Clinical Case Report

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Rupture of multiple pseudoaneurysms as a rare complication of common iliac artery balloon occlusion in a patient with placenta accreta

A case report and review of literature

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Abstract

Rationale: Placenta accreta is the main cause of severe obstetric postpartum hemorrhage (PPH) and hysterectomy. Several hemostatic techniques have been performed in patients with placenta accreta to prevent PPH and reserve fertility. Abdominal aorta and pelvic arteries balloon occlusion are the only techniques which could be performed before cesarean section (CS) in patients who want to keep the fetus and reserve fertility. However, abdominal aorta and pelvic arteries balloon occlusion might lead to severe complications such as formation and rupture of pseudoaneurysm, angiorrhexis, etc.

Patient concerns: We report a case diagnosed with pernicious placenta previa (PPP) combined with Rh(D) negative blood type, who was performed with bilateral common iliac arteries (CIA) balloon occlusion during CS. However, on the first day after CS, the patient caught sudden left-side lumbago and backache accompanied with palpitation and shortness of breath.

Diagnoses: Formation and rupture of multiple pseudoaneurysms in left CIA.

Interventions: Covered stent was inserted into the proximal part of the left CIA and the ipsilateral internal iliac artery was embolized by coil to prevent endoleak.

Outcomes: The patient recovered and discharged from hospital in stable condition without other complications 9 days after CS.

Lessons: It is of paramount importance that obstetricians and radiologists correctly estimate the appropriate occlusion volume and pressure of pelvic arteries before CS to avoid formation and rupture of a pseudoaneurysm. And if the rupture of a pseudoaneurysm occurred, it should be quickly identified and treated with endovascular intervention.

Abbreviations: CIA = common iliac arteries, CS = cesarean section, CTA = computed tomography with angiography, DSA = digital subtraction angiography, ICU = intensive care unit, MRI = magnetic resonance imaging, PPH = postpartum hemorrhage, PPP = pernicious placenta previa, USG = ultrasonography.

Keywords: case report, common iliac artery balloon occlusion, literature review, multiple pseudoaneurysms, placenta accreta

1. Introduction

Placenta accreta is the main cause of severe obstetric postpartum hemorrhage (PPH) and hysterectomy.[1] Efficient hemostatic techniques should be performed in patients with placenta accreta before, during and after cesarean section (CS). And that would be a key element to save the lives of the patients when they complicated with Rh(D) negative blood type, in which case the homomorphous type blood resource is usually insufficient, meanwhile, placenta accreta would induce severe PPH. At present, there are so many obstetric hemostatic techniques, such as uterine artery embolization,[2] abdominal aorta and pelvic arteries balloon occlusion,[3–5] internal iliac artery ligation,[6,7] uterine cavity filling,[8] etc. However, abdominal aorta and pelvic arteries balloon occlusion are the only techniques which could be performed before CS in patients who want to keep the fetus and reserve fertility. Whereas, placement of artery balloon before operation might make the fetus exposure to some dose of radiation[9,10] and result in some risk of complications from vascular access and balloon dilatation.[11] We present a case of formation and rupture of multiple pseudoaneurysms in the left common iliac artery (CIA) after CIA balloon occlusion in a patient with pernicious placenta previa (PPP) and Rh(D) negative blood type. We reviewed published case reports of pseudoaneurysm after pelvic artery balloon occlusion. To our knowledge, this case of complication is presented for the first time in the literature.

2. Case report

2.1. General information and history

A 34-year-old woman (gravid 3, para 1) was admitted to our center because of PPP combined with Rh(D) negative blood type

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at 37 weeks of gestation. She had a history of vaginal bleeding at gestation age of 3 months, and was diagnosed with state of complete placenta previa. Hereafter, she underwent antenatal cares at regular intervals, and the Rh(D) blood type antibody screening was normal. She had a history of CS because of malpresentation 3 years ago and a history of natural abortion 4 years ago. The PPH volume of last CS was 600 mL because of adherent placenta, but no blood transfusion was needed.

