PREECLAMPSIA/ACUTE STROKE

Ten Things You Should Know About Preeclampsia to Care for Your Patients

Brian T. Bateman, MD, MSc, Assistant Professor, Department of Anesthesia, Critical Care, and Pain Medicine, Harvard Medical School and Massachusetts General Hospital, Boston

Classification of hypertensive disorders: based on American Congress of Obstetrics and Gynecology Taskforce on Hypertension; gestational hypertension—defined as new onset of hypertension at >20 wk gestation without proteinuria; generally has milder course than preeclampsia, although preeclampsia develops in 25% to 33% of cases as pregnancy progresses; induction of labor at 37 wk recommended; preeclampsia—categorized as “preeclampsia without severe features” or “preeclampsia with severe features” (previously referred to as mild or severe preeclampsia); change in terminology emphasizes that no preeclampsia considered mild and that condition becomes severe if left untreated; chronic hypertension—predates pregnancy; associated with wide range of adverse maternal and fetal outcomes (eg, intrauterine growth restriction [IUGR], stillbirths); obstetric management usually includes induction of labor at 39 wk to avoid intrauterine demise (frequent consequence of chronic hypertension); when superimposed on preeclampsia, risk for morbidity greater than that with preeclampsia alone; associated with relatively high incidence of pulmonary edema and maternal complications

Diagnostic criteria for preeclampsia: blood pressure (BP) >140/90 mm Hg at >20 wk gestation, with proteinuria; severe features include high BP with end-organ involvement

Treatment of preeclampsia: without severe features—manage expectantly until 37 wk, then induce labor; with severe features—obstetricians may prolong pregnancy for short period to allow for administration of steroids and maturation of fetal lungs; as severity increases, delivery indicated, even if preterm

Pathophysiology of preeclampsia: inadequate placentation considered fundamental defect; as patient enters second trimester, placenta becomes increasingly hypoxic, which causes release of antiangiogenic factors and other mediators, with resulting endothelial dysfunction, manifested as hypertension and proteinuria; end-organ manifestations—highly variable; pulmonary edema; hematologic abnormalities (eg, thrombocytopenia, disseminated intravascular coagulation [DIC]; rarely); central nervous system manifestations (eg, cerebral edema, stroke, seizure [ie, eclampsia]); liver dysfunction (eg, hepatocellular necrosis, subhepatic bleeding, rupture of liver); cardiac manifestations (eg, hyperdynamic cardiovascular state, cardiomegaly); placenta poorly perfused (comorbid IUGR common)

Control of BP: preeclampsia markedly elevates risk for intracranial hemorrhage (main cause of death; relative risk 10); endothelial dysfunction causes loss of autoregulation, and hypertension results in cerebral hyperperfusion; coagulopathy also increases risk for hemorrhage; United Kingdom survey (2006-2008)—19 deaths attributable to preeclampsia, with >50% due to intracranial hemorrhage; failure to control BP factor in most cases; target BP—study by Martin et al (2005) observed that 100% of patients with preeclampsia who suffered stroke had systolic BP >155 mm Hg; diastolic pressure not always elevated; concluded that focus of treatment should be on systolic pressure

Recommendations: urgent control of BP >150 mm Hg; study by Martin et al also showed that >50% of strokes occurred in postpartum period, so vigilance in control of BP after delivery crucial; uterotonic agents—avoid use of methylergonovine (causes exaggerated hypertensive response); consider alternative agents (eg, carbetropin)

Antihypertensive agents: BP goal should not be more than 15% to 20% below baseline (and/or <150 mm Hg); bringing BP too low has adverse effect on uteroplacental perfusion (because uterine blood flow dependent on BP and not autoregulated); agents—Cochrane analysis concluded that data insufficient to allow recommendation of specific agents; choice of drug depends on clinician’s experience; most expert reviews recommend labetalol, hydralazine, and nifedipine as first-line drugs; second-line agents should be used when patient refractory to first-line agents, and include nicardipine, sodium nitroprusside, and esmolol

Spinal anesthesia (SA) for cesarean delivery: previously considered relatively contraindicated in severe preeclampsia because of associated risk for hypertension; however, recent data indicate that SA can be safe in patients with no contraindications; Visalyaputra et al (2005)—in multicenter randomized controlled trial (RCT), compared SA to epidural anesthesia; hypotension seen more frequently, and ephedrine used more often, with SA; rate of clinically significant hypotension (systolic pressure <80 mm Hg) and neonatal outcomes similar in 2 groups; concluded that SA safe; severely compromised fetus—with reversal of umbilical artery diastolic flow, even transient hypotension concerning (consider low-dose SA as part of combined spinal-epidural technique, or epidural alone)

