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Takotsubo syndrome due to occupational stress in a physician

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Abstract

Occupational Takotsubo syndrome (“broken heart syndrome”) has been reported very rarely, and only twice among healthcare personnel; the present case being, to our knowledge, the third documented occurrence. Here, we describe the case of a 57-year-old female neonatologist who developed the syndrome after 2 years of intense work-related stress, culminating in the management of a particularly delicate emergency.

The diagnosis was made through cardiac imaging techniques that demonstrated the typical deformation (“ballooning”) of the left ventricle that gives the syndrome its name (takotsubo in Japanese means “octopus trap”).

The case draws attention to the risk of Takotsubo cardiomyopathy as a consequence of intense work-related psychophysical stress and to the need for hygiene and organizational measures to prevent both mental and cardiological disorders. Female emergency physicians should be considered a professional category at greater risk of developing the syndrome.

Key words: cardiomyopathy, work stress, cardiac imaging, psychiatric evaluation, occupational disease.

Introduction

First described in 1990 [1], takotsubo syndrome (also known as “apical ballooning syndrome”) is a non-ischemic, reversible cardiomyopathy characterized by left ventricular dysfunction, which often simulates an acute coronary event: chest pain, dyspnea, electrocardiographic and necrosis enzyme alterations [2-4]. Imaging techniques typically show a transient balloon-shaped modification of the left ventricular apex, which makes the ventricle take on the shape of the round-bottomed, narrow necked pot (*tsubo*) used by Japanese fishermen as an octopus (*tako*) trap [5].

The syndrome is categorized into four primary types based on the anatomical distribution of regional wall motion abnormalities: apical (the most common: 80% of cases), mid-ventricular, basal (inverted variant), and focal. Additional rare variants have also been reported [3]. Takotsubo cardiomyopathy is more common in post-menopausal women. It can be elicited by a trigger (typically a physical or emotional stress: “broken heart syndrome”) acting on pre-existing vulnerable ground (oestrogen deficiency, genetic and epigenetic factors, inflammatory conditions), and causing sympathetic hyperactivity. Consequently, catecholaminergic myocardial damage and coronary microvascular spasm occur, leading to heart dysfunction [6].

Occupational stress (defined as the physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker [7]) is a recognized cause of cardiovascular disease [8]. However, work-related takotsubo cardiomyopathy has been reported very rarely [9-17], and (before the present report) only twice among healthcare personnel [18,19]. We describe here a case of occupational takotsubo syndrome occurring in a physician.

Case Report

The patient is a 57-year-old female, in menopause since the age of 53, suffering from chronic autoimmune thyroiditis on replacement therapy with levothyroxine. Nothing else relevant in her family, physiological and medical history (in particular, no cardiologic or psychiatric record).

After completing her university studies (medical degree and specialization in pediatrics), she always worked in a hospital unit of neonatology and neonatal intensive care (over the last 20 years as a first-level medical director). In the two years preceding our observation, she faced a significant increase in workload and related responsibilities, with excessive hierarchical control associated with devaluing attitudes.

After managing a serious emergency case under conditions of extreme psychological pressure, the patient developed chest pain, worsening dyspnea, and lower extremity edema. She was

hospitalized. On admission, chest radiography revealed interstitial pulmonary edema, widening of the cardiomeastinal image, and hilar-perihilar vascular congestion. Electrocardiography showed nonspecific repolarization abnormalities, without signs of ischemia. Hematic high-sensitivity troponin I (hs-TNI) concentration was 0.51 ng/mL.

Transthoracic echocardiography disclosed a hypokinetic zone in the apical region (and adjacent segments) of the left ventricle, with good function of the mid-basal segments. Global systolic function was slightly reduced (ejection fraction: 45%). The ratio of early (E) to late (A) diastolic transmitral flow velocities (E/A ratio) was 1.1 (pseudonormal). The left atrium showed moderate dilation, while the right atrium and ventricle were normal.

Coronary angiography revealed normal coronary arteries, while ventriculography (Figure 1) and cardiac magnetic resonance (Figure 2) confirmed left apical akinesia, with hyperkinesia of the basal and middle segments, and reduced systolic function.

