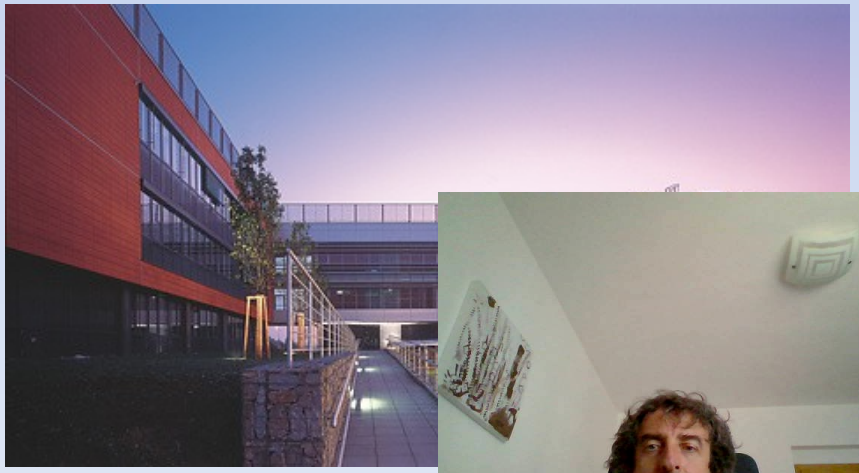
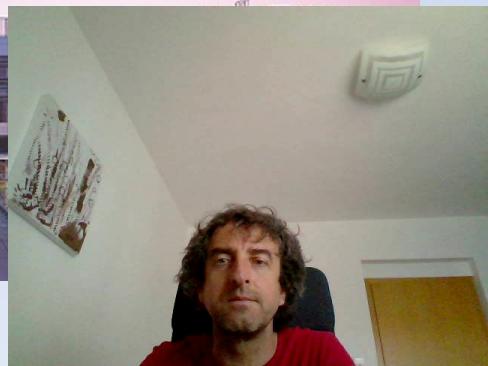
Acute coronary syndrome

Jiří Pařenica
Coronary Care Unit
Internal and Cardiology Department
University Hospital Brno





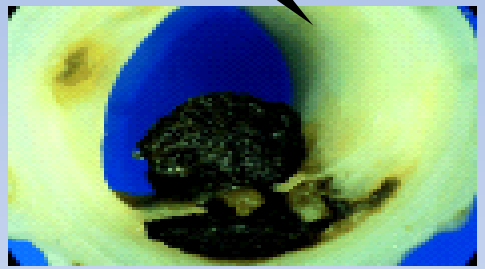
Signs

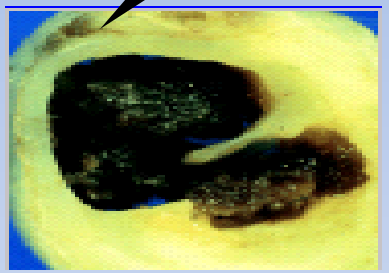
Chest pain

(Dyspnoe, Cardiac arrest)

Working diagnosis

Acute Coronary Syndrome





ECG

ST/T abnormalities or normal ECG

Persistent ST-elevation, LBBB

Troponin

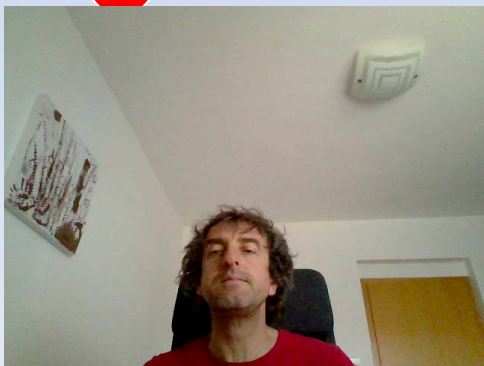
negativ

positiv

Diagnosis

Unstable AP

NSTEMI

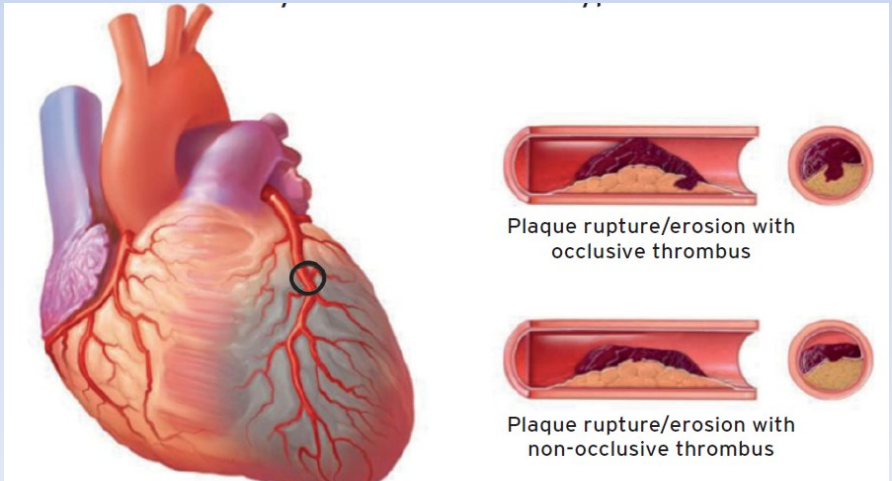


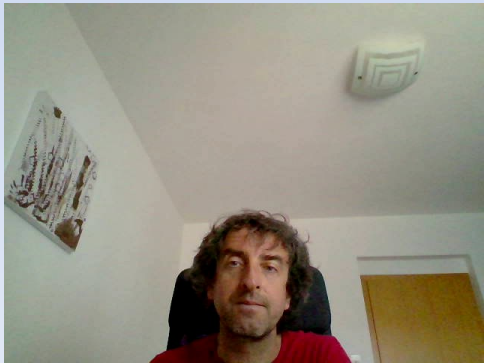
Fourth Universal Definition of MI

- **Myocardial injury – evidence of elevated cardiac troponin. The injury is considered acute if there is a rise and/or fall cTn values.**
- **Acute myocardial infarction (MI) - myocardial injury** with clinical evidence of acute myocardial ischemia.

- Symptoms of ischemia.
- New significant ST-segment–T wave (ST–T) changes or LBBB, Q-waves
- New regional wall motion abnormality.
- Identification of an intracoronary thrombus

