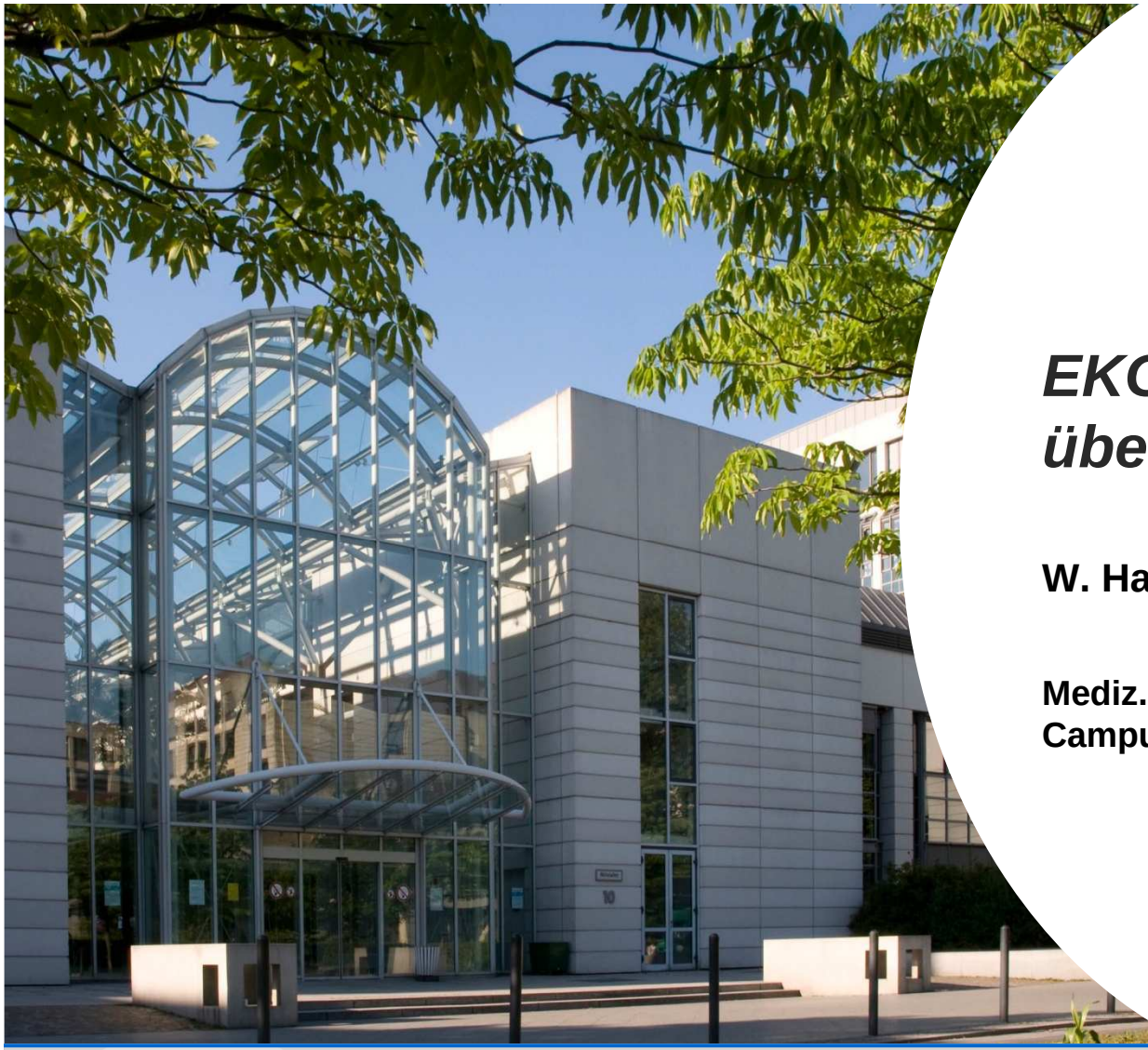


CHARITÉ
UNIVERSITÄTSMEDIZIN BERLIN

EKG - Was Sie nicht übersehen sollten

W. Haverkamp

Mediz. Klinik m. S. Kardiologie
Campus Virchow-Klinikum

Sherlock Holmes

Watson …

– *You know my methods, Watson!*

– *You did not know where to look, and so you missed all that was important.*

Wie EKG-Interpretation lernen?

Clin. Cardiol. 23, 4–13 (2000)

Special Article

Methods Used to Interpret the 12-Lead Electrocardiogram: Pattern Memorization versus the Use of Vector Concepts

J. WILLIS HURST, M.D.

Division of Cardiology, Department of Medicine of Emory University, Atlanta, Georgia, USA

Wie EKG-Interpretation lernen?

Summary: This article extols the value of using Grant's approach to the interpretation of electrocardiograms (ECGs). The essay includes a discussion on how people learn and emphasizes the difference in memorizing information, thinking, and learning. Simply stated, the brains of most people are not designed to memorize countless numbers of ECG patterns. Accordingly, the essay supports the view that a method of interpretation must be used, and the reader is encouraged to use basic principles of electrocardiography, including vector concepts, to interpret each ECG.

Hurst 2000

Vektorielle EKG Interpretation

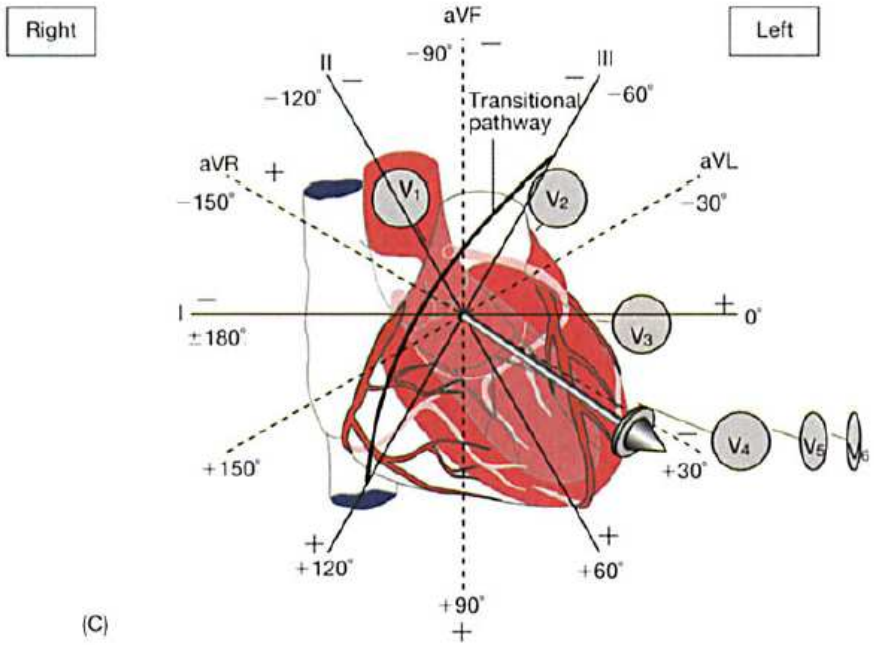


FIG. 2 (C) The mean S-T vector is directed at + 35° in the frontal plane. Using Grant's method of analysis,[4] let us assume that the mean S-T vector was calculated to be directed approximately 10° anteriorly. Such an S-T segment vector is commonly produced by the epicardial injury associated with generalized pericarditis or uncommonly produced by a myocardial infarction located near the cardiac apex. Pericarditis due to infection is usually generalized and involves the entire pericardium and epicardium. Accordingly, it produces an S-T segment vector that tends to be parallel with the anatomic axis of the heart, whereas an S-T segment displacement produced by the epicardial injury related to myocardial infarction is usually located in a segment of the left ventricle. Therefore, an S-T segment vector due to myocardial infarction is usually directed laterally to the left, anteriorly, inferiorly, posteriorly, or laterally to the right. Epicardial injury caused by an apical infarction is an exception to the general rule just stated; the mean S-T segment abnormality caused by an apical infarction is directed toward the cardiac apex. Therefore, an "apical" infarct may not produce abnormal Q waves because there is no viable myocardium opposite the apex and the direction of the mean S-T vector may simulate the S-T vector of pericarditis because it is also directed toward the apex. An apical infarct may be caused by an obstruction in a diagonal branch of the left anterior descending coronary artery, the obtuse marginal branch of the circumflex coronary artery, or rarely the posterior descending branch of the right coronary artery.

Hurst 2000

EKG-Analyse und Eye-Tracking

ELSEVIER

Journal of Electrocardiology 47 (2014) 922–929

JOURNAL OF
Electrocardiology

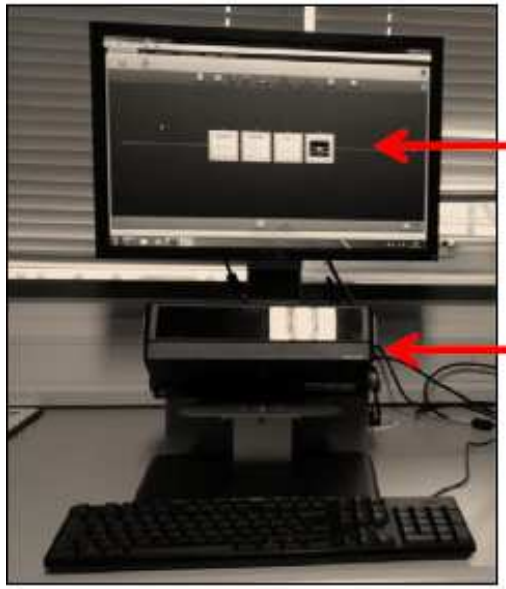
www.jecgonline.com

An evaluation of eye tracking technology in the assessment of 12 lead electrocardiography interpretation☆,☆☆

Cathal J. Breen, BSc, Hons,[a,*] Raymond Bond, PhD,[b] Dewar Finlay, PhD[c]

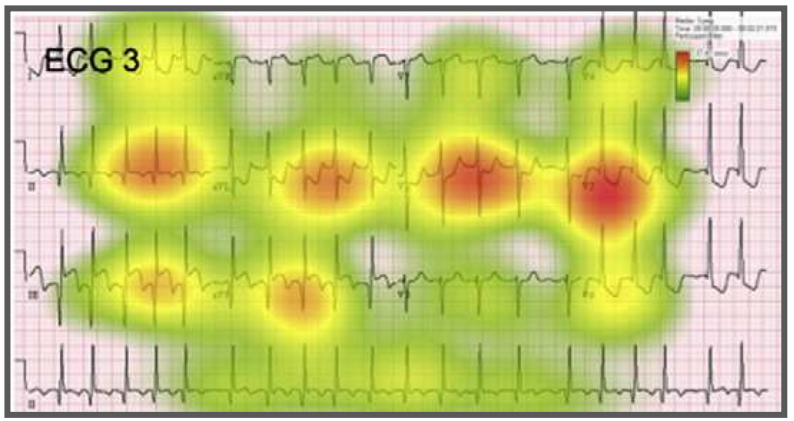
[a] *School of Health Sciences, University of Ulster, Shore Road, Newtownabbey, N. Ireland, United Kingdom*
[b] *School of Computing and Mathematics, University of Ulster, Shore Road, Newtownabbey, N. Ireland, United Kingdom*
[c] *School of Engineering, University of Ulster, Shore Road, Newtownabbey, N. Ireland, United Kingdom*

EKG-Analyse: Eye-Tracking



High resolution (1440px x 900px) 24" LCD monitor

Tobii Eye Tracker System



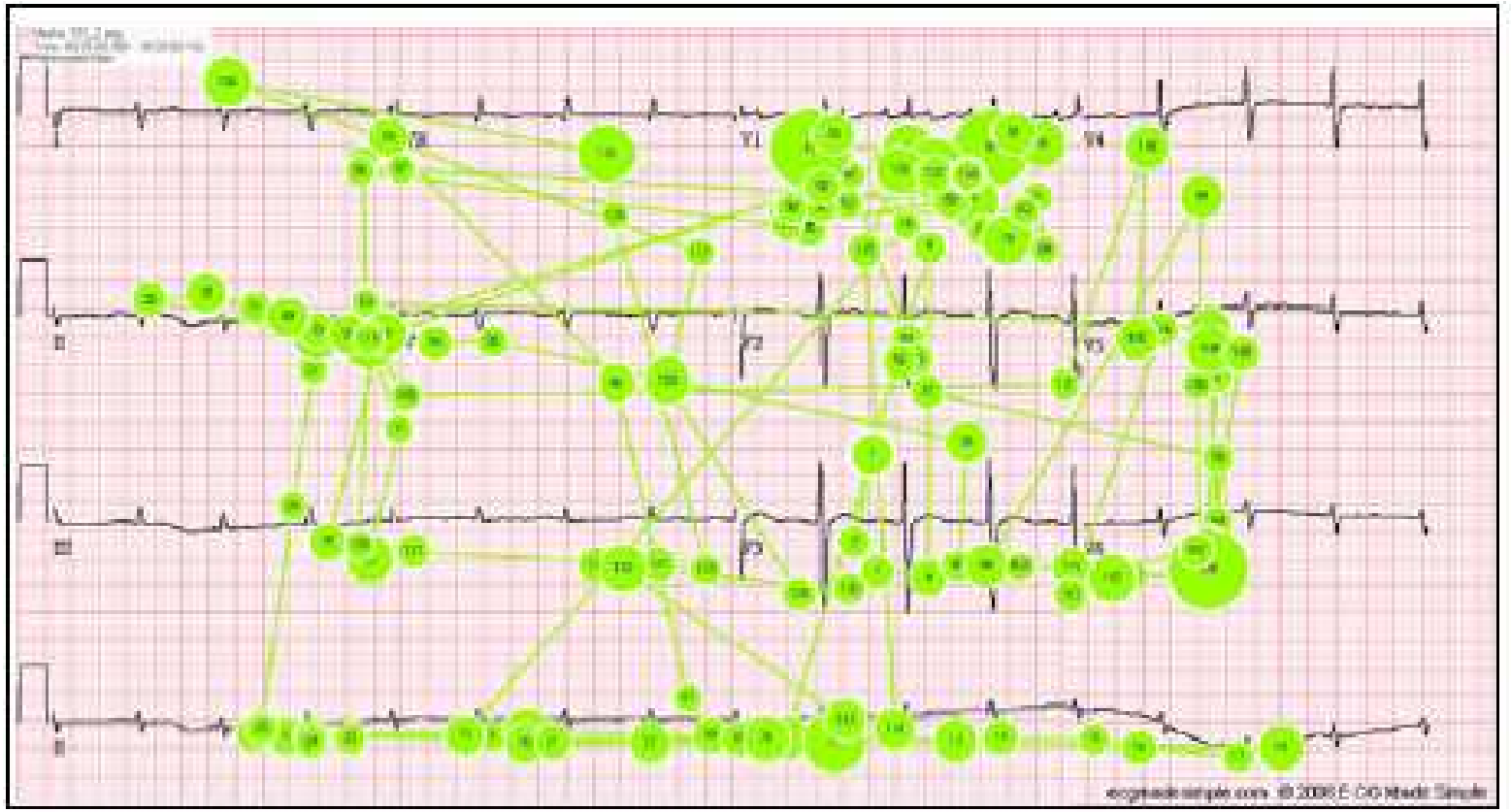
Breen et al. 2014

EKG-Analyse: Eye-Tracking

Heat-Map (Verteilung der Aufmerksamkeit)

Breen et al. 2014

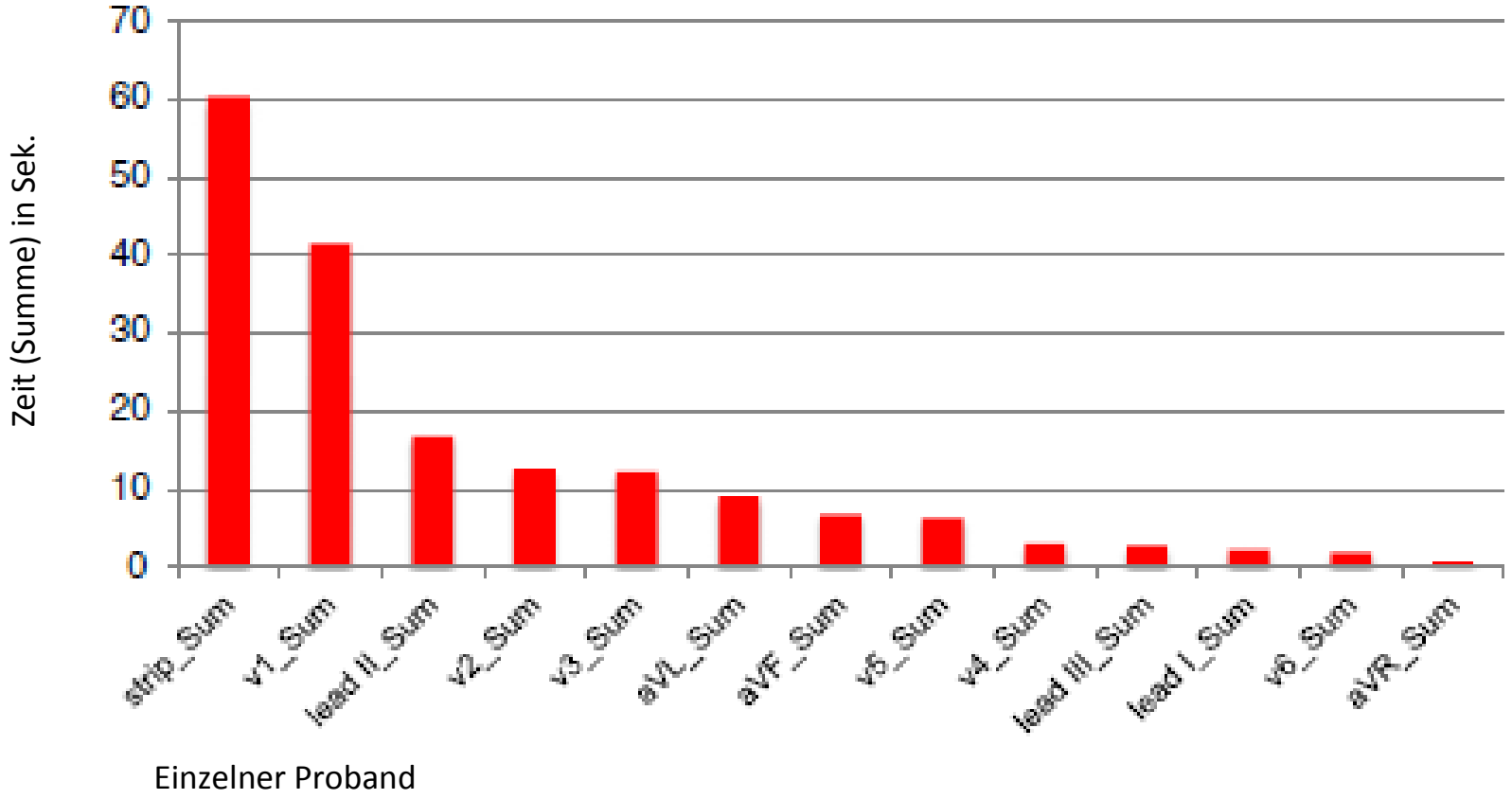
EKG-Analyse: Eye-Tracking



Bewegungsmodus (ruckartige Bewegungen)

