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CASE REPORTS / CASE SERIES

# Iliac artery rupture related to balloon insertion for placenta accreta causing maternal hemorrhage and neonatal compromise

# Rupture de l'artère iliaque liée à l'insertion d'un ballonnet pour placenta accreta ayant provoqué une hémorragie maternelle et un risque néonatal

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**Abstract**

**Purpose** *The use of internal iliac artery balloons for prevention of hemorrhage in cases of placenta accreta is increasing. Most described complications of this technique are maternal and thromboembolic in nature. Complications related to vascular rupture are rare, their presentation is not well described, and the resultant neonatal consequences are infrequently reported.*

**Clinical features** *A 35-yr-old term parturient with suspected placenta accreta underwent prophylactic endovascular placement of iliac balloons prior to Cesarean delivery. The patient complained of contraction-like pain during balloon placement, and an arterial wall tear was discovered after abdominal incision. This produced significant maternal bleeding and the birth of a neonate with an umbilical venous pH of 6.95 and Apgar scores of 3 and 7.*

**Conclusion** *In addition to the known maternal risks, fetal risks must be considered when planning the placement of endovascular iliac balloons during pregnancy. We recommend continuous monitoring of maternal and fetal status when performing the procedure. Contraction-like pain during placement should raise the suspicion of arterial disruption.*

**Résumé**

**Objectif** *On utilise de plus en plus des ballonnets dans les artères iliaques internes pour la prévention des hémorragies en cas de placenta accreta. La plupart des complications décrites avec cette technique concernent la mère et sont de type thromboembolique. Les complications liées aux ruptures vasculaires sont rares, leur tableau clinique n'est pas bien défini et les conséquences néonatales ne sont pas toujours signalées.*

**Caractéristiques cliniques** *Une parturiente à terme de 35 ans avec suspicion de placenta accreta a subi la mise en place à titre préventif de ballonnets iliaques endovasculaires avant un accouchement par césarienne. La patiente s'est plainte d'une douleur de type contraction au cours de la mise en place du ballonnet et une déchirure de la paroi artérielle a été découverte après l'incision abdominale. Cela a provoqué une hémorragie maternelle significative et la naissance d'un nouveau-né dont le pH ombilical était de 6,95 et les scores d'Apgar de 3 et 7.*

**Conclusion** *En plus des risques maternels connus, les risques fœtaux doivent être pris en compte lors de la mise en place de ballonnets iliaques endovasculaires au cours de la grossesse. Nous préconisons une surveillance*

**Author contributions** *Jordan Gagnon, Louis Boucher, Ian Kaufman,* and *Richard Brown* participated in the clinical case. *Jordan Gagnon, Louis Boucher, Ian Kaufman, Richard Brown,* and *Albert Moore* helped write the manuscript.

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*continue de l'état de la mère et du fœtus avant de réaliser la procédure. Une douleur de type contraction pendant leur mise en place doit faire soupçonner la survenue d'une rupture artérielle.*

Placenta accreta, defined as the abnormal invasion of the placenta into the myometrium, is an increasing cause of obstetric morbidity and mortality.[1] Removal of the morbidly adherent placenta can result in massive maternal hemorrhage, which may require hysterectomy and result in damage to pelvic structures.[2] Endovascular occlusive balloons can be placed prior to delivery of known or suspected cases of placenta accreta. Balloon inflation or injection of embolizing material may then be used to decrease uterine blood flow, thereby facilitating control of postpartum hemorrhage.[3] Due to its novelty and the lack of randomized controlled trials, the indications, benefits, and risks of this technique remain unclear. To understand the risks associated with this technique, it remains necessary to provide descriptions of complications and their effect on outcomes. We present a case of a parturient with suspected placenta accreta whose management with endovascular iliac occlusive balloons resulted in significant maternal and neonatal morbidity.

