



TRANSITORY ST SEGMENT ELEVATION DURING THE EXERCISE STRESS TEST

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ABSTRACT

Cardiovascular diseases (CVD) are the most common cause of death in the world. Coronary artery disease is the most common disease that leads to lethal outcome in Serbia and in the world. Exercise stress test is the most frequently used non-invasive method for diagnosing coronary artery disease. Patients Lj.M. born in 1955. had performed exercise stress test in 2014. The test was defined as positive and coronarography was suggested. But the patient felt well until 2016, which was the reason why he did not go to regular cardiology examinations. In April 2016, he was admitted at Emergency room of the Institute for treatment and rehabilitation Niska Banja due to repeated chest pains that disappeared spontaneously after a few minutes. Again, an exercise stress test was suggested. On exercise test the patient felt pain in the mediastinum, while the electrocardiogram registered the occurrence of ST segment elevation in all precordial leads, along with transitory short-term ventricular tachycardia, which was the reason why the test was interrupted. An urgent coronary angiography was suggested. On coronarography two-vessel coronary disease was reported: LAD in the medial segment suboccluded, OM1 80 % narrowed. On this occasion, a percutaneous intervention with the implantation of a single stent in the LAD was performed. After three months a second PCI with implantation of one stent in OM1 was performed. After intervention patient is feeling good, without chest pain. The reason why in 2014 during exercise stress test our patient had a ST segment depression on electrocardiogram and in 2016 ST elevation is probably due to the degree of lesion stenosis that led to ischemic changes. Patient did not come to the regular controls and stenosis advanced during this two-year period.

KEYWORDS : coronary heart disease, exercise stress test, elevation of ST segment

INTRODUCTION

Cardiovascular diseases (CVD) are the most common cause of death in the world. Every year more than 4 million Europeans die from CVD, which is about 45% of total mortality (1). According to the latest data from 2017, 801 thousand Americans died due to CVD, which means that every 3rd death occurs due to cardiovascular disease (2). The most common cardiovascular disease leading to a lethal outcome is the coronary heart disease (3).

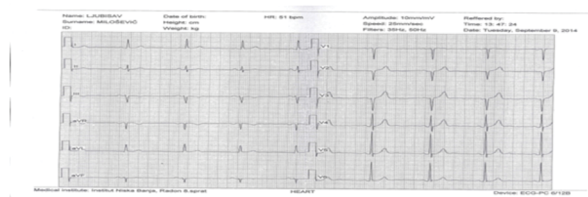
Coronary disease diagnosis is based on the clinical picture, electrocardiogram, laboratory analysis, non-invasive and invasive methods (4). Non-invasive methods includes various functional tests (exercise stress test, echocardiographic stress test, pharmacodynamic test), and various imaging methods (MRI, CT, etc.). Although echocardiographic stress test is a more sensitive functional method (5, 6), exercise stress test is the most frequently used non-invasive method for diagnosing coronary artery disease because of its cost-effectiveness and availability.

CASE REPORT

Patient Lj. M. from Niška Banja, born in 1955 was admitted at The Emergency room of Institute for treatment and rehabilitation Niska Banja on 8th Sept 2014. with the symptoms of puncturing pain in the epigastrium that appeared in rest but was not irradiating and spontaneously disappeared after 3-4 minutes. At that time, the measured arterial tension was 160/100 mmHg, heart beats 68/min

and the electrocardiogram registered QS formations in V1-V3 leads (Figure 1). The patient reported hypertension, hyperlipidemia, smoking and heredity as the risk factors for ischemic heart disease. The introduced therapy included: ASA, ACE inhibitor, statin, long-acting nitrates, sedative. Ultrasound examination of the heart and exercise stress test were suggested.

Figure 1. Electrocardiogram at Emergency room of Institute



On the 13th of September 2014, the ultrasound examination of the heart registered regular diameters of heart cavities with preserved contractile force and without segmental disorders in contractility. On the 15th of September 2014 the performed exercise stress test showed signs of myocardial ischaemia and complex heart rhythm disorders - bigeminy of monomorphic VES and frequent couplets of VES (Figures 2 and 3).

