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Clinical parameters of uterine artery embolization in patients with postpartum hemorrhage

Zerrin AVUL[1], Bihter Senem FEYZİOĞLU[1], Bayram KAHRAMAN[2], Dilek UYSAL[3], Cenk Mustafa GÜVEN[4], Elif DEMİR ÇINAR[5]

[1]Clinic of Obstetrics and Gynecology, Private Erciyes Hospital, Kayseri, Türkiye
[2]Department of Radiology, Private Radiology Clinic, Malatya, Türkiye
[3]Department of Obstetrics and Gynecology, İzmir Katip Çelebi University Atatürk Education and Research Hospital, İzmir, Türkiye
[4]Clinic of Obstetrics and Gynecology, İzmir Private Can Hospital, İzmir, Türkiye
[5]Department of Obstetrics and Gynecology, Private Obstetrics and Gynecology Clinic, Kayseri, Türkiye

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ABSTRACT

Objectives: Postpartum hemorrhage (PPH) is a leading cause of maternal deaths in the world. To decrease maternal mortality rates, surgical and non-surgical methods are used in treatment of patients with PPH. Uterine artery embolization (UAE) is an important procedure to treat patients with PPH without surgery. The objective of this study was to determine critical patient parameters the success of UAE for the treatment of PPH.

Materials and Methods: From 2018 to 2022, a total of 22 women who have given birth (mean age was 29.4±6.0 years) who were diagnosed PPH was included in the study and their demographic and clinical characteristics were recorded. Patients were subjected to UAE using polyvinyl alcohol and the significant clinic parameters were determined on the success of the UAE.

Results: The UAE method was successful in 14 patients. The success rate for UAE was about 64%, and the age, body mass index, gravidity, parity, and type of delivery were deeply associated with the clinical efficiency of UAE method in patients with PPH. Moreover, no correlation was found between gestational age of the cases and the success of the UAE method.

Conclusion: Our findings suggest that UAE is an effective treatment method to stop uterine bleeding with low complication.

Keywords: Postpartum hemorrhage; uterine artery embolization; pregnancy; risk factors

Address for Correspondence: Zerrin Avul, Clinic of Obstetrics and Gynecology, Private Erciyes Hospital, Kayseri, Türkiye
E-mail: z.avul@erciyeshastanesi.com.tr **ORCID ID:** orcid.org/0000-0003-3894-5272
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INTRODUCTION

Postpartum hemorrhage (PPH) is a life-threatening complication of childbirth. Generally, PPH is diagnosed in women who lost about 500 mL of blood after normal vaginal delivery or approximately 1000 mL of blood loss after cesarean delivery within 24 hours of birth. PPH is the leading cause of maternal mortality. Every year, an average of 14 million women is diagnosed with PPH in the world, and 70,000 of these cases result in death. Therefore, PPH is recognized as an important public health problem globally.[1-5]

PPH is a serious condition when occurs about 1 to 5 in 100 women giving birth. PPH is generally observed within a day after giving birth but can be happened up to the 12th week.[6,7] There are many factors that can induce an individual's chance of developing PPH. Uterine atony (or uterine tone) is considered to be the main cause of PPH.[8-10] Also, uterine inversion, uterine rupture, placental defects (placental abruption, placenta previa, retained placenta, placenta accrete), obesity, preeclampsia, infections, and intrahepatic cholestasis of pregnancy are other risk factors of the PPH.[3,11-13]

Uterine artery embolization (UAE) is an important radiologic procedure which was first described in 1995. UAE is defined as nonsurgical treatment method for women who want to preserve their uterus and avoid surgery. In this method, embolic agents [usually polyvinyl alcohol (PVA)] are injected into both uterine arteries to decrease perfusion to uterine fibroids and stimulate ischemic alterations without permanent damage to the uterus. Therefore, UAE is accepted as an alternative method instead of hysterectomy to prevent PPH in clinic.[14-16]

UAE is an alternative non-surgical method used in the treatment of PPH, but our knowledge of the clinical potentials of UAE is unfortunately insufficient. In this report, we aimed to investigate the clinical success of UAE methods in patients with PPH after delivery.

MATERIALS AND METHODS

A total of 22 cases of women were diagnosed with PPH and treated at the Clinic of Obstetrics and Gynecology, Private Erciyes Hospital, Kayseri, Türkiye, between 2018 and 2022. The study protocol was reviewed and approved by the Local Ethics Committee of Acıbadem University (2022-09/10).

