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CASE REPORT
Heart failure

Failing in reverse: a case report of reverse Takotsubo syndrome complicating peripartum

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Background Pregnancy and the peripartum are states of stress for the cardiovascular system. These conditions can trigger different cardiomyopathies. Among these, Takotsubo cardiomyopathy (TC) has been increasingly recognized as a cause of transient left ventricular dysfunction associated with pregnancy.

Case summary We present the case of a 31-year-old multiparous woman with an unusual variant of TC after caesarean delivery.

Discussion Peripartum cardiomyopathy and TC are particularly interesting differential diagnoses for new systolic dysfunction in pregnancy. Some features, such as the time of presentation, regional or diffuse wall motion abnormalities, evolution, and biomarkers, can guide the clinician to the right diagnosis.

Keywords Takotsubo cardiomyopathy • Peripartum cardiomyopathy • Reverse Takotsubo • Pregnancy • Case report

ESC curriculum 2.2 Echocardiography • 6.4 Acute heart failure • 6.5 Cardiomyopathy • 9.8 Pregnancy with cardiac symptoms or disease

Learning points

- Takotsubo syndrome might be an under-recognized form of cardiomyopathy complicating the peripartum period.
- It can be associated with the stress imposed over the heart by the pregnant state and other stressful events in the peripartum.
- Some clinical and echocardiographic features can help in the differentiation from peripartum cardiomyopathy.

Introduction

The structural and haemodynamic changes needed to create and deliver a new life impose great stress on women's hearts. For some, this physiological milieu may trigger myocardial dysfunction.[1,2] Despite declining maternal mortality among developed (except for the USA) and developing countries, cardiovascular diseases have increased, complicating 1–4% of all pregnancies. Cardiomyopathies cause a significant proportion of maternal deaths (12.5%).[3–5] Takotsubo cardiomyopathy (TC) is characterized by acute transient left ventricular systolic dysfunction, with some preference for apical segments of the left ventricle (LV). It is often caused by physical or emotional stress[6] and has been increasingly recognized as a cause of myocardial dysfunction after childbirth and during pregnancy.[7–9]

Herein, we describe a case of reverse TC complicating delivery.

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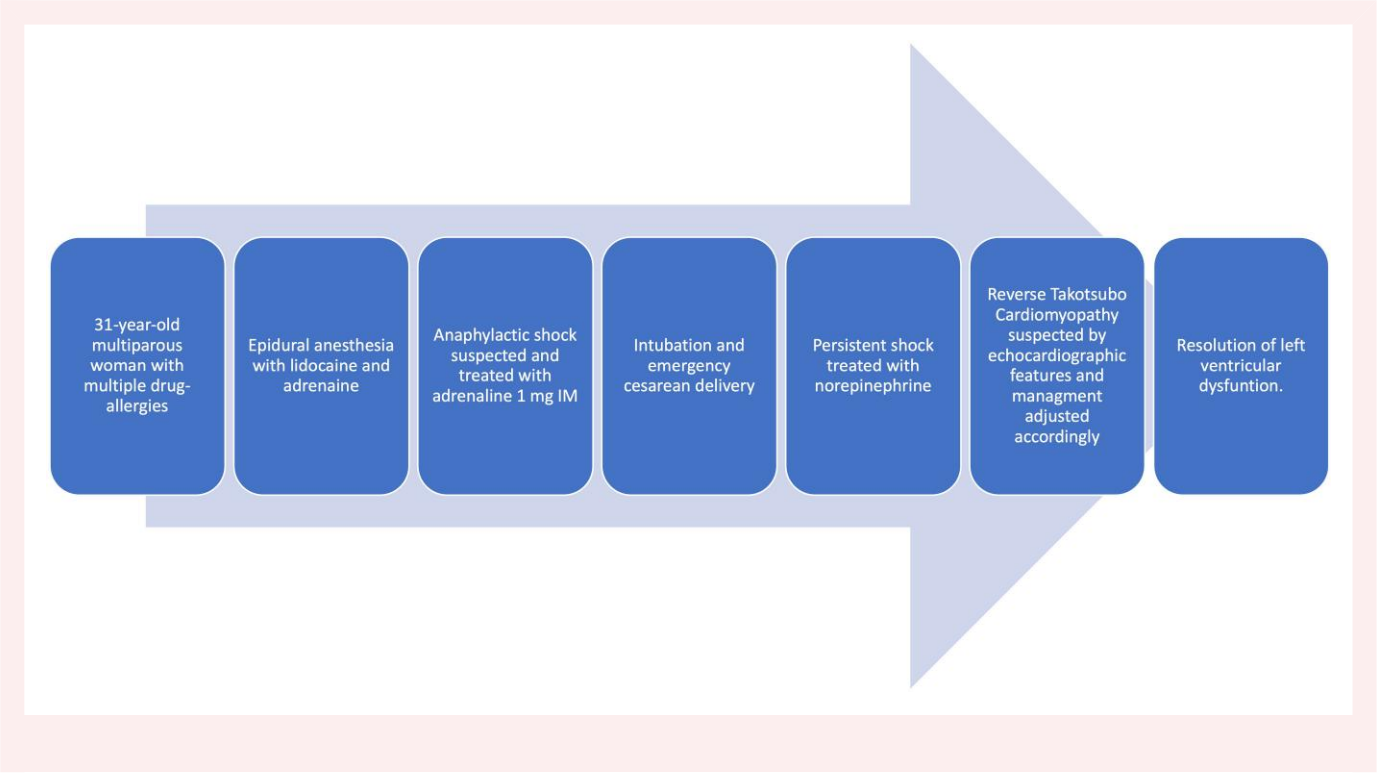
Summary figure



