CASE REPORT

Epidural Anesthesia for Elective Cesarean Delivery with Intraoperative Arterial Occlusion Balloon Catheter Placement

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Obstetric hemorrhage is a leading cause of maternal mortality. We describe the anesthetic management of elective cesarean delivery in patients at high risk for hemorrhage. The utility and limitations of intraarterial balloon catheter placement and epidural anesthesia are described. Supported internally by the Stanford University Department of Anesthesiology, Stanford University School of Medicine, Stanford, California.

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Obstetric hemorrhage is a leading cause of maternal mortality and the primary reason for postpartum intensive care unit admissions (1). Recent improvements in obstetric imaging techniques allow earlier and more reliable diagnosis of abnormalities associated with hemorrhage (e.g., abnormal placentation and uterine arteriovenous malformations [AVM]) (2,3). Our case series describes the use of perioperative interventional radiology to minimize blood loss during elective cesarean section deliveries (CS) at high risk for hemorrhage. Obstetric and radiologic experience with pelvic arterial embolization for control of obstetric hemorrhage at our institution has been previously reported (4). This is the first case series describing anesthetic management of elective CS with preoperative intraarterial balloon catheter placement in patients in whom major hemorrhage was anticipated.

Case Report

Case details, including patient characteristics, anesthetic technique, surgical details, and resuscitation are outlined in Table 1. All patients were at risk for massive hemorrhage based on prenatal imaging evidence of abnormal placentation and underwent scheduled CS between 34 and 37 wk gestation. Patients were premedicated with routine aspiration prophylaxis (IV metoclopramide 10 mg and ranitidine 50 mg and oral sodium bicitrate). All patients had two large-bore peripheral IV catheters and a radial arterial line placed. Patients were administered hetastarch 500 mL. Epidural catheters were placed at L3–4 and a T4 sensory level obtained with 15–20 mL 2% lidocaine with 2 mEq/mL bicarbonate and 5 μg/mL epinephrine and fentanyl 50–100 μg. Left uterine displacement was attained with a right hip wedge. A rapid infusion device and crossmatched blood was in the room before commencement of the case. After epidural placement, interventional radiologists placed internal iliac artery occlusion balloon catheters (IIAOBC) via the femoral arteries using fluoroscopic guidance and angiographic confirmation. Fetal heart rate was monitored every 15 min during IIAOBC placement. Phenylephrine in 50–100 μg aliquots was used to maintain arterial blood pressure. Midazolam 0.5–2 mg was administered to alleviate patient anxiety during the procedure. All patients were given epidural morphine 4 mg for postoperative pain relief.

Discussion

Regional anesthesia (RA) has a number of advantages over general anesthesia (GA) in obstetrics, including reduced aspiration risk, better postoperative pain control, improved maternal birth experience, and decreased fetal exposure to the depressant effects of GA (5,6). GA drugs also lead to decreased uterine tone and decreased platelet function (7). RA has been associated with decreased blood loss and decreased need for transfusion in major obstetric hemorrhage (8,9). Furthermore, in elective CS randomized to RA or GA, blood loss is lower with RA (10).

In addition to the above-mentioned advantages of RA for CS, an epidural technique facilitates placement

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Table 1. Individual Case Descriptions

	Gravida/ Parity	Special considerations	EBL	Resuscitation	Anesthetic technique	Surgical details
Case 1	2/1	High flow retroplacental AVM	2 L	3.6 L crystalloid	Epidural	IIOABC eliminated bleeding
Case 2	6/3	Twin pregnancy; placenta percreta adherent to bladder	5 L	10 U PRBC, 2 U FFP, 10L crystalloid	Epidural→GA	Hysterectomy
Case 3	6/5	5 previous CS; placenta percreta adherent to bladder	4 L	6 U PRBC, 2 U FFP, 10L Crystalloid	Epidural→GA	Hysterectomy
Case 4	1/0	Placenta percreta	1 L	2 L crystalloid	Epidural	No placental abnormality
Case 5	3/2	Placenta accreta	5 L	5U PRBC, 2U FFP, 4L crystalloid	Epidural	Hysterectomy
Case 6	3/2	Small placenta accreta	0.8 L	1 L crystalloid	Epidural	CS
Case 7	6/2	Placenta accreta	2.6 L	2 U PRBC	Epidural	CS

