MODERATE SEDATION/RADIATION ONCOLOGY

Moderate Sedation in the Hospital

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Procedures outside operating room (OR): increasing in frequency; driven by rapid expansion of diagnostic and interventional techniques performed outside of OR; cost of performing procedures in OR increasing, providing incentive to perform procedures in remote locations; patients demand general anesthesia and sedation for procedures; gastroenterology, cardiology, interventional radiology, bronchoscopy, dentistry, and emergency medicine all present opportunities; exponential growth in anesthesia outside of OR at Mayo Clinic from 2003 to 2010

Challenges: remote locations; unfamiliarity with locations of supplies and equipment; help frequently unavailable; lighting often poor; spaces often cramped; equipment sometimes outdated; cases becoming increasingly complex; patients older, with more severe comorbidities; increasing production pressures often present

Centers for Medicare and Medicaid Services (CMS): in 2009, interpretive guidelines stated anesthesia includes general anesthesia, regional anesthesia, monitored anesthesia care (MAC), and deep sedation analgesia; stated only qualified anesthesia professionals could perform these services; all services along the anesthesia continuum must be organized under single anesthesia service directed by qualified physician; director has authority and responsibility for directing administration of all anesthesia throughout hospital, including off-site locations; provides opportunity for anesthesia departments to demonstrate value to hospital; director responsible for planning, directing, and supervising all activities of anesthesia service, including establishment of criteria for granting privileges for providing all levels of anesthesia and analgesia

Continuum of anesthesia: continuum exists from minimal sedation to general anesthesia, often determined simply by dose of medication; no clear boundary between anesthesia and analgesia; CMS encourages hospitals to establish policies concerning administration of anesthesia vs analgesia and to consider characteristics of patients served, skill set of clinical staff, and characteristics of sedation medications used in variety of settings; anesthesia department responsible for providing expert guidance for sedation policies

Rescue: sedation should be performed only where rescue possible; ability to assist respiration essential; patients may easily transition to deeper levels of anesthesia; personnel without training in anesthesia often unsure about desired level of sedation

Establishment of hospital policies: opportunity to show value to hospital and to set policies; establish standards, educational requirements, and quality improvement metrics; opportunity and responsibility to intervene when problems detected

Difficulties in establishing safe doses: hospital policies often focus on allowing or forbidding specific medications instead of considering doses; patient comorbidities, age, tolerance, and current medications influence safe doses of drugs for sedation; personnel untrained in anesthesia often unaware of variability in patients’ response to sedation; options include restricting provision of moderate sedation to anesthesia professionals and training nonanesthesia professionals to perform it

Key principles: regardless of location, patients must be safe; location must comply with regulations; patients must be offered optimal comfort and efficiency; problems arise when patient's comfort and efficiency assume priority over safety or compliance with regulations

Value of training: with adequate training, level of care improves and number of complications decreases; difficulties arise when clinician performs low volume of procedures and therefore has low level of experience with sedation (“uncomfortable” and fairly common situation)

Program at Mayo Clinic: speaker’s institution had good results training mobile team of registered nurses in moderate sedation; in 2010, team assisted >500 patients with procedures including bone marrow biopsies, dressing changes, placement of chest tubes, and gastrointestinal (GI) procedures; success derived from education and requirements for competencies among team members; implemented tailored list of quality metrics; ongoing problems — inconsistent documentation, including history and physical (H and P), do-not-resuscitate orders, and do-not-intubate orders; capnography not implemented consistently at all locations; discharge disposition still presented difficulties

American Society of Anesthesiologists (ASA) closed claims case no. 1: morbidly obese woman aged 36 yr with ASA class 3 underwent endoscopic retrograde cholangiopancreatography (ERPc) under MAC; patient received midazolam, fentanyl, propofol, and oxygen (O2) via nasal cannula in prone position; patient experienced bradycardia and given atropine; asystole occurred and code initiated, but patient never regained consciousness

ASA closed claims case no. 2: man weighing 100 kg and aged 75 yr with ASA class 2 underwent ERPc under MAC; patient

Educational Objectives

The goals of this program are to improve the management of moderate sedation in remote locations and to improve the administration of anesthesia for radiation oncological procedures. After hearing and assimilating this program, the clinician will be better able to:

1. Comply with Centers for Medicare and Medicaid Services interpretive guidelines on anesthesia care.
2. Assume the authority and responsibility for directing hospital-wide sedation services.
3. Overcome the challenges of providing sedation in remote locations.
5. Provide optimal conditions for the radiologic treatment of malignancies.

