



# Atelier pratique en Electrocardiogramme ECG

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wikispace



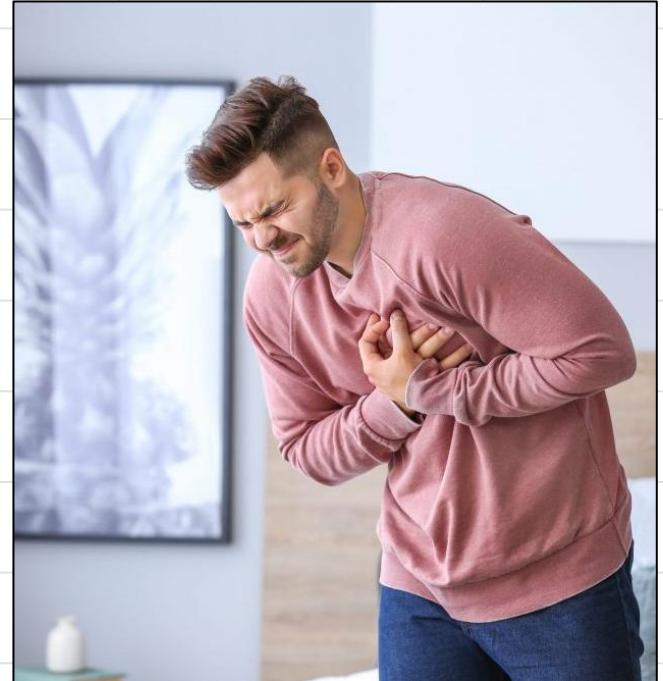
**Let's practice  
and learn!**

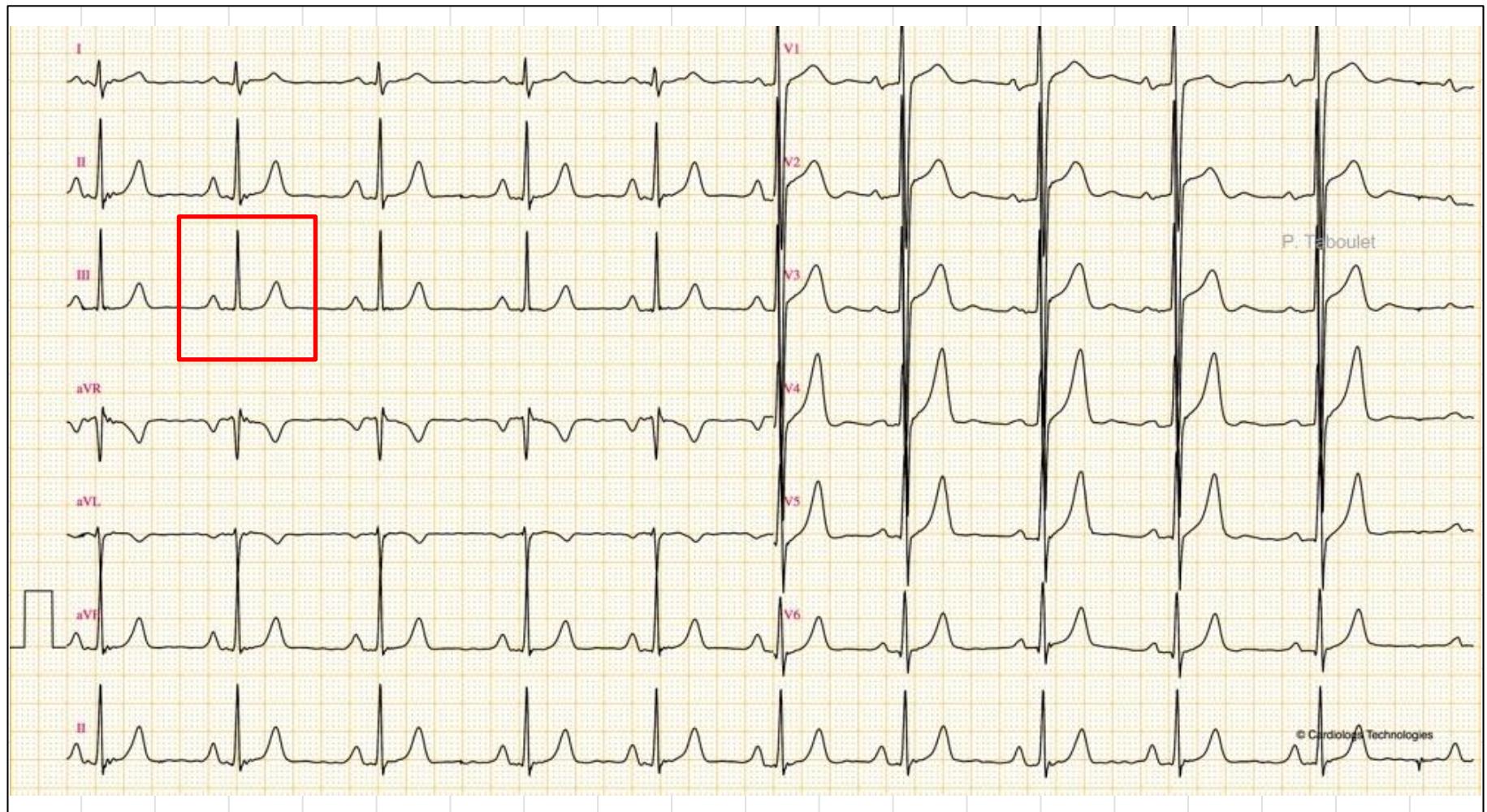
on interprète et on déduit des règles à la fin

# ECG N° 01

Sujet jeune de 28 ans consulte aux urgences de cardiologie pour douleur thoracique

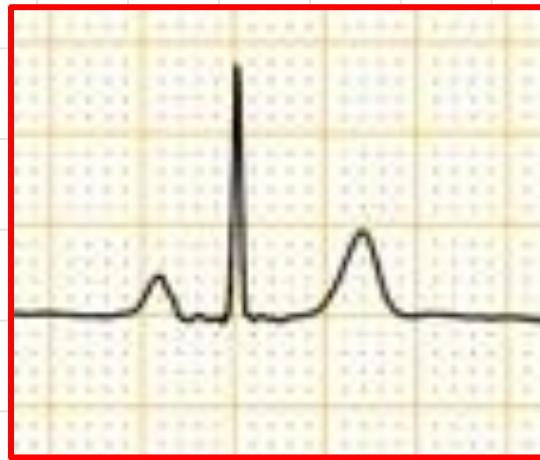
1. Fumeur
2. Sportif
3. Notion d'angoisse



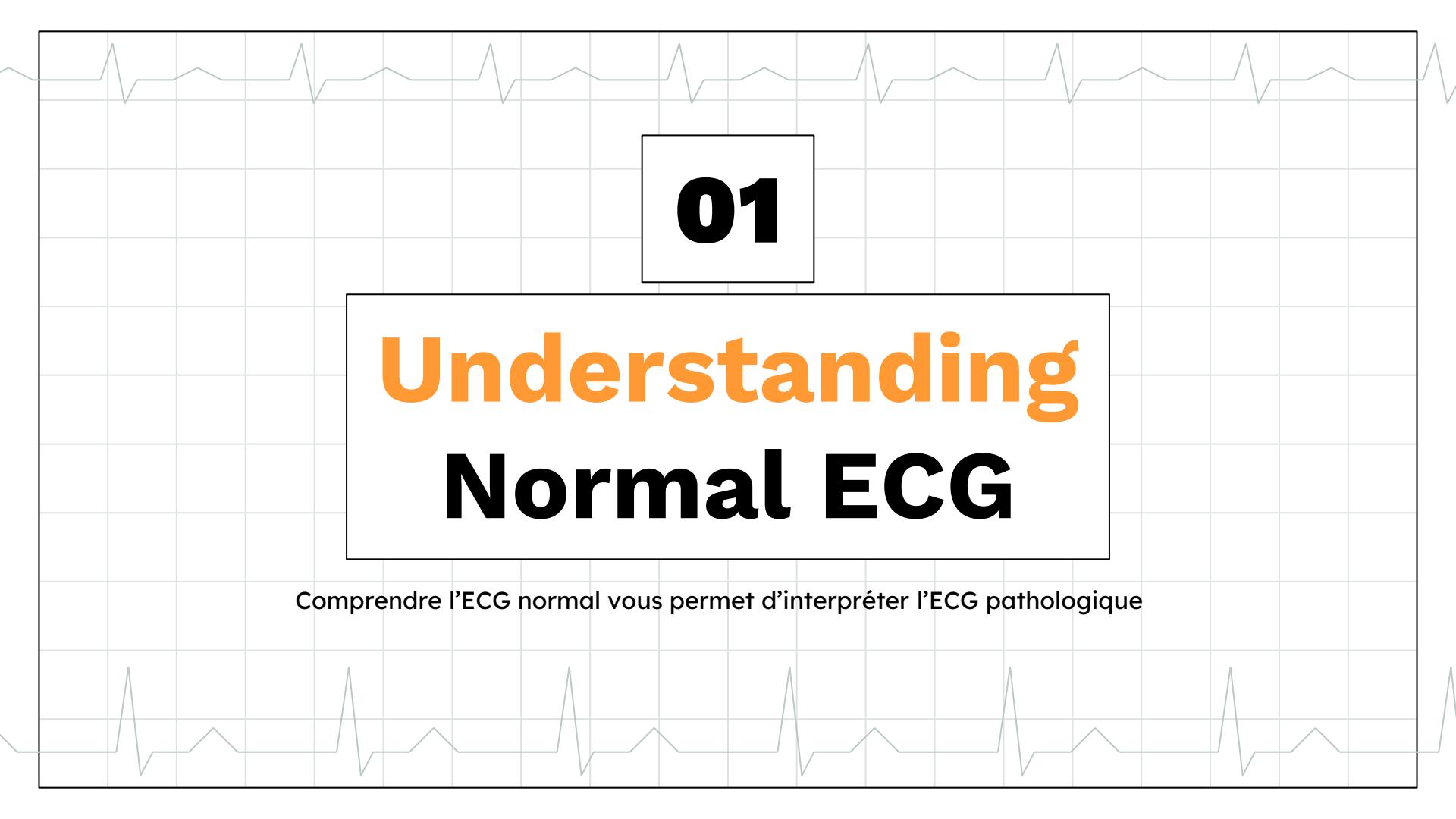


P. Taboulet

© Cardiolog Technologies



Quel est l'origine de cet aspect ?



01

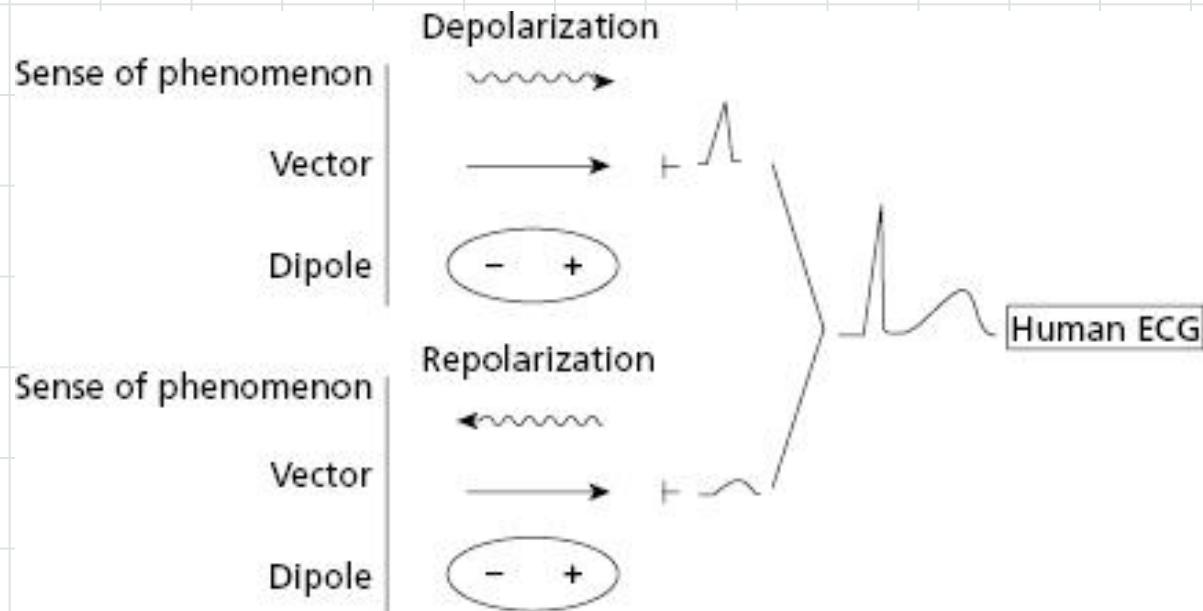
# Understanding Normal ECG

Comprendre l'ECG normal vous permet d'interpréter l'ECG pathologique

# Introduction

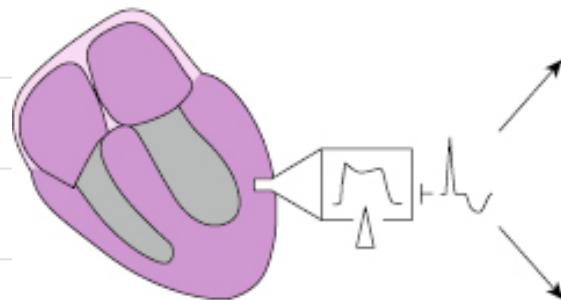
L'electrocardiogramme est une image  
multidimensionnelle de l'activité électrique du  
coeur.

# Understand the dipole

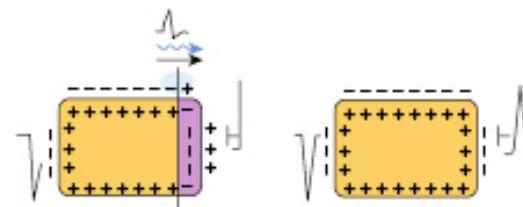
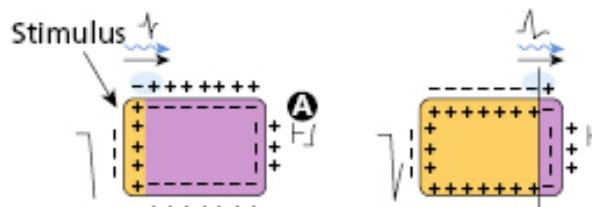


# Understand the dipole

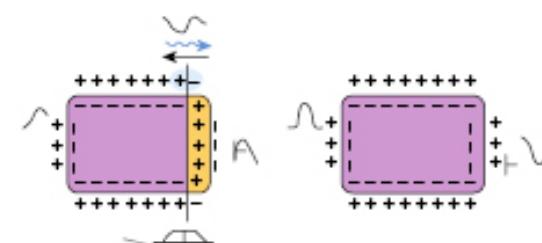
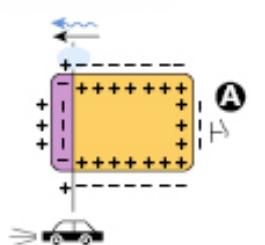
A.



B. DEPOLARIZATION



C. REPOLARIZATION



Inside electrode



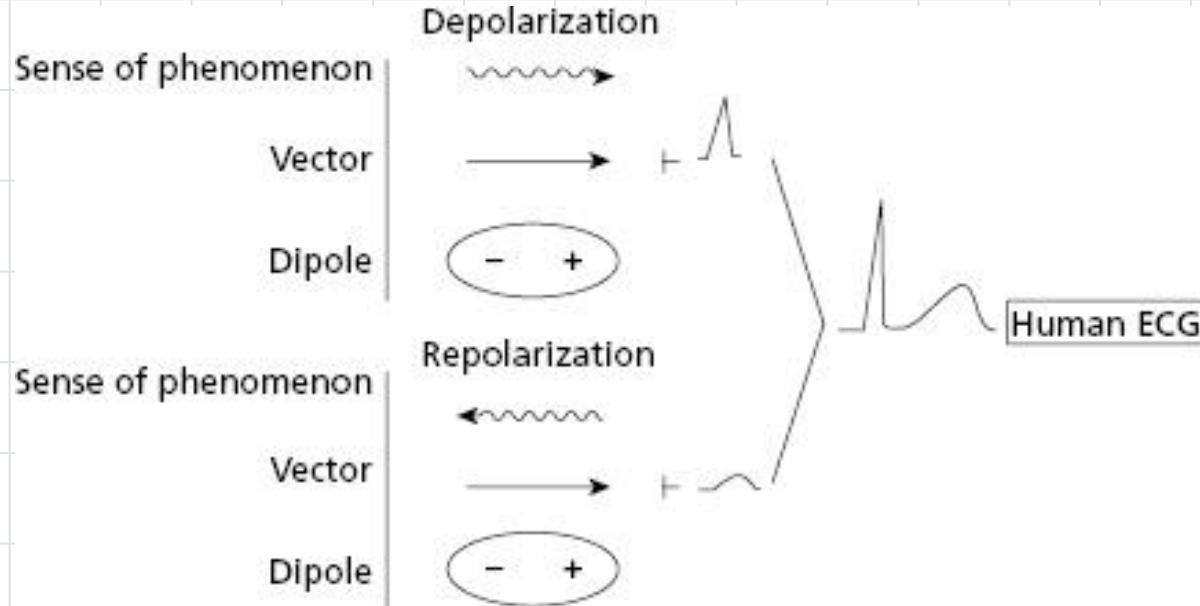
External electrode

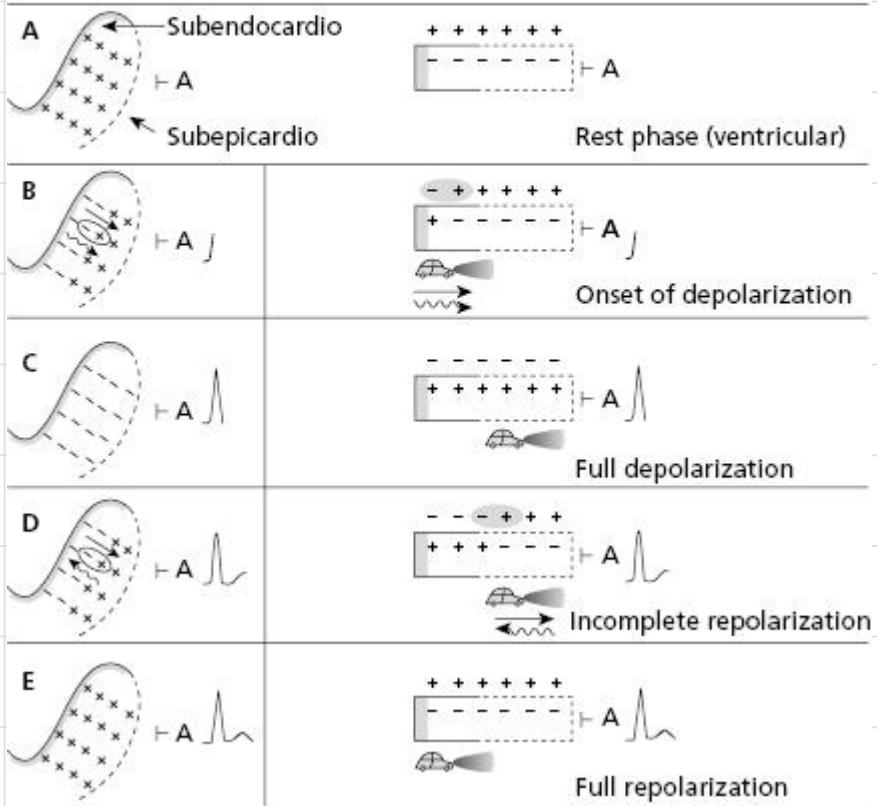
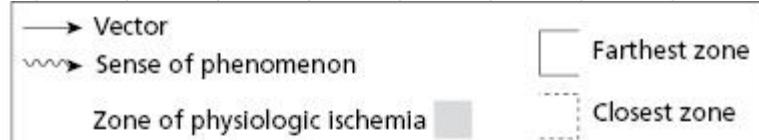
→ Vector

~~ Sense of phenomenon

$$B+C =$$

# Understand the dipole



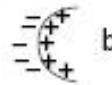


**A**                    Ventricular level

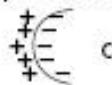
Resting phase



Depolarization

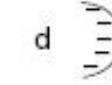


Repolarization

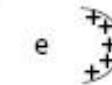


**B**

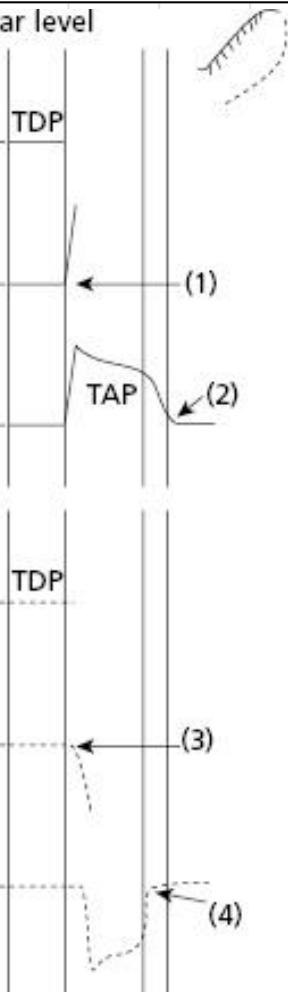
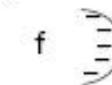
Resting phase



Depolarization



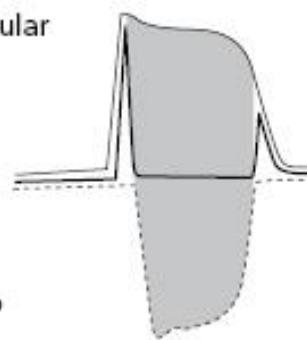
Repolarization



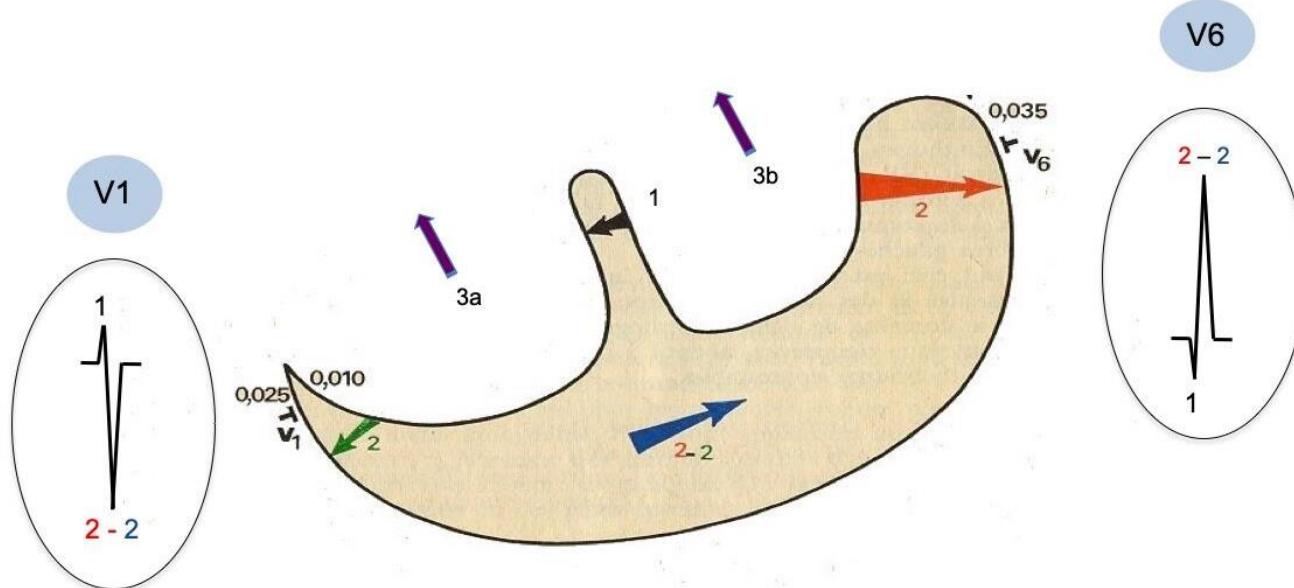
— Curve corresponding to distal ventricular zone (A)

- - - Curve corresponding to proximal ventricular zone (B)

— Resultant curve after summation two curves

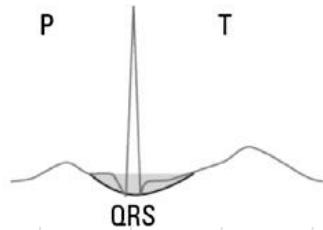
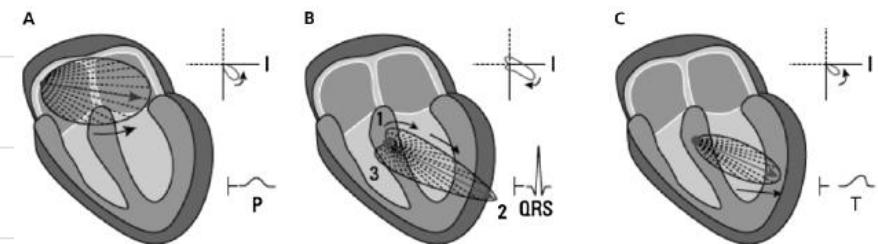
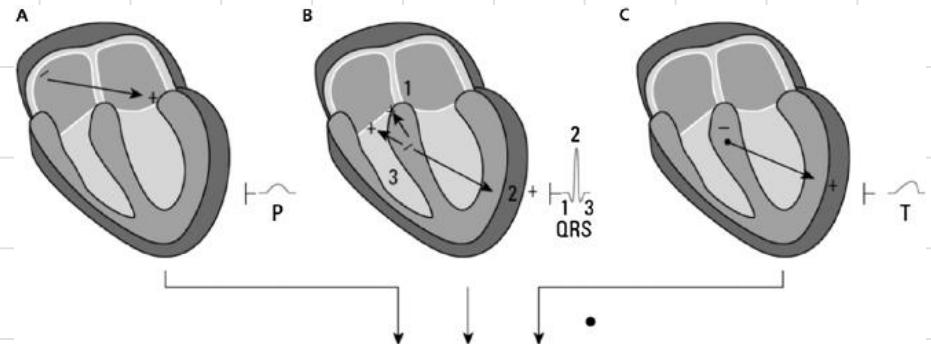


# Understand Activation Vectors



(D'après Pr J. Valty: Signes cardiaques, Ed. Sandoz 1977)

1. Le septum est dépolarisé de la gauche vers la droite à l'origine de l'onde r en V1 et q en V6;
2. Dépolarisation simultanée des ventricules avec un vecteur résultant tourné vers la gauche;  
3a et 3b. Dépolarisation tardive des portions postérobasales (non représentée).

