

CASE REPORT

Takotsubo Cardiomyopathy and Myocardial Perfusion Image: Unusual Binomial in the Investigation of Acute Coronary Syndrome without Obstructive Lesions

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Introduction

Takotsubo cardiomyopathy (TC), also known as broken heart syndrome or stress-induced cardiomyopathy, was primarily described in Japan in 1990, is named after its morphological similarity to the vase used by Asian people to catch octopuses, which has a rounded bottom and a narrow bottleneck.¹ This condition is characterized by transient left ventricular (LV) systolic dysfunction, commonly preceded by physical or emotional stress, mimicking the presentation of acute myocardial infarction.² In the present article, we describe a case of TC focusing on its updated approach, highlighting the applicability of myocardial perfusion scintigraphy (MPS) in the acute phase of chest pain and presenting images rarely described in this scenario.

Description

A 66-year old woman with hypertension and dyslipidemia using aspirin, angiotensin receptor blocker (ARB), statin, and beta-blocker (BB) presented at the emergency department due to smoke inhalation after a fire in her house. Under observation, she evolved into typical chest pain, her electrocardiogram (ECG) showed sinus rhythm and ST-segment elevation in the inferior wall (Figure 1). Laboratory tests revealed high troponin levels, reaching 1106 pg/mL (reference value < 14 pg/mL), and physical examination did not show abnormalities. The patient was treated as having acute coronary syndrome (ACS) with ST-segment elevation, thus

Keywords

Takotsubo Cardiomyopathy; Chest Pain; Acute Coronary; Ventilation-Perfusion Scan.

receiving dual antiplatelet aggregation therapy, low-molecular weight heparin, and vasodilators, and was referred to a referral hospital.

On admission, patient's pain improved, and ST segments remained elevated. She was then referred to the department of hemodynamics for primary coronary angioplasty, which did not find any significant obstructive lesion (Figure 2). Ventriculography was not performed due to periprocedural hemodynamic instability. The patient was kept under monitoring for stabilization and diagnostic investigation, and she had an InterTAK score of 61, which means non-high probability of TC, according to the European Society of Cardiology (ESC). Transthoracic echocardiography was performed, showing reduced ejection fraction (36%), mid-apical segmental akinesis, and basal segmental hyperkinesis.

During hospitalization, the patient evolved into a new episode of typical chest pain, with spontaneous relief, in which T-wave inversion was identified in precordial leads V3 to V6. On that occasion, the procedure of choice was MPS with sestamibi-^{99m}Tc, which showed reduced myocardial perfusion in LV juxta-apical segments and preserved basilar segments; furthermore, rest ejection fraction was estimated at 34%. There were also findings suggestive of subendocardial necrosis and myocardial stunning, compatible with the diagnosis of TC (Figure 3).

The patient remained stable during the 4 days de hospitalization, follow-up tests showed a decrease in troponin levels, and inflammatory workup was negative. She was discharged with optimized doses of BB, angiotensin-converting enzyme inhibitors (ACEIs), statin, and aspirin. On patient's follow-up outpatient visit after 4 weeks, recovery of ventricular function was observed on control echocardiography.

