Position statement: nonanesthesiologist administration of propofol for GI endoscopy

This statement on the use of nonanesthesiologist-administered propofol (NAAP) for GI endoscopy is issued jointly by The American Association for the Study of Liver Diseases, American College of Gastroenterology, American Gastroenterological Association, and American Society for Gastrointestinal Endoscopy. A 4-member committee, composed of a representative from each society, prepared the first draft of this document, which was then reviewed and approved by the governing board of each organization. This document is designed to provide an evidence-based assessment of propofol-mediated sedation by properly trained gastroenterologists and other nonanesthesiologists. The safety, efficacy, cost-effectiveness, and training issues involved with nonanesthesiologist administration of propofol for GI endoscopy are reviewed, and a series of concluding statements and recommendations are provided. Whenever possible, these summary conclusions are graded based upon the strength of the supporting evidence (Table 1).

BACKGROUND

Propofol (2,6 diisopropyl phenol) is an ultra-short–acting sedative agent with no analgesic properties, which provides sedative and amnestic effects.[1] Approved by the Food and Drug Administration for the induction and maintenance of anesthesia, propofol's product label indicates that it ''should be administered only by persons trained in the administration of general anesthesia.'' Since its introduction in the 1980s, however, its clinical applications have expanded to include monitored anesthesia care (MAC) and procedural sedation. The worldwide safety experience of endoscopist-administered propofol sedation now exceeds 460,000 patients.[2]

Two methods have evolved for the administration of propofol under the direction of an endoscopist: (1) nurse-administered propofol sedation (NAPS) and (2) combination or balanced propofol sedation (BPS). Both methods involve the administration of small, titrated bolus doses of propofol. Whereas NAPS uses propofol as a single agent and is titrated to deep sedation,[3] BPS combines propofol with a small induction dose of a narcotic, a benzodiazepine, or both, and is targeted to moderate sedation.[4] Both techniques emphasize the importance of appropriate patient selection, education and training of nursing personnel, use of an established protocol for drug administration, and careful assessment of a patient's physiologic and clinical parameters throughout the procedure; however, several important differences between these techniques do exist.[5]

For the purposes of this document, the following definitions apply:

- Monitored anesthesia care (MAC) is the service provided by an anesthesia specialist to a patient undergoing a diagnostic or therapeutic procedure. In many instances, although not all, MAC results in deep sedation, and the normal airway protective reflexes may be lost. MAC can include general anesthesia with endotracheal intubation.[6]
- Standard sedation refers to the administration of intravenous drugs, usually a benzodiazepine and an opioid, under the supervision of an endoscopist. A level of moderate sedation is usually targeted.
- Nonanesthesiologist-administered propofol (NAAP) describes the administration of propofol under the direction of a physician who has not been trained as an anesthesiologist. Propofol may be used either alone or in combination with 1 or more additional agents. A level of moderate-to-deep sedation is targeted with NAAP.
- Nurse-administered propofol sedation (NAPS) describes the administration of propofol as a single agent under the direction of a physician who has not been trained as an anesthesiologist. A level of deep sedation is targeted with NAPS.
- Balanced propofol sedation (BPS) describes the administration of the combination of a benzodiazepine, an opioid, and propofol under the direction of a physician who is not an anesthesiologist. The opioid and benzodiazepine are each given as a single dose, which is followed by small incremental doses of propofol administered to achieve a target level of moderate sedation.

This article is being published jointly in *Gastrointestinal Endoscopy, American Journal of Gastroenterology, Gastroenterology,* and *Hepatology.*
0016-5107/$36.00
doi:10.1016/j.gie.2009.07.020

