L'ECG nell'adulto

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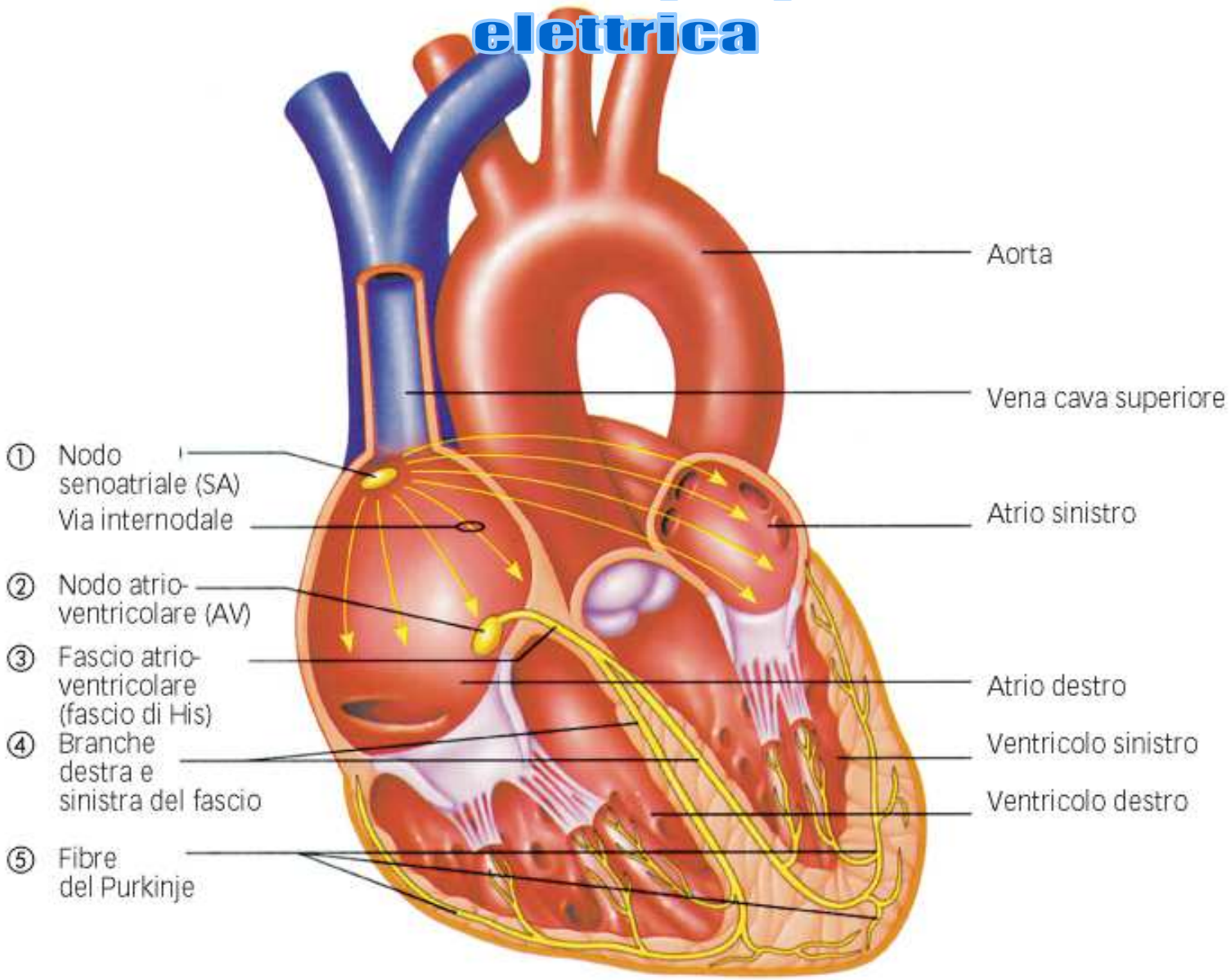
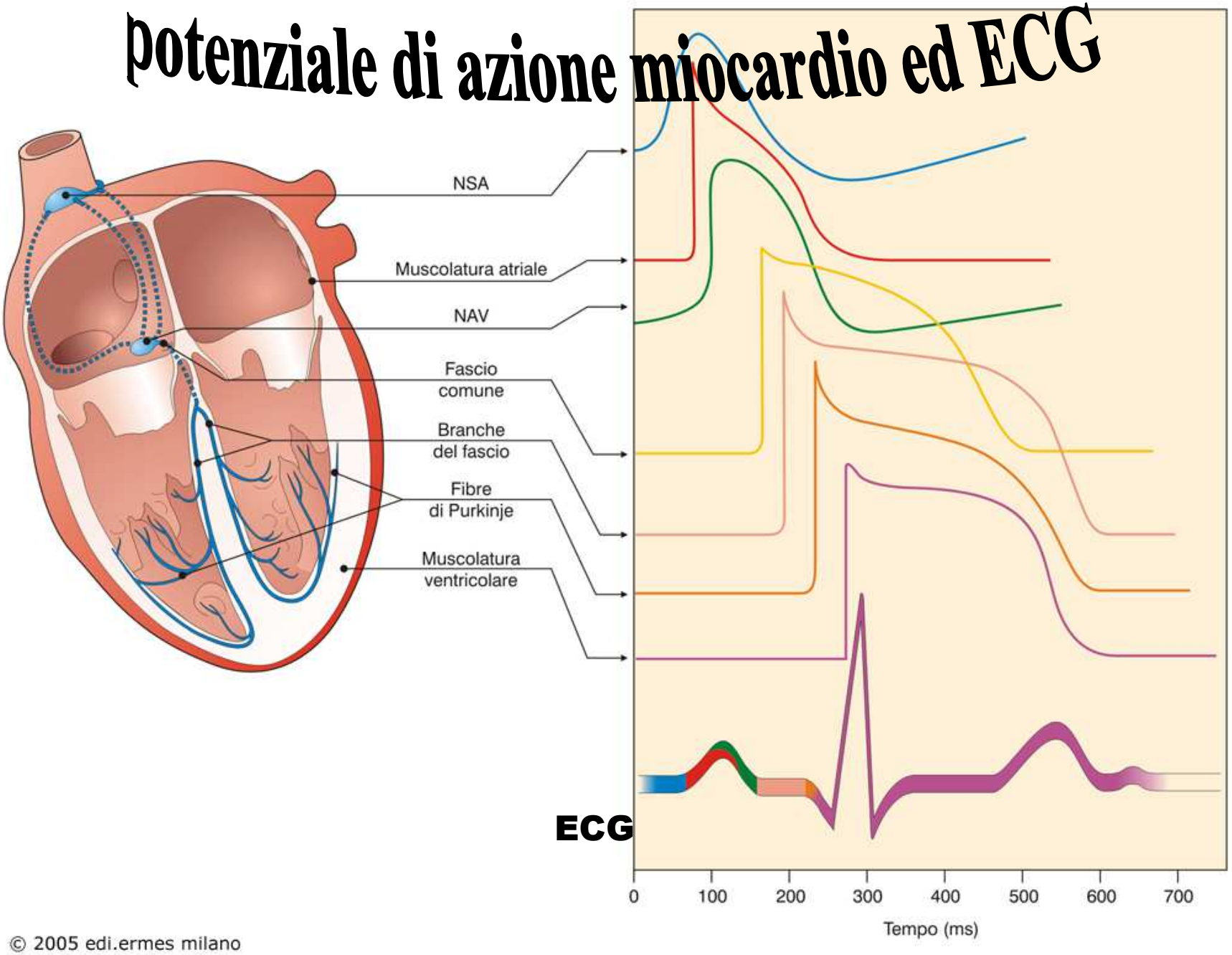
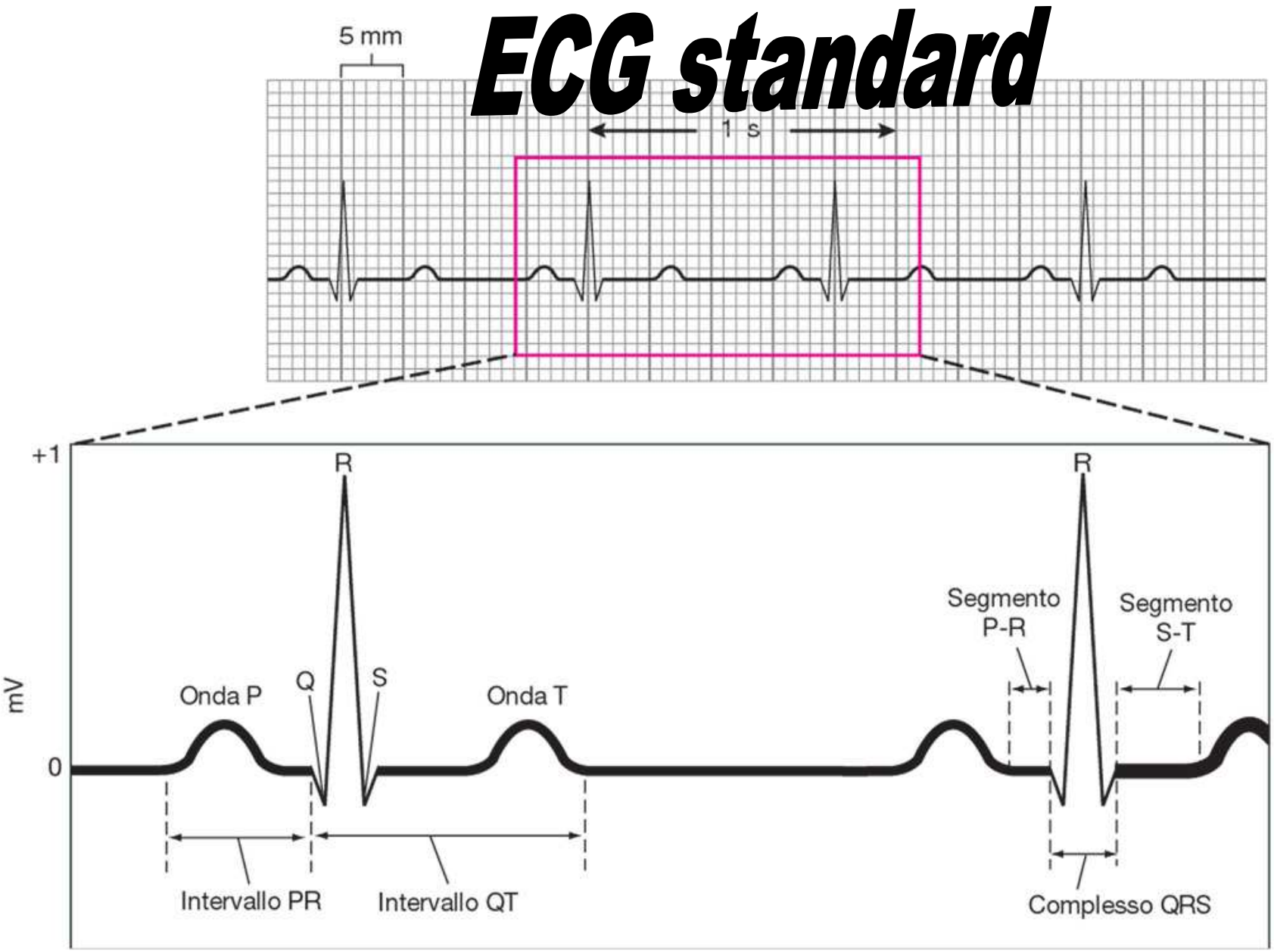
valutazione proprietà elettrica



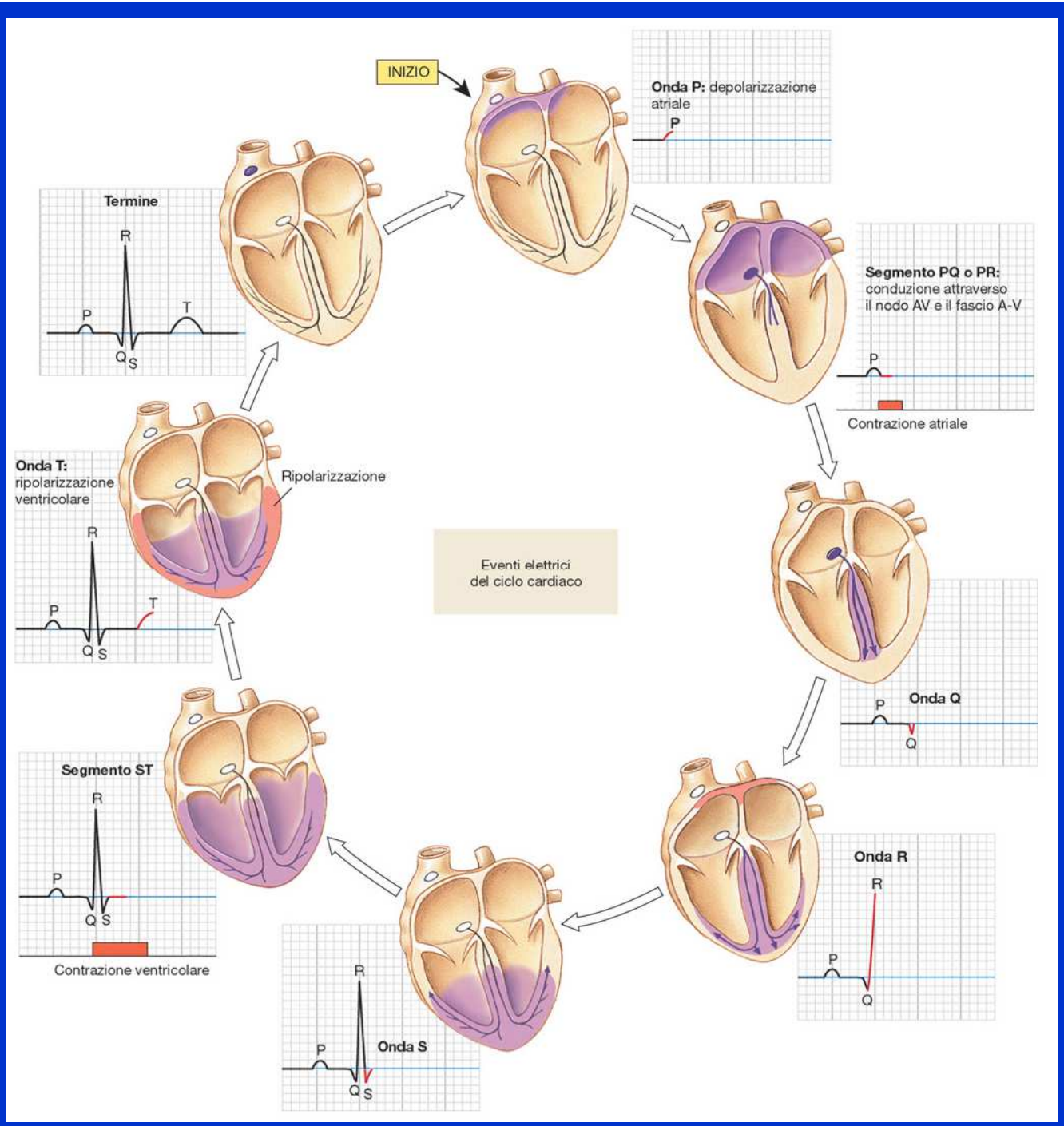
Potenziale di azione miocardio ed ECG



ECG standard

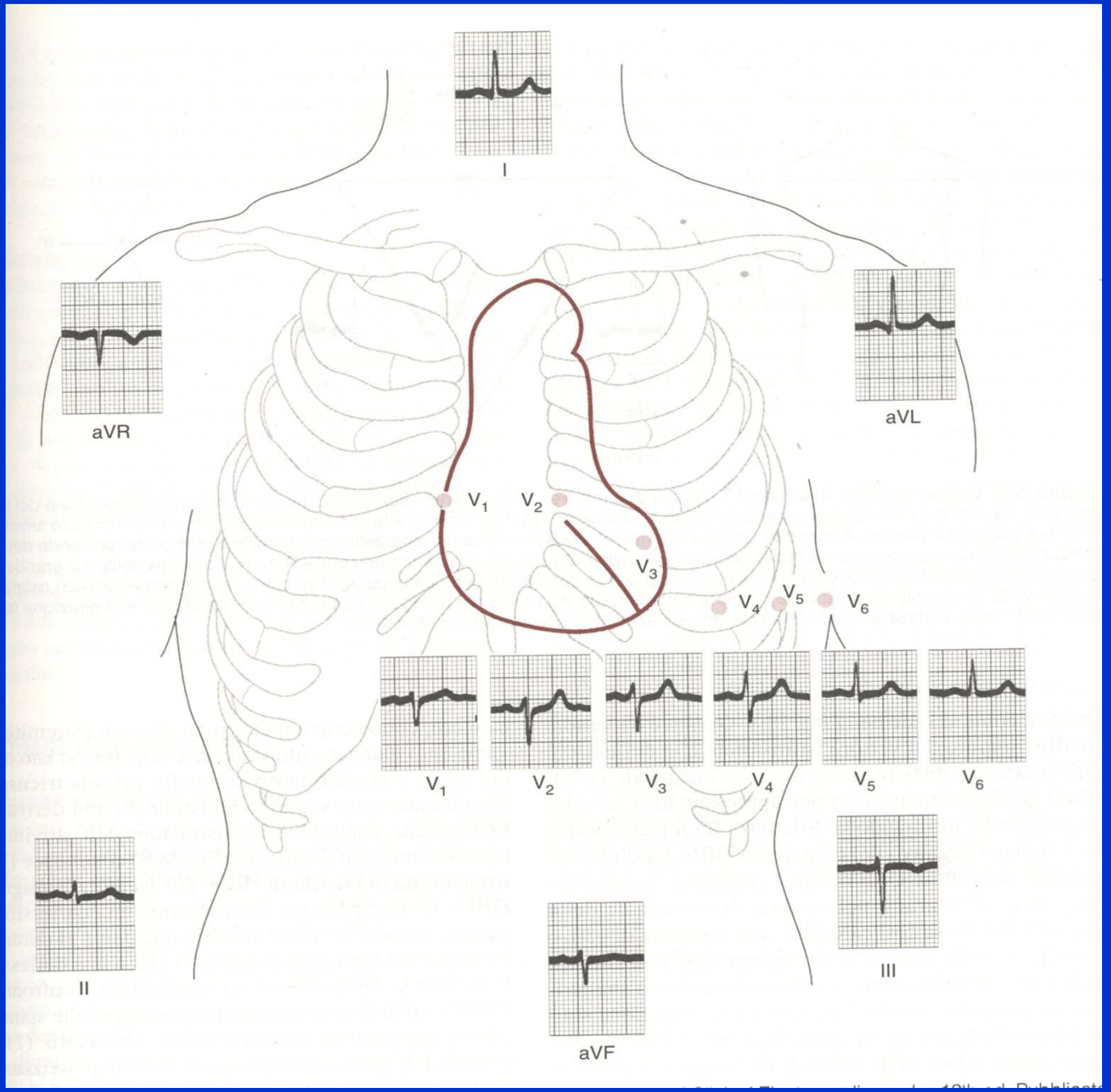


ECG


INIZIO
Onda P: depolarizzazione atriale
P
Segmento PQ o PR: conduzione attraverso il nodo AV e il fascio A-V
P
Contrazione atriale
Onda Q
P
Q
Onda R
R
P
Q
Onda S
R
P
Q S
Segmento ST
R
P
Q S
Contrazione ventricolare
Onda T: ripolarizzazione ventricolare
R
P
T
Q S
Ripolarizzazione
Termine
R
P
T
Q S
Eventi elettrici del ciclo cardiaco

ECG

12 derivazioni



Normale

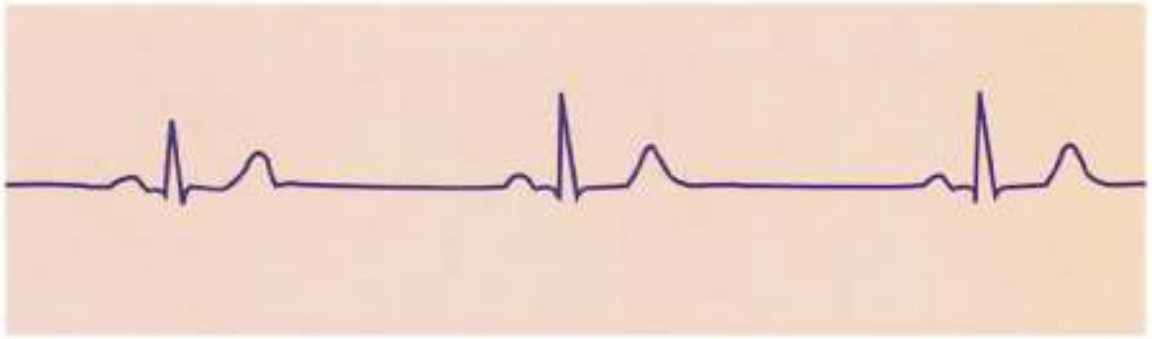
Tachicardia sinusale (con inversione dell'onda T)