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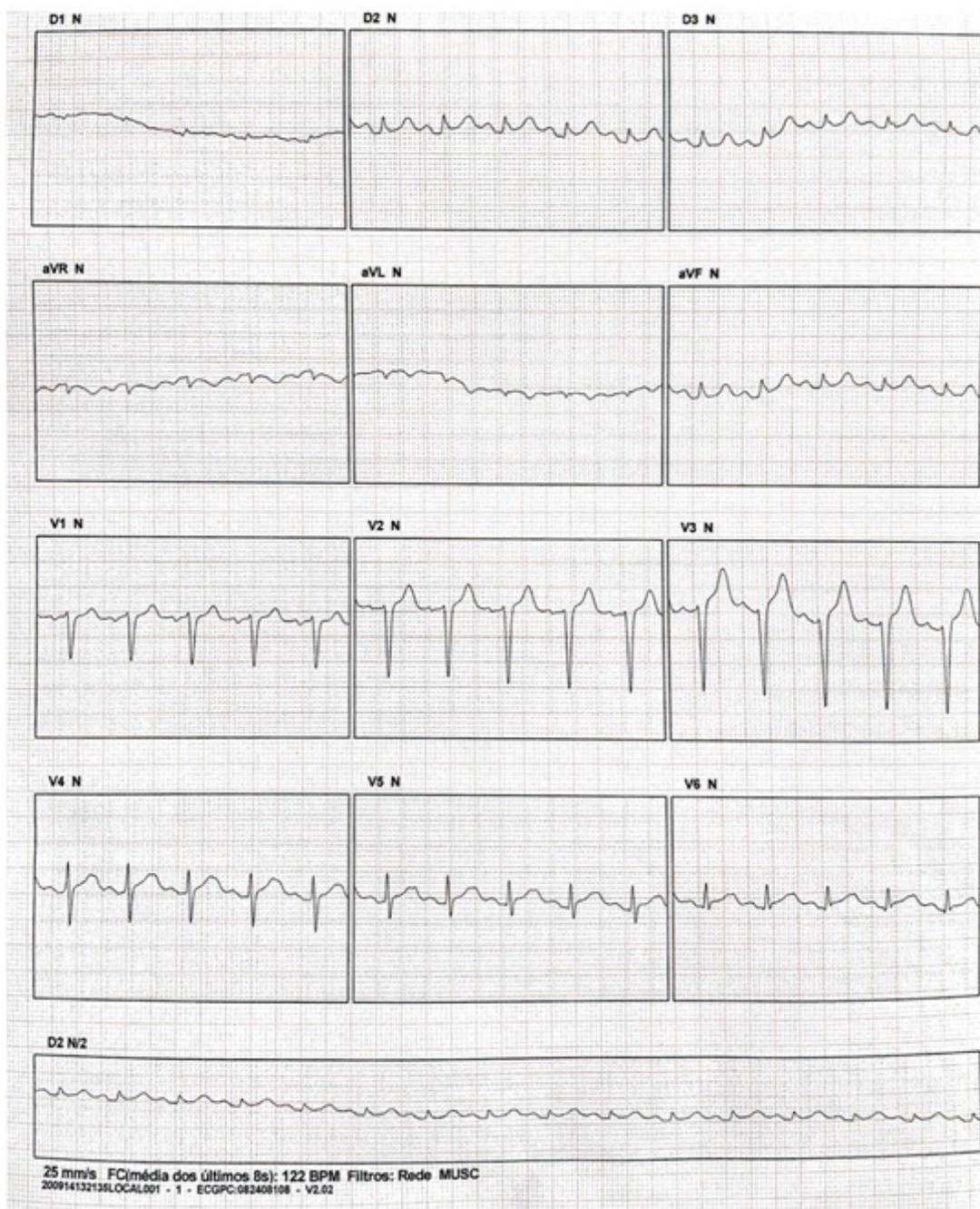


Figure 1 – 12-lead electrocardiogram showing ST-segment elevation in the inferior wall.

Source: the author.

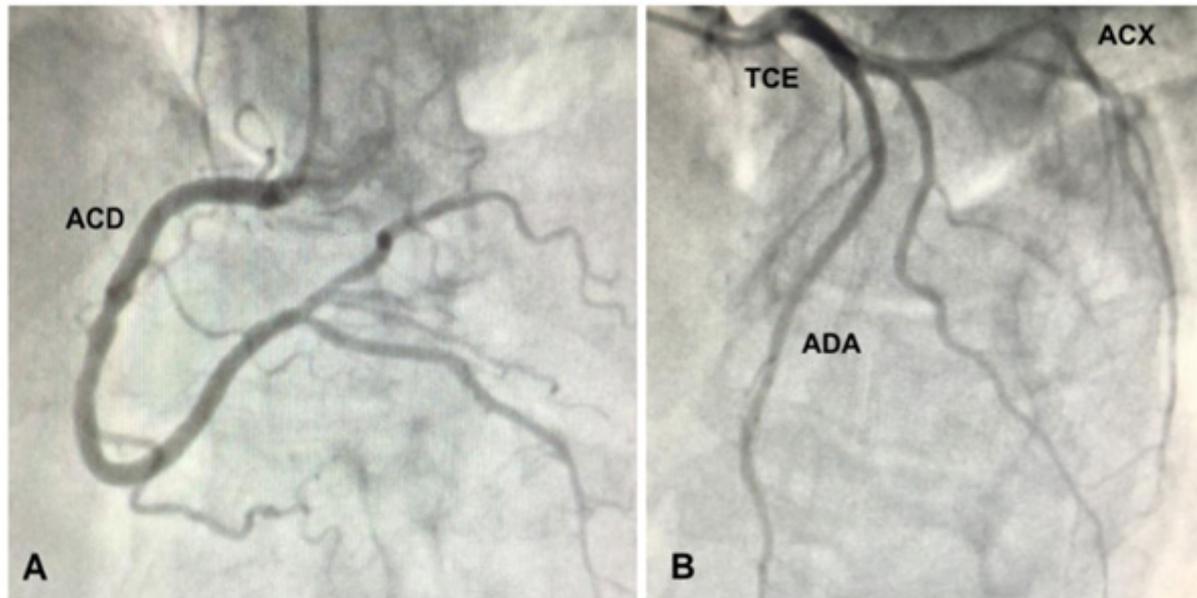


Figure 2 – Coronary angiography of the right (A) and left (B) coronary arteries, showing absence of obstructive lesions. ACD: right coronary artery; TCE: left coronary trunk; ACX: circumflex artery; ADA: anterior descending artery.