TABLE 1. Grades of recommendation

Grade of recommendation	Clarity of benefit	Methodological strength/ supporting evidence	Implications
1A	Clear	Randomized trials without important limitations	Strong recommendations; can be applied to most clinical settings
1B	Clear	Randomized trials with important limitations (inconsistent results, nonfatal methodological flaws)	Strong recommendations; likely to apply to most practice settings
1C+	Clear	Overwhelming evidence from observational studies	Strong recommendations; can apply to most practice settings in most situations
1C	Clear	Observational studies	Intermediate strength recommendation; recommendation may change when stronger evidence is available
2A	Unclear	Randomized trials without important limitations	Intermediate strength recommendation; best action may differ depending upon circumstances or patients' societal values
2B	Unclear	Randomized trials with important limitations (inconsistent results, nonfatal methodological flaws)	Weak recommendation; alternative approaches likely to be better under some circumstances
2C	Unclear	Observational studies	Very weak recommendation; alternative approaches likely to be better under some circumstances.
3	Unclear	Expert opinion only	Very weak recommendation; likely to change as data becomes available

Adapted from Guyatt G, Gutterman D, Baumann MH, et al. Grading strength of recommendations and quality of evidence in clinical guidelines: report from an American College of Chest Physicians Task Force. Chest 2006;129:174-81.

SAFETY OF NONANESTHESIOLOGIST-ADMINISTERED PROPOFOL FOR GI ENDOSCOPY

A systematic review of the published articles and abstracts in which propofol was administered by nonanesthesiologists for endoscopic procedures was performed. The methodology for the inclusion of published literature is outlined in Appendix 1. Forty-six articles were identified initially.[2,3,7-49] Eighteen articles[7-23] were subsequently excluded because it was evident from the text or, in cases of uncertainty, from discussions with the authors that cases were reported in more than 1 publication. Including the single largest report, published thus far only in abstract form,[2] there are 460,651 cases available for review. It is important to emphasize that the majority of the reported cases involve NAPS. These reports include a total of 3 deaths, all of which occurred during or after an esophagogastroduodenoscopy (EGD).[2] One generalized seizure was described, but there was no permanent injury to the patient. All 3 deaths occurred in patients with significant comorbidities and would be considered high-risk cases for sedation. No other deaths or permanent injuries have been described. The need for bag-mask ventilation to treat apnea or airway obstruction was greater during upper endoscopic procedures than during colonoscopy. There were no mortalities in patients undergoing colonoscopy, and no mortalities in procedures that involved patients classified as American Society of Anesthesiology class I or II.[2]

Although most of the NAAP experience resides with EGD and colonoscopy, 4 randomized, controlled trials comparing NAAP to meperidine/midazolam[11,24,38] or pentazocine/midazolam[48] for elective ERCP and/or EUS found no differences in the rates of hypoxemia or bradycardia or the need for airway intervention.

The low rate of serious adverse events in these series underscores the safety of NAAP for GI procedures, provided that it is administrated by a team of individuals who have received training specific to the administration of propofol. The safety of NAAP is comparable to what has been reported for endoscopists administering standard sedation.[50-54] A systematic review and meta-analysis of randomized, controlled trials of moderate sedation

for routine EGD and colonoscopy compared NAAP to standard sedation regimens. In studies comparing propofol to midazolam for EGD, no significant difference in hypoxemia was found between the 2 methods of sedation. In a comparison of propofol versus the combination of a narcotic and midazolam for EGD and colonoscopy, no significant difference in hypoxemia, bradycardia, or hypotension was detected.[55] The results from NAAP series also exhibit safety comparable to that of general anesthesia[56-63] and MAC.[64] Given the extraordinarily low rate of adverse events with NAAP, it appears very unlikely that MAC would further improve the safety of endoscopic sedation during routine upper endoscopy and colonoscopy in low-risk patients.[2,65]

Recommendations

1. The safety profile of NAAP is equivalent to that of standard sedation with respect to the risks of hypoxemia, hypotension, and bradycardia for upper endoscopy and colonoscopy (grade 1B).
2. The safety profile of NAAP when it is administered during ERCP and EUS appears to be equivalent to that of standard sedation. However, the worldwide experience with NAAP during these procedures is insufficient to draw definitive conclusions about its use in these settings (grade 1C).

