

What is NORA? What is so hard about it?

Avoiding crisis, managing proceduralists, and financial implications.

Jason S. Lane MD, MPH

Nashville, Tennessee

Travis J. Hamilton, DO

Objectives

1. Define NORA.
2. Evaluate the patient safety risks associated with providing anesthesia care outside the operating room environment.
3. Discuss possible anesthetic techniques for the various diagnostic and therapeutic procedures that occur in endoscopy suites.
4. Discuss possible anesthetic techniques for the various diagnostic and therapeutic procedures that occur in interventional radiology, MRI, PET, CT, and radiation oncology.
5. Discuss strategies in anesthesia support service scheduling and communication with proceduralists to optimize care of NORA patients.
6. Understand the importance of knowledge of basic aspects of the planned intervention in creating a safe and effective anesthetic plan.
7. Compare and contrast the financial implications of providing NORA support services in the private practice and academic anesthesiology settings.

Stem Case & Key Questions

A 67-year-old male with a recent history of melena presents to the endoscopy suite at your hospital for endoscopic gastro-duodenoscopy (EGD). He is in the endoscopy suite pre-op holding unit when you meet him and his family. He appears pale and frail. He has a complex medical history including:

Past Medical History

- Stage IV Gastro-esophageal junction adenocarcinoma (unresectable, being treated with palliative chemotherapy and radiation)
- Severe coronary artery disease (PCI with DES 2 years ago)
- Hyperlipidemia
- Heart failure (EF 20%)
- Hypertension
- Insulin dependent diabetes
- Recent acute embolic parietal lobe stroke

Medication List

- Atenolol 100mg QD
- Simvastatin 40m QD
- Warfarin 5mg QHS
- Carboplatin IV weekly
- Paclitaxel IV weekly
- Zoledronic acid IV weekly

His most recent laboratory studies show a hematocrit 25, platelet count 150, WBC 2.9, Creatinine 1.2, Potassium 4.1, INR 2.0. He has a 20-gauge well-functioning IV in his right hand.

Vital signs: HR: 105 bpm, BP 110/60; RR 15; SpO2 97% on room air

You introduce yourself as the attending anesthesiologist who will be providing the anesthesia for his EGD. He tells you that he been battling unresectable esophageal cancer for the past 15 months. He states that he has known metastasis to his left hip, left eighth rib and abdominal lymph nodes. At his initial presentation when esophageal cancer was diagnosed (15 months ago) he was unable to take solid foods. However, after several rounds of chemotherapy and radiation he is now able to tolerate solid foods normally and is actually gaining weight. He goes on to tell you that he had a stroke approximately 4 months ago, for which his symptoms resolved and he is currently taking an anticoagulant (Warfarin) per his doctors' recommendations. Over the past three days he has felt progressively weaker, tired, and has noticed black "tarry" feces.

1. *What are your concerns about delivering anesthesia to this patient for his EGD?*

2. *What questions do you want to ask him in pre-op holding? What aspects of the physical exam are most important to you?*
3. *What are your options for anesthetic technique for his EGD?*

Based on your pre-operative interview you direct your anesthesia care team to provide a spontaneously breathing general anesthetic with nasal cannula supplemental oxygen and Total Intravenous Anesthetic (TIVA) propofol technique.

1. *What are your preferred monitors for this anesthetic technique?*

Once an adequate level of anesthesia is obtained in your spontaneously breathing patient, the gastroenterologist begins the EGD. There is friable mucosa at the gastro-esophageal junction but no obvious bleeding point. The EGD continues, stomach appears normal with a small amount of old clotted blood in the fundus. Upon passing through the pylorus with endoscope, a large visible pulsatile vessel on the posterior wall of the duodenum is seen with adherent clot. The gastroenterologist proceeds to irrigate the clot, and suddenly a large amount of pulsatile blood flashes upon the video screen. The gastroenterologist tries to suction the blood, and cauterize the bleeder with minimal success. He retracts the endoscope back into the stomach and you see blood visibly entering retrograde through the pylorus into the stomach.

1. *What are you concerned about most now at this point in the case?*
2. *What is your plan for the patient's airway given this newly found bleeding source? IV access?*

After discussion with the gastroenterologist, you convince him to remove the endoscope and allow your team to rapidly intubate the patient. You bolus Succinylcholine 150mg iv, and your CRNA quickly passes an endotracheal tube between the vocal cords using a McGrath video laryngoscope. At the same time, another anesthesia team member tries to get larger peripheral iv access without success.

