Broken heart syndrome
A case study

Keywords
chest pain; dyspnoea; heart diseases

Case study
Edith, aged 65 years of age, lives in a rural township. She experienced sudden onset severe chest pain and dyspnoea after learning that her husband had died. Edith’s daughter drove her to the local hospital where investigations were performed. Investigations included an electrocardiograph (ECG) and a blood test for troponin I. Edith’s ECG is shown in Figure 1; her troponin I was elevated at 1.1 µg/L (reference range <0.04 µg/L).

Question 1
Based on the history and investigation findings, what is the most likely diagnosis? What are the differential diagnoses?

Question 2
Which of the following statements about Edith’s troponin result is most correct?
A. This degree of troponin elevation is always associated with acute coronary syndrome
B. Edith’s troponin result suggests that she was experiencing an acute myocardial infarction, as troponin testing has a sensitivity and specificity of almost 100%
C. Troponin elevation of this level can be seen in almost all forms of myocardial injury.

Question 3
What features of Edith’s history are associated with takotsubo cardiomyopathy?

Case study continued
Edith was transferred to a tertiary hospital where an echocardiogram confirmed an akinetic left ventricular apex with preserved basal systolic function. An urgent coronary angiogram (Figure 2) was arranged which revealed normal coronary arteries.

Question 4
By what other names is takotsubo cardiomyopathy known?

Question 5
What are the pathogenesis, prognosis and possible complications of takotsubo cardiomyopathy?

Question 6
Outline the key elements in the diagnosis and management of Edith’s presentation?

Answer 1
Many conditions show abnormal findings on ECG, and in some cases without clinical correlation, these may be difficult to distinguish. In this case, takotsubo cardiomyopathy (TTC) is the most likely diagnosis.

Differential diagnoses include early acute ST elevation myocardial infarction (STEMI), acute non-ST elevation myocardial infarction or acute pulmonary embolism.

The most common acute ECG findings of takotsubo cardiomyopathy are ST segment elevation in the praecordial leads and T-wave inversion in most leads. Unlike in acute myocardial infarction, ECG changes in takotsubo cardiomyopathy are not limited to one coronary vascular territory.

This differs from the typical ECG changes in an acute STEMI, which include elevation of the ST segments in contiguous leads accompanied by reciprocal ST depression in leads remote from the site of an acute infarct. This pattern is a highly sensitive indicator of an acute STEMI.

Electrocardiogram changes that may be
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clinical

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seen in pulmonary embolism include sinus

tachycardia, complete/incomplete (R) bundle

branch block, S1Q3T3 pattern (deep S-wave

in lead 1, pathological Q-wave and T-wave

inversion in lead 3), ST elevation/T-wave

inversion in inferior/septal leads.

Characteristic ECG findings in takotsubo
cardiomyopathy are shown in Figure 3.

Electrocardiogram changes are often dramatic
and not in proportion with the changes in
troponin levels.

Takotsubo cardiomyopathy was first
described by Sato et al2 in 1990. It is described
as a depression of the contractile function
of the mid and apical segments of the left
ventricle with compensatory hyperkinesis
of the basal walls. This leads to ballooning of the
ventricular apex with systole. It was given the
name ‘takotsubo’ due to the visual similarities
with a traditional Japanese octopus-catching
pot (in Japanese ‘takotsubo’ means ‘fishing
pot for trapping octopus’). Prevalence has been
shown to be between 1.2–2.2% of all patients
that present with suspected acute coronary
syndrome.3

Answer 2

Option C is correct. Although the troponin assay
is a highly sensitive test for diagnosis of acute
myocardial infarction, it lacks specificity. A
number of clinical conditions (such as acute
pulmonary embolism, heart failure, sepsis,
pericarditis and stroke) can cause an elevation
in troponin in the absence of acute coronary
syndrome.4 Troponin is generally a sensitive
biomarker of myocardial injury and in most
situations indicates adverse prognosis.

