

First Documented Case Report of Peripartum Takotsubo Cardiomyopathy in Diyala Province: Clinical Presentation and Follow-Up

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Abstract

Background: Takotsubo Cardiomyopathy (TTC) is a condition that can present like a myocardial infarction, however unlike a myocardial infarction it is reversible. It has been shown to be very rare during the peripartum period with little available literature on the subject. This report will document formally the first case of peripartum Takotsubo cardiomyopathy in Iraq, particularly in the Diyala Province. **Case Presentation:** A previously healthy 25-year-old mother with one prior uncomplicated delivery and a normal electrocardiogram and echocardiogram (ejection Fraction 68%) underwent an elective Cesarean Section at AlZahra hospital in Diyala. Within 24 hours of delivery there was development of significant dyspnoea and orthopnoea. Echocardiography revealed symptoms of Left Ventricular dilation, moderate mitral regurgitation and akinesia of the midseptal wall. The Ejection fraction was significantly reduced at (38%) however the Echocardiogram also revealed deterioration of left ventricular function. The ECG showed ST Elevation in the septal leads with T-wave inversion in the lateral leads. The elevation of Troponin was measured at 200ng/l, the Pro Brain Natriuretic Peptide was markedly Elevated. CT coronary angiogram excluded significant coronary artery disease. The patient was given standard heart failure therapy and displayed a rapid recovery both clinically and on Echocardiograph. At 6 days postpartum the patient's Ejection Fraction was back to normal (61%) and the patient was discharged from the hospital in stable condition. **Conclusion:** This case highlights the importance of including Takotsubo cardiomyopathy in the differential diagnosis of peripartum cardiac dysfunction. The rapid recovery that patients experience with supportive therapy is distinctive for Takotsubo cardiomyopathy compared to peripartum cardiomyopathy. The early identification and appropriate management of Takotsubo cardiomyopathy are essential for the best outcomes for mothers. This case adds to the very limited documentation available for peripartum Takotsubo cardiomyopathy and represents the first case to be documented in our area.

Keywords: Takotsubo cardiomyopathy; stress cardiomyopathy; peripartum period; acute heart failure; cesarean section; cardiac dysfunction

Introduction.

Takotsubo cardiomyopathy (TTC), an acute myocardial failure with transient left ventricular dysfunction without obstructive coronary artery disease, is being recognised increasingly as an acute

myocardial syndrome found frequently amongst women after menopause (1). Described first in Japan by Dr. Sato in 1990, the name comes from the shape of the apical portion of the left ventricle in systole, which resembles the shape of a Pokemon-inspired Japanese octopus trap, the Takotsubo (2). Estimates suggest 80-90% of all cases occur in postmenopausal women (3). TTC pathophysiology is still not fully understood; however, some potential mechanisms have been proposed including catecholamine excess-induced myocardial stunning (4), coronary microvascular dysfunction, endothelial dysfunction, oxidative stress and inflammatory processes (5 & 6). Each of these mechanisms will play a varied contribution to each patient due to the heterogeneous nature of TTC (7). Clinical presentation for patients with TTC closely resembles acute coronary syndrome as patients typically present with dyspnea, chest pain and electrocardiograms indicative of myocardial ischemia based upon ST elevation (8). Troponin & B-type natriuretic peptide are often elevated and further complicate the differential diagnosis (9). To provide a standardised framework for the diagnosis of TTC, the International Takotsubo Diagnostic Criteria (InterTAK Diagnostic Criteria) were developed to aid physicians with the identification of TTC and reinforce the importance of the exclusion of obstructive coronary artery disease in addition to establishing regionally specific wall motion abnormalities beyond the distribution of a single coronary artery (10). There have been many reports of several different forms of TTC, with the typical type being apical, midventricular, basal and focal types (11). Each type exhibits its own unique patterns of abnormal wall motion in the ventricles and may also be linked to various underlying causes or outcomes. The apical type accounts for 75% of all cases, and has akinesis/dyskinesis of the apical and midventricular segments with preserved/hyperkinetic function of the basal segments (12).

The peripartum period is unique because it has drastic changes in hemodynamics, hormones, and emotions that potentially lay the groundwork for TTC (13). However, the cases of peripartum TTC are very rare and only a few case reports are currently available in the literature (14,15). The fact that this presentation is so rare may be due to the fact that most women who are pregnant tend to be young, coupled with the protective effect of estrogen, which is likely one reason that postmenopausal women have the highest incidence of TTC (16).

