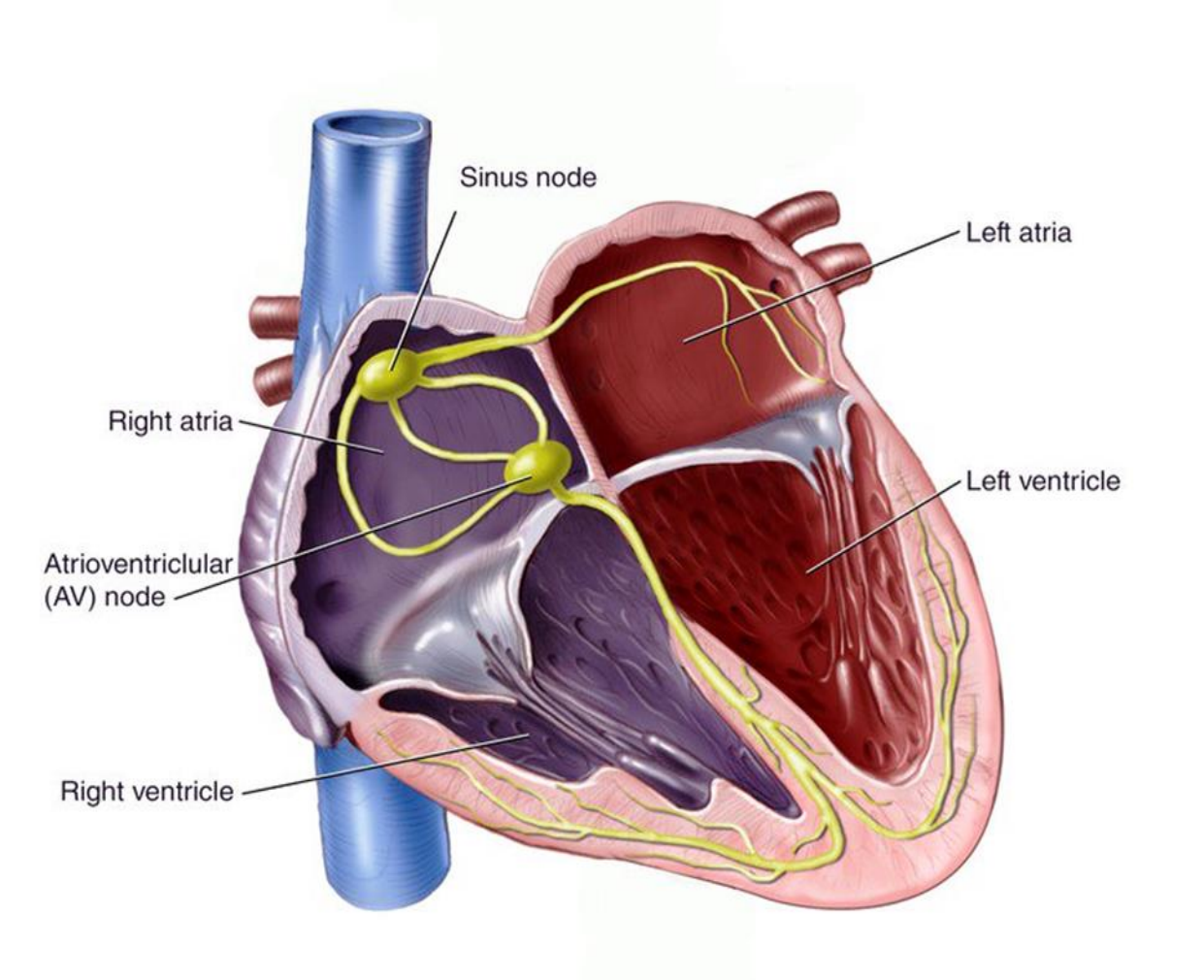
ECG – ALL YOU WANTED TO KNOW, BUT YOU WERE AFRAID TO ASK !

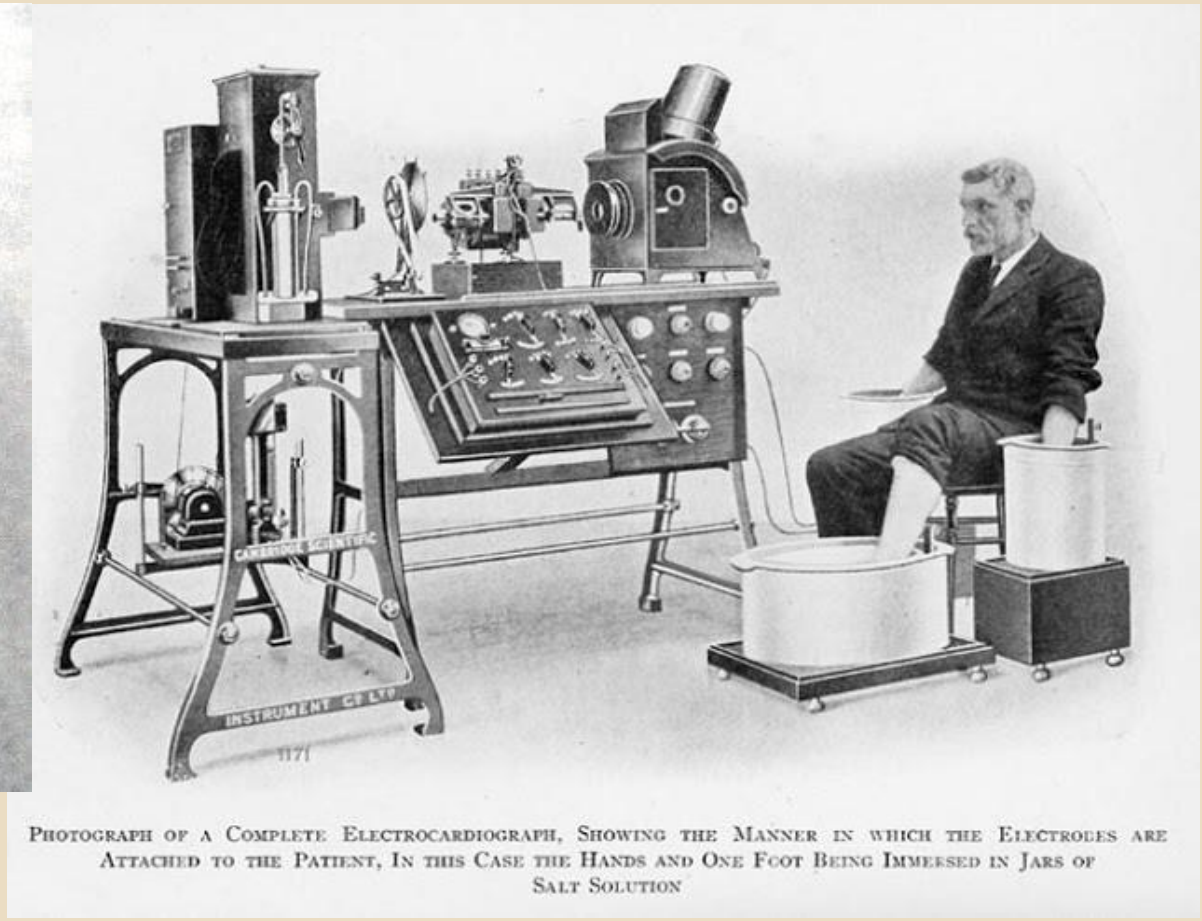
L.Křivan

Interní kardiologická klinika FN Brno

Nodes responsible for cardiac rhythm

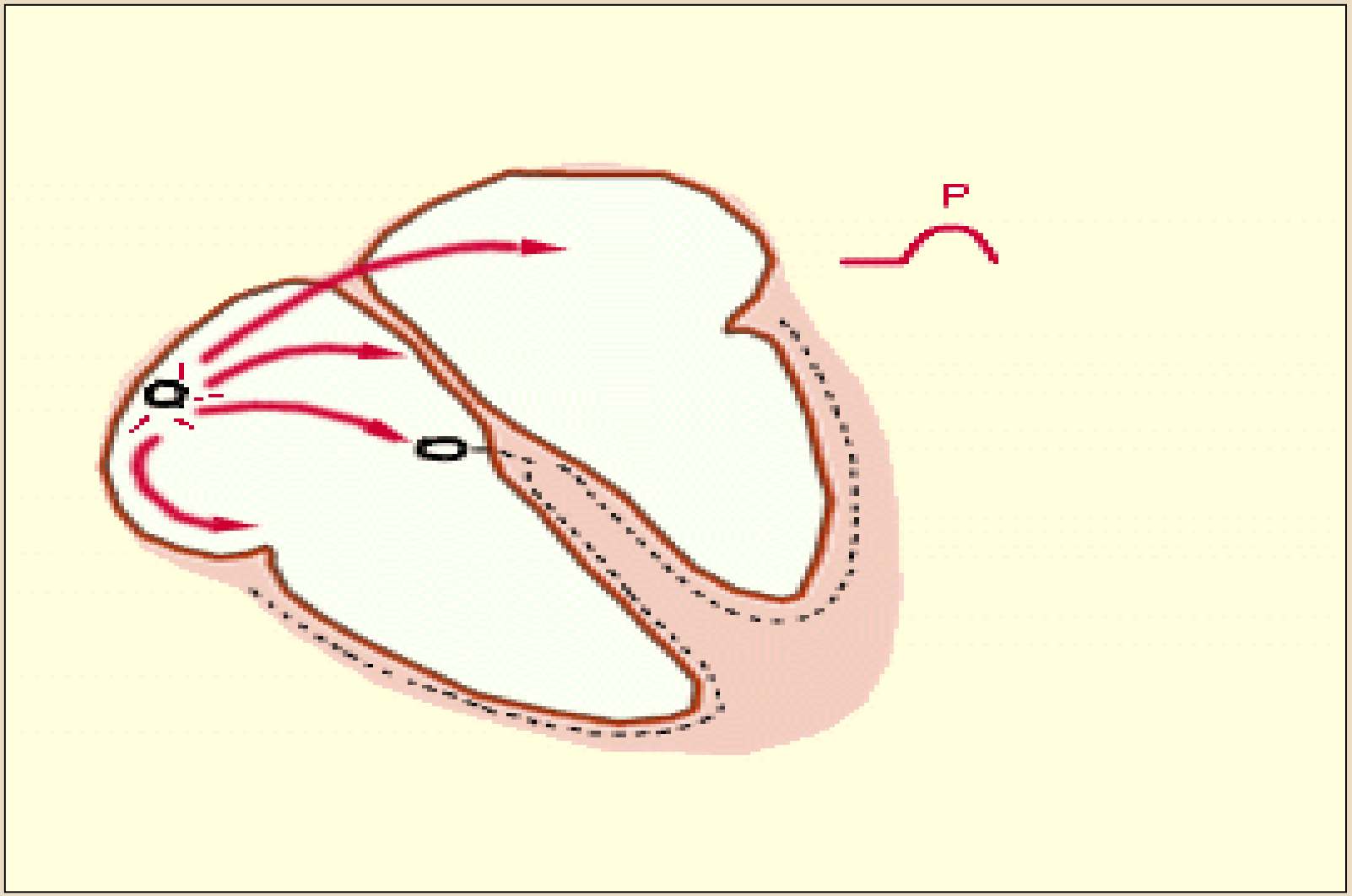


Electrical cardiac activity can be recorded

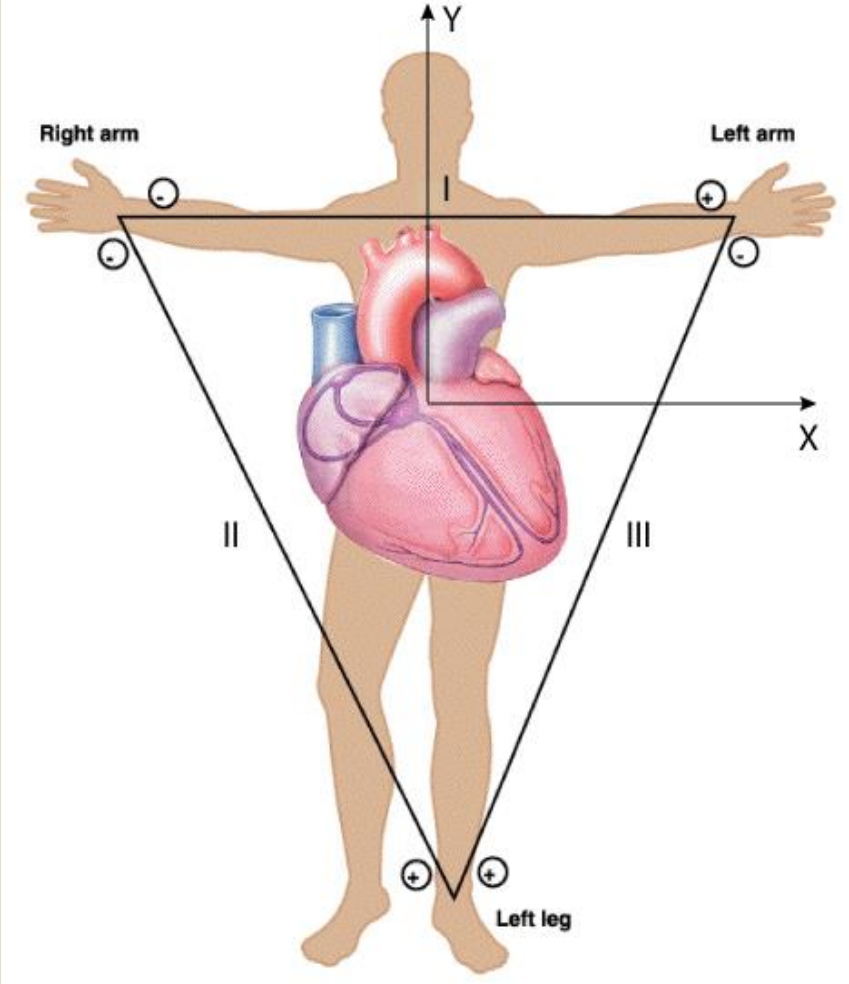


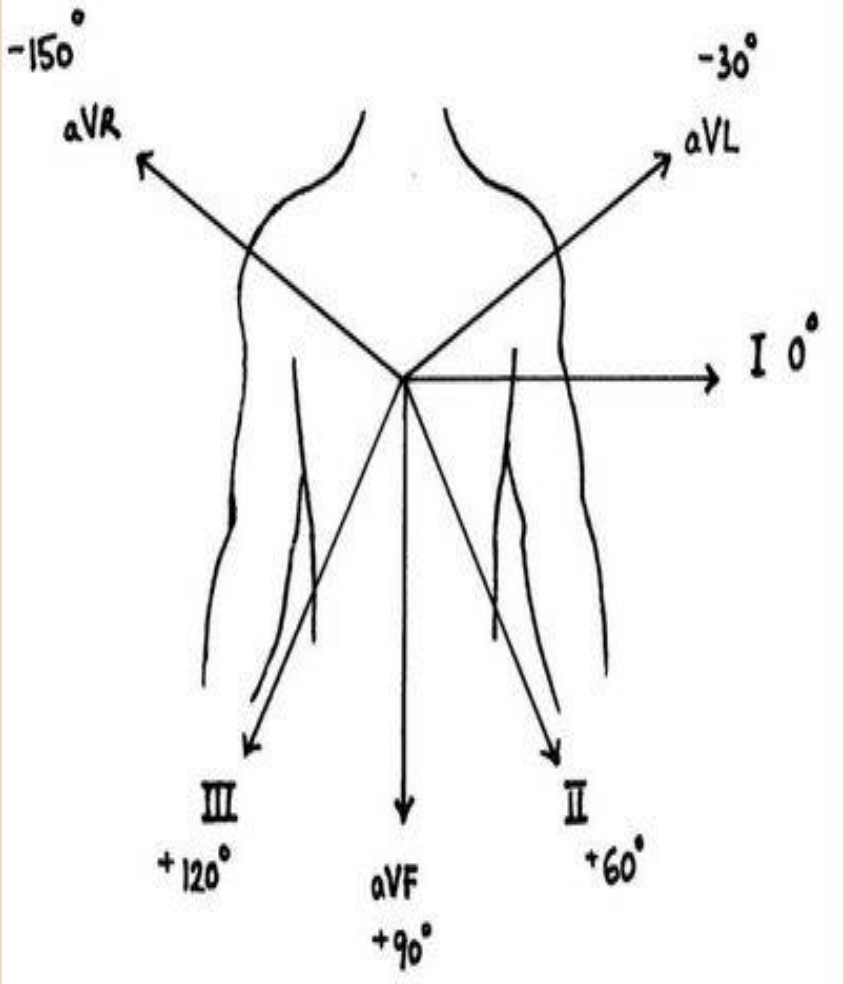
Photograph of a Complete Electrocardiograph, Showing the Manner in which the Electrodes are Attached to the Patient, In this Case the Hands and One Foot Being Immersed in Jars of Salt Solution

ECG (Willem Einthoven 1893)

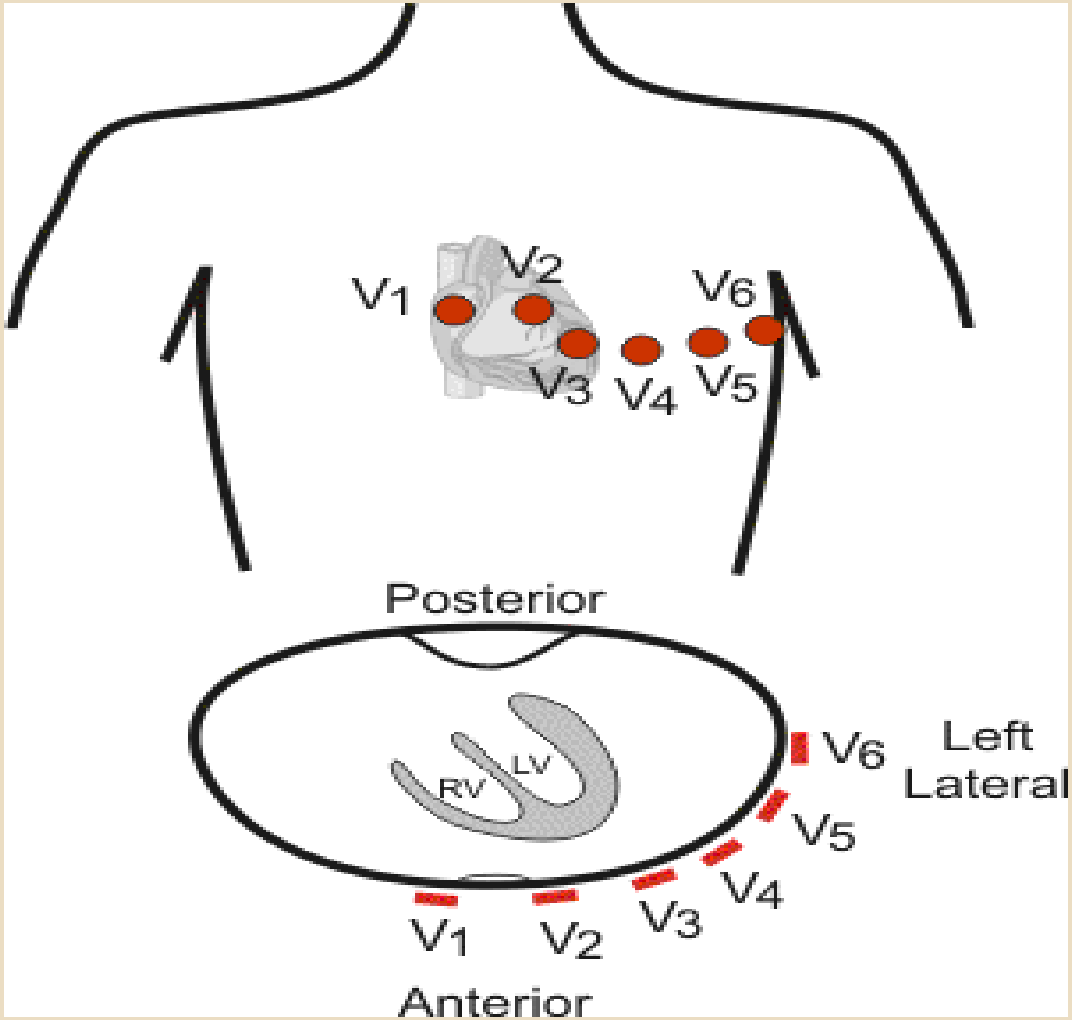


ECG – limb leads

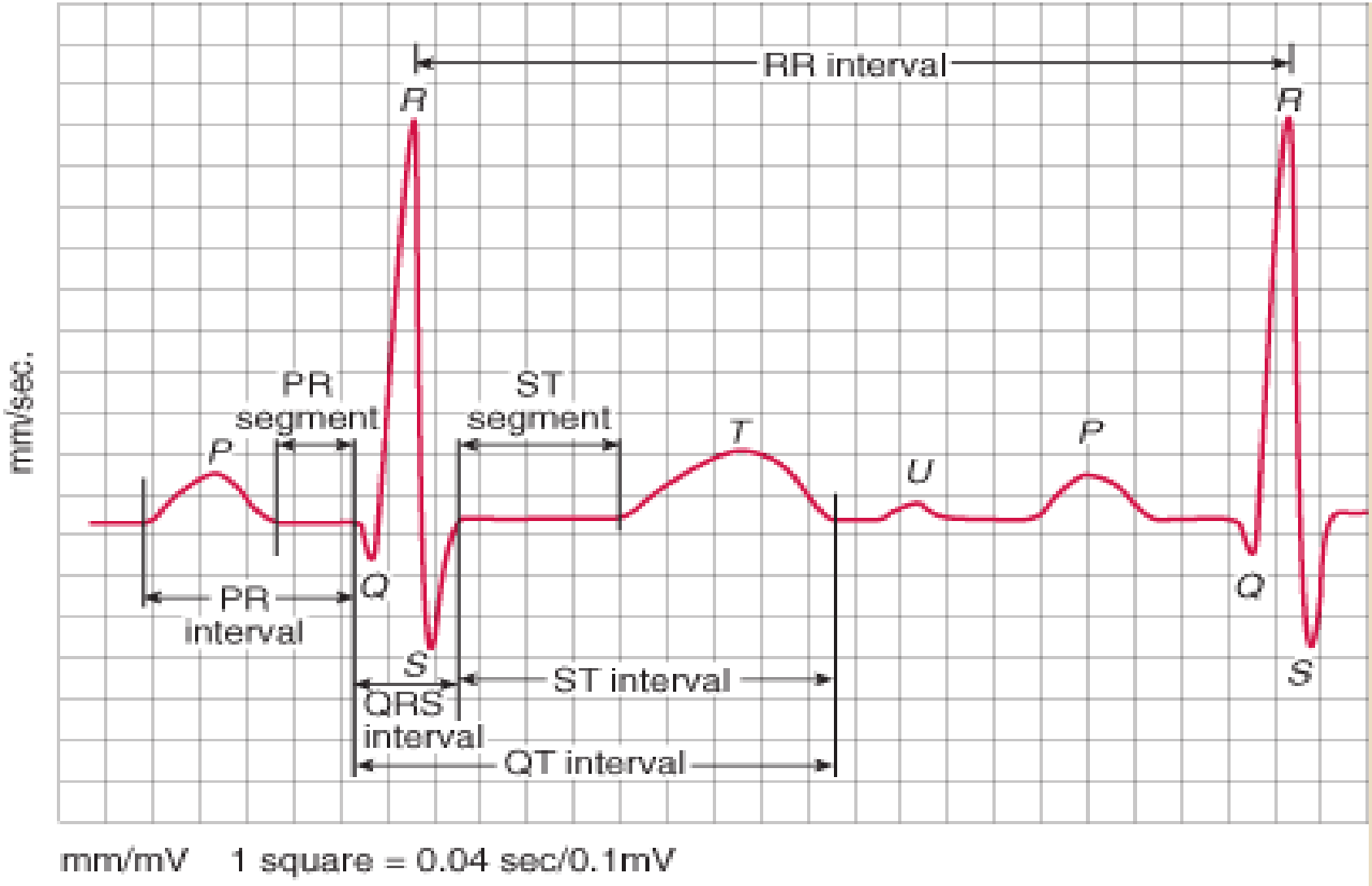




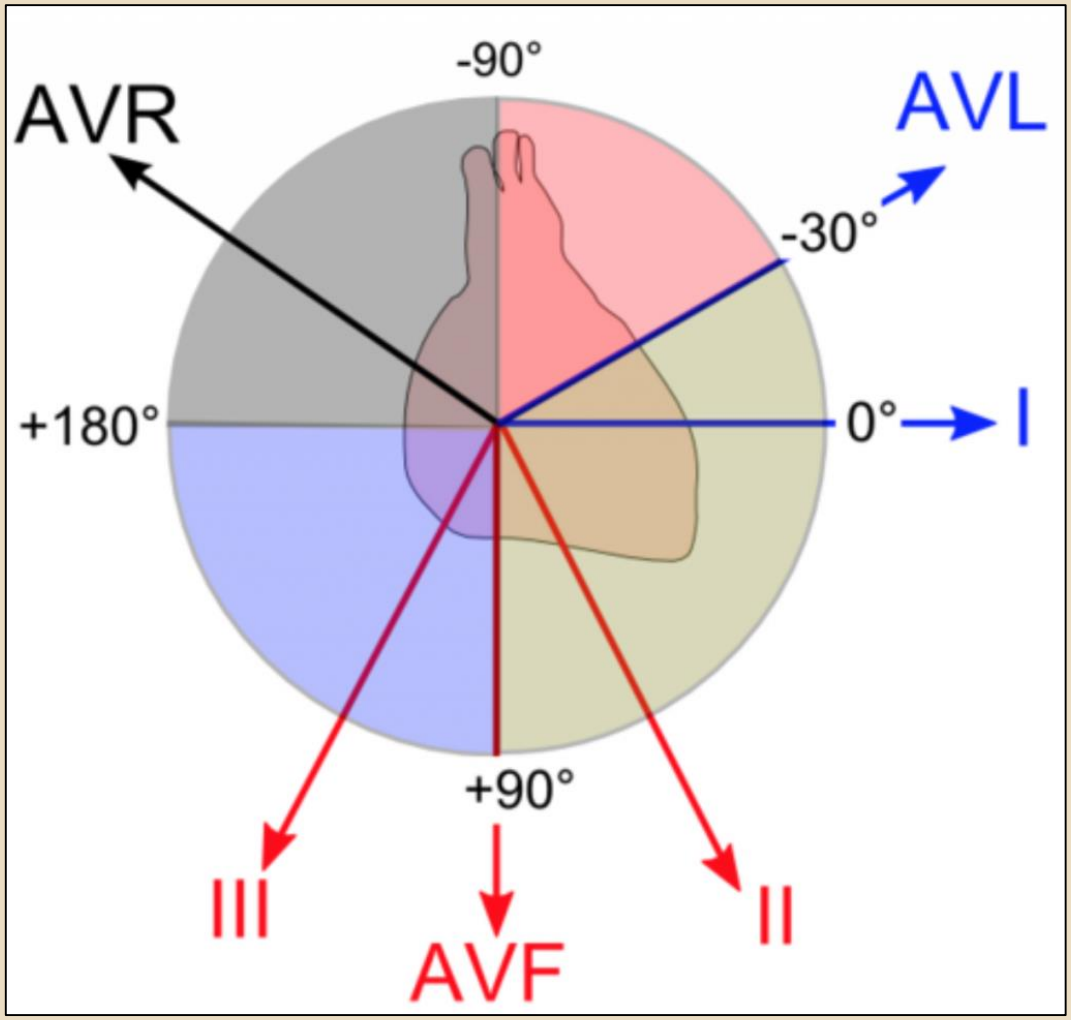
ECG- precordial leads

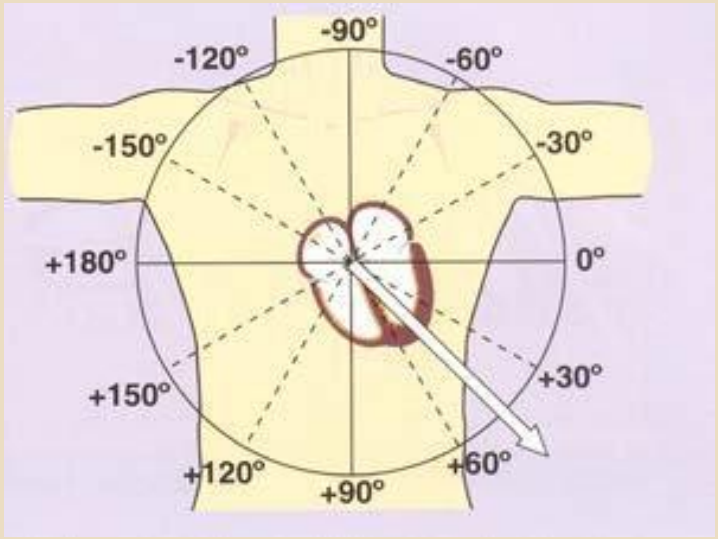


ECG – intervals (PQ < 0.2s, QRS < 0.1s, QTc < 0.44s)

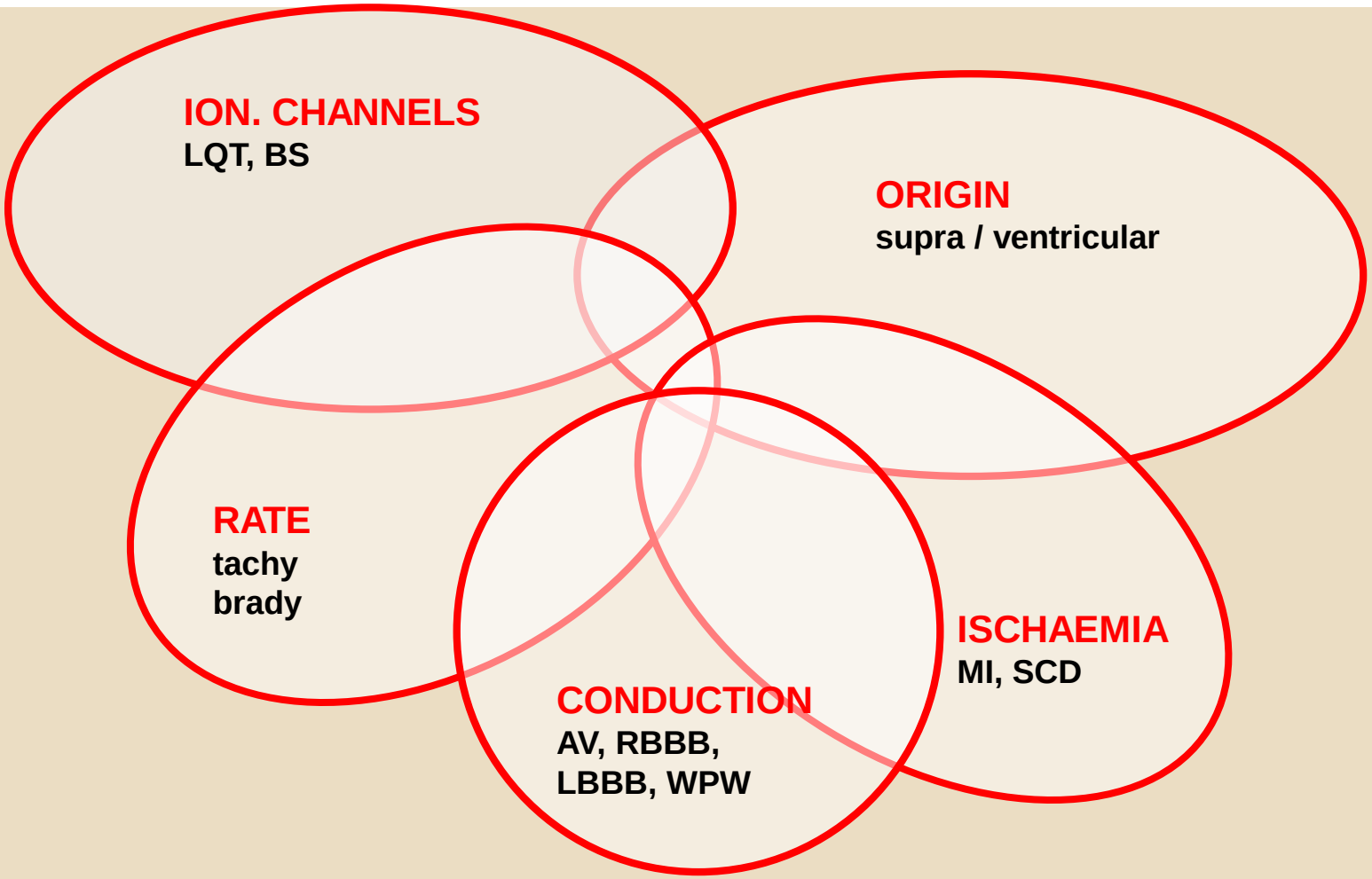


Electrical axis of the heart





ECG disorders



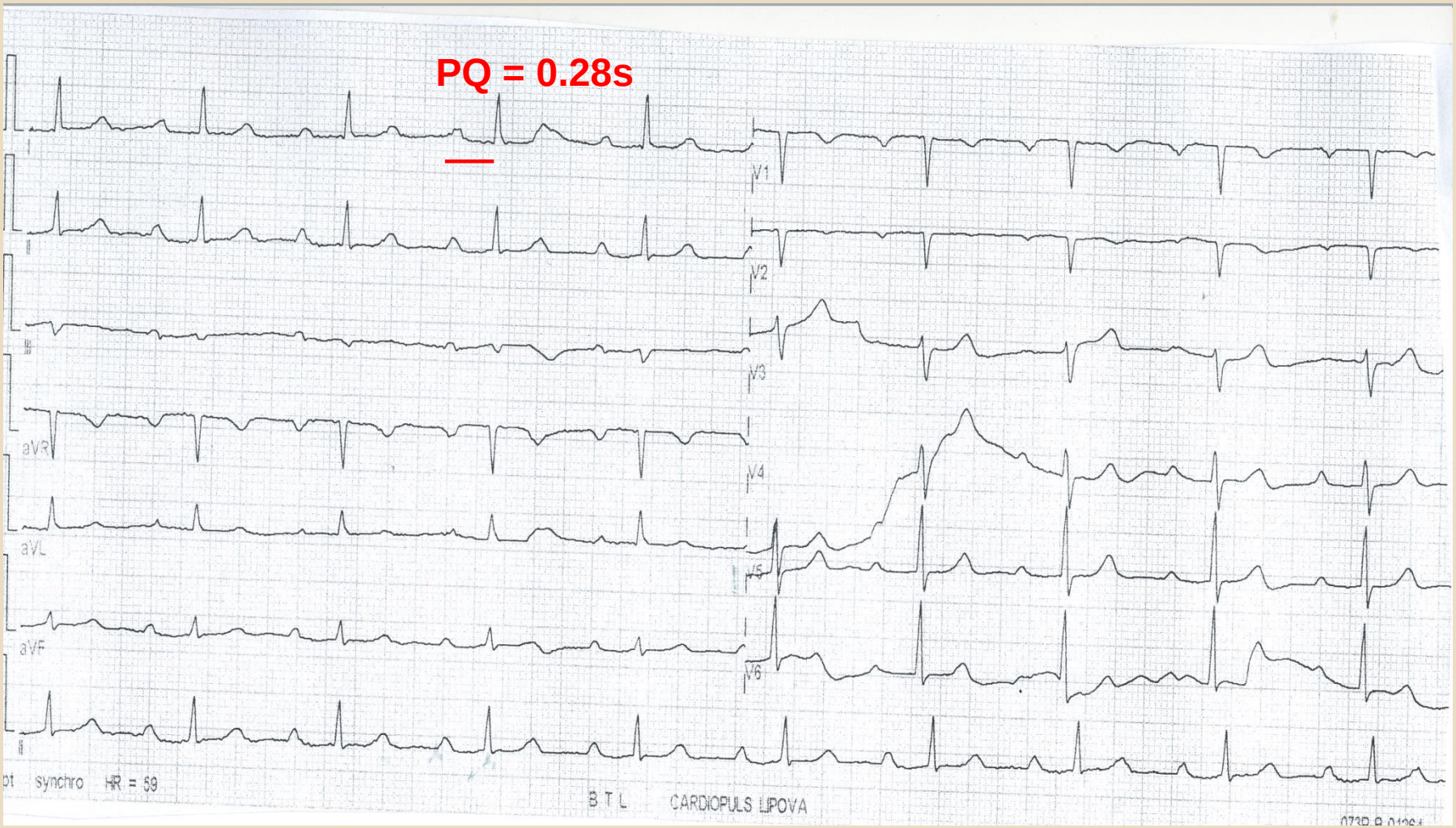
Conduction disorders

AVB (I.st, II.nd, III.rd)

