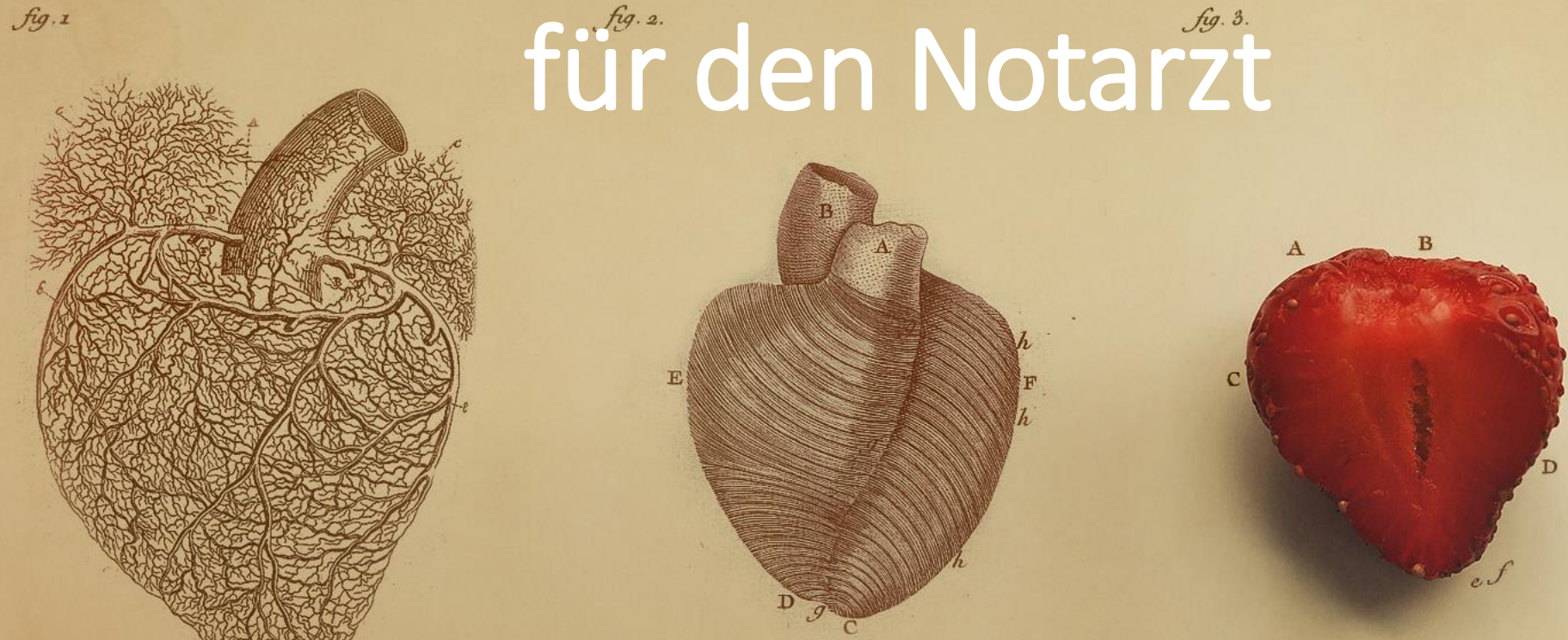
# Relevante Rhythmusstörungen für den Notarzt

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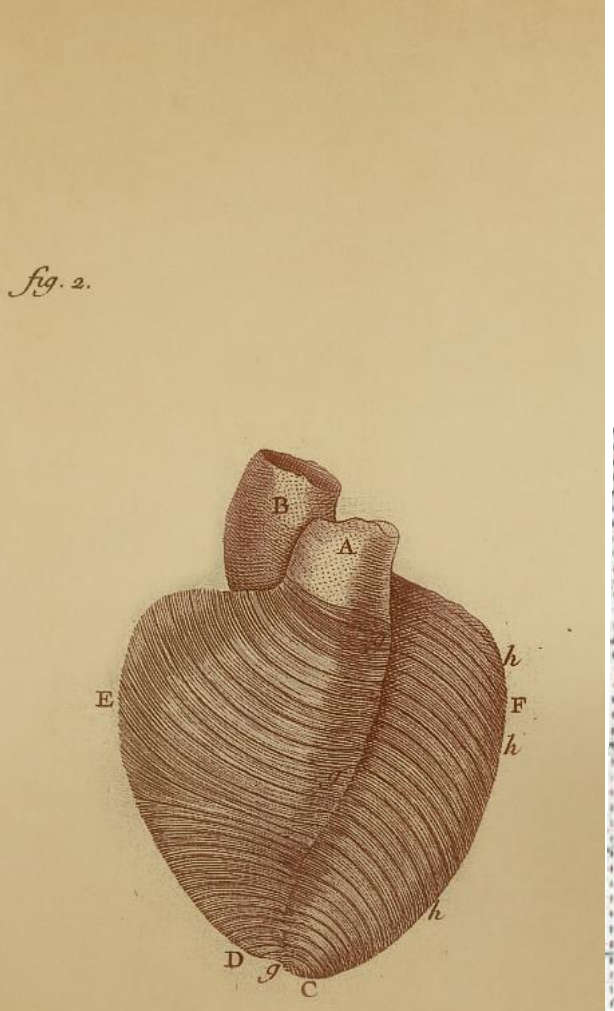
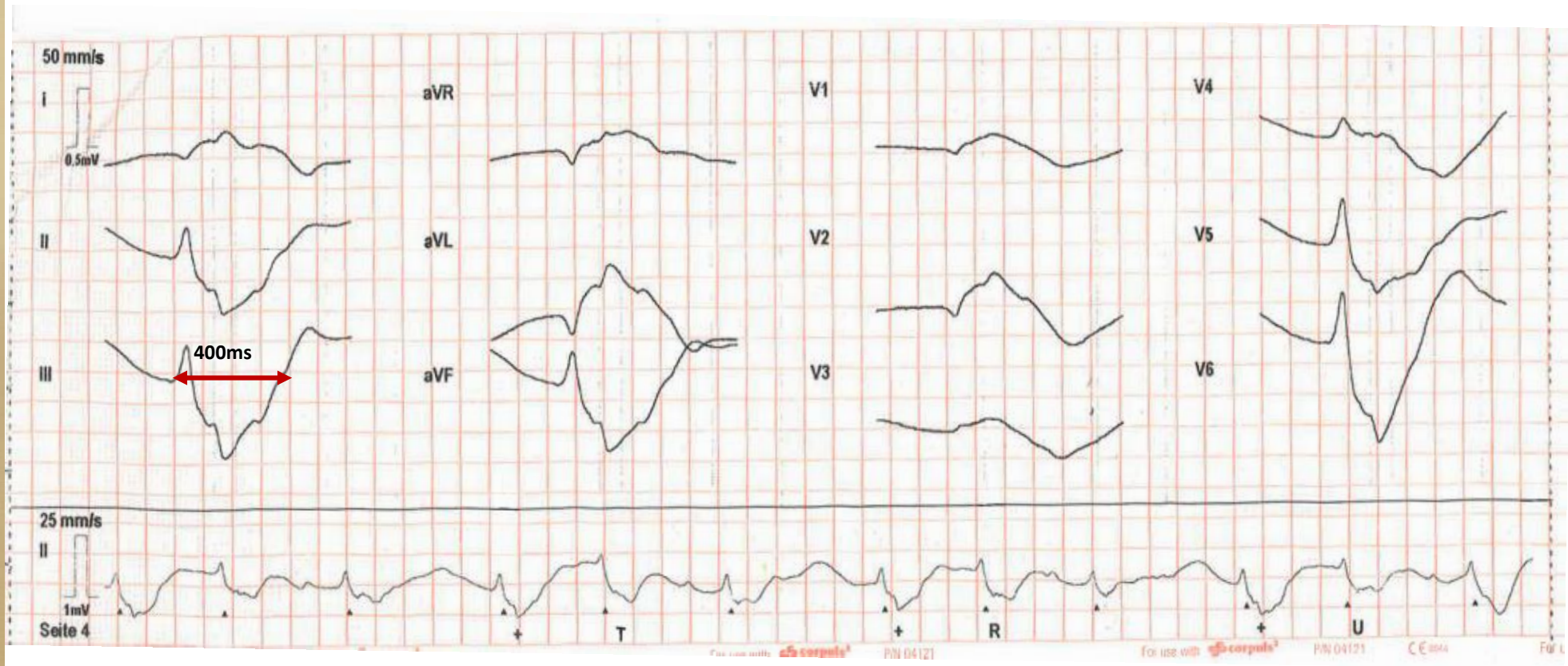
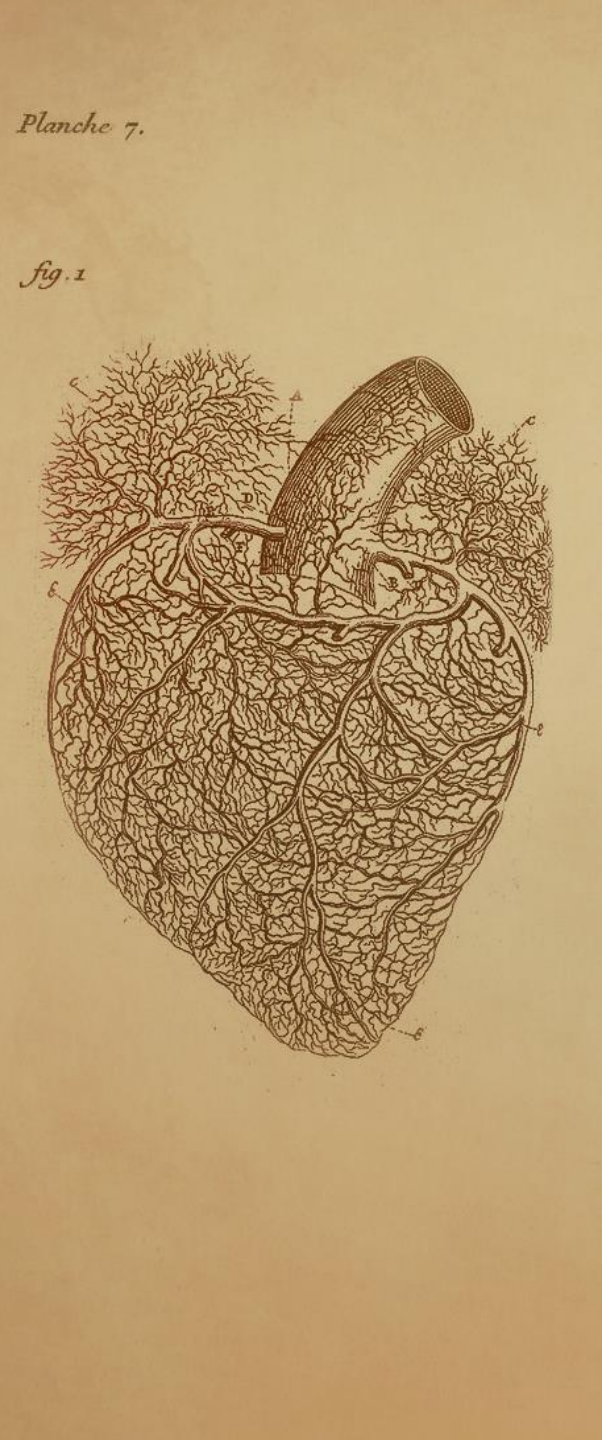
www.pediatricarrhythmia.com

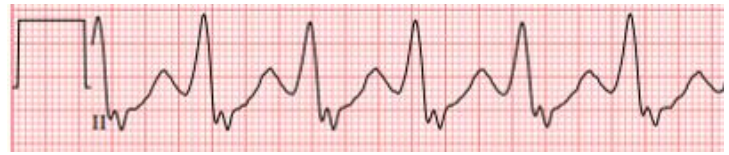
# Es war einmal...



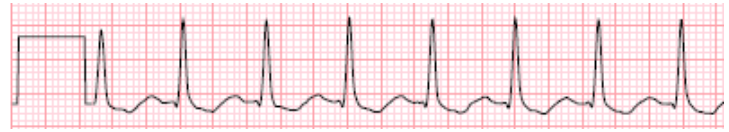





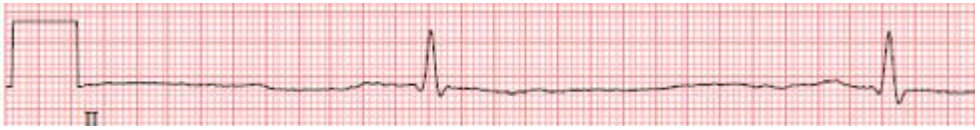

# Take Home Message

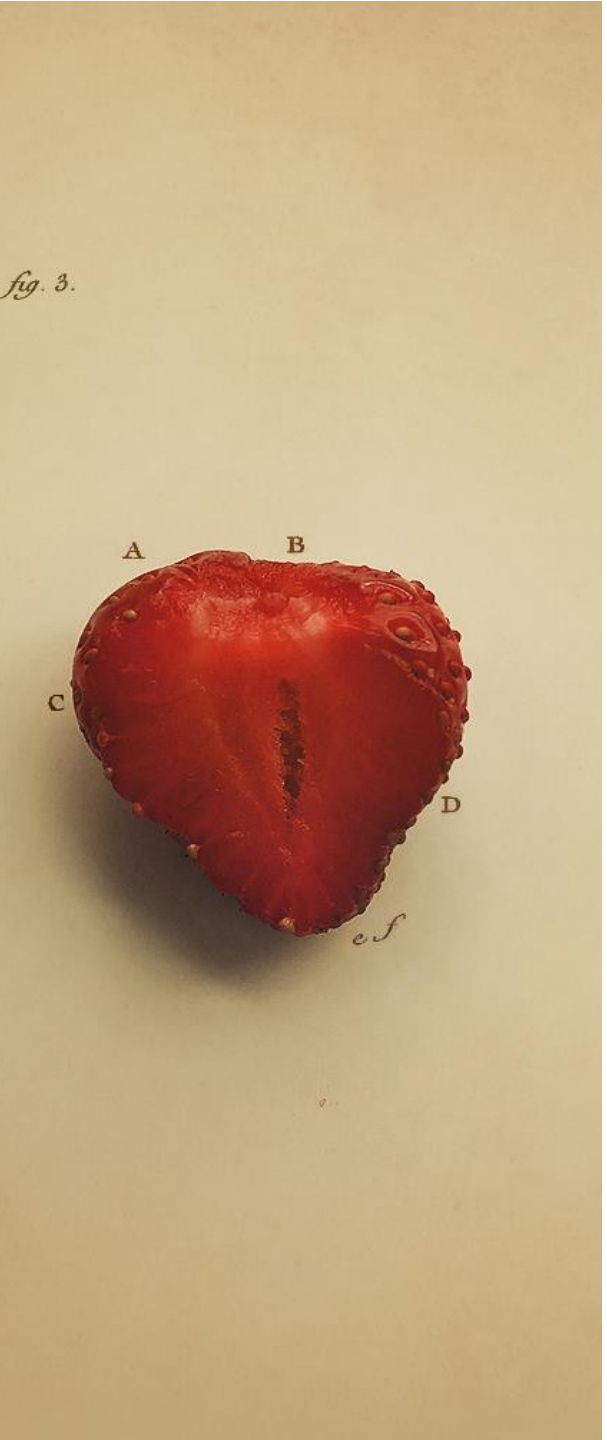


- **Tachykardie:** NCT vs WCT
  - NCT: Valasva, Adenosin, Strom, Amiodaron
  - WCT: Lidocain, Amiodaron, Strom



- **Bradykardie**: AVB, Sinusbradykardie, Intox
  - Adrenalin, (Atropin), externes Pacing






