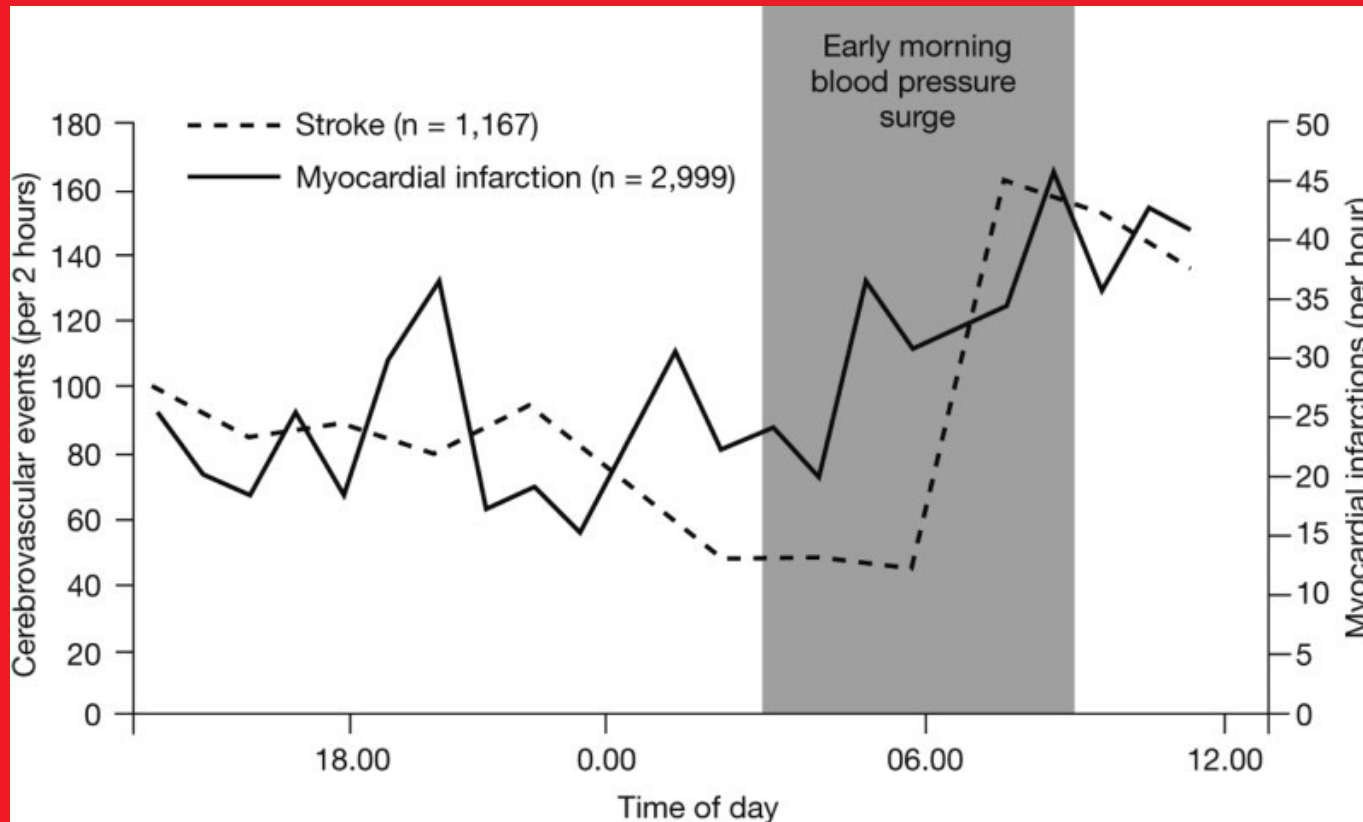


# ECG in myocardial infarction and ischemia

# Acute myocardial infarction (AMI)

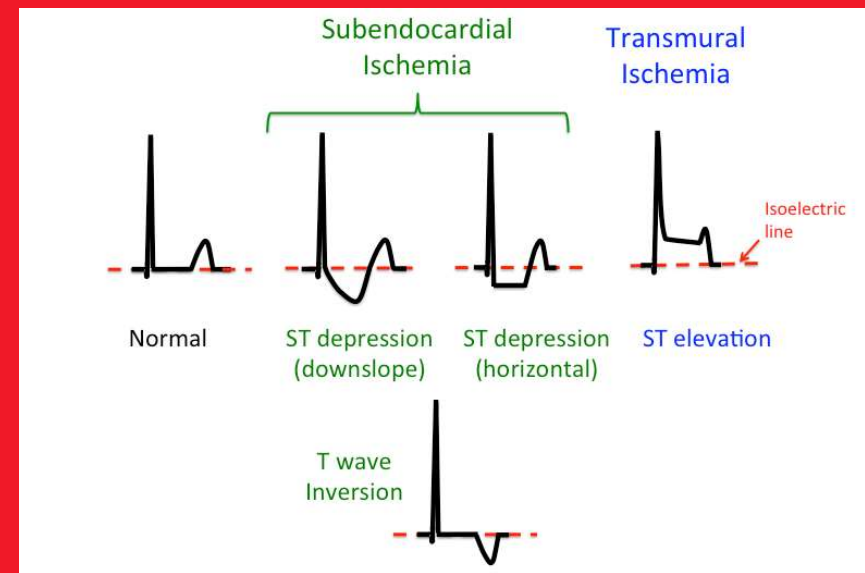
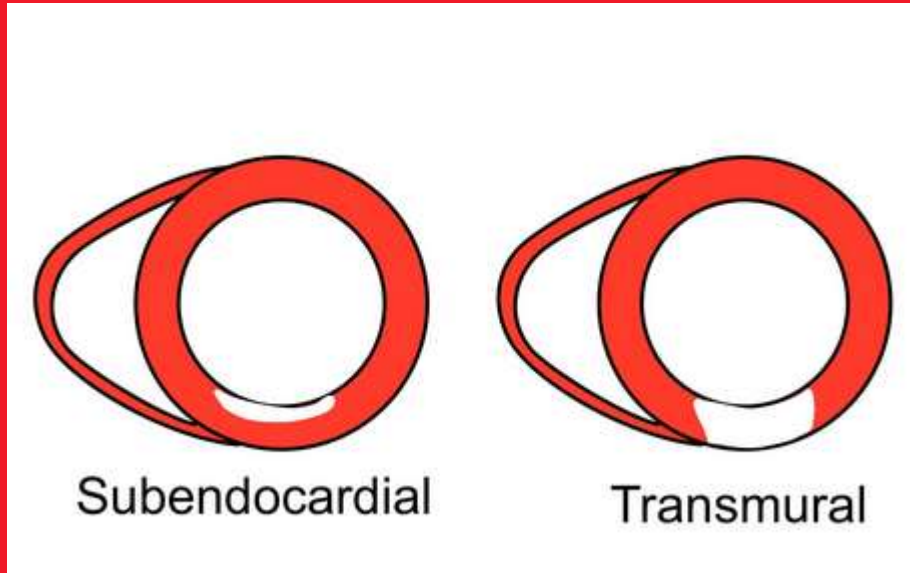
- Generally, the term „infarction“ can be used for any local acute ischemia with necrosis, irrespectively of affected organ
- However, myocardial and cerebral infarction most usually lead to death or invalidity
- Myocardial infarction is the most common life threatening complication of coronary atherosclerosis
- In most cases, its cause is a rupture of unstable atherosclerotic plaque with subsequent thrombosis
- Rare causes: thrombembolism, coronary artery dissection, acute overload of ischemized myocardium
