CASE REPORTS

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Dynamics of electrocardiographic changes, brain-natriuretic peptide and cortisol levels in a patient with stress (takotsubo) cardiomyopathy – a case report

Dinamika elektrokardiografskih promena, nivoa moždanog natriuretskog peptida i kortizola kod bolesnika sa stres (takotsubo) kardiomiopatijom

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Abstract

Introduction. Takotsubo cardiomyopathy is a transient acute heart failure syndrome caused by stress that provokes left ventricular mid-apical akinesis and mimics acute coronary syndrome. **Case report.** A 66-year-old woman had chest pain and dispnoea a few hours before hospitalization. A sudden emotional stressful event preceded the symptoms. Electrocardiographic abnormalities – precordial ST elevation and modest increase of cardiac troponin mimiced acute myocardial infarction. However, echocardiographic examination showed apical ballooning with markedly diminished left ventricle ejection fraction and the obstruction in the outflow tract of the left ventricle. Coronary angiography at admission showed no coronary stenosis and slower blood flow through the left anterior descending artery. According to anamnesis, echocardiography and coronarography finding we established the diagnosis of stress cardiomyopathy – takotsubo cardiomyopathy. We described in details the slow but dynamic electrocardiographic changes, levels of brain natriuretic peptide, cortisol and echocardiography evolution of disease during a 4-month follow-up till the full recovery. **Conclusion.** Stress (takotsubo) cardiomyopathy – became an important differential diagnosis of acute anterior myocardial infarction and it should be reconsidered every time when emotionally stressed patients with transient-apical akinesis or dyskinesis of the LV are present.

Key words:
takotsubo cardiomyopathy; risk factors; diagnosis; diagnosis, diferential; treatment outcome.

Apstrakt

Uvod. Takotsubo kardiomiopatija je sindrom prolazne akutne srčane slabosti izazvan stresom koji dovodi do apikalne akinezije leve komore i podražava akutni koronarni sindrom. **Prikaz bolesnika.** U radu je prikazana 66-togodišnja žena sa bolovima u grudnom košu i gušenjem nastalim nekoliko časova pre hospitalizacije. Iznenadni emocionalni stres predhodio je simptomima. Elektrokardiografske promene ST-segmenta (elevacija) i umereni porast kardiospecifičnih enzima podražavali su akutni infarkt miokarda. Ehokardiografija je pokazala apikalno baloniranje sa značajno sniženom ejekcionom frakcijom leve komore i sa opstrukcijom u izlaznom traktu leve komore. Koronarna angiografija učinjena po prijemu pokazala je odsustvo stenoza krvnih sudova srca i usporeni tok krvi kroz levu koronarnu arteriju. U skladu sa anamnezom, ehokardiografijom i nalazom koronarografije postavljena je dijagnoza: stres kardiomiopatija – takotsubo. Detaljno je opisana spora, ali dinamična evolucija bolesti tokom četiri meseca praćenja sve do potpunog oporavka. **Zaključak.** Stres (takotsubo) kardiomiopatija postala je bitna diferencijalna dijagnoza akutnog infarkta prednjeg zida i treba je uzeti u razmatranje kad god imamo bolesnika izloženog jakom emocionalnom stresu sa apikalnim baloniranjem leve komore srca.

Ključne reči:
kardiomiopatija, takotsubo; faktori rizika; dijagnoza; dijagnoza, diferencijalna; lečenje, ishod.