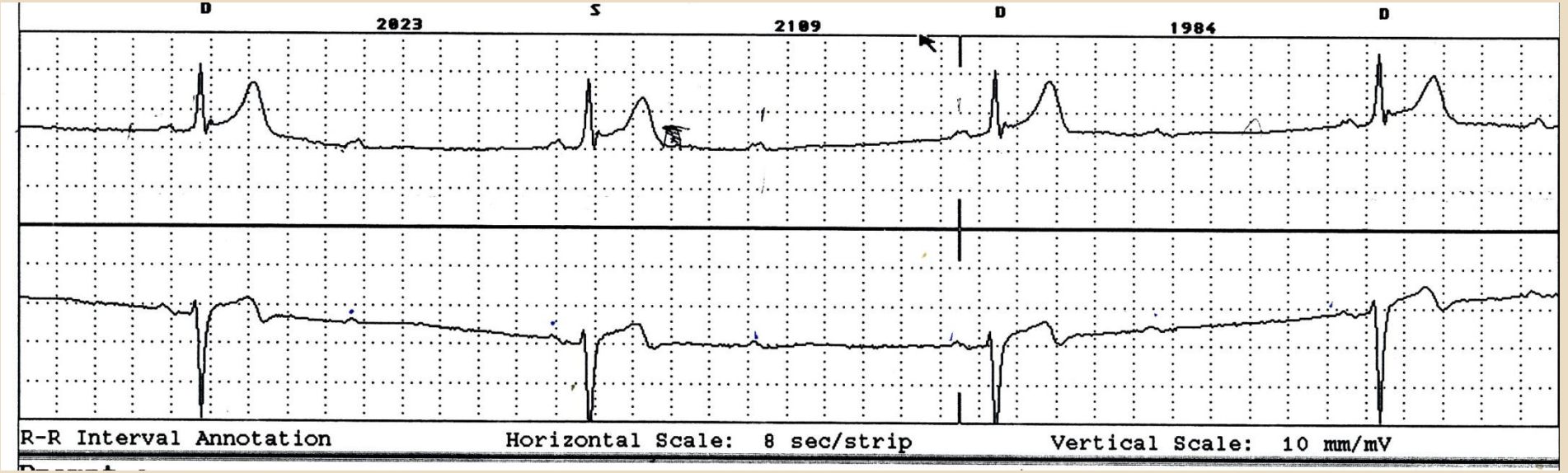
RBBB

LBBB

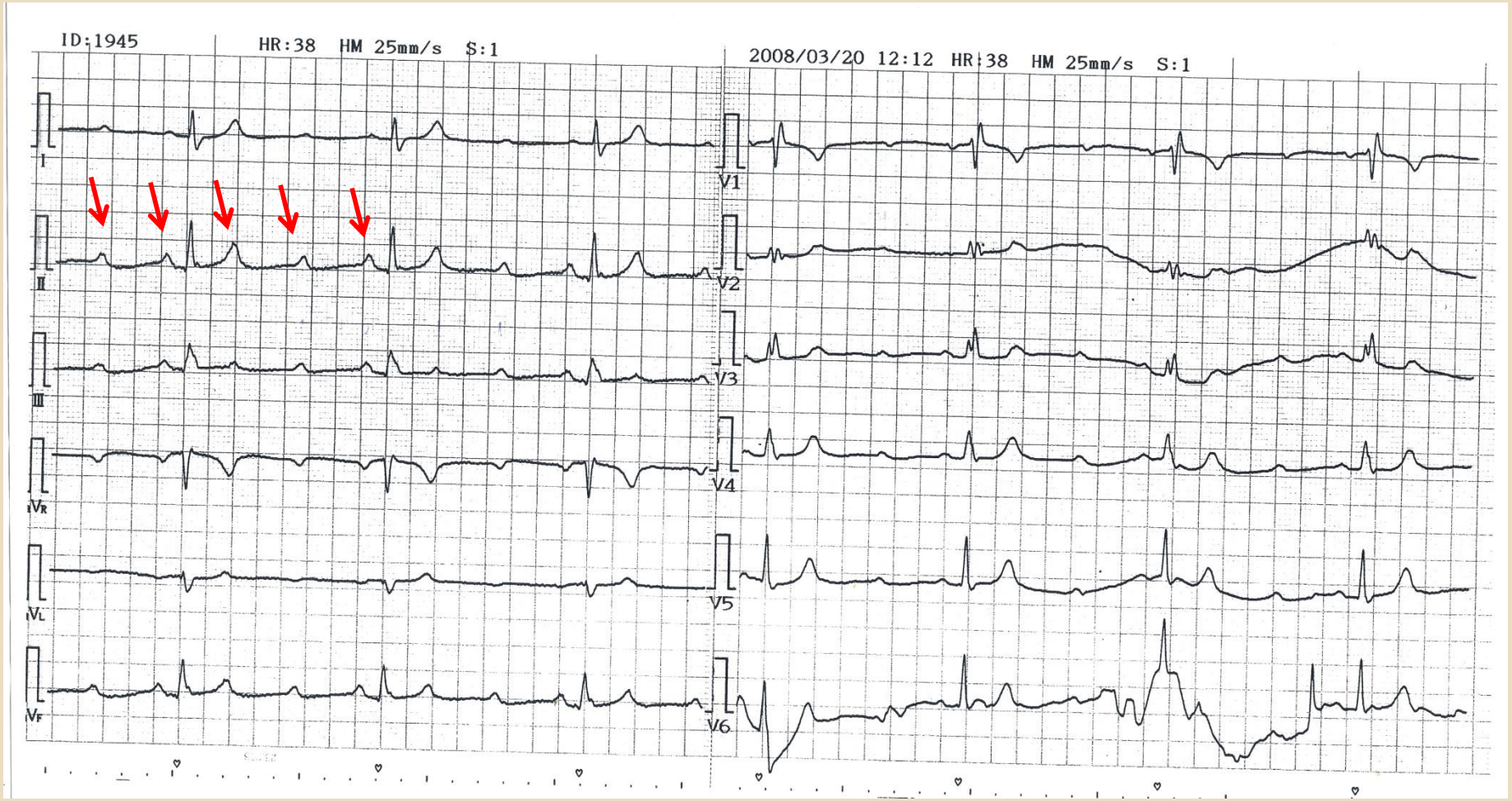
AVB I.st degree (PQ > 0,2s)



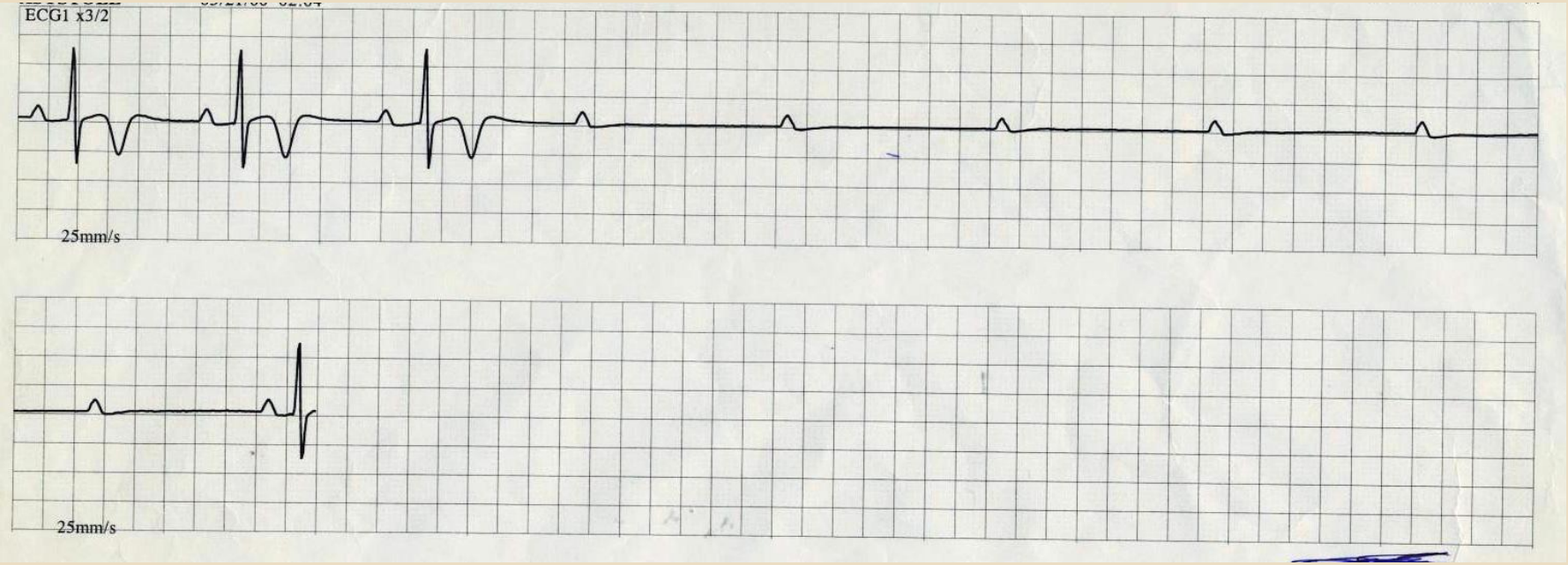
AVB II.nd degree (2/1)



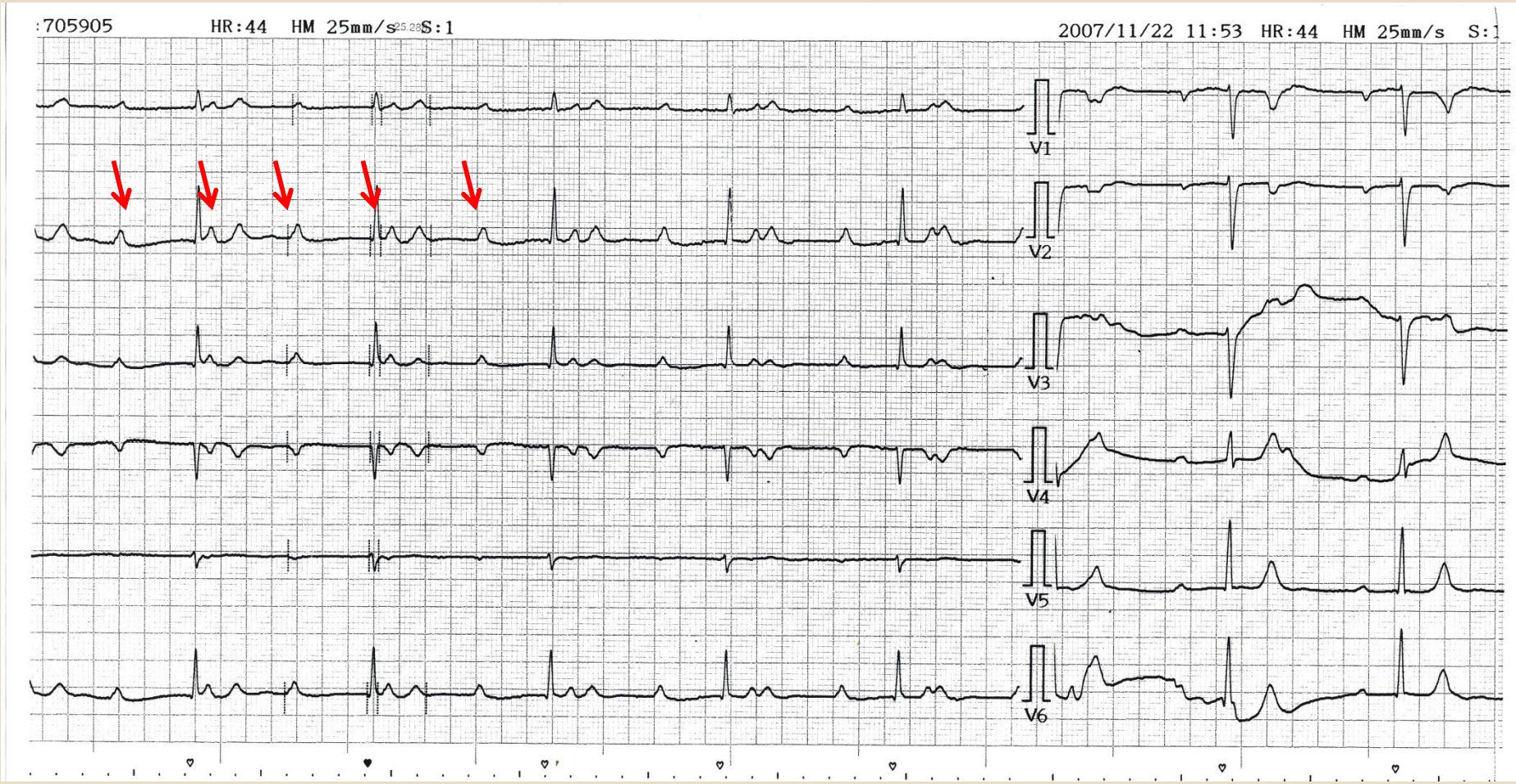
AVB II.nd degree (Mobitz 3/1)



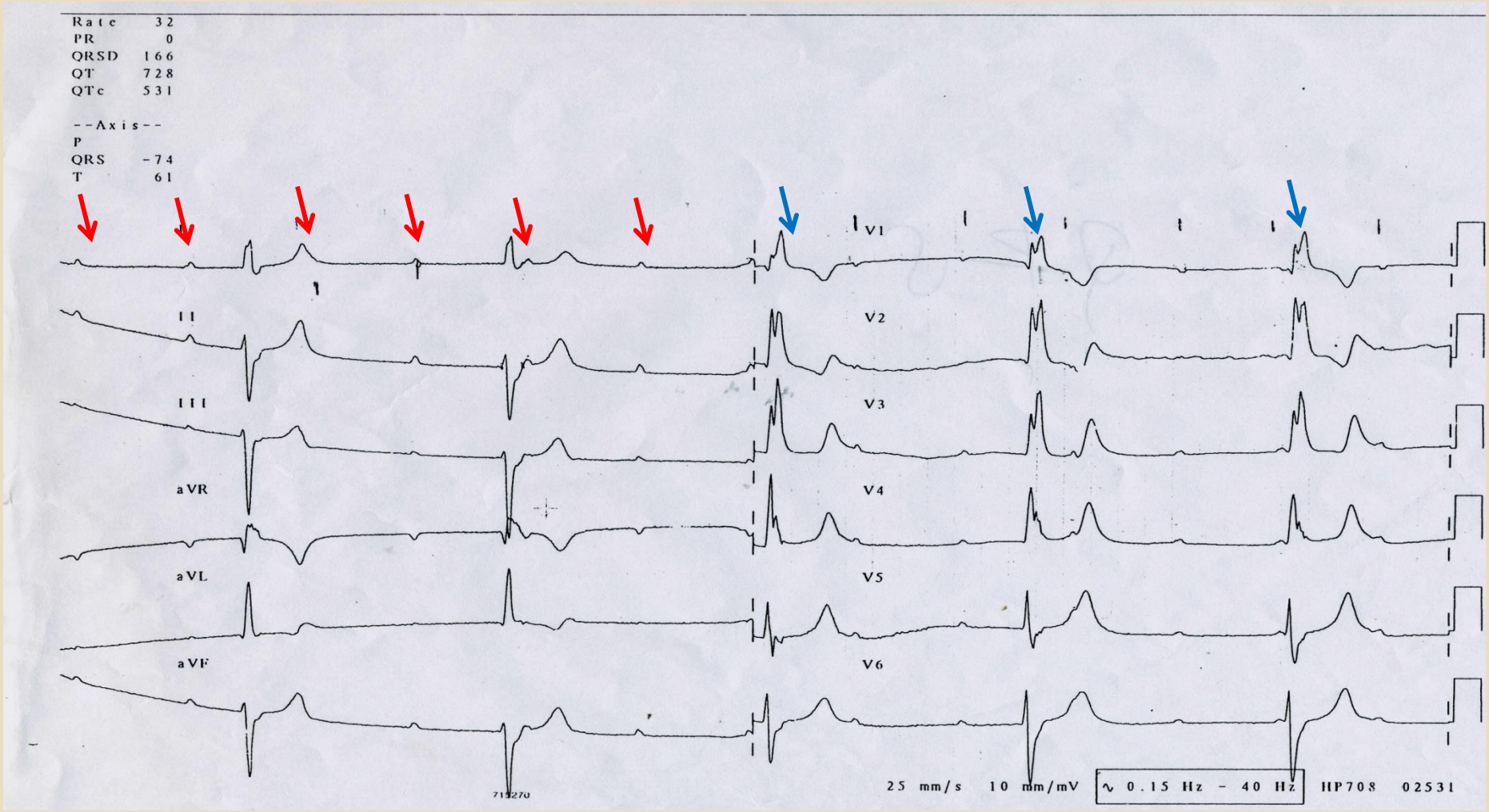
AVB III.rd degree (no secondary, tertiary autom. centre)



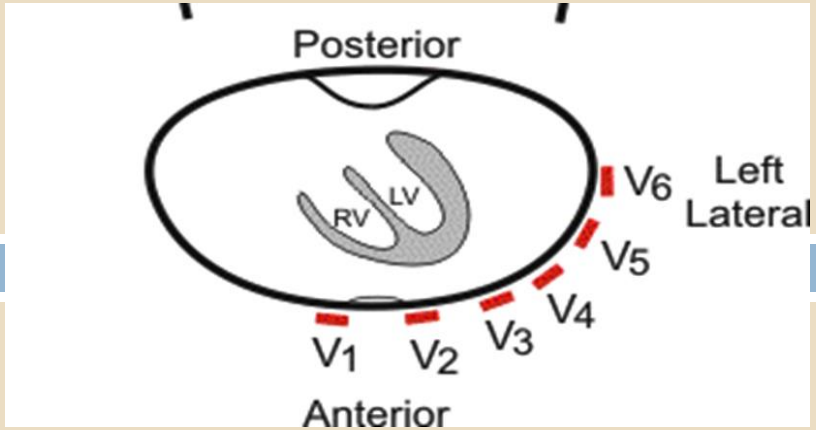
AVB III.rd degree (escape rhythm from AV junction)

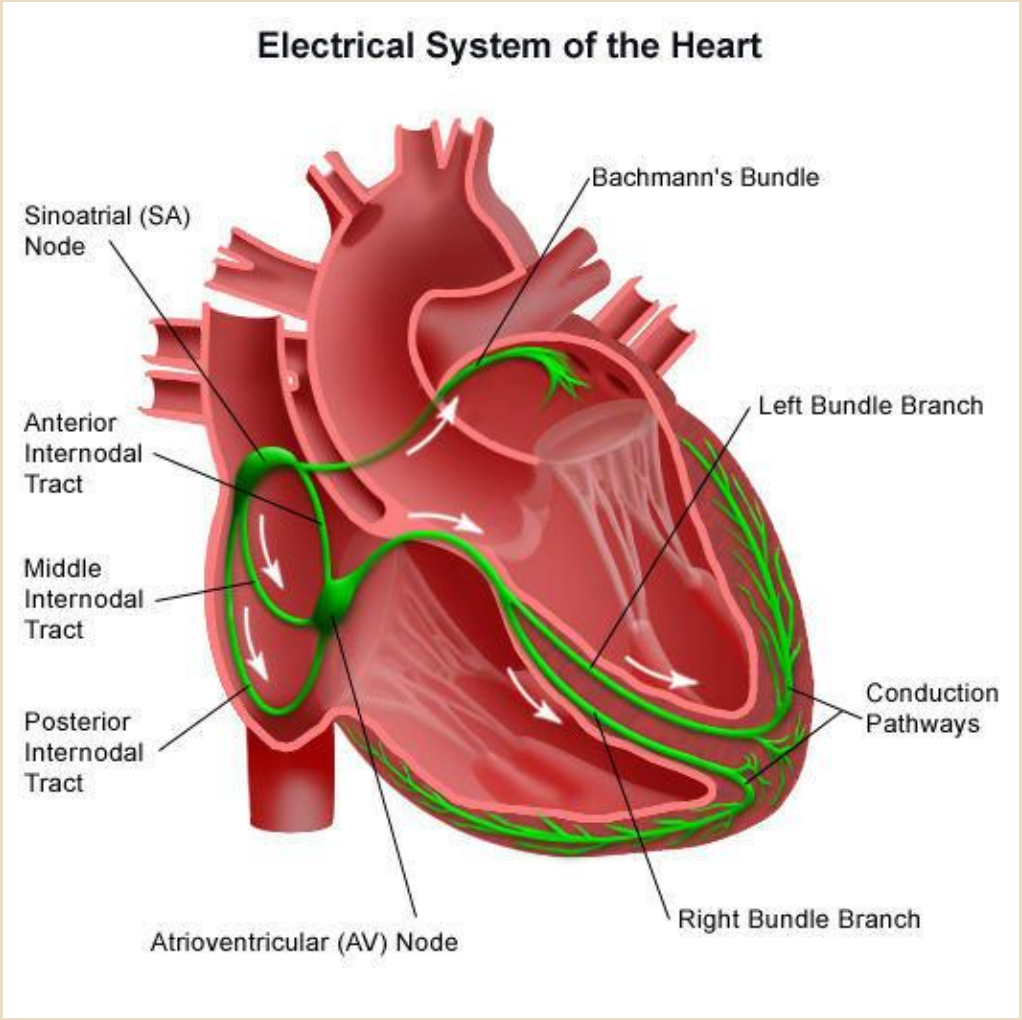


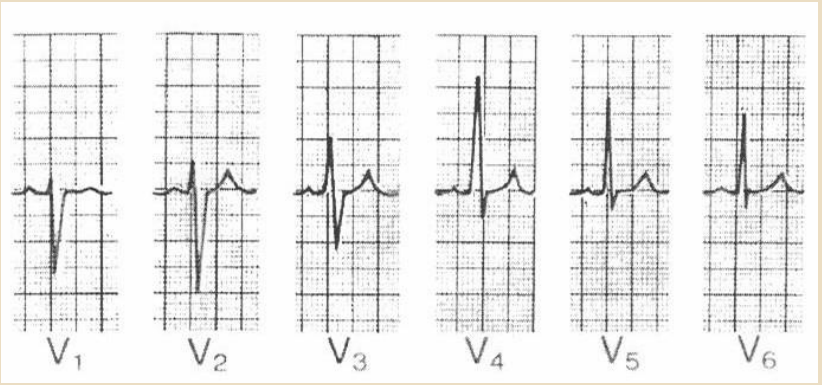
AVB III.rd degree (escape ventricular rhythm)

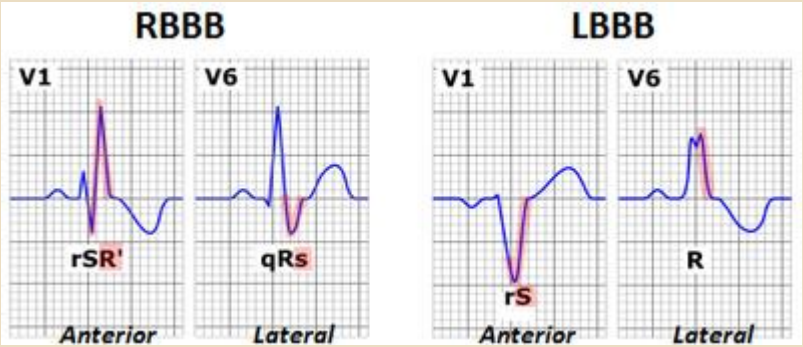


Bundle branch block

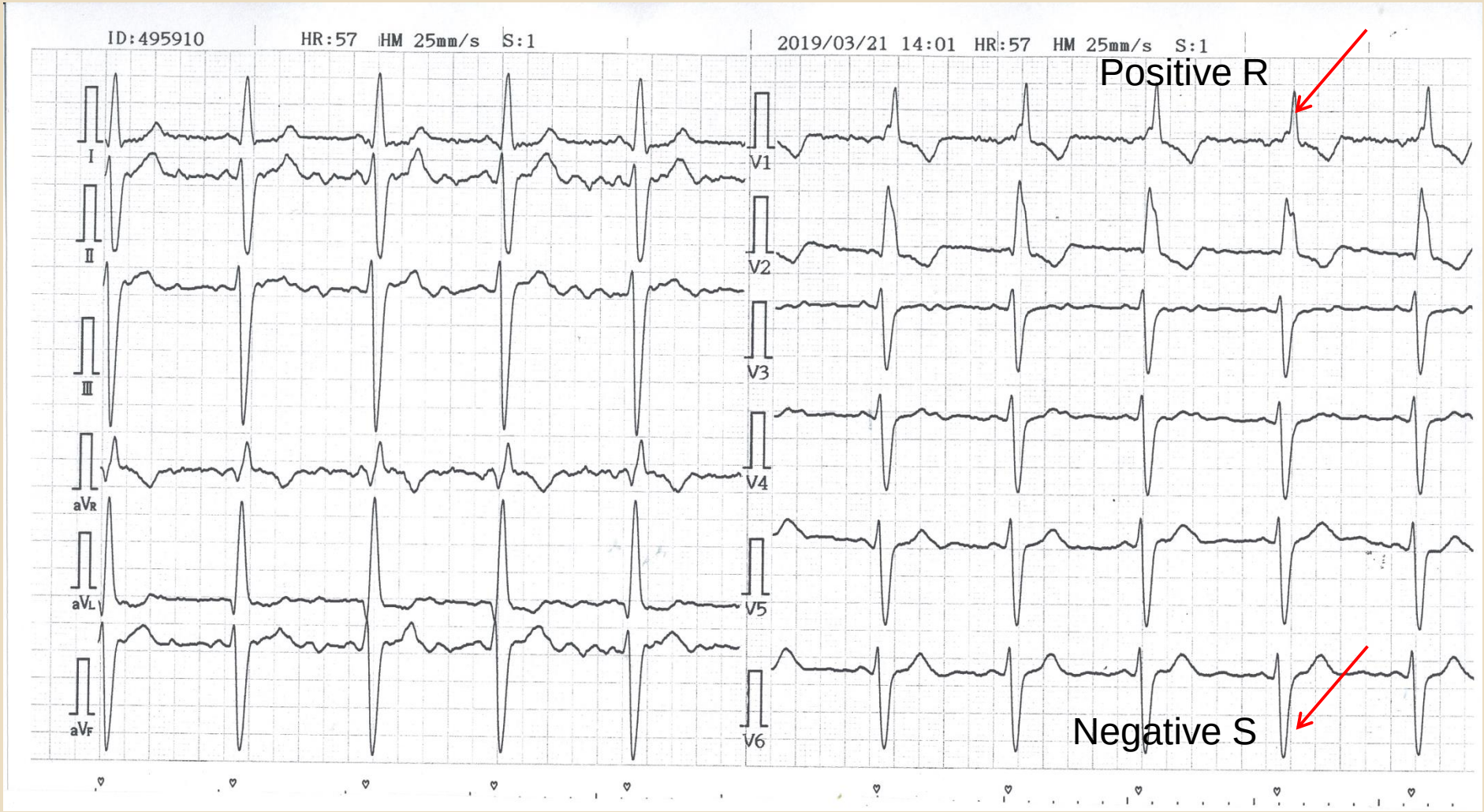




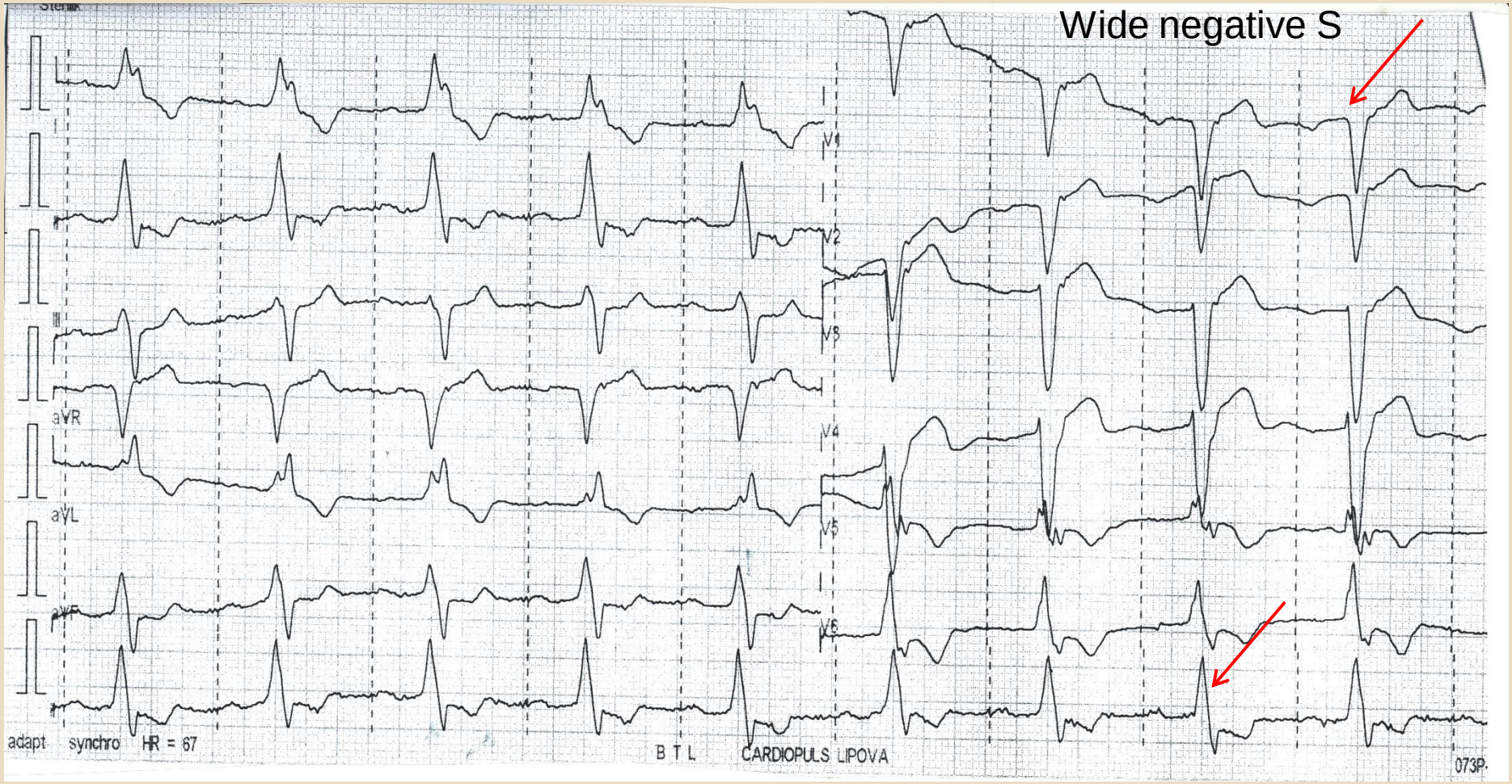




Right bundle branch block - RBBB



Left bundle branch block - LBBB



Wide positive R

Supraventricular arrhythmias

Premature atrial contraction

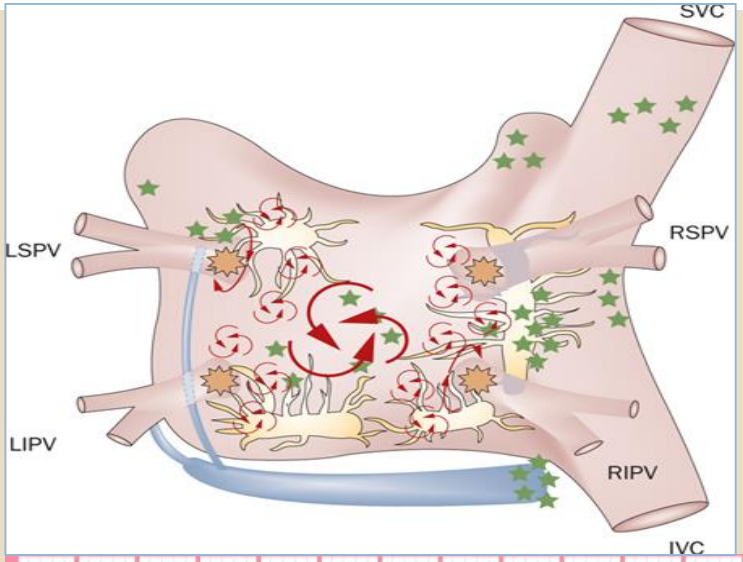
Atrial fibrillation

Atrial flutter

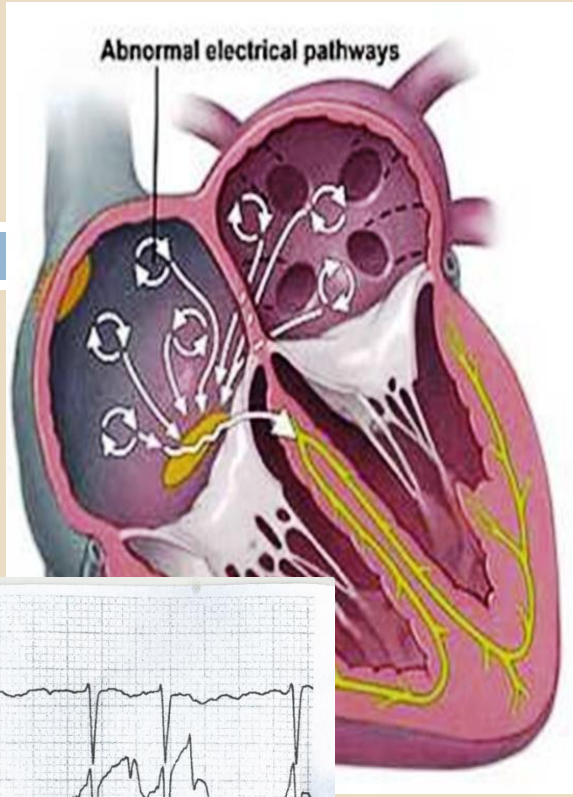
AVNRT

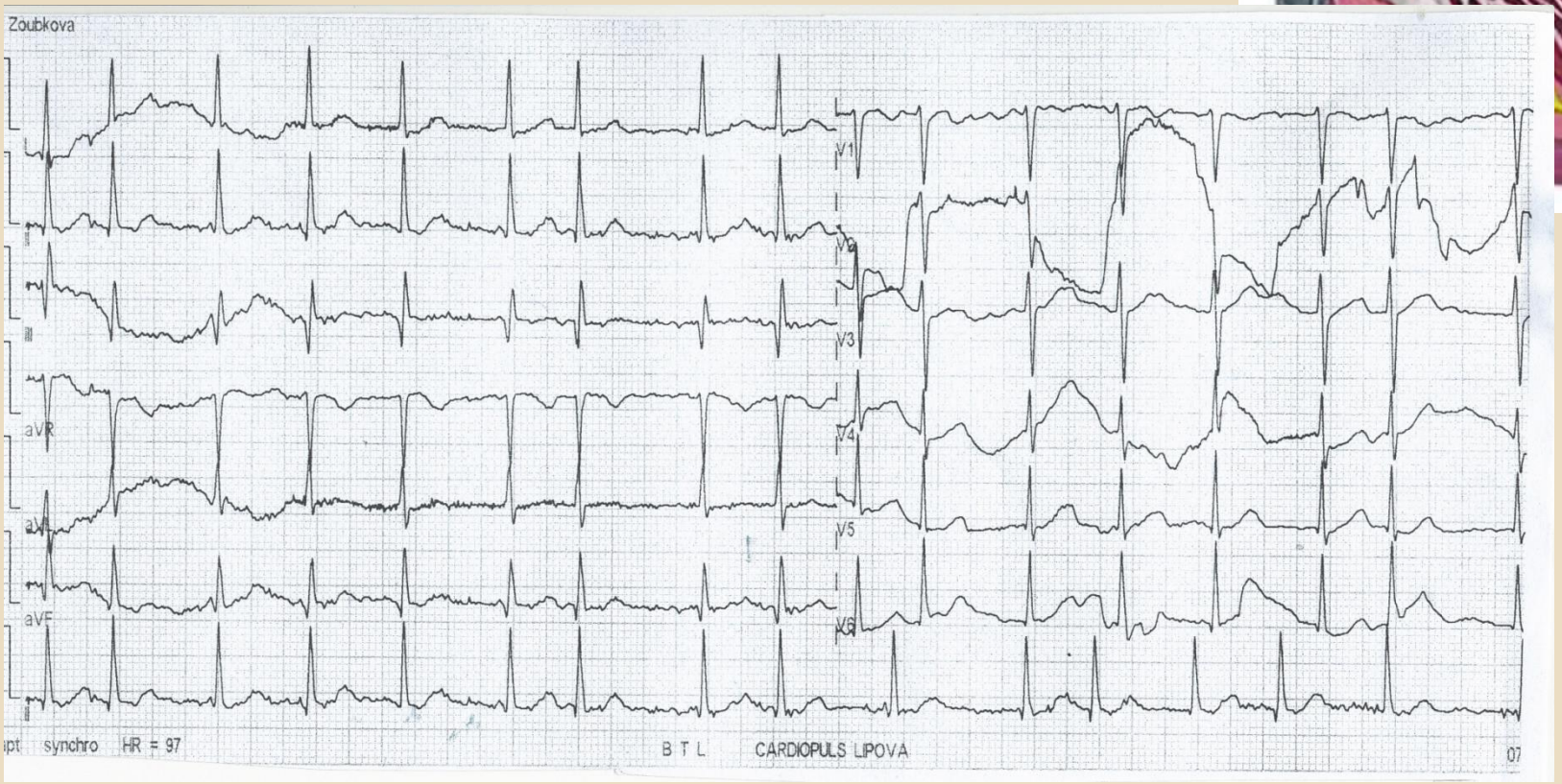
AVRT (WPW)

Premature atrial contraction (PAC)

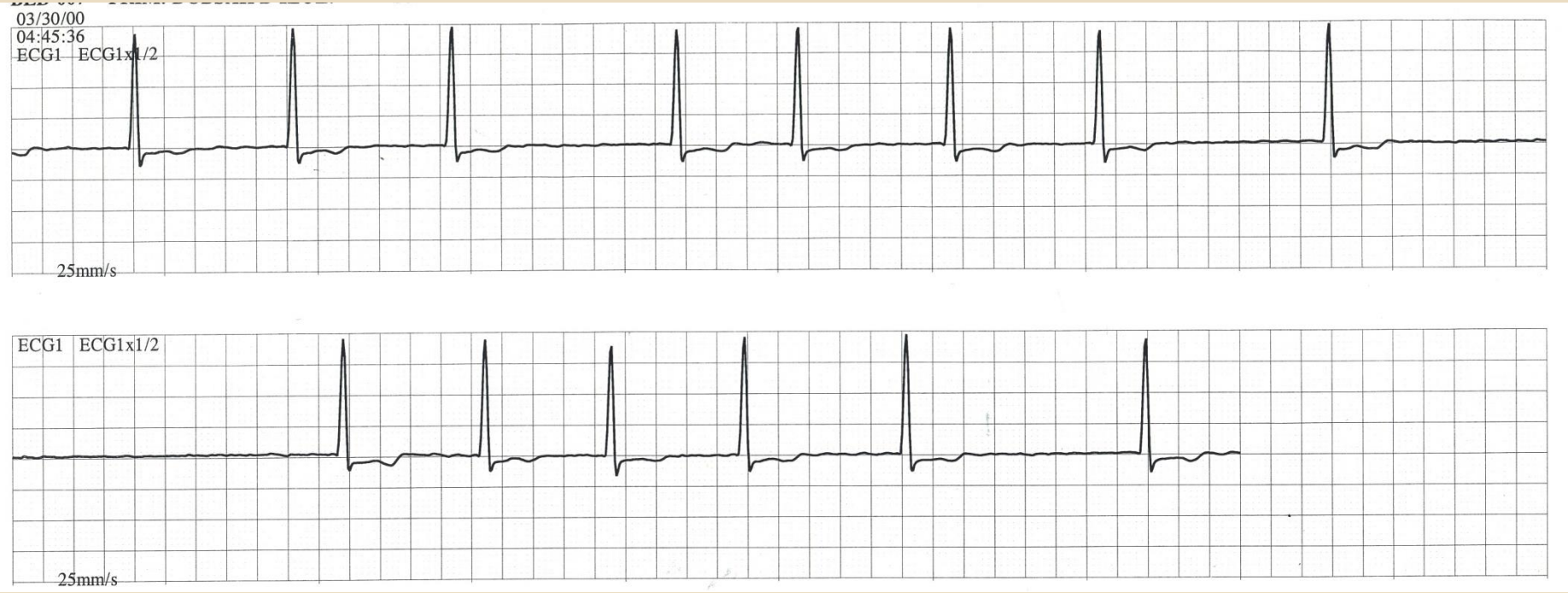


Atrial fibrillation (AF)

