

ADVANCES IN ENDOSCOPY

Current Developments in Diagnostic and Therapeutic Endoscopy

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The Role of the Anesthesiologist in the GI Endoscopy Unit

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G&H How do general anesthesia and monitored anesthesia care differ?

RR Gastroenterologists tend to define general anesthesia as the presence of an endotracheal tube and the administration of inhaled anesthetic gases. Conversely, they view the absence of an endotracheal tube and the administration of intravenous drugs as sedation. Anesthesiologists contribute to this misconception because we frequently use the term sedation as well, until we place a laryngeal mask airway or an endotracheal tube. Part of the reason for this is that insurance companies do not always recognize the need to administer a general anesthetic for some endoscopic procedures. Even if we end up administering sufficient intravenous propofol to achieve general anesthesia, we often hide it under the broad term of monitored anesthesia care (MAC). MAC can range from purely monitoring vital signs and administering no drugs to very sick patients to administering general anesthesia to healthy patients for whom reimbursement would be disallowed if it was called general anesthesia. In actuality, general anesthesia is not defined by airway appliances or the drugs used; it is defined by a loss of protective reflexes in the airway and a loss of awareness. These two circumstances can occur without an endotracheal tube and with intravenous drugs such as midazolam-opioid combinations or propofol by itself.

G&H What are the advantages and disadvantages of deep sedation and general anesthesia compared to moderate sedation?

RR The primary advantage of deep sedation is the lack of awareness by the patient of any aspect of the procedure.

A second, counterintuitive, advantage is that patients may recover faster from deep sedation than moderate sedation because the drug most commonly used to produce deep sedation, propofol, has a much shorter half-life and recovery time than the drugs typically used for moderate sedation (midazolam and fentanyl). The primary disadvantage of deep sedation is the increased risk of hypoxemia. Hypoxemia, detected by pulse oximetry, presents when the patient's upper airway becomes obstructed, usually by the tongue, or when the patient ceases to breathe because of drug-induced apnea. Most of the time, airway obstruction is readily relieved by one of several maneuvers well-known to anesthesia providers without interfering with the endoscopy. The treatment of apnea requires the endoscopist to remove the endoscope, so that the patient can be manually ventilated. These maneuvers can be taught to nonanesthesia providers, but there is a significant learning curve. If a gastroenterologist is both directing the deep sedation and performing the endoscopy, a conflict of attention occurs when hypoxemia develops that may limit the completeness of the examination or success of the procedure because the gastroenterologist may feel compelled to work faster or stop sooner than he normally would if everything was going smoothly.

The primary advantage of general endotracheal anesthesia over deep sedation is that the airway patency is guaranteed during the procedure. This advantage is particularly apparent in patients who snore, have obstructive sleep apnea, or are obese. The major disadvantage of general endotracheal anesthesia is the increased nonendoscopy time in the procedure room that limits the number of complex procedures, particularly endoscopic retrograde cholangiopancreatography (ERCP) and combined endoscopic ultrasound with ERCP, that can be performed within a given block of time. It takes time to induce anesthesia, place an endotracheal tube, position the patient prone, and then, at the end, reposition the patient supine, reverse the muscle relaxants that were likely used, and extubate the patient.

G&H In your department, how do you decide which patients require endotracheal intubation with general anesthesia when undergoing ERCP?

RR When I first started providing anesthesia support for ERCP, our unwritten protocol was to administer general

endotracheal anesthesia in 100% of patients. Discussions with my gastroenterologists led me to rethink the logic of this. A review of the literature revealed that 80–90% of patients in the United States receive moderate to deep sedation for ERCP and only 10–20% receive general anesthesia with an endotracheal tube. Thus, our policy of using endotracheal tubes with general anesthesia in 100% of patients appeared to make us an outlier. However, as a practitioner at an academic medical center, I did not think it was possible to achieve the figures noted in the literature, as we have higher percentages of patients who have either failed sedation for any reason in the private sector or who are obese or morbidly obese and, thus, more likely to have airway difficulties. Currently, in my department, I aim for sedating 60–70% of patients without an endotracheal tube and only 30–40% of patients with an endotracheal tube.

Having said this, my initial approach is to assume that I will use intravenous sedation without an endotracheal tube on all patients unless they have a relative contraindication. Factors such as a markedly increased levels of aspiration risk support the use of an endotracheal tube. It is my clinical judgment that patients with significantly delayed or impaired gastric emptying and patients with active acute severe pancreatitis fall into this category, but not patients who are diabetic. Although many anesthesia providers assume that diabetics are aspiration risks, I have not found them to be a significant problem, based upon gastric volume. The second relative contraindication would be those patients who have a high likelihood of having an obstructed airway or would have difficulty maintaining a good oxygen saturation level. This includes the obese population, patients with a heavy snoring history, and patients with obstructed sleep apnea. In addition, there is a category of patients who are more difficult to sedate or more unpredictable in the sedation process, including patients who have chronic pain problems and are taking high doses of opioids, patients who are in substance abuse programs, or patients who have significant substance abuse issues, particularly alcohol. The last category, which comprises a fairly high percentage of our patients, includes cancer patients undergoing ERCP for stent placement. If it appears that the stent placement will be complicated (ie, require more time than usual), I am more likely to intubate the patient and administer a general anesthetic to avoid any airway management issues that might force me to cut short the procedure. However, this decision requires a conversation with the gastroenterologist.

