




ECG normal

Adel Rhouati  
CHU Benbadis  
Constantine



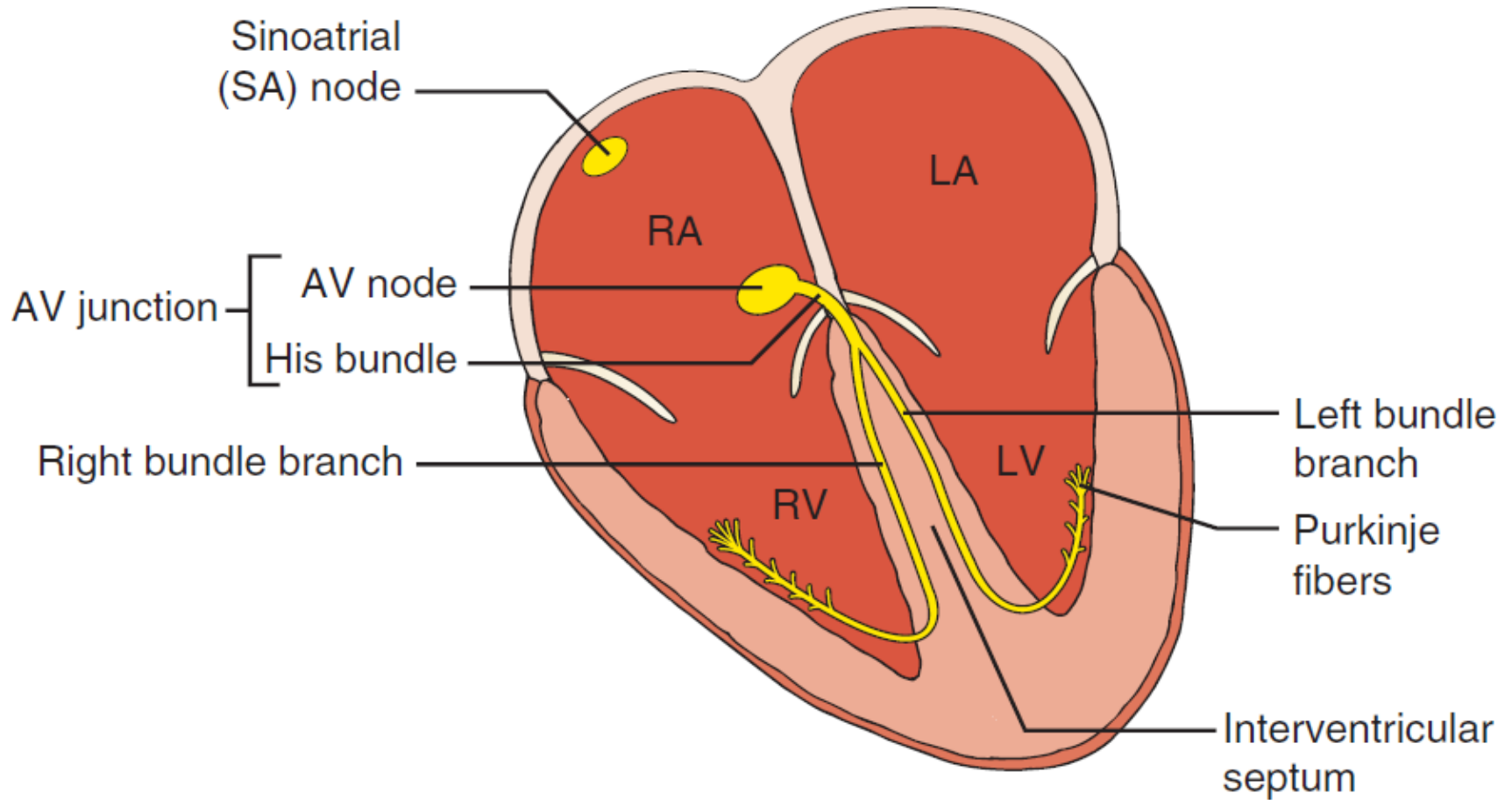
- **Enregistrement de l'activité électrique** du cœur détectée par des électrodes attachées à la peau.
- La différence de potentiel entre ces électrodes est représentée par des **dérivations**
- Examen disponible, non invasif et peu cher.
- Utile dans diverses pathologies: troubles du rythme et de conduction, cardiopathie ischémique, troubles métaboliques,...

1. Activité électrique du cœur: **électrophysiologie**
2. Enregistrement de l'activité: **dérivations**
3. Résultats: **interprétation**

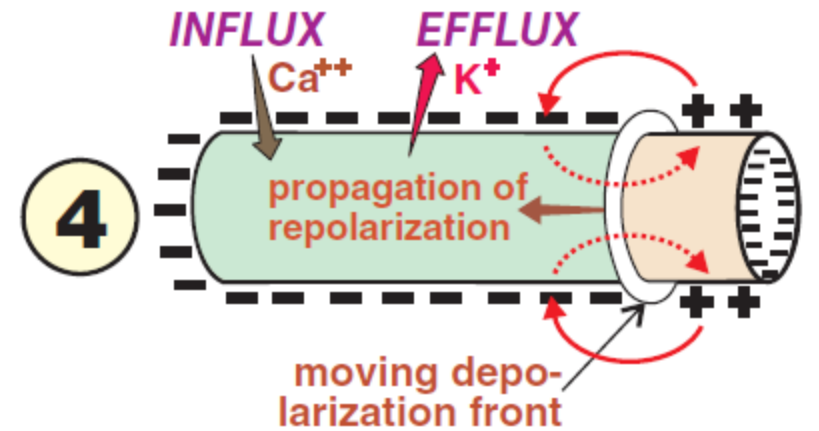
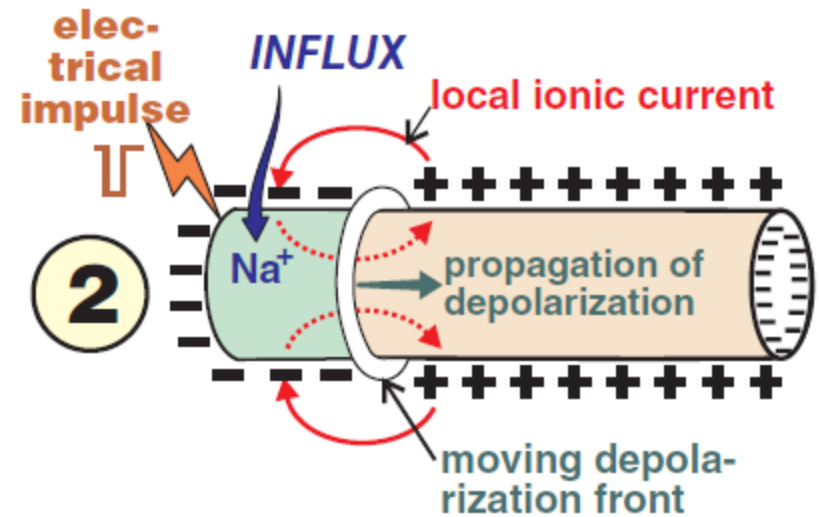


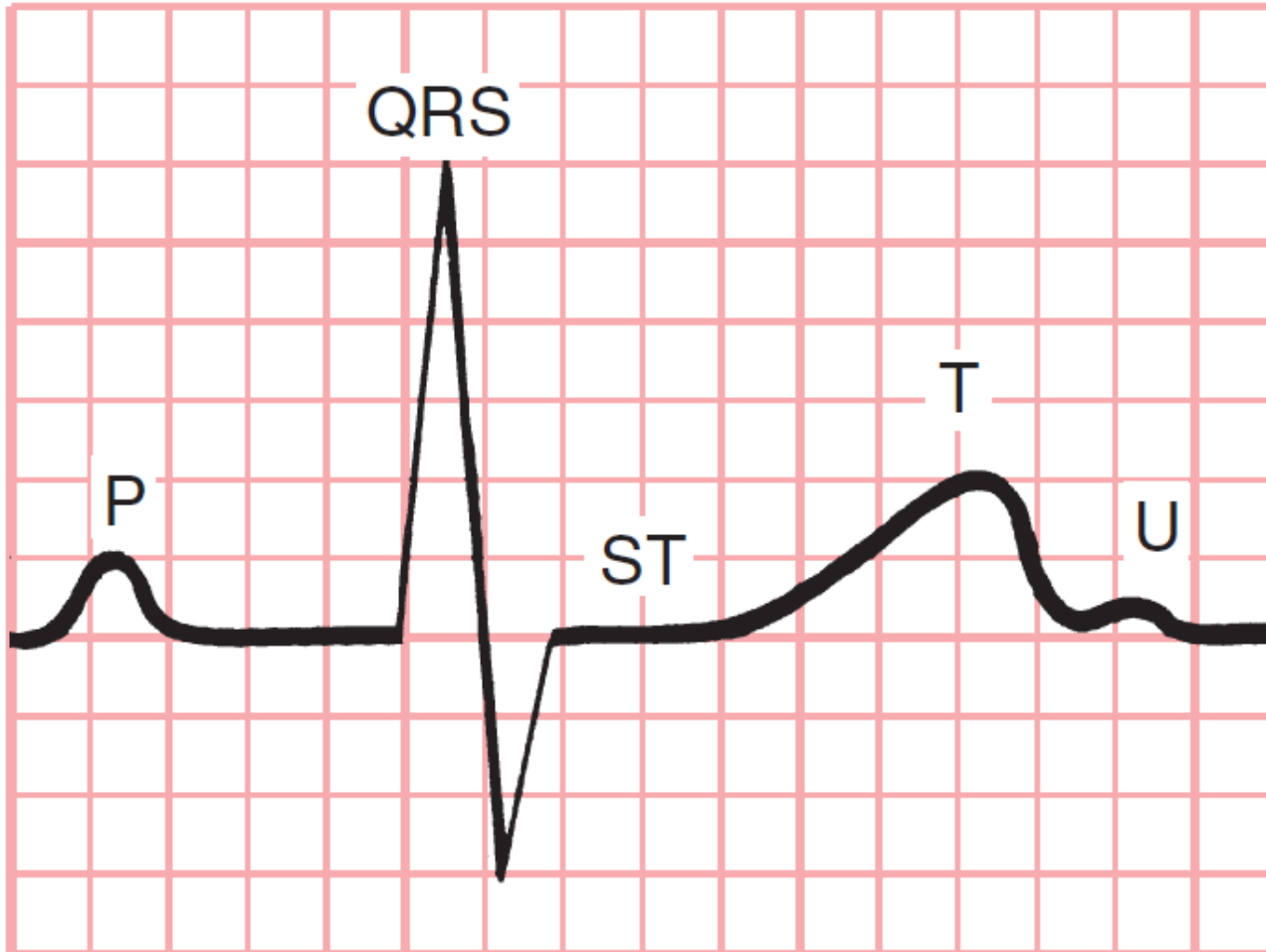
# Electrophysiologie

# Système de conduction cardiaque



# Dépolarisation et repolarisation





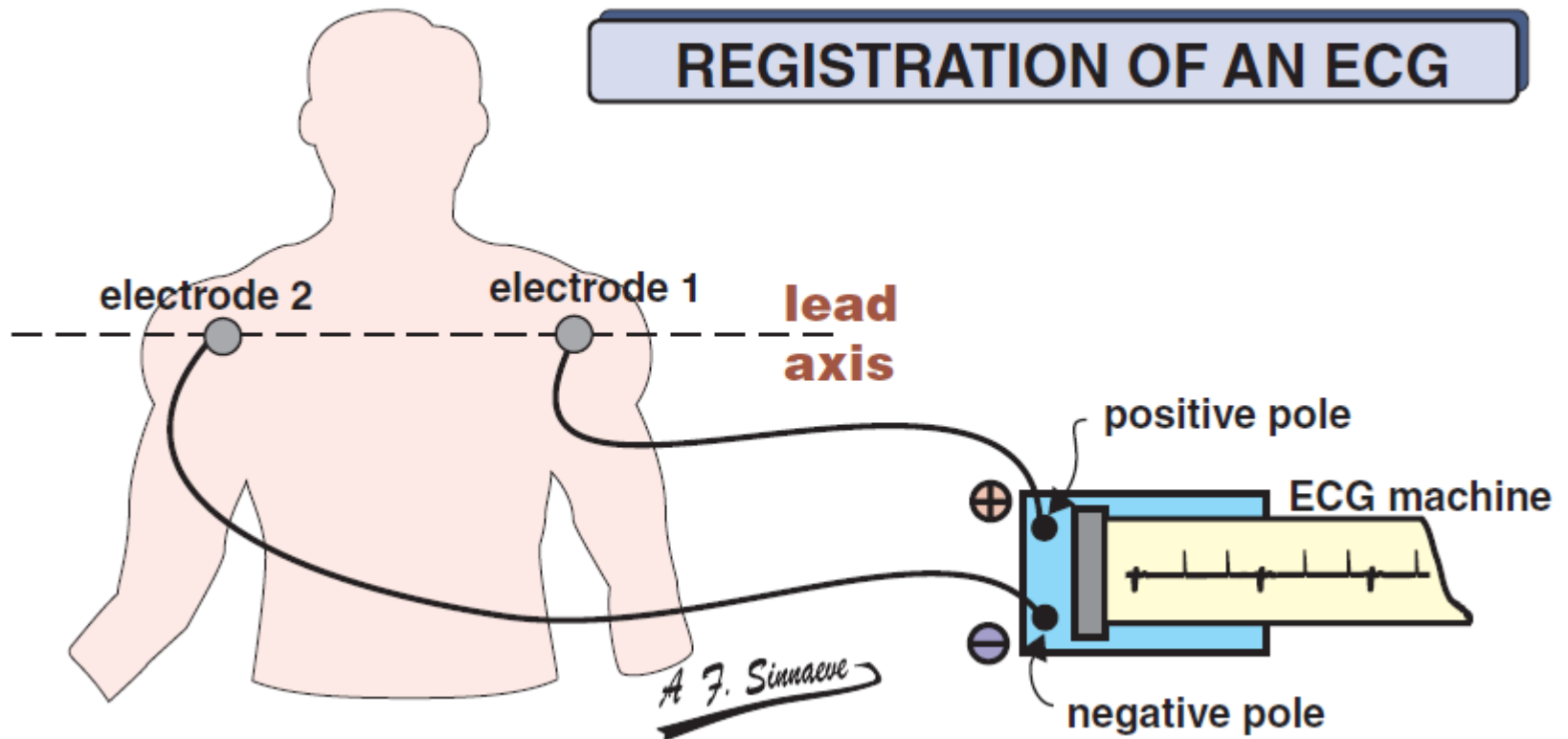
- P: dépolarisation atriale
- QRS: dépolarisation ventriculaire
- ST-T-U: repolarisation ventriculaire

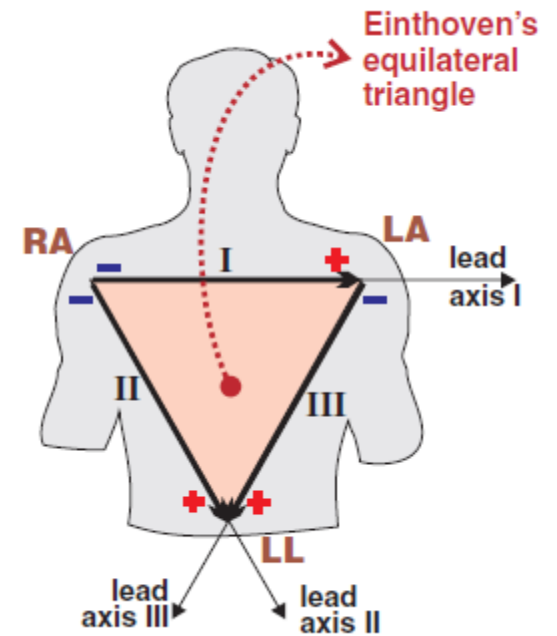
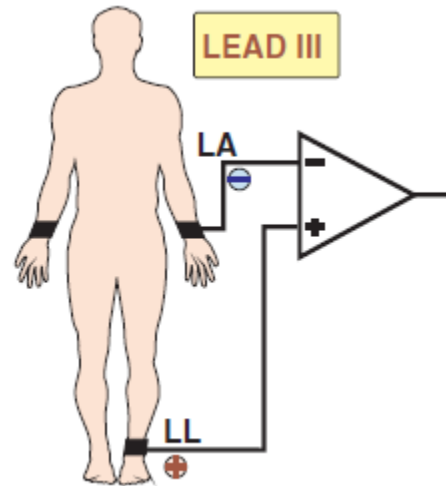
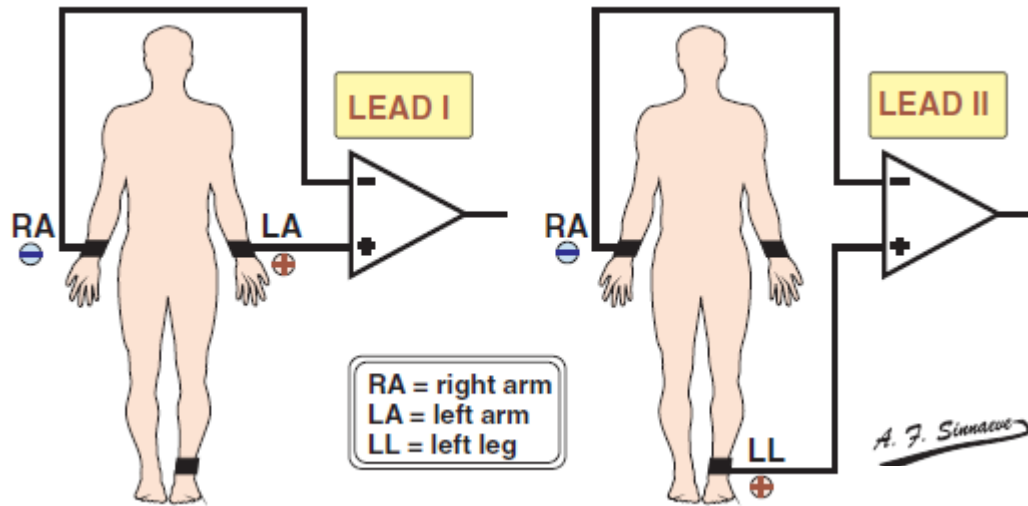