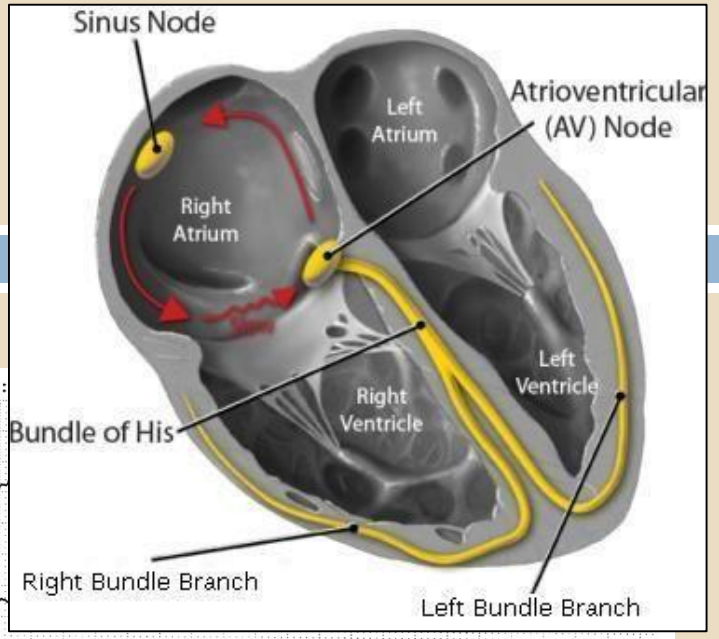




Atrial fibrillation + slow ventricular response

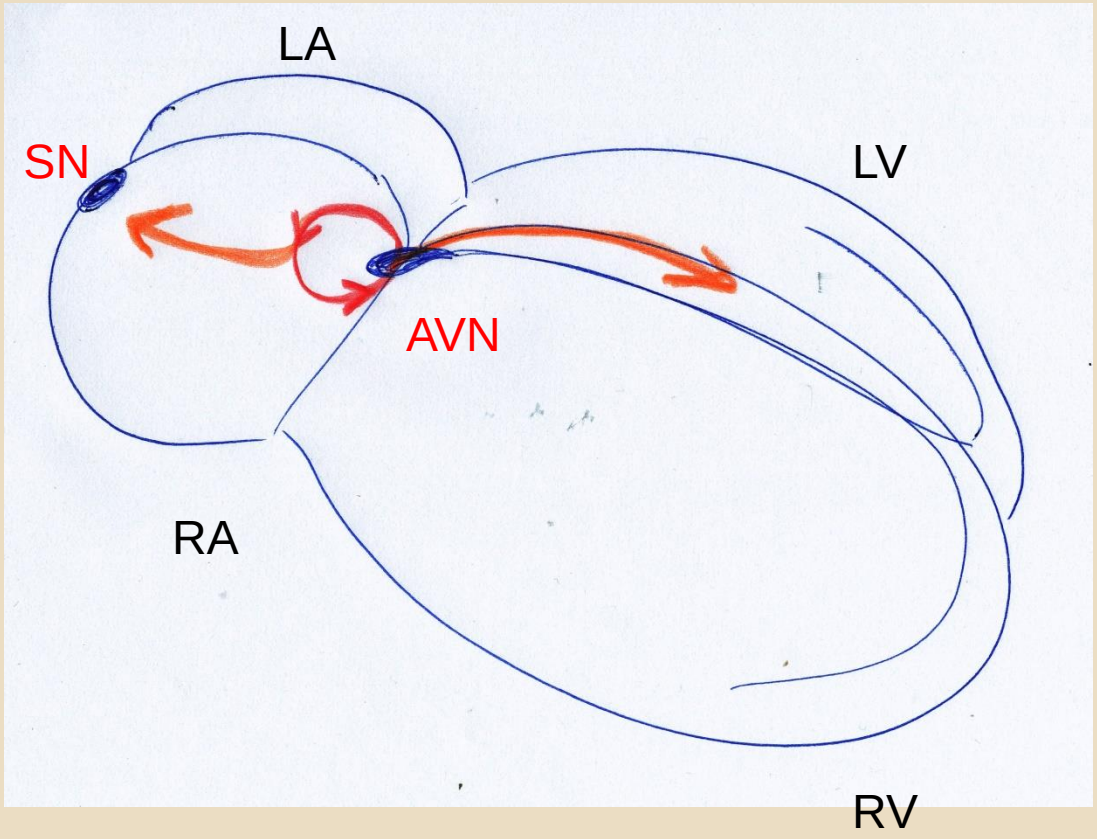


Atrial flutter

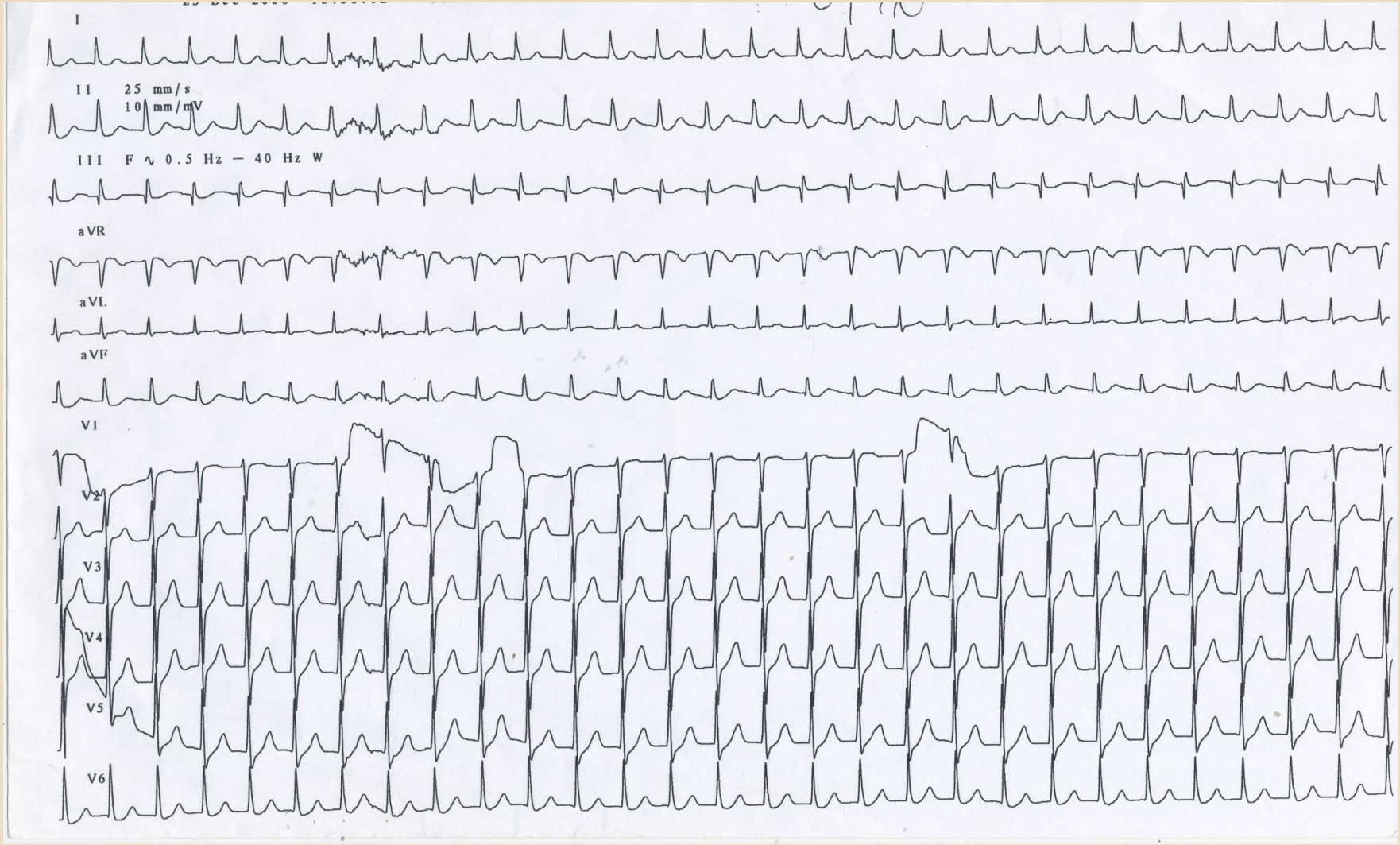


saw tooth pattern II, III, aVF

AVNRT (Atrio Ventricular Nodal Reentry Tachycardia)

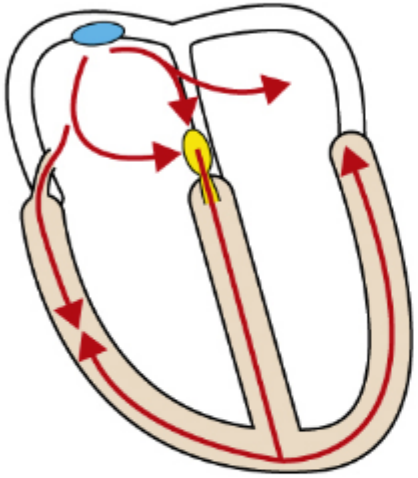


AVNRT (Atrio Ventricular Nodal Reentry Tachycardia)



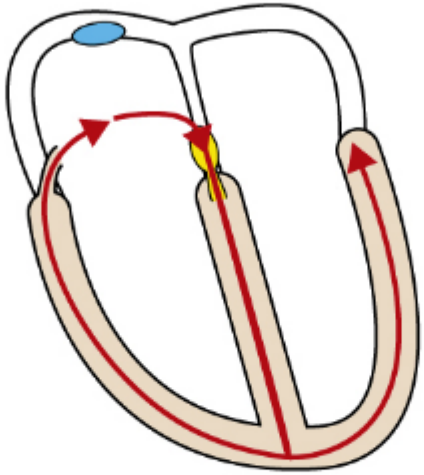
Accessory pathway

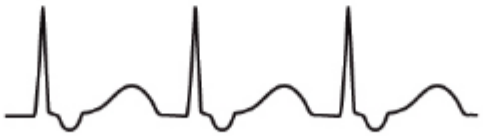
Pre-excitation



- Short PR interval
- In this case the PR segment cannot be seen.

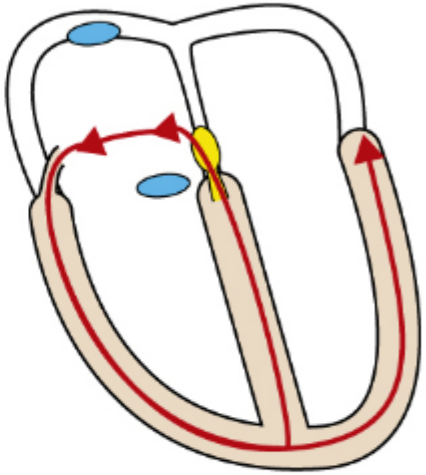
Orthodromic AVRT
Antegrade conduction through atrioventricular node





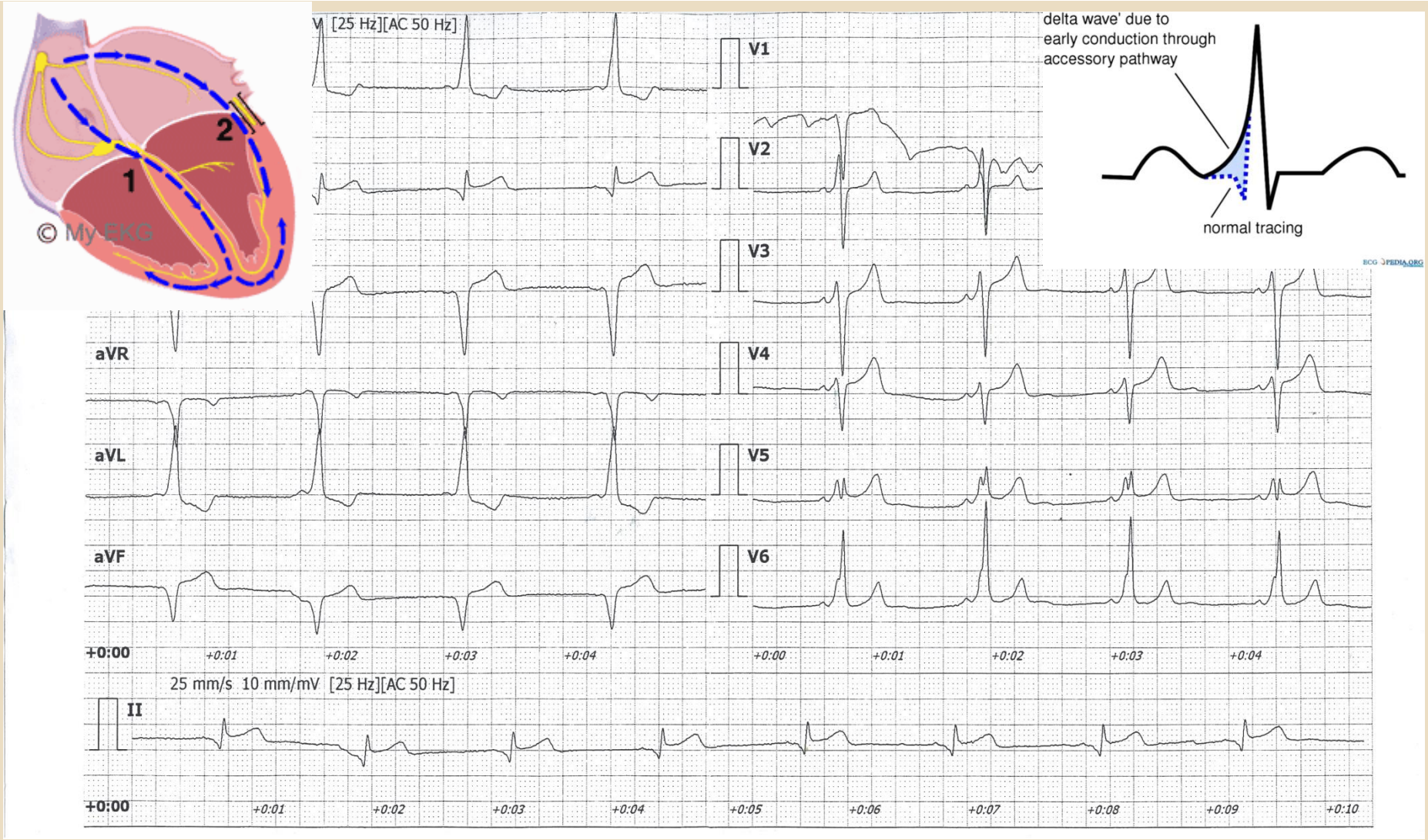
- Normal QRS duration
- No delta wave
- Retrograde P-wave after QRS

Antidromic AVRT
Retrograde conduction through atrioventricular node

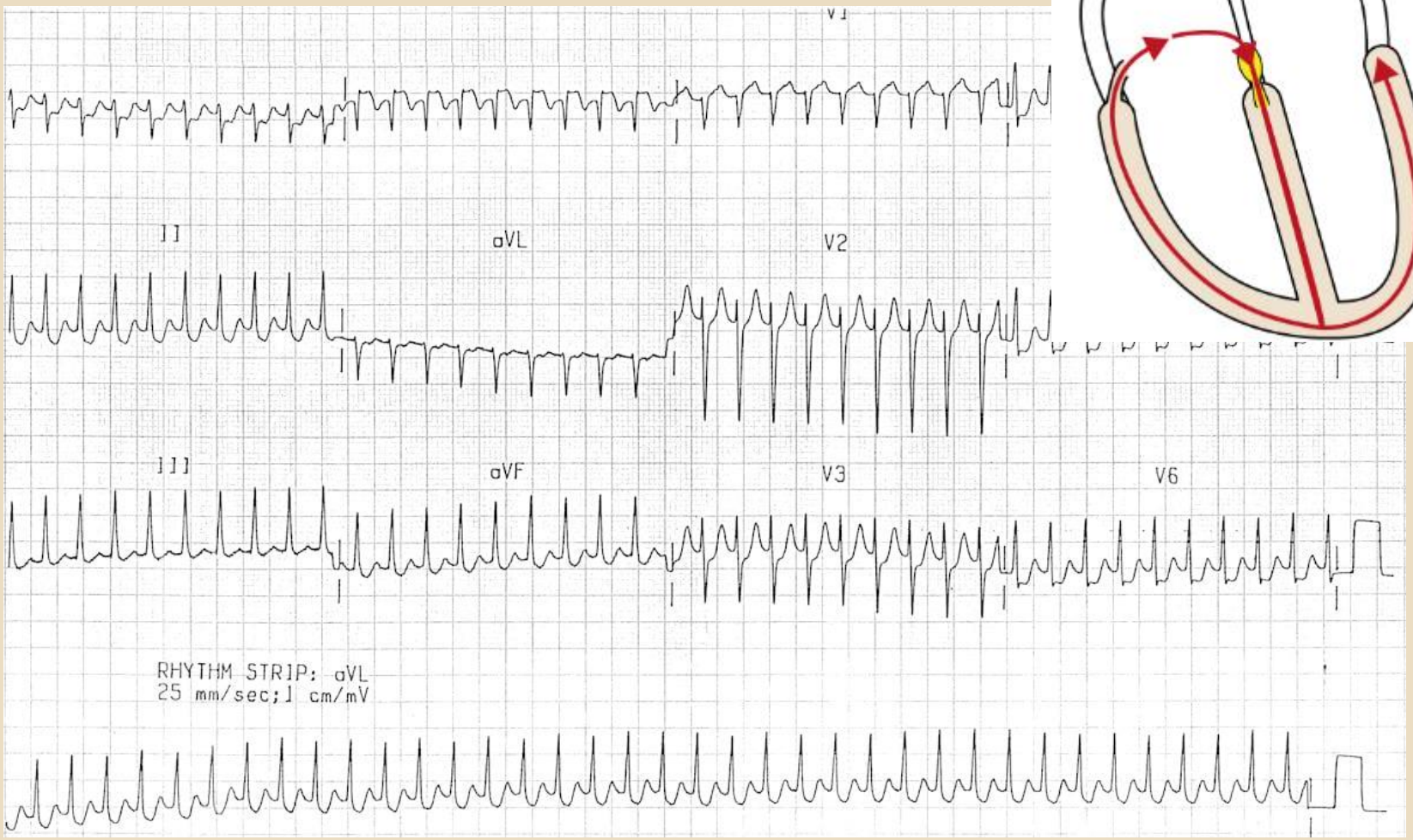


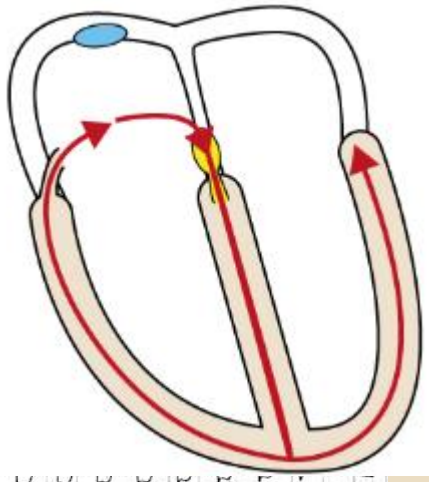
- Wide QRS complex with delta wave
- P-wave rarely seen
- If P-wave visible, it is retrograde and occurs just before the QRS

Preexcitation – delta wave

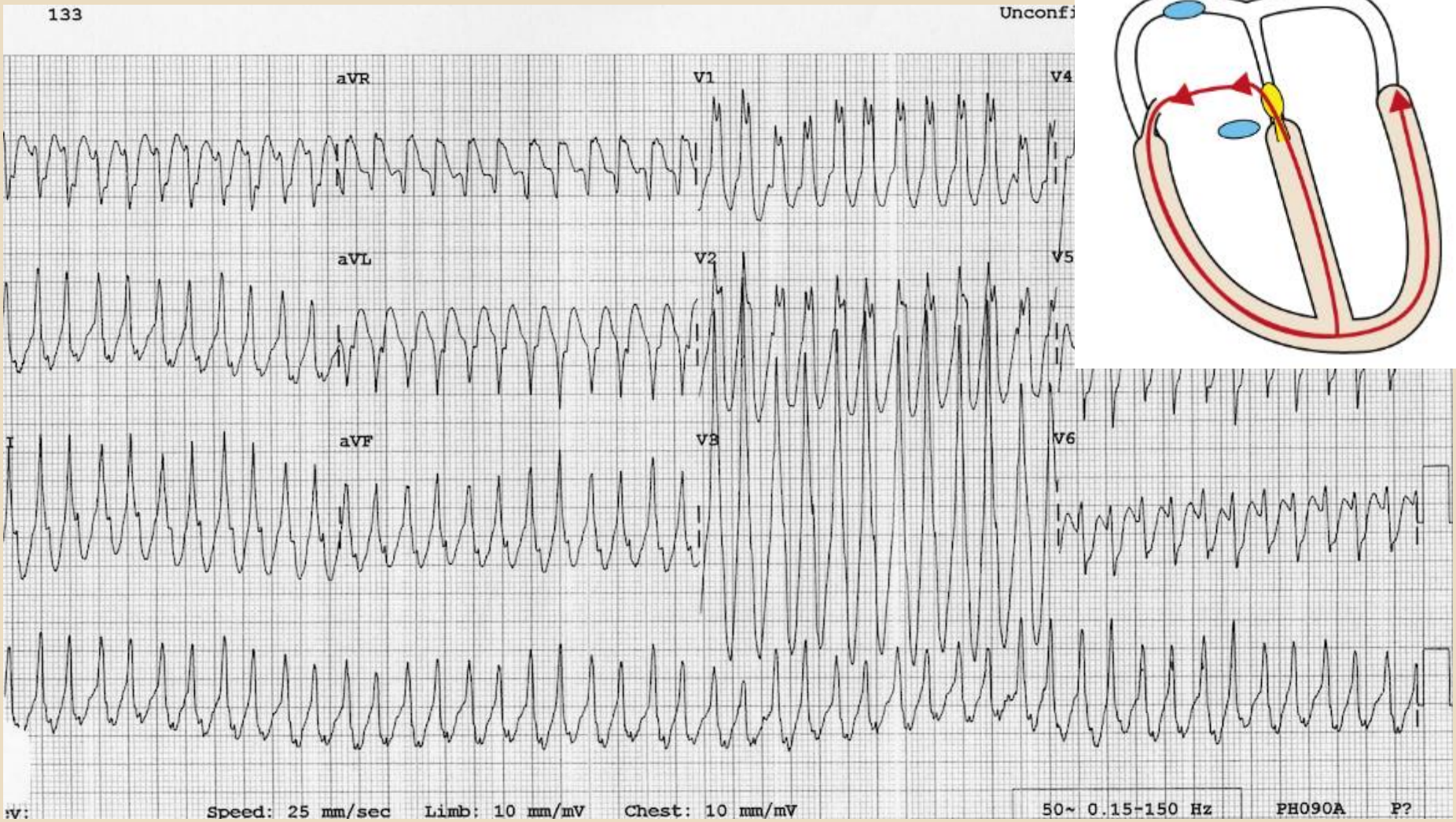


AVRT (Atrio Ventricular Reentry Tachycardia) ORTHO

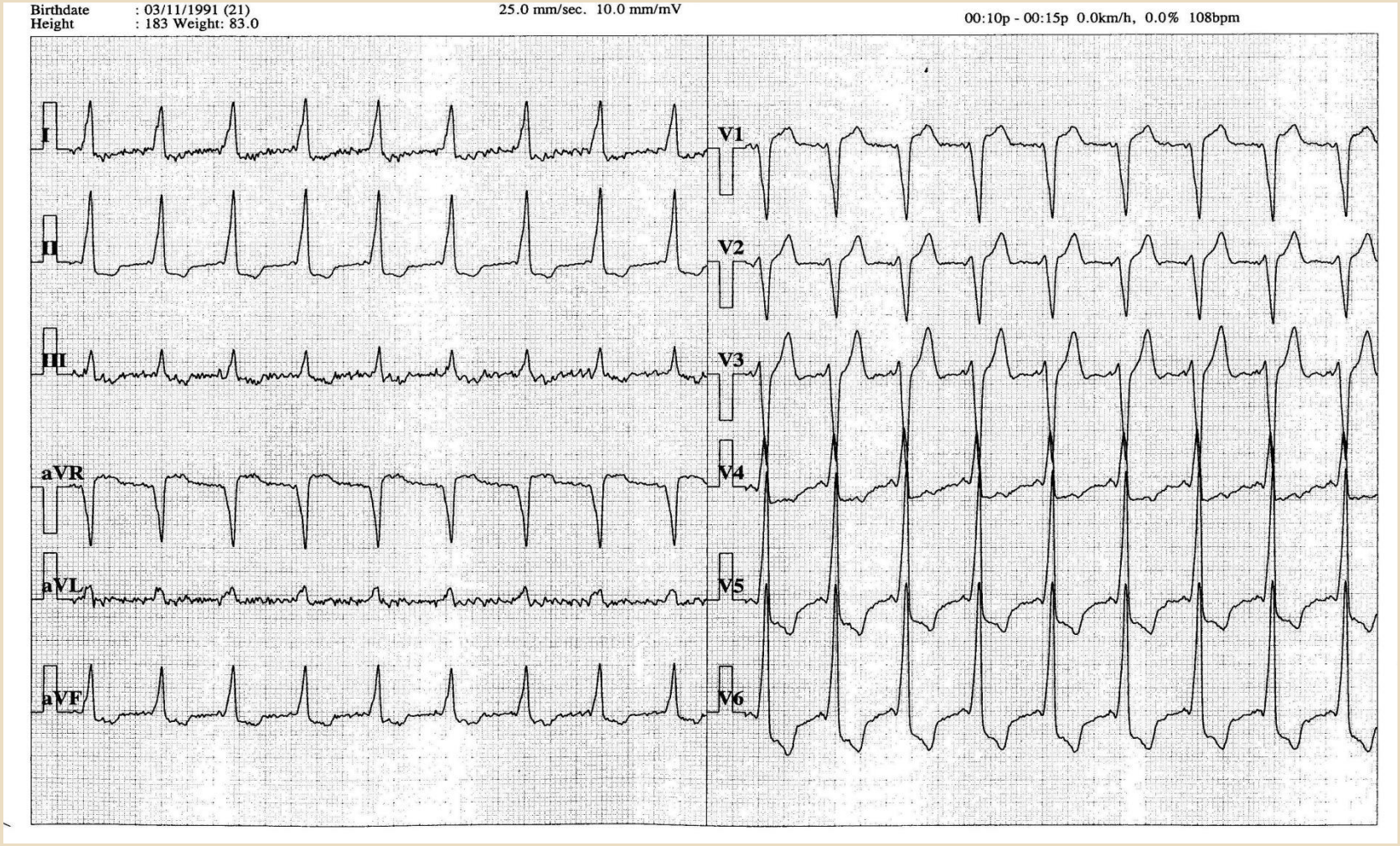




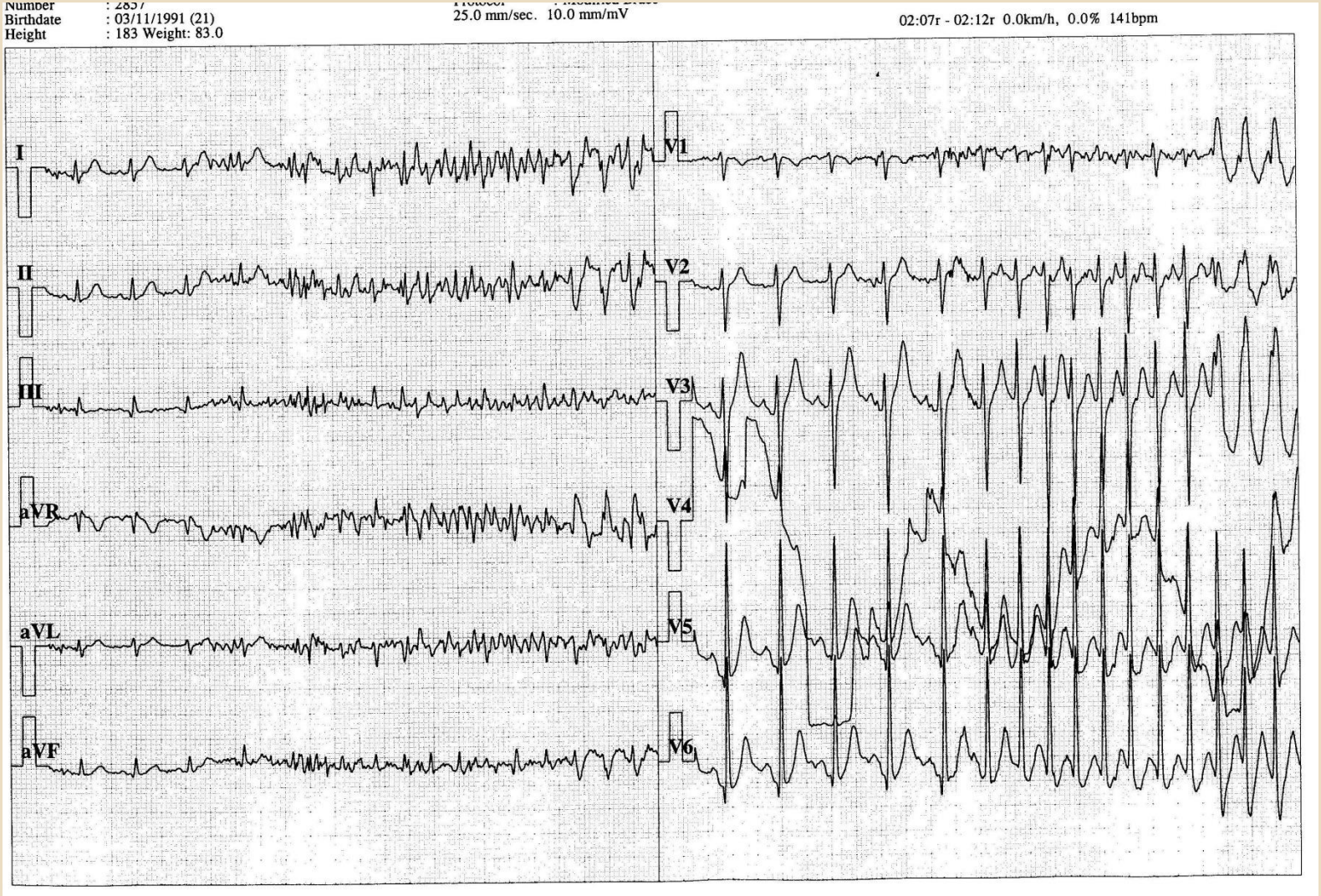
AVRT (Atrio Ventricular Reentry Tachycardia) ANTI



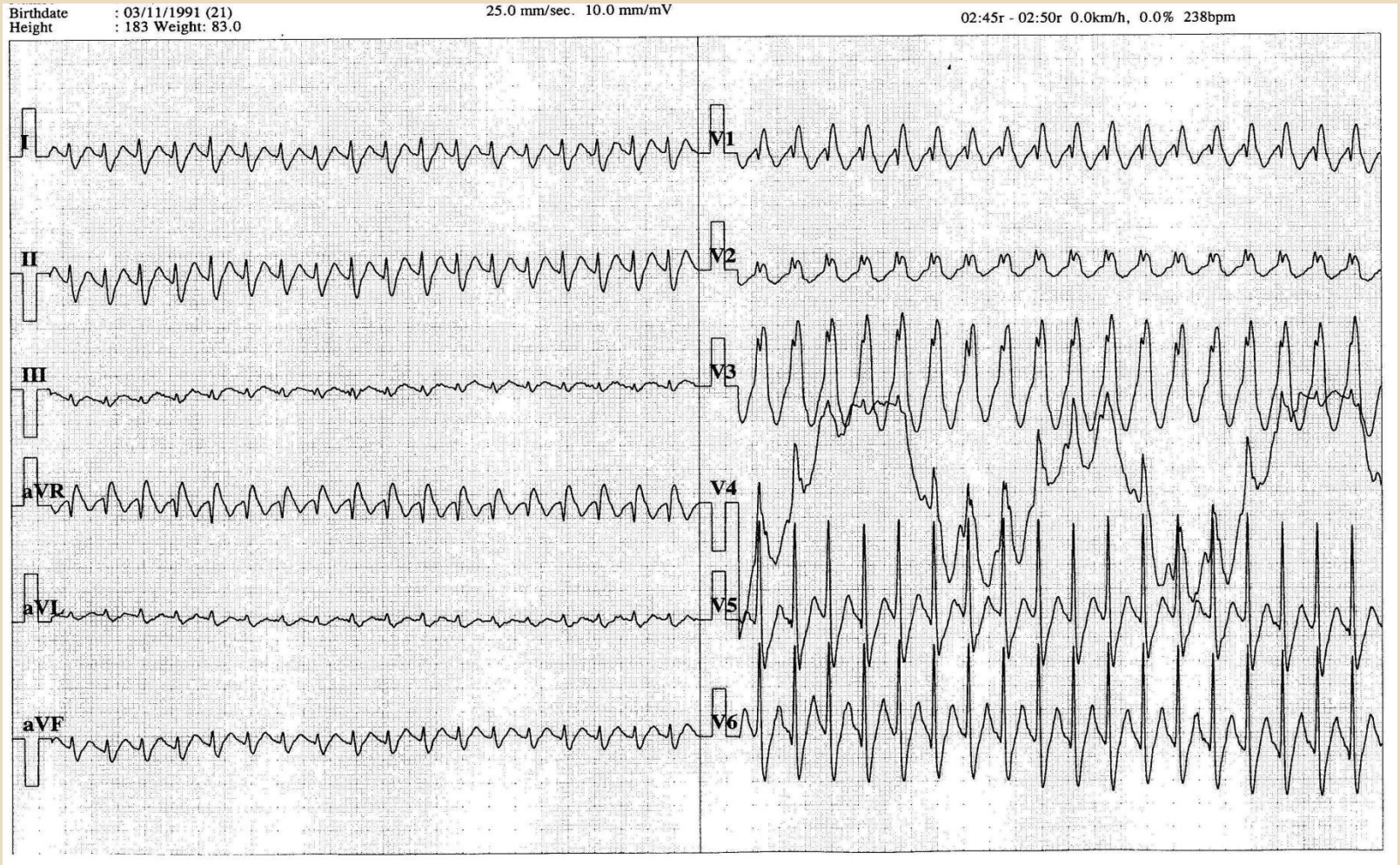
Delta wave prior to treadmill test



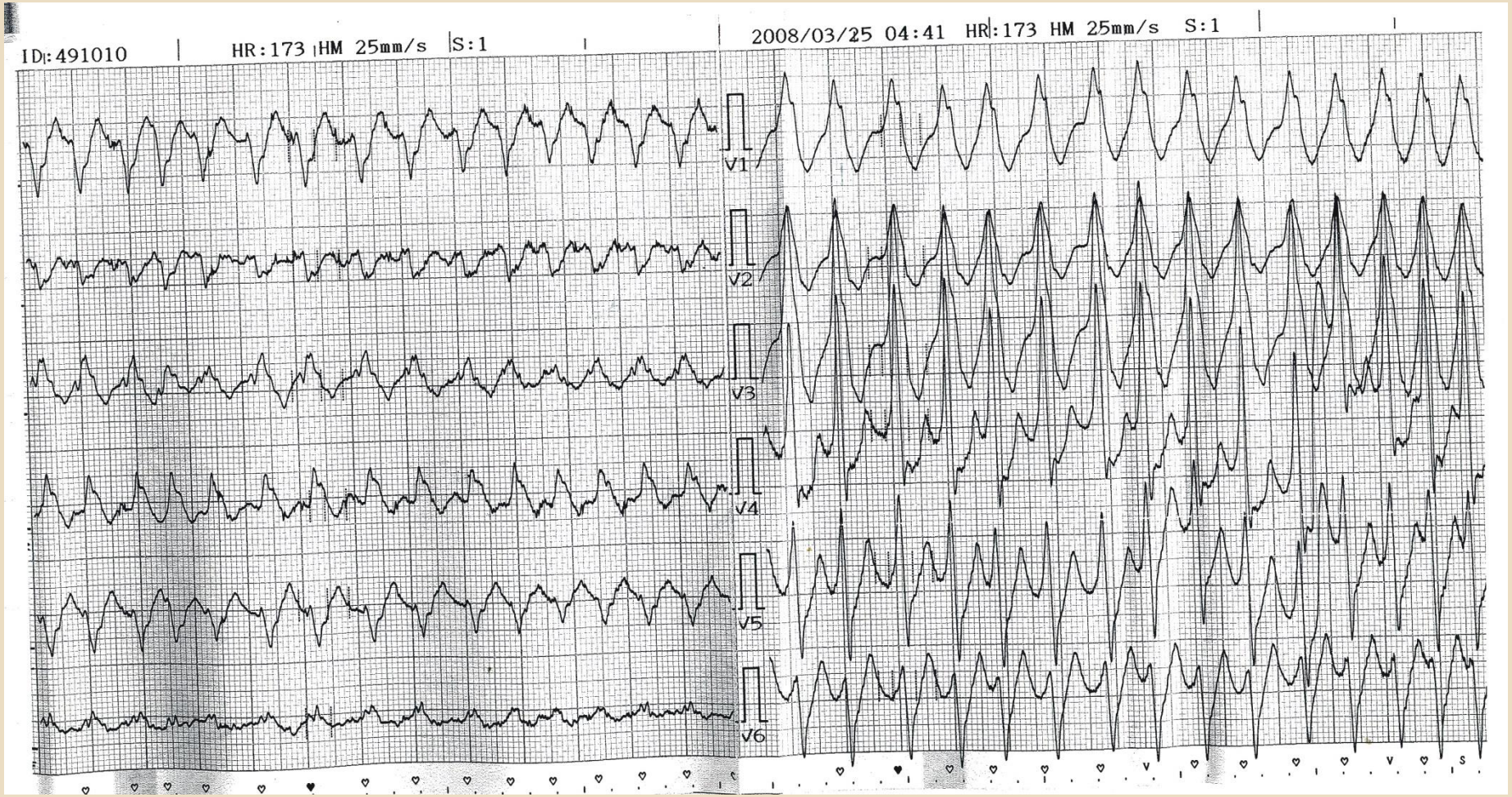
Orthodromic tachycardia (AVRT) with RBBB



Orthodromic tachycardia (AVRT) with RBBB



Atrial fibrillation + accessory pathway



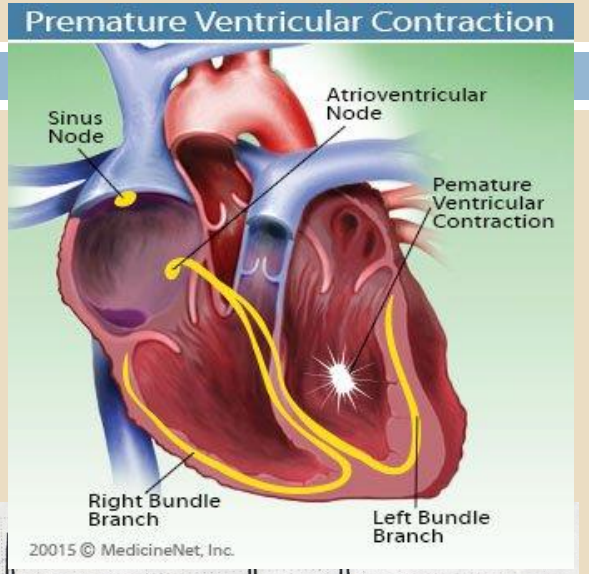
Ventricular arrhythmias

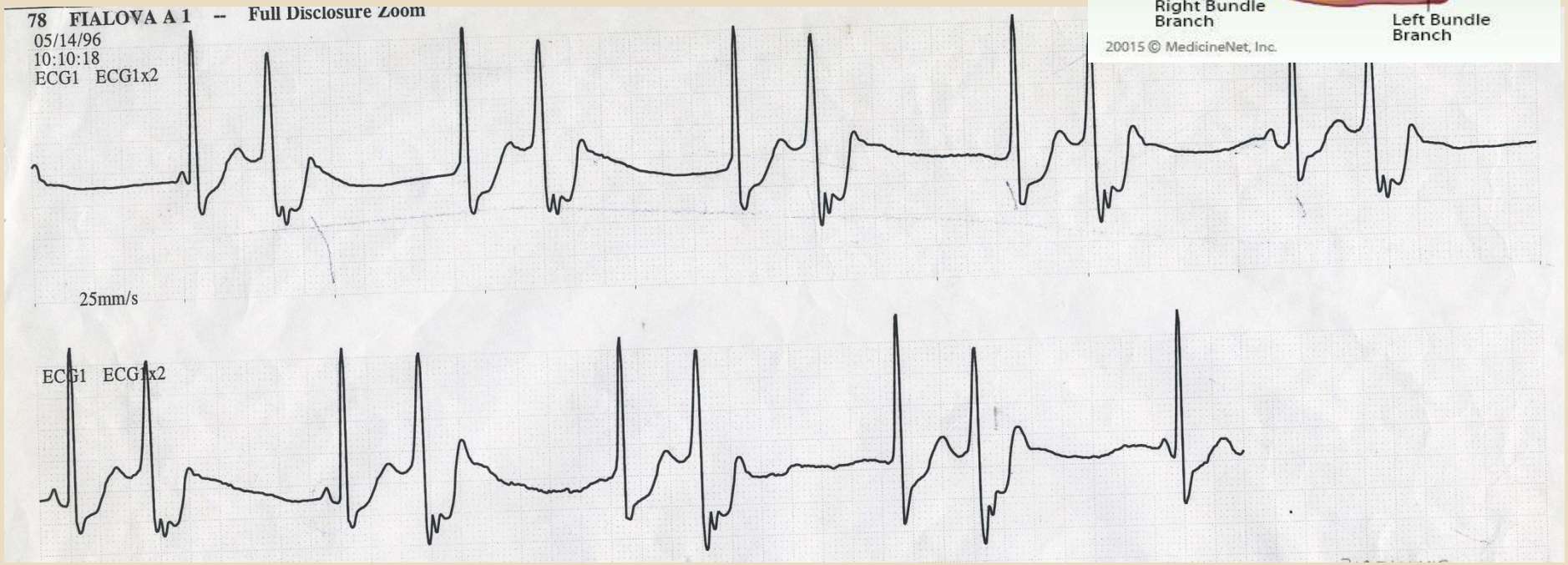
Premature ventricular contraction (PVC)

