CLINICAL STUDY

Uterine Artery Embolization before Delivery to Prevent Postpartum Hemorrhage

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ABSTRACT

Purpose: To assess the safety and outcomes of uterine artery embolization (UAE) performed before delivery in patients with placental implant anomalies at high risk for peripartum or postpartum hemorrhage.

Materials and Methods: From January 2013 to January 2015, 50 consecutive patients with placental implant anomalies at 35–36 weeks of pregnancy were recruited. UAE was performed superselectively by injecting reabsorbable pledgets. We applied 5 dosimeters to patients' backs to measure the uterine radiation dose, considered to be the same radiation dose that the fetus received. Newborns were assessed immediately after birth and at 6-month follow-up.

Results: All procedures were technically successful. Of patients, 64% did not require transfusions. Mean blood units transfused was 0.7 U (range, 0–4 U). No patient was transferred to the intensive care unit. Hysterectomy was performed in 13 patients (26%). Mean fluoroscopy operative time was 3 minutes 42 seconds (range, 1 min 21 s–6 min 58 s), and mean uterine radiation dose was 15.61 mGy (range, 8.15–38.18 mGy). Mean time between embolization and delivery was 6 minutes 4 seconds (range, 4 min 18 s–8 min 12 s). The 1-minute and 5-minute Apgar scores were 8–9 in all newborns; 8 newborns were lost to follow-up at 6 months. A normal cognitive outcome was evident in all 42 children studied.

Conclusions: UAE before delivery appeared to reduce bleeding during cesarean sections in this consecutive series of patients with placental implant anomalies. In the hands of experienced staff, radiation dose to the fetus was minimal.

ABBREVIATIONS

Bayley-III = Bayley Scales of Infant Development, third edition, CIRSE = Cardiovascular and Interventional Society of Europe, PRBCs = packed red blood cells, UAE = uterine artery embolization

Placental implant anomalies (ie, placenta previa and invasive placenta, including placenta accreta, placenta increta, and placenta percreta) are leading causes of maternal morbidity and mortality from peripartum and postpartum hemorrhages. The rate of placental implant anomalies, now estimated to affect 1 in every 530 pregnancies (1), has been continuously increasing secondary to the rising incidence of cesarean sections over the past few decades (2,3).

The efficacy and safety of endovascular procedures in the management of obstetric hemorrhages with different etiologies have already been demonstrated (4,5). However, the role of endovascular procedures in the management of placental implant anomalies is a subject of discussion (6). Different approaches have been reported, including balloon occlusion alone, a combination of balloon occlusion and embolization, prophylactic catheter placement, and embolization before hysterectomy. Finally, although prophylactic bilateral uterine artery embolization (UAE) to reduce bleeding during cesarean sections has shown promising results, the existing literature on its feasibility and safety is still scarce (5,7–11).

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All the above-mentioned procedures entail performing the embolization after the delivery is completed. The aim of this study is to assess the feasibility of performed superselective UAE before delivery in patients with diagnosed placental anomalies. The main objective of the procedure is to reduce blood loss after cesarean delivery. To minimize the radiation dose that the fetus absorbs, effective measures are applied, as reported in the guidelines for the use of radiation during pregnancy and published in accordance with the Society of Interventional Radiology (SIR) and the Cardiovascular and Interventional Society of Europe (CIRSE) (12).

MATERIALS AND METHODS

Our institutional review board approved this prospective, single-center study, which was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants.

Patient Data

From January 2013 to January 2015, 50 pregnant patients at high risk for postpartum hemorrhage as a result of placental anomalies were consecutively registered in a single center. All patients accepted the endovascular treatment proposed. Each patient in the sample was Caucasian. The average age of the patients was 33.2 years (range, 24–41 y), and a placental implant anomaly was diagnosed in each patient. Of the patients, 46 (92%) had previous pregnancies, with a mean gravidity value of 3 (range, 0–6) and a mean parity value of 2 (range, 0–5); 44 (88%) had a previous cesarean surgery; and 19 (38%) reported previous uterine curettage (Table 1).

Table 1. Demographic and Clinical Characteristics

Characteristic	Value
Mean age, y (range)	33.20 (24–41)
Gestational age at delivery, wk	35–36
Gravidity (range)	3 (0–6)
Parity (range)	2 (0–5)
Previous cesarean section	
0	6
1	29
2	9
≥ 3	6
Previous uterine curettage	
0	31
1	11
2	6
≥ 3	2
Placental implant anomalies	
Previa	23
Depth of placental invasion	
Accreta	21
Percreta	6

Management Protocol

The primary endpoint of this study was to decrease the number of units of blood transfused to avoid the risk of disseminated intravascular coagulation and to consequently accelerate hospital recovery. The secondary endpoint was to avoid hysterectomies to preserve fertility. Each clinical case was discussed in multidisciplinary meetings with interventional radiologists, gynecologists, and neonatologists. Each embolization procedure was scheduled and planned beforehand once the cesarean section was scheduled; no patient had been treated emergently. The inclusion criteria included the prenatal diagnosis of a placental implant anomaly based on ultrasound (US) or magnetic resonance (MR) imaging and the presence of risk factors, such as previous cesarean deliveries and uterine curettage.

The placental status was examined using color Doppler US; in cases of placental anomaly, whether suspected or confirmed by US, MR imaging was required to assess the placental status fully and to plan the procedure correctly to avoid fatal hemorrhages. MR imaging was performed using a 1.5-tesla scanner and T2-weighted fast spin echo sequences (repetition time = 10,000 ms, echo time = 110 ms, slice thickness = 5 mm, matrix 256 × 256, scan time = 10 s) in three orthogonal planes with and without fat saturation.

Abnormal placental status was confirmed clinically, after delivery, or histopathologically. Patients were admitted to the hospital between the 35th and 36th week of pregnancy. On the day before the intervention, a leaflet detailing information about the endovascular procedure was provided, and the risk-benefit ratio was carefully explained by an interventional radiologist before obtaining written informed consent from patients.

Superselective embolization was performed in the operating room before each cesarean section, leaving a right femoral 5-F introducer on site. After 24 hours, an interventional radiologist removed the introducer, performed manual compression for 30 minutes, and applied a hemostasis patch that was removed after a further 24 hours of the patient lying supine in bed.

The gynecologist attempted to remove the placenta with conservative management (uterus preservation). Hysterectomies were not planned in advance but were evaluated during the cesarean surgery and performed in cases of deep placental accretism, assessed during surgery; massive bleeding; and severe uterine atony or organ compromise. Infusion of packed red blood cells (PRBCs) was executed in the presence of a hemoglobin value < 7 g/dL, measured with arterial blood gas analysis, and associated with pronounced pallor. Neonatal evaluation was performed immediately postpartum with a follow-up as a neonatology outpatient after at least 6 months.