Source: the author.

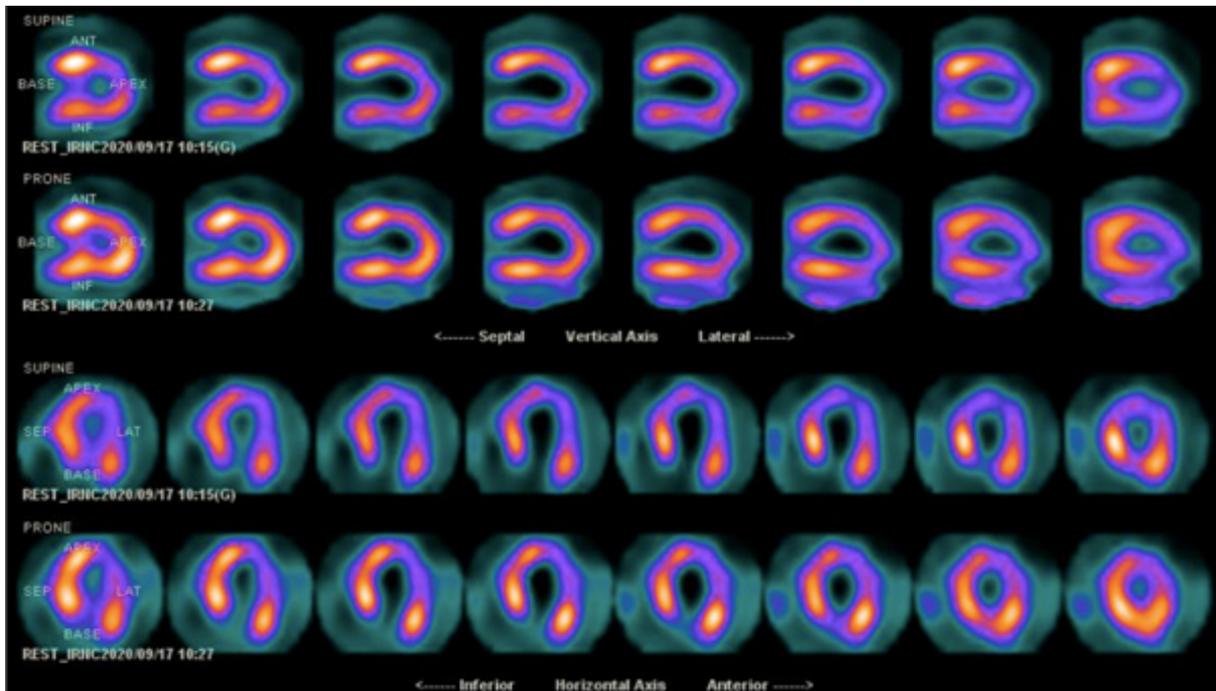


Figure 3 – Myocardial scintigraphy with sestamibi-99mTc at rest. It shows an abnormal distribution in myocardial perfusion, with moderate reduction in the apex and mid-apical segments of the lateral wall, with a slight inferolateral extension, affecting 20-25% of the LV area (SRS = 15). The basal regions are preserved.

Source: the author.

Discussion

TC is an underdiagnosed condition with an estimated prevalence of 1-2% among patients diagnosed with ACS.³ The most common forms of ventricular involvement are apical ballooning in 75-80% of the cases, and mid-ventricular ballooning in 10-20%.⁴

Although the relationship between TC and the autonomous central nervous system has only recently been known, thanks to neuroimaging tests, increased blood flow in hippocampus, basal ganglia, and brainstem was identified during the acute phase of TC, showing the involvement of the limbic system in the pathophysiological mechanism of the disease.⁵ An hypothesis to explain this activation would be catecholaminergic storm, which would induce both microvascular vasospasm and direct toxicity to the vascular endothelium, resulting in myocardial stunning.⁶