- **Type 1 MI – evidence of athero-trombosis**

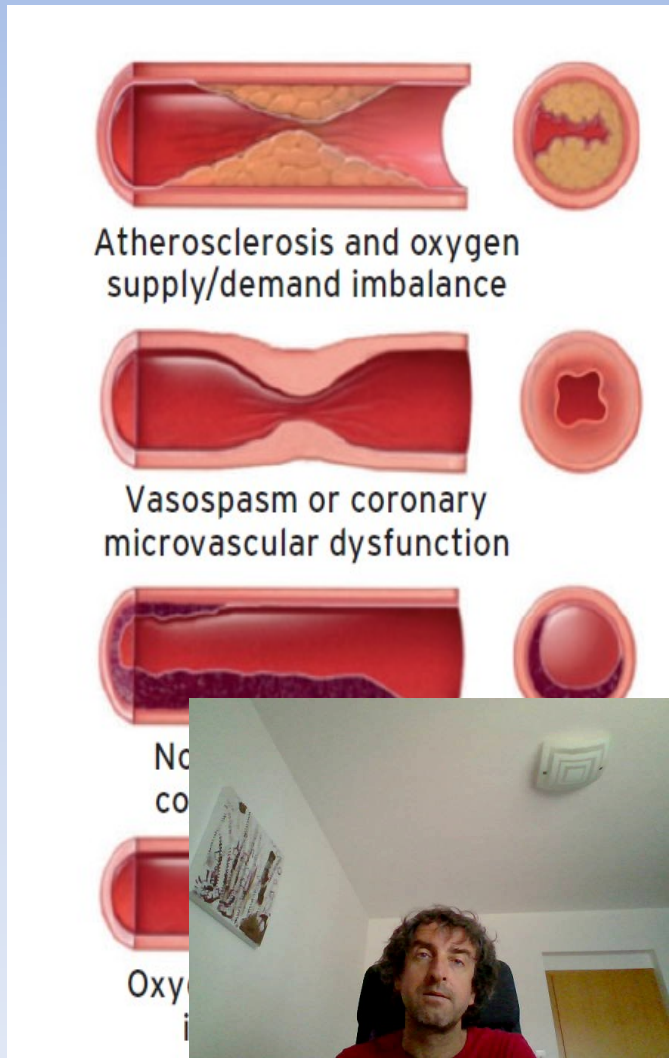




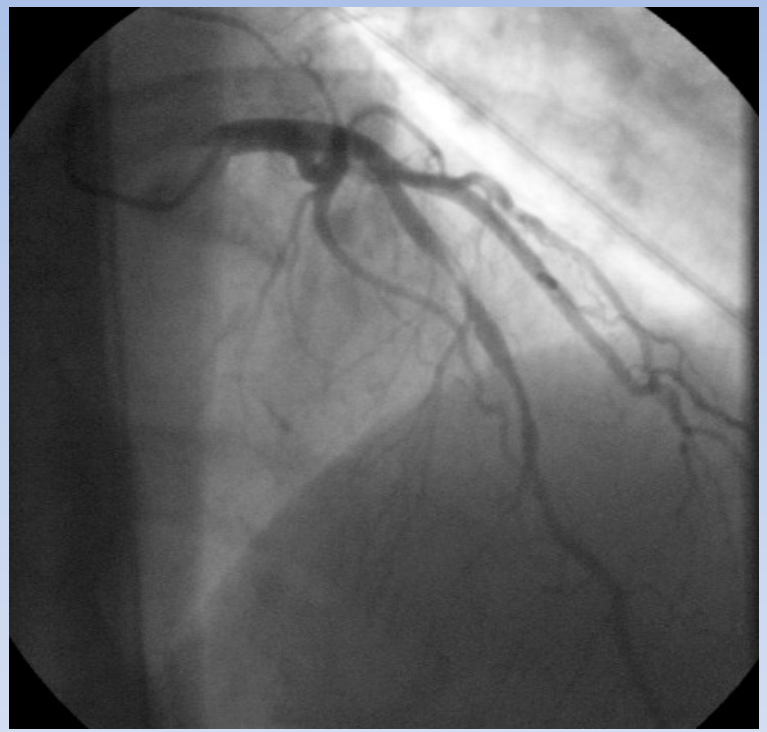
Fourth Universal Definition of MI

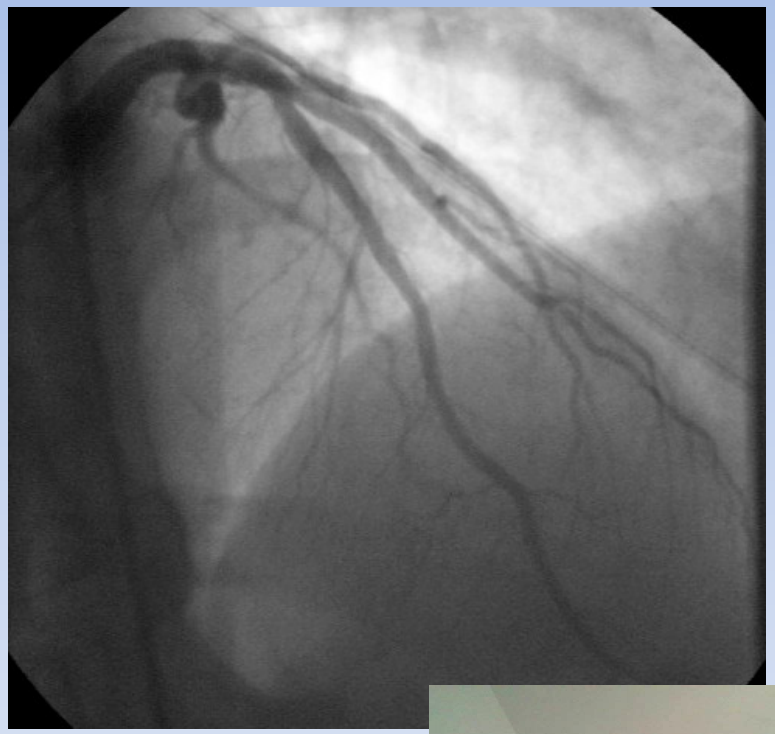
Type 2 MI - <u>secondary to an ischaemic imbalance</u> (other than athero-trombosis) between myocardial oxygen supply and/or demand.

- e.g. coronary endothelial dysfunction, coronary artery spasm, coronary artery disease without evidence of trombosis, coronary embolism, coronary artery dissection, tachy-/brady-arrhythmias, anaemia, respiratory failure, hypotension, septic shock, and hypertension with or without LVH.



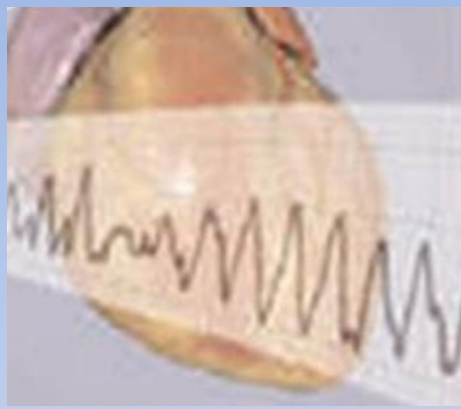
MI type 2 - vasospasm





Fourth Universal Definition of MI

Type 3: Myocardial infarction resulting in death when biomarker values are unavailable



Cardiac death with symptoms suggestive of myocardial ischaemia and presumed new ischaemic ECG changes or new LBBB, but death occurring before blood samples could be obtained or before cardiac biomarker could rise.

Type 4a: Myocardial infarction related to percutaneous coronary intervention (PCI)

Type 4b: MI related to stent thrombosis

Type 5: MI related to CABG

Other causes of myocardial injury - elevated troponin

Cardiac conditions

Heart failure

Myocarditis, Cardiomyopathy, Takotsubo syndrom

Coronary revascularization procedure and other procedure, ablation, defibrilator shocks, cardiac contusion, surgery, ablation

Systemic conditions

Sepsis, infectious disease

Chronic kidney disease

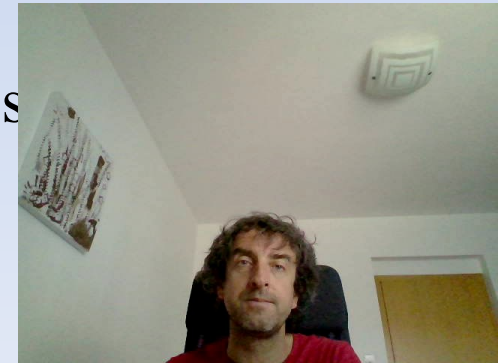
Stroke, subarchnoid haemorrhage

Pulmonary embolism, pulmonary hypertension

Infiltrative disease, e.g. Amyloidosis, sarcoidosis

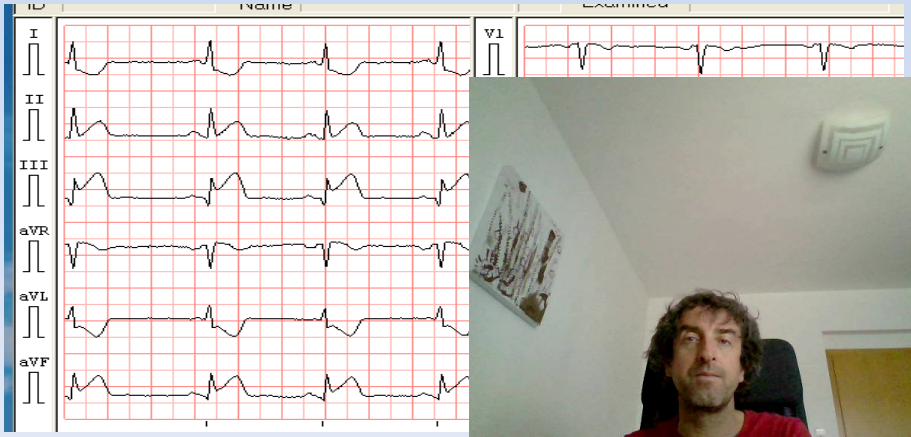
Chemoterapeutic cardiotoxic agents, e.g. anthracyclines