Ventricular tachycardia

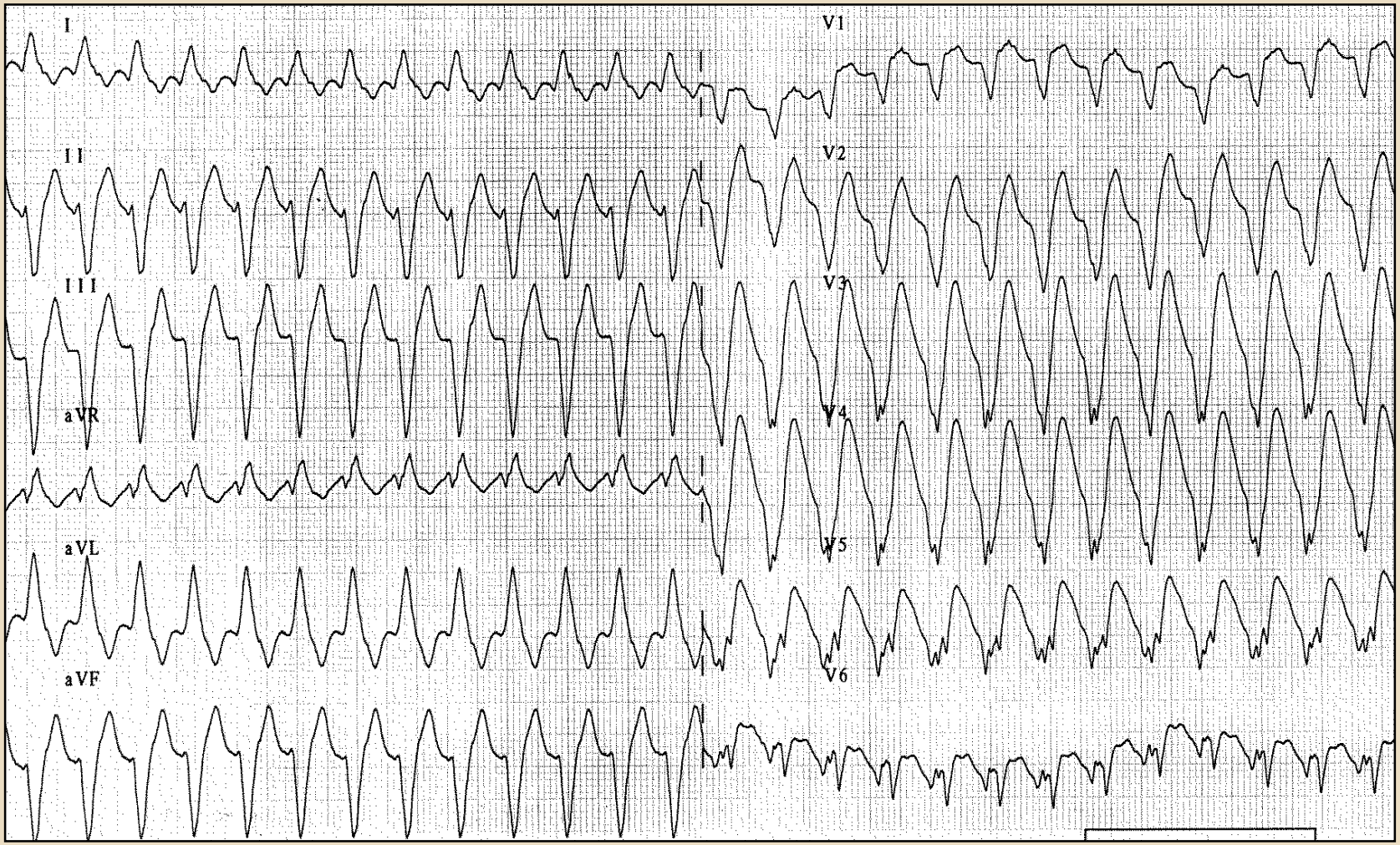
Ventricular fibrillation

PVC (Premature ventricular contractions - bigeminy)



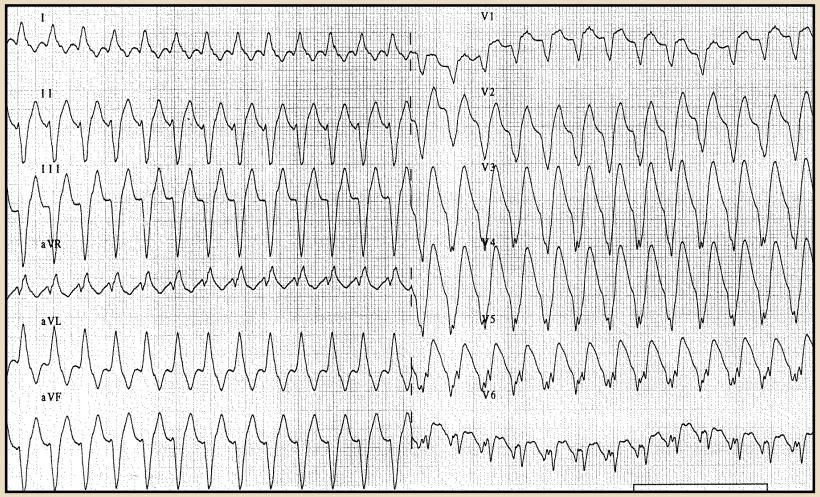


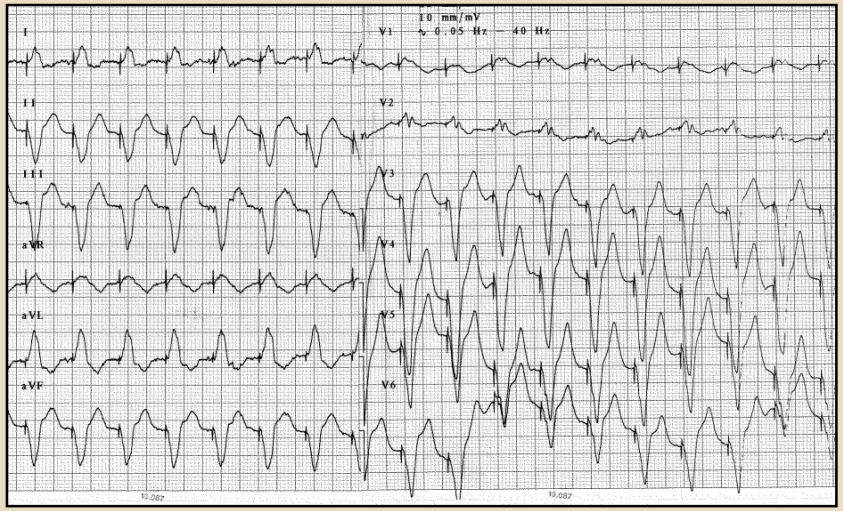
VT LBBB – like



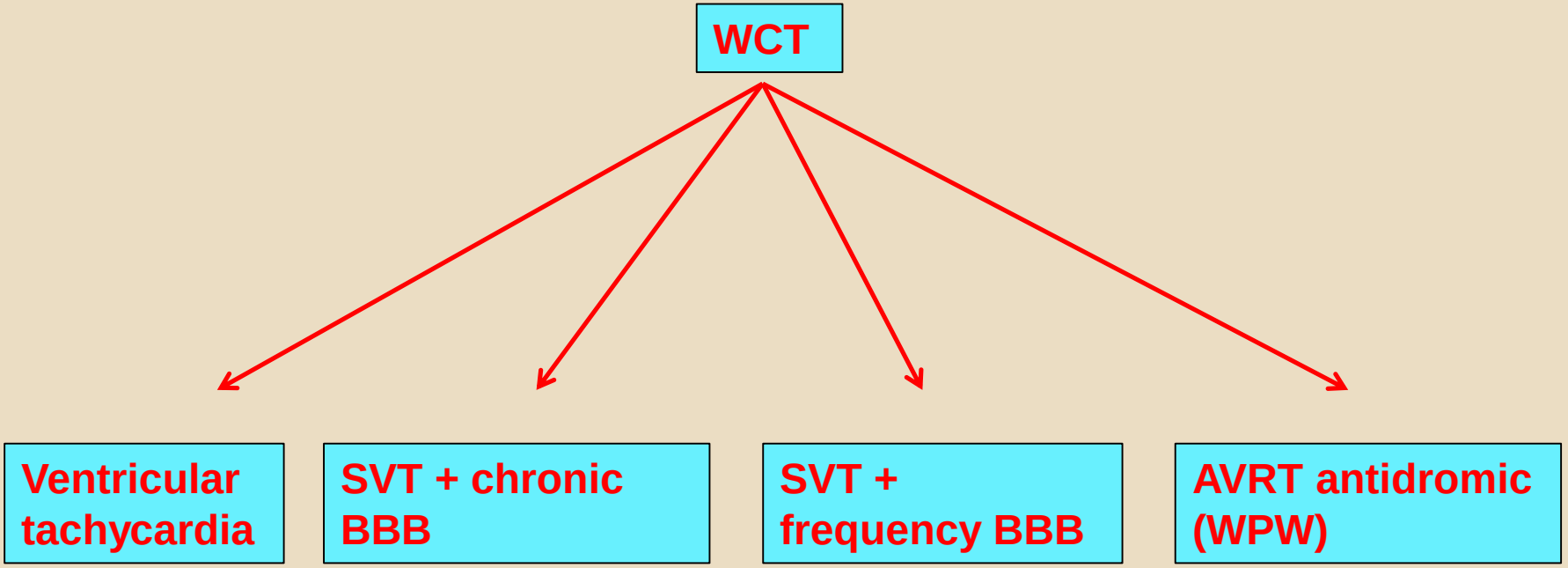
VT RBBB – like

Differential diagnosis of wide complex tachycardia

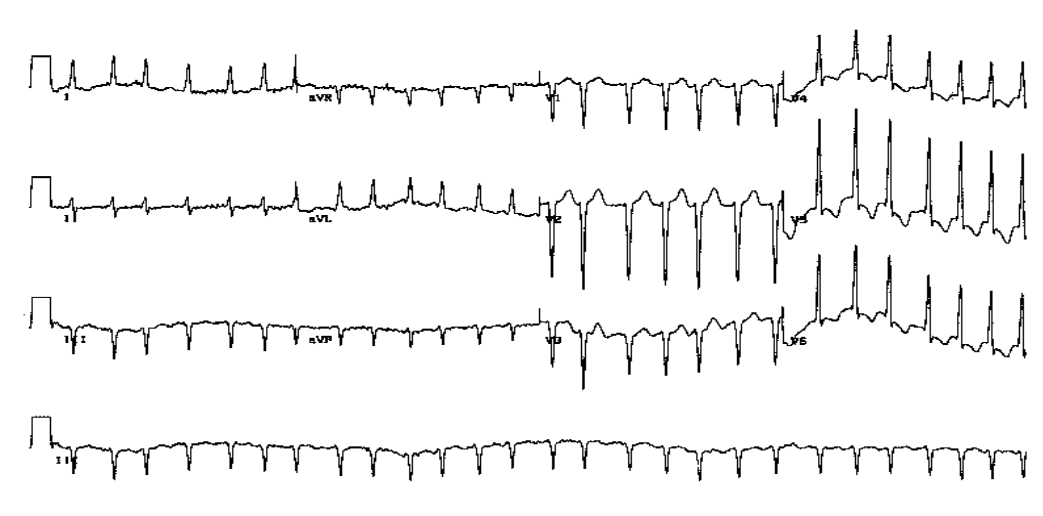


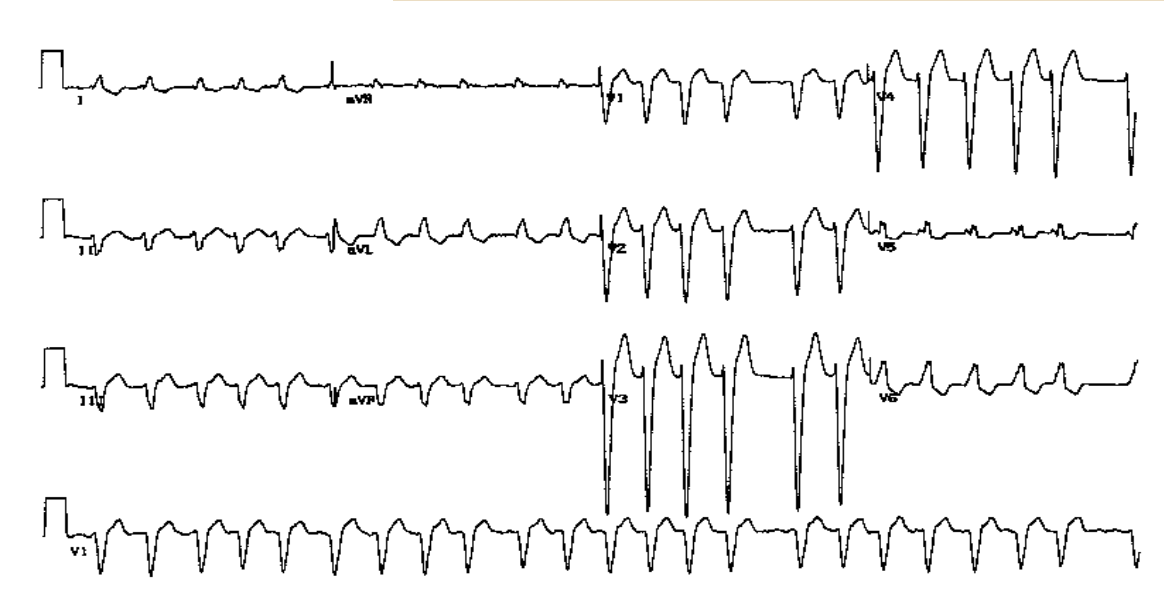


Wide complex tachycardia (WCT)

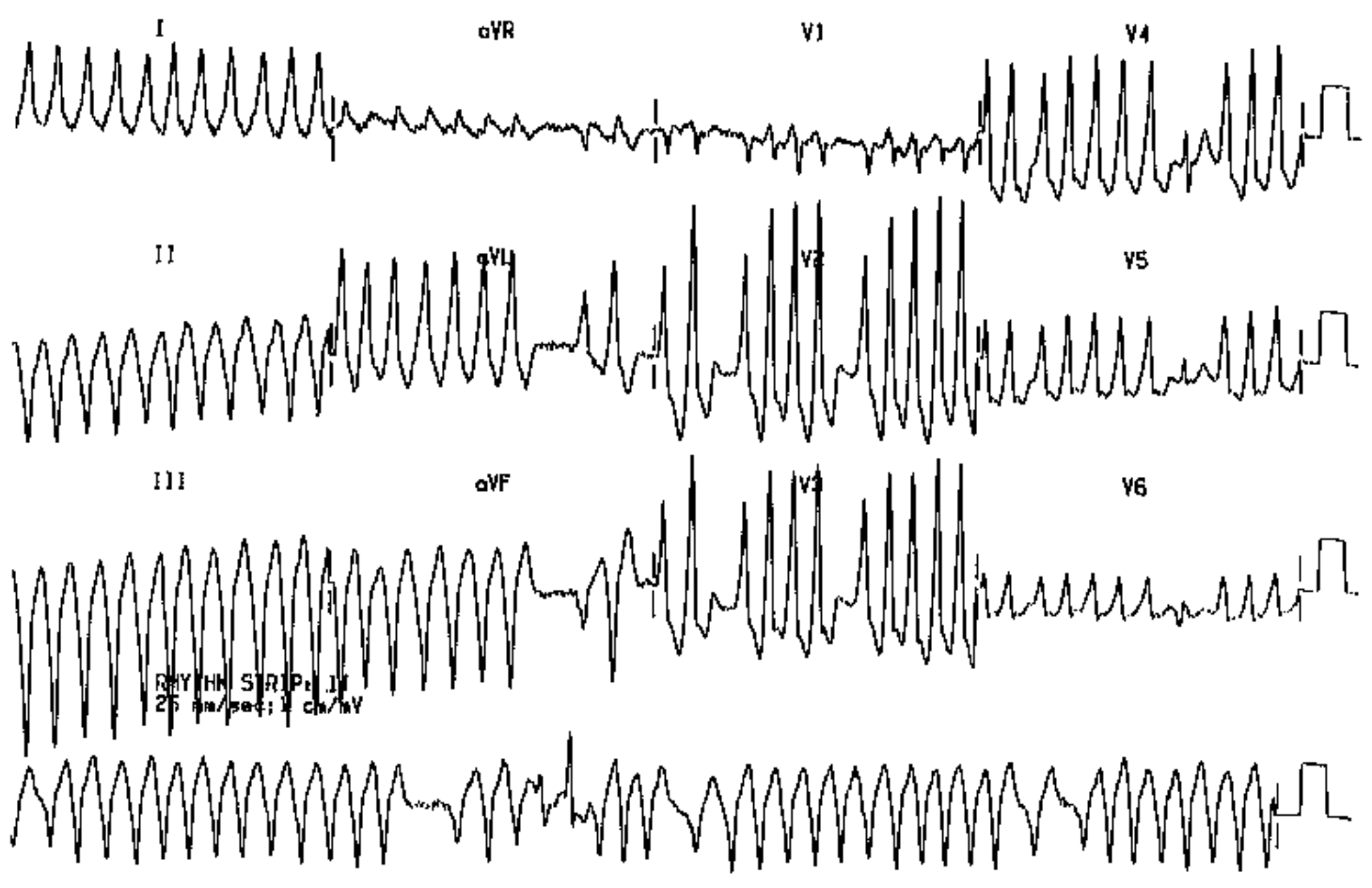


AF with frequency BBB

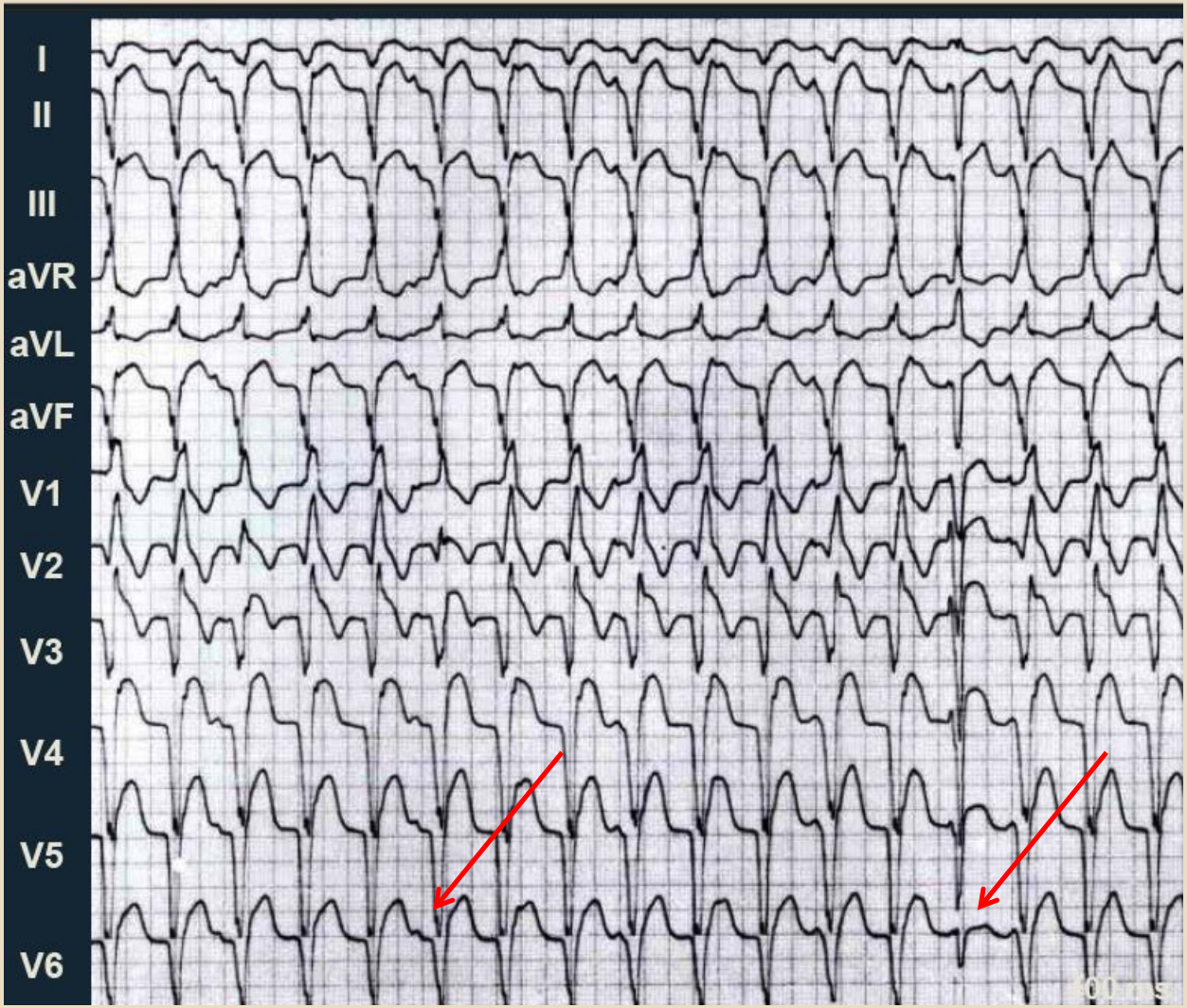




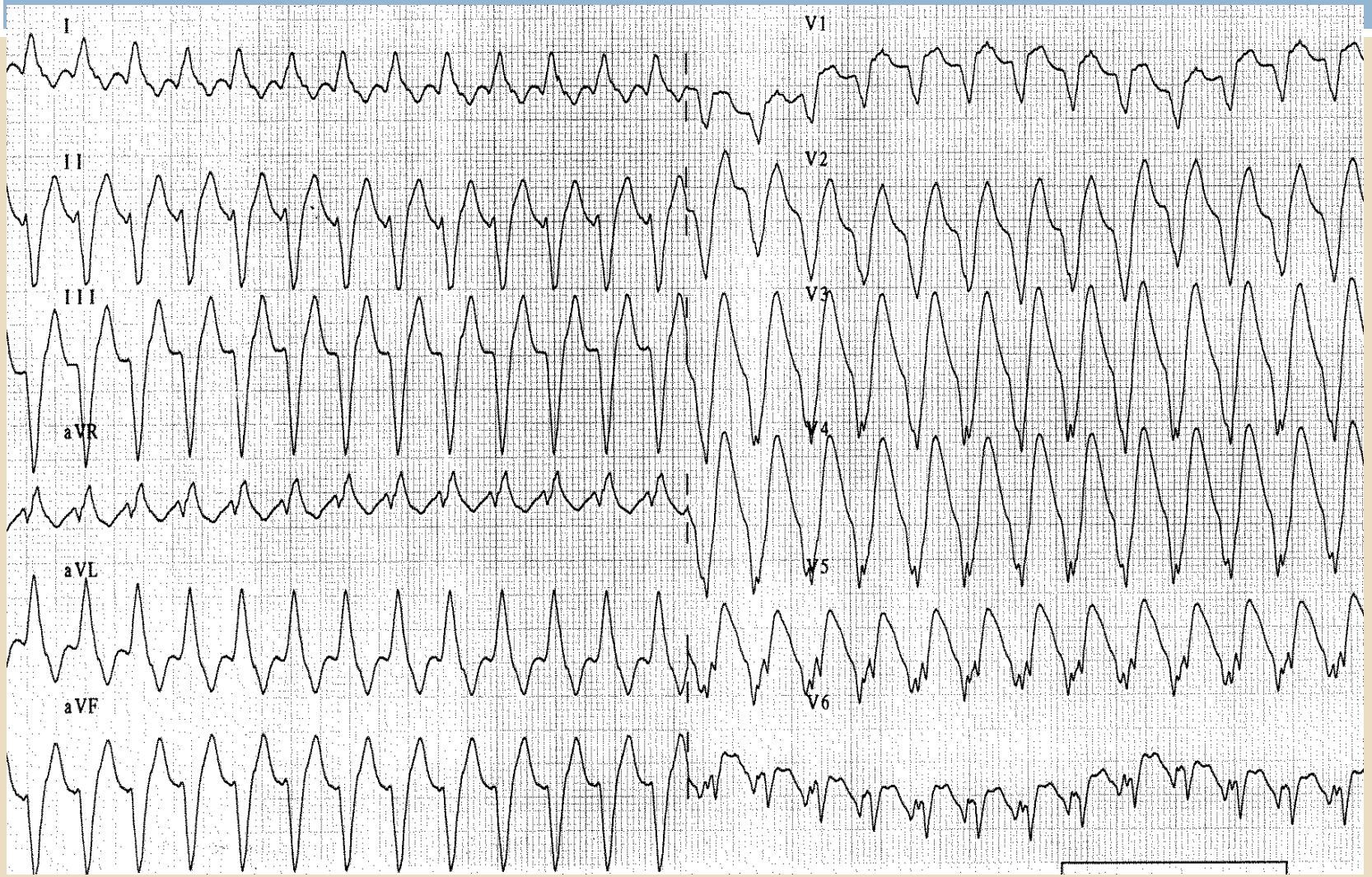
AF + accessory pathway



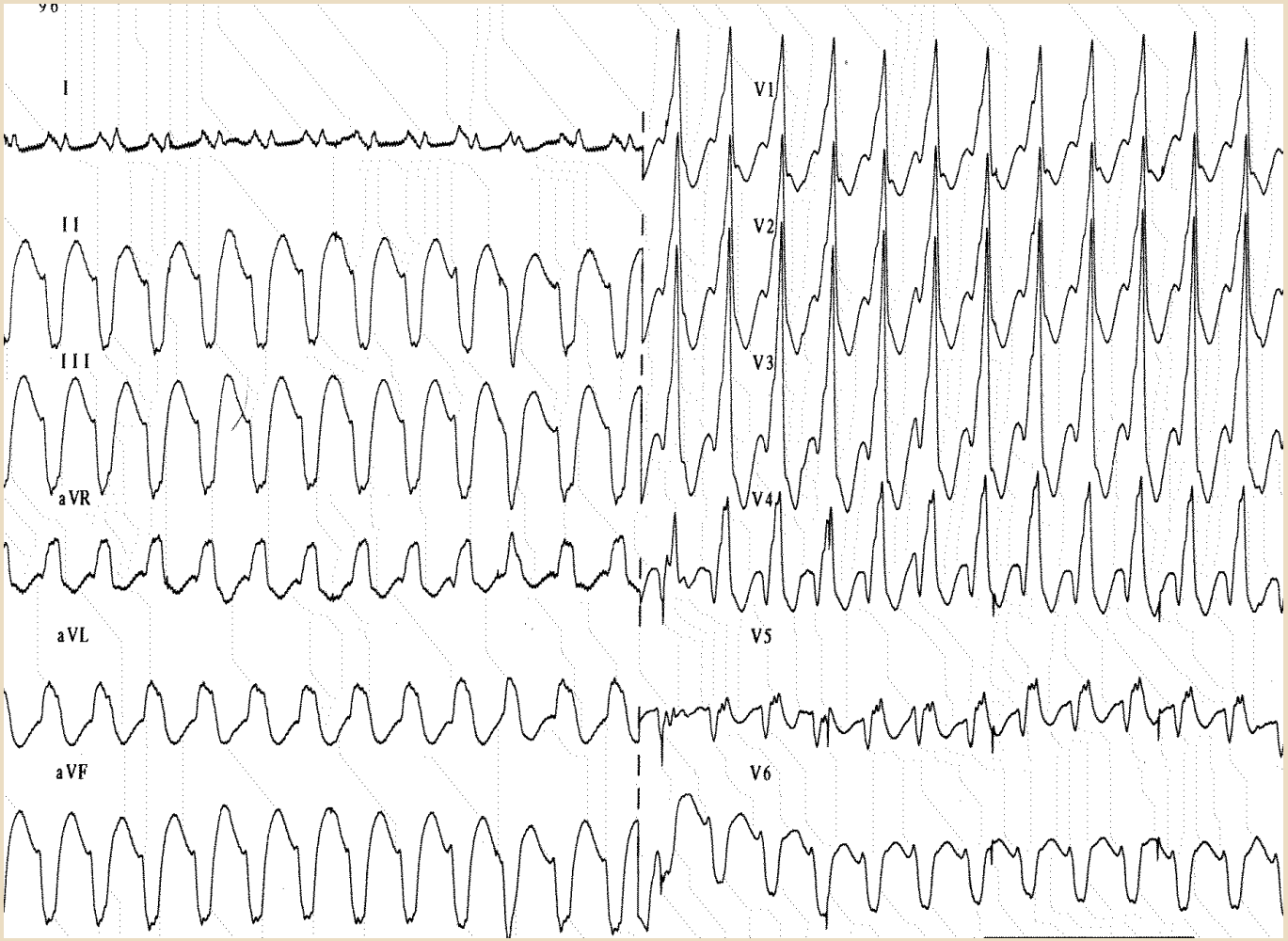
VT RBBB – like, VA dissociation and fusion beat

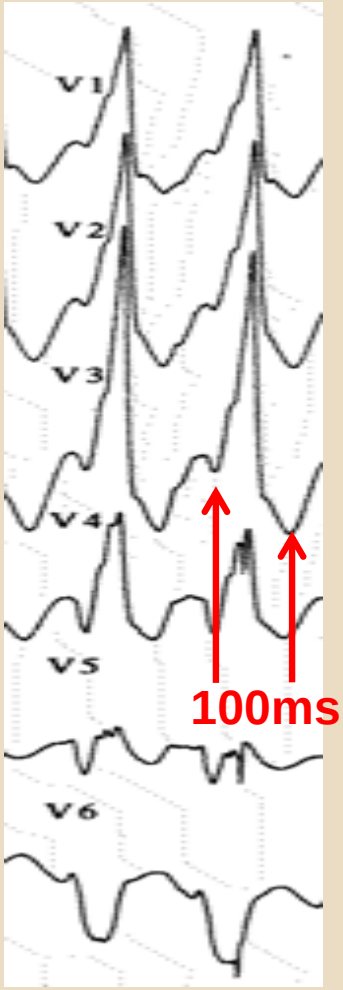


Identic QRS orientation in precordial leads

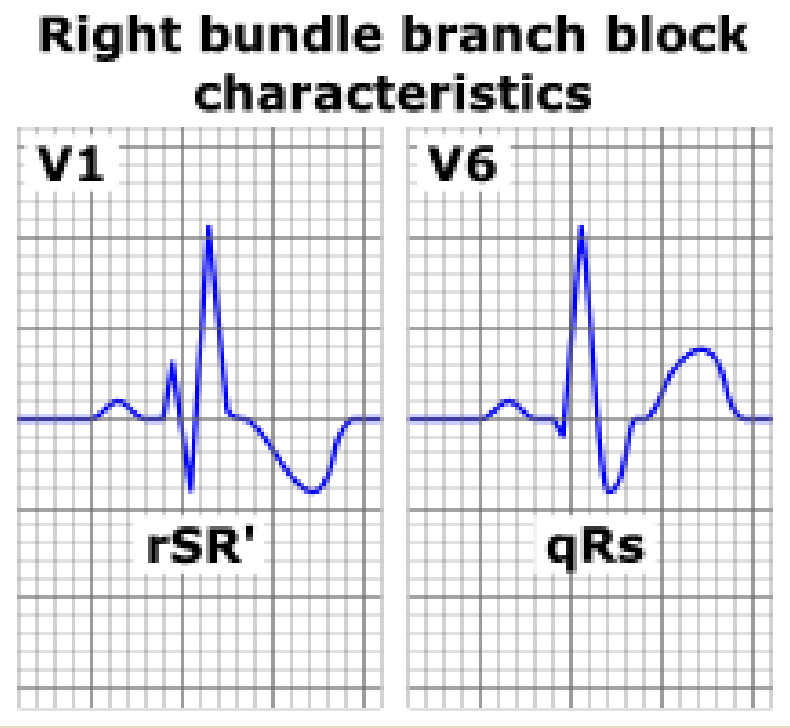


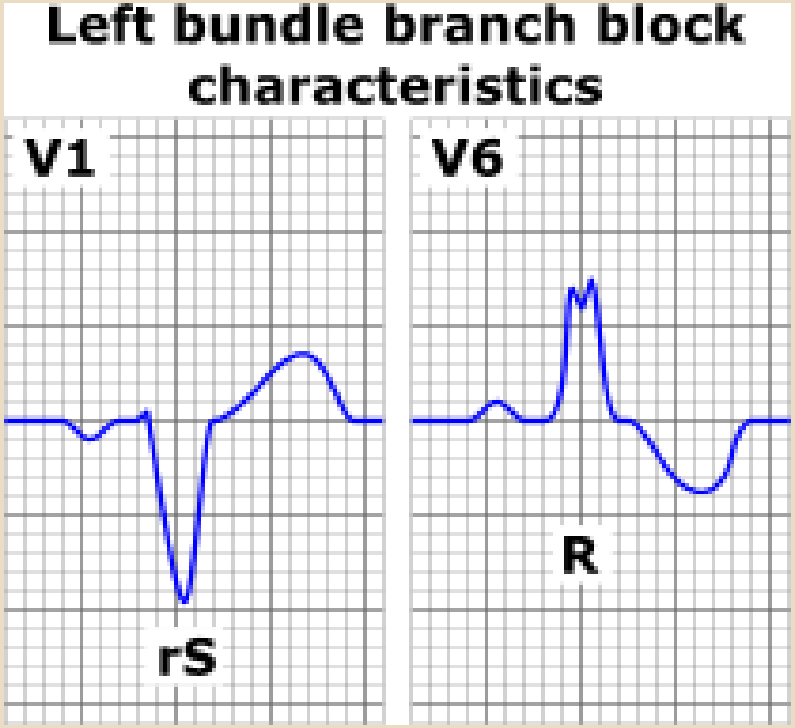
RS duration > 100ms



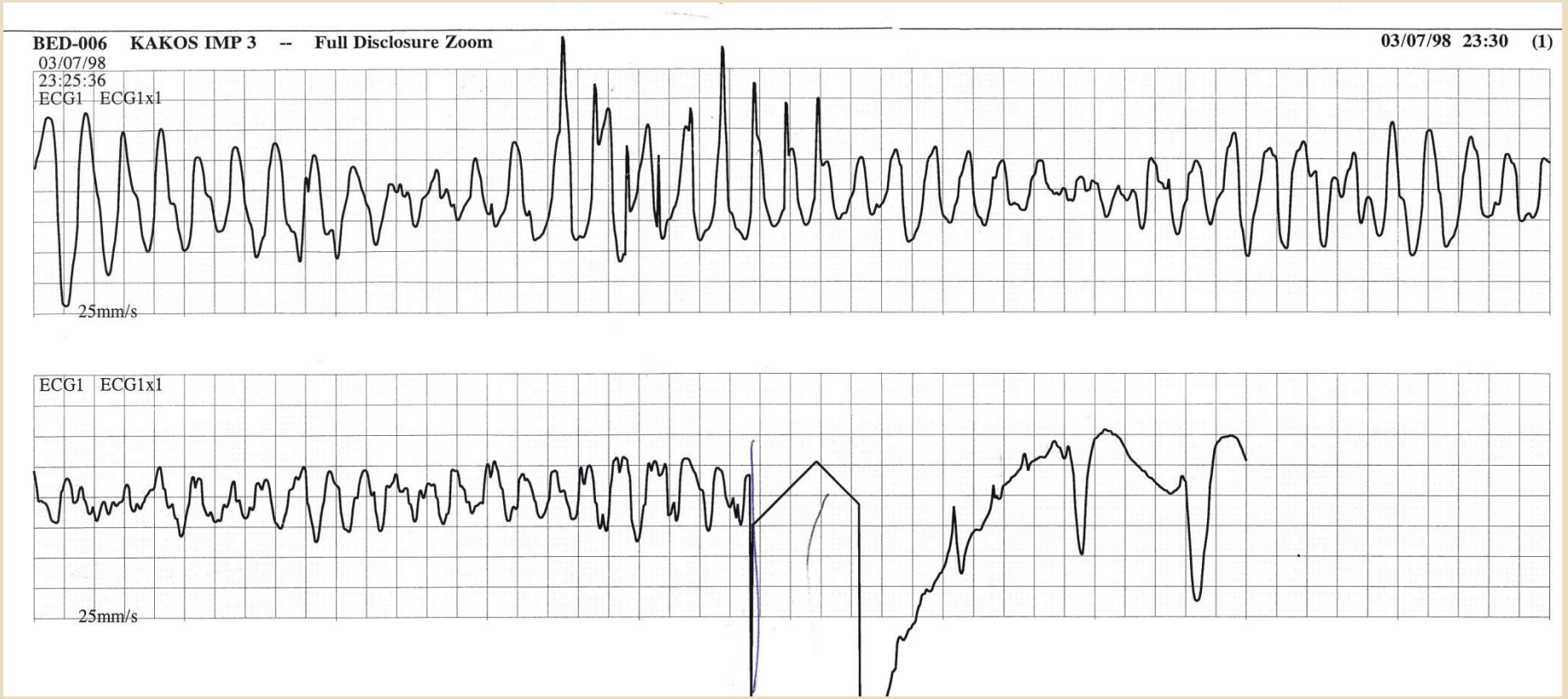


Absence of typical BBB pattern





Ventricular fibrillation (VF terminated by ICD shock)