2.2. Clinical features before CS

Ultrasonography (USG) and magnetic resonance imaging (MRI) images (Fig. 1) revealed placenta completely covered the lower segment of anterior and posterior wall of the uterine, and implanted into the uterus cesarean scar of the lower segment reaching the uterine serosa layer. Rich blood sinus was seen above the internal cervical os, and the length of the cervix uteri was 28 mm. The estimated bleeding volume during operation was large and the patient had a strong desire to maintain fertility. Meanwhile, the patient was combined with a rare blood type that homomorphous type blood resource was insufficient.

2.3. CS

After obtaining consent from the patient, CIA balloons were placed in her bilateral CIA before CS. Vascular engorgement was seen in the anterior wall of the uterus and part of the vascular formed to blood sinuses penetrating the placenta during the operation. The balloons in the right and left CIA were filled with 6 and 6.5 mL normal saline immediately after the fetus delivered, respectively. The placenta in the lower segment of the anterior uterine wall was seen adhering closely with uterine muscles, and a 5×4 cm district of the anterior uterine wall was only seen a thin serosa layer. Placenta was manually removed, and carefully clipped. The surface of placental separation was locally sutured and the ascending branches of bilateral uterine arteries were ligatured. Then 1-0 absorbable suture was strapped in the lower uterine segment. And 1-0 absorbable suture cerclage was placed in the lower uterine segment via the posterior fornix. After observation of no active bleeding, the occlusion balloons were released and the uterine and abdominal incisions were closed layer by layer. The weight of the infant was 3100 g, the Apgar scores were 10 in 1 and 5 minutes. Time of CIA balloon occlusion was 15 minutes. The hemorrhage volume intraoperation was 1000 mL, and the patient was transfused with 2 units of red blood cells.

2.4. Clinical features and treatments after CS

At 10 AM the first day after CS, the patient caught sudden left-side lumbago and backache accompanied with palpitation and shortness of breath when she turned over in the bed. The blood pressure was 92/50 mm Hg, heart rate was 145 bpm, and she was suspicious of being combined with massive bleeding in the peritoneal cavity. The emergency ultrasound revealed a $14 \times 9.1 \times 5$ cm liquid mass in the middle and lower abdominal. Abdominal computed tomography with angiography (CTA, Fig. 2A) revealed rupture of multiple pseudoaneurysms which extended from the left common iliac artery branch to the external iliac artery. Digital subtraction angiography (DSA) showed extravasation of a little contrast agent 0.6 cm from the bifurcation of left CIA (Fig. 2B). Endovascular intervention was performed emergently. A 13.5×60 mm covered stent was inserted into the proximal part of the left CIA and the ipsilateral internal iliac artery was embolized by coil to prevent endoleak. DSA revealed smooth blood flow of bilateral CIA and the external iliac artery, no extravasation of contrast agent and a good location of the stent.

2.5. Clinical results and follow-up

The patient was observed in the intensive care unit (ICU) for another 3 days and USG showed the retroperitoneal hematoma gradually diminished. The reviewed CTA displayed well coverage of the covered stent, smooth blood flow of bilateral common and external iliac arteries with no vasodilation and endoleak (Fig. 3A). Eight days after endovascular intervention, the patient was discharged in stable condition without other complications. She was followed up by regular clinic visits, and the retroperitoneal hematoma was absorbed completely 6 months after endovascular intervention. One year later, she was admitted to our department again because of subsequent pregnancy. Abdominal CTA (Fig. 3B) was performed after abortion to recheck the location and shape of the covered stent which showed normal location of the stent, smooth blood flow of bilateral