Bradicardia sinusale

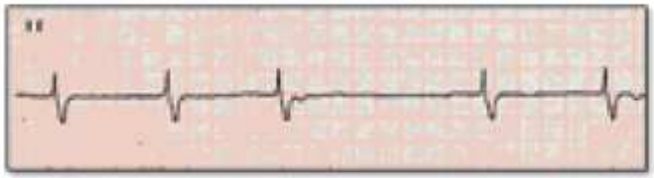
Lettura ECG

Normale

Bradicardia sinusale



Regular

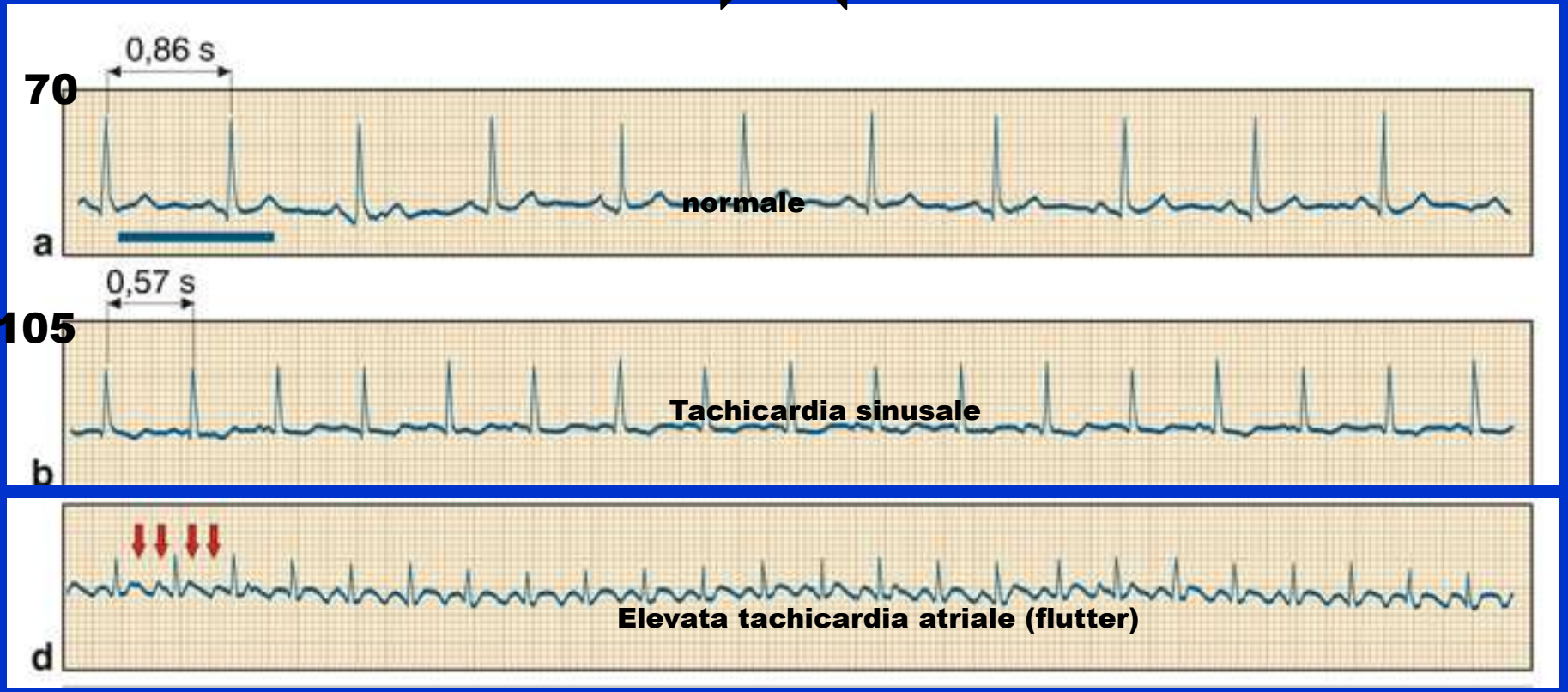


Regularly irregular

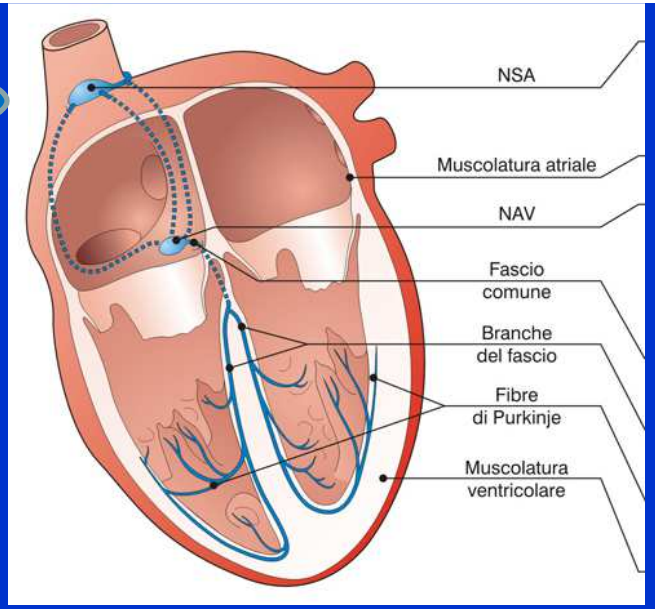
Regular early beat

Irregularly irregular

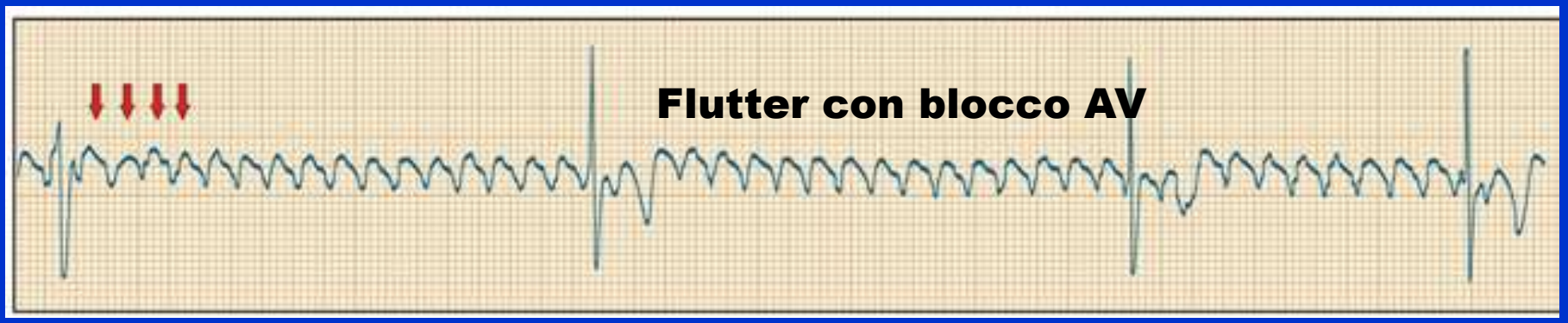
Lettura ECG


0,86 s
70
normale
a
0,57 s
105
Tachicardia sinusale
b
Elevata tachicardia atriale (flutter)
d

Lettura ECG


NSA
Muscolatura atriale
NAV
Fascio comune
Branche del fascio
Fibre di Purkinje
Muscolatura ventricolare


Normale
1 mV
1 sec

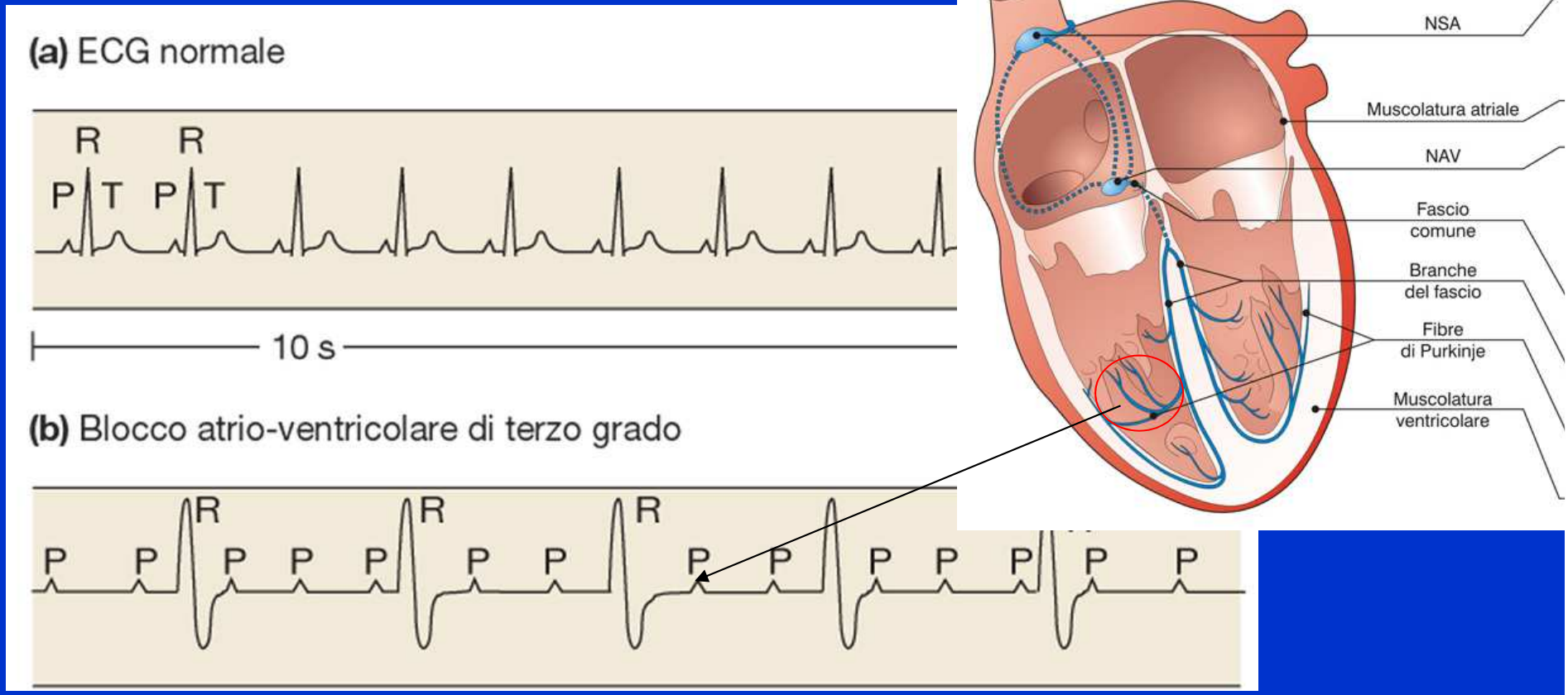

Flutter con blocco AV


Fibrillazione atriale
g

Lettura ECG

ECG cardiopatie

blocco atrio-ventricolare



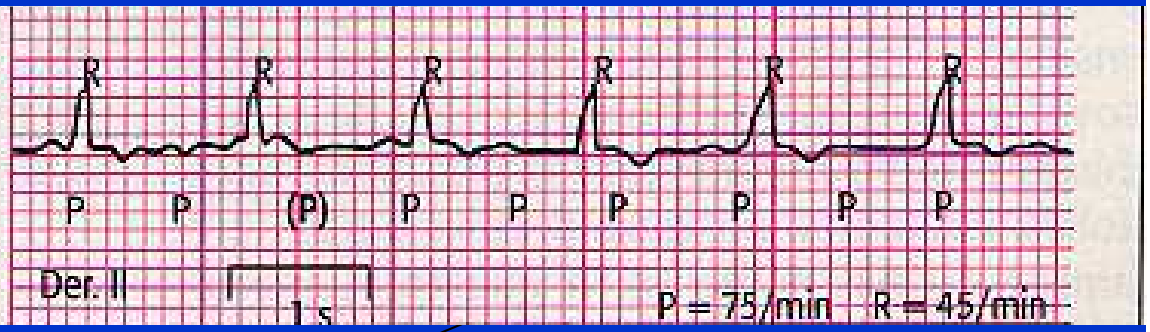
Lettura ECG

ECG cardiopatie

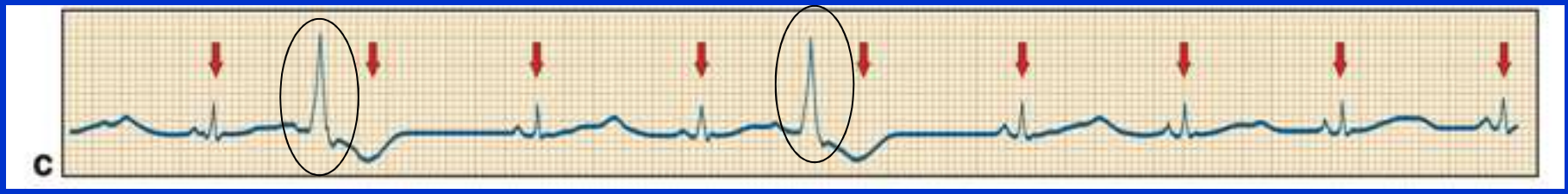
blocco atrio-ventricolare

5 Blocco AV totale
con ritmo ventricolare

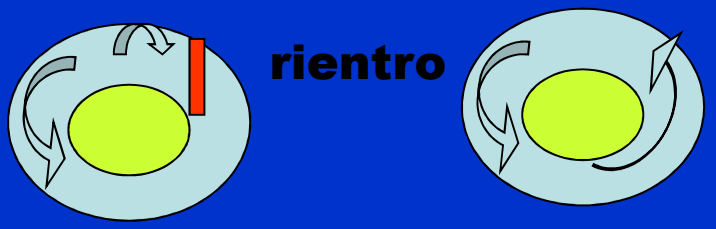
III grado

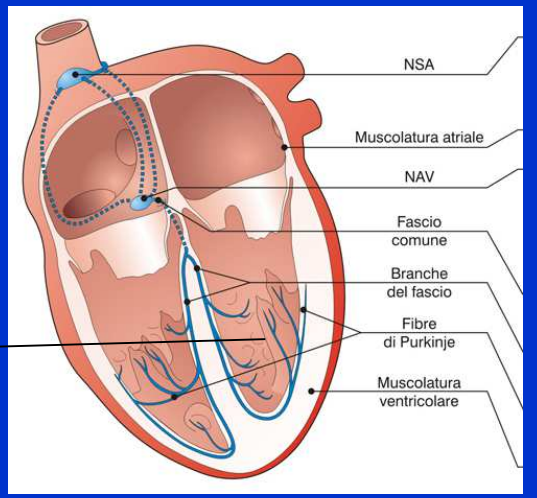


Lettura ECG



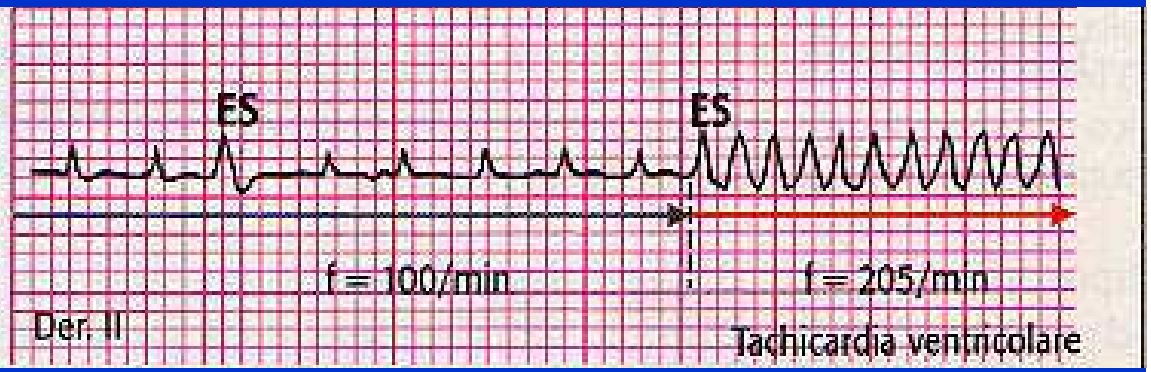
Extrasistole ventricolare



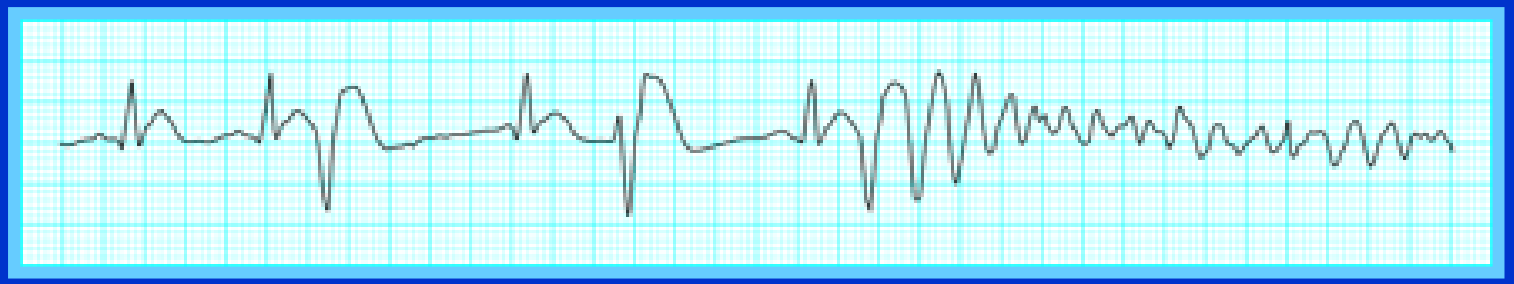


Lettura ECG

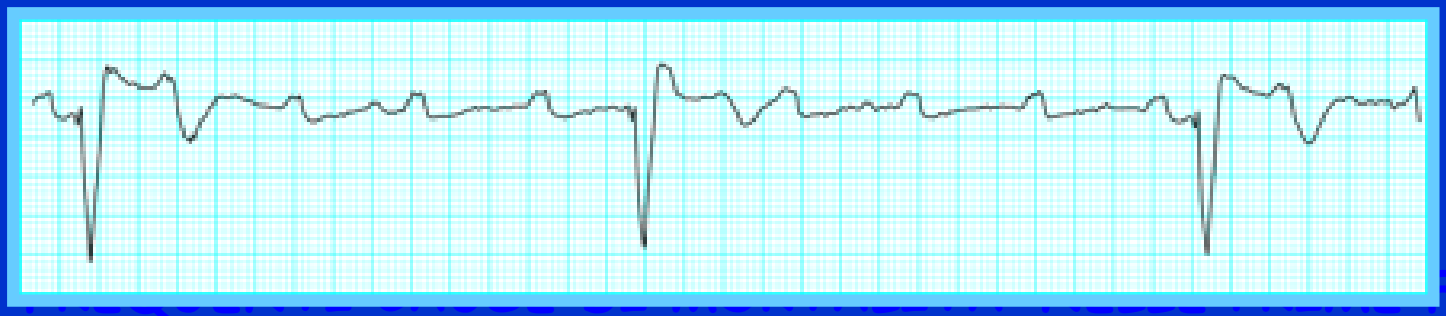
3 Tachicardia ventricolare dopo extrasistole



COMPLICANZE dell'IMA di tipo ARITMICO

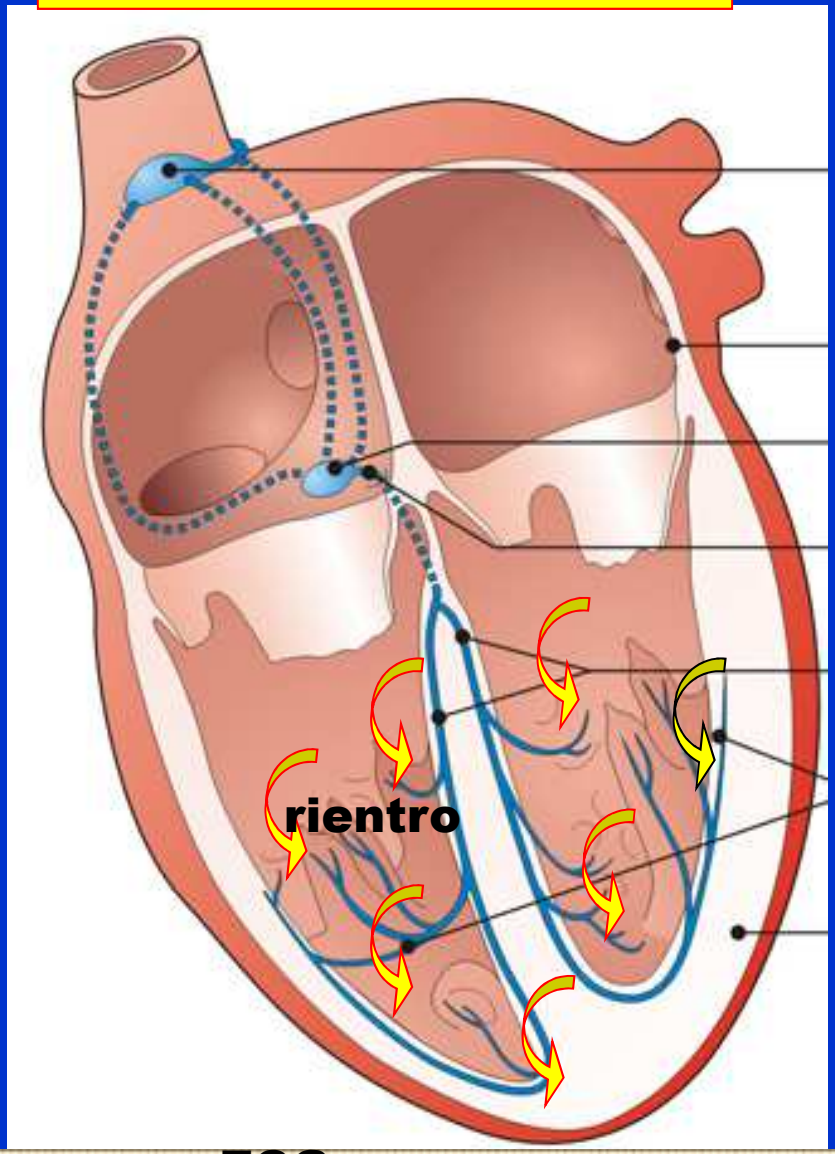


fibrillazione ventricolare innescata da "R suT"

