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Postpartum Hemorrhage

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Postpartum hemorrhage (PPH) is an obstetric emergency that has an incidence of 3% to 6% of births and accounts for approximately 27% of maternal deaths worldwide and 11% of maternal deaths in the US.^{1,2} Timely diagnosis and intervention are essential to improve maternal outcomes.

Risk Factors for PPH

Risk factors for PPH include abnormal placental location or invasion of the myometrium (placenta accreta spectrum), prior cesarean delivery, multiple gestation, advanced maternal age (>35 years), preeclampsia, chorioamnionitis, uterine fibroids, macrosomia, and history of PPH.²

Primary and Secondary PPH

Primary PPH is defined as blood loss exceeding 1000 mL or signs and symptoms of anemia within 24 hours of a cesarean or vaginal delivery.³ The most common cause of primary PPH is uterine atony (approximately 70%), which occurs if the uterus does not contract adequately after delivery.

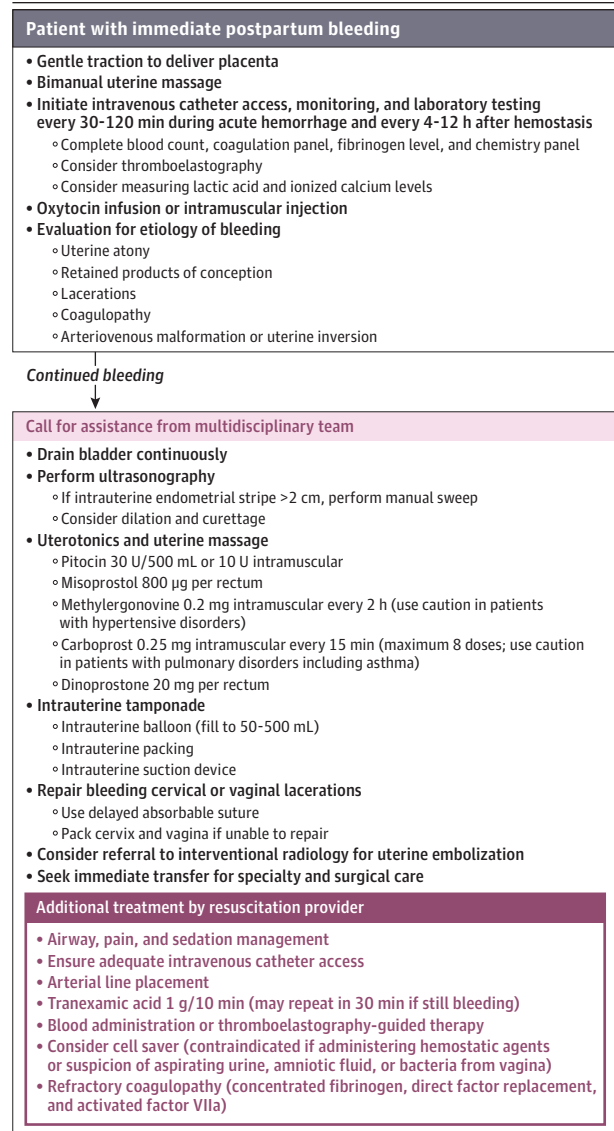
Other causes include retained placental and/or fetal tissue products of conception (approximately 15%), genital tract injury (approximately 10%), coagulopathies, uterine inversion, and uterine arteriovenous malformations (AVMs) (all <5%). Delivery risk factors for primary PPH include forceps or vacuum vaginal delivery, episiotomy, placenta abruption, and stillbirth.³

Secondary PPH is defined as excessive bleeding that occurs more than 24 hours after delivery and up to 12 weeks post partum,³ and may be due to retained products of conception, infection (endometritis), inherited coagulopathies (such as von Willebrand disease, hemophilia A and B, factor deficiencies, and platelet disorders), uterine AVM, and subinvolution of the placental site, defined as persistently large dilated spiral arteries in the myometrium where the placenta was previously attached.³

Assessment of Primary Postpartum Bleeding

Bleeding occurs with all vaginal deliveries. However, active management of the third stage of labor (tension on the umbilical cord to deliver the placenta quickly), oxytocin infusion, bladder drainage, and a bimanual uterine massage are first-line therapies performed with vaginal births that typically resolve postpartum bleeding.³ If primary postpartum bleeding does not resolve rapidly with these measures, bimanual palpation should be performed to assess uterine tone and the cervix and vagina should be visually examined for lacerations. Abdominal or pelvic ultrasonography should also be performed to evaluate the uterus and endometrial contents. An endometrial stripe greater than 2 cm is highly suggestive of retained products of conception. A Focused Assessment with Sonography in Trauma may help evaluate for intraperitoneal blood. Laboratory studies should include a complete blood count, chemistry panel, prothrombin time/international normalized ratio, partial thromboplastin time, fibrinogen, and blood type and crossmatch testing to match and reserve

Figure. Management of Postpartum Bleeding Algorithm



blood for transfusion. Thromboelastography, which is a point-of-care diagnostic test that assesses real-time clot formation, strength, and stability, can help guide selection of blood products.