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Introduction

Stress or takotsubo cardiomyopathy (TCM) is a transient, often severe left ventricle dysfunction caused by stress and mimics acute coronary syndrome. It was first described in Japan in 1990 by Sato et al. [1]. Patients often present with chest pain, have ST-segment elevation and/or T-wave inversion on electrocardiogram, and elevated cardiac enzyme levels consistent with a myocardial infarction. Echocardiography examination typically demonstrates dyskinesis and akinesis of the left ventricular mid-apical segments and hyperkinesis of the basal segments with ballooning appearance of the left ventricle (LV). The regional wall motion abnormalities extend beyond a single coronary artery distribution. Coronary angiography in acute phase of the disease does not show any structural abnormalities of the coronary arteries. The name of the disorder is taken from the Japanese name for octopus trap – takotsubo [2], which has a shape similar to the apical ballooning configuration of the LV in systole in the "typical" form of this disorder. The condition is also referred to as stress cardiomyopathy, stress-induced cardiomyopathy, neurogenic myocardial stunning, ampulla cardiomyophaty, broken heart syndrome or apical ballooning syndrome [1, 2]. The exact etiology of TCM is still unknown, but several theories have been proposed and are being investigated. The most commonly discussed possible mechanism for takotsubo cardiomyopathy is stress-induced catecholamine release, with toxicity to and subsequent stunning of the myocardium. Studies have reported that 1.7–2.2% of patients who had suspected acute coronary syndrome were subsequently diagnosed with TCM [3, 4]. Stress-induced cardiomyopathy is much more common in women than men. Nearly 90% of reported cases involve postmenopausal women [5]. In a review of ten prospective series, women accounted for 80 to 100 percent of cases, with a mean age of 61 to 76 years [6]. Acute complications occur in approximately 20% of patients, including cardiogenic shock, heart failure, pulmonary edema, dysarrhythmias, left ventricular thrombus formation, left ventricular free wall rupture, and death. Estimates of mortality rates have ranged from 1 to 3.2% [5, 7]. Prognosis is excellent, with nearly 95% of patients experiencing complete recovery within 4–8 weeks. Recurrence rate varies but is estimated at 3% [8, 9].

The aim of this case report was to describe the dynamics of electrocardiographic and echocardiography findings, and the curve of brain natriuretic peptide (BNP) and cortisol blood levels in a patient with severe stress induced cardiomyopathy.

Case report

A 66-year-old postmenopausal woman was admitted to the Clinic for Emergency Internal Medicine at the Military Medical Academy, Belgrade, because of sudden onset angina like chest pain occurred after severe emotional stress – she had lost her identity card and had a problem with police. The chest pain was localized substernal with irradiation to the left arm end left scapula. She also felt anxiety and nausea with vomiting. Her cardiovascular risk factors were arterial hypertension, dyslipidemia, borderline hyperglycemia and positive family history of coronary artery disease (her mother died from myocardial infarction). Upon admission her blood pressure was 100/70 mmHg, heart rate 115/min and the electrocardiogram (ECG) showed sinus tachycardia with 3 mm ST-segment elevation in all precordial leads and in DI, DII leads. The results of laboratory analysis showed the elevated serum troponin level of 5.7 ng/ml, creatine kinase 261 IU/L, creatine kinase (CK) MB 42 IU/L, complete blood count (CBC) showed only mild leukocytosis and biochemistry results were in normal range. She was, thus, diagnosed with ST-elevation acute myocardial infarction and sent for emergency transtoracic echocardiogram and coronary angiography. A transthoracic echocardiogram revealed regional systolic dysfunction of the LV walls with dyskinesis-akinesis of the mid-apical segments with apical ballooning phenomena and hyperkinesis of the basal segments generating a LV outflow tract obstruction ejection fraction (EF) of 30%, mild mitral regurgitation 3+, normal right ventricular size and function, the absence of pericardial effusion or pulmonary hypertension (Figures 1 and 2). Coronary angiography showed epicardial coronary arteries with no evidence of significant atherosclerotic changes, spasm or thrombosis (Figure 3). In this moment the patient was diagnosed with stress cardiomyophaty – takotsubo. The patient was then transferred to the Coronary Intensive Care Unit for post-procedure continuous monitoring and treated with oral aspirin, clopidogrel, and subcutaneous low molecular weight

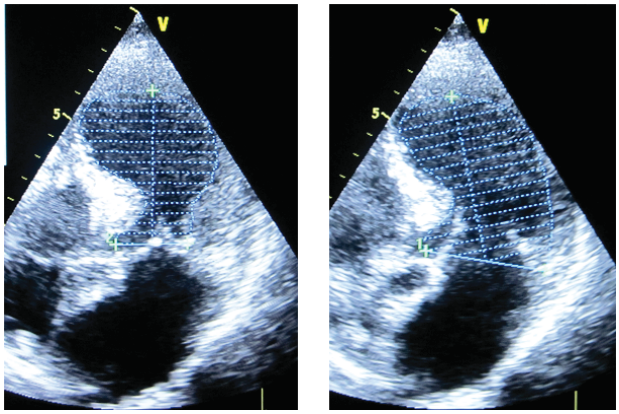


Fig. 1 – Echocardiography performed after admission, a 4-chamber apical view in systole and diastole.

