Prophylactic Hypogastric Artery Ballooning in a Patient with Complete Placenta Previa and Increta

Abnormal attachment of the placenta (Placenta accreta, increta, and percreta) is an uncommon but potentially lethal cause of maternal mortality from massive postpartum hemorrhage. A 33-yr-old woman, who had been diagnosed with a placenta previa, was referred at 30 weeks gestation. On ultrasound, a complete type of placenta previa and multiple intraplacental lacunae, suggestive of placenta accreta, were noted. For further evaluation of the placenta, pelvis MRI was performed and revealed findings suspicious of a placenta increta. An elective cesarean delivery and subsequent hysterectomy were planned for the patient at 38 weeks gestation. On the day of delivery, endovascular catheters for balloon occlusion were placed within the hypogastric arteries, prior to the cesarean section. In the operating room, immediately after the delivery of the baby, bilateral hypogastric arteries were occluded by inflation of the balloons in the catheters previously placed within. With the placenta retained within the uterus, a total hysterectomy was performed in the usual fashion. The occluding balloons were deflated after closure of the vaginal cuff with hemostasis. The patient had stable vital signs and normal laboratory findings during the recovery period; she was discharged six days after delivery without complications. The final pathology confirmed a placenta increta.

Key Words : *Placenta Increta; Hypogastric Artery; Balloon Occlusion*

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INTRODUCTION

Abnormal attachment of the placenta to the myometrium may occur when there is a deficiency of the decidua and when there is myometrial invasion by chorionic villi (1). There are three entities (accreta, increta, and percreta) that are defined by the histological degree of placental invasion into the myometrium. These conditions have been associated with immediate postpartum hemorrhage and significant maternal morbidity and mortality.

The current treatment for third trimester hemorrhage due to abnormal placental attachment, is a cesarean hysterectomy, which may be complicated by a large volume of blood loss (2). Therefore, in this case we used a technique that provided temporary prophylactic balloon occlusion of the hypogastric arteries to avoid massive postpartum hemorrhage during the hysterectomy. The patient had a complete placenta previa and increta; the peripartum bleeding was successfully managed by the hypogastric artery occlusion using endovascular balloons.

CASE REPORT

A 33-yr-old, gravida 2 para 1, who was diagnosed with a placenta previa, was referred due to intermittent vaginal spotting without abdominal pain at 30 weeks gestation. She had a history of a prior cesarean section due to a placenta previa five years ago. On ultrasound, the size and weight of the fetus were compatible with the gestational age, but a complete type of placenta previa was revealed. In addition, there was loss of the decidual interface between the placenta and the myometrium on the lower part of the uterus, and multiple intraplacental lacunae were noted (Fig. 1A). The color Doppler imaging showed increased periplacental vascularity with turbulent internal flow at the placental implantation site. For further evaluation of the placenta, non-contrast pelvic magnetic resonance imaging (MRI) was performed and revealed a placenta previa, complete type, and findings suggestive of a placenta increta (Fig. 1B).

The patient was scheduled for an elective cesarean delivery at 38 weeks, and a subsequent hysterectomy was also planned

