

Efficacy of Uterine Artery Embolization for Control of Postpartum Hemorrhage

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ABSTRACT

Background and Objective: Postpartum hemorrhage is the most common cause of maternal morbidity, especially in developing countries, and a major cause of direct maternal death worldwide. Considering the importance of timely postpartum hemorrhage management and access to low-risk methods, assessing the efficacy of uterine artery embolization (UAE) is essential. Therefore, the present study was conducted to evaluate the success rate and outcomes of UAE in the treatment of delayed postpartum hemorrhage.

Methods: This cross-sectional study was performed on women with delayed postpartum hemorrhage who were referred to the gynecology and obstetrics clinic of a referral hospital in Urmia city under treatment of UAE. The census method was used for choosing the patients and all women with delayed postpartum hemorrhage between April 2019 and March 2020 were entered into the study.

Results: During the study period, the number of 22 women with delayed postpartum hemorrhage were entered into the study. The mean age of the women was 29.36 ± 5.09 years. The success rate of UAE was 95.6%. The number of 20 (90.9%) cases did not report complications. For one case, UAE complication was associated with amenorrhea and for the other one with vaginal bleeding.

Conclusion: The results showed that the UAE method as an effective method with high efficacy and low complications can be considered a suitable choice for the treatment of delayed postpartum hemorrhage.

Keywords: Uterine artery embolization, Vaginal bleeding, Interventional radiology, Complication

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Introduction

Postpartum hemorrhage is defined by the World Health Organization as the loss of more than 1000 cc of blood following cesarean delivery or more than 500 cc following vaginal delivery (1). Postpartum hemorrhage can be due to uterine atony, placental abruption, genital injury, coagulation problems, and uterine rupture (2). Postpartum hemorrhage is one of the major problems of the health system that can impose a great economic burden on society (2,3). The prevalence of this hemorrhage has been reported 2-4% in vaginal delivery and 6% in cesarean section (4).

Delayed postpartum hemorrhage occurs after the 24 hours to six weeks after delivery and its most

common causes are retained products of conception, infection, and uterine atony, and its rare causes are pseudoaneurysms, venous arterial malformation, and choriocarcinoma, and sometimes has no known cause (5,6). Extensive bleeding is characterized by a 10% reduction in hematocrit after delivery and the need for blood transfusions, occurring in 4% of cases after vaginal delivery and 6% after cesarean section (7).

The first step in the success of postpartum hemorrhage is to rapidly identify the underlying cause and control of the bleeding. In most cases, to control postpartum hemorrhage from various conservative treatments such as bi-manual

massage, bladder emptying, administration of Oxytocin and Methergine (Methylergonovine) and Prostaglandin, especially misoprostol and surgical treatments such as uterine and vaginal packing, uterine artery closure, hypogastric artery closure and uterine pack, (8-11). When bleeding fails to control by conservative treatments, vascular ligation or hysterectomy are alternative options (12,13).

UAE is a useful method in the treatment of postpartum hemorrhage with a success rate of 83-96% and complications of 6-9% (15). The uterus is fed by the uterine artery (90%) and the ovary, both of which originate from the aorta, therefore, embolization of this artery will be useful in controlling bleeding from these arteries. The ovarian artery originates directly from the aorta and embolization of this artery causes ovarian loss. Uterine necrosis is another rare complication following the UAE (14-16).

Most of the reports show that UAE is a safe and effective method in the management of postpartum hemorrhage. However, most reports are related to western societies and studies in our country are limited in this regard. Considering the importance of timely postpartum hemorrhage management and access to low-risk methods, assessing the efficacy of the UAE is essential. Therefore, the present study was conducted to evaluate the success rate and outcomes of UAE in the treatment of delayed postpartum hemorrhage.

Materials and Methods

This cross-sectional study was performed on women with delayed postpartum hemorrhage who were referred to the gynecology and obstetrics clinic of the referral hospital in Urmia city under treatment with UAE between April 2019 and March 2020. The census method was used for choosing the patients and all women with delayed postpartum hemorrhage during the mentioned time period were entered into the study.

The ethics committee of Urmia University of Medical Sciences approved the protocol of the study (IR.UMSU.REC.1400.157). We used a researcher-made checklist to collect required information from the patients. This checklist includes demographic information including age, BMI, parity, number of live births, number of abortions, number of neonatal deaths, and previous deliveries, as well as the patient's clinical condition including duration of bleeding, ultrasound findings, CT-angio findings, and detectable complications following UAE such as fever, amenorrhea, and bleeding as well as treatment outcome. This information was extracted from the

patients' medical records and interviews with the patients by the trained obstetrician.