Strenuous exercise



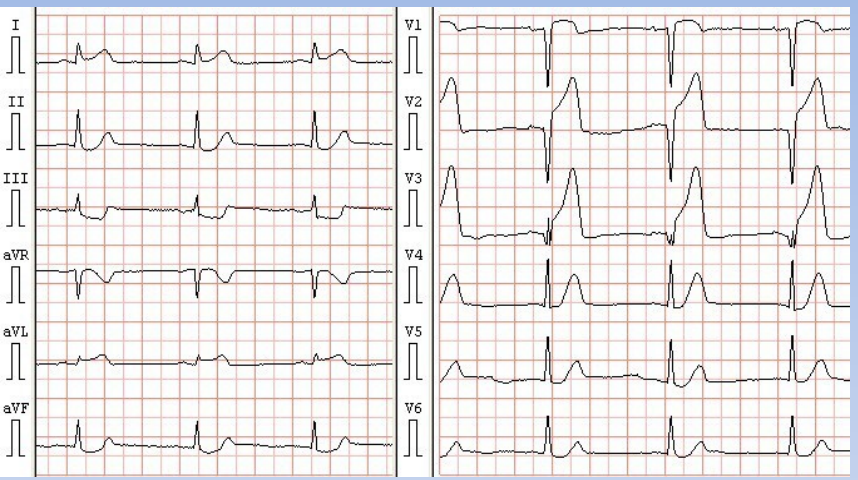
Initial diagnosis of STEMI

- Clinical symptoms - chest pain lasting 10 min and more, malignant arrhythmia, atypical chest pain, dyspnoe
- ECG – ST elevation at 2 or more leads at least 0,1 mV, (presumed) new LBBB lasting > 20min, repeated ECG recording often needed
- ***2-D echocardiography*** *to rule out major acute myocardial ischemia and other causes of chest pain/discomfort*
- ***Coronary angiography***
- ***Biomarkers - troponin***