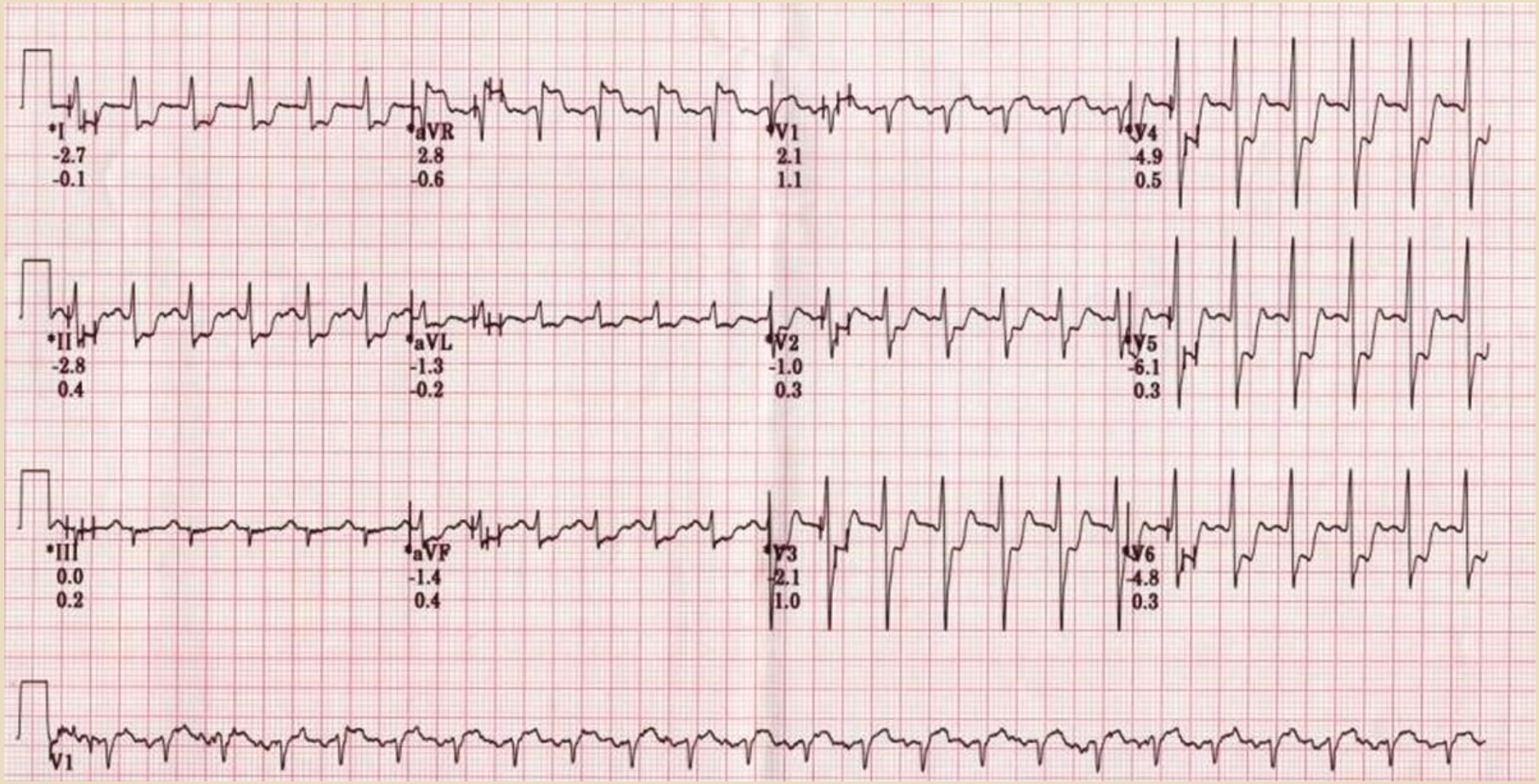
Ischaemia

Subendocardial – angina pectoris

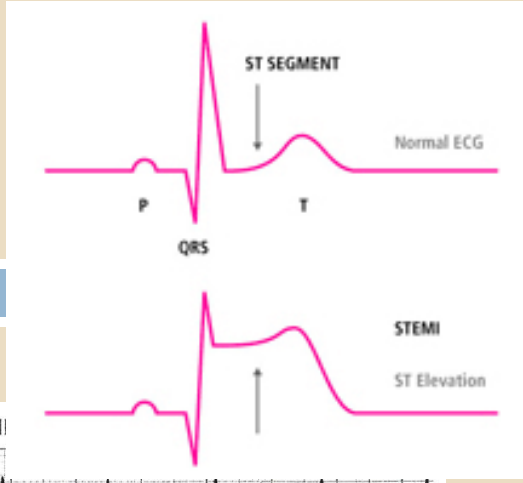
STE Myocardial Infarction

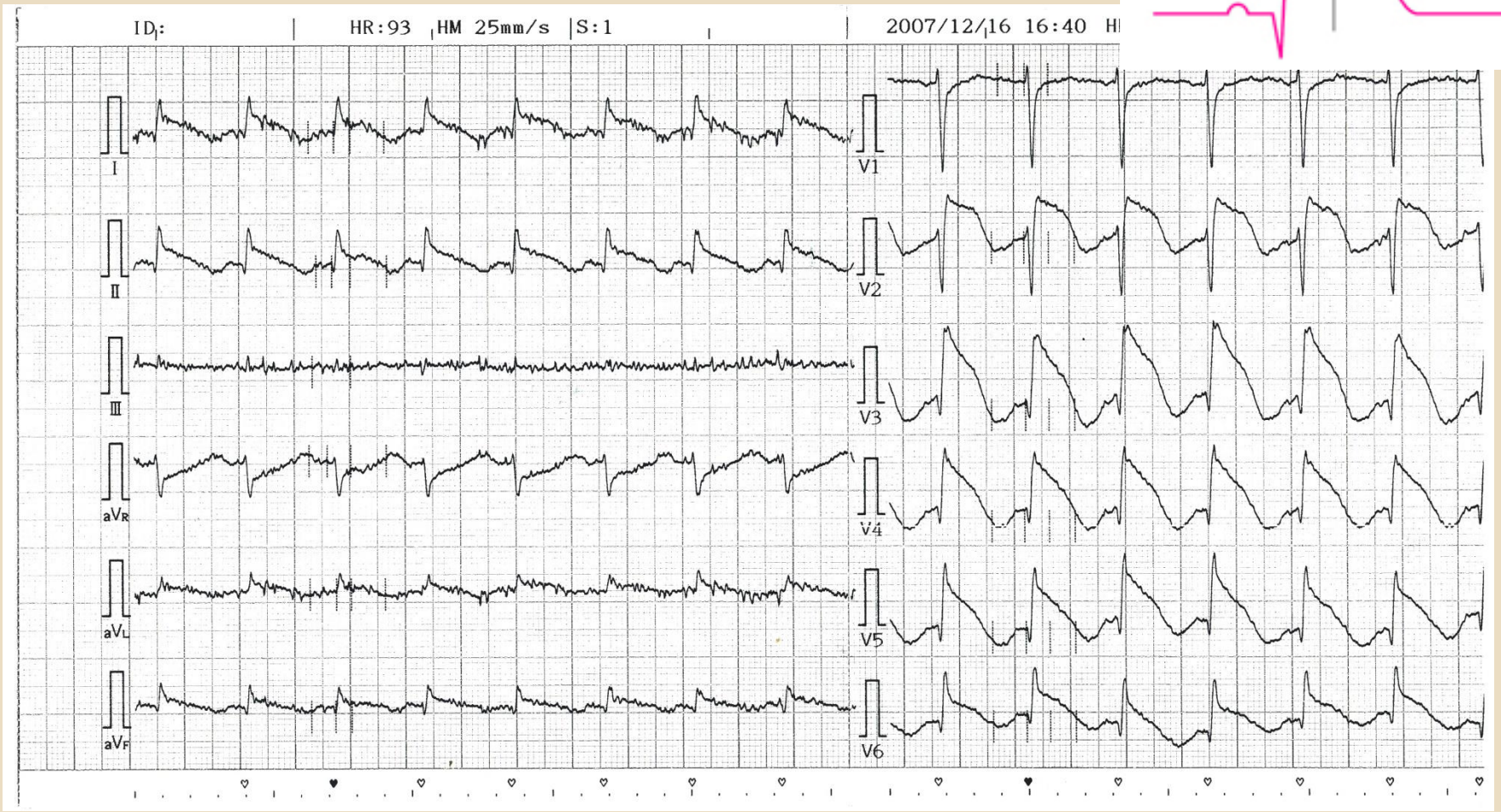
Post MI changes

ST depressions during treadmill test

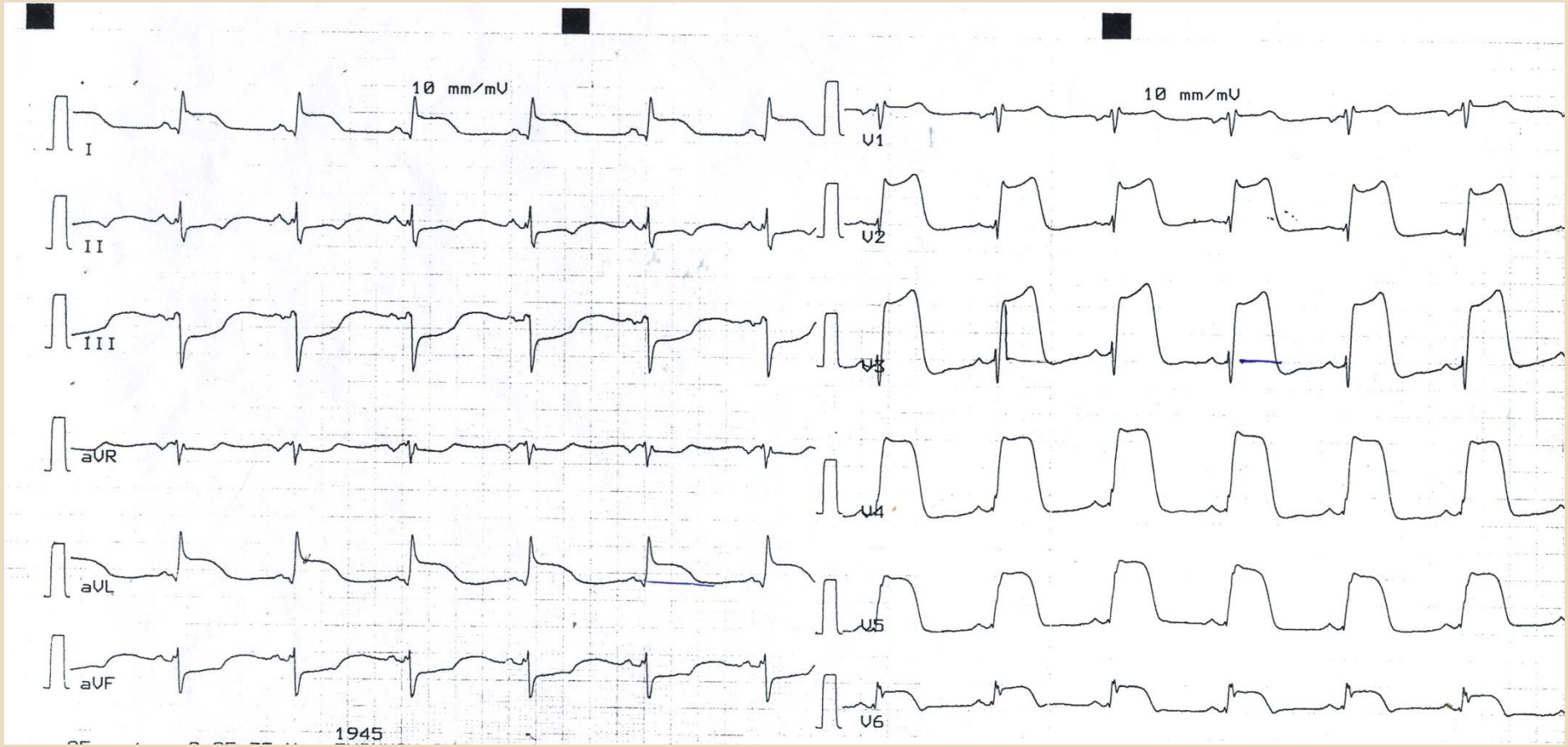


STEMI in left main artery occlusion

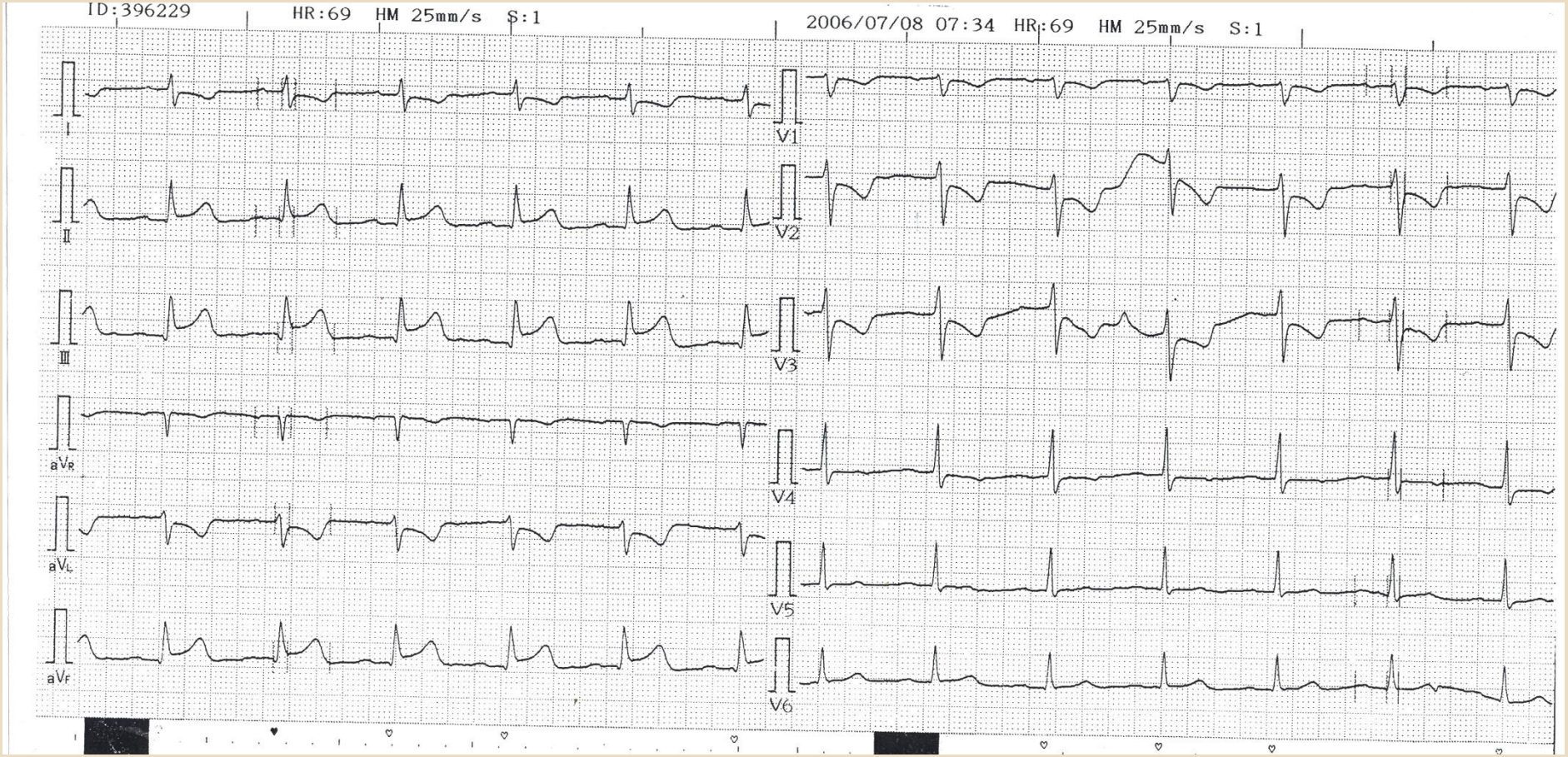




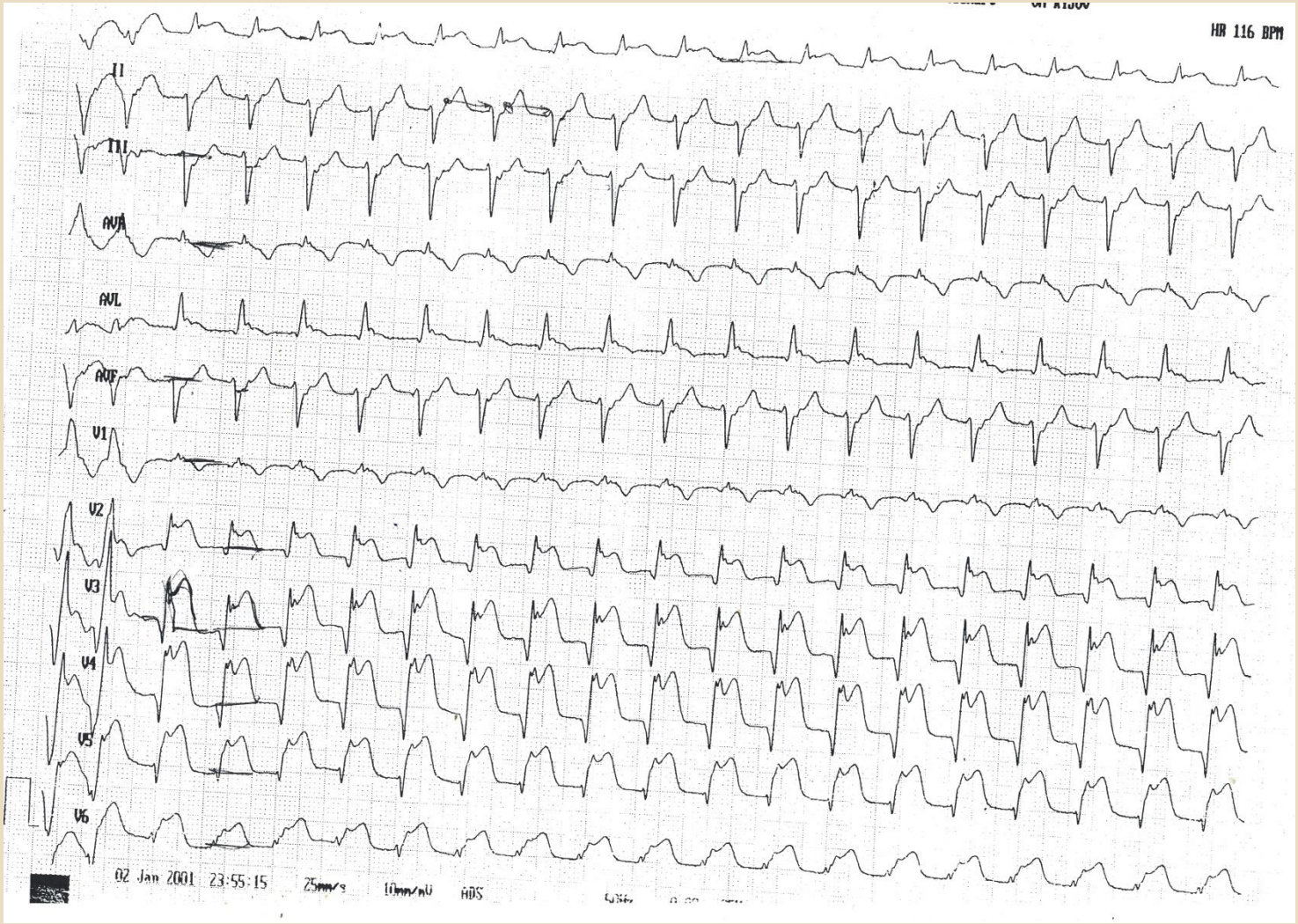
STEMI in left anterior descending artery occlusion



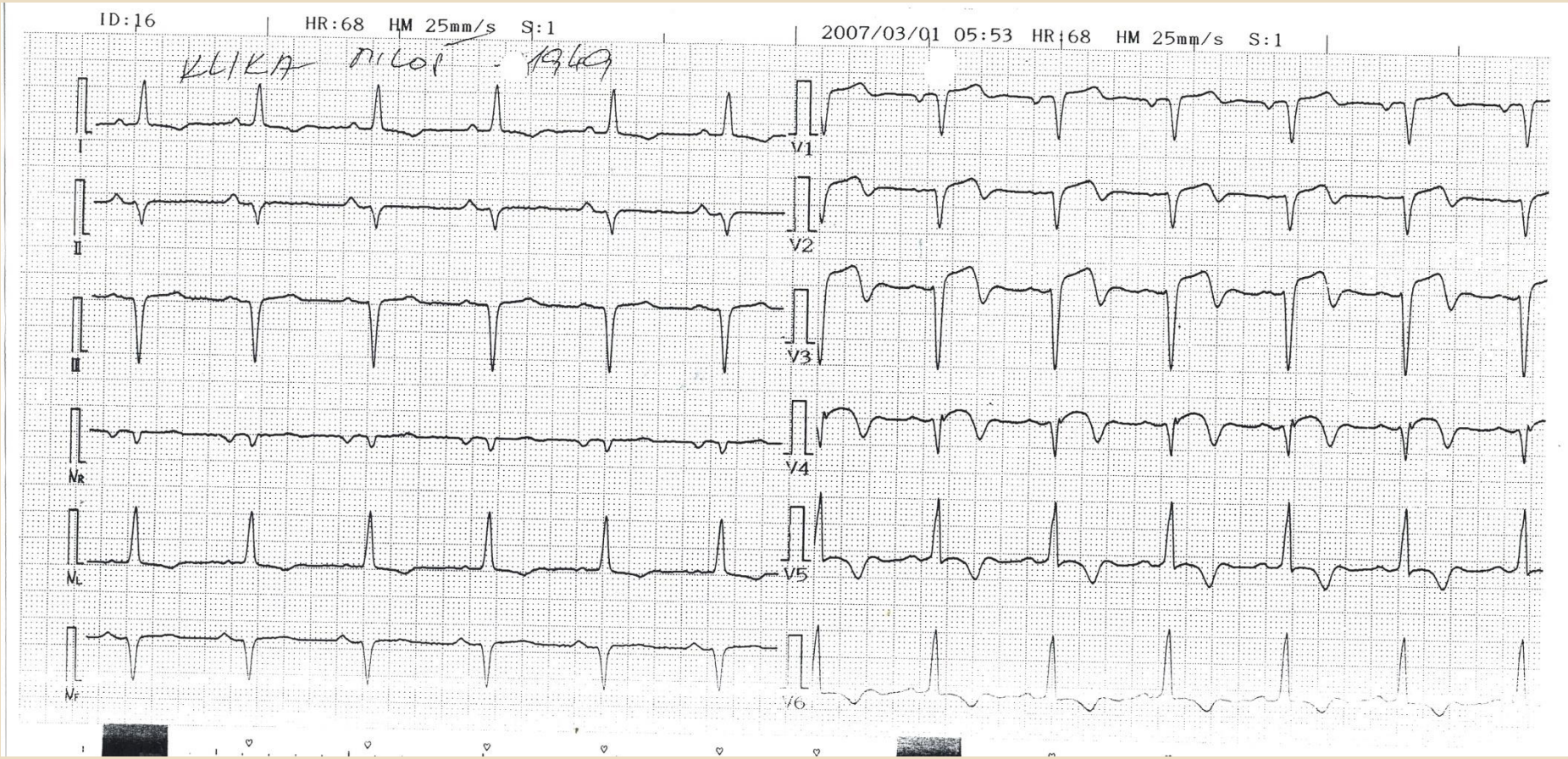
STEMI inferior wall



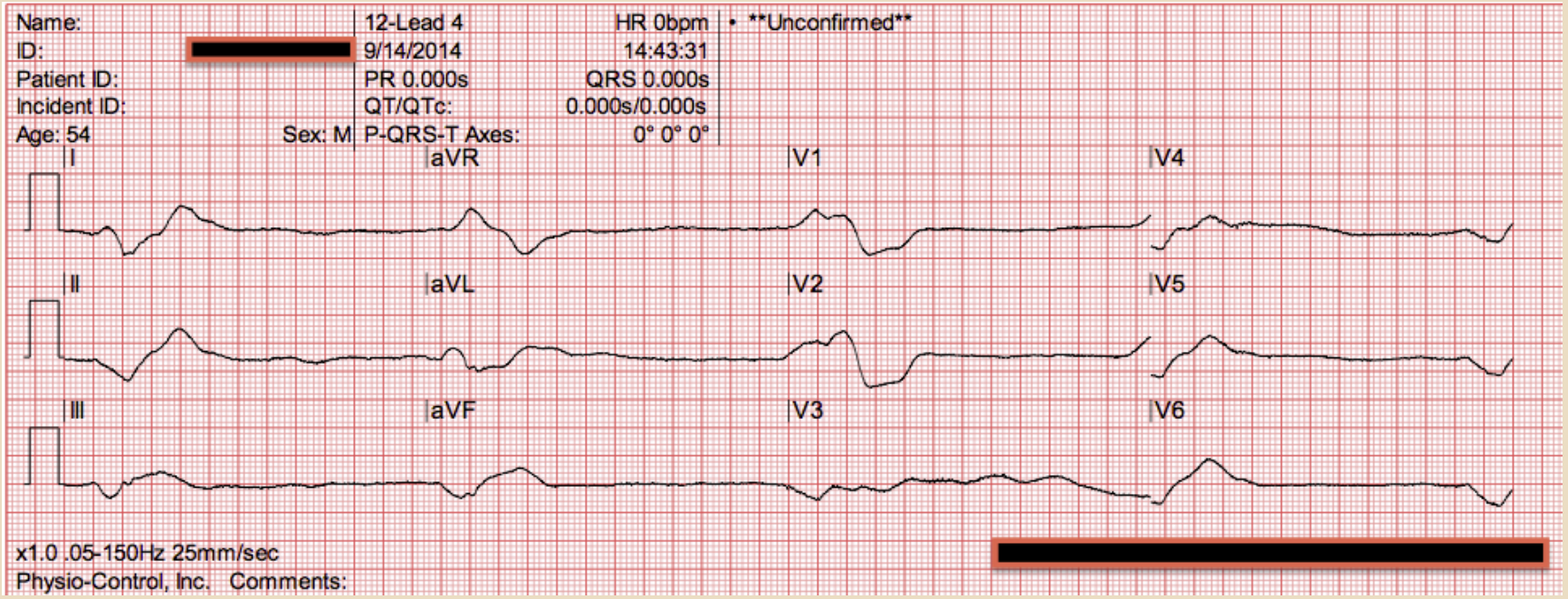
STEMI anterior wall (AE)

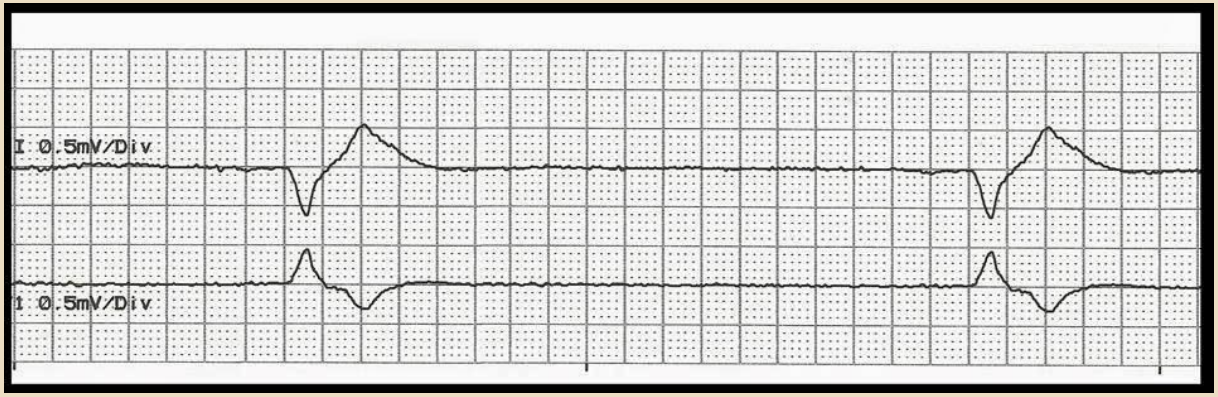


Post STEMI with formating aneurysm of ant. wall



Terminal rhythm - Electro mechanic dissociation





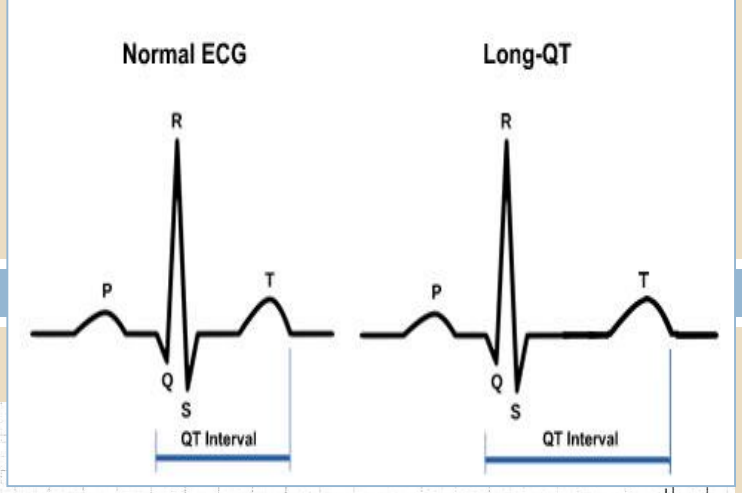
Ionic channel disorders

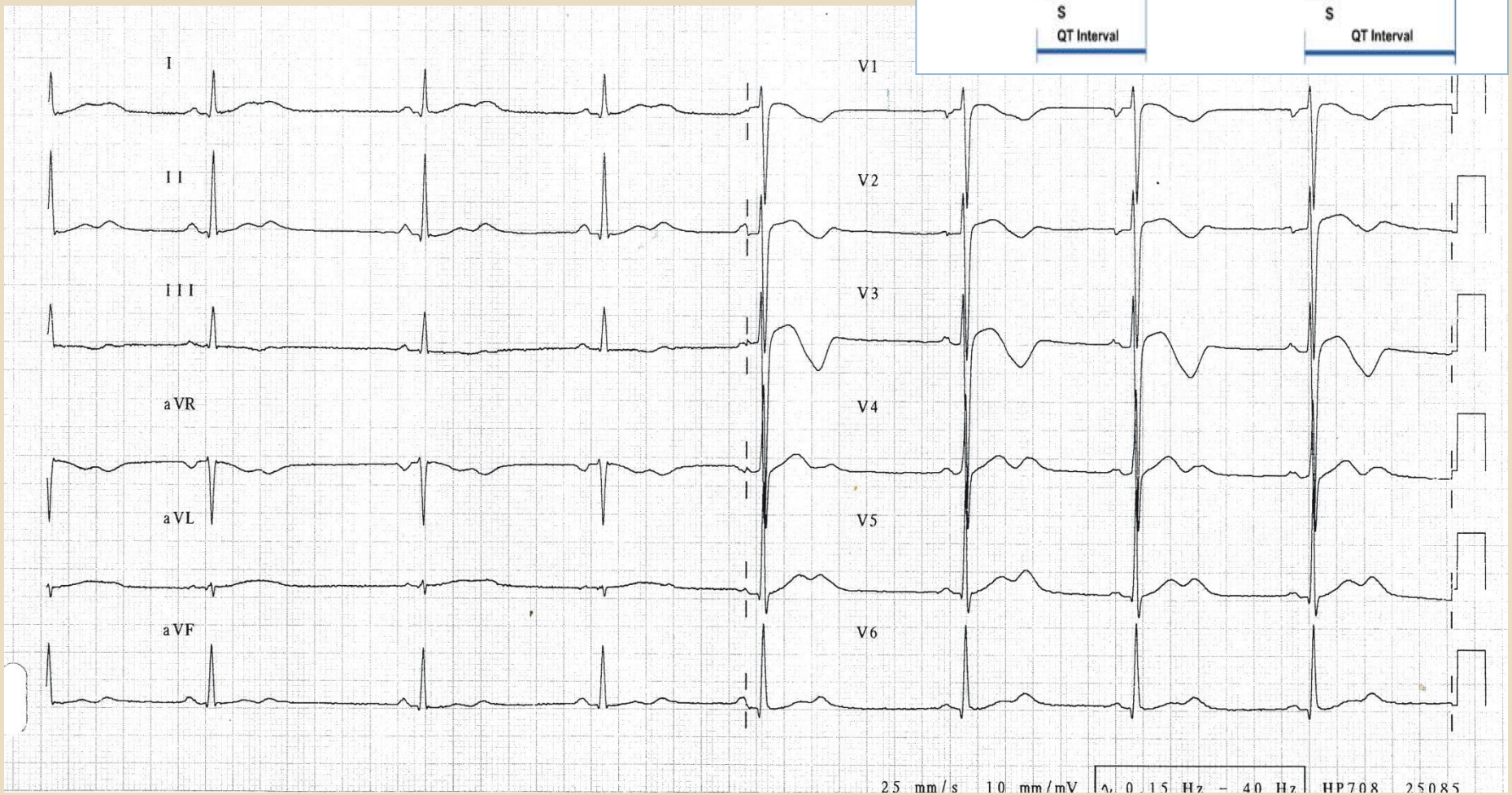
LQT syndrome

Brugada syndrome

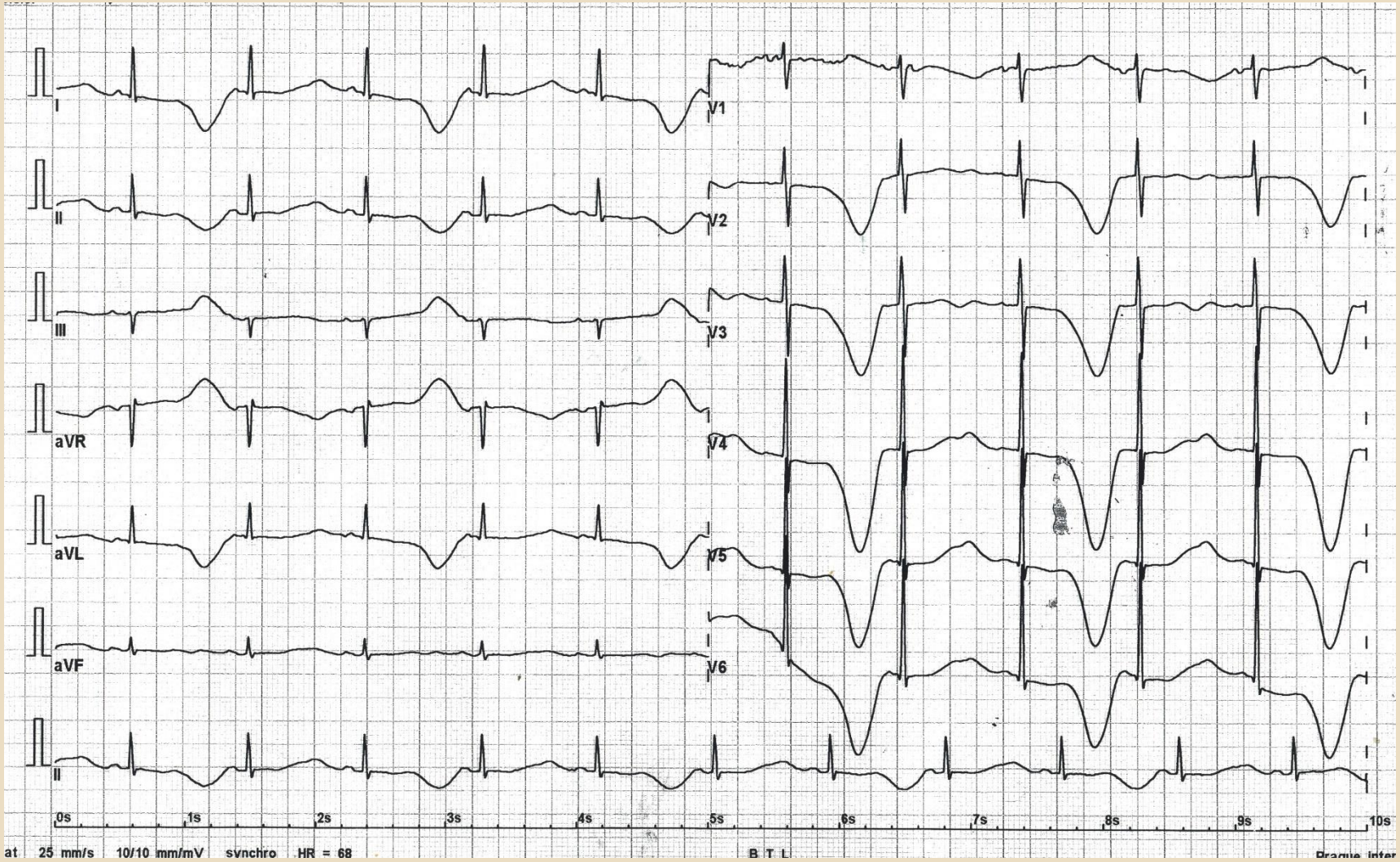
Catecholaminergic polymorphic VT

LQT syndrome

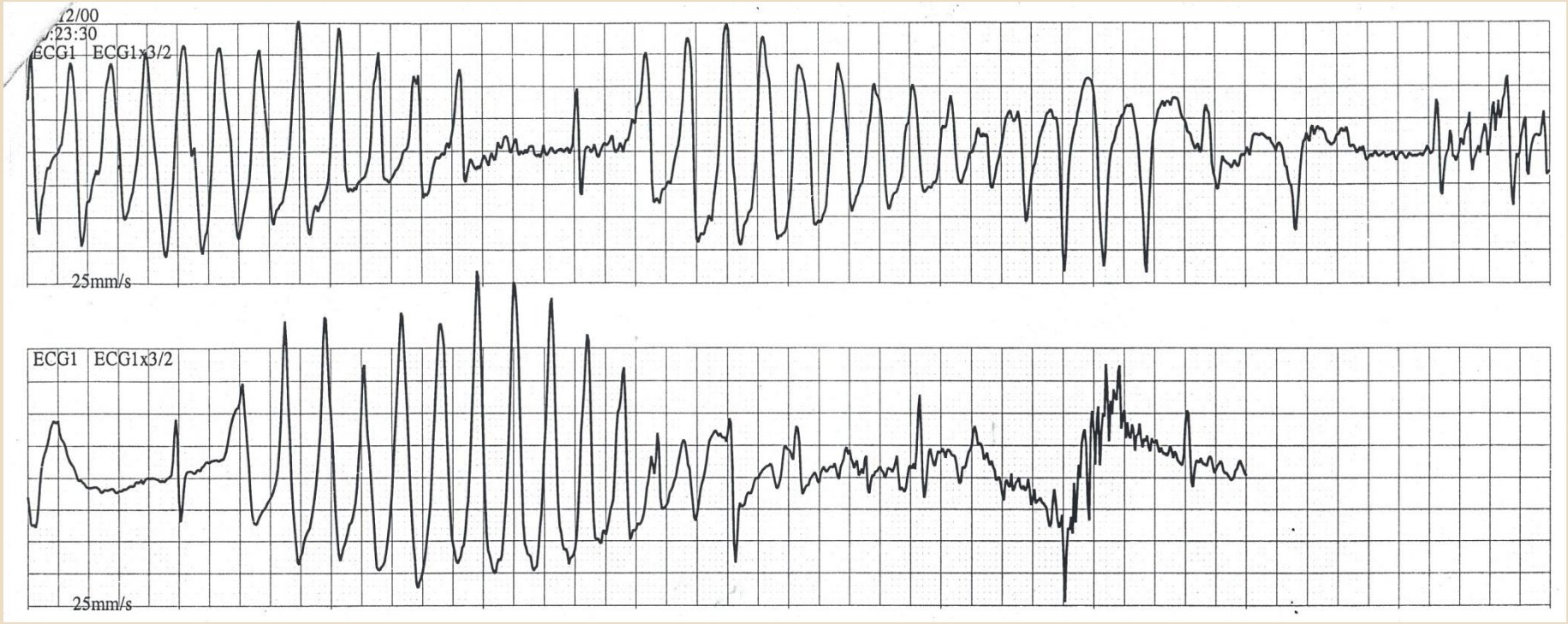




LQT syndrome + TWA

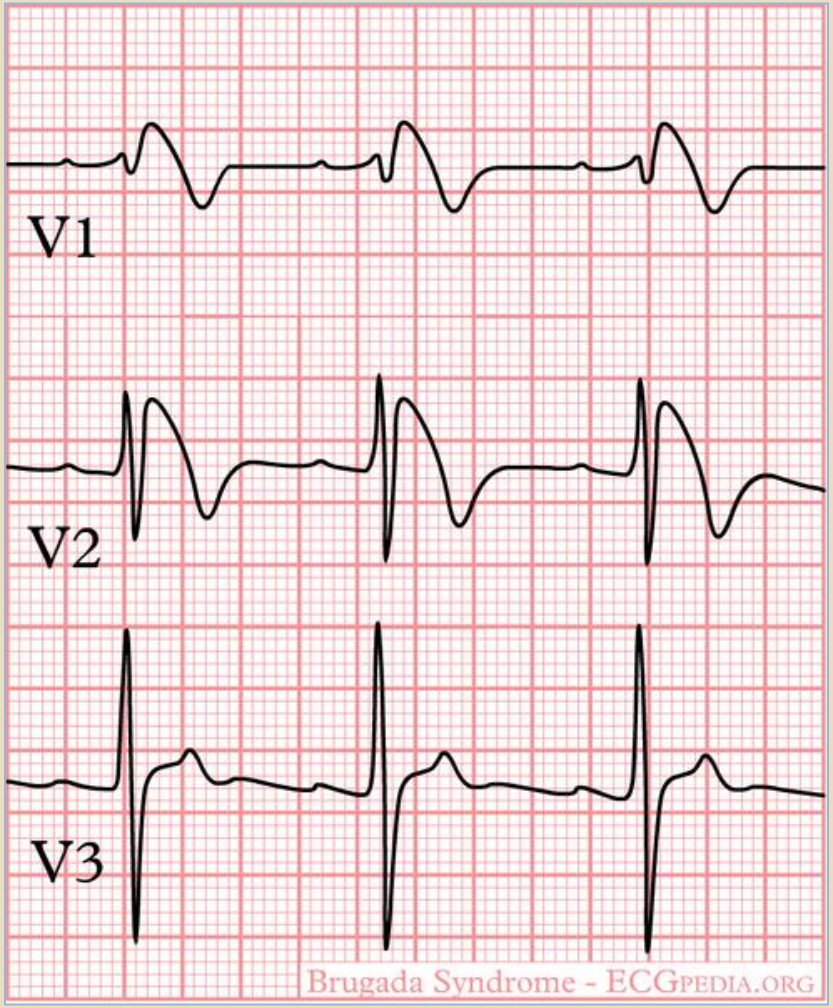


VF TdP type (Torsades de pointes)



Brugada syndrome

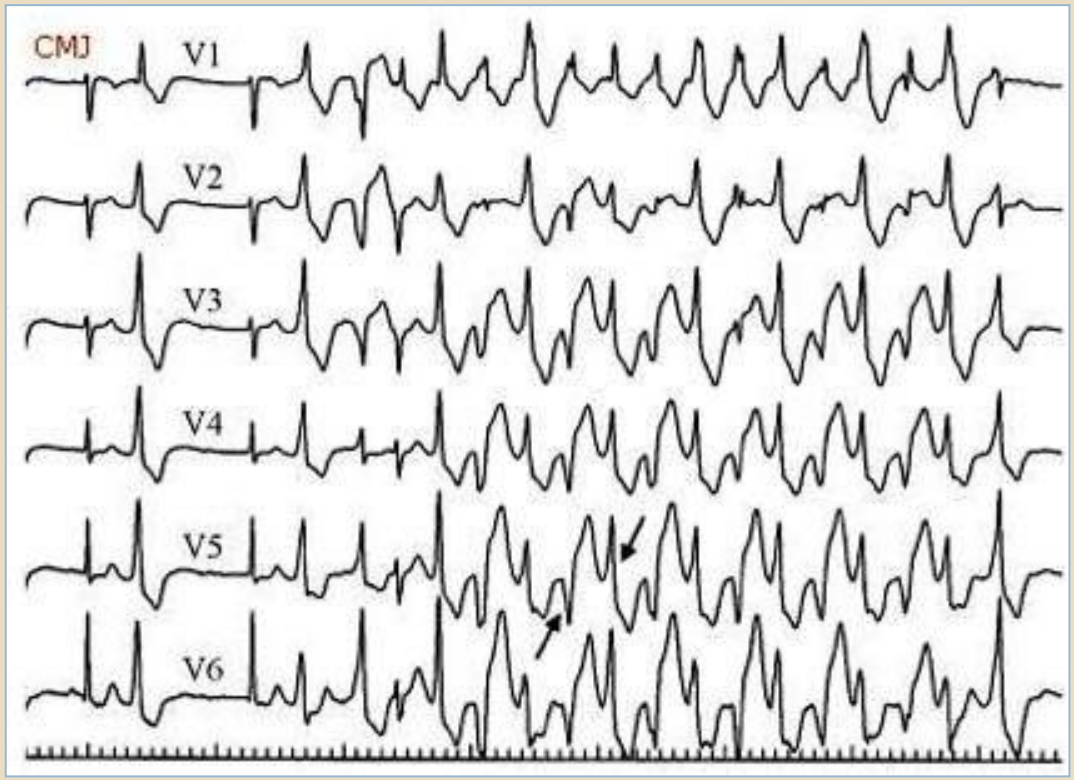
Autosomal hereditary disorder of genes responsible for Na and Ca channels.



