# Clinical case of a patient with myocardial bridging

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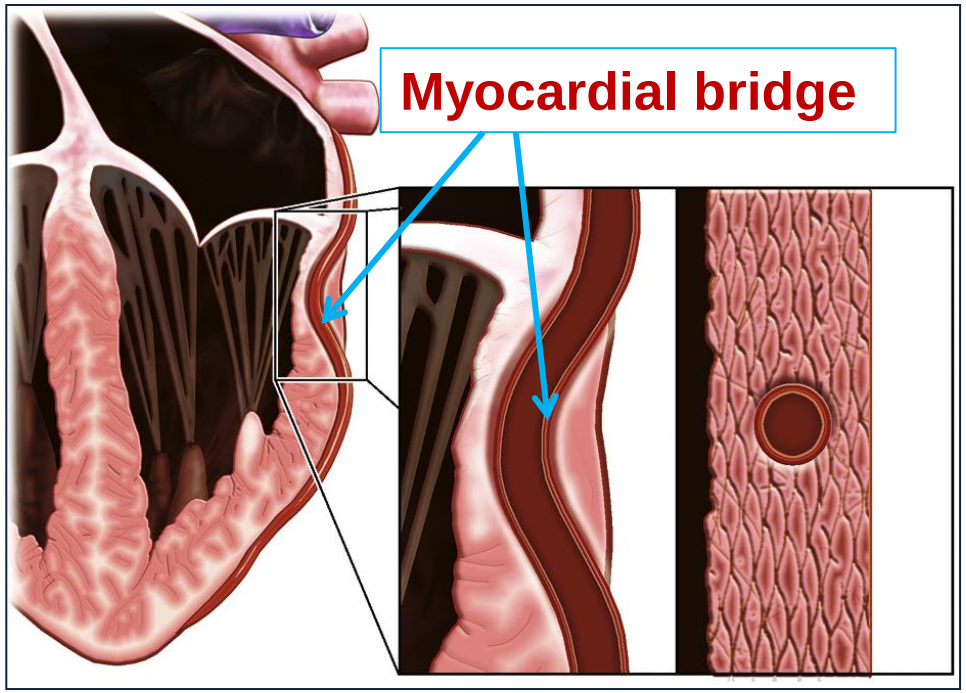
# Introduction

- Myocardial bridging (MB) is a congenital anomaly in which a segment of a coronary artery takes a “tunneled” intramuscular course under a overlying myocardial “bridge” resulting in its systolic compression.
- Most common localization for MB is middle segment of the left anterior descending coronary artery (LAD).

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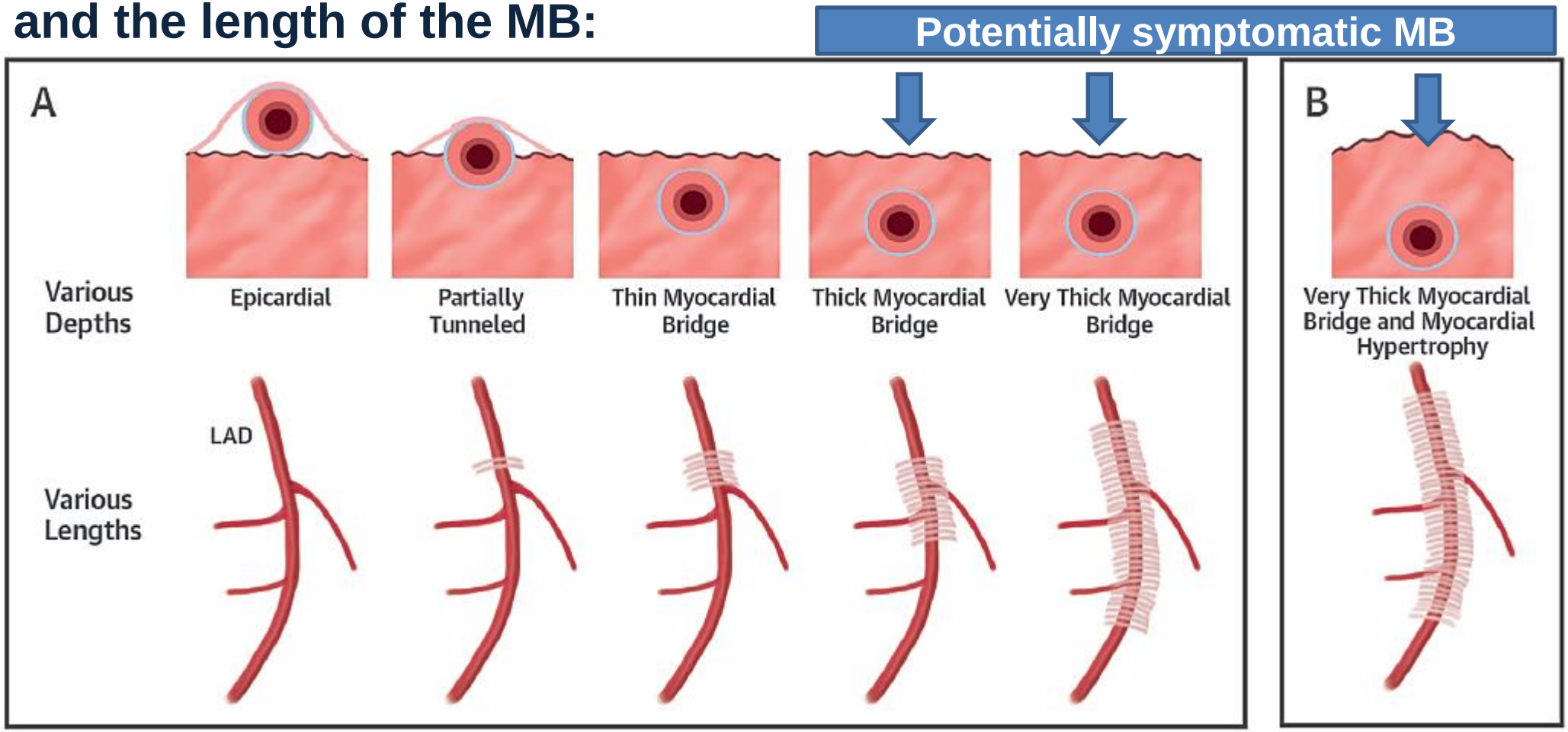
- Patients can be asymptomatic or present with myocardial ischemia, acute coronary syndromes, coronary spasm, exercise induced dysrhythmias, conduction abnormalities and sudden cardiac death.

