

**Case Letter**

# Perimortem caesarean section: A case report of an out-of-hospital arrest pregnant woman

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## Dear editor,

In July 2015, a 39-year-old gravida 2, para 0 lady at 35 weeks' gestation was found collapsed at home and sent to the emergency department (ED) by ambulance. She had a background of chronic hypertension on anti-hypertensives and aspirin, but repeatedly refused inpatient treatment for her uncontrolled hypertension. She had received pre-hospital cardiopulmonary resuscitation (CPR) for 17 minutes en route to the ED, with no shock delivered by the automated external defibrillator on the ambulance. A resuscitation team consisting of two specialist emergency physicians and emergency nurses were on stand-by in the ED. One obstetrician and two pediatricians were summoned prior to the patient's arrival.

The patient was in asystole on arrival to the ED, with a term uterus and no apparent vaginal bleeding. Advanced cardiac life support (ACLS) was immediately commenced by the ED resuscitation team. Perimortem Caesarean section (PMCS) was jointly decided by the ED and performed by the obstetrician 14 minutes after the patient's arrival [down time 35 minutes with no return of spontaneous circulation (ROSC)], and the baby was delivered 4 minutes later. Intraoperatively a retroperitoneal blood clot of approximately 1,000 mL was found, with no intrauterine clot, and the placenta was delivered intact. The estimated blood loss was 1,500 mL.

The newborn male baby was flaccid with no spontaneous breathing or detectable heart rate. His Apgar score was 0 at birth. Active resuscitation was immediately performed by the pediatric team with no interval ROSC. The baby was certified dead 73 minutes after delivery.

Simultaneous maternal resuscitation was continued

throughout. Transient ROSC was noted at 30 minutes post-delivery, but thereafter the rhythm was largely pulseless electrical activity (PEA) with transient episodes of ROSC. A total of 8 units of whole blood were transfused. The patient was transferred to the intensive care unit (ICU) after approximately 3 hours of resuscitation in the ED. On ICU admission, her blood pressure was 66/39 mmHg on dopamine infusion, but she developed PEA again and failed resuscitation. She was certified dead 4 hours and 18 minutes after hospital arrival. The clinical diagnoses were pre-eclampsia related complication and placenta abruptio. Post-mortem examination of the placenta showed acute atherosclerosis, consistent with pre-eclampsia, as well as chorangiomas.

## DISCUSSION

Postmortem Caesarean section dates back to the Roman times for reasons such as funerals and baptisms as documented in ancient and Middle Ages literature. It was often performed on women after they died in childbirth.<sup>[1]</sup> Its role in modern obstetric resuscitation was established in the 1980s<sup>[2]</sup> with emerging reports of improved success of maternal resuscitation<sup>[2-4]</sup> and infant survival<sup>[4,5]</sup> following PMCS, including one case from Hong Kong,<sup>[5]</sup> and awareness of the specific physiological differences in pregnant women resulting in difficulties in maternal resuscitation,<sup>[6-9]</sup> namely: (1) Aortocaval compression by the gravid uterus from 20 weeks' gestation onwards, reducing venous return, cardiac output, and efficacy of chest compressions during cardiopulmonary resuscitation; (2) Difficulties in ventilation caused by reduced maternal respiratory buffer reserve, increased oxygen consumption, diaphragmatic splinting by the gravid uterus, difficulty in intubation

and increased risk of aspiration, and (3) Increased risk of hemorrhage from hyperdynamic circulation.<sup>[6-9]</sup>

The uterus should be manually displaced to the left during maternal CPR, or by means of a tilted table.<sup>[4,6-8]</sup> Delivery of the fetus empties the uterus, thus improving the aforementioned physiologic changes.

Katz et al<sup>[2]</sup> in their case series of 38 PMCSs, reported ROSC immediately after delivery in the 12 out of 20 mothers, who had their outcome documented, but the findings were subject to publication bias. Einav et al<sup>[3]</sup> also demonstrated maternal survival benefit with PMCS in 31.7% of the 94 PMCS cases reviewed, and there was no case of worsened maternal status after the delivery.