Diagnosis of takotsubo syndrome, apical variant, was therefore formulated. The patient was treated with intravenous infusion of sodium nitroprusside, beta-blocker (bisoprolol), and diuretics (furosemide, spironolactone), with gradual improvement of the clinical picture. She was discharged after five days with maintenance oral therapy, which was subsequently discontinued, after returning to normal cardiovascular status.

The patient returned to work after a period of sick leave lasting nine months. The hospital occupational physician formulated a judgement of job fitness with limitations (no shifts longer than eight hours per day, no on-call services and night shifts). In the meantime she had developed an anxious-depressive state, requiring psychotherapeutic and psychopharmacological treatment (vortioxetine: an antidepressant of the serotonin modulator and stimulator class [20]).

The subject was therefore evaluated with the interdisciplinary diagnostic protocol (occupational health visit, psychiatric interview, psychological counselling and testing) utilized by our group for work-related psychopathological issues [21]. The occupational medicine visit included a thorough anamnesis (with particular attention to the work history, collected in chronological order) and a complete physical examination, while the psychoevaluation comprehended psychiatric anamnesis (familial and personal), assessment of mental status (speech, emotional expression, thinking and perception, cognitive functions), and three psychometric tests: Occupational Stress Indicator (OSI), Cognitive Behavioral Assessment 2.0 (CBA 2.0), and Structured Clinical Interview for DSM – Screening for Personality Questionnaire (SCID-5-SPQ).

The OSI is a broad-spectrum test for the detection of psychosocial stress in organizations. It is divided into a biographical questionnaire and seven sections that measure different dimensions of stress: What do you think, how do you feel about your job (22 items); How do you rate your

current state of health (18 items); Your physical health (12 items); How do you usually behave (14 items); How do you interpret the events that happen around you (12 items); Sources of pressure in your job (61 items); Your way of dealing with stress (28 items) [22].

The CBA-2.0 is a battery of psychometric tests composed of ten forms, each including homogeneous items, which probe a specific aspect of the subject. Forms 1 (24 items) and 4 (59 items) investigate the autobiography of the patient, exploring the educational level, current living arrangements, affective relationships, general health status, eating and sleeping habits, reported psychological troubles, and motivation for possible psychological treatment. Forms 2 (20 items), 3 (20 items) and 10 (10 items) assess anxiety. Form 5 (48 items) evaluates some stable dimensions of personality such as introversion-extroversion, emotional stability, maladjustment and antisociality, simulation and social naivety. Form 6 (30 items) provides an assessment of stress and psychophysiological disorders. Form 7 (58 items) evaluates fears. Form 8 (24 items) evaluates depressive symptoms. Finally, form 9 (21 items) analyses obsessions and compulsions [23].

The Diagnostic and Statistical Manual of Mental Disorders (DSM) is the most widely used nosographic system for psychopathological disorders, both in clinical practice and in research [24]. The subject was administered SCID-5-SPQ (106 items), a self-assessment questionnaire aimed at investigating personality disorders.

The patient retraced her recent occupational and medical vicissitudes (see above), characterized by the progressive onset of psychological distress (with feelings of demoralization and negative emotions in relation to her professional role) culminating in the acute cardiac event, followed by the anxious-depressive manifestations. At the time of the evaluation, the patient presented thymic compensation, good global functioning, normal cognitive function, and valid emotional resources with insight capacity. Most of the work-related difficulties had subsided.

OSI standardized scores indicative for high perceived occupational stress were recorded in 5 out of 6 sections. At CBA 2.0, scores suggesting anxiety and depression were recorded on forms 2 (state anxiety), 3 (trait anxiety), and 8 (depressive symptoms). SCID-5-SPQ did not indicate personality disorders.

Final diagnoses were occupational takotsubo syndrome and mixed anxiety-depressive disorder, according to ICD-11 criteria [25].

The case met four primary medical-legal causal link criteria, namely temporal relationship (chronological criterion), consistency and specificity, biological plausibility and coherence, differential etiology (exclusion of other causes) [26]. Under Italian law, occupational injuries and diseases, including those of psychosomatic origin resulting from organizational dysfunction, may entail criminal, civil, and insurance liability, requiring mandatory reporting.