# Arrhythmien im Kindesalter

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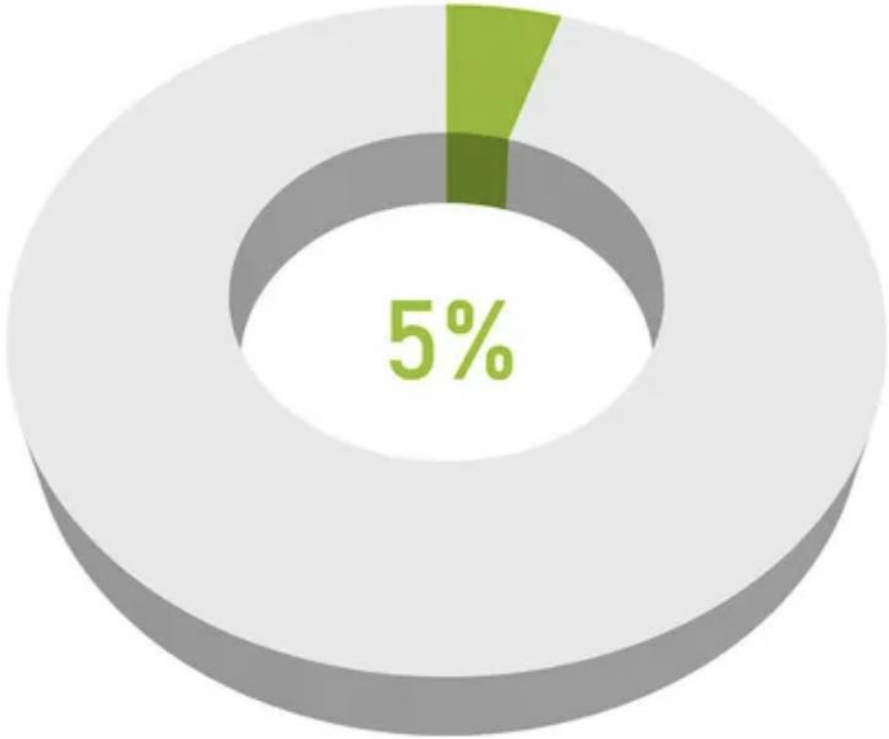
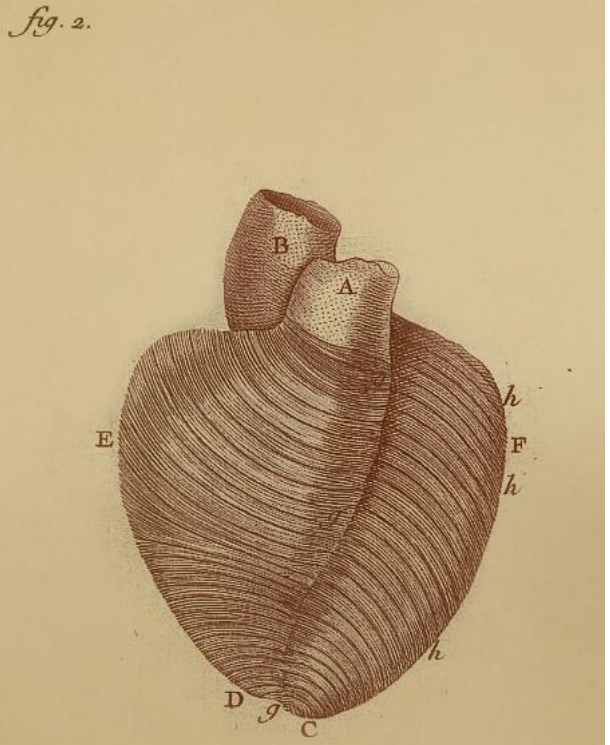
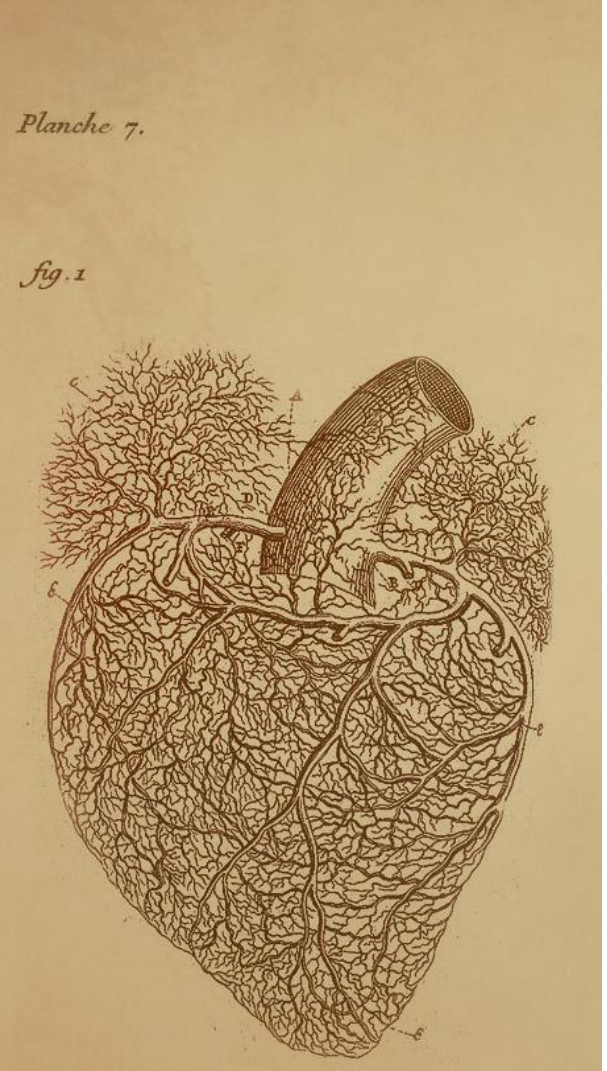
- Defibrillator selten notwendig
- Geringe Mortalität
- >>> supraventrikulär
- Lange stabil
- Load & Go



# Symptome

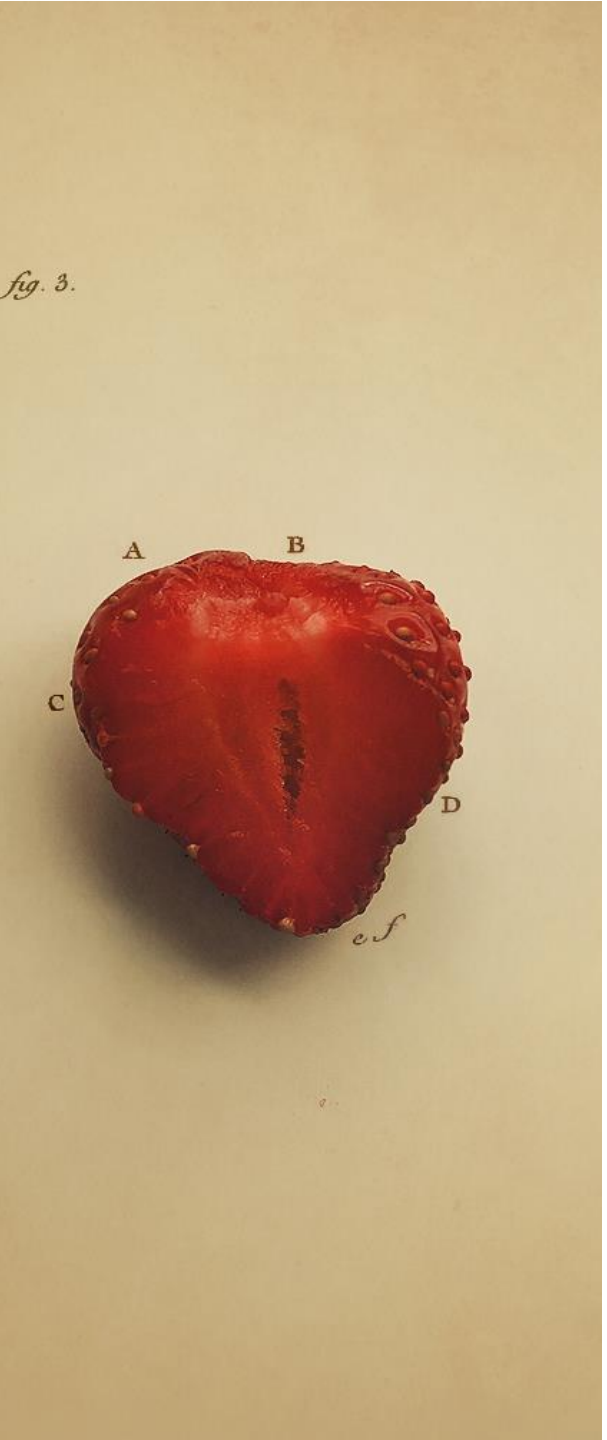



- Schwäche
- Müdigkeit
- Palpitationen („spürt das Herz schlagen“)
- Art. Hypotension
- Schwindel
- Pre-/Synkope
- Schlechtes Trinkverhalten (Sgl)
- Inadäquate Gewichtszunahme (Sgl, incessante Tachy)




# Ursachen

- Angeborene Herzfehler
- Angeborene anatomische Besonderheiten (Leitungsbahn,...)
- Infektionen
- Elektrolytstörungen
- Reizleitungsstörungen (angeboren/erworben)
- Ionenkanalerkrankungen (Long QT, Brugada,...)




# „If you hear hoof beats ..."

## Tachykardien

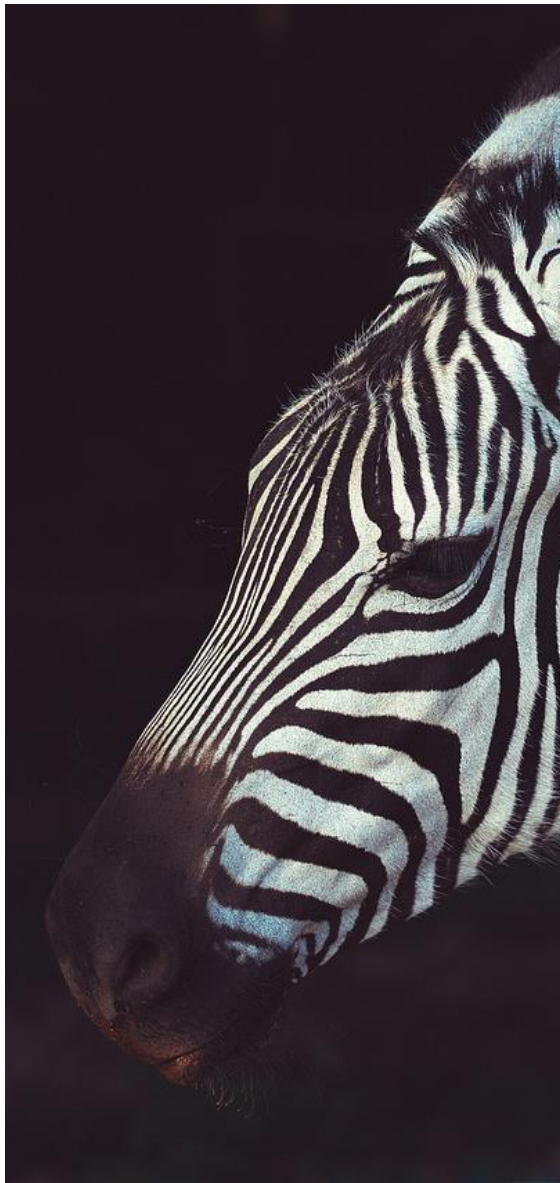
- Schmalkomplextachykardien: 1:250 – 1:1.000
  - AV Reentry Tachykardie (AVRT; WPW Syndrom) – **80%**
  - AV Knoten Reentry Tachykardie (AVNRT) – 15%
  - 5% - Atriale Tachykardie, Vorhofflattern/-flimmern, PJRT,...

**95%**

- Breitkomplextachykardien:
  - SVT mit Schenkelblock
  - Antidrome AVRT
  - Ventrikuläre Tachykardie (VT) – 8:100.000
  - Sehr selten TdP, polymorphe VT, VF,...

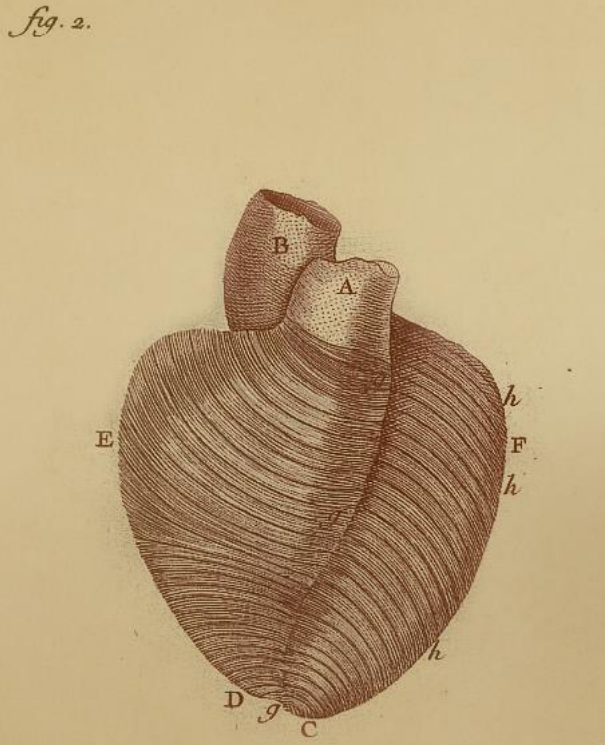
## Bradykardien

- Sinusbradykardie (Anorexie, Hirndruck, Toxine...)
- AV Block
- Sinusknotendysfunktion,...



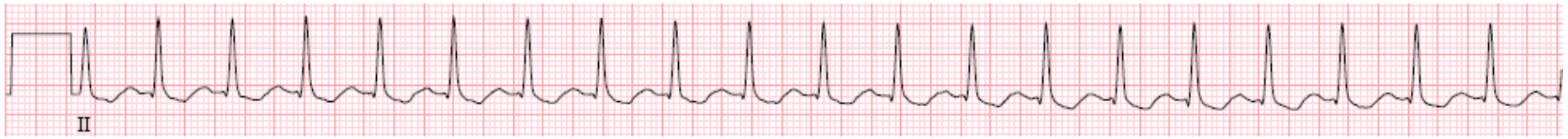
Hanash CR, Crosson JE. Emergency diagnosis and management of pediatric arrhythmias. J Emerg Trauma Shock. 2010 Jul;3(3):251-60.
Carolina A. Escudero, Reina Bianca M. Tan, Cheyenne M. Beach, Aarti S. Dalal, Martin J. LaPage, Allison C. Hill. Approach to Wide Complex Tachycardia in Pediatric Patients. CJC Pediatric and Congenital Heart Disease, 2022.