It can be difficult to differentiate between TTC during the peripartum period and peripartum cardiomyopathy (PPCM). PPCM is defined as heart failure occurring during the last month of pregnancy or within 5 months after delivery with no other cause present, and typically shows persistent ventricular dysfunction and requires a long-term treatment (17). In contrast, TTC typically has a rapid resolution of symptoms (from within days to weeks), and complete normalization of ventricular function occurs in most patients. The time-course of recovery is what differentiates these conditions (18).

During pregnancy, the hemodynamic changes consist of increased cardiac output (30-50% greater than baseline), increased blood volume, decreased systemic vascular resistance, and increased heart rate (19). The body will undergo major changes and adjustments during the second trimester and also in delivery. In the immediate postpartum period, the return of blood volume to the patient and the cessation of uterus to placenta circulation can lead to rapid hemodynamic instability and cardiac decompensation. In addition, stress from labor, physical stress from the pain and anxiety during labor, and blood loss during labor can cause an increased level of catecholamines in the body, creating a favorable environment for the development of TTC (20).

Surgical stress is also a considerable contributor to the development of TTC, as the procedure and trauma from a C-section can also lead to stress from anesthesia, pain, and anxiety (21). Physiological surgical stress leads to activation of the sympathetic nervous system and hypothalamic-pituitary-adrenal (HPA) axis, leading to increased catecholamines and cortisol levels (22). This rapid increase in catecholamines and cortisol can lead to the development of TTC in patients who may be predisposed to developing TTC as a result of pre-existing cardiac disease or hypertension. Likewise, the changes seen in hemodynamics during the postpartum period can also increase the possibility of developing TTC in patients with pre-existing cardiac disease.

Electrocardiographic changes are typically seen over time in cases of TTC. Initially, there is ST elevation, mostly in the precordial leads, followed by T-wave inversions, which may last for weeks or months (23). Prolongation of the QT interval is also commonly seen in cases of TTC and can increase the risk of ventricular arrhythmias. The absence of significant ST depression and ST elevation in ≥ 2 coronary territories (i.e., ST elevation in the same lead beyond a single coronary vessel) suggest a diagnosis of TTC rather than an acute coronary syndrome (24).

Echocardiography is the preferred imaging modality for the diagnosis and follow-up of TTC. Regional wall motion abnormalities that involve an area larger than the supply zone of one coronary artery, apical aneurysms of the left ventricle, and dynamic left ventricular outflow tract obstruction (in a subset of patients) are characteristic for the diagnosis of Takotsubo Cardiomyopathy (TTC) (25). As demonstrated by serial echo evaluations, ventricular function improves progressively over time and typically normalizes in 1-4 weeks. Advanced imaging modalities such as cardiac MRI and nuclear imaging may provide added diagnostic value to help distinguish TTC from other types of cardiomyopathy (26).

The primary component of treatment for TTC is supportive care utilizing standard heart failure medications. Medical therapy for TTC includes ACE inhibitors or ARBs, beta-blockers, and diuretics (27). The role of beta-blockers remains somewhat controversial, as these medications may theoretically increase the severity of dynamic left ventricular outflow tract obstruction, but in general, beta-blockers are recommended as they may have cardioprotective effects and reduce catecholamine-mediated toxicity. Anticoagulation should be considered for patients with severe ventricular dysfunction and evidence of apical thrombus formation (28).

The prognosis for most patients diagnosed with TTC is favorable as they will completely recover. However, serious complications can arise during the acute phase of illness including cardiogenic shock, ventricular arrhythmias, thromboembolic events, and ruptured heart (29). In-hospital mortality rates for patients that present with TTC are estimated to be 1-4%, which is substantially lower than the in-hospital mortality rate of an acute myocardial infarction; nonetheless, mortality is still a possibility (3). There is a 1-2% recurrence rate for patients diagnosed with TTC on an annual basis, and for some patients, multiple episodes of TTC will occur over their lifetime (30).