## Case description

The patient's consent was obtained to publish this case. A 35-yr-old healthy woman with a suspected placenta accreta was referred to our tertiary care obstetric centre which delivers 4,000 neonates and performs five to ten endovascular balloon placements per year. Attempted vaginal delivery during her first pregnancy failed and resulted in Cesarean delivery. During her current pregnancy she experienced supine pre-syncopal episodes that, based on her history, we attributed to aortocaval compression. Physical examination was unremarkable and laboratory values were within normal limits. Her 34-week ultrasound examination showed an anterior marginal placenta previa with irregularly shaped lacunae suggestive of placenta accreta. Magnetic resonance imaging showed a focal area of slightly thickened low T2 signal septations which corresponded to an area of hemorrhage on the T1 weighted sequences. This indicated a likely head of placenta accreta with no convincing evidence of invasion through the myometrium (Fig. 1). The patient was scheduled for prophylactic radiological placement of endovascular iliac balloons immediately prior to Cesarean delivery under epidural anesthesia. Both the radiologic procedure and delivery were performed in the same operating room.

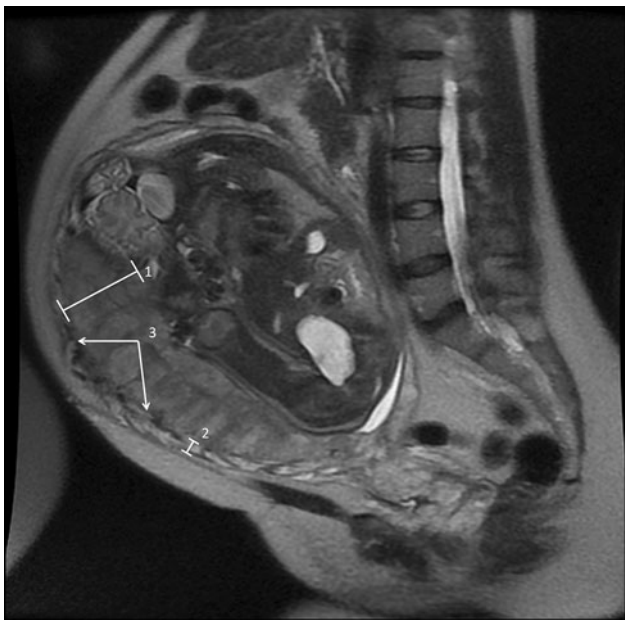


**Fig. 1** The abdominal magnetic resonance image of the patient showing (1) placenta, (2) myometrial lining, and (3) myometrial thinning, placental bulging, and thickened linear septations that raised the suspicion of placenta accreta

Throughout her care, the patient was maintained in the wedged position. On the day of her delivery an epidural catheter was placed after installation of venous and arterial cannulae. The catheter was tested with lidocaine 60 mg, and an additional 80-mg bolus of lidocaine was administered. The epidural anesthesia was provided to ensure patient comfort, as per our routine anesthesia practice. Ten minutes later, prior to beginning the radiologic procedure, the patient complained of feeling faint, and her blood pressure dropped from 110/80 mmHg to 90/60 mmHg. This complaint was attributed to aortocaval compression and the hypotension and symptoms resolved after the patient was turned to the left lateral decubitus position. She was returned to the wedged position and the radiology procedure was commenced. After skin preparation, single-wall puncture needles were advanced into both common femoral arteries, and bilateral wires were introduced over which 45-cm 7F Ansel 2 sheaths were placed. A Cobra catheter (Cook Medical Inc., Bloomington, IN, USA) and guidewire were then used to cross over the aortic bifurcation and access the contralateral iliac arteries over which the sheaths were advanced. An angiogram was performed with minimal contrast and wires were manipulated into the internal iliac arteries. The tips of the sheaths were then positioned within the proximal internal iliac arteries. A compliant balloon (Boston Scientific, Berenstein Occlusion Balloon Catheter 8.5/11.5 mm, cat # 17-301) was advanced over the wire.