1. *What do you do now? Do you let the gastroenterologist attempt again to control the bleeding now that your team has safely secured the airway?*
2. *Do you stop the gastroenterologist and upgrade to a large bore central venous catheter?*

Patient's HR is now rising (120bpm) and his blood pressure is now 90/50. You have crystalloid fluid running wide-open via the 20-gauge iv. You opt to let the gastroenterologist attempt EGD control of bleeding again while your team members try to gain large peripheral iv access. The

gastroenterologist's endoscope enters the duodenum and clearly shows pulsatile, uncontrolled bleeding. Suction aspiration of blood via endoscope cannot keep up with the amount of bleeding. The gastroenterologist decides to "tamponade" the bleeding source by placing the endoscope against the bleeding vessel with pressure from the endoscope. This appears to have temporarily controlled the bleeding. You quickly place a Right internal jugular large bore central venous catheter and request a "MTP: Massive Transfusion Protocol" be initiated. Within 5 minutes you receive word back from the Hospital's blood bank that the endoscopy suite is not eligible for MTP. Instead you are issued three units of packed red cells which you quickly administer via the central line.

1. *What do you do now?*

After discussion with the gastroenterologist, a joint decision is made between the both of you to emergently consult interventional radiology for coil embolization control of the bleeding.

1. *What are your priorities now that you have decided the patient needs to be transferred to interventional radiology?*
2. *How do you initiate transfer to interventional radiology? Who makes the call to interventional radiology (GI physician? Anesthesiologist? Someone else?)*
3. *What about the case that is scheduled to follow in that endoscopic procedure room?*

The patient's blood pressure is now stable at 105/70, with a heart rate of 90bpm. Your team transfers the patient down the hallway to the interventional radiology suite. The gastroenterologist accompanies you as he is still holding the endoscope in place to apply pressure to the bleeding vessel. The interventional radiology staff usher you into an empty procedure room where the patient is transferred onto the fluoroscopy table.

1. *What are your concerns now that you have changed venue from endoscopy suite to Interventional radiology suite?*

The anesthesia technician brings an anesthesia machine into the IR procedure room. You connect the patient to the anesthesia machine. While the IR staff prep the patient's groin for vascular access for intervention, your team places a right radial arterial line. The gastroenterologist is still present holding pressure on the bleeding vessel via endoscope. Blood pressure drops again (70s/40s) with an increase in heart rate to 125bpm. You request an additional 3 units of packed red cells from the blood bank and are promised the blood will arrive via tube transport system in 2 minutes. The blood doesn't arrive. You decide to continue resuscitating patient with crystalloid fluids. The interventional radiologist begins the procedure. Approximately 15 minutes later, a nurse from the endoscopy suite comes running into the IR procedure room with the 3 units of blood that were supposed to have been sent via

tube system direct to IR suite. The gastroenterologist leaves the procedure room (because he has another case to start in the endoscopy suite) with his endoscope, thus removing the pressure on the GI bleeding point. The interventional radiologist performs angiography of the abdominal aorta, focusing on the celiac artery, and superior mesenteric artery. A blush is seen on fluoroscopy at the gastro-duodenal artery. Coils are deployed and the bleeding is confirmed to have been stopped by coil embolization. Vitals return to baseline (HR 90bpm, Blood pressure 110/60) as resuscitation continues.

The gastroenterologist returns to the IR suite (as he realizes he does not have an anesthesia team to provide anesthesia support for his case in the endoscopy suite). The interventional radiologist requests that the gastroenterologist perform another EGD on this patient in the IR fluoro procedure room to confirm endoscopically that all bleeding has stopped. The gastroenterologist performs an EGD and confirms that the IR coil embolization procedure has indeed been successful in stopping the bleeding.

- 1. What do you do now? Extubate the patient? Transfer to ICU? Bring to recovery room? Which Recovery room (Radiology? GI Endoscopy? or Main OR Recovery Room?).*
- 2. If transferring to an ICU, who makes the call to arrange an ICU bed for the patient?*
- 3. Who talks with the patient's family in the endoscopy waiting room about what happened to their loved one?*
- 4. Should a call be placed to your hospital risk manager to alert them to what happened?*

Problem Based Learning Discussion

Providing anesthesia support to patients outside the traditional operating room setting can be very challenging. With the marked increase in the minimally invasive procedures now offered by gastroenterologists, cardiologists, radiologists, neurologists, and pulmonologists, there is an ever increasing need for anesthesia support in remote locations.