# Pathophysiology of MB

- Myocardial perfusion occurs primarily in diastole, in normal conditions, only 15% of coronary blood flow occurs during systole. The degree of myocardial ischemia and resulting symptoms appear on first glance to be out of proportion to the degree of compromise in coronary blood flow by MB.
- Tachycardia associated with increased sympathetic drive due to exercise or emotional distress can unmask the ischemic effect of MB. It reduces flow and myocardial perfusion by shortening diastolic perfusion time, and also increases coronary vasoconstriction as well as contraction of the MB over the tunneled artery.
- Another factors contributing to myocardial ischemia are associated with the increasing left ventricular diastolic dysfunction associated with hypertension, and also with the coronary atherosclerosis which usually spares the MB itself and appears proximally from tunneled artery over the course of time.

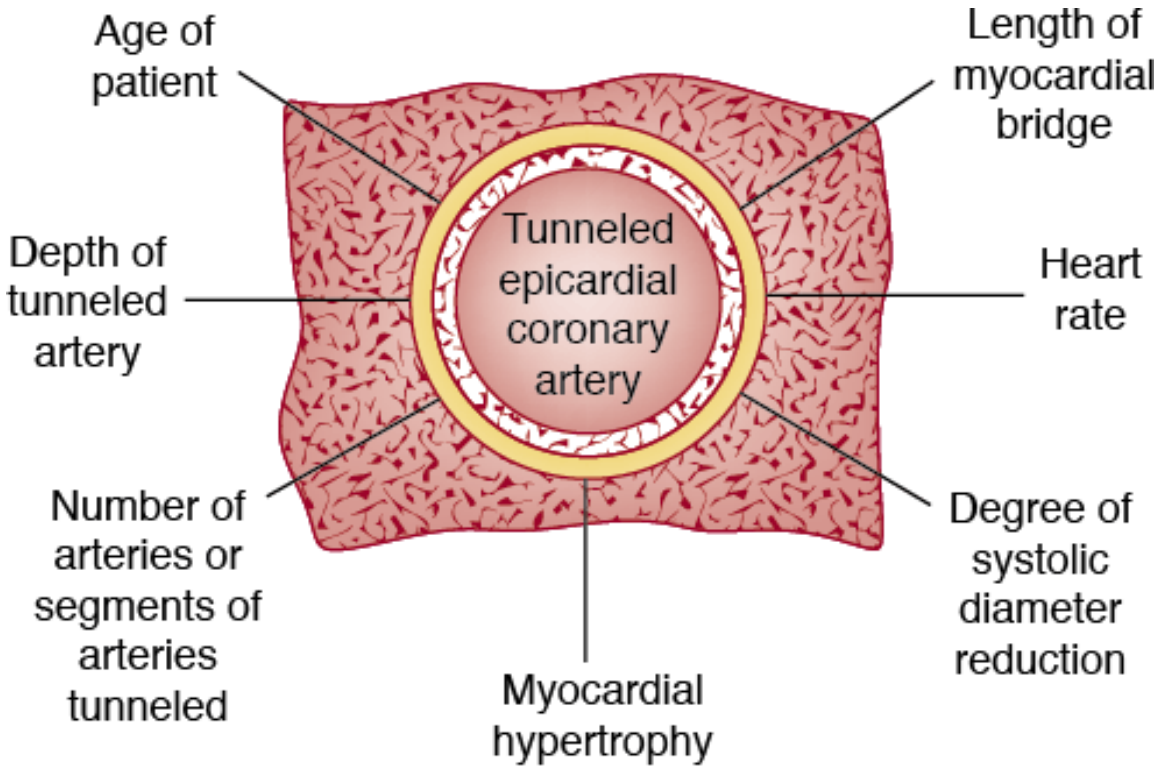
# Types of myocardial bridges

**There are several types of myocardial bridges based on the depth and the length of the MB:**



# Pathophysiology of MB

**Factors which define hemodynamic impact, clinical presentation and outcomes in patients with MB**




Source: Fuster V, Walsh RA, Harrington RA: *Hurst's The Heart, 13th Edition:* www.accessmedicine.com

