

# Interventional radiology in the management of post-partum hemorrhage

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## Summary

Post-partum hemorrhage (PPH) remains a major issue in the management of deliveries and is still burdened by significant morbidity and mortality. Several conservative treatments were developed to aid obstetric surgeons dealing with PPH, but in life-threatening cases, hysterectomy cannot be avoided. Interventional radiology had a significant development in last years. The improvement of embolization materials and techniques lead to new application scenarios. Several embolization protocols were proposed in last years showing the effectiveness of uterine artery embolization in the management of PPH. Nevertheless, many concerns remain on the modalities, indication and on timing of UAE. The aim of this article is to resume the state of the art on these topics.

**Key words:** Abnormally invasive placenta; Post-partum hemorrhage; High-risk pregnancy; Hysterectomy; Uterine artery embolization.

## Introduction

In spite the increasing scientific progress in the obstetric field, post-partum hemorrhage (PPH) management remains a tricky issue to deal with for modern medicine. It is still burdened by significant morbidity and mortality in the Western world [1] and it remains a major cause of maternal mortality worldwide [2]. PPH has an incidence of the 2% with a mortality of about 3%, has several risk factors, and it is mostly due to uterine atony [1].

PPH blood loss is at least of 500 ml for vaginal deliveries, but it could exceed 5,000 ml in abnormal implantation deliveries [3] leading to severe morbidities such as respiratory distress syndrome, hypovolemic shock, disseminated intravascular coagulation, and Sheehan's syndrome.

Several conservative treatments were developed to deal with PPH (e.g.: uterotonic drugs, packing gauzes, hemostatic square sutures, B-Lynch suture, insertion of Bakry balloon, etc.), but in life-threatening cases, the obstetric surgeon has to resort often to hysterectomy [2].

Interventional radiology (IR) represents the radiology subspecialty that mostly impacted on the scientific community in last years [4]. The development of new techniques and materials allowed IR to provide a significant support in the treatment of several gynecological diseases [5, 6], including PPH. In fact, many authors highlighted the positive impact of uterine artery embolization (UAE) in the treatment of PPH as an alternative to surgical intervention,

as it is less invasive, with fewer adverse side effects, and it has the possibility to avoid hysterectomy [7]. Hence, different guidelines included the UAE in the management of PPH, highlighting that high risk pregnancies should be managed considering IR with multidisciplinary team when dealing with PPH [2, 8]. Despite, the fact that feasibility and efficacy of UAE is well-defined, many issue remains concerning modalities, technique, indication, and timing. The aim of this paper is to resume the state of the art on these topics.

## Discussion

The identification of women at risk of PPH is the first step for optimizing their management and outcome [2, 8]. Risk factors include: maternal age and education (years of school attendance), previous deliveries, gestational age, uterotonic drugs, and anaemia [1]; moreover, since abnormal placental implantation is one of the main risk factors, all the predisposing factors to accretism should be investigated (previous damage or fibrosis of the myometrium and endometrium, such as previous cesarean sections or uterine trauma, artificial delivery, curettage, maternal age older than 35 years or previous multiple births) [3]. Antenatal ultrasound (US) is the technique of choice used to establish the diagnosis and guide clinical management; MRI should be performed using gadolinium contrast intravenously in



Figure 1. — Sagittal T2 weighted MRI. A complete previa placenta, covering the internal cervical os (arrow); of note the protrusion of placental tissue beyond the outer confines of the uterine myometrium (arrow head) and the absence of a certain cleavage from the bladder (asterisk) that raise the suspicion of placenta percreta.

the case of non-definitive US findings [9]. Actually, MRI is the gold standard imaging of the placenta to establish its relationship to the internal cervical os (Figure 1) [10].

Success rate of UAE has been reported in the range of 79–95 % [11], which could decrease to less than 50% in case of abnormal implantation deliveries [12]. A recent single center study conducted by Aas-Eng *et al.* demonstrated that the introduction of UAE in the trust guidelines did not improve the hysterectomy rate considering all the deliveries performed in their institution [13]. Even so, the relevance of UAE could clearly emerge considering those groups of women at high risk of hemorrhage [14], not only for the reduced mortality and hysterectomy rates; in case of failure in bleeding control, UAE reduces bleeding in the operating field, aiding the surgeon.

