

“Dokter, het fladdert alle kanten op in mn borst”

Boezem- en Kamerritmestoornissen

Dr. Alexander Hilt, AIOS cardiologie LUMC

NVHVV congress 28-5-2024



DISCLOSURES

geen



Foto afkomstig van
website Efteling.com,
2017

SVT en VT:
hier zijn de
boeken nog
niet over
gesloten...



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[Hendrik Conscience Heritage Library in Antwerp](#)

Date 25 July 2016, 22:57:29

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Author [Missmaretta](#)photography

Aritmieen

A pianist is composing classical music from irregular heartbeats, to help diagnose patients

Flauti 1, 2

Oboi 1, 2

*Clarineti 1, 2
in B \flat*

Fagotti 1, 2

*Corni 1, 2
in E \flat*

*Trombe 1, 2
in C*

*Timpani
in C, G*

Violino I

Violino II

Viola

Violoncello

Contrabasso

20 September 2017, 16:16

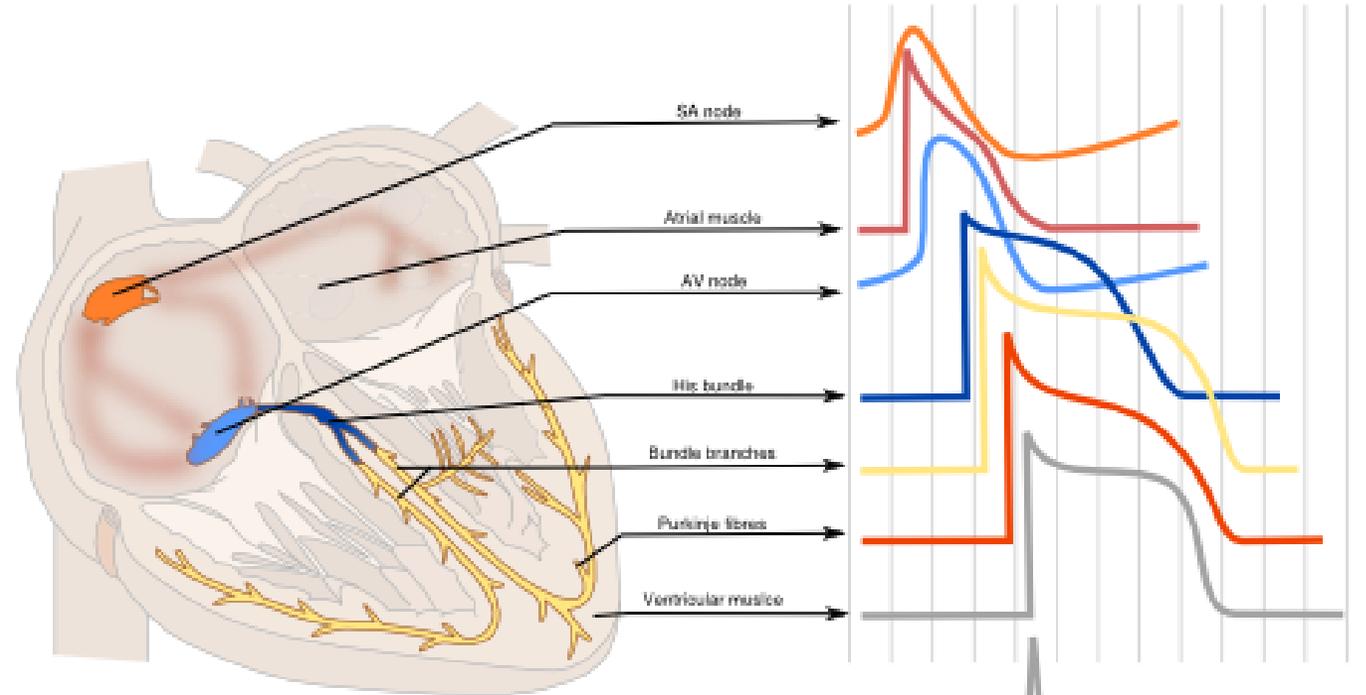
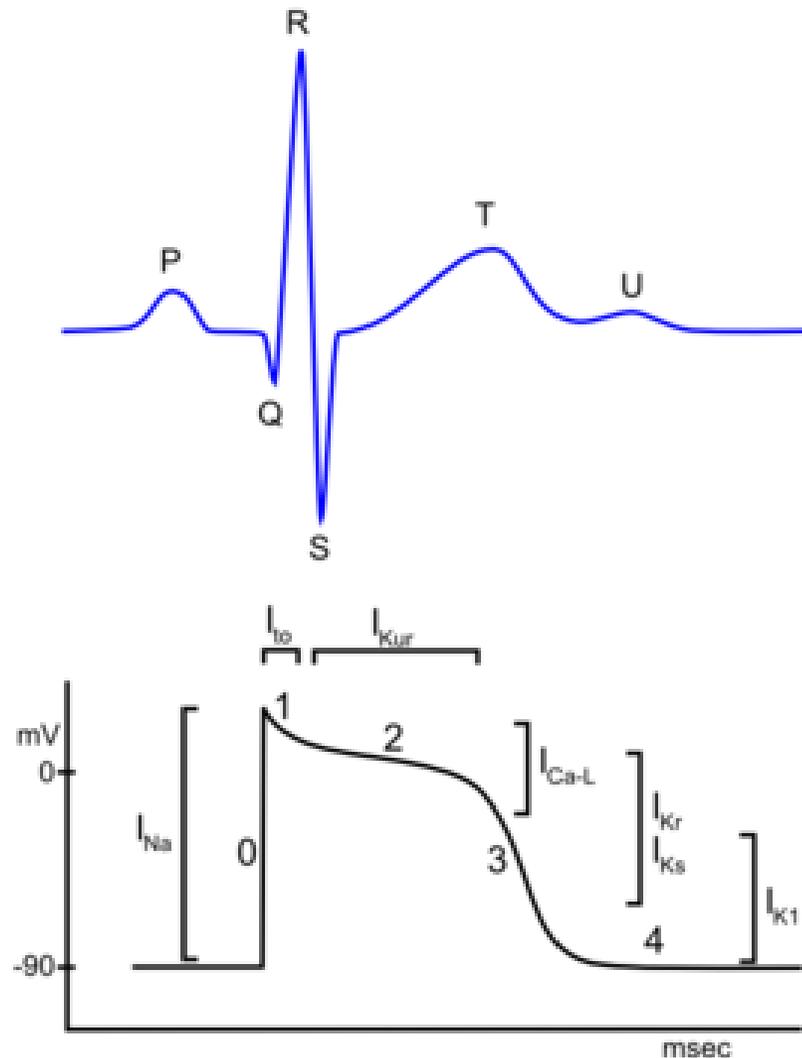
Pianist and scientist Elaine Chew.
Photo © Brian Morri

A musical score in bass clef with a tempo of $\text{♩} = 64.2$. The score is divided into sections A and B. Section A starts at measure 9 with a tempo of $\text{♩} = 70.8$ and includes a triplet. Section B starts at measure 16 with a tempo of $\text{♩} = 69.4$ and includes a triplet. The score continues to measure 21, also featuring a triplet. The time signature changes from 3/4 to 5/4 and back to 3/4.

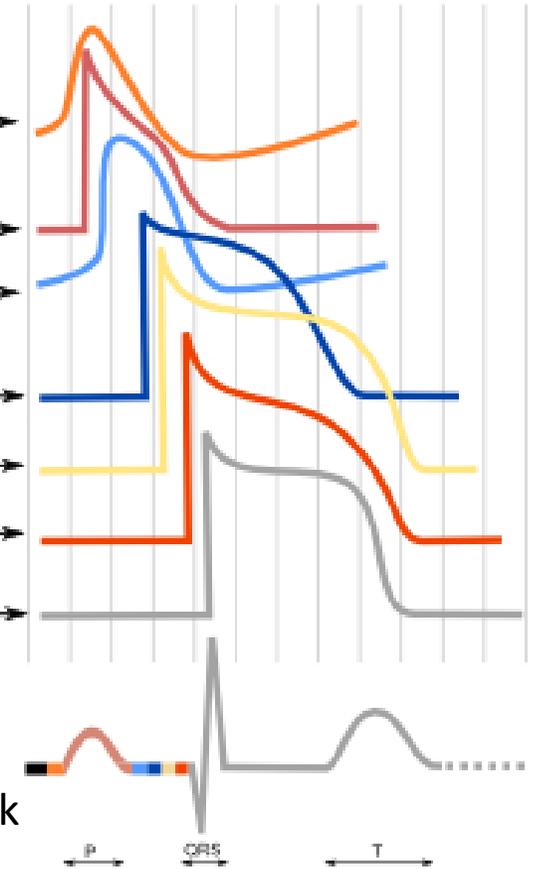
Inhoudsopgave

- Opfrissers
- Aritmieën: hoe ontstaat dat?
- Van Pathofysiologie naar ECG; wat zie ik?
- Overzicht ritmestoornissen
 - Speciale aandacht: Atriale Flutter en Ventrikel Tachycardie
 - PVC's: wat moet je ermee?
- Afsluitende woorden, take home/take to the clinic

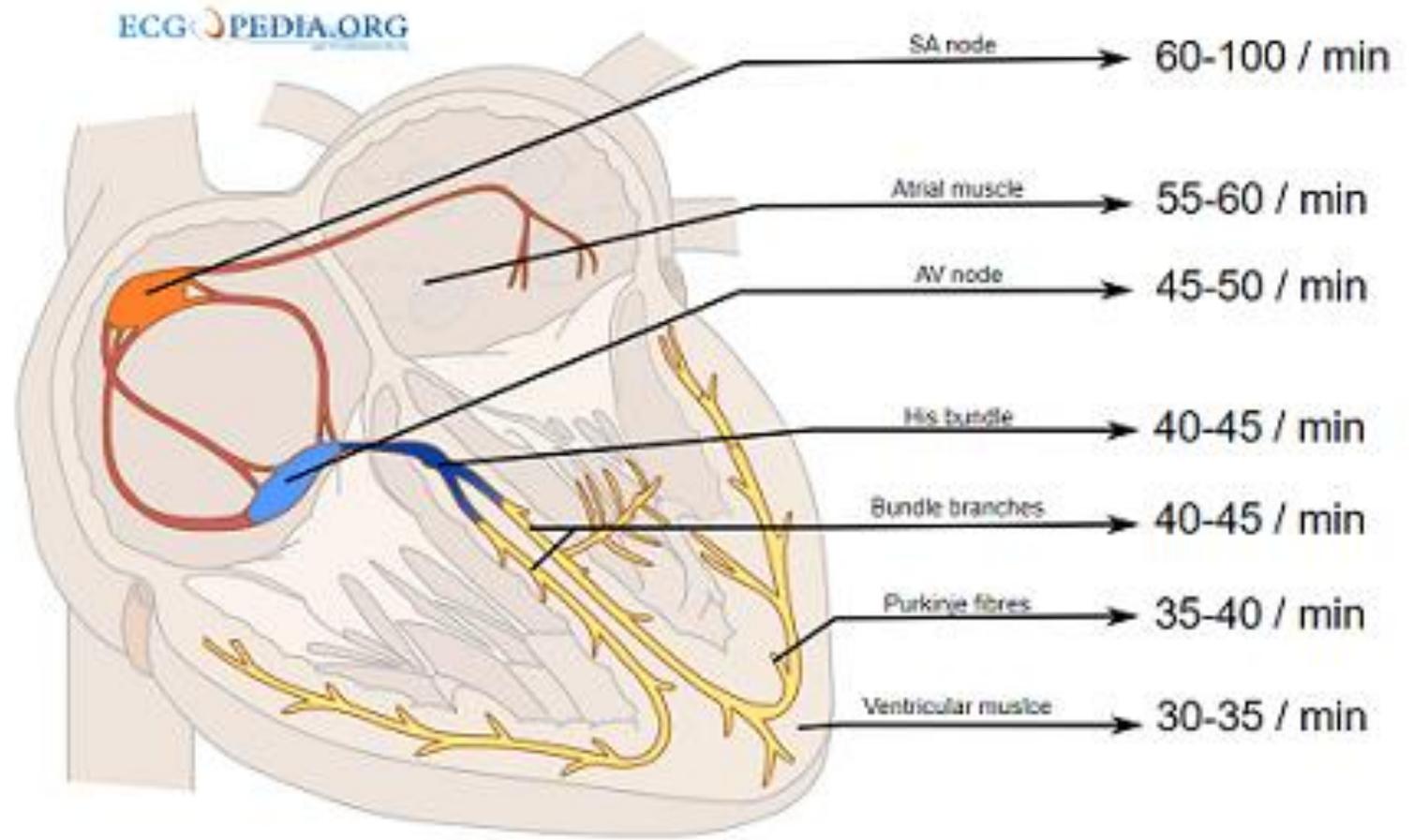
Geleidingssysteem: korte opfrisser (1)



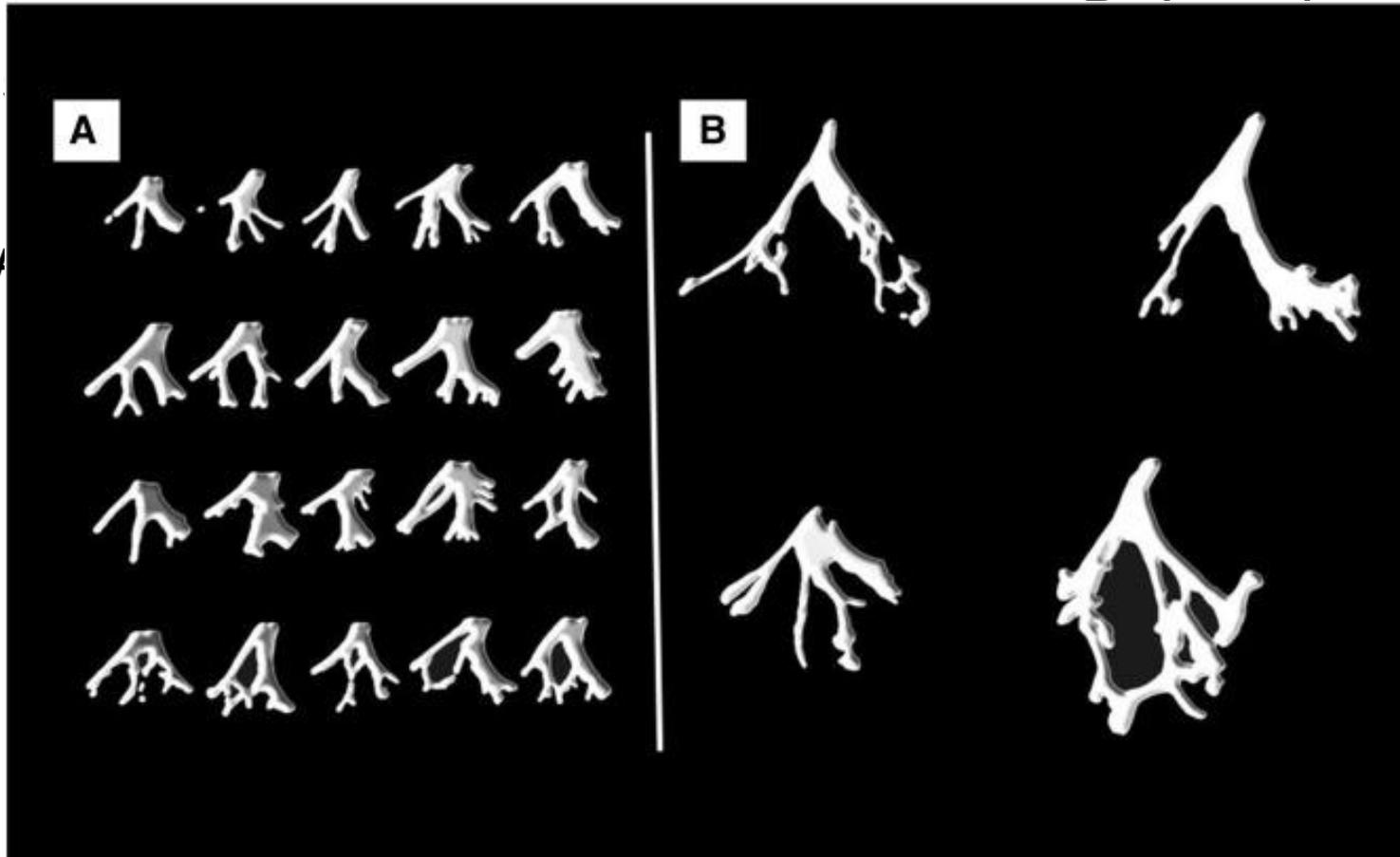
- Sinusknoop: mn Ca^{2+} -influx afhankelijk
- Overig weefsel; mn Na^{+} -influx afhankelijk



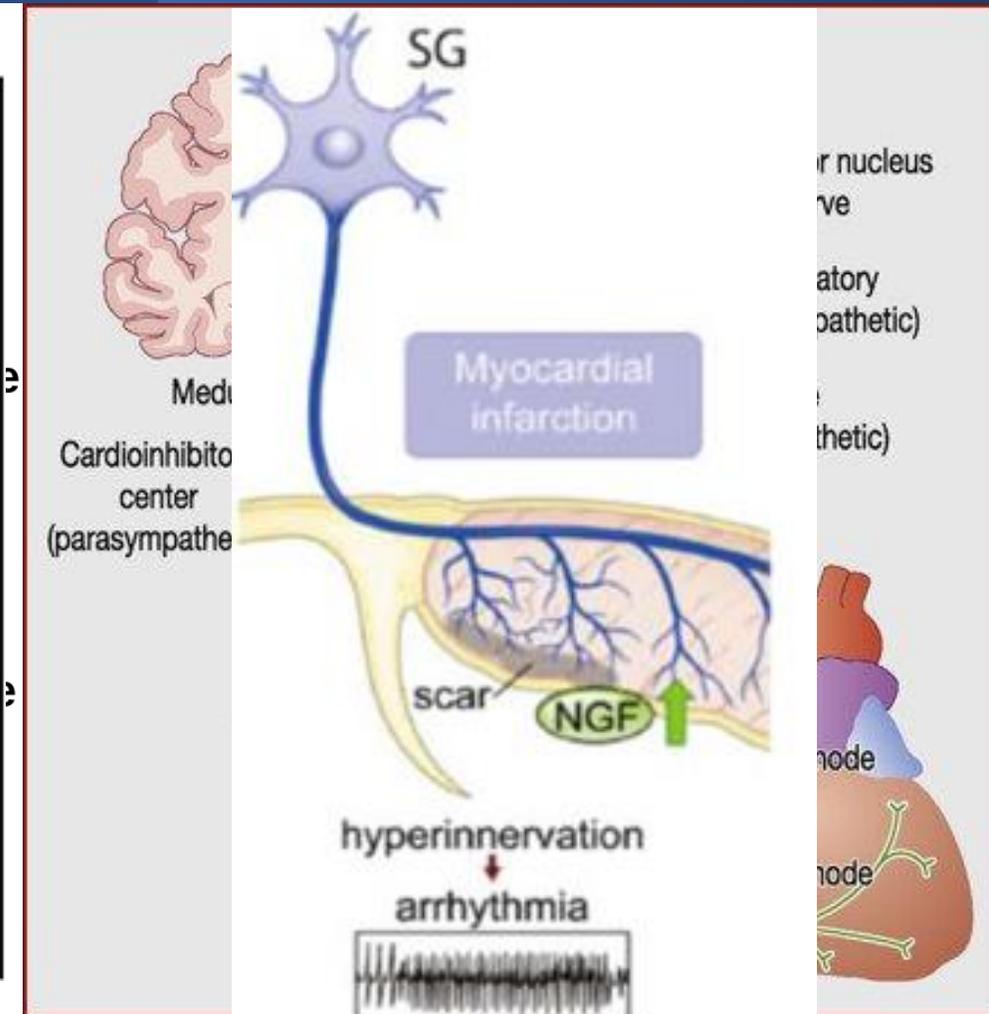
Rangorde?

