

Case Series

Perimortem Caesarean Section in a Reference Hospital in Southern Nigerian: Case Series

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ABSTRACT

Perimortem caesarean section (PMCS), also called resuscitative hysterotomy is not a common procedure as maternal cardiac arrest is rare, yet it could be a live-saving emergency surgery for both mother and fetus when optimally carried out. *Case series*: We report 2 cases of perimortem caesarean sections carried out in emergency unit of the Nigerian Navy Reference Calabar, Nigeria following maternal cardiac arrest. The Primary pathology in both cases was complications of hypertensive disorder of pregnancy in unbooked patients. There were both maternal and neonatal mortality in the first case. The second case had a better outcome of a live baby (with good APGAR score) who was later discharged to the relatives, whereas the mother had a return of spontaneous circulation (ROSC) sustained for 3 days in the Intensive Care Unit before she was confirmed dead. The aim of this report is to stimulate thought and increased preparedness for this rare and challenging, yet life-saving procedure.

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INTRODUCTION

Perimortem caesarean section (PMCS) is not a common obstetric procedure, as maternal cardiac arrest is a rare event, occurring in approximately 1 in 12500 pregnancies.^[1-4] It is a therapeutic measure at the extreme limit of the emergency physician's range of practice, reserved for

situations which most emergency physicians will never face, and which those who do will experience likely once.^[5] Perimortem CS is usually indicated in cardiac arrest which could result from haemorrhage (45%), amniotic fluid embolism (13%), heart failure

(13%), anaesthetic complications (8%) and trauma (3%).^[1,6] The primary pathology in our series were due to complications of hypertensive disorders of pregnancy.

The rarity of maternal cardiac arrest and the relatively uncontrolled nature of the clinical situation mean that research evidence is understandably scarce.^[7] Evidence supporting the practice of PMCS is limited to case reports and case series. Review of 38 cases by Katz et al, revealed that PMCS performed within 4-5 minutes of maternal cardiac arrest is beneficial to both maternal and fetal survival at gestational age above 20 weeks.^[2] The review found that the procedure did not deteriorate maternal condition but rather improved return of spontaneous circulation (ROSC), hence the recent terminology, resuscitative hysterotomy which emphasizes maternal survival the primary aim of PMCS, and secondarily the fetus.

We report our first experience with PMCS in Nigerian Navy Reference Hospital, Calabar, Nigeria. Both were cases of maternal cardiac arrest (with viable fetuses) in O&G emergency unit of the hospital. There were both maternal and neonatal mortality in the first case. The second case had a better outcome of a live baby with good APGAR scores who was later discharged to the relatives, whereas the mother had a return of spontaneous circulation (ROSC) sustained for 3 days in the Intensive Care Unit before she was confirmed dead. Although it was not summarily a success story, the authors believed sharing the experience will add to the body of knowledge and stimulate thought and increased preparedness for this rare and challenging procedure.

CASE 1

Patient was a 31-year-old unbooked primigravida who presented to the emergency unit of the Nigerian Navy Reference Hospital Calabar, Nigeria at about 1400hrs. She was unconscious at presentation. The husband, who was the informant, reported she had seizure (which was generalized and tonic clonic in nature, lasting about 20 seconds and aborted spontaneously) about an hour before presentation and became unconscious about 30 minutes later.

She did not receive any form of antenatal care prior to presentation. She was not a known seizure disorder patient, and she had no family history of such. There was no history of any chronic or acute illness or trauma. She was not a known hypertensive.

Physical examination revealed an unconscious patient with Glasgow coma scale of 5/15. Temperature was 36.7°C. She had bilateral pitting leg edema up to the knee. Blood pressure was 213/145mmHg and pulse rate was 74 beats per minute. Heart sound heard were only S1 and S2. Respiratory rate was 34 cycles/minute, breath sound was vesicular, and SPO₂ at room air was 56%.

