Review Article

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Takotsubo Cardiomyopathy: Nightmare for Anaesthesiologists

M. P. Nath

Abstract

Takotsubo cardiomyopathy (TTC), also transient apical ballooning if the left ventricle is a recently described and often underdiagnosed entity. The syndrome observed predominantly in the postmenopausal women with signs very mimicking acute myocardial infarction. In most of the case reports emotional or physical stress factors has been identified as a trigger and perioperative stress has been suggested as the trigger in some cases. Outcome is favourable with the right treatment, though recurrences are possible. Here in this review the etiopathogenesis, diagnosis, prevention and management of this syndrome is elaborately described in terms of literature evidence.

Introduction

Takotsubo syndrome, also known as ampulla cardiomyopathy, broken heart syndrome, idiopathic apical ballooning syndrome, and stress induced myocardial stunning, has been first described by Japanese authors in 1996 and subsequently specified in 2001; it derives from the resemblance between the ancient round bottomed, narrow-necked Japanese fishing pots used to trap octopus in Asia and the end-systolic appearance of the left ventricle on ventriculography [1]. In Japanese, tako translates as octopus and tsubo as pot, hence the name. Initially as most cases from Japan were reported, a genetic component was suspected, although now lots of cases are reported from non-Asian populations in the United States and Europe [2]. It is common among post-menopausal women precipitated by sudden emotional or physical stress [3, 4]. These patients usually have a benign or unremarkable past medical history and the degree of symptom severity and presentation varies [3]. There is marked gender discrepancy in TTC and female in the postmenopausal area with mean age 58 to 77 years are commonly affected [5]. It is also proposed that during post-menopausal period, there is altered endothelial function in response to reduced estrogens levels after exposure to sudden, unexpected emotional or physical stress. Cases are reported in younger age group of patients, a noteworthy case of 31 year old healthy women during caesarean section [6] and 31 year old premenopausal women during breast surgery [7].

Etiology

Almost all studies on TTC are small and observational and the etiology still not clear from any of the case reports described. This disease is potentially life threatening. A completely reversible rare syndrome after severe emotional stress or extended surgery has also been described. It can occur in any of the stressful surgical situations from Electroconvulsive therapy unit [8] to the liver transplant surgery [9]. The trigger for this syndrome remains uncertain. Analysing the various reports of TTC after general anaesthesia, there are no apparent similarities in past medical history, performed procedures or used drugs. Even in patients underwent specific preoperative cardiac examination ; no hint for heart abnormalities was evidenced. Considering the low prevalence of this condition, it will be very difficult to find a feasible way of preoperative screening.

Several proposed mechanisms leading to the LV wall motion abnormalities has been postulated and include a wraparound left anterior descending coronary artery anatomy, microvascular coronary spasm, microvascular dysfunction, transient excessive levels of catecholamine, and abnormal stress response to

Author's Affiliations:

Asstt. Prof. & I/c Cadiao-thoracic Anesthesia, Gauhati Med. College Hospital, Bhangagarh, Guwahati, Assam 781032

Corresponding Author:

M. P. Nath, AAsstt. Prof. & I/c Cadiao-thoracic Anesthesia, Gauhati Med. College Hospital, Bhangagarh, Guwahati, Assam 781032

E-mail: drmridupaban@yahoo.com

catecholamines, specifically epinephrine and norepinephrine [10]. The relationship between stress induced catecholamine release and myocardial dysfunction was noticed by Wittstein and colleagues and they measured the catecholamine plasma levels in women presenting with transient LV apical ballooning syndrome and they discovered that the levels were markedly higher than in women presenting with an acute myocardial infarction [11]. Many authors also report an abnormal fatty acid metabolism with impaired glucose metabolism, transient abnormal catecholamine response or coronary micro vascular dysfunction [3]. The mechanisms of coronary vasospasm that leads to temporary direct myocardial injury are cyclic AMP mediated calcium imbalance, free radicals or contraction band necrosis due to elevated catecholamines [11]. Although various hypotheses have been proposed, there is no established explanation for the susceptibility of elderly women to this condition or why particular myocardial segments are prone to dysfunction when this cardiomyopathy occurs.

Clinical presentations

Although takotsubo syndrome classically presents with chest pain, dyspnea, and ECG changes, these findings are not invariably present. Dyspnea may be a more common presentation in African American women [12]. Theage (62–75years) and gender predominance (about 80%–100% postmenopausal women) encountered in classic takotsubo syndrome may be less obvious in the variant forms in which patients often are younger and more often male. Although most patients recover without complications after an episode of takotsubo cardiomyopathy, serious complications including congestive heart failure (occurringin as many as 44%–57% of patients) [13], pulmonary oedema often requiring endotracheal intubation and mechanical ventilation, and cardiogenic shock (15%-45% of cases) requiring vasopressor or inotropic therapy [14] and even intra aortic balloon pumping [15] do occur. Other complications such as ventricular arrhythmias including torsade de pointes [16], syncope, cardiac arrest, apical thrombosis, and thromboembolism including stroke, dynamic intra ventricular gradients, and obstruction (up to 25%) [17] with or without systolic anterior motion of the mitral valve, severe mitral regurgitation, ruptured ventricle, and death (1%–3% but as high as 21%) have been reported [14]. Elesber et al [18] at the Mayo Clinic observed a recurrence rate of 11.4% over an average follow-up of 4.4 +/-4.6 years of 100 patients with takotsubo cardiomyopathy (2.9% per year over the first 4 years and 1.3% per year thereafter). Interestingly, only 2 of the 10 patients who experienced a recurrence had an identifiable precipitating event at that time.