AVM = arteriovenous malformation; CS = cesarean section delivery; FFP = fresh-frozen plasma; IIAOBC = internal iliac artery occlusion balloon catheter; PRBC = packed red blood cells; EBL = estimated blood loss; GA = general anesthesia.

of IIAOBC that can take 45 minutes. Starting these cases with GA exposes babies to large doses of anesthesia, which is of concern in certain high-risk situations, such as the premature twins in our series. We chose an epidural as opposed to a single-shot spinal to reduce the initial sympathectomy and to allow redosing if the operation was prolonged. Many clinicians continue to use GA for CS when postpartum hemorrhage is anticipated, citing concerns of sympathectomy with blood loss. This case series demonstrates that CS with high risk for postpartum hemorrhage can be safely conducted under RA with preoperative IIAOBC placement.

Two patients had extensive placental abnormalities requiring long surgeries with persistent blood loss despite IIAOBC. These were converted to GA because of concerns regarding development of airway edema because of continuing resuscitation (11), patient restlessness, and surgeons' concerns regarding the extensive dissection and potential continued blood loss. This decision was not influenced by any concern for the sympathectomy induced by epidural anesthesia and could have been managed under epidural anesthesia from a hemodynamic standpoint. It is our practice to intubate the airway in a timely fashion to minimize potential for a difficult airway after extensive fluid resuscitation.

In our case of uterine AVM, the utility of intraarterial balloons is undisputable, as the blood loss was terminated by IIAOBC. However, in other cases blood loss, although decreased, continued with the IIAOBC inflated. It is possible for abnormal placentas to have collateral blood flow, causing blood loss despite occlusion of the internal iliac arteries (12) and contingency plans should be made. In cases of placenta accreta, potential for blood loss is massive. In a report of 56 cases of placenta accreta, estimated blood loss exceeded 2000 mL in 41 cases, 5000 mL in 9, 10,000 mL in 4, and 20,000 mL in 2, with 3 patients requiring 70 U of blood (13). The efficacy of arterial balloon catheters and pelvic embolization in active obstetric hemorrhage is well established (4,14,15), but the role of prophylactic arterial balloon catheter placement is still to be determined (4,16,17). However, given the incidence of significant morbidity in patients with placenta percreta adherent to the bladder (13), we believe that blood loss would have been larger without IIAOBC (18,19).

In one case, despite suspected placenta percreta on prenatal imaging, no placental abnormality was found at CS. Starting this case under GA would have exposed mother and fetus to the risks of GA unnecessarily. Sensitivity and specificity of ultrasound diagnosis of placenta accreta are reported to be as frequent as 82% and 97% (3), respectively. Magnetic resonance imaging (MRI) is helpful for imaging patients with a history of myomectomy or posterior placenta (2). However, a retrospective study shows that the sensitivity of these techniques may be as low as 38% for MRI and 33% for ultrasound (20). Diagnostic accuracy probably depends on institutional expertise and will likely improve as technology evolves.

At Stanford University, all patients with prenatal imaging suggestive of a major placental abnormality are considered candidates for IIAOBC placement. The cases in Table 1 represent 18 months of experience at our institution. In our series, the two patients who still had major blood loss despite the IIAOBC had placenta percreta with adherence to the bladder and represent a subset of patients at risk for major morbidity and death (13,18,19).

The prophylactic use of IIAOBC placement is controversial and large randomized controlled trials will be necessary to prove that the technique decreases blood loss. These will be difficult to conduct because

of the large numbers required and variability associated with abnormal placentation. Anecdotally, we believe that IIAOBC improve surgical conditions and reduce blood loss when compared with cases in which similar patients are without the catheters. When making the decision to use prophylactic IIAOBC, it is important to balance the risks of catheter placement such as arterial injury, radiation exposure, and bleeding with potential benefits of hemorrhage control and preservation of fertility (21). To minimize morbidity in these cases, there should be a multidisciplinary team approach, including involvement of anesthesiologists, obstetricians, and, possibly, other specialists such as interventional radiologists and gynecological oncologists.

In our experience, CS in patients at risk for hemorrhage who receive prophylactic IIAOBC can be successfully performed under epidural anesthesia. However, IIAOBC does not control all cases of hemorrhage and provisions for the possibility of significant hemorrhage and conversion to GA must be anticipated.

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