

Introductie ECG

Jonas de Jong

zoeken

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[overleg](#)

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[geschiedenis](#)

Hoofdpagina

Welkom bij ECGpedia, een [wiki](#) electrocardiografie (ECG) cursus en tekstboek gericht op artsen en verpleegkundigen. Er is ook een [Engelstalige](#) versie van deze site die op sommige complexere onderwerpen dieper ingaat.

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voorbeeld ecg's

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De ECG cursus



Ga naar de ECG cursus voor de Grondbeginselen en

- het 7+2 stappenplan:
 1. Ritme
 2. Hartfrequentie
 3. Geleidingstijden
 4. Hartas
 5. P top
 6. QRS morfologie
 7. ST morfologie
- Download en print dit handige [ECG zakkaartje](#) als PDF (verbeterde versie van april 2009!, let op de printinstructies). U kunt er ook een laten toesturen.
- Powerpoint presentaties van ECG cursussen
- ECGpedia cursus in levende lijve



Het ECG zakkaartje  

Het ECG tekstboek



Bekijk het ECG Tekstboek met o.a.:

- [Het normale ECG](#)
- [De geschiedenis van het ECG](#)
- [Technische problemen](#)
- [Geleidingsstoornissen](#)
 - [AV geleiding](#)
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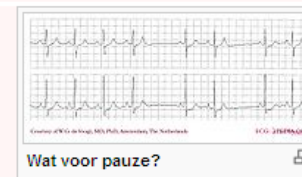
Casus



Casus:

- [Oefen ECG's](#)
- [Raad de culprit van deze infarct-ECG's](#)
- [Bijzondere ECG's](#)
- [Rhythm Puzzles van Prof. Dr. A.A.M. Wilde](#) (op de Engelstalige site)
- [Bekijk ook de case reports van Dr. De Voogt](#)
- [Het ECG archief van Dr. De Voogt](#) met meer dan 2000 ECG's is nu gerubriceerd en online op de Engelstalige site.

Casus van de maand



Basics van het ECG

Waarom?



- Screening: uitsluiten hartziekte
- Aantonen chronische hartziekte: LVH
- Diagnose acuut infarct
- Ritmestoornissen:
 - acuut: wel of niet klappen?
 - chronisch: boezemfibrilleren
- Risico-inschatting medicatiegebruik

Grondbeginselen

Vent. rate 81 BPM
PR interval 120 ms
QRS duration 80 ms
QT/QTc 376/436 ms
P-R-T axes 81 80 73

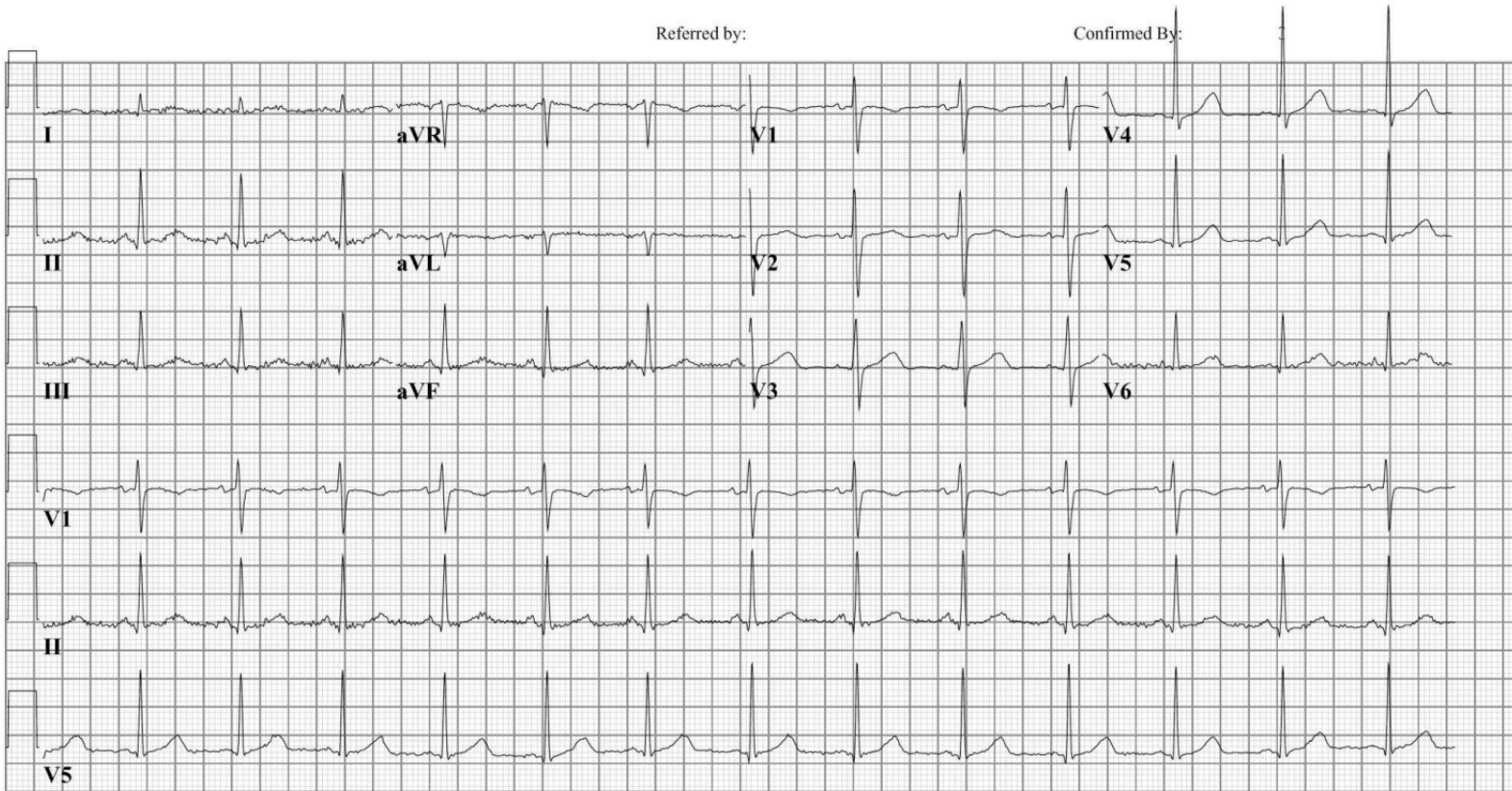
*** Leeftijds en geslacht specifieke ECG analyse ***
Normaal sinusritme
Normaal ECG
Geen oud ECG aanwezig

Loc:23

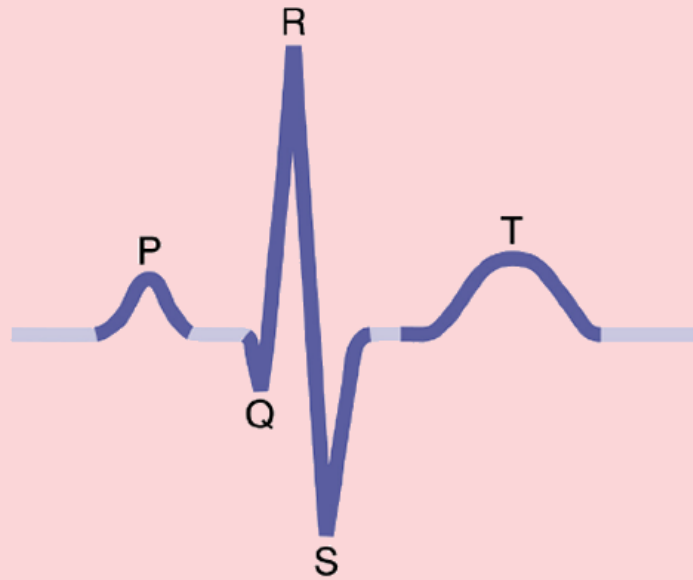
Technician:

Referred by:

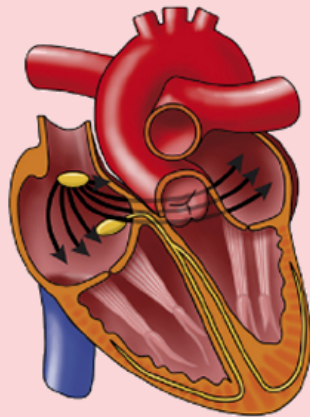
Confirmed By:



25mm/s 10mm/mV 40Hz 005E 12SL 233 CID: 10

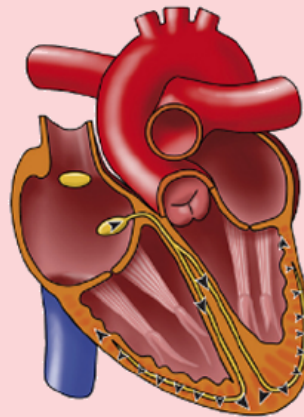


P golf



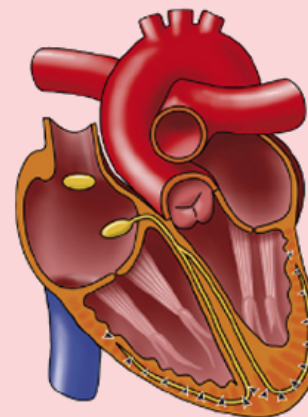
Activatie van
het atrium

QRS complex

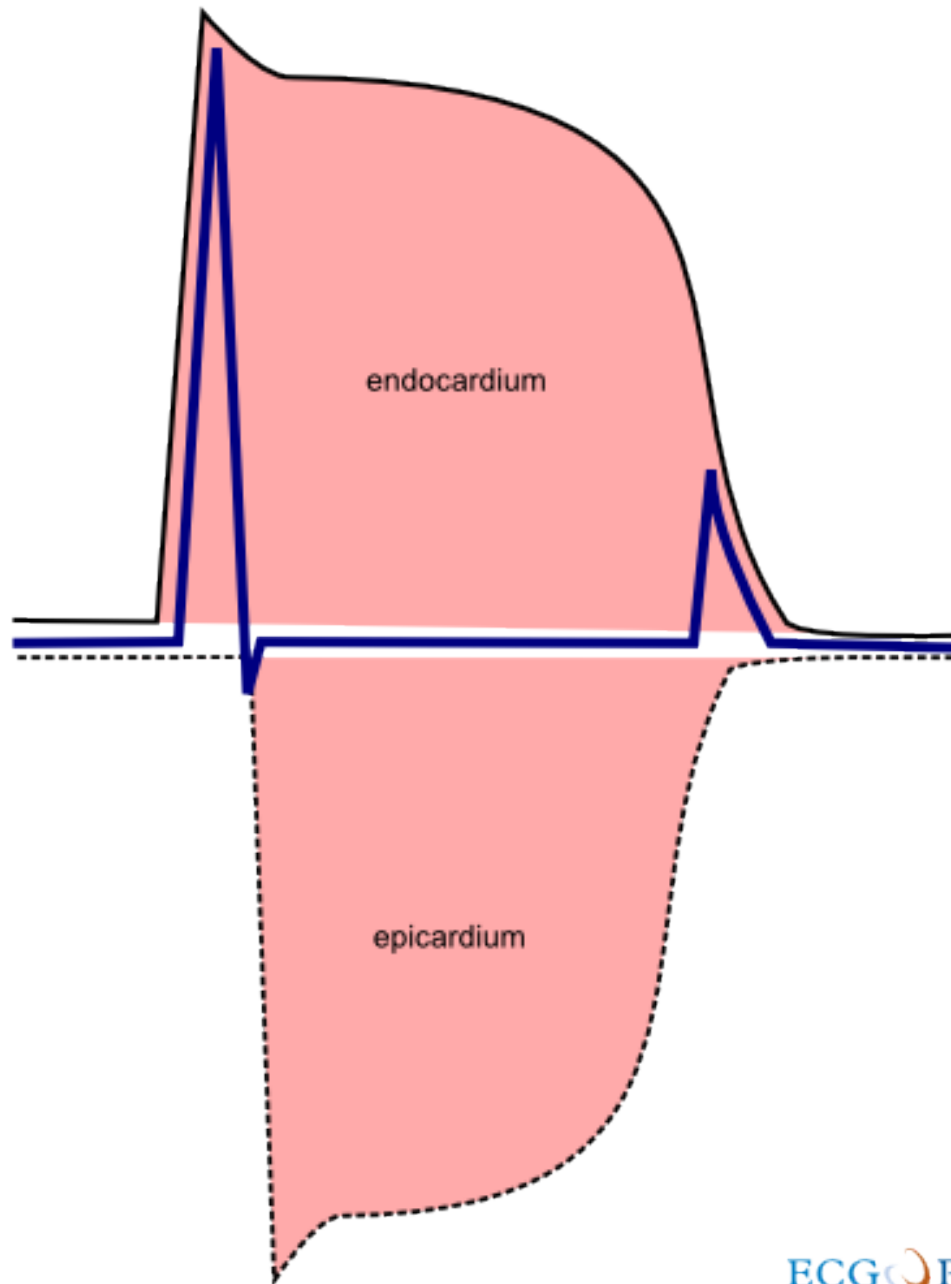


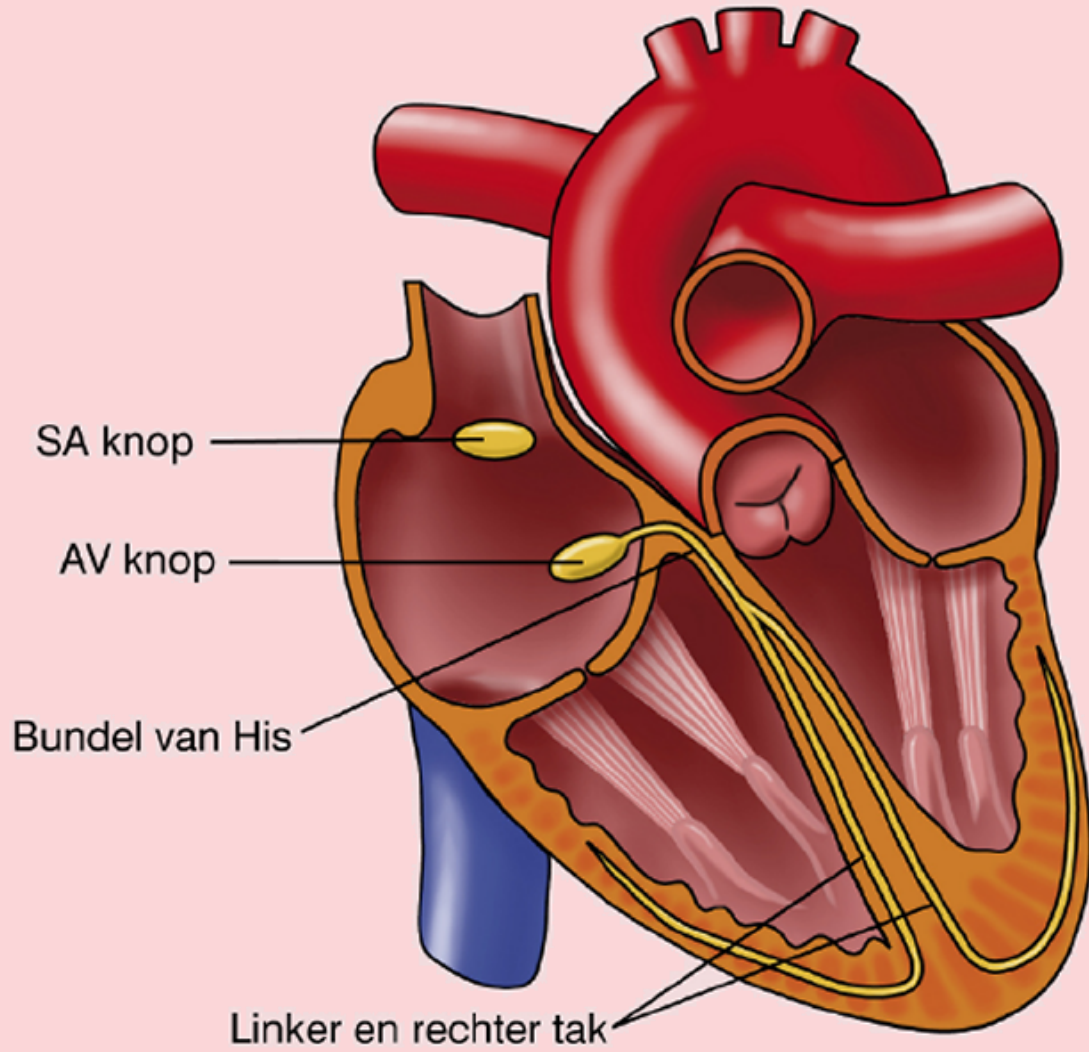
Activatie van
de ventrikels

T golf

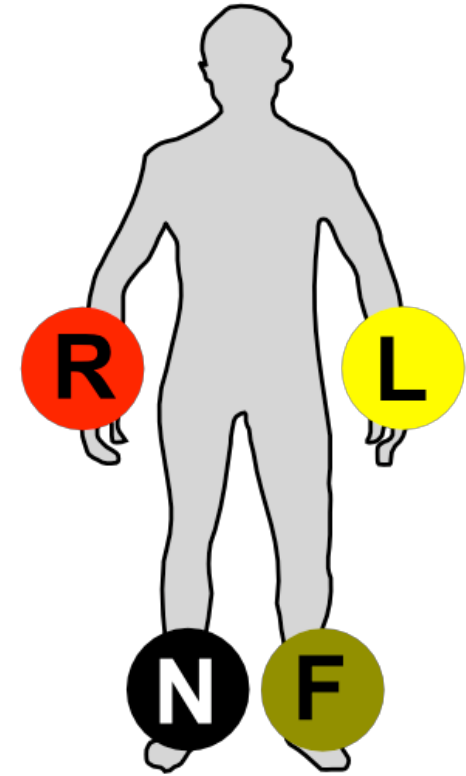
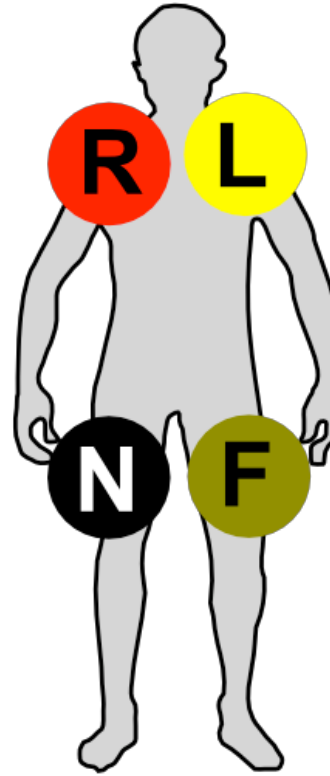
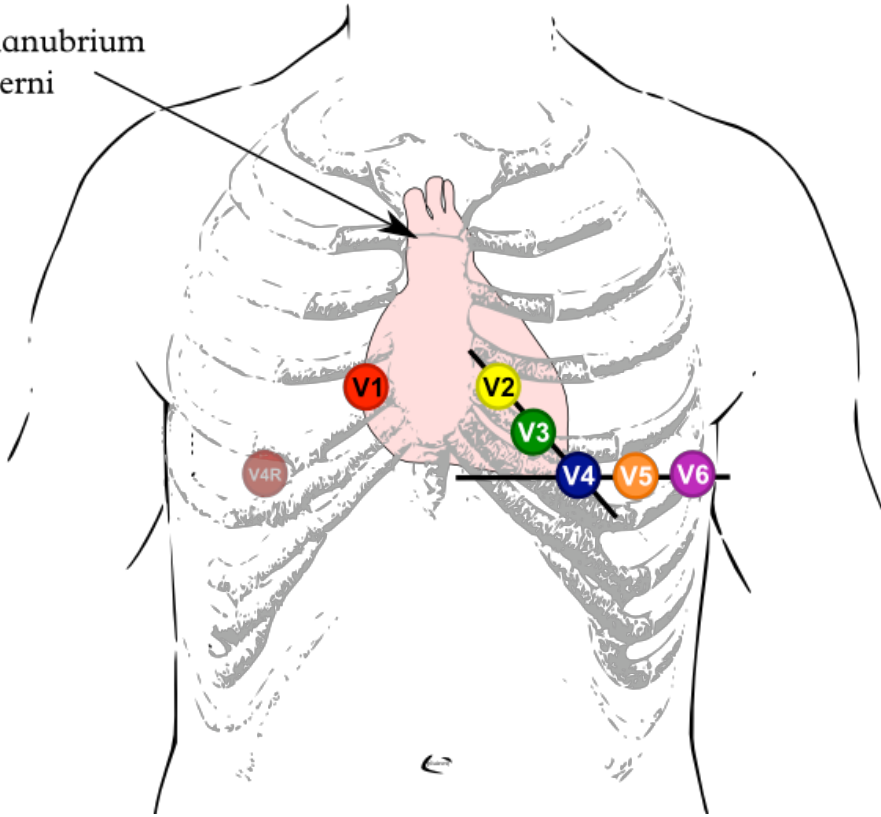