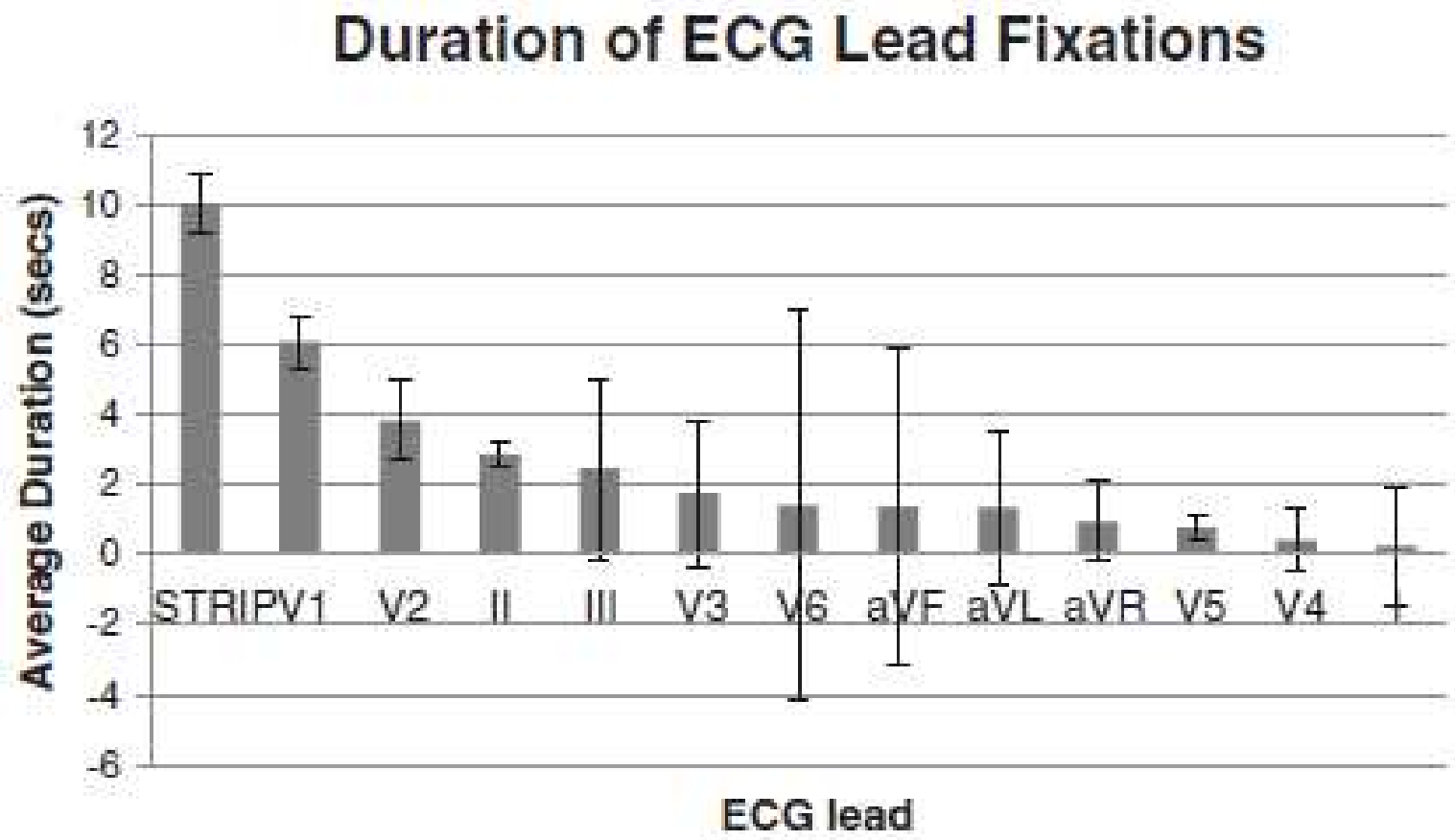
Breen et al. 2014

EKG und Eye-Tracking: EKG-Anfänger



Breen et al. 2014

EKG und Eye-Tracking: Anfänger



Alle Probanden

Breen et al. 2014

EKG-Analyse und Eye-Tracking

ELSEVIER

Journal of Electrocardiology 47 (2014) 895–906

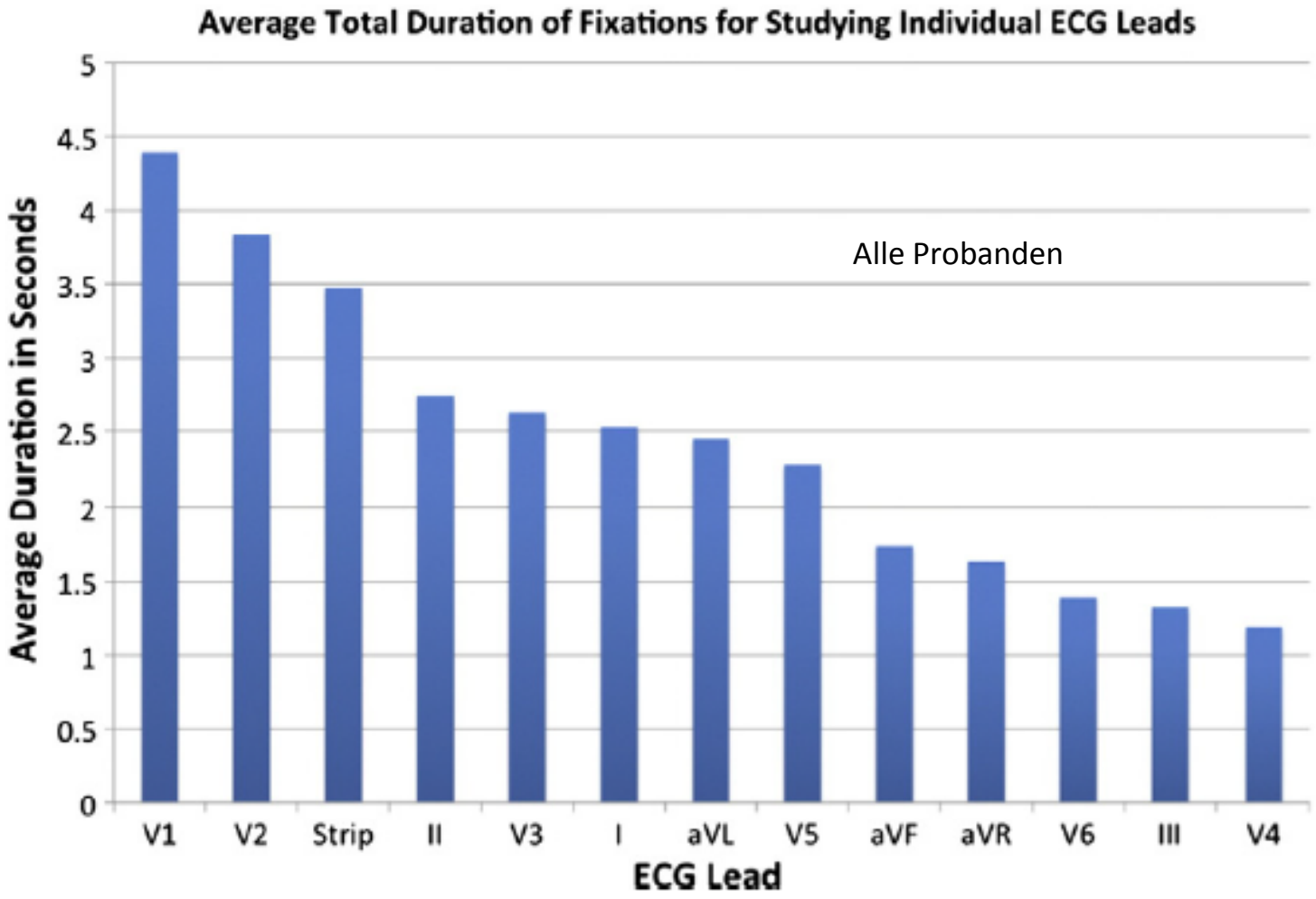
JOURNAL OF
Electrocardiology

www.jecgonline.com

Assessing computerized eye tracking technology for gaining insight into expert interpretation of the 12-lead electrocardiogram: an objective quantitative approach

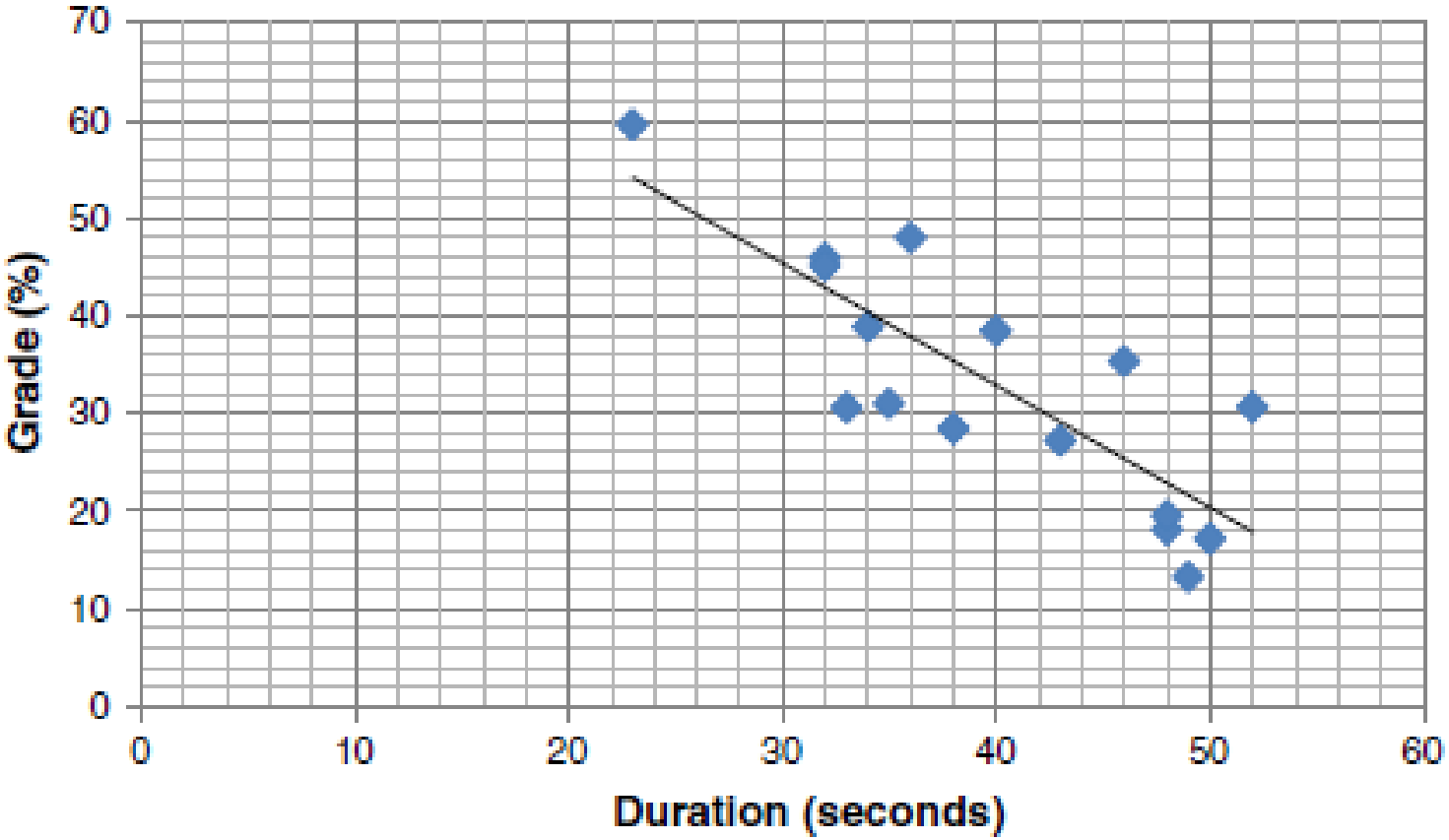
R.R. Bond, PhD,[a,*] T. Zhu, MSc,[b] D.D. Finlay, PhD,[a] B. Drew, PhD,[c] P.D. Kligfield, MD,[d]
D. Guldenring, PhD,[a] C. Breen, BSc,[a] A.G. Gallagher, DSc,[e]
M.J. Daly, MD,[f] G.D. Clifford, PhD[g]

EKG und Eye-Tracking: Experte



Bond et al. 2014

Qualität der EKG-Auswertung



r = -0,81

Je schneller, desto besser.

