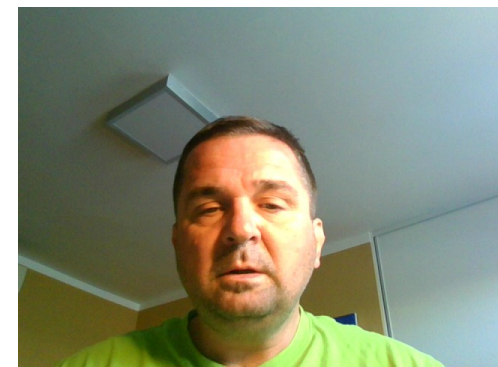
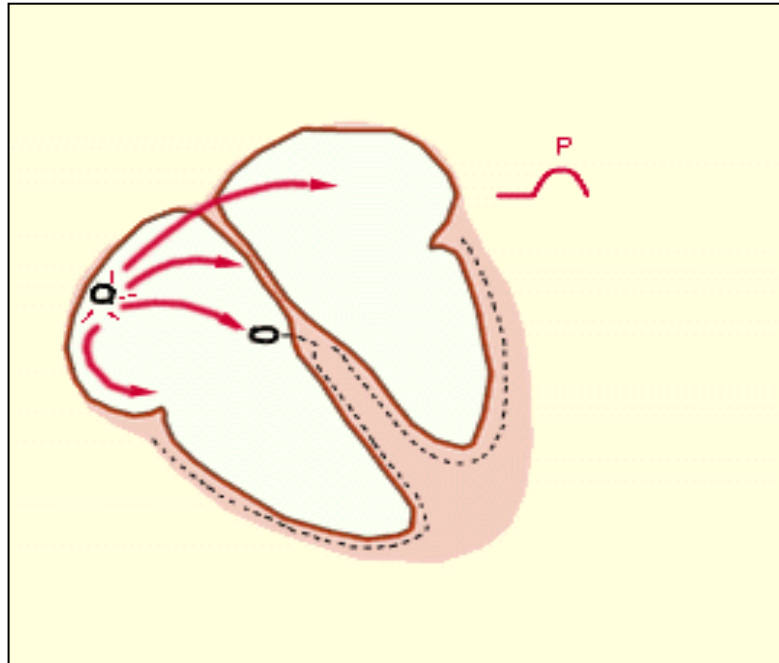


# Bradycardia, pacing

J. Vlašínová  
L. Křivan

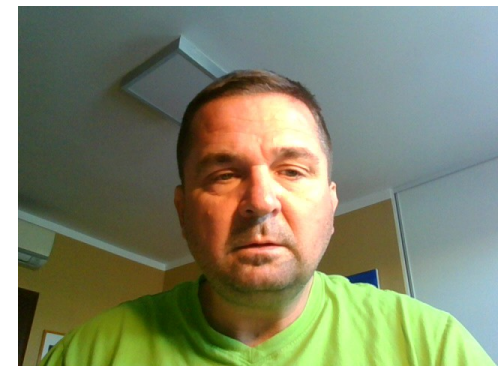
# Bradycardia

- Bradycardia = any heart rate  $< 50$  bpm.
- SA node disorder
- AV node disorder



# Sinus node dysfunction

- Sinus bradycardia
- Sinus node arrest
- SSSy - tachy – brady form
- Chronotropic incompetence

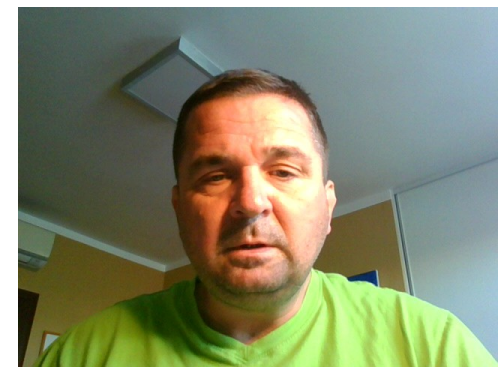
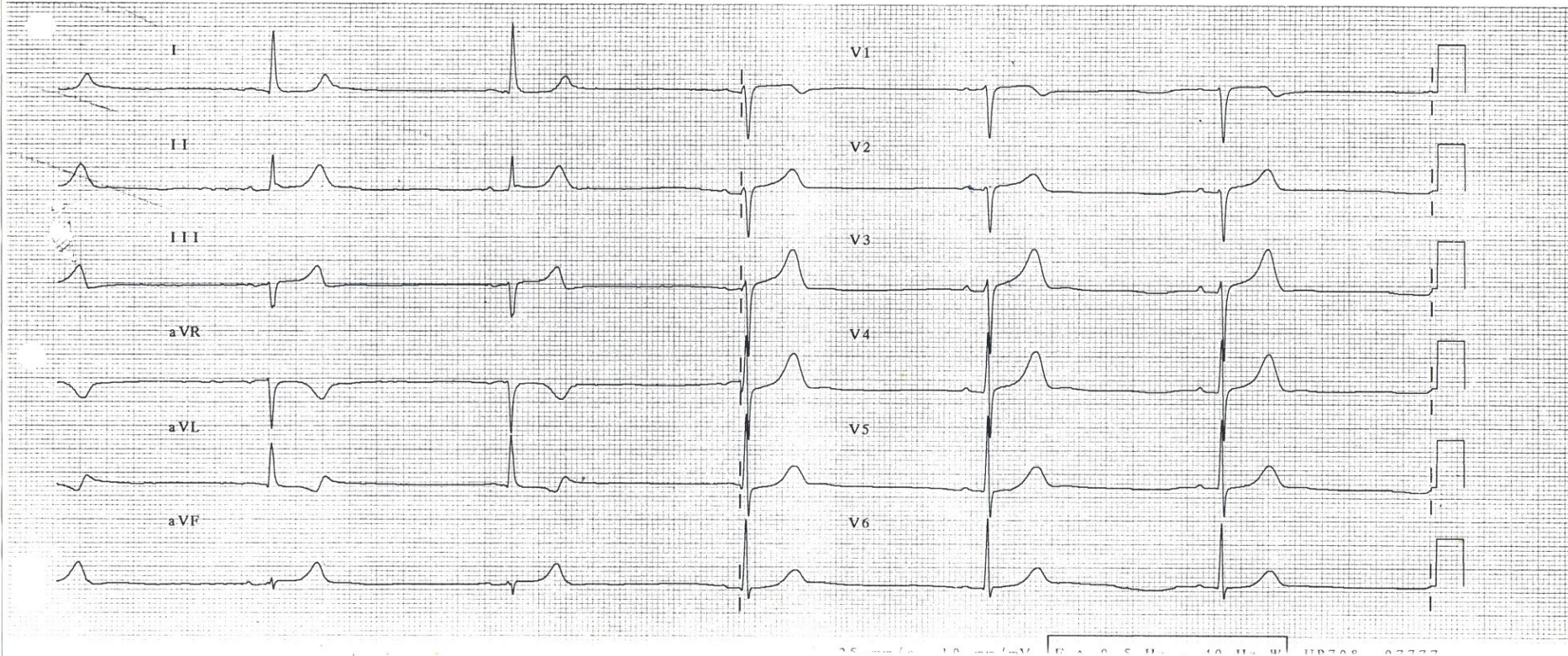


# Sinus bradycardia

Rate 34  
PR 169  
QRSD 94  
QT 574  
QTc 432

--Axis--  
P -7  
QRS 3  
T 67

Operator: MW



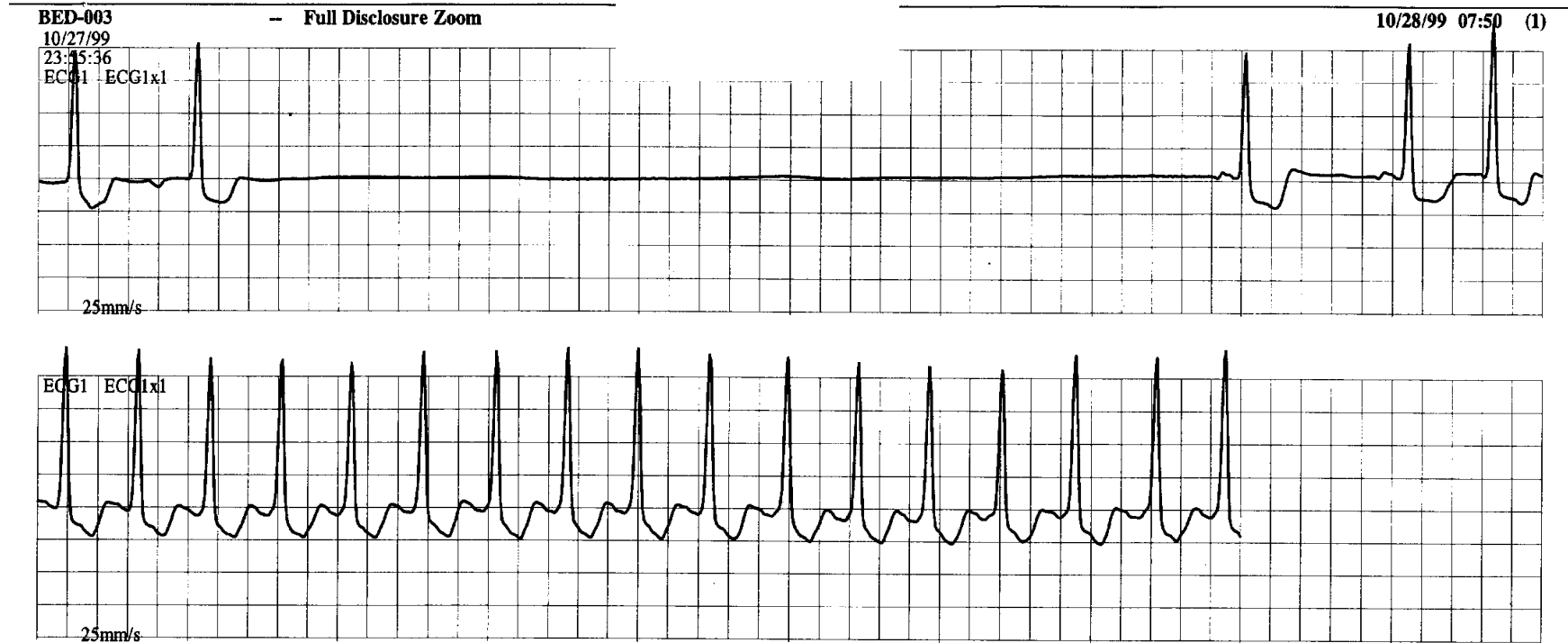
## Sinus node arrest



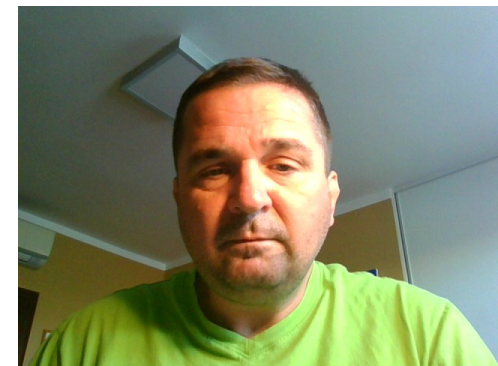
Failure of SN discharge – absence of atrial depolarization