# Symptoms and signs of MM

**Up to one-third of patients with a myocardial bridge do not have any symptoms.**

**In symptomatic patients clinical manifestations are most likely caused by the myocardial ischemia and may include:**

- **chest pain,**
- **Tightness or heaviness in the chest, associated with the pain in the left arm or jaw,**
- **shortness of breath,**
- **fatigue**

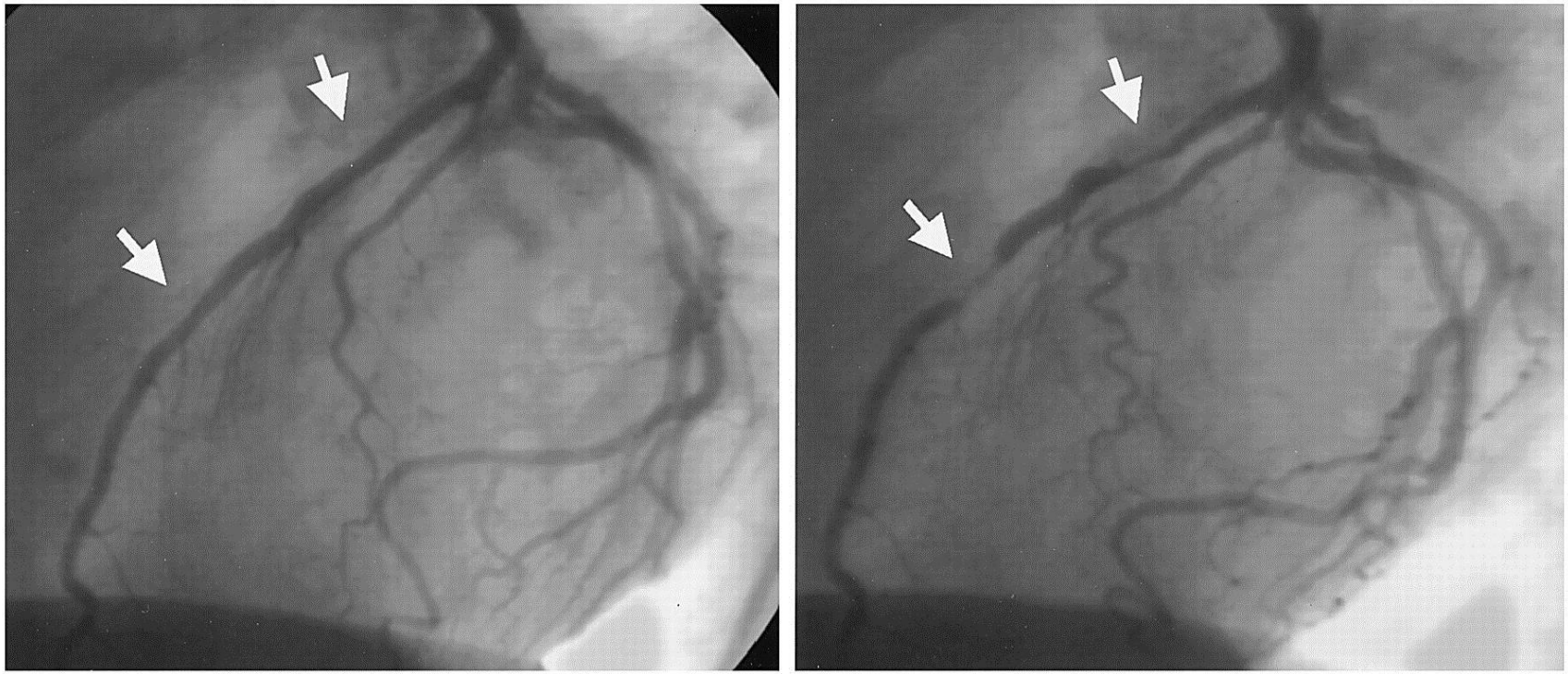
**Symptoms usually do not develop before the third decade; the reason for this is not clear.**

# Diagnosis of MM

**Diagnostic tests include:**

- **Coronary angiography**
- **Intracoronary Doppler**
- **Intravascular ultrasound**
- **Fractional flow reserve Cardiac computed tomography (CT) angiography**