- The ischemia leads to decrease of ATP and subsequent overload of cardiomyocyte by  $\text{Ca}^{2+}$ , local lactacidosis, permanent depolarization
- Cell death: myocardial necrosis, apoptosis in prolonged ischemia, autophagy is rather protective
- Compared to AMI, causes of cerebral stroke are much more heterogenous, atherosclerosis is often not required (thrombosis, thrombembolism, hemorrhage...)

# AMIs and strokes during the day



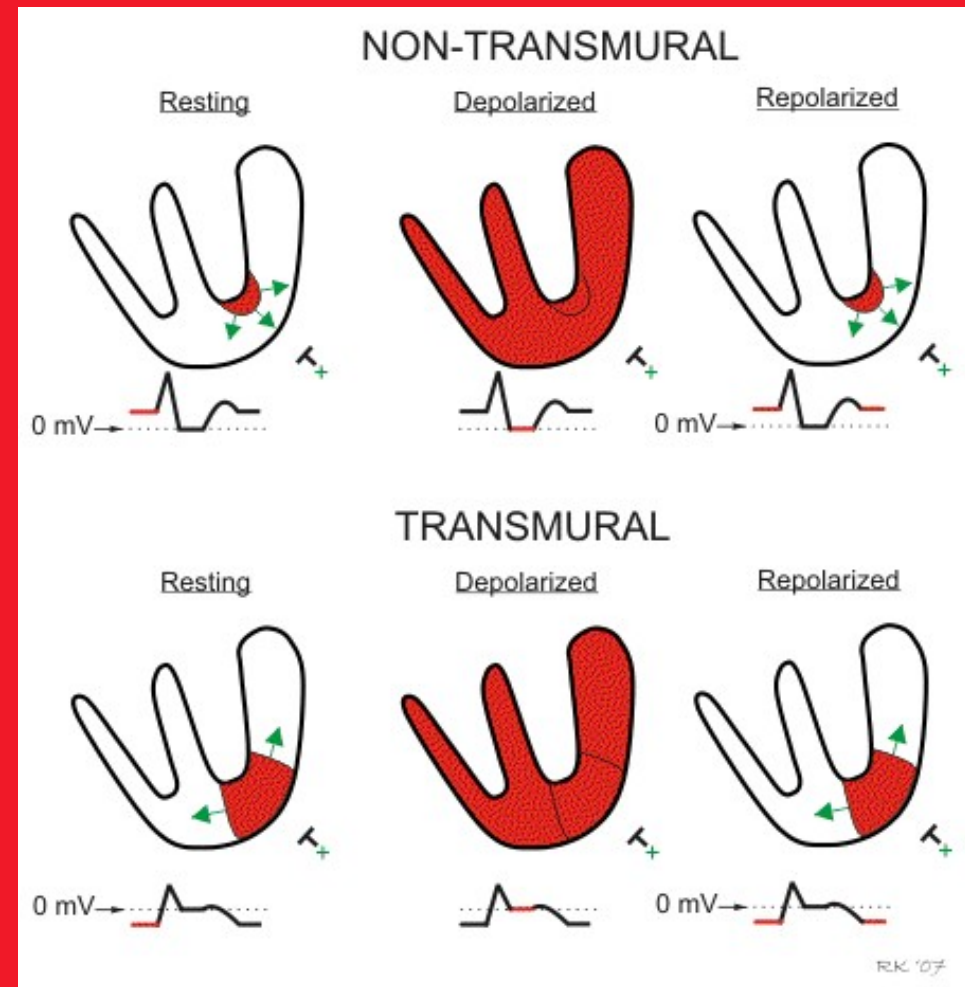
- Higher incidence of cerebral and myocardial infarctions in the morning is caused with higher activity of sympathetic nervous system and higher blood pressure in morning hours
- An important exception are the patients with sleep apnea syndrome