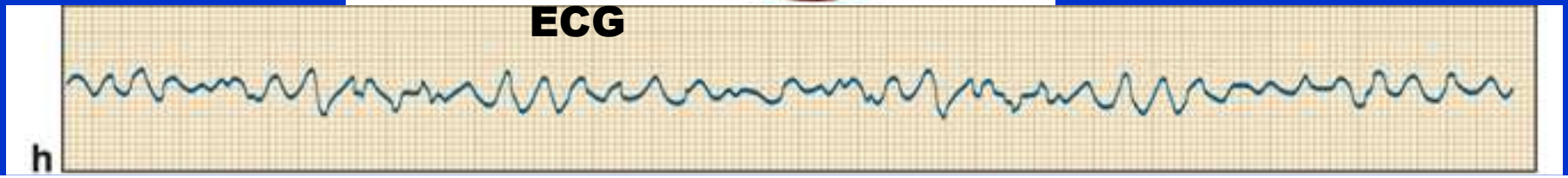


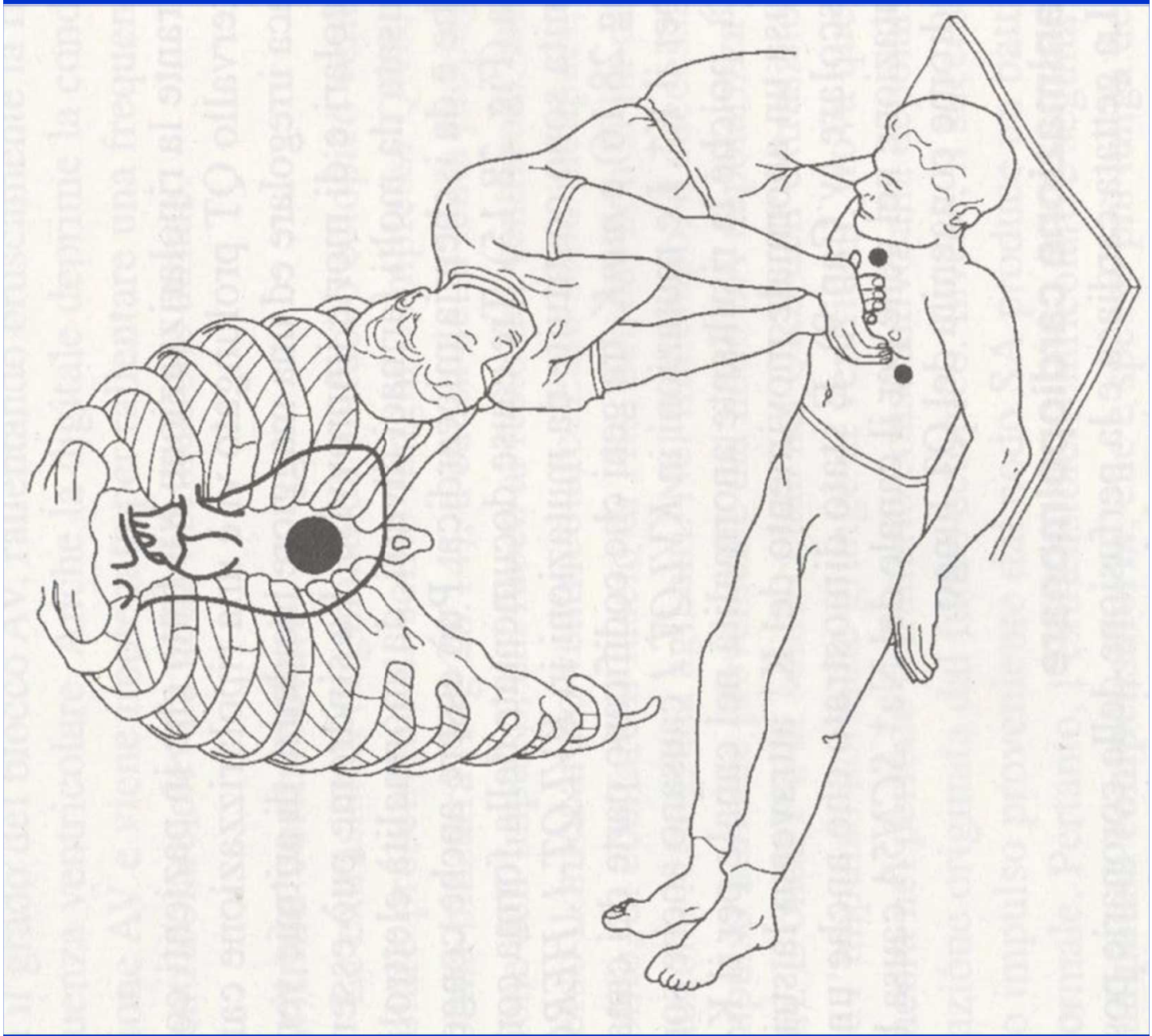
Blocco AV completo in IMA

Fibrillazione ventricolare



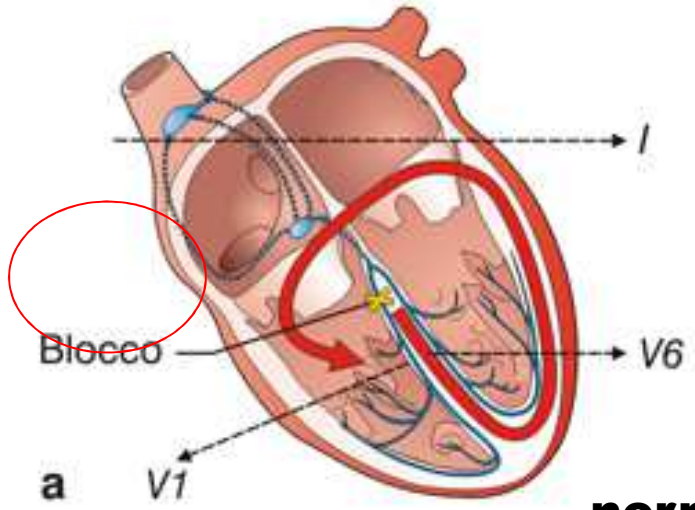
trattamento con defibrillatore



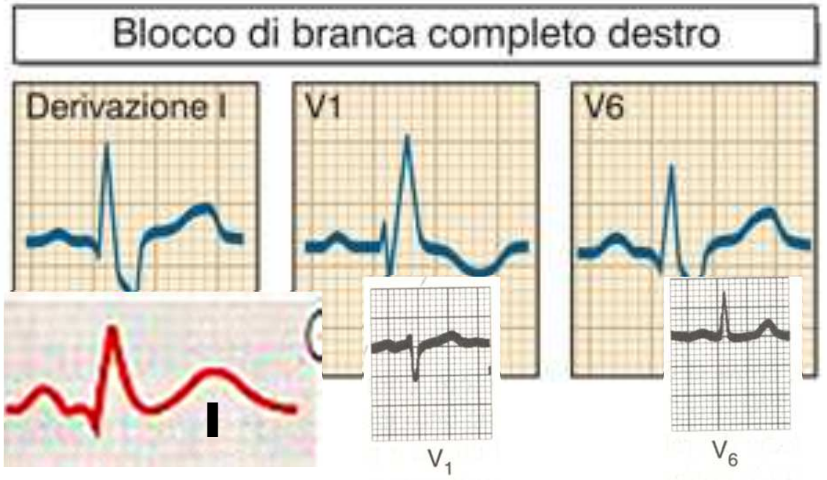


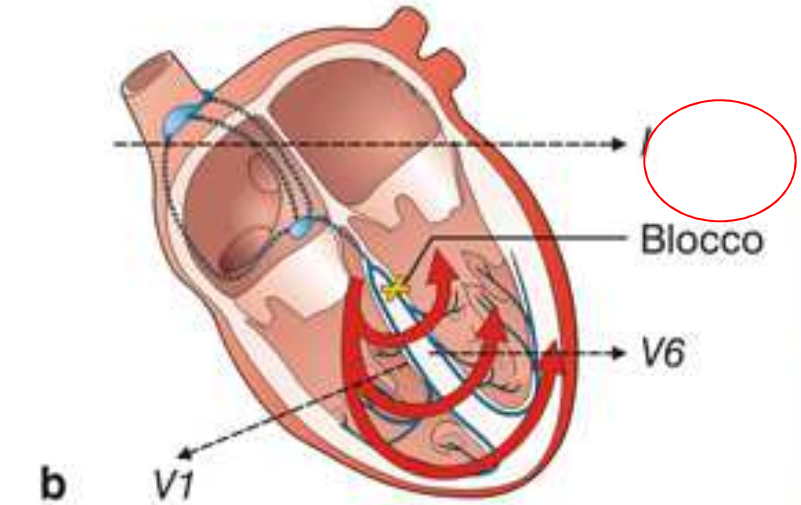
modificazioni temporali e di forme

ECG

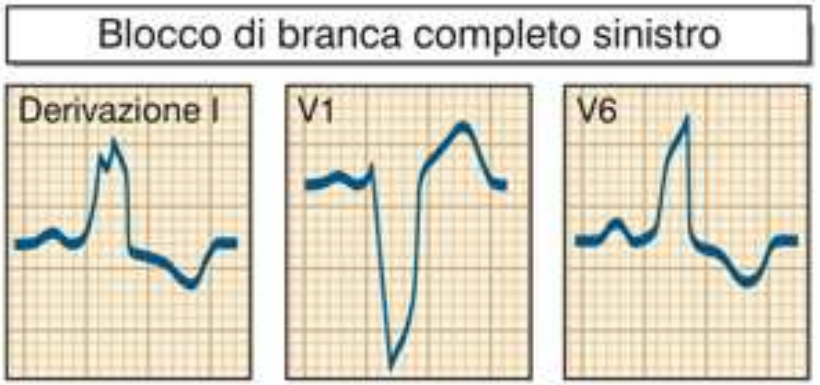


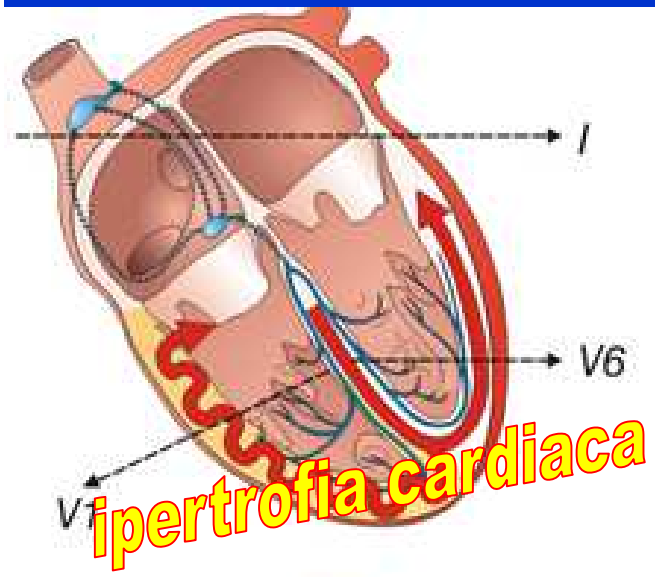
normale



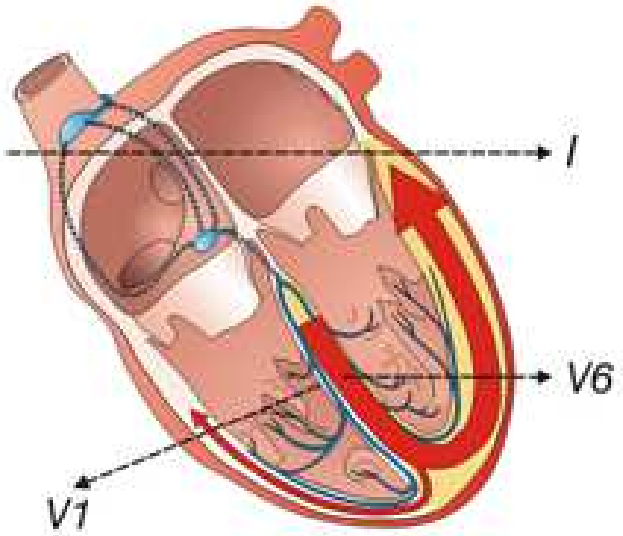


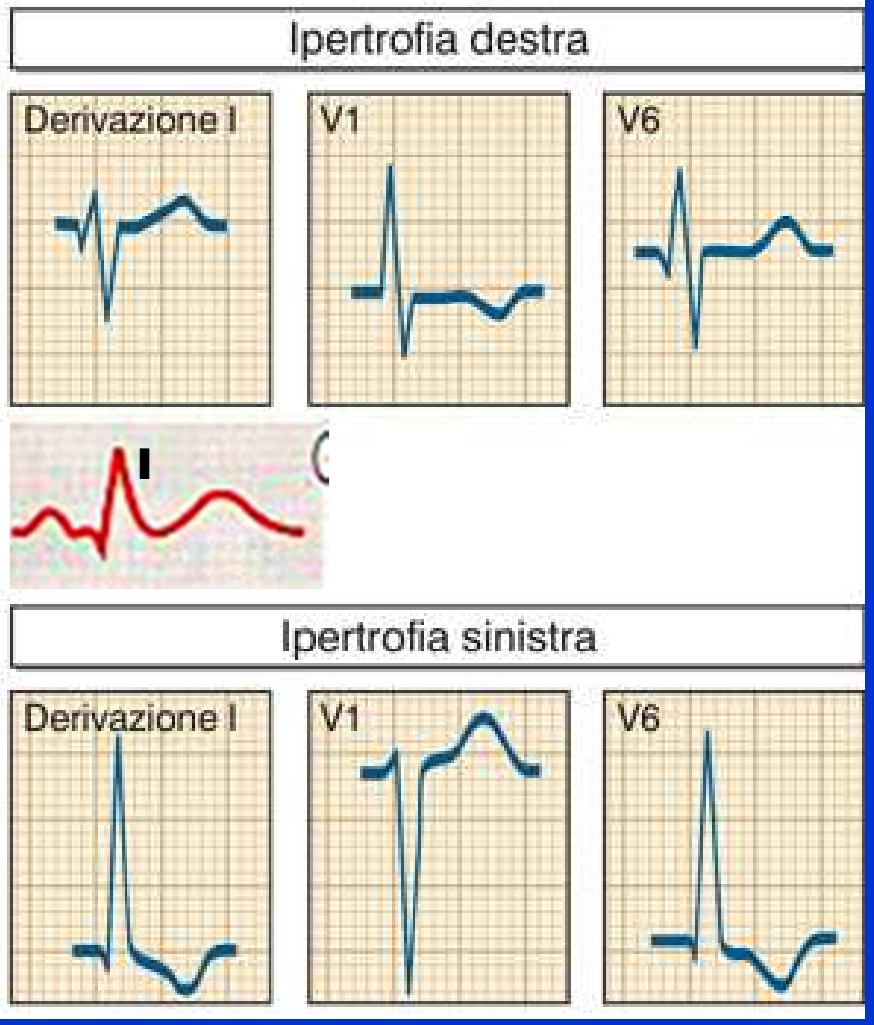
I

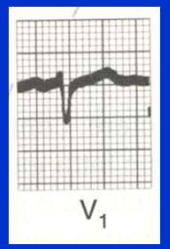


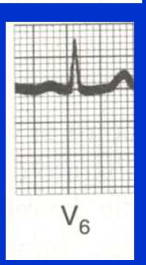


ipertrofia cardiaca



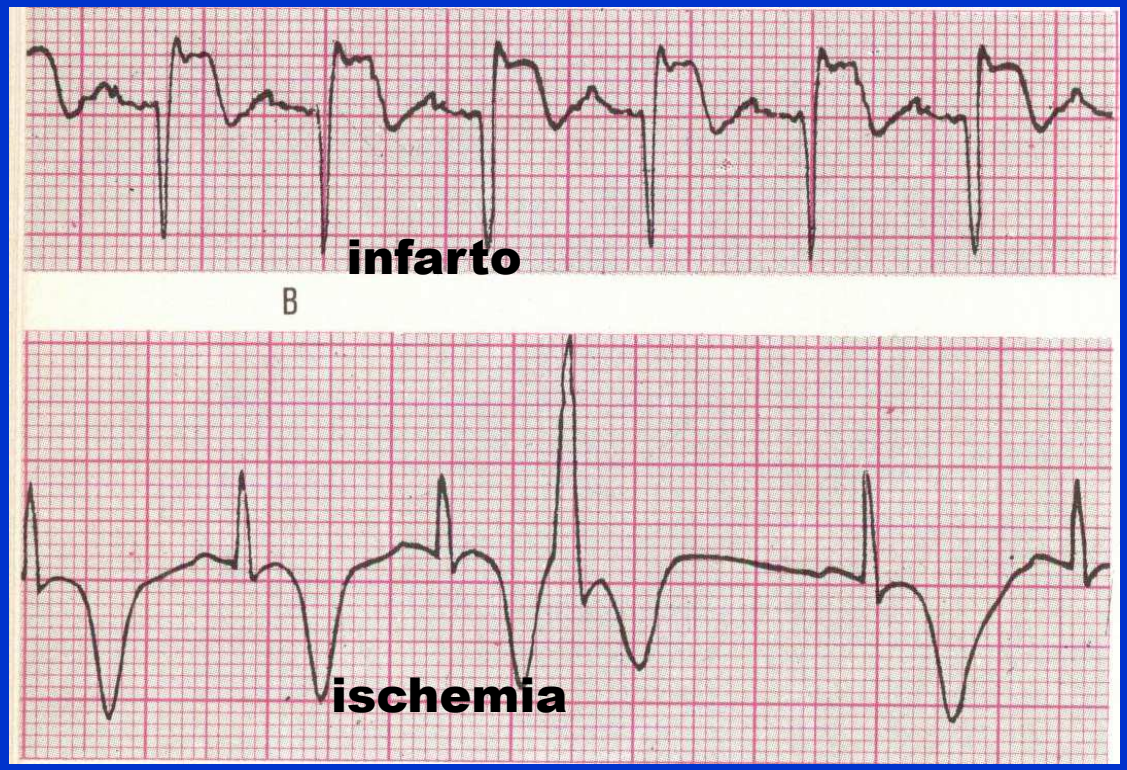




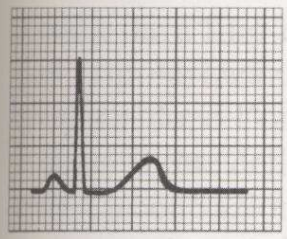


normale

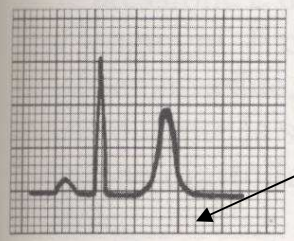
alterazioni ECG ischemia e infarto



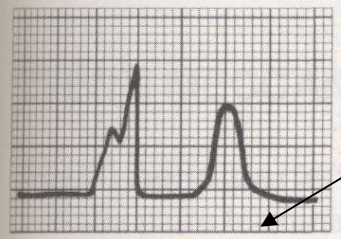
K+ e modificazioni ECG



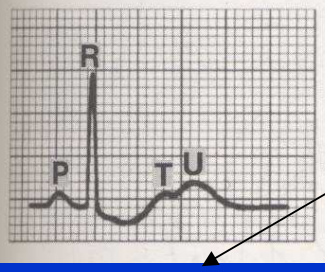
Tracciato normale (K^+ nel plasma 4-5,5 mEq/l). Intervallo PR = 0,16 s, intervallo QRS = 0,06 s; intervallo QT = 0,4 s (normale per una frequenza cardiaca di 60).



Iperpotassiemia (K^+ nel plasma ± 7,0 mEq/l). Gli intervalli PR e QRS sono entro i limiti normali. Compaiono onde T molto appuntite, alte e sottili.

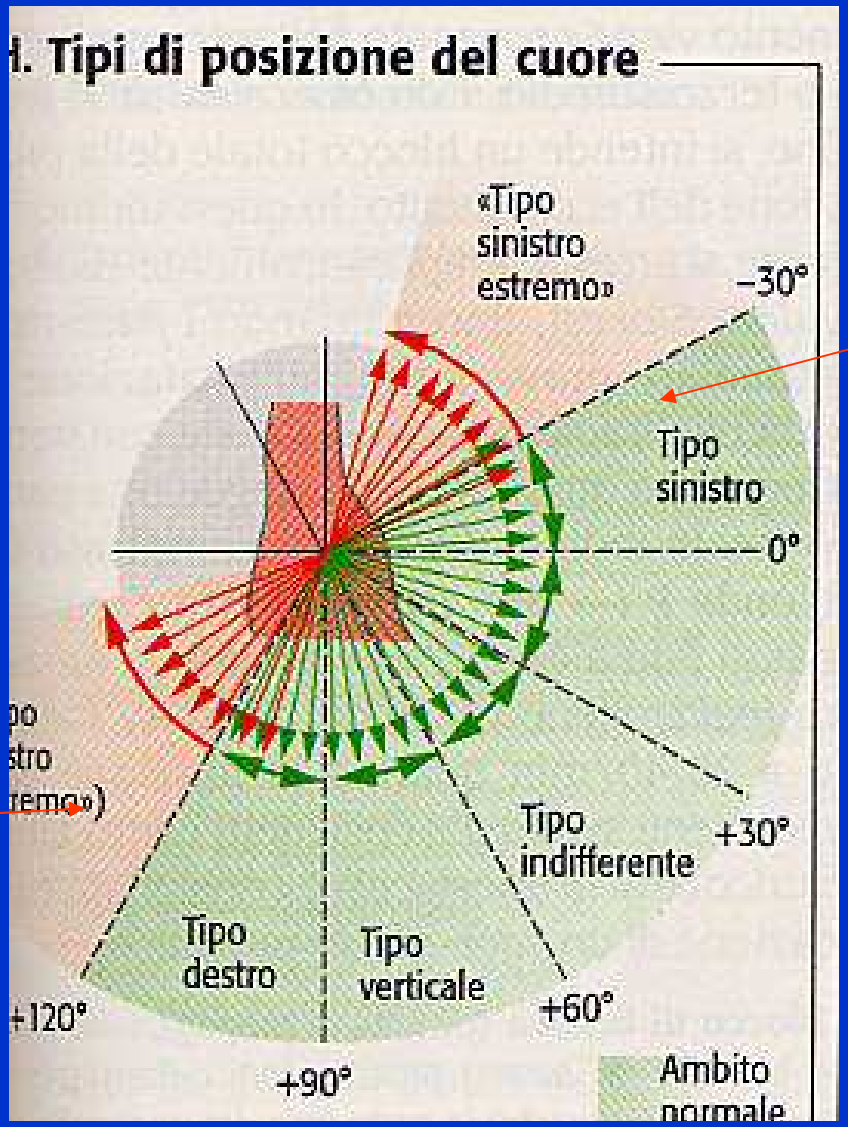


Iperpotassiemia (K^+ nel plasma ± 8,5 mEq/l). Nessun segno di attività atriale; il complesso QRS è largo e irregolare e l'intervallo QRS raggiunge 0,2 s. L'onda T rimane alta e sottile. Un'ulteriore elevazione della potassiemia può portare alla tachicardia ventricolare o alla fibrillazione ventricolare.



Ipopotassiemia (K^+ nel plasma ± 3,5 mEq/l). Intervallo PR = 0,2 s; intervallo QRS = 0,06 s; depressione del segmento ST. Un'accentuata onda U segue immediatamente la T. L' intervallo QT effettivo rimane di 0,4 s. Se l'onda U venisse erroneamente considerata parte della T, l'intervallo QT risulterebbe falsamente prolungato a 0,6 s.

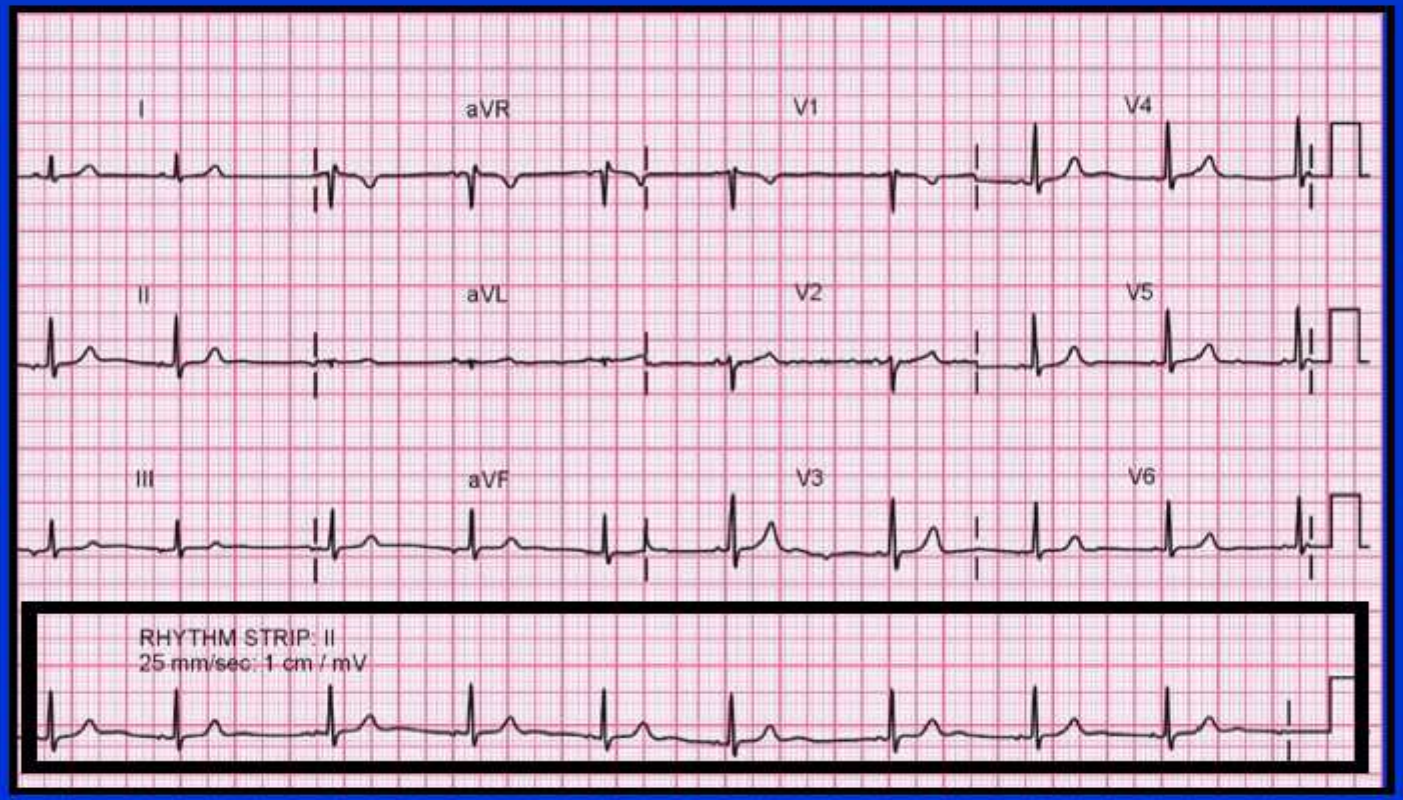
asse cardiaco



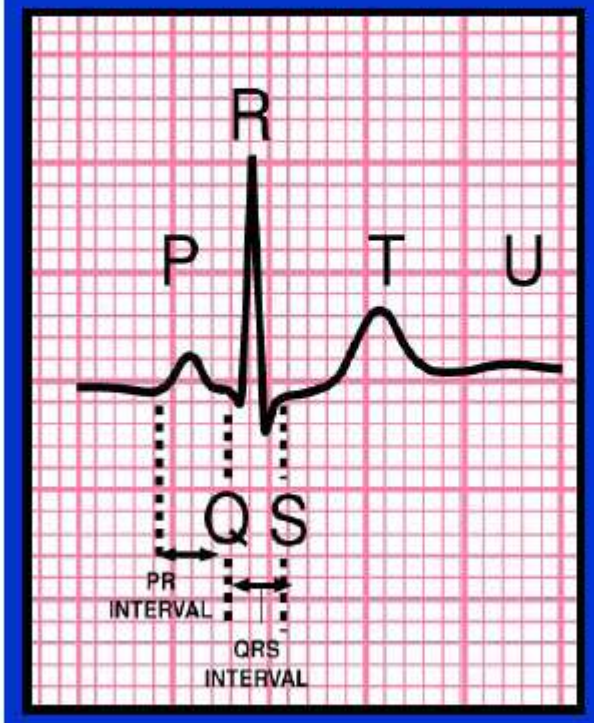
Enfisema
Iperkalemia
Blocco Sx

Ipertrofia Dx
Blocco Dx
Malattie polmonari

12 lead ECG


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
RHYTHM STRIP: II
25 mm/sec; 1 cm / mV

