Corso avanzato di elettrocardiografica clinica

Giovedì 15, ore 9.30-13.30
Referenti Scientifici: F.sco De Luca, F. Meli

Cenni di anatomia e fisiologia del tessuto di conduzione
Basi teorico-pratiche dell'ECG e percentile di normalità in età pediatrica

Esercitazioni pratiche

Ipertrofia cardiaca destra e sinistra
Alterazioni Ecografiche prodotte da condizioni non primitivamente cardiache: le diselettrolitemie e...

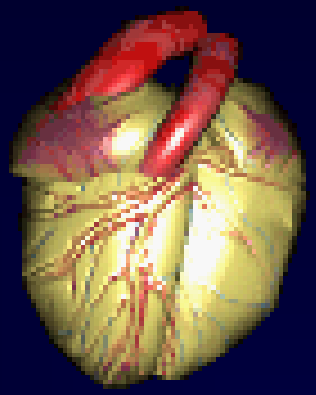
Esercitazioni pratiche

Blocchi di branca ed extrasistoli: c'è da preoccuparsi?
Le bradicardie e i disturbi della conduzione
Le Sindromi da Preeccitazione ventricolare
QT lungo e Sindrome di Brugada

Esercitazioni pratiche

Le tachicardie sopraventricolari
Le tachicardie ventricolari
Emergenze aritmiche: saperle riconoscere, saperle trattare
Principi di elettrocardiografia nelle principali cardiopatie congenite

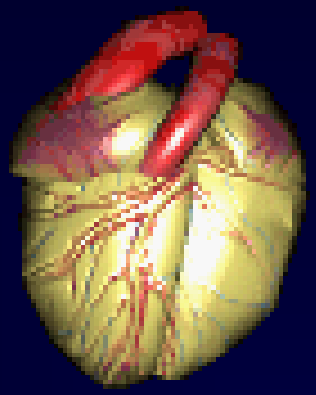
Francesco De Luca,
Agata Privitera
U.O.C. di Cardiologia Pediatrica, Ospedale Santo Bambino CATANIA
www.cardiologiapediatricact.com



Il cuore

Ha funzione di pompa

spinge il sangue in quantità adeguata
al fabbisogno dell'organismo



Il cuore

Ha funzione di pompa

spinge il sangue in quantità adeguata
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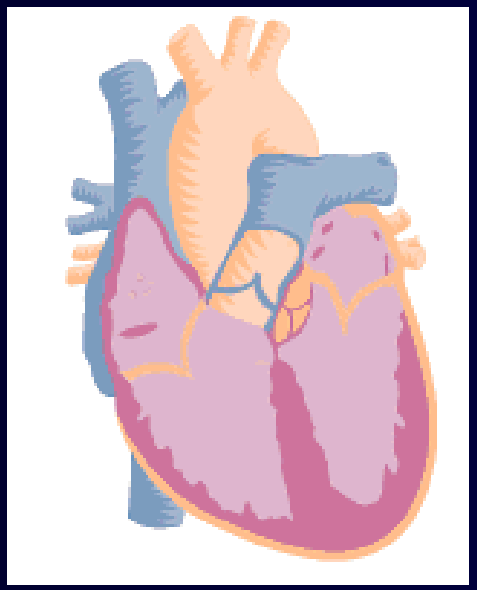
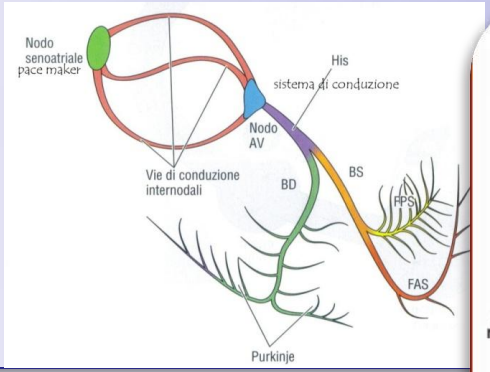
Una Stimolazione Elettrica precede e determinata la contrazione meccanica

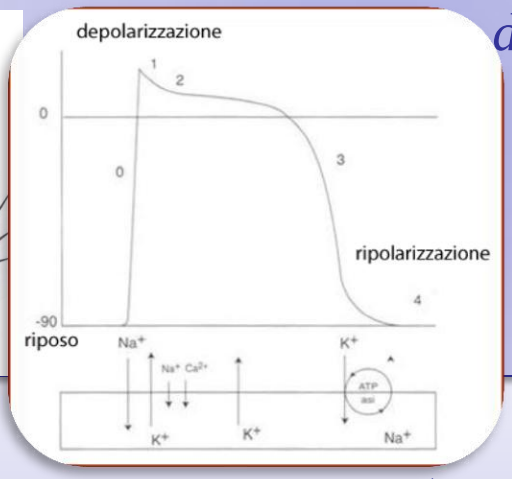


Un ciclo cardiaco completo è costituito da una diastole e da una sistole atriale e ventricolare

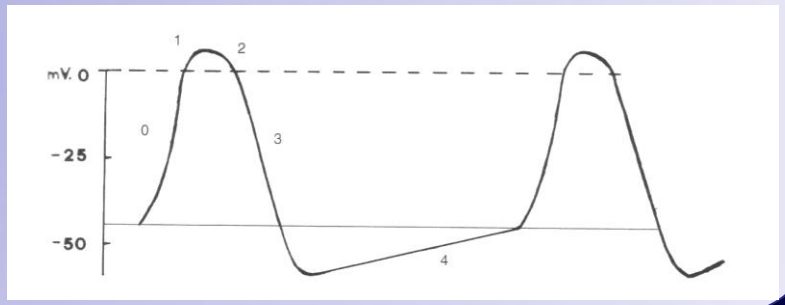
Fibrocellule cardiache suddivisione:

Miocardio specifico
(cellule deputate alla attività elettrica):

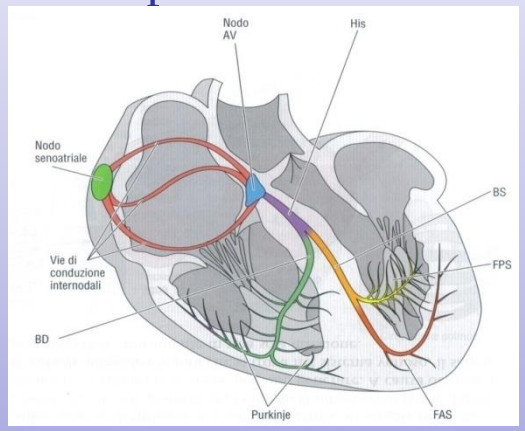




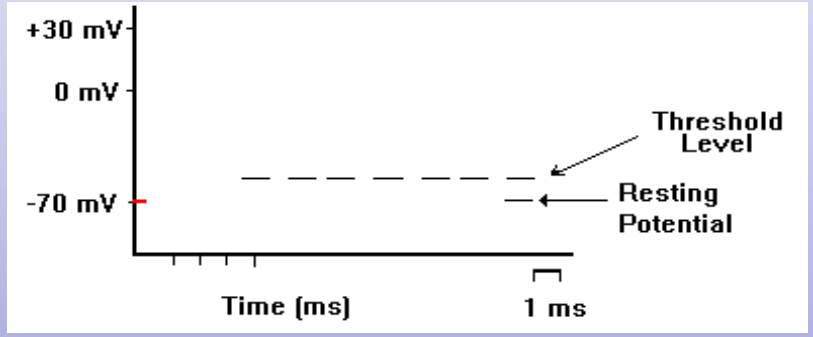
Si depolarizzano spontaneamente durante la fase di recupero (4) fino a dare un potenziale d'azione a -30mV



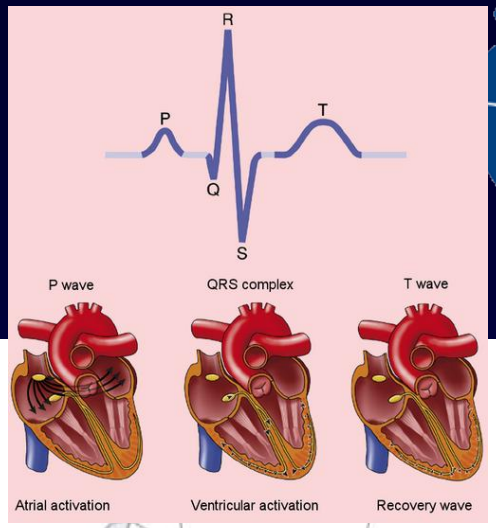
Miocardio comune
(cellule deputate alla contrazione meccanica):

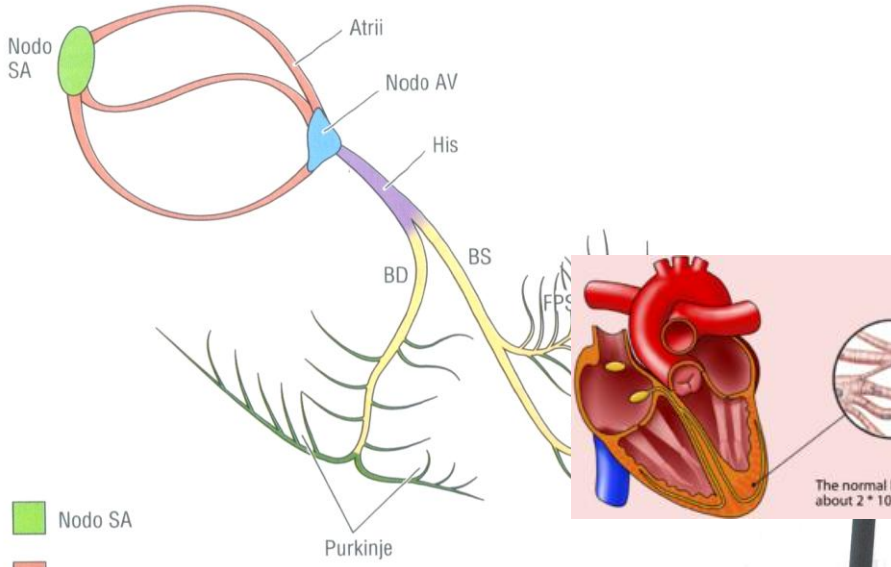


vengono depolarizzate dalle cellule pacemaker

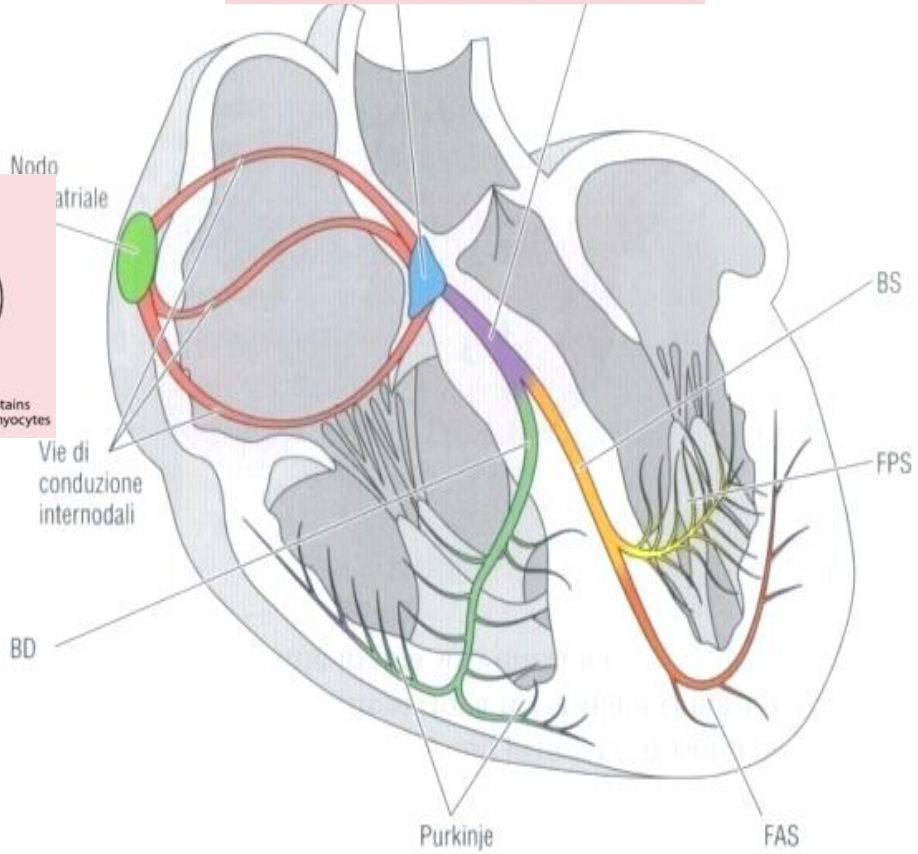


Elettrofisiologia





Intervallo PR e sue relazioni con il sistema di conduzione.



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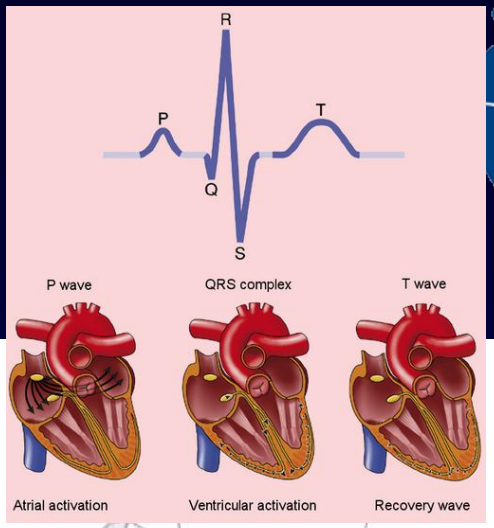
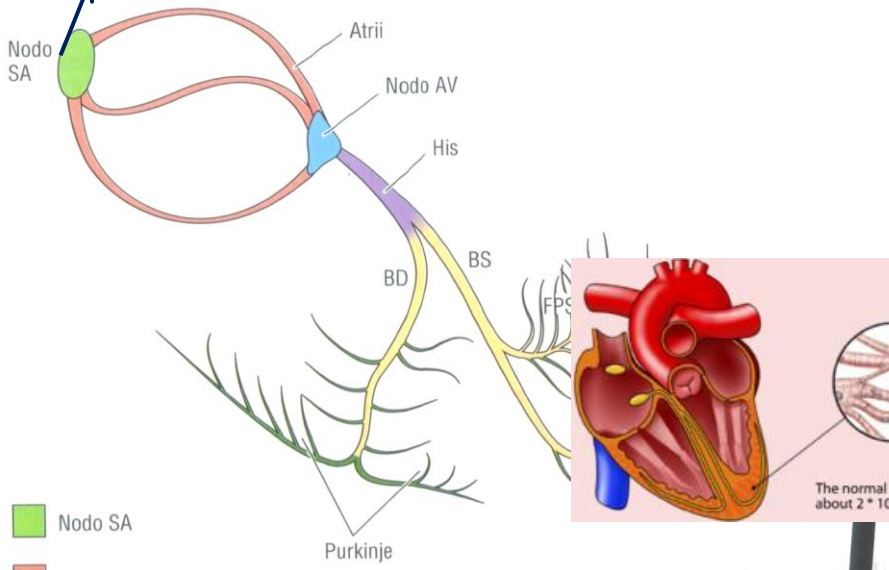
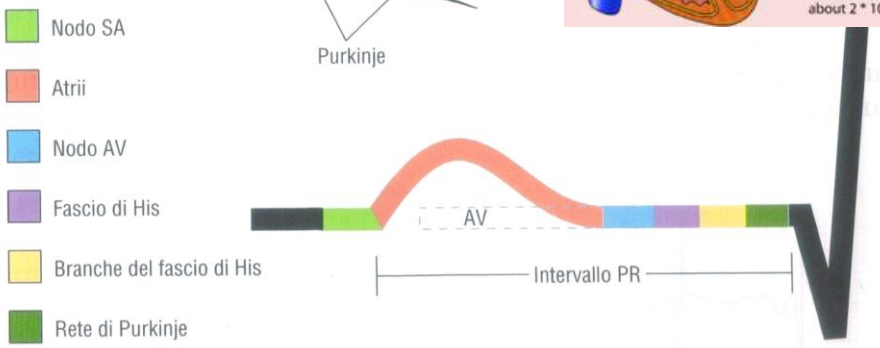


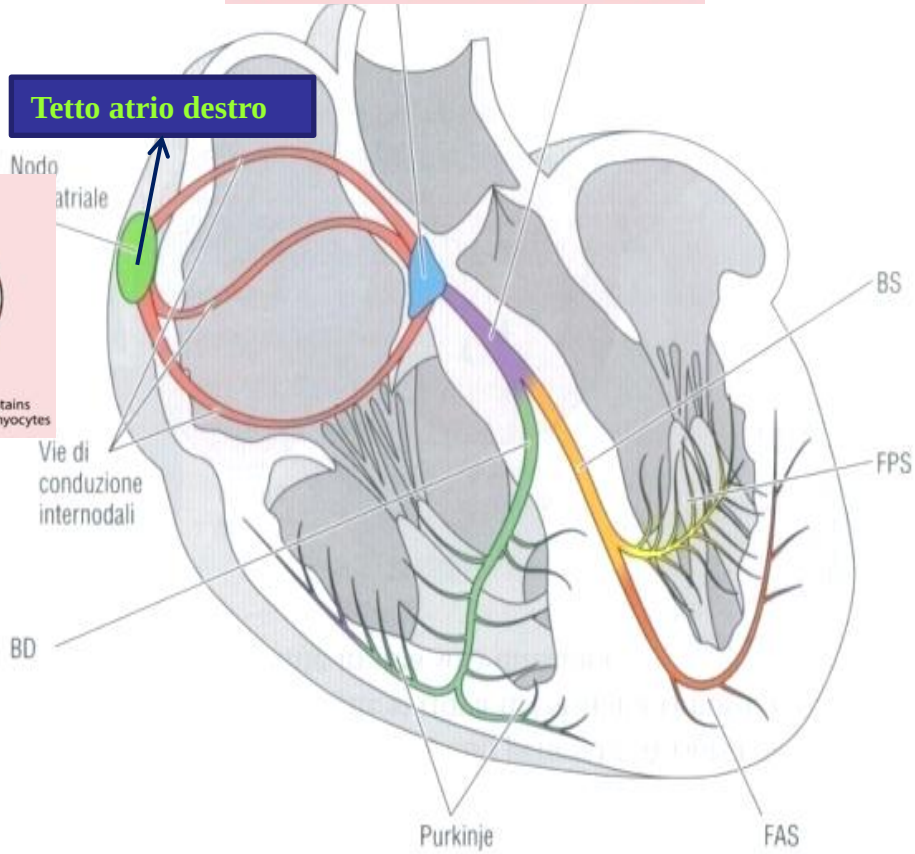
L'impulso origina



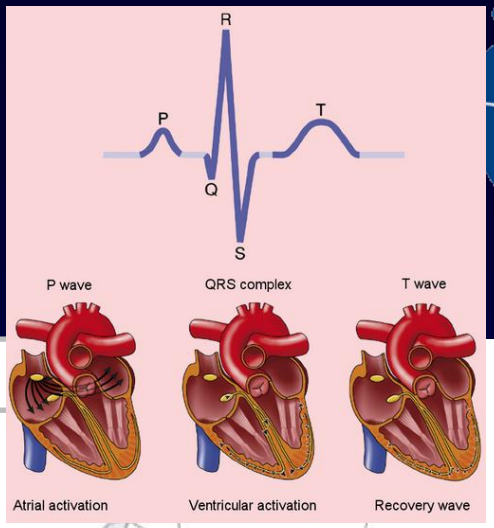


Intervallo PR e sue relazioni con il sistema di conduzione.

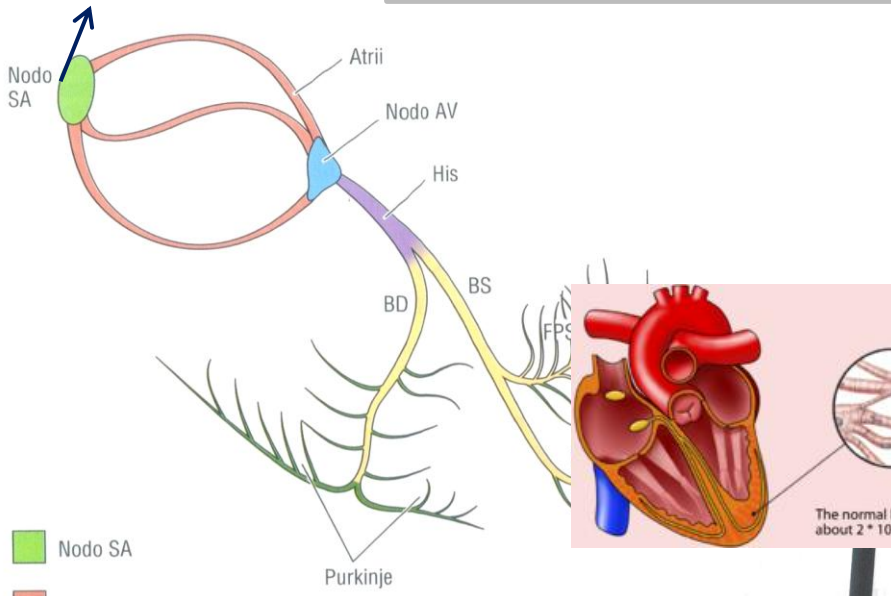
Tetto atrio destro



Elettrofisiologia

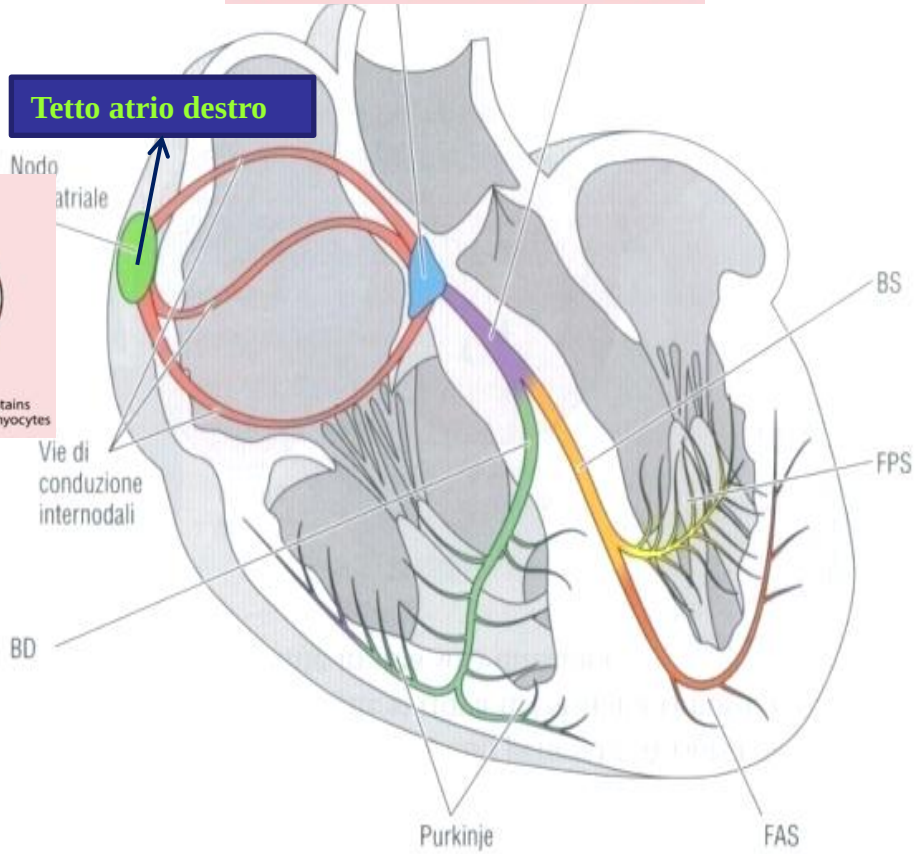


L'impulso origina → Depolarizza le cellule atriali dando origine all'onda **P**

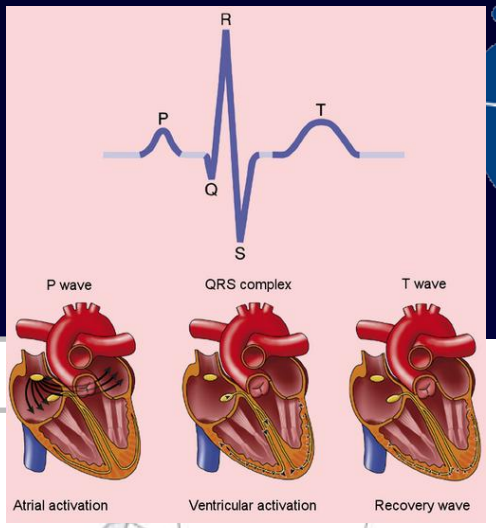


Intervallo PR e sue relazioni con il sistema di conduzione.

Tetto atrio destro



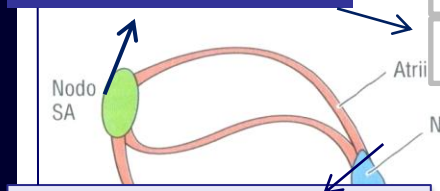
Elettrofisiologia



L'impulso origina

Depolarizza le cellule atriali dando origine all'onda P

Attraverso le fibre internodali raggiuge il **NAV**



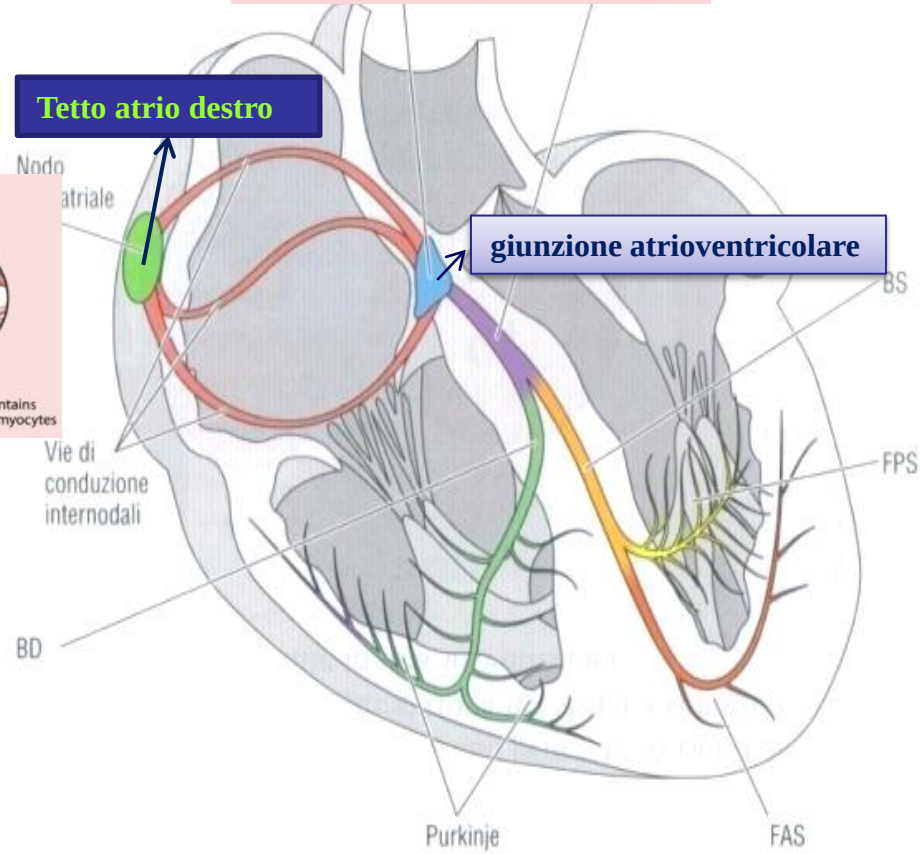
subisce un forte rallentamento

Consentendo il completamento della depolarizzazione atriale

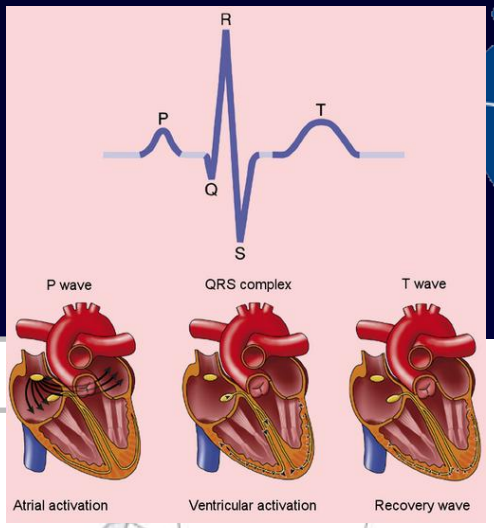
Intervallo PR e sue relazioni con il sistema di conduzione.

Tetto atrio destro

giunzione atrioventricolare



Elettrofisiologia



L'impulso origina

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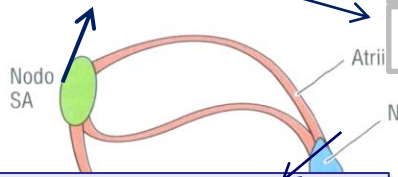

subisce un forte rallentamento

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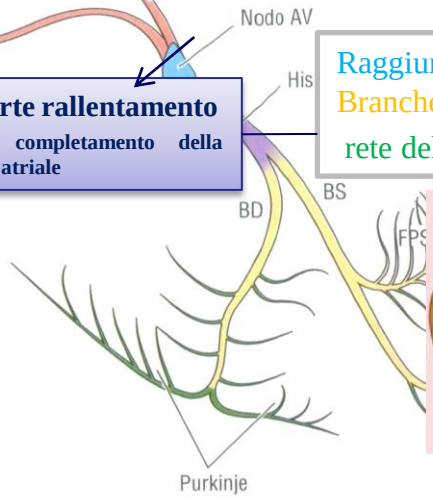
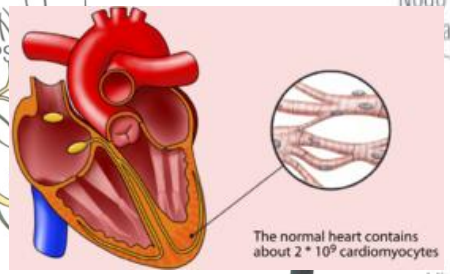
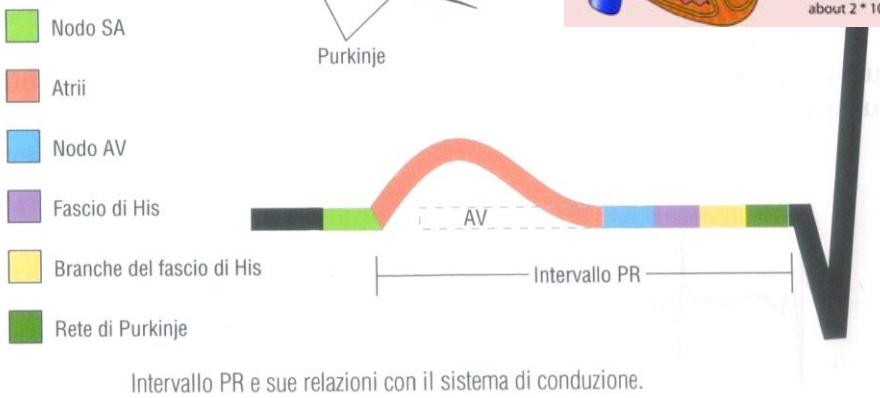


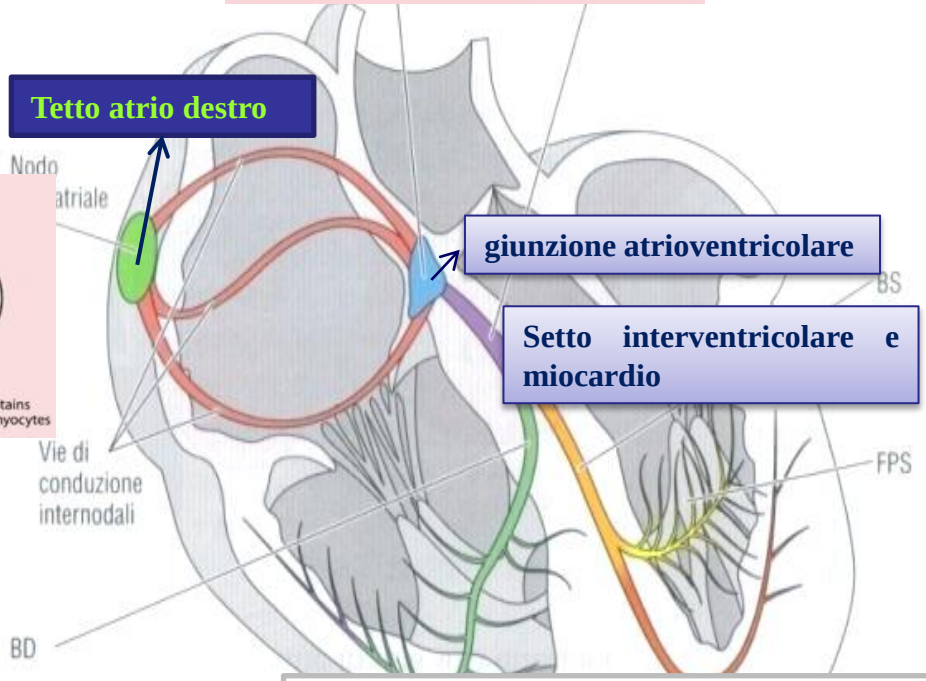
Raggiunge fascio di HIS
Branche dx e sn
rete del Purkinje





Intervallo PR e sue relazioni con il sistema di conduzione.