# Changes of ST segment during myocardial infarction



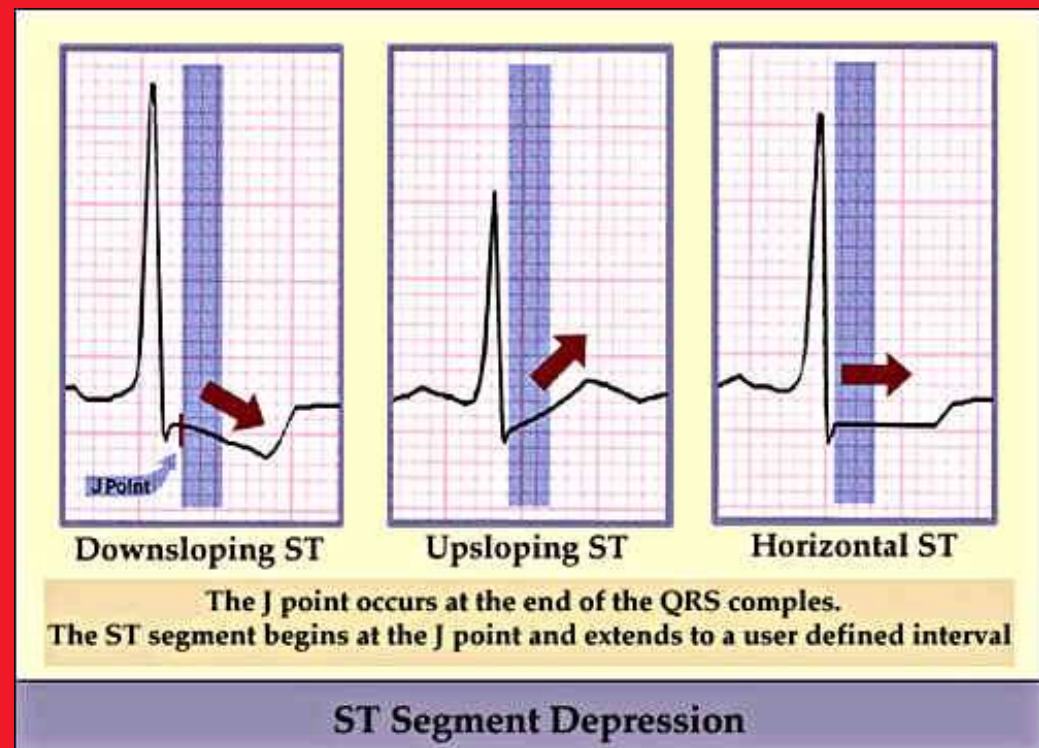
# Changes of ST segment 2

- ST elevations or depressions during AMI are caused mainly by a shift of isoelectric line, not ST segment
- During diastole, an ischemic focus generates electric currents
- Depending on its prevailing direction, we can observe elevations (transmural AMI) or depressions (non-transmural AMI) of ST segment – in fact, there is a shift of isoelectric line in opposite direction
- The differences in the plateau phase and repolarization lead into different shape of ST segment