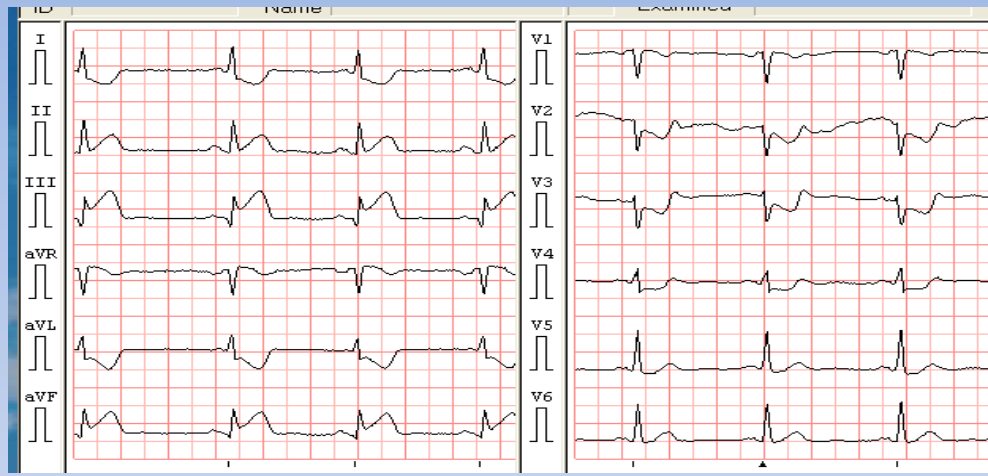


Diagnosis of STEMI

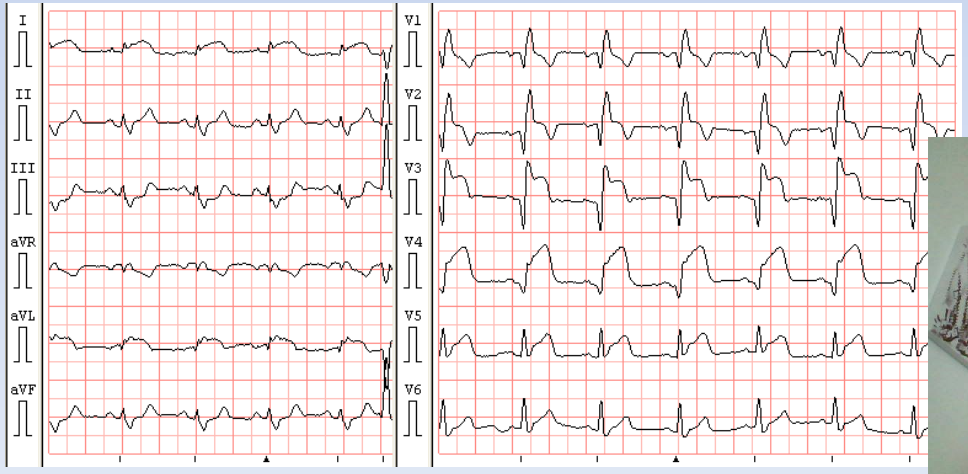
STEMI anterior wall

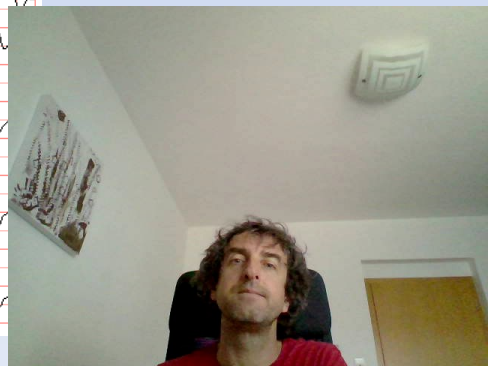


STEMI inferior wall



STEMI anterior wall + RBBB



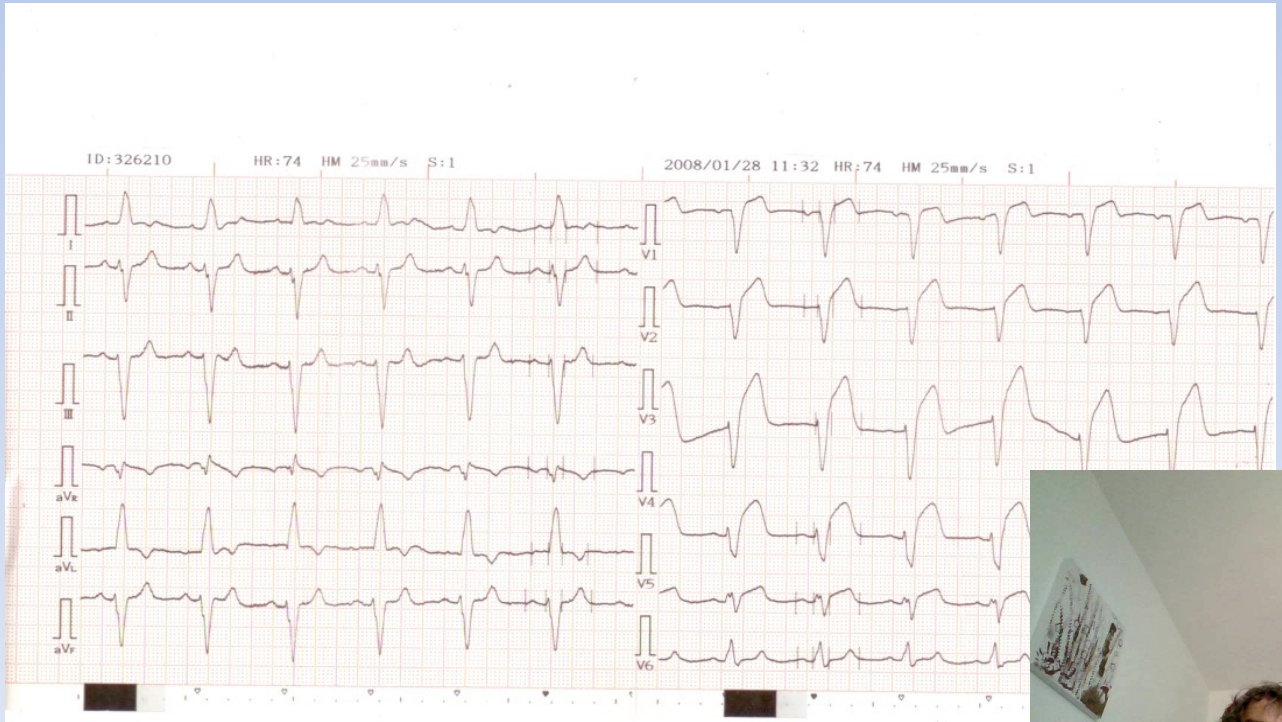


Diagnosis of STEMI - LBBB

Criteria can be used to improve the diagnostic accuracy of STEMI in LBBB

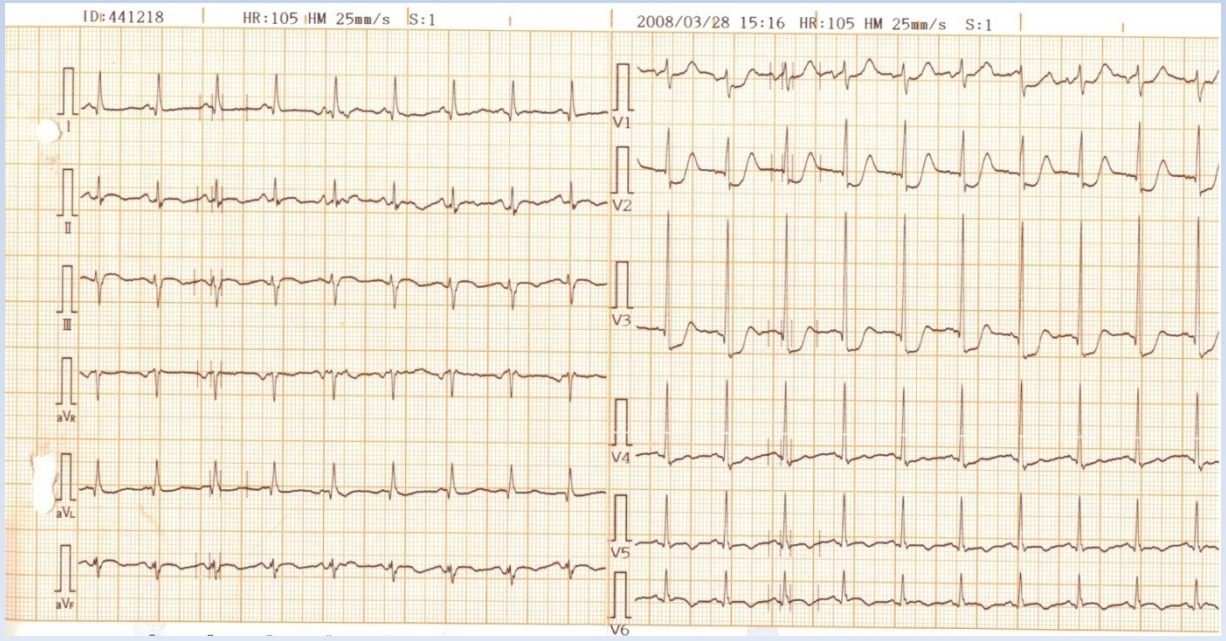
- Discordant ST-segment elevation ≥ 5mm in leads with a negativ QRS
- Concordant ST-segment elevation ≥1mm in leads with a positive QRS
- Concordant ST segment depresion ≥ 1 mm in V1-3

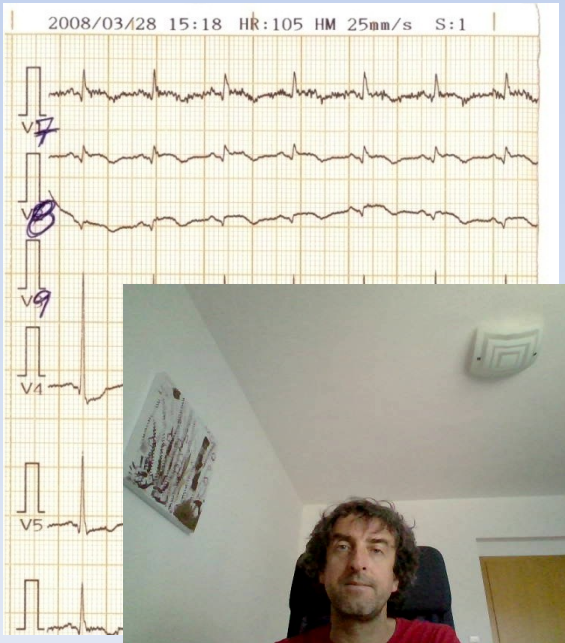
Consider acute echocardiography (regional akinesis)



True posterior infarction - Rcx

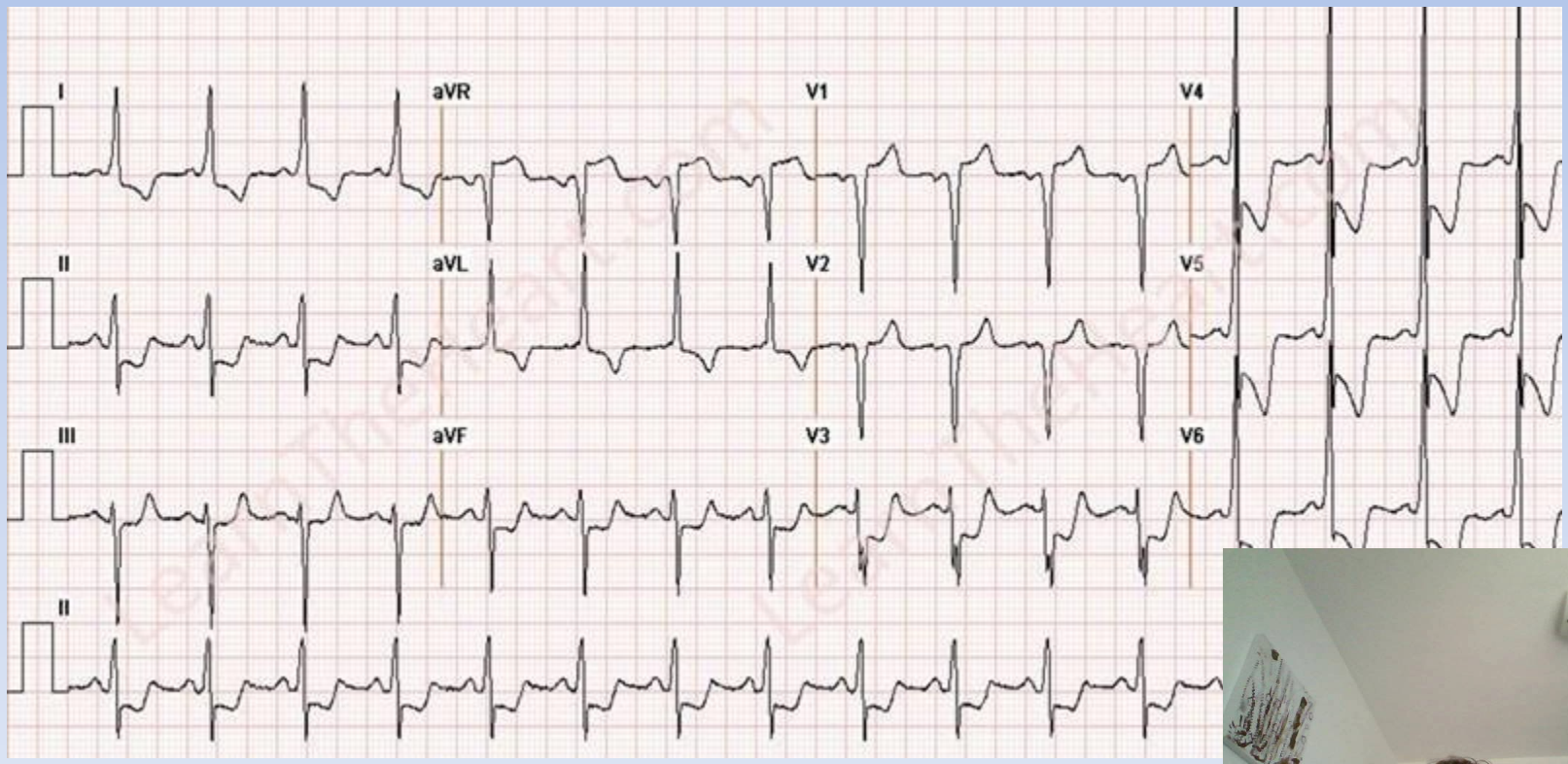
- Lasting chest pain without significant ST elevation!!
- Rs V1,2
- ST segment elevation <u>V7-V9</u> ≥ 0,05 mV
- ST segment depression V1-4 ≥ 0,05 mV
- Non-significant elevation ST II, III, AVF
- Ischemia in Rcx can lead to acute Mi insufficiency