Tetto atrio destro



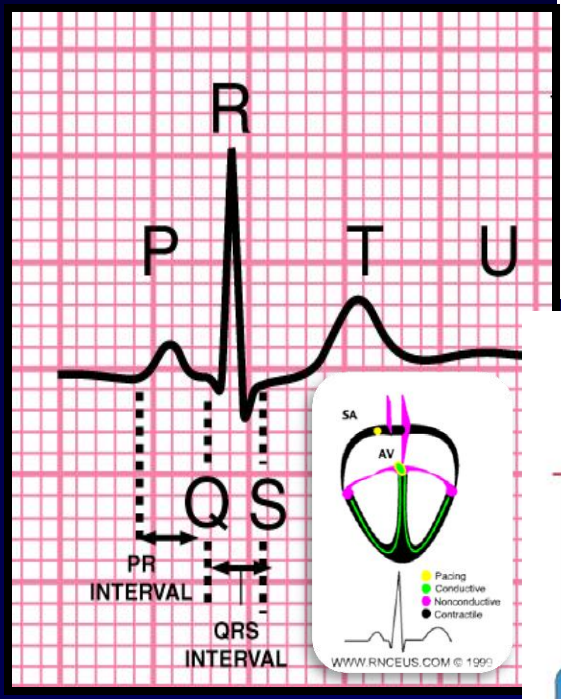
giunzione atrioventricolare

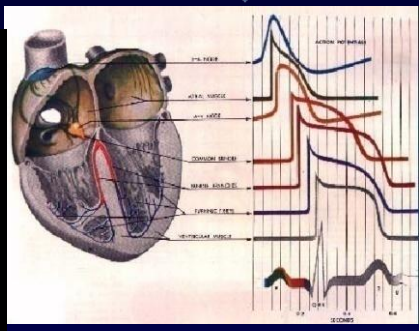
Setto interventricolare e miocardio

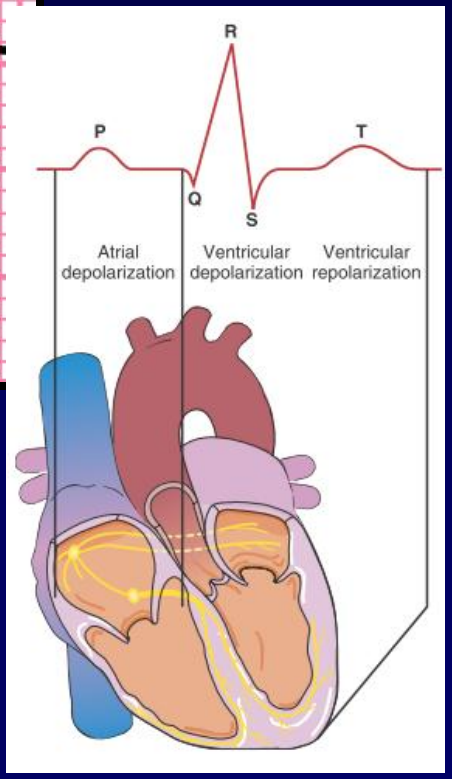
Le fibre del Purkinje depolarizzano le cellule miocardiche dando origine al complesso **QRS**

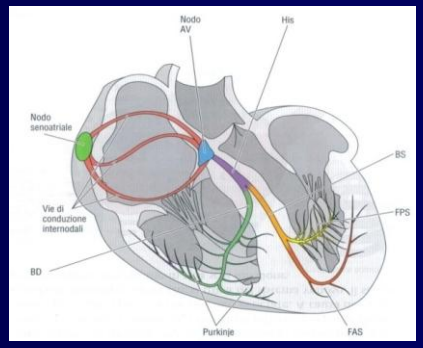
Elettrocardiogramma

è la registrazione dei potenziali del flusso di corrente generati dal muscolo cardiaco





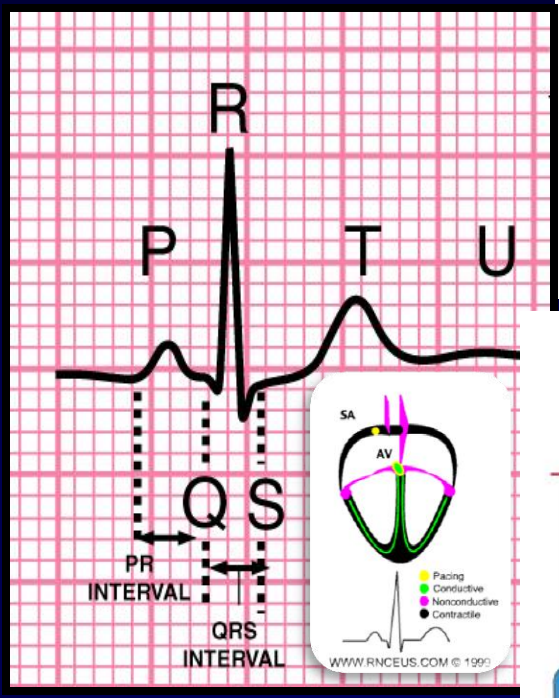


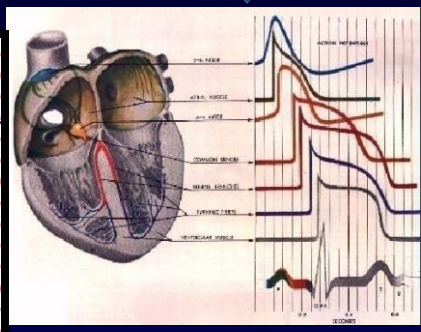


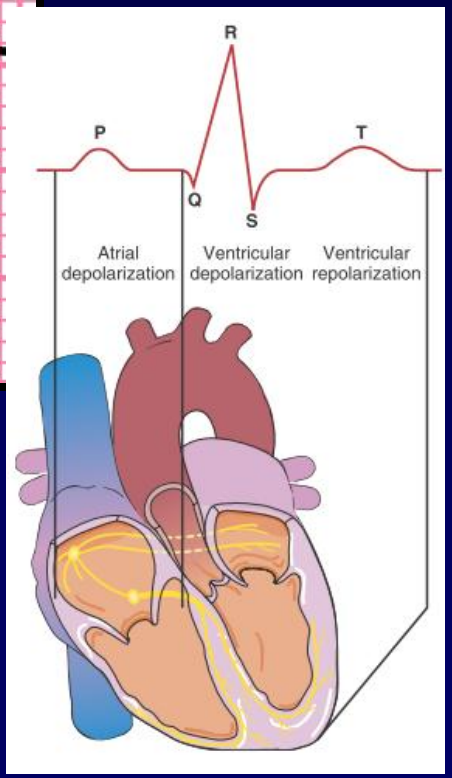
Elettrocardiogramma

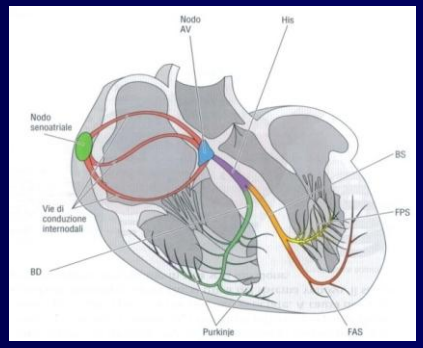
è la registrazione dei potenziali del flusso di corrente generati dal muscolo cardiaco

Cosa identifichiamo?



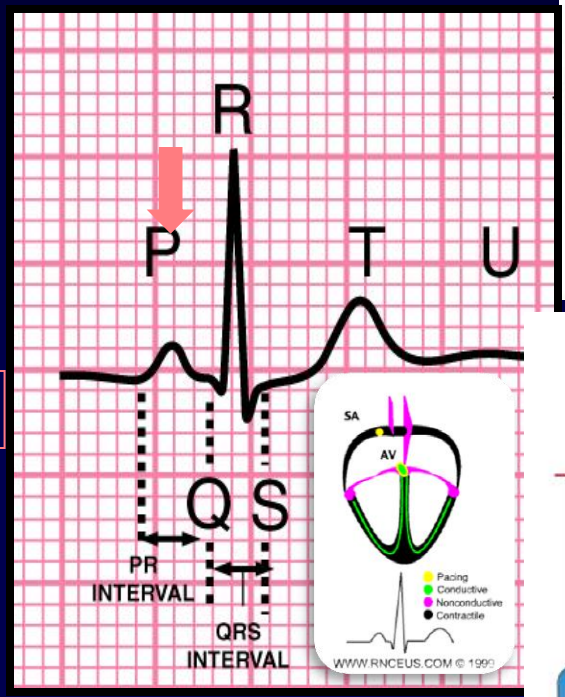


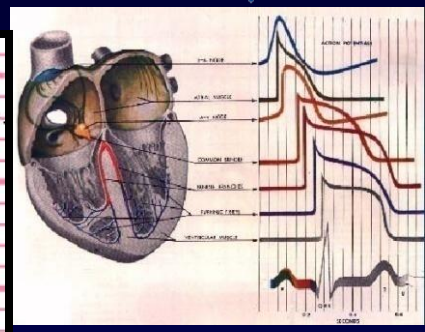


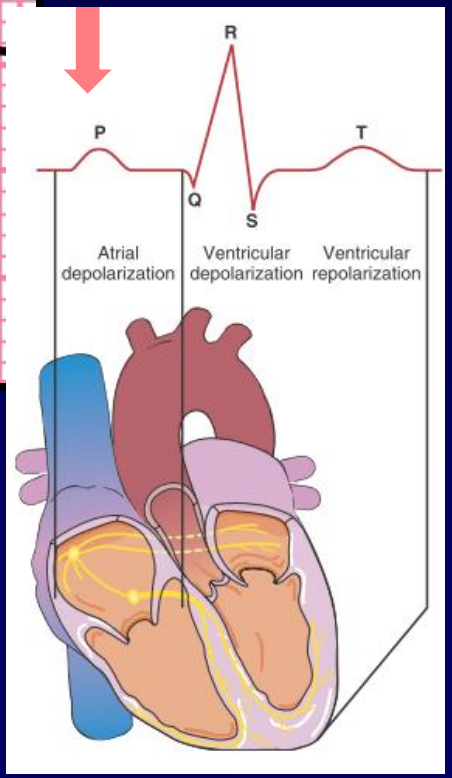


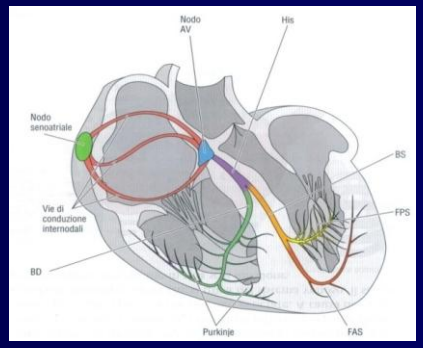
Elettrocardiogramma

è la registrazione dei potenziali del flusso di corrente generati dal muscolo cardiaco







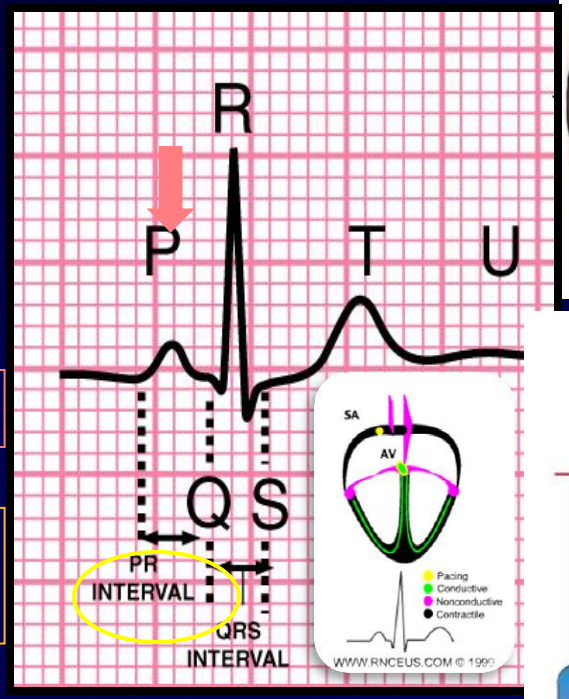


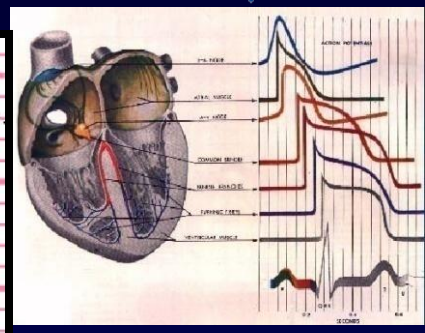
Cosa identifichiamo?

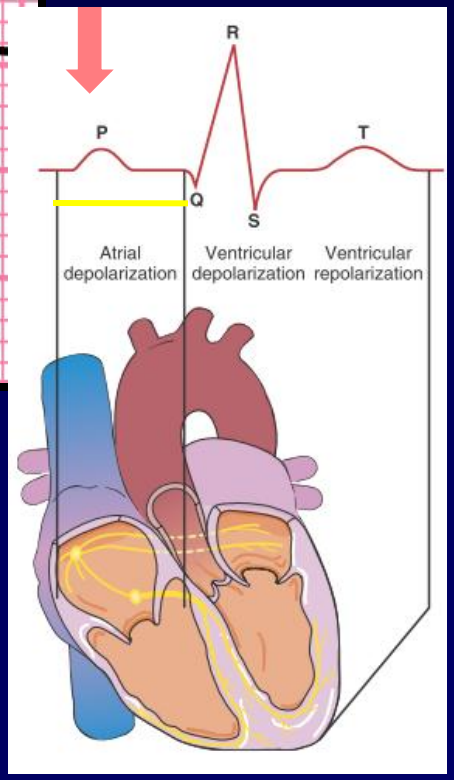
1. P: depolarizzazione biatriale

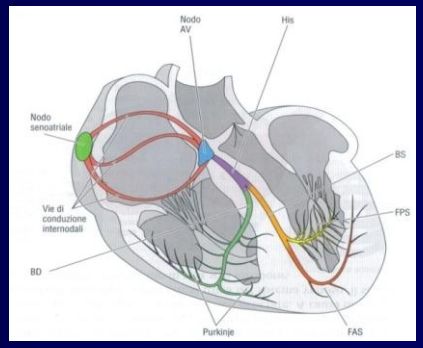
Elettrocardiogramma

è la registrazione dei potenziali del flusso di corrente generati dal muscolo cardiaco









Cosa identifichiamo?

1. P: depolarizzazione biatriale

2. PR: tempo che intercorre perché l'impulso dagli atri arrivi ai ventricoli

Elettrocardiogramma

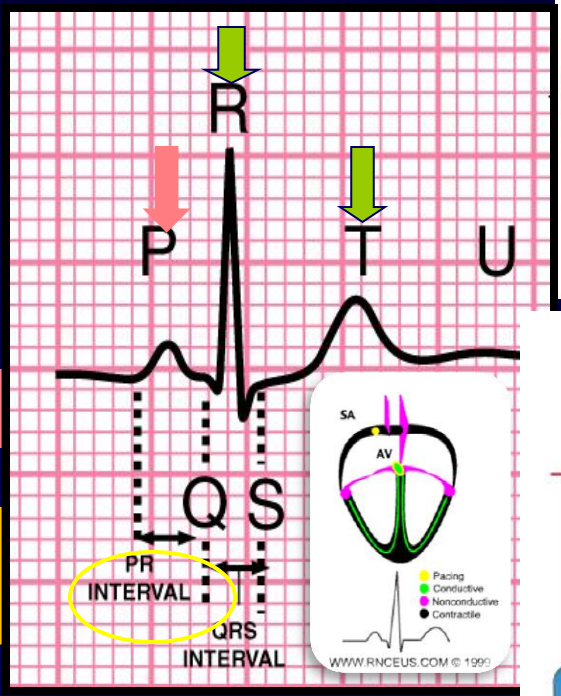
è la registrazione dei potenziali del flusso di corrente generati dal muscolo cardiaco

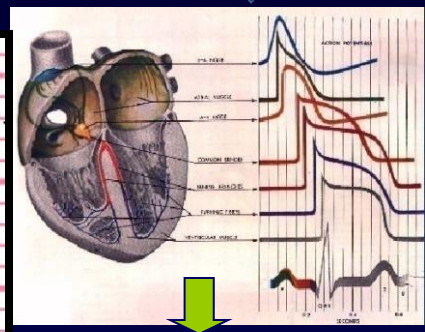
Cosa identifichiamo?

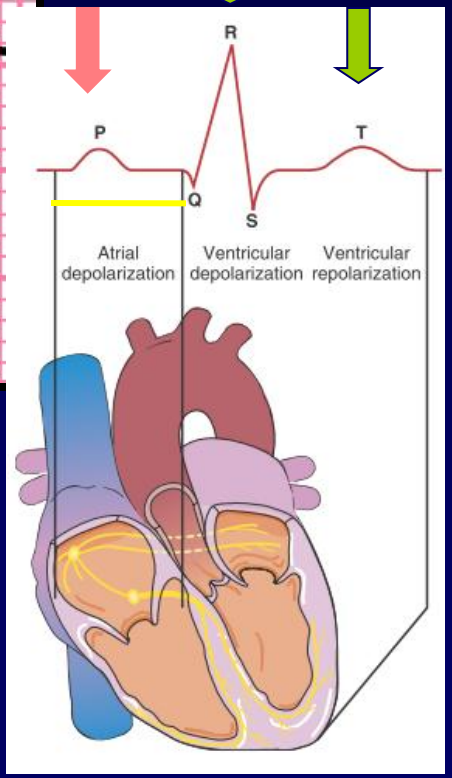
1. P: depolarizzazione biatriale

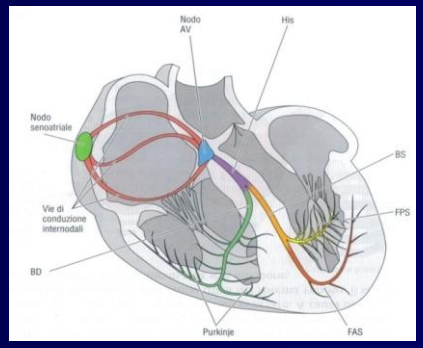
2. PR: tempo che intercorre perché l'impulso dagli atri arrivi ai ventricoli

3. QRST: sistole biventricolare
   a. Complesso QRS depolarizzazione
   b. Il tratto ST-T ripolarizzazione



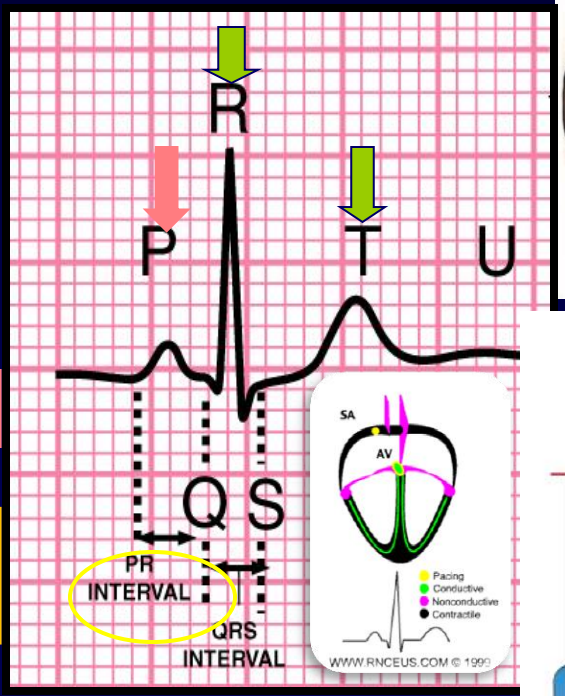


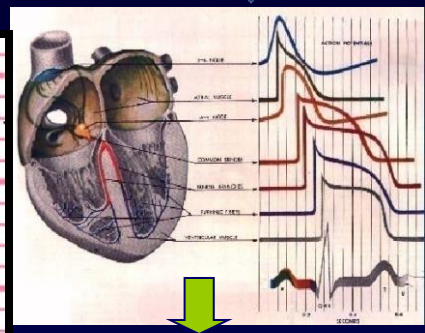


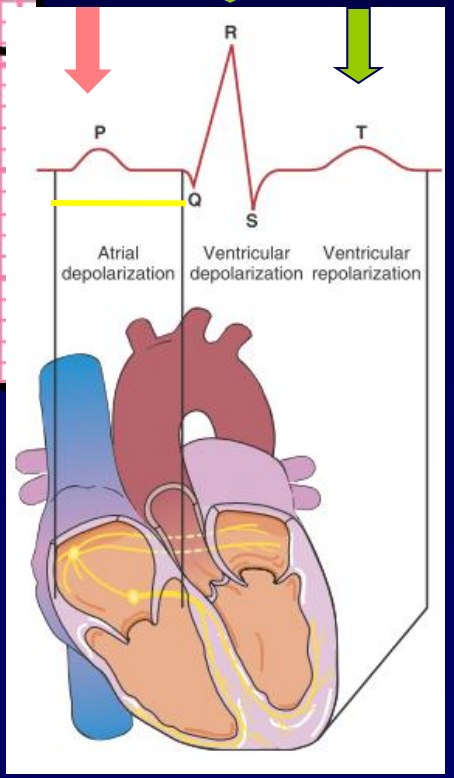


Elettrocardiogramma

è la registrazione dei potenziali del flusso di corrente generati dal muscolo cardiaco







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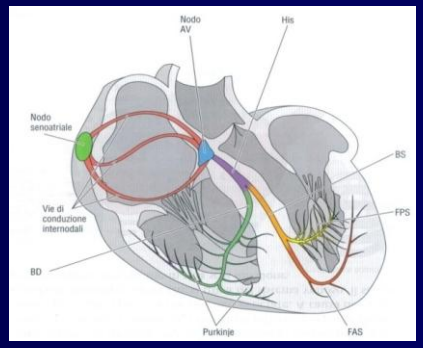
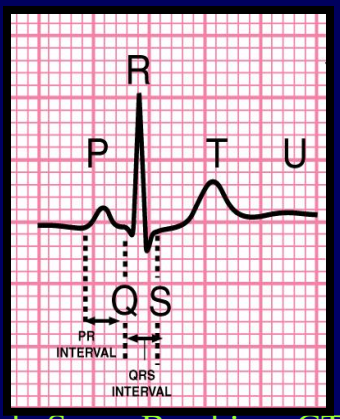
3. QRST: sistole biventricolare
   a. Complesso QRS depolarizzazione
   b. Il tratto ST-T ripolarizzazione

4. RR ciclo completo ventricolare
5. PP ciclo completo atriale

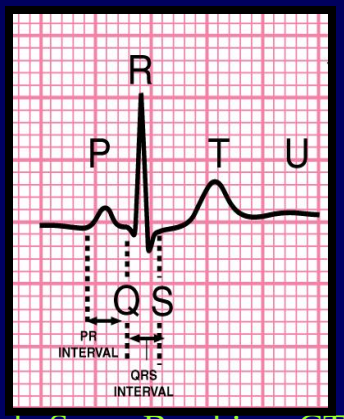


Alcune notizie preliminari…



Alcune notizie preliminari…

- L’ECG viene fatto scorrere su carta millimetrata



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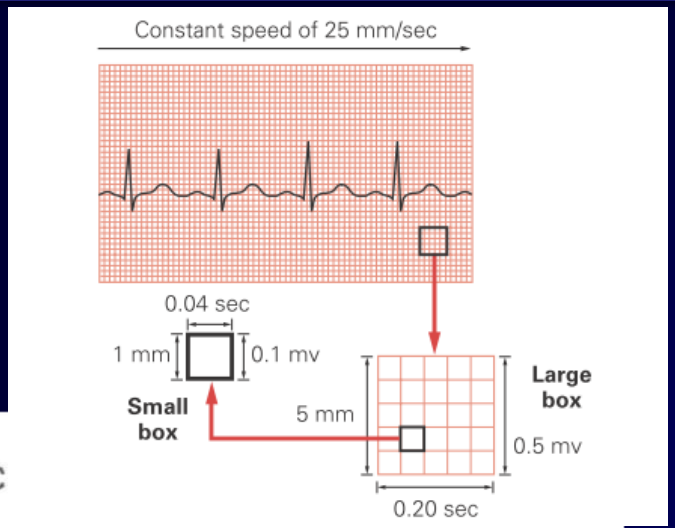

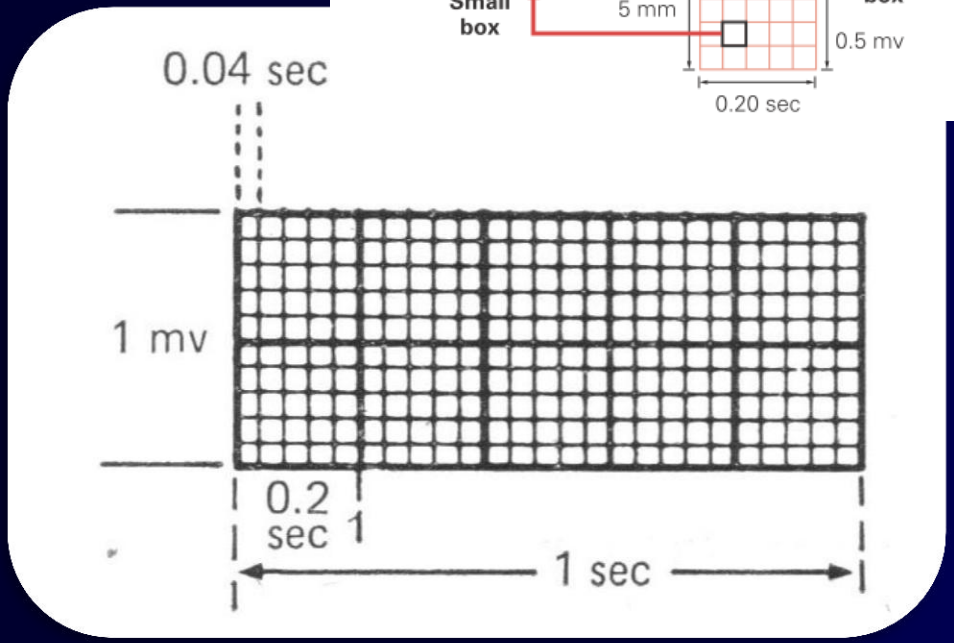

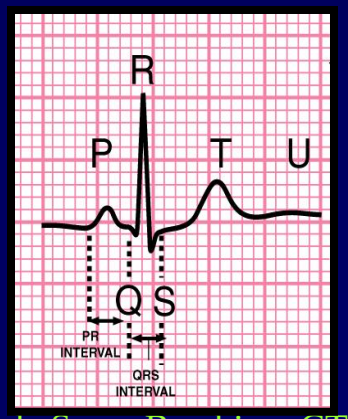

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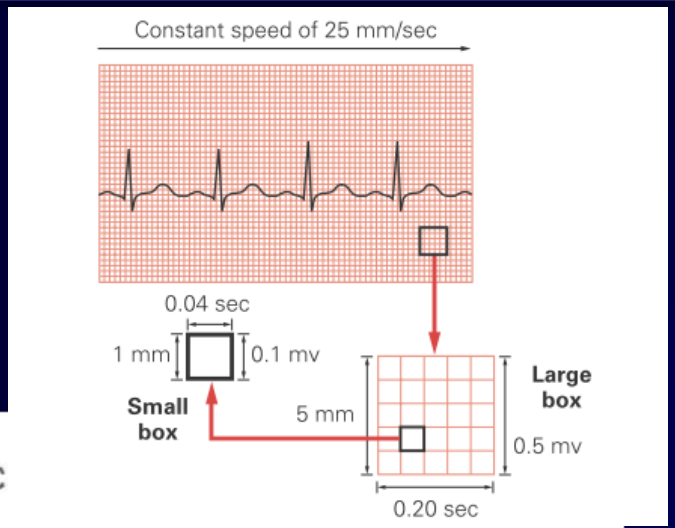
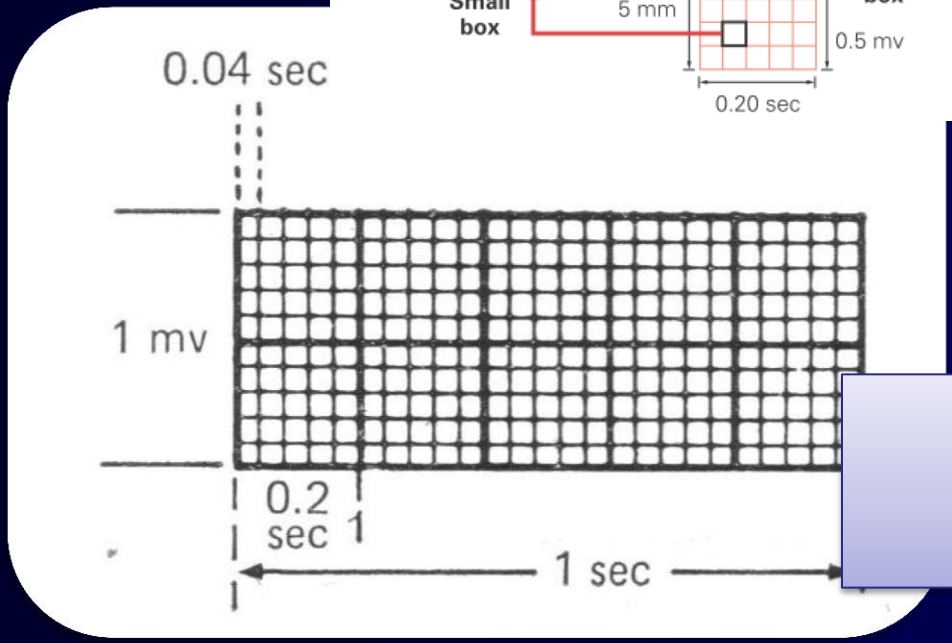
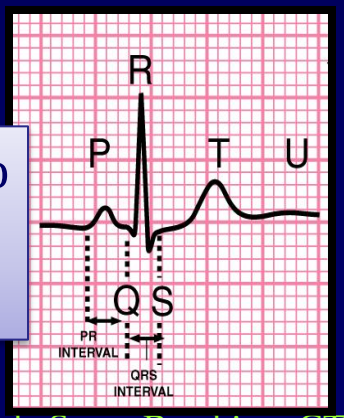




- velocità di scorrimento della carta è 25 mm/sec,
- 5 mm/sec, 50 mm/sec



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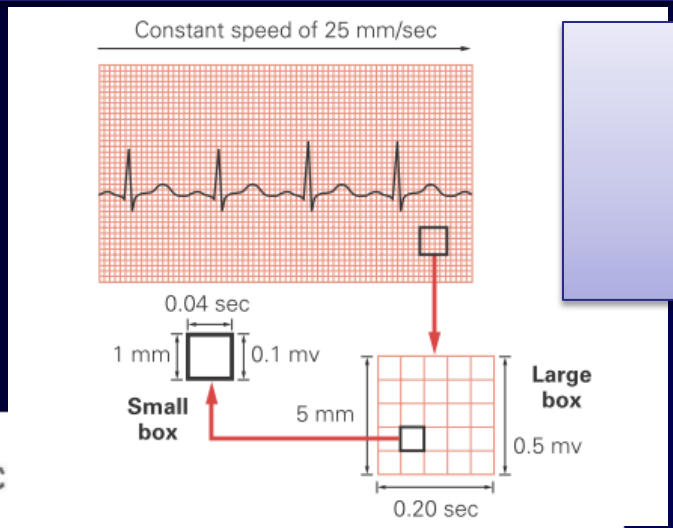
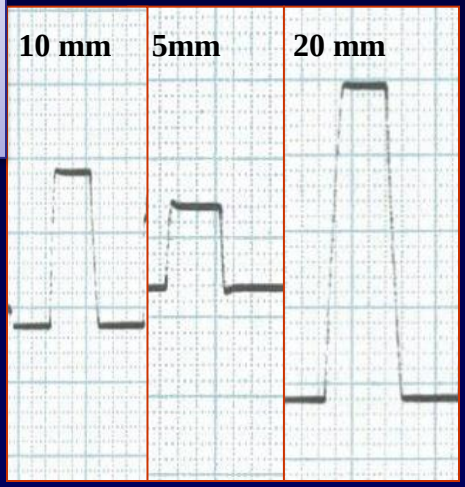
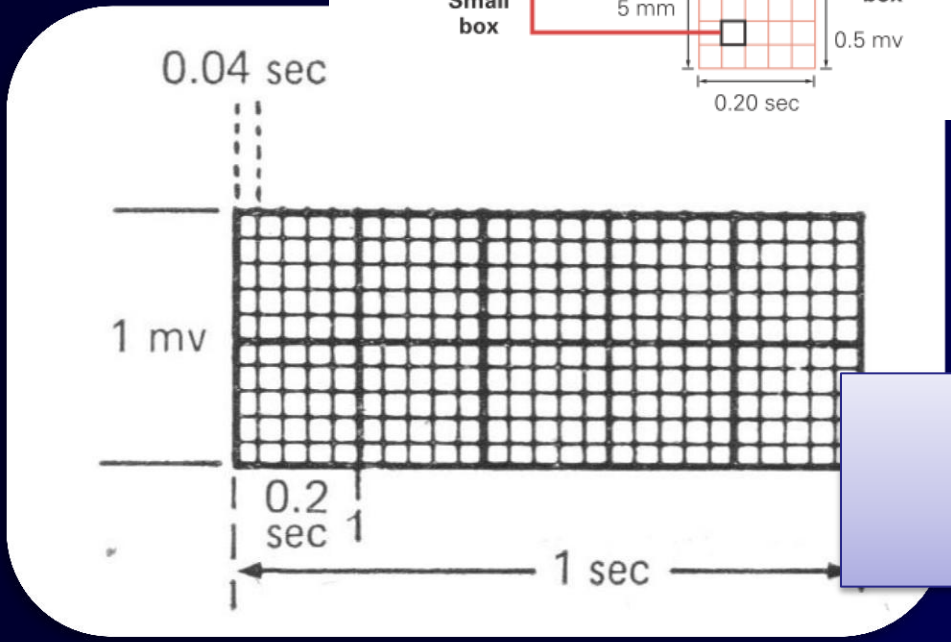


Tarato ad
- 1 mV
- 0.5 mV
- 2 mV





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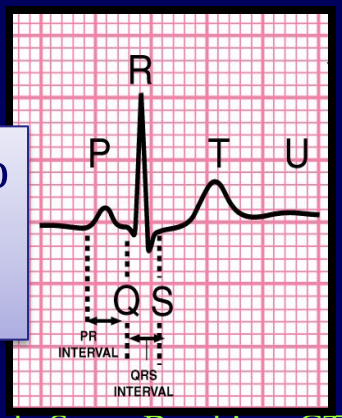


ECG

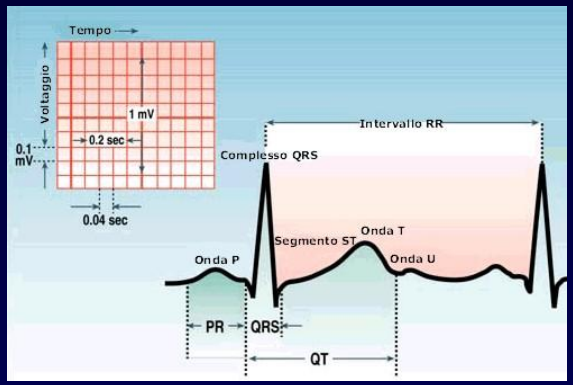
Calcolo della frequenza cardiaca

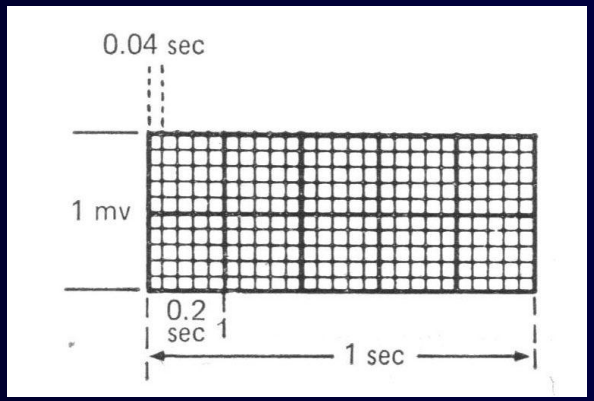
Alla velocità standard di scorrimento della carta di 25 mm/sec

Contare il numero di battiti compresi in un intervallo di sei secondi e moltiplicarlo per 10

Tabella 2. - CALCOLO DELLA FREQUENZA CARDIACA.

