

Review Article

Postpartum Hemorrhage : Prevention and Treatment

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Introduction

It is not known nor is it recorded when the first death from postpartum hemorrhage occurred. It is certain, however, that such deaths have been occurring since the dawn of time. Since then, numerous efforts have been made throughout the world to prevent postpartum hemorrhage eg. the establishment of a national training system for midwives in Sweden in the late 1700s under the direction of the Swedish Collegium Medicum.

Concerted efforts to reduce the mortality rate associated with postpartum hemorrhage only increased in the last century. Many improvements resulted from the efforts of the World Health Organization (WHO) working in conjunction with national medical associations and, in particular, national bodies of obstetricians and gynecologists. These efforts, combined with advancement in information technology have provided new possibilities for rapid advancements in medical care, especially in remote areas.

Several therapeutic measures are described recently with the twin objectives of saving the woman's life and preserving her uterus for future pregnancies.

Classification of causes

The four major causes of postpartum hemorrhage are generally classified by the mnemonic, the four Ts—Tonus (uterine atony), Tissue, Trauma, and Thrombin (coagulopathy). The most common by far (70%)¹ is uterine atony or loss of tone. It is not known why some women with no predisposing factors develop it and others with numerous risk factors (age, ethnicity, BMI>30, parity, macrosomia, multiple pregnancy, etc.) are able to deliver with minimal blood loss. By "tissue" is meant those conditions that may favor retention of placenta or placental fragments. The retained placenta accounts for approximately 10% of all cases of postpartum hemorrhage¹. In recent years, the increasing prevalence of Cesarean Section has resulted in more instances of placenta accreta, a condition previously rarely seen throughout the career of an individual obstetrician. Trauma reportedly accounts for postpartum hemorrhage in 20% of cases¹. Not all traumas occur after delivery of macrosomic infants or use of vaginal instrumentation. Some may be related to the rapidity of the delivery of the head or to lacerations of a previously scarred cervix or vagina. Disorders of the clotting cascade and platelet dysfunction (characterized by the acronym "Thrombin") account for only about 1% of cases¹.

The present (2003) estimate of the International College of Midwives and FIGO is that 200,000 women die each year from PPH.

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Therapeutic Options

Uterine Atony

The adoption of active management of the third stage of labor is used to decrease the incidence of postpartum hemorrhage. The active management concept embraces four distinct steps. The first is the administration of an uterotonic agent (oxytocin, ergometrine, or misoprostol). The second is the application of controlled cord traction, along with counter attraction to the uterus to assist in the delivery of the placenta. The third and fourth, respectively, consist of massaging the uterine fundus through the abdominal wall to ensure its contractility and monitoring the patient for further signs of bleeding. That these steps actually work is confirmed in numerous reports and summarized in the meta-analysis conducted by Prendiville, Elbourne, and McDonald in their Cochrane review of 2003². Salient findings from this study are shown in Table 1.

Table 1. Active Versus Expectant Management.

Management of Third Stage of Labor	Blood Loss* < 500 mls	Blood Loss* > 1000 mls
Expectant (n=3126)	13.6%	2.6%
Active (n=3158)**	5.2%	1.7%

* Clinical estimation generally thought to be underestimates by about 34-50%

** Oxytocin, ergometrine or both IM/IV

Misoprostol (heat stable) has gained widespread acceptance as a prophylactic and a therapeutic agent in recent years in the treatment of PPH. The most important misoprostol study emanated from the Belgaum region of India in 2006¹⁰. This National Institutes of Health (NIH) sponsored randomized control trial included 812 women. Because the standard of care for home deliveries in the Belgaum region was not to use an uterotonic agent, women in the therapeutic arm received two tablets of oral misoprostol after delivery and women in the control arm received two tablets of an identical appearing placebo. Women who received oral misoprostol experienced a significant decrease in acute PPH (12.0% to 6.4%, $p < 0.0001$) and acute severe PPH (1.2% to 0.2%, $p < 0.0001$). The relative risks of acute PPH and acute severe PPH, respectively, were 0.53 (95% CI; 0.39, 0.74) and 0.20 (95% CI; 0.04, 0.91). This information was deemed sufficiently important that the delegates of the Goa International Conference on PPH issued a consensus statement as follows: "Oral and rectal misoprostol should be

available at the community level either at the hands of trained personnel or for self administration, especially when traditional uterotonics are neither present nor practical for use."

A second method for treatment of uterine atony is bimanual compression, whereby one hand is inserted deep into the vagina and rotated either clockwise or counterclockwise against the cervix and uterus that is being firmly grasped by the abdominal hand. The advantage of this technique is that it can be applied by midwives also, and training requirements are minimal.