In recent years, long-term outcomes for patients that are diagnosed with TTC have been studied extensively. The majority of patients diagnosed with TTC will have their ventricular function return to normal; however, some patients continue to have persistent cardiac symptoms and reduced quality of life (31). Small cardiac functional abnormalities may continue to persist despite full restoration of function as noted on conventional imaging. The long-term cardiovascular risk profile of patients that survive TTC and the length of time that patients should continue with medical therapy are areas currently under investigation.

Geographic differences in the presentation and incidence of TTC have been noted worldwide, likely due to genetic, environmental, or healthcare system utilized in the diagnosis. While the syndrome was first identified in Japan, it has now been recognized in most parts of the world. However, a need still exists for systematic epidemiological research in many areas of the world, especially in the Middle East and developing countries. This case report adds to the body of knowledge regarding TTC by presenting the first known case of peripartum TTC in Diyala Province, Iraq, thereby increasing our understanding of the geographical distribution and presentation patterns of this particular syndrome

Research Methodology.

Study Design and Setting

This report describes one patient who had peripartum Takotsubo cardiomyopathy, admitted to AlZahra hospital, and then transferred to Almuqdadia general hospital in Diyala province, Iraq, during January and February 2026. The case was identified by standard clinical care, documented prospectively, and followed the standard institutional protocols. Data for this case report were obtained in accordance with the principles established by the Declaration of Helsinki and were approved by the institutional ethics committee. Written informed consent was obtained from the patient prior to the publication of her case report, including any photographs.

Inclusion Criteria and Patient Selection

The patient met the International Takotsubo (InterTAK) diagnostic criteria that defined Takotsubo syndrome: (1) transient left ventricular dysfunction manifested as apical ballooning or another type of regional wall motion abnormality extending out of a single epicardial vascular distribution ; (2) absence of obstructive coronary artery disease or acute plaque rupture; (3) newly developed electrocardiographic performance abnormalities (either ST-segment elevation and / or T-wave inversion) or increases in cardiac troponin levels; and (4) absence of either pheochromocytoma or myocarditis. The temporal association with the peripartum period and the classic pattern of rapid functional recovery assisted in the diagnosis.

Clinical Data Collection Methodology

All clinical data collected were from the patient's medical record, which included a comprehensive history, physical examination findings, and clinical history. The entire clinical history included demographic data, a past medical history (including previous obstetric outcomes), a description of the present pregnancy and delivery, the onset and course of symptoms, and the course of treatment. At admission, and during the hospital stay; the patients' physical examinations including vital signs were recorded along with the cardiovascular examination and any evidence of heart failure. The way in which the patient progressed was documented through physician assessments, daily progress notes, and nursing records.

Laboratory tests were drawn and analyzed prior to the patient's cesarean section, on day 1 renal, liver, and electrolyte function performed during the hospitalization. The hematological tests performed were a complete blood count (CBC) with differential, where hemoglobin, hematocrit, white blood cell count, and platelets, were measured by means of an automated hematology analyzer; and the biochemical tests were renal function study (serum creatinine and blood urea nitrogen levels and calculated glomerular filtration; using Modification of Diet in Renal Disease), liver function studies (serum alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, total and direct bilirubin, and albumin), and serum electrolytes (sodium, potassium, chloride, and bicarbonate). Cardiac biomarkers studied were high-sensitivity cardiac troponin I (using electrochemiluminescent immunoassay) and N-terminal pro-brain natriuretic peptide (NT-proBNP) using electrochemiluminescent immunoassay. The reference range for cardiac troponin I was <14 ng/L as normal, otherwise >50 ng/L indicates a myocardial infarction; the NT-proBNP reference range is age-related (young adults <125 pg/mL).

Twelve-lead electrocardiograms (ECGs) with a standard electrocardiograph machine (25 mm/sec paper speed, 10 mm/mV voltage) were performed routinely as pre-operative testing, at the time of cardiac symptoms, and daily during hospitalisation. A thorough examination of individual ECGs was conducted by examining the rate, rhythm, axis, intervals (i.e., PR, QRS, QT and corrected QT intervals using Bazett's equation), ST segment changes (i.e., j point elevation or depression), T-wave morphology, and the presence of Q-waves. ECG data was collected and assessed by an experienced group of Cardiologists, cross-compared over different timeframes to assess gradual progression as a result of Takotsubo cardiomyopathy, with particular emphasis being given to the ST segment elevation and T-wave abnormalities by documenting the associated lead and deviation magnitude from baseline.

