Patient Safety: Does the Anesthesia Care Team Contribute to Risk for Infection?

Anthony N. Passannante, MD, Professor and Executive Vice Chair; Department of Anesthesiology, University of North Carolina at Chapel Hill School of Medicine, and Associate Operating Room Medical Director, UNC Hospitals, Chapel Hill

Background: overall, anesthesia and surgical outcomes have improved, but adverse events due to infection becoming increasingly larger percentage of avoidable burden; infection control violations in operating room (OR) — anesthesiologist with loosely tied mask; multiple rings worn on hands by anesthesiaca practitioners; failure to wash hands before patient contact; incomplete coverage of hair of staff member; intravenous (IV) bag entered with 18-G needle; stopcock left open; failure to swab port with alcohol for 15 sec before access; failure to allow skin preparation to dry for 30 sec before interventional procedure; anesthesia practitioners must consider their contribution to risk for infection.

Maintaining hand hygiene (HH): most important activity in reducing risk of transmitting infection to patients; hands contact multiple items in OR, and become contaminated after contact with any contaminated surface (active decontamination of surfaces likely to increase in future); multiple areas on hands often missed during routine use of alcohol scrub; viruses, staphylococci, Candida, and respiratory syncytial virus cultured from incompletely cleaned hands; HH study (2012) — looked at 8000 HH opportunities; overall failure rate ≈70% for anesthesiologists and nurse anesthetists (current failure rate likely >50%)

Risks for contamination of hands: Dartmouth study — bacterial genome analysis of patient postoperative infections showed 10% to 20% likely directly connected to anesthesiology practitioners; change in routine habits of HH (rather than “special” procedures) needed to eliminate risk; Centers for Disease Control and Prevention (CDC) study — all evidence showing that strict aseptic technique reduces transmission of infection categorized as IA or IB (ie, strongest levels); often, senior staff least likely to practice good aseptic technique and most resistant to change of habits

Spread of infection: transmission of hepatitis C — well documented; case 1 — anesthesiologist in endoscopy center responsible for severe breaches in sterile technique (eg, reuse of syringes, single-dose propofol vials entered multiple times) transmitted hepatitis C virus from patient to patient; clinic now bankrupt; physician charged with second-degree murder; CDC genome analysis indicated 99.99% chance that patients infected on single day by single anesthesiologist (virus originated from single patient); efforts to eliminate use of multidose vials often met with resistance, based on ethical and economic considerations (however, use waning); Netherlands study — systemic inflammatory response syndrome due to misuse of single-dose vials and injections given to multiple patients well documented

Safe use: properties of propofol — lipid emulsion; good culture medium; must be discarded if opened for >6 hr; be aware of and follow Food and Drug Administration guidelines for safe handling; glass ampules — swipe neck with alcohol before opening; use device on needle or syringe to filter out any pieces of glass; currently being discontinued at many sites; guidelines require swiping rubber stopper on vial (even immediately after removal of plastic cap)

CDC guidelines on injection safety: use aseptic technique; do not administer medications from one syringe to multiple patients; use fluid bags only once; do not enter fluid bag with used needle; use single-dose vials whenever possible; if multidose vial must be used, enter only once, then discard; do not leave multidose vials in immediate patient treatment area (including Pyxis machine); wear mask during lumbar punctures; case 2 — anesthesiologist did not wear mask during lumbar puncture; analysis proved that bacteria from physician’s pharyngitis caused meningitis in patient

University of North Carolina protocols

Use of graphics: placed in every area of institution; messages include one-time-only use of single-dose medication vials and drawing up of injectables as needed (rather than ahead of time); CDC — current nationwide campaign designed to increase awareness of providers’ effect on medication safety (“one needle, one syringe, one time”); consistent practice decreases risk of transmitting blood-borne infections; Joint Commission mandate at UNC — high-level disinfection of laryngoscope blades requested; although not proven to be common source of transmission of infection, intentional use of contaminated equipment unjustifiable