In our patient, prior to PMCS no ROSC was documented, and after PMCS there had been several, despite brief, periods of ROSC during the course of resuscitation, reflecting the possible benefit resuscitative efforts with the delivery.

Our patient had a clear antenatal history and an obviously term uterus at the time of arrest. If gestational age is difficult to ascertain in the emergency situation, a simple method is when the fundus is at or above the level of the umbilicus, there would be aortocaval compression and thus PMCS is indicated.<sup>[6-9]</sup>

While PMCS may favor neonatal survival, as timely delivery reduces the risk of permanent neurological damage from anoxia,<sup>[9]</sup> the primary aim of the procedure is to empty the uterus to aid maternal resuscitation<sup>[3,6-7,9]</sup> and not fetal survival, and fetal monitoring should not be performed during CPR.<sup>[6,8-9]</sup>

The resuscitation of the newborn in our case, despite an APGAR score of 0 with no return of spontaneous circulation, was longer than the recommended 10 minutes.<sup>[10]</sup> In such an unexpected, sudden and tragic scenario, we performed simultaneous resuscitation of both the mother and the newborn, rather than that of mother only, for the remote possibility of a favorable outcome. Moreover, the father and family needed time to understand and accept the situation.

After managing the patients in our case and reviewing the recommendations in the literature<sup>[10]</sup> we would suggest terminating resuscitative efforts of the baby earlier should a similar situation occur in the future.

Current resuscitation and obstetric guidelines recommend PMCS to be considered within 4 minutes,<sup>[4,6-8]</sup> and delivery achieved within 5 minutes<sup>[3-4,7-8]</sup> of unsuccessful maternal resuscitation. This is based on the assumption of cessation of irreversible brain damage occurring within 4–6 minutes of cessation of cerebral

blood flow.<sup>[11]</sup> This time frame was under scrutiny in 2005 by the authors who advocated the 4-minute rule.<sup>[12]</sup> They reported 25 infant survivals among the 38 reviewed PMCS cases, 7 of which were delivered more than 15 minutes after maternal cardiac arrest.<sup>[12]</sup> Other literature also reported successful maternal and/or neonatal outcomes of PMCS more than 15 minutes from maternal arrest, especially at more advanced gestational ages beyond 30 weeks.<sup>[5,13-14]</sup> However, the longer the delay from cardiac arrest to PMCS, the worse the maternal and fetal prognosis.<sup>[13]</sup>

When the mother is obviously non-survivable, it is reasonable to directly proceed to PMCS, especially when the fetus is viable. For an unwitnessed arrest or prolonged pulselessness, as in our patient, PMCS could have started immediately.<sup>[6,9]</sup> In actual practice, delivery within 5 minutes of maternal arrest is seldom achieved.<sup>[9,13]</sup> Possible sources of delay included transporting the woman to theater, waiting for the equipment and personnel, time consuming antiseptic procedures and fetal monitoring.<sup>[4,8]</sup> PMCS should be performed at the site of resuscitation, and can be done with a scalpel and a quick pour of antiseptic on the abdomen. The choice of incision, vertical or Pfannenstiel (horizontal), should be one the PMCS operator is most familiar with,<sup>[8-9]</sup> but the former may provide faster abdominal access<sup>[15]</sup> and abdominal view, which may guide the diagnosis and/or treatment of the course of arrest.<sup>[9]</sup> In our patient a vertical incision was chosen, and a retroperitoneal clot was found during the procedure, giving a provisional diagnosis of placenta abruptio.

During the PMCS procedure, full CPR efforts should be continued.<sup>[6-9]</sup>

## CONCLUSION

In conclusion, PMCS is beneficial to resuscitation of the pregnant patient (beyond 20 weeks' gestation) in cardiac arrest, should be prepared for early in the course of resuscitation, and have delivery preferably achieved within 5 minutes of arrest. While multidisciplinary involvement may eventually be necessary, it should not defer this potentially life-saving procedure being performed right in the ED.

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