Fig. 1. (A) Multiple hypoechoic spaces (arrows) were noted on the placenta with ultrasound. (B) Axial T2-weighted MRI image shows a complete placenta previa with invasion into posterior myometrium of the uterus, suggestive of a placenta increta (arrow).
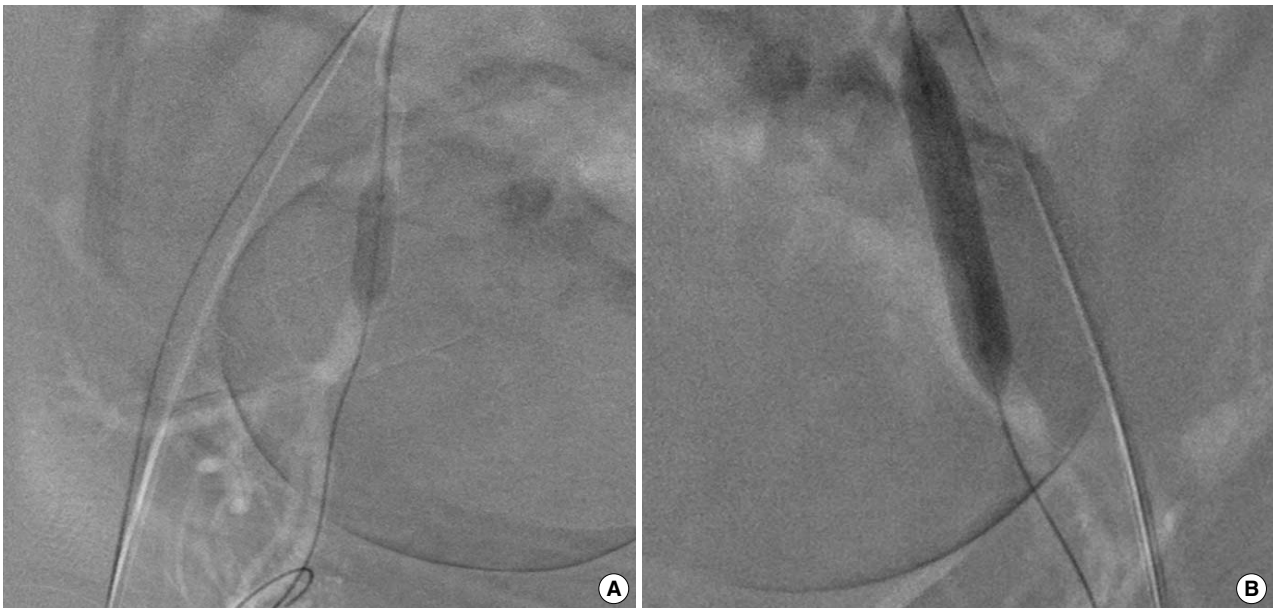

Fig. 2. Fluoroscopy shows the endovascular balloons positioned in the main lumen of the hypogastric arteries bilaterally (A: right and B: left) for occlusion.

for definitive treatment. Preoperatively the hemoglobin (Hb) was 10.6 g/dL; the other laboratory findings including the coagulation profiles were normal.

On the scheduled day of delivery, the patient was transferred to the angiography suite before the operation. Bilateral femoral arterial punctures were performed and 6-Fr vascular sheaths (Terumo Coration, Tokyo, Japan) were inserted under local anesthesia with subcutaneous injection of lidocaine. Under fluoroscopy guidance, selective catheterization of the hy-

pogastric arteries, bilaterally, was performed using 5 Fr Cobra catheters (Cook Incorporated, Bloominton, IN, USA), with the tips positioned in the proximal parts of the hypogastric arteries (Fig. 2). Particular attention was paid to ensuring minimal fetal radiation exposure during the procedure, using appropriate shielding and intermittent low-dose fluoroscopy. The total fluoroscopic time was 2 min and 10 sec at a 15 pulse/sec rate. The total radiation dose was 55 milligray (mGy) and the dose area product was 782 microgray (μGy) per square
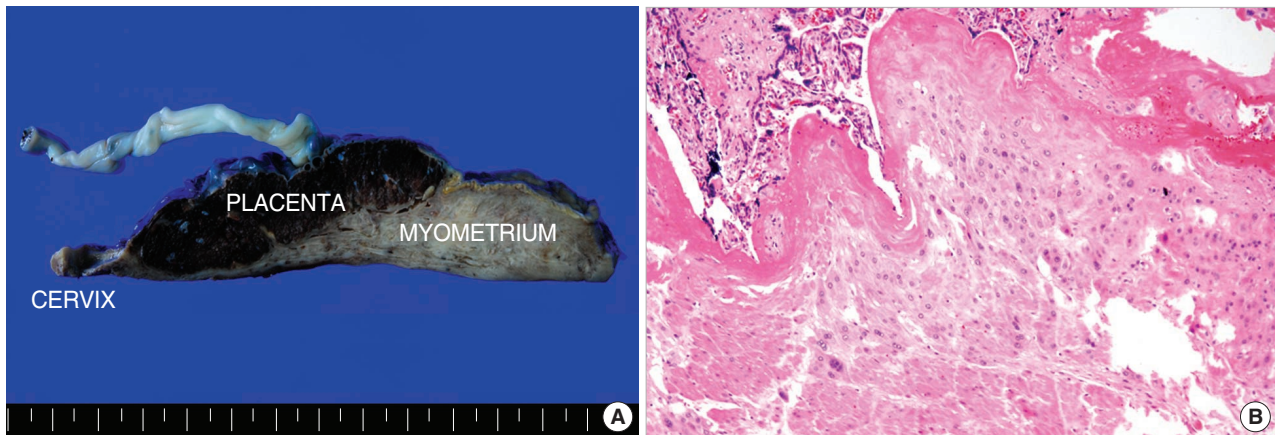
Fig. 3. Microscopic findings. (**A**) Cut surface of the uterus with attached placenta and umbilical cord. The left end of the uterus is the uterine cervix (arrow), and the right end of uterus is the uterine fundus. The cut surface shows abnormal placental adherence in the low uterine segment (placenta previa). The placenta invades into the myometrium, but does not penetrate through it (placenta increta). (**B**) The placenta invades the myometrium without intervening decidua. It is partially separated from focally hyalinized myometrial smooth muscle cells by a layer of fibrin. Partial or complete absence of decidua basalis, which may be replaced by loose connective tissue, is the cardinal feature in microscopic examination (H&E stain, × 100).