Educational Objectives

The goals of this program are to reduce risks to patients associated with anesthesia procedures, and to improve the outcomes of patients undergoing anesthesia for endovascular procedures. After hearing and assimilating this program, the clinician will be better able to:

1. Recognize the role that anesthesia practitioners play in increasing patients’ risk for infection.
2. Prevent adverse events associated with failure of anesthesia practitioners to follow guidelines on hand hygiene, use of injectable medications, and use of masks.
3. Implement safety measures proven to control hospital infections.
4. Evaluate the evidence supporting the use of endovascular repair and lumbar drainage in the treatment of thoracic and abdominal aneurysms.

5. Select appropriate anesthesia techniques for patients undergoing endovascular repair of aneurysms.

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.
Catheter-related blood stream infections (CRBSI): rates significantly reduced at UNC; contamination of infusate (uncommon) and contamination of hub (from patient’s endogenous flora) possible modes of infection; infection rates due to insertion now substantially reduced, so catheters now become contaminated mostly during daily use (increased swabbing of ports expected to further reduce these rates); **CDC recommendations** — strength of evidence mostly IA and IB; UNC implemented all recommendations throughout institution between 2000 and 2009, and rate of central line–associated infection decreased markedly over same period; hospital provides specialized kit that contains all materials needed; recommendations included routine use of ultrasound guidance for central line insertion; **arterial lines** — epidemiologists at UNC requested that program for central lines be applied; less evidence supports routine infection of arterial lines, but speaker sees no reasonable reason to resist implementation; **Changing behavior:** expensive from institutional perspective; accomplishing change throughout medical staff requires resources, attention, and personnel willing to be persistent in enforcing new protocols; **Clean In-Clean Out program** — nurses deputized to observe all members of health care team and intervene if patient contact attempted before HH; most physicians and staff comply regularly after several prompts; program highly successful in past year; current HH compliance rate 94%, vs <50% in 2009; change likely not durable in absence of observation (may require continued investments in observation and intervention); pediatric intensive care unit (ICU) first unit on program; CRBSI and pneumonia rates now extremely low; **hand sanitizer** — must be easily accessible; dispensers placed at entrances to all ORs, next to anesthesia assignment board, and at all outpatient entry and exit areas; dispensers checked and restocked daily by environmental services; periodic hand washing still necessary to avoid dry hands due to alcohol

**Use of stopcocks:** convenient and easy to use; alcohol swabs effective for cleaning outside, but cleaning inside extremely difficult; replacing stopcocks with luer valves (eg, Clave, Clearlink, NU-SITE) may eventually be required; University of Florida study — looked at use of device impregnated with alcohol to swab inside stopcock for cleaning; however, process ineffective (incapable of uniformly contacting all internal surfaces)

**Joint Commission Sentinel Event Alert:** preventing infection from misuse of vials to be considered sentinel event; accreditation evaluation now to include review of policies and procedures for use of single- and multidose vials

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**Endovascular Procedures: Anesthetic Approaches and Perioperative Considerations**

**Harendra Arora, MBBS, Professor of Anesthesiology, University of North Carolina at Chapel Hill, School of Medicine**

**Endovascular aneurysm repair (EVAR): case 1 — 65-yr-old man with infrarenal aneurysm presents for aorto-bi-iliac endovascular stent graft; surgeon requested regional anesthesia, citing improved morbidity and mortality; aneurysm repair performed via abdominal incisions until early 2000s; associated with significant blood loss and long stays in ICU; perioperative in-hospital mortality ≈5%; EVAR first performed in 1991, and now comprises 75% of repairs; reasons for difference include reduced risk for migration and endoleaks; procedure — bilateral groin incisions made; 18 to 24 Fr sheaths used; stent deployed several centimeters above aneurysmal sac; iliac sections then deployed; avoids need for large incision and clamping of aorta; blood loss, morbidity, and hospital stay minimized; Cochrane review — 30-day mortality significantly lower with EVAR (in-hospital mortality 1.4%, vs 4.2% for open repair; odds ratio 0.33); however, no difference seen in long-term mortality (odds ratio 0.98); reasons for difference unclear (likely due to comorbidities and/or other underlying conditions); reintervention rates significantly higher in EVAR group in long term (15%-25% return for correction of endoleak or graft migration)

