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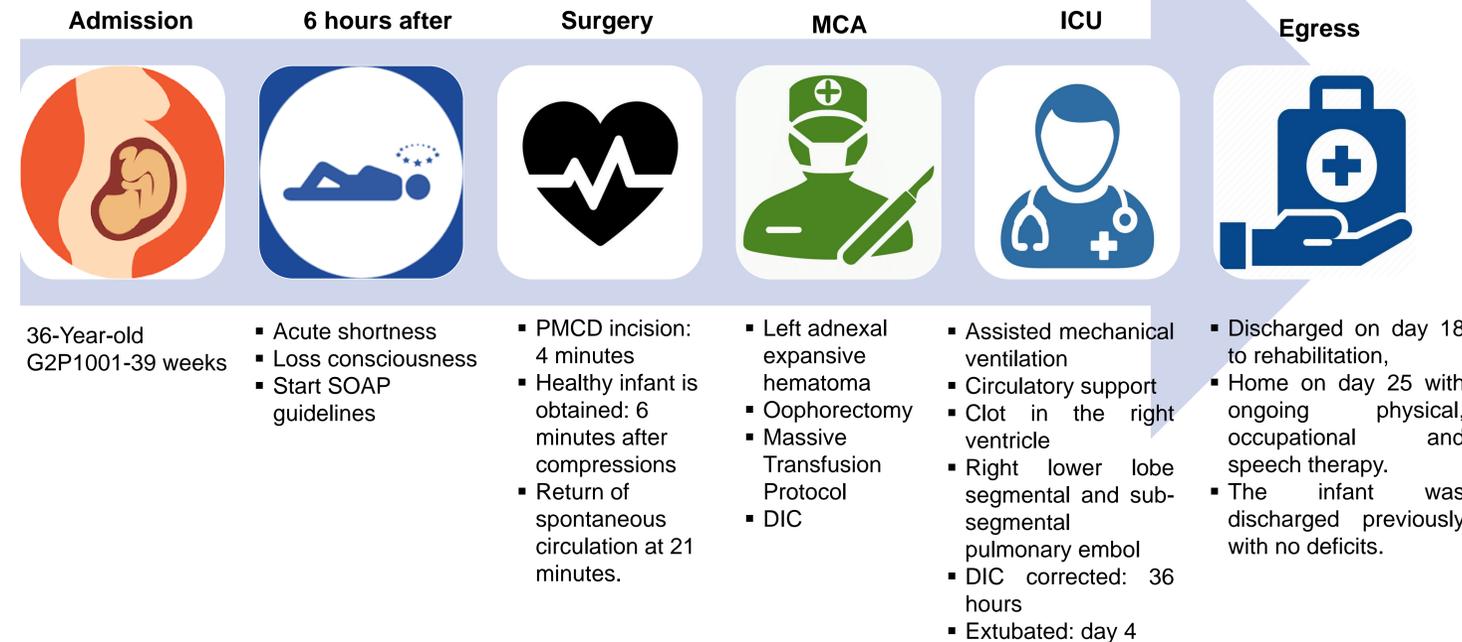
INTRODUCTION

Assessment of maternal cardiac arrest (MCA) from the United Kingdom place the incidence at 2.78 per 100,000 maternities (1:36,000).¹ Amongst patients admitted for delivery in the United States, data shows a higher rate at 1:12,000 with hemorrhage, heart failure or amniotic fluid embolism (AFE) as the most frequent causes.² Parturients who suffer an MCA face a mortality rate from 42% to 58%,^{1,3} despite basic life support (BLS) and advanced life support (ALS), due to the ineffectiveness of chest compressions from aorto-caval compression during late pregnancy.⁴ The time it takes to start ALS/BLS has less effect on maternal survival than the time from collapse to Perimortem Cesarean Delivery (PMCD) with median time to PMCD for survivors being 3 minutes versus 12 minutes for decedents.¹ PMCD should be considered within 4 minutes of an MCA with ongoing cardiopulmonary resuscitation (CPR), with the goal of delivery within 5 minutes.⁵

REPORT

- 36-year-old G2 P1001 parturient with a history of asthma admitted at 39 5/7 weeks for induction of labor.
- Six hours after misoprostol placement, she experienced a painful contraction followed by acute shortness of breath followed immediately by loss of consciousness.
- Compressions were started immediately and PMCD incision was made 4 minutes later in the labor and delivery suite.
- The patient was intubated concurrent with compressions and hysterotomy.
- 6 minutes after compressions, healthy infant is obtained.
- This eventually led to return of spontaneous circulation at 21 minutes.
- Surgical exploration of the mother's abdomen is performed, observing left adnexal expansive hematoma, so they perform oophorectomy.
- Massive Transfusion Protocol was initiated for blood loss and disseminated intravascular coagulation (DIC).
- The patient is transferred to the intensive care unit:
 - Deserving assisted mechanical ventilation
 - circulatory support: blood transfusion, infusion of epinephrine, vasopressin, and inhaled nitric oxide.
- Bedside echocardiogram showed a dilated right ventricle (clot in the right ventricle)
- CT: showed right lower lobe segmental and sub-segmental pulmonary emboli.
- She was taken to interventional radiology where a uterine artery embolization was performed, and a right sided pulmonary artery catheter was placed for tissue plasminogen activator infusion.
- DIC was essentially corrected by 36 hours, and she was extubated on day 4
- CT Brain found subtle hypo attenuation along the frontal lobe and Follow-up MRI of the brain showed chronic cerebral hemispheric watershed infarcts with chronic associated micro hemorrhage as well as chronic cerebellar infarcts.
- She improved clinically and was discharged on day 18 to rehabilitation, then to home on day 25 with ongoing physical, occupational and speech therapy. The infant was discharged previously with no deficits.

