Managing Obstetric Hemorrhage

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Risk assessment: ultrasonography facilitates visualization of placental abnormalities; categories of patients at high risk include those with placenta previa, vasa previa, abruptio, accreta, increta, and percreta; inclusion of placenta accreta among high-risk categories debated; >90% of patients with placenta accreta lose >3 L blood during cesarean delivery or hysterectomy

Imaging studies: possible to assess abnormalities detected on ultrasonography with magnetic resonance imaging, but studies indicate outcomes not improved by use of imaging

Multidisciplinary planning: consult with obstetrician, nursing team, and other teams that may become involved; these patients are at risk for developing disseminated intravascular coagulation, transfusion-related acute lung injury, transfusion-associated circulatory overload, and adult respiratory distress syndrome; address potential necessity for additional surgical services; patients at high risk for renal insufficiency; bleeding and hypovolemia can cause myocardial and cerebral ischemia

Karpati et al (2004): investigated 55 women admitted to intensive care unit (ICU) for postpartum hemorrhage, defined as blood loss >1 L; troponin levels elevated in >50%; elevations of troponin accompanied by changes in electrocardiography and myocardial contractility; incidence of myocardial injury directly correlated with amount of blood loss; troponin levels elevated in all patients who received catecholamines during resuscitation; authors postulated uteerotic agents may contribute to risk by causing coronary artery vasospasm; independent risk factors for development of myocardial injury included heart rate >115 bpm, systolic blood pressure (BP) <88 mm Hg, and diastolic BP <50 mm Hg

Patients at moderate risk: optimal management unclear; regional anesthesia usually preferred by patient; it also avoids instrumenting airway and reduces risk for aspiration; disadvantages include potential for emergency induction of general anesthesia and intubation in patient with acute hypovolemia and hypotension; consider all relevant clinical factors when planning care; additional considerations include whether patient Jehovah’s Witness and whether patient has hemolysis, elevated liver enzymes, and low platelet count (HELLP syndrome), uterine atony, anemic fluid embolus, or underlying coagulopathy

Categories of bleeding: surgical bleeding managed by surgical solutions; systemic bleeding of greater concern; massive transfusion can lead to systemic raw surface bleeding because of deficiencies or dysfunction of clotting factors and platelets

Preparation for patients at high risk: high-risk patients require preparation for general anesthesia, large-bore intravenous (IV) access, and invasive monitoring; ensure immediate availability of rapid infusion devices, point-of-care testing devices, vasoactive agents, and blood products

Preparation for patients at moderate risk: consider risks and benefits of regional vs general anesthetic; can establish large-bore IV access in patients receiving regional; assess need for invasive monitors; ensure availability of necessary equipment, vasoactive agents, and blood products

Transfusion therapy: consider ability of blood bank to rapidly deliver blood products; speaker suggests having 20 units blood and 20 units fresh frozen plasma (FFP) available in operating room for patients at high risk, and 10 of each for patients at moderate risk; consider implementing tiered system for massive transfusion; rapid infusion devices capable of delivering 300 mL/min to 500 mL/min

Holcomb et al (2008): investigated nearly 500 trauma patients and followed for 1 yr; assessed effects of different ratios of FFP to red blood cells (RBC) and platelets to RBC; higher survival at 30 days in patients receiving higher FFP:RBC and higher platelet:RBC ratios compared with patients receiving lower ratios; overall survival 74% in high-plasma/high-platelet (HPHP) group and 41% in low-plasma/low-platelet (LPLP) group; survival metrics at 6 hr, 24 hr, and 30 days higher in HPHP group; significantly higher numbers of hospital-free days, ICU-free days, and ventilator-free days in HPHP group compared with LPLP group

Borgman et al (2007): performed retrospective chart review of almost 250 patients in combat hospital who received massive transfusion, defined as ≥10 units RBC over 24 hr; divided patients into low-, medium-, and high-ratio groups; mortality rates significantly different between low- and high-ratio groups; low-ratio group received 1 unit FFP per 8 units RBC, with mortality rate 65% at 30 days; high-ratio group received 1 unit FFP per 1.5 units RBC, with mortality 19%

