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Original Research Article

## An analysis of the efficacy of uterine artery embolization in obstetrical hemorrhage

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### ABSTRACT

**Background:** Obstetrical hemorrhage is the single most important cause of maternal morbidity and mortality. The study is conducted at a tertiary-care hospital to assess the efficacy of uterine artery embolization as a treatment for obstetrical uterine hemorrhage. It examines various aspects such as the outcome of the procedure, need of blood and blood products, need of secondary procedures post intervention and the possibility of future pregnancies.

**Methods:** It was a retrospective observational study conducted with sample size of 20 patients with obstetrical hemorrhage at the Department of Obstetrics and Gynecology of Bhagwan Mahaveer Jain Hospital, Bengaluru in India between January 2011 to July 2019.

**Results:** Records of 20 patients with obstetrical hemorrhage were assessed. The study indicates that 11 patients experienced postpartum hemorrhage (PPH), 5 postabortal bleeding & 4 bleeding due to scar ectopic. Out of 20 patients, hemodynamic stability was achieved in 17 cases (85%), hysterectomy was needed in 2 cases (10%) and 1 (5%) patient died after the procedure. Of total 20 cases, 18 (90%) required secondary procedures post-intervention like dilatation and evacuation 6 cases (33.3% of total cases), vaginal suturing and packing 10 cases (55.5% of total cases) and supportive measures like PPH and Disseminated intravascular coagulation (DIC) management in 2 cases (11.1% of total cases). Blood transfusion was given in 15 cases (75%) after the procedure. Future pregnancy was attained in 8 cases (47%) after considering the history of the patients, loss of follow-up, possibility of complications, family planning and hysterectomy performed.

**Conclusions:** Uterine artery embolization is a very effective method to control obstetric hemorrhage with high success and low complication rate and hysterectomy can be avoided to preserve fertility.

**Keywords:** Obstetric hemorrhage, Postpartum hemorrhage, Postabortal hemorrhage, Uterine artery embolization

### INTRODUCTION

Obstetric hemorrhage refers to excessive bleeding that occurs during pregnancy, childbirth, or in the postpartum period. This type of hemorrhage is a major cause of maternal morbidity and mortality worldwide.<sup>1</sup>

Uterine Artery Embolization (UAE) is used for more than 20 years to control obstetrical hemorrhage. The American

College of Obstetricians and Gynecologists (ACOG) defines uterine artery embolization (UAE) as a minimally invasive procedure that involves the injection of small particles or beads through a catheter into the uterine arteries to block the blood supply to the uterine tissues. However, it also emphasizes the importance of careful patient selection and counseling regarding the risks and benefits of UAE, as well as the need for close follow-up and monitoring after the procedure.<sup>2</sup>

UAE has a potential role in uterine salvage and is useful in situations in which preservation of fertility is desired when surgical options have been exhausted in controlling PPH both atonic and traumatic. The procedure appears to be less time-consuming, poses less instability to hemodynamic status and is relatively free from long-term complications.<sup>2,3</sup> However, it continues to be underutilized as awareness about the procedure still remains limited.

The aim of this retrospective study is to evaluate the efficacy of uterine artery embolization as a treatment for obstetrical uterine hemorrhage at a tertiary-care hospital. This study aims primarily at assessing the outcome of UAE including rate of procedural success and clinical effectiveness. Further, the need for blood transfusion and secondary procedures post-intervention are also assessed. It does not preclude the possibility of future pregnancies in desirous women as a secondary outcome.

**METHODS**

This is a retrospective study conducted on patients who had undergone UAE for obstetrical hemorrhage from January 2011 to July 2019 in the maternal-fetal medicine department of Bhagwan Mahaveer Jain Hospital, Bengaluru (KA), India. Past records of these patients were included in this study. During this period, we diagnosed 20 patients with obstetrical hemorrhage following abortion and delivery.

UAE was performed only after all usual maneuvers for the treatment of obstetrical hemorrhage were used. This usually included intravenous uterotonic agents, aggressive uterine massage, uterine packing, manual removal of the placenta, repair of genital lacerations, and often balloon tamponade.

