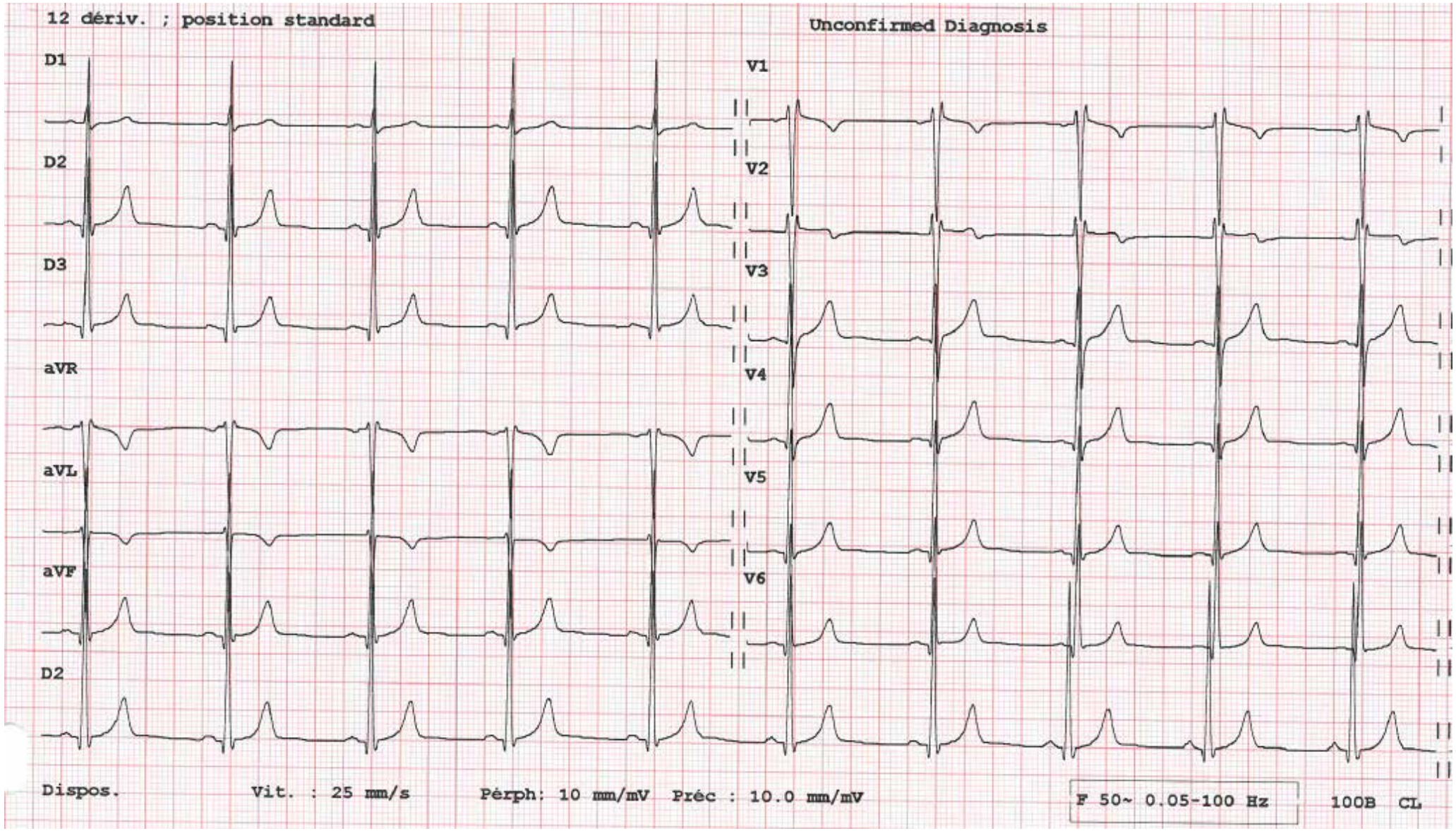
ECG pratique

Cours pour jeunes médecins de famille

Congres SSMIG, Sept 2018, Montreux

Cas clinique

- Jeune femme de 22 ans, syncope avec TC précédé par vertiges lors d'un épisode de gastro-entérite
- Consulte son médecin de premier recours
- TA: 90/68 mm Hg, FC 90 bpm debout, 60-70 bpm couchée, T 38.5, pâle, qqc douleurs abdo


12 dériv. ; position standard
Unconfirmed Diagnosis
D1
D2
D3
aVR
aVL
aVF
D2
V1
V2
V3
V4
V5
V6
Dispos.
Vit. : 25 mm/s
Périph: 10 mm/mV Préc : 10.0 mm/mV
F 50~ 0.05-100 Hz
100B CL

Suspicion diagnostique

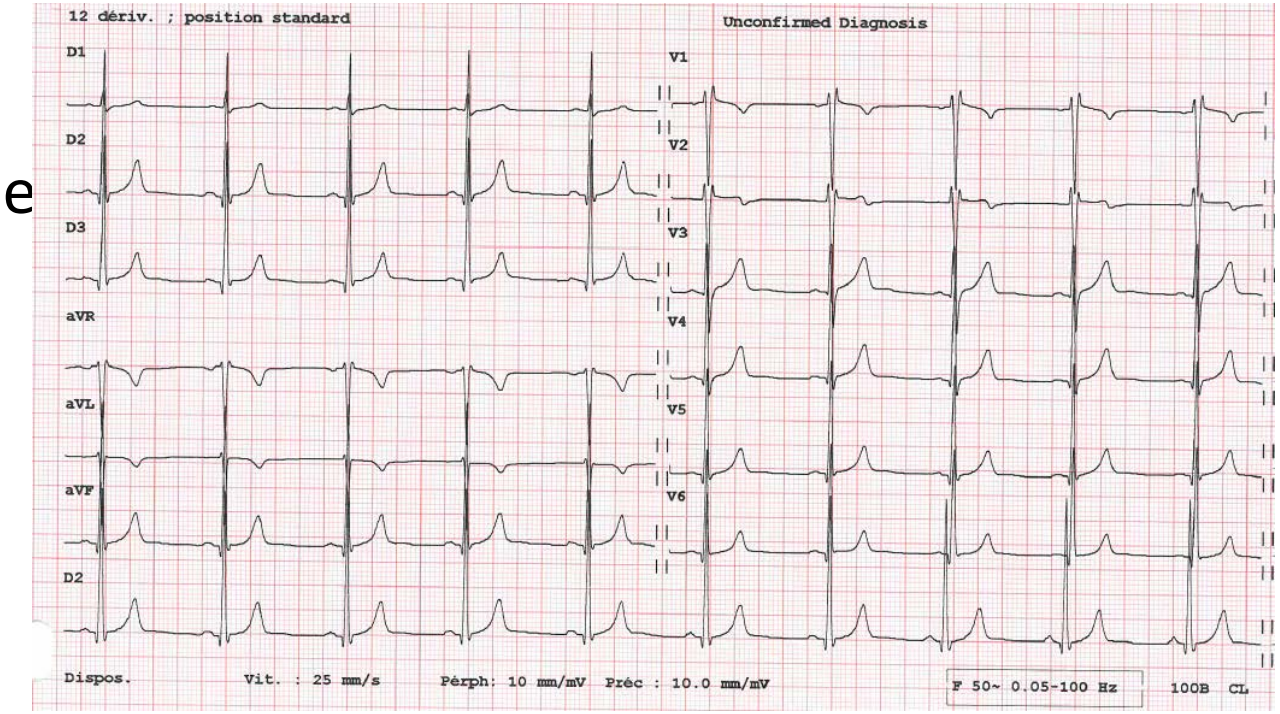
1. Sd de Brugada
2. Infarctus antérieur au décours
3. Embolie pulmonaire
4. Aucune réponse juste

Suspicion diagnostique

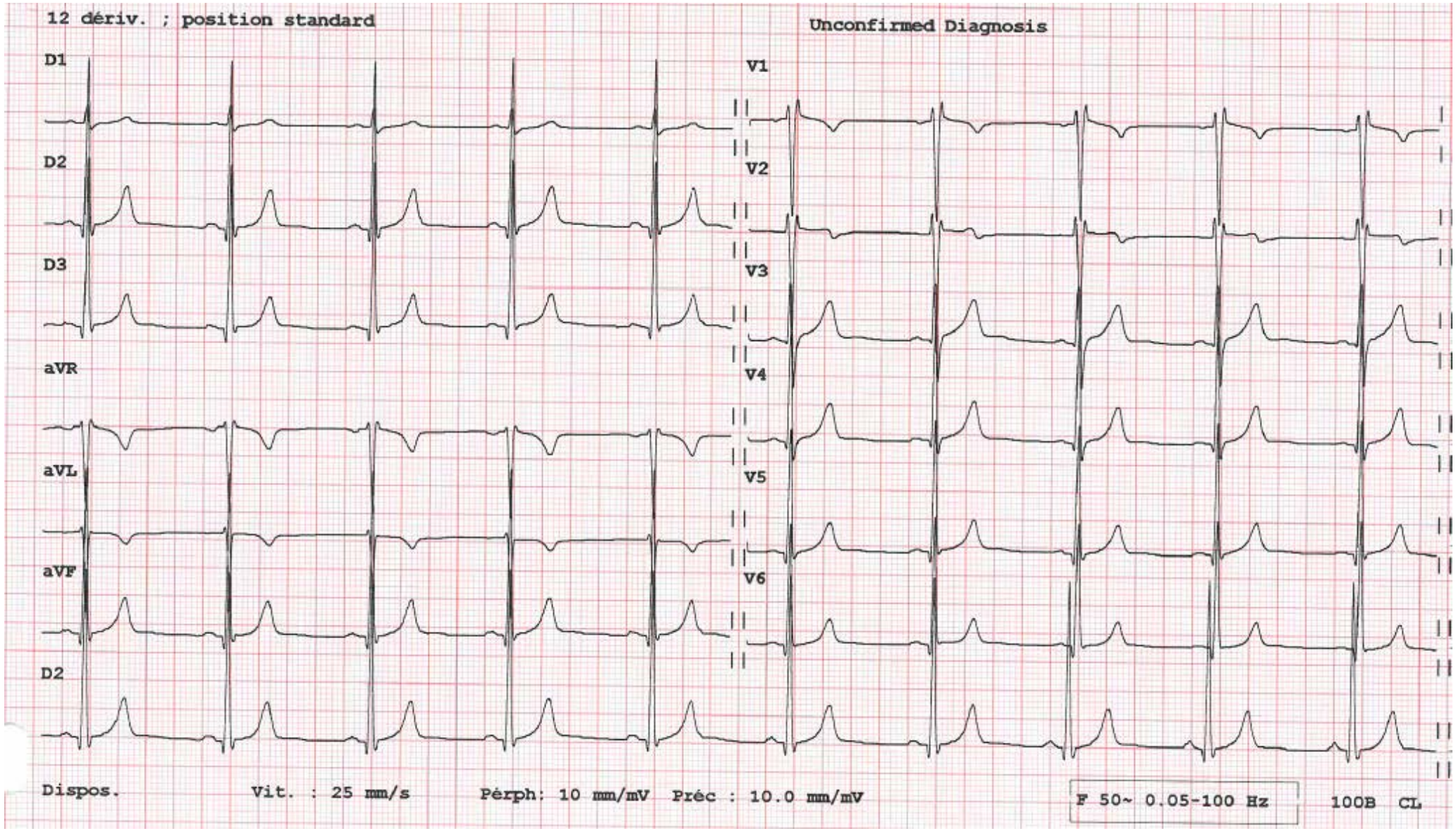
1. Sd de Brugada
2. Infarctus antérieur au décours
3. Embolie pulmonaire
4. Aucune réponse juste

Placement trop haut des électrodes V1-V2

- Onde P sinusale négative en V1-V2 (DD à faire avec rytme atrial ectopique ou hpertrophie OG)
- Aspect rSr’ /QR/Rs en V1/V2
- Onde T négative en V1/V2 associée