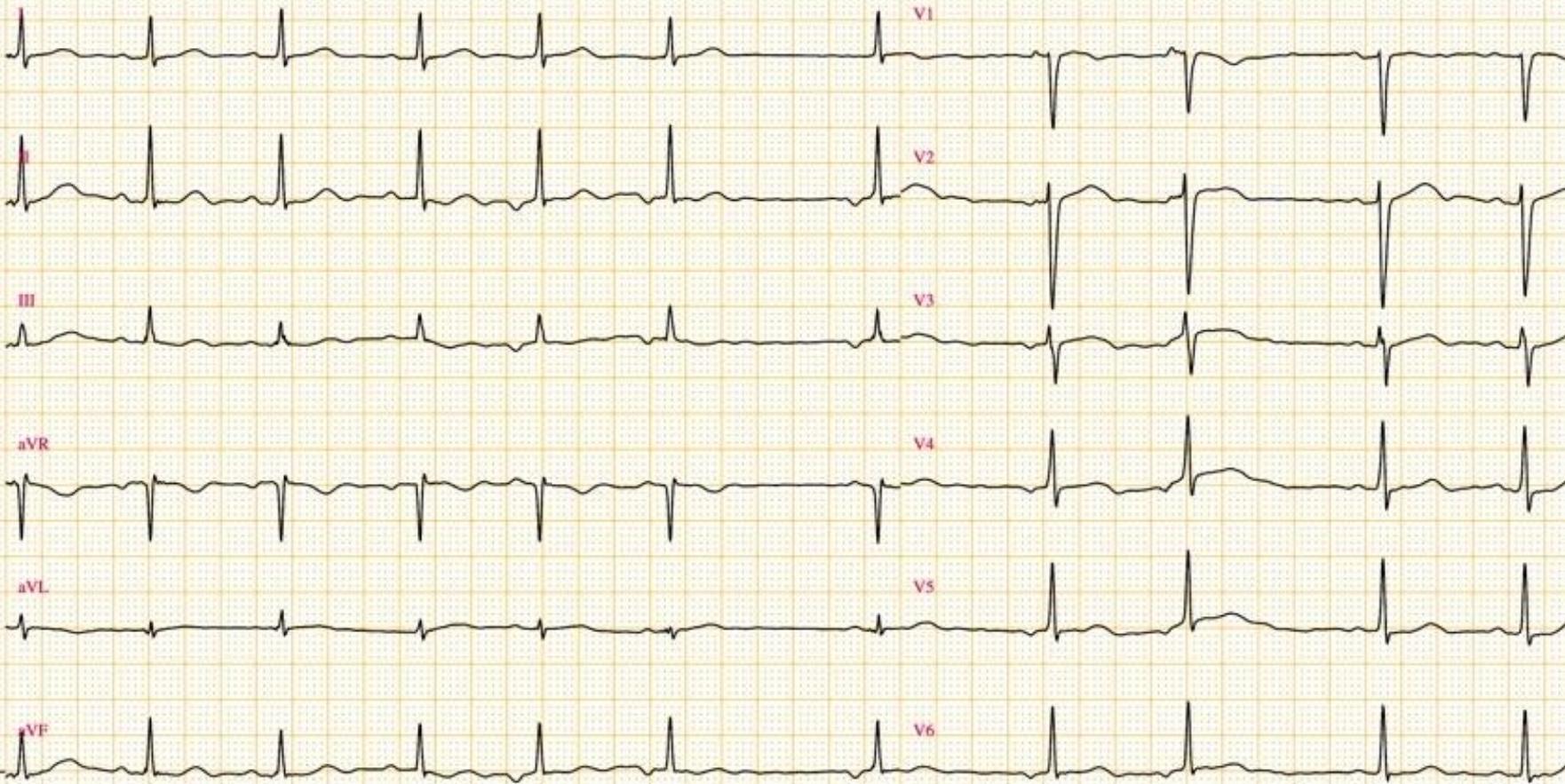


# ECG N° 02

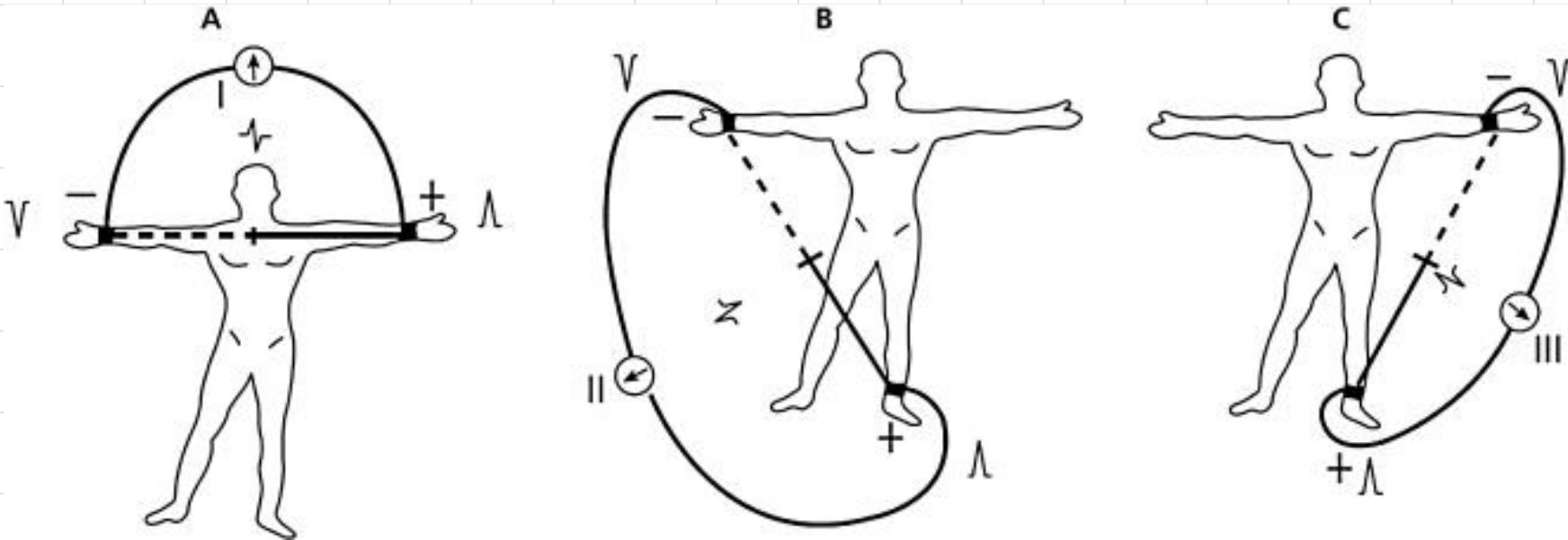
Sujet jeune adolescent de 18 ans consulte aux urgences de cardiologie pour une dyspnée

1. Dyspnée
2. Sportif
3. Maigre

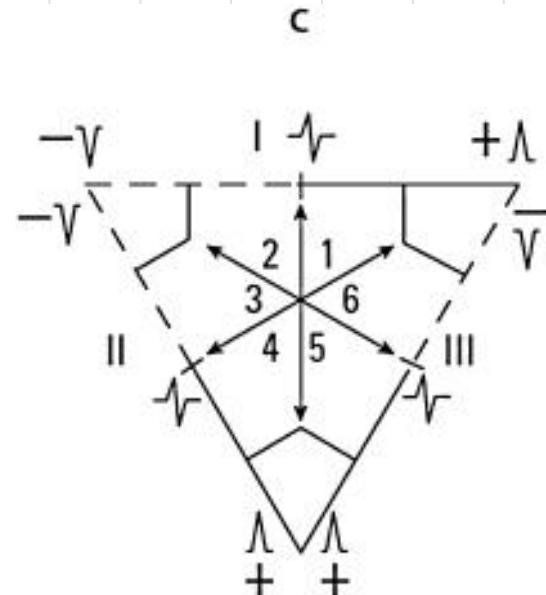
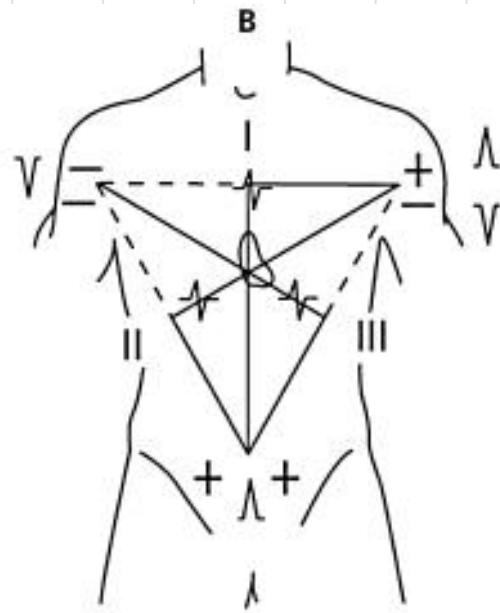
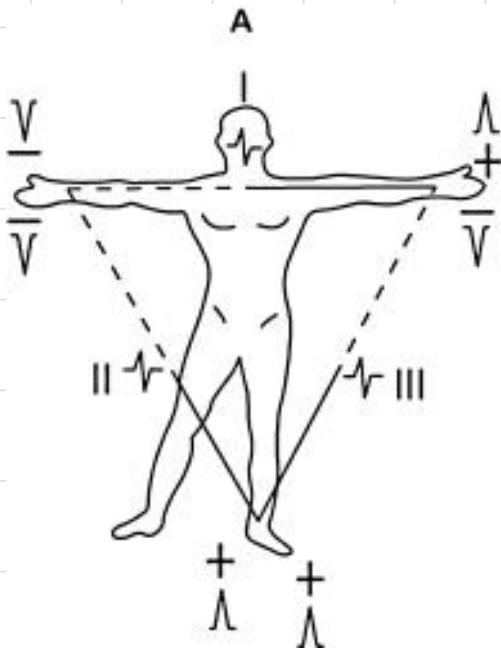




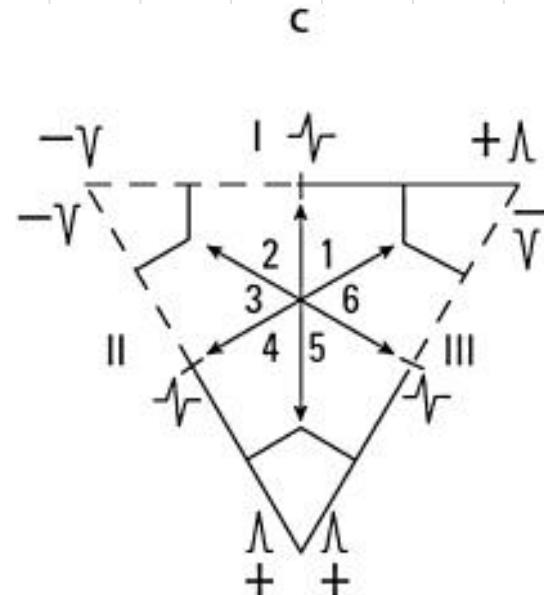
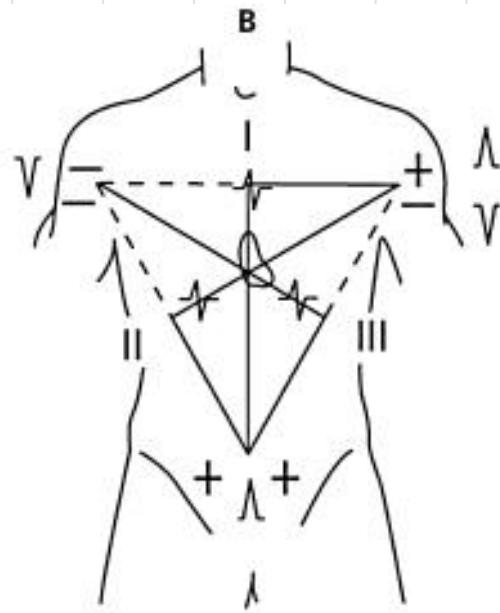
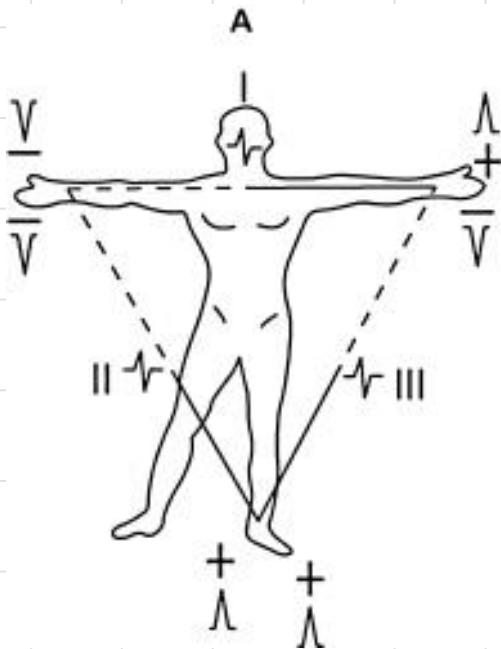
# Understand ECG leads



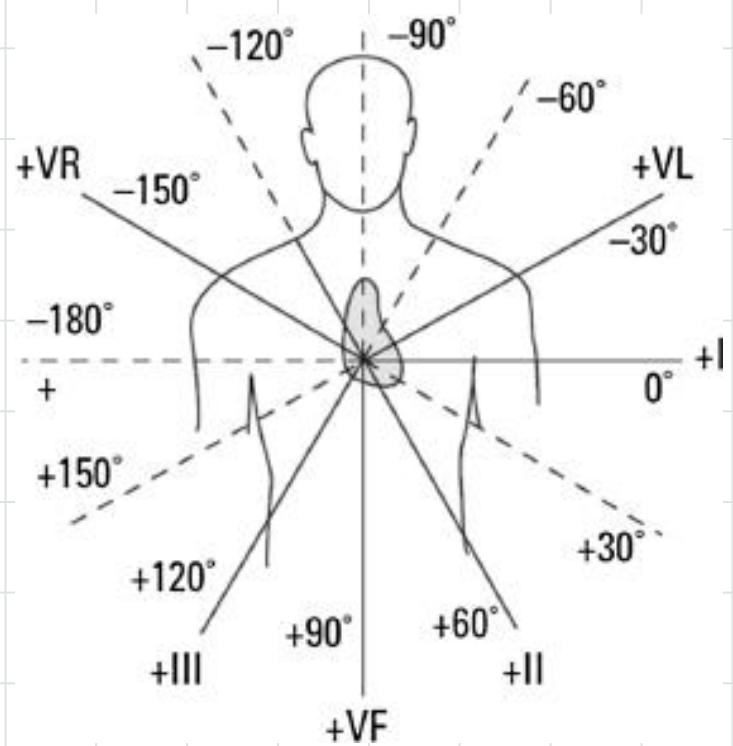
# Understand ECG leads



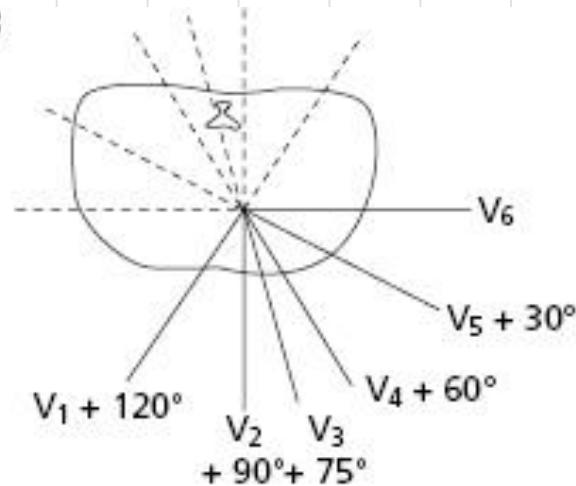
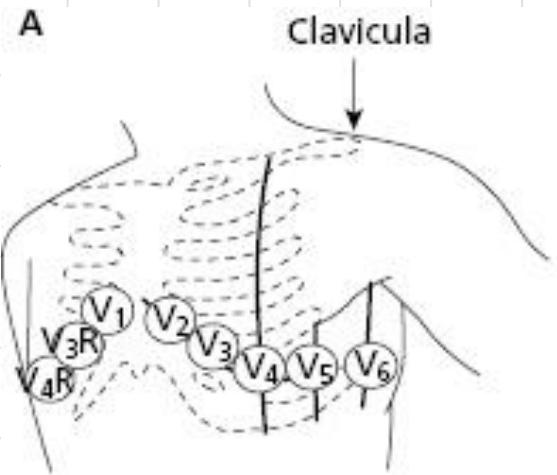
# Understand ECG leads



# Frontal or limb leads



# Precordial leads



V1= 4th intercostal space (ICS) to the right of sternum

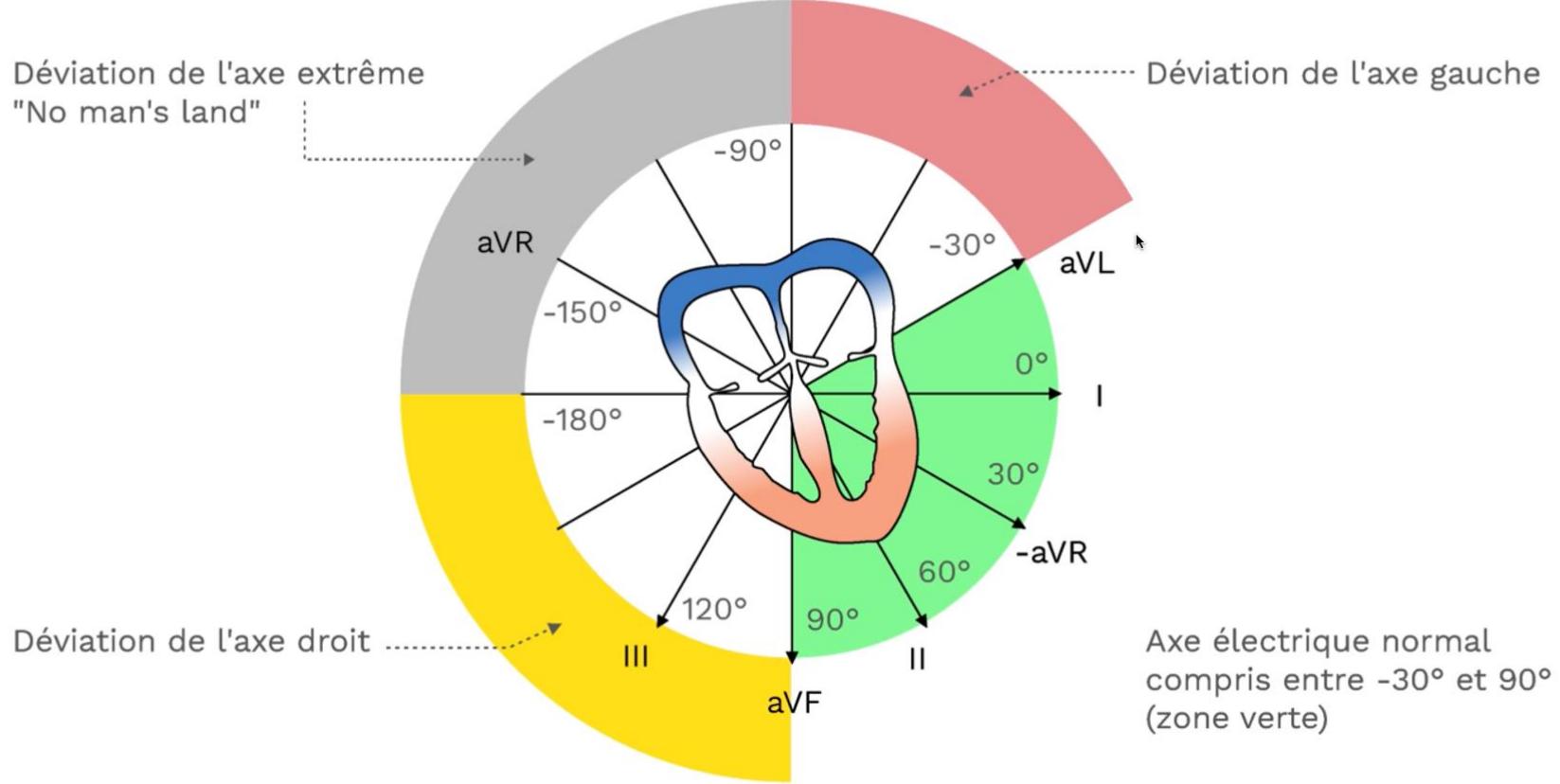
V2= 4th intercostal space (ICS) to the left of sternum

V3= between V2 and V4

V4= middle clavicular line in the 5th ICS

V5= anterior axillary line (at V4 level)

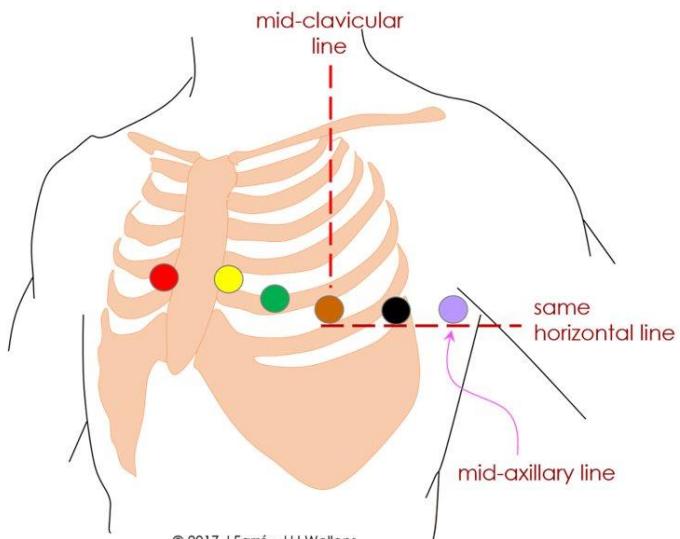
V6= middle axillary line (at V4 level)



# Precordial leads

colors in  
Europe

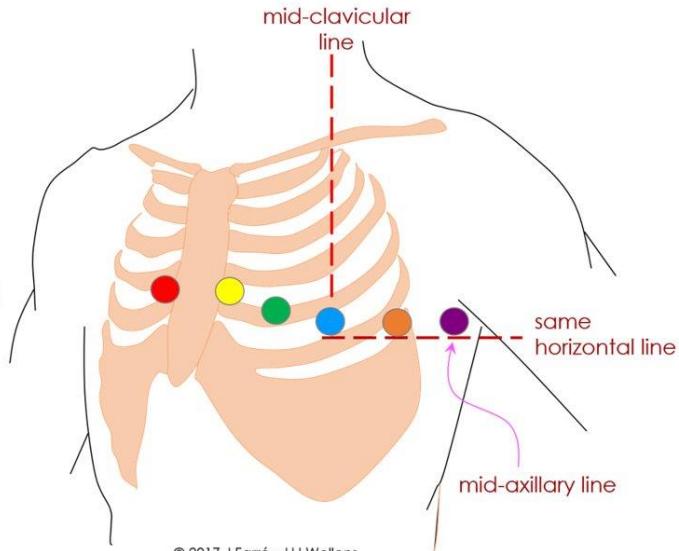
V1	Red
V2	Yellow
V3	Green
V4	Brown
V5	Black
V6	Violet



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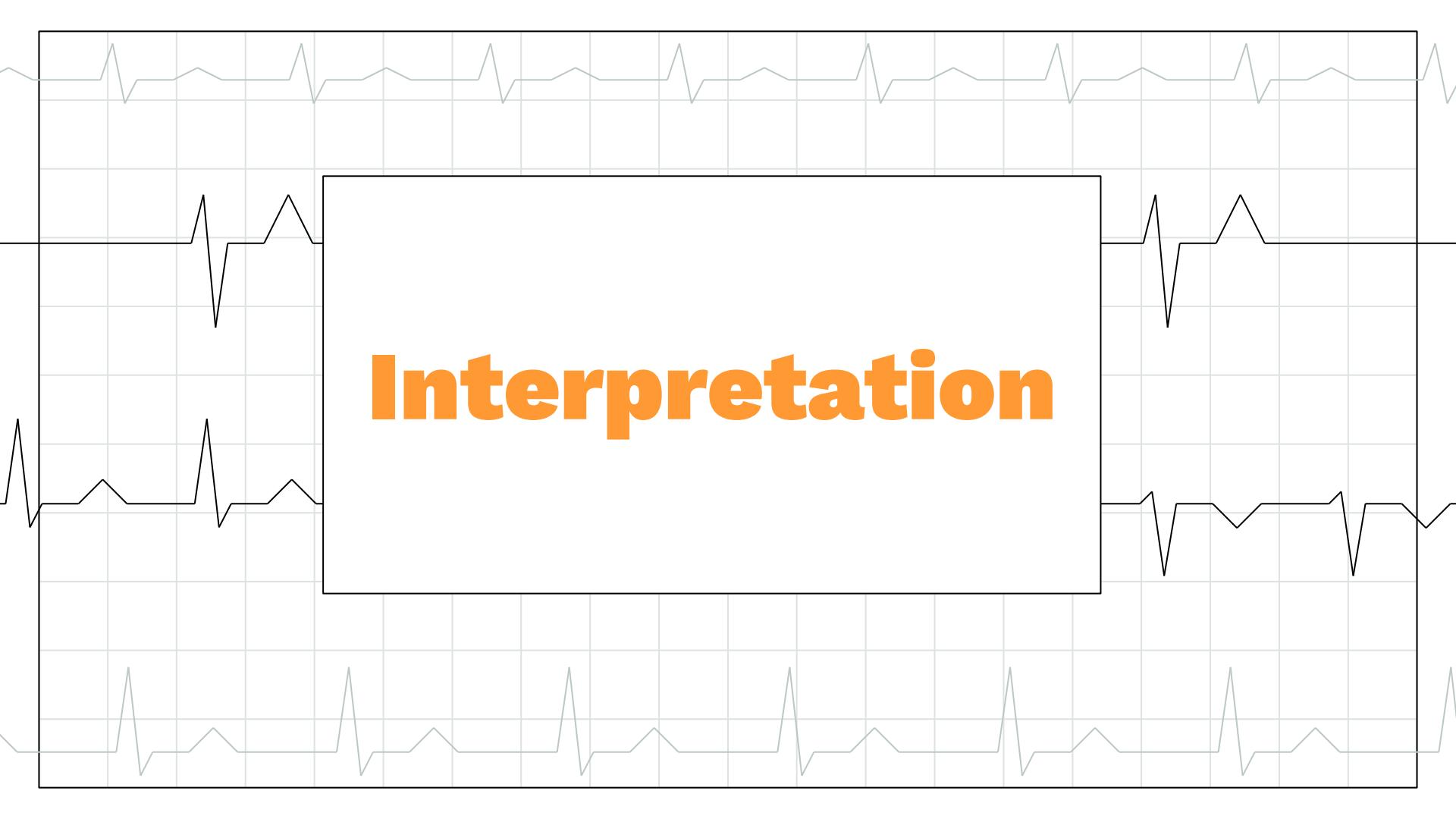
colors in  
America

V1	Red
V2	Yellow
V3	Green
V4	Blue
V5	Orange
V6	Purple



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# Interpretation



# **Etude avancé d'un ECG**

**ECG = Examen Clinique**

**Analytique**

Analyse méthodique des  
différents parties du tracé

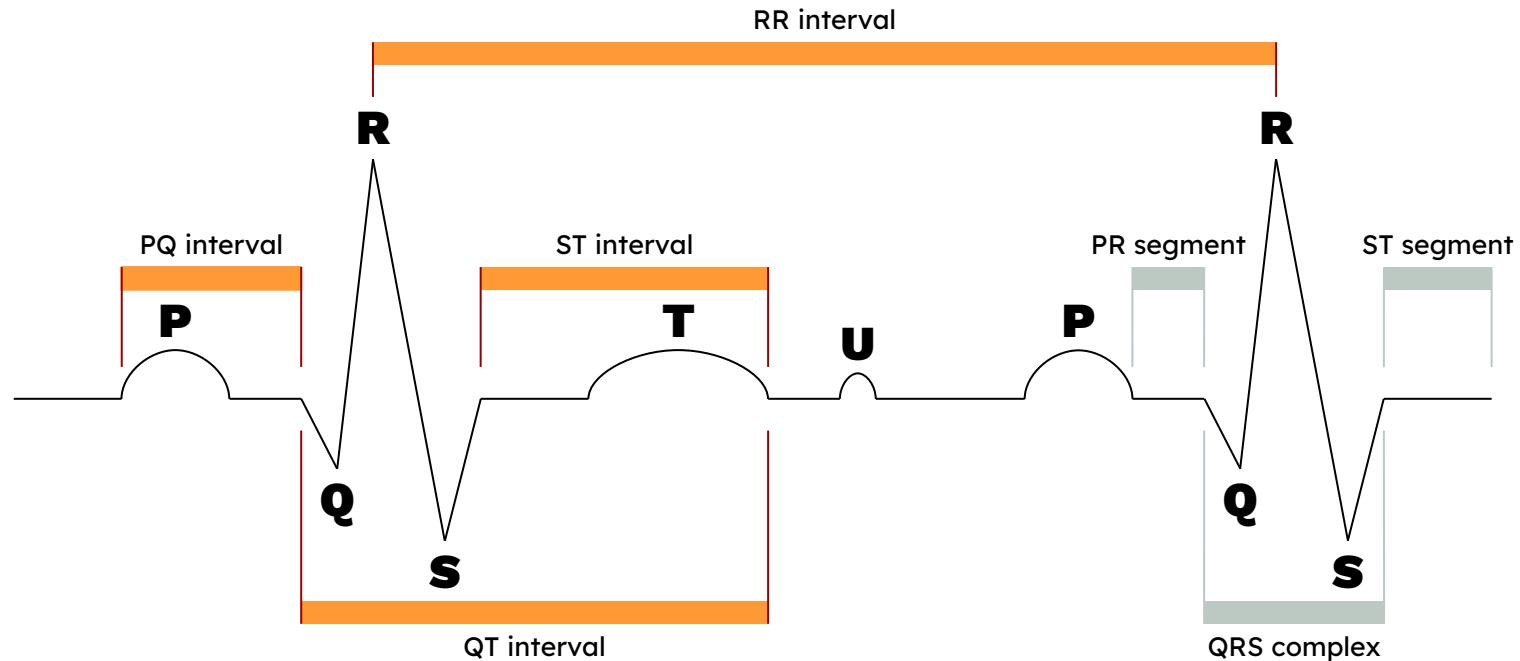
**Synthétique**

Regroupement des  
anomalies retrouvées dans  
un diagnostic électrique

**Conclusion**

Conclusion syndromique et  
clinique.