The process of UAE was performed according to the relevant standard as follows: After filling and drip under local anesthesia, the first 6 french arterial sheaths were inserted in the common femoral artery to allow continuous access to the arterial system. The common iliac artery angiography was performed by a cobra catheter 2 with a diameter of 5 French, to determine the origin of the left or right uterine artery after selective angiography of the internal iliac artery. Then, by micro-guide and micro-catheter, 2.9 French catheterizations of the left or right uterine artery were performed in order to perform superselective angiography of the uterine artery. After determining the uterine artery, the microcatheter was advanced to the transverse part of the uterine artery and superselective angiography was performed. Once the ovarian artery was not clearly bleeding from the right or left uterine artery, the embolization agent should have been included, Gelfoam, in cases where the patient had AVF, and if there was Cyanocrylate_N or coil, it should be injected into the uterine artery. After embolization, control angiography was performed to ensure complete success and then the procedure was terminated. It should be noted that this procedure was performed for the right and left uterine arteries and, if necessary, unilateral embolization was performed. Patients with pseudoaneurysm or vascular complication who had drawn blood from only one side of the uterine artery became unilateral embolization, and those with hypervascularity from both sides had bilateral embolization. Finally, the patients were followed up clinically to ensure cessation of vaginal bleeding.

Descriptive statistics including mean and standard deviation for description of continuous variables and frequency and percentage for categorical variables were used. Data were analyzed using SPSS Statistics for Windows, Version 23.0.

Results

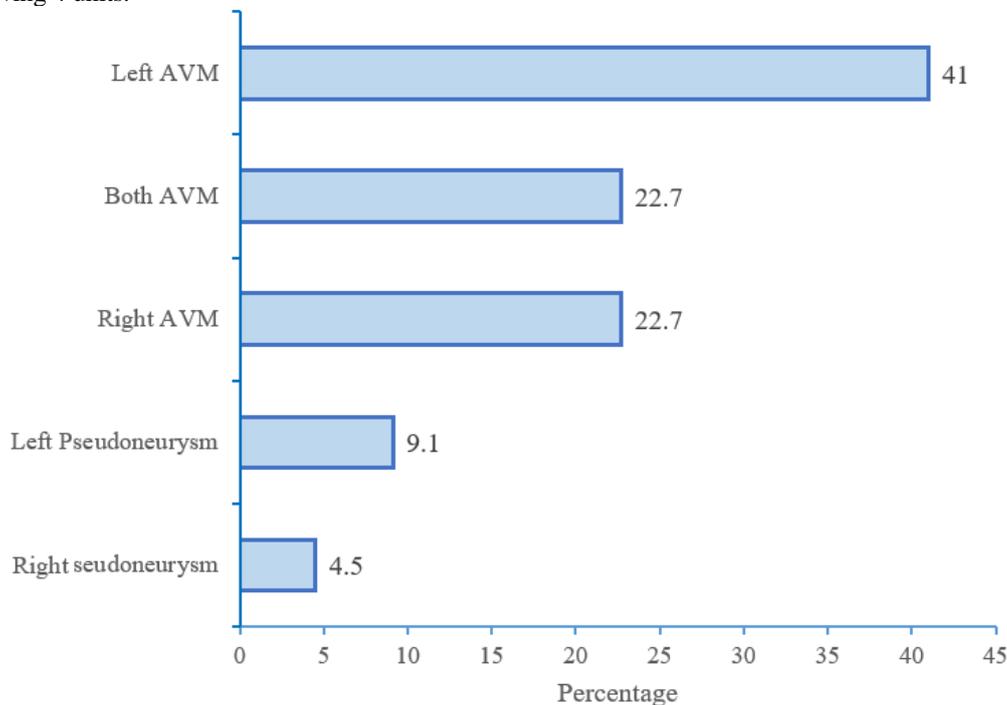
From April 2019 to March 2020, a number of 22 women with delayed postpartum hemorrhage were entered to the study. Their mean age and BMI were 29.36 ± 5.09 years and 25.27 ± 3.28 kg/m², respectively. Other information regarding means of their gravidity, live birth, stillbirth, abortion and previous vaginal delivery or cesarean are presented in Table 1. The means of bleeding duration was 14.23 ± 14.85 days (range: 1-60).