1 battito ogni sec	=	60/minuto		
1 battito ogni 4/5 sec	=	5/4	× 60 =	75
1 battito ogni 3/5 sec	=	5/3	× 60 =	100
1 battito ogni 2/5 sec	=	5/2	× 60 =	150
1 battito ogni 1/5 sec	=	5/1	× 60 =	300





ECG

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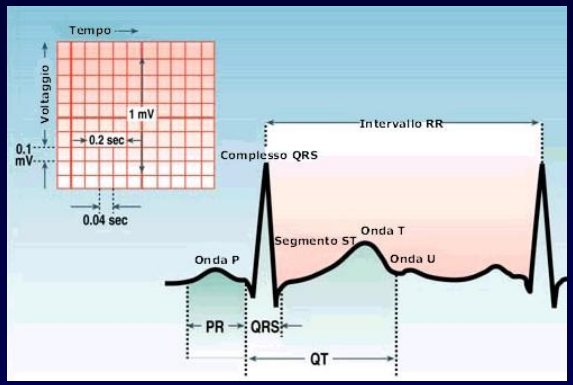

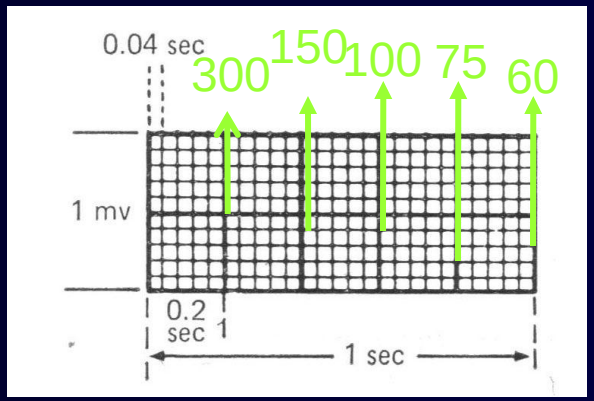

ECG

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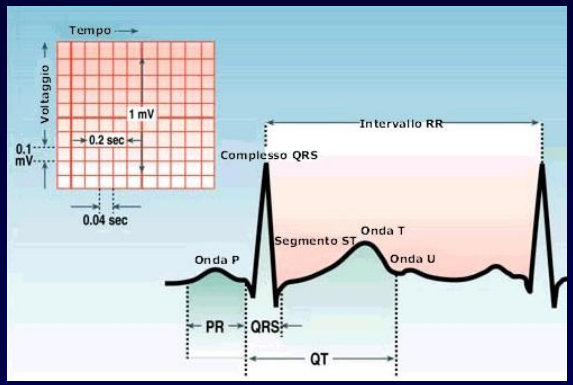

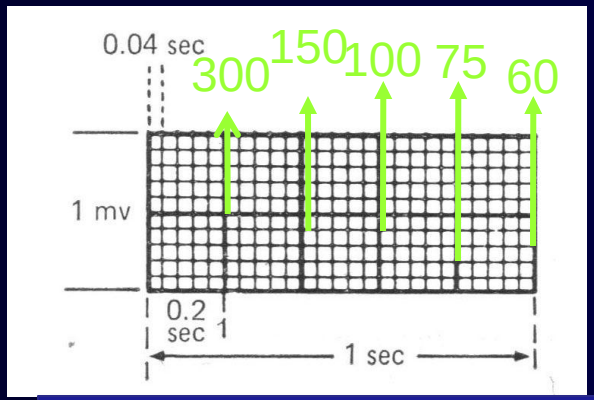

300/numero di quadrati grandi tra due onde R (60 sec/min = 300 box/min)

1500/numero di quadrati piccoli tra due onde R (60 sec/min = 1500 box/min)

ECG

Calcolo della frequenza cardiaca

Alla velocità standard di scorrimento della carta di 25 mm/sec

Contare il numero di battiti compresi in un intervallo di sei secondi e moltiplicarlo per 10

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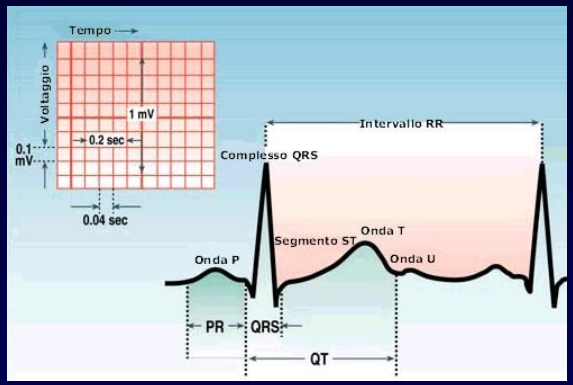
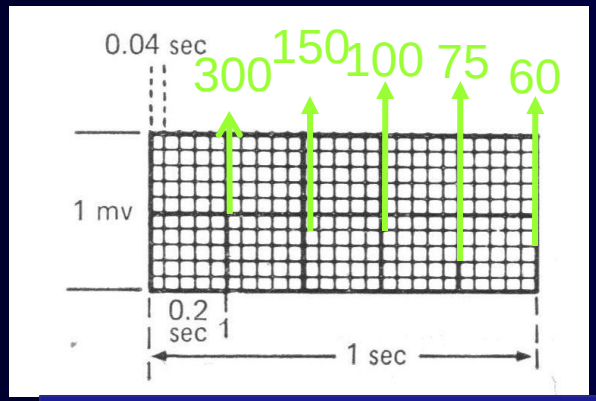
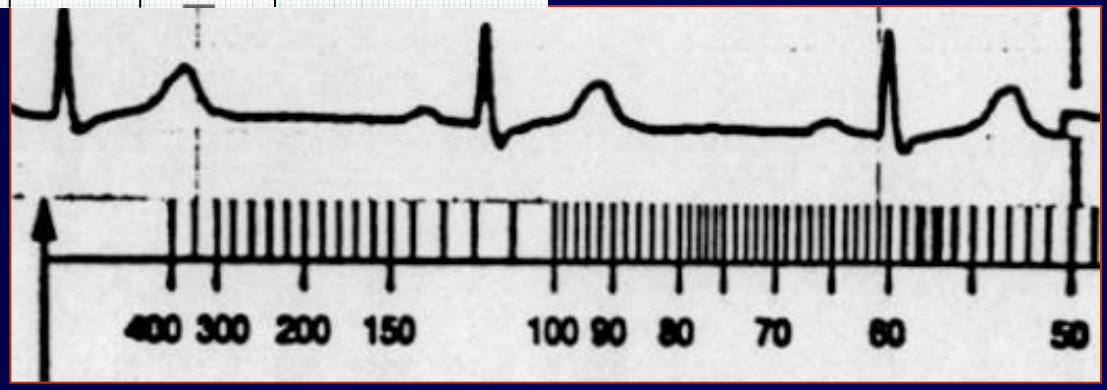






300/numero di quadrati grandi tra due onde R (60 sec/min = 300 box/min)

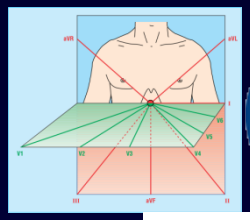
1500/numero di quadrati piccoli tra due onde R (60 sec/min = 1500 box/min)

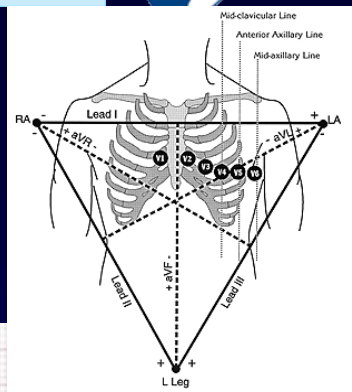
ECG

	Frequenza cardiaca (battiti/min)					
Age	Min.	5 %	Media	95 %	Max.	S.D.
0-24 ore	85	94	119	145	145	16,1
1-7 giorni	100	100	133	175	175	22,3
8-30 giorni	115	115	163	190	190	19,9
1-3 mesi	115	124	154	190	205	18,6
3-6 mesi	115	111	140	179	205	21,0
6-12 mesi	115	112	140	177	175	18,7
1-3 anni	100	98	126	163	190	19,8
3-5 anni	55	65	98	132	145	18,0
5-8 anni	70	70	96	115	145	16,1
8-12 anni	55	55	79	107	115	15,0
12-16 anni	55	55	75	102	115	13,5

1500/numero di quadrati piccoli tra due onde R (60 sec/min = 1500 box/min)

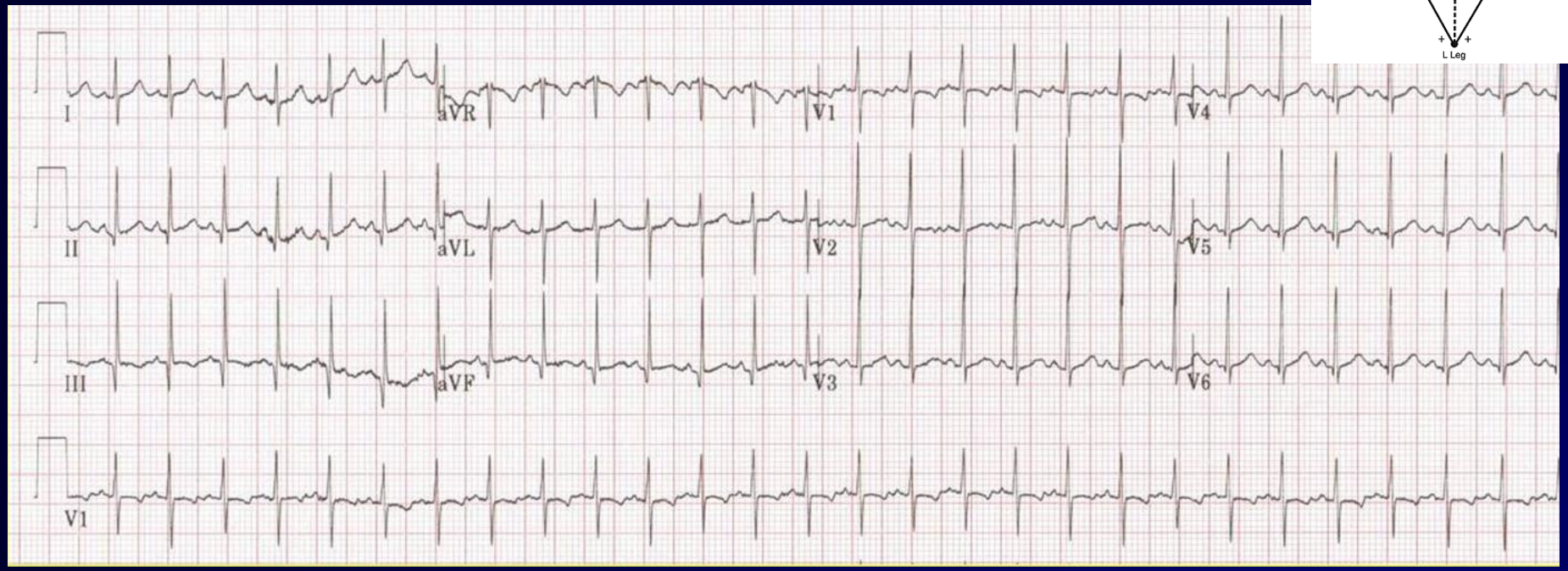
ECG di superficie



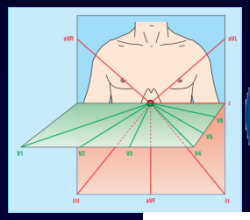


I potenziali elettrici del cuore vengono registrati mediante ***elettrodi***

Gli elettrodi sono variamente orientati nello spazio secondo assi standardizzati che vengono chiamati ***derivazioni***



ECG di superficie



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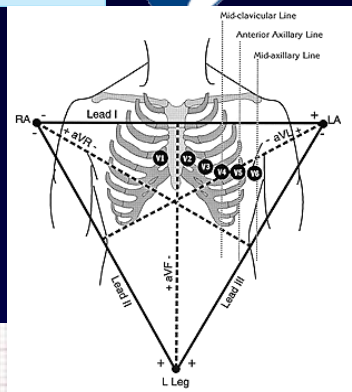
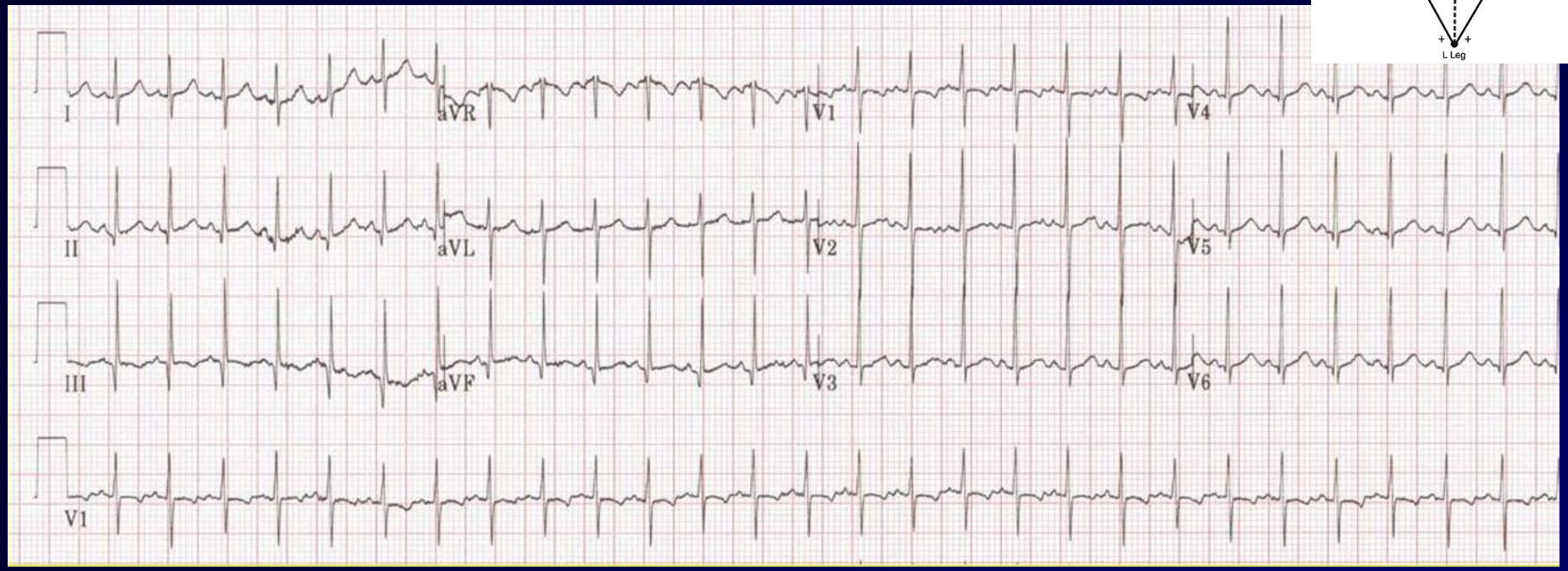


Dodici derivazioni



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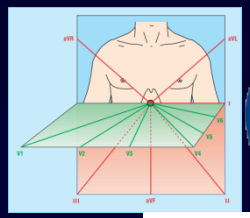

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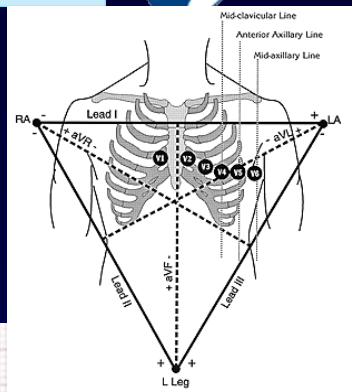
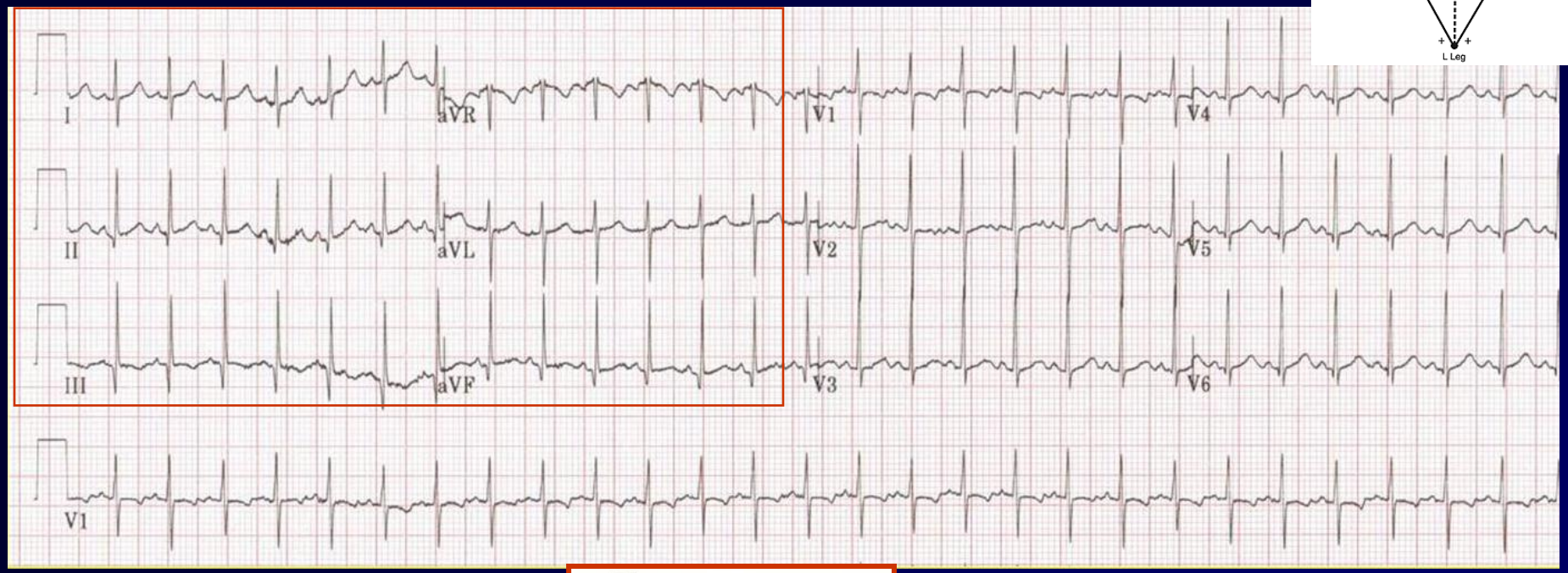
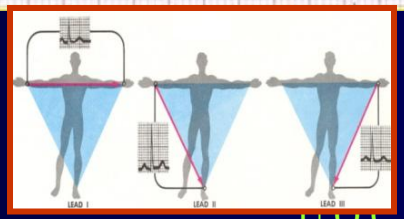


Dodici derivazioni

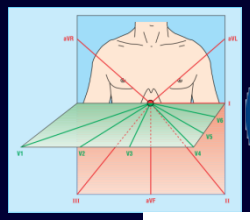


Sei *periferiche* registrate

su un piano frontale

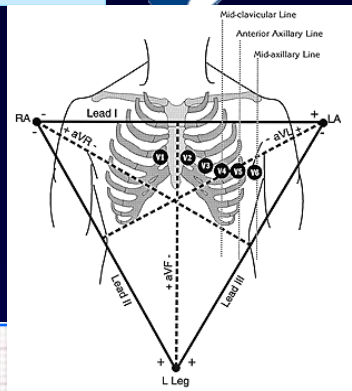


ECG di superficie

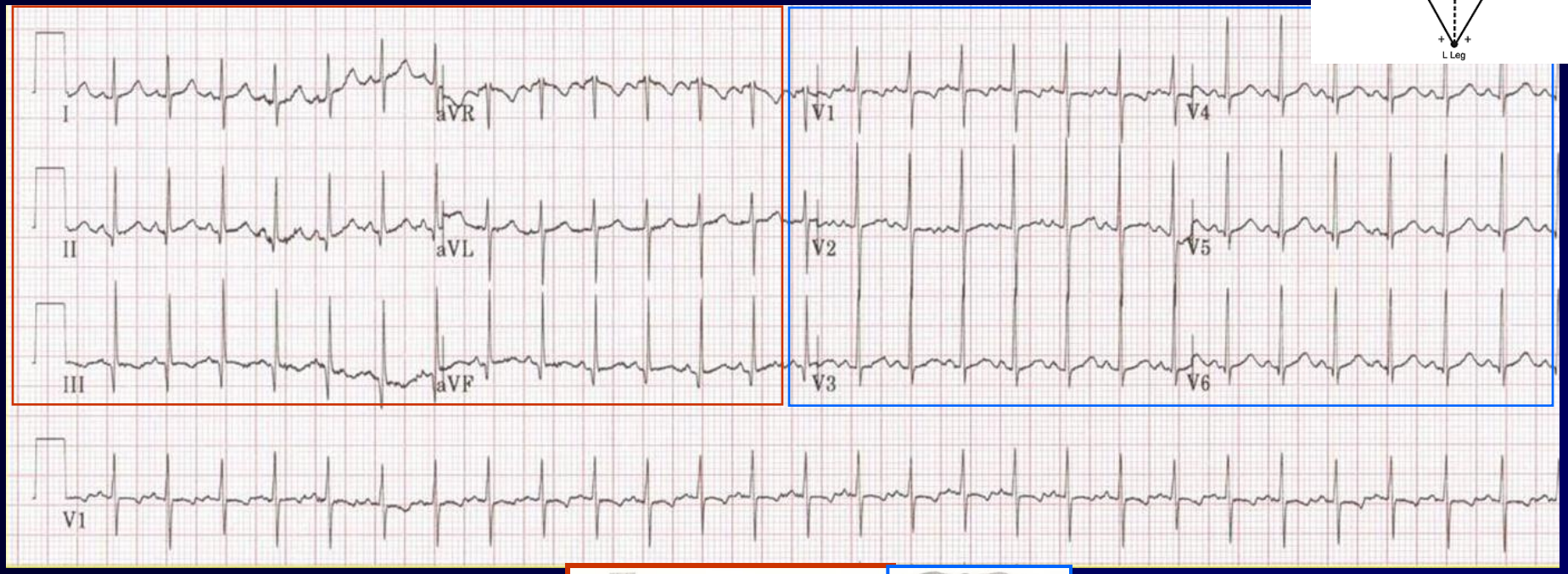


I potenziali elettrici del cuore vengono registrati mediante ***elettrodi***

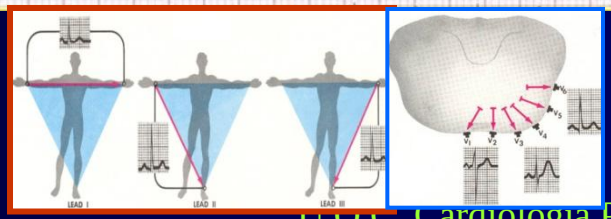
Gli elettrodi sono variamente orientati nello spazio secondo assi standardizzati che vengono chiamati ***derivazioni***



Dodici derivazioni

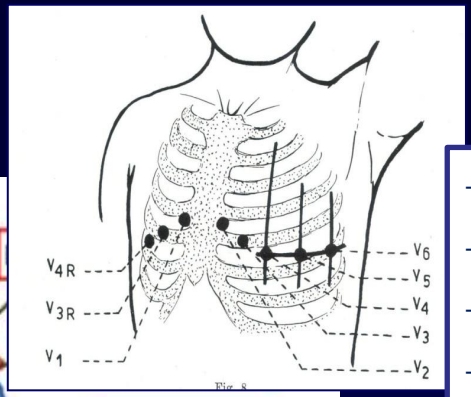


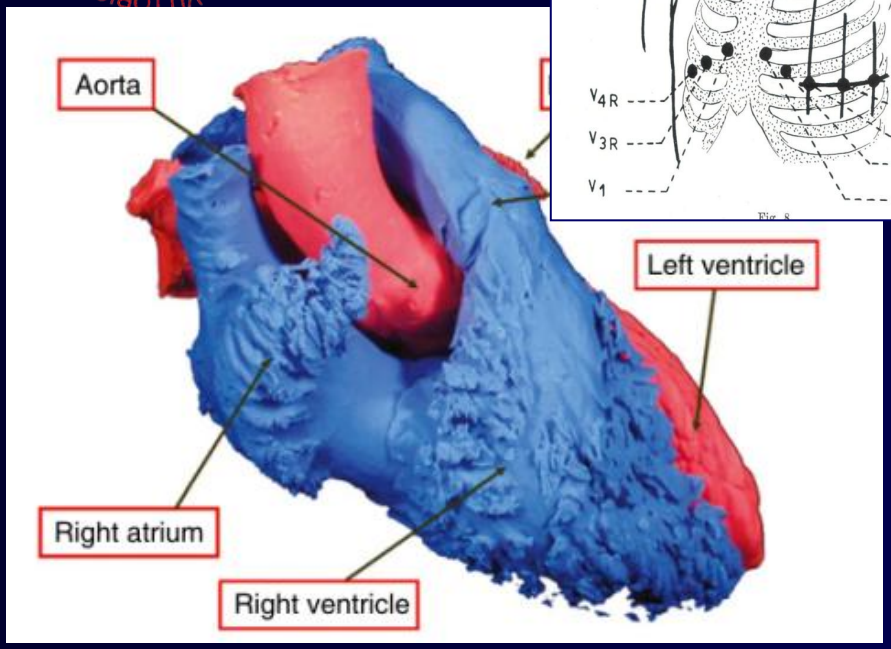
Sei *periferiche* registrate *su un piano frontale*



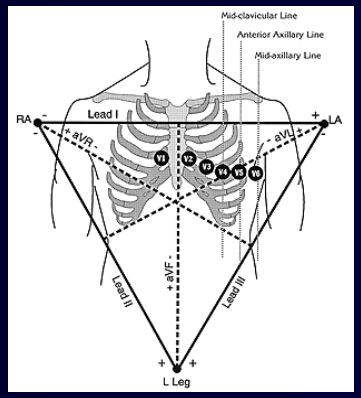
Sei *precordiali registrati su un piano orizzontale*

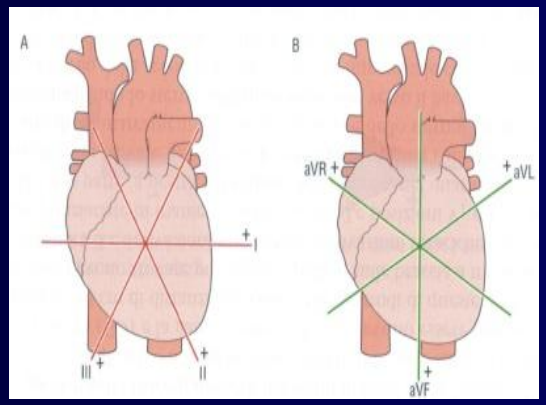
Nozioni di Anatomia

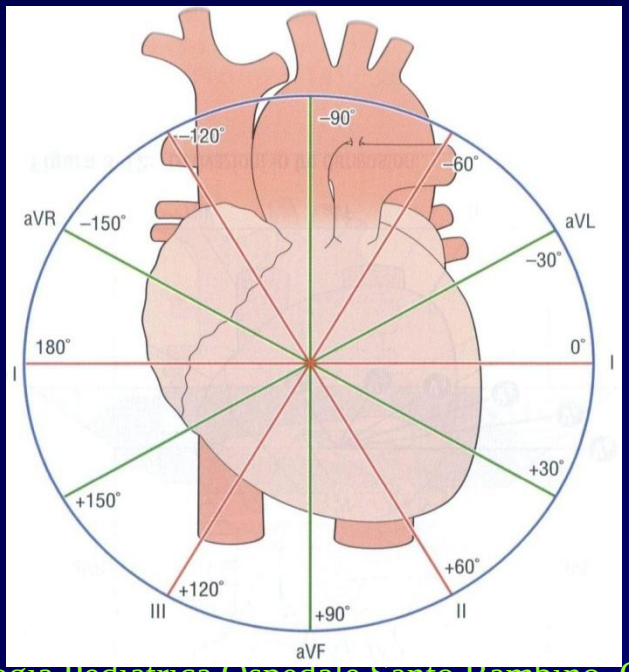




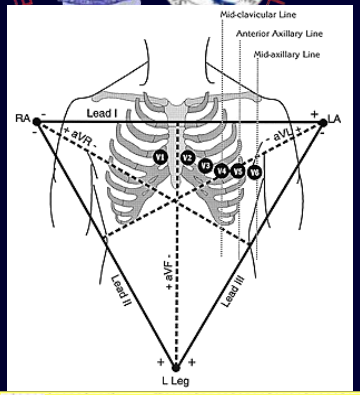
- –V1 4 spazio intercostale margimo sternale dx
- –V2 4 spazio intercostale margimo sternale sn
- –V3 tra V2 e V4
- –V4 5 spazio intercostale nella linea emiclaveare
- –V5 5 spazio intercostale linea ascellare anteriore
- –V6 5 spazio intercostale ascellare media

