

Original Article

Uterine arterial embolization in the management of severe post-partum hemorrhage: A successful rescue method to avoid peripartum hysterectomy

Huann-Cheng Horng^a, Wei-Min Hu^b, Hsiou-Shan Tseng^c, Wen-Hsun Chang^d,
Kuan-Chong Chao^a, Ming-Jie Yang^{a,*}

^aDepartment of Obstetrics and Gynecology, Taipei Veterans General Hospital and National Yang-Ming University School of Medicine, Taipei, Taiwan, ROC

^bYuan-Hsin Obstetrics and Gynecology Clinic, New Taipei City, Taiwan, ROC

^cDepartment of Radiology, Taipei Veterans General Hospital and National Yang-Ming University School of Medicine, Taipei, Taiwan, ROC

^dDepartment of Nursing, Taipei Veterans General Hospital, Taipei, Taiwan, ROC

Received November 1, 2010; accepted January 10, 2011

Abstract

Background: Although the effects of uterine arterial embolization (UAE) for the control of post-partum hemorrhage on menstruation, fertility and future pregnancy have been reported before, domestic reports on long-term outcomes are lacking.

Methods: From April 2001 to March 2005, 9 patients who underwent UAE for post-partum hemorrhage were evaluated retrospectively. The analyses included both immediate and long-term outcome, including menstruation, future fertility and subsequent pregnancies.

Results: The median follow-up was 82 months, ranging from 63 months to 108 months. All the women had regular menstruation after UAE treatment, but 5 had hypomenorrhea. Four women attempted pregnancy, and 3 had successful term deliveries. One woman was infertile.

Conclusion: UAE appeared to be a safe procedure. Hypomenorrhea was common after UAE treatment (55.6%), although regular menstruation returned successfully. Future pregnancy seemed possible, and without complications.

Copyright © 2011 Elsevier Taiwan LLC and the Chinese Medical Association. All rights reserved.

Keywords: Fertility; Menstrual cycle; Post-partum hemorrhage; Pregnancy; Uterine artery embolization

1. Introduction

Post-partum hemorrhage (PPH) remains one of the leading causes of maternal deaths and may occur immediately or several hours or days after delivery.^{1,2} Primary PPH is defined as a loss of more than 500 mL of blood or more during the first 24 hours after delivery.³ Hemorrhage that occurs after the first 24 hours and up to 6 weeks after birth is classified as secondary PPH. Potential causes of hemorrhage include uterine atony, retained products of conception, placental abnormalities, uterine inversion, uterine rupture, lower genital tract lacerations, cervical pregnancy, and coagulopathies.⁴

Care of these patients requires rapid identification of the cause and control of the bleeding, because of the potentially life-threatening situation.⁵ In most cases, severe PPH can be managed by conservative treatment which is based on the administration of uterotonic drugs, vaginal packing, and surgical repair of genital tract lacerations.⁶ When bleeding fails to respond to conservative treatment, the use of vascular ligation or hysterectomy may be needed.^{2,7,8} Since the late 1960s, transcatheter arterial embolization procedures have been used for the control of pelvic hemorrhage resulting from malignancy, trauma, and radiation.⁹ This furthermore seems to be an alternative procedure for the management of PPH. In 1979, transcatheter embolization to control post-partum bleeding was initially described by Brown et al.¹⁰ Subsequently, several authors have reported the usefulness of this technique as first-line treatment for PPH in those patients refractory to conservative treatment.¹¹ Data on the long-term

* Corresponding author. Dr. Ming-Jie Yang, Department of Obstetrics and Gynecology, Taipei Veterans General Hospital, 201, Section 2, Shih-Pai Road, Taipei 112, Taiwan, ROC.

E-mail address: mjyang@vghtpe.gov.tw (M.-J. Yang).

effects of the reappearance of normal menstruation and fertility are also available.¹² Most of the reports indicate that arterial embolization is a safe and effective procedure and offers patients a fertility-preserving option,¹³ although there are always some concerns.^{14,15} However, it seems that all of the reports are restricted to Western racial groups, and there is a lack of data on Eastern racial groups, although some similar reports, such as those regarding uterine vessel occlusion performed by laparoscopy or laparotomy, can be found.^{8,16,17} Therefore, it would be of interest to know whether racial group differences influence the outcome of transcatheter embolization. The objective of this report, therefore, is to share our experience using transcatheter UAE in the management of severe obstetrical hemorrhage in 9 patients of Asian descent.

