

Broken Heart Syndrome

Post-operative Takotsubo Cardiomyopathy in Elective Mitral Valve Replacement

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Abstract

Takotsubo cardiomyopathy is a type of stress cardiomyopathy that is usually seen in postmenopausal patients and can be triggered by emotional stress, hypoglycemia, hypothyroidism, and surgery. A patient post cardiac surgery can present with multiple complications causing hemodynamic compromise. Hence, takotsubo cardiomyopathy remains a diagnostic dilemma. Here, we present an interesting electrocardiogram (ECG) of the same condition in a patient after mitral valve replacement with normal patent coronaries but presenting with anterolateral massive infarction with shark fin pattern in the ECG.

Keywords: Heart failure with mildly reduced ejection fraction; heart failure with preserved ejection fraction; SGLT2-inhibitors

Case Presentation

A 47-year-old menopausal female patient presented a case of rheumatic heart disease with a giant left atrium (73×92 mm), severe mitral stenosis (0.5 cm²), severe tricuspid regurgitation (tricuspid annulus 32 mm) and severe pulmonary hypertension (74 mmHg). She had good biventricular function after a balloon mitral valvotomy four years back with an ejection fraction of 60%. The chest X-ray showed a cardiomegaly and the electrocardiogram (ECG) showed an incomplete right bundle branch block and a borderline repolarization abnormality (fig. 1). The invasive coronary angiography showed normal coronary arteries.

A mitral valve replacement with a mechanical valve was performed with the preservation of the subvalvular apparatus and partial preservation of the posterior mitral leaflet with the posterior tricuspid annular plication. Aside from a trivial tricuspid regurgitation on the immediate post-operative echocardiography,

the surgery was uneventful. The patient was transferred to the post-operative ICU for elective ventilation under inotropic support with adrenaline 0.02 µg/kg/min and noradrenaline 0.02 µg/kg/min. The immediate post-operative ECG showed no changes.

On the first post-operative day, the patient was unable to maintain blood pressure and required an increase in inotropic supports (adrenaline 0.1 µg/kg/min, noradrenaline 0.1 µg/kg/min). The ECG showed significant ST segment elevations in leads V3 to V6 marking an anterolateral infarction with diagonal and circumflex territory involvement (fig. 2). An intra-aortic balloon pump (IABP) was inserted immediately and the inotropic support was continued. An urgent echocardiography showed a normally functioning mechanical mitral valve, an akinesia of the mid- and apical segment of the left ventricle and an ejection fraction of 25% indicating a stress cardiomyopathy. Cardiac enzymes were mildly elevated

on post-operative days 1 and 2, and there was no abnormality on the CT coronary angiography on the first post-operative day. The patient was diagnosed with Takotsubo cardiomyopathy.

Solution

Patient management included tapering of inotropic supports and continuation of mechanical assistance with the IABP. Diuresis was continued to prevent pulmonary edema. Anticoagulation was started in the form of low-molecular-weight heparin 0.6 ml once a day. The new post-operative ECG changes (ST elevation in leads V3 to V6) settled on the third post-operative day while the borderline repolarization abnormality from the pre-operative ECG persisted (fig. 3). On the sixth post-operative day, serial transthoracic echocardiography showed a gradual improvement of the ejection fraction to 55%. The patient was discharged on the tenth day and continues to maintain follow-up in the outpatient department.

Discussion

Takotsubo cardiomyopathy (TCM) is most commonly observed in postmenopausal women after emotional stress or after surgery. TCM after cardiac surgery develops when patients have risk factors for pre-operative cardiomegaly combined with inadequate myocardial protection strategies and inadequate rest time prior to discontinuation of cardiopulmonary bypass. The exact cause of TCM is unknown [1]. The reason for delayed development of TCM during the post-operative period is also

understudied. The most accepted hypothesis still remains a catecholamine-mediated myocardial stunning due to a combination of myocardial ischemia with multiple epicardial coronary spasms and metabolic injury [2, 3]. Therefore, a reasoned use of catecholamines in TCM has been suggested. Myocardial fibers have a non-uniform response to catecholamines and thus, regional wall motion abnormalities can be present [4]. A sudden decrease in post-operative ventricular preload and increase in afterload may cause a mismatch in myocardial mechanics with increased stress and oxygen consumption [5]. Systemic inflam-