Coagulation status: thrombocytopenia relatively common feature of preeclampsia; DIC rare, but may be associated with significant liver involvement, placental abruption, or intrauterine fetal demise; epidural hematomas—reported in case studies; platelet count—necessary when considering neuraxial anesthetic; good data on threshold values lacking; 100,000/µL considered safe; 80,000/µL considered safe;

Educational Objectives

The goal of this program is to improve outcomes of patients with preeclampsia and acute stroke. After hearing and assimilating this program, the clinician will be better able to:

1. Define the hypertensive disorders of pregnancy and the diagnostic criteria for preeclampsia.
3. Choose an appropriate anesthetic technique for a patient with preeclampsia.
4. Weigh the advantages and disadvantages of local vs general anesthesia for patients undergoing endovascular therapy for acute stroke.
5. Assess the evidence on the discontinuation of antihypertensive treatment in patients with acute stroke.

Faculty Disclosure

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<50,000/μL precludes neuraxial anesthetic; range of 50,000 to 80,000/μL gray zone (consider risk-benefit analysis, including, eg, difficulty of airway; coagulation profile — necessity before initiating neuraxial anesthetic debatable; Leduc and colleagues [1992] noted that coagulation abnormalities present in patients with severe preeclampsia only when platelet count <100,000/μL, and therefore concluded that waiting for coagulation profile unnecessary when platelet count >100,000/μL; as platelets counts can decrease rapidly, recheck every 6 to 8 hr once labor underway Placement of neuraxial catheter: if platelet count falls to between 80,000 to 100,000/μL, consider early placement of neuraxial anesthetic; minimize number of needle passes; use of flexible wire-embedded catheter may reduce trauma; wait for platelet count to recover to >75,000/μL before removing catheter; consider spinal technique with small-caliber needle; maintain low threshold for consulting neurologist or neurosurgeon if any symptoms suggest epidural hematoma

Control of BP during endotracheal intubation and extubation: general anesthesia (GA) less desirable than neuraxial block for cesarean delivery in patients with preeclampsia because of risk for transient hypertension during intubation and extubation; indications for GA include severe coagulopathy, thrombocytopenia, severe postpartum hemorrhage, and fetal bradycardia, which may require emergent GA; transient hypertension may precipitate pulmonary or cerebral edema; Huang and colleagues (2010) reported that, in patients with preeclampsia having cesarean delivery, risk for stroke 2-fold greater with GA than with neuraxial block; multiple case reports describe cerebral hemorrhage occurring on induction; intubation — in patient with severe hypertension, consider arterial line prior to induction (enables rapid response to changes in BP); titrate BP to <140/90 mm Hg before induction to allow for some increase at time of laryngoscopy; speaker recommends titration with boluses of labetalol during preoxygenation (or another medication that blunts hypertensive response [eg, esmolol, nitroglycerine, sodium nitroprusside, remifentanil]); if remifentanil used, give dose of 0.5 μg/kg (as effective as 1 μg/kg but with less risk for hypotension); extubation — also period of risk and increased need for vigilance

Airway management: in general, difficult airway more likely in pregnant patient, particularly if preeclampsia due to edema (associated with narrowing of upper airway, enlargement and limited mobility of tongue, and subglottic narrowing); coagulopathy in patients with severe preeclampsia predisposes patient to airway bleeding: GA should be avoided in patients with difficult airway; if GA necessary, prepare for difficult intubation by ensuring availability of smaller endotracheal tubes and other necessary equipment; if performing awake fiber-optic intubation in patient with coagulopathy, avoid airway injections

Use of magnesium: standard of care for seizure prophylaxis in severe preeclampsia; 2010 Cochrane review — included 6 RCTs totaling >11,000 patients; magnesium compared with placebo or other anticonvulsants; relative risk with use of magnesium 0.4, with trend toward reduction in risk for maternal death; 50 patients need to be treated to prevent one seizure; use of magnesium in patients with mild features more controversial; effects of magnesium — inhibits release of acetylcholine and decreases its sensitivity at neuromuscular junction; increases potency and duration of nondepolarizing neuromuscular blocking agents; case reports suggest risk for prolonged mechanical ventilation when patients given magnesium in combination with nondepolarizing neuromuscular agent (if latter given, use low dose and monitor response carefully with peripheral nerve stimulator); consider not using nondepolarizing blocking agents because obstetricians do not need muscle relaxation for cesarean deliveries; magnesium does not affect succinylcholine; interaction with calcium channel blockers — combination may cause hypotension or neuromuscular blockade; however, recent studies indicate magnesium can be safely given with nifedipine, without risk for hypotension; tocolytic effects — multiple rigorous studies have found no evidence of increased blood loss with use of magnesium; maintaining infusion of magnesium during cesarean delivery reasonable