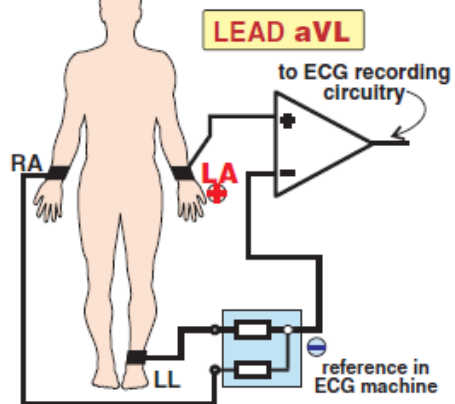
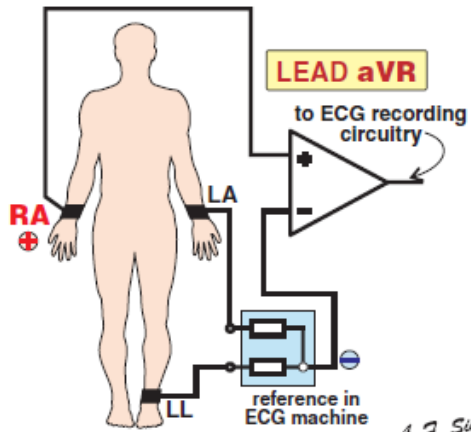
# Dérivations



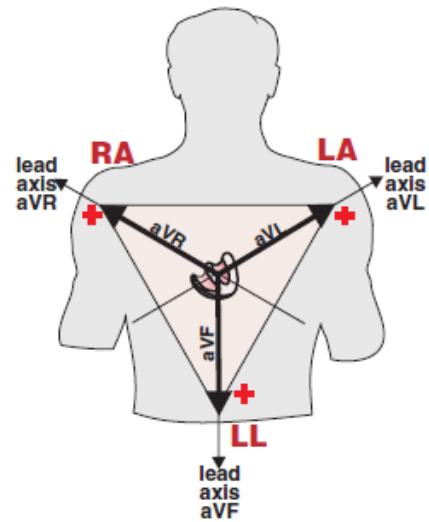
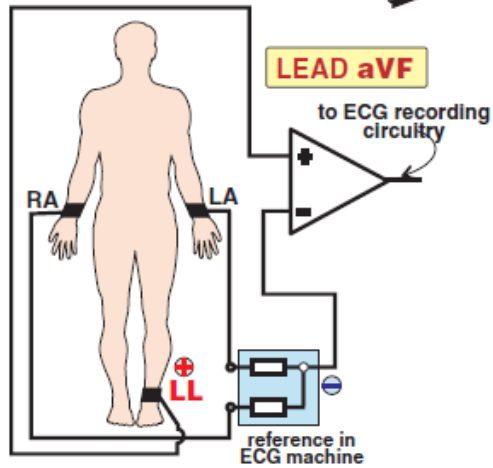
## REGISTRATION OF AN ECG