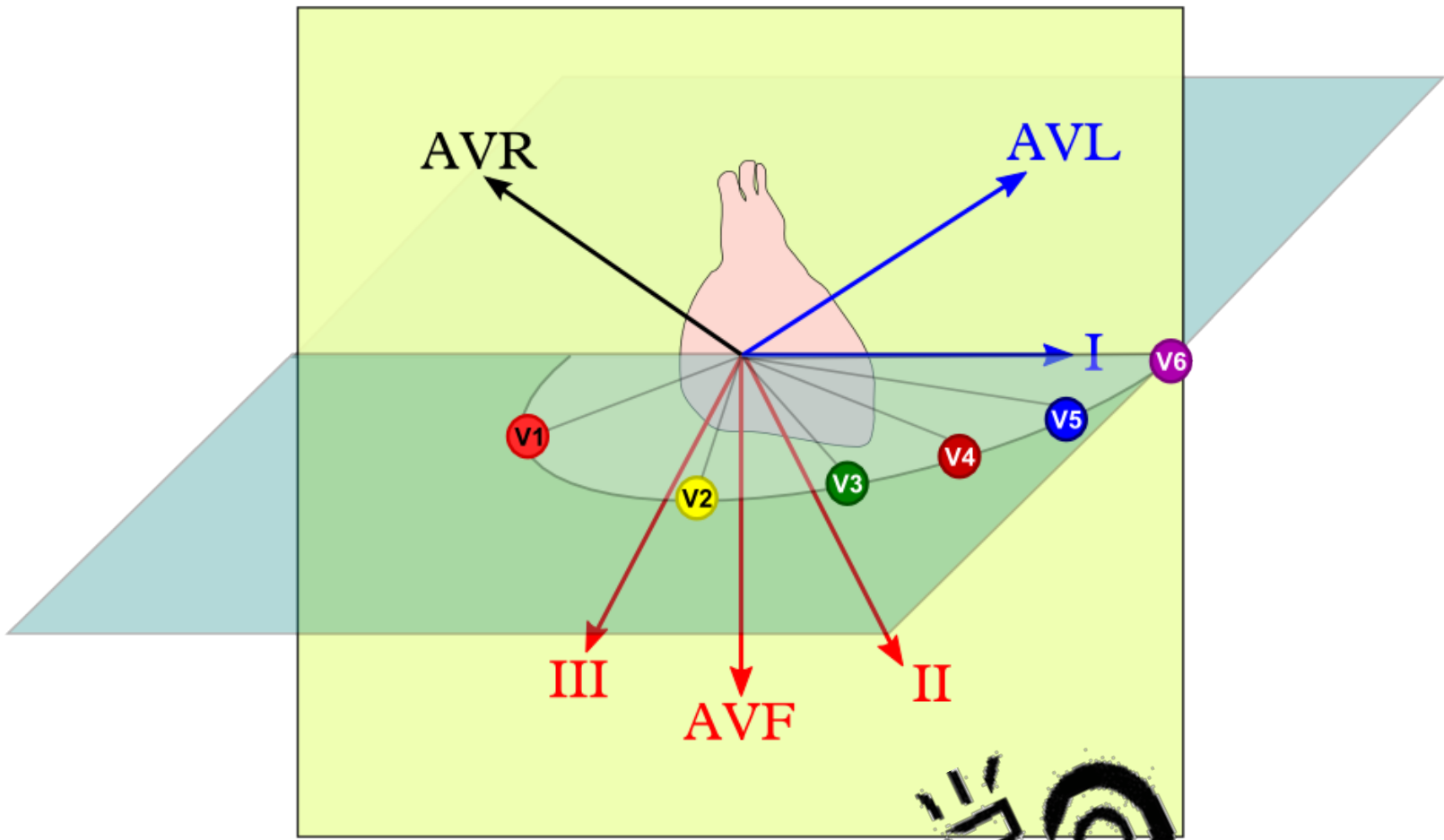
Herstel golf





Manubrium
Sterni



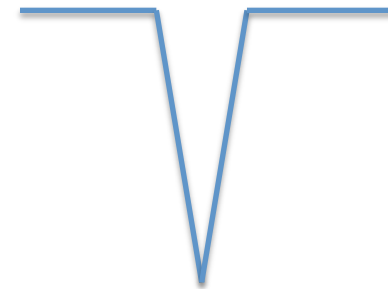




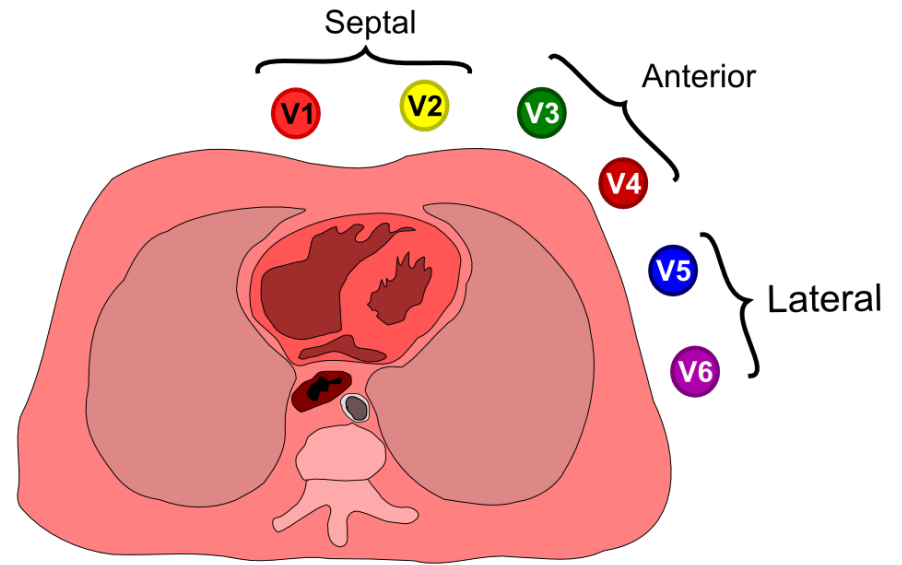
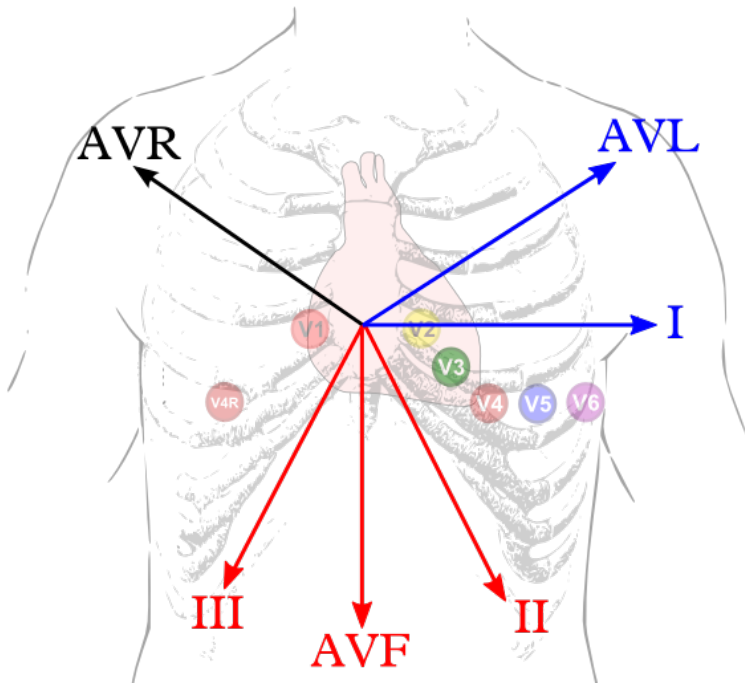
Positief complex



Iso-electrisch complex

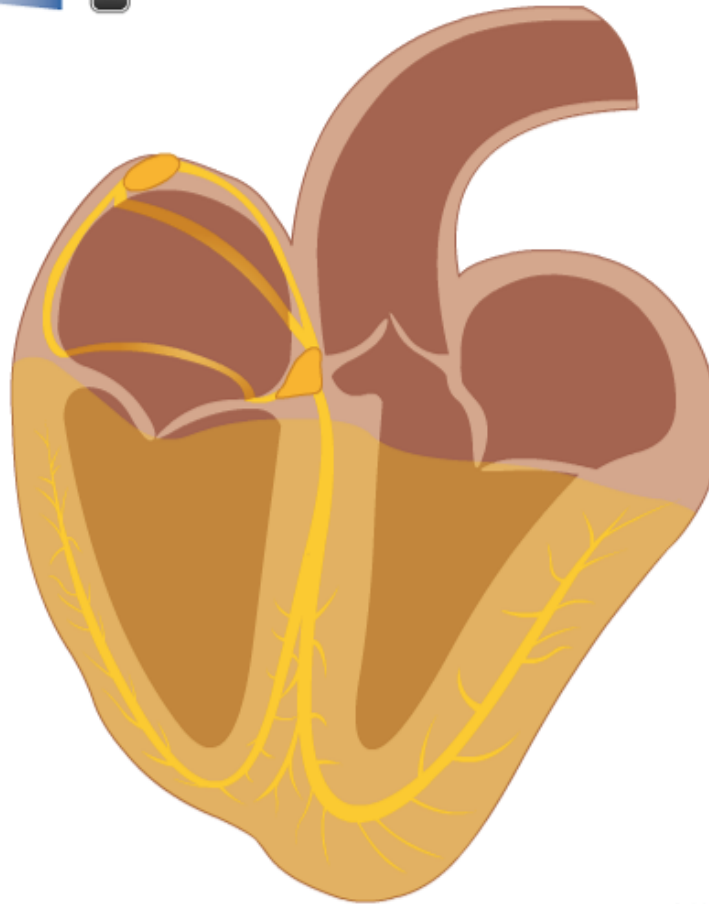
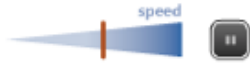


Negatief complex



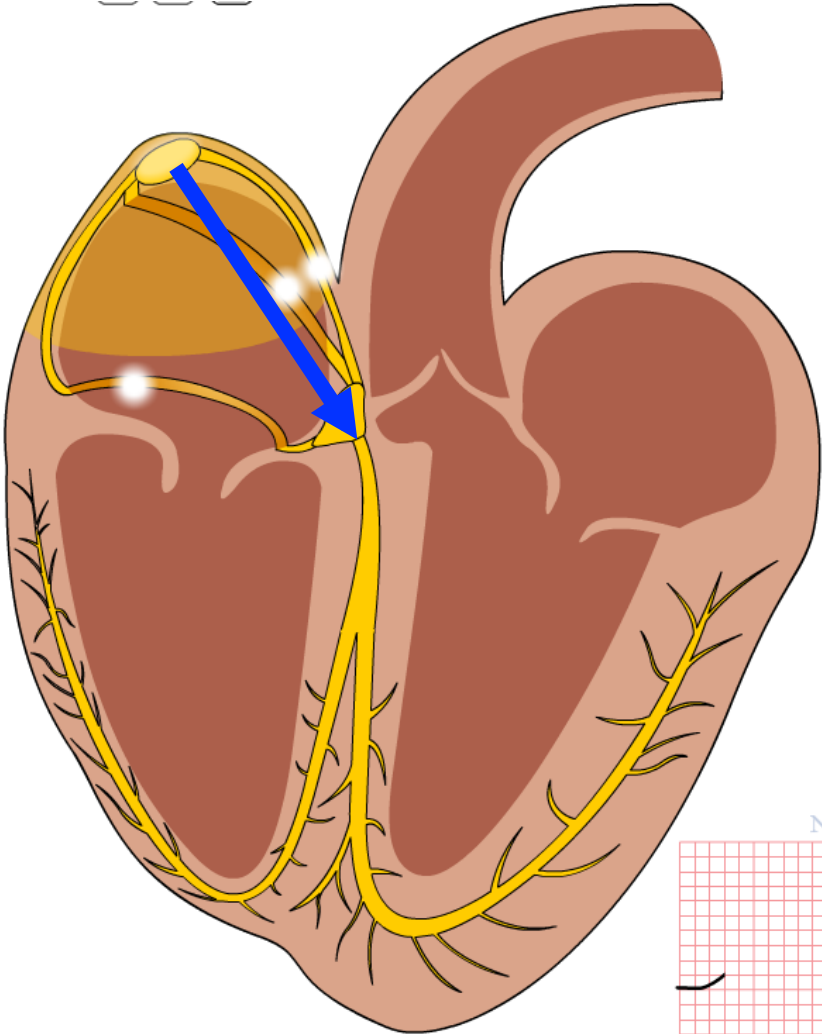
Bij elkaar horende afleidingen

I Lateraal	V1 Septaal
II Inferior	V2 Septaal
III Inferior	V3 Anterior
aVR Hoofdstam	V4 Anterior
aVL Lateraal	V5 Lateraal
aVF Inferior	V6 Lateraal

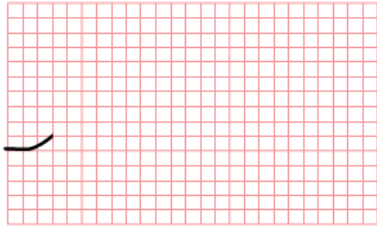


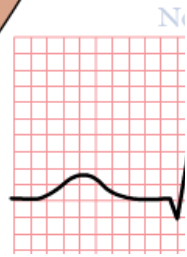
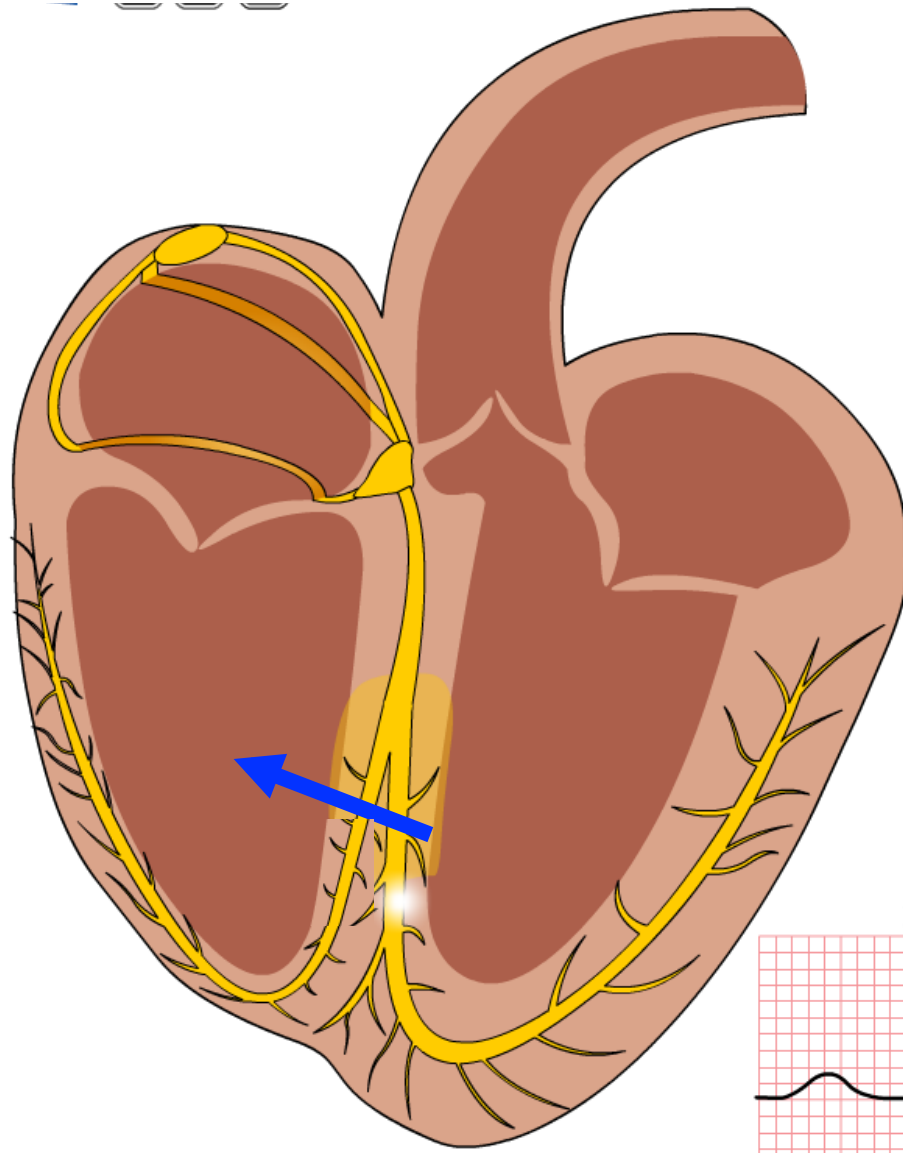
Normal Sinus Rhythm