2. Methods

From April, 2001 to March, 2005, 9 patients who were treated with transcatheter UAE were evaluated retrospectively.

A digital substration angiography of the bilateral internal iliac arteries was performed by the interventional radiologist (Dr Tseng) using the right-side femoral approach with a 4F cobra-shaped catheter (Cobra; Cordis, the Netherlands) and a 0.035-inch-diameter hydrophilic polymer-coated guide-wire (Radiofocus; Terumo, Japan). Bilateral uterine arteries were also catheterized using a 2.5 F coaxial catheter (Renegade, Boston Scientific, MA, USA). Embolization of the uterine arteries was carried out preferentially with absorbable polyvinyl alcohol dehydrated particle (PVA, Ultra-Drivalon; CathNet-Science, France), or gelatin sponge pieces (Gelfoam; Spongostan, Johnson & Johnson Medical Limited, UK) or both. Subsequently, vascular occlusion was confirmed by repeat angiography, and uterotonic agents were administered; further treatments were performed when necessary.

3. Results

The general characteristics of the patients are shown in Table 1. The mothers' median age was 35 years (range 25–42) and the babies' median gestational age was 38 weeks (36–40 weeks). Eight pregnancies were spontaneous, and 1 involved assisted reproductive technologies (IVF, *in vitro* fertilization), resulting in triple pregnancies. All deliveries were scheduled, including 5 cesarean sections (C/S) and 4 inductions with normal vaginal delivery. The main cause of PPH in 8 patients (89%, 8/9) was placental accreta; one patient had atony. One patient was also complicated with complete placenta previa. The embolization procedures involved bilateral uterine arteries in 6 cases, right uterine artery in 2 cases, and left uterine artery in 1 case. Absorbable polyvinyl alcohol, Gelfoam, or both, was used for embolization in all cases (Table 2). After the procedure, 4 women had abdominal pain or lower back pain (Visual analog scores are 4, 6, 4, 5 right after UAE, five days later, VAS score 1, 2, 1, 2), 2 women had urinary frequency, and 1 woman had pelvic inflammatory disease (under control of oral antibiotics for 14 days).

The median follow-up was 82 months, ranging from 63 months to 108 months (Table 3). Menstruation returned for all women after UAE or ceasing breast-feeding, but 5 reported hypomenorrhea. None had dyspareunia, change in sexual function, or menopausal symptoms or signs. None were menopausal during the follow-up period.

Four women attempted pregnancy, and 3 had successful and uncomplicated term deliveries. One woman was infertile, and the cause was unexplained.

4. Discussion

PPH is one of the main causes of maternal mortality throughout the world, and occurs in approximately 5% of all

Table 1
General characteristics of the patients

Case	Age (yr)	Parity	History	Labor condition (gestational wk)	Clinical diagnosis	EBL (mL) hemoglobin change before UAE	Clinical managements before UAE
1	31	G6P2A3	C/S twice, D & C triple times	C/S (39)	Placenta accreta	>2000 5.3 g/dL	Oxytocin, methylergonovine
2	29	G2P0A1	D&C once	C/S (39)	Placenta accrete	6.1 g/dL	Oxytocin, methylergonovine
3	42	G6P2A3	NSD twice, D&C triple times	Induction (40)	Placenta accreta	>2000 4.4 g/dL	Packing; massage; oxytocin, methylergonovine
4	36	G3P1A1	D&C once	C/S (39)	Placenta accreta	>1000 3.3 g/dL	Packing; massage; pitocin
5	25	G1P0A0	IVF + ET with triple pregnancy, OHSS	C/S (36)	Atony	>2000 6.6 g/dL	Oxytocin, methylergonovine
6	38	G5P3A1	C/S twice; GDM; tocolytic treatment	C/S (37)	Total placenta previas	>2000	Oxytocin, methylergonovine
7	38	G2P1A0	NSD once	Induction (39)	Retained placenta	>1000	Packing; massage; oxytocin, methylergonovine
8	39	G6P1A4	NSD once, D&C triple times	Induction (40)	Placenta accreta	3.2 g/dL >2000 6.3 g/dL	Packing; massage; oxytocin, methylergonovine
9	30	G1P0A0		Induction (40)	Placenta accreta	>2000 6.1 g/dL	Packing; Massage; oxytocin, methylergonovine

C/S = cesarean section; EBL = estimated blood loss; G = gravida; GDM = gestational diabetes; IVF + ET = *in vitro* fertilization and embryo transfer; OHSS = ovarian hyperstimulation syndrome; P = para; UAE = uterine artery embolization.