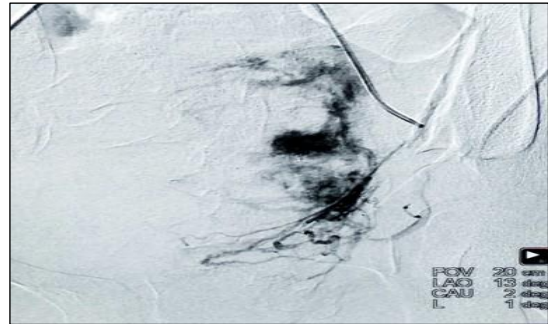
Informed consent for UAE was obtained from all patients. Patients who were not consenting were excluded from the study. Data were analyzed using descriptive statistics.

Digital subtraction angiography (DSA) was used during the operation. The femoral artery on one side was punctured by the Seldinger technique and the vascular sheath was placed. A 5F uterine artery (merit medicals,) catheter was passed in to contralateral internal iliac artery, DSA performed to identify the uterine artery. Superselective catheterization of uterine artery done under fluoroscopy, again DSA was done to look for contrast extravasation or vascularity of uterine wall. This was followed by embolization using poly vinyl alcohol (PVA) particles of size 500-700 microns suspended in dilute contrast till there was cessation of flow in the uterine artery branches and stasis in main trunk. Later, embolization with gel foam pellets or coil was done if the flow persisted. The ipsilateral uterine artery was selectively catheterized and embolization was carried out in similar fashion.

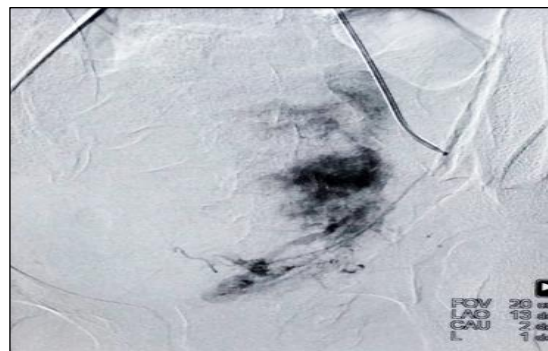
After completion the catheter was removed but the introducer sheath was kept till obstetrician did P/V

examination to make sure bleeding stopped. In case of post abortion hemorrhages complete evacuation was done on the Angio Suite. Later, the introducer sheath was removed and hemostasis was obtained at entry site by manual compression.

Figure 1 & 2 below shows about pre and post embolization impact of the procedure.



**Figure 1: Pre-embolization image of extravasation of contrast seen in left sided uterine artery.**



**Figure 2: Post-embolization image of left sided uterine artery.**

**RESULTS**

Table 1 shows the distribution of women having obstetrical hemorrhage in relation to age. In 20-25 years of age 7 (35%) patients had obstetrical hemorrhage, while in 26-30 years maximum 9 (45%) women were affected, in 31-35 years of age 3 (15%) women and above 35 years 1 (5%) had obstetrical hemorrhage. The mean age of presentation of obstetrical hemorrhage was 26.87 years.

**Table 1: Distribution of women according to age group.**

Age of patients (years)	Number of cases (N=20)	Percentage
20-25	7	35
26-30	9	45
31-35	3	15
Above 35	1	5

Table 2 shows the distribution of women with obstetrical hemorrhage in relation to profile of cases.

**Table 2: Profile of cases.**

Case profile	Number of cases (N=20)	Percentage
Post-partum hemorrhage	11	55
Postabortal hemorrhage	5	25
Scar ectopic pregnancy	4	20

Out of total 20 cases of obstetrical hemorrhage, 11 (55%) were of postpartum hemorrhage, 5 (25%) patients were postabortal hemorrhage and 4 (20%) patients were with scar ectopic pregnancy. Patients with postpartum hemorrhage (includes 5 normal delivery and 6 caesarean section patients).

**Table 3: Distribution of patients according to gravidity.**

Gravidity	Number of Cases (N=20)	Percentage
Primigravida	7	35
Multigravida	13	65

Table 3 shows the distribution of women with obstetrical hemorrhage in relation to gravidity.

