

Case Report

# Perimortem Caesarean Section - Every Second Counts! A Report of Two Cases

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## A B S T R A C T

Perimortem caesarean section (PMCS), also referred to as resuscitative hysterotomy, is a caesarean section done during maternal cardiac arrest with the ultimate goal to assist maternal resuscitation with a good foetal outcome. Here, we present a report of two cases of PMCS performed in the setting of maternal cardiac arrest in a tertiary care hospital. Both the mothers had underlying cardiac disease and the cause of cardiac arrest was pulmonary embolism in first case and arrhythmia in the other. When there was no return of spontaneous circulation (ROSC) by 5 minutes of resuscitation, PMCS was done at the place of the cardiac arrest. The patients were made supine, left uterine displacement was done and cardio-pulmonary resuscitation (CPR) was continued. The abdomen and the uterus was opened by a scalpel via a midline vertical incision. The baby was handed over to the paediatrician. CPR was continued while the surgery was taking place. The mothers could not be revived in any of the cases, but babies were resuscitated well and later discharged in healthy condition. Clinicians should be aware of the need of PMCS in case of cardiac arrest in pregnant women at or above 20 weeks of gestation.

**Keywords:** Perimortem Caesarean Section (PMCS), Maternal Cardiac Arrest, Return of Spontaneous Circulation (ROSC), Hysterotomy

## Introduction

Maternal cardiac arrest during the peripartum period is a rare event with an estimated incidence of 1/36,000 pregnancies.<sup>1</sup> Cardiac arrest in pregnancy is a unique scenario in resuscitation and can occur due to various conditions. The most common causes of maternal cardiac

arrest requiring Perimortem caesarean section (PMCS) are trauma, pulmonary embolism, cardiac causes, sepsis, eclampsia and other complications during pregnancy. The outcome, primarily for the mother but also for the foetus, depends on prompt and effective resuscitation. Resuscitation of a pregnant woman differs from that of a non-pregnant woman. Thus providers of maternal care,

including physicians, should know the key highlights in managing such patients.

PMCS, sometimes referred to as resuscitative hysterotomy, is a caesarean delivery in the setting of maternal cardiopulmonary arrest, primarily used to assist maternal resuscitation (in the interest of maternal survival). Foetus may also be saved in the process, though that is not the primary aim.

Here, we present a case report of two PMCS performed in the setting of maternal cardiac arrest in a tertiary care hospital in New Delhi. While these case reports do not characterise ideal care, they do provide valuable scenarios for discussion of the salient features of perimortem caesarean section.

## Case Reports

### Case 1

A 38-year-old woman, Gravida 4 Para 3 Live 3 at 30 weeks period of gestation (POG) with a known case of RHD with moderate MS and severe MR was admitted with NYHA class 3. On examination, it was found that the patient had tachypnea, SpO<sub>2</sub> of 98% on room air, and crepitation at bilateral lung bases. Pulse rate was 110 beats per min regular and blood pressure of 100/60 mmHg. Pallor was present, JVP was not raised, and pedal oedema was absent. ABG was suggestive of acute respiratory alkalosis. The ECG showed sinus tachycardia. Chest X-ray showed bilateral haziness in lower zones suggestive of pulmonary oedema. Repeat echocardiography showed RHD with severe MS, moderate MR, mild AR, moderate TR, and pulmonary HTN with an ejection fraction of 60%. The patient was admitted to Obstetrics HDU and managed conservatively with multidisciplinary approach.

At POG of 32 weeks, the patient had an episode of sudden onset breathlessness associated with shivering, followed by a cardiac arrest. ECG done just prior to the cardiac arrest showed S1Q3T3 pattern – typical of pulmonary embolism. The maternal cardiac arrest team (anaesthetist, obstetrician and paediatrician) was activated, the patient was made supine, left uterine displacement was done and cardiopulmonary resuscitation (CPR) was started. The decision for Perimortem caesarean section (PMCS) was taken instantly when there was no return of spontaneous circulation (ROSC) by 5 minutes of resuscitation. The PMCS was done concurrently with the CPR at the place of the cardiac arrest. PMCS was done with the minimal requirement of scalpel only. The abdomen was opened via a midline vertical incision and the uterus was opened via a vertical incision. It was a cumulative effort of the obstetricians, the anaesthetists, and the neonatologists. A male baby (weight 2010 gm) was delivered who did not cry immediately after birth. Apgar scores of the baby at 1 min, 5 min and 10 min were 1, 5, and 7 respectively. CPR to the mother was continued for 12

cycles according to the ACLS protocol, but she could not be revived. The baby was intubated and was admitted to the NICU. He was discharged after a month in a stable condition and is presently doing well at 2 years of age.