Echocardiographic Examination

Study patients underwent transthoracic echocardiography using a high-resolution Imaging System and a phased array transducer (2.5-3.5MHz). Full two-dimensional and Doppler echocardiograms were performed pre-operatively (January 26, 2026), at the time of presentation with cardiac symptoms (February 01, 2026), each day during hospitalization (February 02-07, 2026), and at discharge. Standard echocardiographic imaging views were obtained using the parasternal long-axis, parasternal short-axis, apical four-chamber, apical two-chamber, and apical long-axis views. Measurements of left ventricular dimensions were taken according to guidelines established by the American Society of Echocardiography and included the left ventricular end-diastolic and end-systolic diameters, the interventricular septal thickness, and the left-ventricular posterior wall thickness. The left ventricular ejection fraction was calculated using the Modified Simpson's biplane method based on apical 4 and 2-chamber view data. Regional wall motion was assessed using a 17-segment model and was classified according to wall motion criteria of normal, hypokinetic, akinetic, and dyskinetic. The combined wall motion index was calculated as the overall score of the visualized segments divided by the total number of segments visualized. Assessment of valvular function was conducted systematically through color Doppler echocardiography (CDE), continuous wave Doppler echocardiography (CWDE) and pulsed wave Doppler echocardiography (PWDE). Grading of the severity of mitral regurgitation (MR) was undertaken according to both qualitative and quantitative parameters based on vena contracta width (VCAw), regurgitant volume (RV) and the effective regurgitant orifice area (EROA). All echocardiograms were performed and interpreted by experienced echocardiographers (trained in using the 3D echocardiographic technique) and either cardiologists or experienced cardiac sonographers in accordance with standard protocols that provided reliable and reproducible measurements whilst ensuring optimal image quality.

Cardiac Imaging

A CT-based coronary angiogram was performed during the admission of the patient as part of the investigations into the aetiology of their presentation to exclude the presence of obstructive coronary artery disease. The examination was completed utilizing a 64-slice CT with the administration of an intravenous

iodinated contrast agent. Image acquisition was performed in a single breath-hold with retrospective electrocardiographic gating to minimize motion artefact. The study included evaluation of the coronary arteries (anatomically and with respect to significant stenotic lesions), evaluation of the coronary artery calcium score (CAC), and evaluation of left ventricular function. Three-dimensional CT and multiplanar reformatted imaging were used to optimize visualisation of the coronary arteries. Images were evaluated using dedicated CT cardiac workstations by experienced radiologists and cardiologists and included in the systematic evaluation of the major coronary arteries (left main, left anterior descending, left circumflex and right coronary arteries) and their branches. The standardized criteria were used to assess the amount of coronary stenosis with the criteria defining significantly stenosis being $\geq 50\%$ for left main coronary artery diameter narrowing and $\geq 70\%$ other major epicardial arteries.

Medical Management Protocol

When Takotsubo cardiomyopathy was suspected at the same time of diagnosing acute heart failure, patient started on heart failure drugs per established guidelines for heart failure therapy. The patient received pharmacologic treatment with loop diuretics (IV furosemide) to manage volume overload and provide symptomatic relief with dyspnea and orthopnea. Angiotensin converting enzyme inhibitors were utilized to block the neurohormonal system, and to prevent ventricular remodeling. Beta-adrenergic blocking agents were utilized for controlling heart rate and providing cardioprotection. Dosing was based on patient's hemodynamics, renal status and the amount of side effects experienced by the patient. Dosing was intently titrated to achieve a therapeutic effect with minimum side effects. The patient was provided with supplemental oxygen to maintain adequate arterial oxygen saturation. Fluid balance was monitored very closely with daily weights, intake and output measurements, and by clinical assessment. The patient maintained continuous telemetry for cardiac monitoring for detection of arrhythmias. Serial physical examinations were done to measure effectiveness of therapy based on evaluation of vital signs, jugular venous pressure, pulmonary auscultation, cardiac examination, and examination for peripheral edema. The patient was encouraged to ambulate as tolerated, with an emphasis on early ambulation once hemodynamic stability was established.