United Kingdom guidelines recommend that where IR services are not available locally, trusts should ensure the provision of these services from other facilities [8]. Although, patient transfer from the obstetric suite to the angiographic one demonstrated to increase morbidity and mortality [15]; the more so, the transfer to another hospital will increase the morbidity and mortality risk as well [15]. Consequently, some authors proposed the use of a hybrid operating room in order to ensure a prompt and effective

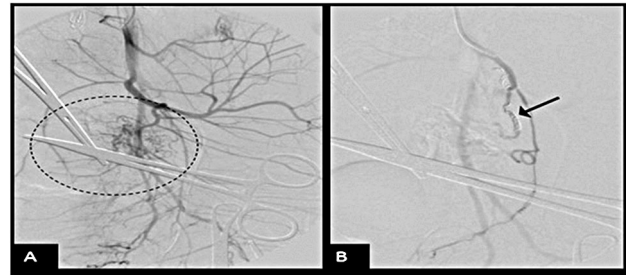


Figure 2. — Angiograms pre- and post-embolization. Active bleeding at angiogram (circle in figure A) and the final acquisition after coil embolization of the anterior branch of the internal iliac artery (arrow in figure B). The surgical instruments in the field of view can be noted.

treatment even in unstable women with massive PPH [3, 16].

There are two issues concerning the embolization technique: timing of embolization and embolic agents. Re-absorbable embolic agents are the most common use in UAE due to their temporary action and the reduced ischemic complications [8]. Nevertheless, placental hypervascularisation of the uterus could lead to an insufficient hemostasis of absorbable sponge [17]. Accordingly, some authors recommend the use of PVA particles in case of failure with sponge alone [18]. On the other hand, small non-absorbable agents, such as PVA microparticles, could cause a distal and permanent occlusion of arteries, leading to uterine necrosis; moreover, accretism might develop arteriovenous shuntings in the uterus which could cause distal dissemination of the embolic agents [19]. Liquid embolic agents, mainly N-butyl cyanoacrylate (NBCA) glue (there are few reports on the use of Onyx [3]), are recommend to obtain the definitive occlusion of the vessels [20], as well as coils (Figure 2); moreover, NBCA demonstrate to be effective in case of uterine bleeding due to pseudoaneurysm or lacerated arteries [20,21].

The prophylactic positioning of occluding balloons (OCB) in the internal iliac artery or in the common iliac artery is an emerging technique; it provides the pre-delivery positioning of the OCB followed by the inflation of the balloons just before or immediately after the delivery [22]. OCB technique allows a safe delivery and it reduces the bleeding in the surgical field aiding the surgeon; a possible complication is the ischemia of distal organs, or inferior limbs (low rate of incidence are reported), but allows the conversion to other embolic agents. Even if data confirmed the feasibility of OCB technique, it did not show to be more effective than UAE [2, 8].

Niola *et al.* recently reported their experience performing UAE before delivery, using gelatin sponge, with promising results [23]. This technique, as well as OCBs, raises concerns about the radiation exposure of the newborn, that

even if acceptable in most of cases, sometimes exceeds the suggested limit of 10 mGy [24]. Moreover, further studies are required to assess the effect of uterine and placental ischemia and the influence of iodinate contrast media in newborns [24,25].

## Conclusion

UAE demonstrates to be an effective and feasible procedure to manage PPH. Despite the role of UAE is well-established, there are no evidences regarding the superiority of one embolization technique among the other one. Each institution should choose the UAE protocol depending on the team expertise and preference. All the trusts dealing with high risk deliveries should include in their institutional guidelines the IR unit, providing treatment algorithms which clearly identify the timing and place of UAE in such women. In case of high volume blood loss, even when hysterectomy cannot be avoided, UAE should always be considered and included in patient management to allow the best outcome.

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