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Case report
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POSTERIOR WALL MYOCARDIAL INFARCTION: A CASE REPORT

INFARKT ZADNJEJ ZIDA MIOKARDA: PRIKAZ SLUČAJA

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Summary

Introduction. Acute myocardial infarction is a clinical manifestation of coronary disease which occurs when a blood vessel is narrowed or occluded in such a way that it leads to irreversible myocardial ischemia. ST segment depression in leads VI–V3 on the electrocardiogram points to the anterior wall ischemia, although it is actually ST elevation with posterior wall myocardial infarction. In the absence of clear ST segment elevation, it may be overlooked, leading to different therapeutic algorithms which could significantly affect the outcome. **Case report.** A 77 year-old female patient was admitted to the Coronary Care Unit due to prolonged chest pain followed by nausea and horizontal ST segment depression on the electrocardiogram in VI–V3 up to 3 mm. ST segment elevation myocardial infarction of the posterior wall was diagnosed, associated with the development of initial cardiogenic shock and ischemic mitral regurgitation. An emergency coronarography was performed as well as primary percutaneous coronary intervention with stent placement in the circumflex artery, the infarct-related artery. Due to a multi-vessel disease, surgical myocardial revascularization was indicated. **Conclusion.** Posterior wall transmural myocardial infarction is the most common misdiagnosis in the 12 lead electrocardiogram reading. Routine use of additional posterior (lateral) leads in all patients with chest pain has no diagnostic or therapeutic benefits, but it is indicated when posterior or lateral wall infarction is suspected. The use of posterior leads increases the number of diagnosed ST segment elevation myocardial infarctions contributing to better risk assessment, prognosis and survival due to reperfusion therapy.

Key words: Myocardial Infarction; Electrocardiography; Diagnosis; Coronary Angiography; Risk Assessment; Myocardial Revascularization; Myocardial Reperfusion; Diagnostic Errors; Prognosis

Introduction

Acute myocardial infarction is a clinical manifestation of coronary disease which occurs when a blood vessel is narrowed or occluded in such a way that it leads to irreversible myocardial ischemia [1, 2]. Acute ST elevation myocardial infarction (STEMI) is diagnosed based on clinical presentation, new-onset persistent elevation registered on electrocardiogram (ECG) in at least two leads i.e. transitory ST

Sažetak

Uvod. Akutni infarkt miokarda je klinički oblik koronarne bolesti koja nastaje pri suženju koronarnog krvnog suda ili njegovoj okluziji koji dovode do nastanka ireverzibilne ishemije miokarda. Elektrokardiografski registrovana depresija ST segmenta u odvodima VI–V3 ukazuje na ishemiju prednjeg, iako se zapravo radi o ST eleviranom infarktu miokarda zadnjeg zida. Izostanak jasne elevacije ST segmenta doprinosi da se on previdi, što vodi drugačijem terapijskom algoritmu koji u značajnoj meri može da utiče na ishod. **Prikaz slučaja.** Pacijentkinja starosti 77 godina primljena je u jedinicu intenzivne kardiološke nege zbog tegoba u vidu prolongiranog bola u grudima, praćenog mučninom, i elektrokardiografski registrovane horizontalne denivelacije ST segmenta u VI–V3 do 3 mm. Postavljena je dijagnoza ST eleviranog infarkta miokarda zadnjeg zida koji se komplikovao razvojem incipijentnog kardiogenog šoka i ishemijske mitralne regurgitacije. Urađena je urgentna koronarografija i primarna perkutana koronarna intervencija sa implantacijom stenta u *ramus circumflexus* koja je bila infarktna arterija, a zbog višesudovne koronarne bolesti indikovana je hirurška revascularizacija miokarda. **Zaključak.** Transmuralni infarkt miokarda zadnjeg zida je najčešće previdena dijagnoza prilikom tumačenja 12-kanalnog elektrokardiograma. Rutinska upotreba dodatnih posteriornih (lateralnih) odvoda kod svih bolesnika sa bolom u grudima nema dijagnostički i terapijski benefit, ali je indikovana kod sumnje na infarkt posteriornog ili lateralnog zida. Upotreba posteriornih odvoda povećava broj dijagnostikovanih ST eleviranih infarkta miokarda, što doprinosi boljoj proceni rizika, prognozi i preživljavanju zahvaljujuću reperfuzionoj terapiji.