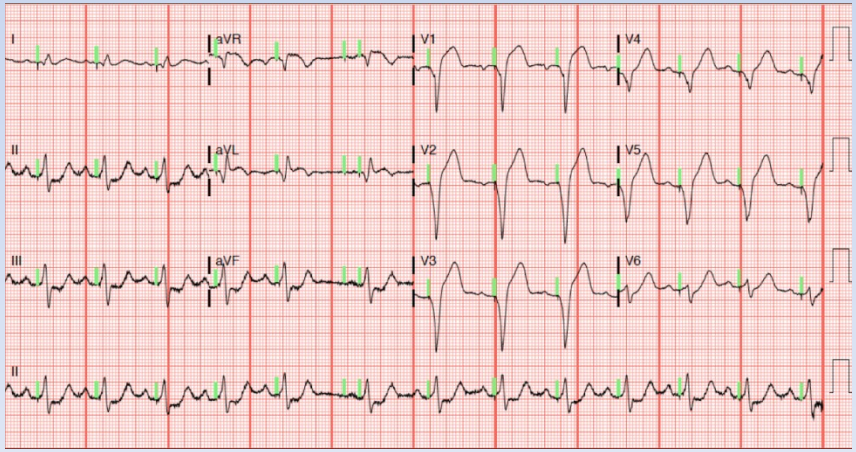
Ischaemia due to left main or MVD

- ST depresion > 1 mm in 8 or more leads, coupled with STE in aVR and/or V1
- Severe anaemia!!



Atypical ECG presentation that deserve prompt management in patients with signs and symptoms of ischemia

- **Ventricular paced rhytm**
  - During RV pacing, the ECG also shows LBBB, you can aplly rules for LBBB criteria of MI
- Patiens without diagnostic ST-segment elevation but with persistent ischaemic symptoms

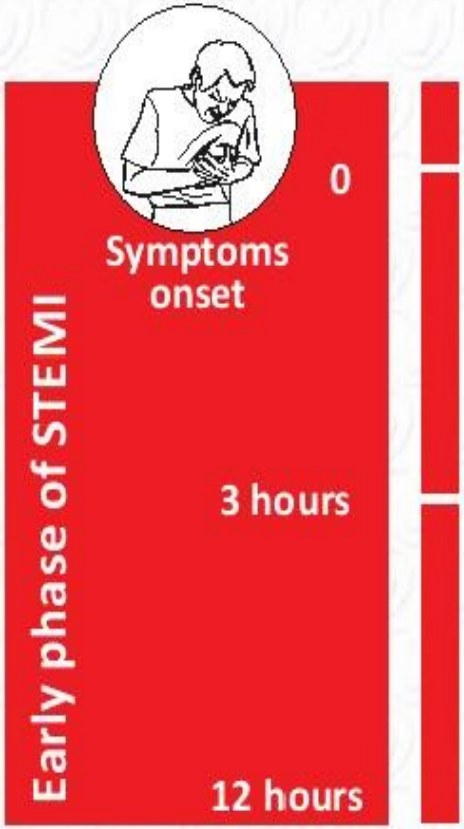


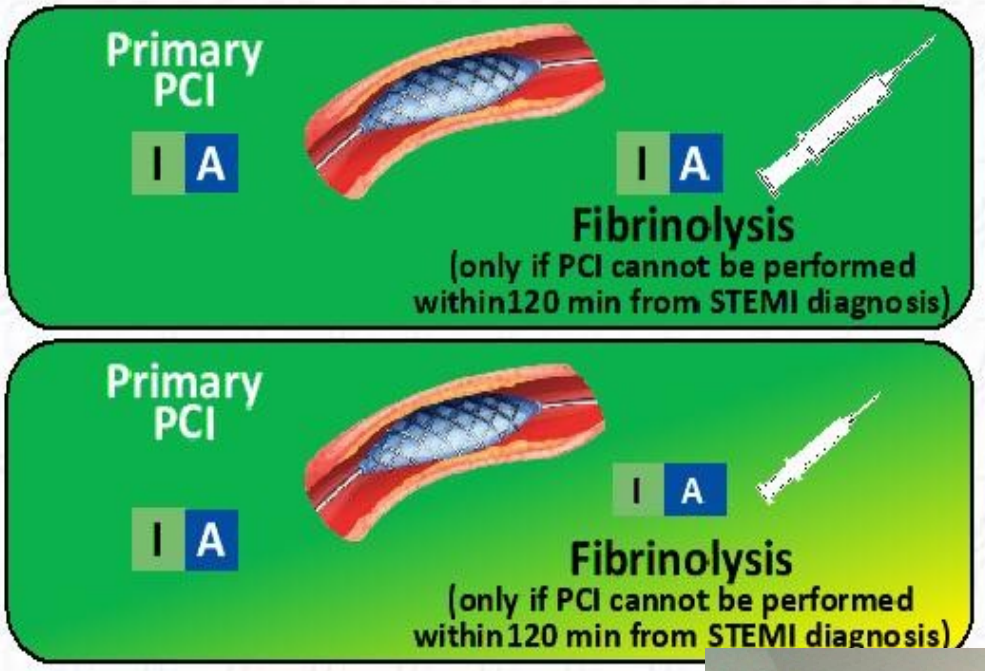
Pre-hospital Management of STEMI

- Pre-hospital mortality – sudden death 10-20%?
- Preinfarction unstable AP – 50% of STEMI
- First medical contact (FMC) - working diagnosis of STEMI must be done by staff of emergency ambulance - based on ECG (lifenet is helpfull) and chest pain
- FMC – 12-lead ECG must be obtained within 10min
- Primary transport to PCI-center (max. 9

Reperfusion strategies in the infarct-related artery according to time from symptoms onset

