Learning From Others:

A Case Report From the Anesthesia Incident Reporting System

Anesthesia Quality Institute
ANESTHESIA INCIDENT REPORTING SYSTEM (AIRS)

Review of unusual patient care experiences is a cornerstone of medical education. Each month, the AQI-AIRS Steering Committee abstracts a patient history submitted to the Anesthesia Incident Reporting System (AIRS) and authors a discussion of the safety and human factors challenges involved. Real-life case histories often include multiple clinical decisions, only some of which can be discussed in the space available. Absence of commentary should not be construed as agreement with the clinical decisions described. Feedback regarding this article can be sent by email to the AIRS Committee: hpyzGhzhox5vyn. Report incidents or download the AIRS mobile app at ~ ~ ~ 5hxphpyz5vyn.

Case 2016-12: Cleanliness is Next to Godliness

Former 33-week gestational age premie from the neonatal intensive care unit (NICU) who developed necrotizing enterocolitis (NEC), which required surgical exploration. The baby presented to the operating room with a single lumen Shiley central venous catheter and a 24-gauge peripheral intravenous (PIV). The baby came from the NICU with dextrose infusing through the central access and the team in the operating room (O.R.) connected an isotonic intravenous solution to the PIV for bolus medication administration. General anesthesia was induced and the trachea was intubated. Laparoscopic exploration was converted to an open small bowel resection that occurred without complication. The hematocrit at the start of the procedure was 26 percent. The blood pressures were low at the time of conversion to the open procedure so the anesthesia team began transfusing 30 mL of packed red blood cells (PRBC). The dextrose infusion line through the central access was exchanged for the PRBC transfusion with gloved hands, but not in a sterile fashion. The dextrose infusion was then piggy backed to the PRBC line. The case progressed without complication and the baby was transferred tracheally intubated to the NICU. Upon arrival to the NICU, the NICU staff noticed the dextrose line had been disconnected from the central line and asked the anesthesia team if this was done in a sterile manner as per NICU protocol. The anesthesia team told the NICU they were unaware of this policy as it had not previously been distributed to the anesthesia staff, and an incident report was filed. The NICU has a very strict policy for sterile technique that they use when accessing central lines in attempt to reduce their acquired infections (CLABSI). While this policy was well known within the NICU, it was never communicated to the anesthesia staff as a policy or on a patient specific basis on handoff of patient's with in-situ central venous catheters.

Discussion:

Hospital acquired infections (HAIs) continue to cause significant morbidity and mortality in the United States. The Centers for Disease Control and Prevention (CDC) conducted a HAI prevalence survey and reported that in 2011, there were an estimated 722,000 HAIs in U.S. acute care hospitals and that approximately 75,000 of those patients died during their hospitalization.[1] As anesthesiologists, we are acquainted with surgical site infections (SSI), central line associated bloodstream infections (CLABSI) and catheter acquired urinary tract infections (CAUTI). These and other conditions such as ventilator associated pneumonia (VAP) and gastrointestinal illnesses have taken on more significance over the last 10-15 years knowing their association with overall morbidity and mortality as well as financial penalties imposed by third-party payers for their occurrence.

There are published CDC guidelines for the prevention of HAIs, which include insertion and maintenance bundles for both CLABSI and CAUTI,[2] that have been adopted by presumably a large percentage of U.S. acute care hospitals. Yet there appears to be an enormous gap between publication and dissemination of these guidelines and their actual incorporation into clinical practice. This should come as no big surprise to any of us. The statistic often cited is that it takes at least 17 years to turn 14 percent of original research into clinical practice.[3]

The CDC CLABSI guidelines are divided into two separate bundles, an insertion bundle and a maintenance bundle. The central line insertion bundle recommends that practitioners adopt maximum barrier precautions by practicing hand hygiene, wearing a mask, hat and a gown and donning sterile gloves. The patient should be fully covered with a surgical drape from head to toe, not just from the nipple line. Chlorhexidine is recommended as the skin cleansing agent rather than alcohol or iodine-based solutions. The femoral site is not recommended in adults due to the increased risk of infection and deep vein thrombosis.