Management of Primary PPH

Patients with PPH should undergo close hemodynamic monitoring, with placement of intravenous catheters and infusion of intravenous fluids and blood, if needed. The Figure outlines a management algorithm for postpartum bleeding. PPH is optimally managed with a multidisciplinary team, including obstetricians, anesthesiologists, hematologists, and critical care specialists. Patients treated at centers without this specialty care should be promptly transferred

to a higher-level facility if postpartum bleeding does not resolve with standard interventions.

For patients with PPH and hypotension or tachycardia, blood transfusion can be given in a 1:1:1 ratio of type-specific packed red blood cells, fresh frozen plasma, and platelets. Thromboelastography-guided transfusion, compared with a fixed 1:1:1 ratio-based protocol, is associated with increased use of cryoprecipitate and antifibrinolytics and may reduce transfusion-related complications such as transfusion-related acute lung injury and cardiac overload.^{4,5} Other hemostatic agents such as antifibrinolytics, specific coagulation factor replacement to treat hemophilia, and activated factor VIIa may be used in refractory PPH if platelet count is greater than $50\,000 \times 10^3/\mu\text{L}$, hematocrit greater than 24%, and fibrinogen greater than 200 mg/dL.

For patients with retained products of conception, intrauterine evacuation with manual extraction or suction curettage should be performed. Bleeding due to uterine atony is treated with uterotonic medications such as oxytocin, methylergonovine, misoprostol, and other prostaglandins such as 15-methyl-prostaglandin F_{2α}. In a trial of 20 060 women with PPH, mortality due to bleeding was lower in the tranexamic acid group vs the placebo group (1.9% vs 1.5%; risk ratio [RR], 0.81 [95% CI, 0.65-1.00]), with no increase in adverse events.⁶ Among those treated within 3 hours of delivery, death due to bleeding was 1.2% in the tranexamic acid group vs 1.7% in the placebo group (RR, 0.69 [95% CI, 0.52-0.91]; $P = .008$).⁶

Several intrauterine devices are used to treat postpartum bleeding. Intrauterine balloons, inflated with 50 to 500 mL of saline in the endometrial cavity, apply pressure to achieve hemostasis. Intrauterine vacuum devices use negative pressure to collapse the uterine walls and decrease bleeding. If these devices are unavailable, the uterus can be packed with laparotomy sponges. These devices, which have greater than 85% success rates in stopping bleeding, remain in the uterus until uterine tone has normalized by palpation and clot formation occurs, typically after 2 to 24 hours.³

Bilateral uterine vessel embolization, performed using fluoroscopy to inject embolic material (coils or sponge particles) through a catheter into the uterine arteries, stops bleeding in approximately 95% to 98% of patients with persistent PPH. If bilateral uterine vessel embolization is unavailable or PPH continues after uterine vessel embolization, a surgical intervention should be performed. In the operating room, obstetricians or surgeons perform a laparotomy to expose the uterus and ap-

ply specialized uterine sutures to compress the uterus. Other surgical interventions to reduce uterine bleeding include ligation of the utero-ovarian vessels, uterine vessels, and anterior branch of the hypogastric arteries. If these attempts are unsuccessful, a hysterectomy may halt bleeding, but is associated with high rates of surgical complications, including urinary tract injury (up to 18%).⁷

Secondary PPH

Initial evaluation includes a physical examination, assessment of hemodynamic stability, and quantification of blood loss. Transvaginal ultrasonography should be performed to identify retained products of conception, subinvolution of the placental site, and uterine abnormalities such as AVMs and pseudoaneurysms. For suspected or confirmed retained products of conception, uterine evacuation via suction curettage is recommended. For patients with endometritis (fever and uterine tenderness or foul-smelling vaginal drainage in the postpartum period), intravenous antibiotics such as a penicillin or first-generation cephalosporin in combination with an aminoglycoside should be initiated. Uterine balloon tamponade may temporize bleeding, especially in patients with subinvolution of the placental site. Uterine artery embolization or hysterectomy may be required for persistent or severe secondary PPH.

Prevention and Future Directions

Regular prenatal care may identify patients at risk of PPH through history, laboratory studies, and imaging. Anemia during pregnancy should be treated with supplemental intravenous or oral iron. Pregnant patients with antenatally identified placental anomalies (eg, placenta previa, placenta accreta) should be transferred to medical centers with surgical specialists who manage these conditions. Simulation and training of obstetric hemorrhage may improve adherence to management protocols, reduce time to initiate definitive interventions, and improve team communication.⁸

Conclusion

PPH is an obstetric emergency associated with substantial maternal mortality. Effective management involves multidisciplinary care with early identification, stabilization, and treatment, which may include uterotonic medications, uterine massage, mechanical devices, uterine artery embolization, and/or surgical interventions.

ARTICLE INFORMATION

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