Breen et al. 2014

Diagnostisches Vorgehen: „Erste Blick Ansatz“

Betrachtung einer einzelnen Ableitung

↓

Verdachtsdiagnose

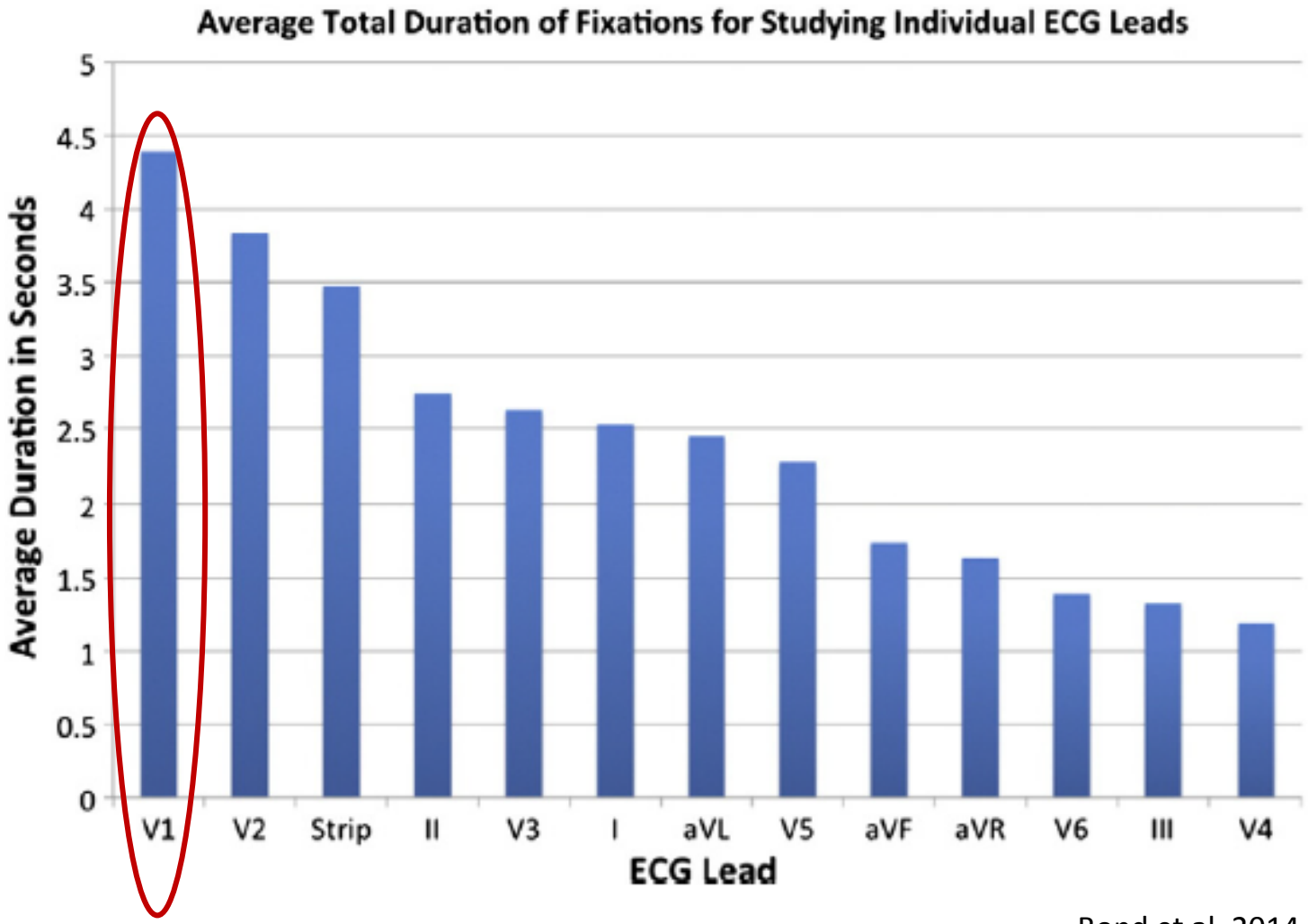
↓

Gezielte Betrachtung weiterer Ableitungen

↓

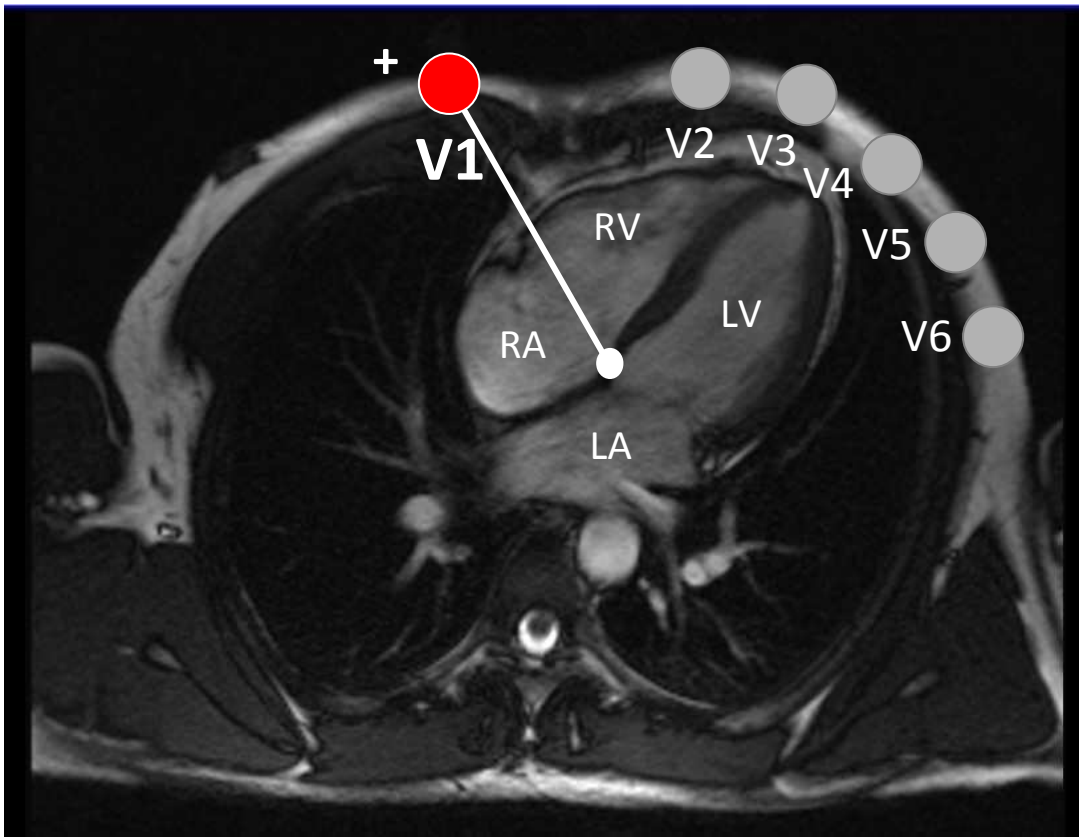
Stellung der finalen Diagnose

EKG und Eye-Tracking: Experte

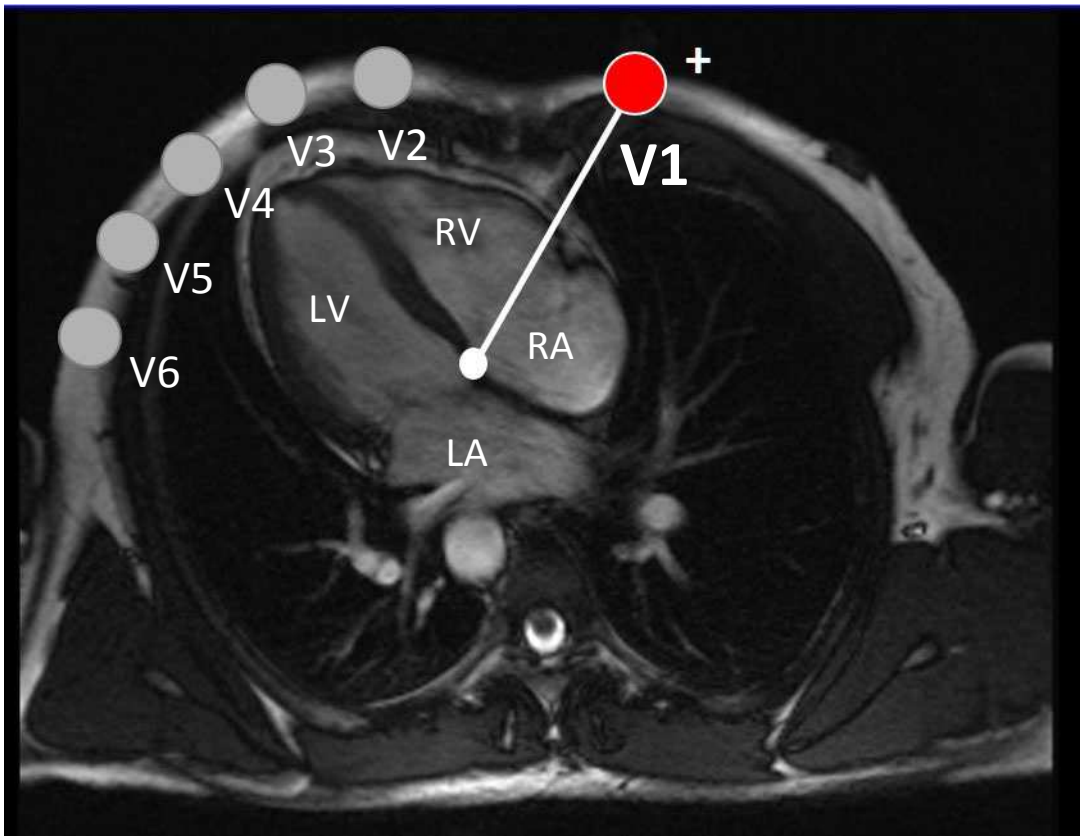


Bond et al. 2014

Ableitung V1 - MRT



Ableitung V1 – MRT horizontal gespiegelt

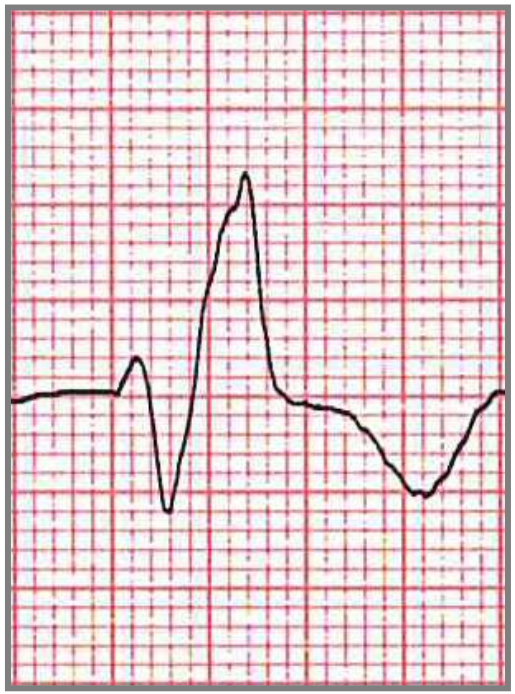


Anleitung zu den Übungsaufgaben

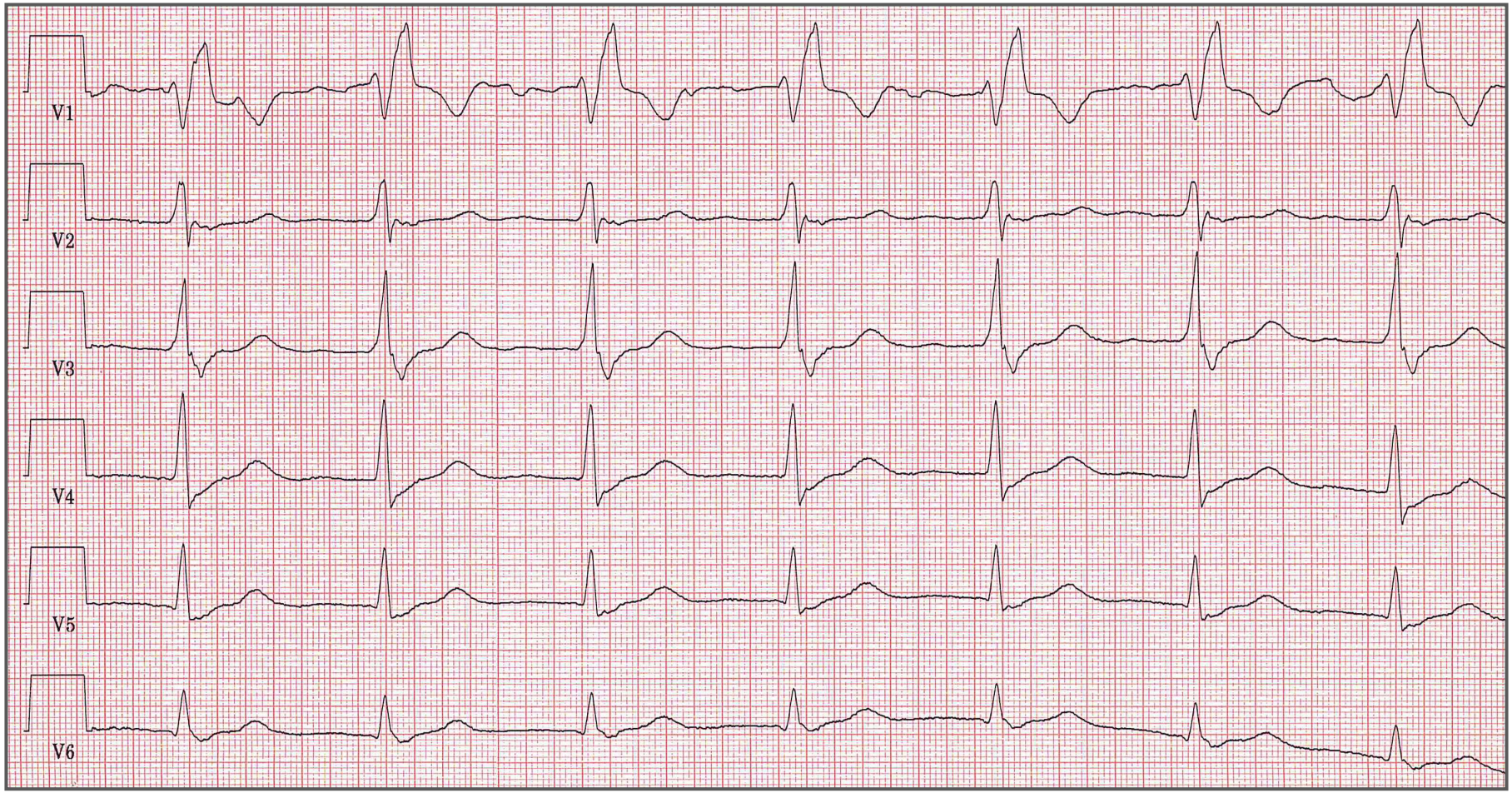
- Ich werden Ihnen nachfolgend EKGs präsentieren.
- Dargestellt ist eine Herzaktion – und zwar nur Ableitung V1.
- Bitte stellen sie eine (Verdachts-)diagnose.
- Sie brauchen heute kein Handzeichen geben und warten, bis Sie drankommen – schreien Sie das Ergebnis in den Raum.
- Hierzu haben Sie pro Übungsaufgabe 4 Sek. Zeit.

Ableitung V1: Verdachtsdiagnose?

V1



Ableitung V1: Rechtsschenkelblock

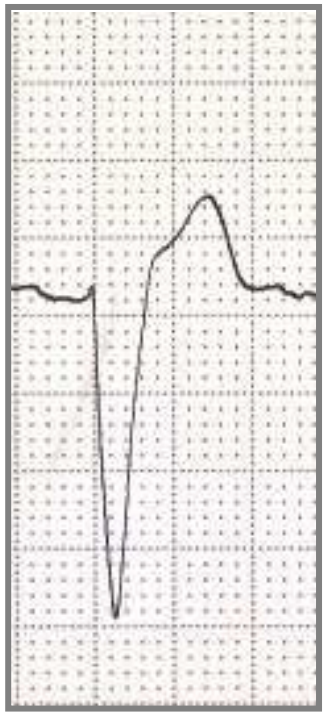


RSB: EKG-Kriterien

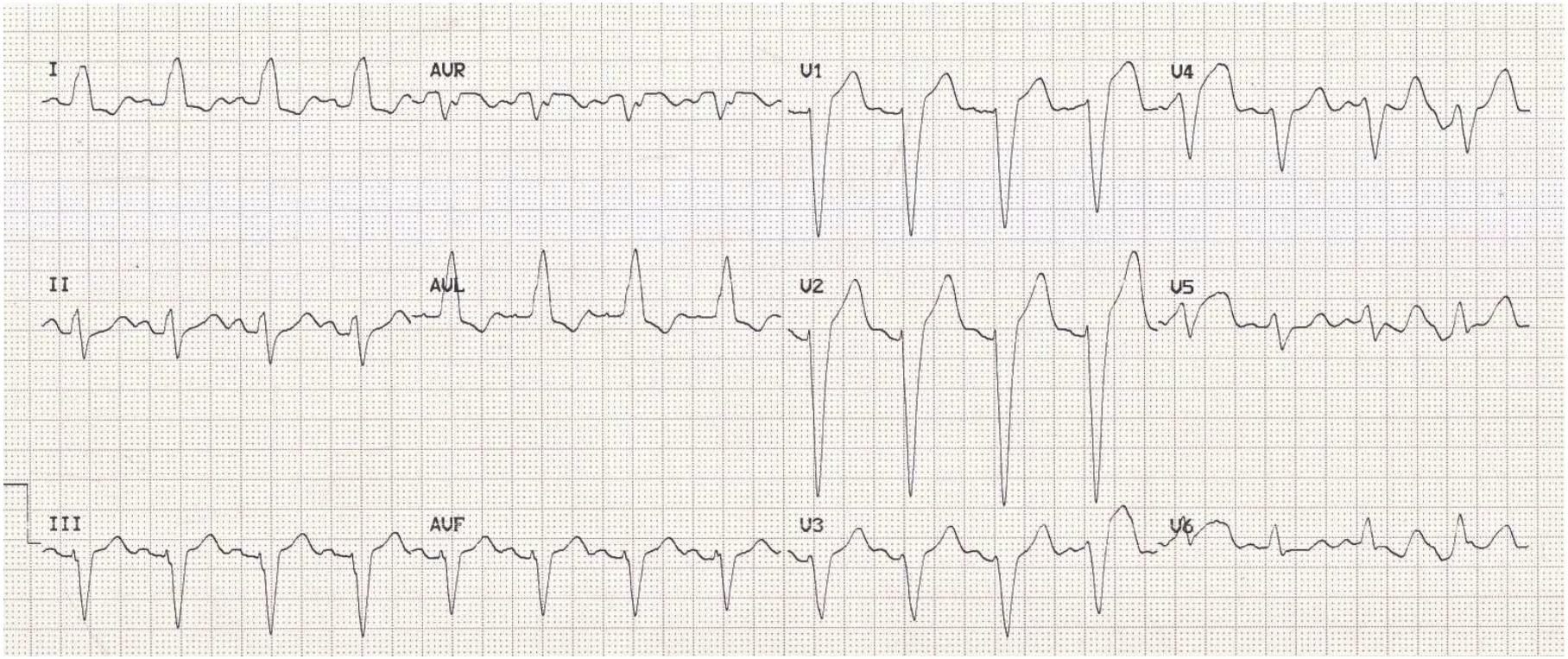
- QRS-Dauer ≥ 120 ms (definiert die Schenkelblockierung)
- rSR´-Komplex in V1, so genannte M-Form (verspätete rechtsventrikuläre Aktivierung)
- Verspätung der größten Negativitätsbewegung in V1 (> 50 ms)
- Breite S-Zacken in I, aVL und V5/6 (Spiegelbild der verspäteten rechtsventrikulären Aktivierung)

Ableitung V1 – Verdachtsdiagnose?