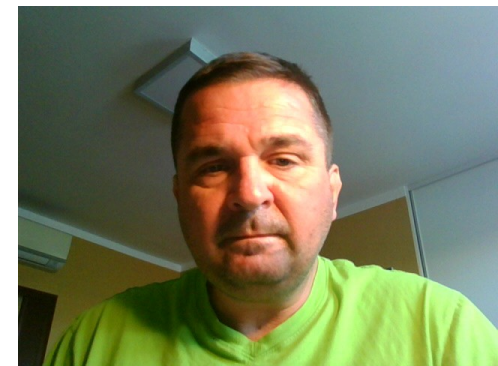
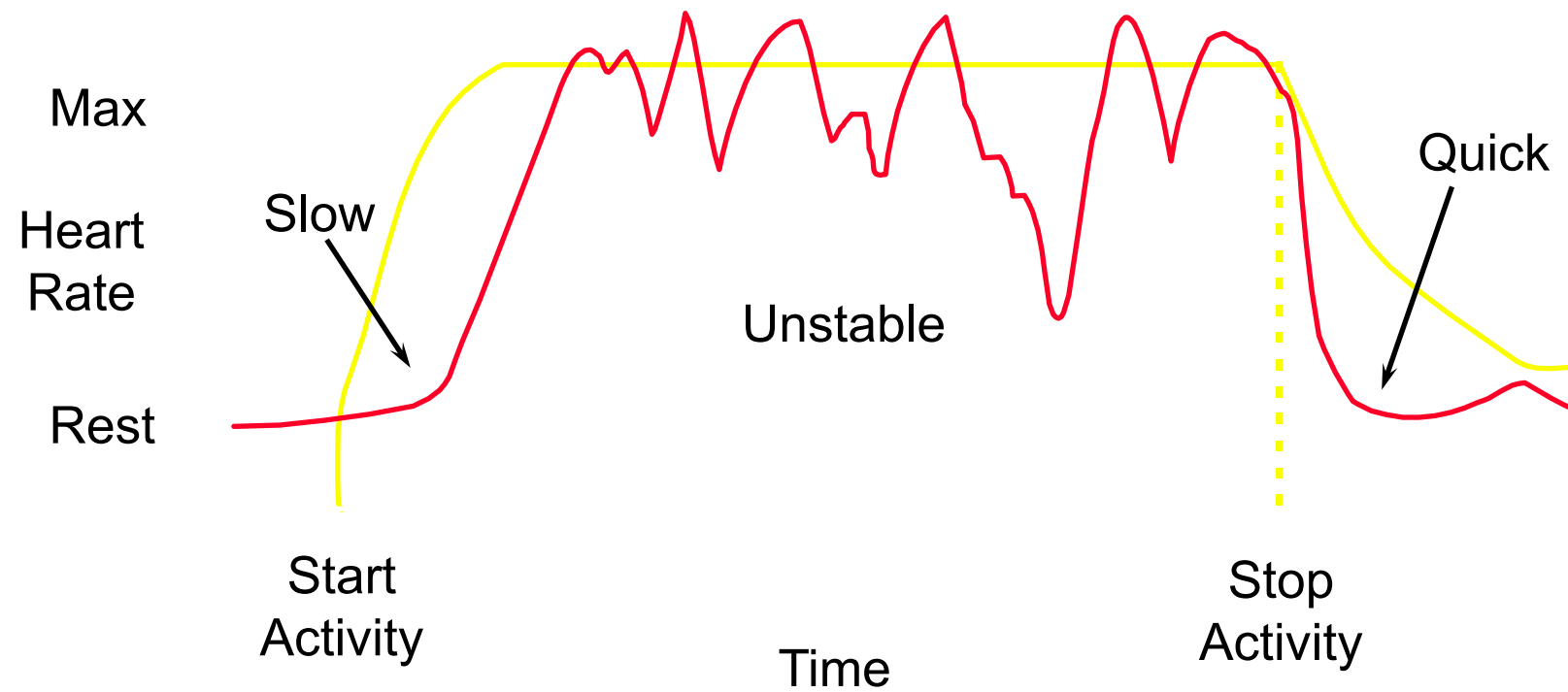
# Sick sinus syndrome (SSS)



Intermittent episodes of slow and fast rhythm from SA node, or atria



# Chronotropic incompetence



# AV node dysfunction

AVB I

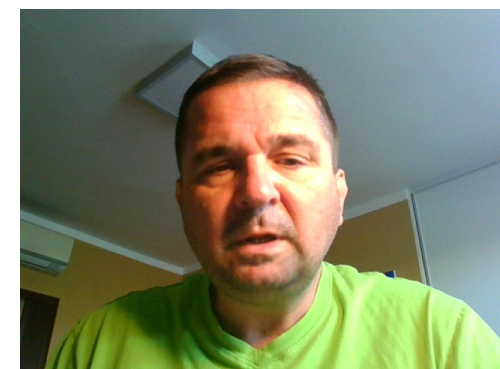
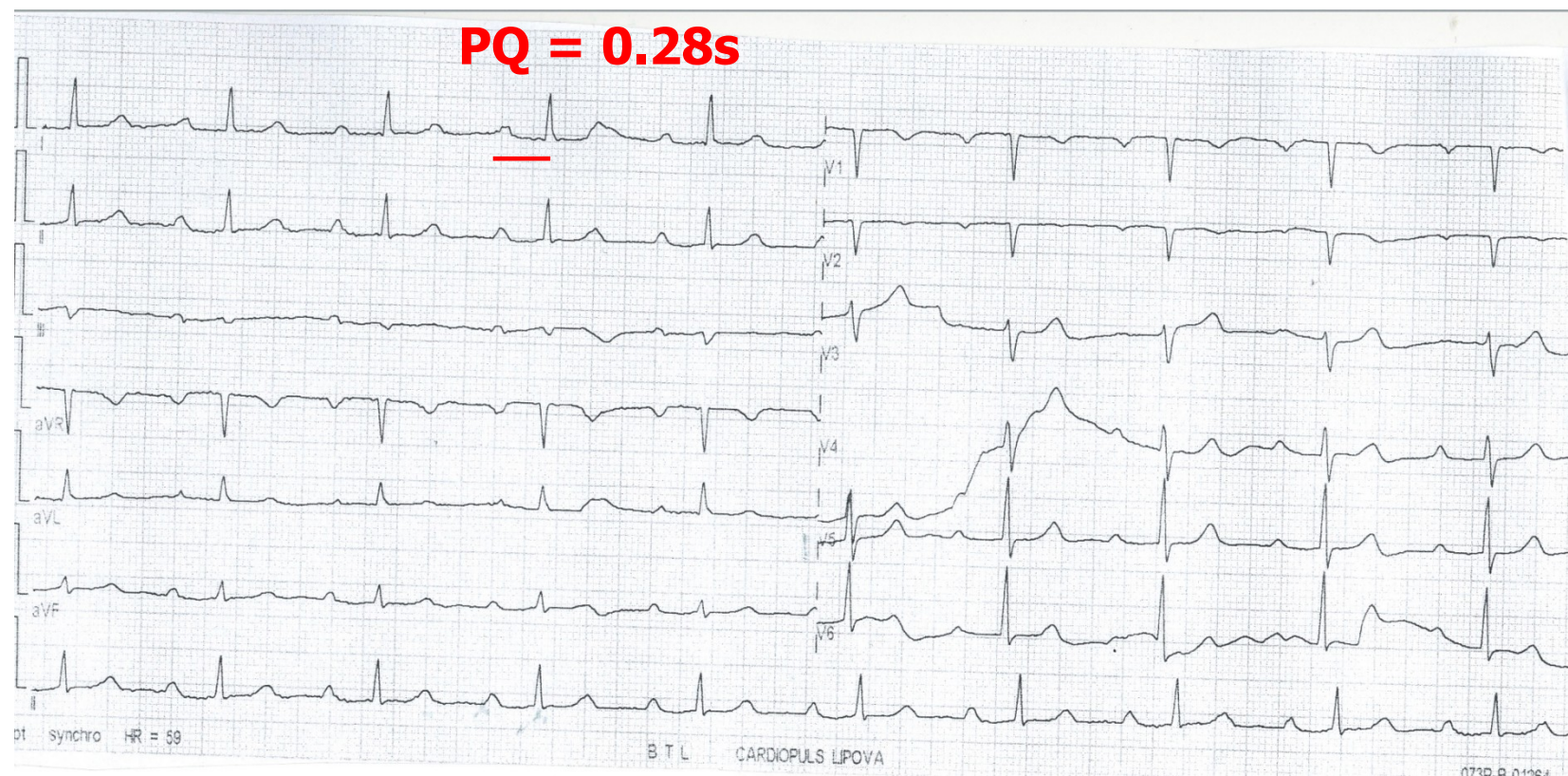
AVB II