Figure 2. Signs of myocardial ischemia on electrocardiogram during exercise stress test

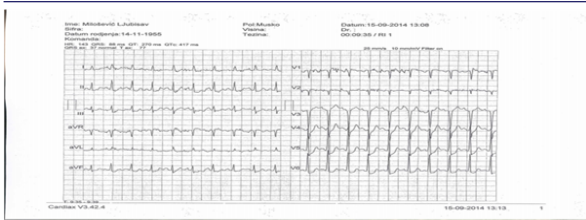
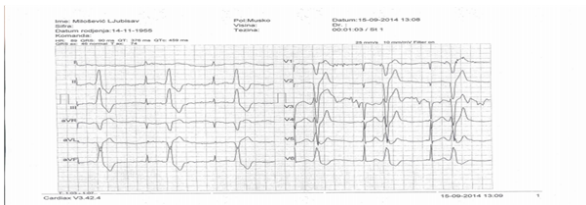


Figure 3. Bigeminy of monomorphic VES on electrocardiogram during exercise stress test



Antiarrhythmic (amiodarone) was introduced in the therapy. A month later, an ECG holter registered no complex arrhythmias. The patient felt well until 2016, which was the reason why he did not go to regular cardiology examinations. In April 2016, he was admitted at The Emergency room of the Institute due to repeated chest pains that disappeared spontaneously after a few minutes. At that time the performed electrocardiogram did not register any changes compared to the previous ones.

The exercise stress test was again performed on Treadmill on the 6th of April 2017. At the 2nd stress level in the 4th minute, the patient felt pain in the mediastinum, while the electrocardiogram registered the occurrence of ST segment elevation in all precordial leads, along with transitory short-term ventricular tachycardia (VT), which was why the test was interrupted (Figures 4 and 5).

Figure 4. ST segment elevation on electrocardiogram during exercise stress test

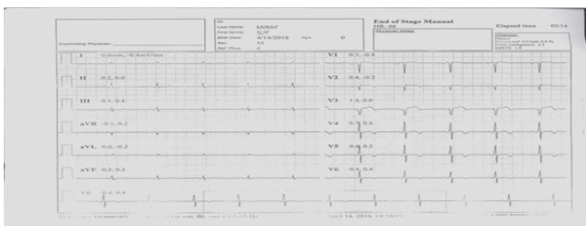


Figure 5. ST segment elevation and VT on electrocardiogram during exercise stress test



The patient received NTG and Tbl.ASA 300mg. Soon after the administered therapy, the symptoms disappeared and the electrocardiogram registered regression of the described changes (Fig.6).

Figure 6. Electrocardiogram after therapy



The patient was then transferred to the Coronary Unit of the Institute where his condition was treated according to the protocol for acute coronary syndrome. The performed ECG holter registered no complex arrhythmias, the doppler of carotides registered no haemodynamically significant stenotic lesions and the ultrasound examination of the heart registered no segmental disorders in contractility. Ultrasound registered the initial septum hypertrophy and mild mitral regurgitation (Figures 7 and 8). An urgent coronary angiography was suggested.

Figure 7. Mitral regurgitation on ultrasound examination of heart

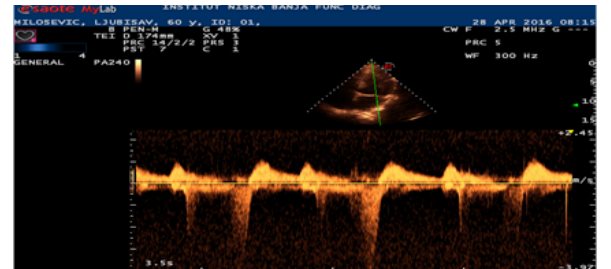
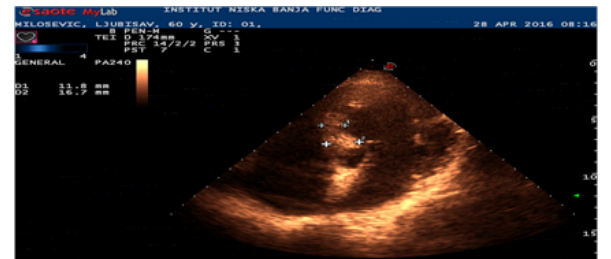


Figure 8. Hypertrophy of septum on ultrasound examination of heart



An invasive examination of coronary circulation was performed on the 17th of May 2016 and a two-vessel coronary disease was reported (LAD in the medial segment suboccluded, OM1 80 % narrowed). On this occasion, a percutaneous intervention with the implantation of a single stent in the LAD was performed and it was suggested that on the next occasion, an elective PCI should be performed on the OM1 branch (Figures 9 and 10).