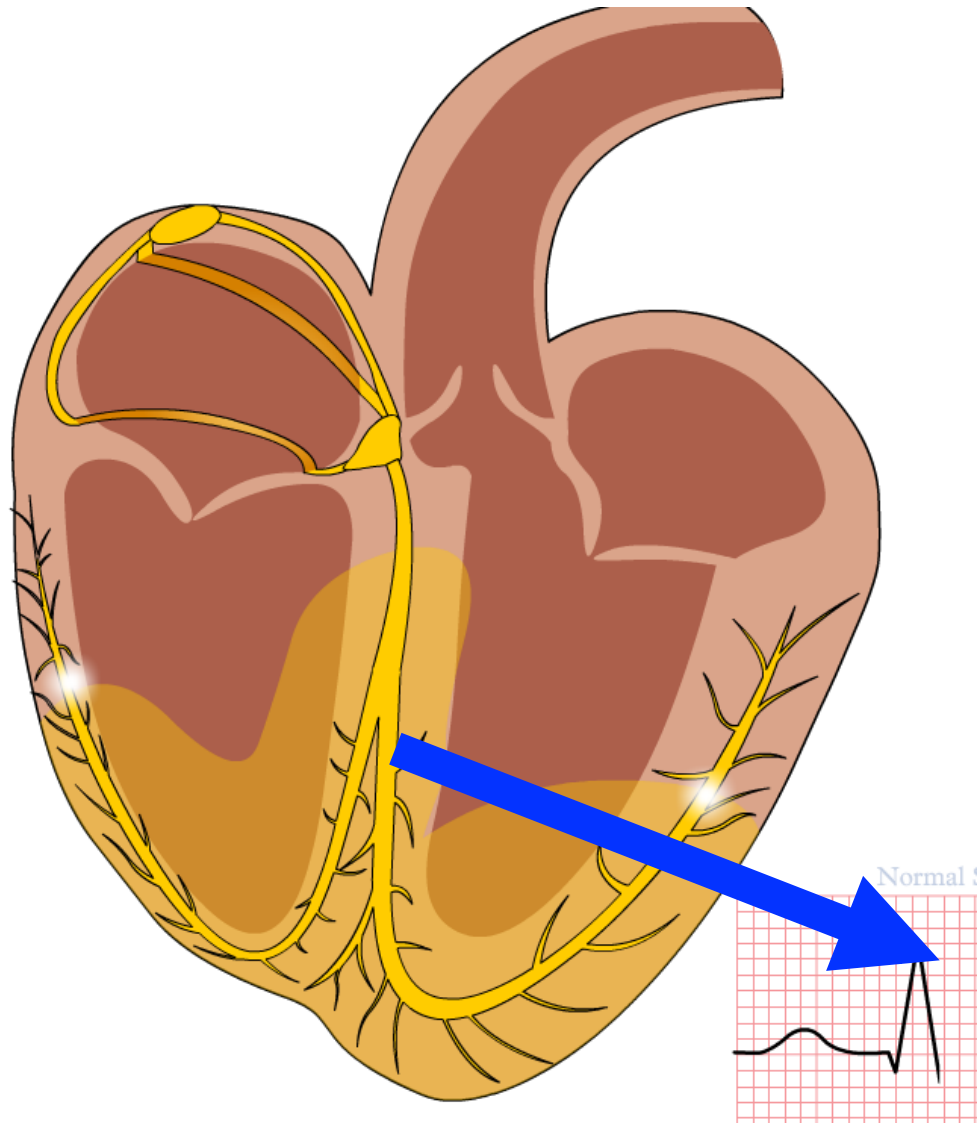


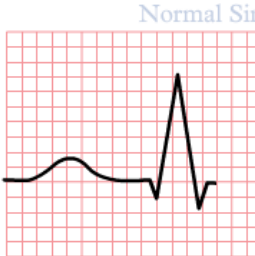
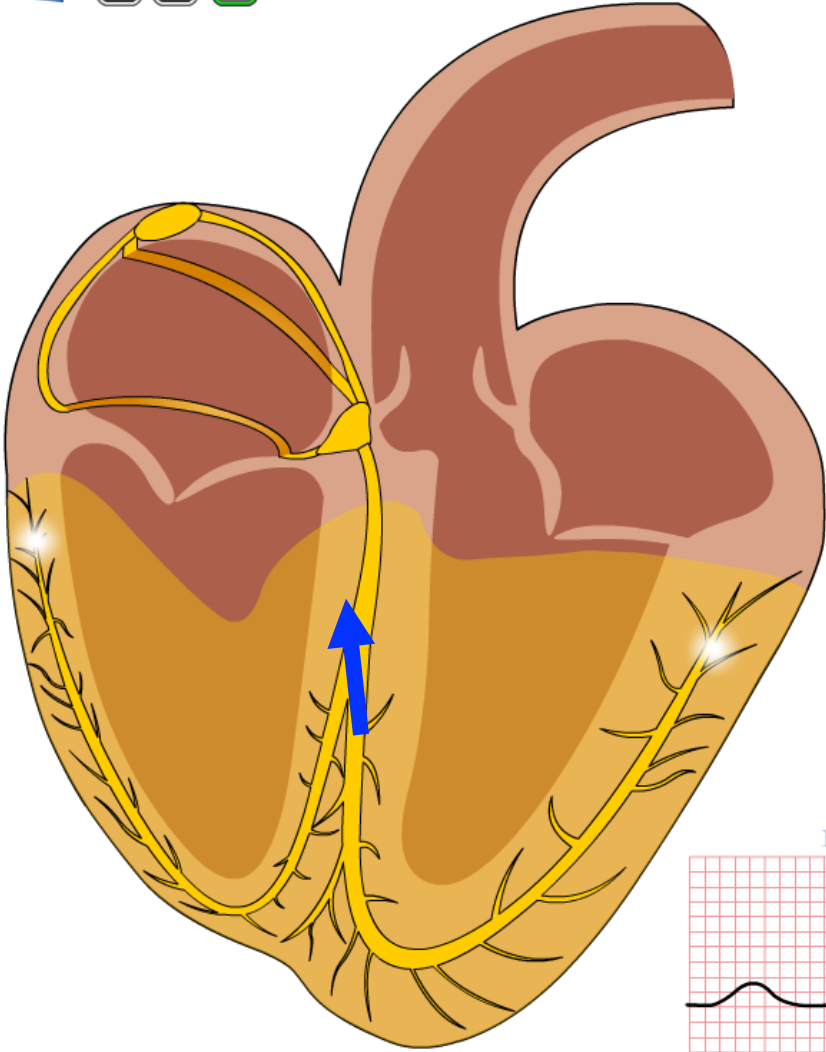


Normal Sinus Rhythm









SYSTEMATISCHE BEOORDELING

Systematische beoordeling

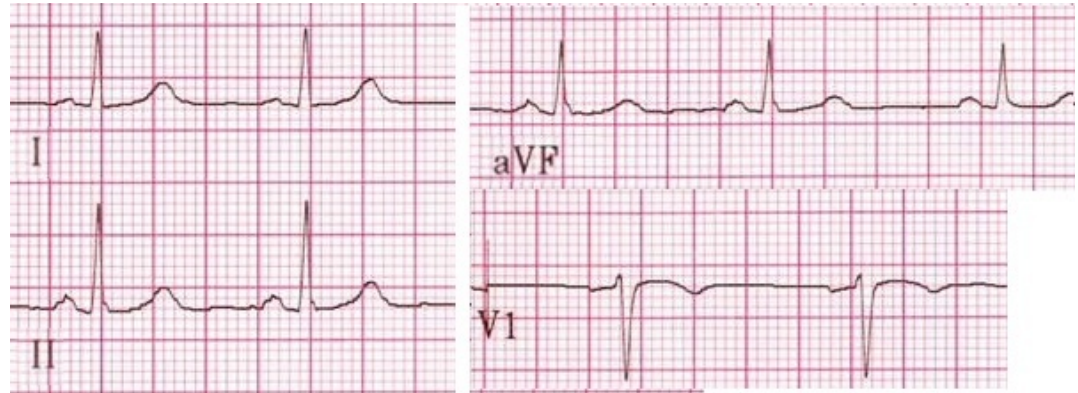
1. Ritme
2. Frequentie
3. Geleidingstijden
4. Hart-as
5. P top morfologie
6. QRS morfologie
7. ST morfologie

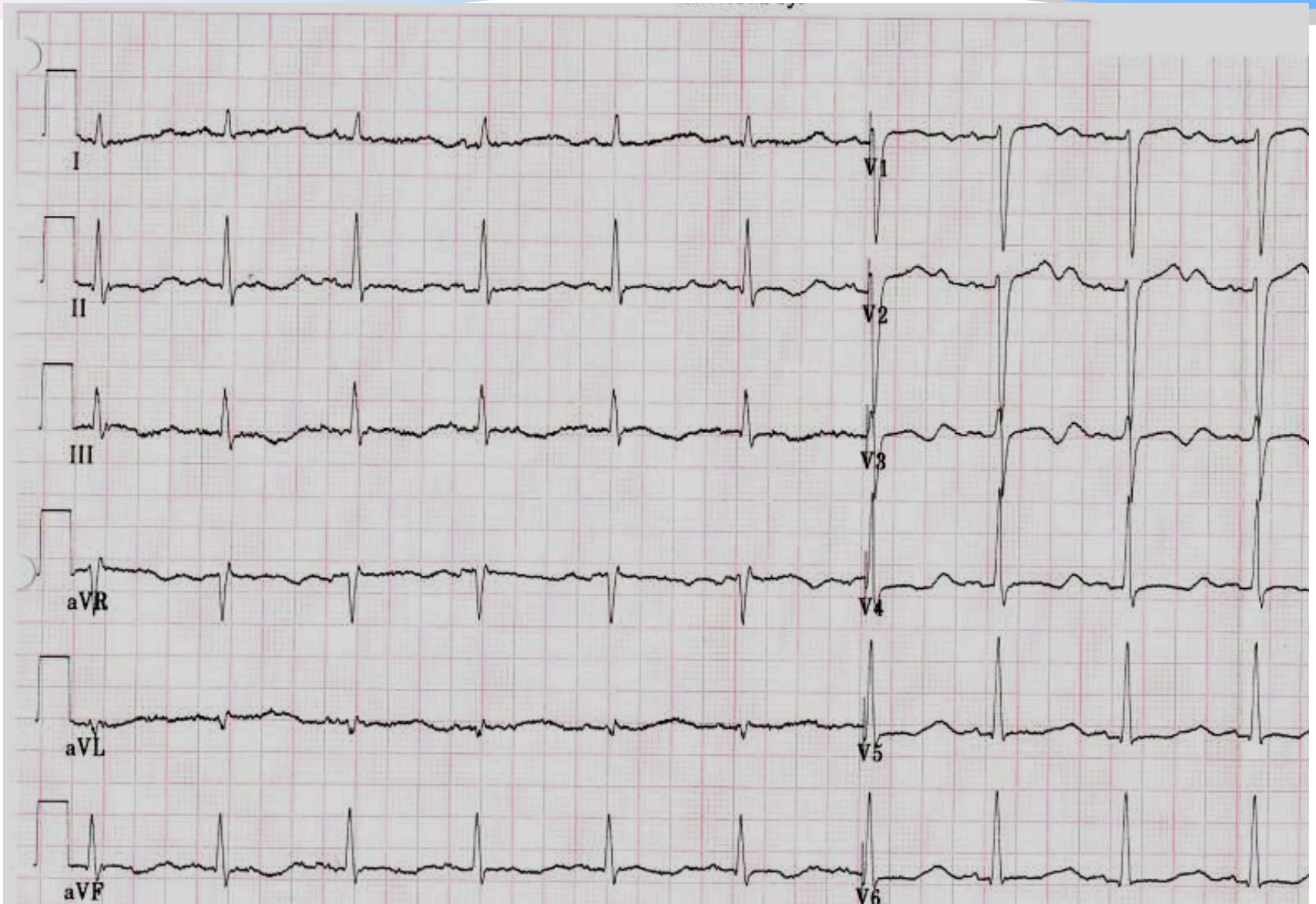
8. Vergelijking met oud ECG
9. Conclusie

1 Ritme

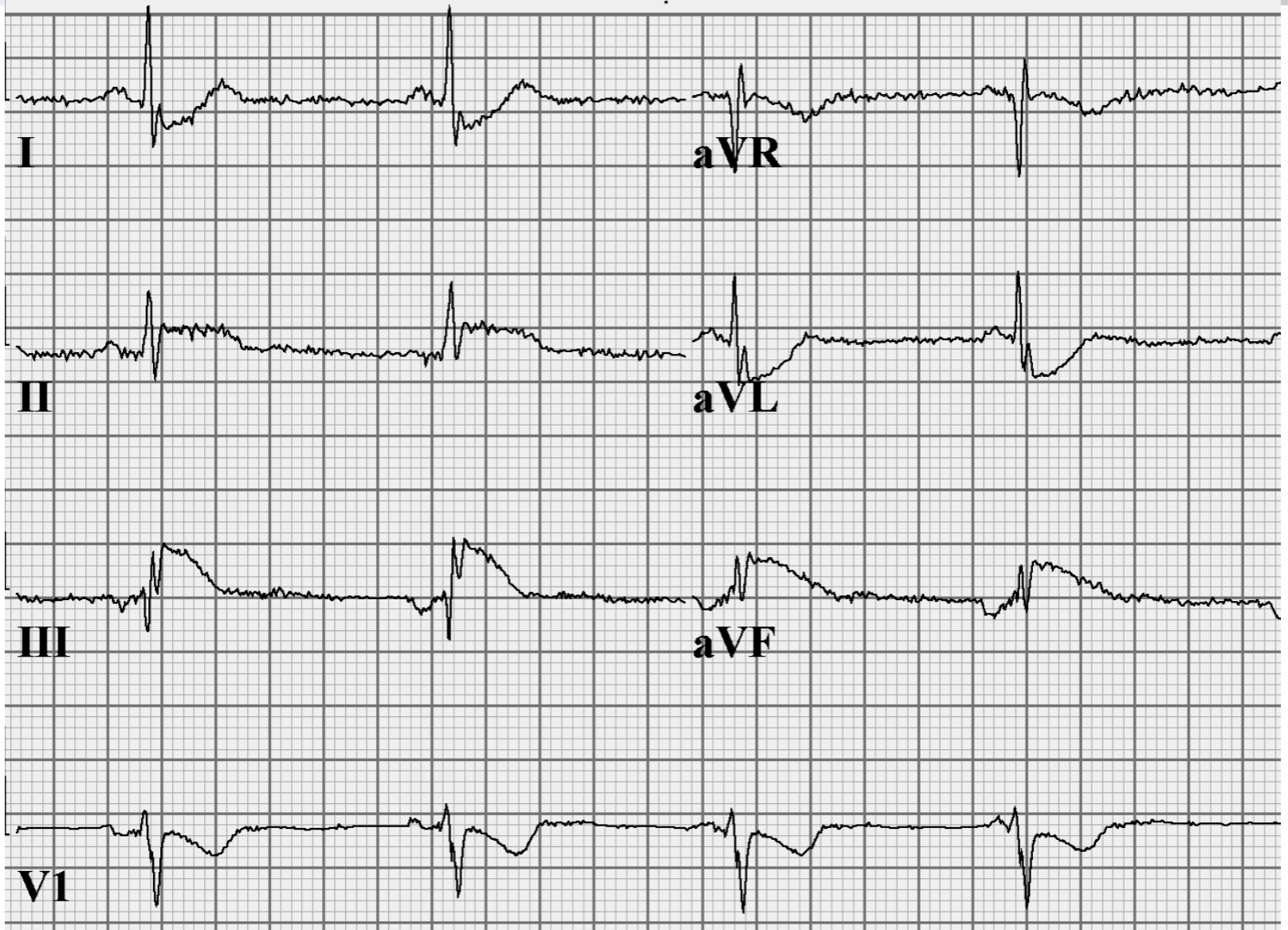
Eigenschappen van normaal sinusritme

- Op een P-top volgt meestal een QRS complex
- Het ritme is regelmatig, maar varieert licht met de ademhaling
- De **frequentie** ligt tussen de 60 en 100 / minuut.
- De p top is **positief in II** en **AVF**, en bifasisch in V1
- De **PQ tijd** is tussen de 0,12 en 0,2 seconden





Sinusritme?



Sinusritme?

