

Takotsubo Cardiomyopathy causing “Transient Heart Failure” after Cardiac Surgery: A Rare Phenomenon

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Abstract

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“Takotsubo cardiomyopathy”, also known as “broken heart syndrome” and “stress cardiomyopathy” was first identified in the Japanese population in 1990 as a transient non-ischemic cardiomyopathy predominantly affecting post-menopausal females [1]. Patients presented with features similar to an acute myocardial infarction with a characteristic wall motion abnormality of a hyperkinetic base with hypokinesis/akinesis and ballooning of the mid-apical segments; the diagnosis was not confirmed until coronary angiography was performed and ruled out significant underlying coronary artery disease. This syndrome was subsequently recognized to have a global presence after a case series of 19 patients from Baltimore presenting in a similar fashion to their Asian counterparts was published in the *New England Journal of Medicine* [2, 3]. A preceding stressful event in the form of a physical and/or emotional trigger is commonly associated with this cardiomyopathy, particularly in certain high-risk patient groups like post-menopausal women and patients with underlying psychiatric or neurological disorders [1]. Stress cardiomyopathy likely results from neuro-cardiogenic stunning through epicardial and/or micro-circulatory dysfunction after an extreme stressor leads to an increased spillover of catecholamines and stress-related neuropeptides in the neuro-cardiac axis [1, 4]. Takotsubo cardiomyopathy still, however, continues to be an under-diagnosed and poorly understood disease process.

Physical triggers for this cardiomyopathy can range from acute medical conditions like a cerebral bleed, sepsis, acute respiratory failure, pheochromocytoma to patients dealing with stressors in the post-surgical setting. Takotsubo cardiomyopathy has been previously described in the literature extensively in association with various intermediate-high risk non-cardiac surgeries like gastrectomy, head and neck reconstructive surgery, lung lobectomy, carotid endarterectomy, and liver transplantation [5-9]. However, other than a few isolated case reports describing the development of stress cardiomyopathy after mitral valve replacement, the data is sparse for patients undergoing cardiac surgery [10-12]. In this issue of the *Journal of Cardiac Surgery*, a case-control comparison from a single-center experience by Kim et al analyzes patients who develop Takotsubo cardiomyopathy following cardiac surgery retrospectively and identifies factors that increase the risk of cardiomyopathy through their case-control comparison. The overall incidence of Takotsubo cardiomyopathy in this study for all patients undergoing cardiopulmonary bypass is low at 0.9% (total of 52 cases)— patients undergoing coronary artery bypass surgery or cardiac transplantation were excluded from this analysis. The average time to development of this cardiomyopathy was 4-5 days after surgery and the mean period for myocardial recovery was estimated at 7 months, which is longer than what has been noted in prior literature for Takotsubo cardiomyopathy [13]. Interestingly, the majority of patients (approx. 69%) who had developed Takotsubo cardiomyopathy had undergone mitral valve surgery, which is in line with prior published case reports. No significant differences in the cardiopulmonary bypass or aortic cross-clamping times were noted between the cases and the controls. Further, based on the multivariate analysis, the use of inotropes or vasopressors was positively associated with the development of stress cardiomyopathy.

Cardiac surgery can be a source of extreme physical stress for the body through multiple mechanisms— it can induce systemic inflammation and a catecholaminergic surge through cardiopulmonary bypass, direct handling of the myocardial tissue can cause direct toxicity and can also induce inflammation, patients after cardiac surgery are commonly subjected to use of multiple inotropes and vasopressors to counteract vasoplegia—it is surprising that the development of stress or Takotsubo cardiomyopathy in this setting is not seen more often. It is possible that limited access to diagnostic modalities in the post-cardiotomy period (limited electrocardiograms and trans-thoracic echocardiogram windows due to open chest cavity) leads to underdiagnosis of stress cardiomyopathy in this patient population.

To conclude, this case-control study will serve as the first step to help establish the phenomenon of post-cardiotomy Takotsubo syndrome, however, further research with longer follow-up data and prospective study design would help address our knowledge gaps in the pathophysiology of this disease process. Further studies are needed to investigate the increased predisposition of Takotsubo cardiomyopathy with mitral valve replacement surgeries compared to other cardiac surgeries. While no difference in the relative frequencies of mitral stenosis or mitral regurgitation as the predominant etiology for mitral valve surgery was noted between the cases and controls in this analysis, further research is needed to explore if the afterload mismatch in patients with long-standing or very severe mitral regurgitation predisposes them to a stress cardiomyopathy

syndrome after mitral valve surgery. The association of catecholamine use (particularly epinephrine and dobutamine based on the multivariate analysis in this study) with increased predisposition to post-cardiotomy stress cardiomyopathy also warrants further research to address if the association is merely correlational or causative. Finally, the relationship of the extent and types of cardioprotective strategies with the incidence of post-op Takotsubo syndrome would also need to be studied.

Management of Takotsubo syndrome is radically different from other etiologies for cardiogenic shock in the post-op setting— hence, timely diagnosis of post-cardiotomy Takotsubo syndrome is essential— this study would help the cardiac intensivists and cardiac surgeons identify patients at high risk for this phenomenon and aid timely detection and appropriate management of Takotsubo syndrome in the post-op period.

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