Case Report

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REBOA Enables Operative Management of the Peripartum Trauma Patient in Hemorrhagic Shock

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Trauma-related injury is the leading cause of non-obstetric maternal death. The gravid uterus is at risk for injury, particularly during motor vehicle accidents. Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a means of controlling pelvic hemorrhage in the setting of trauma. We report the use of REBOA in a hemodynamically unstable, multiply-injured young woman with viable intrauterine pregnancy.

Keywords: *REBOA; Trauma; Pregnancy; Peripartum*

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INTRODUCTION

Trauma-related injury is the leading cause of non-obstetric maternal death [1]. Motor vehicle accidents comprise half of all traumas in pregnancy and are responsible for the majority of trauma-associated fetal deaths [2]. The intra-abdominal position of the intrauterine pregnancy in the second and third trimesters as well as the significant risk of improper lap belt use during pregnancy are major pre-disposing factors for this fetal mortality [3].

The multiply-injured pregnant trauma patient is a unique subset of the trauma population. The physiologic changes of pregnancy are well adapted to the potential for obstetric bleeding, with a disproportionate increase in maternal plasma volume relative to red cell volume resulting in the minimized loss of red blood cells while ample plasma proteins allow for hemostasis [4].

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A growing body of literature increasingly supports the use of REBOA in trauma patients. A recent report from the Aortic Occlusion for Resuscitation in Trauma and Acute Care Surgery (AORTA) registry demonstrated comparable outcomes between open and endovascular resuscitative aortic occlusion [5]. Further, REBOA has utility in augmenting the systolic blood pressure in patients with pelvic trauma [6]. Interestingly, within the Obstetrics literature, there are multiple reports on the utility of endovascular occlusive techniques of the iliac arteries for the management of peripartum hemorrhage [7–9]. In this paper, we report the use of REBOA in a young woman with blunt exsanguinating hemorrhage of the placenta.

CASE REPORT

A 20-year-old woman arrived at the trauma bay after a motor vehicle collision with ejection. Admission vitals were Glasgow Coma Scale 14, blood pressure 90/60s, heart rate 60s. She was intubated for extensive facial trauma and combativeness. In concert with intubation, early arterial access was secured with ultrasound-guided placement of an 18-gauge arterial line in the right common femoral artery, and a central venous cordis catheter placed in the subclavian vein. Chest x-ray showed the endotracheal tube to be in an adequate position, and a left chest tube thoracostomy was subsequently performed for the finding of hemothorax. With intubation and chest decompression, systolic blood pressure improved to the 150s. The primary survey was otherwise intact, and the secondary survey was notable for deep

lacerations to the face, an unstable mandible, and road rash to the chest and abdomen. Focused assessment with sonography in trauma (FAST) exam was negative for free fluid but did reveal an intrauterine pregnancy.

Pan computed tomography (CT) imaging revealed extensive facial fractures, blunt cerebral vascular injury, rib fractures, and uterine wall bleeding with indeterminate finding of uterine wall rupture (see Figure 1). In consultation with Obstetrics, the decision was made to pursue non-operative management given an estimated fetal gestational age of 24 weeks, at the borderline of viability. However, just prior to transfer to the Shock Trauma Intensive Care Unit (ICU), the patient became hypotensive requiring 2 units of packed red blood cells and 2 units of fresh frozen plasma with transient response. The massive transfusion protocol was initiated and she was transferred emergently to the operating room.

On arrival at the operating room, systolic blood pressure was in the 60s with massive transfusion ongoing. The right femoral arterial access was upsized to 7 French sheath, and an ER-REBOA device deployed via anatomic landmarks to zone 3 at 16:46 local time. Blood pressure improved and was maintained at 90s systolic. A laparotomy was performed and a quick survey of the abdomen revealed no gross hemoperitoneum. The gravid uterus was elevated into the field and found to have no free wall rupture but the uterus was grossly enlarged and blood filled. A cesarean section was performed, and the newborn in extremis handed off to Neonatal staff for resuscitation at 16:55. The bleeding placenta was subsequently delivered. The uterus was closed in layers and found to have appropriate tone. After delivery of the infant and survey of the lower abdomen revealing no zone 3 retroperitoneal hematoma, the REBOA balloon was sequentially deflated in coordination with Anesthesia with final down time at 17:04. The REBOA catheter was removed at 17:15 with the sheath left in place. A second look at the abdomen revealed a Morel–Lavallee defect to the left lower quadrant with transected rectus abdominus. The avulsed edges of the inferior epigastric artery were not actively bleeding but were ligated. The abdomen was closed and the patient transported back to the ICU. The ER-REBOA device was inflated at zone 3 for a total of 18 minutes. Intra-operative blood product requirement was 11:11:12 of packed red blood cells: fresh frozen plasma:platelets. The REBOA sheath was removed in the ICU within 24 hours of placement in the Emergency Room.

With regard to REBOA deployment in the setting of pregnancy, the decision was made due to the mother's cardiovascular status and impending hemodynamic collapse. It was believed that any fetal decompensation related to occlusion of uterine blood flow was a superior option compared to loss of vitals in the mother. Placement of REBOA and sterile preparation of the abdomen occurred concurrently. Trauma laparotomy and subsequent delivery of the infant occurred expediently after aortic vascular occlusion.