Abdominal examination revealed a gravidly enlarged uterus with symphysio-fundal height of 31cm, corresponding to estimated gestational age of 31 weeks. A singleton fetus in longitudinal lie and cephalic presentation was palpated. Fetal heart tone by hand-held doppler was 154 per minute, strong and regular. A vaginal examination done revealed a grossly normal vulva and vagina. Cervix was uneffaced, and cervical os closed. Examining fingers were not significantly stained.

Urgent urinalysis by dipstick revealed 3+ of proteinuria. Complete blood count, serum electrolyte and creatinine/urea, liver function test, and clothing profile were requested. Samples were taken but investigations not followed up due to the turn of events.

A working diagnosis of antepartum eclampsia with coma in an unbooked primigravida was made. The airway was secured with oropharyngeal tube, and she was placed on oxygen by nasal prongs at a flow rate of 5L per minute (SPO₂ was improved to 95%). Patient was placed on parenteral magnesium sulphate and anti-hypertensives. Intramuscular dexamethasone was also administered. Fluid input/output was kept. The paediatrician and the Special Care Baby Unit (SCBU) were notified. Relatives of the patient were counseled on findings and prognosis.

About 45 minutes on admission, patient was found to be making no respiratory efforts and pulse was not palpable, SPO₂ was 35%. Cardiopulmonary resuscitation (CPR) was commenced by the emergency team. The fetal heart

tone was 124 per minute. The obstetrician was invited

About 7 minutes after the commencement of CPR, there was no return of spontaneous circulation (ROSC). Fetal heart tone was present at 105 per minute. Consent was obtained from relatives for PMCS. Patient was wheeled into the emergency theatre adjoining the O&G emergency room and procedure was done (about 8 minutes from cardiac arrest) within 20 seconds while CPR was ongoing. Outcome was a live but asphyxiated female (APGAR score of 3 at delivery) neonate that weighed 1.2kg and was handed over to the neonatologist for resuscitation.

The CPR was discontinued after about 7 minutes of CPR following PMCS, and patient was confirmed dead at about an hour on admission. Patient relatives were counseled on outcome and body was dressed and moved to the morgue. The neonate also died in the SCBU at about 4 hours post-delivery, after all resuscitation efforts failed.

CASE 2

A 32-year-old unbooked gravida 3 para 2 with 2 living children. She presented at the emergency unit of the Nigerian Navy Reference Hospital, Calabar with altered consciousness at about 0900hrs. She had complained of severe throbbing headache few hours before she gradually became unconscious. She had no history of trauma or any known illness preceding the event. However, her second pregnancy was terminated at 28 weeks gestation due to severe pre-eclampsia. At presentation, her blood pressure was 210/130mmHg, pulse rate was 84 beats per minute, respiratory rate was 20 cycles per minute and SPO₂ was 95% at room air, urine was dark brown colored. Urgent urinalysis by dipstick showed 4+ proteinuria and red blood cells⁺⁺ were noted. Complete blood count, serum electrolyte and creatinine/urea, liver function test, and clothing profile were requested but investigations results were not ready before she developed cardiac arrest. The abdomen was gravidly enlarged with a uterine size of 32cm. A singleton fetus with a heart tone of 143 beats per minute which was strong and regular was recorded.

A working diagnosis of severe pre-eclampsia was made. An urgent brain CT revealed

massive intra-ventricular hemorrhage. About 30 minutes on admission, while stabilizing was ongoing, patient developed cardiac arrest. Cardiopulmonary resuscitation was commenced by the emergency team. The fetal heart tone was 134 per minute. Consent was obtained from relatives for PMCS which was carried out in the emergency theater within 5 minutes of maternal cardiac arrest. Outcome was a live but asphyxiated male neonate with APGAR score of 5 at 1minutes and 9 at 5 minutes of resuscitation. The baby weighed 1.7Kg. There was RSOC in the mother within 2 minutes of CPR post-delivery. She was intubated and ventilated mechanically. She was reviewed by a neurosurgeon who co-managed the patient in the ICU. The patient was confirmed dead after about 72hrs in the ICU. The fetus did well and was discharged to the family after about 3 weeks of nursing in the SBCU.