# Angiography in MB

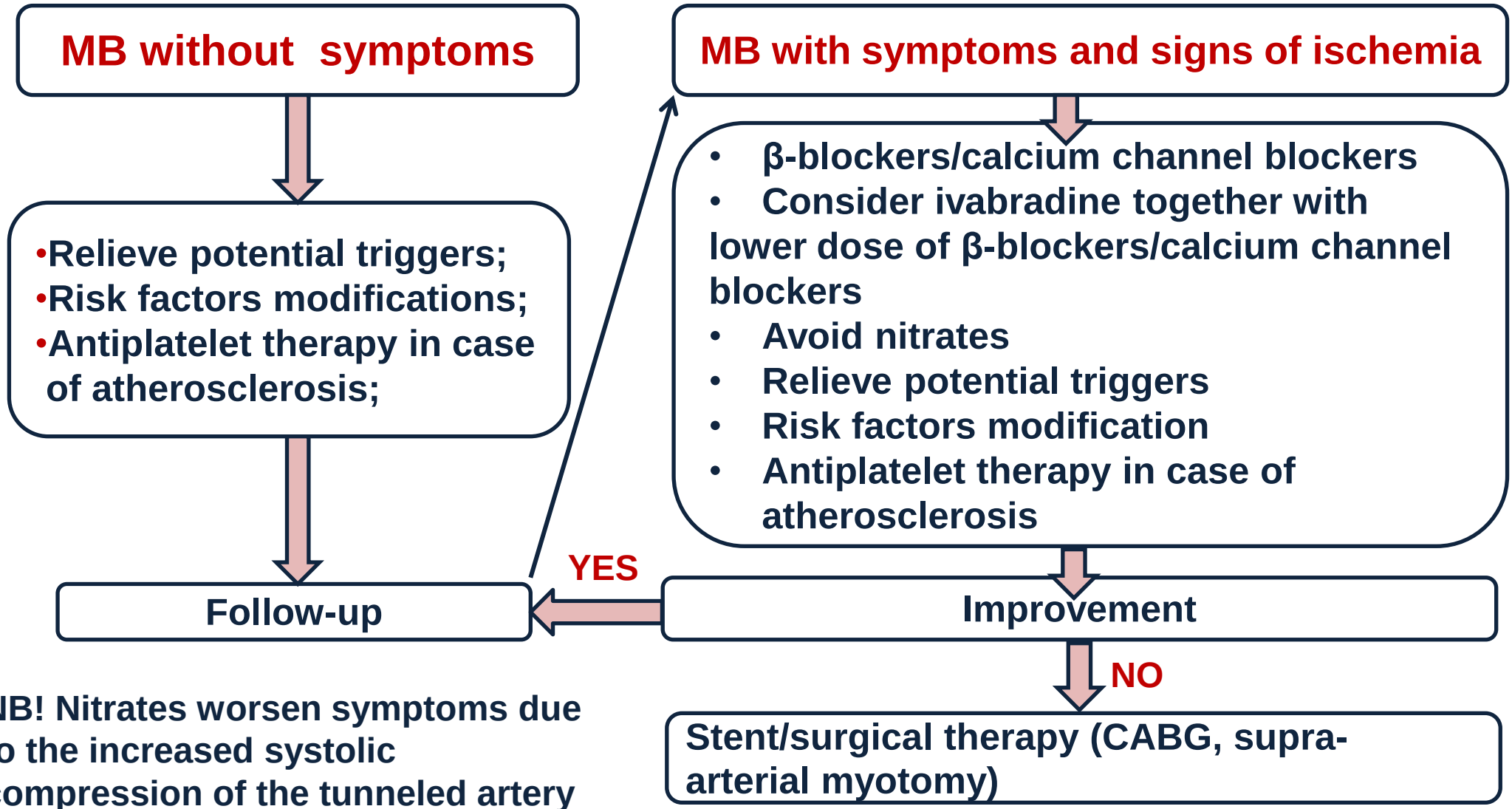


Diastole Systole

- **Typical systolic compression (arrows) of the mid LAD at two sites in series. Diastolic lumen dimensions are normal. The coronary tree shows no angiographic signs of coronary atherosclerosis.**

https://www.ahajournals.org/doi/epub/10.1161/01.CIR.0000038420.14867.7A

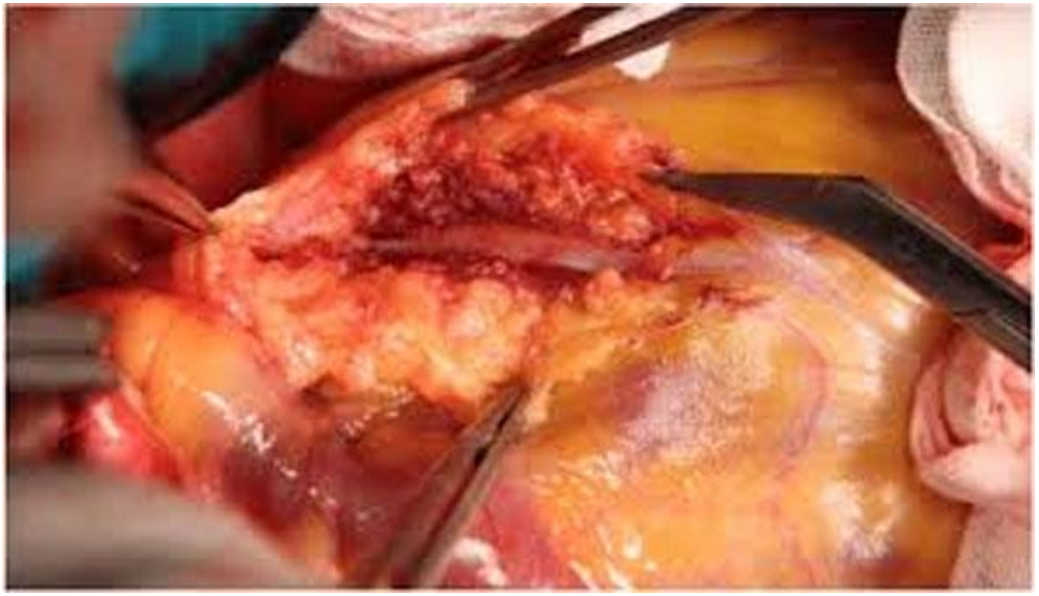
# Treatment strategy of MB




**NB! Nitrates worsen symptoms due to the increased systolic compression of the tunneled artery**

# Supra-arterial myotomy

- **Supra-arterial myotomy involves resection of the overlying muscle fibers resulting in elimination of the symptoms and increase in the coronary flow.**
- **The procedure is used in patients with refractory symptoms despite medical therapy, especially in those with demonstrated inducible ischemia and those who are at high risk for myocardial infarction, ventricular tachycardia, or resuscitated cardiac arrest.**
- **Surgical risks include dissection into the ventricle in patients with myocardial bridges that take a deep subendocardial course.**