EFFICACY OF NONANESTHESIOLOGIST-ADMINISTERED PROPOFOL FOR GI ENDOSCOPY

For patients undergoing EGD and colonoscopy, the average time to sedation induction is shorter for propofol than for benzodiazepines. There is no difference in procedure times among colonoscopy patients receiving propofol alone or midazolam plus a narcotic. The average recovery time after colonoscopy was shorter in patients receiving propofol alone (15.6 min) or propofol plus a narcotic (14.3 min) than for patients receiving a combination of benzodiazepine and a narcotic (54.9 min).[55,66] Studies comparing patient satisfaction with NAAP and standard sedation during EGD and colonoscopy have yielded varying results, with propofol-based sedation being either equivalent or superior to a benzodiazepine/opioid combination.[8,9,55] However, the degree of improvement is small and primarily seen when deep sedation is targeted.[55]

During ERCP and EUS, NAAP resulted in faster induction of sedation and shorter recovery times when compared to standard sedation.[11,24,38,47] Patient satisfaction with NAAP was superior in 1 study[11] and equivalent in 2 other studies.[24,38]

Currently, there are no studies comparing the safety and efficacy of NAAP to standard sedation with a benzodiazepine/opioid to anesthesiologist-administered sedation for GI endoscopy.

Recommendations

1. For EGD, colonoscopy, ERCP, and EUS, the time for sedation induction is shorter with NAAP than with standard sedation (grade 1A).
2. Recovery time for EGD, colonoscopy, ERCP, and EUS when using NAAP is shorter than for standard sedation with a narcotic and a benzodiazepine (grade 1A).
3. Patient satisfaction with NAAP is equivalent or slightly superior to that with standard sedation (grade 1A).

ECONOMICS OF NONANESTHESIOLOGIST-ADMINISTERED PROPOFOL FOR GI ENDOSCOPY

There are limited data comparing the cost-effectiveness of NAAP to that of standard sedation or anesthesiologist-mediated sedation. A cost-effectiveness analysis comparing gastroenterologist-administered propofol to standard sedation in patients undergoing ERCP or EUS found that propofol administered by a trained registered nurse was the dominant strategy in spite of the additional costs that are associated with its use.[24] In another study, the total procedural costs (recovery and medications) of NAPS and standard sedation were similar.[11] Economic modeling that used data derived from randomized trials demonstrated that rapid recovery agents, such as propofol, can improve practice throughput and are economically beneficial when compared to standard sedation agents.[66] It should be noted, however, that this conclusion was based upon mathematical modeling rather than the results of a prospective trial and, therefore, is only as good as the assumptions used to create the model. There are no cost-effectiveness data comparing NAAP to anesthesiologist-administered sedation for GI endoscopy. The cost of having an anesthesiologist present in the endoscopy suite to administer MAC ranges from $150 to $1500 or more, however, depending upon local conditions.[67]

Recommendations

1. For ERCP and EUS, NAAP is more cost-effective than standard sedation (grade 1B).
2. Nonanesthesiologist-administered propofol sedation improves practice efficiency when compared to standard sedation (grade 2C).
3. The use of anesthesiologist-administered sedation for healthy, low-risk patients undergoing routine GI endoscopy results in higher costs with no proven benefit with respect to patient safety or procedural efficacy (grade 2C).

TRAINING GUIDELINES FOR NONANESTHESIOLOGIST-ADMINISTERED PROPOFOL FOR GI ENDOSCOPY

Although training guidelines for procedural sedation exist, the optimal educational experience to facilitate the

acquisition of knowledge and the development of appropriate skill sets remain uncertain.[68-70] Experts agree, however, that specialized training is required of individuals planning to administer propofol. There is evidence, based upon the experience with advanced cardiac life support training and several small-scale studies, that a multifaceted interdisciplinary program is a more effective training strategy than either single interventions or unstructured, self-directed learning. All members of the sedation team—both physicians and nursing personnel—should participate in training and have prior training and experience in using moderate sedation.

The training curriculum for individuals planning to administer propofol should comprise 4 components.

- Didactic training
- Airway workshop
- Simulation training
- Preceptorship

After the completion of a program, trainees should undergo periodic retraining in an airway workshop and/or human simulation laboratory.