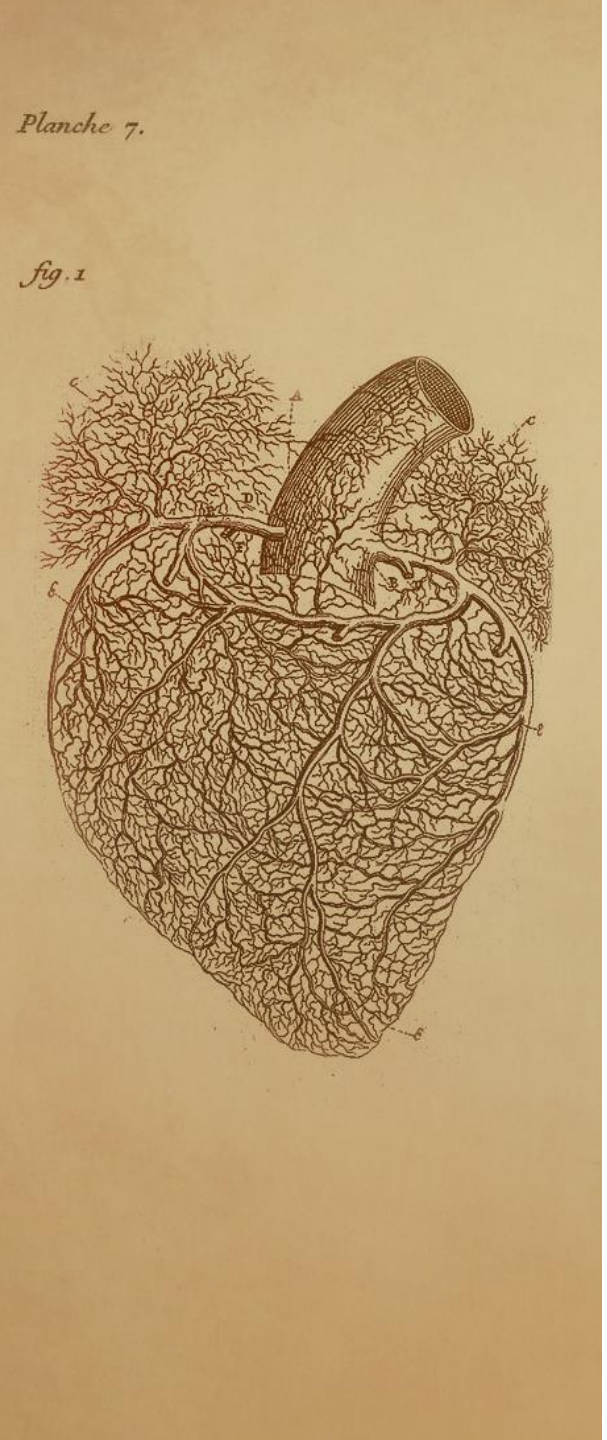
# Schmalkomplextachykardien



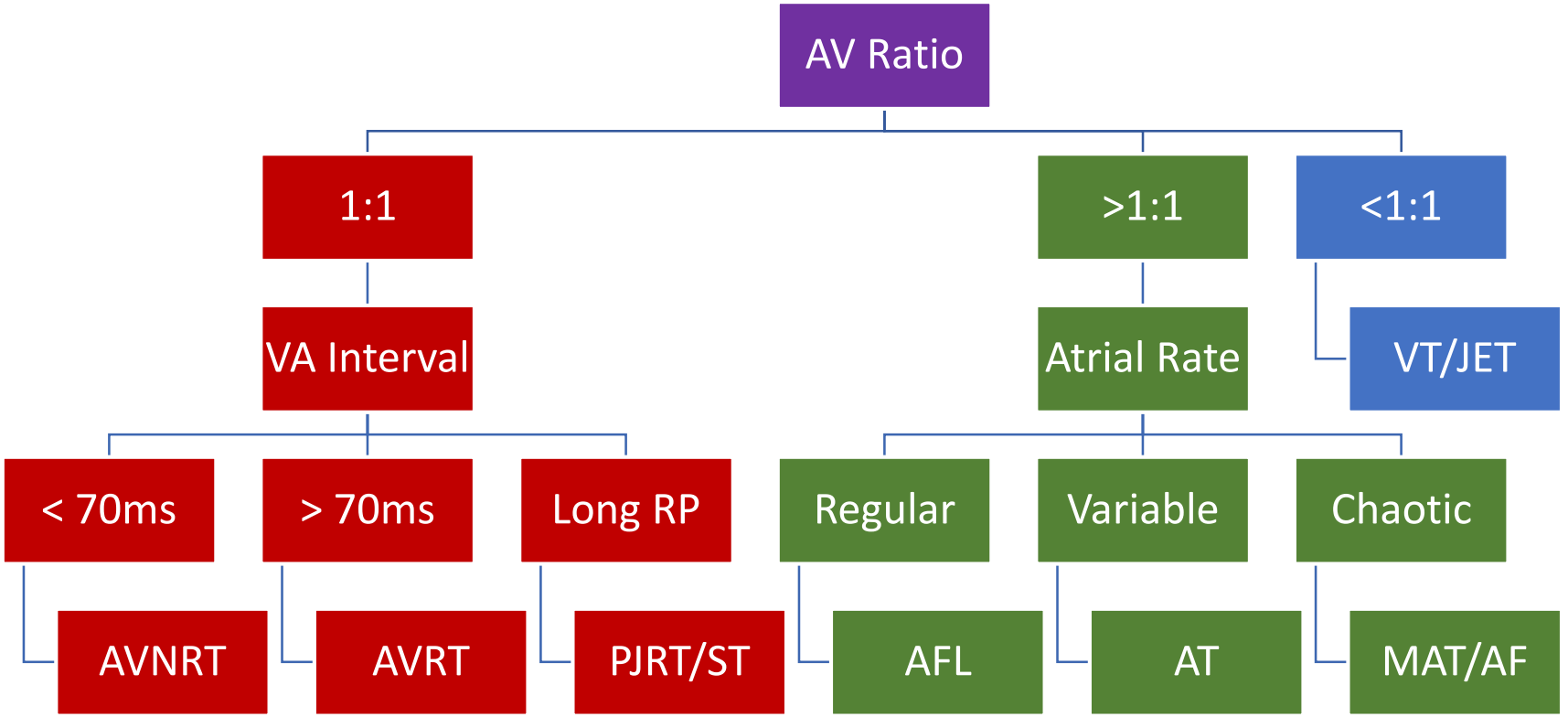

**QRS <100ms**, rhythmisch, tachykard

Differentialdiagnose → P Wellen suchen

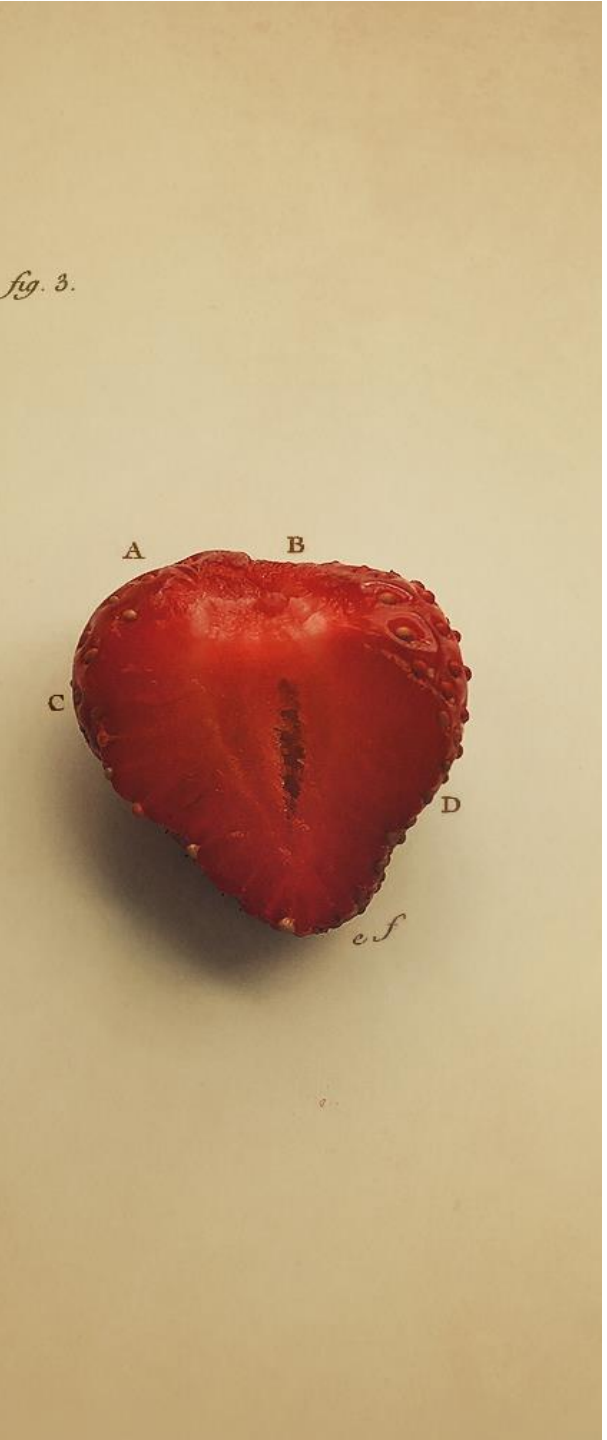




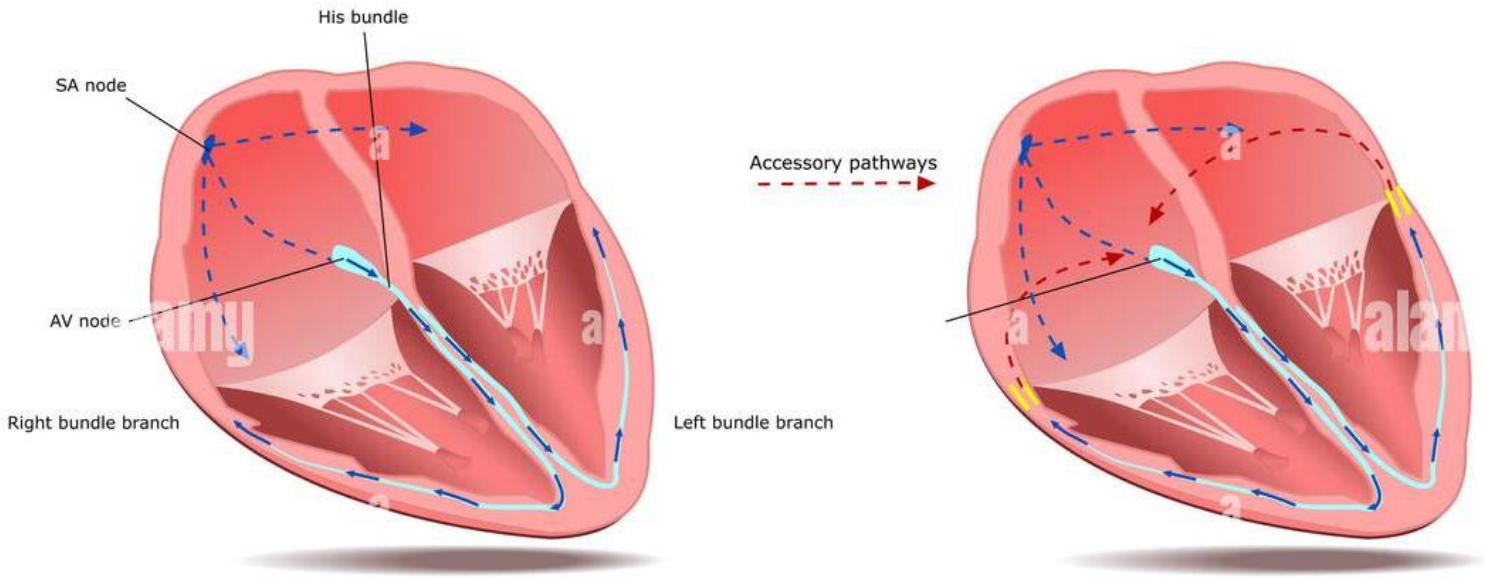

# SVT EKG DD



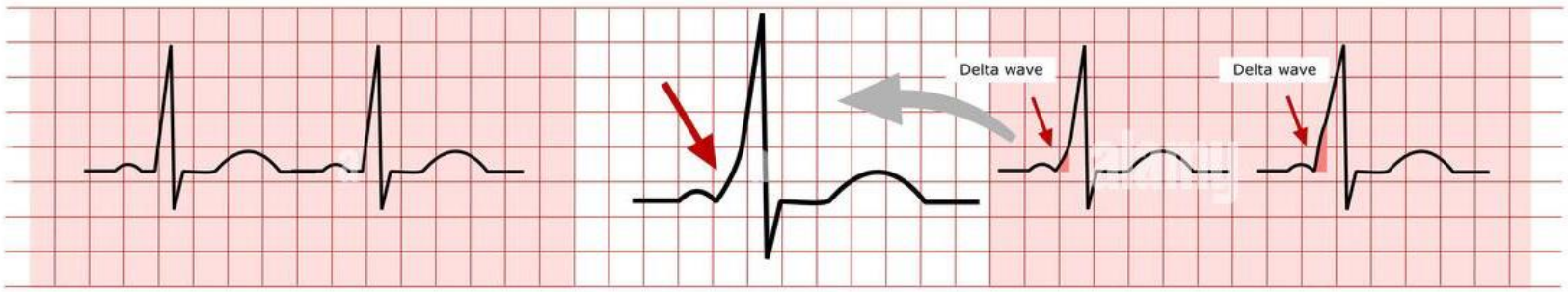

Adapted from Walsh EP, Saul JP, Triedman JK. Cardiac arrhythmias in children and young adults with congenital heart disease. Philadelphia: Lippincott Williams & Wilkins; 2001.



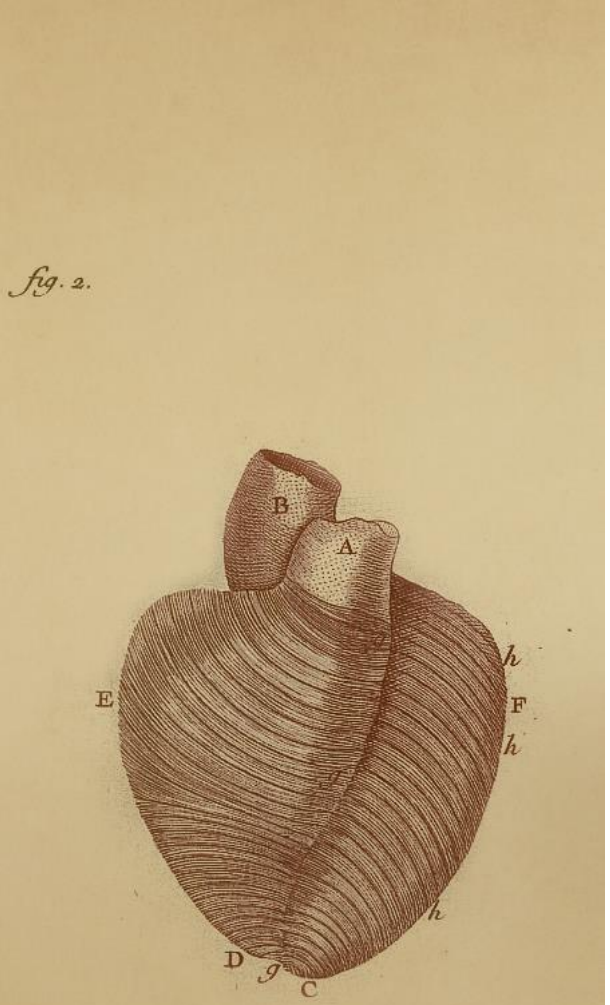

# Beispiel AVRT




Quelle: www.alamy.com



# Beispiel AVNRT



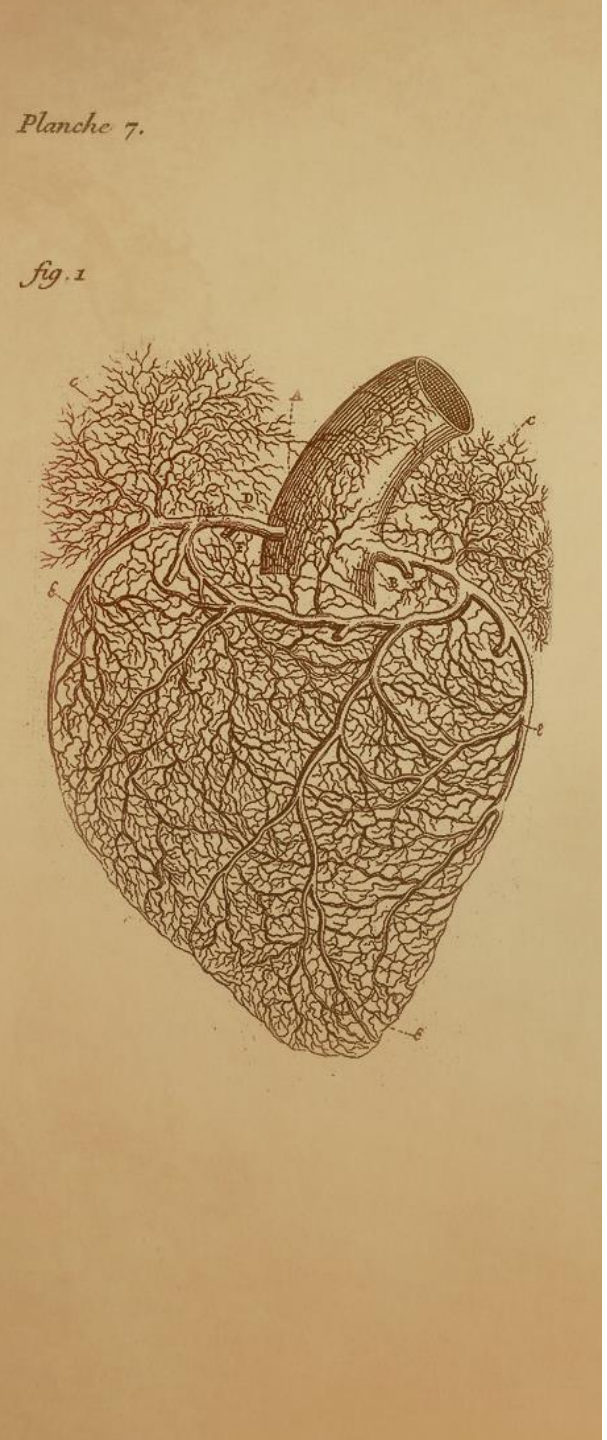
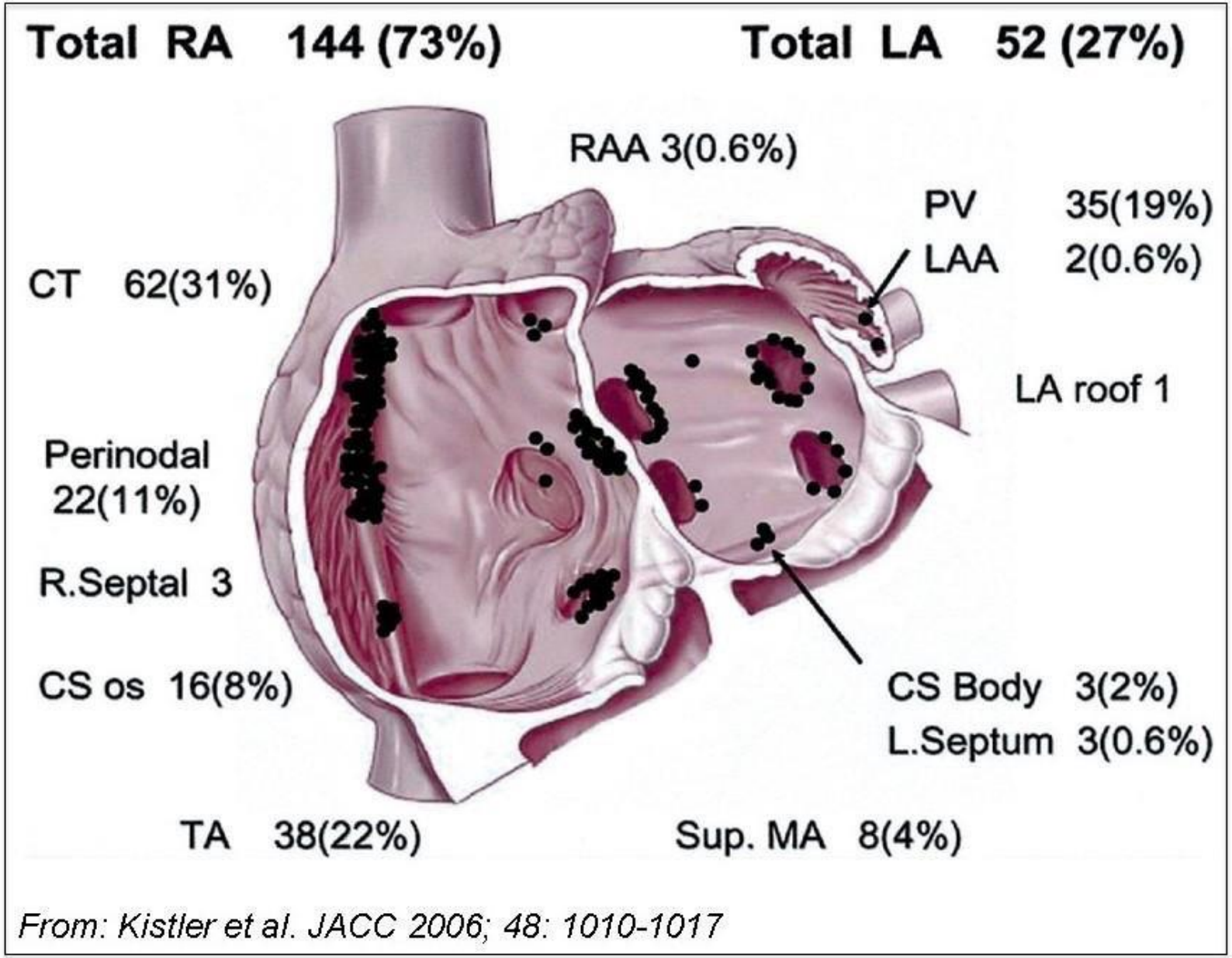
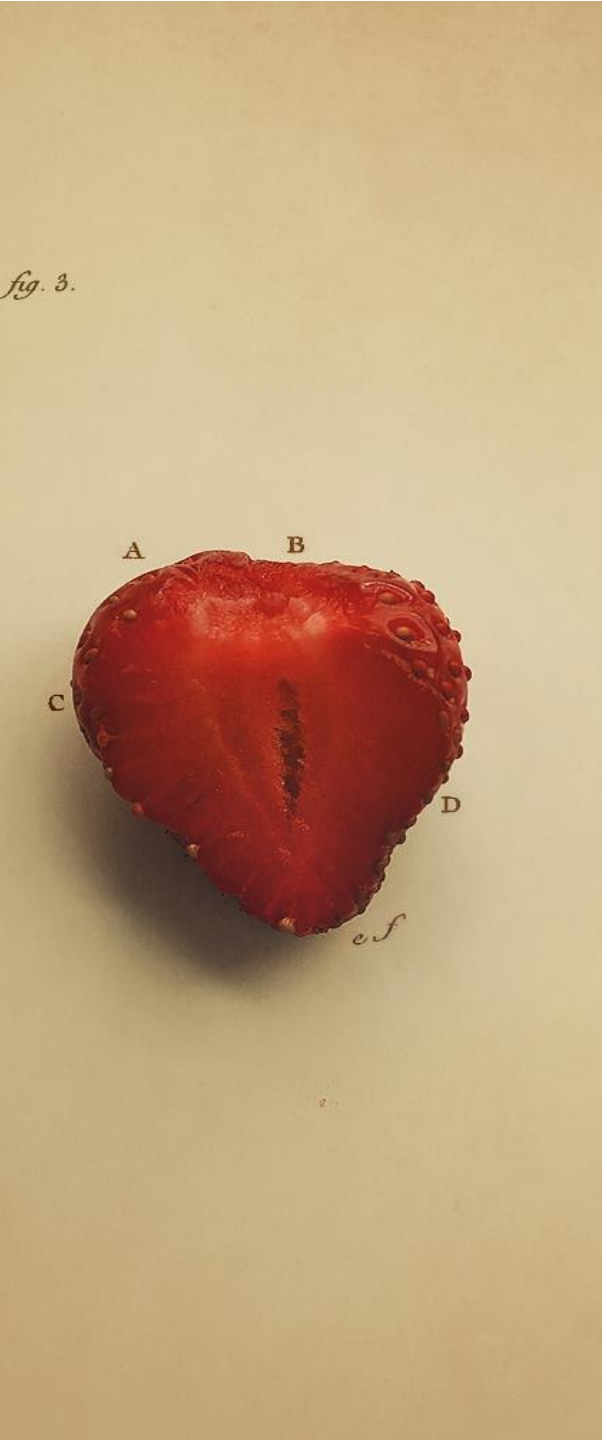



