



Application of ultrasound-guided balloon occlusion in cesarean section in 130 cases of sinister placenta previa

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ABSTRACT

Objective: To investigate the clinical utility of ultrasound-guided balloon occlusion in cesarean section in patients with sinister placenta previa.

Methods: The Interventional and Ultrasound Departments of the authors' center assisted obstetrics to complete cesarean section in cases of sinister placenta previa. A total of 130 patients with implanted sinister placenta previa were diagnosed using obstetrical ultrasound and magnetic resonance imaging (MRI). Before cesarean section, the balloon was positioned in the bilateral radial or abdominal aorta. Immediately after delivery of the fetus, the balloon was temporarily filled to transiently seal the target vessel. According to the obstetrician's assessment of hemostasis, the balloon was withdrawn at the appropriate time. Among the 130 patients, there was one case of abdominal aortic occlusion, with 129 cases blocked by the bilateral common iliac artery.

Results: All 130 cases were successfully blocked, with an average blocking time of <15 min, while intraoperative blood loss was 800–1500 ml.

Conclusion: Ultrasound-guided balloon blocking treatment before cesarean section can mitigate the dangers of placenta previa and significantly reduce blood loss with no exposure to X-ray radiation. Thus, the technique merits serious consideration.

Due to increases in the rate of cesarean section in recent years, and with complete liberalization of the two-child policy in China, maternal placenta abnormal adhesions, including the incidence of placenta previa, placenta implantation and penetrating placenta, the incidence of major bleeding and postpartum hemorrhage in related procedures has also increased, seriously threatening the lives of mothers.^{1,2} The effectiveness of X-ray-guided balloon closure for the treatment of sinister placenta previa has been confirmed in many studies; however, due to radiation exposure from X-rays, clinicians and patients have expressed varying degrees of concern; moreover, the procedure requires a dedicated catheterization room. Transport of the chamber increases the difficulty of the operation; therefore, clinical applications are limited. The present summary report describes our department's collaboration with the departments of ultrasound and obstetrics in using ultrasound-guided balloon pre-positioning, intraoperative sealing, and control of bleeding to achieve favorable results.

1. Materials and methods

1.1. General information

A total of 130 patients (mean age, 34 years [range, 32–38 years]; 32–37 weeks' gestational age [mean, 34 weeks]) with a history of cesarean section was included. Patients who underwent elective surgery underwent color Doppler ultrasonography and magnetic resonance imaging (MRI) diagnosis of central placenta previa. 130 patients were treated using bilateral common iliac artery balloon occlusion; the device used for closure was a double-chamber thrombus catheter.

1.2. Equipment and surgical materials

The ultrasound guidance device was a Voluson E8 (GE Healthcare, Milwaukee, WI, USA). Catheter and sheathing devices included the following: 6 F (8 F) vascular sheath; 5.5 F (6 F) Edward double lumen

Abbreviations: MRI, Magnetic resonance imaging; TAE, Transcatheter arterial embolization; DSA, digital subtraction angiography.

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thrombus catheter (12TLE405F35 or 12TLE805F35); super-slip guide-wire; 5.5 F (filling balloon diameter 0.7–1.1 cm left and right); and 6 F (filling the balloon diameter approximately 0.9–1.3 cm) double lumen thrombus catheter.

1.3. Surgical methods

1.3.1. Preoperative preparation

All patients were evaluated before surgery. The timing of termination of pregnancy was determined according to gestational age and condition. The type of placenta previa, attachment position, and placenta attachment were determined according to the results of color Doppler ultrasound or MRI. After the patients were fully informed about their condition, they provided written consent to undergo the procedure and preparation of a full blood source.