TC classically occurs in postmenopausal women with history of anxiety disorder and a factor of emotional stress within the last 5 days.² Emotional triggers include death, romantic conflicts, violence, natural disasters, and great financial losses. Conversely physical triggers encompass critically-ill patients, major surgical procedures, severe pain, sepsis, and exacerbation of chronic lung diseases.³

Chest pain was the predominant symptom in more than 75% of the cases of TC, making its diagnosis challenging.⁴ For this reason, the InterTAK score was created as an auxiliary diagnostic tool in 2017 and was incorporated to the International Consensus published by the ESC in the following year. Its variables are: female sex, emotional stress, physical stress, absence of ST-segment depression, former psychiatric disorder, former neurological disorder, and prolonged QT interval. These variables score 25, 24, 13, 12, 11, 9 and 6 points, respectively. An InterTAK score higher than 70 points suggests high probability of TC and recommends transthoracic echography. Conversely, a score lower or equal to 70 suggest ACS and indicates angiography.⁷

One of the most accepted criteria are those of the Mayo Clinic, published in 2008, which include: transient hypokinesia, akinesia, or dyskinesia of LV mid segments, with or without apical involvement (regional wall-motion abnormalities extend beyond a single epicardial vascular distribution); a stressful trigger is often, but not always, present; absence of obstructive coronary artery disease or angiographic evidence of acute plaque rupture; new ECG abnormalities (either ST elevation and/or T-wave inversion) or modest elevation in cardiac troponin; absence of pheochromocytoma or myocarditis.⁸

Some ECG characteristics suggest TC with high sensitivity and specificity, such as: T-wave inversion; prolonged QT interval; absence of reciprocal change; absence of abnormal Q waves; and greater ST elevation in leads V4 to V6 compared to that observed in V1 to V3.⁹ Biomarkers of myocardial injury are modestly elevated, with a typical discrepancy between the expected level and the significant degree of myocardial compromise.⁴

Imaging tests are essential in diagnostic procedures. According to indication and urgency, cineangiography should be prioritized. Transthoracic echocardiogram is the preferred non-invasive test, since it enables to identify LV outflow obstruction and acute mitral insufficiency, complications with the worst prognosis.⁷ Cardiac magnetic resonance (CMR) has an important role in the diagnosis of myocarditis, being able to reveal inflammation and myocardial edema, and late gadolinium-enhanced CMR may be used in cases of scars and fibrosis.¹⁰ However, it is still a high-cost test not commonly available in hospitals.

Cardiac perfusion imaging, a technique based on nuclear medicine, is an attractive option for the additional evaluation of chest pain. Ideally, it should be performed with the patient at rest, up to 6 hours after pain improved, which is the period with greater sensitivity for abnormalities.¹¹ In TC, most reports show essentially normal perfusion.¹² In this report, moderate hypoperfusion was observed in the dysfunctional myocardial regions, indicating that MPS with sestamibi-^{99m}Tc is a promising additional tool for the understanding of TS pathophysiology, as well as for its diagnosis. Conversely, scintigraphy with iodinated meta-iodobenzylguanidine MIBG¹²³ (which has a structure similar to that of noradrenaline, ie, selective to sympathetic nerves) is consolidated as diagnostic method, even days after injury, thus corroborating its pathophysiology.¹¹

With regard to treatment, it is based on clinical and hemodynamic support. In the long term, it is necessary to approach risk factors and triggers, such as anxiety disorders and depression.⁷ ACEIs have shown to improve survival and reduce disease recurrence, with no strong evidence for BBs in this scenario.^{4,7} Anticoagulant agents may be considered in cases of severe LV compromise to prevent intracavitary thrombi.⁷

Although intra-hospital mortality due to TC is relatively low, complications such as acute mitral insufficiency, LV outflow obstruction, arrhythmia, and ventricular thrombi

should be monitored.^{4,7} Recovery usually takes from 1 to 2 weeks, but may extent up to 6 weeks. Recurrence is common, with a rate of approximately 3% per year, reaching up to 20% in a decade.⁴

Conclusion

We reported a case of TC with a good outcome, highlighting the practical applicability of the current approach and the importance of MPS as an additional tool in the understanding of TC pathophysiology. We presented an unusual scan obtained from this imaging modality in this scenario, with apical myocardial hypoperfusion in the acute phase of disease, a finding rarely described in the literature using this imaging modality.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Author contributions

Acquisition of data: Brida MS, Guimarães RB, Rothlisberger L, Patrício MV. Writing of the manuscript: Brida MS, Guimarães RB, Rothlisberger L, Patrício MV. Critical revision of the manuscript for intellectual content: Brida MS, Guimarães RP, Rothlisberger L.