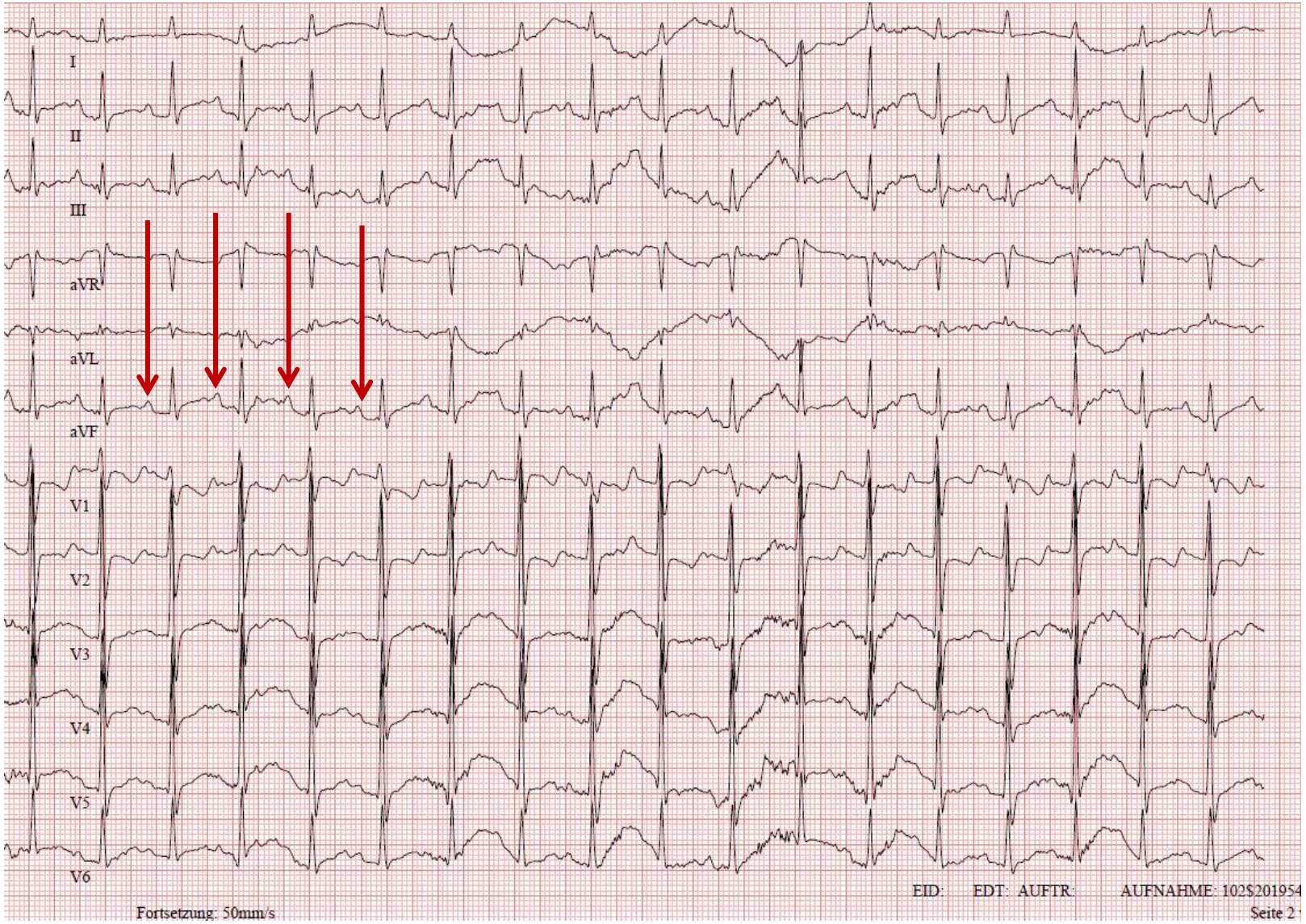
Planche 7.
fig. 1

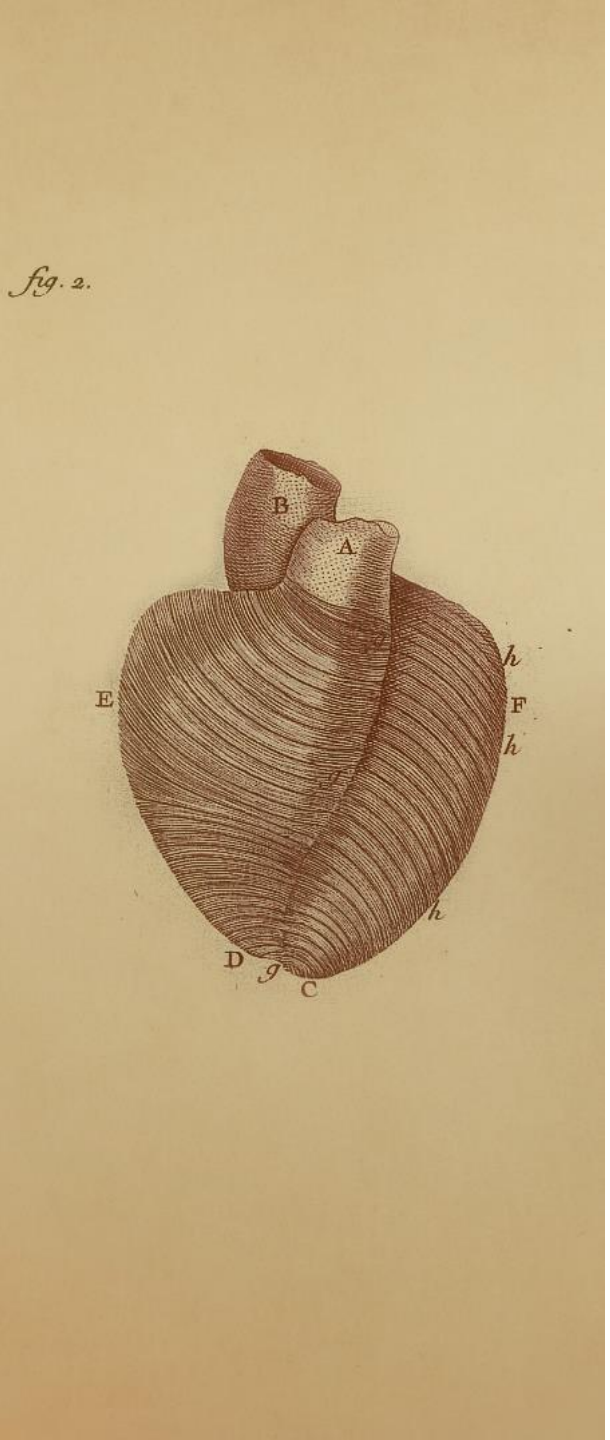
# Beispiel AT


Total RA 144 (73%)
Total LA 52 (27%)
RAA 3(0.6%)
PV 35(19%)
LAA 2(0.6%)
CT 62(31%)
LA roof 1
Perinodal 22(11%)
R.Septal 3
CS os 16(8%)
CS Body 3(2%)
L.Septum 3(0.6%)
TA 38(22%)
Sup. MA 8(4%)
From: Kistler et al. JACC 2006; 48: 1010-1017




# Beispiel Sinustachykardie






# SVT Therapie

**NCT (QRS <100ms)**

**SVT**

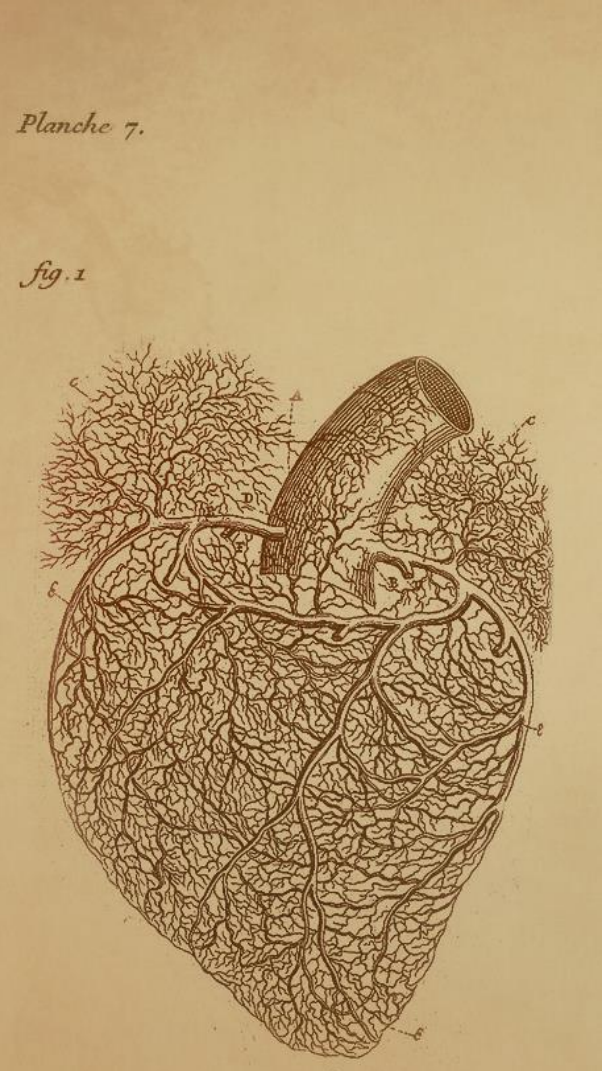
Vagal maneuvers

Rule #13 House of God: The delivery of good medical care is to do as much nothing as possible.

**Adenosine 0,1 mg/kg i.v.**
(push i.v. & flush with saline!!)

Repeat: 0,2 mg/kg;  0,3 mg/kg

**Cardioversion 1 J/kg**
**“synchronized” !!**




# Adenosin bei WPW

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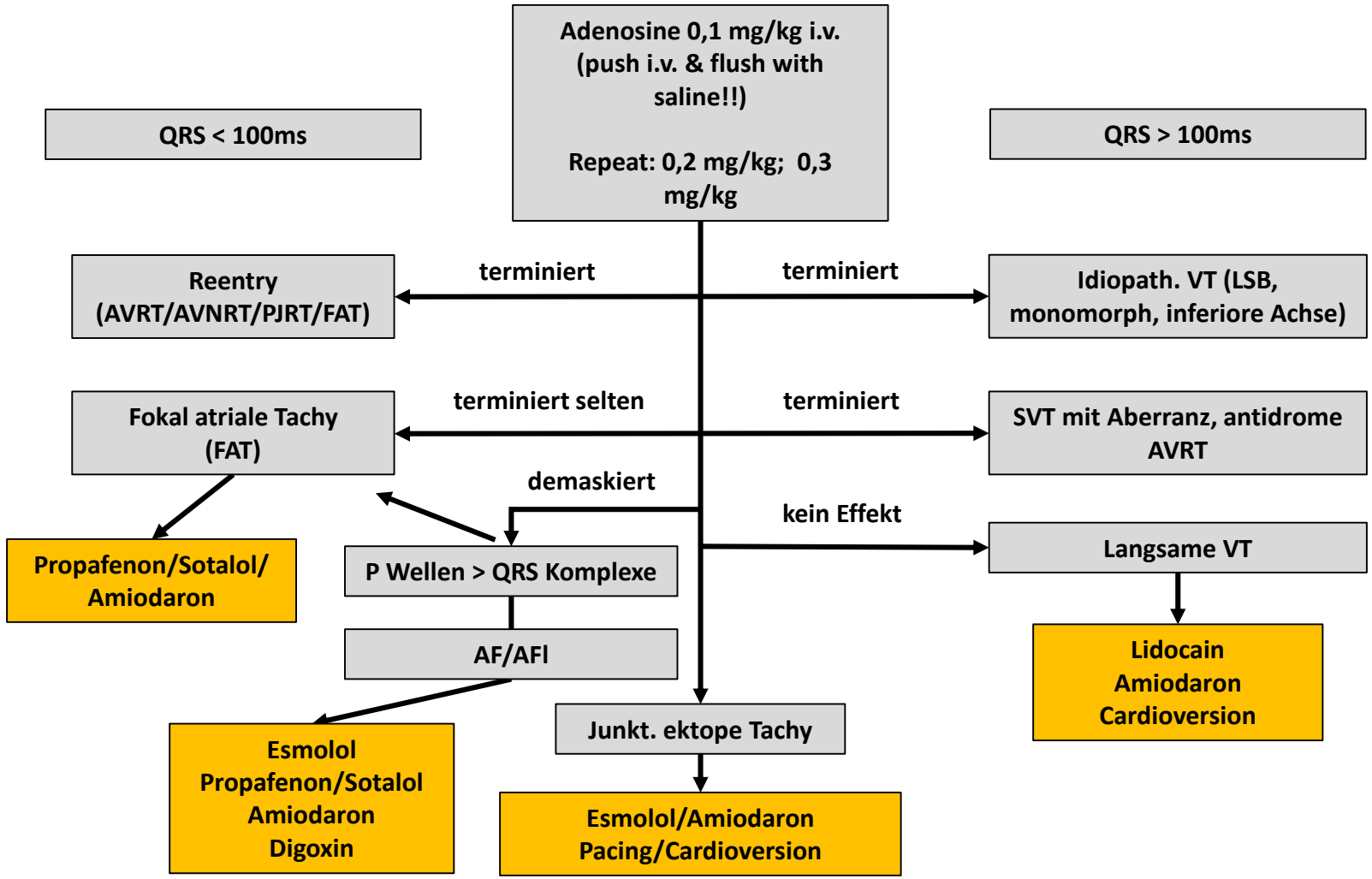
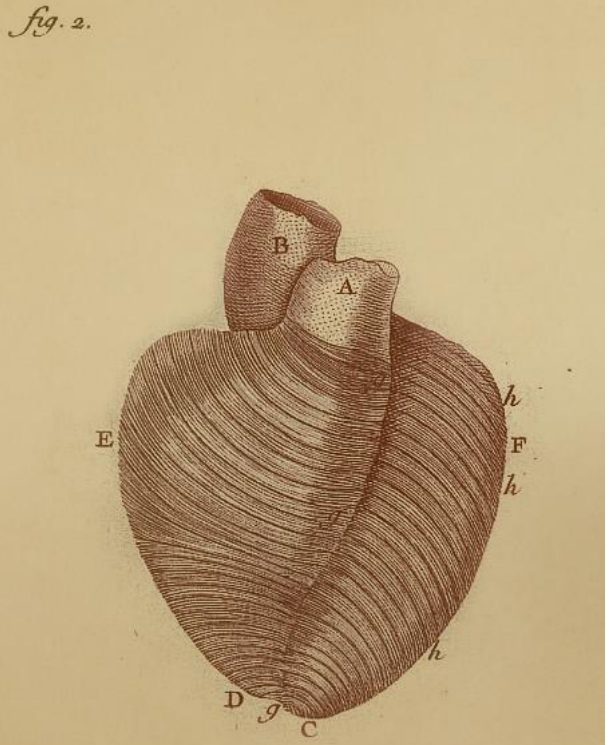
- Darf man das?
- CAVE: rasche antegrade Leitung über AP → 1:1 Leitung von AF!
- AF mögliche Nebenwirkung von Adenosin!
- Bei bekanntem WPW **Defi-Pads vor Adenosingabe** kleben


**0,1 mg/kg iv push (0,2 mg/kg; 0,3 mg/kg)**

# Diagnostik mit Adenosin

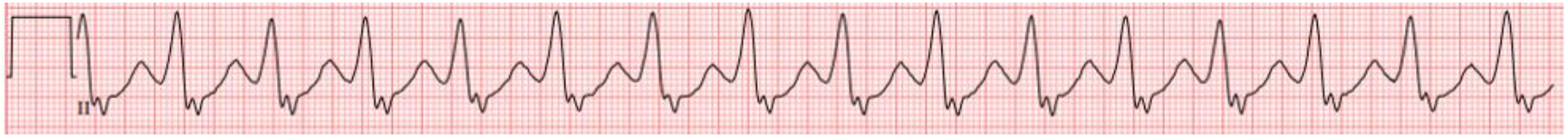


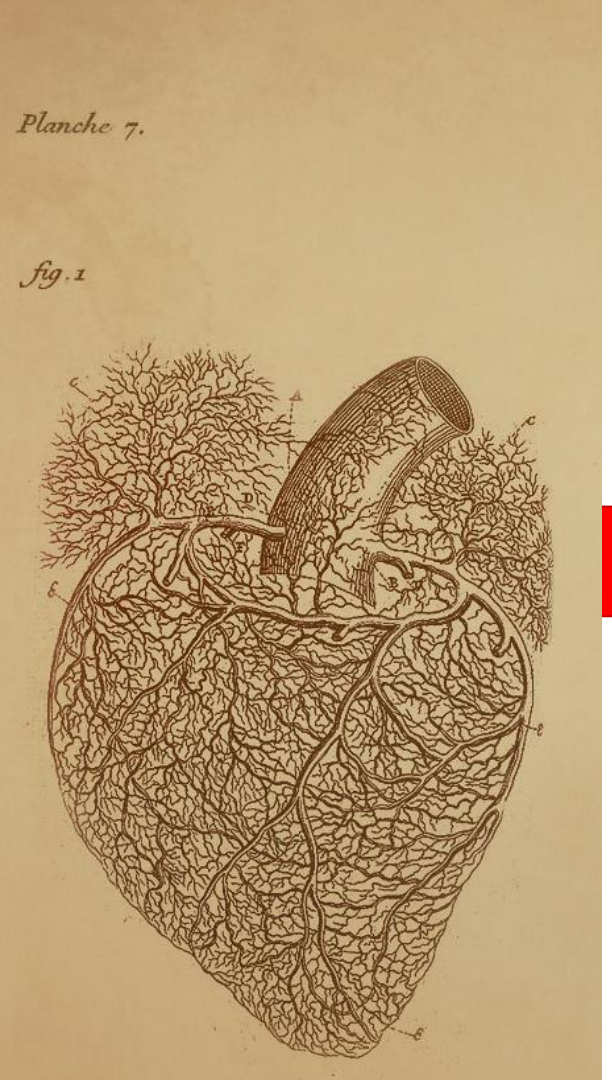
# Breitkomplextachykardie




**QRS >100ms**

Meist supraventrikulärer Ursprung (Schenkelblock, ...)



