TRANSARTERIAL EMBOLIZATION FOR THE CONTROL OF POSTPARTUM HEMORRHAGE

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Postpartum hemorrhage (PPH) is a potentially fatal obstetric emergency. Despite recent advances in the treatment of PPH, it continues to be one of the main causes of maternal deaths in the developed world [1]. Surgical options that avoid hysterectomy, such as uterine artery ligation and internal iliac artery ligation, are available for women who wish to preserve their fertility. However, internal iliac ligation remains technically challenging and has a poor success rate [2]. Selective bilateral uterine artery embolization has been used since the late 1970s for the conservative treatment of PPH with good success and low complication rates [3]. We report one PPH case treated by transarterial embolization (TAE) with successful hemorrhage cessation.

A 24-year-old woman, gravida 1, para 0, at 40^{+1} weeks of gestation, was admitted because of regular uterine contractions and uterine cervix dilation of 6 cm. The whole labor course was smooth and uneventful. A male baby weighing 3,930 g and with Apgar scores of 8 and 9 at 1 and 5 minutes, respectively, was delivered by elective vacuum extraction. Despite manual exploration of the uterus, vigorous uterine massage, administration of uterotonic drugs (pitocin and misoprostol), curettage of the uterine cavity, and intrauterine packing with gauze, PPH ensued soon after expulsion of the placenta. The patient had an estimated blood loss of 1,000 mL in the delivery room before she was transferred to the interventional radiology suite to receive TAE.

Emergent pelvic, left internal iliac and left uterine arterial angiographies were performed smoothly via right transfemoral catheterization. They showed a dilated and elongated left uterine artery and abnormal contrast pooling showing as a pseudoaneurysm on the left side of the uterine body supplied by a branch of the left uterine artery (Figures 1 and 2). After highly superselective catheterization of the left uterine artery, immediate TAE was performed smoothly using Gelfoam cubes and a coil (MWCE-35-2-3; Cook, Bloomington, IN, USA) in the proximal end of the left side of the uterine cavity, and no more opacification of the pre-TAE contrast

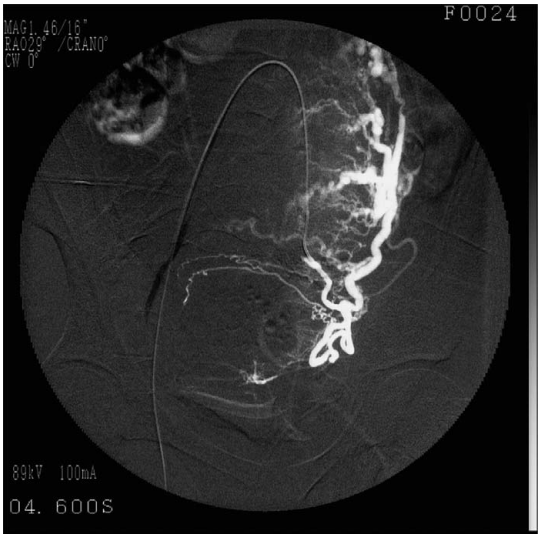

Figure 1. Early arterial phase of left uterine arteriogram revealing engorged left uterine arterial branches.

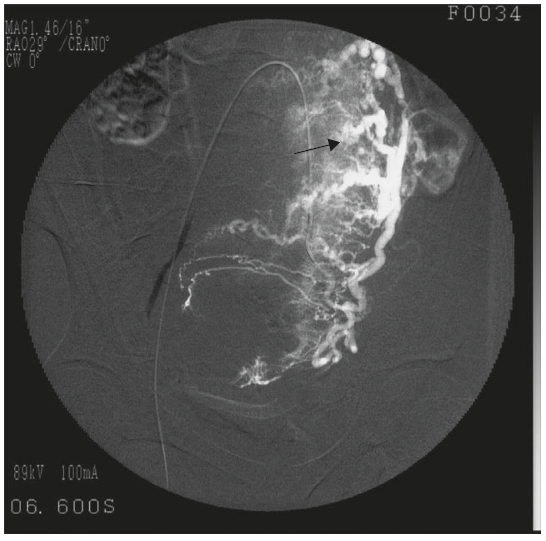

Figure 2. Late arterial phase of left uterine arteriogram showing a pseudoaneurysm (arrow) in a branch of the left uterine artery in the left uterine body.

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pooling was seen (Figures 3 and 4). The patient tolerated the whole procedure well. No further intervention was required. In the interventional radiology suite, an additional estimated blood loss of 800 mL was noted.

The patient was stabilized with 2 U of packed red blood cells, HAES-steril 1,000 mL, and lactated Ringer's solution 500 mL. She was discharged on postpartum day 4 and her periods resumed 3 months later.

