

Postpartum Hemorrhage and Placenta Accreta Spectrum: A Review

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Abstract: In this article, we review the epidemiology, treatment, and management of postpartum hemorrhage (PPH) and placenta accreta spectrum (PAS) including medical management, endovascular procedures, and surgical management. We discuss uterine artery embolization technique and its role in uterine-sparing treatment for PPH and PAS. We review additional therapies for PAS, including balloon occlusion catheter placement. Finally, we review the role of interventional radiologists in the management of PPH and PAS.

VASCULAR DISEASE MANAGEMENT 2021;18(11):E206-E208. Epub 2021 November 4.

Key words: placenta accreta, placenta accreta spectrum, postpartum hemorrhage, uterine artery embolization

Introduction

Postpartum hemorrhage (PPH) is a leading cause of maternal morbidity and mortality. Primary PPH is defined as blood loss greater than 500 mL within the first 24 hours after delivery; secondary PPH is defined as excessive blood loss after the first 24 hours from delivery up to 6 weeks. Although there are numerous causes of PPH, the most common can be attributed to the four Ts: tone, tissue, trauma, and thrombin.^{1,2}

Uterine tone decreases with multiple gestations and the use of general anesthesia, which is associated with cesarean section or prolonged labor. Tissue refers to abnormal placentation, which may be retained placental tissue, placenta previa, or any disorder in which the placental villi extend beyond the endometrium, known as invasive placenta or placenta accreta spectrum (PAS). PAS includes placenta accreta, placenta increta, and placenta percreta. Trauma may be secondary to lacerations, iatrogenic (such as with episiotomy), or include less common etiologies such as pseudoaneurysms. Thrombin refers to the enzyme in the common pathway of the coagulation cascade. Disruption in the ability of thrombin to function normally can be pre-existing or secondary to disseminated intravascular coagulation.^{1,3}

PAS is one of many etiologies that can lead to PPH due to the highly vascular nature of placental tissue. PAS occurs when the placenta attaches directly to the myometrium with varying invasion of chorionic villi into and through the myometrium. There has been a greater than fivefold increase in PAS in the last few decades due to increased rates of uterine instrumentation.⁴ Approximately 50% of women with PAS experience PPH, and 17% of women with PAS require hysterectomy.⁴ At least 90% of patients with PAS will require blood transfusions, with 40% of them requiring 10 or more units of packed red blood cells. The maternal mortality rate for this condition is approximately 7%.

Uterine artery embolization (UAE) is a minimally invasive, safe, and effective treatment to treat PPH and PAS after other

conservative measures have failed. Additionally, it can help decrease patient morbidity and may preserve fertility by avoiding a hysterectomy.³

Management of PPH

Active management during the third stage of labor has been shown to decrease the prevalence of PPH and is the standard of care. For patients who develop PPH after these measures, management begins with further conservative measures such as volume resuscitation, uterotonic medications, uterine massage and packing, and uterine balloon tamponade.⁵

Next steps typically include surgical exploration and repair, compression sutures, and arterial ligation. Uterine or pelvic arterial embolization has been shown to be an effective treatment for primary or secondary PPH regardless of the etiology. Additionally, it can be used as an adjunct treatment before or after surgery or hysterectomy to decrease blood loss.

Hysterectomy is reserved for when more conservative measures fail. While UAE has reduced the rate of peripartum hysterectomy for PPH, studies show it is still underutilized.⁶

Management of PAS

Management of PAS differs from the traditional management of PPH. First-line management for PAS is typically expectant. When PAS is diagnosed on prenatal imaging, these patients undergo a scheduled cesarean hysterectomy. When PAS is unknown at the time of delivery, forced delivery of the placenta can place patients at extreme risk of hemorrhage, necessitating emergent hysterectomy.⁷

Conservative management is an alternative option for PAS and focuses on preservation of the uterus or adjacent organs when they are involved. Conservative therapy attempts to promote placental involution without removal, which can

be achieved with post-delivery UAE, methotrexate therapy, or a combination of both. When placental tissue is left behind, patients are at increased risk of sepsis, delayed PPH, and treatment failure, which may necessitate hysterectomy. They also require rigorous postpartum evaluation and monitoring to ensure they do not develop complications. Benefits of conservative management may include reduced PPH, preservation of adjacent organs with placental involvement, and preserved future fertility.⁷ Future studies are needed to fully understand when conservative management is most beneficial.