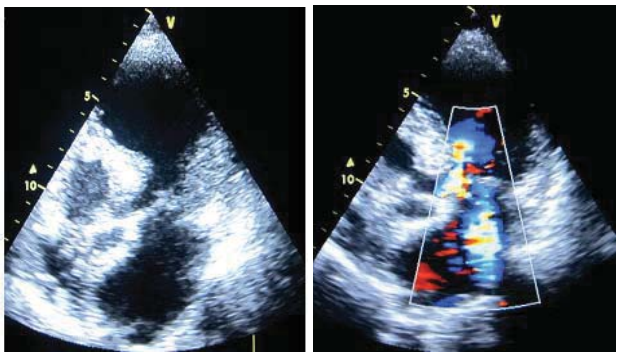
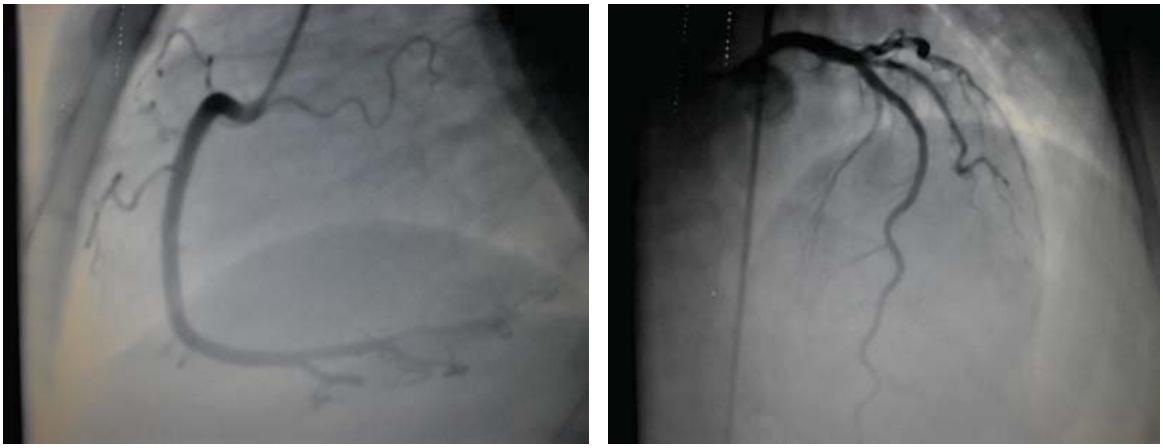


Fig. 2 – Two-dimensional echocardiography in takotsubo cardiomyopathy showing a typical apical ballooning configuration of the left ventricle (LV) in systole, and significant mitral regurgitation.



Right coronary artery (RCA)

Left main coronary artery (LMCA), left anterior descending artery (LAD) and circumflex (ACX)

Fig. 3 – Coronary angiography showing epicardial coronary arteries with no evidence of significant atherosclerotic changes.

heparin. She was also treated with beta blockers and diuretics. Inotropic therapy with medium dosage of dopamine started but caused transient worsening of hemodynamic and was stopped very soon. Twenty four hours after admission troponin level was lower (3.03 ng/ml) and CK achieved the peak of 301 IU/L with the level of CK-MB 28 IU/L. At that time the serum level of BNP was 1209.26 pg/ml (normal range: 0,00–86,10 pg/mL), cortisol level in 08:00 h was 1045,8 nmol/L (normal range 118,6–618,0 nmol/L) and in 16:00 h 1013 pg/L. These results confirmed the existence of severe stress. The rest laboratory analyses were in normal range except increased levels of C-reactive protein (CRP) 22.60 mg/L and fibrinogen 4.51g/L. During the 4-month follow-up, electrocardiography examination was performed very often and the changes of PQRST complex and the extension of the T-wave negativity in the V4 precordial lead were the most prominent changes (Figures 4 and 5). Very deep negative precordial T-waves persisted

