Practice Advisory from the American Society of Regional Anesthesia and Pain Medicine

Joseph M. Neal, MD, Anesthesiology Faculty, Virginia Mason Hospital and Seattle Medical Center, Seattle, WA

Anticoagulation and regional anesthesia: fourth version of American Society of Regional Anesthesia and Pain Medicine’s advisory on anticoagulation developed in 2014; for first time worked with European Society of Anaesthesiology in attempt to formulate single document; warfarin — with international normalized ratio (INR) of 1.5 to 3, may safely remove or maintain catheter provided patient observed; previously considered safe to remove catheter only with INR <1.4; however, when warfarin used for 48 hr factors VII and IX depressed, and therefore recommended to remove catheters before 48 hr and then wait for 24 hr for signs of neurologic compromise; unfractionated subcutaneous heparin — in third edition, dosing 3 times daily could not be recommended because of lack of data; in version 4, dosing 2 or 3 times daily acceptable and not contraindication for neuraxial techniques; however, suggested to wait at least 4 hr, and ideally 6 hr, after last dose before placing needle or catheter; after placement of spinal or epidural catheter, heparin may be given immediately (provided that tap not grossly bloody), because effects peak only after several hours

Low-molecular-weight heparin (LMWH): once-daily dosing for prophylaxis — previously stated that first dose should be 8 hr after surgery; now considered safe to start drug 12 hr after placement of epidural or spinal; second dose should be delayed full 24 hr after first; removal of catheter — should wait 4 hr after pulling catheter before administering dose; changed from previous recommendation of 2 hr in order to be consistent with FDA and American College of Physicians; twice-daily dosing — first dose either day after surgery or no sooner than 12 hr after placement of epidural or spinal; removal of catheter should be done at trough; if patient receiving twice-daily dosing, may keep catheter overnight, then remove catheter, wait 4 hr before first dose, and start twice-daily dosing

Antiplatelet medications: clopidogrel — unchanged from previous recommendations; ideally held for 7 days before neuraxial block, but 5 days probably safe; if concerns arise, obtain and document normal platelet study; newer agents — prasugrel ideally stopped 7 to 10 days before spinal or epidural anesthesia; ticagrelor should be held 5 days

Fondaparinux: for patients receiving 2.5 mg prophylactic dose, recommended to wait slightly more than 3 days before doing regional anesthesia; for 5 mg therapeutic dosing, recommended not to do neuraxial block under any circumstances; no literature regarding safety of administering fondaparinux while epidural in place; studies that demonstrated safety limited its use to patients who had successful spinal injection on first pass, atraumatic technique, and no indwelling catheter; recommended to use only when these criteria fulfilled

Novel anticoagulants: patient should be off drug for 5 half-lives (3 days for rivaroxaban and apixaban, and 5 days for dabigatran) before neuraxial block; especially important in patients with renal insufficiency; if patient off drug for less time and neuraxial block judged to be preferred anesthetic, document normal partial thromboplastin time or ecarin clotting time; if anticoagulation desired postoperatively, recommended to remove catheter and wait 6 hr; if catheter already in place, should wait 2 half-lives before catheter removed

Spinal stenosis: common condition; occurs with hypertrophy of ligamentum flavum or hypertrophy of bony elements of spinal canal, resulting in smaller cross-sectional area; with smaller space, concern that patients at higher risk for spinal cord injury from hematomas; case reports of paralysis after spinal and epidural anesthesia in patients who were found at autopsy to have had spinal stenosis; Swedish study — examined 1.7 million neuraxial anesthetics; found hematomas in >30 patients, often in elderly women (1 in 4000 patients), compared to young women undergoing epidural for labor (1 in >200,000 events); some were treated outside guidelines; 9 patients noted to have spinal stenosis; since then, other studies have confirmed slightly higher incidence of neurologic complications in women with known spinal cord pathology, with complication rate of 1.1%; studies have methodologic problems; recommendations — in patient with known severe spinal stenosis, particularly at level of placement of needle, if procedure can be performed with similar results under general anesthesia, should consider risk/benefit ratio; if tight canal at L4 and planning mid-thoracic epidural for abdominal surgery, should not be problem; undiagnosed stenosis presents challenge