mation after cardiopulmonary bypass poses an additional risk due to monocyte activation and interleukin-6 elevation [6, 7]. Post-cardiotomy cardiogenic shock proves to be another risk factor for TCM [8]. Especially during mitral valve surgery, the loss of ventriculo-annular continuity, when the heads of the papillary muscles and both leaflets are excised, may cause a left ventricular dysfunction, thus making the preservation of the subvalvular apparatus essential [9]. Additional risk factors for TCM include hormonal imbalance, genetic predisposition as well as psychiatric and neurological disorders with emotional and physi-

cal triggers [10]. A Swiss cheese model by Arcari et al. suggests these factors to be protective mechanisms, defects in which can trigger TCM [11]. The diagnosis of TCM is often challenging as it mimics an acute myocardial infarction in ECG and cardiac markers [12]. At our institution we follow the International Takotsubo (InterTAK) diagnostic criteria. These include transient left ventricular dysfunction, emotional or physical trigger (non-obligatory), new ECG abnormalities (ST elevation or depression, T wave inversion and QT prolongation), mild to moderate cardiac biomarker increase, no evidence of infectious

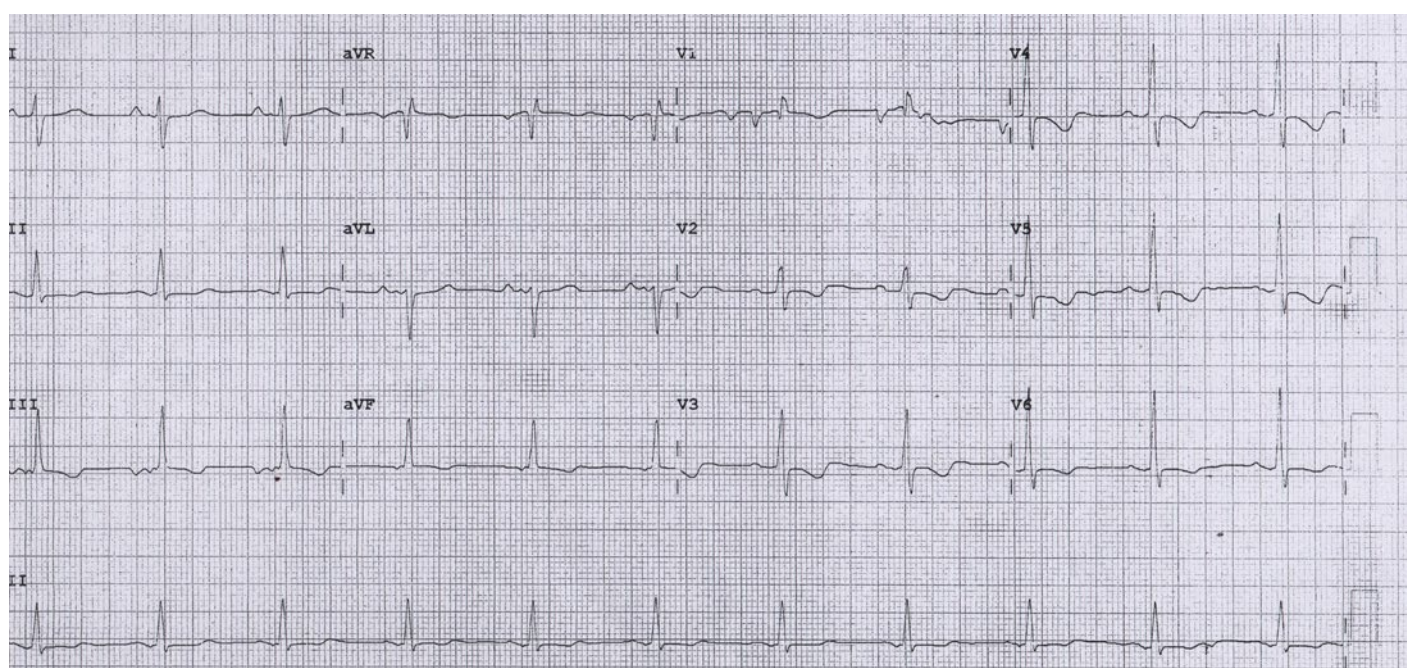


Figure 1: Pre-operative electrocardiogram (ECG) with borderline repolarization abnormality.