- Peut servir pour démasquer un syndrome de Brugada


12 dériv. ; position standard
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D1
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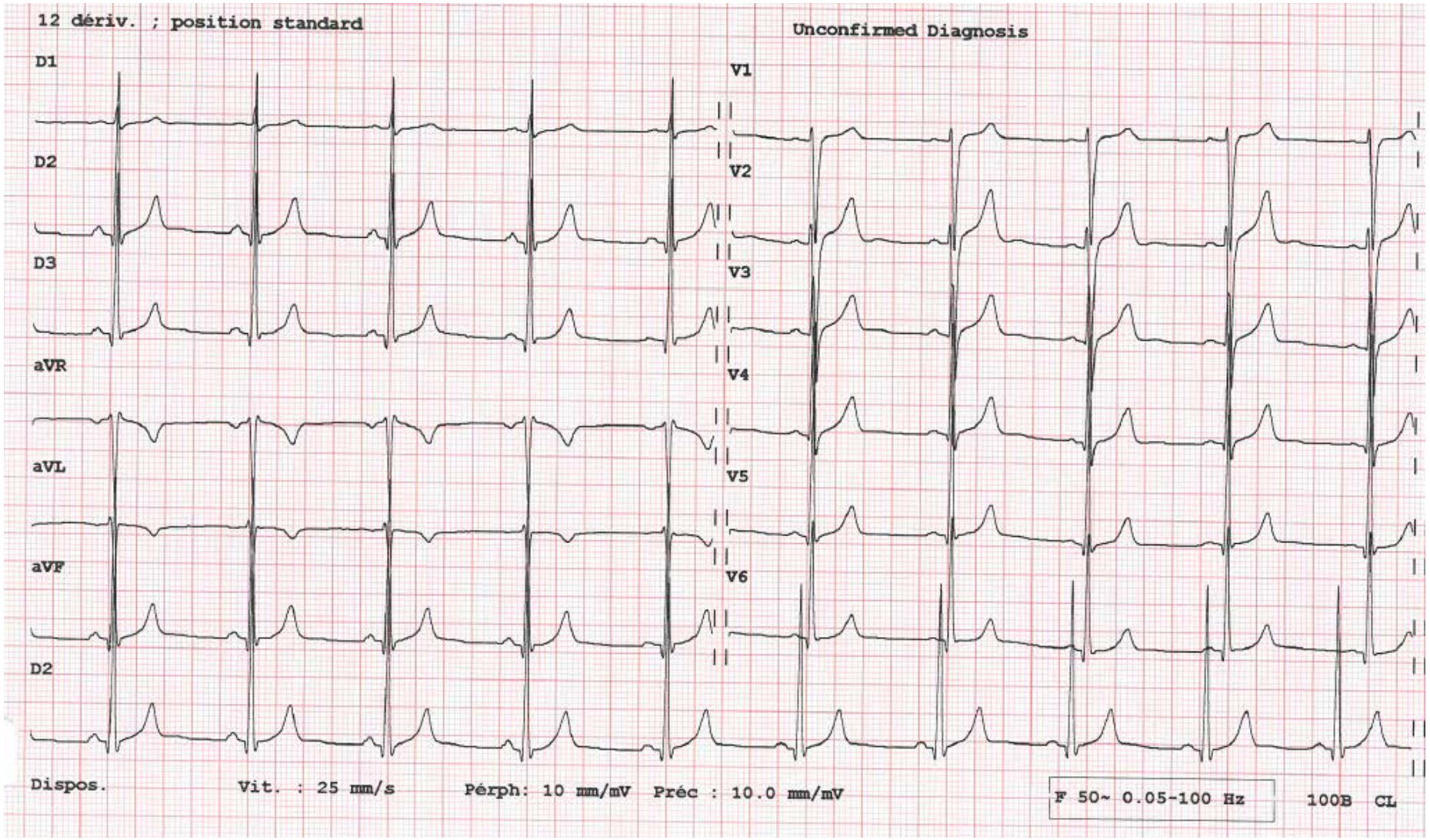
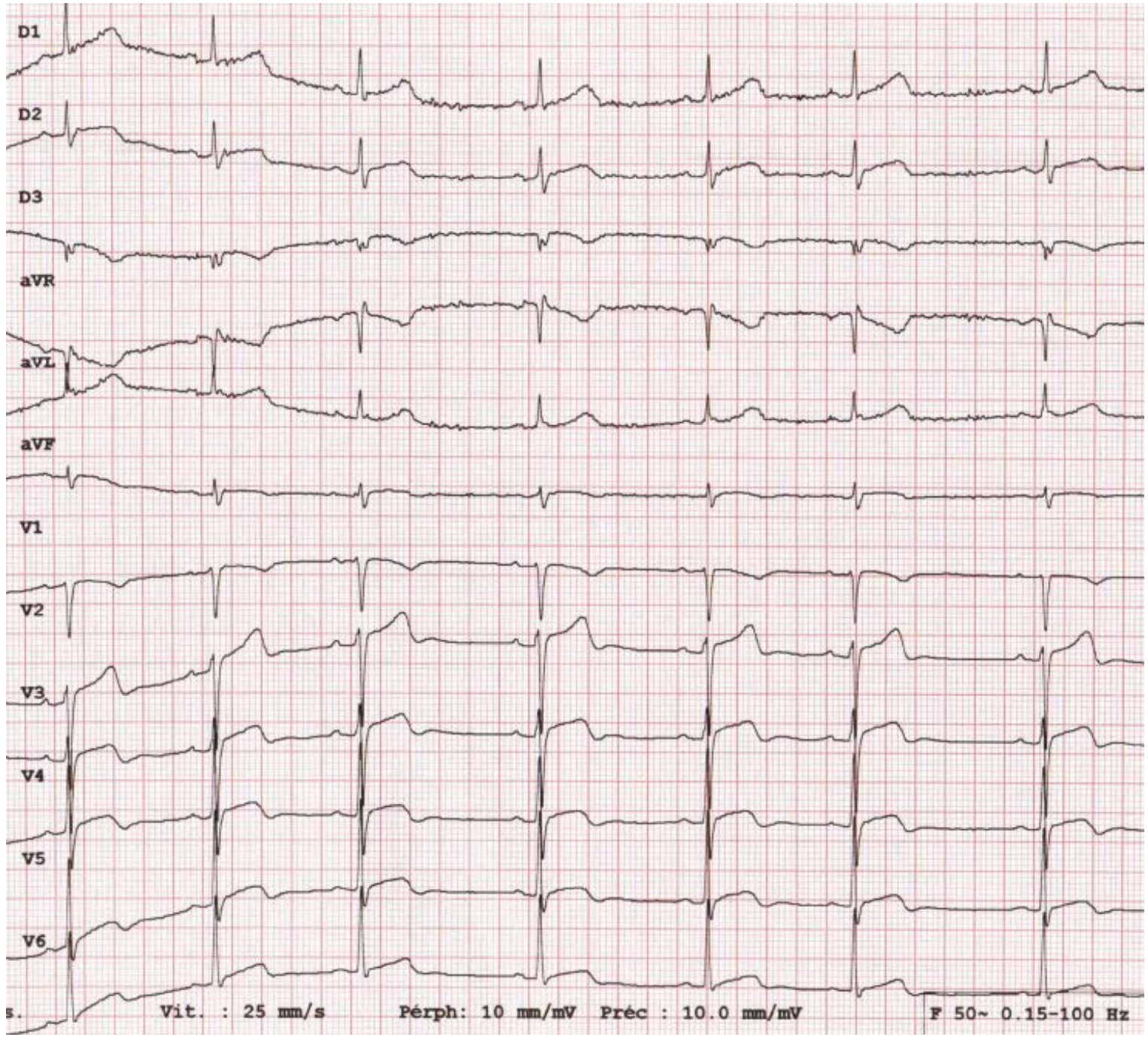
V4
V5
V6
Dispos.
Vit. : 25 mm/s
Périph: 10 mm/mV Préc : 10.0 mm/mV
F 50~ 0.05-100 Hz
100B CL

Positionnement correct des électrodes V1-V2



Cas clinique

- Jeune patient de 35 ans, tabagisme actif à 5 UPA, consommation importante de cannabis
- Douleurs thoraciques opressives, respiro-dépendantes (pas clair), survenues après avoir fait du disco-roller.
- Pas d’ ATCD familial vasculaire


D1
D2
D3
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
Vit. : 25 mm/s
Périph: 10 mm/mV
Préc : 10.0 mm/mV
F 50~ 0.15-100 Hz

Suspicion diagnostique

1. ECG normal de jeune
2. Infarctus antérieur
3. Péricardite
4. Répolarisation précoce

Suspicion diagnostique

1. ECG normal de jeune
2. Infarctus antérieur
3. Péricardite
4. Répolarisation précoce

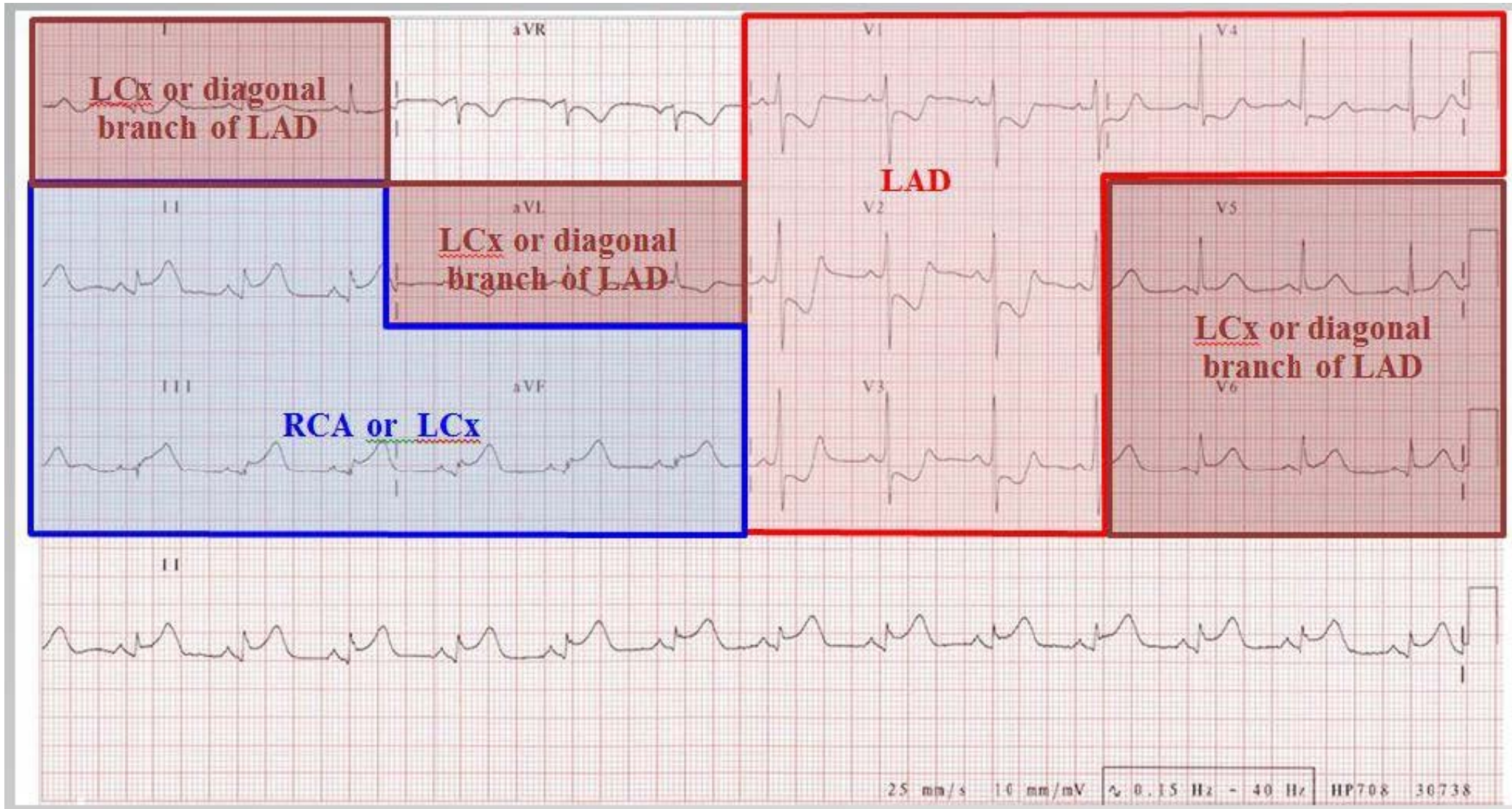
ST elevation
New ST elevation at the J point in two contiguous leads with the cut-points: ≥0.1 mV in all leads other than leads V_2–V_3 where the following cut points apply: ≥0.2 mV in men ≥40 years; ≥0.25 mV in men <40 years, or ≥0.15 mV in women.
ST depression and T wave changes
New horizontal or down-sloping ST depression ≥0.05 mV in two contiguous leads and/or T inversion ≥0.1 mV in two contiguous leads with prominent R wave or R/S ratio >1.

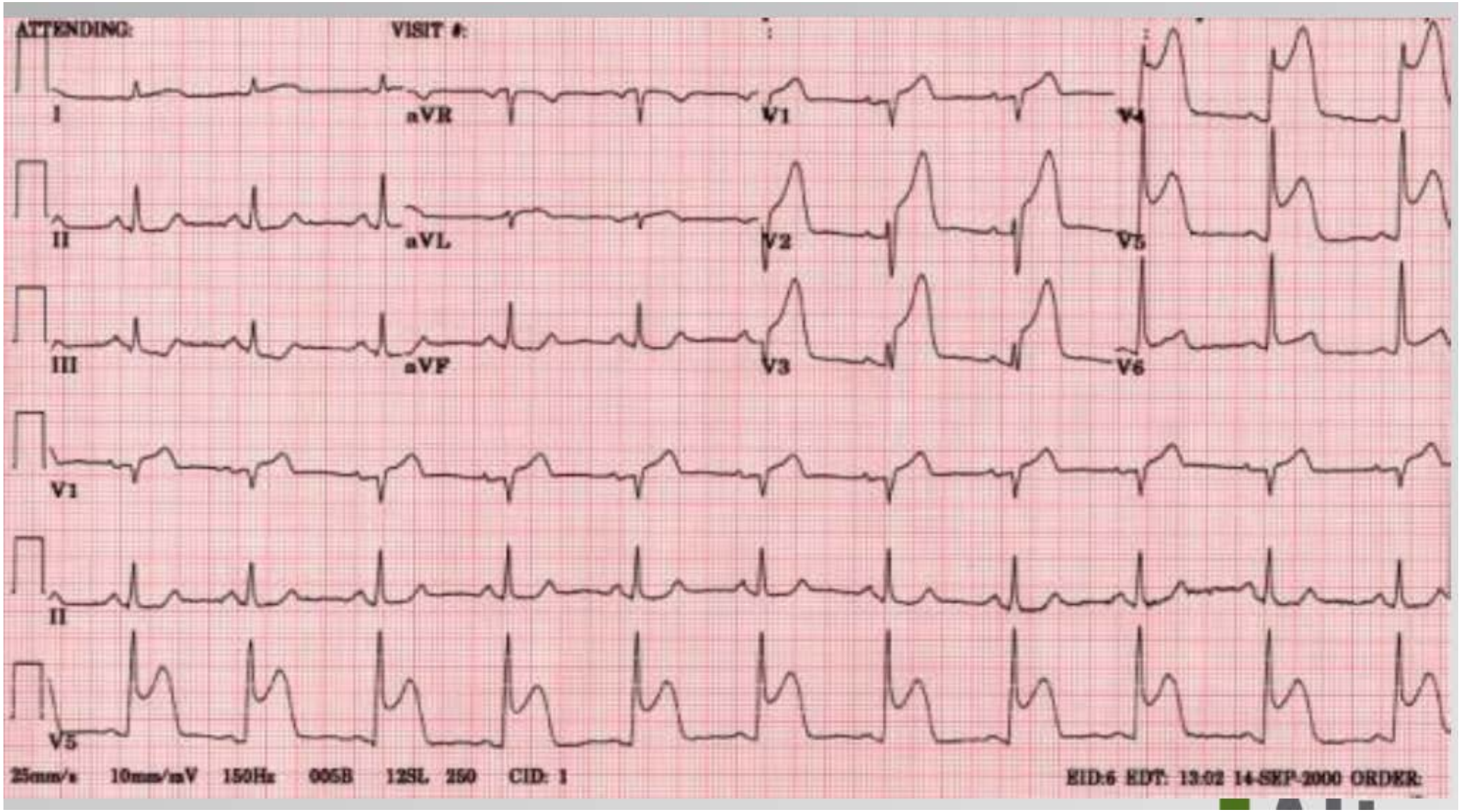
Bax, Jeroen J., et al. "Third universal definition of myocardial infarction." *Journal of the American College of Cardiology* 60.16 (2012): 1581-1598.

Table 4. ECG Changes Associated With Prior Myocardial Infarction (in Absence of LVH and LBBB)

Any Q wave in leads V_2–V_3 ≥0.02 sec or QS complex in leads V_2 and V_3.
Q wave ≥0.03 sec and ≥0.1 mV deep or QS complex in leads I, II, aVL, aVF or V_4–V_6 in any two leads of a contiguous lead grouping (I, aVL; V_1–V_6; II, III, aVF).[a]
R wave ≥0.04 sec in V_1–V_2 and R/S ≥1 with a concordant positive T wave in absence of conduction defect.

[a]The same criteria are used for supplemental leads V7–V9.