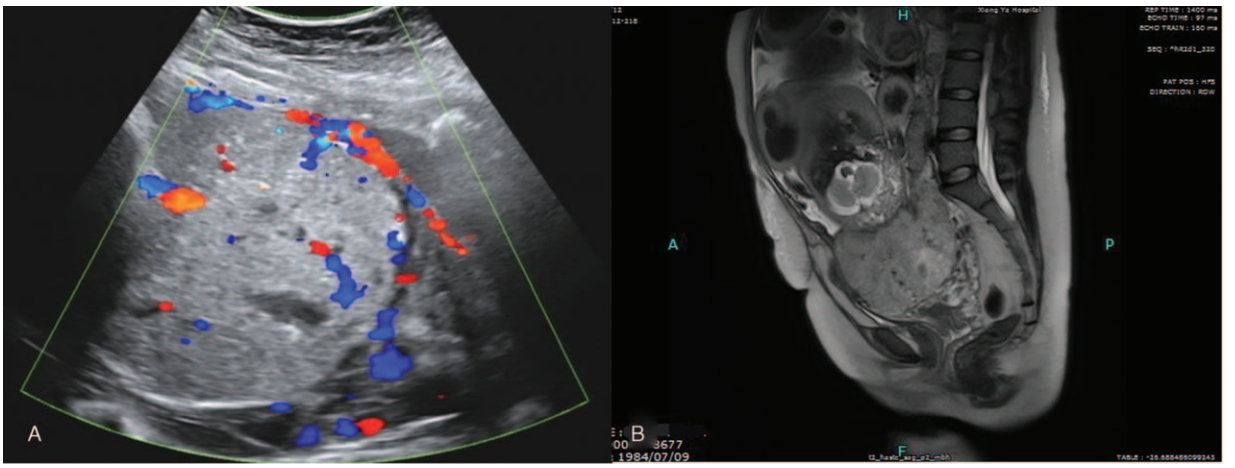

Figure 1. USG and MRI images before cesarean section. (A) USG showed placenta accreta, fluid dark areas in placenta, and rich blood flow between placenta and the anterior wall of lower segment of uterine. (B) MRI revealed placenta completely covered the lower segment of anterior and posterior wall of the uterine, and implanted into the uterus cesarean scar of the lower segment.

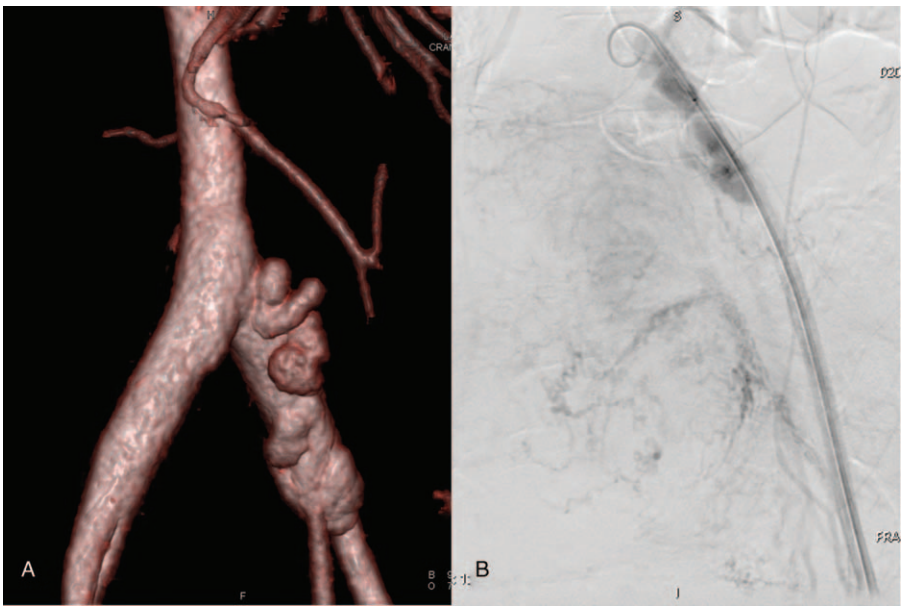

Figure 2. CTA and DSA images before covered stent placement. (A) CTA showed multiple pseudoaneurysms of the left common iliac artery. (B) DSA revealed extravasation of a little contrast agent 0.6 cm from the bifurcation of common iliac artery.

common and external iliac arteries, and formation of the left CIA collateral circulations to supply the left pelvic cavity. She was recovered and discharged from hospital without complications.

