Basiscursus ECG voor co-assistenten

Jonas de Jong

CARDIO NETWORKS.ORG

Improving access to medical knowledge

ECG PEDIA.ORG

part of cardionetworks.org

Cursusoverzicht

- basis, systematische beoordeling
- ischemie en ritmestoornissen
- geleidingsstoornissen

De cursus is interactief. Onderbreek gerust!

Cardionetworks

Auteurs:

- Jonas de Jong
- Ivo van der Bilt
- Martijn Meuwissen
- Dr. Renée van den Brink
- Dr. Joris de Groot

Illustraties:

- Rob Kreuger
- Bart Duineveld

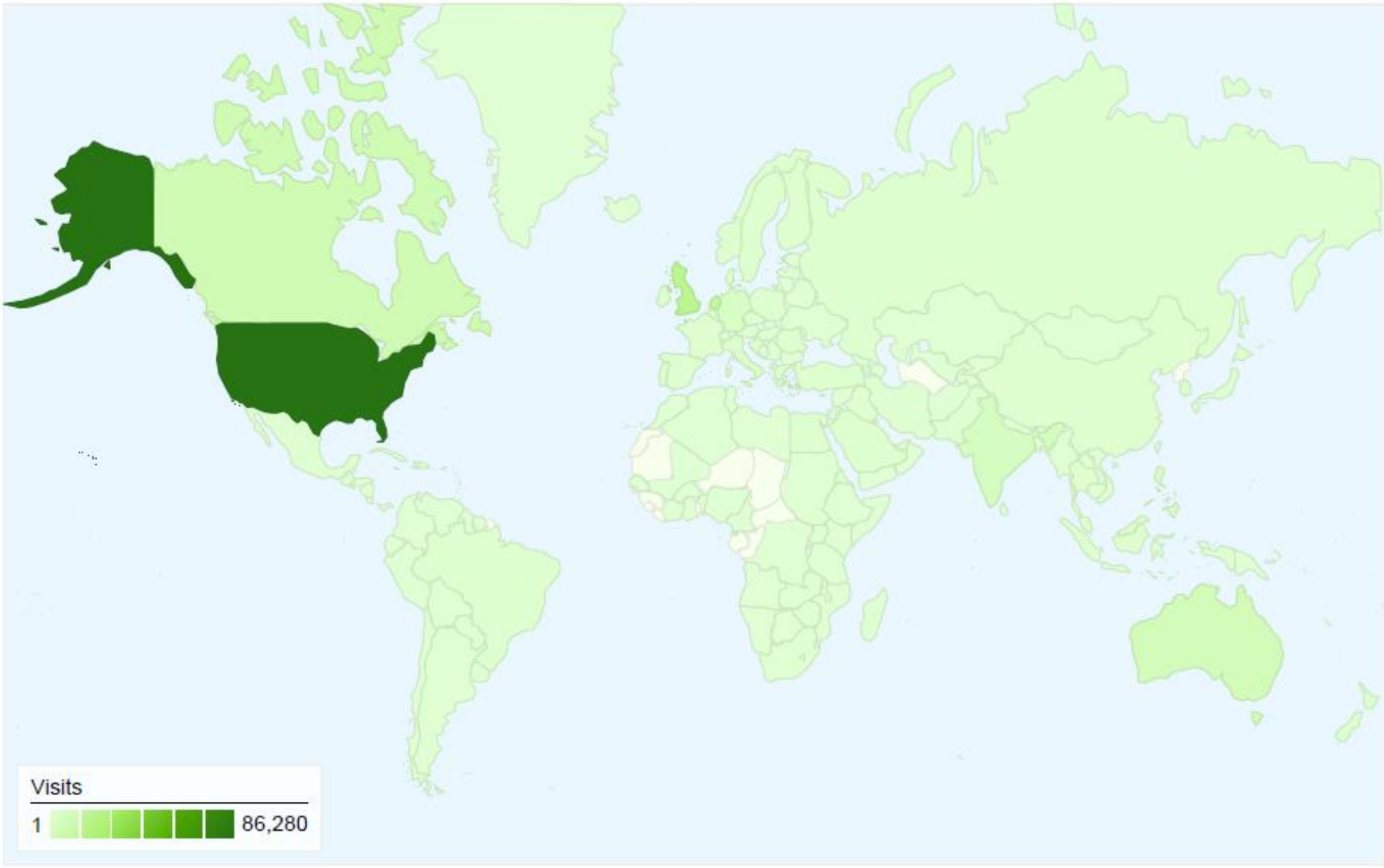
Met dank aan:

- Prof. Arthur Wilde
- Dr. Rudolph Koster

Boeken:

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

Bezoekers uit 192 landen



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Aanmelden / registreren

pagina | overleg | brontekst bekijken | geschiedenis

zoeken

OK Zoeken

navigatie

- Hoofdpagina
- Voorbehoud
- Veelgestelde vragen
- Donateurs
- Inhoudelijk bijdragen
- Powerpoint presentaties
- Suggesties
- 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
- - Congenitaal
- - 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!, 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.:

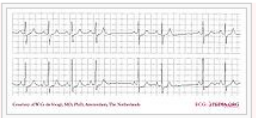
- Het normale ECG
- De geschiedenis van het ECG
- Technische problemen
- Geleidingsstoornissen
  - AV geleiding
  - Ventriculaire geleiding
- Ritmestoornissen
  - Supraventriculair
  - Nodaal
  - Ventriculair
  - Congenitaal
  - Ectopische slagen
- Infarct/Ischemie
- Inspanningstesten
- Hypertrofie
- 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?

CARDIONETWORKS.ORG

non-profit / open access / physician moderated / up-to-date

Basics van het ECG

Grondbeginselen

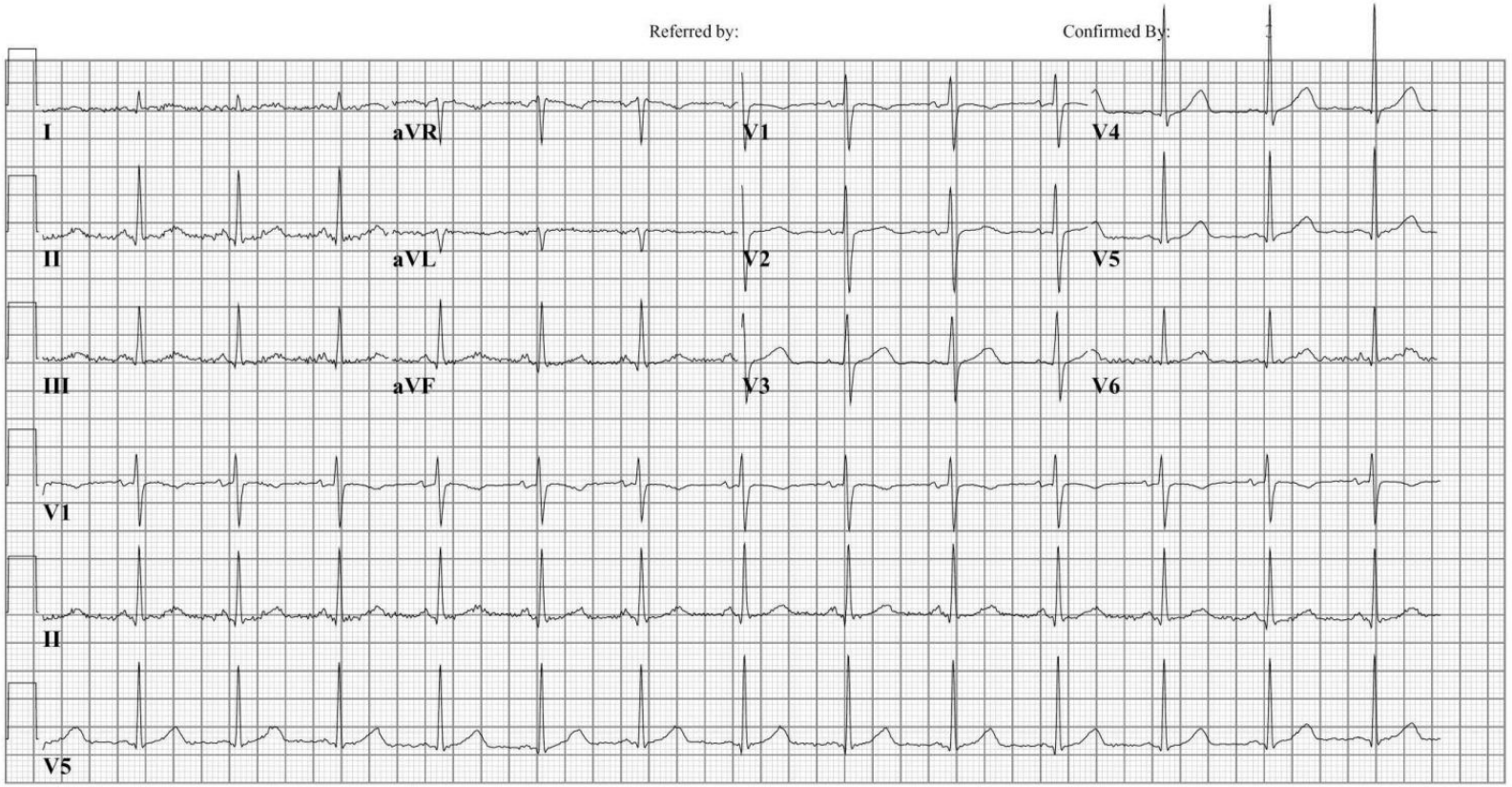
Vent. rate	81	BPM	*** Leeftijds en geslacht specifieke ECG analyse ***
PR interval	120	ms	Normaal sinusritme
QRS duration	80	ms	Normaal ECG
QT/QTc	376/436	ms	Geen oud ECG aanwezig
P-R-T axes	81 80	73	

Loc:23

Technician:

Referred by:

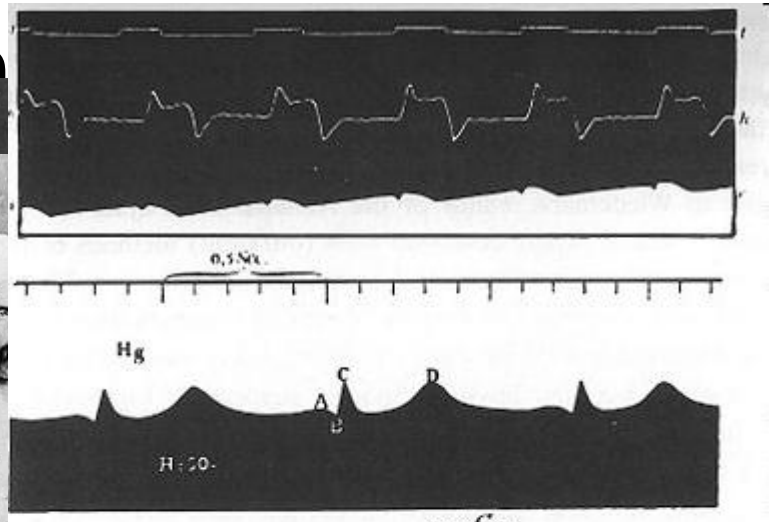
Confirmed By:

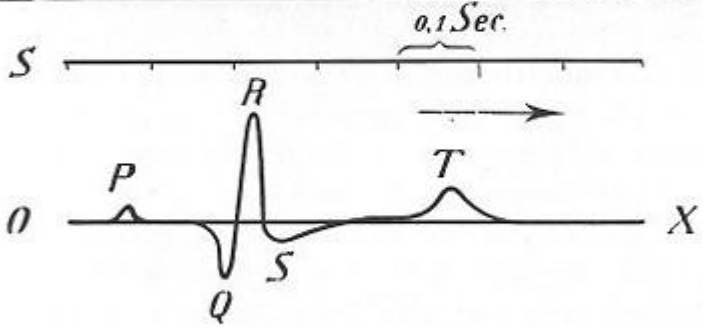


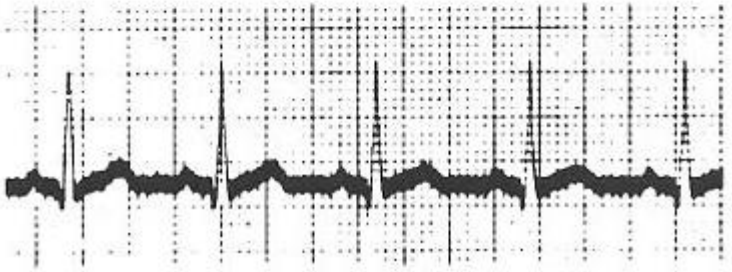
25mm/s 10mm/mV 40Hz 005E 12SL 233 CID: 10

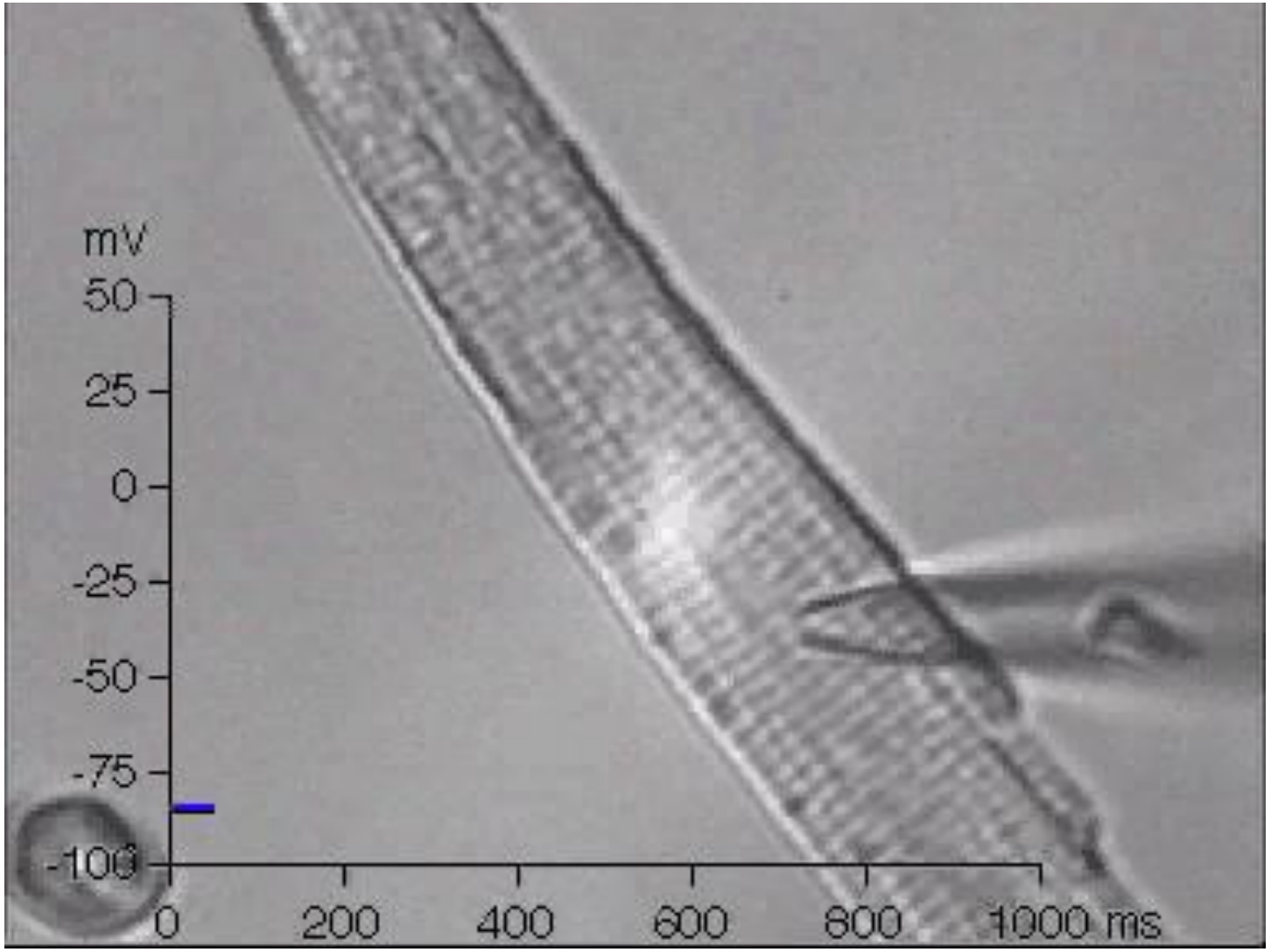
Page 1 of 1

Gesch

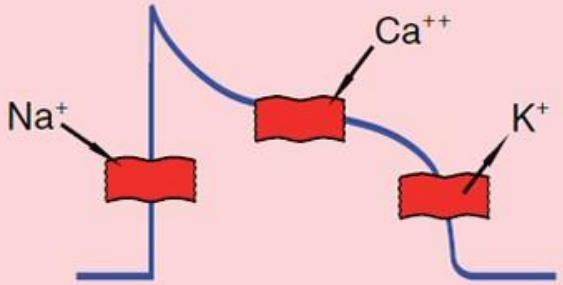




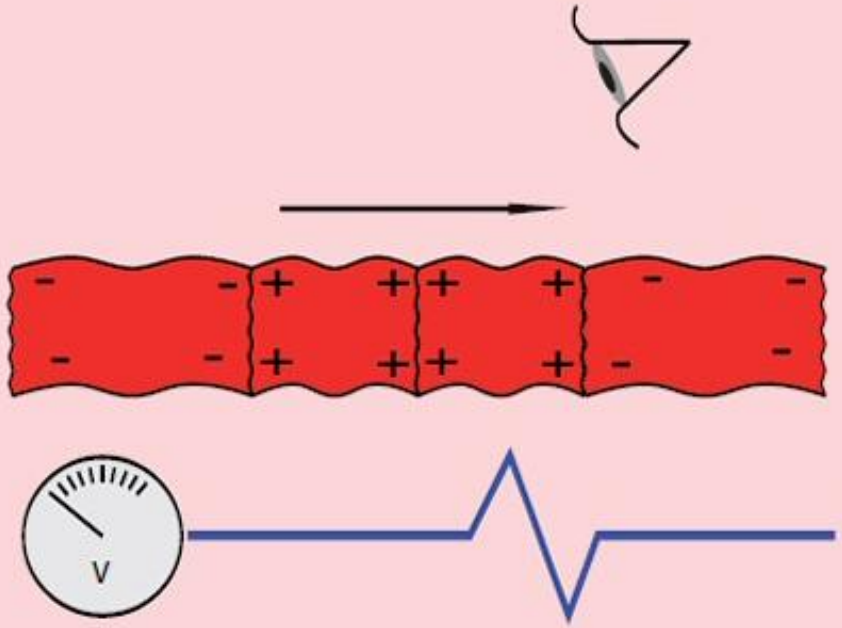




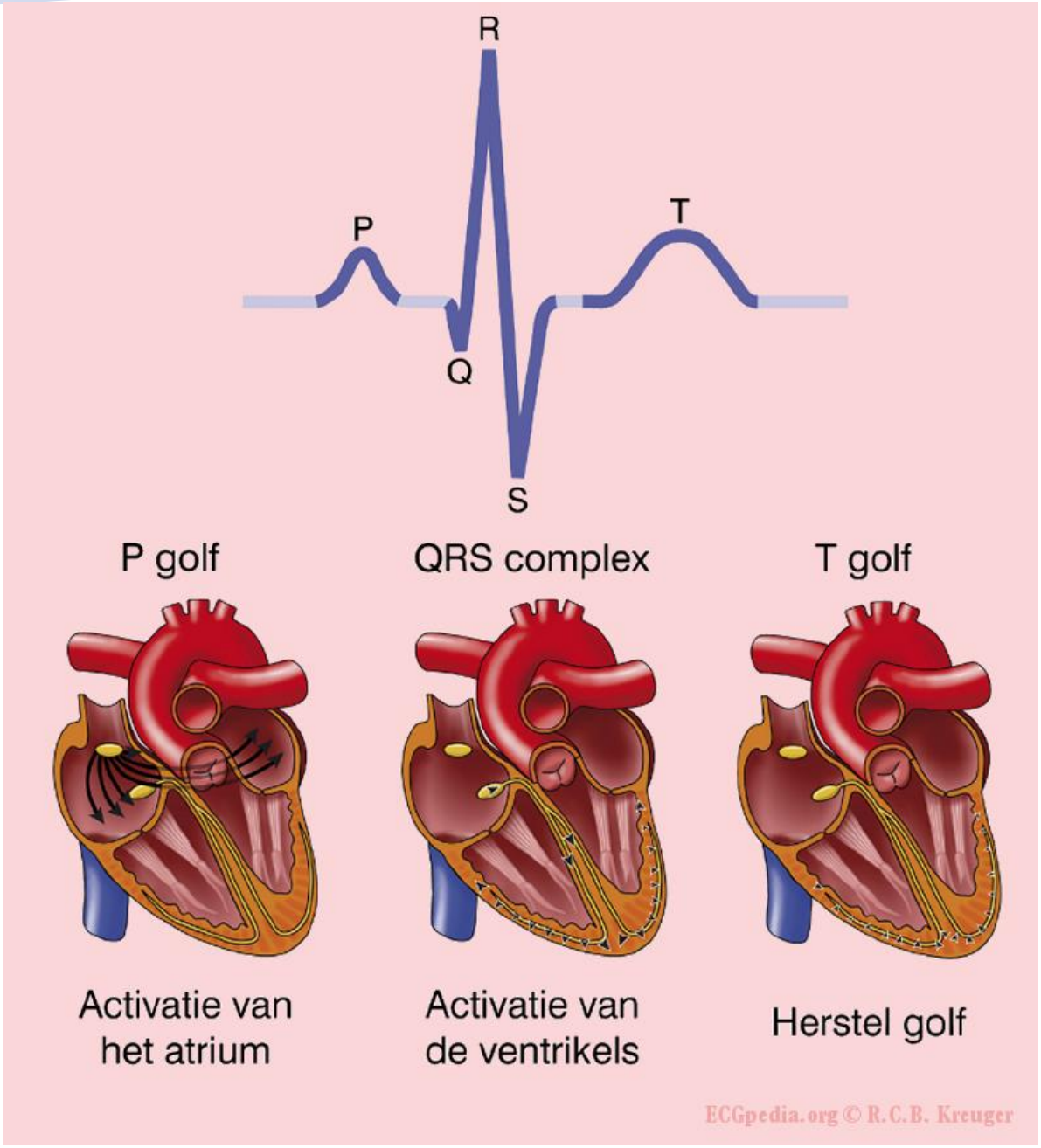
courtesy of Antoni van Ginneken

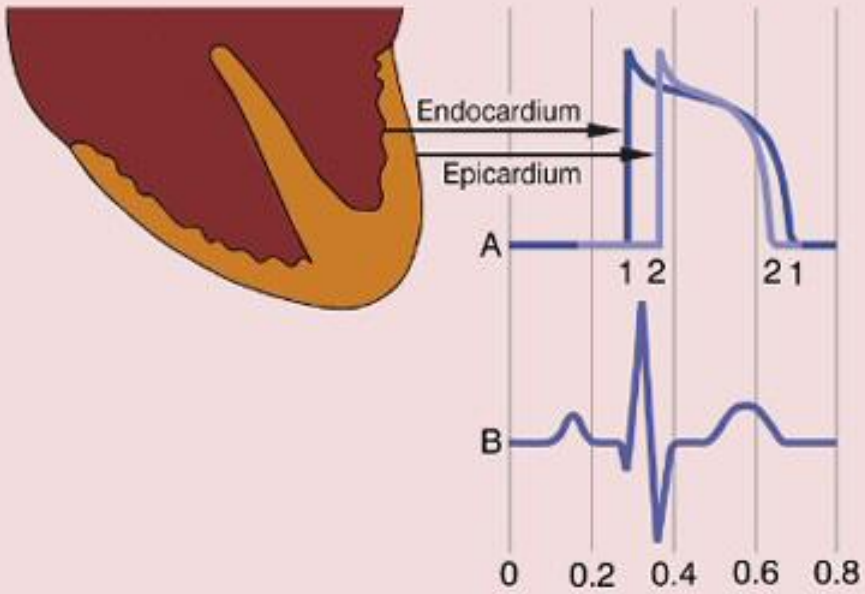


De lading verandering zorgt voor ion stromen over de hartcelwand.
Eerst Na^+ stromen naar binnen, dan Ca^{++} en daarna K^+ naar buiten



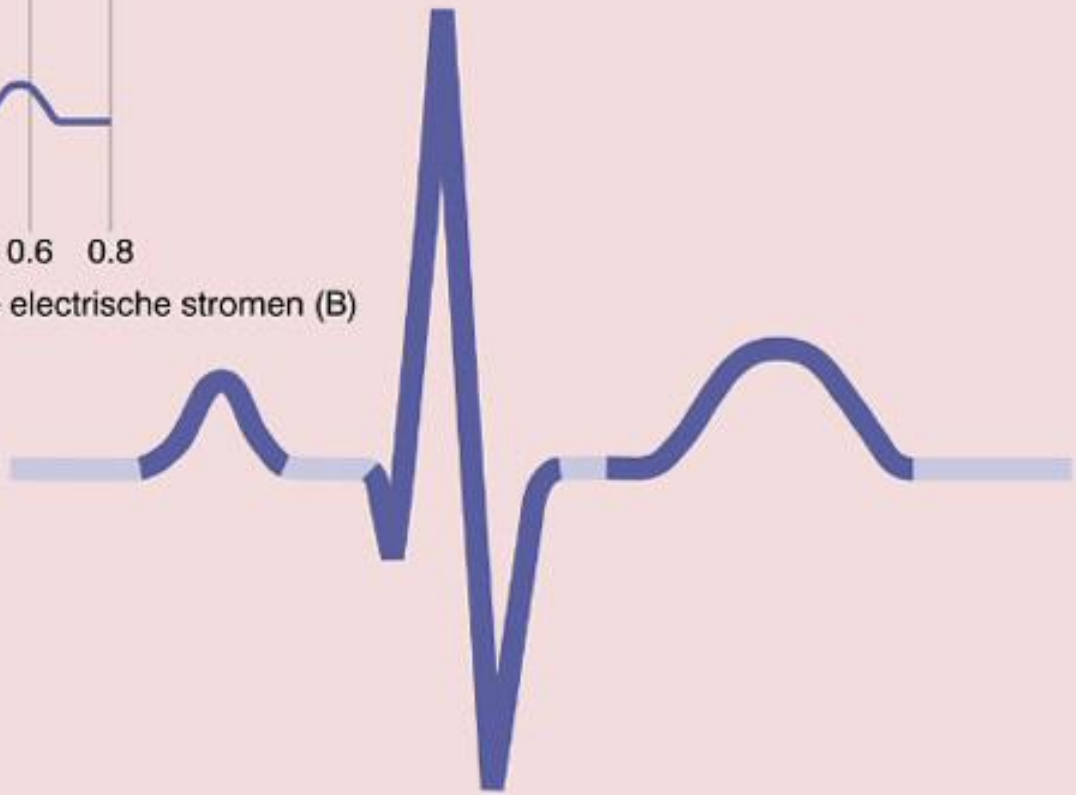
Signaal naar je toe is positieve uitslag

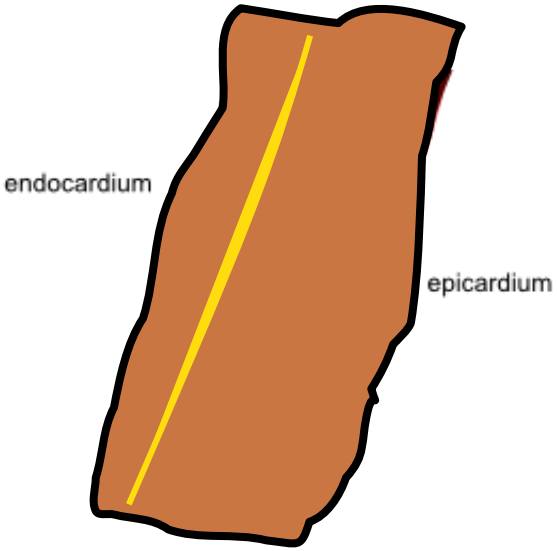

R
P
T
Q
S
P golf
QRS complex
T golf
Activatie van het atrium
Activatie van de ventrikels
Herstel golf
ECGpedia.org © R.C.B. Kreuger

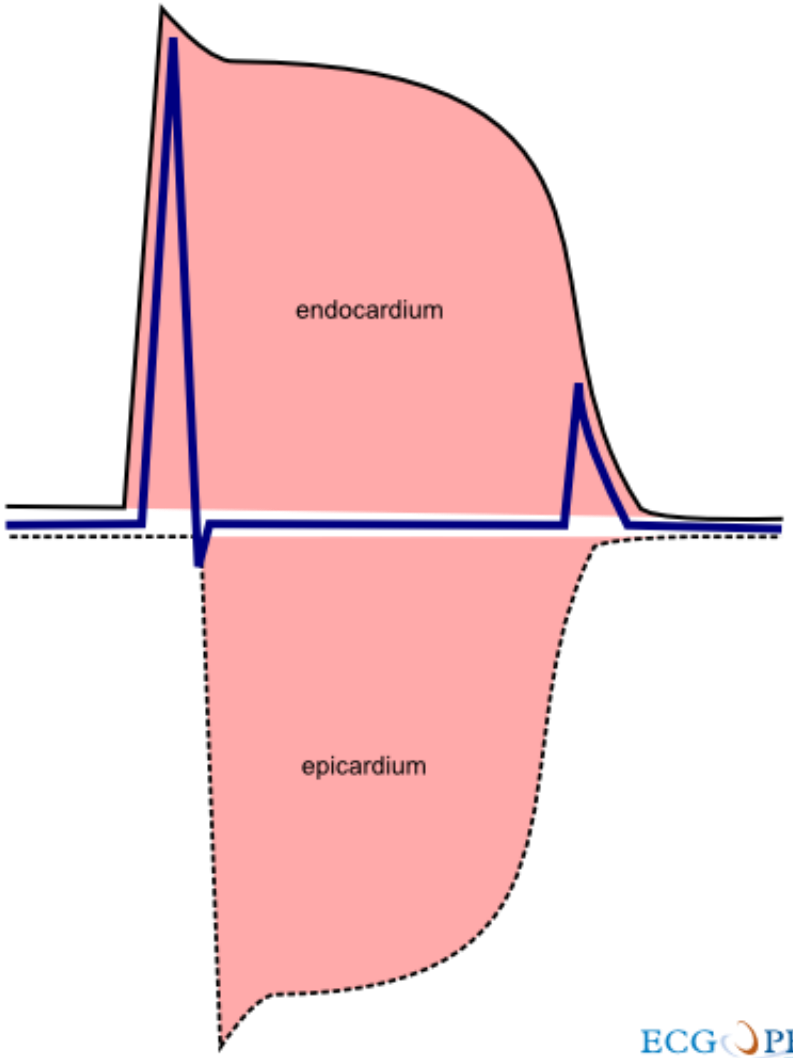


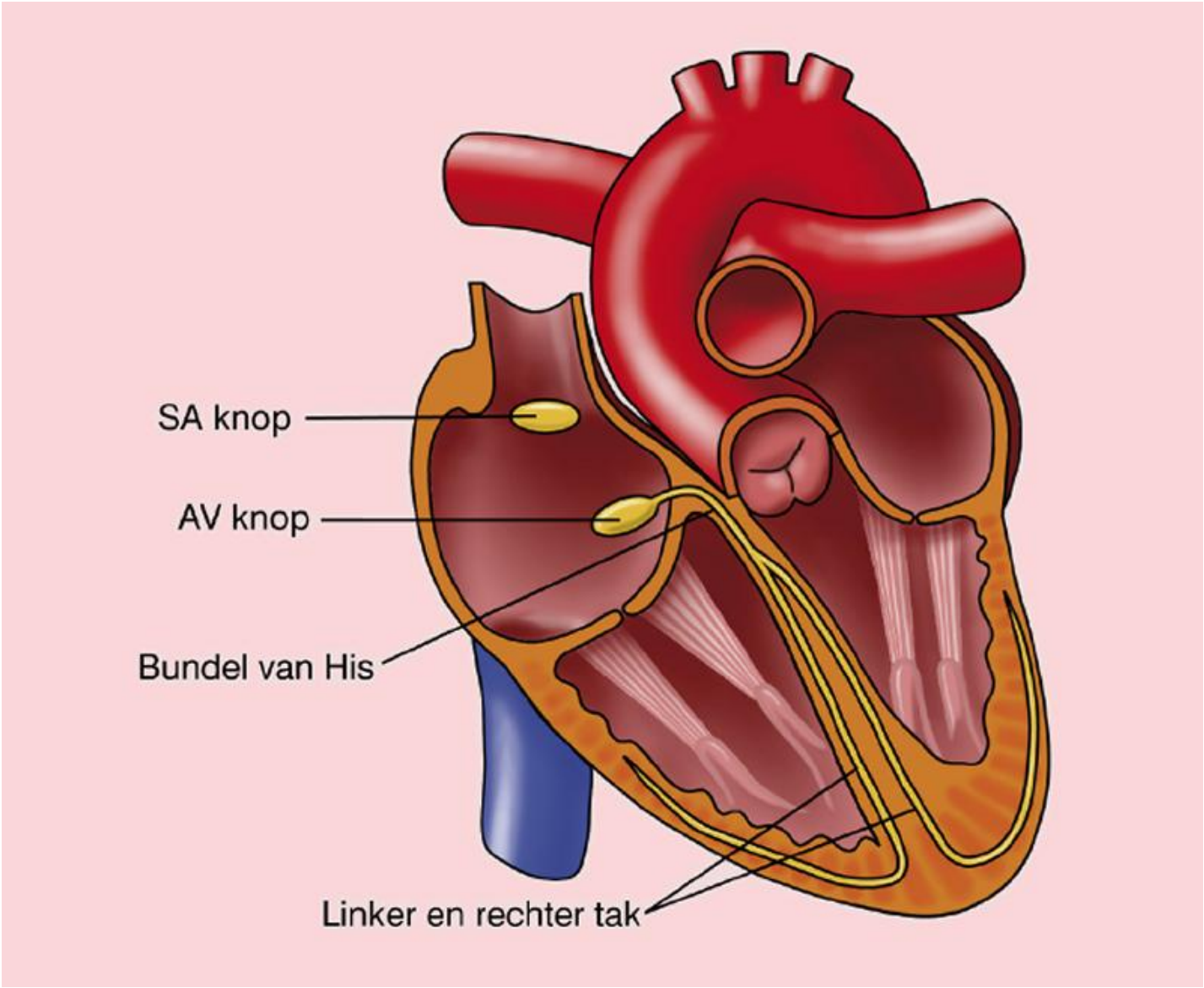
Het ECG registreert de optelsom van deze electrische stromen (B)

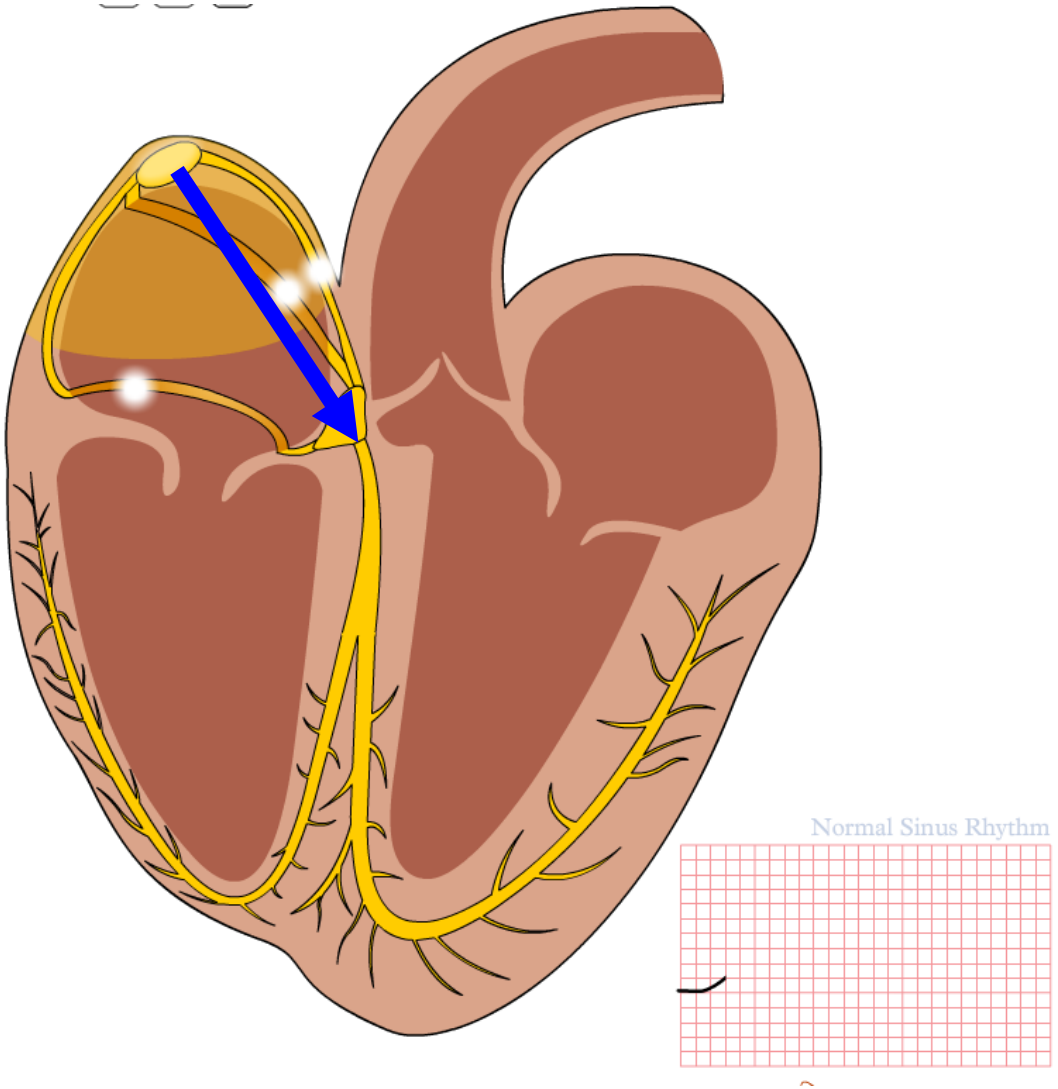
Het resultaat:

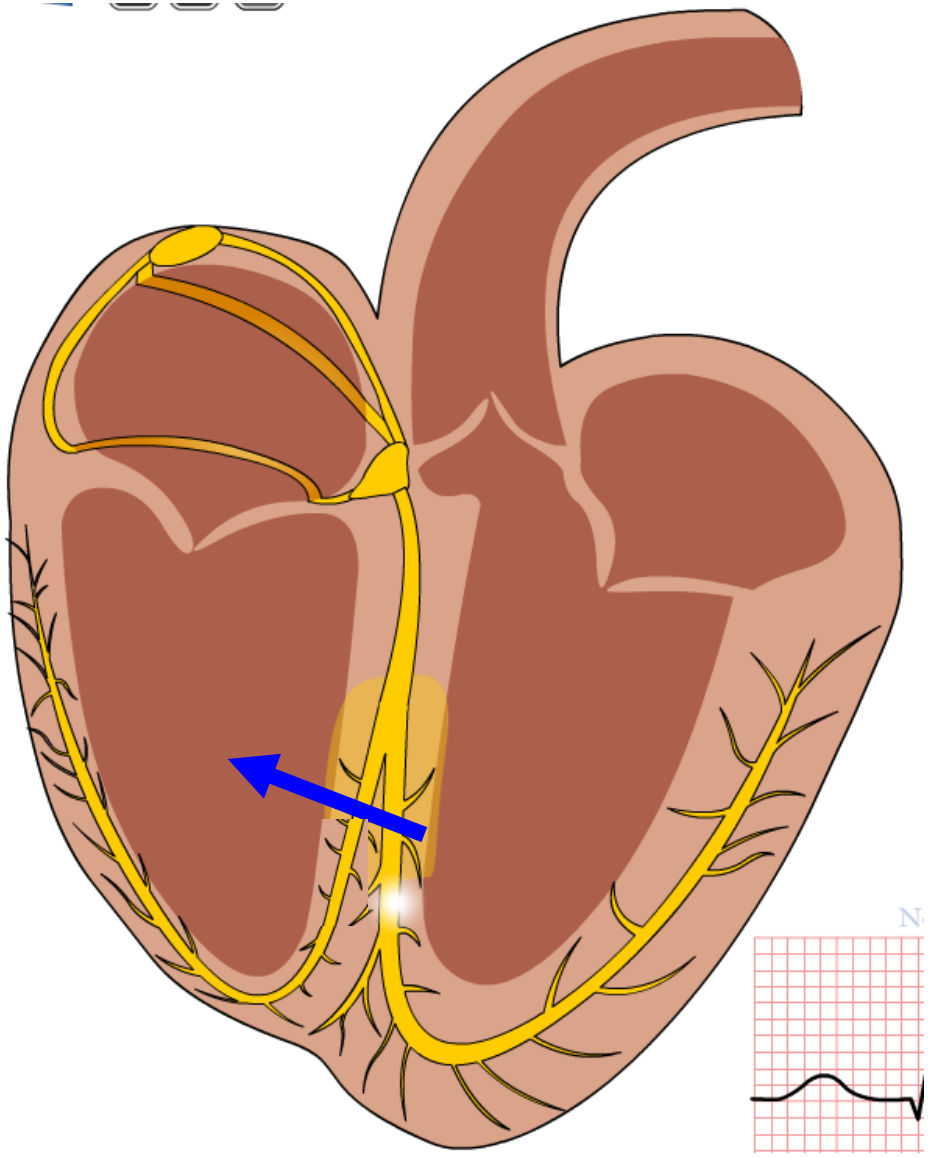


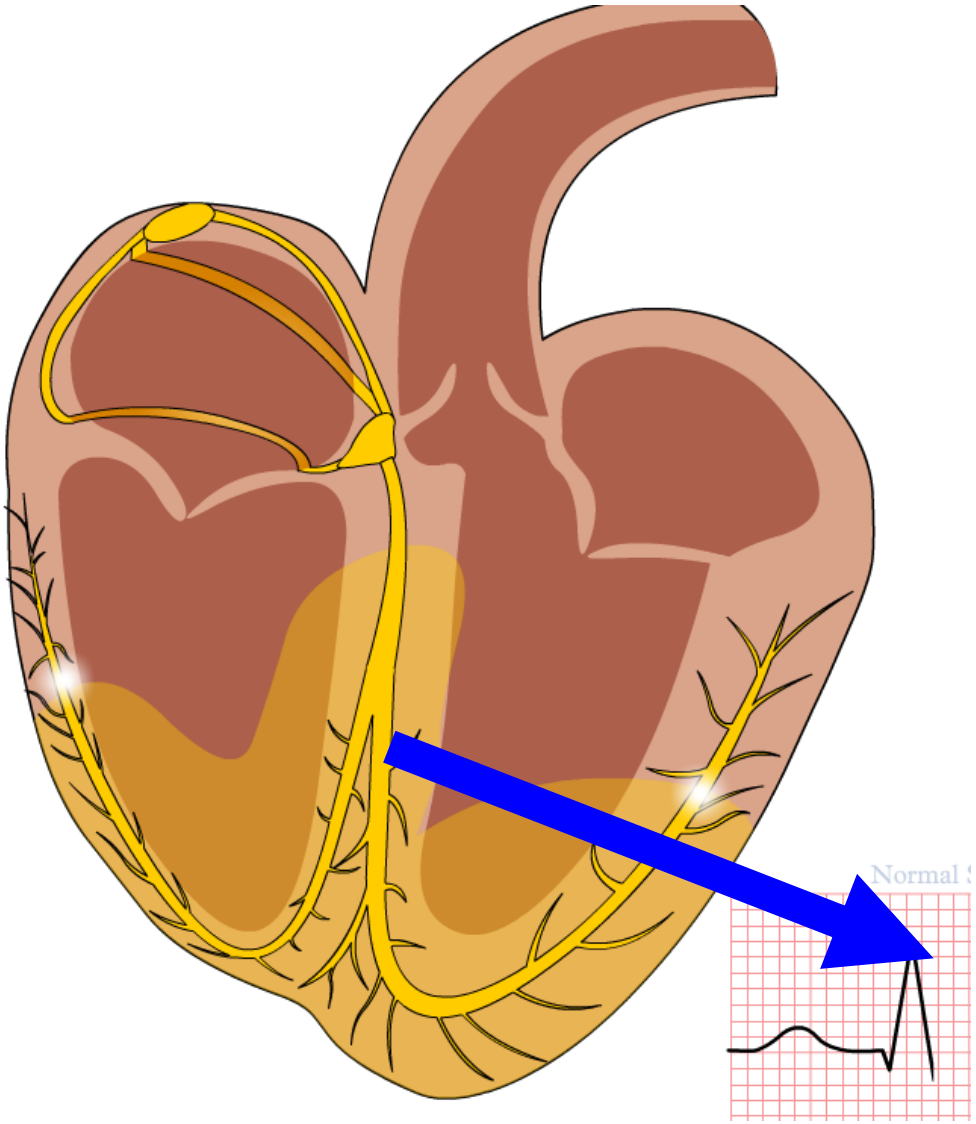


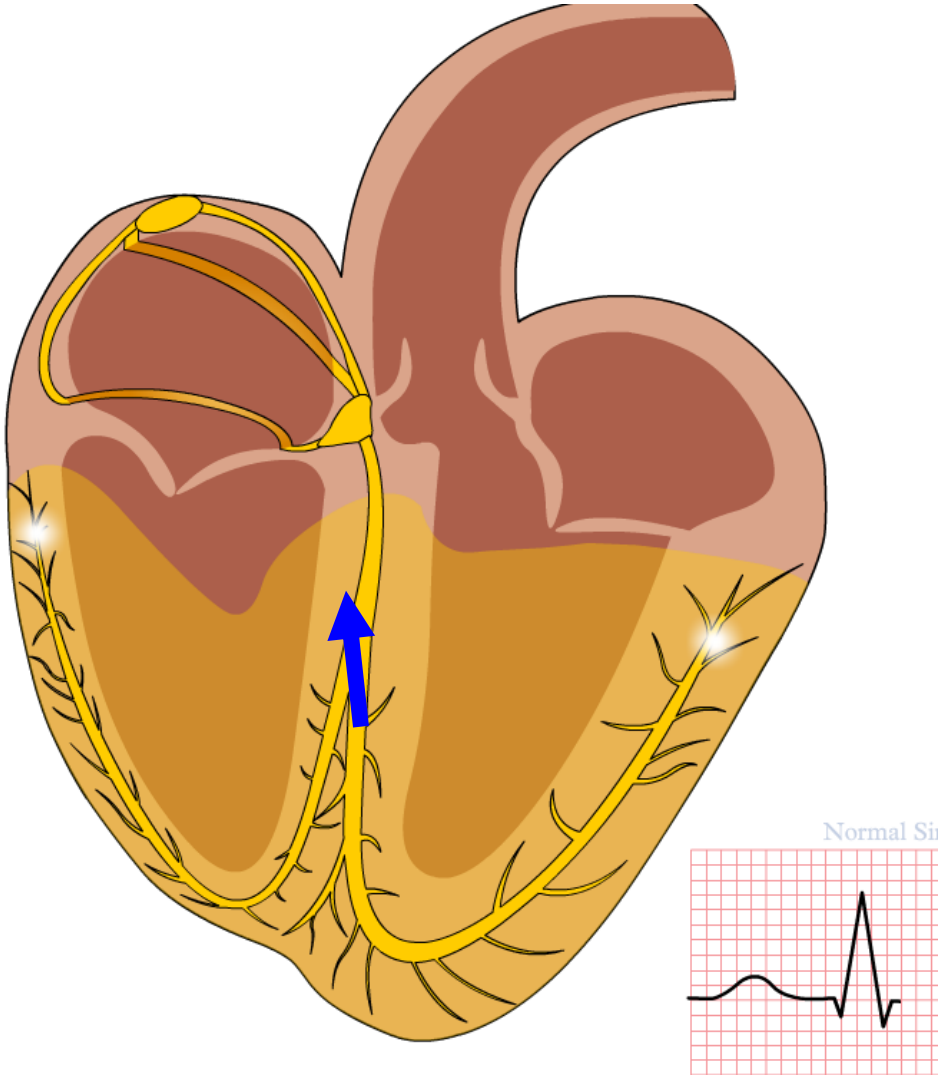


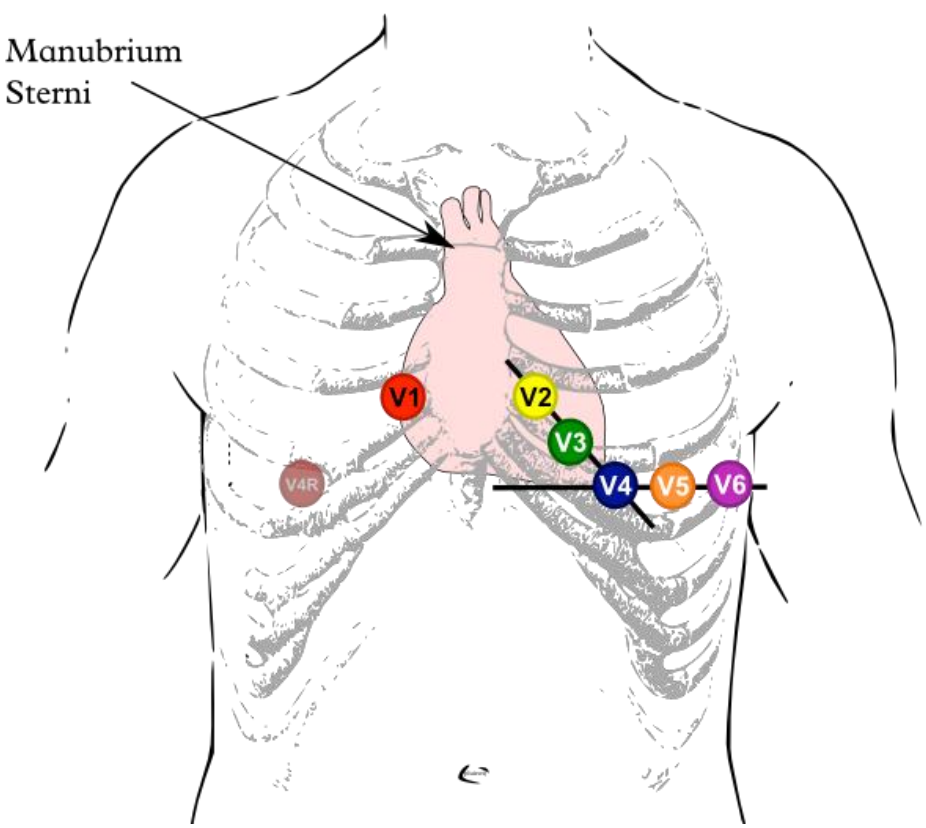

SA knop
AV knop
Bundel van His
Linker en rechter tak

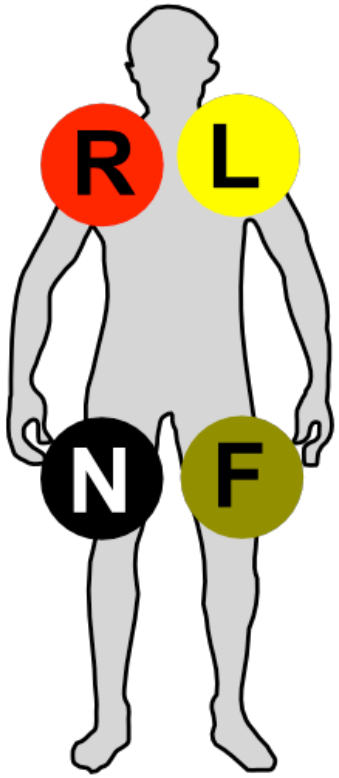

Normal Sinus Rhythm

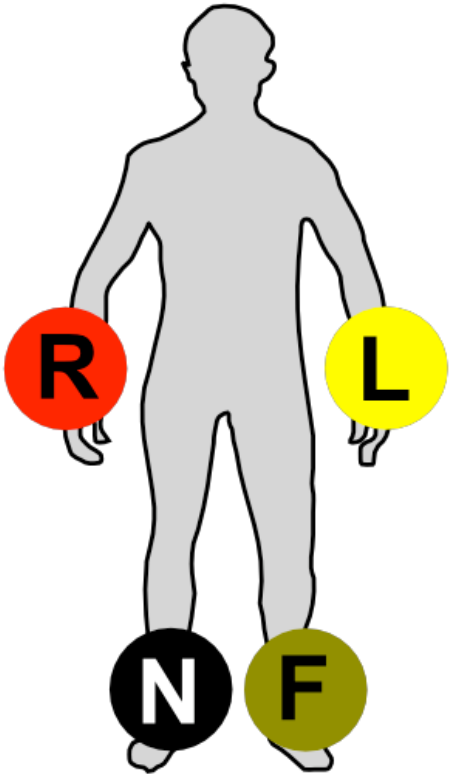


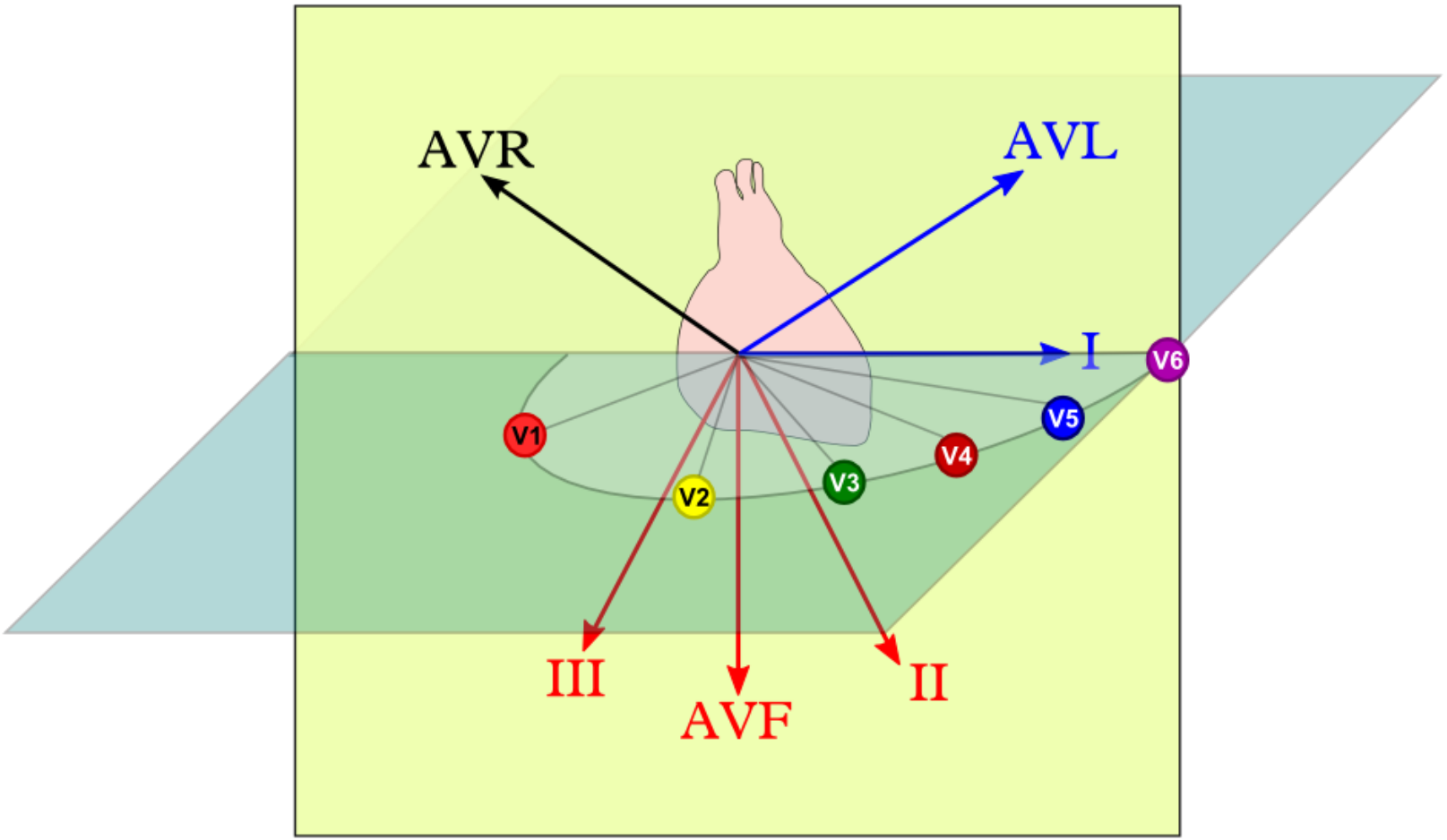

Normal

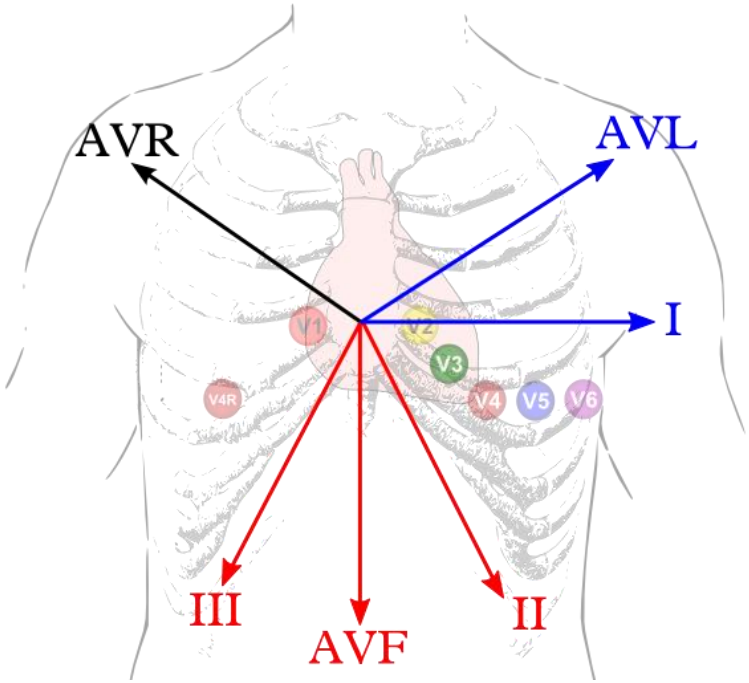

Normal Si

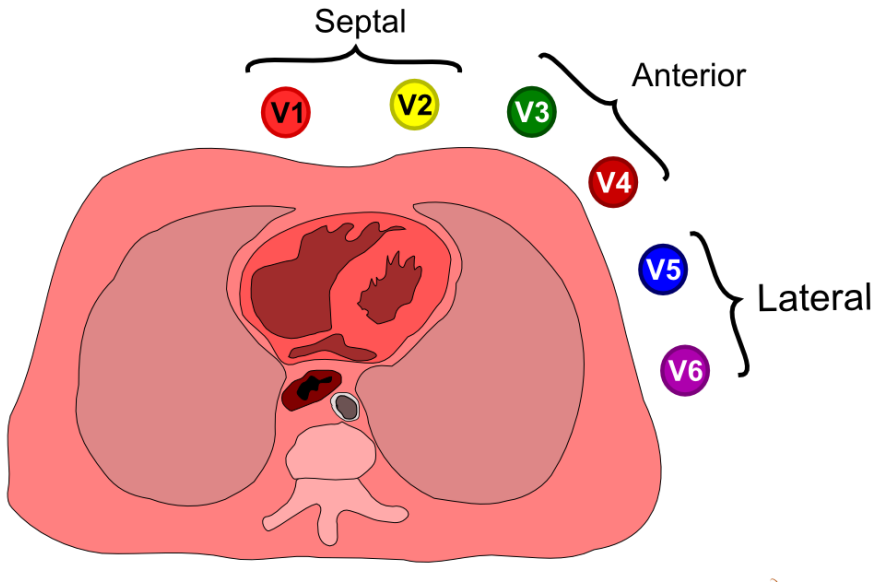

Manubrium
Sterni
V1
V2
V3
V4
V5
V6
V4R


R
L
N
F


R
L
N
F




AVR
AVL
I
III
AVF
II
V1
V2
V3
V4R
V4
V5
V6

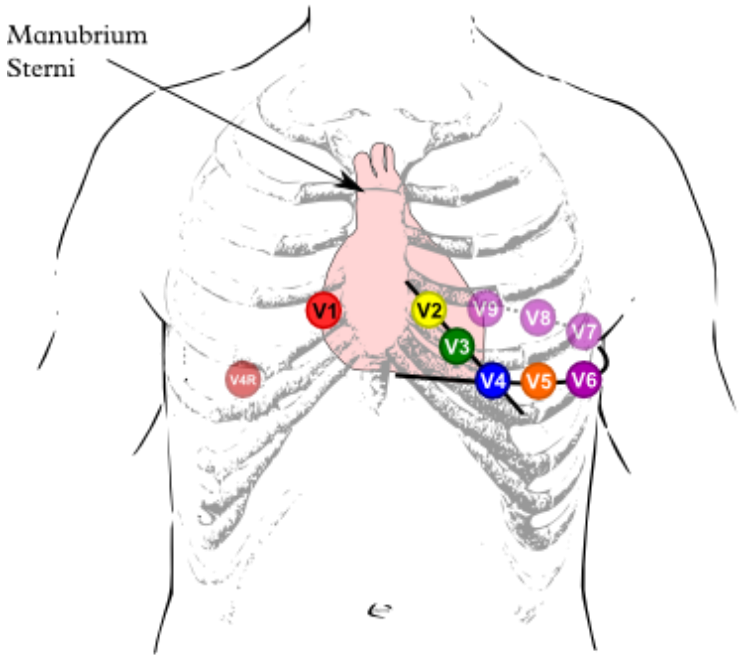

Septal
Anterior
Lateral
V1
V2
V3
V4
V5
V6

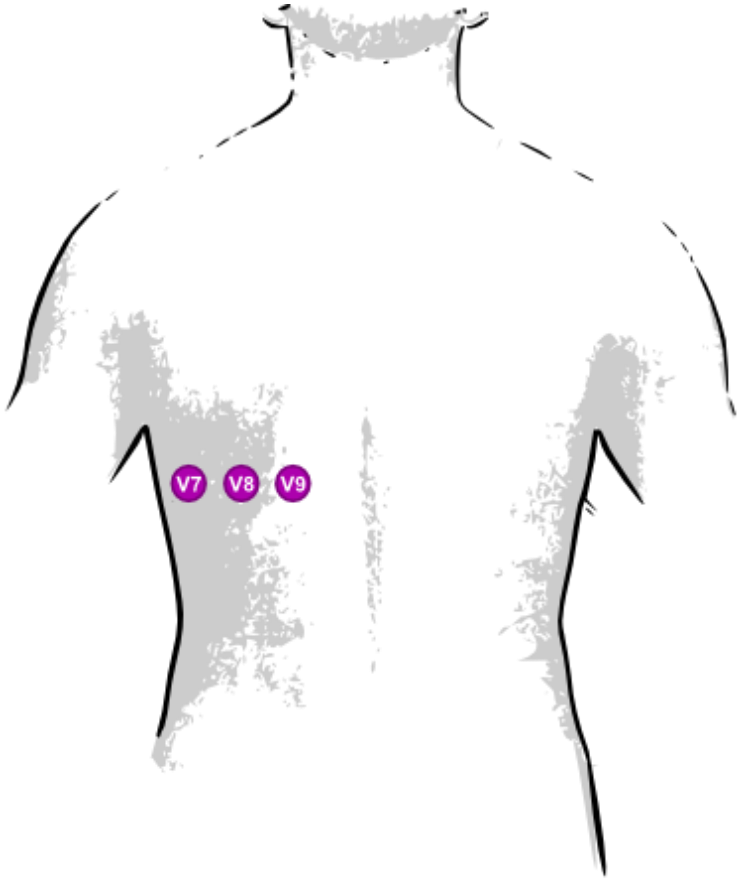
Bij elkaar horende afleidingen

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





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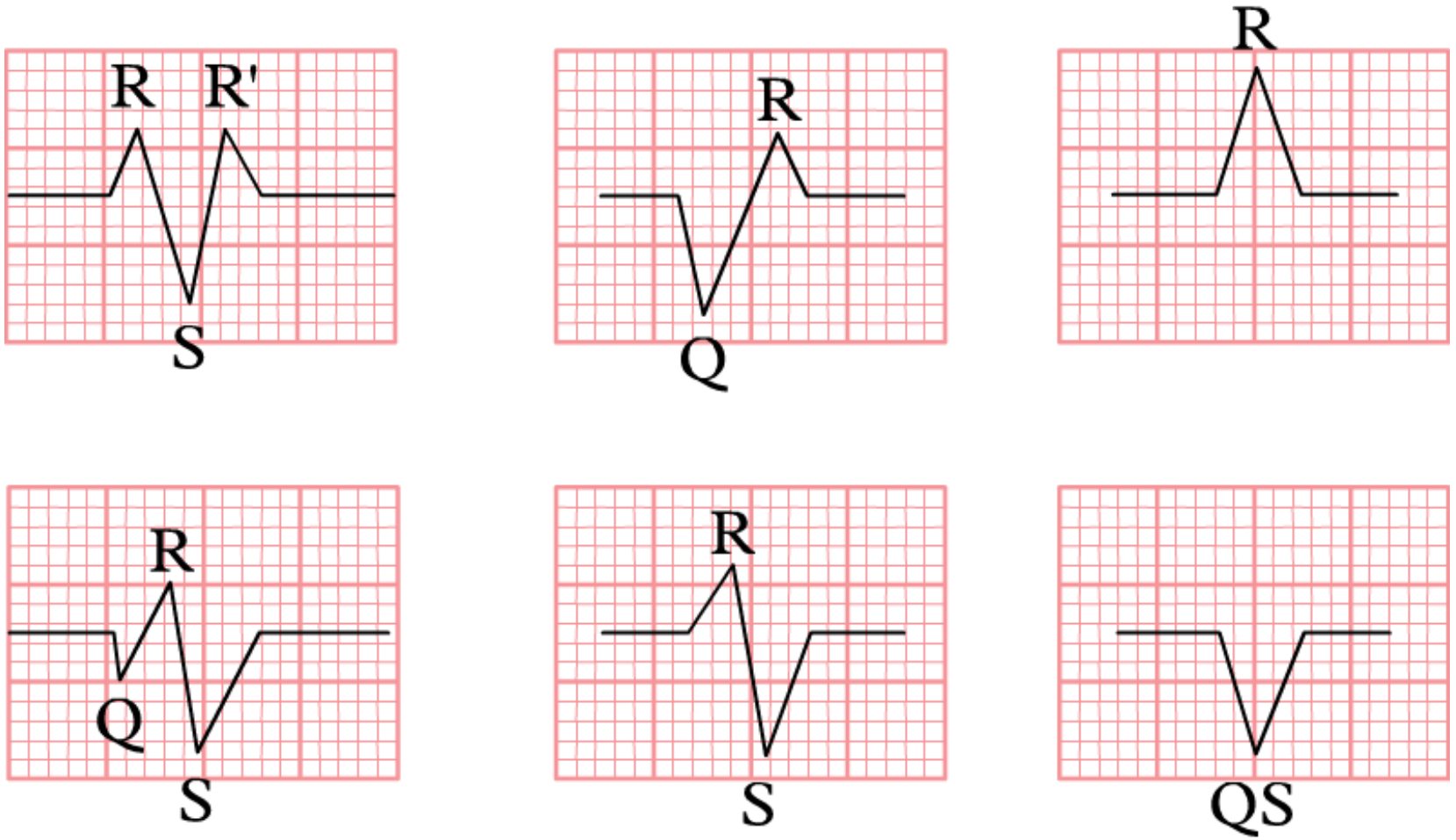
Nomenclatuur



QRS shapes - ECGPEDIA.ORG

SYSTEMATISCHE BEOORDELING

Systematische beoordeling

- Kijk nooit eerst naar de pathologie!
- ALTIJD systematisch beoordelen!
- U mist belangrijke punten als u dat niet doet!

Systematische beoordeling

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

1. Vergelijking met oud ECG
2. Conclusie

1 Ritme

Eigenschappen van normaal sinusritme

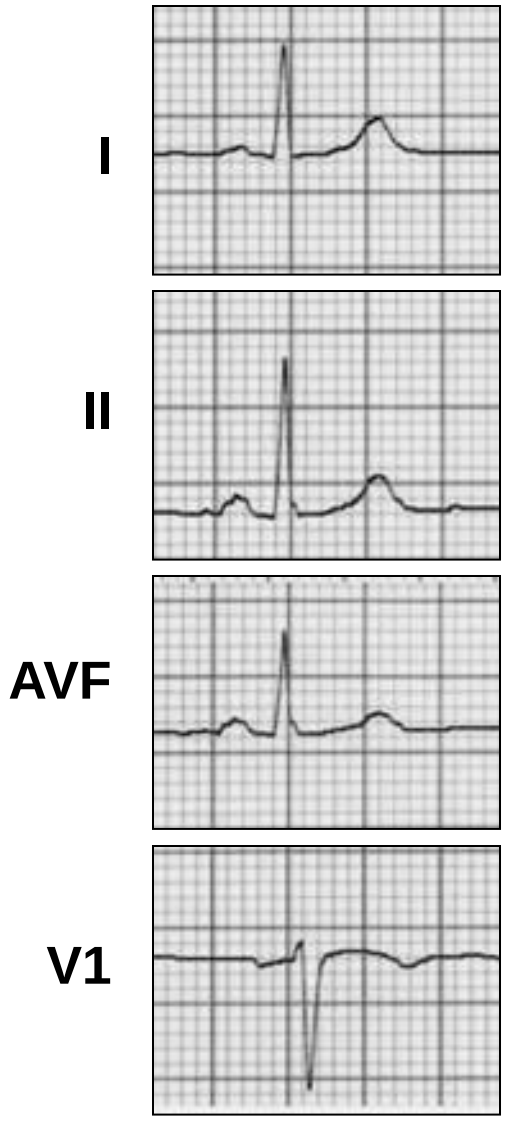
•Op een P-top volgt meestal een QRS complex

•Het ritme is regelmatig, maar varieert licht met de ademhaling

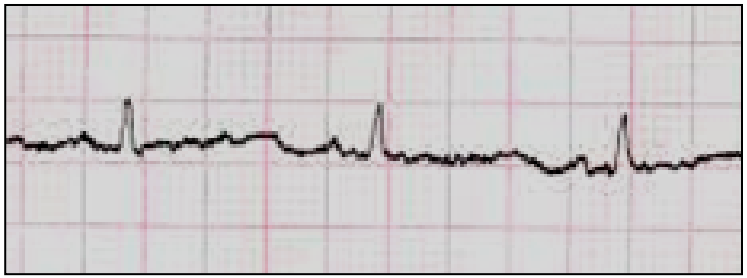
•De **frequentie** ligt tussen de 60 en 100 / minuut.

•De p top is **positief in II** en **AVF**, en bifasisch in V1

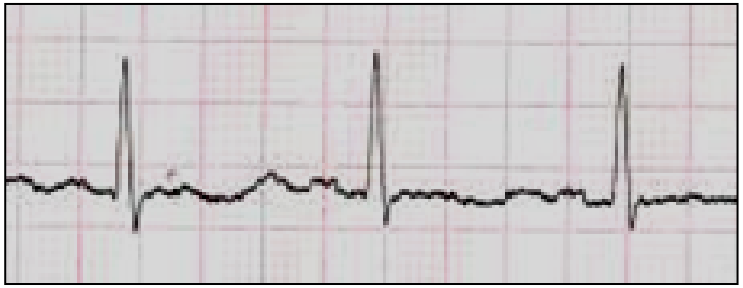
•De **PQ tijd** is tussen de 0,12 en 0,2 seconden



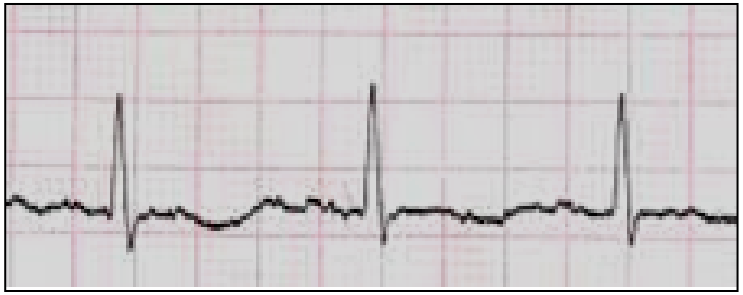
I



II



AVF

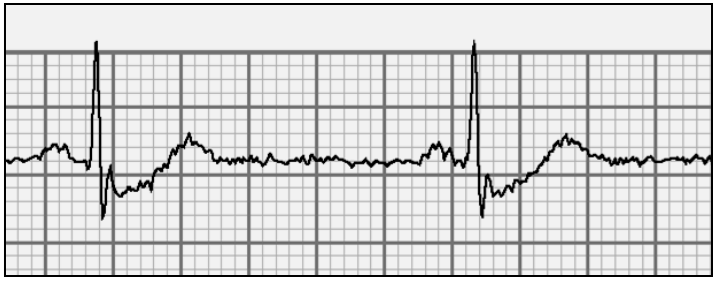


V1

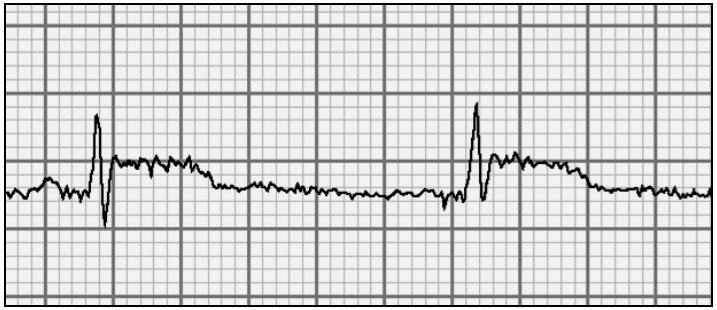
Is dit sinusritme?

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

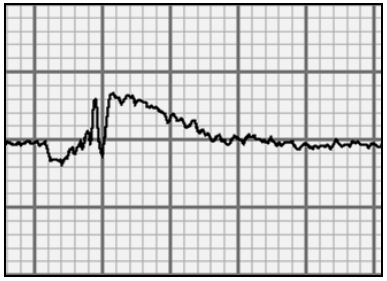
I



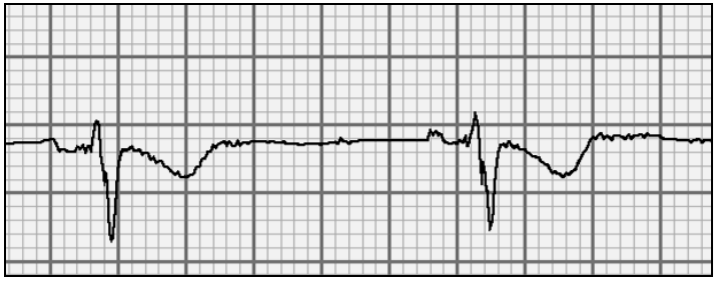
II



AVF



V1



Wat is het ritme?:

1. Sinusritme
2. Boezemfibrilleren
3. Boezemflutter
4. Boezemritme
5. SR met 1egr AV blok
6. SR met 2e gr AV versnelling
7. WPW
8. Nee, anders

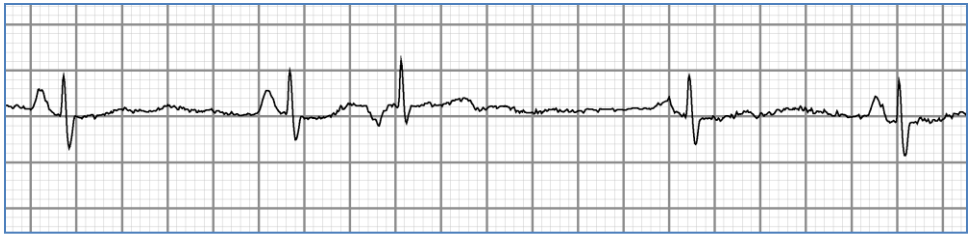
Extrasystolen

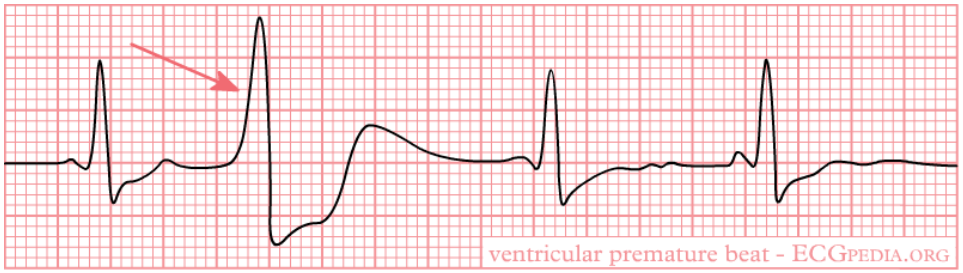
-Boezemextrasystole

Non-compensatoire pauze

-Ventrikelextrasystole

Compensatoire pauze

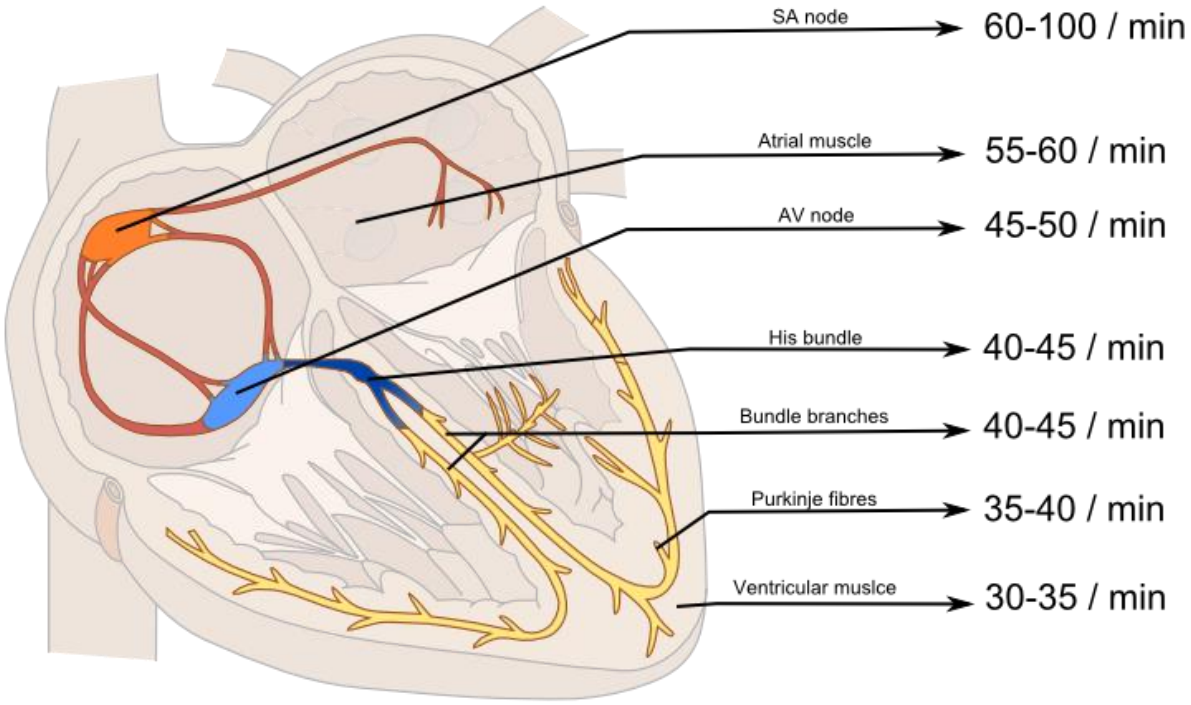




Klinische betekenis VES

- 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)

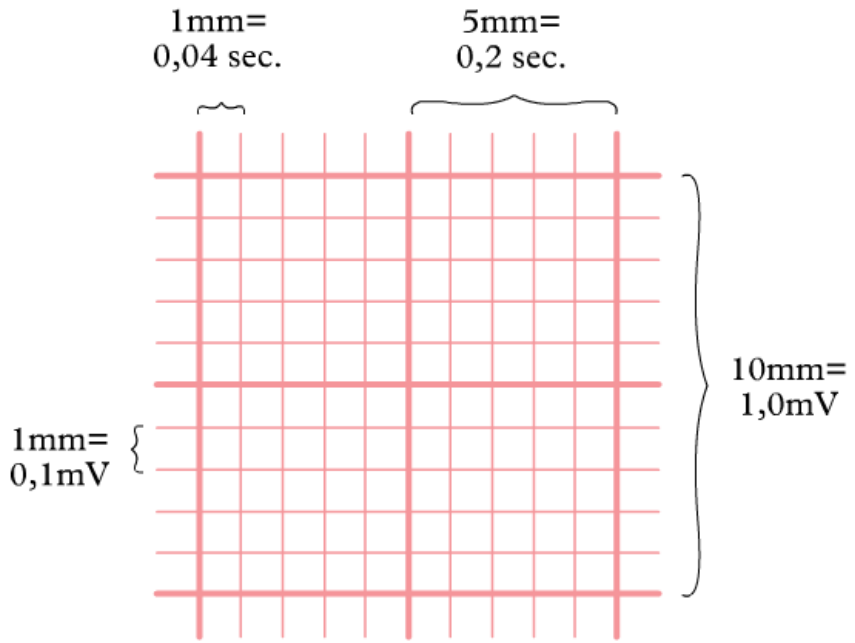
Escaperitme

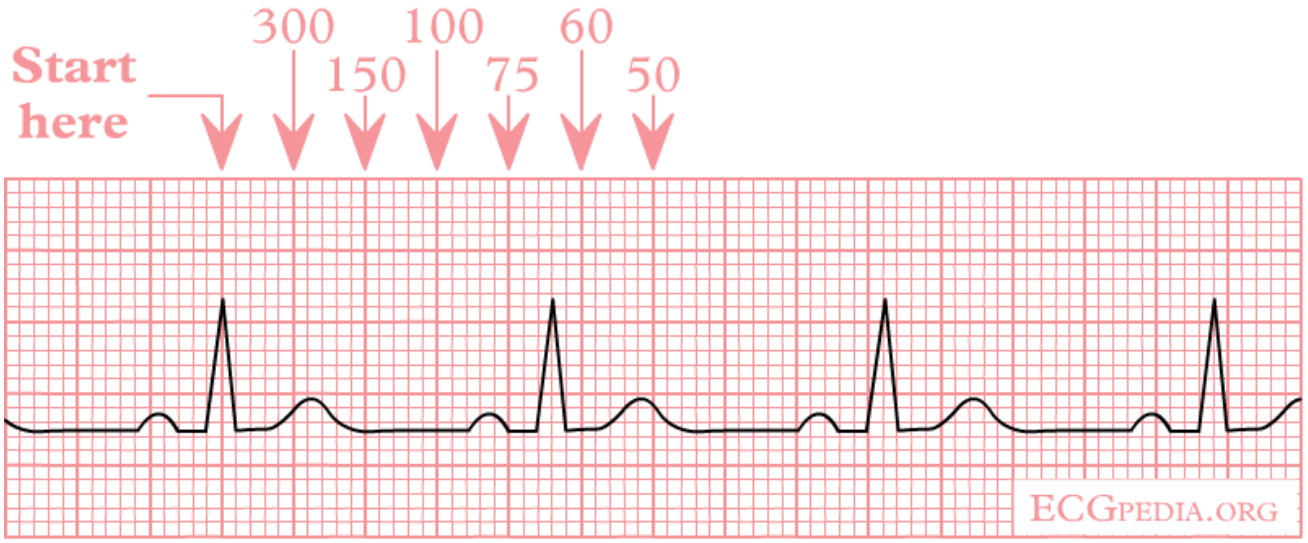


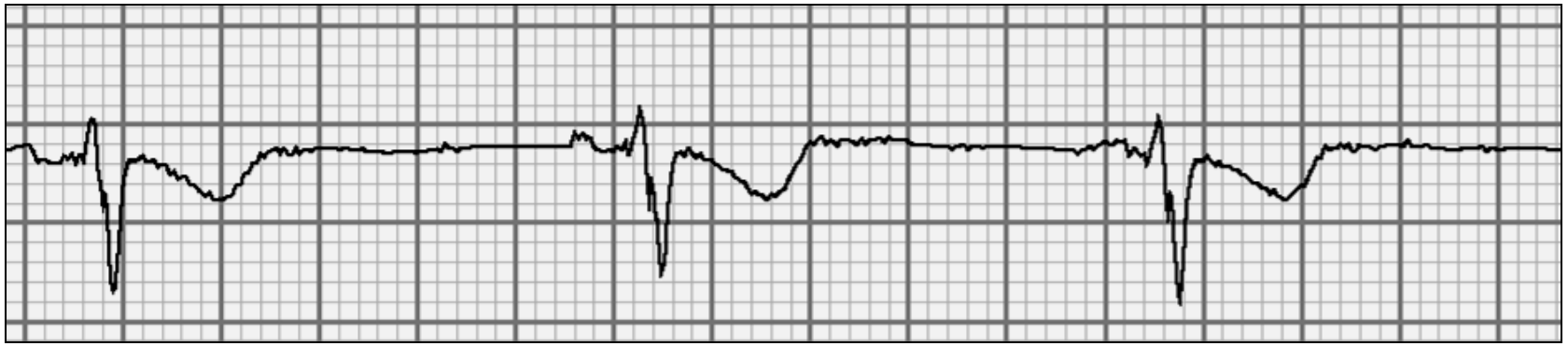
2 Frequentie

3 methoden:

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

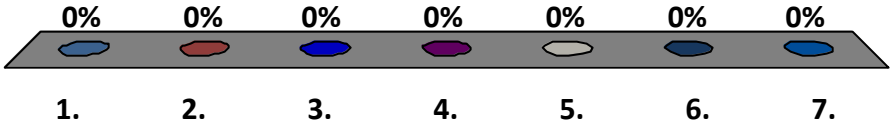






Wat is de frequentie?