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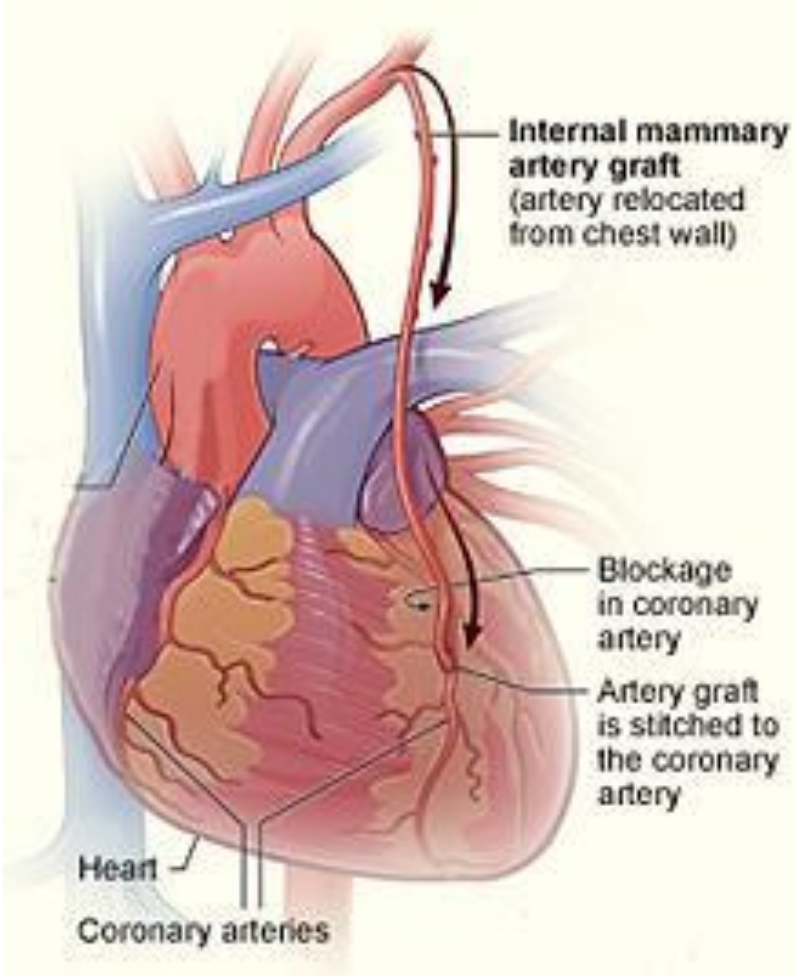
# CABG

- **Coronary artery bypass graft (CABG) surgery in treatment of MB typically involves anastomosis of the left internal mammary artery to the LAD artery.**
- **CABG can be considered a treatment option for myocardial bridging, especially in extensive and deep bridges.**




https://news.emory.edu/stories/2013/03/acc_mtg_hybrid_revasc/thumbs/LIMAtoLAD.jpg

# Our patient

- **Name: B. O. P.**
- **Sex: male**
- **Age: 50 years**
- **Location: Kharkiv**
- **Occupation: not working (disability II degree).**

# Complaints

- **Dyspnea on moderate physical exertion (on walking up to 300 m)**
- **Periodical pressing chest pain with duration of 3-5 minutes with irradiation to the left arm, shoulder blade on physical exertion (walking or climbing stairs rapidly) relieved by rest**
- **General weakness, malaise**

# Anamnesis morbi

- **Since 2013 had periodical chest discomfort relieved by rest which appeared without apparent reason, the patient didn't seek for medical help. 19.07.2014 while playing basketball on vacation first appeared intense chest pain not relieved by rest.**
- **The patient was urgently hospitalized to Primorsk hospital where the diagnosis of antero-lateral ST elevation myocardial infarcion (STEMI) was made. Angiography and percutaneous coronary intervention (PCI) were not performed due to absence of such capacities. The patient was treated with thrombolytics (streptokinase). Acute period of the disease was complicated with acute heart failure (treated with levosimendan) and formation of an aneurism of an apex of left ventricle.**
- **14.08.14 was transferred for the rehabilitation to the Kharkiv hospital #8 where angiography was performed which showed the presence of myocardial bridge of anterior descending artery occluding its lumen by 80% in systole.**

# Anamnesis morbi-2

- Was recommended surgical treatment and the patient was referred to the Kyiv heart center where the coronary artery bypass grafting procedure (CABG) was performed (31.10.14). Postoperative period passed without complications. With the improvement of his condition was discharged under supervision of cardiologist.
- Annually had planned hospitalization. Since 2020 periodically experienced chest discomfort 1-2 times in a month, treated with beta-blockers under control of HR and ECG.
- Last hospitalization in November 2020 due to worsening of his condition which started 1 month ago with an increased dyspnea, retrosternal chest pain.