3. Discussion

Complications associated with the pelvic balloon occlusion include maternal thromboembolic events resulting in acute limb ischemia, ischemia reperfusion injury, arterial pseudoaneurysms, dissection, and arterial rupture.[12,13] Rupture of multiple pseudoaneurysms after pelvic artery balloon occlusion in a patient with PPP is a rare and potentially life threatening complication. We performed a review of all cases in PubMed Medline database and found a total of 25 cases with pseudoaneurysm associated with pelvic artery balloon occlusion or other obstetric vascular interventional methods in 11 articles (Table 1). Of the 25 cases to date, the main choice for pelvic vascular intervention was uterine artery, so the occurrence of pseudoaneurysm after obstetric vascular interventional treatment was mainly seen in uterine arteries, which occurred more in the left side than in the right side.[14–16] Though occasionally reported in the internal iliac artery,[17] multiple pseudoaneurysms

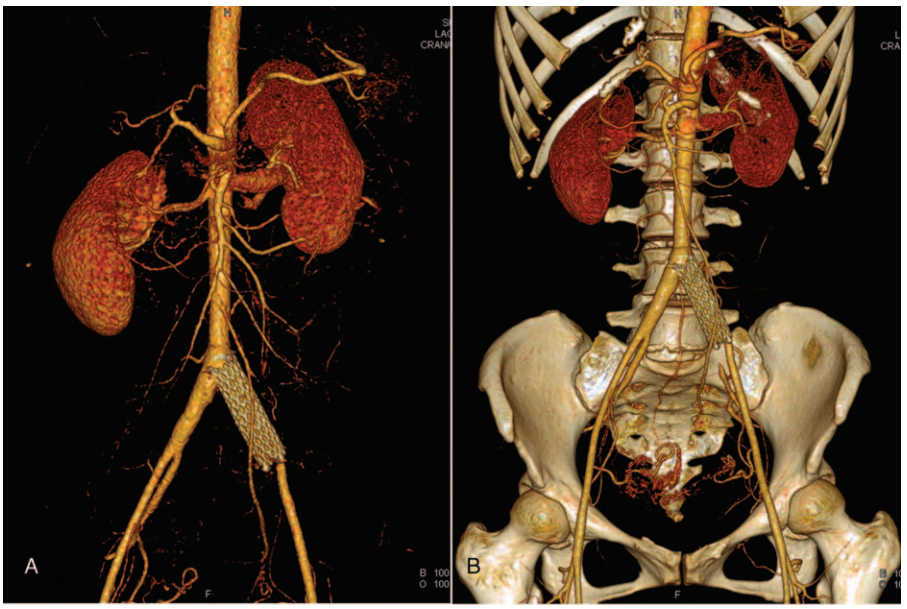

Figure 3. CTA images after covered stent placement. (A) CTA revealed the area of the multiple pseudoaneurysms was completely covered by the covered stent. (B) CTA showed normal position and morphology of the covered stent 1 year after.

Table 1

Pseudoaneurysms associated with pelvic artery balloon occlusion or other obstetric vascular interventional methods.