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
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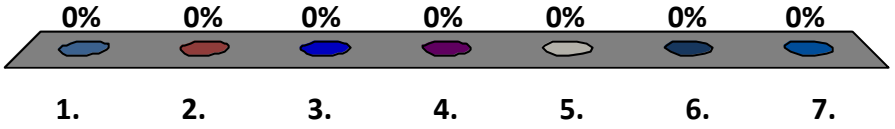
6. 55
7. 45



3 Geleidingstijden

PQ tijd tussen 0.12 en 0.20 seconde

- te kort → WPW
- te lang → AV blok

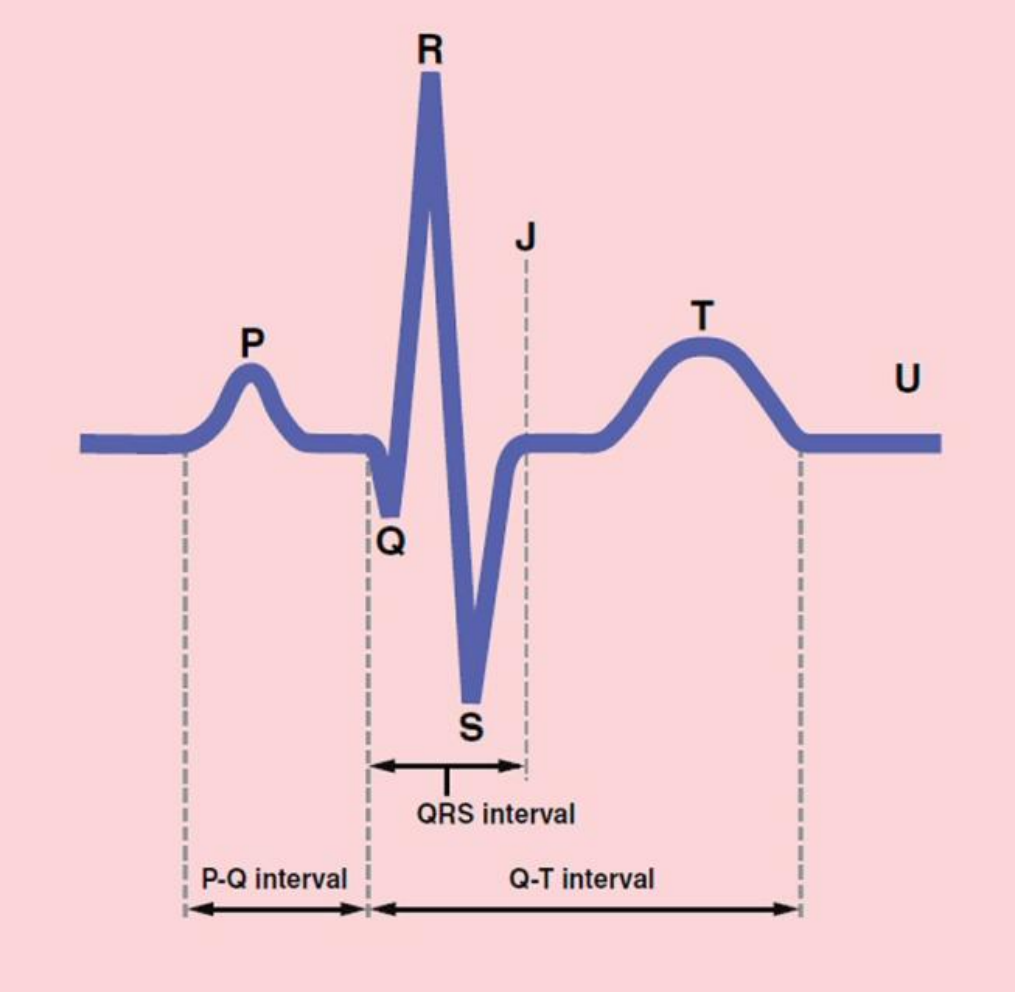
QRS duur <= 0.10-0.12 seconde

Te lang → LBTB / RBTB

QTc tijd = repolarisatie

Mannen < 450ms

Vrouwen < 460ms



Check de QT tijd die de computer uitrekent!

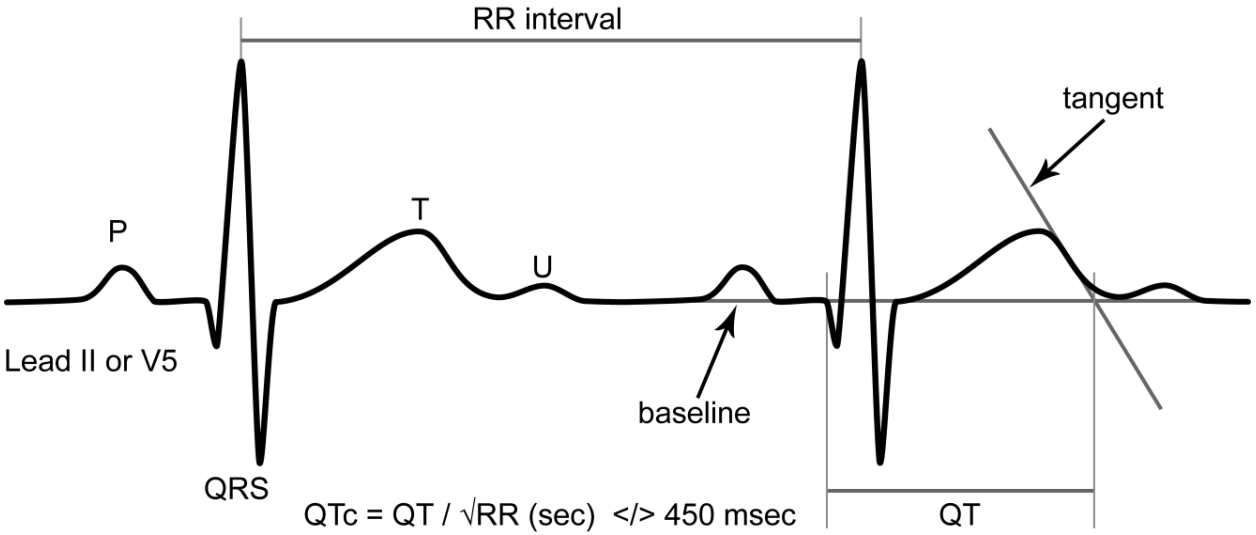
Verlengde QTc tijd geeft verhoogd risico op plotse dood. Met name > 480-500 ms.

Dan geen QTc verlengende medicatie:

- Sotalol
- Amiodarone
- Erythromycine
- Clarithromycine
- Haldol

Zie www.torsades.org voor medicatielijst

Zie ECGpedia.org voor calculator



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

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

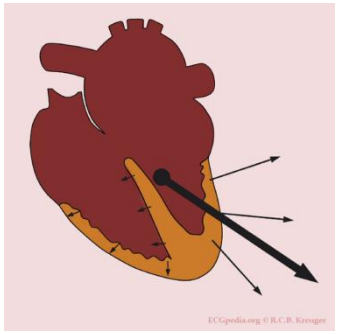
4 Hartas

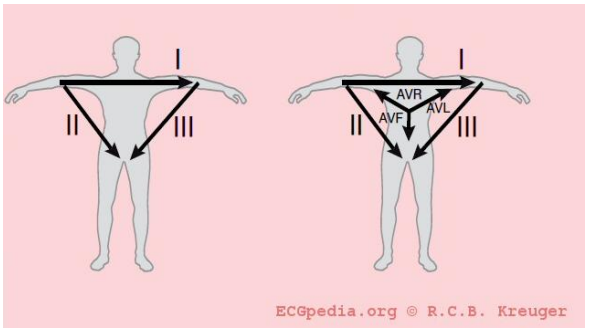
Geeft de gemiddelde electrische activiteit aan

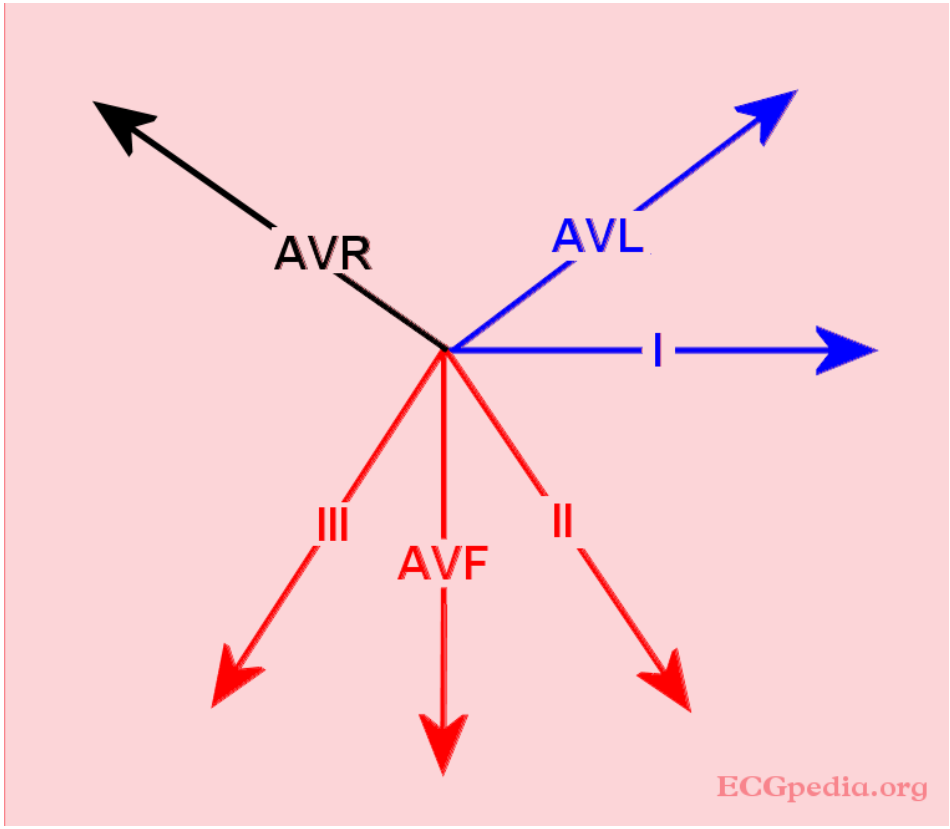
Normaal is tussen -30 en +90 graden.

Positief in I en AVF? → hartas = normaal

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

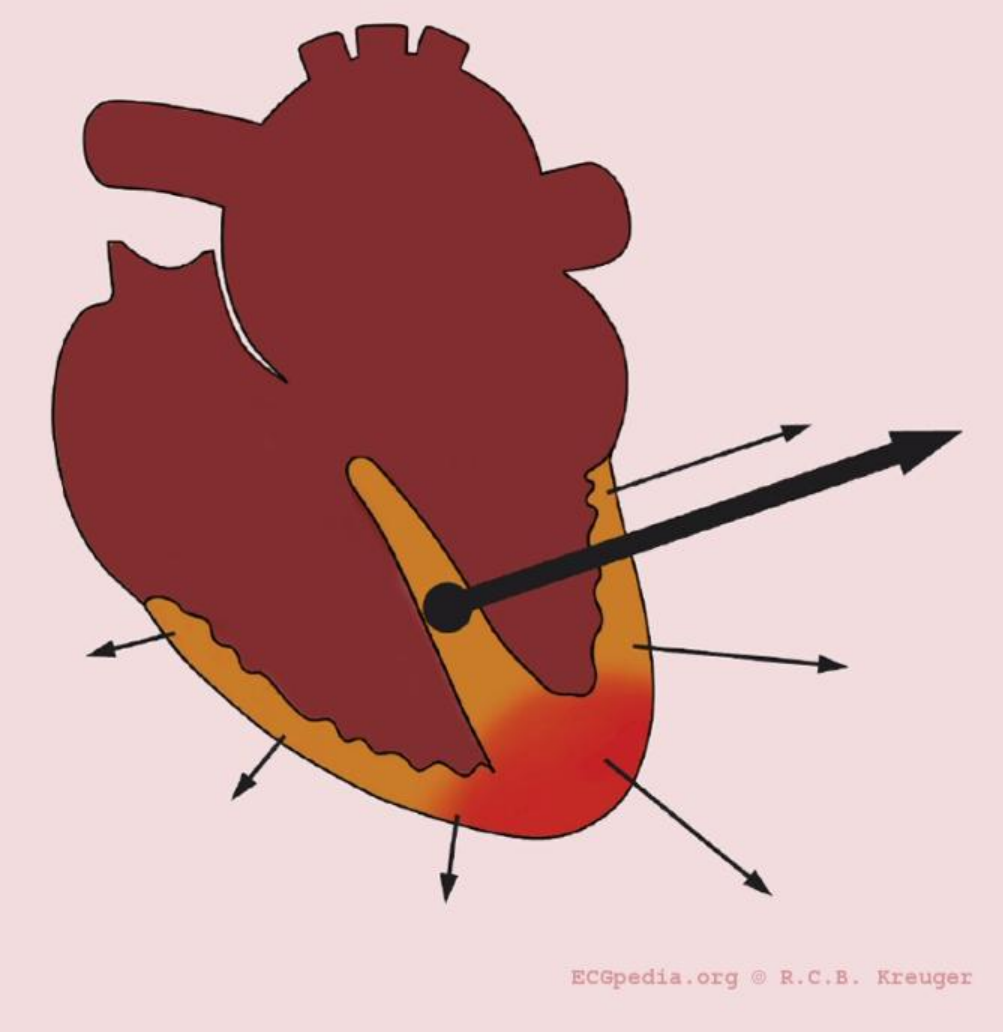






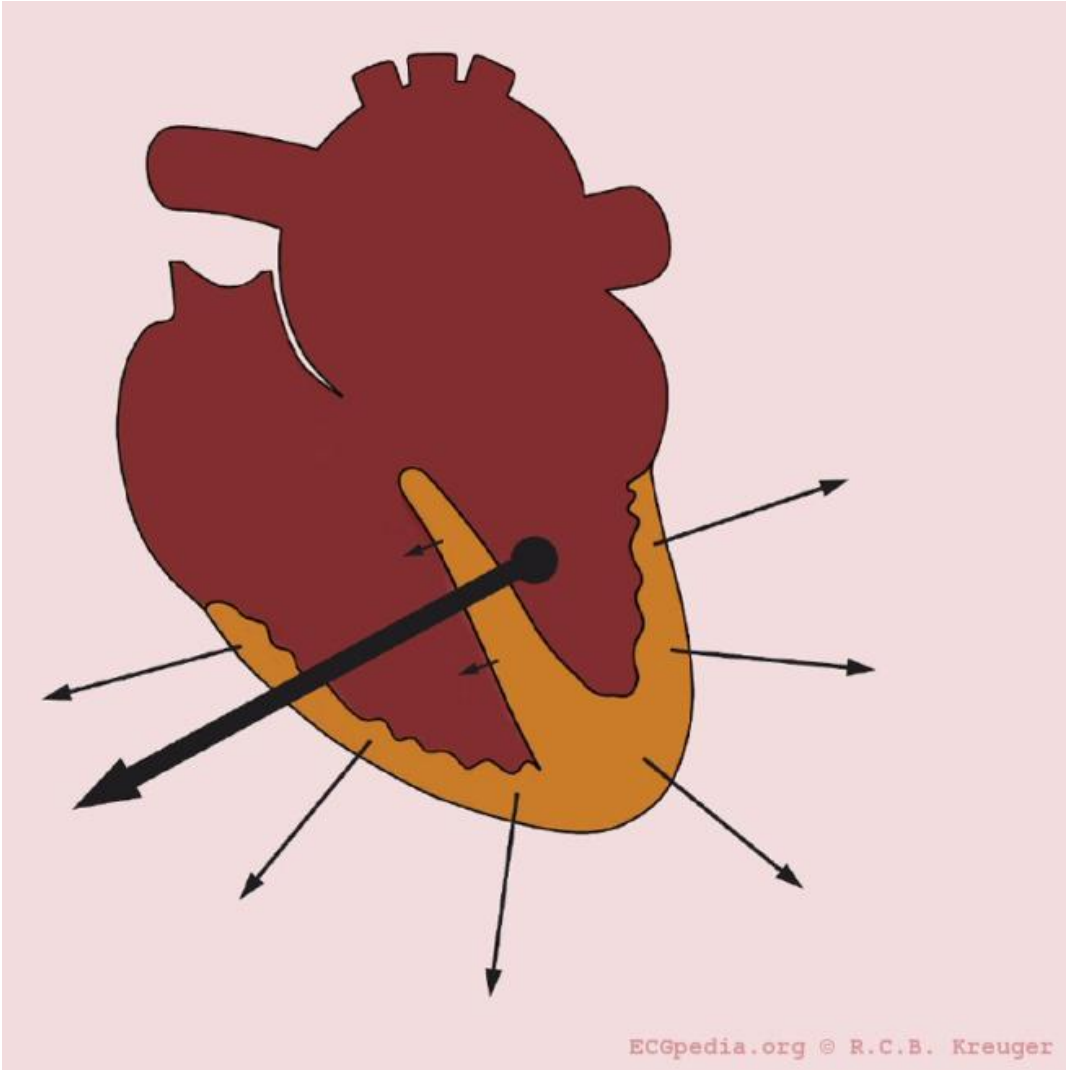
Linker hartas

- Linker anterior hemiblok
- Onderwandinfarct
- Linker ventrikelhypertrofie
- Pacemakerritme



Rechter hartas

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

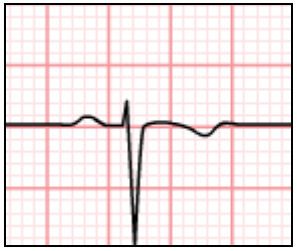


Wat is de hartas?

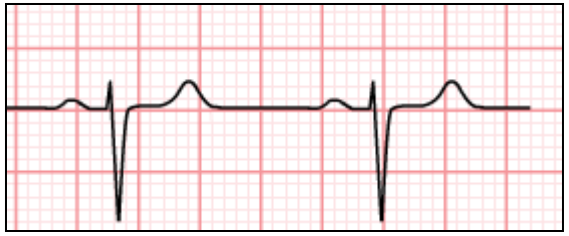
I

II

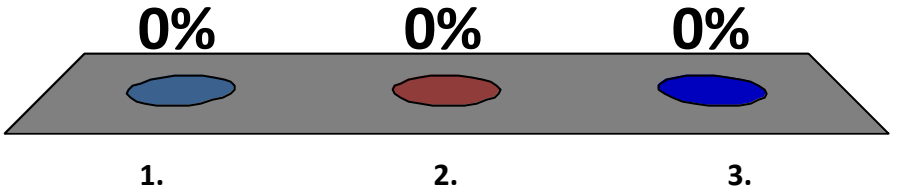
III



AVF



1. Links
2. Intermediair
3. Rechts



Wat is de hartas?

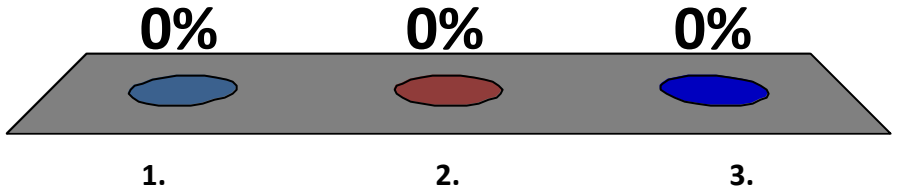
I 

II 

III 

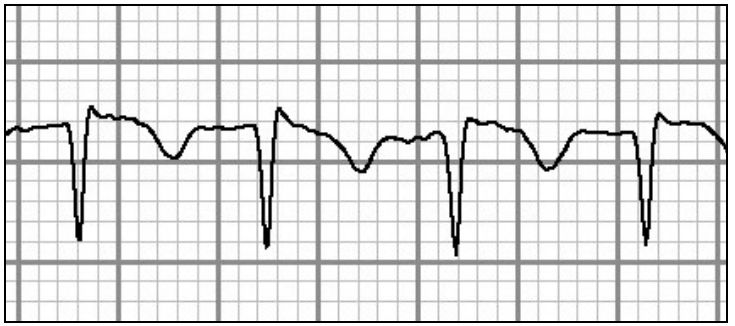
AVF 

1. Links
2. Intermediair
3. Rechts ✓

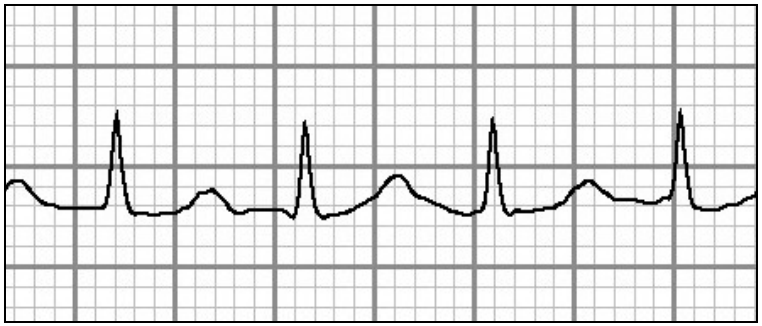


I

aVR

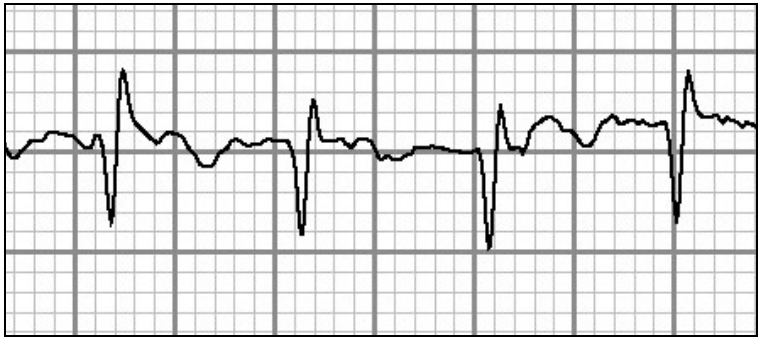


II

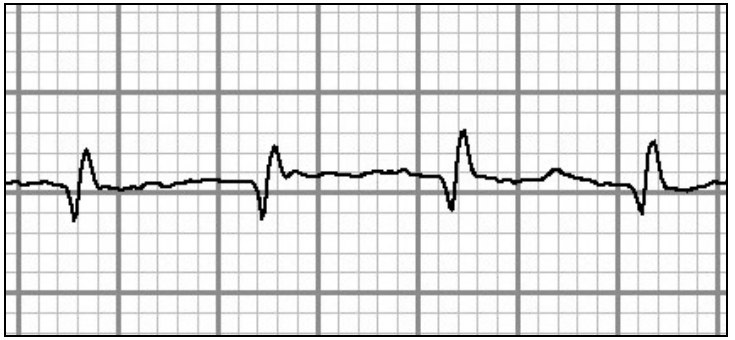


aVL

III

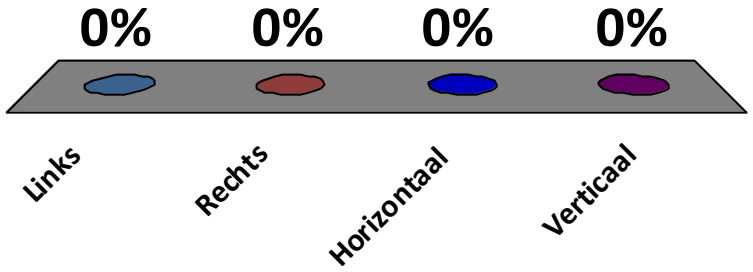


aVF



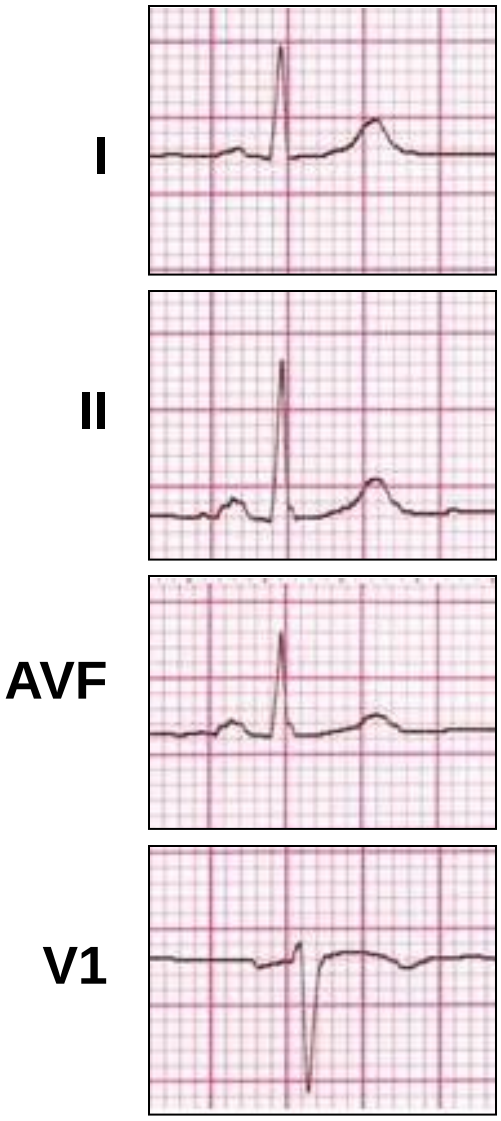
Hartas?

1. Links
2. Rechts
3. ✓ Horizontaal
4. Verticaal



5 P top morfologie

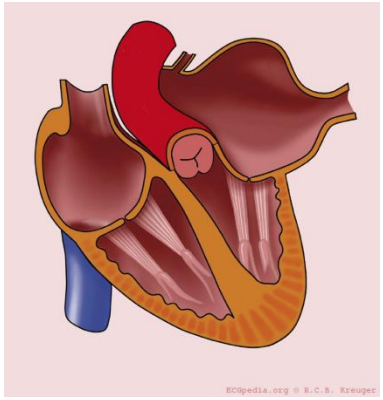
- De maximale hoogte van de p top is 2,5 mm in II en / of III
- De p top is positief in II en AVF, en bifasisch in V1
- De breedte van de p top is normaal korter dan 0.12 seconde

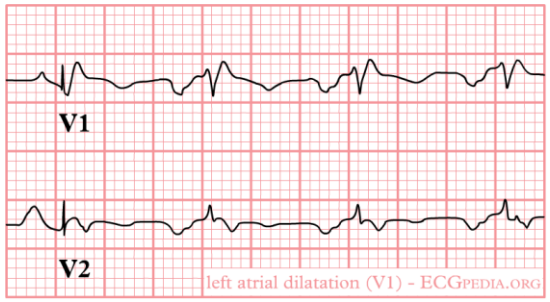


Linkeratriumdilatatie

Terminaal deel in V1 > 1mm2

en/of P >0,12 sec in I en/of II

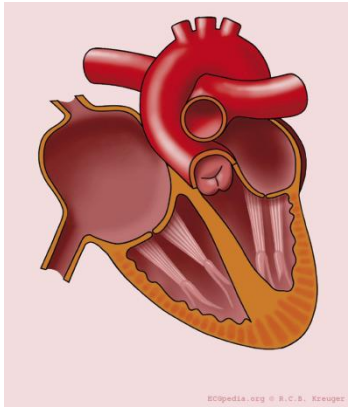


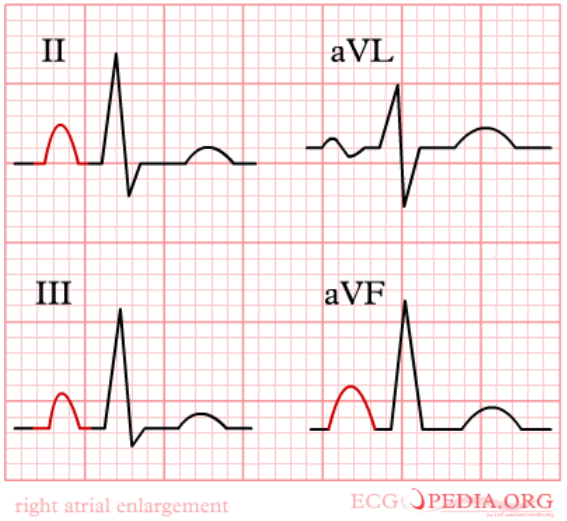


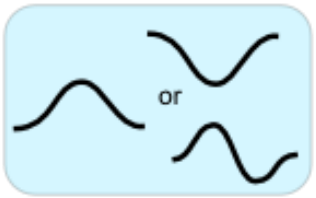
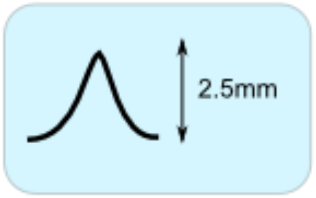
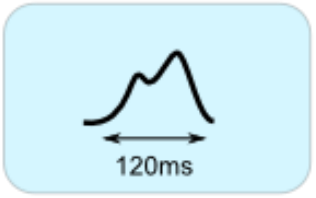
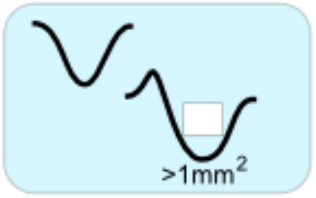
Rechteratriumdilatatie

P >2,5 mm in II / III / aVF

en/of P >1,5 mm in V1





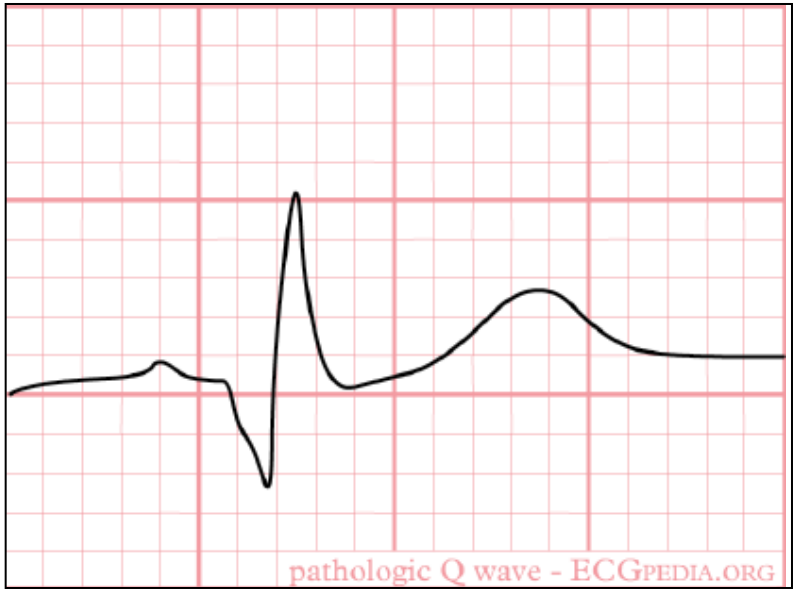
Condition	P Wave Morphology	
	Lead II	Lead V1
Normal Sinus Rhythm		
Right atrial enlargement (= **P P**ulmonale)		
Left Atrial Enlargement (= **P M**itrale)		

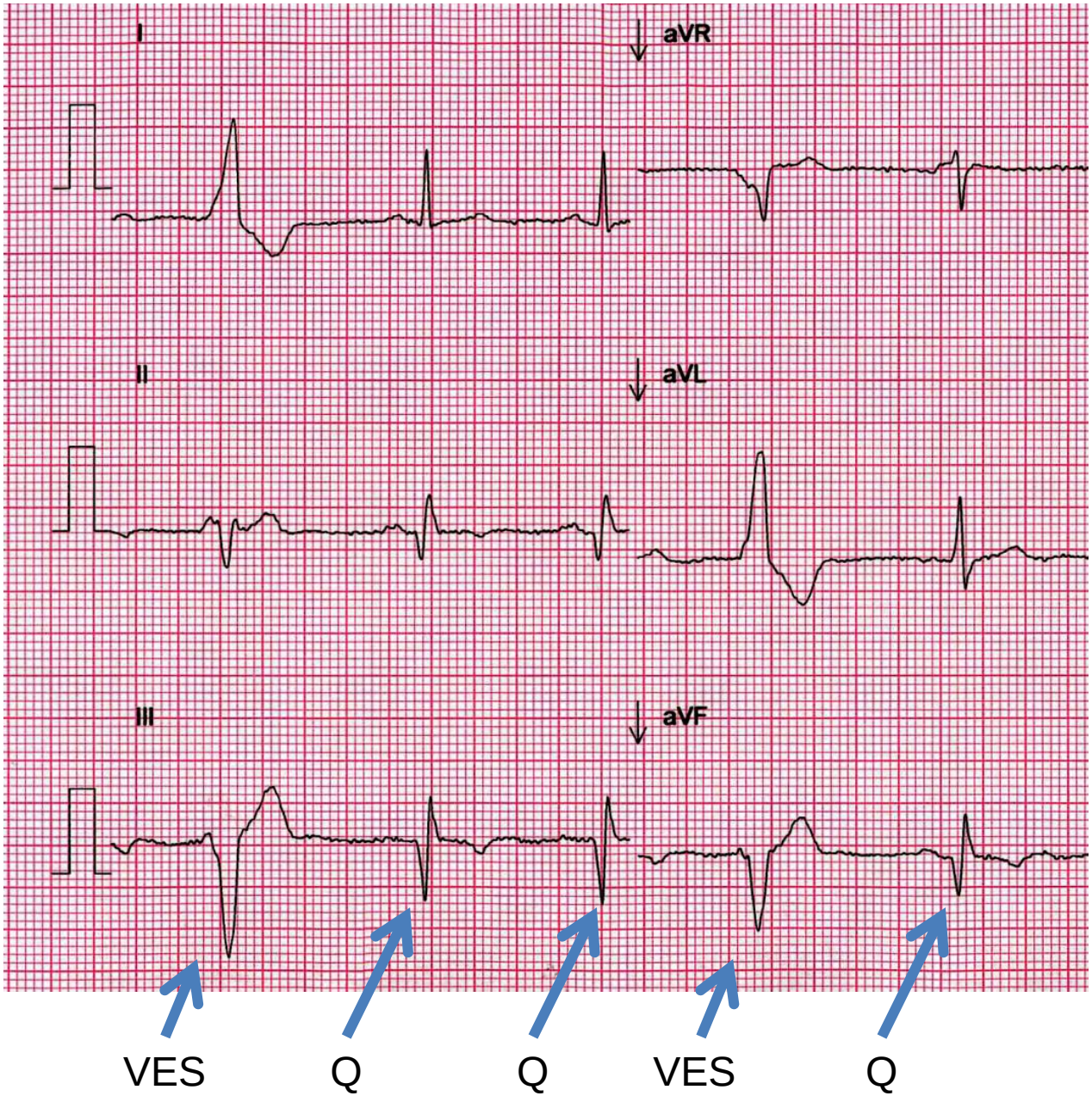
6 QRS morfologie

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

6 QRS morfologie

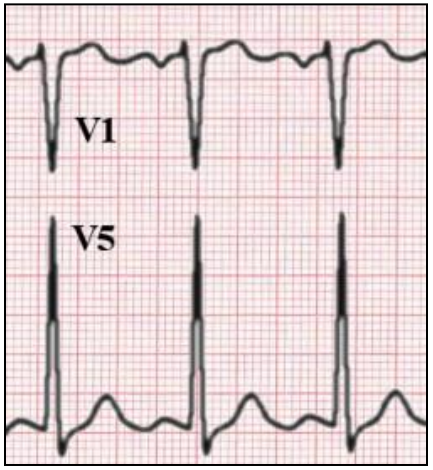
- **Pathologische Q top?**
  - Breedte ≥ 0.04 sec
  - Diepte > ⅓ van de R
  - Niet indien alleen in III of AVR!
- Differentiaal diagnose?
  - Oud infarct
  - Cardiomyopathie (HCM, DCM)
  - COPD
  - Intraventriculaire geleidingsstoornissen




I
aVR
II
aVL
III
aVF
VES
Q
Q
VES
Q

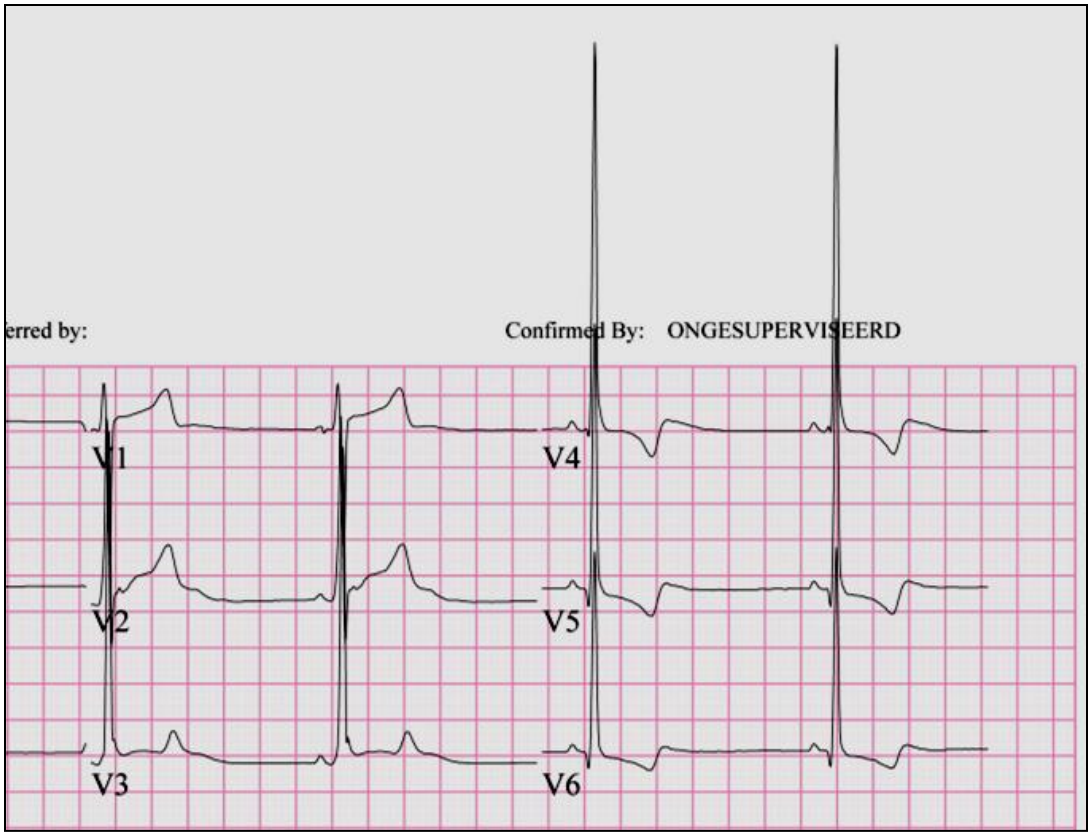
6 QRS morfologie

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



LVH:

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



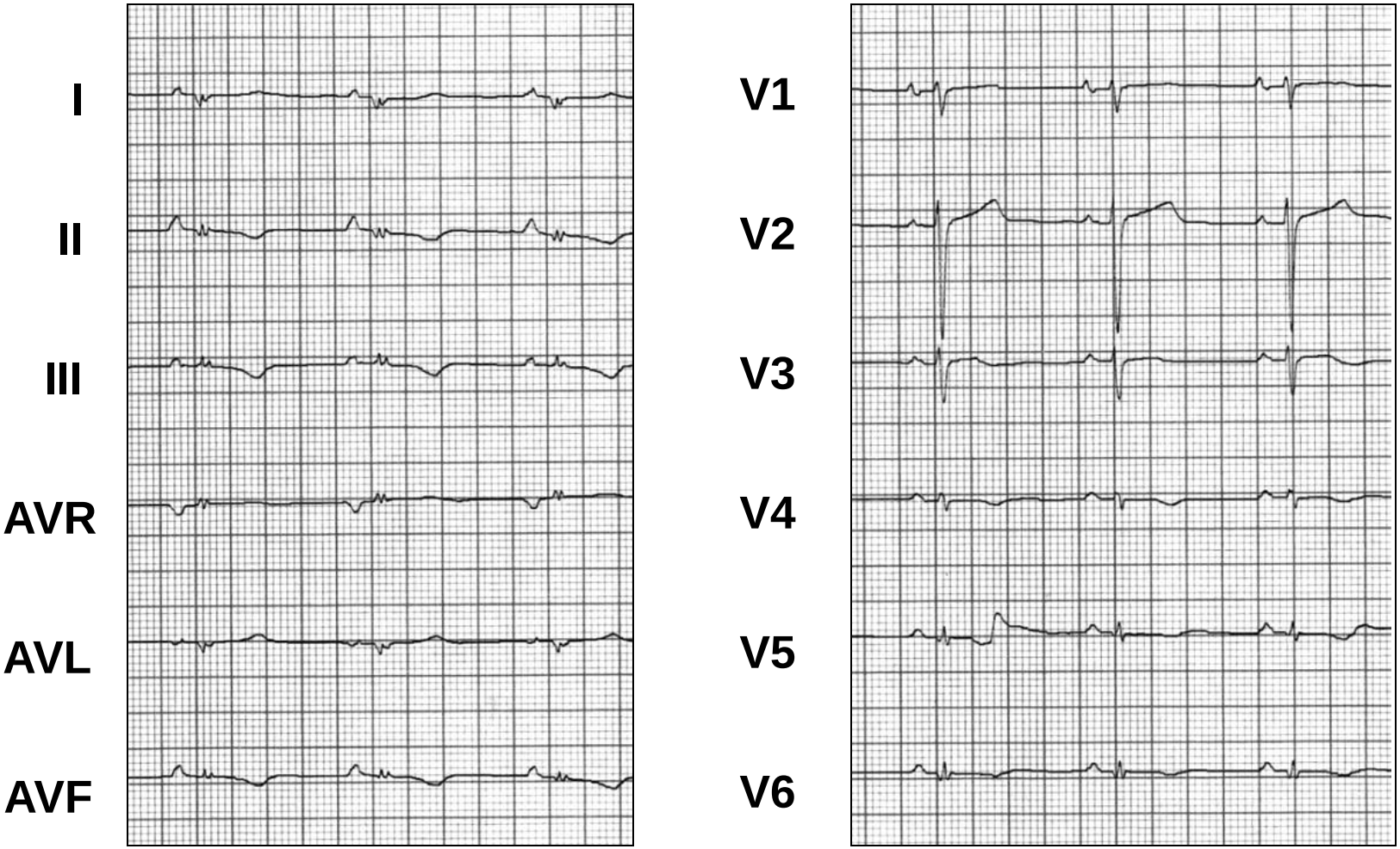
6 QRS morfologie

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

RVH:
R>S in V1

V1

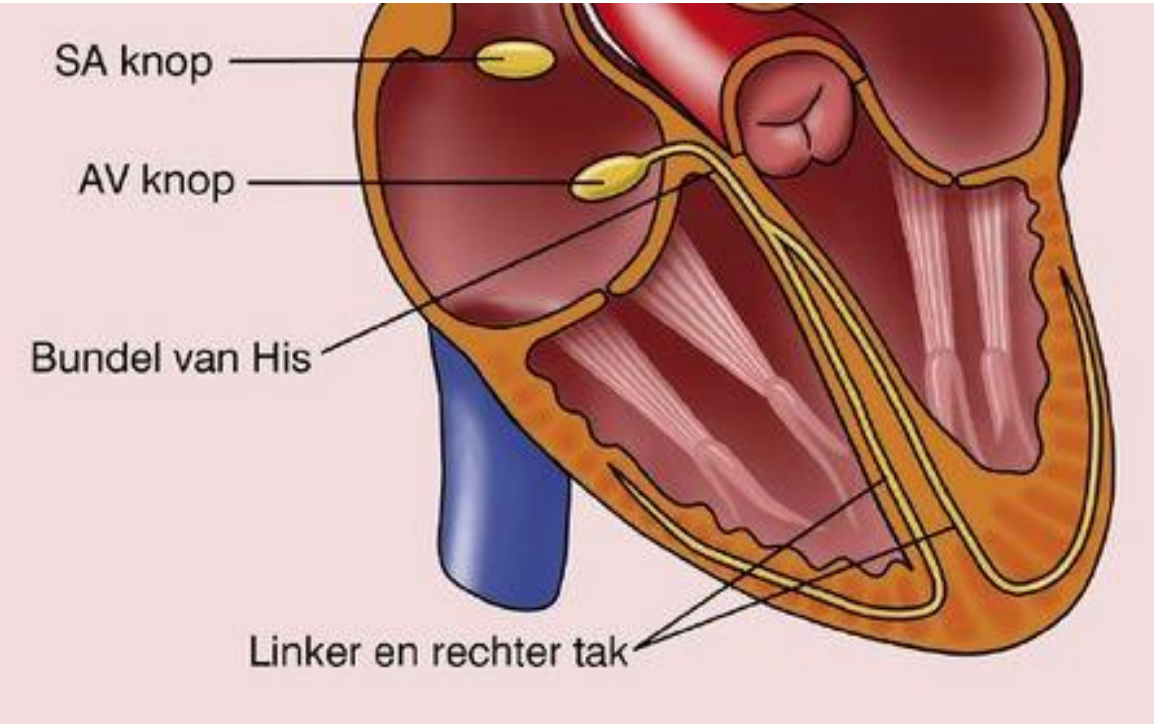
6 QRS morfologie



microvoltages

6 QRS morfologie

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



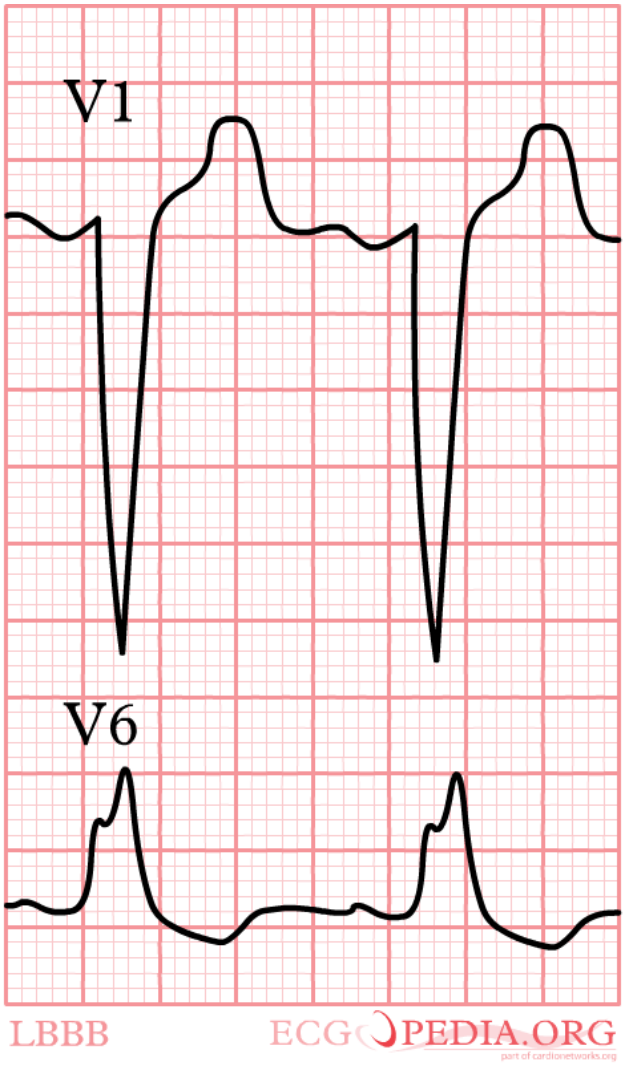
LBTB

QRS > 0.12 seconde

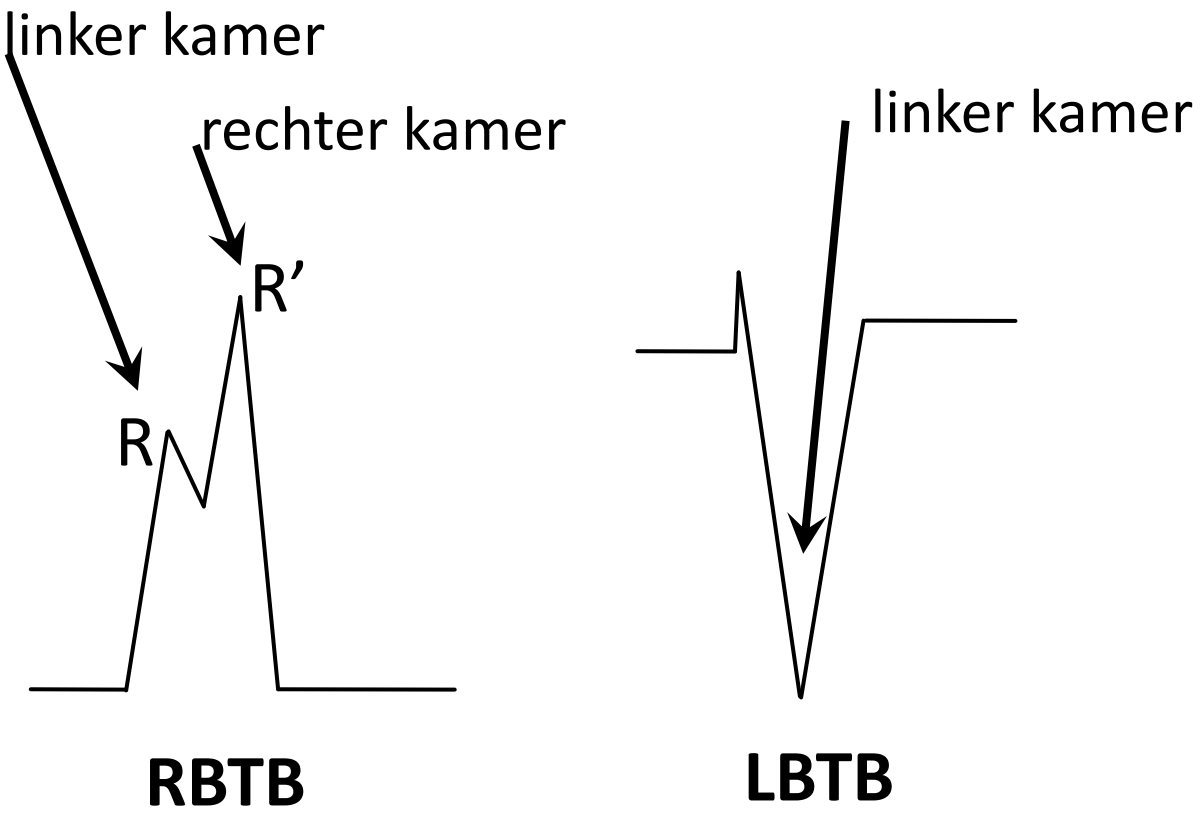
(r)S in V1

Brede R en geen q in I, V6

(Infarctdiagnostiek lastig want ST segment afwijkend)



afleiding V1



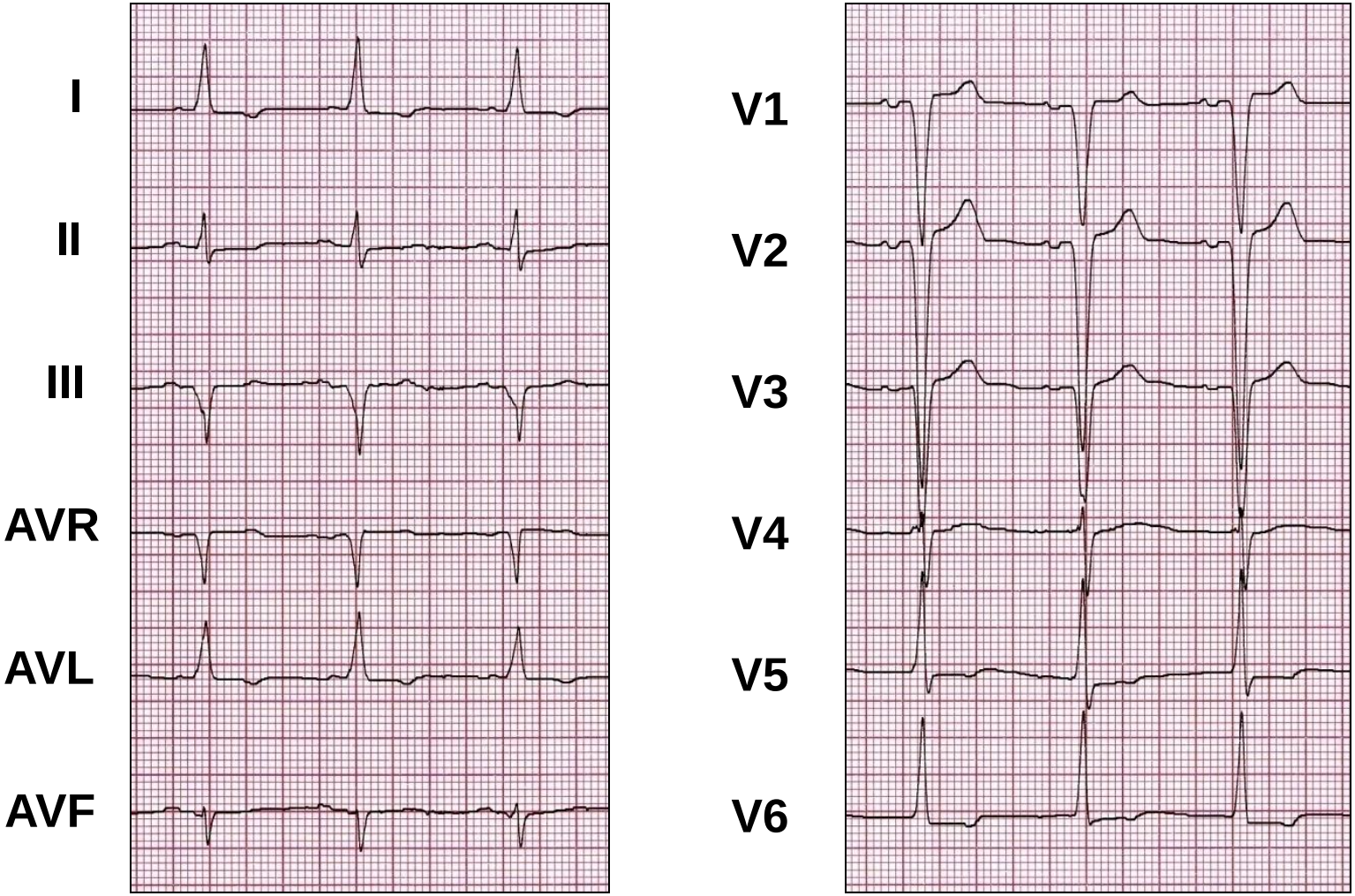
RBTB

QRS > 0.12 seconde

rsR’ in V1

R’ > R

(Infarctdiagnostiek goed mogelijk)

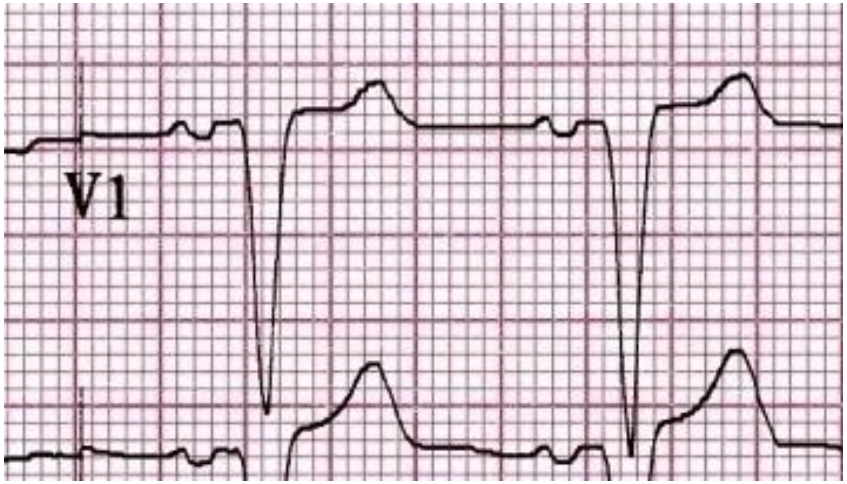


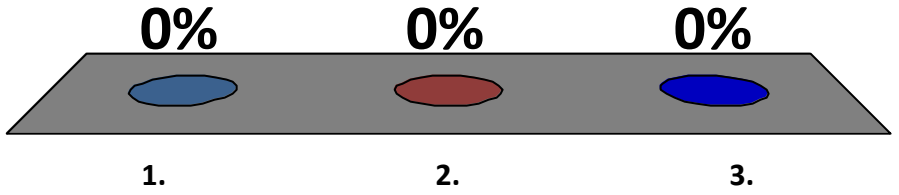
RBTB of LBTB?

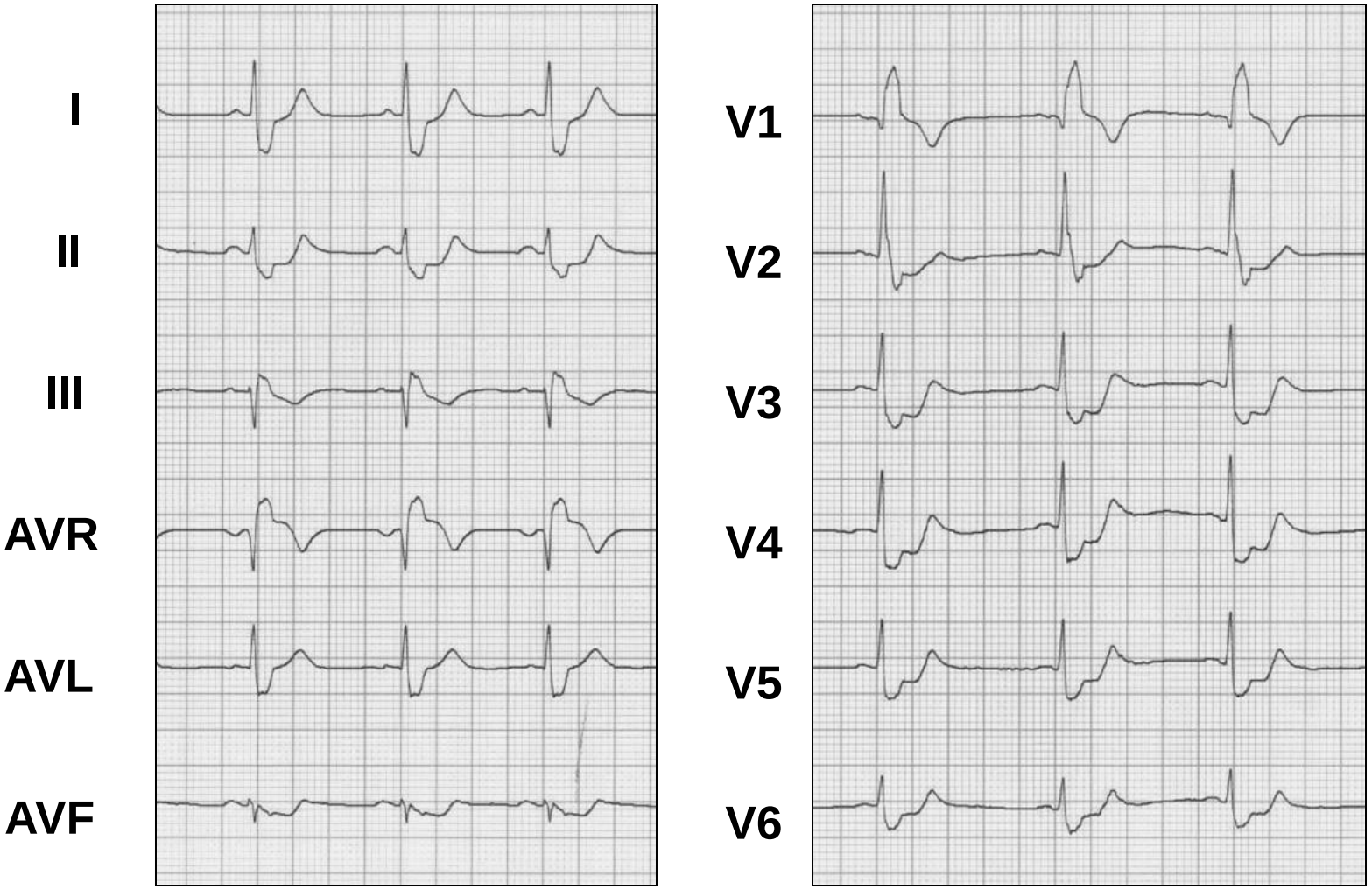
Courtesy of W.G. de Voogt, MD, PhD

LBTB of RBTB?

1. LBTB
2. RBTB
3. Intraventriculaire geleidingsvertragin



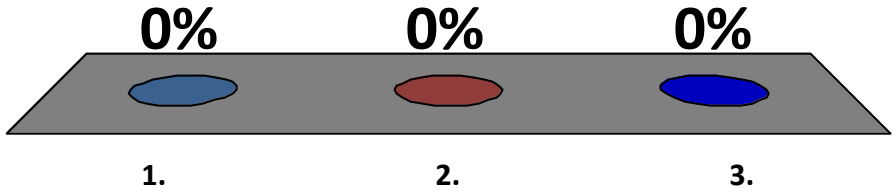


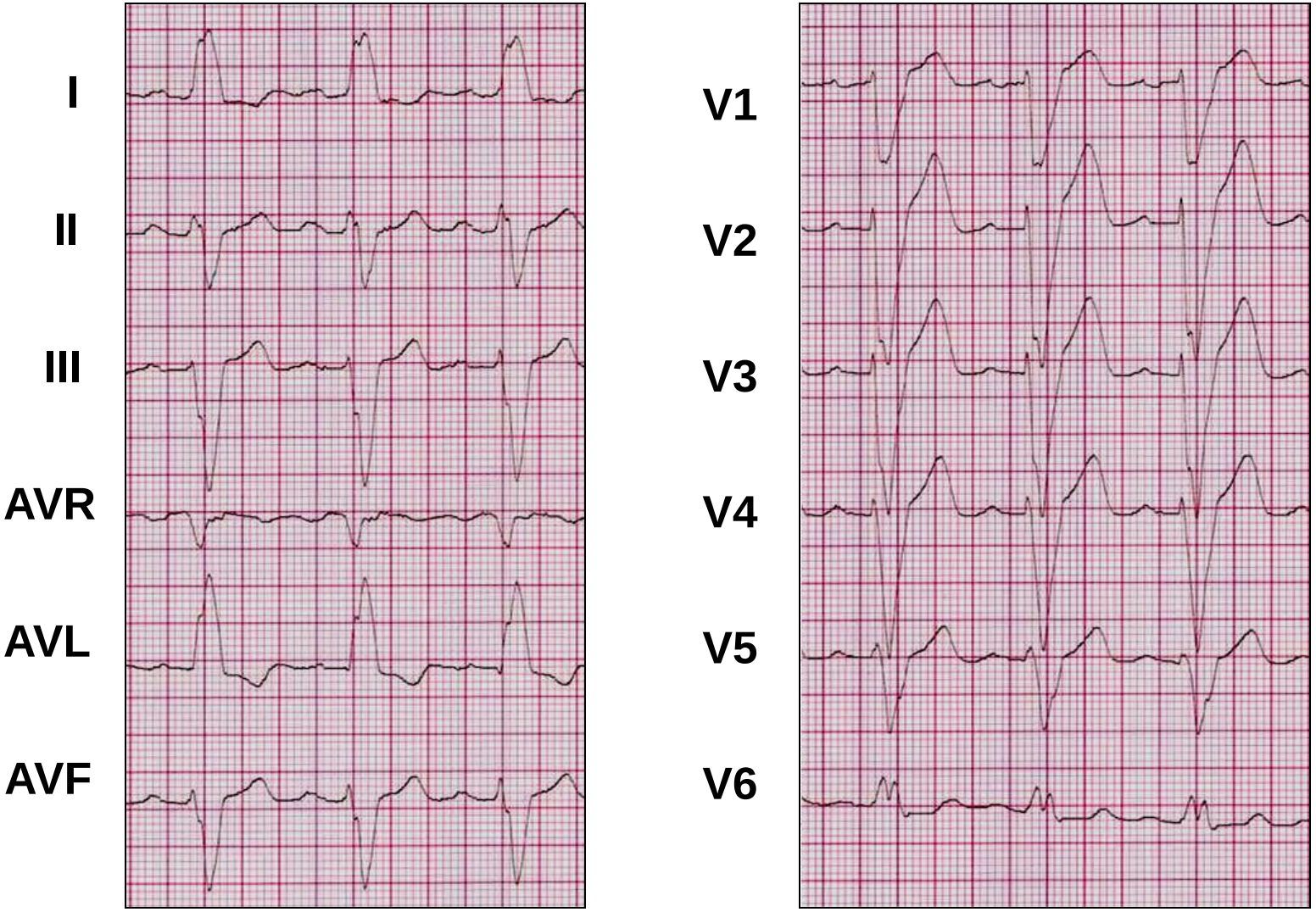


Courtesy of W.G. de Voogt, MD, PhD

LBTB of RBTB?

1. LBTB
2. ✓ RBTB
3. Intraventriculaire geleidingsvertraging



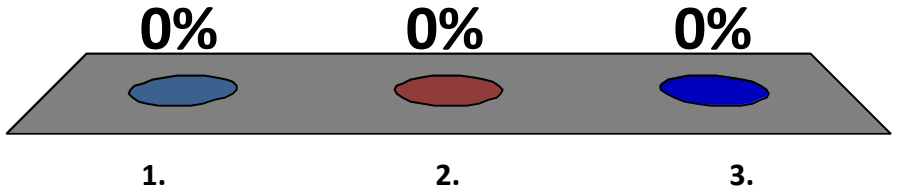


RBTB of LBTB?

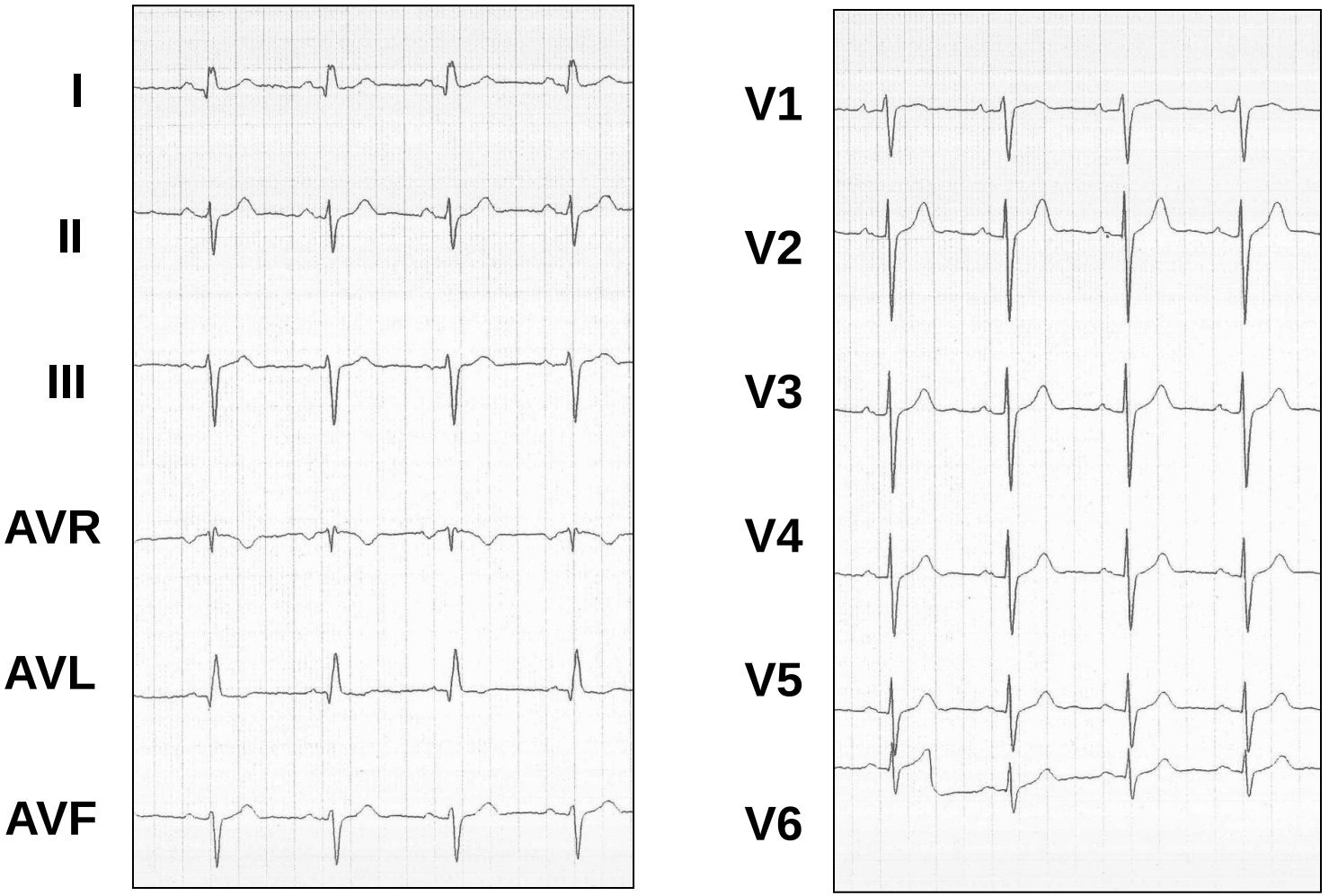
Courtesy of R.W. Koster, MD, PhD

LBTB of RBTB?

1. LBTB
2. RBTB
3. Intraventriculaire geleidingsvertraging



LAHB



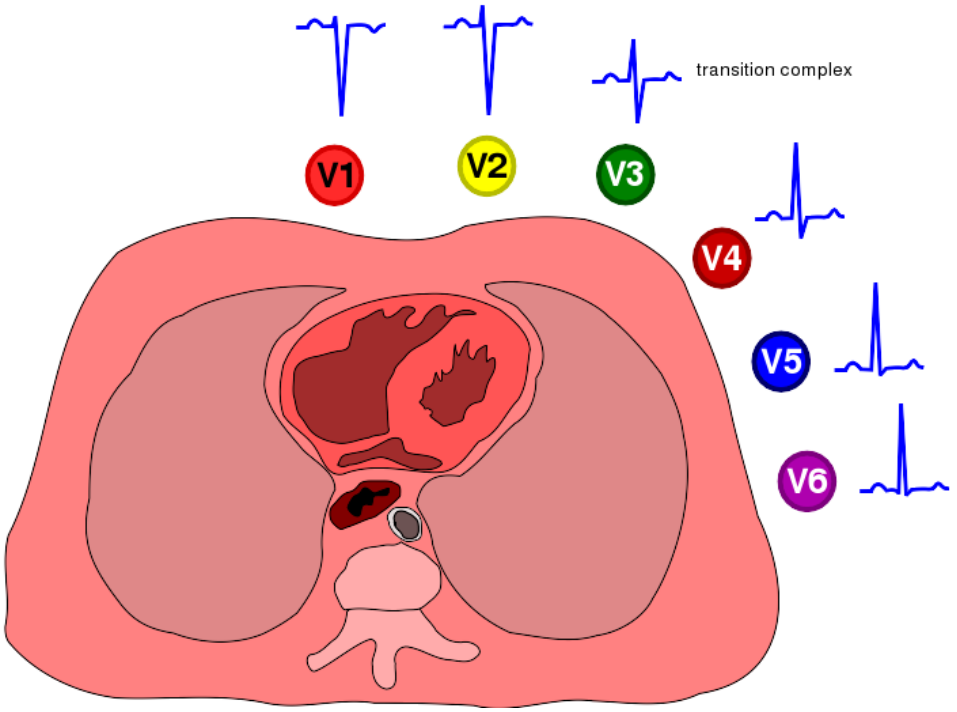
Courtesy of R.W. Koster, MD, PhD

Criteria LAHB

- asdeviatie naar links (<-30°)
- 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)

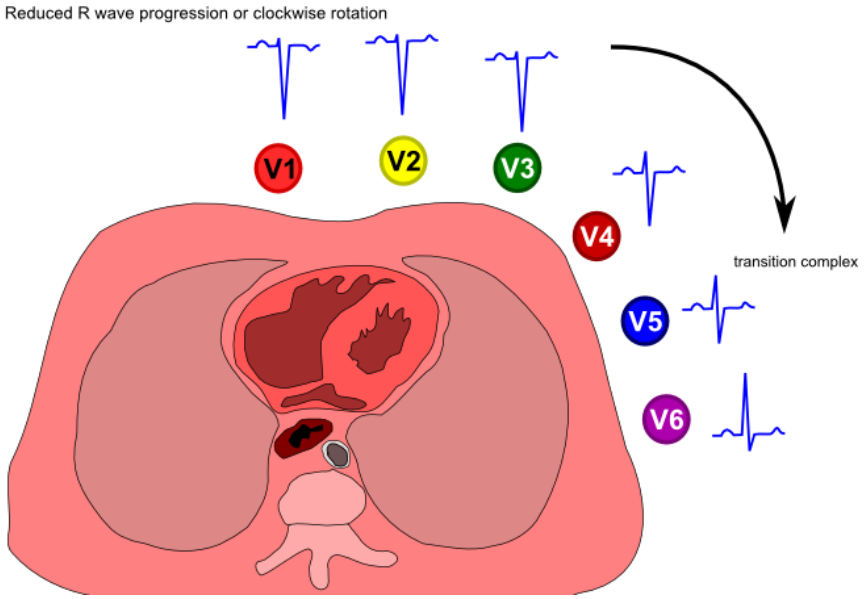
7+2 STAPPENPLAN
Stap 6: QRS morfologie

- 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

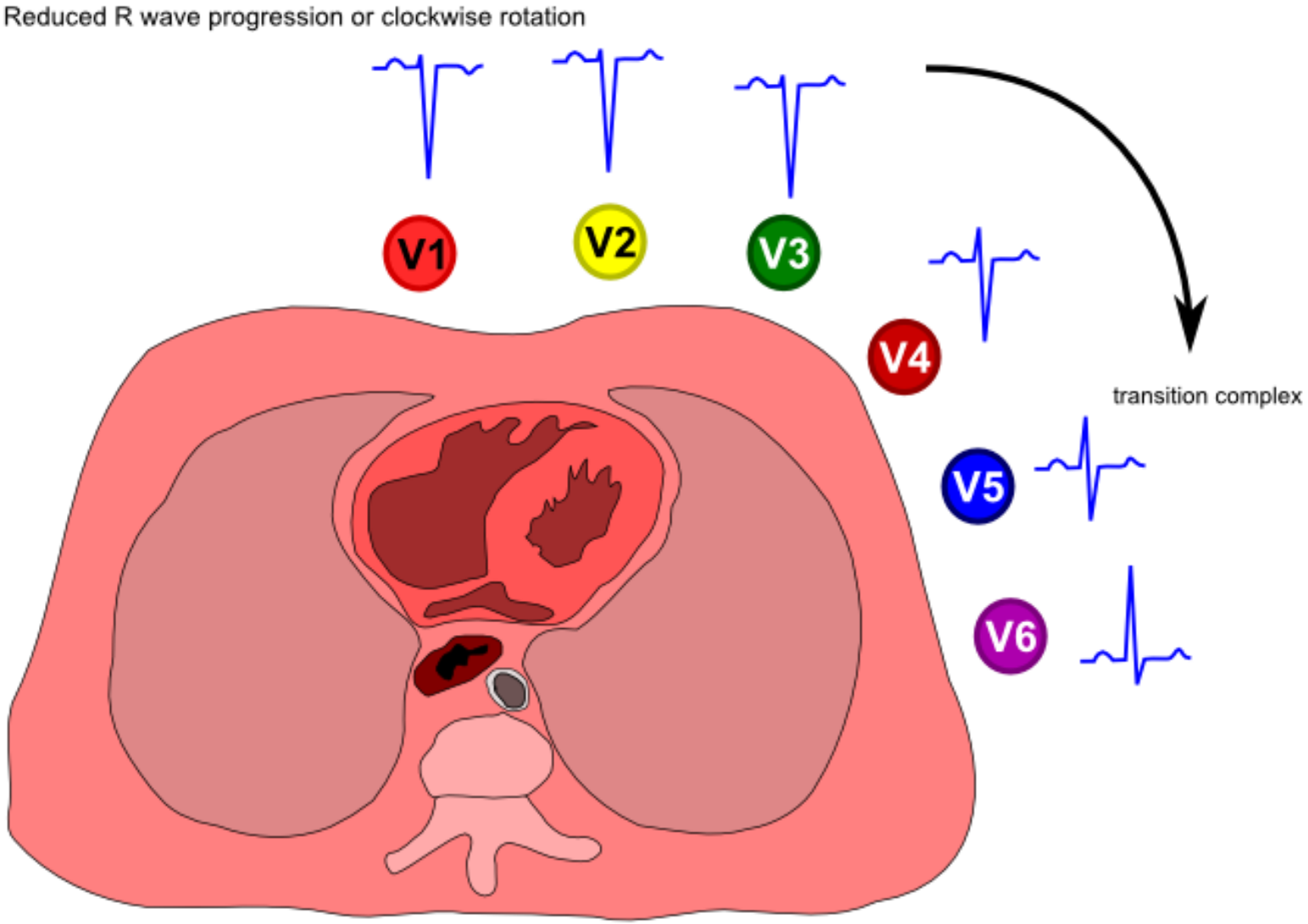


7+2 STAPPENPLAN
Stap 6: QRS morfologie

- 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
V1
V2
V3
V4
V5
V6
transition complex

7 ST morfologie

ST elevatie

Ischemie

Pericarditis

Aneurysma cordis

Normale variant

ST depressie

Reciproke bij ischemie

LVH

Digitalis

Hypokaliemie

Neurologisch

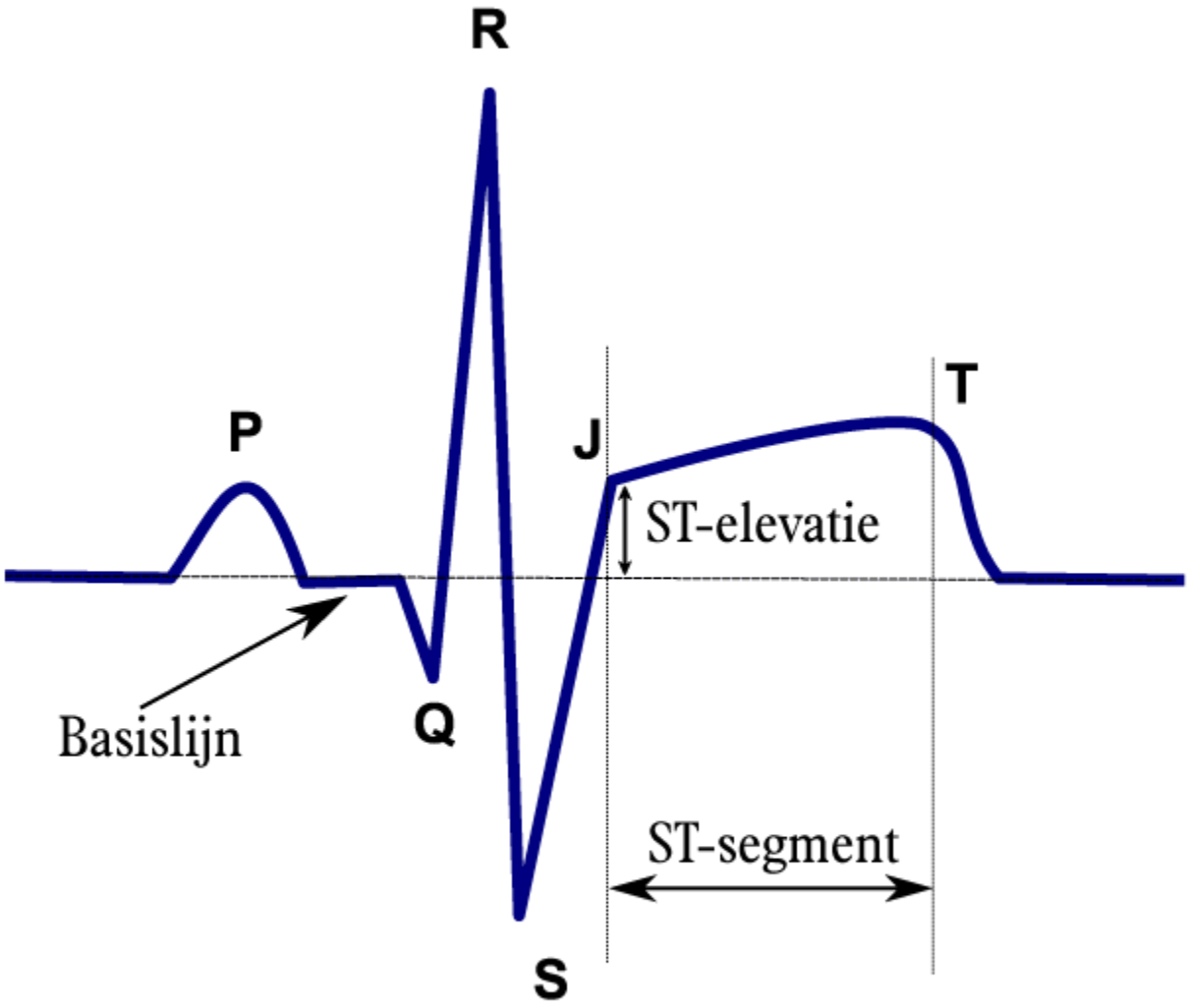
T top verandering

Ischemie

Pericarditis

Myocarditis

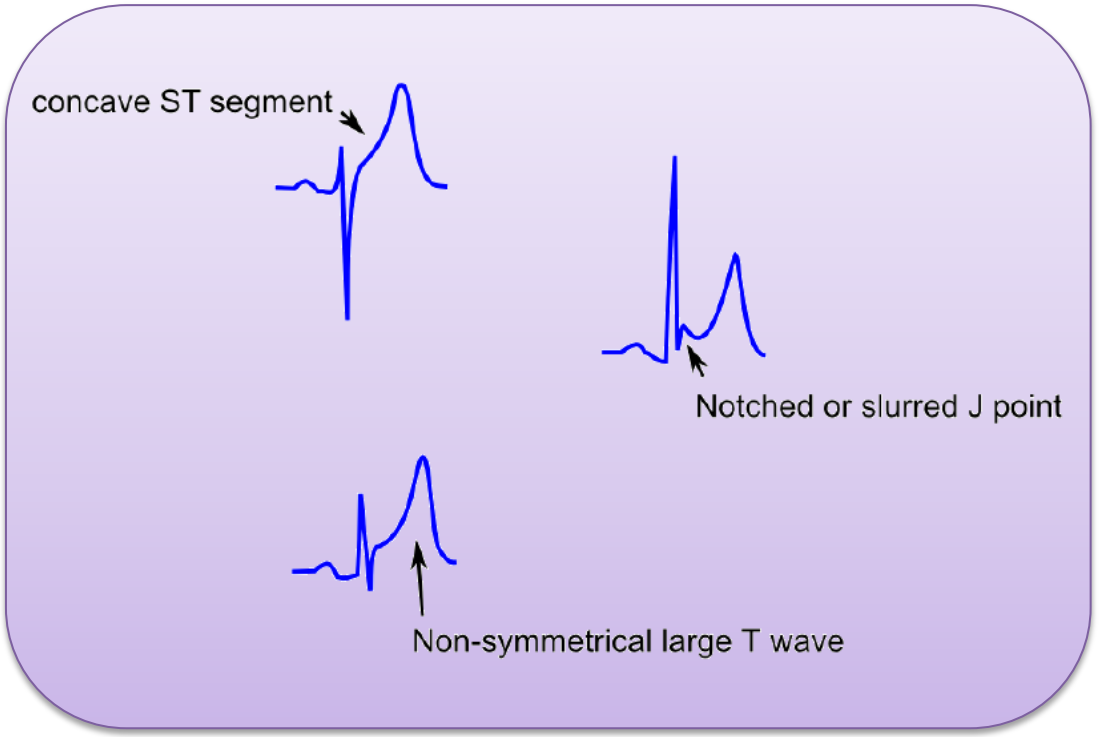
LVH / RVH



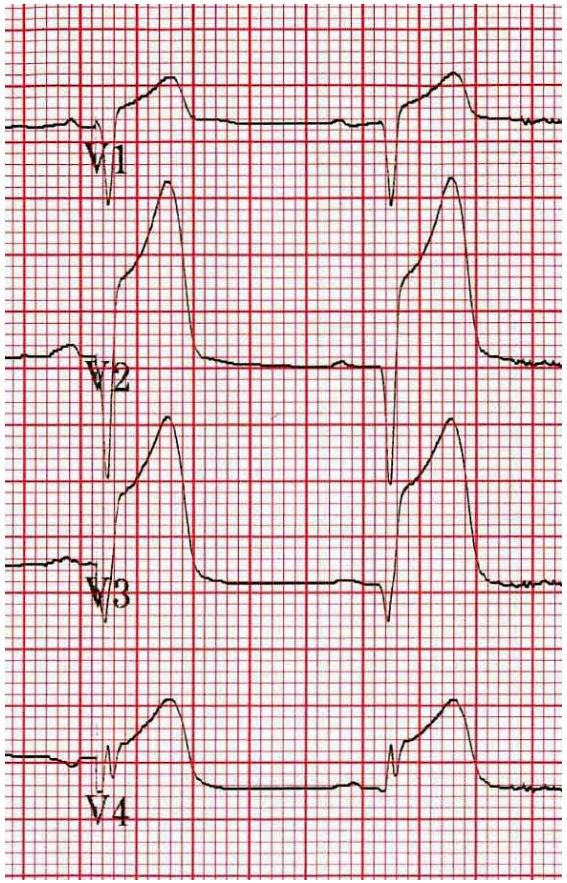
Hoe meet je ST-elevatie?

