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Prophylactic abdominal aorta balloon occlusion during caesarean section: a retrospective case series

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ABSTRACT

Background: The management of patients with morbidly adherent placenta has been described using vascular balloon catheters placed in the iliac arteries, but rarely in the aorta. This case series presents our experience with prophylactic lower abdominal aorta balloon occlusion in 45 women.

Methods: The records of patients in our centre who underwent caesarean section between May 2013 and June 2014 were retrospectively analysed for the use of prophylactic lower abdominal aorta balloon occlusion.

Results: Forty-five cases were identified. All patients had a morbidly adherent placenta, including placenta accreta ($n=22$), placenta increta ($n=20$) and placenta percreta ($n=3$). A subtotal hysterectomy was performed in four cases. Eleven of the 45 patients received red blood cell transfusion of a mean of 1.7 units. Mean preoperative and postoperative haemoglobin concentrations were 10.1 g/dL and 9.4 g/dL, respectively. Mean estimated blood loss was 835 mL [range 200–6000 mL]. The incidence of complications was 4.4% (2/45), including one case of lower extremity arterial thrombosis and one case of ischaemic injury to the femoral nerve. Follow up at one year was completed in 22 patients at which time all babies were well.

Conclusions: Prophylactic lower abdominal aorta balloon occlusion has the potential to reduce intraoperative blood loss, transfusion and hysterectomy rate in patients with morbidly adherent placenta undergoing caesarean section. Careful patient selection is critical as the technique may be associated with potentially serious complications.

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Keywords: Aorta; Balloon; Caesarean; Placenta abnormality

Introduction

Massive obstetric haemorrhage accounts for 150 000 maternal deaths worldwide each year with mortality particularly high in developing countries.¹ Women with anterior or central placenta praevia who have had two or more caesarean sections have a nearly 40% risk of developing placenta accreta.² Patients with placenta accreta have traditionally required hysterectomy to control life-threatening haemorrhage.³ Effective methods to control intraoperative bleeding are important for these patients.

Interventional endovascular techniques to control traumatic bleeding were first reported in 1954.⁴ Since then, more reports of the use of interventional radiology to control obstetric haemorrhage have emerged,⁵ using the two main techniques of balloon occlusion and

selective arterial embolization.⁶ Prophylactic balloon occlusion involves placing a balloon catheter in a vessel preoperatively and inflating it after delivery of the fetus to reduce intraoperative bleeding and to enable the procedure to be carried out in a relatively bloodless field. During caesarean section, balloon catheters are usually placed bilaterally in the common or internal iliac arteries.^{7,8} However, reports of abdominal aorta balloon occlusion have been published.^{9–12}

In this case series, we present our experience with prophylactic lower abdominal aorta balloon occlusion (PABO) in the management of 45 women with morbidly adherent placenta undergoing caesarean section. The efficacy, risks and benefits of this technique as well as the anaesthetic management are discussed.

Methods

A retrospective study was carried out at the First Affiliated Hospital of Zhengzhou University, Zhengzhou, China by a database search (DoCare Anaesthesia

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Clinical Information System, DCAIS V5.0; Mehdi Houston Co. Ltd, China). Records of all patients who had a preoperative diagnosis of placenta praevia or placenta accreta and received PABO during elective caesarean section, between May 2013 and June 2014, were reviewed. The diagnosis was based on history of previous uterine surgery, Doppler ultrasound and magnetic resonance imaging (MRI). Patients at less than 34 weeks of gestation or with severe co-morbidities such as preoperative massive haemorrhage, organ failure or haemolysis, elevated liver enzymes and low platelet count (HELLP) syndrome were excluded.

Age, weight, surgical conditions, estimated blood loss, volume of intravenous fluid and blood transfusion, pre- and postoperative haemoglobin concentration, length of postoperative hospital stay, fetal condition and complications associated with PABO were recorded. Patients were followed up by telephone one year after delivery.

Surgery took place in a hybrid operating room equipped with a C-arm for digital subtraction angiography (DSA). The right femoral artery was punctured and a 5–8 French gauge vascular sheath was inserted under local anaesthesia. Under fluoroscopic guidance, a pigtail catheter was introduced into the upper abdominal aorta using a Seldinger technique to identify the origins of the renal arteries with reference to lumbar vertebrae and to measure the diameter of the lower abdominal aorta (Fig. 1). A non-compliant balloon catheter (Bard Peripheral Vascular, Inc, Queensbury, NY, USA) which had an approximate 15 mL capacity and a diameter similar to the lower abdominal aorta was selected. Balloon catheters with four optional diameters were available: 12 mm, 14 mm, 16 mm and 18 mm. If the measured

diameter of the lower abdominal aorta was 15 mm or 16 mm, a 16 mm balloon catheter was selected. The balloon catheter was inserted into the lower abdominal aorta with the tip just below the origins of the renal arteries (Fig. 2). Guidewires were wetted and catheters were flushed with heparinized saline. Continuous right toe pulse oximetry was used to detect lower limb ischaemia.