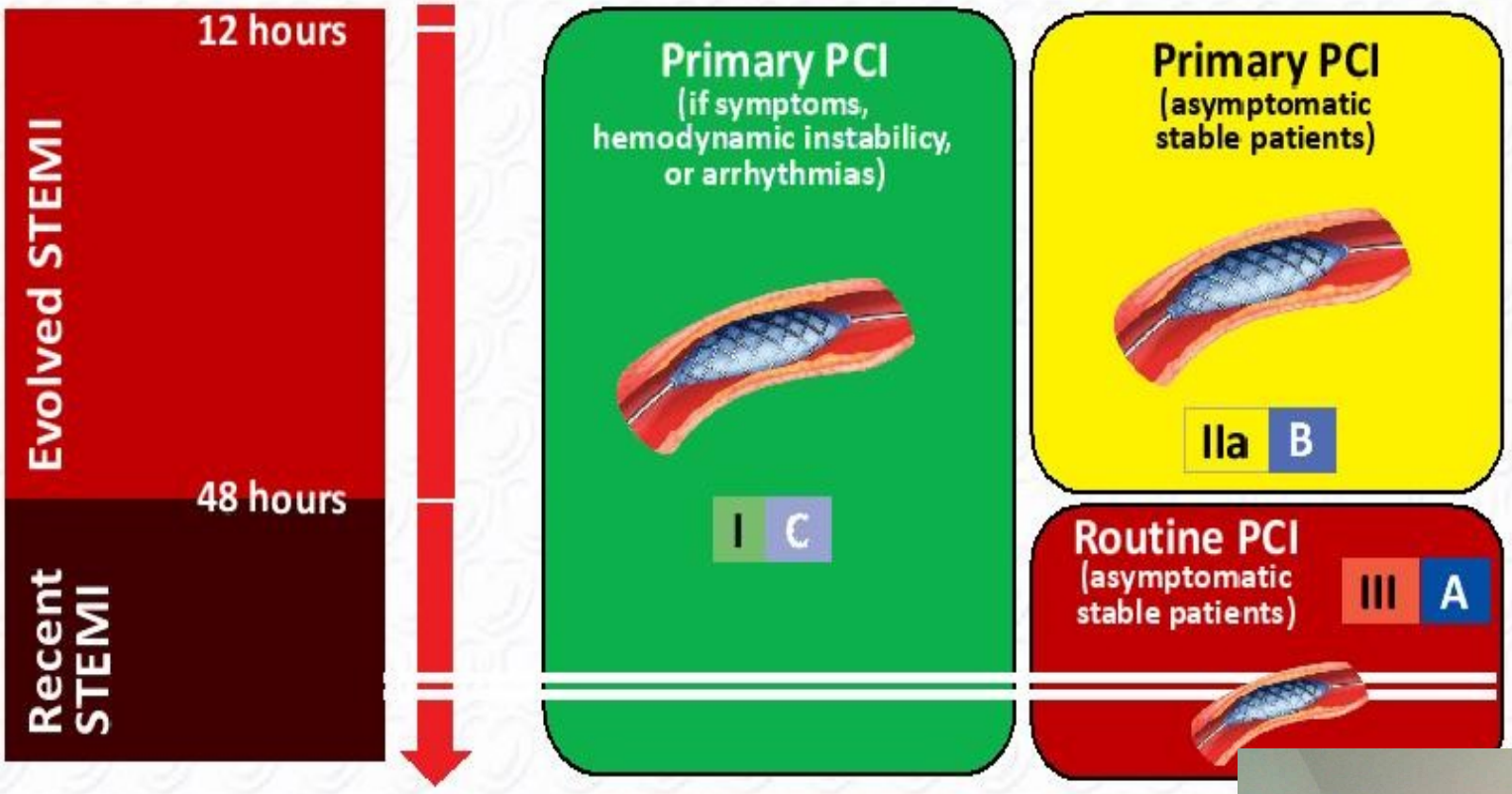
ESC
European Society of Cardiology





Reperfusion strategies in the infarct-related artery according to time from symptoms onset *(continued)*

ESC
European Society of Cardiology



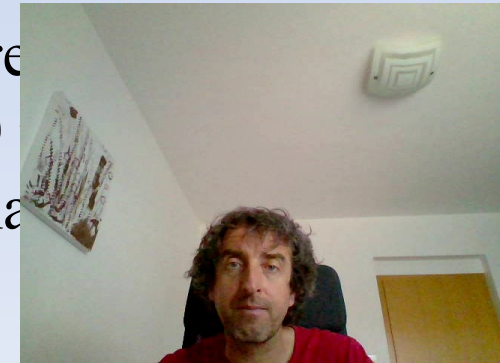
Fibrinolytic therapy

- In STEMI patients with early presentation < 3 h and an expected time ECG- PCI >2 h
- If primary PCI cannot be performed timely after STEMI diagnosis, fibrinolytic therapy is indicated within 12 hours of symptom onset
- A fibrin-specific agent (alteplase 15 mg iv. bolus, 50 mg/30 min, 35 mg/60 min), reteplase, tenecteplase
- Co-therapy – aspirin + clopidogrel
- Heparin 60 IU/kg iv bolus and infusion 12 IU/kg (aPTT 50-70 s) or Enoxaparin i.v.
- Coronary angiography 2-24 hours after fibrinol
- Rescue PCI – after failed fibrinolysis

Contra-indication to fibrinolytic therapy

- Previous intracranial haemorrhage or stroke of unknown origin
- Ischaemic stroke in the preceding 6 M
- Central nervous system damage, neoplasm, arteriovenous malformation
- Recent major trauma/surgery/head injury (within month)
- Gastrointestinal bleeding within month
- Known bleeding disorder
- Aortic dissection
- Non-compressible punctures in the past 24 hours

Relative CI – TIA 6M, oral anticoagulant therapy, pre
week postpartum, refractory hypertension (SBD>180
peptic ulcer, advanced liver disease, prolonged/trauma
resuscitation.



Pre-hospital treatment

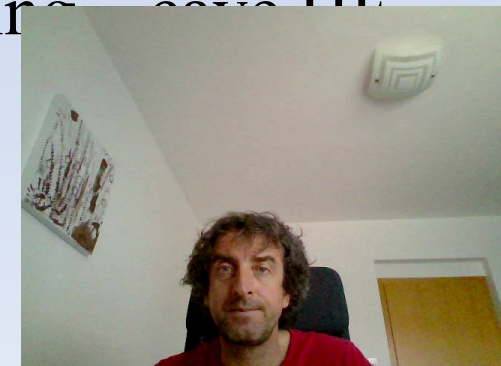
- **Relieve pain and anxiety** (Fentanyl 2 ml i.v., morphin 2-8 mg i.v., Diazepam 5-10 mg i.v.)
- **Antithrombotic therapy**
  - **ASA 250-500 mg i.v. bolus** *(150-300 mg soluble -no enteric-coated forms)*
  - **Heparin 100 IU/kg** *(enoxaparin 0,5 mg/kg iv bolus)*
  - *Bivalirudin i.v.*
- Beta-blockers Metoprolol 2-5 mg i.v. only in Killip I without bradycardia or hypote

Pre-hospital treatment of acute heart failure

- 02 (2-4 L/min) by mask **only** in patients with hypoxaemia (SaO2<90% or PaO2<60mmHg)
- Diuretics (Furosemide 40-80 mg – cave hypovolemia)
- Nitrates (if no hypotension)
- Opioids (Fentanyl 2 ml i.v., morphin 2-8 mg i.v) to relieve pain
- Invasive pulmonary ventilation (Killip III- be considered early

Right ventricular infarction

- In a patient with inferior STEMI and proximal occlusion of RCA
- Diagnosis – ST-segment elevation in V4R
- Right ventricular infarction may be suspected by hypontension, clear lung fields, raised jugular venous pressure
- Echocardiography may confirm the diagnosis
- Often complicated by AF – should be corrected
- Primary PCI may result in haemodynamic improvement
- Therapy 1000-2000 ml of fluids during first hours, then 100-200 ml/h until hemodynamic stabilization (PCWP 15-18 mmHg) with carefull heamodynamic monitoring – cave HF
- Noradrenaline could be considered
- Cave nitrates, diuretics, ACEI/ARB