V1



Ableitung V1: kompletter Linksschenkelblock

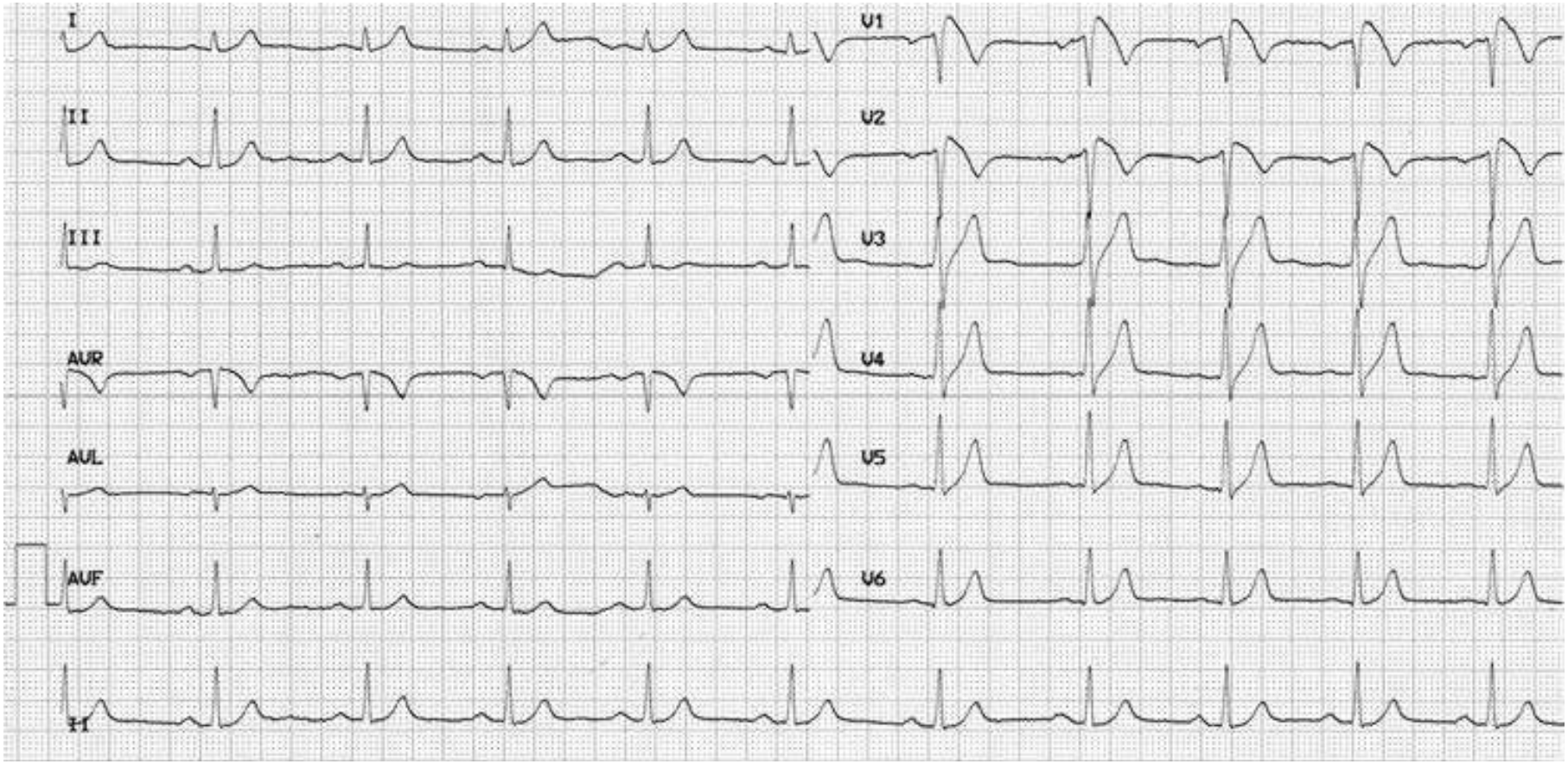


LSB: EKG-Kriterien

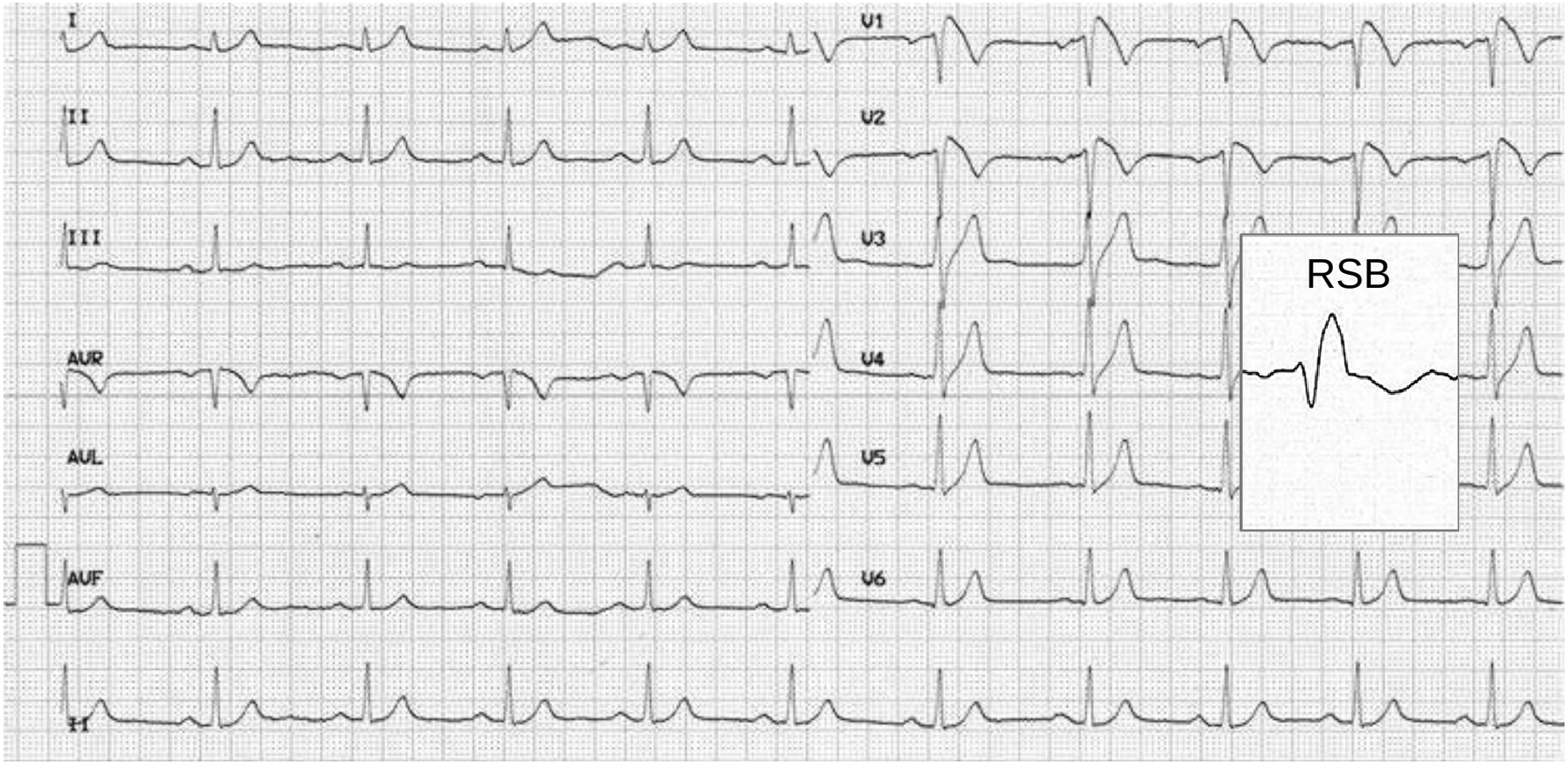
- QRS-Dauer ≥ 120 ms, oft >150 ms (definiert die Schenkelblockierung)
- Plumpe und breite QRS-Komplexe in V5/V6, I und aVL, Q-Zacken fehlen (verspätete linksventrikuläre Aktivierung)
- rS- oder QS-Komplexe in V1 bis V4 (Spiegelbild der verzögerten linksventrikulären Aktivierung)
- Abrupter Übergang zu den positiven QRS-Komplexen in V5 bis V6
- Verlängerung des Intervalls vom Beginn des QRS-Komplexes bis zum Punkt der endgültigen Negativitätsbewegung in V5/V6 (≥60 ms)

Ableitung V1: Verdachtsdiagnose?

Brugada-Syndrom

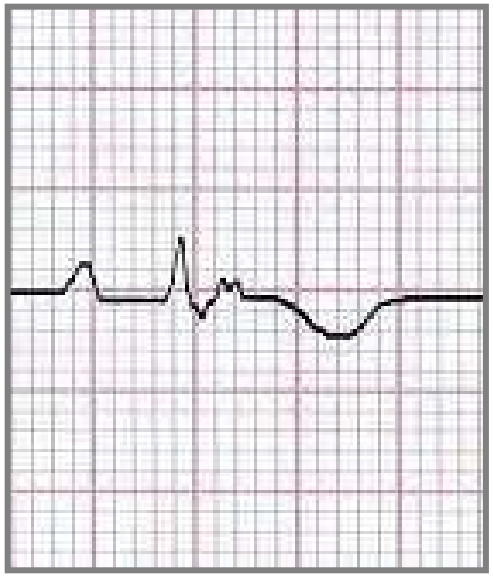


Brugada-Syndrom



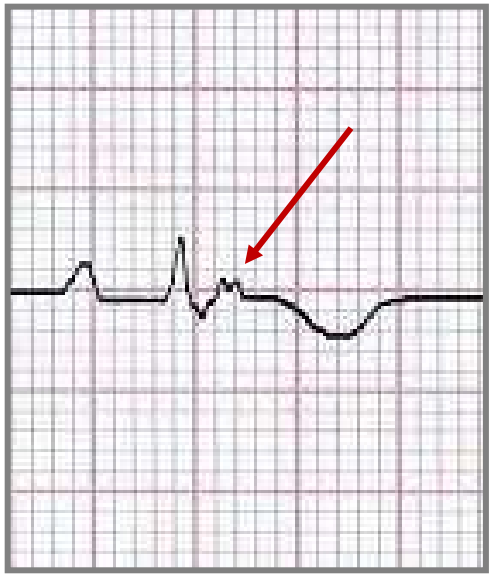
Ableitung V1: Verdachtsdiagnose?

V1

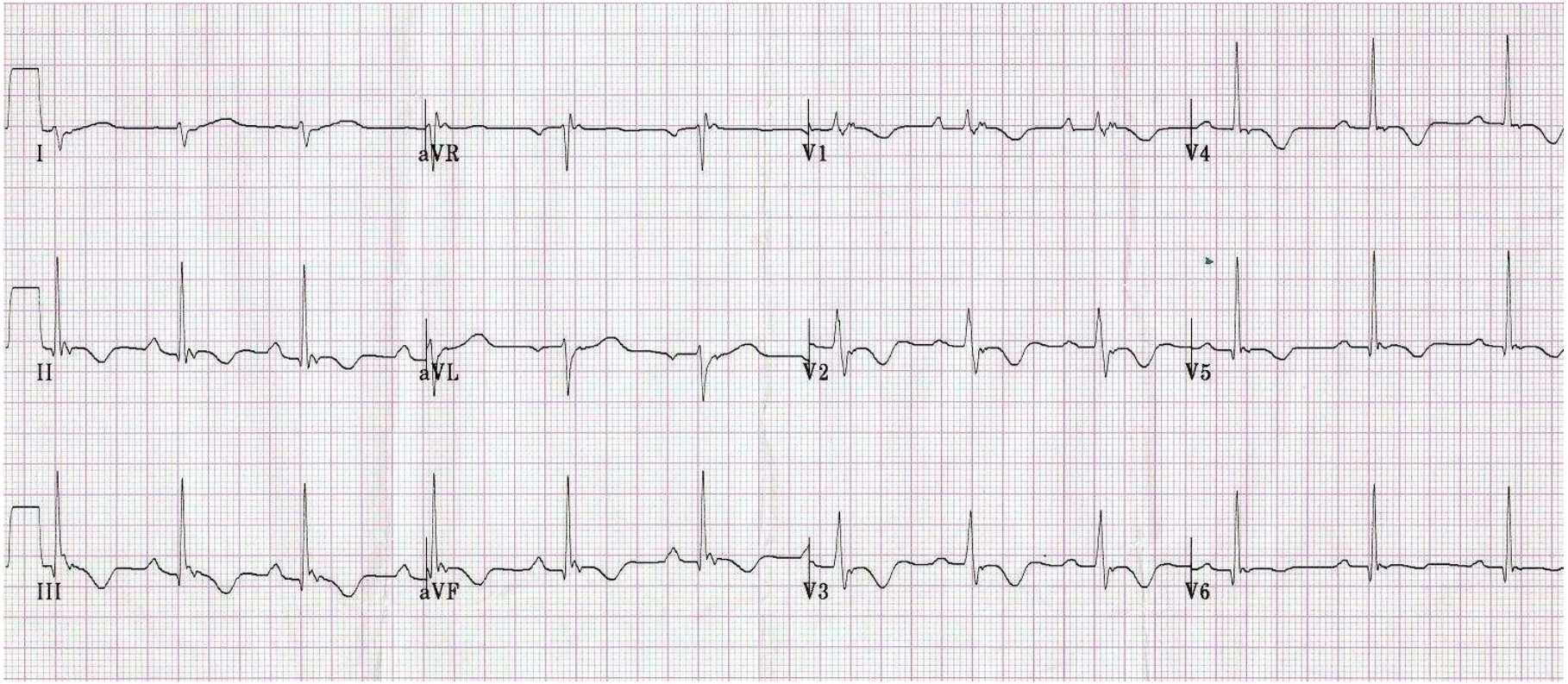


Ableitung V1: Epsilon-Welle

V1



Arrhythmogene rechtsventrikuläre Kardiomyopathie



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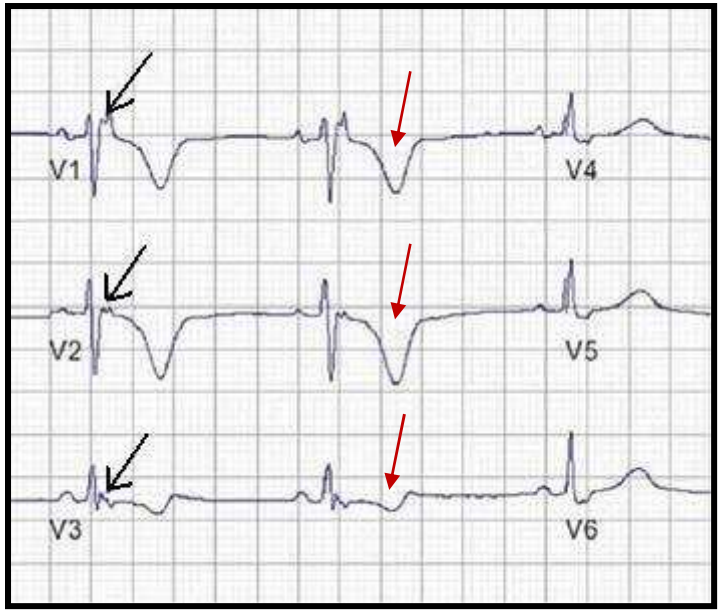
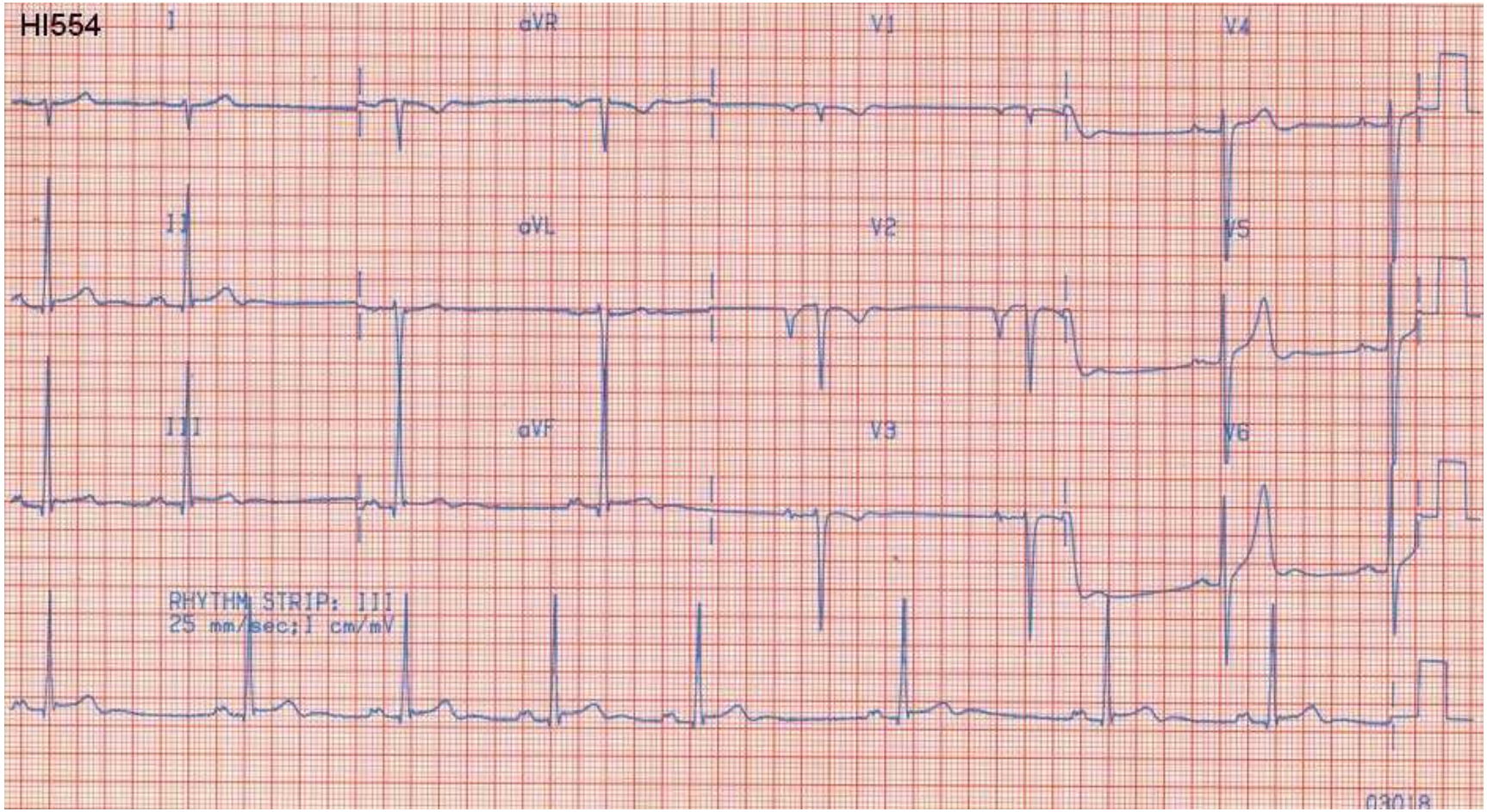
Arrhythmogene rechtsventrikuläre Kardiomyopathie



