

Massive obstetric hemorrhage: High- and low-tech tools

Smart bombs, carpet bombs, and balloons

Massive postpartum hemorrhage is the sleeping giant we hope will never awake in our delivery room, though we realize the threat is never completely absent. So we prepare, to the best of our ability and budget. Thankfully, clinically significant advances in management of this life-threatening obstetric emergency have brought about new, effective approaches, both high-tech and low-tech.

Conservative approach

Historically, management includes a search for the source and cause of bleeding. If the uterus is the suspected site, sequential steps include fluid and blood support, uterine massage, uterotonics (oxytocin, carboprost, methylergonovine, misoprostol), uterine exploration and curettage, and uterine packing. If these interventions are ineffective, a classic surgical approach has been laparotomy with repair of uterine injuries and ligation of the internal iliac (hypogastric) artery or branches of the uterine artery (O'Leary stitch).¹ Also, uterine compression sutures (B-Lynch,² Pereira³) have shown efficacy. Compression sutures reduce uterine perfusion pressure, allowing the endogenous clotting system to seal open vessels.

These measures allow for future pregnancy. Pregnancy has been reported after use of the B-Lynch compression suture combined with internal iliac artery ligation.⁴ Another benefit of exploratory laparotomy is that it allows opportunity to perform the definitive operation for postpartum uterine bleeding—hysterectomy—if necessary.

"Systems" approach

Clinical teams have realized that develop-

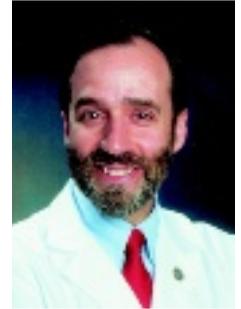
ment of institution-specific standardized emergency response algorithms and rehearsing the emergency response with a simulated patient is an effective "systems approach."

New high-tech approaches

"Smart bombs" and "carpet bombs." One of the most important advances has been percutaneous transcatheter embolization (PTE). Selective angiography sometimes identifies a single bleeding vessel as the cause of the hemorrhage. With PTE, the bleeding vessel can be occluded by thrombotic agents, such as a slurry of Gelfoam (*Pharmacia & Upjohn, Kalamazoo, Mich*). This is a "smart bomb" approach to the clinical problem.⁵ Alternatively, if bleeding is more diffuse, Gelfoam can be injected into the uterine artery to occlude bleeding vessels within the uterus. If time and anatomy do not allow catheterization of the uterine artery, Gelfoam can be injected into the internal iliac artery, a type of "carpet bombing" of the entire pelvic circulation.

Time and money limits. It may take 2 hours or more to mobilize an interventional radiology team, especially at night. When a patient has massive postpartum bleeding, a 2-hour wait may not be practical. In addition, a modern interventional radiology suite costs millions to build and operate, making it unavailable in some hospitals.

Preventive balloon placement. An evolving high-technology approach to *prevention* of postpartum hemorrhage, is the "*prophylactic*" placement of internal iliac balloons, in the deflated state, prior to delivery in women at high risk for hemorrhage. For example, for a woman with 2 prior cesarean sections



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Selective angiography sometimes identifies a single bleeding vessel, which can be occluded by thrombotic agents

and an ultrasound that demonstrates placenta previa and abnormal thinning of the myometrium, placement of internal iliac balloons before repeat cesarean may be helpful. If postpartum hemorrhage develops in such a patient, the internal iliac balloons can be inflated to help reduce blood flow to the pelvis. If hysterectomy is planned, the inflated balloons will help reduce blood loss during the surgery.^{6,7} If a conservative (non-hysterectomy) approach is planned, the balloons can be left inflated and the cesarean completed. Twelve to 48 hours later, the internal iliac artery balloons can be deflated and bleeding may not ensue.

Preoperative placement of the internal iliac balloons allows interventional radiology resources to be electively mobilized *prior* to delivery, rather than after hemorrhage has become catastrophic. Many small obstetric units have no access to highly experienced interventional radiology teams. In the face of acute and massive postpartum hemorrhage, PTE or placement of vascular balloons might not be a practical option and the obstetrician will need to use other approaches.

New low-tech approaches

Tamponade balloons. An alternative to traditional uterine packing is uterine tamponade balloons. Clinicians have described the use of the Sengstaken-Blakemore tube in the uterus for tamponade of uterine bleeding.^{8,9} In most women, bleeding stops after placement of the tube.

The US Food and Drug Administration recently approved the SOS Bakri tamponade balloon (*Cook Urological, Spencer, Ind*) for temporary control or reduction of hemorrhage when conservative management of uterine bleeding is warranted. The Bakri balloon has a filling capacity of 500 mL and strength to withstand a pressure of 300 mm Hg.¹⁰ The Bakri balloon is less expensive than the Sengstaken-Blakemore stomach balloon-tube and has a large port to monitor whether the uterus is bleeding.

A positive “tamponade test”—observable marked reduction in bleeding through the outlet port after placement of the bal-

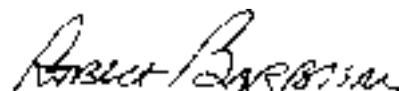
loon—suggests that the intervention will be successful. Continued bleeding through the port after placement of the balloon suggests that additional interventions, such as hysterectomy or PTE, may be necessary. The Bakri balloon is inexpensive and can be used without the resources necessary to perform a laparotomy or interventional angiography.

Combined approaches

Some physicians combine low- and high-technology approaches. For example, in a recent case of massive postpartum hemorrhage in the middle of the night, an attending placed an SOS Bakri tamponade balloon to stabilize the patient. The next morning, when the interventional radiology team had assembled, the patient had the balloon removed and underwent PTE of the uterine arteries.

What is your strategy?

It is gratifying to see parallel development of effective low- and high-technology approaches to management of massive postpartum hemorrhage. What technical interventions have you found most effective for the treatment of massive postpartum hemorrhage? Should all obstetric services have access to the high-technology interventional radiology procedures? Please share your thoughts with us.



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