As mentioned above in Table 3, 13 (65%) women were multigravida and 7 (35%) women were Primigravida among the cases reported in the study.

All 20 patients had undergone bilateral uterine angiography (100%). Based on the assessment, 16 (80%) patients required bilateral uterine artery embolization and 4 (20%) patients required unilateral UAE. This shows that bilateral embolization was mostly required to control the haemorrhage (Table 4).

**Table 4: Patients undergone UAE.**

Type of UAE	Number of cases (N=20)	Percentage
Bilateral uterine artery embolization	16	80
Right uterine artery embolization	3	15
Left uterine artery embolization	1	5

Table 5 illustrate the need for transfusion of blood and blood products after the UAE procedure. Blood transfusion was needed in only 15 (75%) cases. The prior hemoglobin levels of these patients were less than 7-8gms before the procedure. 1-5 units were required in 7 (35%), 5-10 units were required in 3 (15%) and more than 10 units in 5 (25%) patients. The mean blood transfusion required

was 14.4 units. However, it is biased as the patients with failure of procedure required a greater number of blood and blood products. So, the median is more reliable which came to 4 units in present study. Inference can be drawn that maximum number of patients (60%) who had undergone UAE needed less than 5 units of blood transfusions.

**Table 5: Distribution of women as per need of blood and blood product.**

Transfusion requirement (units)	Number of cases (N=20)	Percentage
0	5	25
1 - 5	7	35
6 - 10	3	15
> 10	5	25

Fresh frozen plasma, platelet concentrate, platelet rich plasma and cryoprecipitate were included as blood products in the study.

Out of total 20 cases, 18 (90%) required secondary procedures like dilatation and evacuation in 6 cases (33.3%) for removal of retained products of conception, vaginal suturing and packing in 10 cases (55.5%) for management of genital tract injuries and traumatic PPH and supportive measures like PPH and DIC management in 2 cases (11.1%) (Table 6).

**Table 6: Patients requiring secondary procedure after UAE.**

Secondary procedure required	Number of cases (N=18)	Percentage
D & E	6	33.3
Vaginal suturing and packing	10	55.5
Supportive measures	2	11.1

**Table 7: Outcome of the procedure.**

Total patients	UAE procedural success (%)	Procedural failure (%)	
		Obstetric hysterectomy	Mortality
20	17 (85)	2 (10)	1 (5)

Table 7 above narrates the clinical success rate of the UAE procedure. Procedural success was achieved in 17 (85%) patients. In the rest 3 (15%) patients, the procedure failed out of which 2 patients had to undergo obstetric hysterectomy and 1 patient died. The cause of procedural failure leading to obstetric hysterectomy in 2 cases was intractable PPH and adherent placenta respectively. Whereas, the cause of mortality was DIC with sepsis with multiple organ failure. The technical success rate of UAE procedure was 100%. However, clinical success rate and effectiveness was around 85% in our study.

In our study, 17 patients had the possibility of future pregnancy. Out of these 8 (~47%) patients conceived and

9 (~53%) patients still have the possibility of pregnancy in the future (Table 8).

**Table 8: Fertility outcome.**

	Number of cases (N=20)	Percentage
<b>Patient having possibility of future pregnancy</b>	17	85
<b>Patient conceived after procedure</b>	8	47

The proper and timely management of all patients at this tertiary care center was made possible due to the availability of round-the-clock trained staff and blood and blood products.

## DISCUSSION

Obstetrical hemorrhage is the most common and serious complication in obstetrics, which seriously endangers maternal life. Studies have shown that uterine atony is an important cause of maternal hemorrhage, and uterine contractile force often coexists with placental factors, referring to placental adhesion or placenta implantation caused by myometrial dysplasia.<sup>4</sup>

Further, the Four T's mnemonic can be used to identify and address the four most common causes of postpartum hemorrhage - uterine atony [Tone]; laceration, hematoma, inversion, rupture [Trauma]; retained tissue or invasive placenta [Tissue]; and coagulopathy [Thrombin].<sup>5</sup>

The treatment of maternal massive hemorrhage in the past largely relied on medical interventions such as giving uterotonic and hemostatic drugs, intrauterine gauze packing, tamponade and blood transfusion. However, these treatments frequently failed to achieve the desired outcome.<sup>6</sup> Further, Obstetric hysterectomy was often the last resort for these patients with severe hemorrhage, which not only led to the loss of fertility but also caused double trauma to the patient's physiology and psychology.

