

AMC basiscursus ECG voor co-assistenten 2011

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CARDIO  NETWORKS.ORG

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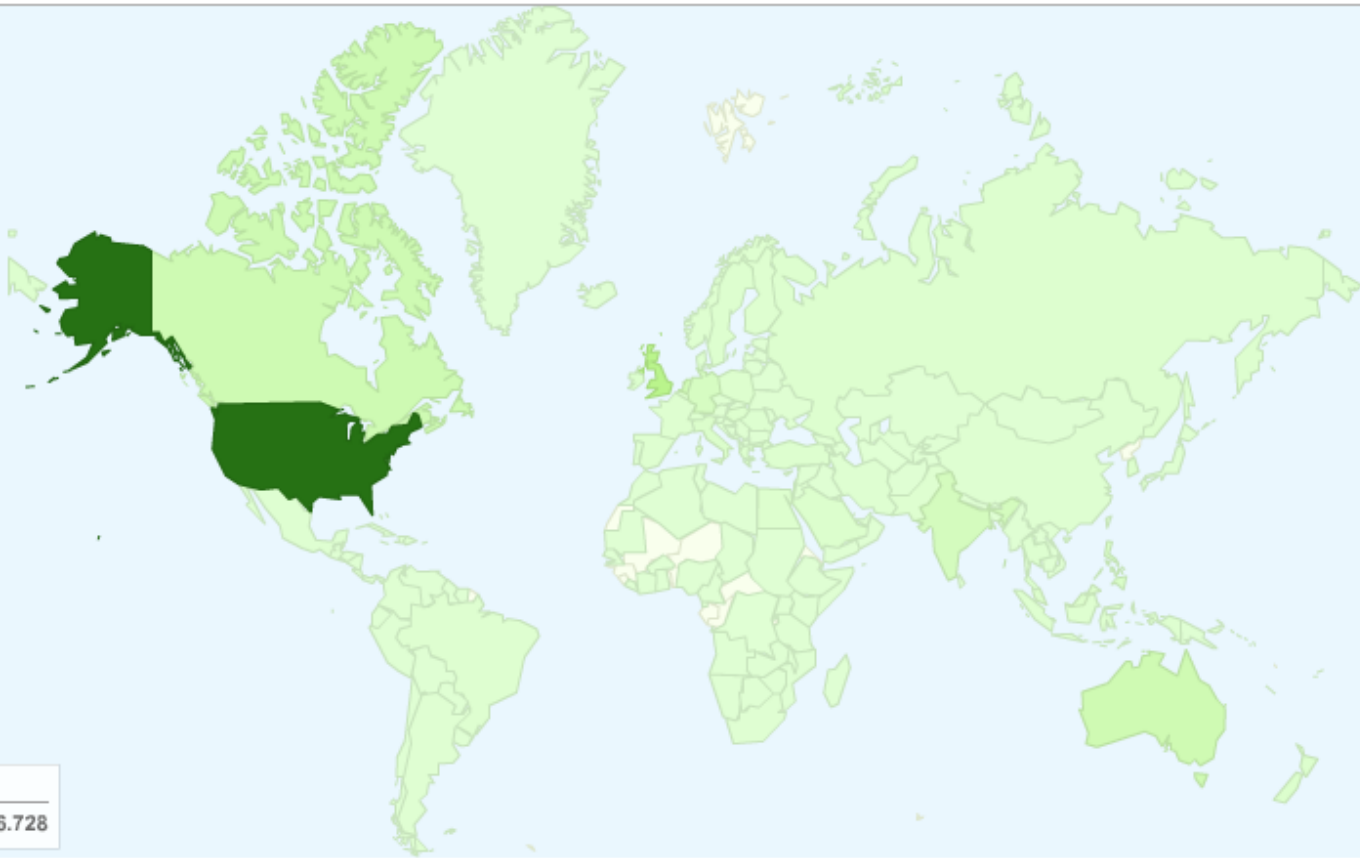
Met dank aan:

- Prof. Arthur Wilde
- Dr. Rudolph Koster

Boeken:

- Wellens: *The ECG in Emergency Decision Making*
- Garcia / Miller: *Arrhythmia Recognition*
- *Braunwald Heart Disease*

Bezoeken ▾



373.872 bezoeken zijn afkomstig van 201 landen/gebieden

zoeken

pagina

overleg

brontekst bekijken

geschiedenis

OK Zoeken

navigatie

- Hoofdpagina
- Voorbehold
- Veelgestelde vragen
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- Powerpoint presentaties
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- Contact

de ecg cursus

- Grondbeginselen
- Ritme
- Hartfrequentie
- Geleidingstijden
- Hartas
- P top
- QRS morfologie
- ST morfologie

het ecg tekstboek

- Het normale ECG
- Technische problemen
- AV geleiding
- Ventriculaire geleiding
- Ritmestoornissen
- - Supraventriculair
- - Nodaal
- - Ventriculair
- - Congentaal
- - Ectopische slagen
- Infarct/ischemie
- Hypertrofie
- Elektrolytstoornissen
- Pacemakers
- Overigen

voorbeeld ecg's

- De ECGpedia ECG collectie

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.

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

1. vergelijking met het oude ECG
2. conclusie

- Download en print dit handige ECG zakkaartje als PDF (verbeterde versie van april 2009!). Iet op de printinstructies). U kunt er ook een laten toesturen.



Het ECG zakkaartje

- Powerpoint presentaties van ECG cursussen
- ECGpedia cursus in levende lijve

Het ECG tekstboek



Bekijk het ECG Tekstboek met o.a.:

- Het normale ECG
- De geschiedenis van het ECG
- Technische problemen
- Geleidingsstoornissen
 - AV geleiding
 - Ventriculaire geleiding
- Ritmestoornissen
 - Supraventriculair
 - Nodaal
 - Ventriculair
 - Congentaal
 - Ectopische slagen
- Infarct/Ischemie
- Inspanningstesten
- Hypertrofie
- Elektrolytstoornissen
- Pacemakers
- ECG veranderingen bij sporters
- Overigen

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



Wat voor pauze?

Cursusoverzicht

Avond 1

- basis, systematische beoordeling
- ritme- en geleidingsstoornissen
- Technische problemen

Avond 2

- Ischemie
- Diversen (electrolyten, klinische beelden)
- Oefenen

De cursus is interactief. Onderbreek gerust!

Basics van het ECG

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

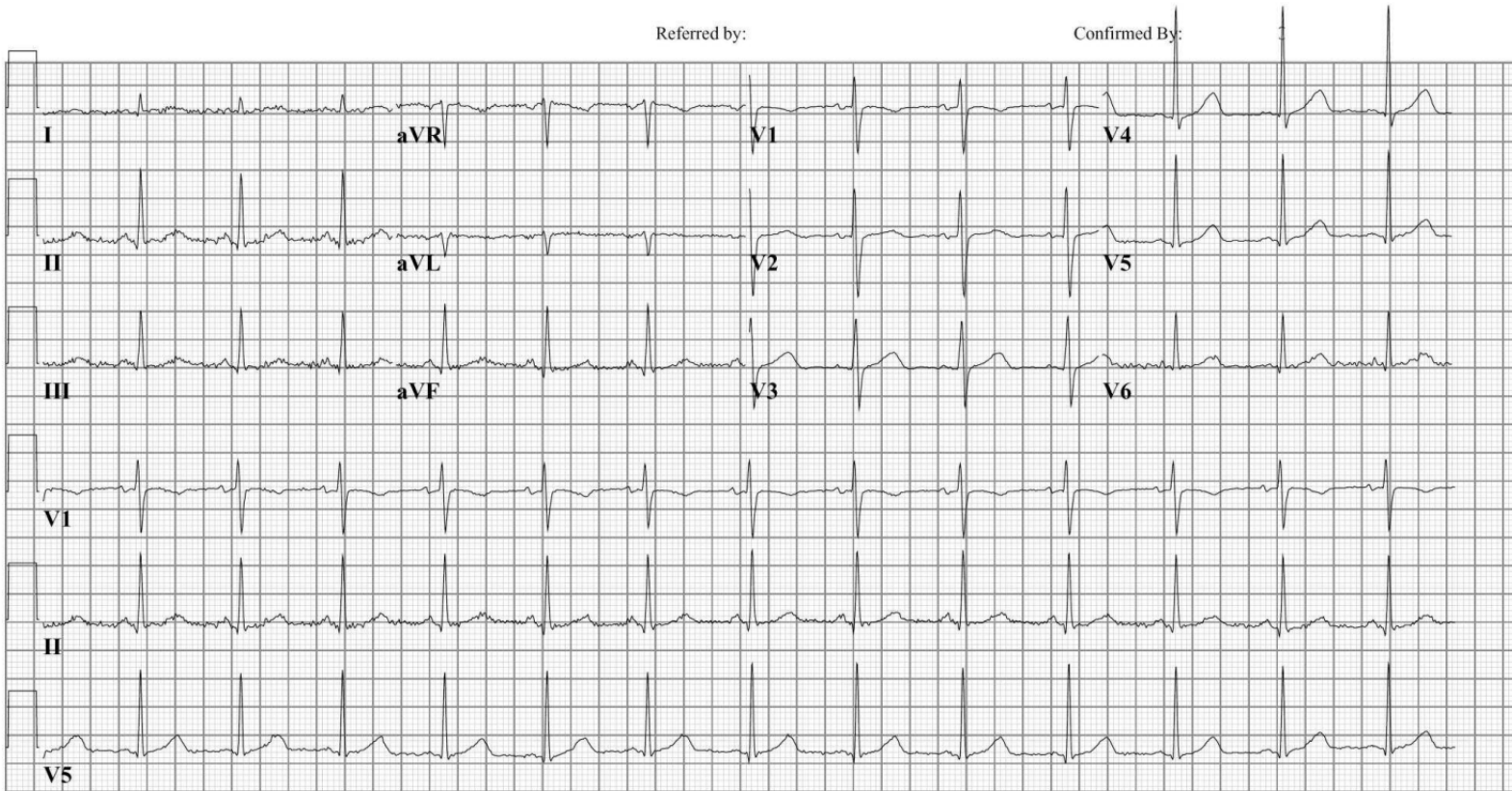
*** Leeftijds en geslacht specifieke ECG analyse ***
Normaal sinusritme
Normaal ECG
Geen oud ECG aanwezig

Loc:23

Technician:

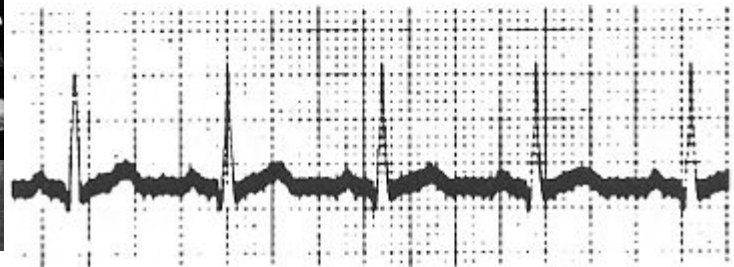
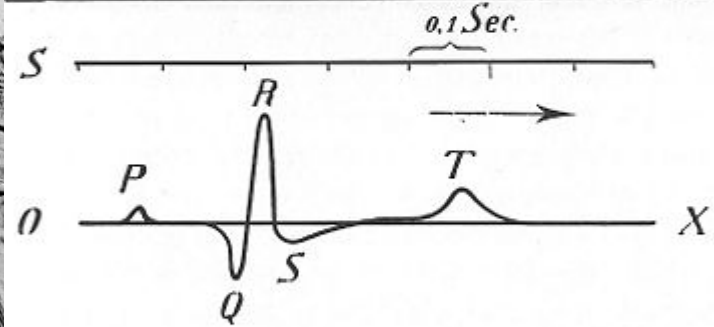
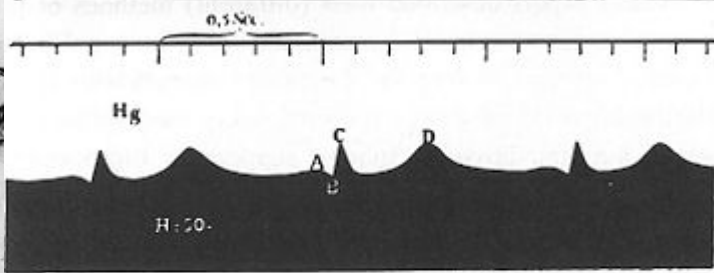
Referred by:

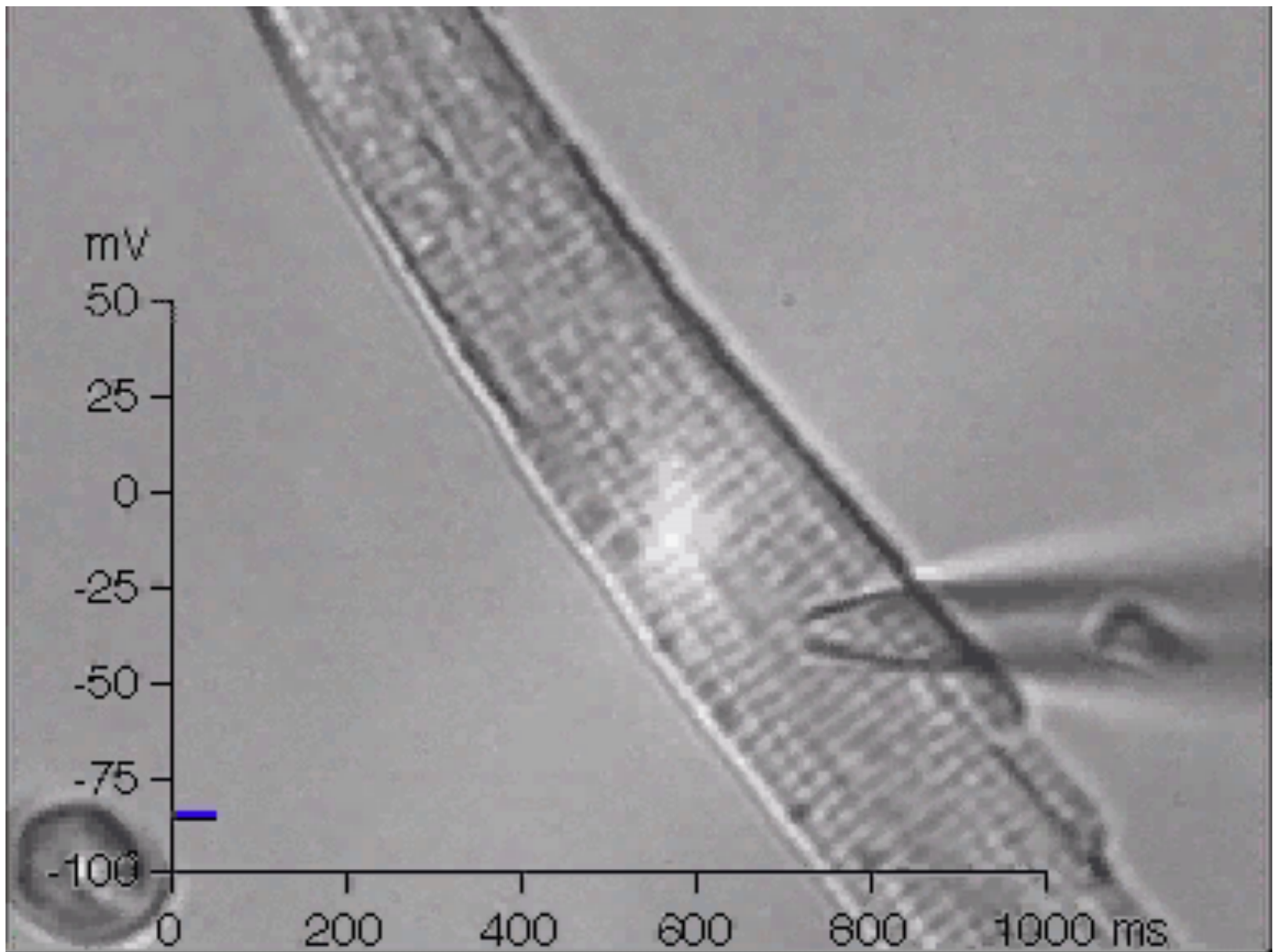
Confirmed By:



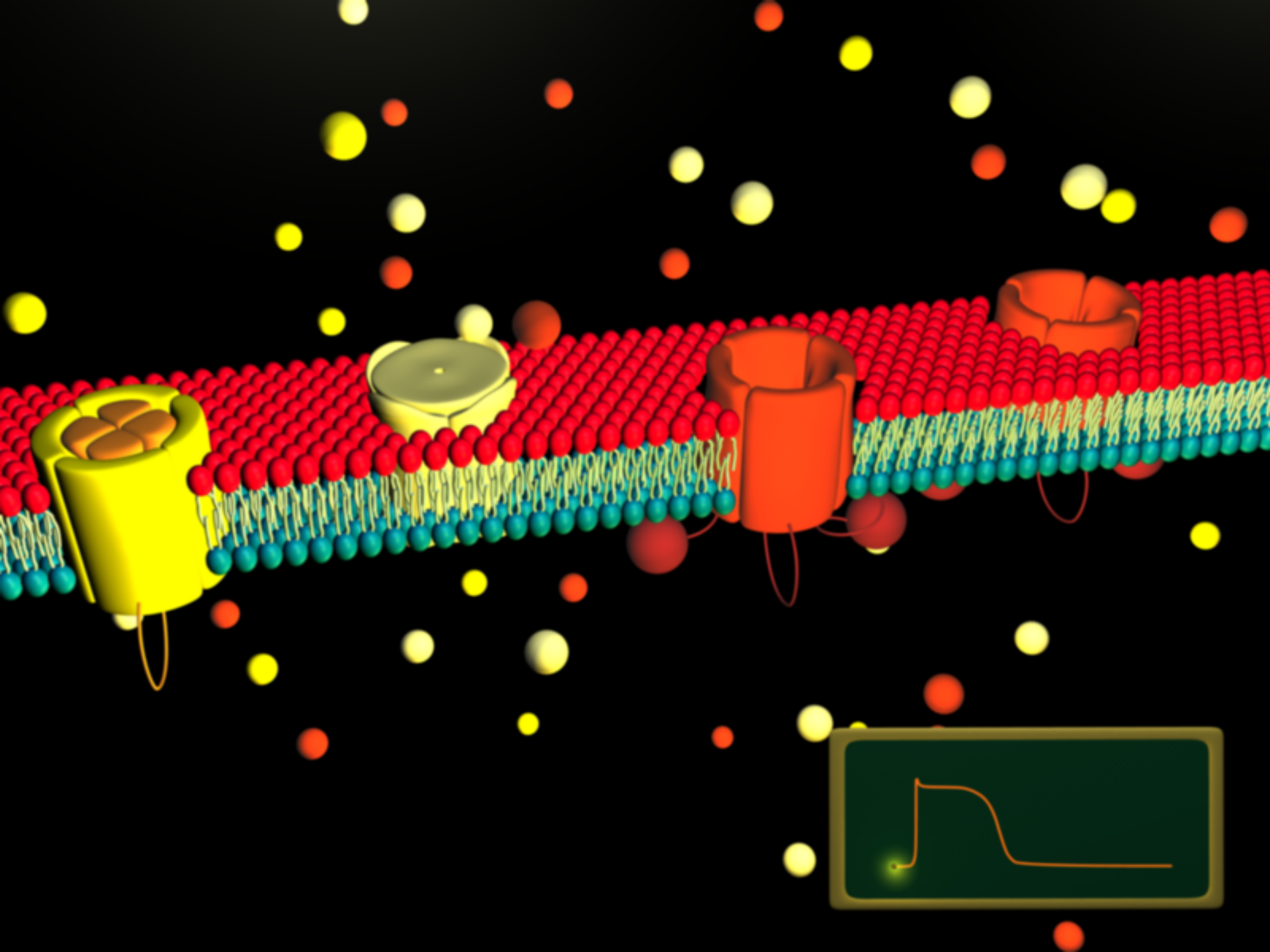
25mm/s 10mm/mV 40Hz 005E 12SL 233 CID: 10

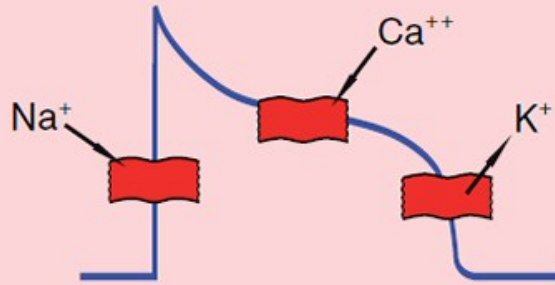
Gosch



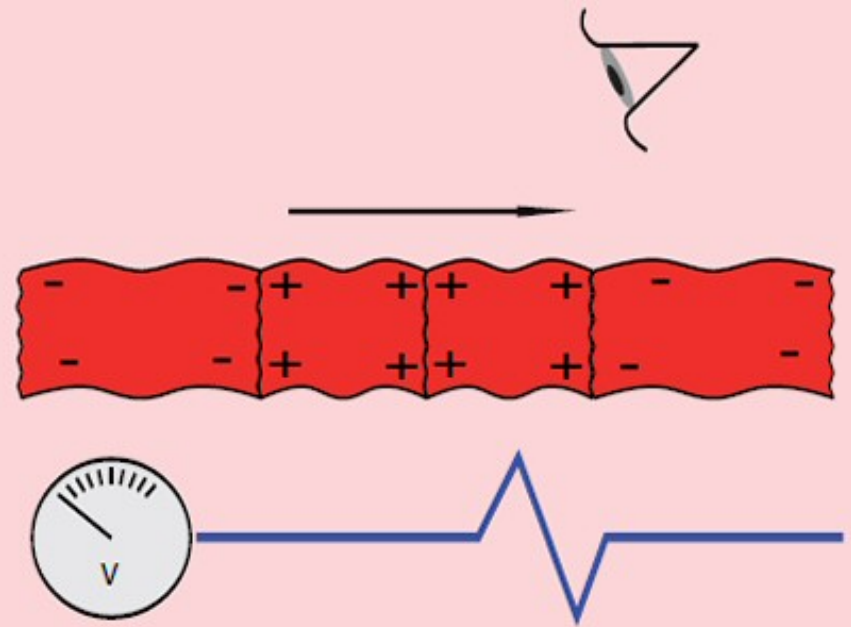


courtesy of Antoni van Ginneken

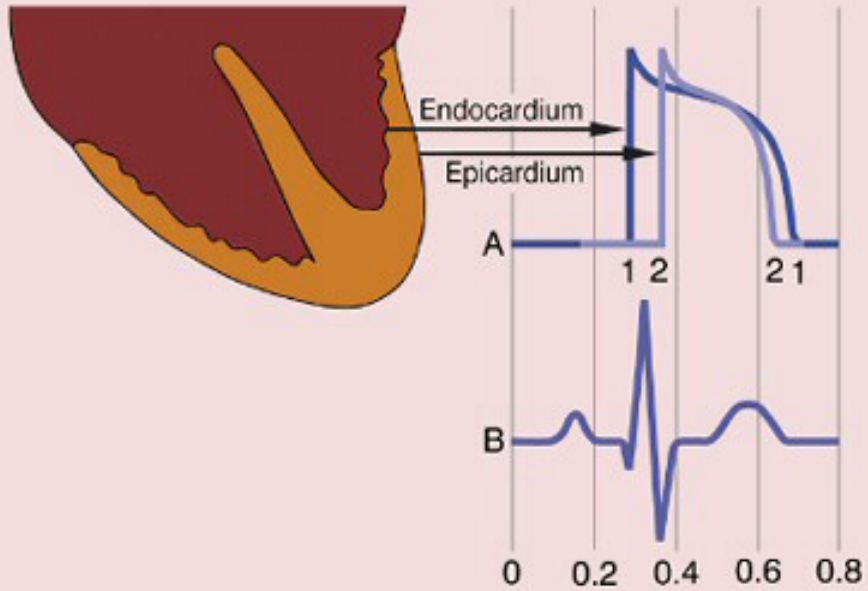




De lading verandering zorgt voor ion stromen over de hartcelwand.
 Eerst Na^+ stromen naar binnen, dan Ca^{++} en daarna K^+ naar buiten

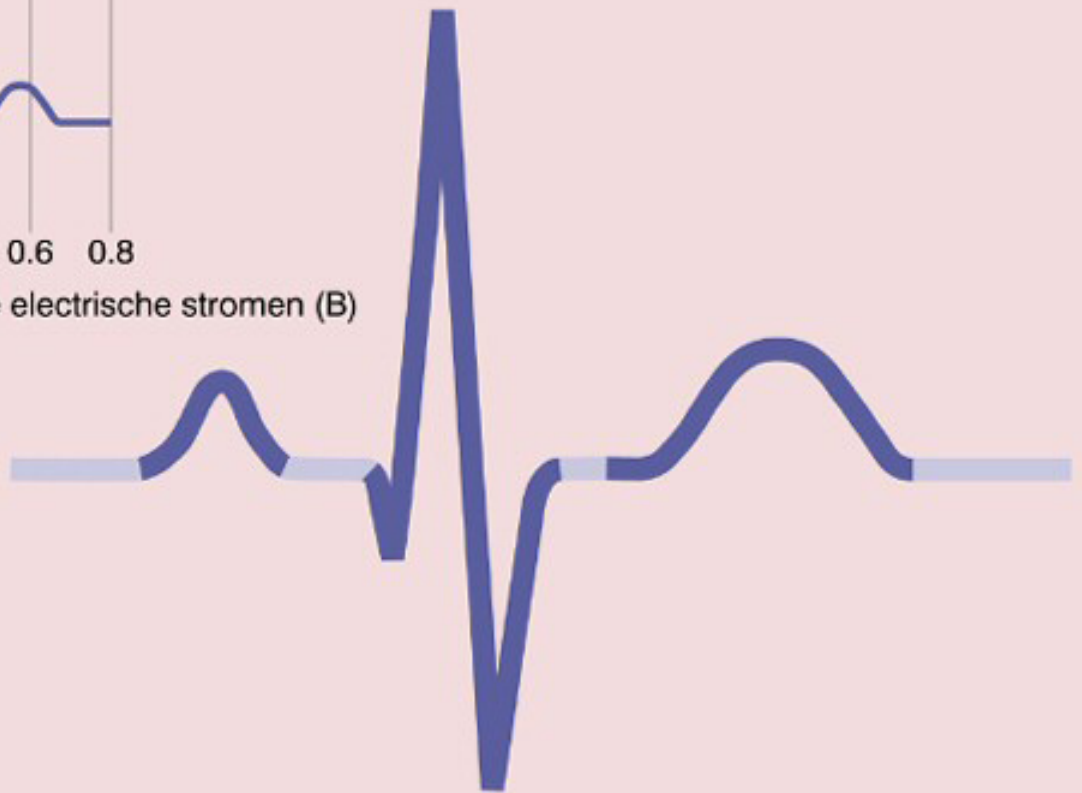


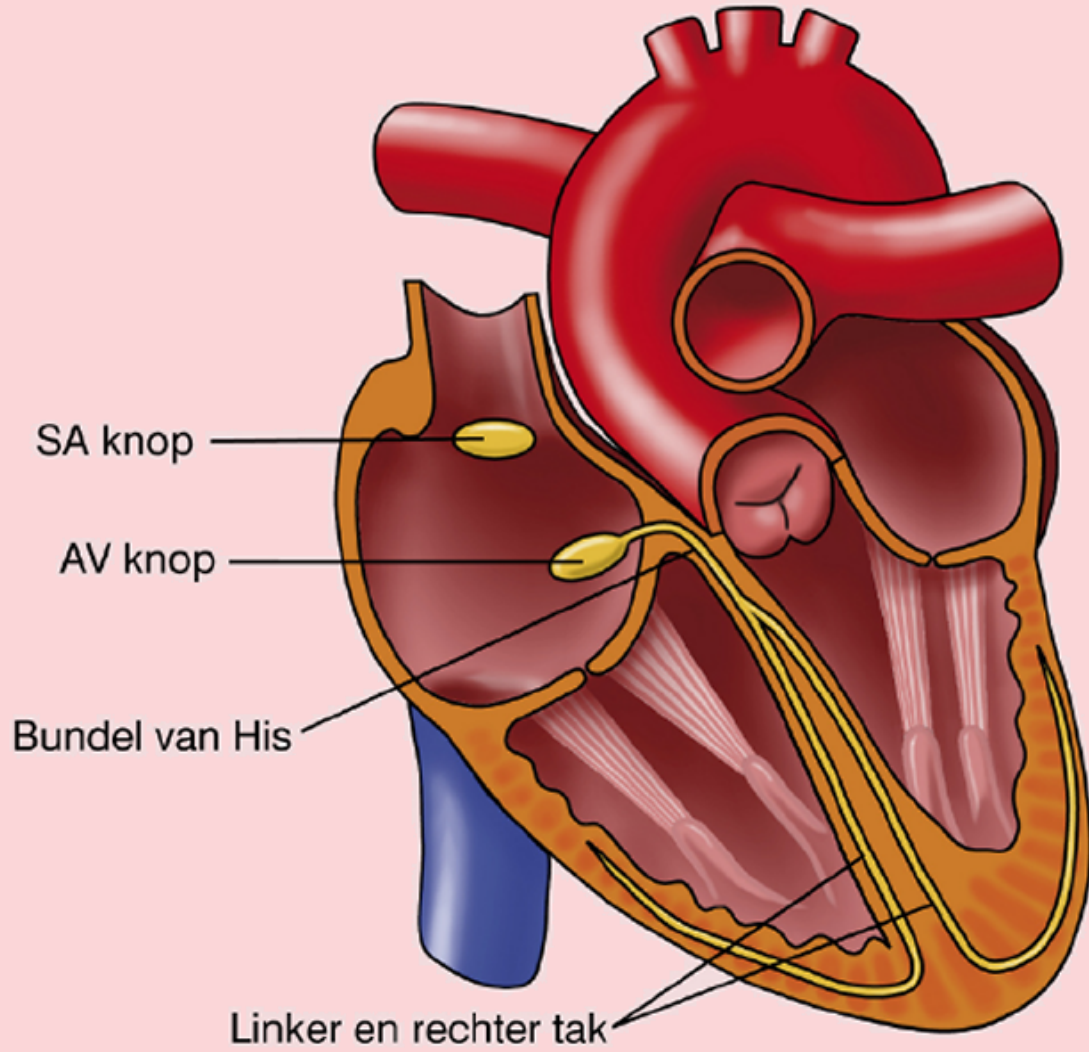
Signaal naar je toe is positieve uitslag

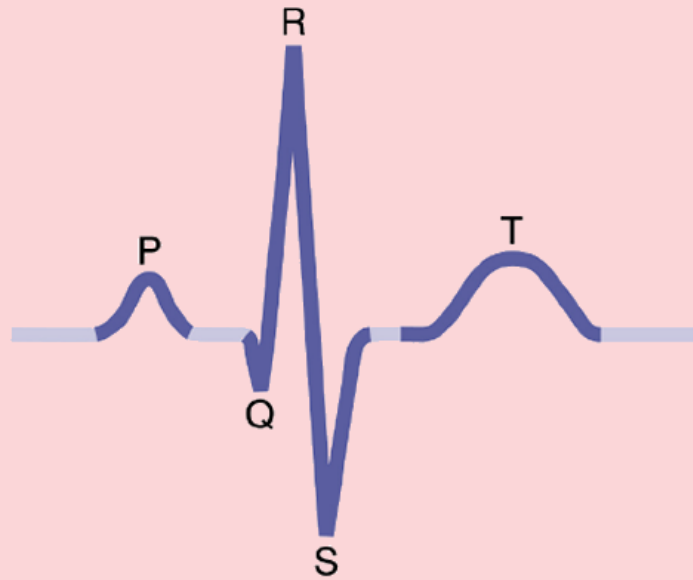


Het ECG registreert de optelsom van deze elektrische stromen (B)

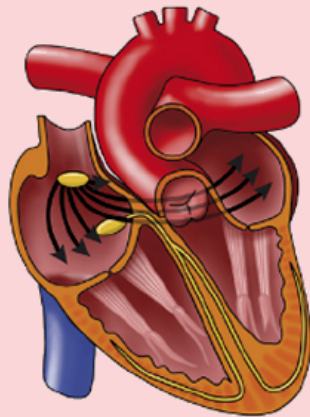
Het resultaat:





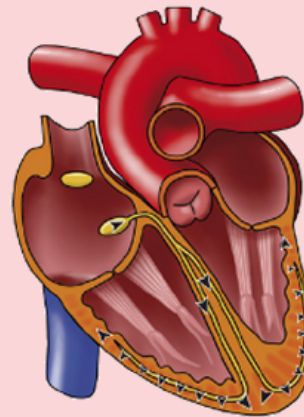


P golf



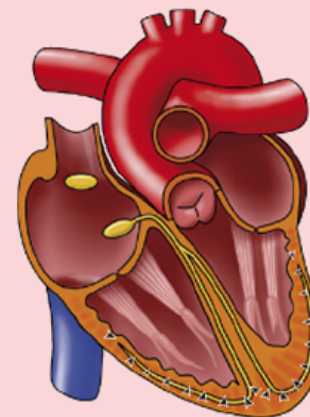
Activatie van
het atrium

QRS complex

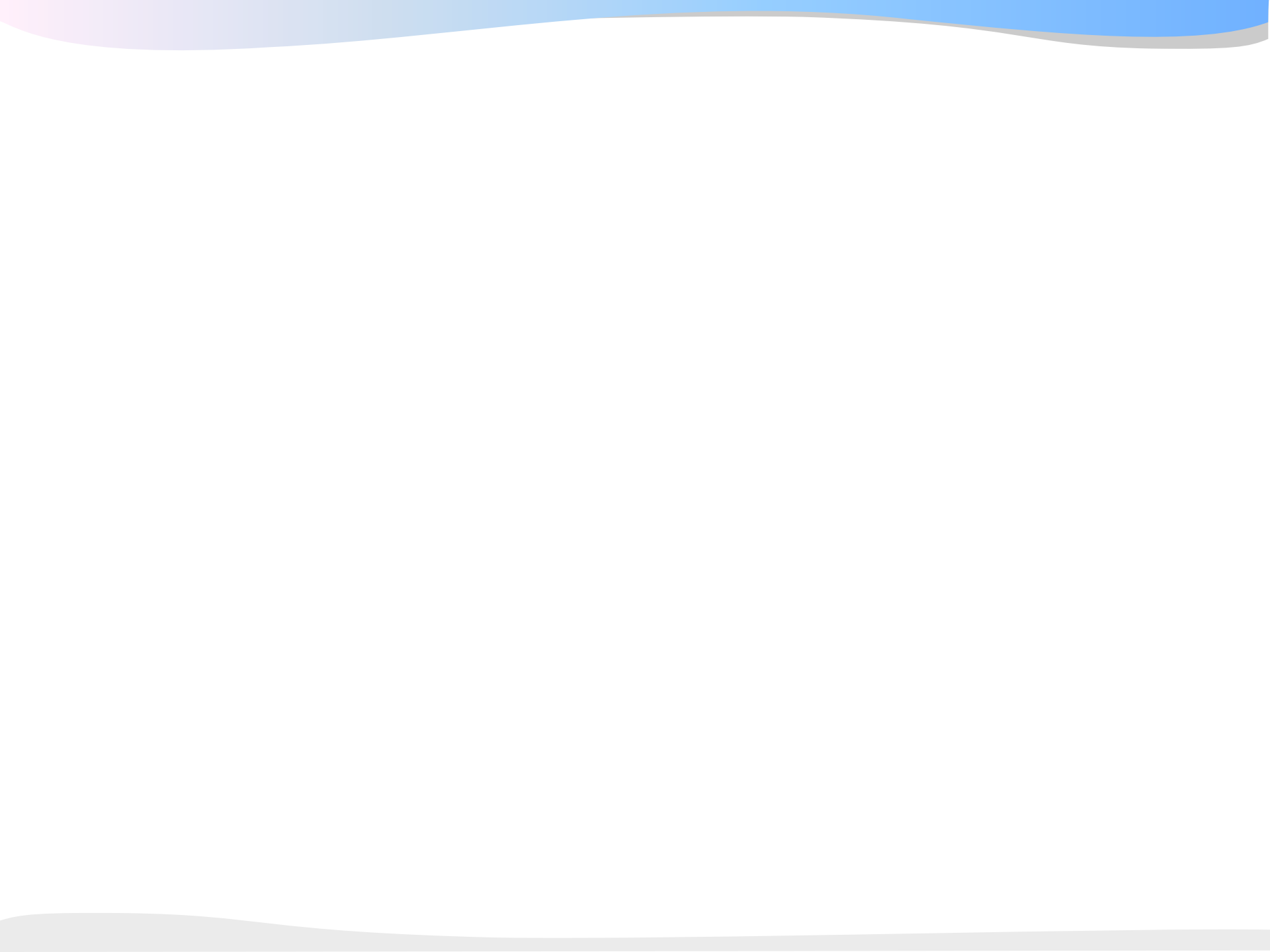


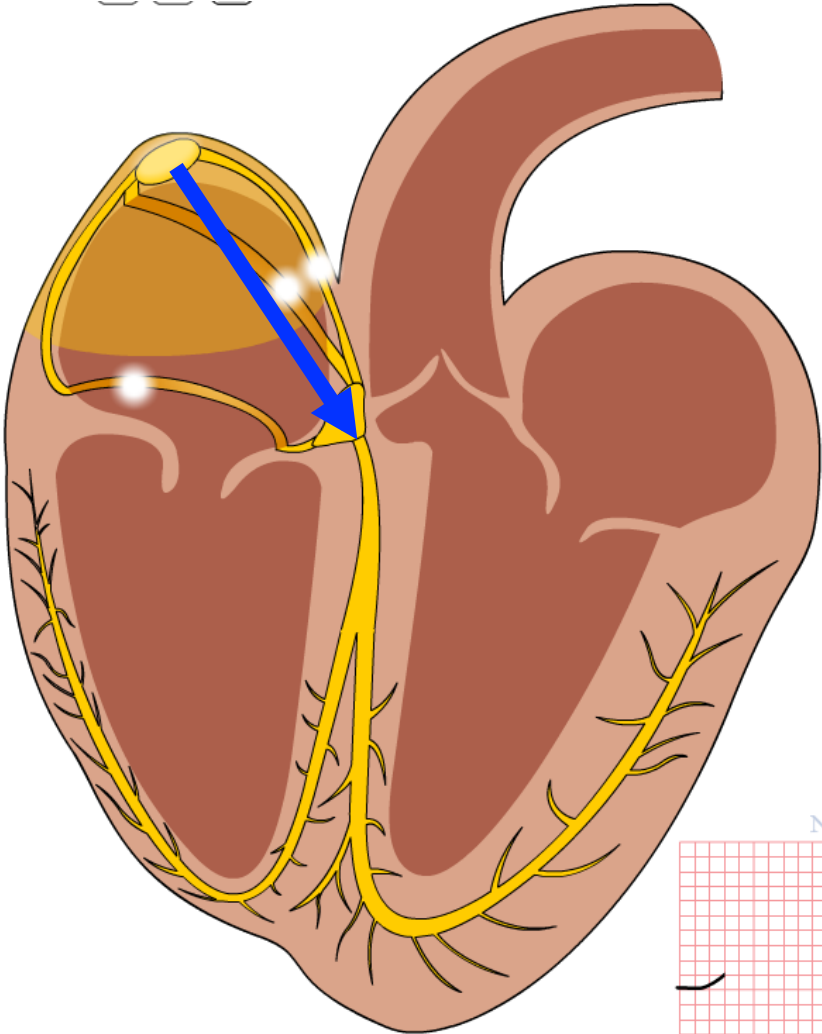
Activatie van
de ventrikels

T golf

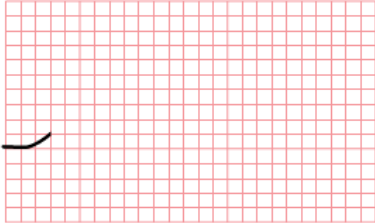


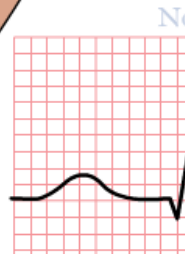
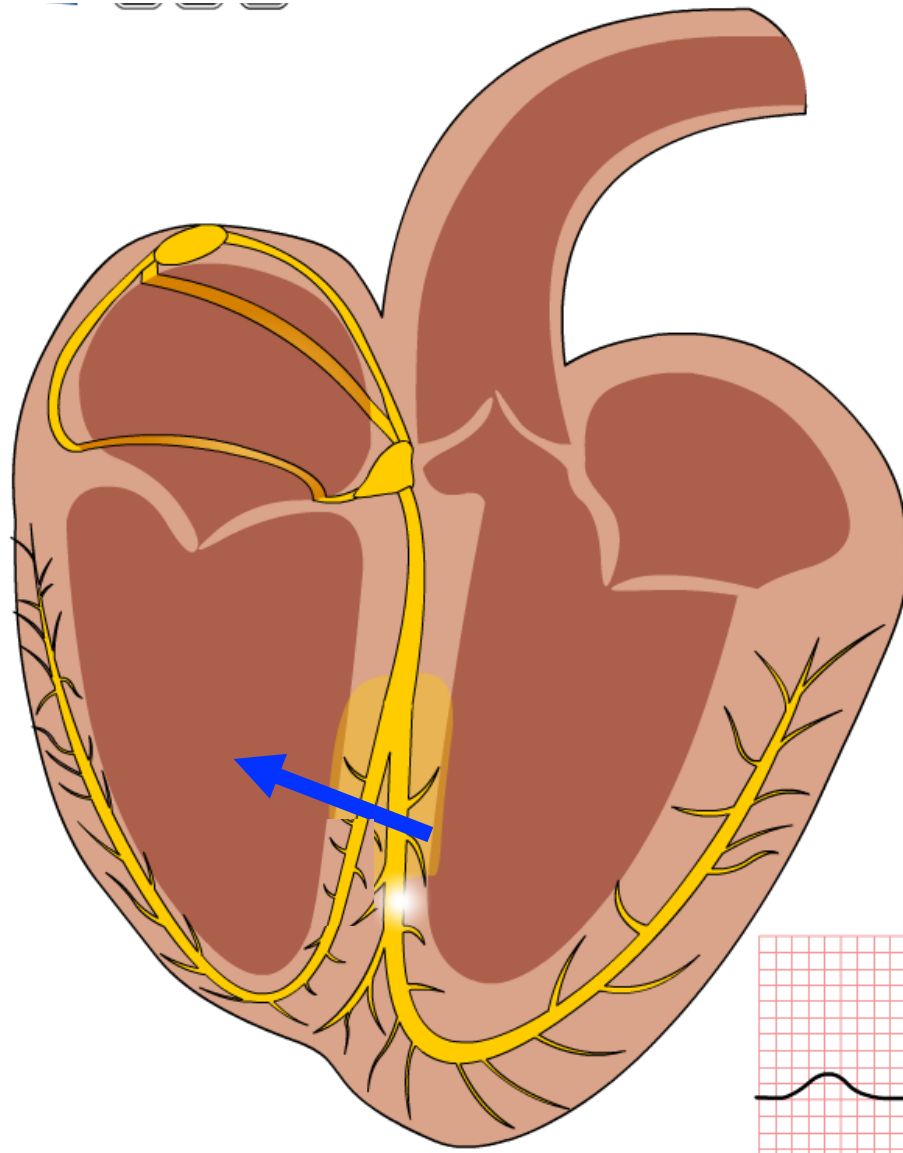
Herstel golf

