Non-Operating Room Anesthesia Service

Walter G. Maurer, MD, Section Chief, Non-Operating Room Anesthesia, and Staff Anesthesiologist, Department of Anesthesiology, Anesthesia Institute, Cleveland Clinic, Cleveland, OH

Non-operating room anesthesia (NORA): rapidly advancing area of anesthesia; usually performed in medical procedure areas by specialists unable to obtain access to operating room (OR); with regard to scheduling, areas should function similarly to OR to allow efficient use of anesthesia time (eg, all cases scheduled on 1 day/wk)

Gastroenterology: patients arrive at scheduled times, but rate of “add-ons” and cancellations ≈50%; outpatients assumed to be relatively healthy and to require “minimally invasive anesthetic”; gastroenterologists accustomed to fast turnover of patients; patient’s past medical history often unknown; gastroenterologists unable to perform endotracheal intubation; status of “nothing by mouth” (NPO) unclear and must be verified because gastrointestinal preparations vary in volumes and timing

Multisociety Sedation Curriculum for Gastrointestinal Endoscopy (2012): provides standards for nonanesthesiologists; topics include pharmacology, informed consent, peri-procedural assessment, levels of sedation, specific agents, airway management, use of anesthesia services, and monitoring; competence assessed by completion of Advanced Cardiac Life Support (ACLS), written examination covering issues not addressed by ACLS, and demonstration (by use of models) of competence to open airway, prevent aspiration, assess airway risk, and manage compromise of airway and other complications of sedation

Deep sedation: currently viewed by Center for Medicare Services as form of anesthesia and subject to statutory requirements applicable to anesthesia services in general; care of sedated patient — provider must demonstrate competence performing head lift, jaw thrust, and application of mask (but not use of laryngeal mask airway); training in capnography, electrocardiography, and understanding of limitations of oxygen saturation; one assistant primarily focuses on monitoring of patient; for patients under deep sedation, provider must be present for uninterrupted observation of respiratory and cardiovascular status of patient (ie, not responsible for tasks related to endoscopy); pulse oximetry supplemental to (does not replace) clinical observation of patient; use of propofol — routine use in patients at average risk cannot be endorsed; however, document also states that propofol may be safely given by nonanesthesiologist physicians and nurses; assistance of anesthesia specialist should be considered for patients with ASA class III, IV, or V; training for providers administering propofol should comprise didactic materials, workshop for management of airway, simulations, preceptorships, and periodic retraining; provider must demonstrate competence in management of upper and lower airway complications, including manual techniques for reestablishing patency of airway, use of oral and nasal airway devices, and bag ventilation

Case 1: 58-yr-old woman with recent cholecystitis and intermittent obstruction of common bile duct; past medical history includes chronic respiratory insufficiency due to severe scoliosis; resting CO2 60 mm Hg; O2 saturation 96% on 3 L O2; has severe restrictive lung disease (30% of predicted); required bilevel positive airway pressure at night; surgeon refused to operate on patient; pulmonary consultant recommended that patient not be intubated (because predicted difficulty with postprocedural extubation); management — patient received glycopyrrolate, ketorolac, and midazolam 15 min before endoscopic retrograde cholangiopancreatography (ERCP); fentanyl avoided; 15 mL of viscous lidocaine 2% administered topically in mouth; procedure performed using light propofol sedation, allowing for continuous spontaneous respirations; ERCP completed in 1 hr; other options of anesthetic management include administration of ketamine, dexmedetomidine, and monitoring of transcutaneous CO2

Case 2: 55-yr-old man presented with large tracheoesophageal fistula secondary to radiation therapy for esophageal cancer; has had multiple episodes of aspiration; O2 saturation 89% on 4 L O2; informed consent stressed avoidance of endotracheal intubation; anesthetic management — glycopyrrolate, ketorolac, midazolam, and lidocaine “swish and swallow”; esophageal stent placed successfully