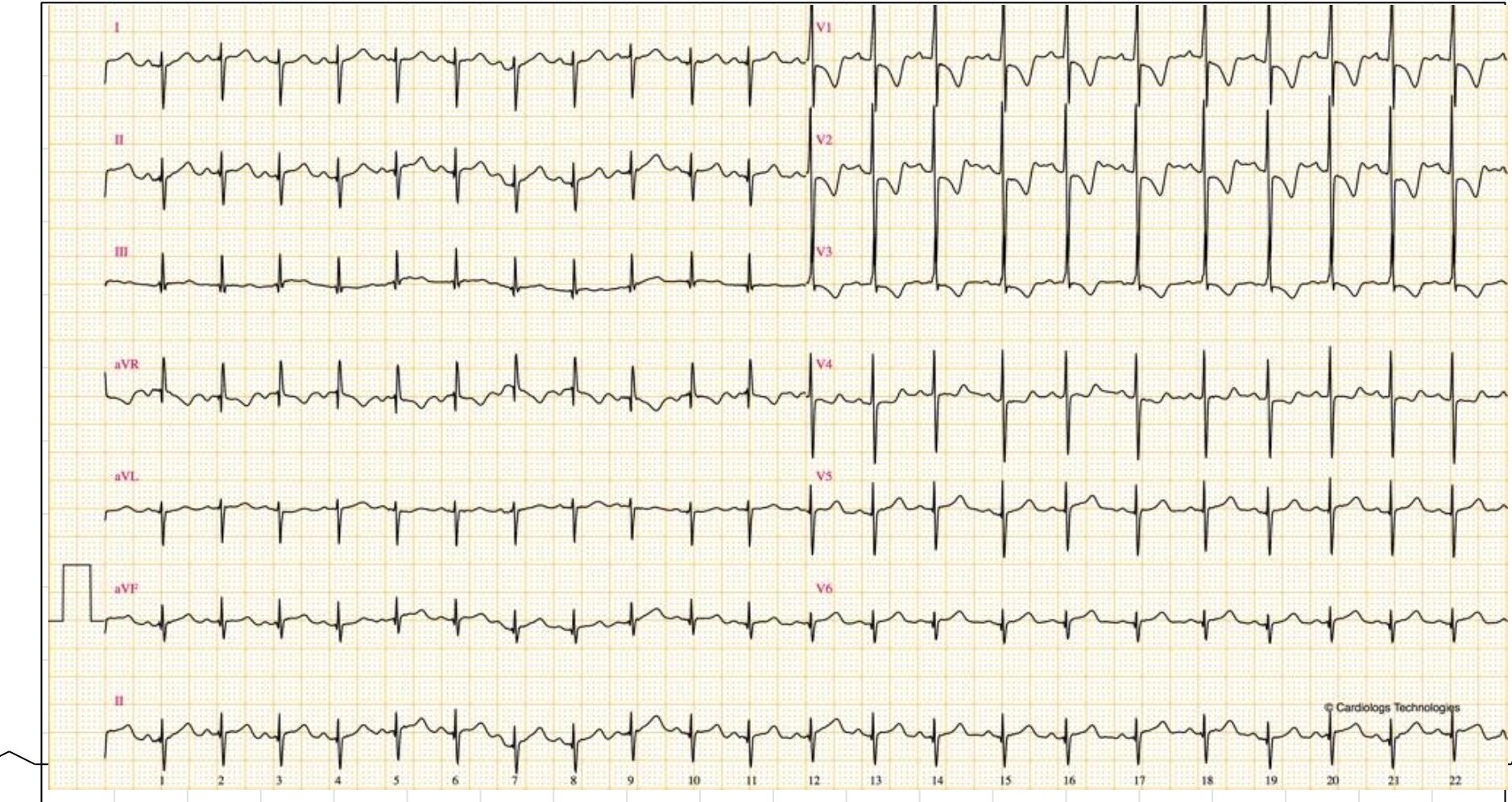
# Interpretation and significance



# ECG N° 03

ECG envoyé par votre ami sur facebook  
Pas de renseignements clinique

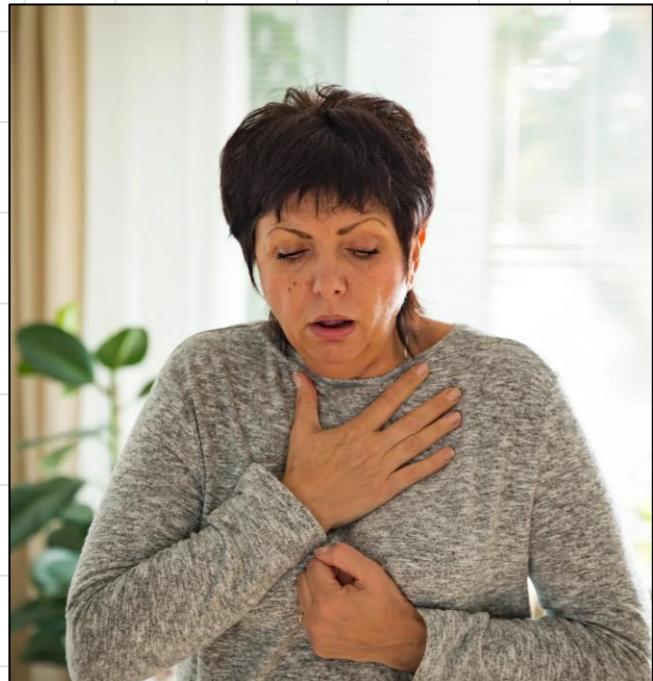


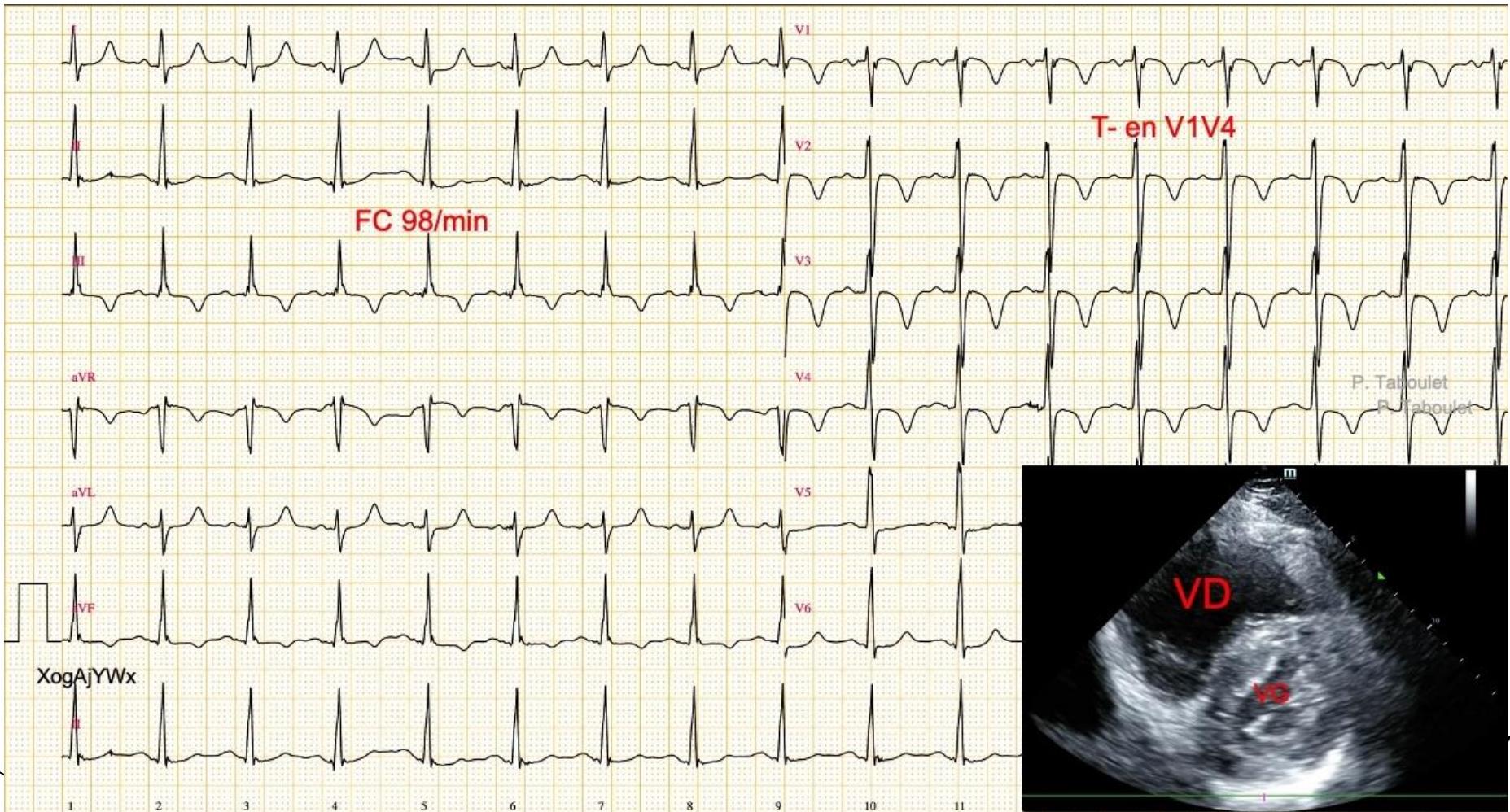


# ECG N° 04

Femme agée de 57 ans consulte aux urgences de cardiologie pour une dyspnée et palpitation ;

1. ATCDs d'une TVP récidivante non traitée
2. KC du sein opérée
3. Obèse
4. Echo : Cœur pulmonaire aigu

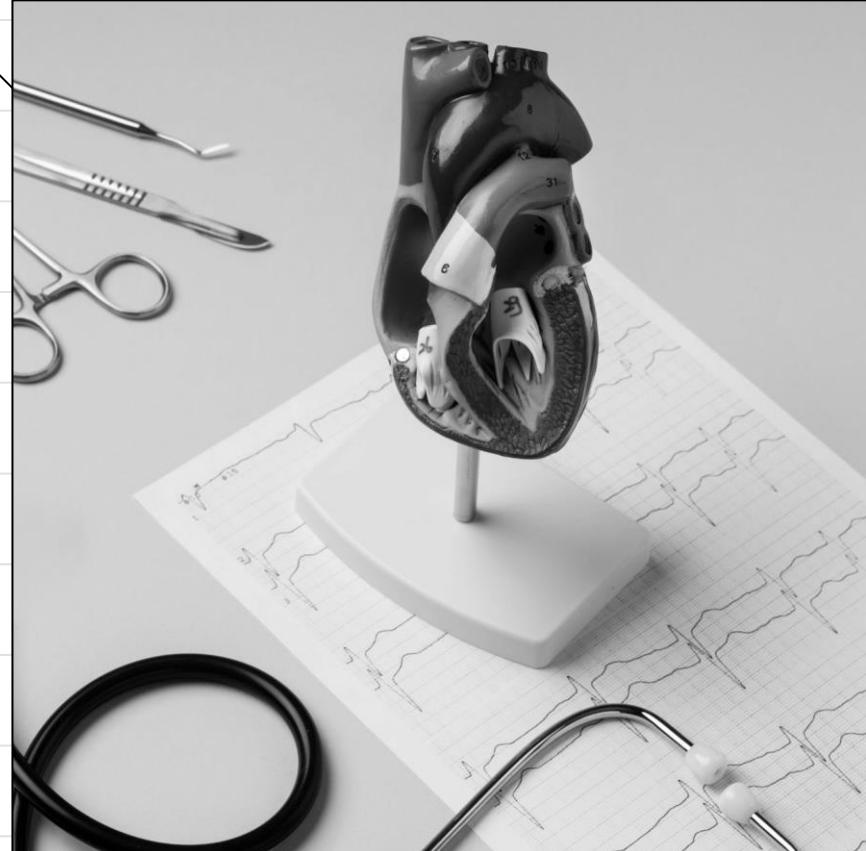




# Clinique

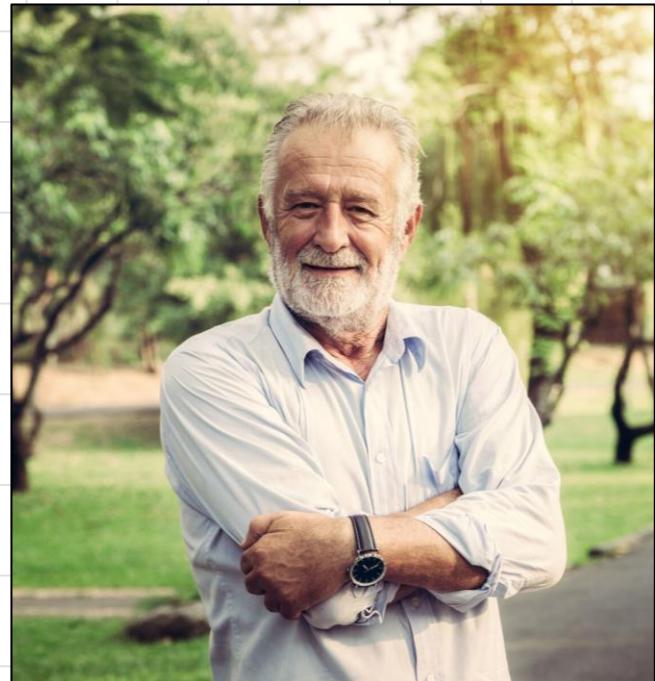
Chaque ECG doit etre interpréter avec une présentation clinique :

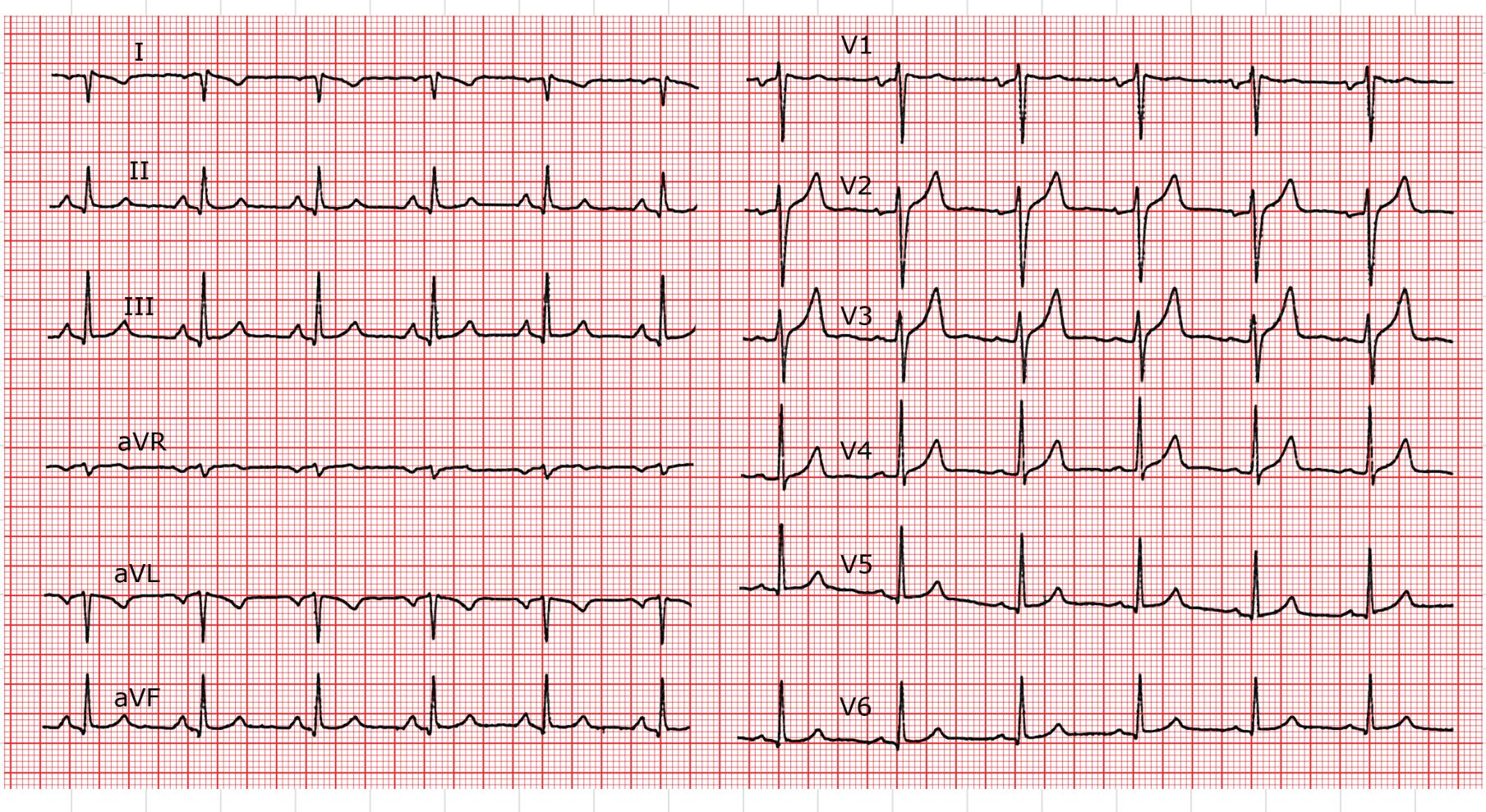
- Age
- Sexe
- ATCDs
- Signes fonctionnels



# ECG N° 05

Homme âgé de 67 ans  
ECG dans le cadre d'un bilan préopératoire  
Sans symptôme

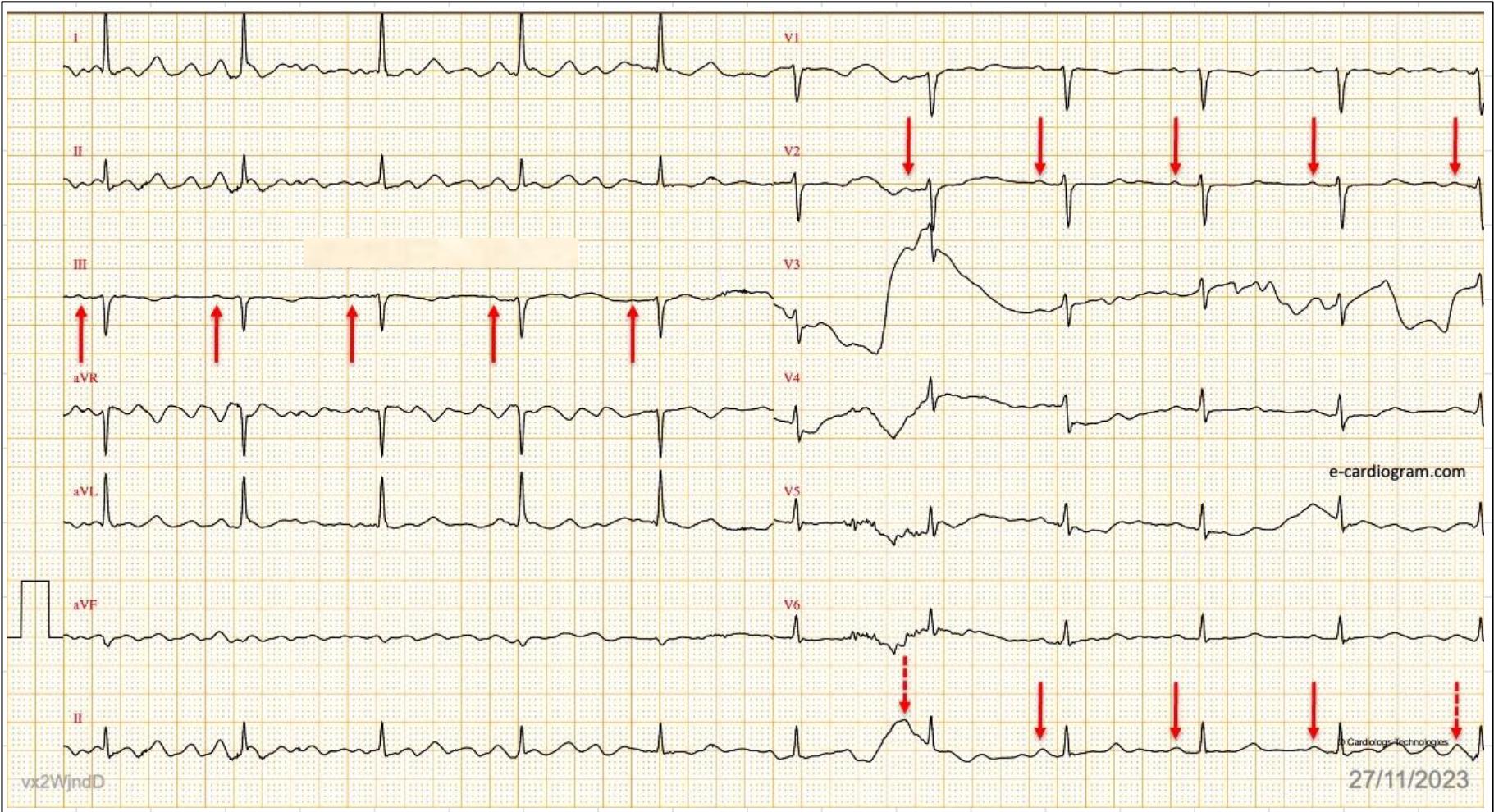




# ECG N° 06

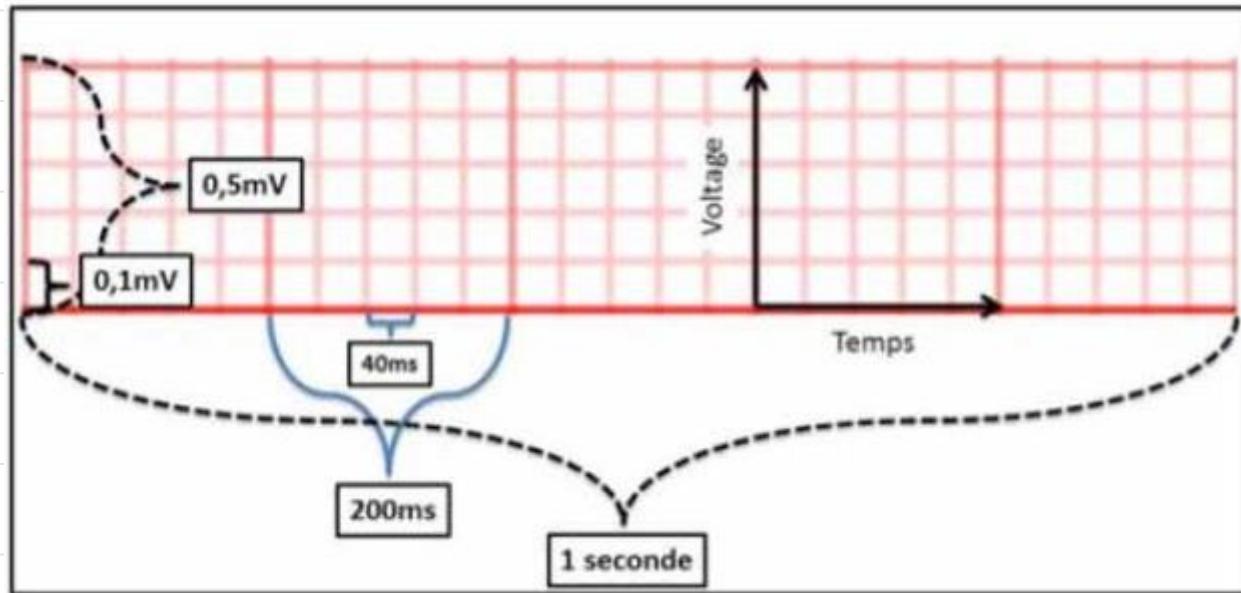
Homme âgé de 37 ans  
ECG dans le cadre d'un bilan préopératoire  
Sans symptôme





# Critère de Qualité

- Etalonnage de Vitesse et d'amplitude
- Artéfact et parasitage
- Inversion / mal placement des électrodes



# Critère de Qualité

Qualité	Interpretation
01	Nom prénom et date
02	Parasitage , dérivations et Pistes
03	Etalonnage

## Remarques

Attention à l'étalonnage +++++ et le nom du patient

# Rythme



# Rythme

**Sinusal**

**Non Sinusal**

# Rythme

Régulier

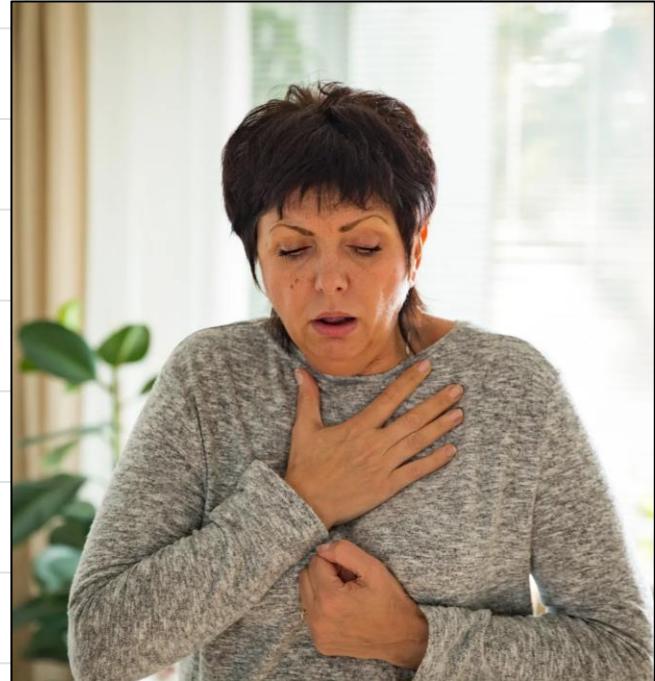
Irrégulièrement  
régulier

Irrégulièrement  
irrégulier

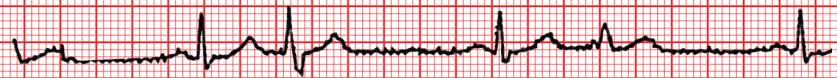
# ECG N° 07

Femme agée de 60 ans consulte pour des palpitation paroxystique :

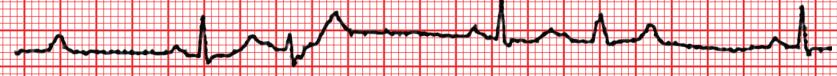
1. ATCDs d'un RAA
2. HTA
3. Diabétique



I



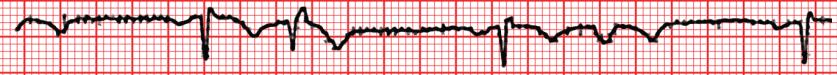
II



III



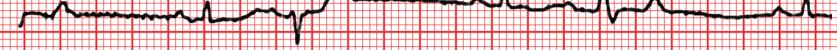
aVR



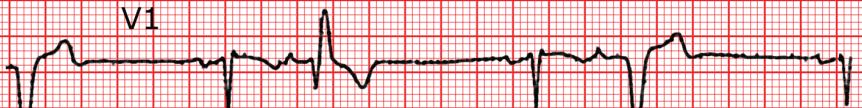
aVL



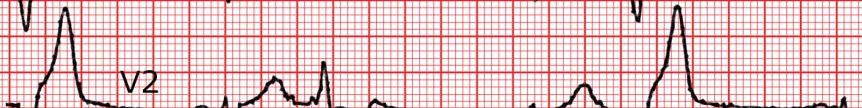
aVF



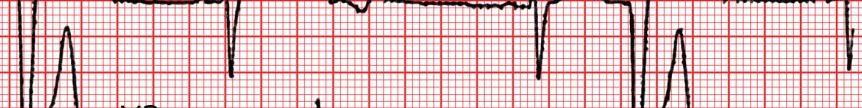
V1



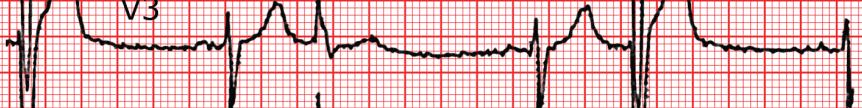
V2



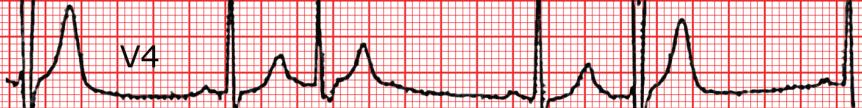
V3



V4



V5



V6

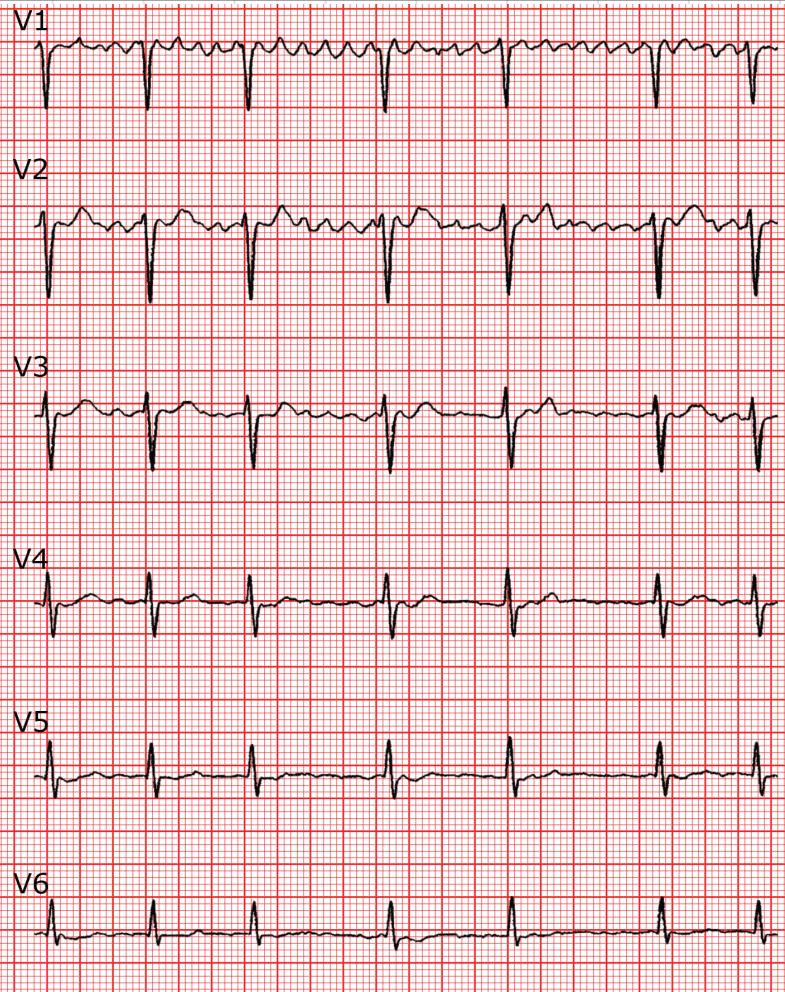
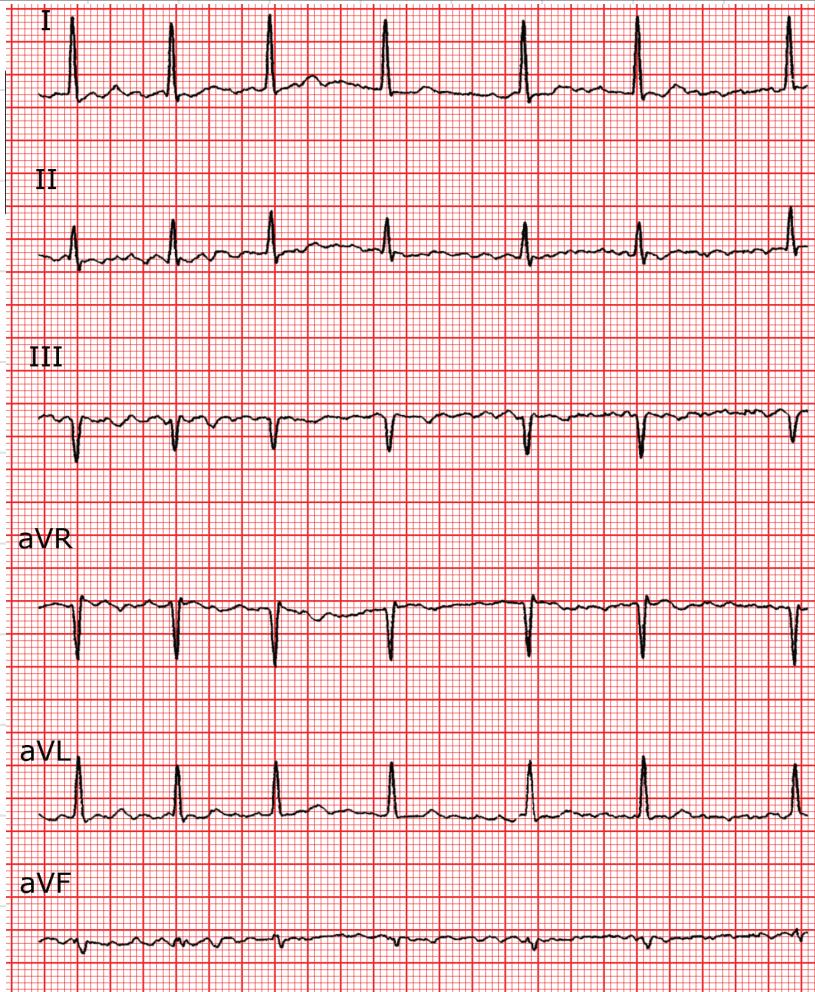