PPH remains a major cause of maternal morbidity and mortality. It is a potentially fatal obstetric emergency [4]. The major causes of PPH include uterine atony, retained placental fragments, placenta accreta, abruptio placentae, lower genital tract lacerations, uterine rupture, coagulopathy, and uterine inversion [5]. Early PPH is most often due to uterine atony [6]. Genital tract lacerations can also cause significant bleeding in the early postpartum period [7]. Despite recent advances in the treatment of PPH, it continues to be one of the top five causes of maternal deaths in the developed world [8].

Figure 3. Post-transarterial embolization image revealing the coils in the proximal portion of the left uterine artery and the effect of embolization producing contrast medium stasis between the two coils.

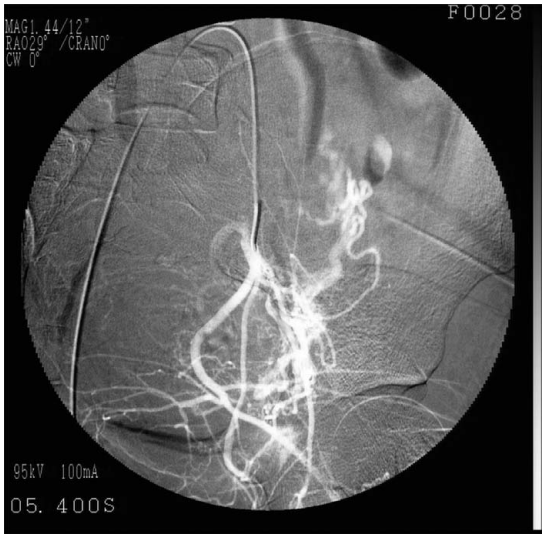

Figure 4. Post-transarterial embolization left internal iliac arteriogram revealing no pseudoaneurysm over the branch of the left uterine artery.

Historically, the surgical approach to persistent and massive PPH involves an emergent hysterectomy. Other surgical options to avoid hysterectomy, such as uterine artery ligation and internal iliac artery ligation, are available for women who wish to preserve their fertility. However, internal iliac artery ligation is successful in only 42% of cases [2]. Since the late 1970s, diagnostic angiography with transcatheter embolotherapy has become a major way of treating PPH and persistent bleeding after gynecologic surgery [9].

Uterine artery embolization was first described as a treatment for PPH in 1979 by Brown et al [10], followed shortly after by Pais et al in 1980 [11]. It has been gaining in popularity ever since because of reports of high success rates relative to ligation and hysterectomy [12]. It represents an effective alternative to surgery to control intractable bleeding, even though rare complications may occur. Several authors have reported the usefulness of TAE as first-line treatment for postpartum bleeding, refractory to conservative local treatment [9]. Gelfoam pledgets are usually used, because the 2- to 4-week duration of the occlusion is sufficient to prevent further hemorrhage but still permit slow development of collaterals, thus preventing ischemia. Even when both uterine arteries are completely occluded, collateral flow from other branches reconstitutes intrauterine branches. Ovarian arteries that arise from the anterolateral abdominal aorta may divert blood to maintain the viability of the uterus in sudden uterine occlusion. The round ligament artery can also provide a blood supply to the previously embolized uterine artery [13]. Coil embolization alone for PPH is not advocated. The failure of coil embolization was well illustrated in a report by Minck et al [14], in that initial coil placement into the internal iliac artery seemed to stop the hemorrhage. However, bleeding recurred and repeat angiography was necessary. Collateral branches, such as the medial circumflex artery from the profunda femoris and branches from the inferior epigastric artery, reconstituted the distal supply and bleeding continued. Only after selective Gelfoam embolization of these collateral branches did the hemorrhaging finally stop [14]. Performance of both unilateral and bilateral embolization of the internal iliac arteries and/or uterine arteries has been widely reported.

Reports of eventual hysterectomy after failed embolization because of persistent bleeding from the branches of the contralateral internal iliac artery have illustrated

the need for thorough angiography and the importance of searching for other sources of bleeding after unilateral embolization is performed [15]. Success rates for TAE have been reported to be more than 90%. Complications resulting from this procedure are relative rare and represent 6–7% of the cases in the reported series [9]. The most common complication is postembolization fever, which typically subsides in 2 or 3 days. Other complications include pelvic infection, non-targeted embolization of other pelvic structures, foot ischemia, bladder and rectal wall necrosis, nerve injury, and late bleeding [12,16,17]. Deaths after uterine artery embolization have also been reported [18]. Some publications suggest preservation of fertility after bilateral uterine embolization [19,20]. Studies seem to show that women who undergo arterial embolization can expect a return of normal menses with no adverse effects on future fertility [21].

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