The acuity of patient illness and associated comorbidities is increasing. Gone are the days when you could expect your average GI endoscopy patient to be an ASA-1 or ASA-2 presenting for a screening colonoscopy. It is now commonplace to have patients in the endoscopy suite who just underwent a liver transplant 48 hours prior and are in need of endoscopic retrograde cholangiopancreatography to determine source of a bile leak. Likewise, in interventional radiology, we are now expected to care for patients with morbid obesity, obstructive sleep apnea, severe coronary artery disease, aortic stenosis, and pulmonary hypertension presenting for CT guided cryo-ablation of renal cell carcinoma in the prone position.

With this explosion in patient acuity and case volume in the Non-Operating Room Anesthesia (NORA) realm, multiple issues we typically never worried about when in the OR, now become vitally important to providing safe, efficient anesthesia care of these patients far away from the operating room. System issues such as scheduling of cases, availability of anesthesia equipment, and appropriate staffing of NORA locations present challenges for those working in the academic and private practice setting. In addition, financing a NORA service can be difficult, especially with highly variable reimbursement rates among third party payers for anesthesia services in remote locations.

Communication and flexibility are two of the most important aspects of NORA. With a group of interventionalists not used to the tempo or local culture of the operating room, combined with a wide variety of different procedures and patient comorbidities, it comes down to the anesthesiologist to prioritize patient safety and efficient delivery of sedation and anesthesia services. When dealing with patients in the endoscopy suites, airway management is often of prime importance. For example, if a patient with a history of base of tongue cancer is to undergo an EGD with dilation of radiation stricture, it is critical that the gastroenterologist and anesthesiologist converse prior to the case to lay out a clear plan for airway management. Availability of advanced airway adjuncts

(video laryngoscopes, fiberoptics bronchoscopes, etc.) should also be taken into account when devising an anesthetic and associated airway management plan. If the planned procedure is an antegrade (from the mouth) extended small bowel enteroscopy, consideration should be given to securing the airway upfront so the procedure can move forward unimpeded by episodes of airway obstruction from a room air, TIVA technique. However, if the gastroenterologist decides to perform an extended small bowel enteroscopy via a retrograde approach (i.e..from the rectum) then not securing the airway may be the appropriate approach for the patient. Knowledge about the basics of the planned procedure, and communication across disciplines makes for safe and efficient patient care in the endoscopy suite.

The radiology suite, whether interventional radiology, radiation oncology, MRI, PET, or CT brings with it a unique set of challenges for the anesthesiologist. Presence of radiation emitting equipment (fluoroscopy) or powerful magnetic fields (MRI Zone 3 & Zone 4) creates additional safety concerns for both patient and members of the anesthesia care team that are not usually experienced in the operating room environment. Again, clear communication with the interventionalists, and basic knowledge of the planned procedure are both required to deliver safe and efficient anesthesia care to patients in these locations.

Funding a NORA service can take a wide variety of forms. Each anesthesia department/group needs to evaluate the need for its services in remote locations, skill-set of its anesthesiologists and nurse anesthetists, and overall impact on medical center productivity. Some groups have dedicated NORA teams that consist of team members familiar with the NORA locations, procedures being performed, and have established working relationships with the interventionalists. Other groups might “float” an anesthesiologist & nurse anesthetist to a remote location every once and a while as a cost savings measure.

Reimbursement for anesthesia support services in NORA varies. While currently favorable for anesthesia services in the endoscopy suites, it is not favorable in the radiology suites at our academic medical center. We rationalize the investment in providing anesthesia services to all remote locations as an investment in patient safety, overall case throughput of the procedural area, and savings on opportunity cost by freeing up valuable operating room block time for more profitable procedures.

Regardless of the current number of non-operating room cases done at your hospital, the trend is for marked growth in both the number and complexity of these procedures across the world. Anesthesiologists and anesthesia care teams are going to be faced with a wide array of new procedures that they are going to be asked to anesthetize patients for, far far away from the operating room. On the near horizon, MRI guided High Intensity Focused Ultrasound (HIFU) ablation of prostate cancer, MRI guided laser ablation of brain tumors, and Peroral Endoscopic Myotomy (POEM) procedures are just a sampling of what the future holds for our specialty in NORA.

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