Thus, the case was reported to the Judicial Authority, as established by the Italian Penal Code, and referred to the Italian Workers' Compensation Authority (INAIL).

The patient was judged able to continue her job, in accordance with the recommendations already formulated by the occupational physician of the hospital where she was employed.

Discussion

The case presents several typical features of takotsubo syndrome. Indeed, the cardiomyopathy arose in a postmenopausal woman following intense psychophysical stress, simulating an acute coronary event. Electrocardiography did not show signs of ischemia, and coronary angiography was normal. The diagnosis was made by cardiac imaging (echography, ventriculography and magnetic resonance) which demonstrated the pathognomonic deformation of the left ventricle which gives the syndrome its name. The patient responded favourably to pharmacological therapy, with gradual restoration of normal cardiac function.

On admission to the hospital, the patient had an elevated concentration of high-sensitivity troponin I (0.51 ng/mL). A normal troponin level is less than 0.04 ng/ml, with variability among laboratories. Levels higher than 0.04 ng/ml can indicate an ischaemic attack or other injuries and conditions that affect the heart, such as takotsubo cardiomyopathy [27].

Until recently, takotsubo syndrome was considered as a benign condition for its self-limiting nature. However, recent data indicates that haemodynamic and electrical instability during its acute phase expose subjects to a relevant risk of life-threatening complications, similar to patients with acute coronary syndromes, and to a non-negligible risk of recurrence [4]. Even though the patient described here had a favourable cardiological outcome, she developed reactive psychopathological problems, and was able to resume her job only several months after the acute event, with appropriate limitations. Although standardized instruments specifically targeting anxiety and depression were not administered, the comprehensive psychometric assessment, together with an in-depth psychiatric evaluation focused on work-related stress, supported the diagnosis of mixed anxiety-depressive disorder. The interdisciplinary diagnostic protocol developed by our group in recent years for work-related psychopathological issues [21] was used also to assess the favourable evolution of her psychological status, and to corroborate the judgement of job fitness formulated by the employer's occupational physician.

The most interesting aspect in the case reported here is its etiological association with occupational stress. In the scientific literature, there is limited information on the link between work and takotsubo cardiomyopathy. A European and US cohort study of 1750 takotsubo patients demonstrated that up to 28% of cases were precipitated by emotional stressors; of

these 7% were related to financial or work-related issues [28]. The nature of the jobs and of the emotional triggers, however, were not described.

Additionally, we retrieved eleven case reports describing work-related stress as a cause for the disease (Table 1). Interestingly, four cases occurred in teachers [9,10,12,15], and two were related to the recent COVID-19 pandemic [15,18]. Only one of the reported patients was a (relatively young) man. This case was highly unusual since it was complicated by left ventricular septal rupture, requiring surgical closure [16].

Before the present report, occupational takotsubo syndrome has been described only twice among healthcare workers. One of them (female, 60 years old) had been working at a senior nursing home living facility for 19 years. During the COVID-19 pandemic, her place of employment had laid off several workers, resulting in an increase in her job duties. At the start of the pandemic, the facility had insufficient personal protective equipment.

Furthermore, many nursing home residents who the patient had known personally for a significant amount of time, had died from COVID-19. She was hospitalized with chest pressure and dyspnoea on exertion, and initially treated for non-ST elevation myocardial infarction. Cardiac magnetic resonance allowed for the correct diagnosis and treatment, and the symptoms regressed over the course of several weeks [18].

Al-sadi et al. described the case of a post-menopausal ophthalmologist who developed the syndrome triggered by an unusually stressful schedule while in the operating theatre. In this case too, the diagnosis was made thanks to cardiac imaging, and the clinical evolution was favourable [19].

