



### Staged Management of Placenta Accreta in a Hybrid Operating Room Suite

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#### Abstract

**Background:** The proper management of placenta accreta remains challenging, with risks of significant blood loss. Interventional radiology assistance for control of hemorrhage is considered for difficult cases however this involves transportation of a critically ill patient.

**Case:** We performed a multi-step cesarean hysterectomy for placenta accreta in a hybrid operating room suite. With intra-arterial catheters placed pre-operatively, the cesarean was performed leaving the placenta in utero, with intra-operative pelvic artery embolization followed by completion of the hysterectomy. The total estimated blood loss was 1100mL.

**Conclusion:** Single location cesarean section with pelvic artery embolization in a hybrid operating room was associated with significantly less blood loss. Larger case series of staged single location cesarean hysterectomy for placenta accreta variants would be required to confirm the overall improved outcomes.

angiographic imaging equipment into the operating room setting. The patient is able to undergo open surgical procedures in conjunction with complex angiographic procedures, allowing for a more interdisciplinary approach to patient care without transportation. At the time of this procedure, there was no other case report of handling placenta accreta variants in a hybrid operating suite. However the use of the hybrid operating room for patients who are at increased risk for adverse outcome, including patients with cardiovascular disease, patients with intracranial pathology and accreta variants has been published [4]. This case series did not utilize ligation of the cephalad uterine blood supply. Reported here is a case of antenatally diagnosed placenta accreta managed in the hybrid suite with a staged multidisciplinary approach.

#### Case Presentation

The patient is a 36 year-old Gravida 8 Para 4125 whose pregnancy was complicated by a history of two prior low transverse cesarean deliveries. A sonogram performed at thirty-four weeks gestation revealed complete placenta previa and was highly suspicious for placenta accreta. The patient underwent magnetic resonance imaging which was notable for findings consistent with placenta increta with invasion almost to the level of the uterine serosa. Due to the extensive nature of this accreta, the recommendation to the patient was for cesarean section, arterial embolization and hysterectomy as sequential staged procedures in the hybrid suite. The patient gave informed consent.

The following is a review of the staged procedure:

**Stage 1:** In the hybrid operating room with all teams and equipment present and ready, local anesthesia was administered by

#### Introduction

Placenta accreta is associated with significant morbidity with 40% requiring more than 10 units of packed red blood cells and a maternal mortality rate as high as 7% [1]. Internal iliac balloon-tipped catheters have been used in an attempt to reduce hemorrhage, with mixed results [2]. Embolization has mainly been used as a salvage procedure. Angstmann et al. published a retrospective review of a cohort of patients with known placenta accreta who underwent embolization after delivery [3]. These patients had reduced overall blood loss and transfusion rates. However, their approach required moving the patient from the operating room suite to interventional radiology for the embolization with a return to the operating room for the hysterectomy. A hybrid operating suite integrates high-end

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the interventional radiologist. Through the common femoral arteries bilaterally, 6 French Ansell sheaths (Cook Medical) were negotiated over the aortic bifurcation into the contralateral internal iliac arteries, bilaterally. Over-the-wire Fogarty balloon catheters (Edwards Lifesciences) were advanced through each sheath into the internal iliac arteries and positioned there to provide immediate cessation of flow to the pelvic arteries, if needed. Electronic fetal heart rate monitoring was performed throughout the procedure by the labor and delivery nursing staff. Time lapse: 24 minutes with 5.6 minutes of fluoroscopy. Ureteral stents were not placed as the hybrid operating room table cannot be positioned for safe placement.

**Stage 2:** General anesthesia was provided and the cesarean section was performed by the Maternal Fetal Medicine team through a vertical skin incision. As the placenta was a known previa, there was no manipulation of the cervix intra-operatively. Ultrasonographic placental mapping confirmed the location of the placenta to prevent placental A transverse fundal uterine incision was performed to avoid the placenta. The neonate was delivered via breech maneuvers and handed off to the awaiting neonatal team. The placenta was fused with the myometrium with no cleavage plane visualized throughout the lower uterine segment and extensive hyperemic vasculature was visualized in the area of the bladder. Therefore, instead of attempting placental delivery, the hysterotomy was then closed with a running interlocking suture. The patient did not receive ecbolics after the delivery due to concern of placental shearing with contraction.