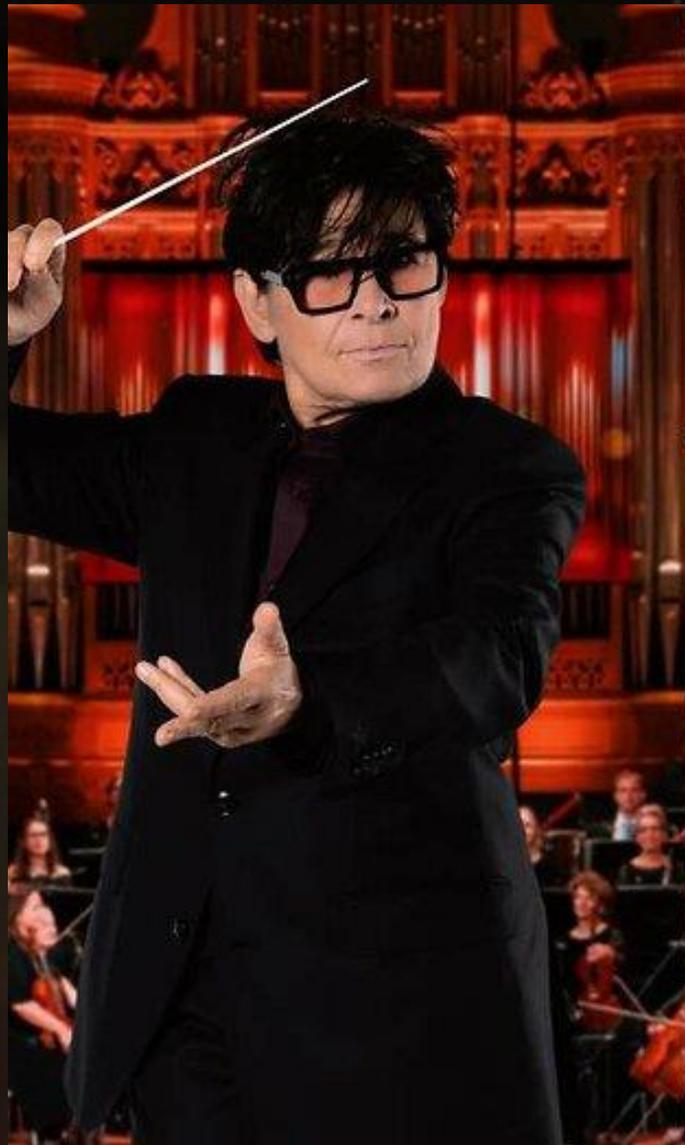


Geleidingssysteem: korte opfrisser (2)



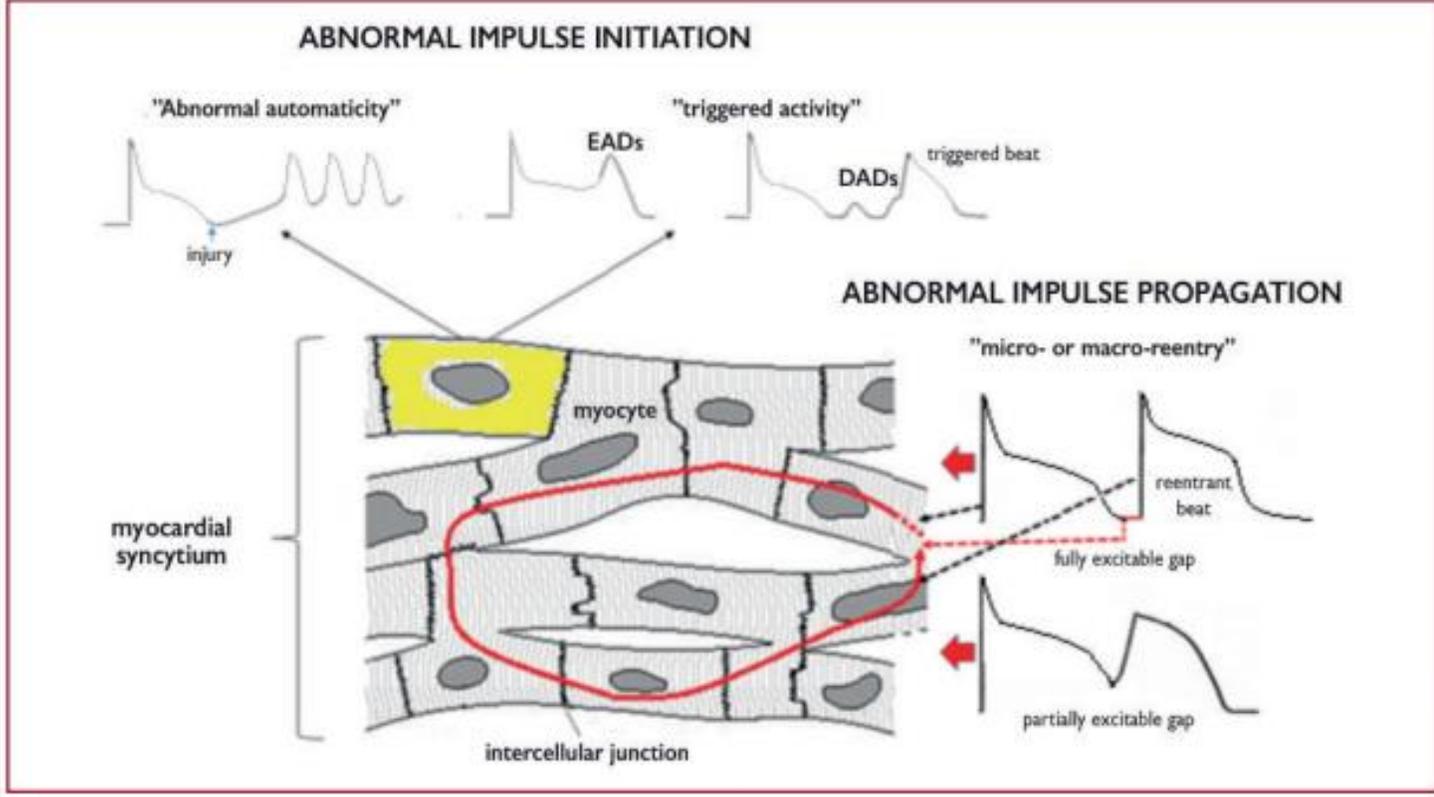
Elizari MV. The normal variants in the left bundle branch system. J Electrocardiol. 2017 Jul-Aug;50(4):389-399.



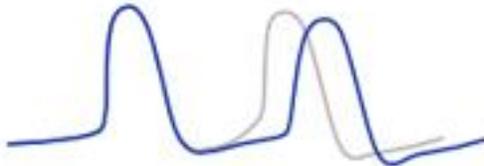


Aritmie Mechanismen

Active arrhythmia mechanisms



Abnormal Automaticity



Re-entry



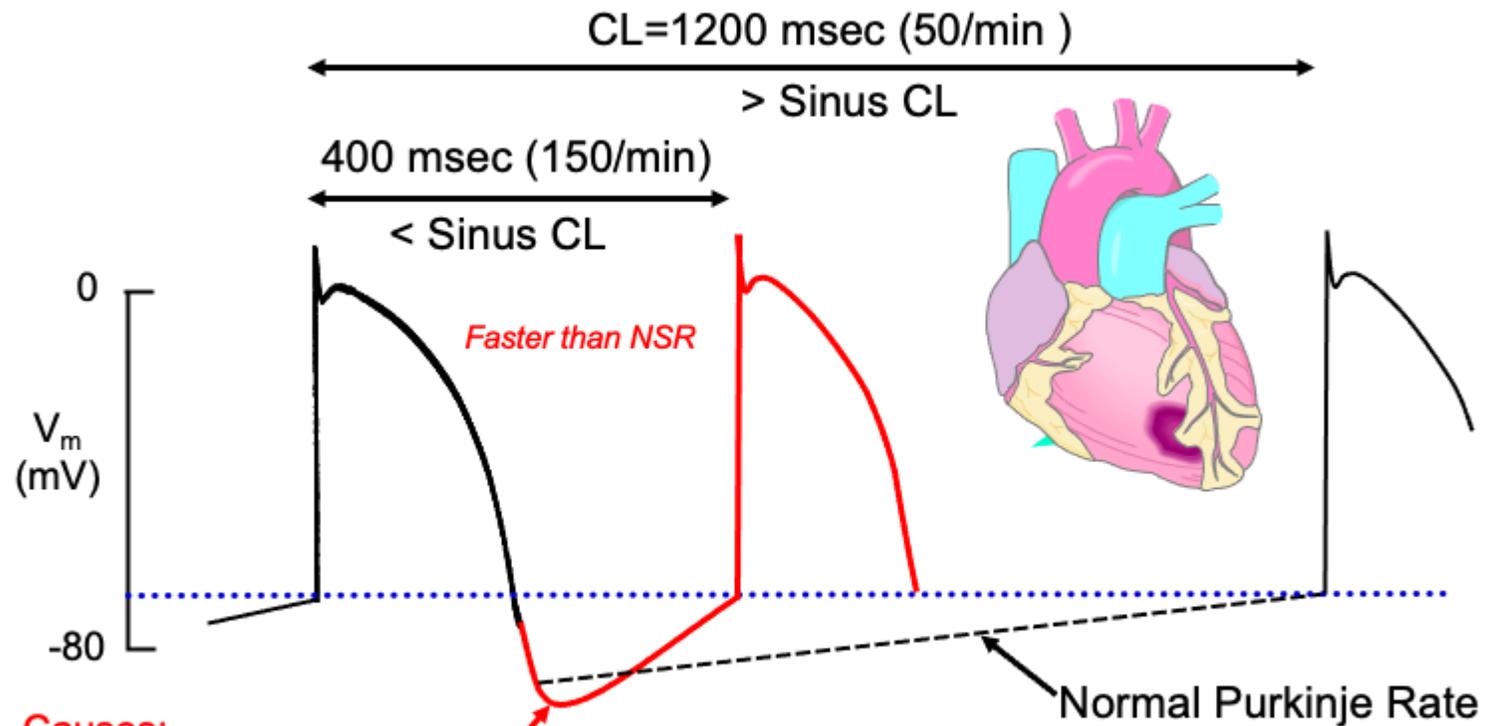
©ESC 2019

Abnormale automaticiteit: verandering naar een pacemaker-cel

Ectopic Pacemaker (Enhanced Normal Automaticity)

• $CL = \frac{BPM}{60.000}$

• $BPM = \frac{CL}{60.000}$



Causes:

Catecholamine excess (cocaine, amphetamines.... $\rightarrow \uparrow I_f$ activation)

Post MI: β_1 supersensitivity (NorEpi $\rightarrow \uparrow AC \rightarrow \uparrow cAMP \rightarrow \uparrow I_f$)*

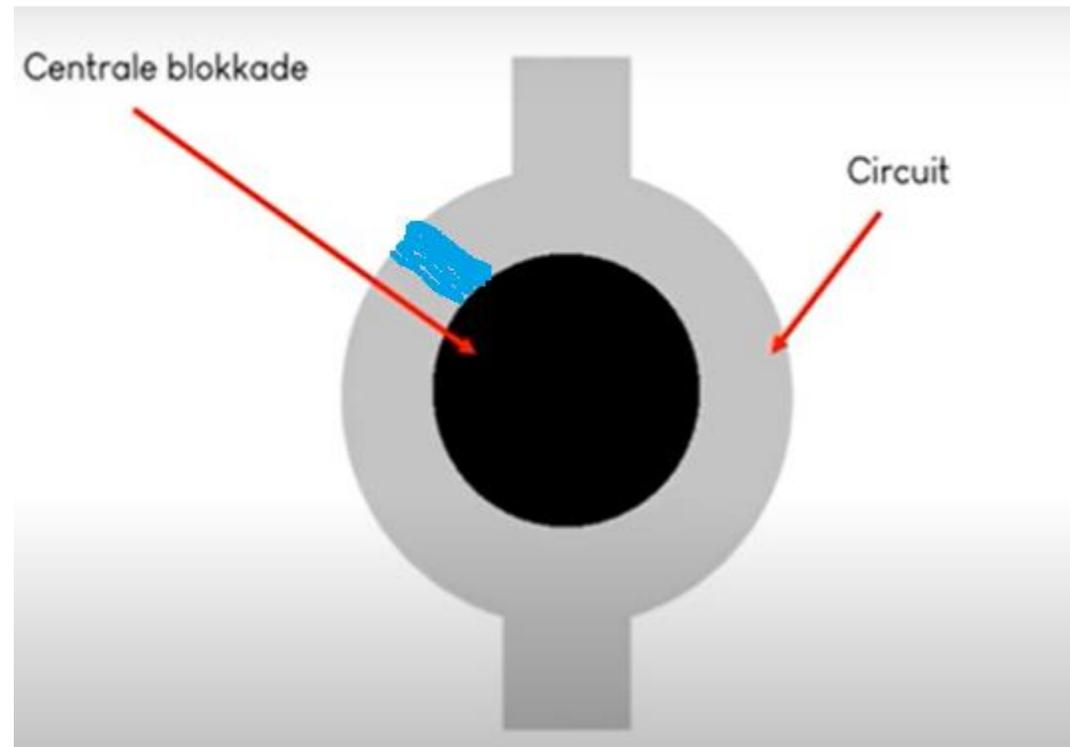
Hypokalemia diuretic side effect (more neg E_K & $V_m \rightarrow \uparrow I_f$ activation)

Abnormale geleiding: Re-Entry Circuit (1)



Re-Entry rondom;

- 1) Anatomische centrale blokkade (tricuspidalis – of mitralisklep, scar)
- 2) Functionele centrale blokkade (tussen cellen met verschillende excitatie eigenschappen zoals in boezemweefsel of ventrikel)