Case presentation

A 31-year-old woman with a history of obstetric haemorrhage complicating the partum of her second child and an anaphylactic reaction due to ketorolac after caesarean delivery of her third child was admitted in labour at 36.2 weeks of gestation of her fourth pregnancy. She had no previous illnesses but an acetaminophen, ketorolac, and penicillin allergy.

Epidural anaesthesia with lidocaine and adrenaline (20 mL of a 2 mg/0.005 mg/mL mixture) was performed before delivery with no signs of vascular or spinal injection on the test dose; however, 5 min later, her blood pressure dropped to 60/40 mmHg, and she complained of dyspnoea with an O_2 saturation of 84% on 7 L/min of supplemental oxygen through a simple face mask. She was intubated and received adrenaline 1 mg intramuscularly for suspected anaphylactic shock. An emergency caesarean section was performed with no significant bleeding giving birth to a healthy female. After two 500 mL boluses of normal saline, a noradrenaline drip (5 mcg/min) was started to treat persistent hypotension. The patient was transferred to the intensive care unit where our cardiology team assessed her haemodynamic status.

On initial evaluation, she was sedated due to residual effects of the medications given for rapid sequence intubation (midazolam and fentanyl); she was on mechanical ventilation with minimum support achieving an O_2 saturation of 99% with a FiO_2 of 35% and had a mean arterial pressure of 70 mmHg with 5 mcg/min of noradrenaline. We found normal S1 and S2 without murmurs and no venous jugular distention on physical examination. Her lungs were normally ventilated with no rales. Her pulses on the four extremities and capillary refill time were normal, with no oedema.

Her initial electrocardiogram showed normal sinus rhythm with new ST-segment depressions in V3–V6, DII, DIII, and aVF and with ST-segment elevation in aVR (*Figure 1A*). A transthoracic echocardiogram showed a normal-sized LV (end-systolic diameter of 48 mm) with dyskinesia of the basal segments and hyperkinesia of the apical segments and an ejection fraction of 48% (*Figure 2A*). No significant valve pathology and systolic pulmonary pressure was estimated at 26 mmHg (see Supplementary material online, *Video S1*). On workup, her haemoglobin was 12 g/dL (reference value 12.2–18.1 g/dL), creatinine 0.8 mg/dL (0.6–1.4 mg/dL), lactate 2.6 mmol/L (0.9–1.9 mmol/L), and troponin I 1276 ng/L (0–15.6 ng/L). Given these findings, we calculated an InterTAK score of 68 points and made a presumptive diagnosis of a basal variant of TC. Given the relatively preserved systolic, we decided to give supportive therapy, optimizing preload with IV fluids to avoid vasopressors.