Didactic training session

The didactic component of a training program should provide a comprehensive overview of propofol including its pharmacology and dosing schema, a discussion of the continuum of sedation and its implications related to the use of propofol, and a review of those elements of the preprocedure, intraprocedural, and postprocedure patient assessment that are specific to the administration of propofol. Prereading or background study before the scheduled training sessions by handbook, interactive CD-ROM, video learning, or Web-based learning is recommended as an adjunct to the structured components of this program.[72] Upon completion of the didactic session, individuals should be required to obtain a passing score on an examination designed to evaluate their knowledge and understanding of the concepts and principles taught.

Airway workshop

Airway management is the single most important emergency skill required of individuals involved with the administration of propofol. This module of the curriculum is designed to train personnel in the recognition and management of ventilatory complications associated with propofol sedation. The recommended airway skills include the following.

- Airway assessment
- Ability to restore airway patency by using manual, oral, or nasopharyngeal airway techniques
- Bag-mask ventilation

The preprocedural airway assessment is designed to identify those patients with anatomic findings that predict difficulty with either tracheal intubation or bag-mask ventilation. This would include the Mallampati classification and knowledge of predictors of difficult bag-mask ventilation. Competency with manual techniques for producing a patent airway (head extension, chin lift, and jaw thrust), the use of oral and nasal airway devices, and development of skills necessary to perform successful bag-mask ventilation would be required.[70] Successful completion of basic life support or advanced cardiac life support training is an important prerequisite for individuals participating in NAAP sedation.[68-71]

The use of extended physiologic monitoring techniques such as capnography should be reviewed. Capnography is recommended when it is difficult to visually assess respiration or during prolonged procedures such as ERCP and EUS. In these clinical settings, capnography has been shown to significantly reduce the incidence of hypoxemia and apnea. Currently there are no data to support its use for upper endoscopy and colonoscopy. At least 1 individual certified in advanced cardiac life support and experienced with bag-mask ventilation should be present during NAAP.[72]

Simulation training

High-fidelity patient simulators have gained widespread acceptance in the field of anesthesia as a tool for training and assessment of clinical skills.[73,74] Clinical scenarios can be reproduced in the simulation laboratory in order to provide teams of healthcare providers with a real-life experience managing critical events. The instructor observes the scenario and facilitates a discussion once the scenario is completed. Misses and near misses can be discussed, and opportunities for improvement and further study/practice can be suggested. A debriefing also serves to highlight important resuscitation skills, including decision-making, situational awareness, teamwork, prioritization, communication, and leadership.

Preceptorship

Physicians and nursing personnel wishing to institute a propofol sedation program within their endoscopy units should adopt one of the published protocols for propofol use that have been shown to be safe and effective in the hands of nonanesthesiologists. A formalized set of policies and procedures pertaining to NAAP should then be formulated, and staff members should be trained thoroughly to understand and perform their responsibilities according to the prescribed policies and procedures. Preceptorship under the direction of an anesthesiologist or a qualified endoscopist is recommended for units that are initiating a propofol sedation program. The number of mentored cases necessary to demonstrate competency is currently unknown and requires evaluation.

Upon completion of a training program, individuals working in a hospital or ambulatory care center will require institutional approval in order to administer propofol independently. Applicable state medical and nursing board policies may also influence local policies related to the administration of propofol by registered nurses.

Performance measures designed to assess patient safety and satisfaction should be evaluated periodically. Such measures might include evaluation of performance in unplanned cardiopulmonary events, unplanned termination of the procedure or hospital transfer, emergency interventions, and death. Patient satisfaction surveys also provide useful data on the success of endoscopic sedation.