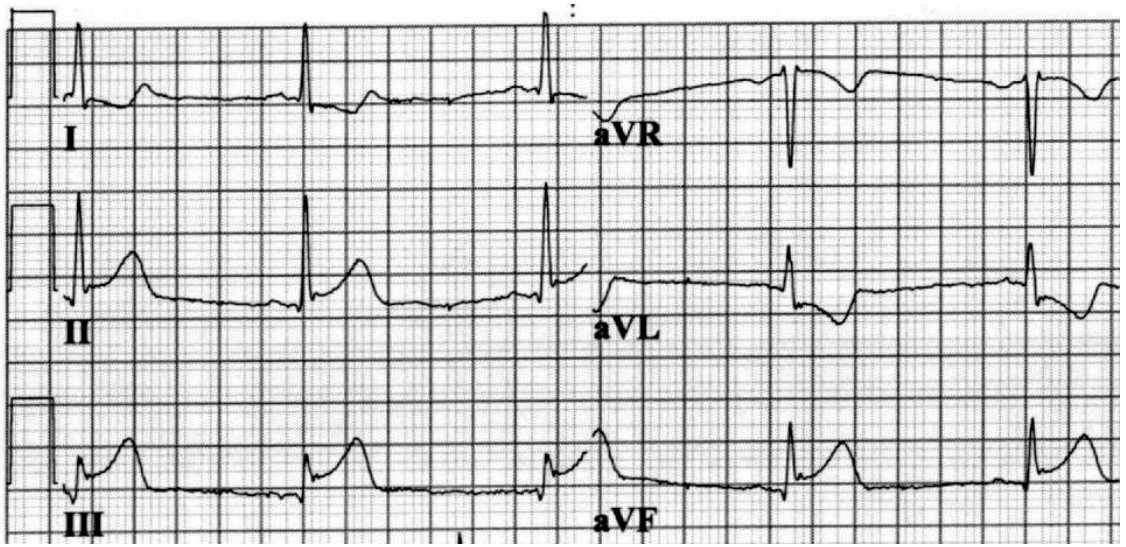
Vroege Repolarisatie

- Zeer frequente bevinding
- “Smiley”configuratie
- Overigens gezonde asymptomatische 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.

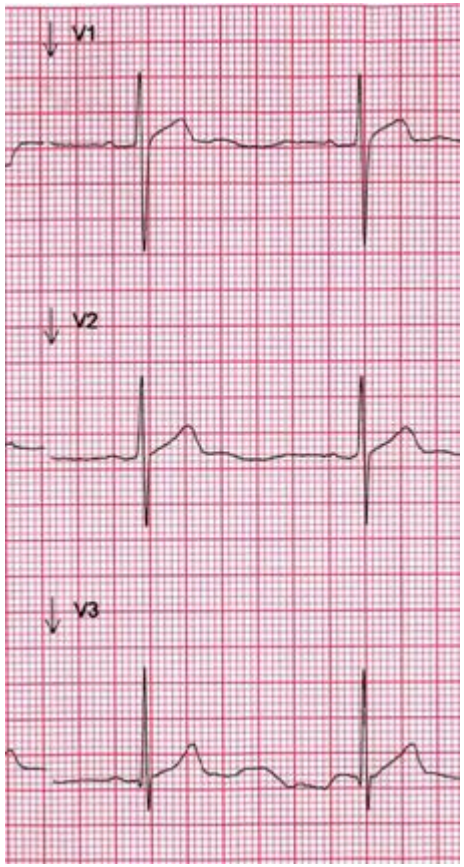


ST elevatie bij ischemie

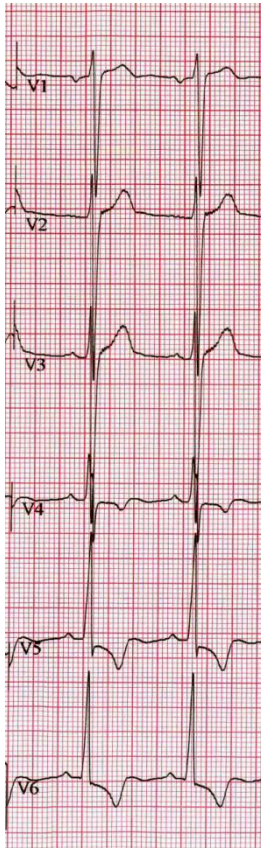




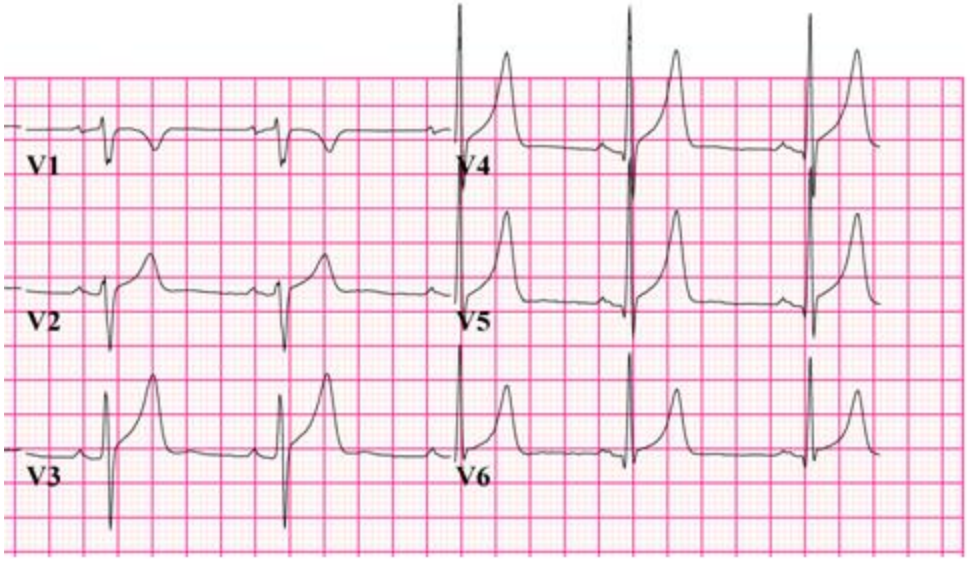
ST elevatie, geen infarct



17 jaar, gezond

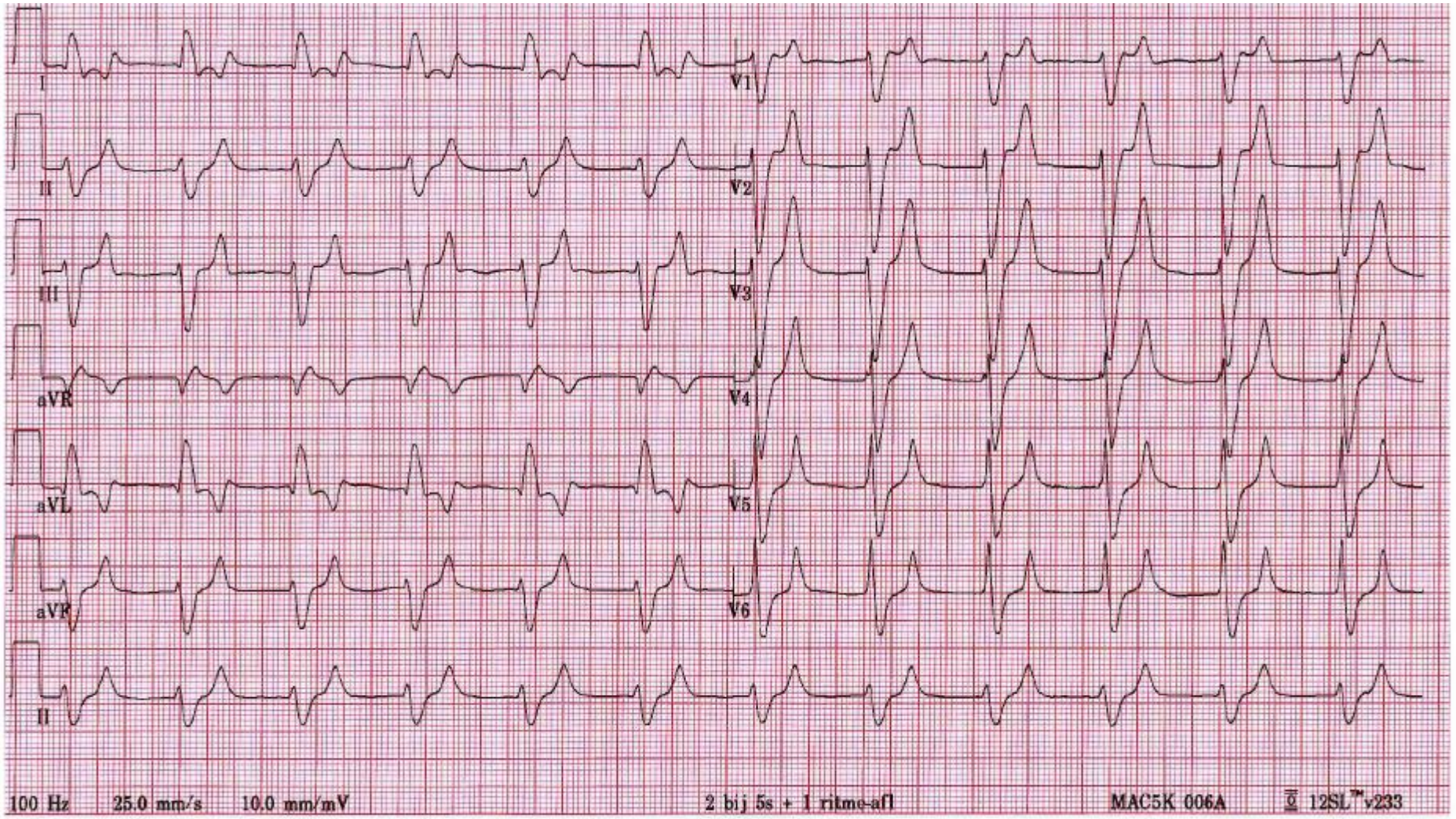


LVH



pericarditis

Hyperkaliemie



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

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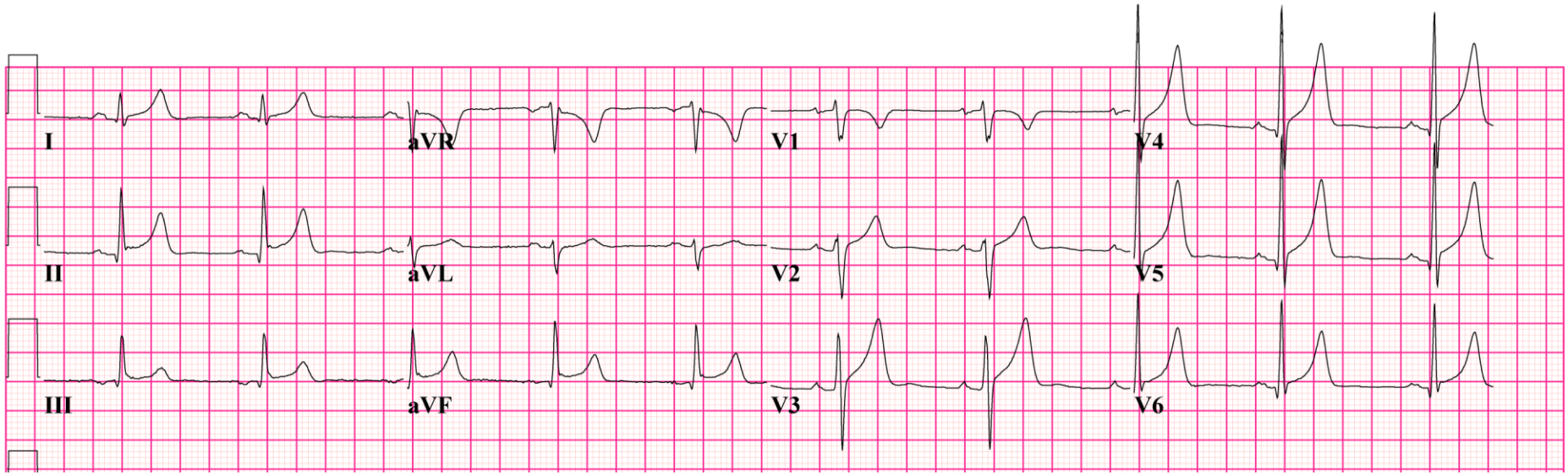
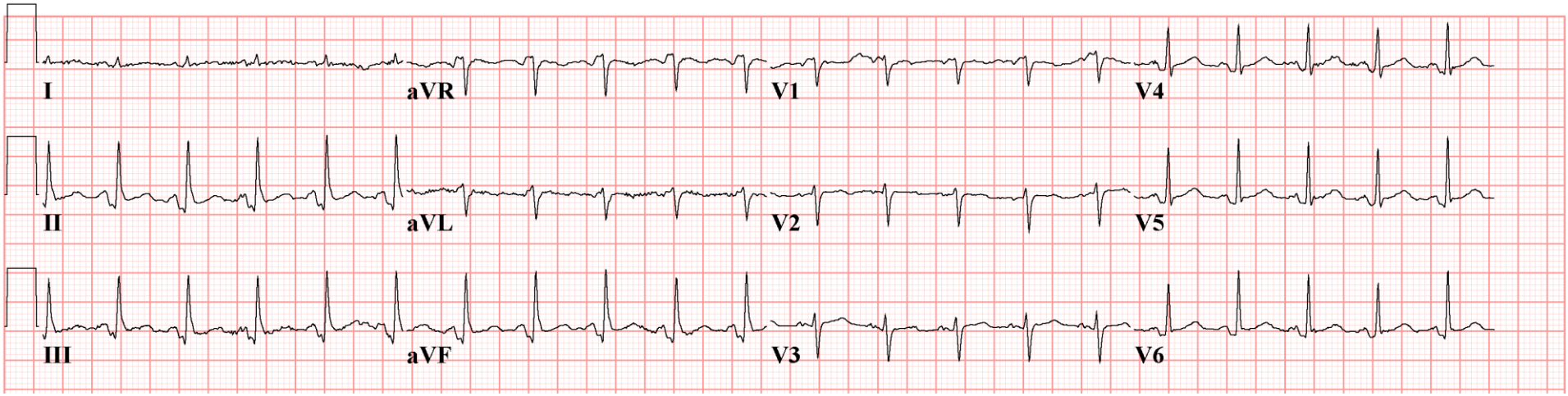
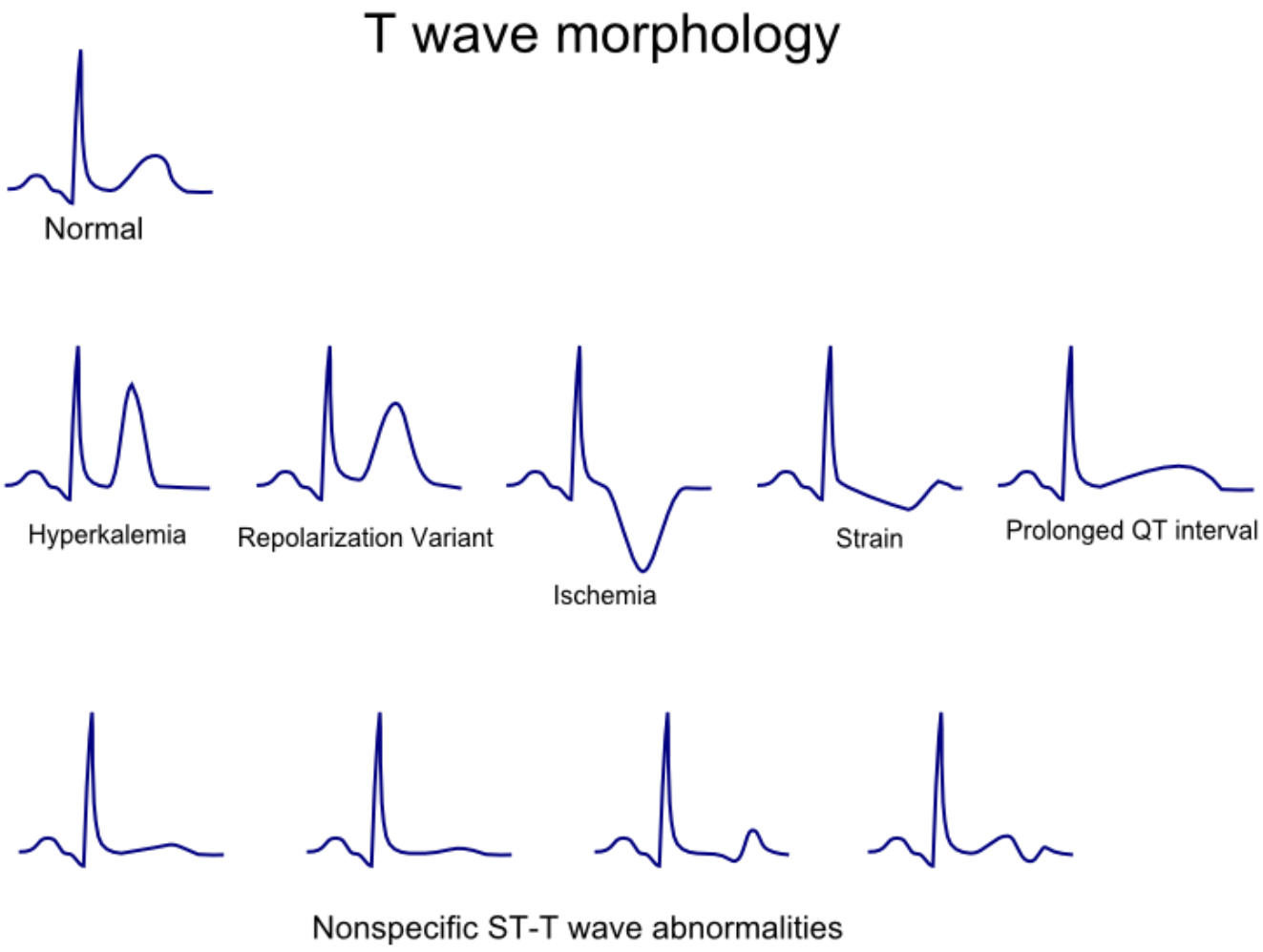
Pericarditis

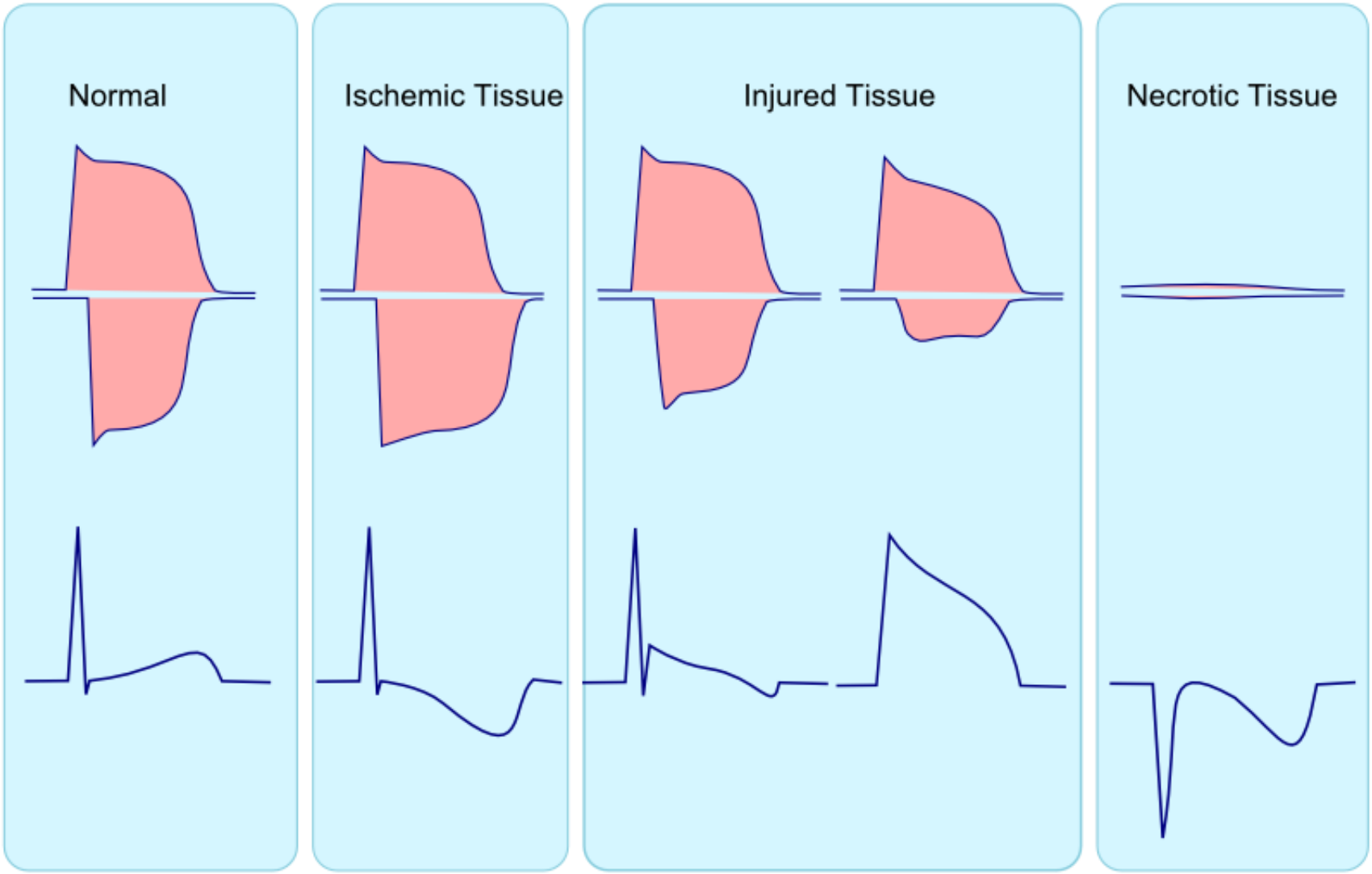




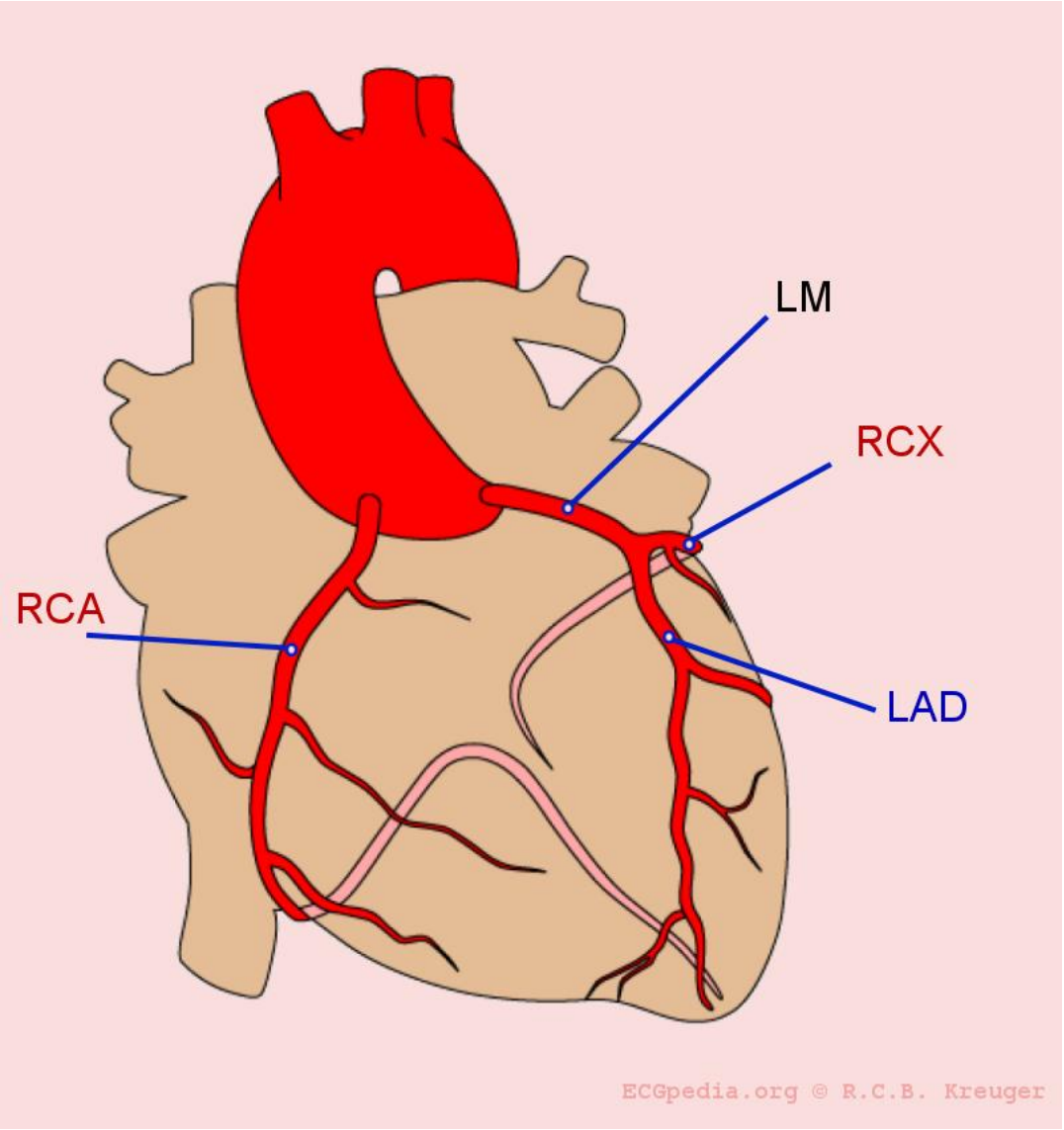
Vlak = < 0.5mm in I, II, V3-V6

Negatief = > 0.5mm in I, II, V3-V6





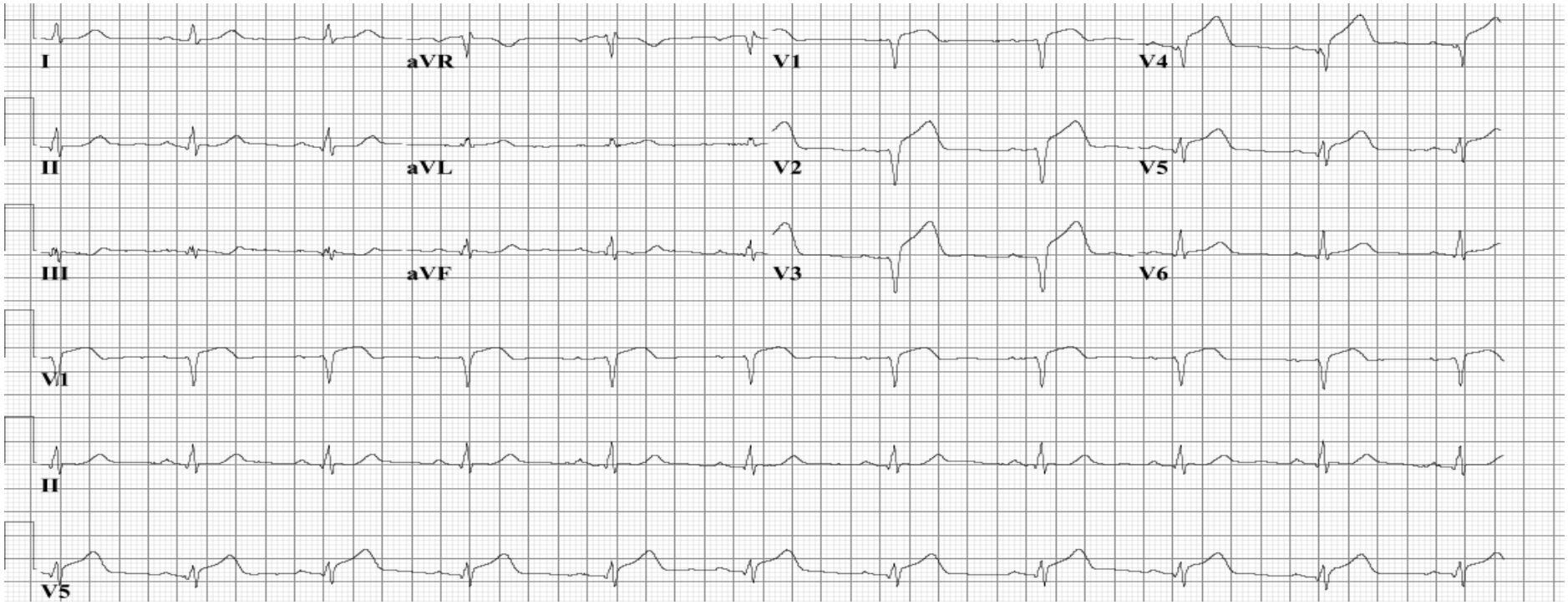
Kransslagvaten



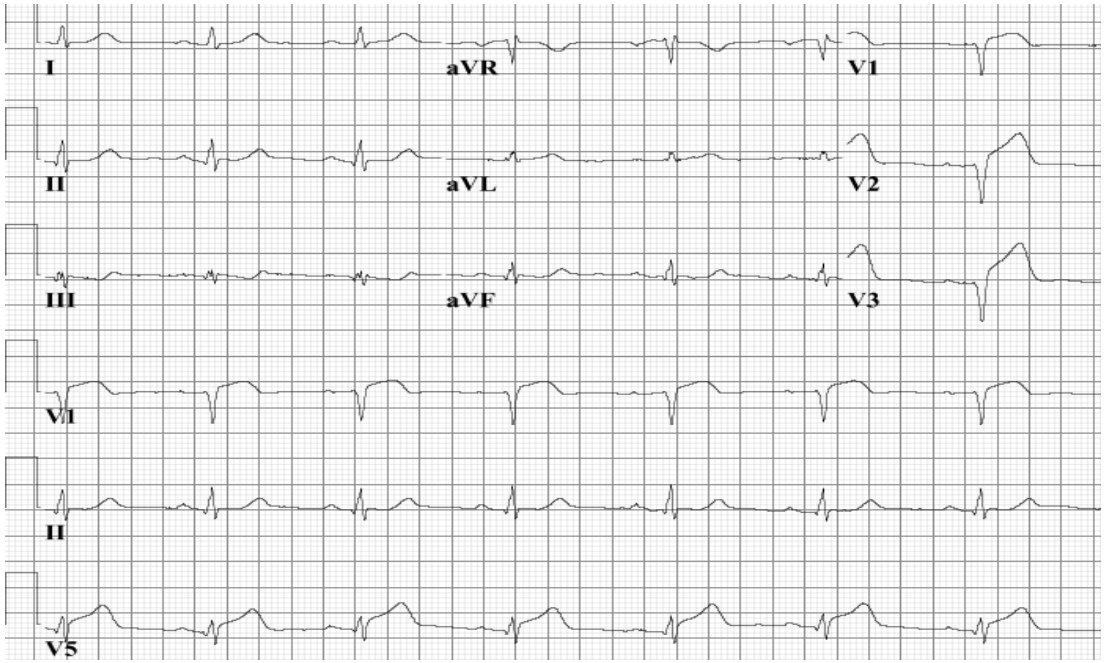
♀ 46 jr.

A: Bij presentatie 1 uur AP

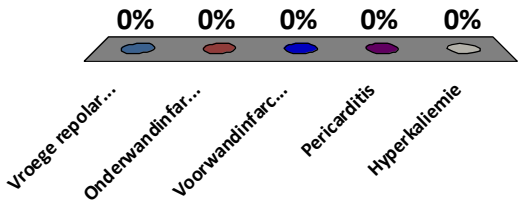
VG: Hypertensie, familie, hyperlipidemie, roken +++.



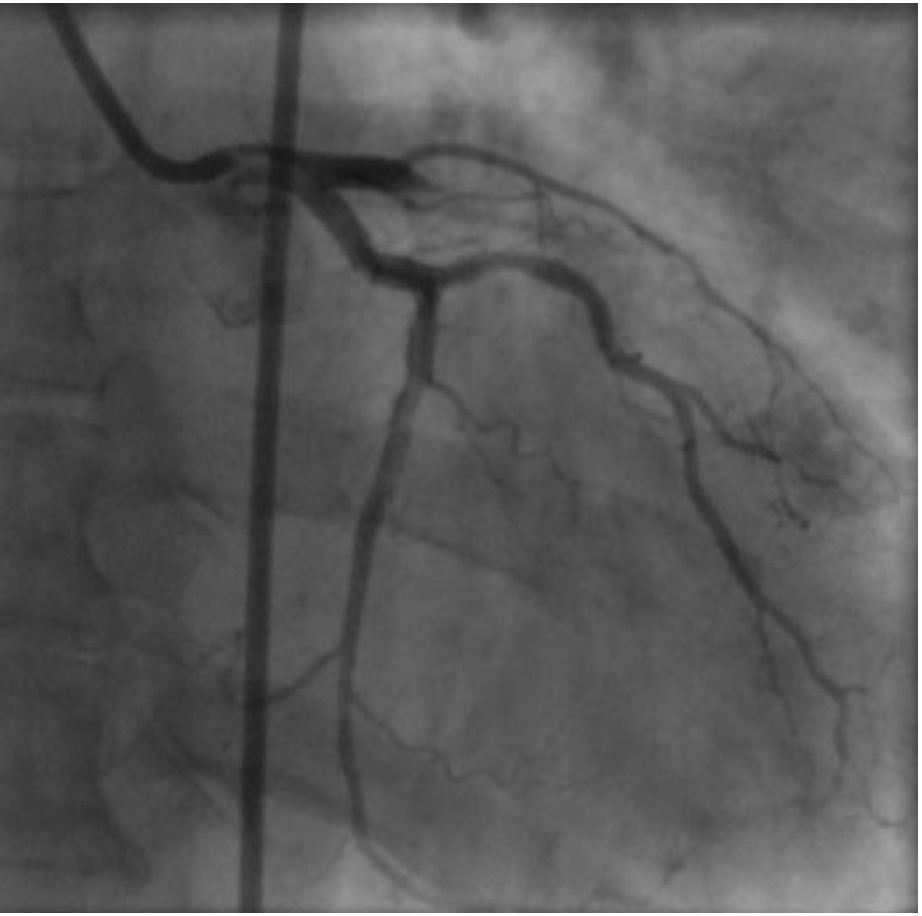
Maak uw keuze...