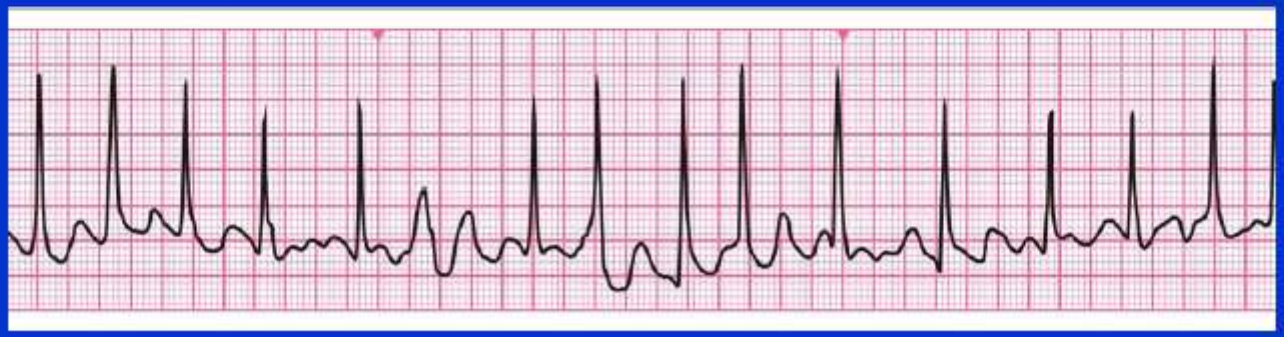
The QRS complex



- PR interval – 0.12 - 0.2 secs (3-5 small squares)
- QRS = ventricular depolarisation < 0.12 secs (< 3 small squares)
- ST segment = isoelectric
- T wave = usually positive, except AVR (possibly V1)

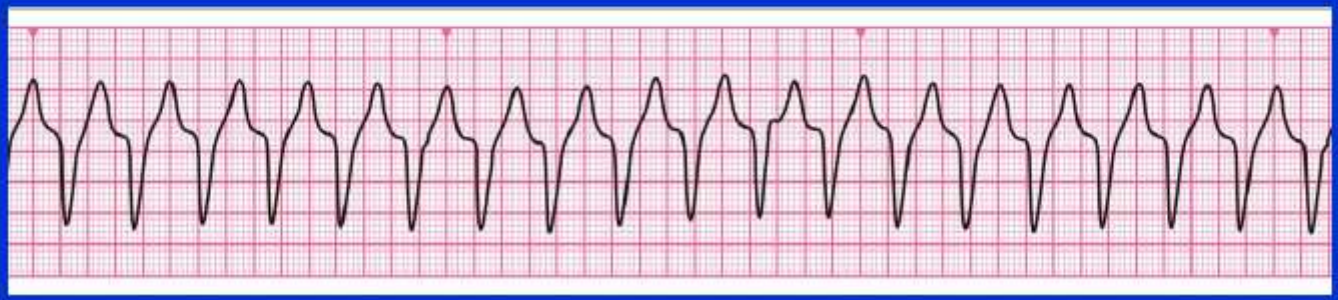
Is the QRS rhythm regular or irregular?

- Unclear at rapid heart rates
- Compare R-R intervals
- Irregularly irregular = AF

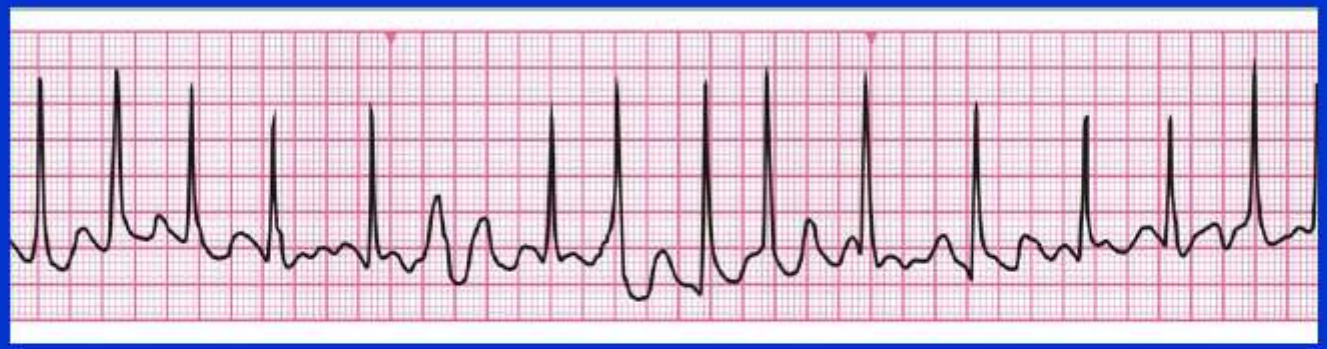


Is the QRS width normal or prolonged?

- Prolonged QRS (> 0.12 s) arises from:
  - ventricular myocardium
  - supraventricular with aberrant conduction
  - paced rhythm

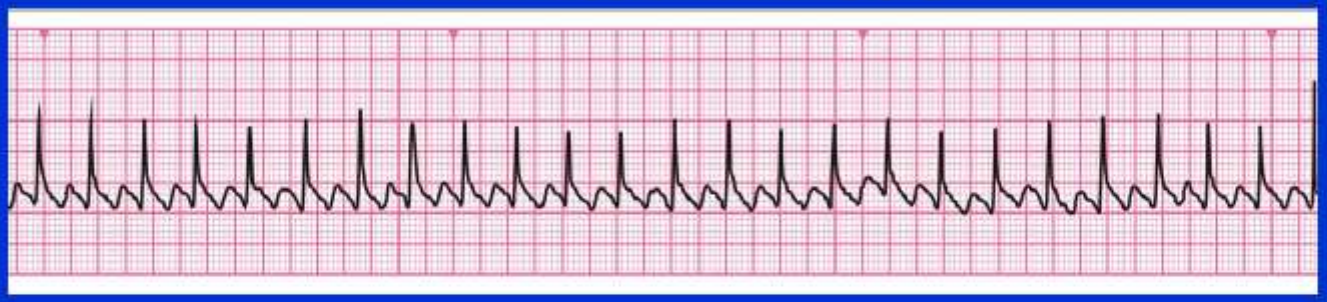


Atrial fibrillation



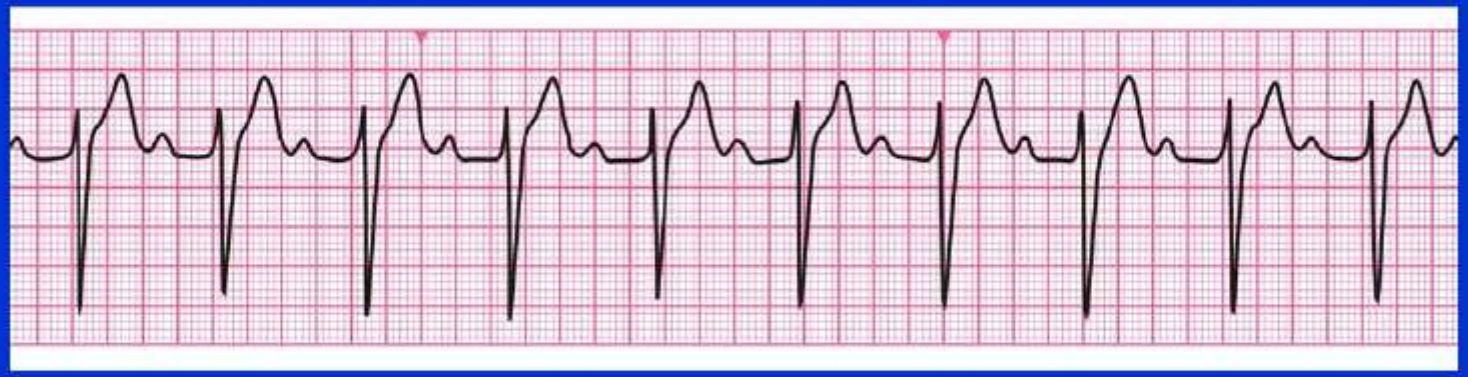
- Rate – atrial rate usually between 400-650bpm
- P wave – not present – 'wandering' baseline
- QRS – normal
- Conduction – variable AV conduction – if untreated ventricular response is usually rapid
- Rhythm -= irregularly irregular

Atrial flutter

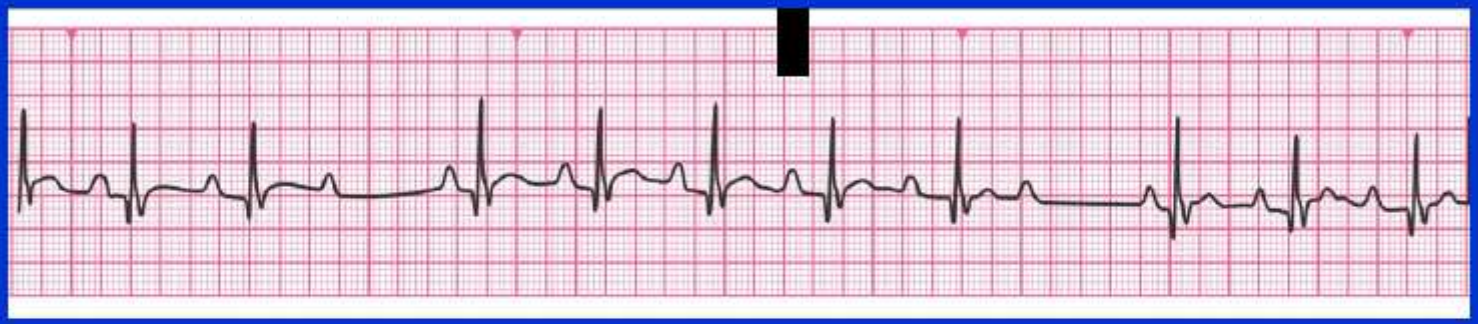


- Rate – atrial rate usually 300bpm. Ventricular rate depends on conduction through AV node
- P wave – 'saw' tooth pattern usually present
- QRS – normal
- Conduction – 2:1 most common but can be variable
- Rhythm – usually regular but can be irregular if AV block varies

Heart Block: First Degree



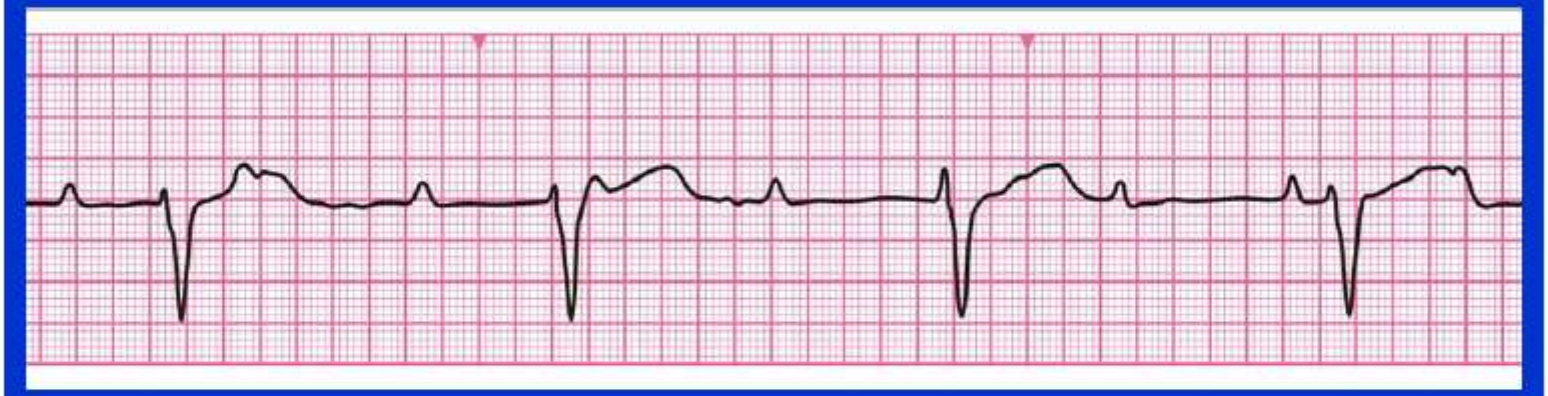
Heart Block: Second Degree



2:1 AV Block

- Rate – variable
- P wave – normal morphology
- QRS – normal
- Conduction – alternate P waves not followed by QRS complexes
- Rhythm - regular

Heart Block: Third Degree



- Site of pacemaker:
  - AV node 40 - 50 min^{-1}
  - Ventricular myocardium 30 - 40 min^{-1}

Heart block summary…

First degree heart block

- Prolonged PR interval but constant

2nd degree heart block

Mobitz type I AV block (Wenckebach):

- Gradual lengthening of the PR interval with each beat, until one P wave fails to produce a QRS complex

Heart block summary…

Mobitz type II AV block:

- The PR interval is fixed and normal, but occasionally a P wave fails to produce a QRS complex

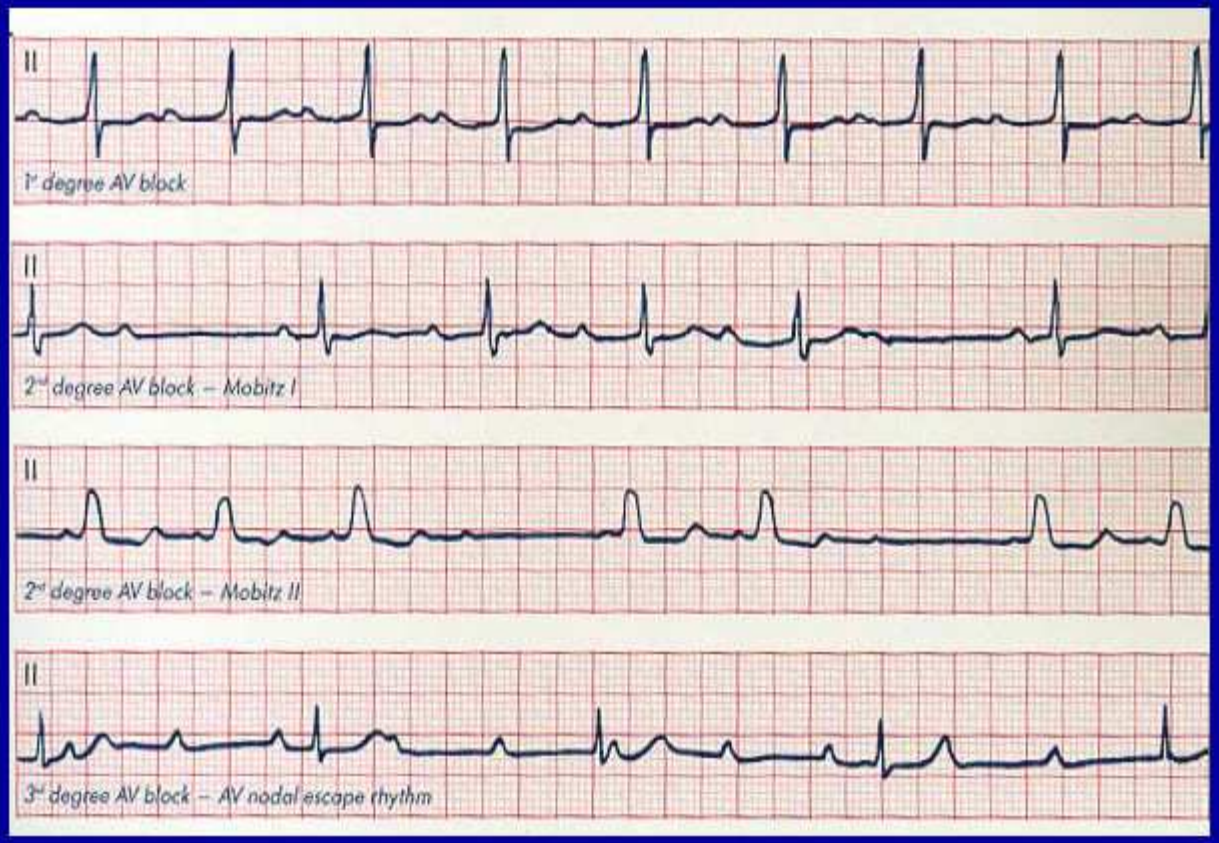
2:1 AV block:

- Alternate P waves are not followed by a QRS complexes

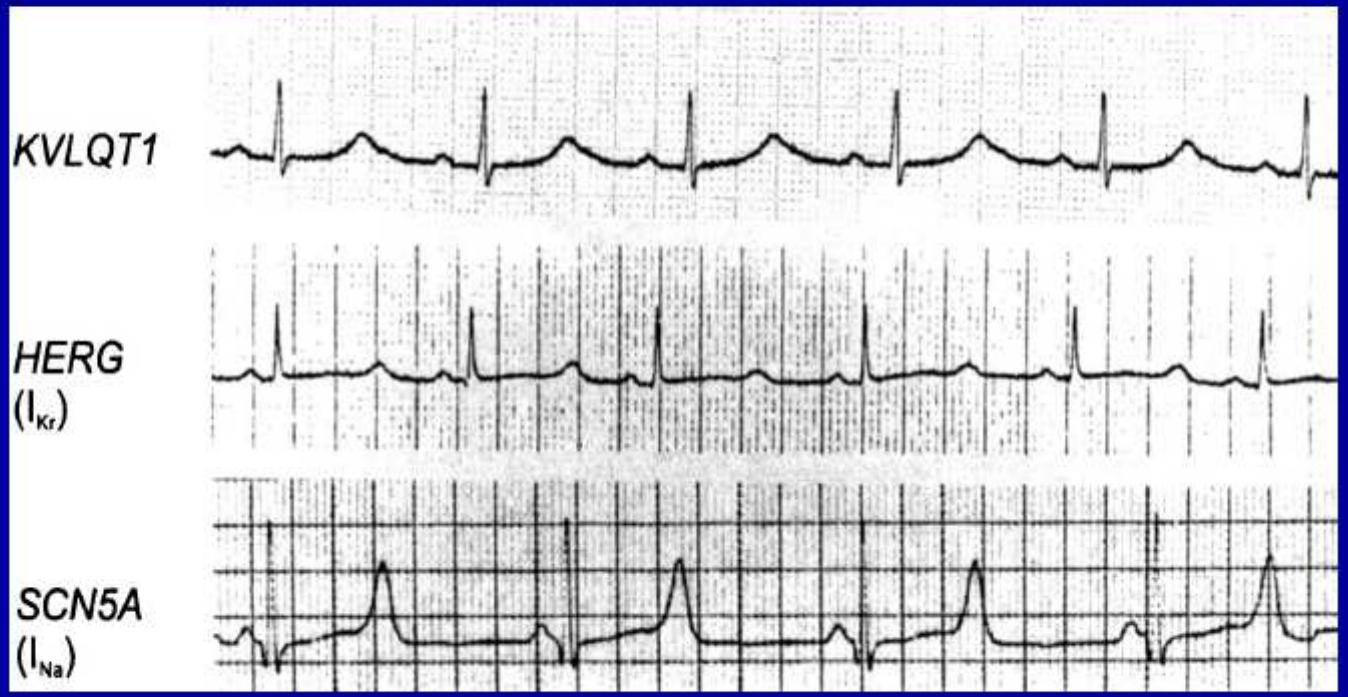
Third degree AV block (complete heart block)

- There is no relationship between P waves and QRS complexes

AV Block

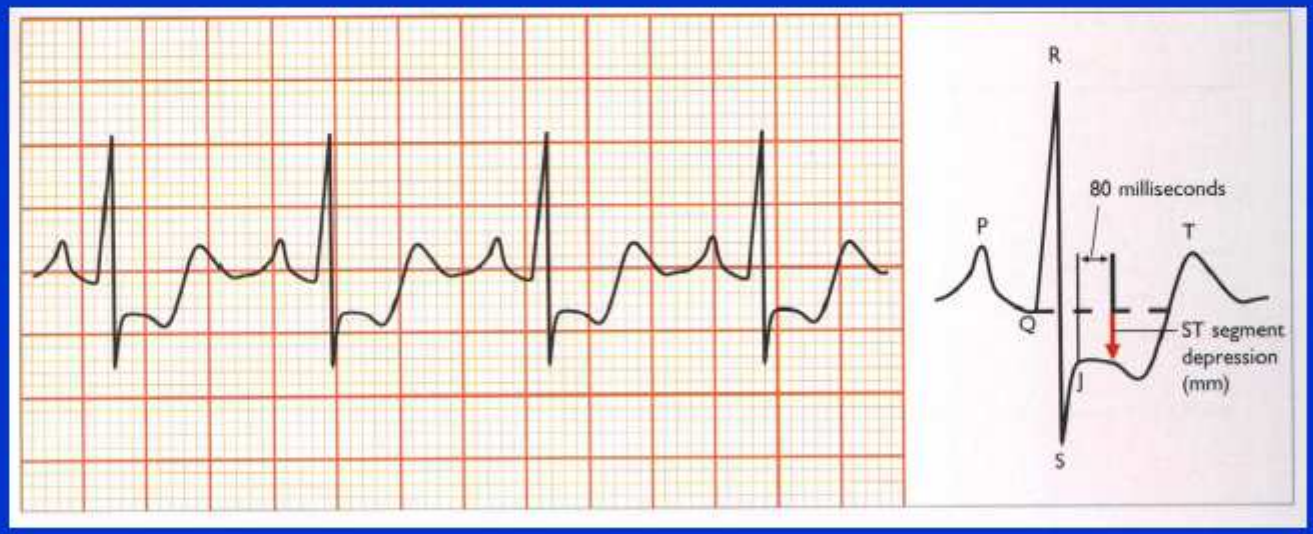

II
1st degree AV block
II
2nd degree AV block – Mobitz I
II
2nd degree AV block – Mobitz II
II
3rd degree AV block – AV nodal escape rhythm

Gene-Specific ECG Patterns of LQTS

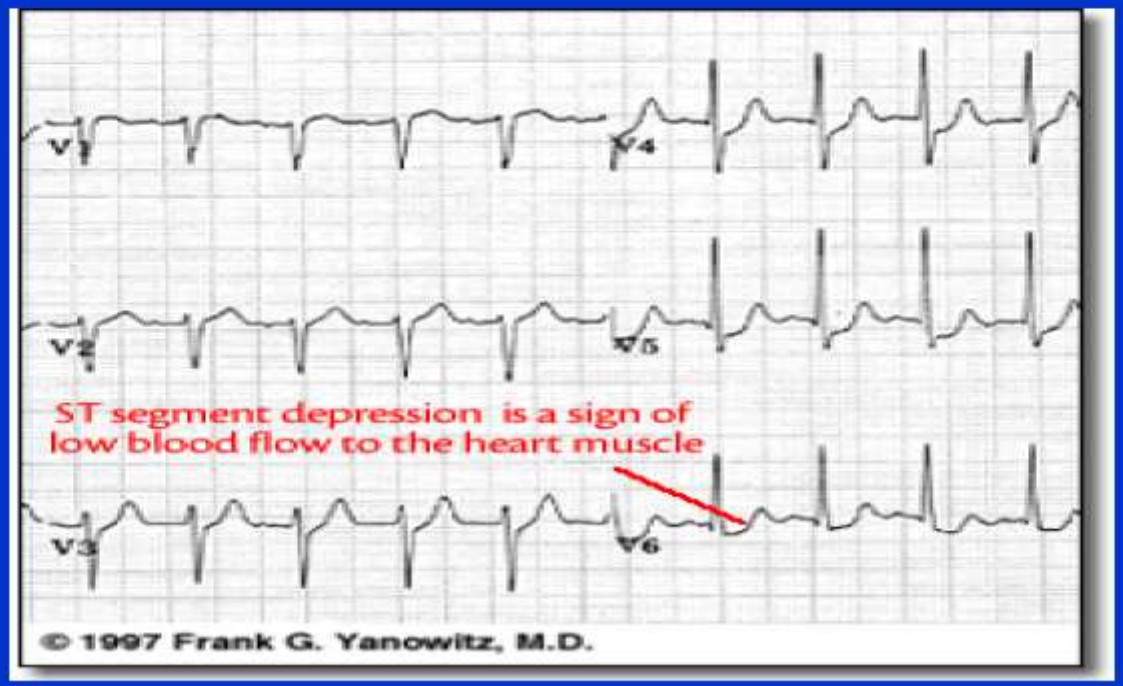


Adapted from Moss, et al, LQTS Registry, 1998

ST Depression



ST SEGMENT DEPRESSION



Phases of Myocardial Infarction

The relative age of myocardial infarction can be estimated by typical ECG changes.

a) Normal ECG complex.

b) **Acute phase:** within ***minutes*** to ***hours*** of the onset of infarction there is ST segment elevation, indicating acute zone of injury. During this time, reciprocal changes can also be seen.
Giant upright T waves are also present.
At this stage no QRS changes have occurred.
Although such a pattern is frequently said to show ***acute infarction***, no definitive evidence of infarction is shown.

c) **Subacute phase:** within ***hours*** to ***days*** the R wave voltage has fallen and pathological Q waves have appeared. These changes are sufficient to prove the occurrence of infarction. The ST elevation is less pronounced and T wave inversion has appeared.

d) **Evolving phase:** within ***one or more weeks*** the ST segment changes revert to normal. The R wave voltage remains reduced and the pathological Q wave persists. Deep symmetrical T wave inversion occurs.