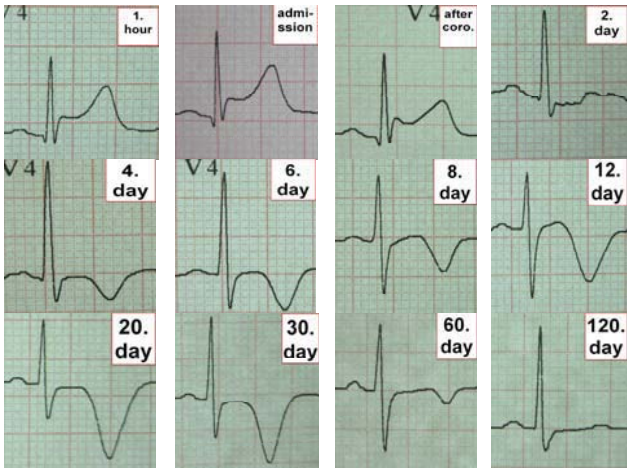


Fig. 4 – Electrocardiography (ECG) changes recorded in the lead V4 from the onset of symptoms to full recovery after 4 months, with the emphasis to changes in T-wave.

for one month with the nadir between 20–30 days after the disease onset. Shallow negative T-waves were present after 4-months. Meticulous echocardiography follow-up was also done. Regional wall motion abnormalities were resolved

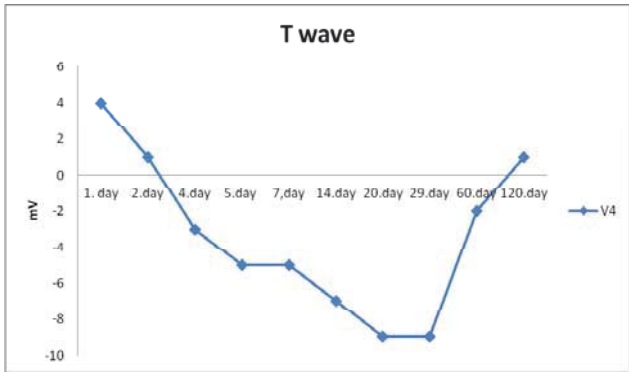


Fig. 5 – T-wave changes from the onset of symptoms until full recovery in the lead V4, showing maximum negativity at the end of the first month and then slow return to isoelectric line in the next 3 months.

slowly with a significant improvement of LVEF after 7 days and the normalization of LVEF after 4 months (Figure 6).

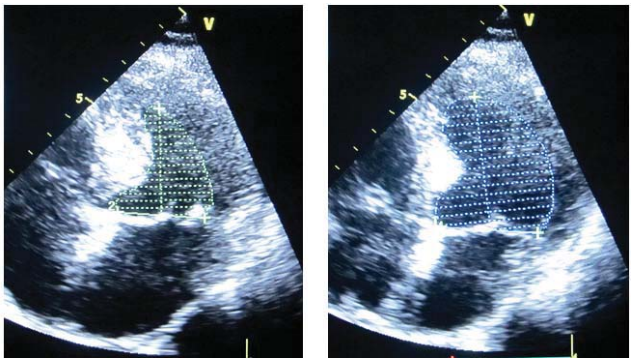


Fig. 6 – Electrocardiography preformed after 4 months, a 4-chamber apical view in systole and diastole, revealing full recovery.

Velocity of the blood flow in the outflow tract of the left ventricle measured by pulse Doppler showed a slow decline from admission to the seventh day when it achieved a plateau (Figure 7).

Mitral regurgitation was very prominent at admission and after 14 days it was trivial (Figure 2). Blood level of BNP was

very high at admission with slow decrease over the next two months when it reached the reference value (Figure 8). Serum cortisol level was elevated at admission with the vanished diurnal variation (it was measured at 8 am and 4 pm for the first several measurements) and it was slowly decreased to the normal values after two weeks (Figure 9).