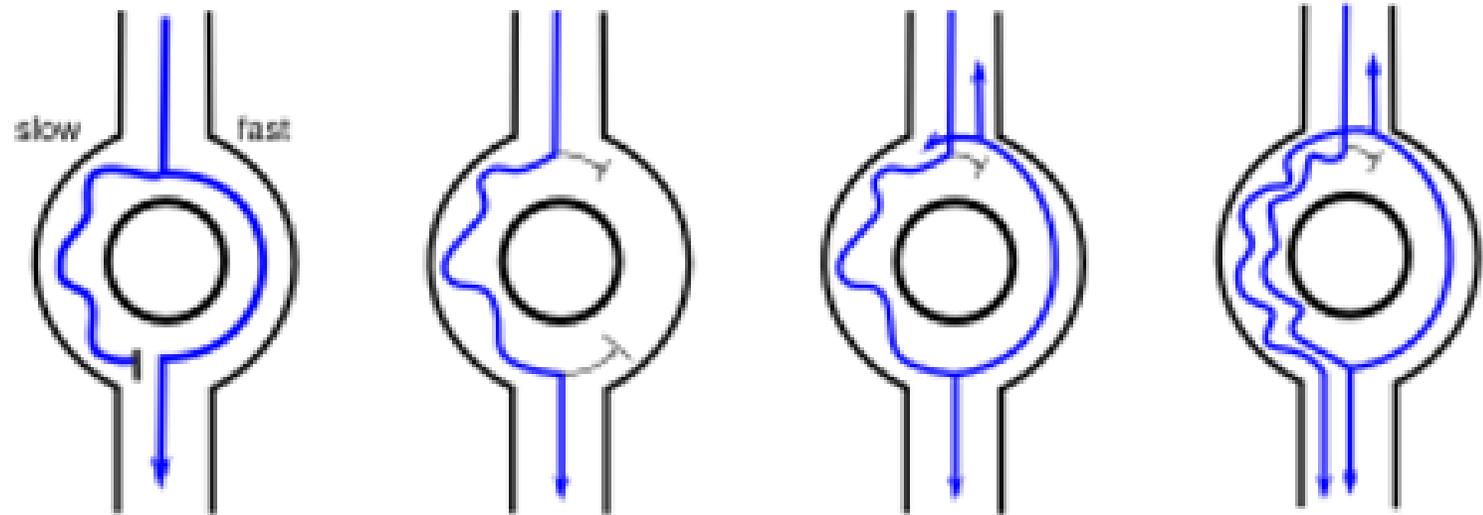


Re-Entry Circuit (2)

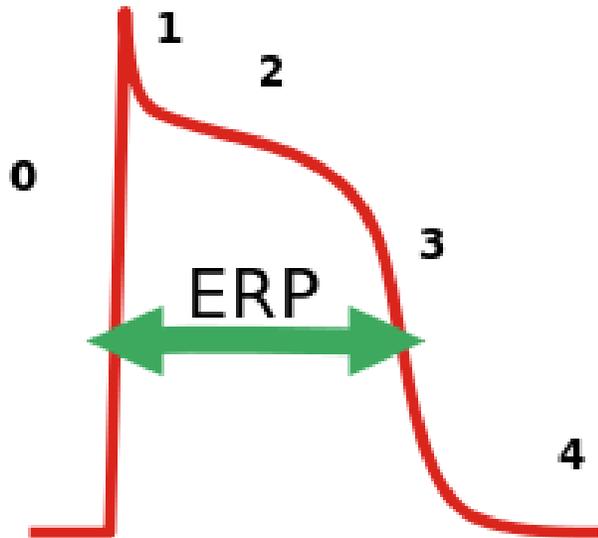


- 1) in ischemisch hartweefsel (VT-> VF)
- scar formatie leidt tot trage geleiding, normaal weefsel geleid snel.
- 2) In AV-nodaal weefsel (AV(N)RT)
- extra pathway geleid traag naast normale snelle geleiding.
- 3) In boezemweefsel obv wisselende geleigenschappen (Atriumfibrilleren) en anatomische blokkade (CTI bij flutter).

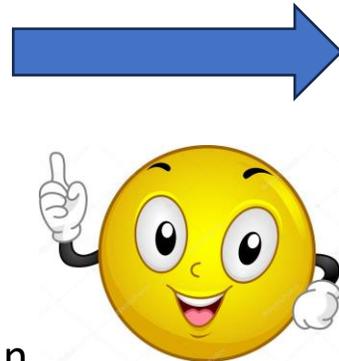
! het wordt pas een probleem bij toename automaticiteit door bij ischemie, electrolytstoornissen, acidemie, stress etc.



Behandeling op celniveau



Effective Refractory Period:
Actiepotentiaal periode waarin
geen nieuwe prikkel kan ontstaan.



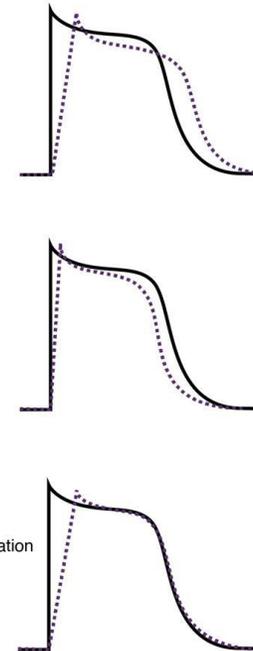
Antiarrhythmics

Class I
Decreased slope of
phase 0 depolarization

Class IA
↑ ERP
↑ AP duration

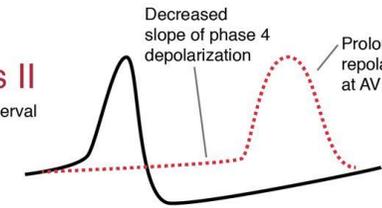
Class IB
↓ ERP
↓ AP duration

Class IC
Normal ERP
Normal AP duration



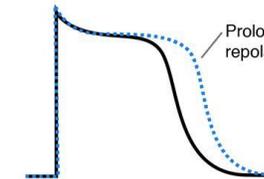
Class II
↑ PR interval

Decreased slope of phase 4 depolarization
Prolonged repolarization at AV node



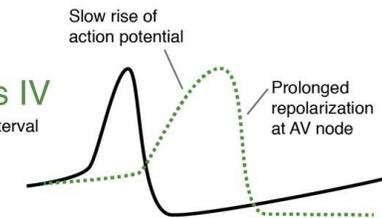
Class III
↑ ERP
↑ AP duration

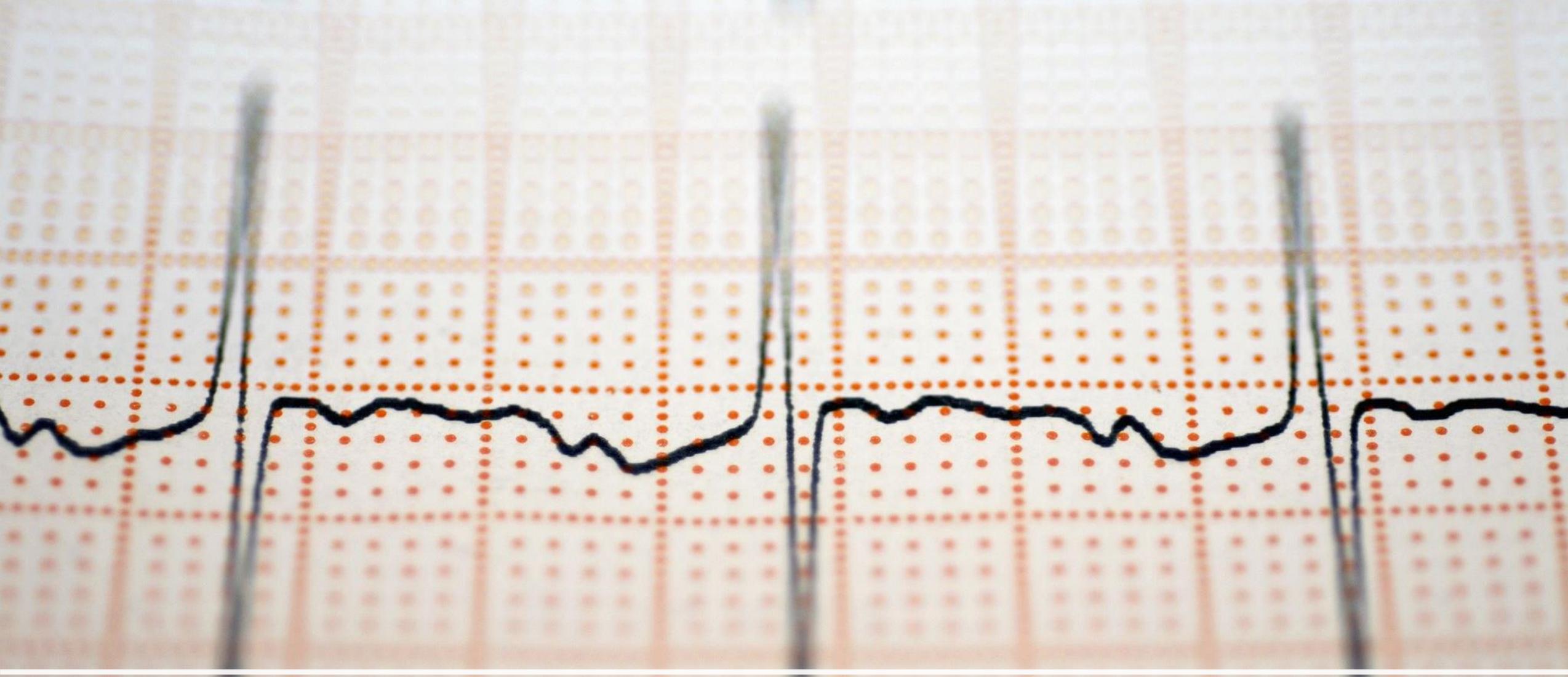
Prolonged repolarization



Class IV
↑ PR interval
↑ ERP

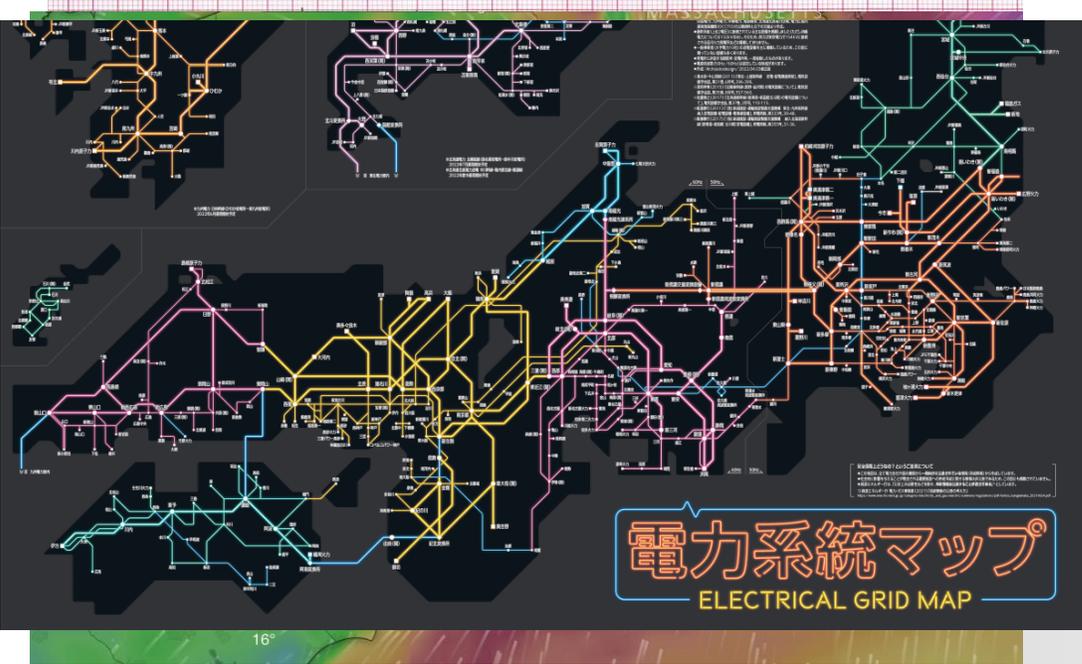
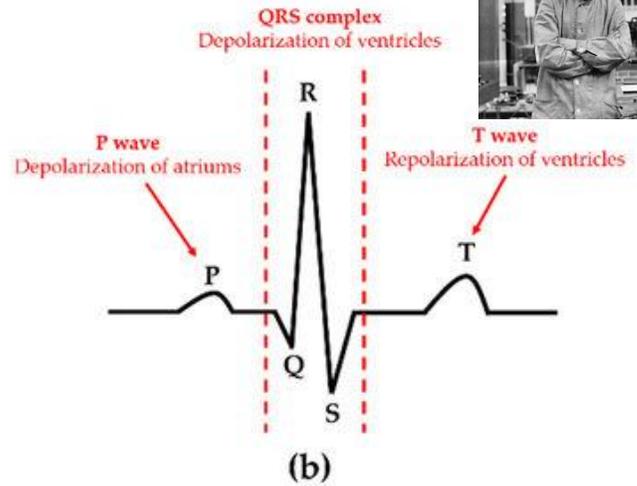
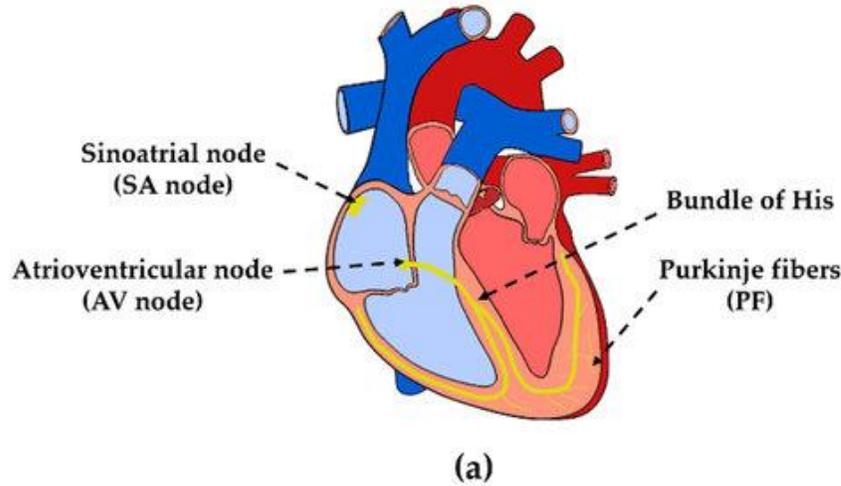
Slow rise of action potential
Prolonged repolarization at AV node



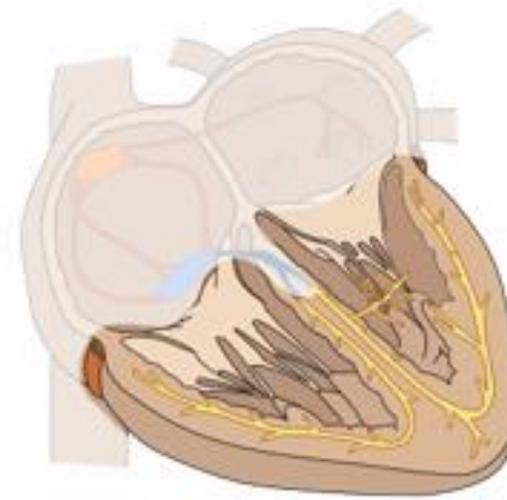
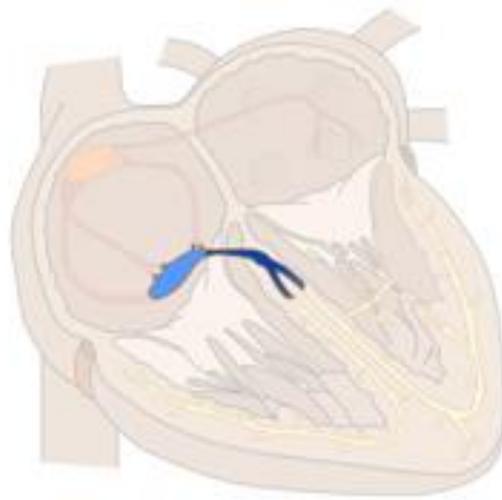
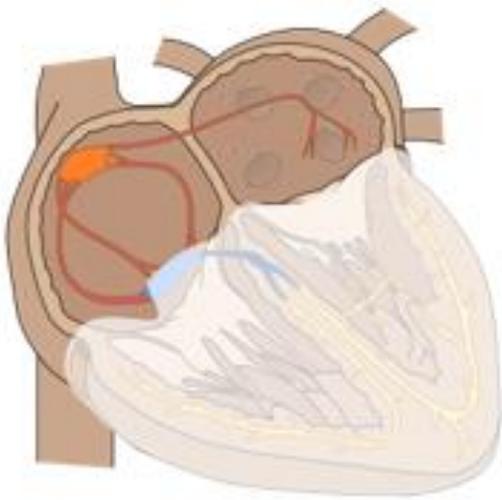
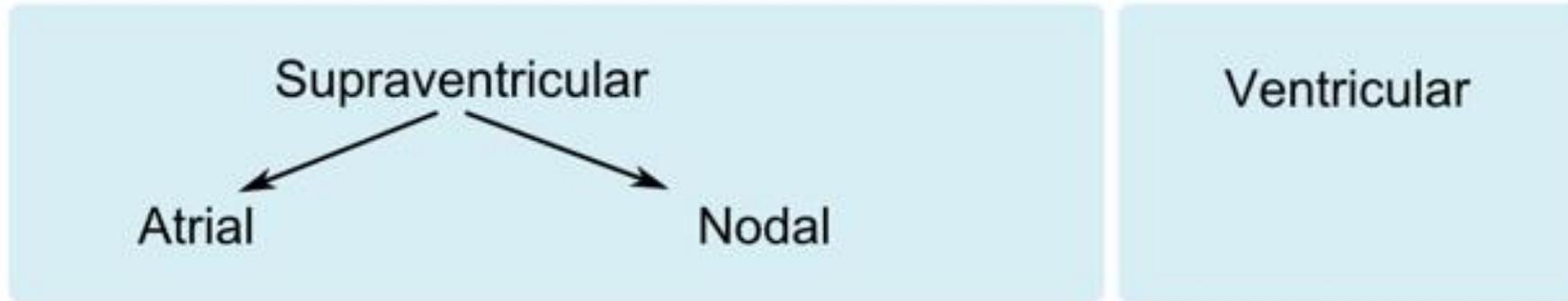