TIMELINE



DISCUSSION

- Our team reports the successful salvage of both mother and infant despite an unexpected occurrence of this MCA. Her only risk factor was advanced maternal age. She was in early labor and experienced complete cardiovascular collapse over the course of 1-2 minutes.^{2,3} Our in-house obstetrician was present due to the Obstetric alert, and we agreed to begin the PMCD. The procedure began at the recommended 4-minute mark, but delivery occurred at 6 minutes post-MCA which falls just short of the 5-minute goal.^{5,6}
- The successful outcome of this case was facilitated by the pre-arrangement of an obstetric rescue team based on SOAP guidelines.⁸ This provided an immediate response by Anesthesiology, Obstetrics, Nursing, Pharmacy and Respiratory therapy. Within 3 minutes there were 4 Anesthesiologists, 2 Obstetricians, 1 intensivist and roughly 15 nurses, midlevels, pharmacists and techs. A pre-checked bedside caesarean tray was utilized as opposed to going to the operating room which increases PMCS survival to 72% from 36%, respectively.¹
- CT confirmed a PE, but ultrasound of the leg veins was negative. Pregnancy is a pro-thrombotic state, and maternal uterine vein thrombosis has been described. Cardiac echocardiogram immediately after the case, showed suspicion for right ventricular thrombus and McConnell's sign, but this thrombus was not confirmed on subsequent studies and McConnell's sign could be due to significant pulmonary vascular resistance from an AFE.^{9,10}

CONCLUSION

Healthy, full-term parturients may experience a sudden MCA during labor in the absence of pre-existing cardiac conditions or ROM. AFE through an unknown placental abruption or thrombotic PE triggered by dislodgment of thrombus in the uterine or deep pelvic veins may lead to MCA. Due to the size of the full-term uterus and fetus, this event necessitates PMCD. This extremely rare event can be successfully managed if there are pre-existing teams and protocols established and practiced in advance.

REFERENCES

- Beckett VA, Knight M, Sharpe P. The CAPS Study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study. *BJOG*. 2017;124(9):1374-1381.
- Mhyre JM, Tsen LC, Einav S, Kuklina EV, Leffert LR, Bateman BT. Cardiac arrest during hospitalization for delivery in the United States, 1998-2011 *Anesthesiology*. 2014;120:810-818
- Schaap TP, Overtom E, van der Akker T, Zwart JJ, van Roosmalen J, Bloemenkamp KWM. Maternal cardiac arrest in the Netherlands: A nationwide surveillance study. *Eur J Obstet Gynecol Reprod Biol*. 2019;237:145-150.
- Marx GF. Cardiopulmonary resuscitation of pregnant women. *Anesthesiology*. 1982;56(2):156.
- Einav S, Kaufman N, Sela H. Maternal cardiac arrest and perimortem caesarean delivery: Evidence or expert-based? *Resuscitation*. 2012;83(10):1191-1200.
- Vanden Hoek TL, Morrison LJ, Shuser M, et al. Part 12: cardiac arrest in special situations: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2010;122:S829-S861.
- Kobori S, Toshimitsu M, Nagaoka S, Yaegashi N, Murotsuki J. Utility and limitations of perimortem cesarean section: A nationwide survey in Japan. *J of Ob Gyn Research*. 2019;45(2):325-330.
- Lipman S, Cohen S, Einav S, Jeejeebhoy F, Mhyre JM, Morrison LJ, et al. The society for obstetric anesthesia and perinatology consensus statement on the management of cardiac arrest in pregnancy. *Anesth Analg*. 2014;118(5):1003-16.
- Knight M, Tuffnell D, Brocklehurst P, et al. Incidence and Risk Factors for Amniotic-Fluid Embolism. *Obstetrics and Gynecology*. 2010;115(5):910-917
- Leibovitz Z, Degani S, Shapiro J, Tal J, Paz B, Levitan Z, Aharoni A, Toubi A, Schliamser L, Bar-Meir E, Ohel G. Diagnosis of pregnancy-associated uterine venous plexus thrombosis on the basis of transvaginal sonography. *J Ultrasound Med*. 2003;22(3):287-93.