# ECG N° 08

Homme agée de 66 ans consulte pour des palpitation :

1. HTA sous trithérapie
2. Diabétique sous insuline





# **Fréquence**

**Bradycardie**

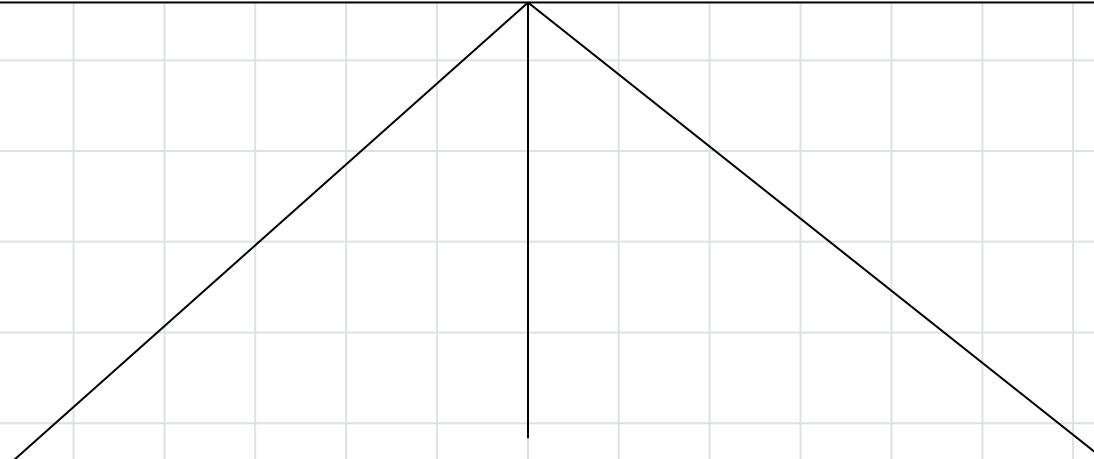
**< 60**

**Normal**

**60-100**

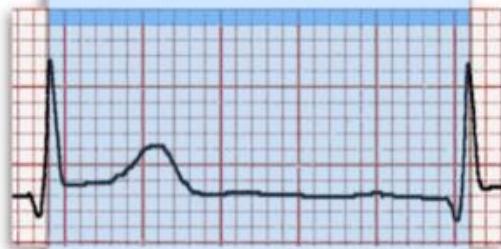
**Tachycardie**

**>100**





**27 SMALL squares**



$$\frac{1500}{27} = 55.6$$

= 56 bpm

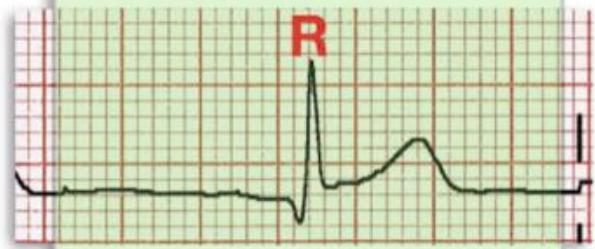
**5.4 LARGE squares**



$$\frac{300}{5.4} = 55.6$$

= 56 bpm

**9 x R waves**



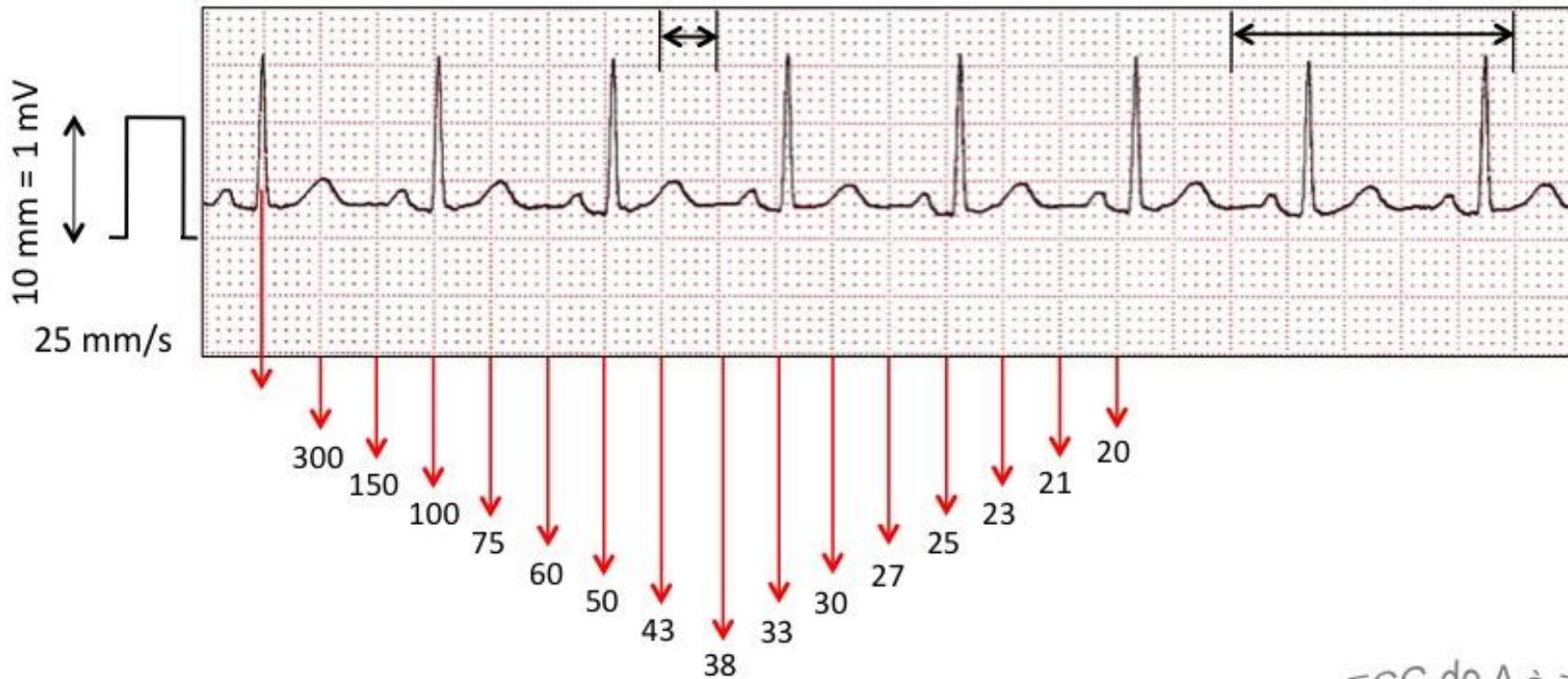
**9 beats in 10 seconds**  
= 9 x 6 beats in 1 minute

= 54 bpm

**Speed: 25 mm/sec**

1 grand carré  
= 5 mm = 0,2 s

5 grands carrés  
= 25 mm = 1 s



# Rythme et Fréquence

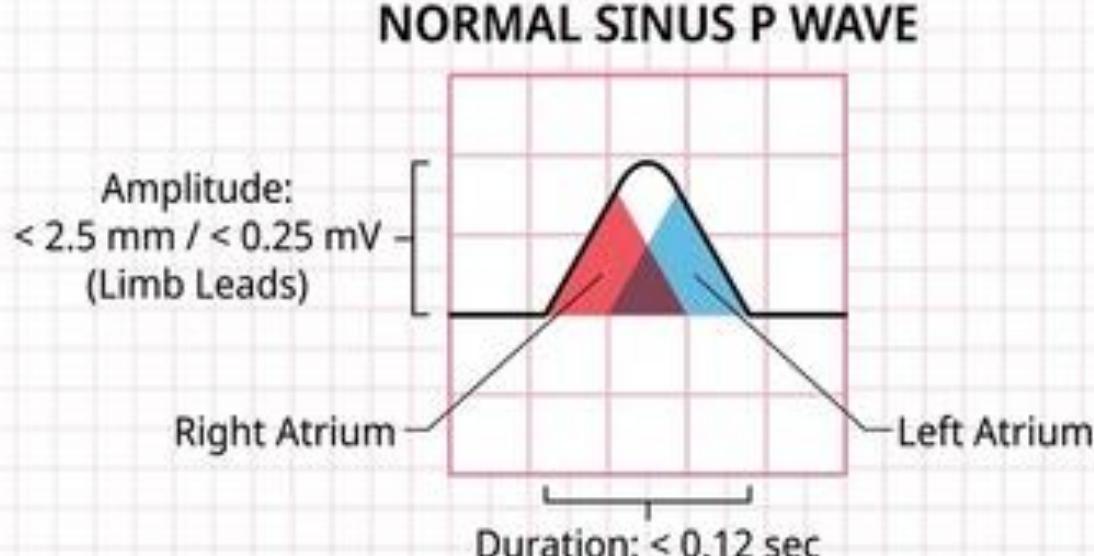
Qualité	Interpretation
04	Rythme
05	Fréquence ventriculaire
06	Cadence ventriculaire moyenne

## Remarques

En cas d'un rythme irrégulier on calcule la cadence ventriculaire moyenne

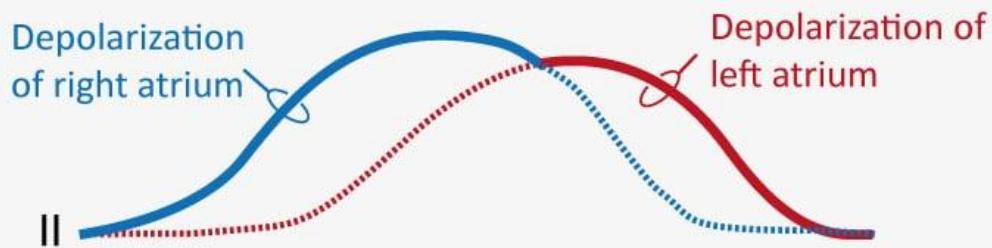
# Auriculogramme

- One P :
  - Durée
  - Amplitude
  - Axe
  - Morphologie
- Espace PR :
  - Durée
  - Rythme



# Onde P

Contour of the normal P wave



The P-wave is always positive in lead II if the rhythm is sinus rhythm. The P-wave may, however, display two humps , as shown here. This is due to the fact that the atria are not depolarized (activated) simultaneously.



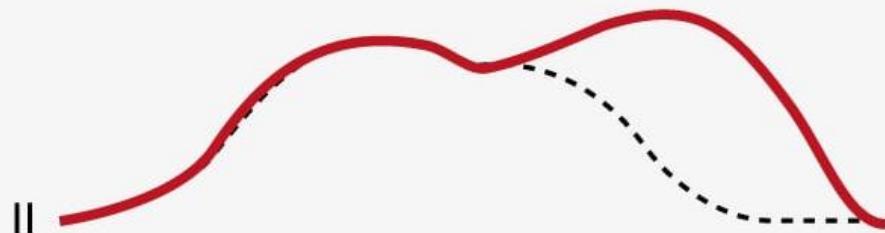
The P-wave in lead V1 may be biphasic, due to the negative deflection caused by depolarization of the left atrium (the electrical vector is directed away from V1).



# Onde P

## P-mitrale

P mitrale is a consequence of left atrial enlargement (often caused by mitral stenosis). Enlargement of the left atrium amplifies its contribution to the contour of the P wave.



Enhanced second hump in lead II.

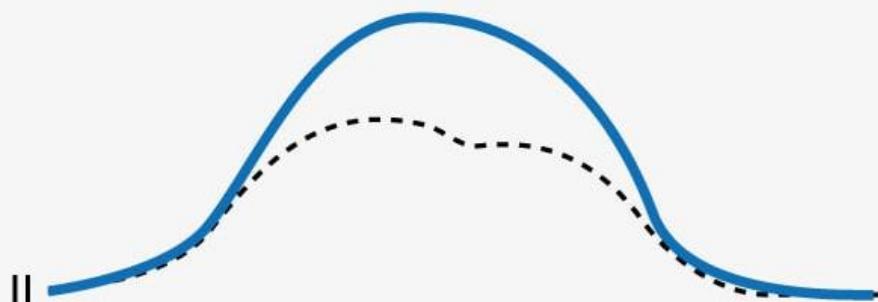


Enhanced negative deflection in V1.

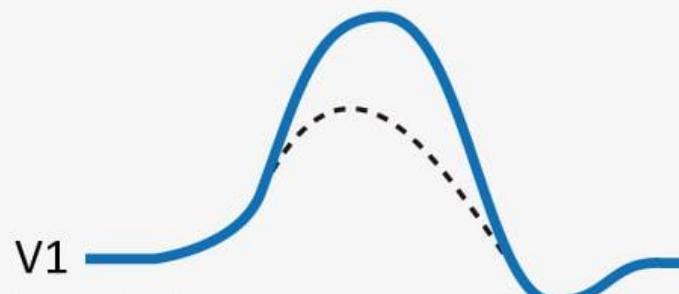
# Onde P

## P-pulmonale

P pulmonale is a consequence of right atrial enlargement. This is often a consequence of pulmonary valve stenosis or increased resistance in the pulmonary circulation. Enlargement of the right atrium causes an increased P wave amplitude in both leads.

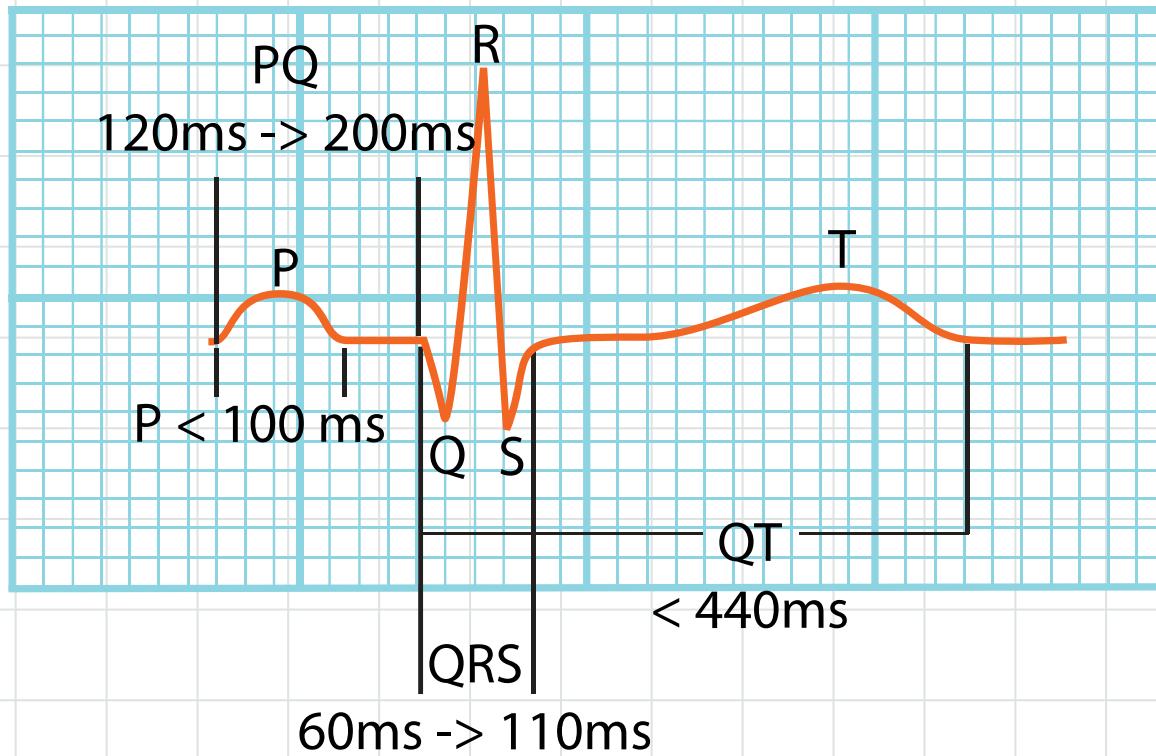


Increased P wave amplitude.



Increased P wave amplitude.

# Espace PQ ( PR )



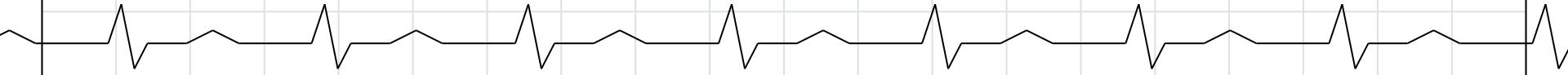
# Auriculogramme

Auriculogramme		Interpretation
07	Onde P	<ul style="list-style-type: none"><li>• Onde P sinusale</li><li>• Durée : 80 ms</li><li>• Axe : 60°</li><li>• Amplitude : 0,1 mV</li><li>• Morphologie : Biphasique en V1, negative en AVR</li><li>• Onde P absente remplacée par des trimulations de la ligne de base</li></ul>
08	Intervalle PR	<ul style="list-style-type: none"><li>• PR : de durée normale : 160 ms</li><li>• Constant dans toute les derivation</li><li>• PR inconstant avec allongement progressive</li><li>• Absence d'intervalle PR par absence de conduction auriculoventriculaire.</li></ul>

# Ventriculogramme

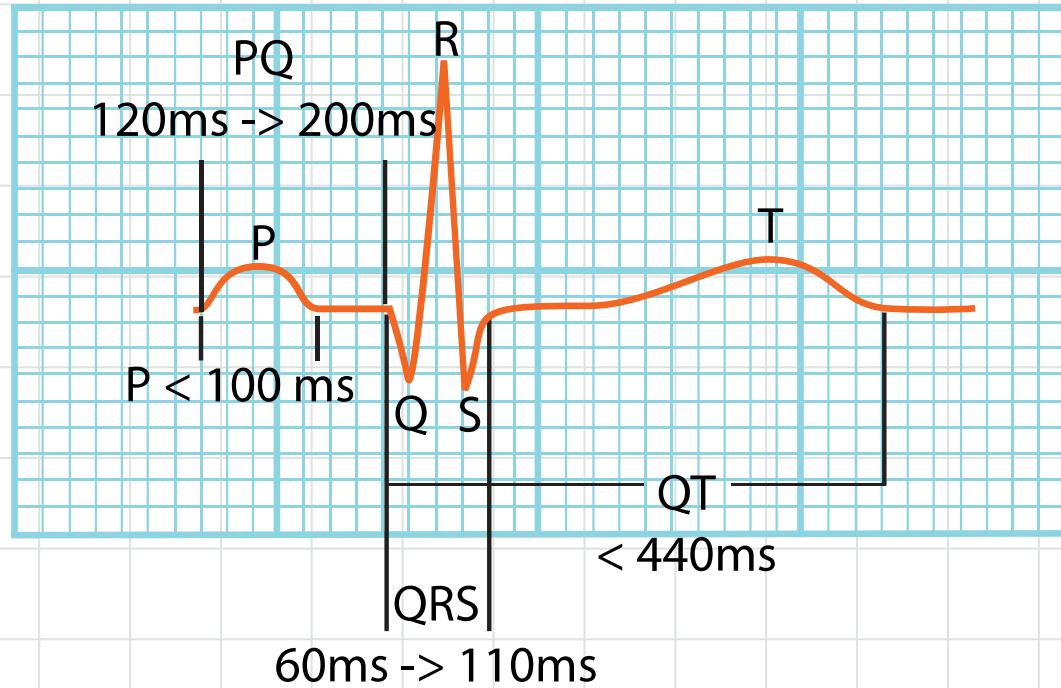
- **Complexe QRS:**

- **Durée**
- **Amplitude**
- **Axe ( axe du Coeur )**
- **Morphologie**



# Durée QRS

**Fin**  
01  
02      **Large**



# Amplitude QRS

01

**Normovolté**

02

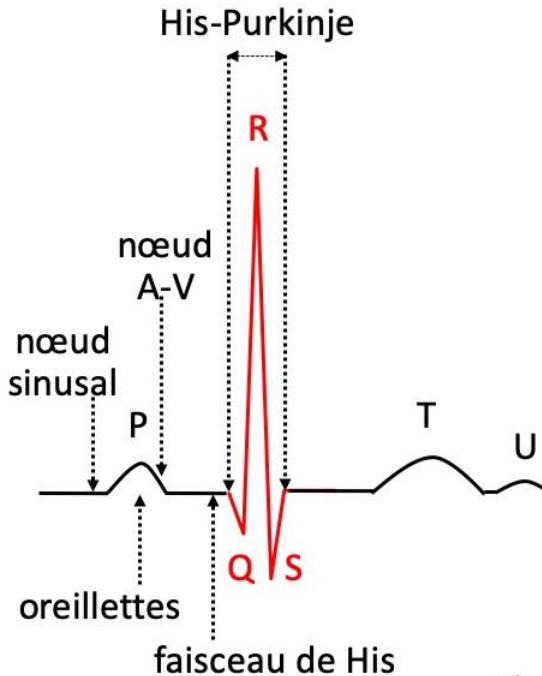
**Hypervolté**

04

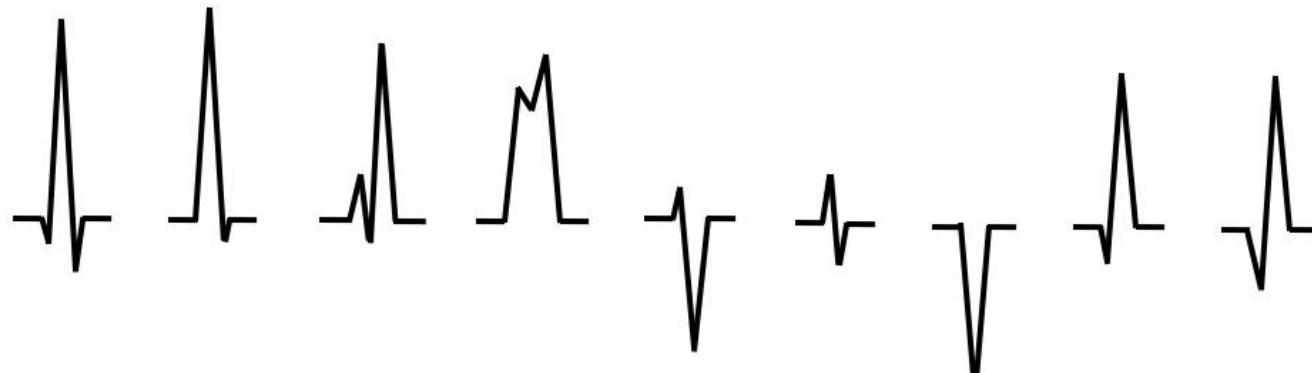
**Microvolté**

02

**Alternant**



# Morphologie QRS



qRs

Rs

rsR'

RR'

rS

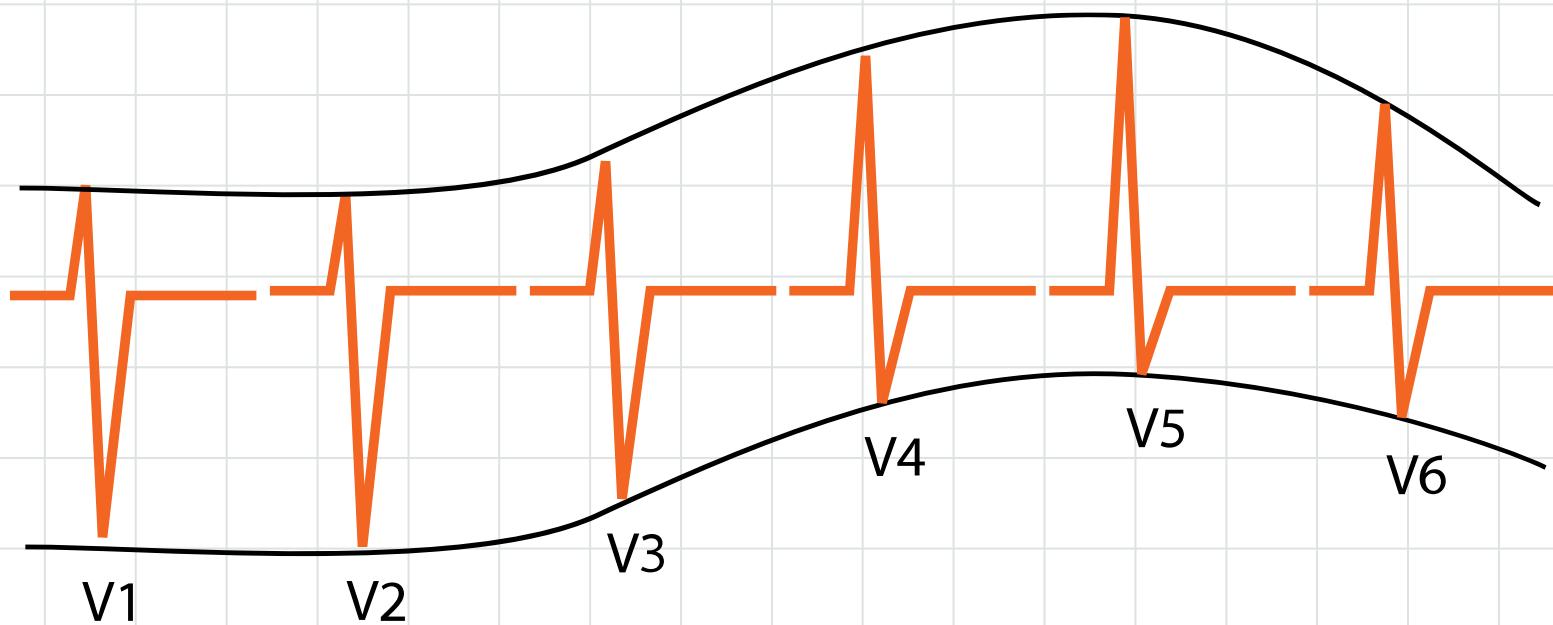
rs

QS

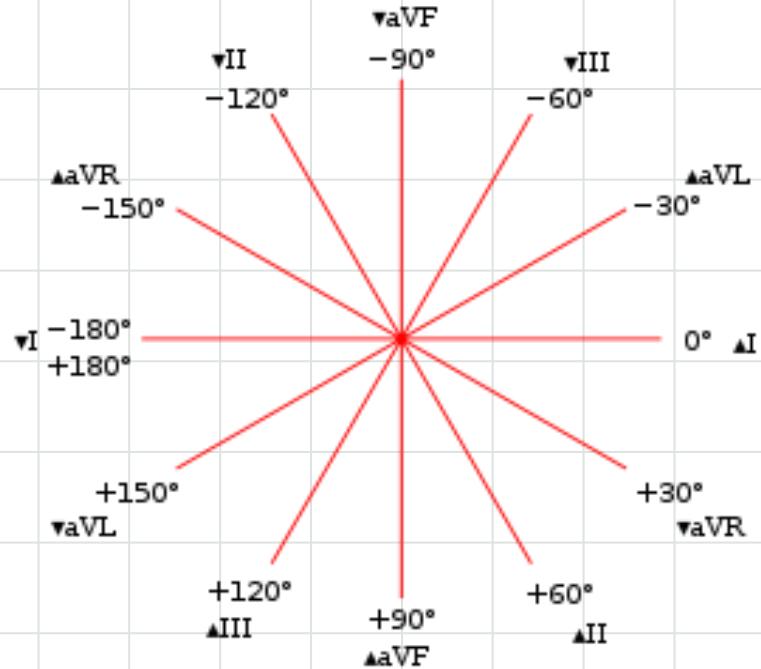
qR

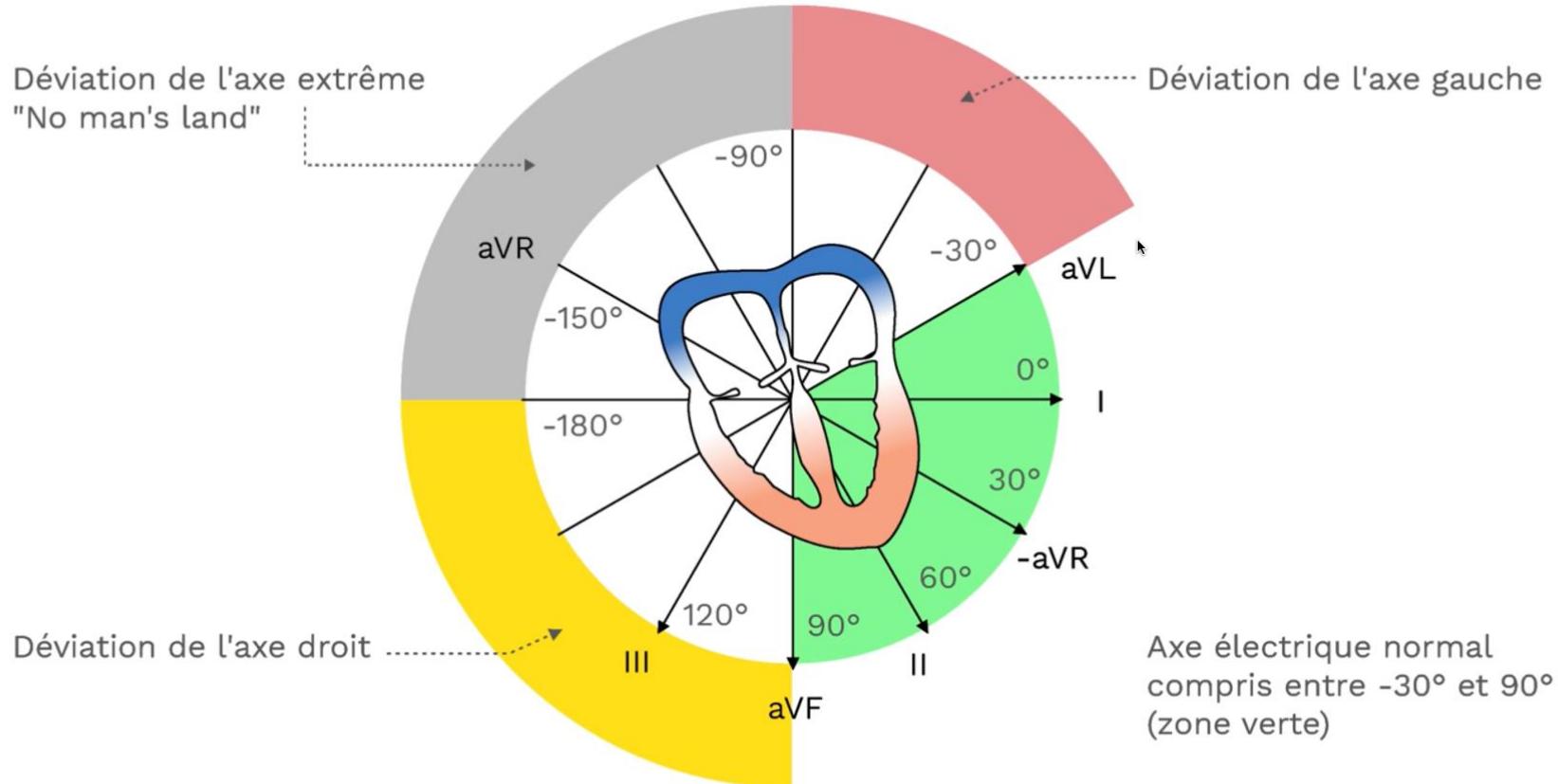
QR

# Morphologie QRS



# Axe du QRS





## AXE du Coeur

# Ventriculogramme

ventriculogramme	Interpretation
09	<p>Complexe QRS</p> <ul style="list-style-type: none"><li>• Fin de :</li><li>• Durée : 80 ms</li><li>• Axe en DII</li><li>• Hypervolté avec des indices élevés</li><li>• Aspect QS en DII DIII , Rabotage de l'onde R de V1 à V4</li><li>• Large de 130 ms de durée</li><li>• Axe hypergauche -50°</li><li>• Aspect R large empaté dans sa partie initiale</li><li>• Aspect QS de de V1 à V4</li></ul>

# Définition de Q de nécrose

**Table 3 Electrocardiographic changes associated with prior myocardial infarction (in the absence of left ventricular hypertrophy and left bundle branch block)**

Thygesen K et al. Eur Heart J. 2018

Any Q wave in leads V<sub>2</sub>-V<sub>3</sub> > 0.02 s or QS complex in leads V<sub>2</sub>-V<sub>3</sub>.