KLjučne reči: infarkt miokarda; elektrokardiogram; dijagnoza; koronarna angiografija; procena rizika; revascularizacija miokarda; reperfuzija miokarda; greške u dijagnostikovanju; prognoza

elevation longer than 20 minutes, and positive cardiac-specific enzymes [3]. In certain cases chest pain along with the signs of ischemia on ECG and cardiac-specific enzymes can have origins other than coronary, like in myopericarditis [4]. Equivalents to ST elevation myocardial infarction represent a great diagnostic problem. They are: ST segment elevation in aVR lead indicating left main coronary artery stenosis, the left bundle branch block in myocardial infarction, and posterior myocardial infarction [5, 6]. In

Abbreviations

ECG	– electrocardiogram
CCU	– Coronary Care Unit
STEMI	– ST elevation myocardial infarction
pPCI	– primary percutaneous coronary intervention
RCx	– circumflex artery
LAD	– left anterior descending artery
PDA	– posterior descending artery
OM	– obtuse marginal
RCA	– right coronary artery
MI	– myocardial infarction

these cases it is rather difficult to diagnose transmural myocardial infarction because their electrocardiographic manifestations do not show clear signs of lesions. The existence of ST depression in $V_1 - V_3$ leads on ECG strictly points to the anterior wall myocardial ischemia although it is actually the ST elevation myocardial infarction [3, 7]. In this way misdiagnosis can be made leading to inadequate reperfusion therapeutic algorithms which may significantly influence the outcome and cause complications. One of the most common complications, especially of the posterior wall myocardial infarction, is significant ischemic functional mitral regurgitation [9].

This paper presents a case of a patient admitted due to acute myocardial infarction of strictly posterior region which was complicated by the development of cardiogenic shock and acute ischemic mitral insufficiency. The condition was recognized and adequately treated.

Case report

A 77 year-old female patient was admitted to the Coronary Care Unit (CCU) at the Institute of Cardiovascular Diseases of Vojvodina due to prolonged feeling of chest pain followed by nausea and horizontal ST segment at $V_1 - V_3$ up to 3 mm registered by ECG (**Figure 1**). Discomforts began two hours before admission as first manifestations of coronary disease. From risk factors for ischemic disease she confirmed having high blood pressure and insulin independent diabetes mellitus.

On admission, the patient's general condition was critical. She was in cardiogenic shock, conscious, adynamic, with difficulties in communication, hypotensive, with normal heart rhythm. Her skin was pale, cold and sweaty.

ST segment elevation posterior myocardial infarction was diagnosed in accordance with the clinical presentation and registered ECG changes (**Figure 2**).

An emergency coronarography was immediately performed, registering occlusion of the circumflex artery (RCx) medial segment as the infarct-related artery. Significant lesions at the left anterior descending artery (LAD) segment were also registered as well as at the right coronary artery (RCA) - posterior descending artery (PDA) (**Figure 3**).

Primary percutaneous coronary intervention was performed along with stent placement at the RCx medial segment. It was followed by balloon dilatation of

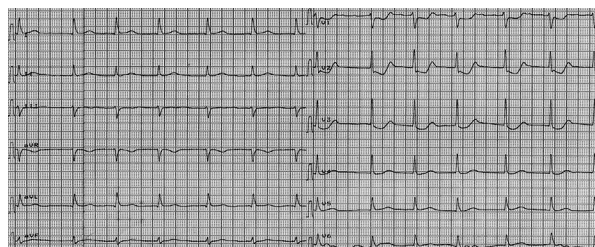


Figure 1. ECG taken after admission to the CCU – registered horizontal ST segment depression up to - 3 mm in $V_1 - V_3$

Slika 1. Elektrokardiogram snimljen nakon prijema u koronarnu jedinicu – registrovana je horizontalna de-nivelacija ST segmenta do 3 mm u $V_1 - V_3$

obtuse marginal (OM) branch establishing a satisfactory anterograde flow (**Figure 4**).

After the intervention, the patient was clinically stable. Echocardiography, which was performed a day after the intervention, registered lower left ventricular ejection fraction (EF 48%) and mediobasal inferior and mediobasal inferolateral hypokinesia, as well as severe ischemic mitral insufficiency.