With the continuous development of interventional technology in recent years, uterine artery embolization has become a new minimally invasive treatment technology for obstetric hemorrhage, which has a good therapeutic effect. It can promptly diagnose and block the blood supply of the uterine artery to effectively reduce uterine bleeding. The absorbability of commonly used embolic materials such as absorbable gelatin sponge particles allow for the reopening of the uterine artery and restoration of normal blood supply, enabling uterine artery embolization to preserve maternal reproductive function.<sup>7</sup>

Hong et al reported that angiography performed revealed engorged and tortuous uterine arteries in all patients and 80% of patients underwent bilateral UAE which is similar to our findings.<sup>8</sup> They also reported that angiography is the standard method for recognition of vascular abnormalities and definitive treatment by embolization.<sup>8</sup>

Steinauer et al reported that UAE was successful in 90% (38 of 42) of cases of post-abortion hemorrhage.<sup>9</sup> Our study shows a success rate of 100% of cases (5 out of 5) of post-abortion hemorrhage.

Hong et al highlighted that the success rate of UAE in cesarean scar ectopic pregnancy cases was 88.06% (59 out of 67 cases).<sup>10</sup> In the present study, it is 100% (4 out of 4 cases).

Jung et al concluded in their study that they were able to successfully control PPH in 14 out of 17 patients (82.4%).<sup>11</sup> They also reported UAE appears to be a safe and effective means to control PPH. In the present study, of 11 PPH cases UAE was able to control bleeding in 8 cases (72.7%).<sup>11</sup>

According to Hansch et al, the use of uterotonic agents, uterine tamponade and internal iliac artery ligation can have a failure rate as high as 50 % and can lead to a more radical procedure like hysterectomy.<sup>12</sup> Our study shows the failure rate of only 15% in the case of uterine artery embolization which makes this procedure quite effective.

**Table 9: Comparison of success rate with other studies.**

Study conducted by	Success rate (%)
<b>Present Study</b>	85
<b>Zhang et al<sup>13</sup></b>	97
<b>Delotte et al<sup>14</sup></b>	92
<b>Agrawal et al<sup>15</sup></b>	100
<b>Choi et al<sup>16</sup></b>	90

From the above table 9, we can infer that the success rate of UAE in the cases of obstetrical hemorrhage in the present study is comparable to other studies.

Delotte et al showed that of 154 patients who had possibility of future pregnancy, 45 (~29%) had conceived.<sup>14</sup> Another study conducted by Salomon et al highlighted that total 17 out of 27 patients who had possibility of future pregnancy were tracked and 5 (29.41%) patients had conceived from this study group.<sup>17</sup> Gaia et al reported a pregnancy rate of 62% in patients who desired and attempted conception. In the present study, 17 patients had the possibility of future pregnancy, out of these 8 (~47%) patients conceived after considering the

history of the patient, loss of follow-up, family planning and hysterectomy performed.<sup>18</sup> However, the present study does not consider the number of females who did not intend to conceive due to any reasons.

The future scope of the study includes the effort for standardization of patient selection at inter-hospital level and evaluation of the appropriate position of UAE. Further, Recall bias in the retrospective study must be avoided for fair results and more long-term, larger studies are needed to determine the impact of uterine artery embolization on fertility outcomes

## CONCLUSION

Selective uterine artery embolization is a safe and effective treatment option for obstetric hemorrhage. UAE can avoid the need for obstetric hysterectomy and thus preserve fertility with minimal blood product requirements. This study shows that the procedure has high success rate with a significant impact and it also does not hamper future obstetric performance, emphasizing its value in obstetric care. However, the lack of advanced healthcare infrastructure, clinical capacity among obstetricians, and well-trained interventional radiologists limits its use.

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