Follow-Up and Outcome Assessment

Daily clinical and echocardiographic assessment was performed throughout the patient's hospitalization for evaluation of therapy, and to guide the decision from the physician. Daily echocardiography provided real-time monitoring of the recovery of the patient's ventricular function, which is an important distinguishing feature of Takotsubo cardiomyopathy. Discharge requirements included need for clinical stability, resolution of dyspnea and orthopnea at rest; near or complete left ventricular dysfunction recovery (introduction fraction=50%); hemodynamic stability, ability to tolerate medications orally, and education about the patient's condition and prescribed medications, and warning signs and when to seek emergency care, and follow-up plan. A follow-up plan was established post-discharge that included the monitoring of the patient's continued recovery, and the potential for complications or recurrence.

Data Analysis and Presentation

Clinical, laboratory, electrocardiographic and echocardiographic data were organized and tabulated to facilitate the clear presentation of the patient's case and data for analysis. Temporal trends were assessed for key data points, particularly ejection fraction and cardiac biomarkers, for illustrating the characteristic timecourse of the evolution of Takotsubo cardiomyopathy. Descriptive statistics were used to present the case findings. The case was reviewed and analyzed within the context of the literature regarding Takotsubo cardiomyopathy and peripartum cardiac complications including diagnostic criteria, differential diagnoses, and management. This comprehensive methodology has created a thorough record of the case presentation and has properly documented and analyzed this rare case.

Result

A 25 year-old female (Randa K. Mohammed) was admitted with decompensated heart failure (acute decompensated heart failure) after an elective cesarean section and was ultimately diagnosed with Takotsubo cardiomyopathy peripartum. This represents the first documented incidence of the condition in the Diyala province. A summary of the patient's clinical course, lab values, and imaging data are summarized in the tables below.

Table 1: Patient Demographics and Clinical History

Parameter	Value
Age	25 years
Sex	Female
Past Medical History	Negative
Obstetric History	Gravida 2, Para 1, one previous uncomplicated vaginal delivery
Admission Date	1 February 2026
Procedure	Elective cesarean section
Hospital	AlZahra Hospital, Diyala Province

Table 2: Laboratory Investigations Timeline

Investigation	Pre-operative (26 Jan)	Post-presentation (2 Feb)
Hemoglobin (g/dL)	Normal range	10.0
Renal Function Tests	Normal	Normal
Liver Function Tests	Normal	Normal
Electrolytes	Normal	Normal
Cardiac Troponin I (ng/L)	Not measured	200
NT-proBNP	Not measured	Markedly elevated

Table 3: Serial Echocardiographic Findings

Parameter	26 Jan (Pre-op)	1 Feb (Acute)	7 Feb (Recovery)
Ejection Fraction (%)	68	38	61
LV Size	Normal	Dilated	Normal
Wall Motion	Normal	Mid-septal akinesia	Normal
Mitral Regurgitation	None/Trivial	Moderate	Mild

Table 4: Clinical Timeline and Management

Date/Timeline	Clinical Event/Finding
26 January 2026	Pre-operative assessment: normal ECG, normal echocardiogram (EF 68%), routine laboratory tests within normal limits
1 February 2026	Elective cesarean section performed at AlZahra Hospital, Diyala; uneventful delivery
1 Feb (Day 1 PP)	Acute onset of severe dyspnea and orthopnea within 24 hours post-delivery
2 February 2026	Transfer to Almuqdadia General Hospital; diagnostic workup revealed: ECG changes (ST elevation in septal leads, T wave inversion in lateral leads), elevated troponin I (200 ng/L), markedly

	elevated pro-BNP, echocardiography showing EF 38% with mid-septal wall akinesia and moderate MR, normal CT coronary angiography. Initiated on heart failure therapy.
2-7 February	Daily echocardiographic monitoring showing progressive improvement in cardiac function; symptomatic improvement with diuretics, ACE inhibitors, and beta-blockers
7 February 2026	Near-complete recovery: echocardiography showing EF 61%, resolution of wall motion abnormalities, mild residual MR. Patient discharged in stable condition with oral medications and follow-up plan.

The assessment of the clinical picture, study findings, and quick resolution support the diagnosis of Takotsubo cardiomyopathy per the InterTAK diagnostic criteria. Findings that support this conclusion include: no obstructive CAD on CT coronary angiogram, characteristic wall motion abnormalities not limited to a particular coronary territory; changes on an ECG; elevation in cardiac biomarker; and especially, resolution of left ventricular function within 6 days. The timing surrounding the peripartum period and the correlation of the cesarean section provide an obvious likely stressful event leading to the development of this acute cardiac syndrome.