Viscoelastic coagulation testing: tend reflected in trauma and transplantation literature to use viscoelastic testing for evaluation of coagulation status; conventional coagulation laboratory tests evaluate specific individual factors; viscoelastic testing assesses coagulation of whole blood in tissue conditions; utility in obstetric population debatable; pregnancy affects coagulation profile; pregnant patients generally anemic and thrombocytopenic; factors VII, VIII, IX, and von Willebrand factor increased; factors V and XII unchanged; fibrinogen levels can double during pregnancy; good reference values for viscoelastic testing in pregnant patients unavailable; concentrations of fibrinogen correlate with clot amplitudes on FIBTEM (rotational thromboelastometry [TEM] using tissue factor activation in combination with cytochalasin D); TEM parameters and tracings strongly correlate with conventional coagulation tests

TEM studies: 2 studies found lower amplitudes on TEM in women with postpartum hemorrhage compared with women without; in one, women with postpartum hemorrhage experienced decreases in FIBTEM amplitudes before fibrinogen levels dropped

Fibrinogen concentrate: initially approved by Food and Drug Administration for patients with congenital or acquired hypofibrinogenemia; low risk for transfusion reactions; virally inactivated

Educational Objectives

The goal of this program is to improve the management of patients with obstetric-related hemorrhage and patients with obstructive sleep apnea. After hearing and assimilating this program, the clinician will be better able to:

1. Assess patients at risk for obstetric hemorrhage.
2. Formulate care plans for patients at risk for hemorrhage.
4. Recognize risk factors for obstructive sleep apnea (OSA).
5. Minimize perioperative complications related to OSA.

Faculty Disclosure

In adherence to ACCME Standards for Commercial Support, Audio Digest requires all faculty and members of the planning committee to disclose relevant financial relationships within the past 12 months that might create any personal conflicts of interest. Any identified conflicts were resolved to ensure that this educational activity promotes quality in health care and not a proprietary business or commercial interest. For this program, members of the faculty and planning committee reported nothing to disclose. In her lecture, Dr. Wang presents information related to the off-label or investigational use of a therapy, product, or device.
Fenger-Eriksen et al (2008) conducted retrospective study and found administration of fibrinogen concentrate decreased requirement for blood transfusion; Wikkelso et al (2015) investigated administration of fibrinogen concentrate in setting of postpartum hemorrhage, defined as blood loss >1 L; patients received 2 gm fibrinogen concentrate or placebo; found no difference in requirement for blood transfusion

**Factor VIIa:** initially approved for patients with inherited factor deficiencies; first documented use in obstetric patient 2001; Ahonen et al (2005) published case series suggesting factor VIIa improved or stopped bleeding when conventional methods failed, but wide range of dosages used with no correlation between dose and response

Francini et al (2008) performed meta-analysis of 31 studies involving 118 cases of women with postpartum hemorrhage who received factor VIIa; median dose 72 µg/kg; concluded this dosage sufficient to stop or reduce bleeding in 90% of cases; authors recommended administration of single dose of factor VIIa between 60 µg/kg and 90 µg/kg if patient has failed to respond to transfusions; if patients fails to respond to first dose, recommended second dose after 30 min; if second dose ineffective, hysterectomy recommended

Thrombosis: potential risk of administration of factor VIIa; evidence from trauma literature suggests patients do not have increased risk for thrombosis when factor VIIa administered in setting of coagulopathy; package insert quotes risk of thrombosis 1.6%; speaker recommends caution using factor VIIa in patients with comorbidities predisposing to thromboembolic complications and in those with sepsis or malignancies or who have received other prothrombotic agents

**Tranexamic acid:** some randomized controlled trials suggest less postpartum blood loss after cesarean delivery when tranexamic acid given preventively, but many studies underpowered and of indeterminate clinical significance; speaker mentions Tranexamic Acid for Preventing Postpartum Hemorrhage (TRAP) trial; TRAP study protocol published in 2015; Novikova et al (2015) Cochrane database review looked at 12 trials involving 3300 healthy patients who received tranexamic acid or placebo; blood loss <0.5 L less common in patients who received tranexamic acid compared with those who did not

**Systems improvement:** ≈98,000 patients die in United States annually because of substandard care; crisis resource management strategies promote team building and communication, expedite recognition of dangerous situations, and facilitate feedback among team members; Institute of Medicine recommends establishment of training programs through simulation or in situ training; Draycott et al (2006) found rate of APGAR scores ≤6 at 5 min decreased after implementation of training sessions for obstetric emergencies; Crofts et al (2006) found increased use of correct maneuvers after simulation training for shoulder dystocia; Marshall et al (2015) conducted longitudinal study across 6 hospitals in Oregon; found significantly improved response times for management of postpartum hemorrhage after team training using simulation