Routine monitoring included pulse oximetry, invasive blood pressure and electrocardiogram and a right internal jugular vein catheter was inserted. General or epidural anaesthesia without premedication was administered as deemed appropriate by the anaesthesiologist-in-charge. If general anaesthesia was used, the femoral sheath and the balloon catheter were inserted before induction of anaesthesia; if epidural anaesthesia was used, the femoral sheath and balloon catheter were inserted after induction of anaesthesia. General anaesthesia was induced with propofol and remifentanyl, and a muscle relaxant was given before tracheal intubation. For epidural anaesthesia, an epidural catheter was inserted and 2% lidocaine 10–15 mL and 1% ropivacaine 10 mL was injected. After delivery of the fetus and umbilical cord clamping, the aortic balloon was inflated with 0.9% saline 15 mL to reduce blood flow. The pressure or other parameters of the balloon were not monitored. Successful occlusion was assumed if the lower extremity pulse oximeter ceased to read.

Following delivery, the obstetricians attempted to remove the placenta. The interventional radiologist adjusted the balloon according to the bleeding. Five to 10 minutes after first occlusion, if no obvious bleeding was found, the balloon was slowly deflated. If bleeding then occurred, the balloon was re-inflated and further surgical haemostasis was attempted. These procedures

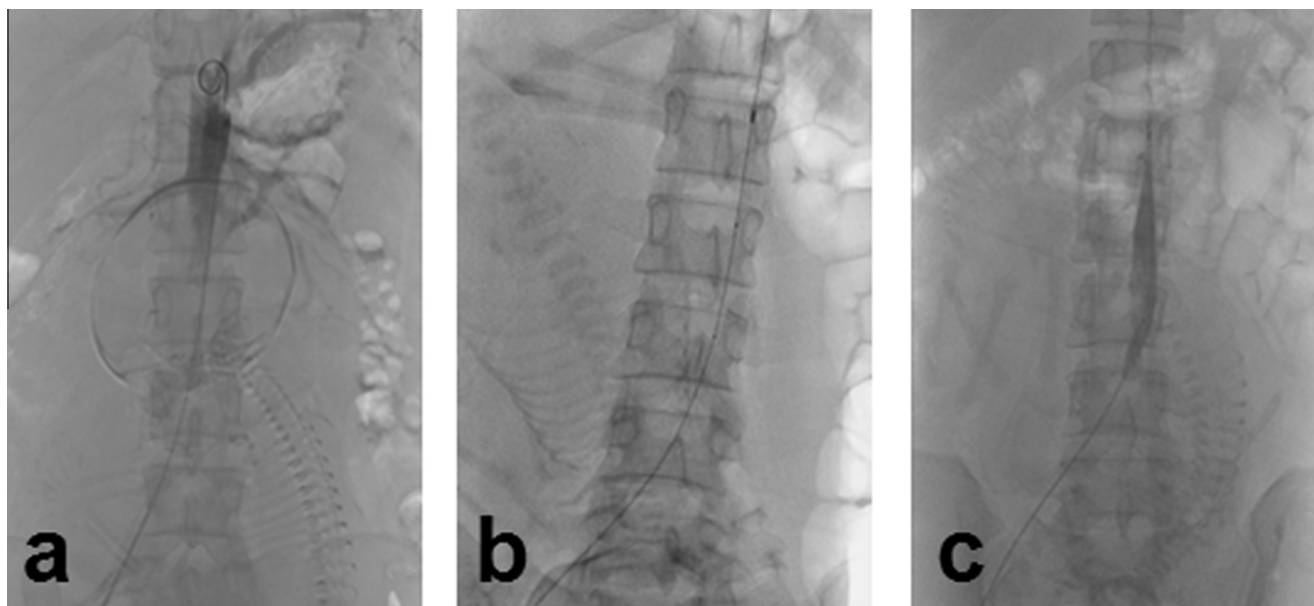


Fig. 1 Process of balloon catheter insertion under fluoroscopic guidance. A pigtail catheter is introduced into upper abdominal aorta (a). The balloon catheter is inserted (b). The balloon is positioned with reference to lumbar vertebrae (c)

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