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.
received midazolam, fentanyl, propofol, and O₂; patient experienced desaturation and bradycardia; patient sustained anoxic brain injury.

Metzner et al (2009): reviewed closed claims database to examine risk and safety of anesthesia in remote locations in United States; temporary injuries or permanent disabilities more common in OR, but death more common in remote locations; authors concluded moderate sedation at remote locations poses significant risk for patient, particularly related to oversedation and inadequate oxygenation or ventilation during MAC; similar anesthesia and monitoring standards and guidelines should be used in all anesthesia care areas.

Oxygenation vs ventilation: be wary of overreliance on pulse oximetry, particularly in environment of supplemental O₂; oximeter masks inadequately ventilates; some proceduralists tend to perform cursory evaluations involving minimal H and P; CMS requires H and P; speaker’s Institution utilizes template for H and P and brief checklist for nurses providing sedation; criteria implemented for anesthesia consultation.

Capnography: recommended by ASA and Anesthesia Patient Safety Foundation, but practically difficult (expensive); technically difficult for GI procedures; Barnett et al (2009) concluded capnography failed to improve patient safety and satisfaction for routine colonoscopy; capnography helpful in nonroutine cases.

Discharge: CMS requires discharge to responsible adult after patient has received sedation, but does not define “responsible adult,” and unclear what modes of transportation acceptable; taxi not advisable.

Provision of sedation by proceduralist: medications appropriate for relief of pain, treatment of anxiety, and moderate sedation often same (eg, opioids, benzodiazepines), and some proceduralists utilize increased doses to evade sedation policies; according to ASA and CMS guidelines, perfoming procedure cannot also administer sedation; however, emergency medicine has concept of “interruptible” procedure, and some believe this allows proceduralist to administer sedation; use of propofol, ketamine, etomidate, and other medications can quickly lead to problems.

Propofol: warning indicates propofol intended for general anesthesia or MAC for sedation; should be administered only by persons trained in administration of general anesthesia and not involved in conduct of surgical or diagnostic procedure; sedated patients require continuous monitoring; facilities for maintenance of patent airway and instituting cardiovascular resuscitation must be immediately available; these requirements often ignored; joint statement by ASA and the American Association of Nurse Anesthetists states that practitioners utilizing propofol should be prepared for general anesthesia.

Computer-assisted personalized sedation systems: Sedasys system recently withdrawn from market because of limited market penetration, enormous training costs, and safety concerns expressed by Food and Drug Administration.

Emergency department (ED): CMS relaxing some requirements for sedation in ED; patients in ED usually have food in stomachs, but sedation given regardless; one study indicated complications rare, but methodologies and interpretation debatable; expectations lower in ED than in OR.

Suggested Reading

Anesthesia Challenges in Radiation Oncology

Peter K. Schoenwald, MD, Associate Professor of Anesthesiology, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Associate Program Director, Center for Anesthesiology Education, and Staff Anesthesiologist, Cleveland Clinic Anesthesiology Institute, Cleveland, OH

Risks of nonoperating room anesthesia: long distance from OR; ancillary help not available; long distance from equipment and resources; nurses, technicians, and proceduralists do not understand equipment required for emergency; in radiation oncology, anaesthesiologist’s access to patient and patient’s airway often poor; surroundings crowded and poorly designed for anesthesia; lighting often poor; patients often present with significant comorbidities; positioning of patient often presents challenge; environmental risks (radiation) frequently present.