The subject described here is also a physician, with roles of great responsibility in the field of neonatal intensive care. Emergency healthcare workers are especially exposed to highly stressful conditions given the long working hours, shift work, and emotional demands. Females experience significantly higher levels of stress, burnout, anxiety, and depression compared to their male counterparts. This disparity is driven by factors such as higher exposure to gender discrimination, work-family conflict, and lower social support [29,30]. Given the association of takotsubo syndrome with occupational stress, and its higher occurrence among women, female healthcare workers should be considered at increased risk, thus requiring specific preventive protection (e.g., supportive work environment, gender-sensitive organizational interventions, flexible schedules accounting for family responsibilities). Prevention of the syndrome among healthcare workers can also make use of occupational stress models (such as the demand-control-support model or the effort-reward imbalance model), which are theoretical frameworks used to understand how workplace demands, interpersonal dynamics, and systemic pressures interact to cause mental and physical strain on employees, and to guide

organizational strategies to prevent burnout, improve well-being, and optimize productivity [31,32].

Six of the previously published cases of occupational takotsubo syndrome [9,11-14,17] were caused by a single stressful episode, configuring themselves as workplace accidents, while the remaining five [10,15,16,18,19], as well as the case reported here, followed a longer period of occupational stress, and can therefore be regarded as occupational diseases. We referred our case to the appropriate legal authorities.

At the time this article is written, the medico-legal evaluation is still ongoing. Work-related stress and resulting disease (including cardiopathy) has complex implications, in the penal, civil, and insurance contexts. For example, the Italian Workers' Compensation Authority (INAIL) includes "mental and psychosomatic illnesses due to work organization dysfunction (organizational coerciveness)" among the inventory of occupational diseases (Italian Ministry of Labour and Social Policy: Decree 27th April 2004).

Thus, an accurate diagnostic procedure is essential not only for clinical (prognostic and therapeutic-rehabilitative) reasons, but also for the possible demonstration of the causal link between stressful events in the workplace and suffered cardiac and mental damages.

Conclusions

The case confirms the risk of takotsubo syndrome ("broken heart syndrome") as a consequence of intense work-related psychophysical stress, recalling the need for better hygiene and organizational measures aimed at preventing not only mental disorders but also severe cardiological diseases.

Emergency doctors perform vital tasks in often sub-optimal conditions, yet their risks are frequently underestimated. The adequate assessment of stress risk in the hospital context, and the implementation of adequate health surveillance protocols, are priorities to protect the health of this professional category.

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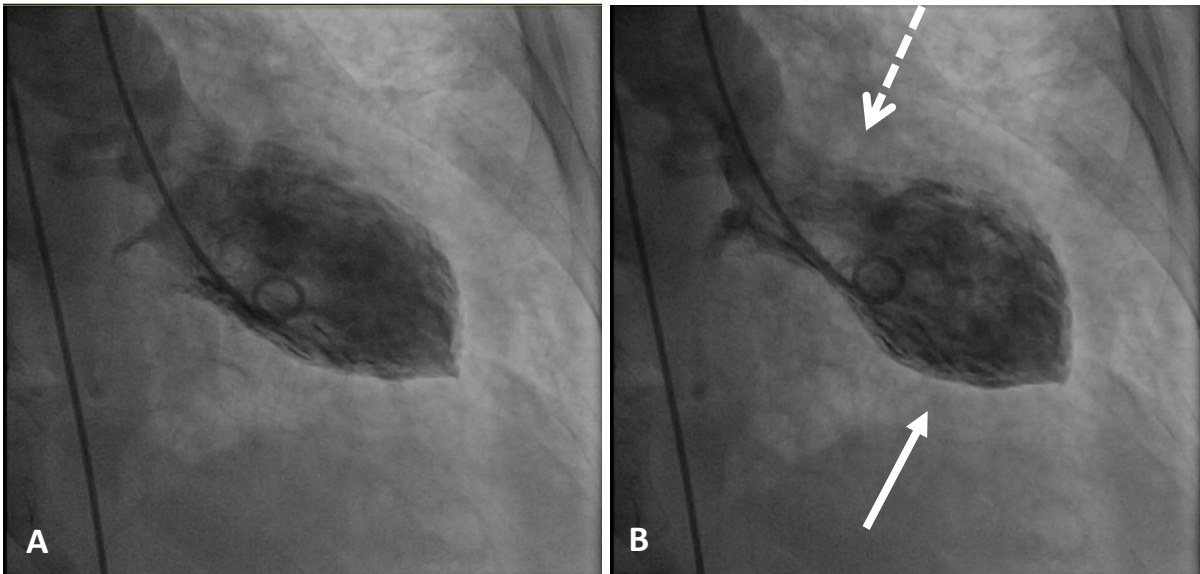