DISCUSSION

The challenges physician encounter when faced with maternal cardiac arrest with viable fetus(es) include: why and when to make decision for PMCS, the ethics of decision and consent; where, who and how to carry out the procedure? It is a chaotic situation with no luxury of time, space, and logistics, requiring timely decision and optimal action for any possible benefits.

The primary goal of PMCS is to improve maternal resuscitation and secondarily fetal salvage. Physiologically, pregnant women are likely to become hypoxic more rapidly than non-pregnant women because of higher oxygen demand.^[8] Additionally, the gravid uterus impairs venous return with aortocaval compression, reducing cardiac output by up to 60%.^[9] Emptying the uterus by delivering the fetus reduces compressive forces on the great vessels (thereby increasing cardiac preload) and reduces oxygen consumption. Also, emptying the uterus allows more effective maternal CPR and potentially more rapid ROSC.^[9]

Ideally, PMCS should be considered when, in maternal cardiac arrest, the standard algorithm for cardiopulmonary resuscitation (CPR) fails to restore spontaneous circulation after 4 minutes of arrest. Review by Katz et al, suggest that PMCS gives better outcome when performed within 4-

5minutes of maternal cardiac arrest^[2,10] Although some reviews of case reports have challenged the 4-5 minute rule by Katz, most agree that PMCS is beneficial to both mother and viable fetus, and the earlier initiated the more likely a better outcome.^[1] In our first case, the decision and consent was gotten after about 7 minutes of CPR and the procedure was completed within 20 seconds. This delay, possibly, may have contributed to the poor outcome. However, our patient presented in coma following several episodes of eclamptic seizures which may have resulted in cerebro vascular accident (CVA) resulting in fatal maternal outcome. The fetus was also preterm (31 weeks estimated gestational age), and possibly the morbidity associated with poor lung maturity at this stage may have equally contributed to the perinatal mortality. The better outcome in the second case could be attributed to an improved experience and preparedness resulting in a more speedily approach in accomplishing the procedure within 5 minutes of maternal cardiac arrest. This is in tandem with the 4–5-minute rule proposed by Kalz et al.

Although case reviews have suggested mutual benefit of PMCS to both mother and fetus, it still raises serious ethical challenge in view of maternal consent and autonomy. However, because PMCS appears to be a potentially life-saving intervention for the woman during cardiac arrest, it would fall under the traditionally understood emergency exception to the need for informed consent to treatment. Such exception to the necessity of informed consent requires three conditions be met: that the person be unconscious or lack capacity to consent, that a life-threatening injury or disease requiring immediate treatment be present, and that under such circumstances, a reasonable person would consent to the treatment.^[7] Our cases fulfilled the three conditions, and consent was obtained from the surrogate decision-makers, the patients' husbands. Nonetheless, this argument may not always be that simple in consideration of the dilemma of 'fetal consent' or more accurately, the consent of the child the fetus may become, (considering permanent neurological assault that may result from prolonged asphyxia in maternal cardiac arrest). Again, in situation where cardiac arrest results from a non-survivable insult to the mother, PMCS no longer confers benefit on the mother.

Also, the dilemma of consent or refusal by family or surrogate decision-maker, and the overriding decision power of the physician on the interest of the mother and fetus, possible outcome, and litigations are challenging issues. Interestingly, according to Drukker *et al* as at 2014, no civil or criminal charges have been labeled against physicians performing a perimortem CS without consent of the next of kin. On the contrary, two lawsuits have been filed in the USA for not carrying out the procedure timely.^[5] Such ethical bottlenecks did not arise in our cases.