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**WCT (QRS >100ms)**

**Unstable**

**Pulse +**

**Cardioversion 1 J/kg „synchronized“ !!**

**Pulseless**

**Defibrillation 4 J/kg**

**Stable**

**Analyze ECG**

**VT**

Lidocaine 1 mg/kg i.v. (followed by 20-50 µg/kg/min)

Amiodarone 5 mg/kg i.v. (over 20 – 60 min; max dose 300mg!!)

**Cardioversion 1 J/kg „synchronized“ !!**

**Torsade de pointe**

Mg-Sulfate 25 - 50 mg/kg i.v. (max dose 2000mg!) Cormagnesin 0,1ml/kg (=40mg/kg) over 20-30 min

Lidocaine 1 mg/kg i.v. (followed by 20-50 µg/kg/min)

**Cardioversion 1 J/kg „synchronized“ !!**

**or if pulseless Defibrillation 4 J/kg**

**SVT aberrant conduction**

Vagal maneuvers

Adenosine 0,1 mg/kg i.v. (push i.v. & flush with saline!!)

Repeat: 0,2 mg/kg; 0,3 mg/kg

**Cardioversion 1 J/kg “synchronized” !!**

# Beispiel VT

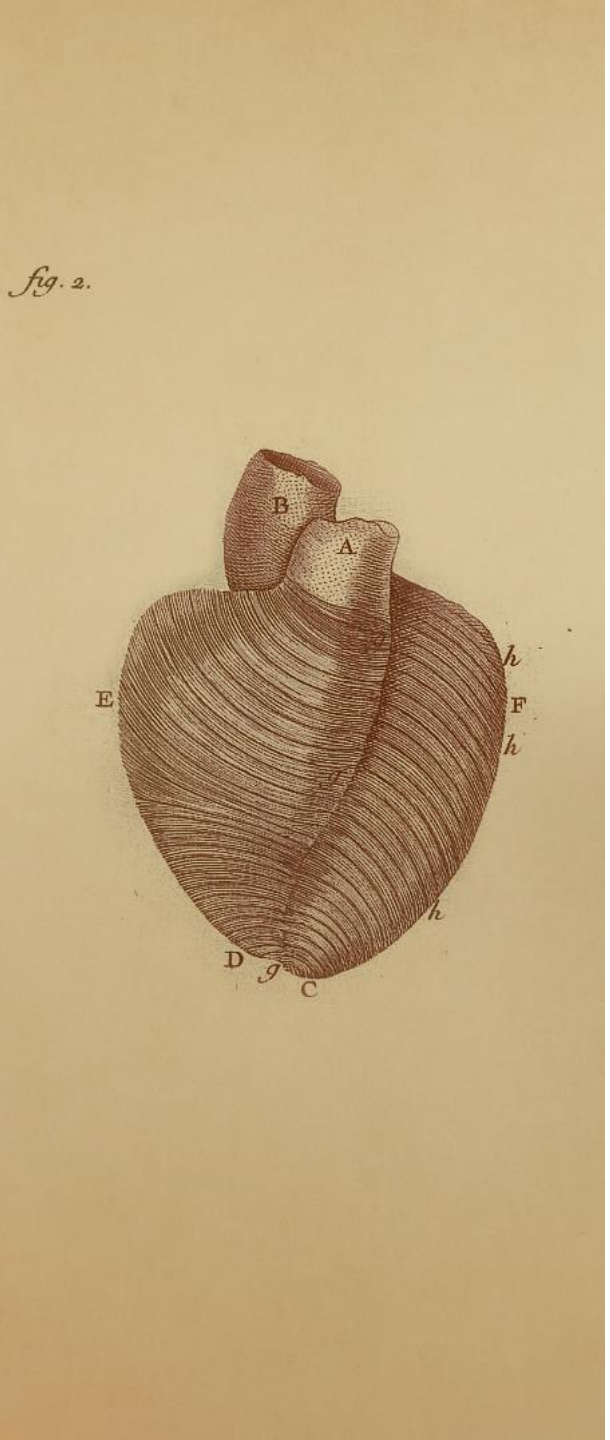
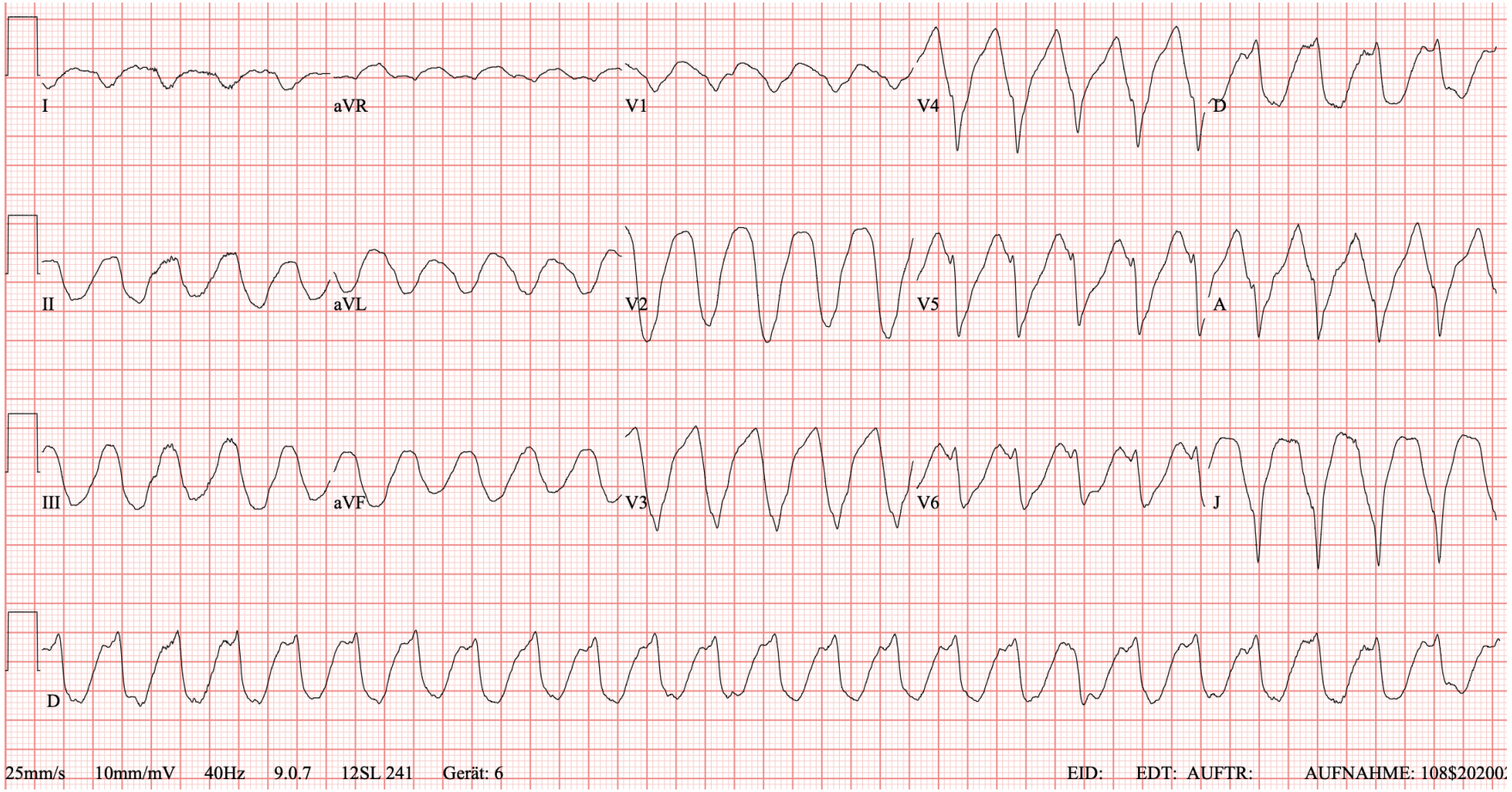
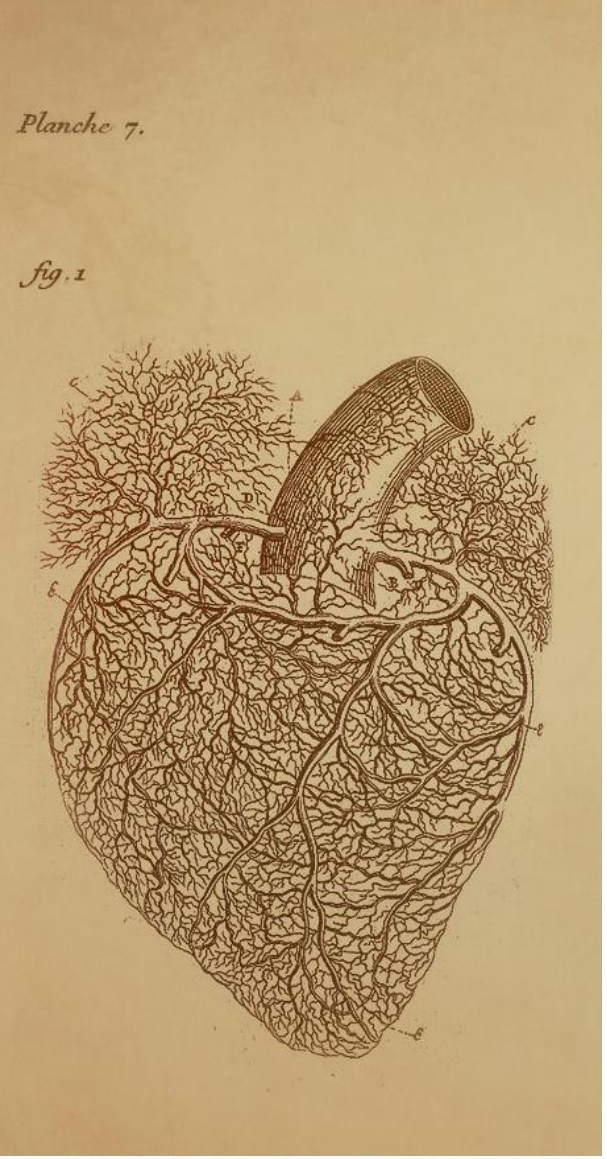
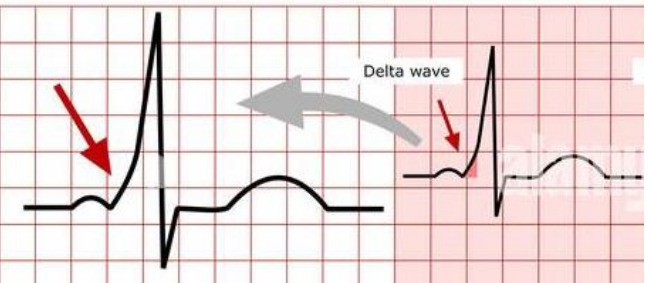


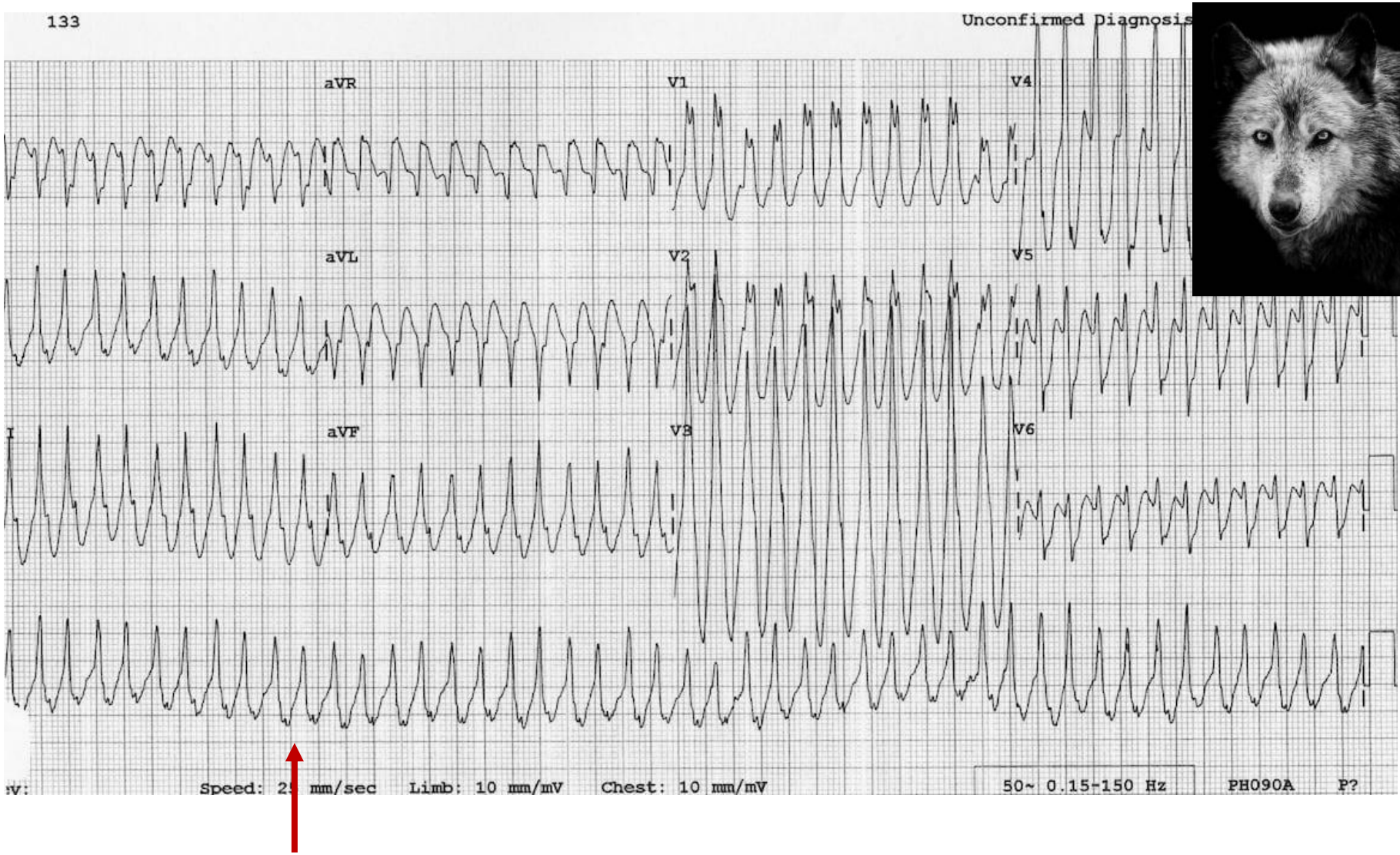
fig. 2.
B
A
E
F
h
h
h
D
g
C


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
D
25mm/s 10mm/mV 40Hz 9.0.7 12SL 241 Gerät: 6
EID: EDT: AUFTR: AUFNAHME: 108$20200