I
aVR
V1
V4
LCx or diagonal branch of LAD
LAD
II
aVL
V2
V5
LCx or diagonal branch of LAD
LCx or diagonal branch of LAD
III
aVF
V3
V6
RCA or LCx
II
25 mm/s
10 mm/mV
0.15 Hz - 40 Hz
HP708
30738


ATTENDING:
VISIT #:
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
25mm/s 10mm/mV 150Hz 0058 12SL 250 CID: 1
EID:6 EDT: 13:02 14-SEP-2000 ORDER:


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

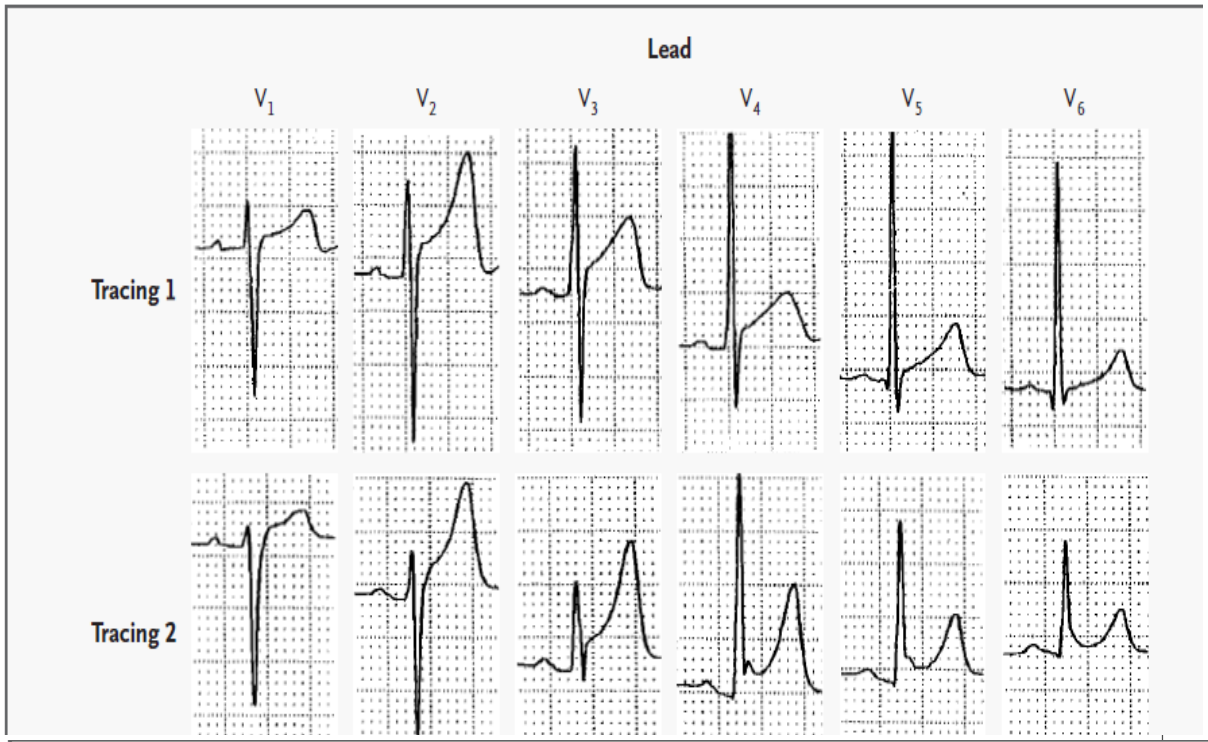


Figure 1. Electrocardiograms Showing Normal ST-Segment Elevation and Normal Variants.

Tracing 1 shows normal ST-segment elevation. Approximately 90 percent of healthy young men have ST-segment elevation of 1 to 3 mm in one or more precordial leads. The ST segment is concave. Tracing 2 shows the early-repolarization pattern, with a notch at the J point in V_4. The ST segment is concave, and the T waves are relatively tall. Tracing 3 shows

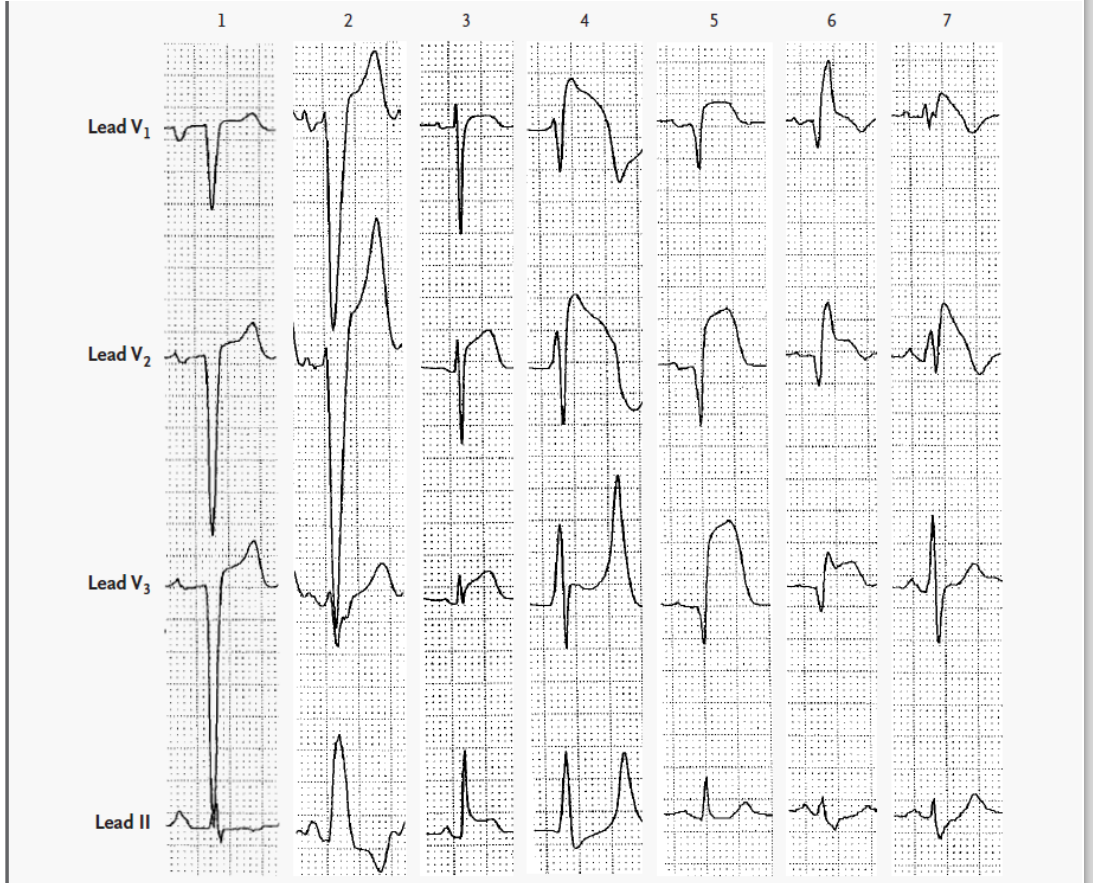


Figure 2. Electrocardiograms Showing ST-Segment Elevation in Various Conditions.

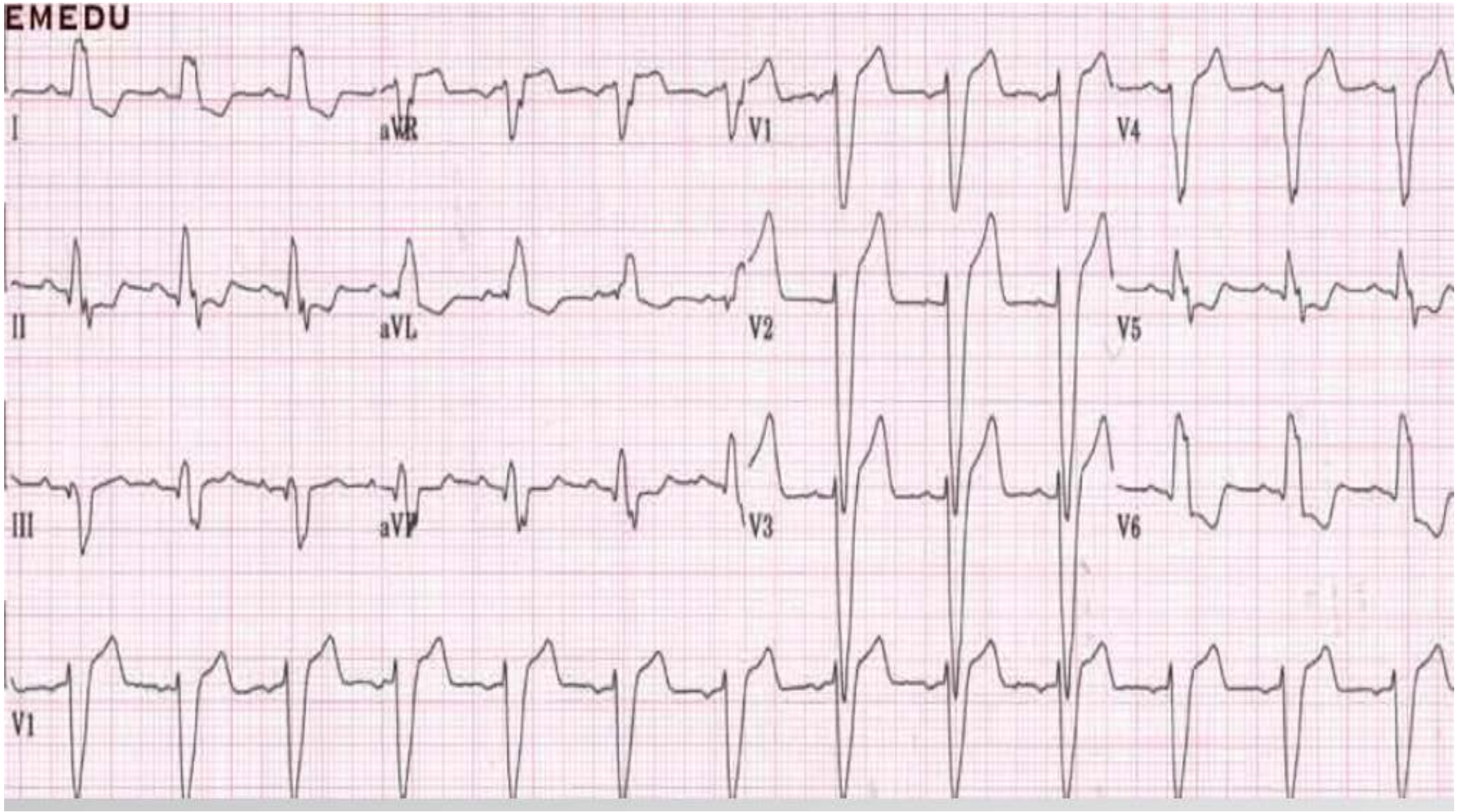
Tracing 1 is from a patient with left ventricular hypertrophy, and tracing 2 is from a patient with left bundle-branch block. Tracing 3, from a patient with acute pericarditis, is the only tracing with ST-segment elevation in both precordial leads and lead II and PR-segment depression. Tracing 4 shows a pseudoinfarction pattern in a patient with hyperkalemia. The T wave in V_3 is tall, narrow, pointed, and tented. Tracing 5 is from a patient with acute anteroseptal infarction. The distinctive features of tracing 6, from a patient with acute anteroseptal infarction and right bundle-branch block, include the remaining R' wave and the distinct transition between the downstroke of R' and the beginning of the ST segment. Tracing 7, from a patient with the Brugada syndrome, shows rSR' and ST-segment elevation limited to V_1 and V_2. The ST segment begins from the top of the R' and is downsloping.

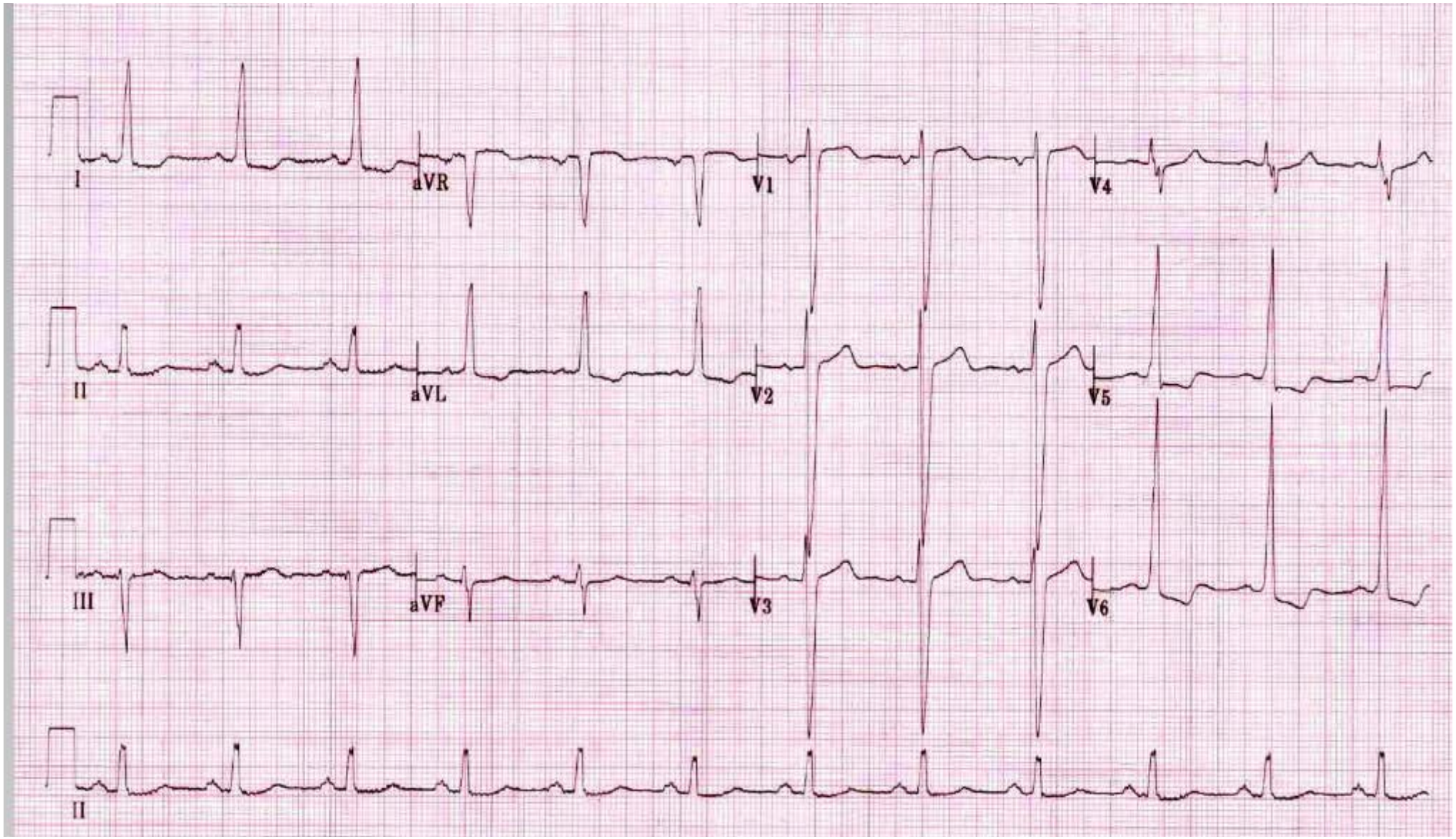
Wang, K., Asinger, R. W., & Marriott, H. J. (2003). ST-segment elevation in conditions other than acute myocardial infarction. *New England Journal of Medicine*, *349*(22), 2128-2135.

