Three-Dimensional Entertainment as a Novel Cause of Takotsubo Cardiomyopathy

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ABSTRACT

Takotsubo cardiomyopathy (TC) is an uncommon entity. It is known to occur in the setting of extreme catecholamine release and results in left ventricular dysfunction without evidence of angiographically definable coronary artery disease. There have been no published reports of TC occurring with visual stimuli, specifically 3-dimensional (3D) entertainment. We present a 55-year-old woman who presented to her primary care physician's office with extreme palpitations, nausea, vomiting, and malaise <48 hours after watching a 3D action movie at her local theater. Her electrocardiogram demonstrated ST elevations in aVL and V₁, prolonged QTc interval, and T-wave inversions in leads I, II, aVL, and V₂-V₆. Coronary angiography revealed angiographically normal vessels, elevated left ventricular filling pressures, and decreased ejection fraction with a pattern of apical ballooning. The presumed final diagnosis was TC, likely due to visual-auditory-triggered catecholamine release causing impaired coronary microcirculation.

Introduction

Takotsubo cardiomyopathy (TC) is an uncommon entity. It is known to occur in the setting of extreme catecholamine release and results in left ventricular dysfunction without evidence of angiographically definable coronary artery disease. Diagnostic criteria include acute substernal chest pain with ST-segment elevation and/or T-wave inversion, absence of significant coronary arterial narrowing by angiography, systolic dysfunction (ejection fraction, $29 \pm 9\%$), with abnormal wall motion of the mid and apical segments of the left ventricle (ie, apical ballooning) and typically profound psychological stress immediately preceding and triggering the cardiac events.¹ The left ventricular dysfunction is transient and usually resolves with supportive care. The demographic most commonly affected includes middle-aged postmenopausal women. Typically, stressors such as divorce, domestic abuse, or death of a loved one are described, which probably led to the entity initially being called broken heart syndrome. Other published triggers include hypoglycemia, lightning strikes, earthquakes, alcohol withdrawal, hyperthyroidism, catastrophic medical diagnoses, financial losses, or following surgical procedures.^{2,3} Visual images are known to have the capability of resulting in adverse neurological events such as headaches and seizures. This has prompted warnings to be issued by organizations in medicine as well as the entertainment industry warning susceptible individuals to refrain from watching certain modes of entertainment.^{4,5} There have been no published reports of TC occurring with visual stimuli, specifically 3-dimensional (3D) entertainment.

Case Report

A 55-year-old white female presented to her primary care physician's office on July 26, 2010. Her past medical history was significant for diet- and exercise-controlled hypertension and hyperlipidemia. Her only medication was an occasional over-the-counter Tylenol for degenerative disc disease. Family history was notable for hypertension and coronary artery disease. She presented <48 hours after watching a 3D movie. The patient's symptoms occurred abruptly, approximately 30 minutes after the movie began; she described several episodes of extreme palpitations with dyspnea, nausea, and ultimately repeated emesis forcing her to leave the theatre. An electrocardiogram (ECG) performed in her primary care physician's office revealed ST elevations in aVL and V₁; T-wave inversions in limb leads I, II, aVL and precordial leads V₂-V₆; and a prolonged QTc interval of 620 msec. She was immediately admitted to the hospital. On serial interviews, she and her husband denied the presence of new psychological stressors.

On admission, her troponins-I value was elevated at 0.77 mg/dL (normal, <0.11 mg/dL). A transthoracic echocardiogram was next obtained, and abnormalities of the left ventricle were noted. The mid anterolateral, mid inferoseptal, apical anterior, apical lateral, and apical inferior wall segments were hypokinetic. The mid anteroseptal, mid anterior, and apical septal wall segments were akinetic. The left ventricular ejection fraction was estimated at 35% to 40%. The remaining study was notable for mild mitral regurgitation and trace tricuspid regurgitation. Given the new wall motion abnormalities a cardiac catheterization was pursued. Selective coronary angiography revealed patent epicardial vessels

and no angiographically definable disease. Left-ventricular filling pressures were elevated at 23 mm Hg, and systolic blood pressures were in the 140 to 170 mm Hg range. Left ventricular angiogram revealed an overall ejection fraction of 35% as well as apical ballooning (Figure 1). Cardiac magnetic resonance imaging (CMR) was performed. CMR findings were consistent with TC, including absence of hyperenhancement on late post-gadolinium imaging, which indicated lack of irreversible injury. T2-weighted imaging indicated myocardial edema or reversible myocardial injury⁶ (Figure 2). CMR did not reveal the presence of an ischemic scar, iron overload, or infiltrative disease. Left ventricular ejection fraction was measured at 44%. Wall motion abnormalities of the left ventricle were found consistent with those on the echocardiogram and angiogram.

The remainder of her hospitalization was uneventful. She was discharged on β -blocker and angiotensin-converting enzyme inhibitor therapy, with plans for follow-up echocardiogram and CMR in 4 to 6 weeks (Figure 3).

Discussion

This is the first published association of TC in association with visual stimulation. TC is an increasingly recognized condition that was first described by Japanese physicians in 1991.⁷ It was originally described as a ballooning of the left ventricular apex. Visually, this resembles the octopus traps historically used in Japan, hence the name takotsubo.⁸ Most experts agree that the epidemiology includes stressful triggers; however, the exact pathophysiology of this condition remains a mystery. A recent summary of the current state of knowledge was presented by Bielecka-Dabrowa et al. The authors concluded that the etiology was more than likely multifactorial. The female predominance is possibly due to the smaller cavity of the left ventricular size

Figure 1. Left ventriculogram in systole demonstrating akinesis of the mid anteroseptal, mid anterior, and apical septal wall segments. Estimated ejection fraction is 35%.

Figure 2. An inversion recovery delayed enhancement image demonstrating the absence of myocardial edema.

Figure 3. Two-chamber view completed through cardiac magnetic resonance imaging demonstrating a return of normal left ventricular function.

when compared to males.⁹ The ECG findings typically do not correlate to a typical coronary artery distribution.^{8,10,11} TC is agreed to be the end result of a single emotional or stressful event or cumulative of trivial and repetitive stress.⁹ It is likely that the patient's observation of a 3D action movie potentiated several moments of high catecholamine release that resulted in the cumulative end result of TC. The palpitations the patient experienced were most likely ventricular in origin, and our patient did not develop any other complications, such as pulmonary edema, mitral regurgitation, or ventricular rupture. Forty-nine days following her initial presentation, repeat transthoracic

echocardiogram and CMR demonstrated a return of normal left ventricular function with no residual wall motion abnormalities.

Film and television companies advise that pregnant women, elderly, those with serious medical conditions, the sleep deprived, and those who are intoxicated should refrain from watching 3D movies. One company warns that it may cause alarming side effects such as confusion, nausea, convulsions, altered vision, light-headedness, dizziness, and involuntary movements such as eye or muscle twitching and cramps. Although 3D movies do state that these side effects are possible, there is no mention of the possibility of life-threatening cardiac complications.⁵ TC remains a relatively rare entity, and it should be pointed out that even in situations where the incidence is disproportionately high, such as in earthquake stricken regions, the vast majority of the exposed population does not develop the syndrome.³ The current incidence of this cardiomyopathy is thought to be 1% of cardiomyopathy patients. Although one cannot definitely state that 3D movies will have any effect on the incidence of TC, it is prudent that individuals who experience angina, dyspnea, or extreme palpitations seek medical attention immediately.

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