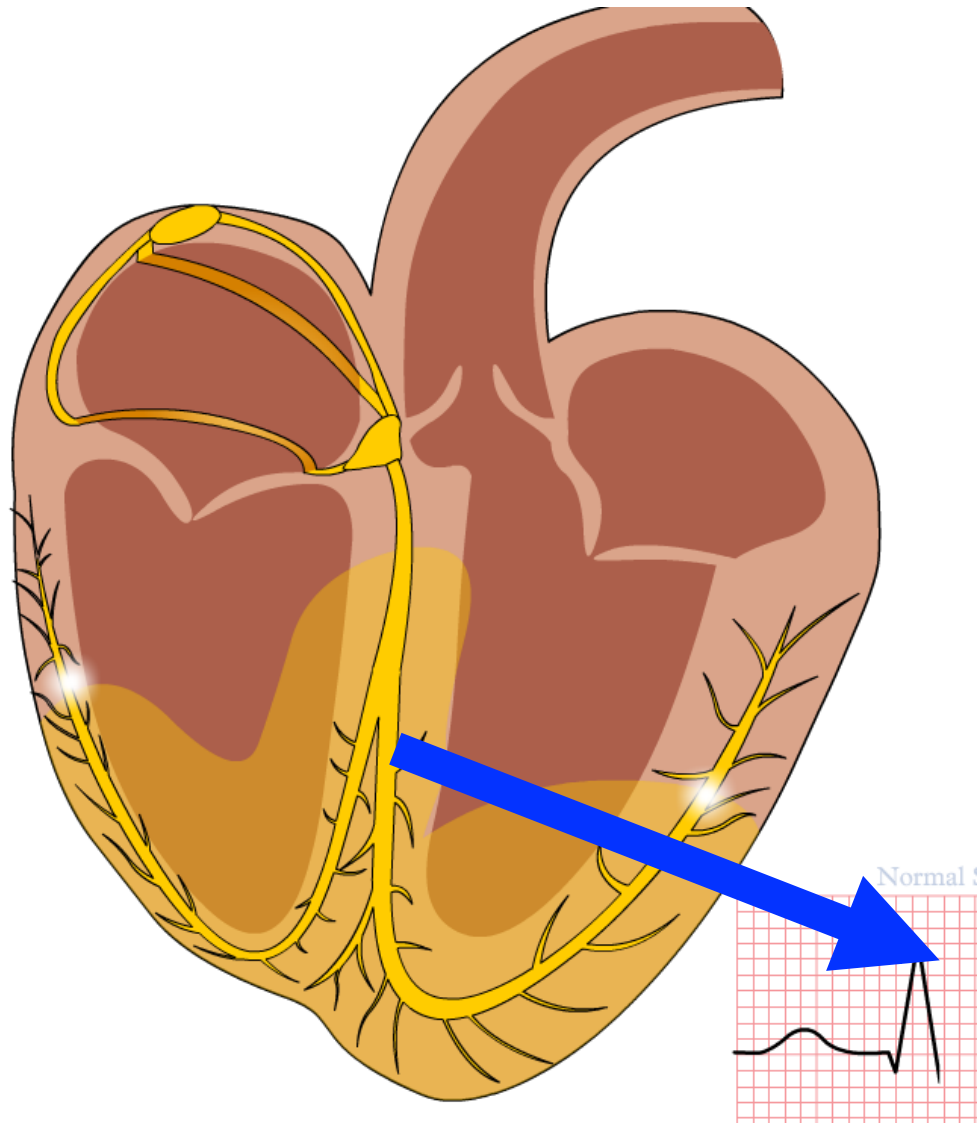


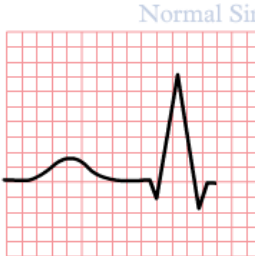
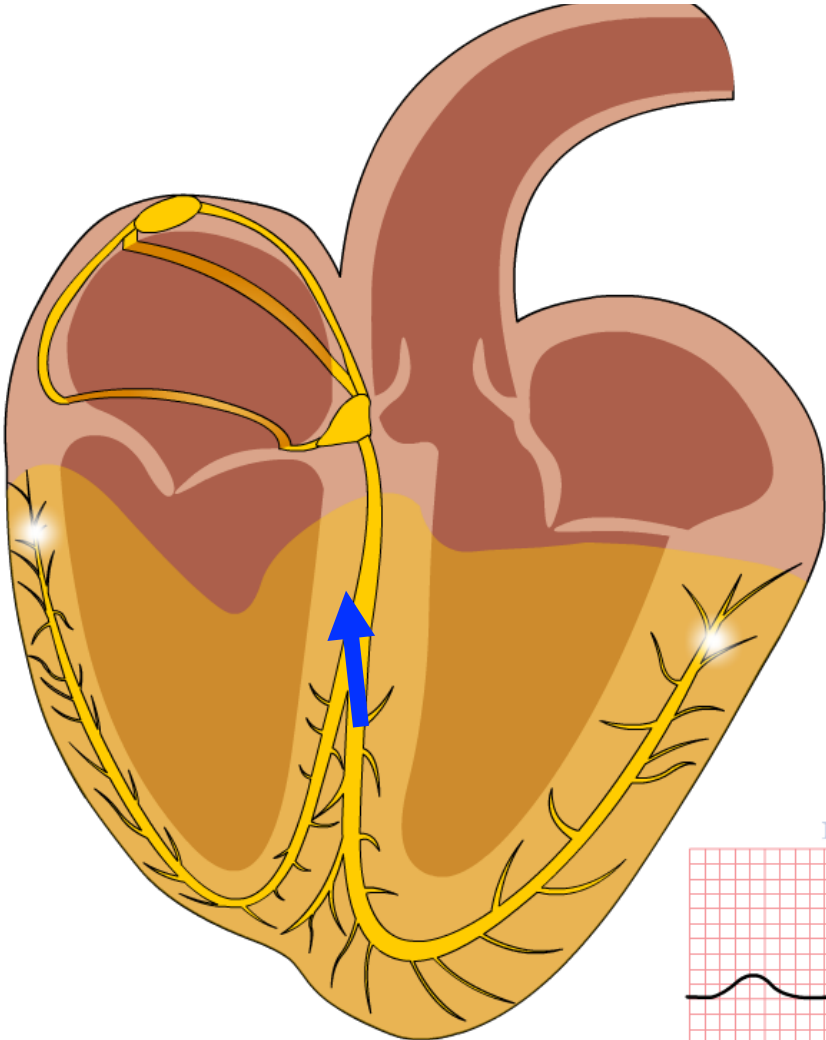


Normal Sinus Rhythm

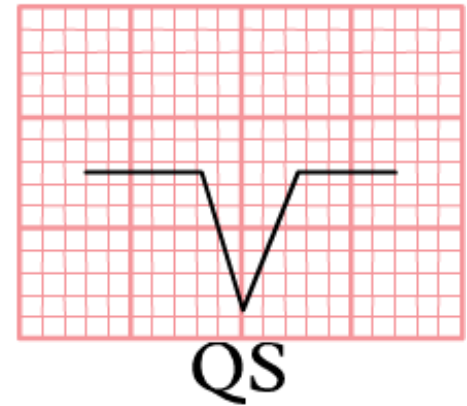
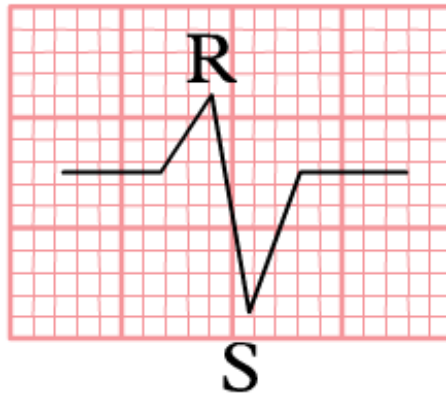
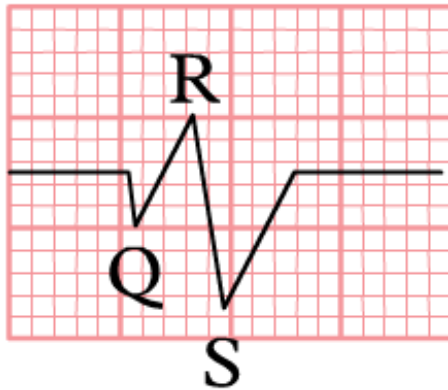
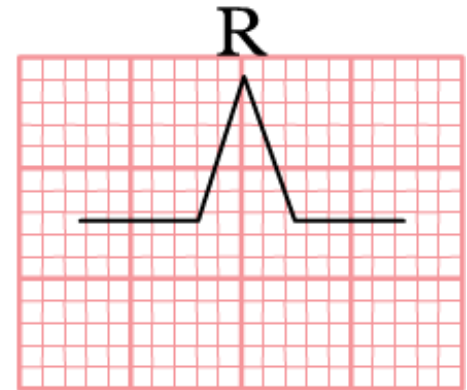
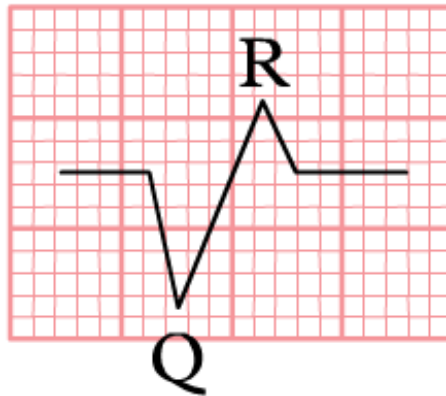
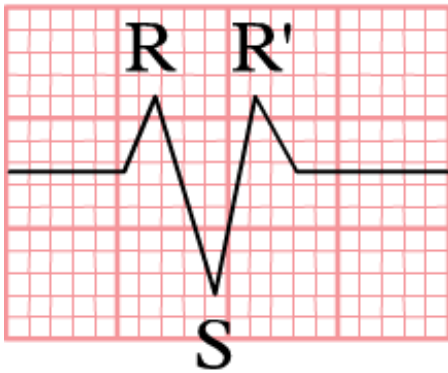




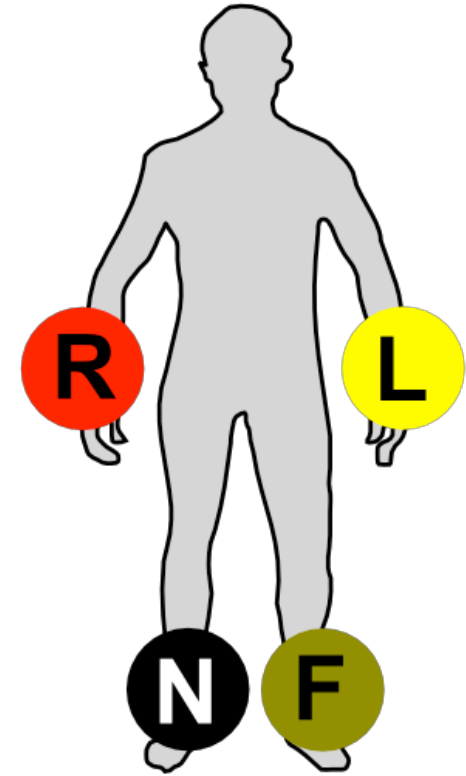
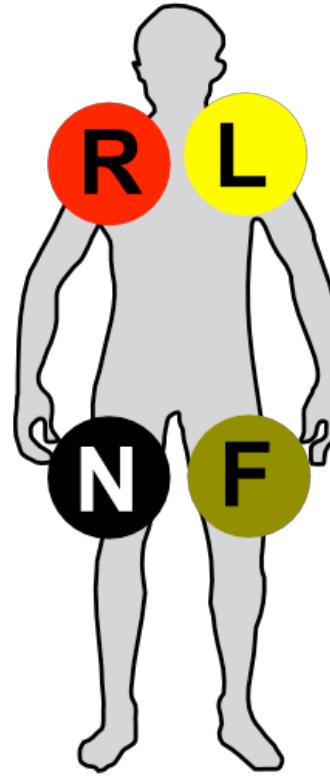
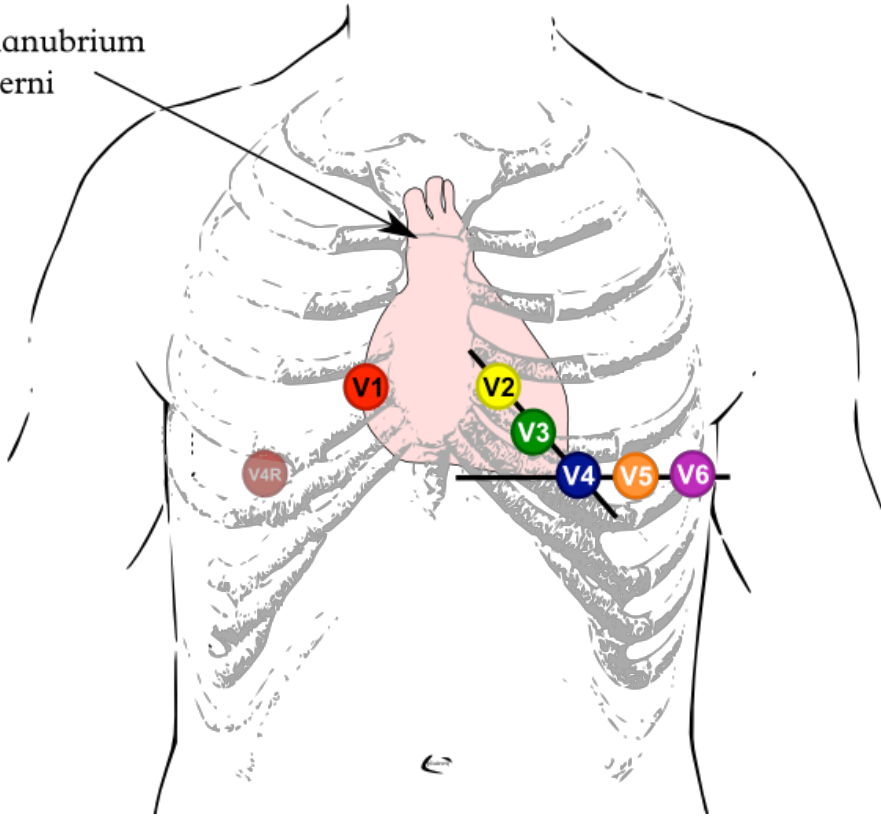


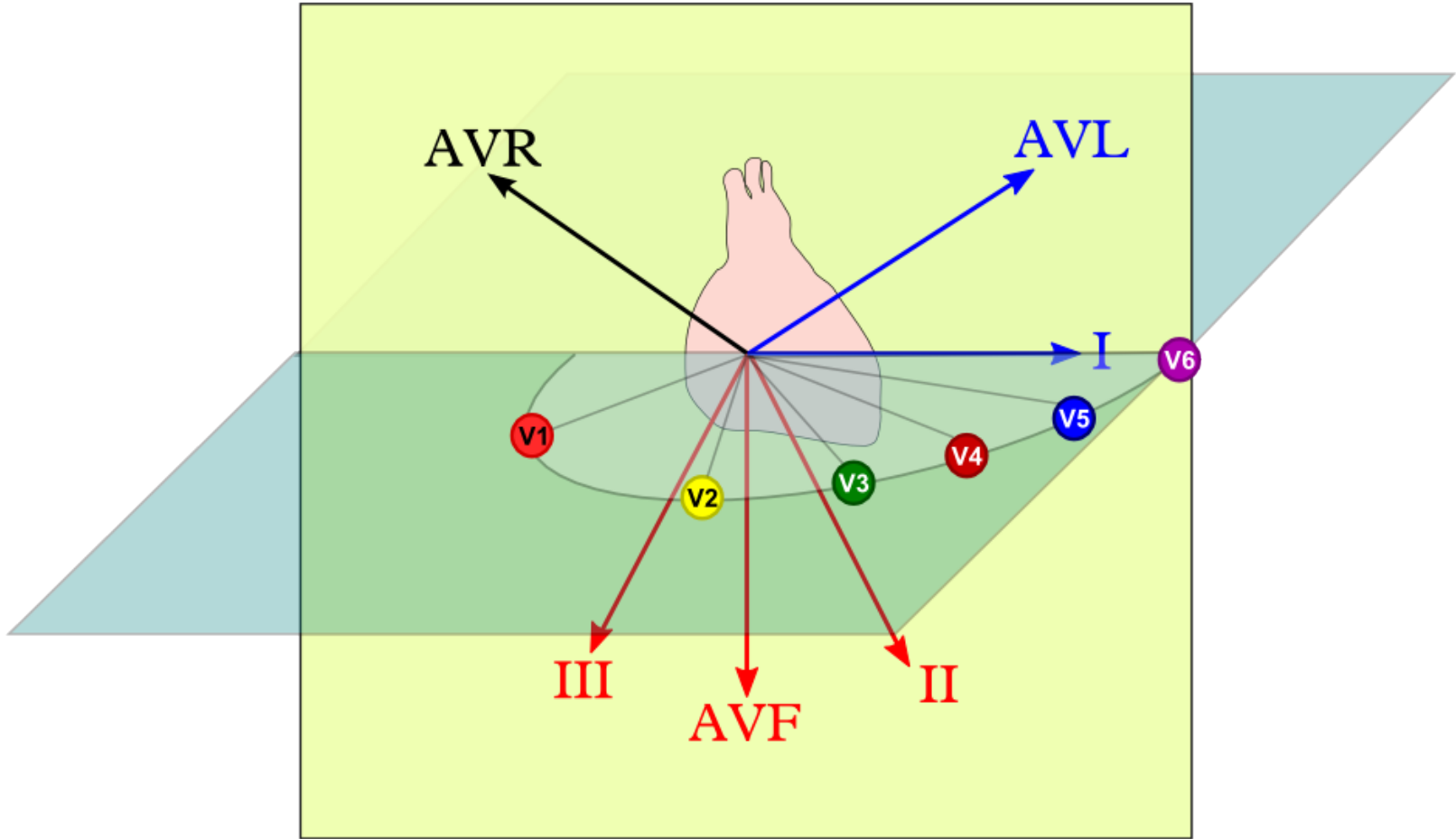


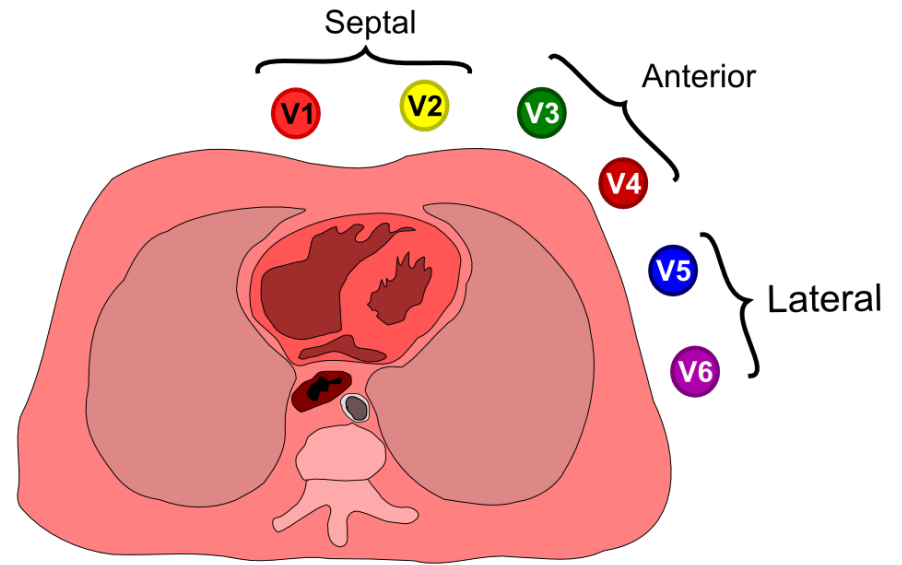
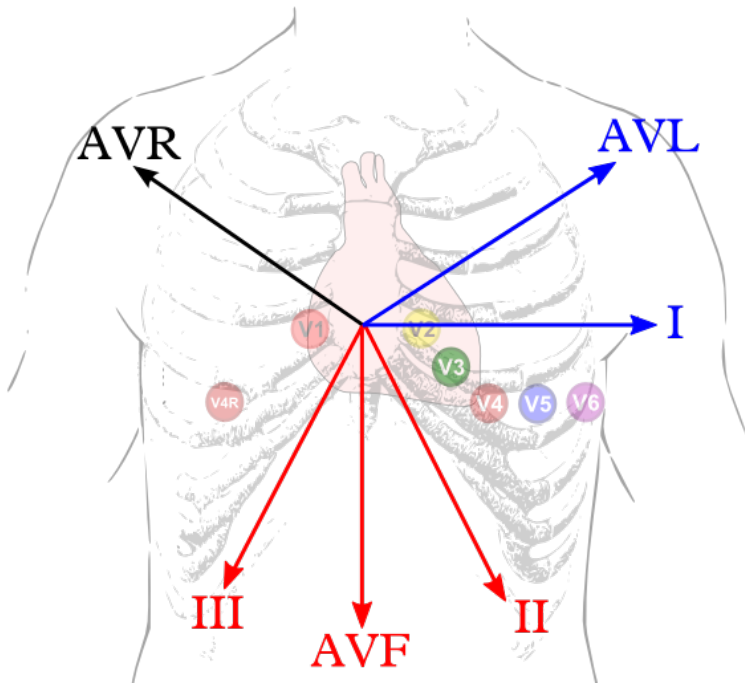
Nomenclatuur



Manubrium
Sterni







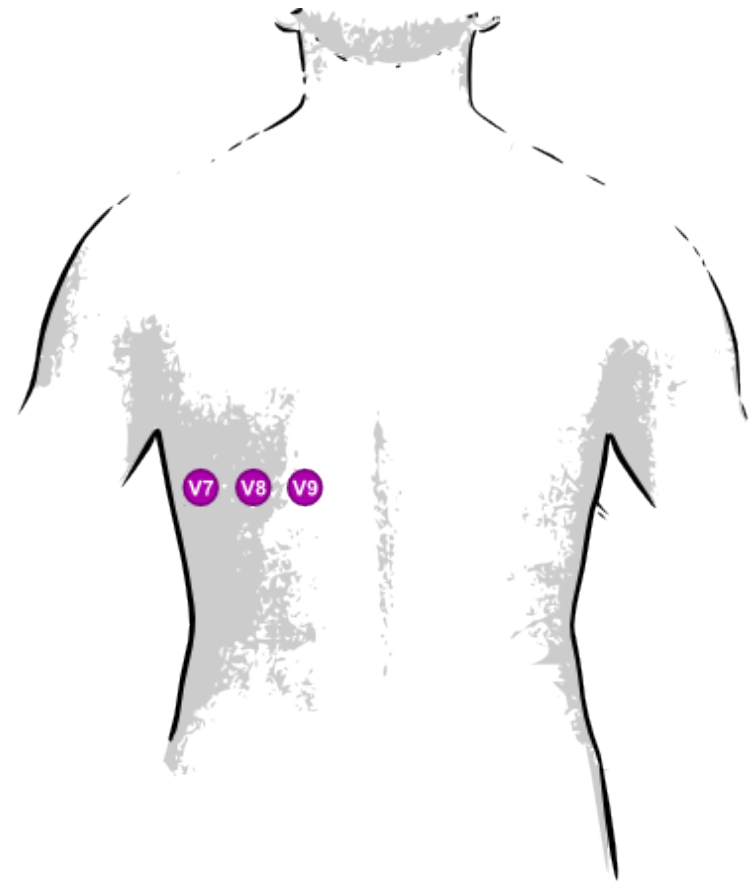
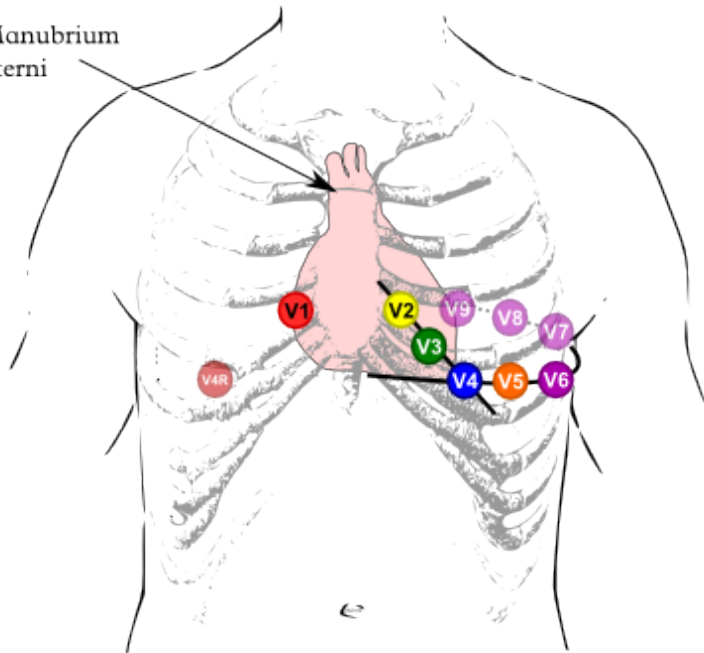
Bij elkaar horende afleidingen

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

Extra Leads

V4R, V7-V9

Manubrium
Sterni



SYSTEMATISCHE BEOORDELING

Systematische beoordeling

- Kijk nooit eerst naar de pathologie!
- **ALTIJD** systematisch beoordelen!
- Je mist belangrijke punten als je dat niet doet!

Systematische beoordeling

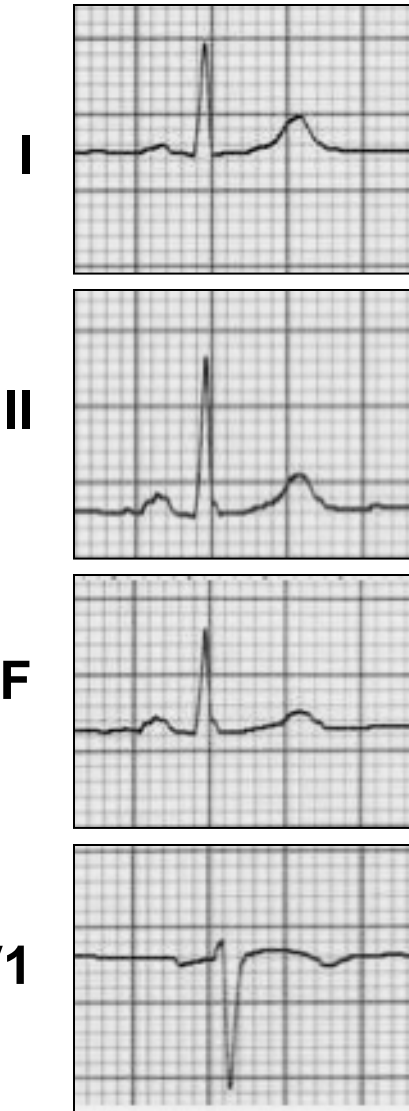
1. Ritme
2. Frequentie
3. Geleidingstijden
4. Hart-as
5. P top morfologie
6. QRS morfologie
7. ST morfologie

8. Vergelijking met oud ECG
9. Conclusie

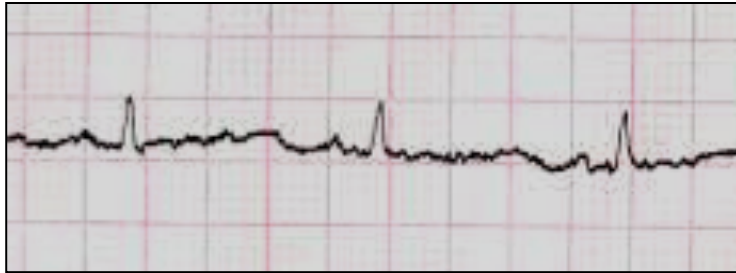
1 Ritme

Eigenschappen van normaal sinusritme

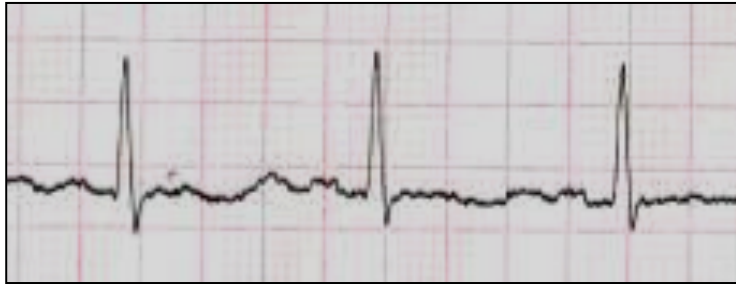
- Op een P-top volgt een QRS complex
- Het ritme is regelmatig, maar varieert licht met de ademhaling
- De **frequentie** ligt tussen de 60 en 100 / minuut.
- De p top is **positief in II** en **AVF**, en bifasisch in V1
- De **PQ tijd** is tussen de 0,12 en 0,2 seconden



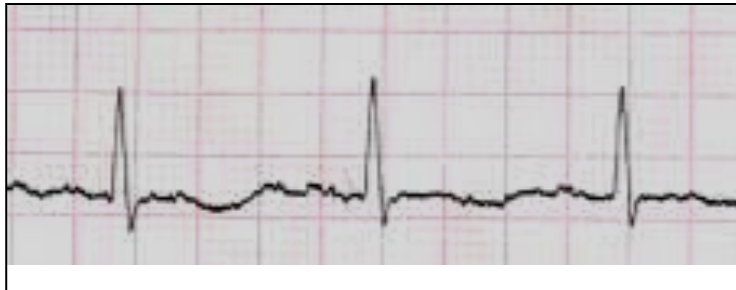
I



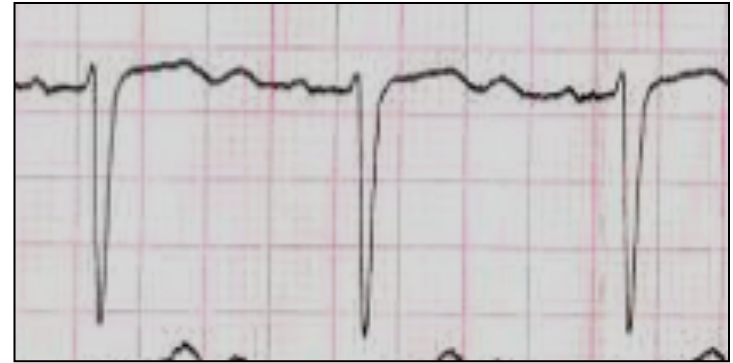
II



AVF



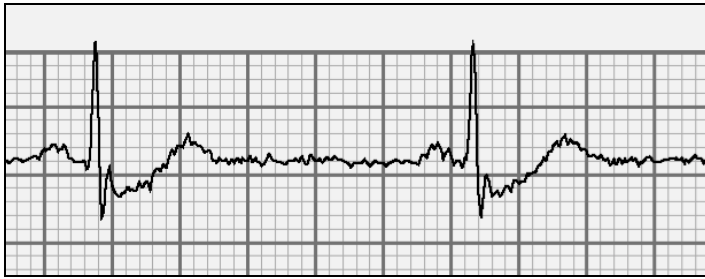
V1



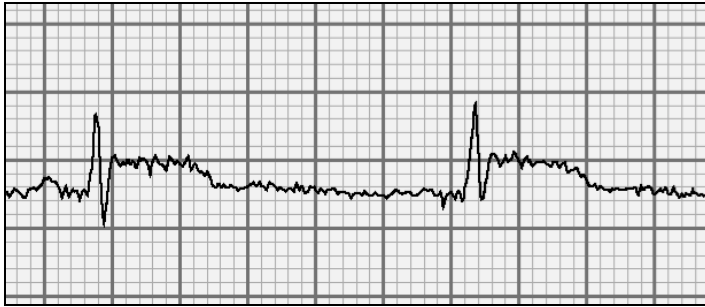
Is dit sinusritme?

1. Ja, sinusritme
2. Nee, boezemfibrilleren
3. Nee, boezemflutter
4. Nee, anders

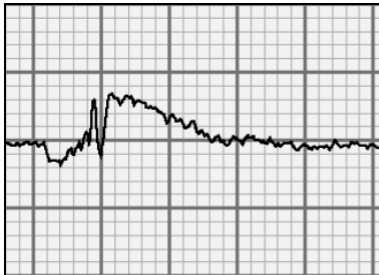
I



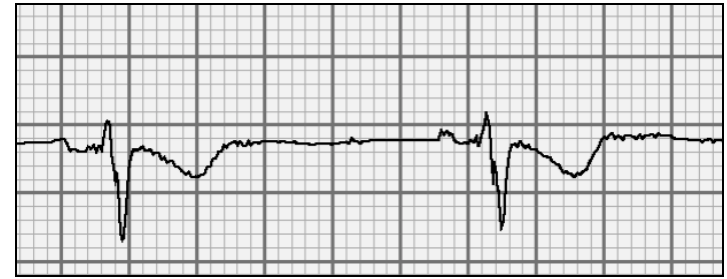
II



AVF



V1



Wat is het ritme?:

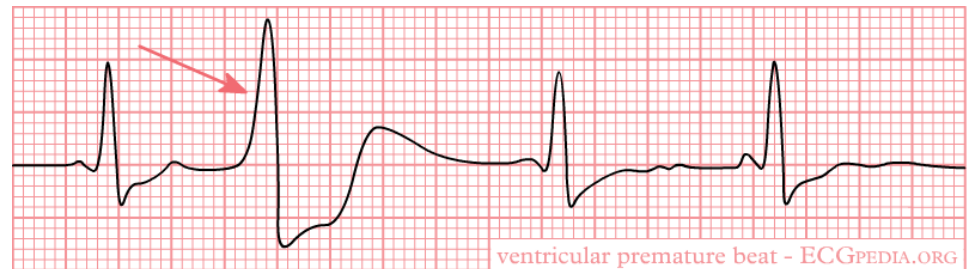
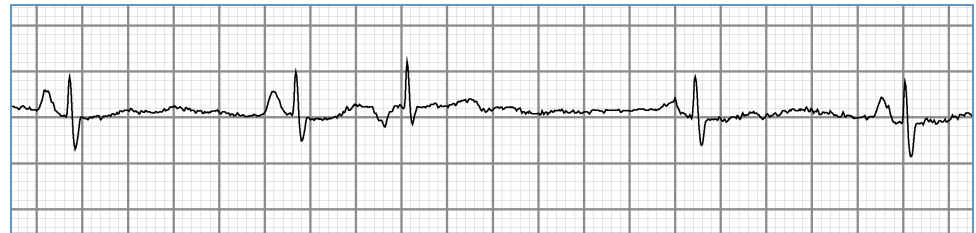
Extrasystolen

-Boezemextrasystole

Non-compensatoire pauze

-Ventrikeextrasystole

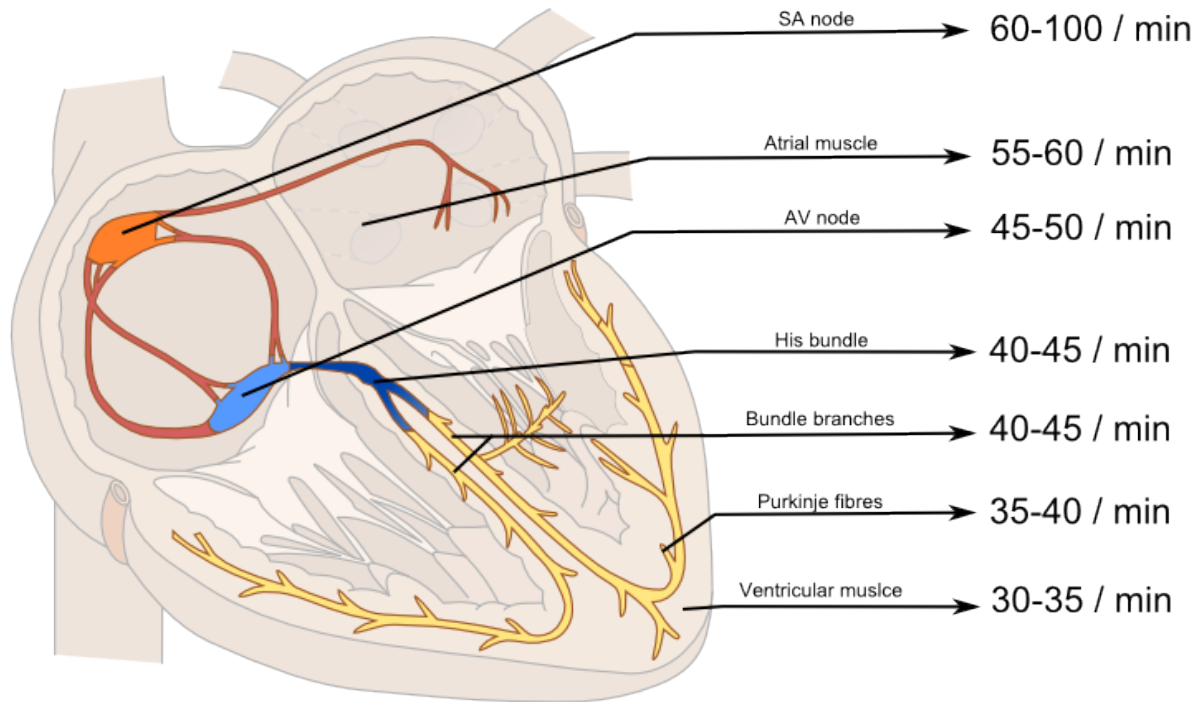
Compensatoire pauze



Klinische betekenis VES

- Prevalentie 4.4% in een studie met 15637 'gezonden'
- Slechtere prognose (SCD risk 4.2) bij:
 - Frequente VES (>30 / uur)
 - Complexe VES (multiform, coupletten, tripletten, NSVT's, R op T)

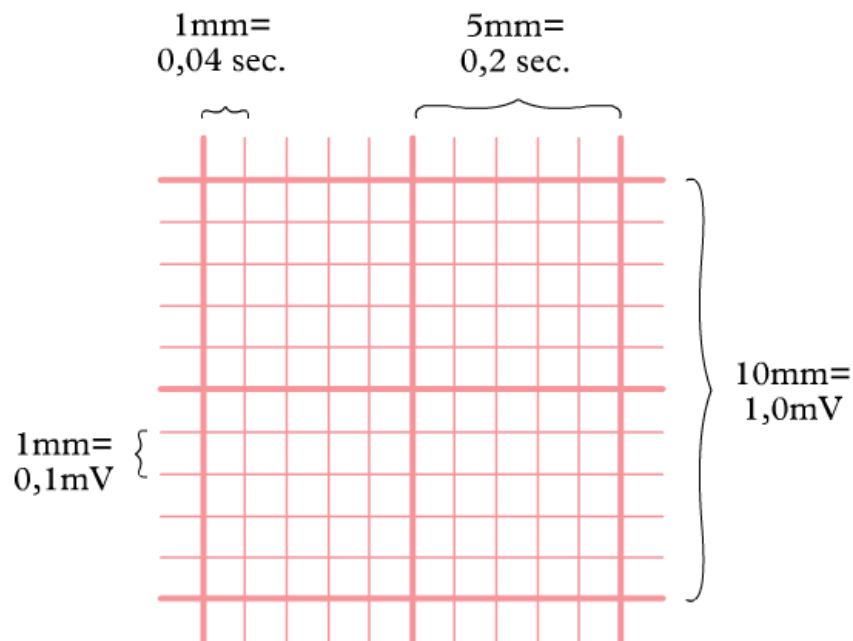
Escaperitme



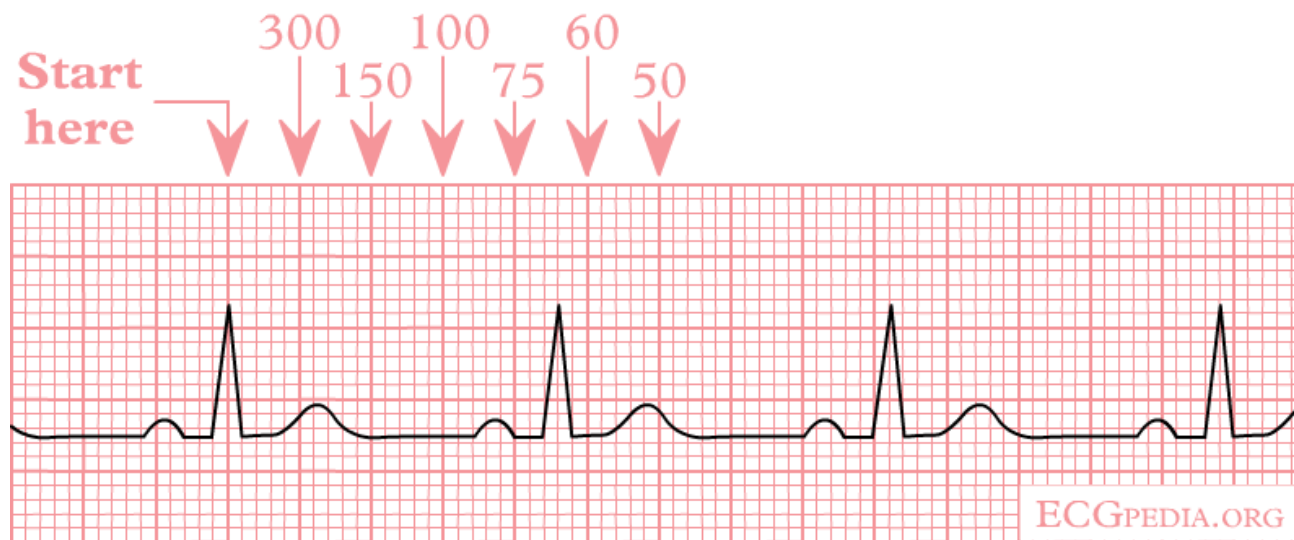
2 Frequentie

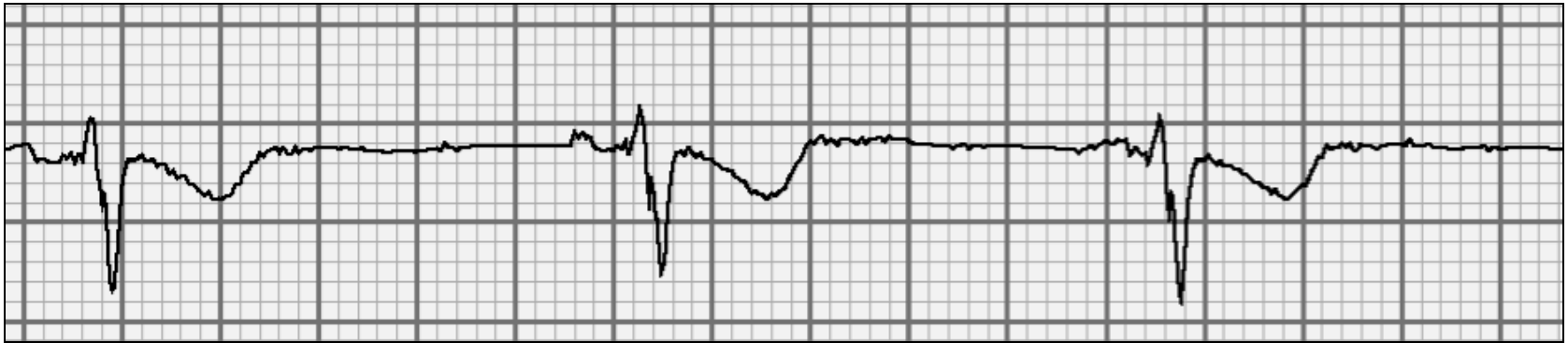
3 methoden:

1. Aftelmethode
2. Berekenen: $1500 /$ aantal kleine hokjes tussen 2 hartslagen
3. Marker methode



ECGPEDIA.ORG





Wat is de frequentie?