Depending on cause, maternal cardiac arrest can happen anywhere: within the hospital (theater table, delivery suite, emergency unit, wards, or clinic) and outside (home, ambulance, trauma scene etc) the hospital setting. Where is the ideal place for carrying out PMCS? The standard algorithm for CPR should be initiated by trained personnel as soon as diagnosis of cardiac arrest is made. Following katz rule, PMCS should be carried out within 5 minutes of failure of ROSC following standard CPR. This may not allow time to move patient to obstetric theater for the procedure especially outside hospital setting. In hospital setting, the surgery should be performed in the delivery room or in the emergency unit.^[5,11] In rare circumstances, PMCS may be considered in the pre-hospital care setting but only when appropriately trained members of medical staff are available.^[12] In any case, no general anesthesia is required and bleeding is initially minimal.^[13] Our cases happened in the O&G emergency ward of the hospital, and PMCS was done in the emergency theatre adjoining ward. The procedure was not performed in the ward for convenience, respect to patient and family, and also consideration for other patients in the ward that might not stand the sight. However, very minimal time was wasted wheeling the patient into the adjoining emergency theatre while CPR was ongoing. No anesthesia was given, and there was no routine skin preparation.

The next challenges are: who should do PMCS, and how should it be done? What are the necessary requirements? Perimortem CS need not be performed by an obstetrician. An emergency physician or any trained medical personnel with basic knowledge and skill for caesarean section could do the procedure.^[13] Time is critical to both maternal and fetal survival, and so much protocol

is not required. In our case, an Obstetrician carried out the procedure assisted by the anesthesiologist who led the CPR team.

In PMCS, anesthesia, the routine scrubbing and aseptic draping, equipment, full setting and protocols for standard caesarean section are not required. The surgeon should make do with protective disposable apron/gears, a scalpel and cord clamps.^[13] There may be need for towels for drying and wrapping baby, sterile abdominal towel/gauze. It is advisable that hospitals provide 'PMC Sbox' to minimize delay in assembling the needed items in the chaotic situation. The 'PMCS box' was provided in our emergency theater in the A&E following the first case; hence the delay in assembling the needed items was averted, accounting for the timely procedure and better outcome in the second case.

The choice of incision for abdominal entry is left to the discretion, skill and experience of the surgeon, but midline sub-umbilical incision is usually preferred for speed and better access.^[5,6] That was the choice of incision in our cases. The choice between a lower-segment transverse incision and a vertical (classical) incision in the uterus depends on several factors, including the operator's experience and importantly, the gestation. The type of uterine incision chosen should facilitate the quickest possible delivery of the fetus. If the surgeon is inexperienced in performing caesarean sections, or if the lower segment is narrow (more likely at 20–28 weeks of gestation), then a vertical midline incision should be made in the anterior uterus.^[13] We made use of classical incision in our cases.

Upon delivery of the fetus, placenta delivery and subsequent management will depend on success or failure of ROSC. If the resuscitation succeeds, the third stage and subsequent management should be as in standard CS. There may be need to transfer patient to obstetric theatre and general anesthesia administered including broad spectrum antibiotics.

It is advisable (especially in coroner's death) that all intravenous access ports, lines and intubation equipment in place at the time of

declaration of death are left in situ.^[13] The placenta should not be removed if it was in place at the time of death, and if the uterus was open it should be left uncultured.^[13] Preferably, an open abdomen should be left as such and covered with a dressing.^[13] However, out of consideration for the feelings of family members, it might be appropriate to close the skin edges of a large incision with a minimal number of simple sutures before covering the wound with a dressing. In our first case, there was no ROSC about 7 minutes post PMCS when CPR was discontinued. The placenta was delivered, the uterus was not sutured but the abdomen was massively apposed with a continuous vicryl-2 suture. In the second case, the standard protocol for CS (post-delivery) was followed upon ROSC before the patient was transferred to ICU. Proper and detailed documentations of all procedures should be kept.

