

## Novel techniques in treatment of intractable obstetric hemorrhage

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Intractable obstetric hemorrhage can occur in the antepartum, intrapartum, or postpartum period. Common causes of antepartum hemorrhage include placental abruption, placenta previa, uterine rupture, and vasa previa. Common causes of postpartum hemorrhage include uterine atony, genital trauma, retained placenta, placenta accreta, and uterine inversion.

In the antepartum period, vaginal delivery is pursued if there is no fetal or maternal compromise. Cesarean section is reserved for severe maternal hemorrhage or worsening coagulopathy. Blood product availability and continuous electronic fetal monitoring are essential to successful and safe outcome.

### ANESTHETIC MANAGEMENT

Preparation includes placement of large-bore intravenous catheters, pulmonary aspiration prophylaxis, left uterine displacement, and supplementary oxygen. Monitoring and fluid management are managed with invasive arterial blood pressure, central venous pressure (CVP), and urine output catheter.

Regional anesthesia is contraindicated in hemorrhaging parturients with acute fetal distress, coagulopathy, or hypovolemia. Most patients with severe obstetric hemorrhage and acute fetal distress require cesarean section. General anesthesia, with rapid sequence induction using ketamine (0.75-1 mg/kg) or etomidate (0.3 mg/kg), and cricoid pressure are recommended. Use of a halogenated agent, increases the risk for blood loss from uterine atony.

### UTERINE ATONY

Uterine atony is a common cause of and/or complication during intractable obstetric hemorrhage. The uterine smooth

muscle fails to contract after delivery of the fetus resulting in hemorrhage from the dilated venous and arterial bleeders within the placenta. Pharmacological treatment includes use of intravenous oxytocin, intramuscular methylergonovine, intramuscular 15-Methyl PGF<sub>2α</sub>, and rectal misoprostol. If pharmacological treatment fails, surgical therapy may be necessary and includes B-Lynch procedure, Bakri balloon placement, or hysterectomy.

The B-Lynch procedure involves suturing the uterus, with a single, long, absorbable suture in order to avoid hysterectomy. The suture is run over the uterus so as to fold the uterus over itself, while compressing uterine blood vessels. If this procedure is not successful in controlling bleeding, hysterectomy may have to be resorted to manage the same.

Bakri balloon placement involves inserting an intrauterine balloon catheter, inflating the balloon with 500 mL saline to create a tamponade effect, leaving it in for up to 24 hours, and gradually deflating it over a few hours. It was originally designed for the non-contractile lower uterine segment of placenta previa patients, but its use has now been extended to the more global uterine relaxation seen in uterine atony patients.

### COAGULATION MONITORING

The diagnosis of coagulopathy is based on prothrombin time, activated partial thromboplastin time, platelet count, fibrin split products, and thromboelastogram (TEG), if available. TEG has been used for detection of coagulation defects associated with intraoperative blood loss in parturients and may help in monitoring coagulation parameters and in reducing usage of blood and blood components in hemorrhaging parturients.

## BLOOD CONSERVATION

Some blood conservation techniques that can be employed rapidly and safely during intractable obstetric hemorrhage include acceptance of a lower hematocrit as a trigger for transfusion, erythrocyte salvage, rectal misoprostol, intravenous desmopressin, intravenous antifibrinolytics, and intravenous recombinant factor VIIa. Additional techniques useful for hemorrhage prophylaxis include use of preoperative sub-cutaneous recombinant erythropoietin, preoperative autologous blood donation, preoperative placement of bilateral hypogastric artery balloon catheters, and intraoperative autologous blood donation with acute normovolemic hemodilution.

Based on the guidelines from the National Institutes of Health and American Society of Anesthesiologists, *lower hematocrit* levels are now accepted before transfusion of packed red blood cells. Preoperatively, in a pregnant patient, I recommend a starting hematocrit of at least 30%. However, postoperatively, it may not be necessary to transfuse blood if the patient is euvoletic, hemodynamically stable, and maintaining adequate urine output, even though the hematocrit is less than 20%.

*Erythrocyte salvage*, in obstetrics, has increased during the last few years. The main concern in obstetrics is one of amniotic fluid embolism. Waters and colleagues have recently demonstrated a complete elimination of fetal squamous cells from filtered erythrocyte salvaged suspension by using a leukocyte reduction filter.

*Misoprostol* administered, per rectally, has been recommended (1,000 mg) as a means to control excessive blood loss during third stage of labor. However, most studies using misoprostol, during the third stage of labor, have been for prophylaxis against hemorrhage. Recommended doses 400-600 mg (oral or per rectum) have been met with some success when compared to placebo.

Intravenous *desmopressin* may help reduce intraoperative hemorrhage by increasing platelet aggregation. The dosage is 0.15-0.3 mcg/kg over thirty minutes. Side effects include hyponatremia, hypotension, and water retention.

Intravenous antifibrinolytics, like *aprotinin*, help preserve platelet adhesion during hemorrhage. It also has some anti-inflammatory properties. Dosage is 2,000,000 KIU intravenous bolus, initially, followed by 500,000 KIU/hr intravenous infusion. Side effects include allergic reactions, renal toxicity, and massive thrombosis.

Intravenous *recombinant factor VIIa* has been reported recently to control intractable hemorrhage. Use in obstetrics has been limited so far. It activates factor X production, besides increasing the rate and amount of thrombin generation. The dosage is 60 mcg/kg. It has a short half life and re-dosing may be necessary. Side effects include generalized thrombosis.

In summary, massive blood loss can occur in obstetrics. Recent work has shown that novel treatments like erythrocyte salvage, rectal misoprostol, intravenous desmopressin, intravenous antifibrinolytics, and intravenous recombinant factor VIIa may help reduce hemorrhage and improve outcome.

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