The patient's case was presented at the Board of Cardiologists and Cardiac Surgeons and surgical myocardial revascularization and repeated echocardiography examination of mitral insufficiency, four weeks after myocardial infarction, were indicated, but prior to the surgery.

Since the control echocardiography registered gradual recovery of the mitral valve function with decrease of regurgitation volume, a myocardial revascularization was performed. The patient underwent triple aortocoronary bypass surgery (left internal mammary artery - LAD, RCx - OM1 and RCA) without mitral valve correction six weeks after myocardial infarction.

After surgical treatment the patient had no discomforts. Two years after myocardial infarction, control echocardiography showed mild to moderate mitral regurgitation.

Discussion

Posterior myocardial infarction is caused by necrosis of the posterior, infra-atrial part of the left ventricle located beneath the atrioventricular sulcus. Pathophysi-

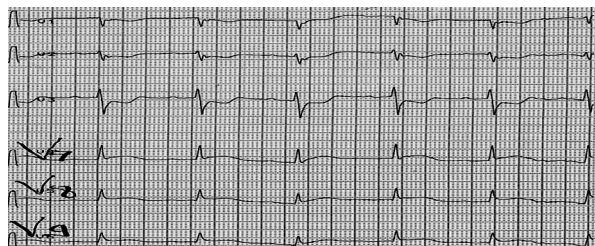


Figure 2. ECG showing posterior (lateral) leads and $V_7 - V_9$ elevation

Slika 2. Elektrokardiogram prikazuje zadnje (lateralne) odvođe sa prisutnom elevacijom u $V_7 - V_9$

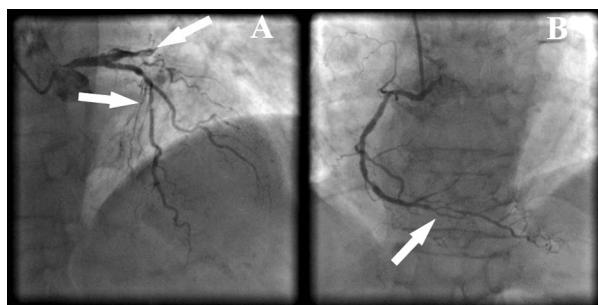


Figure 3. In the left image, the upper arrow shows an occlusion of medial RCx segment, while the lower arrow shows significant lesions of medial LAD segment. In the right image the arrow shows a significant lesion on the RCA - PDA

Slika 3. Na slici s leve strane, gornja strelica pokazuje okluziju medijalnog segmenta r. circumflexus, dok donja strelica pokazuje značajnu leziju u medijalnom segmentu r. interventricularis anterior. Na slici sa desne strane strelica prikazuje značajnu leziju r. interventricularis posterior i a. coronariae dextrae

ologically, there is a significant stenosis or occlusion of the RCx, while in some patients the infarct related artery is the RCA - its PDA [16–18].

Clinical presentation, risk factors and differential diagnosis of posterior myocardial infarction do not differ from other localizations of myocardial infarction. When the diagnosis is made, ECG interpretation has to correlate with the clinical presentation and laboratory findings i.e. characteristic increase of cardiac specific enzymes. It should be emphasized that ECG changes can be uncharacteristic (complete left bundle branch block, changes in avR lead), making the diagnosis even more difficult [5, 8].

Depending on the anatomy of coronary arteries and location of blood vessels, posterior myocardial infarction is commonly accompanied with inferior and/or lateral wall infarction, thus causing a large infarction area with a high risk of complications such as left ventricular dysfunction, right ventricular infarction, ischemic mitral regurgitation, arrhythmias and fatal outcome [8, 9].

After the 17-segment model of the left ventricle was adopted based on echocardiography and magnetic resonance imaging data, it was recommended that se-

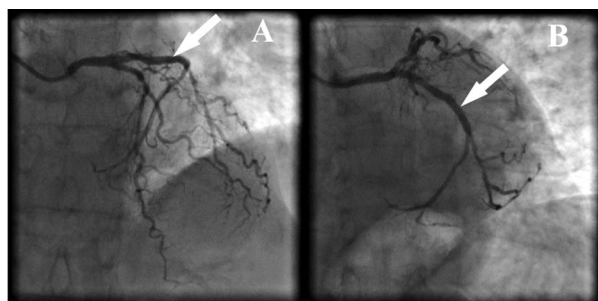


Figure 4. Arrows are pointing to the area of the implemented stent with optimal results

Slika 4. Strelice pokazuju segment gde je implantiran stent, sa postignutim optimalnim rezultatom

gment 4 should be named inferobasal instead of posterior [21]. Both terms are still being used in the literature to indicate the localization of myocardial infarction.