Refs.	Years	Age	Gravida/ para	Past obstetric history	Location of pseudoaneurysm	Early appearance	Solution
Kwon et al[14]	2013	29	G2P2	CD	Left uterine artery	PPH	Left UA
		32	G3P3	CD (2 times)	Left uterine artery	PPH	Left UA
		36	G1P1	No relevant prior history	Right uterine artery	PPH	Right UA
		35	G2P1	SA	Right uterine artery	PPH	Cervical branch of right OA
		33	G1P1	No relevant prior history	Left uterine artery	PPH	Left UA
		24	G2P1	AA	Left uterine artery	PPH	Both UA
		30	G1P1	No relevant prior history	Right uterine artery	PPH	Both UA
		27	G1P1	No relevant prior history	Left uterine artery	PPH	Both UA
		31	G1P1	No relevant prior history	Left uterine artery	PPH	Left UA
		37	G2P2	CD	Left uterine artery	PPH	Both UA
		33	G3P2	CD	Right uterine artery	PPH	Both UA (reembolization)
Yi and Ahn[15]	2010	37	G2P2	CD 8 days earlier	Right uterine artery in the fundal area of the uterus	Sudden abdominal pain and profuse vaginal bleeding	Both UA
Sharma et al[16]	2013	25	G2P1	SD 1 y ago; oral abortifacients 30 d ago	The terminal part of left uterine artery	Continuous bleeding per vaginum for 30 d, following oral abortifacients	Both UA
Kwon and Kim[17]	2002	28		SD followed by D&C 7 mo earlier	Left uterine artery	Intermittent vaginal bleeding	Left UA
		35		After D&C for a therapeutic abortion 9 wk earlier	Left uterine artery	Intermittent vaginal bleeding	Left UA
		30		D&C for a therapeutic abortion. Underwent embolization twice	Right uterine artery and right internal pudendal artery	Massive vaginal bleeding	After bilateral embolization of the uterine arteries and the right internal pudendal artery
Bhatt et al[31]	2010	26	G2P2	SD 2 y ago; CD 6 wk earlier	Left uterine artery	Severe vaginal bleeding	Left UA
Kim et al[32]	2014	37	G3P2	SD 8 d ago (preterm labor with preterm premature rupture of membranes)	Right uterine artery	Vaginal bleeding.	Right UA
		28	G1P1	SD 7 d ago (preterm premature rupture)	Uterine artery	Vaginal bleeding	UA additional embolization was performed 3 times
		28	G1P1	SD 30 d ago	Uterine artery	Vaginal bleeding	UA
Hayata et al[33]	2010	24	G1P1	CD in October 2007 (arterial hemorrhaging from the left lower uterine incision occurred during the operation and the artery was ligated with silk thread immediately and completely)	Branch of the left uterine artery	Massive and continuous vaginal bleeding and received blood transfusions for shock	Branch of Left UA
Mou et al[35]	2014	25	G3P2	Four years ago a missed miscarriage at 9 wk of gestation, surgical curettage. Two years ago elective cesarean	Uterine artery	Amenorrheic for 2 mo; painless vaginal bleeding that had lasted for 15 d	A hysterectomy
Moatti et al[36]	2011	29	G1P1	CD 42 d ago	Branch of the left uterine artery	Brisk, painless heavy vaginal bleeding	Transarterial embolization
Henrich et al[37]	2002	35	G2P2	CD 4 wk ago	Right uterine artery	Increased vaginal hemorrhage and severe lower abdominal pain	Hysterectomy
Zimon et al[38]	1999	31	G3P2	CD 5 y ago; a dilation and extraction procedure 1 y ago	Left uterine artery	Postpartum day 8 (SD) with sudden-onset suprapubic pain characterized as moderate, sharp, and radiating to the flanks bilaterally	Left UA

AA = artificial abortion, CD = cesarean delivery, D&C = dilation and curettage, OA = ovarian artery, PPH = postpartum hemorrhage, SA = spontaneous abortion, SD = spontaneous vaginal delivery, UA = uterine artery.

occurred in CIA was rarely reported. Rupture of pseudoaneurysm in uterine arteries of the patients in the past case reports were mainly manifested with vaginal bleeding, abdominal pain, PPH, and one case with hemorrhagic shock. And they were treated with interventional uterine artery embolization or a hysterectomy. Common interventional techniques for pseudoaneurysm included intravascular embolization[18] and stent placement,[19]the parent artery could be directly performed embolization with the coil or gelatin sponge when it was a terminal artery or an artery with abundant peripheral vascular anastomosis, and the technology is relatively simple and safety.[20] However, for a trunk artery or an artery with no collateral circulation to supply the distal visceral tissues, the parent artery should be performed with covered stent placement.

A pseudoaneurysm, unlike a true aneurysm, which is a partial expansion of vessel diameter by 1.5 times and consisting of all 3 layers of the vessel wall tissues, is a partial arterial defect which results in vascular leaks surrounded by soft tissue, a hematoma, or a thin fibrous capsule, forming patent turbulent blood flow in a defined space beyond the confines of the vessels. A pseudoaneurysm is mainly caused by iatrogenic injury (vascular interventional treatment,[11] lumbar disc surgery,[21] kidney transplantation,[22] etc), infection (bacteria,[23,24] tuberculosis,[25] or fungi[26]), some diseases (lymphoma,[27] Behcet disease,[28–30] etc), and non-iatrogenic trauma. Hematomas form surrounding the injured portion of the vessel where lysis occurs as time proceeds, creating a confined space with an intravascular–extravascular connection, thus forming a pseudoaneurysm. Pseudoaneurysms are fragile as they lack the 3 arterial layers of a true aneurysm (tunica, media, and adventitia). The boundaries most often are the surrounding tissues and blood clots, with a direct communication with the main artery through the injury to that artery. They can rupture with physical activity, or a rise in blood pressure. The early clinical symptoms and signs of pseudoaneurysm rupture were concerned with the arterial sites. For example, when the uterine arteries and its branches ruptured, it mainly manifested with severe vaginal bleeding,[31] or vaginal bleeding accompanied by pelvic hematoma formation.[32,33] However, when the rupture