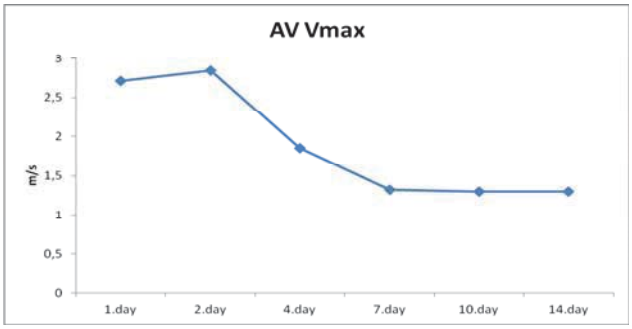


Fig. 7 – Blood flow velocity in the outflow tract of the left ventricle (AV Vmax) measured by pulse Doppler showing slow decline from admission to the 7th day when it achieved a plateau.

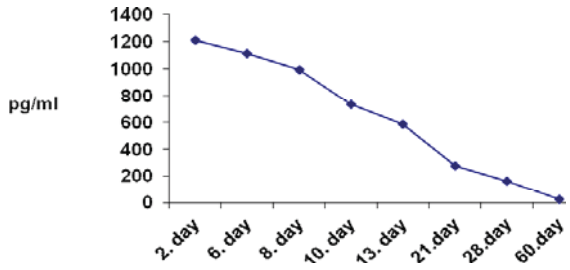


Fig. 8 – Levels of brain natiuretic peptide (BNP) showing a pick value during the first 24 h and slow reduction after, until reaching referent values.

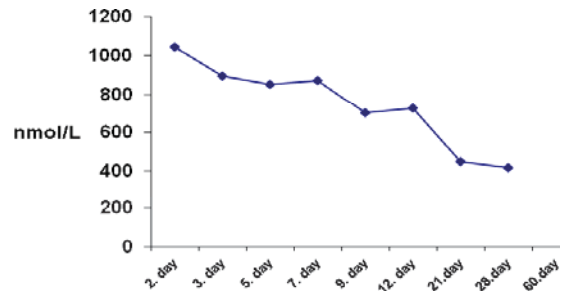


Fig. 9 – Levels of cortisol showing a pick value on the first day and normalization at the end of the first week.

Discussion

The basic aim of this case report was to show dynamic changes of the most prominent electrocardiographic findings, echocardiography parameters, BNP and cortisol levels in a patient with severe stress cardiomyopathy. As far as we know the exact timing of these important parameter changes in takotsubo was not presented. The basic echocardiography measurements were normalized after one month as well as BNP and cortisol levels. ECG changes were persistent for the longer period of time with the most prominent changes at the end of the first months with slow regression through the next 4 months. Most of the published case reports and studies also reported the same dynamics changes in ECG during a follow-up period in TCM. The echocardiography changes that we found in the presented patient are also very similar to other case reports. In our patient the level of BNP was highest in the first 24 hours and then it slowly decreased until the normal range after one month. In the study of Akashi et al. [10], BNP levels in their patients peaked within a first week and then normalized within the next few months. A high serum level of BNP is a marker of poor prognosis [11–13], in our patient very high BNP level was observed in the acute phase when it was hemodinamically compromised with arterial hypotension and significant decrease of global left ventricle EF. Improvement of left ventricular performance and decrease of BNP were parallel during the next month with complete recovery of EF and normalization of BNP. In our patient we measured morning serum cortisol levels as a stress hormone every other day for the first seven days and once weekly for one month and we showed increase of this hormone levels with the peak after 24 h and slow decrease of its level through the next two weeks when it achieved the normal levels. According to the best of our knowledge there is only one study on cortisol levels measured by Madhavan et al. [14], but they compared levels of biomarkers at admission in patients with takotsubo and acute MI, but did not find any difference, and they did not provide dynamics of cortisol levels in patients with stress cardiomyopathy. Thus, more investigations on this point remain to be performed in the future.

Conclusion

Stress (takotsubo) cardiomyopathy is an important differential diagnosis of acute anterior myocardial infarction and it should be reconsidered every time in emotionally stressed patients with transient-apical akinesis or dyskinesis of the LV present themselves. Despite dramatic clinical appearance and significant hemodynamic compromise in a large proportion of patients, the condition has good prognosis. Takotsubo should be discriminated from MI by early coronary angiography. Highly elevated levels of BNP and cortisol could also point out to severe stress and, therefore, to takotsubo. There is no specific treatment for takotsubo, so every patient requires a unique approach.

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