Brugada P., Am Coll Cardiol 1992

CPVT – Catecholaminergic polymorphic VT

Mutation of cardiac proteins of Ca exchange. Malignant arrhythmias during excersice



Bytešník., et al. Cor Vasa 2011;53(Suppl 1)

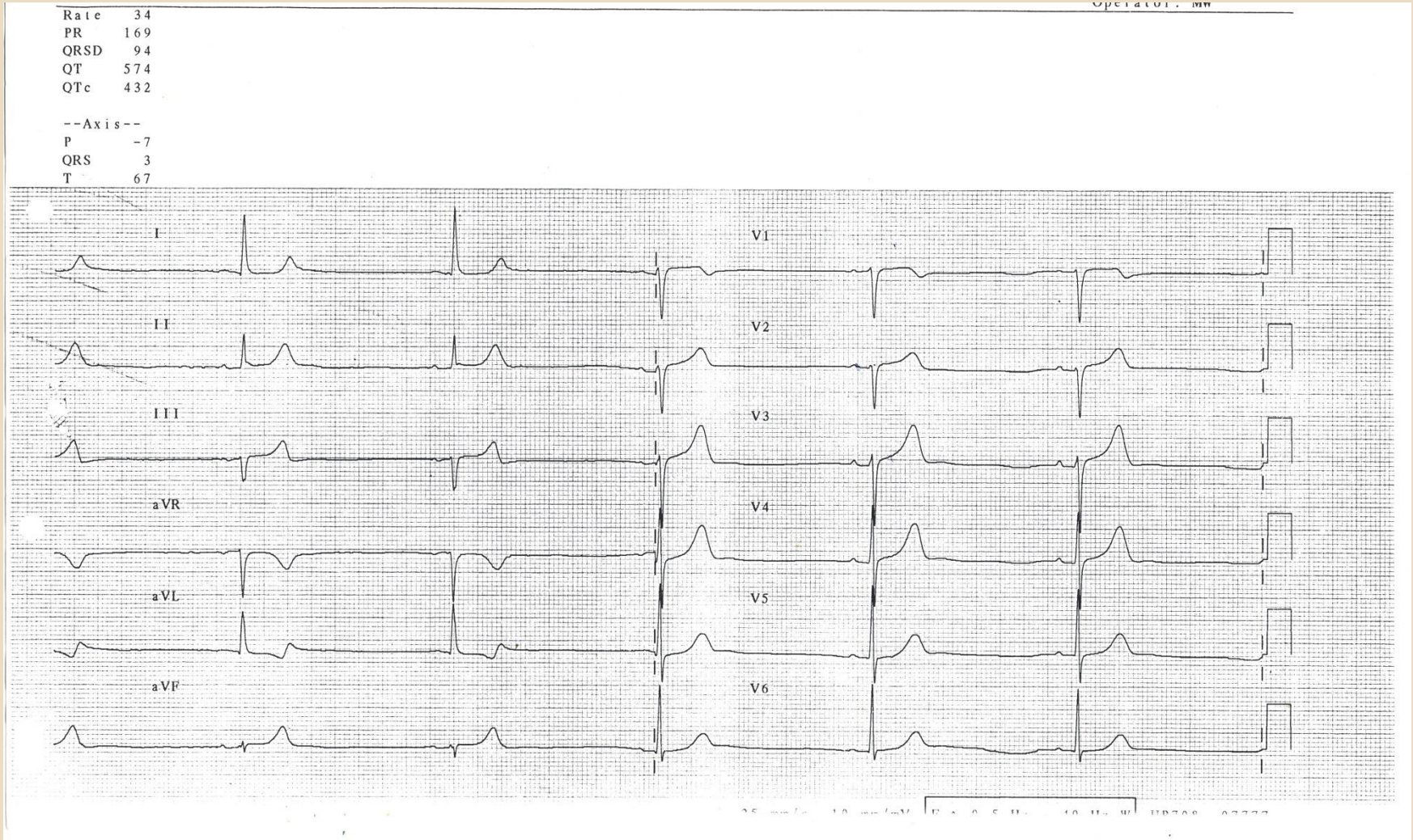
Pacing

Anti – bradycardia pacing

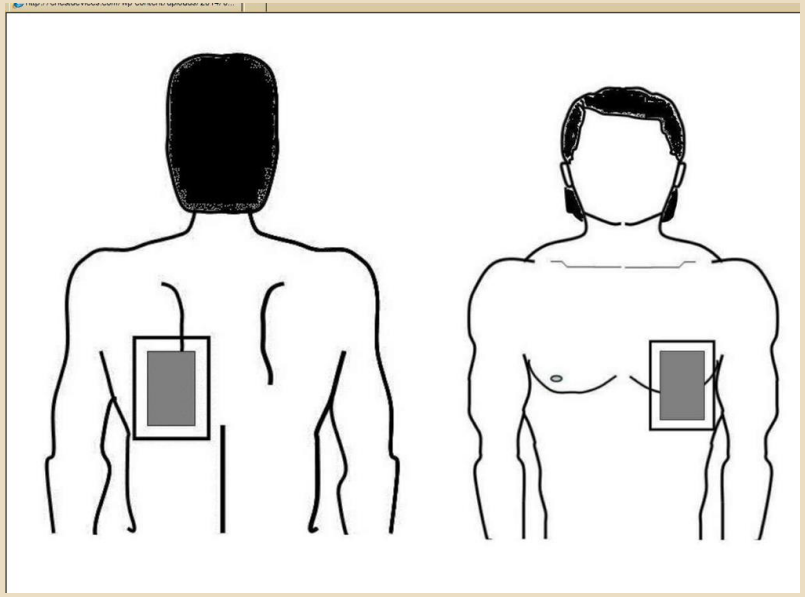
Anti – tachycardia pacing

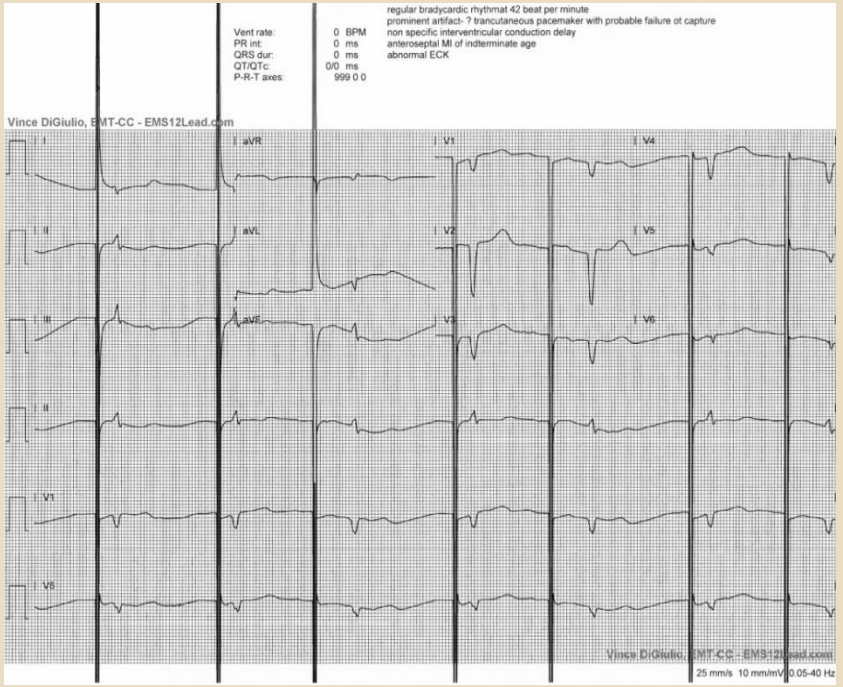
Resynchronization pacing

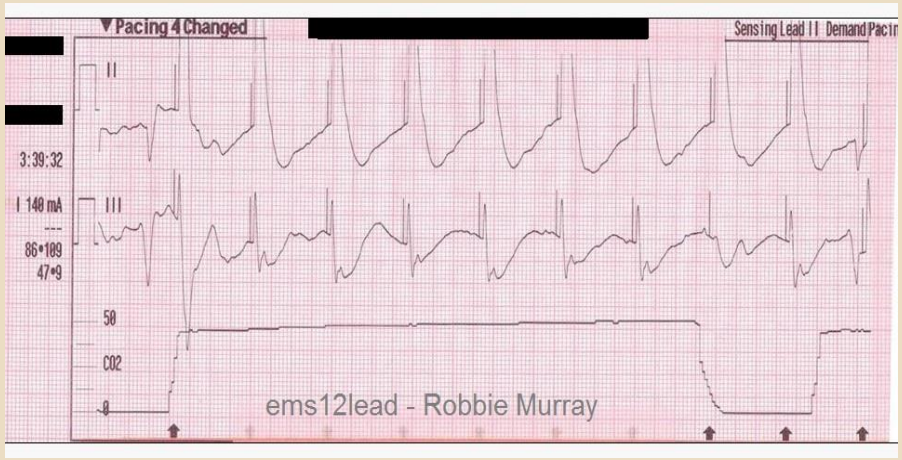
Sinus bradycardia



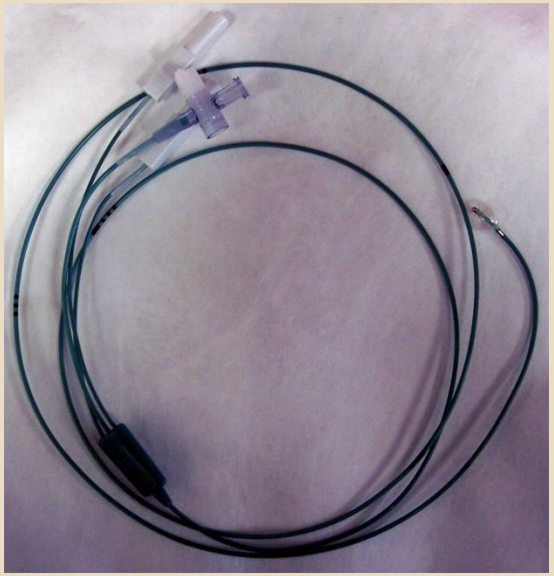
External pacing

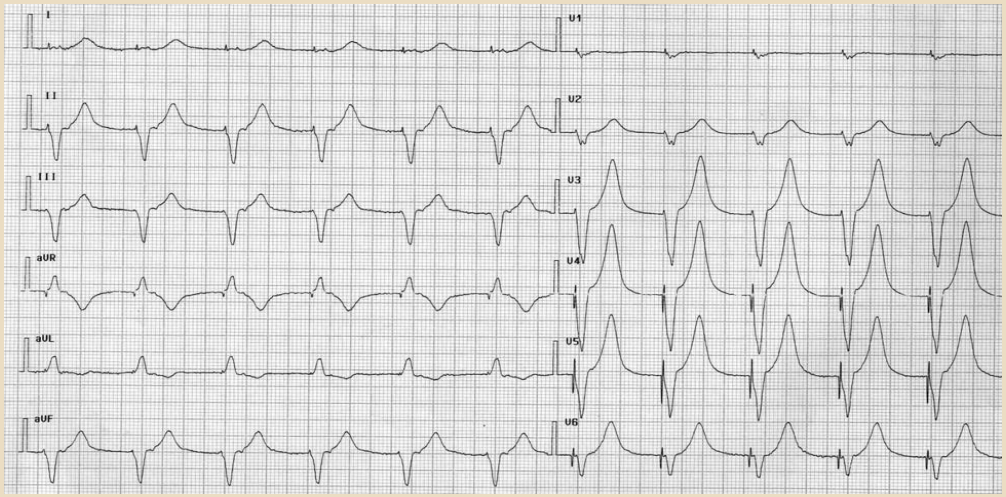






Temporary transvenous pacing



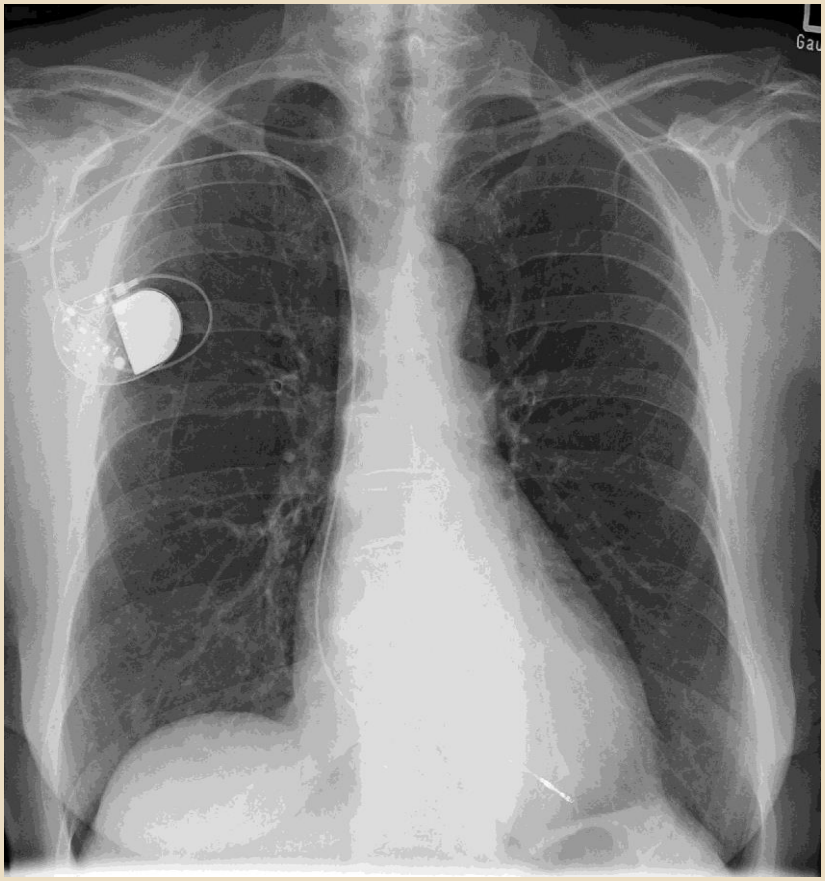


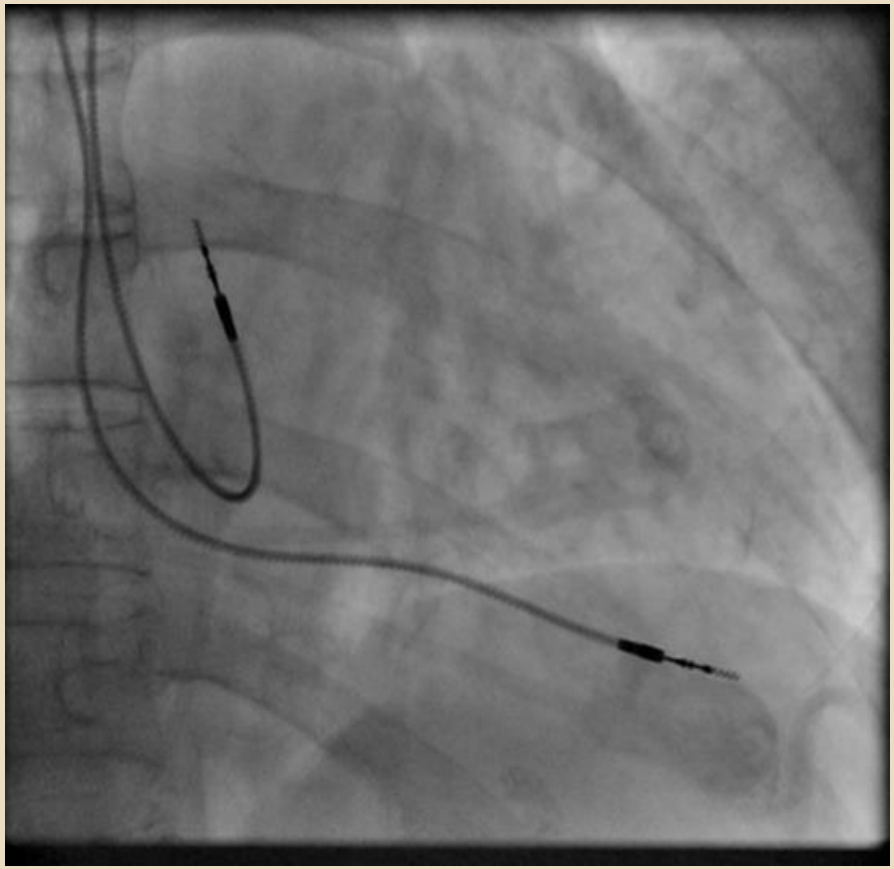
Transvenous pacing from 1958

Elmquist + Senning 8.10.1958

Arne Larsson 1915 - 2001

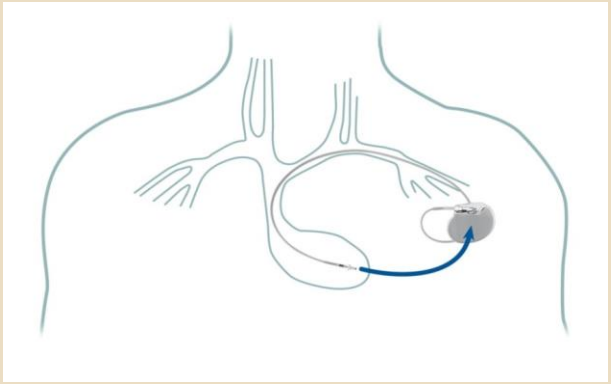
Single and dual chambre PM

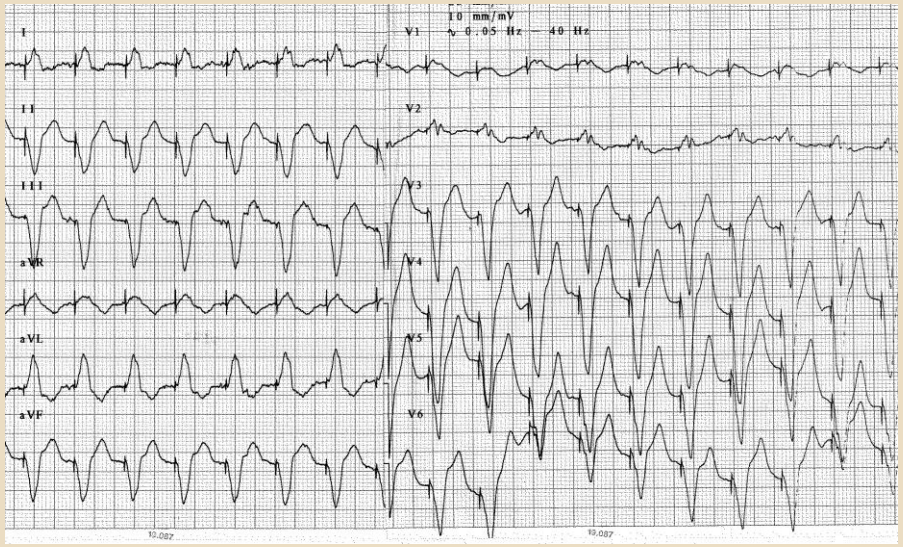




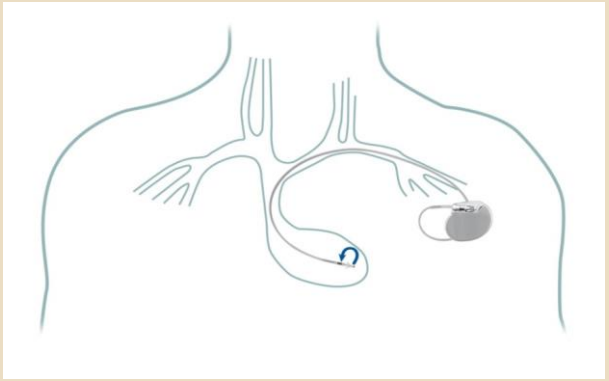
Pacing

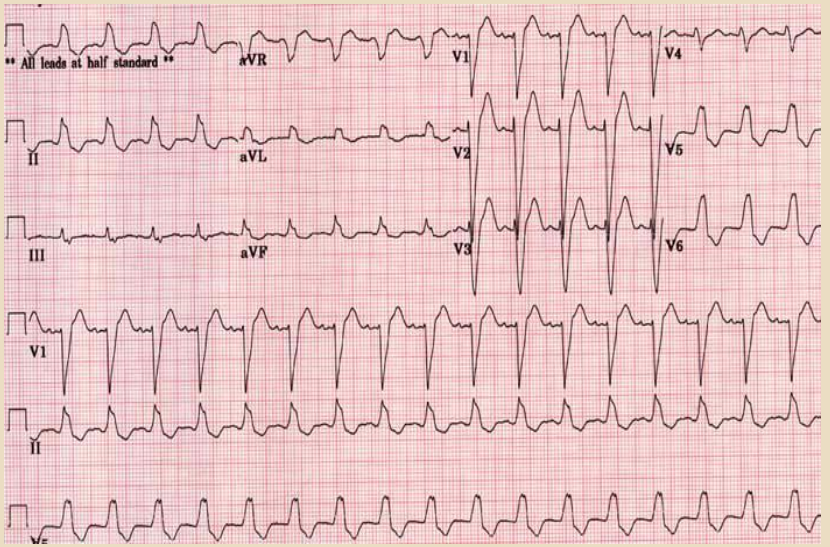
UNIPOLAR



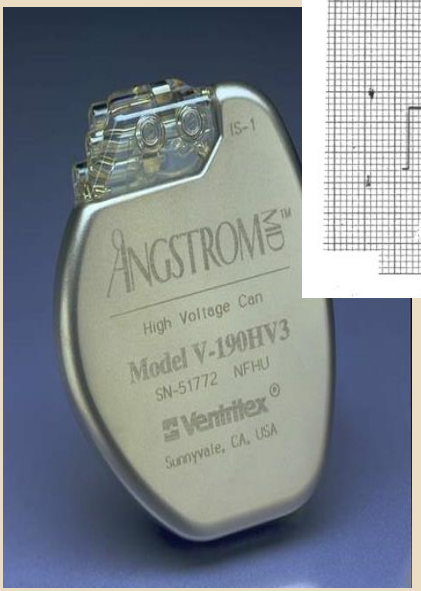


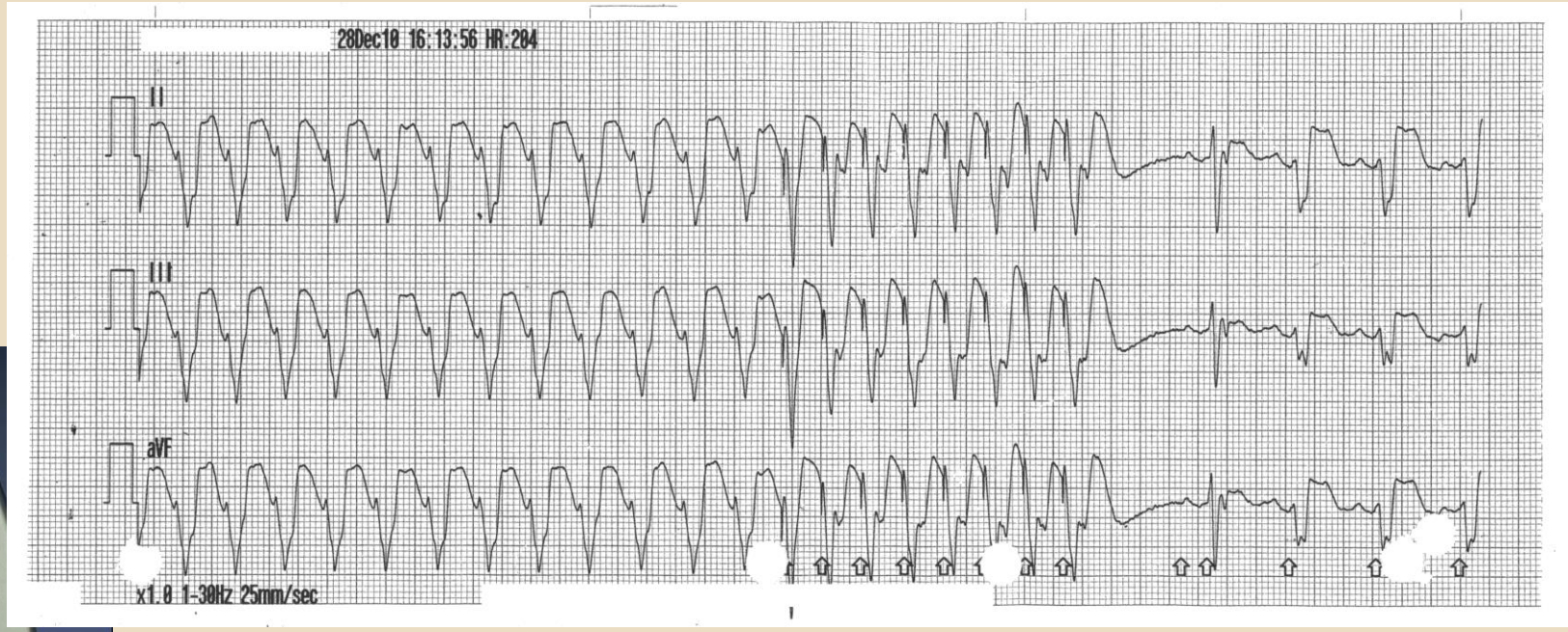
BIPOLAR



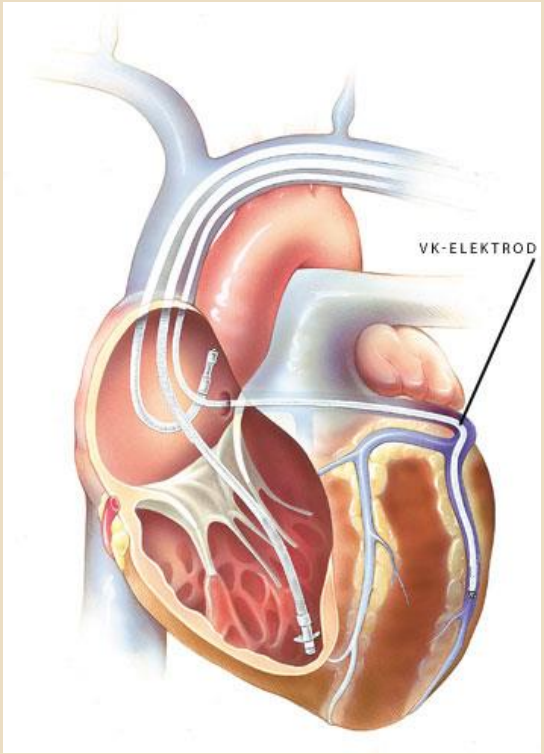


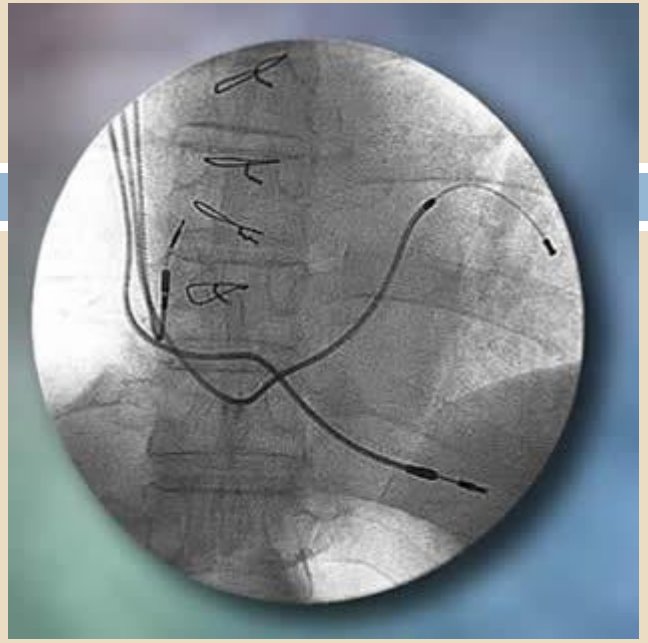
Antitachycardia pacing in ICD

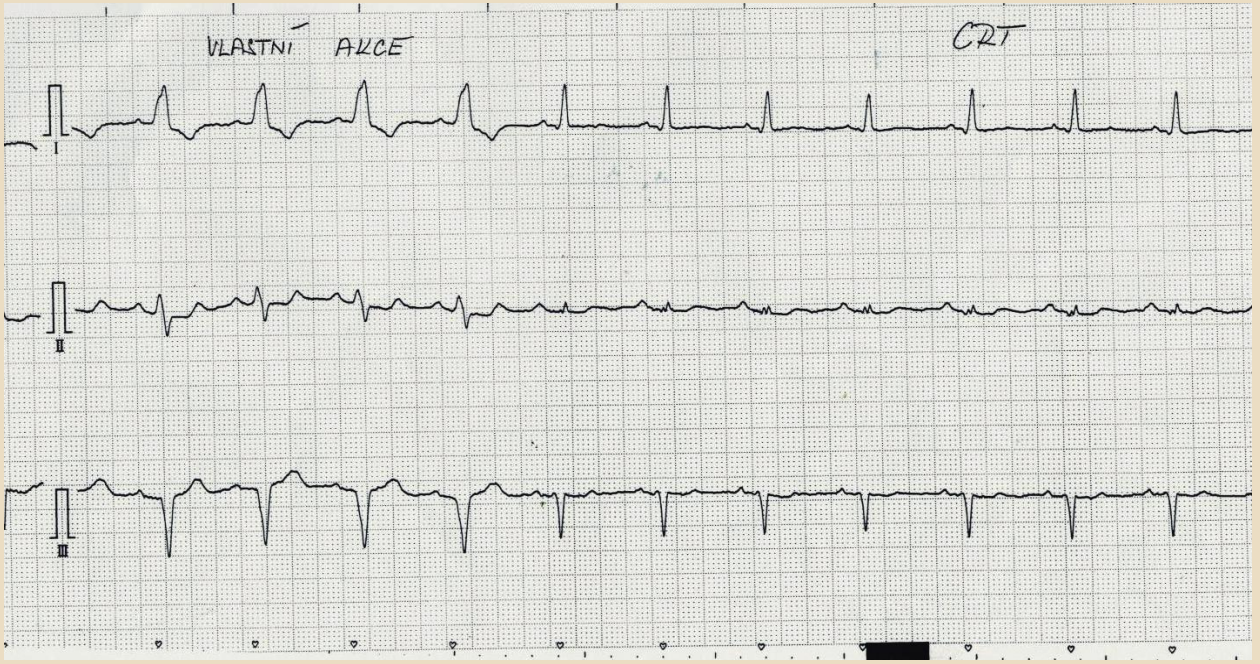




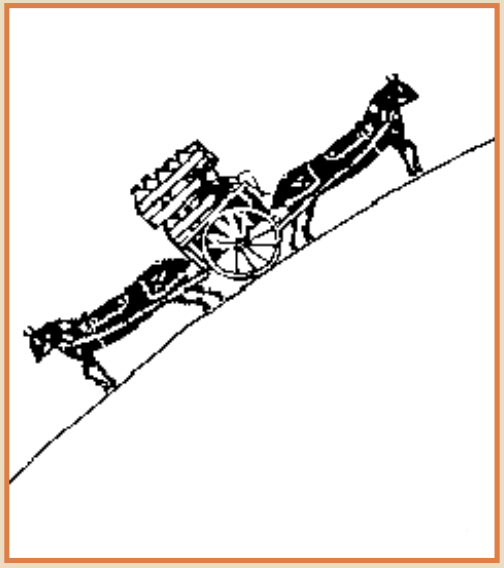
Resynchronization therapy