Additional recommendations are that practitioners use a checklist to minimize the likelihood of a deviation from standard process. Most of all, it is imperative that organizations promote a culture of safety in which all members of a team who are present during a central line insertion feel empowered to speak up should they observe a break in sterility regardless of their position or role on the team (medical students, nursing students, nurses, residents, fellows, attendings). Many experts believe that is useful if the most senior member of the team instructs team members to speak up prior to beginning the procedure. Other practical measures

that may decrease the incidence of infection are the use of antimicrobial-impregnated catheters and the use of chlorhexidine-impregnated dressings.

The case presented in this article illustrates a clinical scenario that is not unusual – a fragile patient undergoing a major surgical procedure with limited venous access. The central line may often be the "best" access and the anesthesia team utilizes the central line to administer fluids and/or blood products. There are a number of catheters that fall into the category of central lines. These include percutaneous lines, tunneled catheters, venous ports and peripherally inserted central catheters (PICC).

The CDC has guidelines for the handling of central lines known as the maintenance bundle. They recommend practicing hand hygiene prior to handling the line. Gloves should be worn. The injection hub/port should be scrubbed prior to the injection of any drug. Central catheters should only be accessed by sterile devices. Hand hygiene devices may not be readily available near the anesthesia machine which may be a barrier to compliance. From a human factors perspective, it may be difficult to adhere to the guidelines in the O.R. setting due to the rapidly changing nature of the patient's condition and the necessity to administer drugs quickly.

Anesthesiologists are trained to care for and manage patients in the perioperative setting. While residency training focuses on the various aspects of perioperative care, perhaps programs should consider the role that anesthesiologists play in perioperative infections. Anesthesia teams are responsible for administering antibiotics in a timely fashion in order to prevent SSIs. However, it is possible that we can play a much larger role in the prevention of perioperative infections. For example, we have known for 20 years that inappropriate practices associated with the administration of propofol can result in cross-contamination and infectious outbreaks.[4]

All of us consider O.R.s to be a sterile environment. We clearly adhere to sterile surgical technique, ensure that all surgical instruments are sterile and that surgical personnel practice appropriate hand hygiene and wear appropriate surgical attire. The truth is that the O.R. is far from a sterile environment. While we strive to maintain sterility in our practices, the O.R. itself is a harbinger of multiple organisms and it would be impossible to eradicate the O.R. of organisms. The anesthesia work environment (AWE) can be conceptualized as the area in the O.R. in which we practice. The anesthesia machine, the equipment carts, all anesthesia-related equipment, drug carts, I.V. carts and regional anesthesia carts all fall into this category. These areas can be contaminated as quickly as four minutes with contamination increasing as the case proceeds.[5] Part of the reason for this may be that the layout of the AWE is generally not conducive to easy access to our patients. They are under drapes, sometimes with arms to the side. We do not have the same access to a central line that those in the ICU might have (sometimes we are literally working in a tunnel to get to the line). This can lead to an more contamination of both the line and the surrounding environment by blood taken from the line.

One concern is that the nature of anesthetic practice may cause anesthesiologist to serve as vectors of infectious disease transmission due to contaminated hands and gloves.[6] Hand hygiene awareness and education among anesthesiologists may be lacking. The World Health Organization (WHO) currently advocates the "5 moments for hand hygiene"[7]:

1. Before contact with the patient
2. Before an aseptic task
3. After body fluid exposure risk
4. After patient contact
5. After contact with patient surroundings

Many elements are required for successful implementation and adoption of these guidelines. Among these are dissemination of the material, education of staff and examining the environmental factors problems (lack of hand hygiene devices, constant contact with body fluids, constant contact with patient surroundings). Fernandez et al. studied the gaps in knowledge among anesthesiologists regarding the five moments of hand hygiene.[8] They found one or more knowledge deficits in over 80 percent of respondents with a mean number of correct answers of 2.89 out of five questions.

Birnbach et al. conducted a study using high-fidelity simulation to investigate the extent to which anesthesiologists can contaminate the AWE.[9] They asked 10 anesthesia residents to conduct a simulated induction and intubation sequence for six minutes. Prior to initiation of the simulation, the lips and the inside of the mouth of the patient simulator was coated with a fluorescent marker. Residents were instructed to don gloves but no instructions were given regarding when to remove them. The investigators then used an ultraviolet marker to determine the objects in the AWE that were positive for fluorescence.