Figure 1. Left ventriculography. A) Diastolic phase. B) Systolic phase. In the systolic phase, apical ballooning of the left ventricle is visible, typical of takotsubo syndrome, due to akinesia of the ventricular apex which therefore takes on a swollen appearance (solid arrow), compared to the basal segments which instead contract in a hyperkinetic manner (dotted arrow).

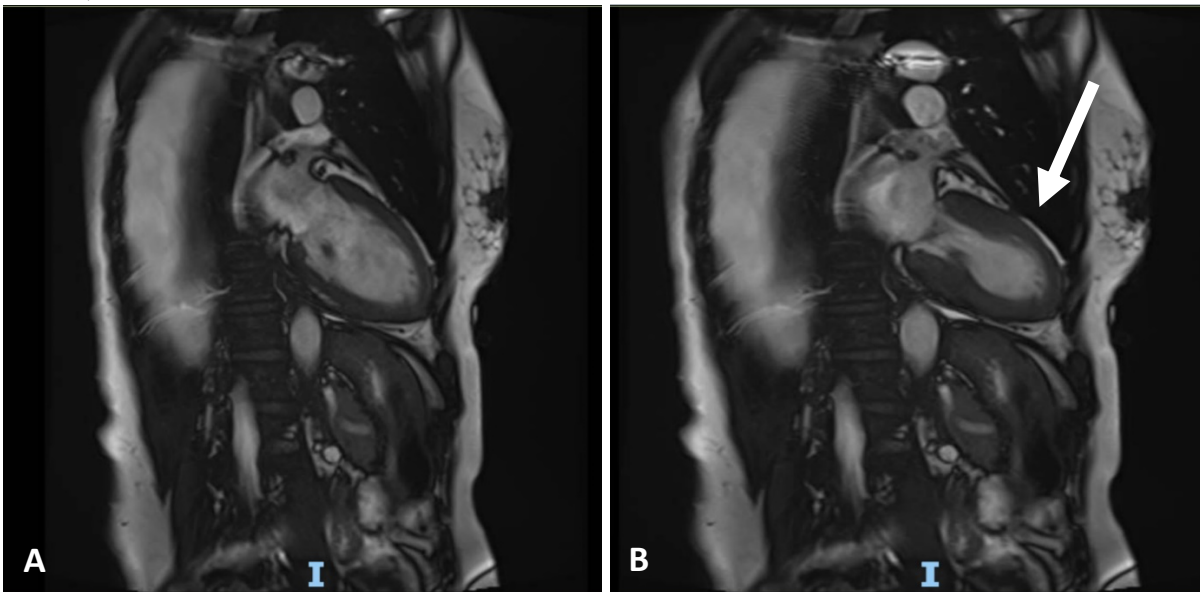


Figure 2. Cardiac magnetic resonance (section showing the left ventricle). A) Diastolic phase. B) Systolic phase. Apical ballooning (arrow) is visible in the systolic phase.

Table 1. Work-related takotsubo syndrome: published case reports.

Ref.	Gender	Age (years)	Occupation	Trigger factors
9	Female	55	High school teacher	Quarrel with boss
10	Female	72	University lecturer	Stage-fright
11	Female	48	Lawyer	Workplace meeting
12	Female	56	Teenagers community educator	Physical assault
13	Female	43	Not specified	Verbal abuse by colleague
14	Female	49	Not specified	Verbal abuse by client
15	Female	58	Elementary school teacher	COVID-19 pandemic
16	Male	31	Not specified	Fear of losing job
17	Female	56	Not specified	Online work meeting
18	Female	60	Healthcare worker in nursing home	COVID-19 pandemic
19	Female	63	Ophthalmologist	Work overload
*	Female	57	Neonatologist	Work overload

*Present case.