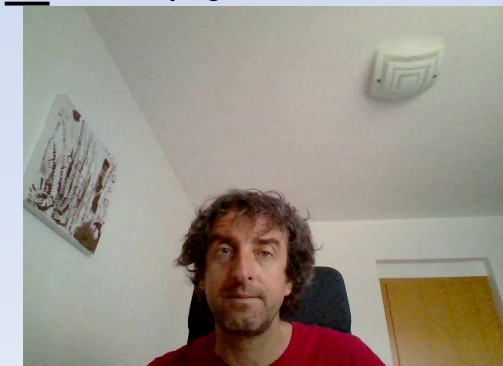


Antiplatelet therapy

- **ASA** 75-100 mg long term
- **Prasugrel** 60mg/10mg (CI after stroke, ≥ 75 y)
- **Ticagrelor** 180/90 BID
- Clopidogrel 600 mg/75 mg
- (6-) 12 month
- LWMH (enoxaparin 24 h after PCI, then only as thromboembolic prophylaxis as needed)
- Oral anticoagulation INR 2-3 in patie
  not tolerate aspirin/clopidogrel/Ticag
  Prasugrel

Medical treatment after MI

- **BB** (early use with the aim of HR 60-70/min and BPs 120 mmHg, in patients with HF – carvedilol, metoprolol, bisoprolol)
- **Statins** – early use since the first day (LDL < 1.4 mmol/l)
- **ACEI** – should be started in the first 24 h
- **ARB** – in patients, who do not tolerate ACEI
- **Spironolactone**, **eplerenone** – EF LV≤ 40%



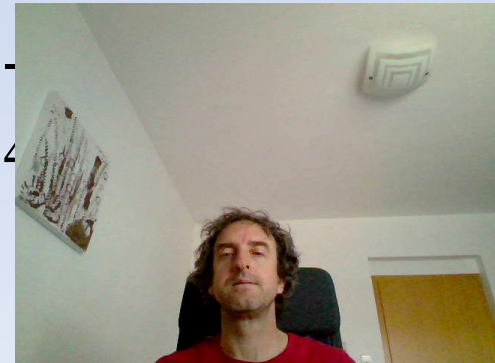
Long term management of specific coronary risk factors and LV dysfunction

- **Smoking cessation**
- **Physical activity** – moderate intensity aerobic exercise at least 4 times a week
- **Diabetes management** – HbA1C < 6,5%
- **Weight reduction** (BMI ≤ 30 kg/m2)
- **BP control -** 130/80
- **Lipid control -** LDL< 1,4 mmol/l
- **Management of HF** or LV dysfunction – medical treatment; **CRT** in patients with < 35%, LVDd >55 mm and QRS>120ms who remain in NYHA III-IV in spite of optimal medical therapy
- **Prevention of sudden death**

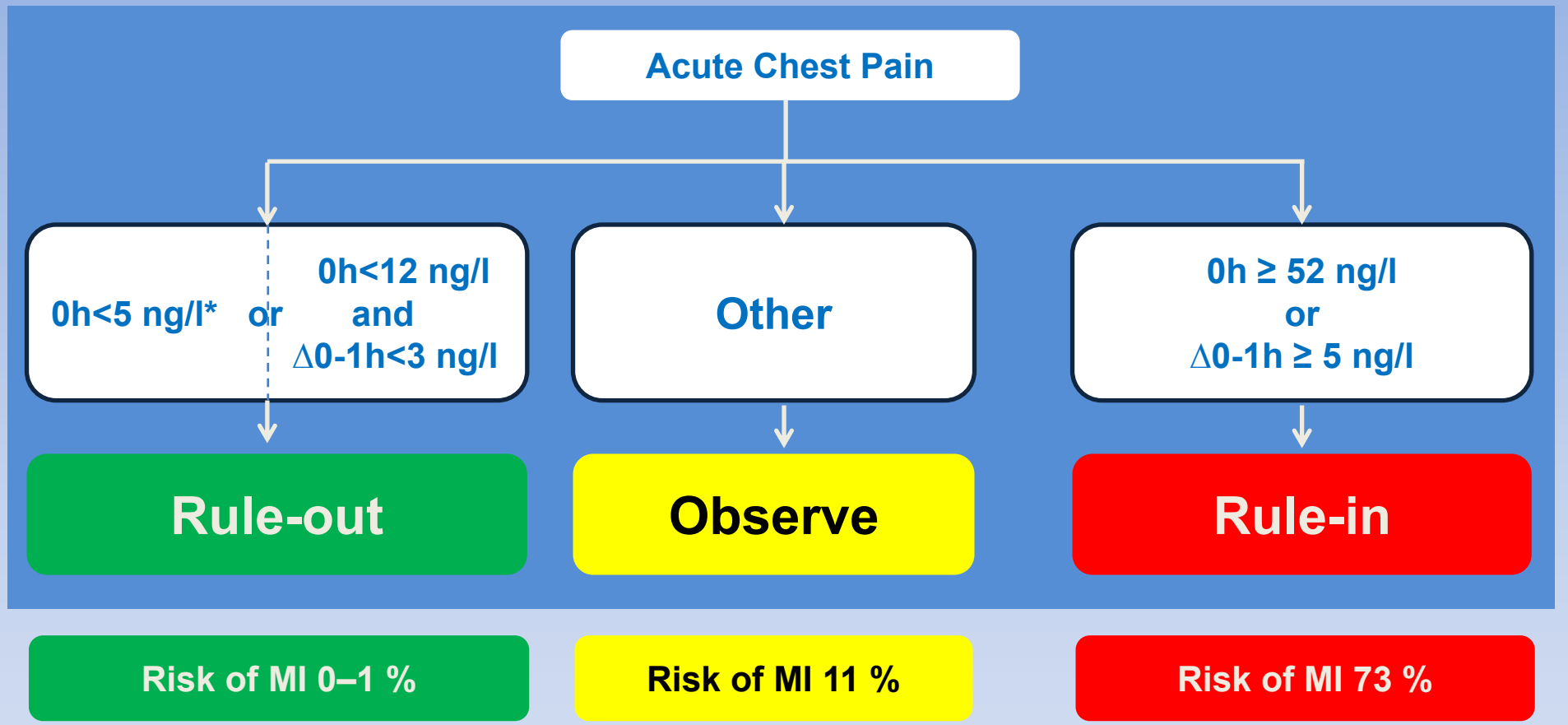
  ICD if EV≤35% and NYHA II-II at least 40 days

NSTEMI -Differential diagnosis of chest pain

- ACS 20-40%
- Aortic dissection, aneurysma
- Pulmonary embolism 5%
- Pericarditis, myocarditis, Tako-tsubo
- Anemia
- Pleuritis
- Pneumothorax
- Herpes zoster
- Ulcus ventriculi, pancreatitis
- Reflux esophagitis
- Neurasthenia 5-
- Vertebrogenic pain 1
- Tietze syndrome

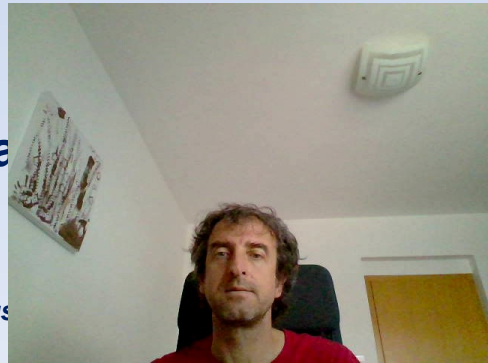


Algorithm rule-out/rule-in at 0-1 h (hs-cTnT)