2 Frequentie

3 methoden:

1. Aftelmethode

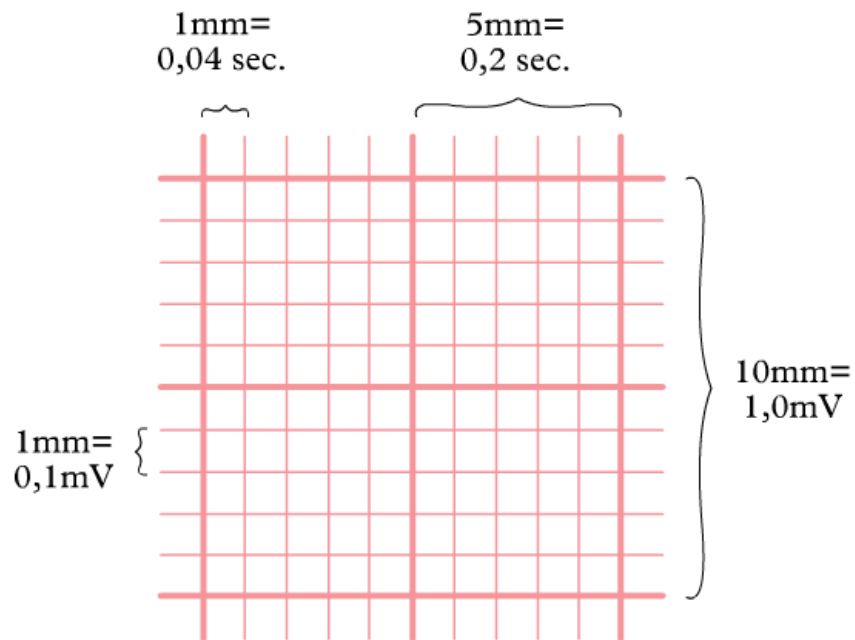
2. Berekenen: $1500 / \text{aantal}$
kleine hokjes tussen 2
hartslagen

3. Marker methode

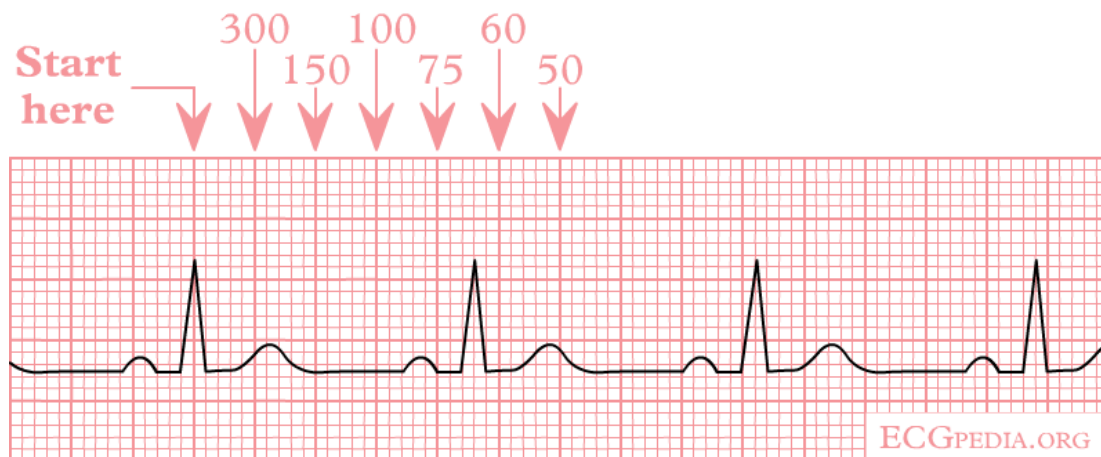
De hartfrequentie wordt
beïnvloed door:

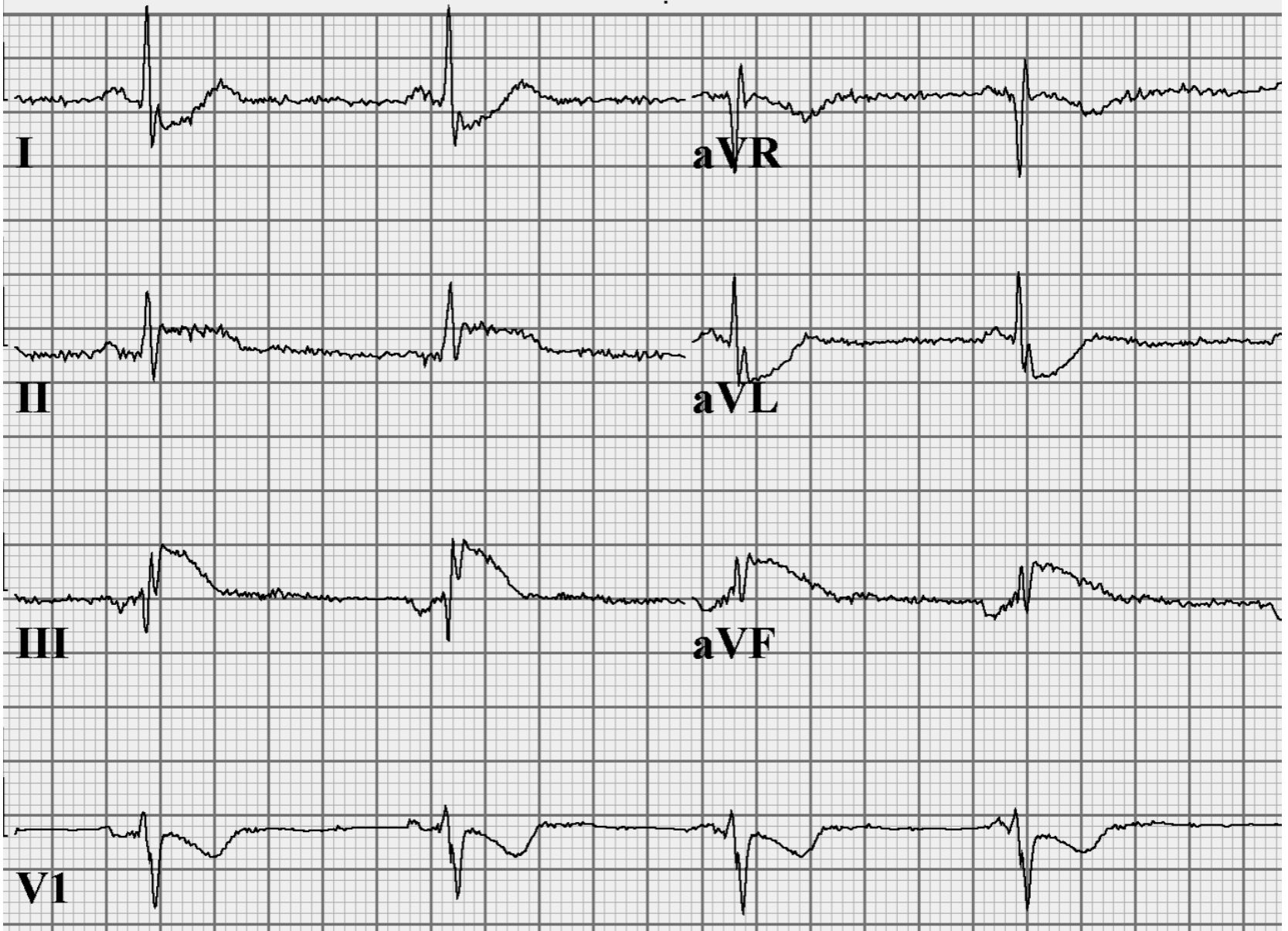
Het autonome
zenuwstelsel

De vulling van het hart



ECGPEDIA.ORG





Frequentie?

3 Geleidingstijden

PQ tijd tussen 0.12 en 0.20
seconde

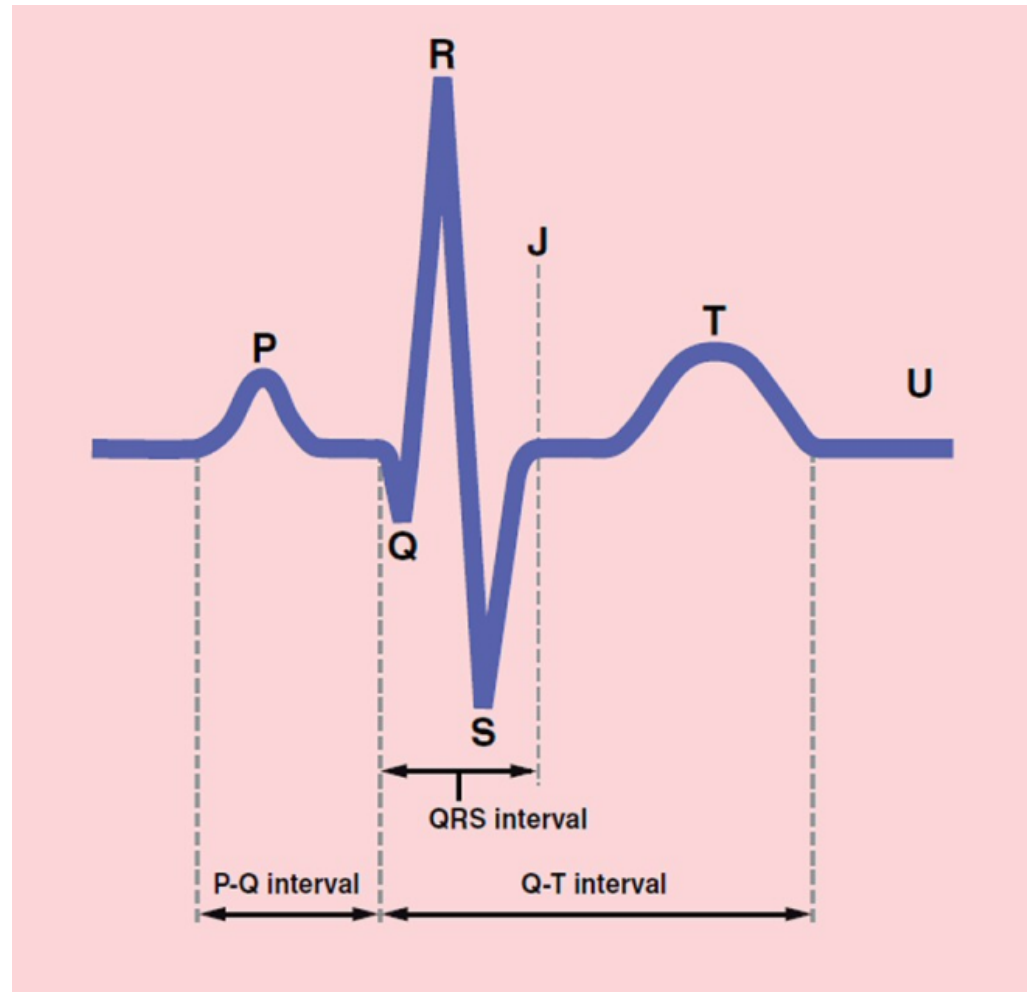
QRS duur \leq 0.10-0.12
seconde

Te lang \rightarrow LBTB / RBTB

QTc tijd = repolarisatie

Mannen $<$ 450ms

Vrouwen $<$ 460ms

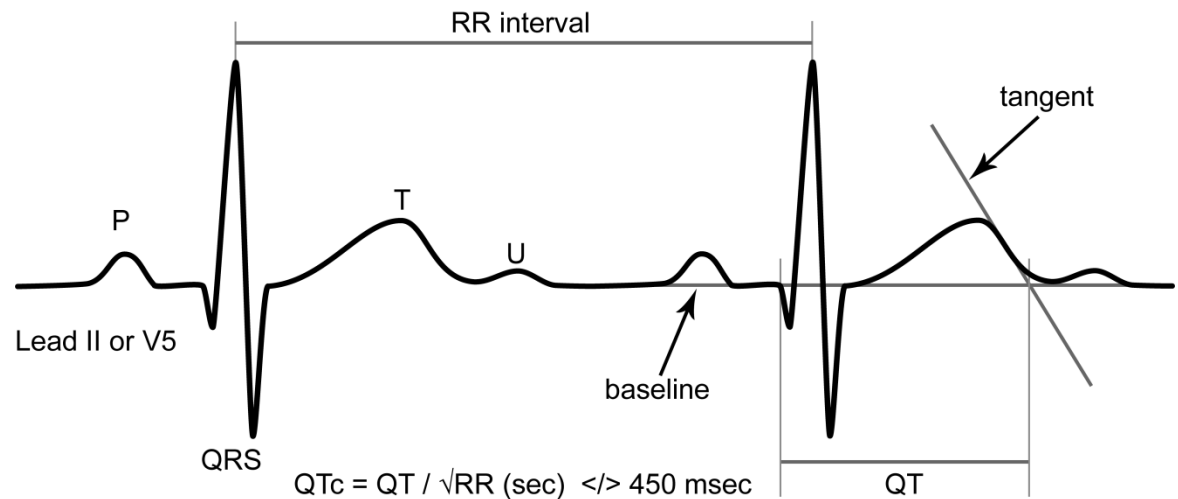


Check de QT tijd die de computer uitrekent!

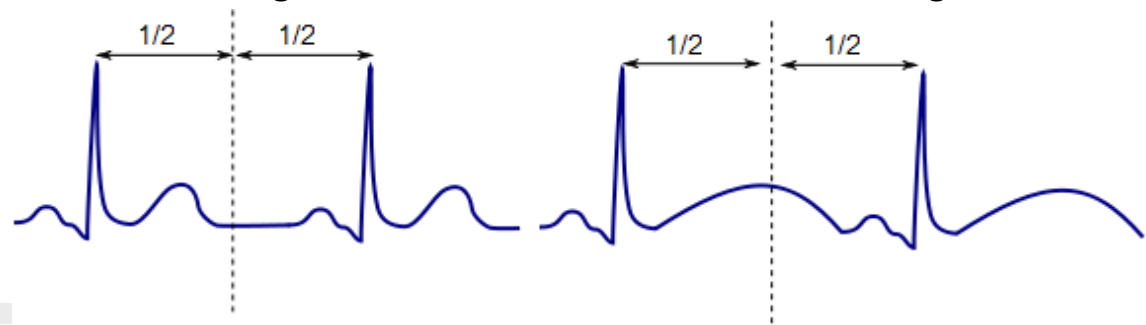
Verlengde QTc tijd geeft verhoogd risico op plotse dood. Met name > 480-500 ms.

Dan geen QTc verlengende medicatie!

$$QTc = \frac{QT}{\sqrt{RR \text{ interval (sec)}}}$$



Eyeballing: als T top eindigt voorbij het punt halverwege RR is de QT meestal verlengd



4 Hartas

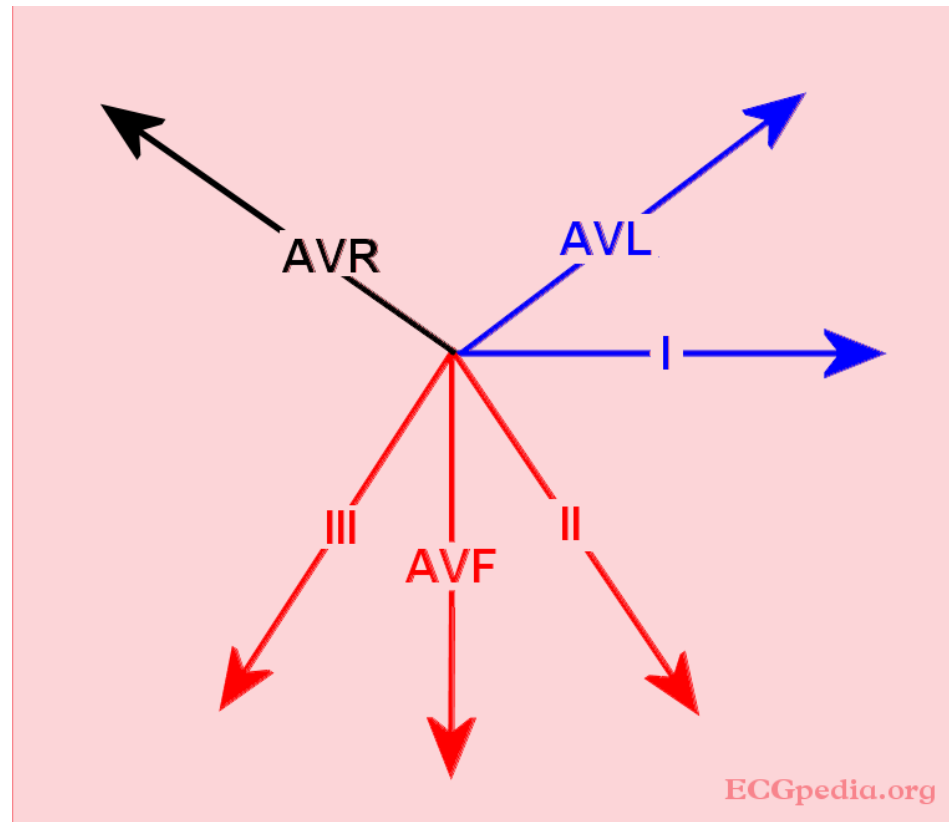
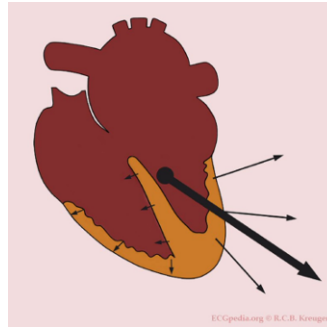
Geeft de gemiddelde elektrische activiteit aan

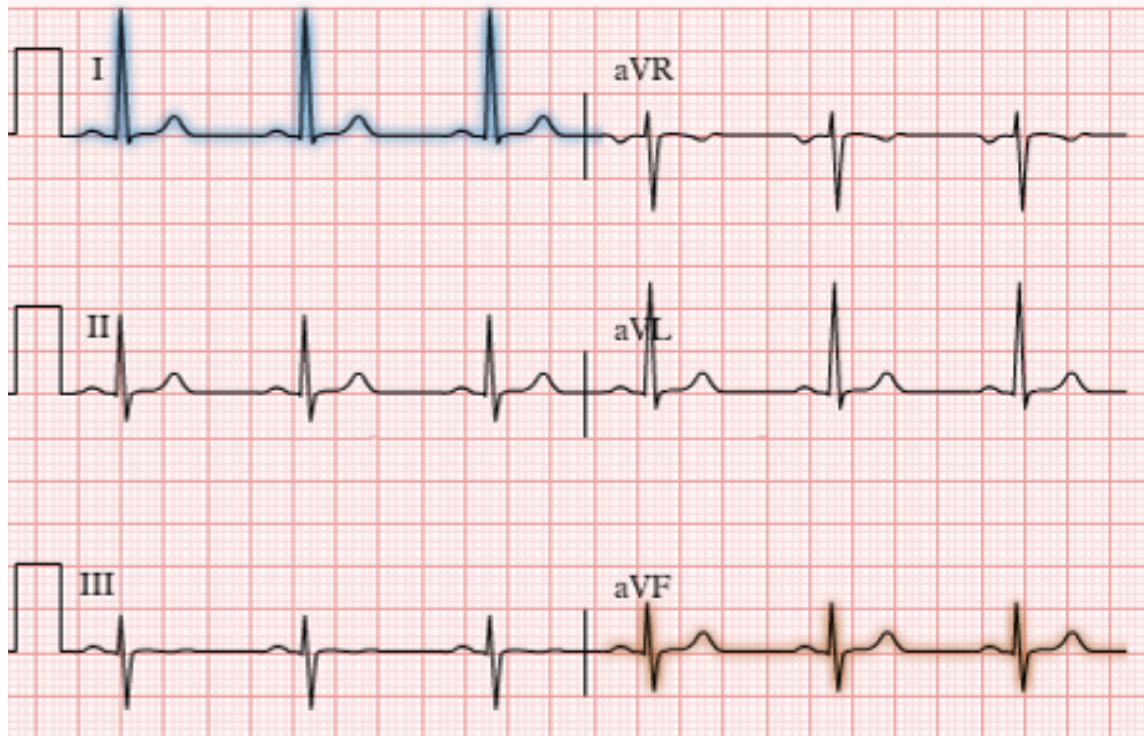
Normaal is tussen -30 en +90 graden.