Fluid management: preeclampsia causes low colloid oncotic pressure because of effect on endothelial function and increased capillary permeability; pulmonary edema — incidence 3%; leading cause of admission of patients with preeclampsia to intensive care unit; risk factors include advanced maternal age, chronic hypertension, preexisting renal disease, and early onset of disease (gestation <34 wk); excess fluid administration strong risk factor; management — restrictive approach to fluid intake reasonable; because of renal effects of preeclampsia, oliguria does not necessarily reflect hypovolemia; pulmonary edema should be treated with furosemide

Management in postpartum period: patients highly vulnerable after delivery; even though delivery of infant cure for preeclampsia, risks for pulmonary edema, sustained hypertension, stroke, and airway obstruction persist; fluid intake and urine output should be monitored; risk for pulmonary edema highest 2 to 3 days after delivery, at which time mobilization of fluid increases intravascular volume; as risk for stroke greatest in postpartum period, maintenance of BP at <150 mm Hg crucial; postpartum preeclampsia — pathophysiology unclear; accounts for 6% of cases; occurs ≤4 wk postpartum; admitting patient for 24 hr of monitoring recommended (administer magnesium for seizure prophylaxis for 24 hr and control BP)

Prophylaxis for venous thromboembolism (VTE): VTE after cesarean delivery important cause of maternal mortality; latest guidelines from American College of Chest Physicians recommend pharmacologic prophylaxis; if medications contraindicated, mechanical prophylaxis should be used in patients with risk for VTE >3%; preeclampsia with IUGR considered major risk factor; administer enoxaparin or subcutaneous heparin in postdelivery period; preeclampsia without IUGR considered minor risk factor (however, combination with second risk factor, eg, cigarette smoking, obesity, places patient at high risk)

Acute Stroke
Zirka H. Anastasian, MD, Assistant Professor of Clinical Anesthesiology, Columbia University Medical Center, New York, NY

Overview: intravenous tissue plasminogen activator (IV tPA) — only method proven to improve outcome of ischemic stroke; improvement of outcome time-dependent, ie, benefit minimal when administered >360 min after stroke; administration recommended when patient presents within 4.5 hr of onset of symptoms; does not reopen ≥50% of large vessels; indications for endovascular therapy — presentation 4.5 to 8 hr after symptom onset; patient not candidate for IV tPA or has failed IV tPA; occlusion of large vessels

Anesthetic techniques for endovascular procedures: advantages of GA include immobility (which facilitates procedure), control of pain, and protection of airway; disadvantages include vasodilation with hemodynamic changes and potential delay in time to treatment; local anesthesia (LA) — advantages include more stable hemodynamics and capability to assess neurologic status during procedure; disadvantages include lack of airway protection and possible agitation, which may increase duration of procedure

Studies comparing GA to LA: all studies retrospective; GA associated with larger infarct and poorer clinical outcome; however, patients who underwent intubation presented with higher National Institutes of Health Stroke Scale (NIHSS) scores (ie, patients in poor condition more likely to receive GA); Davis et al (2012) — demonstrated that LA associated with good outcomes, but patients undergoing GA had higher baseline NIHSS scores and much lower BP

Management of BP in stroke: International Stroke Trial — demonstrated U-shaped relationship between BP and death; optimal systolic BP 140 to 160 mm Hg (risk for death and dependency increased with lower BP); antihypertensive agents after acute stroke — 2 RCTs (Scandinavian Candesartan Acute Stroke
Trial [SCAST] and Continue or Stop post-Stroke Antihypertensives Collaborative Study [COSSACS]) compared continuing vs stopping medications; both studies demonstrated neither different outcomes or improved outcomes with discontinuation of medications; in contrast, subgroup analysis of patients enrolled <24 hr after stroke in China Antihypertensive Trial in Acute Ischemic Stroke (CATIS) revealed better outcomes in group treated with antihypertensives; Efficacy of Nitric Oxide in Stroke (ENOS) trial — patients presenting <48 hr after symptom onset randomized to continue or discontinue antihypertensive medications; quality of life and cognition better for those who discontinued medications; results support need for higher BP immediately after stroke

Conclusions: “time is brain” — for each minute of delay in revascularization, estimated 1.9 million neurons lost; management needs to be patient-specific; when patient presents for management of acute stroke in endovascular unit, anesthesiologist should speak to interventionalist to determine what needs to be done and level of difficulty of procedure; time between onset of symptoms and treatment important; move quickly (eg, place lines as procedure starting); when giving GA, maintain BP of 140 mm Hg