AVB III

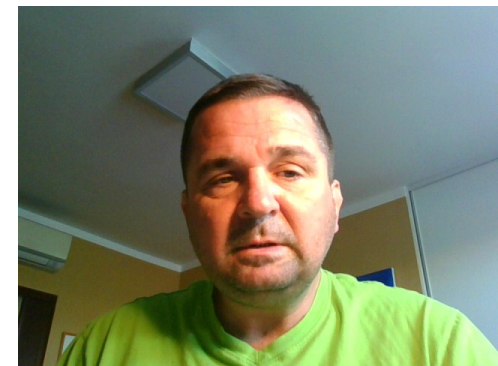
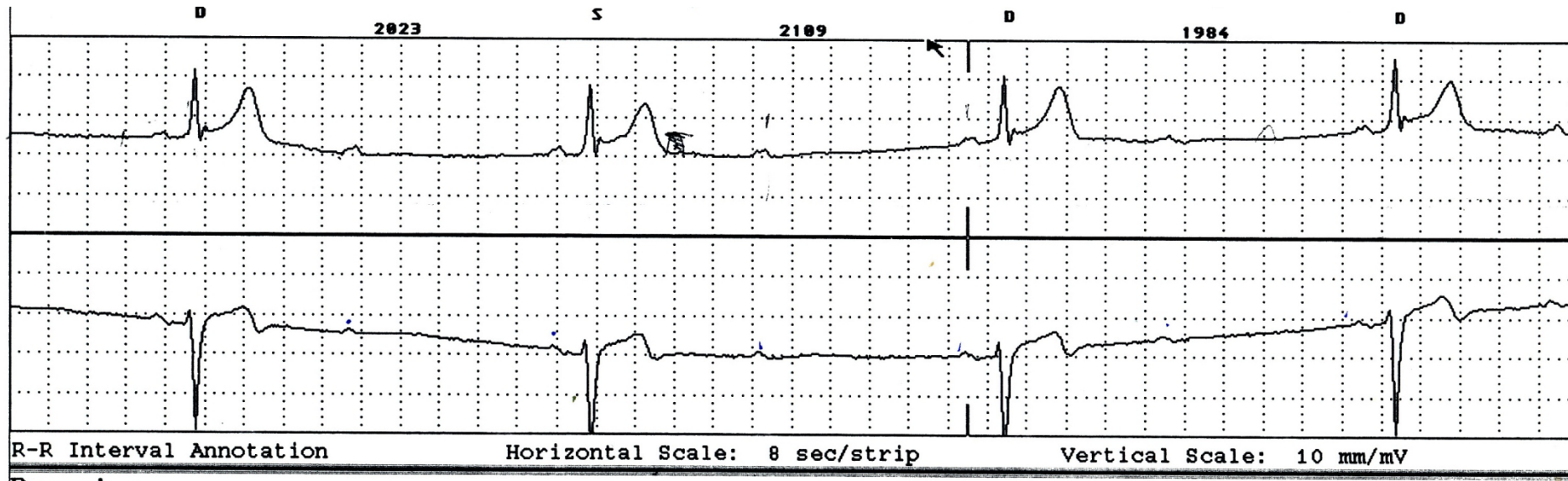




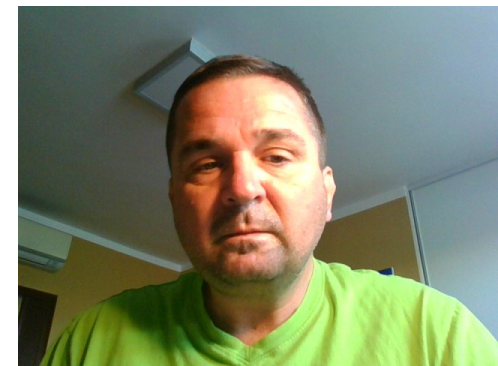
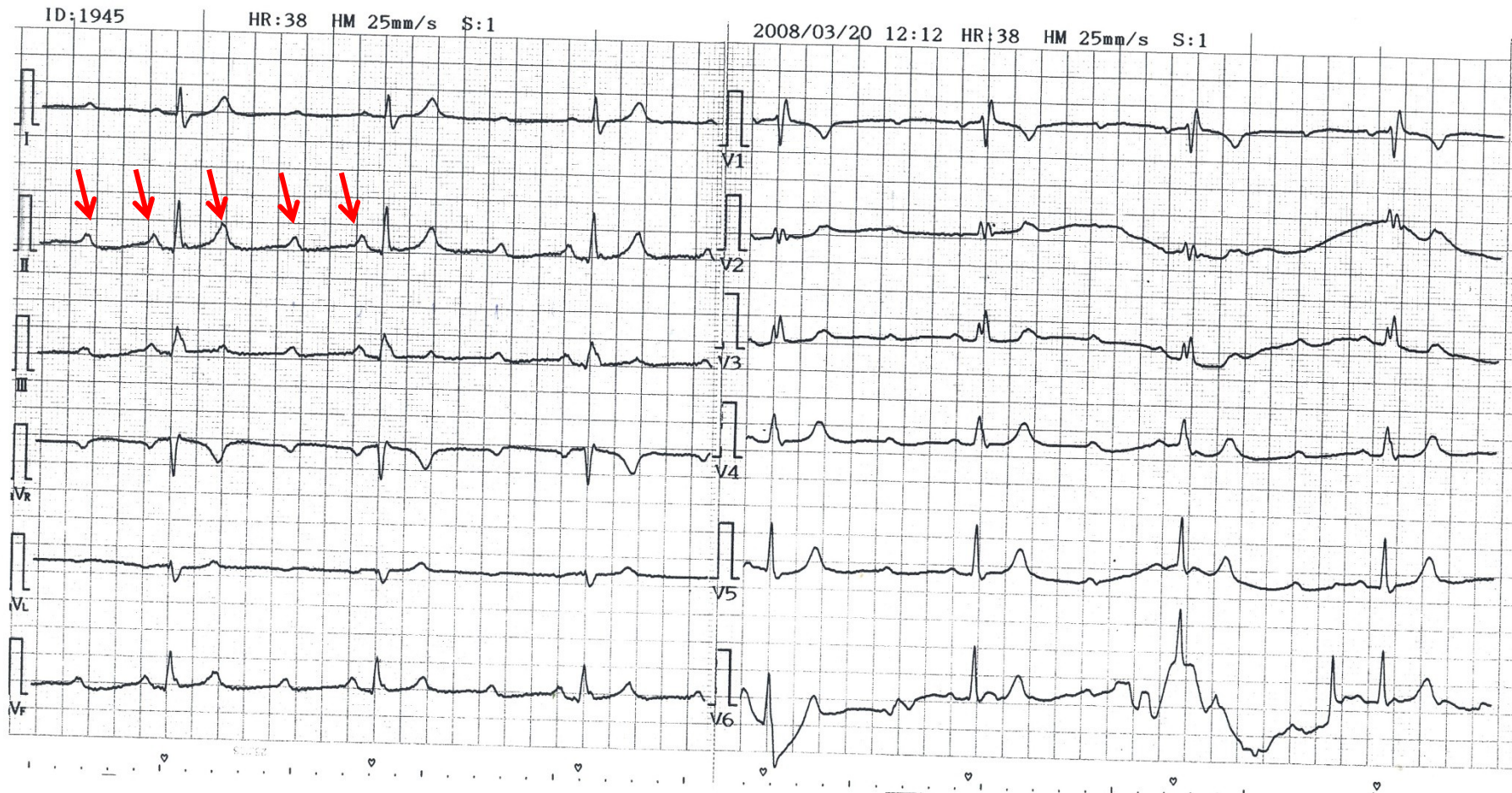
# AVB I.st degree (PQ > 0,2s)



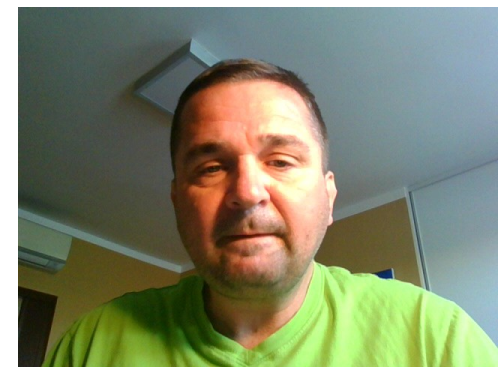
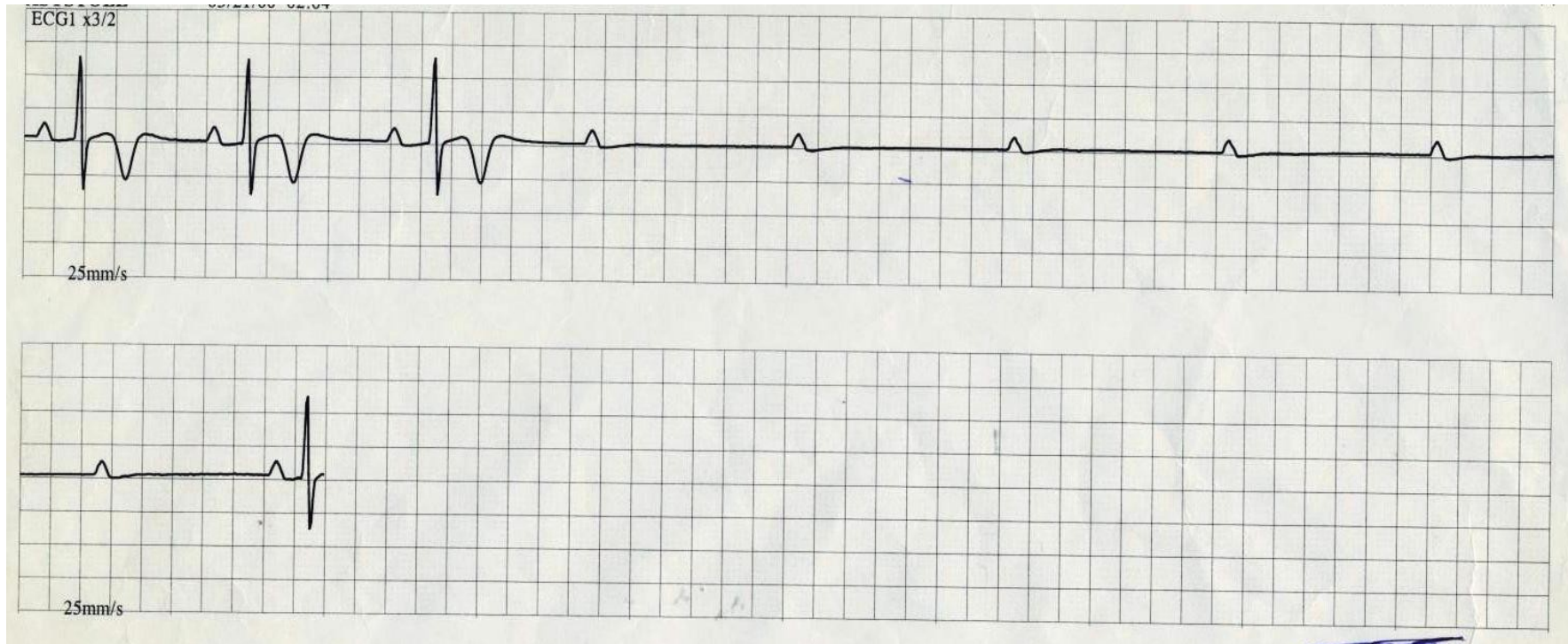
# AVB II.nd degree (2/1)