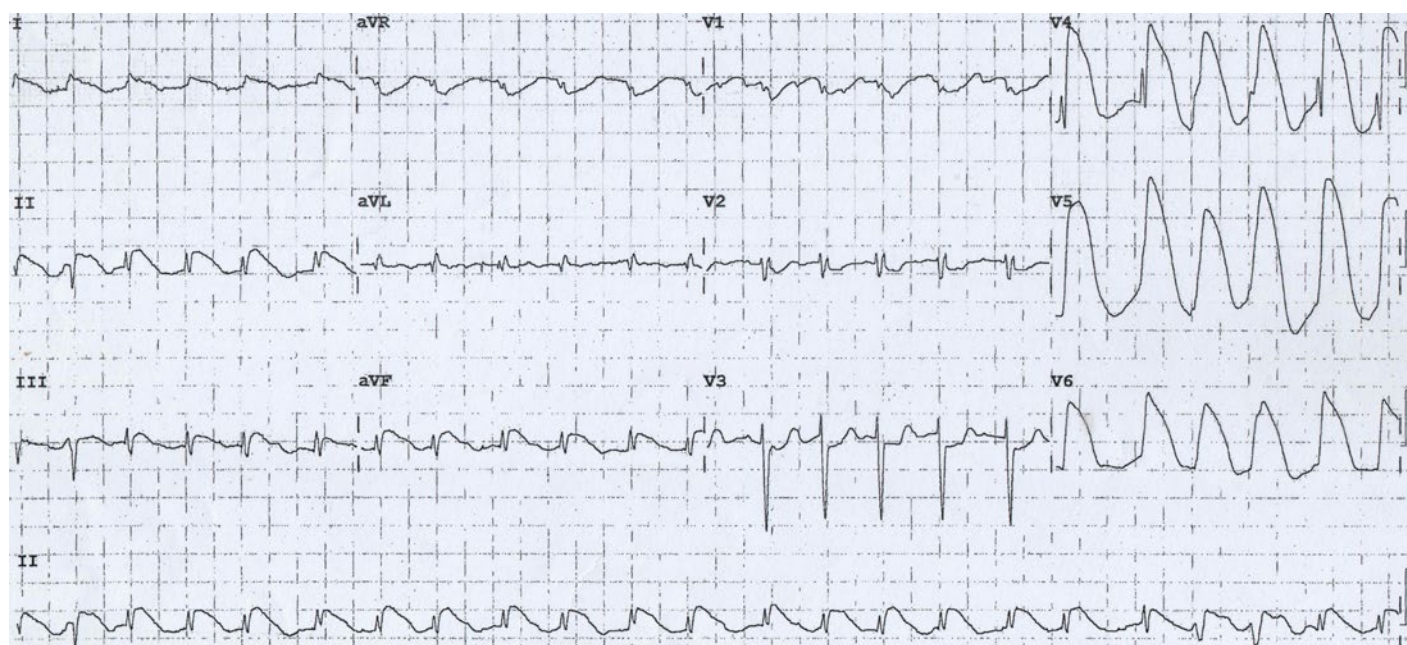


Figure 2: Post-operative day 1 electrocardiogram (ECG) showing anterolateral infarct with normal coronaries (Takotsubo cardiomyopathy).

