Case report ■

Acute Myocardial Infarction with an Initially Non-Diagnostic Electrocardiogram - Clinical Intuition is Crucial for Decision Making

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SUMMARY

Acute myocardial infarction (AMI) is a common cause of reduced cardiac capacity and functional status of a patient. Successful primary percutaneous coronary intervention (pPCI) in acute coronary syndrome and appropriate, complex cardiovascular rehabilitation play a major role in preserving left ventricular function and improvement of prognosis and quality of patient's life. The aim of this paper was to present a clinical course in a patient with acute myocardial infarction who did not have a classic ECG presentation in the form of ST-segment elevation. We showed that in everyday clinical work it is essential to timely recognize the symptoms of acute myocardial infarction, make the proper diagnosis and perform right treatment strategy. The next step is cardiovascular rehabilitation program, which positive effects, in our patient, was achieved through the retrieval of functional capacity and correction of risk factors.

Key words: acute myocardial infarction, percutaneous coronary intervention, cardiovascular rehabilitation

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INTRODUCTION

That a man is as old as atherosclerotic changes have affected his blood vessels is a well-known scientific fact.

Atherosclerosis is a chronic, generalized, progressive immune/inflammatory disease of arterial blood vessels, of unpredictable flow, characterized by local thickening of intimate parts and creation of atherosclerotic plaques. The most common clinical manifestation of coronary atherosclerosis as a consequence of the rupture of atherosclerotic plaque is the acute coronary syndrome (1).

The term acute myocardial infarction (MI) is used when there is evidence of myocardial necrosis in a patient who presents with the signs of acute myocardial ischemia. Under these conditions, any of the following criteria is sufficient for the diagnosis of MI: registering the increase and/or decrease in the value of cardiac biomarkers preferably cardiac troponin (cTn)] with at least one value over 99th percentile of the upper reference level (URL), and with at least one of the following: ischemic symptoms; emerging or assumed new significant changes of ST-segment-T-wave (ST-T) or new left branch block (LBB); development of pathologic Q wave in ECG; imaging evidence of new loss of myocardial viability or emerging regional movement disorder; identification of intracoronary platelet by angiography or autopsy, cardiac death with symptoms suggestive of myocardial ischemia and assumed newly created ischemic changes (2).

Epidemiologically, probably the most comprehensive register for ST segment elevation myocardial infarction (STEMI) is located in Sweden, with an incidence of 66 STEMI per 100,000 patients per year. Similar data were reported in the Czech Republic, Belgium and the United States. The incidence rates of STEMI (per 100,000) decreased since 1997 till 2005 from 121 to 77, while the incidence rate of non-STEMI increased slightly from 126 to 132 (3). Rationale for this may be a more accurate diagnosis in the field of more sensitive biomarkers of myocardial damages (high sensitive troponin).

Electrocardiogram (ECG) changes in acute myocardial ischemia (in the absence of LVH and LBB): recent changes or alike, J point elevation >0.1 mV occurs in any drain except in V2 and V3. In healthy men younger than 40 years, J point elevation in drains V2 and V3 can be greater than 0.25 mV, which decreases with increasing age. Gender differences require different values for women, so that the elevation of the J point in healthy women is lower than in men (4).

Patients in whom there is no diagnostic ECG in acute coronary syndromes: in some patients with acute coronary artery occlusion initial ECG may be without ST-segment elevation, sometimes because they are examined in the early stage of symptoms (in this case, one should look for hyper-acute T waves that may precede ST segment elevation). It is important to repeat ECG and monitor ECG changes. Additionally, there is a concern that some patients with real coronary artery occlusion and present myocardial infarction (e.g. those with circumflex coronary artery, vein graft occlusion, or in the main tree of the disease) may not have the ST segment elevation, so there is no need for implementation of reperfusion therapy, which leads to an increase in infarct zone and adverse outcomes. In any case, if there still is the clinical suspicion of the existence of myocardial infarction - in addition to medical treatment - there is an indication for immediate coronary angiography with the possibility of revascularization, even in patients with no diagnostic ST segment elevation (3).