Her condition improved over the following 24 h, and her ventilatory and vasopressor support was withdrawn. Her electrocardiogram evolved to a pattern of tall T-waves with a wide base and a long QTc (592 ms) (*Figure 1B*), and troponin I was reported on 1896 ng/L. At that time, serum electrolytes including magnesium were normal, and telemetry monitoring showed no arrhythmias.

Given the low pre-test probability of ischaemic cardiomyopathy, we decided to perform a computed tomography coronary angiography, demonstrating normal coronary anatomy with no obstructions.

We repeated the echocardiogram on Day 4 (*Figure 2B*) (see Supplementary material online, *Video S2*), with significant improvement in basal segments, wall motion abnormalities, some remaining hypokinesia, and an LV ejection fraction of 61%. On Day 5, her repolarization pattern improved on the electrocardiogram with a QTc of 433 ms (*Figure 1C*) and troponin I of 739 ng/L.

During her evaluation, the patient mentioned being stressed about this pregnancy owing to her history of adverse outcomes in the previous two. She also worried about the future of her three children if anything would happen to her during this delivery.

After 6 days of hospitalization, her clinical status and myocardial function improved, and she was discharged home on bisoprolol 2.5 mg daily along with the company of her healthy newborn. At 6 month follow-up,

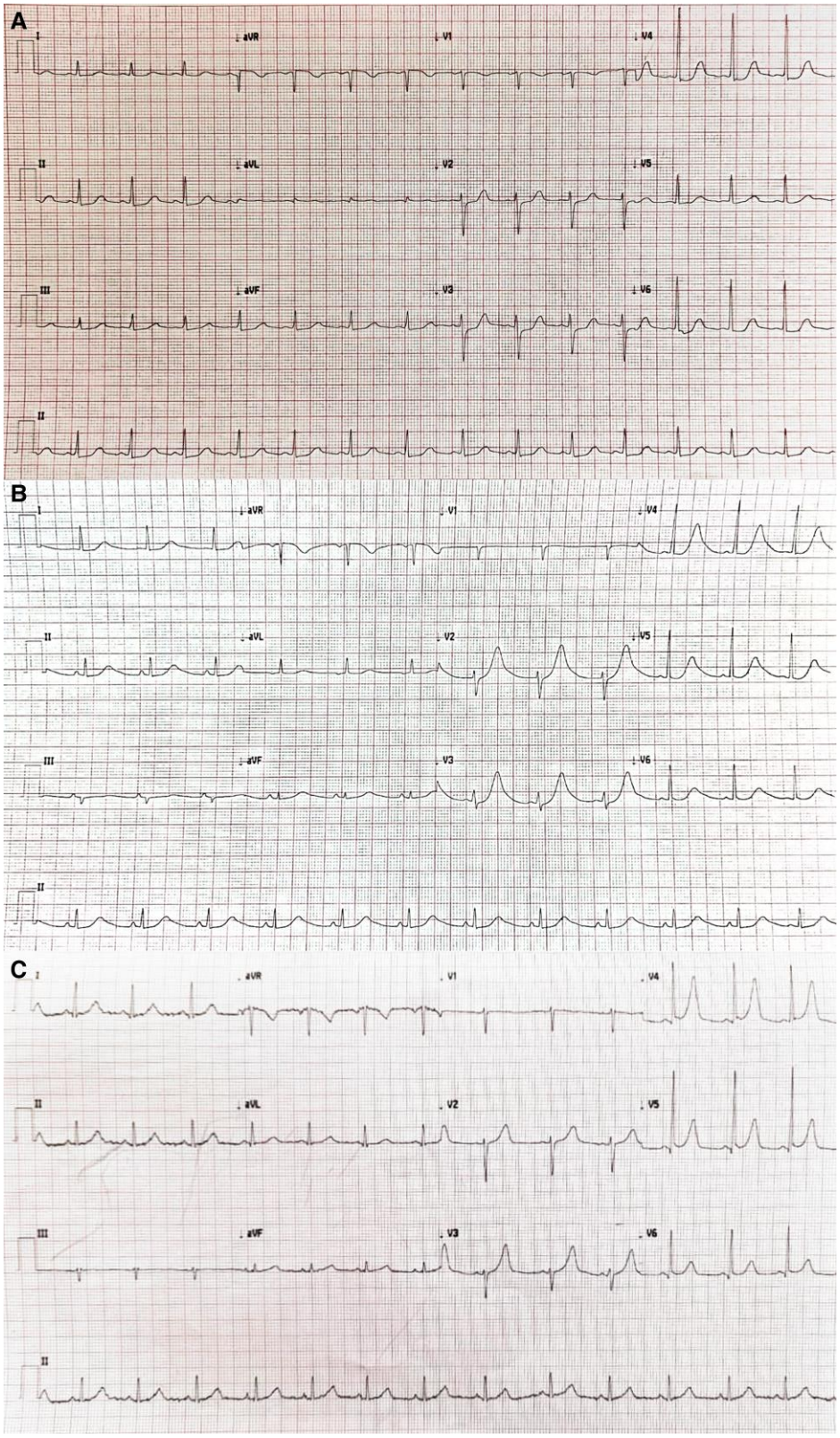