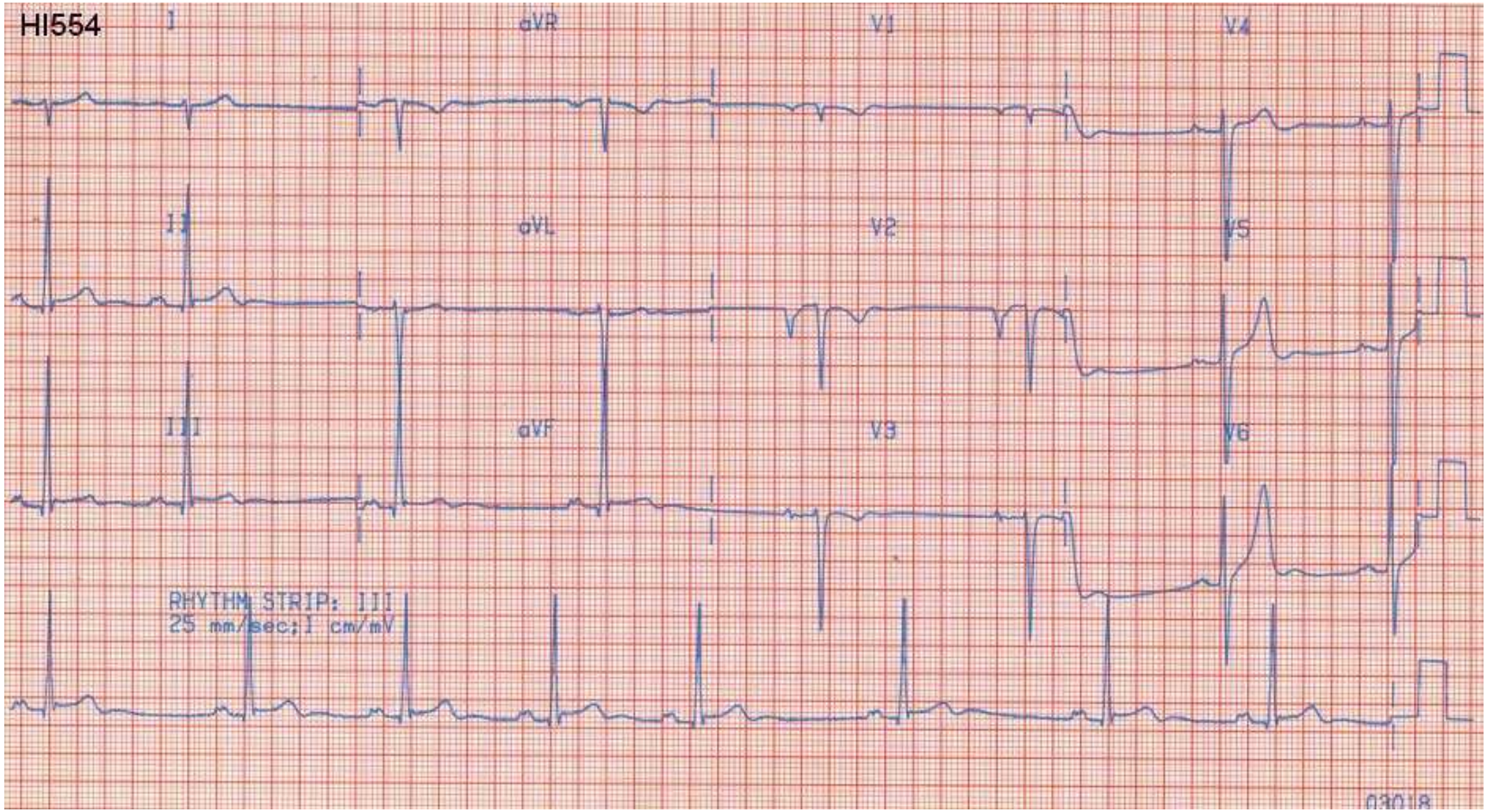
- Epsilon-Welle in V1 (V2-V3)
- Negative T-Welle in V1 – V3

Diez u. Brugada, 2008

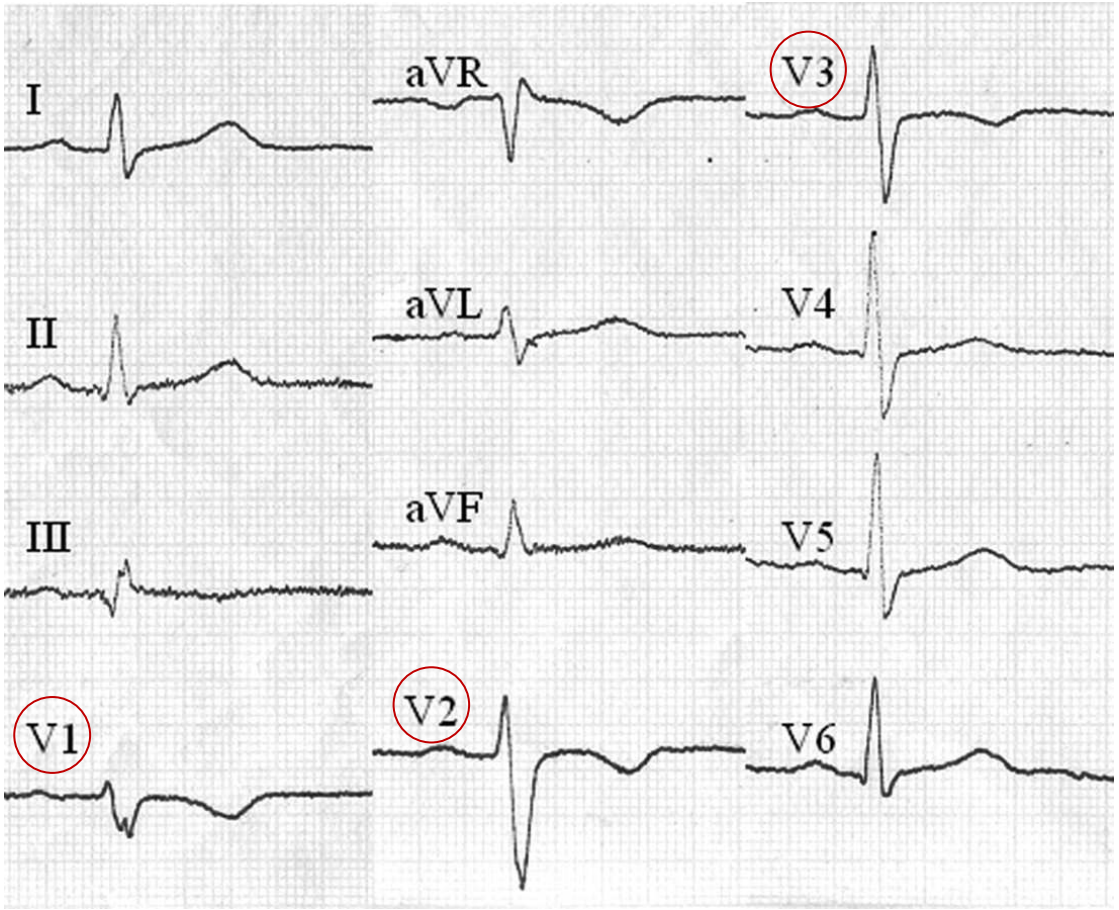
T-Inversion rechtspräkordial



T-Inversion rechtspräkordial bei Trichterbrust



T-Inversion rechtspräkordial



T-Inversion rechtspräkordial als Normvariante

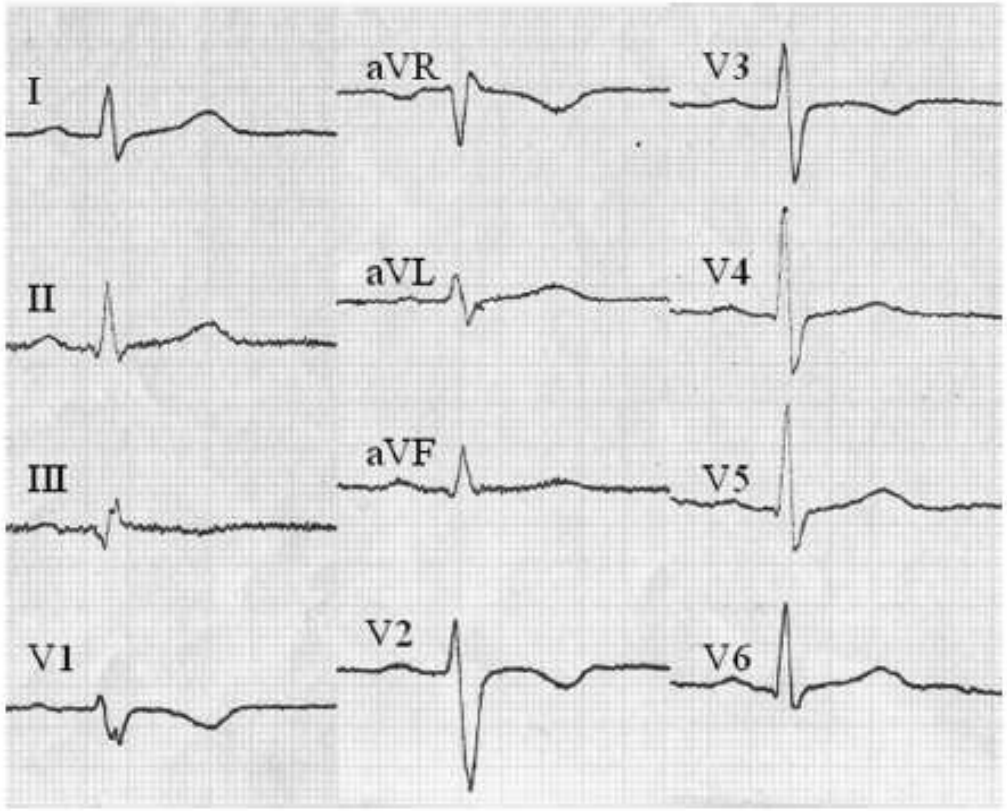
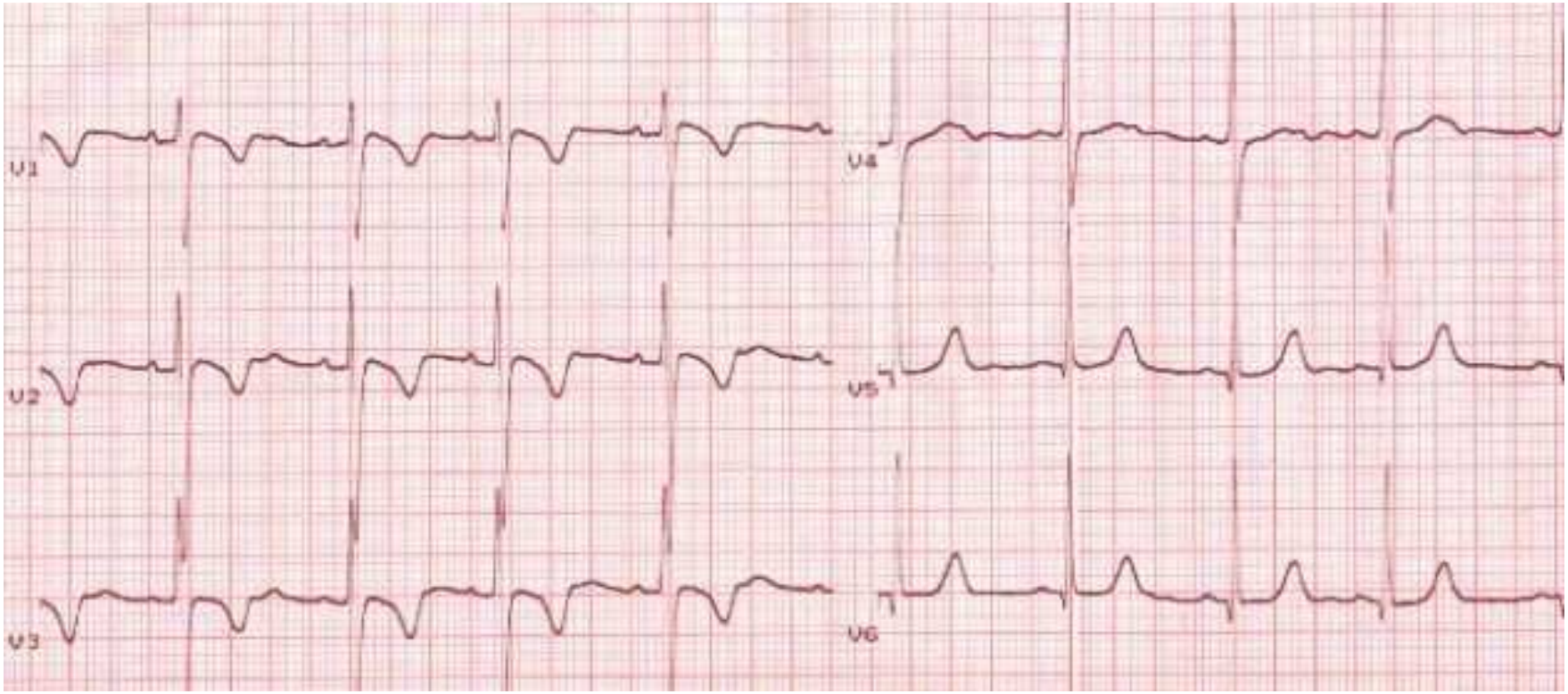


Figure 1. ECG of a 31-year-old woman presenting typical mildly inverted T waves in right precordial leads V_1 to V_3. She was still alive 40 years later at the end of the survey. Paper speed is 50 mm/s.