meter.

In the operating room, through a vertical incision of the uterus, a healthy 3,500 g male infant was delivered, with Apgar scores of 8 at 1 min and 9 at 5 min. Immediately after the baby was delivered, the hypogastric arteries were occluded bilaterally by inflation of the balloons through the catheters already in place.

With the placenta retained within the uterus, a total hysterectomy was performed immediately following the delivery. The occluding balloons were deflated after closure of the vaginal cuff with complete hemostasis of bleeding. The estimated blood loss was about 800 mL. The postoperative recovery was uneventful and the Hb was 11.2 g/dL. The patient was discharged from the hospital on the sixth postoperative day without any complication. The final histopathology of the uterus confirmed a placenta previa with increta (Fig. 3).

DISCUSSION

Obstetric hemorrhage is the leading cause of the maternal mortality related to pregnancy (3). Cesarean hysterectomy is a definitive treatment for life-threatening postpartum bleeding of uterine origin that is unresponsive to medical or less invasive surgical treatments. Abnormal placentation (accreta, increta, and percreta) has emerged over uterine atony as the leading indication for peripartum hysterectomy (4). This data likely reflects the increased proportion of obstetric patients with prior cesarean deliveries, a known risk factor for placenta accreta (5). Additional risk factors for abnormal placental implantation include advanced maternal age, multiparity, and repeated dilatation and curettage.

Clinically, the three variants of abnormal placentation that are associated with massive hemorrhage, which may lead to hypovolemic shock or a disseminated coagulopathy at delivery; this can cause considerable maternal morbidity and mortality. Therefore, antepartum recognition of invasive placentation is important for planning a multidisciplinary approach to a safe delivery and minimizing the risks of postpartum hemorrhage. Preoperative ultrasound with color Doppler imaging and MRI are used to establish the diagnosis of abnormal placentation and guide the clinical management, which can lead to more favorable outcomes (6).

Recently, prophylactic hypogastric artery occlusion was introduced to reduce intraoperative blood loss in patients at high risk for peripartum hemorrhage. Alvarez et al reported the usefulness of prophylactic hypogastric artery occlusion without embolization in a small case-control study among patients at high risk for peripartum hemorrhage (7). They found that the mean blood loss and transfusion requirements during hysterectomy were significantly decreased in patients who had the procedure, compared to those who did not. However, other studies have shown conflicting results concerning the efficacy of prophylactic hypogastric artery ballooning; some have reported satisfactory outcomes for decreasing the mean blood loss and transfusion requirements (8, 9), and others have reported no benefit (5, 10). The investigators, who failed to find a benefit with the endovascular occlusion, suggested that the mean blood loss did not decrease because of the rich collateral blood supply to the uterus. Thus, they proposed that a subsequent embolization, before the deflation of the balloons, should be mandatory for better control of postpartum bleeding (11). Some reports have suggested significant side effects with the procedure, such as arterial thrombosis, due to the hypercoagulable state of pregnancy, which may increase vascular complications (10).