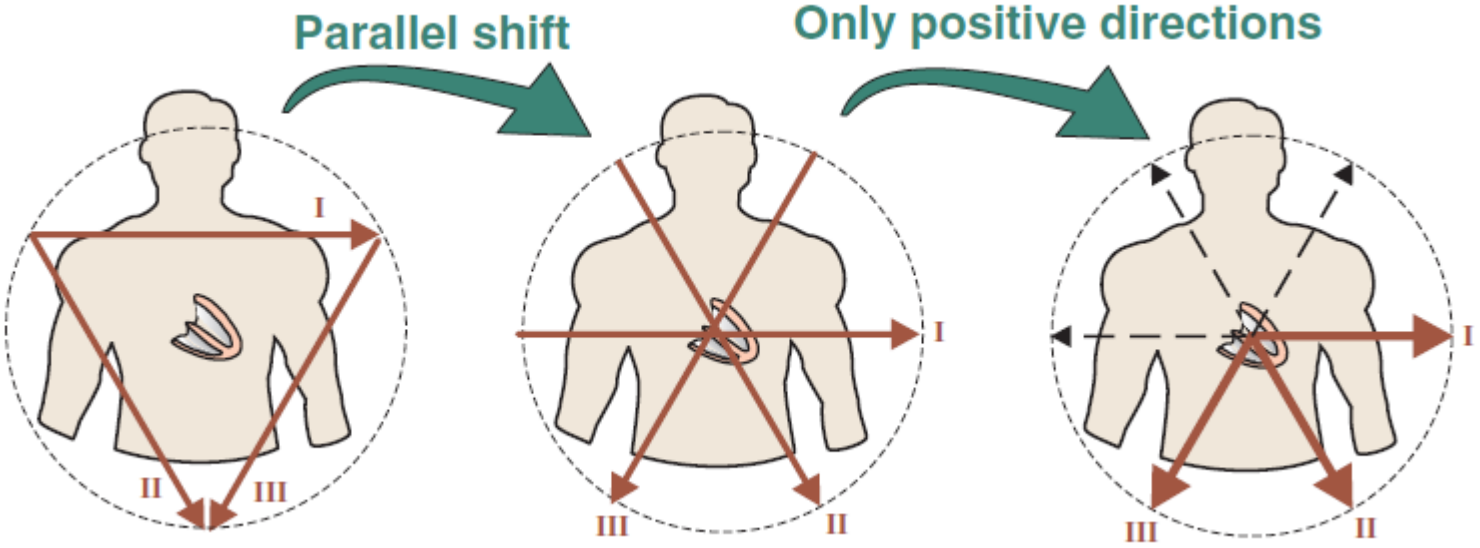


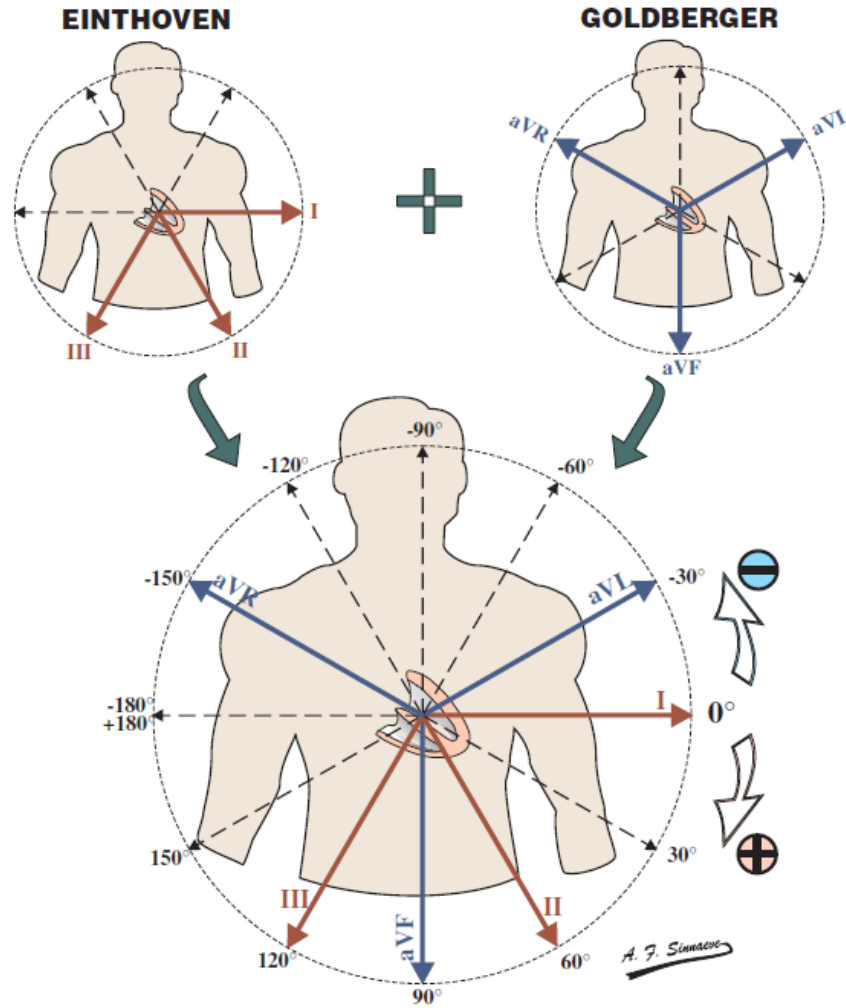




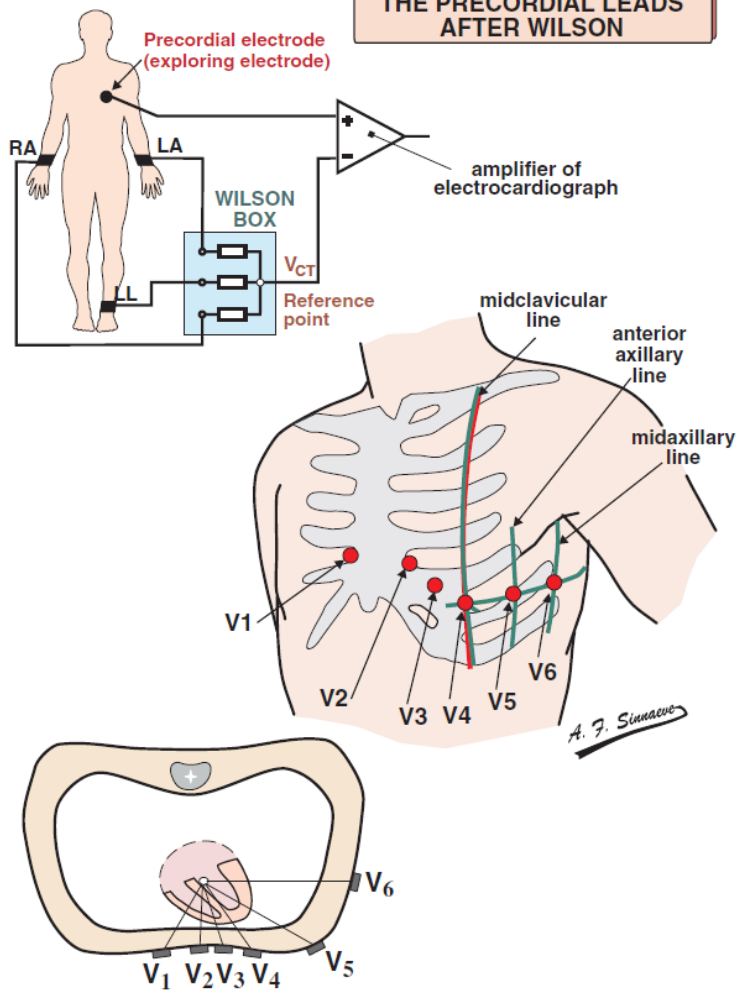
*A. F. Simaev*



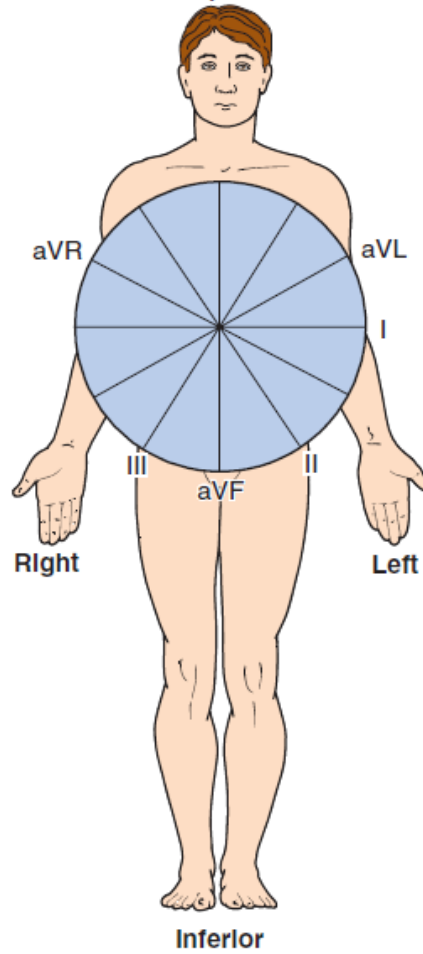


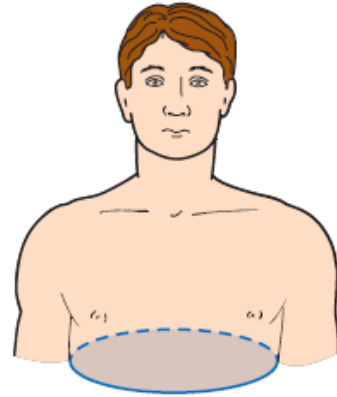


## THE PRECORDIAL LEADS AFTER WILSON

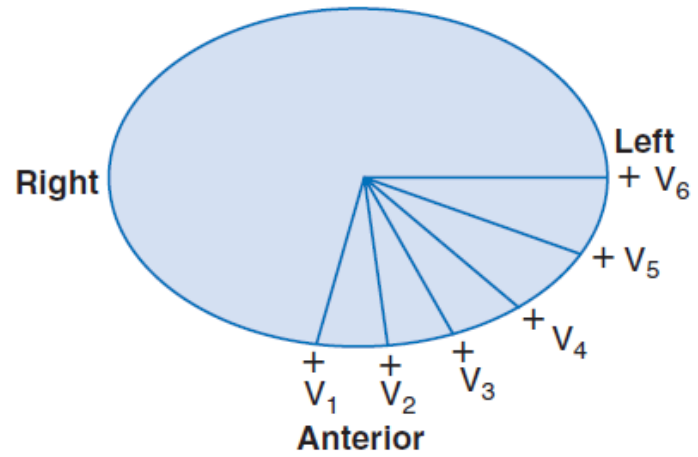


Frontal Plane Leads  
Superior

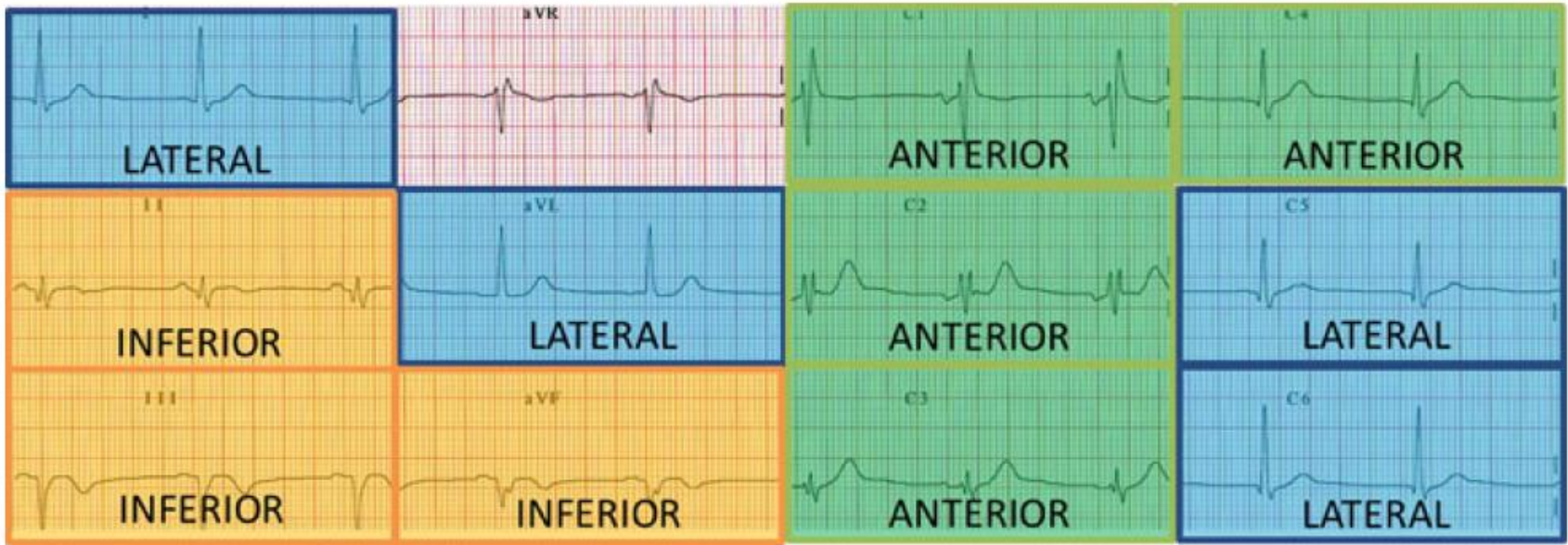




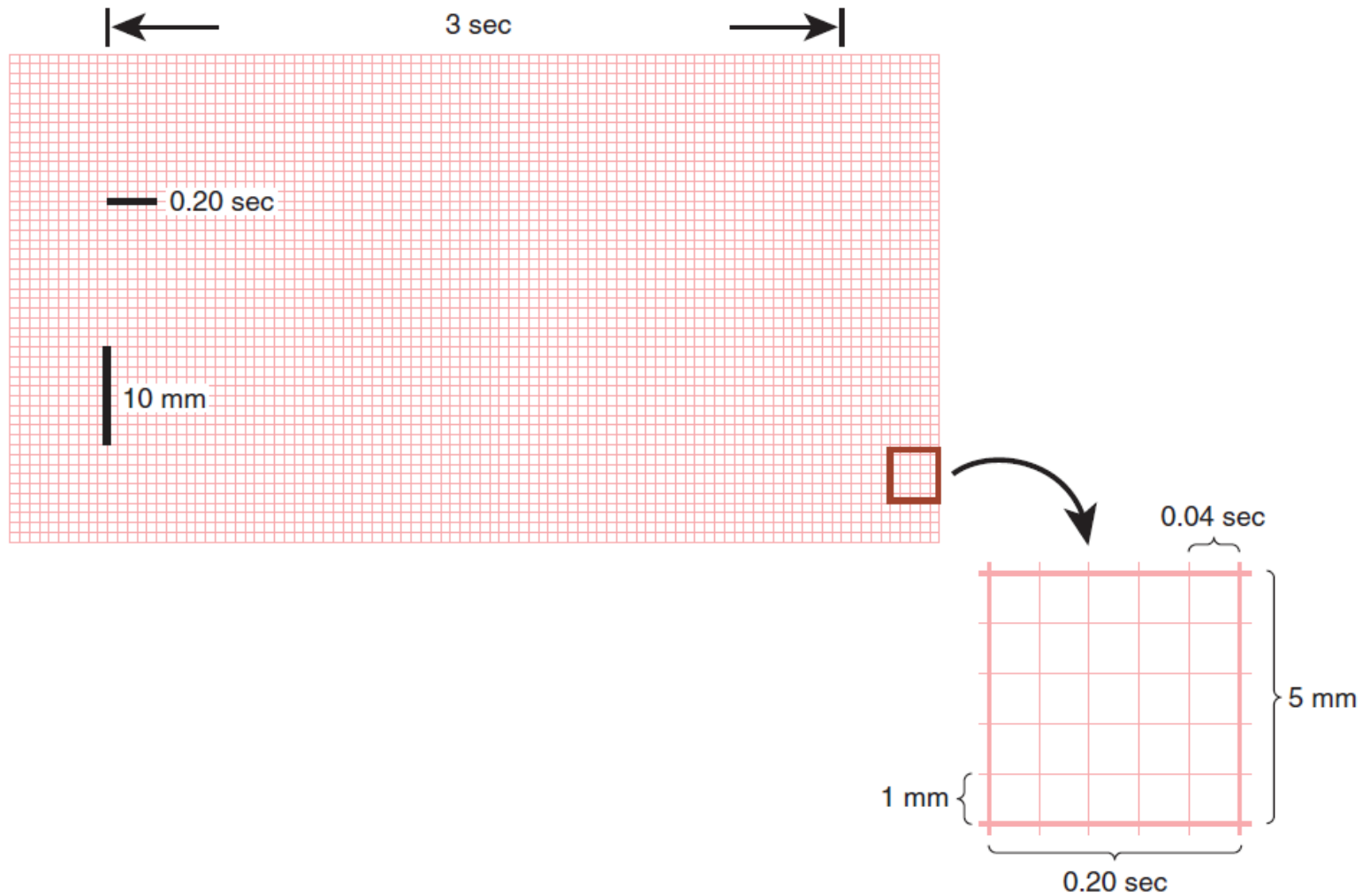
Posterior

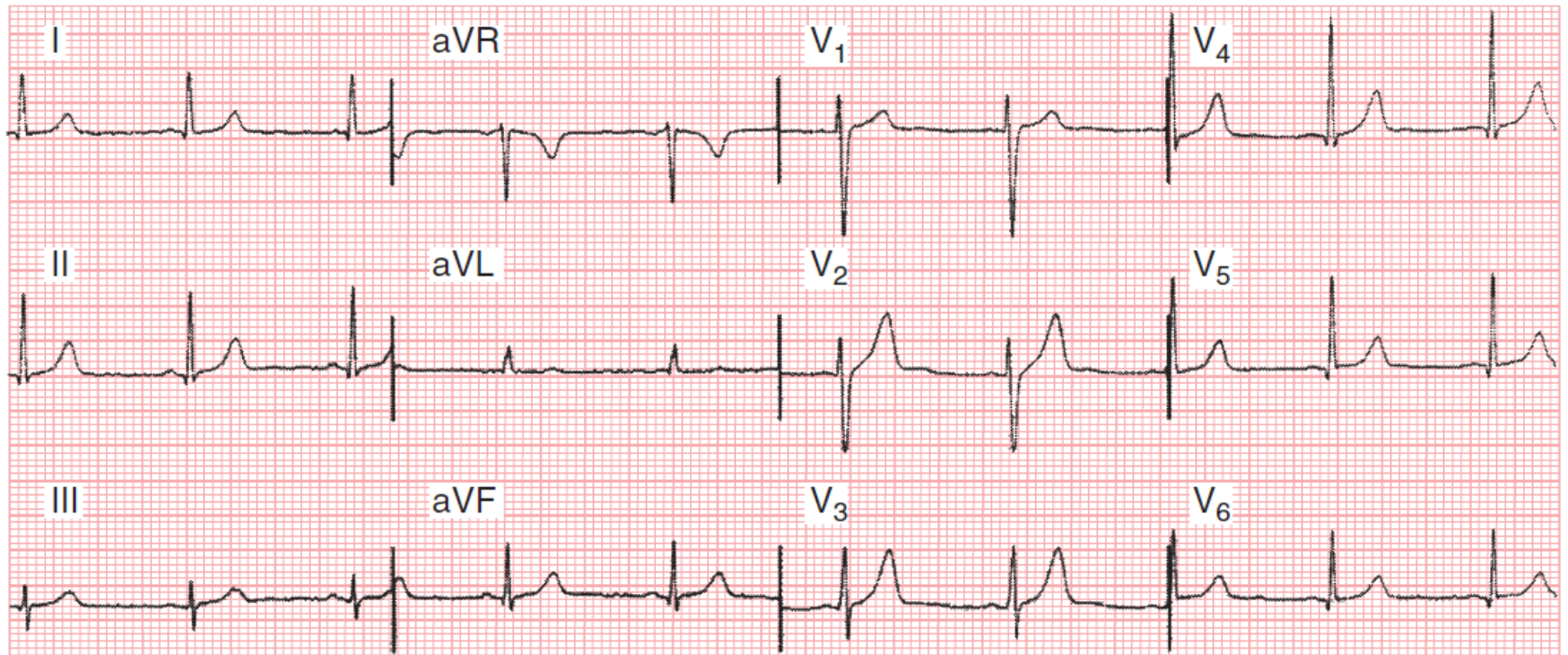






# Papier ECG







# Interpretation

# Plan de l'interprétation

- 1- Qualité
- 2- Fréquence
- 3- Rythme
- 4- Onde P
- 5- Intervalle PR
- 6- Complexe QRS
- 7- ST-T
- 8- Intervalle QT