1.3.2. Ultrasound-guided balloon placement

The length and diameter of the bilateral common iliac artery were evaluated by the sonographer before surgery, and the inner diameter of the balloon was selected accordingly. The Seldinger puncture technique uses the bilateral femoral approach to bury the arterial sheath. The sonographer re-explored the right common iliac artery during the operation, measured the length and inner diameter of the common iliac artery, and then fixed the probe position at the bifurcation of the internal and external iliac artery. Introducing a 0.035 Loach guide wire, the ultrasound guide clearly depicted the guide wire passing through the bifurcation of the internal and external iliac artery. Under ultrasound observation, the position of the guide wire head continued to move slightly forward, approximately 5–10 cm, and the double-lumen catheter was introduced along the guide wire. The anterior and posterior bifurcations were advanced approximately 1–3 cm (depending on the length of the common iliac artery), the catheter position was fixed, the guide wire was withdrawn, and blood flow was observed using ultrasound Doppler before unblocking. When the internal and external arteries of the iliac crest exhibited blood flow, the balloon was filled. Doppler clearly depicted interruption of the internal and the external iliac arteries, indicating that temporary sealing was effective, and the balloon was evacuated. Similarly, the contralateral balloon was fixed and the catheter was fixed to the balloon catheter and sheath portion in vitro. As the number of surgical cases increased, the authors chose to complete the procedures directly in the department of anesthesiology. After the balloon was removed, a cesarean section was performed, causing the balloon to avoid the process of moving bits It changes. We did balloon repositioning directly in the

anesthesiology department. Under ultrasonic guidance. If the balloon is preset under the DS guidance first, the position of the balloon may change during the process of moving the patient to the operating room Figs. 1, 2 and 3.^{3,4}

The obstetrician performed the cesarean section and, immediately after delivery of the fetus, a double-sided thrombectomy catheter balloon was temporarily filled to transiently seal the target vessel. According to the obstetrician's assessment of hemostasis, the balloon was evacuated at an appropriate time to observe for continued bleeding. If the amount of bleeding remained large, the balloon was repeatedly filled for blocking. If the hemostatic effect was obvious, the balloon was withdrawn and used after the work of the obstetrician. The hemostatic patch compresses the bilateral femoral artery puncture points to stop bleeding and does not require the use of an elastic bandage for compression after surgery Figs. 4 and 5.

1.3.3. Postoperative treatment

Patients were monitored for vital signs, uterine contractions, vaginal bleeding, and function in the lower limbs for 4 h. Activity resumed after 6 h and, with deep squat movement at 24 h, bilateral foot dorsal artery pulsation was assessed.^{5,6}

2. Results

All cases underwent temporary occlusion of the common iliac artery by balloon, all of which were completed by ultrasound. The technical success rate after improvement of the surgical procedure was 100%, and intraoperative blood loss was approximately 800–2100 ml. The obstetrician carefully sutured and completed hemostasis. Among these, 4 cases were removed from the uterus. The reason for the resection was that the placenta was positioned too deep, the serosal area was large, and the patient had multiple pregnancies. All patients did not have coagulation function after massive bleeding. In the case of disorder, the bleeding volume of several patients exceeded 1500 ml. During the operation, blood was prepared before infusion, and those who lost <1000 ml did not undergo blood transfusion. All patients were not administered hemostasis after the operation. No complications, such as late postpartum hemorrhage or infection, occurred. No intervention-related complications, such as postoperative thrombosis, occurred in this group of patients; therefore, no postoperative uterine artery embolization was performed, and the ideal outcome was achieved.^{7,8}

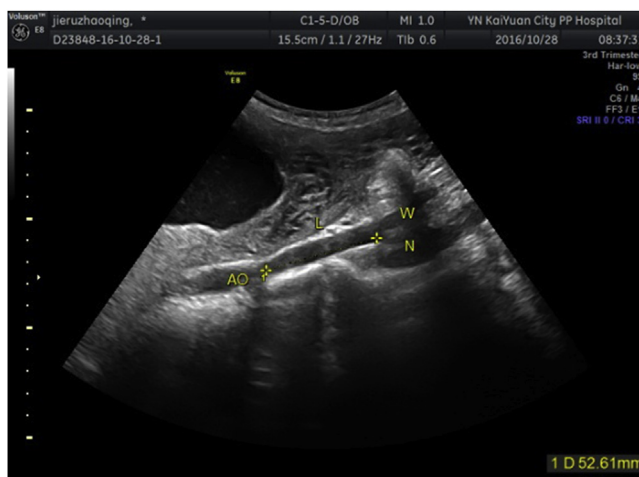


Fig. 1. Ultrasound measurement of the common iliac artery.