Van Pathofysiologie naar ECG

Elektrocardiogram



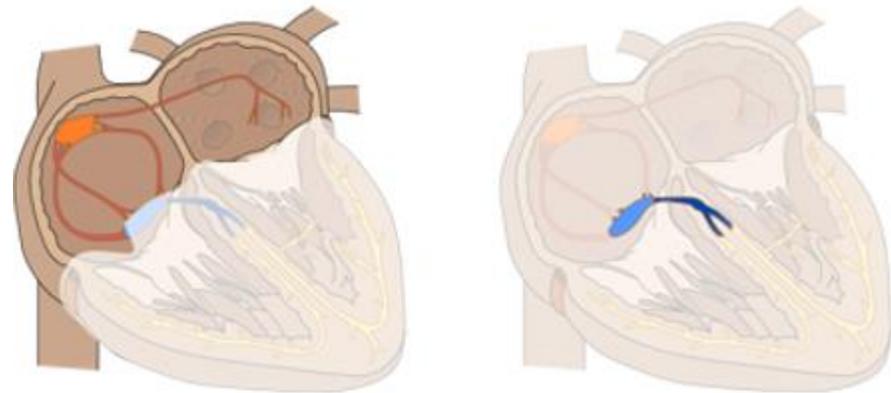
Ritmestoornissen in verschillende smaken

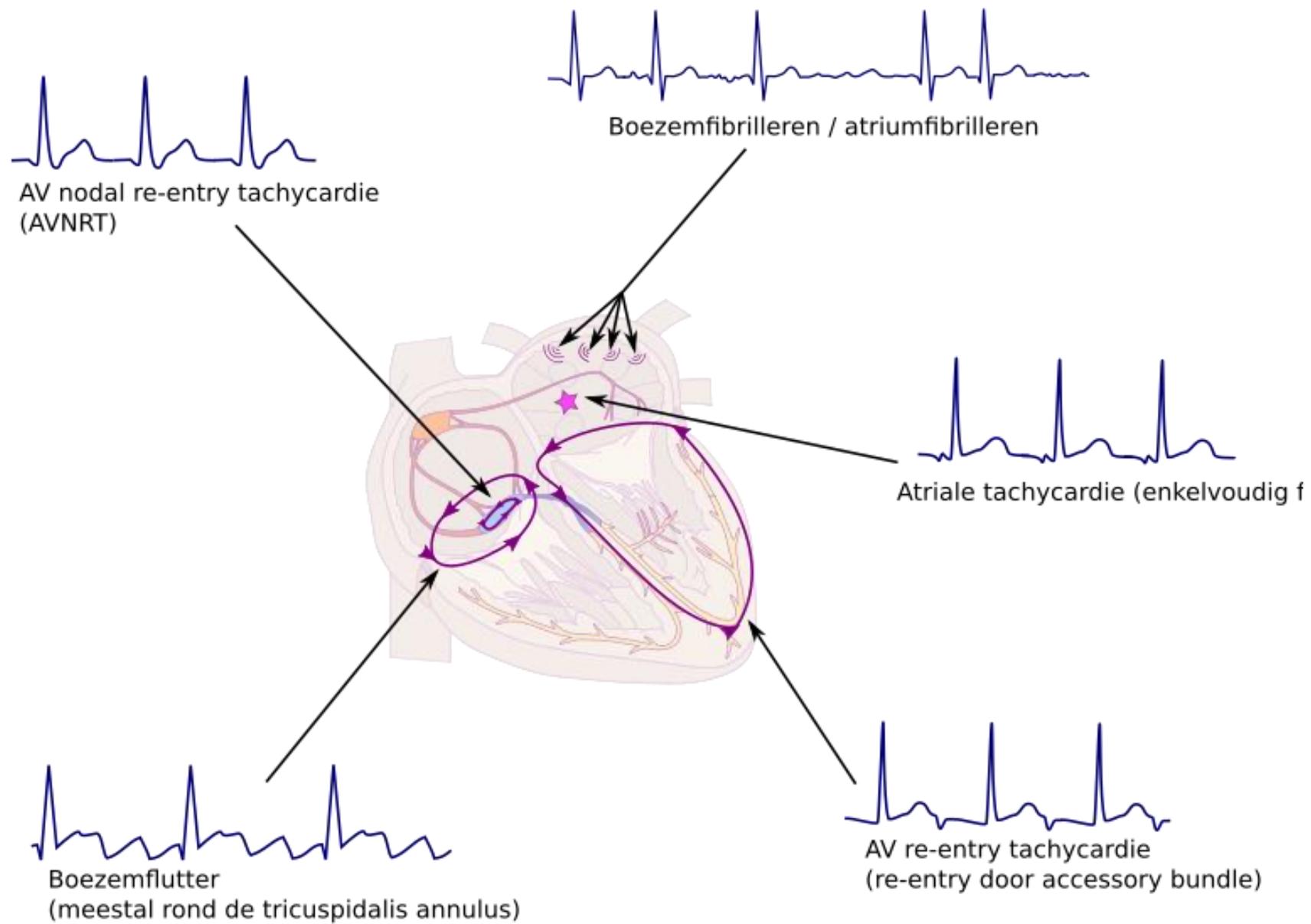


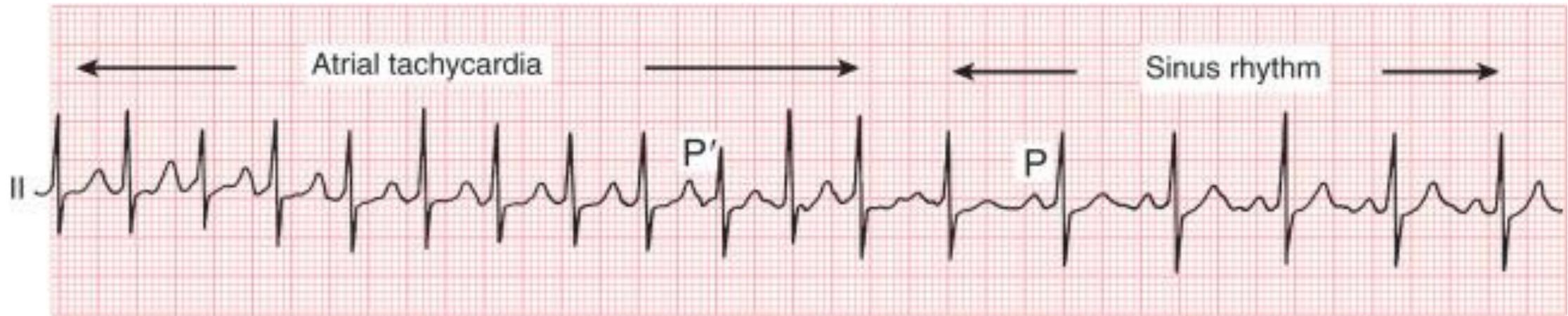
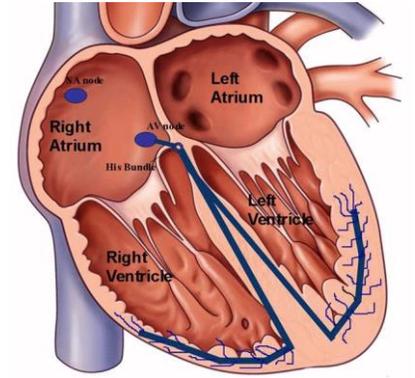
Supraventriculaire ritmestoornissen



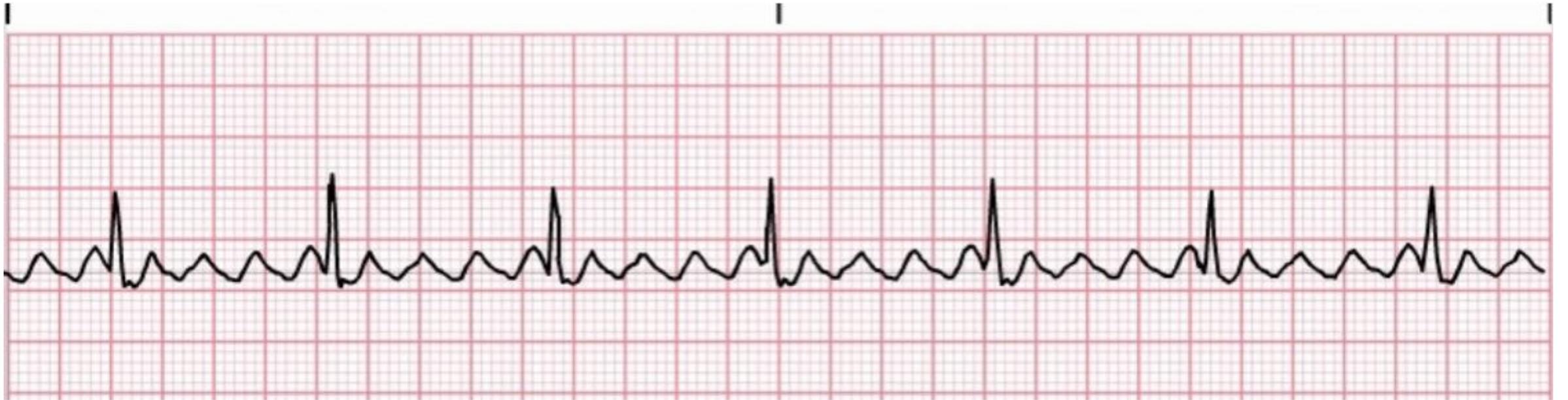
- Atriale tachycardie (AT)
- Atriale flutter (Aflut)
- Atriumfibrilleren (AF)
- AV-nodale re-entry tachycardie (AVNRT) / AVRT



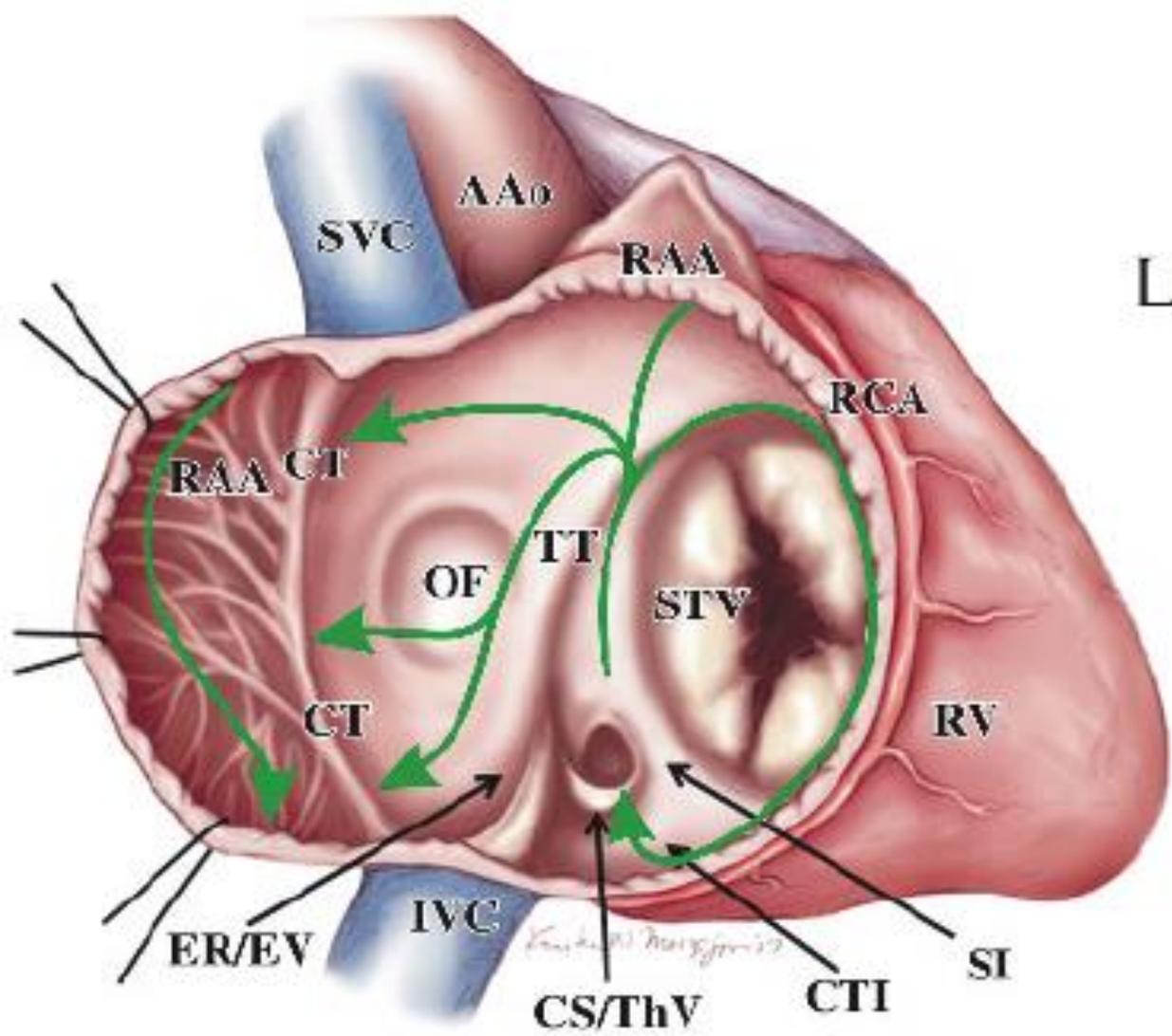




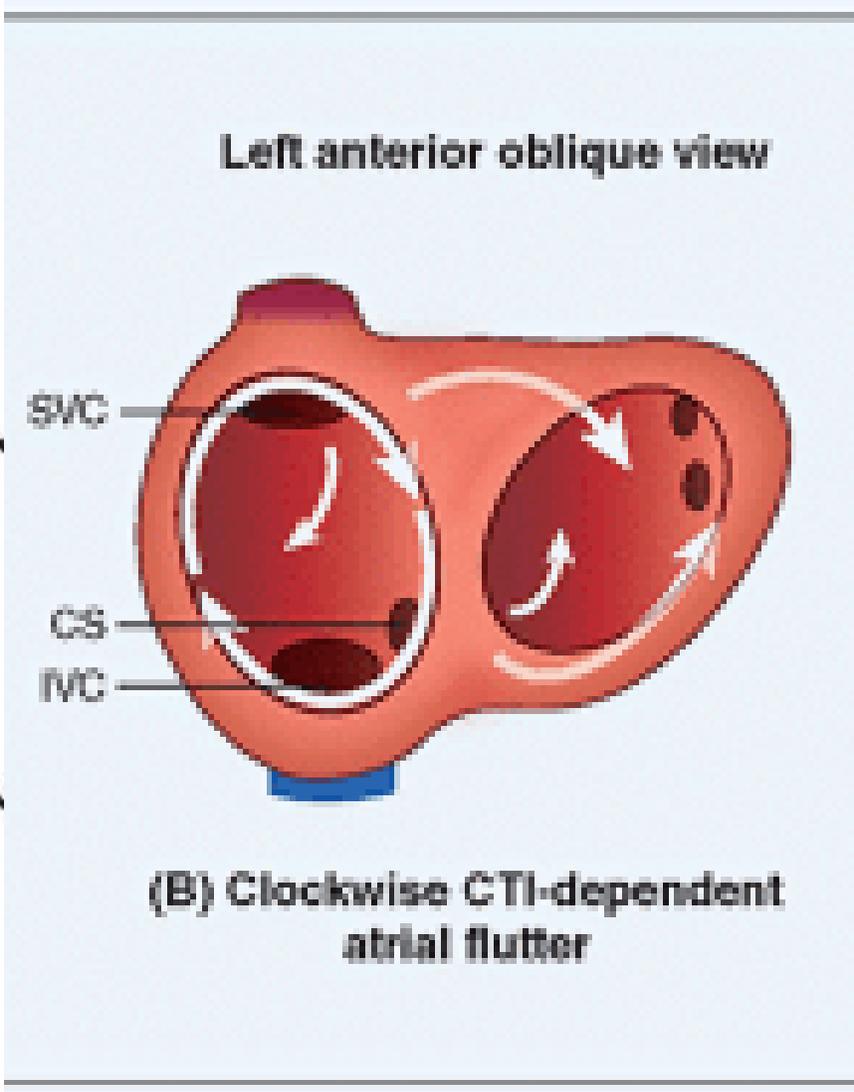
Atriale tachycardie (AT)