PPH was detected in women who gave birth between the ages of 20-40. UAE was performed using PVA (embolic agent) by an experienced radiologist. To confirm the embolization in the vessels, angiograms were taken with an angiography device using contrast media with hydrophilic catheters placed in the uterine artery. It was observed that there was no bleeding in the angiograms and the procedure was terminated. The patients were kept under observation in the gynecology service after the UAE procedure, and surgical procedure was performed on the patients who were not clinically successful. The patients' demographic and clinical data, including maternal age, body mass index (BMI), gravida and parity, gestational age, type of delivery, obstetric history, indications, postpartum processing time, embolizing vessel, early and late complications after embolization, technical and clinical success of embolization, and hospitalization time were all recorded.

Statistical Analysis

The statistical package for the Social Sciences (SPSS) version 20.0 software was used for statistical analysis. The Mann-Whitney U test and Student's t-test were used for statistical analysis. Data are presented as mean ± standard deviation and p value <0.05 was considered significant.

RESULTS

A total of 22 women with PPH were treated with the UAE method using PVA and their clinical success was compared with the different characteristics of the cases. Clinical characteristics and the outcomes in patients are shown in Table 1. The average age of the patients was 29.4±6.0 years old (range: 20-40). The mean BMI was calculated as 22.3±3.6 kg/m^2 (range: 18-30). The average gestational age was 38.6±6.0, gravidity was 2.1±1.2 (range: 1-5), and parity was 1.6±0.8 (range: 1-4). More than half of the pregnant women included in the study had a normal vaginal spontaneous delivery (63.6%). It was determined that thirteen of these 22 women (59.1%) did not have pathological conditions in their pregnancy history. In this study, 77.3% of the 22 women with PPH were diagnosed as having uterine atony. An average of 2.9 hours after delivery, 86.4% of the women underwent bilateral UAE. Early and late complications did not observe in the majority of cases after the UAE. The average hospitalization time was 3.04±1.6 days.

As shown in Table 2, 14 women were treated successfully with UAE using PVA without any additional intervention. Of the eight women who failed the UAE method, four cases had to undergo a hysterectomy operation because of severe PPH. Furthermore, bilateral hypogastric artery ligation was performed in two patients. There is a statistically significant relationship between the success of the UAE method and the age, BMI, gravidity, parity, cesarean delivery, and length of hospital stay of the women who gave birth. Large for gestational age, high BMI, gravidity, and parity of the patients increase the clinical success of UAE. There were no significant differences with gestational age and normal vaginal spontaneous delivery between the successful UAE and unsuccessful UAE subgroups.

Table 1. Clinical characteristics and the outcomes in patients treated with UAE using PVA

Characteristic	Value
Age (years)	29.4±6.0 (range: 20-40)
BMI (kg/m²)	22.3±3.6 (range: 18-30)
Gravidity (n)	2.1±1.2 (range: 1-5)
Parity (n)	1.6±0.8 (range: 1-4)
Gestational age	38.6±1.4 (range: 35-40)
Type of delivery	
Normal spontaneous vaginal delivery	14 (63.6%)
Cesarean delivery	8 (36.4%)
Obstetric history	
Placental abruption	1 (4.5%)
Gestational hypertension	2 (9.1%)
Fetal distress	2 (9.1%)
Twin pregnancy	1 (4.5%)
Preeclampsia	2 (9.1%)
Placenta previa	1 (4.5%)
N/A	13 (59.1%)
Indications	
Uterine atony	17 (77.3%)
Placenta accrete	1 (4.5%)
Placenta previa	1 (4.5%)
Right uterine artery tear	1 (4.5%)
Uterine arteriovenous malformation	2 (9.1%)
Postpartum process time (hour)	2.9±1.75 (range: 1-6)
Embolizing vessel	
Bilateral uterine artery	19 (86.4%)
Right uterine artery	1 (4.5%)
Left uterine artery	2 (9.1%)
Early complications	
Atelectasis	1 (4.5%)
Urinary system infection	3 (13.6%)
Wound infection	1 (4.5%)
N/A	17 (77.3%)
Late complications	
Incisional hernia	2 (9.1%)
Oligomenorrhea	1 (4.5%)
Infertility	1 (4.5%)
N/A	18 (81.8%)
Hospital stay (days)	3.04±1.6

PVA: Polyvinyl alcohol; UAE: Uterine artery embolization; BMI: Body mass index

Table 2. Significant parameters affecting the success of the UEA method in patients diagnosed with PPH

	Uterine artery embolization		*p*
	Successful (n=14)	Unsuccessful (n=8)	
Age (years)	26.4±4.6	34.8±4.1	<0.001
BMI (kg/m²)	20.6±2.4	25.1±3.7	0.019
Gravidity (n)	1.5±0.8	3±1.3	0.025
Parity (n)	1.28±0.5	2.25±1.0	0.031
Type of delivery			
Normal spontaneous vaginal delivery	7 (50%)	6 (75%)	0.546*
Cesarean delivery	7 (50%)	2 (25%)	<0.001
Hospital stay (days)	2.0±0.0	4.9±1.2	<0.001