1. 105
2. 95
3. 85
4. 75
5. 65
6. 55
7. 45



Wat is de frequentie?

1. 105
2. 95
3. 85
4. 75
5. 65
6. 55
7. 45

3 Geleidingstijden

PQ tijd tussen 0.12 en 0.20 seconde

- te kort → WPW
- te lang → AV blok

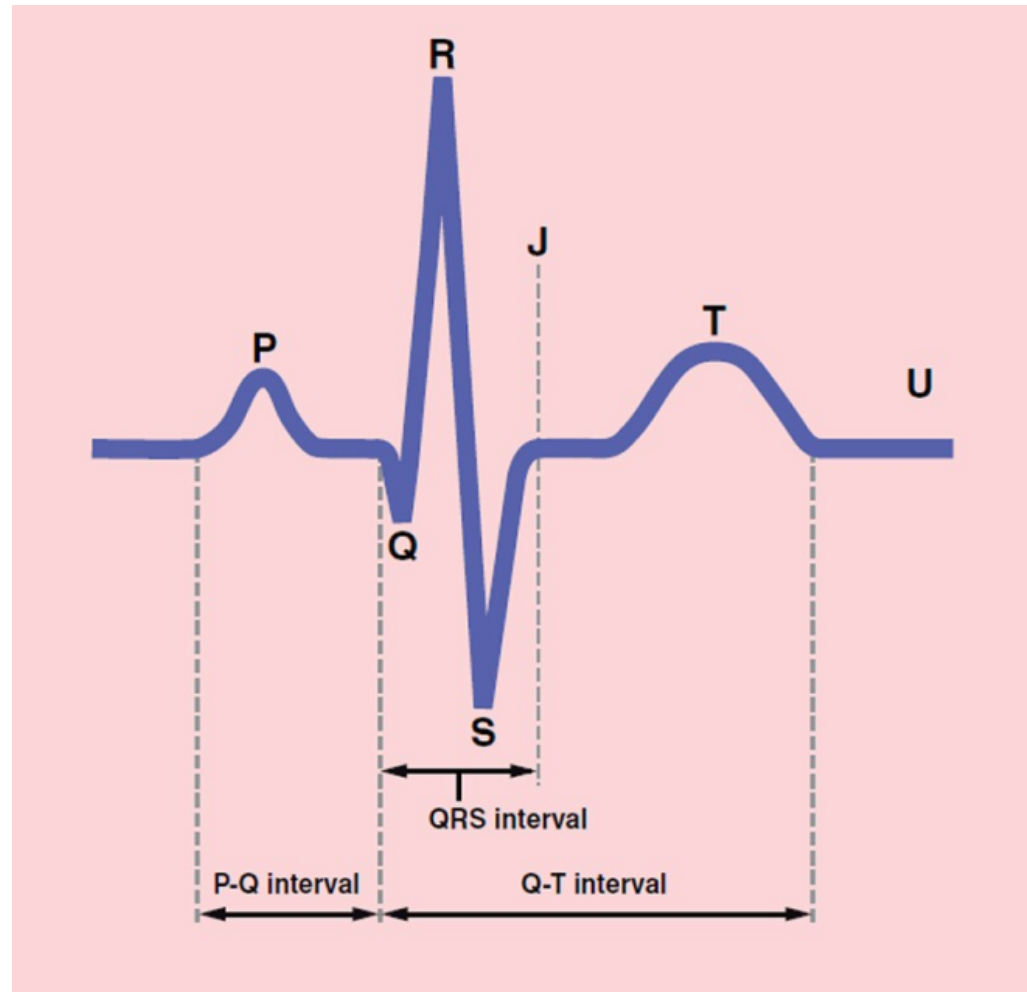
QRS duur ≤ 0.10-0.12 seconde

Te lang → LBTB / RBTB

QTc tijd = repolarisatie

Mannen < 450ms

Vrouwen < 460ms



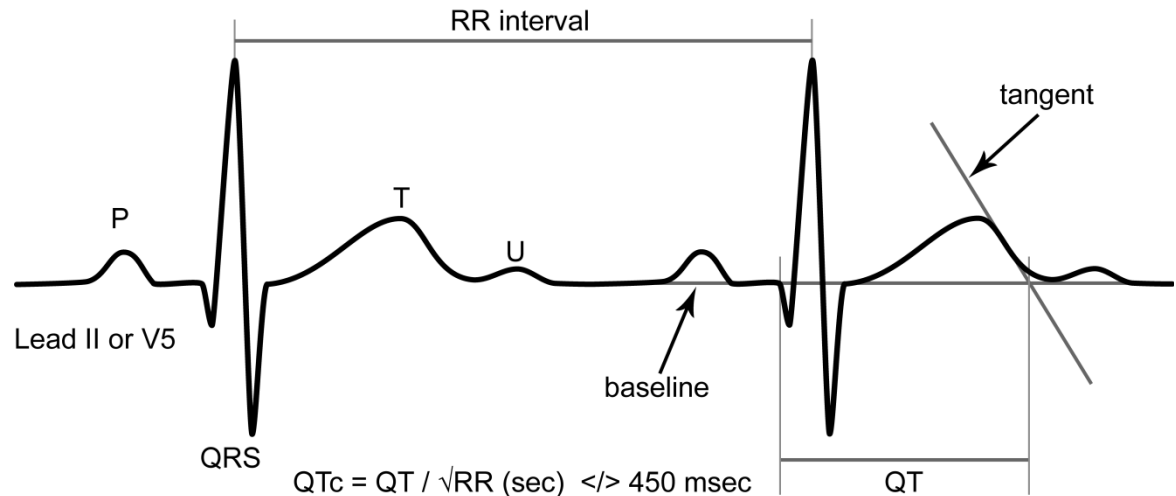
Check de QT tijd die de computer uitrekent!

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

Dan geen QTc verlengende medicatie:

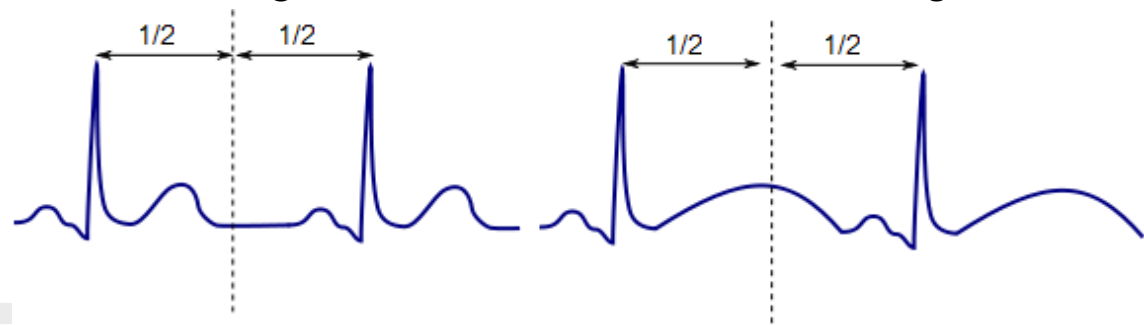
- Sotalol
- Amiodarone
- Erythromycine
- Clarithromycine
- Haldol

Zie www.torsades.org



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

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



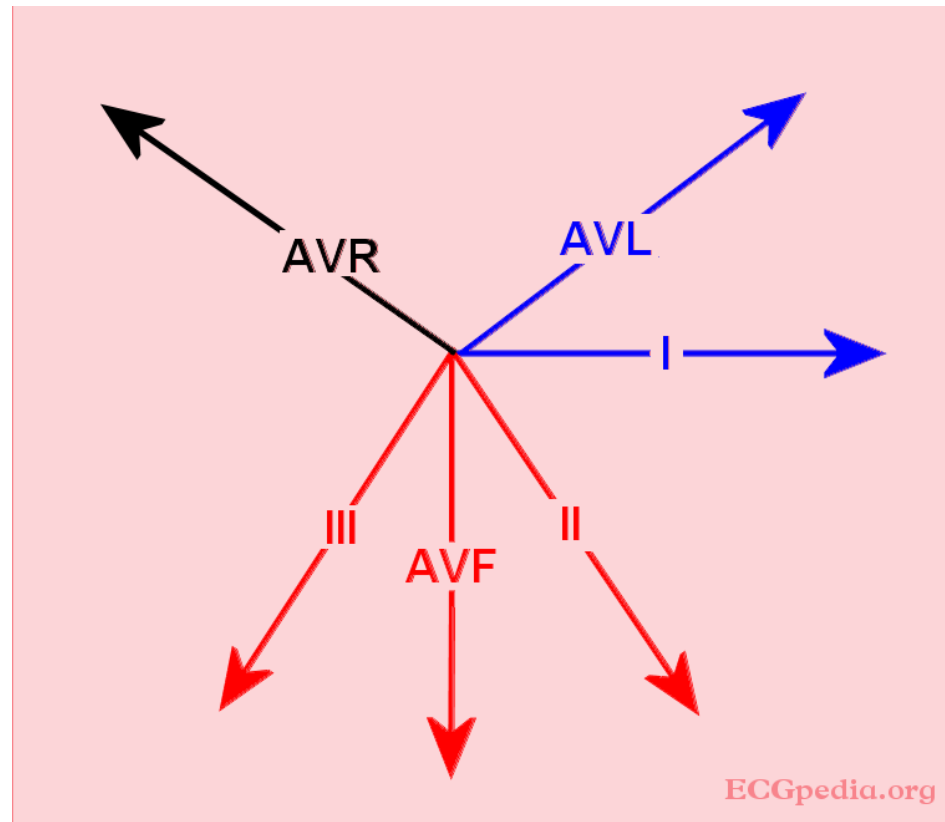
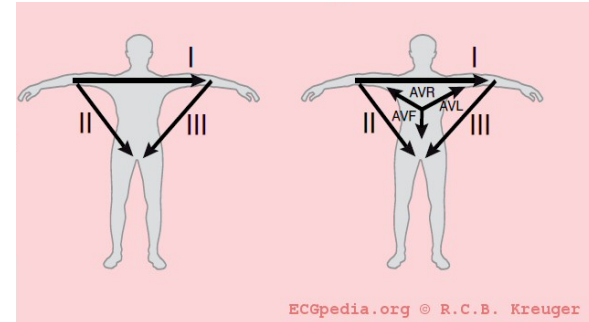
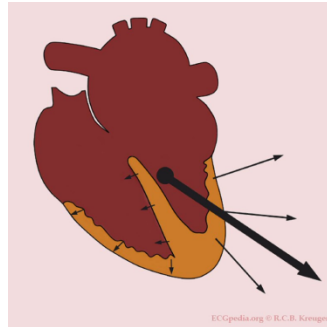
4 Hartas

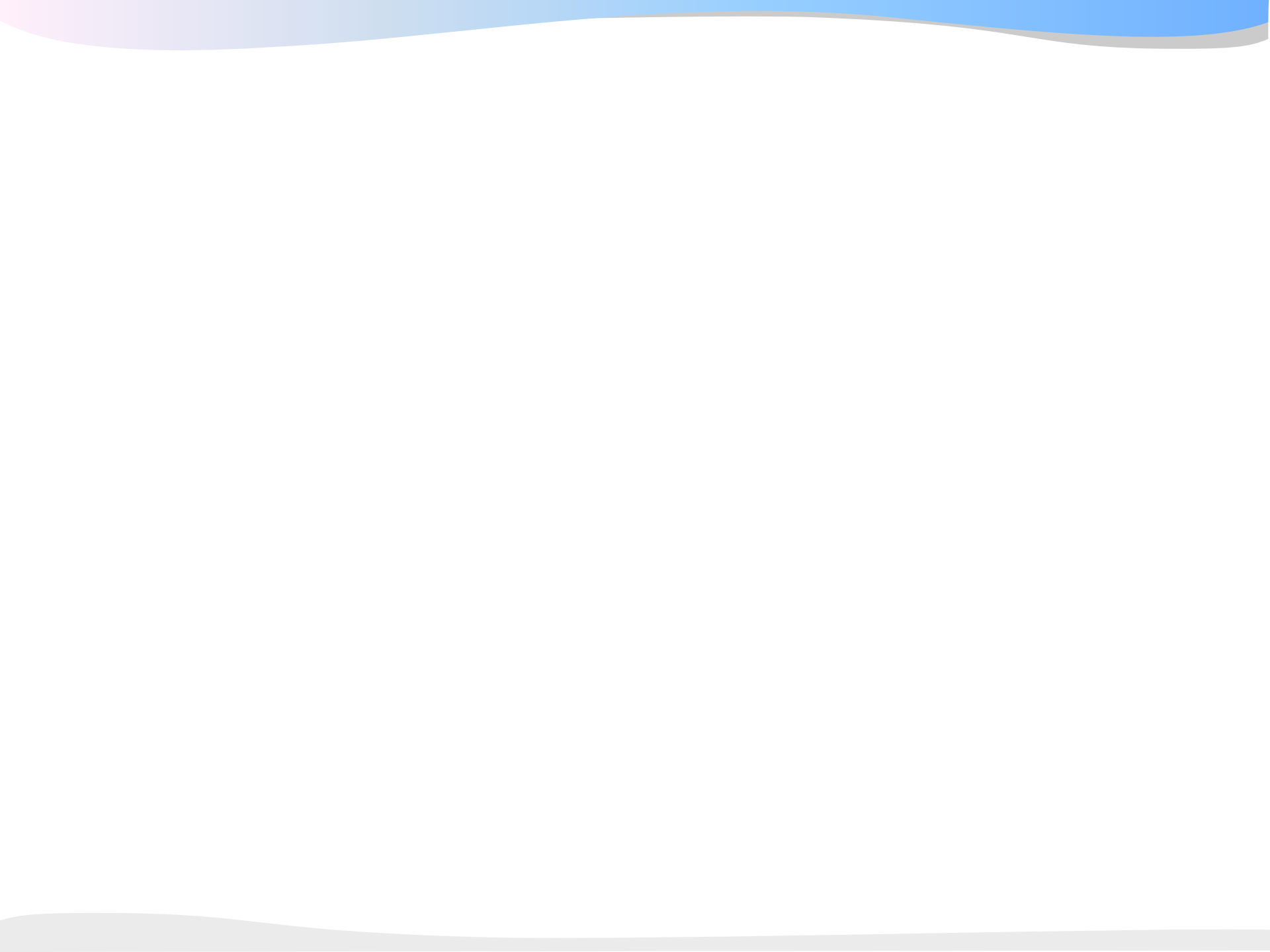
Geeft de gemiddelde elektrische activiteit aan

Normaal is tussen -30 en +90 graden.

Positief in II en AVF? →
hartas = normaal

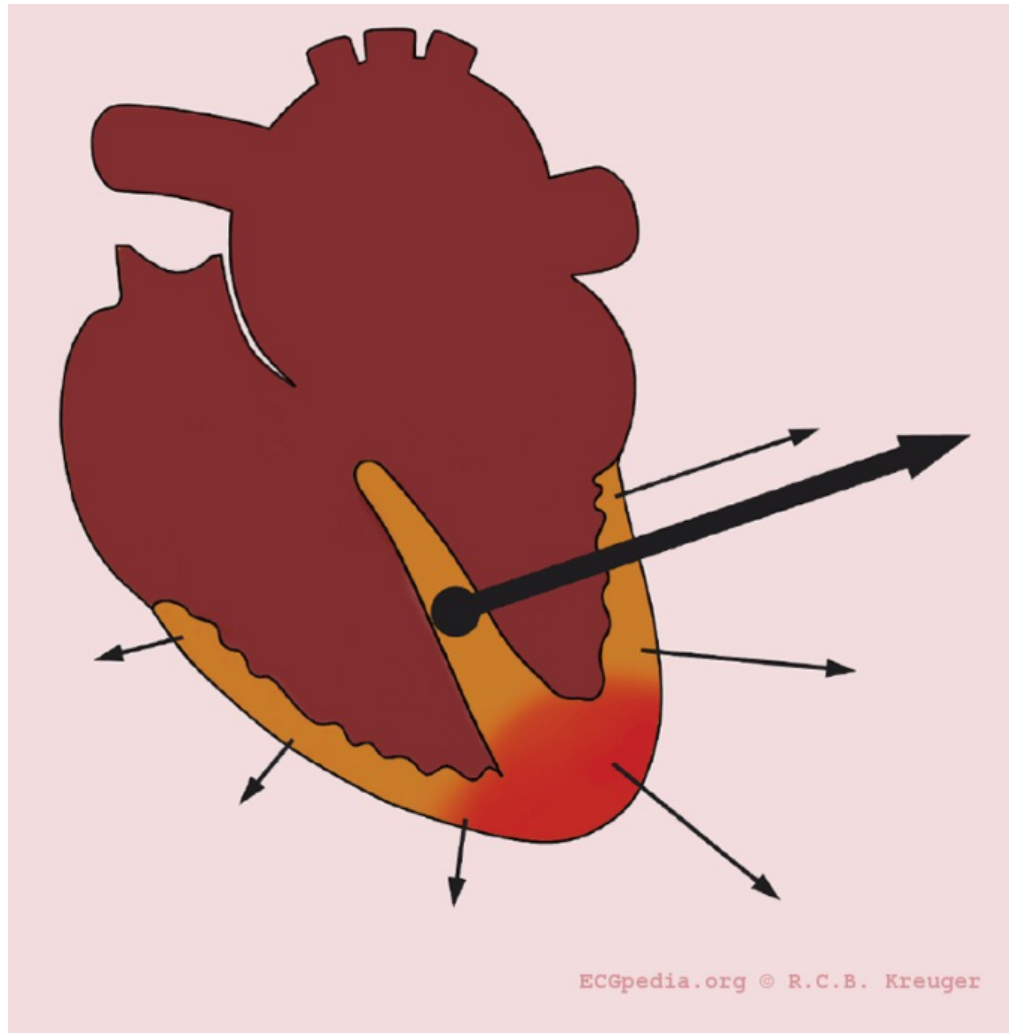
Kijk op het ECG! De computer heeft het meestal goed.





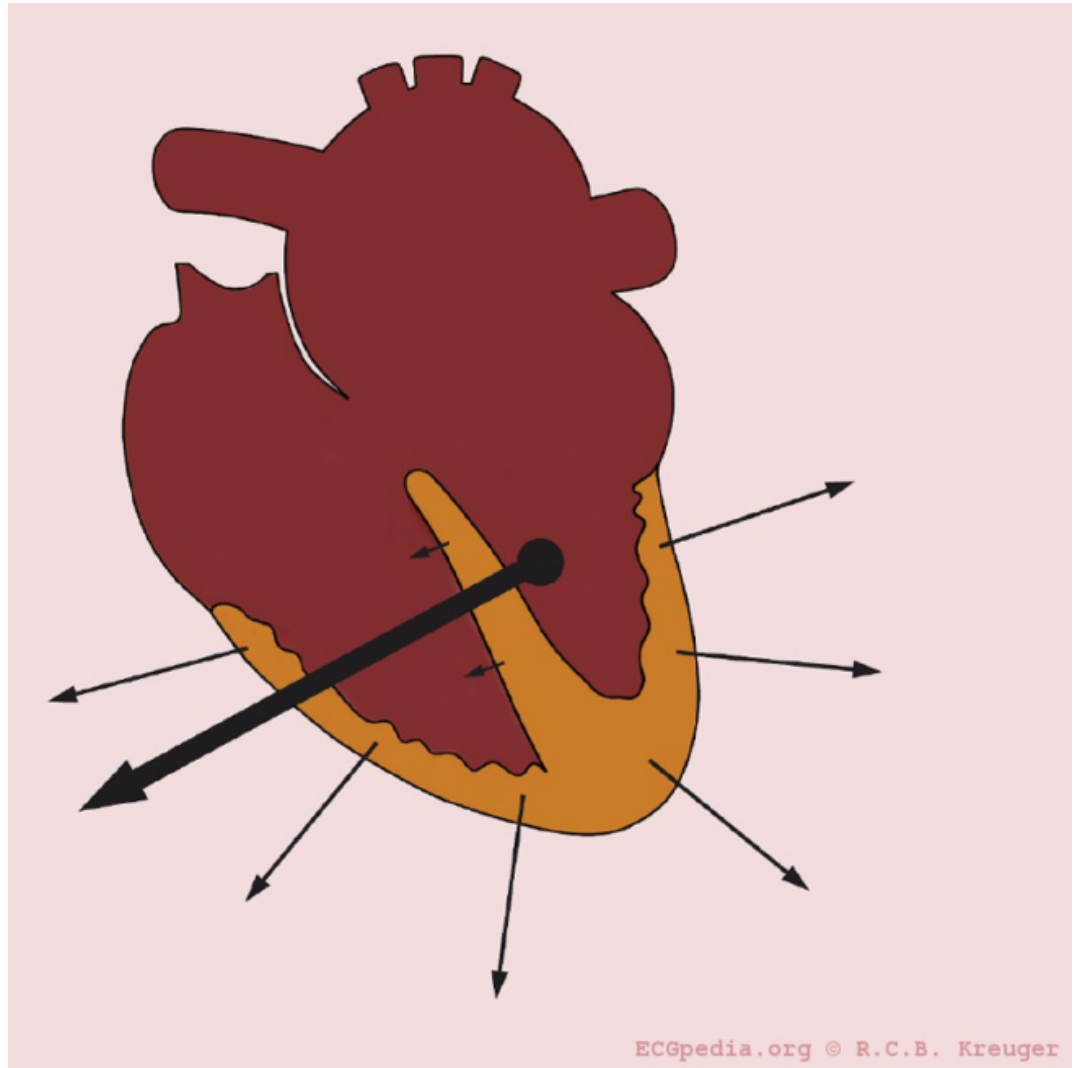
Linker hartas

- Linker anterior hemiblok
- Onderwandinfarct
- Linker ventrikelhypertrofie
- Pacemakerritme

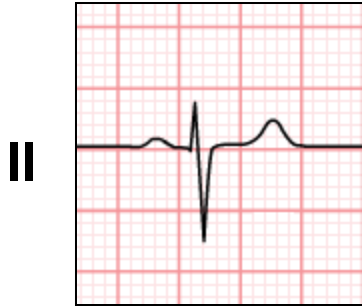


Rechter hartas

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



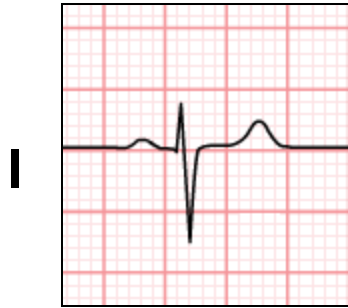
Wat is de hartas?



AVF

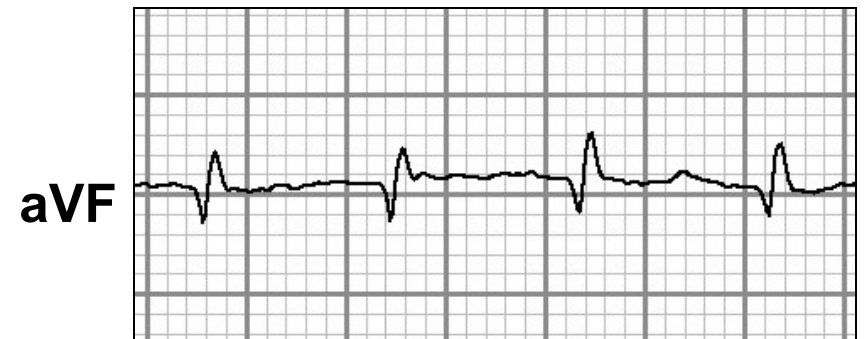
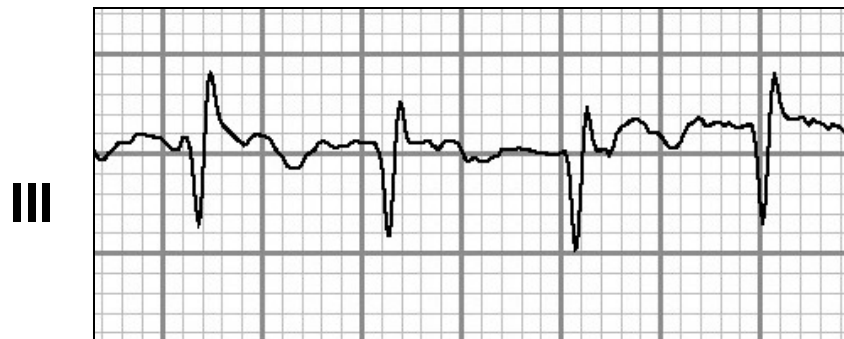
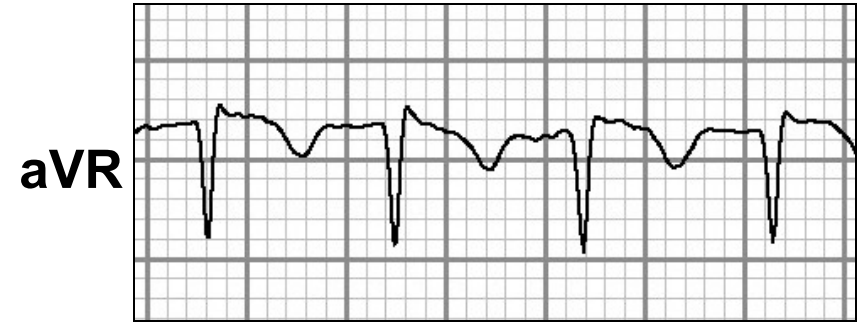


Wat is de hartas?



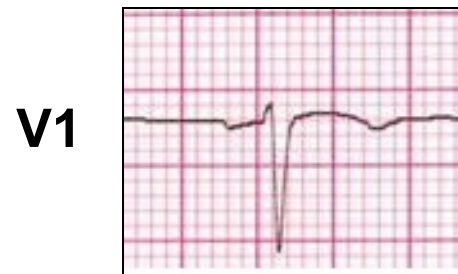
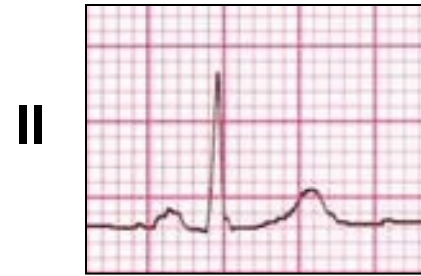
AVF





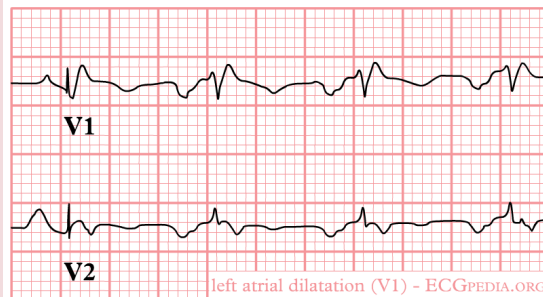
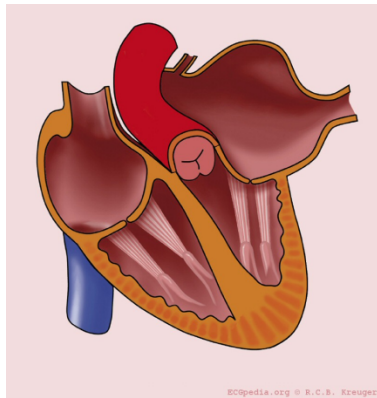
5 P top morfologie

- 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



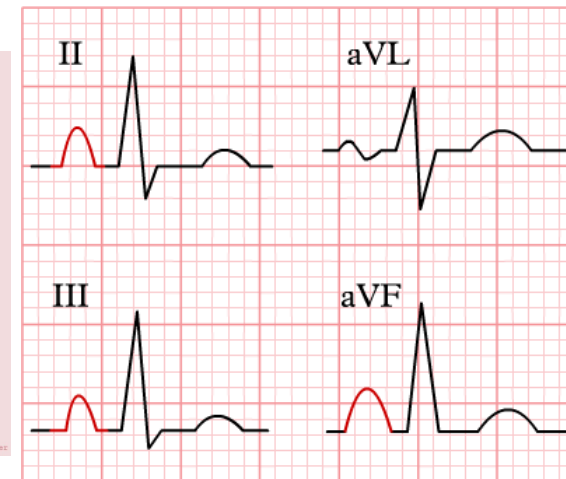
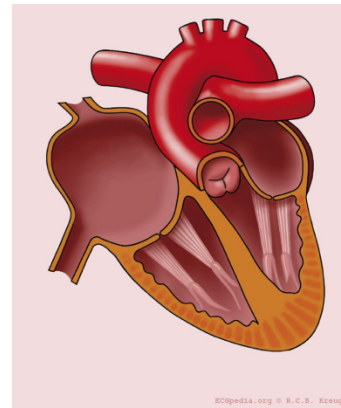
Linkeratriumdilatatie

Terminaal deel in V1 > 1mm2
en/of P >0,12 sec in I en/of II



Rechteratriumdilatatie

P >2,5 mm in II / III / aVF
en/of P >1,5 mm in V1



right atrial enlargement

ECGPEDIA.ORG

Condition

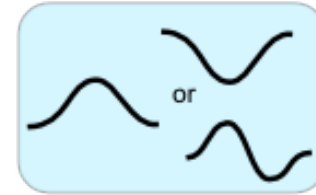
P Wave Morphology

Normal Sinus Rhythm

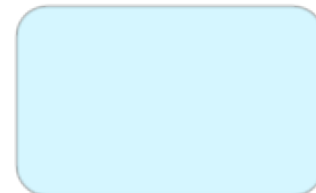
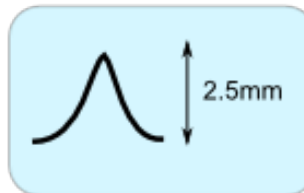
Lead II



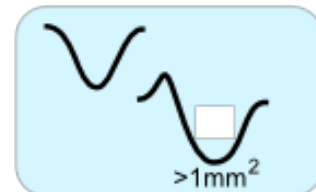
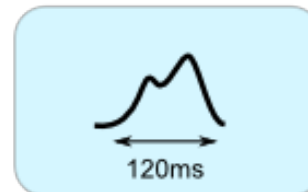
Lead V1



Right atrial enlargement
(= **P Pulmonale**)



Left Atrial Enlargement
(= **P Mitrale**)

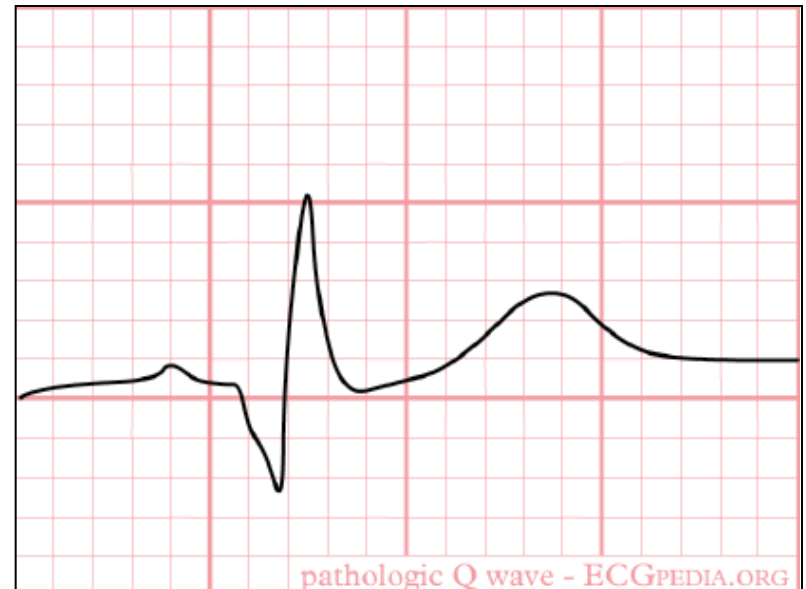


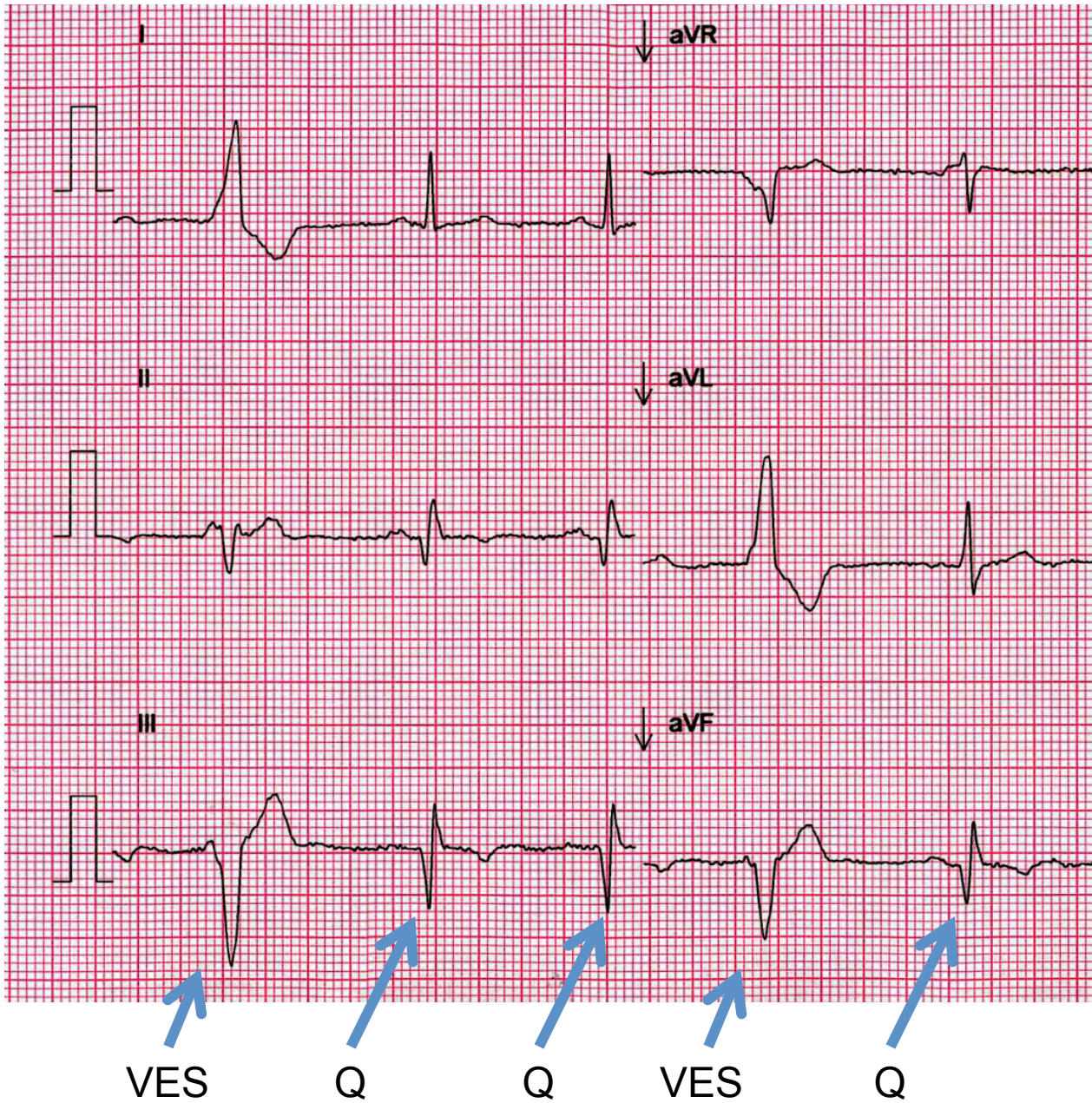
6 QRS morfologie

- 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
 - Niet indien alleen in III of AVR!
- Differentiaal diagnose?
 - Oud infarct
 - Cardiomyopathie (HCM, DCM)
 - COPD
 - Intraventriculaire geleidingsstoornissen