bei 0,5% der mittelalten finnischenBevölkerung

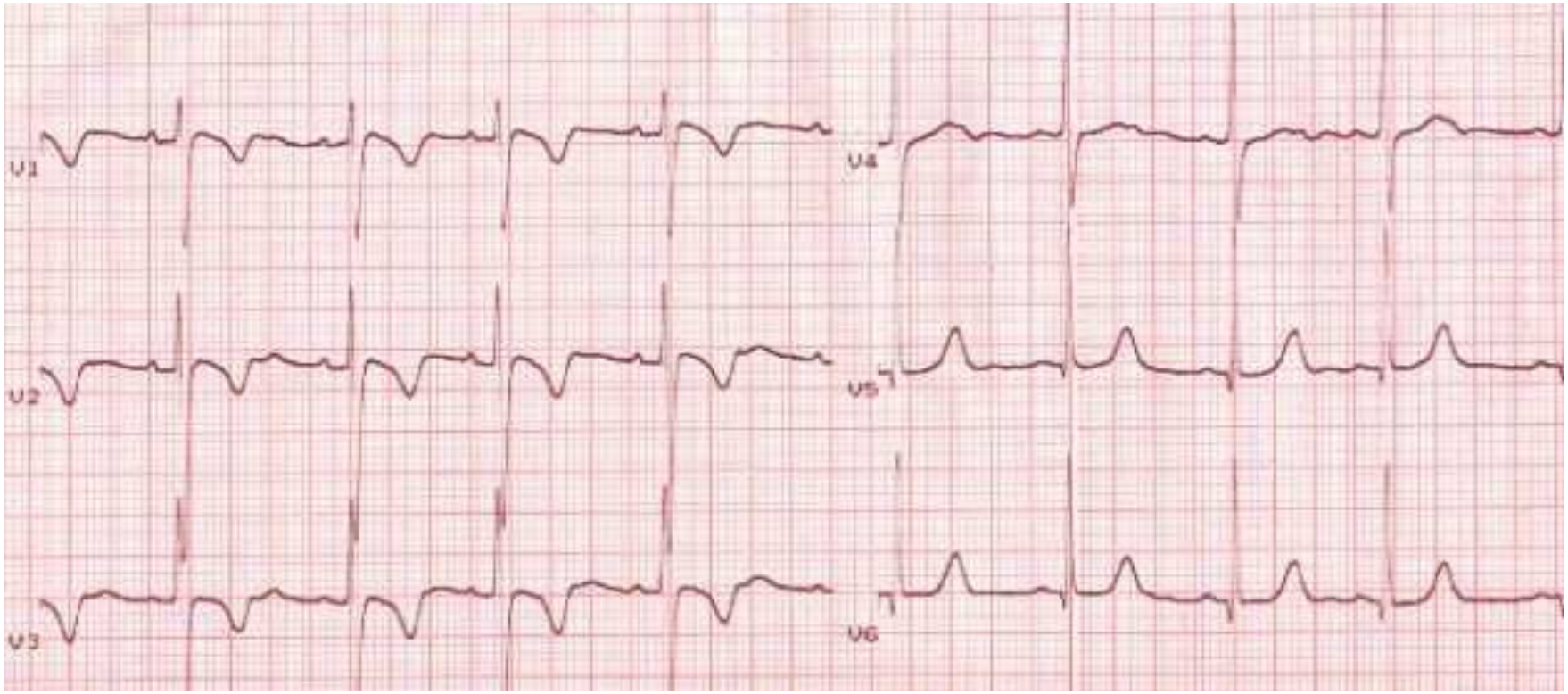
Aro et asl. 2012

T-Inversion rechtspräkordial



lifeinthefastlane.com

T-Inversion rechtspräkordial als Normvariante

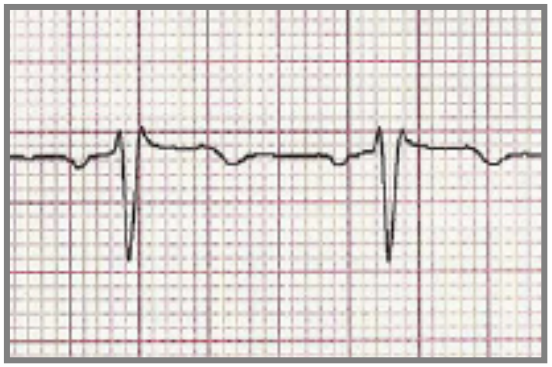


Gesunder Schwarzafrikaner

lifeinthefastlane.com

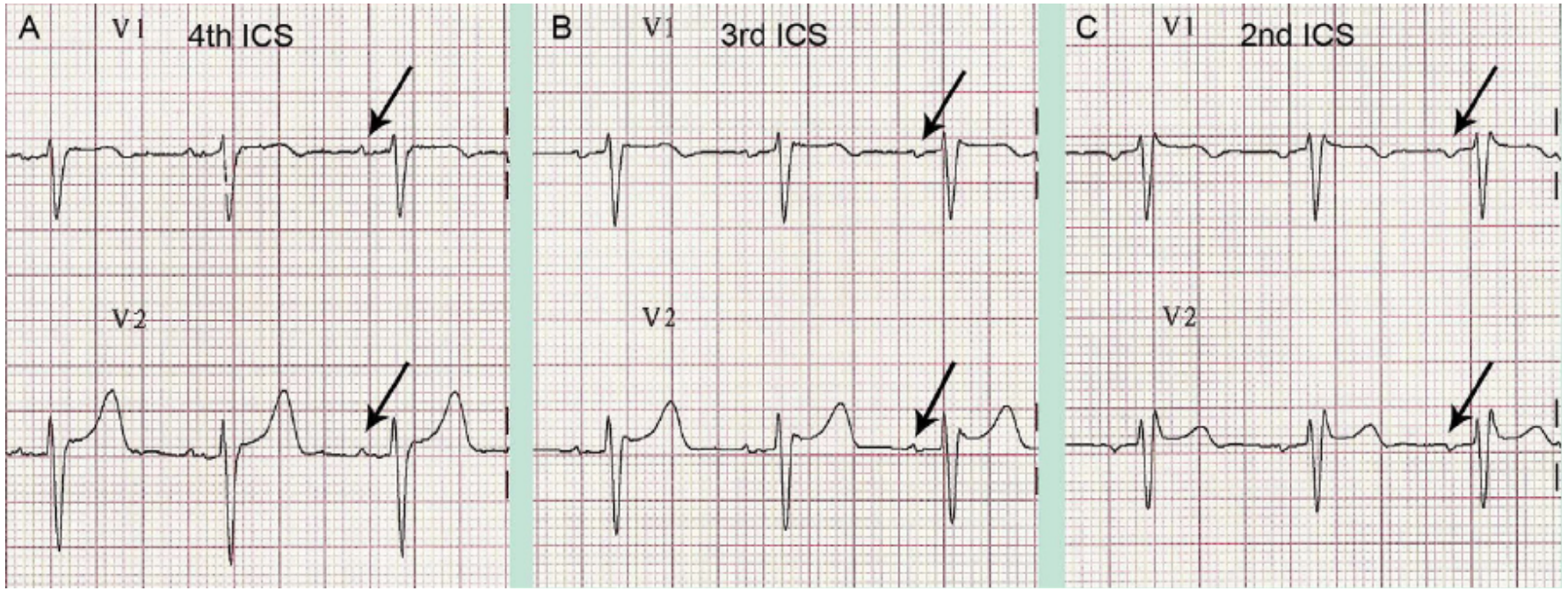
Ableitung V1: Verdachtsdiagnose?

V1



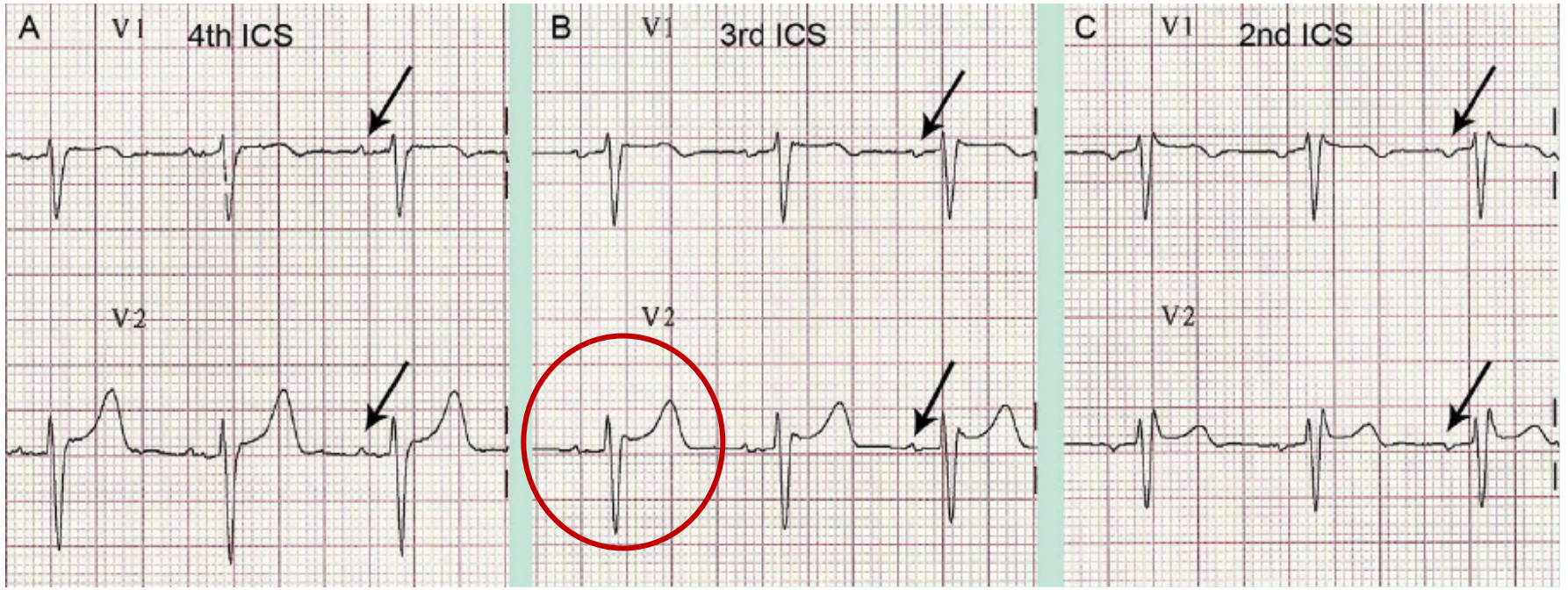
García-Niebla et al. 2012

Ableitung V1: Elektrodenfehlplatzierungen



García-Niebla et al. 2012

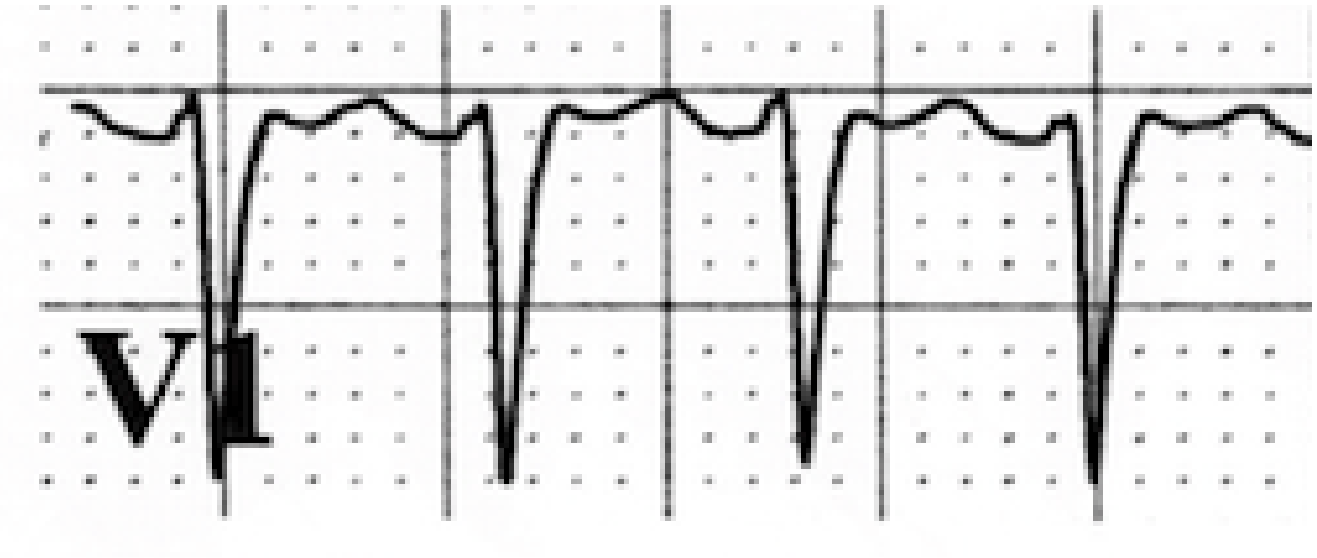
Ableitung V1: Elektrodenfehlplatzierungen



Brugada-EKG Typ II?

García-Niebla et al. 2012

Ableitung V1: Verdachtsdiagnose?



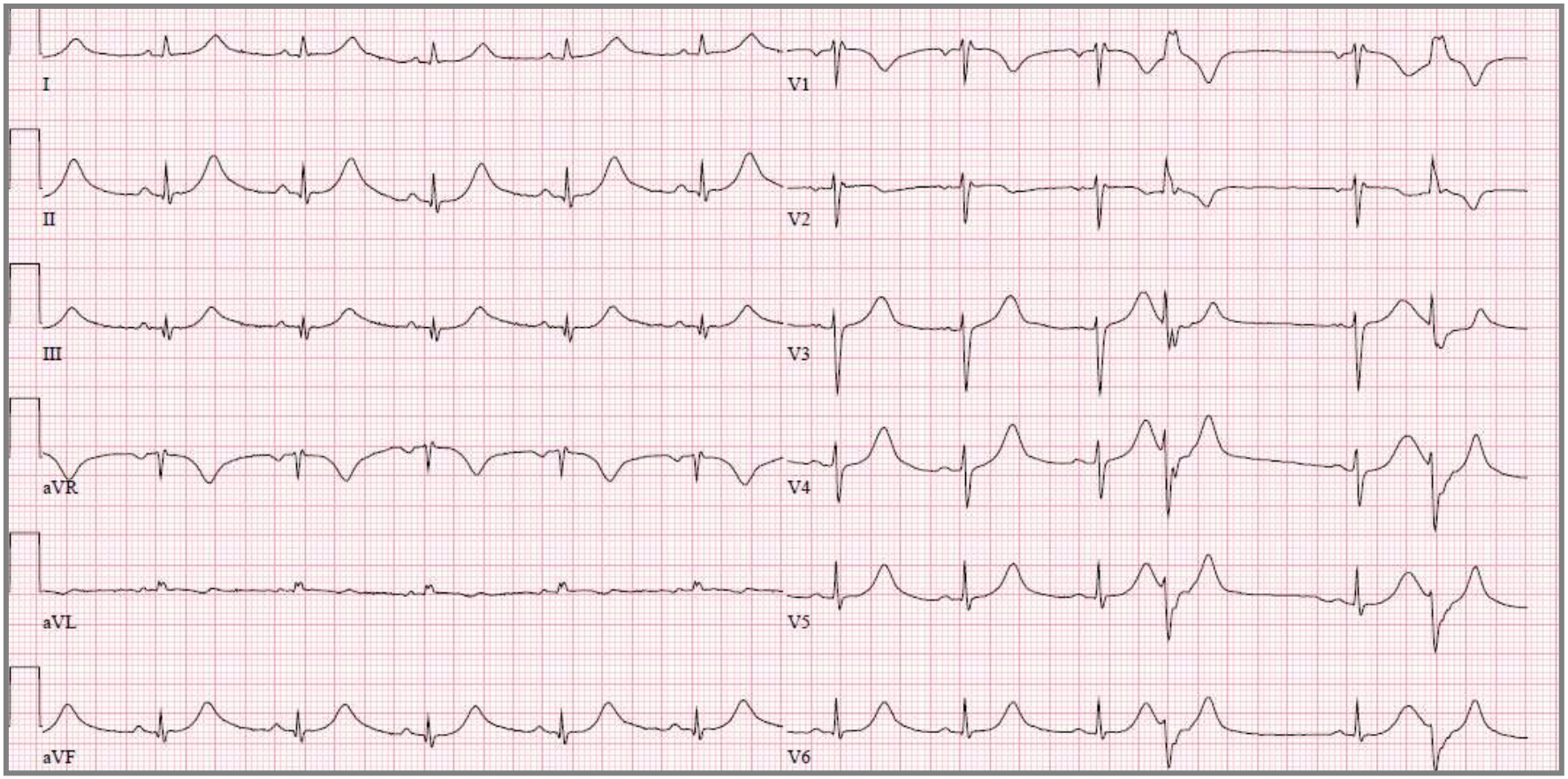
Ableitung V1: AV-Knoten-Reentry-Tachykardie

Pseudo-R-Zacken

Fox D J et al. Mayo Clin Proc. 2008;83:1400-1411

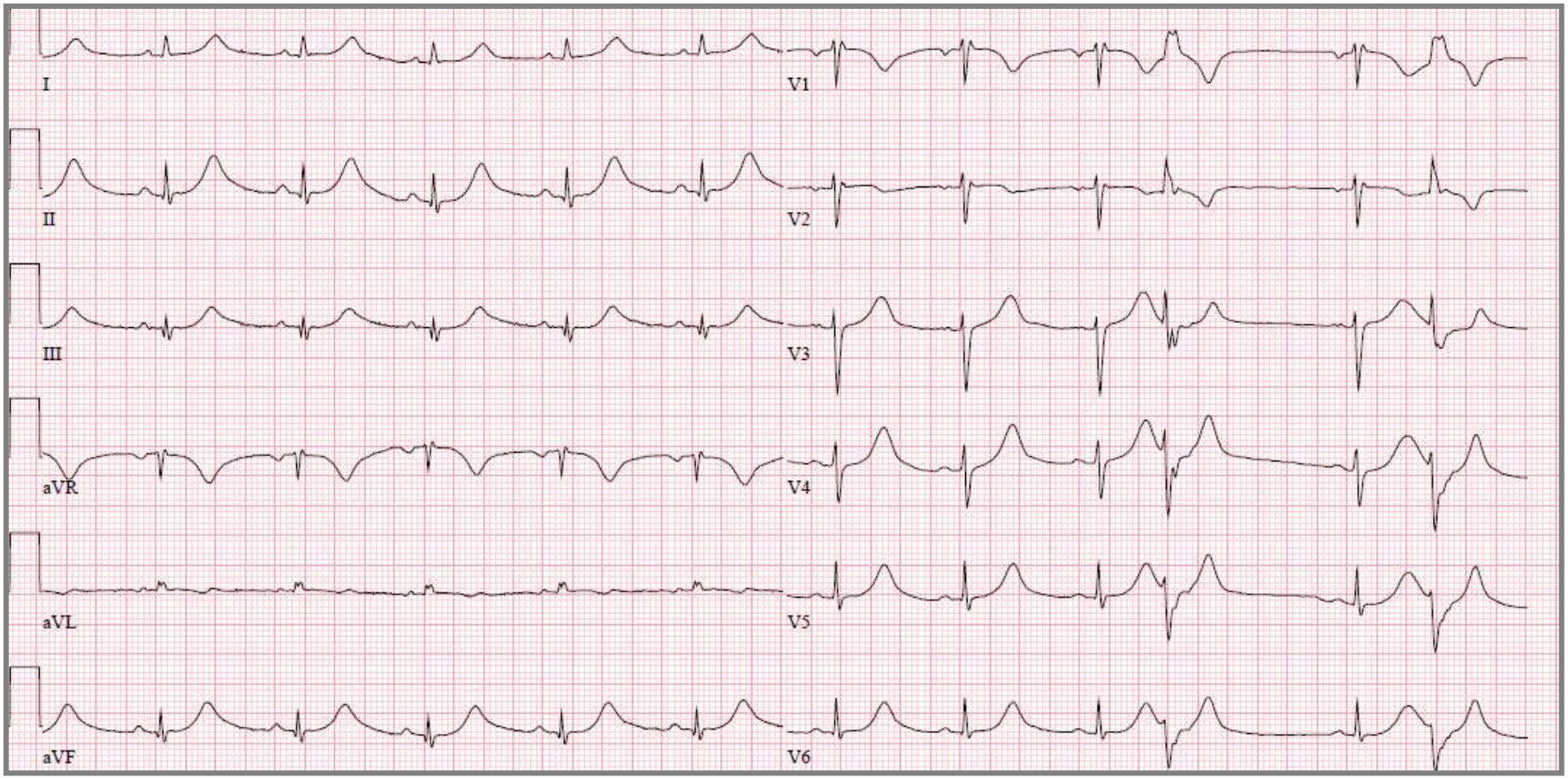
MAYO CLINIC
Mayo Clinic Proceedings

12-Kanal-EKG: Verdachtsdiagnose?