### Case 2

A 21-year-old woman, Gravida 4 Abortion 3, at 36 weeks and 4 days period of gestation with a known case of atrial septal defect (ASD)/ pulmonary artery hypertension (PAH) was referred from a district hospital to the Gynaecology emergency with complaints of breathlessness for last 4-5 days. On examination, she had tachypnea with a respiratory rate of 36 per minute, SpO<sub>2</sub> of 88% on room air, bilateral crepitation at lung bases, pulse rate of 122 bpm, and blood pressure of 100/60 mmHg. She perceived adequate foetal movements. She was admitted to the Cardiac Care Unit where a diagnosis of ASD/ PAH/ bilateral lower zone pneumonia with Type 2 respiratory failure was made. She was investigated thoroughly and chest X-ray showed bilateral peripheral fluffy opacities. CT scan of the thorax showed an enlarged heart with dilated right heart chambers – findings that were concomitant with PAH and large ASD. 2D echo was done showing ostium secundum ASD (25 mm) with bidirectional shunt/ severe PAH/ dilated right atria and right ventricle. The treatment provided included oxygen, injectable antibiotics, diuretics and low molecular weight heparin prophylaxis. She was managed conservatively and monitored with multidisciplinary approach.

Immediate termination of pregnancy was planned via emergency lower segment caesarean delivery in consultation with an anaesthetist in view of maternal decompensation.

Before the patient could be shifted to the operation theatre, she developed ventricular tachycardia followed by cardiac arrest. The patient was made supine, left uterine displacement was done and CPR was started as per ACLS protocol. The decision for PMCS was taken instantly when there was no ROSC by 5 minutes of resuscitation. PMCS was done at the place of the cardiac arrest itself, with the minimal initial requirement of a scalpel only. The abdomen was opened via a midline vertical incision, and the uterus was also opened via a vertical incision. CPR was continued while the surgery was taking place. CPR was given for a total of 12 cycles following the ACLS protocol, but the mother could not be revived. A baby boy (weight 1830 gm) was delivered who did not cry immediately after birth. He was intubated and resuscitated and had an APGAR of 2, 4, and 8 at 1 min, 5 min and 10 min respectively. He was shifted to the NICU. He was extubated after 48 hours and discharged within a week in a healthy condition. He is presently doing well at 6 months of age.

### Outcome and Follow-Up

In both cases, the mothers had an underlying cardiac disease

and the cause of cardiac arrest was pulmonary embolism in first and fatal arrhythmia in another. The mothers did not survive the cardiac arrest, but the babies did. The babies initially developed birth asphyxia, but eventually, they were discharged in healthy condition. The long-term follow-up of the babies was satisfactory. In both cases, the husband and other family members were explained about the case and were given psychological support.

## Discussion

One of the oldest surgical procedures, perimortem caesarean section, can be traced back to ancient civilizations. In 239 BC, Scipio Africanus was reportedly the first survivor of a postmortem caesarean section. In 1588, a Swiss pig-gelder named Jacob Nufer delivered his son by caesarean section, and this is noteworthy because his wife also survived the procedure. There is mention of PMCS in texts of mythology and folklore of both eastern and western cultures, as well as in medical textbooks from the 14th through the 16th centuries.<sup>2</sup> Although first performed to free the dead child from the dead mother so that they could be buried separately, the perimortem caesarean section was later performed on dying mothers in a desperate attempt to save the infant and the mother.<sup>2-4</sup> Now, it has evolved to a procedure that is done also to aid in maternal resuscitation. In cases when the resuscitation does not rapidly result in ROSC, PMCS appears to improve the outcome of maternal cardiac arrest.<sup>5</sup>

The concept of PMCS was introduced by Katz et al. in 1986.<sup>2</sup> The earliest large scale systematic reviews were done by Weber et al. and Katz et al.<sup>2,6</sup> Katz et al. summarised the successful cases of postmortem caesarean reported between 1900 and 1985. 93% (57 of 61) of these neonates were born within 15 minutes of maternal death, and only two were found to have neurologic deficit. In fact, in the cases reviewed by Katz, he initially focused on infant survival and found that 69% of infants survived when PMCS was performed within 5 minutes. Additionally, there was a 100% (42 of 42) absence of neurologic injury among those newborns delivered less than 5 minutes from the time of maternal death.

However, when Katz et al. explored maternal outcomes, they found that hypoxic brain injury only occurred if PMCS was performed after 6 minutes. After these systematic reviews, since 1992, the American Heart Association guidelines for perimortem CS have become a standard of care.

Prior to 1986, 188 cases were reported. From 1986 to 2004, only 38 additional cases were reported in the United States, and a second review between 1980 and 2010, which partially overlapped the first, identified 94 cases.