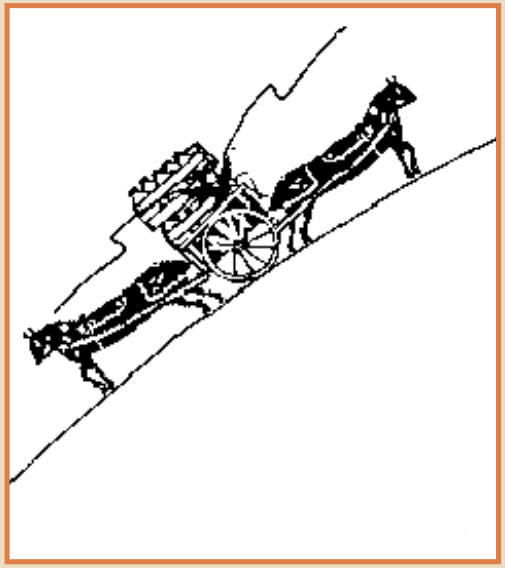


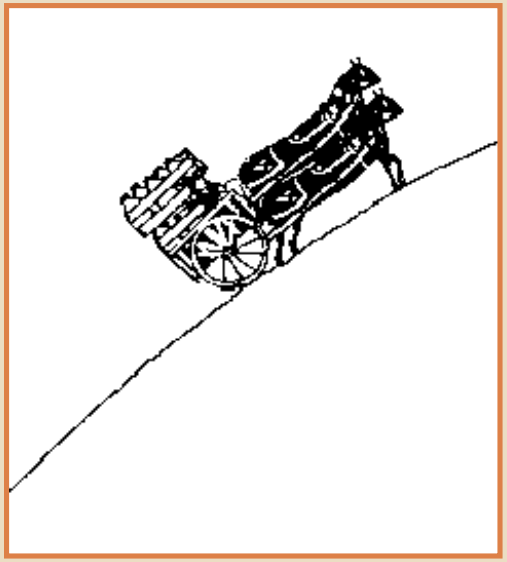




Principle of CRT



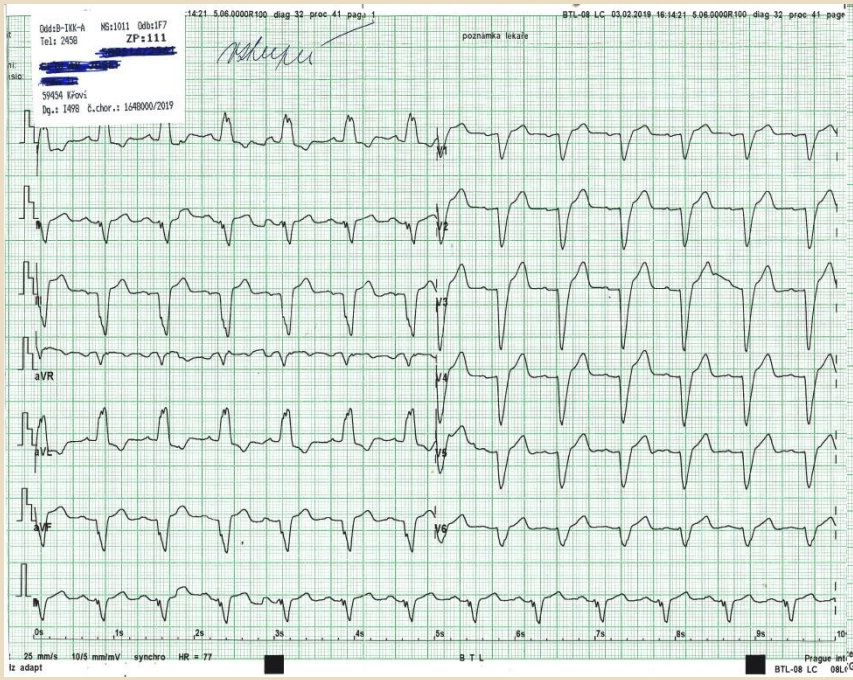




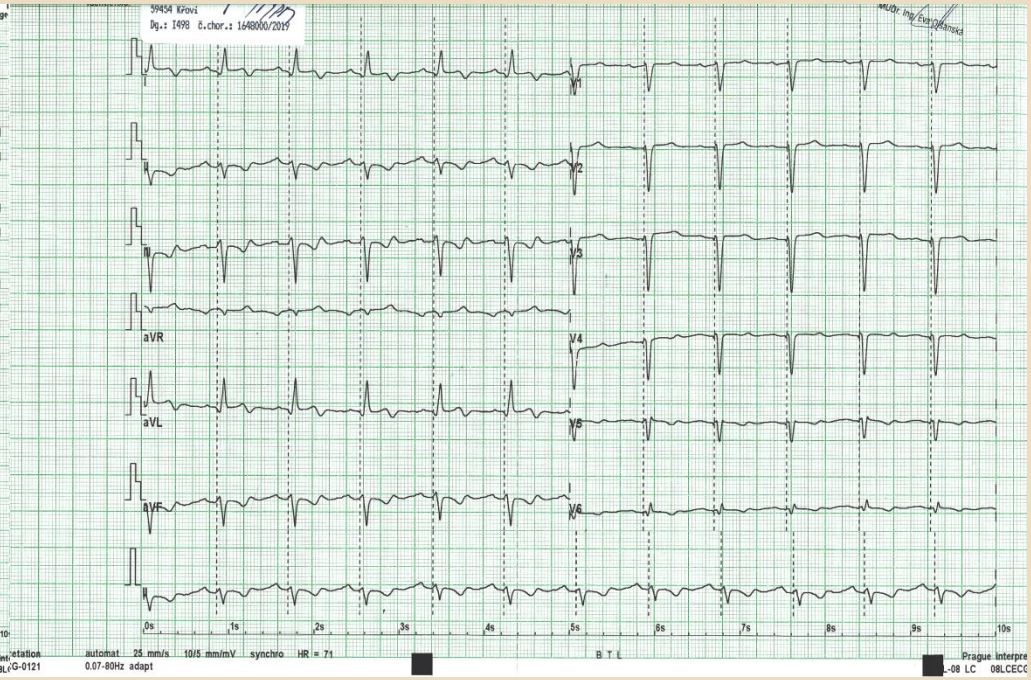
Katz AM. Am J Cardiol. 1988

Effect of resynchronization

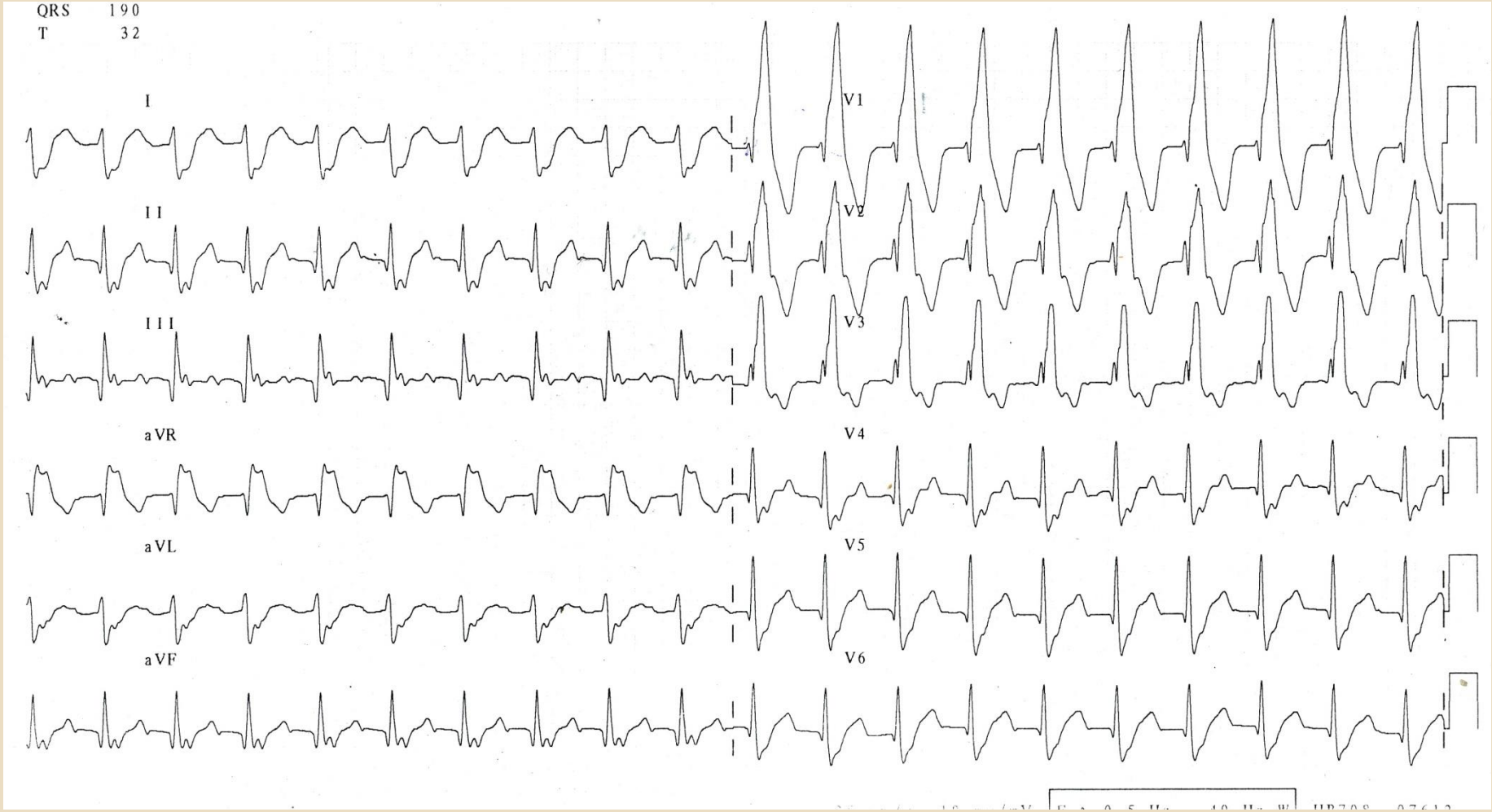
LBBB prior to CRT implantation



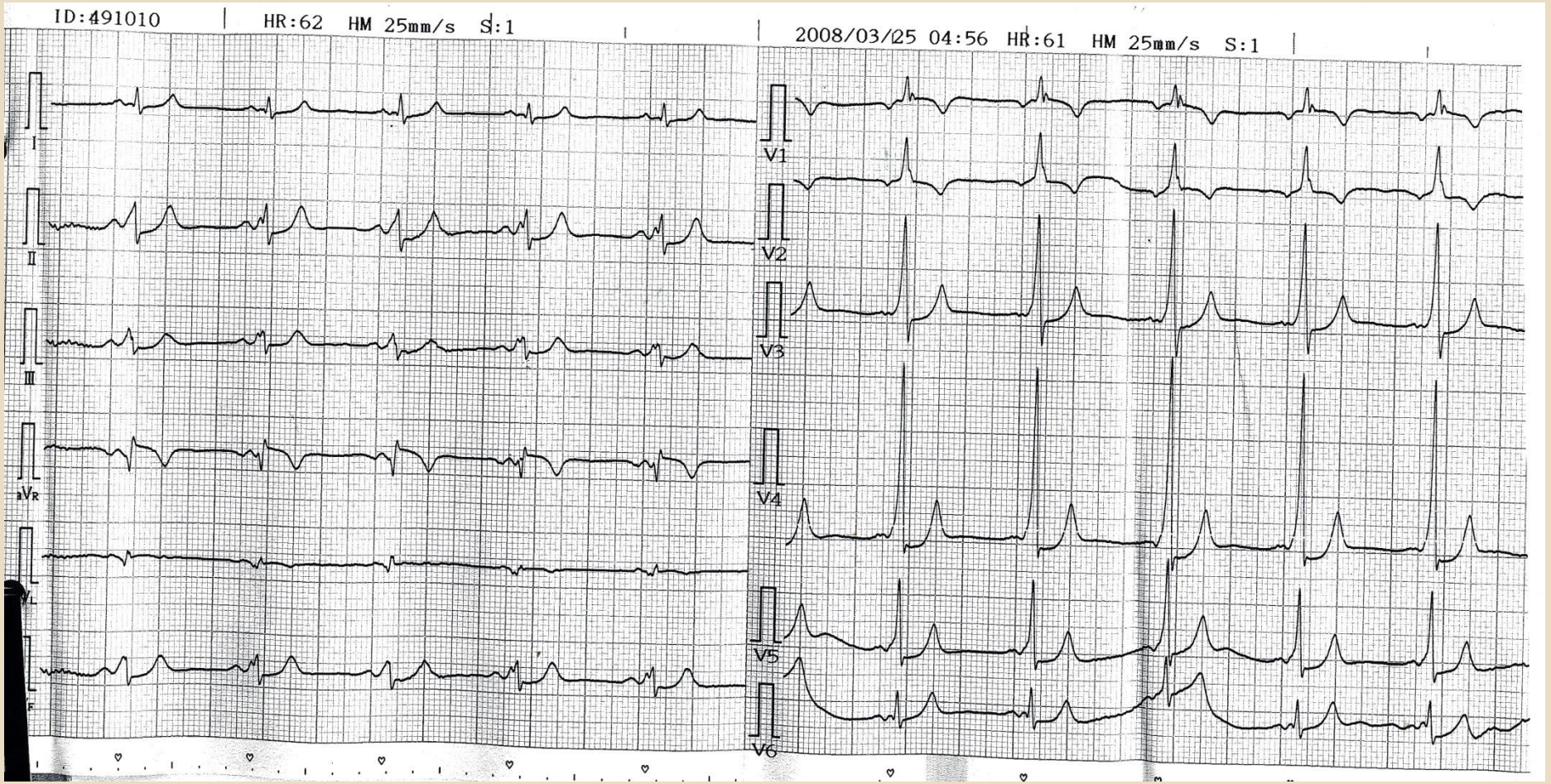
Narrow QRS after CRT implantation



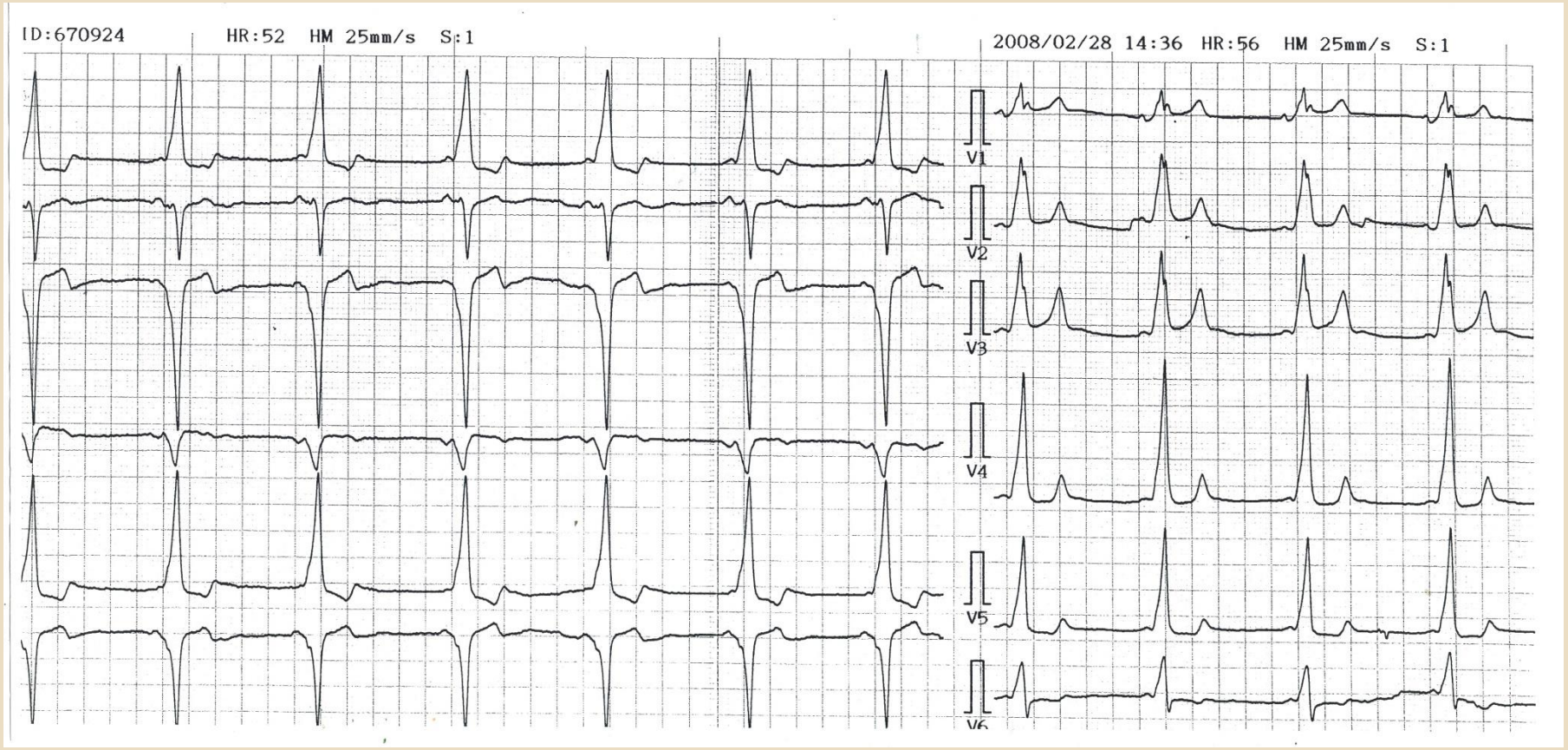
ECG 1



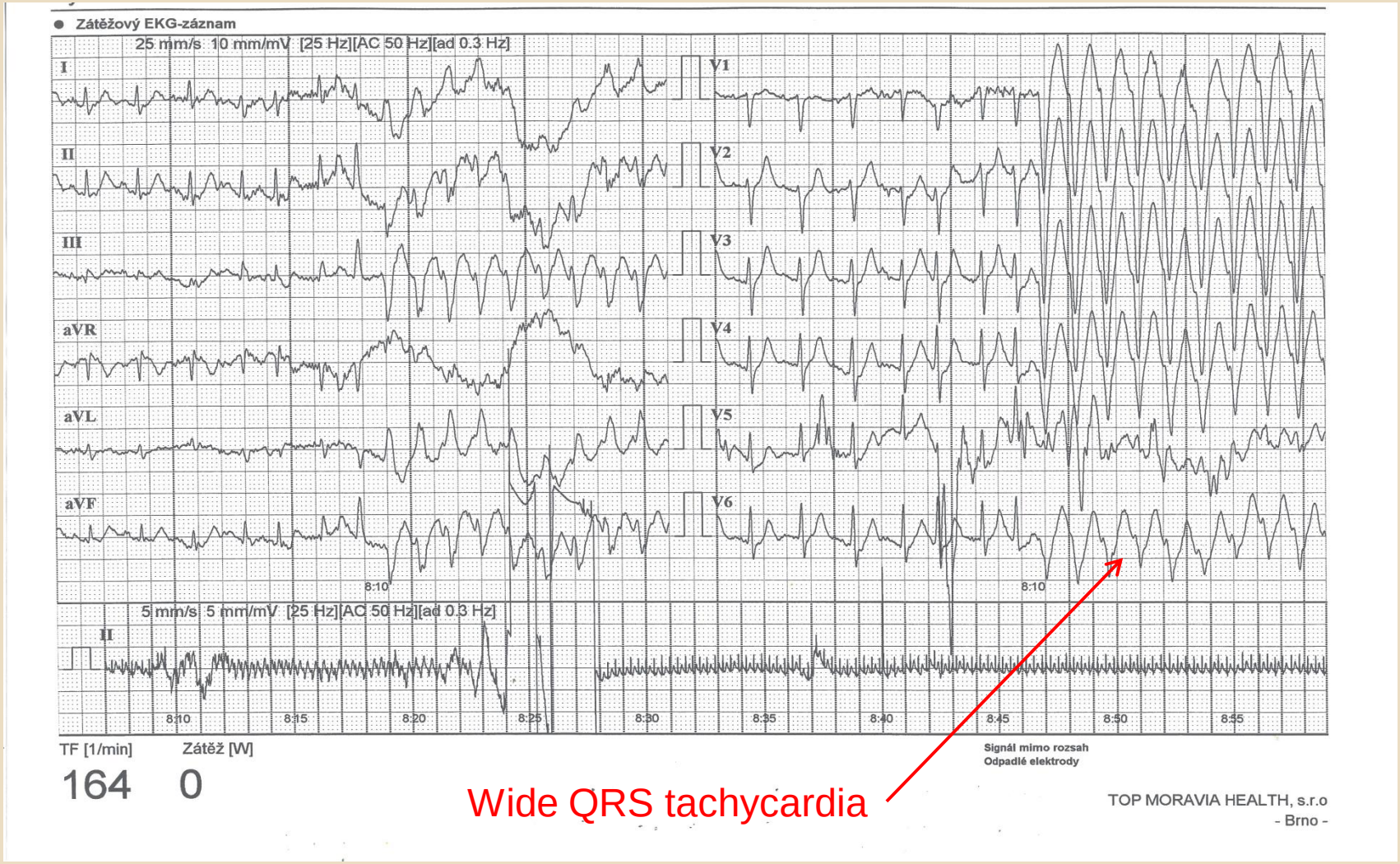
ECG 2


ID:491010
HR:62 HM 25mm/s S:1
2008/03/25 04:56 HR:61 HM 25mm/s S:1
I
II
III
aVR
V1
V2
V3
V4
V5
V6

ECG 3

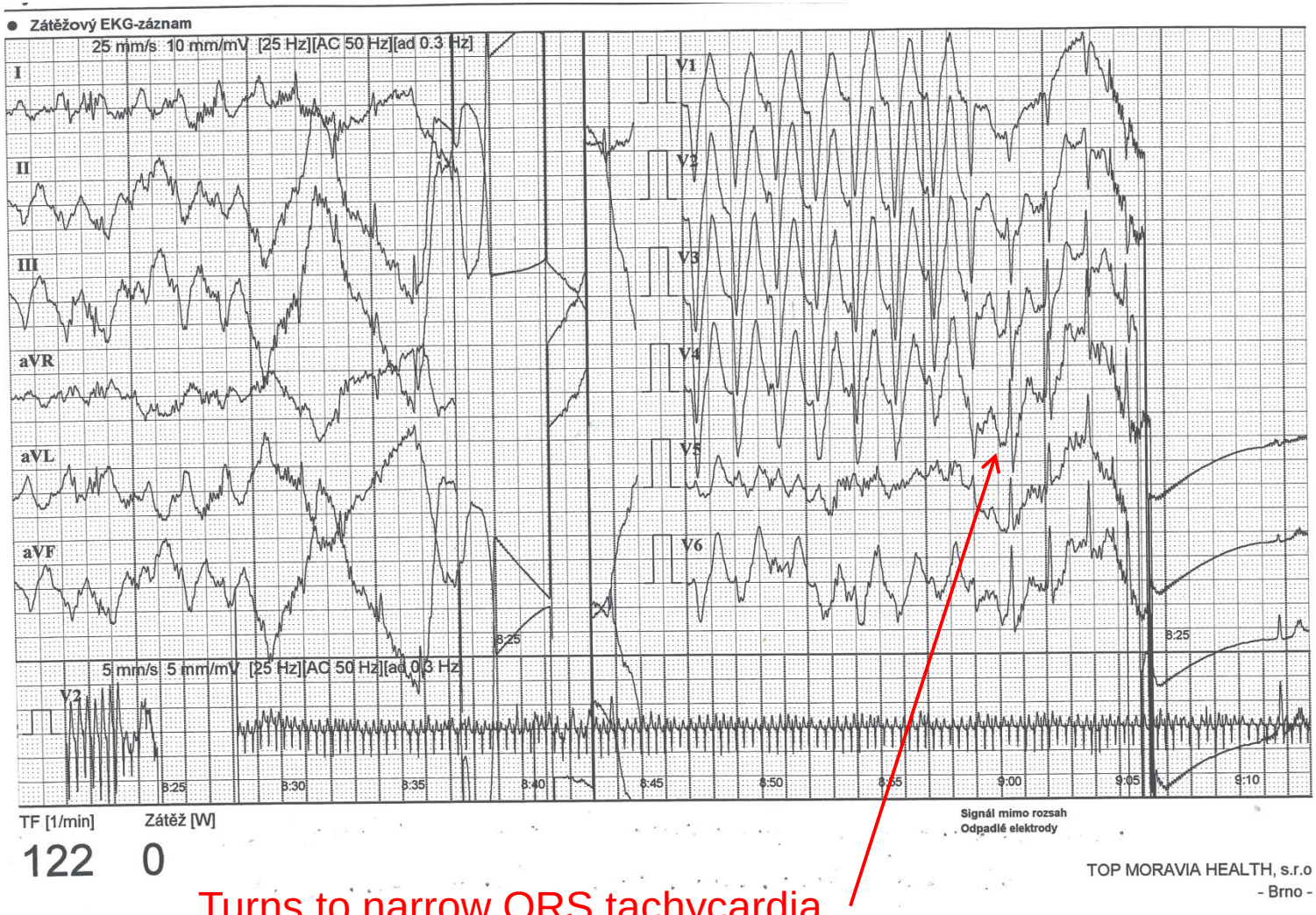

ID:670924
HR:52 HM 25mm/s S:1
2008/02/28 14:36 HR:56 HM 25mm/s S:1
V1
V2
V3
V4
V5
V6

ECG 4 Tachycardia during treadmill test



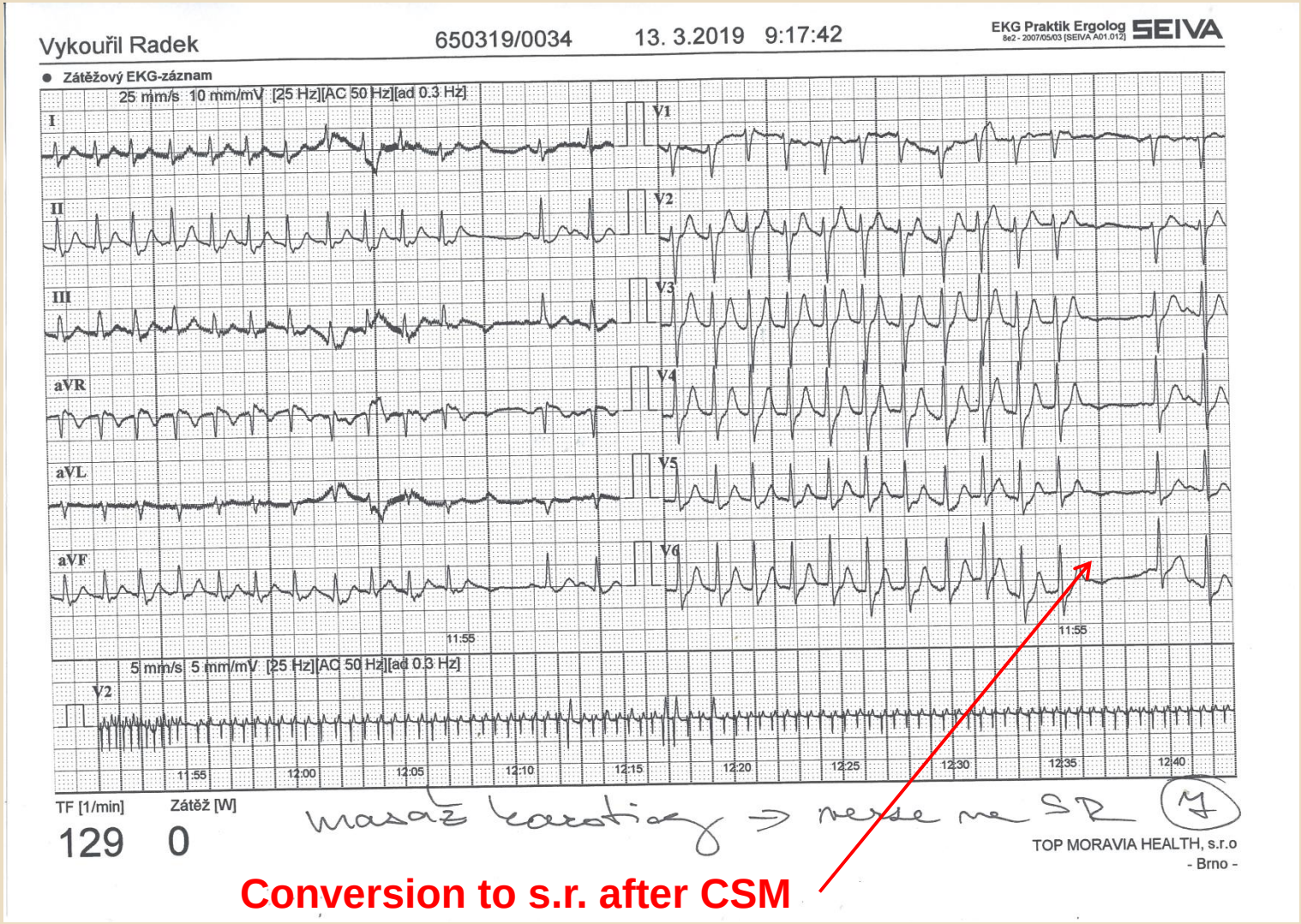
Wide QRS tachycardia

ECG 4 Tachycardia during treadmill test

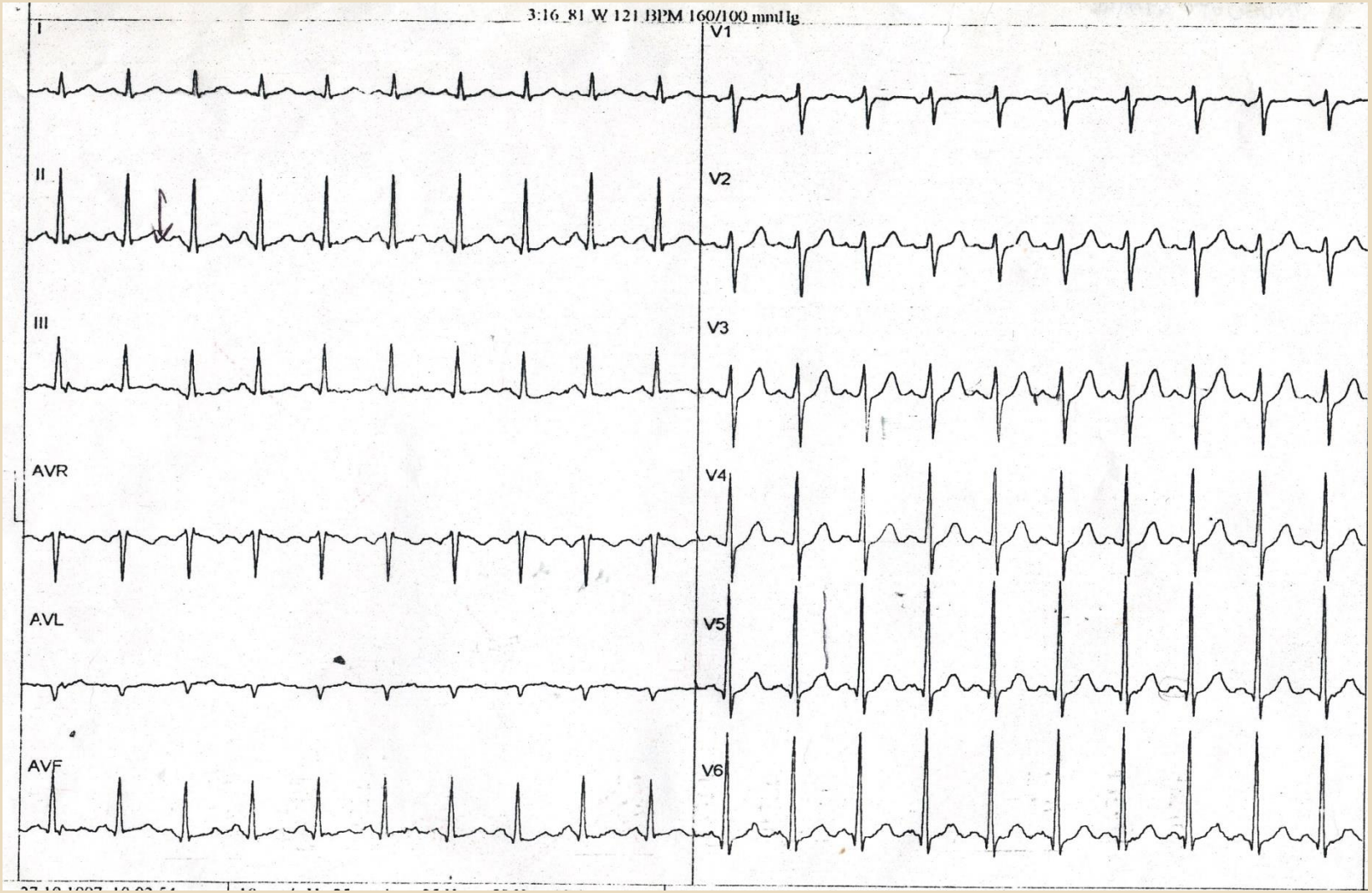


Turns to narrow QRS tachycardia

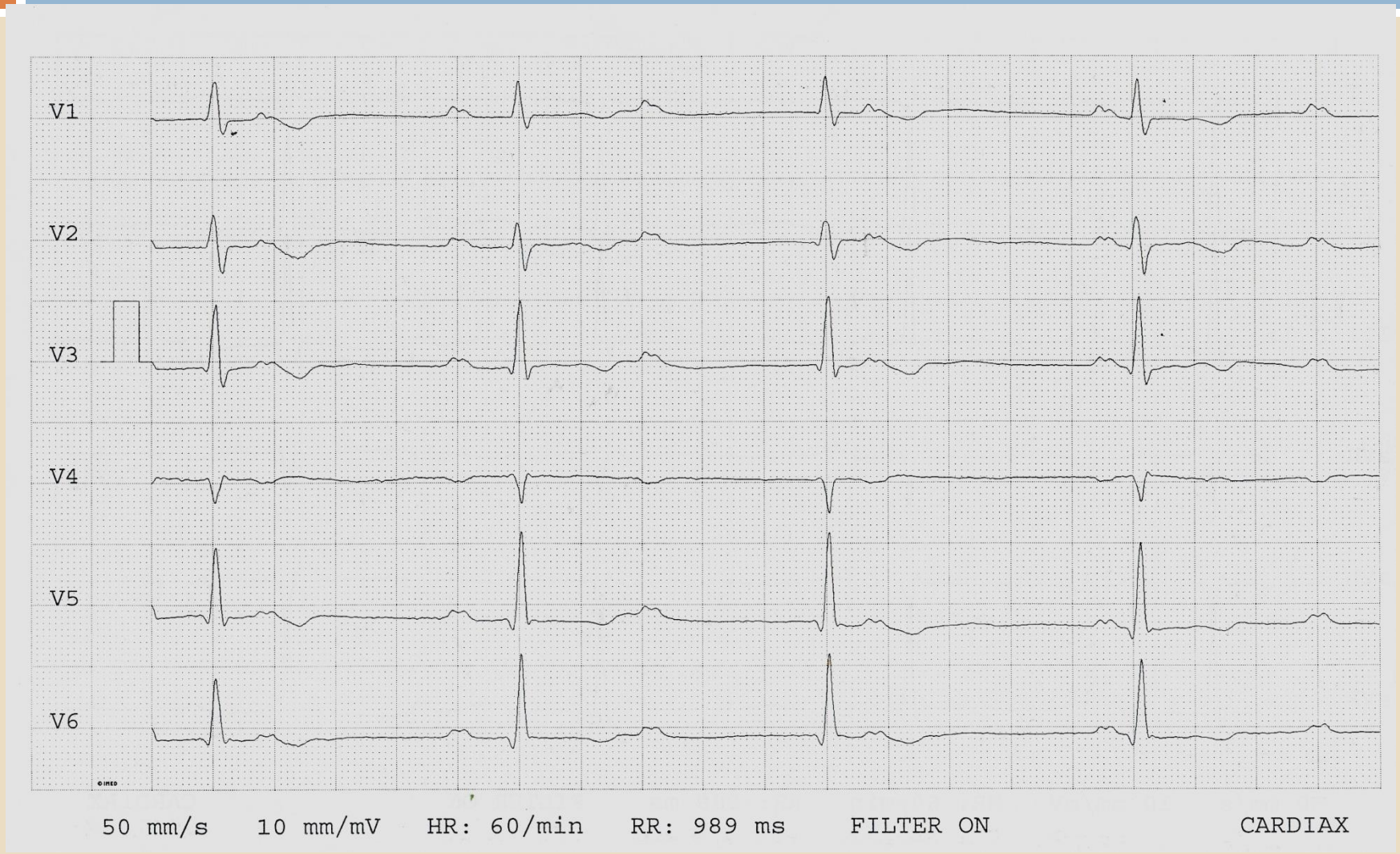
ECG 4 Tachycardia during treadmill test



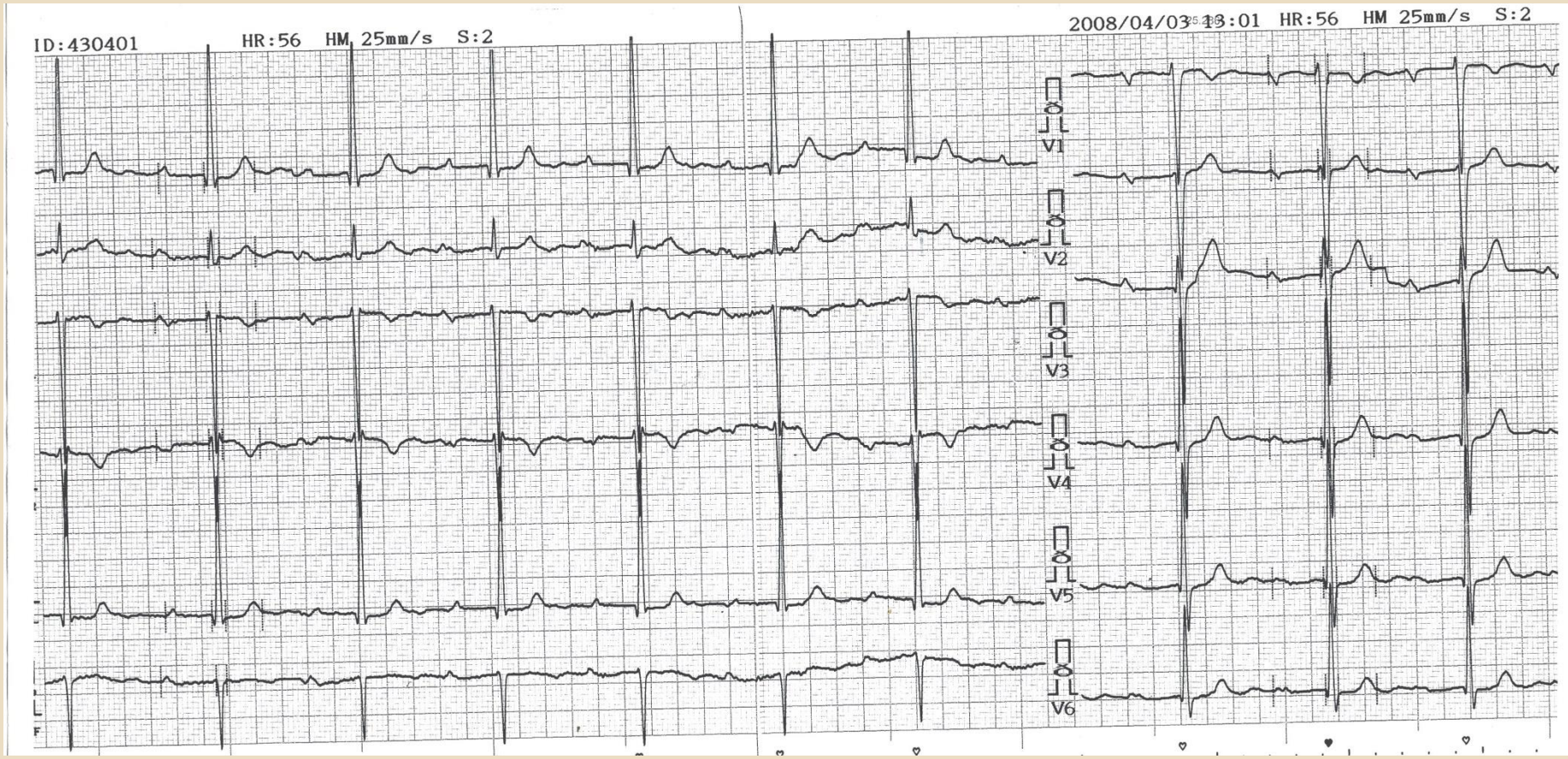
ECG 5



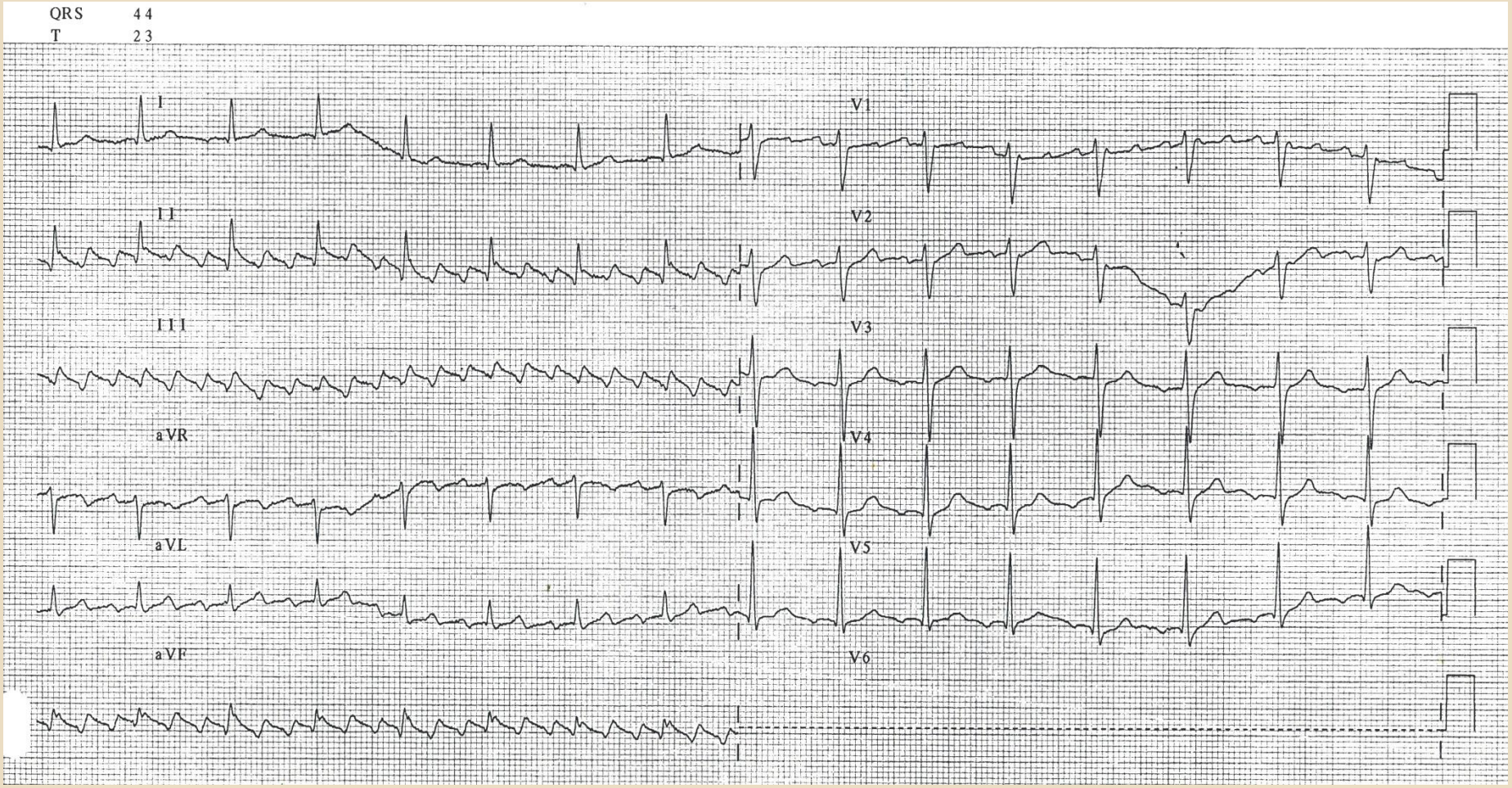
ECG 6


V1
V2
V3
V4
V5
V6
50 mm/s
10 mm/mV
HR: 60/min
RR: 989 ms
FILTER ON
CARDIAX

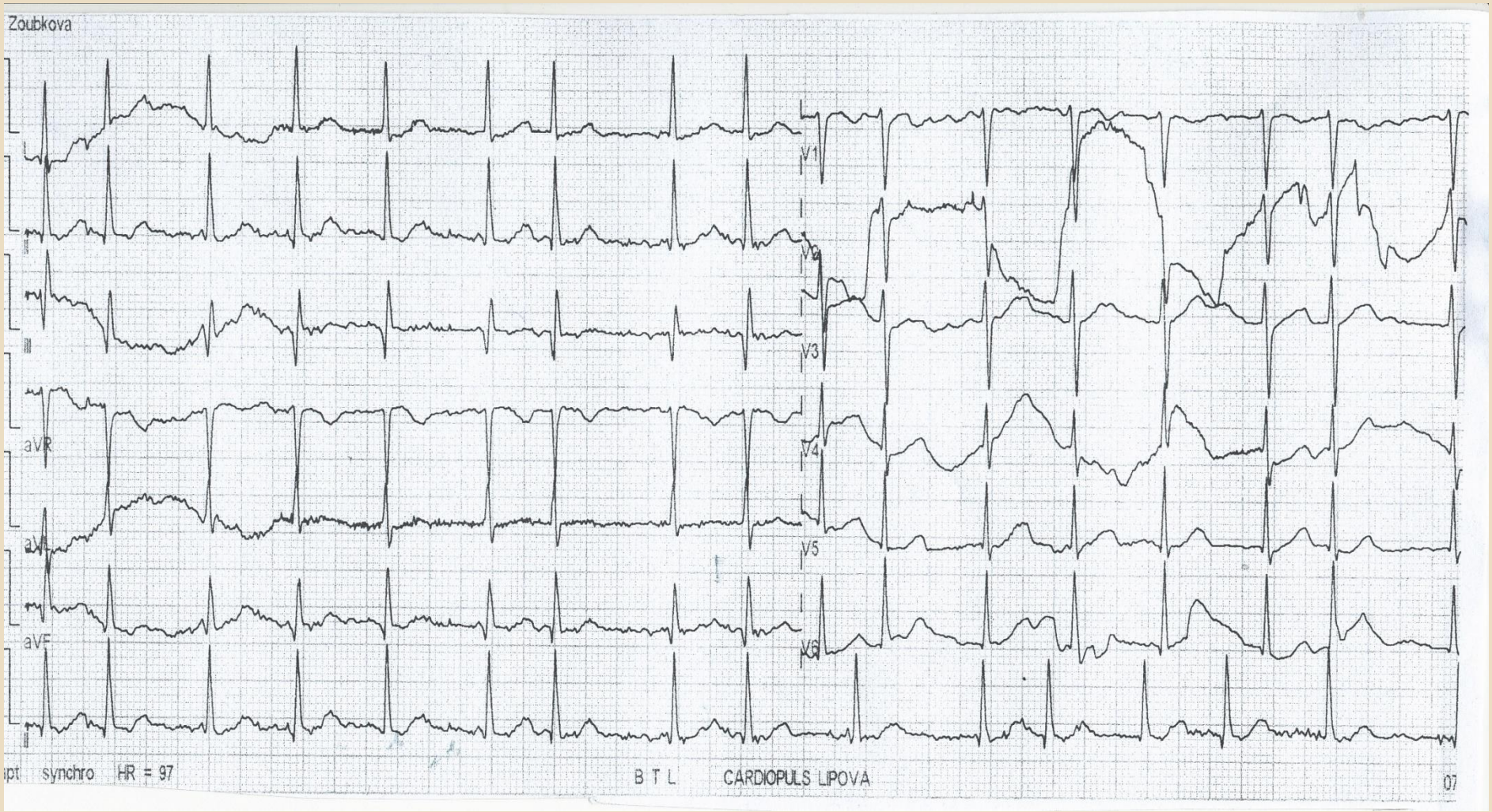
ECG 7


ID:430401
HR:56 HM 25mm/s S:2
2008/04/03 13:01 HR:56 HM 25mm/s S:2
V1
V2
V3
V4
V5
V6