**Optimal anesthetic for EVAR:** all studies retrospective reviews; **European study** — 5500 patients divided into low and high risk; length of stay, need for admission to ICU, systemic complications, and mortality significantly lower in patients undergoing local or regional vs general anesthesia (GA); greater benefit seen in high-risk patients; **Wake Forest study** — among 6000 patients undergoing elective EVAR, GA associated with slight increase in length of stay compared with spinal and local anesthesia, but no difference when compared to epidural anesthesia; increased pulmonary morbidity seen with GA vs spinal or local anesthesia

Local or monitored anesthesia care (MAC): in German study, all patients undergoing EVAR received local anesthesia first, unless excluded due to predefined criteria (offered to 85% of patients; conversion rate ≈7%); because of potential for bias with use of regional or local anesthesia (ie, more often used in patients with lower-complexity procedures), strong conclusions cannot be drawn from current data; 2 large retrospective reviews suggest that local and regional anesthetic possibly superior to GA; Wake Forest study suggests spinal superior to epidural; local anesthesia possible in significant number of patients

Case 1 (continued): surgeon request for regional anesthesia appropriate; single-shot spinal used for short procedures; epidural or combined spinal-epidural (CSE) performed for longer procedures; GA back-up option if regional anesthesia contraindicated; local anesthesia rarely used

**Fenestrated endovascular repair (FEVAR):** case 2 — 70-yr-old man presented for 4-vessel FEVAR of Crawford type 3 thoracoabdominal aneurysm; surgeons requested lumbar drain; Crawford type 3 — involves aorta from sixth rib to aortic bifurcation; involves critical vessels (eg, renal, celiac, and superior and inferior mesenteric arteries); graft must cover involved aorta while lining up fenestrations to critical vessels (procedure often difficult and prolonged); use of 3-dimensional reconstruction allows surgeons to locate position and angle of fenestrations; used to manufacture device customized for individual patient; procedure — stent deployed, and holes lined up with vessels; graft completed in iliac vessels; candidates for FEVAR tend to have more complex aortic disease and higher risk than those for EVAR; surgeons must have expertise in placement; perioperative mortality (5%-7%) higher than that with EVAR; patients also have 4% to 8% risk for spinal cord injury and ischemia

**Anesthesia for FEVAR:** usually performed under GA; right-sided radial arterial line usually placed because left axillary artery used for access; lumbar drain often requested; epidural or CSEs rarely used, unless only 1 to 2 vessels involved; local or MAC generally not used

**Placement of lumbar drain in FEVAR:** spinal cord perfusion pressure optimized by increasing mean arterial pressures and decreasing cerebral spinal fluid (CSF) pressure through use of lumbar drain, with goal of maintaining spinal cord perfusion pressure above 70 to 75 mm Hg; most clinicians zero CSF drain transducer at level of right atrium; overdrainage should be avoided (can cause herniation, bleeding from bridging veins, and intracranial hemorrhage); drainage maintained at 10 to 15 mL/hr (more if patient has active symptoms of ischemia); target CSF pressure 10 to 15 mm Hg; drains usually left in place for 48 to 72 hr

**Thoracic endovascular repair:** case 3 — 70-yr-old man undergoing thoracic endovascular repair for type B dissection; surgeons requested lumbar drain; graft covers descending aorta,
starting from subclavian artery; risk for paraplegia increased if length of graft >15 cm (lumbar drain requested in those cases); speaker recommends placing lumbar drain and performing spinal anesthetic through lumbar drain, with small dose of local anesthetic to obtain spinal level; drainage of CSF begins when surgeon ready to deploy stent