Even when performed, delay in interval between the decision to deliver and actual delivery compromises the outcome of

both the mother and the baby. The rationale for this time scale is that the pregnant women become hypoxic more quickly than non-pregnant women, and irreversible brain damage can ensue within 4-6 minutes.

In the supine position, aortocaval compression can occur for singleton pregnancies starting at approximately 20 weeks of gestational age or when the fundal height is at or above the level of the umbilicus.<sup>7</sup> During maternal cardiac arrest, the gravid uterus impairs venous return and cardiac output (60%) secondary to aortocaval compression. Delivery of the foetus and placenta by PMCS reduces oxygen consumption, improves venous return and cardiac output, facilitates chest compressions and makes ventilation easier.

Resuscitation of the pregnant woman is the first priority because it may lead to increased survival of both the mother and the foetus. Thus, it is recommended that if there is no ROSC to correctly performed CPR within 5 minutes, a PMCS should be done to relieve aortocaval compression in women over 20 weeks of gestational age, or when the uterus is felt at or above the level of the umbilicus.<sup>5</sup> In the meantime, manual left lateral uterine displacement (LUD) effectively relieves aortocaval pressure and can be stopped immediately prior to incision.

The recent recommendations from the Royal College of Obstetrics and Gynaecology<sup>8</sup> state that PMCS should be undertaken to assist maternal resuscitation, even if the foetus is already dead and there is no need to check foetal viability before PMCS. PMCS should not be delayed by moving the woman. It should be performed where the maternal cardiac arrest has occurred and resuscitation is taking place. PMCS can be performed by a scalpel with a no. 10 blade, being the only essential equipment required.<sup>8</sup>

To ensure that there are no delays in executing a PMCS when indicated, the equipment necessary should be immediately available on the resuscitation trolley. With no circulation, blood loss is minimal, and no anaesthetic is required. Basic aseptic measures, such as pouring antiseptic solution over the woman's abdomen prior to incision, may be considered. The best incision may be a midline vertical abdominal incision from xiphoid to the pubis. Subcutaneous tissue should be cut through to get to the peritoneal wall. After blunt dissection of the peritoneum using fingers, the uterus should be delivered. Its lower half should be cut vertically to avoid the placenta and the incision should be extended upwards until the baby is reached. After delivering the baby, the umbilical cord should be clamped and cut. Packing or towels should be placed in the opened uterus and abdomen. Further closure of the incision depends on the maternal response resuscitative effort CPR should be continued on the mother as per ACLS protocol until ROSC is achieved. Following successful resuscitation after birth, the patient should be promptly transferred to an operating

room for closure under anaesthesia, sedation, and control of haemorrhage by completing the operation. Also, the patient should receive antibiotic prophylaxis.<sup>9</sup>

It further goes on to say that a perimortem caesarean section tray should be available on the resuscitation trolley in all areas where maternal collapse may occur, including the accident and emergency department.<sup>8</sup>

Needless to say, early delivery is associated with better maternal and neonatal survival.<sup>2,10</sup> Most series of postmortem caesarean show the most favourable results with deliveries occurring less than 5 minutes from the time of maternal death but present significant logistic challenges to the healthcare facility. There are isolated reports of neonatal survival without neurologic deficit when delivery is delayed by as much as 25 minutes.<sup>11,12</sup> Maternal survival following perimortem CS, varies greatly among the different studies, ranging between 34% and 54%.<sup>13</sup>

The AHA 2020 guidelines state that delivery should ideally be accomplished within 5 minutes of the time of arrest, and to achieve this, preparation for perimortem caesarean delivery should be started while initial BLS and ACLS interventions are being performed. A multidisciplinary team including obstetricians, intensivists, neonatologists, medicine, and emergency specialists should be involved at an early stage. No time delay should occur while trying to find foetal heart by any means (stethoscope, Doppler, or sonography).<sup>5</sup> Thus providers of maternal care should be aware of the basic knowledge concerning maternal cardiac arrest and PMCS.

Although medico-legal issues remain a concern, and even more so in India, it should not be a deterrent to perform this procedure. The doctrine of 'the best interests of the patient' would apply to the conduct of this procedure being carried out without consent.<sup>8,14</sup> Despite being an invasive procedure, in the emergency setting, perimortem CS should not be delayed in an attempt to obtain consent.

## Conclusion

Cardiac arrest can occur in the obstetric ward as well as in other wards and ICUs. Performing the PMCS timely in both of our cases saved the lives of the babies. The clinicians must be aware of the need of PMCS in case of cardiac arrest in pregnant women at or after 20 weeks of gestation.

**Conflict of Interest:** None

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