Table 2
Summary of embolization data

Patient No.	Angiogram finding	Embolization	Material	Successful	Complication
1	Active bleeding of bilateral uterine artery	Yes (bilateral uterine artery)	Ivalon	Yes (no more active bleeding)	None
2	Abnormal hypervascular stains in uterine cavity especially from left uterine artery	Yes (bilateral uterine artery)	Ivalon	Yes (no residual hypervascular stains)	None
3	Contrast extravasation from right uterine artery	Yes (right uterine artery)	gelfoam	Yes (loss of contrast leakage)	None
4	No definite active bleeding	Yes (bilateral uterine artery)	Ivalon; gelfoam	Yes	None
5	Contrast extravasation and pooling into the uterine cavity from left uterine artery	Yes (left uterine artery)	Ivalon	Yes (total occlusion)	None
6	Extravasation and pooling into the uterine cavity more in right side	Yes (bilateral uterine artery)	Ivalon	Yes (total obliteration)	None
7	Bilateral faint contrast extravasation and pooling into the uterine cavity	Yes (bilateral uterine artery)	Ivalon; gelfoam	Yes (total occlusion)	None
8	Active bleeding of right uterine artery	Yes (right uterine artery)	Ivalon; gelfoam	Yes (total obliteration)	None
9	More prominent in right side	Yes (bilateral uterine artery)	Ivalon	Yes (decreased vascularity)	None

Ivalon: PVA: 250–355 mm polyvinyl alcohol particle (Ultra-Drivalon), 50–100 mg; Gelfoam: gelatin sponge pieces.

deliveries.² Although uterine atony is the main cause of primary PPH (70%),¹⁸ other causes, including trauma (laceration) to the lower genital tract and retained placental tissue should be considered; the latter, especially, contributes to maternal morbidity rather than mortality.¹⁹ Treatment of PPH is centered on resuscitation of the patient and arrest of the bleeding. Strategies range from conservative to destructive. Conservative management includes uterine massage, vaginal packing, uterotonic drugs, and surgical repair of lower genital tract lacerations. If these attempts fail, intensive treatment, including surgical ligation of the internal iliac arteries or uterine arteries and transcatheter arterial embolization follows. These rescue methods can avoid the need for the most of immediate or delayed post-partum hysterectomies,² because the overall successful rate of UAE is more than 90%.^{20–22} In this study, the UAE procedure had completely cured the more

troublesome PPH successfully and avoided hysterectomy. Furthermore, the UAE complication rate is low and the occurrence of complications is ‘operator dependent’; adequate expertise and skill can keep the complication rate to a minimum of less than 1.6%.²³ Complications include those related to the angiography procedure itself, such as anaphylaxis and renal toxicity, and those related to embolization, such as embolus dislodgment leading to tissue necrosis (bladder and rectal wall necrosis) and other rare conditions, such as fever, nerve injury, and late rebleeding.²³

Numerous cases of pregnancy after bilateral ligation of the internal iliac arteries²⁴ or the uterine arteries²⁵ have been reported in the literature. However, currently available data are insufficient to routinely offer UAE to women who wish to preserve or enhance their fertility.¹⁴ Since the possibility of a negative impact on the ovarian function is always a concern when using the UAE procedure, there is an argument about the deterioration of ovarian function after UAE.^{26,27} Recently, long-term follow-up and implications for pregnancy have also been reported after UAE.^{12,28} According to these reports, the influence on fertility is minimal, although some concerns are still raised based on the experience with fibroid treatment.^{12–16} In fact, in this study, pregnancy occurred spontaneously in those patients who had a desire. However, one important sequela that should be emphasized is the recurrence of severe post-partum hemorrhage.²³

Although all patients returned to a normal menstrual cycle after UAE, the findings in this study are consistent with those of previous reports,²⁸ and even consistent with uterine vessel occlusion performed by laparoscopic uterine vessel occlusion either with or without simultaneous blockage of the uterine vessels and the anastomotic sites between the uterine vessels and the ovarian vessels.^{14,15} However, the amount of menstrual blood flow was decreased significantly in this study, and more than half of the patients reported hypomenorrhea. Because UAE is becoming a well-accepted choice in the management