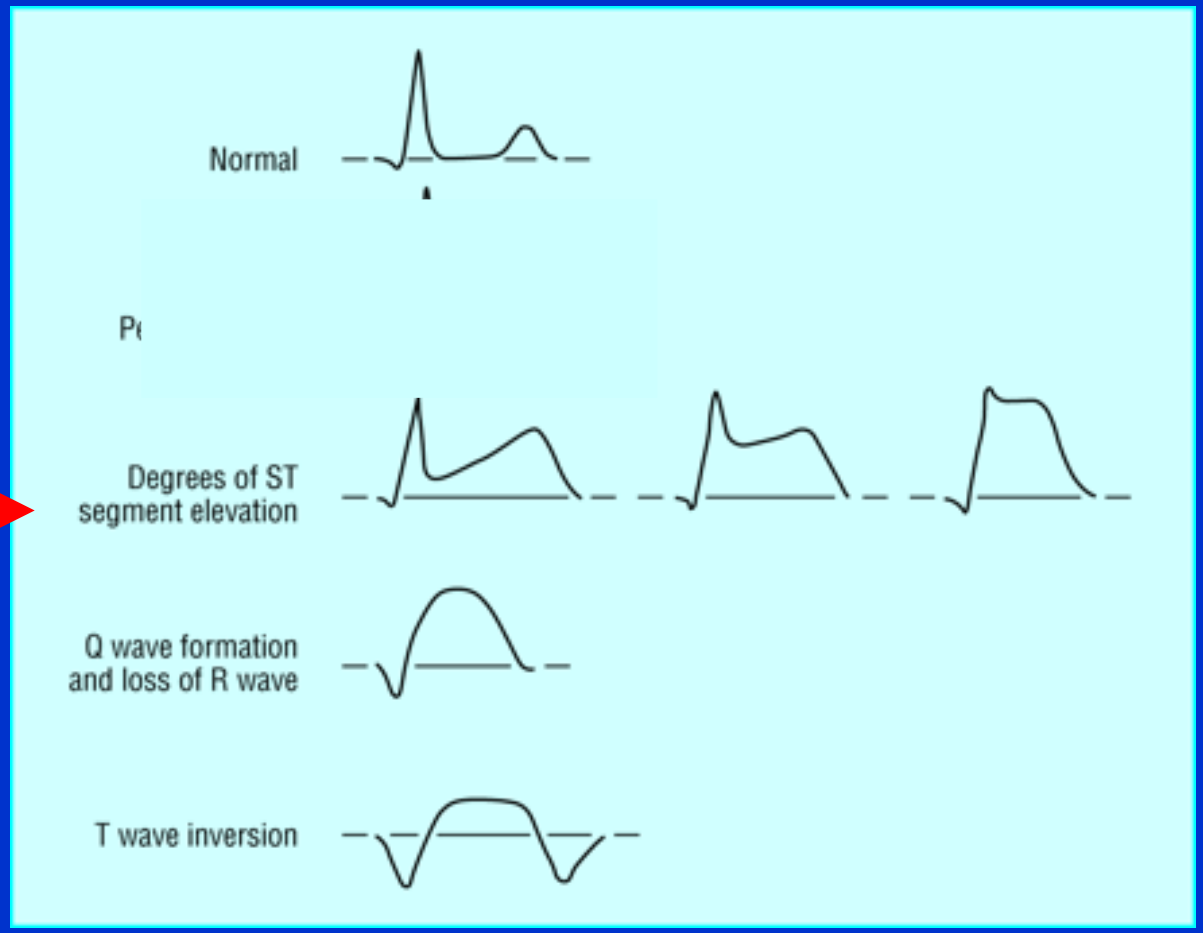
e) **Resolved:** ***months*** after the infarction the T waves may gradually return to normal. The pathological Q waves and reduced R wave voltage persists.

ST Segment Elevation

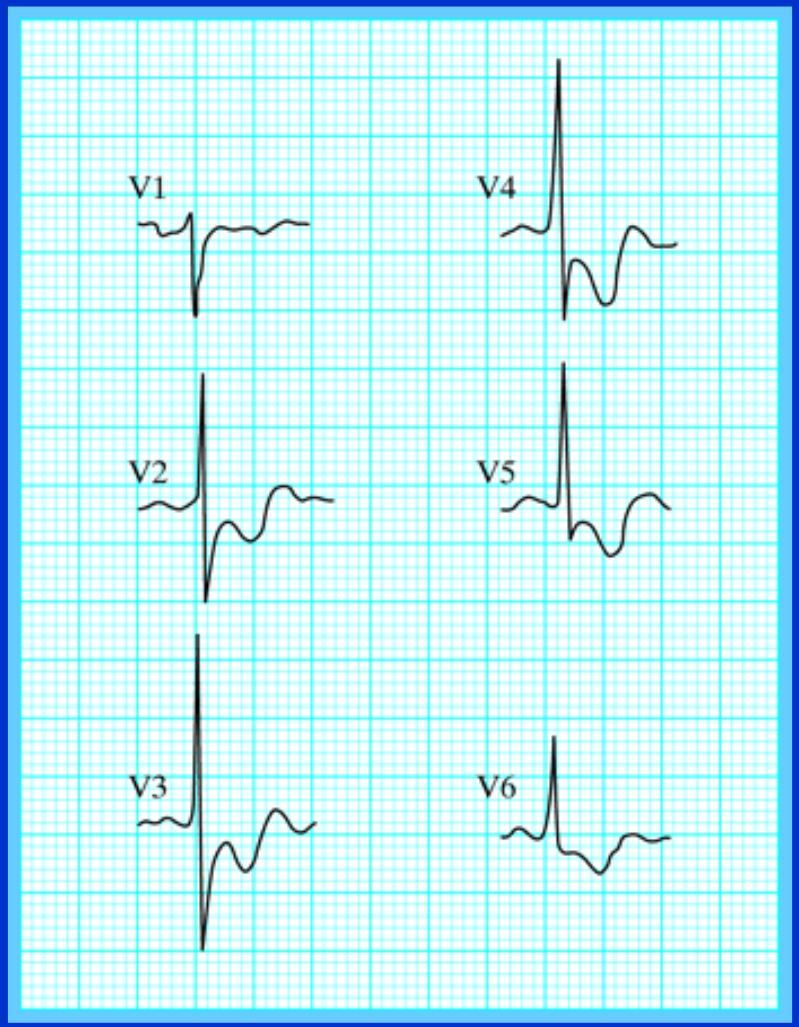
- ST Segment Elevation

↑ 1 mm above baseline (limb)
↑ 2 mm above baseline (chest)
.08 sec to right of J point
Look for in two or more leads facing same area

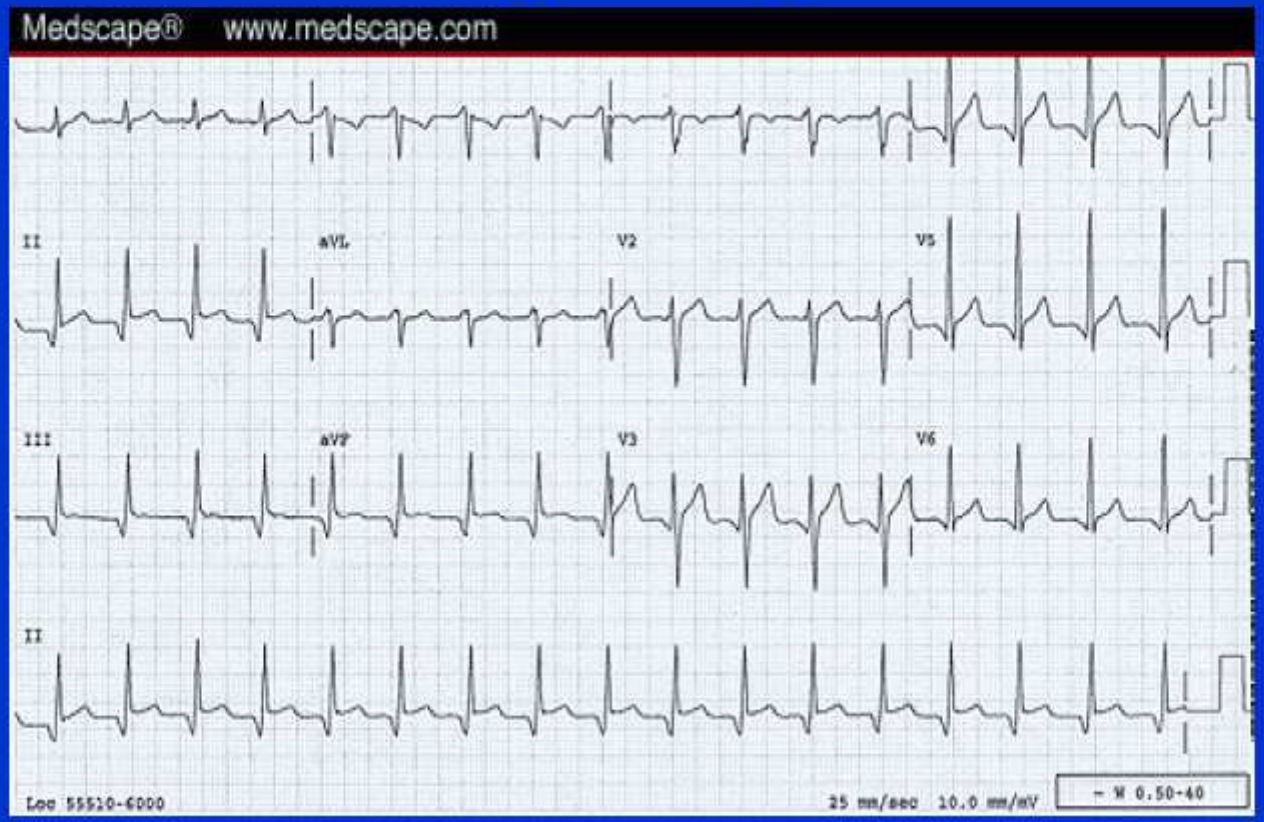
Sopraslivellamento del tratto ST



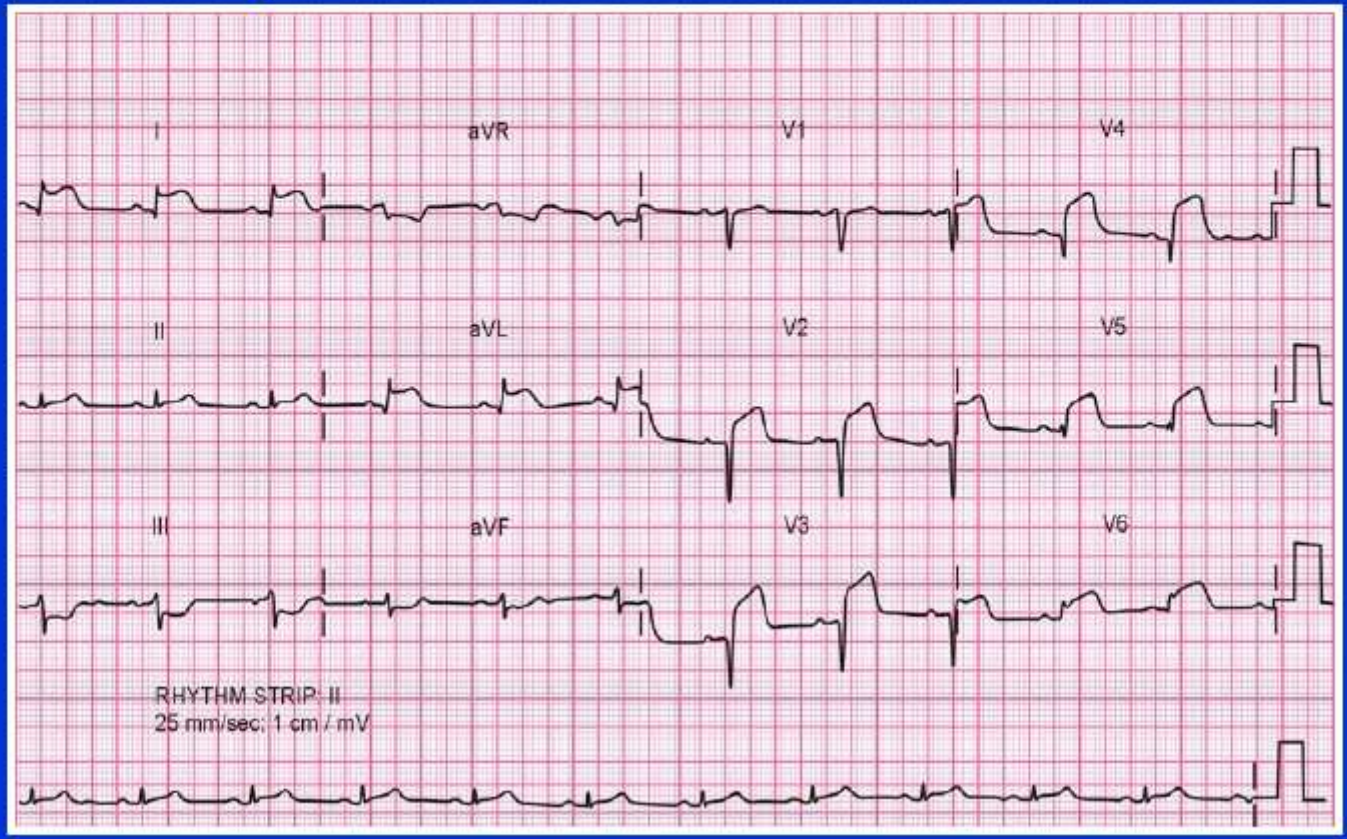
Sottoslivellamento ST diffuso e onda T negativa in un malato con angina instabile