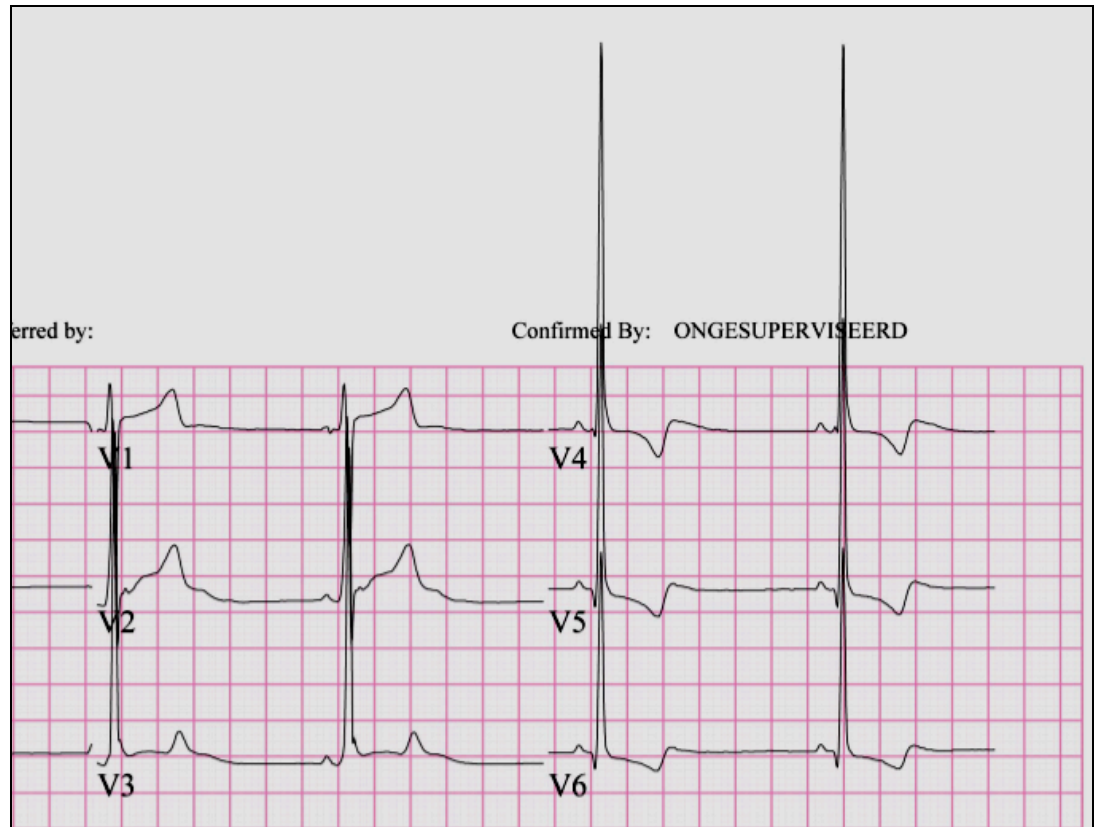
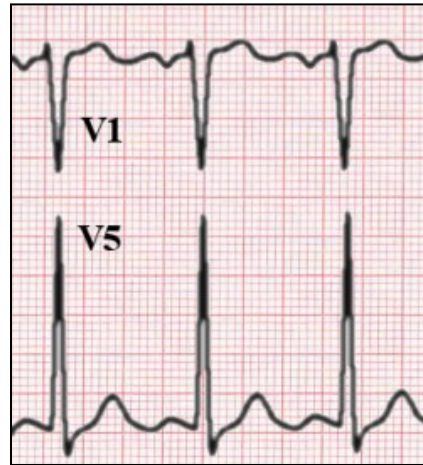


6 QRS morfologie

- 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



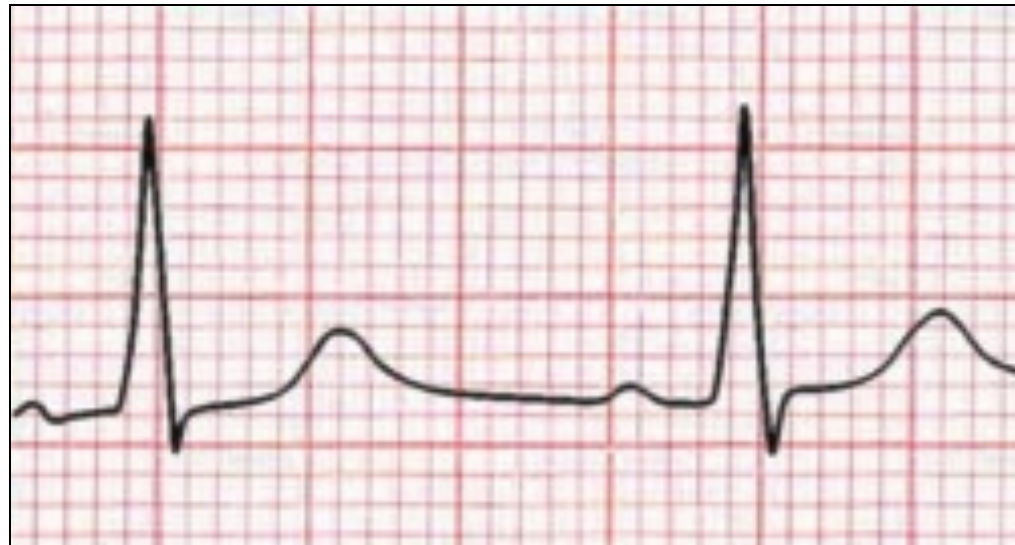
6 QRS morfologie

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

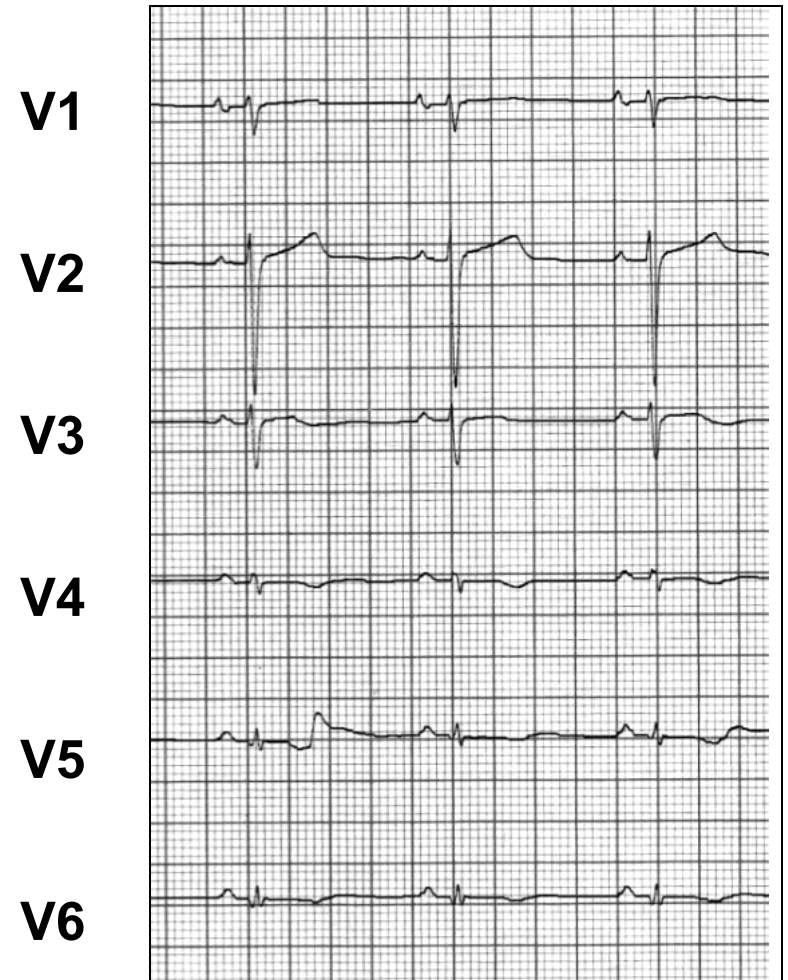
RVH:

R>S in V1

V1



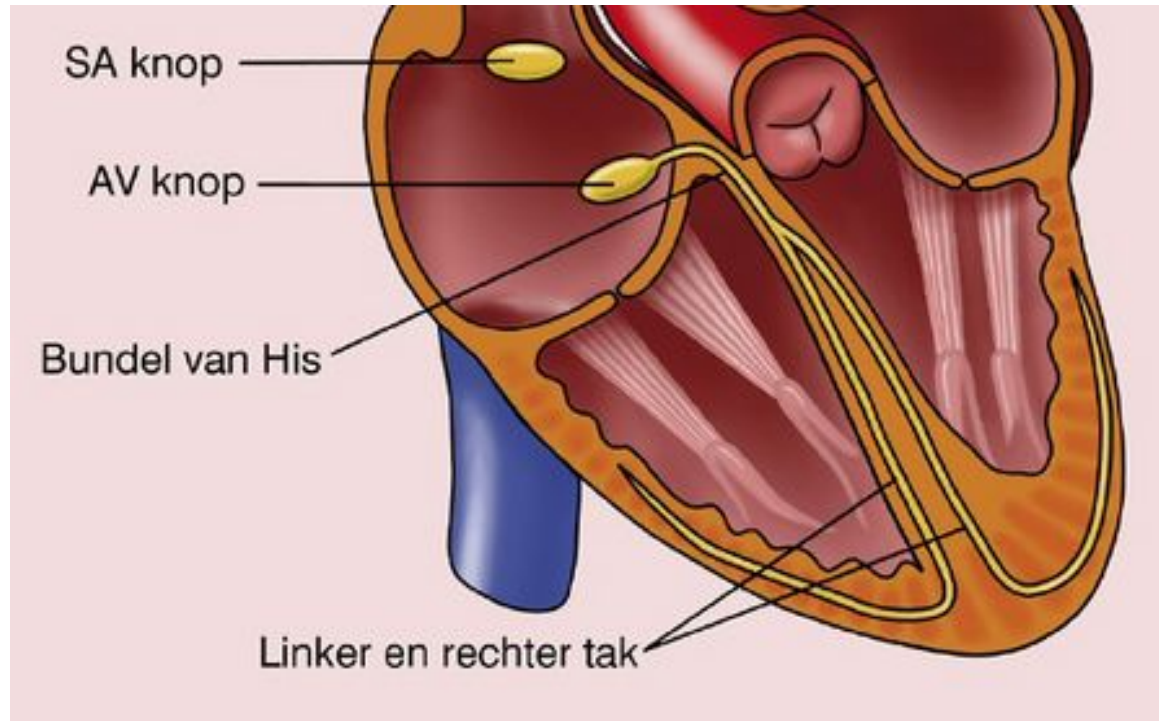
6 QRS morfologie



microvoltages

6 QRS morfologie

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



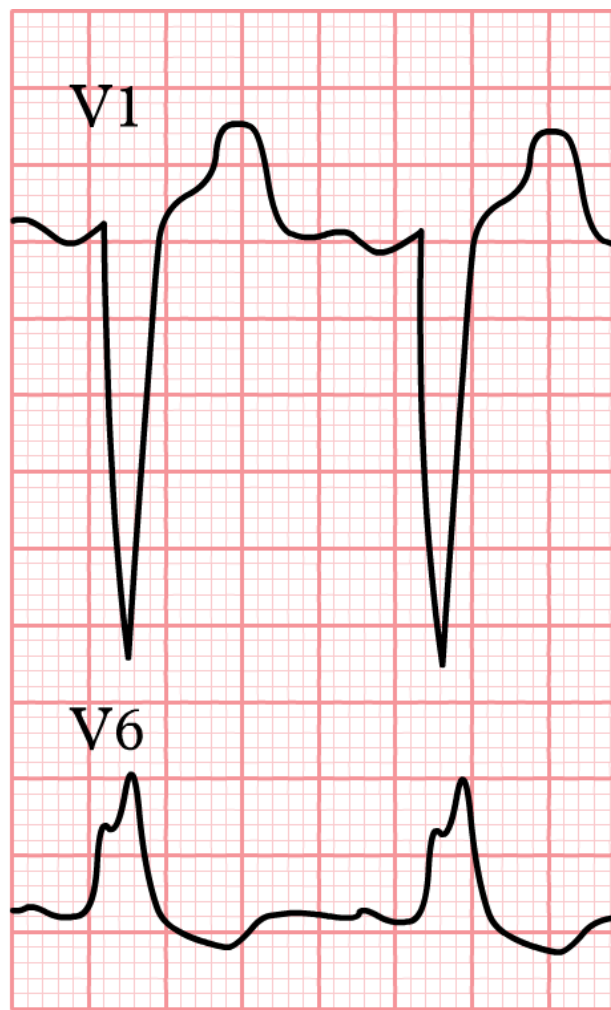
LBTB

QRS > 0.12 seconde

(r)S in V1

Brede R en geen q in I, V6

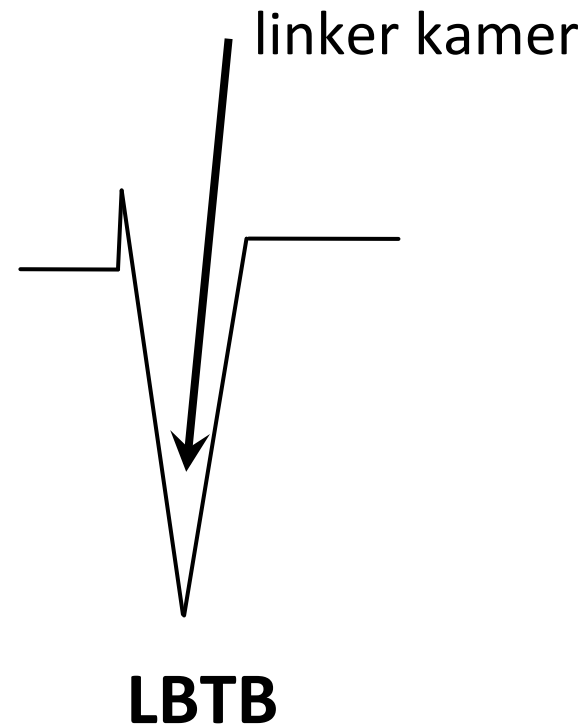
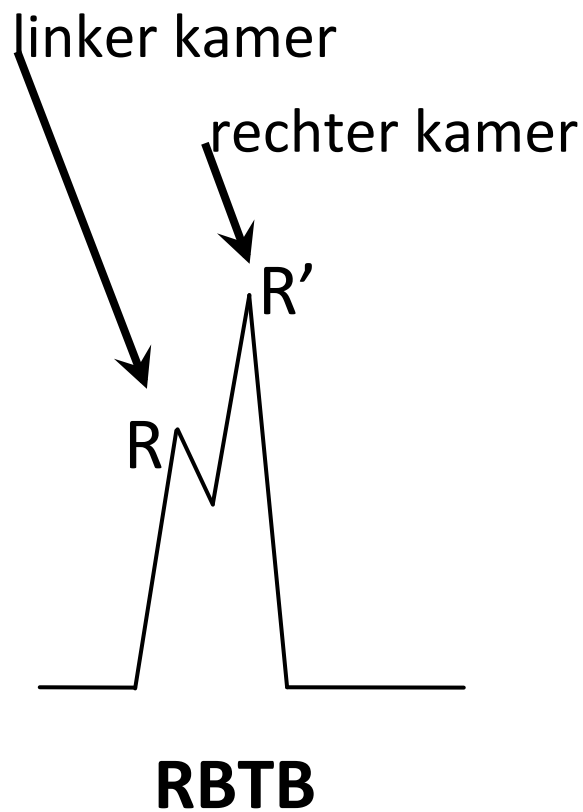
(Infarctdiagnostiek lastig
want ST segment
afwijkend)



LBBB

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afleiding V1



RBTB

QRS > 0.12 seconde

rsR' in V1

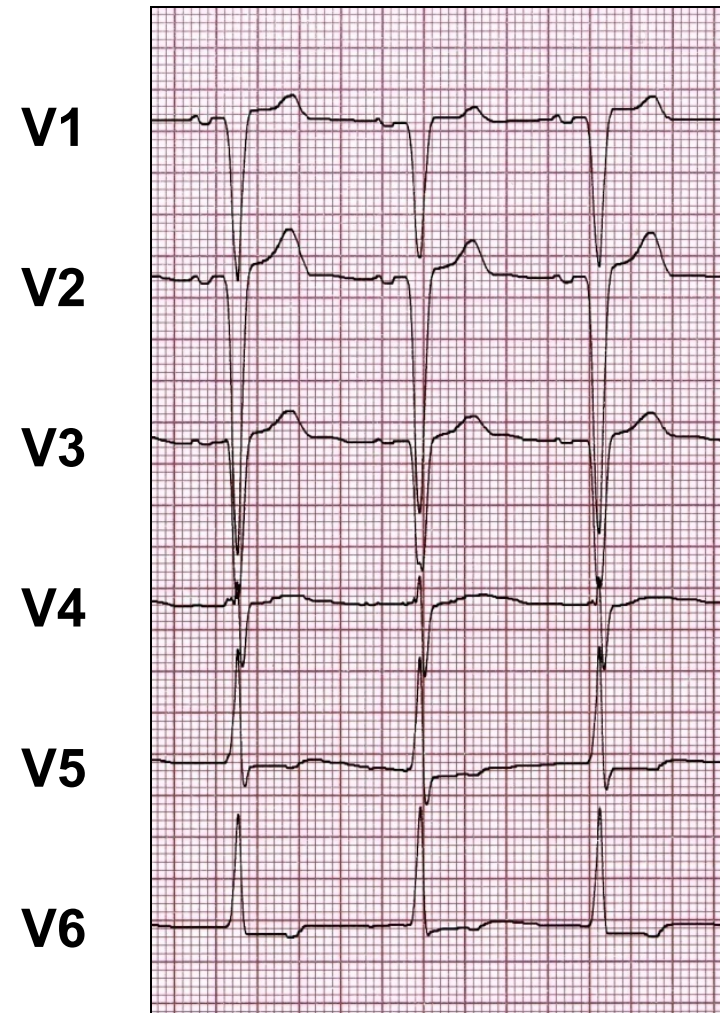
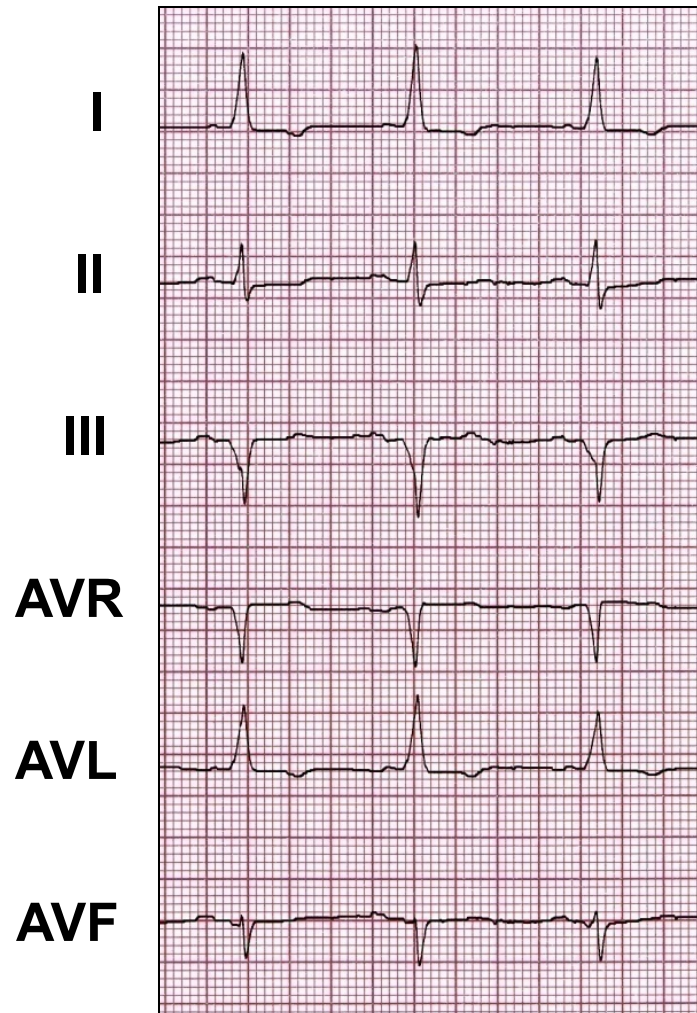
R' > R

(Infarctdiagnostiek goed
mogelijk)



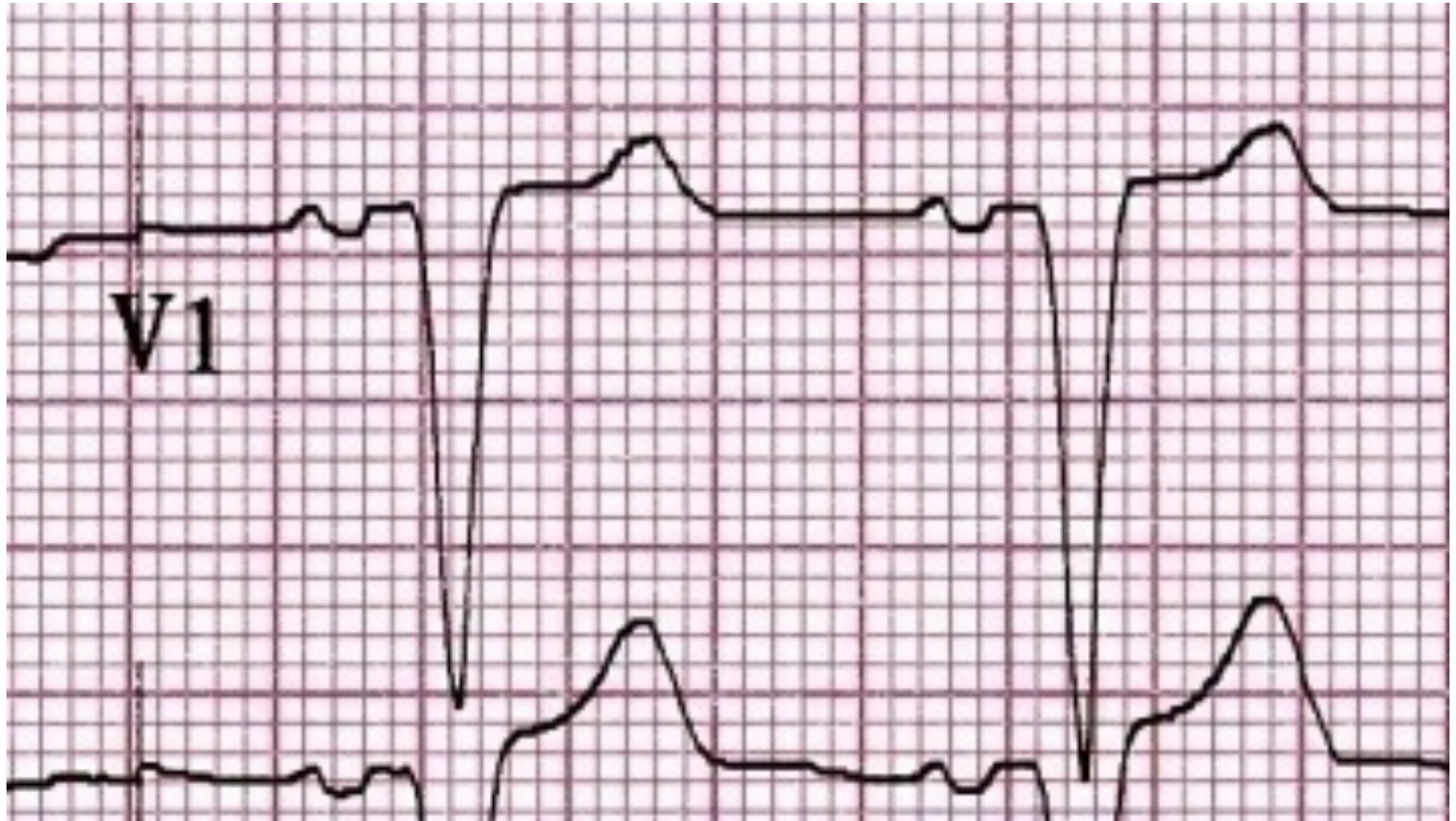
RBBB

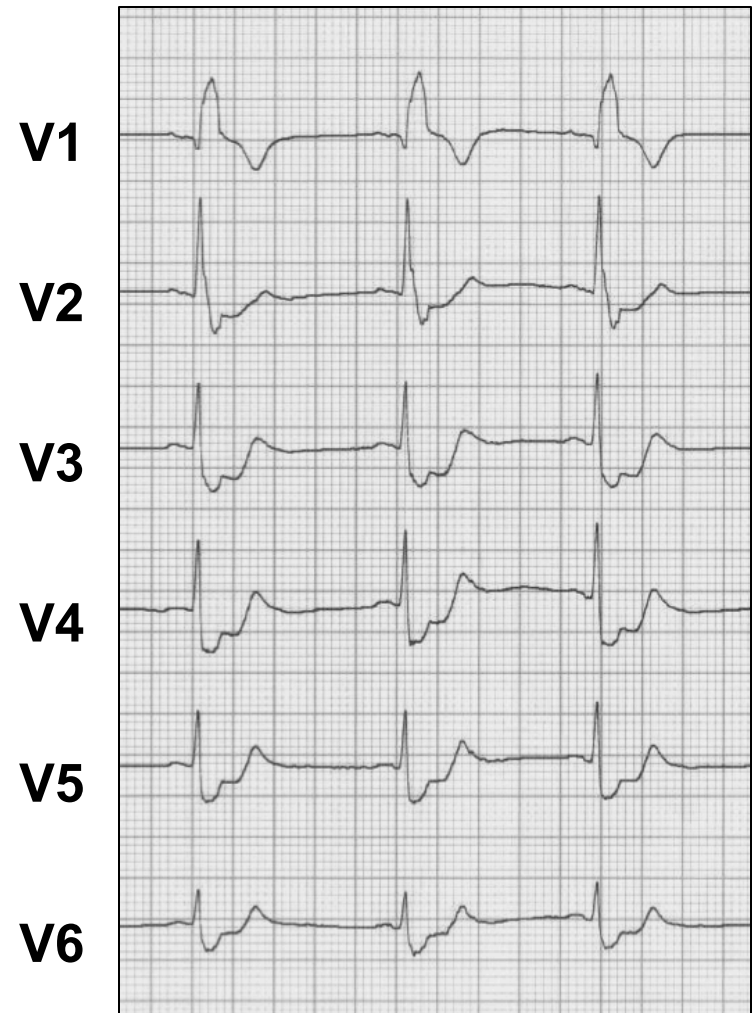
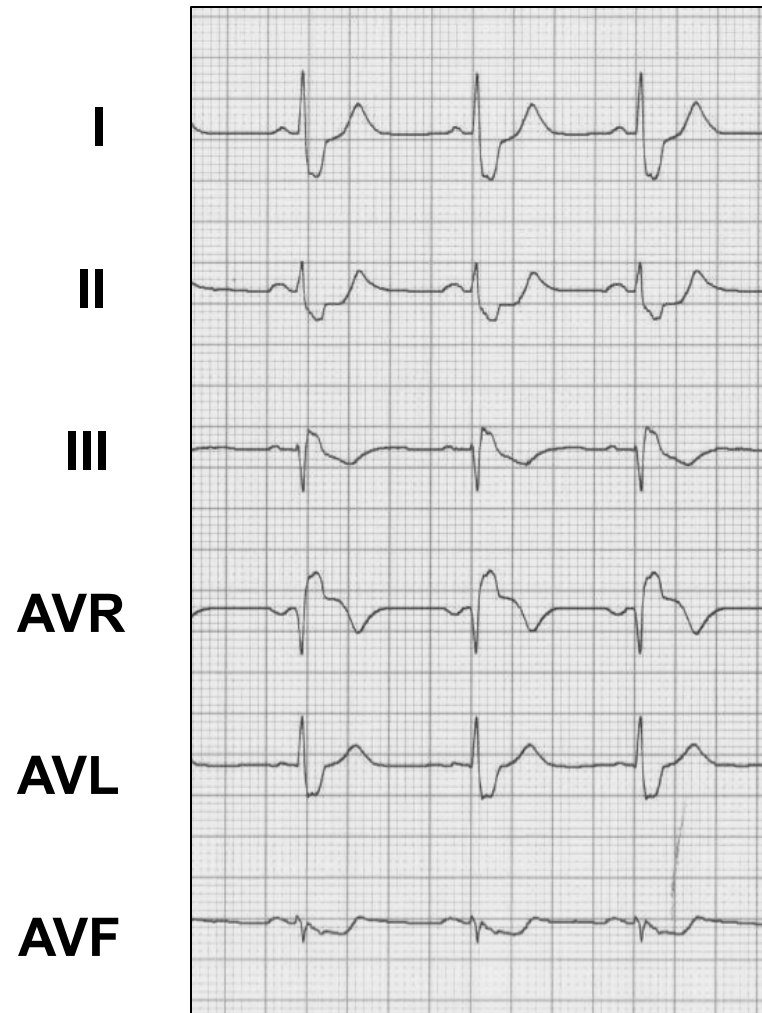
ECG PEDIA.ORG
part of cardionetworks.org



RBTB of LBTB?

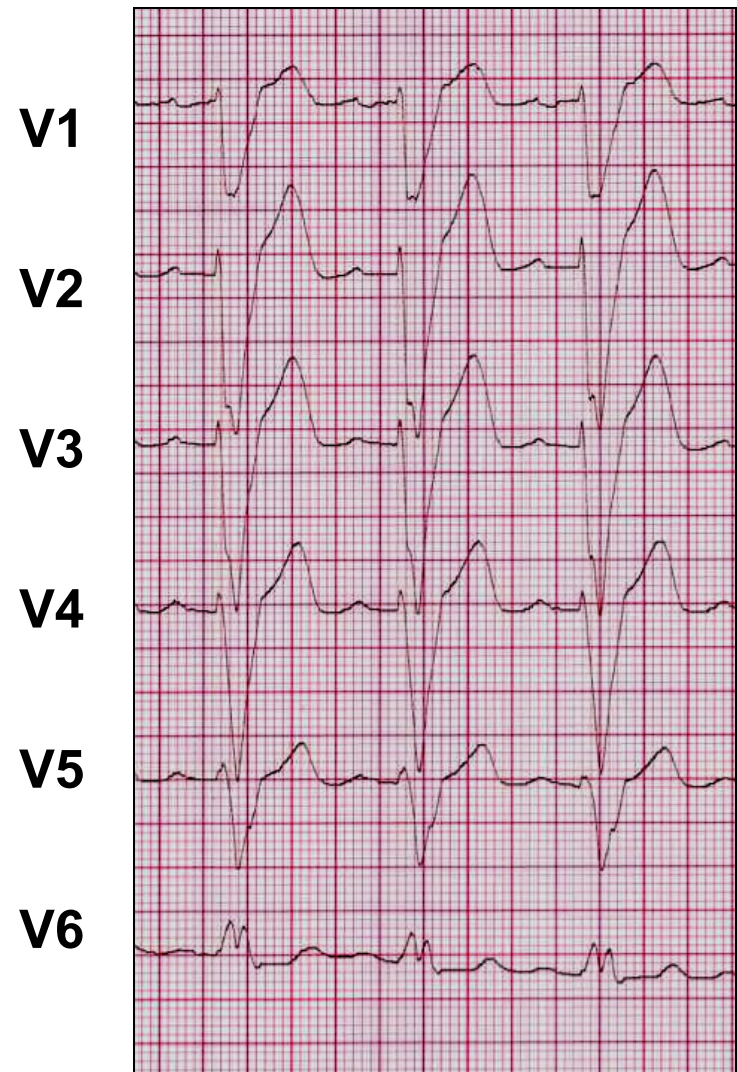
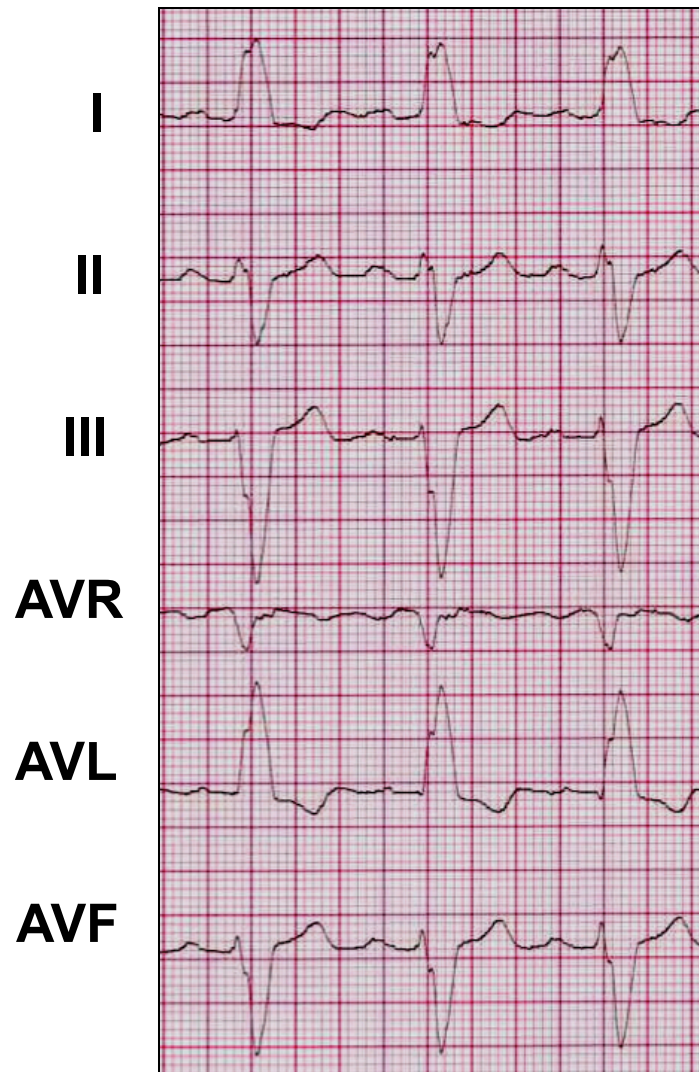
LBTB of RBTB?





LBTB of RBTB?



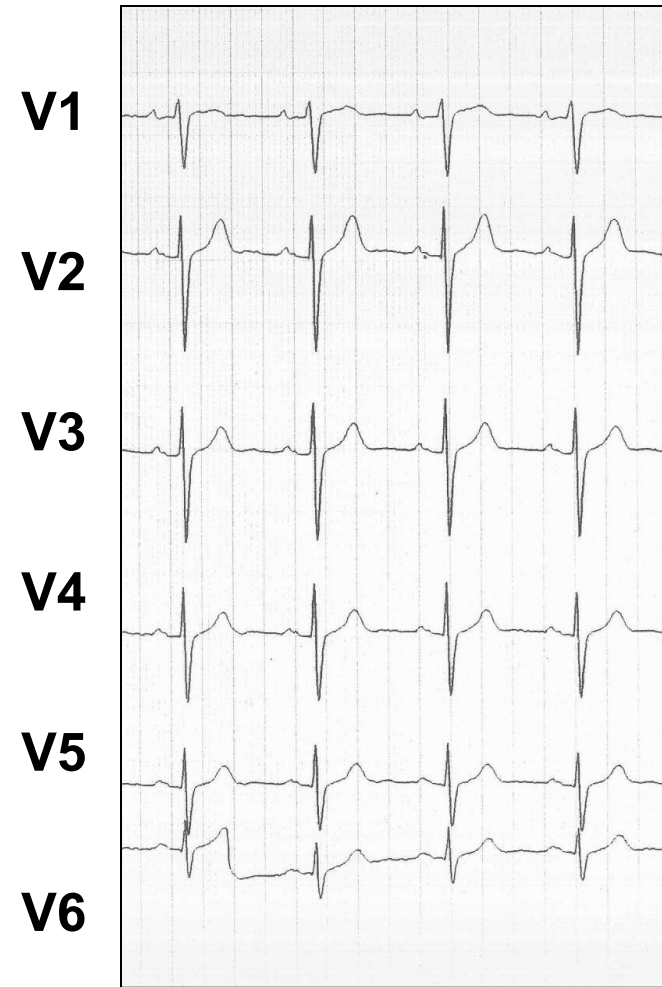
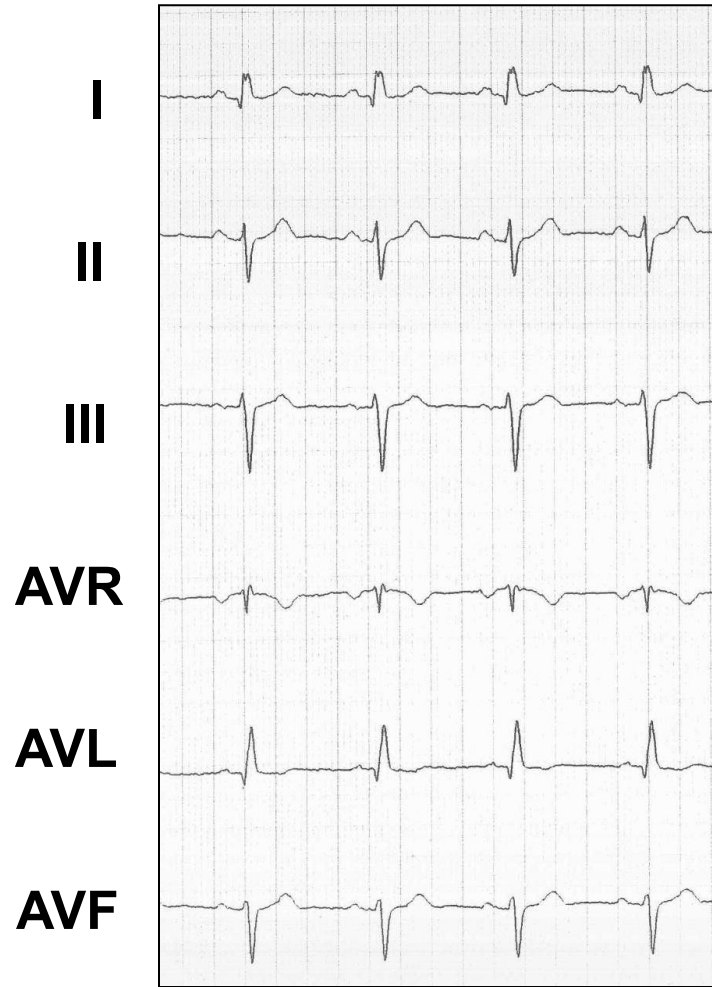


RBTB of LBTB?

LBTB of RBTB?