Neuraxial blocks and autoregulation of blood pressure (BP): hypotension often not treated; brain and spinal cord autoregulate BP to match metabolic demands; injection of spinal cord with local anesthetic causes fall in BP, but with concomitant decrease in metabolic demands, so blood flow appropriately lowered; however, at some point, perfusion becomes totally pressure dependent; lower limit of spinal cord autoregulation (below which ischemia occurs) not known; results from animal studies indicate that BP 20% to 40% below baseline risks ischemia; in large clinical series and medicolegal cases of ischemic injury of cord, prolonged periods of hypotension only factor

Educational Objectives
The goal of this program is to improve the care of patients who require anticoagulation while undergoing neuraxial anesthesia and who undergo surgery at ambulatory surgery centers. After hearing and assimilating this program, the clinician will be better able to:

1. Cite the new guidelines from the American Society of Regional Anesthesia and Pain Medicine for the management of anticoagulation in patients undergoing neuraxial anesthesia.
2. Recognize the lower limits of autoregulation of blood pressure in patients undergoing neuraxial block.
3. Outline management strategies for the treatment of systemic toxicity of local anesthetics.
4. Evaluate the exclusion criteria for ambulatory surgery.
5. Consider the indications for preoperative testing before ambulatory surgery.

Faculty Disclosure
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detected; previously thought that 50 mm Hg lower limit of spinal cord autoregulation for brain and spinal cord, but likely to be too low; recommended that lower limit be 60 to 70 mm Hg; clinical studies — no good data for spinal cord; in large studies of brain function, 30% decrease of mean arterial pressure from baseline for prolonged periods (eg, 10 to 40 min) associated with increased risk for perioperative stroke; during cardiopulmonary bypass, lower limit of autoregulation ≈66 mm Hg; lower limit not predictable based on baseline BP

**Systemic toxicity of local anesthetics:** dosage of local anesthetic should be reduced in patients at extremes of age, in whom drugs not well metabolized; particularly true in patients with cardiac disease, congestive heart failure, or liver failure, and in small children; historically, overdose occurred more frequently from peripheral nerve blocks; larger doses more likely to result in toxicity, regardless of weight of patient (reflected in case reports); toxicity inversely correlated with weight; influence of guidance by ultrasonography — increased confidence in accurate placement of needle; has resulted in using lower doses of anesthetic; study of ≈27,000 patients demonstrated reduction of systemic toxicity by 67%; however, risk for systemic toxicity still 1 in 1000; use of incremental dosage and adding epinephrine still encouraged

Timing of toxicity: 50% of systemic toxicity occurs soon after injection, probably because of intravascular injection; however, can be delayed 1 to 10 min because of partial intravenous injection or rapid systemic uptake of drug; 15% delayed 10 to 30 min; therefore, patients should not be left unmonitored after injection; should be particularly careful in very elderly and children

Clinical manifestations: commonly thought that central nervous system manifestations occur first, and only afterward do cardiac toxicities occur; however, for lipid-potent agents (eg, bupivacaine, ropivacaine) first manifestation cardiac arrest in 10% of patients; textbooks say toxicity starts with ringing in ears, agitation, seizures, and then cardiac arrest; however, this sequence occurs only in 20% of cases; some can manifest initially as cardiac arrest or seizure, particularly when sedation used

Treatment of toxicity: primacy of airway; avoid hypoxemia, acidosis, and hypercapnia, because these make resuscitation more difficult; control seizure with benzodiazepines and not with propofol; cardiopulmonary resuscitation (CPR) for toxicity from local anesthetic not same as advanced cardiac life support CPR; administer lipid emulsion; for ventricular tachycardia, do not give lidocaine; not recommended to give β-blocker, calcium channel blocker, or vasopressin; epinephrine should be given only when needed and in small doses (1 μg/kg); consider cardiopulmonary bypass early if patient not doing well; should keep local anesthetic kit wherever local anesthesia used; propofol not substitute for lipid

**Ambulatory Anesthesia Practice: Challenges, Controversies, and Recent Developments**

Ty L. Bullard, MD, Clinical Assistant Professor and Associate Medical Director, Ambulatory Surgery Center, Department of Anesthesiology, UNC Hospitals, University of North Carolina at Chapel Hill