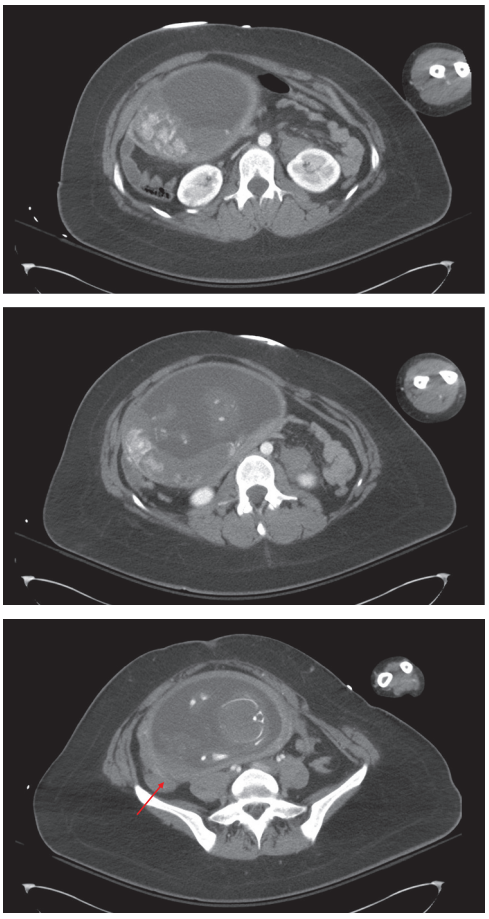

Figure 1 CT abdomen/pelvis axial images, venous phase, demonstrating active hemorrhage of the placenta and uterine wall, and concern for uterine wall rupture in the lowermost image.

PATIENT OUTCOME

The patient had a prolonged hospital stay with multiple operations for fixation of complex facial and orthopedic fractures. After intensive in-hospital rehabilitation, she was discharged home to the care of her family on hospital day 38. The patient's son, born at an estimated gestational age of 24 weeks, unfortunately passed away due to complications of extreme prematurity 3 weeks into the hospital admission.

DISCUSSION

We report the use of REBOA in a multiply-injured pregnant trauma patient. In this instance, placental bleeding manifested delayed onset of hemorrhagic shock. Deployment of the ER-REBOA device allowed augmentation of the hemodynamic status in the setting of impending vascular collapse. A total deployment time of 18 minutes

facilitated rapid laparotomy, delivery of the fetus, and definitive management of the bleeding uterus. REBOA has utility in the exsanguinating trauma patient and has potential applications in the management of both trauma and non-trauma-related obstetric bleeding.

TEACHING POINTS

- REBOA is deployed via percutaneous access of the common femoral artery. Access of the superficial femoral artery risks vascular occlusion or dissection of the artery. Access of the distal external iliac artery risks retroperitoneal hemorrhage which is not compressible.
- Access of the common femoral artery is ideally performed with ultrasound guidance. Access utilizing landmarks, fluoroscopy, cut-down or blind is also possible and dictated by available materials and the urgency of the patient's condition.
- In the trauma setting, zone 1 of the aorta is from the origin of the left subclavian artery to the celiac artery. Zone 2 is from the celiac artery to the most distal renal artery. Zone 3 is from the most distal renal artery to the aortic bifurcation.
- The decision to utilize REBOA in the setting of the trauma injured pregnant patient must be made with the understanding that vascular occlusion of the aorta, while potentially augmenting the hemodynamic status of the mother, will likely result in decompensation of the fetus due to ischemic injury. REBOA is a temporizing maneuver until definitive control of hemorrhage can be obtained.
- REBOA is an emerging technology. Its indications in resuscitation are institution dependent and likely to evolve with emerging data.

REFERENCES

[1] Fildes J, Reed L, Jones N, Martin M, Barrett J. Trauma: the leading cause of maternal death. J Trauma. 1992; 32(5):643–5.

[2] Mattox K, Goetzl L. Trauma in pregnancy. Crit Care Medicine. 2005;33(10 Suppl):385–9.

[3] Motozawa Y, Hitosugi M, Abe T, Tokudome S. Effects of seatbelts worn by pregnant drivers during low impact collisions. Am J Obstet Gynecol. 2010;203(1):62.

[4] Leshikar D, Salcedo E, Cocanour C. Trauma in pregnancy. In: Moore E, Feliciano D, Mattox K, editors. Trauma. 8th ed. New York: McGraw Hill Education; 2017. Chapter 37, pp. 731–9.

[5] Dubose j, Scalea G, Brenner M, et al. The AAST prospective aortic occlusion for resuscitation in trauma and acute care surgery (AORTA) registry: data on contemporary utilization and outcomes of aortic occlusion and resuscitative balloon occlusion of the aorta (REBOA). J Trauma Acute Care Surg. 2016;81:409–19.

[6] Pieper A, Thony F, Brun J, et al. Resuscitative endovascular balloon occlusion of the aorta for pelvic blunt trauma and life-threatening hemorrhage: a 20-year experience in a level 1 trauma center. J Trauma Acute Care Surg. 2018; 84:449–53.

[7] Cho Y, Oh Y, Kim S, et al. The efficacy of pre-delivery prophylactic trans-catheter arterial balloon occlusion of bilateral internal iliac artery in patients with suspected placental adhesion. Obstet Gynecol Sci. 2017;60(1): 18–25.

[8] Nicholson P, O'Connor O, Buckley J, et al. Prophylactic placement of internal iliac balloons in patients with abnormal placental implantation: maternal and foetal outcomes. Cardiovasc Intervent Radiol. 2018;41(10): 1488–93.

[9] Shahin Y, Pang C. Endovascular interventional modalities for haemorrhage control in abnormal placental implantation deliveries: a systematic review and meta-analysis. Eur Radiol. 2018;28(7):2713–26.