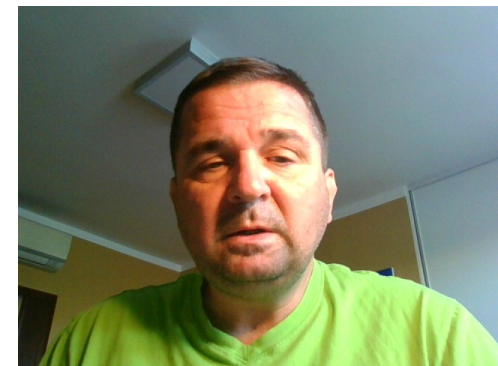
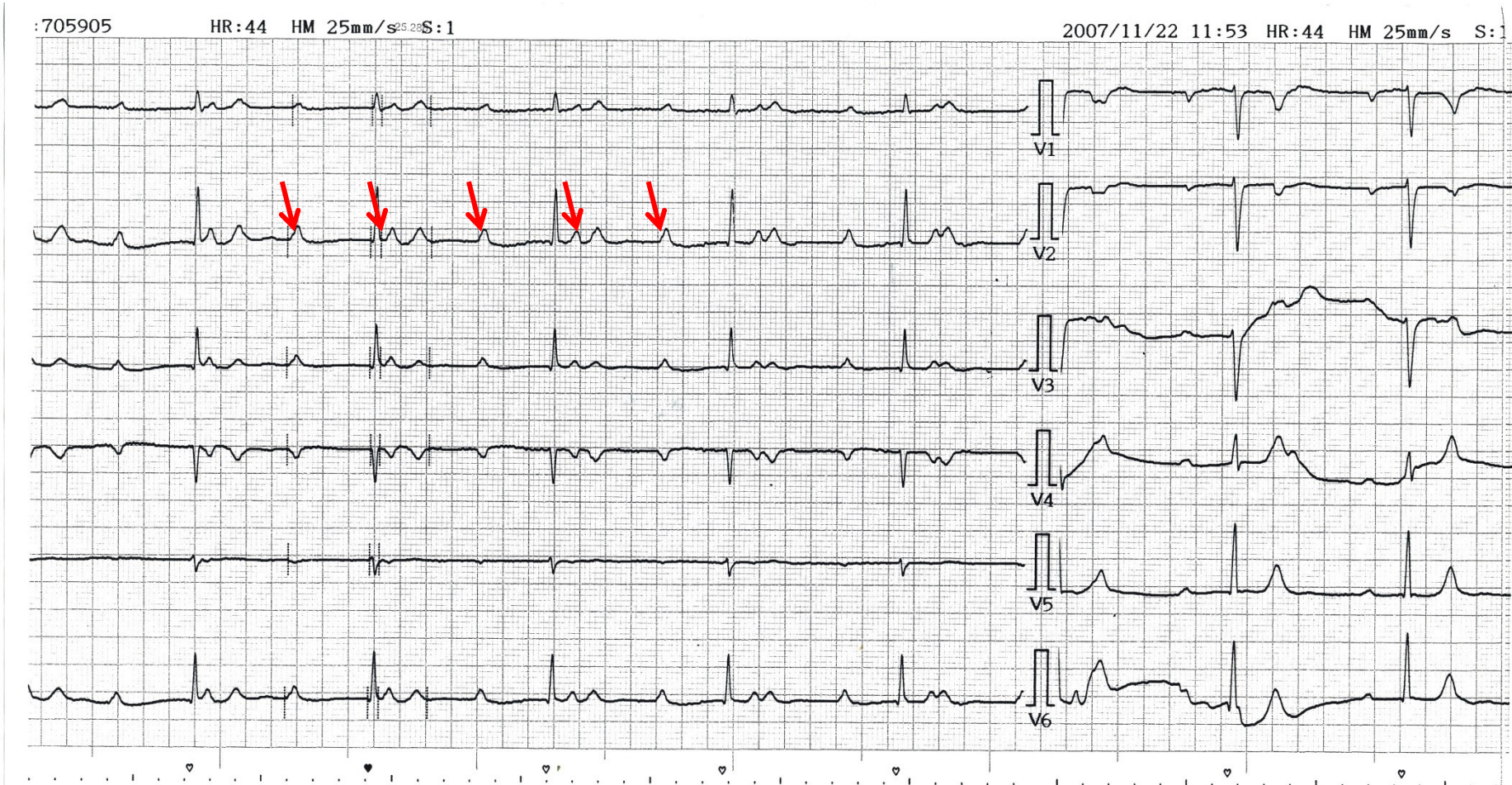
# AVB II.nd degree (Mobitz 3/1)



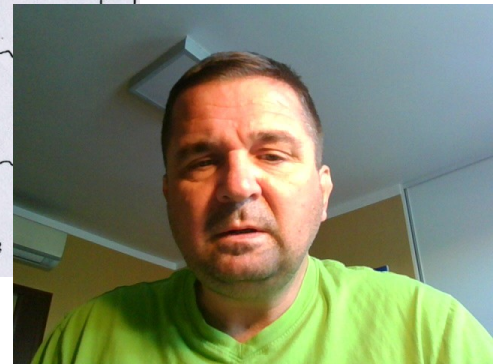
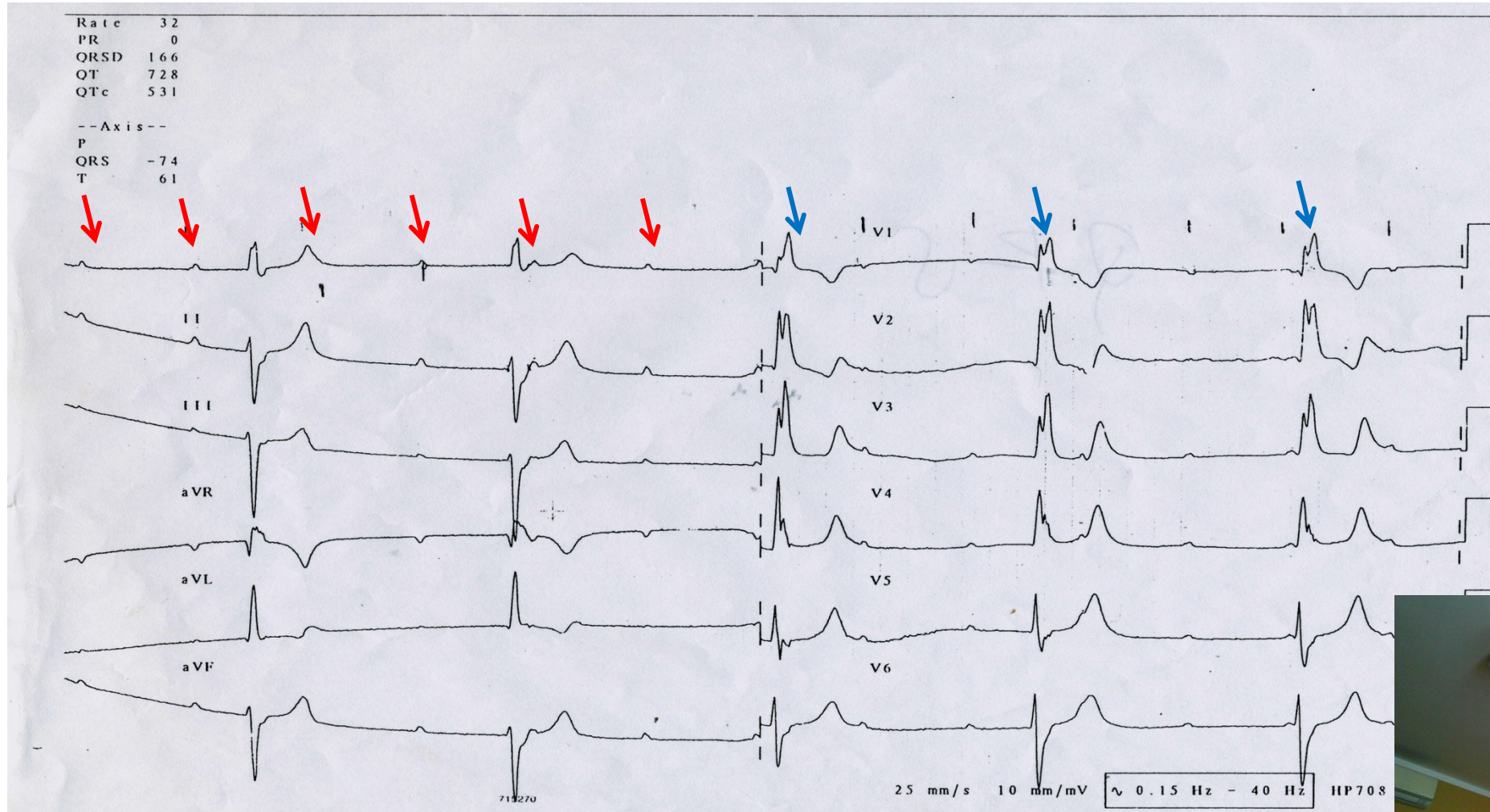
# AVB III.rd degree (no secondary, tertiary autom. centre)