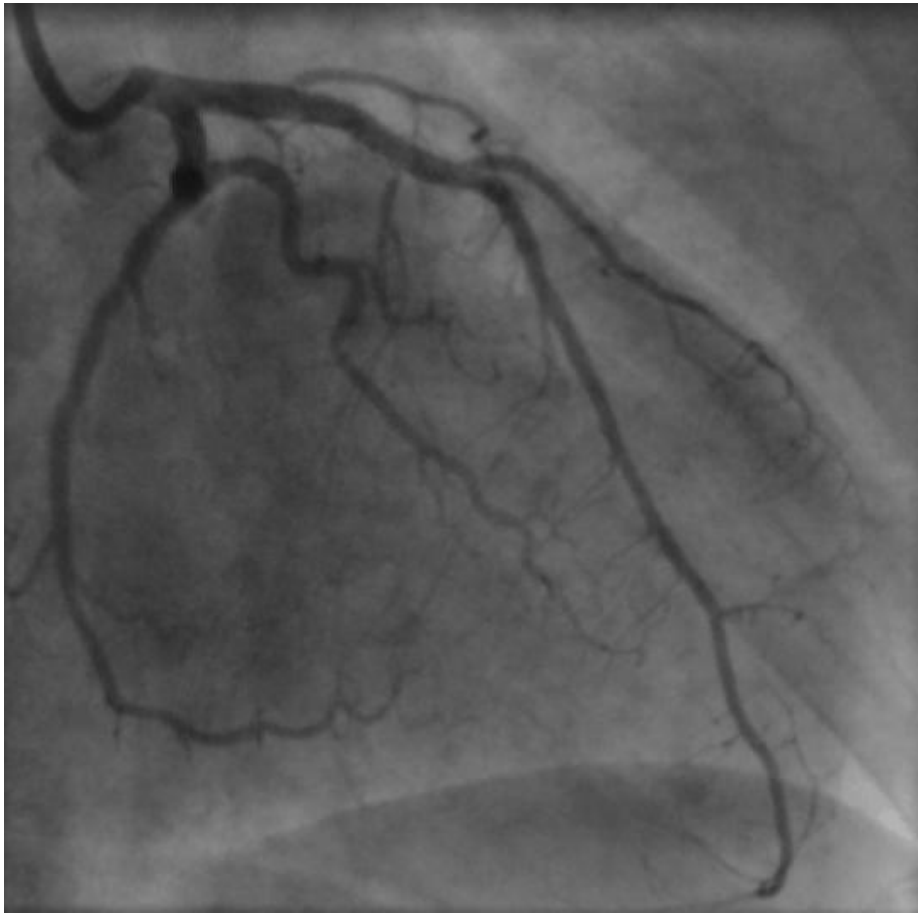


1. Vroege repolarisatie
2. Onderwandinfarct
3. ✓ Voorwandinfarct
4. Pericarditis
5. Hyperkaliemie



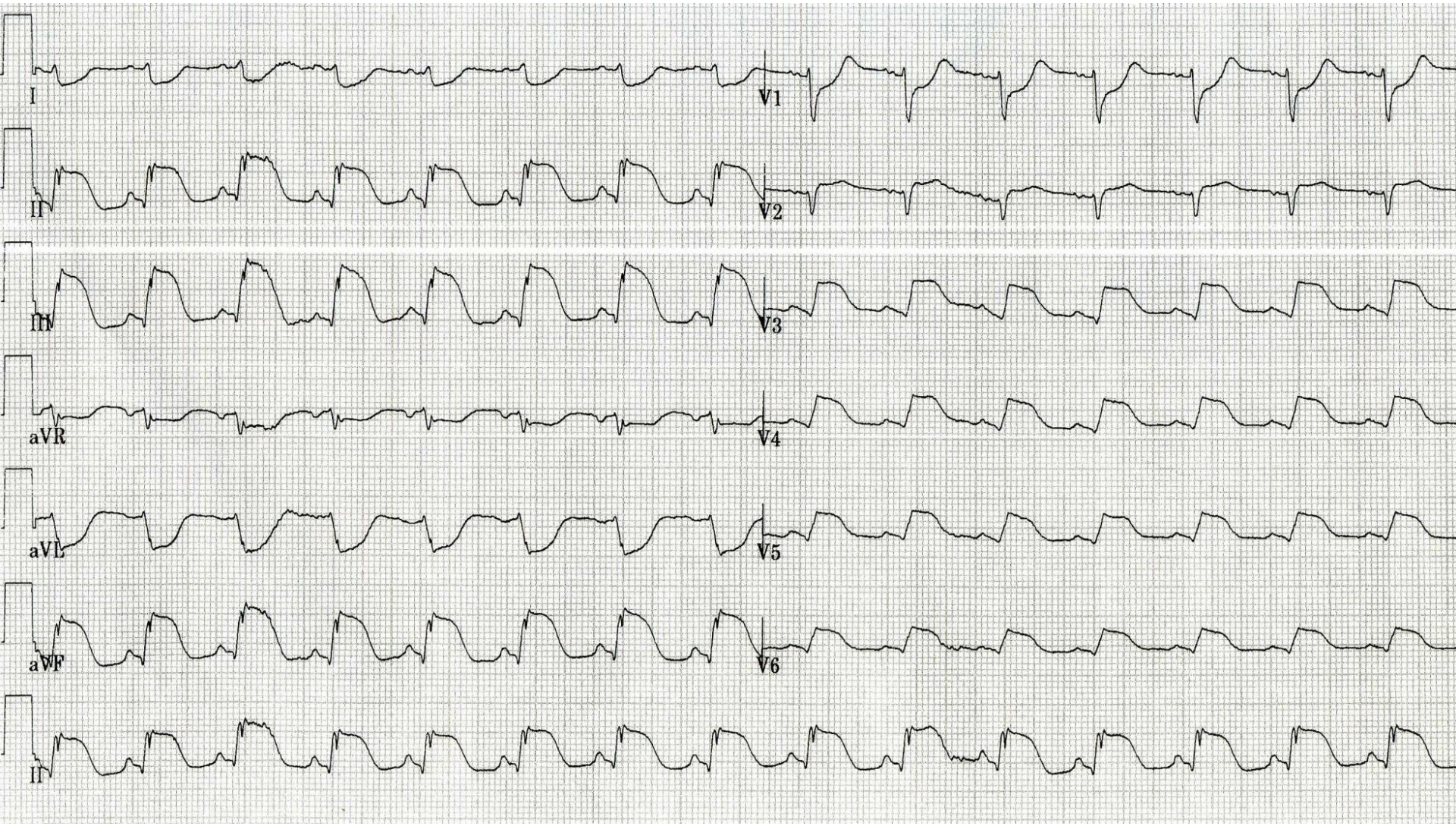
LCA pre en post PCI



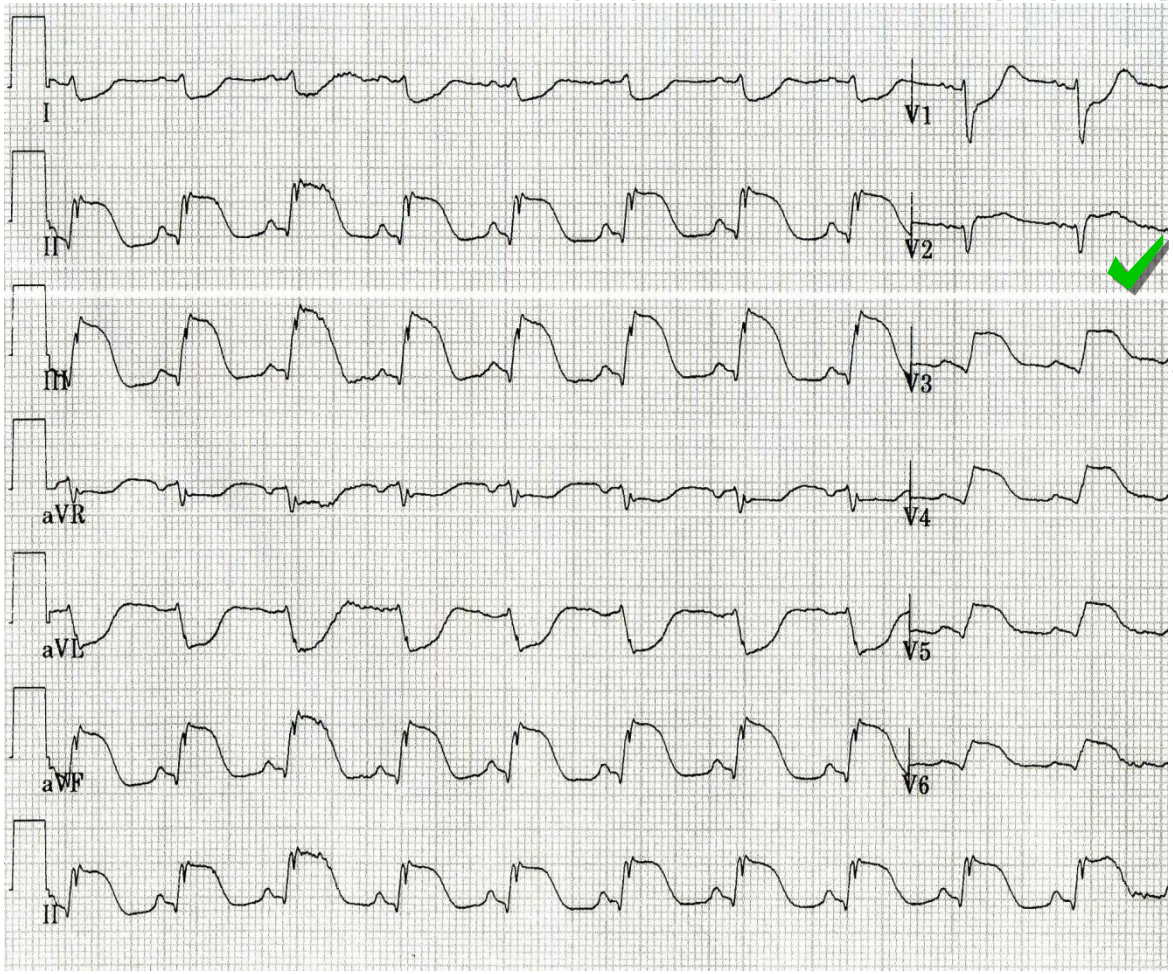


Proximale LAD occlusie, voor eerste septale tak, na diagonale tak

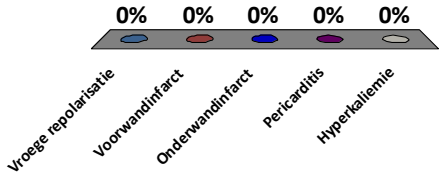
♂ 52 jr.



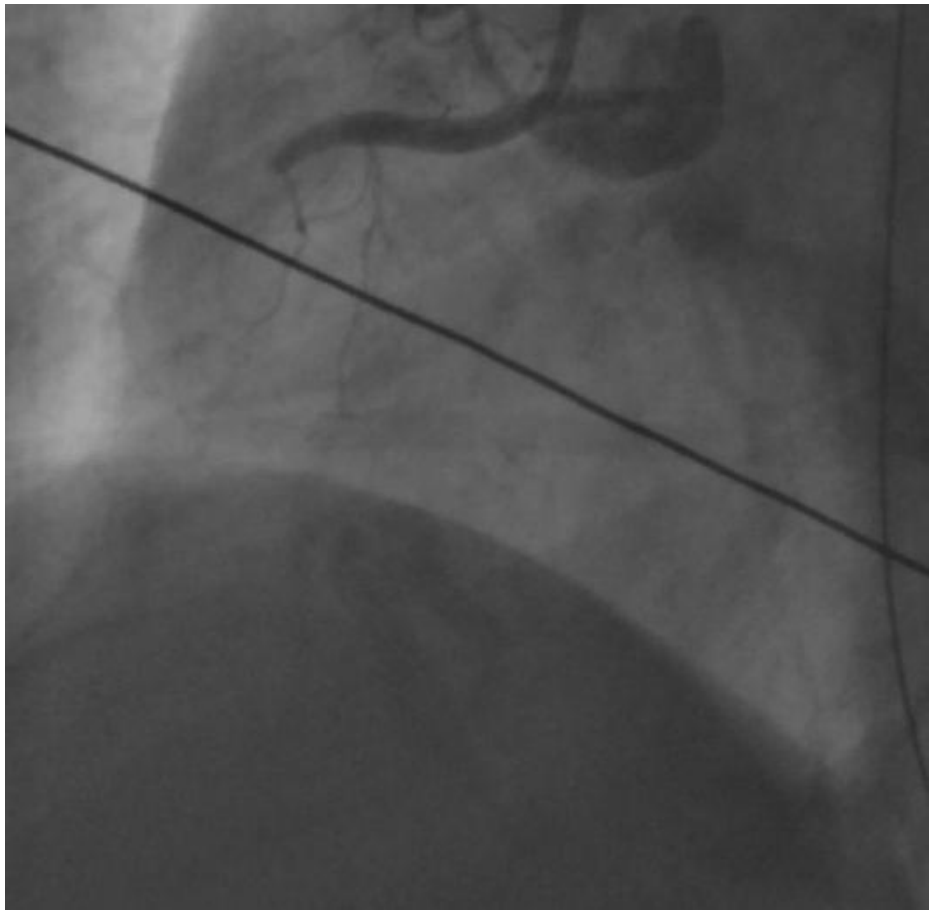
Maak uw keuze...

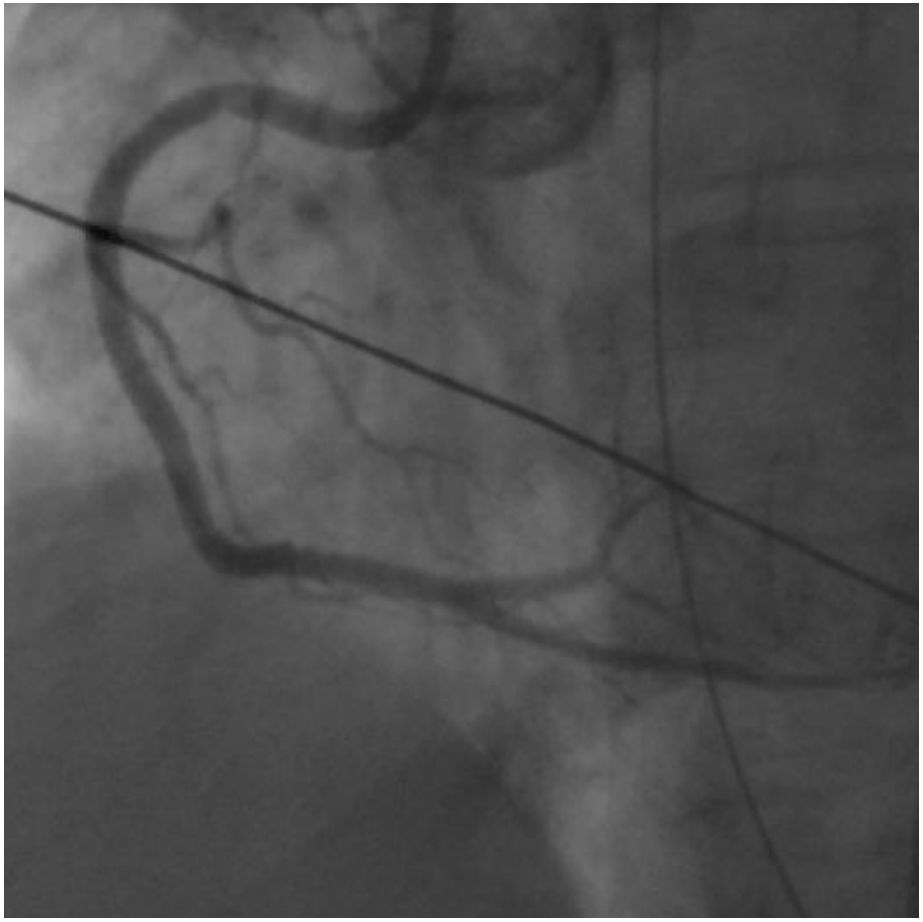


1. Vroege repolarisatie
2. Voorwandinfarct
3. Onderwandinfarct
4. Pericarditis
5. Hyperkaliemie



RCA pre en post PCI





7+1 Vergelijken met oud ECG

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

7+2 Conclusie

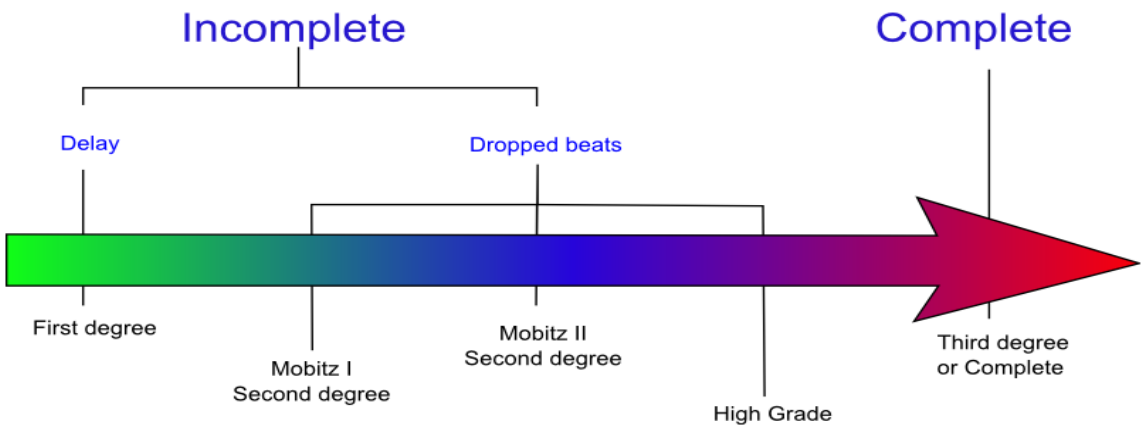
Voorbeelden:

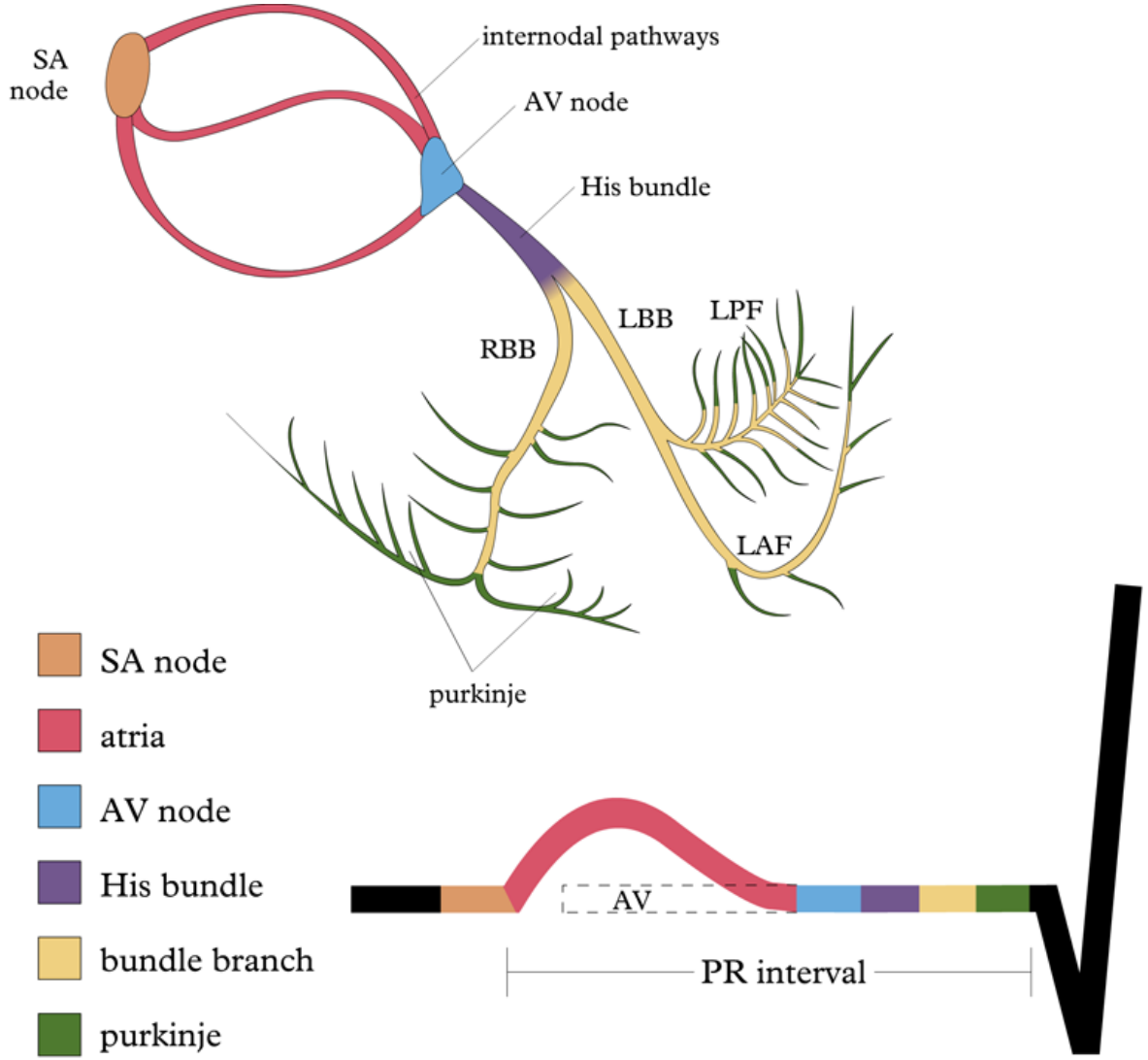
- "Sinustachycardie met ST elevatie over de voorwand, passend bij een acuut voorwandinfarct"
- "Supraventriculaire tachycardie van 200/min op basis van een AV nodale re-entry"
- "Oud onderwandinfarct met nu een acuut lateraal myocard-infarct met QRS verbreding ten opzichte van het ECG van 14 augustus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

Geleidingsstoornissen

Geleidingsstoornissen

- 1e graads: verlengde PQ tijd > 200ms
- 2e 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
- 3e graads: totaal blok





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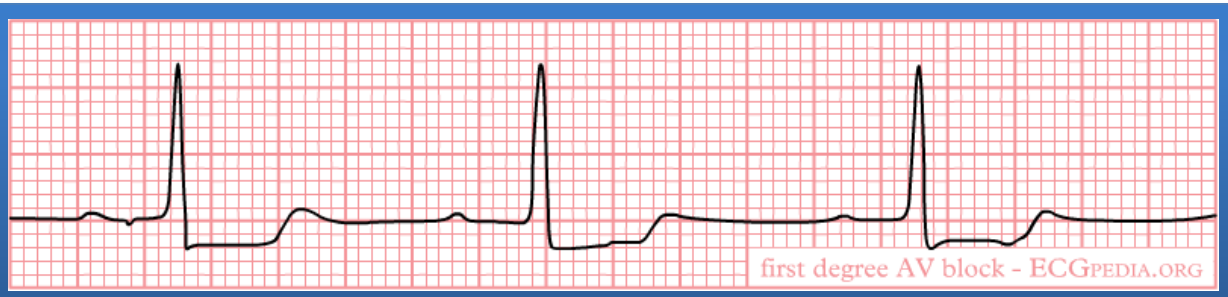
part of cardionetworks.org

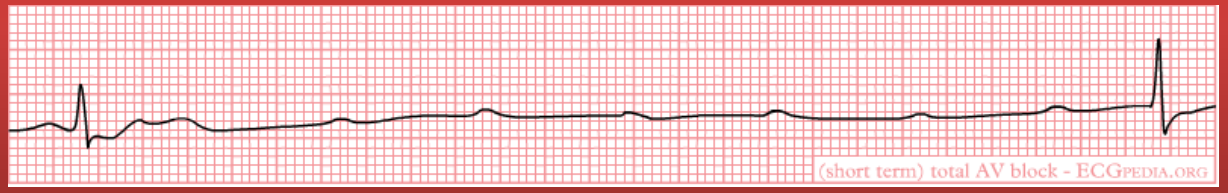
1e graads AV blok



2e graads AV blok I
Wenkebach

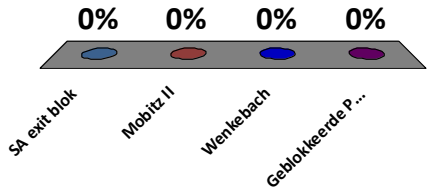
2e graads AV blok II
Mobitz

3e graads AV blok
Totaal AV blok



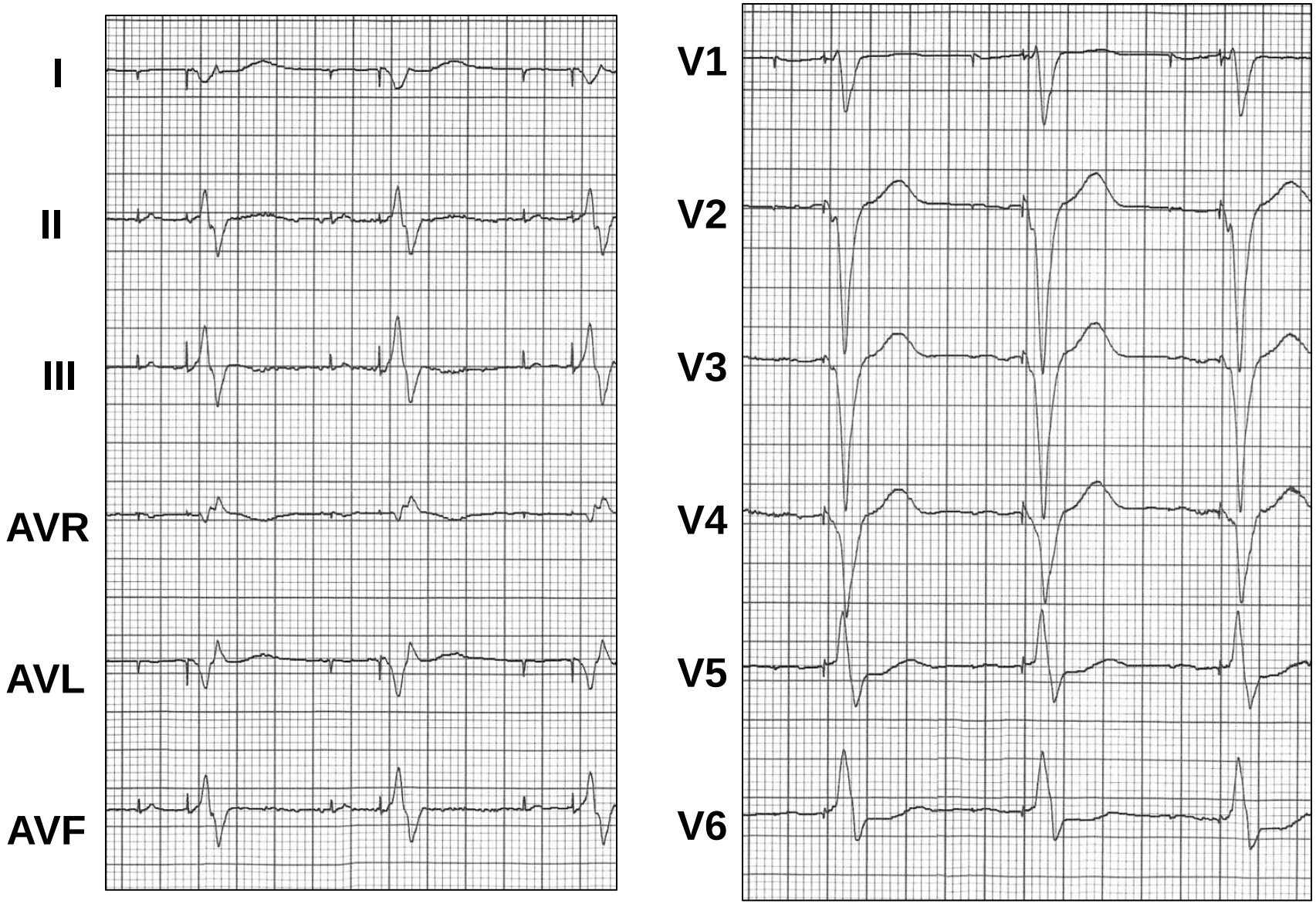
Wat is dit voor blok?

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



Geleidingsstoornissen

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


I
II
III
AVR
AVL
AVF
V1
V2
V3
V4
V5
V6

Ritmestoornissen

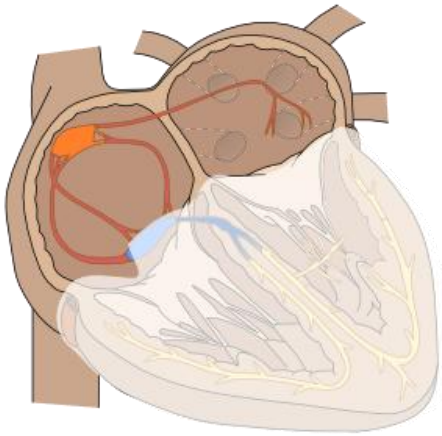
Geen sinusritme? Tachycardie?

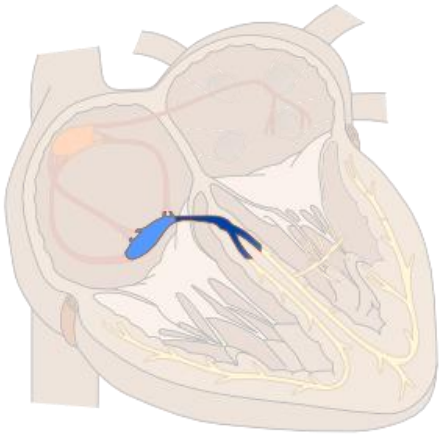
Supraventricular

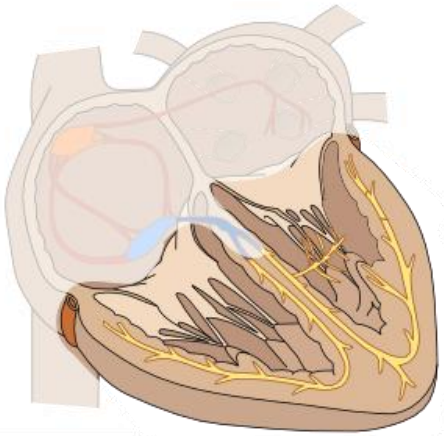
Atrial

Nodal

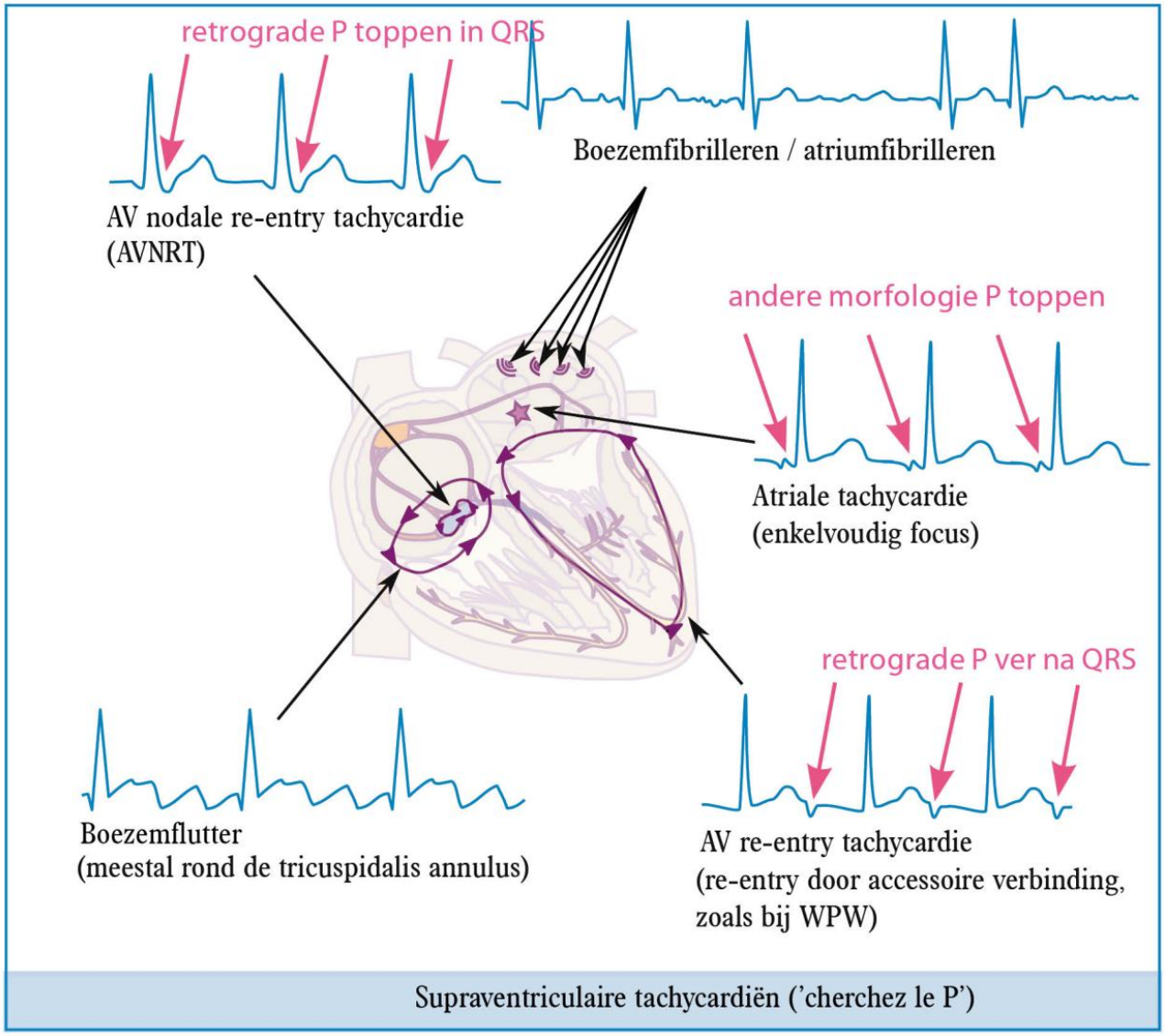
Ventricular



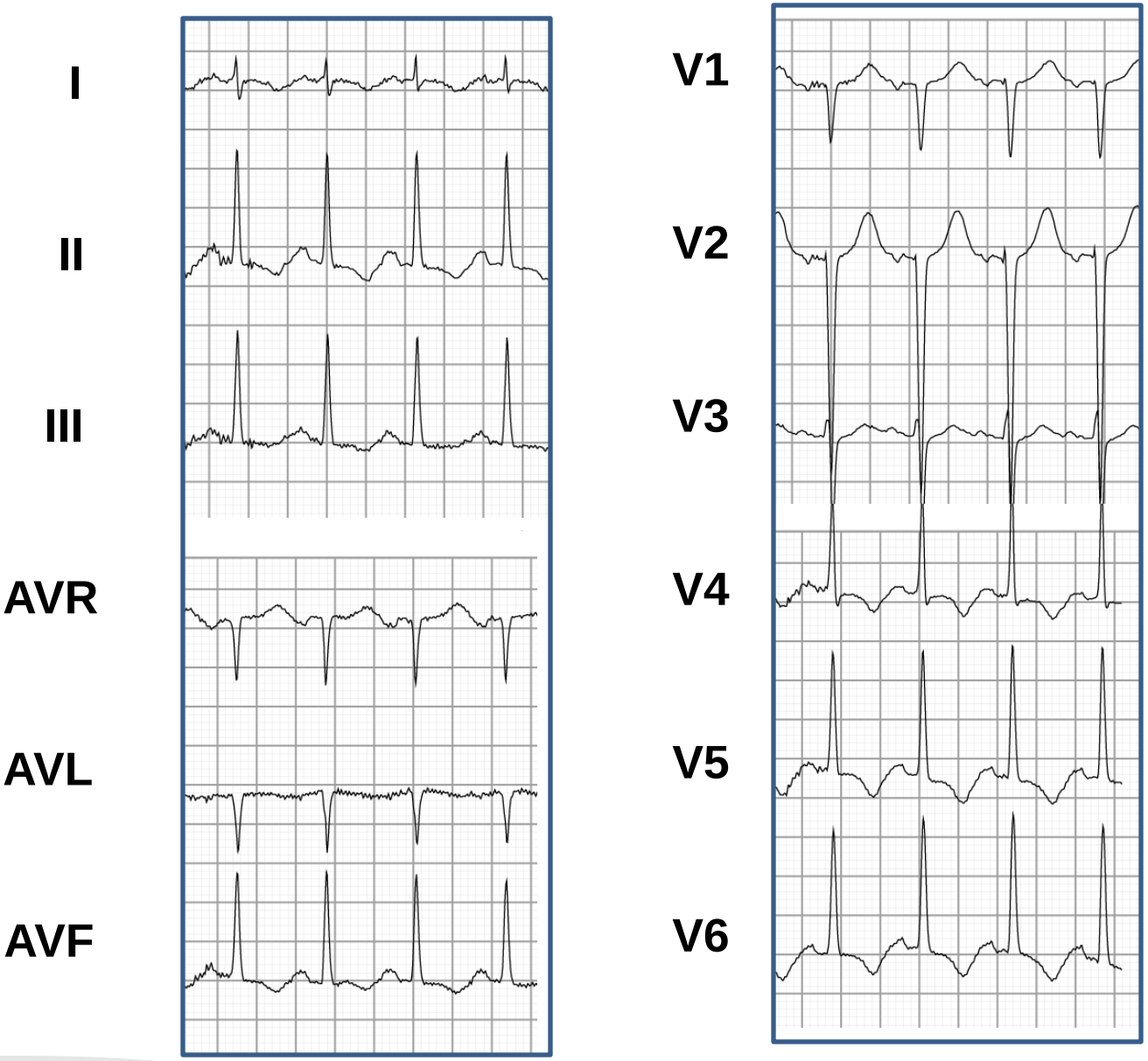




SVT?