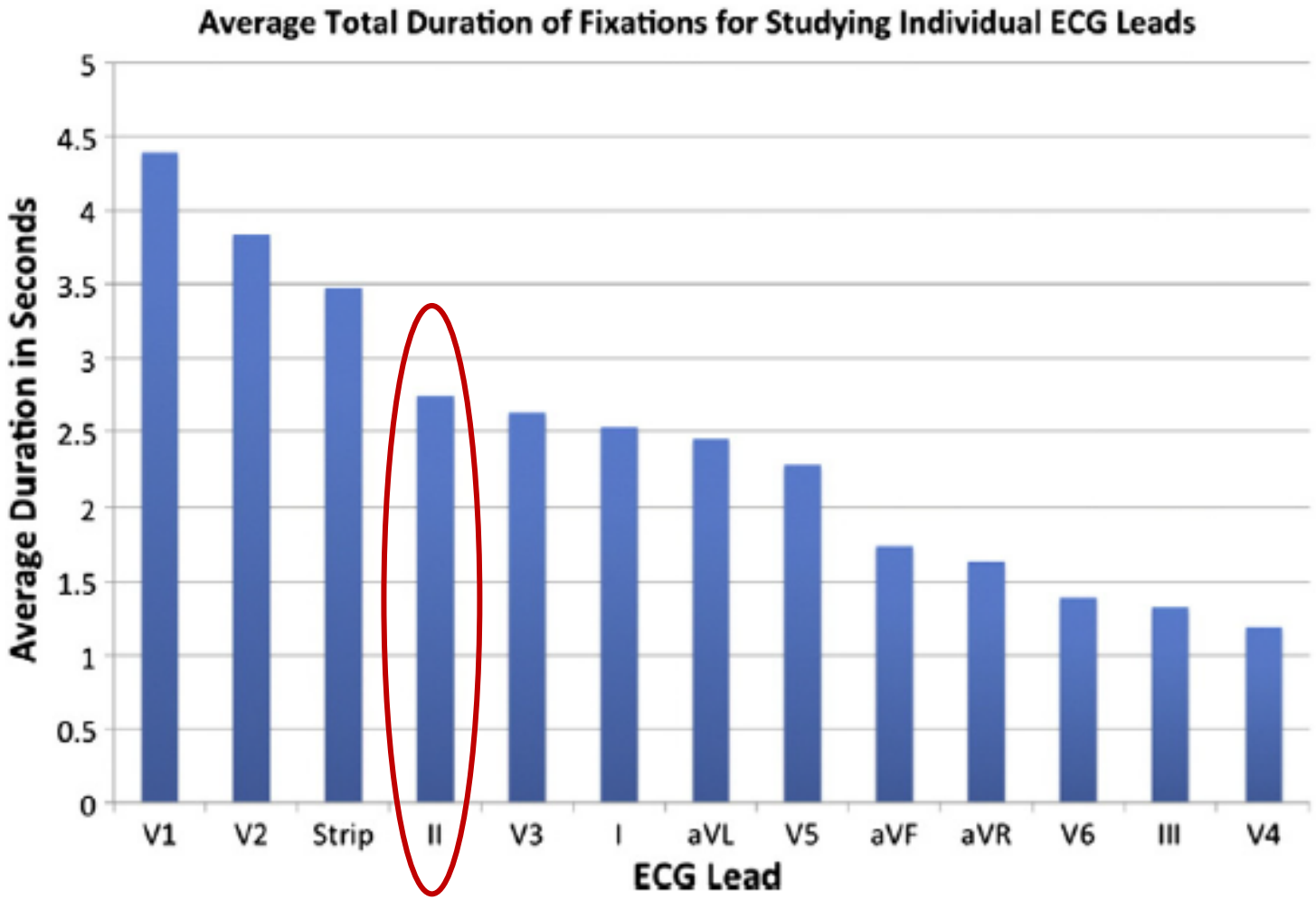
Zur Verfügung gestellt: J. Reisinger, 2016

Langes QT-Syndrom: Wo das QT-Intervall messen?



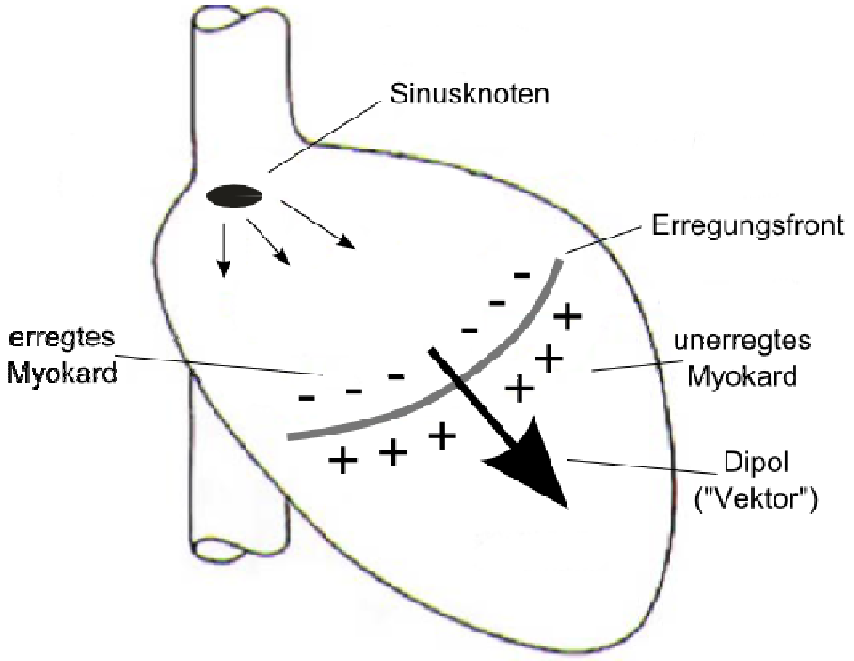
Zur Verfügung gestellt: J. Reisinger, 2016

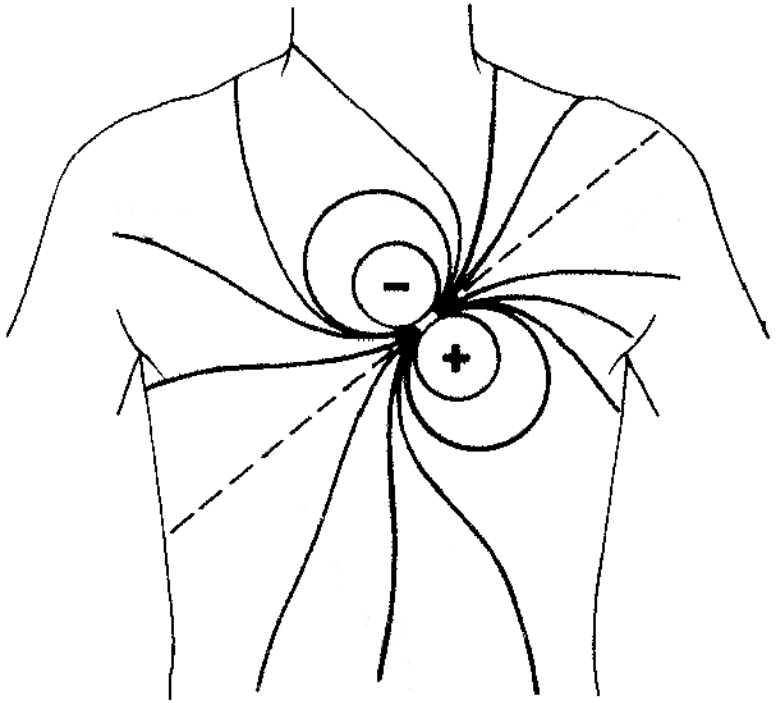
EKG und Eye tracking: Experte



Bond et al. 2014

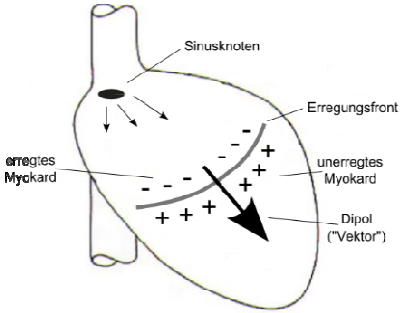
EKG-Grundlagen I

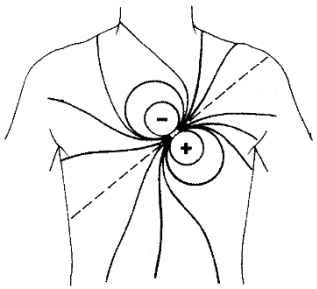


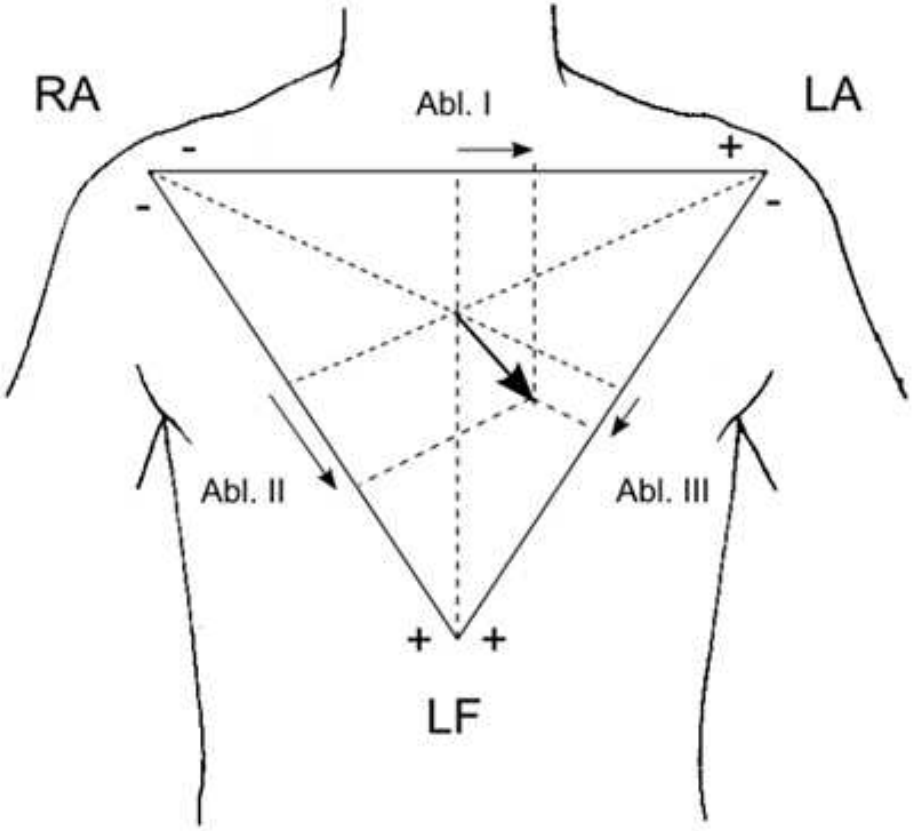


Dipol: zwei benachbarte, nicht zusammenfallende Ladungen; Größe mit Vektorcharakter

EKG-Grundlagen II

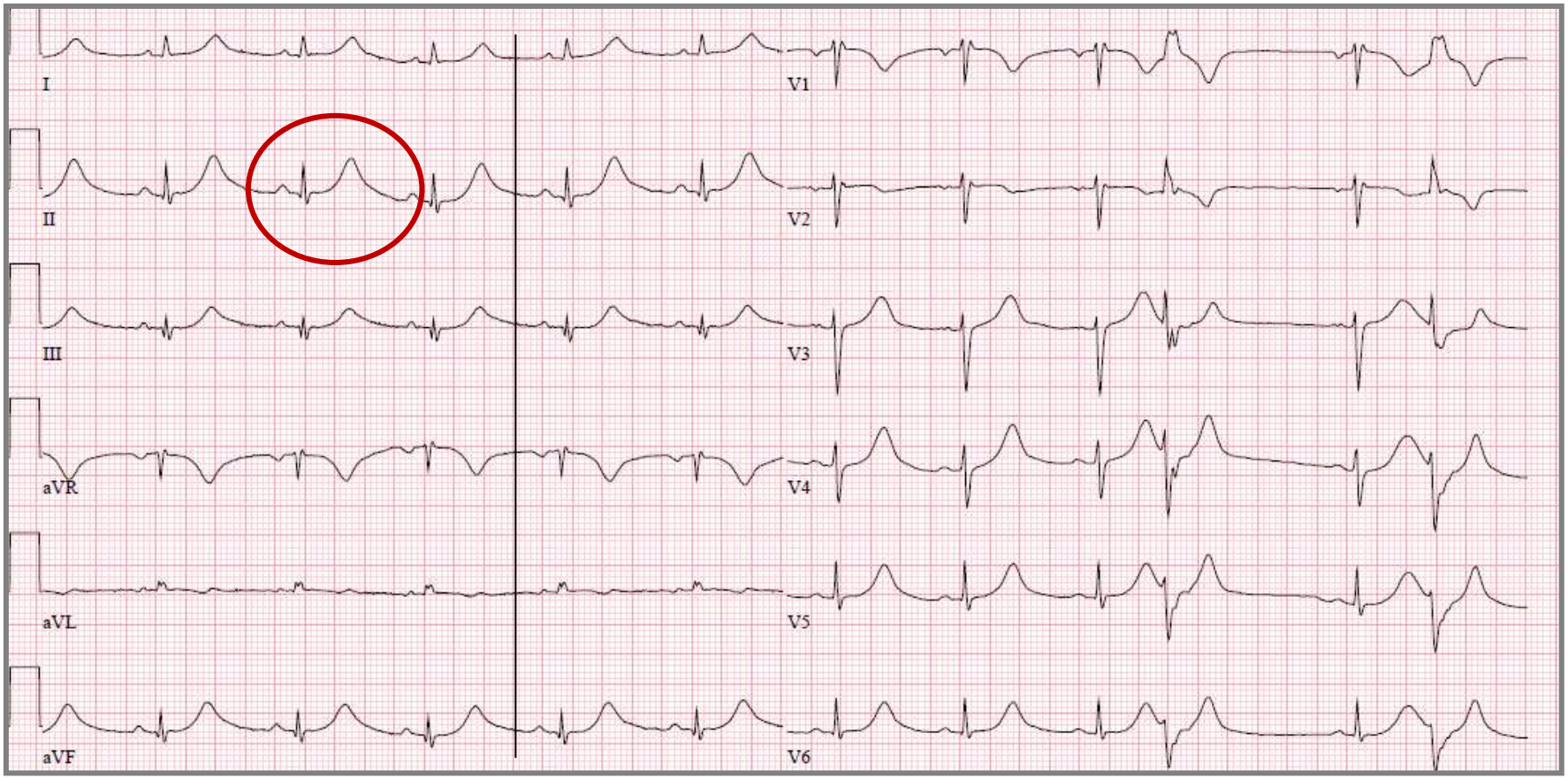






Einthoven-Dreieck: I + III = II

12-Kanal-EKG: Wo das QT-Intervall messen?

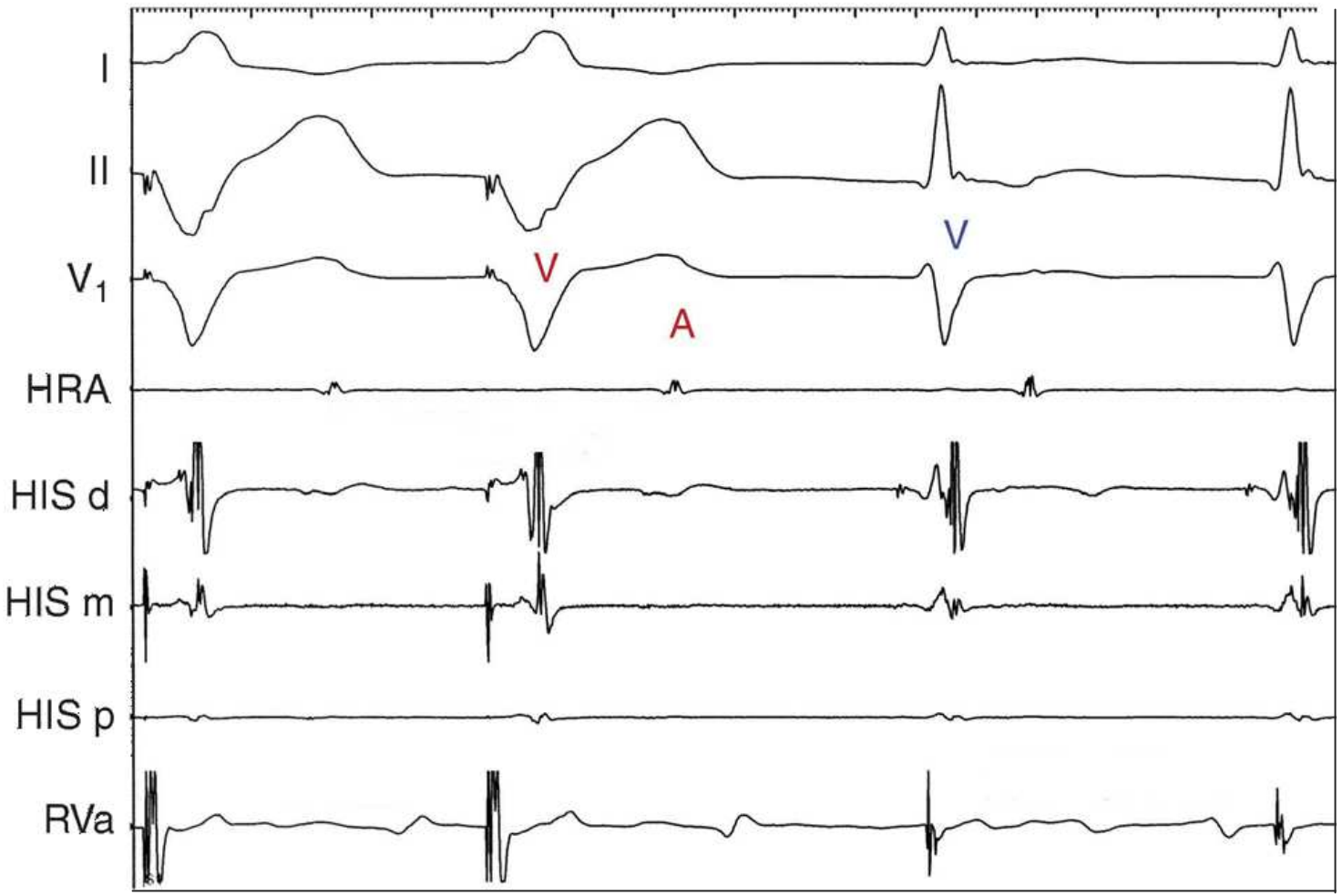


QTc: 524 ms; 6.3.2016

Wo messen?