In addition, I think that the prone position is much safer without an endotracheal tube than the supine position is without an endotracheal tube. This means that if ERCPs are performed as they are at our institution

(with the patient basically prone with a roll under their right chest), the regurgitant stomach contents are more likely to escape out of the mouth, and less likely into the back of the throat, and down into the trachea. The prone position allows the tongue to fall forward rather than backward and obstruct the airway. The roll placed under the right chest frees up the diaphragm, enabling the patient to breathe more easily. I recommend using the prone position without an endotracheal tube. However, if the patient develops an airway obstruction that does not resolve with simple maneuvers, turning the patient back onto a stretcher to intubate takes time and there is not much time if you have already struggled trying to restore the airway when the patient is prone. This is the biggest fear that anesthesia providers have. Even though this situation rarely occurs, it is difficult to overcome this fear absent frequent exposure to, and experience in, the endoscopy suite.

G&H Do all patients undergoing ERCP under general anesthesia need to be paralyzed?

RR There is a tendency, for most anesthesia providers, to assume that a muscle relaxant is required whenever an endotracheal tube is placed. In fact, my favorite technique when placing an endotracheal tube is to induce anesthesia with propofol and lidocaine (in most cases, the patient has already received a small dose of midazolam and fentanyl) and then intubate without a muscle relaxant. This technique, however, does not always work; it usually has a slightly lower success rate than when muscle relaxants are also administered. In addition, as this method allows for only one good opportunity to intubate before the patient starts either to cough or develop laryngeal spasm, it is not a technique for an inexperienced anesthesia provider. With an experienced provider and a patient with a normal airway, it is a great technique.

G&H What are the advantages and disadvantages of using propofol as a sedative for endoscopic procedures?

RR The primary advantage of propofol is its fast onset and recovery times. Another advantage is the lack of a hangover associated with its use, as opposed to other drugs frequently used to induce anesthesia, particularly barbiturates. From an anesthesia provider's perspective, the most significant advantage is the ability to rapidly achieve the desired level of sedation or anesthesia and the reasonably short recovery time when the propofol infusion is turned off.

The primary disadvantage of this drug is that it can cause low blood pressure or hypotension, particularly at

deeper levels of sedation. In addition, there is a fairly narrow margin between a patient breathing spontaneously and adequately during deep sedation and a patient not breathing, particularly if opioids are administered concurrently with the propofol. Again, most anesthesia providers are very comfortable with these restrictions, and the problems can be easily addressed or are short in duration. The most frequent side effect of propofol is that there is some pain on injection. We have tried to minimize this pain by adding lidocaine to the propofol solution or administering intravenous lidocaine prior to the administration of intravenous propofol.

G&H What is the role of adjunctive agents during propofol sedation?

RR It is difficult to establish hard-and-fast rules for the use of adjunctive agents. The primary reason for their use is to reduce the total dose of administered propofol. With longer procedures, higher doses are required, and longer recovery times become an issue. By administering drugs such as midazolam, ketamine, lidocaine, or fentanyl, the propofol dose can be lowered considerably.

In addition, a small number of patients, even with high-dose propofol, still experience awareness of the procedure, despite the fact that one of the goals of deep sedation is to produce a lack of awareness. Combining propofol with other drugs eliminates this problem.

Adjunctive agents are also used for analgesic reasons. Some procedures (eg, dilation of the esophagus, sphincterotomy, biopsy) can be painful. As propofol has very few analgesic properties, opioids or ketamine, which do have these properties, can be useful in these patients.

G&H Is propofol appropriate for administration by nonspecialist providers?

RR This is a very controversial topic, but it becomes less controversial if it is broken down into smaller, better-defined circumstances. Generally speaking, when non-anesthesia specialists think of propofol, they typically think of providing moderate to deep sedation. The duration of sedation is shorter than when midazolam, fentanyl, or meperidine is used. Frequent bolus doses of propofol are given rather than continuous infusions. When anesthesia providers think of propofol, they almost invariably think about it from the perspective of deep sedation or general anesthesia. Therefore, the two groups of providers do not start on the same page. If we could agree on a definition of moderate-to-deep sedation—sedation that is not deep enough to necessitate supporting the airway—then the data are actually overwhelming that equivalent sedation can be provided

with the same number or fewer side effects with propofol than with midazolam and an opioid, with a shorter wake-up time. Even as an anesthesia provider, I must admit that the data also overwhelmingly demonstrate that nonanesthesia providers can provide this sedation as safely as anesthesia providers. However, it is essential to agree on the definition of moderate sedation, as discussed above, and there has to be a rigorous adherence to it. In terms of specific patient populations, I think that a gastroenterologist would have to agree that anesthesia providers are better at administering propofol to sicker patients than nonanesthesia providers.