LAHB



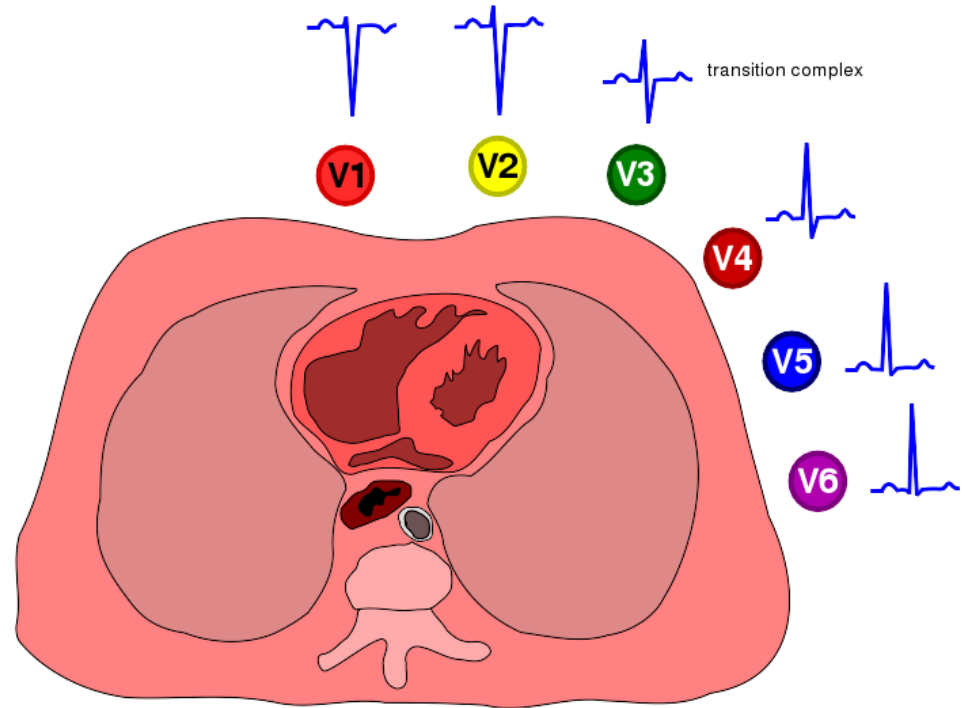
Criteria LAHB

- asdeviatie naar links ($<-30^\circ$)
- geen of vrijwel geen S in I
- normale kleine q in I
- $S > R$ in II, III
- QRS niet of slechts in geringe mate verbreed (100ms)

7+2 STAPPENPLAN

Stap 6: QRS morfologie

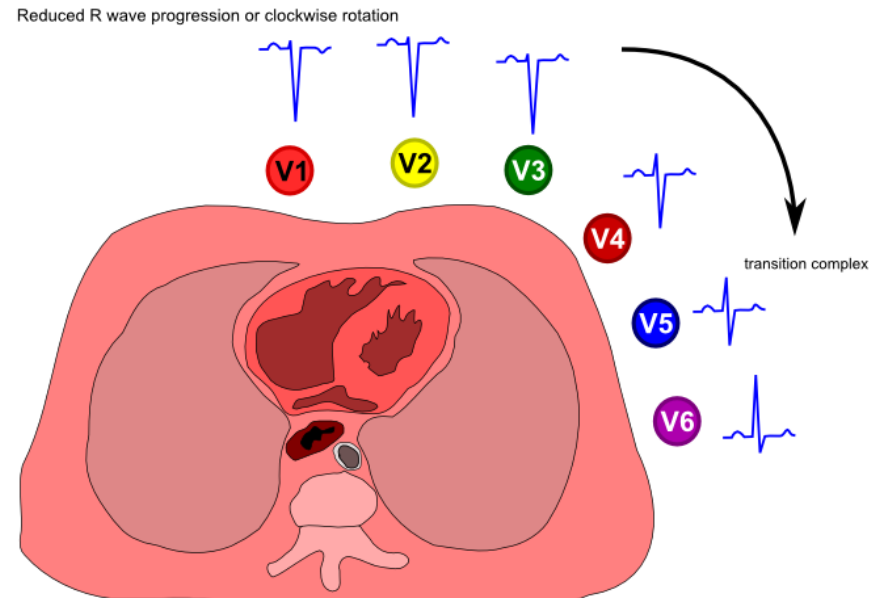
- **R-top progressie?**
 - Overgangs complex in V3, V4
 - Normaal zit het overgangs complex (waar de R-top groter wordt dan de S) bij V3 tot V4



7+2 STAPPENPLAN

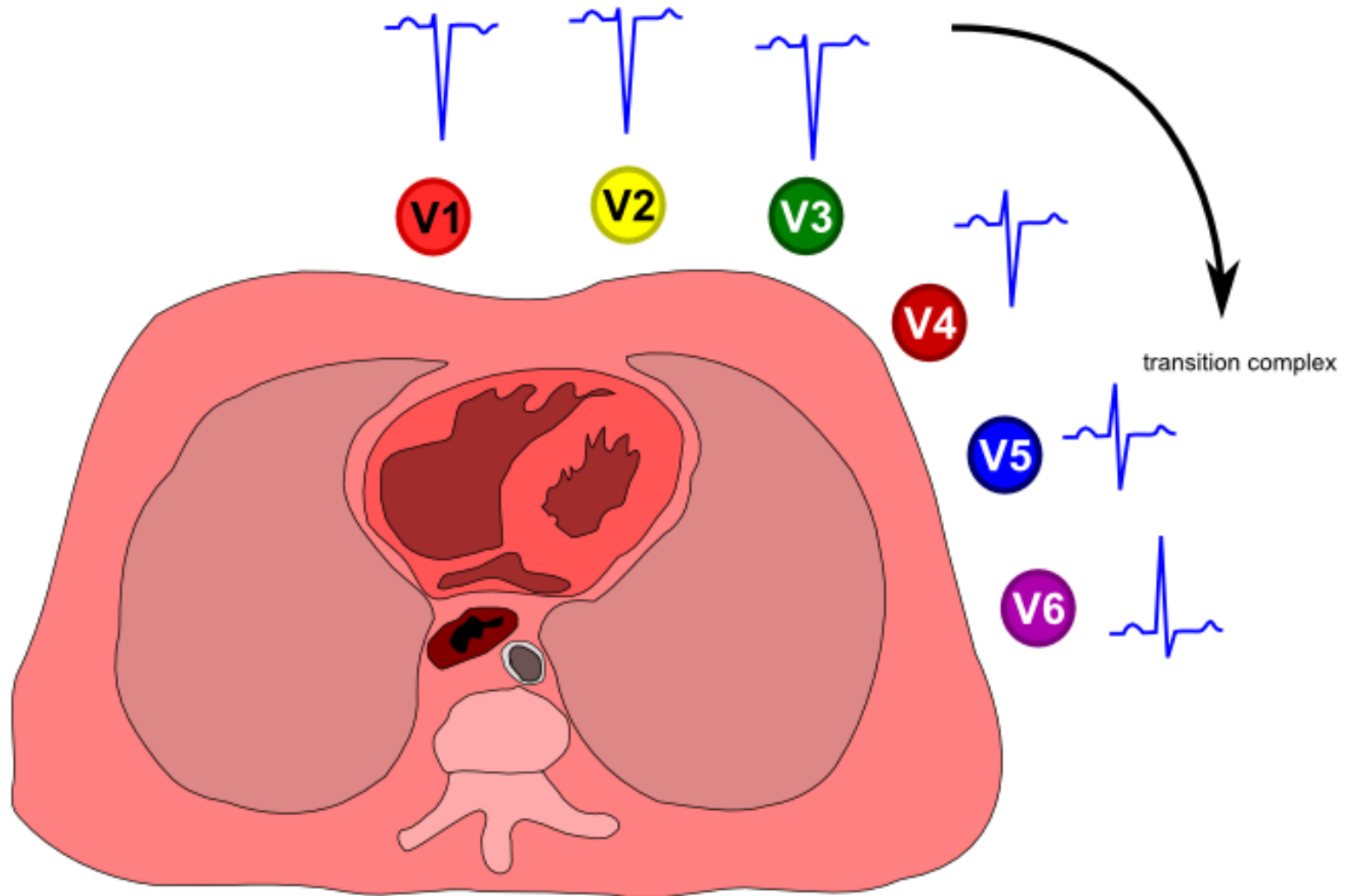
Stap 6: QRS morfologie

- R-top progressie?
 - Differentiaal diagnose onvoldoende r-top progressie?
 - RV hypertrofie
 - COPD, asthma
 - Voorwand infarct of anteroseptaal infarct
 - Geleidingsstoornissen (LBBB, Left anticus hemiblok, intraventriculaire geleidings vertraging)
 - Cardiomyopathie
 - Thorax afwijking
 - Normale variant
 - Precordiale afleidingen verkeerd geplaatst



**ANAMNESE EN LO/ ZIJN EXTREEM BELANGRIJK
VOOR JUISTE INTERPRETATIE VAN HET ECG**

Reduced R wave progression or clockwise rotation



7 ST morfologie

ST elevatie

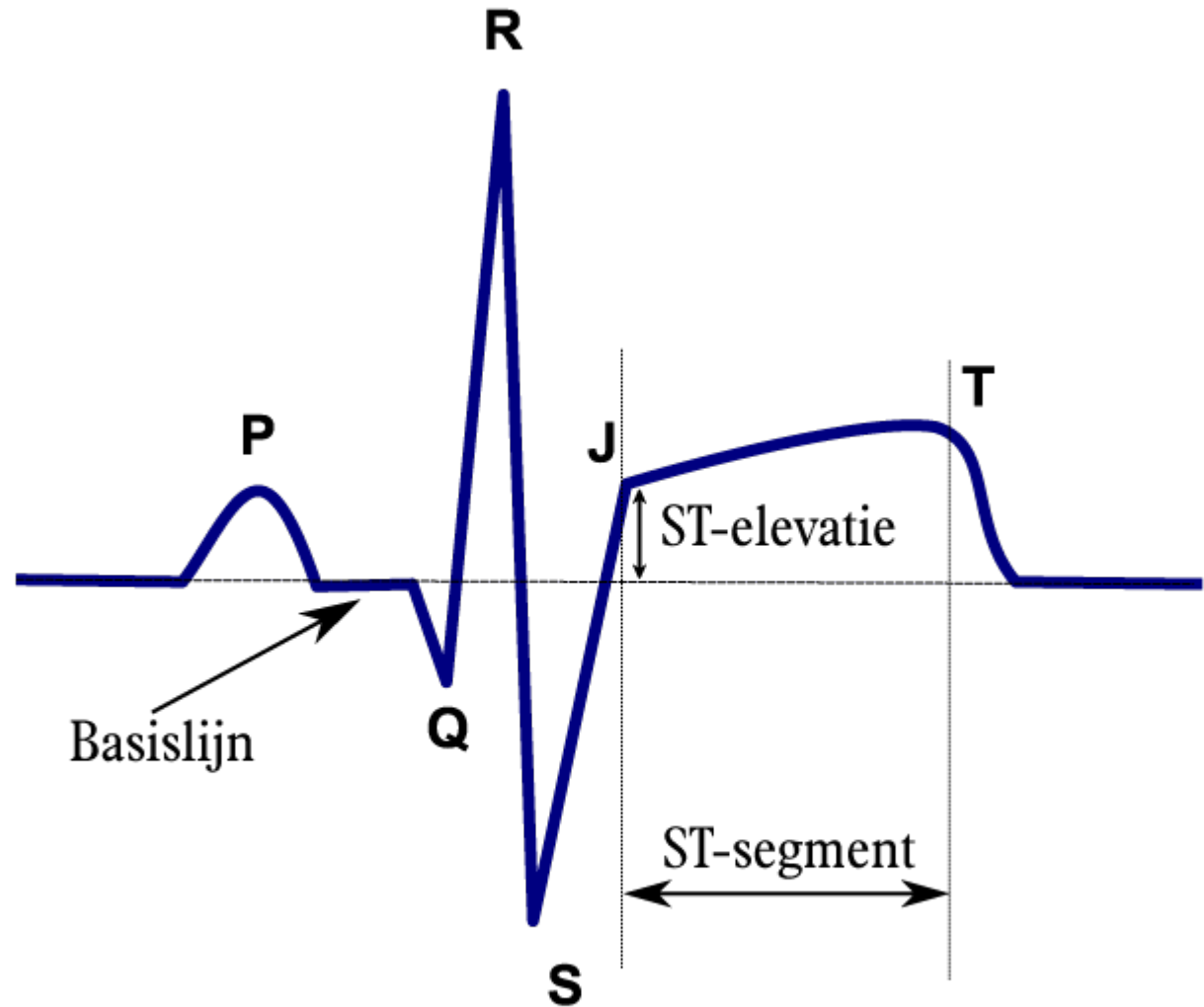
Ischemie
Pericarditis
Aneurysma cordis
Normale variant

ST depressie

Reciproke bij ischemie
LVH
Digitalis
Hypokaliemie
Neurologisch

T top verandering

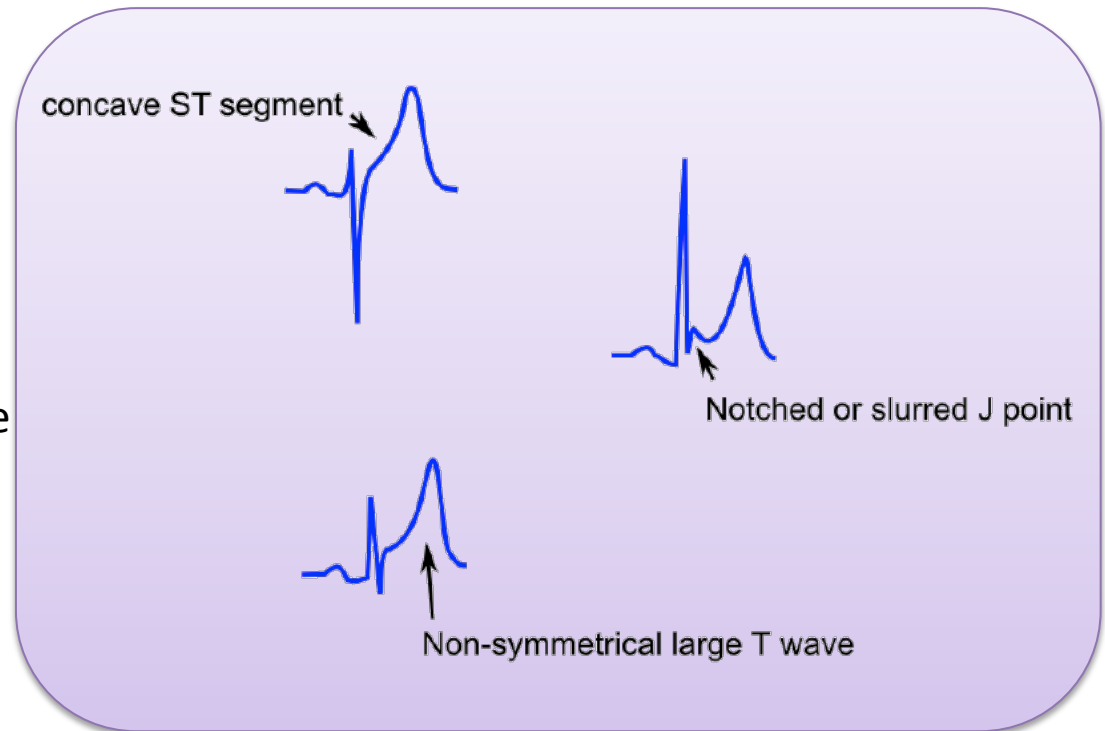
Ischemie
Pericarditis
Myocarditis
LVH / RVH



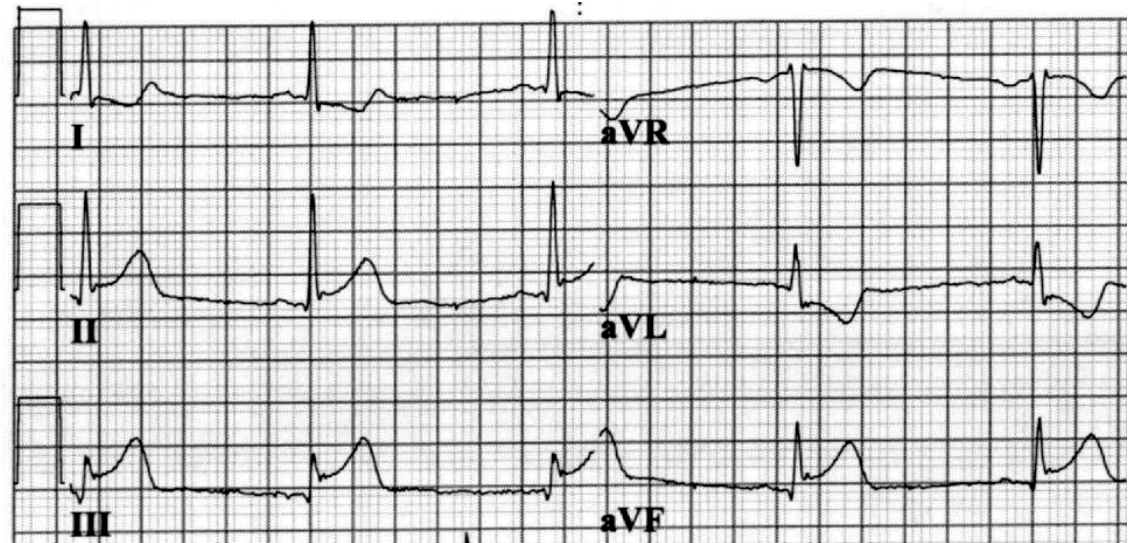
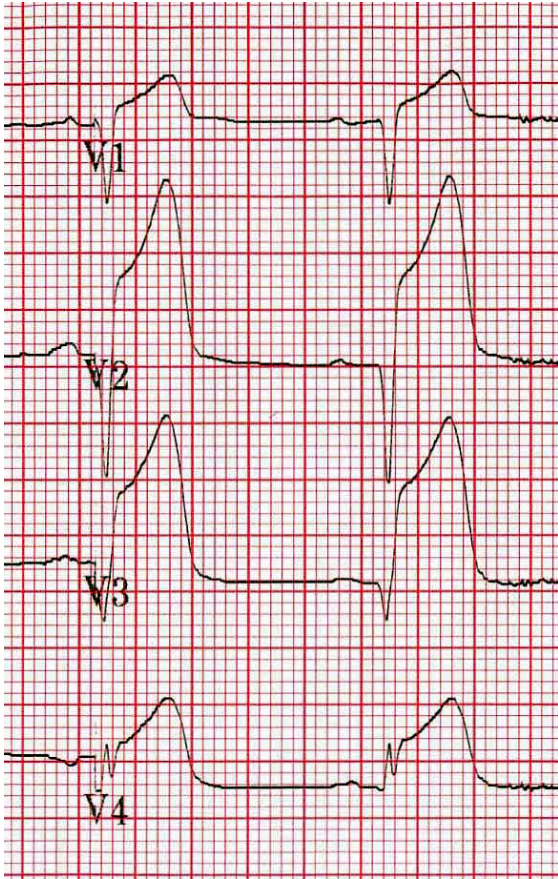
Hoe meet je ST-elevatie?

Vroege Repolarisatie

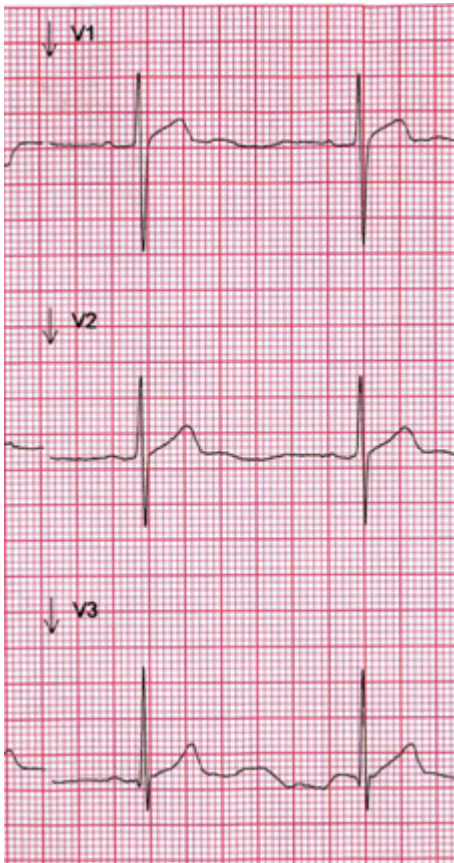
- Zeer frequente bevinding
- “Smiley” configuratie
- Overigens gezonde asymptotische jonge volwassene
- Met name V1-V3
- Notching J punt
- Geen Q
- Geen reciproke ST depressie
- 90% van gezonde dienstplichtige mannen heeft ST-elevatie in precordiale afleidingen.



ST elevatie bij ischemie



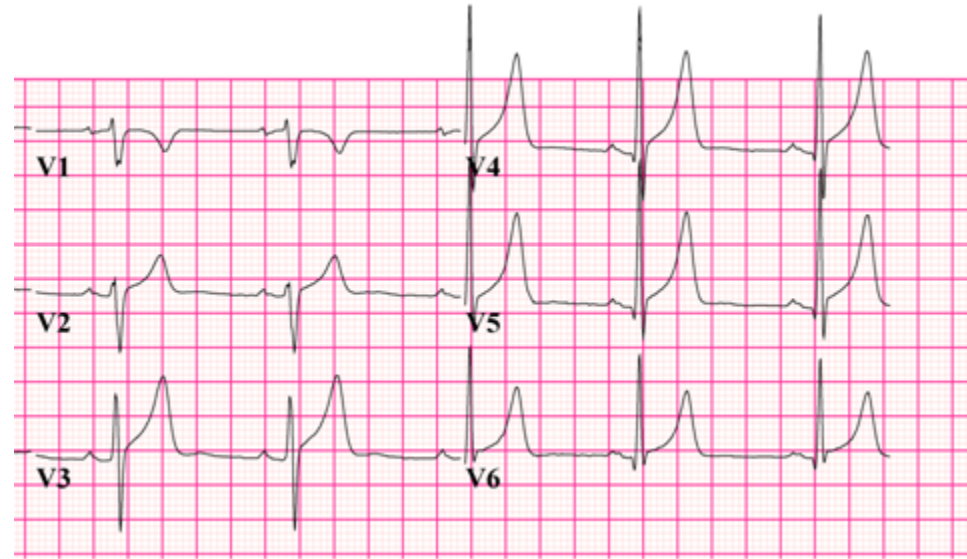
ST elevatie, geen infarct



17 jaar, gezond

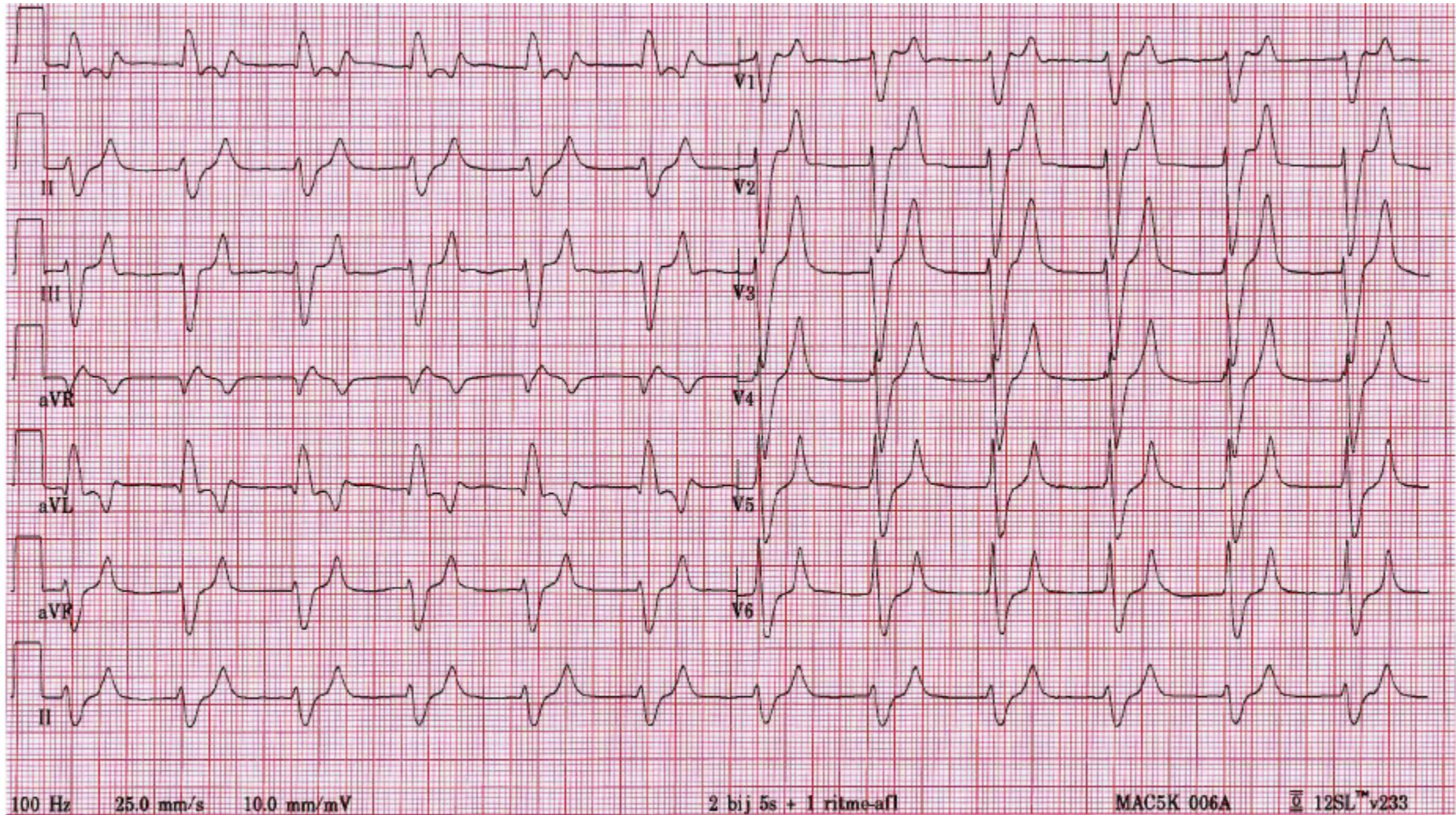


LVH

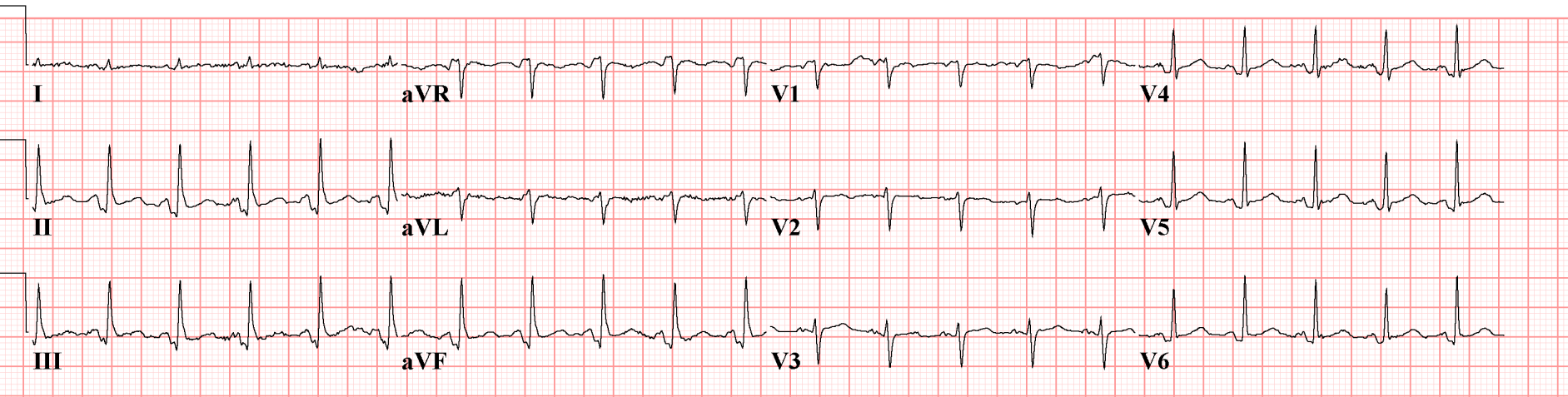
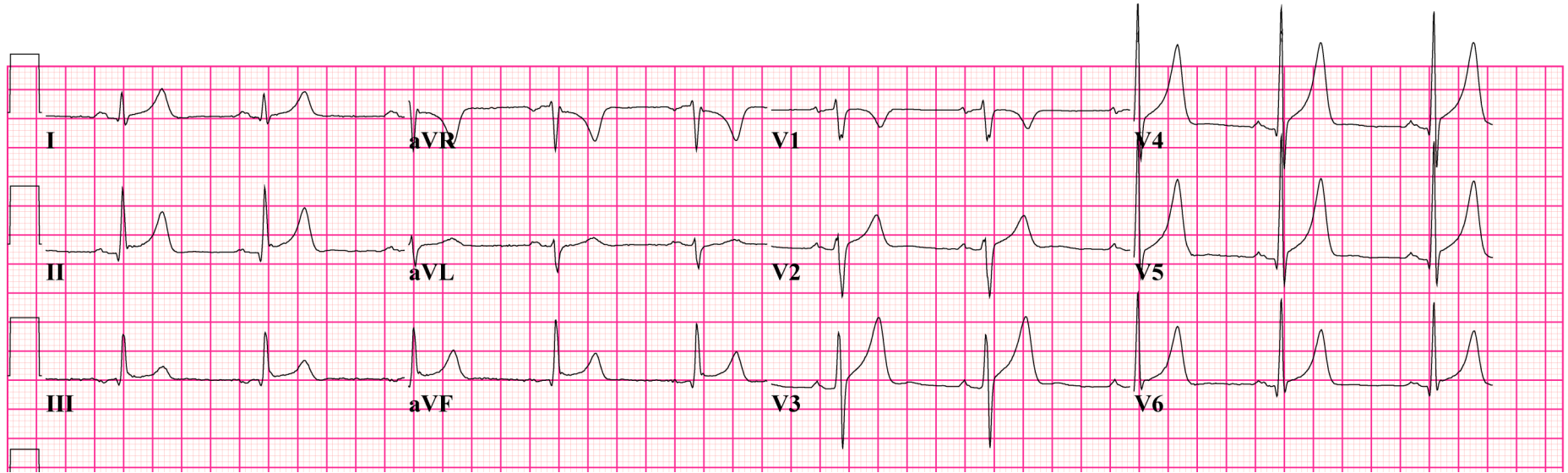


pericarditis

Hyperkaliemie



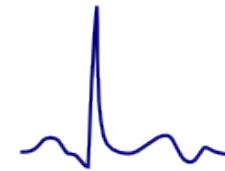
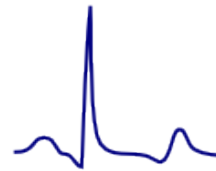
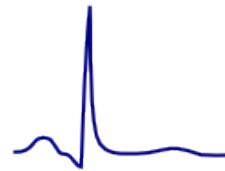
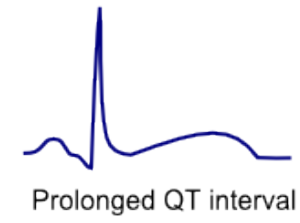
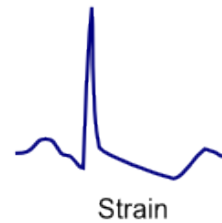
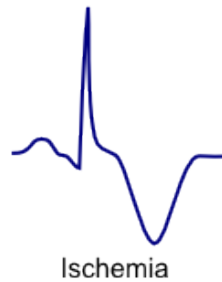
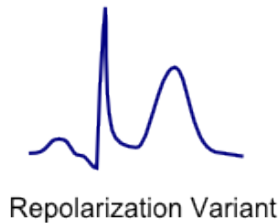
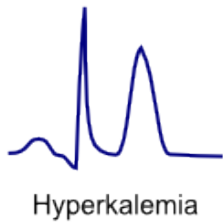
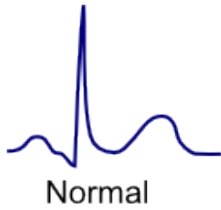
Pericarditis



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

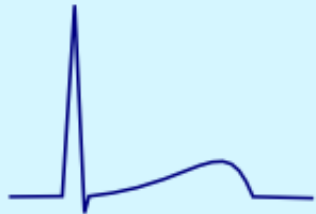
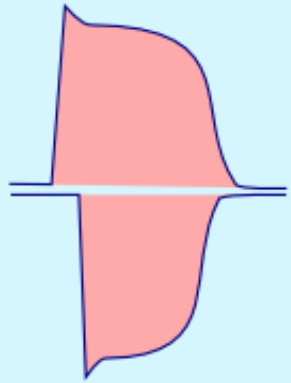
Negatief = $> 0.5\text{mm}$ in I, II, V3-V6

T wave morphology

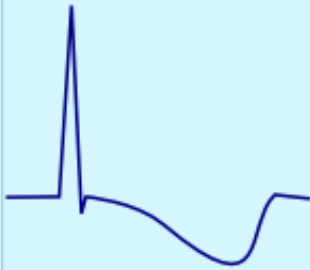
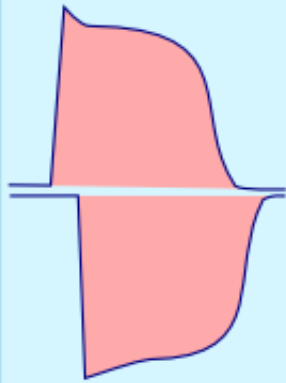


Nonspecific ST-T wave abnormalities

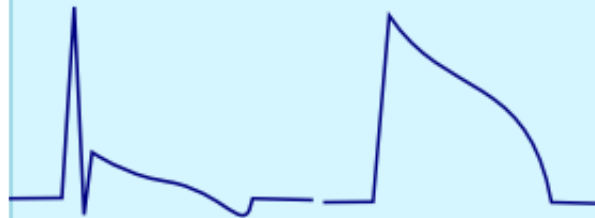
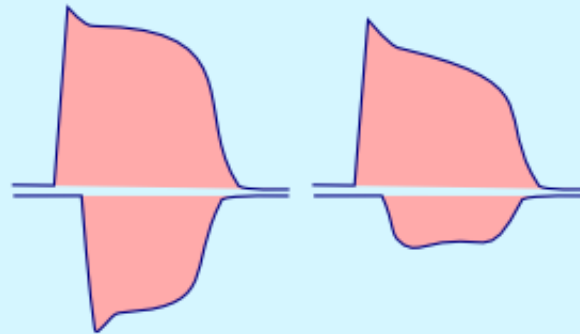
Normal



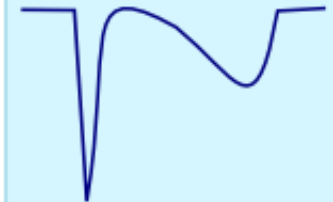
Ischemic Tissue



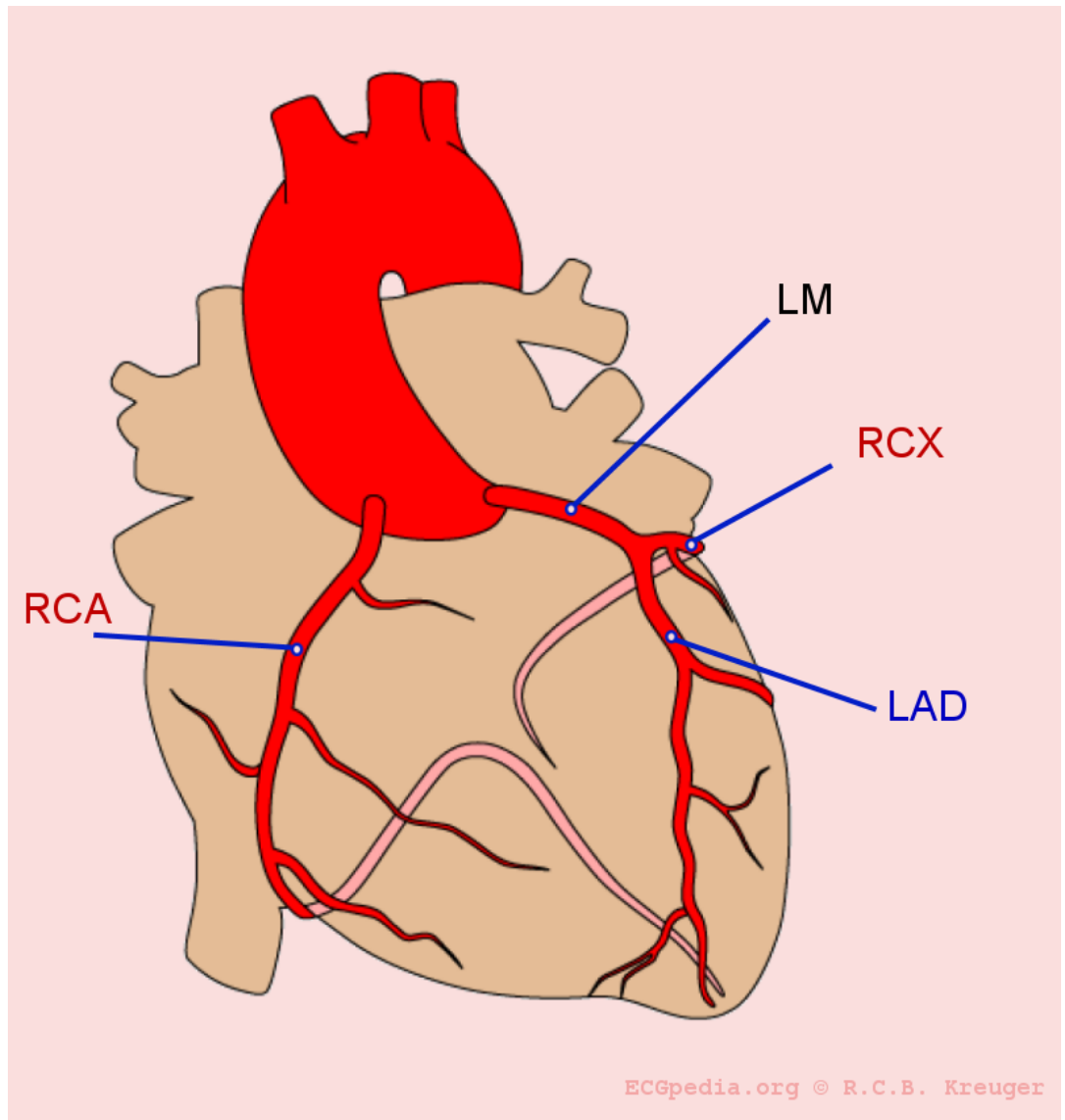
Injured Tissue



Necrotic Tissue



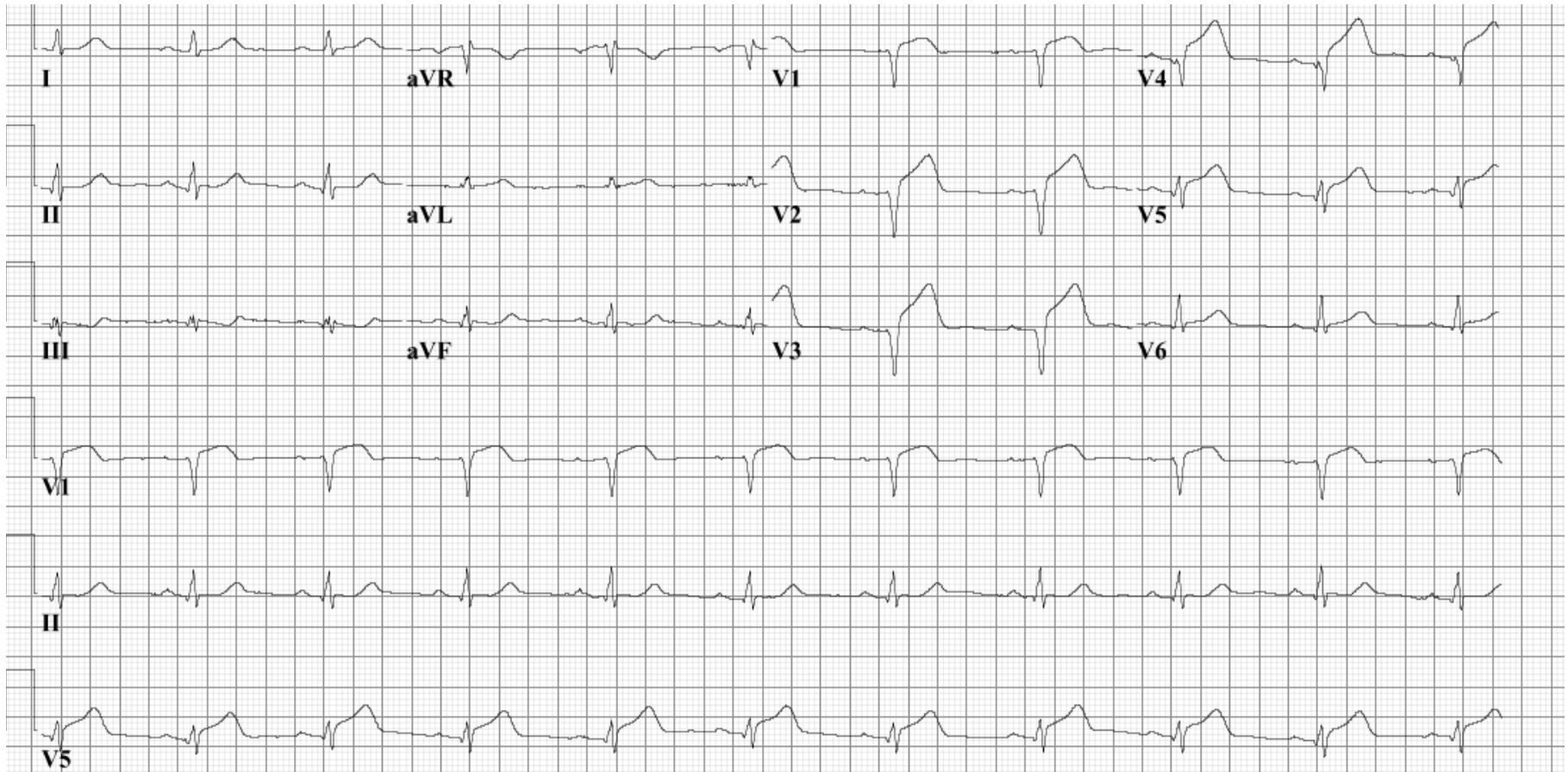
Kransslagvaten



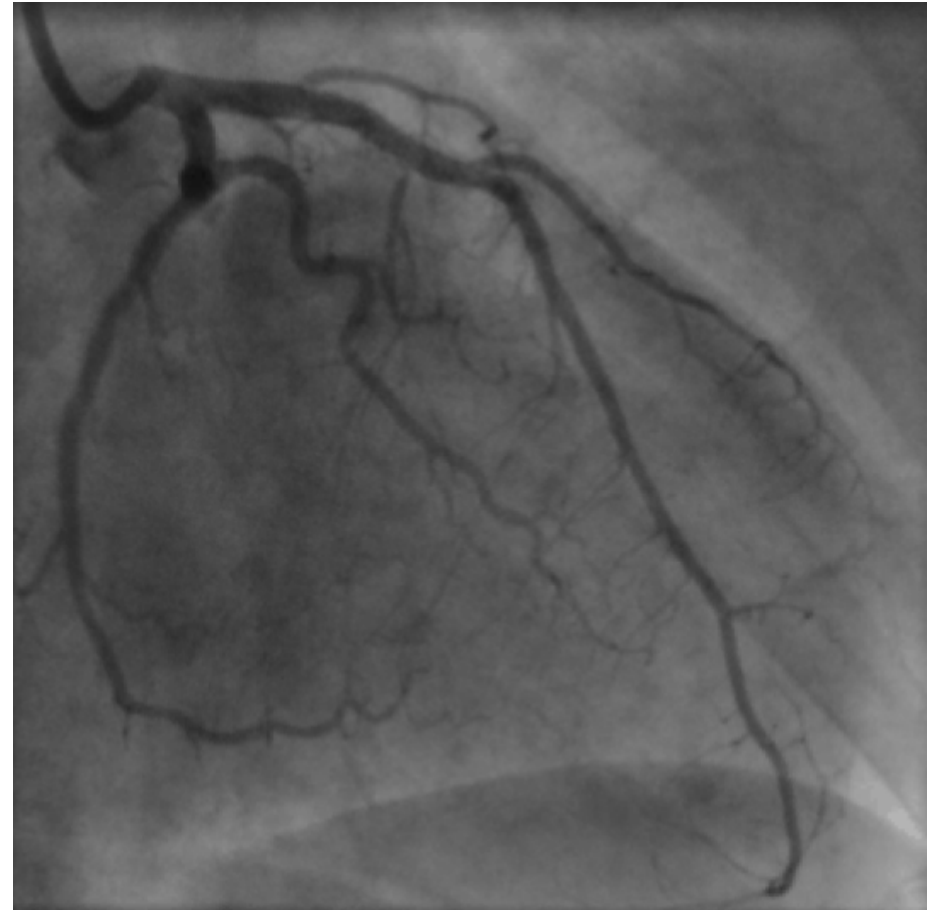
♀ 46 jr.

