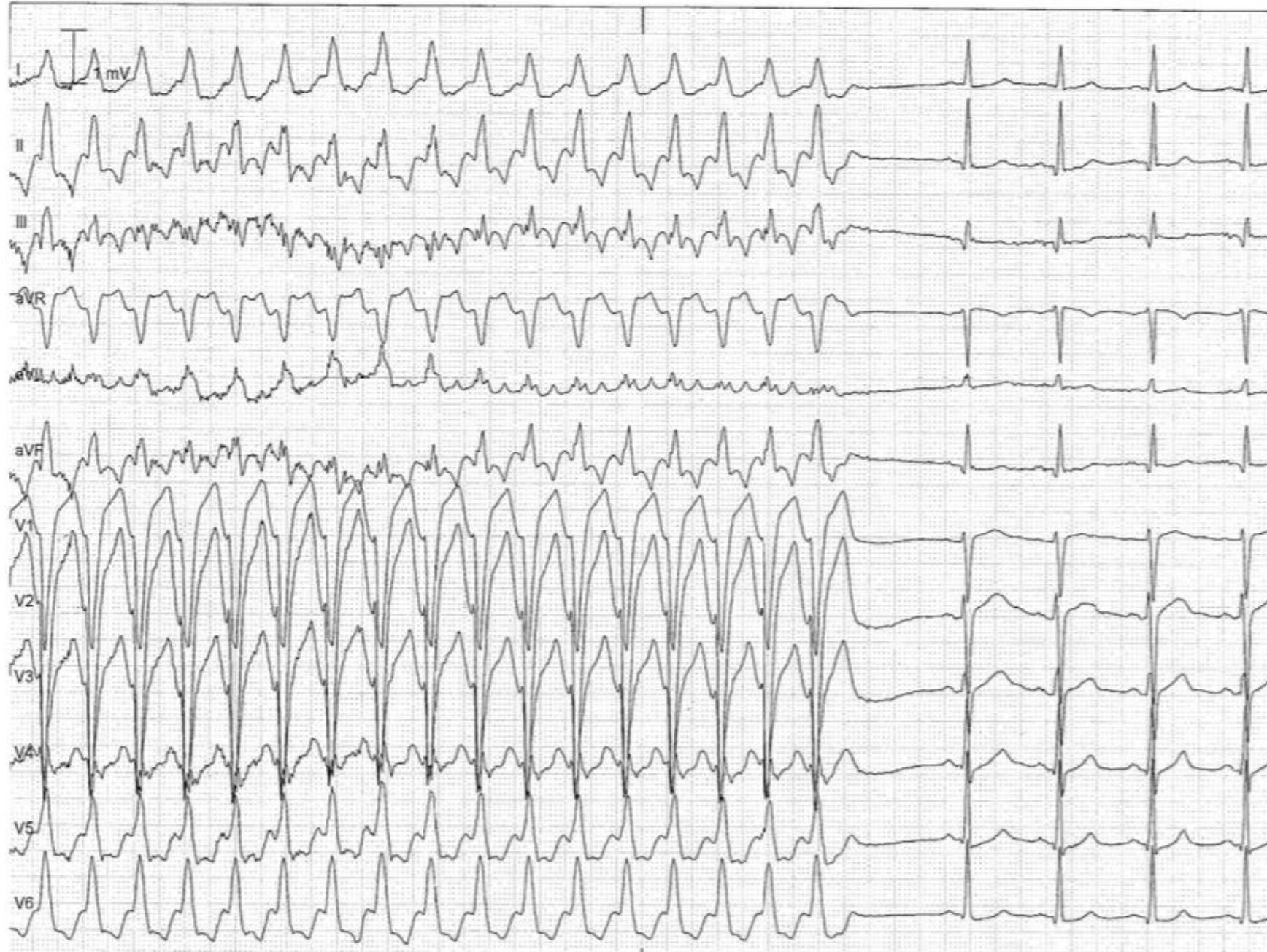
PATIENT #6



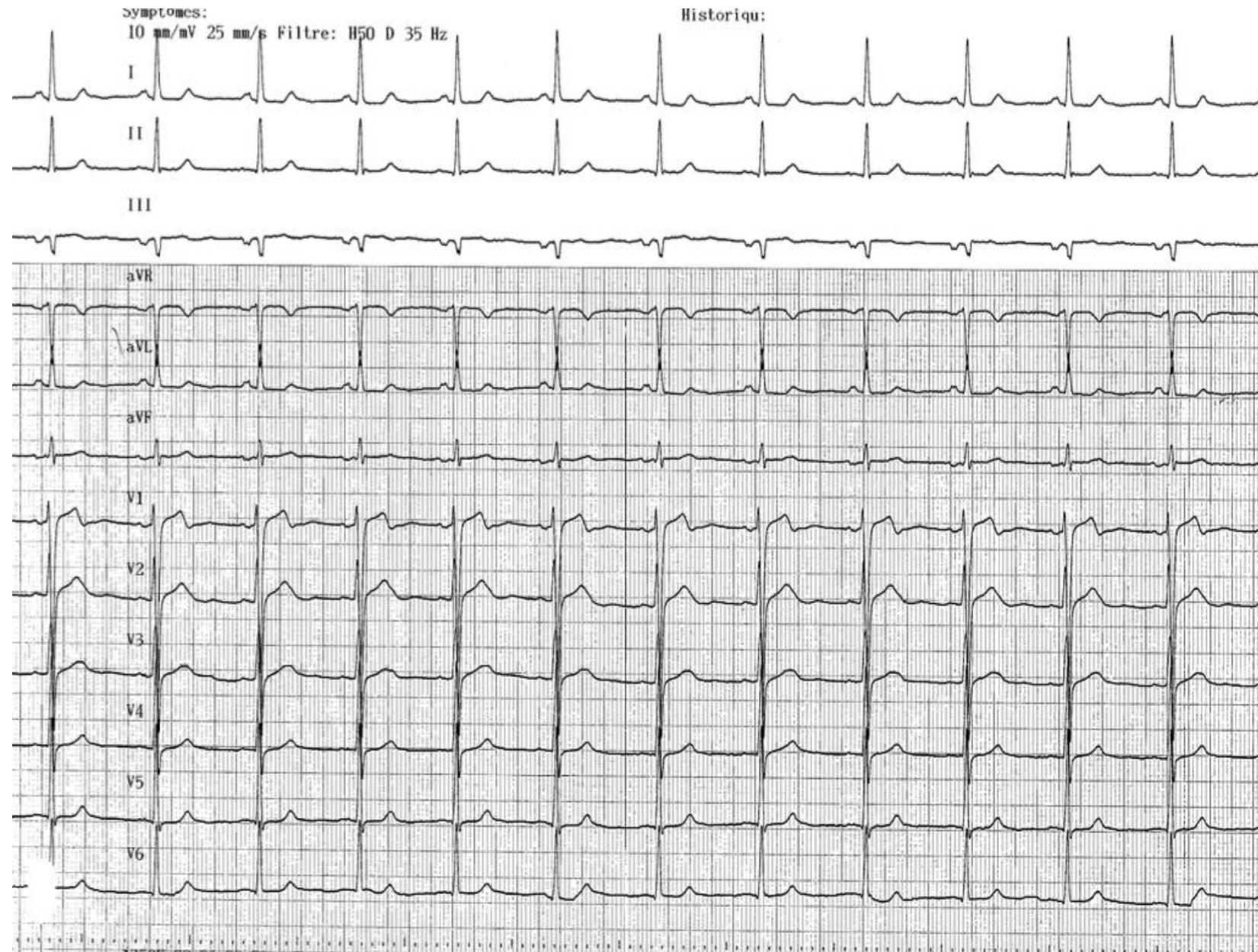
PATIENT #6



PATIENT #6 : manœuvres vagales



PATIENT #6 = RIN atypique + BBG fonctionnel