**Patient selection:** biggest controversy in ambulatory surgery center (ASC); need to consider resources and personnel, both practitioners and support personnel; high-risk patients — increasing demand because of payers limiting hospital stays, patient choice, improved technologies allowing more complex procedures to be performed, and pressure from inpatient facilities working at full capacity

**Design of ASC:** ideally should have 1.5 to 2 preoperative bays for every operating room (OR); ASC at University of North Carolina — 8 ORs, 15 postanesthesia (PACU) bays, and 15 short-stay beds, which works well; handheld blood analyzer, but not formal laboratory; frozen section center; no blood bank

**Location of ASC:** consider relationship to inpatient facility; various arrangements including ASC physically connected to tertiary care facility; on-campus but physically separate; stand-alone facility with affiliation with tertiary care facility with established protocol of emergency transfer (ie, where patient will go, type of transportation, time required to get to receiving institution, cost); affiliated with low acuity facility; completely stand-alone facility with no affiliation; importance of location — in determining which patients to treat, need to know time required for transfer, availability of consultations (eg, cardiology, respiratory therapy); critical care resources: blood bank, intensive care unit; need to consider that ASC closes at night; may require physician in-house coverage; transfer of patients can be dangerous even when on same campus

**Exclusion criteria:** conventional criteria include high body mass index (BMI), sleep apnea, very young age, premature infants, need for invasive monitoring, known need for blood transfusion; with push for more ambulatory surgery, drastic reduction of exclusion criteria has occurred; at UNC unplanned transfer rate has tripled (previously 0.5%, which approximates national average); no cases of significant morbidity or mortality have occurred, but costs have increased; Mathis and colleagues — significant risk factors for major complications within first 72 hr of ambulatory surgery include chronic obstructive pulmonary disease, history of cerebrovascular accident or transient ischemic attack, high BMI, previous percutaneous coronary intervention or cardiac surgery, prolonged time in OR, and hypertension

Safety of relaxing exclusion criteria: improved technology to manage difficult airway (eg, video laryngoscope); expanded facility means more anesthesiologists on site and greater availability for help; with larger facility more surgical resources available (eg, otolaryngologist or general surgeon often on site to perform surgical airway); availability of short-stay beds allows for extended recovery; emphasis on regional anesthesia, which minimizes use of opioids; BMI — previous exclusion criterion of >30 has been relaxed; probably safe to treat patients with higher BMI; obesity does not increase difficulty of tracheal intubation, although large neck circumference does; Mallampati score may be predictive of difficult airway, particularly in patient with morbid obesity; Chung and colleagues — reviewed ≈18,000 patients, looking at preexisting events as predictors of adverse events in PACU; obesity associated with very high rate of events (including cardiovascular, respiratory, pain, and nausea and vomiting); most events were pain and nausea and vomiting; incidence of pain may be increased because of attempts to decrease use of opioids in obese patients; smoking and asthma also associated with high rates of adverse events; Davies and colleagues — study of ≈11,000 patients comparing those with BMI <35 to those >35 found no difference in need for more attention after discharge

**Preoperative testing:** toxin screen — patients with positive screen (eg, cocaine, methamphetamine) have no difference in outcomes; more important to check for pott's toxemia (eg, hypertension, tachycardia, delirium, Q-T prolongation; history of cardiopulmonary disease — according to American College of Cardiology/American Heart Association guidelines from 2009, important to consider coexisting factors; emergency surgery (not relevant to ASU); active cardiac conditions (eg, unstable or severe angina), severe arrhythmia (eg, supraventricular tachycardia or atrial fibrillation with high ventricular rate), Mobbiz II (type 2 second-degree atioventricular block), third-degree heart block; if these factors not present and surgery low risk (which should be case for ambulatory surgery), no need for further tests
Indications for preoperative testing: many practitioners testing even with low-risk surgery and no active cardiac conditions; too many tests being ordered; for cataract surgery, if patient able to lie flat and tolerate topical anesthesia, and surgeon able to perform operation quickly without much sedation, no further testing necessary; Cochrane review 2012 — preoperative medical testing does not reduce risk for adverse intraoperative or postoperative events when compared to selective or no testing; however, testing does increase costs 2.5-fold; no difference in cancellation rate