Ruptured abdominal aortic aneurysm (AAA): case 4 — 70-yr-old man presented emergently to OR for ruptured AAA (historically difficult to manage in OR; in-hospital mortality 50% to 80%); endovascular repairs markedly improve outcomes; meta-analysis study — perioperative mortality significantly lower for endovascular repair vs open repair (odds ratio 0.62); optimal anesthesia — limited data available; local anesthesia or MAC can be used in patients presenting with contained AAA (improves control of hemodynamics); EVAR placed after groin incisions made, with use of GA if any further surgical treatment needed; GA needed if patient unstable; goal to maintain relative hypotension until graft deployed; maintain relative hypertension after graft deployed to maintain perfusion to spinal cord

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1. Despite overall improvements in surgical and anesthesia outcomes, the proportion of avoidable burden due to infection is increasing.
   (A) True ** (B) False

2. Which of the following statements about maintaining hand hygiene (HH) in the operating room is true?
   (A) 3% to 5% of postoperative infections appear to be directly related to HH among anesthesia practitioners
   (B) On observation of 8000 HH opportunities, a failure rate of 70% was seen among anesthesiologists and nurse anesthetists
   (C) Senior staff members are the most likely to learn new HH habits and to practice optimal aseptic technique
   (D) Strength of evidence showing that strict aseptic technique reduces infections is generally category II

3. Federal safety guidelines for propofol and medication injection include which of the following?
   1. Alcohol swipe is not required after first removal of cap from a propofol vial
   2. Single-dose vials should be used when possible, and for one patient only
   3. More than one medication may be delivered with the same syringe if the needle has been replaced
   4. Face masks should be used during lumbar punctures
   5. Multidose vials should not be left in the immediate patient treatment area
   (A) 1,2 (B) 3,4 (C) 1,3,5 (D) 2,4,5 **

4. High-level disinfection of laryngoscope blades is:
   (A) Unjustified because there is no proof that they are a significant source of infection
   (B) Justified because they have been shown to be a common source of infection
   (C) Justified despite the fact that there is no proof that they are significant source of infection

5. Which of the following is true of the “Clean In-Clean Out” program for improving HH?
   (A) Depended on self-monitoring by physicians and staff
   (B) Increased HH compliance rates from <50% to 65%
   (C) Resulted in significant reduction in pneumonia in the pediatric intensive care unit
   (D) Was easy to implement and required minimal costs in time, effort, and personnel

6. Patients treated with endovascular aneurysm repair (EVAR) had lower _______. compared with patients who underwent open repair.
   1. Perioperative blood loss
   2. Long-term mortality
   3. 30-day mortality
   4. Reintervention rates
   (A) 1,2 (B) 3,4 (C) 1,3 ** (D) 2,4

7. Studies of patients undergoing EVAR suggest that length of stay and pulmonary and systemic complications were increased in patients who received _______ anesthesia.
   (A) Epidural (B) General (C) Spinal (D) Local

8. Which of the following is typically used in patients undergoing 4-vessel fenestrated endovascular repair (FEVAR)?
   (A) Lumbar drain (B) Combined spinal-epidural anesthesia
   (C) Left-sided radial arterial line (D) All the above

9. During FEVAR, drainage of cerebral spinal fluid should be _______ if there are active signs of ischemia; _______ can cause herniation or intracerebral hemorrhage.
   (A) Increased; overdrainage (B) Decreased; overdrainage
   (C) Increased; underdrainage (D) Decreased; underdrainage

10. Which of the following statements about hemodynamically stable patients who undergo endovascular repair of an abdominal aortic aneurysm is true?
   (A) Perioperative mortality is similar to that of patients who undergo open repair
   (B) Local anesthesia is preferable to general anesthesia
   (C) Relative hypotension should be maintained after the stent is deployed
   (D) None of the above