**Stage 3:** The utero-ovarian pedicles (round and utero-ovarian ligaments, fallopian tube, vascular anastomoses) were divided by the gynecologic oncology team with a stapling device with the intent being to improve the efficiency of the subsequently planned embolization. The estimated blood loss from stages 2 and 3 was 800mL. Most of this was from the uterine incision. There was not extensive vaginal bleeding noted. Time lapse for stages 2 and 3–15 minutes

**Stage 4:** Moist laparotomy pads were placed over the abdominal incision. Due to the extensive hyperemic vasculature, and goal of preventing excessive blood loss, the decision was made to proceed with embolization instead of inflation of the balloon catheters. Although common iliac occlusion can be considered for these patients, this would have been exceedingly challenging with enlarged uterus within the pelvis in conjunction with the patient's body habitus [5]. The previously placed balloon catheters were removed over a guidewire and each exchanged for a 4 French Cobra catheter (Angiodynamics) which was advanced into the anterior division of the internal iliac arteries bilaterally utilizing road mapping technique. Coaxially, a high-flow Renegade microcatheter (Boston Scientific) was advanced into the uterine arteries bilaterally, again utilizing road mapping. The uterine arteries were embolized bilaterally using a combination of Embospheres (500-700 microns, 700-900 microns) (Merit Medical), gelfoam slurry (Pharmacia & Upjohn Co.) and microcoils (Penumbra). At the conclusion, both uterine arteries had complete cessation of flow. Time lapse: 95 minutes with 34 minutes of fluoroscopy.

**Stage 5:** The hysterectomy was then performed by the gynecologic oncology team. The estimated blood loss from the hysterectomy was 300mL. There was no excessive blood loss during the dissection of the lower uterine segment, peritoneal bladder reflection and cervical dissection portions of the procedure. Time lapse – 70 minutes.

Intra-operatively, the patient received 6 units PRBC (all prior to the hysterectomy) and remained hemodynamically stable throughout the procedure. Anesthesiology justified the transfusions based on preoperative anemia and the substantial likelihood of major blood loss. She was taken to the intensive care unit intubated yet stable post-operatively.

Her post operative hemoglobin was 13.6 (preoperative=11.4). She was extubated on post operative day 1 and was then discharged from the intensive care unit to the floor in stable condition. Her post operative course was unremarkable and she was discharged home with her baby on post-operative day 5. She did not require additional

blood transfusions and her discharge hemoglobin was 13.5. The uterus was evaluated after the completion of the procedure confirming a densely adherent placenta which was fused with the lower uterine segment and extensive placental invasion which was confirmed on pathology to extend to 0.1 cm from the anterior uterine serosa. The only patient with similar suspected placental uterine invasion that was not managed in a hybrid suite required activation of the massive transfusion protocol, an extended intensive care admission and her post-operative stay was 31 days. This patient was managed by the same surgical team, which managed all of the placenta accreta variants for our hospital.

## Discussion

The one site management of this patient was different than others documented in the literature. As expected, the blood loss was reduced in comparison to cases without concomitant embolization by interventional radiology. The other unique aspect of this case was division of the utero-ovarian pedicles prior to embolization.

The use of balloon catheters to reduce the uterine blood flow is an option for patients with placenta accreta variants as published [6]. Balloon migration after placement, resulting in insufficient arterial balloon occlusion, is a known risk and therefore considering the extensive vascularity, the option of embolization instead of balloon inflation was taken.

Management of known placenta accreta as a staged procedure in a hybrid suite was associated with relatively low blood loss, avoidance of transportation issues and their associated risks and delays and an overall good outcome. Although this case was uncomplicated, the risk of maternal morbidity and/or mortality with accreta variants is significant. The cost benefit for pelvic embolization for placenta accreta variants has not been published. However there is a significant cost benefit known for pelvic artery embolization compared to vaginal hysterectomy with a reduction in costs of €469 [7]. The use of a hybrid operating suite, with intra-operative pelvic arterial embolization is still a relatively new management scheme for patients with placenta accreta variants and therefore larger case series of staged single location cesarean hysterectomy for placenta accreta variants would be required to confirm the overall improved outcomes.

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