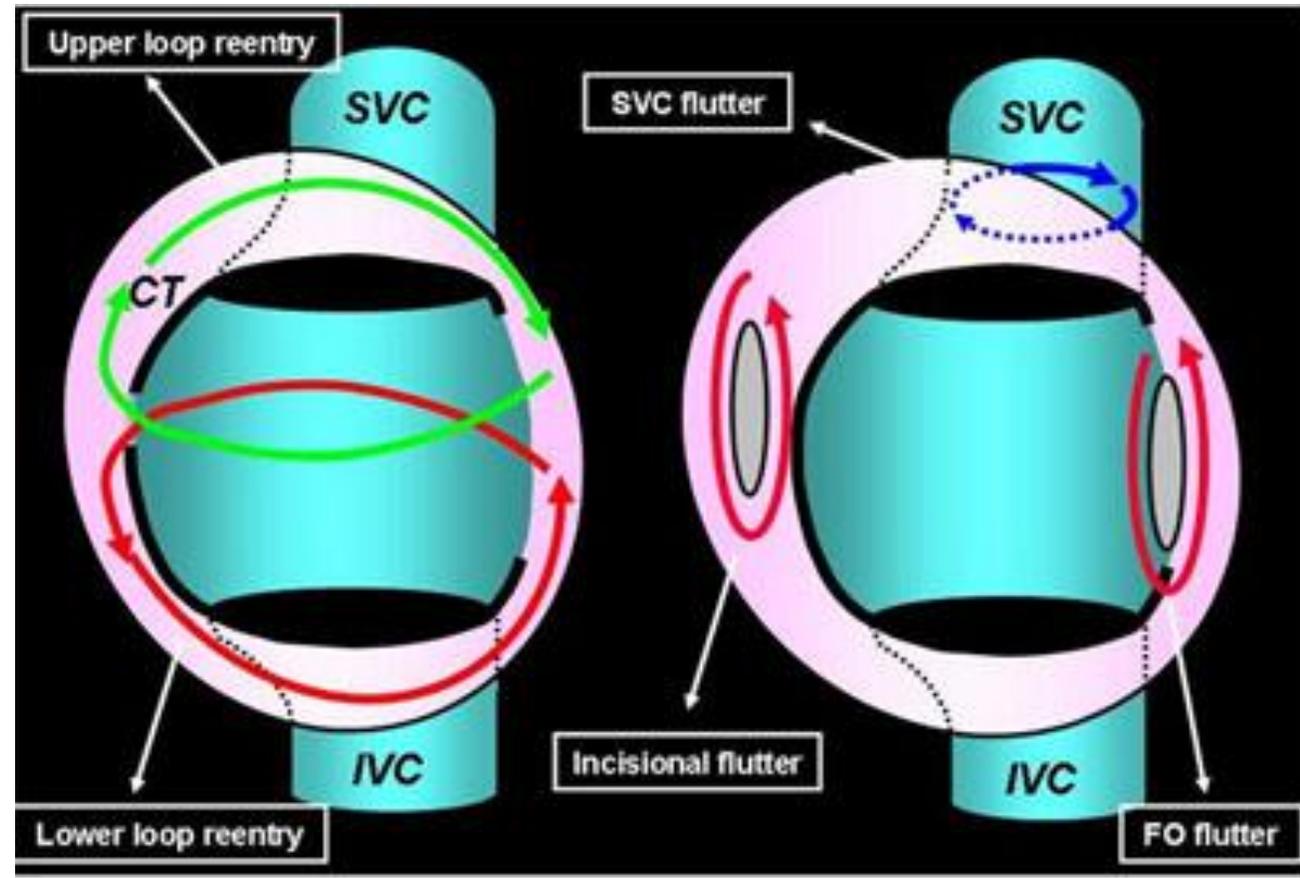
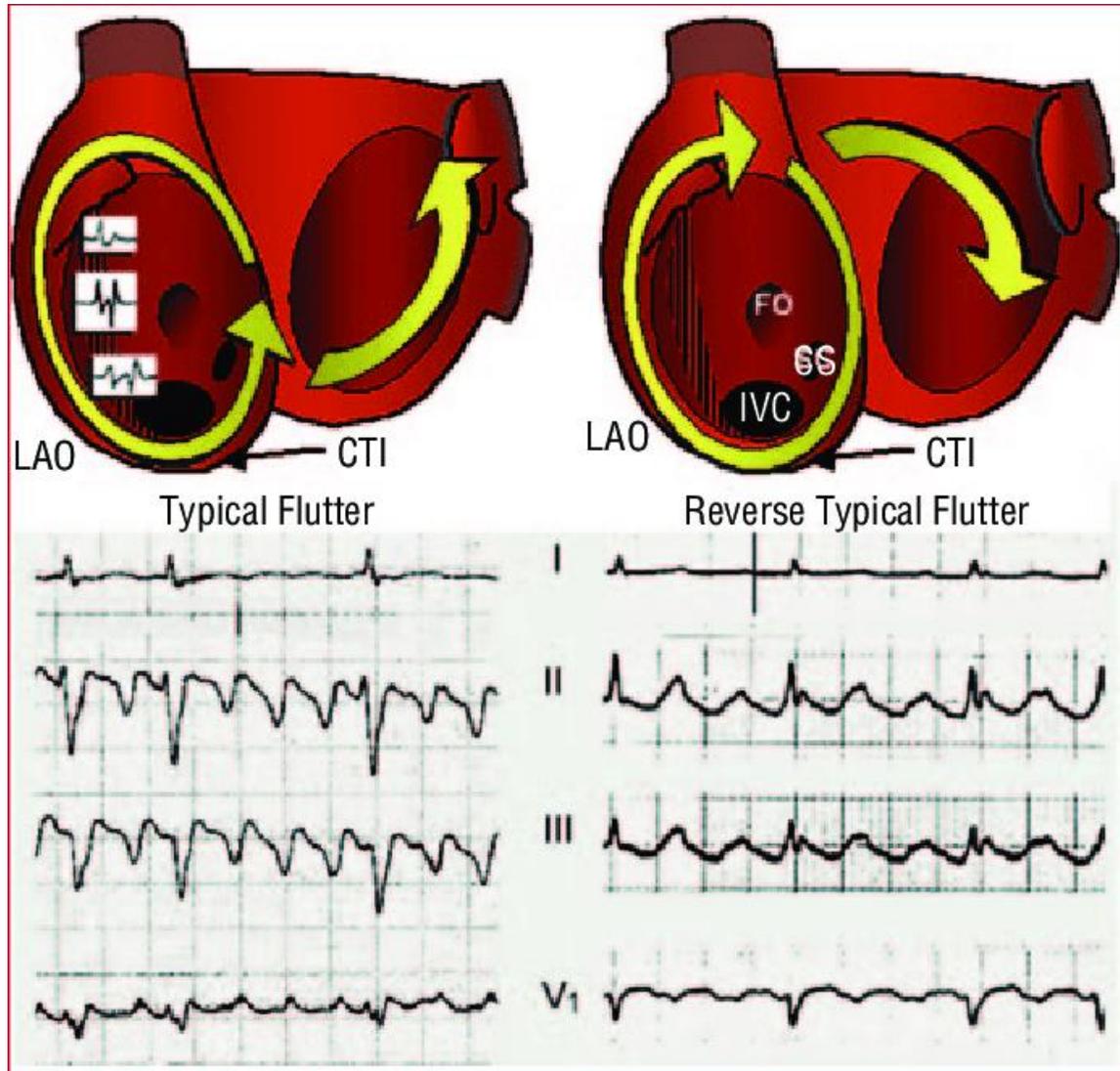
Atriale flutter



Lead II



Atrial Flutter



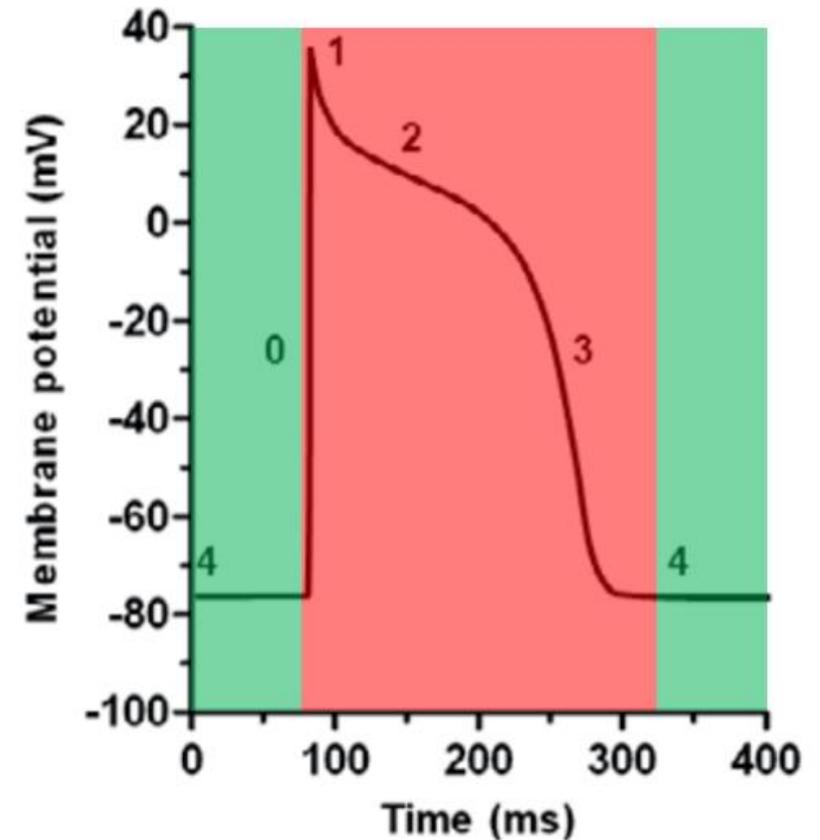
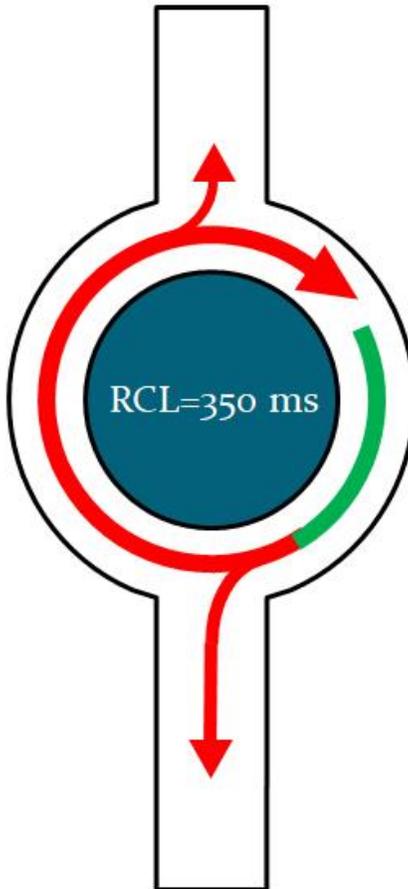
Atriale flutter: typisch/atypisch

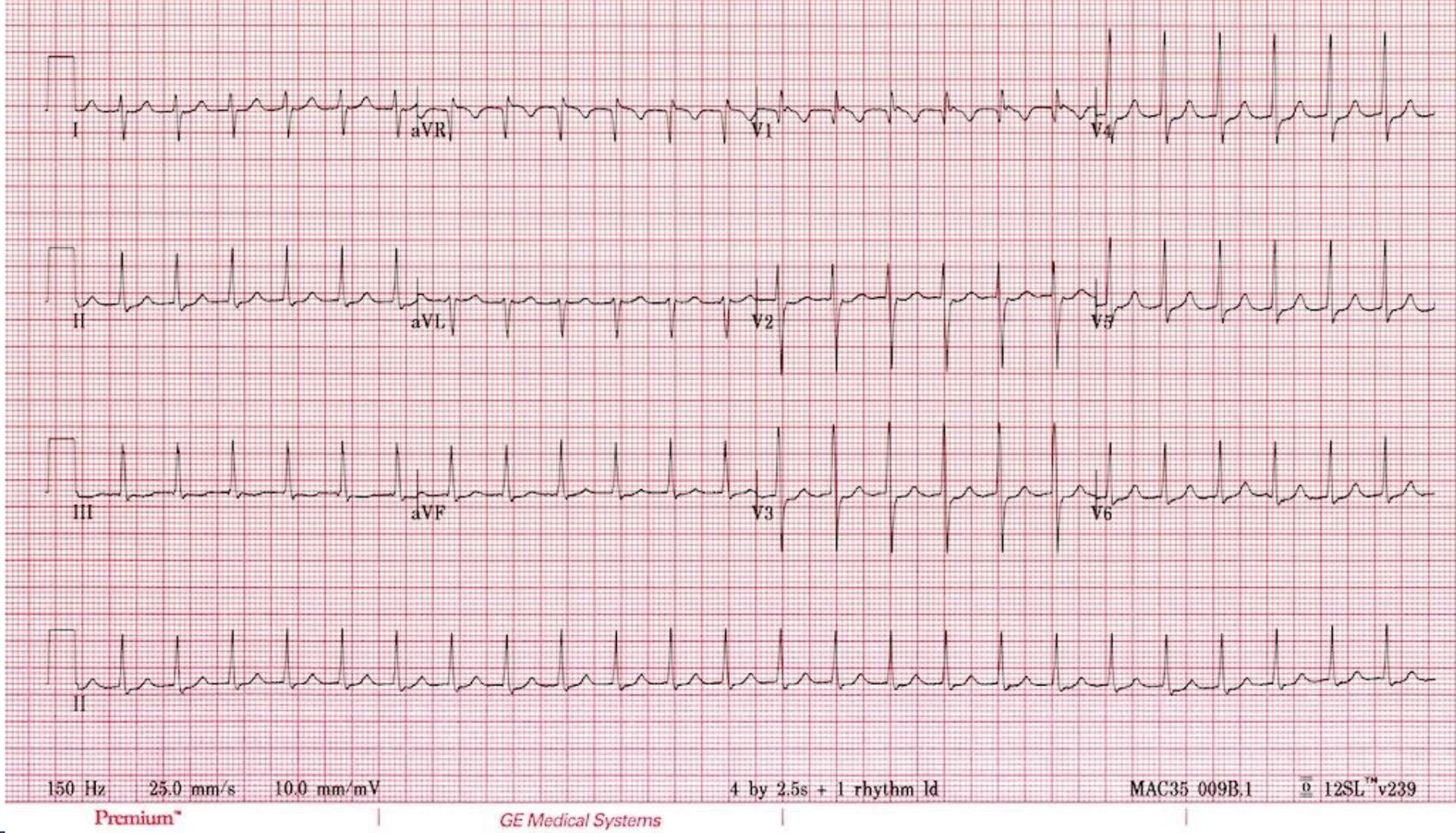


Diagnostiek? Adenosine!

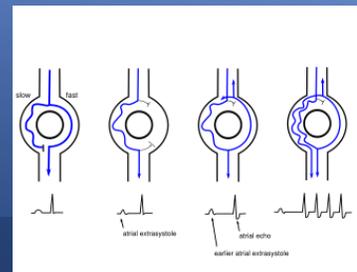
Behandeling; waarom zo moeilijk?

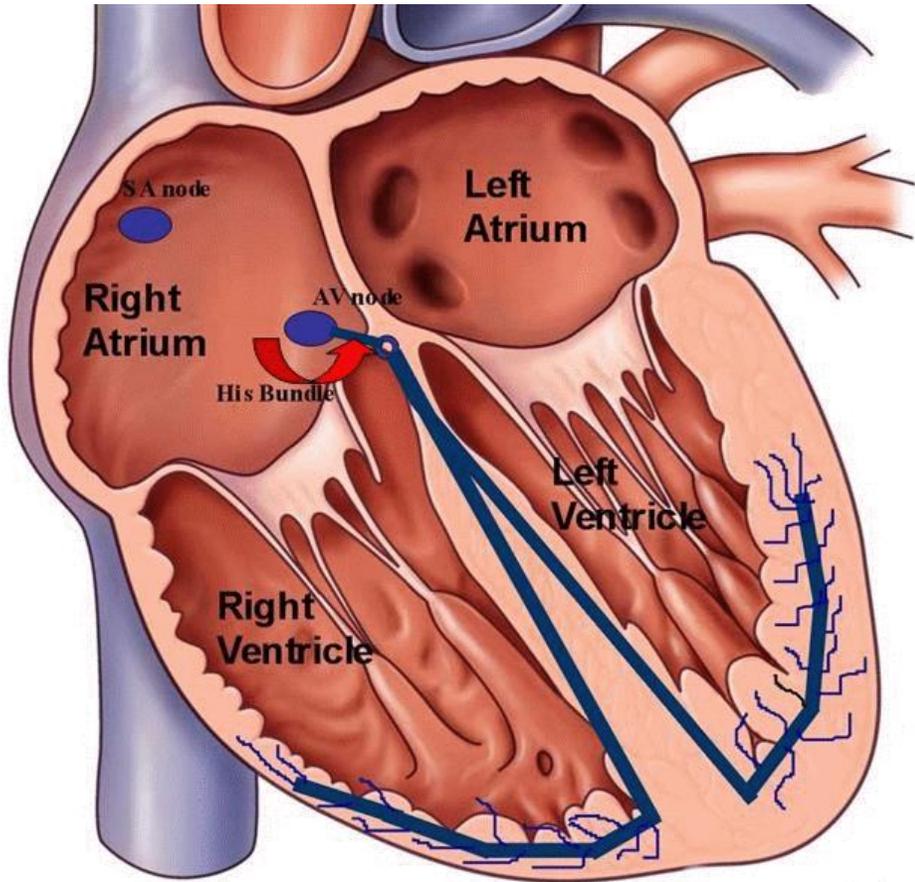
- Medicatie komt moeizaam aan in anatomisch afhankelijk re-entry circuit om te kunnen cardioverteren.
- Dus; rate controle middels Ca-antagonist of betablokkade (digoxine)
- Cardioversie middels;
 - ECV
 - in sommige gevallen; ATP