Acknowledgments

Dr. Bateman spoke at the 28th Annual Conference: Challenges for Clinicians, presented by the Department of Anesthesia and Critical Care, University of Chicago Medicine and Biological Sciences. For information on upcoming CME conferences from the Department of Anesthesia and Critical Care, University of Chicago Medicine and Biological Sciences, please visit cme.uchicago.edu. Dr. Anastasia spoke at the 68th Annual Postgraduate Assembly in Anesthesiology, presented by the New York State Society of Anesthesiologists. For information on upcoming meetings sponsored by the New York State Society of Anesthesiologists, please visit nysa-pga.org, or visit our website, Audio-Digest.org, and click on “Upcoming Meetings.” The Audio Digest Foundation thanks the speakers and the sponsors for their cooperation in the production of this program.

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PREECLAMPSIA/ACUTE STROKE

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1. Which of the following statements about chronic hypertension in pregnancy is true?
   (A) Does not increase the risk for maternal complications
   (B) Associated with high risk for fetal demise
   (C) Early induction of labor is not recommended
   (D) When superimposed on preeclampsia, risk for morbidity similar to that with preeclampsia alone

2. The leading cause of death attributable to preeclampsia is which of the following?
   (A) Pulmonary edema
   (B) Intracranial bleeding
   (C) Liver failure
   (D) Airway obstruction

3. Which of the following statements about the treatment of hypertension in patients with preeclampsia is correct?
   (A) Systolic pressure ≥130 mm Hg requires urgent treatment
   (B) Diastolic pressure ≥100 mm Hg requires urgent treatment
   (C) Data show that >50% of strokes occur in the postpartum period
   (D) Methylergonovine is the recommended uterotonic agent

4. Which of the following is considered by most experts to be a first-line agent for control of hypertension in patients with preeclampsia?
   (A) Esmolol
   (B) Sodium nitroprusside
   (C) Nicardipine
   (D) Hydralazine

5. Select the true statement about considerations for the use of neuraxial anesthesia in a patient with preeclampsia having a cesarean delivery.
   (A) A platelet count <80,000/μL is a contraindication to placement
   (B) Coagulation abnormalities are present in all patients with severe preeclampsia
   (C) Platelet count typically remains stable throughout labor
   (D) The catheter should not be removed until platelet count is >75,000/μL

6. Which of the following statements about the use of general anesthesia (GA) for cesarean delivery in patients with preeclampsia is true?
   (A) The risk for stroke with GA is equal to that with neuraxial block
   (B) Blood pressure should be titrated to <120/80 mm Hg
   (C) Use of sodium nitroprusside is recommended for control of blood pressure during preoxygenation
   (D) Remifentanil may be given to blunt the hypertensive response to laryngoscopy

7. Which of the following is the most accurate statement about the clinical use of magnesium?
   (A) In randomized controlled trials, it shows no greater efficacy than other anticonvulsants in preventing seizures
   (B) Interacts with nondepolarizing neuromuscular blocking agents
   (C) Interacts with succinylcholine
   (D) Increases blood loss during cesarean deliveries

8. After acute stroke, endovascular therapy should be considered for which of the following?
   1. Patients presenting within 4 hr of onset of symptoms
   2. Patients who are not candidates for intravenous tissue plasminogen activator (IV tPA)
   3. Patients who have failed IV tPA
   4. Occlusion of large vessels
   (A) 2, 4
   (B) 1, 3
   (C) 2, 3, 4
   (D) 1, 2, 3, 4

9. Which of the following statements about the use of GA for endovascular procedures in patients with acute stroke is correct?
   (A) Revascularization prevents ischemic damage if performed at any time within 6 hr of symptom onset
   (B) When administering GA, blood pressure should be maintained at 120 mm Hg
   (C) GA is associated with poorer clinical outcomes than those seen with local anesthesia (LA)
   (D) Studies have found no significant differences between patient who receive GA and those who receive LA after stroke

10. Choose the accurate statement(s) about the management of blood pressure in patients with acute stroke.
   (A) The International Stroke Study demonstrated a linear relationship between blood pressure and outcomes
   (B) Most studies show that discontinuation of antihypertensive agents worsens outcomes of patients with stroke
   (C) Blood pressure should be maintained between 140 and 180 mm HG in the acute management of stroke
   (D) All the above

Answers to Audio Digest Anesthesiology Volume 57, Issue 13: 1-D, 2-A, 3-B, 4-D, 5-A, 6-D, 7-D, 8-C, 9-B, 10-B