A third method of dealing with atony is uterine tamponade, an intervention that acknowledges the site of the placental attachment representing a 20 cm diameter wound that bleeds after the placenta has been detached¹¹. Some commercial balloons have been reported as being useful in this regard, including the Sengstaken-Blakemore tube, the Rusch hydrostatic balloon catheter, and the Bakri balloon (Figure 1). When these are not available, one can use Foley balloon catheters filled to 75 or 100 cc in each instance. Despite being designed for a 30 ml capacity, anecdotal reports suggest that 150 ml can be reached before the catheter bursts¹²⁻¹³. In the absence of urinary catheters, a condom can be inserted into the uterus on a straight catheter, inflated with 200-500 ml of normal saline according to need and tied off with silk so as to facilitate retention into the uterus¹⁴.



Figure 1. Bakri balloon.

Surgery included ligation of one or both of the internal iliac (hypogastric) arteries.

This effectively removes the trip-hammer effect of blood coursing through one of its major branches, namely the uterine artery. The technique of uterine artery embolization (UAE), is also used for this effect.

The B-Lynch suture compression technique was reported for first time in 1997¹⁵. The principle of the operation is to insert one continuous suture into the lower uterine segment on one side of the uterus, bring it across the fundus, re-enter into the posterior surface on the same side, traverse to the anterior surface, and exit in the front of the uterus perhaps four or five inches lateral to where the suture was first inserted. The effect is, in simple terms, to place a “belt and suspenders” on the body of the uterus, whereby the fundus is compressed and held in a compressed position. The intervention is ideal after a Cesarean Section when a hysterotomy wound exists on the anterior uterine surface. In the event the operation is attempted after a vaginal delivery, however, a hysterotomy can be accomplished immediately after opening the abdomen. Placement of a hysterotomy wound has the additional advantage of allowing the surgeon to search for and remove any retained placental fragments. According to Lynch et al the patients retain menstrual capacity and their uterus, and future reproduction is not compromised¹⁵.

Retention of Tissue

Effective uterine contraction to aid hemostasis requires complete expulsion of the placenta. When the placenta is not forthcoming, it can be removed manually, unless it is a placenta accreta or a placenta percreta. Both placenta accreta and placenta percreta are exceedingly rare, occurring in less than 0.5% of all deliveries. The retained placental lobe is far more common. Placental fragments do detach, are retained, and do interfere with hemostatic contractions. Manual exploration of the uterus can be painful in the absence of general anesthesia or adequate analgesia. Retained fragments may be missed and bleeding may continue.

Obstetric Trauma

Obstetric trauma can be a minor tear in the labia minora or a rupture of the uterus. Whereas the former may respond to pressure or a few simple sutures, the latter requires major surgical intervention. Between these extremes there can be of traumatic lacerations to the

introitus, the vaginal wall, and/or the cervix. Lacerations may be superficial or extend into the underlying subcutaneous tissue. Occasionally the bladder, and/or the rectum, can be damaged. The repair of extensive lacerations consists of determining the extent, depth, and degree of involvement of the adjacent tissues. The operator should not miss deep tissue injuries that can proceed to form hematomas.

Thrombin Aberrations

Disorders of coagulation may be known to the obstetrician antenatally. Accordingly, appropriate remedies should be made available at the time of delivery. More common are the disorders of coagulation that occur as a result of postpartum bleeding. Under normal circumstances through a series of haemostatic changes (rise in coagulation failure and a rise in fibrinogen) prevent hemorrhage at the time of delivery. Approximately four weeks after delivery, the hemostatic system returns to normal¹⁶.

Obstetric and consumptive coagulopathy may occur after blood loss, transfusion, volume replacement, or placental abruption¹⁶. Acute consumptive coagulopathy presents almost invariably with bleeding, and laboratory investigations are essential to establish its diagnosis. The basic principles in treatment of consumptive coagulopathy are removal of the precipitating cause, correction of aggravating factors, and replacement of missing coagulation factors and platelets. The usual regimen includes administration of FFP containing fibrinogen and coagulation factors, platelets, and cryoprecipitate.

Although recombinant activated factor VII (RFVIIa) is not licensed for use in pregnancy, it has been used in obstetric patients who did not respond to other treatment options¹⁷⁻¹⁸.

Further Considerations

The Hospital Drill

All functioning obstetric units should possess a multidisciplinary massive hemorrhage protocol that should be updated regularly¹⁹. Teamwork is an absolute necessity in a hospital drill, which in essence is a practice run. Running a drill allows hospital staff to scrutinize local arrangements, test them, and test the staff's knowledge. Drills must be accompanied by teaching practical skills that may be required. The following skills may be needed and must be taught—

medical skills (bimanual uterine compression, aortic compression, and cardiopulmonary resuscitation) and surgical skills (insertion of a uterine balloon, application of a Brace suture, intravenous cut-down for venous access).