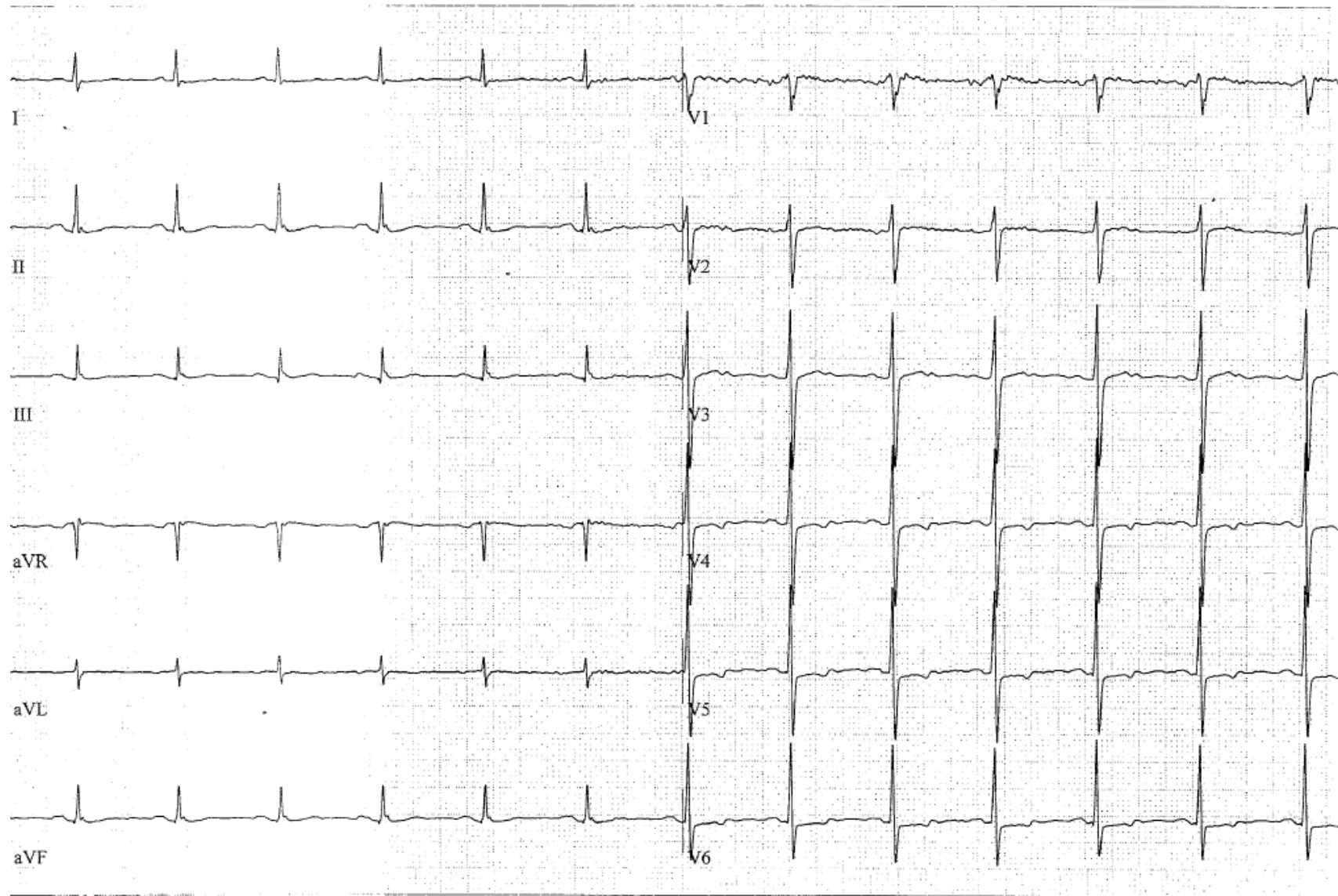
PATIENT #7

250637 03

81 /min
160/90 mmHg

REPOS
#1
00:21

VELO HOMME
0 W
0 tpm



PATIENT #7

250637 03
4

148 /min
220/90 mmHg

EFFORT
PALIER 4
09:18

VELO HOMME
120 W
67 tpm