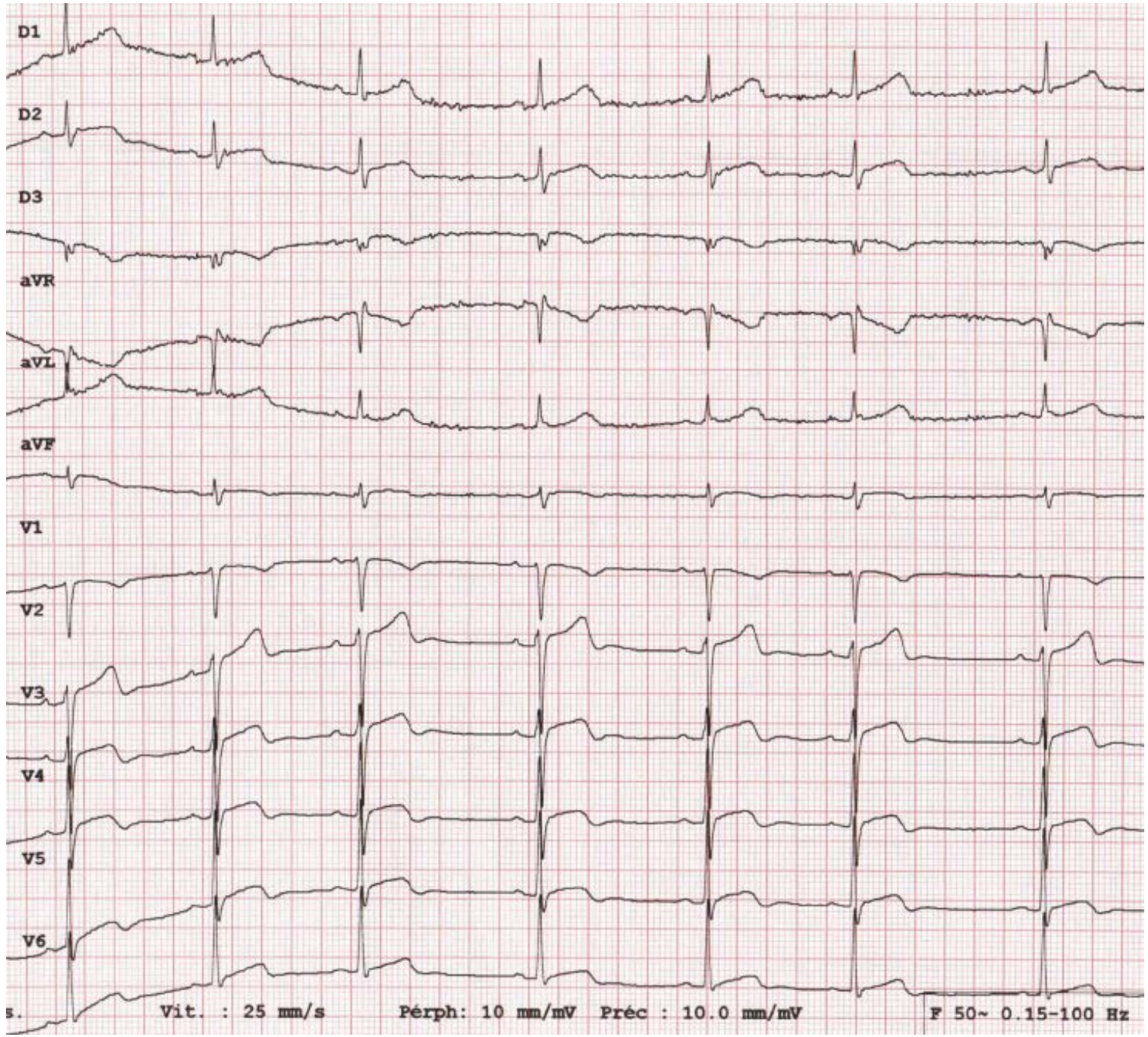
Table 1. ST-Segment Elevation in Normal Circumstances and in Various Conditions.

Condition	Features
Normal (so-called male pattern)	Seen in approximately 90 percent of healthy young men; therefore, normal Elevation of 1–3 mm Most marked in V_2 Concave
Early repolarization	Most marked in V_4, with notching at J point Tall, upright T waves Reciprocal ST depression in aVR, not in aVL, when limb leads are involved
ST elevation of normal variant	Seen in V_3 through V_5 with inverted T waves Short QT, high QRS voltage
Left ventricular hypertrophy	Concave Other features of left ventricular hypertrophy
Left bundle-branch block	Concave ST-segment deviation discordant from the QRS
Acute pericarditis	Diffuse ST-segment elevation Reciprocal ST-segment depression in aVR, not in aVL Elevation seldom >5 mm PR-segment depression
Hyperkalemia	Other features of hyperkalemia present: Widened QRS and tall, peaked, tented T waves Low-amplitude or absent P waves ST segment usually downsloping
Brugada syndrome	rSR' in V_1 and V_2 ST-segment elevation in V_1 and V_2, typically downsloping
Pulmonary embolism	Changes simulating myocardial infarction seen often in both inferior and antero-septal leads
Cardioversion	Striking ST-segment elevation, often >10 mm, but lasting only a minute or two immediately after direct-current shock
Prinzmetal's angina	Same as ST-segment elevation in infarction, but transient
Acute myocardial infarction	ST segment with a plateau or shoulder or upsloping Reciprocal behavior between aVL and III

Wang, K., Asinger, R. W., & Marriott, H. J. (2003). ST-segment elevation in conditions other than acute myocardial infarction. *New England Journal of Medicine*, *349*(22), 2128-2135.


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

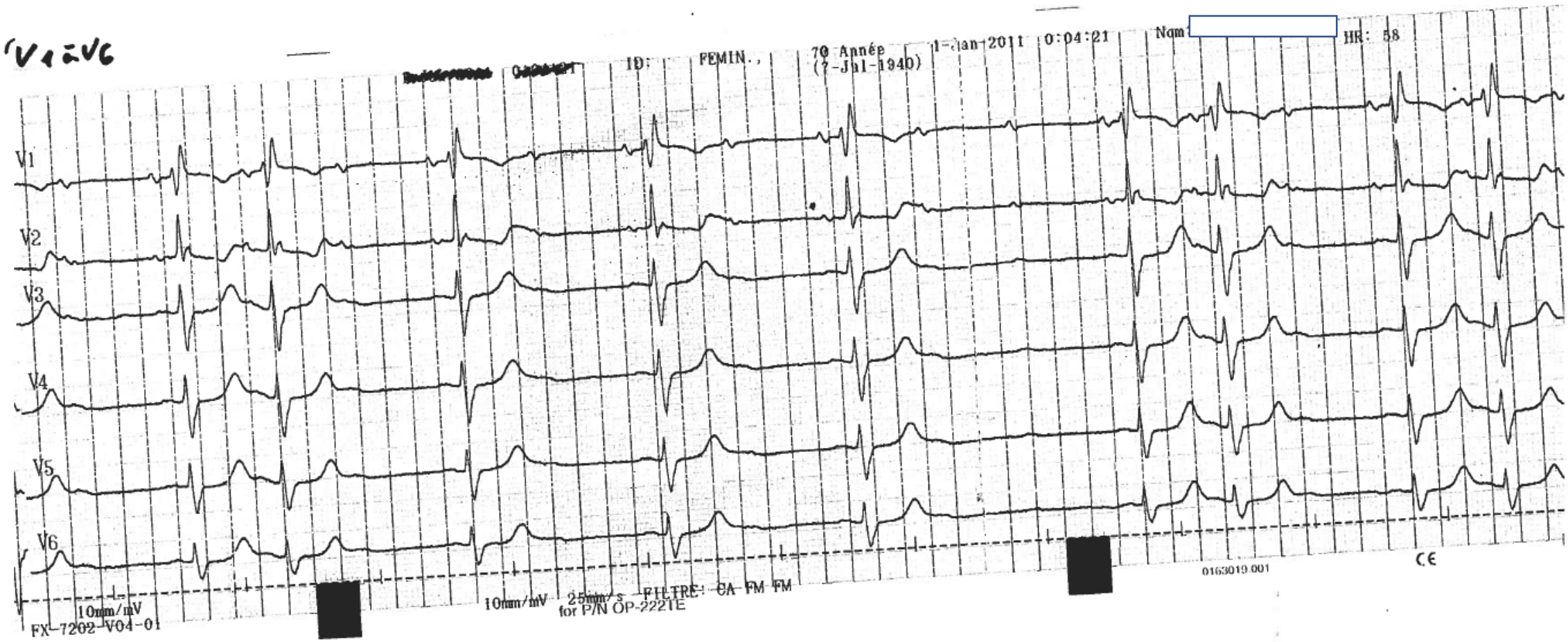

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II


D1
D2
D3
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
Vit. : 25 mm/s
Périph: 10 mm/mV
Préc : 10.0 mm/mV
F 50~ 0.15-100 Hz

Cas clinique

- Patiente de 78 ans, très active, consulte son médecin traitant pour intolérance nouvelle à l’effort
- Aucun antécédent ou médication notable

V1 à V6


ID: FEMIN.,
70 Année
(7-Jul-1940)
1-Jan-2011 0:04:21
HR: 58
V1
V2
V3
V4
V5
V6
10mm/mV
FX-7202-V04-01
10mm/mV 25mm/s FILTRE: CA FM FM
for P/N OP-2221E
0163019.001
CE

Suspicion diagnostique

1. Bloc AV Wenchebach
2. Bloc AV II Mobitz II
3. Extrasystoles bloquées
4. Artéfact

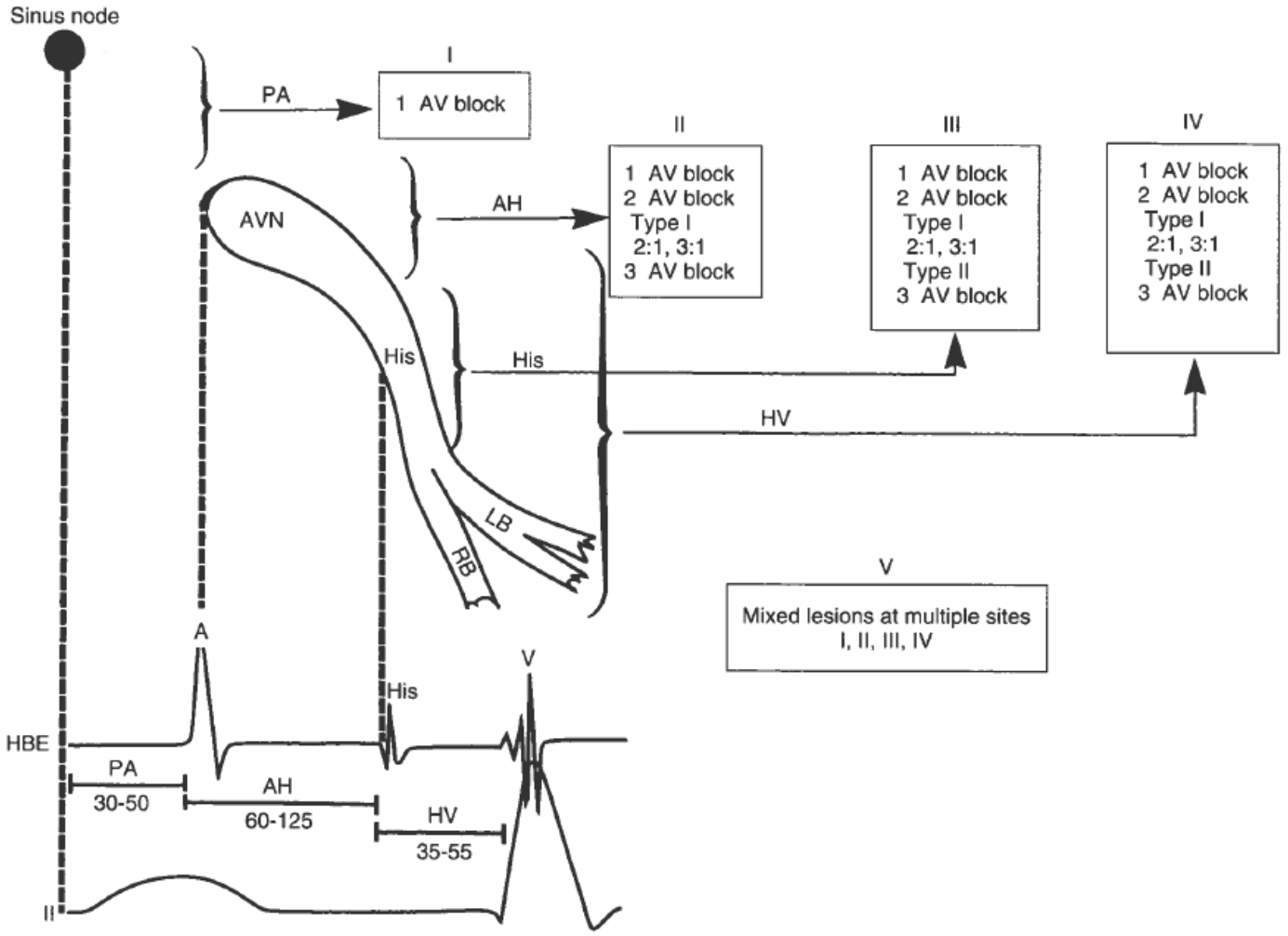
Suspicion diagnostique

1. Bloc AV Wenchebach
2. Bloc AV II Mobitz II
3. Extrasystoles bloquées
4. Artéfact

Caractéristiques BAV

- BAV I
  - absence de P non conduits
  - PR constant >200 ms, jusqu'à des fois 400 ms
- BAV II wenchebach
  - Présence de P non conduits;
  - Allongement progressif du PR jusqu'au P non conduit
  - Apparition des battements grouppées
  - Intervalles RR se raccourcissent
- BAV II Mobitz II
  - Présence de P non conduits sans variation de l'intervalle PR, RP
- BAV III
  - dissociation complète P/R
  - Échapement QRs fin ou large