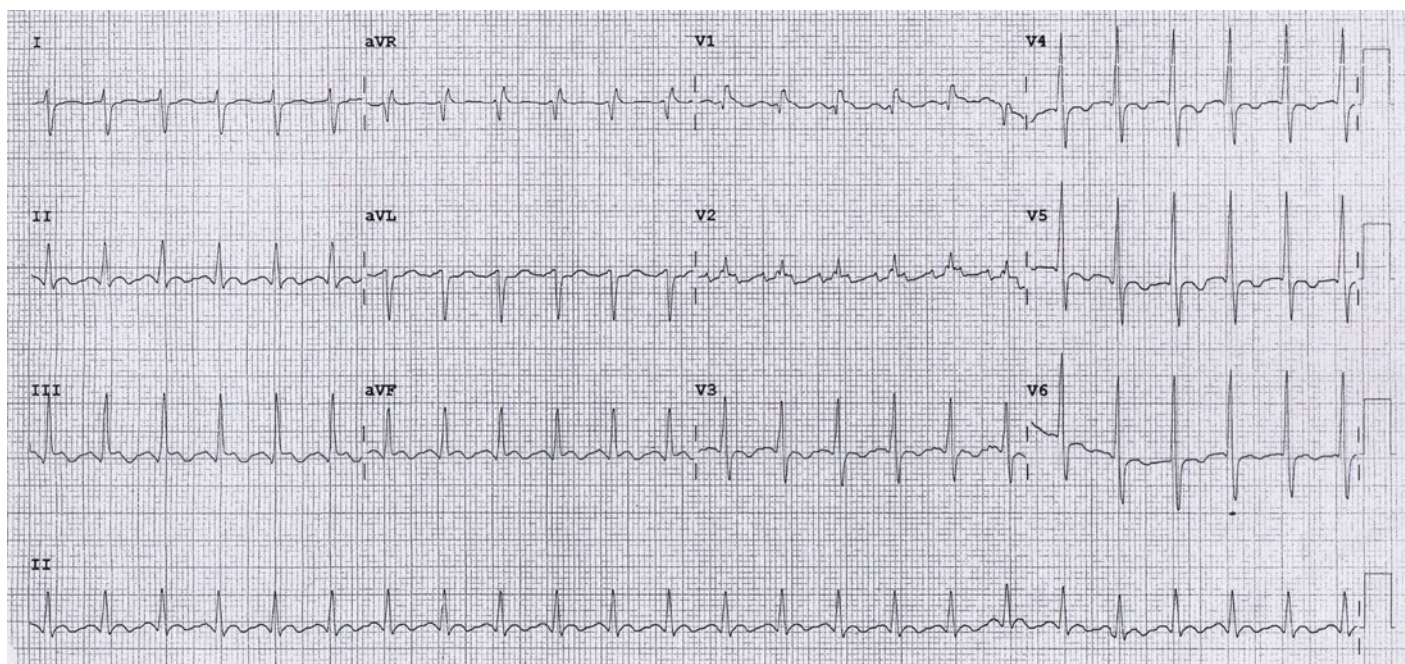


Figure 3: Post-operative day 3 electrocardiogram (ECG) showing no new changes and settling of ST elevation.

myocarditis and predominance of postmenopausal women [10]. Our institutional protocol for the management of potential TCM cases consists of the use of antegrade and retrograde cardioplegia, crossover alpha- and pH-stat strategies, and the use of local hypothermic agents like ice slush to improve myocardial protection. Conservation of the subvalvular apparatus and chordal preservation is done whenever possible. Large hearts are usually weaned off cardiopulmonary bypass slower and after an adequate resting time has been given to the beating heart. During the immediate post-operative period, care is taken to avoid high dose catecholamines while aggressively using mechanical support devices. Fluid balance is maintained depending on congestive heart failure or cardiogenic shock. Medical post-operative management includes the use of beta blockers to increase the diastolic ventricular filling time and left ventricular end-diastolic volume, phenylephrine to increase the afterload with a reduction of the intraventricular gradient as well as anticoagulants and plaque stabilizers immediately after surgery [13].

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Ethics Statement

The research complies with guidelines for human studies and was conducted in accordance with the World Medical Association Declaration of Helsinki. Written informed consent was obtained.

Conflict of Interest Statement

The authors have no potential conflicts of interest to declare.

Author Contributions

AP: Principal investigator and corresponding author.
SP: Article compilation and literature search.
UJ: Proof-reading and data collection.

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