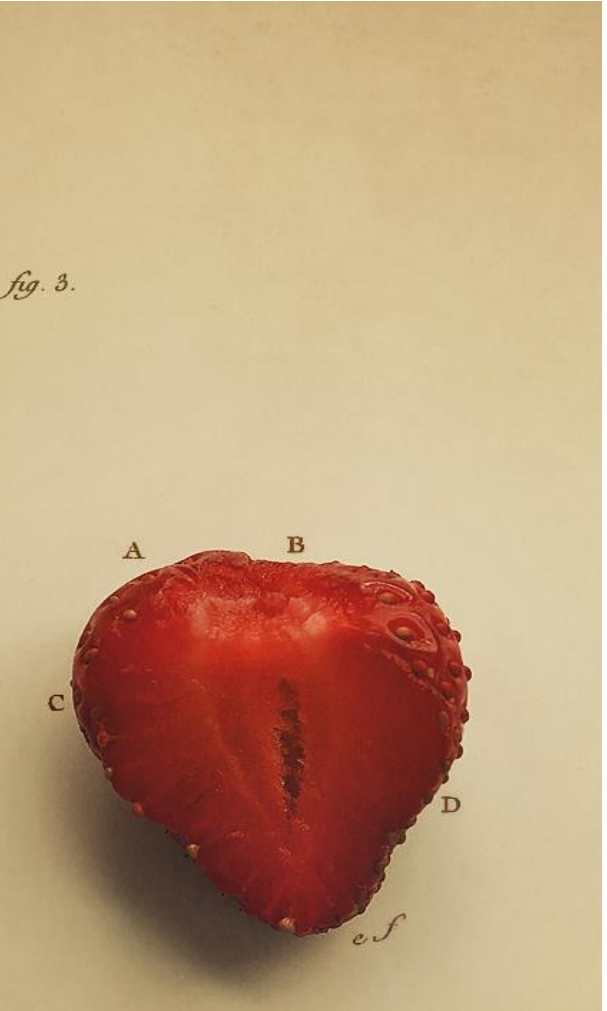
# Beispiel antidrome Tachy



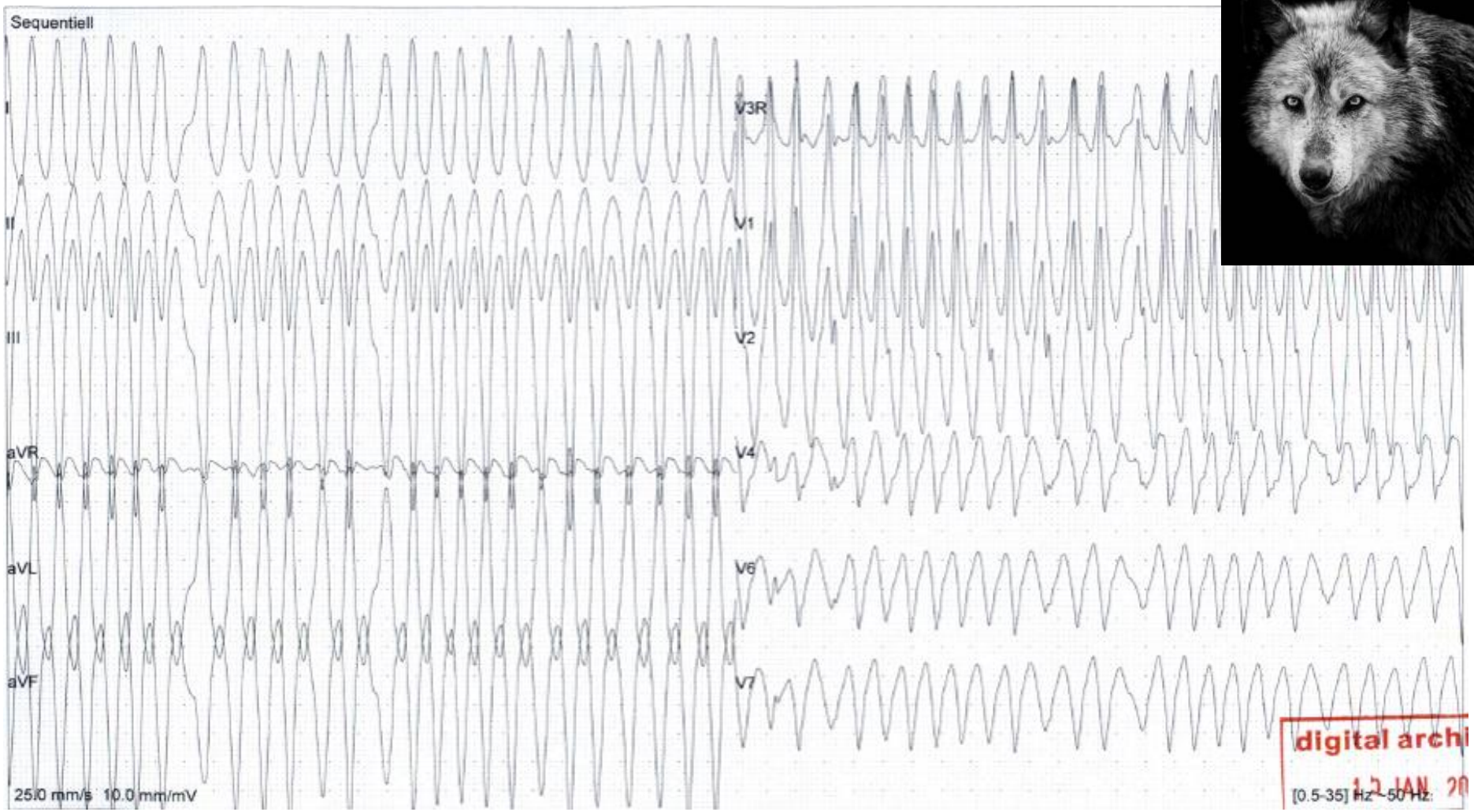
# Beispiel FBI



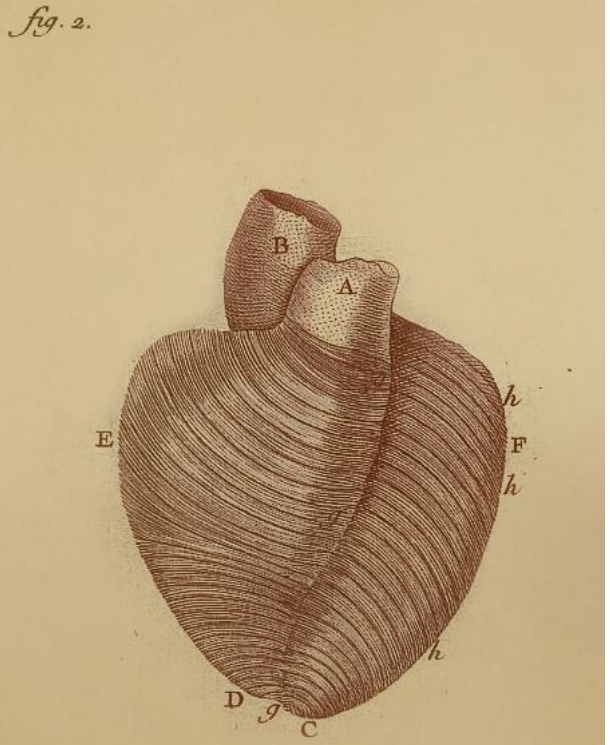

**F**ast

**B**road

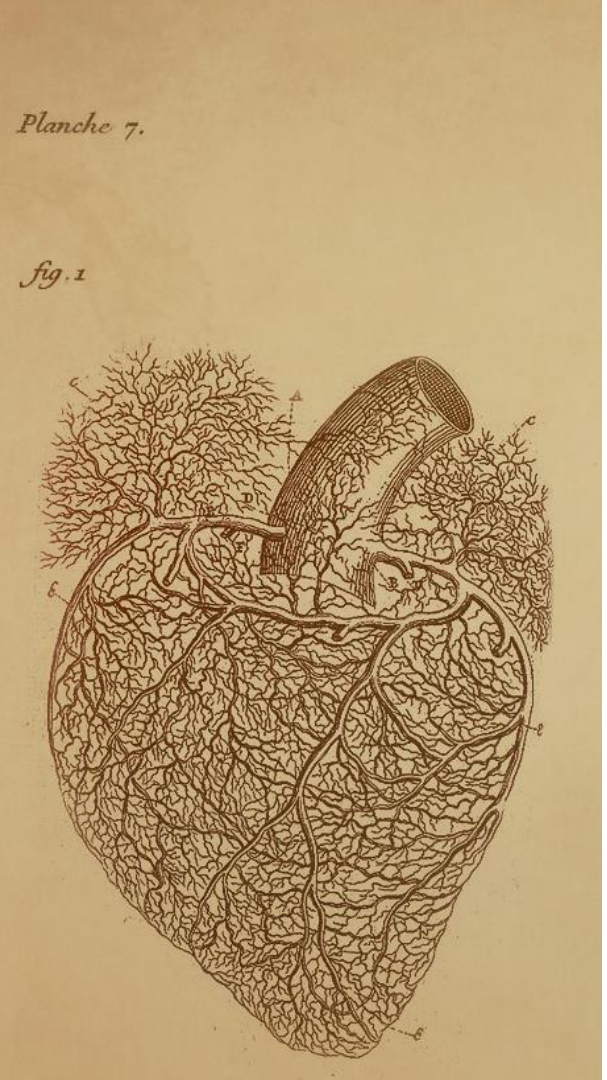
**I**rregular



# Bradykardien

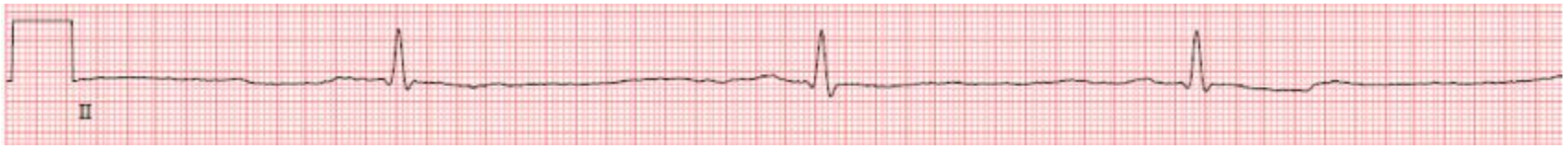



- Frühgeborene / Neugeborene
- Anorexie Patient*innen
- Hirndruck
- Medikamente (Betablocker,...)
- AV Block
- Sinusknotendysfunktion
- Postoperative Herzkinder




# Bradykardie

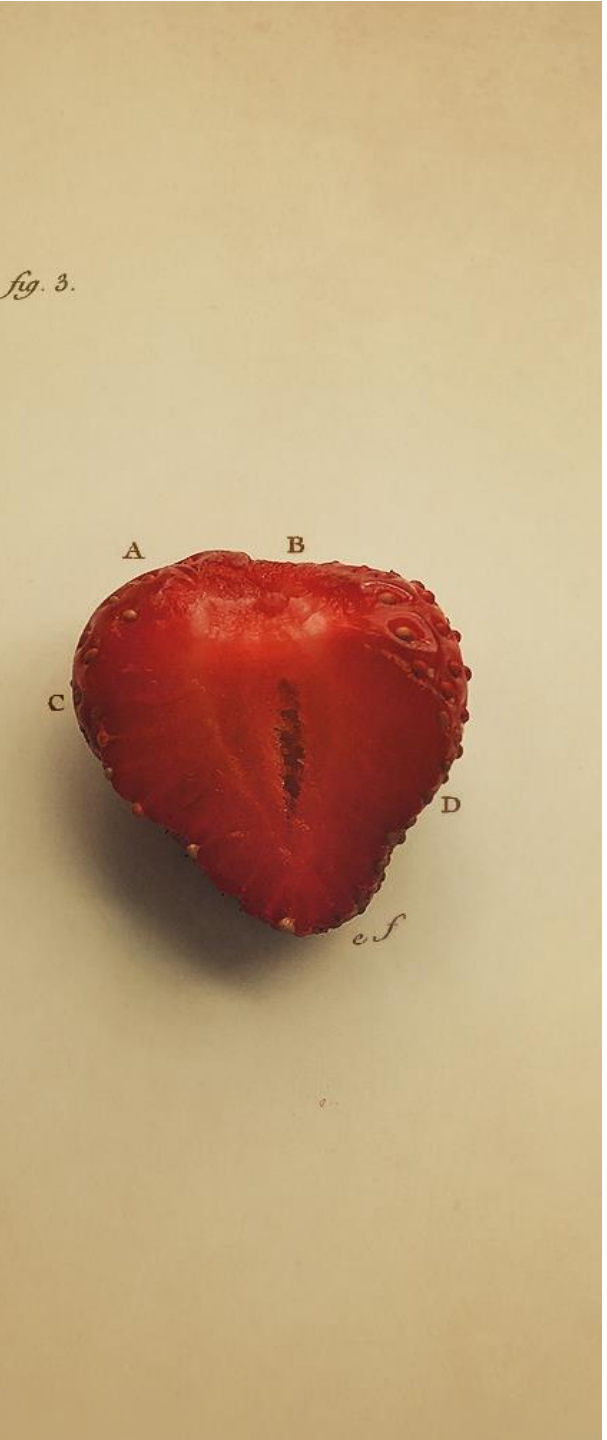
- HF < Altersnorm

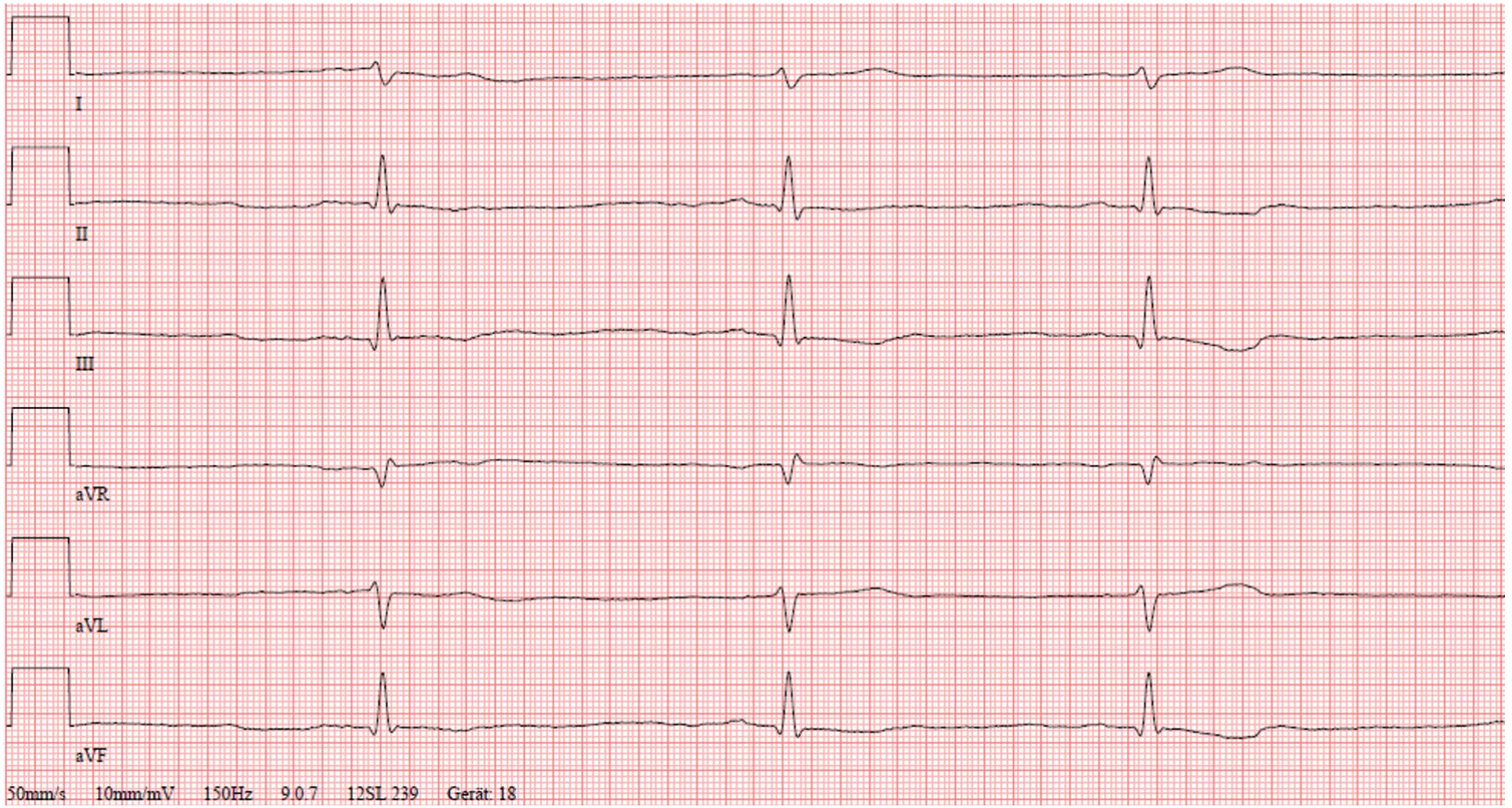


- Therapie:
  - Adrenalin 0,01mg/kg iv
  - Atropin 0,2 mg/kg iv
  - Externes Pacing

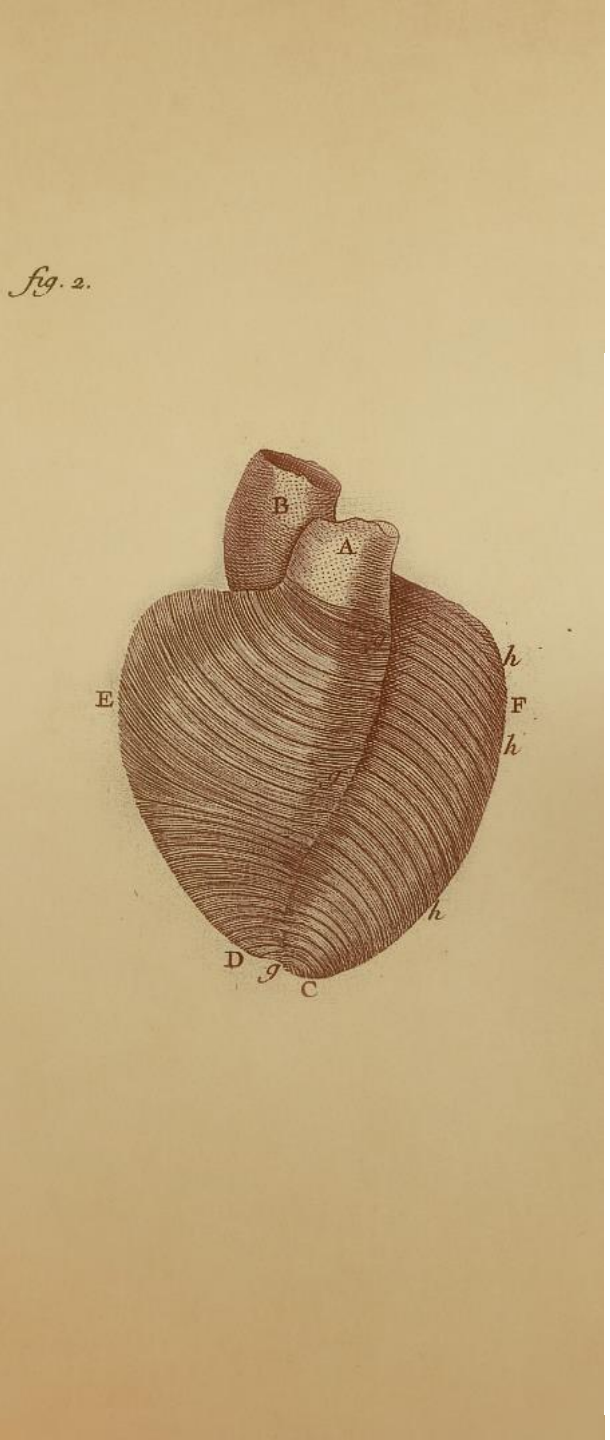
| Age | Beats/Min |
|---|---|
| Neonates | 110-150 |
| 2 yr | 85-125 |
| 4 yr | 75-115 |
| More than 6 yr | 60-100 |