Case 3: 72-yr-old woman had history of tracheoesophageal fistula secondary to radiation therapy for lung cancer; suffered from shortness of breath and had multiple episodes of food impaction secondary to large esophageal stent pressing on trachea; presented for removal of stent; laryngoscopy performed with good visualization; 7.0-F endotracheal tube passed but resistance encountered after passage beyond vocal cords; exhale CO2 intermittently fell; endoscopy demonstrated friable esophagus, and therefore, forceful advancement of endotracheal tube contraindicated; O2 saturation

Educational Objectives

The goals of this program are to improve the anesthetic care of patients in nonoperating room locations and of patients undergoing surgery for glaucoma. After hearing and assimilating this program, the clinician will be better able to:

1. Identify unique challenges in the anesthetic care of patients in nonoperating room locations.
2. Manage the airway in high-risk patients undergoing gastrointestinal endoscopic procedures.
3. Outline competencies required for administration of anesthesia during procedures in cardiology and interventional radiology suites and for bronchoscopy.
4. Recognize steps in surgery for glaucoma during which stillness of the patient is critical.
5. Consider preoperative and postoperative issues unique to patients undergoing surgery for glaucoma.

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.
declined to 40%; exhaled CO₂ became undetectable; 16-G catheter passed through cricothyroid membrane and jet ventilation applied; emergency tracheostomy performed; lessons learned — endoscopy units should be equipped with necessary supplies when performing complex procedures (eg, overhead lights, tracheostomy kit)

**Recommended anesthetic techniques:** if proceduralist requires absence of movement, perform endotracheal intubation; esophagogastroduodenoscopy increases salivation; therefore, recommended to administer 0.2 mg glycopyrrolate (antisialagogue) 15 min before procedure (also blocks hypersalivation in patients given ketamine)

**Cardiology:** history of cardiac disease known, but coexisting diseases may be poorly described in history and physical examination; prior history usually well-known by cardiologist; cardiologists unable to intubate patients but familiar with ACLS; NPO status usually enforced but should be checked; consensus statement from North American Society of Pacing and Electrophysiology for use of conscious sedation — precise localization of arrhythmogenic substrate leads to longer procedures as well as discomfort and anxiety; deep sedation requires anesthesia services; registered nurses (RN) permitted to advance sedation continuum beyond level of response to verbal commands; practice boundaries exceeded if patient not able to maintain patent airway; presence of physician necessary if radiofrequency ablation or countershock being performed; trained individual (usually RN) must be continuously present whose primary responsibility includes administration of sedation and monitoring of patient; intravenous sedation may be initiated and maintained by RN under orders by physician and with physician in accessible proximity; pharmacologic agents for intravenous sedation include propofol, methohexitol, and etomidate

**Interventional radiology:** patients usually arrive at scheduled times, with occasional emergency cases (eg, transjugular intrahepatic portosystemic shunt); turnover times depend on whether OR and postanesthesia care unit (PACU) used; patient history unknown by radiologist; anesthesiologist may have to obtain informed consent and function as “primary doctor”; radiologists do not have competence in intubation; dedicated PACU required if volume increases; practice guidelines of American College of Radiology/Society of Interventional Radiologists refer to ASA and Joint Commission levels; administration of deep sedation requires greater level of skill and experience and more intensive monitoring than those described in guidelines

**Bronchoscopy:** prior history of pulmonary disease well known by pulmonologist; of all NORA areas, pulmonologists most skilled at intubation; nonmoving patient not required; intubation may be required but usually small endotracheal tube used to permit working around tube; American College of Chest Physicians guidelines include use of propofol; American Association of Respiratory Care recommends performing first 50 procedures under direct supervision and another 50 procedures under indirect supervision

**Society for Non-OR Interventionalists and Anesthesiologists (SONORIA):** new subspecialty society; liaisons with other societies; Accreditation Council for Graduate Medical Education mandate (2016) — all residency programs must develop and teach programs for NORA

**Suggested Reading**


**Anesthesia for Glaucma Surgery**

**Korey A. Jaben, MD, Glaucoma Fellow and Clinical Instructor, Emory University Eye Center Atlanta, GA**

**Case vignette:** 29-yr-old woman presented to emergency department with 3-day history of pain in left eye, photophobia, decreased vision, and nausea and vomiting; past medical history notable for poorly controlled insulin-dependent diabetes; on examination, visual limited to light in right eye and hand motion in left eye; intraocular pressure (IOP) in left eye elevated.