One of the most important tasks is the accurate recording of the time that specific interventions are performed and the name of staff members performing them. This is crucial when the case is reviewed at a later date. An approach to improving hospital systems for the care of women with major obstetric hemorrhage was described by Skupski et al²⁰⁻²¹.

Transfusion practices have undergone numerous revisions since the 1960s, when single units were deemed insufficient to correct anemia and therefore considered useless²²⁻²⁵. By 1987 articles appeared demonstrating that a single unit transfusion increased the hematocrit to a safe level, especially in patients with a low body mass index²⁶.

There were concerns regarding the risk of viral transmission with blood transfusion, in particular the HIV virus details are provided by Nana et al²⁷. In 1992, the WHO published a tabulation of its 1990 estimates of the global death burden from all forms of anemia. Women of reproductive age were determined to be at greater risk of mortality than were other groups²⁸. Figure 2 shows the case fatality rates in relation to maternal anemia. Severe anemia during pregnancy increases the risk of death, as the loss of less than 500 ml of blood could be fatal. When the hemoglobin concentration is <8g/l, compensatory mechanisms fail, lactic acid accumulates, and patients become breathless at rest. Cardiac failure may occur when the hemoglobin concentration is <4g/l, especially with twin pregnancies or splenomegaly.

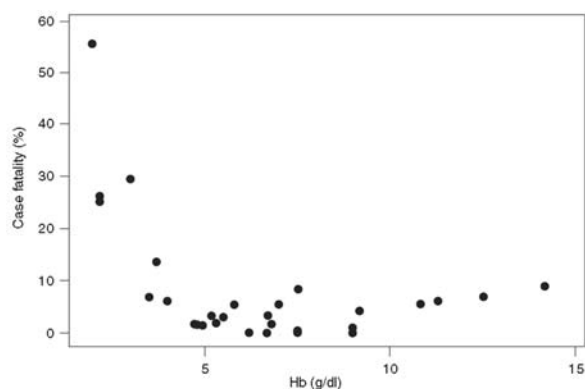


Figure 2. Analysis of anemia and pregnancy-related maternal mortality.

Pelvic Pressure Pack

Abdominal and post-surgical packing of the pelvis is a concept, that has been used to control hemorrhage²⁹. Most methods require a second laparotomy to remove the packing materials after initial stabilization from hemorrhage and restitution of lost volume. In 1926, Logothetopoulos described a pack for the management of uncontrolled post-hysterectomy pelvic bleeding³⁰.

Pelvic pressure packs control hemorrhage from large raw surfaces, venous plexuses, and inaccessible areas by exerting well distributed pressure and compressing bleeding areas against the bony and fascial resistance of the pelvis³¹⁻³². As of 2006, a success rate for obstetric hemorrhage was described by Dildy et al. of 85% (11/13 cases)³³. Figures 3 and 4 illustrate how the pack is prepared and applied. A sterile X-ray cassette drape or other sterile bag of a plastic nature is filled with 4 or 5 rolls of kerlix gauze starting at the dome of the pack, with the tail of the gauze protruding from the neck of the pack. The filled pack is then introduced trans-abdominally into the pelvis so that the “neck” can be delivered trans-vaginally to the introitus through the top of the vagina that remains open after the uterus has

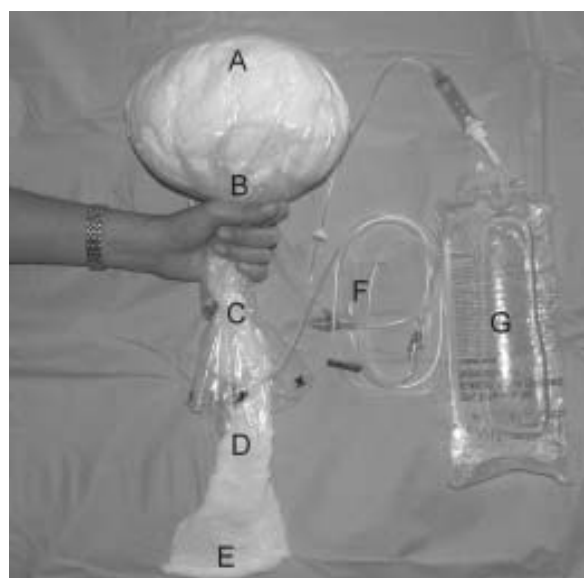


Figure 3. Photograph of a pelvic pressure pack, as constructed from an X-ray cassette drape, sterile gauze rolls, and an intravenous infusion set-up. (A) “Dome” of the pack - a bag filled with gauze rolls tied end-to-end. (B-E) “Tail” of the gauze protruding from the “neck.” (F) Traction and thereby pressure are applied to the pack by tying intravenous tubing to the neck of the pack and suspending a (G) 1-liter i.v. fluid bag off the foot of the bed.