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

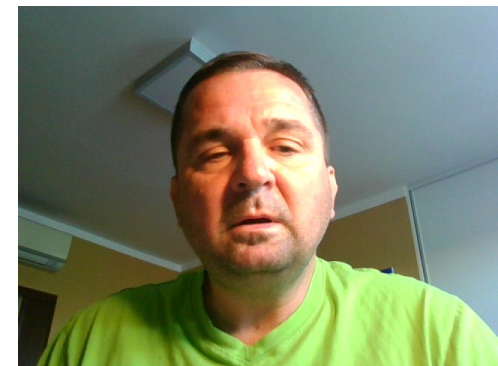


# AVB III.rd degree (escape ventricular rhythm)



# Etiology

- **Age**
- **Fibrosis**
- **Ischemia (acute, chronic)**
- **Inflammation – myocarditis**
- **Drugs (antiarrhythmics)**
- **Hypothyreosis**
- **Hyprekalemia**



# Symptoms

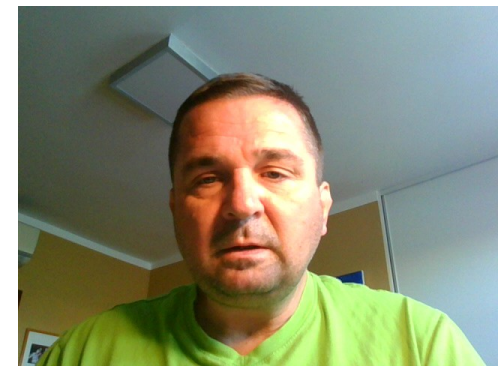
- Asymptomatic**
- Palpitations**
- Dizziness, weakness**
- Dyspnea**
- Exercise intolerance**
- Syncope**
- Sudden cardiac death**





# Diagnosis

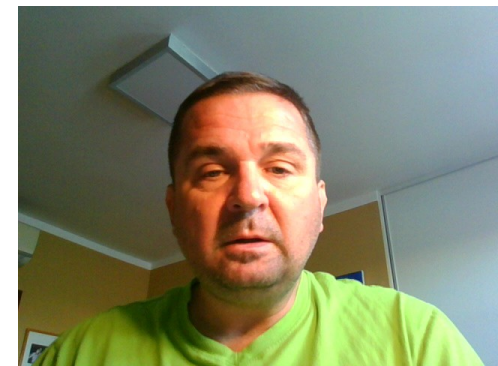
- ECG
- Holter (24 hrs – 7 days)
- Implantable loop recorder



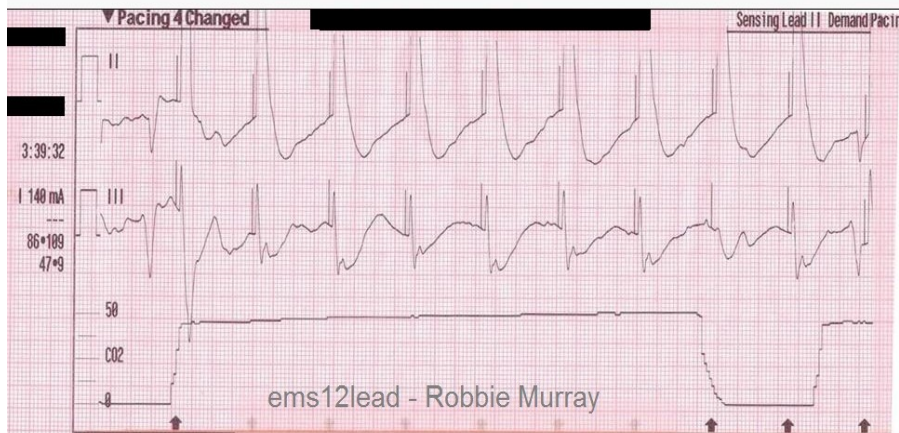
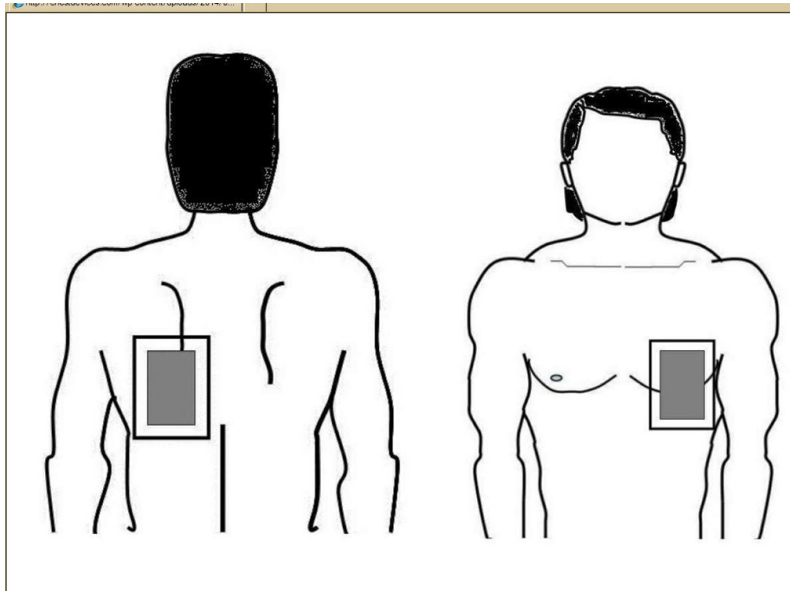
# Treatment

- No treatment
- Avoiding antiarrhythmic drugs
- Elimination of reversible cause
- Atropin, Isoprenalin
- Temporary external pacing
- Temporary transvenous pacing
- Epicardial pacing
- Permanent transvenous pacing

# Indication for pacing – symptomatic bradycardia

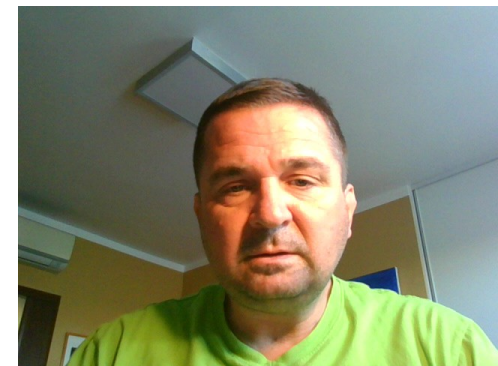
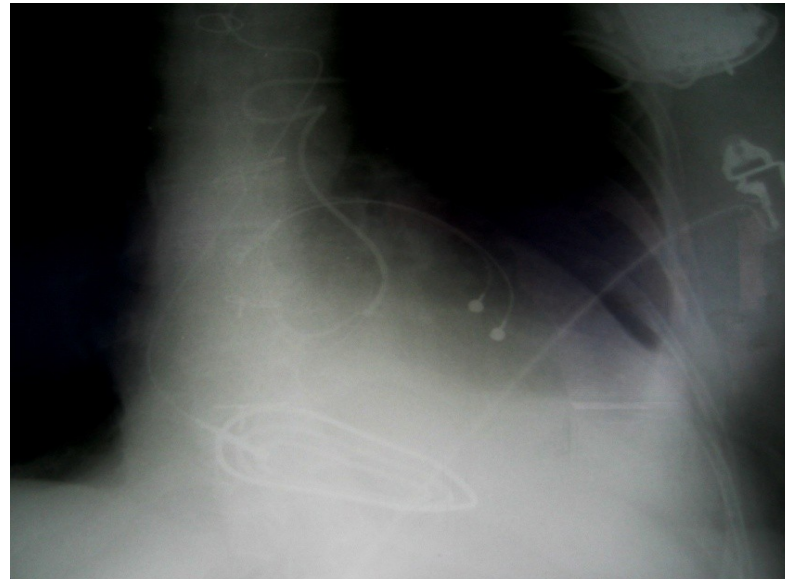
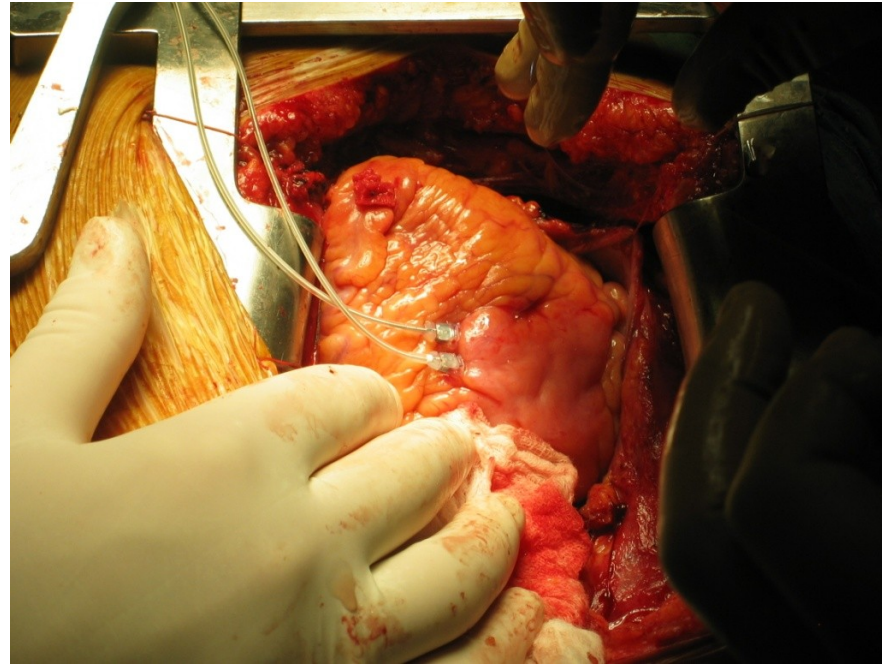
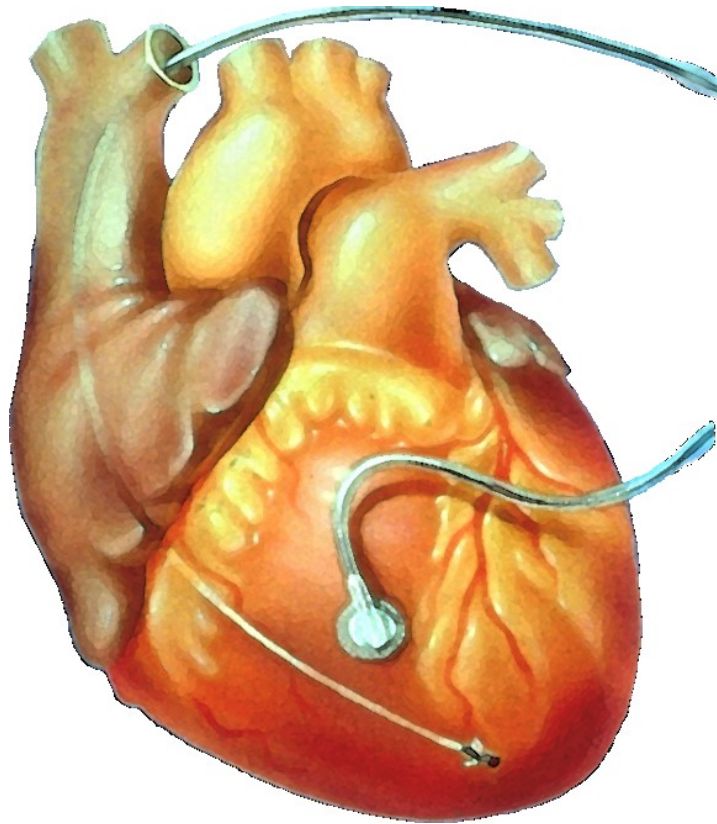