**Glaucma:** elevated IOP caused by interference with aqueous drainage of eye; “angle” refers to space between cornea and iris; glaucoma divided into 3 broad categories (ie, open-angle, closed-angle, and mixed); open-angle glaucoma — drainage angle remains open but drainage channels partially blocked; damage to optic nerve occurs slowly; does not cause symptoms; loss of vision not noticed until extensive damage has occurred; closed-angle glaucoma (CAG) — usually complete closure; can be acute or chronic; acute CAG presents with pain, blurred vision, blurring of cornea, nausea, vomiting, headache, red eye, and other symptoms, and requires immediate treatment

Causes of acute CAG; primary causes often related to formation of eye; secondary causes more commonly require urgent operation; etiologies either push or pull iris forward; phacomorphic glaucoma caused by large cataract that pushes iris forward; scleral buckle (for repair of detached retina) may change shape of eye and push iris forward; tumors in posterior eye, effusions, and large cysts may also push iris forward; iris can be pulled outward by, eg, incarceration of iris (eg, after trauma) fibrovascular membrane

**Case vignette (continued):** patient had flagrant neovascularization; gonioscopy showed many vessels forming fibrovascular membrane, with resulting closure of angle (ie, neovascular glaucoma); ischemia of retina most common predisposing factor for neovascular glaucoma

**Treatment of acute CAG:** initial approach conservative, ie, administration of ocular antihypertensive drops, usually accompanied by oral carbonic anhydrase inhibitors (eg, acetazolamide [Diamox; for patients without renal dysfunction], methazolamide); unfortunately, these agents often fail to reduce IOP; intravenous mannitol — may be administered but not recommended in patients with congestive heart failure; may cause nausea and vomiting; not often used in outpatient setting; laser therapy — for other causes of acute angle closure, used to create hole in iris that provides alternate route for drainage of fluid; however, in patients with neovascular glaucoma, high level of inflammation results in rapid closure of hole; surgery considered last resort

**Surgical options for glaucoma:** trabeculectomy and placement of glaucoma drainage device most common procedures; trabeculectomy not recommended in inflamed eyes because site of trabeculectomy tends to scar; application of antibiotic agents (eg, mitomycin C, 5-flourouracil) have increased success rates of trabeculectomy

**Key points for trabeculectomy:** traction suture placed to allow adequate exposure of surgical site; dissection under conjunctiva exposes bare sclera; for patient on anticoagulation therapy, surgeon may require more time to achieve hemostasis;
partial-thickness scleral flap created in superior sclera and hinged at limbus; dissection under scleral flap then undertaken; at this point, it becomes imperative that patient remain still; blade used to enter anterior chamber behind hinge of scleral flap; entrance into anterior chamber then enlarged; needs to be accomplished quickly to avoid escape of aqueous and flattening of chamber (which makes suturing more difficult); moreover, flattening of chamber accompanied by decrease in IOP, which predisposes patient to devastating complications (eg, choroidal hemorrhage); sutures placed to close scleral flap; careful attention paid to closing conjunctiva over flap because postoperative leak through conjunctiva creates risk for infection; fluorescein strip often used to confirm closure of conjunctive

Preoperative considerations: many patients receiving oral ocular antihypertensive agents (eg, acetazolamide, methazolamide) and may have electrolyte imbalances (eg, mild hyperchloremic metabolic acidosis, hypokalemia); because acetazolamide and methazolamide sulfis compounds, history of allergies should be obtained; anticoagulation — important factor if considering retrobulbar anesthesia; bleeding at surgical site always of concern; bleeding under trabeculectomy flap complicates performing postoperative suture lysis with laser; postoperative hyphema can result in transient increase in IOP

