



Long-term follow-up of abdominal aortic balloon occlusion for the treatment of pernicious placenta previa with placenta accreta

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ABSTRACT

Objective: To evaluate the efficacy and safety of balloon occlusion of the abdominal aorta for the treatment of pernicious placenta previa with placenta accreta.

Methods: The clinical data of 623 patients with pernicious placenta previa combined with placenta accrete, who were admitted to our hospital from January 2013 to January 2019 were retrospectively analyzed. All patients underwent abdominal aortic balloon occlusion combined with cesarean section, and 78 patients underwent sequential bilateral uterine artery embolization. We analyzed the operation time, intraoperative blood loss, blood transfusion volume, intraoperative and postoperative complications, fetal radiation exposure time and dose, and the Apgar score of the newborns. We also performed other evaluations to ascertain the efficacy and safety of abdominal aortic balloon occlusion treatment for dangerous placenta previa with placenta accrete.

Results: Of the 623 patients, 545 underwent only abdominal aortic balloon occlusion, and 78 underwent uterine artery embolization due to intraoperative or postoperative bleeding. The uterus was successfully preserved in all patients. Except for five cases of right lower extremity arterial thrombosis, the remaining patients did not have postoperative lower extremity arteriovenous thrombosis, renal insufficiency, late postpartum hemorrhage, ectopic embolism, spinal cord or peripheral nerve damage, pelvic infection, or other serious complications. The mean operative time was 65.3 (± 14.5) min. The mean intraoperative blood loss was 620 (± 570) ml. Ninety-six patients (15.4%, 96/623) were treated with blood transfusion, and the average amount of blood transfused was 750 (± 400) ml. The average number of hospitalization days was 6.8 (± 3.4) days, the average time of fetal ray exposure was 5.2 (± 1.6) s, and the average radiation dose was 4.1 (± 2.7) mGy. The neonatal Apgar score, was 8.4 (± 0.6) points at 1 min, and 9.6 (± 0.4) points at 5 min. In the follow-up to May 31, 2019, 29 patients were lost to follow-up, 96 were lactating, and 498 were menstruating. Except for the cases lost to follow-up, the remaining 596 surviving newborns (including 2 twins) showed no abnormalities at the 42-day postnatal outpatient follow-up examination.

Conclusion: Balloon occlusion of the abdominal aorta is a safe and effective method for the treatment of pernicious placenta previa with placenta accreta.

Introduction

Placenta previa that occurs after cesarean section is termed pernicious placenta previa.¹ With the increase in the curettage and cesarean section rate, the incidence of pernicious placenta previa with placenta accreta has continued to increase annually.² Dangerous placenta previa combined with placenta accreta can become a serious complication during delivery, which can cause massive hemorrhage during delivery and lead to

hysterectomy or may even endanger the life of the mother and fetus.³ A number of studies have shown that abdominal aortic balloon occlusion combined with cesarean section can effectively reduce the risk of hysterectomy and reduce intraoperative blood loss,^{4,5} but there is still a lack of long-term follow-up data from large samples. This article retrospectively analyzed the clinical data of 623 patients with pernicious placenta previa complicated with placenta accreta in our hospital, and found that balloon occlusion of abdominal aorta was a safe and effective treatment method.

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Materials and methods

General data

We included 623 patients with pernicious placenta previa and placenta accrete, who were admitted to our hospital from January 2013 to January 2019, in the study. All patients were diagnosed with pernicious placenta previa with placenta accreta by color Doppler ultrasound and MRI before operation, at a gestation >28 weeks. All patients agreed to undergo abdominal aortic balloon occlusion combined with cesarean section. Temporary closure of the abdominal aorta via balloon catheter was successful in all patients, and the fetuses were successfully delivered, (625 surviving neonates, including 2 twins). In total, 545 patients had no major bleeding during or after surgery, and 78 patients underwent emergency sequential uterine artery embolization due to intraoperative or postoperative bleeding. The uterus was preserved in all patients. The age of the 623 patients was 30.5 (± 5.2) years. All pregnancies were singletons with an average of three gravidae and one or two parities. All women had a history of multiple pregnancies and all had undergone one or more cesarean sections, with a mean gestational age of 36 weeks. By May 31, 2019, 29 patients were lost to follow-up, 96 were lactating, and 498 were menstruating. Except for the cases lost to follow-up; the remaining 596 surviving newborns showed no abnormality in the 42-day postnatal outpatient follow-up examination.