AVNRT/AVRT



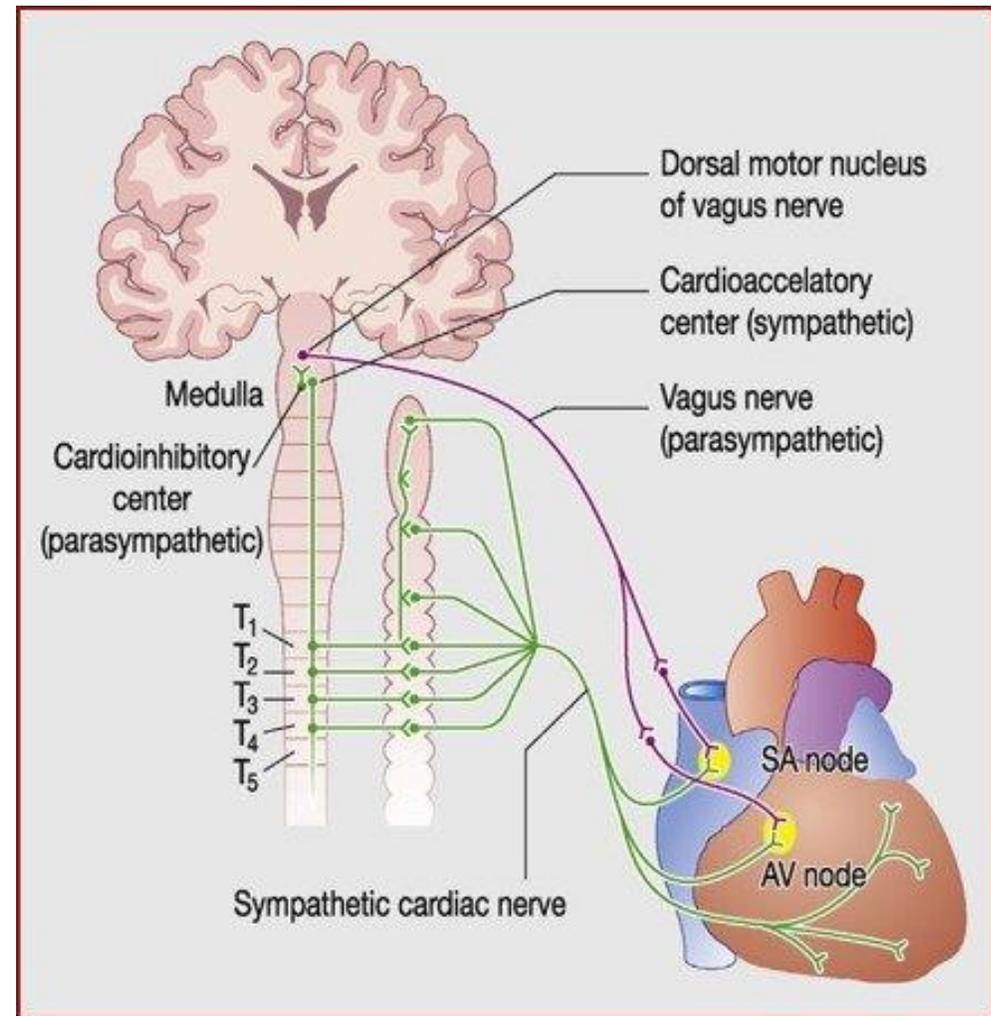
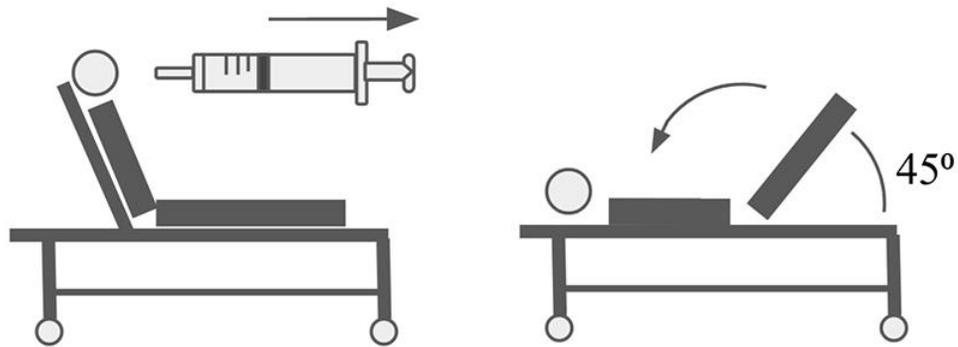


Orthodromic AVRT	Antidromic AVRT
<p>SA node AV node Accessory pathway</p> <p>II</p> <p>III</p> <p>Retrograde P waves</p>	<p>II</p> <p>III</p>
<ul style="list-style-type: none"> • Narrow QRS complex • P wave typically follows QRS complex • No delta wave 	<ul style="list-style-type: none"> • Wide QRS complex • Delta and P waves may not be visible

AVNRT/AVRT

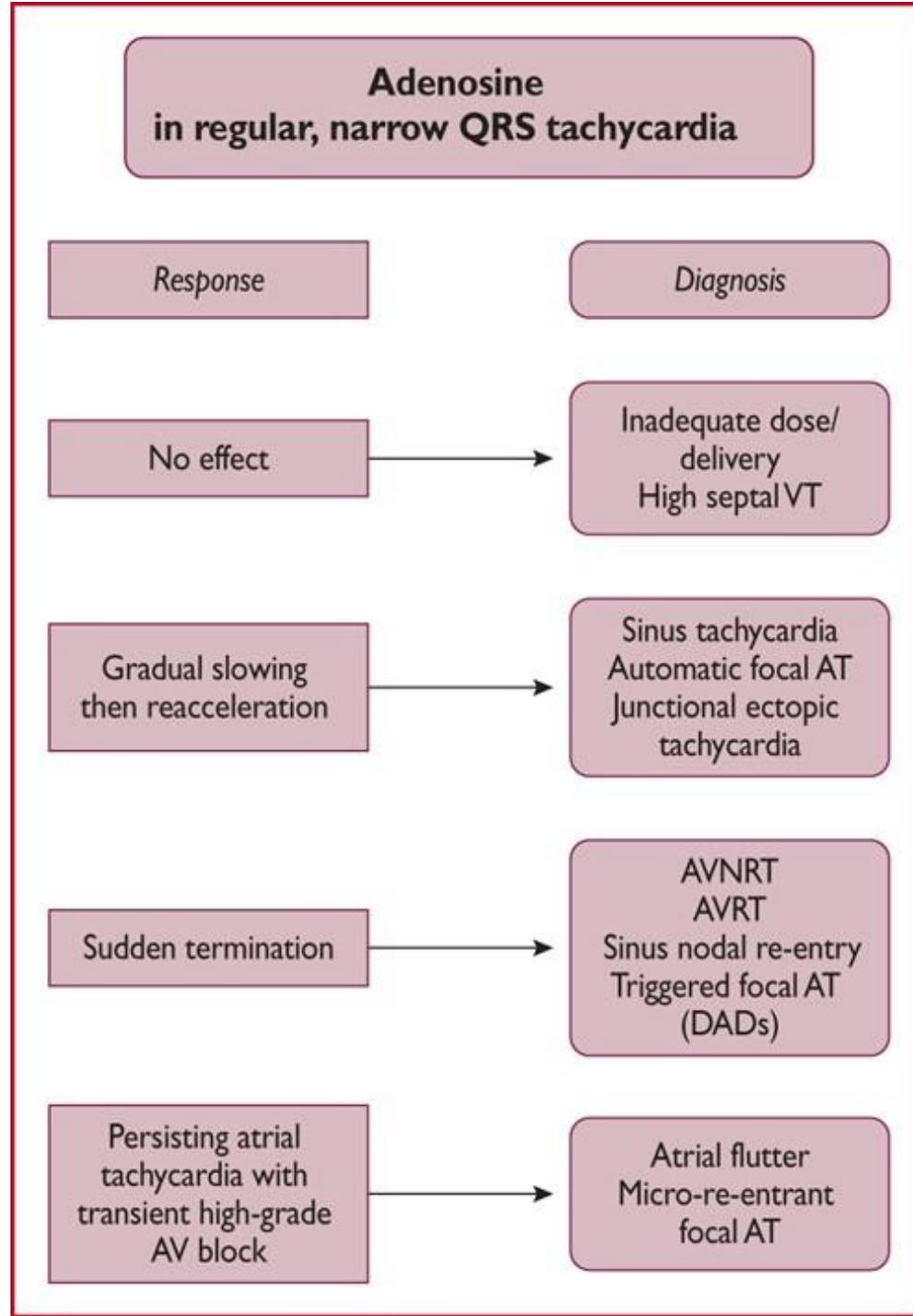
Behandeling middels vagale stimulatie;

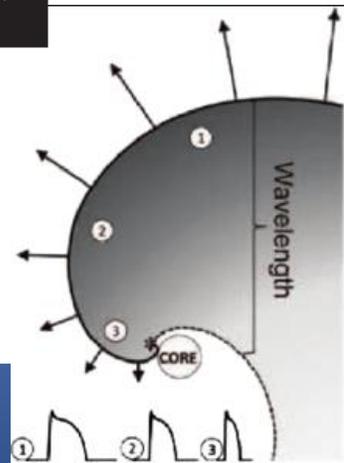
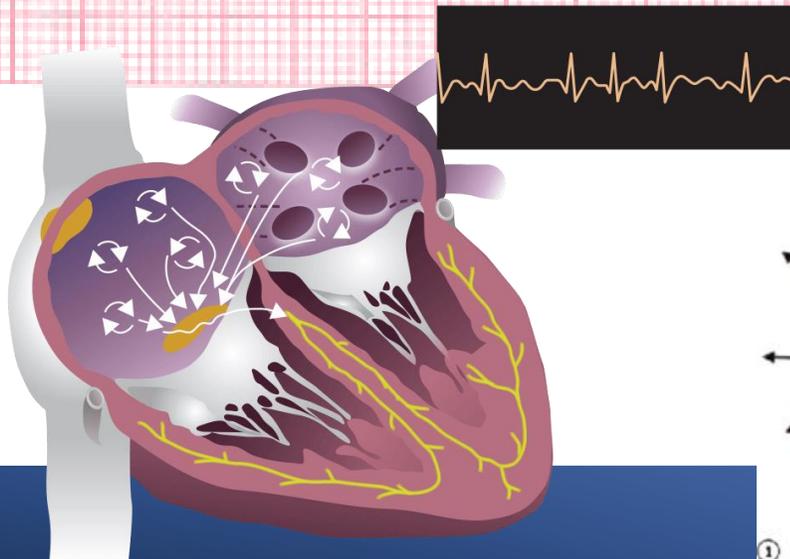
- 1) Valsalva of Modified Valsalva
- 2) Adenosine (purinenucleoside) welk aangrijpt op adenosine receptoren Avknoop (6mg – 12mg – 18mg – stop)
- 3) Verapamil (oraal/IV)



AVNRT (2)

Adenosine well of geen effect?





Atriumfibrillieren

Behandeling van SVTs

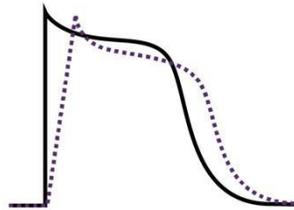
Antiarrhythmics

Class I

Decreased slope of phase 0 depolarization

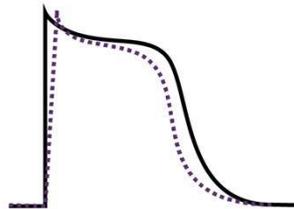
Class IA

↑ ERP
↑ AP duration



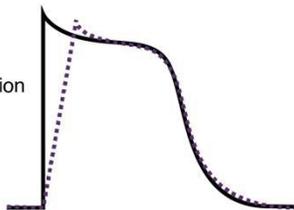
Class IB

↓ ERP
↓ AP duration



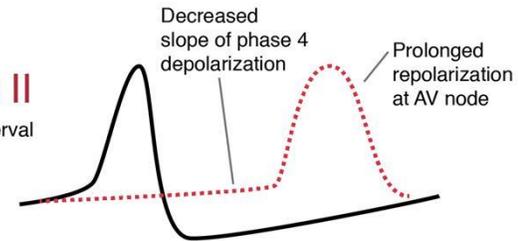
Class IC

Normal ERP
Normal AP duration



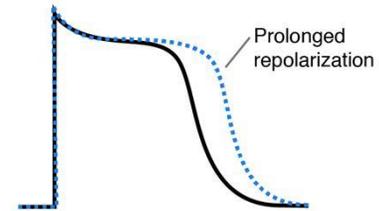
Class II

↑ PR interval



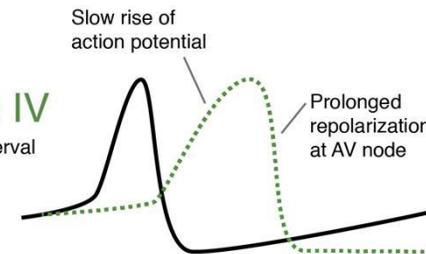
Class III

↑ ERP
↑ AP duration



Class IV

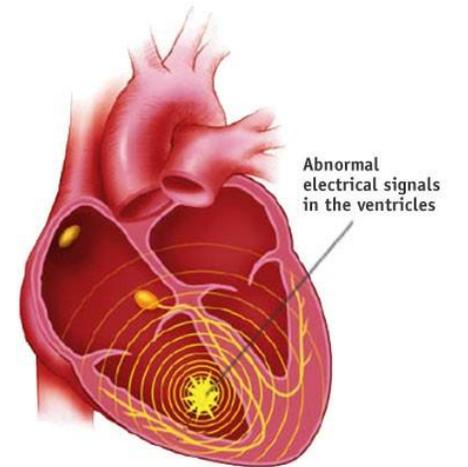
↑ PR interval
↑ ERP



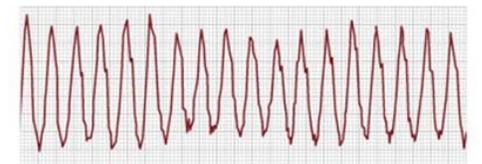
Ventriculaire ritmestoornissen



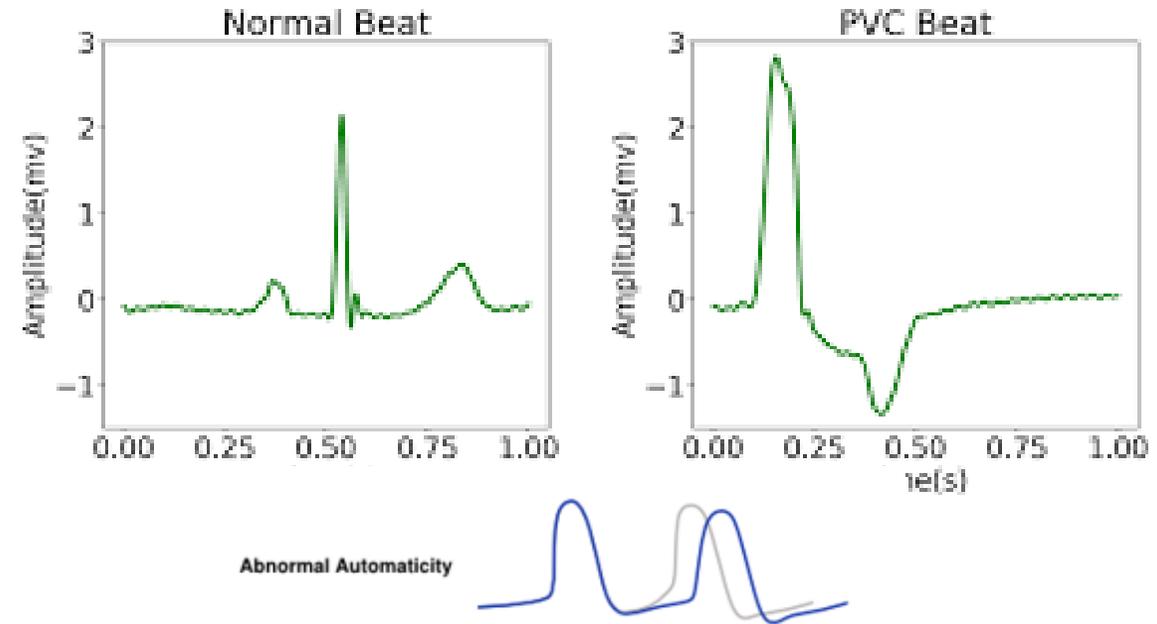
- Prematuur Ventriculair Complex (PVC)
- Ventrikel Tachycardie (VT)
- Ventrikel Fibrilleren (VF)



Ventricular Tachcardia ECG

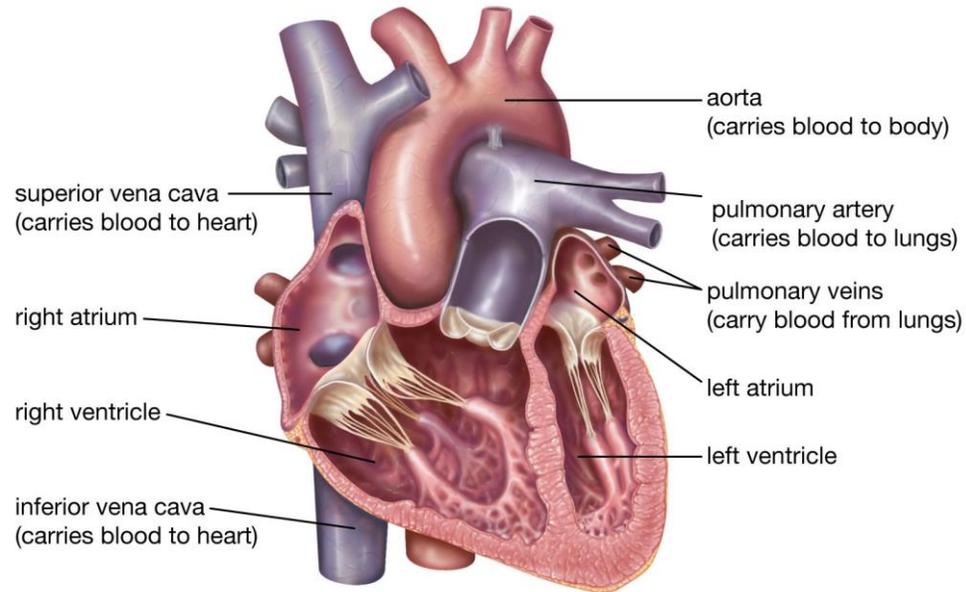


PVC; wat moet je ermee?