UAE: Uterine artery embolization; PPH: Postpartum hemorrhage; BMI: Body mass index; *: $p>0.05$

DISCUSSION

In the literature, the optimal conditions of UAE have not yet been sufficiently investigated in patients with PPH because there is not enough evidence from randomized controlled trials. In the present study, we reported that UAE was a non-surgical treatment method in women with serve PPH, and some clinical characteristics and outcomes decide the efficiency of UAE in patients. Obtained results demonstrated that the age, BMI, gravidity, parity, and type of delivery of the patients were determined as significant parameters affecting the success of UAE.

After vaginal and cesarean delivery, the contraction of the uterine muscles provides the compression of the blood vessels attached to the placenta, thus this mechanism stops the bleeding. Inability to contract or weak contraction of the uterine muscles (also called uterine atony) causes life-threatening blood loss. According to the World Health Organization (WHO), uterine atony has been reported as the most important cause of PPH.[17,18] Uterine atony was diagnosed in about 77% of the 22 PPH patients included in our study.

In our study, advanced maternal age adversely (34.8±4.1 years) affects the success of the UAE in patients with PPH and resulting in surgical intervention. Experimental and clinical studies reported that older maternal age (≥35 years) is an independent risk factor for PPH. Decreased vascular reactivity and vascular stiffness are important pathological conditions that increase with advanced maternal age. Aging leads to decrease in the elasticity of the soft birth canal and disruption of uterine contraction.[19,20] Moreover, the prevalence of placenta previa and placental abruption in advanced maternal age provoke PPH. All these complications that increase PPH negatively affect the efficiency of the UEA method in women who have given birth at an advanced age.

According to the WHO, a BMI over 25 kg/m^2 is considered overweight.[21] Tissue injury and surgical morbidity are pathological conditions observed more frequently in overweight women than in normal weight women. The prevalence of pregnant women with overweight is a significant parameter to explain the increase in PPH incidence.[22,23] It has been reported that overweight and obesity are limiting parameters for UEA method in the prevention of bleeding in gynecological cases, but there is no sufficient study on the relationship between overweight and the success of UEA in PPH.[24] Our findings demonstrated that the increase in BMI is a parameter that negatively affects the clinical success of UEA in treatment of PPH.

Clinical studies reported that uterine atony is the most common cause of PPH, and multiparity and high gravidity are significant risk factors for uterine atony. Therefore, multiparity and high gravidity are closely associated with PHH.[25,26] In this study, multiple pregnancy and multiparity were associated with an increased risk of UAE.

In order to evaluate clinical success of the UEA method, type of delivery and postpartum process time were examined on patients with PPH. Our results indicated that no statistically significant difference was observed in the clinical success of IEA by normal spontaneous vaginal delivery. Also, UAE method was successful in 7 out of 9 women with PPH after cesarean section ($p<0.05$). Compared to normal spontaneous vaginal delivery, cesarean delivery increases the risk of PPH and hemorrhage-related morbidity. Therefore, the application of the UEA method using PVA has a big potential for the treatment of PPH after cesarean delivery. In the literature, there is no study about relationship between type of delivery and the efficiency of the UAE method in patients with PPH.

It is well-known that UAE is an important alternative method to treat PPH without surgery. Similar to the literature, a 2.5-fold decrease was observed in the length of hospital stay of the patients treated with the UAE method.[27]

CONCLUSION

The authors' findings suggest that the age, BMI, gravidity, parity, and type of delivery of the patients have significant effect on success of UEA in patients with PPH. Furthermore, the absence of early and late complications in most of the women after the IEA procedure has emerged as another important advantage of the technique.

ETHICS

Ethics Committee Approval: The study protocol was approved by the Local Ethical Committee of Acıbadem University, Türkiye (2022-09/10).

Informed Consent: Informed consent was provided from all patients who wanted participated in the study.

FOOTNOTES

Contributions

Surgical and Medical Practices: Z.A., B.S.F.; Concept: Z.A., B.S.F., B.K.; Design: Z.A., B.S.F., B.K., D.U., C.M.G., E.D.Ç.; Data Collection or Processing: Z.A., B.S.F. B.K.; Analysis or Interpretation: Z.A., B.S.F., B.K., C.M.G., E.D.Ç.; Literature Search: Z.A., B.S.F., B.K., D.U., C.M.G., E.D.Ç.; Writing: Z.A., B.S.F.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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