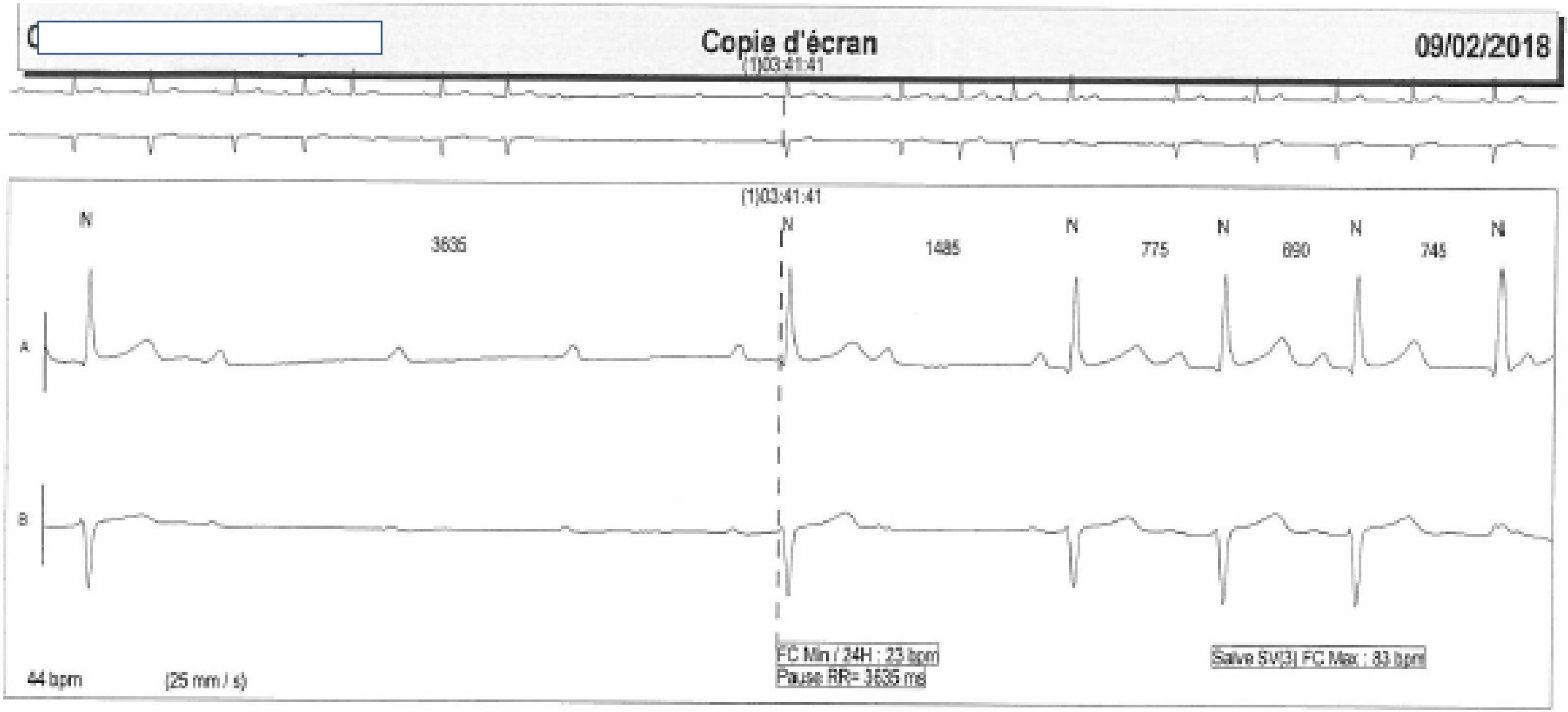
Localisation du site du bloc

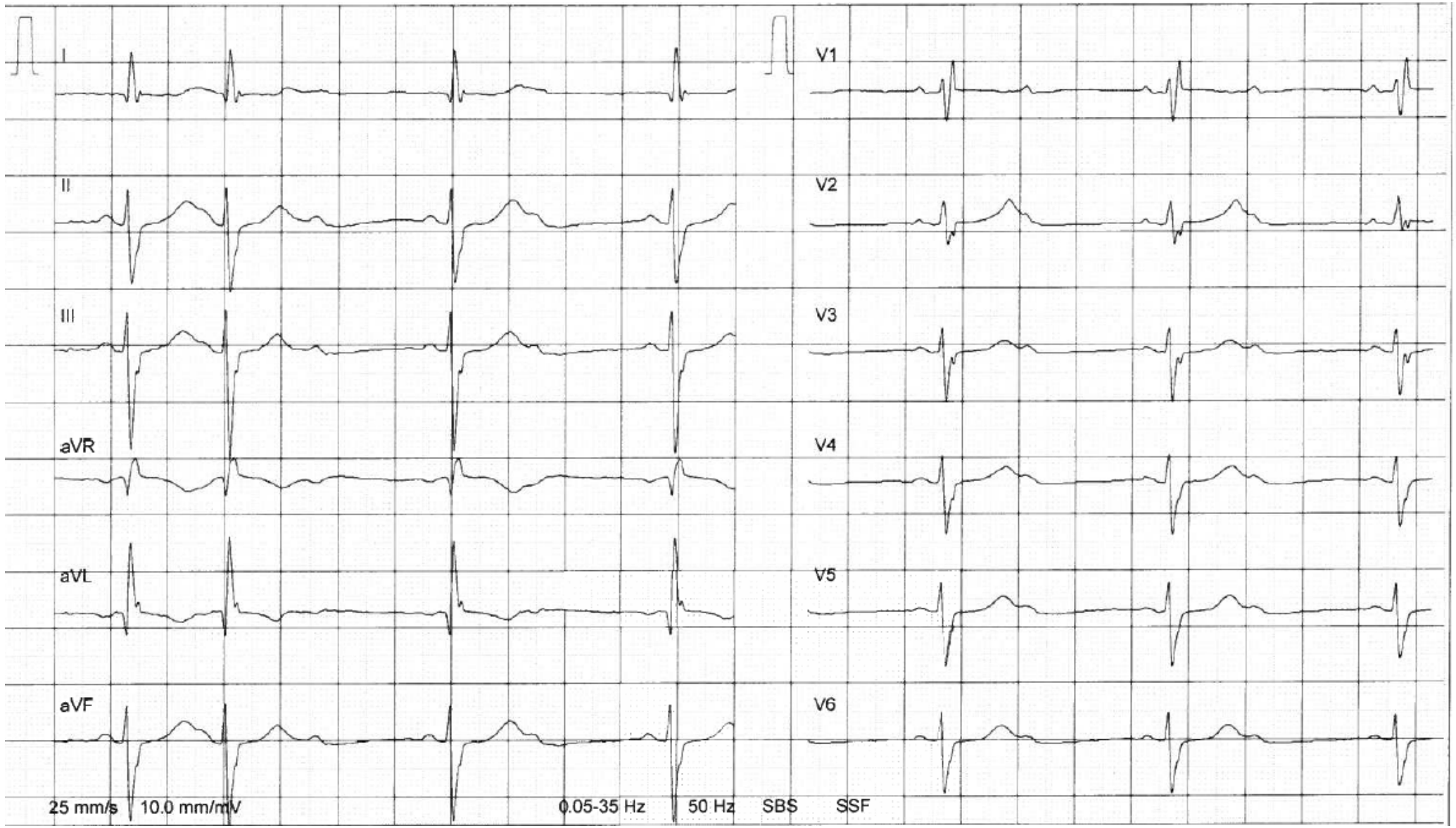


Wellens –Connover, ECG in Emergency Decision Making, second edition

Copie d'écran

09/02/2018




I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
25 mm/s
10.0 mm/mV
0.05-35 Hz
50 Hz
SBS
SSF

Points importants

- Un ECG démontrant des troubles de conduction étagées (P ex PR long et BBG complet large, ou BBD et HBAG/HBPG) est plus parlant d'un système de conduction déficitaire qu'un BAV III avec des QRs fins et échappement rapide, qui peut être médié vagal
- la plus importante est la localisation du bloc AV (infra ou suprahissien): bloc infrahissien est de mauvais pronostique, bloc AV nodal est de meilleur pronostique
- Un QRS large dans un contexte de BAV est un indicateur de bloc AV haut grade

Faut il l'implanter d'un pacemaker?

1. Oui
2. Non

Faut il l'implanter d'un pacemaker?

1. Oui
2. Non

Recommendations	Class [a]	Level [b]
1) Sinus node disease. Pacing is indicated when symptoms can clearly be attributed to bradycardia.	I	B
2) Sinus node disease. Pacing may be indicated when symptoms are likely to be due to bradycardia, even if the evidence is not conclusive.	IIb	C
3) Sinus node disease. Pacing is not indicated in patients with SB which is asymptomatic or due to reversible causes.	III	C
4) Acquired AV block. Pacing is indicated in patients with third- or second-degree type 2 AV block irrespective of symptoms.	I	C
5) Acquired AV block. Pacing should be considered in patients with second-degree type I AV block which causes symptoms or is found to be located at intra- or infra-His levels at EPS.	IIa	C
6) Acquired AV block. Pacing is not indicated in patients with AV block which is due to reversible causes.	III	C

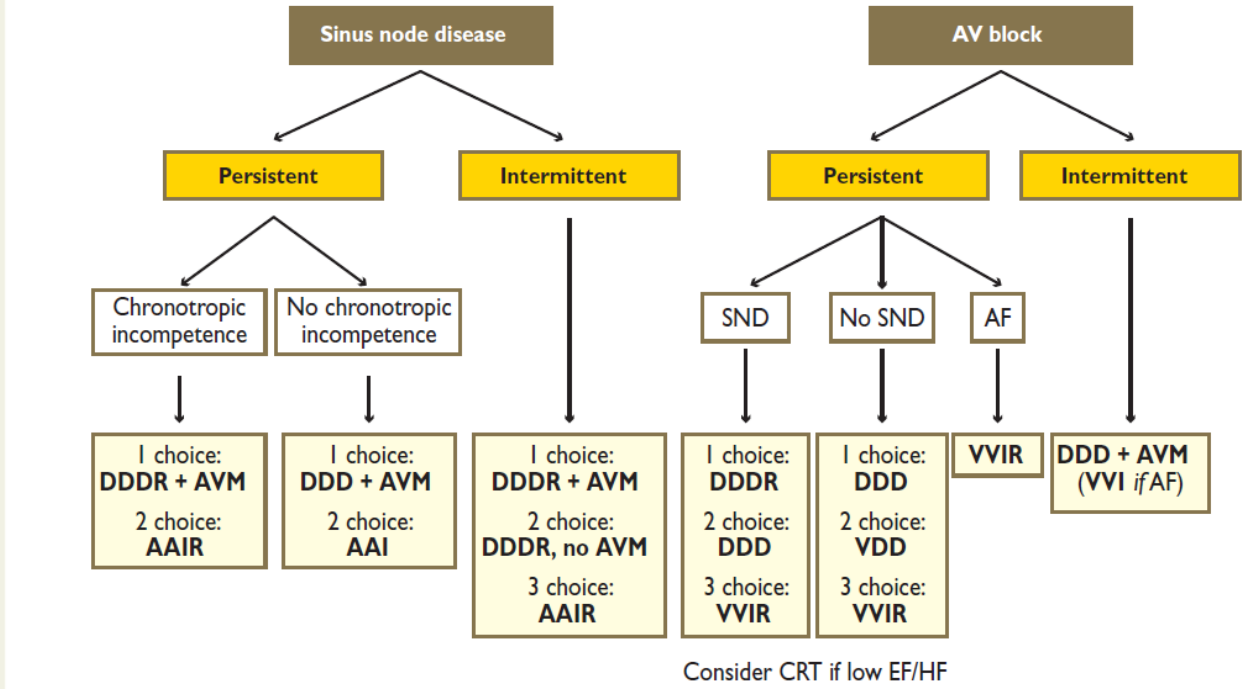


Figure 3 Optimal pacing mode in sinus node disease and AV block. AF = atrial fibrillation; AV = atrioventricular; AVM = AV delay management, i.e. to prevent unnecessary right ventricular pacing by means of manual optimization of AV interval or programming of AV hysteresis; SND = sinus node disease.

2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy: the Task Force on cardiac pacing and resynchronization therapy of the *European heart journal*, *34*(29), 2281-2329

THREE-LETTER PACEMAKER CODE (ICHD)

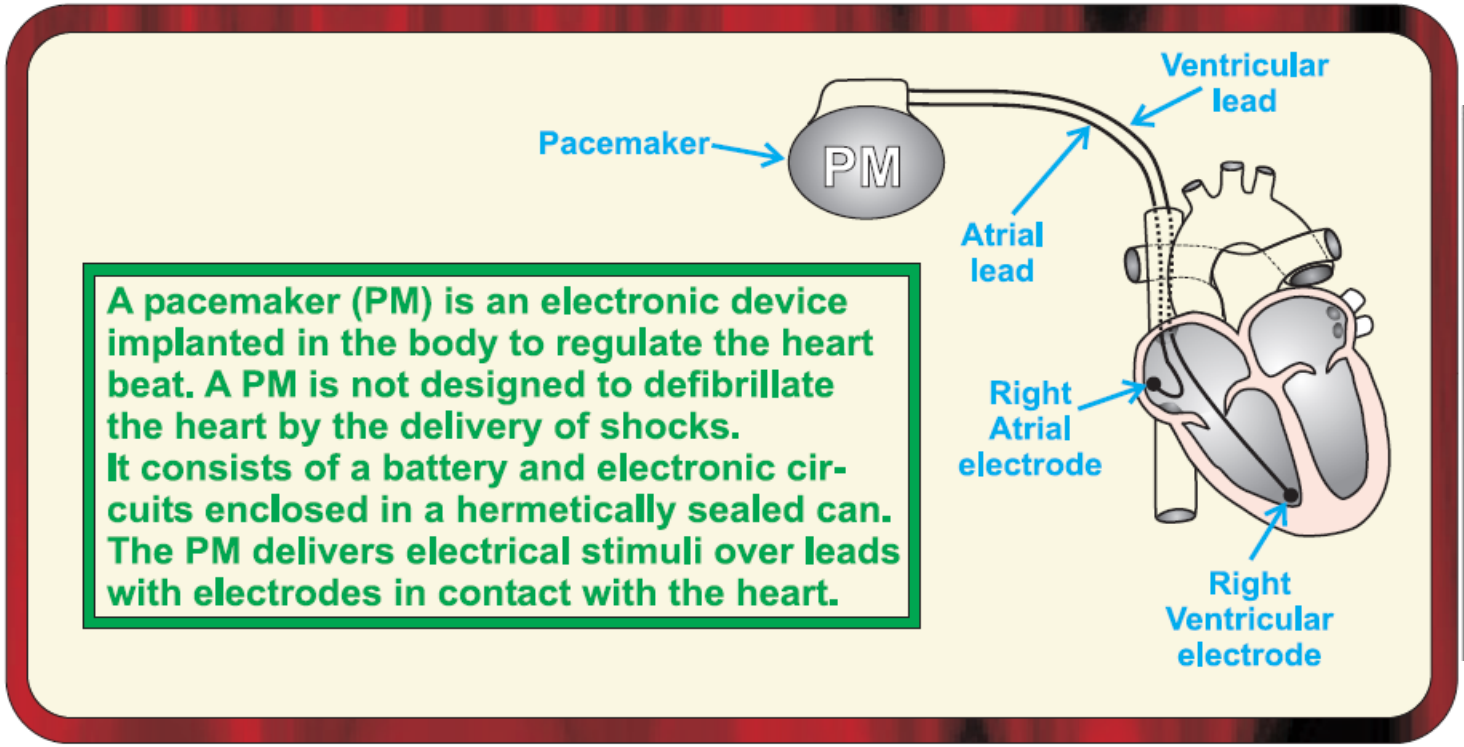
POSITION	1st	2nd	3rd
CATEGORY	CHAMBER(S) PACED	CHAMBER(S) SENSED	MODE OF RESPONSE
LETTERS	V = VENTRICLE A = ATRIUM S = SINGLE	V = VENTRICLE A = ATRIUM S = SINGLE O = NONE	T = TRIGGERED I = INHIBITED O = NONE

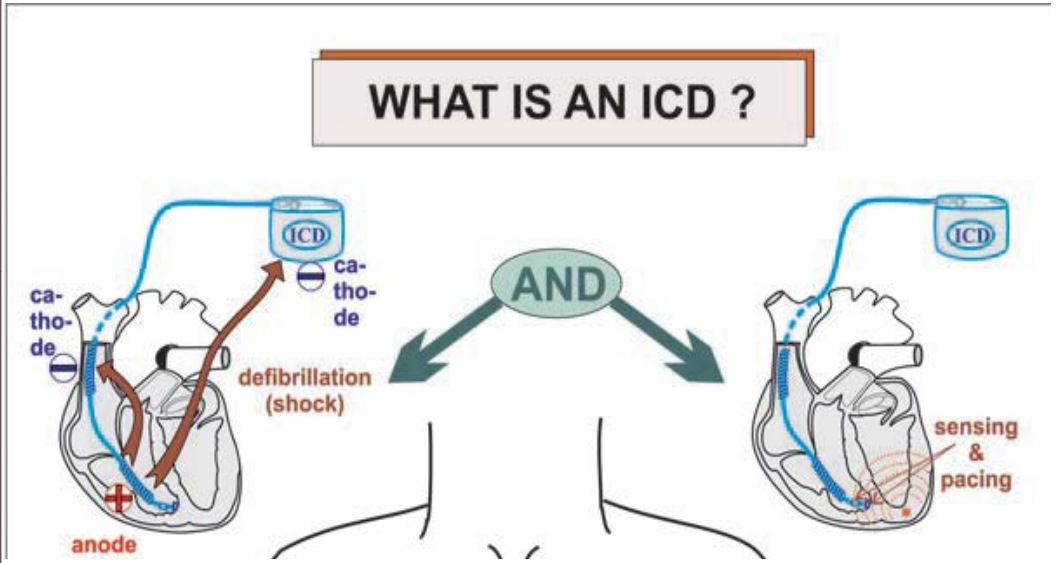
EXAMPLES :

AAI = a pacemaker pacing and sensing in the atrium, being inhibited by spontaneous electrical activation of the atrium

VVT = a pacemaker pacing and sensing in the ventricle and working in the triggered mode (each sensed ventricular event elicits a pacemaker stimulus)