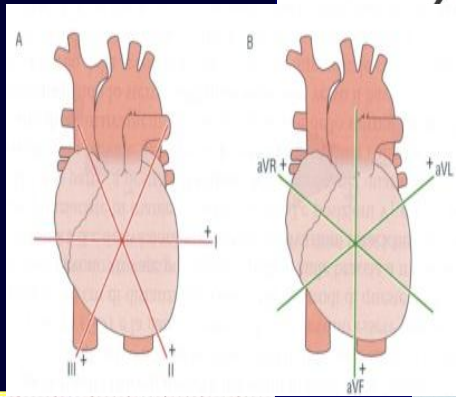


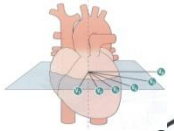


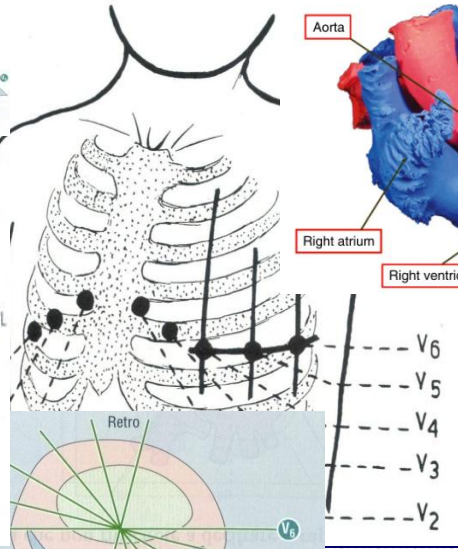


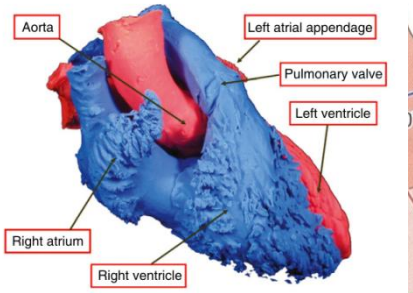
ECG

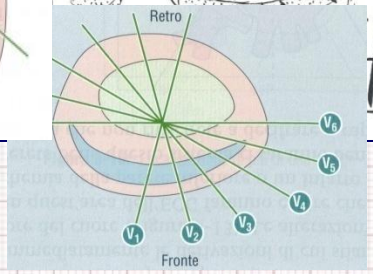






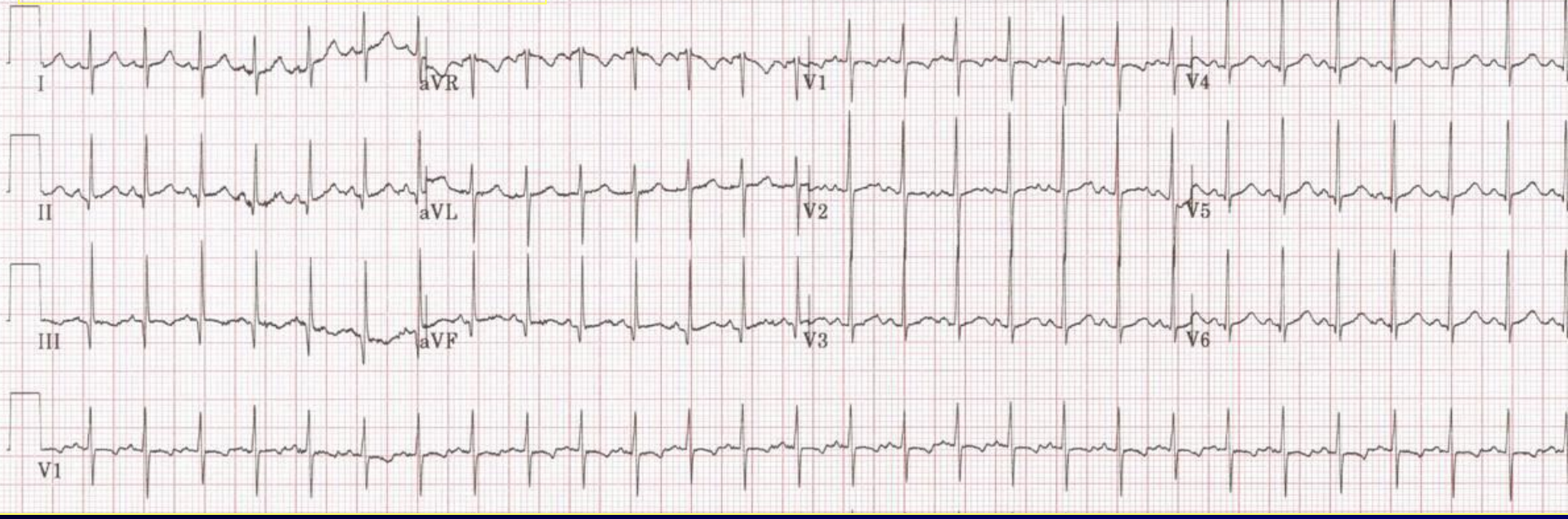




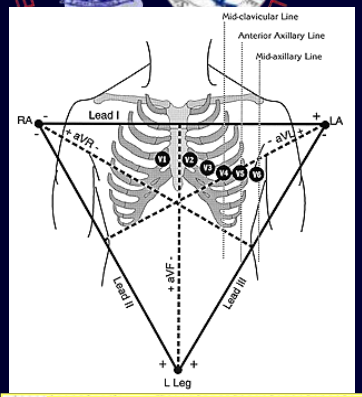


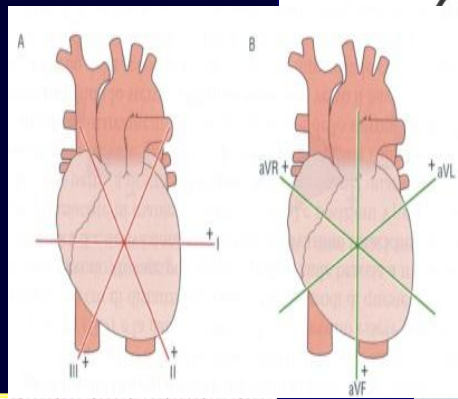
Derivazioni

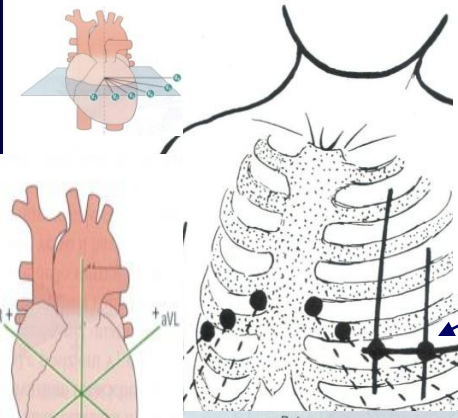
Laterali **Inferiori** **Anteriori**

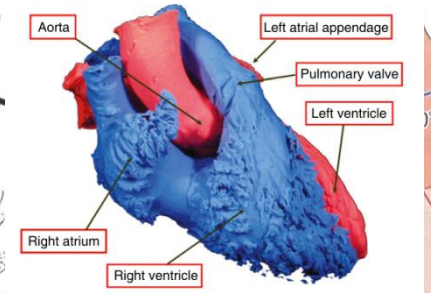


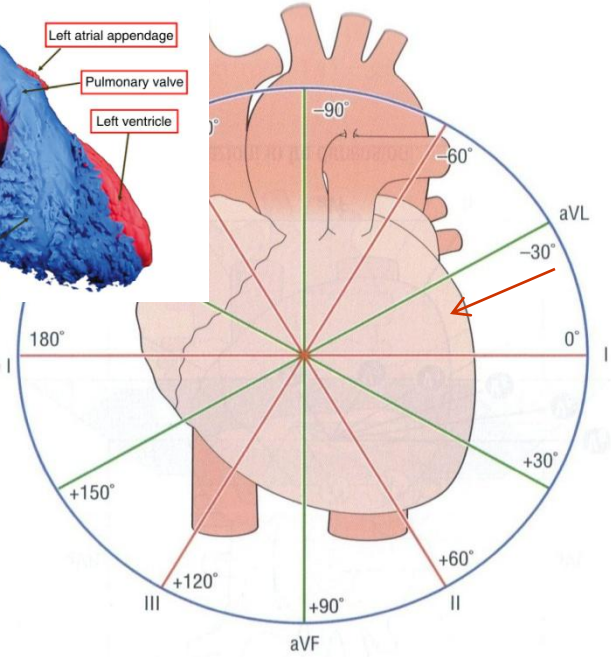
ECG

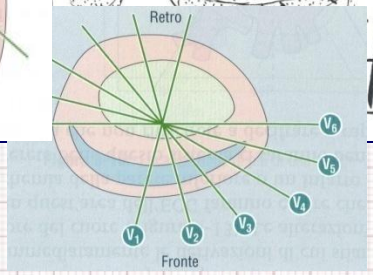






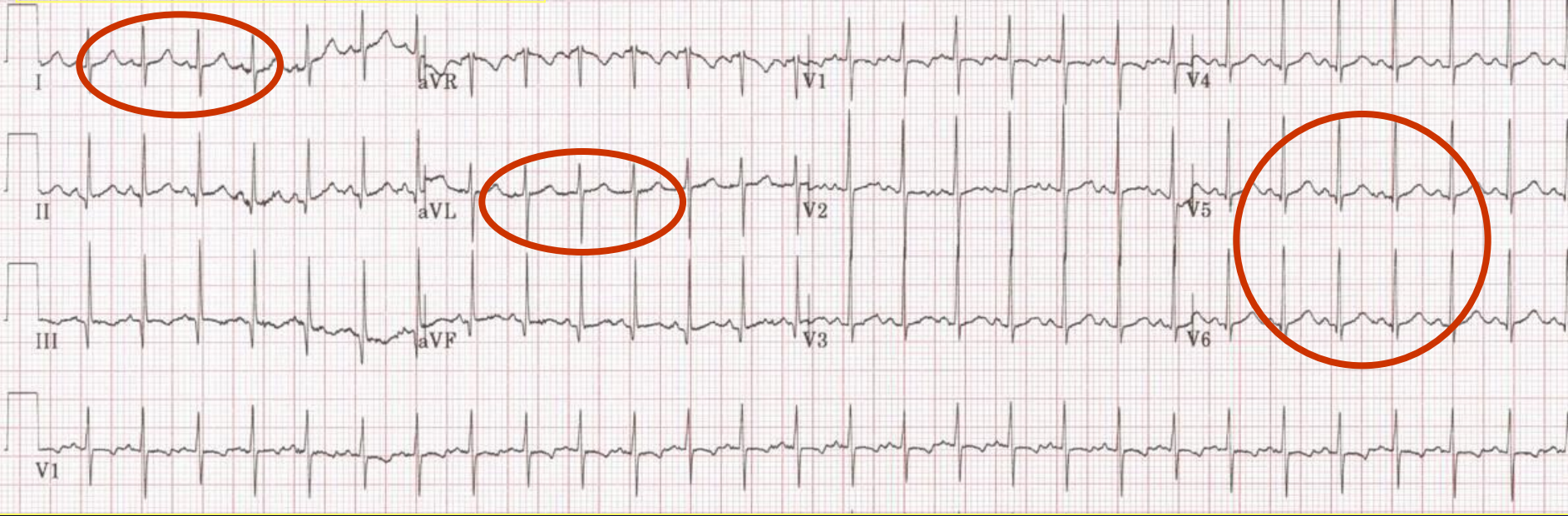






Derivazioni

Laterali **Inferiori** **Anteriori**



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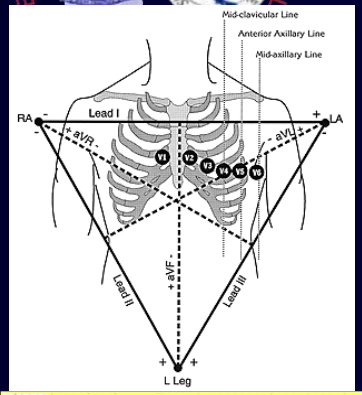
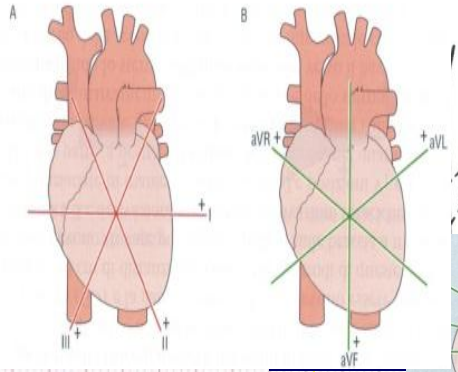
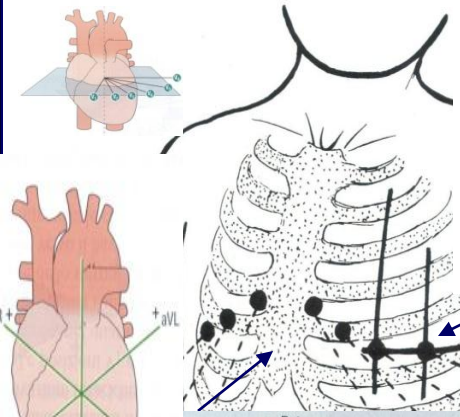
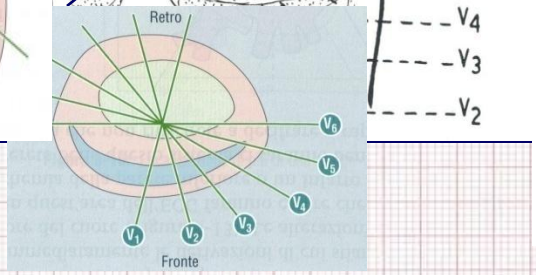
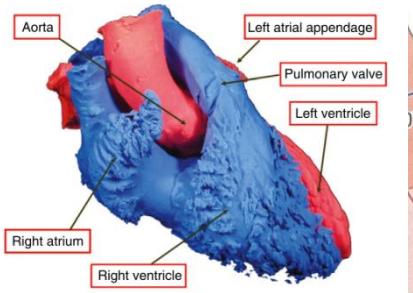




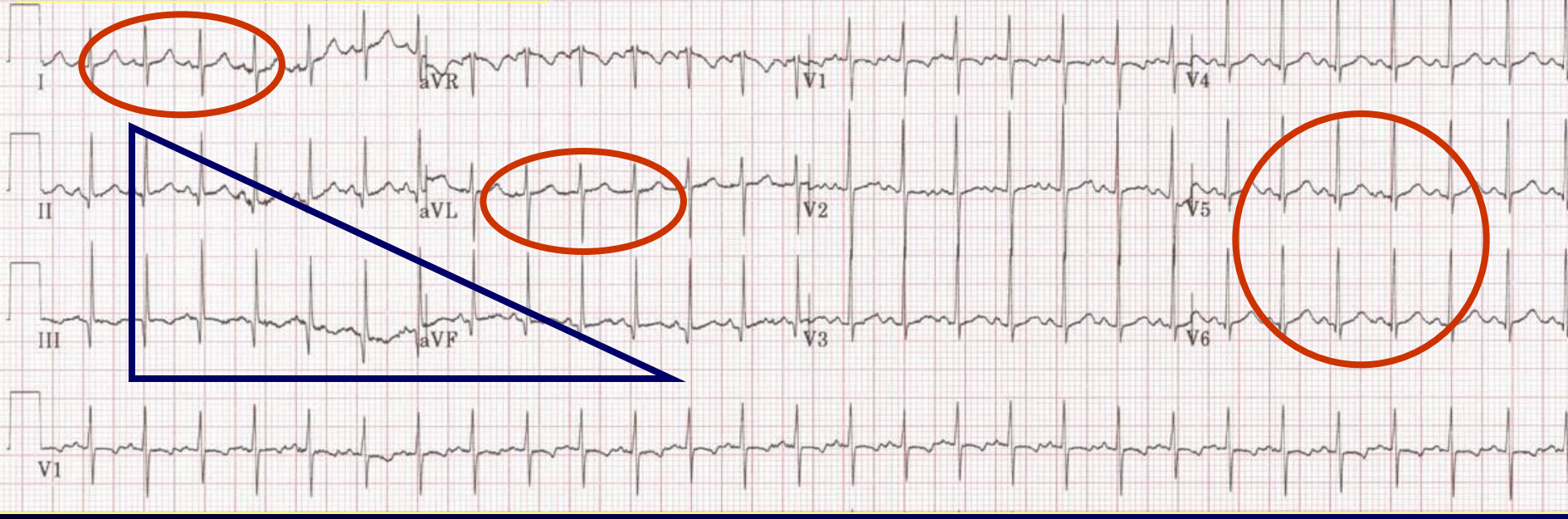






Derivazioni

Laterali **Inferiori** **Anteriori**



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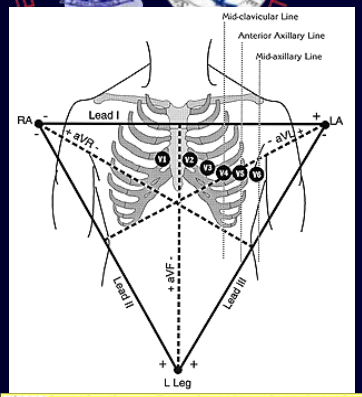
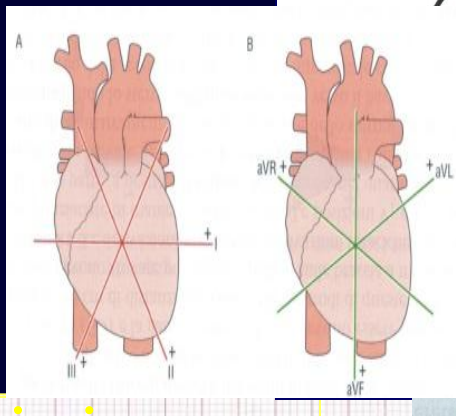
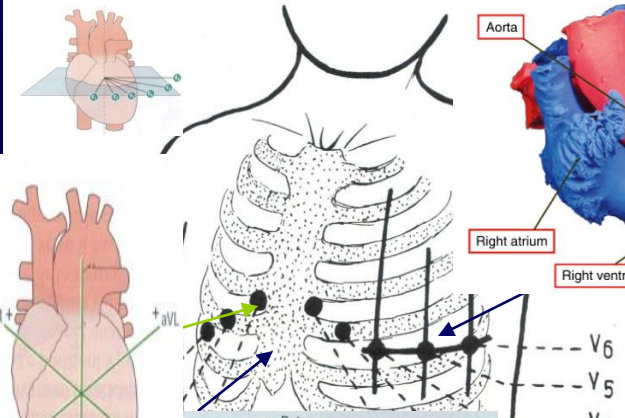
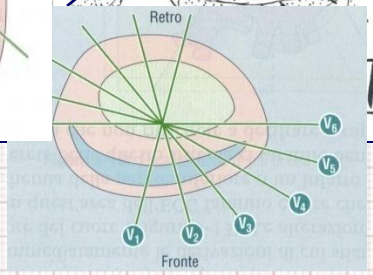
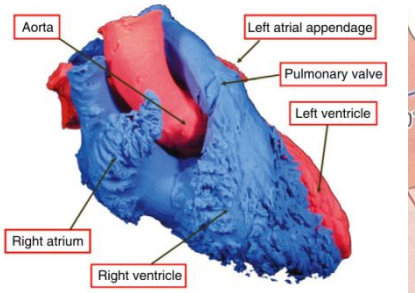




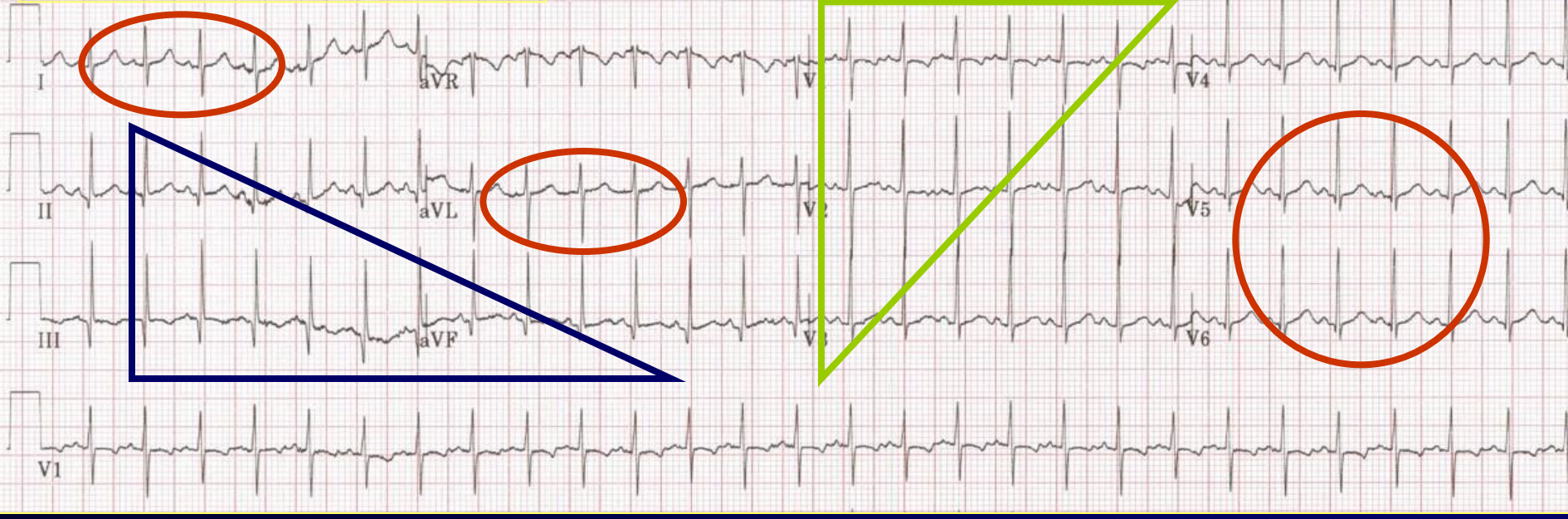




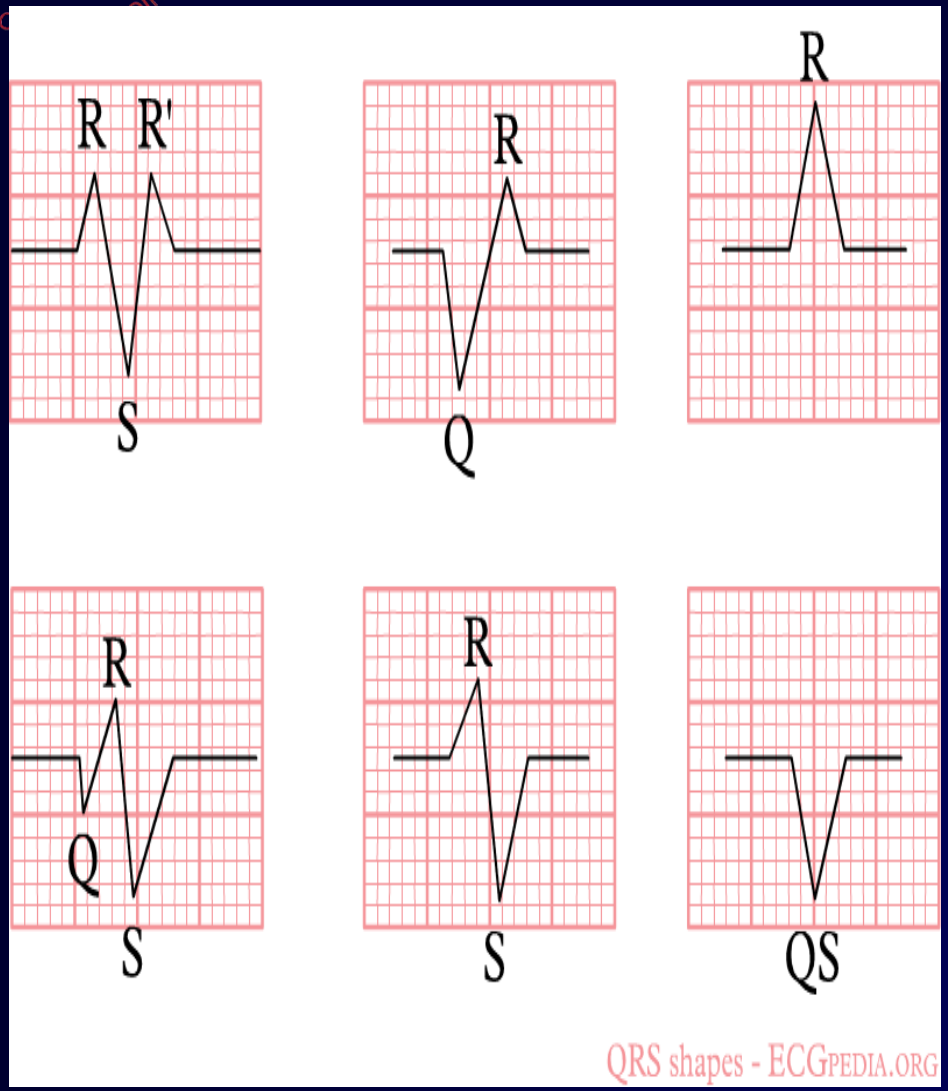


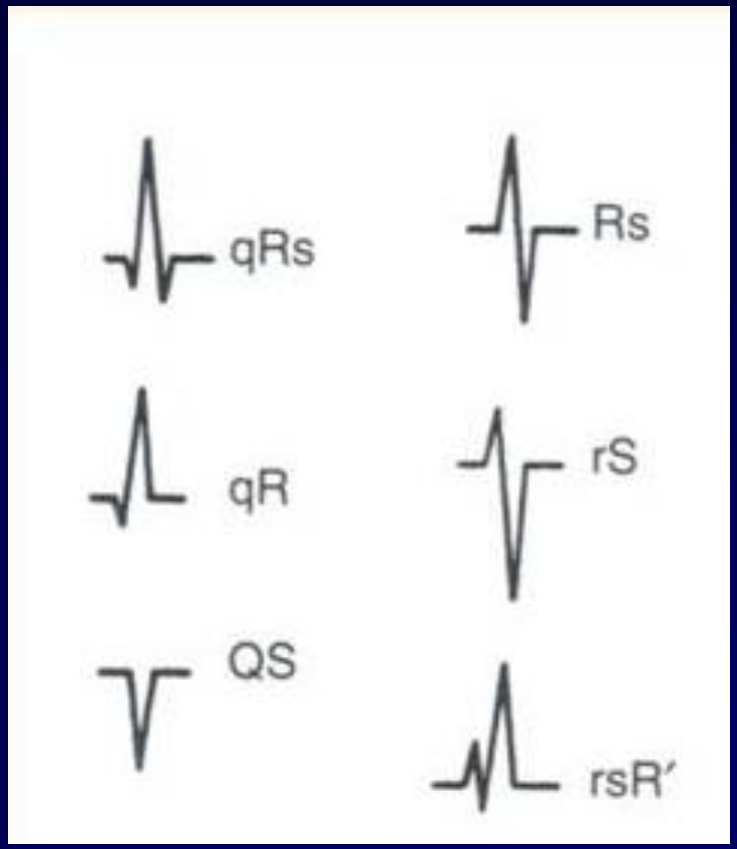
Derivazioni

Laterali **Inferiori** **Anteriori**

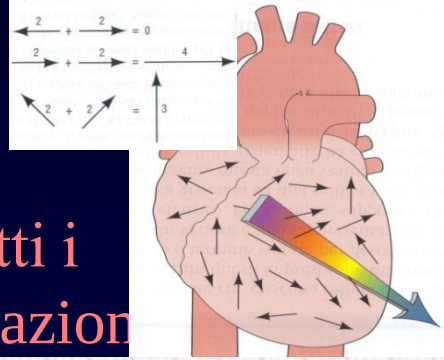


Complesso QRS nelle varie Derivazioni





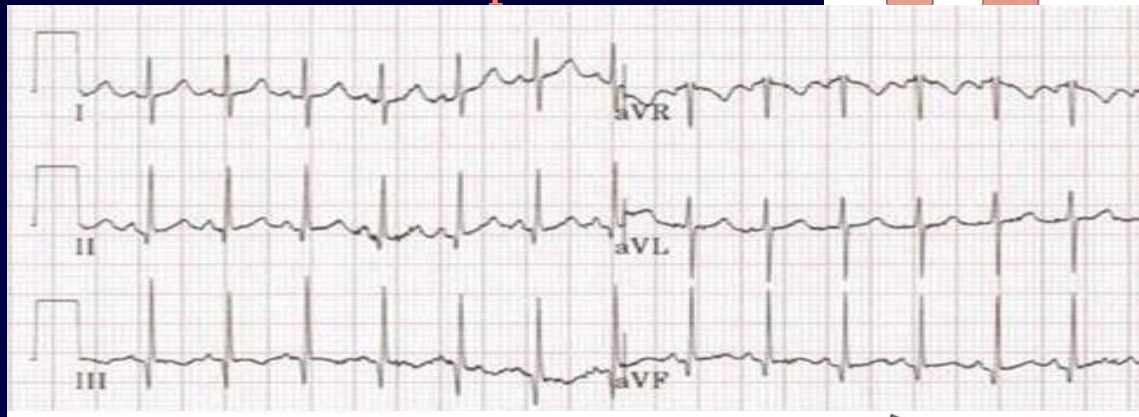
Assi elettrici cardiaci

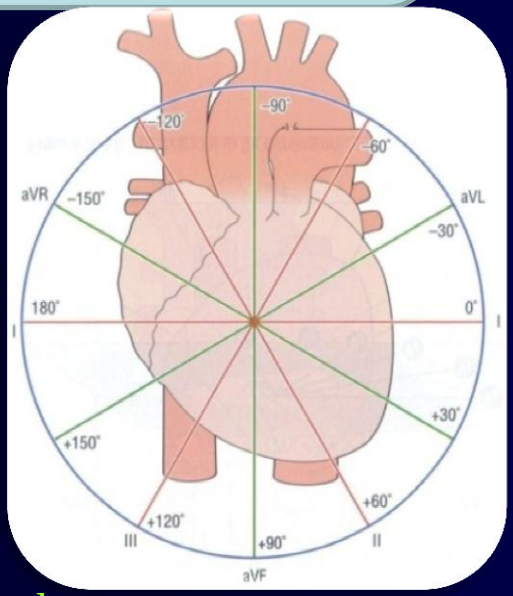


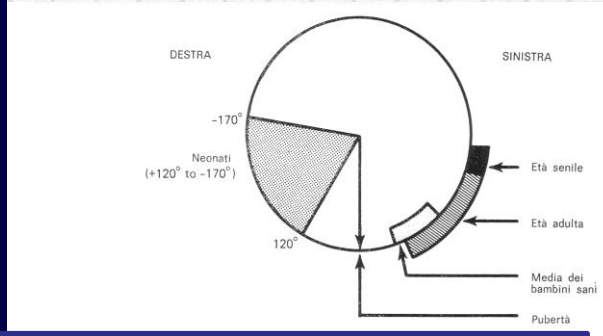
L’asse elettrico è la sommatoria risultante di tutti i vettori istantanei generati durante la depolarizzazion

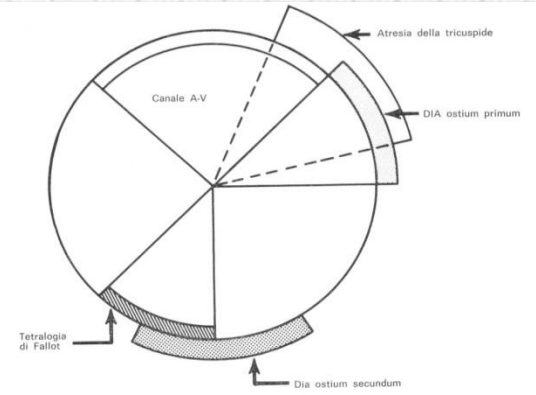
L’ asse del QRS Esprime:

- Posizione del cuore
- Cavità prevalente



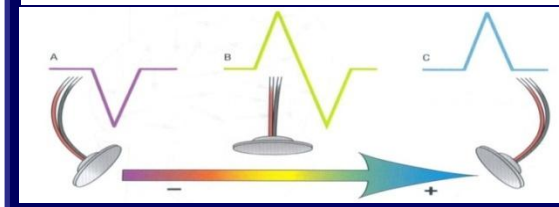






Asse QRS Valori normali per età

–I^ sett.	+ 110 (+30 a +210)
–Neonato	+ 110 (+30 a +190)
–1-3 mesi	+ 070 (+10 a +125)
–3mm/3aa	+ 060 (+05 a +110)
–> 3 anni	+ 060 (+20 a +120)



Si calcola anche:

asse elettrico onda P

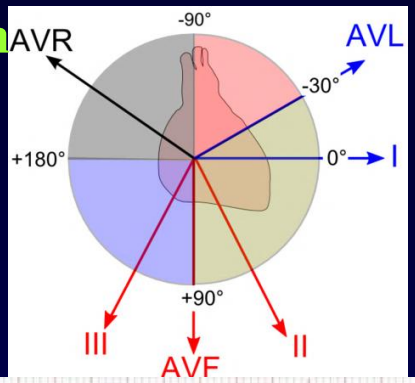
asse onda T concordanza con QRS

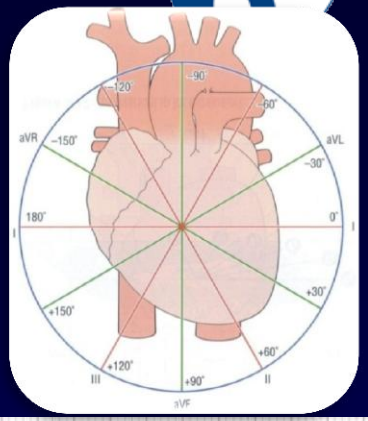
ECG neonato 20 giorni

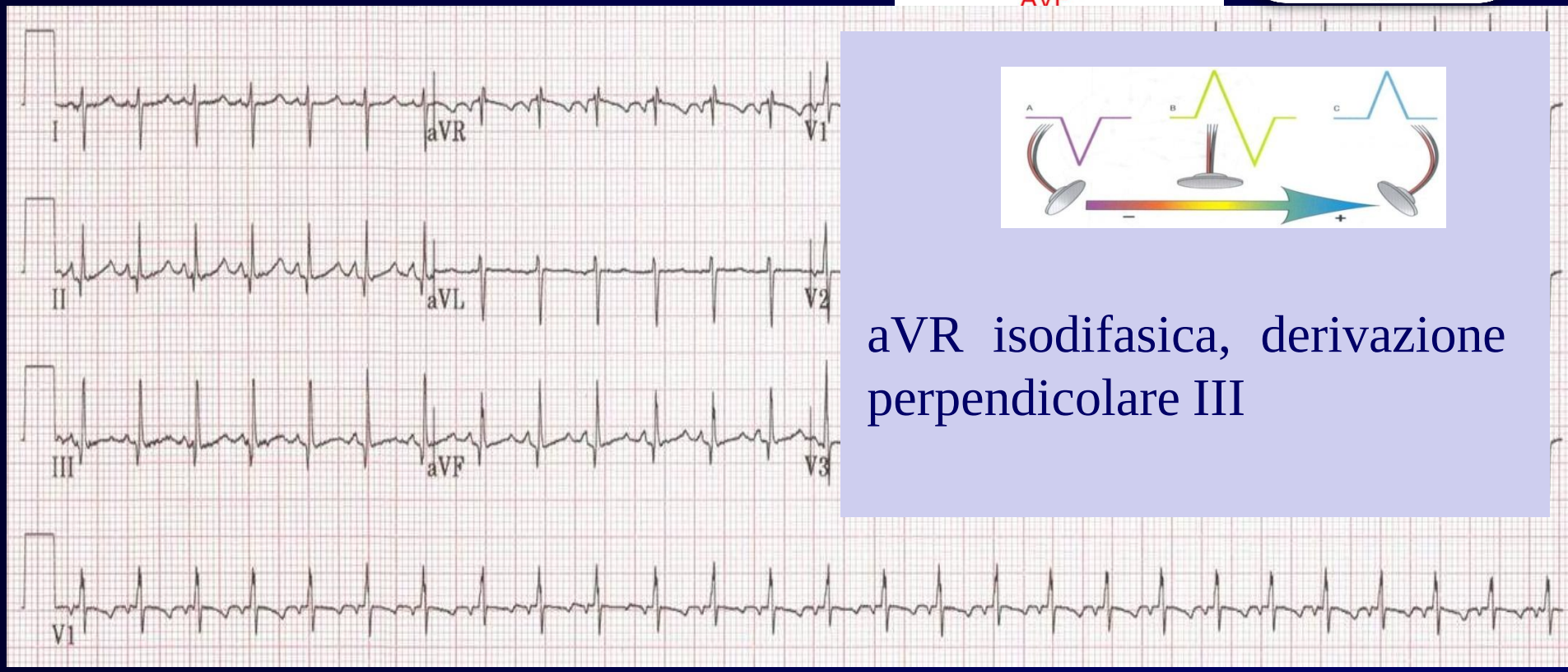
Caratteristiche sino al I mese di vita

Asse elettrico normale nel neonato tra 90° e 180° (III sempre positiva)

Asse 115-120°



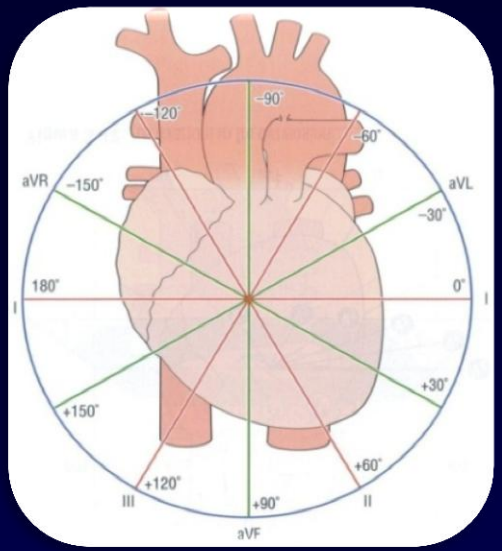


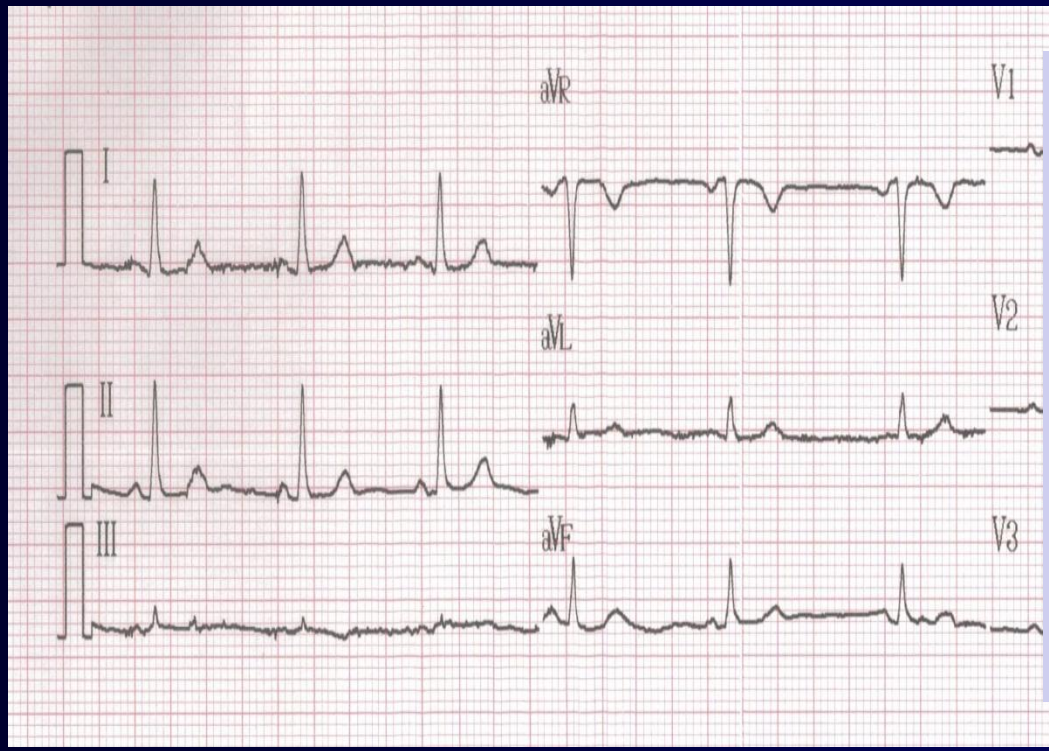


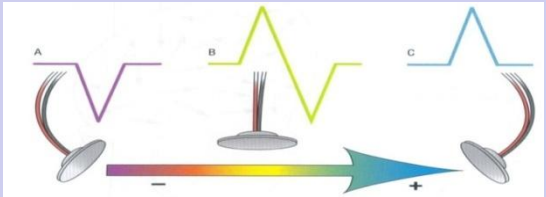
aVR isodifasica, derivazione perpendicolare III