In recent years, the development of cardiovascular medicine has caused modern concept of cardiac rehabilitation patients after both coronary events and interventional cardiology procedures. Cardiovascular rehabilitation after a cardiac event belongs to a class I recommendation by the European Society of Cardiologists and the American College of Cardiology and the American Heart Association. Recent studies suggest that comprehensive cardiovascular rehabilitation reduces mortality from CVS by 26-36 overall mortality by 13-26.

The aim of this paper was to present of the clinical course in a patient with acute myocardial infarction who did not have a classic ECG presentation in the form of ST-segment elevation.

CASE REPORT

Male patient M. B.,forty three years old, felt the first symptoms in the form of constricting chest pain on 15 December 2013 at 7:00 am. Chest pain woke him up, spread to the lower jaw and left forearm. As the pain persisted, an ambulance transported the patient at 9:00 am to the Cardiology Clinic at the Institute Niška Banja. Risk factors for cardiovascular disease: high blood pressure for one year, moderately elevated cholesterol, smoker for 20 years. Electrocardiogram on admission, recorded lower R-wave amplitude in D3, aVF and V1-V3 with nonspecific (concave) ST segment elevation up to 1.0 mm in V2 and V3 (Figure 1).

For the next hour, chest pain persisted in spite of applied analgesic, oxygen, nitroglycerin infusion, complete antiplatelet and anticoagulant therapy, however without the dynamics of the ECG. Troponin value was about 0.07 ng/ml. Taking into a count the clinical presentation, at 10:15 am, after consultation with cardiac catheterisation team of the Clinical Center Niš, the ambulance took the patient to the Clinic for Cardiovascular Diseases, Clinical Center Niš. Immediately upon admission, the patient underwent emergency coronarography, which showed the occlusion of medial segment of LAD, while LCx and RCA were unchanged. Simultaneously, the patient underwent primary PCI LAD with the implantation of one DES stent with TIMI 3 flow at the end of the procedure. After two days (on 17 December 2013), the patient was transferred to the Cardiology Clinic, In-

stitute "Niška Banja" to prolonged hospitalization. At that time the ECG recorded low amplitude of r wave and negative T waves over all precordial leads (Figure 2).

Echocardiography examination showed normal size of the left ventricle, preserved global contractility EF 55% with akinesia of the apical segment of the anterior wall and hypokinesia of medioapical segment of the lateral wall. 24-h electrocardiographic (ECG) Holter recording did not register complex disorders of heart rate and implementation.

During hospitalization at the Institute, the patient was involved in an early program of cardiovascular (CV) rehabilitation that included breathing exercises, sitting on the edge of the bed and exercise on the edge of the bed. The early rehabilitation program was followed by specialized CV rehabilitation in the period from 24 January 2014 till 14 February 2014, at the Institute "Niška Banja". Electrocardiogram on admission to the cardiovascular rehabilitation is shown in Figure 3.
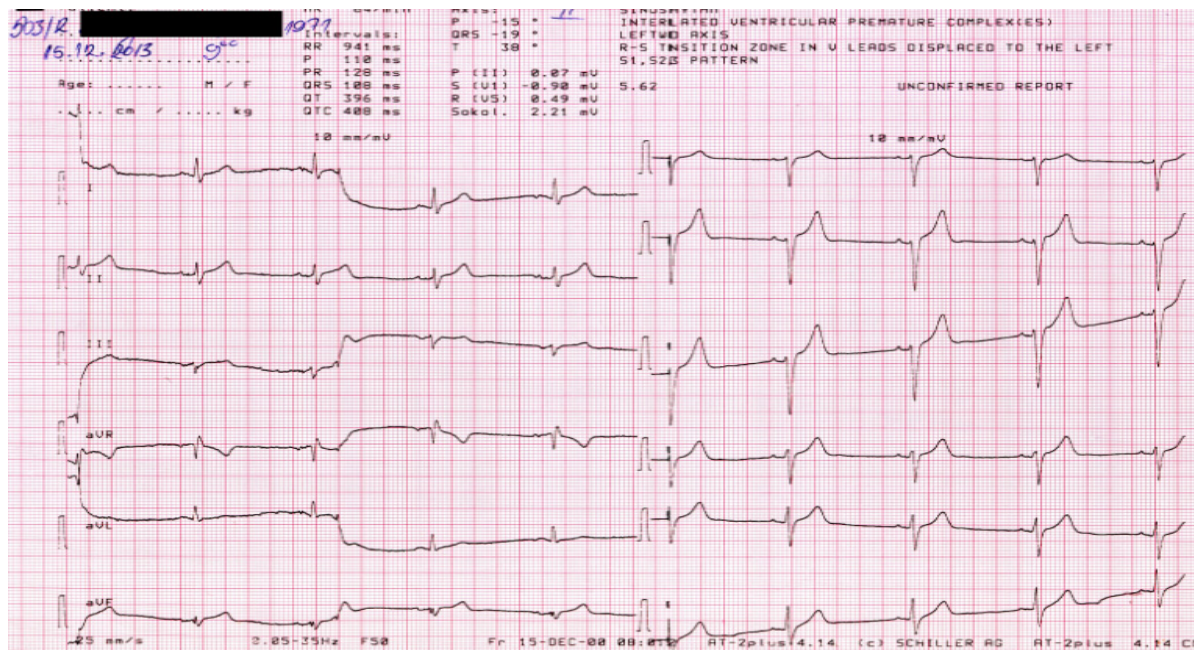