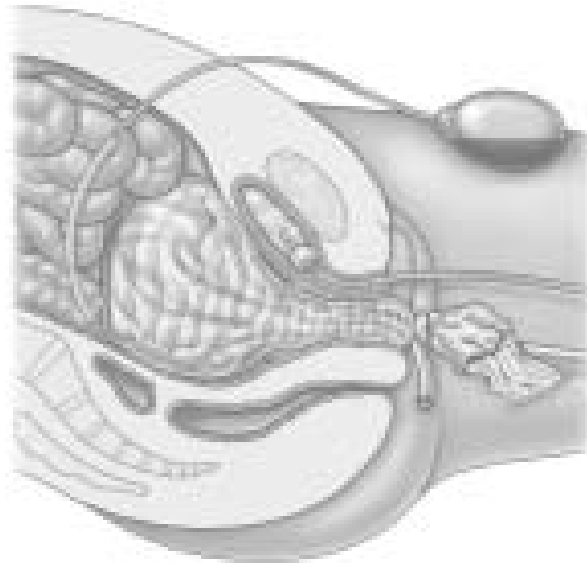


Figure 4. Diagram of the pelvic pressure pack *in situ*.

been extirpated. Traction is then applied by the connection of a small weight to the neck of the pack. An indwelling urinary catheter allows monitoring urinary output. After hemodynamic stabilization, the pack can be removed slowly under intravenous sedation to allow gradual decompression without inciting additional bleeding. Optimal time to leave the pack varies from patient to patient. Broad spectrum antibiotics should be administered until the patient is afebrile for at least 48 hours.

Non-Pneumatic Anti-Shock Garment (NASG)

The NASG is a simple device that provides first aid treatment for reversing hypovolemic shock and decreasing blood loss secondary to obstetric hemorrhage by applying lower body counter-pressure³⁴. It is useful particularly to help maintain vital signs and viability during long transports from remote lower-level facilities to centrally located institutions with more sophisticated therapeutic options. The NASG was adapted from a prototype pressure unit designed to protect hemophilic children from bleeding into elbow and knee joints by straightening and compressing the joint until medical attention was available.

The NASG is particularly suited for use in low-resource settings. A prime benefit of the NASG is that the design of the garment permits complete perineal access, so that the genital lacerations can be repaired, speculum or

bimanual examinations performed, or placental removal accomplished. Another benefit is that it significantly reduces further blood loss because its external circumferential counter-pressure is distributed evenly throughout the abdominal cavity and to the outside of the circulatory vessels, thus tamponading venous bleeding. A final benefit for use in low-resource settings is that people with no medical background can learn to apply the garment safely with minimal training. Figure 5 shows the garment. The technique of application is to stretch the neoprene panels to the maximum of one's ability and fasten them with the Velcro attachments as tightly as possible. The lowest (ankle segment) is applied first and the abdominal segment last. If the patient experiences difficulty in breathing, the abdominal section should be loosened slightly but not removed.

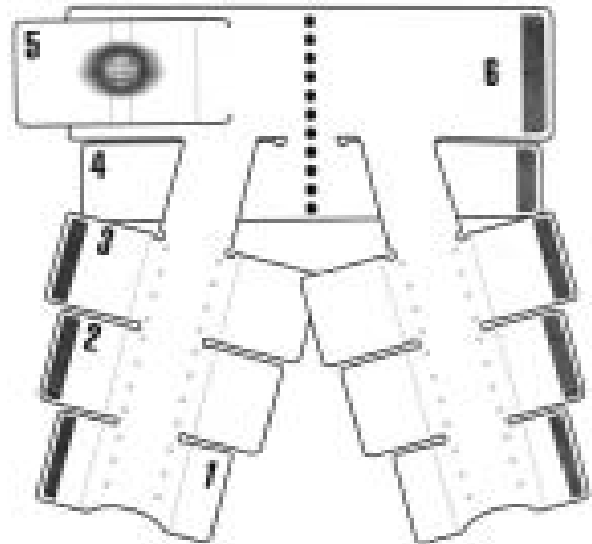


Figure 5. Schematic diagram of the non-pneumatic anti-shock garment.

Recent field studies with the NASG show that patients placed in the garment experienced rapid resuscitation from hypovolemic shock and an extended period of stabilization while awaiting definitive treatment. There appeared to be no adverse effects from this prolonged stabilization, with the mean time in the NASG being more than 30 hours³⁵.

Conclusion

Major advances in the care of women with postpartum hemorrhage have been reported since the mid 1980s.

Taken together, they provide many new possibilities for reducing mortality and or morbidity. Significant reductions have taken place in deaths from obstetric hemorrhage in most parts of the developed world. Important reductions are being noted in many parts of the developing world. India is devoting resources toward the reduction of its maternal mortality rate, most of which is attributable to obstetric hemorrhage. India's efforts are promoted by the joint collaboration of the government and important non-governmental sources such as FOGSI.

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