Bambino 12 anni

Asse 30-60°



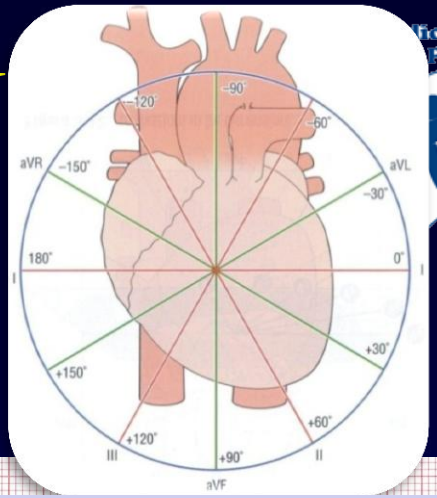


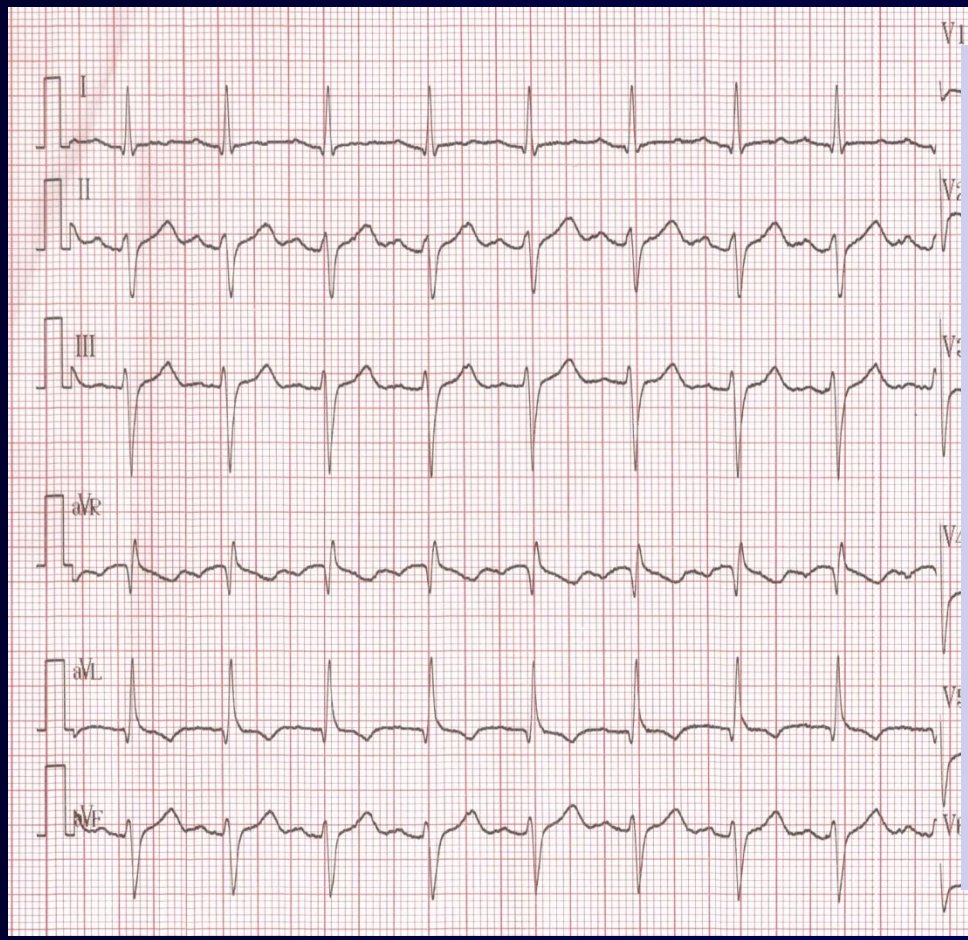


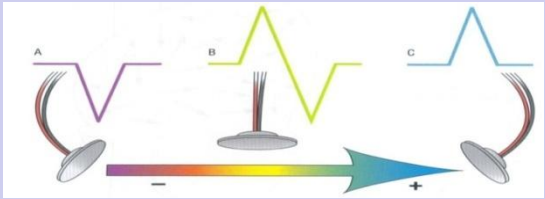
III isodifasica derivazione perpendicolare aVR

CAV posizione anomala del NAV

- asse della P normale
- Asse elettrico a -60-30°







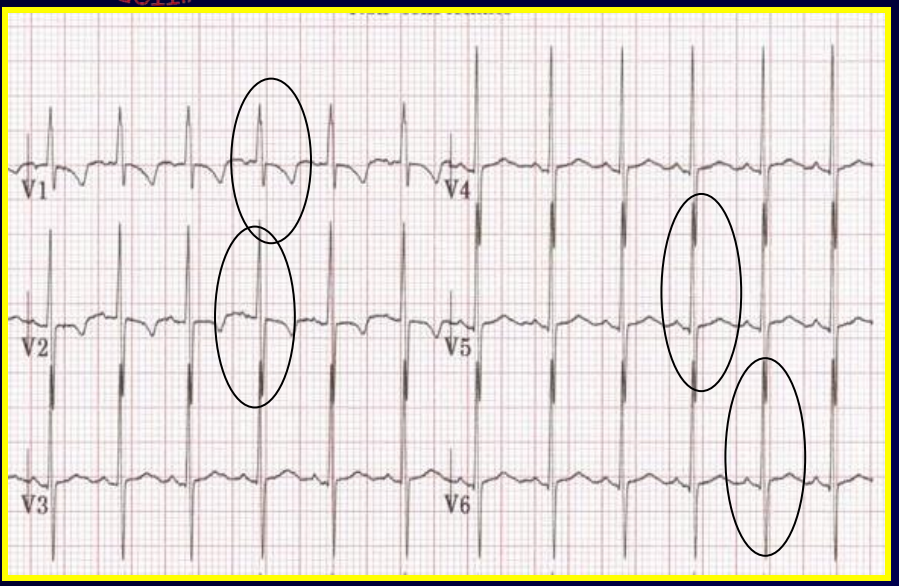
aVR isodifasica, derivazione perpendicolare III

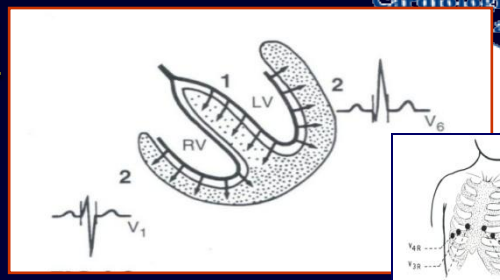
III derivazione negativa

Complesso QRS Precordiali

QRS ≥ 0.05 < 0.07 sec

R< 10 mm in V1 onda q < 5 mm in V6

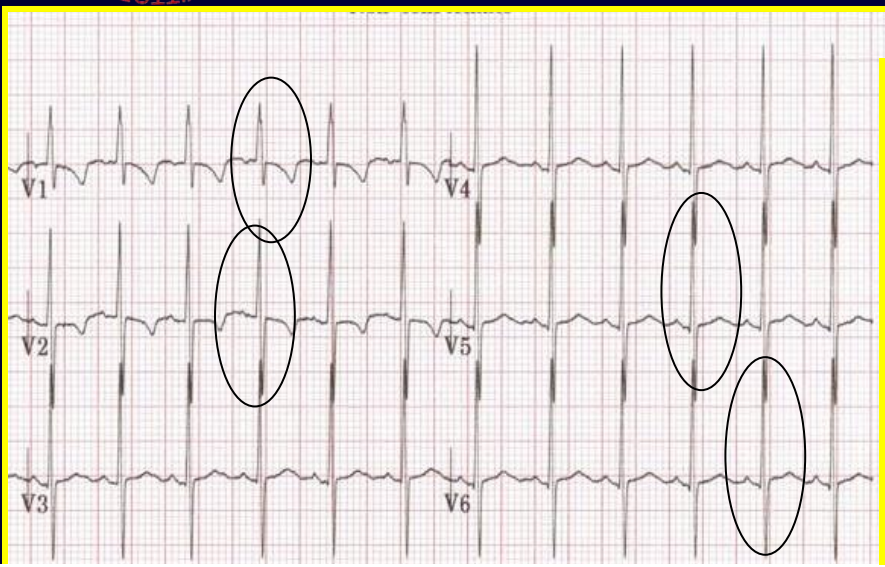


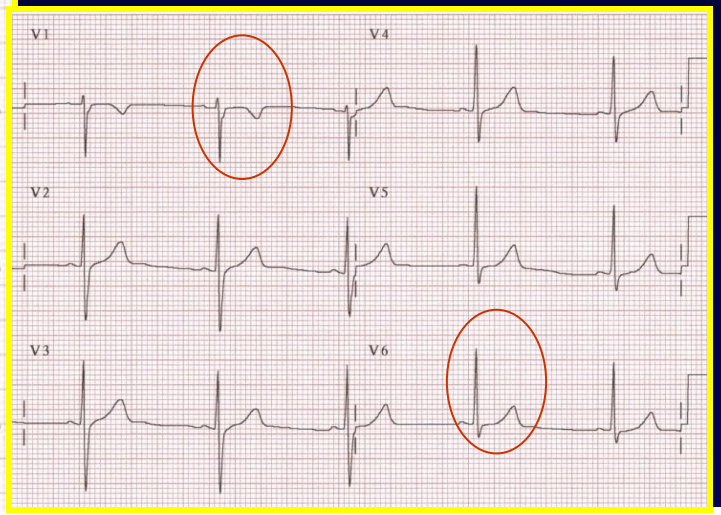


Complesso QRS Precordiali

QRS ≥ 0.05 < 0.07 sec

R< 10 mm in V1 onda q < 5 mm in V6





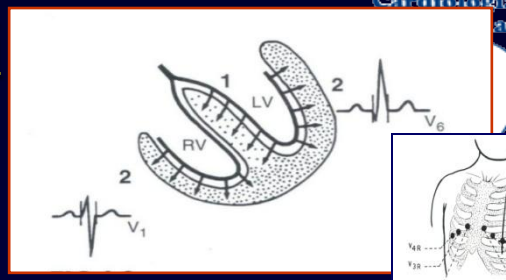


Tabella 6. - Ampiezza delle principali componenti del complesso QRS nelle derivazioni precordiali destre.

Ampiezze in V1 (mm)

	Onda R						Onda S					
Age	Min.	5 %	Media	95 %	Max.	S.D.	Min.	5 %	Media	95 %	Max.	S.D.
0-24 ore	5,5	7,0	14,8	20,0	20,5	3,72	0,0	2,5	9,3	27,0	28,5	7,99
1-7 giorni	5,5	9,0	18,2	27,4	29,5	5,44	1,5	4,6	10,4	18,8	25,5	4,70
8-30 giorni	2,5	4,2	11,4	19,8	26,5	4,97	0,0	2,5	5,0	12,8	18,5	3,73
1-3 mesi	0,0	3,6	9,4	17,9	20,5	5,12	0,0	2,0	5,7	17,4	19,5	5,52
3-6 mesi	5,5	6,1	10,8	16,7	17,5	3,14	1,5	2,1	6,8	11,8	13,5	2,80
6-12 mesi	0,0	4,0	7,3	16,0	17,5	3,84	1,5	1,9	6,2	14,4	16,5	3,73
1-3 anni	2,5	3,6	8,8	15,0	17,5	3,23	0,0	2,2	10,7	20,5	28,5	5,90
3-5 anni	0,0	2,6	6,9	15,6	17,5	3,84	4,5	5,0	11,8	24,8	34,5	6,00
5-8 anni	0,0	2,6	6,7	13,5	20,5	3,84	1,5	5,3	12,7	21,0	25,5	5,21
8-12 anni	0,0	3,6	5,7	11,3	17,5	3,10	1,5	4,8	14,0	22,3	25,5	5,74
12-16 anni	0,0	2,1	4,8	11,1	17,5	3,19	1,5	5,5	13,4	22,3	25,5	5,32

Tabella 7. - Ampiezza delle principali componenti del complesso QRS nelle derivazioni precordiali sinistre.

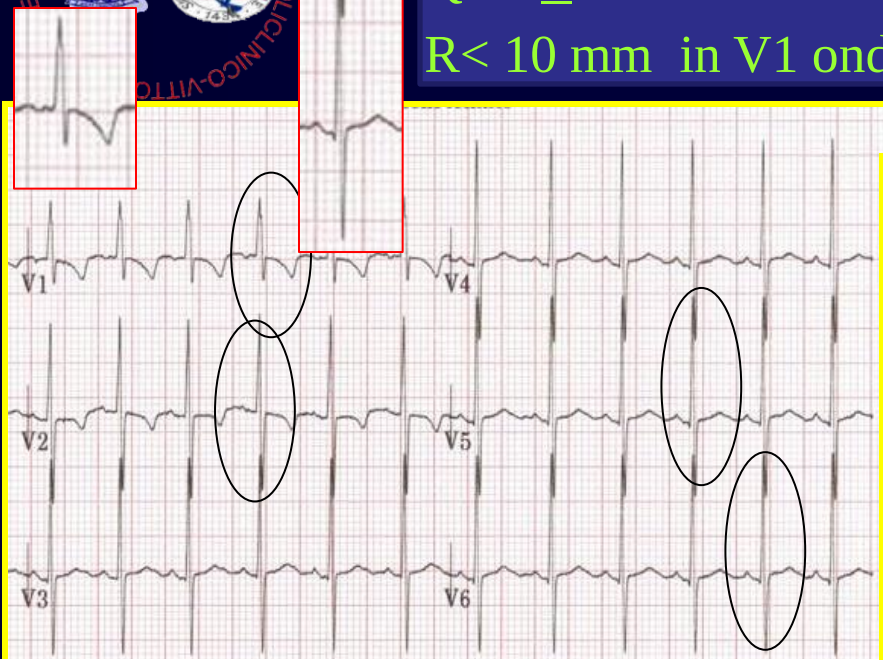
Ampiezze in V5 (mm)

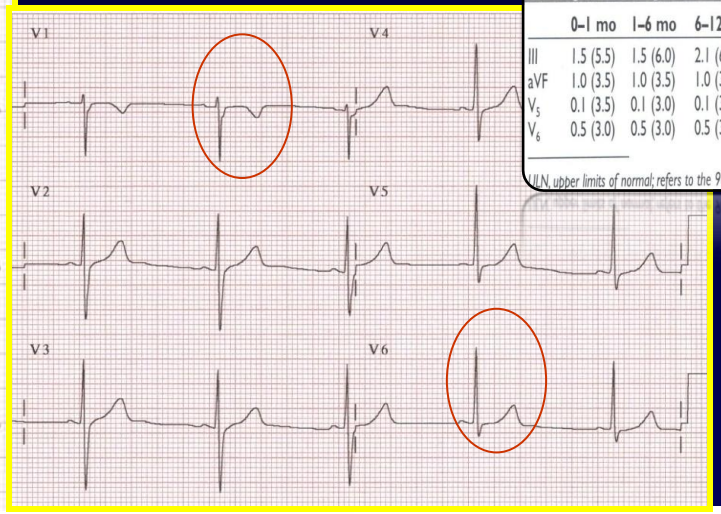
	Onda R						Onda S					
Age	Min.	5 %	Media	95 %	Max.	S.D.	Min.	5 %	Media	95 %	Max.	S.D.
0-24 ore	0,0	4,0	10,2	18,0	24,0	5,44	0,0	0,0	11,9	24,0	31,5	6,87
1-7 giorni	0,0	3,4	10,7	19,3	28,0	5,54	0,0	3,6	6,8	16,2	19,5	4,73
8-30 giorni	0,0	3,5	11,9	27,0	36,0	7,28	0,0	2,7	4,8	12,3	13,5	3,50
1-3 mesi	4,0	7,3	13,6	20,7	24,0	3,87	0,0	2,0	4,7	12,7	13,5	4,14
3-6 mesi	8,0	9,3	17,8	25,5	28,0	4,83	0,0	1,9	4,2	15,4	16,5	5,08
6-12 mesi	8,0	9,7	17,1	24,7	28,0	4,03	0,0	2,0	2,9	8,0	10,5	2,41
1-3 anni	8,0	9,1	17,6	27,7	40,0	6,69	0,0	1,8	2,2	7,0	10,5	2,33
3-5 anni	8,0	9,4	18,5	30,0	36,0	6,59	0,0	1,8	2,0	5,8	7,5	1,91
5-8 anni	8,0	10,0	20,2	31,2	40,0	6,15	0,0	1,9	2,4	6,6	10,5	2,08
8-12 anni	8,0	10,9	21,9	30,0	36,0	6,23	0,0	1,8	1,7	4,4	10,5	1,91
12-16 anni	4,0	8,4	17,2	26,7	36,0	5,42	0,0	1,8	1,7	5,0	7,5	1,81

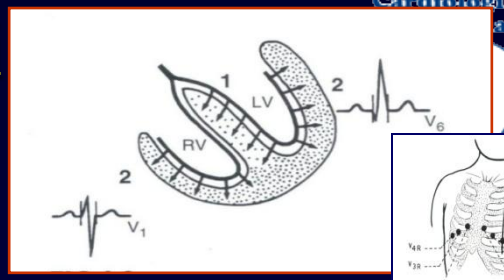
Complesso QRS Precordiali

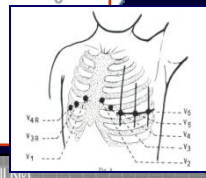
QRS ≥ 0.05 < 0.07 sec

R< 10 mm in V1 onda q < 5 mm in V6









Q Voltages[3] According to Lead and Age: Mean (and ULN[4])

	0–1 mo	1–6 mo	6–12 mo	1–3 y	3–8 y	8–12 y	12–16 y	Adults
III	1.5 (5.5)	1.5 (6.0)	2.1 (6.0)	1.5 (5.0)	1.0 (3.5)	0.6 (3.0)	1.0 (3.0)	0.5 (4)
aVF	1.0 (3.5)	1.0 (3.5)	1.0 (3.5)	1.0 (3.0)	0.5 (3.0)	0.5 (2.5)	0.5 (2.0)	0.5 (2)
V_5	0.1 (3.5)	0.1 (3.0)	0.1 (3.0)	0.5 (4.5)	1.0 (5.5)	1.0 (3.0)	0.5 (3.0)	0.5 (3.5)
V_6	0.5 (3.0)	0.5 (3.0)	0.5 (3.0)	0.5 (3.0)	1.0 (3.5)	0.5 (3.0)	0.5 (3.0)	0.5 (3)

ULN, upper limits of normal; refers to the 98th percentile

Tabella 6. - AMPIEZZA DELLE PRINCIPALI COMPONENTI DEL COMPLESSO QRS NELLE DERIVAZIONI PRECORDIALI DESTRE.

Ampiezze in V1 (mm)

	Onda R						Onda S					
Age	Min.	5 %	Media	95 %	Max.	S.D.	Min.	5 %	Media	95 %	Max.	S.D.
0-24 ore	5,5	7,0	14,8	20,0	20,5	3,72	0,0	2,5	9,3	27,0	28,5	7,99
1-7 giorni	5,5	9,0	18,2	27,4	29,5	5,44	1,5	4,6	10,4	18,8	25,5	4,70
8-30 giorni	2,5	4,2	11,4	19,8	26,5	4,97	0,0	2,5	5,0	12,8	18,5	3,73
1-3 mesi	0,0	3,6	9,4	17,9	20,5	5,12	0,0	2,0	5,7	17,4	19,5	5,52
3-6 mesi	5,5	6,1	10,8	16,7	17,5	3,14	1,5	2,1	6,8	11,8	13,5	2,80
6-12 mesi	0,0	4,0	7,3	16,0	17,5	3,84	1,5	1,9	6,2	14,4	16,5	3,73
1-3 anni	2,5	3,6	8,8	15,0	17,5	3,23	0,0	2,2	10,7	20,5	28,5	5,90
3-5 anni	0,0	2,6	6,9	15,6	17,5	3,84	4,5	5,0	11,8	24,8	34,5	6,00
5-8 anni	0,0	2,6	6,7	13,5	20,5	3,84	1,5	5,3	12,7	21,0	25,5	5,21
8-12 anni	0,0	3,6	5,7	11,3	17,5	3,10	1,5	4,8	14,0	22,3	25,5	5,74
12-16 anni	0,0	2,1	4,8	11,1	17,5	3,19	1,5	5,5	13,4	22,3	25,5	5,32

Tabella 7. - AMPIEZZA DELLE PRINCIPALI COMPONENTI DEL COMPLESSO QRS NELLE DERIVAZIONI PRECORDIALI SINISTRE.

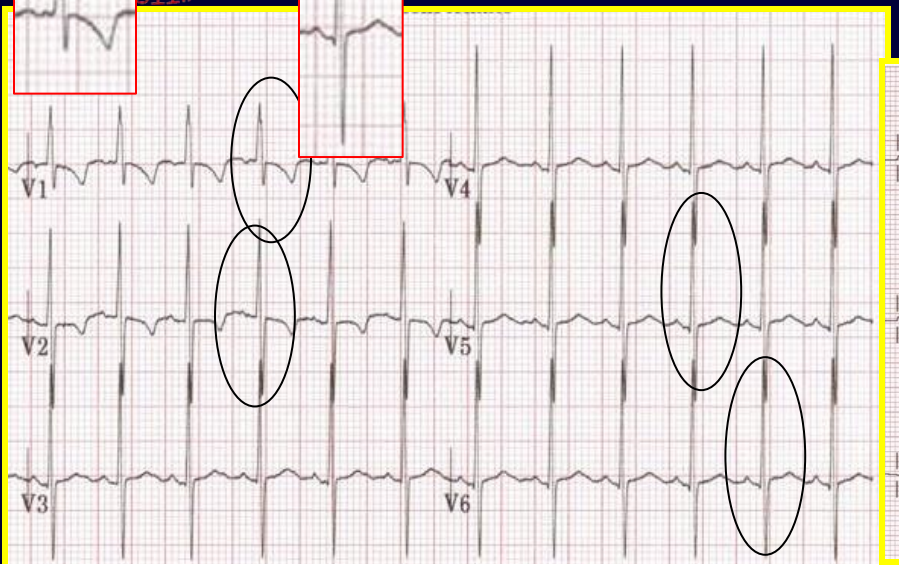
Ampiezze in V5 (mm)

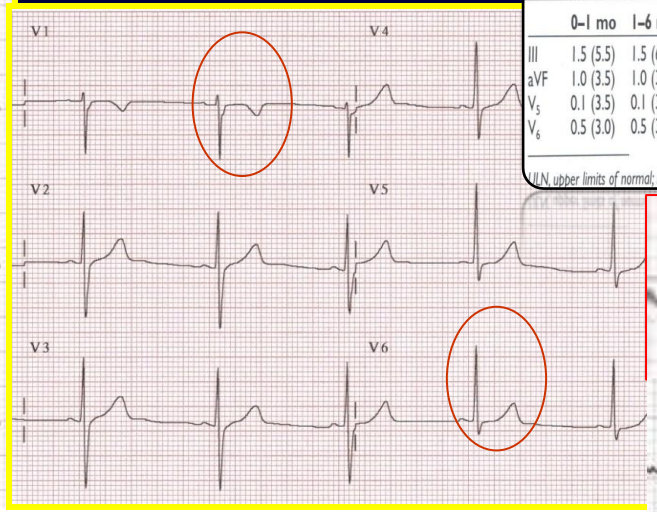
	Onda R						Onda S					
Age	Min.	5 %	Media	95 %	Max.	S.D.	Min.	5 %	Media	95 %	Max.	S.D.
0-24 ore	0,0	4,0	10,2	18,0	24,0	5,44	0,0	0,0	11,9	24,0	31,5	6,87
1-7 giorni	0,0	3,4	10,7	19,3	28,0	5,54	0,0	3,6	6,8	16,2	19,5	4,73
8-30 giorni	0,0	3,5	11,9	27,0	36,0	7,28	0,0	2,7	4,8	12,3	13,5	3,50
1-3 mesi	4,0	7,3	13,6	20,7	24,0	3,87	0,0	2,0	4,7	12,7	13,5	4,14
3-6 mesi	8,0	9,3	17,8	25,5	28,0	4,83	0,0	1,9	4,2	15,4	16,5	5,08
6-12 mesi	8,0	9,7	17,1	24,7	28,0	4,03	0,0	2,0	2,9	8,0	10,5	2,41
1-3 anni	8,0	9,1	17,6	27,7	40,0	6,69	0,0	1,8	2,2	7,0	10,5	2,33
3-5 anni	8,0	9,4	18,5	30,0	36,0	6,59	0,0	1,8	2,0	5,8	7,5	1,91
5-8 anni	8,0	10,0	20,2	31,2	40,0	6,15	0,0	1,9	2,4	6,6	10,5	2,08
8-12 anni	8,0	10,9	21,9	30,0	36,0	6,23	0,0	1,8	1,7	4,4	10,5	1,91
12-16 anni	4,0	8,4	17,2	26,7	36,0	5,42	0,0	1,8	1,7	5,0	7,5	1,81

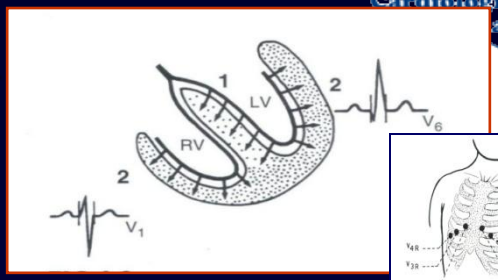
Complesso QRS Precordiali

QRS ≥ 0.05 < 0.07 sec

R< 10 mm in V1 onda q < 5 mm in V6







Q Voltages[3] According to Lead and Age: Mean (and ULN*)

	0–1 mo	1–6 mo	6–12 mo	1–3 y	3–8 y	8–12 y	12–16 y	Adults
III	1.5 (5.5)	1.5 (6.0)	2.1 (6.0)	1.5 (5.0)	1.0 (3.5)	0.6 (3.0)	1.0 (3.0)	0.5 (4)
aVF	1.0 (3.5)	1.0 (3.5)	1.0 (3.5)	1.0 (3.0)	0.5 (3.0)	0.5 (2.5)	0.5 (2.0)	0.5 (2)
V_5	0.1 (3.5)	0.1 (3.0)	0.1 (3.0)	0.5 (4.5)	1.0 (5.5)	1.0 (3.0)	0.5 (3.0)	0.5 (3.5)
V_6	0.5 (3.0)	0.5 (3.0)	0.5 (3.0)	0.5 (3.0)	1.0 (3.5)	0.5 (3.0)	0.5 (3.0)	0.5 (3)

*ULN, upper limits of normal; refers to the 98th percentile

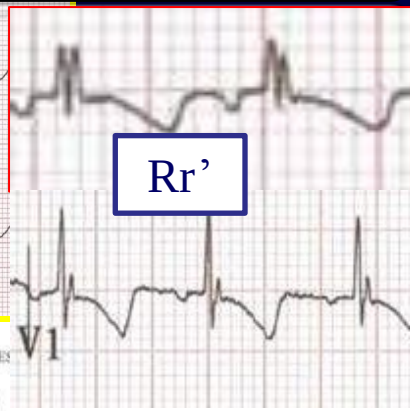


Tabella 6. - AMPIEZZA DELLE PRINCIPALI COMPONENTI DEL COMPLESSO QRS NELLE DERIVAZIONI PRECORDIALI DESTRE.

Ampiezze in V1 (mm)

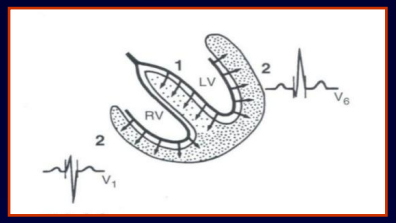
	Onda R						Onda S					
Age	Min.	5 %	Media	95 %	Max.	S.D.	Min.	5 %	Media	95 %	Max.	S.D.
0-24 ore	5,5	7,0	14,8	20,0	20,5	3,72	0,0	2,5	9,3	27,0	28,5	7,99
1-7 giorni	5,5	9,0	18,2	27,4	29,5	5,44	1,5	4,6	10,4	18,8	25,5	4,70
8-30 giorni	2,5	4,2	11,4	19,8	26,5	4,97	0,0	2,5	5,0	12,8	18,5	3,73
1-3 mesi	0,0	3,6	9,4	17,9	20,5	5,12	0,0	2,0	5,7	17,4	19,5	5,52
3-6 mesi	5,5	6,1	10,8	16,7	17,5	3,14	1,5	2,1	6,8	11,8	13,5	2,80
6-12 mesi	0,0	4,0	7,3	16,0	17,5	3,84	1,5	1,9	6,2	14,4	16,5	3,73
1-3 anni	2,5	3,6	8,8	15,0	17,5	3,23	0,0	2,2	10,7	20,5	28,5	5,90
3-5 anni	0,0	2,6	6,9	15,6	17,5	3,84	4,5	5,0	11,8	24,8	34,5	6,00
5-8 anni	0,0	2,6	6,7	13,5	20,5	3,84	1,5	5,3	12,7	21,0	25,5	5,21
8-12 anni	0,0	3,6	5,7	11,3	17,5	3,10	1,5	4,8	14,0	22,3	25,5	5,74
12-16 anni	0,0	2,1	4,8	11,1	17,5	3,19	1,5	5,5	13,4	22,3	25,5	5,32

Tabella 7. - AMPIEZZA DELLE PRINCIPALI COMPONENTI DEL COMPLES SINISTRE.