Methods

Among the 623 patients included, 260 patients underwent cesarean section combined with abdominal aortic balloon occlusion in the compound operating room of our hospital, which was equipped with a digital subtraction angiography (DSA) device (Allura Xper FD20, Philips; Best, The Netherlands). The remaining 363 patients underwent balloon implantation in the interventional operating room, which was also equipped with a DSA device (ARTIS zeego, Siemens, Munich, Germany). Patients were then sent to the obstetric operating room for cesarean section combined with balloon occlusion. A finger oximeter was placed on the right great toe of each patient before surgery. Before cesarean section, the right femoral artery was punctured and a 7/8F vascular sheath was placed under local anesthesia. A guidewire was introduced through the sheath and a balloon catheter was introduced over the guidewire (Bard Peripheral Vascular, Inc, Tempe, AZ., USA) and placed in the abdominal aorta, and it was fluoroscopically ensured that the balloon body was located at the level of the thoracic 12th and 1st lumbar vertebrae. The tee was connected, and the sheath and balloon were secured. After the obstetrician cut off the umbilical cord of the fetus, the interventional physician immediately used normal saline to inflate the balloon to block the abdominal aorta, and monitored the balloon occlusion index, ensuring that the blood oxygen of both toes slowly dropped to 0, the blood oxygen curve remained straight, and the heart rate could gradually no longer be detected.

The obstetrician peeled the placenta at the same time. The balloon inflation time was selected according to the intraoperative placental detachment. The inflation time did not exceed 15 min in any patient. If necessary, the balloon was completely released for 1 min, after which it was re-inflated, and the total inflation time did not exceed 45 min. If the placenta was found to be implanted into the cervix during the operation, gauze packing was temporarily pressed to stop the bleeding, and emergency sequential bilateral uterine artery embolization was performed after suturing the uterus. After completing placental separation, the placental and myometrial wounds were sutured. After the uterine incision was sutured and the uterine fundus was pressed, active bleeding was still observed. The balloon was then withdrawn, and a 5F Cobra catheter was introduced through the sheath for bilateral uterine arteriography, and a 350–560 μm gelatin sponge particle plug was applied.

Indicators and follow-up

The main outcome measures were placental implantation, total intraoperative blood loss, blood transfusion, fetal radiation dose, neonatal Apgar score, and intraoperative and postoperative complications. The total amount of bleeding was assessed using volumetric and weighing methods. The time and dose of X-ray radiation received by the fetus were estimated according to the fluoroscopy time indicated by the DSA device and the dose received by the skin X-ray during balloon placement. The compression bandage was released 4 h after the operation to allow bedside lower-extremity color Doppler ultrasonography, to determine whether there were related complications such as arterial and venous thrombosis, arteriovenous fistula, and pseudoaneurysm. Within 7 days after surgery, the movement, sensation, and dorsalis pedis artery pulsation of the lower limbs of patients were observed; patients were monitored for fever, abnormal pain, and other symptoms. The maternal serum human chorionic gonadotropin (HCG) levels and abdominopelvic ultrasound were reexamined 42 days after operation.

Statistical analysis

Statistical analysis was performed using SPSS 19.0 (SPSS Inc., Chicago, IL, USA) statistical software. Normally distributed measurement data are expressed as mean (\pm standard deviation), and enumeration data are expressed as frequency and rate.

Results

In 623 cases of cesarean section, the abdominal aorta was temporarily occluded by balloon catheter, the fetus was delivered uneventfully, and 625 neonates (including 2 twins) survived. Of the mother, 545 patients had no major bleeding during or after surgery and did not undergo uterine artery embolization. Seventy-eight patients underwent emergency sequential uterine artery embolization for intraoperative or postoperative bleeding. Of the 78 patients, 13 were found to have cervicoplacental adhesions during surgery. In these cases, where suture and hemostasis failed, gauze packing was first used for temporary compression and hemostasis, and uterine suture was followed by emergency sequential bilateral uterine artery embolization. In the other 65 patients, the fundus was pressed after suturing the uterus, and bilateral uterine artery embolization was performed due to visible active bleeding. All 623 patients had successful uterine preservation.