However, most prior studies have the limitation of a small sample size. In addition, the optimal placement site of the catheter for ballooning and the balloon inflation time during the operation can be critical factors affecting the outcome and side effects. In most reports, the anterior branch of the hypogastric artery was used as the site of ballooning for vessel occlusion. By contrast, we used the proximal parts of the hypogastric arteries before their division into the anterior and posterior branches; this approach decreased the intervention time and reduced the fetal exposure to radiation. An exposure to radiation of less than 200 mGy would not increase the risk for fetal congenital malformations in humans (12). In our case, the dose area product was 782 μGy per square meter, which was much smaller than 200 mGy of radiation. A major concern is the potential oncogenic effects of radiation to the fetus. However, whether fetal radiation exposure in utero is associated with an increased risk of childhood cancers remains controversial. According to the National Radiological Protection Board of the United Kingdom, the risk barely exceeds the threshold for diagnostic studies (13).

Occlusion of the hypogastric arteries does not eliminate the blood flow to the uterus because of the collateral vascular structures in the pelvis. However, the technique reduces the pulse pressure distal to the site of occlusion, thus minimizing blood loss during a hysterectomy (8). In fact, surgical hypogastric artery ligation has been used to attempt to control otherwise intractable obstetric hemorrhage. Surgical ligation and hypogastric artery occlusion with balloons both provide devascularization of the uterus by inhibiting the flow of blood through the hypogastric arteries. Previous data have shown that the success rates for surgical ligation of the uterine or hypogastric arteries varied from 40% to 100% (14). Although the overall efficacy and success rates of temporary hypogastric artery occlusion, using endovascular balloons, have not been established due to the limited number of cases studied, most investigators have suggested comparable effects with the surgical ligation for limiting blood flow during inflation. Obstetric hemorrhage related to abnormal placentation tends to occur during delivery or during the immediate postpartum period (15). Therefore, for a patient that is anticipated to have heavy postpartum bleeding, as in our case, the early placement of balloon catheters prior to a cesarean delivery can minimize the blood flow by immediate inflation of the balloons; consequently the amount of bleeding and subsequent maternal morbidity might be reduced with the balloon occlusion method. On the other hand, the surgical ligation would take a longer time to control bleeding, and thus the prophylactic use of bilateral hypogastric artery ligation has been found to have limited advantages in the reduction of intra-operative bleeding (16).

In addition, and importantly, little is known about the fertility and pregnancy outcomes for patients that have undergone surgical ligation of hypogastric artery to prevent peripartum hemorrhage. Recently, a retrospective study report-

ed that the procedure appears to have no adverse effects on subsequent pregnancies (17). The development of a collateral blood supply soon after ligation might contribute to the preservation of fertility (18). However, further study is needed to determine the outcome of pregnancies in women with prior hypogastric artery ligation. By contrast, the hypogastric arteries occlusion with endovascular balloons, a "temporary" method for control of bleeding, is for a limited period of time during surgery, and is unlikely to affect fertility or pregnancy outcomes.

This case illustrates that prophylactic temporary occlusion of the hypogastric arteries using balloons might be a safe and effective treatment option for patients at high risk for peripartum hemorrhage. In our experience, the use of prophylactic balloon occlusion in a patient with placenta previa increta showed satisfactory results with no transfusion requirement under stable intraoperative conditions. A short operative time with early removal of the endovascular catheters and close postoperative surveillance of the vascular system is required with this procedure to minimize the risk of vascular complications.

However, further studies are needed to determine whether the potential benefits of prophylactic hypogastric artery occlusion outweigh the potential risks associated with fetal radiation exposure and vascular complications.

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