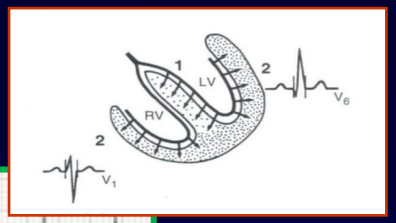
Ampiezze in V5 (mm)

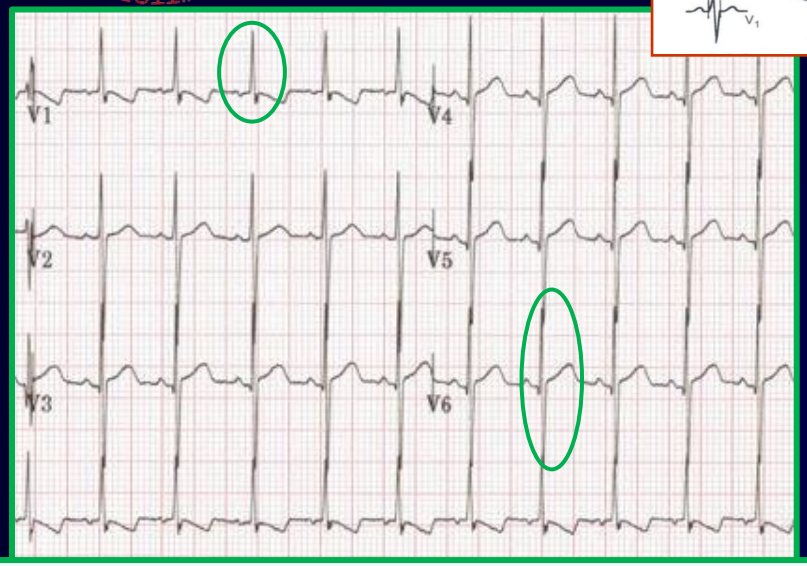
	Onda R						Onda S					
Age	Min.	5 %	Media	95 %	Max.	S.D.	Min.	5 %	Media	95 %	Max.	S.D.
0-24 ore	0,0	4,0	10,2	18,0	24,0	5,44	0,0	0,0	11,9	24,0	31,5	6,87
1-7 giorni	0,0	3,4	10,7	19,3	28,0	5,54	0,0	3,6	6,8	16,2	19,5	4,73
8-30 giorni	0,0	3,5	11,9	27,0	36,0	7,28	0,0	2,7	4,8	12,3	13,5	3,50
1-3 mesi	4,0	7,3	13,6	20,7	24,0	3,87	0,0	2,0	4,7	12,7	13,5	4,14
3-6 mesi	8,0	9,3	17,8	25,5	28,0	4,83	0,0	1,9	4,2	15,4	16,5	5,08
6-12 mesi	8,0	9,7	17,1	24,7	28,0	4,03	0,0	2,0	2,9	8,0	10,5	2,41
1-3 anni	8,0	9,1	17,6	27,7	40,0	6,69	0,0	1,8	2,2	7,0	10,5	2,33
3-5 anni	8,0	9,4	18,5	30,0	36,0	6,59	0,0	1,8	2,0	5,8	7,5	1,91
5-8 anni	8,0	10,0	20,2	31,2	40,0	6,15	0,0	1,9	2,4	6,6	10,5	2,08
8-12 anni	8,0	10,9	21,9	30,0	36,0	6,23	0,0	1,8	1,7	4,4	10,5	1,91
12-16 anni	4,0	8,4	17,2	26,7	36,0	5,42	0,0	1,8	1,7	5,0	7,5	1,81

Ecg: complesso QRS



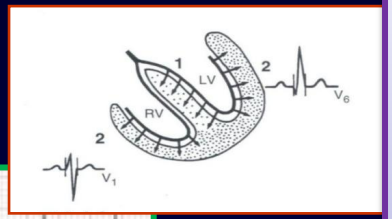
Ecg: complesso QRS



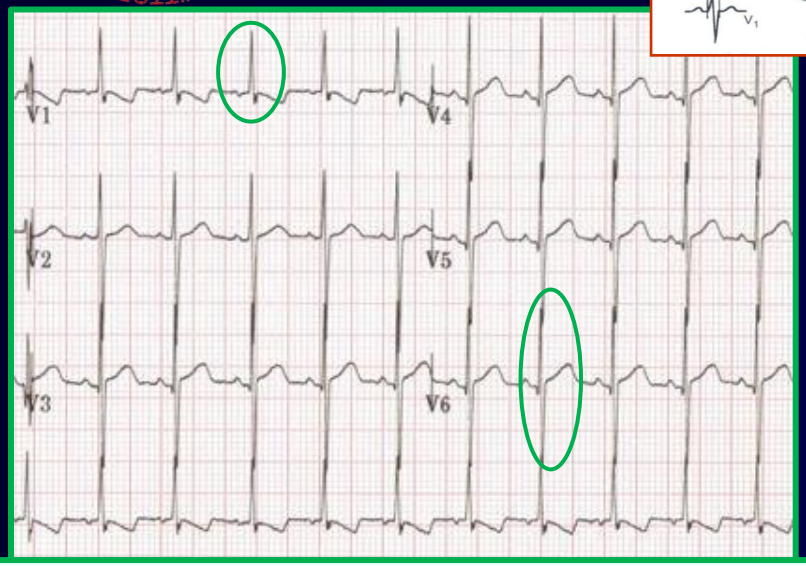


QRS	Modello neonatale	
V1:	**R/S>1**	R<25 mm S<20 mm
	R	<13/10mm I sett/dopo
V6:	**R/S≤1**	S<10 mm

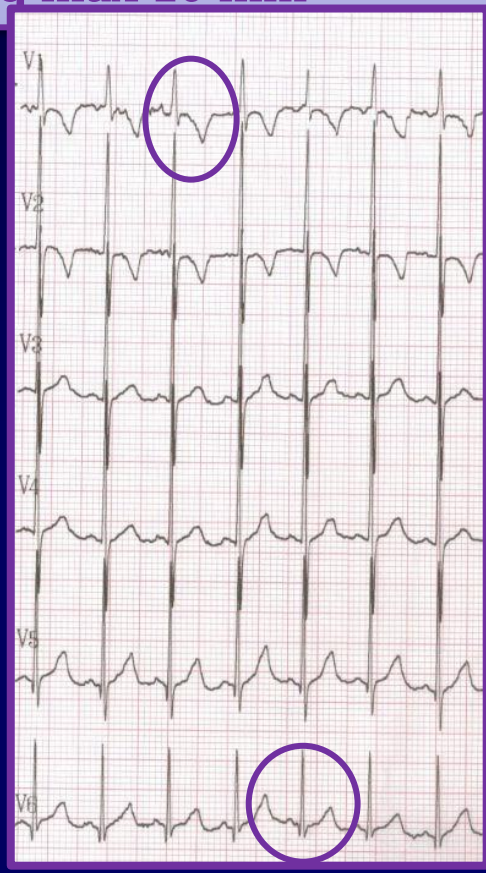
Ecg: complesso QRS



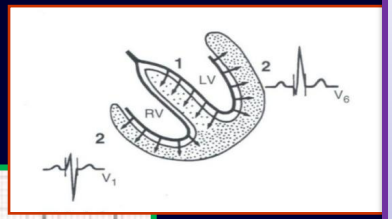
QRS	Modello lattante	
V1:	R/S≥1	R<20 mm
	R <10 mm	
V6:	R/S>1	R<25 mm S<10 mm
II-III-aVF-V6	q max 10 mm	



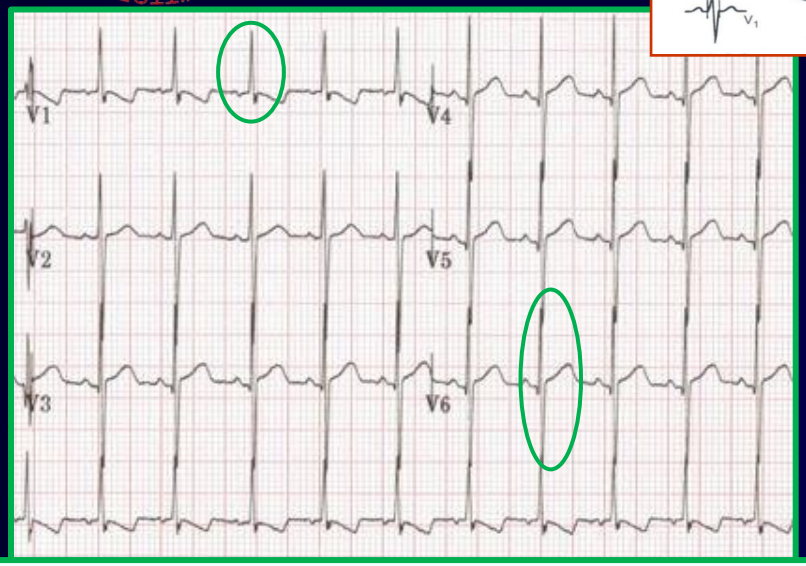
QRS	Modello neonatale	
V1:	**R/S>1**	R<25 mm S<20 mm
	R	<13/10mm I sett/dopo
V6:	**R/S≤1**	S<10 mm



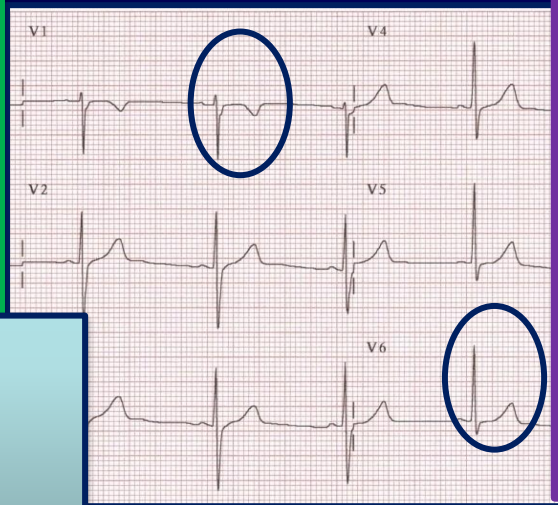
Ecg: complesso QRS

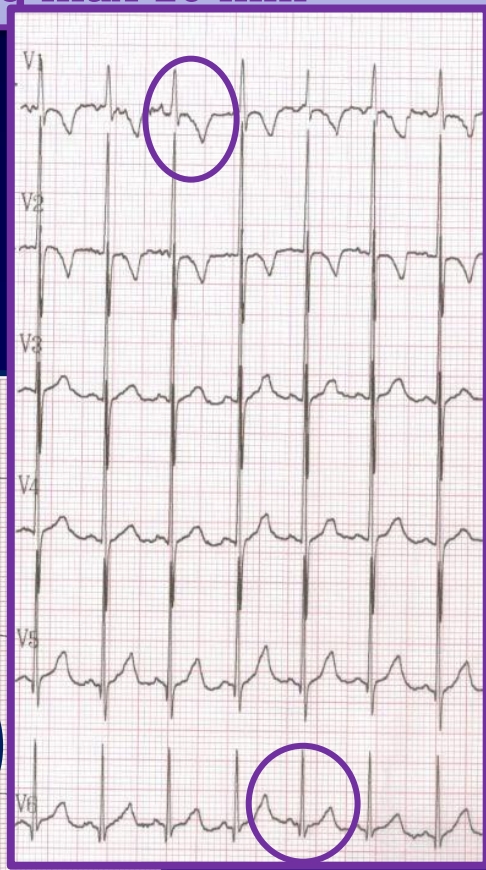


QRS	Modello lattante	
V1:	R/S≥1	R<20 mm
	R <10 mm	
V6:	R/S>1	R<25 mm S<10 mm
II-III-aVF-V6	q max 10 mm	



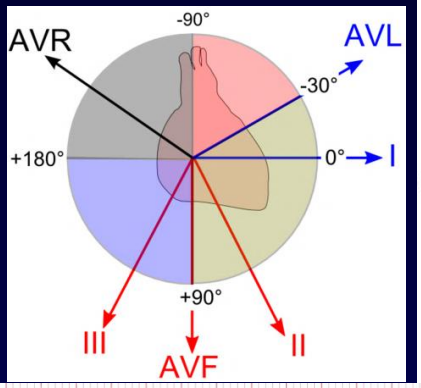
QRS	Modello neonatale	
V1:	**R/S>1**	R<25 mm S<20 mm
	R	<13/10mm I sett/dopo
V6:	**R/S≤1**	S<10 mm

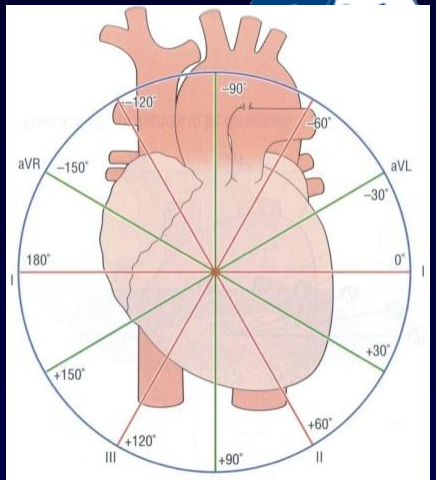




QRS	Modello adulto da i 2-3aa	
V1:	**R/S <1**	S<25 mm **R mai**
V6:	**R/S>1**	R<25 mm S<5mm

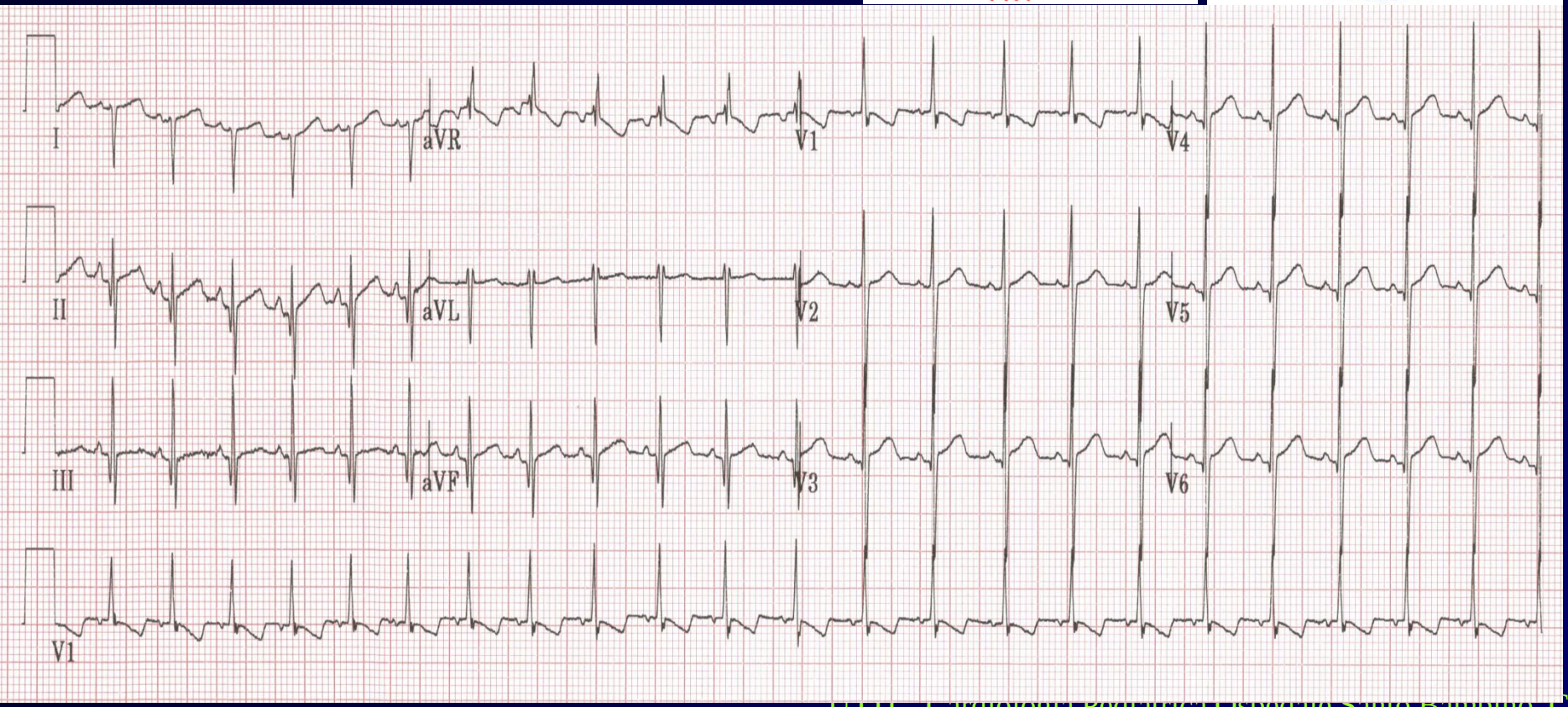
ECG neonato 20 giorni





Asse elettrico normale 115-120°

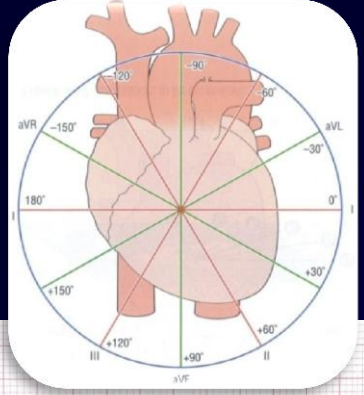
V1 R>S V6 R<(S≤20mm)

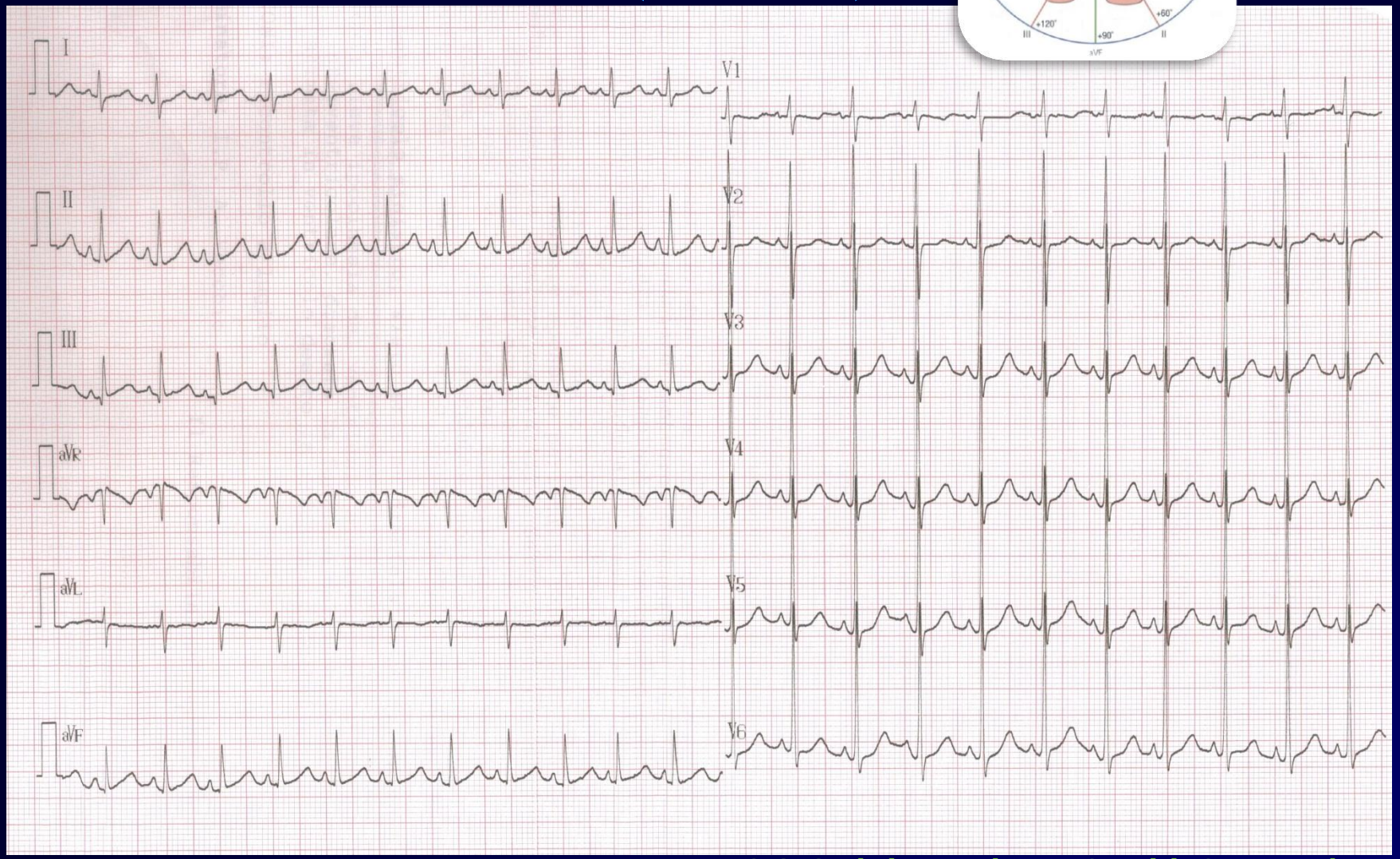


Lattante 2 mesi

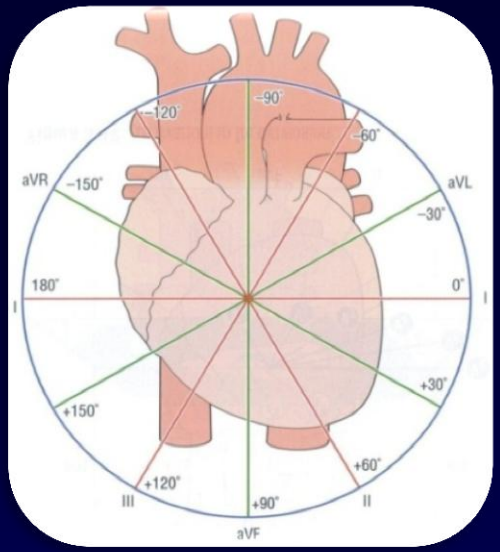
Asse elettrico normale 75-90°

V1 R>S V6 R≥(S<10 mm)



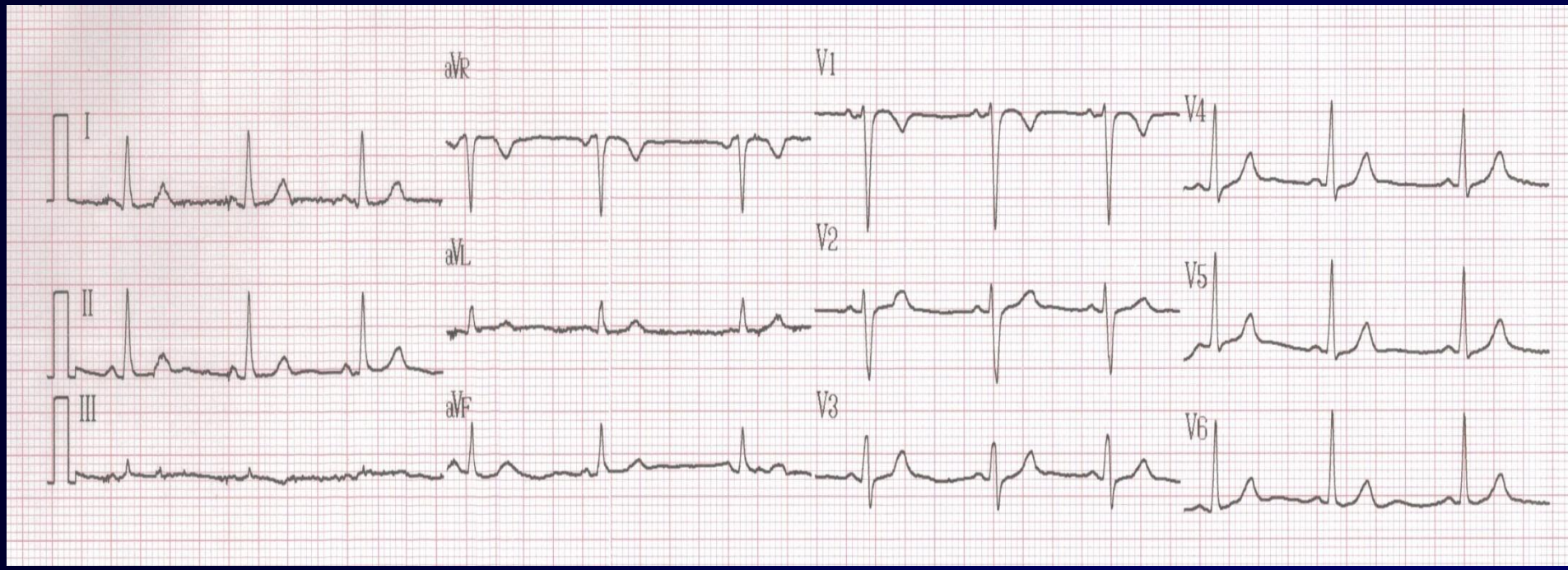


Bambino 12 anni



Asse elettrico normale 30-60°

V1 R<S V6 R>(S≤5 mm)



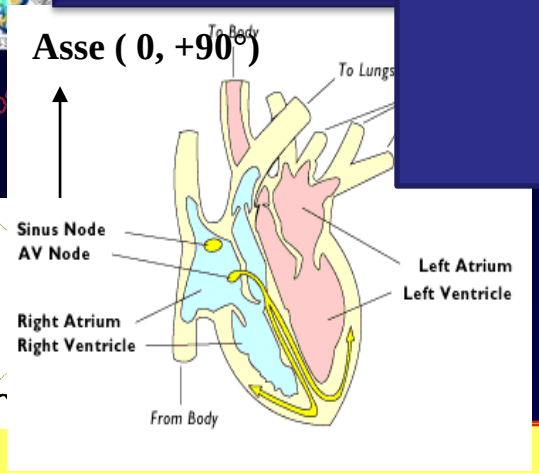
Onda P

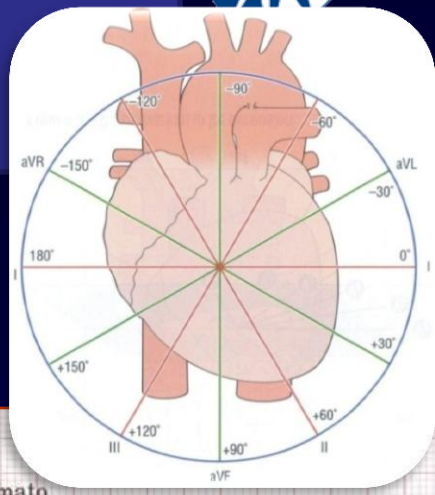
rappresenta la depolarizzazione biatriale

Ampiezza ≥1.5 ≤ 2.5 mm

Durata 0.06-0.08 sec

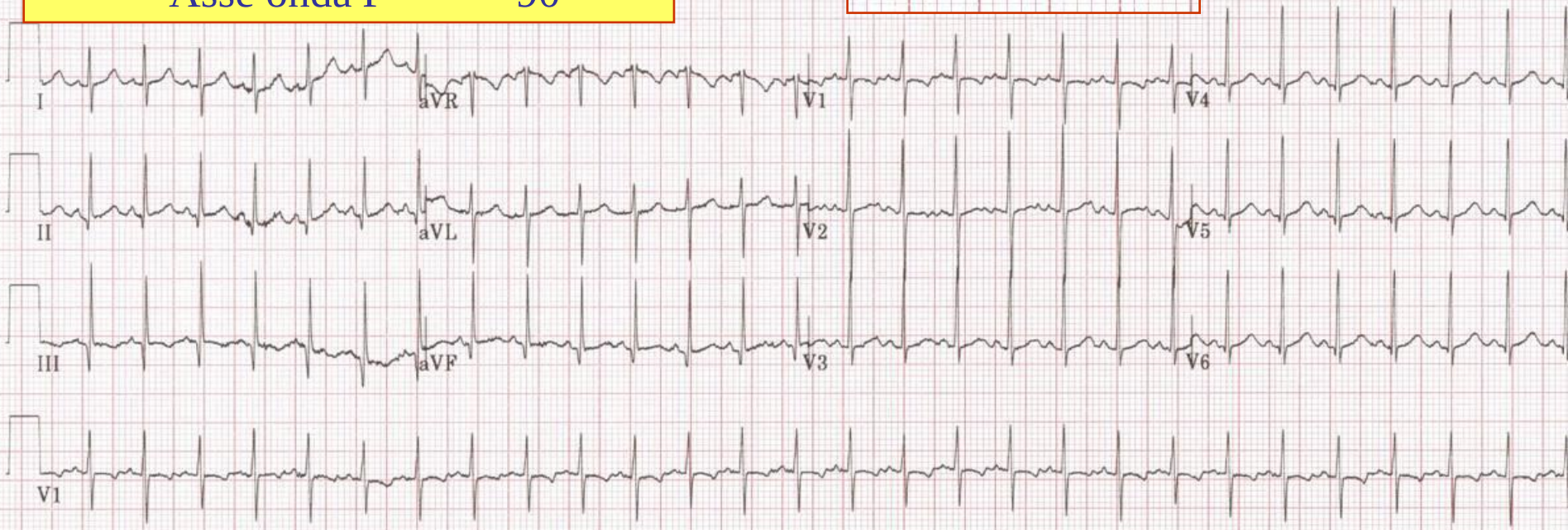
Asse 0-90°





Ritmo sinusale

– Asse onda P 90°



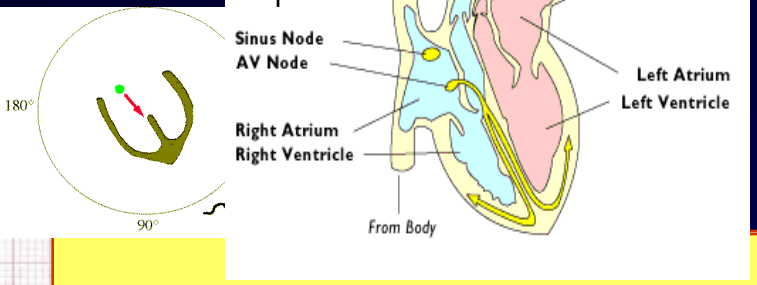
Onda P

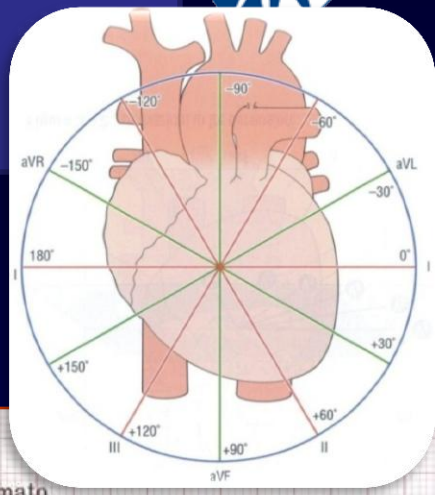
rappresenta la depolarizzazione biatriale

Ampiezza ≥1.5 ≤ 2.5 mm

Durata 0.06-0.08 sec

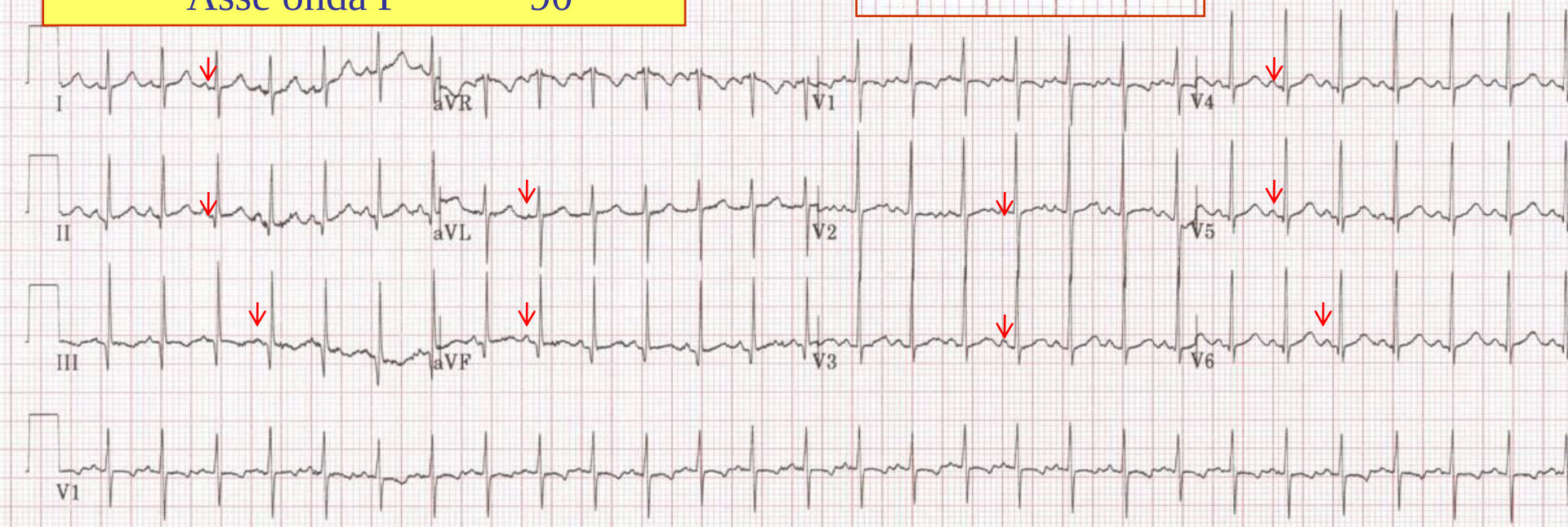
Asse 0-90°





Ritmo sinusale

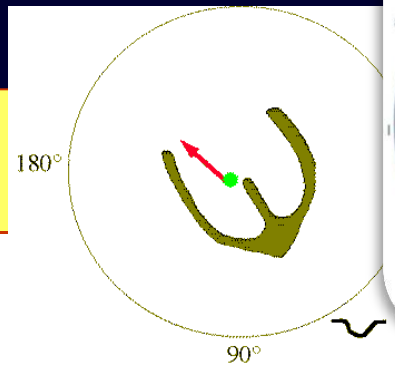
– Asse onda P 90°

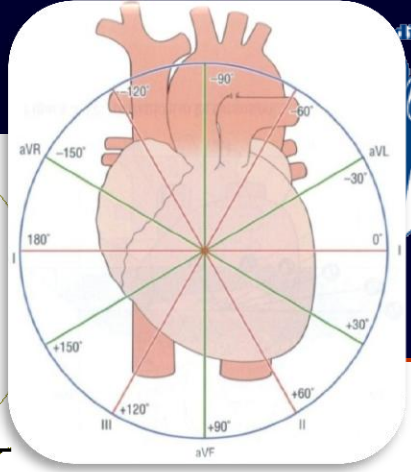


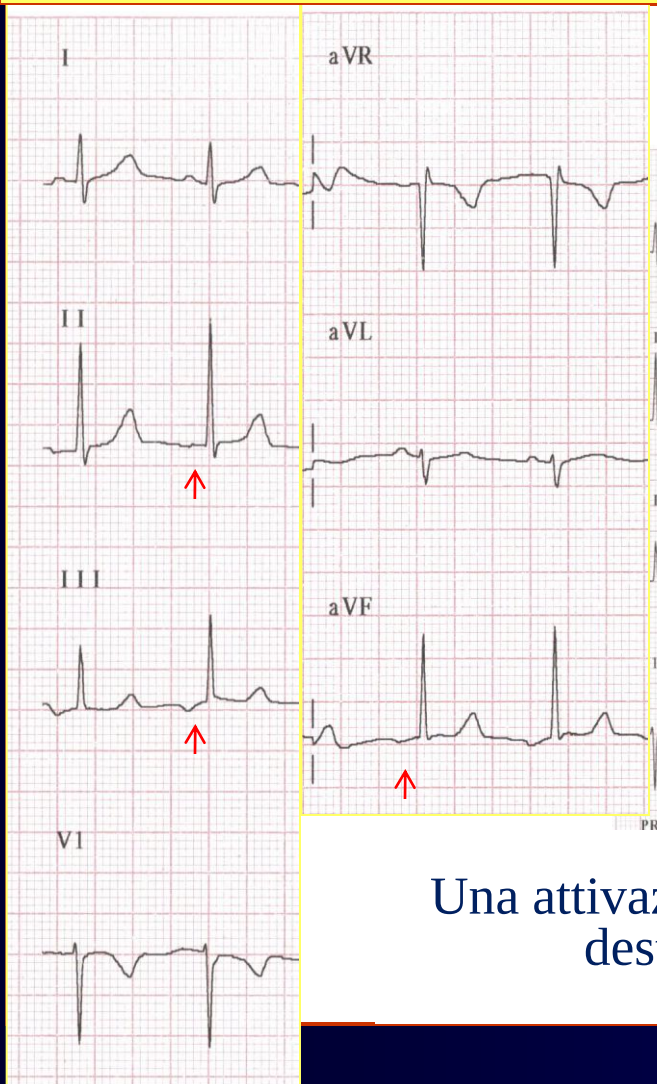
Onda P

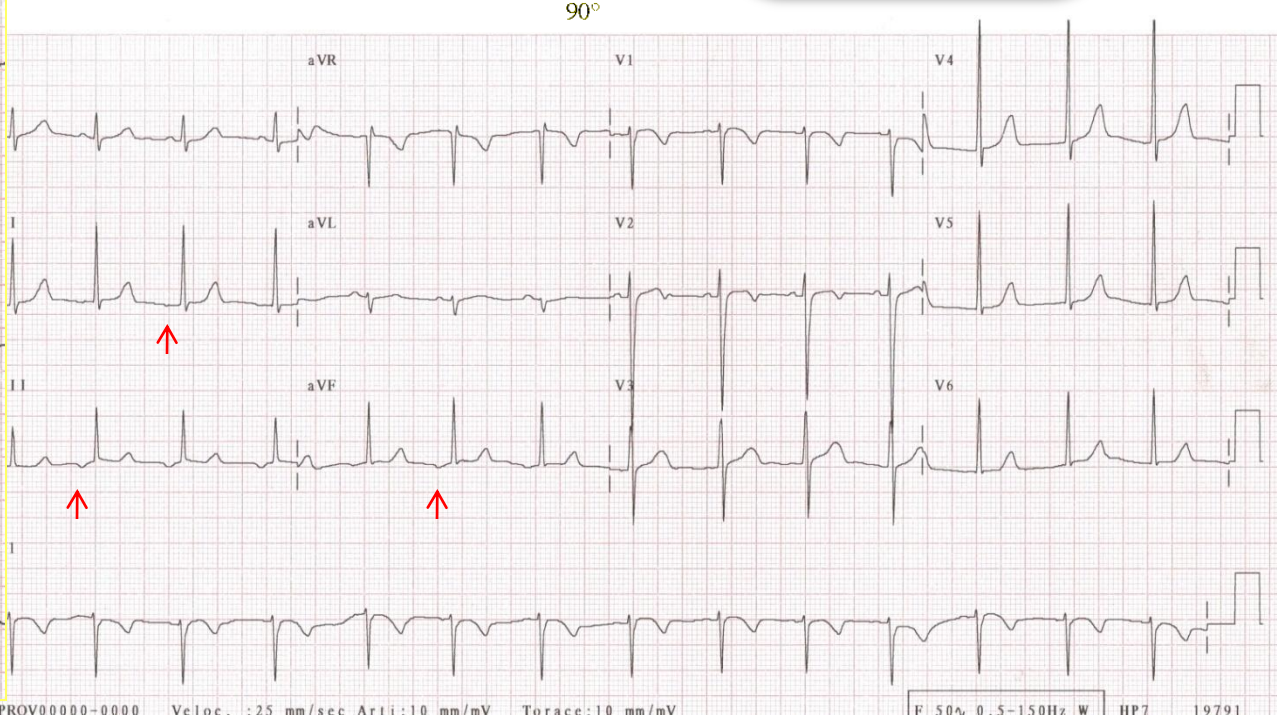
Ritmo del seno coronarico

– Asse dell'onda P – 30°



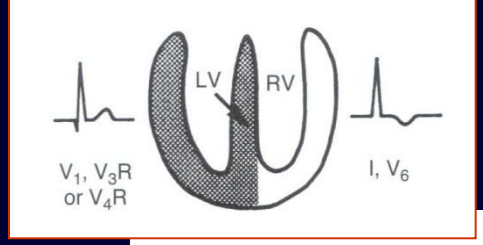




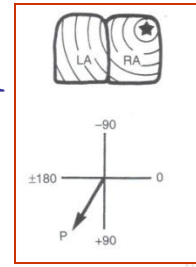


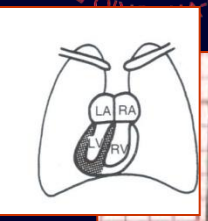
Una attivazione atriale che origina in modo anomalo – atrio destro basso- darà onde P negative in II, aVF, III