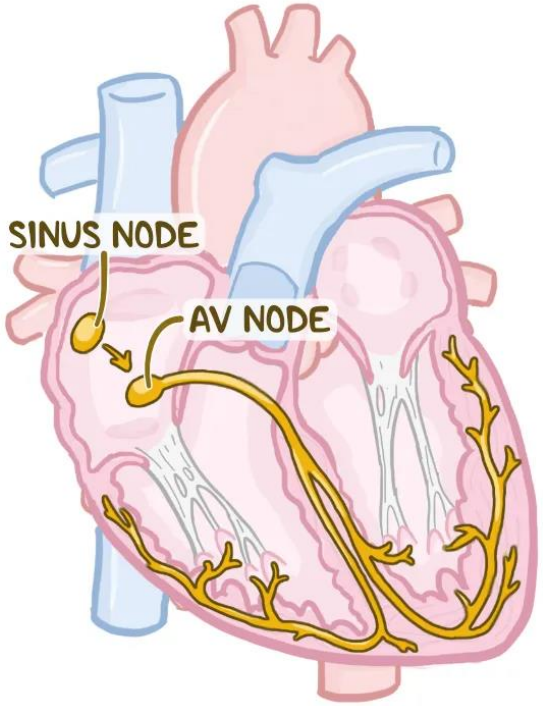
# Beispiel Anorexie



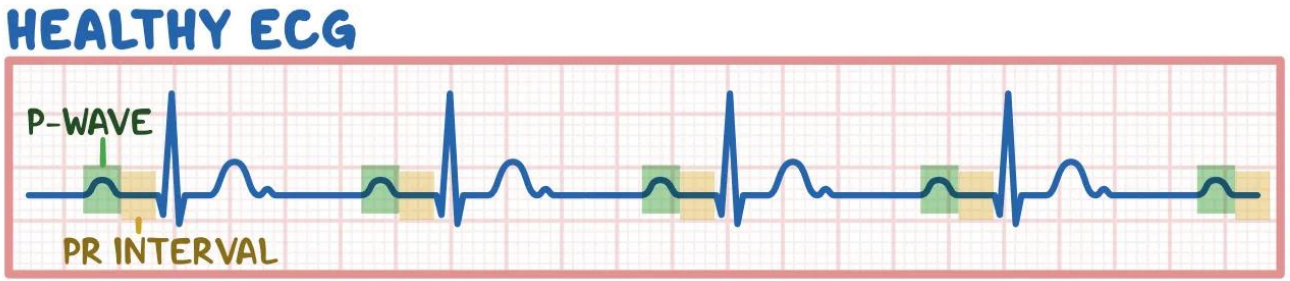



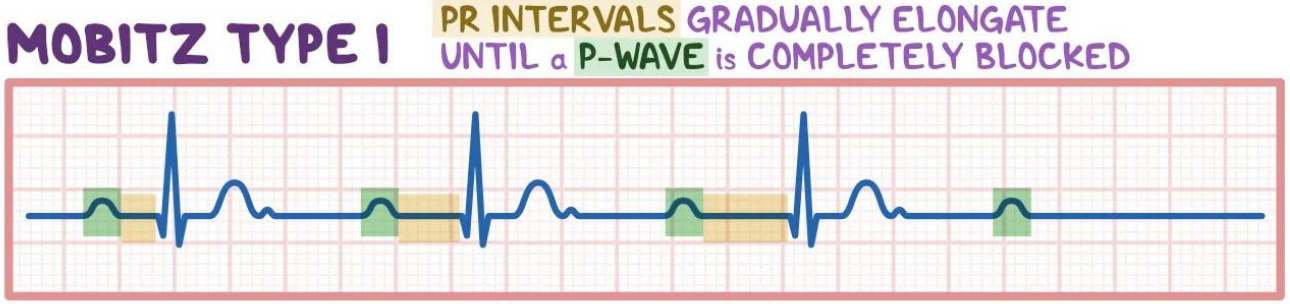
# Beispiel AV Block

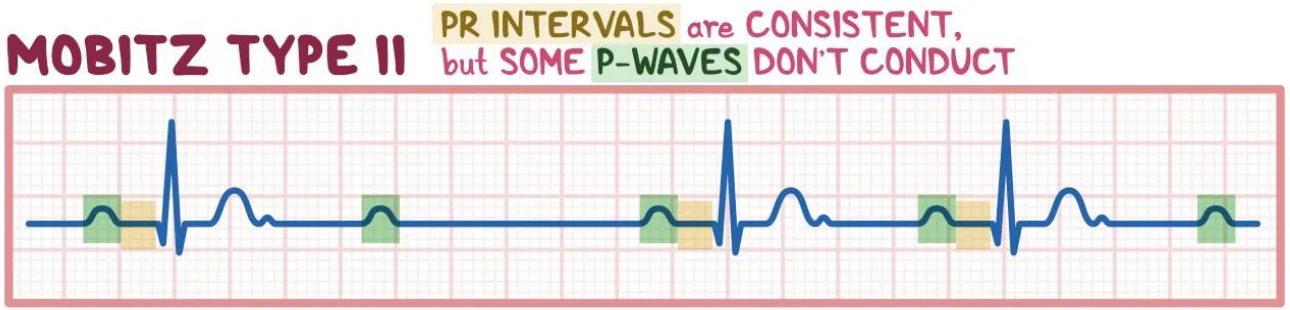


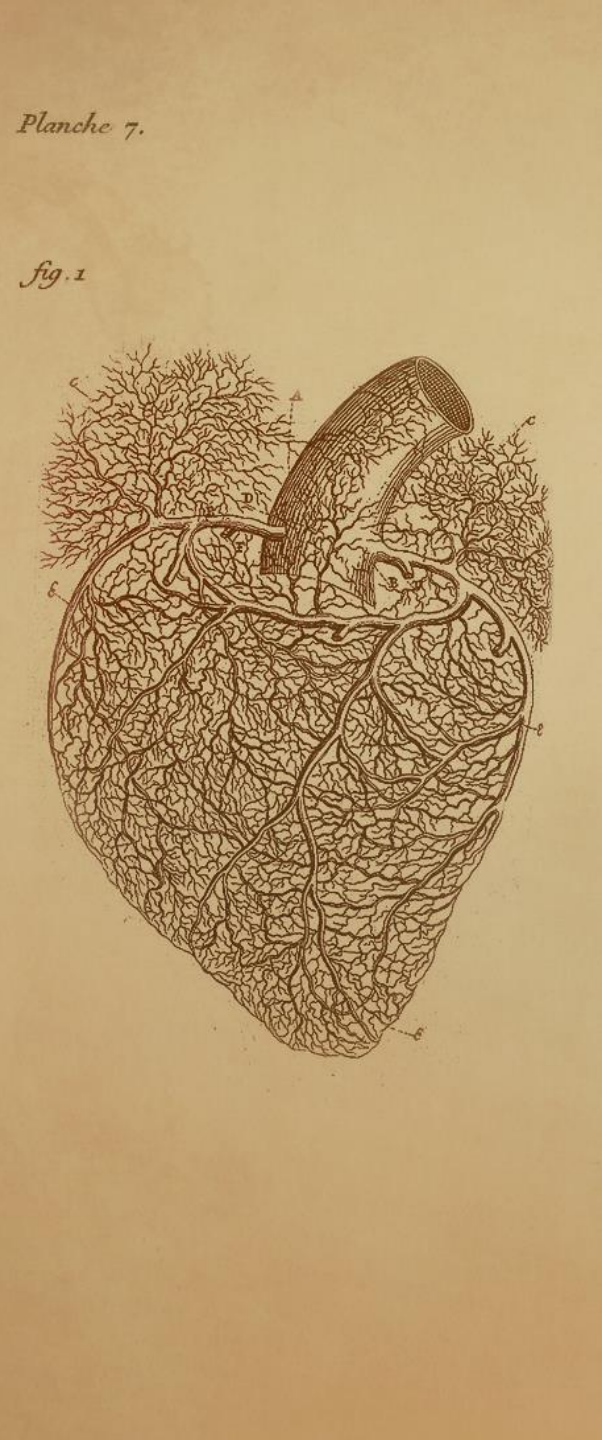




OSMOSIS.org

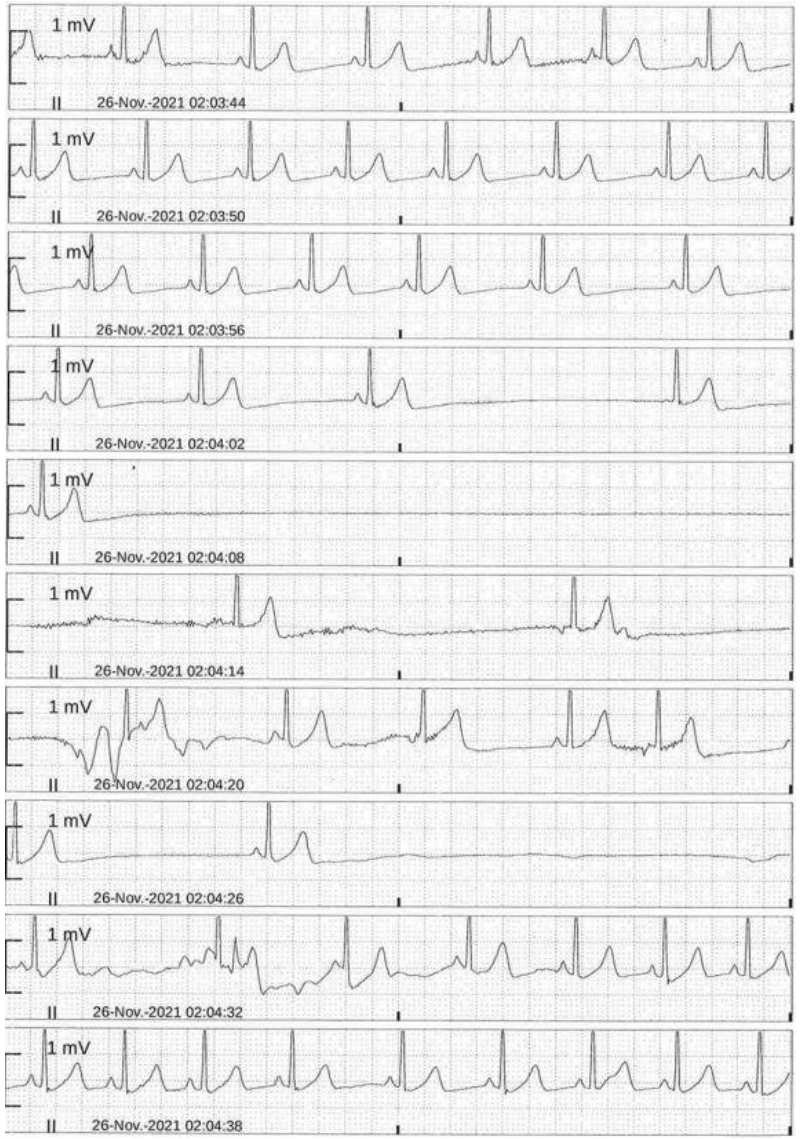




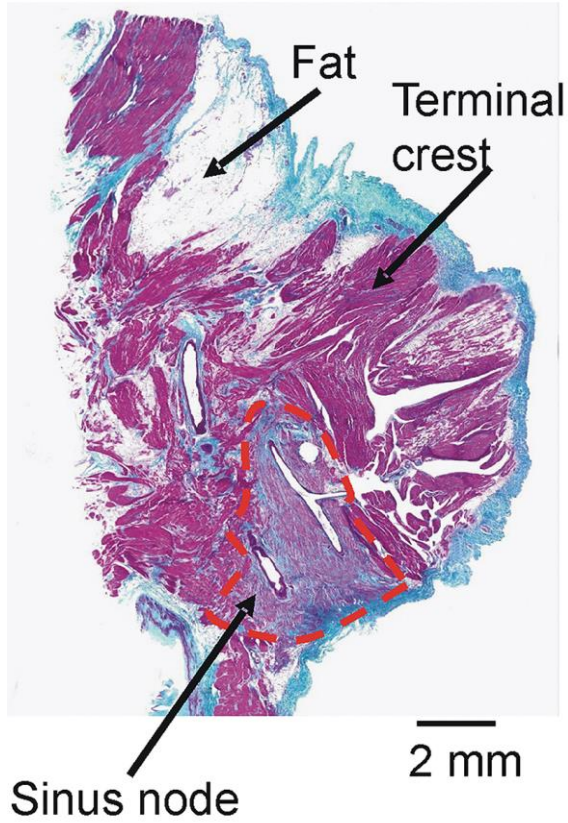

# Beispiel SND

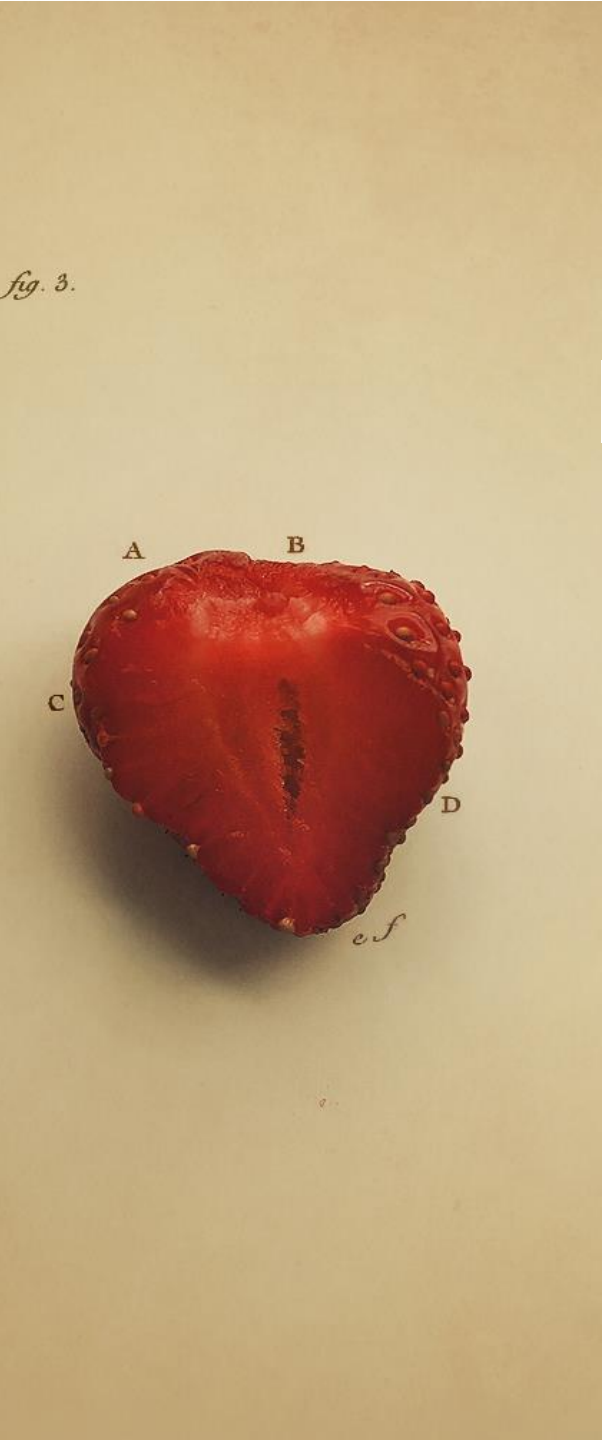



Med Uni Graz

*Human SAN*

*Young heart*






# Antiarrhythmika

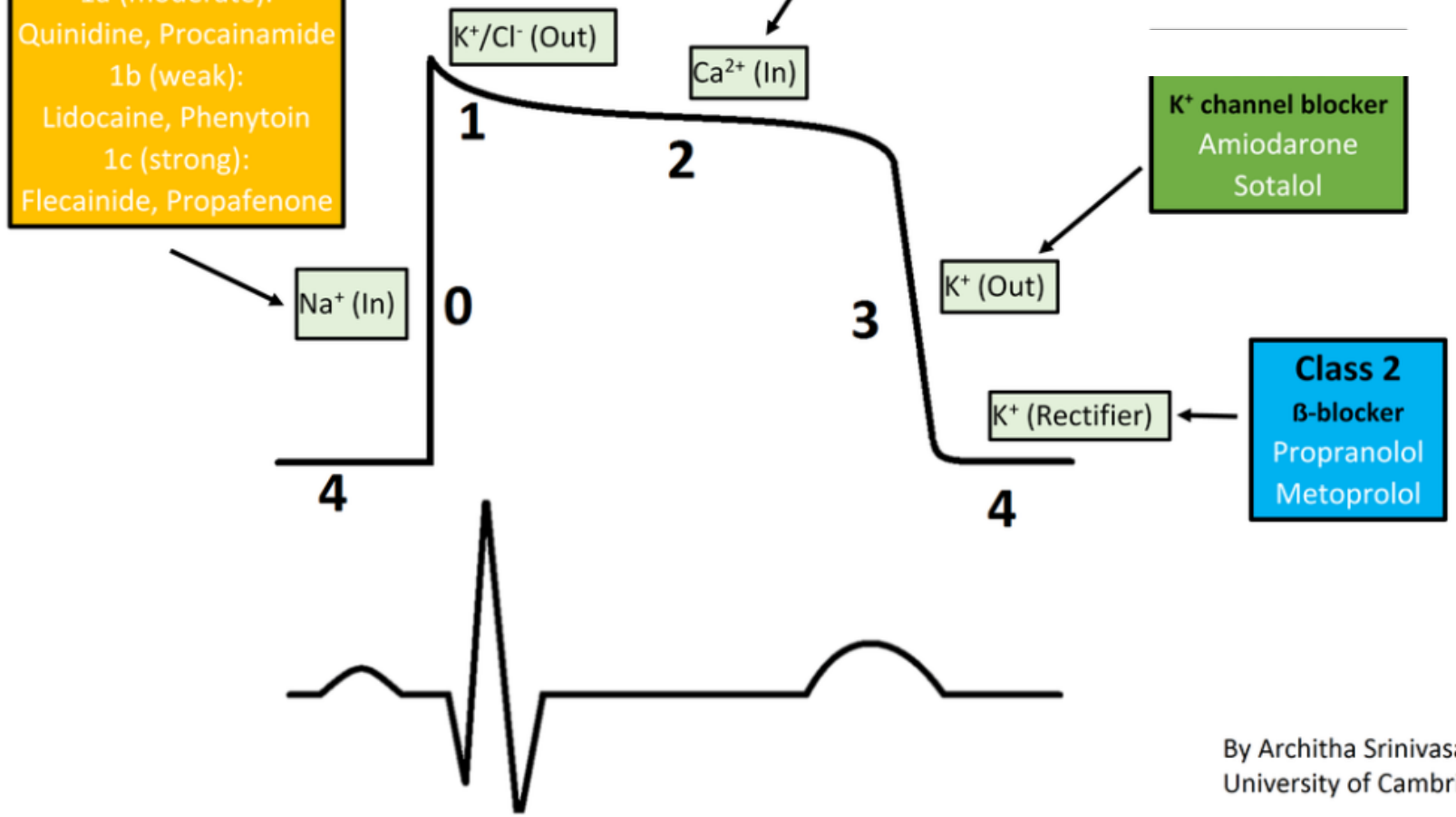
Med Uni Graz

**Class 1**
**$Na^+$ channel blocker**
1a (moderate):
Quinidine, Procainamide
1b (weak):
Lidocaine, Phenytoin
1c (strong):
Flecainide, Propafenone

**Class 4**
**$Ca^{2+}$ channel blocker**
Verapamil
Diltiazem

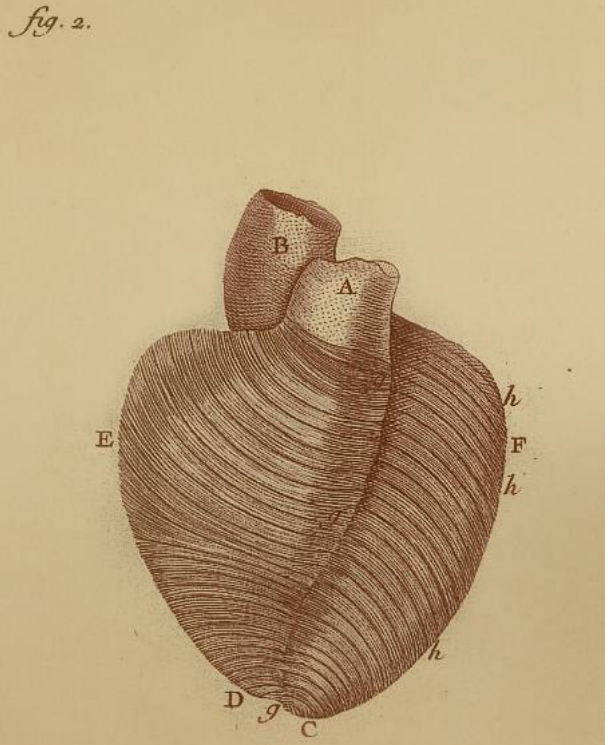
**$K^+$ channel blocker**
Amiodarone
Sotalol