A. F. Sinnaeve



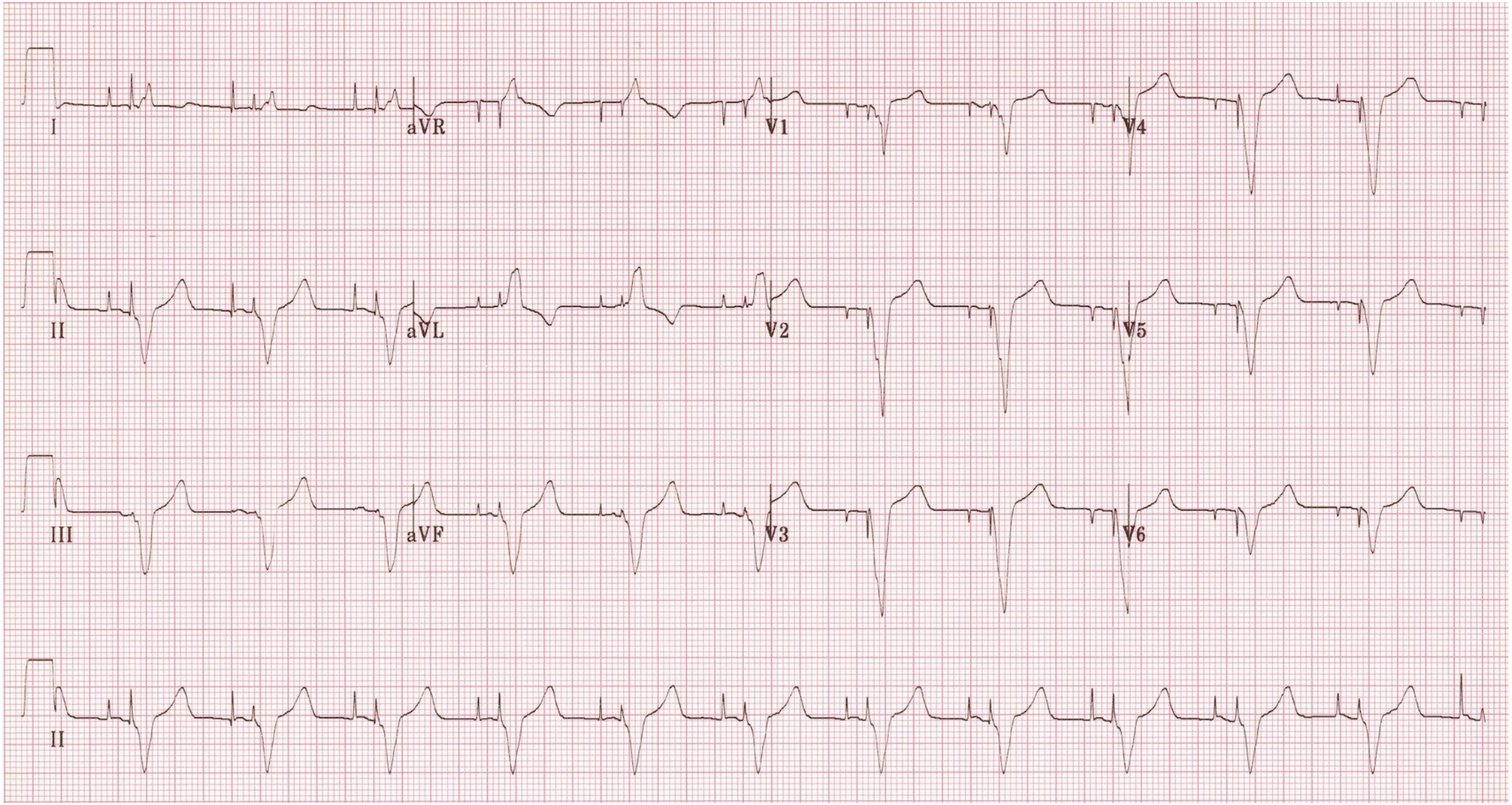


An ICD or implantable cardioverter-defibrillator is an electronic device implanted in the body to protect against dangerous high ventricular rates. It is designed to defibrillate the heart by delivering high voltage shocks or to stop malignant tachycardias by antitachycardia pacing (short burst of rapid pacing sequence). Contemporary ICDs also contain a classic pacemaker for bradycardia pacing.

CRT

But thérapie de resynchronisation

Pacing du ventricule droit et gauche proche de 100%, avec resynchronisation de contractions ventriculaires
Système CRT-D (resynchronisation et défibrillateur) ou CRT-P (resynchronisation sans défibrillateur)


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

Cas clinique

- Jeune patient de 17 ans, triathlète d'élite
- Syncope à l'emporte pièce à l'effort
- Aucun ATCD de syncope ou MCS


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
25 mm/s 10.0 mm/mV
0.05-35 Hz
50 Hz
SBS
SSF

Suspicion diagnostique

1. ECG normal d’athlète
2. Cœur pulmonaire
3. Hémibloc postérieur
4. Aucune réponse juste

Inversion des electrodes

- Toujours regarder la polarité de l'onde P et des QRS.
- Si l'onde P parait sinusale dans les précordiales, se méfier d'une inversion des électrodes périphériques

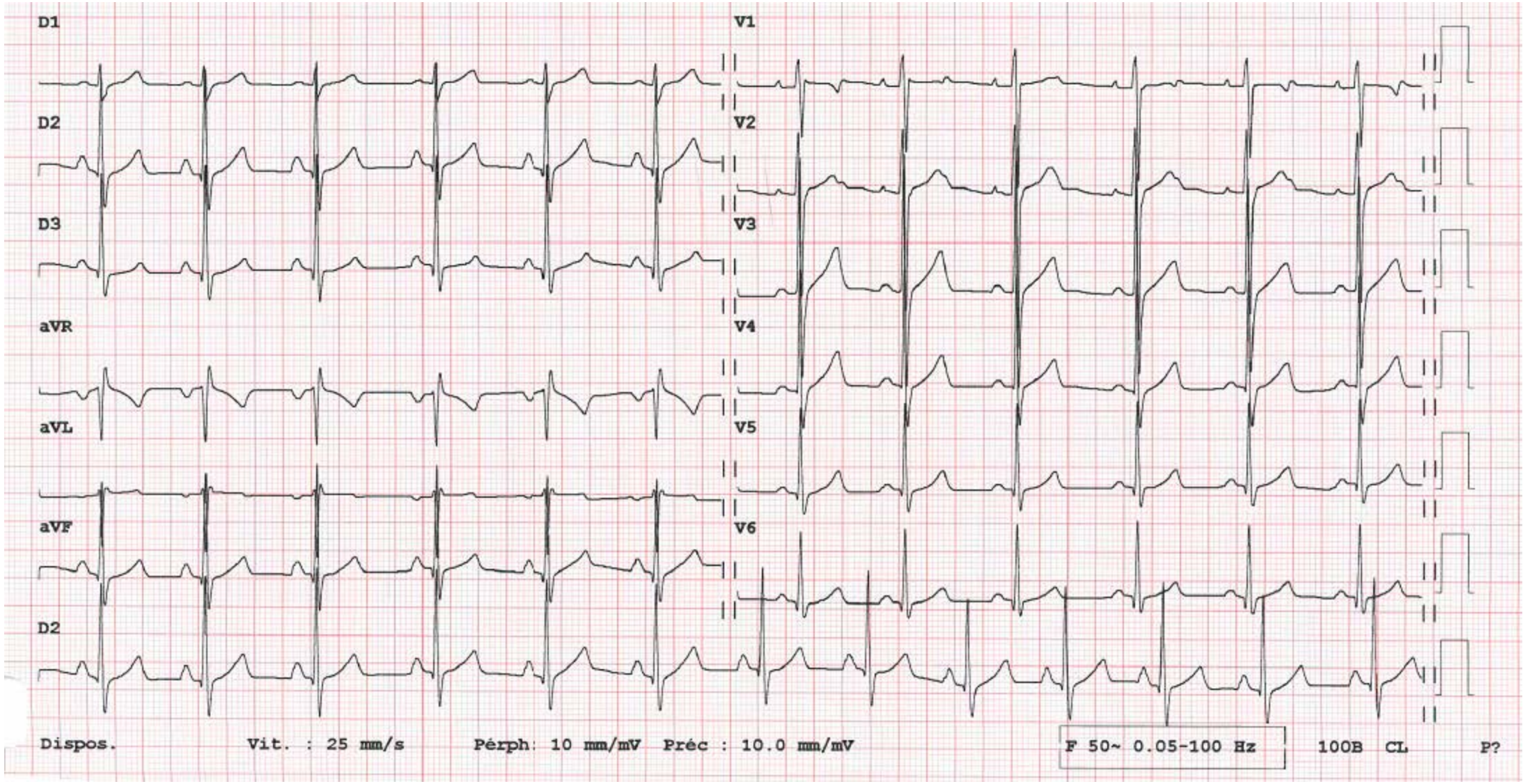
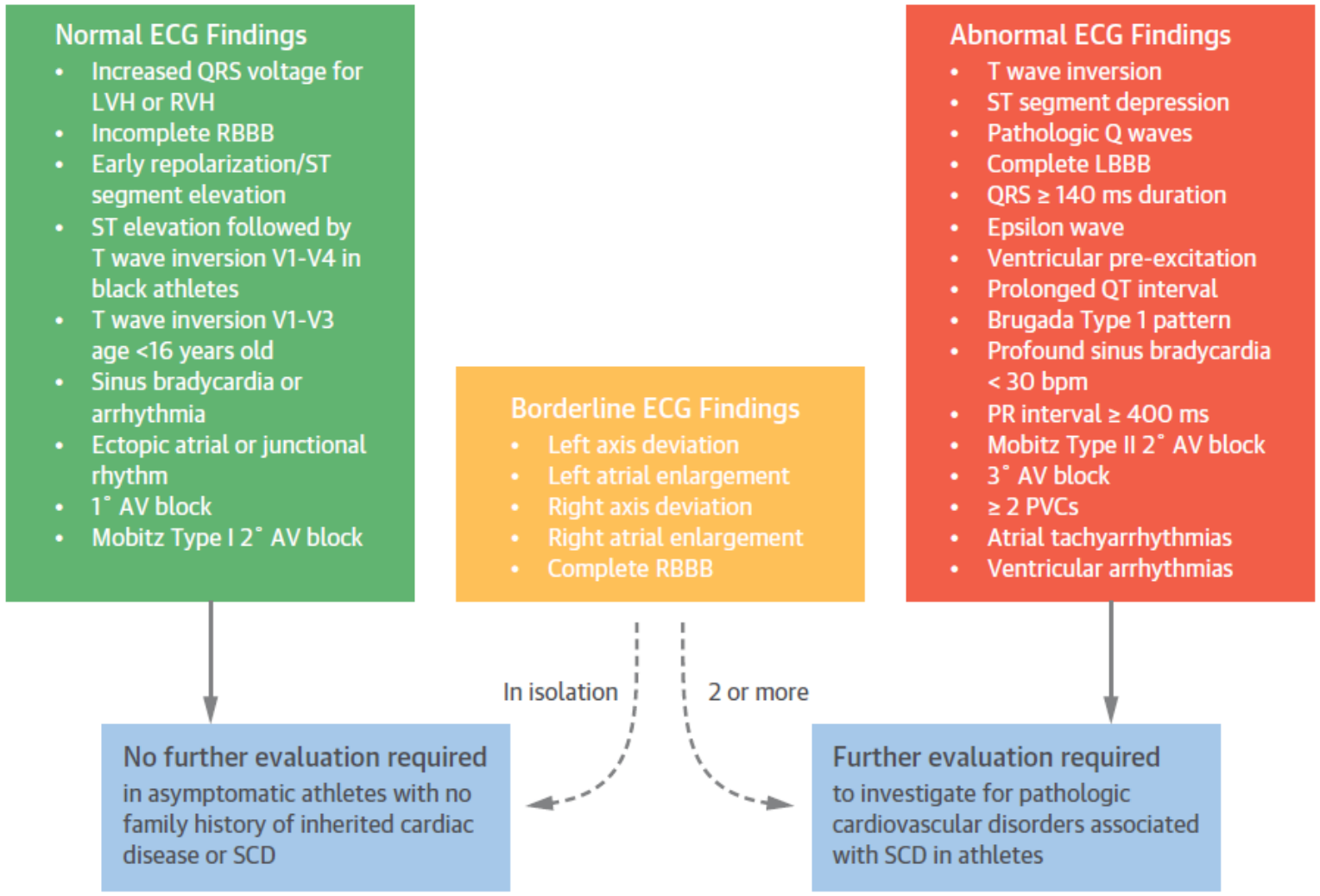

D1
D2
D3
aVR
aVL
aVF
D2
V1
V2
V3
V4
V5
V6
Dispos.
Vit. : 25 mm/s
Périph: 10 mm/mV
Préc : 10.0 mm/mV
F 50~ 0.05-100 Hz
100B CL
P?

FIGURE 1 International Consensus Standards for Electrocardiographic Interpretation in Athletes

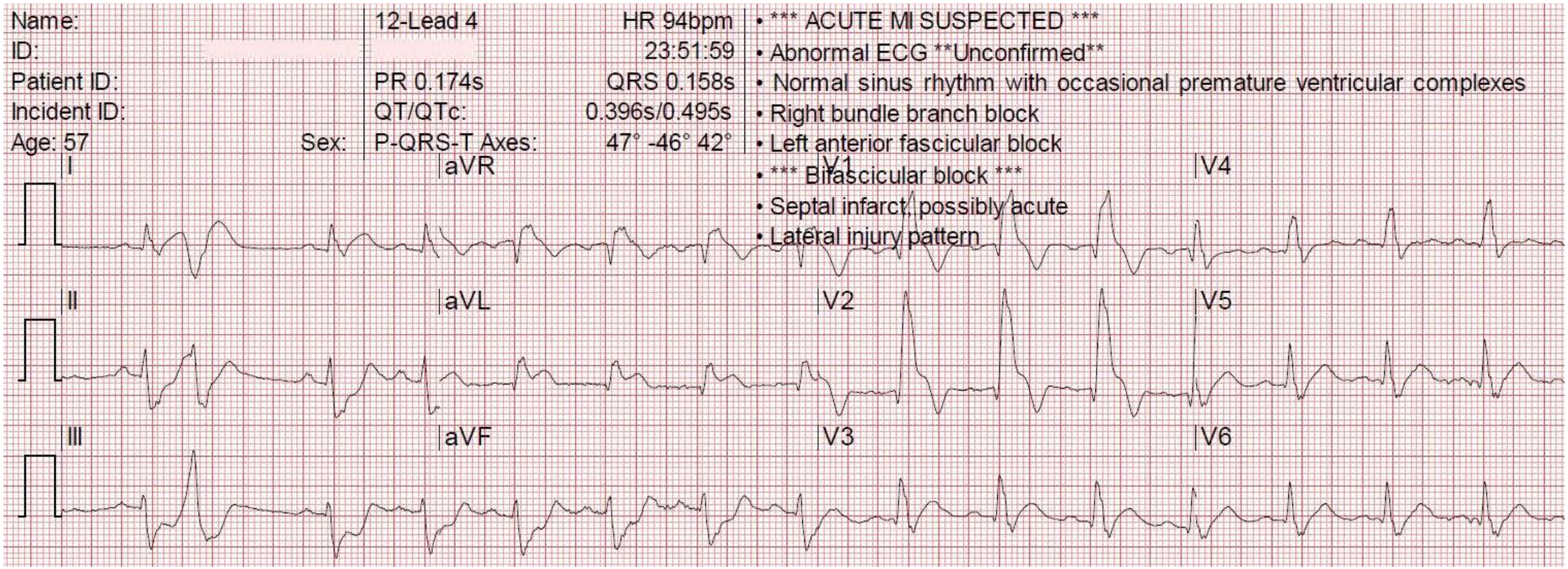


AV = atrioventriular block; LBBB = left bundle branch block; LVH = left ventricular hypertrophy; RBBB = right bundle branch block; RVH = right ventricular hypertrophy; PVC = premature ventricular contraction; SCD = sudden cardiac death.