Figure 1 (*A*) Initial electrocardiogram showing a sinus rhythm with discrete ST-segment depressions in leads V3–V6, DII, DIII, and aVF and elevation in aVR. (*B*) Follow-up ECG on Day 2, showing tall T-waves with a wide base and long QTc of 592 ms. (*C*) Follow-up ECG showing almost complete resolution, with QTc of 433 ms.

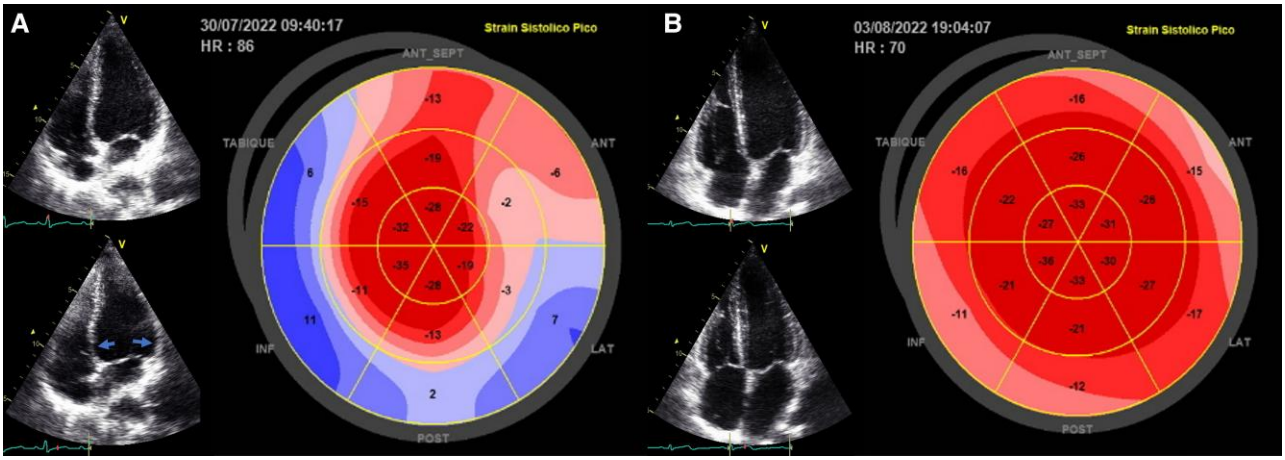


Figure 2 (*A*) Initial echocardiogram in the four-chamber view showing basal ballooning of the basal segment (arrows) with apex hypercontractility. The bullseye shows the left ventricular strain with severe systolic impairment of the basal segment and hypercontractility of the apex. (*B*) Follow-up echocardiogram showing almost complete recovery of systolic function, including strain.

Table 1 Distinctive features of peripartum cardiomyopathy and peripartum Takotsubo cardiomyopathy

	Peripartum cardiomyopathy	Peripartum Takotsubo cardiomyopathy
Imaging features	Left ventricle dilation with global dysfunction. Late gadolinium enhancement with a non-ischaemic distribution	Segmentary dysfunction; typically, apical dyskinesia, but in our case, basal dyskinesia with apical hyperkinesia
Time of presentation	Usually, weeks around delivery	Hours to days around delivery
Biomarkers	Mild rise in serum troponin	Marked rise in serum troponin
Time to recovery	Half of the patients with recovered LVEF at 6 months	Almost full recovery in the first month

she was doing well and asymptomatic, with good adherence to her treatment.