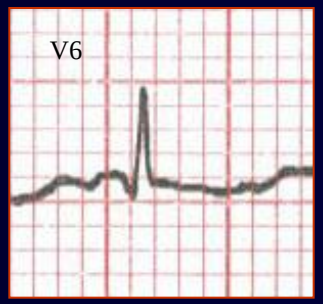
Asse elettrico posizione cuore



Situs inversus in destrocardia
neonato 2g



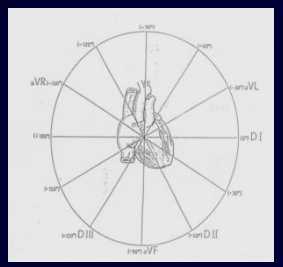


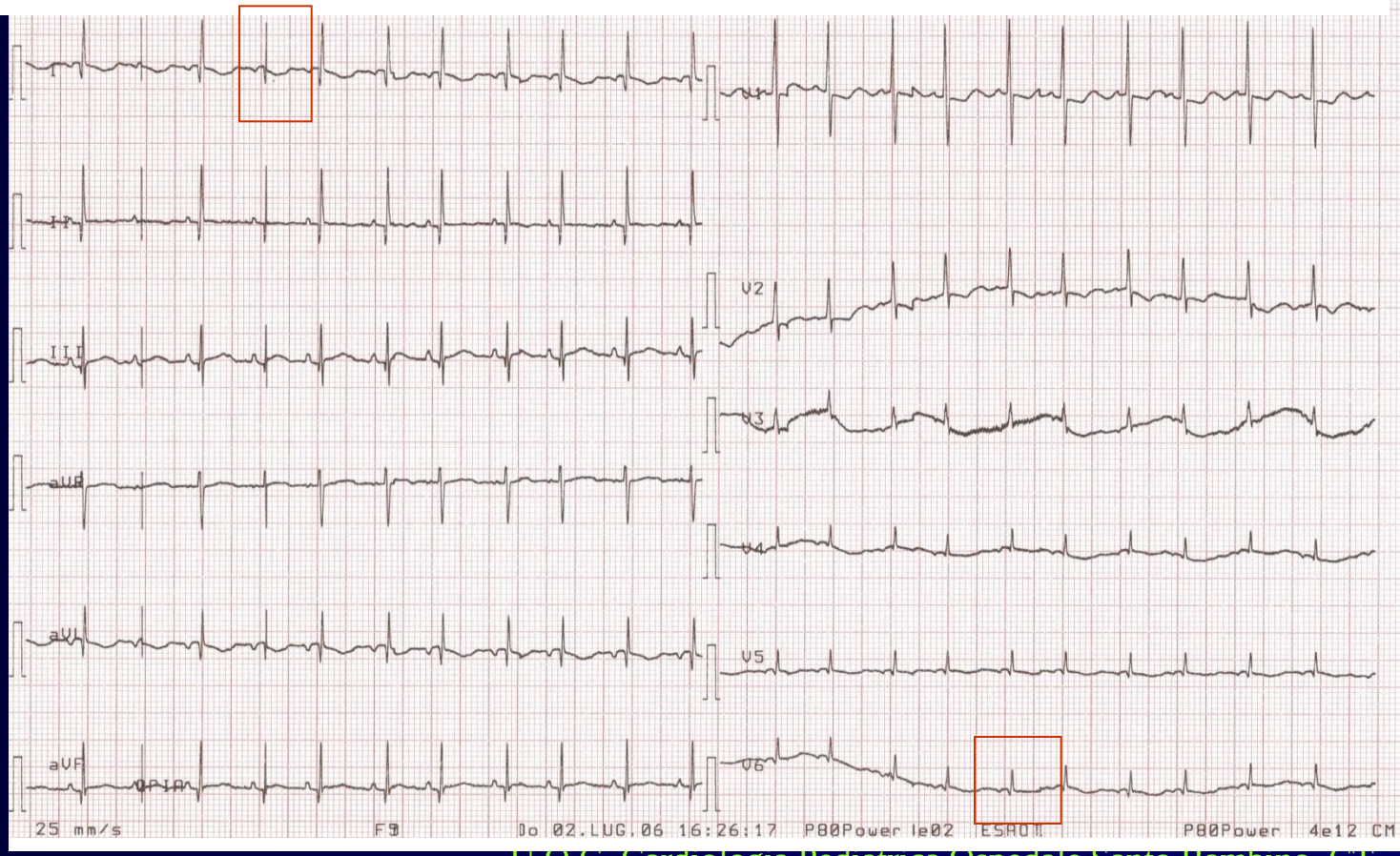


Asse della P a 120°

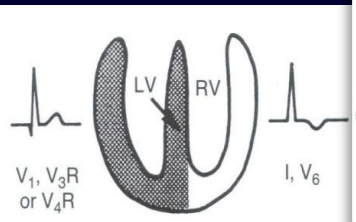
complessi rsR' in I,V6

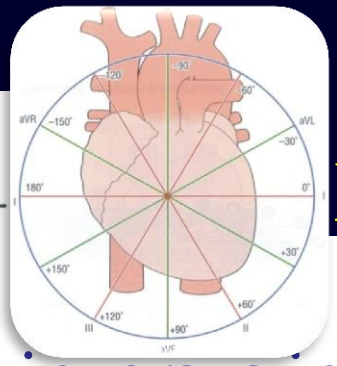
Decremento dell'onda R da V1 a V6



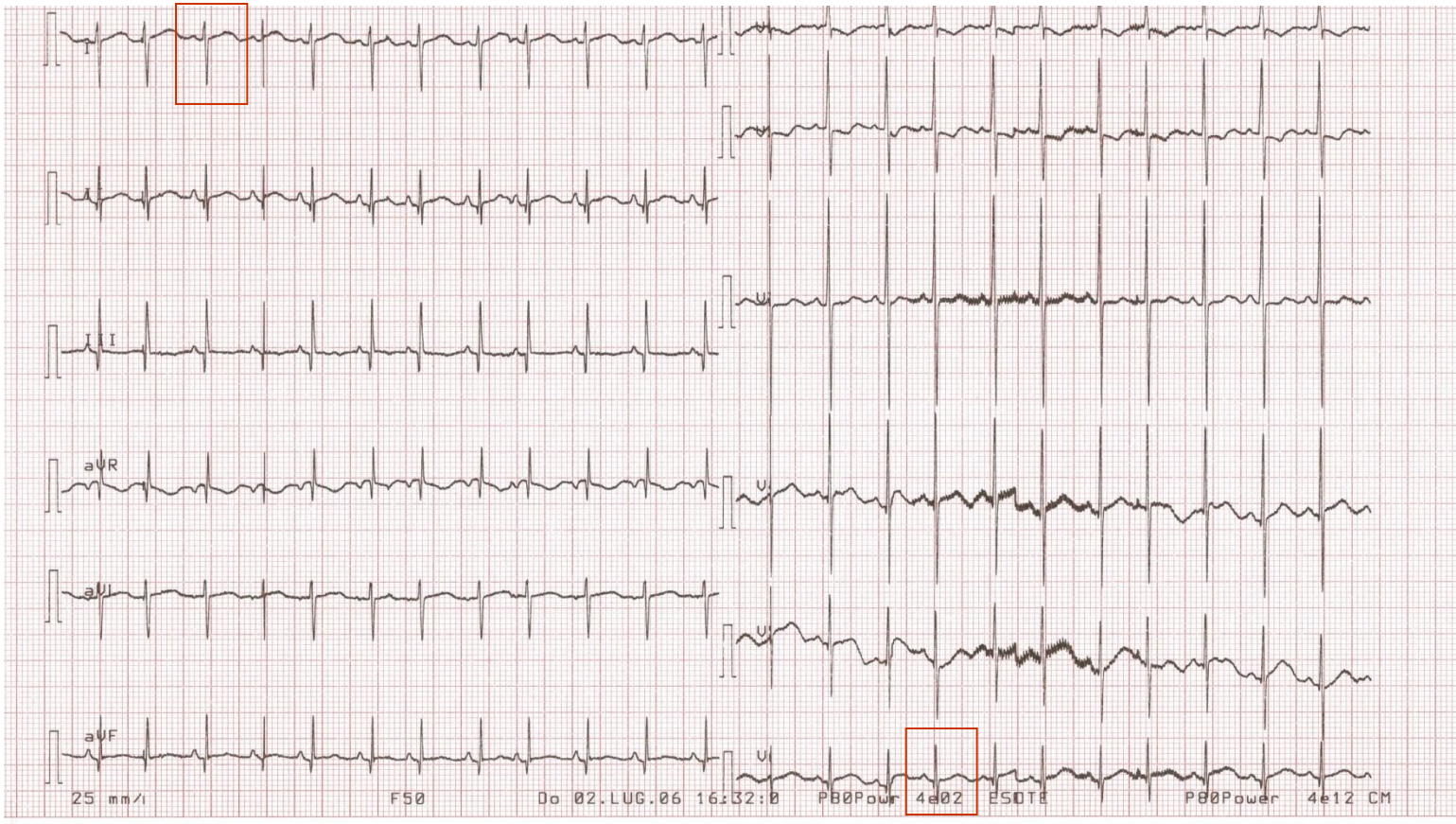


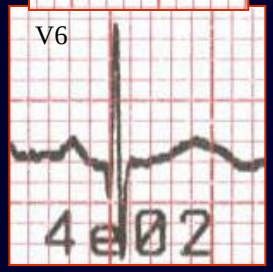
Asse elettrico posizione cuore



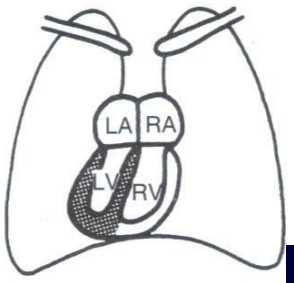


Situs inversus in destrocardia neonato 2g
Etettrodi invertiti



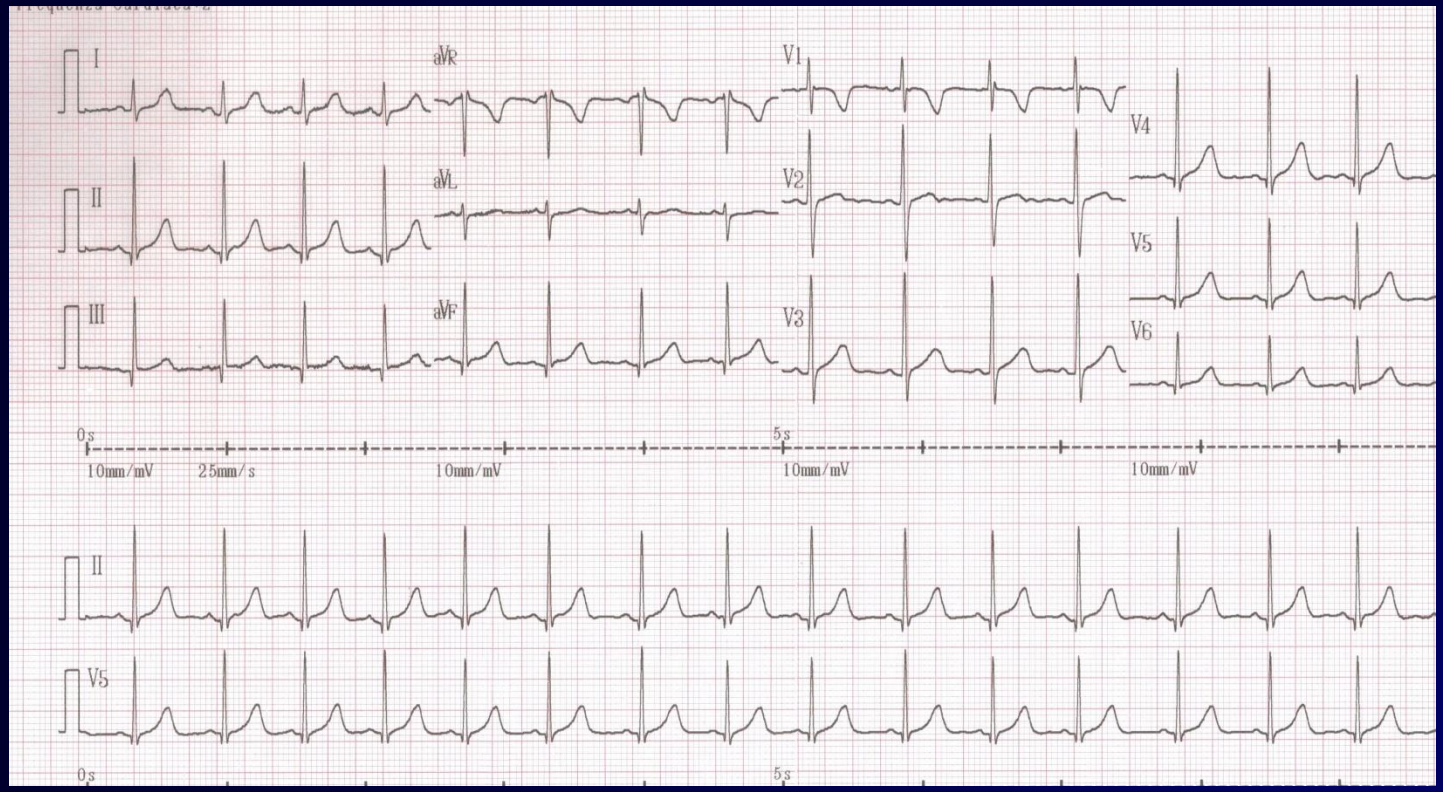


Complessi QRS in V6



Tratto ST- T
ripolarizzazione ventricolare

Il tratto ST è rappresentato da un segmento orizzontale “isoelettrico” stessa linea del tratto PR e TP



Tratto ST- T ripolarizzazione ventricolare

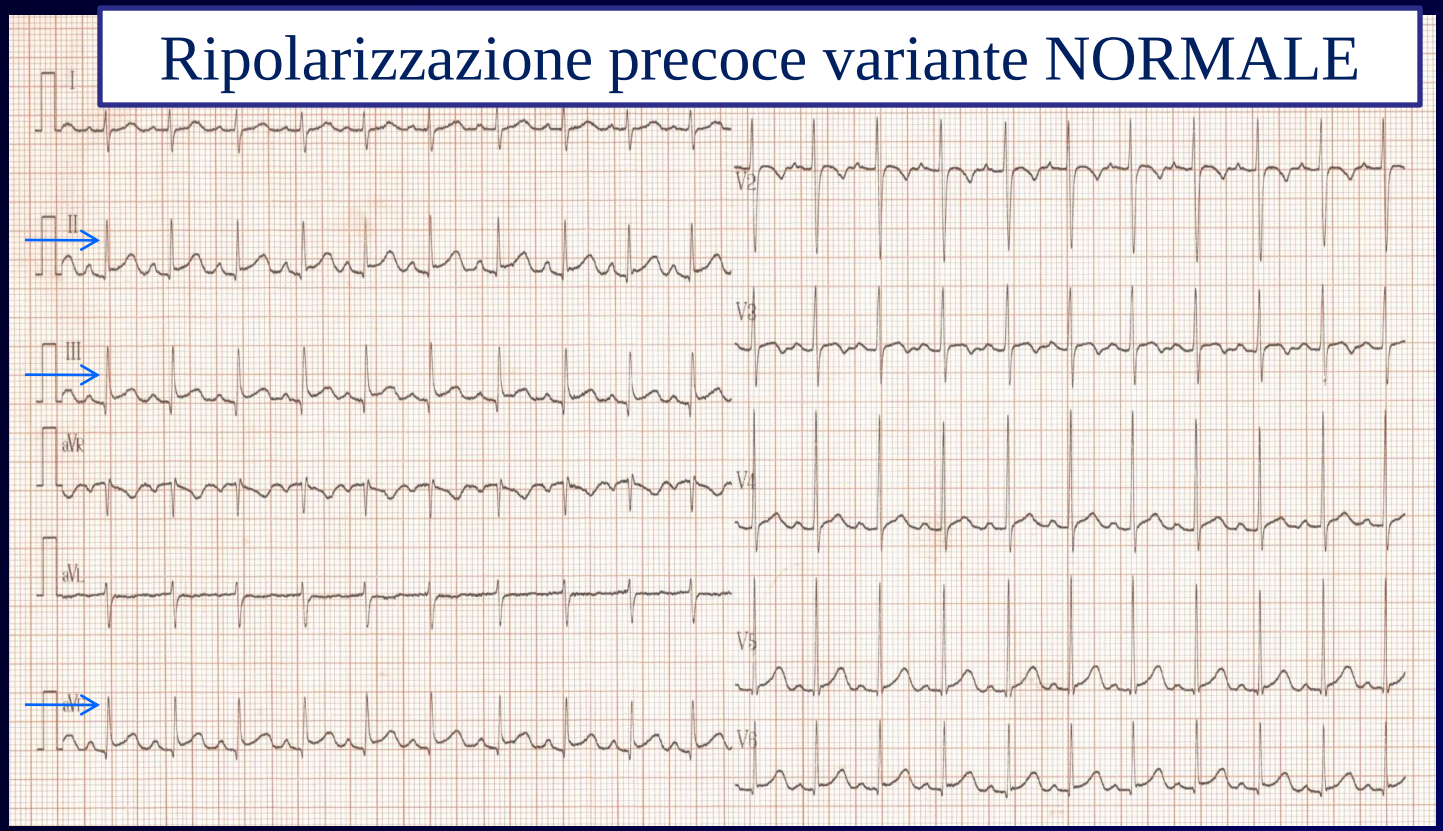
Il tratto ST è rappresentato da un segmento orizzontale “isoelettrico” stessa linea del tratto PR e TP

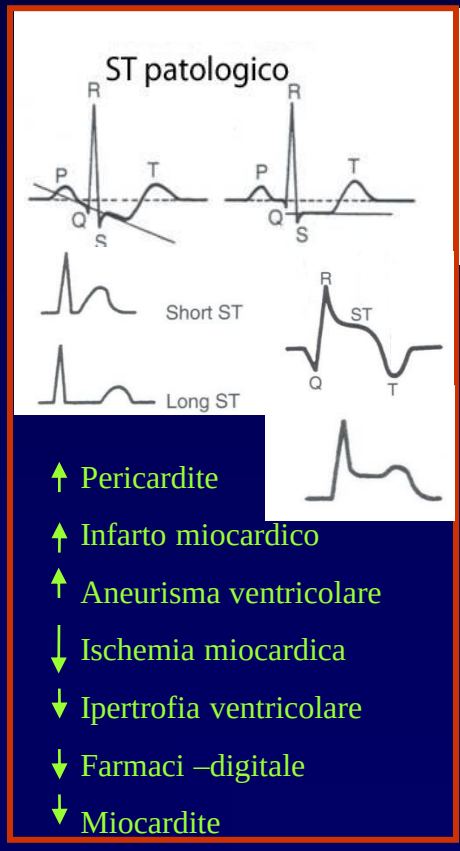
Ripolarizzazione precoce variante NORMALE

Tratto ST- T ripolarizzazione ventricolare

Il tratto ST è rappresentato da un segmento orizzontale "isoelettrico" stessa linea del tratto PR e TP

Ripolarizzazione precoce variante NORMALE

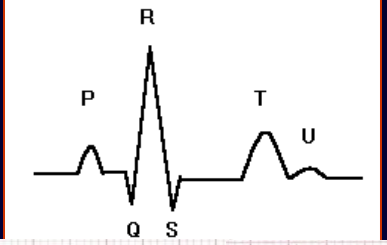


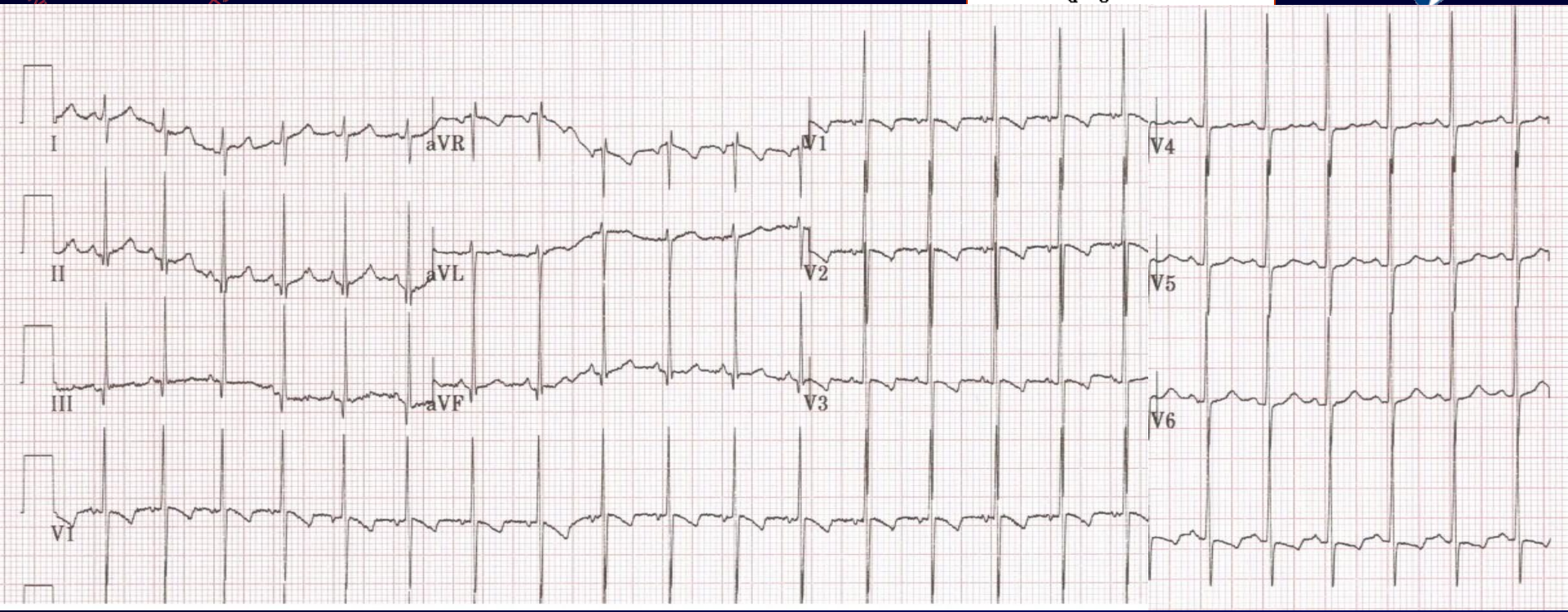


- ↑ Pericardite
- ↑ Infarto miocardico
- ↑ Aneurisma ventricolare
- ↓ Ischemia miocardica
- ↓ Ipertrofia ventricolare
- ↓ Farmaci –digitale
- ↓ Miocardite

- Sono anormali sopralivellamenti o sottolivellamenti:

ONDA T





Morfologia Dopo I^ settimana

negativa in V1, V2,V3R, V4R e positiva in V5-V6

negativa in V1, V2,V3 8-10 aa o fino adolescenza

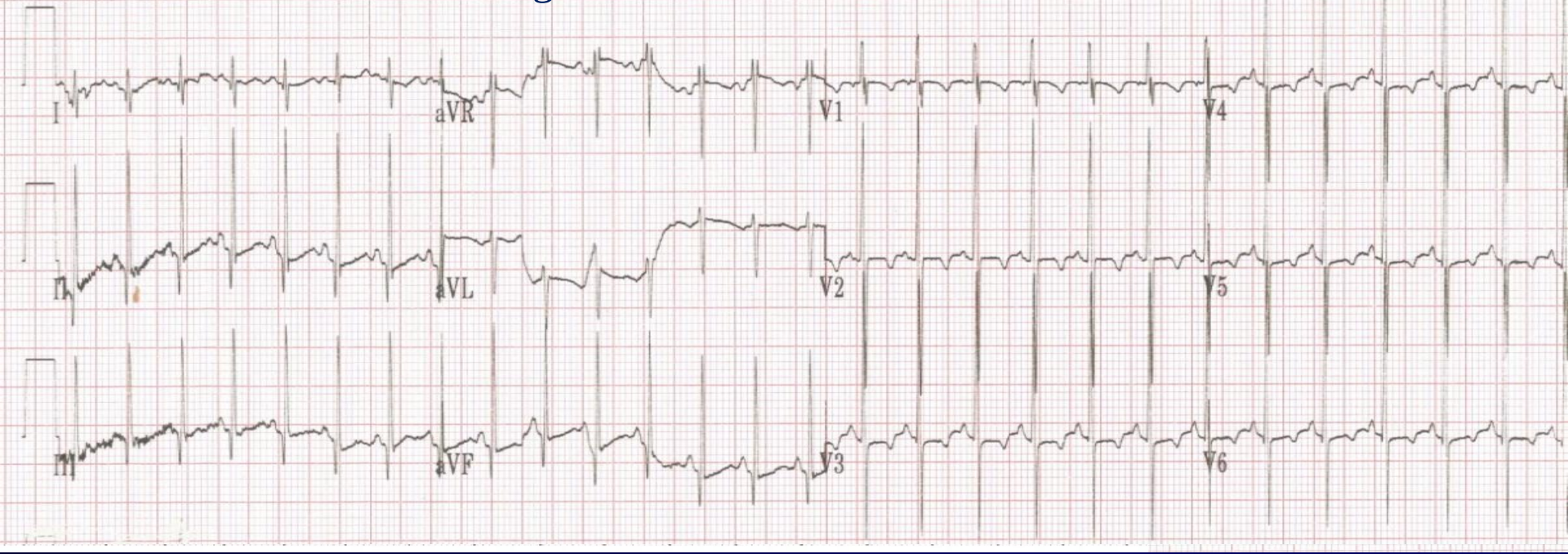
Ampiezza

–Derivazioni periferiche <6 mm

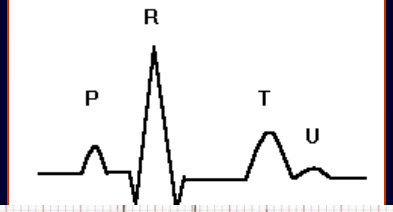
–Derivazioni precordiali <10 mm

ONDA T

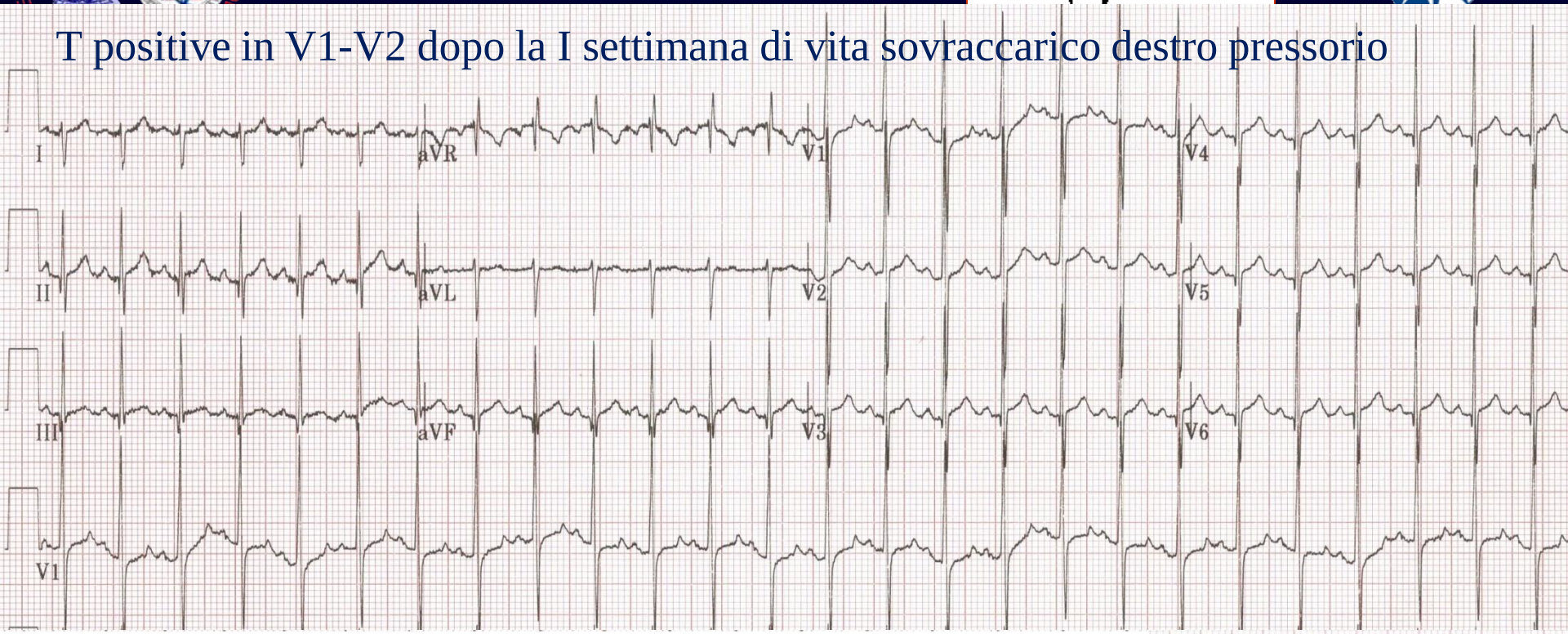
T negative da V1 a V6 sovraccarico volumetrico destro



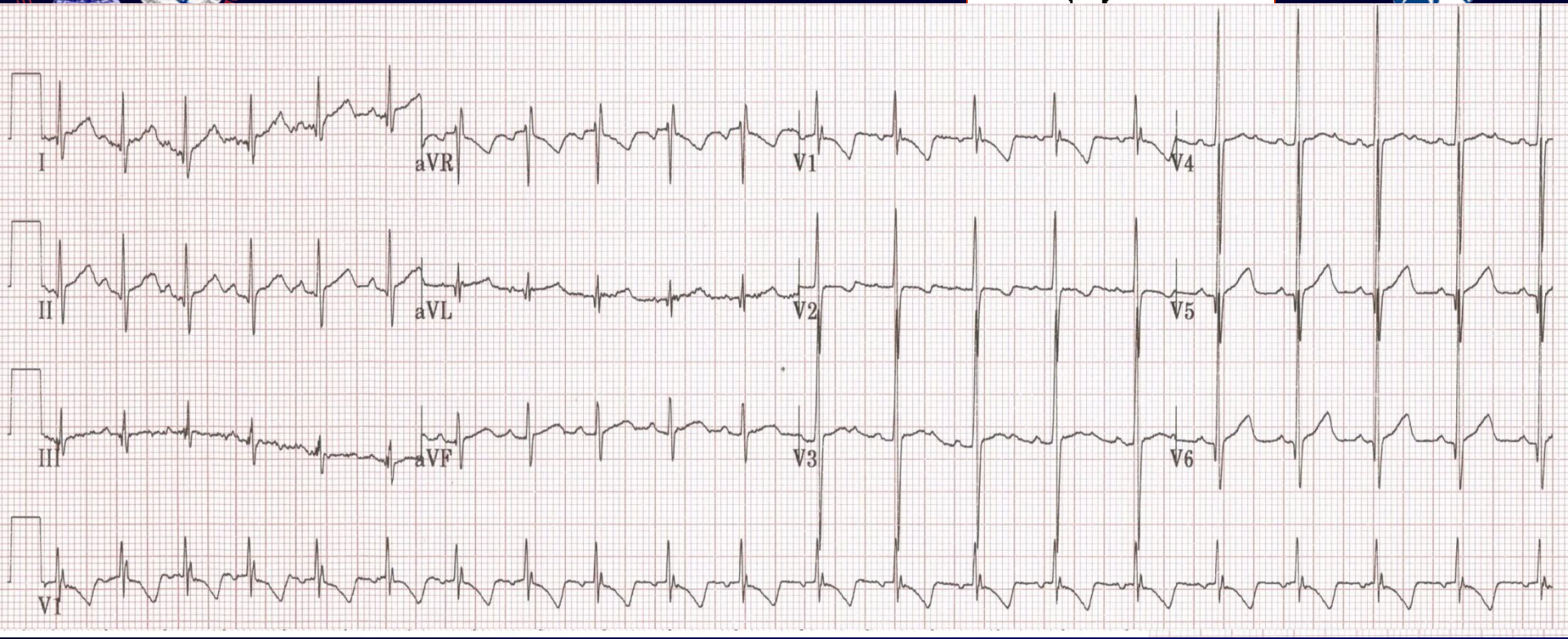
ONDA T



T positive in V1-V2 dopo la I settimana di vita sovraccarico destro pressorio



ONDA T



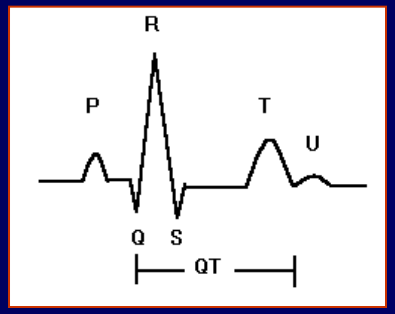
ONDA U

Rappresenta (opinioni controverse):

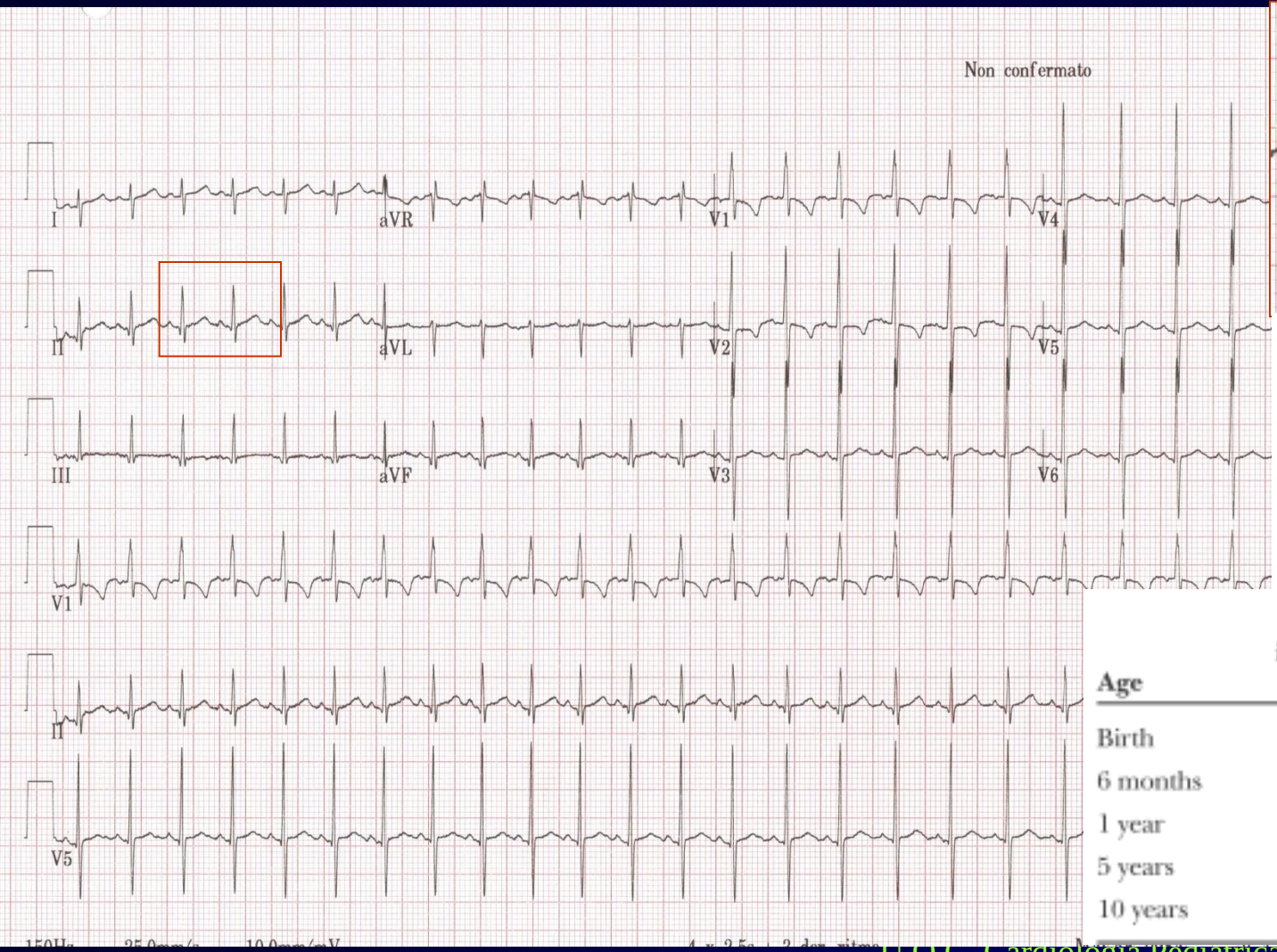
- Postpotenziali del muscolo ventricolare
- Ripolarizzazione delle fibre del Purkinje
- Onde U patologiche ipokaliemia

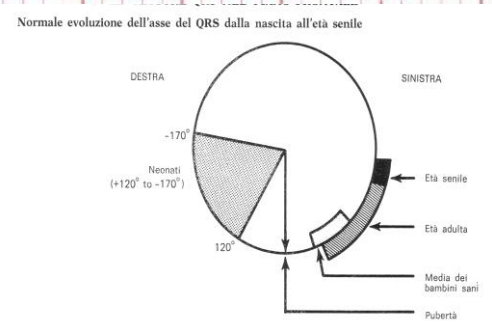
Intervallo QT

- È misurato dall'inizio del QRS al termine della T
- La sua durata è funzione della frequenza, pertanto viene misurato con la formula di Bazett $QT_C = QT/\sqrt{RR}$ (in sec)
- Le derivazione che meglio si prestano alla misurazione sono II-V5-V6
- QT corretto normale è $\leq$ 440 e $\geq$ 300-320 msec

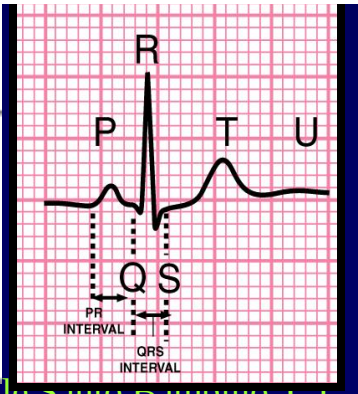


Quindi per un corretto approccio all'elettrocardiogramma bisogna...