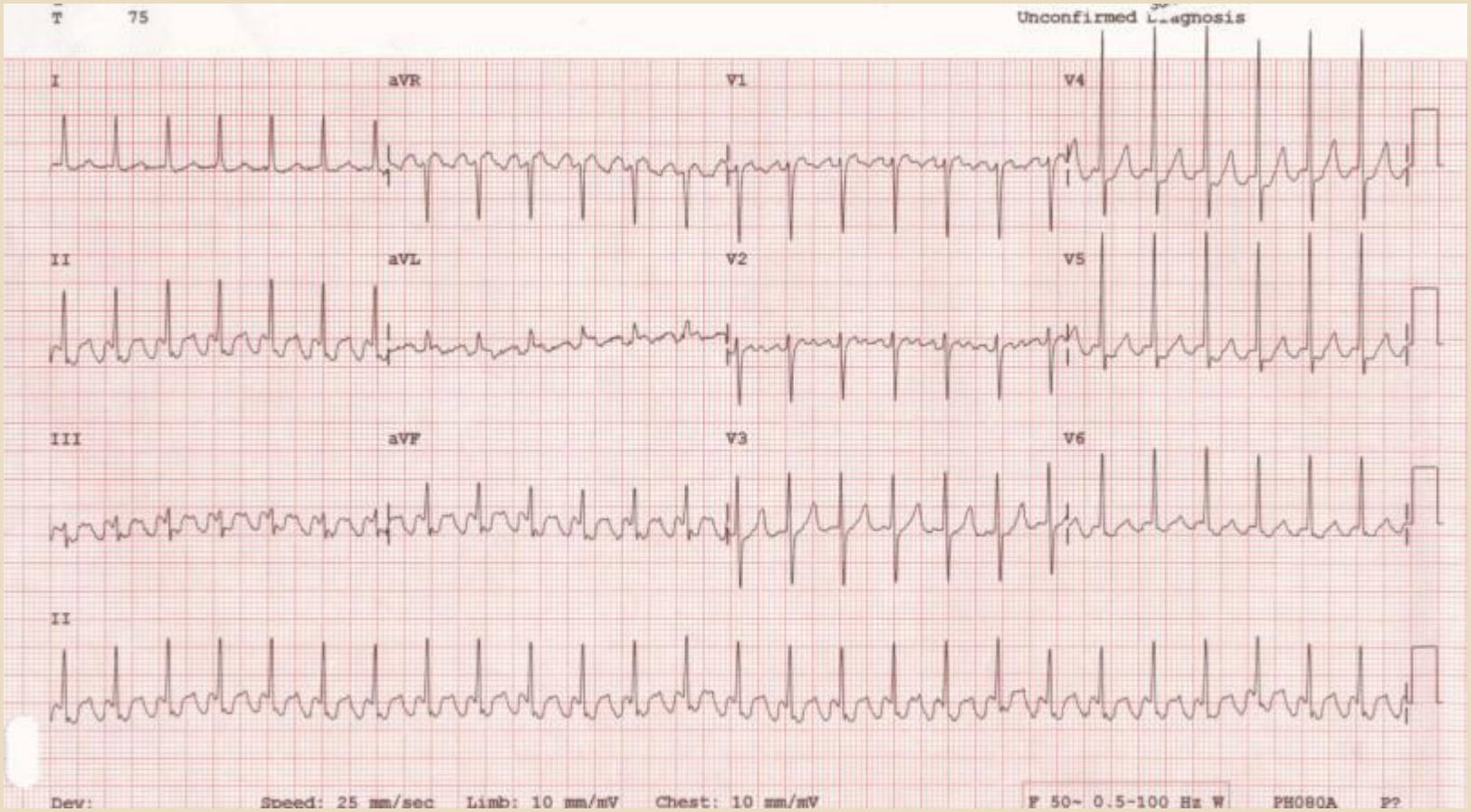
ECG 8



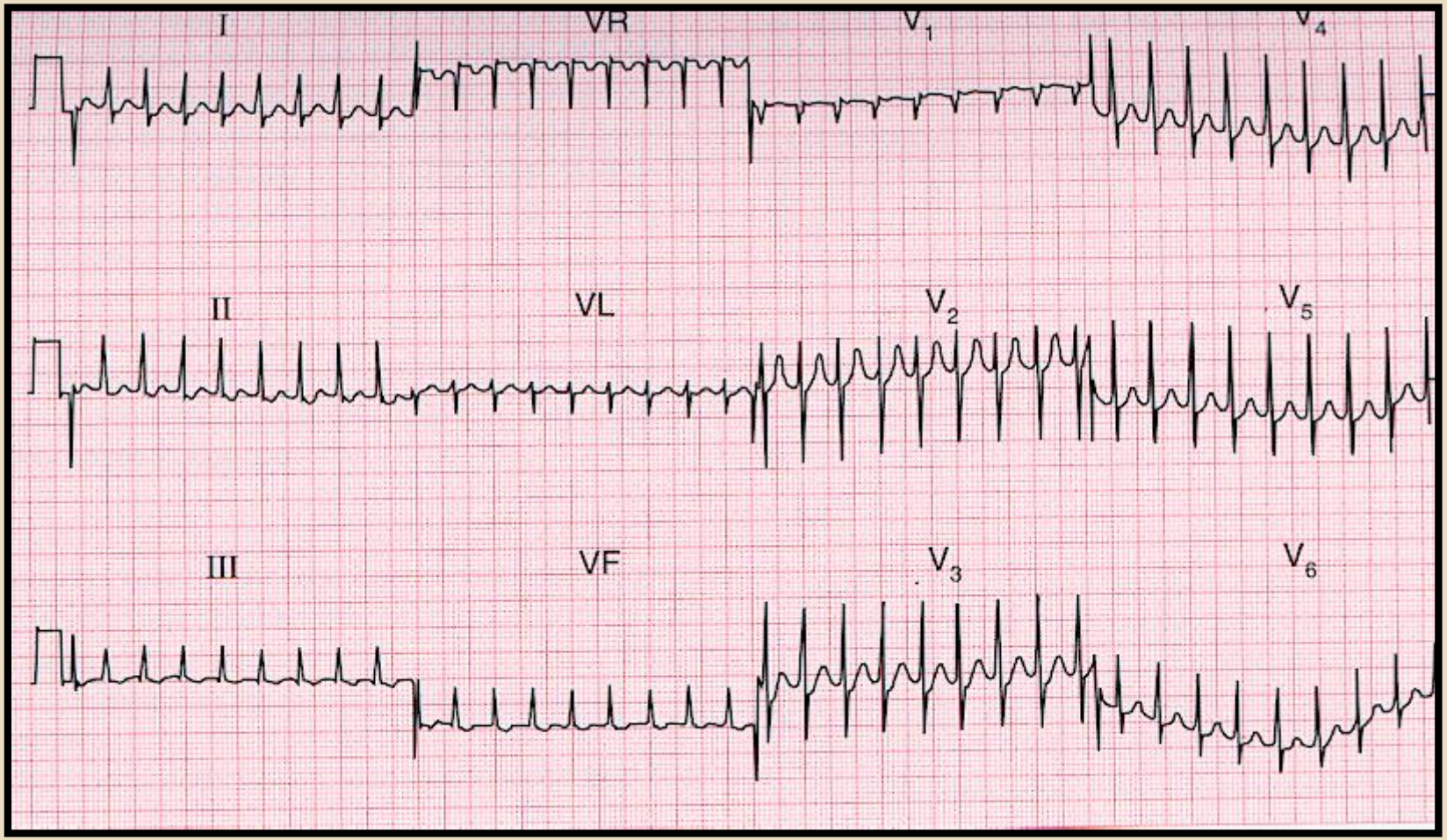
ECG 9


Zoubkova
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
synchro HR = 97
B T L CARDIOPULS LIPOVA

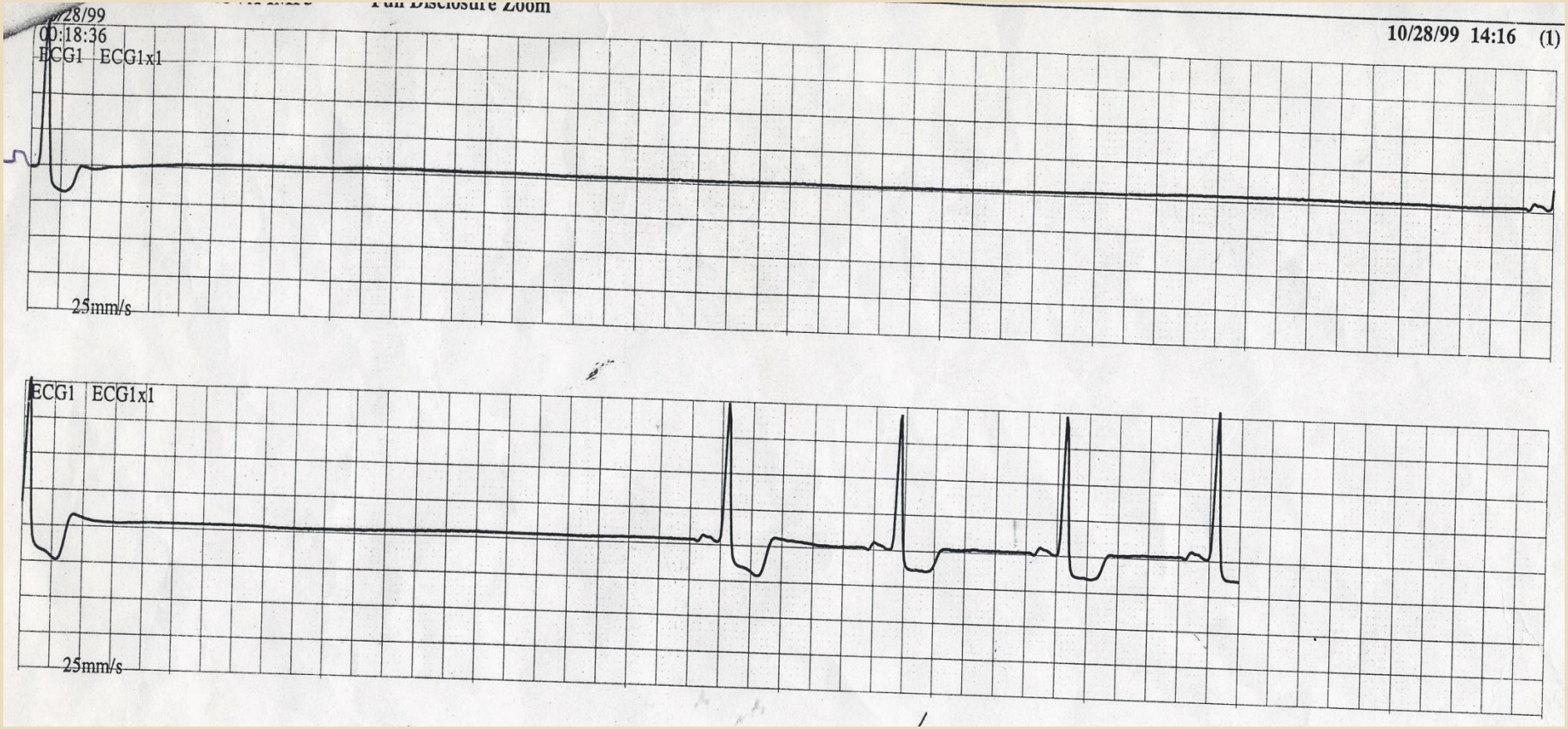
ECG 10


T 75
Unconfirmed Diagnosis
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Dev:
Speed: 25 mm/sec
Limb: 10 mm/mV
Chest: 10 mm/mV
F 50~ 0.5-100 Hz W
PH080A
P?

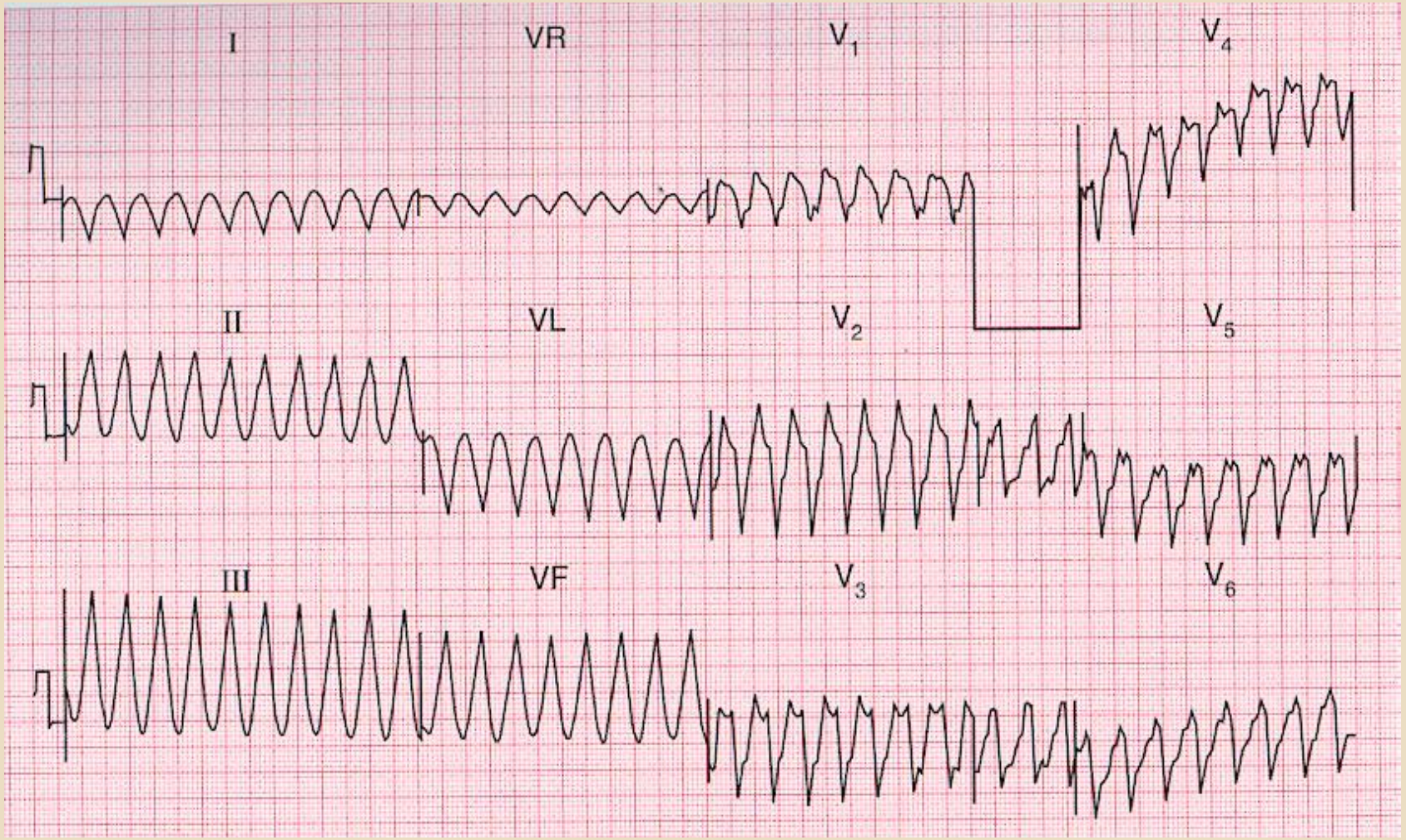
ECG 11



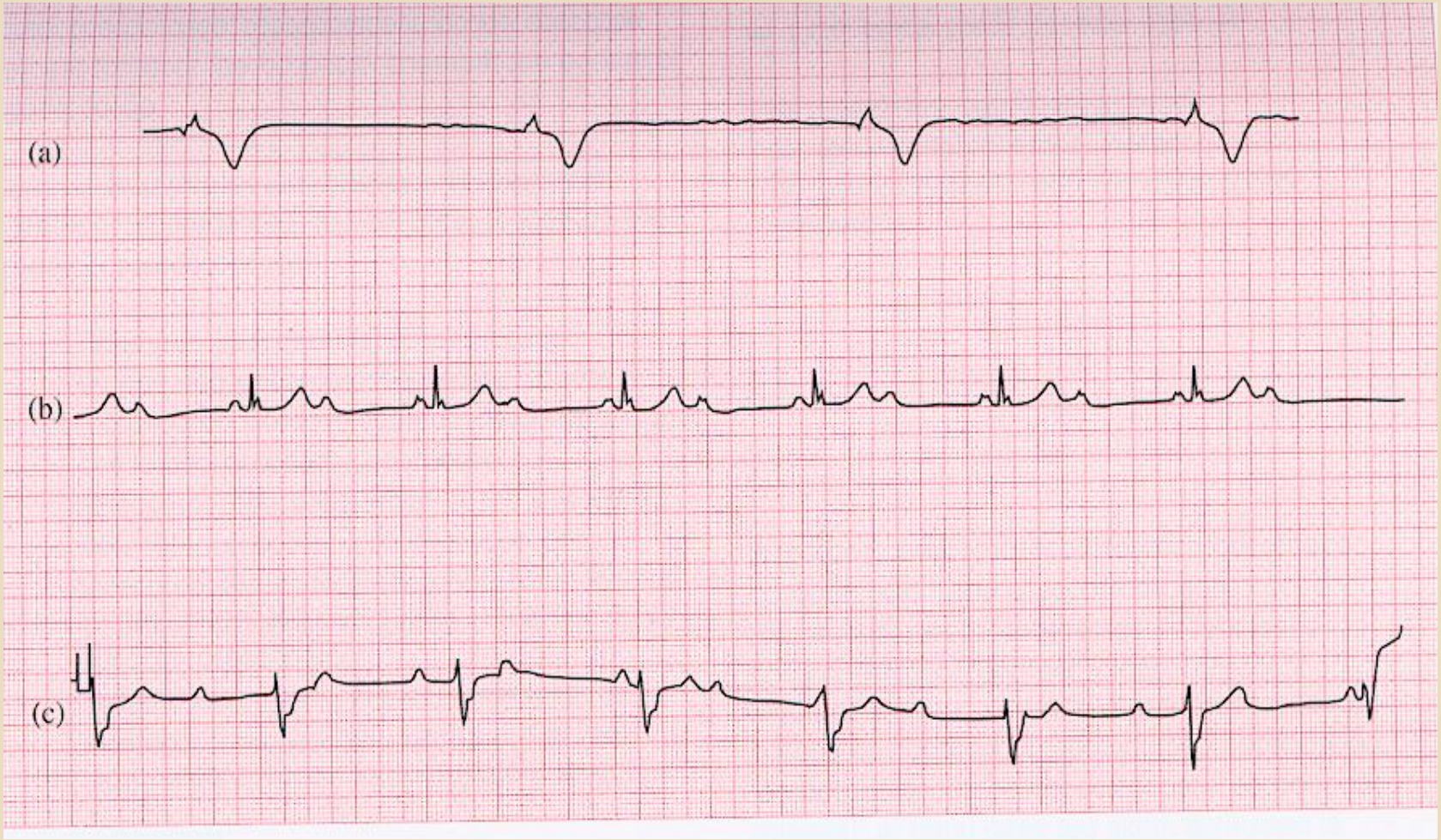
ECG 12



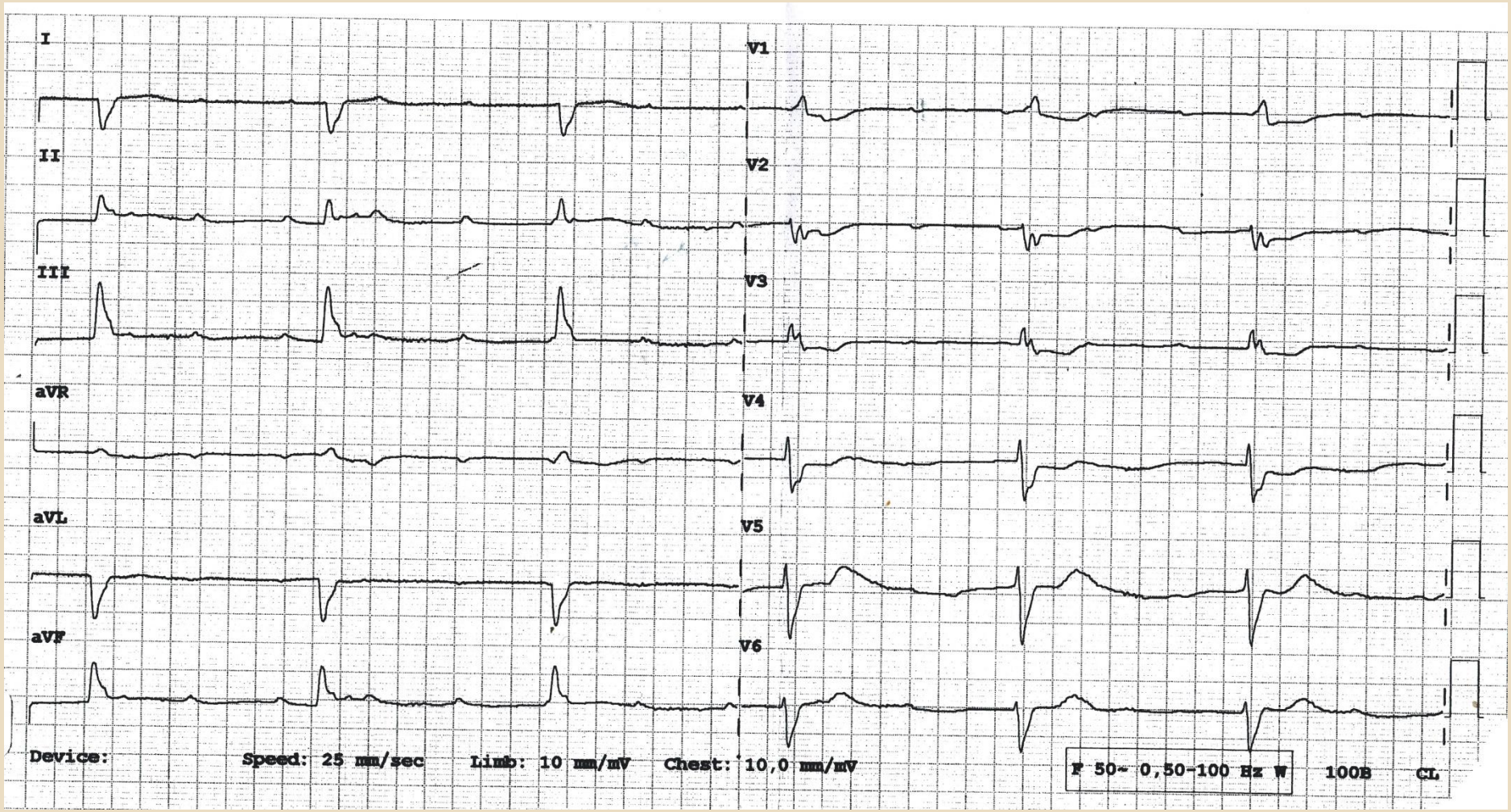
ECG 13



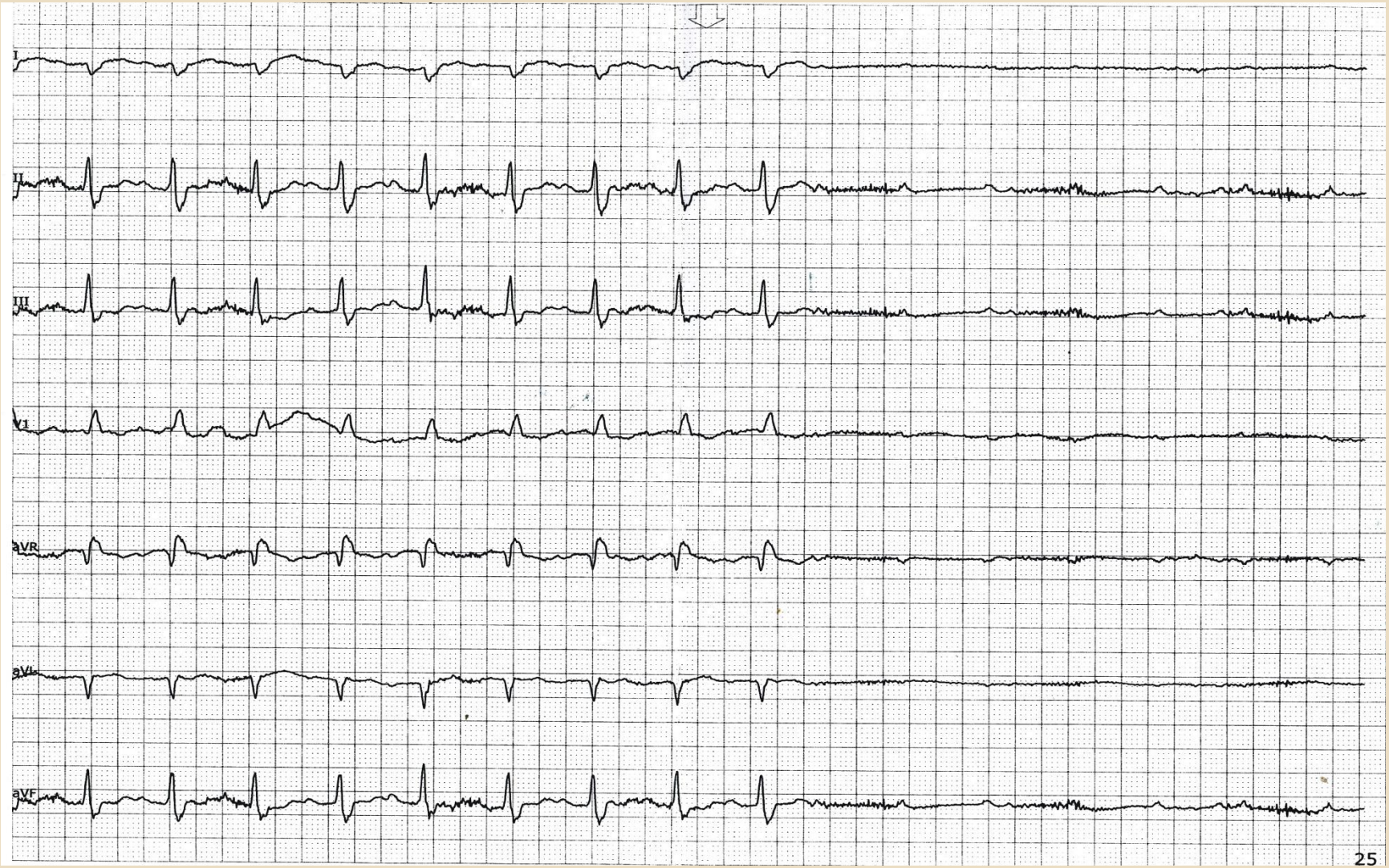
ECG 14



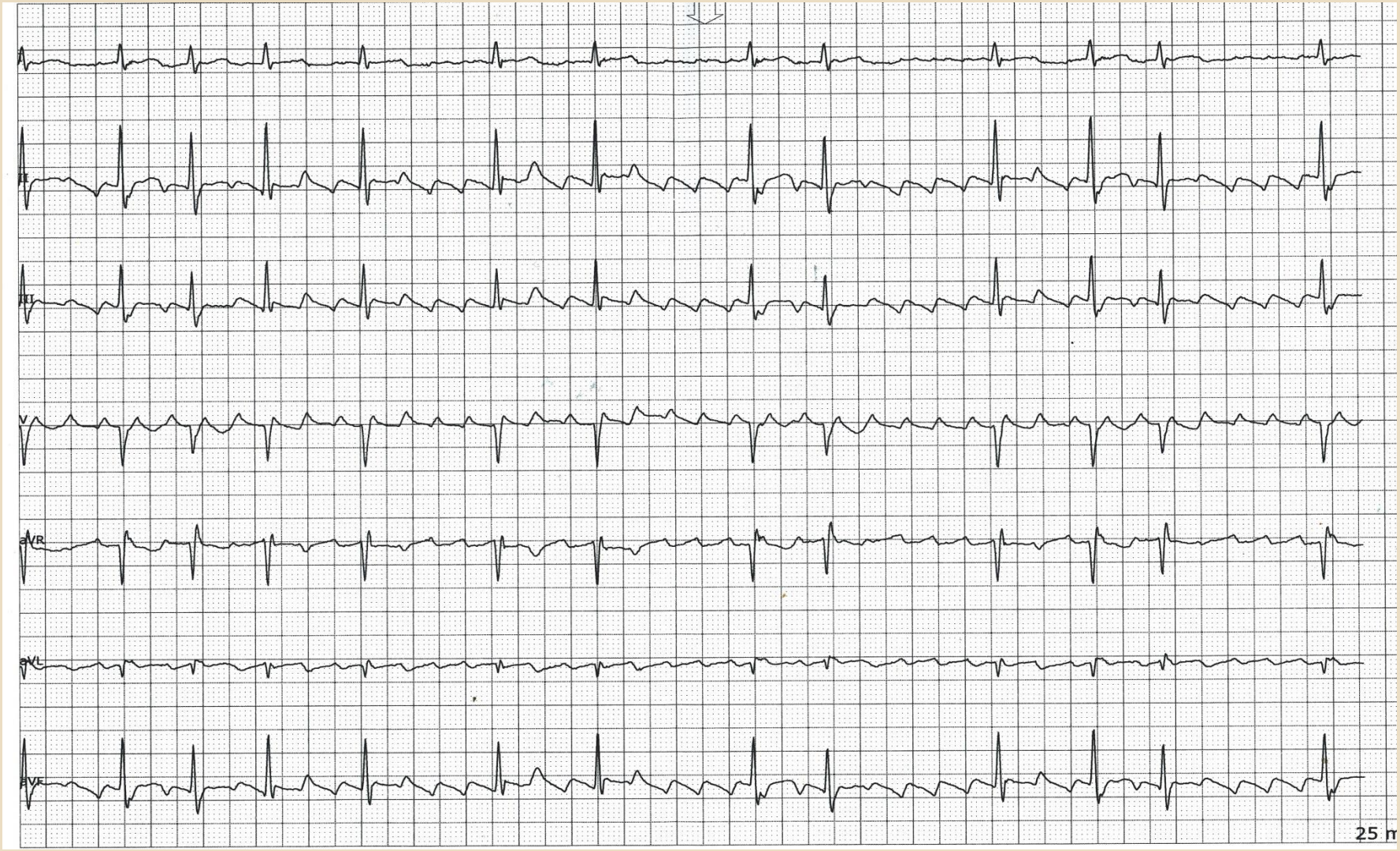
ECG 15


I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
Device:
Speed: 25 mm/sec
Limb: 10 mm/mV
Chest: 10,0 mm/mV
F 50~ 0,50-100 Hz W
100B
CL

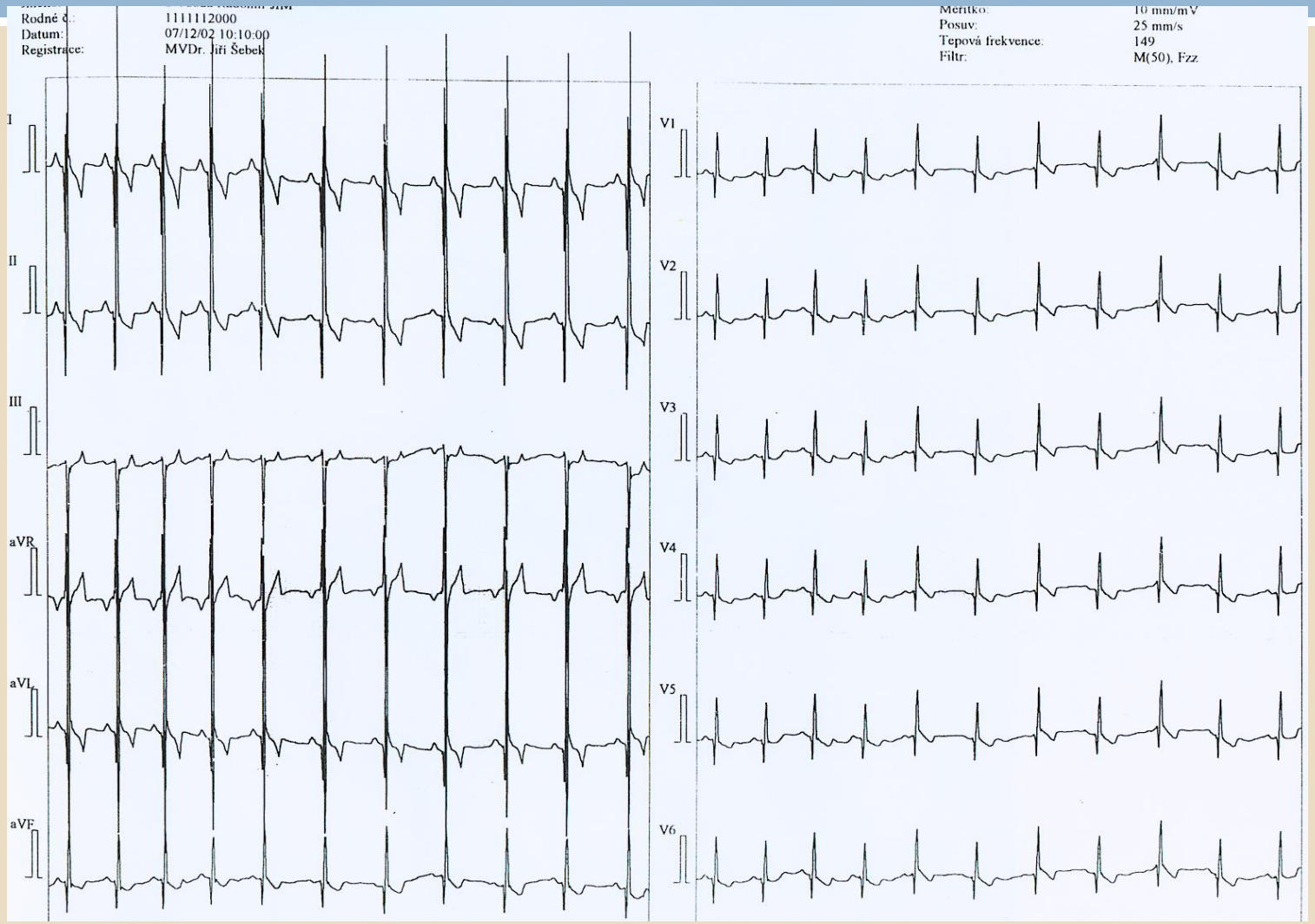
ECG 16



ECG 17



ECG 18


Rodné č.: 1111112000
Datum: 07/12/02 10:10:00
Registrace: MVDr. Jiří Šebek
Měřítko: 10 mm/mV
Posuv: 25 mm/s
Tepová frekvence: 149
Filtr: M(50), Fzz
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6


FN BRNO