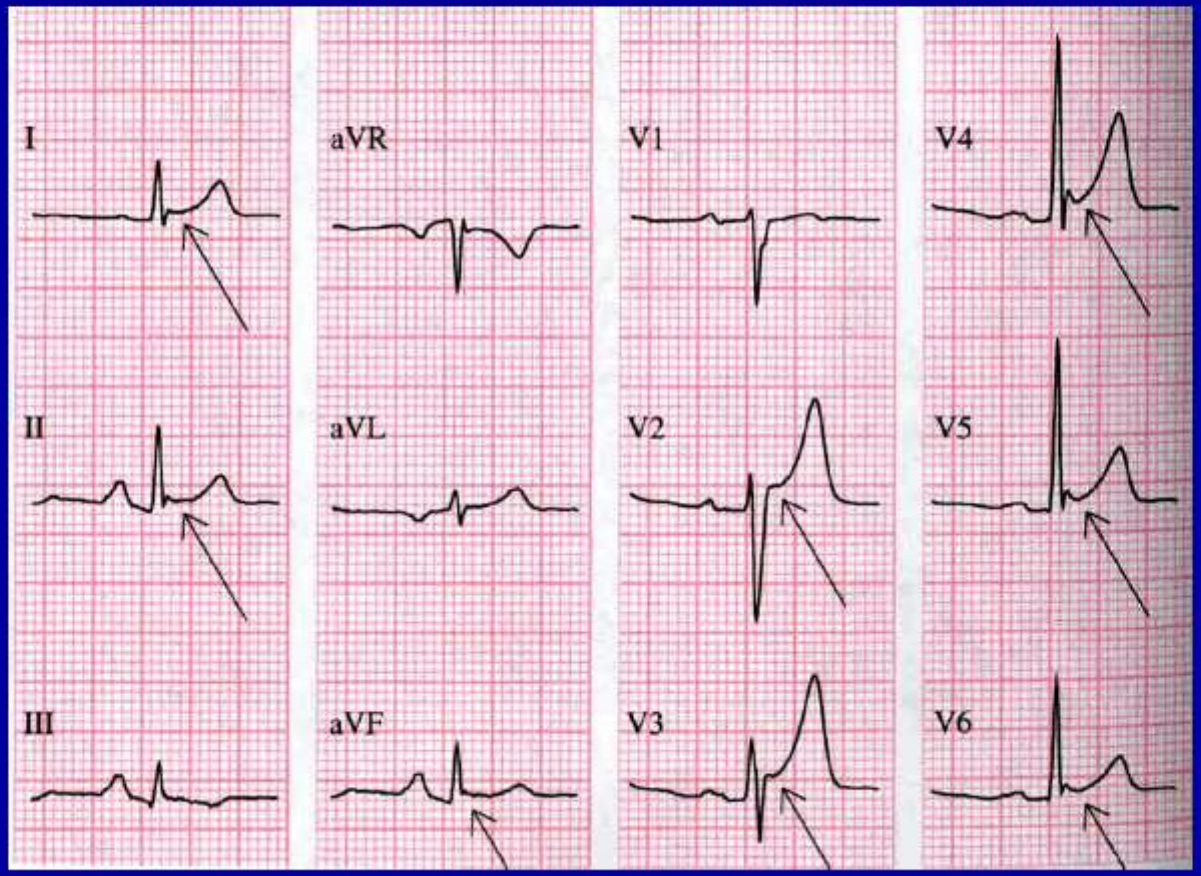
Pathological Q Waves



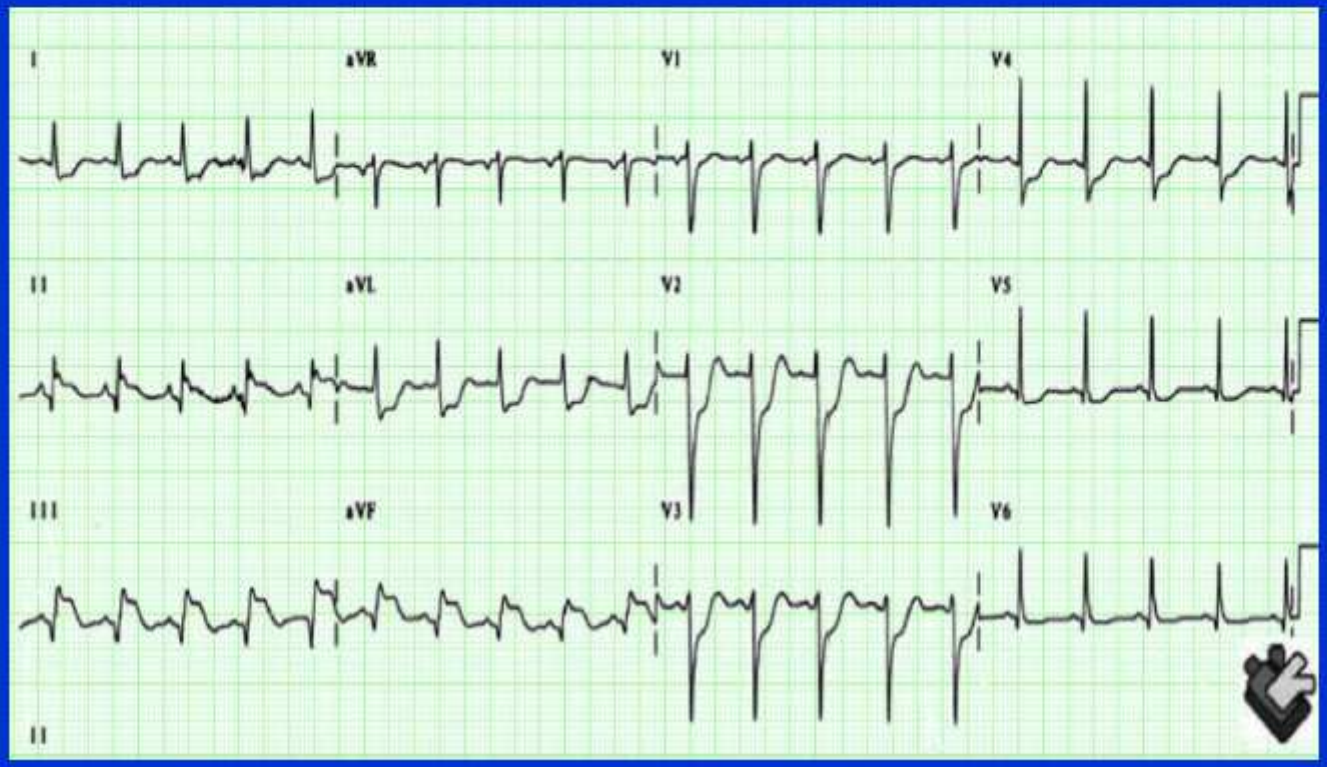
Antero-lateral myocardial infarction



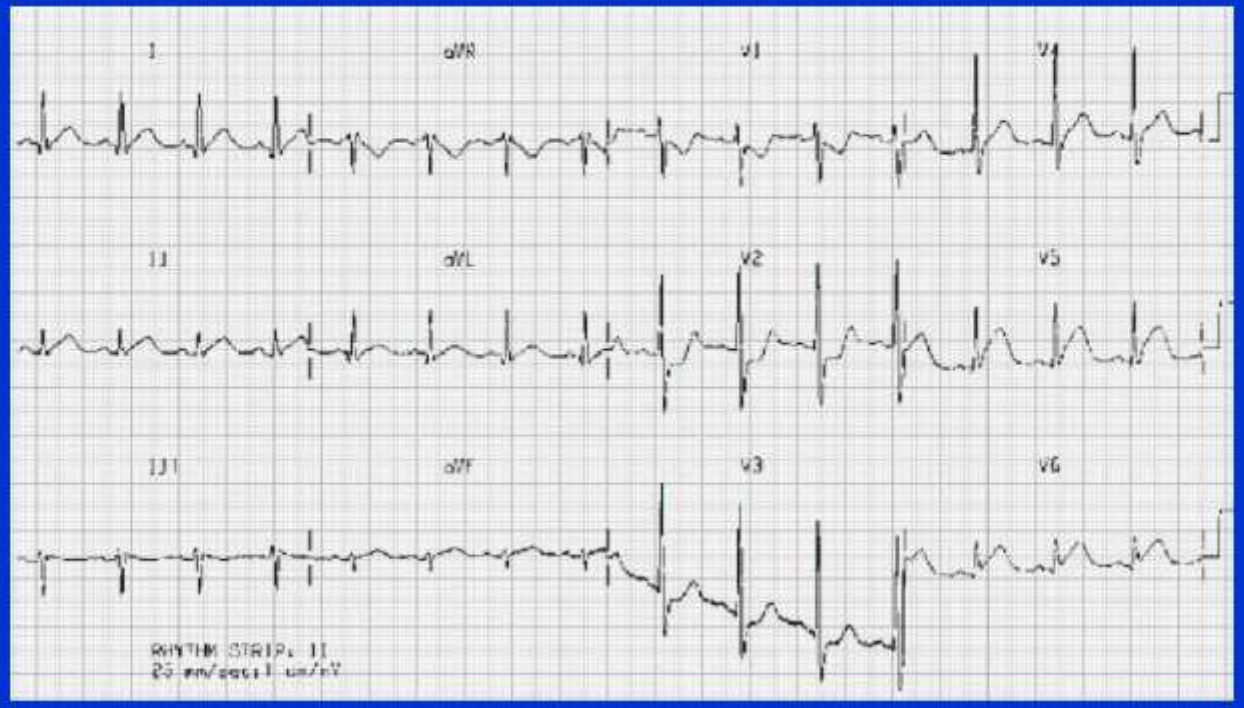
Acute Pericarditis



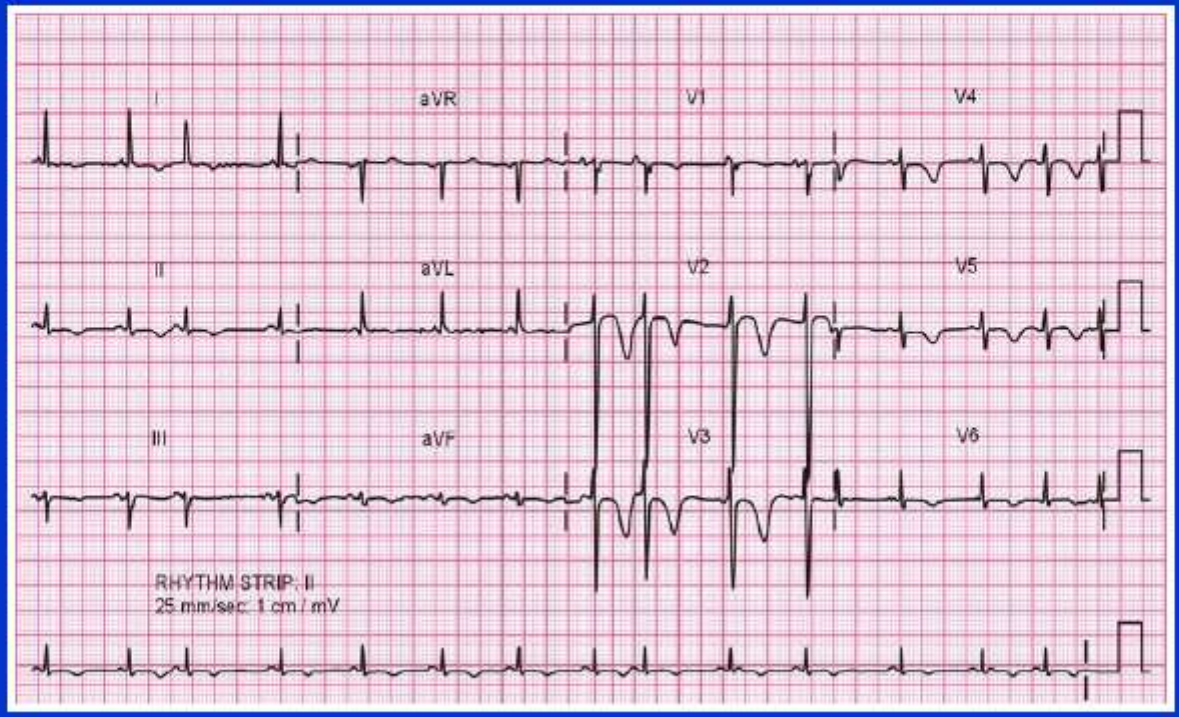
Inferior MI



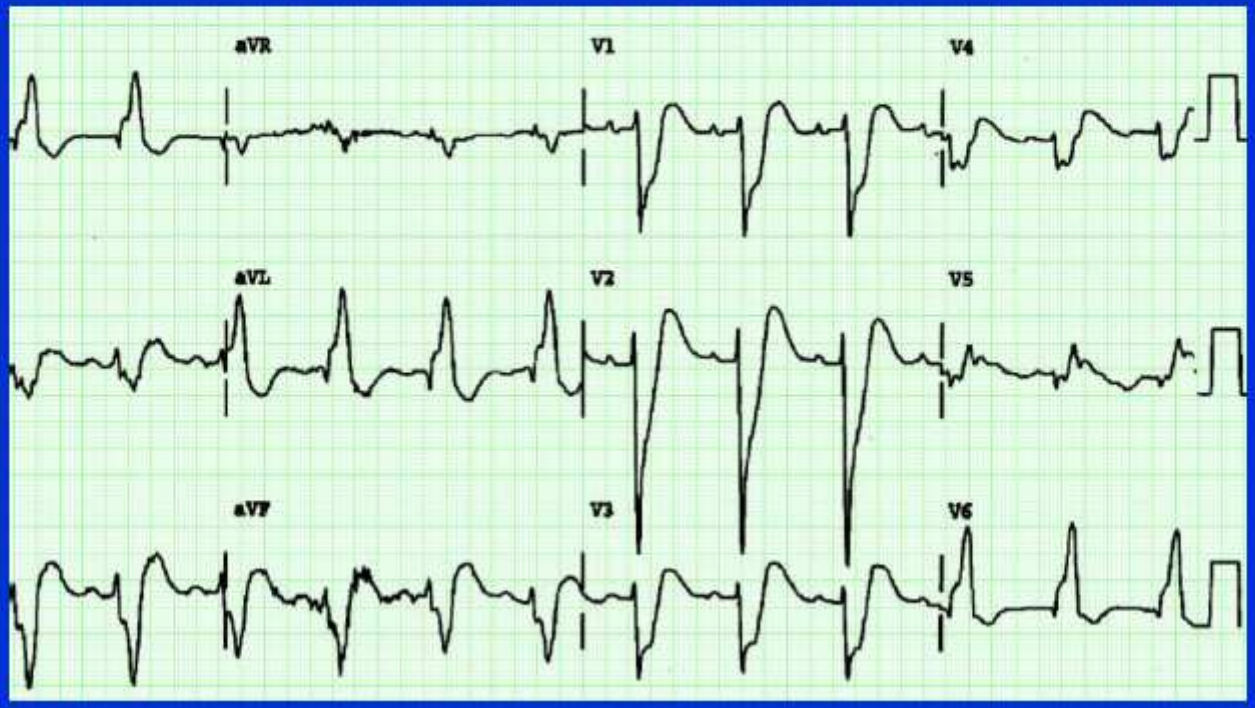
Posterior MI



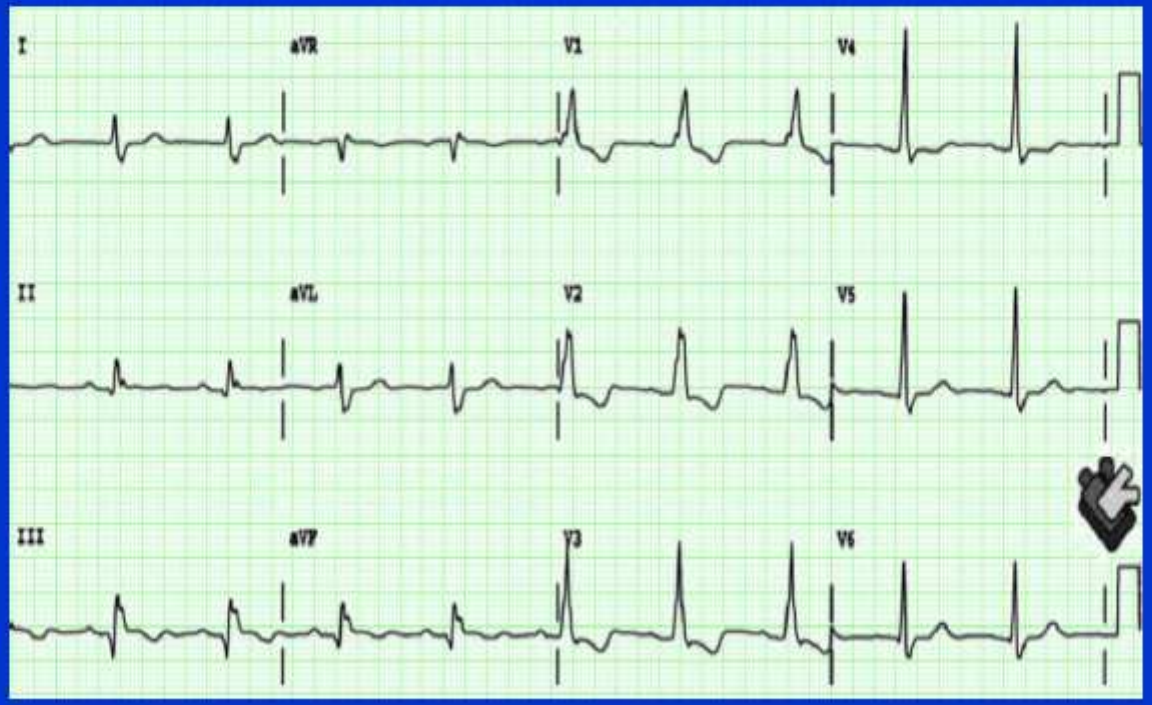
Non ST elevation MI



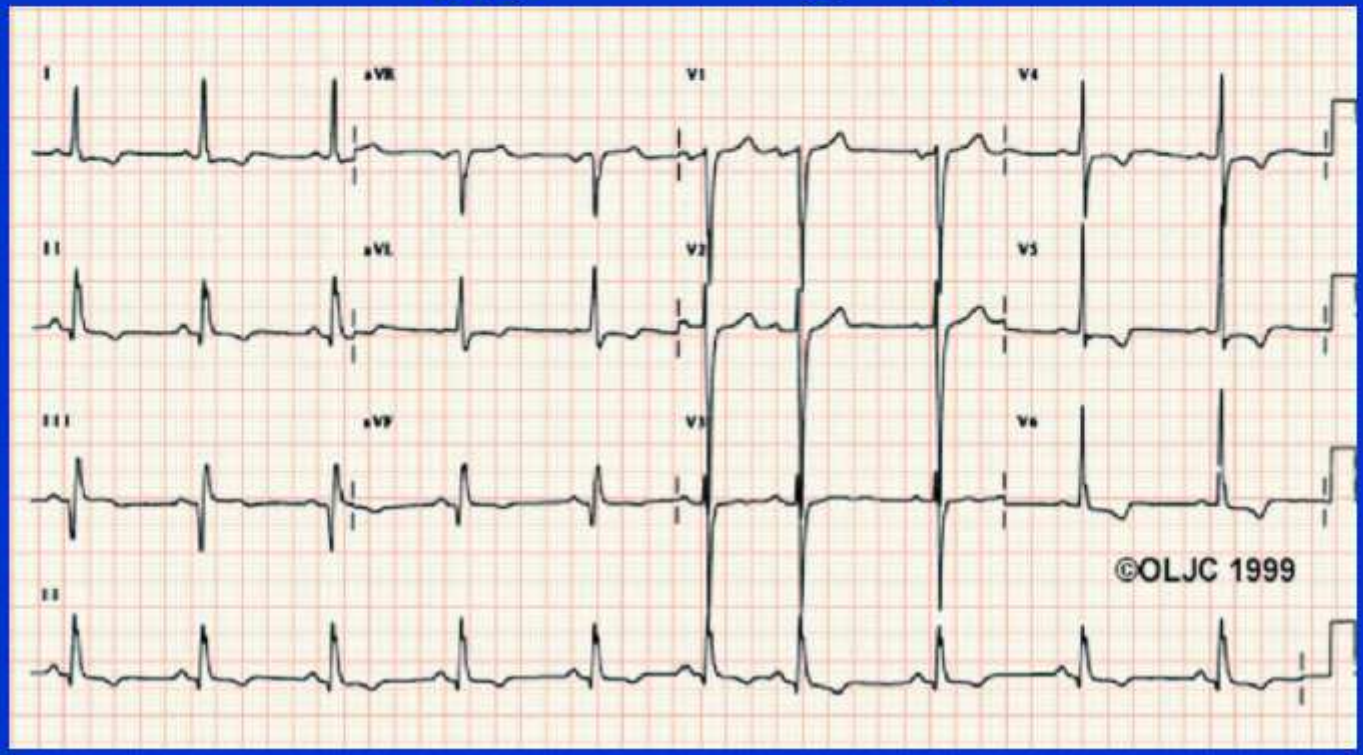
Left Bundle Branch Block



Right Bundle Branch Block



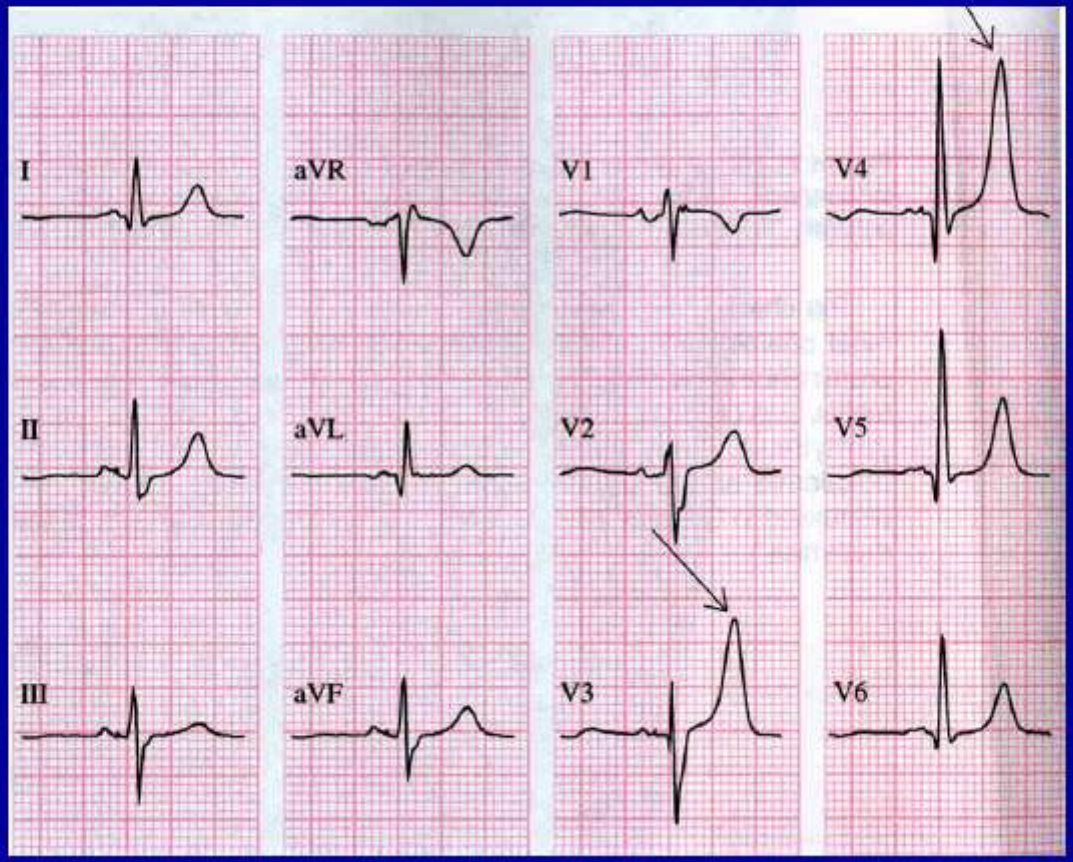
Left Ventricular Hypertrophy



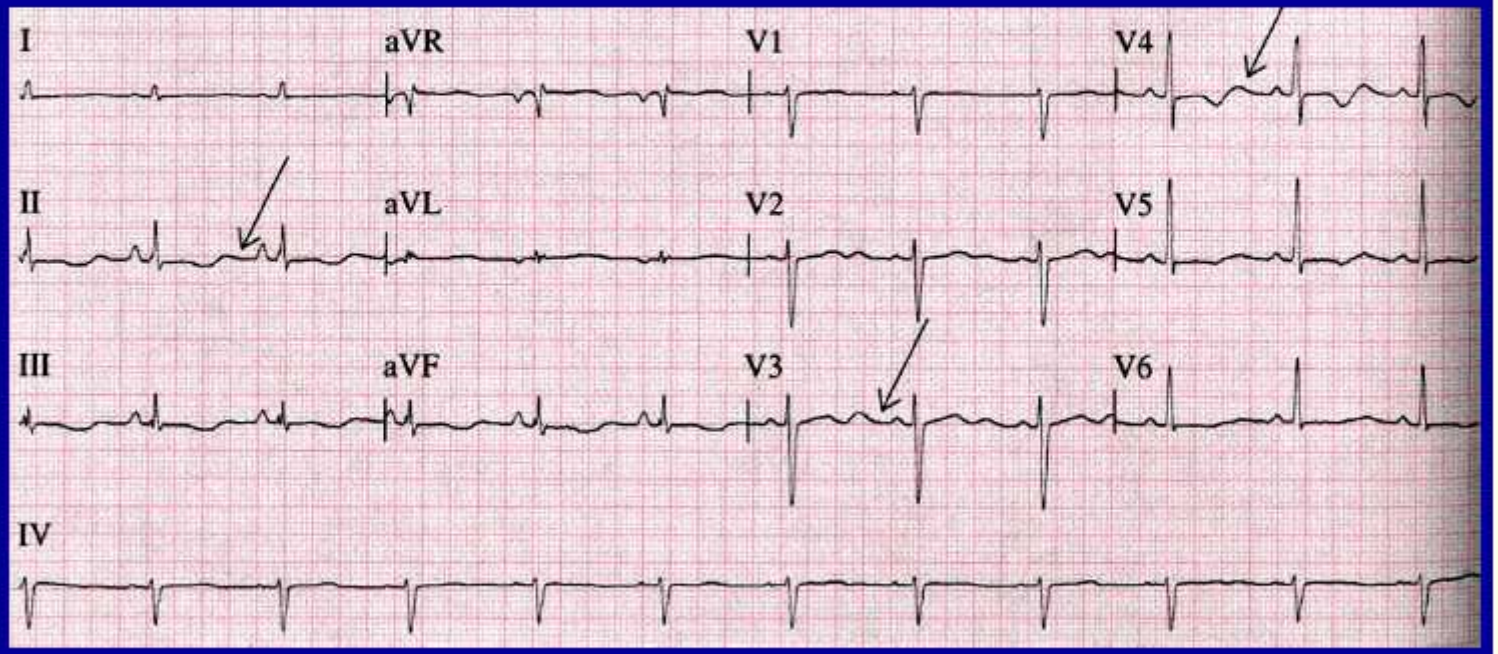
Left Ventricular Hypertrophy Voltage Criteria

- The R wave in V5 or V6 exceeds 25mm
- The S wave in V1 or V2 exceeds 25mm
- The total of the R wave in V5 or V6 plus the S wave in V1 or V2 exceeds 35mm
- NB – not for young, thin individuals
- A diagnosis of LVH can only be confirmed by Echocardiography