- Prematuur vallende verbrede contractie (QRS >120msec), verbrede T-golf in tegenovergestelde richting van QRS complex, zonder atriale of AV-nodale activatie.
- En dan?
- 10% -20% burden geassocieerd met LVdysfunctie binnen 5 jaar (jaarlijks follow-up geïndiceerd TTE/holter) + behandeling.
- <10%; follow-up of pas bij toename klachten.

Oorzaken PVC's...



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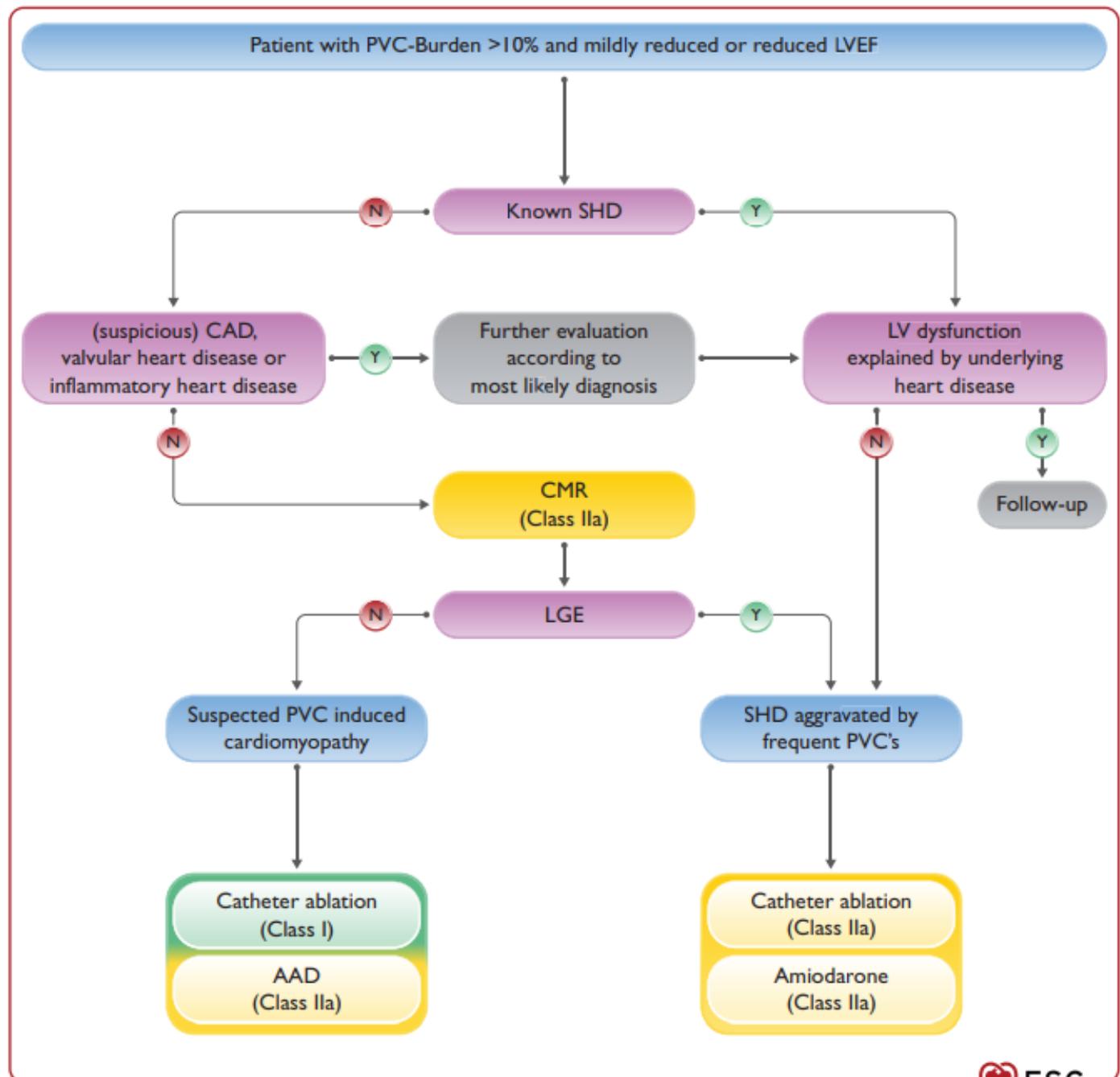
Wees beducht op:

- Ischemie?
- Wandspanning?
- Electrolytstoornis?

Non-cardiac causes [\[edit \]](#)

- Adrenaline excess
- Anemia^[4]
- Catecholamine excess
- Certain medicines such as tricyclic antidepressants, aminophylline^[5]
- Chemical (electrolyte) abnormalities in the blood (e.g. "pills")^[7] and hypomagnesaemia (magnesium deficiency)
- Contact with the carina (trachea/bronchi) when coughing
- Drugs/substances such as:^[3]
 - Amphetamines^[5]
 - Alcohol^[8]
 - Caffeine^[9]
 - Cocaine
 - Nicotine
 - Theobromine^[10]^[unreliable medical source?]
- Hypercapnia (CO₂ poisoning)^[3]
- Hypertension (high blood pressure)^[11]
- Hyperthyroidism^[4]
- High blood calcium^[3]
- Hypoxia^[3] and/or hypercapnia^[5]
- Lack of sleep/exhaustion^[12]
- Sarcoidosis^[13]
- Smoking
- Stress^[12]
- Anxiety^[4]

Workup bij
>10% PVCs en
LVF 40-50%

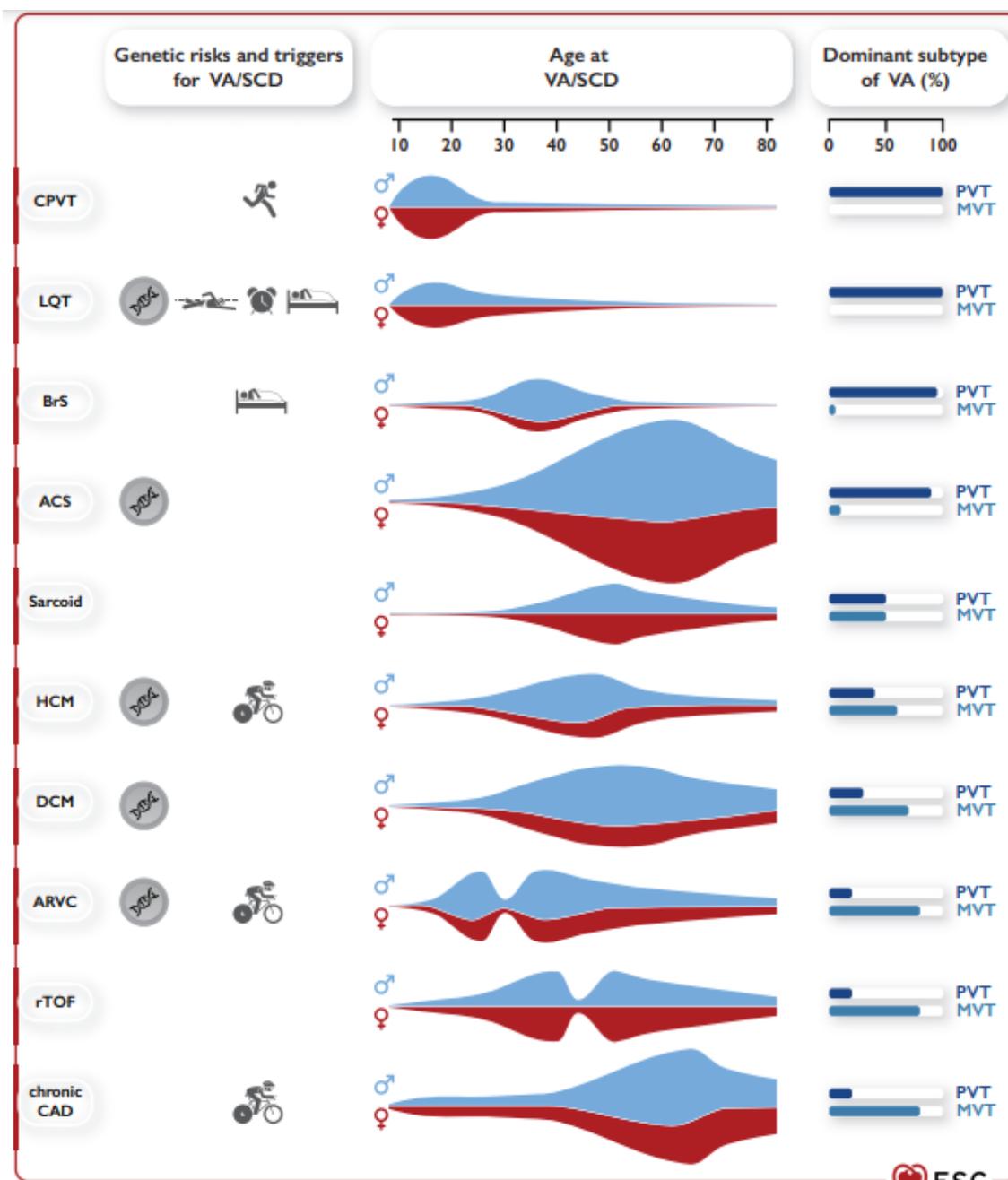


Ventrikel Tachycardie (VT)

- **Definitie:** >3 opeenvolgende slagen met ten minste 100/min, vanuit ventrikels los van AV-geleiding.
- VT = langer dan 30 seconden aanhoudend.
- NSVT = korter dan 30 seconden, maar ten minste 3 slagen opeenvolgend.
- Mono-morf: 1 soort configuratie
- Polymorf: meerdere soorten configuratie

- Electricische Storm; binnen 24u, 3 of meer episodes (5min of langer ertussen) van ventriculaire aritmieën waarvoor therapie gegeven is (medicatie, ECV).

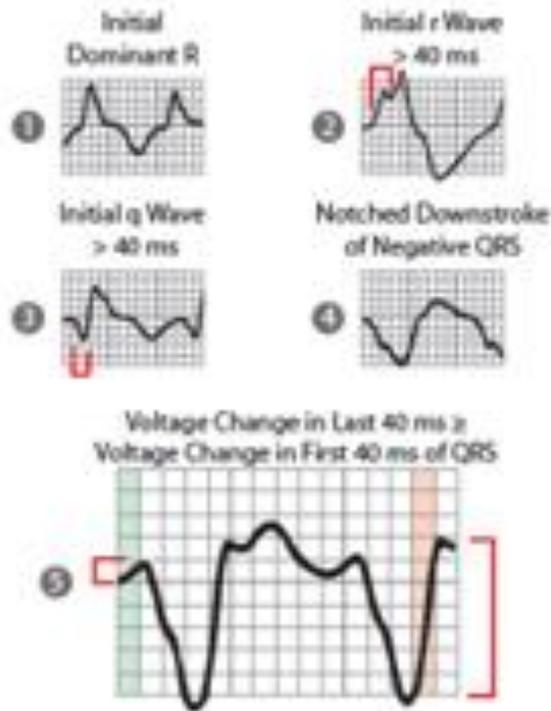
Ventrikel Tachycardie (VT) (2)



K. Zeppenfeld et al. 2022 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. Eur Heart J. 2022 Oct 21;43(40):3997-4126

Is het een VT?: een overzicht

Lead aVR Algorithm



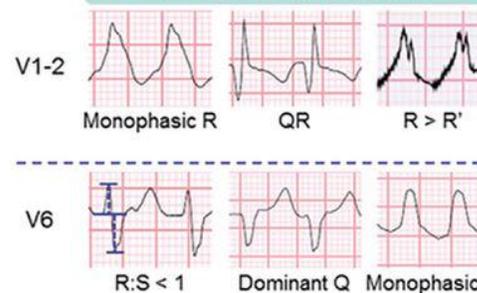
Any of the above in lead aVR \rightarrow VT
 None of the above in lead aVR \rightarrow SVT