Figure 9. Coronarography: subocclusion LAD, stenosis on Om1

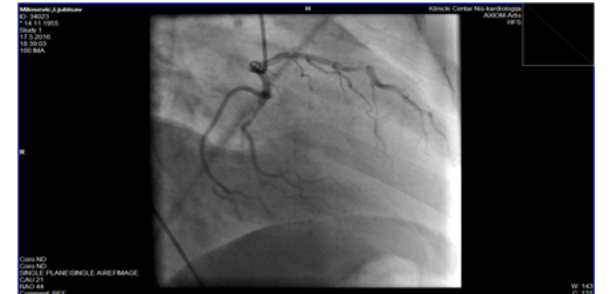
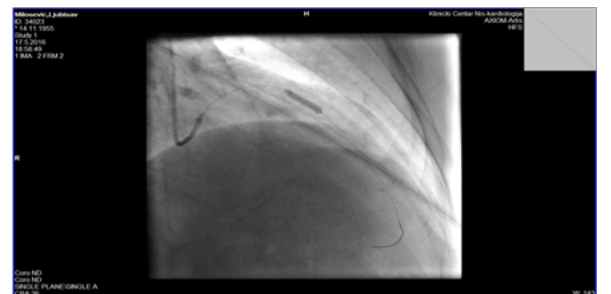


Figure 10. PCI on LAD



The second percutaneous intervention with stent implantation on

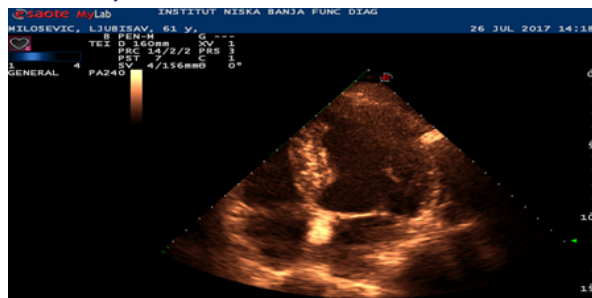
the OM1 branch was performed on 11th August 2016. On this occasion, no other stenotic lesions were registered and the LAD stent was passable (Fig. 11).

Figure 11. PCI on Om1



Since the second intervention, patient is feeling good, without chest pain. The last ultrasound examination of the heart in July 2017 registered the preserved contractile force, EF 60%, with no segmental disorders in contractility.

Figure 12. Ultrasound of the heart – no segmental disorders in contractility



DISCUSSION

Exercise stress test is the most commonly used method for the diagnosis of coronary disease, although the sensitivity and specificity of this method is significantly lower than in other non-invasive methods (7). The occurrence of ST segment elevation during exercise stress test is a bad prognostic sign and is usually the result of proximal stenosis of some of the coronary arteries (8, 9).

The reason why in 2014 during exercise stress test our patient had a ST segment depression on electrocardiogram and in 2016 ST elevation, is probably due to the degree of lesion stenosis that led to ischemic changes. As the patient did not go to regular control examinations and took therapy on his own, the process of atherosclerosis was probably accelerated, leading to a subocclusion of the anterior descending artery which is probably responsible for the changes in the electrocardiogram results during the exercise stress test. Pronounced transmural myocardial ischemia causes elevation of the ST segment, leads to significant electrical instability and can cause cardiac rhythm disorders, as reported in our patients. The second question that arises is why ST elevation was transitory, i.e. why there was no development of transmural heart attack. One of the possible solution is that there was a spasm of the blood vessel (10). However, as there was an arterial subocclusion, the spasm probably had no significant role. Another possible solution is that there was dyskinesia of the left ventricular walls that can also be followed by the appearance of ST elevation during the exercise stress test (11). However, the later performed ultrasound examination of the heart registered preserved contractile force, without segmental disorders in contractility. Hibernating and preconditioning of myocardium and the presence of collaterals are

the cause why ST elevation was transitory and why the patient did not developed a massive transmural heart attack of the front localization on exercise stress test (12).

CONCLUSION

The exercise stress test is the most commonly used method for the diagnosis of coronary heart disease. The occurrence of ST segment elevation during the exercise stress test is always caused by transmural ischemia and requires an immediate invasive examination of coronary circulation. Hibernating myocardium and preconditioning of a heart play a great role in preventing unwanted outcome.

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