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British Journal of Anaesthesia **93** (4): 591–4 (2004)
doi:10.1093/bja/ae237 Advance Access publication July 26, 2004

Management of severe postpartum haemorrhage by uterine artery embolization

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We report a case of postpartum haemorrhage which was successfully treated by embolization of the uterine artery. This technique is not well known and is thought to be underused in this condition. We wish to alert medical personnel to its role in this life-threatening situation.

Br J Anaesth 2004; **93**: 591–4

Keywords: arteries, hypogastric ligation; arteries, uterine, embolization; complications, postpartum haemorrhage

Accepted for publication: June 14, 2004

Obstetric haemorrhage is a significant cause of maternal morbidity and mortality throughout the world.¹ Causes of haemorrhage include uterine atony, retained products of conception, and lacerations to the birth canal. If local measures to control bleeding are unsuccessful, bilateral uterine or hypogastric artery ligation may be attempted. However, because of the extensive collateral circulation in the pelvis, the success rate of this approach may be as low as 42%.² Hysterectomy often follows, but there are reports of persistent bleeding after both arterial ligation and hysterectomy.³ Arterial embolization may be performed as alternative management. We present this case report to highlight its use in cases of severe postpartum haemorrhage.

Case report

A 33-yr-old primigravida ASA I woman was admitted in early labour at 39 weeks gestation. After 16 h, an epidural provided good pain relief and a Syntocinon infusion was commenced to augment labour. Four hours later, delivery

by Caesarean section was planned for failure to progress. A live male infant was delivered and Syntocinon 10 U was given as a bolus followed by an infusion of 40 U in 500 ml 0.9% saline over 4 h. The operation was completed uneventfully and blood loss was estimated at 500 ml.

In the recovery room, the patient was initially stable with a blood pressure of 110/50 mm Hg, pulse 90 per min, Sp_o₂ 99% and respiratory rate 22 b.p.m. Later she complained of feeling light-headed and observations showed a blood pressure of 80/45 mm Hg, pulse 125 per min, Sp_o₂ 94% and respiratory rate 30 b.p.m. She became very pale and sweaty, so Gelofusine 1000 ml and blood 2 U were given, to good effect. However, 1 h later, the patient again experienced the same symptoms with accompanying hypotension. A further 2 U of blood were given and examination of her abdomen revealed some distension, but it was soft and not tender.

Based on her clinical symptoms, she was assumed to have bled intra-abdominally and was taken back to the operating theatre for a laparotomy. With appropriate monitoring, general anaesthesia was induced using a rapid sequence

technique. At laparotomy, 3 litres of blood was evacuated from the pelvic cavity. A bleeding point was found in the left uterine artery and the abdomen closed after haemostasis was secured. During surgery, further blood and fresh frozen plasma (FFP) were given to the patient while the Syntocinon infusion was continued. At the end of the operation, a central venous catheter was placed in the right internal jugular vein and an arterial line in the left radial artery, as arrangements were made to transfer the patient to the intensive care unit (ITU).

While awaiting transfer to the ITU, the patient's blood pressure dropped to 85/35 mm Hg. The heart rate was 110 beats min^{-1} , Sp_{O_2} 99% and CVP 3 mm Hg. Examination revealed heavy bleeding from the vagina with an atonic uterus. Vigorous external massage of the uterus resulted in a very large blood clot being expelled, but cessation of the massage immediately resulted in uterine atony. Ergometrine was given i.v. in small boluses to a total dose of 200 μg , in addition to prostaglandin $\text{F}_{2\alpha}$ 250 μg i.m. The obstetric specialist registrar was called to re-examine the patient and his opinion was that haemostasis in the abdomen had been secured but the problem now was one of uterine atony with continued haemorrhage.

The patient was transferred to the ITU under propofol sedation while her trachea remained intubated and her lungs ventilated. A series of haematological investigations were taken, showing continued anaemia with the lowest haemoglobin at 5.4 g dl^{-1} and a platelet count of $30 \times 10^9 \text{ litre}^{-1}$. Coagulation studies showed the worst results to be an INR of 1.4 and APTT of 44 s (control 32 s), with a fibrinogen level of 0.71 g litre^{-1} (range 2–4 g litre^{-1}). More blood products were given in the form of packed red cells, FFP, cryoprecipitate and platelets in an attempt to correct the coagulopathy and stop the bleeding. Despite this, the patient continued to bleed vaginally and her vital signs remained unstable. After much discussion with the obstetricians, a radiologist suggested that she could undergo embolization of the uterine artery in an attempt to stop the bleeding whilst preparations were being made for further laparotomy with a view to hysterectomy.