Table 3
Menstrual pattern and fertility compared with those before uterine artery embolization

Patients	Menstruation pattern duration/interval	Amount	Fertility
1	Similar (3–4/25 d)	Similar	Infertility
2	Similar (5–7/28 d)	Hypomenorrhea	C/S 18 mo after UAE (GA 37 wk, male, 3574 g) C/S 46 mo after UAE (GA 37 wk, female, 3000 g)
3	Similar (3–4/28 d)	Hypomenorrhea	No attempt
4	Similar (3–4/26 d)	Hypomenorrhea	No attempt
5	Similar (5–7/22 d)	Similar	No attempt
6	Similar (3–4/28 d)	Hypomenorrhea	No attempt
7	Similar (5–7/29 d)	Similar	C/S at 17 mo after UAE (GA 38 wk, male, 3340 g)
8	Similar (3–4/28 d)	Hypomenorrhea	No attempt
9	Similar (3–5/29 d)	Similar	C/S at 36 mo after UAE (GA 38 wk, female, 3230 g)

C/S = cesarean section; GA = gestational age; UAE = uterine artery embolization.

of women with symptomatic uterine fibroids, especially hypermenorrhea or menorrhagia, the findings in our study are not so surprising. However, a potentially compromised ovarian function may actually be present. In our recent publications,^{14,15} we found that different approaches to treating blockage of the uterine feeding vessels result in different patterns of follicular stimulating hormone changes and therapeutic outcomes. The more uterine feeding vessels are occluded, the more effective the therapeutic outcomes, but more elevated basal levels of follicular stimulating hormone are found. Therefore, the ovarian function or future fertility outcome is still arguable.

In this study, there are some limitations including the small sample size, the lack of hormone status or menstrual flow data before UAE and also lack of furthermore evaluation of right decision timing of UAE when after multiple procedures failed.

In conclusion, selective UAE is a safe and effective method to control obstetric intractable hemorrhage in those case with failed medical or obstetrical conservative treatment. This technique might be considered as a choice before performing a furthermore destructive surgery. Preservation of the uterus remains an indisputable advantage of UAE for women desiring another pregnancy. With the satisfactory results mentioned above, it seems that a patient with severe post-partum hemorrhage the UAE could be an appropriate method in Taiwan.