**Class 2**
**ß-blocker**
Propranolol
Metoprolol




By Architha Srinivasan
University of Cambridge

# Dosierungen

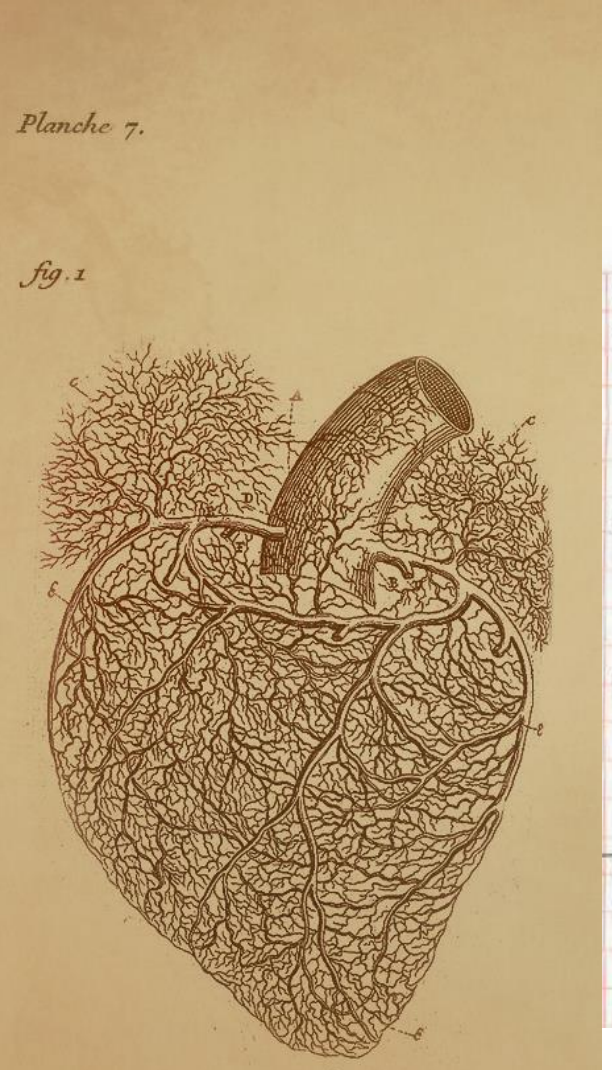



- Adenosin: 0,1mg/kg i.v. (0,2/0,3mg/kg)
- Esmolol: 50 – 300 (-500) mcg/kg i.v. Bolus (25 – 100cmg/kg/min.)
- Propranolol: 0,01 – 0,15mg/kg i.v. in 10` (Sgl. 1mg; Kind 3mg)
- Metoprolol: 0,1 – 0,3 mg/kg i.v. (in 1h)
- Propafenon: 1 (-2)mg/kg i.v. (in 1h) (4 – 10 mcg/kg/min.)

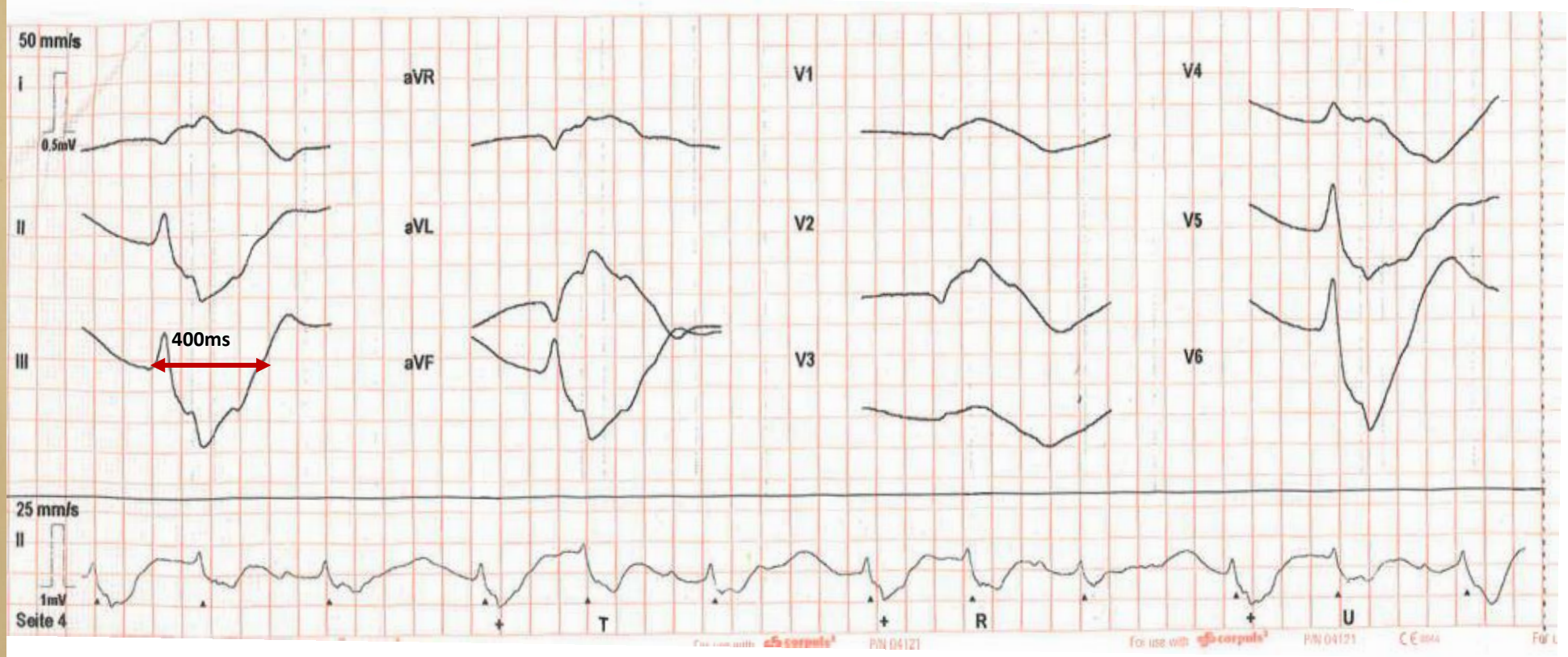
- Lidocain: 1mg/kg i.v.
- Amiodaron: 5mg/kg i.v.

- Atropin: 0,2 mg/kg

Washington University School of Medicine in St. Louis Pediatric Drug Guide, **www.pediatriccardiology.wustl.edu**




# Class I AAD

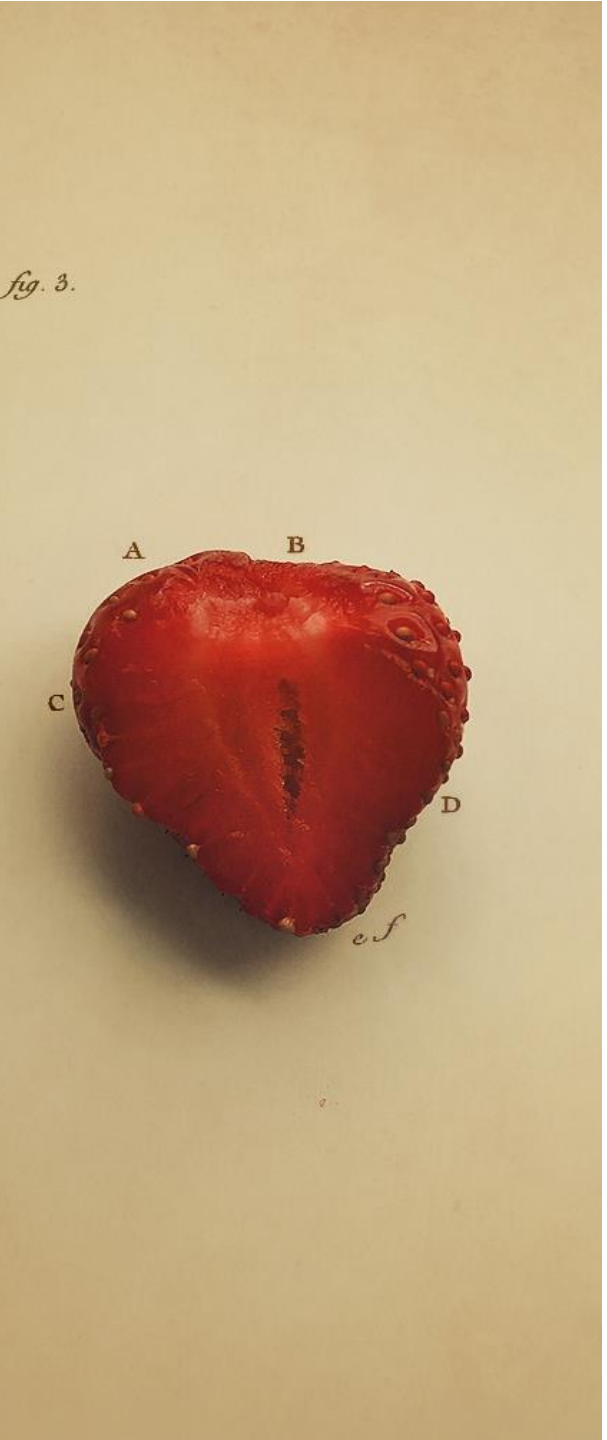



**Symptome**

Art. Hypotension
Bradykardie (breiter QRS)
AV Block, Arrhythmien
Krampfanfälle
Cardiac Arrest

**EKG Veränderungen**

PQ Verlängerung
QRS Verbreiterung
Arrhythmien (VT/VF, Bradykardie, Asystolie,…)




# Class I AAD Intox - Therapie

Med Uni Graz


**NaBic 1mmol/kg**

**Glucagon 0.1 mg/kg (max. 2mg) iv Bolus, dann 0.3 – 2 µg/kg/min**

**Isoproterenol 0.1 – 2 µg/kg/min**

**Calcium-Gluconat 10% 0.5ml/kg (max. 20ml) iv Bolus**

**Temporary pacing** (z.B. 80-100/min, 15 – 30 mA), Monitoring Puls

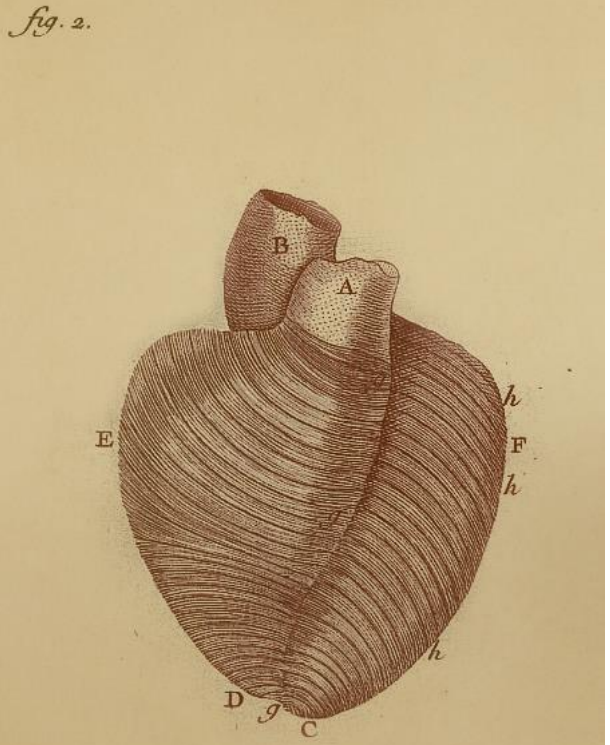
**Magenspülung 10ml/kg (max. 200-400ml) repetitiv**
**Aktivkohle 1g/kg po/pS**

**<u>Insulin + Glukose</u>: 0,5-1 IE/kg/h + 3g/kg/h Glc**

**Lipid Emulsion:**
1-1.5 ml/kg IVLE 20% Bolus über 1 min., dann 0.25 – 0.5ml/kg/min (bis hämodynamisch stabil)

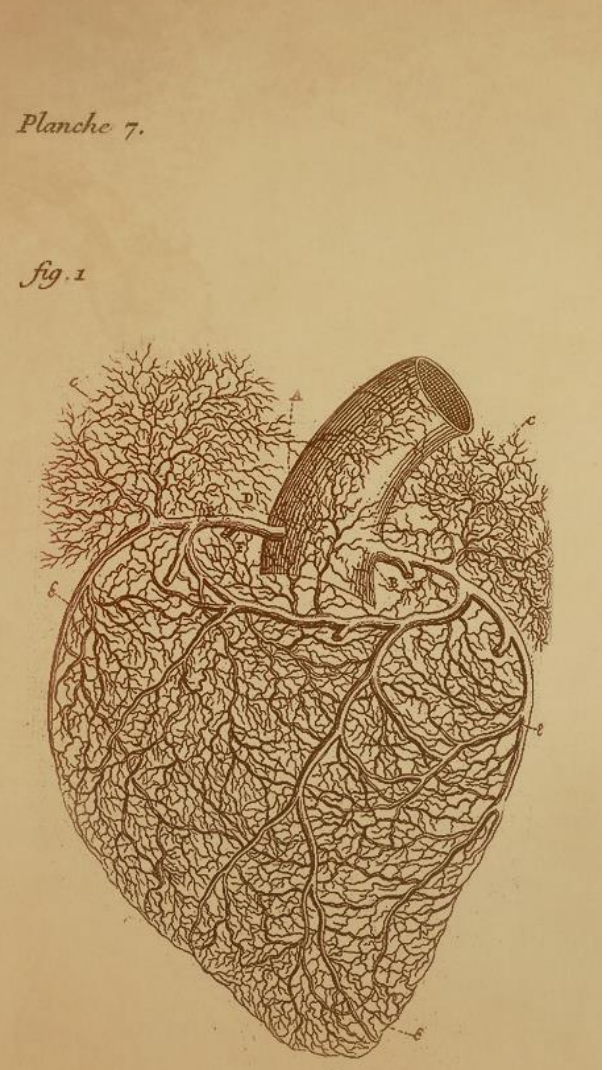
**Temporary pacing:**
Externe Klebeelektroden über Defi (z.B. 80-100/min, 15 – 30 mA), Monitoring Puls (Palpation/Arterie)

# Wrap Up - Essentials



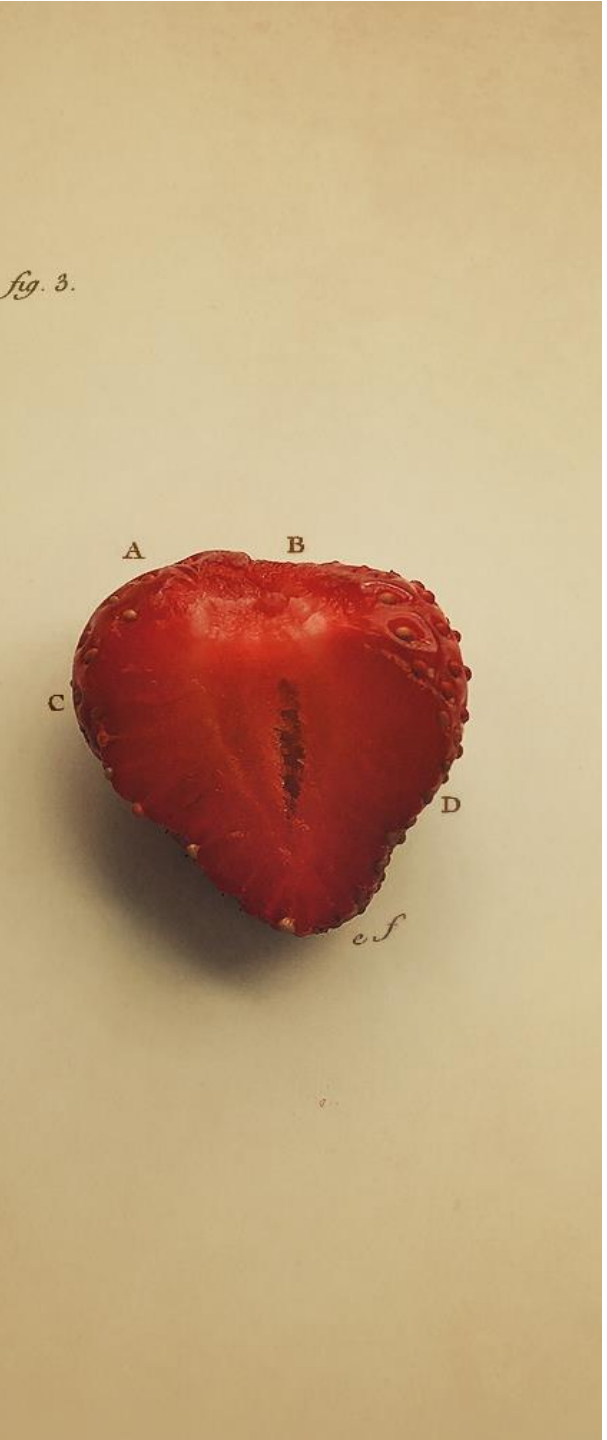

- >>> SVTs (Reentry)
- Breitkomplextachykardien >>> supravent. Ursprungs
- Lange hämodynamisch stabil (kippen rasch)
- Antiarrhythmika sind keine „Zuckerln“

- Dosierungen:
  - Adenosin 0,1 mg/kg (0,2/0,3 mg/kg) iv Push
  - Lidocain 1 mg/kg iv
  - Amiodaron 5 mg/kg iv




# Take Home Messages

- **Tachykardie:** NCT (< 100ms) vs WCT (> 100ms)
  - NCT: Valasva, Adenosin, Strom, Amiodaron
  - WCT: Lidocain, Amiodaron, Strom
- **Bradykardie:** AVB, Sinusbradykardie, Intoxikation
  - Adrenalin, (Atropin), externes Pacing




# Rhythm is a Dancer...

www.pediatricarrhythmia.com