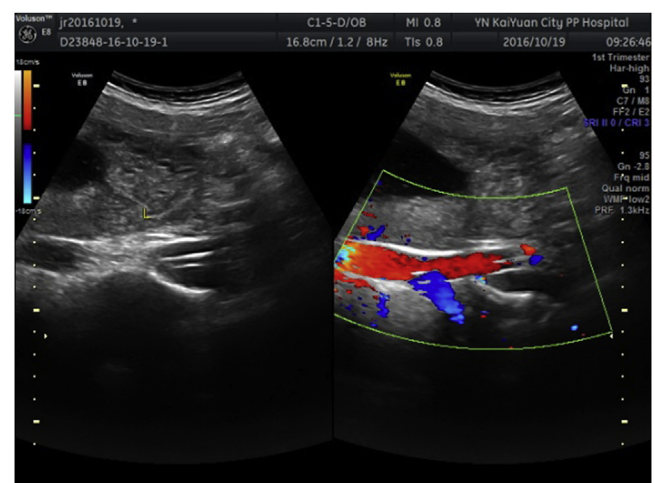


Fig. 2. Ultrasound to position and clearly visualize the catheter. Under conditions of unblocked color Doppler, blood flow in the internal and external iliac arteries is observed. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

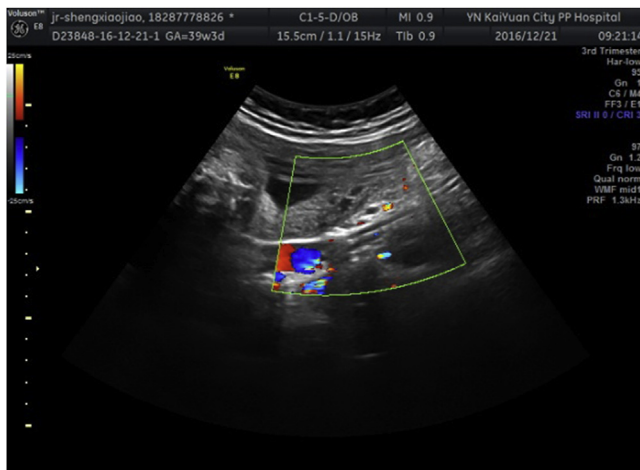


Fig. 3. Blood flow interruption in the internal and external iliac arteries confirmed that blocking was effective.

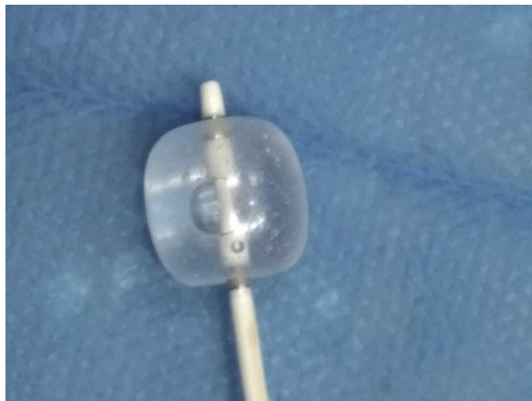


Fig. 4. In this group of operations, an Edward's double-chamber thrombus catheter was filled in state.



Fig. 5. After filling, the balloon was attached to the catheter wall.

3. Discussion

According to guidelines (2014) for the prevention and treatment of postpartum hemorrhage, transcatheter arterial embolization (TAE) can be used for effective conservative treatment of various intractable forms of postpartum hemorrhage (including uterine inertia, placenta, and birth

canal injury factors). In hospitals with facilities equipped to manage sinister placenta previa, prophylactic internal iliac balloon occlusion can also be used to reduce intraoperative bleeding. Therefore, interventional techniques, such as abdominal aorta, arteria *iliaca communis*, and internal iliac artery balloon occlusion are used to reduce the rate of cesarean morbidity and mortality.^{9,10} To save lives, it is worth promoting and applying to avoid the physical and psychological damage caused by hysterectomy, and the ability to regain fertility.