References

1. Yalinkaya A, Guzel AI, Kangel K. Emergency peripartum hysterectomy: 16-year experience of a medical hospital. *J Chin Med Assoc* 2010;**73**:360–3.
2. Yang MJ, Wang PH. Peripartum hysterectomy risk factors in Taiwan. *J Chin Med Assoc* 2010;**73**:399–400.
3. Cheng YY, Hwang JI, Hung SW, Tyan YS, Yang MS, Chou MM, et al. Angiographic embolization for emergent and prophylactic management of obstetric hemorrhage: a four-year experience. *J Chin Med Assoc* 2003;**66**:727–34.
4. Yu PC, Ou HY, Tsang LLC, Kung FT, Hsu TY, Cheng YF. Prophylactic intraoperative uterine artery embolization to control hemorrhage in abnormal placentation during late gestation. *Fertil Steril* 2009;**91**:1951–5.
5. Lee WL, Wang PH. Major postpartum hemorrhage as an initial presentation of acute myeloid leukemia. *Int J Gynaecol Obstet* 1999;**66**:173–4.
6. Novikova N, Hofmeyr GJ. Tranexamic acid for preventing postpartum haemorrhage. *Cochrane Database Syst Rev* 2010;**7**:CD007872.
7. Chou YC, Wang PH, Yuan CC, Yen YK, Liu WM. Laparoscopic bipolar coagulation of uterine vessels to managing delayed postpartum hemorrhage. *J Am Assoc Gynecol Laparosc* 2002;**9**:541–4.
8. Wang PH, Liu WM, Fuh JL, Chao HT, Yuan CC, Chao KC. Symptomatic myoma treated with laparoscopic uterine vessel occlusion and subsequent immediate myomectomy – which is the optimal surgical approach? *Fertil Steril* 2009;**92**:762–9.
9. Ring EJ, Athansoulis C, Waltman AC. Arteriographic management of hemorrhage following pelvic fracture. *Radiology* 1973;**109**:65–70.
10. Brown BJ, Heaston DK, Poulson AM. Uncontrollable postpartum bleeding: a new approach to hemostasis through angiographic arterial embolization. *Obstet Gynecol* 1979;**54**:361–5.
11. Gonsalves M, Belli A. The role of interventional radiology in obstetric hemorrhage. *Cardiovasc Intervent Radiol* 2010;**33**:887–95.
12. Berkane N, Moutafoff-Borie C. Impact of previous uterine artery embolization on fertility. *Curr Opin Obstet Gynecol* 2010;**22**:242–7.
13. Gupta JK, Sinha AS, Lumsden MA, Hickey M. Uterine artery embolization for symptomatic uterine fibroids. *Cochrane Database Syst Rev* 2006;(1):CD005073.
14. Lee WL, Liu WM, Fuh JL, Tsai YC, Shih CC, Wang PH. Basal follicle-stimulating hormone level changes after different types of uterine vessel occlusion in the management of uterine fibroids. *Fertil Steril*. doi: 10.1016/j.fertnstert.2009.11.038, in press.
15. Lee WL, Liu WM, Fuh JL, Tsai YC, Shih CC, Wang PH. Use of uterine vessel occlusion in the management of uterine myomas: two different approaches. *Fertil Steril* 2010;**94**:1875–81.
16. Wen KC, Chen YJ, Sun BL, Wang PH. Comparing uterine fibroids treated by myomectomy through traditional laparotomy (LT) and two modified approaches: ultraminilaparotomy (UMLT) and laparoscopically-assisted ultraminilaparotomy (LA-UMLT). *Am J Obstet Gynecol* 2010;**202**:e1–8.
17. Liu WM, Wang PH, Chou CS, Tang WL, Wang IT, Tzeng CR. Efficacy of combined laparoscopic uterine artery occlusion and myomectomy via minilaparotomy in the treatment of recurrent uterine myomas. *Fertil Steril* 2007;**87**:356–61.
18. Combs CA, Murphy EL, Laros RK. Factors associated with post partum haemorrhage with vaginal birth. *Obstet Gynecol* 1991;**77**:69–76.
19. Khong TY, Khong TK. Delayed postpartum hemorrhage: a morphologic study of causes and their relation to other pregnancy disorders. *Obstet Gynecol* 1993;**82**:17–22.
20. Delotte J, Novellas S, Koh C, Bongain A, Chevallier P. Obstetrical prognosis and pregnancy outcome following pelvic arterial embolisation for post-partum hemorrhage. *Eur J Obstet Gynecol Reprod Biol* 2009;**145**:129–32.
21. Salazar GM, Petrozza JC, Walker TG. Transcatheter endovascular techniques for management of obstetrical and gynecologic emergencies. *Tech Vasc Interv Radiol* 2009;**12**:139–47.
22. Vegas G, Illescas T, Muñoz M, Pérez-Piñar A. Selective pelvic arterial embolization in the management of obstetric hemorrhage. *Eur J Obstet Gynecol Reprod Biol* 2006;**127**:68–72.
23. Lee JS, Shepherd SM. Endovascular treatment of postpartum hemorrhage. *Clin Obstet Gynecol* 2010;**53**:209–18.
24. Mengert WF, Burchell RC, Bulmstein RW, Daskal JL. Pregnancy after bilateral ligation of the internal iliac and ovarian arteries. *Obstet Gynecol* 1969;**34**:664–6.
25. AbdRabbo SA. Stepwise uterine devascularization: a novel technique for management of uncontrollable postpartum hemorrhage with preservation of the uterus. *Am J Obstet Gynecol* 1994;**171**:694–700.
26. Kim HS, Tsai J, Lee JM, Vang R, Griffith JG, Wallach EE. Effects of utero-ovarian anastomoses on basal follicle-stimulating hormone level change after uterine artery embolization with tris-acryl gelatin microspheres. *J Vasc Interv Radiol* 2006;**17**:965–71.
27. Tropeano G, Amoroso S, Scambia G. Non-surgical management of uterine fibroids. *Hum Reprod Update* 2008;**14**:259–74.
28. Eriksson LG, Mulic-Lutvica A, Jangland L, Nyman R. Massive postpartum hemorrhage treated with transcatheter arterial embolization: technical aspects and long-term effects on fertility and menstrual cycle. *Acta Radiol* 2007;**48**:635–42.