A: Bij presentatie 1 uur AP

VG: Hypertensie, familie, hyperlipidemie, roken +++.

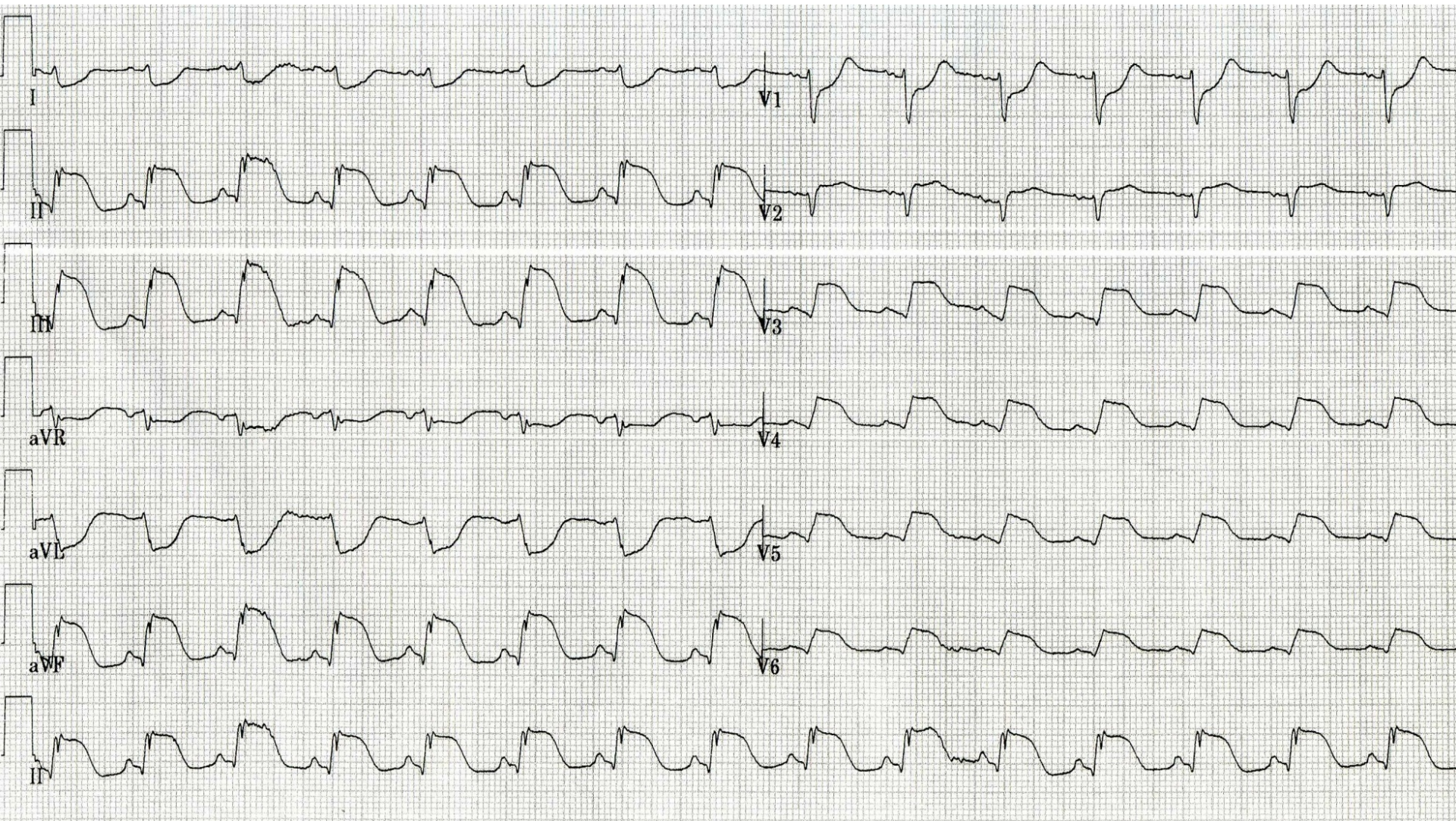


LCA pre en post PCI

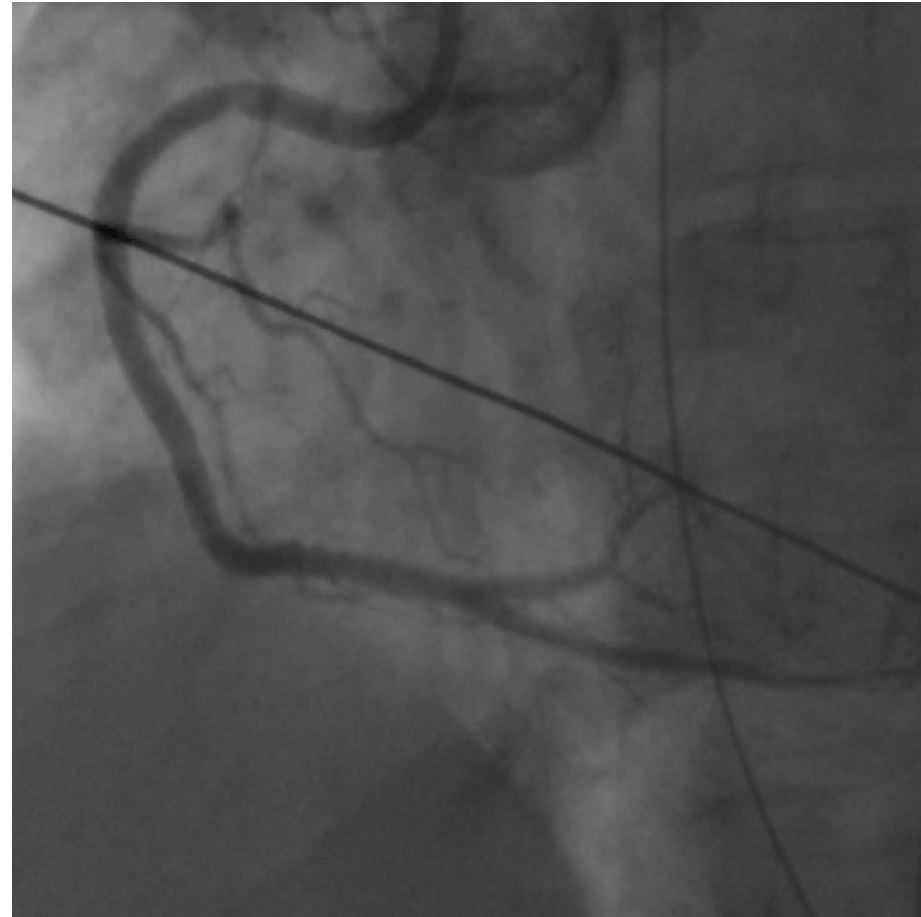
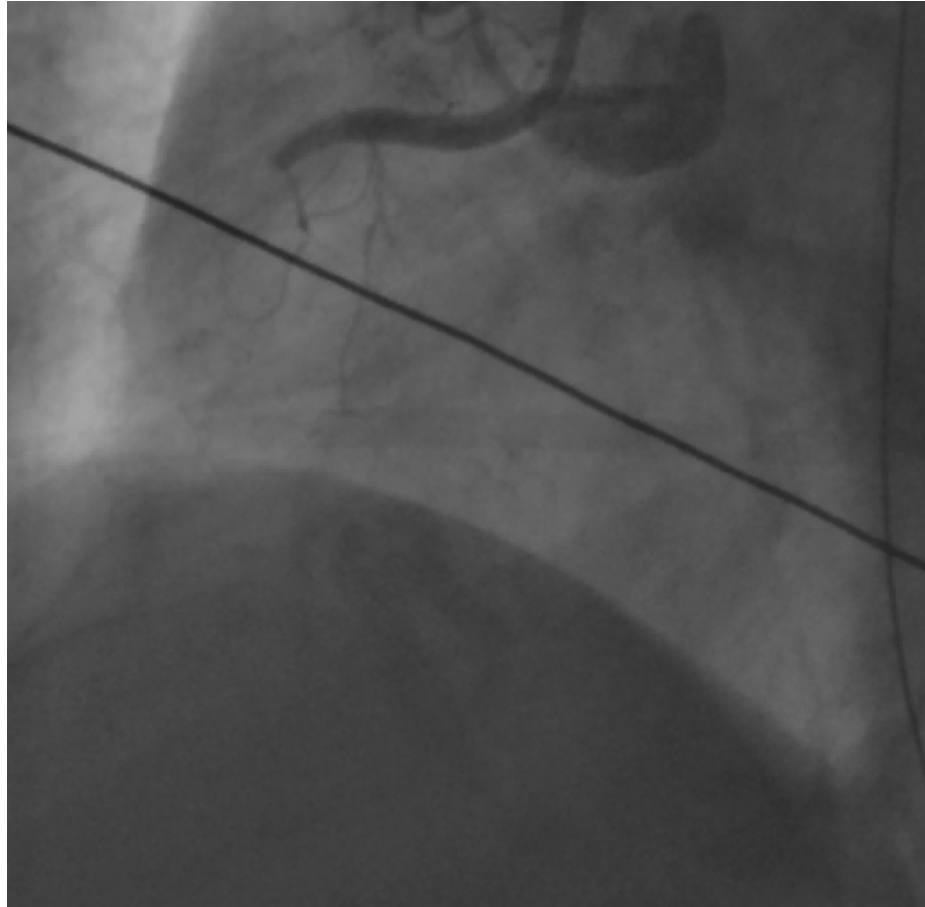


Proximale LAD occlusie, voor eerste septale tak, na diagonale tak

♂ 52 jr.



RCA pre en post PCI



7+1 Vergelijken met oud ECG

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

7+2 Conclusie

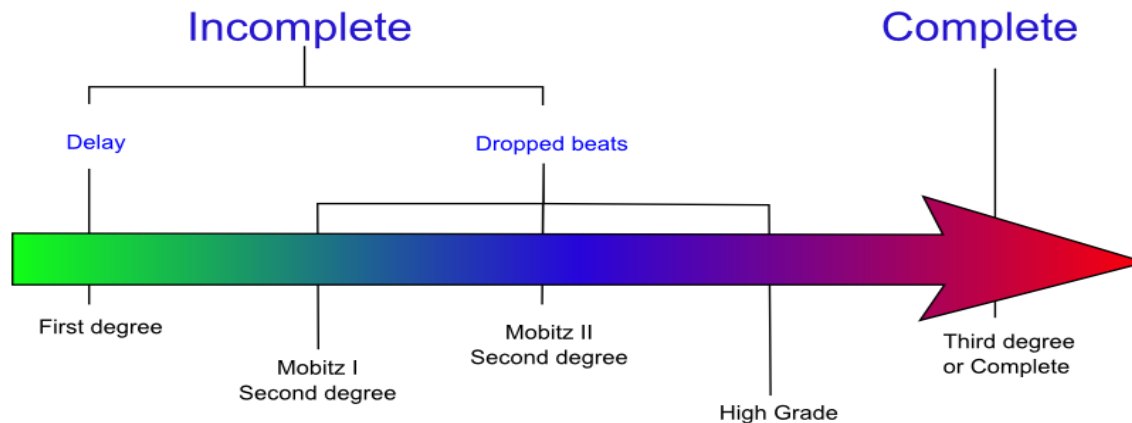
Voorbeelden:

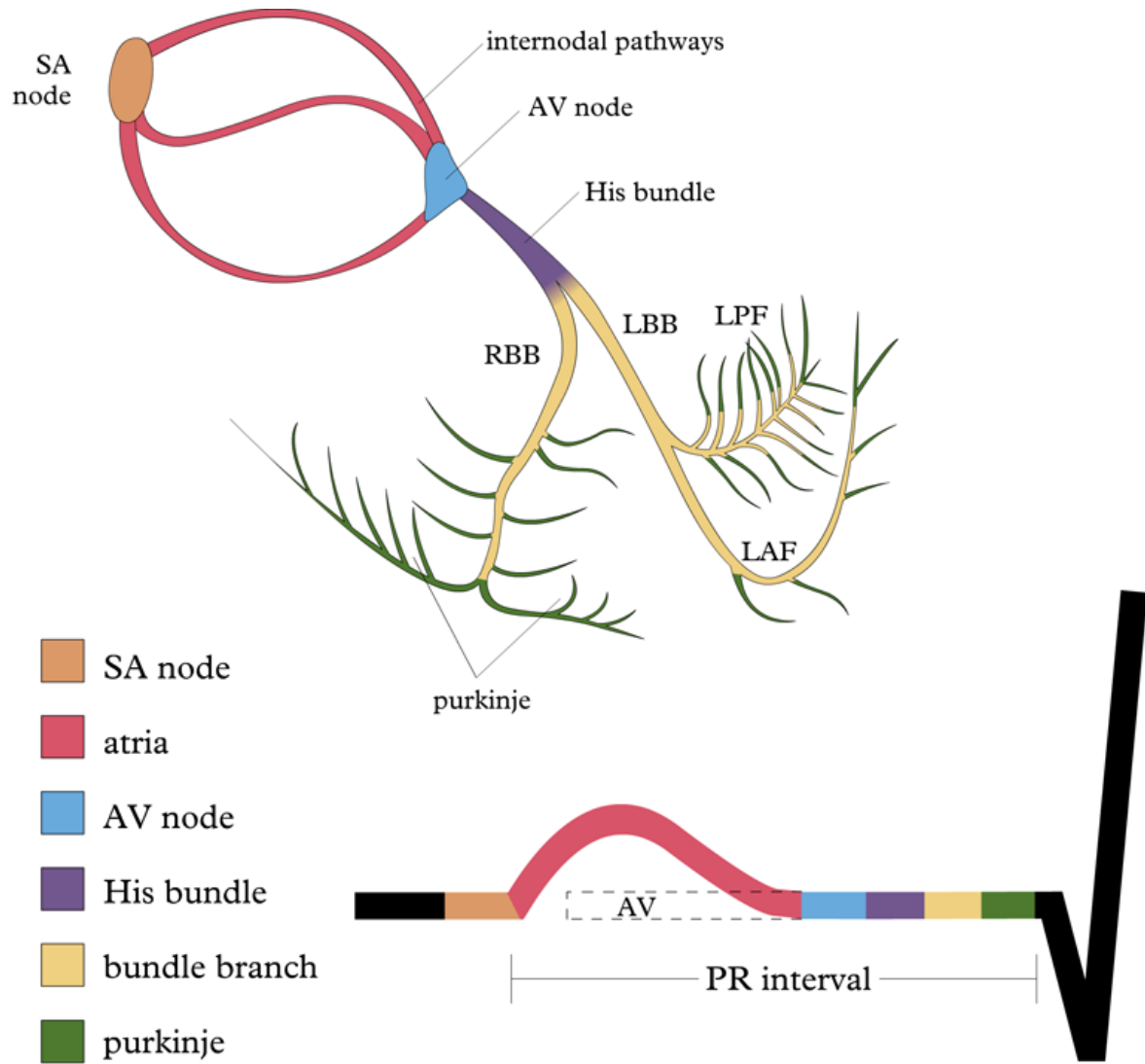
- "Sinustachycardie met ST elevatie over de voorwand, passend bij een acuut voorwandinfarct"
- "Supraventriculaire tachycardie van 200/min op basis van een AV nodale re-entry"
- "Oud onderwandinfarct met nu een acuut lateraal myocard-infarct met QRS verbreding ten opzichte van het ECG van 14 augustus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

Geleidingsstoornissen

Geleidingsstoornissen

- 1^e graads: verlengde PQ tijd > 200ms
- 2^e graads
 - Type I (Wenkebach): PQ tijd neemt toe van complex tot complex tot er een complex uitvalt.
 - Type II (Mobitz): PQ tijd is normaal, maar niet alle p-toppen worden gevolgd (plotselinge uitval)
- Hooggradig AV blok
- 3^e graads: totaal blok





1^e graads AV blok



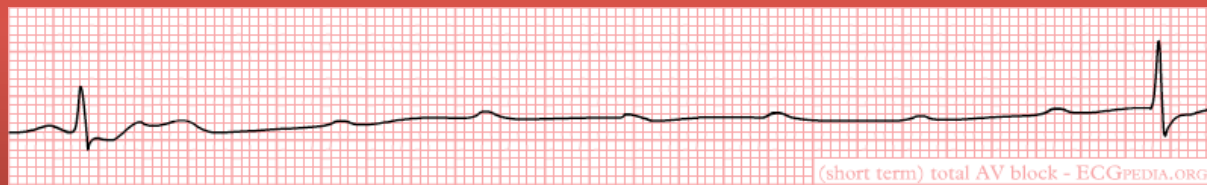
2^e graads AV blok I
Wenkebach



2^e graads AV blok II
Mobitz



3^e graads AV blok
Totaal AV blok



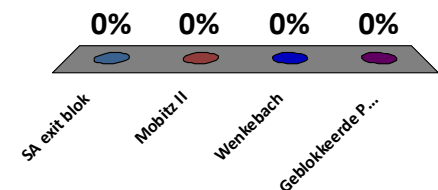
Wat is dit voor blok?

1. SA exit blok
2. Mobitz II
3. Wenkebach
4. Geblokkeerde PAC



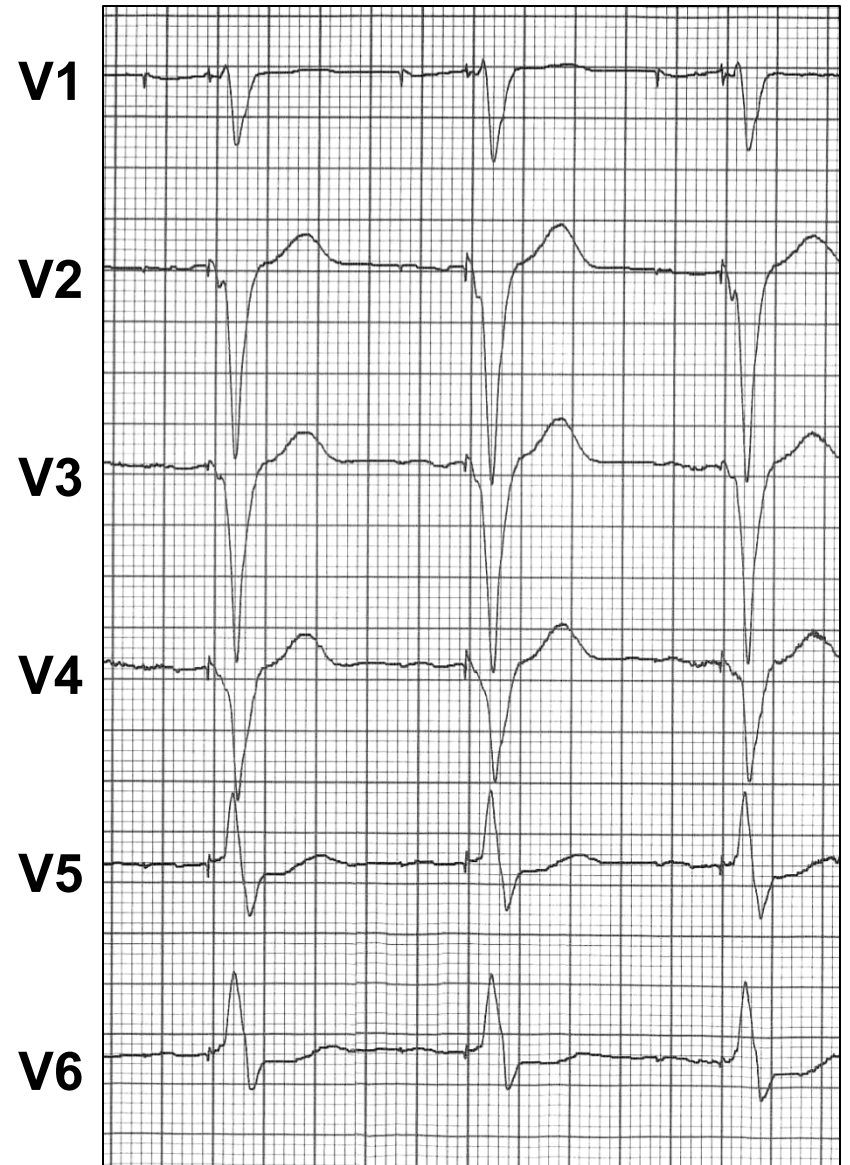
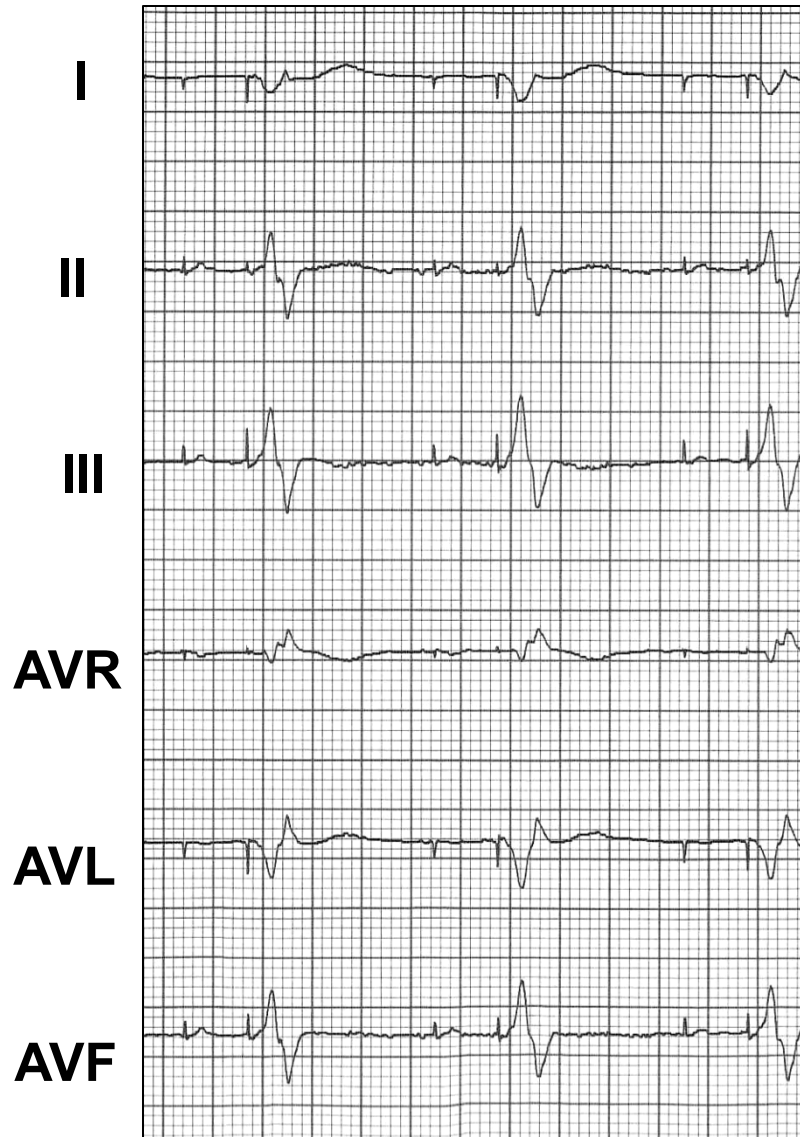
de Voigt, MD, PhD, Amsterdam, The Netherlands

ECG



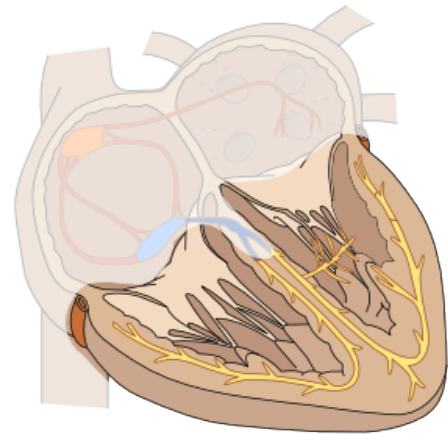
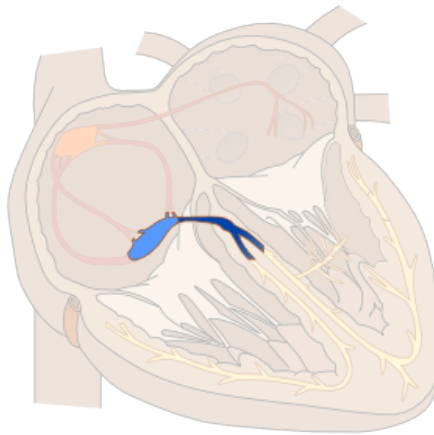
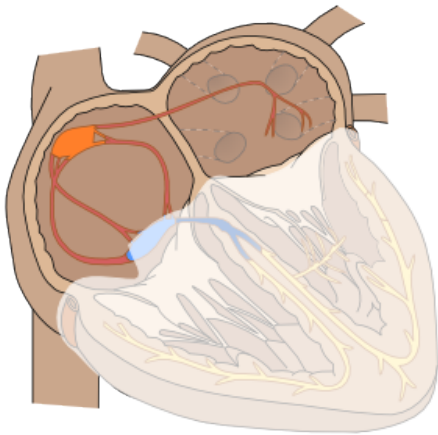
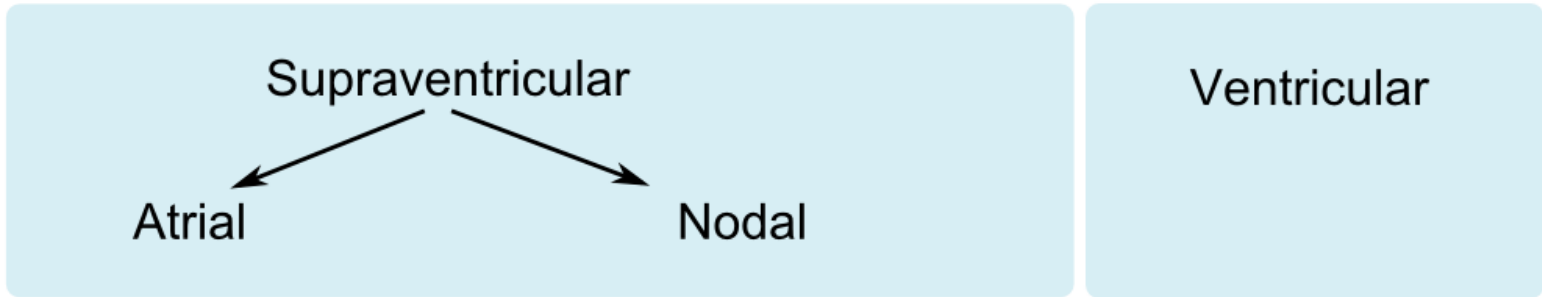
Geleidingsstoornissen

AV blok	Locatie oorzaak	Therapie
1^e graads	AV knoop	Geen
2^e graads type I (Wenkebach)	AV knoop.	Geen. Pacemaker indien symptomatisch en geen behandelbare oorzaak.
2^e graads type II	Purkinje	Pacemaker
Hooggradig AV blok	AV knoop of lager	Pacemaker
Totaal AV blok	AV knoop of lager	Pacemaker

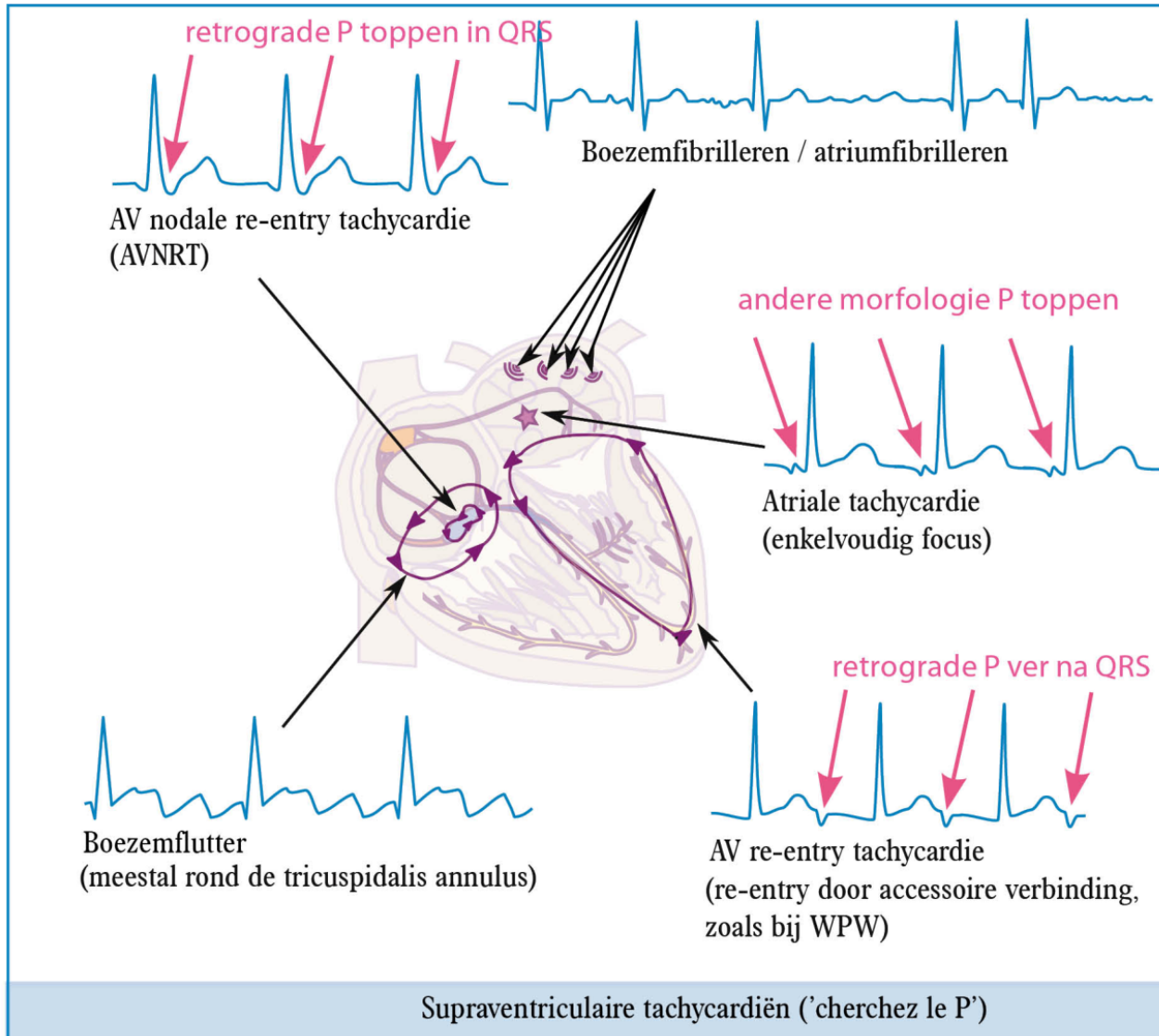


Ritmestoornissen

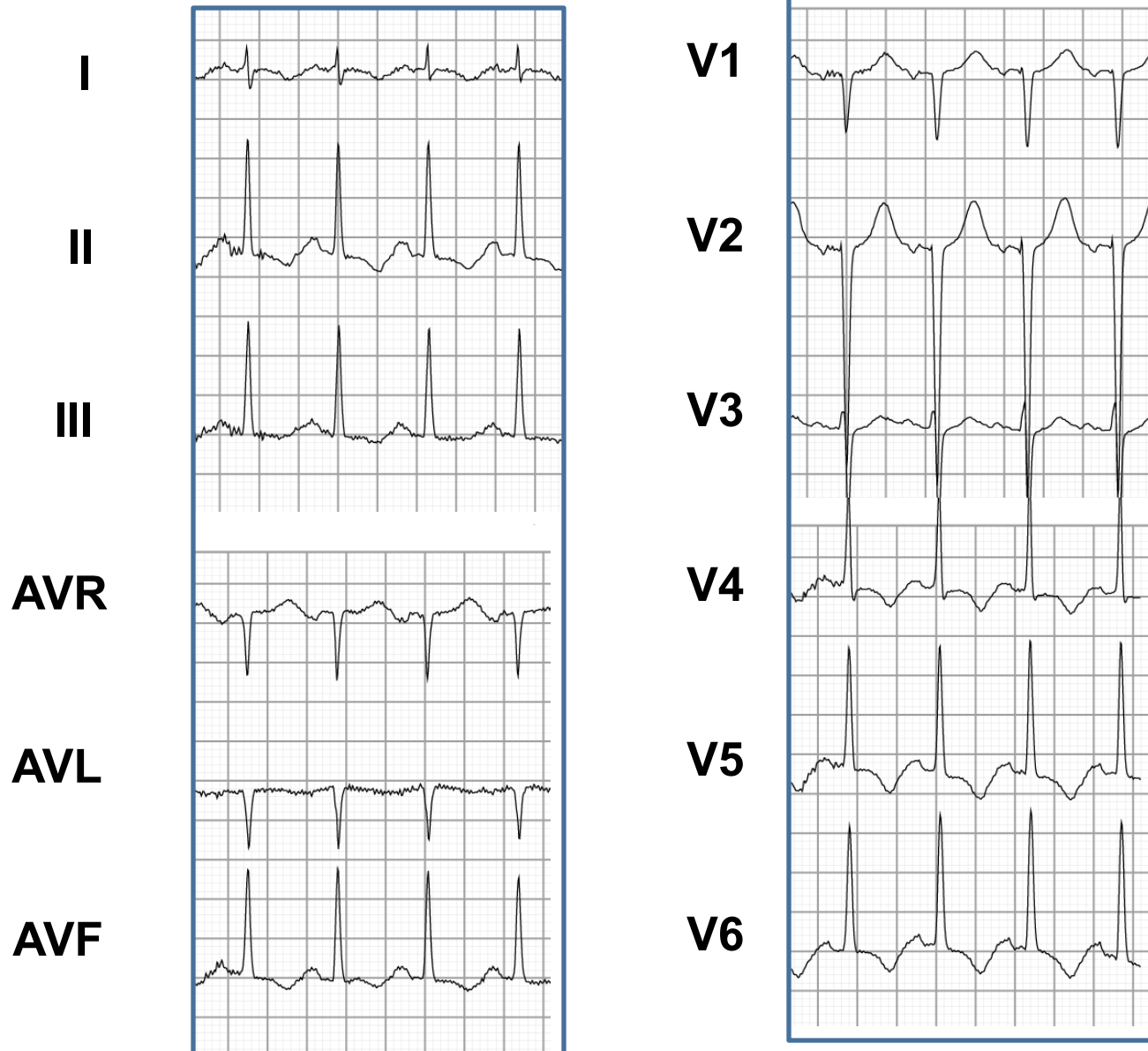
Geen sinusritme? Tachycardie?



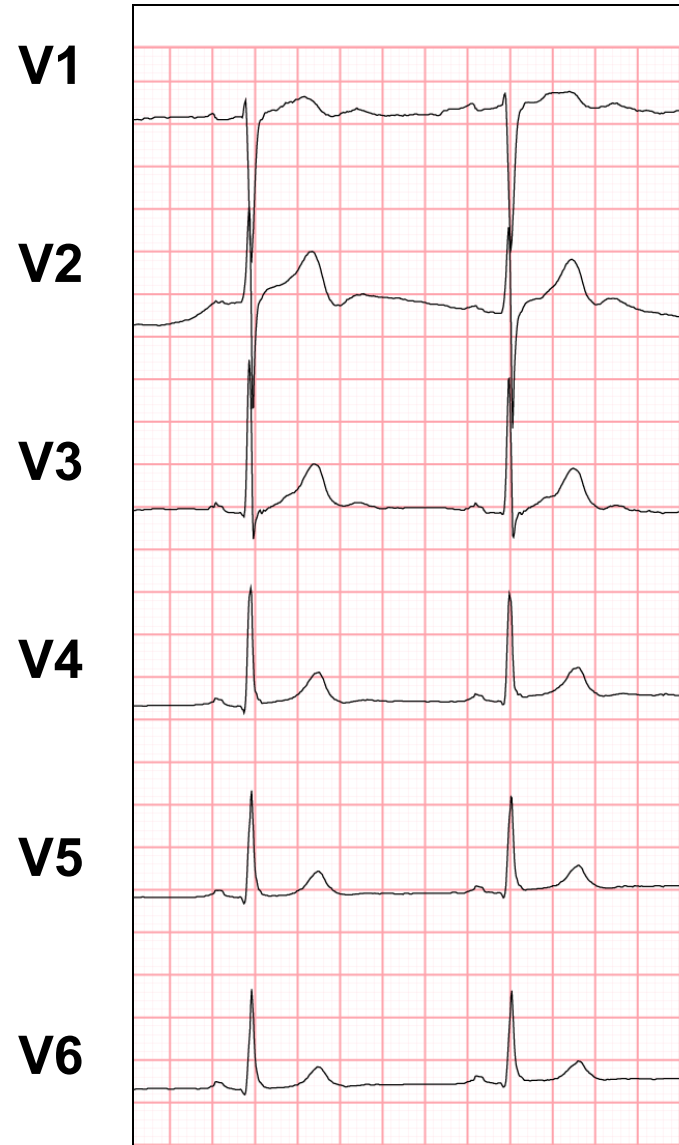
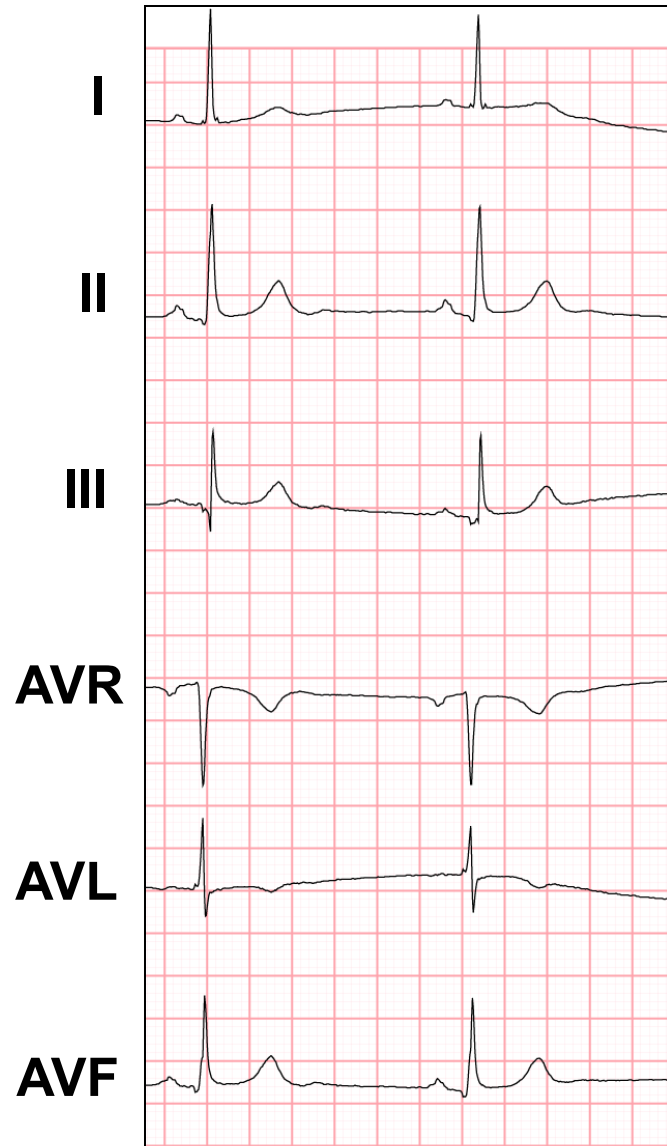
SVT?