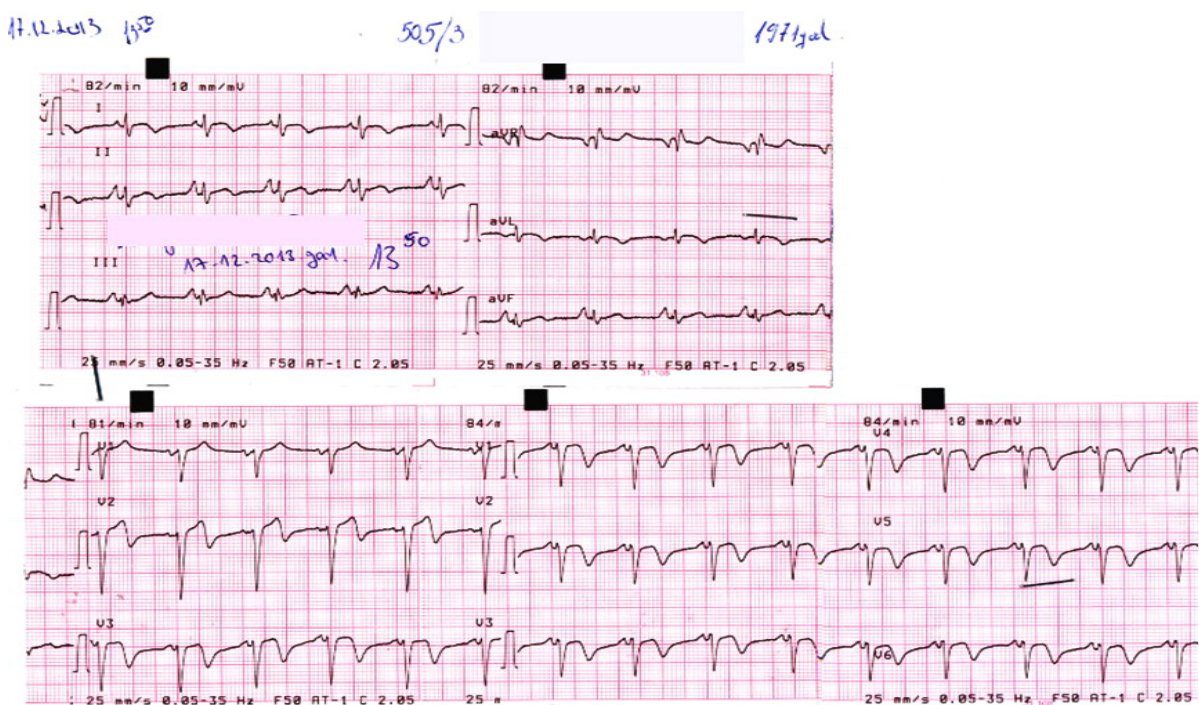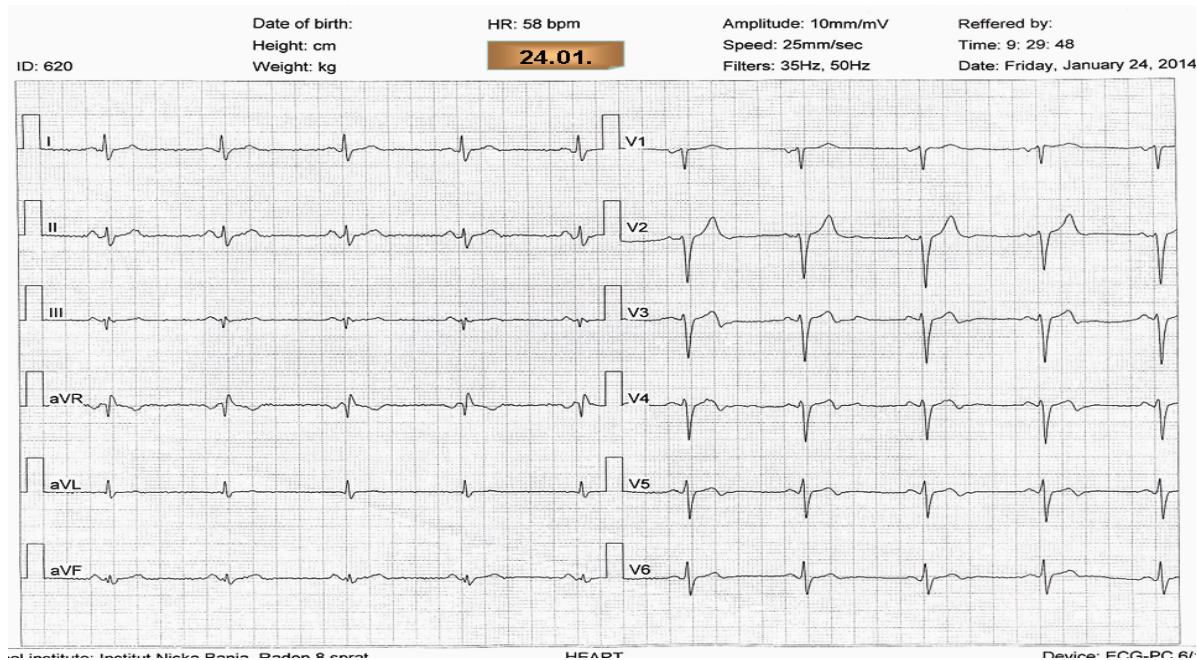**Figure 1.** *Electrocardiogram on admission to the Institute*