Discussion

Takotsubo cardiomyopathy peripartum is a rare form of cardiomyopathy due to emotional stress and this case report demonstrates the first documented instance of this condition in the Diyala Province of Iraq. The patient in this case presented with acute heart failure due to severe left ventricular (LV) dysfunction obtained shortly after a cesarean section (CS). The patient subsequently recovered rapidly from LV dysfunction allowing for classic features of Takotsubo cardiomyopathy to be evident and to face the unusual obstacles of development during the peripartum period.

The doctor's diagnoses followed established criteria developed by the International Takotsubo Diagnostic Criteria (8). The patient showed transient LV dysfunction plus abnormal function of the heart wall (regional wall motion abnormality), which failed to show known obstructive coronary artery disease based on CT coronary angiography; additionally, the patient had new and abnormal electrocardiogram patterns and had a low but detectable level of cardiac troponin (12). However, most importantly, the patient returned to normal LV function within six (6) days. This return to normal LV function is the pattern that differentiates Takotsubo Cardiomyopathy from other causes of LV failure and particularly differentiates it from peripartum cardiomyopathy (13).

The underlying cause of Takotsubo cardiomyopathy is not yet fully understood; however, it is widely accepted that Takotsubo cardiomyopathy occurs most often due to catecholamine-induced myocardial toxicity. The release of excess catecholamines occurs with periods of emotional stress and/or physical stress. Catecholamines, such as epinephrine and norepinephrine, can cause direct myocardial damage. The release of catecholamines during stressful episodes leads to excess calcium influx into myocytes (calcium overload), production of reactive oxygen species (oxidative damage), and metabolic alteration of myocyte metabolism (metabolic derangement) (20). The peripartum period and cesarean section are likely examples of significant stressors that may trigger the release of excessive catecholamines. Acute sympathetic nervous system activation has been triggered by the stress of either surgical procedures, blood loss, anxiety disorders, labor, or the tremendous hemodynamic alterations which occur immediately after delivery; this has led to increased levels of norepinephrine, epinephrine, and other chemical mediators searching for their relations. For these individuals prone to such a response, activation exceeds the threshold necessary for myocardial damage, ultimately resulting in the onset of acute Takotsubo cardiomyopathy (21).

Several differential diagnoses exist for the peripartum heart failure syndrome, including but not limited to: peripartum cardiomyopathy, acute myocardial infarction, pulmonary embolism and amniotic fluid embolism. One challenge with diagnosing Takotsubo cardiomyopathy versus peripartum cardiomyopathy is

that each typically presents very similarly in their initial clinical presentations. Peripartum cardiomyopathy can develop any time during the last month of pregnancy or within five months following delivery with signs/symptoms of heart failure and left ventricular systolic dysfunction—but without any identifiable cause(s). However, the clinical course is different than in Takotsubo cardiomyopathy since most patients with peripartum cardiomyopathy will go on to demonstrate persistent evidence of heart dysfunction that require a longer time frame for medical management (17,32); additionally, while recovery from Takotsubo cardiomyopathy typically occurs within days to weeks, recovery from peripartum cardiomyopathy may take several months or longer. Roughly half of women diagnosed with peripartum cardiomyopathy will not recover completely or will continue to demonstrate signs of heart dysfunction vs nearly all patients with Takotsubo will show signs of recovery upon discharge from the hospital (33).

For this reason, there are several features present in this case that support the diagnosis of Takotsubo cardiomyopathy as compared to peripartum cardiomyopathy. The timing of the onset of symptoms (24 hours post-delivery) is consistent with an acute stress induced condition in comparison to peripartum cardiomyopathy, which generally develops over time. The T-wave abnormality seen in the electrocardiogram (elevated ST-segment in septal leads with inverted T-waves in lateral leads) is also consistent with the presentation of Takotsubo cardiomyopathy vs the usual nonspecific electrocardiographic findings seen in peripartum cardiomyopathy. Additionally, the relatively rapid return of ventricular function to nearly normal levels several days after the onset of symptoms would distinguish this case from most cases of peripartum cardiomyopathy (which may take months or longer to resolve) and acute myocardial infarction (i.e., patients with myocardial infarction do not show this degree of improvement over the course of six days) (18).