Another issue is the subjectivity of what moderate and deep sedation entail. Some of this is cultural bias; a provider in the United States will usually mean deep sedation when using the term sedation, in contrast to many European and Asian countries, where patients are expected to tolerate some diminished consciousness and discomfort with their procedures. The definition of moderate sedation in the United States connotes a deeper level of sedation than it does outside the United States, and this is an important factor to keep in mind.

Another factor is that the rigor of published trials that show that nonanesthesia providers can administer propofol safely is not as strictly adhered to outside of the clinical trial setting. In other words, outside of trials, the providers are more likely to administer deeper sedation, which is associated with greater risks and complications. In addition, skill levels of providers can differ greatly. Individuals in high-volume institutions are often well trained and administer propofol sedation frequently each week to a sizable number of patients, and, consequently, have overcome a fairly significant learning curve. It is unfair to compare these providers to ones who do not have as much training and are not at high-volume institutions. The ideal situation would be for gastrointestinal endoscopists and anesthesia providers at any location to divide the patient population into two groups: a large group that could have propofol administered by nonanesthesia providers and a smaller group in which it might make sense for an anesthesia provider to be involved. The anesthesia provider could also help with training and quality assurance issues.

G&H Could you discuss fospropofol, which was once considered a potential replacement as the preferred agent for use by nonspecialist providers?

RR I must confess upfront that I have no experience administering fospropofol, but I have talked to several people who have. As discussed previously, a significant disadvantage of propofol is pain on injection. It is unknown

why patients experience this pain, but it is suspected that it may be related to the lipid emulsion in which it is suspended. The advantage that fospropofol has is that it is delivered in an aqueous solution, so there appears to be no pain on injection. However, a significant disadvantage to fospropofol is that it has to be metabolized to propofol for it to be active. This extra step translates into a longer onset and recovery time. If a provider is trying to administer sedation by infusion and increases the infusion flow rate in order to increase the depth of sedation, the provider prefers the drug to have a faster onset time rather than a longer one. With a longer onset time, the provider is more likely to overshoot and administer too much of the drug. If the provider is trying to achieve the appropriate level of sedation with a single bolus injection, then fospropofol may be an improvement over propofol.

Another issue that gastroenterologists do not always consider, but is an important medicolegal issue, is that nearly any time sedation is administered, a small percentage of patients experience hallucinations during the administration of the anesthetic. These hallucinations frequently have sexual orientations, and there have been cases in which anesthesia providers have been accused of attacking or molesting female patients. A side effect of fospropofol is perineal irritation, of unclear etiology, that occurs in up to 85% of patients. It remains to be demonstrated whether the perineal irritation will increase the likelihood of sexual hallucinations.

The last problem with fospropofol is that one of the metabolites is formaldehyde, a poison, which is not an issue with propofol. Having said this, this risk is purely theoretical thus far; no cases have been reported of formaldehyde poisoning associated with fospropofol.

G&H Are there any drugs in the pharmaceutical pipeline that appear to have potential as endoscopic sedatives?

RR Unfortunately, I am not aware of any potential drugs in the pipeline. The two drugs that were considered to be potential challengers to propofol were fospropofol, which has not been widely adopted, as discussed above, and dexmedetomidine, which appears to be effective for long-term sedation in intensive care unit patients, but not that effective during procedures with varying degrees of stimuli. I could certainly devise a sedative technique that

includes dexmedetomidine, but it would involve being more creative than I am with propofol, so I have not done so as of yet. I have experience administering the drug and have tried using it in gastrointestinal endoscopy, but the clinical studies that I have seen, and my personal experience, suggest that it is no better, and occasionally worse, than propofol.

Perhaps more exciting than new drugs are computer-assisted delivery systems for propofol that I hope will be approved and widely utilized.

G&H What are the next steps for future research in this area?

RR Most of the new research that I am aware of relates to the monitoring of the anesthetic as opposed to the development of new anesthetic drugs (eg, a better monitor for ventilation, so that the anesthesia provider has an earlier warning that the patient is not breathing effectively). A lot of work is being done on this issue, though it is more applied engineering than new science. We are still seeking a good depth of sedation or loss of awareness monitor. We have reasonably effective monitors for anesthetic depth but not for lighter levels of sedation. There is also some engineering activity aimed at developing devices that would keep the airway open, the tongue from interfering, and the endoscope from moving the tongue to enable the provider of the sedation to administer oxygen and, if necessary, ventilate without withdrawing the endoscope.

Suggested Reading

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