Immediate postoperative considerations: hyphema of anterior chamber may cause occlusion of tube (may require reoperation); nausea, vomiting, and Valsalva maneuver important issues in glaucoma surgery; strong Valsalva maneuver can result in breaking of sutures (may require reoperation for repair); pain in PACU — causes include high IOP, low IOP (possibly caused by leak through conjunctiva), and corneal abrasions; migration of tube — tube that touches cornea may lead to corneal failure; tube that touches iris may lead to inflammation and plugging of tube; diplia and strabismus — more common after implantation of Baerveldt tube; initially treated with glasses or prisms but may require removal of implant; bleb leak warrants aggressive treatment to avoid infection

Treatment of glaucoma in patients hospitalized for other reasons: glaucoma low on list of priorities; avoid any topical medications that dilate eye (eg, scopolamine, atropine); systemic medications usually safe; avoid antibiotics and tobramycin (can cause angle closure)

Suggested Reading

1. According to the Multispecialty Curriculum for Sedation and Analgesia in Gastrointestinal Endoscopy, standards of care for nonanesthesiologists include all the following, EXCEPT:
   (A) Training in use of capnography
   (B) Training in use of electrocardiography
   (C) Competence in use of laryngeal mask airway
   (D) Provider dedicated to uninterrupted monitoring of patient

2. A 58-yr-old woman presented for a retrograde endoscopic cholangiopancreatography. Her past medical history included chronic respiratory insufficiency due to severe scoliosis, resting CO₂, 60 mm Hg, and severe restrictive lung disease (30% of predicted). Appropriate anesthetic management includes all the following, EXCEPT:
   (A) Administration of small doses of propofol
   (B) Administration of ketamine
   (C) Administration of dexmedetomidine
   (D) General anesthesia with endotracheal intubation

3. Which of the following agents are useful for reducing salivation?
   1. Glycopyrrolate
   2. Midazolam
   3. Ketamine
   (A) 2  (B) 1,2  (C) 2,3  (D) 1

4. According to the consensus statement of the North American Society of Pacing and Electrophysiology, which of the following must be performed by anesthesia services?
   (A) Advance of sedation beyond level of response to verbal commands
   (B) Deep sedation
   (C) Initiation of intravenous sedation
   (D) Monitoring of patient

5. According to guidelines from specialty societies, propofol may be administered by which of the following nonanesthesiologists?
   (A) Gastroenterologist
   (B) Cardiologist
   (C) Pulmonologist
   (D) All the above

6. Phacomorphic glaucoma is caused by which of the following?
   (A) Cataract
   (B) Scleral buckle
   (C) Effusion
   (D) None of the above

7. Which of the following is the initial treatment of acute-closure neovascular glaucoma?
   (A) Administration of ocular antihypertensive drops
   (B) Administration of intravenous mannitol
   (C) Laser surgery to create drainage hole in iris
   (D) Immediate surgical correction

8. During trabeculectomy, it is most critical that the patient remain still during which of the following steps?
   (A) Placement of traction suture
   (B) Entry into anterior chamber
   (C) Suture of scleral flap
   (D) Closure of conjunctiva

9. Which of the following treatments for glaucoma is associated with increased risk for oculocardiac reflex?
   (A) Mitomycin trabeculectomy
   (B) Baerveldt shunt
   (C) Paracentesis
   (D) Ahmed shunt

10. Which of the following medications should be avoided in patients with glaucoma?
    (A) Phenytoin
    (B) Tegretol
    (C) Pregabalin
    (D) Topiramate

Answers to Audio Digest Anesthesiology Volume 58, Issue 17: 1-B, 2-C, 3-A, 4-C, 5-D, 6-A, 7-C, 8-B, 9-A, 10-D