Myocardial infarction represents another significant differential diagnosis to consider in patients with chest pain, dyspnea, electrocardiographic abnormalities, and an elevated cardiac biomarker. Because this patient had normal coronary arteries on computed tomography coronary angiography, obstructive coronary artery disease can be excluded as a cause of her presentation. The presence of wall motion abnormalities in two or more coronary territories, and their pattern of recovery, further supports the diagnosis of myocarditis versus myocardial infarction. In addition, coronary imaging demonstrates coronary artery dissection as the underlying cause of acute coronary syndrome in a small number of young women, particularly during the peripartum period (34,35).

In young women of childbearing age, Takotsubo cardiomyopathy represents a distinct departure from commonly reported demographics because the majority of patients with Takotsubo cardiomyopathy are postmenopausal (average age at presentation is typically in the age range of 60s to 70s) (3), and there may be an association between lower estrogen levels and the development of Takotsubo cardiomyopathy. Takotsubo cardiomyopathy may occur in 25-year old women; however, the majority of case reports of this condition arise from exceptionally difficult physical or emotional stressors. Given the unique nature of both the peripartum period, due to both its extreme physiological and hormonal fluctuations, it is an extreme stressor that could induce a Takotsubo; potentially even in a younger female adult.

The echocardiographic findings from this patient were very interesting, and require further clarification. The echo before surgery showed normocardiac left ventricle size with normal pumping ability (EF of 68%) with no evidence of significant valve disease... The findings on the first echo after delivery were extensive: the left ventricle was dilated, the EF was significantly reduced (to 38%), there were significant abnormalities of wall motion (including akinesia of the mid-septal wall region) and moderate mitral regurgitation. The pattern of wall motion abnormality (ie: in mid-myocardium), is suggestive of the midventricular variant of the Takotsubo syndrome (11), one of several different morphological variants. The fact that mitral regurgitation developed during the acute phase likely reflects the combined effect of dysfunction of the papillary muscles (secondary to regional wall motion abnormality) and geometric changes of the left ventricle.

The daily echocardiographic monitoring during the patient's hospitalization was labor-intensive and provided invaluable information regarding the classic rapid recovery course of patients with Takotsubo syndrome for management of their symptoms. This allowed for real-time assessment of treatment response and provided reassurance regarding the diagnosis. By day 6 postpartum, the patient's EF had improved to 61% (normal values), and the wall motion abnormalities had resolved. While this recovery course is typical of the Takotsubo syndrome, it would not be seen with other forms of cardiomyopathy or myocardial infarction; thus confirming the diagnosis (18). Although there are no current evidence-based protocols available for Takotsubo cardiomyopathy, the medical management approach adopted in this case was in accordance with standard

heart failure guidelines, and included diuretics for volume management and symptomatic relief; angiotensin-converting enzyme (ACE) inhibitors for neurohormonal modulation; and beta-blockers for heart rate control and cardioprotection. The use of beta-blockers in the treatment of Takotsubo cardiomyopathy has generated some controversy. Although beta-blockers are theoretically capable of worsening dynamic left ventricular outflow tract obstruction, they also may provide beneficial effects through the reduction of catecholamine-mediated toxic effects and through heart rate reduction (27). As there were no dynamic obstructions present in this patient's case, beta-blockers appeared to be safe and potentially beneficial. Based on the rapid improvement in symptomatology and functional status that this patient demonstrated in response to this treatment regimen, standard heart failure therapy appears to be appropriate for the acute treatment of Takotsubo cardiomyopathy.

The decision to perform CT coronary angiography instead of invasive coronary angiography represents an increasingly utilized and pragmatic approach to evaluating suspected acute coronary syndrome, particularly in younger patients and women who have a low pretest likelihood of having significant obstructive coronary artery disease. CT coronary angiography, as a non-invasive imaging modality, has the ability to provide excellent visualization of coronary anatomy and can exclude significant stenosis with more reliability than invasive catheterization, thus avoiding the associated risks, costs, and radiation exposure. For this case, the normal results of CT coronary angiography excluded obstructive coronary artery disease as well as spontaneous coronary artery dissection; therefore, the diagnosis of Takotsubo cardiomyopathy was supported. Current clinical practices and evidence-based guidelines support proper use of non-invasive coronary imaging in specific clinical scenarios.