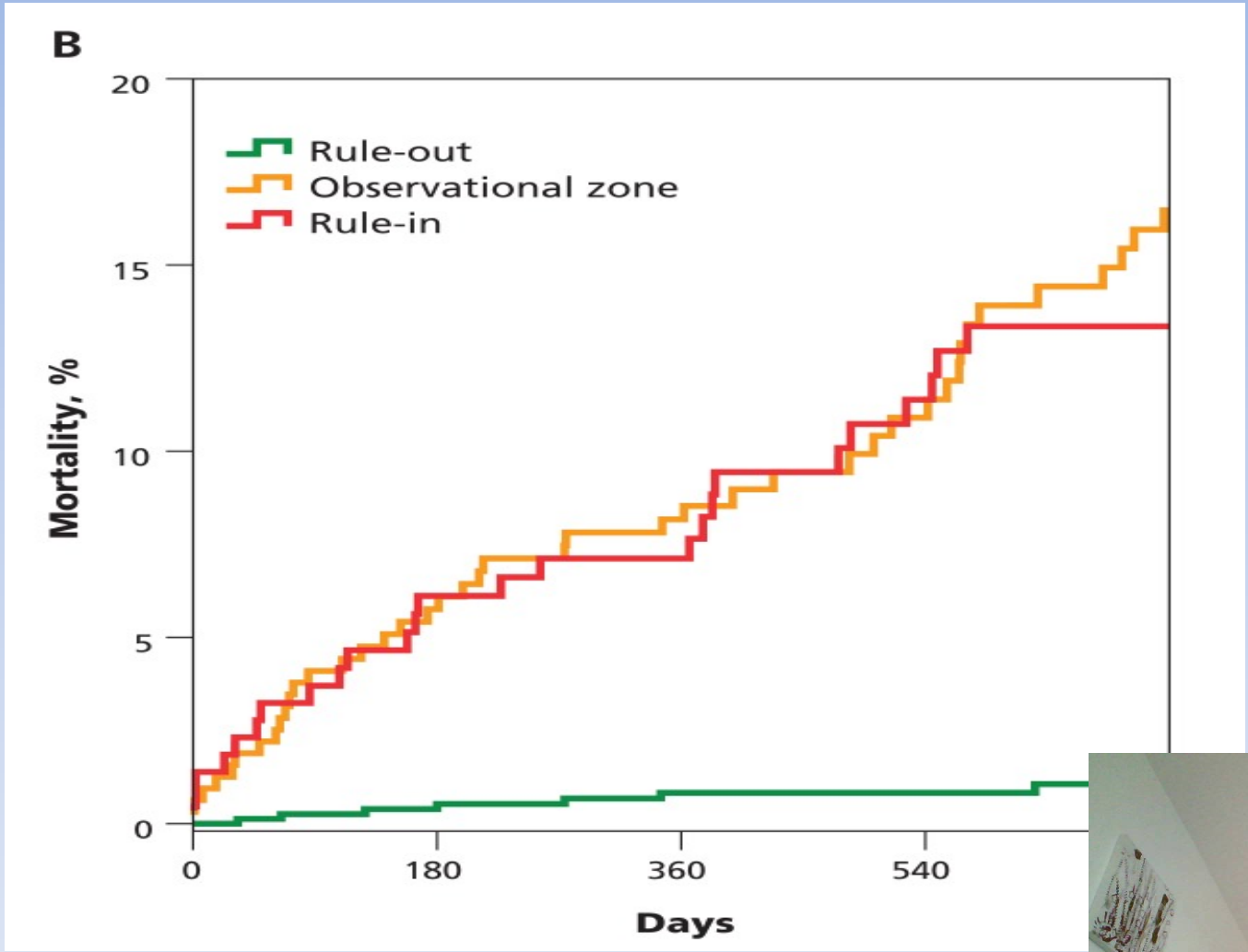
* > 3 hours after onset of chestpain

Further testing at 3-6 h, when is ACS suspected and first 2 sa



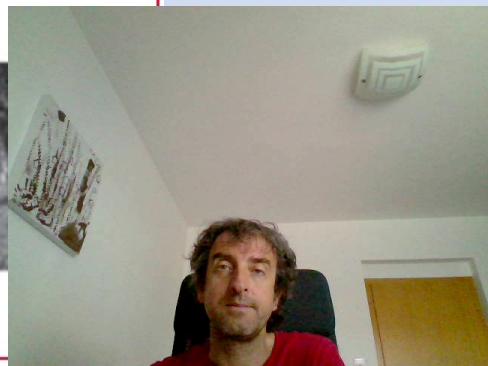
Boeddinghaus 2018

Prognosis



Reichlin, Mueller et al, CMAJ, 201

Cardiac magnetic resonance imaging

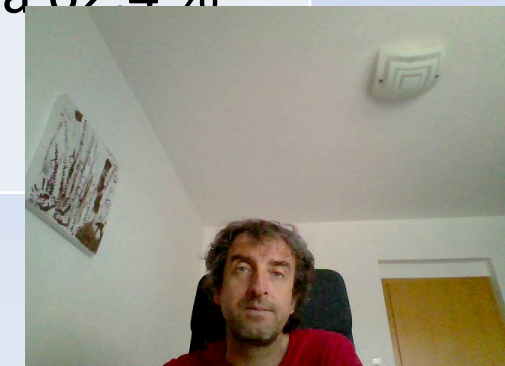


NSTEMI – recommendation for invasive evaluation

- **Urgent < 2h** – with refractory angina, AHF, life-threatening ventricular arrhythmias or hemodynamic instability, RBBB
- **An early invasive strategy < 24h** is recommended in patients with a GRACE score >140, T-wave dynamic changes
- **An invasive strategy (within 72h)** in all patients with recurrent symptoms or with high-risk criterion segment with at least one primary high ri
  (DM, renal insufficiency, EF< 40%, early
  infarction AP, recent PCI, prior CABG, i
  to high GRACE risk score)

Acute heart failure

Killip	Definition	30D and 12M mortality
I (without HF)	Without pulmonary congestion	2,8 % a 6,9 %
II (mild HF)	Rales < 50% of lung and/or gallop	10,9 % a 20,1 %
III (pulmonary oedema)	Rales ≥ 50% of lung	20,6 % a 41,3 %
IV (cardiogenic shock)	Hypotension, tissue hypoperfusion, anuria	38,0 % a 62,4 %



Cardiogenic shock- Killip IV

- The stage in which profound reduction of *effective* tissue perfusion leads first to reversible, and then if prolonged, to irreversible cellular injury
- Persistent (>30 min) hypotension with systolic BP bellow 80-90 mmHg (in normotensive patient) and a mostly marked reduction of cardiac index (<1,8 L/min/m2) in face of elevated left ventricular filling pressure (PCWP > 18 mmHg) or need of vasopressors to achieve BPs >90 mmHg because of HF.
- Evidence of organ hypoperfusion – oliguria ml/h), peripheral hypoperfusion (mottled, w skin), encephalopathy (confusion), acidosis.

Cardiogenic Shock – ACS

- 1. Severe left ventricle dysfunction (EF 20%) – usually involves left main or left anterior descending obstruction or 3VD, low cardiac output, compensatory systemic vasoconstriction
- 2. Moderately severe depression of LV function of 30% and SIRS (systemic inflammatory response syndrome – fever, elevated white blood cell count, CRP, low SVR)
- 3. Mechanical causes of heart failure (free wall rupture, rupture of IVS, rupture of papillar
- 4. Right ventricle MI and CS
- 5. Iatrogenic (hypovolemia, BB)

Cardiogenic shock - management

- **Invasive pulmonary ventilation** according to state and blood gases
- **Inotropic agents + vasopressors** (dobutamin 5-20 ug/kg/min+ NA 0,5-30 ug/min, *levosimendan, adrenaline cont., vasopresin, terlipresine*)
- Hypotension – consider i.v. fluids 250-500 ml or more to achieve PCWP 18-20 mmHg
- IABC (in hemodynamic unstable patients despite optimal farmacologic treatment and mechanical complication, no routine use is recommended), **ECMO,** LVAD
- Emergent **revascularization** by primary PCI or CABG
- Pulmonary artery catheter (CO, PCWP, VR, + oximetry of pulmonary venous blood – 60-65

Thank you for your attention