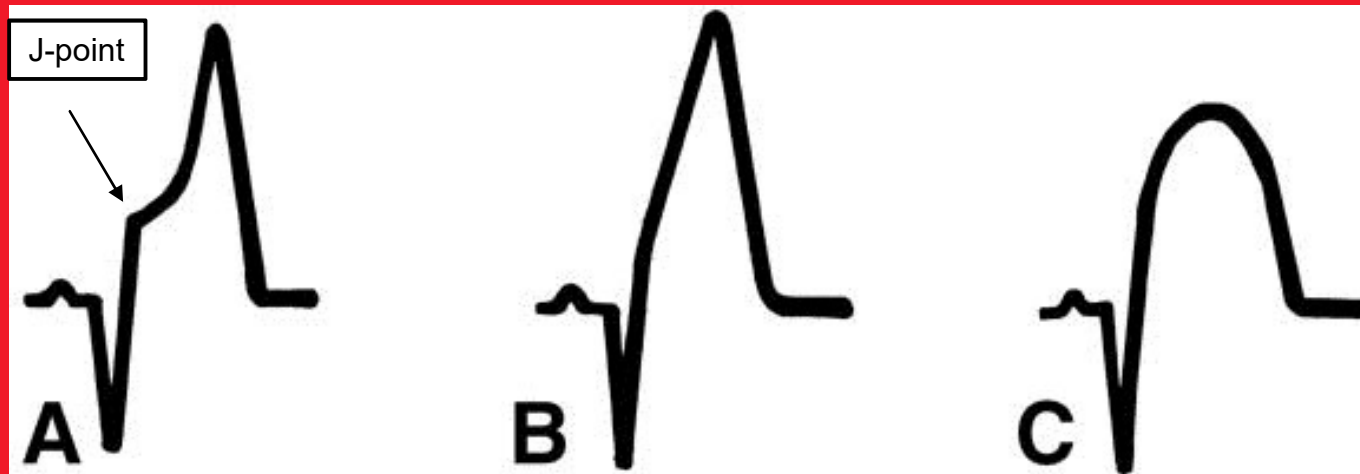


# Upsloping, horizontal and downsloping ST segment depressions

- Subendocardial ischemia - horizontal or downsloping depressions of ST segment
- Downsloping depressions occur also e.g. in bundle branch blocks (phase of plateau is different for each part of the ventricle) or digoxin intoxication
- On the other hand, mild (0.1 – 0.2 mV) upsloping ST depressions occur frequently in healthy heart during exercise



# ST elevations

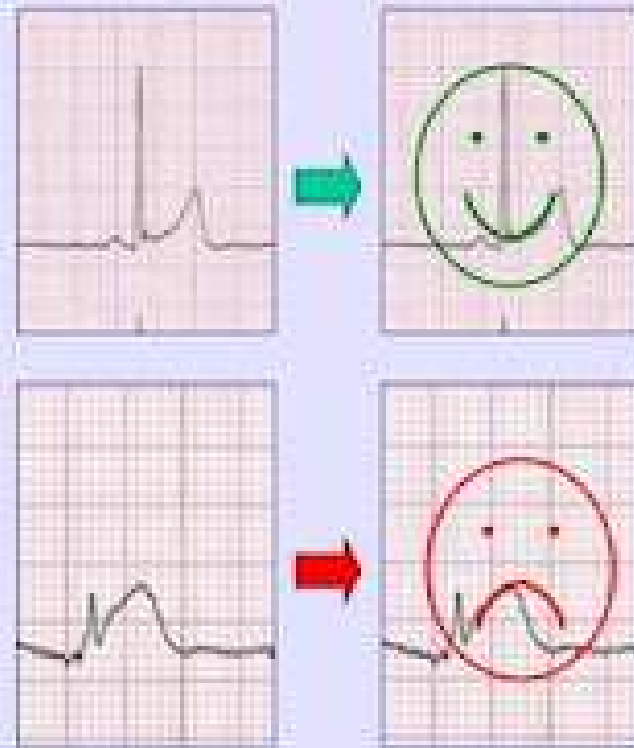


A – concave (often in the hypertrophy of LV)