Positief complex in I en AVF? → hartas ligt tussen de 0 en 90 graden en is normaal

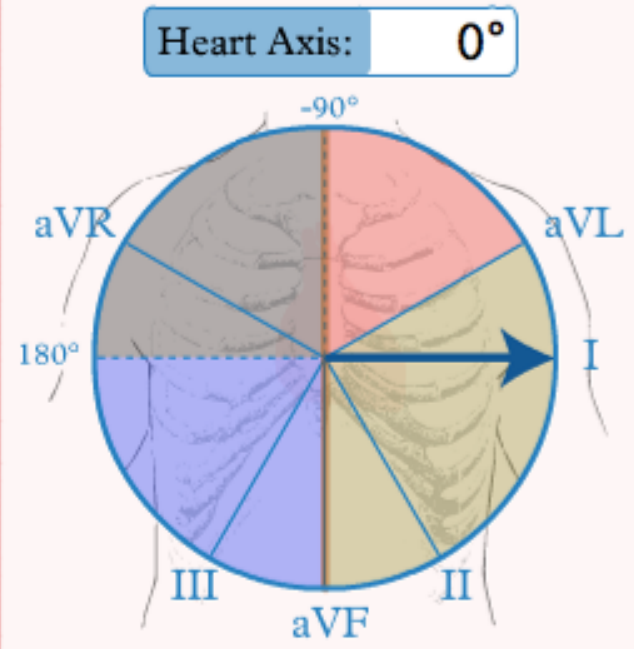
Positief in I, negatief in II → hartas is naar links

V1-V6 doen niet mee met het bepalen van de hartas



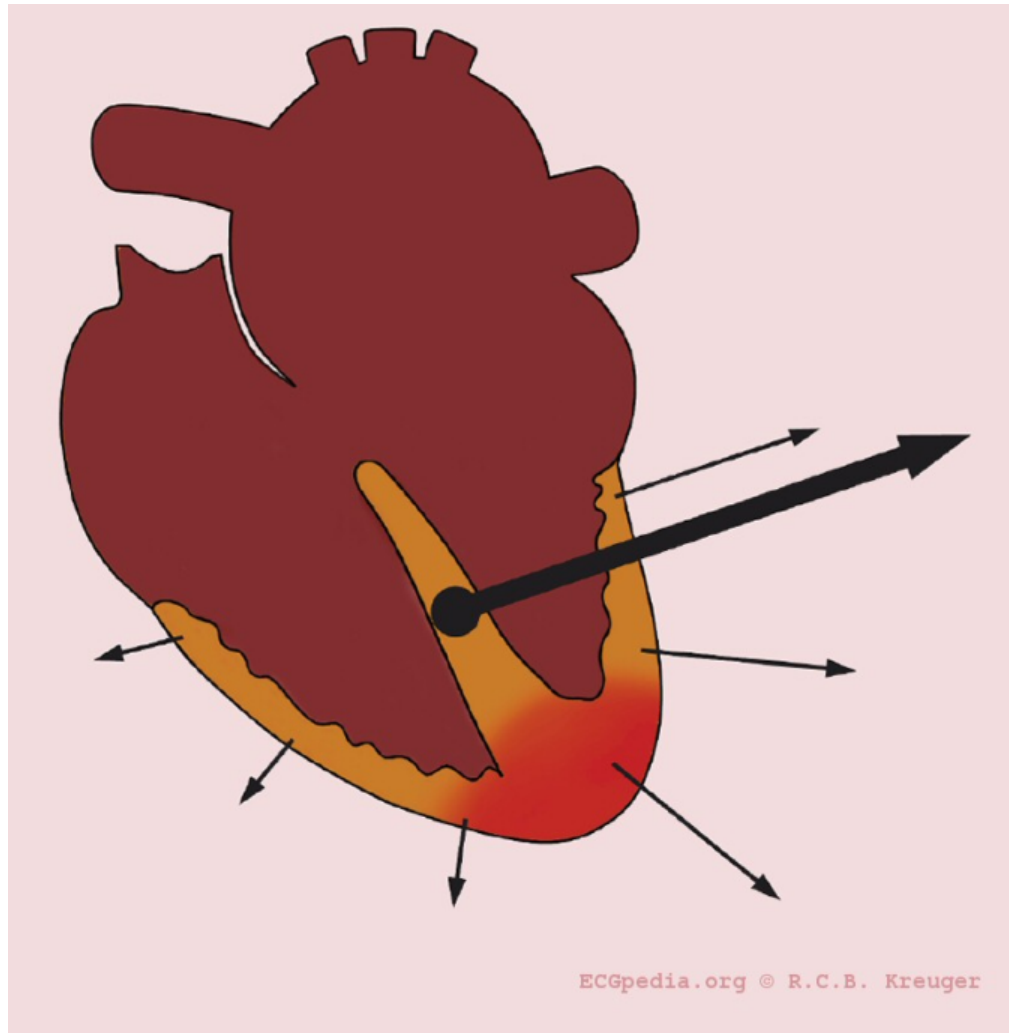


Iso-electric lead: aVF Tallest R wave: I Heart axis: normal (intermediate)



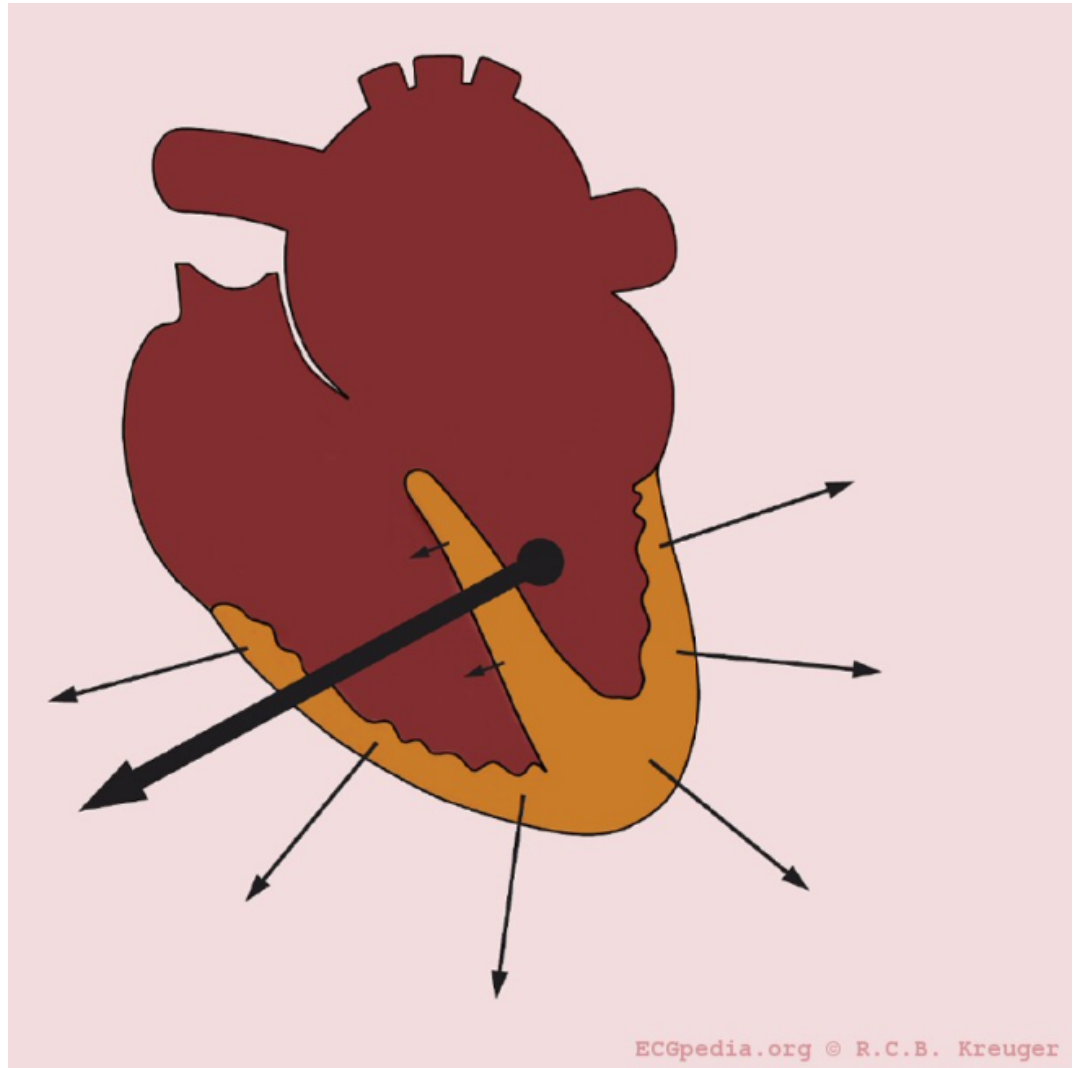
Linker hartas

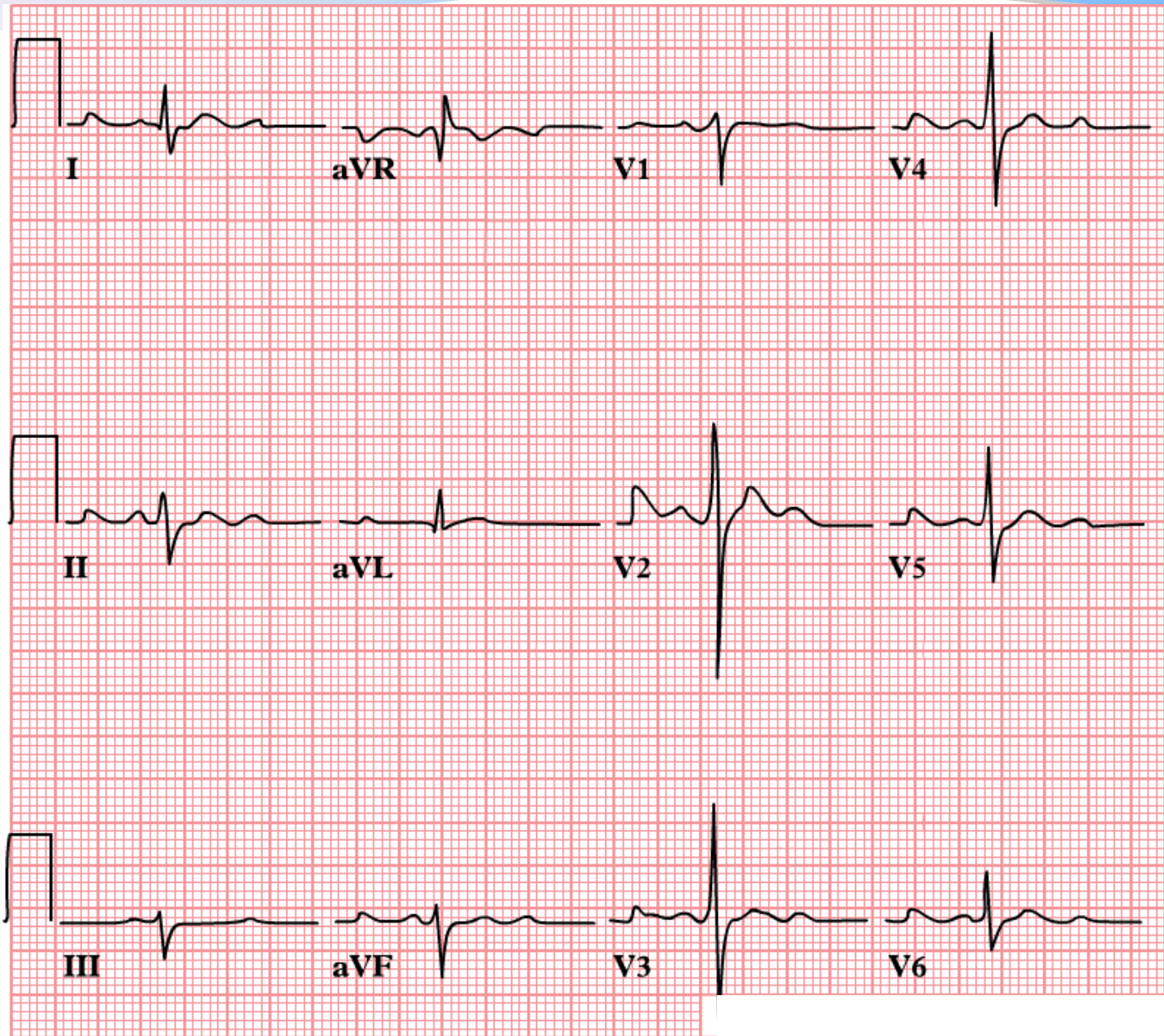
- Linker anterior hemiblok
- Onderwandinfarct
- Linker ventrikelhypertrofie
- Pacemakerritme



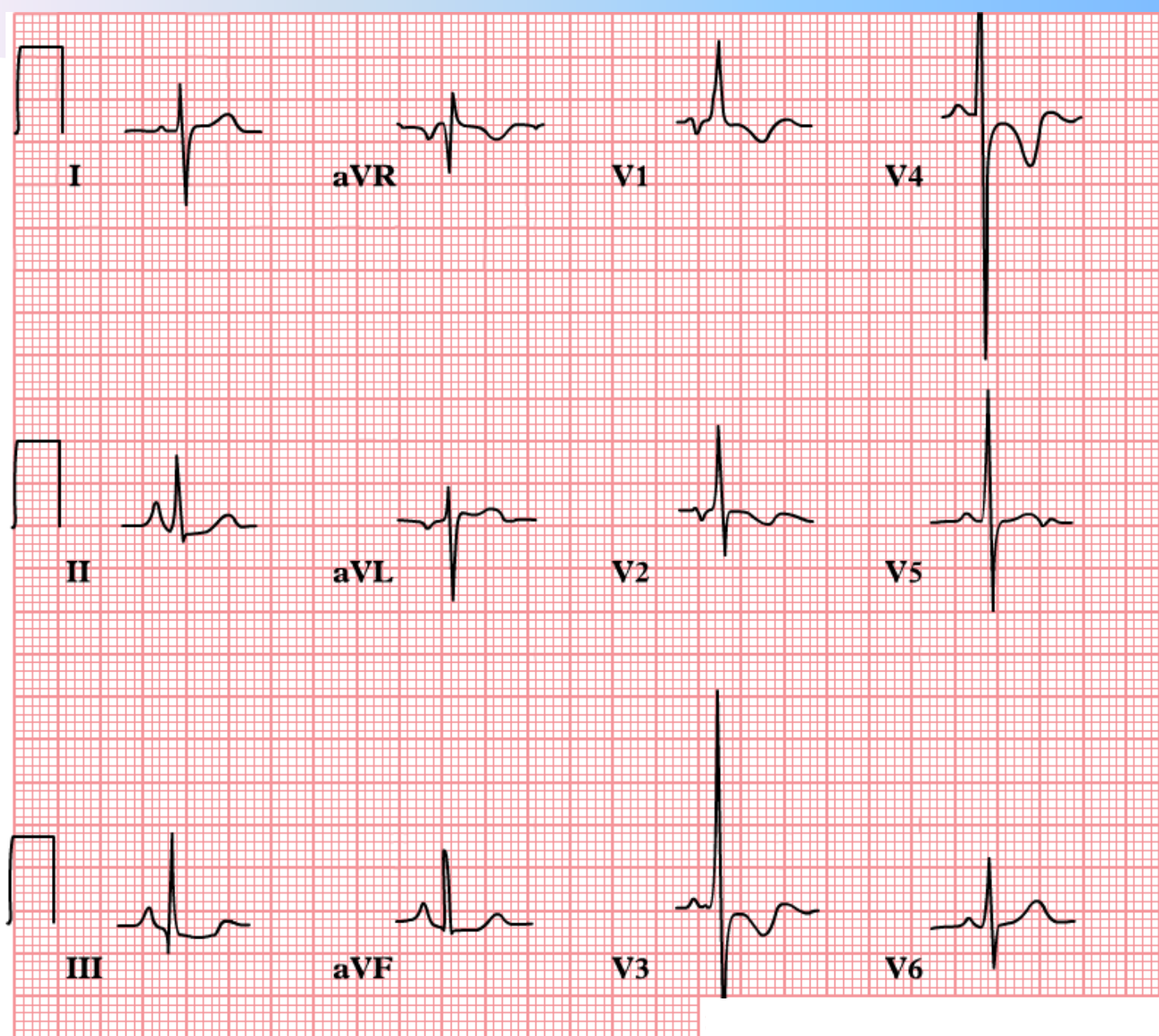
Rechter hartas

- Rechter ventrikelhypertrofie
- Rechter ventrikelbelasting (longembolie / COPD)
- Atriumseptumdefect, ventrikelseptumdefect
- Cave draad verwisseling!





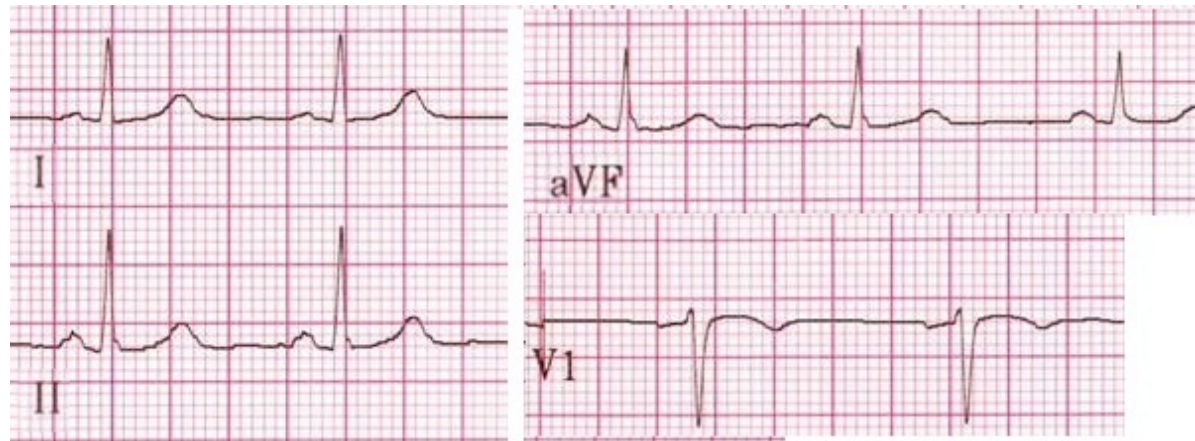
Hartas?



Hartas?