Recommendations

1. NAAP requires the acquisition of skills and abilities that are distinct and apart from those necessary for standard sedation. The training program should provide both didactic and practical, hands-on learning experiences (grade 1C).
2. Individuals administering propofol should be proficient in the management of upper and lower airway complications, including manual techniques for re-establishing airway patency, use of oral and nasal airway devices, and proper bag-mask ventilation. Basic life support or advanced cardiac life support certification is required. Training with life-size manikins and/or human simulators improves the acquisition of these skills (grade 2A).
3. Preceptorship is an important element of training for physicians and nursing personnel acquiring the skills to administer propofol (grade 2C).
4. Capnography reduces the occurrence of apnea and hypoxemia during ERCP/EUS (grade 2B) and upper endoscopy/colonoscopy (grade 2C).

Summary

1. The administration of propofol and standard sedation by nonanesthesiologists is comparable with respect to their efficacy and safety profiles. Proper training and patient selection are crucial for the safe practice of NAAP sedation.
2. Gastroenterologists and registered nurses in many countries have successfully acquired the skills necessary to safely administer propofol-based sedation. Both didactic and hands-on experience as well as airway training and a preceptorship are currently believed to be important elements of a training program.
3. Most studies show that NAAP sedation is superior to standard sedation regimens regarding time to sedation and time to recovery. Patient satisfaction with propofol sedation ranges from equivalent to slightly superior when compared to standard sedation.
4. The use of anesthesiologist-administered propofol for healthy individuals undergoing elective endoscopy without risk factors for sedation-related complications is very costly, with no demonstrated improvement in patient safety or procedural outcome.
5. Further comparative trials of NAPS and BPS are warranted.

DISCLOSURE

The following authors disclosed financial relationships relevant to this publication: J. Vargo: Consultant for Ethicon EndoSurgery. L. Cohen: Consultant for Ethicon EndoSurgery and Eisai Pharmaceuticals. All other authors disclosed no financial relationships relevant to this publication.

Abbreviations: BPS, balanced propofol sedation; EGD, esophagogastroduodenoscopy; MAC, monitored anesthesia care; ERCP, endoscopic retrograde cholangiopancreatography; EUS, endoscopic ultrasonography; NAAP, nonanesthesiologist-administered propofol; NAPS, nurse-administered propofol sedation.

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Received July 10, 2009; Accepted July 10, 2009.

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APPENDIX 1

Selection of articles for safety, efficacy, and cost analysis

Ovid Medline was queried from 1966 to July 2008. The following words were used as primary search terms: propofol, Diprivan®, endoscopy, gastrointestinal, esophagogastroduodenoscopy (EGD), colonoscopy, endoscopic ultrasonography (EUS), endoscopic retrograde cholangiopancreatography (ERCP), anesthesiologist and non-anesthesiologist, nursing, nursing care, nursing services, and specialties/medical. These items were then explored to include secondary headings. The search was limited to the English language and human subjects. All articles were included if it was clear in the text that propofol had been administered by nonanesthesiologists and for GI endoscopic procedures. Reference lists of selected articles were screened for additional references. Gastroenterology and anesthesiology peer review journals as well as Google Scholar were used to locate abstracts for review.

Forty-six articles met the inclusion criteria.[2,3,7-49] To avoid double counting of procedures, 18 articles were excluded[7-23] because it was evident from the text or, in cases of uncertainty, by discussion with the authors, that cases from the same center were reported in more than 1 publication. The included articles[2,3,24-49] described cases from 8 centers in the United States, 3 in Switzerland, 2 in Germany, 2 in Spain, and 1 each in Sweden, Peru, Japan, China, Canada, Australia, and Thailand. A final included article was a summary of both published and previously unpublished data from inside and outside the United States, but the number of centers was not specified.

Among included studies, propofol was administered by either trained nurses or technicians under the direct supervision of the endoscopist or directly by the endoscopist, with the exception of 1 center in Australia, which contributed 22,379 cases. In this center, propofol was given by a nonanesthesiologist general practitioner.[27] Of the included studies, only 1 described data from an entirely pediatric population,[23] and it described only 811 patients. The remainder of the studies was performed entirely or almost entirely in adults. In each report, data were collected prospectively on safety. Although the type of information varied, data in each report included the number of cases, endotracheal intubations, permanent injuries without death, and deaths.