## Plan de l'interprétation

# 1- Qualité

2- Rythme

3- Fréquence

4- Onde P

5- Intervalle PR

6- Complexe QRS

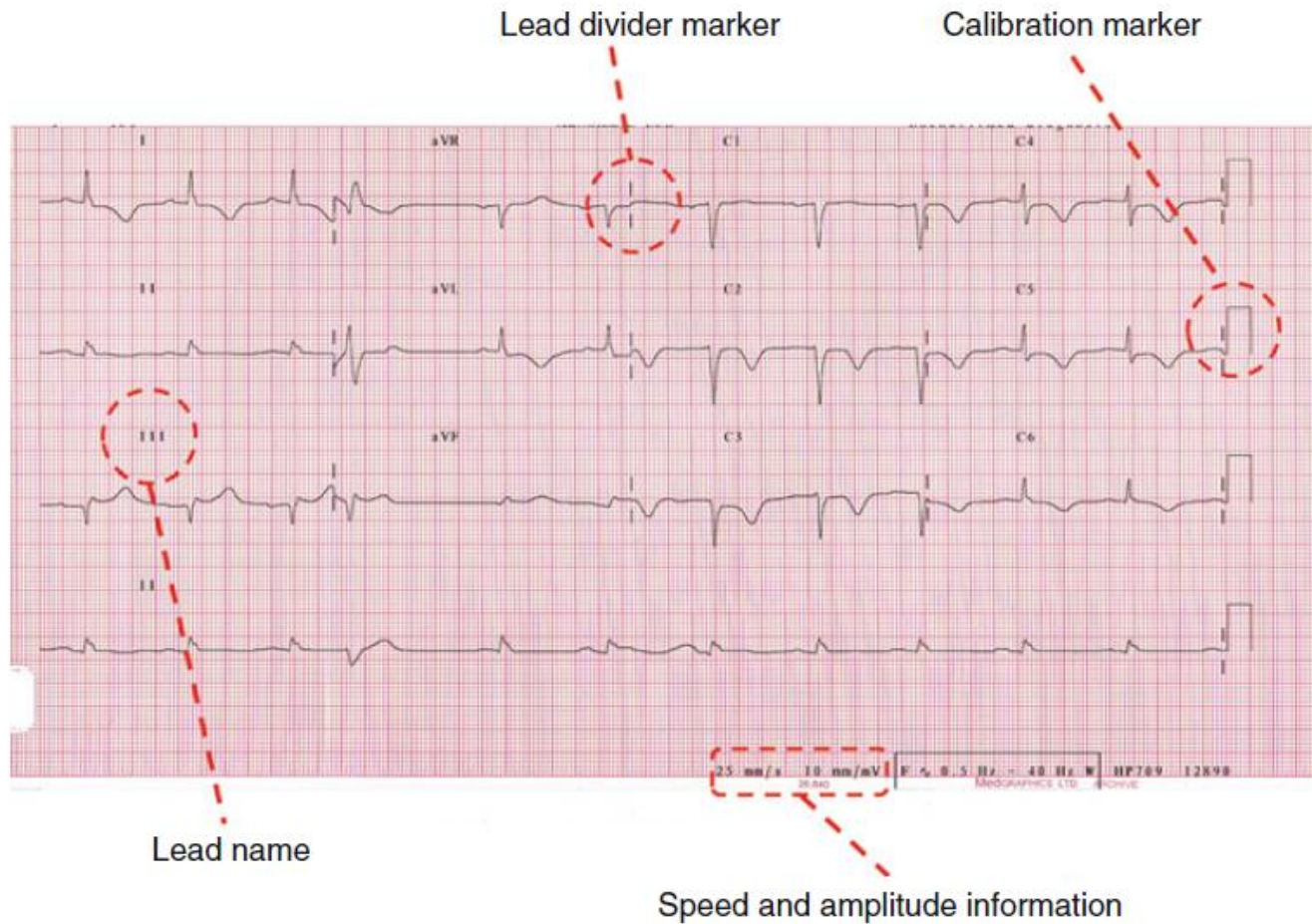
7- ST-T

8- Intervalle QT

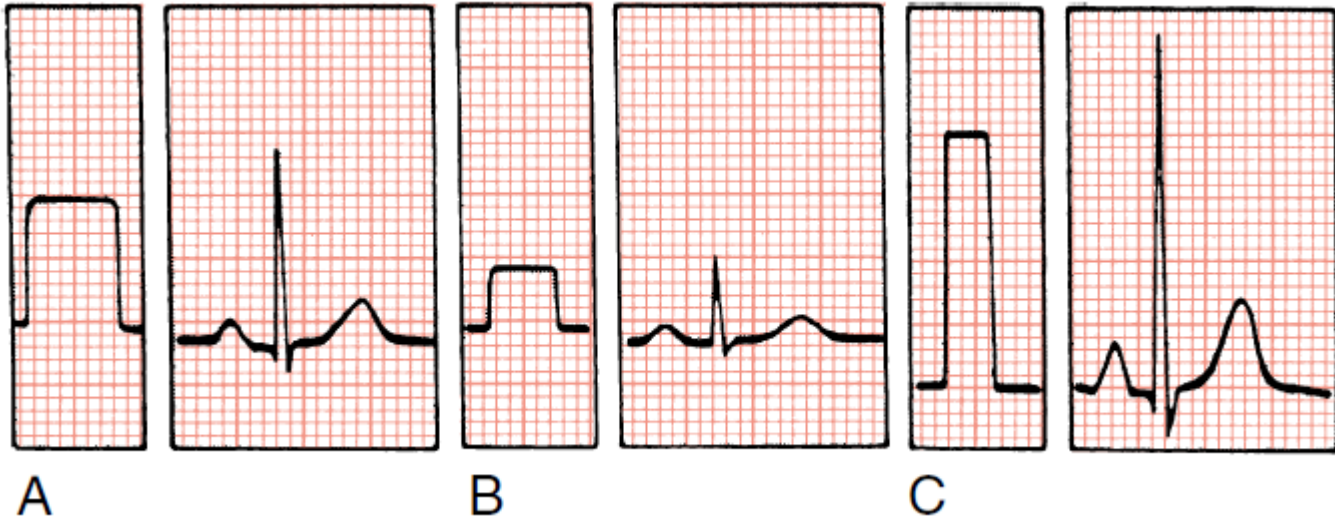
# Qualité

1. Etalonnage
2. Inversion des électrodes
3. Artefacts

# Etalonnage

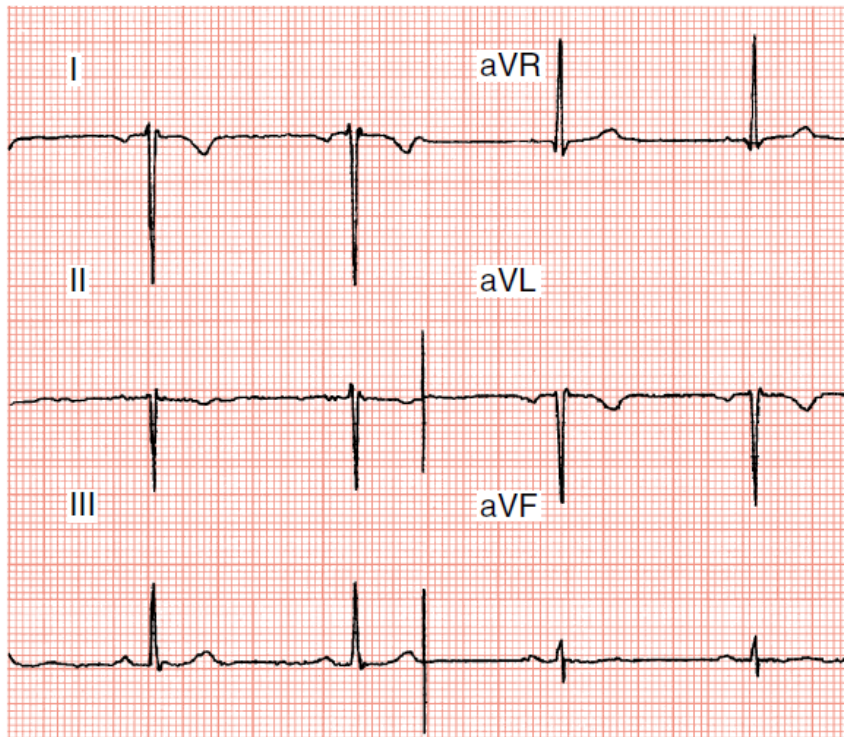




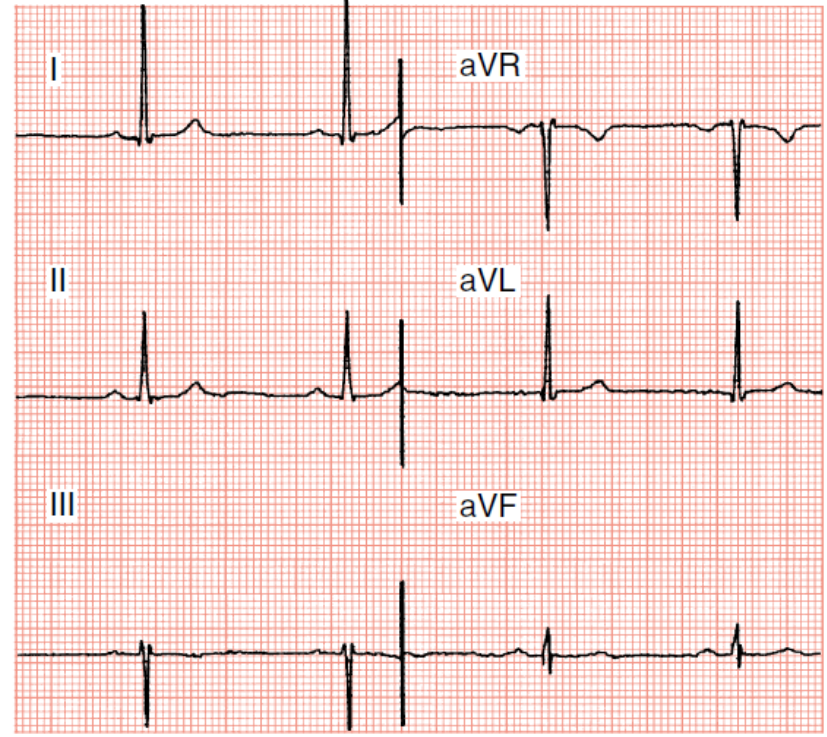


# Inversion des électrodes

Arm Electrodes Reversed

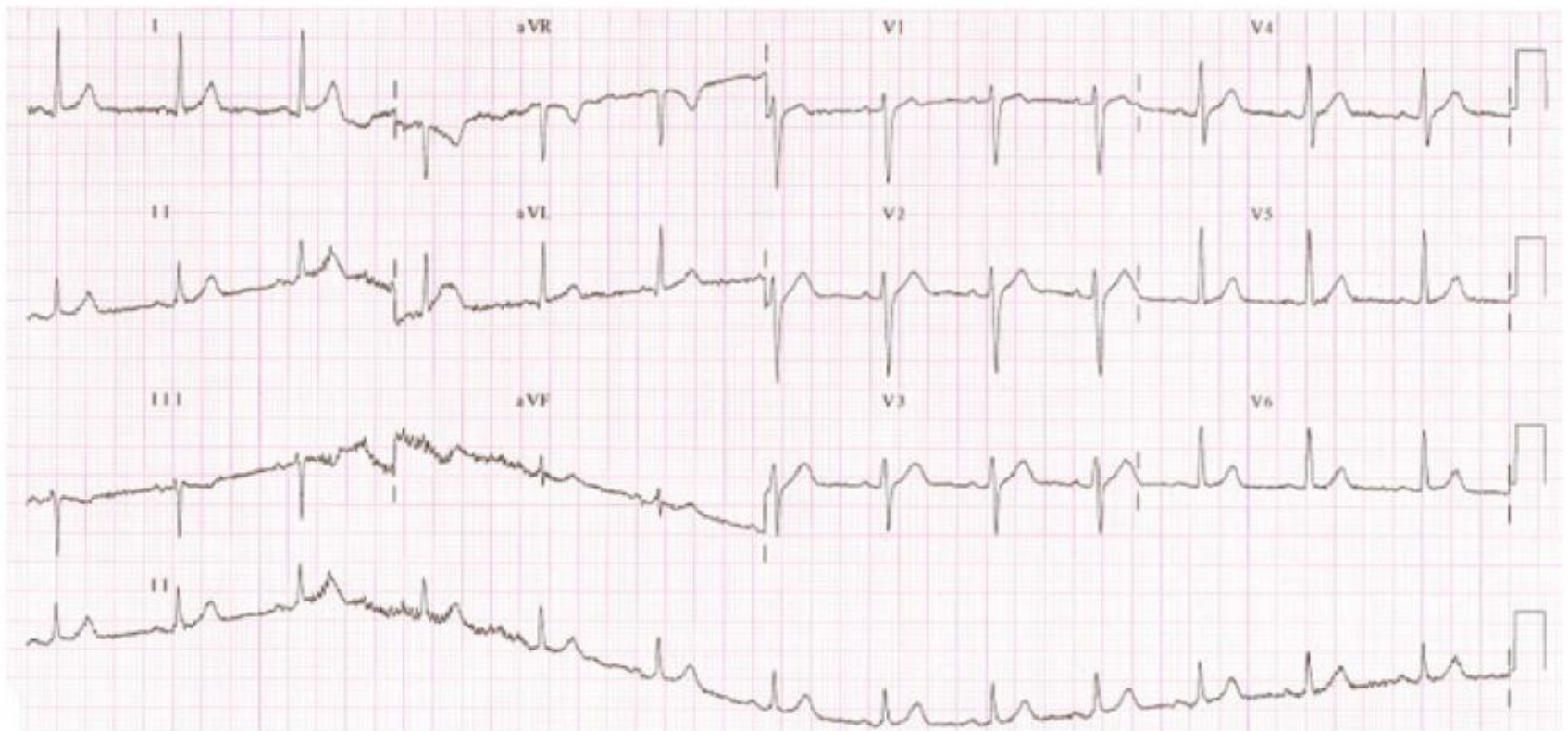


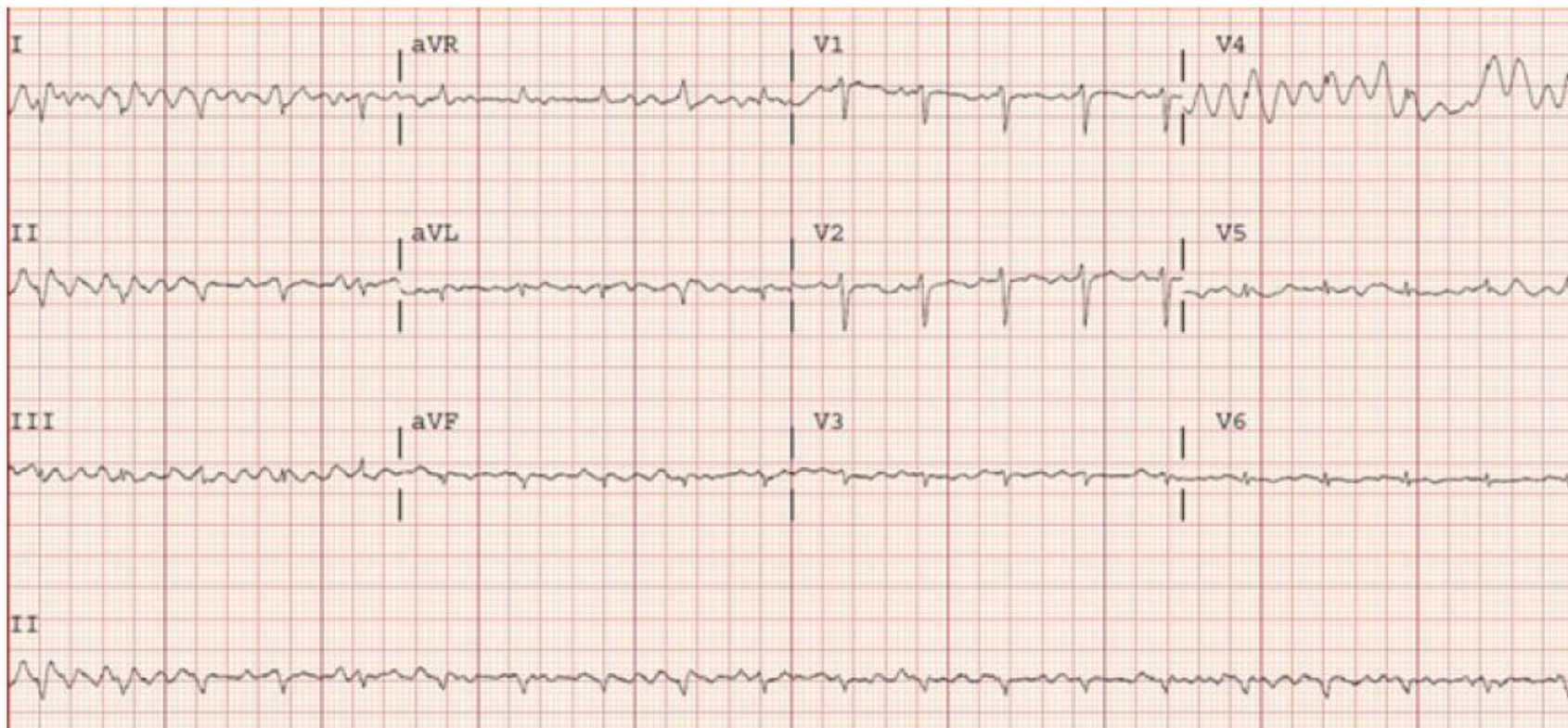
Corrected ECG



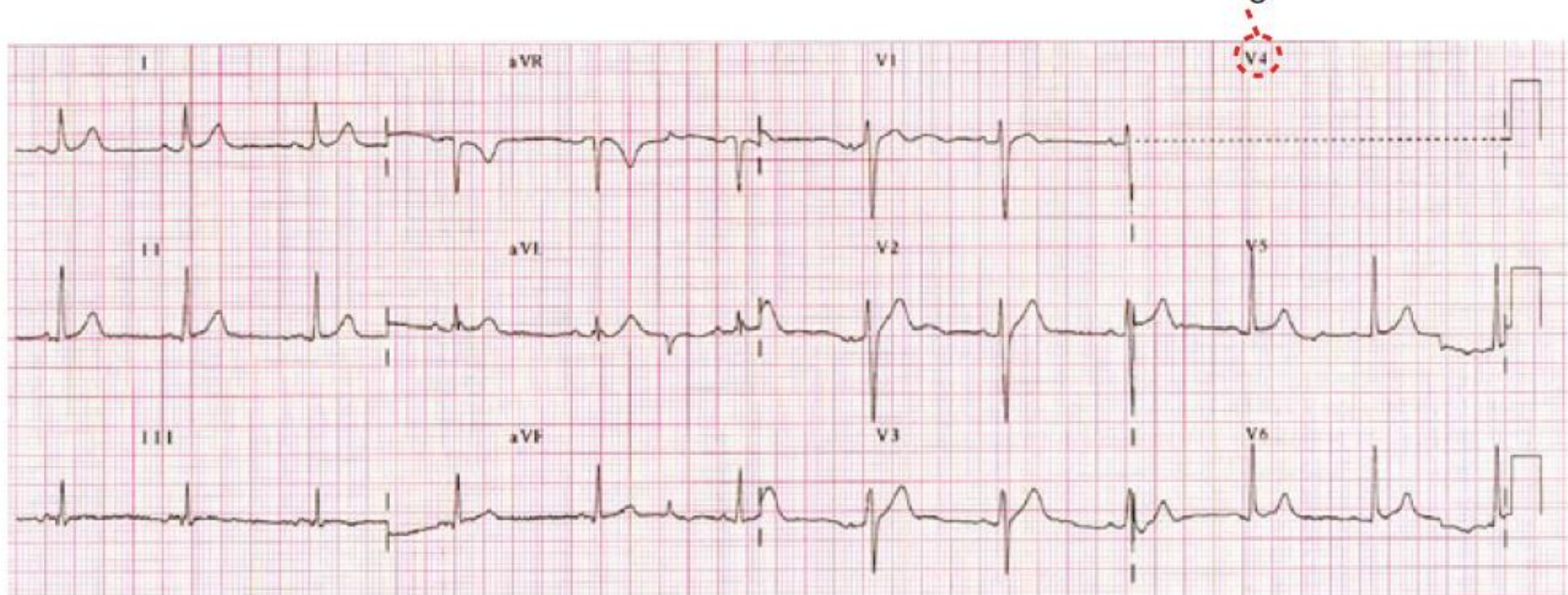
# Artefacts







Missing lead data



# Plan de l'interprétation

1- Qualité

**2- Fréquence: 60-100/min**

3- Rythme

4- Onde P

5- Intervalle PR

6- Complexe QRS

7- ST-T

8- Intervalle QT

$$\text{Heart rate (bpm)} = \frac{300}{\text{Number of large squares}}$$

$$\text{Heart rate (bpm)} = \frac{1500}{\text{Number of small squares}}$$



$1500/26 = 58$

Heart rate = 58 beats per minute

Sinus bradycardia



$1500/13 = 115$

Heart rate = 115 beats/minute

Sinus tachycardia



**150  
bpm**



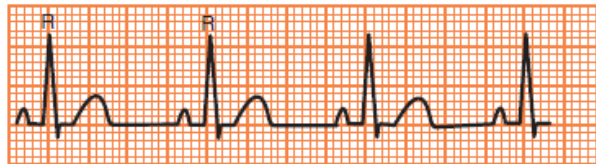
**RR interval  
= 400 ms  
2 large squares**

**100  
bpm**



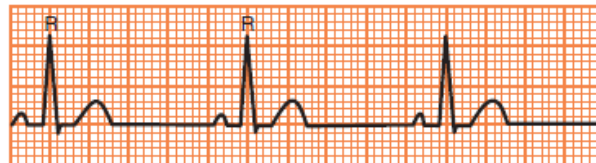
**RR interval  
= 600 ms  
3 large squares**

**75  
bpm**



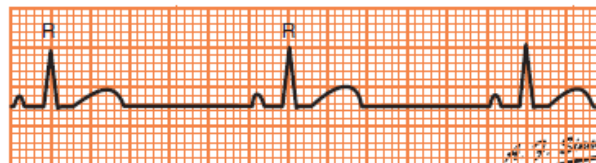
**RR interval  
= 800 ms  
4 large squares**

**60  
bpm**



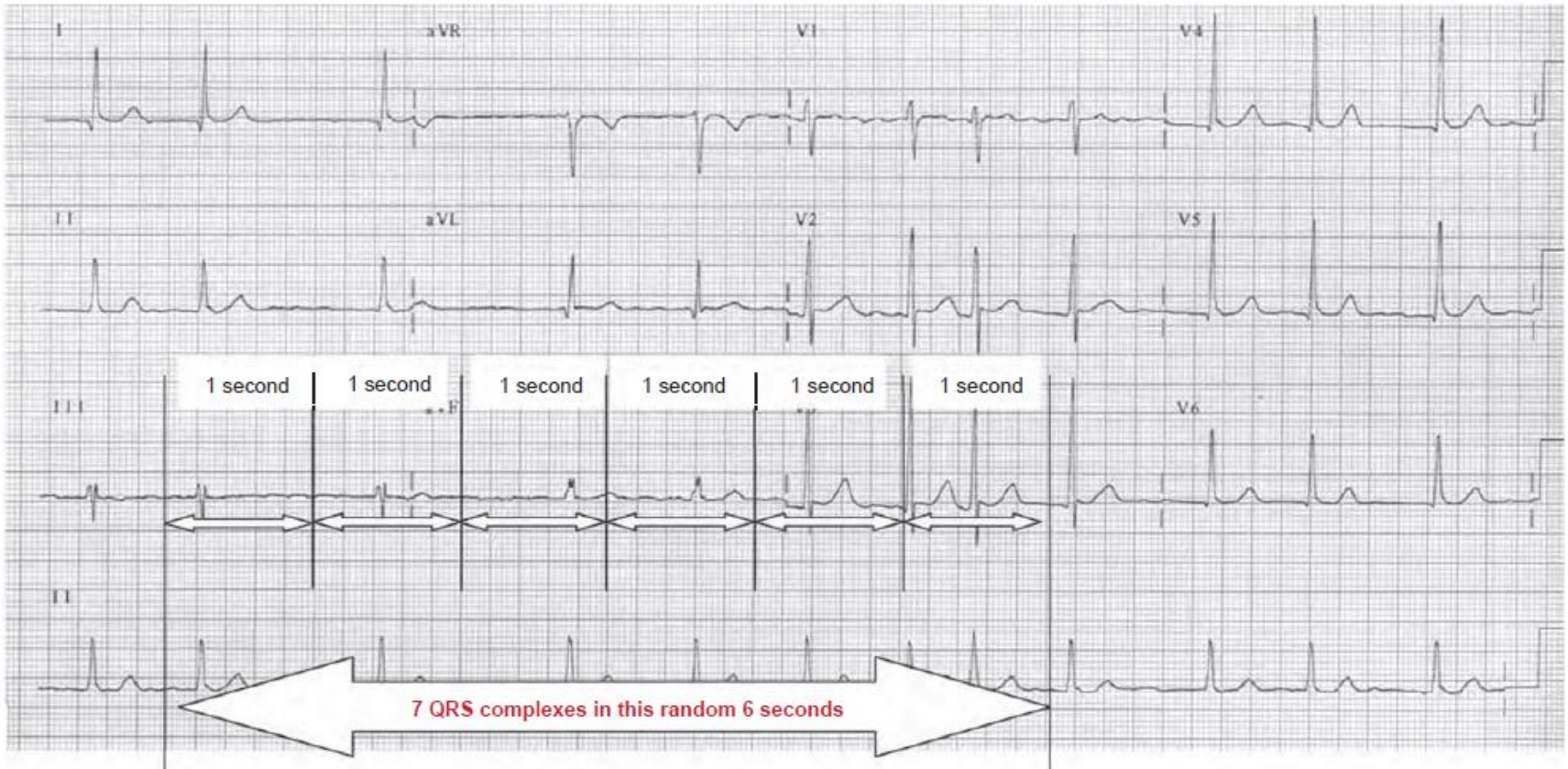
**RR interval  
= 1000 ms  
5 large squares**

**50  
bpm**



**RR interval  
= 1200 ms  
6 large squares**

# Rythme irrégulier



# Plan de l'interprétation

1- Qualité

2- Fréquence

**3- Rythme: sinusal? régulier?**

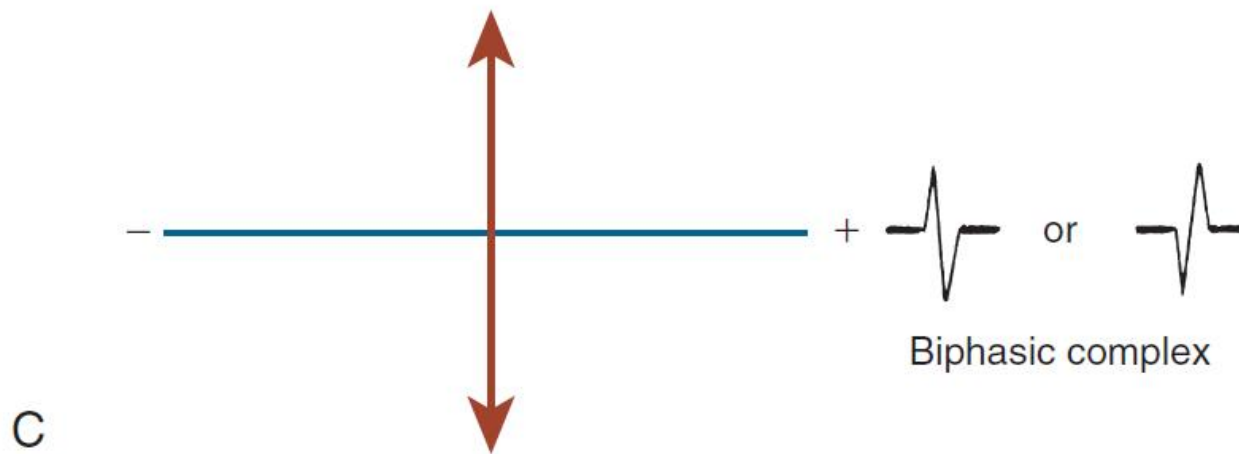
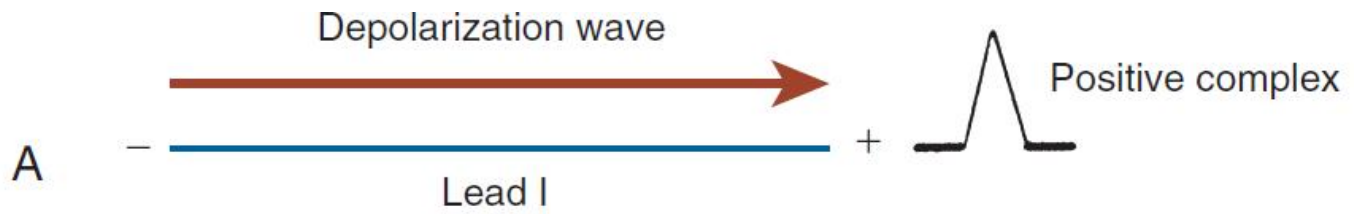
4- Onde P

5- Intervalle PR

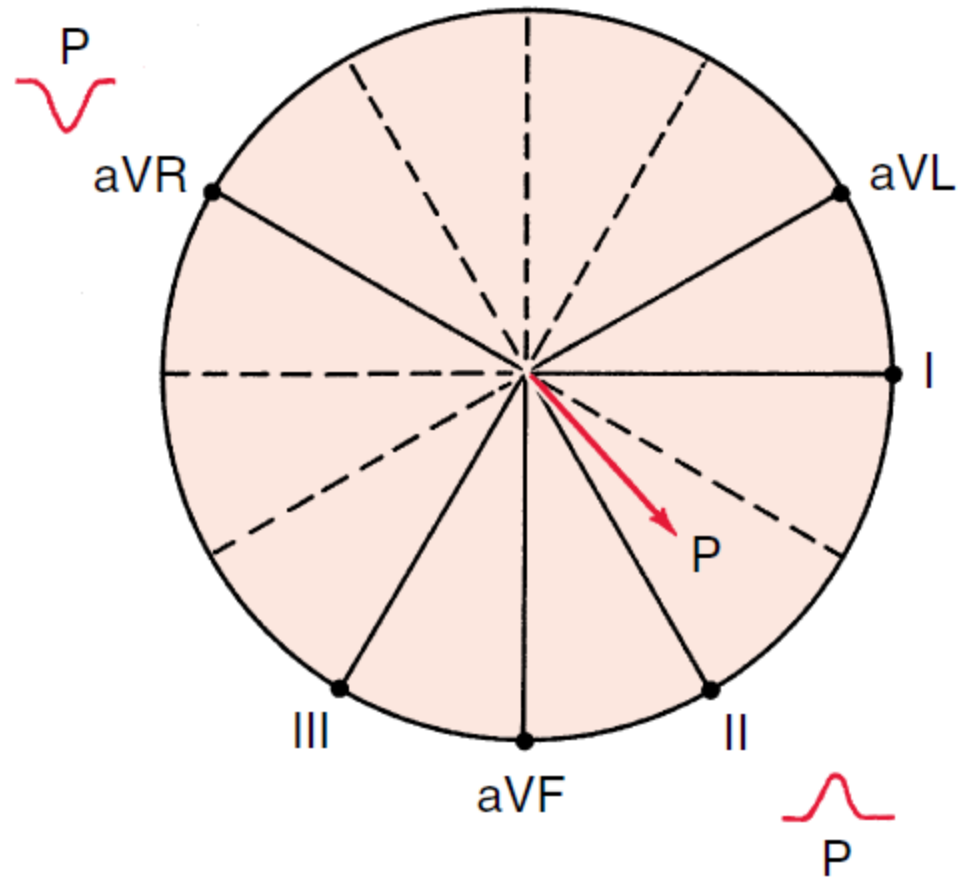
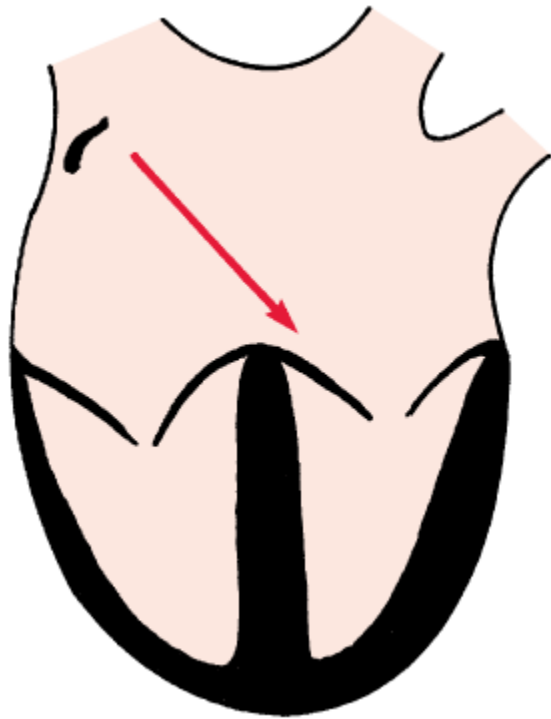
6- Complexe QRS