# External pacing





# Epicardial pacing



# Permanent pacing from 1958

Elmqvist + Senning  
8.10.1958

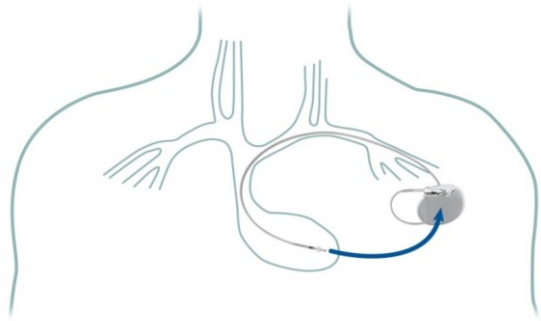


Arne Larsson 1915 -  
2001

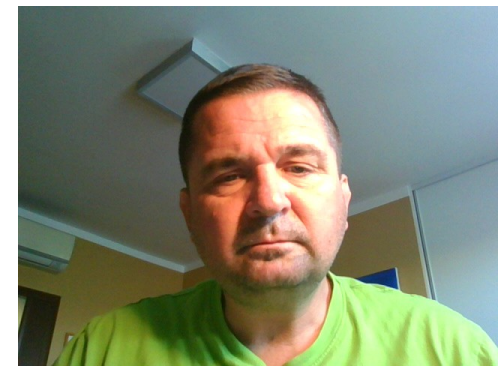
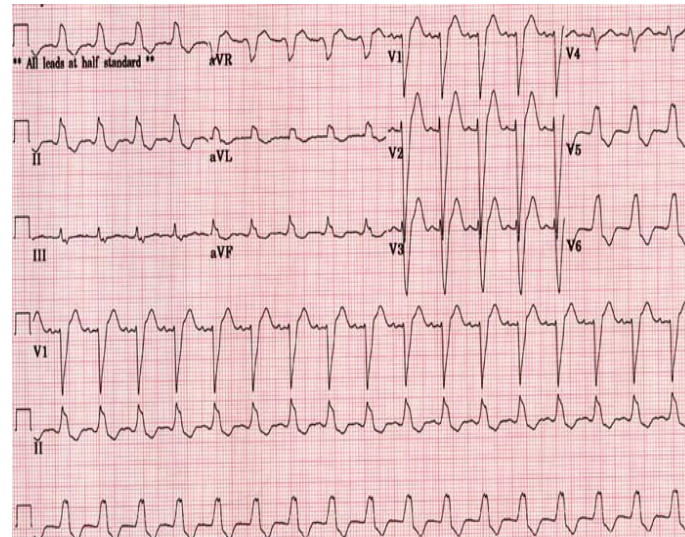
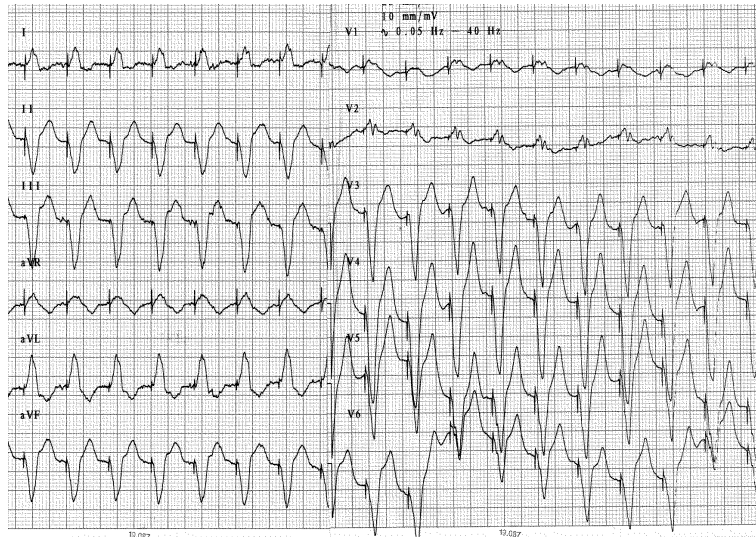
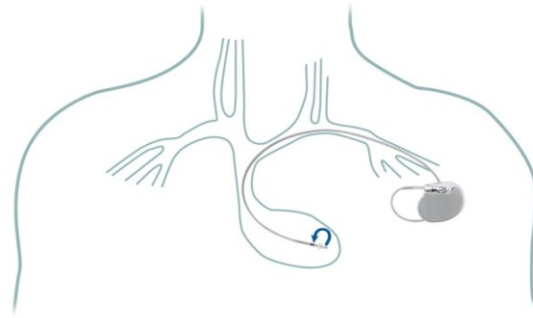


# Pacing

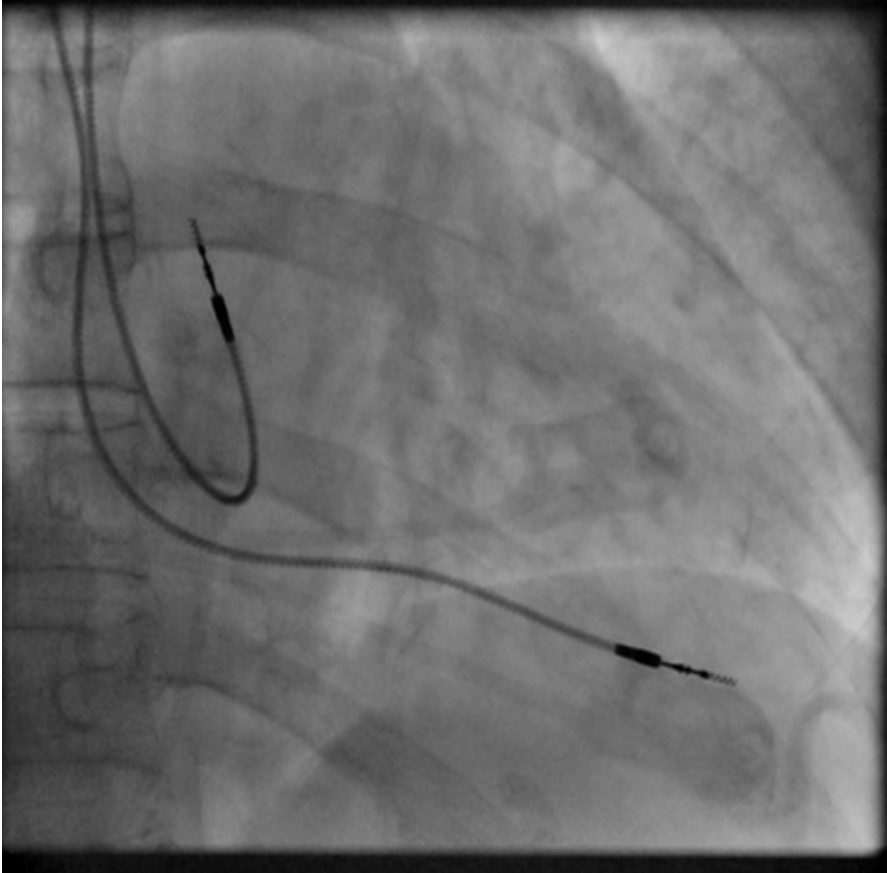
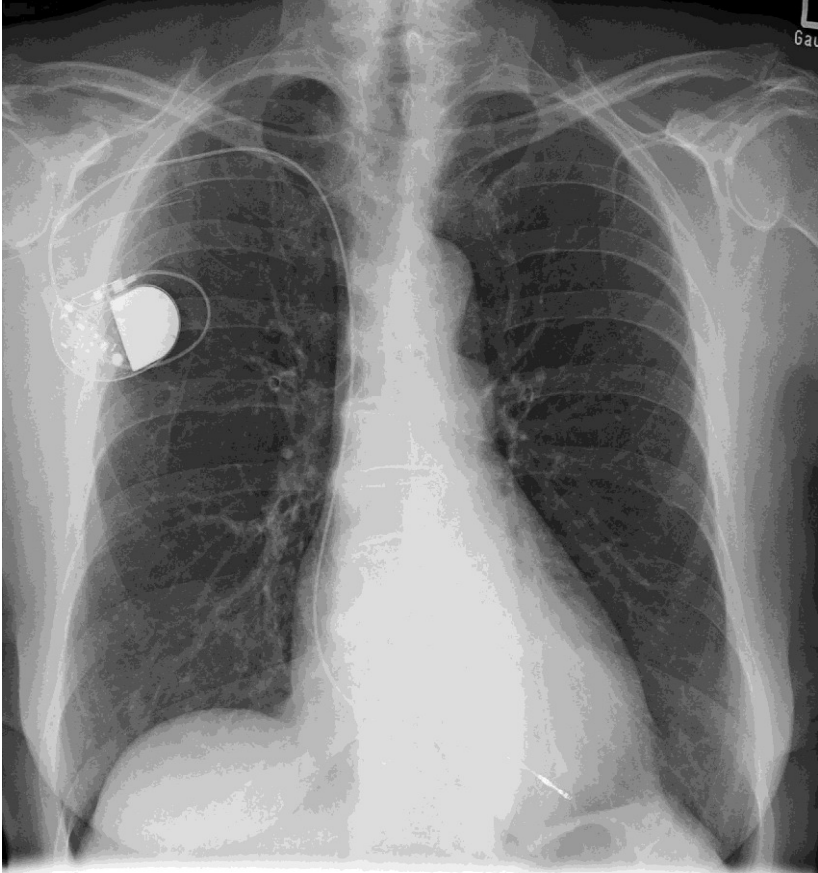
## UNIPOLAR