- Sharma, Sanjay, et al. "International recommendations for electrocardiographic interpretation in athletes." *Journal of the American College of Cardiology* 69.8 (2017): 1057-1075

Cas clinique

- Homme de 50 ans, douleurs thoraciques intenses et dyspnée survenues en post-prandial
- Est tellement mal qu'il n'arrive pas à caractériser les douleurs
- Est amené à l'hôpital par sa compagne
- TA 90/60 mm Hg, FC 100 bpm, dyspnée+++ tachypnée, qqc râles aux bases, TJ présente


Name:
ID:
Patient ID:
Incident ID:
Age: 57
Sex:
12-Lead 4
PR 0.174s
QT/QTc:
P-QRS-T Axes:
HR 94bpm
23:51:59
QRS 0.158s
0.396s/0.495s
47° -46° 42°
• *** ACUTE MI SUSPECTED ***
• Abnormal ECG **Unconfirmed**
• Normal sinus rhythm with occasional premature ventricular complexes
• Right bundle branch block
• Left anterior fascicular block
• *** Bifascicular block ***
• Septal infarct, possibly acute
• Lateral injury pattern
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

Suspicion diagnostique

- Embolie pulmonaire
- Infarctus antérieur aigu
- Péricardite
- Aucune réponse juste

Suspicion diagnostique

- Embolie pulmonaire
- Infarctus antérieur aigu
- Péricardite
- Aucune réponse juste

Vascularisation système conduction

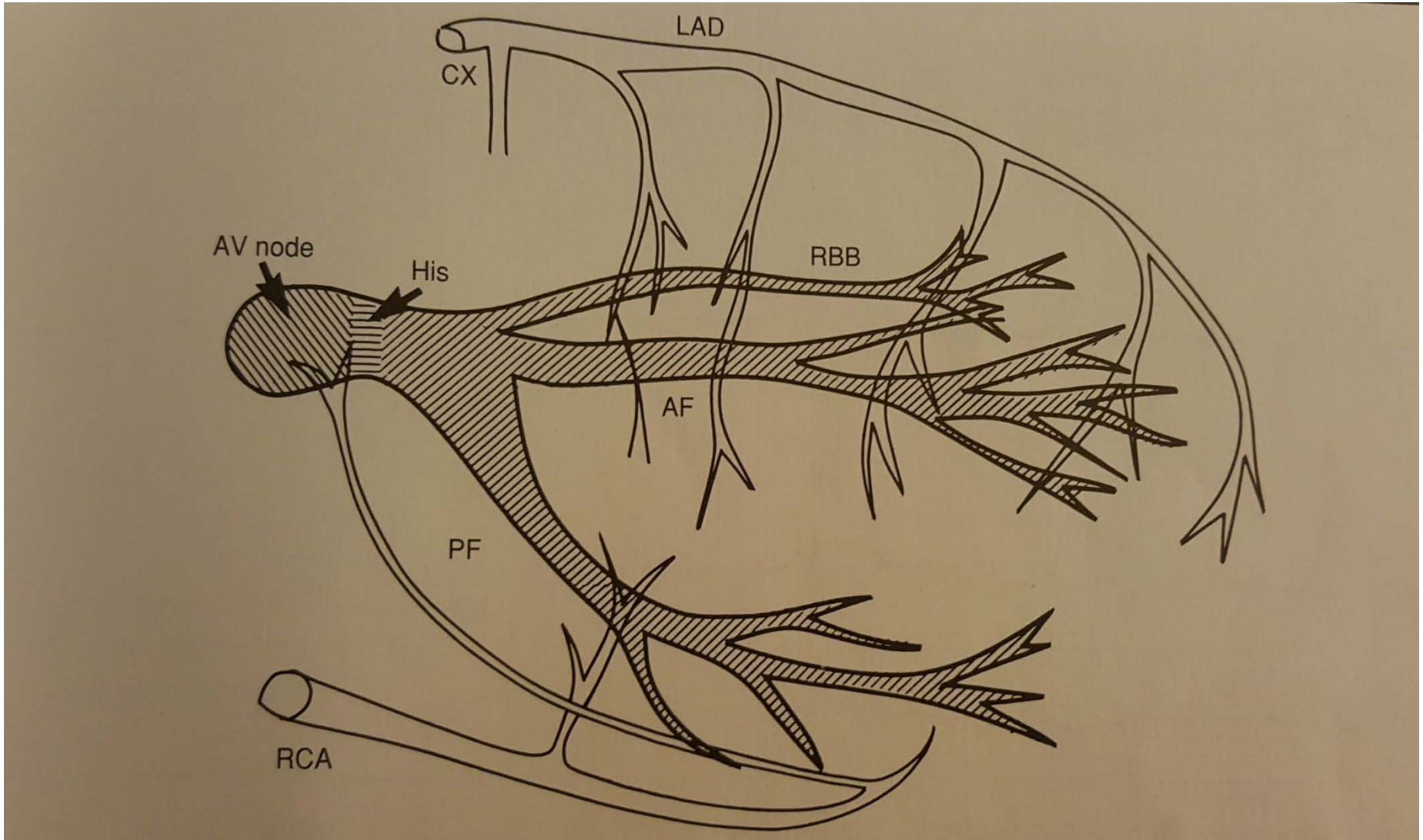


Figure 1-23 Scheme of the blood supply to the AV conduction system. *AF*, anterior fascicle; *PF*, posterior fascicle; *His*, His bundle; *RBB*, right bundle branch.

Wellens –Connover, ECG in Emergency Decision Making, second edition

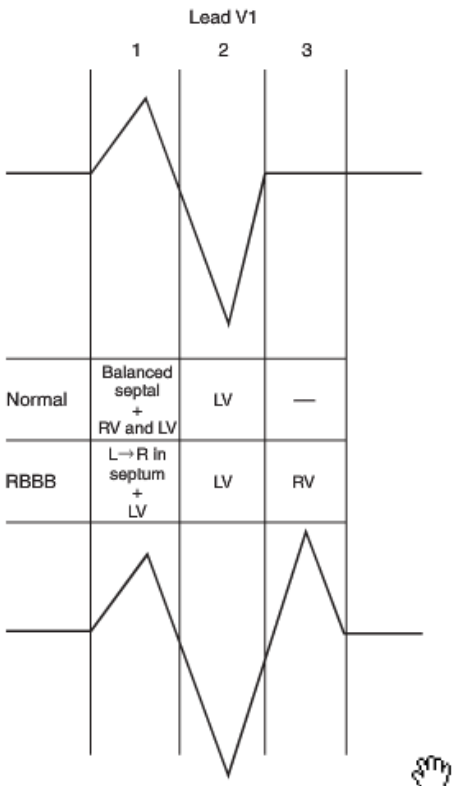


FIGURE 6.5. The contributions from activation of the interventricular septum and the right- and left-ventricular free walls to the appearance of the QRS complex in lead V1, with normal intraventricular conduction **(top)** and with RBBB **(bottom)**. The numbers refer to the first, second, and third sequential 0.04-second periods of time. Only two 0.04-second periods are required for normal conduction, but a third is required when RBBB is present. LV, left ventricle; RBBB, right bundle branch block; RV, right ventricle..

Table 6.1.

Criteria for Right-Bundle-Branch Block

QRS duration ≥ 0.12 s	
Lead V1	Late intrinsicoid (R′ peak or late R peak), M-shaped QRS (RSR′); sometimes wide R or qR
Lead V6	Early intrinsicoid (R peak), wide S wave
Lead I	Wide S wave

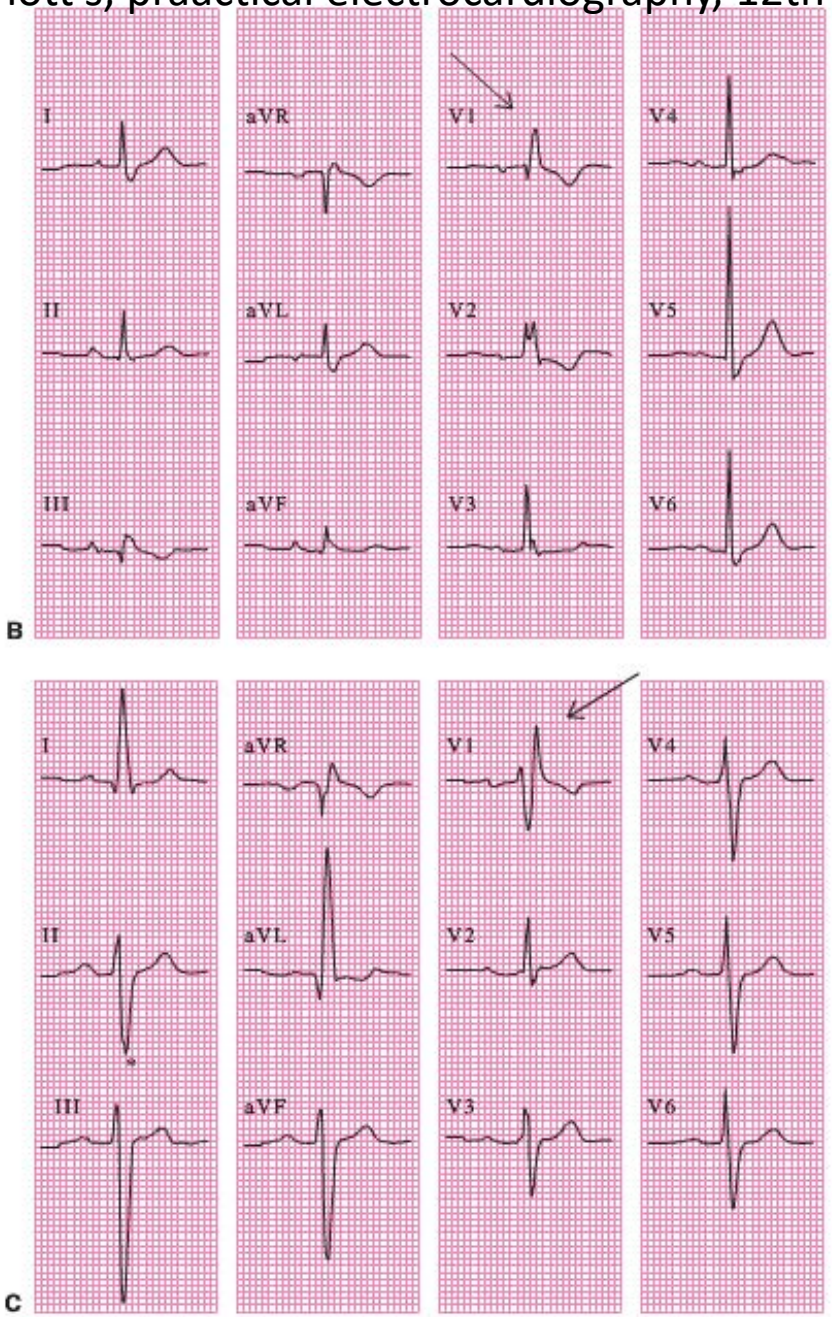
Faible participation du VD à la dépolarisation:

- Peu de modifications du segment ST et onde T
- La phase terminale reste interprétable avec un BBD, sauf V1-V2 (sousdécalage ST, T -)
- Un BBD n’est pas censé créer des ondes Q

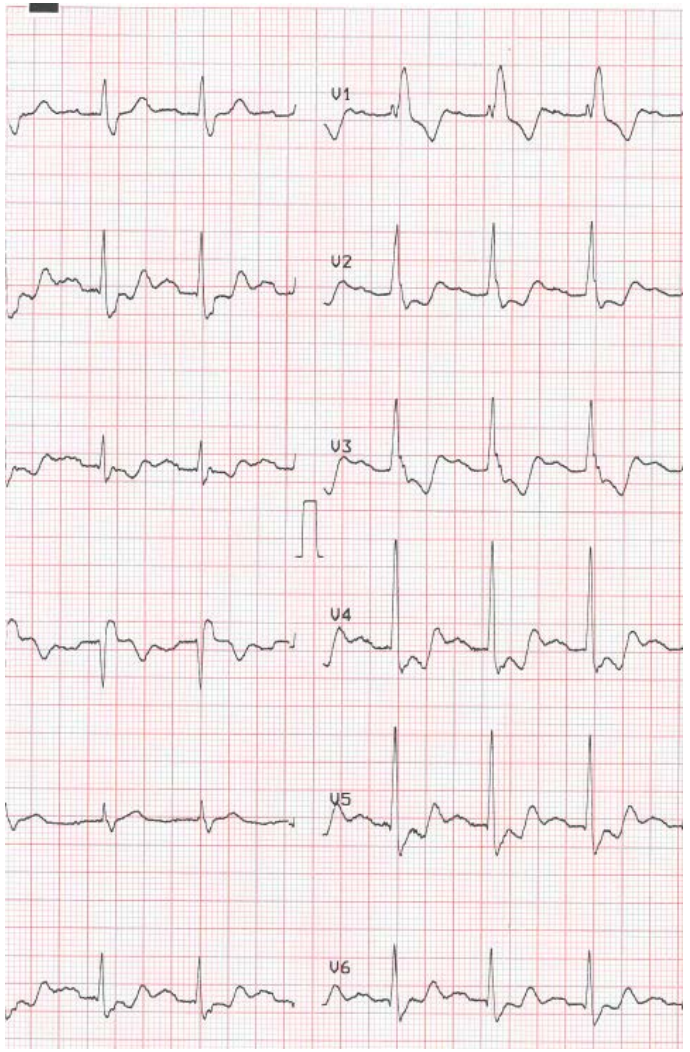
Marriott’s, praactical electrocardiography, 12th edition

Aspects de BBD « typique »

Marriott’s, praactical electrocardiography, 12th edition



Aspects de BBD « atypique », suspicion origine ischémique



Points importants

- Un BBD ne rend pas la repolarisation ininterprétable pour l'ischémie transmurale (contrairement au BBG)
- Pensez origine ischémique (IVA ostiale) dans le DD d'un BBD nouveau et DRS, et non seulement EP