The present study compared ultrasound guidance with digital subtraction angiography (DSA) guidance, and analyzed their advantages and disadvantages:

1. Although there are reports describing the safety of X-ray doses under DSA for infants both domestically and abroad, DSA-guided balloon occlusion cannot completely avoid radiation exposure. It affects the choice of patients and physicians, given that ultrasound guidance can avoid the effects of X-ray radiation exposure, thus completely mitigating the concerns of physicians and the patients' families;
2. DSA equipment is not widely available in hospitals in China; thus, the promotion of this technology is obviously limits the use of this modality. As such, obstetric patients in these hospitals are in a very dangerous situation. However, ultrasound equipment is available and accessible in most hospitals in China. Ultrasound technology is widely used throughout pregnancy. Therefore, the social foundation that can promote ultrasound-guided balloon implantation technology already exists;
3. Ultrasound technology does not use contrast agents, thus avoiding contrast agent-induced kidney injury and many other complications; and
4. The most significant weakness of ultrasound guidance is the lack of the overall view. As such, in this group of patients, choose to block the bilateral common iliac artery in the later stage, based on the following conditions:
 - (1) During pregnancy, ultrasound exploration of the abdominal aorta is more susceptible to fetal occlusion. Observation of the bilateral renal artery and bilateral sacral total bifurcation is not clear; therefore, it is easy to cause the position to be too high or too low. If the blocking position is too high, it affects renal artery blood flow; if the blocking position is too low, blood flow cannot reach the block. The effect of the bilateral renal artery and the bilateral bifurcation can be clearly observed using ultrasound. The closure of the abdominal aorta is also feasible, and the operation is more convenient and quicker.
 - (2) Closure of the bilateral internal iliac artery requires relatively super selection; however, ultrasound guidance is limited. The overall observation is not as good as DSA. Even if it is relatively convenient to super select the internal iliac artery by the contralateral mountain, This is a colloquial expression of our local medical staff. After puncture of one femoral artery, a tube is placed into the contralateral common iliac artery or femoral artery through the common iliac artery. The whole process is like going over a hill. it is still necessary to observe the catheter guide wire across the abdomen. The real-time situation at the next stage avoids the possibility of the guide wire directly entering the abdominal aorta, which is time-consuming and cannot accurately position the catheter or the position of the guidewire for super selection. The catheter guidewire is long in the blood vessel. Proceeding blindly can easily cause damage to the vascular endothelium.

Sadashivaiah et al.¹¹ and Tan et al.¹² reported the use of prophylactic internal iliac artery balloon embolization in implantable placenta cases first, whether the uterus preservation or hysterectomy, intraoperative bleeding and blood transfusion volume were significantly reduced. Domestically and abroad, there are reports of bilateral common iliac artery occlusion and abdominal aortic occlusion. Regardless of whether

the abdominal aorta, bilateral common iliac artery or bilateral internal iliac artery are blocked, the effect of reducing intraoperative bleeding can be achieved.

In this group of patients, we chose to use a double-chamber thrombus catheter because when its balloon was retracted, the balloon wall was completely attached to the catheter and the balloon could be withdrawn. When there is no need for special treatment and the balloon catheter is used for expansion, the balloon wall cannot be completely retracted to the attached state. When the balloon catheter is withdrawn, it is easy to damage the endocardium and increase the incidence of postoperative lower extremity thrombosis.

The number of surgical samples in the present study was small. As such, data from a larger sample is required to investigate the feasibility of ultrasound-guided closure of the abdominal aorta and bilateral internal iliac artery. If the bilateral internal iliac artery can be blocked, it will be the next step; however, if bleeding continues, the most appropriate recourse is to switch to uterine artery embolization as quickly as possible.

Declaration of competing interest

The authors declare no financial or personal relationships with individuals or organizations that could have inappropriately influenced the work. There is no professional or other personal interest of any nature or type in any product, service and/or company that could be construed as influencing the position presented in, or review of, the manuscript.

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