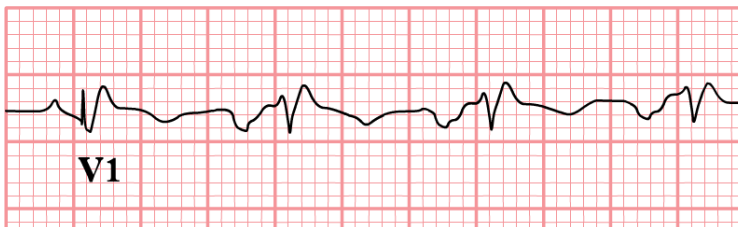
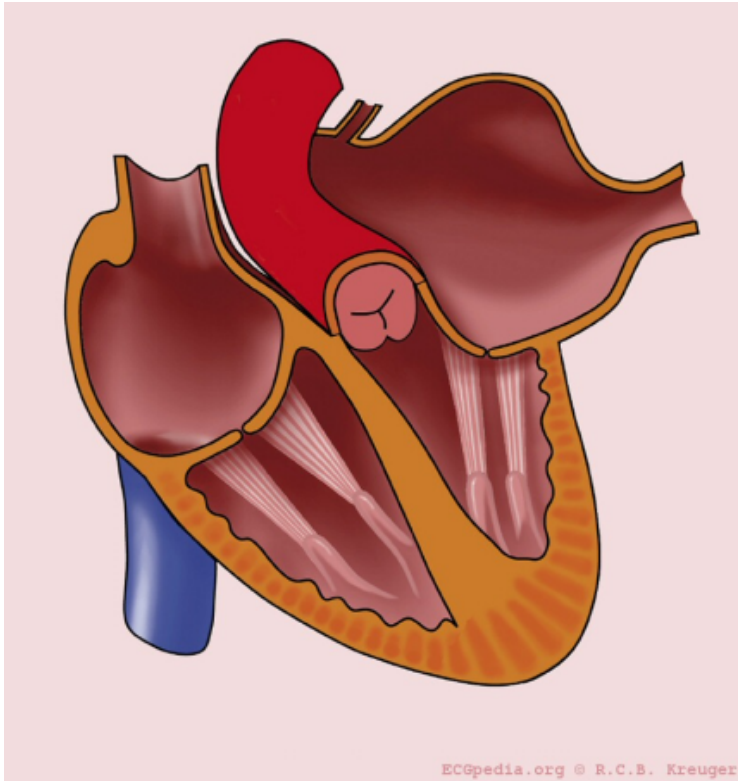
5 P top morfologie

- De maximale hoogte van de p top is 2,5 mm in II en / of III
- De p top is positief in II en AVF, en bifasisch in V1
- De breedte van de p top is normaal korter dan 0.12 seconde



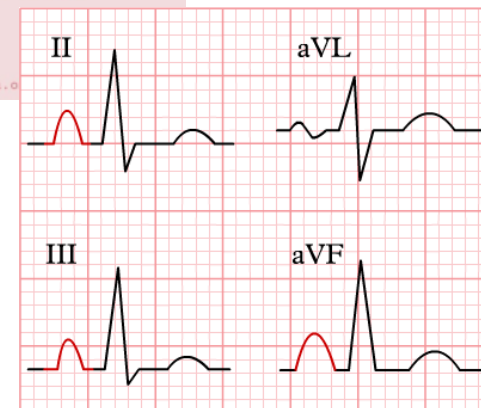
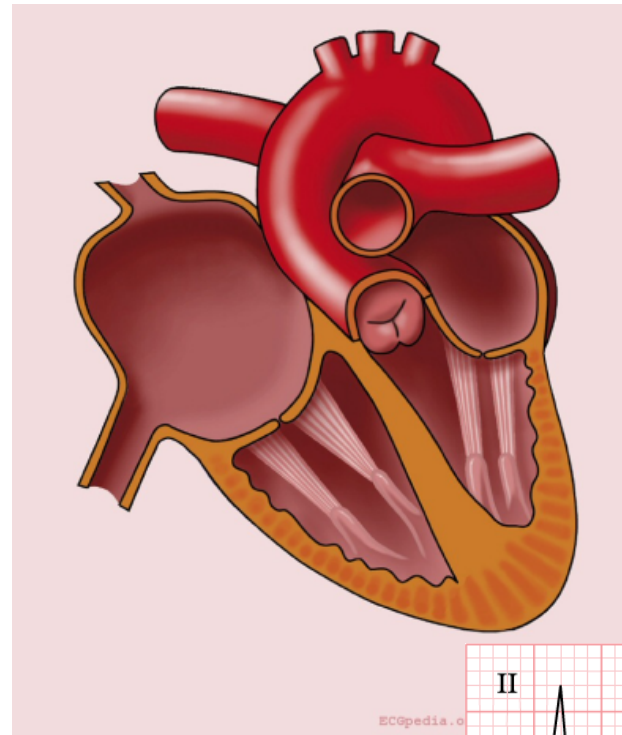
Linkeratriumdilatatie

Terminaal deel in V1 > 1mm2



Rechteratriumdilatatie

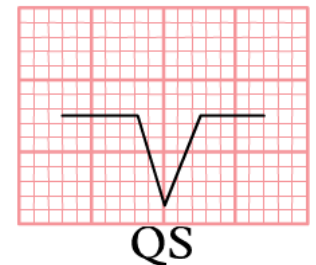
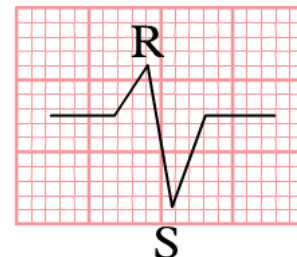
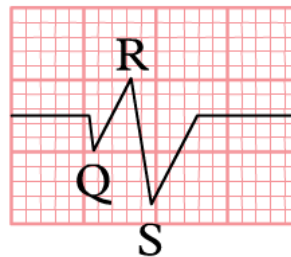
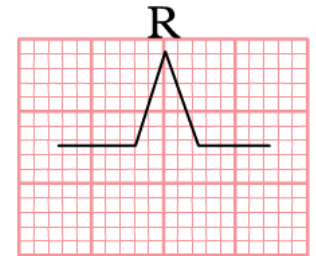
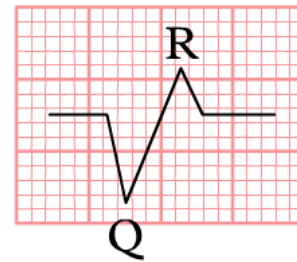
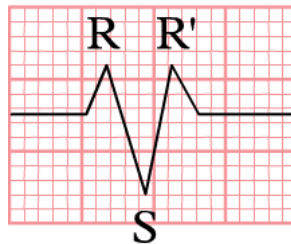
P hoogte >2,5 mm in II / III of AVF



right atrial enlargement

6 QRS morfologie

- pathologische Q golven?
- LVH / RVH?
- microvoltages?
- geleidingsproblemen?
- R top progressie normaal?



6 QRS morfologie

- **Pathologische Q top?**
 - Breedte ≥ 0.04 sec
 - Diepte $> \frac{1}{3}$ van de R
 - In 2 aanpalende afleidingen
- **Differentiaal diagnose**
 - Oud infarct
 - Cardiomyopathie (HCM, DCM)
 - COPD
 - Intraventriculaire geleidingsstoornissen

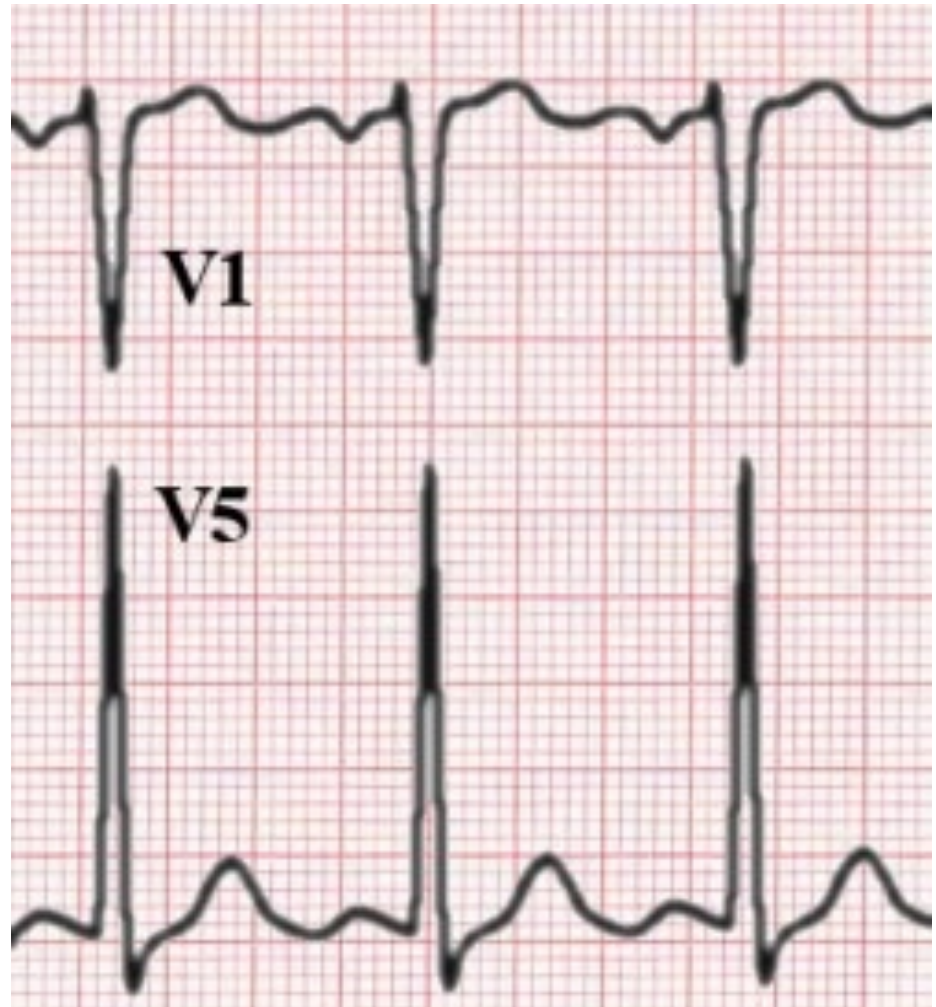


6 QRS morfologie

- pathologische Q golven?
- **LVH / RVH?**
- microvoltages?
- geleidingsproblemen?
- R top progressie normaal?

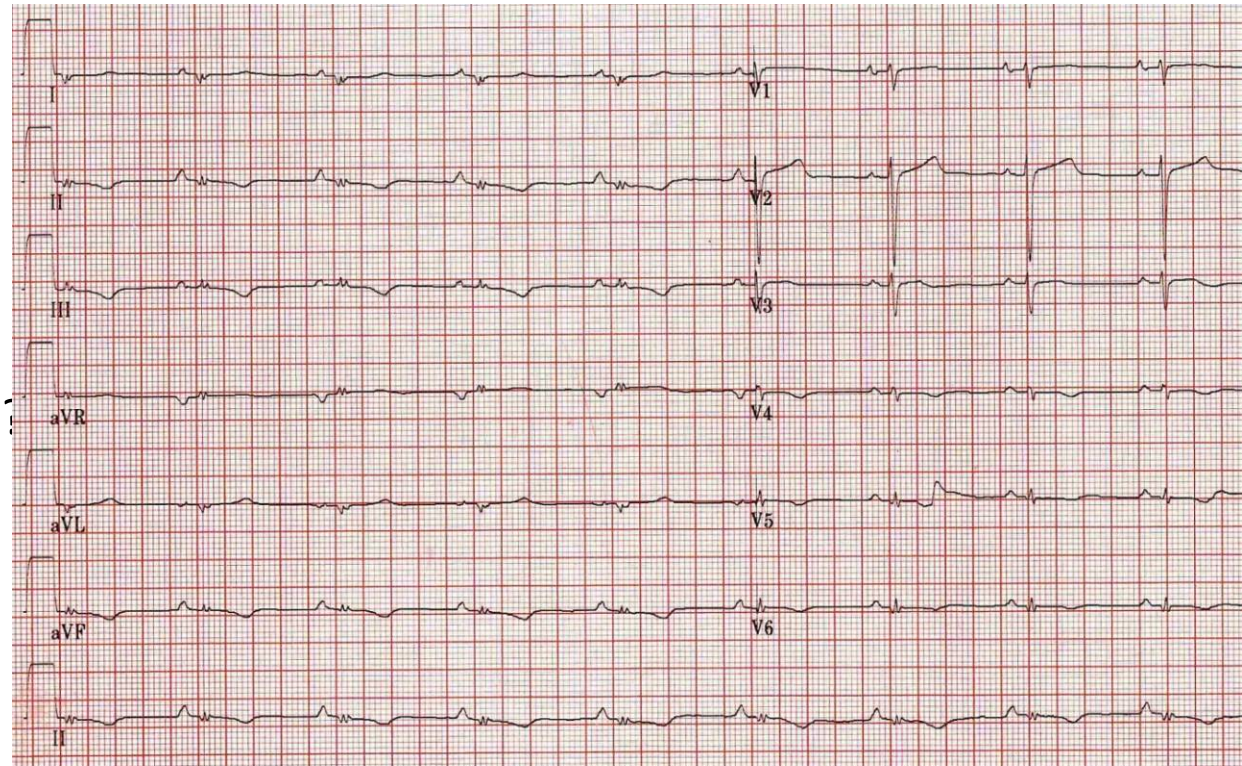
LVH:

- $R \text{ in } V5 \text{ of } V6 + S \text{ in } V1 > 35\text{mm}$ (Sokolow-Lyon criteria)
- Vaak strain patroon V5-V6



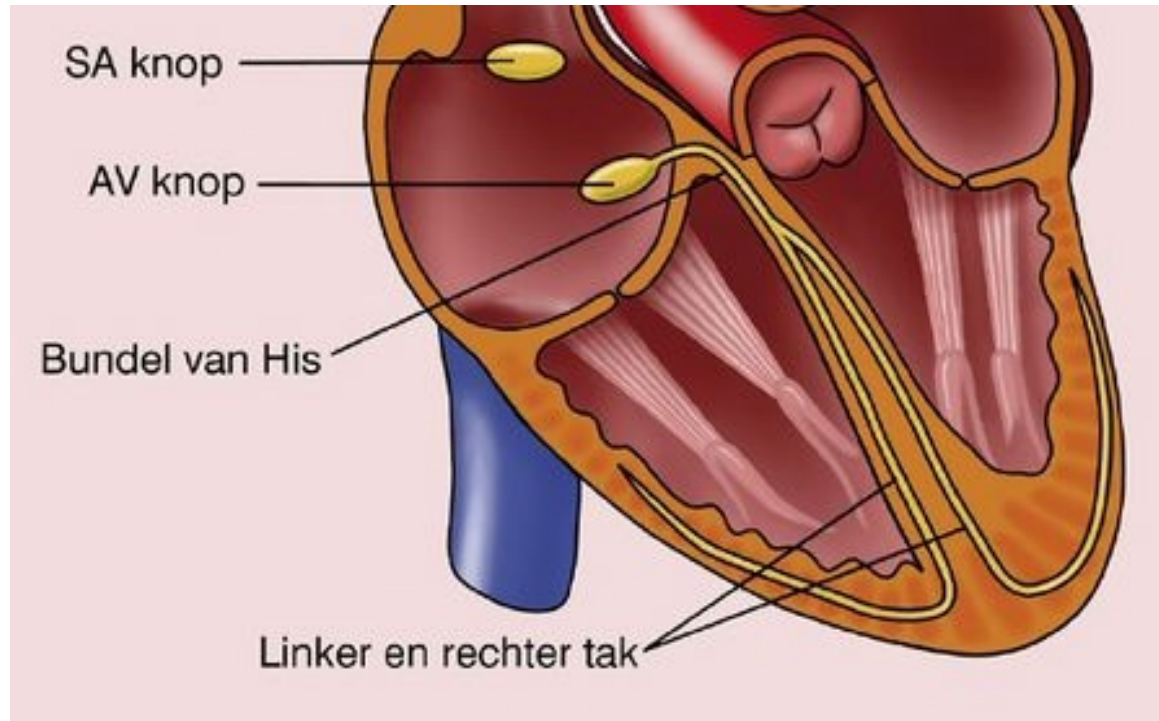
6 QRS morfologie

- pathologische Q golven?
- LVH / RVH?
- **microvoltages?**
- geleidingsproblemen?
- R top progressie normaal?