7- ST-T

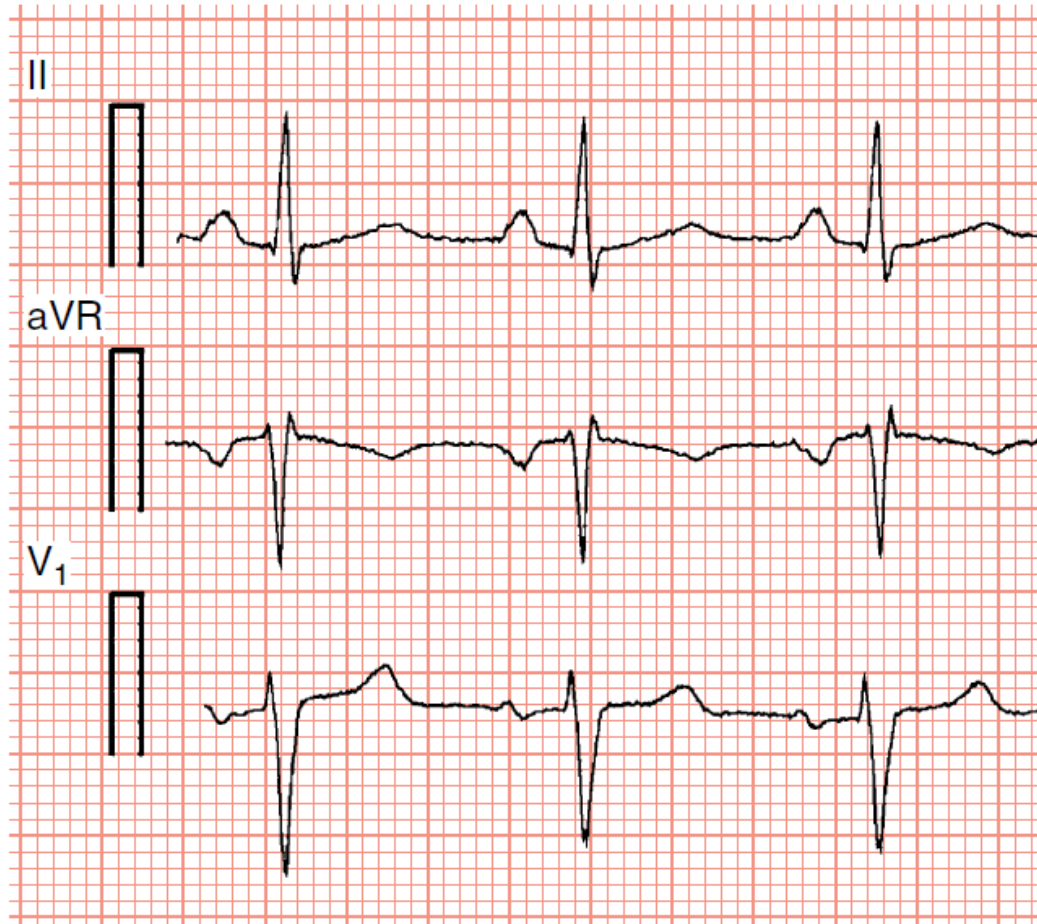
8- Intervalle QT



# Onde P sinusale



# Rythme sinusal





# Plan de l'interprétation

1- Qualité

2- Fréquence

3- Rythme

**4- Onde P:** durée  $< 0.12$  sec, amplitude  $< 2.5$  mm

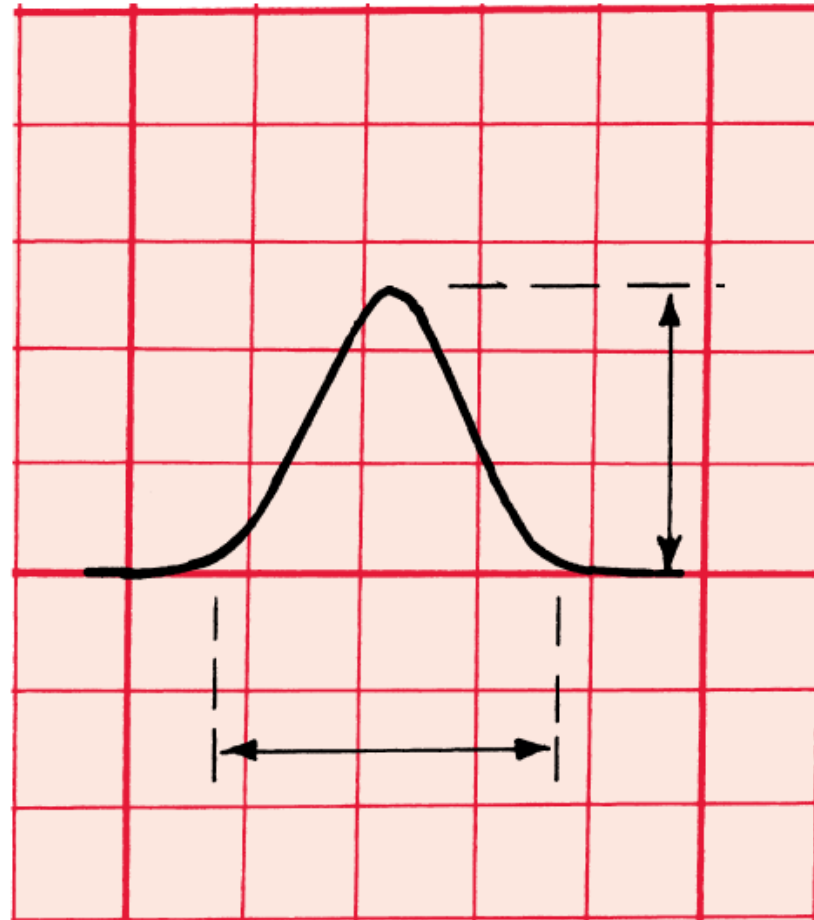
5- Intervalle PR

6- Complexe QRS

7- ST-T

8- Intervalle QT

DII: durée  $< 0.12$  sec, amplitude  $< 2.5$  mm



# Plan de l'interprétation

1- Qualité

2- Fréquence

3- Rythme

4- Onde P

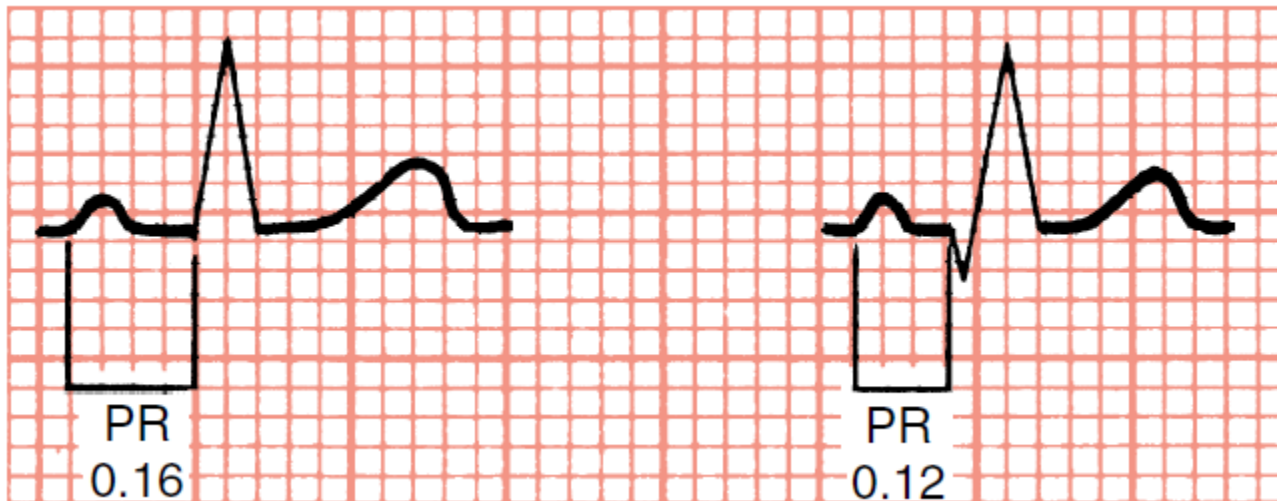
**5- Intervalle PR: 0.12-0.20 sec**

6- Complexe QRS

7- ST-T

8- Intervalle QT

# PR: conduction AV



# Plan de l'interprétation

1- Qualité

2- Fréquence

3- Rythme

4- Onde P

5- Intervalle PR

**6- Complexe QRS**

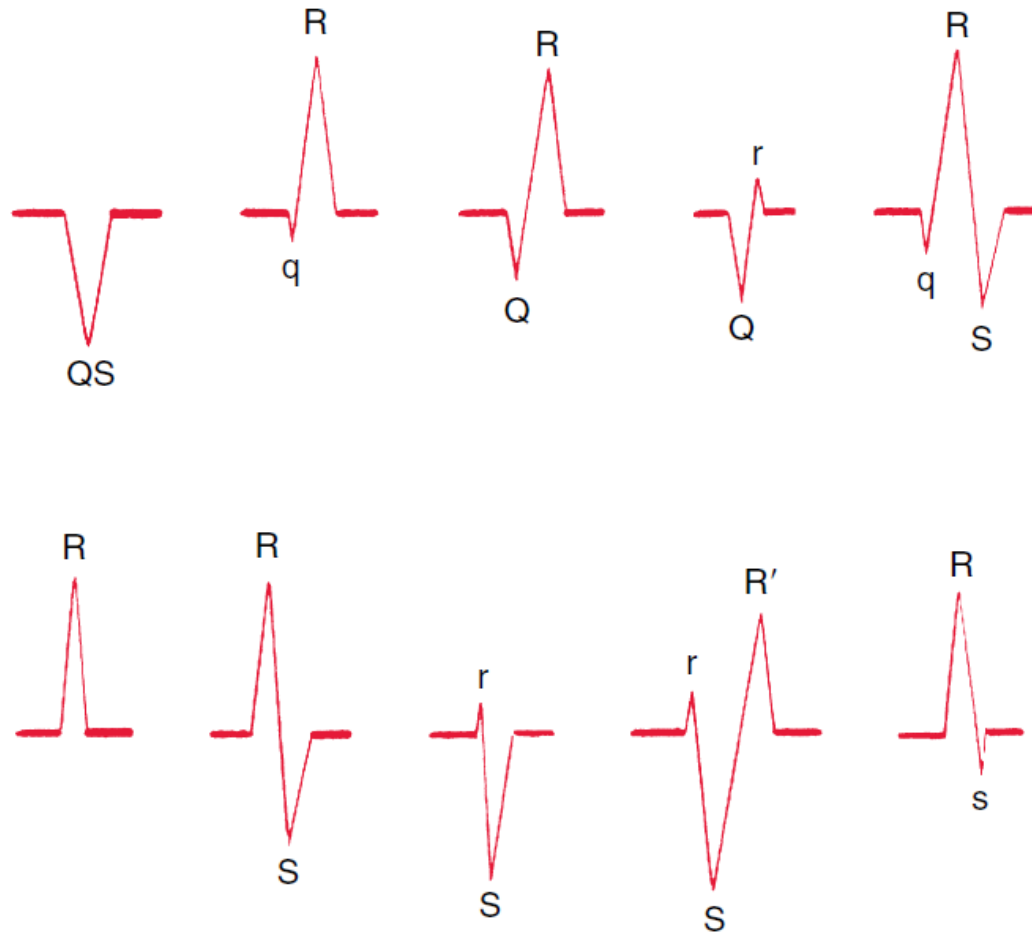
7- ST-T

8- Intervalle QT

# Complexe QRS

- Durée
- Amplitude
- Morphologie
  - Plan frontal: Axe
  - Plan horizontal: Progression de R
  - Q pathologiques

# Nomenclature



1<sup>ère</sup> déflexion positive: R

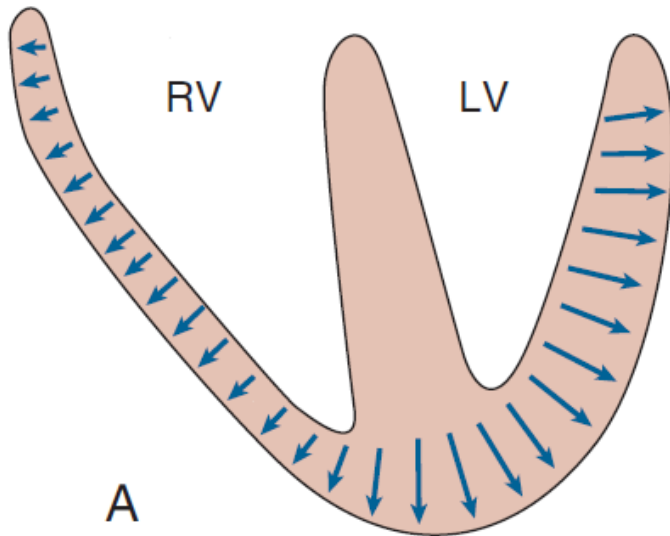
déflexion négative après l'onde R: S

déflexion négative avant l'onde R: Q

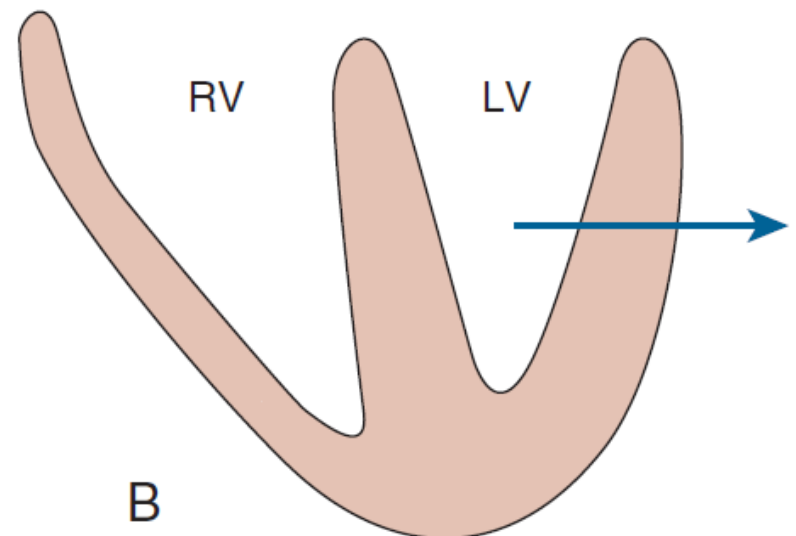
2<sup>ème</sup> déflexion positive R'

# Dépolarisation ventriculaire

Simultaneous Activation Forces

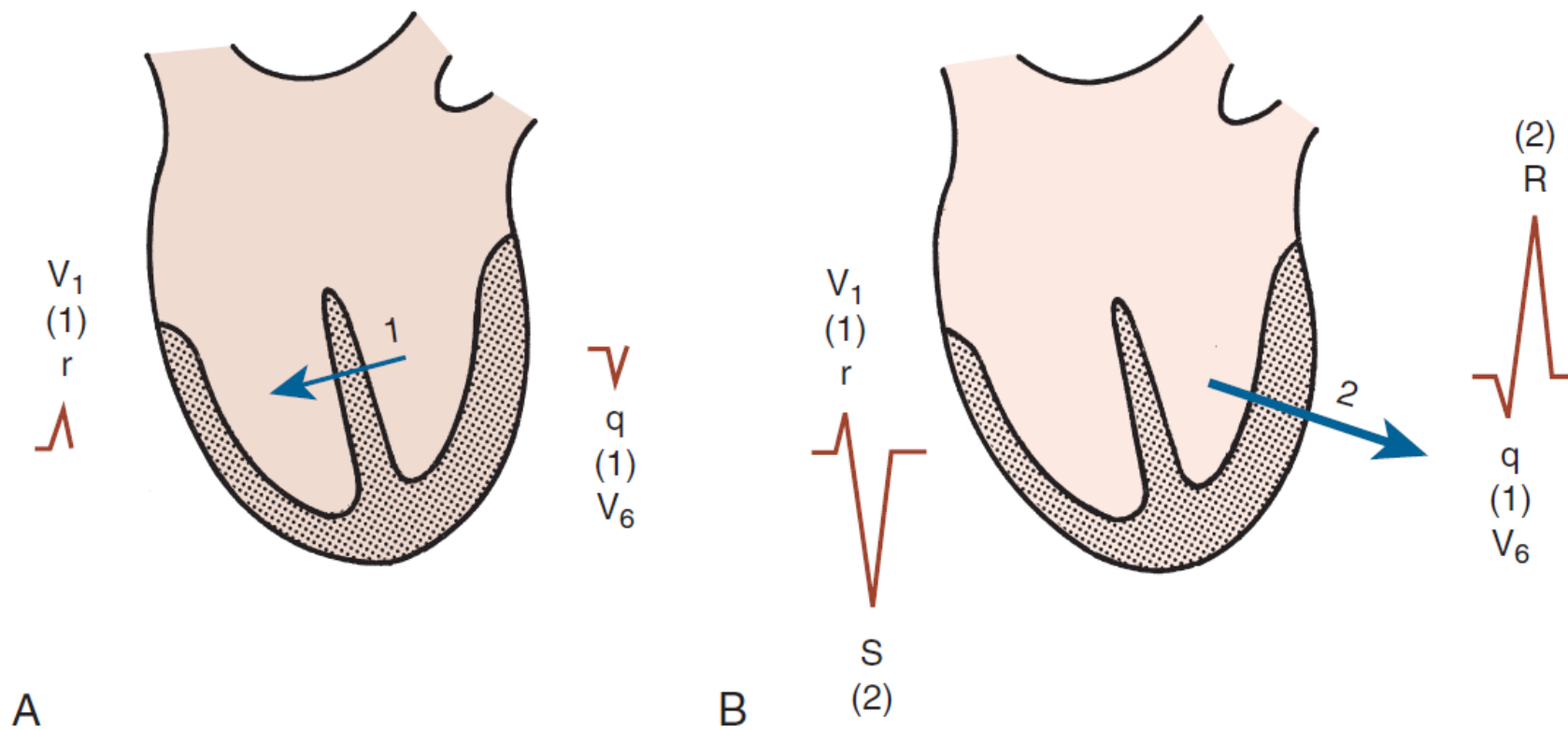


Overall Electrical Force





# Dépolarisation ventriculaire

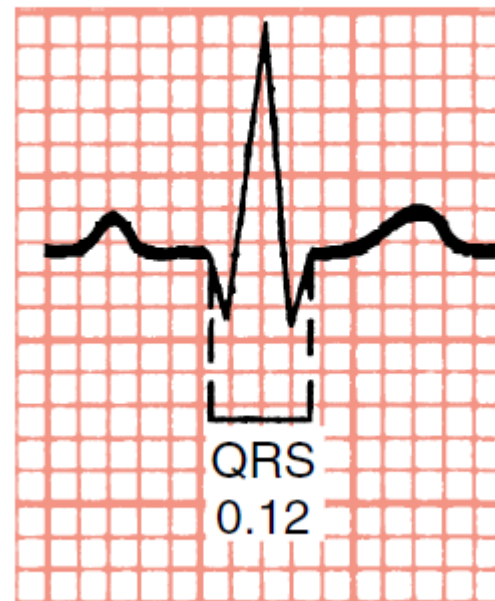
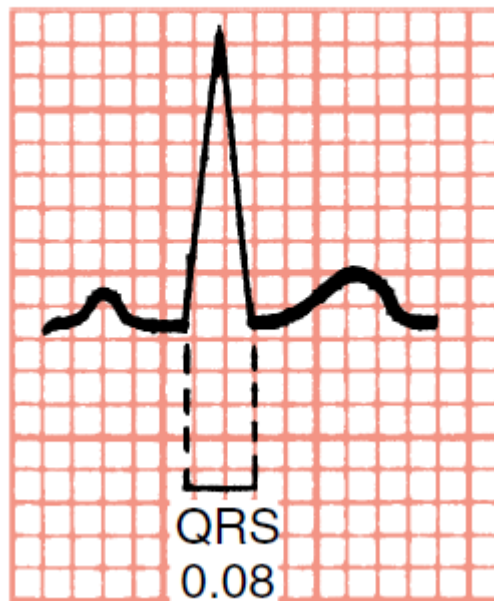