It is assumed that posterior myocardial infarction accompanied by infarction of other localizations accounts for around 15–21%, while isolated posterior myocardial infarction is rarely found [10–12].

Acute ischemia that is typically a consequence of coronary artery occlusion is associated with ST segment elevation on ECG leads, whose positive poles are located over the ischemic region and with reciprocal ST depression in leads whose positive poles are oriented in the opposite direction [13]. The posterior left ventricular wall is not shown directly on the 12-lead ECG, but the posterior wall electrical activity in $V_1 - V_3$ leads is reflected as a “mirror image”, including ST depression, tall R-wave and tall T-wave, which could be signs of STEMI - ST elevation, Q-wave and negative T-wave [14]. Placing additional leads $V_7 - V_9$ on the posterior chest wall assures the posterior wall myocardial infarction to be diagnosed, since the registered ST segment elevation in leads $V_7 - V_9$ clearly indicates the posterior STEMI. Leads are placed on the fifth intercostal area: V_7 on the left posterior axillary line, V_8 on the tip of left scapula and V_9 on the left paraspinal region.

According to the recommendations of the European Society of Cardiology from 2012, the ST elevation in additional leads $V_7 - V_9 \geq 0.05$ mV is important (≥ 0.1 mV in men younger than 40 years of age) in diagnosing posterior myocardial infarction. When there is a suspicion, usage of these leads should be considered (class IIa, C level of evidence), while echocardiography can help in making a diagnosis, but cannot postpone angiography (class IIb, C level of evidence) [3].

Placing electrodes on the back of the thorax in routine practice increases the number of registered posterior myocardial infarctions so the incidence of all myocardial infarctions is considered to be 3.3% [15].

Additional ECG leads are not always necessary. According to Boden et al., if there is a horizontal ST depression, it is acute posterior MI in 100% of patients, as compared with patients with non-Q myocardial infarction where ST depression is registered in the same leads, but down-sloping. However, 5% of diagnosed non ST-segment myocardial infarction are posterior MI, where reperfusion therapy would be justified if the posterior leads were used [10].

In a study of Satture et al., including 1083 patients with suspected acute myocardial infarction, 87 (8%) had ST elevation myocardial infarction, diagnosed using a 12 lead ECG, 15 lead ECG, 2D echo and cardiac specific enzymes. The posterior wall was a more common localization of infarction than it was considered to be (38% of all STEMI). It was shown that posterior MI is associated with a high six-month mortality, similar to the mortality of anterior wall infarction (around 21%). A moderate mitral insufficiency was also registered in 35% of patients with posterior MI on admission, while six-months later it was registered in 3.1% of patients [22].

Insufficient knowledge of all listed electrocardiographic criteria, as well as the absence of additional

leads contributes to the failure to recognize posterior ST elevation myocardial infarction and thus to the delay of reperfusion therapy. It also leads to an increased risk of potentially fatal consequences such as ischemic mitral insufficiency, left ventricular free wall rupture, and even fatal outcome [9, 19–20].

In our case there were clear electrocardiographic criteria that indicted STEMI of the posterior region, which was complicated by the development of cardiogenic shock and severe ischemic mitral regurgitation. Since early diagnosis was correct, the patient received an adequate therapeutic algorithm, in other words mechanical reperfusion and stent placement in the infarct-related artery. Timely revascularization of blood vessel

contributed significantly to the patient's clinical stabilization as well as to later gradual mitral valve recovery.

Conclusion

Posterior wall transmural myocardial infarction is the most common misdiagnosis in 12 lead electrocardiogram interpretation. Routine use of additional posterior (lateral) leads in all patients with chest pain shows no diagnostic or therapeutic benefits. It is recommended only in selected cases, especially in myocardial infarction of the inferior and/or lateral wall. The use of these leads increases the number of diagnosed myocardial infarctions, leading to better risk assessment, prognosis and survival, due to reperfusion therapy.

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