

Original Article

Temporary prophylactic intravascular balloon occlusion of the common iliac arteries before cesarean hysterectomy for controlling operative blood loss in abnormal placentation



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ABSTRACT

Objectives: The purpose of this study was to investigate the efficacy and safety of temporary prophylactic intravascular balloon occlusion of the common iliac arteries (CIA) before planned cesarean hysterectomy for controlling operative blood loss in abnormal placentation.

Materials and methods: A retrospective study of 13 pregnant women at risk for placenta accreta identified using sequential obstetric ultrasonography and magnetic resonance imaging from January 2007 to December 2009 was performed. Temporary prophylactic intravascular balloon catheterization of the bilateral CIA before cesarean hysterectomy was performed by interventional radiologists. The maximum duration of occlusion time of CIA must not exceed 60 minutes. The primary outcome for this study included estimated blood loss and secondary outcomes included the development of thromboembolism, disseminated intravascular coagulation and surgical complications.

Results: Among these 13 patients, the mean age of the patients was 32.8 ± 0.7 years (range 29–37 years). The mean gestational age at cesarean hysterectomy was 32.2 ± 0.9 weeks (range 28–36 weeks), and the mean intraoperative blood loss was 1902.3 ± 578.8 mL (range 500–8000 mL). Operative bleeding was controlled by conservative treatment without additional surgery in two cases. Importantly, two patients (15.8%) had severe complications possibly related to the interventional procedure. One patient was noted to have a popliteal artery thrombosis. A second patient had an external iliac artery thrombosis with 80–90% occlusion. Both patients required antithrombotic treatment without sequelae.

Conclusion: With limited experience in this small series, we observed a statistically significant reduction in operative blood loss after the use of temporary prophylactic balloon occlusion of the CIA technique compared with historical controls of similar demographic characteristics previously published (1902.3 ± 578.8 mL, range 500–8000 mL vs. 4445.7 ± 996.48 mL, range 1040–15,000 mL, $p = 0.0402$). Additionally, two patients had arterial thrombosis. These preliminary findings are based on a small number of patients, and therefore further investigation is needed to determine the effectiveness and safety of this new technique.

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Introduction

Abnormal placentation has become a challenging problem of increasing clinical significance in obstetric practice. Severe abnormal placentation unexpectedly encountered at the time of delivery can lead to catastrophic consequences, such as life-

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threatening hemorrhagic shock, uterine rupture, and even maternal death. Utilization of ultrasonographic and magnetic resonance imaging (MRI) in the setting of conventional risk factors for abnormal placentation (prior cesarean section, placenta previa etc.) allows for accurate prenatal diagnosis and advanced preparation before delivery [1–6], so that an experienced multidisciplinary team can be assembled in advance to manage the potentially dreadful hemorrhagic complications with the optimum strategies to reduce maternal morbidity and mortality.

The most common complication encountered in abnormal placentation is massive hemorrhage, attributed to the development of extensive pelvic collateral circulation in the gravid uterus. We have previously reported an average blood loss of 4445.7 ± 996.48 mL (range 1040–15,000 mL) in a series of placenta accreta [2]. Intraoperative blood loss may necessitate significant blood transfusion with the associated complications of disseminated intravascular coagulation (DIC), fluid overload, pulmonary edema and infection. Other significant surgical morbidities include ureteral injury, and bladder lacerations. In an effort to minimize blood loss and facilitate surgery, intraoperative balloon occlusion of the aorta, common iliac, internal iliac, and uterine arteries has been described in the literature. [7–16]. The theory is that reduced uterine perfusion allows for a more controlled hysterectomy with decreased hemorrhage and surgical complications. To date however, most published literature findings regarding this therapeutic modality have been limited to case reports and case-control comparisons of internal iliac artery catheterization [11–16].

The aim of this study was to investigate the efficacy and safety of temporary prophylactic intraoperative balloon occlusion of the common iliac arteries (CIA) before anticipation of cesarean hysterectomy for controlling operative blood loss in abnormal placentation.