Q wave ≥ 0.03 s and ≥ 1 mm deep or QS complex in leads I, II, aVL, aVF or V<sub>4</sub>-V<sub>6</sub> in any two leads of a contiguous lead grouping (I, aVL; V<sub>1</sub>-V<sub>6</sub>; II, III, aVF).<sup>a</sup>

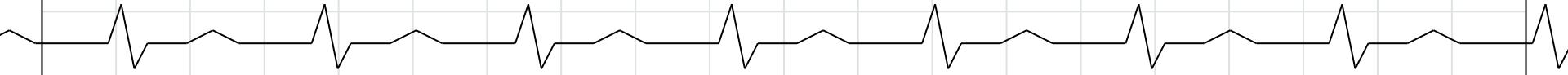
R wave > 0.04 s in V<sub>1</sub>-V<sub>2</sub> and R/S > 1 with a concordant positive T wave in absence of conduction defect.

©ESC/ACC/AHA/WHF 2018

<sup>a</sup>The same criteria are used for supplemental leads V<sub>7</sub>-V<sub>9</sub>. s = seconds.

# Repolarisation

- Segment ST :
  - Morphologie
- Onde T :
  - Amplitude
  - Axe
  - Morphologie
- Intervalle QT :
  - Mesurée
  - Corrigé



# Décalage Segment ST

01

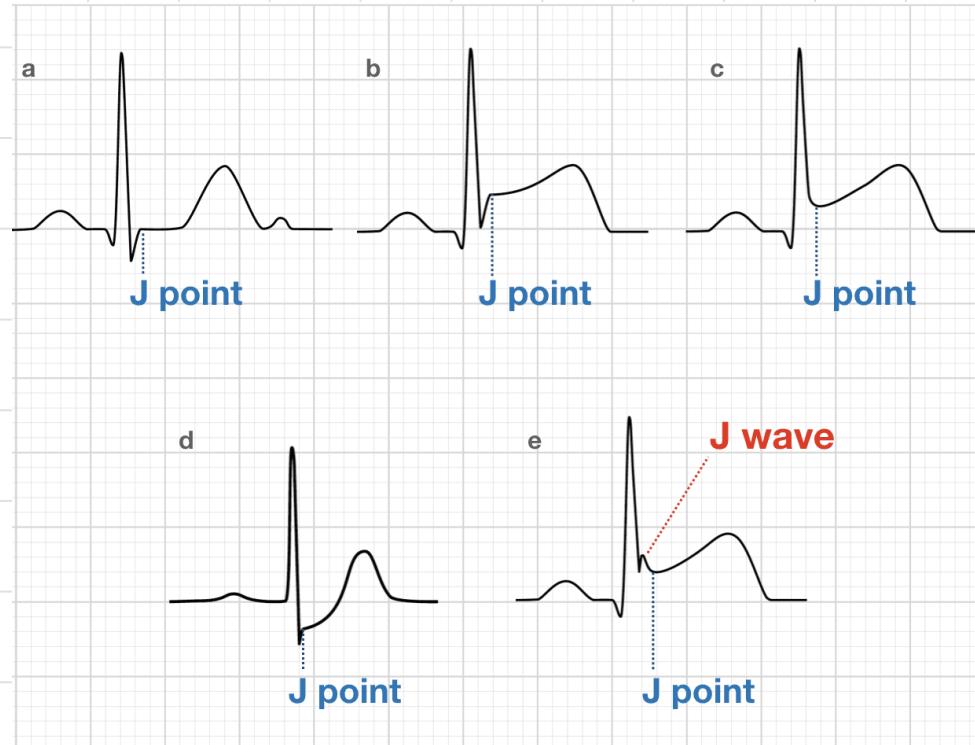
Isoélétrique

02

Sus décalage

03

Sous décalage



# Décalage Segment ST

01

Ascendant

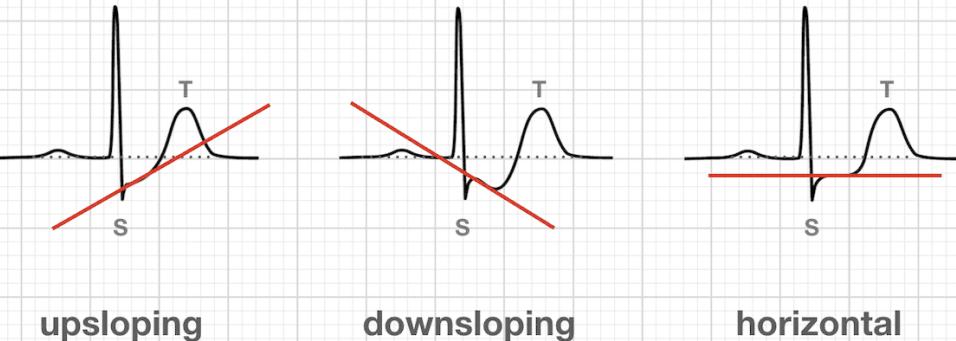
02

Descendant

03

Horizontal

ST segment depression



# Onde T



Normal

Biphasic

Bifid / notched

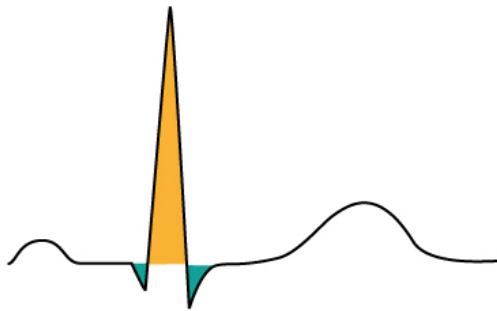
Broad / slow

Flat

Nonspecific ST-T wave abnormalities

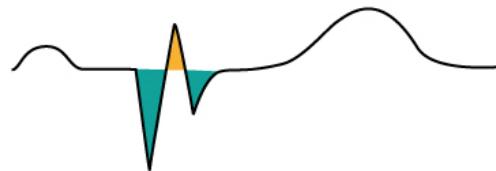
# Onde T

Concordance between QRS and T



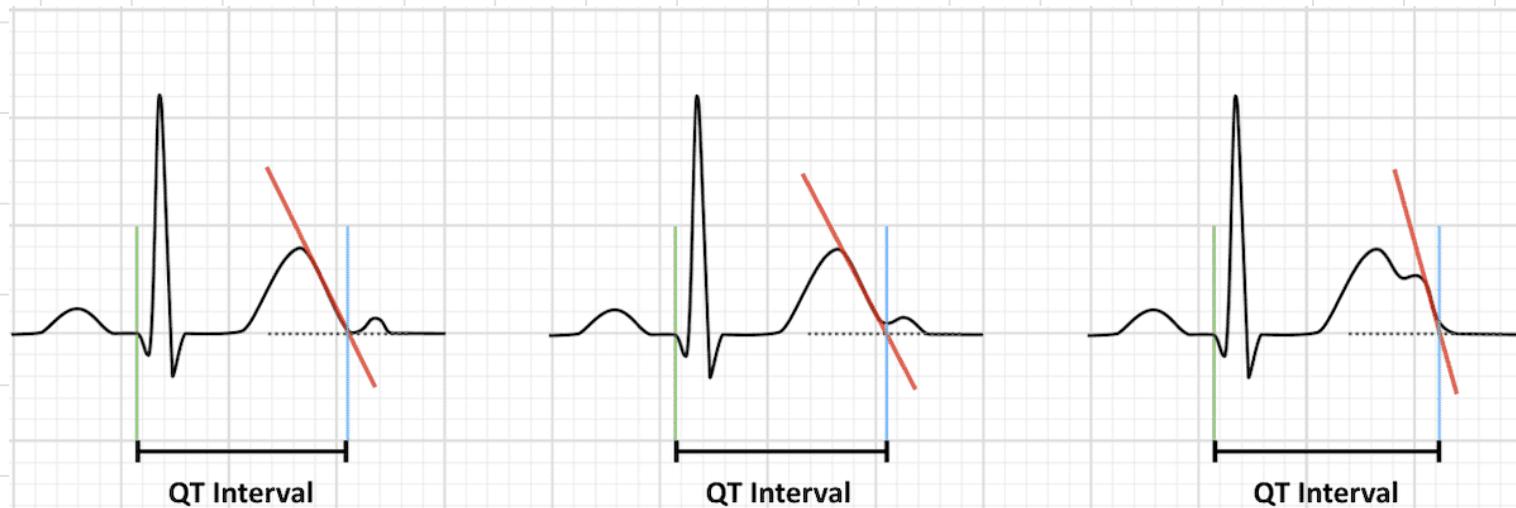
The positive area of the QRS complex is greater than the two negative areas combined. Thus the QRS complex is net positive. The T-wave is also positive.

Discordance between QRS and T



The positive area of the QRS complex is smaller than the negative area. Thus the QRS complex is net negative. The T-wave, on the other hand, is positive.

# Intervalle QT



Intersection of T wave maximum slope with the isoelectric line

# Repolarisation

Repolarisation	Interpretation
10 Segement ST	<ul style="list-style-type: none"><li>• Isoélétrique dans toute les derivation</li><li>• Sus Décalage ascendant du segement ST de 2 mm</li><li>• Concave vers le haut</li><li>• Sous decalage du point J de 2 mm de V1 à V6</li><li>• Avec segment ST horizontal</li><li>• Sus decalage ample du segement ST</li><li>• Convexe vers le haut en inférieur</li></ul>

# Repolarisation

Repolarisation	Interpretation
11 One P	<ul style="list-style-type: none"><li>● Onde P :</li><li>● Ample</li><li>● Symétrique</li><li>● Pointue</li></ul> <ul style="list-style-type: none"><li>● Onde P :</li><li>● Négative</li><li>● Symétrique</li></ul> <ul style="list-style-type: none"><li>● Onde P :</li><li>● Aplatie</li></ul> <ul style="list-style-type: none"><li>● One P ample</li><li>● Englobé par le segment ST</li></ul>

# Repolarisation

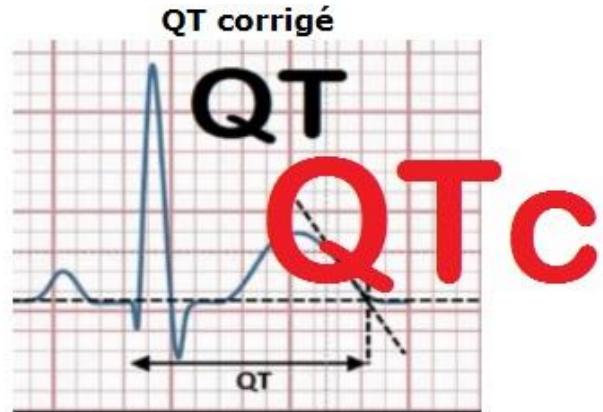
## Repolarisation

## Interpretation

12

Intervalle QT

- QT m = 360 ms
- QT c = 400 ms



QT mesuré :  ms ▾

- Utiliser Fréquence Cardiaque  
 Utiliser Intervalle R-R

Fréquence :  bat./mn

Intervalle R-R :  ms ▾

- Utiliser formule de Framingham  
 Utiliser formule de Bazett  
 Utiliser formule de Fridericia  
 Utiliser formule de Hodges

**Calculer** QT corrigé :  ms

# Masterclass ECG

## Variantes Normales

Repolarisation  
Enfant  
Position du coeur

## Troubles de la conduction

BSA  
BAV

## Hypertrophies

HAD, HAG HBA  
HVD HVG HBV

## Troubles du rythmes

Auriculaire  
Jonctionnel  
ventriculaire

## Blocs intraventriculaire

Blocs et hémibloc  
Gauche et droit  
Bifasiculaire  
Trifasiculaire

## Insuffisance coronaire

SCA ST+ ST-  
IDM

# Masterclass ECG

## Syndromes de préexcitation

WPW  
PR court

## Troubles électrolytique

Dyskaliémie  
Dyscalcémie

## Modifications médicamenteuse

Digitalique  
Quinidine  
Amiodarone  
ETC

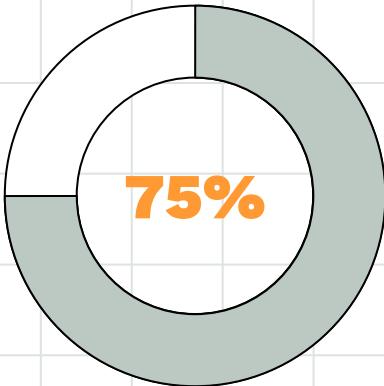
## Entrainement électrosystolique

Pacemaker

## Cas cliniques

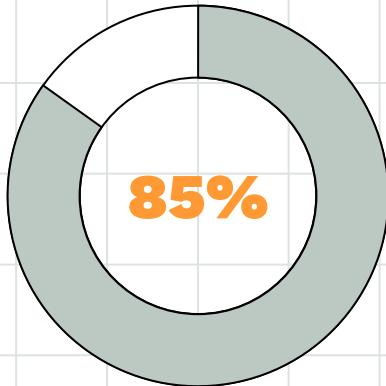
## Stage pratique aux urgences

# Challenges



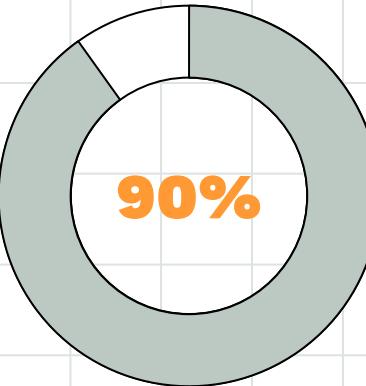
**Analytique**

Travail de groupe



**Synthétique**

Groupe +/- individuel



**Diagnostic**

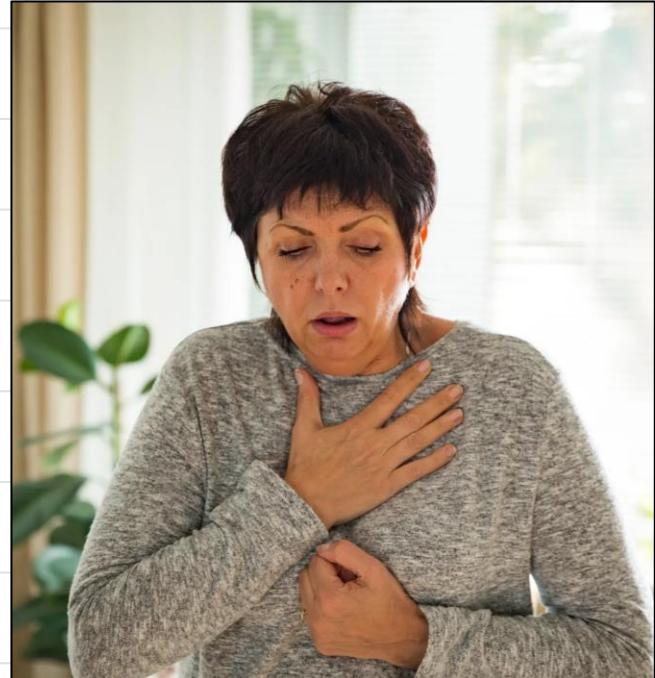
Individuel

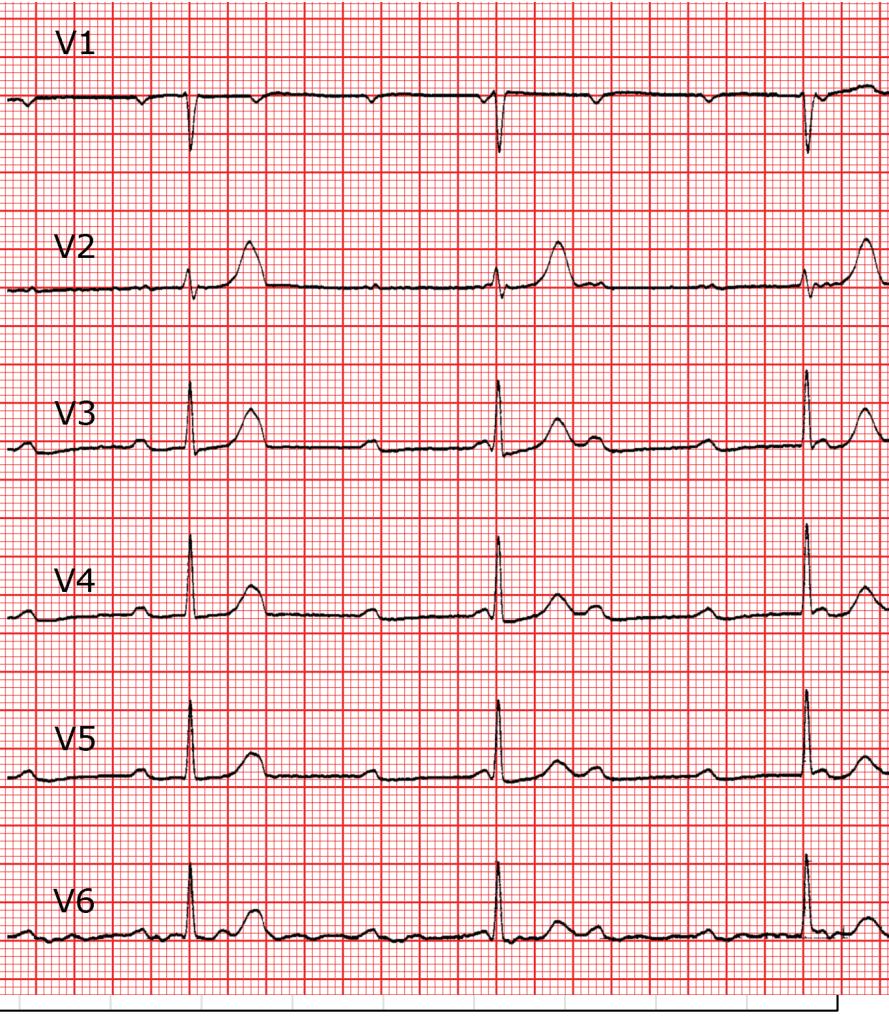
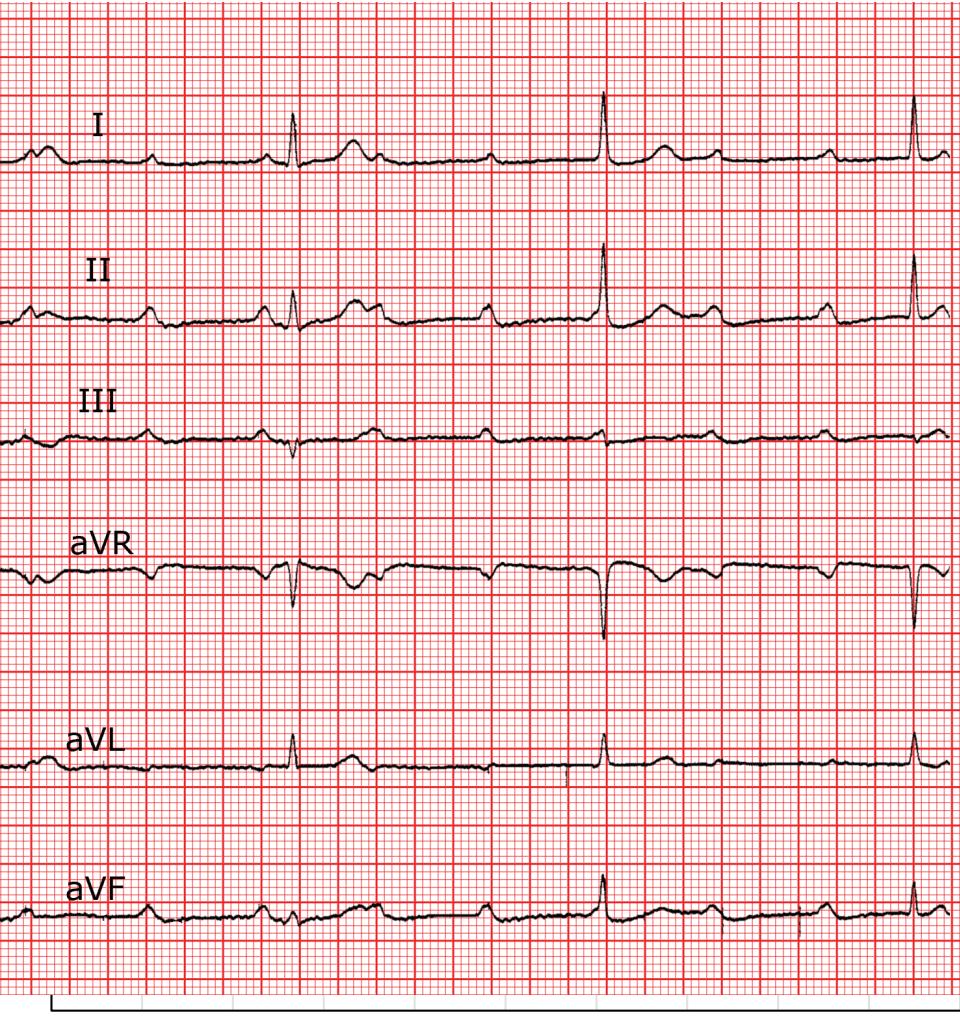


# ECG N° 01

Femme agée de 70 ans consulte pour des  
Des lipothymie :

1. HTA





# ECG N° 01

## Réponse :

### **Rythme de base**

Sinusal, régulier 105/min (pour les ondes P) et 38/min pour les QRS.



### **QRS**

Axe et durée normaux.

### **Segment ST**

Isoélectrique

### **Ondes T**

Normales.

### **Intervalle QT**

Normal.



P-R constant  $\geq$  200 ms



BAV I

P-R croissant  
jusqu'à P bloquée



BAV II Mobitz 1  
(Wenckebach)

P-R constant  
ratio P/QRS = 2



BAV 2/1  
(intranodal QRS fins,  
infranodal QRS larges\*)

P-R constant  
P bloquée parfois



BAV II Mobitz 2  
(infranodal\*)

PP réguliers  
 $\geq$  2 P bloquées



BAV haut degré  
(infranodal\*)

Dissociation entre P  
et complexes QRS



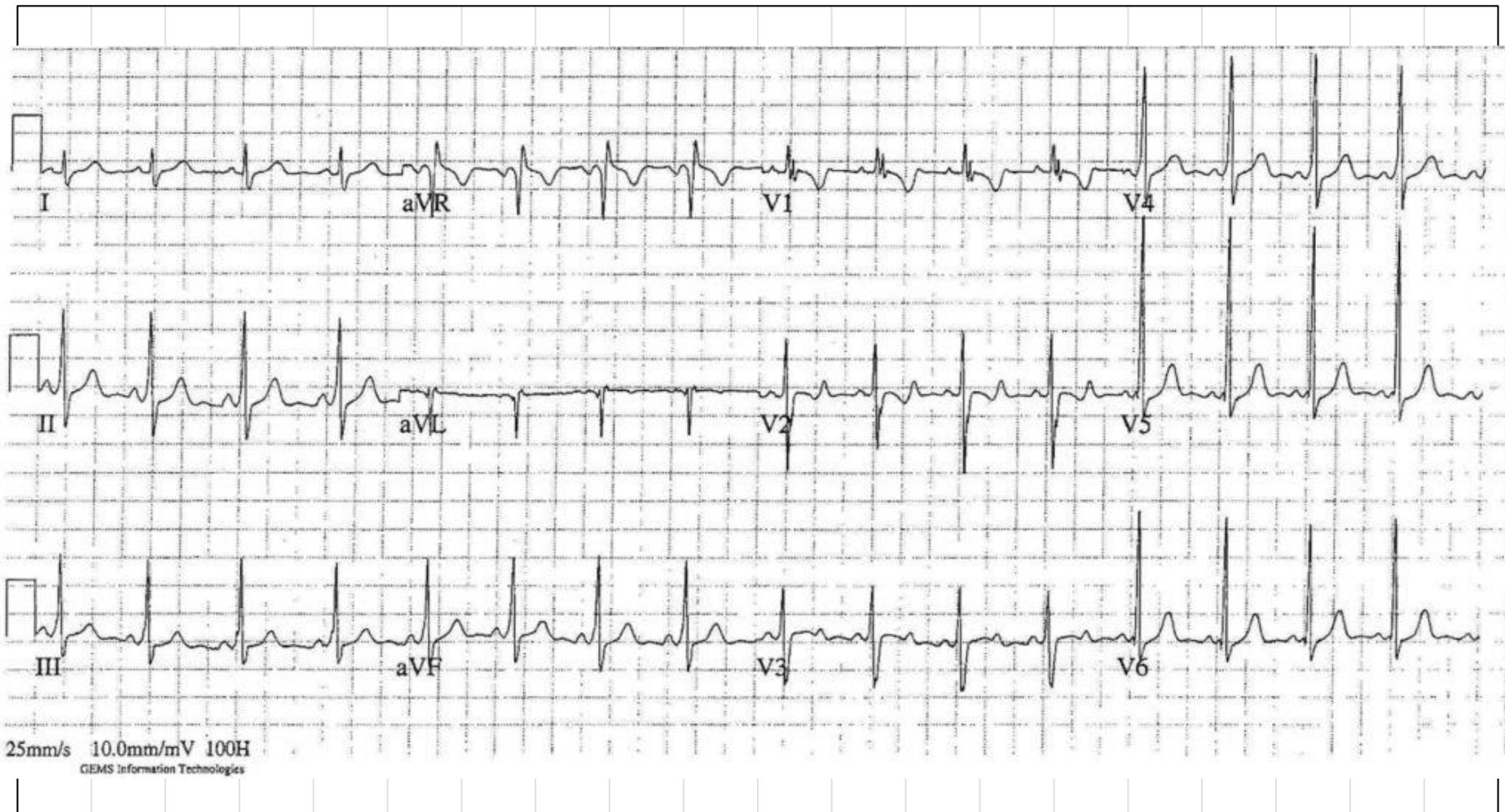
BAV III  
(infranodal\*)

# ECG N° 02

Enfant de 07 ans consulte avec sa maman pour les palpitations :

1. Sans ATCDs pathologique





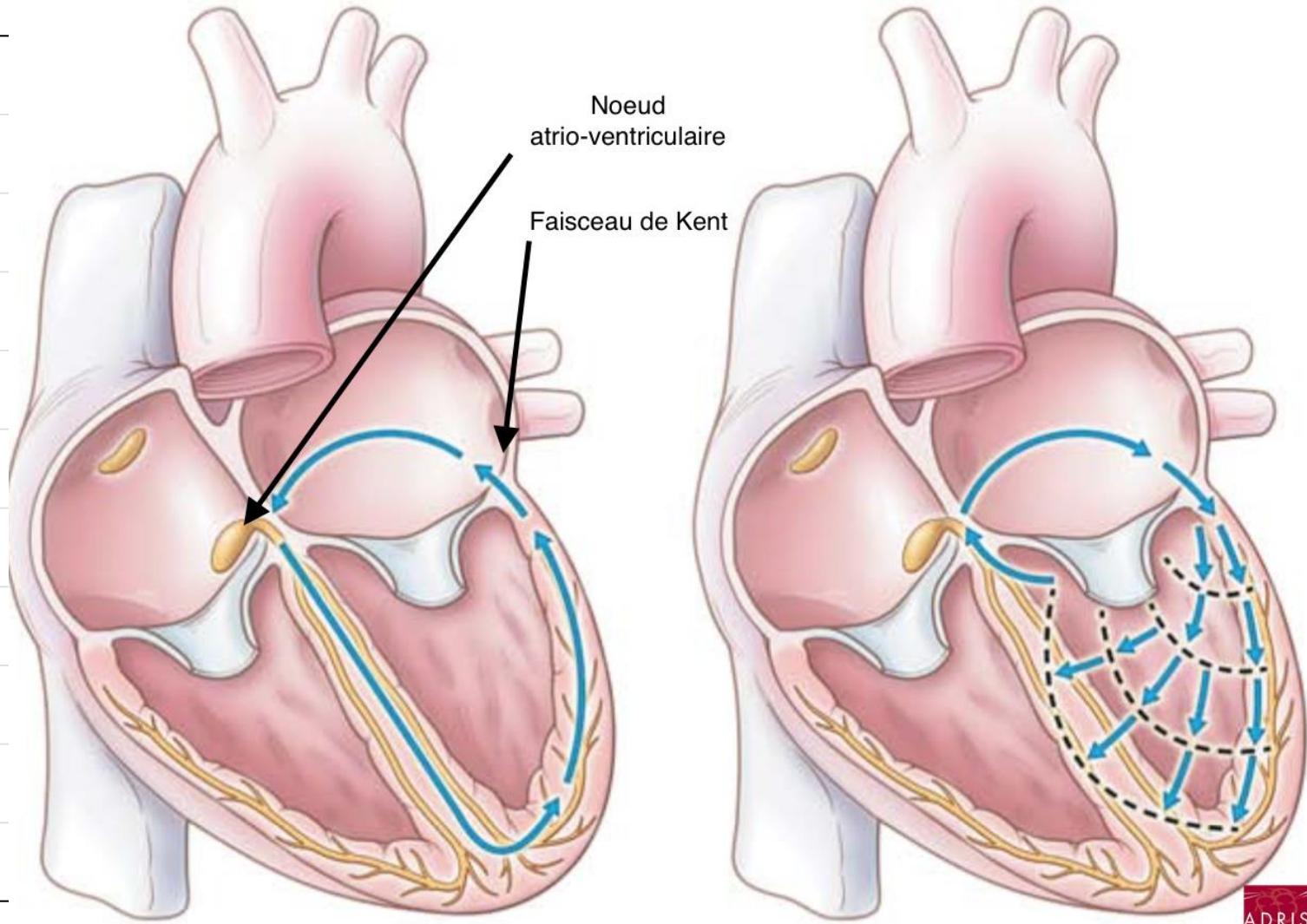
# ECG N° 02

## Réponse :

- Normal sinus rhythm, rate 96 bpm
- Short PR interval ~100ms
- Slightly broad QRS
- Apparent delta waves, best visualised in inferior leads