6 QRS morfologie

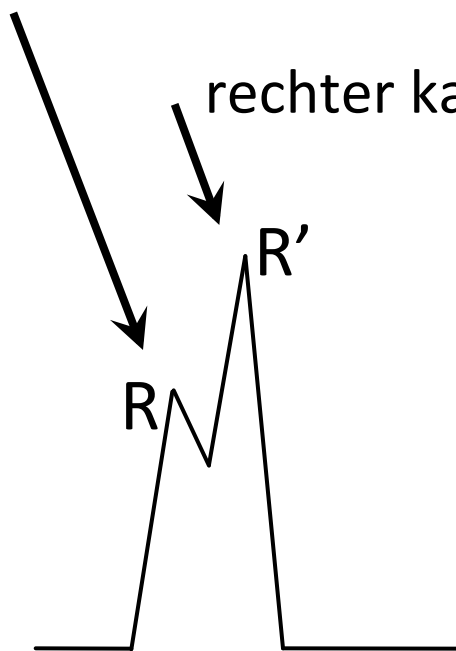
- pathologische Q golven?
- LVH / RVH?
- microvoltages?
- **geleidingsproblemen?**
 - QRS > 0.12 seconde
- R top progressie normaal?



afleiding V1

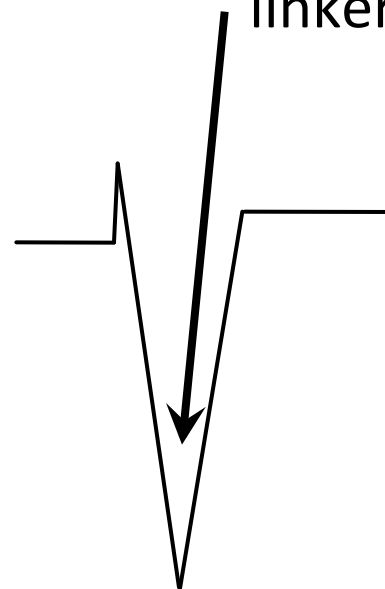
linker kamer

rechter kamer



RBTB

linker kamer



LBTB

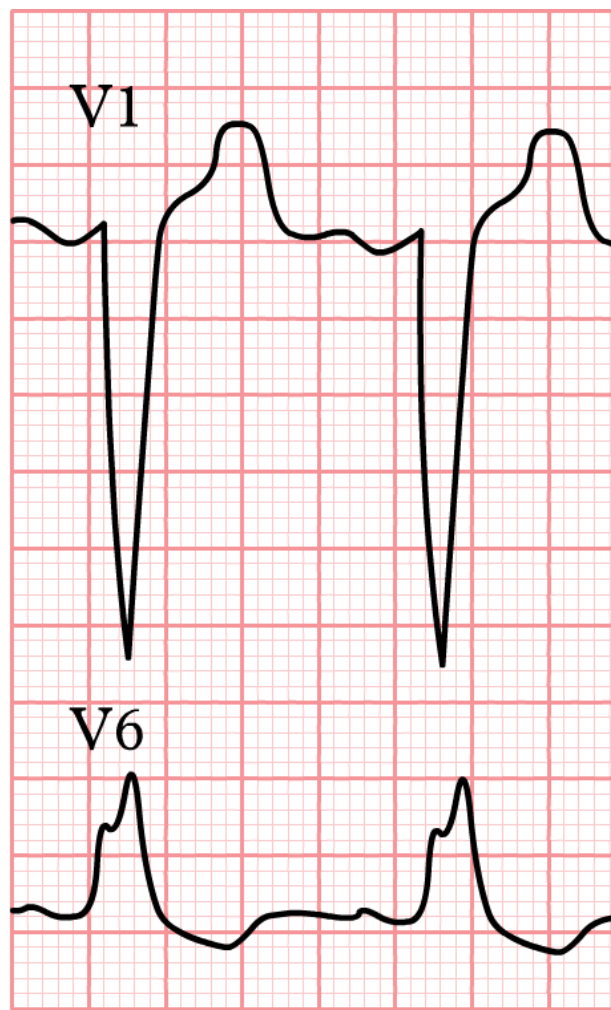
LBTB

QRS > 0.12 seconde

(r)S in V1

Brede R en geen q in I, V6

(Infarctdiagnostiek lastig
want ST segment
afwijkend)



LBBB

ECG PEDIA.ORG
part of cardionetworks.org

RBTB

QRS > 0.12 seconde

rsR' in V1

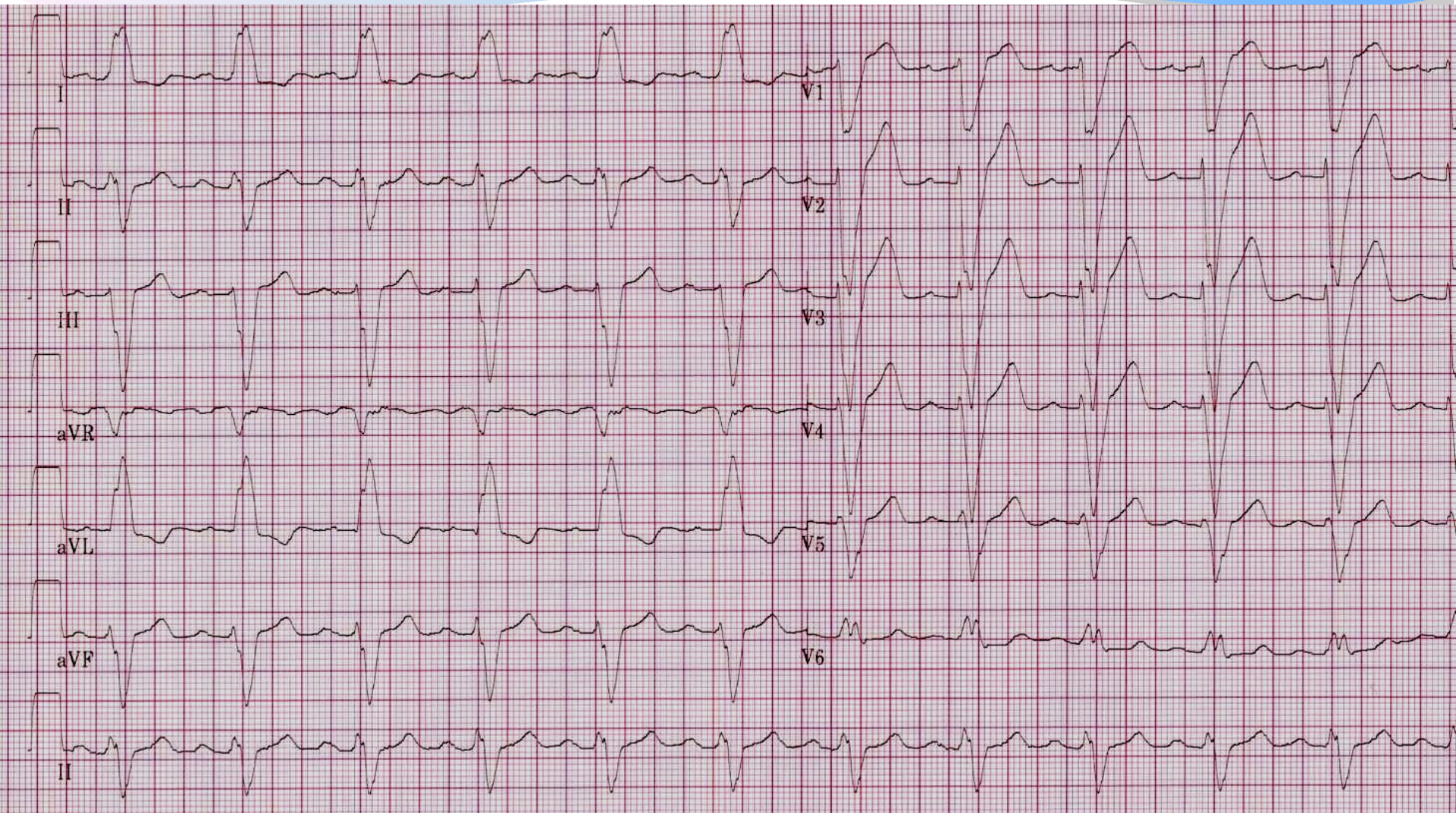
R' > R

(Infarctdiagnostiek goed mogelijk)



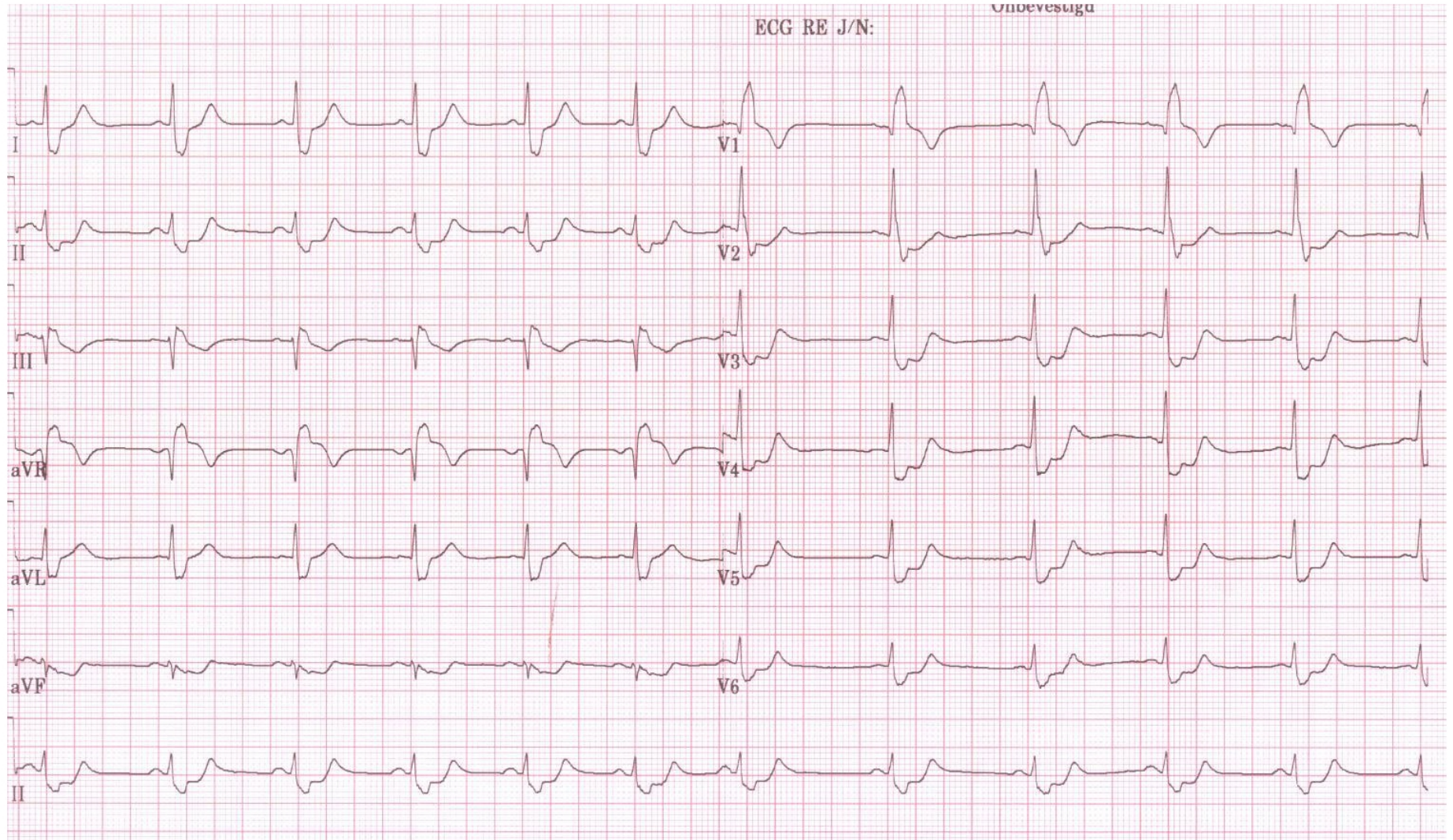
RBBB

ECG PEDIA.ORG
part of cardionetworks.org



Courtesy of R.W. Koster, MD, PhD ECGPEDIA.ORG
AMC, The Netherlands part of cardiomark.org

RBTB of LBTB?

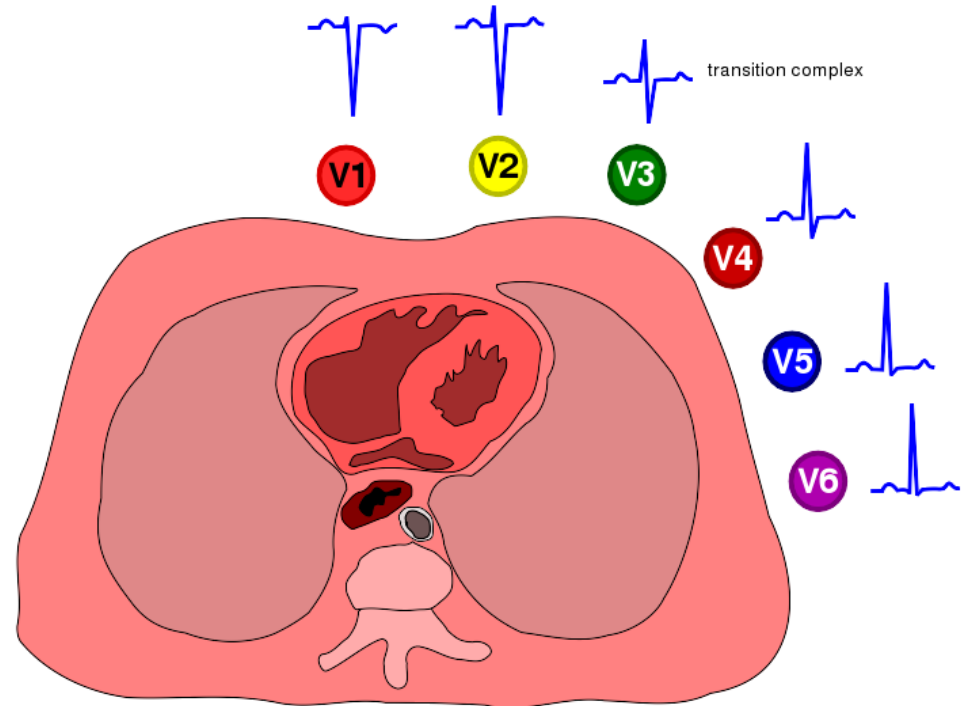


Courtesy of W.G. de Voegt, MD, PhD, Amsterdam, The Netherlands

7+2 STAPPENPLAN

Stap 6: QRS morfologie

- **R-top progressie?**
 - Overgangs complex in V3, V4
 - Normaal zit het overgangs complex (waar de R-top groter wordt dan de S) bij V3 tot V4



7 ST morfologie

ST elevatie

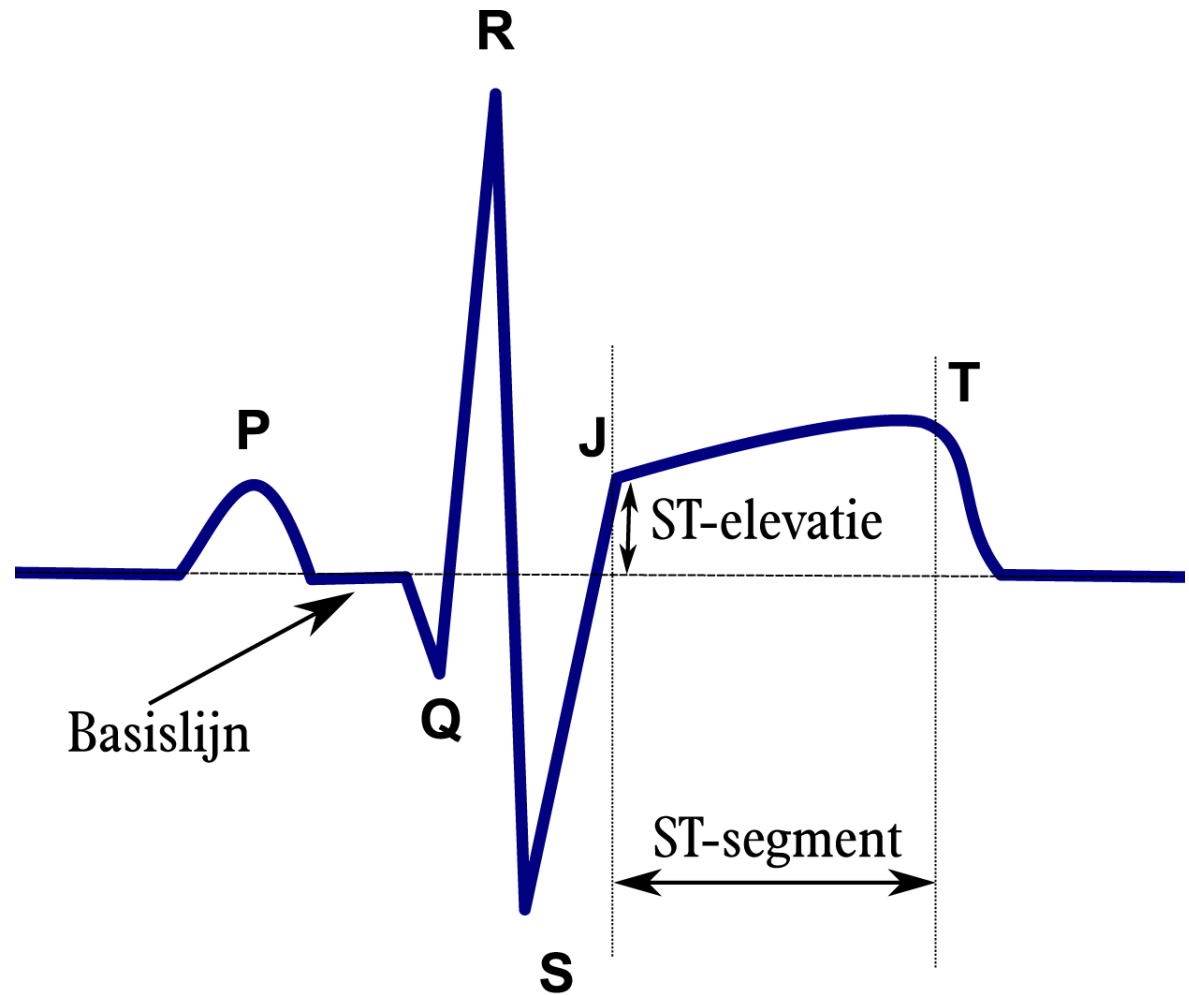
Ischemie
Pericarditis
Aneurysma cordis
Normale variant

ST depressie

Reciproke bij ischemie
LVH
Digitalis
Hypokaliemie
Neurologisch

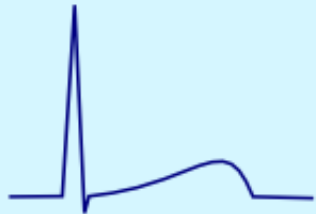
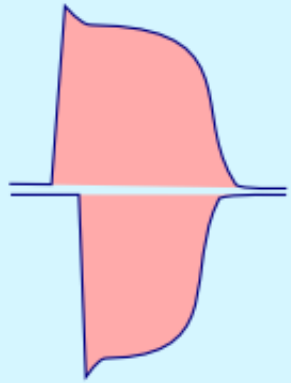
T top verandering

Ischemie
Pericarditis
Myocarditis
LVH / RVH

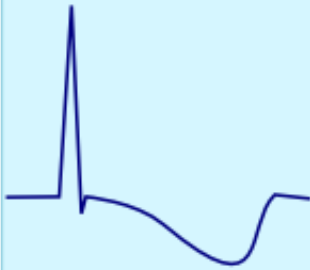
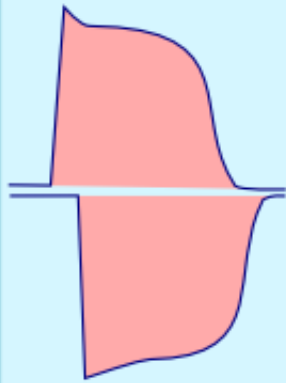


Hoe meet je ST-elevatie?