**Fig. 2** The lower uterine segment showing a blood-filled mass

Due to the tortuosity of the anterior division branches, the balloons could only be placed into the distal internal iliac arteries. To determine the smallest vascular occlusion volume for both internal iliac arteries, contrast-saline solution was injected through the sheath until slow inflation of the balloon caused stagnation of flow (approximately 0.6 mL). The balloons were left deflated after testing. Notably, occlusion of flow was obtained before the vessel wall deformed the balloon. The first balloon was placed in the left iliac artery. After inflation of this balloon the patient spontaneously complained of abdominal pain which she described as similar to a uterine contraction. She began to feel faint and her blood pressure dropped to 70/40 mmHg; however, this responded promptly to a fluid bolus and initiation of a phenylephrine infusion. The patient's condition improved and a single assessment verified the fetal heart rate as normal. The second balloon was then placed on the right side, which took approximately 30 more minutes. The epidural catheter was then bolused with lidocaine 400 mg in divided doses. A Pfannenstiel incision was performed, and upon entry into the peritoneal cavity a large, poorly defined blood-filled mass originating from the lower left uterine segment was discovered (Fig. 2). Suspecting an undiagnosed placenta percreta and worried that the surgery would be more complicated than we had expected, the decision was made to convert to general anesthesia. After performing rapid sequence induction of anesthesia, separation of the bladder from the lower uterine segment revealed the mass to be a hematoma originating from the left broad ligament and extending to the bladder dome. The lower uterine segment was easily accessible, and a low transverse uterine incision was made. A male infant weighing 2,840 g was then delivered one hour after the initial complaint of abdominal pain. Initial examination revealed a blue, hypotonic non-breathing neonate, and resuscitation with stimulation and

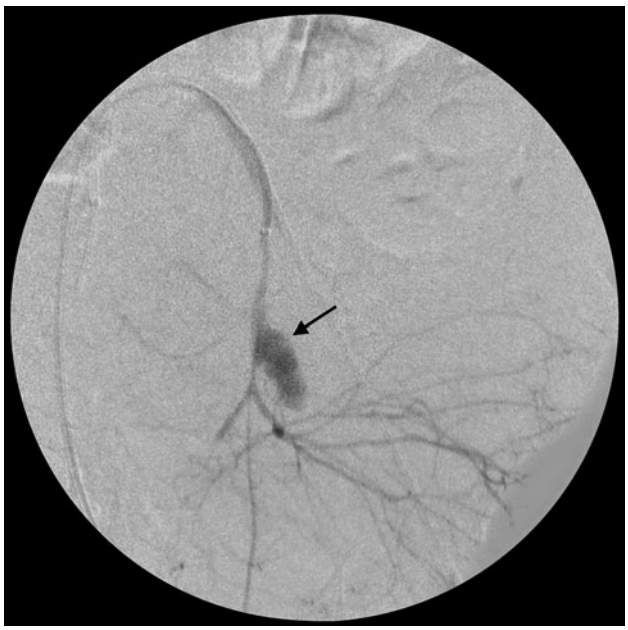

**Fig. 3** The left iliac arteriogram showing extravasation of contrast

positive pressure mask ventilation was commenced. The Apgar scores were three at one minute and seven at five minutes and the umbilical cord venous pH was 6.95. The elapsed time between the induction of anesthesia and delivery was less than two minutes. During this time, the systolic blood pressure, as measured with the arterial cannula, was maintained above 100 mmHg. The placenta was easily removed with no evidence of accreta and the uterus was closed. The hemoglobin was 78 $g \cdot L^{-1}$ and, suspecting a large amount of concealed bleeding, the patient was transfused with two units (500 mL) of packed red blood cells. Given that the hematoma remained stable in size and no further active bleeding was evident, the patient's abdomen was closed with the expectation that the hematoma would self-resorb. Following abdominal closure, the patient became increasingly hypotensive, necessitating continued transfusion of blood products, placement of a central line in the right internal jugular vein, and commencement of a norepinephrine infusion. Abdominal examination revealed a right-shifted uterus with bedside ultrasound showing a large left-sided hematoma. The occlusive balloon in the left iliac artery was removed and an internal iliac arteriogram was performed via the sheath. This showed active extravasation through a tear in the distal left internal iliac artery (Fig. 3). A catheter was then advanced through the sheath and used to select the branches of the internal iliac artery distal to the rupture. These were occluded by injecting Gelfoam® pledgets and a slurry formed by mixing Gelfoam forcibly with contrast. Embolizing the distal branches prevented retrograde flow towards the area of extravasation. The