Syndrome de Wolf Parkinson White



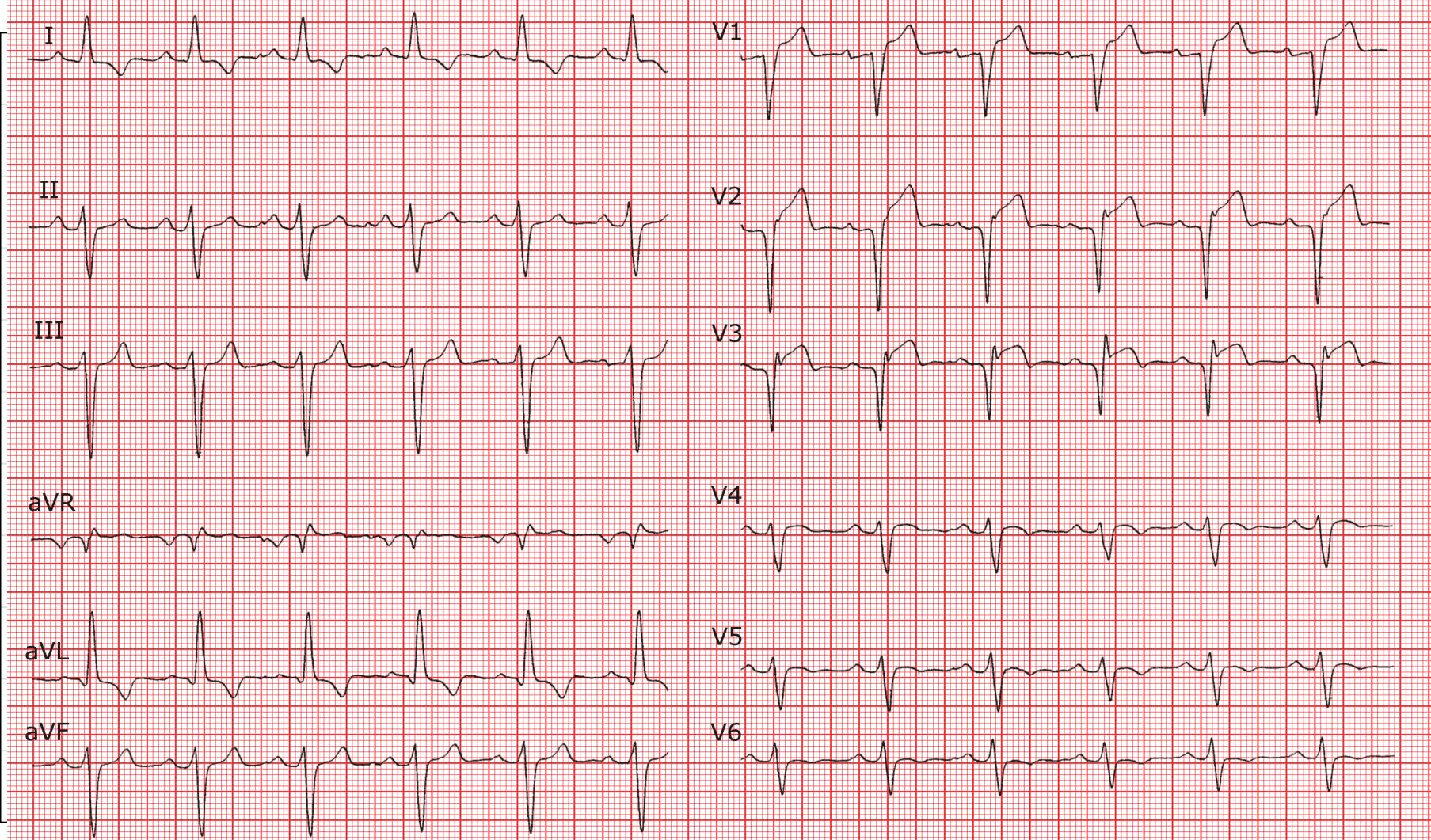


# ECG N° 03

Homme agé de 67 ans consulte pour une dyspnée stade IV de la NYHA avec orthopnée

1. Hypertendu
2. Diabétique mal équilibré
3. Tabagique





# ECG N° 03

## Réponse :

### **Rythme de base**

Sinusal, régulier à 75 bpm.

### **Ondes P**

Normales.

### **Ancien infarctus antérieur avec anévrisme ventriculaire. Hémibloc antérieur gauche.**

Normal.

### **QRS**

Durée normale (110 ms), axe -60° aspect QS de V1 à V3, rS (onde de faible amplitude) de V4 à V6.

### **Segment ST**

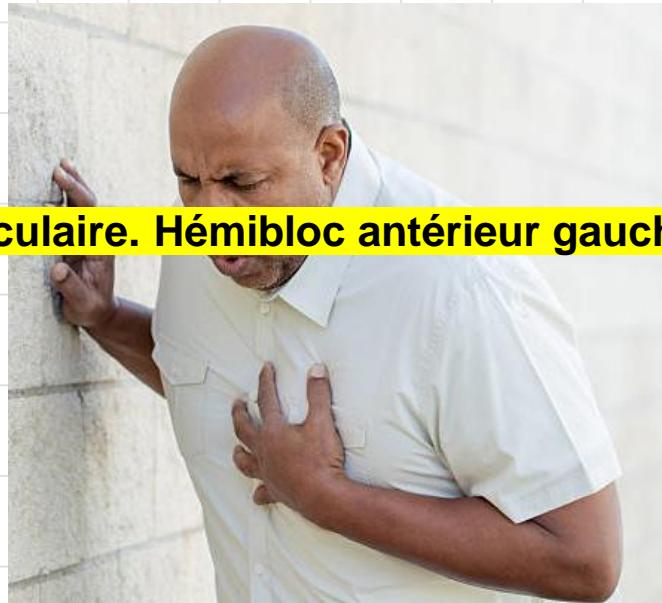
Sus-décalé de V1 à V4.

### **Ondes T**

Négatives en I, aVL et de V4 à V6.

### **Intervalle QT**

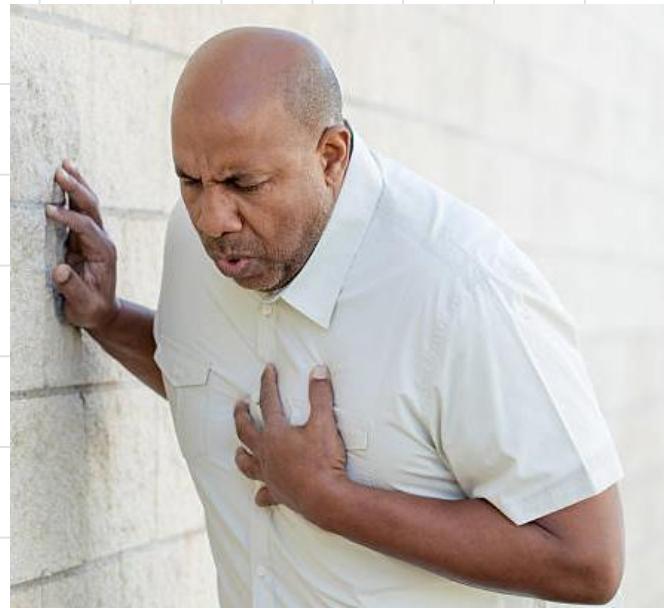
Normal.

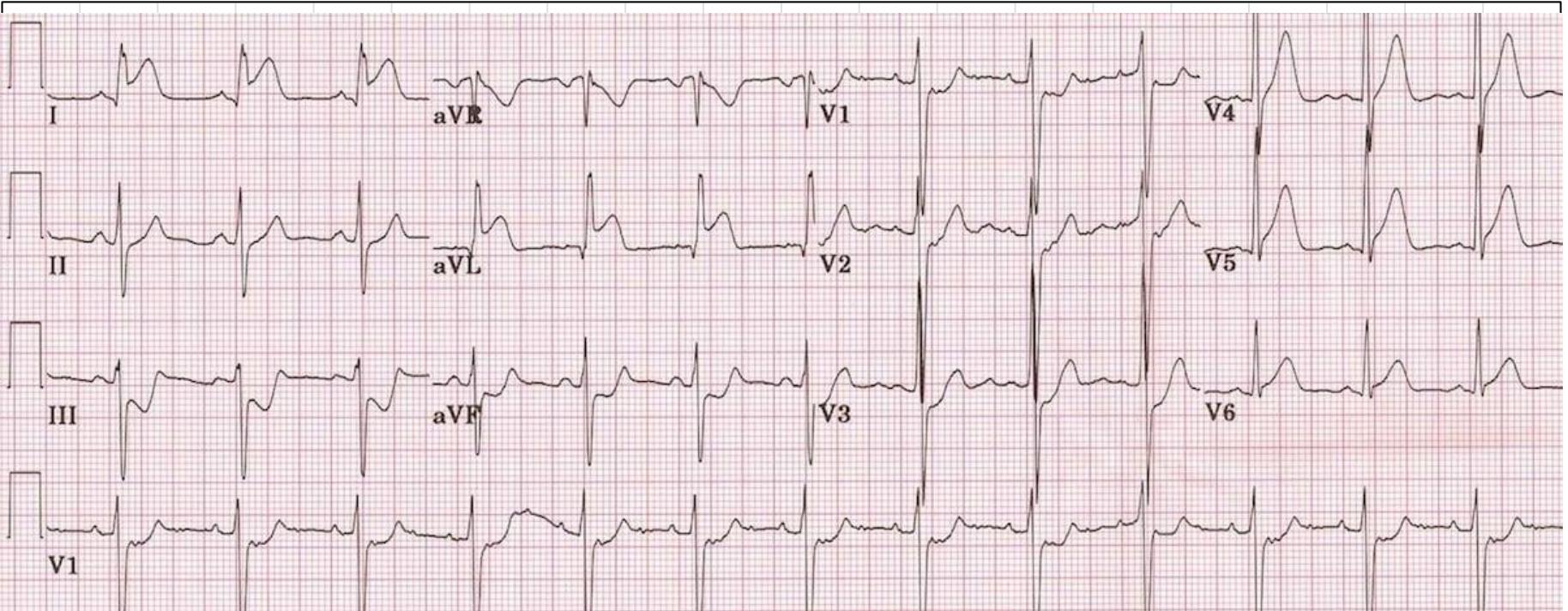


# ECG N° 04

Homme agé de 50 ans consulte pour une douleur thoracique angineuse

1. Tabagic 40 PA



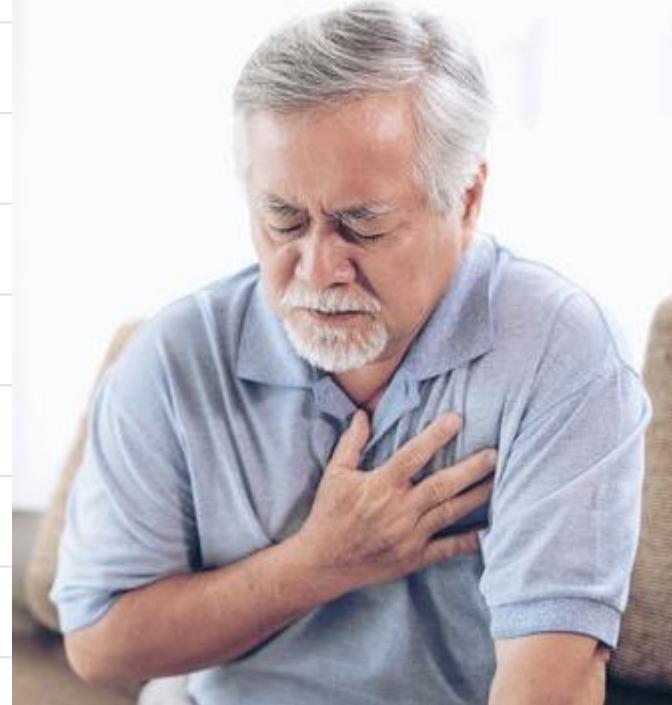


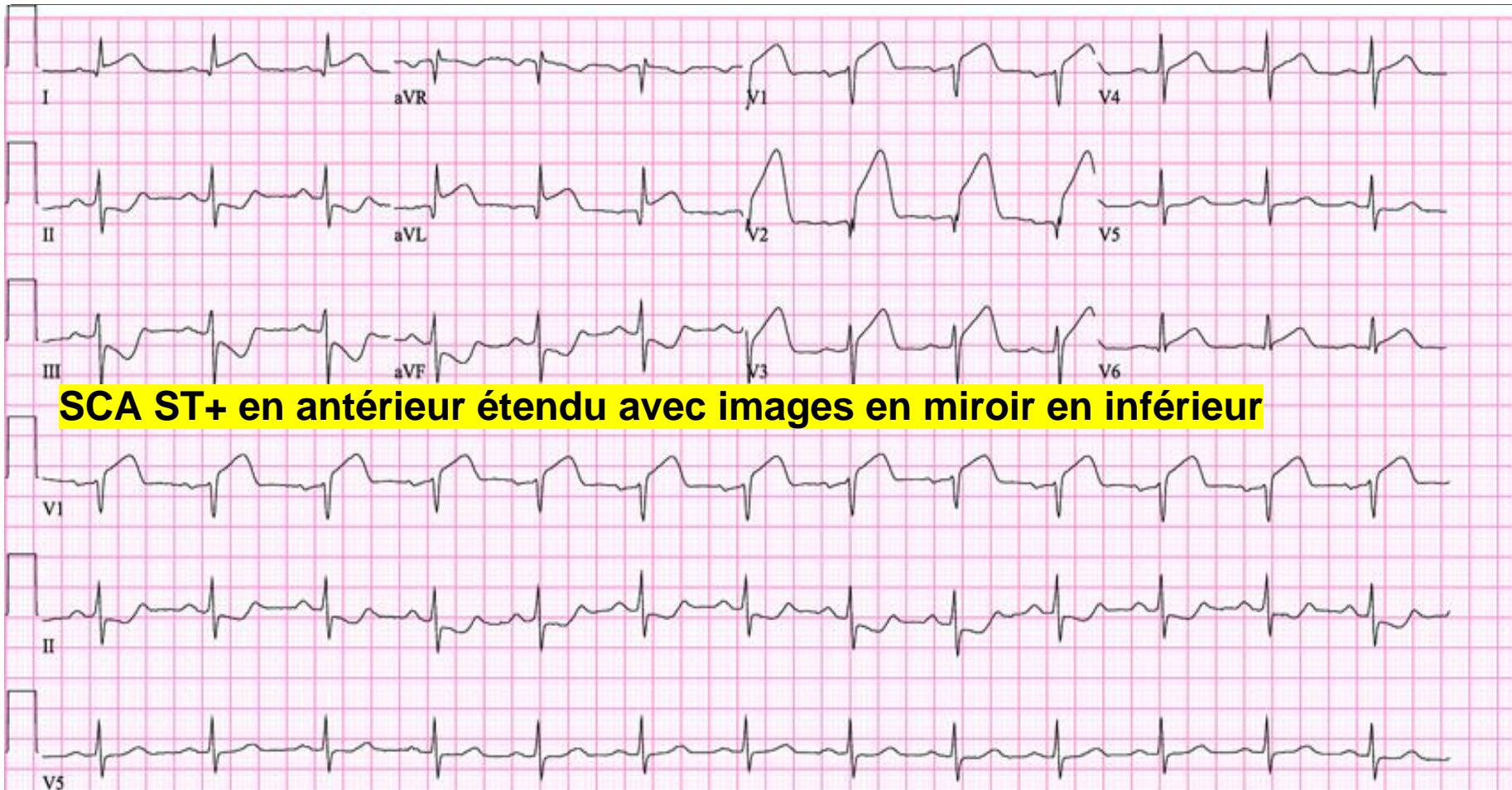
**SCA ST+ en Latéral avec images en mirroire en antéro septal et inférieur**

# ECG N° 05

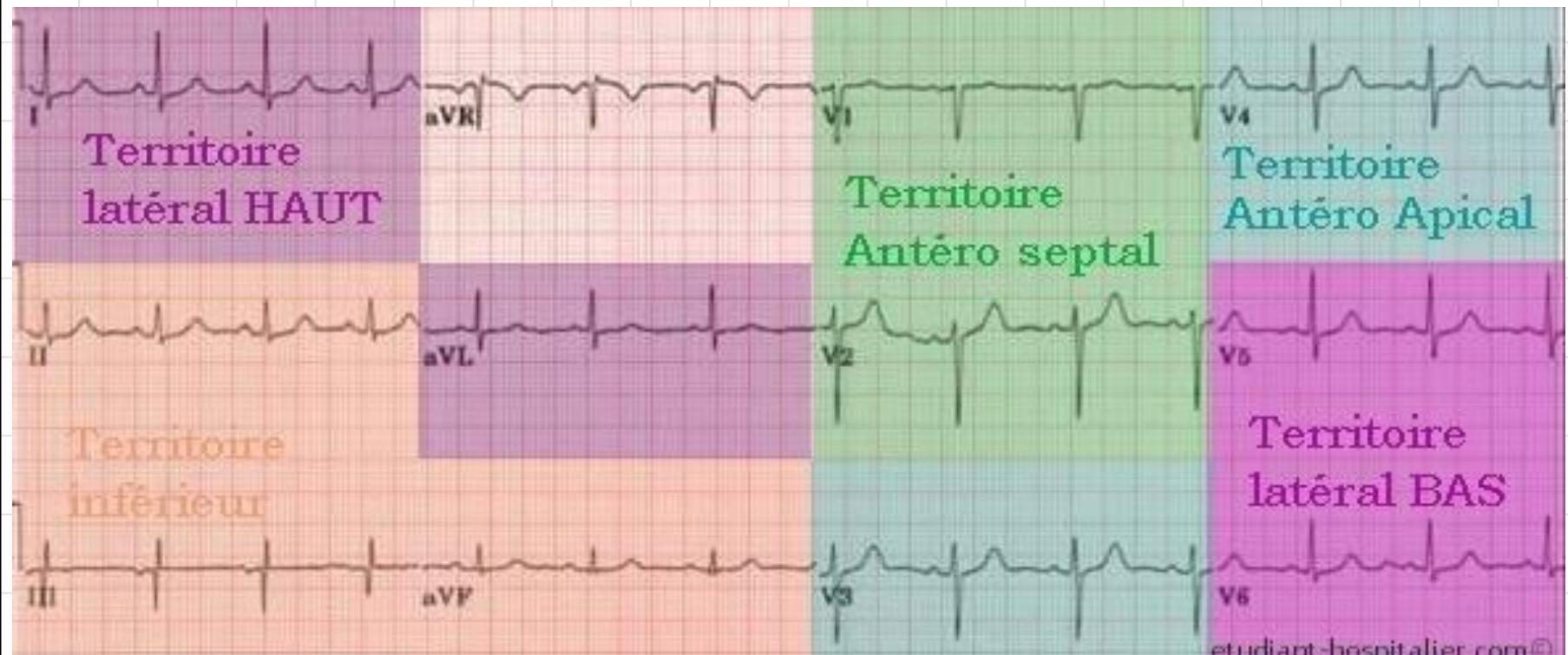
Homme agé de 55 ans consulte pour une douleur thoracique angineuse

1. Tabagique
2. Hypertendu
3. Diabétique
4. Obèse





**SCA ST+ en antérieur étendu avec images en miroir en inférieur**

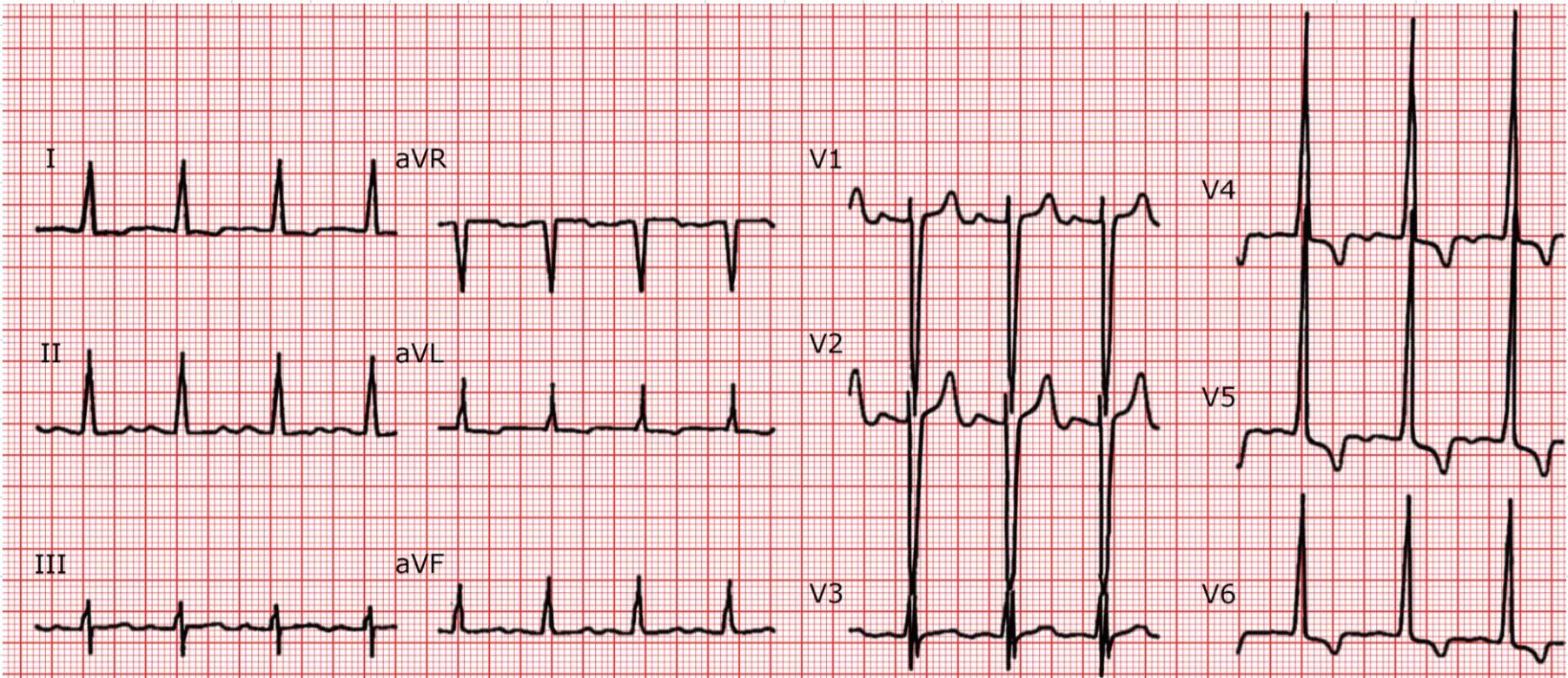


# ECG N° 06

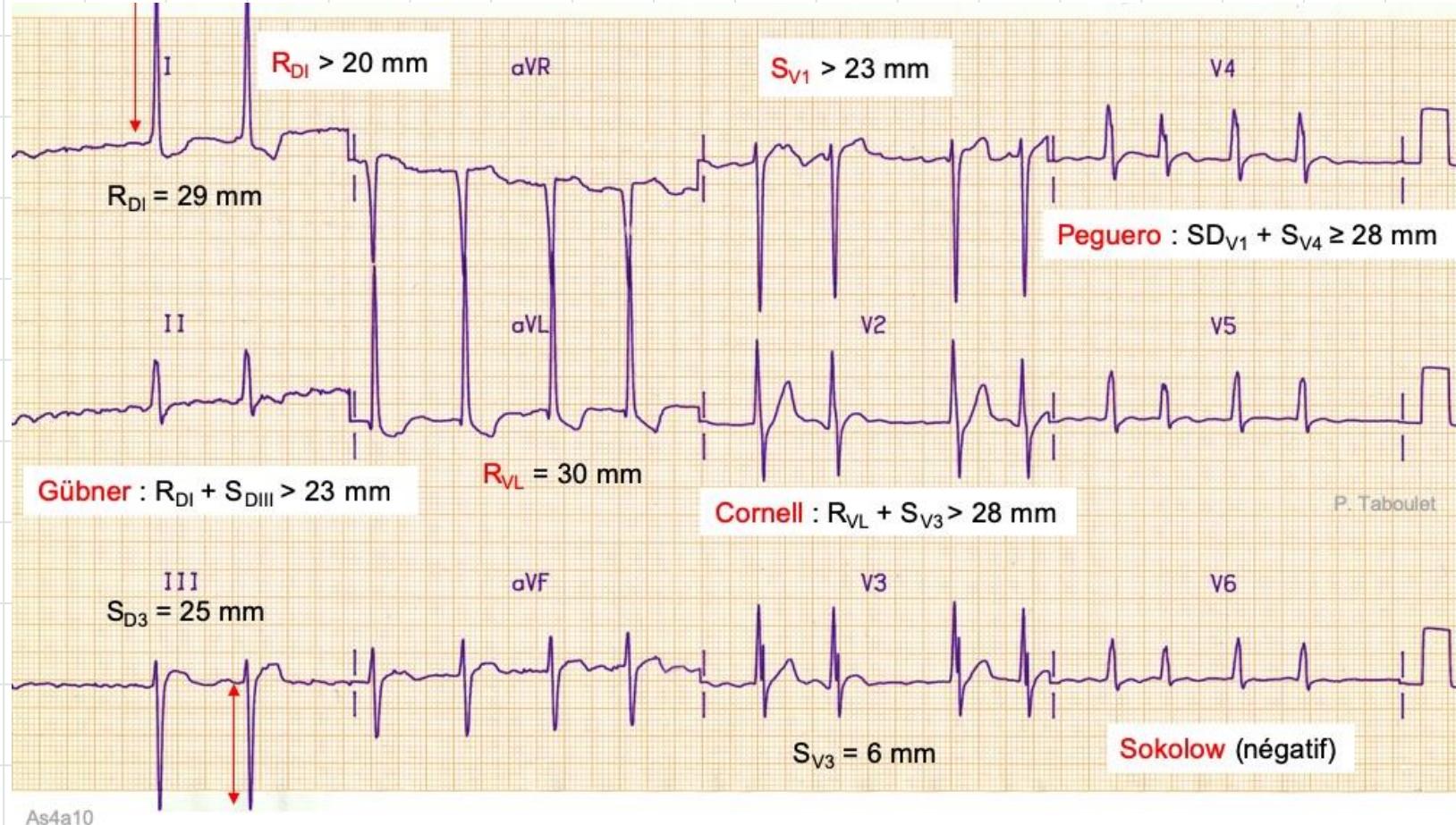
Homme agé de 25 ans consulte pour une douleur thoracique