- **Ableitung II** – Standardableitung für Intervall- und Komplexvermessungen
- Ggf. auf die Brustwandableitung V5(V6) ausweichen
- Vorsicht bei der unkritischen Übernahme von vom Gerät gemessenen Intervallen (Regel: je niedriger die Signal-amplitude, desto größer wird die Wahrscheinlichkeit für Fehlmessungen)

Invasive elektrophysiologische Untersuchung



Welche Ableitungen sind essentiell in der Rhythmologie?

- **Ableitung I** (rechts – links, Vertikalebene)
- **Ableitung II** (oben – unten, Vertikalebene)
- **Ableitung V1** (rechts – links, vorn – hinten, Horizontalebene)

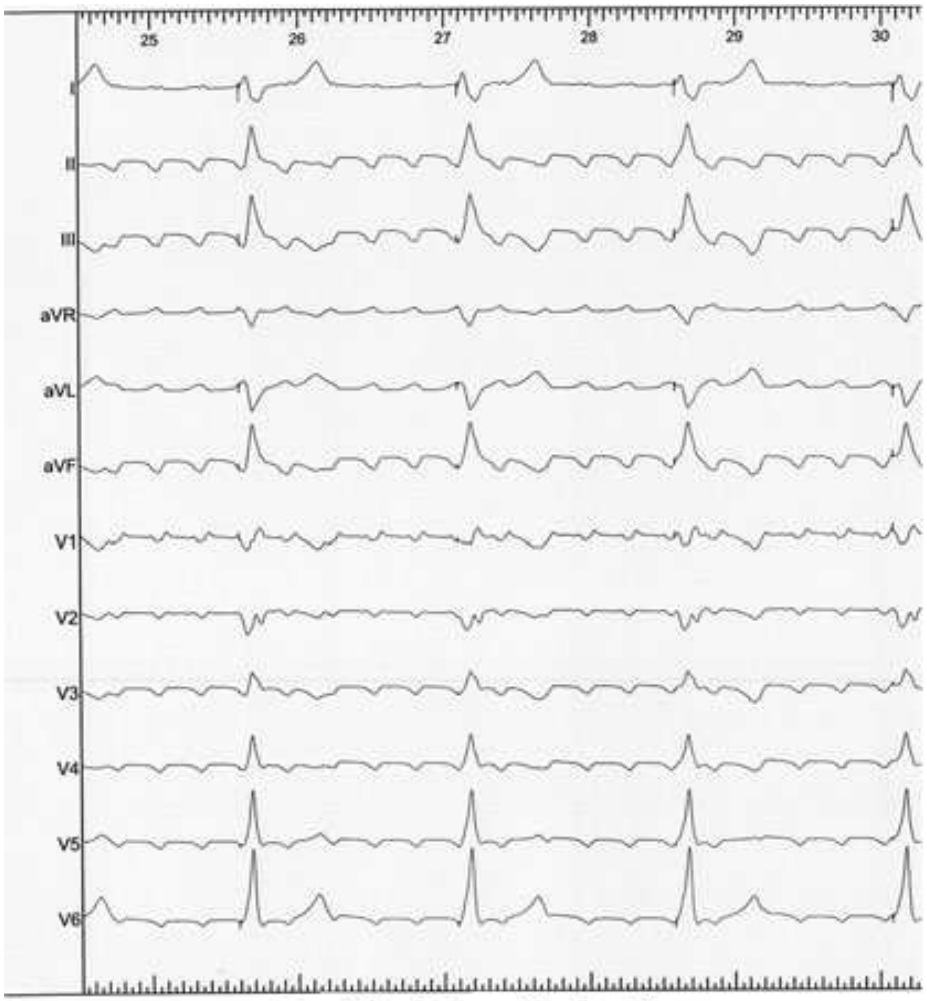
Lokalisation von Vorhofflattern aus dem 12-Kanal-EKG

	II, III, aVF	I, aVL	V1
Typisches Vorhofflattern („counter-clockwise")	–	0/(+)	Biphasisch
Isthmus-abhängiges Vorhofflattern „clockwise"	+	+	Biphasisch
Crista-terminalis-Flattern	Variabel	+	Biphasisch
Inzisionales Vorhofflattern	Variabel	+	Biphasisch
Perimitralflattern, „clockwise"	+	0/–	+
Perimitralflattern, „counter-clockwise"	–	+	+
Pulmonalvenen-/LA Roof-Flattern	++	0/+	+

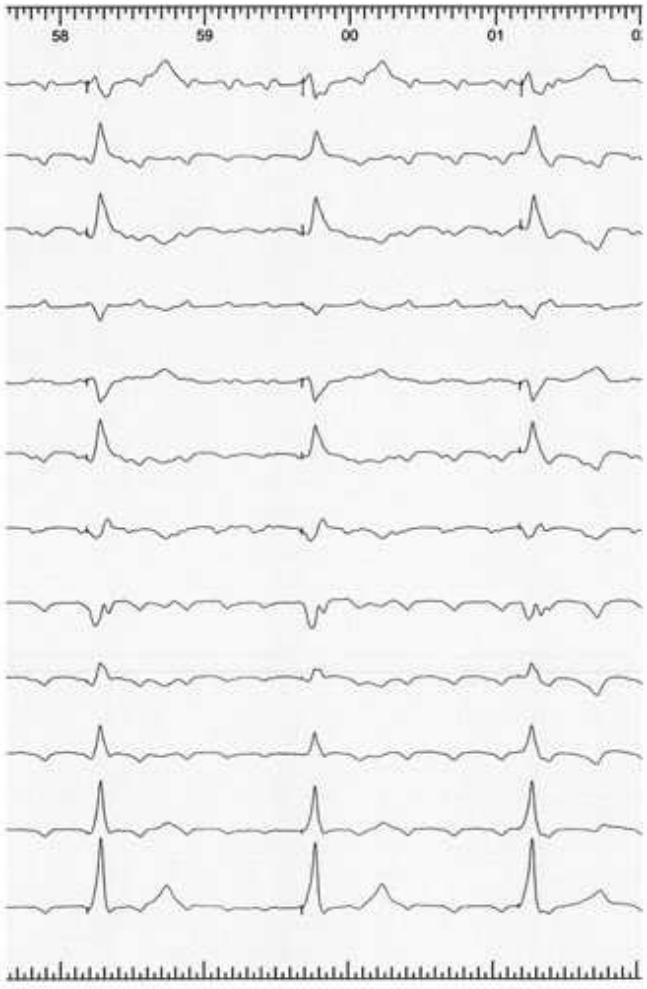
0 isoelektrisch, – negativ, + positiv, *(+)* leicht positiv, *LA* linksatrial.

Rostock et al. 2015

Vorhofflattern (atriale Makro-Reentry-Tachykardien)



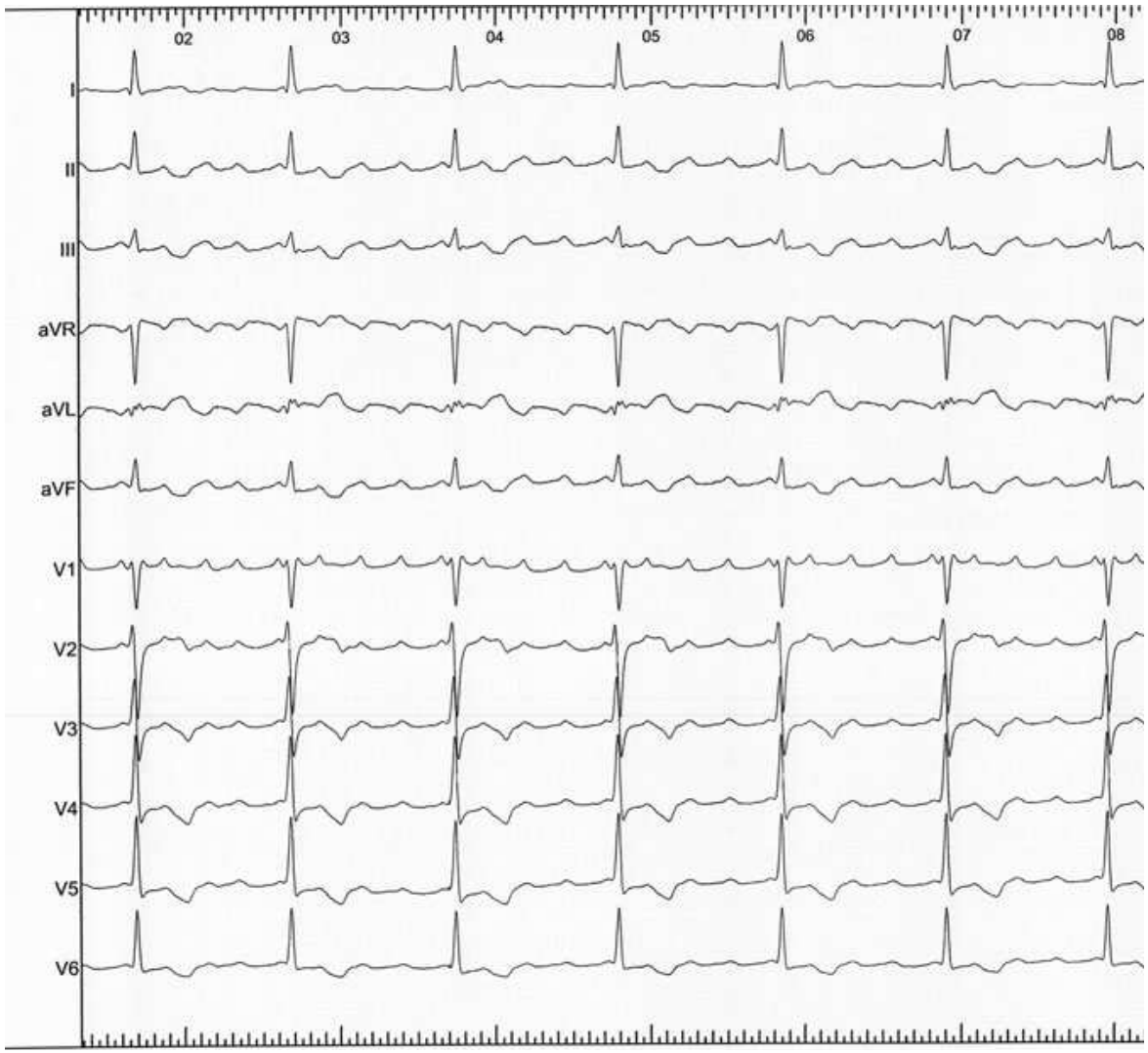
Gewöhnliches Vorhofflattern



Inzisionales Vorhofflattern

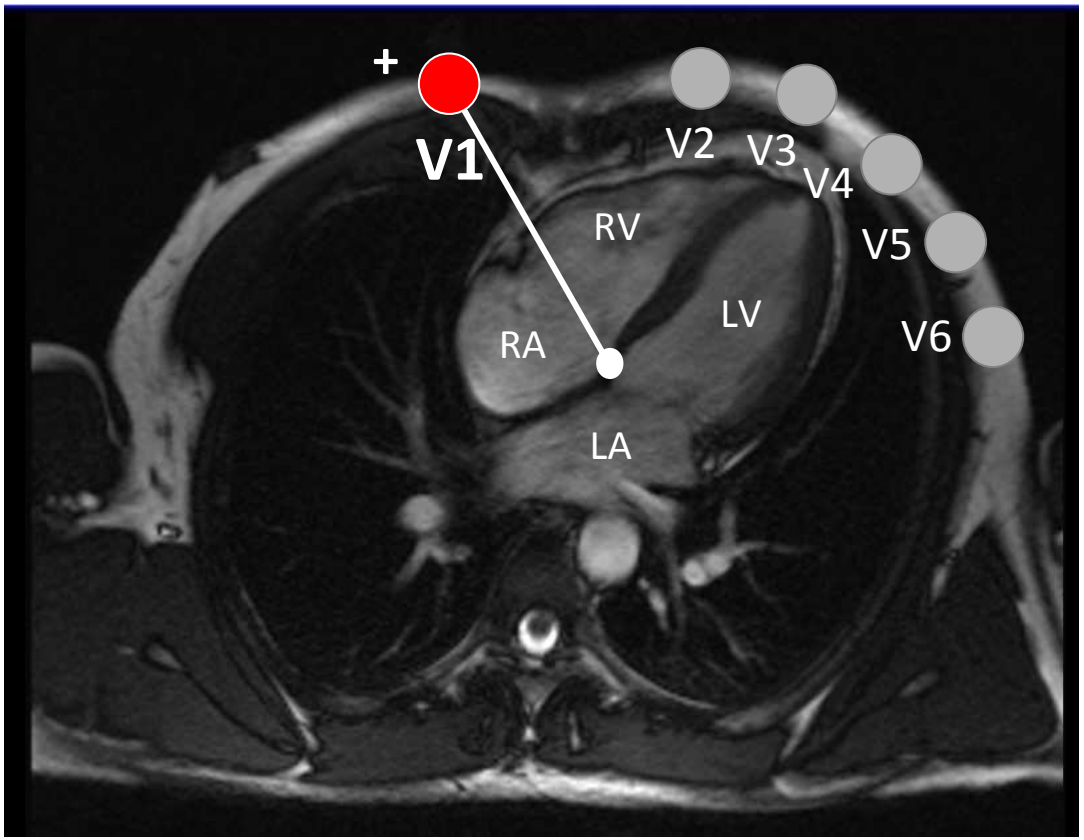
Rostock et al. 2015

Perimitralflattern (um die Mitralklappe)



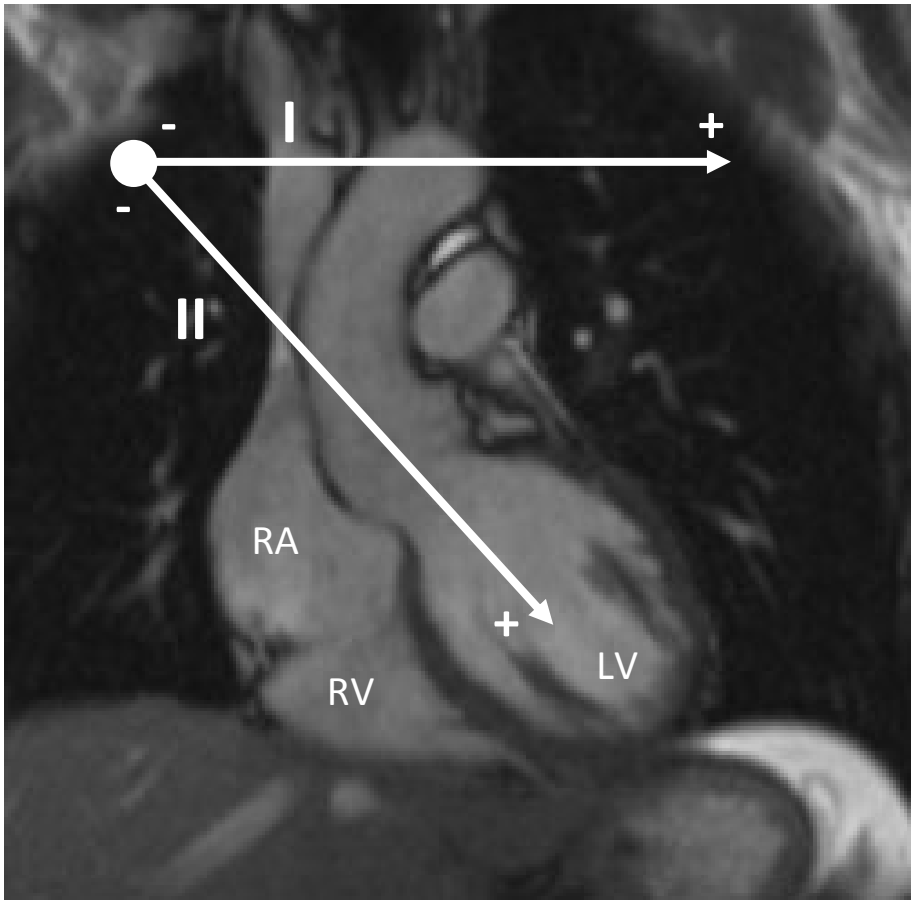
Rostock et al. 2015

Ableitung V1



Horizontalebene

Ableitungen I und II



Frontalebene