Unlike in acute myocardial infarction, most
patients with takotsubo cardiomyopathy have
a small but rapid increase in cardiac enzyme
and biomarker levels. Although some series
report a 100% incidence of troponin elevation,
the absence of elevation does not exclude the
diagnosis of takotsubo cardiomyopathy.

Ramaraj et al suggested that if the levels of
troponin T are greater than 6 ng/mL and troponin
I are greater than 15 ng/mL, the diagnosis of
takotsubo cardiomyopathy is unlikely and acute
coronary syndrome should be considered as
the primary diagnosis. Troponin T also showed
a significant inverse correlation with initial
ejection fraction.5

Answer 3

Takotsubo cardiomyopathy mimics acute
coronary syndrome in presentation and is seen
most commonly in postmenopausal women
following intense emotional or physical stress.
Cases in the literature report a wide range of
triggers including an unexpected death in the
family, gambling and financial losses, receiving
a devastating medical diagnosis, motor vehicle
accidents, stress caused from public speaking,
acute physical trauma, robbery and major
surgical procedures.3 However, approximately
20–35% of cases may not reveal any obvious
precipitant.6

The most common presenting symptom in
takotsubo cardiomyopathy is acute chest pain.
The patient may also present with dyspnoea,
palpitations, syncope, cardiac arrest or
changes on ECG. Although a chest X-ray may
be normal, patients can present with acute
pulmonary oedema and cardiomegaly. Takotsubo
cardiomyopathy can be classified into four types
depending on the location of the contractile
dysfunction (Table 1).

Answer 4

As takotsubo cardiomyopathy is usually triggered
by physical or emotional stress, the alternative
terms ‘stress cardiomyopathy’ and ‘broken
heart syndrome’ are often used. It has also
been called ‘apical ballooning syndrome’ as a
result of the balloon-like appearance of the left
ventricle during systole on echocardiography or
ventriculogram (Figure 4).

Figure 1. ECG showing deep T-wave inversion in all leads

Figure 2. Angiogram showing normal coronary arteries
is generally good. Patients that survive the acute episode typically recover normal ventricular function within 1–4 weeks. Reported inpatient mortality rates for takotsubo cardiomyopathy range from 0–8%. In a study with a mean follow up of 4.4–4.6 years, there was no difference in survival for patients with an acute episode of takotsubo cardiomyopathy compared to an age and gender matched population.⁹

Heart failure with or without pulmonary oedema is the most common clinical complication and was reported in 38 of 215 patients (17.7%).¹⁰ Complications of takotsubo cardiomyopathy include:¹¹

- Left heart failure with and without pulmonary oedema
- Cardiogenic shock
- Dynamic intraventricular obstruction with left ventricular intracavitary pressure gradient generation
- Mitral regurgitation resulting from chordal tethering and systolic anterior motion of the mitral valve apparatus
- Ventricular arrhythmias
- Left ventricular mural thrombus formation
- Left ventricular free-wall rupture
- Death.

Answer 6

The proposed ‘Mayo Clinic’ diagnostic criteria for takotsubo cardiomyopathy include:

- Echocardiographic or angiographic evidence of transient hypokinesis, akinesis or dyskinesis of the left ventricular apical and/or mid segments;
- Absence of obstructive coronary disease or angiographic evidence of acute plaque rupture;
- New ECG abnormalities or modest elevation in troponins; and
- Absence of phaeochromocytoma or myocarditis.¹⁴

Without the use of coronary angiography it can be difficult to objectively distinguish takotsubo cardiomyopathy from acute coronary syndrome. When the diagnosis is in doubt, takotsubo cardiomyopathy should be treated as acute coronary syndrome until proven otherwise. Most patients should be hospitalised for confirmation of the diagnosis and subsequent management.

Treatment of takotsubo cardiomyopathy is usually supportive. Despite the fact that a β-blockade is widely considered to have an important role in treatment, there is a lack of evidence to support its use in this condition. The evidence is based on small observational studies and case series, and the effect of β-blockade on mortality is not well established. Nonetheless, β-blockade is often used in the management of takotsubo cardiomyopathy, as it may help to reduce the risk of arrhythmias and death.