inflow into the internal iliac artery itself was then occluded with injection of Gelfoam pledgets. Gelfoam was used as it is considered a temporary embolic agent that would not lead to permanent occlusion. Injection of contrast confirmed complete occlusion of the left internal iliac system. The patient's hemodynamic parameters stabilized, and the sheath in the right internal iliac artery was removed. During this time, the patient was transfused an additional four units (1,000 mL) of packed red blood cells, six units (1,500 mL) of fresh frozen plasma, and 10 units (150 mL) of cryoprecipitate. The final hemoglobin was 98 $g \cdot L^{-1}$. The patient was transferred to the intensive care unit where the remaining sheath in the left internal iliac artery was removed four hours later. The patient's trachea was extubated later that same day. She was discharged to the ward two days later and home eight days after admission. She returned to the emergency room nine days later with the complaint of abdominal pain. Abdominal ultrasound revealed an 89 x 79 x 119 mm left adnexal avascular hematoma, and she was discharged home with supportive care. Follow-up has shown a gradual involution of the hematoma.

## Discussion

The use of iliac artery occlusive balloons in cases of abnormal placentation was first reported by Dubois in 1997.[4] Since then, multiple reports examining the use of these balloons have been published.[3] The rate of complications related to the procedure has been estimated to be 6-15.8%.[5] Minor complications include subcutaneous hematoma formation or transient lower extremity ischemia that resolves following removal of the balloon catheters or their introducing sheaths.[5,6] The most common major complications appear to be related to ischemia. Vaginal ischemia[7] and thromboembolism of the iliac, femoral, and popliteal arteries has been described.[7–11] Vascular rupture is less commonly described as a complication. Bishop described a case of a leaking pseudoaneurysm that was discovered after abdominal closure.[12] Shrivastava *et al.* described an internal iliac artery dissection that resulted in vascular occlusion and required iliofemoral bypass surgery.[11] In our case, the vascular complication resulted in the birth of a neonate with an initial Apgar score of 3 and umbilical cord venous pH of 6.95, most probably due to uterine hypoperfusion. This demonstrates the need to consider disruption of uteroplacental blood flow and subsequent neonatal compromise as an important risk associated with interventional radiological procedures undertaken in the peripartum period.

It remains unclear why the vascular injury occurred. Compliant balloons were used and the measurement of inflation volumes for occlusion was performed using injection of contrast, which minimizes stress on the vascular wall. An alternate method to measure occlusion volumes involves inflation of the balloon until it is deformed into a sausage shape by the vessel wall. This method relies on the strength of the vessel wall and may result in balloon overinflation and increased risk of vascular damage. Although we did not use this method, our balloon maintained its spherical shape throughout inflation, suggesting either the balloon barely filled the lumen or the vessel wall offered no resistance. Since there was a rupture of the wall, we hypothesize the latter situation occurred, although we do not know why. It is possible this may be related to a systemic arterial wall abnormality. Alternatively, perhaps the epidural anesthesia caused a decrease in the arterial resistance.