Historic context: radiation oncology defined as science of treatment of cancer utilizing ionizing radiation; Wilhelm Röntgen discovered x-rays in 1895; Becquerel noticed something emitted by luminescent compounds exposed photosensitive plates; Marie and Pierre Curie credited with coining term “radioactivity” and discovered pure sources of radiation; Victor Despeigues published report on effects of x-rays on stomach tumor 1896; Leopold Freund reported cure of large surface nevus using ionizing radiation 1897; Dr. Charles Leonard observed effect of Röntgen rays on malignant tissue 1903.

Procedures: malignancies commonly treated with combination of excision or debulking, chemotherapy, and radiation; radiation procedures usually not painful and require minimal or no sedation.

Factors requiring anesthesia: patient with severe anxiety or claustrophobia; patient mentally challenged or uncooperative; presence of severe comorbidities; presence of compromised airway because of obesity, anatomical issue, or tumor; procedural factors — application of devices may be painful; patient may require immobilization for precise targeting of radiation therapy; procedure may be prolonged; positioning may be difficult.

Treatment techniques: intraoperative radiation therapy — includes electron linear accelerators and low-kilovolt x-rays; can be performed in OR after debulking of tumor; ionizing radiation applied in close proximity to residual tumor; interstitial brachytherapy — radioactive compounds temporarily or permanently placed in direct proximity to cancer via hollow needles; intracavitary brachytherapy — always temporary; therapies include low dose rate (LDR) brachytherapy and high dose rate (HDR) brachytherapy.

Considerations for anesthesia providers: techniques and delivery of treatment vary among institutions and treatment teams; technology evolving at rapid pace; flexibility and understanding of procedure plan and risks required; do not compromise safety of patient; communicate with proceduralist; individualize treatment plan to minimize risks.

Fixation and stabilization devices: plastic mesh mask heated and conforms to patient’s face; mask bolted down for treatment; patients with claustrophobia may have difficulty; similarly, bite.
block device facilitates consistent alignment; intravaginal stabilization device facilitates precise placement of radiation

**Brachytherapy:** brachy means “short distance”; radiation applied in close proximity to tumor; sealed radionuclides applied within needle or some other compound; can be applied via interstitial, intracavitary, or transluminal approach, or on mold; mold involves use of device (usually plastic mold) placed over area for treatment, with radiation placed on mold

**Source loading:** delivery of radioactive material to required location; options include preloading at tip of needle, manual afterloading through hollow needle, and remote afterloading; preloaded and manually afterloaded needles significant sources of radiation exposure to proceduralist

**LDR brachytherapy:** older procedure; utilizes radioactive material with slower decay, requiring ≤144 hr to deliver radiation dose; requires inpatient treatment; very expensive; presents risk to health care personnel; uncomfortable because of prolonged immobilization; pressure injuries to skin may occur; application devices painful

**HDR brachytherapy:** outpatient procedure; lower cost compared with LDR brachytherapy; treatment requires 10 min to 20 min and 4 to 6 treatments; because of high dose of radiation, patient at significant risk if equipment malfunctions; emergency procedures for removal of radiation source required; health care personnel exposed to minimal radiation because patient in containment vault; in case of malfunction, designated health care provider required to enter vault to remove radiation source; vault usually concrete or lead; delivery of radioactive source controlled remotely; patient monitored by camera

**Iridium 192:** half-life ≈75 days; very high dose radiation; delivered via hollow cable

**Dwell point:** location within transit tube where radioactive source stopped (adjacent to malignancy) for precise time

**Treatment for cervical cancer:** treatment depends on stage of disease; treatment outcomes generally positive; patient arrives and undergoes preoperative interview; patient given sedation and taken to treatment room; for iridium 192, vault incorporates minimum 15 cm lead or 2.5 ft to 3.5 ft concrete; room small and crowded with equipment and personnel; patient prepped and induction performed

**Anesthesia techniques:** anesthesia not routinely required unless problem exists; formulate plan to address problem; monitored sedation, deep sedation, and general anesthesia all acceptable; transportation to imaging site usually required, meaning that reliable intravenous catheter and airway control required; first treatment longer than subsequent treatments because of time required for medical physicist and radiation oncologist to formulate precise treatment plan; computer programmed and autoloader connected; once procedure begins, access limited to video monitors; access to room controlled by interlock device; requires ≥2 min for interlock to cycle and allow access to room; oxygenation and airway must be “perfect”; treatment requires 10 min to 20 min depending on state of decay of iridium 192