site was located in the retroperitoneal space, including internal iliac arteries, CIA and the abdominal aorta, the mainly clinical characteristics were retroperitoneal hemorrhage or hematoma, abdomen pain, backache, and lumbago or even chest pain, associated with rapid heart rate, blood pressure changes, and even hemorrhagic shock caused by blood loss. If pseudoaneurysms rupture in the pelvic or abdominal arteries, bleeding will be more ferocious and harmful. Therefore, for patients with a history of interventional operations, in the event of unexplained chest and backache, rapid heart rate, syncope or shock, in addition to excluding complications such as pulmonary embolism, ruling out the possibility of traumatic pseudoaneurysm rupture is also needed.

Our present patient had a history of adherent placenta and admitted to our center because of PPP, which were risk factors for severe PPH. The patient's placenta did not violate the cervix and bladder wall, and she had a strong desire to retain uterus, so we chose preoperative pelvic artery balloon occlusion to prevent intraoperative bleeding, which had been proved to be effectively to reduce the hemorrhage volume of the CS. However, before the surgery, we did not correctly estimate the appropriate occlusion volume and pressure of CIA and filled the balloons empirically, which might lead to vascular injury. What's more, we did not confirm whether the patient had an aneurysm preoperatively, which would rupture during balloon occlusion. Therefore, formation and rupture of multiple pseudoaneurysms in the left CIA was occurred to the patient after CIA balloon occlusion. Fortunately, rupture of the multiple pseudoaneurysms was early detected and the patient was treated with intravascular covered stent emergently to avoid the maternal adverse outcome. Meanwhile, embolization of the ipsilateral internal iliac artery was performed to prevent endoleak. And the collateral circulations from left CIA supplying for the left pelvic were found to be formed 1 year later (Fig. 3).

We can learn the following lessons from this case: Before the pelvic artery balloon occlusion, we should correctly estimate appropriate occlusion volume and pressure of the arteries according to the USG and MRI examinations. For patients treated with balloon occlusion, appropriately preoperative assessment of the elasticity and acceptability of iliac artery and correctly intraoperative control of occlusion pressure are critical factors to reduce vascular damage and prevent the formation of pseudoaneurysm. MRI examination can be used to assess the length and diameter of bilateral CIA before operation. Once both balloon catheters were correctly positioned preoperatively, a test volume of dilute water-soluble contrast material should be injected to inflate the occlusion balloons to the optimal size. After the infant was delivered by classical CS, the balloon catheters of bilateral CIA were inflated using the same volume and pressure as for the test occlusion. In addition, dorsalis pedis artery and pulse oximetry of both feet should be established to monitor the water injection pressure and arterial oxygen saturation. We should also notice whether there was an aneurysm in the arteries before placing the balloon, for even small damages to the aneurysm by the interventional surgery could induce the expansion and rupture of the aneurysm. The indwelling vascular sheath of balloon occlusion was advised to retain 24 hours after the CS in order to prevent postoperative bleeding[34] and facilitate the stent placement if rupture of a pseudoaneurysm occurred.

In conclusion, it is of paramount importance that obstetricians and radiologists correctly estimate the appropriate occlusion volume and pressure of pelvic arteries before CS to avoid formation and rupture of a pseudoaneurysm. And if the rupture of a pseudoaneurysm occurred, it should be quickly identified and treated with endovascular intervention.

Author contributions

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Visualization: W-S. Zhang.
Writing – original draft: Q. Peng.
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