# Complexe QRS

- **Durée**
- Amplitude
- Morphologie
  - Plan frontal: Axe
  - Plan horizontal: Progression de R
  - Q pathologiques

Durée < 0.12 sec

## QRS Interval

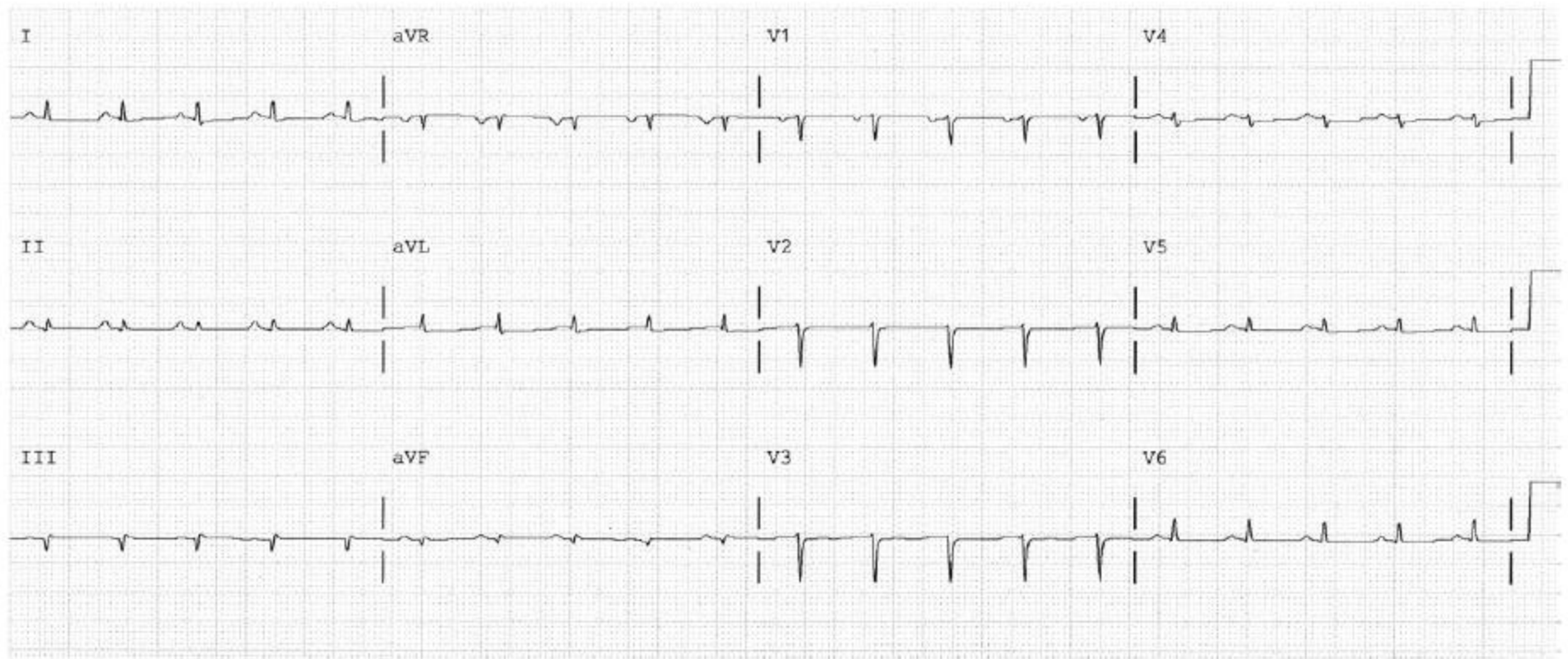


# Complexe QRS

- Durée
- **Amplitude**
- Morphologie
  - Plan frontal: Axe
  - Plan horizontal: Progression de R
  - Q pathologiques

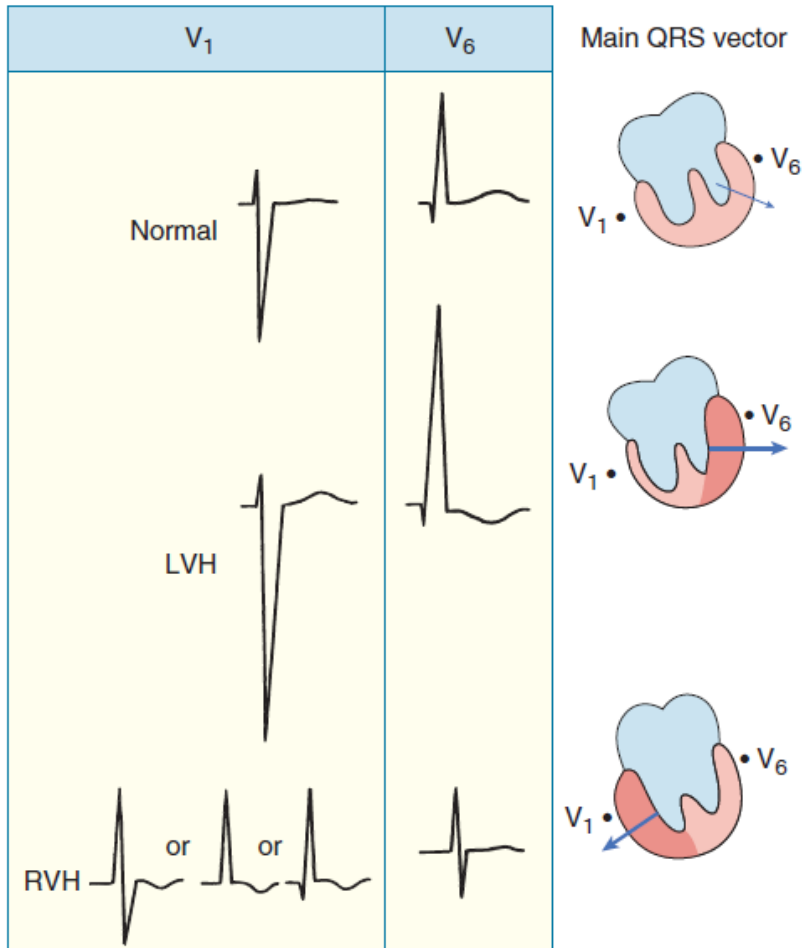
# Amplitude: Bas voltage

- I-aVF < 5 mm
- V1-V6 < 10 mm



# Hypertrophies

QRS in hypertrophy

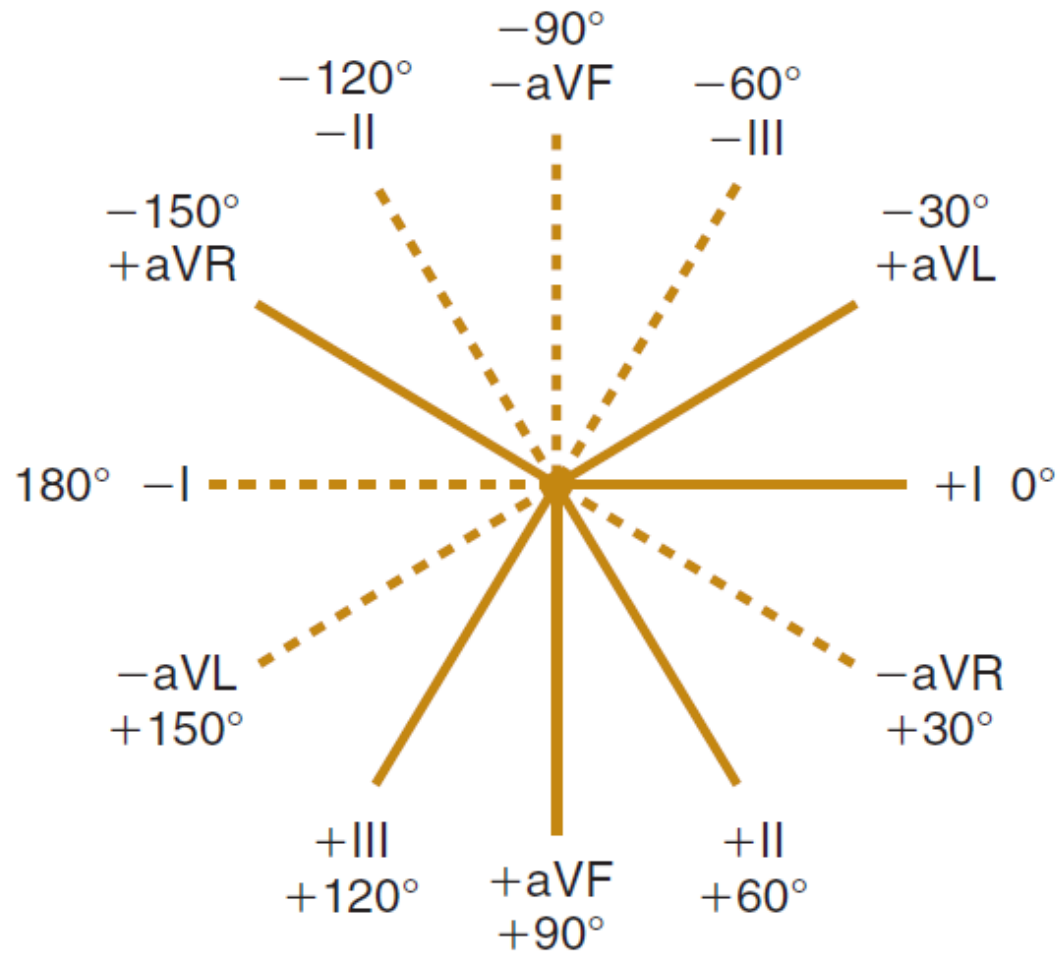


**Sokolow-Lyon:**  $SV_1 + RV_5$  ou  $V_6 > 35$  mm  
**Cornell:**  $RaVL + SV_3 > 28$  (homme)  
 $> 20$  (femme)

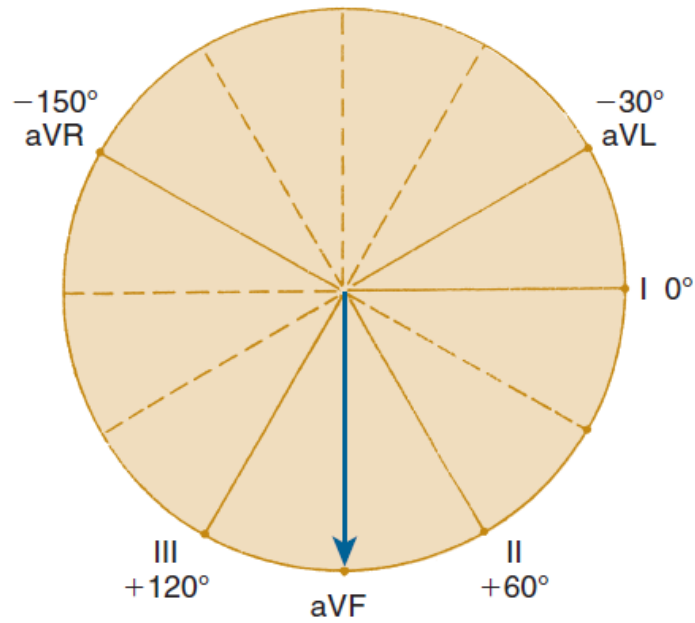
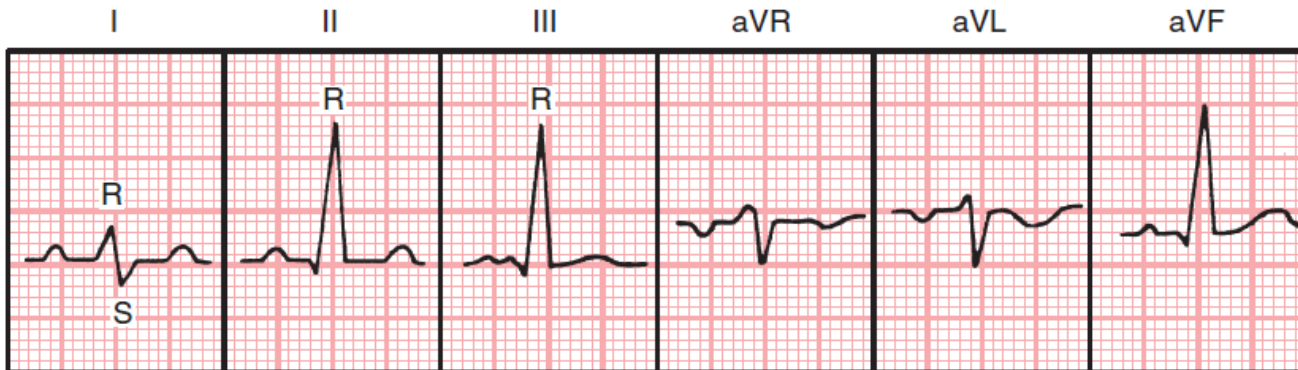
R>S V<sub>1</sub>  
 S>R V<sub>5-6</sub>

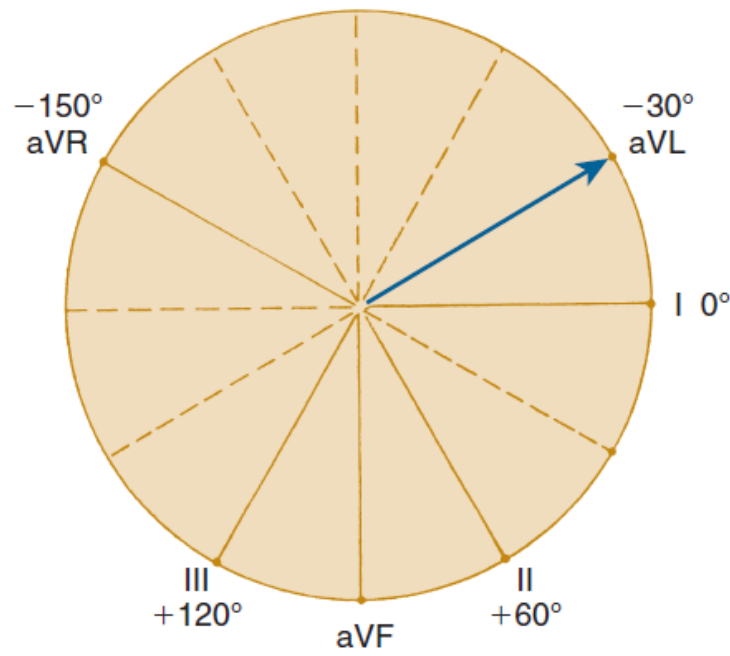
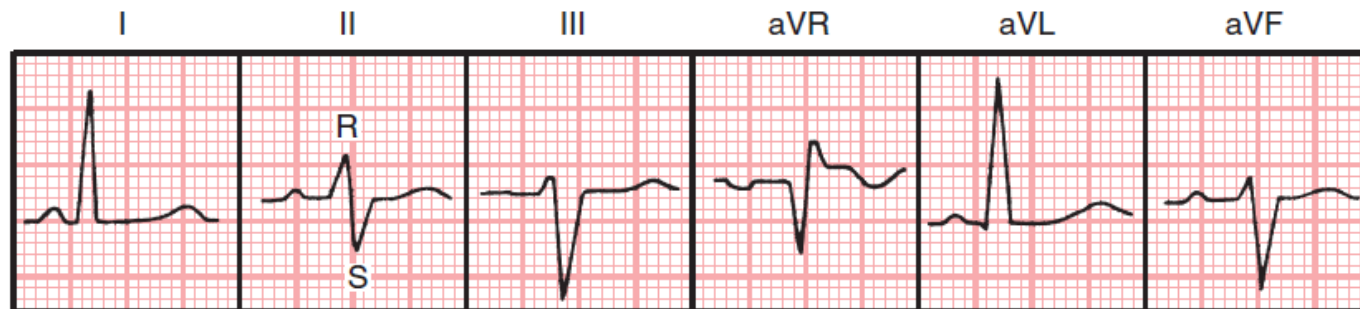
# Complexe QRS