**Risks:** risk of exposure to radioactive material if rescue required; finite time to access patient for difficulties with airway, hemodynamics, or desaturation

**Suggested Reading**


**Acknowledgments**

Dr. Martin spoke at the 66th Annual Postgraduate Symposium on Anesthesiology, presented by the University of Kansas Medical Center, Department of Anesthesiology and the University of Kansas Medical Center Continuing Education and held April 1-3, 2016, in Kansas City, MO. For information on other CME opportunities presented by the University of Kansas Medical Center, please visit ccfcme.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
  - Take pretest: 5 minutes
- Listen to audio program
  - Review written summary and suggested readings: 35 minutes
  - Take posttest: 10 minutes
1. Which of the following is included in the interpretive guidelines for anesthesia issued by the Centers for Medicare and Medicaid Services (CMS) in 2009?
   (A) Only qualified anesthesia professionals may perform anesthesia and sedation
   (B) Monitored anesthesia care is a distinct category separate from general and regional anesthesia
   (C) The anesthesia director’s authority is limited to the hospital itself and does not extend to off-site locations
   (D) The heads of each department are responsible for establishing criteria for granting privileges for providing anesthesia in their department

2. When establishing policies concerning the administration of anesthesia and analgesia, CMS encourages hospitals to consider which of the following factors?
   1. Characteristics of patients served
   2. Cost of medications
   3. Skill set of clinical staff
   4. Availability of ancillary staff
   5. Characteristics of sedation medications
      (A) 1,2 (B) 3,4 (C) 1,2,3 (D) 1,3,5

3. Problems are most likely to arise when which of the following principles of anesthesia care assumes priority over the others?
   (A) Patients must be kept safe
   (B) Locations where anesthesia is provided must comply with regulations
   (C) Patients must be offered optimal comfort and efficiency

4. According to a 2009 review of the American Society of Anesthesiologists’ closed claims data, which type of outcome was more common in remote locations compared with operating rooms?
   (A) Temporary injuries (C) Death
   (B) Permanent disabilities (D) All were equally common

5. All the following statements about the administration of propofol are true, EXCEPT:
   (A) It should be administered only by persons trained to administer general anesthesia
   (B) Sedated patients require continuous monitoring
   (C) Facilities for cardiovascular resuscitation must be immediately available
   (D) It may be administered by the person performing the procedure if the procedure is considered interruptible

6. Who is credited with coining the term “radioactivity”?
   (A) Wilhelm Röntgen (C) Leopold Freund
   (B) Marie and Pierre Curie (D) Dr. Charles Leonard

7. Which of the following statements about the placement of radioactive compounds in brachytherapy is true?
   (A) Interstitial brachytherapy always involves temporary placement
   (B) Interstitial brachytherapy always involves permanent placement
   (C) Intracavitary brachytherapy always involves temporary placement
   (D) Intracavitary brachytherapy always involves permanent placement

8. Which of the following is the most accurate statement about high dose rate brachytherapy as compared with low dose rate brachytherapy?
   (A) Radioactive materials used have a slower decay
   (B) Cost is higher
   (C) Inpatient treatment is required
   (D) Health care personnel have less exposure to radiation

9. What is the half-life of iridium 192?
   (A) ≈75 days (B) ≈90 days (C) ≈105 days (D) ≈120 days

10. A containment vault for brachytherapy treatments utilizing iridium 192 incorporates a minimum of _______ of lead or _______ of concrete.
    (A) 7.5 cm; 1 ft to 1.5 ft (C) 10 cm; 1.5 ft to 2 ft
    (B) 12.5 cm; 2 ft to 3 ft (D) 15 cm; 2.5 ft to 3.5 ft

Answers to Audio Digest Anesthesiology Volume 58, Issue 27: 1-A, 2-C, 3-B, 4-C, 5-C, 6-D, 7-A, 8-D, 9-C, 10-B