**Suggested Reading**


**Anesthesia and Obstructive Sleep Apnea**

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**Obstructive sleep apnea (OSA):** data indicate increased perioperative morbidity and mortality associated with OSA; clinically significant OSA in estimated 4% of men and 2% of women, and ~70% of cases go undiagnosed

**Definitions:** apneic event — cessation of breathing ≥10 sec despite ongoing efforts to breathe; OSA distinct from central apnea; hypopnea — partial obstruction with ≥50% diminished airflow (oxygen desaturation usually associated, but not required for definition); apnea-hypopnea index (AHI) — number of apneic and hypopneic events per hour; used to stratify severity of disease; AHI between 6 and 20 considered mild, between 21 and 40 moderate, and >40 severe

**Pathophysiology:** results from loss of upper airway muscle tone; occurs during rapid eye motion (REM) sleep; attempts to breathe with loss of airway tone generate negative intrathoracic pressure; negative pressure transmitted to airway and causes collapse of upper airway

**Contributing factors:** obesity significant risk factor, but not 100% sensitive; many patients with OSA have normal body mass index (BMI); additional risk factors include large neck circumference and anatomical abnormalities

**Cycle:** patient obstructs, becomes hypoxemic and hypercarbic, and sympathetic surge generated; patient partially rouses, hyperventilates, normalizes pH and blood gases, and resumes deeper sleep; repetition of cycle leads to long-term pathophysiologic consequences

**Pathophysiologic consequences:** patients with OSA predisposed to systemic hypertension (HTN), pulmonary HTN, cardiac arrhythmias, myocardial ischemia, and increased risk for heart failure; Pickwickian syndrome includes obesity, OSA, and retention of carbon dioxide; strongly associated with pulmonary HTN and right heart failure

**Perioperative effects:** sedatives, opioids, and muscle relaxants relax muscle tone; anesthetic agents blunt autonomic response to hypercarbia and hypoxia; patients experience sleep fragmentation leading to sleep deficit and REM rebound; increased time spent in REM sleep postoperatively; effects related to invasiveness of surgery; Chung et al (2014) found increased AHI compared with baseline in patients with OSA through postoperative night 3

**Screening tools:** *America Society of Anesthesiologists (ASA) check-list* — included in ASA guidelines; initially consensus based; considers physical and historical characteristics including snoring, observed plateaus in breathing, and daytime somnolence; presence of 1 item from 2 or more categories indicates OSA; *Berlin questionnaire* — complicated and difficult to apply for rapid bedside evaluation; *STOP-Bang questionnaire* — STOP portion includes snoring, tired, observed apnea, and blood pressure; Bang portion includes BMI ≥35, age ≥50 yr, neck circumference >40 cm, and gender male

**Diagnosis:** gold standard polysonomography/sleep study; measures multiple parameters; includes electroencephalography, eye movement, and air flow; requires overnight stay; at-home alternatives available
Ambulatory surgery: controversial for patients with OSA; ASA proposed risk stratification system (which speaker does not consider useful); Society for Ambulatory Anesthesia (SAMBA) attempted to develop evidence-based guidelines, but data limited; SAMBA recommendations (Joshi et al [2012]) focus on management of comorbid conditions; patients with known OSA and optimized comorbid conditions may be considered for ambulatory surgery if able to use continuous positive airway pressure (CPAP) device during postoperative period; patients with presumed OSA based on screening tools and with optimized comorbid conditions may be considered for ambulatory surgery if postoperative pain manageable with nonopioid analgesic techniques

Management of symptoms: CPAP reduces daytime sleepiness, improves performance on psychomotor tests, and improves HTN and symptoms of heart failure; recommended for patients with AHI >20 or patients with symptoms and AHI >10; uvulopalatopharyngoplasty (UPPP) involves removal of uvula and part of soft palate; results vary; repeat sleep study required for confirmation of cure following UPPP

Perioperative management: invasiveness of surgery more important than type of anesthetic; use of local or regional anesthesia minimizes affects on ventilation; capnography recommended for patients receiving sedation; consider CPAP during sedation; consider general anesthetic with secured airway vs deep sedation; Toshniwal et al (2014) found higher risk for difficult airway in patients with known OSA or with high STOP-Bang scores compared to patients with low STOP-Bang scores; head-up position, use of shorter-acting drugs, and use of adjuvant drugs (eg, nonsteroidal anti-inflammatory drugs, acetaminophen, local anesthetics) recommended for general anesthesia; extubate patients when awake and have strong airway reflexes