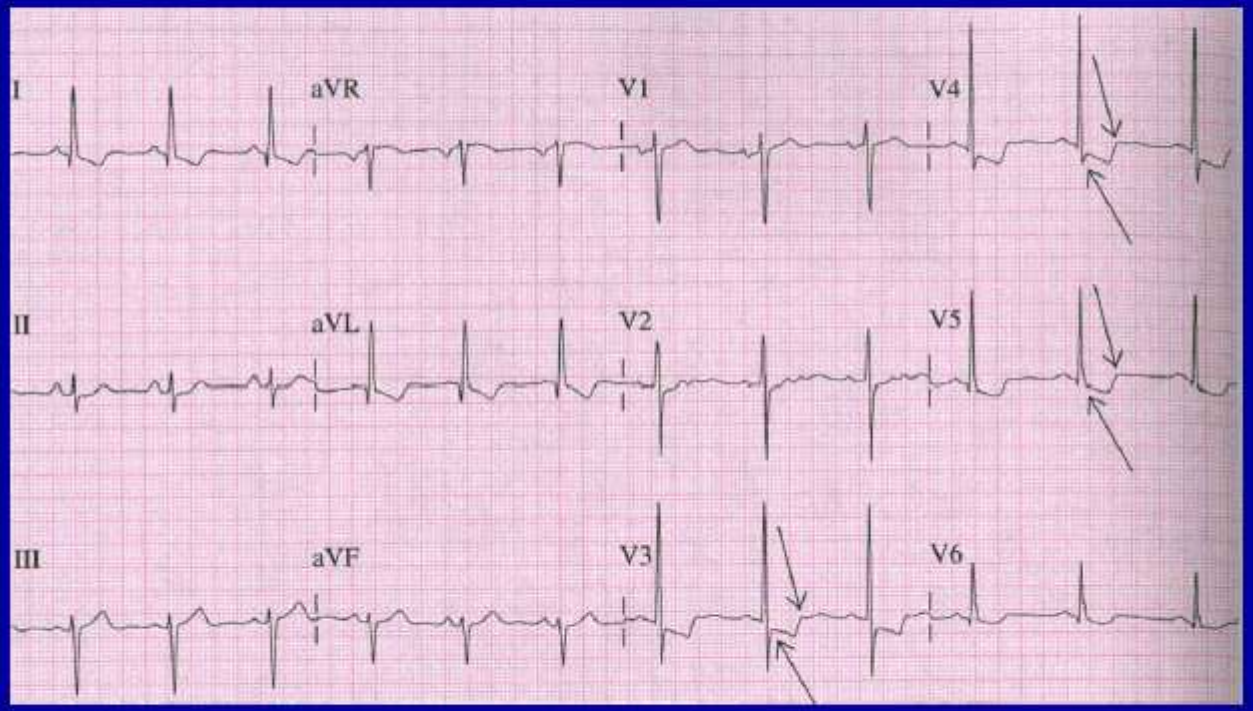
Hyperkalemia

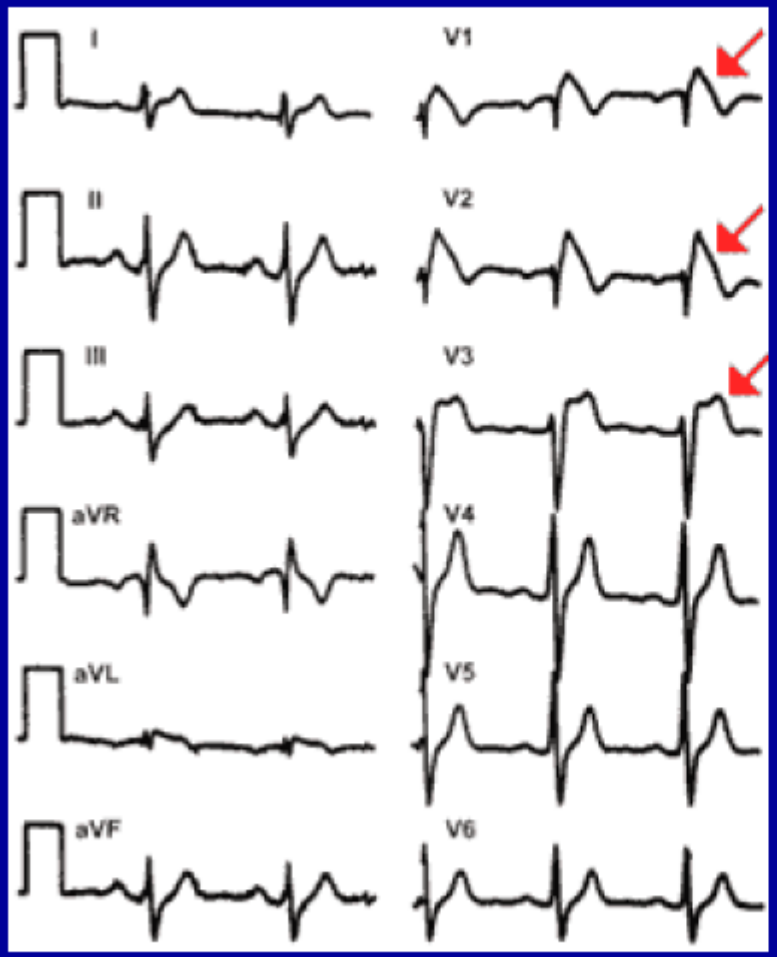


Hypokalemia



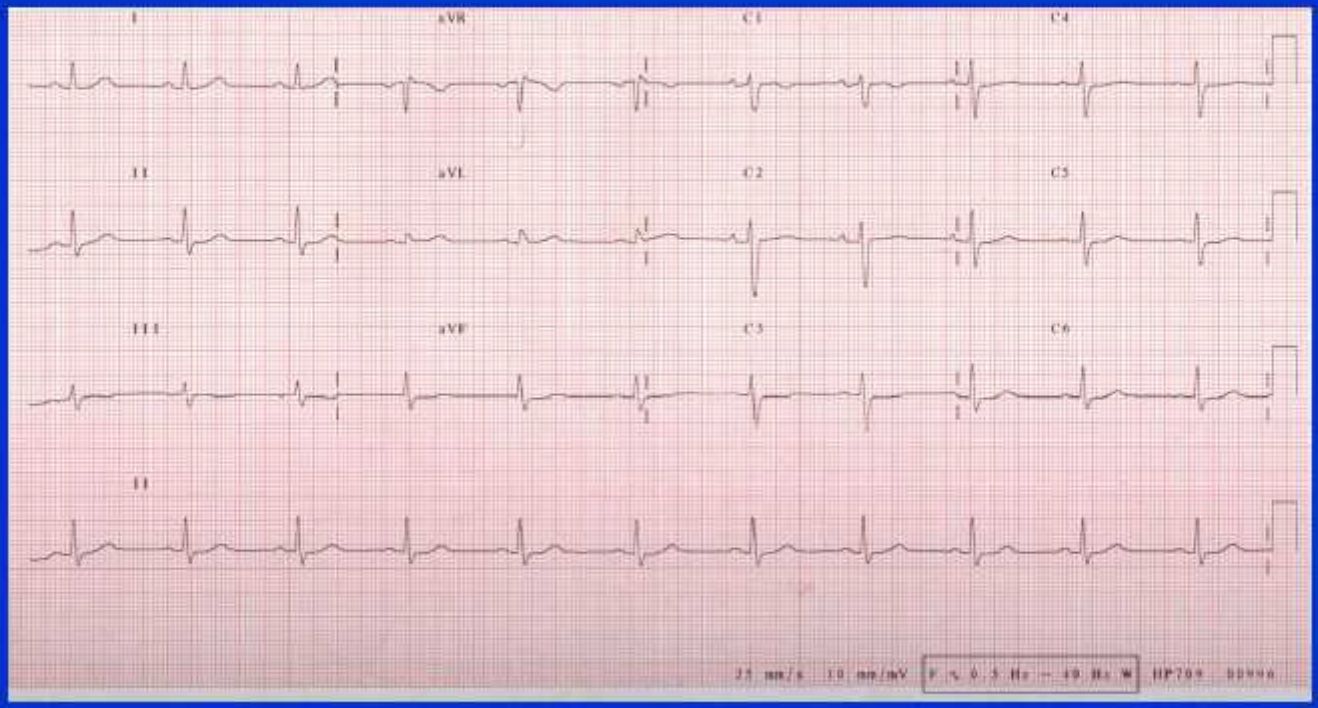
Digoxin Effect



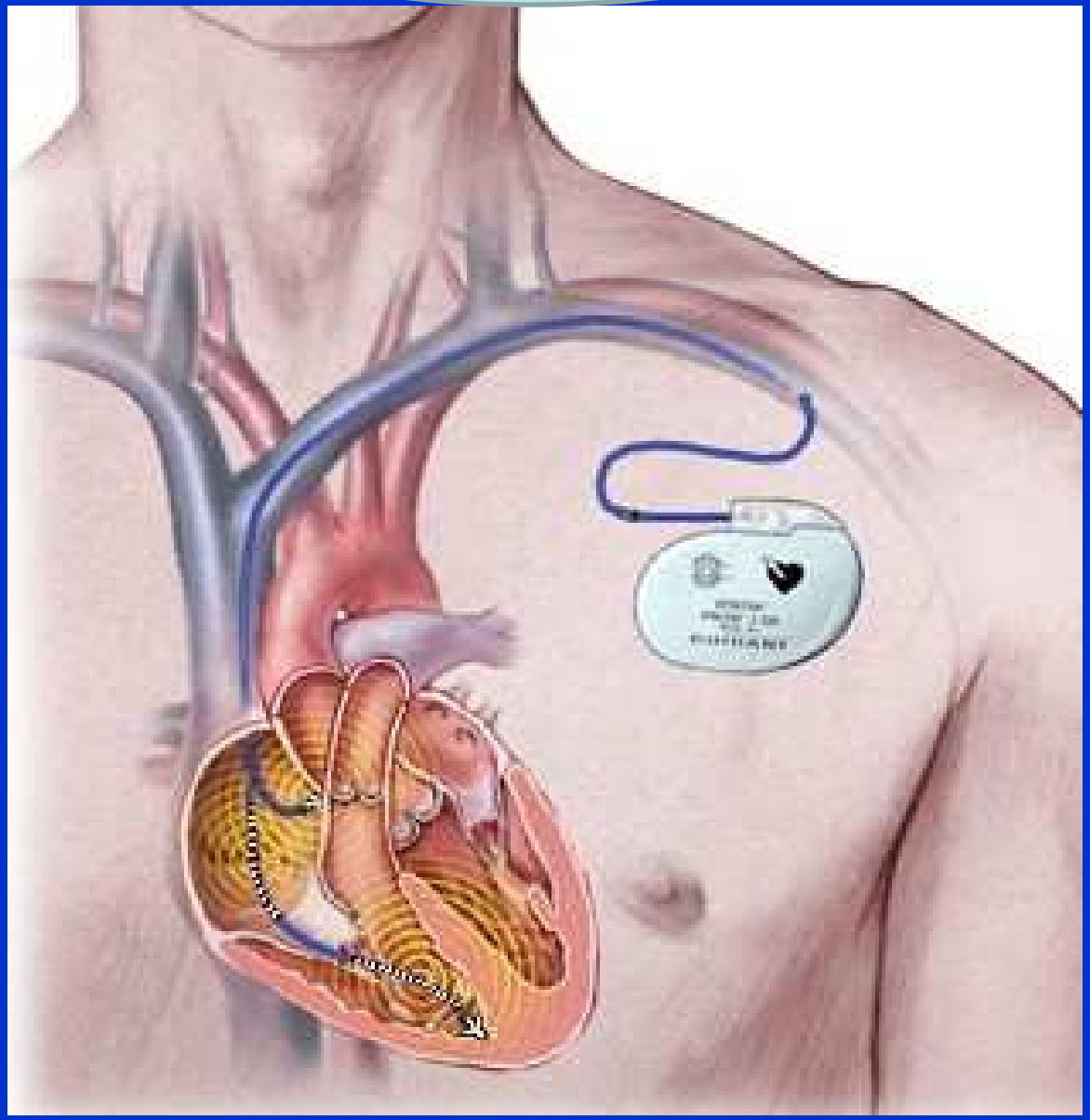


Typical ECG of Brugada syndrome:
Note the pattern resembling a right bundle branch block, the P-R prolongation and the ST elevation in leads V1-V3.

Resting ECG

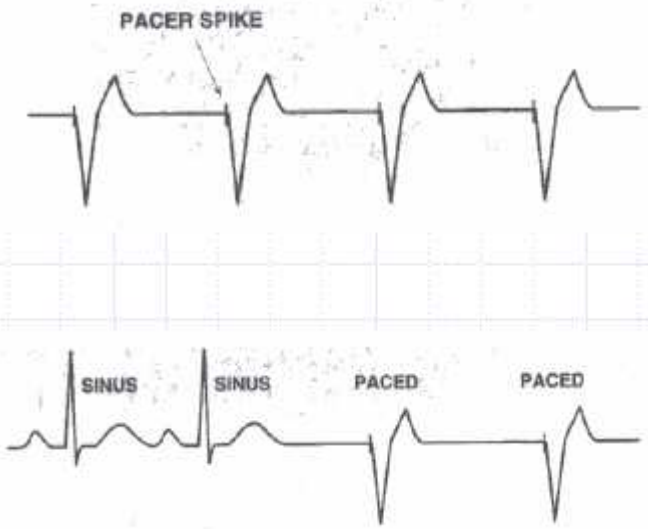


Pacemaker artificiale



Approach to Pacemaker Evaluation(1)

- Assess underlying rhythm:
  - 100% paced whether there is a non-paced intrinsic rhythm with a pacemaker functioning in demand mode



Approach to Pacemaker Evaluation(2)

- Determine the chamber(s) PACED
  - Determine the relationship of pacing spikes to P waves and QRS complexes

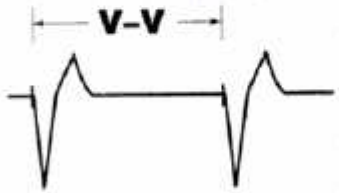
Atrial(A) paced beats

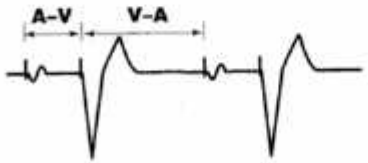
Ventricular(V) paced beats

Atrial(A) and Ventricular(V) paced beats

Approach to Pacemaker Evaluation(3)

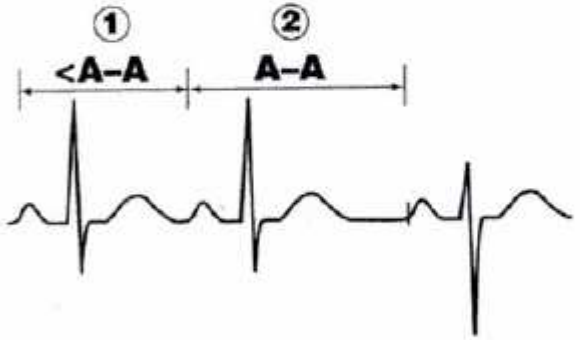
- Determine timing intervals
  - From 2 consecutively paced beats
  - Atrial pacing:
    - A-A interval
  - Ventricular pacing:
    - V-V interval
  - Dual chamber pacing:
    - A-V and V-A interval





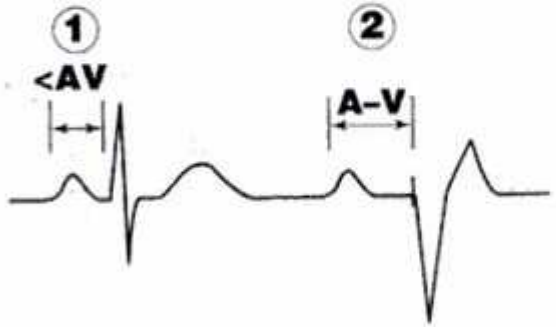
Approach to Pacemaker Evaluation(4-1)

- Determine the chamber(s) SENSED
  - Atrial pacemaker
    - A native P wave that occurs at an interval less than A-A interval
    - An atrial-paced beat that occurs after an interval equal to the A-A interval



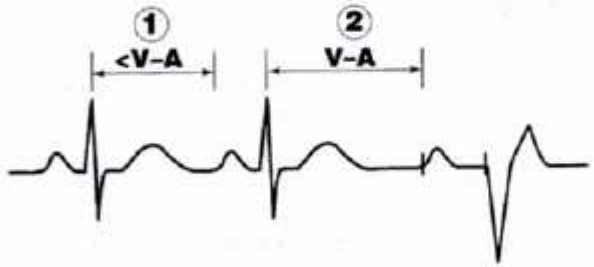
Approach to Pacemaker Evaluation(4-3)

- Dual chamber pacemaker
  - Atrial sensing
    - A native QRS complex that occurs at an interval less than A-V interval
    - An ventricular-paced beat that occurs at an interval equal to the A-V interval



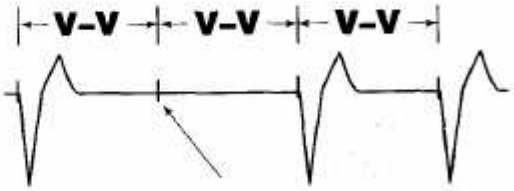
Approach to Pacemaker Evaluation(4-4)

- Dual chamber pacemaker
  - Ventricular sensing
    - A native P wave that occurs at an interval less than V-A interval
    - An atrial-paced beat that occurs at an interval equal to the V-A interval

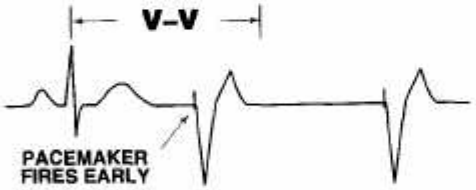


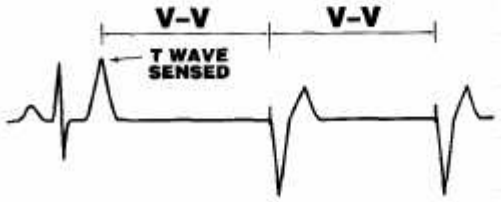
Approach to Pacemaker Evaluation(6)

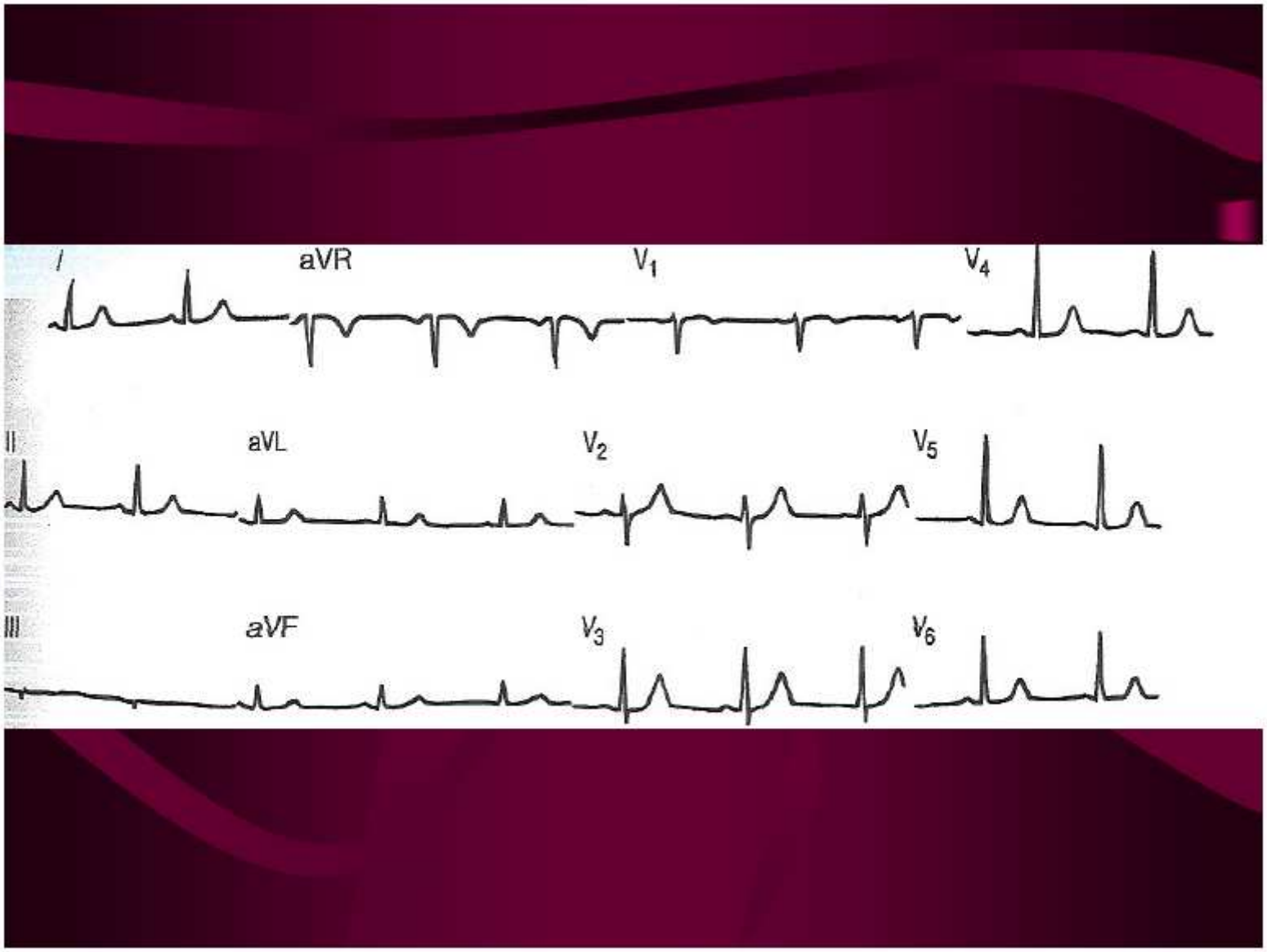
- Look for pacemaker malfunction
  - Failure to capture
    - Are any pacing spikes not followed by a depolarization ?



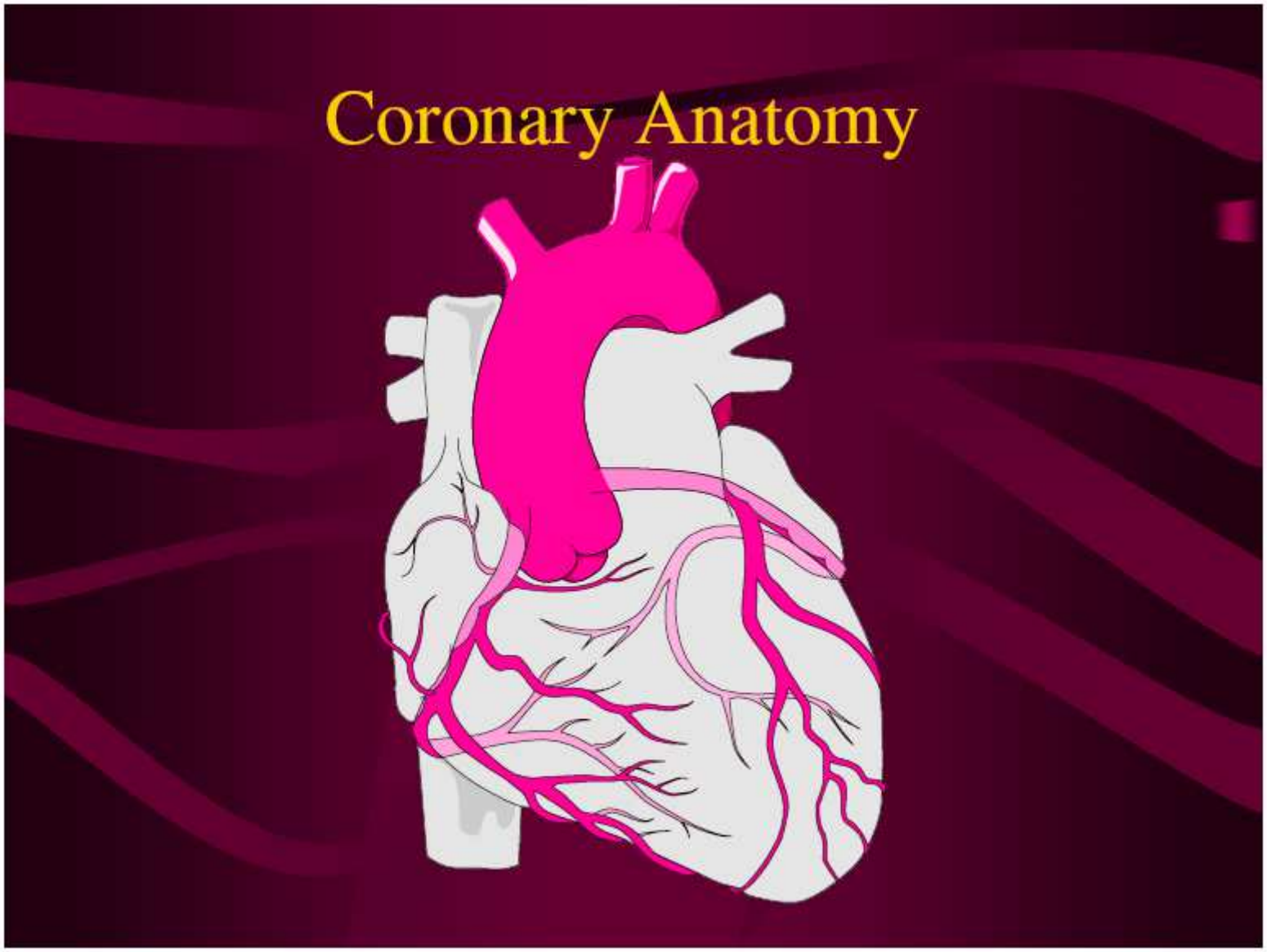
- Sensing Abnormalities
  - Undersensing
  - Oversensing