1. ATCDs familiaux de mort subite



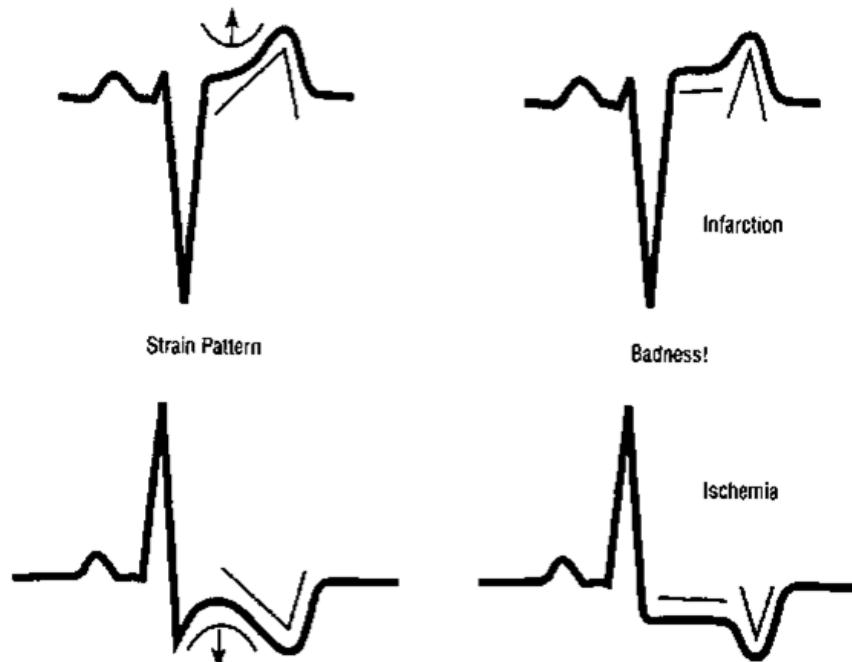


**HVG systolique**



P. Taboulet

# Strain vs Infarction

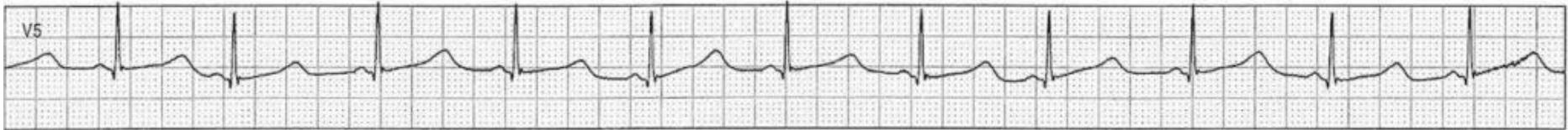
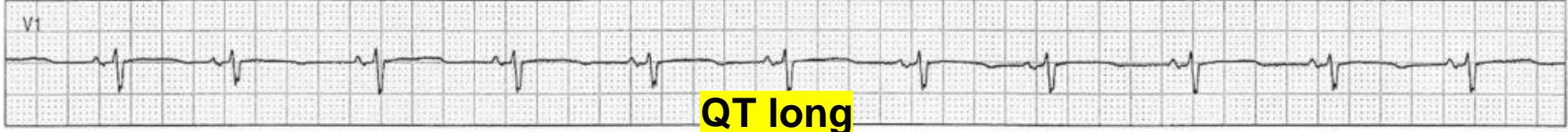
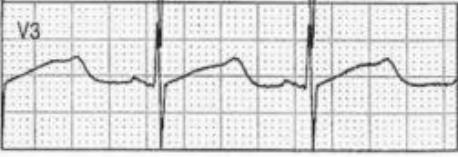
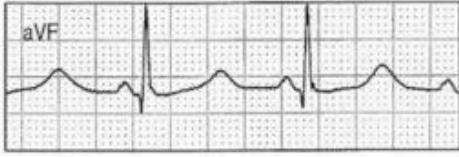
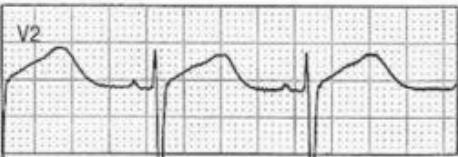
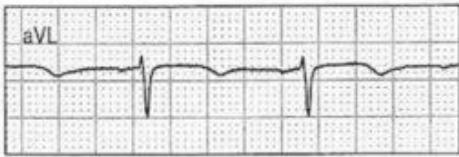
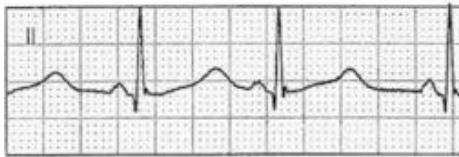
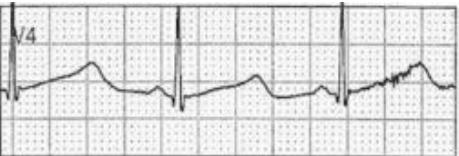
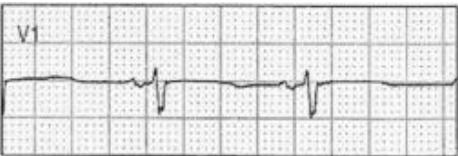
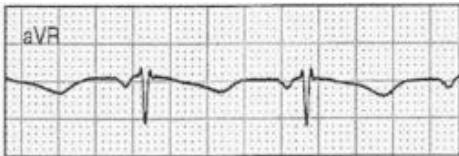
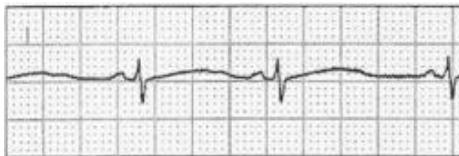


# ECG N° 07

Homme agé de 60 ans consulte suite à  
une prise d'une overdose d'antidépresseur

1. HTA
2. DT2



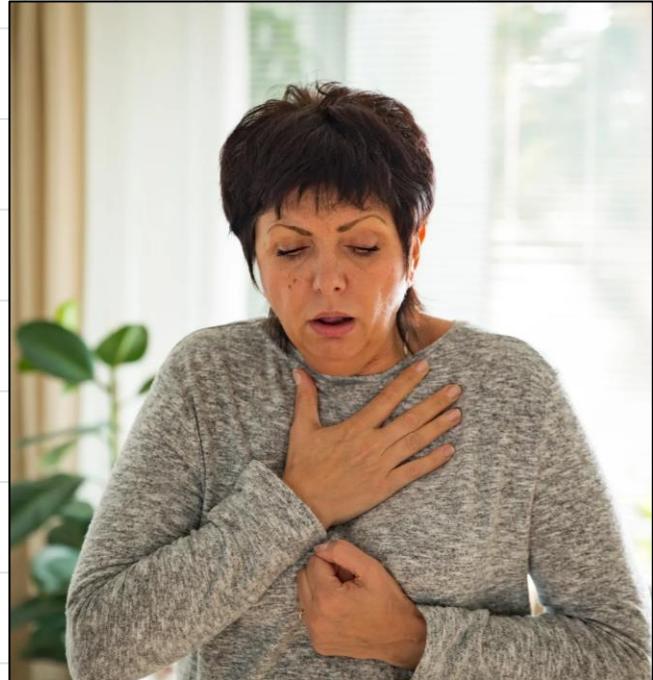


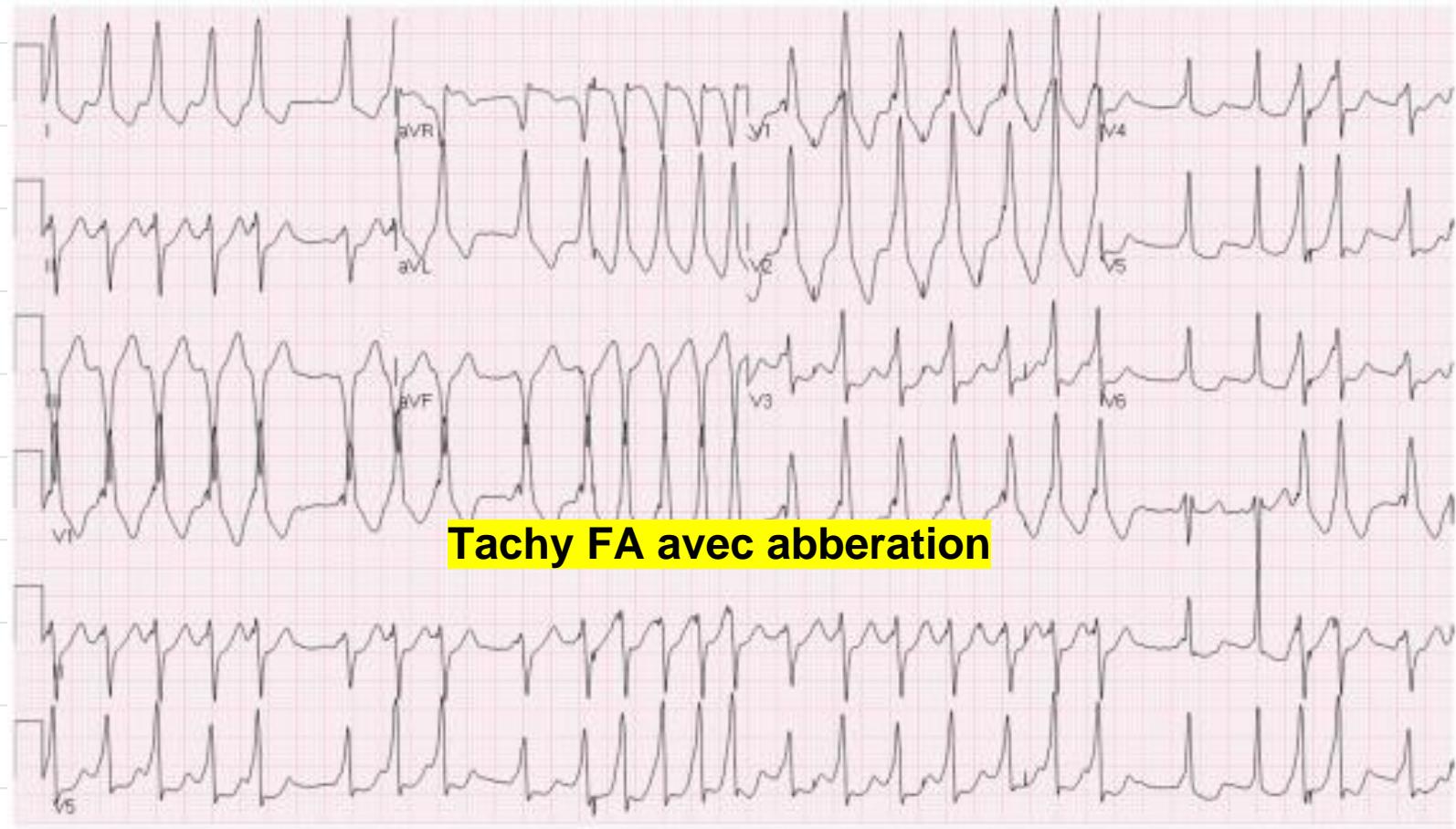
Risque majeur	Risque modéré	Risque faible
Sertindole (Serolect)	Antidépresseurs tricycliques exemple : amitriptyline (Tryptizol)	ISRS Exemple, citalopram (Seropram)
Halopéridol (Haldol)	Venlafaxine (Efexor)	Tétracycliques Exemple : miansérine (Tolvon)
Dropéridol (Droperidol sintetica)	Clozapine (Léponex)	Moclobémide (Aurorix)
Pimozide (Orap)	Olanzapine (Zyprexa)	Lithium (Lithiofor)
Chlorpromazine (Chlorazin)	Rispéridone (Risperdal)	Amisulpride (Solian)
S-Méthadone	Quétiapine (Seroquel)	Aripiprazole (Abilify)

# ECG N° 08

Femme agé de 70 ans consulte Pour des palpitations intense avec hypotension

1. HTA
2. DT2

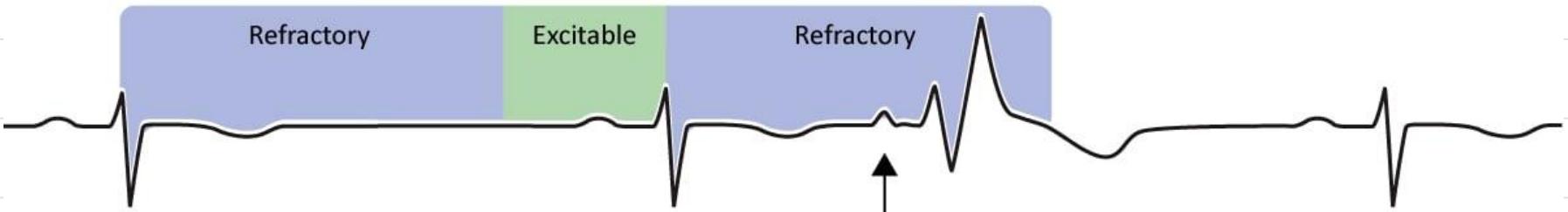




Tachy FA avec abberation

# Aberration

Responsiveness of the bundle branches

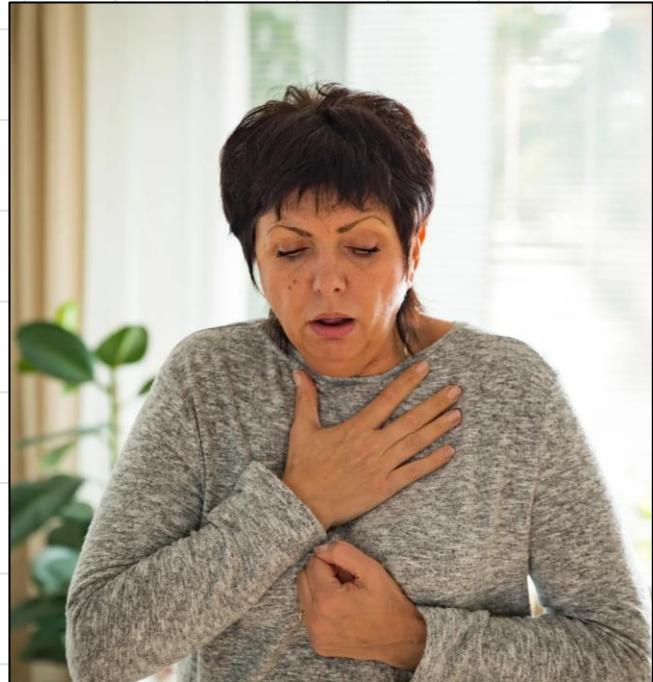


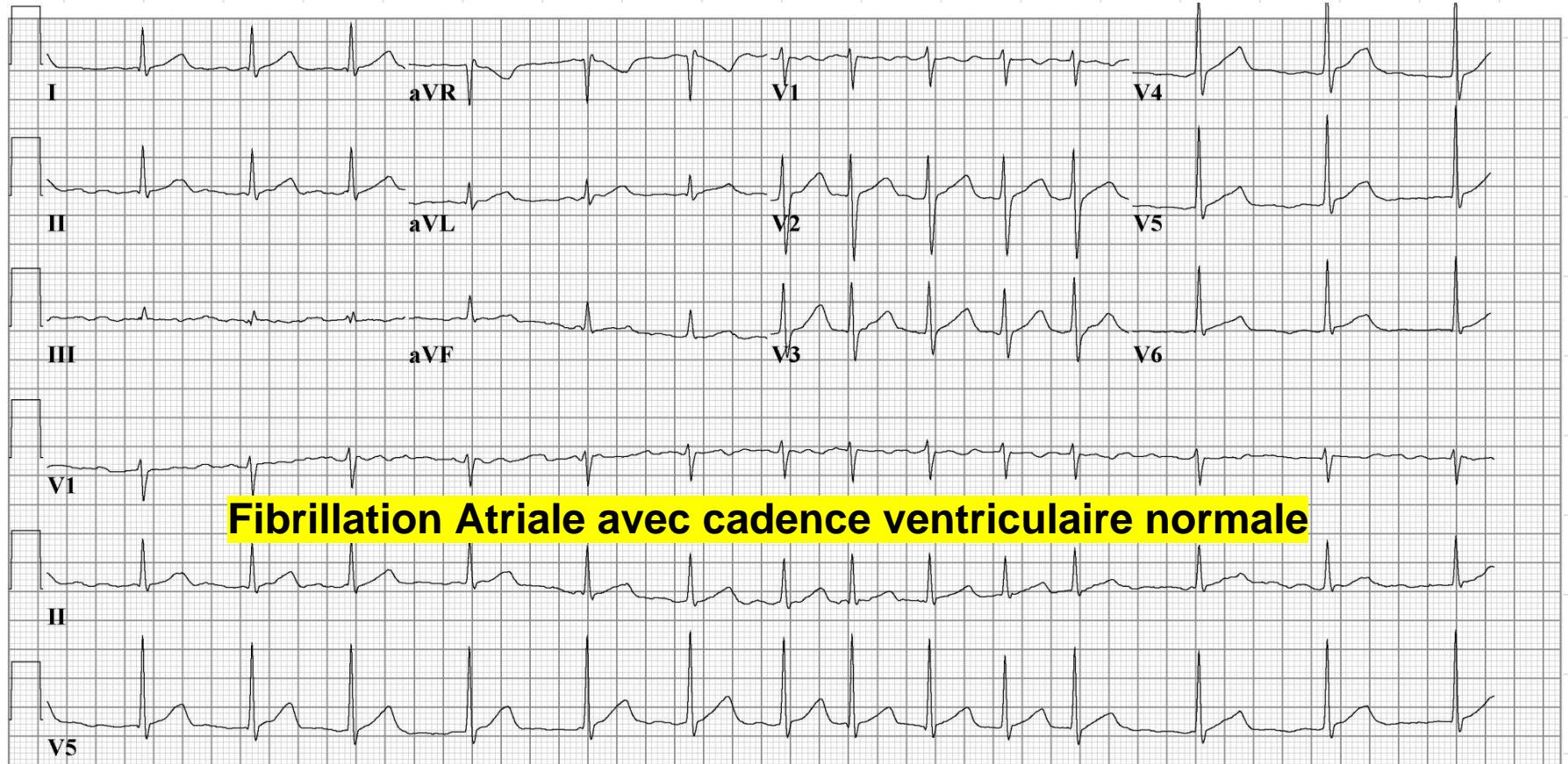
This P-wave occurs earlier than expected and its morphology differs from the other P-waves. Thus, the impulse is discharged from an ectopic focus in the atria. The resulting ectopic beat is an supraventricular extrasystole and it arrives to the ventricles before the right bundle branch has repolarized and therefore the impulse is blocked in the right bundle branch. The resulting QRS-complex displays the typical right bundle branch block pattern.

# ECG N° 09

Femme agé de 65 ans consulte Pour des palpitations

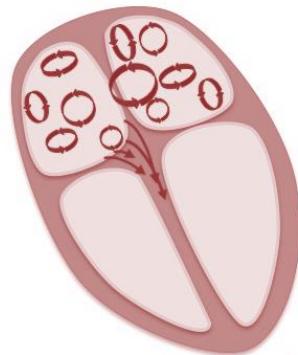
1. HTA
2. DT2
3. Tabagisme actif



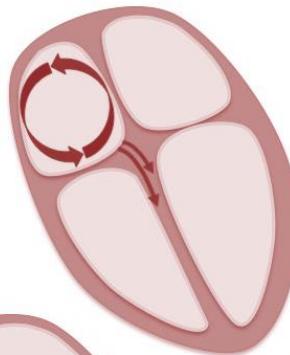


# TSV à QRS fin

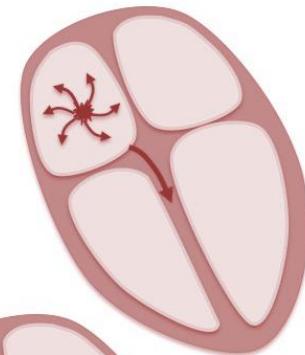
Fibrillation atriale



Flutter atrial



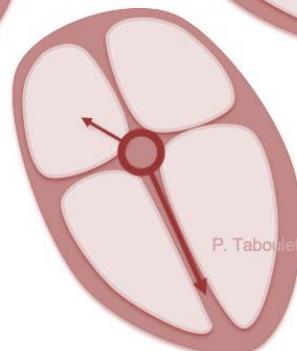
T. atriale focale



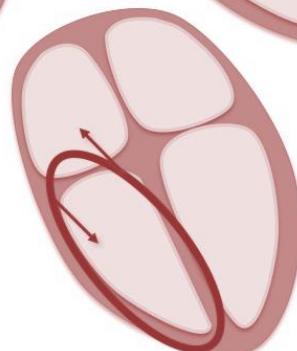
Tachycardies  
atrioventriculaires

-----

- A. réentrée intranodale
- B. faisceau accessoire



A



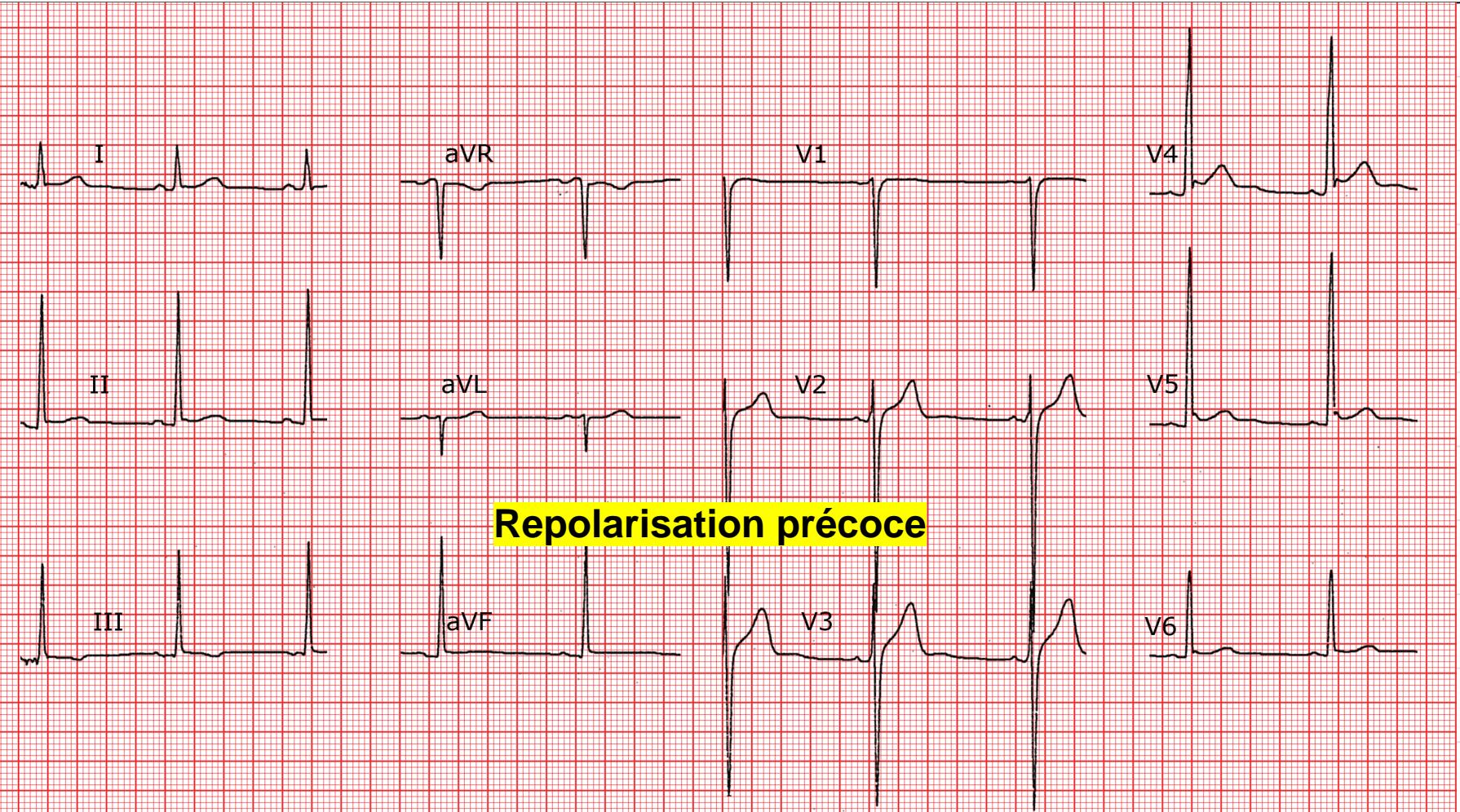
B

# ECG N° 10

Sujet jeune de 21 ans consulte pour une oppression thoracique

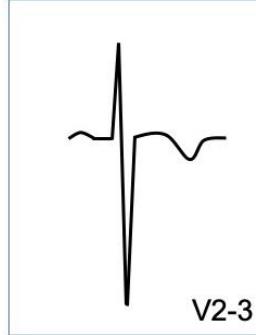
1. Sans ATCDs



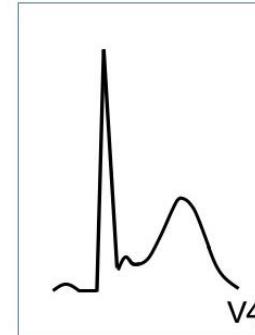


# Variantes physiologiques de repolarisation

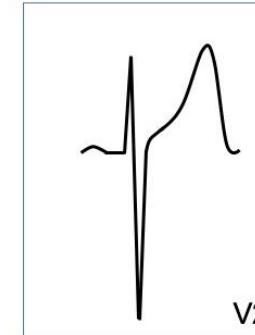
Repolarisation juvénile



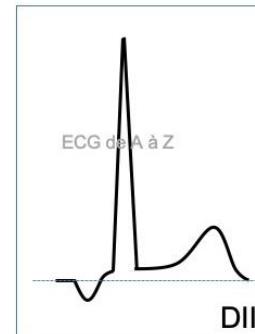
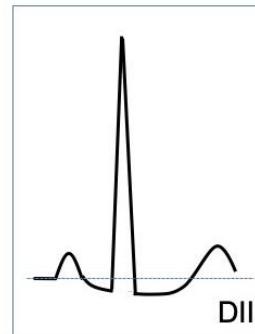
Repolarisation précoce



Repolarisation masculine



Repolarisation  
atriale  
(nœud sinusal)

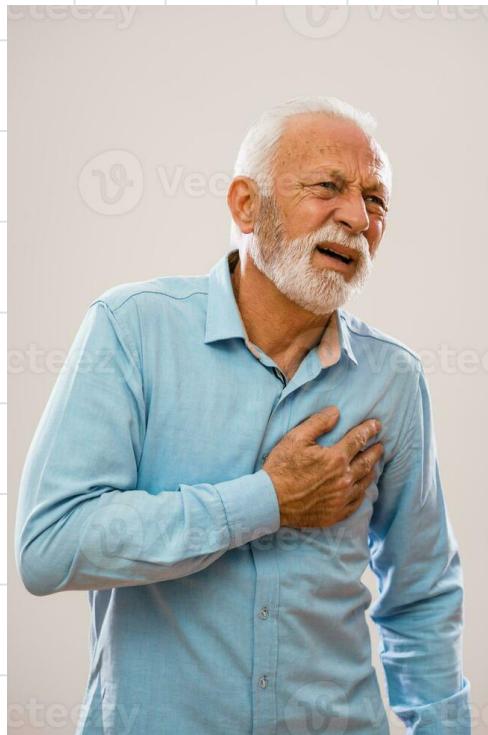


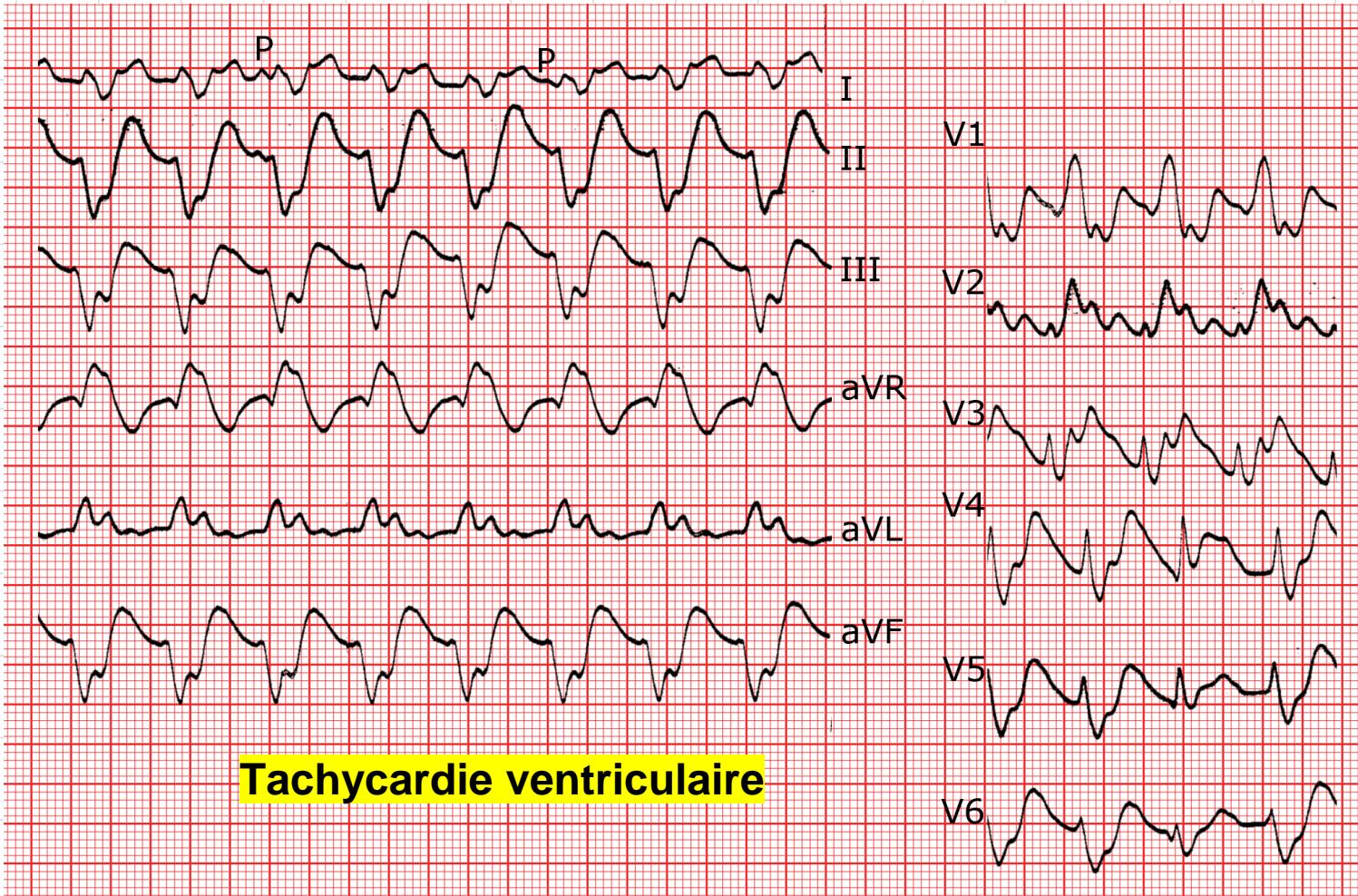
Repolarisation  
atriale  
(nœud sinus  
coronaire)

