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Case Report

Triple threat: Anesthetic approach to IVF twin gestation, pre-eclampsia and peripartum cardiomyopathy in caesarean section

Ranganath Laxman Channappagoudar [a,*], Chaitra Venkatesh Konappanavar [a], T. K. Darshini [a], Akanksha Priya [a]

[a] *S. Nijalingappa Medical College and H.S.K Hospital, Navanagar, Bagalkote, Karnataka, India*

ABSTRACT

Peripartum cardiomyopathy (PPCM) is a rare idiopathic condition frequently presenting with heart failure secondary to left ventricular systolic dysfunction towards the end of pregnancy or in the months following delivery. Can present as acute life-threatening pulmonary oedema in late pregnancy or early puerperium, its diagnosis is mainly by exclusion of other causes of cardiac dysfunction. Anaesthetic management of such cases poses a challenge; due to the increased risk of various perioperative complications. Morbidity is high due to the reduced physiological reserve in pregnancy. PPCM and severe pre-eclampsia can co-exist and their clinical presentation may overlap, making the diagnosis more difficult and often delayed, with potentially devastating consequences. We report the successful anaesthetic management of lower segment caesarean section in a patient with PPCM with preeclampsia of IVF twin gestation.

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1. Introduction

Peripartum cardiomyopathy (PPCM) is a rare form of heart failure occurring late in pregnancy or shortly after delivery, characterized by acute heart failure without prior cardiac dysfunction. Its etiology remains unclear, potentially involving viral infections and hemodynamic stress [1,2]. Symptoms often overlap with other pregnancy complications, making diagnosis and management more difficult [3]. Key risk factors include advanced maternal age, multiple gestations, and pre-eclampsia [4,5]. Effective management necessitates a multidisciplinary approach to optimize maternal and fetal outcomes [6,7]. This case report details a 30-year-old primigravida with PPCM, illustrating the complexities in managing this condition during pregnancy and delivery.

2. Case Presentation

A 30-year-old primigravida at 31.3 weeks of gestation with a dichorionic-diamniotic (DCDA) twin pregnancy with (In Vitro Fertilization) IVF conception, developed gestational hypertension in the third trimester, which was well controlled with Tab Labetalol. The patient presented with complaints of growing fatigue, troubled breathing, and severe dyspnoea on minimal exertion.

* *Corresponding author*. E-mail address: drranganath53@gmail.com (R. L. Channappagoudar)
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On examination, the patient exhibited a systolic murmur and bilateral basal crepitations with a blood pressure of 180/110 mmHg, alongside She had no prior history of hypertension, asthma or other co-morbidities and had not been on any medications before. Initial workup revealed non-specific ST-T wave changes on electrocardiogram (ECG) and echocardiographic findings indicative of peripartum cardiomyopathy (PPCM), including:

Left ventricular ejection fraction (LVEF): 35%, Left ventricular diastolic dysfunction: Grade 3, Dilated right ventricle and right atrium, Mild mitral regurgitation (MR).

She was started on medical therapy with Tab Labetalol (100 mg three times daily), Tab Furosemide (40 mg), and Tab Ecospirin (150 mg). Although she was discharged with medical management, she later presented with worsening symptoms: shortness of breath, orthopnea, chest pain, and peripheral oedema.

Physical examination at this time showed jugular venous distension, peripheral oedema, a loud S3 heart sound, a systolic murmur, and bilateral basal crepitations. Her oxygen saturation was 88% on room air and 92% on 12 liters of oxygen. Her respiratory rate was 31 breaths per minute, and arterial blood gas (ABG) analysis revealed respiratory acidosis.

Repeat echocardiography showed: Ejection fraction: 30-35%, Global hypokinesia, Moderate MR, Mild pericardial effusion, Moderate pleural effusion.

An urgent caesarean section was planned due to non-reassuring fetal heart rate. Preoperatively, her pulse rate was 112 beats per minute, with a non-invasive blood pressure (NIBP) of 130/80 mmHg. Informed consent was obtained after discussing the risks and prognosis with the patient and her family. The patient was wheeled into the operating theatre in a left lateral position and on continuous oxygen therapy. General anaesthesia was planned due to the emergency nature of the surgery, anticoagulation status, and severe left ventricular systolic impairment. Standard monitoring was initiated, including heart rate, NIBP and SpO2. An 18-gauge peripheral IV cannula was inserted, with the table tilted to left lateral position. Left radial artery was cannulated under local anaesthesia (LA). Central right internal jugular cannulation was also performed under LA. Rapid sequence intubation done with Inj Etomidate 20mg IV, Inj Fentanyl 75mcg IV. Endotracheal intubation was facilitated with Inj Atracurium (30 mg IV) and confirmed by auscultation and EtCO2 monitoring. Hemodynamic parameters stabilized with and the invasive arterial blood pressure (IABP) was 118/76 mmHg. Saline boluses of 30ml were administered to maintain adequate preload. Anaesthesia was maintained with isoflurane and oxygen. Saturation was kept between 97-99%. After the delivery of the twin babies, an infusion of oxytocin (20 units in 500 ml normal saline) was started. Both babies were intubated due to respiratory distress.