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

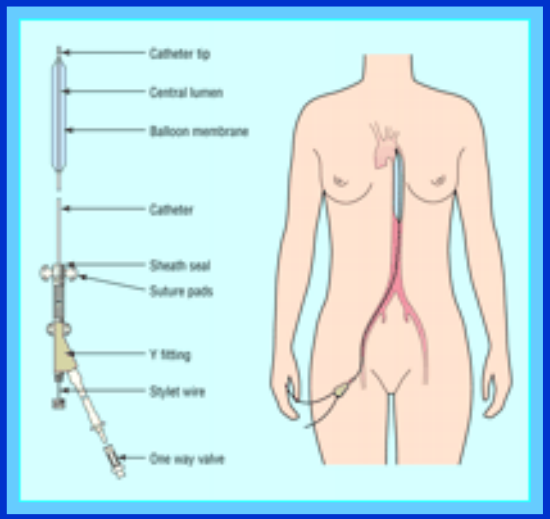
Coronary Anatomy



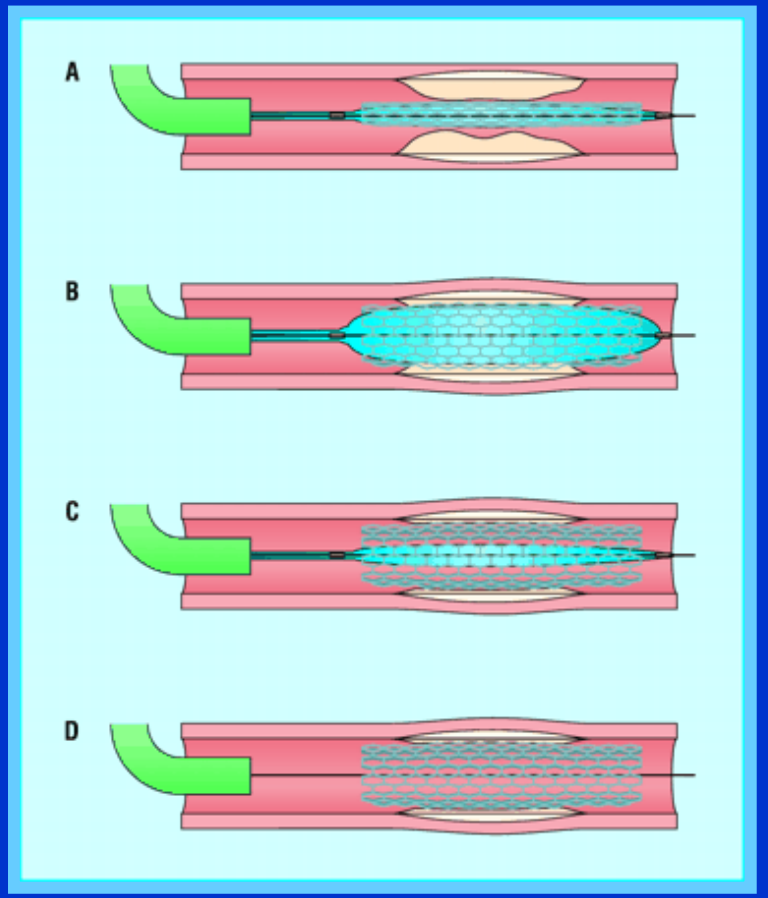
Myocardial Infarction

- Usually result of clot formation at site of fixed lesion

ANGIOPLASTICA CORONARICA PERCUTANEA NELL'IMA

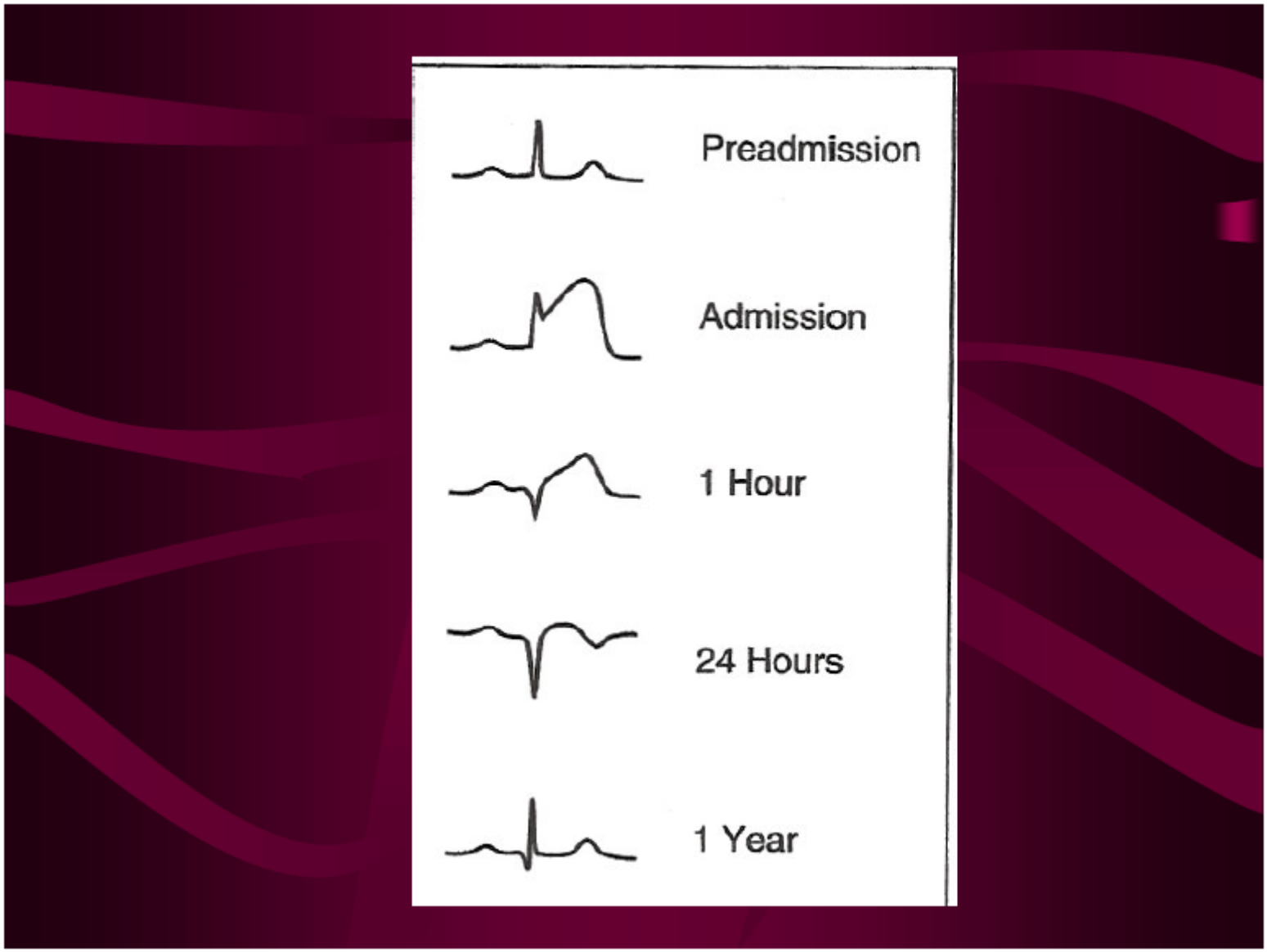


Puntura arteriosa (a. femorale)

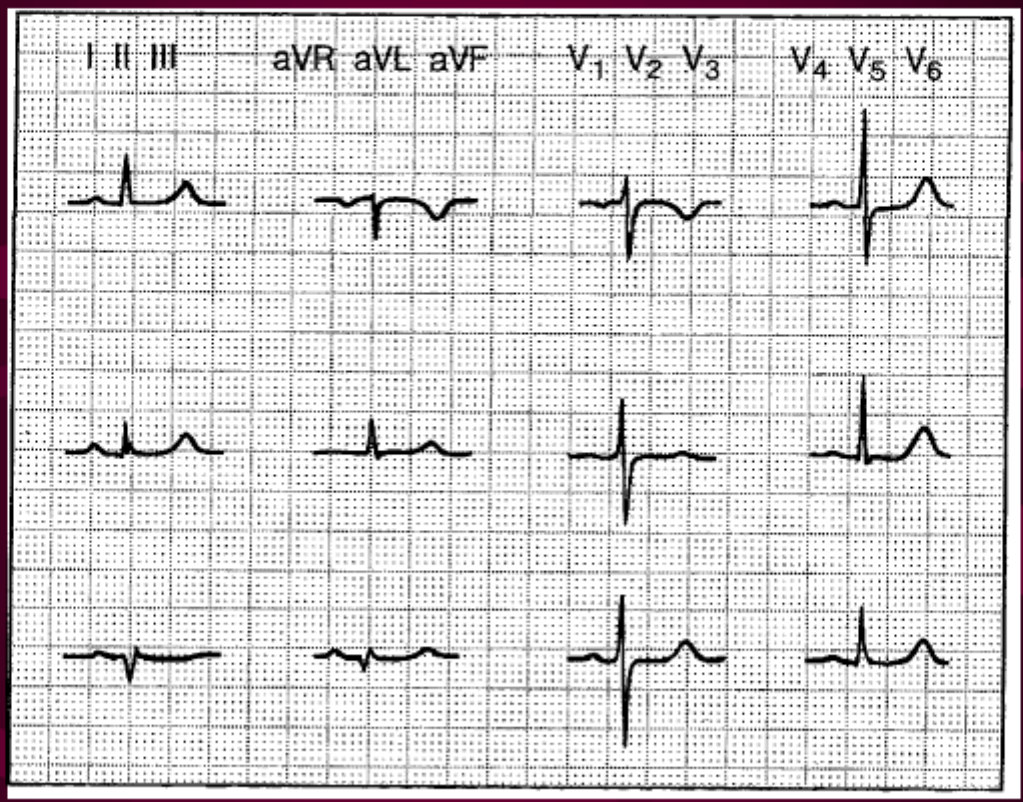


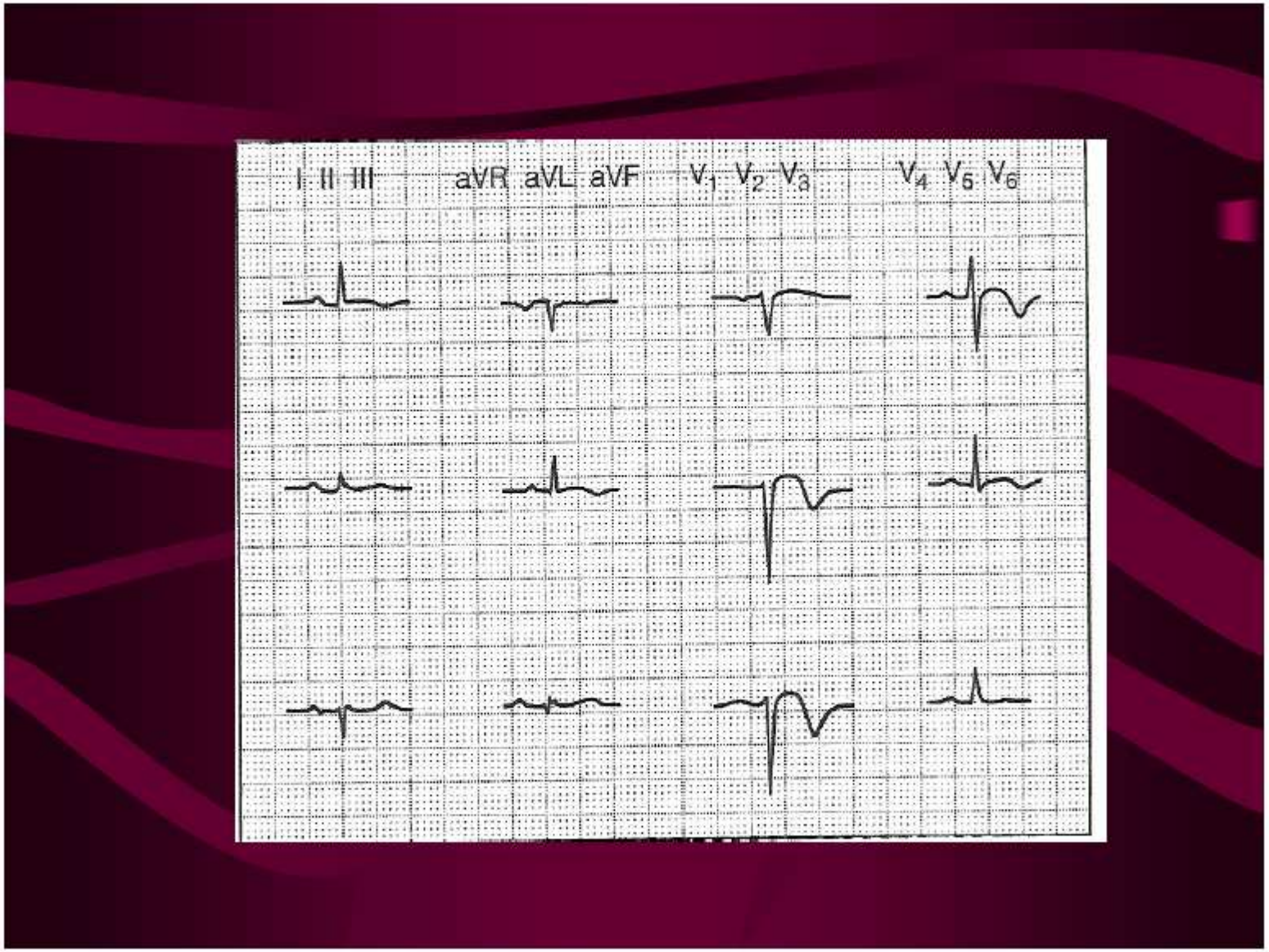
Hallmark of Infarction

- Transmural – full thickness of myocardial wall
  - ST Elevation
  - T Wave Inversion
  - Q Wave Formation

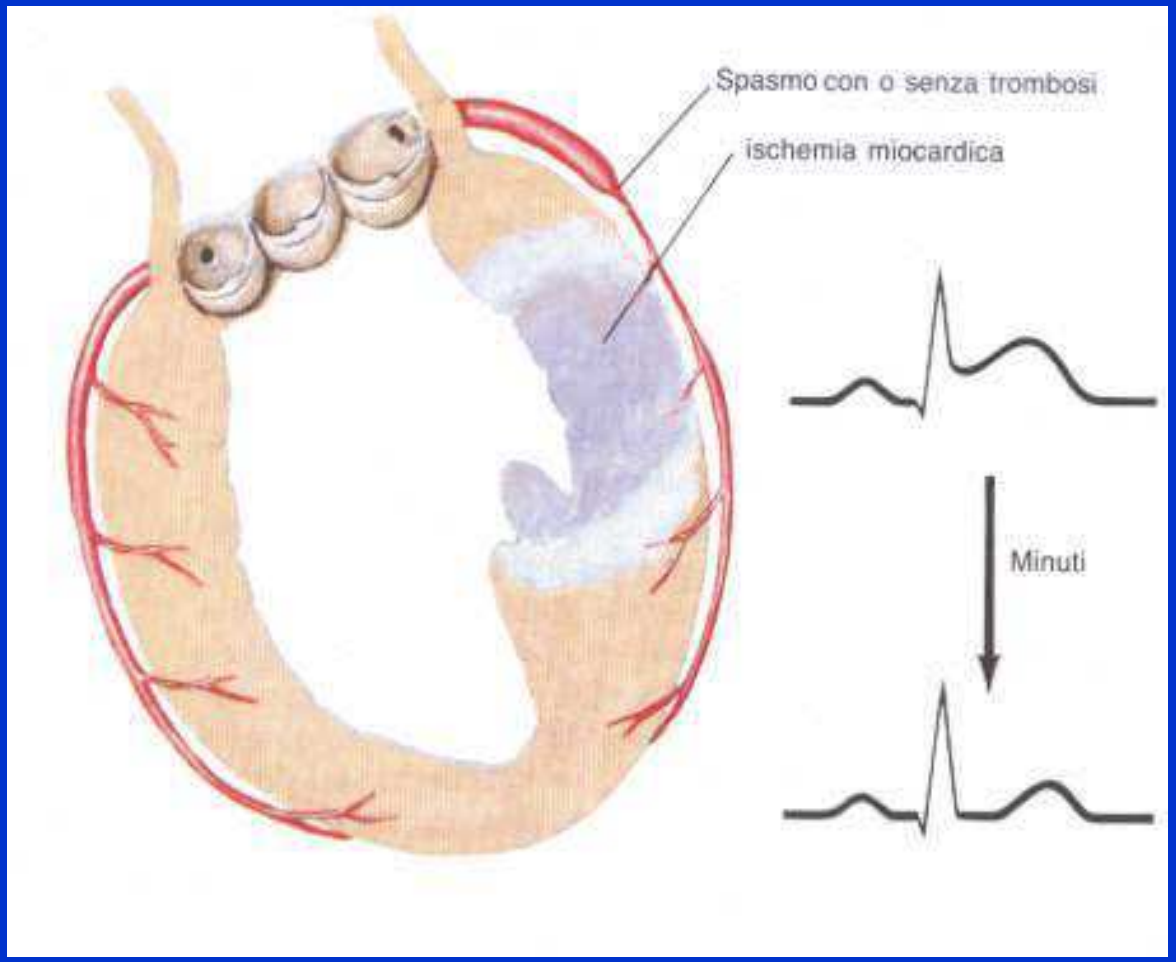

Preadmission
Admission
1 Hour
24 Hours
1 Year

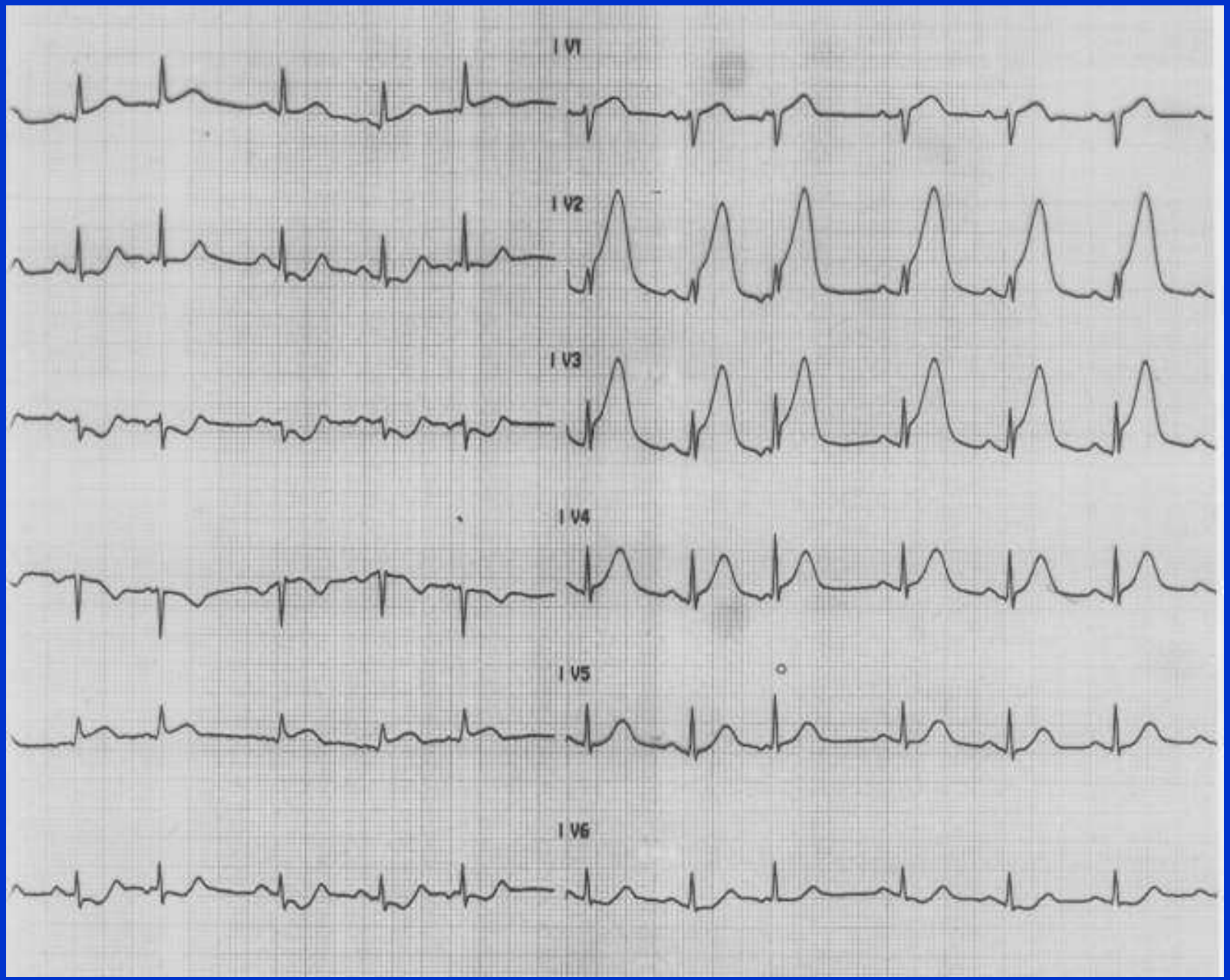
Old Inferior Wall MI

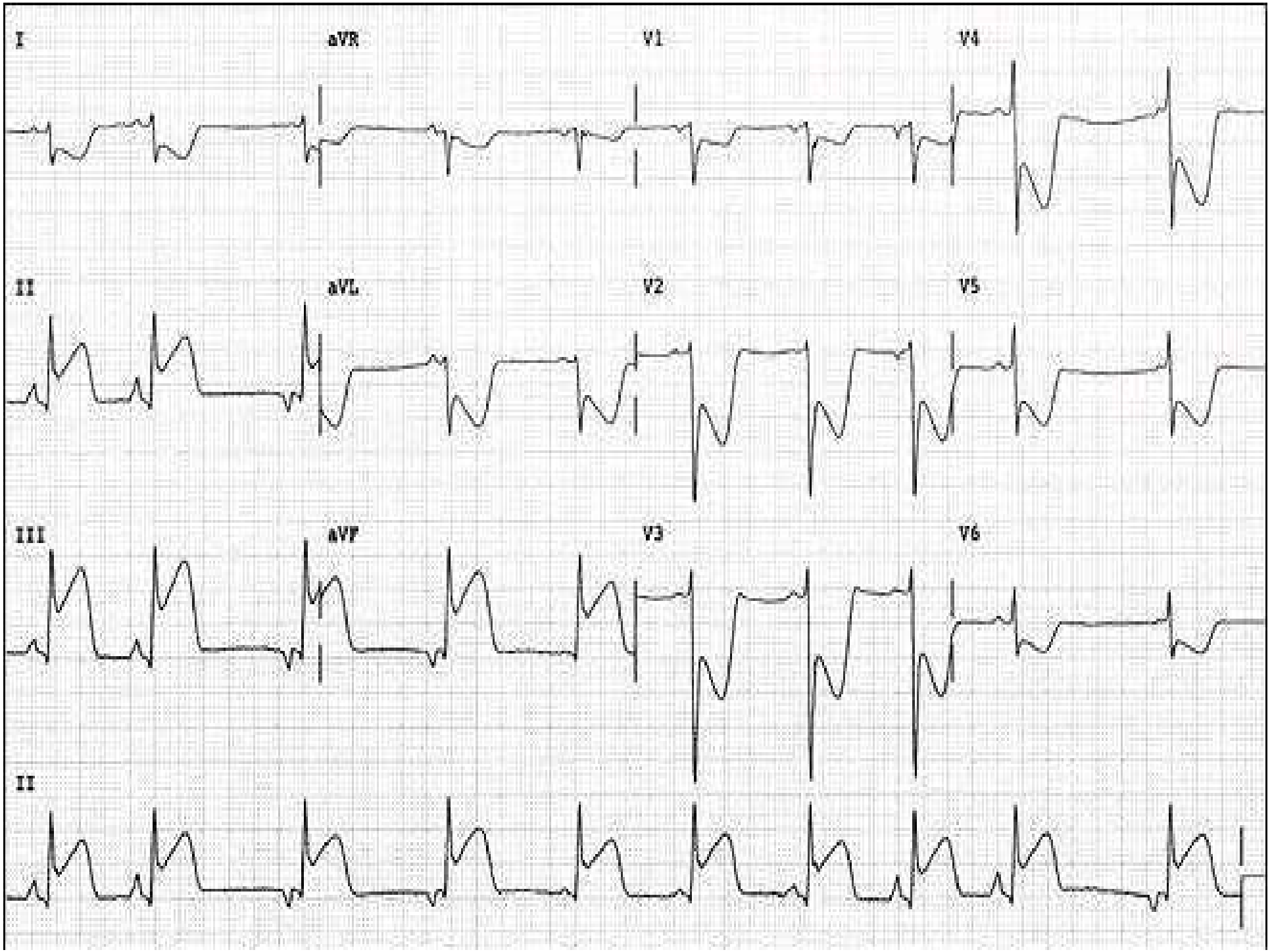



I II III
aVR aVL aVF
V1 V2 V3
V4 V5 V6

Ischemia transmurale Transitoria




I V1
I V2
I V3
I V4
I V5
I V6


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

Grazie per la cortese attenzione

Sconvolti?