B – straight

C – convex

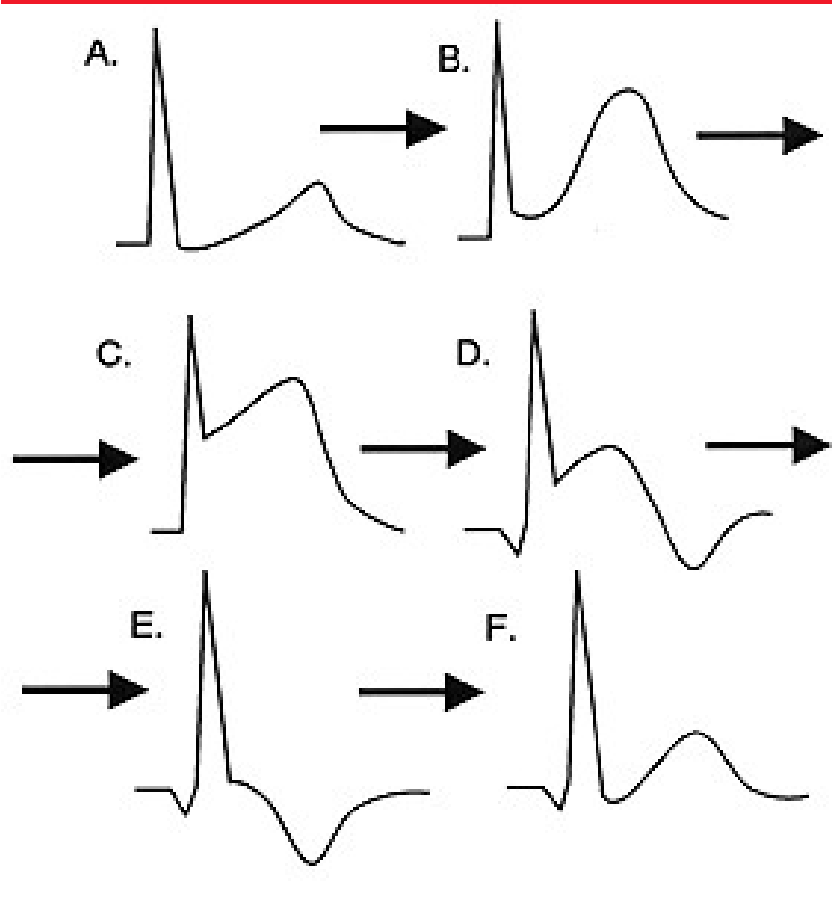
acute transmural myocardial  
infarction



ems12lead.blogspot.com



# ECG changes during Q-MI



- A. initial physiological state
- B. superacute phase
  - Tall positive T waves (minutes)
- C. acute phase
  - ST elevation = Pardee's waves (tens of minutes to hours) - STEMI
- D. subacute phase
  - Normalization of ST segment
- E. Q-wave development (hours to days), event. T - inversion (persists weeks)
- F. ECG after Q-MI
  - persistence of Q