Postoperatively, patient was electively ventilated and transferred to the ICU on ventilatory support. Inj.Furosemide 40mg BD and Infusion Nitroglycerin infusion was titrated in doses of 0.5-8 microgram/kg/min to maintain stable hemodynamics which was gradually tapered off. She was successfully weaned off the ventilator and extubated 12hours later. Post-extubation, the patient was conscious, oriented, and maintaining SpO2 of 97%, NIBP was 110/70 mmHg. She was discharged to the ward on the 6th postoperative day with stable hemodynamics and was prescribed diuretics, and beta-blockers. Both the newborn were successfully weaned from ventilator and discharged after 40days.

3. Discussion

Peripartum cardiomyopathy (PPCM) presents a significant challenge in obstetric anaesthesia, requiring careful management to ensure the safety of both mother and child.

Echocardiography is essential for diagnosing PPCM, assessing left ventricular ejection fraction (LVEF), and ruling out other structural heart diseases. **A**pproximately 15% of PPCM cases have genetic variants similar to those in nonischemic dilated cardiomyopathy. Genetic testing is recommended in most cases.

PPCM is characterised by the onset of acute congestive heart failure without any demonstrable cause in the last trimester of pregnancy or within the first six months after delivery [1]. The diagnostic criteria include: (1) development of heart failure in the last month of pregnancy or within five months postpartum, (2) absence of pre-existing cardiac dysfunction, (3) absence of determinable cause of cardiomyopathy, and (4) left ventricular systolic dysfunction demonstrated by echocardiographic criteria [2].

The overlap between PPCM and severe pre-eclampsia symptoms can complicate timely diagnosis. The patient initially presented with gestational hypertension, which later progressed to symptoms suggestive of heart failure. This progression underscores the importance of maintaining a high index of suspicion for PPCM in pregnant women with cardiac symptoms, especially those with pre-existing hypertensive disorders [3]. The differential diagnosis between PPCM and other pregnancy-related cardiac conditions can be challenging, requiring comprehensive clinical evaluation [4].

In this case, the patient exhibited features such as chest pain, systolic murmurs, and dyspnoea, which suggested acute congestive heart failure. The echocardiographic findings of reduced ejection fraction (30-35%), global hypokinesia, and valvular regurgitation were key in establishing the diagnosis of PPCM [5]. The deterioration of the patient's condition despite initial medical management highlights the potential for rapid progression in PPCM cases, necessitating close monitoring and readiness for urgent intervention [6].

While the exact aetiology of PPCM remains elusive, various factors have been hypothesised, including viral, autoimmune, and hemodynamic stress of pregnancy [7]. Risk factors for PPCM include maternal age over 30 years, multiparity, eclampsia, and obesity [8]. Our patient had underlying risk factors such as advanced maternal age, pre-eclampsia, IVF conception, and twin gestation, along with clinical features consistent with PPCM.

3.1. Medical management

Treatment aligns with heart failure protocols, emphasizing:

- Beta-Blockers: Safe during pregnancy and breastfeeding.
- Hydralazine and IsosorbideDinitrate: Considered safe during pregnancy.
- Diuretics: Use cautiously to avoid dehydration and electrolyte imbalances.
- ACE Inhibitors/ARBs and Mineralocorticoid Receptor Antagonists are generally avoided during pregnancy due to potential teratogenic effects

3.2. Anaesthetic management

The choice of anaesthesia for caesarean delivery in PPCM patients is crucial and should aim to optimise preload and afterload while maintaining myocardial contractility [9]. NeuraxialAnesthesia:generally the preferred choice for cesarean delivery. Provides sympathetic blockade, reducing afterload and preload, which can benefit patients with heart failure. General Anesthesia indicated in cases of cardiopulmonary decompensation requiring intubation or if there are contraindications to neuraxialanesthesia, such as ongoing anticoagulation therapy, severe thrombocytopenia, or the patient's refusal of neuraxialanesthesia. In this case, general anaesthesia was chosen due to the urgent nature of the surgery and the severity of PPCM [10]. The use of invasive haemodynamic monitoring allowed for precise control of the patient's cardiovascular status throughout the procedure [11]. The careful titration of anaesthetic agents (Fentanyl and Etomidate) and the use of low-dose isoflurane for maintenance demonstrate the balance required between providing adequate anaesthesia and avoiding myocardial depression. The goal is to maintain adequate systemic perfusion without overly increasing afterload, which could further compromise cardiac function. The use of small fluid boluses (30 ml saline) to maintain preload demonstrates the cautious approach to fluid management required in PPCM patients.

Table 1. Hemodynamic changes peripartum and plans for mitigation [12].