In our view, the low umbilical venous pH and Apgar scores were due to decreased uterine perfusion from the disruption of the left iliac artery. The decreased perfusion was present for at least one hour, which was the time required for completion of the radiologic procedure and preparation for Cesarean delivery. This seems a sufficient duration to produce these neonatal findings. It is possible that the general anesthesia contributed to the neonatal outcome, but because induction occurred after abdominal incision and surgical exposure of the uterus, the duration of time the fetus was exposed to general anesthesia was most likely too short to result in an umbilical pH of 6.95. The hemodynamic changes associated with induction of general anesthesia in a patient already under epidural anesthesia may also have contributed, but the presence of intra-arterial blood pressure monitoring ensured that the systolic blood pressure was kept above 100 mmHg from the time of induction until delivery.

Our case raises considerations regarding the anesthetic management of endovascular occlusive balloon insertion. Epidural catheters are often placed prior to the procedure to minimize the risk of subsequent balloon dislodgement and epidural anesthesia may then be used for placement of the balloons. Vascular disruption during iliac artery dilation is accompanied by severe pain.[13] In our case, the patient did not feel severe pain, perhaps because the epidural blockade masked the stimulus from the disruption of the arterial wall. The first indication of vascular disruption was the onset of contraction-like abdominal pain, which was more suggestive of uteroplacental insufficiency. If we had used a more extensive epidural blockade, perhaps we may have masked all initial signs of the radiologic complication. While in our case the radiologic procedure was performed in the operating room, the placement of iliac artery balloons may occur in the radiologic suite, often without the presence of anesthesia or obstetric personnel. As evidenced by our case, the placement of iliac balloons

deserves the same level of monitoring present during the subsequent Cesarean delivery.

We performed a single verification of the fetal heart rate after the patient complained of abdominal pain. As the heart rate was normal at that time, we continued the procedure without further fetal monitoring. The fetal compromise most likely developed slowly during the completion of the radiologic procedure and was not present when we performed the single fetal heart rate verification. Perhaps continuous fetal heart rate monitoring may have shown the development of decreased variability, bradycardia, or decelerations that would have alerted us earlier to uteroplacental insufficiency.

The radiologic diagnosis of placenta accreta is not straightforward. The use of ultrasound has sensitivity of 80-100% and specificity of 49-93%, while magnetic resonance imaging has a sensitivity of 60-100% and specificity of 42-88%.[14] The use of magnetic resonance imaging in conjunction with ultrasound may improve the accuracy, especially when the placenta invades through the myometrium (placenta percreta), but there remains the risk of false positives and negatives.[15] As in our case, a false positive diagnosis of abnormal placental invasion can result in the exposure of women and fetuses with normal placentation to the risks related to endovascular iliac artery occlusive balloons.

There is a current lack of prospective randomized controlled trials showing the benefit of iliac artery occlusion for placenta accreta. Several case series have compared results of treated patients with retrospective controls, with only one showing an improvement in blood loss, transfusion amounts, and hospital length of stay.[11,16,17] Since the incidence of complications is unknown, some authors have called for a registry of complications to be formed.[3] In addition, it is not known if the degree of invasion of the placenta has any bearing on the efficacy of endovascular balloons. Taking into consideration the current lack of randomized control trials, we have shown that the risks of this procedure to the mother and to the fetus must be weighed carefully.

Many of the points presented here were raised in an institutional review of this incident, which has led to a change in our practice. Notably, we are developing guidelines to determine which cases are appropriate for endovascular balloon placement. Epidural anesthesia is no longer used routinely for these procedures, but will be provided if clinically required. In addition, we now utilize continuous fetal heart monitoring throughout endovascular radiologic procedures.

The case we present highlights that the use of arterial occlusive balloons for the management of placenta accreta can be associated with complications that occur prior to delivery and may result in both neonatal compromise and maternal morbidity. Contraction-like abdominal pain may reflect arterial rupture and compromise of uteroplacental blood flow and could possibly be masked or confused by the use of epidural anesthesia. Symptoms and signs of compromise of uteroplacental blood flow should be monitored and should be investigated thoroughly when observed.

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**Conflicts of interest** None of the authors declare any conflicts of interest.

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