The patient was transferred to the X-ray department under continued sedation and mechanical ventilation. The right femoral artery was cannulated and an angiogram showed very active bleeding from the right uterine artery, no other bleeding point being demonstrated (Fig. 1). A Sims I catheter (Cook, Letchworth, UK) was positioned with its tip in the right uterine artery, resulting in near cessation of the bleeding, such that uterine massage could be stopped, and the blood pressure began to rise. Embolization was performed successfully with 500 μm polyvinyl alcohol (PVA) particles 0.8 ml (Cook) followed by two 1.5 \times 5 mm Hilal embolization coils (Cook), as shown in Figure 2. A repeat angiogram showed no further bleeding (Fig. 3). The patient was transferred back to the ITU and kept sedated and ventilated overnight, while further blood products were administered as required according to laboratory results.



Fig 1 Angiogram showing bleeding right uterine artery.

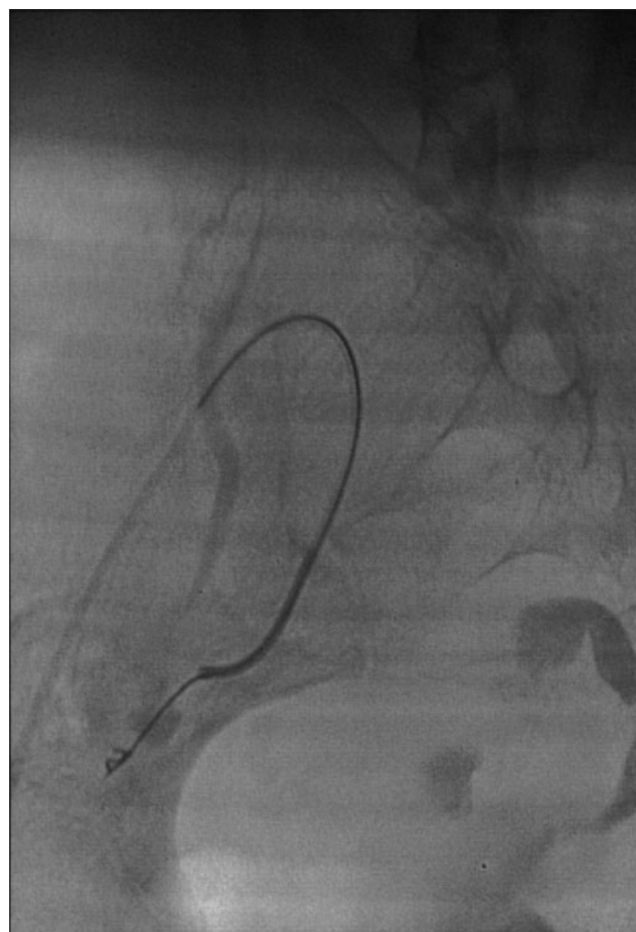


Fig 2 Embolization being performed.



Fig 3 Cessation of bleeding after embolization.

The next day, her haematological variables had returned to acceptable limits (haemoglobin 9.6 g dl^{-1} , platelets $90 \times 10^9 \text{ litre}^{-1}$, INR 1.2, APTT 37 s). Chest X-ray showed no sign of acute lung injury. Sedation was discontinued and her trachea was extubated. The total amount of blood products used was packed red cells 31 U, FFP 16 U, platelets 5 pools and cryoprecipitate 20 U. Continued improvement resulted in her discharge from hospital 7 days after her operation. At follow-up, 2 months later, she remained well.