# Anamnesis vitae

- Not working (until 2014 worked as a school teacher).
- Postponed diseases: URVI, chicken pox in childhood.
- Tuberculosis, diabetes, viral hepatitis, allergic reactions denies.
- Bad habits denies.
- Hereditary history is not burdened.
- According to the patient there were no cardiovascular diseases in the family
- Physical activity: sedentary lifestyle.

# Objective status

- General condition is relatively satisfactory, clear consciousness, posture is active, patient is normosthenic.
- Weight - 85 kg, height – 178 cm. BMI – 26,8 kg/m2; t - 36.7°C.
- Skin and visible mucosae - pink, clean with preserved moistness; subcutaneous adipose tissue - developed moderately, distributed symmetrically. Lymphatic nodes are not palpable. No peripheral edemas.
- Thyroid gland is not enlarged;
- Lungs: resonant percussion sound, on auscultation – prolonged exhalation, RR -19/';
- Heart borders extend 1,5 cm to the left , heart sounds are clear, rhythmic, muffled. HR=pulse=68 bpm. Pulse is rhythmic. BP dex=128/80, BP sin=125/80.
- On palpation abdomen is painless, liver does not protrude from costal margin; spleen is not palpable. Tapping sign is negative on both sides.

# Plan of investigations

- **Full blood count, urinalysis**
- **Biochemical panel (lipid profile, fasting plasma glucose, AST, ALT, albumin, creatinine, total protein, calcium, potassium, sodium, chlorides, coagulogram)**
- **Resting ECG**
- **Exercise ECG test**
- **Holter monitoring**
- **EchoCG**
- **Chest X-ray**
- **Coronary angiography – patient refused from the procedure**

# Full blood count

| Options | Results | Normal range |
|---|---|---|
| Hemoglobin, g/L | 147 | 130,0 – 160,0 |
| Erythrocytes × $10^{12}$/l | 4,4 | 4,0- 5,0 |
| Leukocytes × $10^{9}$/L | 6,1 | 4,0 – 9,0 |
| ESR, mm/h | 5 | 2-15 |
| Stab neutrophils, % | 1 | 1-6 |
| Segmented neutrophils, % | 58 | 47-72 |
| Eosinophils, % | 3 | 0,5-5,0 |
| Basophils, % | 0 | 1-1,0 |
| Lymphocytes, % | 32 | 19-37 |
| Monocytes, % | 6 | 3-11 |

**Conclusion:** **without pathological changes**,

# Urine analysis

| Options | Results | Normal range |
|---|---|---|
| Specific gravity | 1,013 | 1,001-1,040 |
| pH | 6,0 | 5,0-7,0 |
| Protein, g / l | Not detected | to 0.033 |
| Glucose | Not detected | absent |
| Leucocytes, cells/hpf | 1-3 | 6-8 |
| Epithelium, cells/hpf | 1-2 | ≤15-20 |
| Bacteria | Not detected | absent |

**Conclusion:** all parameters within the normal range

# Biochemical panel

| Options | Results | Normal range |
|---|---|---|
| Total protein, g/l | 70 | 54-78 |
| Urea, mmol/l | 6,7 | 1,7-8,3 |
| Creatinine, mmol/l | 0,93 | 0,7-1,4 |
| AST, U | 28 | <41 |
| ALT, U | 27 | <40 |
| FPG (fasting plasma glucose), mmol/l | 4,9 | 3,3-5,5 |
| K, mmol/l | 4,97 | 3,5-5,1 |
| Ca, mmol/l | 2,25 | 2,15-2,57 |
| Na, mmol/l | 144 | 136-146 |
| Cl, mmol/l | 104 | 98–106 |

**Conclusion:** all parameters within the normal range

# Coagulogram

| Parameters | Result | Normal range |
|---|---|---|
| Bleeding time(by Lee-White methods), min | 4,0 | 5-10 min |
| Platelets number | 186 | 180-320 |
| APTT (sec) | 33 | 27-36 |
| Time of plasma recalcification, sec | 87 | 120-60 |
| Prothrombin index, % | 94 | 80-110 |
| Fibrinogen, g/l | 2,6 | 2-4 |