# Pathologic Q

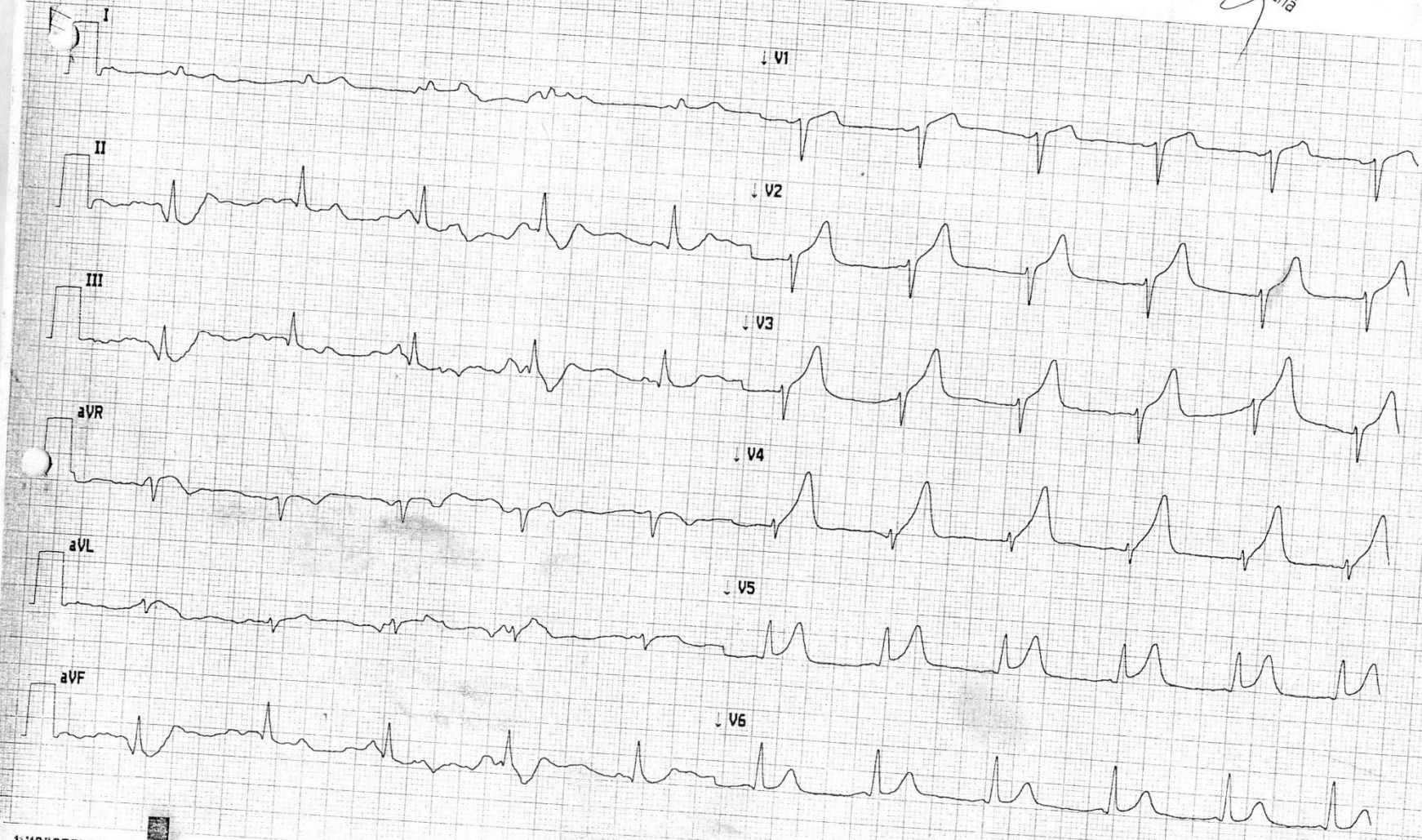


- During several hours after transmural MI, pathologic Q develops
- Pathologic Q corresponds to depolarization of opposing cardiac wall, observed through electrically dead tissue – a scar
- Its depth is  $> \frac{1}{4} R$  (or R is not present at all – QS wave) and its duration is at least 40 ms)
- It usually persists lifelong (except certain cases of stunned myocardium)

14-Crv-2012 02:17:59

Vent frekv: 66 BPM  
PR int: 137 ms  
Cas QRS: 87 ms  
QT/QTc: 371/384 ms  
P-R-T osy: 28 72 22  
Avg RR: 909 ms  
QTcB: 389 ms  
QTcF: 382 ms

Mgr. Jana Konečná



110007000

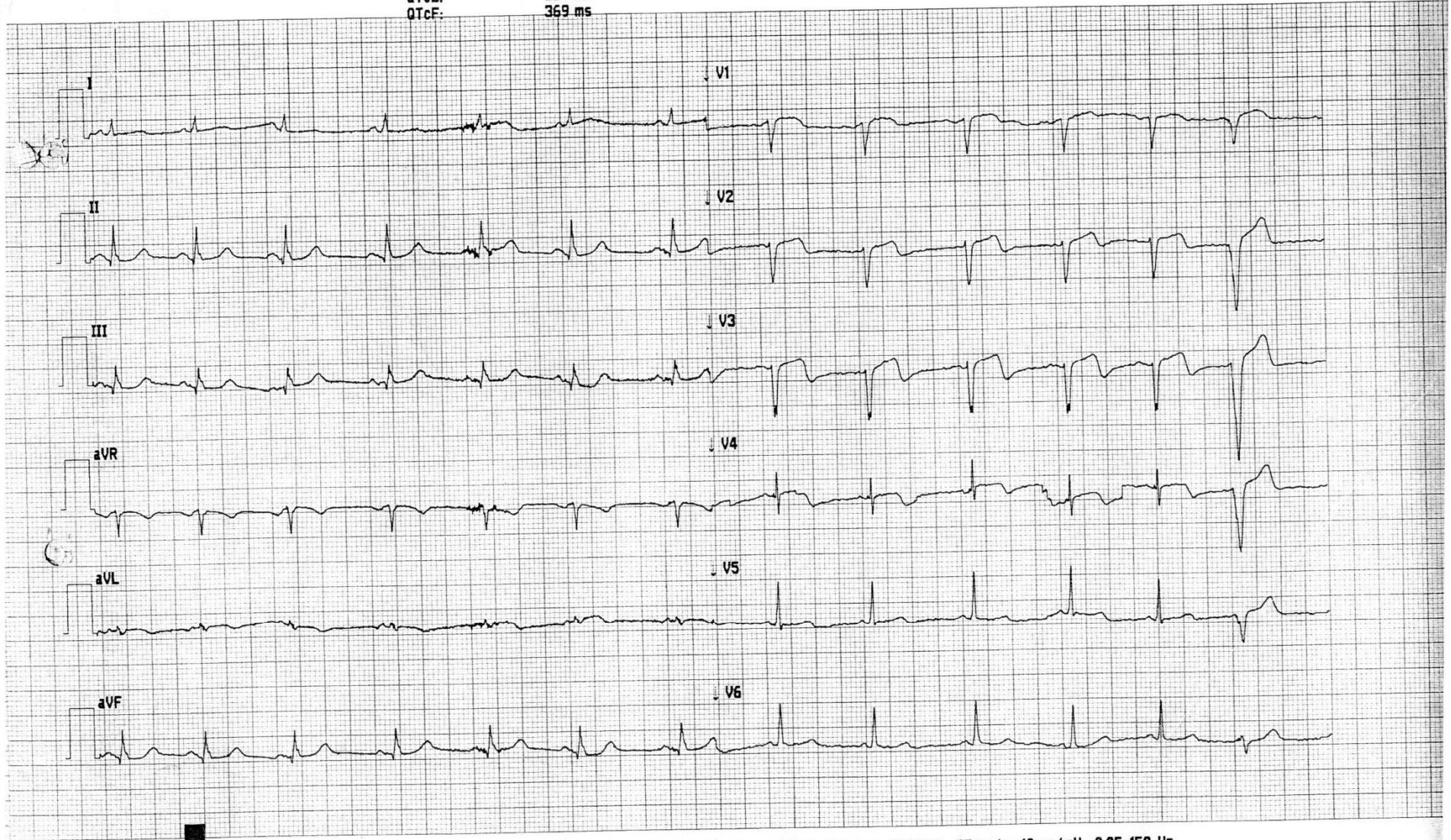


14-Crv-2012 20:35:15

Narozen:  
let,

Vent frekv: 79 BPM  
PR int: 134 ms  
Cas QRS: 85 ms  
QT/QTc: 337/371 ms  
P-R-T osy: 55 59 78  
Avg RR: 758 ms  
QTcB: 387 ms  
QTcF: 369 ms

MISIKALOVA Jana Dis.