Continued on page 42

Continued from page 41

Forty potential sites/objects were studied for fluorescence. The mean number of stained objects was 31 (range 27-35). Of note, 13 sites were contaminated in 100 percent of the scenarios. These included, but were not limited to, the laryngoscope handle and blade, the I.V. hub, the oxygen mask and the anesthesia machine surface (see article on page 20).

In a follow-up study, Birnbach and his colleagues repeated the study but assigned half of the residents to double gloves and half to wear a single glove.[10] The double-gloved residents were instructed by to remove the outer set of gloves immediately after verified intubation. Forty potential objects were again examined for fluorescence. Of the residents who wore single gloves, the mean number of objects positive for fluorescence was 20.3. Of the residents who wore double gloves, the number of objects was 5.0, a statistically significant difference.

"All of us consider O.R.s to be a sterile environment. We clearly adhere to sterile surgical technique, ensure that all surgical instruments are sterile and that surgical personnel practice appropriate hand hygiene and wear appropriate surgical attire. The truth is that the O.R. is far from being a sterile environment."

Conclusion

HAIs continue to plague health care with well-documented consequences in morbidity and morality. Third party payers are refusing to reimburse hospitals for these events so there is a financial impact as well. There is mounting evidence that the AWE is a potential bacterial reservoir and that anesthesiologists may indeed be vectors of transmission. A considerable portion of the April 2015 issue of *Anesthesia & Analgesia* (*A&A*) is devoted to research articles that shed light on the potential impact of anesthesiologists on perioperative infections. In an editorial in the April issue, Dr. Steven Schafer, editor-in-chief of *A&A* at the time, states "anesthesiologists are well positioned to make a difference in perioperative infection."[11] Without question, the O.R. is a challenging environment from an infection control perspective, and the practice of anesthesia only makes the challenge more daunting. However, as the profession and practice of anesthesiology has progressed from the intraoperative arena to the wider perioperative arena, perhaps it is time for all of us take heed of what our roles are in the prevention of perioperative infections.

References:

1. HAI Data and Statistics. Centers for Disease Control and Prevention website. https://www.cdc.gov/hai/surveillance/index.html. Updated March 2, 2016. Accessed September 27, 2016.
2. Healthcare-associated Infections. Centers for Disease Control and Prevention website. https://www.cdc.gov/HAI/bsi/bsi.html. Updated March 1, 2016. Accessed September 27, 2016.
3. Balas EA, Boren SA. Managing clinical knowledge for health care improvement. *Yearb Med Inform.* 2000;(1):65-70.
4. Bennett SN, McNeil NM, Bland LA, et al. Postoperative infections traced to contamination of an intravenous anesthetic, propofol. *N Engl J Med.* 1995;333(3):147-154.
5. Loftus RW, Koff MD, Burchman CC, et al. Transmission of pathogenic bacterial organisms in the anesthesia work area. *Anesthesiology.* 2008;109(3):399-407.
6. Loftus RW, Patel HM, Huysman BC, et al. Prevention of intravenous bacterial injection from health care provider hands: the importance of catheter design and handling. *Anesth Analg.* 2012;115(5):1109-1119.
7. Five moments of hand hygiene. World Health Organization website. http://www.who.int/gpsc/tools/Five_moments/en/. Accessed September 28, 2016.
8. Fernandez PG, Loftus RW, Dodds TM, et al. Hand hygiene knowledge and perceptions among anesthesia providers. *Anesth Analg.* 2015;120(4):837-843.
9. Birnbach DJ, Rosen LF, Fitzpatrick M, et al. The use of a novel technology to study dynamics of pathogen transmission in the operating room. *Anesth Analg.* 2015;120(4):844-847.
10. Birnbach DJ, Rosen LF, Fitzpatrick M, et al. Double gloves: a randomized trial to evaluate a simple strategy to reduce contamination in the operating room. *Anesth Analg.* 2015;120(4):848-852.
11. Schafer SL. Making a difference in perioperative infection. *Anesth Analg.* 2015;120(4):697-699.