Table 1. Demographic characteristics of the patients

Variable	Mean	SD	Range
Age (year)	29.63	5.09	22-43
BMI (kg/m ²)	25.27	3.28	20-31
Gravidity	2.18	0.85	1-4
Live birth	1.95	0.95	0-4
Abortion	0.23	0.43	0-1
Cesarean section	1.05	1.05	0-3
Vaginal delivery	0.95	1.33	0-4
Bleeding time (day)	14.23	14.85	1-60

Of the included cases, one of them had anemia. Sonography findings showed that 5 (22.7%) of them had hmatoma and 17 (77.3%) had arteriovenous malformations (AVM). Moreover, CT-angio findings showed that 4 (18.2 %) had left AVM, 3 (13.6%) had right AVM, 2 (9.1%) had bilateral AVM and 2 (9.1%) had pseudoaneurysm. Prior to embolization, three patients received pack cells, two receiving 2 units and one receiving 4 units.

In regard to complications, one case had amenorrhea, one case vaginal re-bleeding and one case had reported fever. Moreover, according to the embolized vessel, 9 (41%) patients had left AVM, 5 (22.7%) had right AVM, 5 (22.7%) had bilateral AVM, one patient had right pseudoaneurysm and 2 (9.1) patients had left pseudoaneurysm (Figure 1).

**Figure 1.** Categorization of the patients according to embolized vessel

In this study, for 7 cases left embolization, for 2 cases right embolization and for 13 cases left and right embolization was performed. The success rate of UAE was 95.6% and only one case of treatment failure was occurred, which was a 29-year-old woman with a BMI of 22, Grade 1, no history of miscarriage and stillbirth, and a previous cesarean section. The duration of bleeding, in this case, was 15 days, with hematoma, right AVM and previous drug treatment failure.

Discussion

In this report, we investigated the cohort of patients with delayed postpartum hemorrhage treated with UAE in the referral hospital of Urmia

city during 2 years period. The results of the study indicate the high effectiveness of this treatment modality in controlling delayed postpartum hemorrhage. In addition, the serious complications following this treatment were non significant.

In the present study, the success rate of UAE was 95.6%. In a study by Soncini *et al.*, in 2006 in Italy, the success rate of UAE was reported to be 92.5% (17). In 2002, Dildy Iii *et al.*, reported a success rate of 97% (18), while some conducted studies in this regard reported a success rate of 100% (19-21). Other studies had reported the success rate of UAE in the ranges of 85-96% (6, 15, 22-24). Therefore, it seems that the UAE method is an efficient method with a success rate

of over 90% for controlling delayed postpartum hemorrhage.

One of the evaluation criteria for a treatment modality is the frequency of complications following the intervention, which can be very helpful in clinical decisions. In the present study, in 90.9% of cases no complications were occurred and only three cases were observed with amenorrhea, vaginal bleeding, and fever following the intervention. In the study of Soncini *et al.*, no serious complications were observed (17), and in the study of Ganguli and colleagues, the rate of complications was reported to be 4.5% (23). In the study of Kim *et al.*, 21.7% of cases had reported complications following UAE, which included 11 cases of fever above 38.5 for two weeks and one case of ovarian dysfunction (6). According to the results of the present study and comparison with other studies, it seems that the UAE for controlling delayed postpartum hemorrhage can be considered as a low-risk method with low complications. It is difficult to attribute the above-mentioned complications directly to the embolization procedure given pre-existing conditions and other concurrent obstetrical interventions.

Evidence showed that UAE is safer and more effective than a hysterectomy for the control of postpartum hemorrhage and early cooperation between obstetricians and interventional radiologists is associated with the improving outcomes of UAE (25,26).

However, the present study had some limitations. Firstly, in the present study, we did not have a comparison group to compare the results and therefore we could not able to calculate the independent risk factors of failure in UAE. Finally, the small sample size of the study for assessing outcomes with the strongest power can be considered as another limitation of the study.

Conclusion

Due to the high success rate of UAE and its low serious complication, UAE can be used as a conservative treatment for delayed postpartum hemorrhage as an alternative to major surgeries such as hysterectomy. However, stronger evidence by conducting randomized, controlled trials are needed for determining predictors of successful application of UAE for the treatment of delayed postpartum hemorrhage.

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Conflict of Interest

The authors declare that they have no competing interests.

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