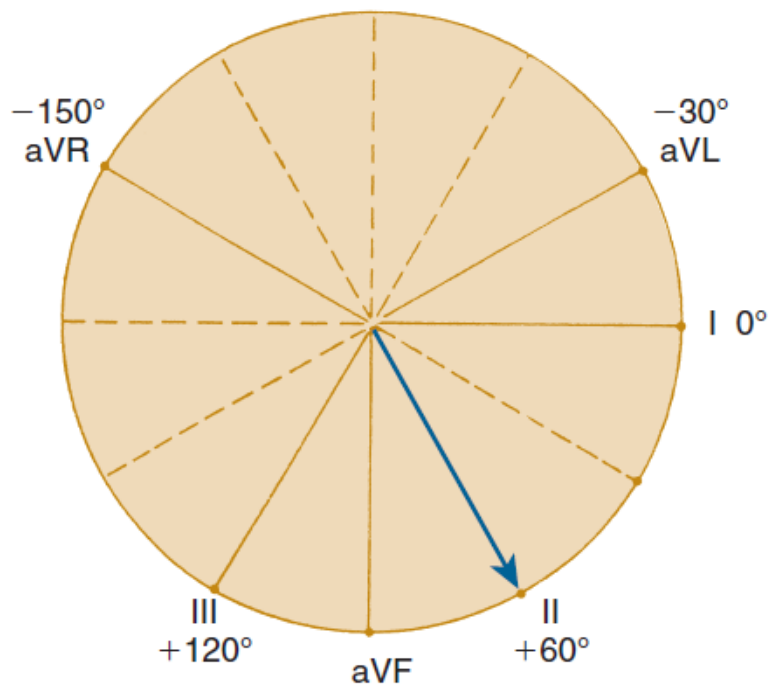
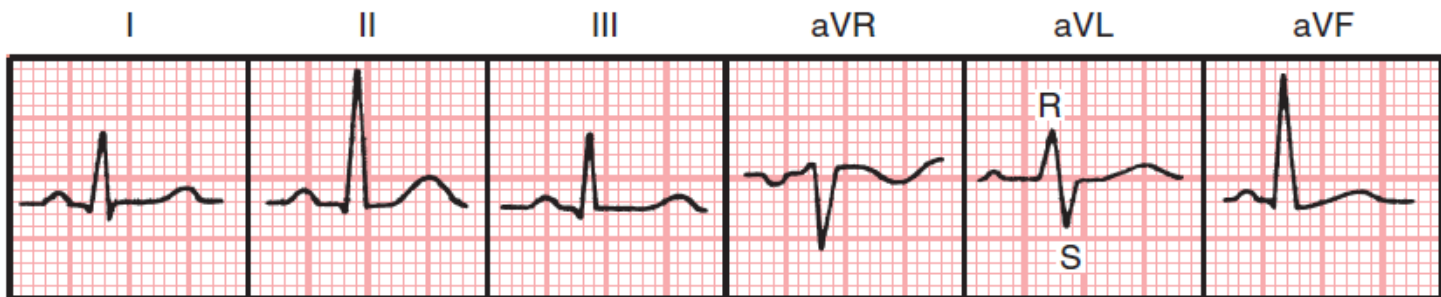
- Durée
- Amplitude
- **Morphologie**
  - **Plan frontal: Axe**
  - Plan horizontal: Progression de R
  - Q pathologiques

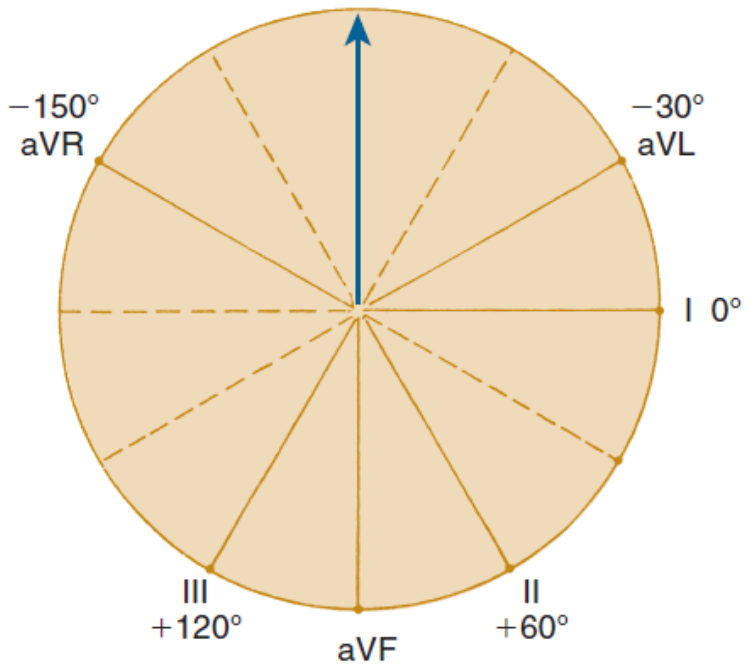
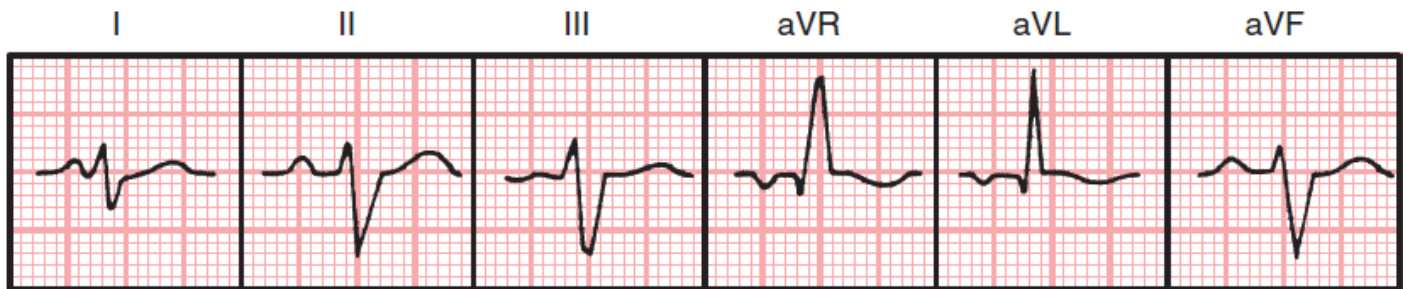


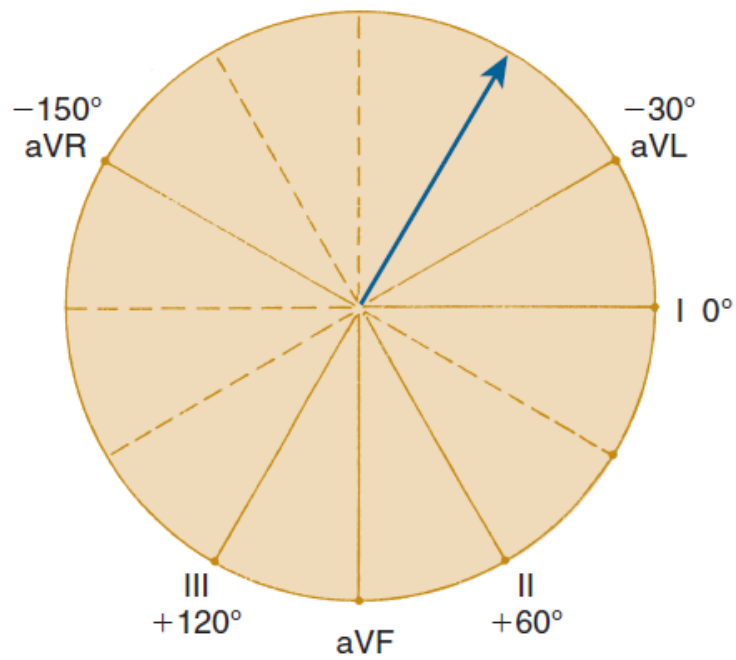
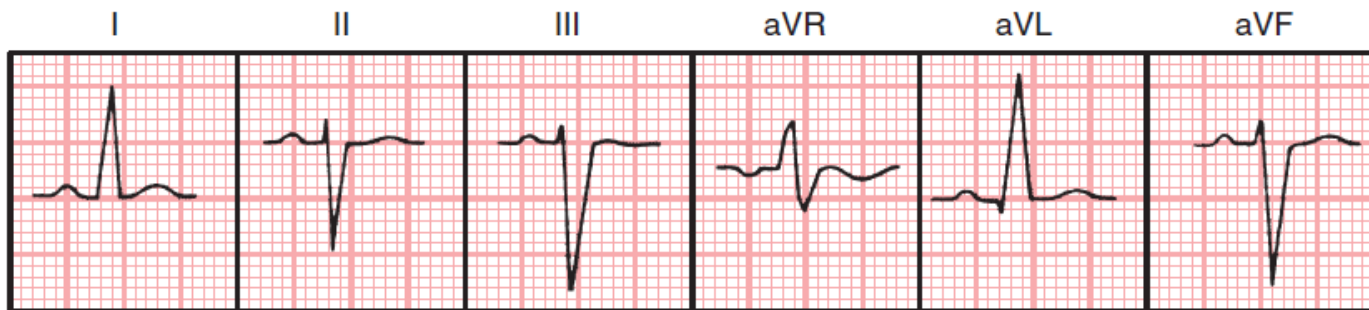


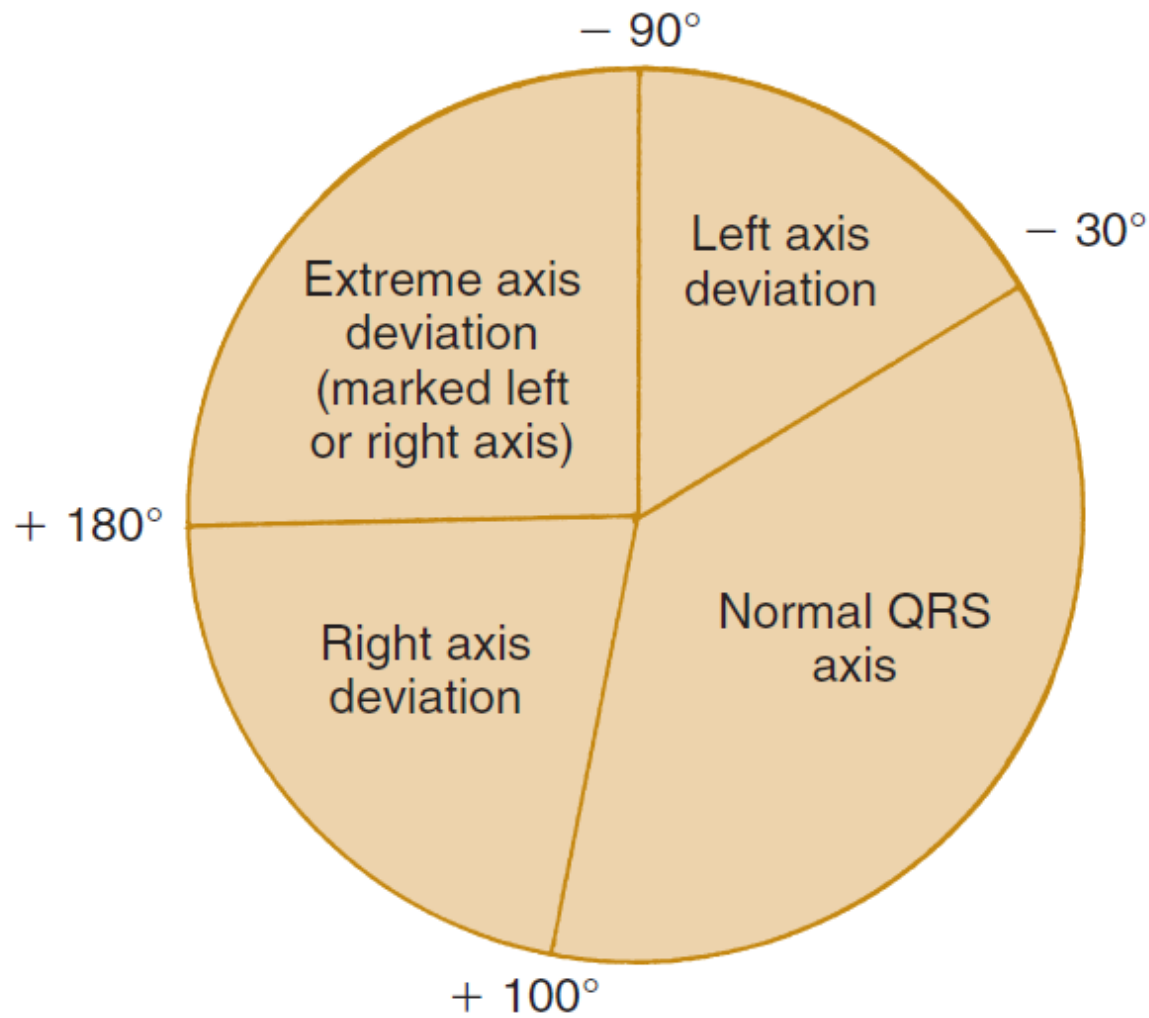




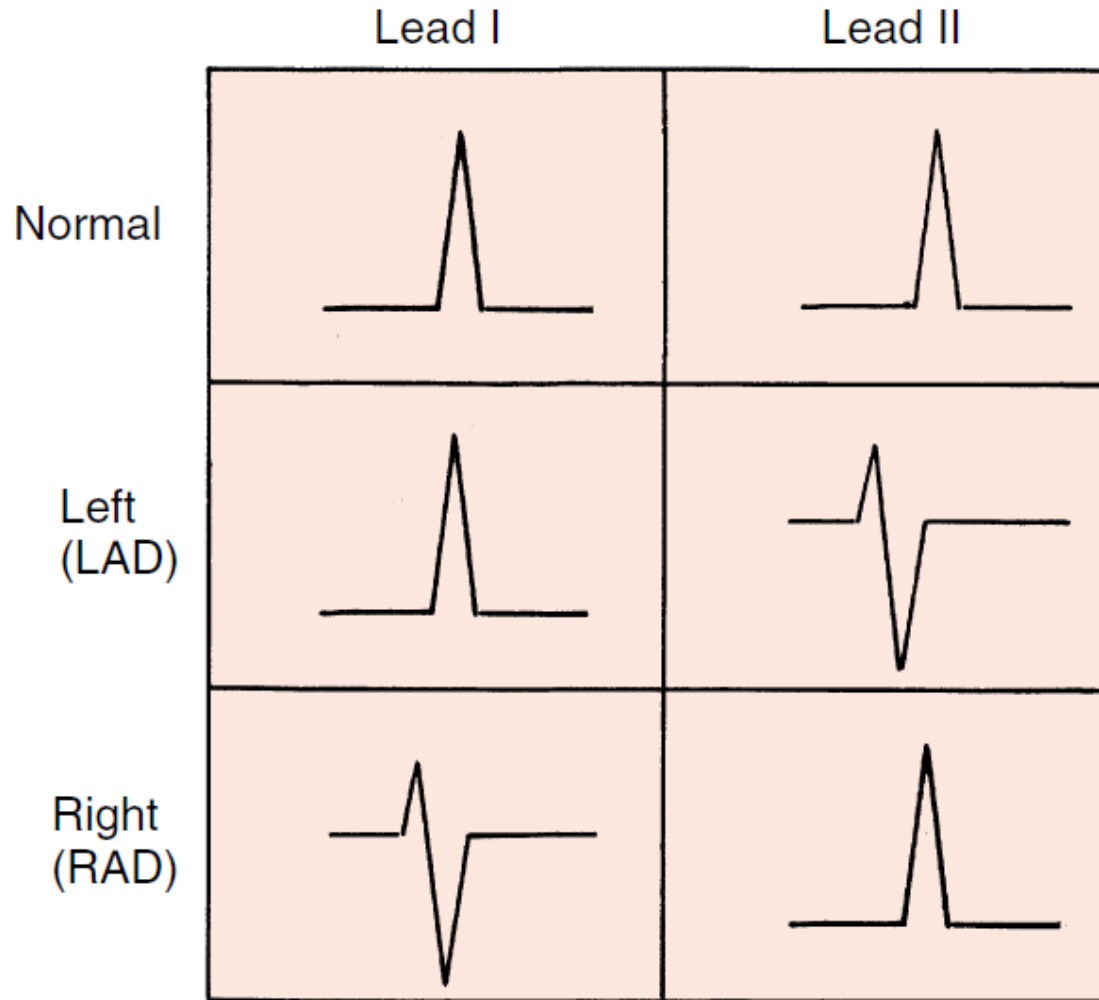




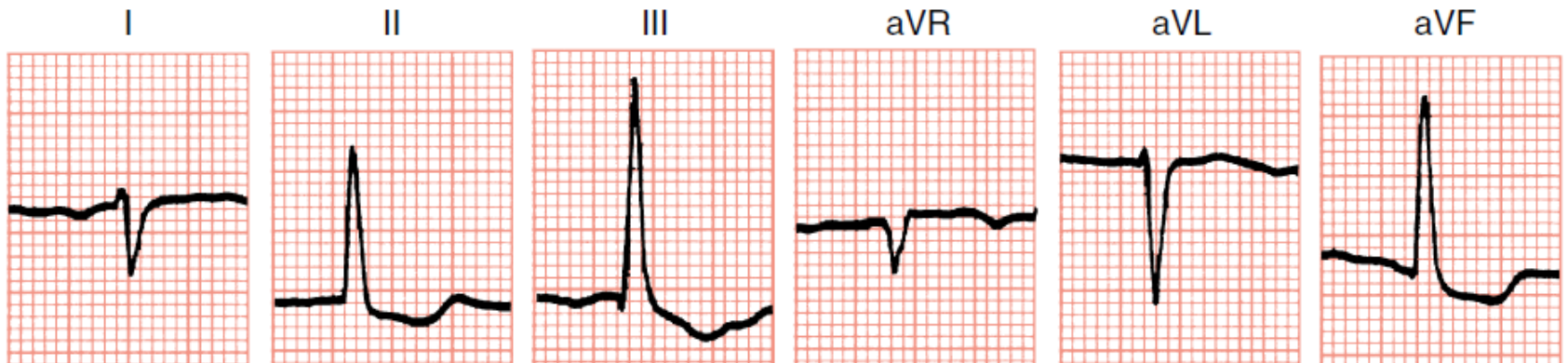




# Deviation axiale gauche et droite

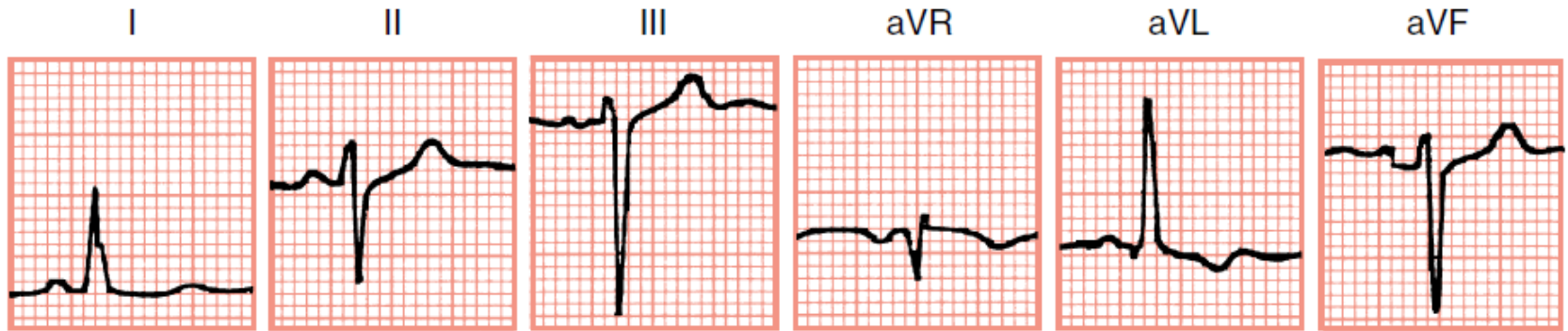


# Axe droit





# Axe gauche



# Complexe QRS

- Durée
- Amplitude
- **Morphologie**
  - Plan frontal: Axe
  - **Plan horizontal: Progression de R**
  - Q pathologiques