111030069619

No Site Name

28.939

Misto\* O Vozik\*

0 Verze 1.50.12 Sekvence #04247 25mm/s 10mm/mV 0.05-150 Hz

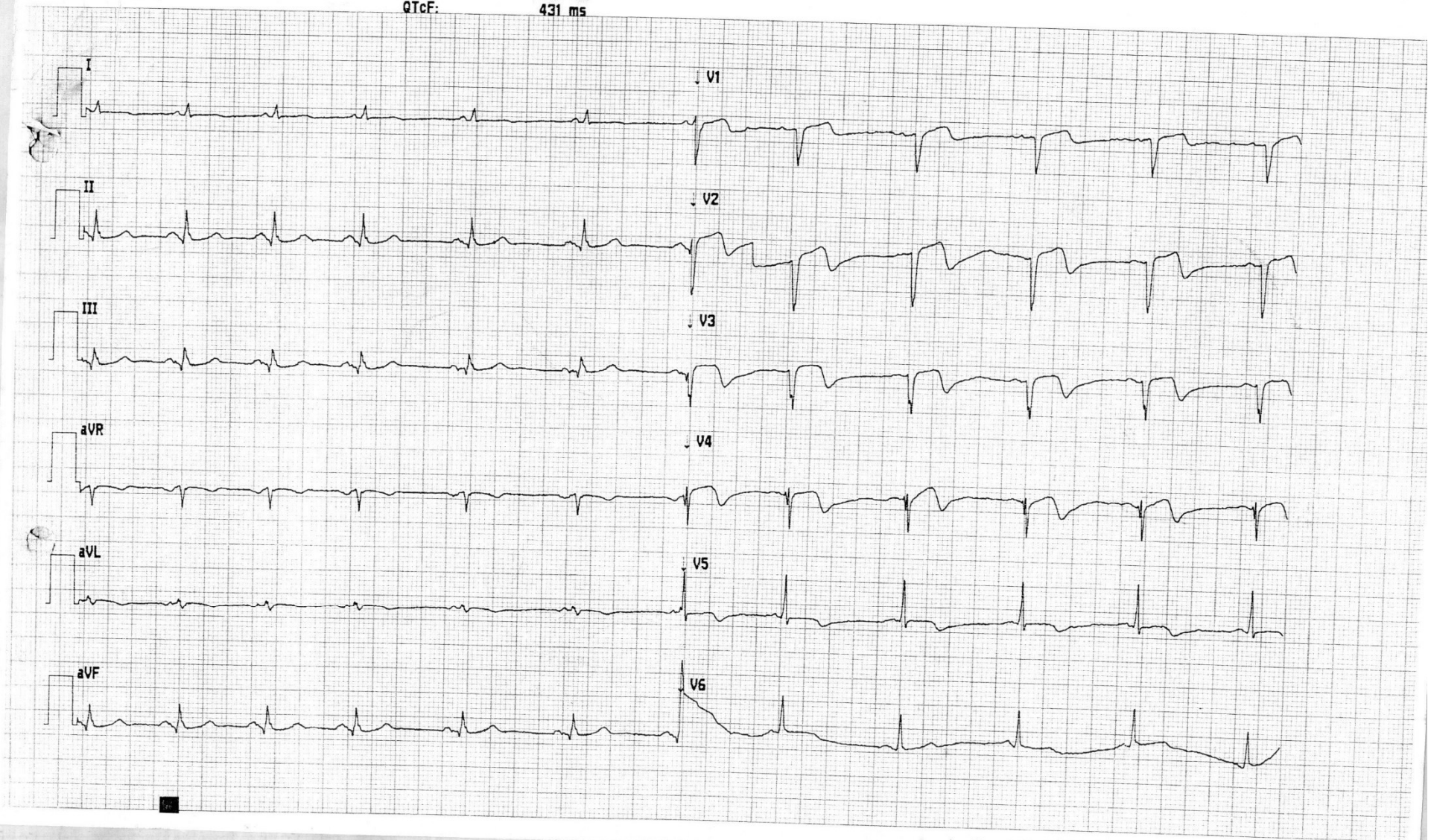
0 Verze 1.50.12 Sekvence #04239 25mm/s 10mm/mV 0.05-150 Hz