# ECG N° 11

Sujet Agé de 75 ans consulte pour une dyspnée et palpitations

1. ATCDs d'IDM sous traitement
2. HTA
3. DT2



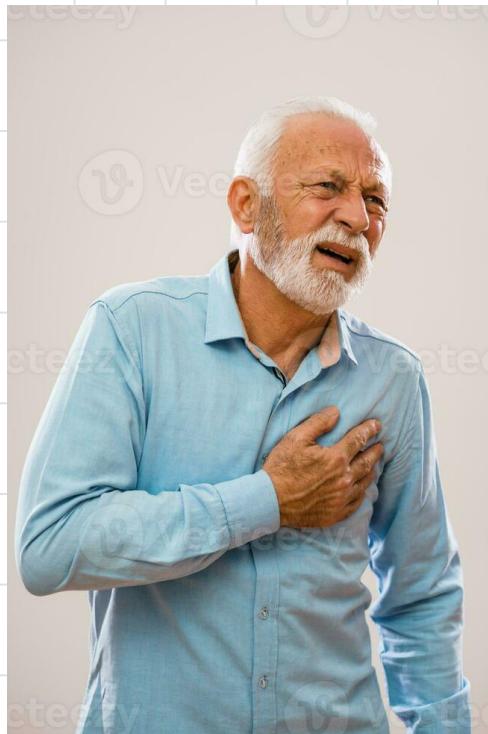


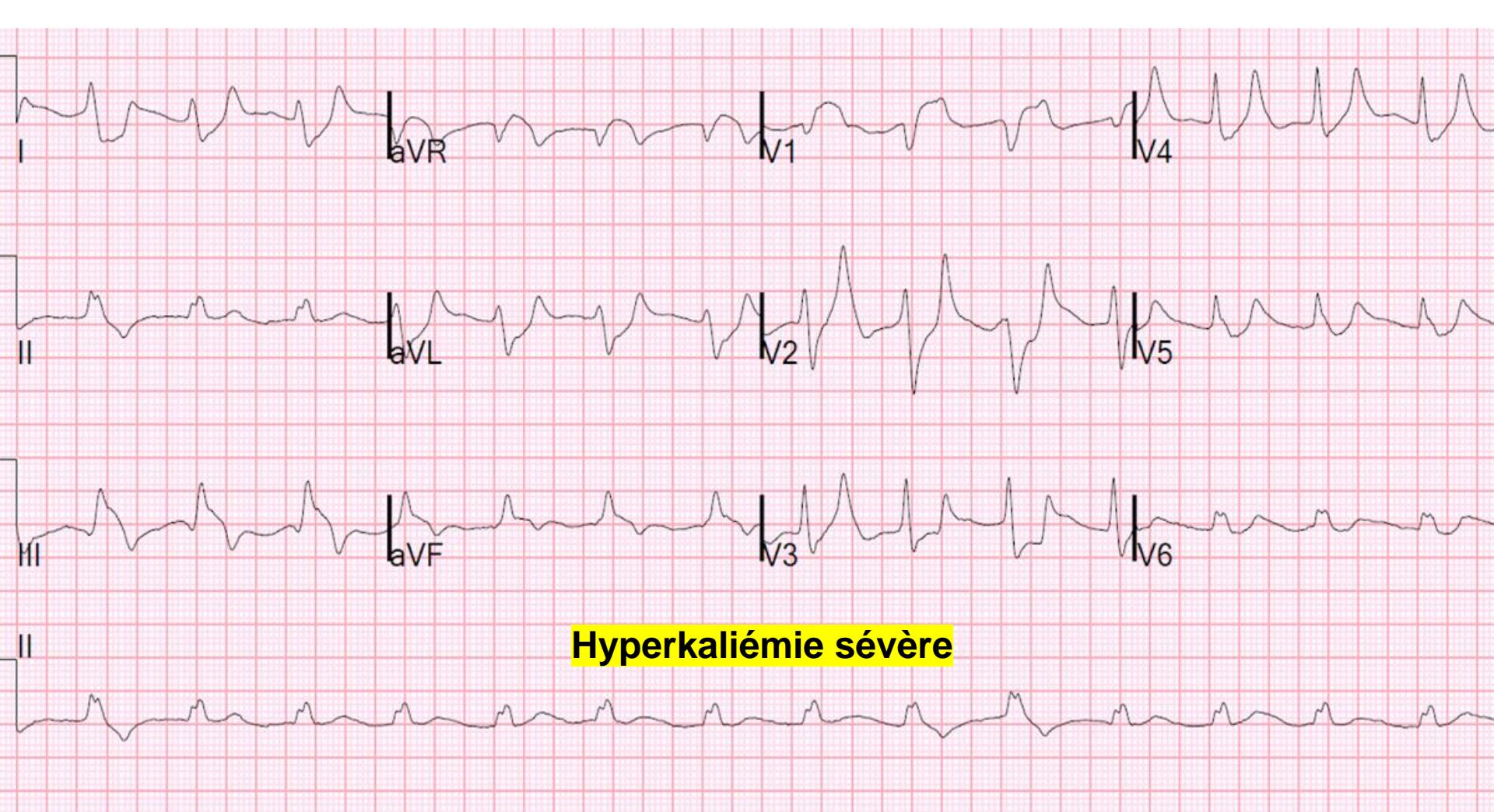
Tachycardie ventriculaire

# ECG N° 12

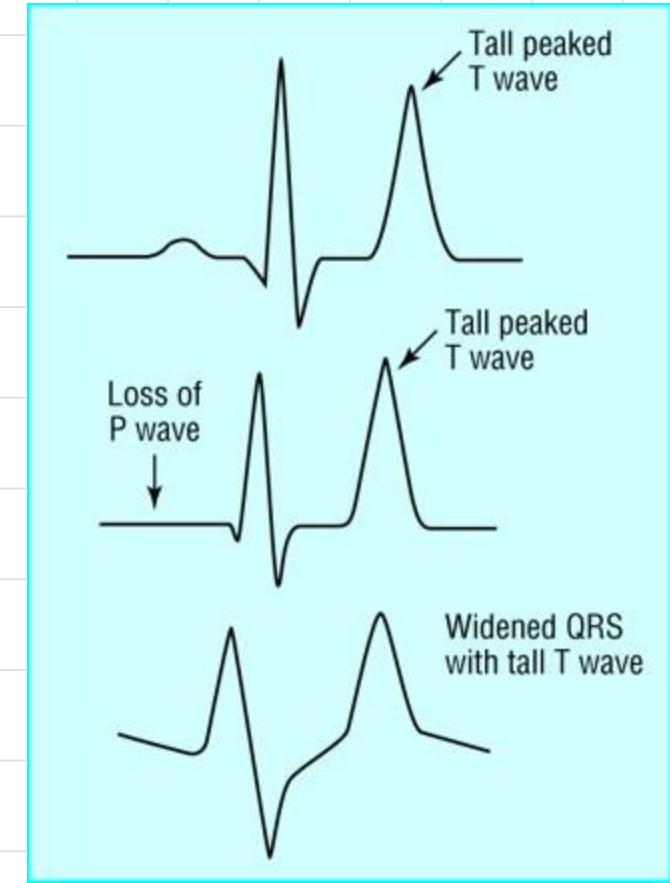
Sujet Agé de 61 ans consulte pour une  
Faiblaisse

## 1. ATCDs d'IRC





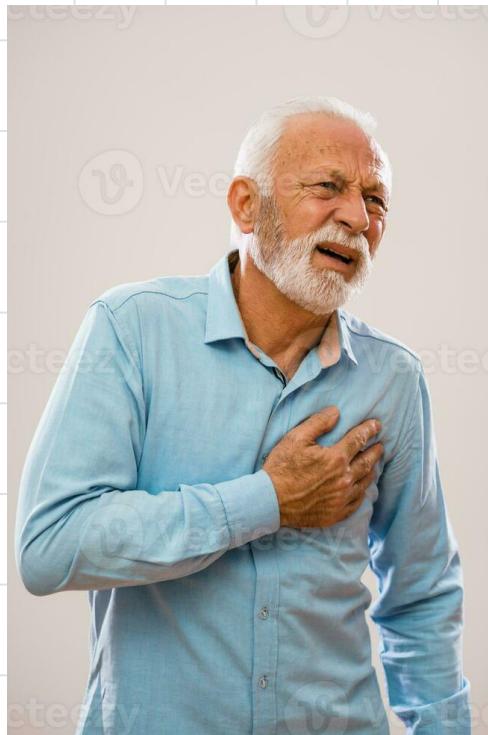
**Hyperkaliémie sévère**

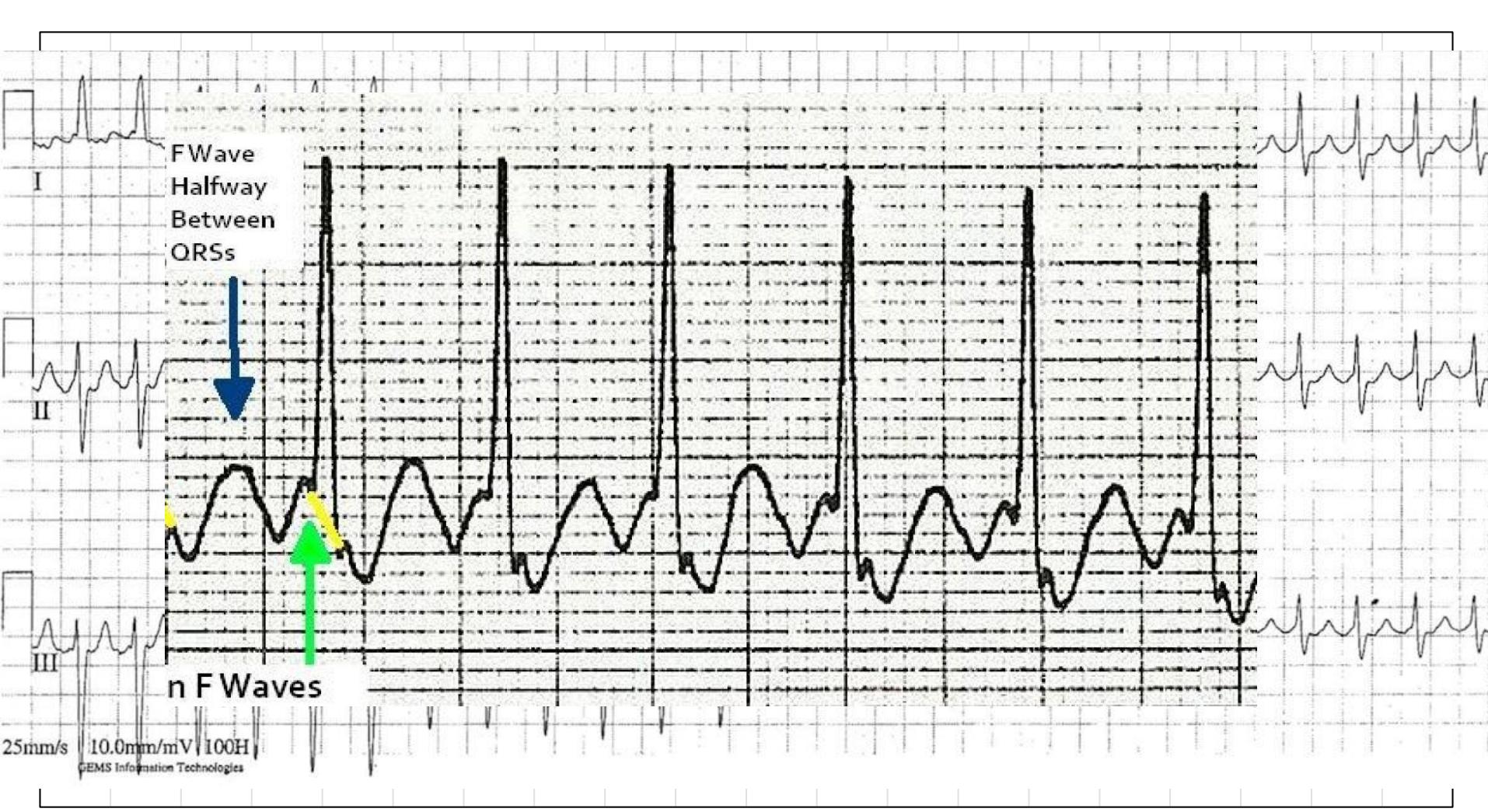


# ECG N° 13

Sujet Agé de 63 ans consulte pour  
Sensation de palpitations

1. ATCDs d'HTA
2. RM moyennement serré



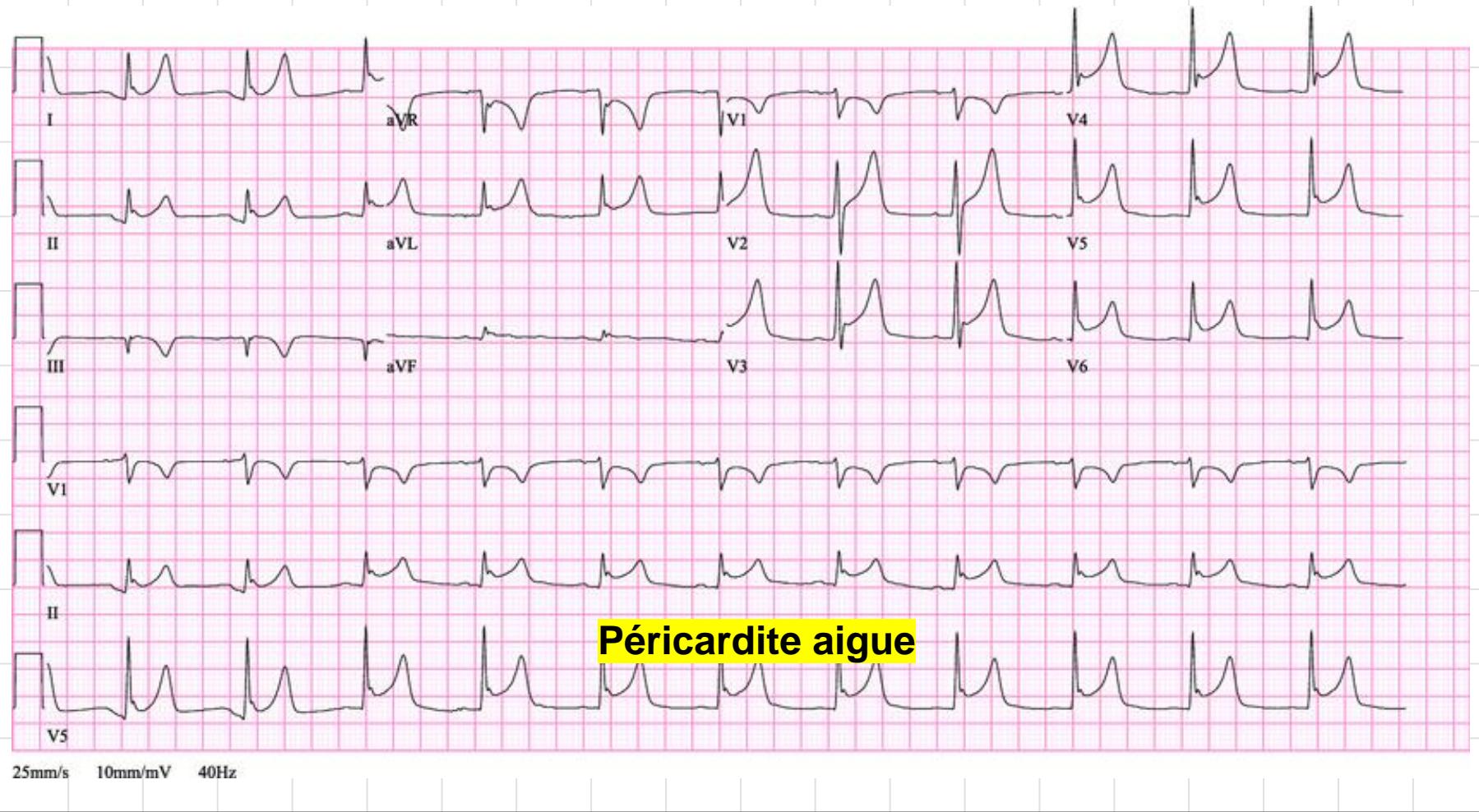


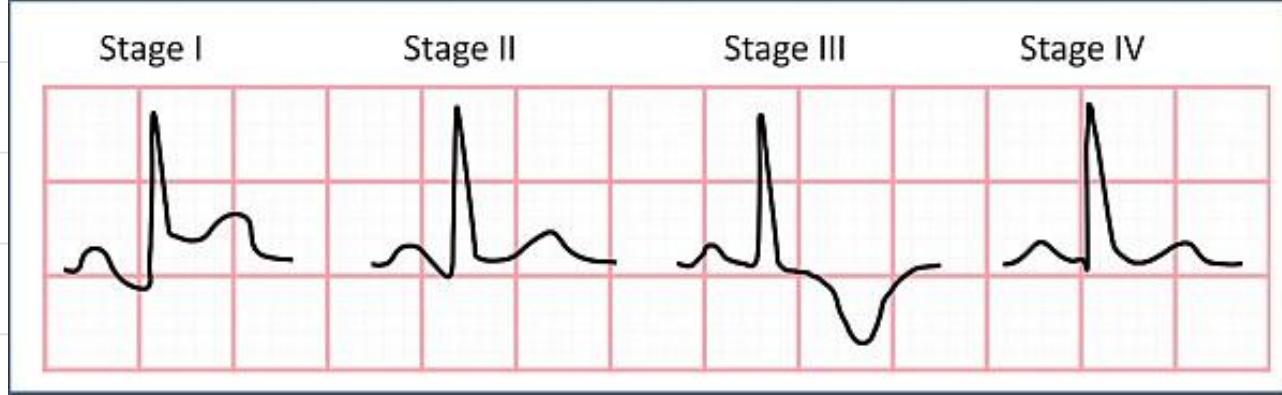
# ECG N° 14

Sujet Agé de 25 ans qui se présente pour une douleur thoracique rétrosternale déclenchée par l'effort

1. Episodes grippale





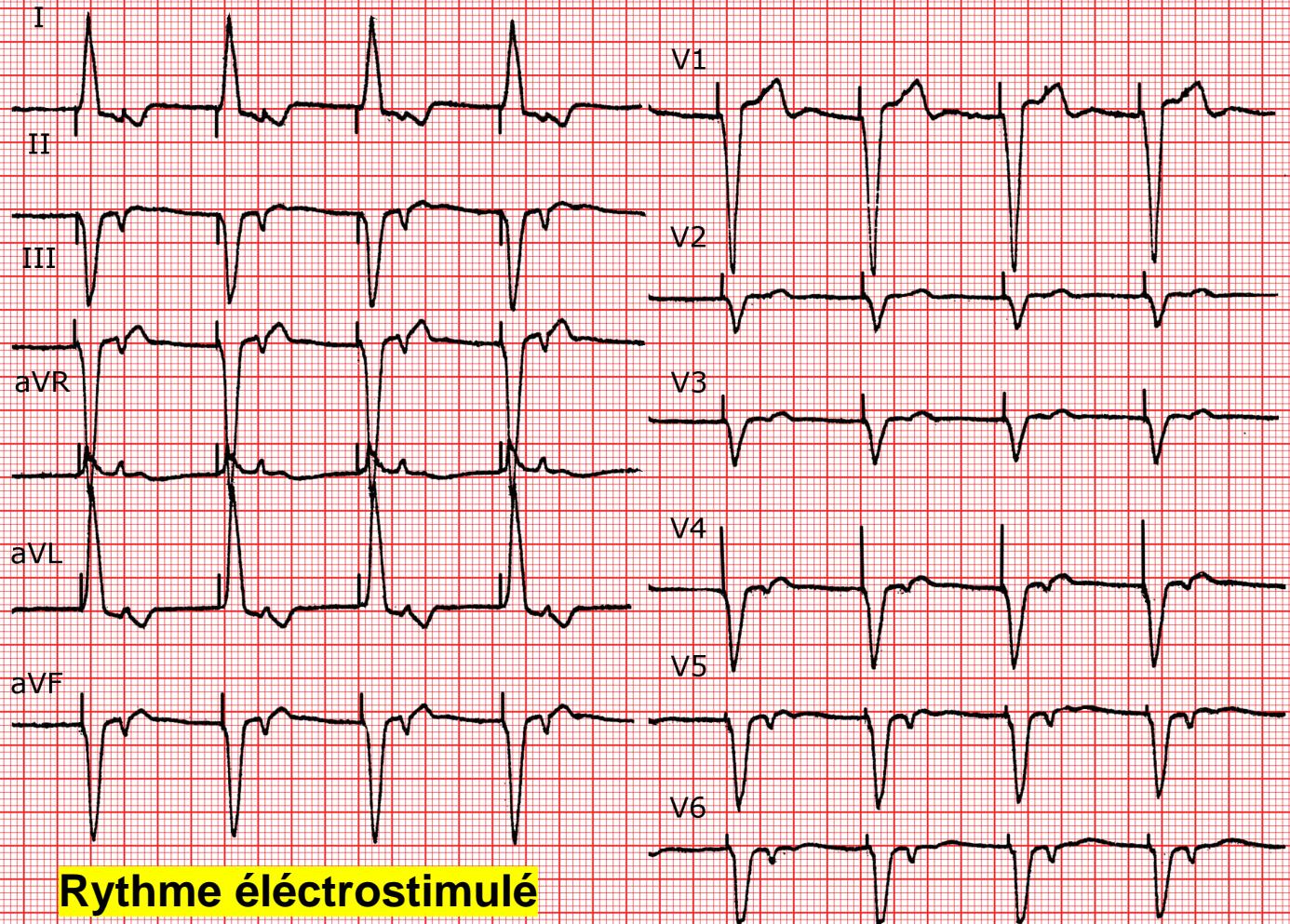


# **ECG N° 15**

Sujet Agé de 50 ans consulte pour une dyspnée

- 1. ATCDs d'un trouble d'électricité du cœur non documenté**







Intervalle de Stimulation

Intervalle d'échappement

Chaines de  
Marqueurs

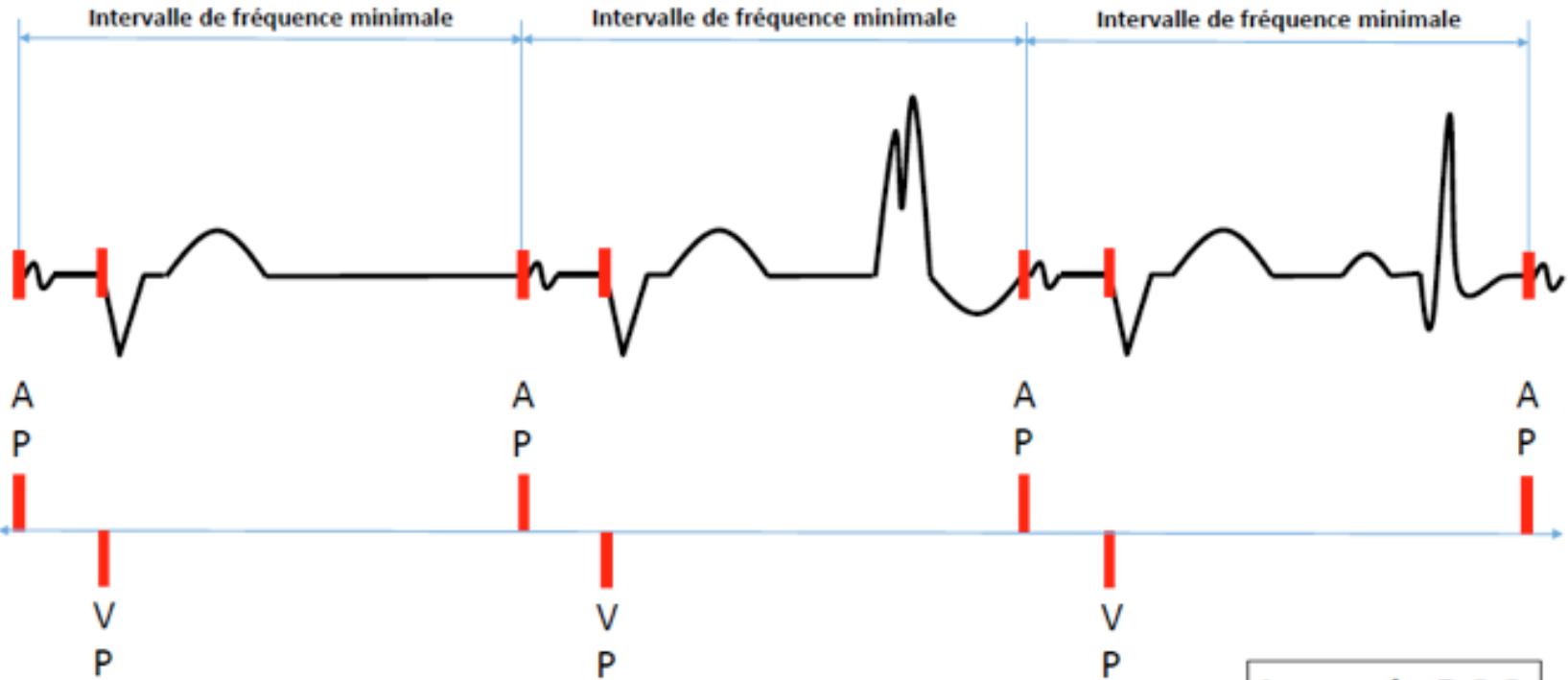
V  
P

V  
P

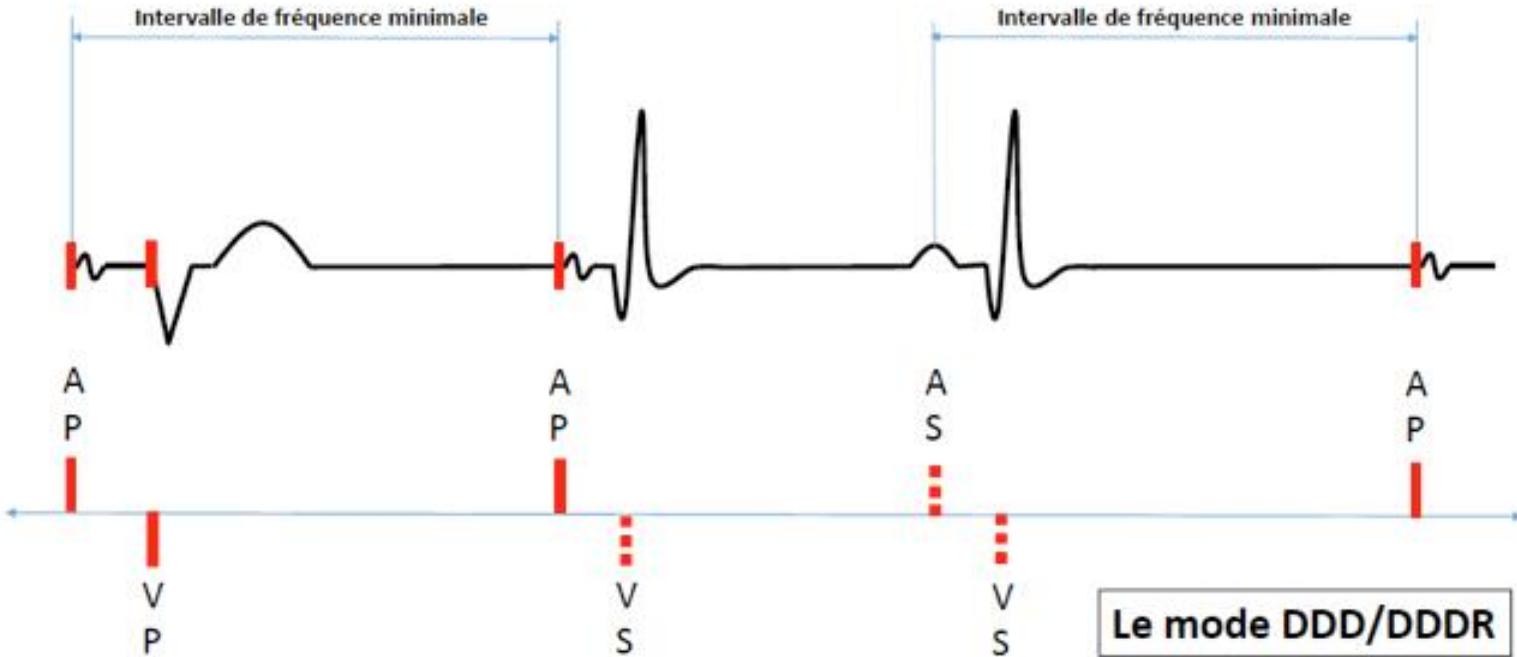
V  
S

V  
P

**Le mode VVI/VVIR**



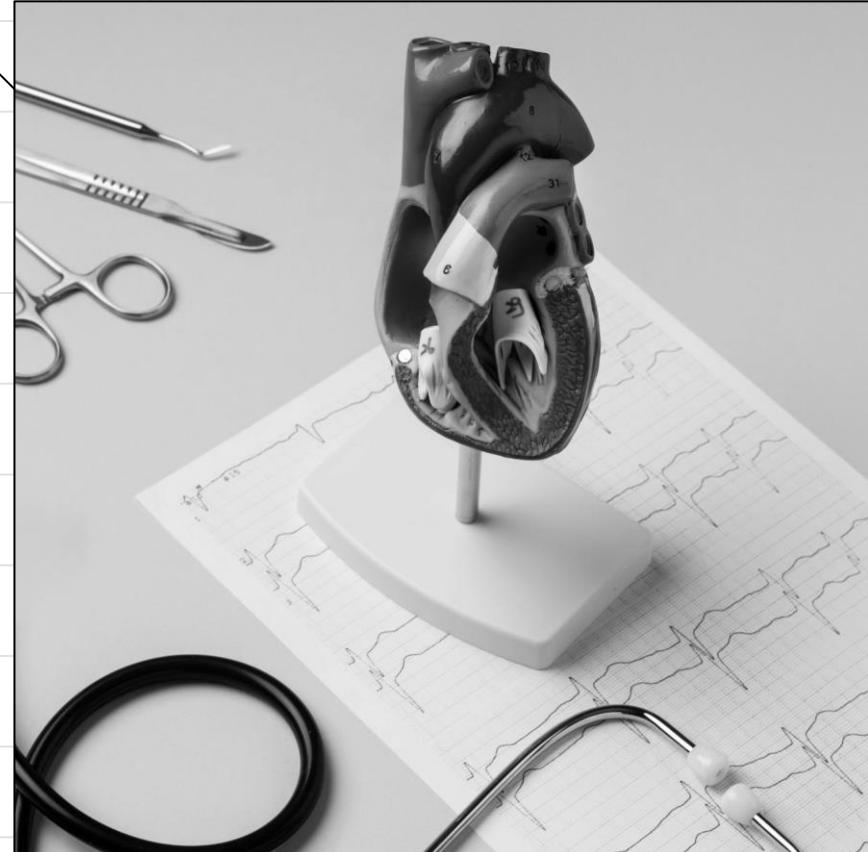
**Le mode DOO**



**Le mode DDD/DDDR**

# Challenge ECG réel

Interprétation des ECGs réel





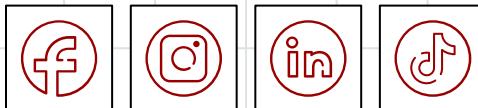
**Free ECG  
session**

# Thanks!

**Do you have any questions?**

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