Discussion

Postpartum haemorrhage occurs in 2–11% of deliveries and is defined as greater than 500 ml blood loss after a vaginal delivery, and greater than 1000 ml blood loss after Caesarean delivery.¹ This may be early within the first 24 h, or late between 24 h and 6 weeks after delivery. In the UK, postpartum haemorrhage is currently the sixth most common direct cause of maternal death, with an incidence of 3.3 per million maternities.⁴

When haemorrhage is severe, successful treatment relies on timely recognition and intervention with appropriate manoeuvres. These include excluding retained products of conception and suturing lacerations to the birth canal. At the same time, the uterus should be massaged and oxytocic drugs administered. Blood should be taken for haemoglobin and/or haematocrit estimation plus coagulation studies and cross-matching. If uterine atony persists despite pharmacological intervention or if excessive bleeding continues in the face of adequate uterine tone, more aggressive methods of haemostasis may be required. Uterine examination should be undertaken and surgical intervention performed if bleeding persists.

The definitive treatment for severe postpartum haemorrhage is hysterectomy, but this renders the woman infertile so other surgical procedures may be considered initially. Packing and other forms of uterine tamponade may be used but advanced surgical techniques may be necessary. The B-Lynch suture⁵ and its modifications⁶ have been used successfully to compress the uterus and control bleeding.

Ligation of the uterine arteries or hypogastric arteries may be performed; both operations require laparotomies. Bilateral hypogastric artery ligation has a success rate ranging from 40 to 100%.^{2,7–9} In contrast, uterine artery ligation has been shown to have a success rate of 92% and a complication rate of 1%.^{10,11} Both these techniques aim to leave the uterus intact and preserve fertility. Bilateral uterine artery ligation is preferred to hypogastric artery ligation because of its overall higher success rate with lower morbidity.¹²

Transcatheter arterial embolization has been a recognized method of haemorrhage control since the 1960s, and has been used in the control of pelvic haemorrhage due to malignancy, trauma and radiation.^{13,14} More recently, this technique has been used successfully in the control of postpartum haemorrhage,^{15,16} with the first such reported use in 1979.¹⁷ Uterine artery embolization has several advantages, including easy identification of the bleeding site, preservation of the uterus and fertility, and decreased rebleeding from collaterals with more distal occlusion of the bleeding vessels. A recent review by Badaway and colleagues included 138 cases of postpartum haemorrhage treated by arterial embolization, with a success rate of 94.9% and a complication rate of 8.7%.¹⁶ In this series, seven cases required hysterectomy as a result of failure of embolization. Some studies have shown the return of menses after the procedure and pregnancies have been reported.¹⁸ Complications of pelvic embolization for postpartum haemorrhage occur at a rate of 8.7%. The commonest complication is low-grade fever and rarer ones include pelvic infection, groin haematoma, iliac artery perforation, transient buttock ischaemia, transient foot ischaemia and bladder gangrene.^{15,16}

Although embolization may be considered to be the technique of choice for managing postpartum haemorrhage by some authors,^{15,19} certain practical issues have to be considered. A radiologist trained in embolization techniques is a prerequisite, as is the appropriate equipment for vascular intervention. Digital road-mapping may be required and the possible complexity means that this procedure can only be performed in a fully equipped X-ray department.

Uterine artery embolization and uterine artery ligation both have reported success rates of greater than 90% with low complication rates. If both techniques are available, embolization is the preferred first choice as it obviates laparotomy, and ligation can be attempted subsequently if embolization is unsuccessful. In contrast, after an unsuccessful uterine artery ligation, embolization may be extremely difficult or even impossible, leaving hysterectomy as the only remaining option.^{12,15}

From a review of the British literature, it would appear that arterial embolization for the control of postpartum haemorrhage is a technique that has either not been widely used or is under-reported. Indeed, a recent survey of maternity units in the UK showed that 86% of these units had never used this technique.²⁰ This is despite a recommendation from the latest triennial report on maternal deaths to consider the use of arterial embolization.⁴ In addition, there has been a joint publication from the Royal College of Radiologists and the Royal College of Obstetricians and Gynaecologists giving guidelines on the use of uterine artery embolization for fibroids, but including a reminder that this technique is also used for the control of postpartum haemorrhage.²¹ Vedantham and colleagues also believe that this therapy is underused, wanting to emphasize its increasingly important role in the control of postpartum haemorrhage.¹⁵

With so many treatment options, ultimately the choice of technique becomes one of individual preference, institutional availability and the individual clinical scenario. In this case, as in many others referred to, selective uterine arterial embolization was effective in the control of postpartum haemorrhage, thus avoiding hysterectomy.

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