Postoperative complications: patients with OSA more likely to experience airway obstruction and desaturation in postanesthesia care unit, require intubation, experience HTN, experience tachyarrhythmias, or require admission; Memtsoudis et al (2013) found neuraxial anesthesia associated with fewer overall combined postoperative complications in patients undergoing hip or knee replacement compared with general anesthesia; provide supplemental oxygen as needed; giving oxygen universally undesirable because of potential for masking hyperventilation; utilize CPAP; patients with OSA require longer period of observation than patients without; assess for episodes of hypoxia or obstruction in unstimulated environment; patients at high risk undergoing major surgery may benefit from overnight stay in intensive care unit

Suggested Reading


Acknowledgments

Dr. Wang was recorded at the Texas Society of Anesthesiologists Annual Meeting, held September 10-13, 2015, in San Antonio, TX, and presented by the Texas Society of Anesthesiologists. For information about upcoming CME opportunities from the Texas Society of Anesthesiologists, please visit tsa.org. Dr. Cummings was recorded at the Comprehensive Anesthesiology Review, held April 4-9, 2016 in Cleveland, OH, and presented by the Cleveland Clinic Anesthesiology Institute. For information about upcoming CME opportunities from the Cleveland Clinic, please visit ccfeme.org. The Audio Digest Foundation thanks the speakers and the sponsors for their cooperation in the production of this program.

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Estimated time to complete the educational process:

- Review Educational Objectives on page 1: 5 minutes
- Take pretest: 10 minutes
- Listen to audio program: 60 minutes
- Review written summary and suggested readings: 35 minutes
- Take posttest: 10 minutes
1. What percentage of patients with placenta accreta can be expected to lose >3 L of blood during a cesarean delivery or hysterectomy?
   (A) >10%  (B) >30%  (C) >60%  (D) >90%

2. In a study of trauma patients conducted by Holcomb et al (2008), survival at 30 days was _____ in patients receiving higher fresh frozen plasma to red blood cell ratios and _____ in patients receiving higher platelet to red blood cell ratios compared with patients receiving lower ratios.
   (A) Increased; increased  (C) Decreased; increased
   (B) Increased; decreased  (D) Decreased; decreased

3. Which of the following clotting factors remains unchanged during pregnancy?
   (A) Factor VII  (B) Factor VIII  (C) Factor IX  (D) Factor XII

4. Wikkelso et al (2015) investigated the administration of fibrinogen concentrate in the setting of postpartum hemorrhage. Which of the following results was seen with fibrinogen vs placebo?
   (A) More women receiving fibrinogen required a blood transfusion
   (B) Fewer women receiving fibrinogen required a blood transfusion
   (C) There was no difference in requirement for transfusion

5. According to the package insert, what is the risk of thrombosis for administration of factor VIIa?
   (A) 0.6%  (B) 1.2%  (C) 2.4%  (D) 4.8%

6. In a commonly cited estimate, about _____ of men and _____ of women in the general US population are said to have clinically significant obstructive sleep apnea.
   (A) 4%; 2%  (B) 8%; 5%  (C) 10%; 10%  (D) 15%; 12%

7. For how long must breathing cease despite ongoing efforts to breathe in order for the cessation to be considered an apneic event?
   (A) ≥5 sec  (B) ≥10 sec  (C) ≥15 sec  (D) ≥20 sec

8. How many total apneic and hypopneic events per hour are required to classify obstructive sleep apnea as severe?
   (A) >6  (B) >20  (C) >30  (D) >40

9. All the following are positive responses (indicating increased likelihood of obstructive sleep apnea) on the STOP-Bang questionnaire, EXCEPT:
   (A) BMI >35
   (B) Age >35 yr
   (C) Neck circumference >40 cm
   (D) Gender male

10. On the apnea-hypoxia index, which of the following represents the threshold above which the use of a continuous positive airway pressure device is recommended?
    (A) >15 events per hr  (C) >30 events per hr
    (B) >20 events per hr  (D) >40 events per hr

Attention, CME/CE Participants
The cutoff date for logging 2016 credits is December 31, 2016. Test forms received after that date will be accrued to 2017.

Answers to Audio Digest Anesthesiology Volume 58, Issue 42: 1-B, 2-D, 3-B, 4-A, 5-B, 6-D, 7-D, 8-B, 9-A, 10-B