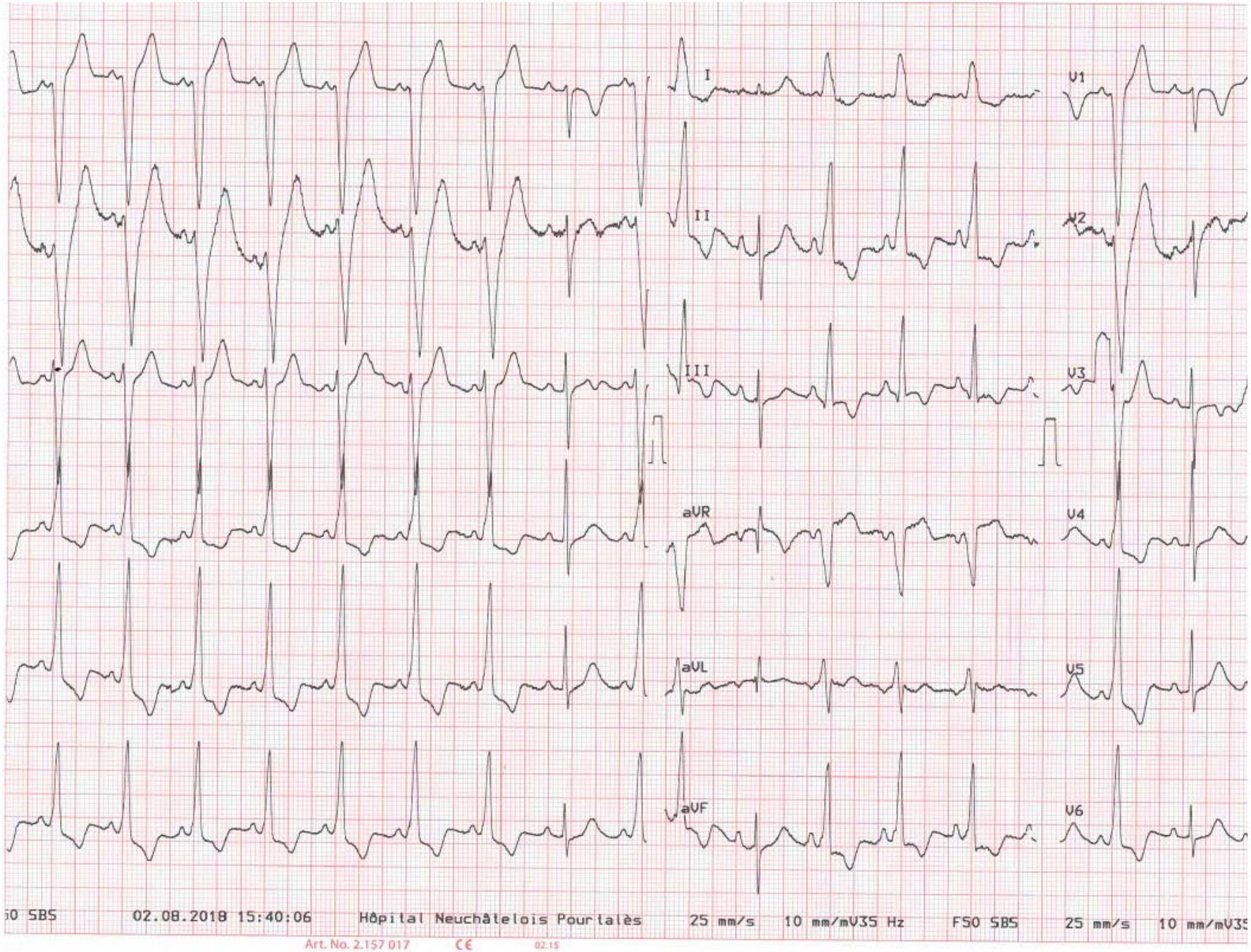
Cas clinique

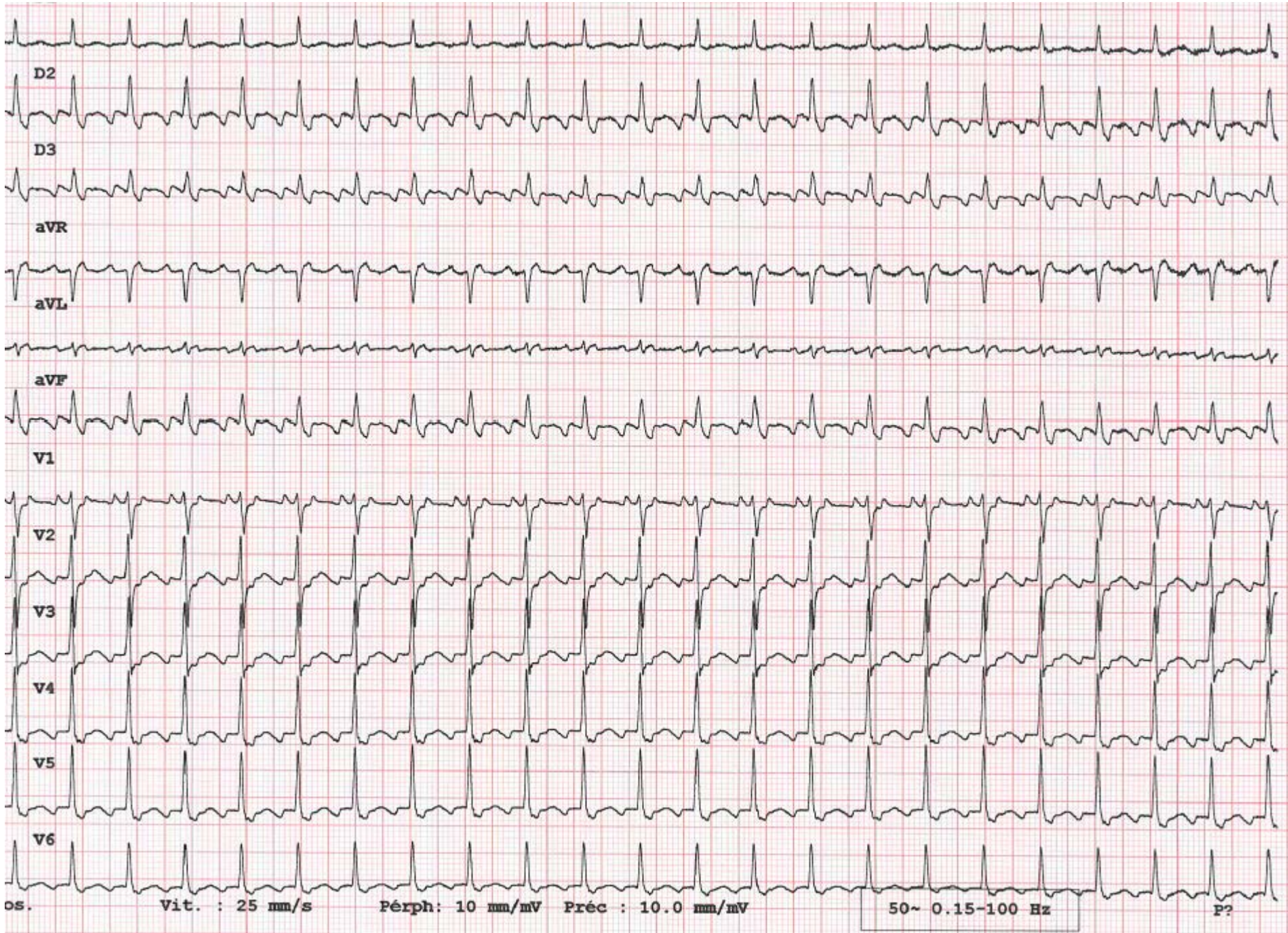
- Patiente de 59 ans, consulte pour palpitations à type « battement manqué »
- sans FRCV, st/p carcinome invasif sein gauche actuellement en rémission depuis 4 ans, avec PAC sousclavièe D toujours en place

Suspicion diagnostique

1. Bloc AV Wenchebach
2. Bloc AV III paroxystique
3. Bloc AV nocturne, banal
4. Artéfact
5. Aucune réponse juste


V1
V2
V3
V4
V5
V6
n/s 10.0 mm/mV
0.05-35 Hz
50 Hz
SBS
SSF
2.72.0
(CS-200 1.62 5.61 2.72.0)
Page 1/1


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
50 SBS
02.08.2018 15:40:06
Hôpital Neuchâtelois Pourtalès
25 mm/s
10 mm/mV35 Hz
FS0 SBS
25 mm/s
10 mm/mV3
Art. No. 2.157 017
CE
02.15


D2
D3
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
os.
Vit. : 25 mm/s
Périph: 10 mm/mV
Préc : 10.0 mm/mV
50~ 0.15-100 Hz
P?

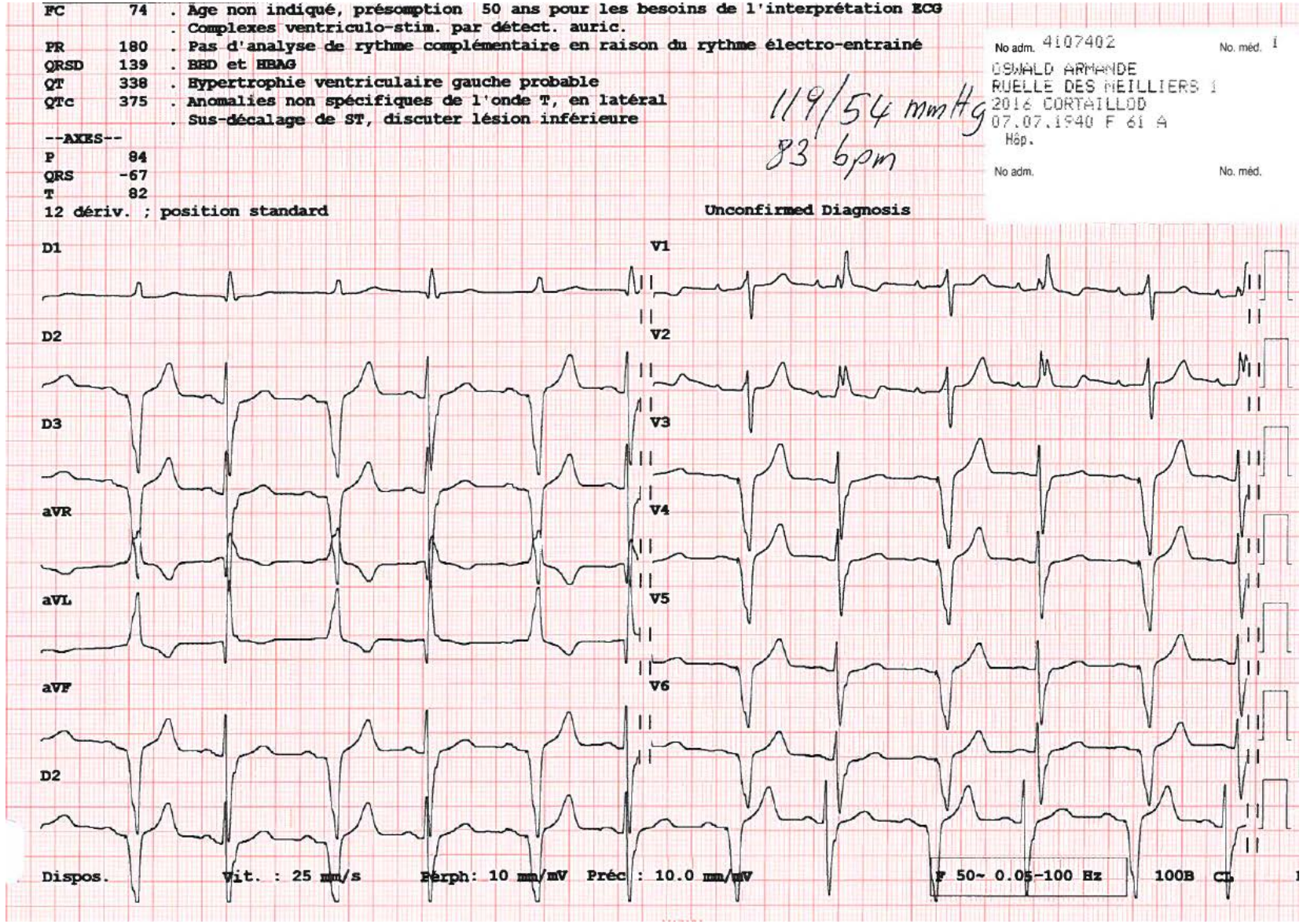

FC 74
PR 180
QRSD 139
QT 338
QTc 375
--AXES--
P 84
QRS -67
T 82
12 dériv. ; position standard
. Age non indiqué, présomption 50 ans pour les besoins de l'interprétation ECG
. Complexes ventriculo-stim. par détect. auric.
. Pas d'analyse de rythme complémentaire en raison du rythme électro-entrainé
. BBD et HBAG
. Hypertrophie ventriculaire gauche probable
. Anomalies non spécifiques de l'onde T, en latéral
. Sus-décalage de ST, discuter lésion inférieure
Unconfirmed Diagnosis
119/54 mmHg
83 bpm
No adm. 4107402
No. méd. 1
OSWALD ARMANDE
RUELLE DES MEILLIERS 1
2016 CORTAILLOD
07.07.1940 F 61 A
Hôp.
No adm.
No. méd.
D1
D2
D3
aVR
aVL
aVF
D2
V1
V2
V3
V4
V5
V6
Dispos.
Vit. : 25 mm/s
Périph: 10 mm/mV
Préc : 10.0 mm/mV
F 50~ 0.05-100 Hz
100B

Table 12.1.

Abnormal Q Waves Suggesting MI

Limb Leads		Precordial Leads	
Lead	Criteria for Abnormal	Lead	Criteria for Abnormal
I	≥0.03 s	V1	Any Q
II	≥0.03 s	V2	Any Q
III	None	V3	Any Q
aVR	None	V4	≥0.02 s
aVL	≥0.03 s	V5	≥0.03 s
aVF	≥0.03 s	V6	≥0.03 s

Modified from Wagner GS, Freye CJ, Palmeri ST, et al. Evaluation of a QRS scoring system for estimating myocardial infarct size. I. Specificity and observer agreement. *Circulation*. 1982;65:345, with permission.

Table 12.3.

Abnormally Large R Waves Suggesting MI

Lead	Criteria for Abnormal
V1	R dur ≥0.04 s, R amp ≥0.60 mV, R amp ≥S amp
V2	R dur ≥0.05 s, R amp ≥1.50 mV, R amp ≥1.5 × S amp

amp, amplitude; dur, duration.

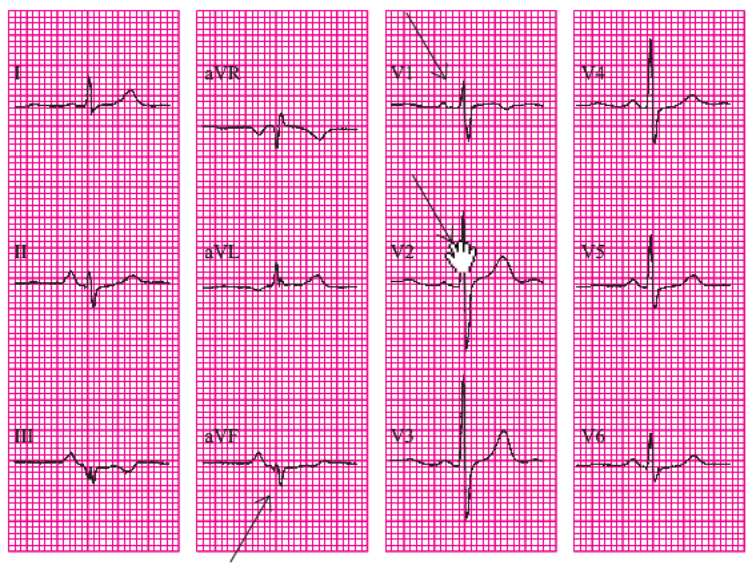


FIGURE 12.11. A 12-lead ECG from a 70-year-old woman with a healed interolateral infarction. *Arrows*, abnormal Q wave in aVF and abnormally prominent R waves in V1 to V2.

1. Elevation of the origin of the ST segment at its junction (J point) with the QRS complex in two or more leads of:

   - 0.1 mV (1 mm) in any lead except for leads V2 and V3
   - in leads V2 and V3 ST-J elevation should be:
     a. 0.25 mV (2.5 mm) in men less than 40 years of age
     b. 0.20 mV (2.0 mm) in men 40 years of age or older
     c. 0.15 mV (1.5 mm) in women of any age.

2. Depression of the origin of the ST segment at the J point of 0.10 mV (1 mm) in two or more of leads V1-V3.