Finally, irrespective of outcome, the distress caused by a maternal cardiac arrest to both staff and family should not be overlooked. For the family, unsuccessful resuscitation means the loss of a wife, daughter or mother, and possibly a much-wanted baby too. Even if resuscitation is successful, for both the family and the members of staff involved in the patient's care, the emotional trauma from such a dramatic event can have significant emotional consequences.^[14,15]

Proper, empathic but clear communication with the family on the management and outcome of PMCS in maternal cardiac arrest cannot be overemphasized.

CONCLUSION

Perimortem caesarean section (also referred to as resuscitative hysterotomy) is not a common procedure as maternal cardiac arrest is rare. Most physicians are unlikely to encounter it more than once in their career. Timely and proper PMCS could be a life-saving procedure for both mother and fetus. It is important, therefore, that awareness, preparedness and training for this rare but life-saving procedure be emphasized among the healthcare personnel and health institutions.

REFERENCES

1. Rose C, Arij Faksh D, Traynor K, Cabrera D, Arendt KW, Brost BC. Challenging the 4- to 5- minute rule: from perimortem cesarean section to resuscitative hysterotomy. *Am J Obstet Gynecol* 2015; 213:653–6.
2. Katz VL. Perimortem cesarean delivery: its role in maternal mortality. *Semin Perinatol* 2012; 36:68–72.
3. Dijkman A, Huisman CMA, Smit M, Schutte JM, Zwart JJ, van Roosmalen JJ, et al. Cardiac arrest in pregnancy: Increasing use of perimortem caesarean section due to emergency skills training? *BJOG* 2010; 117:282–7.
4. Mhyre J, Tsen L, S E, Einav S, Kuklina EV, Leffert LR, Bateman BT. Cardiac arrest during hospitalization for delivery in the United States, 1998–2011. *Anesthesiology* 2014; 120:810–8
5. Drukker L, Hants Y, Sharon E, Seia HY, Grisaru-Granovsky S. Perimortem cesarean section for maternal and fetal salvage: concise review and protocol. *Acta Obstet Gynecol Scand* 2014; 93:965–72.
6. Royal College of Obstetricians and Gynaecologists. Maternal collapse in pregnancy and puerperium. Green-top Guideline No. 56. London: RCOG; 2011. 8
7. Derse AR, Rosen P, Friedman JB. Consent: explicit and presumed. In: Iserson KV, Sanders AB, Mathieu D. (eds) *Ethics in Emergency Medicine*, 2nd ed. Tuscon, AZ: Galen Press, 1995 pp. 95–105.
8. Awe RJ, Nicotra MBNT. Arterial oxygenation and alveolar-arterial gradients in term pregnancy. *Obs Gynecol* 1979; 53:182–6.
9. Royal College of Obstetricians and Gynaecologists. Maternal collapse in pregnancy and puerperium. Green-top Guideline No. 56. London: RCOG; 2011. 8
10. Katz V, Dotters D, Droegemueller W. Perimortem cesarean delivery. *Obstet Gynecol* 1986; 68:571–6 7 8
11. Einav S, Kaufman N, Sela HY. Maternal cardiac arrest and perimortem caesarean delivery: evidence or expert-based? *Resuscitation* 2012; 83:1191–200.
12. Battaloglu E, McDonnell D, Chu J, Lecky F, Porter K. Epidemiology and outcomes of pregnancy and obstetric complications in trauma in the United Kingdom. *Injury* 2016; 47:184–7.
13. Chu JJ, Hinshaw K, Paterson-Brown S, Johnston T, Matthews M, Webb J, Sharpe P. Perimortem caesarean section – why, when and how. *The Obstetrician & Gynaecologist*. 2018; 20:151–158.
14. Catling-Paull C, McDonnell N, Moores A, Homer CS. Maternal mortality in Australia: learning from maternal cardiac arrest. *Nurs Heal Sci* 2011; 13:10– 5. 35
15. Jeejeebhoy FM, Zelop CM, Windrim R, Carvalho JC, Dorian P, Morrison LJ. Management of cardiac arrest in pregnancy: a systematic review. *Resuscitation* 2011; 82:801–9