



Surgical Management of Massive Postpartum Hemorrhage with Uterine Atony.

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Postpartum hemorrhage (PPH) is an obstetrical emergency that can follow vaginal or cesarean delivery. It is a major cause of maternal morbidity, with sequelae such as shock, renal failure, acute respiratory distress syndrome, coagulopathy, and Sheehan's syndrome.⁽¹⁾ PPH is also one of the top five causes of maternal mortality in both high income and low income countries, although the absolute risk of death is much lower in the former than the latter (1 in 100,000 versus 1 in 1000 births).⁽²⁾ Life-threatening PPH occurs with a frequency of 1 in 1000 deliveries in the developed world. The incidence of PPH varies widely, depending upon the criteria used to define the disorder. A reasonable estimate is 1 to 5 percent of deliveries.⁽³⁾ PPH is best defined and diagnosed clinically as excessive bleeding that makes the patient symptomatic (eg, lightheadedness, vertigo, syncope) and/or results in signs of hypovolemia (eg, hypotension, tachycardia, or oliguria). Other definitions that have been proposed can be problematic. The most common definition of PPH is estimated blood loss ≥ 500 mL after vaginal birth or $\geq 1,000$ mL after cesarean delivery.⁽⁴⁾ Estimates of blood loss at delivery are subjective and generally inaccurate. Studies have suggested that caregivers consistently underestimate actual blood loss. Another

proposal suggests using a 10% fall in hematocrit value to define PPH, but this change is dependent on the timing of the test and the amount of fluid resuscitation given.⁽⁵⁾ More importantly, the diagnosis would be retrospective, perhaps useful for research but not so in the clinical setting.

Bleeding after delivery is controlled by a combination of 1) contraction of the myometrium, which constricts the blood vessels supplying the placental bed, and 2) local decidual hemostatic factors, including tissue factor, type-1 plasminogen activator inhibitor, and systemic coagulation factors (eg, platelet and circulating clotting factors). Deficient contraction of the myometrium is manifested clinically as uterine atony. Defective decidual hemostasis is associated with inadequate decidualization (eg, placenta accreta) or bleeding diatheses (eg, factor deficiencies or thrombocytopenia). PPH has many potential causes, but the most common, by a wide margin, is uterine atony, ie, failure of the uterus to contract and retract following delivery of the baby. PPH in a previous pregnancy is a major risk factor and every effort should be made to determine its severity and cause. In a recent randomized trial, birthweight, labor induction and augmentation, chorioamnionitis, magnesium sulfate

use, and previous PPH were all positively associated with increased risk of PPH.⁽⁶⁾

The patient's risk factors and the events leading to the diagnosis of PPH may suggest an underlying etiology, but knowledge that most cases are caused by uterine atony and the need to be systematic argues for a planned, stepwise approach to assessment and management. The status of the patient, the severity of the bleeding, and the response to initial management steps determine if and when the protocol for massive obstetric hemorrhage is instituted.

The initial intervention is suggested the following procedures for initial management upon diagnosis of excessive vaginal bleeding after vaginal delivery:

Fundal massage - Begin fundal massage, which stimulates the uterus to contract.

Intravenous access - Ensure intravenous access, preferably with two large bore catheters (eg, 18 gauge) for fluids, blood, and medications

Uterotonic drugs - Atony is the most common cause of PPH, administer the following uterotonic drugs in women with presumed atony (eg, oxytocin, methyl-ergometrine, prostaglandins).

Fluid resuscitation and transfusion - Infuse a large volume of crystalloid to prevent hypotension (target systolic pressure 90 mmHg).

If the initial interventions described above are not immediately successful in controlling hemorrhage, the woman is placed in stirrups in a room with facilities for general anesthesia and both vaginal and abdominal surgery. The primary source of bleeding, uterine or lower genital tract, can usually be readily determined by visualizing the birth canal and by palpating the uterus. Adequate assistance, exposure, lighting, instruments, and anesthesia are necessary to perform a thorough examination.

Although uterine packing was advocated for treating PPH in the past, it fell out of use largely due to concerns of concealed hemorrhage and uterine overdistension. In recent years, however, several modi-

fications of this procedure have allayed these concerns. Balloon tamponade using either a Foley catheter or a Sengstaken-Blakemore tube has been shown to effectively control postpartum bleeding and may be useful in several settings: uterine atony, retained placental tissue, and placenta accreta.⁽⁷⁻¹⁰⁾ Both the Foley catheter and the Sengstaken-Blakemore tube have open tips, which permit continuous drainage from the uterus. Furthermore, if the concern for concealed hemorrhage still exists, ultrasound can more effectively detect a developing hematoma when the contrast is a fluid-filled balloon as opposed to blood-saturated gauze. Thus, this technique has the advantage of being not only therapeutic but also diagnostic when used in combination with ultrasonography in differentiating the various etiologies described above. Additionally, if intrauterine blood loss exceeds 5 cm/sec, the actual site of arterial bleeding can be pinpointed sonographically using power angiography mode against the contrast of the fluid-filled balloon.

The Foley catheter procedure. The technique is simple. A Foley catheter with a 30-mL balloon capacity is easy to acquire and may routinely be stocked on labor and delivery suites. Using a No. 24F Foley catheter, the tip is guided into the uterine cavity and inflated with 60 to 80 mL of saline.^(7,8) Additional Foley catheters can be inserted if necessary. If bleeding stops, the patient can be observed with the catheters in place and then removed after 12 to 24 hours.