Hemodynamic issue	Possible consequences	Plan
↑ Catecholamines (attributable to pain and anxiety)	↑ Tachycardia and arrhythmias	Avoid sudden alterations in heart rate and rhythm with neuraxialanesthesia
↓ Systemic vascular resistance (attributable to neuraxialanesthesia, pregnancy hormones, and hemorrhage)	↓ Coronary perfusion from decreased aortic diastolic pressure and increased LV end-diastolic pressure	Control sudden decreases in afterload (systemic vascular resistance) with appropriate use of vasopressorsControl sudden decreases in afterload (systemic vascular resistance) with appropriate use of vasopressors
↑ Cardiac output must increase through labor and delivery to accommodate the expected autotransfusion (preload changes	↑ Heart failure	Support the myocardium with inotropic medications or VA ECMO Diuresis as needed
↑ Pulmonary blood flow	↑ Pulmonary pressure if pulmonary vascular resistance cannot decrease↑ Pulmonary pressure if pulmonary vascular resistance cannot decrease	Provide pulmonary vasodilators Control sudden changes in blood volume with diuresis
↓ Oncotic pressure	↑ Pulmonary edema	Diuresis as needed

3.3. Postoperative care

The decision to keep the patient intubated and transfer to the ICU reflects the high-risk nature of PPCM and the need for close monitoring in the immediate postoperative period. The gradual weaning of ventilatory support allowed for a controlled transition to spontaneous breathing and haemodynamic stability.

3.4. Long-term management

The discharge medications (diuretics and beta-blockers) are consistent with current guidelines for managing heart failure in PPCM. However, the management of PPCM extends beyond the immediate perioperative period. Ongoing cardiology follow-up is crucial, as some may experience improvement in cardiac function over time, while others may require long-term management [13].

3.5. Multidisciplinary approach

The successful management of this case required coordination between obstetricians, anaesthetists, cardiologists, and critical care specialists. This multidisciplinary approach is essential in managing the complex needs of PPCM patients and optimising outcomes for both mother and baby.

While this case had a favourable outcome, it raises important questions about the management of future pregnancies in women with a history of PPCM. Current evidence suggests that subsequent pregnancies carry a significant risk of PPCM recurrence and potential worsening of cardiac function. Counselling about these risks and close monitoring in any future pregnancies would be crucial.

Extracorporeal Membrane Oxygenation (ECMO) is a critical last-line support for acute respiratory failure, ventricular failure, or cardiovascular decompensation.

Early ECMO intervention during maternal cardiac arrest has proven lifesaving, with success rates of 87.7% for ECMO-assisted resuscitations compared to 58.9% without it. ECMO use in pregnancy most commonly addresses conditions such as adult respiratory distress syndrome, cardiac failure, pulmonary hypertension, and amniotic fluid embolism. Early deployment of an ECMO team, along with pre-insertion of placeholder sheaths for rapid cannulation, is essential to ensure prompt intervention when necessary [12].

Table 2. Long-term prognosis after peripartum cardiomyopathy [14,15].

1. Recovery of Heart Function:
Many women with PPCM experience partial or complete recovery of heart function over time, particularly with prompt diagnosis and appropriate management. Some may experience persistent heart failure or reduced ejection fraction.
2. Recurrence Risk in Future Pregnancies:
Risk of Recurrence: The risk of recurrence in future pregnancies varies but is generally estimated to be between 20-30%. This risk is higher if the individual had a poor recovery from the initial episode, if they had a low ejection fraction (less than 35%), or if they were diagnosed with severe PPCM.
Managing Recurrence Risk: Women with a history of PPCM should be closely monitored during any future pregnancy. Multidisciplinary care involving a cardiologist, obstetrician, and other specialists is essential. Early detection of recurrence is key to preventing complications.
3. Impact on Future Pregnancies:
Women who have fully recovered or have only mild residual heart damage may be able to safely have additional pregnancies, though the risks need to be carefully weighed.
For women with persistent heart dysfunction, further pregnancies could be associated with an increased risk of worsening heart failure, preterm labor, and other complications like gestational hypertension.
4. Management in Future Pregnancies:
A careful assessment of heart function before conception is essential. Pregnancy could place increased stress on the heart, and women with significant left ventricular dysfunction may be advised to avoid pregnancy.
Medications: Some medications used in treating PPCM, such as ACE inhibitors and certain diuretics, are contraindicated in pregnancy. These may need to be discontinued before conception.

4. Conclusions

This case report illustrates the successful management of a complex PPCM case, emphasizing the importance of early recognition, appropriate anaesthetic technique, and multidisciplinary care in achieving favourable outcomes. The management of PPCM requires a delicate balance between maintaining haemodynamic stability and providing adequate anaesthesia, all while preparing for potential complications.

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The datasets created and/or analyzed during the current study are not publicly available, but are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate
Not applicable.

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