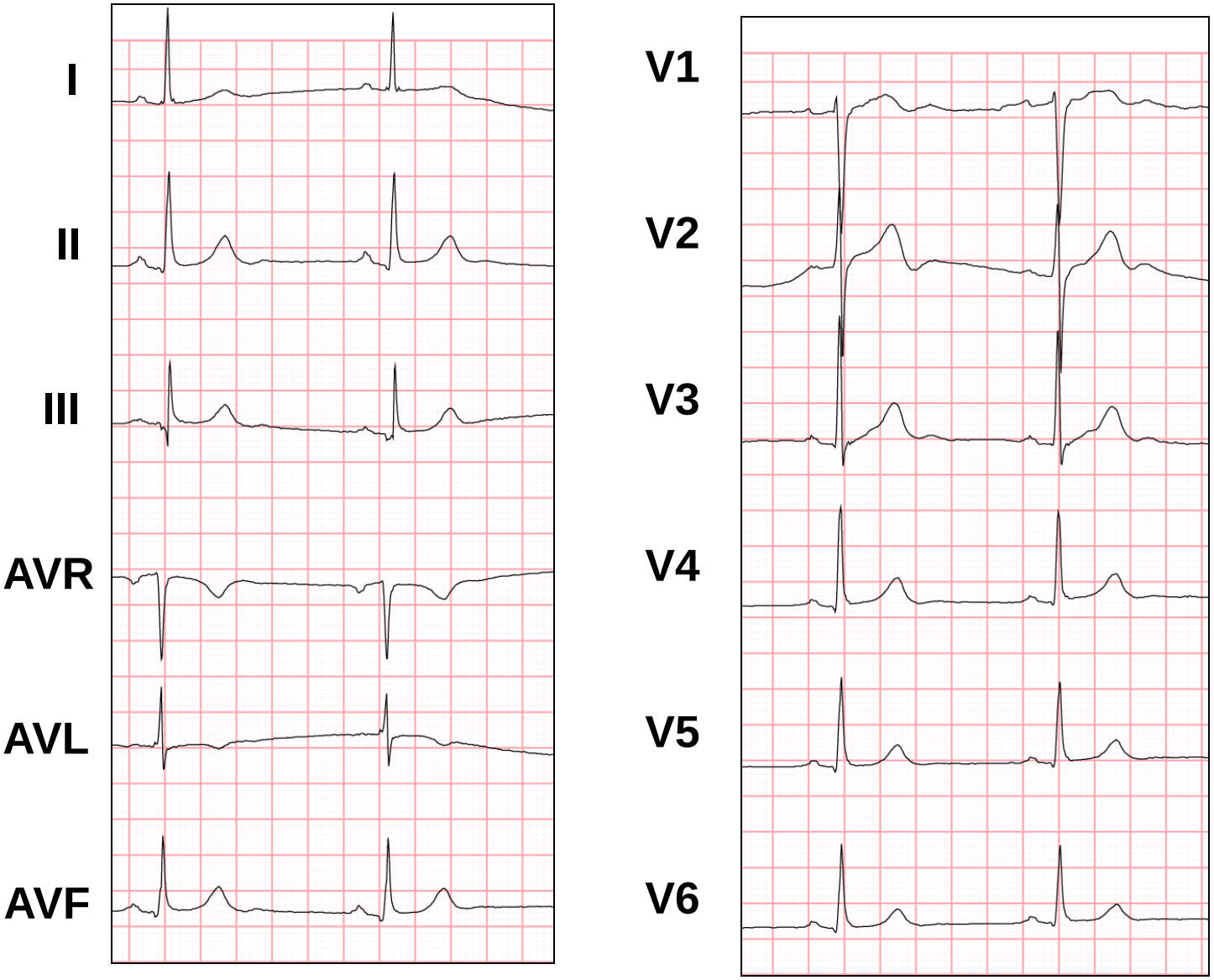

retrograde P toppen in QRS
Boezemfibrilleren / atriumfibrilleren
AV nodale re-entry tachycardie
(AVNRT)
andere morfologie P toppen
Atriale tachycardie
(enkelvoudig focus)
retrograde P ver na QRS
Boezemflutter
(meestal rond de tricuspidalis annulus)
AV re-entry tachycardie
(re-entry door accessoire verbinding,
zoals bij WPW)
Supraventriculaire tachycardiën (’cherchez le P’)

Sinustachycardie

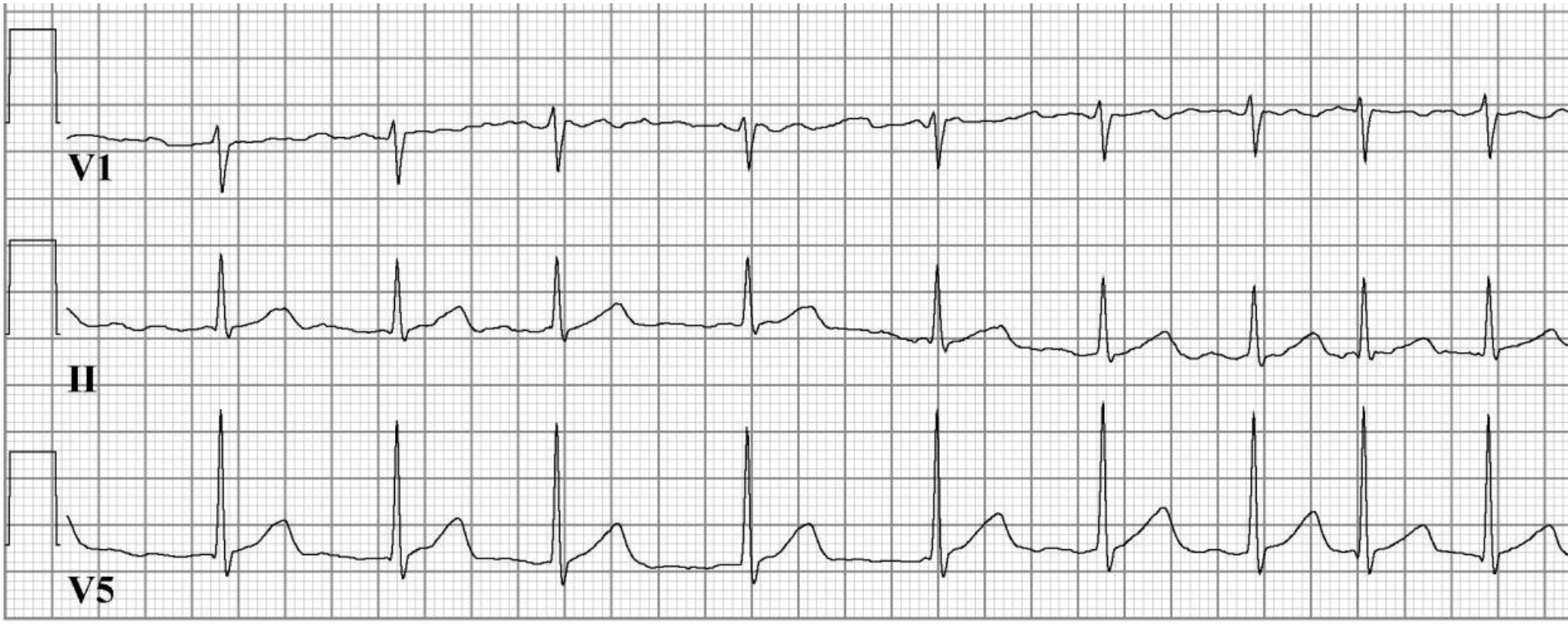


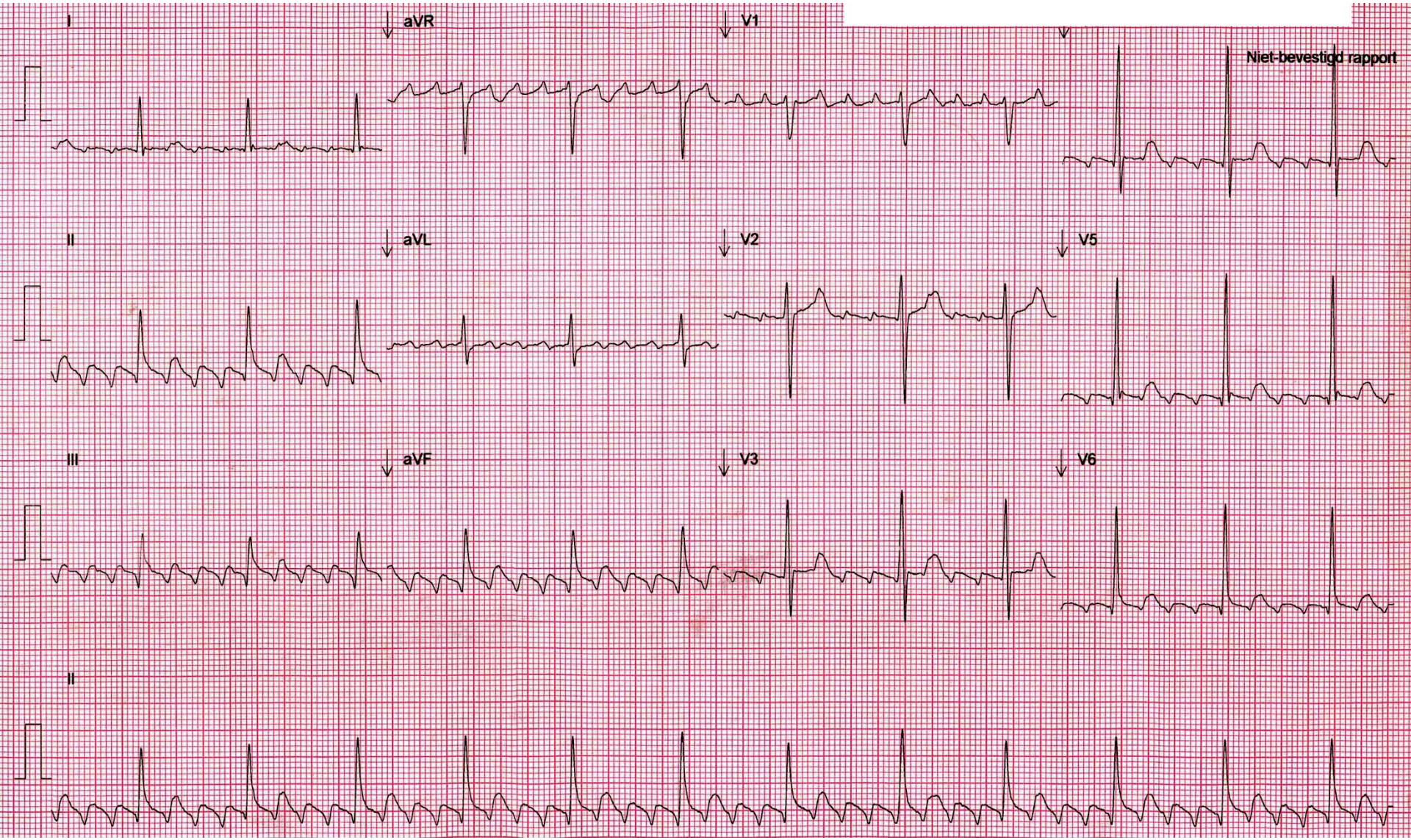
Courtesy of I.A.C. van der Bilt

Sinusbradycardie

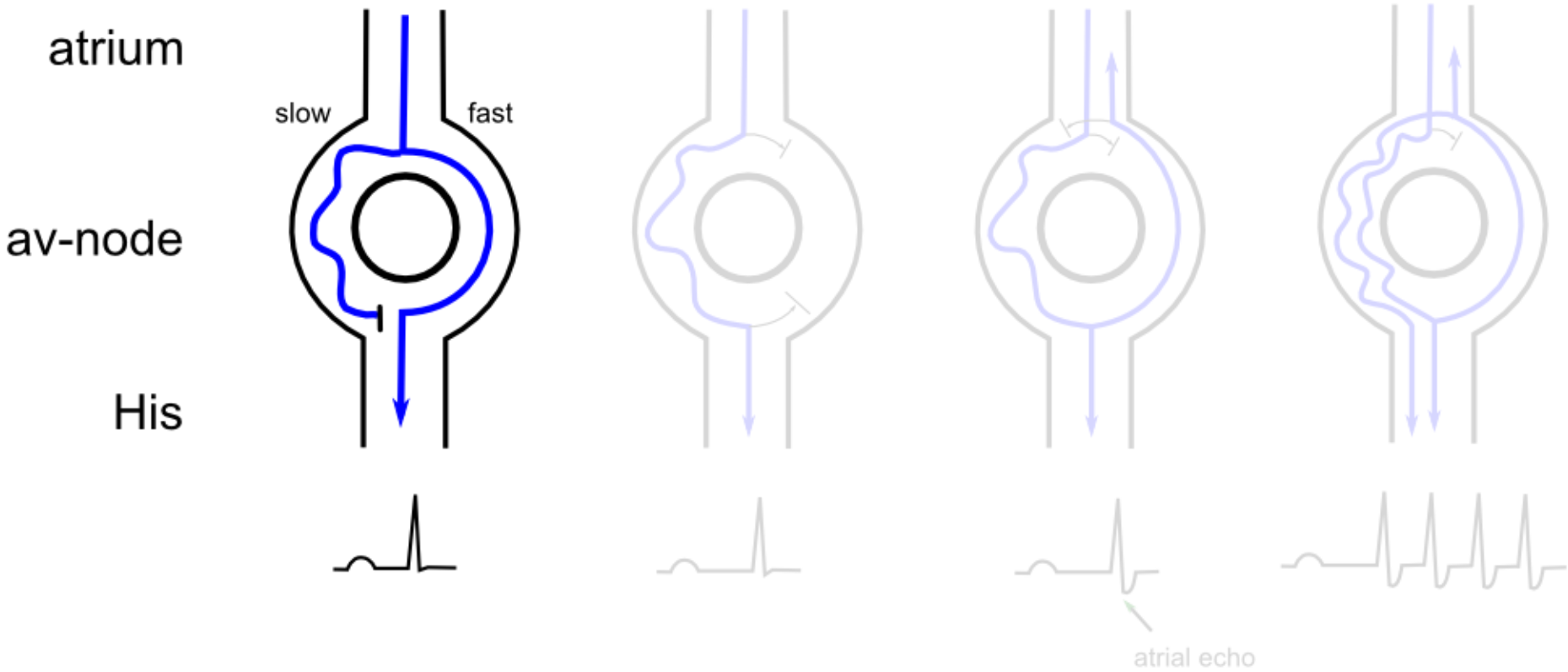


Courtesy of I.A.C. van der Bilt

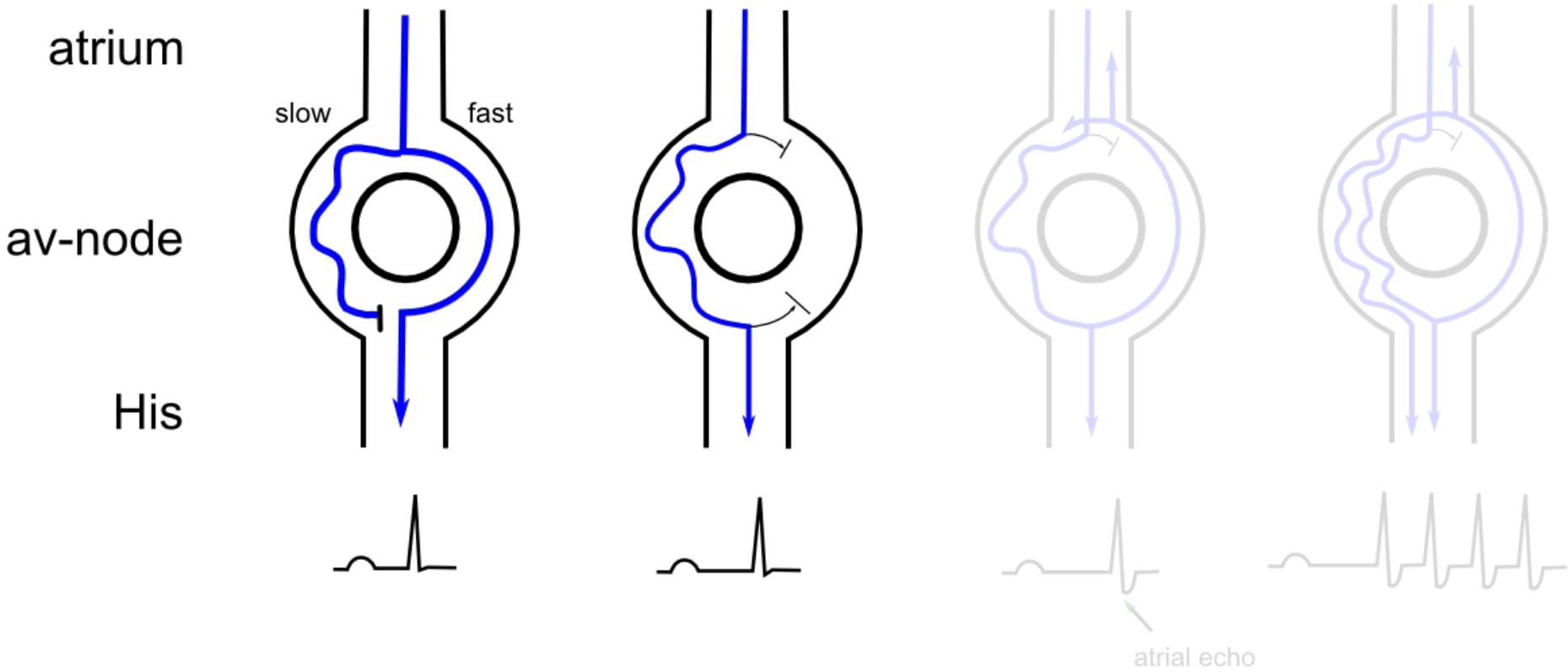

V1
II
V5


I
aVR
V1
Niet-bevestigd rapport
II
aVL
V2
V5
III
aVF
V3
V6
II

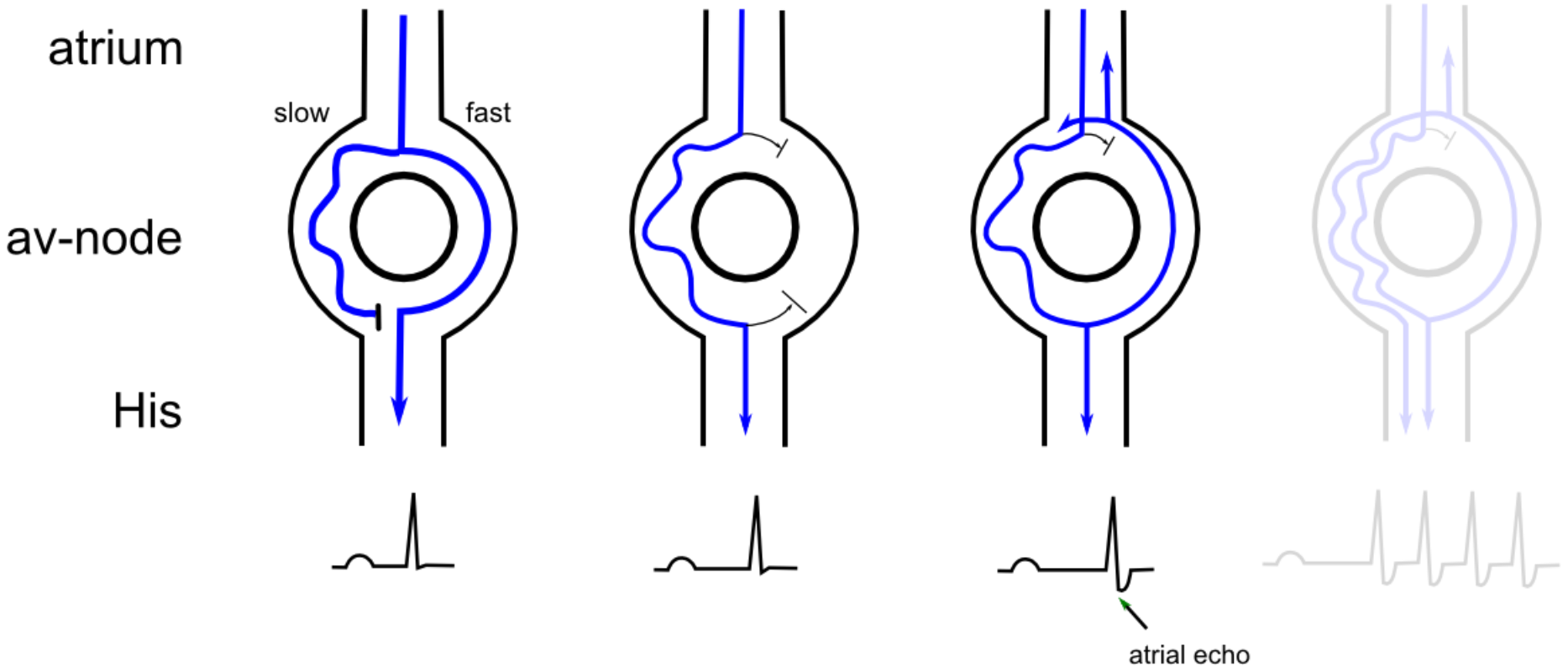
Re-entry



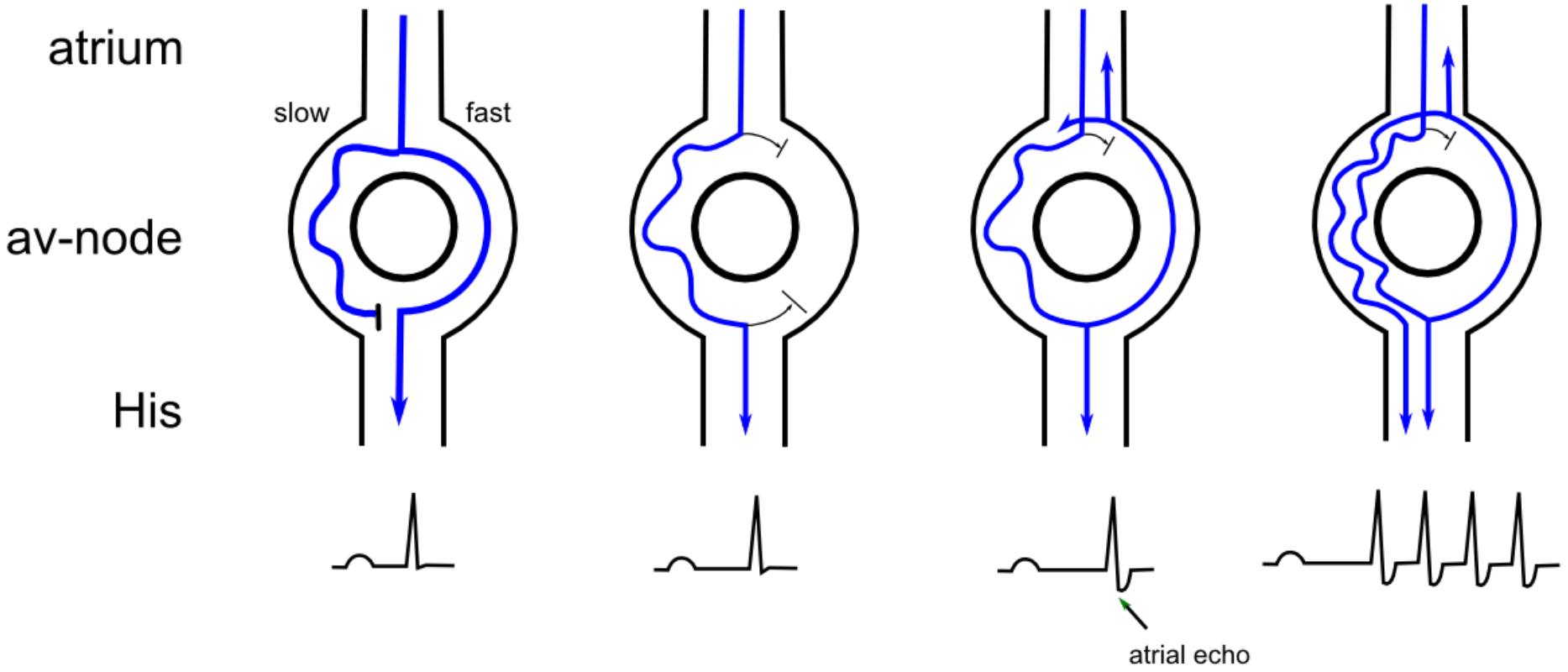
Re-entry

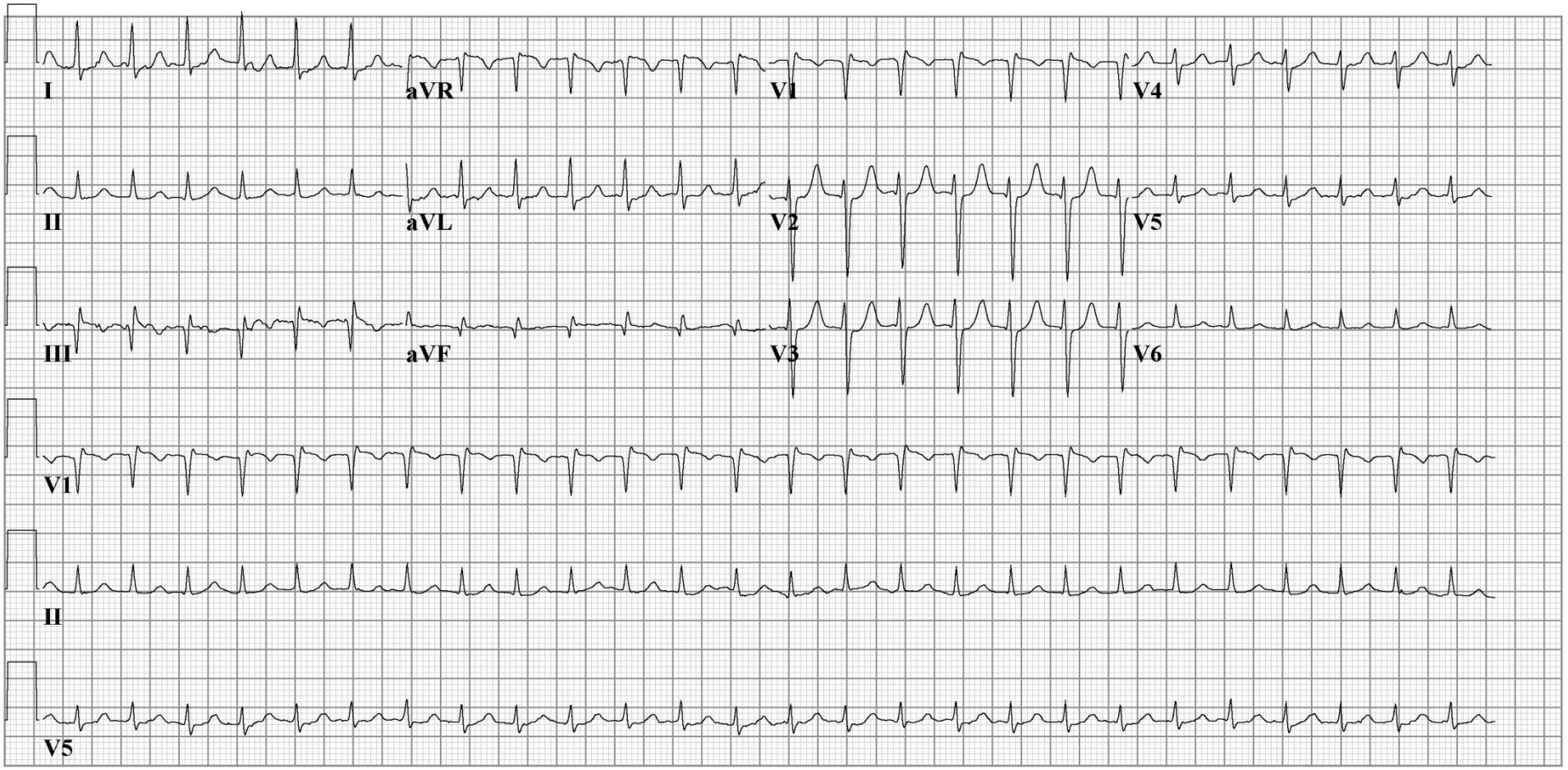


Re-entry

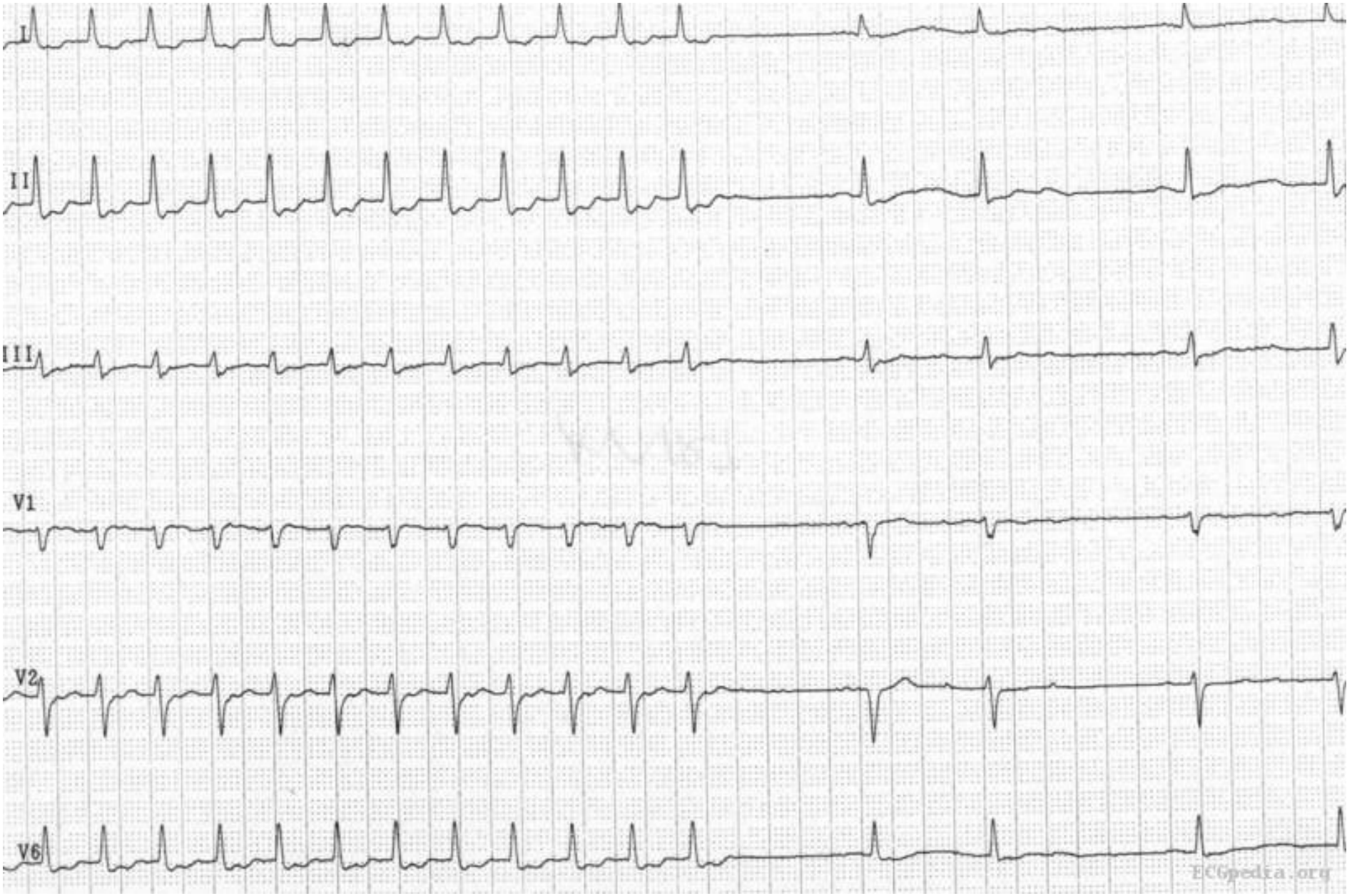


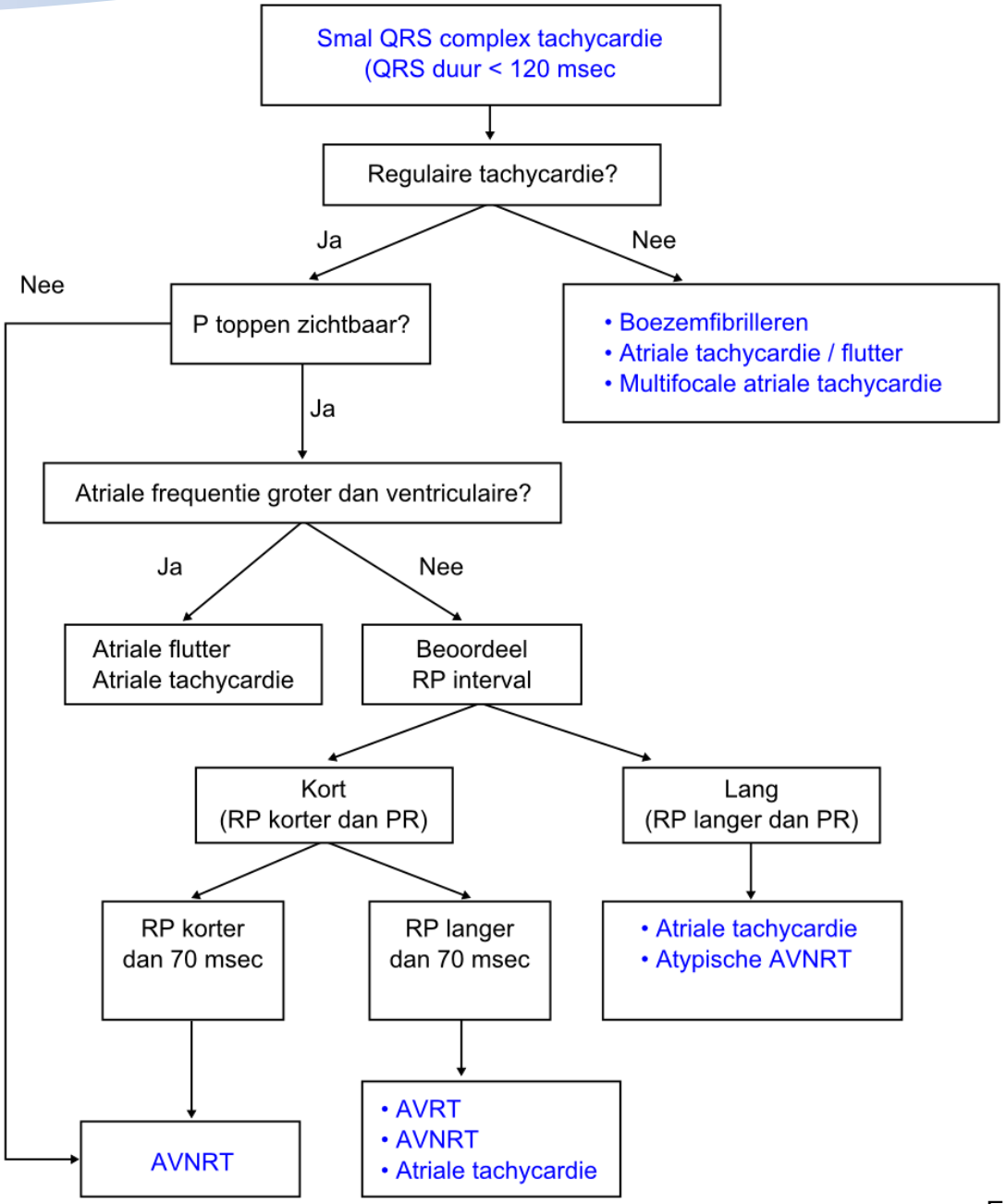
Re-entry



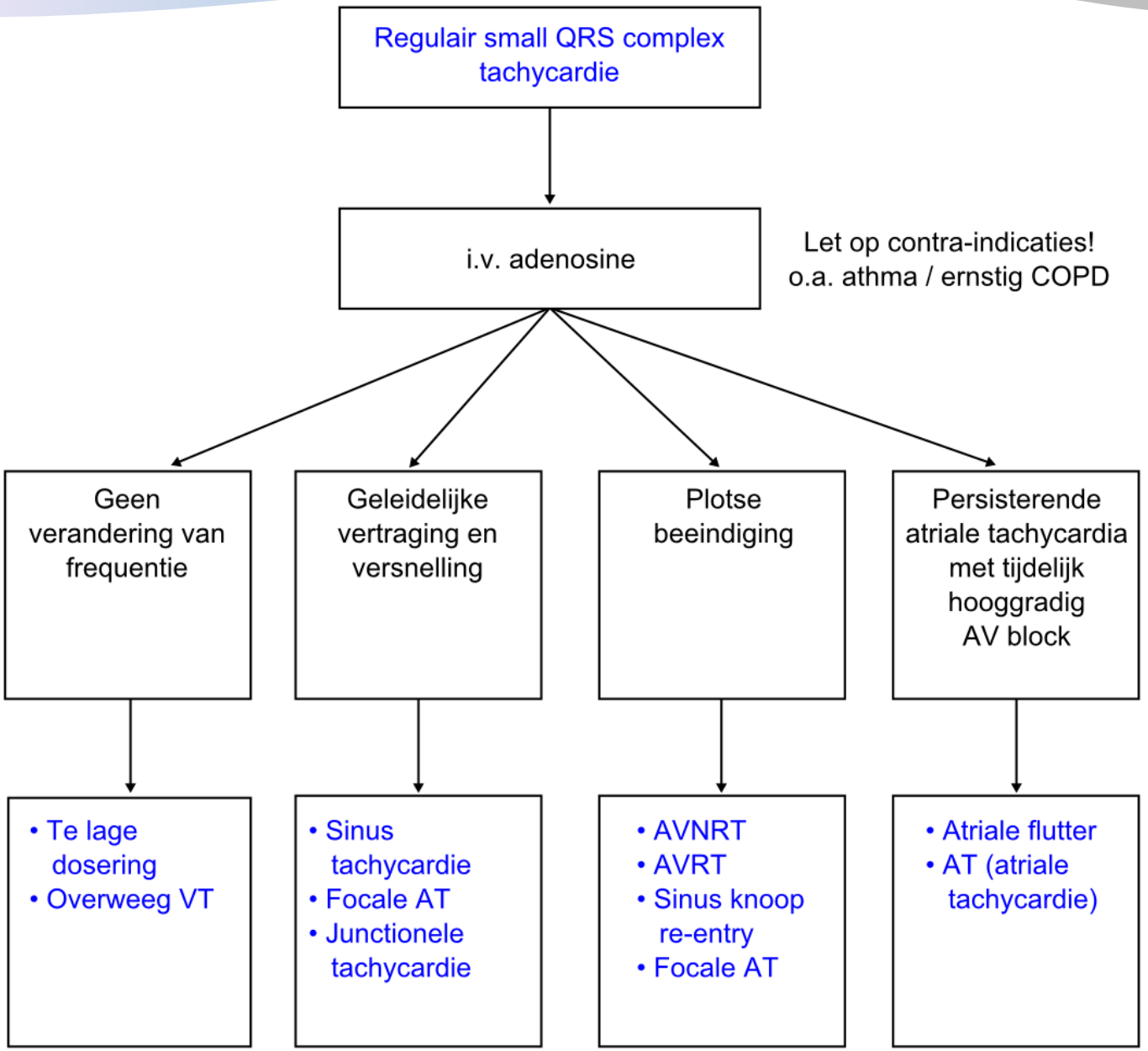

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5

Adenosine





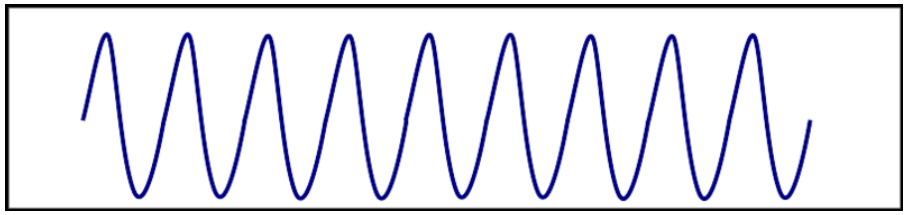
ESC / NVVC richtlijn SVT / VT



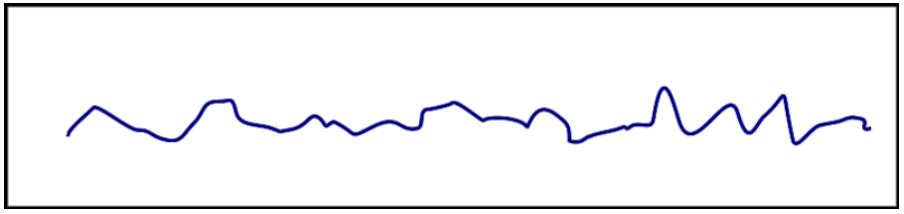
ESC / NVVC richtlijn SVT / VT

Ventriculaire tachycardie?

