CASE REPORT

Regadenoson cardiac stress test-induced stress cardiomyopathy

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SUMMARY

Takotsubo cardiomyopathy, also described as apical ballooning syndrome/stress-induced cardiomyopathy, imitates acute coronary syndrome and is usually related to a massive physiological or emotional stressor. We describe perhaps the first reported case to the best of our knowledge of a 55-year-old Caucasian woman who presented with congestive heart failure after having a regadenoson cardiac stress test a few hours prior to presentation to the hospital. Transthoracic echocardiogram revealed reduced heart function. She had normal coronaries on cardiac catheterisation, and left ventriculography confirmed apical ballooning syndrome. She underwent guideline-directed therapy, and heart function improved in the repeat echocardiogram along with clinical resolution of symptoms.

BACKGROUND

Takotsubo cardiomyopathy (TCM) is a procured, rescindable cardiomyopathy characterised by a transitory decrease in ejection fraction (EF), without significant coronary artery disease, and by reversible left ventricular (LV) dysfunction characterised by apical segmental ('typical') or midventricular ('atypical') akinesia or hypokinesia.^{1 2} The term originated in Japan where in the first case was described in a Japanese woman presenting with chest pain. Her heart dysfunction resembled of an octopus trap used in Japan and is known as 'takotsubo' in Japanese.³ It is proposed to be provoked by physical or emotional stress and mimics acute coronary syndrome. This aetiology has not been fully clarified; however, the most commonly accepted explanation involves catecholamine surge causing temporary coronary vasospasm. This case report describes perhaps the first reported case of regadenoson (Lexiscan)-induced TCM after a perfusion scan.

CASE PRESENTATION

A 55-year-old Caucasian woman presented to the emergency room with worsening shortness of breath over the past few hours. Her dyspnoea was worse on lying down and improved on sitting up with accompanying nausea and diaphoresis. Earlier in the day, she had a regadenoson (Lexiscan) cardiolite nuclear perfusion test, which was negative for ischaemia with no LV wall motion abnormality. Her medical history was

significant for permanent pacemaker placement for tachy-brady syndrome, hypertension and type 2 diabetes mellitus. Initial vitals were significant for blood pressure of 156/112 mm Hg and respiratory rate of 26/minute with 84% saturation on room air. Physical examination was pertinent for positive S3 and bibasilar diminished breath sounds. However, with acute respiratory decompensation, she required bilevel positive airway pressure (BiPAP) support.

INVESTIGATIONS

Laboratory data including troponin and D-dimer were normal. B-type natriuretic peptide was elevated at 685 pg/mL. Electrocardiogram (ECG) showed normal sinus rhythm with heart rate of 70 beats per minute, T wave changes in the anterolateral leads concerning for ischaemia.

Chest X-ray was consistent with congestive heart failure. CT for pulmonary embolism was negative. She was transferred to the intensive care unit on BiPAP with fractional inspired oxygen 60%, being afebrile and haemodynamically stable. She was treated with diuretics for mild pulmonary oedema.

The following day, she had a transthoracic echocardiography (TTE) revealing EF of 30%–35% with severe hypokinesia of the anteroapical and lateral walls that was decreased from 55% as seen on TTE done a month prior and normal EF on perfusion scan on the day of presentation. Coronary angiogram showed no obstructive coronary disease. Left ventriculogram showed apical hypokinesia with basal segment hyperkinesia, estimated EF 20%–25% consistent with TCM (video 1).

DIFFERENTIAL DIAGNOSIS

The initial approach was to exclude acute coronary syndrome and pulmonary embolism.

TREATMENT

Patient was treated symptomatically for acute decompensated heart failure with good clinical response. She was discharged home in good condition on beta blockers and ACE inhibitors along with diuretics.

OUTCOME AND FOLLOW-UP

Patient had a follow-up TTE done 1 month later, which showed EF back to baseline of 50%–55% without any heart failure symptoms.

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DISCUSSION

TCM, also known as stress cardiomyopathy, broken heart syndrome and transient apical ballooning syndrome, is a rare cause of cardiomyopathy.³ The precise mechanism fundamental to this entity is unknown. It may be correlated to neurocardiogenic myocardial disease and superfluous stimulation of beta-1 sympathetic receptors in the background of acute severe emotional or physiological stress reaction⁴ with accompanying coronary vasospasm, plaque rupture and thrombus formation with spontaneous recanalisation/resolution.⁵ In this context, it has also been implied that common hyperadrenergic states, including hyperthyroidism, can predispose to TCM development.⁶

Regadenoson is a selective adenosine A_{2A} receptor agonist developed to reduce the adverse effects experienced with adenosine.⁷ Since its approval by the US Food and Drug Administration in 2008, regadenoson has been broadly incorporated into clinical practice for cardiac perfusion imaging. It has been reported that regadenoson can cause coronary vasospasm by exactly unknown mechanism.⁸ A large retrospective cohort study done to study the safety of regadenoson in patients undergoing outpatient stress test did not reveal any TCM.⁹

TCM has been described in patients undergoing treadmill exercise and dobutamine echocardiogram stress test.^{10–12} Its pathophysiology in general and especially in the context of cardiac stress test can be explained accordingly to catecholamine theory with catecholamine-induced myocardial stunning.¹³ Other medications that have been described to cause TCM include epinephrine, atropine, dobutamine, ergonovine, amitriptyline and ephedrine.¹⁴

Our patient denied any other physical or emotional stressors preceding onset of symptoms, which placed her regadenoson nuclear stress test as the most likely causative factor. At this

point, we are unable to indicate predisposed population who should avoid cardiac stress tests due to risk of development of TCM. No specific treatment of this medical condition has been established yet. The treatment should be considered according to the current guidelines. This case report is unique because of the stress test modality and insidious clinical presentation with delayed symptom onset after a procedure and negative initial troponin.

Contributors JKK is patient's primary cardiologist, who was directly involved in patient's care during admission and followed the patient after discharge. VG performed left ventricular heart catheterisation. DMZ and YA are residents who participated in patient's admission and inpatient care.

Competing interests None declared.

Patient consent Obtained.

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Learning points

- Recognise Takotsubo cardiomyopathy (TCM) as potential complication of Lexiscan stress test.
- Associate new onset heart failure with recent Lexiscan stress test.
- Acknowledge that potential complications can present with certain delay and uncomplicated Lexiscan stress test still carries risk for complications.
- Cruciality to differentiate TCM with acute coronary syndrome.

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