15-Crv-2012 05:28:28

N Narozen:  
let,

Vent frekv:	68 BPM
PR int:	134 ms
Cas QRS:	90 ms
QT/QTc:	413/430 ms
P-R-T osy:	56 62 97
Avg RR:	875 ms
QTcB:	441 ms
QTcF:	431 ms





ie-Cr9-2012 11:45:33

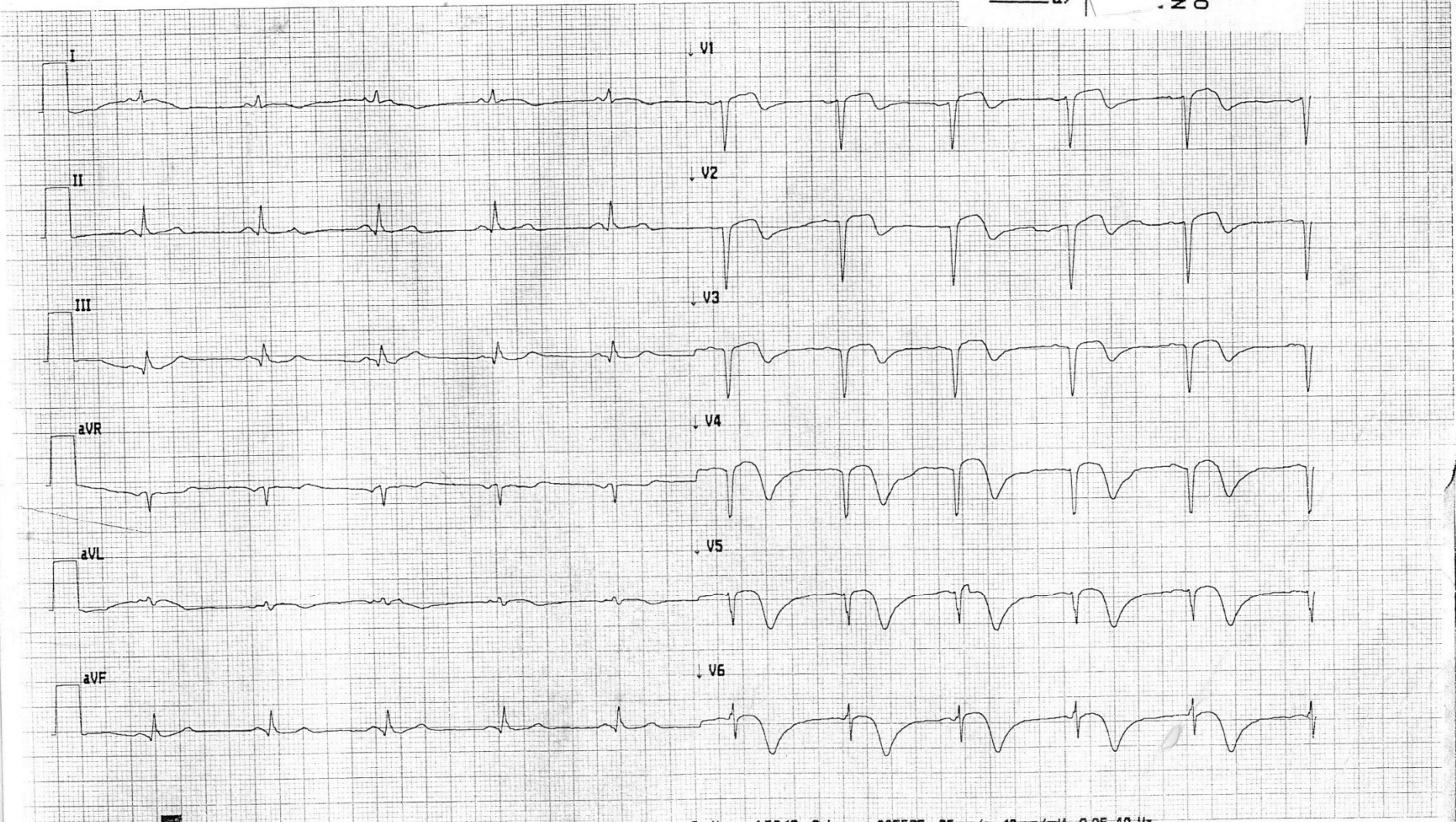
ID:  
Narozen:  
let,

Vent frekv:	64 BPM
PR int:	141 ms
Cas QRS:	114 ms
QT/QTc:	460/469 ms
P-R-T osy:	58 62 115
Aug RR:	937 ms
QTcB:	475 ms
QTcF:	470 ms

*16.6*  
*1300*



NS: 01  
Odd: . .



111100073859

No Site Name

Kisto# 0 Vozik# 0 Verze 1.50.12 Sekvence #05535 25mm/s 10mm/mV 0.05-40 Hz

# Clinical case

- 59 years old man with acute chest pain, because of ST elevations, coronary arteriography was performed within 1 hour after onset
- LAD occlusion was detected and recanalization was performed
- The finding at coronary arteriography well corresponds with the diagnosis of anterior wall STEMI, based on ECG findings