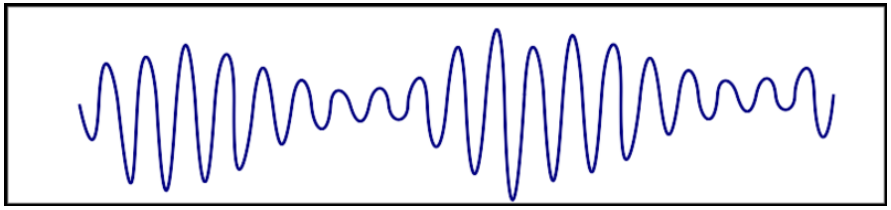
- Ventrikeltachycardie

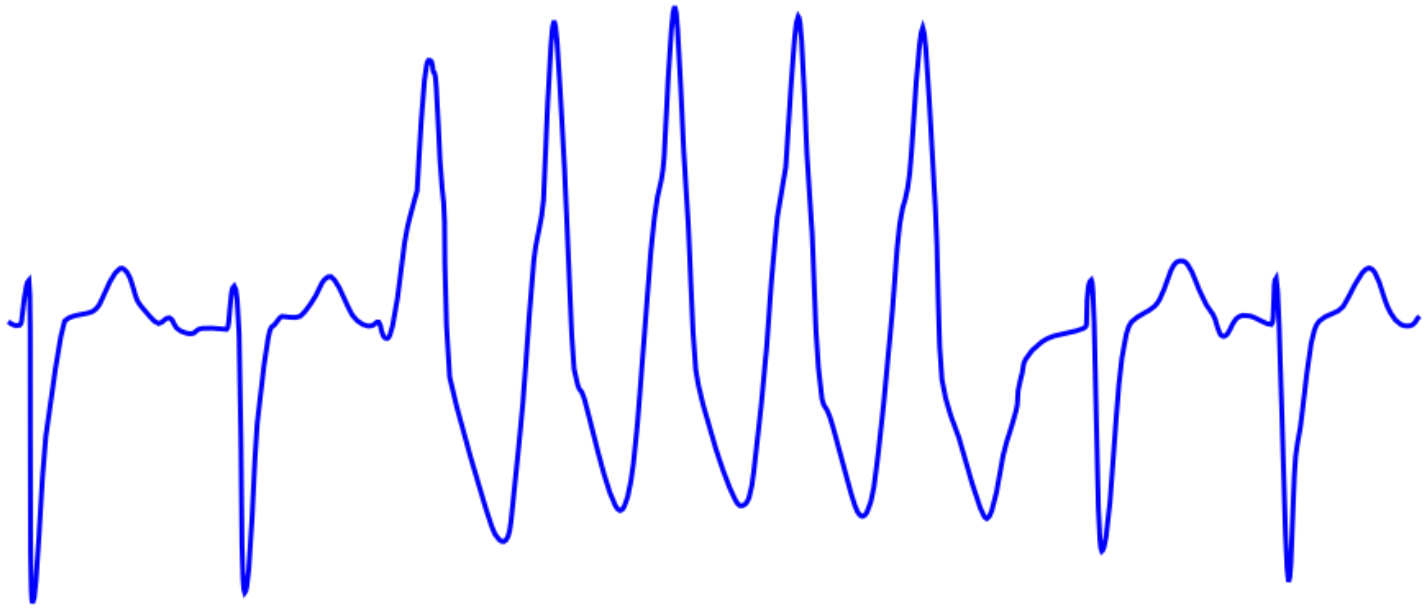


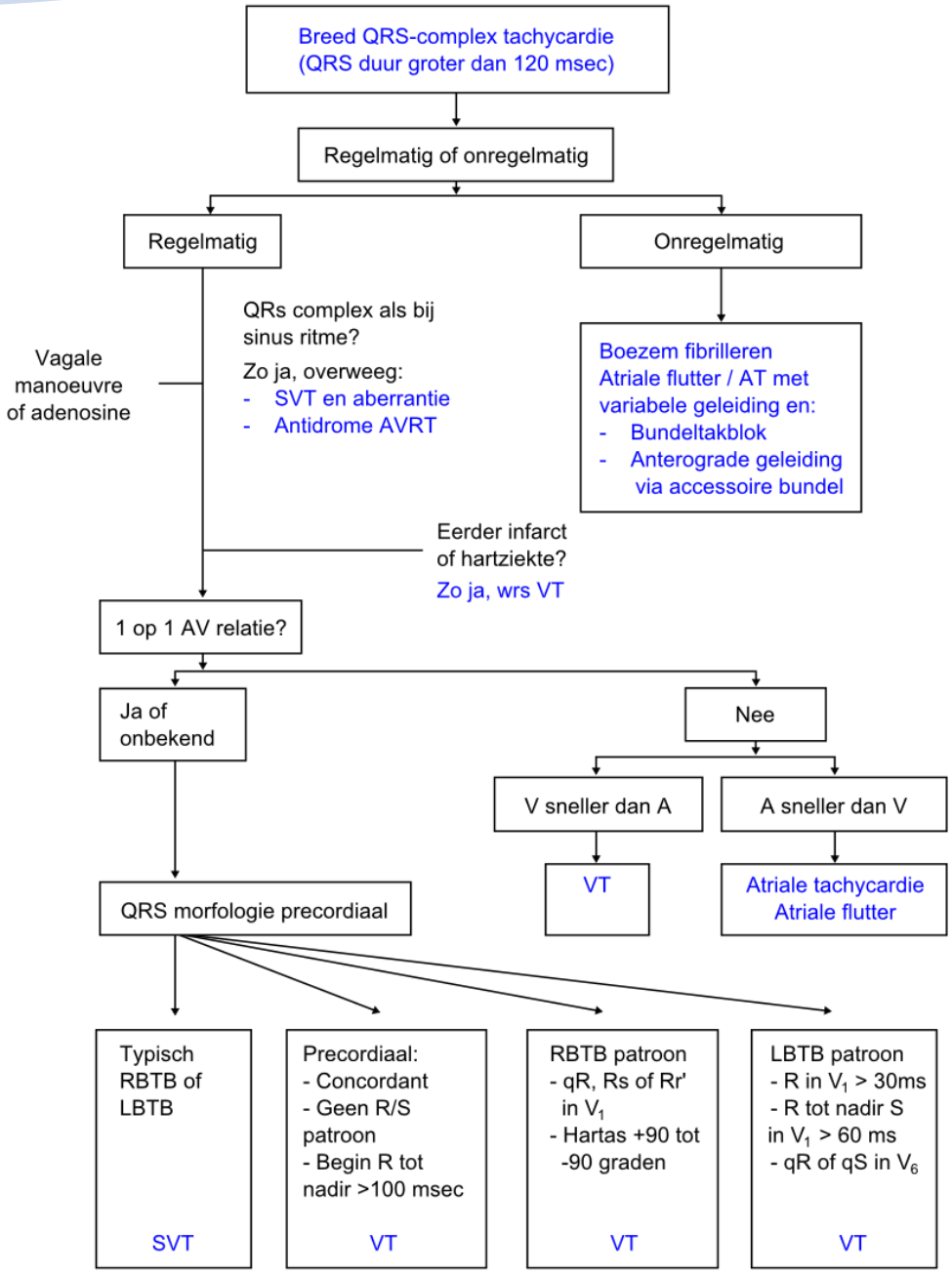
- Ventrikelfibrilleren



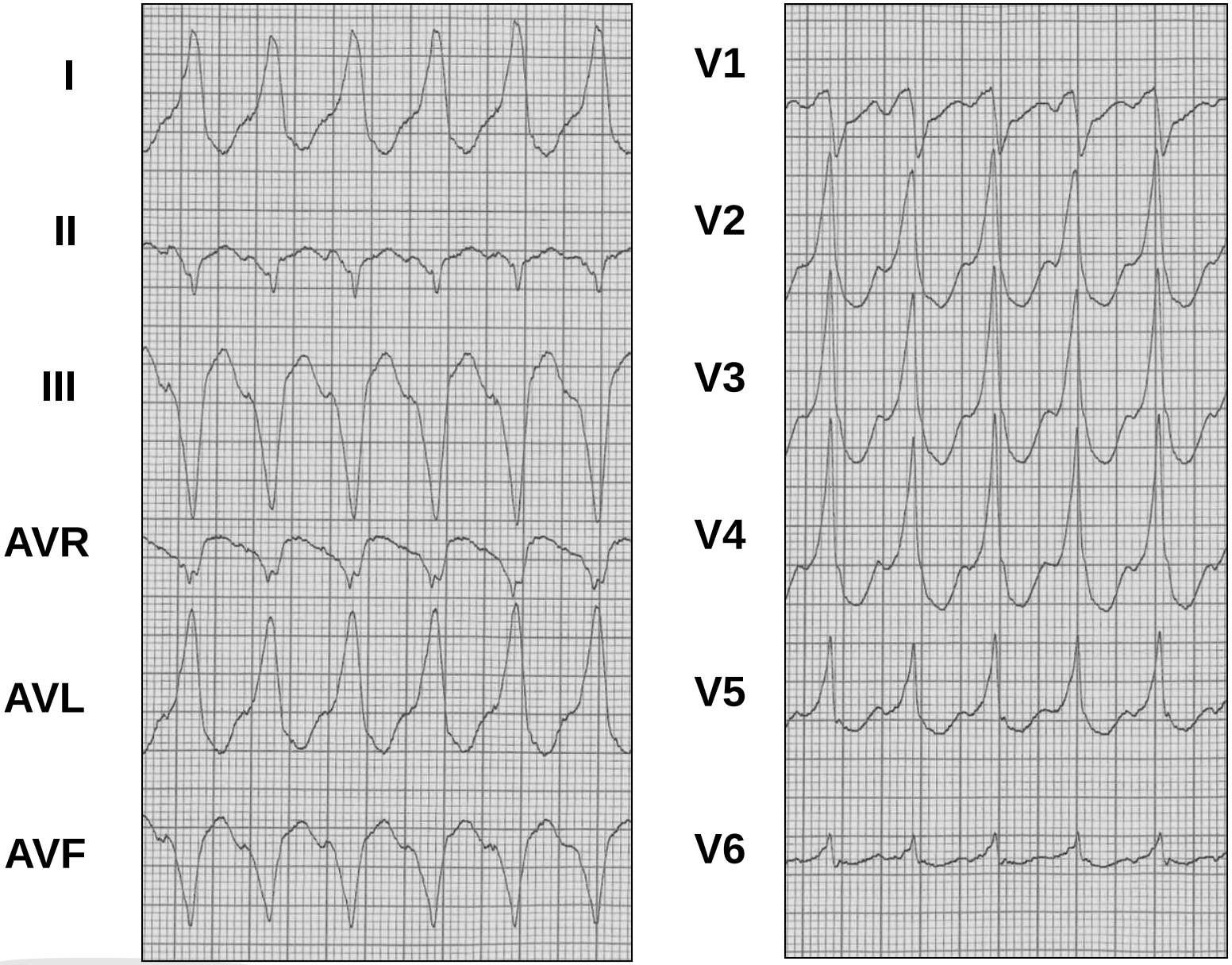
- Torsade de Pointes

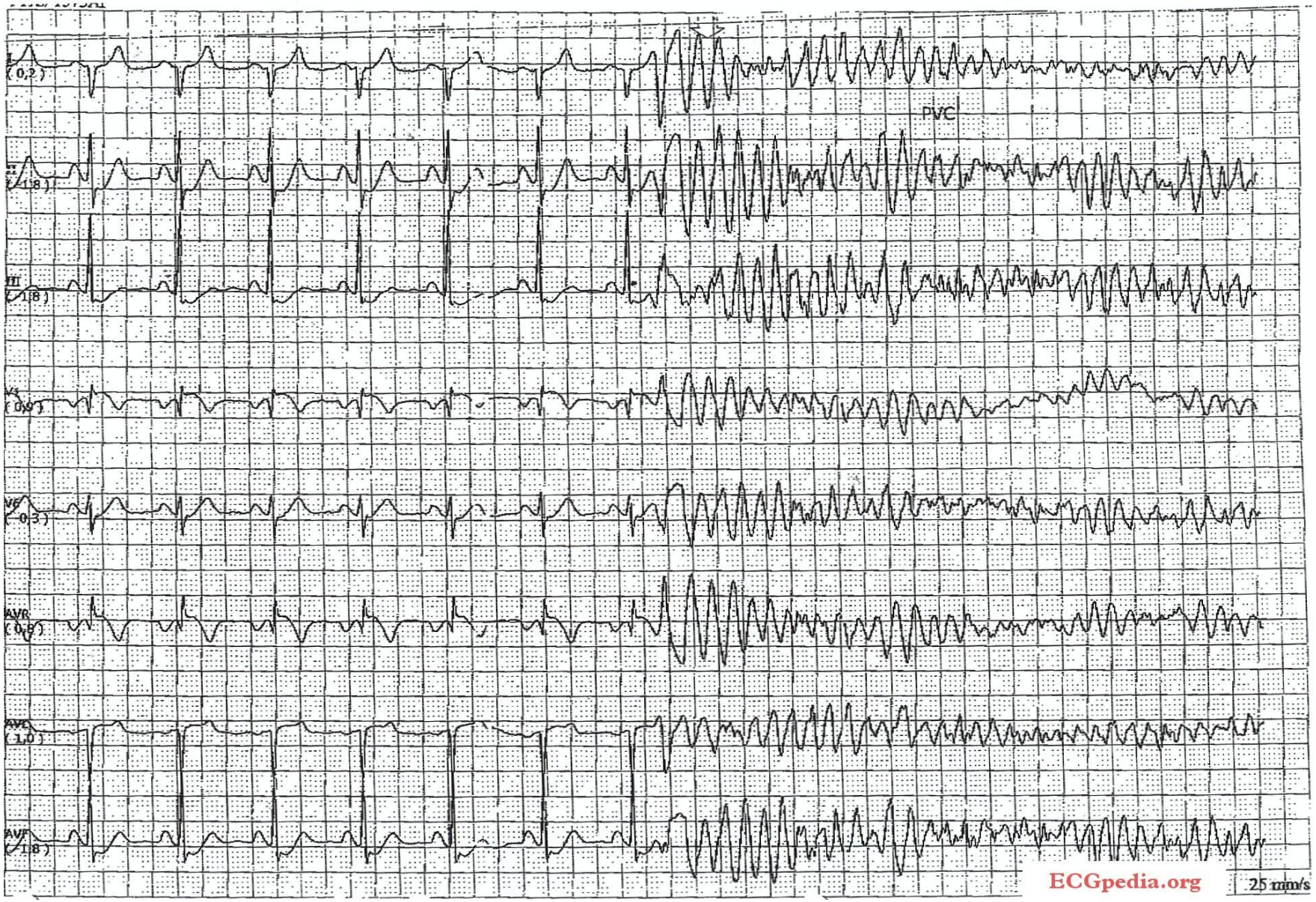




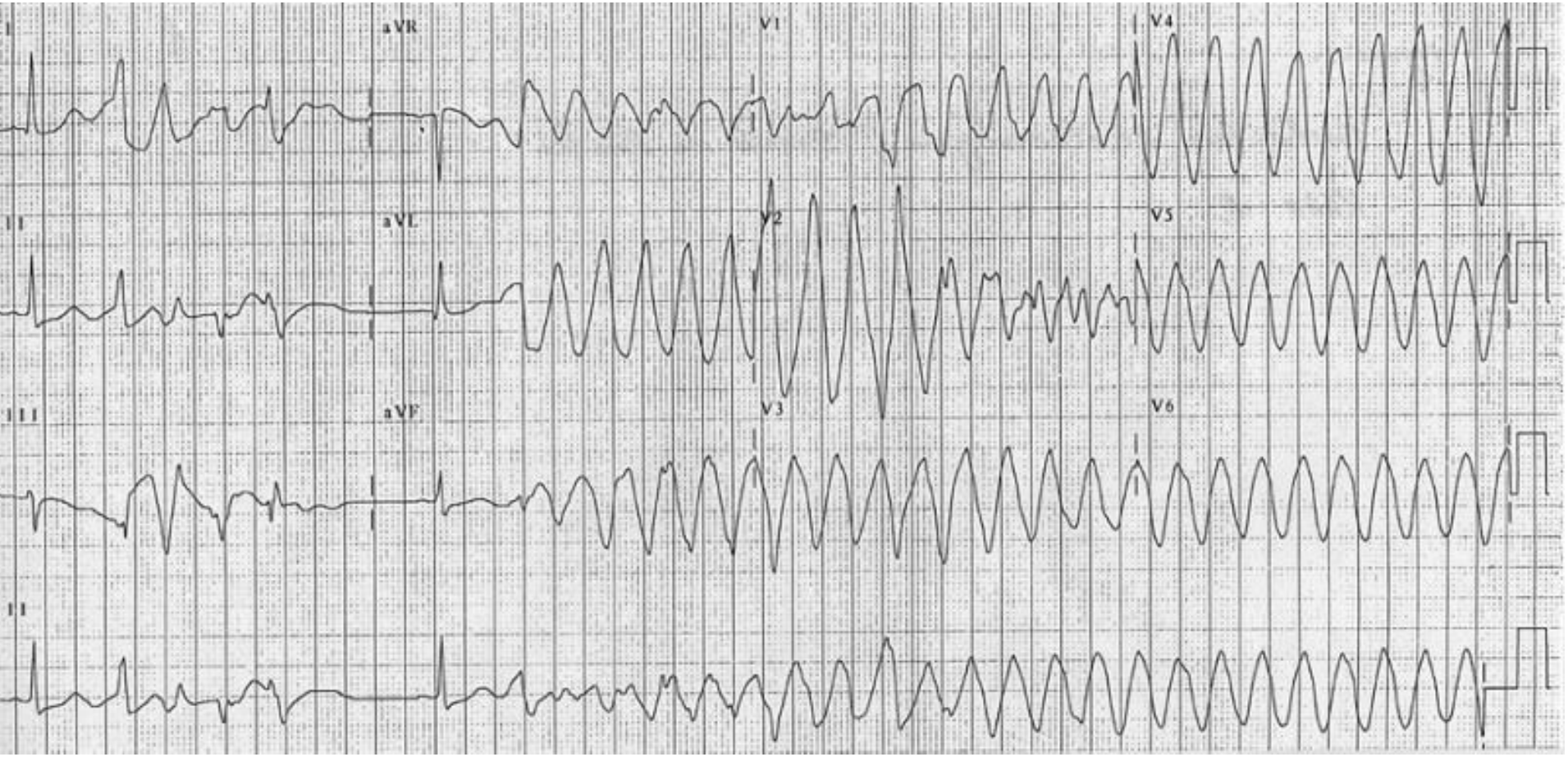


ESC / NVVC richtlijn SVT / VT


I
II
III
AVR
AVL
AVF
V1
V2
V3
V4
V5
V6

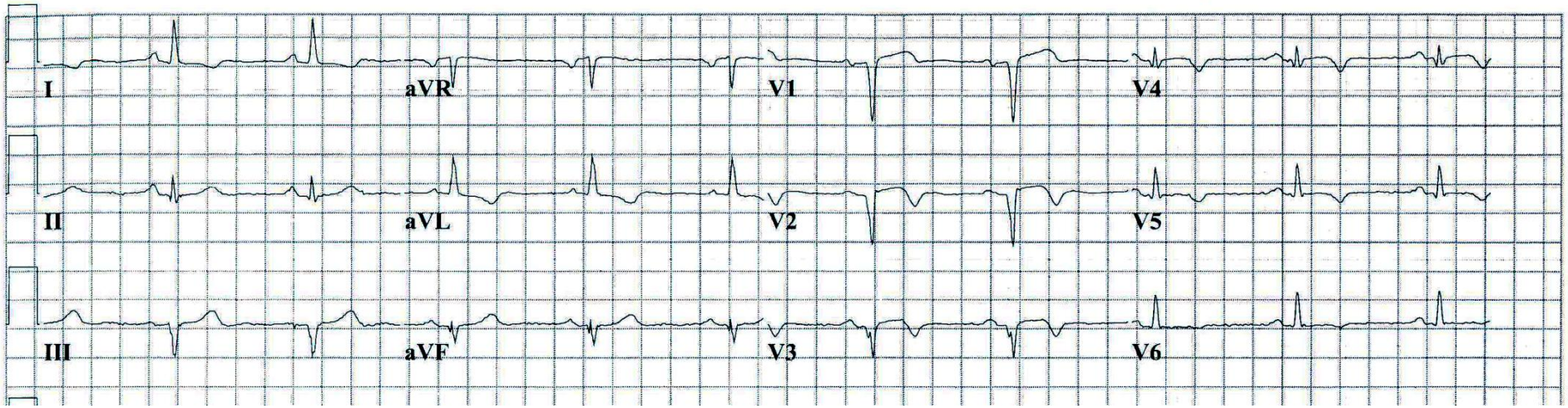


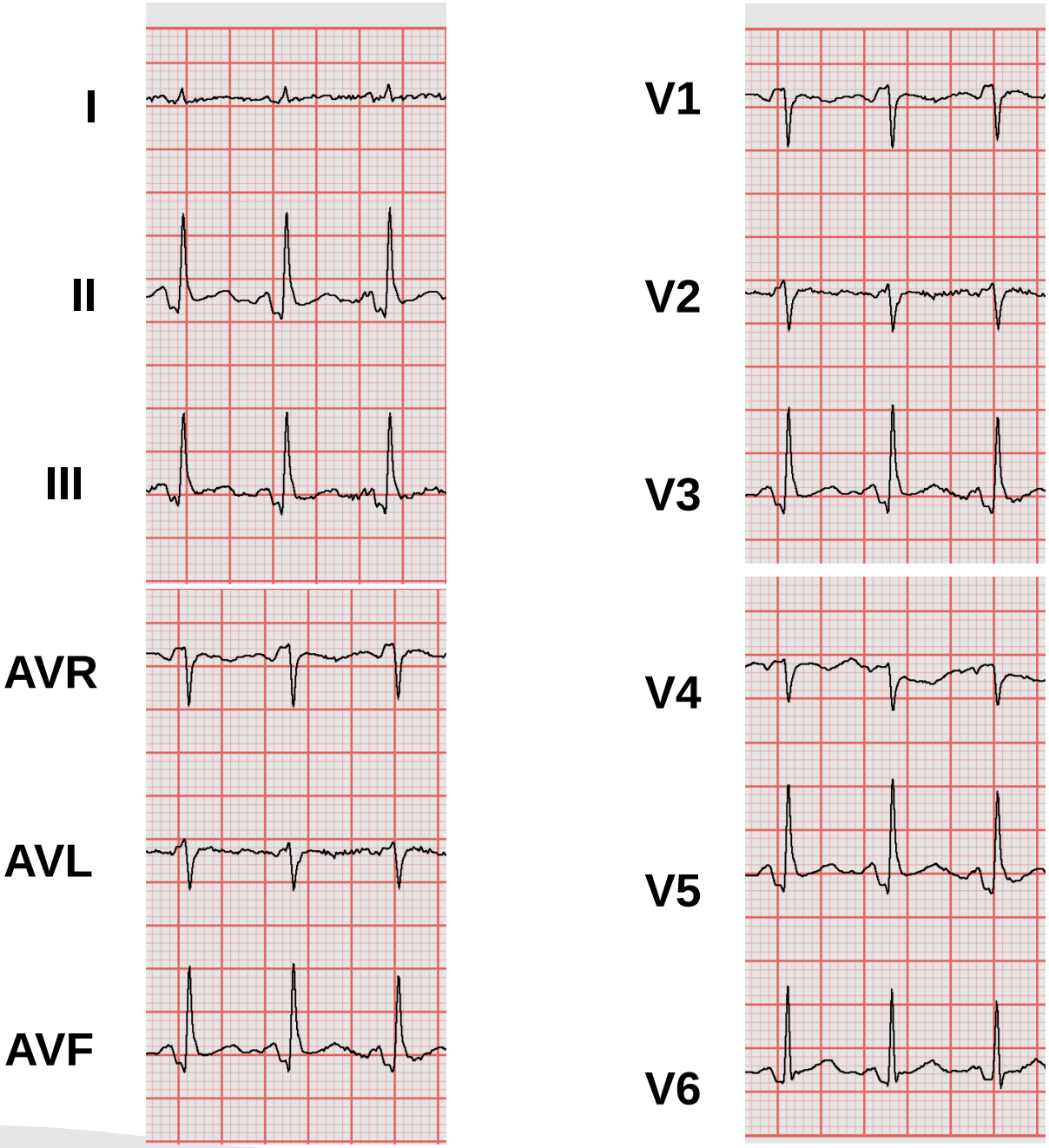
Ventrikelfibrilleren

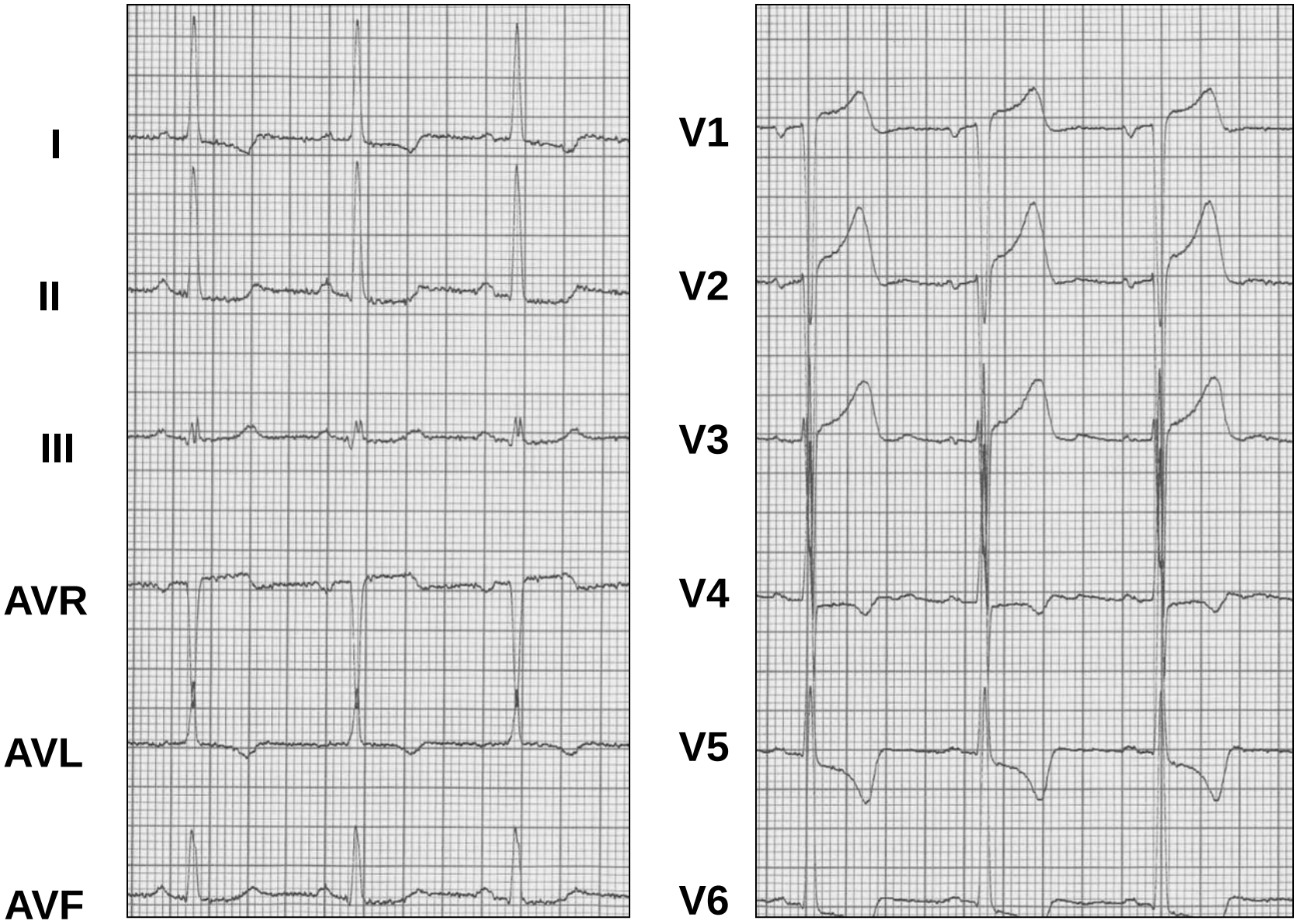


Torsade de Pointes

OEFENEN SYSTEMATISCH BEOORDELEN


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


I
II
III
AVR
AVL
AVF
V1
V2
V3
V4
V5
V6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II
III
AVR
AVL
AVF
V1
V2
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V5
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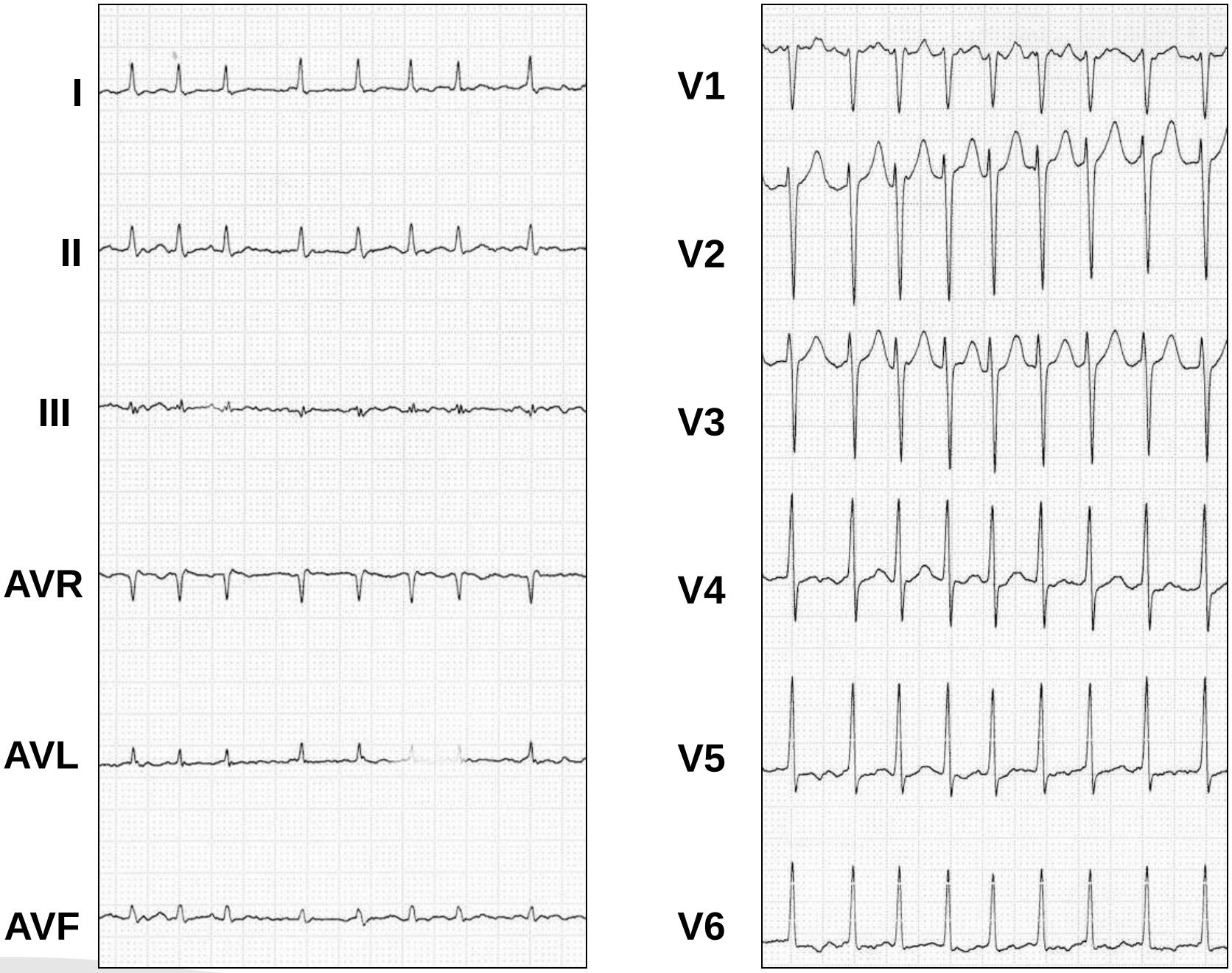
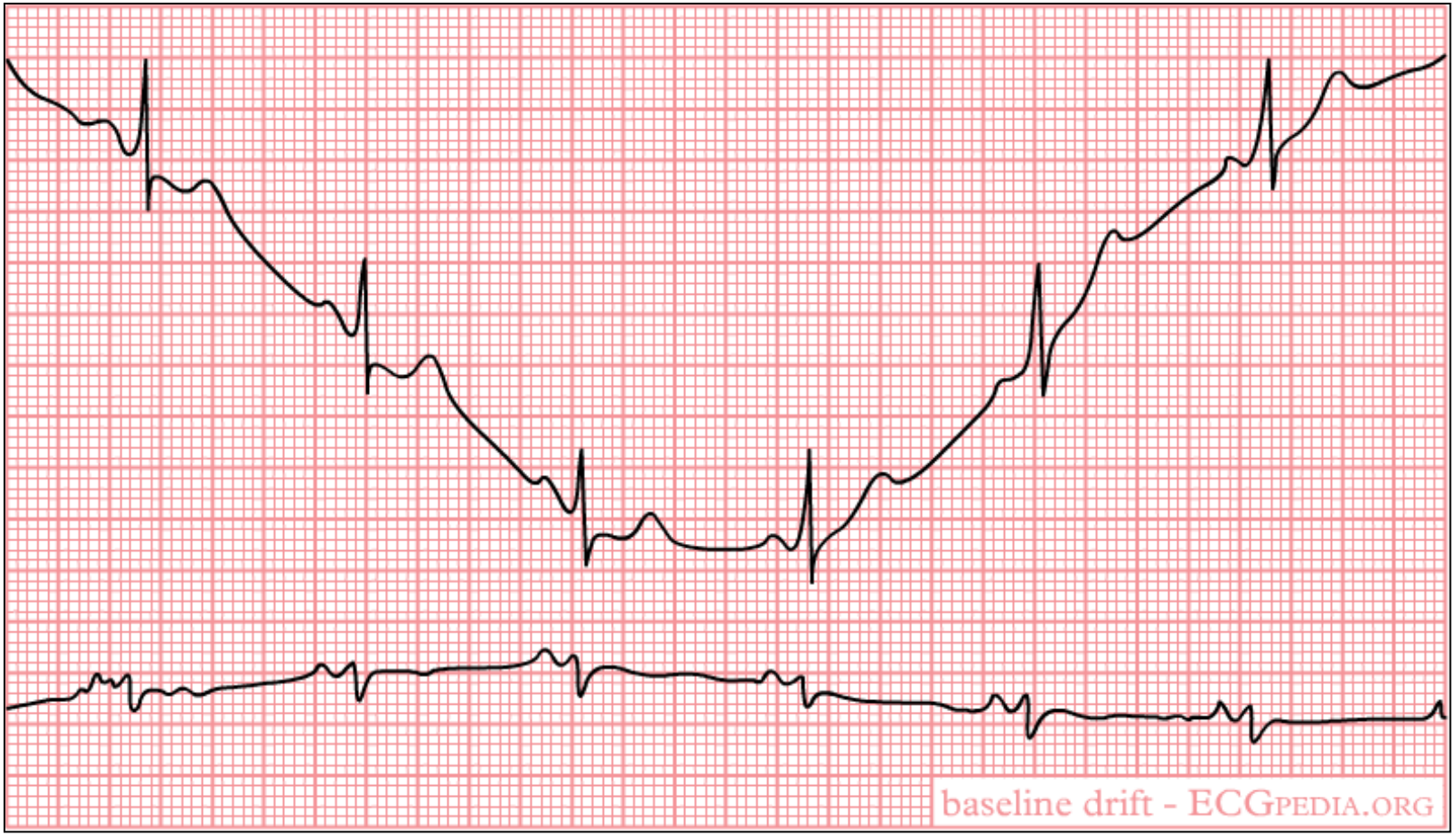

I
II
III
AVR
AVL
AVF
V1
V2
V3
V4
V5
V6

Technische problemen

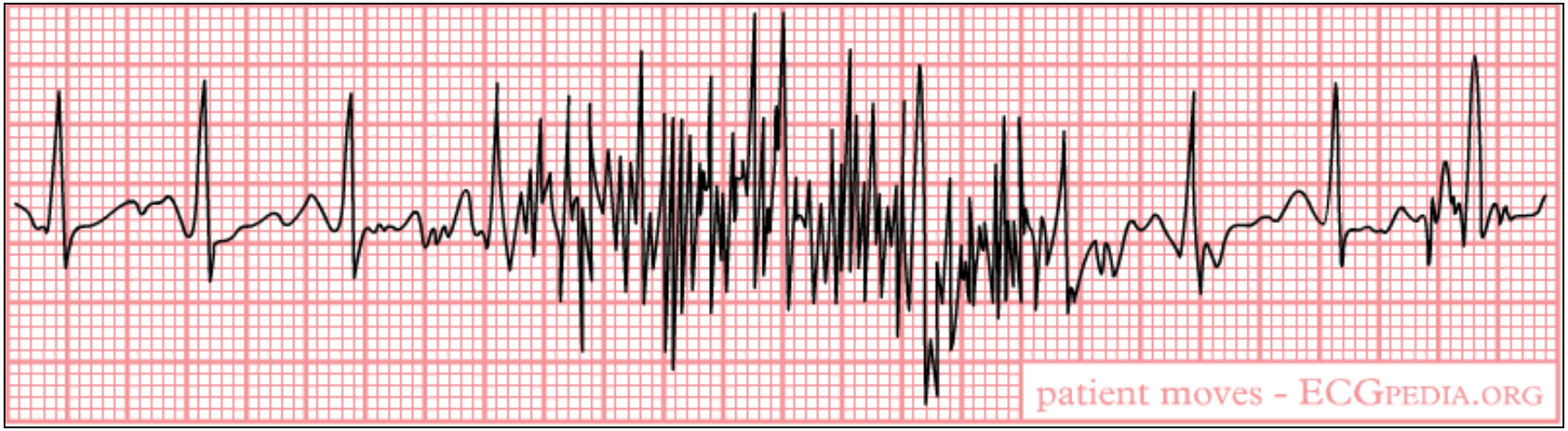
Technische problemen

Baseline drift



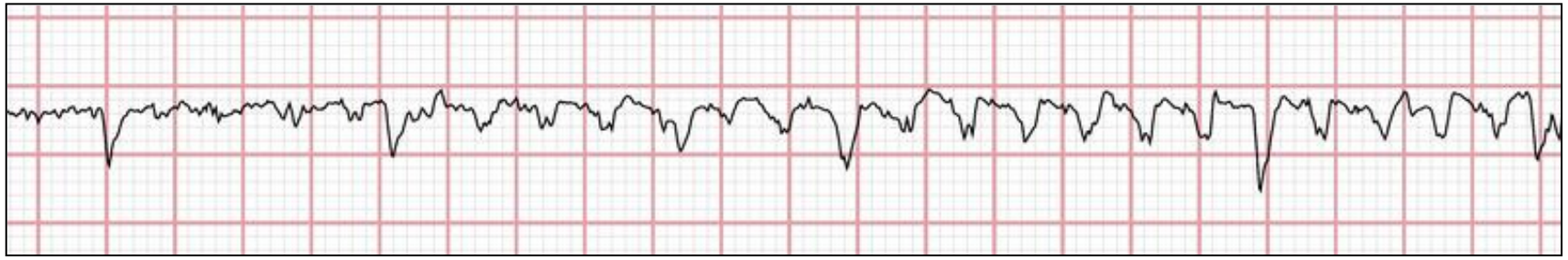
Technische problemen

Bewegingsartefacten



Technische problemen

Parkinson

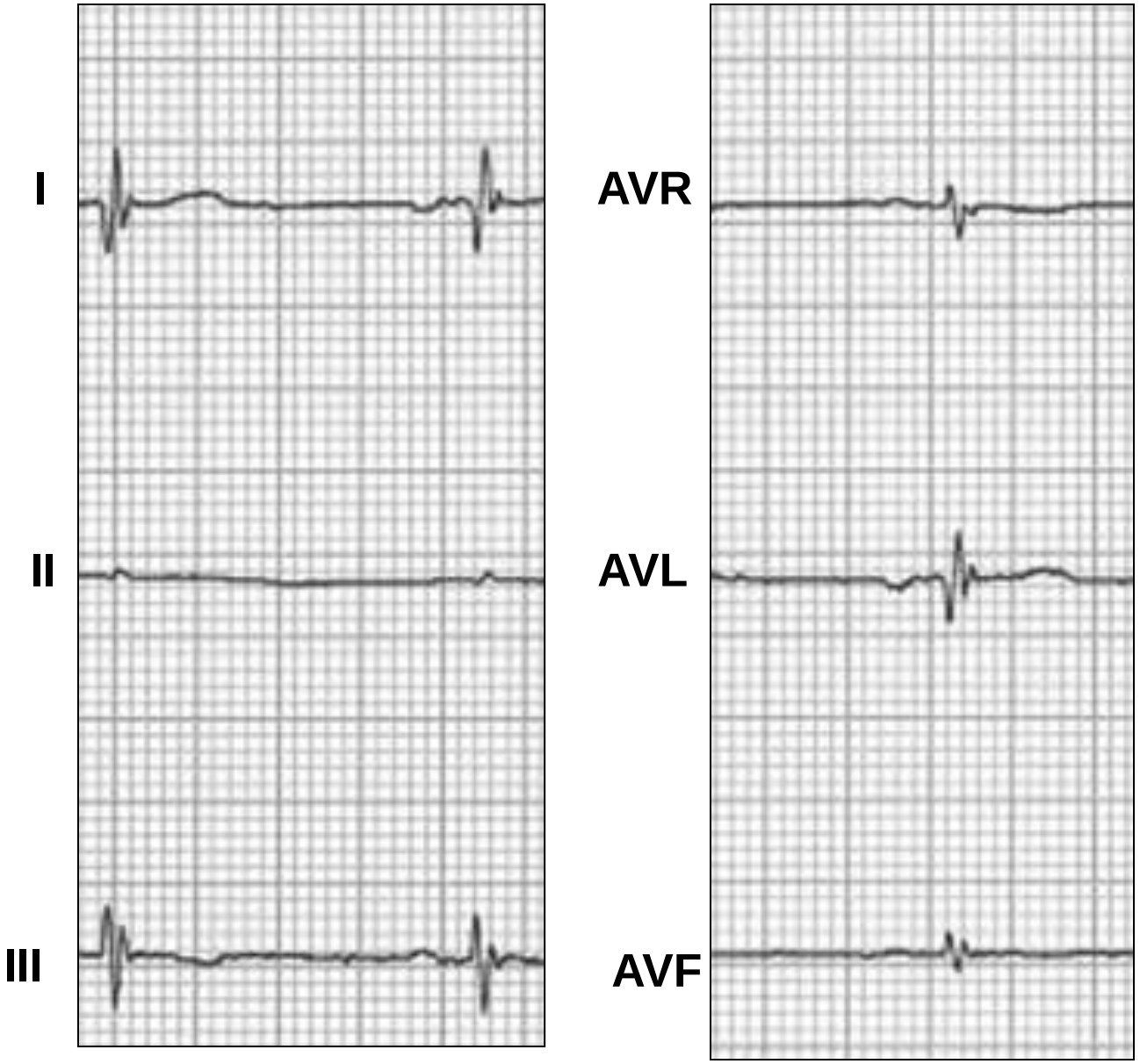


Technische problemen

Draadverwisselingen

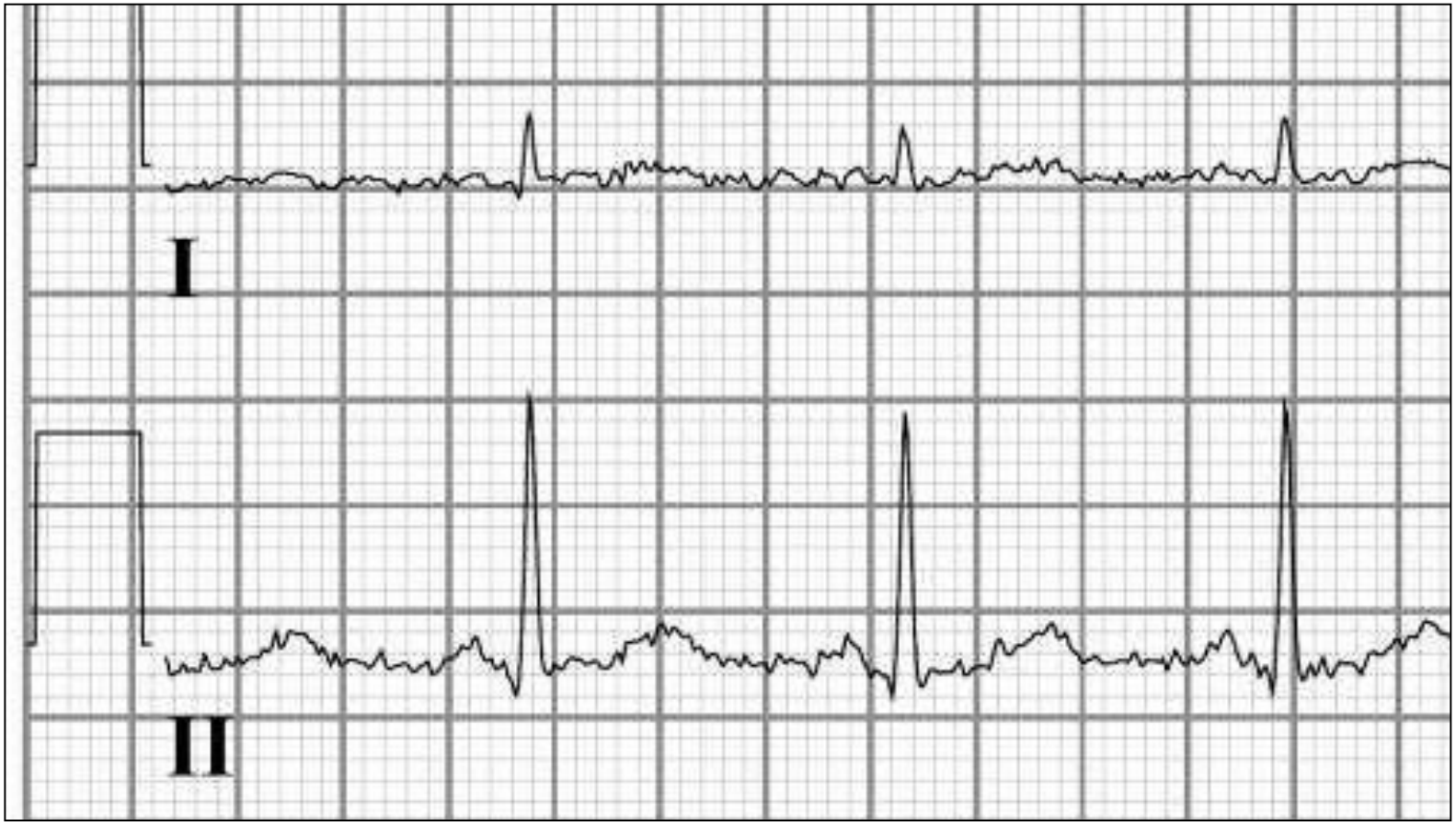
Technische problemen

Draadverwisselingen



Technische problemen

Elektrische interferentie



Technische problemen

Elektrische interferentie