Table 1. Types of takotsubo cardiomyopathy based on wall motion abnormality⁷

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classic, apical ballooning or</td>
<td>Apical ballooning (most commonly reported)</td>
</tr>
<tr>
<td>takotsubo type</td>
<td></td>
</tr>
<tr>
<td>Reverse apical ballooning or</td>
<td>Hyperdynamic apex and akinesis of the base of the left ventricular wall</td>
</tr>
<tr>
<td>reverse takotsubo type</td>
<td>(uncommon)</td>
</tr>
<tr>
<td>Midventricular type</td>
<td>Involves the mid left ventricular wall, sparing the base and the apex</td>
</tr>
<tr>
<td>Local type</td>
<td>Localised wall motion abnormality affecting a segment of the left ventricular</td>
</tr>
<tr>
<td></td>
<td>wall. Most often affects the anterior wall</td>
</tr>
</tbody>
</table>

Answer 5

The most commonly postulated pathogenesis of takotsubo cardiomyopathy is that an intensely stressful emotional or physical trigger causes an excess of circulating catecholamines, which cause both direct myocardial toxicity and microvascular spasm/dysfunction leading to myocardial stunning and consequent contractile dysfunction. The more dense distribution of adrenoceptors at the apex might explain why the apex is usually affected while the base of the ventricle is spared.⁷ Oestrogen down regulates cardiac adrenoceptors and attenuates their response to activation, providing a plausible reason why the condition is largely confined to postmenopausal women.⁸

The prognosis of takotsubo cardiomyopathy is generally good. Patients that survive the acute episode typically recover normal ventricular function within 1–4 weeks. Reported inpatient mortality rates for takotsubo cardiomyopathy range from 0–8%. In a study with a mean follow up of 4.4–4.6 years, there was no difference in survival for patients with an acute episode of takotsubo cardiomyopathy compared to an age and gender matched population.⁹

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Treatment of takotsubo cardiomyopathy is usually supportive. Despite the fact that a β-blockade is widely considered to have an important role in treatment, there is a lack of
large randomised controlled trials to support its routine use. In haemodynamically stable patients, a β-blocker should be considered and diuretics given as necessary for volume overload. β-blockers may block the effects of the catecholamine excess, which is a potential mechanism of takotsubo cardiomyopathy. Moreover, β-blockers have an essential role in reducing left ventricular outflow tract obstruction by decreasing basal segment hypercontractility. Patients without a left ventricular outflow tract gradient should be prescribed an angiotensin converting enzyme inhibitor (ACEI) or an angiotensin receptor antagonist to prevent cardiac remodelling. In a rodent model, takotsubo cardiomyopathy could be prevented with an α-blockade or β-blockade.

Case follow up
Edith remained well on day three and was discharged on a small dose of a β-blocker and ACEI. Follow up was arranged with her general practitioner in 7 days and with a cardiology clinic 4 weeks after a repeat ECG.

Key points
• Takotsubo cardiomyopathy should be suspected in any postmenopausal woman presenting with chest pain and dyspnoea following intense emotional or physical stress.
• ECG changes are often dramatic and not in proportion with the rise in troponin levels.
• Acute coronary syndrome is an important differential diagnosis and suspected cases should be referred to hospital.
• Diagnosis can be confirmed by findings of normal coronary arteries and apical ballooning of the left ventricle on coronary angiography.
• Heart failure with or without pulmonary oedema is the most common clinical complication of takotsubo cardiomyopathy.
• The prognosis of takotsubo cardiomyopathy is usually good, with a mortality rate of 0–8%. Most patients that survive the initial episode will regain normal ventricular function with 1–4 weeks and have a good long term prognosis.

Authors
Atifur Rahman FRACP, is Director of Clinical Services, Coronary Care Unit, Gold Coast Hospital and Associate Professor, Griffith University School of Medicine, Gold Coast, Queensland. atifur@hotmail.com
David Liu MBBS(Hons), BSc, is resident, Gold Coast Hospital and Associate Lecturer, Griffith University School of Medicine, Gold Coast, Queensland.

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correspondence afp@racgp.org.au