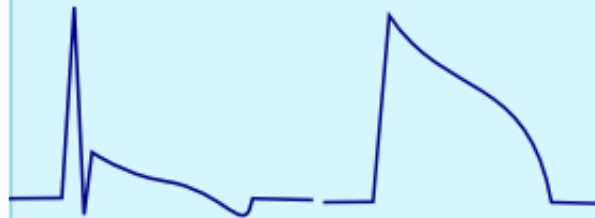
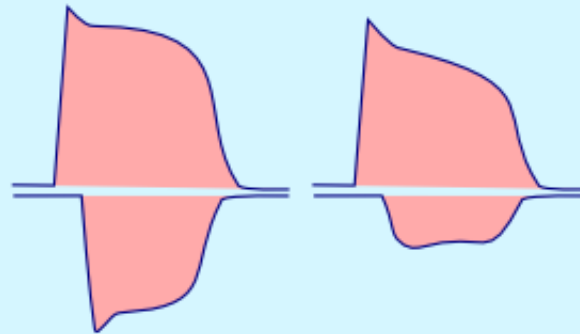
Normal



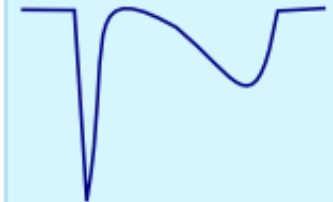
Ischemic Tissue



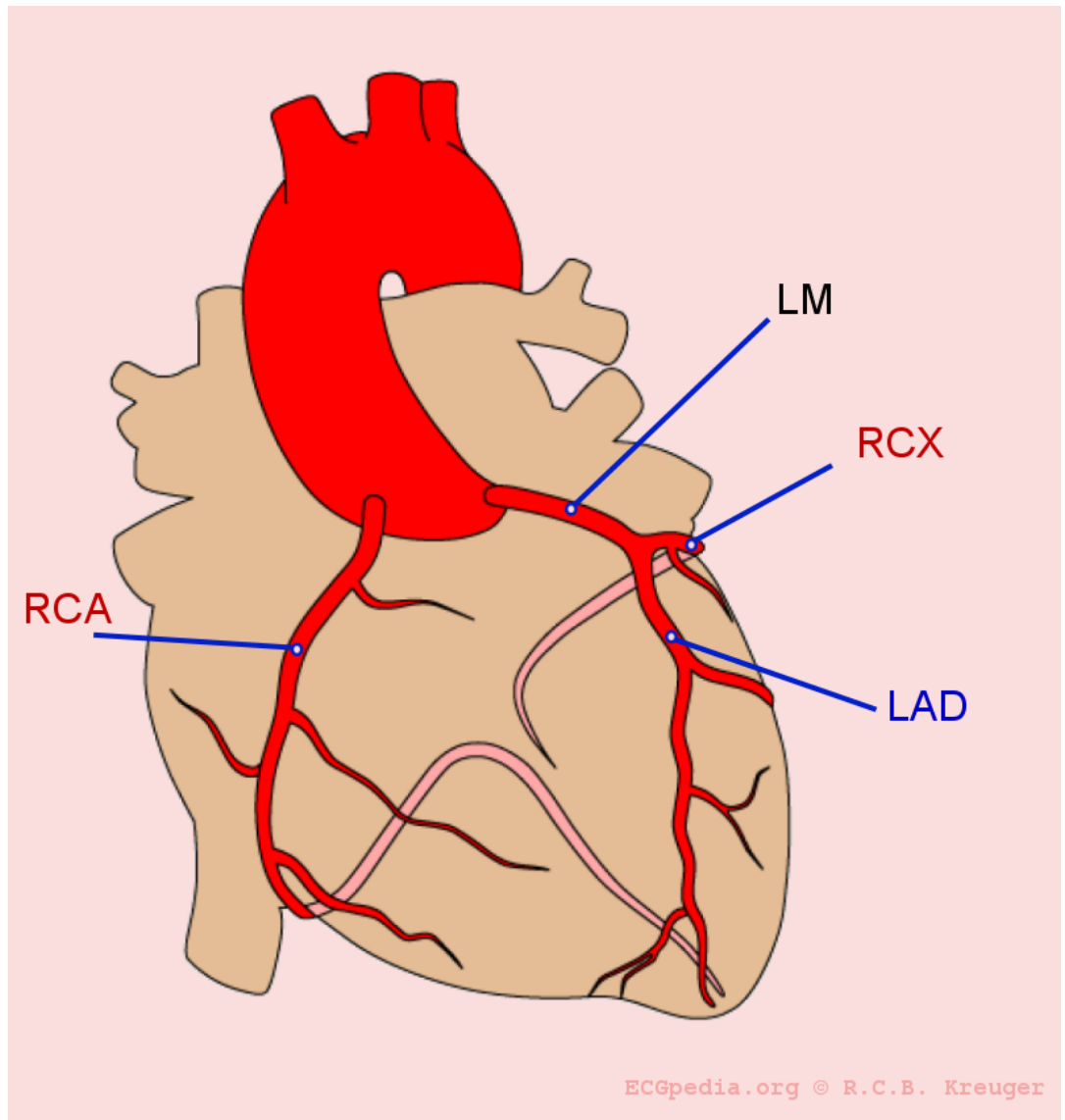
Injured Tissue



Necrotic Tissue

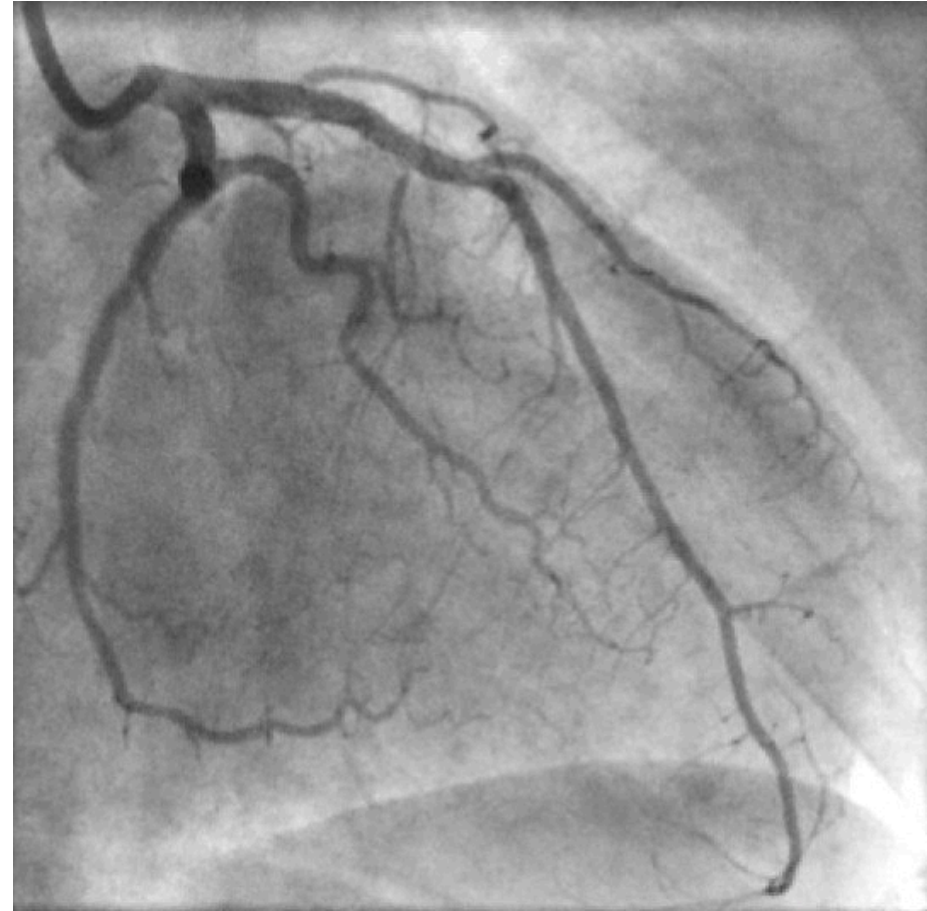
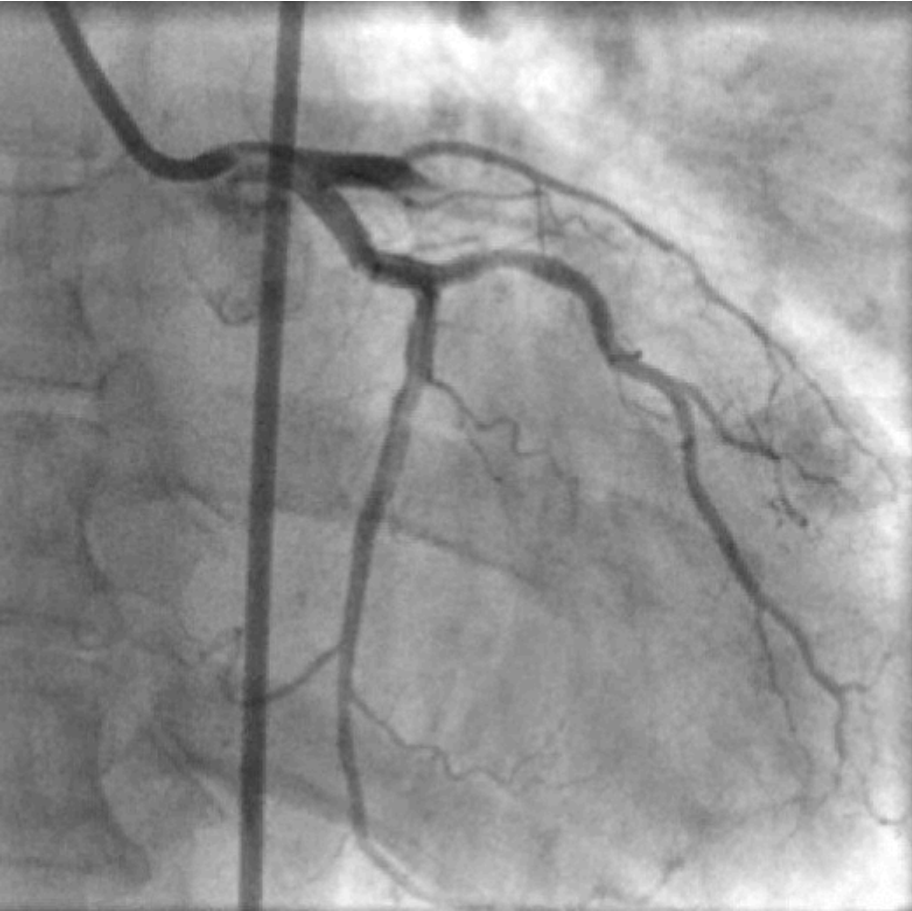


Kransslagvaten





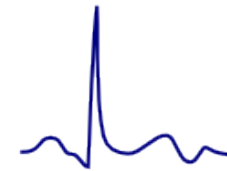
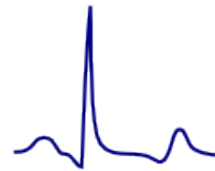
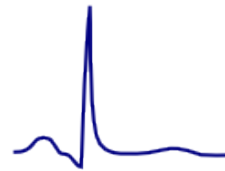
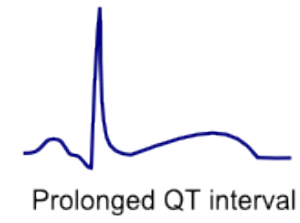
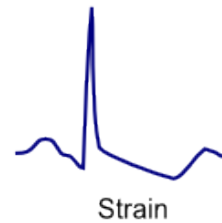
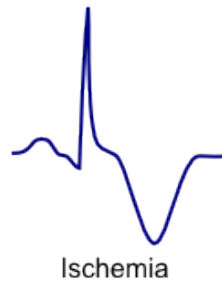
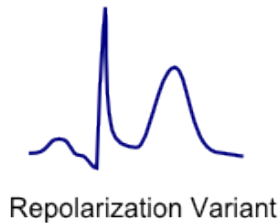
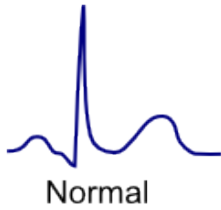
LCA pre en post PCI



Vlak = $< 0.5\text{mm}$ in I, II, V3-V6

Negatief = $> 0.5\text{mm}$ in I, II, V3-V6

T wave morphology



Nonspecific ST-T wave abnormalities

7+1 Vergelijken met oud ECG

- Nieuwe LBTB?
- Asdraai?
- Nieuwe pathologische Q?
- Afname R top hoogte?

7+2 Conclusie

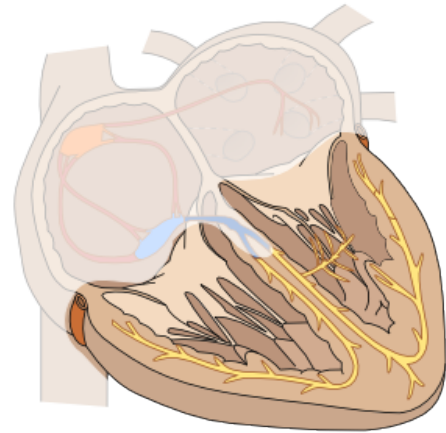
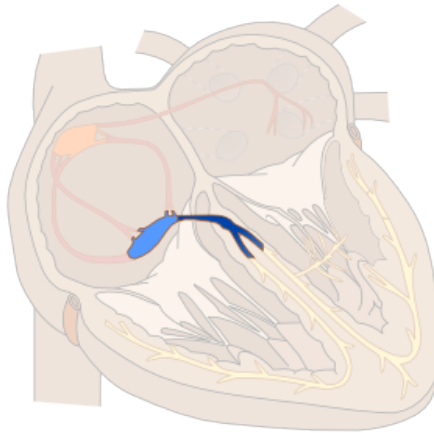
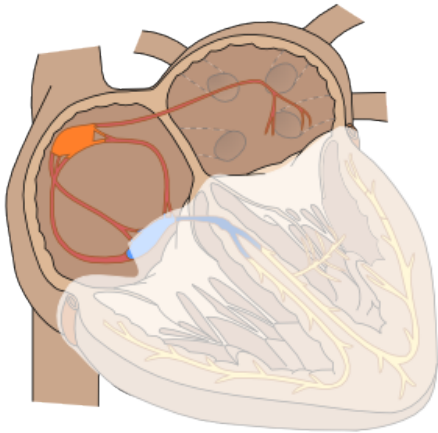
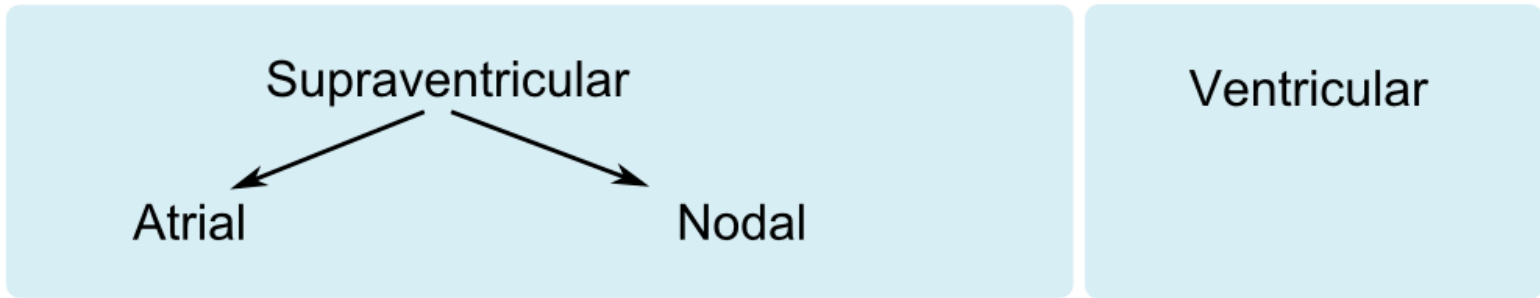
Voorbeelden:

- "Sinustachycardie met ST elevatie over de voorwand, passend bij een acuut voorwandinfarct"
- "Supraventriculaire tachycardie van 200/min op basis van een AV nodale re-entry"
- "Oud onderwandinfarct met nu een acuut lateraal myocard-infarct met QRS verbreding ten opzichte van het ECG van 14 augustus vorig jaar"
- "Normaal ECG"

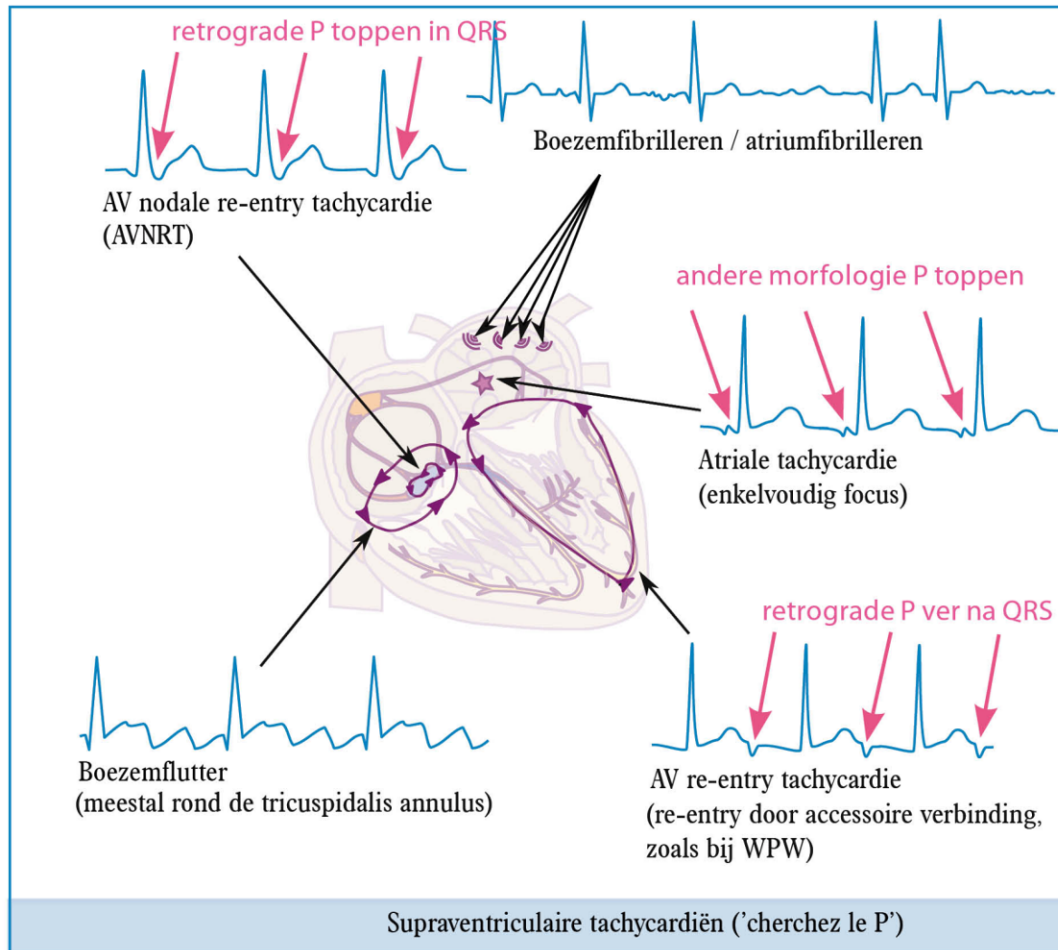
Geen sinusritme?

- Bradycardie? $<60/\text{min}$
 - Sinusbradycardie?
 - Escaperitme?
 - AV blok?
- Tachycardie? $>100/\text{min}$
 - SVT?
 - VT?

Geen sinusritme? Tachycardie?



SVT?



Ventriculaire tachycardie?

- Ventrikeltachycardie
- Ventrikelfibrilleren
- Torsade de Pointes