Sinustachycardie



Sinusbradycardie

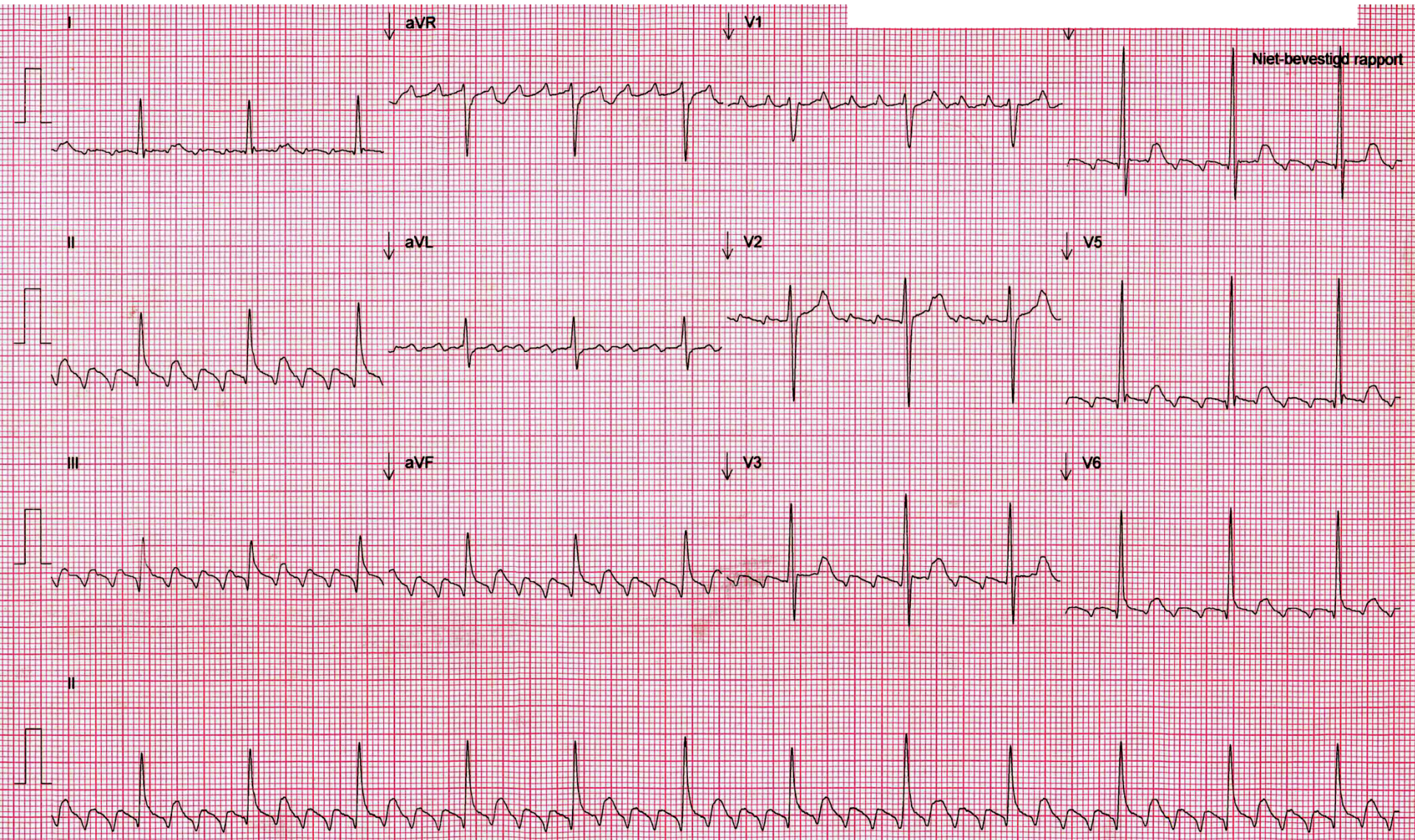


V1

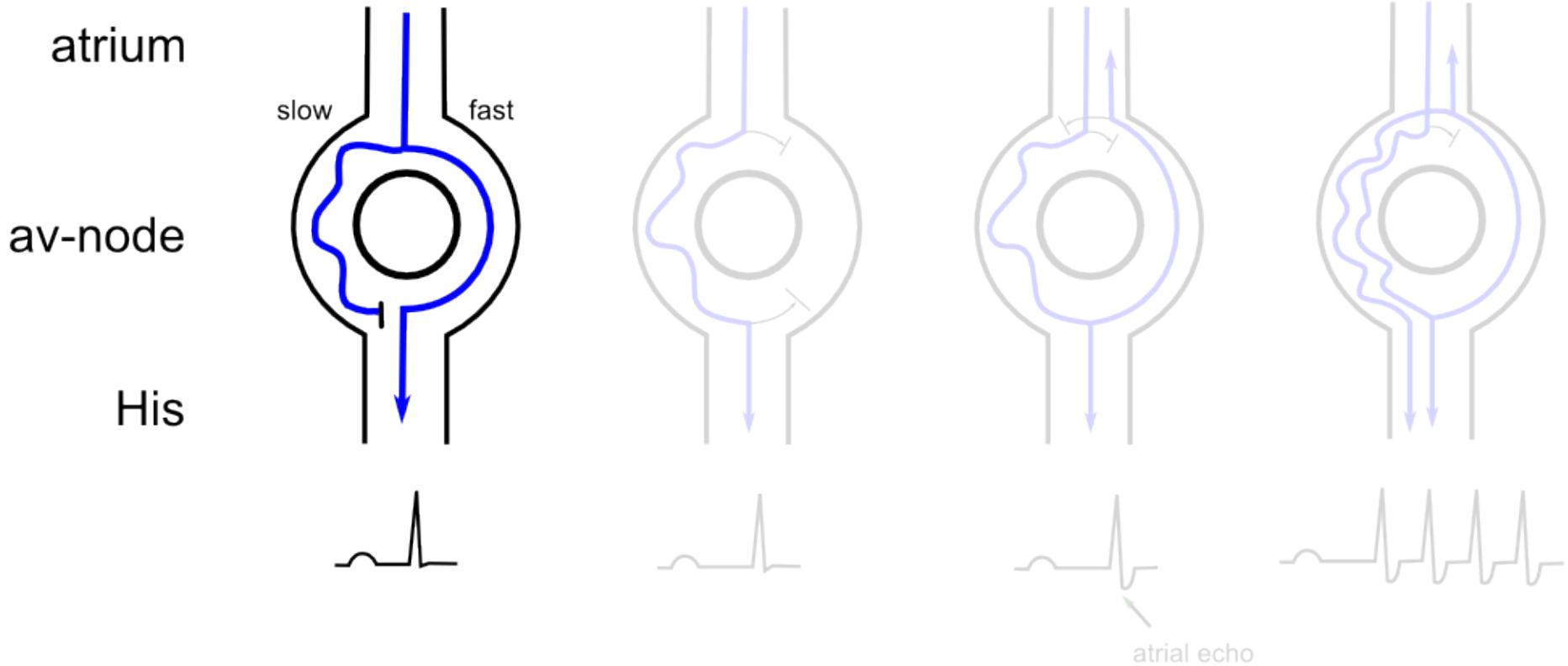
II

V5

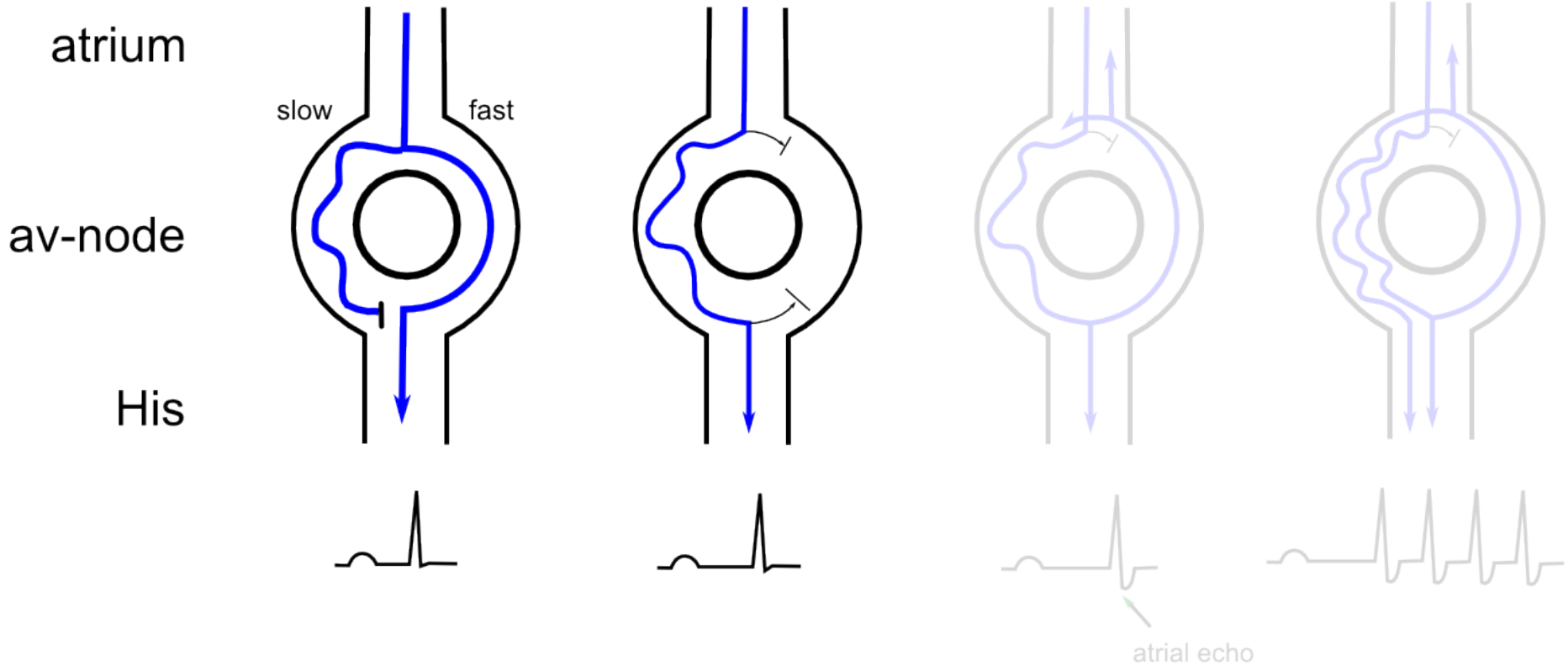




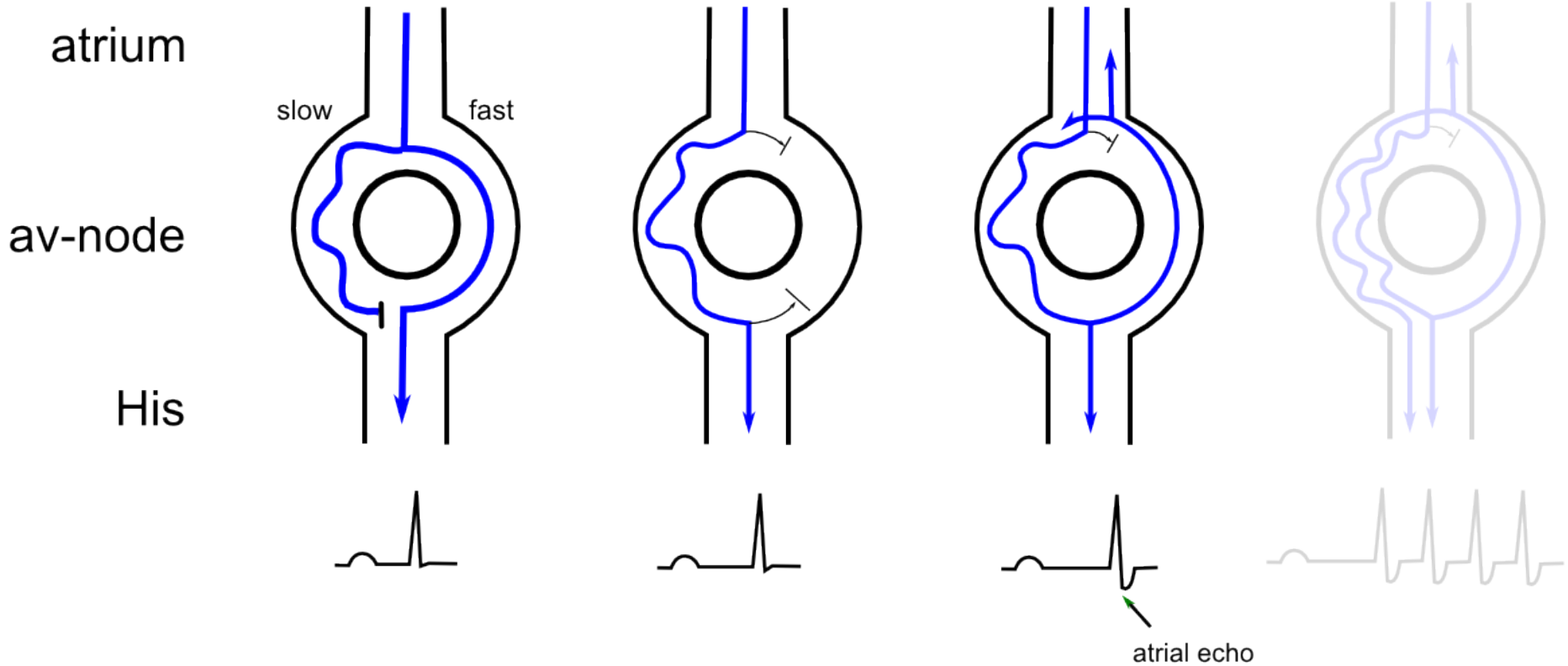
Re-entry



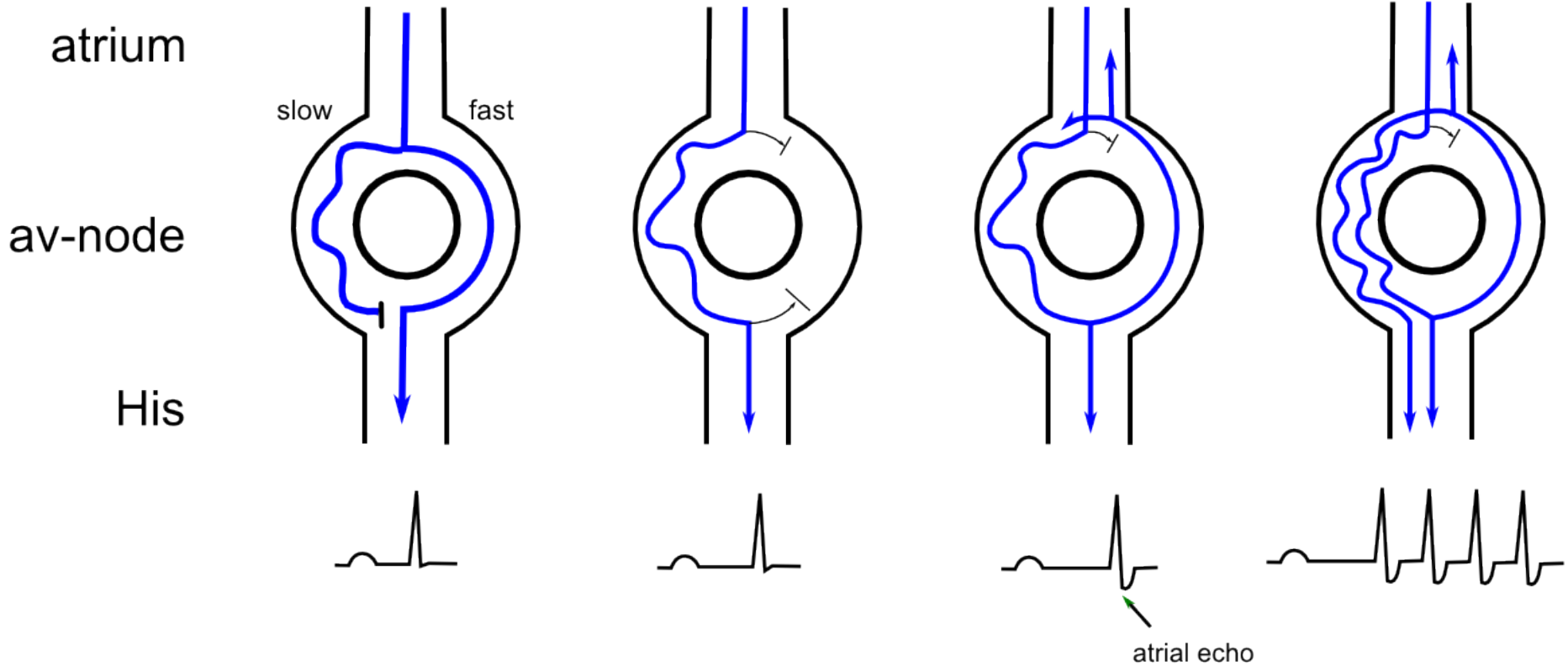
Re-entry

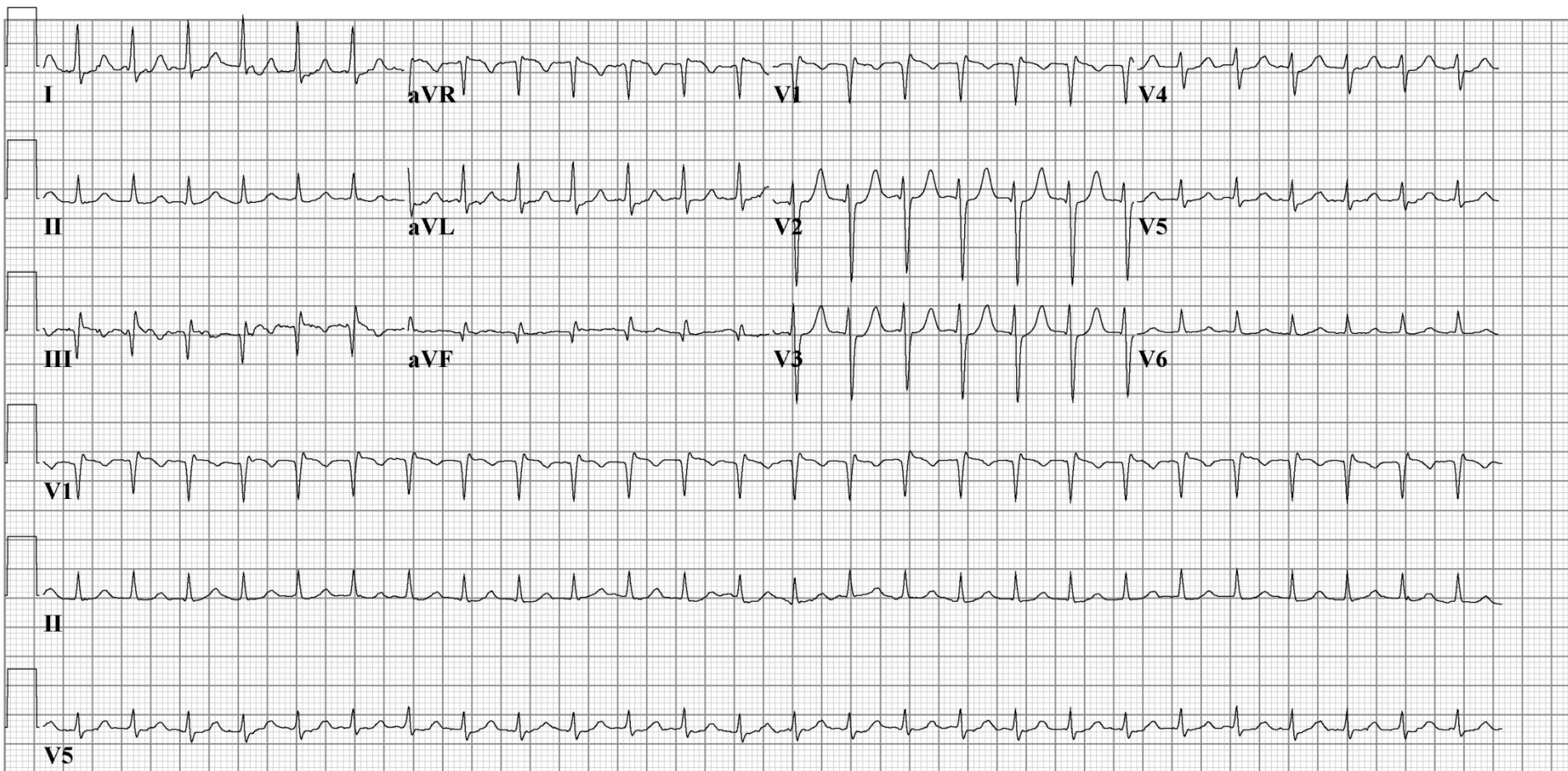


Re-entry

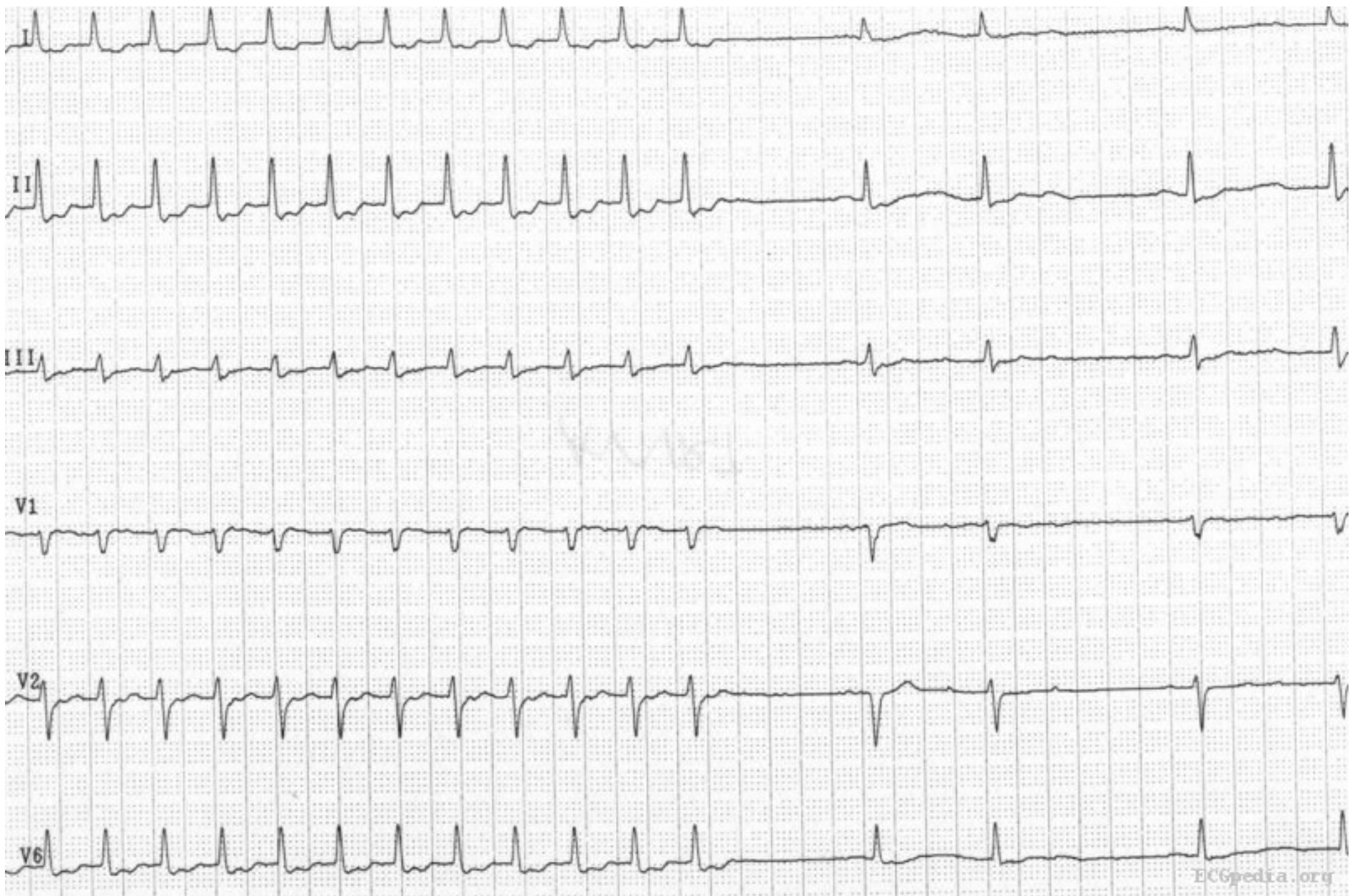


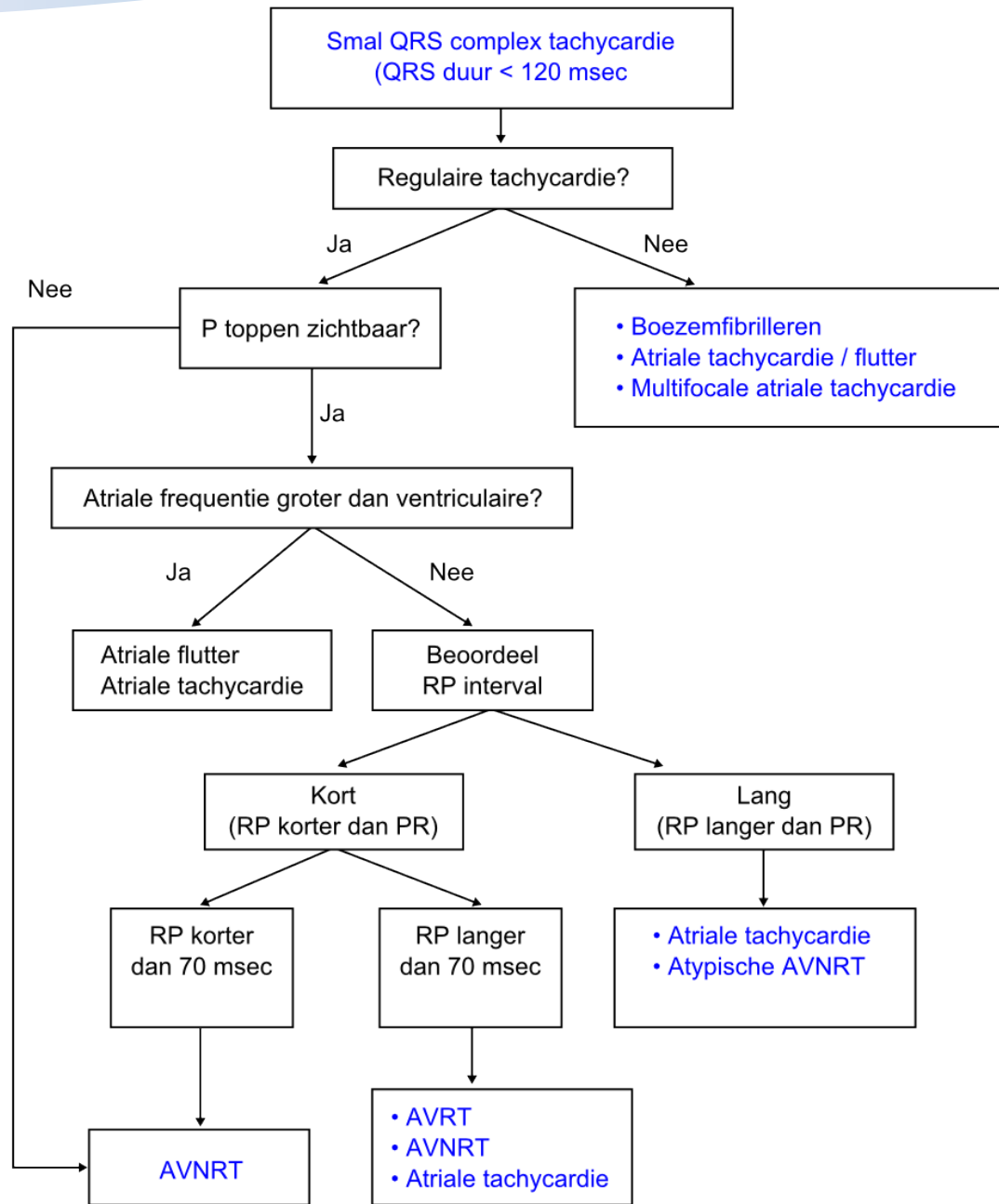
Re-entry

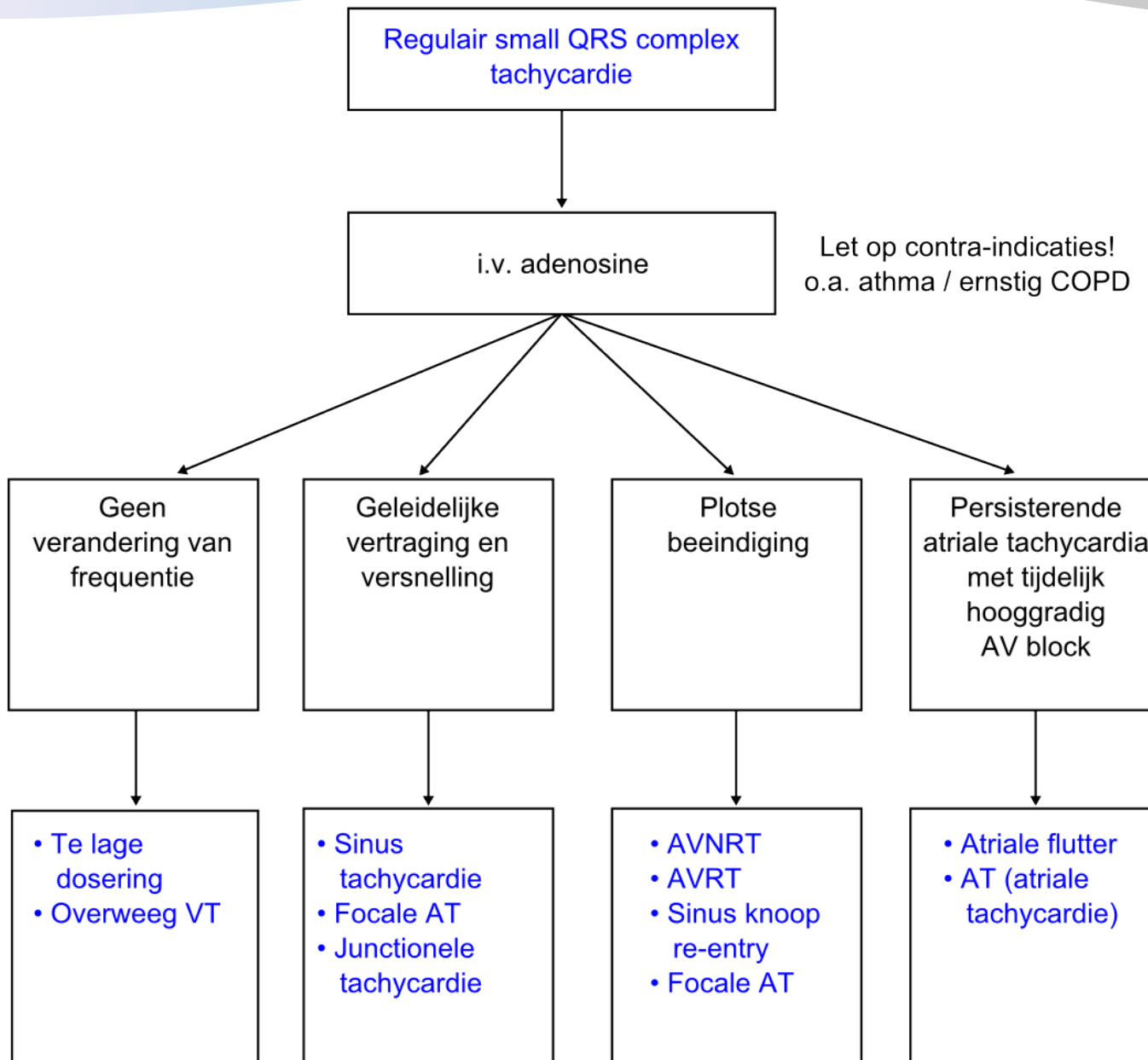




Adenosine

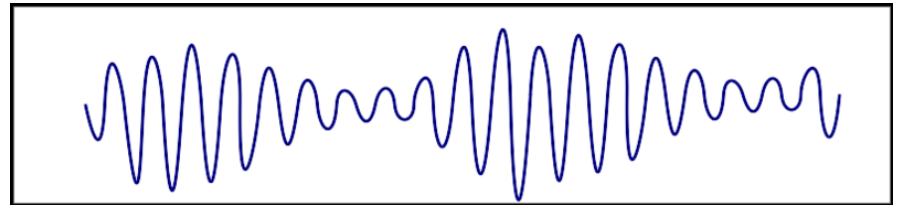
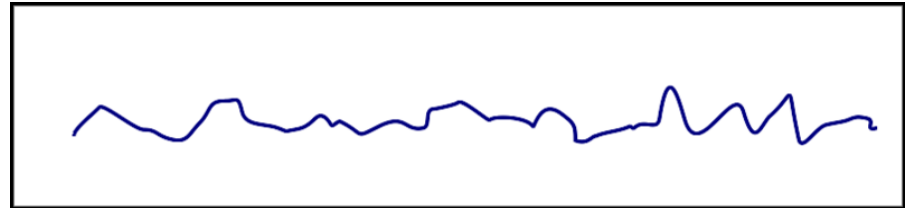
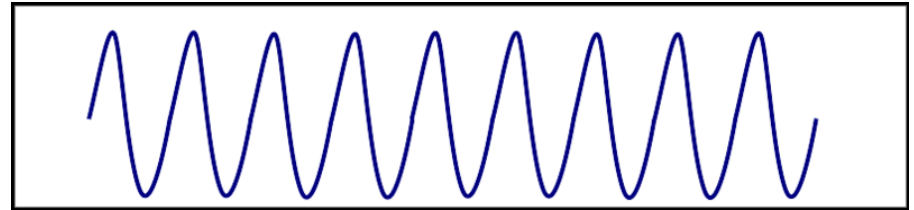


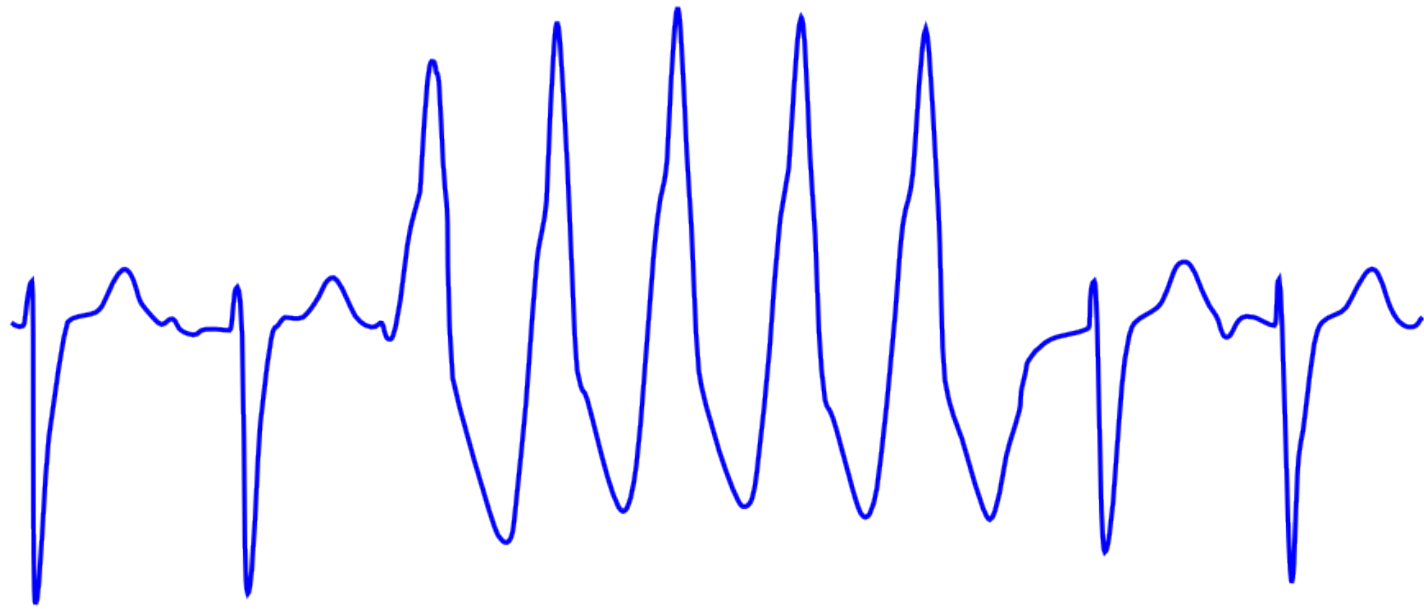


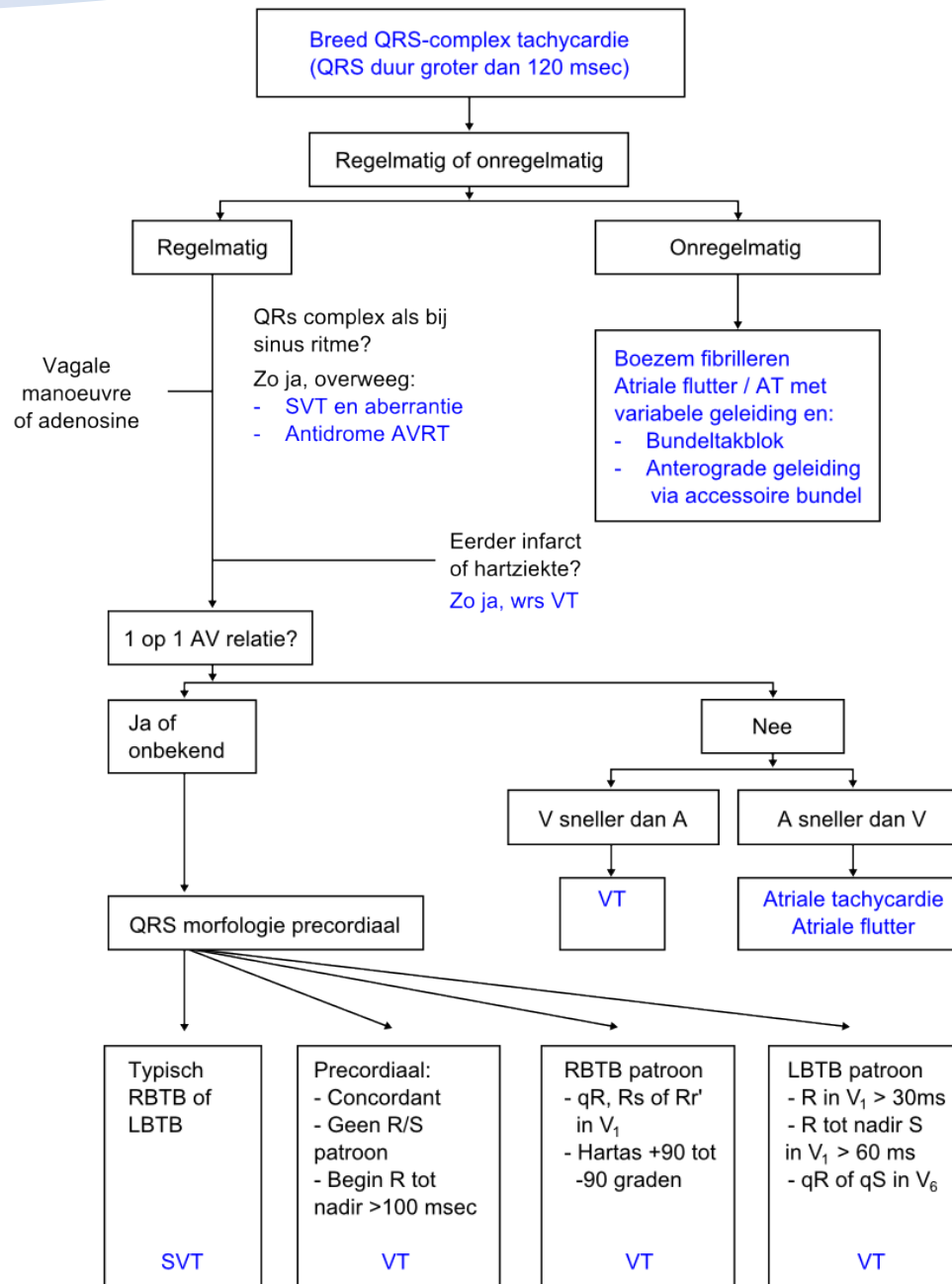


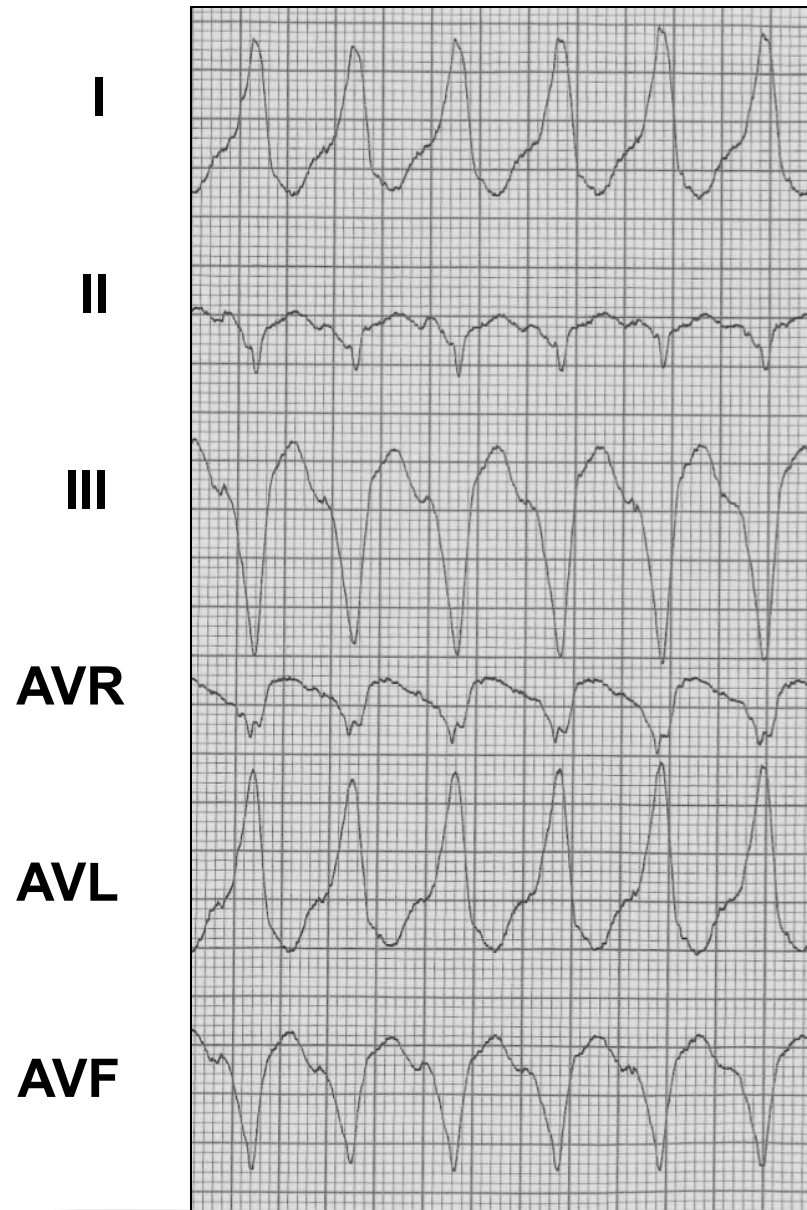
Ventriculaire tachycardie?