AV dissociation

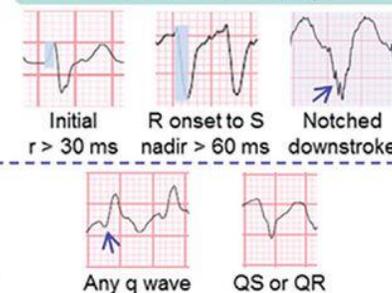


Morphological criteria

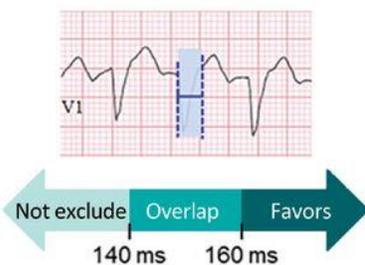
RBBB morphology



LBBB morphology

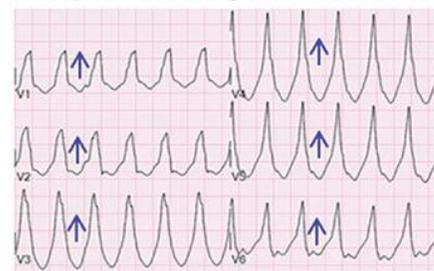


QRS duration

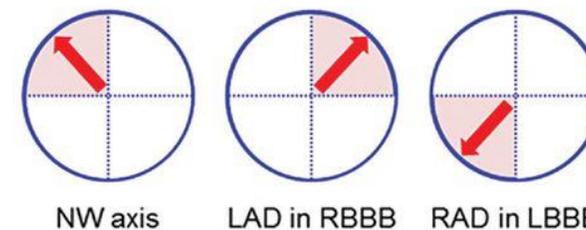


Chest lead concordance

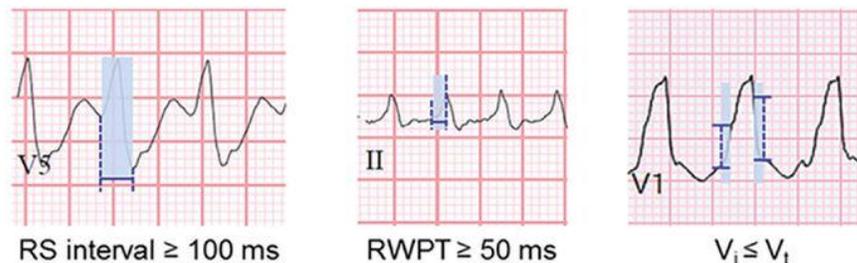
V1-6: positive or negative concordance



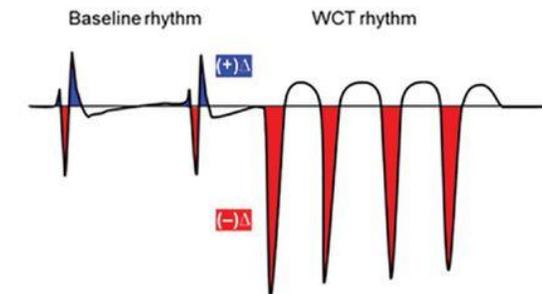
QRS axis



Ventricular activation velocity

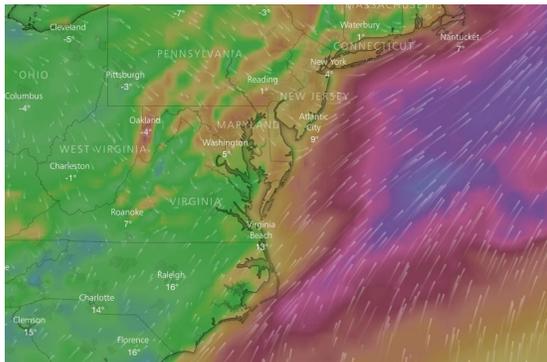
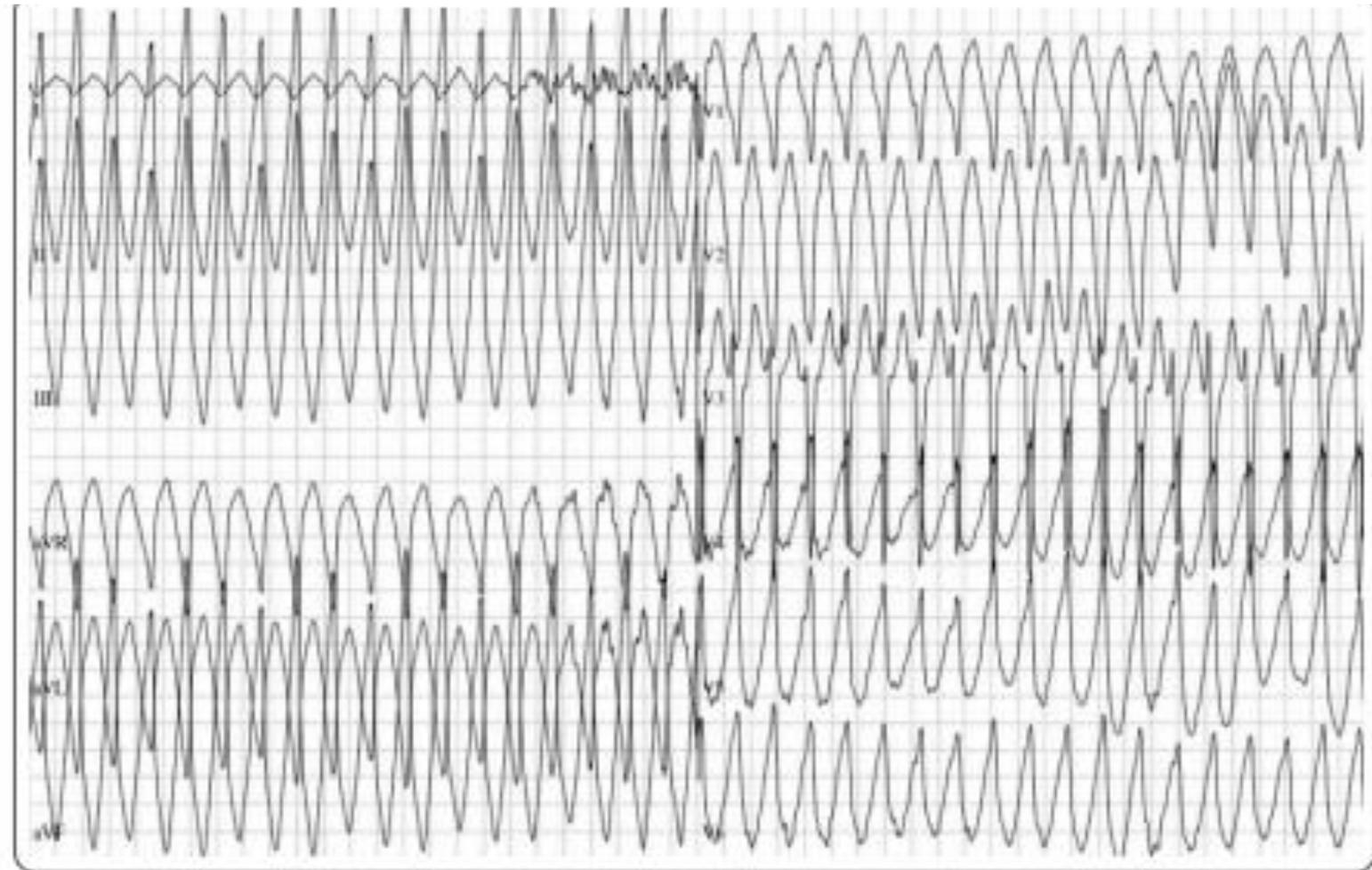
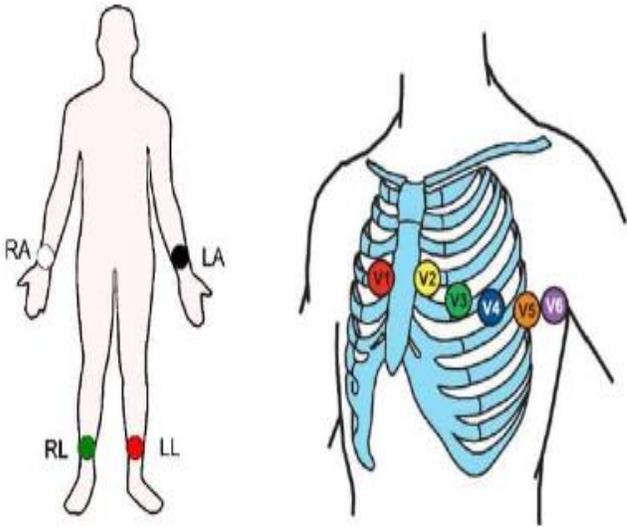


Baseline ECG comparison

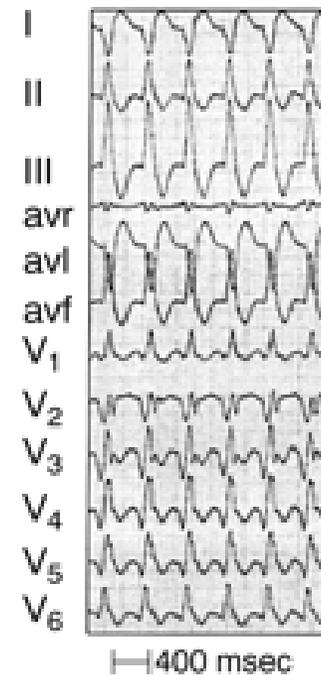
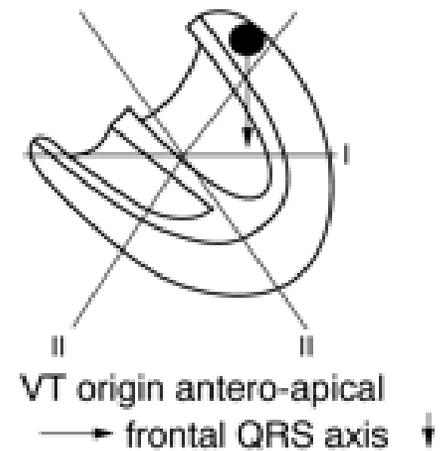
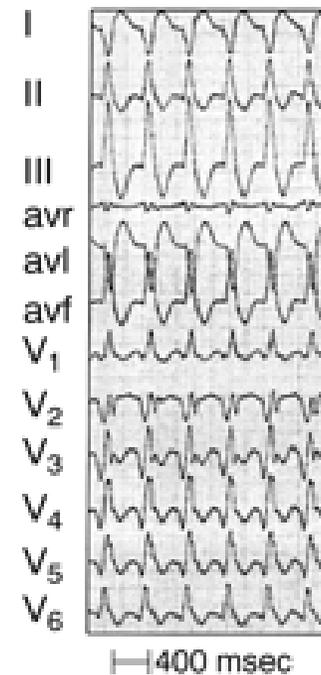
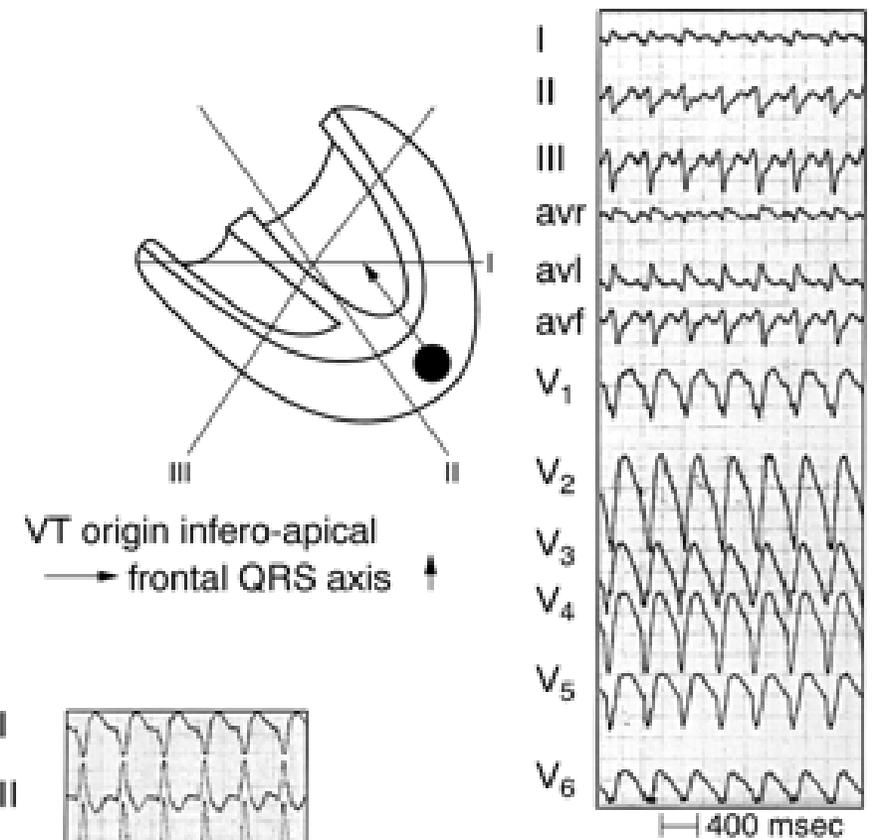


Een voorbeeld:

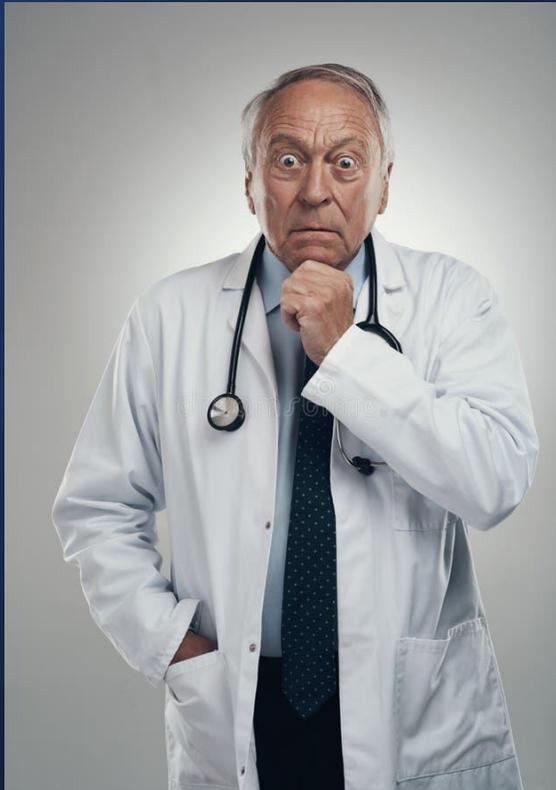
RVOT VT (LBBB-like, inferior axis, V4 transition)



En nog een (met uitleg)



De patient met een VT: vooral praktisch houden!

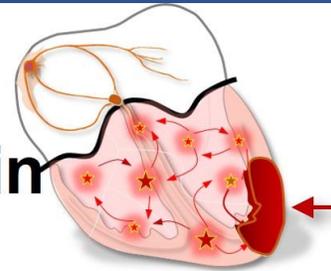


- **Verdenking VT:**
 - - HD instabiel? -> ECV
 - - HD stabiel: er is tijd, evt adenosine ter diagnostiek danwel procainamide/amiodarone bij detoriatie; (ECV)
 - Electrical storm? ICU + sedatie + perfusor, evt spoedablatie.
 - **Wat weet ik:**
 - - voorgeschiedenis (bekende CMP?, STEMI?)
 - **Wat zie ik:**
 - - een smal of breed QRS complex?
 - - welke vorm: RBTB of LBTB?
 - - as (naar onderwand = inferior as, er vanaf = superior as)
 - - transitie (kantelpunt = locatie)
 - - hoe valt dit te rijmen met VG?
 - En verder; richtlijnen voor beoordeling VT
 - Voortschrijdende kliniek; ECV! + onderhouds perfusor.
- NB: ICD aan? Evt detectie verbreden anders magneet erop!

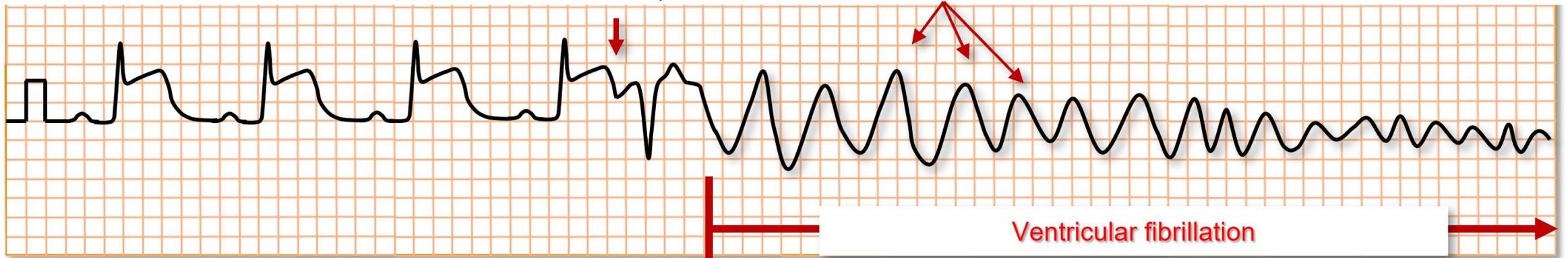
STEMI with a PVB (R on T) resulting in

Standard lead II 50 mm/sec.

VPB (R on T)

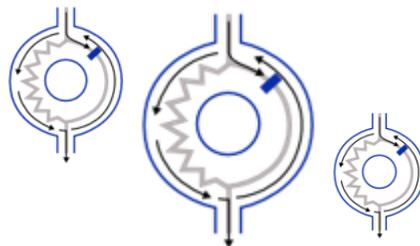
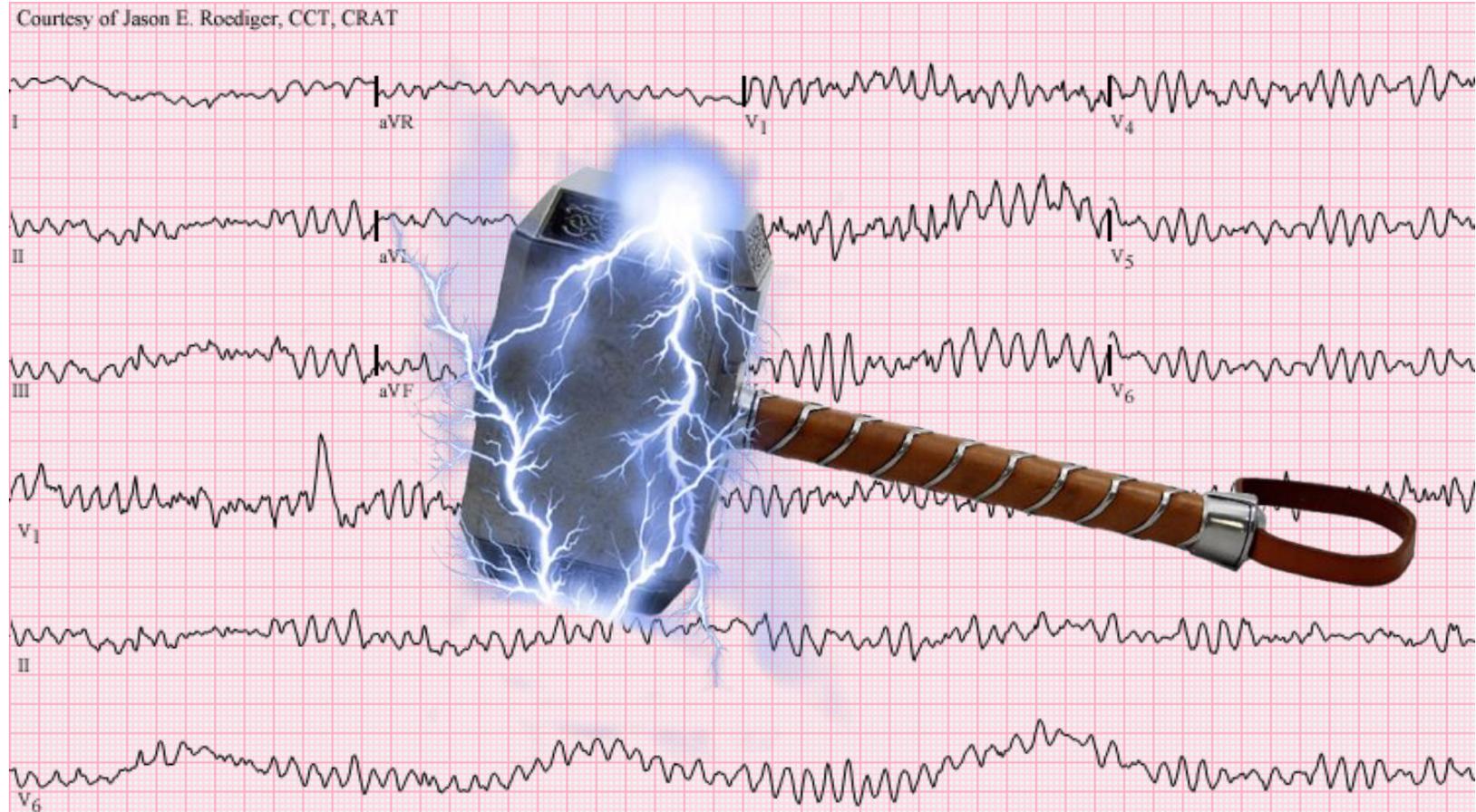


Infarction



Ventricular fibrillation

Tja.. Ventrikel Fibrilleren (VF)



Take to the Clinic Aritmieën

- Begrip van basismechanismen aritmie-formatie helpt bij patronen herkennen en de behandeling:
 - Automaticiteit: verandering van 'dirigent'; membraan eigenschappen lijkend op pacemaker-cel.
 - Re-entry: anatomisch danwel functionele geleidingsproblematiek van automaticiteit.
- ECG als visuele hulp: breng afwijkingen terug op anatomisch niveau.
- Supraventriculair: de natuur is mild; neem de tijd om ECGs te beoordelen en terug te gaan naar de basis.
 - Pas desgewenst adenosine infusie toe ter diagnostiek (Conversie? Fluttergolven?)
 - CAVE: autonome dysfunctie!
 - Registreer van SVT tot aan conversie.
- Ventriculair: soms is de natuur mild:
 - Is er tijd: Wat zie ik? Wat weet ik van deze patient?
 - Zo niet: ECV (met of zonder sedatie)



Dank voor jullie
aandacht!

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