Mayo Clinic diagnostic inclusion criteria of TTC [19, 20]: all the 4 criteria are required for the diagnosis:

1. Transient left ventricular hypokinesis, akinesis, or dyskinesis with or without apical involvement. The regional wall motion abnormalities typically extend beyond a single epicardial coronary distribution. It is frequently, but not always, a stressful trigger.
2. Absence of obstructive coronary artery disease or angiographic evidence of acute plaque rupture.
3. New electrocardiogram changes: ST-segment elevation and/or T-wave inversion or modest elevation of cardiac troponin levels.
4. Absence of pheochromocytoma and myocarditis.

Treatment and prognosis

Timely diagnosis and intervention with hemodynamic support leads to rapid reversal of LV dysfunction and increases the chance of survival [2]. There is no definite treatment for TTC, supportive treatment in patients without com-morbidities leads to successful outcome provided they survive acute severe heart failure period [3]. The most frequent complication is left sided heart failure with or without pulmonary oedema. Other infrequent complications include ventricular dysrhythmias, mitral valvular dysfunction, cardiac rupture, LV thrombus, pulmonary embolism with in hospital mortality up to 8% [10, 19]. In the setting of LV outflow tract obstruction, and inappropriate management, death is much more common [10]. Patients with TTC presents in the emergency with features of acute coronary syndrome (ACS) like:

- Chest pain
- Dyspnoea
- ECG changes
- Small early increase in cardiac biomarkers.

Due to the similarity of symptoms between TTC and ACS, they must be carefully diagnosed, as these

2 cardiac disorders have different pathogenesis, management and outcomes. The following pharmacological interventions improves patient outcome in TTC:

1. Beta blockers: to attenuate the transient LVOT obstruction.
2. Dihydropyridine calcium channel blockers are recommended in patients with coronary artery vasospasm.
3. Aspirin and Angiotensin converting enzyme inhibitors (ACEI) role is not clear. Long term use of ACEI before the onset of TTC protected against cardiogenic shock, sustained ventricular arrhythmias and death [21].
4. Calcium sensitizer Levosimendan is the best choice of inotropes when required [23].
5. If patient presents with acute decompensating heart failure in shock, management includes positive pressure ventilation, LV assist devices, IABP (intra-aortic balloon counter pulsation) support. Dopamine and dobutamine can be used in hypotensive patients without substantial LVOT obstruction [17]. However, it is recommended that dobutamine be avoided in patients with severe systolic dysfunction or LVOT obstruction with hypotension and shock [10].
6. Phenylephrine is an agonistic drug and it should be used with caution, and vigilant haemodynamic monitoring, tissue perfusion, and mentation should be monitored, because it might precipitate coronary vasospasm [17].
7. In presence of QT prolongation in ECG, selective anti-arrhythmic medications should be given.

Anaesthetic Consideration

Perioperative stress and its effect on cardiovascular system are well known. Stress response to Surgery begins during induction of general anaesthesia and lasts till 3-4 days post-surgery that results from activation of sympathetic nervous system that initiates a cascade of physiologic and metabolic events [22]. Mortality following cardiac ailments is the most common cause of death after major surgical procedures[22]. In post-menopausal age group TTC is considered as one of the differential diagnosis in patients demonstrating myocardial dysfunction in the peri-operative period. The anaesthetic management is not different from balanced anaesthetic technique with special interest to:

- Minimizing perioperative anxiety with proper counselling, education, and anxiolytic drugs
- Gentle laryngoscopy smooth extubation
- Maintaining nomovolemia, normoxia, normoarbia in proper depth of anaesthesia to prevent catecholamine surges
- Proper standard monitoring during anaesthesia and close vigilance of ECG and cardiac function
- Intra-operative trans-esophageal echocardiography (TEE) and post-operative trans-thoracic echocardiography (TTE) provides valuable information to rule out myocardial infarction and classical TTC
- Excellent intraop., and postop., pain management plan
- Supportive therapy based on haemodynamic fluctuations

Conclusion

In conclusion, whenever newer onset heart failure develops in any period, there is a need to exclude the main etiologies, such as coronary artery diseases. Stress induced TTC is always a possibility. Introp., TEE or perop., TTE provide valuable information to establish the diagnosis and guide appropriate hemodynamic therapy. Further research is necessary to clarify its etiology, genetic factor, relationship with post-menopausal women and correlation of emotional and psychological stress. Anaesthetists should be vigilant during peri-operative period to encounter such a rare cardiac diagnosis and timely intervention and good critical care support care can save life of such patients.

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