Materials and methods

This was a retrospective, descriptive study performed at the Taichung Veterans General Hospital, Taiwan from January 2007 to December 2009. The institutional review board (IRB C06138) approval was obtained. 13 pregnant women with a diagnosis of placenta previa associated with a prior cesarean delivery, uterine curettage, advanced maternal age, multiparity and/or other associated risk factors, were referred to our institution for detailed evaluations of abnormal placentation. All patients were examined sequentially with 2D ultrasonography (US) followed by 3D US (Voluson 730 Expert; GE imaging system, Kretztechnik, Zipf, Austria) to precisely assess the severity of abnormal placentation before surgical intervention using previously published diagnostic imaging criteria. In addition, preoperative MRI examination (Siemens Sonata 1.5 Tesla scanner; Siemens Medical Solutions, Erlangen, Germany) was used to assess the length and diameter of bilateral common iliac arteries.

On the day of delivery, the patient was taken to the angiography suite, in which, under fluoroscopic guidance, catheterization of the femoral artery was performed by interventional radiologists. A bilateral contralateral approach was used to guide placement of the occlusion balloon catheters (Boston Scientific, Watertown, MA, USA) into the CIA below the aortic bifurcation; they were then inflated with approximately 1–2 mL of iodinated contrast to test and evaluate the degree of occlusion and obtain the desired complete hemostasis of the CIA (Figure 1). Particular attention was paid to ensure minimal fetal radiation exposure during the procedure, using appropriate shielding and intermittent low-dose fluoroscopy. Total fluoroscopy time is kept as short as possible. Dosimetry studies ranged from 108 mR to 294 mR. The catheters were secured, and the patient was subsequently taken directly to

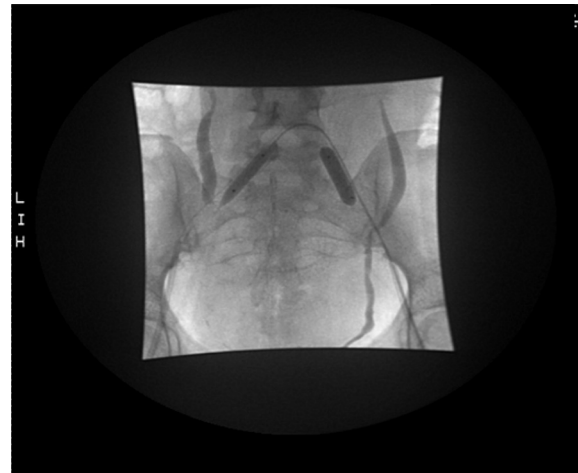


Figure 1. Arteriogram showing two inflated balloon catheters with 1–2 mL of iodinated contrast material placed in the bilateral common iliac arteries just below the aortic bifurcation to occlude the arterial flow in a patient with placenta percreta before cesarean hysterectomy.

the operating room for planned surgery. After the infant was delivered by classical cesarean section, the balloon catheters of bilateral CIA were inflated using the same volume and pressure as for the test occlusion. A supracerical or total hysterectomy was performed. The balloons were usually inflated intraoperatively to ensure that hemostasis was achieved during the resection of the uterus with the abnormally adherent placenta *in situ*. Periodic local infusion of heparinized saline solution was performed through the sheaths and catheters and they were removed the moment hemostasis was achieved.

During the surgical procedure, pulse oximetry of both feet was established to monitor the arterial oxygen saturation. In addition, periodic pedal arterial pulsation was also regularly checked. Catheter removal was performed at the postoperative recovery room if the patient's hemodynamic status and coagulation profile were unremarkable.

The primary outcome for this study included estimated blood loss (milliliters), and secondary outcomes included the development of thromboembolism, surgical complications, and the need for reoperation. Statistical analysis was performed using SPSS software (version 19; SPSS Inc, Chicago, IL, USA), and a *p* value < 0.05 was considered statistically significant.

Results

During the study period, 13 patients at risk exhibited characteristic ultrasonographic findings for abnormal placentation, and ultimately had surgical and pathologic confirmation of abnormal placentation. Maternal demographic characteristics are listed in Table 1.

All patients had combined risk factors for placenta accreta. Among these 13 patients, the mean age of the patients was 32.8 ± 0.7 years (range 29–37 years). All diagnoses were made in the second and third trimesters, at a mean gestational age of 26.7 ± 1.7 weeks (range 18–36 weeks). The mean gestational age at cesarean hysterectomy was 32.2 ± 0.9 weeks in 11 patients. (range 28–36 weeks). The mean balloon occlusion time was 44.6 ± 2.0 minutes (range 30–50 minutes).

We observed a statistically significant reduction in operative blood loss after the use of the temporary prophylactic balloon occlusion of the CIA technique compared with historical controls of similar demographic groups previously published

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