The mean operative time was 65.3 (± 14.5) min. The mean intraoperative blood loss was 620 (± 570) ml. Ninety-six patients (15.4%, 96/623) were treated with blood transfusion, and the average amount of blood transfused was 750 (± 400) ml. The average number of days of hospitalization per patient was 6.8 (± 3.4) d. The average time of fetal ray exposure was 5.2 (± 1.6)s, and the average radiation dose was 4.1 (± 2.7) mGy. In the 625 neonates, the Apgar score was 8.4 (± 0.6) points at 1 min, 9.6 (± 0.4) points at 5 min.

By May 31, 2019, 29 patients had been lost to follow-up, 96 were lactating, and 498 were menstruating. During the follow-up period, except for 5 cases of right lower-extremity arterial thrombosis among the 623 patients, the remaining patients had no lower-extremity arteriovenous thrombosis, renal insufficiency, late postpartum hemorrhage, ectopic embolism, spinal cord or peripheral nerve damage, pelvic infection, or other serious complications. Five patients had arterial thrombosis in the right lower extremity, which may have been related to maternal hypercoagulability and balloon injury of the vascular intima. The symptoms were relieved after symptomatic treatment to promote blood circulation and remove blood stasis. Sixty-seven cases of post-embolization syndrome occurred within 3 days after operation, mainly manifested as lower abdominal distension, pain, and fever; and these individuals were given symptomatic treatment, such as analgesia and antipyresis, and symptoms were relieved after 1 week. Except for the 29 cases lost to follow-up, the remaining 596 surviving neonates showed no

abnormality in the 42-day postnatal outpatient follow-up examination.

Discussion

With the wide application of cesarean section, the incidence of placenta accreta in subsequent pregnancy has also increased significantly²; because placenta accreta is often combined with placenta previa, the incidence of dangerous placenta previa combined with placenta accreta also continues to increase.⁶ The most common treatment for pernicious placenta previa is cesarean section; however, the removal of placenta is often accompanied by massive hemorrhage.³ The uterus is usually removed to control placental wound hemorrhage, but this still involves massive hemorrhage during the operation. Studies have shown that 90% of pregnant women with pernicious placenta previa complicated with placenta accreta have intraoperative blood loss of more than 3000 ml and 10% have blood loss of more than 10,000 ml during cesarean section, which can lead to hemorrhagic shock, disseminated intravascular coagulation and other serious complications, can even endanger the lives of mothers and infants, and is associated with a hysterectomy rate of more than 50%.⁷

With the development of interventional techniques, balloon occlusion has been widely used in various surgeries to control bleeding.⁸ Studies have shown that in patients with pernicious placenta previa with placenta accrete, temporary balloon closure before caesarian section can effectively reduce intraoperative blood loss and blood transfusion, clear the surgical field, and reduce the rate of hysterectomy.^{9–11} Balloon closure of the abdominal aorta is the most commonly used surgical method. However, long-term follow-up studies of abdominal aortic balloon occlusion for the treatment of pernicious placenta previa with placenta accreta are still lacking.^{12–14}

In this study, the mean fluoroscopy time per patient was 5.2 (\pm 1.6) s and the mean radiation dose was 4.1 (\pm 2.7) mGy, which was much lower than the safety standard that the American College of Obstetricians and Gynecologists indicated for pregnant women (less than 50 mGy X-ray irradiation dose in a short period of time).¹⁵ In addition, 78 cases of uterine artery embolization were performed after the delivery of the fetus, which did not increase the radiation dose to the fetus as compared with balloon occlusion alone.

During the follow-up period, none of the 623 patients had major complications, except for 5 cases of right lower extremity arterial thrombosis. Five patients had arterial thrombosis in the right lower extremity, which may be related to maternal hypercoagulability and balloon injury of the vascular intima. The symptoms were relieved after

symptomatic treatment to promote blood circulation and remove blood stasis. The 596 surviving neonates that could be followed-up showed no abnormality in the 42-day postnatal outpatient follow-up examination.

In summary, abdominal aortic balloon occlusion treatment of dangerous placenta previa with placenta accreta can reduce the risk of hysterectomy, reduce intraoperative blood loss, has no adverse effects on pregnant women and newborns, and is a safe and effective treatment for this condition.

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