### Normal R Wave Progression

V<sub>1</sub>

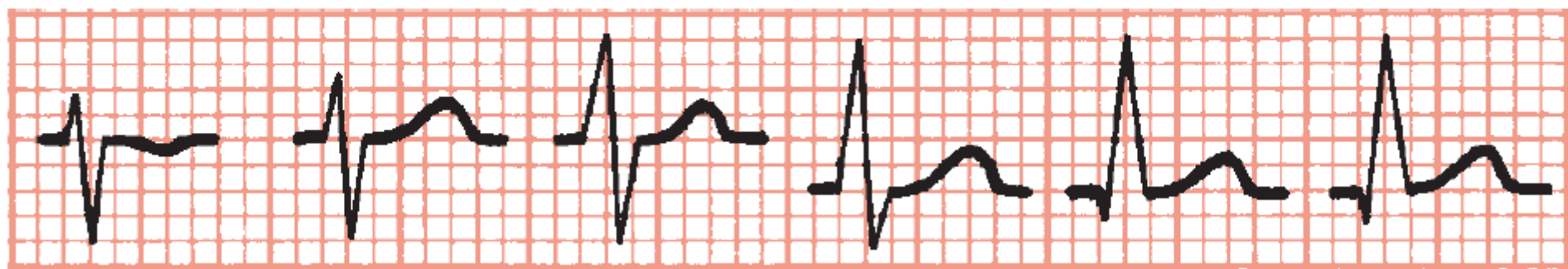
V<sub>2</sub>

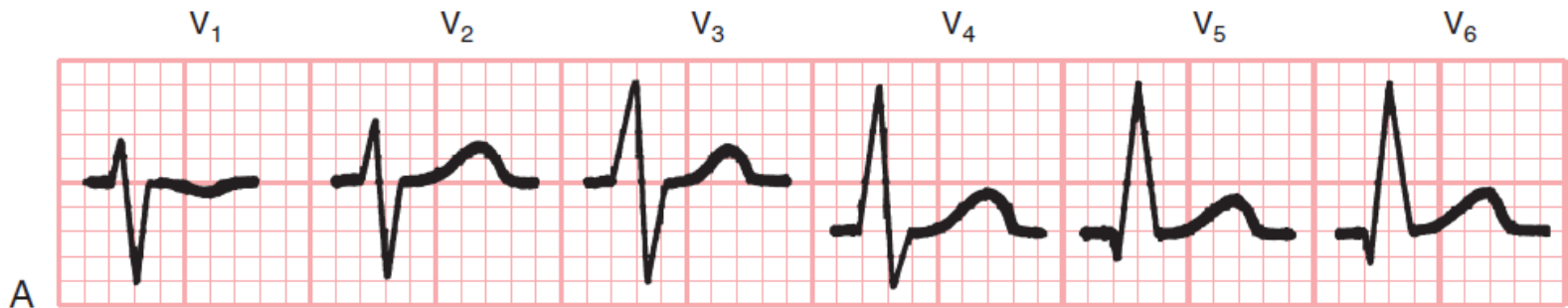
V<sub>3</sub>

V<sub>4</sub>

V<sub>5</sub>

V<sub>6</sub>

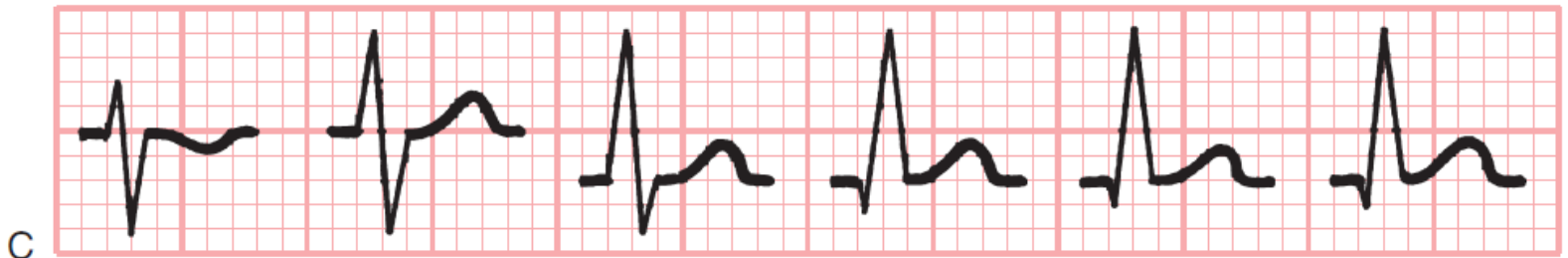




Transition zone



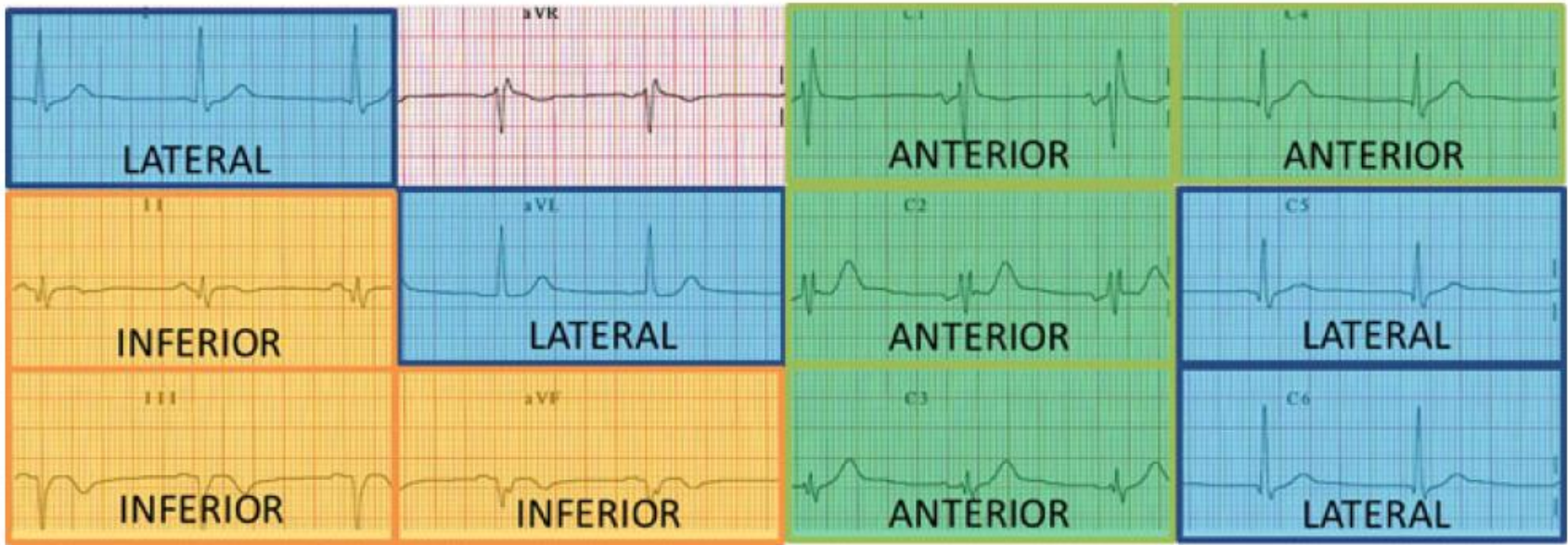
Transition zone



Transition zone

# Complexe QRS

- Durée
- Amplitude
- **Morphologie**
  - Plan frontal: Axe
  - Plan horizontal: Progression de R
  - **Q pathologiques:  $\geq 0.04$  sec / 1mm ou QS sur 2 derivations contigües (même territoire)**



# Plan de l'interprétation

1- Qualité

2- Fréquence

3- Rythme

4- Onde P

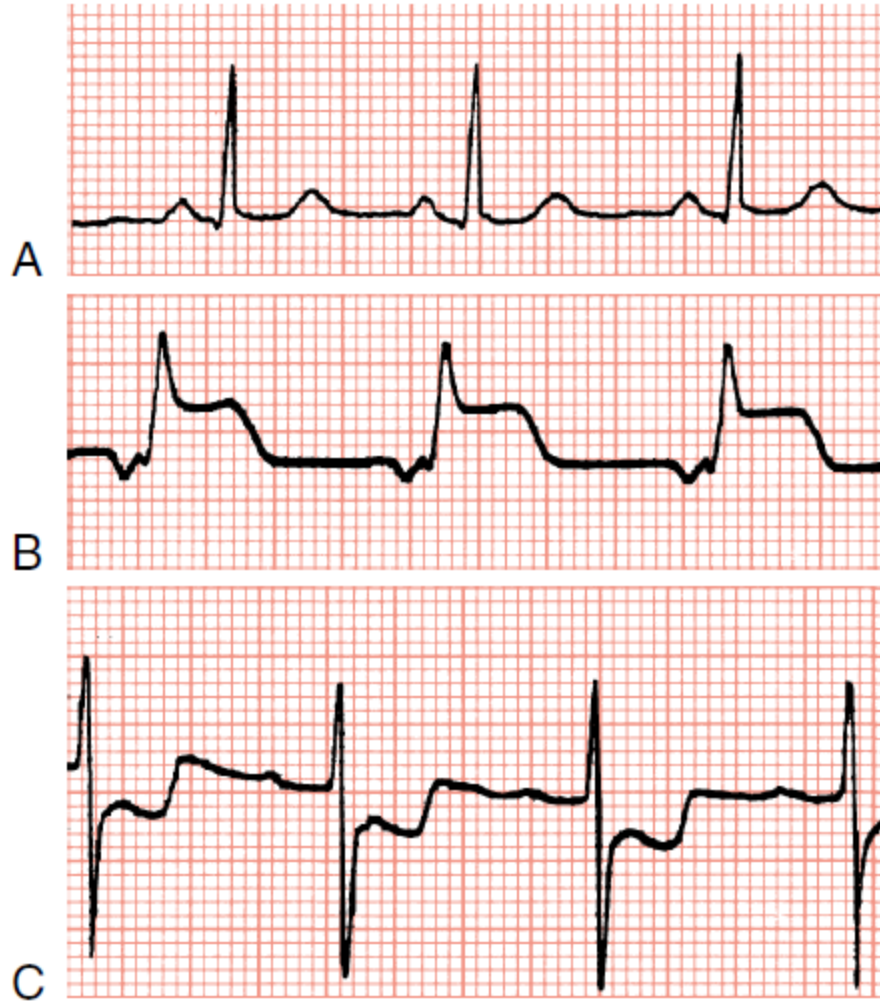
5- Intervalle PR

6- Complexe QRS

**7- ST-T**

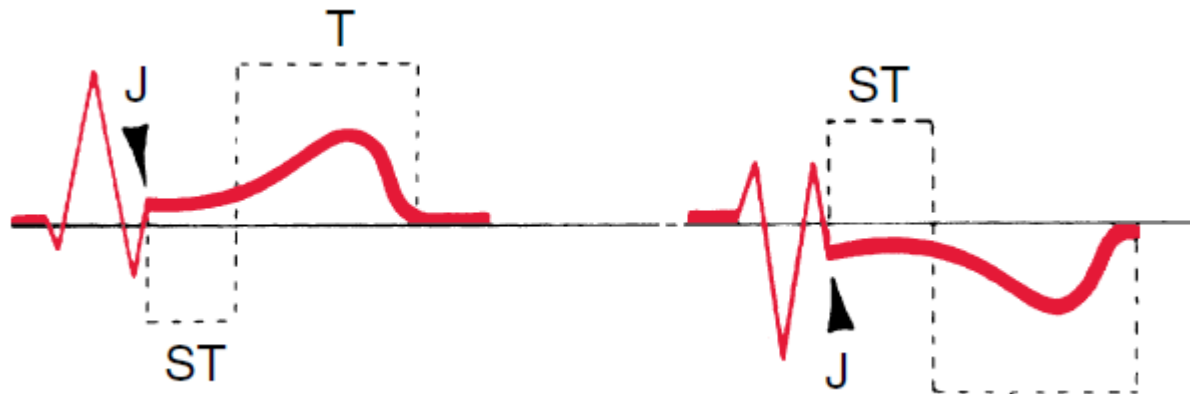
8- Intervalle QT

## ST Segments





## Onde T: Asymétrique et positive



Peut être négative si le QRS est négatif. Ex: aVr, DIII, V1

# Plan de l'interprétation

1- Qualité

2- Fréquence

3- Rythme

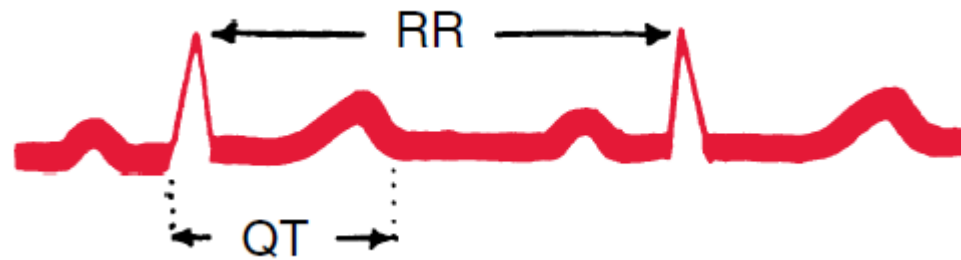
4- Onde P

5- Intervalle PR

6- Complexe QRS

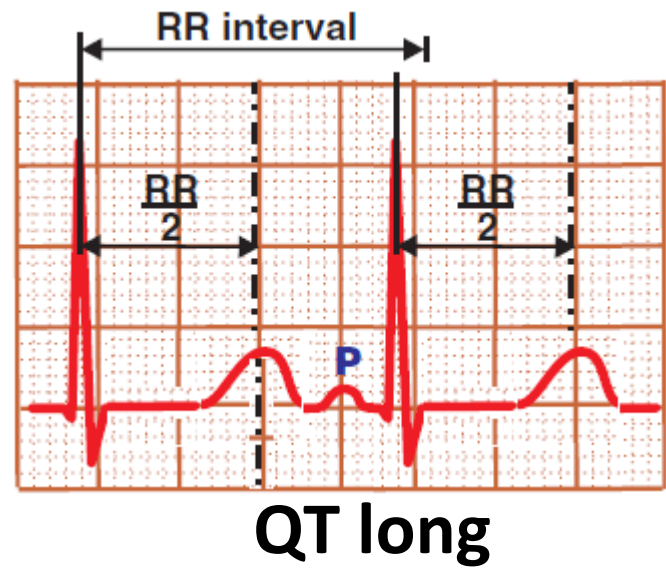
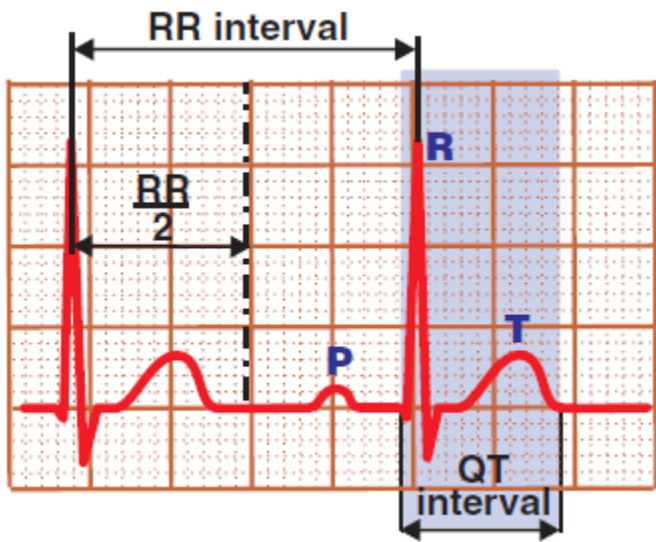
7- ST-T

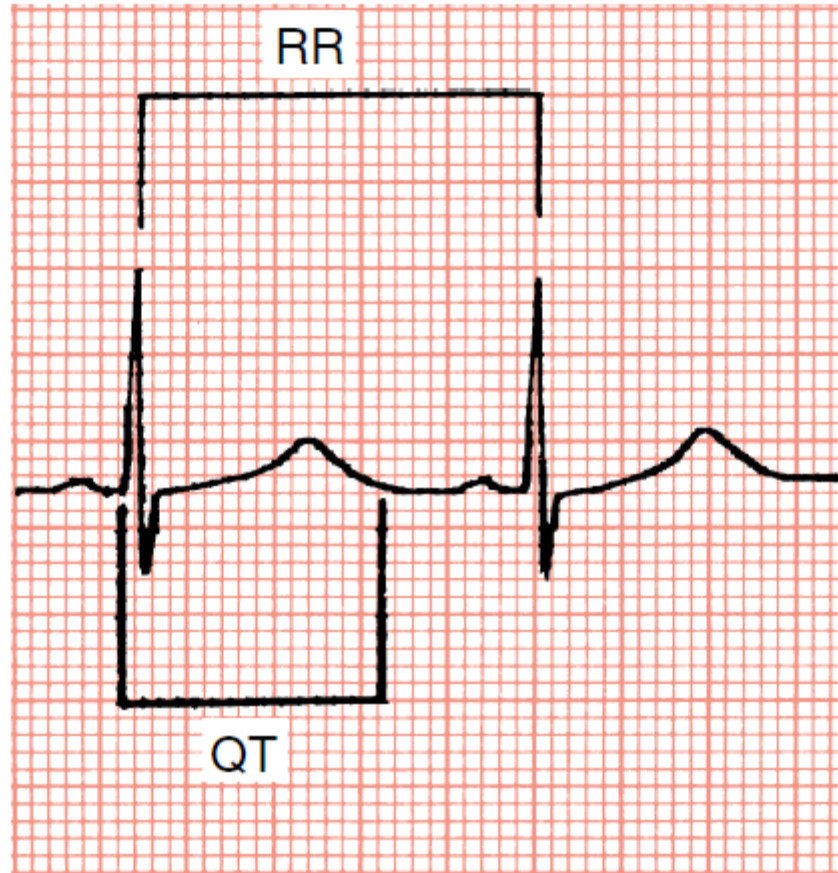
**8- Intervalle QT**



$$QT_c = QT / \sqrt{RR}$$

**$QT_c < 0.45 \text{ sec}$**





$$0.60 \text{ sec} / \sqrt{0.92} = 0.63 \text{ sec}$$

# Conclusion

- Etalonnage: 25mm/sec, 10 mm/mv
- FC: 60-100/min
- P: positive DII, durée < 0.12 sec, amplitude < 2.5 mm
- PR: 0.12-0.20 sec
- QRS:
  - Durée < 0.12 sec
  - ISL < 35 mm
  - Axe N: QRS + DI, + DII
  - Progression R V1-V6
  - Absence de Q pathologique
- ST isoélectrique
- T positives
- QTc < 0.45 sec