Studies have shown that even in extirpative management of PAS, management with interventional radiology can be beneficial. Potential roles for the interventional radiologist in management include placement of occlusion balloon catheters prior to delivery/surgery, prophylactic UAE prior to surgery, and UAE before surgery but after delivery.^{8,9}

UAE Technique

UAE has an important role in the management of PPH and PAS. Arterial access through the radial or common femoral artery is obtained, through which a vascular sheath is placed. Abdominal and pelvic aortic angiograms are obtained to identify active extravasation and ovarian artery contribution, and to fully visualize the vaginal canal. It is important to deflate the intrauterine balloon, if there is one in place, to help identify extravasation.

Typically, the contralateral internal iliac artery is selected first if access was obtained through the common femoral artery. The uterine artery is sub-selected with a microcatheter and microwire and embolized with Gelfoam (Pfizer), n-butyl cyanoacrylate particles, or coils. The ipsilateral internal iliac artery, and subsequently the uterine artery, are then selected and embolized. Post embolization aortic or pelvic angiograms can be performed to confirm hemostasis. In cases in which the uterine artery is unable to be selected on one or more side, internal iliac artery embolization may be performed through selective embolization and is preferred when possible. Collateral supply to the uterus from ovarian arteries arising from the aorta or round ligament arteries arising from the inferior epigastric artery are important to identify in cases of refractory hemorrhage.⁶

Outcomes from UAE for PPH

UAE has demonstrated clinical success rates greater than 80% and even higher technical success rates up to 100%.^{3,10} It is a crucial step in the treatment algorithm for PPH and can allow for preservation of menstruation and fertility where more invasive treatment such as hysterectomy does not.¹¹ As with any procedure, there are complications associated with UAE, including non-target embolization, puncture site hematoma, post-procedure fever, and endometritis, among others. Studies have shown that the risk of major complications with UAE for PPH is low (less than 3%). Potential factors that may decrease the clinical success rate of UAE

include increased transfusion requirement greater than 5 units or blood loss greater than 1.5 L or PAS; however, more data are needed to fully understand the role of UAE in these situations.¹⁰

Outcomes from Interventional Management for PAS

Interventional radiologists can help in the management of patients with PAS through various techniques to reduce blood loss. One such technique is the placement of occlusion balloons prior to cesarean delivery when PAS is known prior to delivery. Balloon occlusion catheter placement has been shown to be a safe procedure that can decrease the duration of a cesarean section as well as intraoperative blood loss.¹² A multicenter study also demonstrated that aortic or iliac artery balloon occlusion in patients with PAS decreased estimated blood loss, transfusion requirements, and adverse events, as well as ICU admissions, after delivery.⁸ Not all studies that have examined balloon occlusion catheter placement have demonstrated benefit, with some showing no difference in blood loss or transfusion requirement. Therefore, more data are needed to help determine the true benefit and ideal patient population for this intervention.¹³

UAE can also play an important role in PAS management. When performed in conjunction with extirpative management, after delivery but prior to hysterectomy, UAE has been shown to decrease estimated blood loss, transfusion requirements, and ICU admissions.¹⁴ UAE may also assist with success in conservative management of PAS through control of PPH.⁷

Conclusion

PPH and PAS result in significant maternal morbidity and mortality. Interventional radiologists have an important role in the management of PPH and PAS and can help improve outcomes associated with these diseases. UAE is a safe and effective treatment for PPH and may play an important role in improving outcomes in patients with PAS. Additional procedures such as balloon occlusion catheter placement may also help in the complex management of PAS. Several studies have demonstrated a clear benefit of UAE in PPH; however, more studies are needed to clearly define the interventional radiologist's role in the management of PAS. ■

Disclosure: The authors have completed and returned the ICMJE Form for Disclosure of Potential Conflicts of Interest. The authors report no conflicts of interest regarding the content herein.

Manuscript accepted September 13, 2021.

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