Discussion

Multiple causes of *de novo* myocardial dysfunction are associated with pregnancy and delivery. Among these, peripartum cardiomyopathy (PPCM) has been classically regarded as the principal cause;[2,8] however, there are several cases reported in the literature of peripartum Takotsubo cardiomyopathy (PTCM) complicating delivery and postpartum[7–10] and recent evidence suggesting a possible misclassification of a large proportion of PTCM cases before the first report in 2007 by Muller et al.[7,11]

Peripartum Takotsubo cardiomyopathy and PPCM share some similarities. Both are forms of idiopathic cardiomyopathy associated with pregnancy, characterized by LV dysfunction with acute heart failure and recovery of contractility on follow-up.[7,10]

Despite these similarities, patients with PTCM tend to have a better prognosis and their management differs from the recommended for PPCM, making it important to look for some features to differentiate them (*Table 1*). Peripartum Takotsubo cardiomyopathy usually has segmentary involvement with well-described patterns, while PPCM patients typically show LV dilation with global dysfunction.

Multimodality imaging is useful for differential diagnosis in this population, especially in doubtful cases. Cardiovascular magnetic resonance (CMR) is more specific to characterize left ventricular systolic dysfunction, chamber dilation, right ventricular involvement, and intracardiac thrombus in PPCM.[12] Late gadolinium enhancement (LGE) with a non-ischaemic distribution and an elevated T2 ratio are also more frequent. In PTCM, functional and structural changes such as typical regional wall motion abnormalities are more evident. Also, the presence of myocardial oedema and no LGE are diagnostic hallmarks of the disease. Coronary computed tomography and nuclear imaging may have a role in some patients.[13]

As opposed to PPCM occurring towards the end of pregnancy or in the following months, most cases of PTCM develop in a short time (days) before or after delivery; PTCM often presents with a higher elevation of troponin than PPCM.[2,7–10] They can also be differentiated during follow-up, with most cases of PTCM fully recovering in the first month[7,10] compared with 86.9% of PPCM patients having persistent heart failure at 1 month[14] and only 46% recovering left ventricular function at 6 months.[15]

Peripartum Takotsubo cardiomyopathy patients represent a special population. They are younger, premenopausal, and often exposed to a variety of drugs with possible effects on catecholamine receptors. In addition, placenta extraction seems to create a high-risk environment possibly due to abrupt oestrogen depletion.[2,7,16] These distinctive

conditions may be the cause of some special features of PTCM, namely the higher incidence of so-called atypical patterns of TCM with mid-ventricular and basal patterns representing 40–59% of cases in two series,[7,10] similar to the reported incidence of cases associated with intravenous catecholamine and beta-receptor agonist administration.[17] Despite growing evidence supporting the diagnosis of this special subset of patients, evidence is still lacking to guide long-term treatment to improve the life-long prognosis of PTCM patients.

Conclusion

Takotsubo syndrome can be an under-recognized form of cardiomyopathy complicating the peripartum. It is usually associated with the stress imposed over the heart secondary to cardiovascular adaptation for pregnancy and to stressful events that can occur in the peripartum period. It is crucial to make an accurate differentiation from other more common forms of cardiomyopathy complicating the peripartum, such as PPCM; history, multimodality image, and evolution features can aid in the differentiation.

In our case, typical imaging characteristics, clinical presentation, and evolution were fully compatible with a diagnosis of PTCM. However, the role of intraoperative adrenaline injections as a contributing trigger is also possible and must be considered.

Lead author biography

Dalí Hernández is a second-year resident in the cardiology department at 'Dr. José E. González' University Hospital. He received his general and internal medicine degrees from Universidad Autónoma de Nuevo León. He has a particular interest in ischaemic heart disease, cardiomyopathies, heart failure, and cardiovascular disease in pregnancy and hopes to obtain an interventional cardiology fellowship following residency.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports* online.

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Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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