HOPITAL RAVI-LEVEQUE



PATIENT #7

250637 03
4

166 /min
220/90 mmHg

RECUP.
#1
00:13

VELO HOMME
30 W
58 tpm

HOPITAL HAUT-LEVEQUE



PATIENT #7

250637 03
4

160 /min

RECUP.
#1
00:27

VELO HOMME
30 W
51 tpm



PATIENT #7

250637 03

4

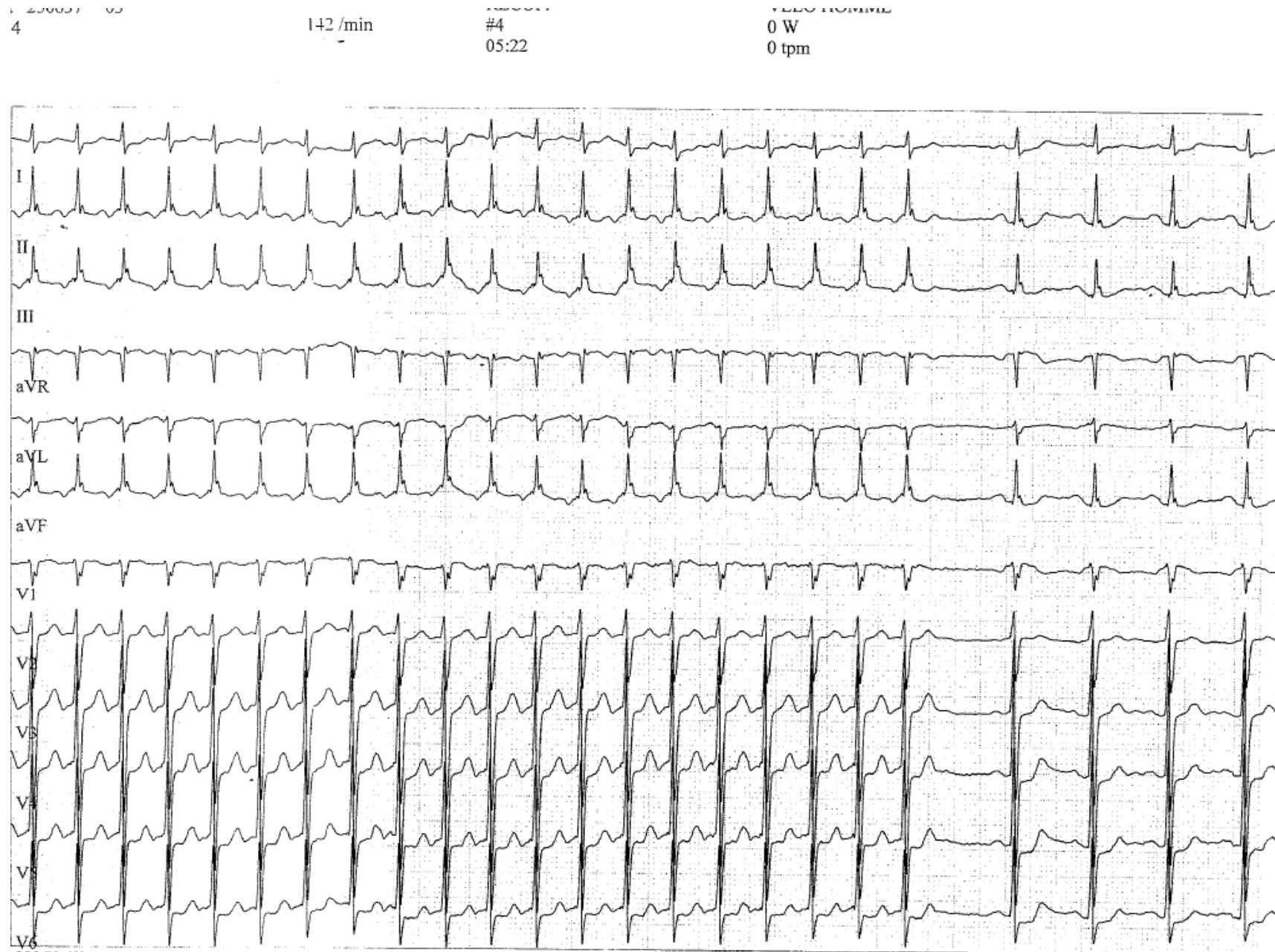
196 /min

RECUP.
#1
00:35

VELO HOMME
30 W
49 tpm



PATIENT #7





MERCI DE VOTRE ATTENTION



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