From an epidemiological and healthcare delivery perspective, the geographic implications for this case report reach beyond one patient and highlight the need for additional awareness regarding the spectrum of illness that encompasses Takotsubo cardiomyopathy in Iraq and the Middle East as a whole. Specifically, this is the first case reported in Diyala Province of peripartum Takotsubo cardiomyopathy; it also represents an opportunity to expand understanding of the syndrome both in Iraq and more widely throughout the region (i.e. Middle East). As with other diseases, geographic differences have been noted concerning the manner in which Takotsubo cardiomyopathy manifests itself (i.e., presentation, incidence) and how genetics, environment, culture, and variations in the healthcare system may influence the risk of developing Takotsubo cardiomyopathy. Documenting cases of Takotsubo cardiomyopathy from multiple geographic regions supports efforts to develop a more thorough understanding of the global distribution of the syndrome; this may lead to important insights into both the epidemiology and pathophysiology associated with the disease. Additionally, this case report will raise awareness among providers about considering Takotsubo cardiomyopathy as a potential diagnosis for women who present with symptoms consistent with peripartum cardiac dysfunction.

The following clinical pearls are derived from this case and should be highlighted. First, Takotsubo cardiomyopathy should be included in the differential diagnoses of any patient who has a new episode of acute heart failure symptoms, abnormal ST segments or T waves on electrocardiogram (ECG), and elevated markers of cardiac injury, regardless of whether the patient is elderly or recently bereaved (i.e. married). Second, providers need to pay attention to postpartum patients due to the potential that peripartum status triggers Takotsubo cardiomyopathy and therefore have increased awareness regarding potential cardiac complications related to postpartum women. The rapid recovery from Takotsubo cardiomyopathy can be used to differentiate this condition from other types of cardiomyopathies. In order to properly diagnose Takotsubo cardiomyopathy, it is also important to rule out any obstructive coronary artery disease through appropriate imaging methods such as coronary CT angiography.

Patients with Takotsubo cardiomyopathy should be followed long-term for potential recurrence of symptoms, to evaluate whether they continue to experience symptoms that are persistent even after full recovery from the event, and also to determine the best duration of medication after full recovery. While the left ventricular function usually returns to normal in a matter of weeks, some patients report still having ongoing symptoms such as chest pain, shortness of breath, and fatigue (31). Further, some patients may demonstrate very subtle abnormalities on advanced imaging tests, even after their ejection fraction has returned to normal as assessed by echocardiography. There is no consensus on how long patients should be treated with medications such as angiotensin converting enzyme inhibitors and beta blockers, thus practices in this area are highly variable. Some clinicians recommend treating for at least a few months after functional

recovery, while other clinicians recommend treating indefinitely in any patient who is at substantial risk for recurrence of Takotsubo cardiomyopathy.

There are several limitations to this case report that deserve to be mentioned. First, as this case is a single case report, it is not possible to generalize from this literature and make clear statements of causation or treatment effectiveness. Second, because the clinical, EKG, echocardiographic, and CT angiographic findings were the basis of diagnosis, the use of cardiac MRI as a part of the diagnosis would have provided important diagnostic information such as detailed assessment of myocardial edema and a more definitive exclusion of myocarditis as the cause of the cardiomyopathy. In addition, as this patient did not undergo invasive hemodynamic manipulation, measurements of the patient's left ventricular filling pressures and confirmation that there was not a dynamic left ventricular outflow obstruction cannot be made with complete certainty. Finally, the follow-up period for this patient covered only the acute hospital stay, longer term follow-up data would be very useful to demonstrate sustained recovery of a patient who has had an episode of Takotsubo cardiomyopathy and will there will be no recurrence of Takotsubo cardiomyopathy.

Conclusion

In summary, this case makes important contributions to the medical literature. It identifies an unusual and rare presentation of Takotsubo cardiomyopathy in a different demographic group for the syndrome, enhances the geographical recognition of this syndrome, illustrates the utility of repeated echocardiographic monitoring in establishing the diagnosis and in making decisions about management of Takotsubo cardiomyopathy, and demonstrates the importance of including Takotsubo cardiomyopathy in the differential diagnosis for any woman who presents with heart failure in the months before or after giving birth. In addition, this case also demonstrates the successful use of standard heart failure medications to achieve a rapid return to normal function and to alleviate the plaintiff's symptoms.

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