Predictors of unplanned inpatient admission: Fleisher and colleagues — strongest predictors operative time >2 hr and use of general anesthesia; compared to regional anesthesia, general anesthesia increases risk of admission 8-fold; remaining exclusion criteria: premature infants and need for blood transfusions; limits of day surgery have clearly progressed, but contraindications remain

Acknowledgments

Dr. Neal spoke at the 20th Annual Advances in Physiology and Pharmacology in Anesthesia and Critical Care, presented by Wake Forest University School of Medicine and held October 25-28, 2014, in White Sulphur Springs, WV. For more information on upcoming CME meetings from Wake Forest University School of Medicine, please visit wakehealth.edu. Dr. Bullard spoke at the 27th Annual Carolina Refresher Course: Update in Anesthesiology, Pain, and Critical Care Medicine, jointly sponsored by the Department of Anesthesiology, University of North Carolina at Chapel Hill School of Medicine, and the Medical University of South Carolina, and held June 25-29, 2014, in Kiawah Island, SC. For more information on upcoming CME meetings sponsored by the University of North Carolina at Chapel Hill, School of Medicine, please visit med.unc.edu/cpd and for meetings from the Medical University of South Carolina, please go to cme.musc.edu 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 issue.

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1. After removing an epidural or spinal catheter, it is currently recommended to wait _______ before giving low-molecular-weight heparin.
   (A) 2 hr (B) 4 hr (C) 8 hr (D) 12 hr

2. When using neuraxial anesthesia while administering fondaparinux, which of the following is recommended?
   (A) Epidural catheter may be placed 1 day after a 2.5 mg dose
   (B) Neuraxial block should not be used after 5 mg dose
   (C) After placement of an epidural catheter, the first dose should be delayed for 24 hr
   (D) All the above

3. It is recommended to stop rivaroxaban for _______ before giving neuraxial block and wait _______ after removing a neuraxial catheter before giving the next dose.
   (A) 3 days; 6 hr (B) 3 days; 12 hr (C) 5 days; 6 hr (D) 5 days; 12 hr

4. It is recommended that during neuraxial anesthesia mean arterial blood pressure be maintained at no less than _______.
   (A) 50 mm Hg (B) 50 to 60 mm Hg (C) 60 to 70 mm Hg (D) 75 mm Hg

5. Which of the following statements about systemic toxicity of local anesthetics is true?
   (A) Use of ultrasonographic guidance for placement of nerve blocks has not reduced the incidence of toxicity
   (B) Over 90% of toxicity occurs soon after injection
   (C) Initially manifested as central nervous system symptoms in 80% of patients
   (D) Cardiac arrest is the first manifestation from bupivacaine injection in 10% of patients on lipid-potent agent

6. In the treatment of systemic toxicity of local anesthetic, which of the following is recommended?
   (A) Propofol (B) Lipid emulsion (C) Vasopressin (D) β-blocker

7. When considering optimal conditions of an ambulatory surgery center, which of the following should be present?
   (A) 1.5 to 2 preoperative bays for each operating room
   (B) Blood bank
   (C) 1 postanesthesia care unit bay for each operating room
   (D) Laboratory

8. In the study by Mathes and colleagues, higher risk for major complications after ambulatory surgery was associated with all of the following, except:
   (A) High body-mass index
   (B) Sleep apnea
   (C) History of percutaneous coronary intervention
   (D) Hypertension

9. Which of the following is not predictive of a difficult tracheal intubation?
   (A) Obesity (B) Large neck circumference (C) High Mallampati score (D) All the above

10. Which of the following statements about preoperative testing before ambulatory surgery is true?
    (A) If methamphetamine is detected on a toxin screen, the surgery should be cancelled
    (B) Preoperative testing should be performed routinely on patients with a history of cardiopulmonary disease even without an active cardiac condition
    (C) Rates of cancelling surgery are higher without preoperative testing
    (D) Patients for cataract surgery who are able to lie flat and tolerate topical anesthesia typically do not require preoperative testing

Answers to Audio Digest Anesthesiology Volume 57, Issue 07: 1-A, 2-D, 3-D, 4-C, 5-A, 6-B, 7-B, 8-A, 9-A, 10-D