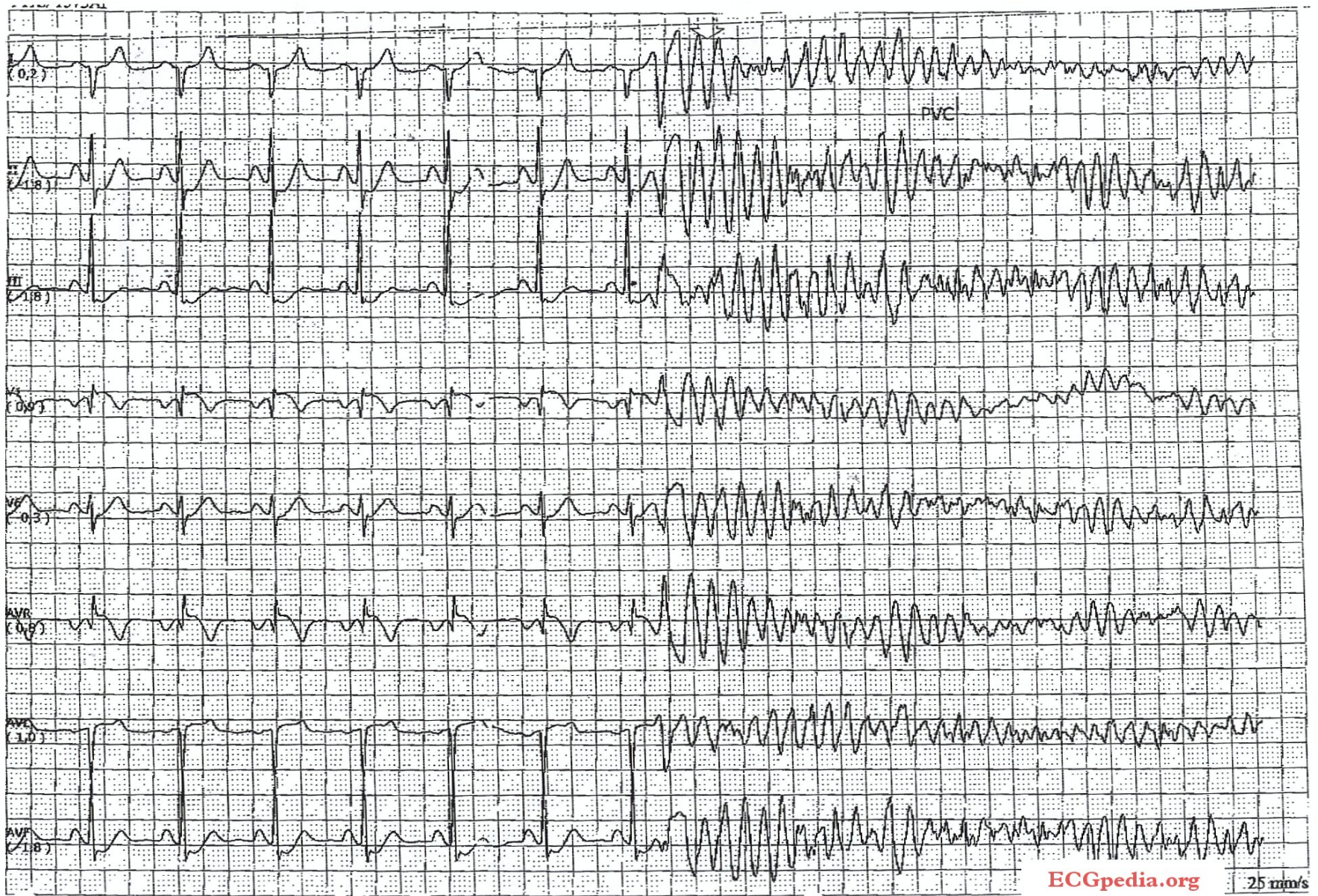
- Ventrikeltachycardie
- Ventrikelfibrilleren
- Torsade de Pointes



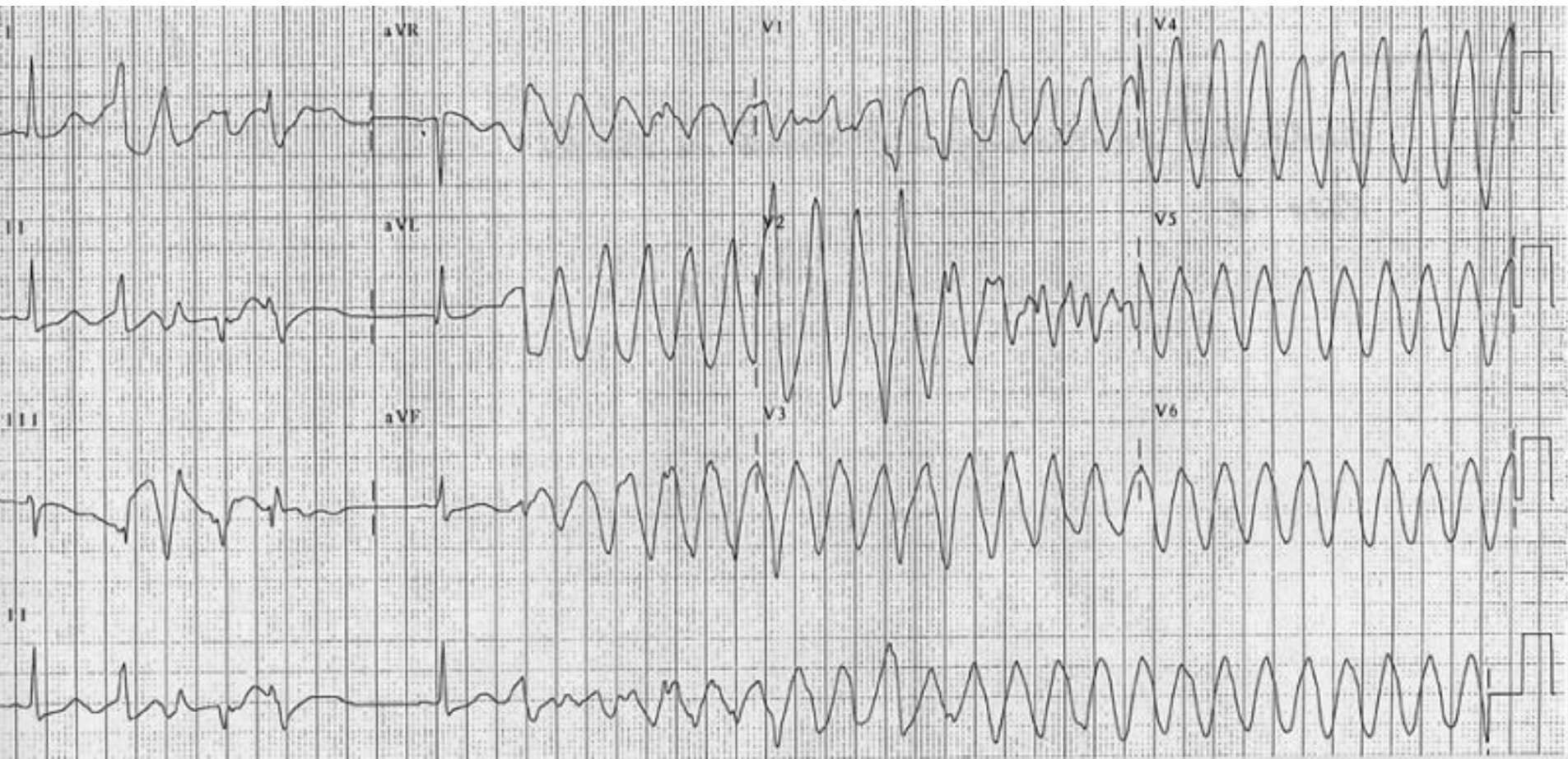






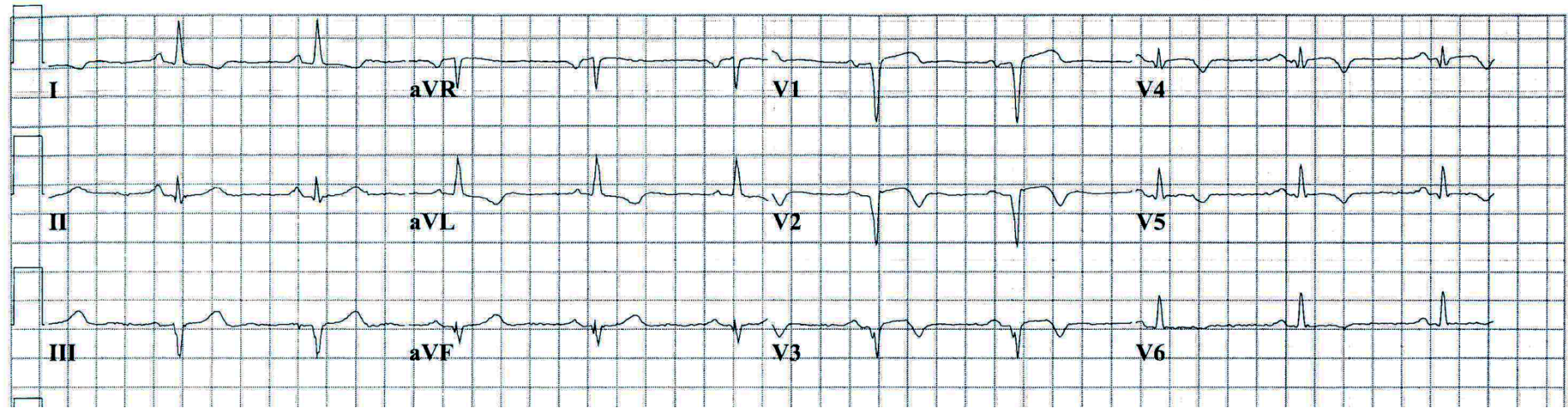


Ventriculofibrillation



Torsade de Pointes

**OEFENEN SYSTEMATISCH
BEOORDELEN**



I



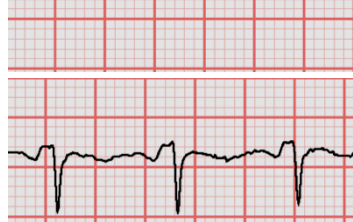
II



III



AVR



AVL



AVF



V1



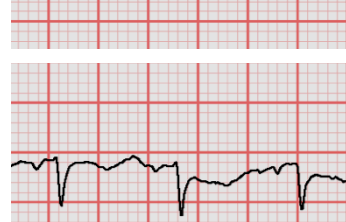
V2



V3



V4

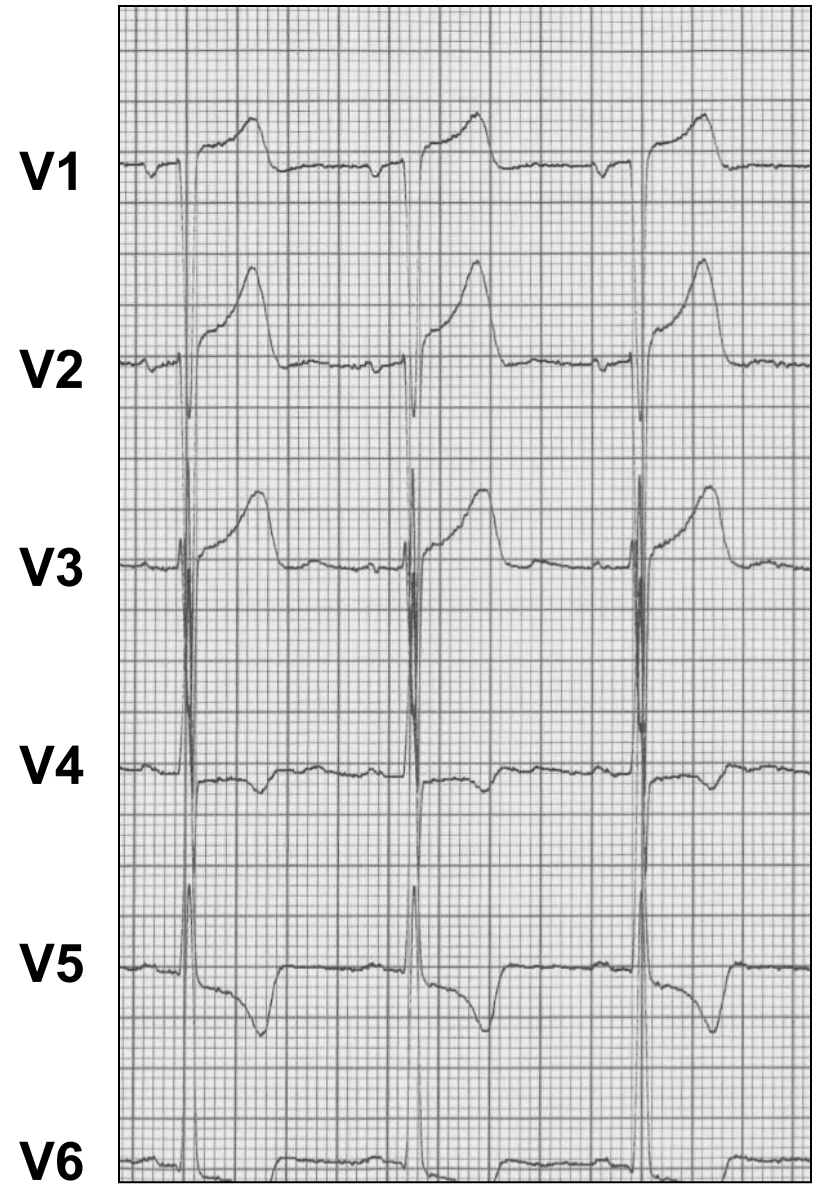
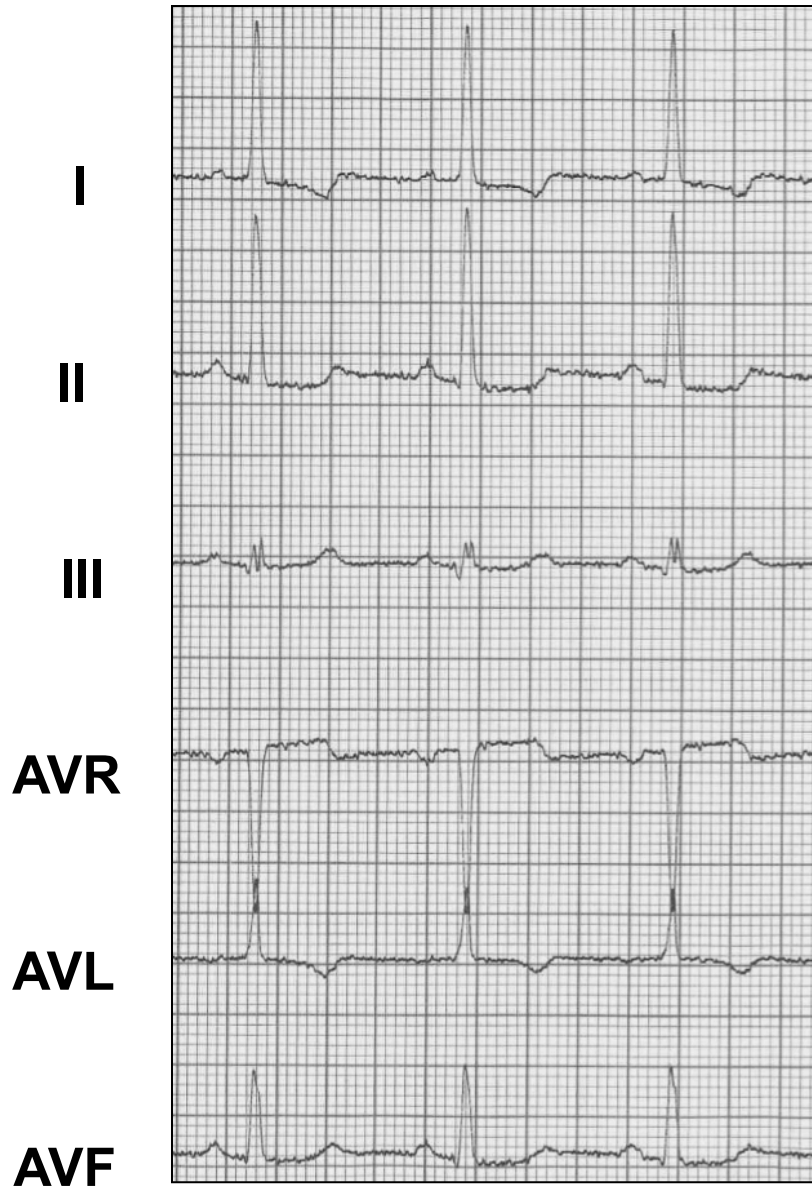


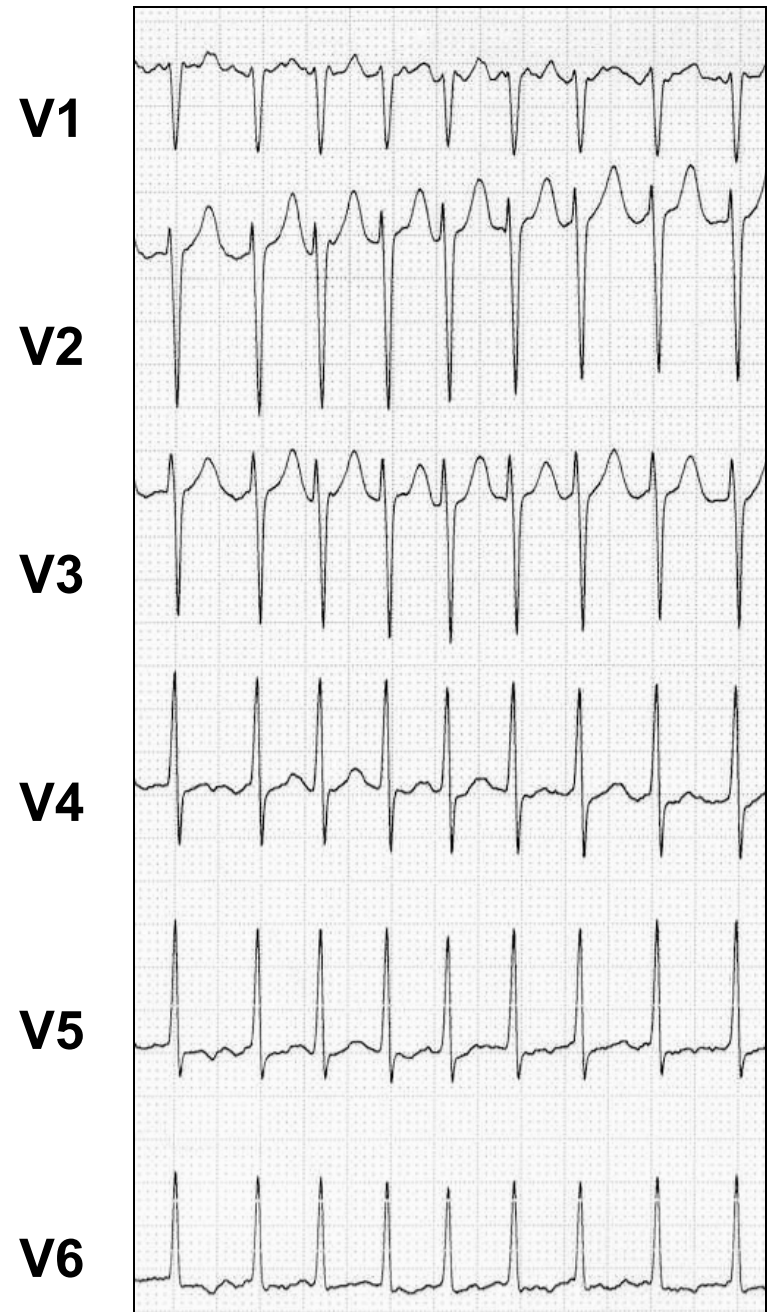
V5



V6



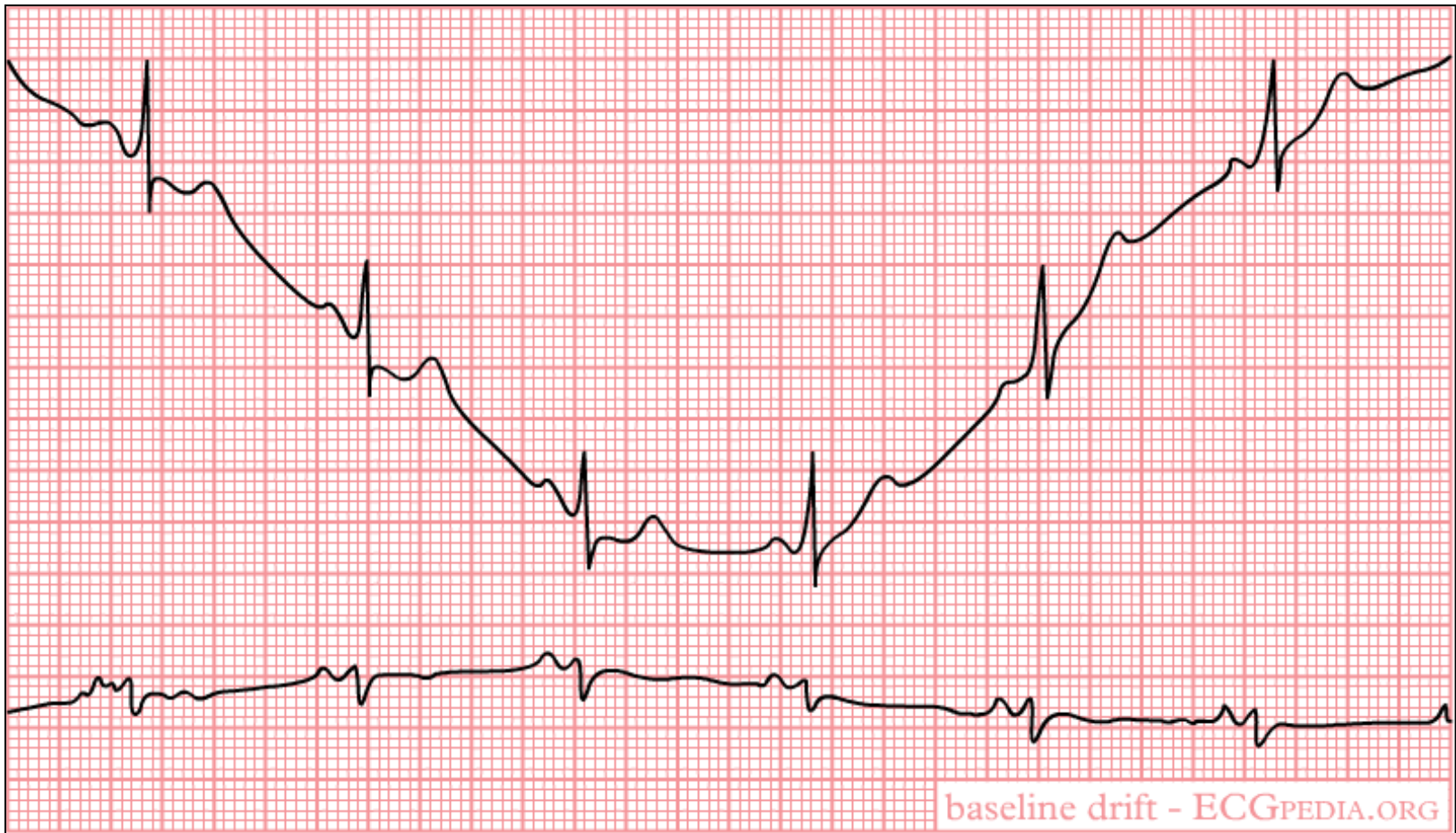




Technische problemen

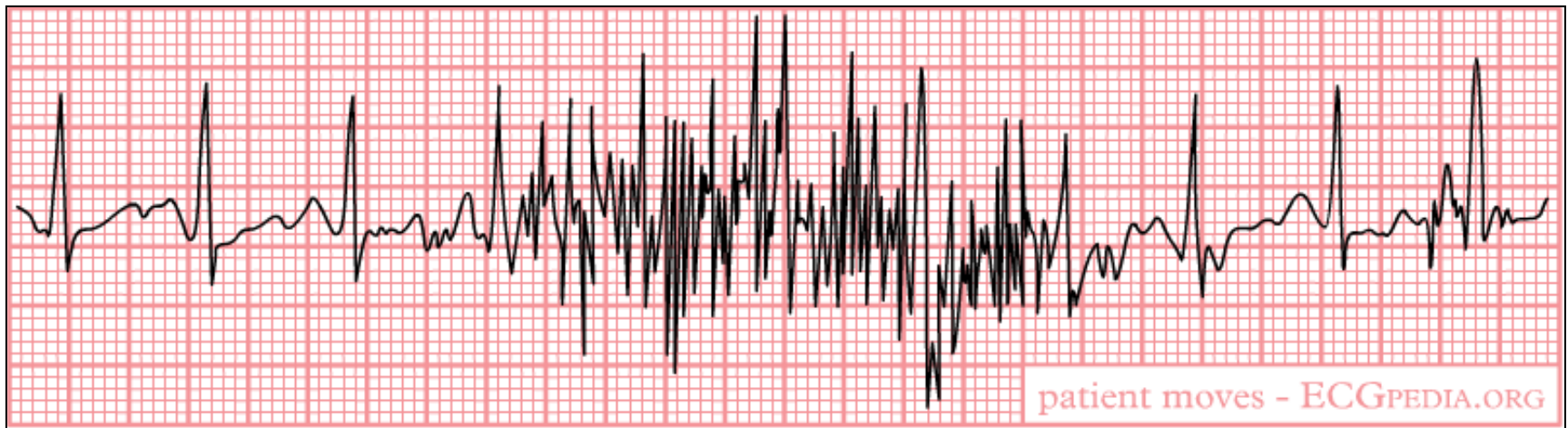
Technische problemen

Baseline drift



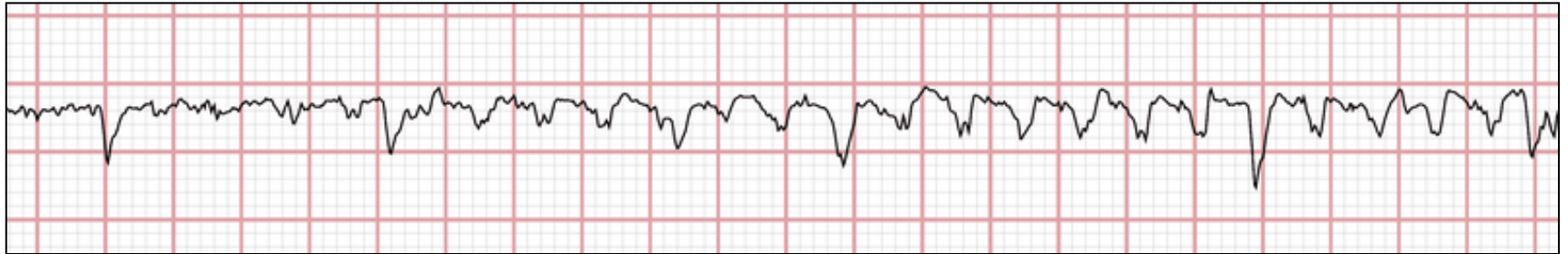
Technische problemen

Bewegungsartefacten



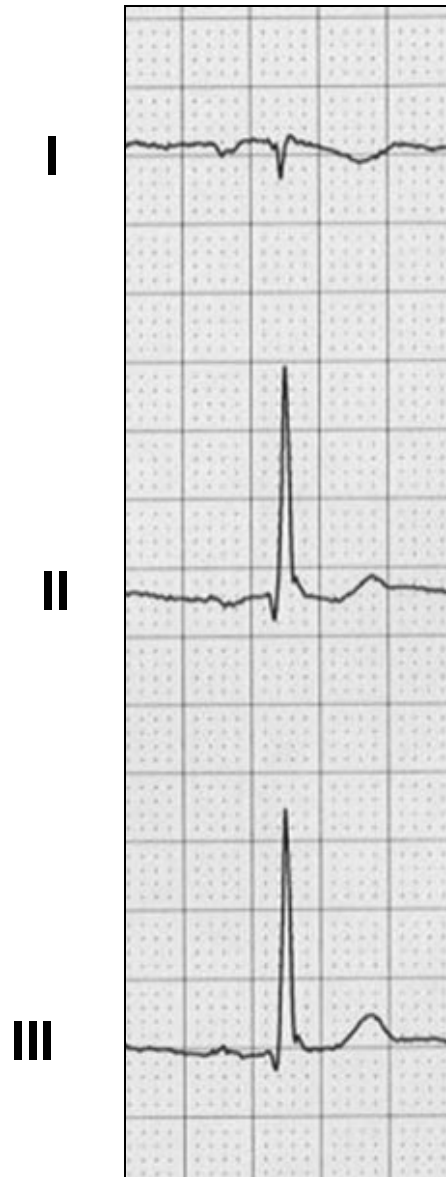
Technische problemen

Parkinson



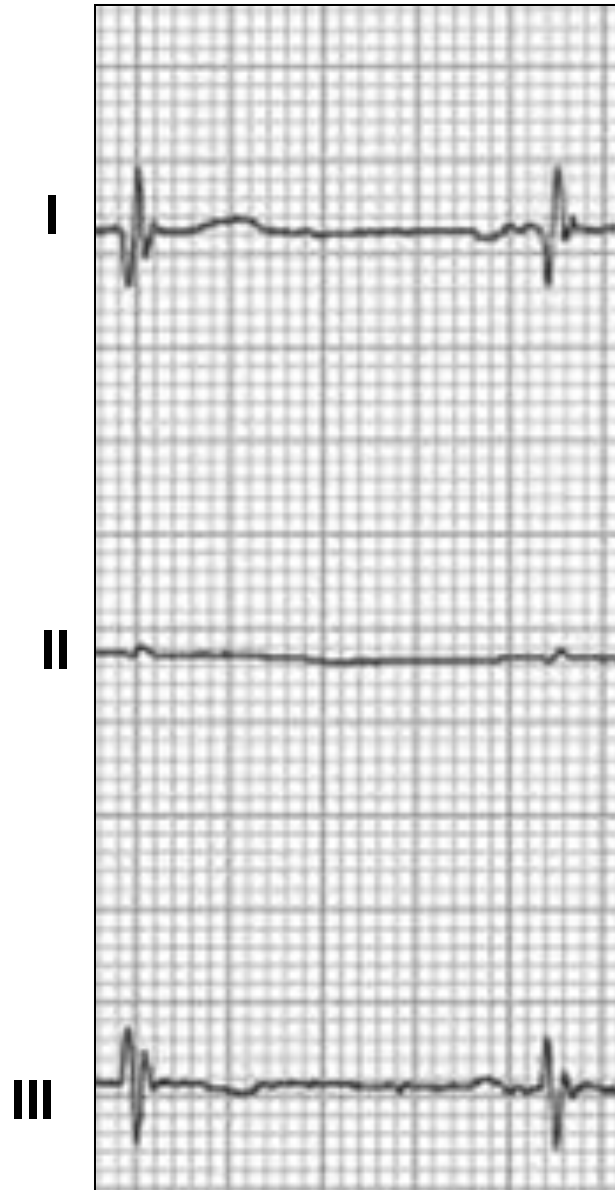
Technische problemen

Draadverwisselingen



Technische problemen

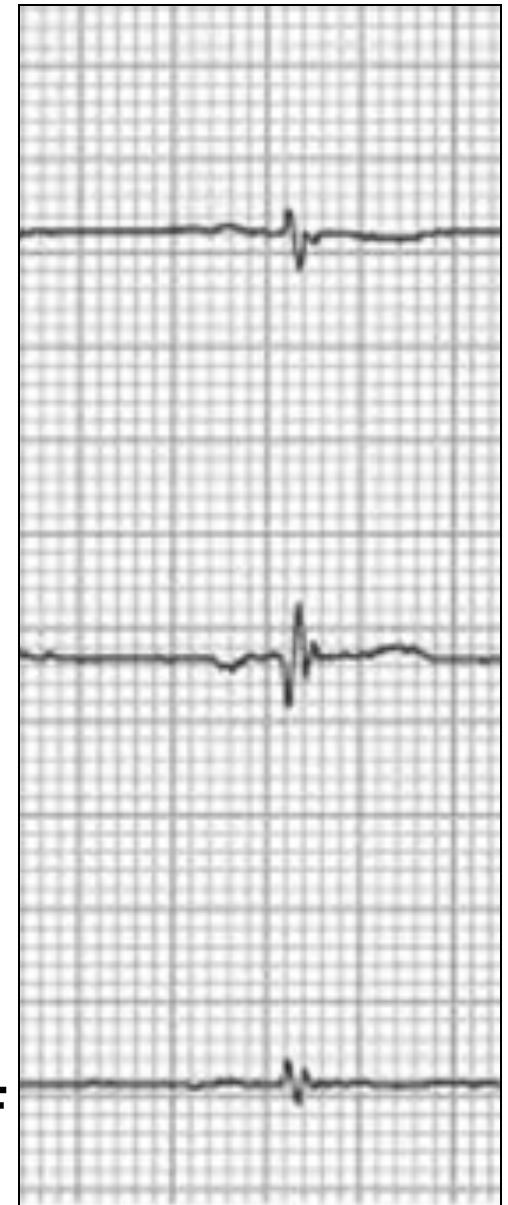
Draadverwisselingen



AVR

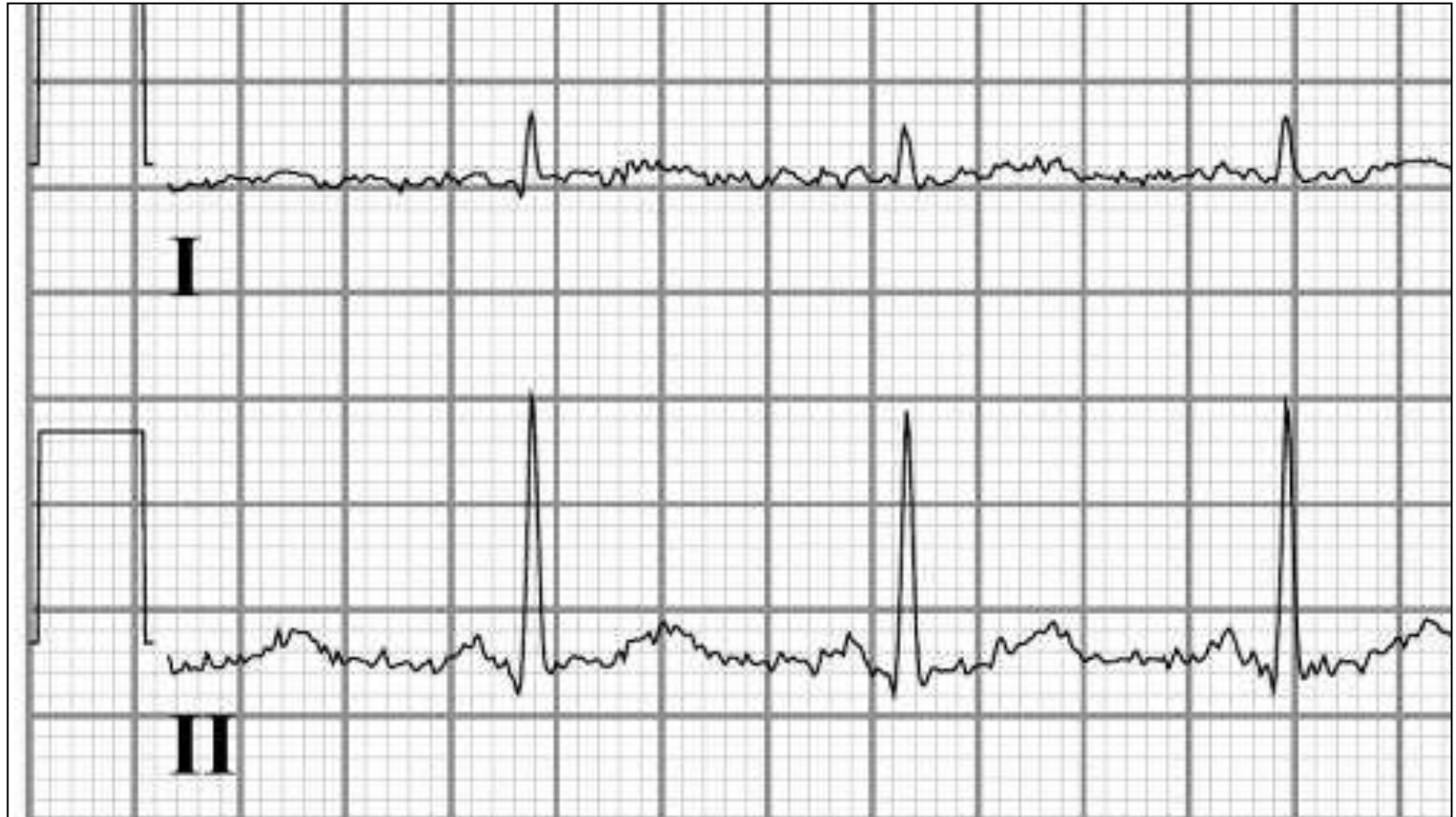
AVL

AVF



Technische problemen

Elektrische interferentie



Technische problemen

Elektrische interferentie