Figure 2. *Electrocardiogram during hospitalization*

Figure 3. *Electrocardiogram on admission to the cardiovascular rehabilitation*

Compared to the previous ECG, ECG on admission to rehabilitation registered positive T waves in all precordial leads with moderate persistent ST segment elevation up to 0.5 mm in V2-V4 and biphasic T waves in V3-V5.

We started individually dosed CV rehabilitation program which included moderate level of calisthenics and cycling under the supervision of a physician with the correction of risk factors, lifestyle modification and daily education. After several days of monitoring, the patient continued with intermediate level of physical activity. The first exercise test (01/28/2014) was done on a treadmill with beta blocker, the Bruce protocol, up to the third level, lasting 6:45 min. (Heart rate: from 62/min to 128/min). The test was terminated because of fatigue and did not show the existence of signs of myocardial ischemia.

On 12 February 2014, the second exercise test was done on a treadmill with a beta blocker, to the fourth level, lasting 9:53 min. (Heart rate: from 83/min to 157/min). It was terminated due to the submaximal heart rate, and the symptoms or ECG signs of myocardial ischemia were not present. After the second exercise test, the level of physical training was increased to highest level of physical activity (according to the heart rate reached on the exercise test) and was being implemented by the end of residential rehabilitation. On the control echocardiographic examination, on 4 March 2014, the increase in left ventricle systolic function (EF 60%), with no turns in segmental contractility, was recorded.

DISCUSSION

Despite the enormous significance of electrocardiogram in diagnosing acute coronary syndromes in daily clinical practice, we often encounter atypical ECG presentations of cardiovascular events. In such cases, clinical and laboratory tests for the confirmation of myocardial necrosis is of the utmost significance. In our patient, the ECG did not indicate an acute coronary event but the clinical picture was typical and he had slightly elevated troponin value, although the chest pain lasted for about 2 hours.

In patients with clinical signs of STEMI within 12 hours of symptoms onset with persistent ST-segment elevation or new LBB, mechanical (PCI) or pharmacological reperfusion should be performed as soon as possible. Primary PCI is the treatment of choice for patients with STEMI, quickly performed by an experienced team. If the patient's first medical contact with the service is in emergency medicine or non PCI center, he should be immediately transported to a PCI center. Primary PCI is effective in the establishment and maintenance of flow through the coronary artery and does not have such a high risk of bleeding as fibrinolysis. Randomized clinical trials have compared the hospital administration of fibrinolysis and primary PCI and proved repeatedly that primary PCI is superior to hospital fibrinolysis (5, 6).

Physical training is a major component of cardiovascular rehabilitation since it increases physical capacity. Positive effects of physical training have been proven in many clinical studies to date (7-10). During cardiovascular rehabilitation, it is desirable to do two exercise tests, before and after the individual daily dose of physical training for 3 weeks. In our patient, at the end of residential rehabilitation we registered a significant increase in functional capacity and left ventricle ejection fraction value.

Rehabilitation training helps delay or prevents atherosclerosis of the coronary artery and improves cardiac functional status after PCI. Recent study demonstrated that physical rehabilitation training for patients after PCI could noticeably increase the physical and working capacity of patients with coronary artery disease, and improve blood supply to the ischemic myocardium. In addition, regular aerobic exercise and appropriate dietary control have been shown to lower triglycerides and increase the high density lipoprotein cholesterol ratio (11-13).

Modification of variable risk factors, regular physical activity can prevent progression of atherosclerosis and reduce cardiovascular mortality. Regular controlled physical training leads to homeostasis of many hemodynamic morphological metabolic neurohormonal vascular and physiological changes in the body. Daily 30-45 minutes of moderate physical activity at least 5 times a week (swimming, cycling, gardening, recreational sport, dancing) can be divided into shorter intervals not less than 10 minutes.

In everyday clinical work it is essential to recognize on time the symptoms of acute myocardial infarction, make the right diagnosis and perform right treatment strategy. The next step is CV rehabilitation program, which positive effects, in our patient, were achieved through the retrieval of functional capacity and correction of risk factors.

CONCLUSION

In cases where the ECG finding is not typical, clinical picture is crucial for the diagnosis and therapeutic approach. Successful percutaneous coronary intervention in acute myocardial infarction contributes to the preservation of left ventricular function due to the timely prevention of irreversible myocardial damage. Conducted cardiovascular rehabilitation and regular physical activity contribute to further improvement of the patient's cardiac status and further improves its prognosis.