**Conclusion:** all parameters within the normal range

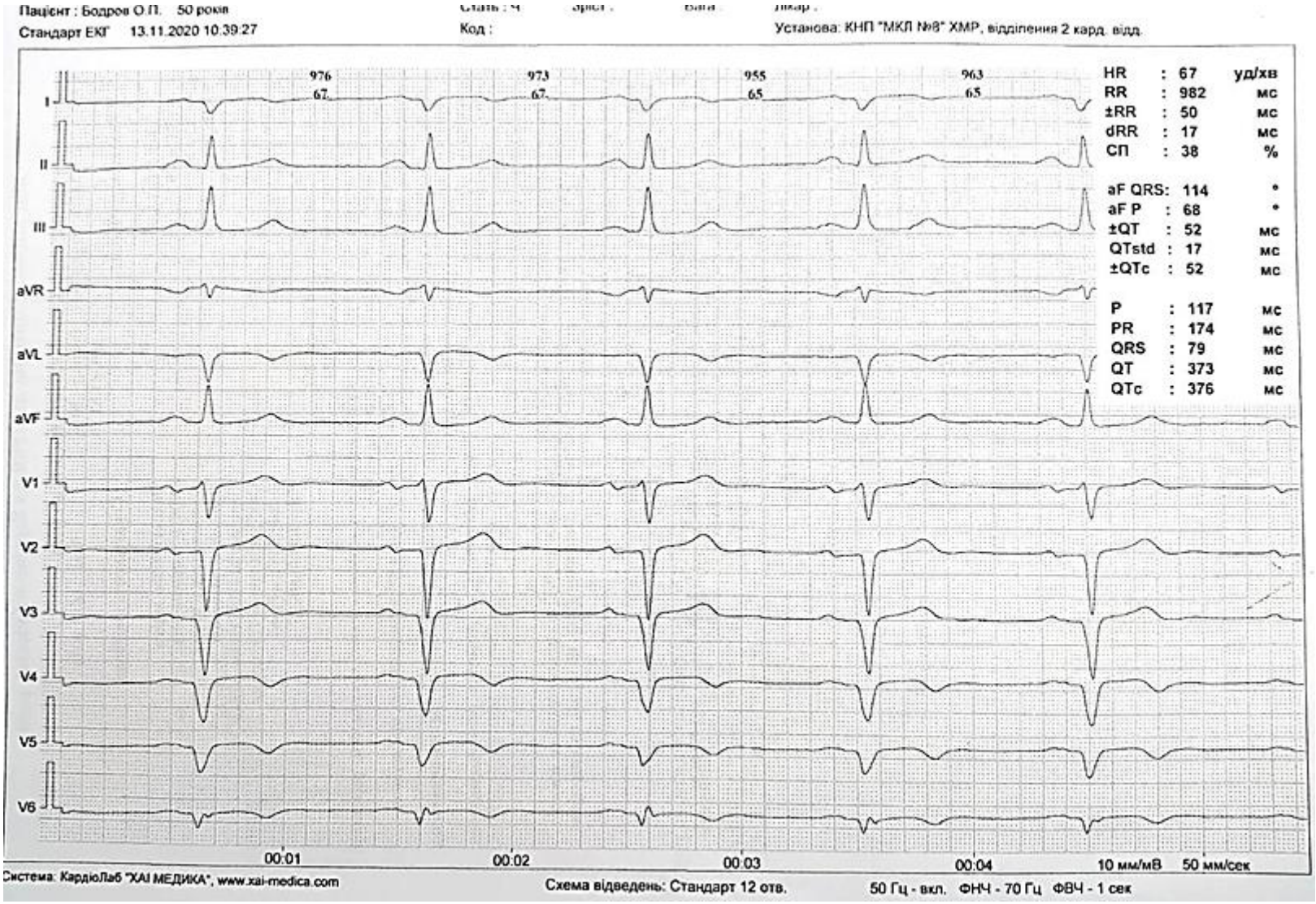
# Lipid profile

| Options | Results | Normal range |
|---|---|---|
| Total cholesterol, mmol/l | 4,22 | 3,0-5,2 |
| Very low-density lipoprotein cholesterol (VLDL-C), mmol/l | 1,7 | <0,88 |
| Low-density lipoprotein cholesterol (LDL-C) ), mmol/l | 1,46 | <3,5 |
| High-density lipoprotein cholesterol (HDL-C) ), mmol/l | 1,06 | >0,9 |
| Triglycerides), mmol/l | 3,74 | <1,7 |
| Atherogenic coefficient | 2,98 | <3,0 |

- Conclusion: increased levels of VLDL and triglycerides

# ECG

- **<u>Conclusion:</u> HR-67 bpm, sinus regular rhythm, ECG signs of postinfarctional cardiosclerosis in the antero-lateral leads and apical aneurism**
- **(pathological Q wave in leads I, aVL, V2-V5, ST elevation in leads V2-V5, T wave inversion in leads aVL, V4, -V6).**