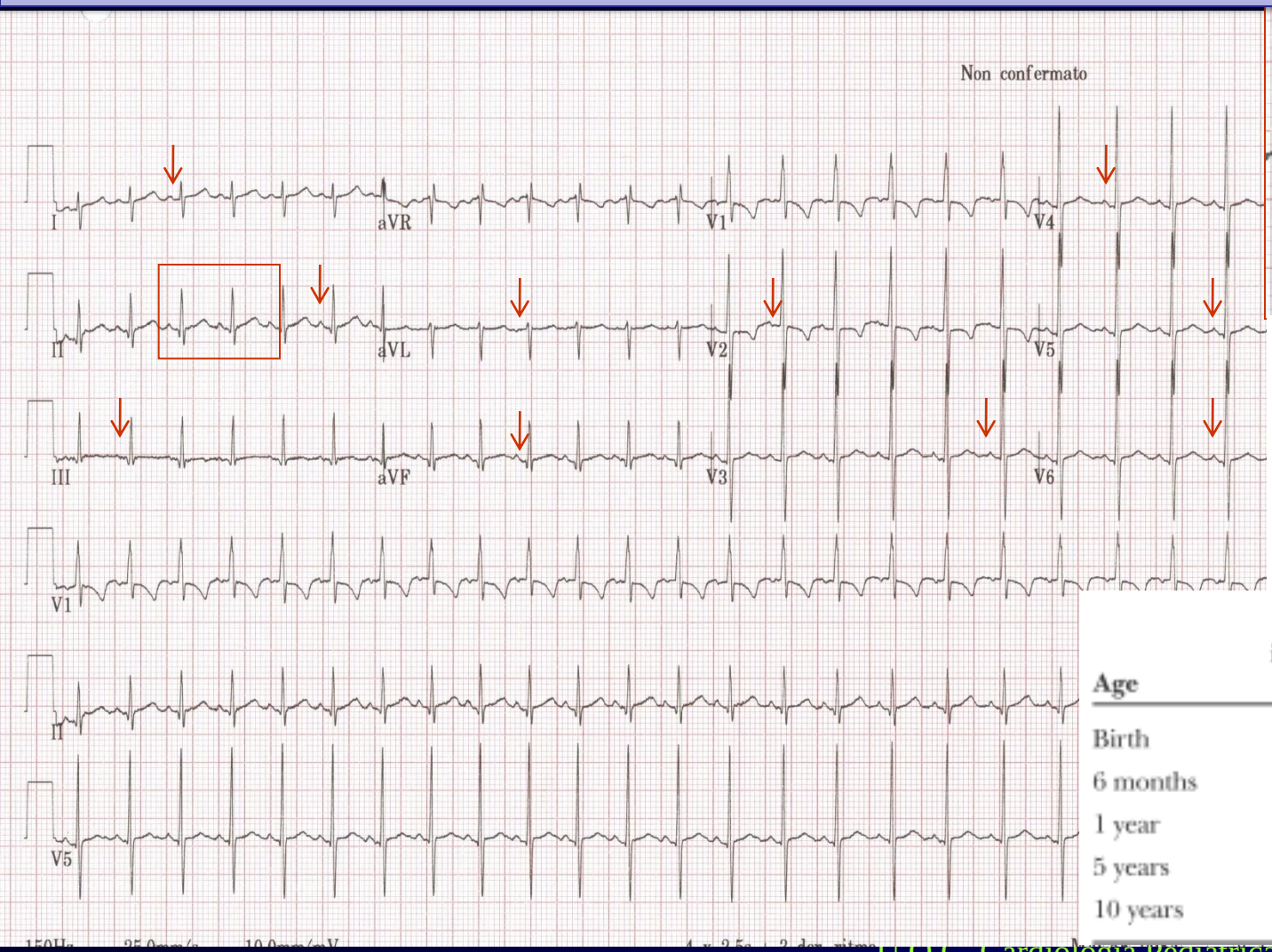


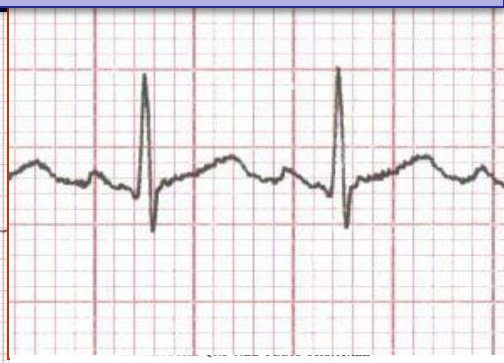
Age	PR interval (ms)
Birth	80-160
6 months	70-150
1 year	70-150
5 years	80-160
10 years	90-170

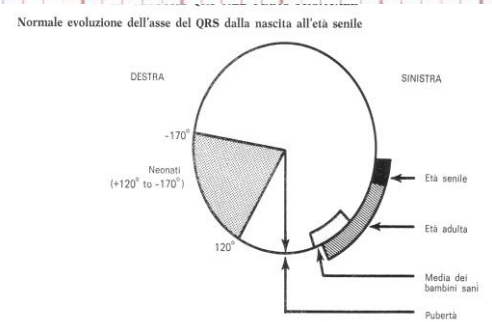


Quindi per un corretto approccio all'elettrocardiogramma bisogna...

Ricercare l'onda P e definire il ritmo







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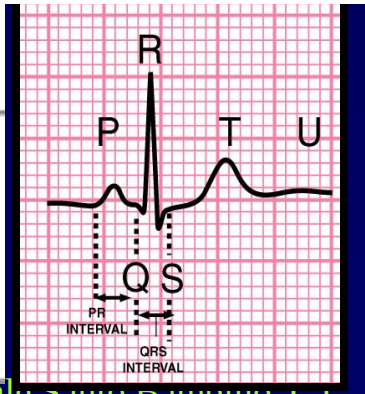
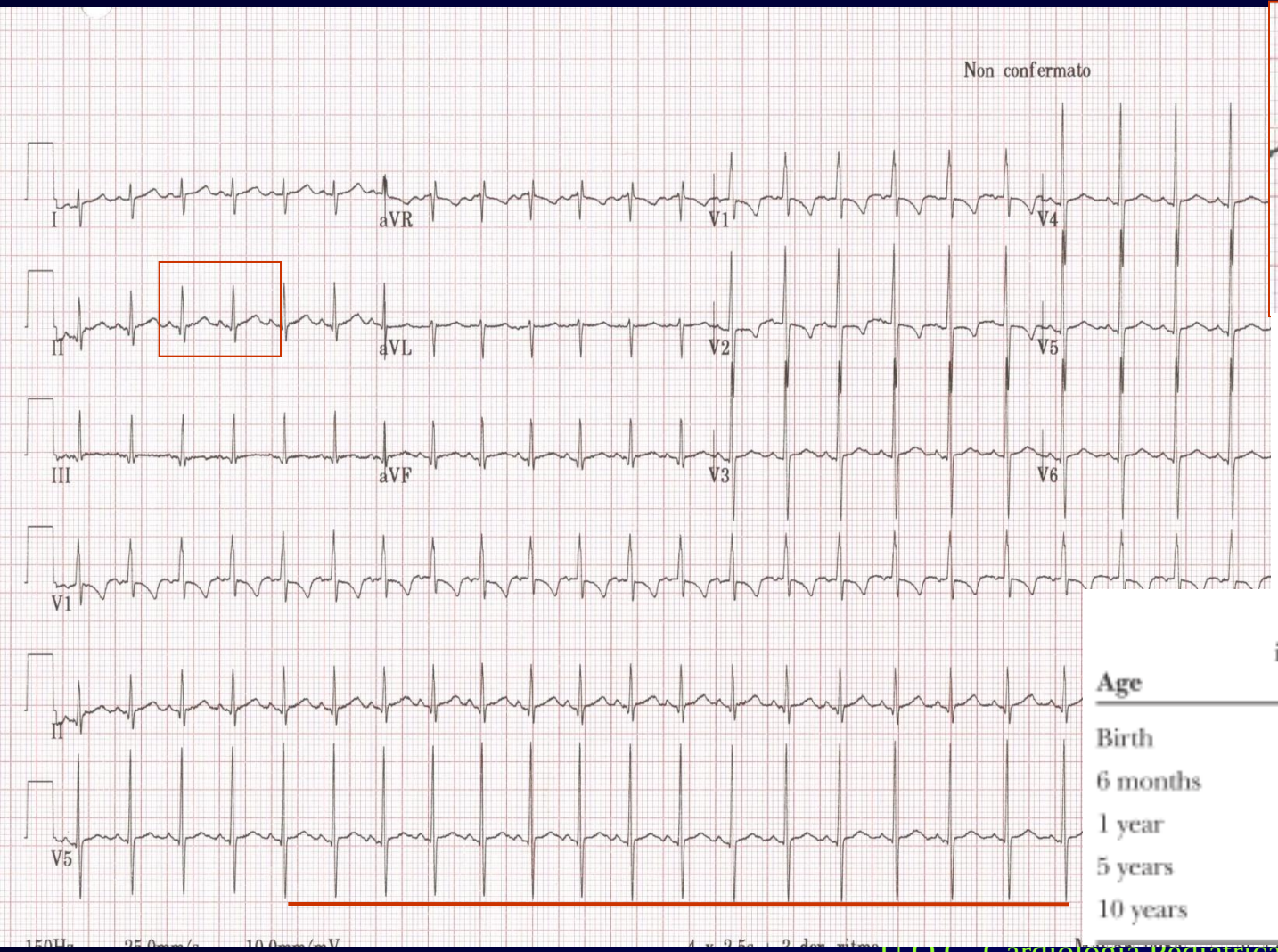
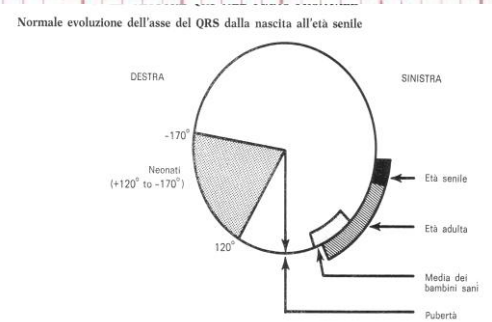


Quindi per un corretto approccio all'elettrocardiogramma bisogna...

Calcolare la frequenza cardiaca v.-n 110-180 bpm.





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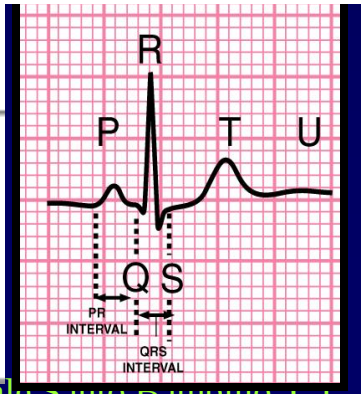
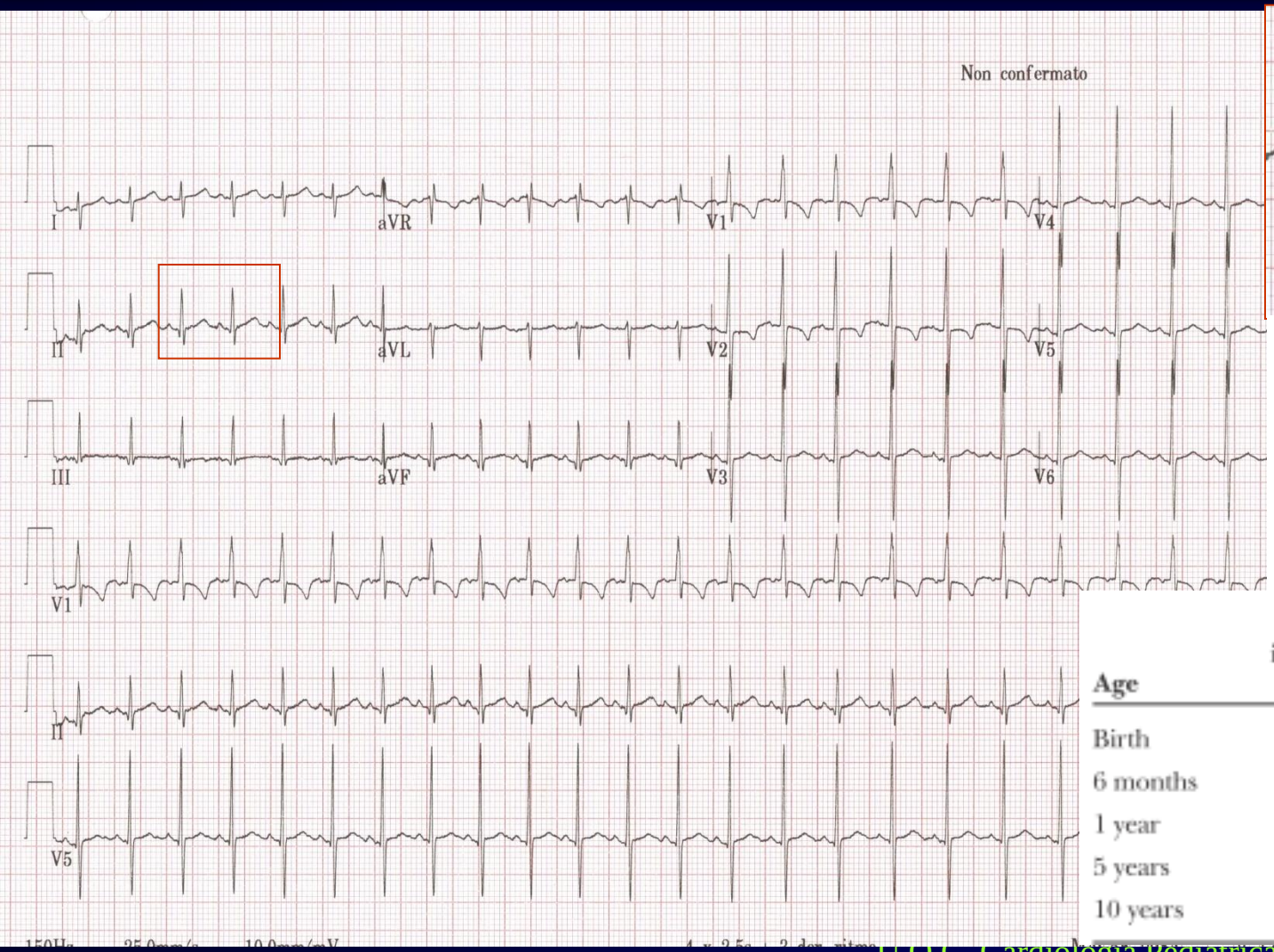
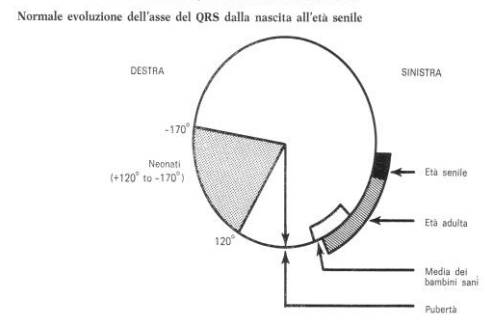


Quindi per un corretto approccio all'elettrocardiogramma bisogna...

Calcolare il tempo di conduzione atrioventricolare (V.N. 0.08-0.18 sec)





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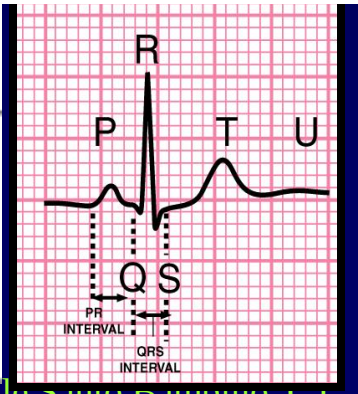
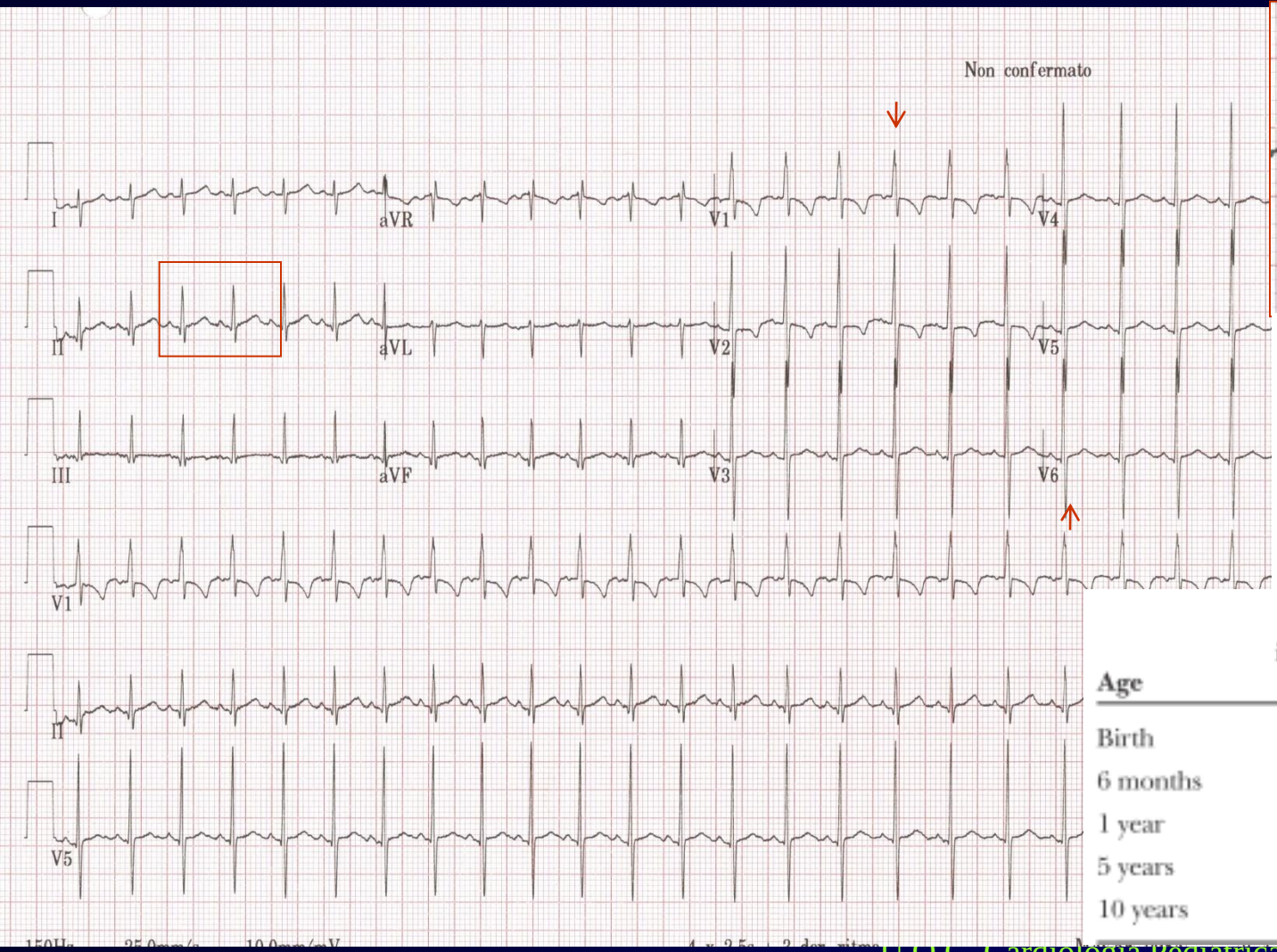
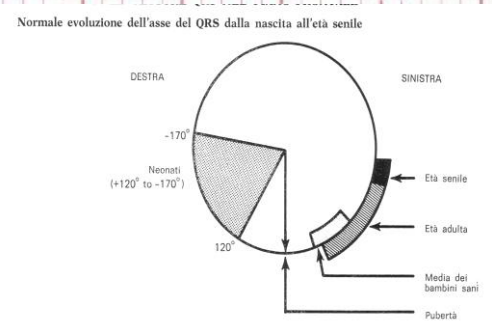


Quindi per un corretto approccio all'elettrocardiogramma bisogna...

Morfologia ed asse del QRS (solo 1a settimana 180°-210°)





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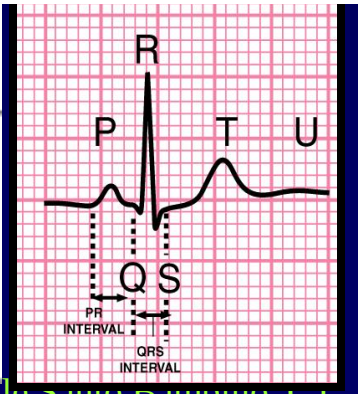
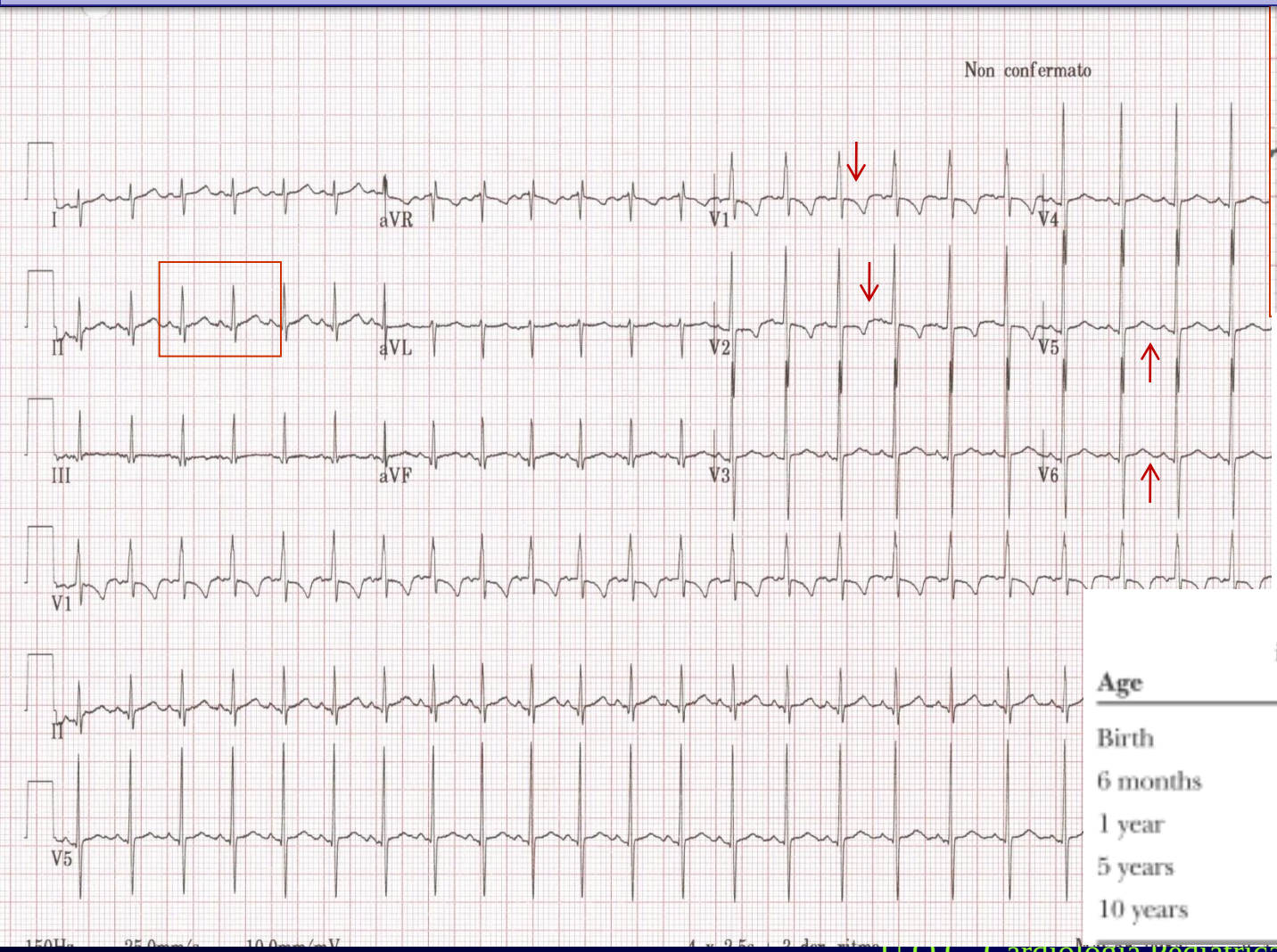
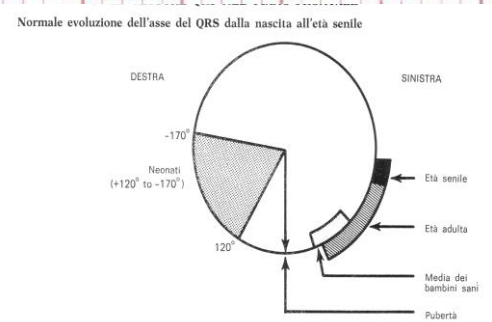


Quindi per un corretto approccio all'elettrocardiogramma bisogna...

Valutare la morfologia dell'onda T





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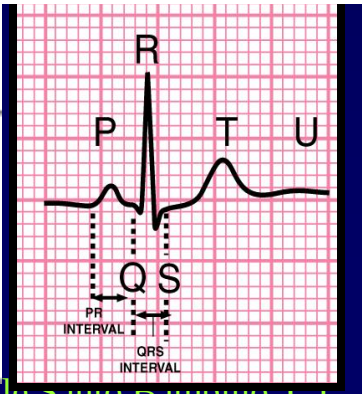
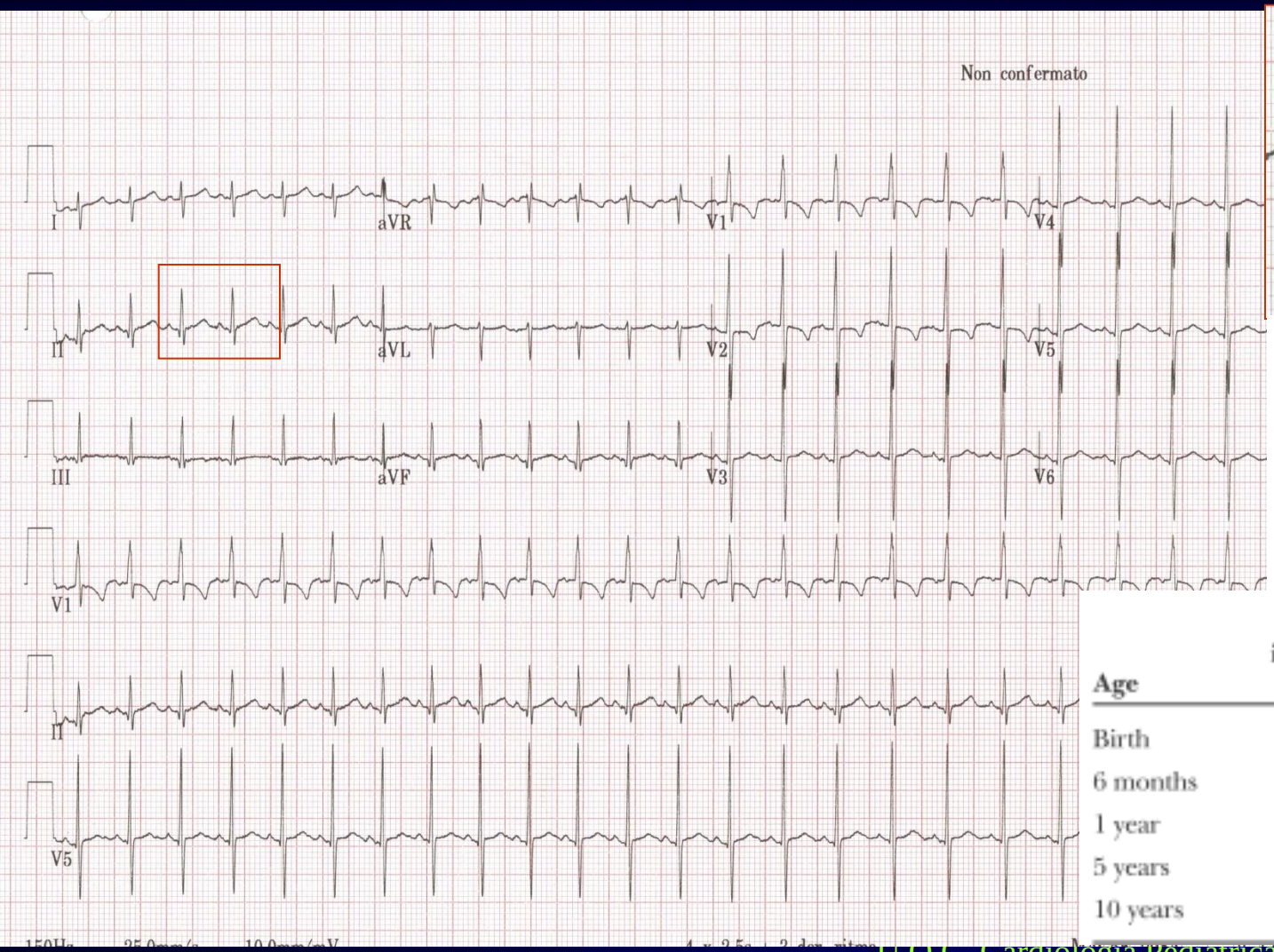
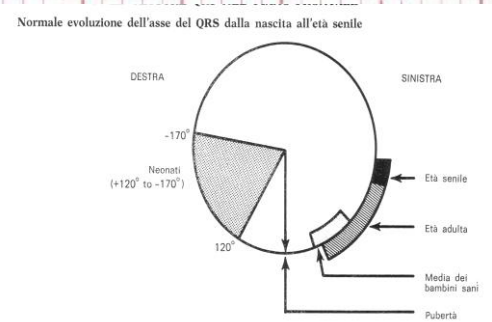


Quindi per un corretto approccio all'elettrocardiogramma bisogna...

Calcolare il QT corretto > 300-320 msec < 440 msec





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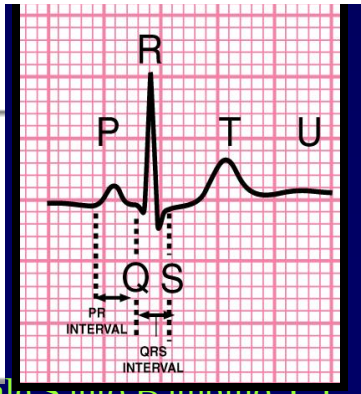

Grazie!

Francesco De Luca, Agata Privitera

U.O. C. di Cardiologia Pediatrica, Ospedale Santo Bambino CATANIA

www.cardiologiapediatricact.com