## BIPOLAR



# Single and dual chambre PM





# Pacing modes

Chamber paced

**A** (atrium)

**V** (ventricle)

**D** (dual A+V)

Chamber sensed

**A** (atrium)

**V** (ventricle)

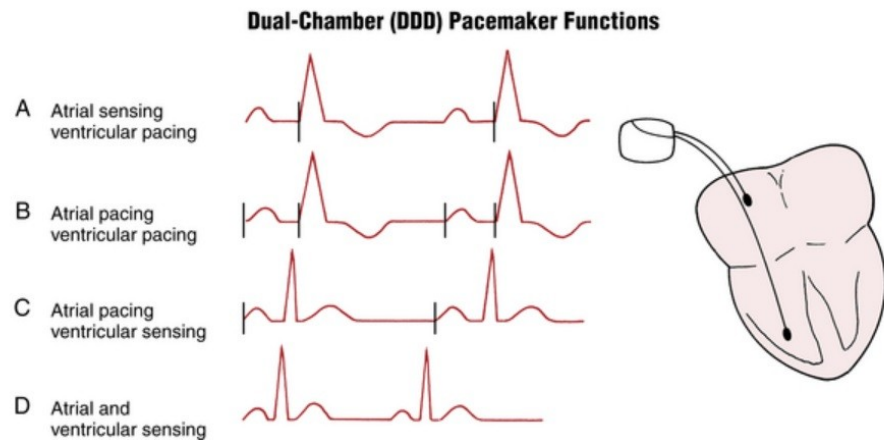
**D** (dual A+V)

Function

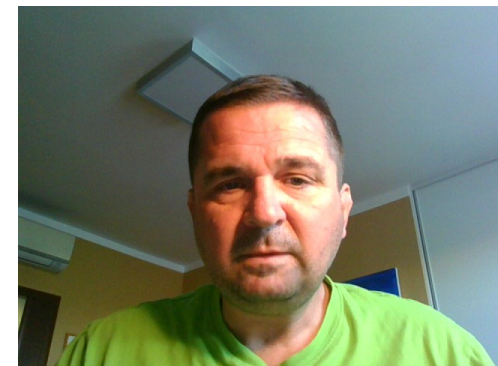
**I** (inhibited)

**I** (inhibited)

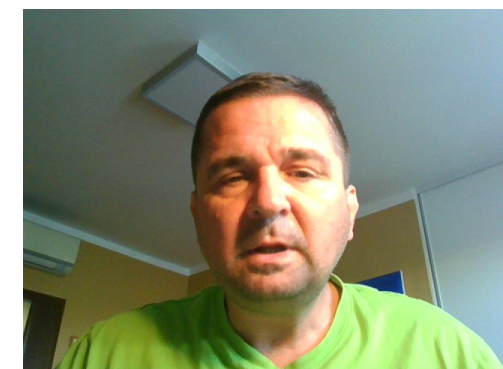
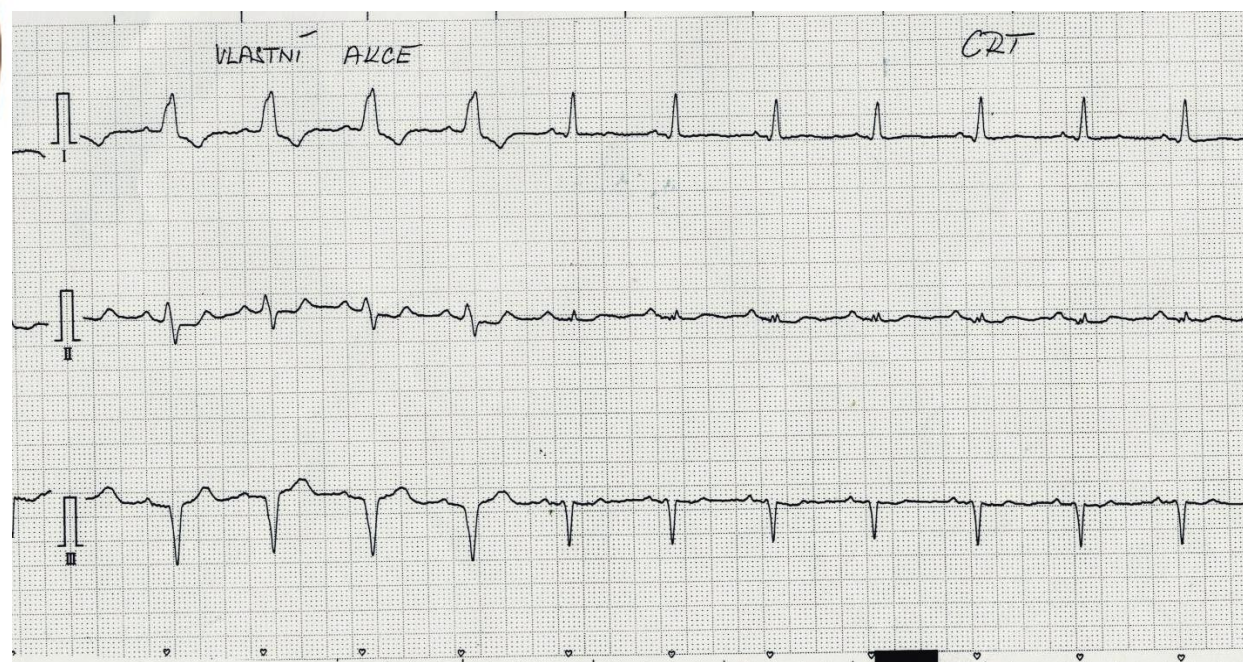
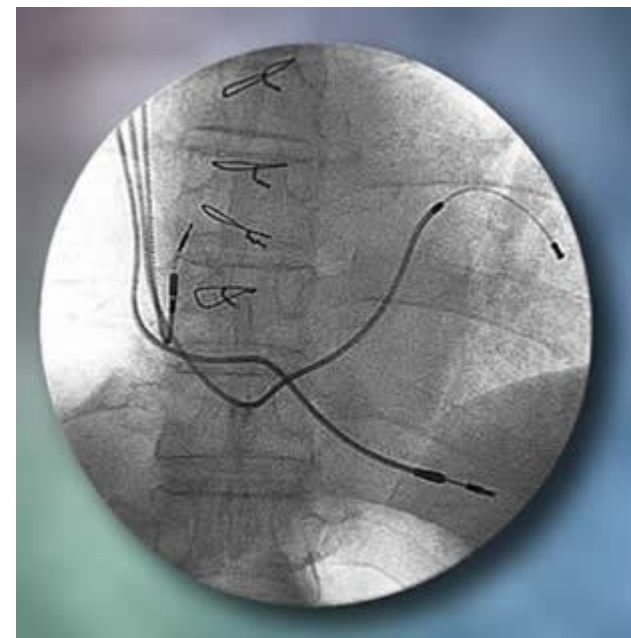
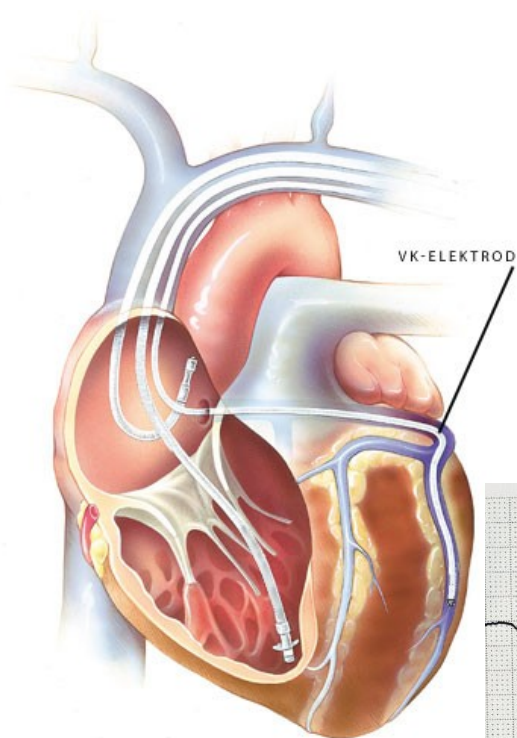
**D** (dual: inh. + triggered)