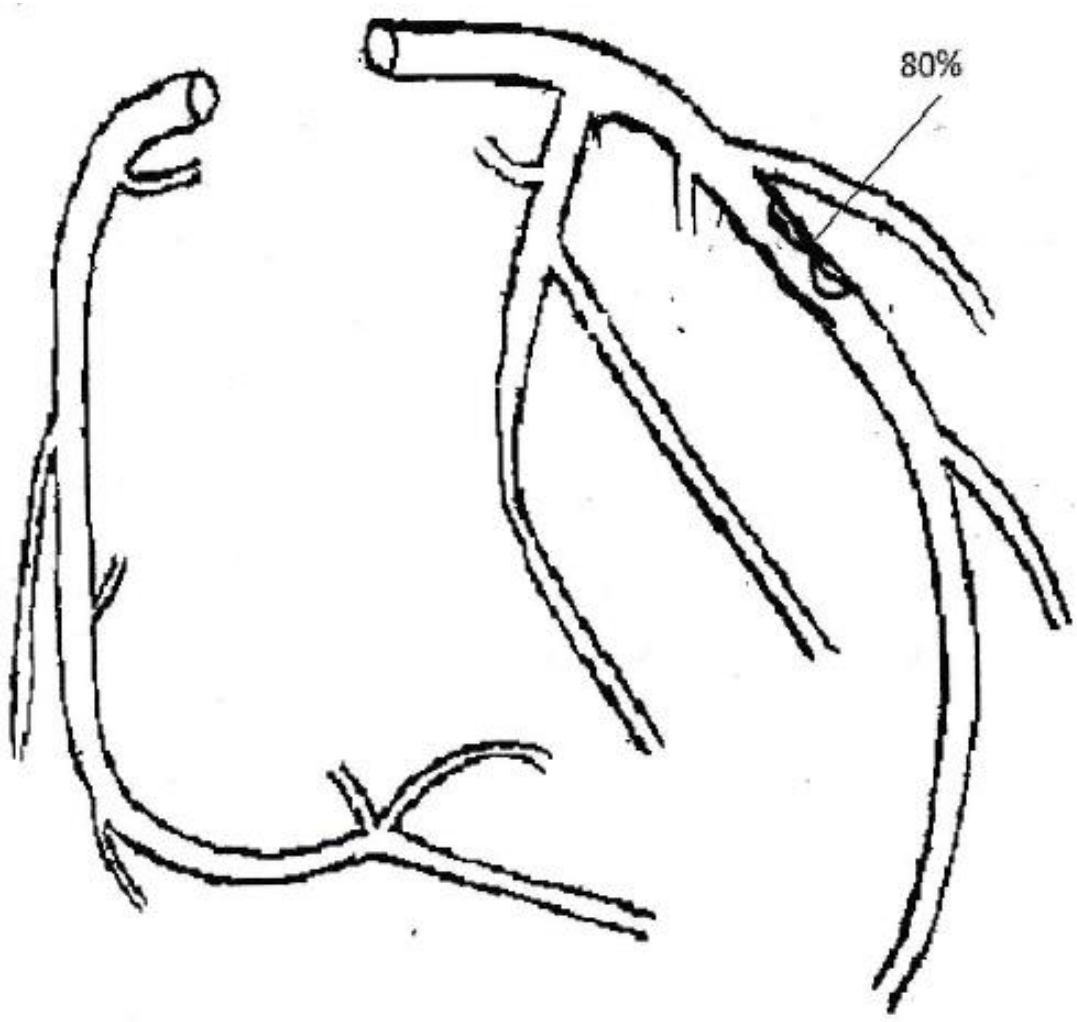


# Instrumental investigations

- **Holter monitoring: sinus rhythm, average HR during the daytime – 75 bpm, during night – 66 bpm, sinus pauses were not detected, during 24 hours were detected 3 PAC and 15 unifocal PVC on the background of postinfarctional cardiosclerotic changes and ST segment deviation of 1 mm.**
- **EchoCG: hypokinesia of antero-septal segments of left ventricle, akinesia of left ventricular apex – echocardiographic signs of postinfarctional aneurism, dilation of the left sided chambers (left atrium -5,1cm, left ventricle end-diastolic diameter -6,3cm), left ventricular hypertrophy, systolic dysfunction of left ventricle (reduced ejection fraction-39%).**
- **Chest X-ray: increased width of the cardiac silhoette, the lungs without focal pulmonary consolidation or pleural effusion.**
- **Treadmil test – total load 7.0 MET, performed the load for 6 minutes, the test was terminated due to the onset of pain and 1 mm ST depression in leads V4-V6, moderate limitation in the level of the threshold load, test is positive.**

# Angiography (2014)

- **Conclusion:**
  **pronounced left type of coronary blood supply. Left coronary artery trunk – without pathology, anterior descending artery - "muscular bridge", occluding the artery lumen by 80% in systole, the circumflex right coronary artery without significant hemodynamic disorders.**



# Diagnosis

**Main diagnosis: Ischemic heart disease: stable angina II FC, postinfarctional cardiosclerosis (antero-lateral STEMI 20.07.2014) in the presence of myocardial bridge (coronary angiography 14.08.14). Postinfarctional aneurism. CABG surgery (31.10.2014). Chronic heart failure IIC with reduced EF (39%).**

# Treatment

- **Life style modification: diet with restriction of satured fat;**
- **Bisoprolol 5 mg once daily under control of HR and ECG;**
- **Eplerenone 25 mg once daily;**
- **Rozuvastatin 20 mg once daily under the control of lipid profile and LFTs;**
- **Ramipril 1,25 mg once daily;**
- **Aspirin 100 mg once daily;**
- **Quercetin 2g twice daily 1 month.**

**<u>Recommendations:</u> coronary angiography is recommended in order to detect exacerbation of the disease and possible complications such as coronary atherosclerosis or shunt stenosis.**

# Conclusion

- **The myocardial bridge is often a benign pathology with an asymptomatic course of the disease. However, in some cases MB is associated with myocardial ischemia, ACS, life-threatening arrhythmias, and sudden death.**
- **Patients with symptomatic MB as in our clinical case require early diagnosis with adequate and timely therapy and dynamic monitoring with the help of coronary angiography and other visualization methods of investigation in order to detect disease exacerbation and prevent further complications which may be associated with MB.**

**Thank you for your attention!**

**Any questions?**