References

1. Wolfs IM, Donners MM, de Winther MP. Differentiation factors and cytokines in the atherosclerotic plaque micro-environment as a trigger for macrophage polarisation. Thromb Haemost. 2011; 106:763-771.
http://dx.doi.org/10.1160/TH11-05-0320
2. Thygesen K, Mair J, Katus H, et al. Third Universal Definition of Myocardial Infarction. Circulation. 2012; 126: 2020-2035.
http://dx.doi.org/10.1161/CIR.0b013e31826e1058
3. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation European Heart Journal 2012; 33: 2551-2567.
4. Mcfarlane PW. Age, sex, and the ST amplitude in health and disease. J Electrocardiol 2001; 34 Suppl: 35-41.
5. Keeley EC, Boura JA, Grines CL. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials. Lancet. 2003; 361: 13-20.
http://dx.doi.org/10.1016/S0140-6736(03)12113-7
6. Andersen HR, Nielsen TT, Rasmussen K. A comparison of coronary angioplasty with fibrinolytic therapy in acute myocardial infarction. N Engl J Med. 2003; 349: 733-742.
http://dx.doi.org/10.1056/NEJMoa025142
7. Cui F, Ren Y, Jin H, Cui B. Rehabilitation training improves exercise tolerance after percutaneous coronary intervention. Journal of Biomedical Research, 2012; 26: 248-252.
http://dx.doi.org/10.7555/JBR.26.20110119
8. Deniz Acar R, Bulut M, Ergün S. Effect of cardiac rehabilitation on left atrial functions in patients with acute myocardial infarction. Ann Phys Rehabil Med. 2014. 57: 105-13.
http://dx.doi.org/10.1016/j.rehab.2014.01.001
9. Martynova VV, Andreev DA, Doletskiĭ AA et al. Early physical rehabilitation after elective percutaneous coronary interventions during incomplete revascularization: exercise regimen calculation by ergospirometry. Ter Arkh. 2013; 85: 23-28 (in Russian).
10. Piestrzeniewicz K, Navarro-Kuczborska N, Bolińska H et al. The impact of comprehensive cardiac rehabilitation in patients up to 55 years old after acute myocardial infarction treated with primary coronary intervention. Pol Arch Med Wewn. 2004 Mar; 111: 309-317 (in Polish).
11. Hambrecht R, Walther C, Mobius-Winkler S et al. Percutaneous coronary angi-oplasty compared with exercise training in patients with stable coronary artery disease: a randomized trial. Circulation 2004; 109: 1371-1378.
http://dx.doi.org/10.1161/01.CIR.0000121360.31954.1F
12. Yu CM, Lau CP, Chau J, et al. A short course of cardiac rehabilitation program is highly cost effective in improving long-term quality of life in patients with recent myocardial infarction or percutaneous coronary intervention. Arch Phys Med Rehabil 2004; 85: 1915-1922.
http://dx.doi.org/10.1016/j.apmr.2004.05.010
13. Munk PS, Butt N, Larsen AI. High-intensity interval exercise training improves heart rate variability in patients following percutaneous coronary intervention for angina pectoris. Int J Cardiol 2010; 145: 312-314.
http://dx.doi.org/10.1016/j.ijcard.2009.11.015

AKUTNI INFARKT MIOKARDA INICIJALNO NEDIJAGNOSTIKOVAN ELEKTROKARDIOGRAMOM - KLINIČKI OSEĆAJ JE NAJVAŽNIJI ZA DONOŠENJE ODLUKE

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Sažetak

Akutni infarkt miokarda (AIM) je čest uzrok smanjenog kardijalnog kapaciteta i funkcionalnog stanja bolesnika. Uspešna primarna perkutana koronarna intervencija (pPCI) u akutnom koronarnom sindromu i adekvatna, kompleksna kardiovaskularna rehabilitacija imaju veliku ulogu u očuvanju funkcije leve komore i poboljšanju prognoze i kvaliteta života bolesnika.

Cilj rada bio je prezentacija kliničkog toka kod bolesnika sa akutnim infarktom miokarda koji nije imao klasičnu EKG prezentaciju u formi elevacije ST segmenta. Pokazali smo da je u svakodnevnom kliničkom radu najbitnije pravovremeno prepoznavanje simptoma akutnog infarkta miokarda, što olakšava postavljanje prave dijagnoze i izbor prave terapijske strategije. Sledeći korak je program kardiovaskularne rehabilitacije, koja je svojim pozitivnim efektima kod našeg bolesnika ostvarila popravljanje funkcionalnog kapaciteta i korekciju faktora rizika.

Ključne reči: akutni infarkt miokarda, perkutana koronarna intervencija, kardiovaskularna rehabilitacija