**R** (rate responsive)



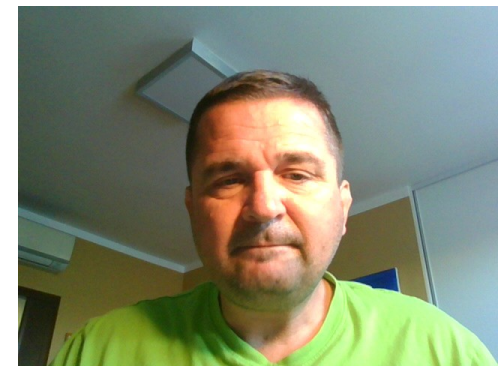
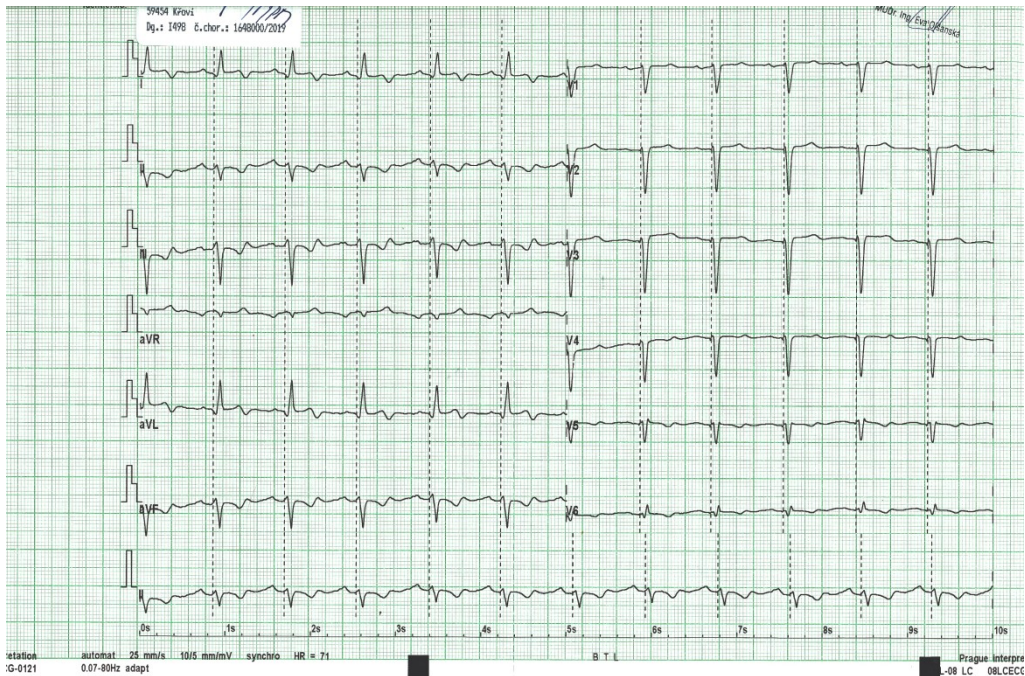
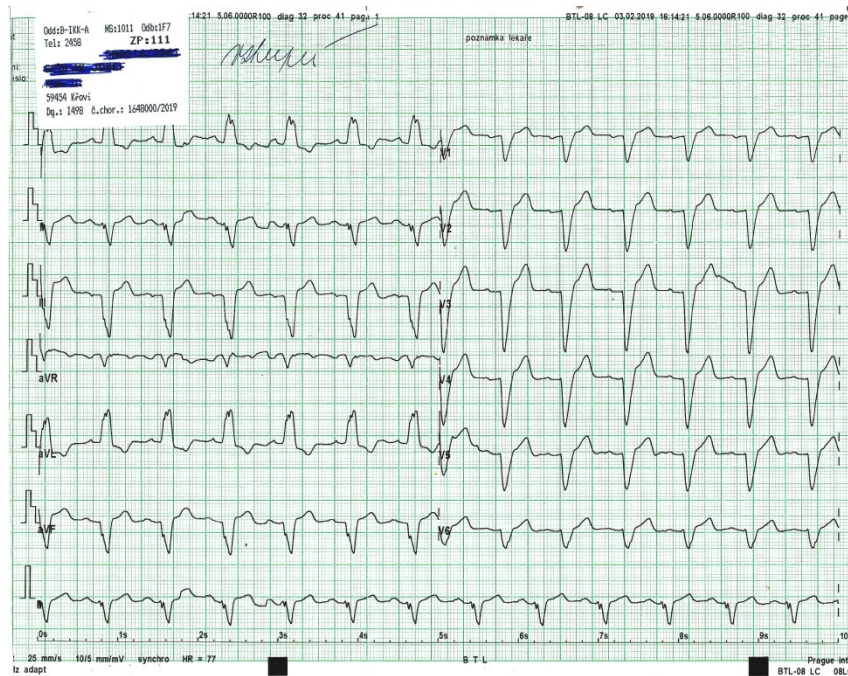
# Resynchronization therapy (CRT)



# Effect of resynchronization

LBBB prior to CRT implantation

Narrow QRS after CRT implantation

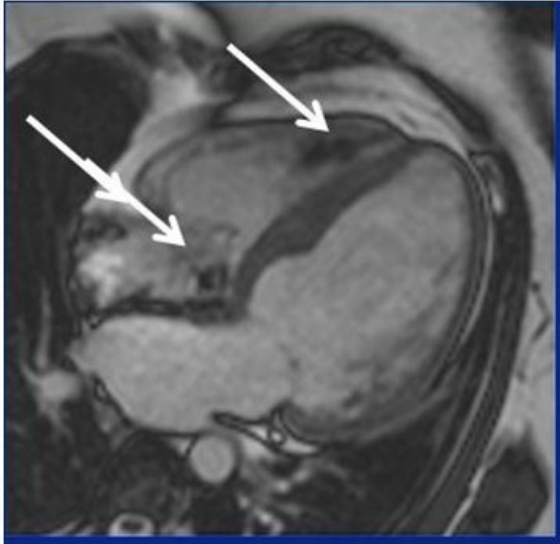


# MRI compatibility

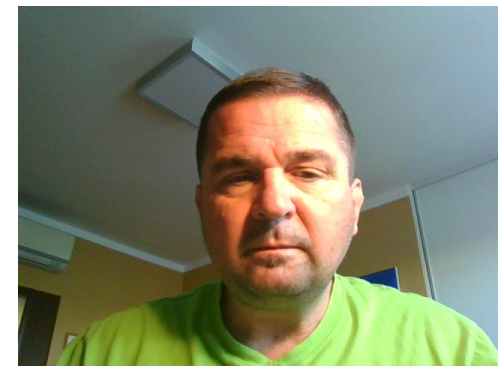
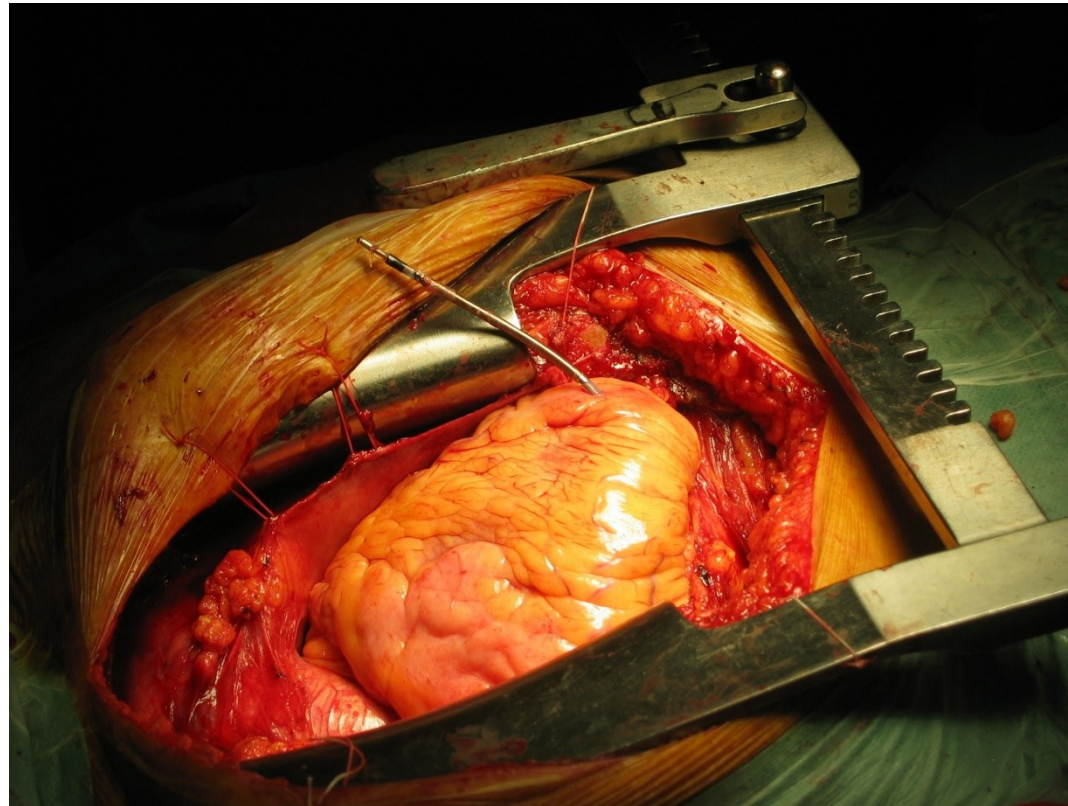
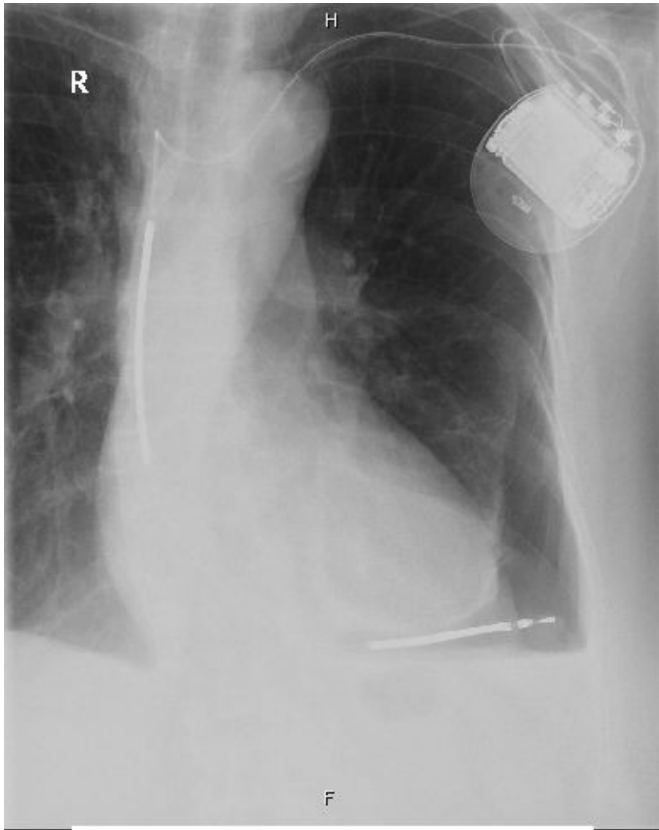
**MRI – contraindicated in older types of PM**



**MRI Safe under specific programming of the device**



# Complications of pacing – cardiac perforation



# Complications of pacing infection, decubitus



# Complications of pacing pocket hematoma



IKK FN Brno