The Sengstaken-Blakemore tube. Originally developed for the tamponade of bleeding esophageal varices, the Sengstaken-Blakemore tube has the advantage over the Foley catheter due to the larger capacity of its balloon tip. Like the Foley catheter, the Sengstaken-Blakemore tube has an open tip that permits continuous drainage. But, unlike the Foley catheter, this device may be more difficult to obtain in an emergency setting because it is not routinely stored on labor and delivery suites. Like the Foley catheter, the Sengstaken-Blakemore tube should be



guided through the cervix into the uterus and the balloon can then be inflated to achieve the desired tamponade and can be removed in 12 to 24 hours.^(9,10)

Bakri Balloon. The SOS Bakri tamponade balloon catheter (Cook Ob/Gyn) is marketed as 100% Silicon (no latex), purpose-designed two-way catheter, to provide temporary control or reduction of postpartum uterine bleeding when conservative management is warranted.⁽¹¹⁾ Again, the insertion technique is simple. Insert the balloon portion of the catheter in the uterus, making sure that the entire balloon is inserted past the cervical canal and internal os, under ultrasound guidance if possible. At cesarean delivery, the tamponade balloon can be passed via the cesarean incision into the uterine cavity with the inflation port passing into the vagina via the cervix. An assistant pulls the shaft of the balloon through the vaginal canal until the deflated balloon base comes into contact with the internal cervical os.⁽¹²⁾ A gauze pack soaked with iodine or antibiotics can then be inserted into the vaginal canal to ensure maintenance of correct placement of the balloon and maximize the tamponade effect. The balloon is then inflated with sterile fluid to the desired volume for tamponade effect. Gentle traction on the balloon shaft ensures proper contact between the balloon and the tissue surface and may enhance the tamponade effect. Success can be judged by the declining loss of blood seen through the drainage port and the fluid connecting bag.

Rüsch hydrostatic urological balloon. This is a two-way Foley catheter which can also be used for postpartum hemorrhage. It has a capacity greater than 500 ml. The technique of insertion is similar to the Sengstaken-Blakemore tube. It is a simple technique.⁽¹³⁾

Ideally, hemostatic defects will have been corrected prior to invasive interventions, but this can be difficult in the presence of continuous brisk hemorrhage. In such cases, blood product replacement

concurrent with initiation of invasive procedures is necessary. Bilateral ligation of the uterine vessels (O'Leary stitch) to control PPH has become the first-line procedure for controlling uterine bleeding in the parturient at laparotomy.⁽¹⁴⁾ It is a more attractive option than internal iliac artery ligation because the uterine arteries are easily accessible, the procedure is more successful, and the field of dissection generally is not near the ureters and the iliac veins. After identification of the ureter, a #0 or #1 chromic catgut or polyglycolic acid suture on a large curved needle is passed through the lateral aspect of the lower uterine segment as close to the cervix as possible, then back through the broad ligament just lateral to the uterine vessels. It is then tied to compress these vessels. If this does not succeed in controlling bleeding, the vessels of the utero-ovarian arcade are similarly ligated just distal to the cornua by passing a suture ligature through the myometrium just medial to the vessels.

Uterine compression sutures are an effective method for reducing postpartum hemorrhage and avoiding hysterectomy. Limited follow-up of women who have had a uterine compression suture suggests that there are no adverse effects on future pregnancy. The B-Lynch suture envelops and compresses the uterus, similar to the result achieved with manual uterine compression. It has been highly successful in controlling uterine bleeding from atony when other methods have failed. The technique is relatively simple to learn, appears safe, and preserves future reproductive potential.⁽¹⁵⁾

A large needle with #1 or #2 polyglycolic acid suture is used to enter and exit the uterus in the lateral lower anterior segment (figure). The stitch is looped over the fundus and another stitch is taken across the posterior lower uterine segment. The stitch is then looped back over the fundus and anchored by entering the lateral lower anterior uterine segment opposite and parallel to the initial bite. The free ends are tied down securely to compress the uterus. The

myometrium should be manually compressed prior to tying down the sutures to facilitate maximal compression.



The figure shows suture technique of B-Lynch suture uterine compression.

The success of B-Lynch suture technique has been replicated in other small series. The success rate of this procedure is 80-85%.⁽¹⁵⁻¹⁸⁾ The study between October 2004 and December 2011, at Department of Obstetrics & Gynaecology, Faculty of Medicine, Ramathibodi Hospital, Mahidol University showed that the B-Lynch suture was performed on 60 patients, to control intractable PPH that did not respond to uterotonic agents. In those cases where the etiology of PPH was uterine atony, the B-Lynch suture was successful in 84% of the cases. Hyste-

rectomy was avoided in 50 cases.

Other techniques which have been reported in small case series represent modifications of the B-Lynch suture. Hayman described placement of two to four vertical compression sutures from the anterior uterine wall to the posterior uterine wall without hysterotomy. A transverse cervicoisthmic suture can also be placed if needed to control bleeding from the lower uterine segment.⁽¹⁹⁾ Pereira described a technique in which a series of transverse and longitudinal sutures of a delayed absorbable multifilament suture are placed around the uterus via a series of bites into the subserosal myometrium, without entering the uterine cavity. Two or three rows of these sutures are placed in each direction to completely envelope and compress the uterus. The longitudinal sutures begin and end tied to the transverse suture nearest the cervix. When the transverse sutures are brought through the broad ligament, care should be taken to avoid damaging blood vessels, ureters, and fallopian tubes.⁽²⁰⁾

Conclusion

PPH is a common complication of childbirth and a leading cause of maternal morbidity and mortality. Clinicians should identify risk factors before and during labor so that care may be optimized for high-risk women. The uterine compression suture (B-Lynch suture) is more available method of conservative surgical management of massive PPH.

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