

Use of this content is subject to the [Terms and Conditions](#) of the MD Consult web site.

Gastrointestinal Endoscopy

Volume 58 • Number 5 • November 2003

Copyright © 2003 American Society for Gastrointestinal Endoscopy

Propofol for endoscopic sedation: a protocol for safe and effective administration by the gastroenterologist

Lawrence B. Cohen, MD ^{*}
Amelia N. Dubovsky, BA
James Aisenberg, MD
Kenneth M. Miller, MD

Current affiliations: Department of Medicine (Gastroenterology)
The Mount Sinai School of Medicine
New York, New York USA

* Reprint requests: Lawrence B. Cohen, MD, 311 East 79th Street, New York, NY 10021.

Manuscript received January 28, 2003; revised manuscript received January 5, 2003, accepted January 2, 2003
PII S0016-5107(03)02010-8

Background

There is increasing interest in the use of propofol, an ultrashort-acting hypnotic agent, for sedation during endoscopic examinations. A protocol was developed for administration of propofol, combined with small doses of midazolam and meperidine, for endoscopic sedation under the direction of a gastroenterologist. Initial experience with using this protocol is described.

Methods

A total of 819 consecutive endoscopic examinations under sedation with propofol, midazolam, and meperidine (or fentanyl), in adherence with the sedation protocol, were reviewed retrospectively.

Results

There were 638 colonoscopies and 181 EGDs; 89% of patients were classified as American Society of Anesthesiologists (ASA) class I or II. Mean dosages of medications were: propofol 63 (33.5) mg, meperidine 48 (7.2) mg, and midazolam 1 (0.12) mg. The dose of propofol was inversely correlated with age and ASA class, and positively correlated with patient weight and duration of examination. Hypotension (>20 mm Hg decline in either systolic or diastolic blood pressure) developed in 218 (27%) patients, and hypoxemia (oxygen saturation <90%) developed in 75 (9%). All episodes of hypotension and hypoxemia were transient, and no patient required administration of a pharmacologic antagonist or assisted ventilation. The average time for recovery after colonoscopy and after EGD was, respectively, 25 minutes and 28 minutes. All EGDs and 98% of colonoscopies were completed successfully.

Conclusions

On the basis of this initial experience, it is believed that propofol, potentiated by small doses of midazolam and meperidine, can be safely and effectively administered under the direction of a gastroenterologist. Additional

research will be necessary to determine whether propofol is superior to the current methods of sedation.

Approximately 15,000,000 endoscopic procedures are performed yearly in the United States. Most are performed under sedation with a benzodiazepine, either alone or in combination with an opioid. The medications most often used in the United States are midazolam and meperidine.^{[1] [2]} These drugs have half-lives sufficiently long to produce residual tranquilizing effects for 30 to 180 minutes after completion of the procedure. This relatively extended recovery period delays return to work and other activities, and reduces the productivity of the endoscopy unit. An agent with a shorter duration of action would be desirable, one that permits more rapid recovery of function, while providing comparable patient comfort during the procedure and that has a safety profile equivalent to medications currently in use. One candidate medication is propofol.^{[3] [4]}

Propofol (2,6-diisopropylphenol) is a substituted alkyl phenol derivative that is believed to facilitate gamma-aminobutyric acid activity in the brain. Its onset of action is almost instantaneous, because of high lipid solubility; and with a half-life of only 2 to 4 minutes, recovery is rapid.^[5] These qualities make propofol an excellent sedative agent for use during short duration procedures such as GI endoscopy. However, propofol also can produce deep sedation, resulting in respiratory depression and even apnea.^[6] There is no known antagonist for propofol. For these reasons, the administration of propofol has been restricted primarily to anesthesiologists and nurse anesthetists trained in emergency airway management.

Among gastroenterologists, there is increasing interest in the use of propofol for endoscopic sedation, and the number of reports of endoscopist-administered efficacy is growing. Propofol often has been given as a single agent.^{[7] [8] [9] [10] [11] [12] [13] [14] [15]} When used alone, relatively large doses may be required to achieve adequate patient comfort. At times, such high doses may exceed the narrow therapeutic window of the drug, resulting in hypotension or respiratory depression.^{[8] [11]}

Propofol also can be administered in combination with other agents, such as a benzodiazepine or an opioid, to enhance its hypnotic and sedative effects.^{[16] [17] [18] [19] [20] [21] [22] [23] [24]} Conceptually, this could reduce the total dose of propofol required for examinations, improve sedation and analgesia, and add an element of reversibility to the sedative regimen. Reported here is our experience with the administration of propofol in combination with small doses of a benzodiazepine and an opioid for endoscopic sedation under the direction of a gastroenterologist in an office setting.

Patients and methods

The charts of all patients who underwent an endoscopic examination between June 1, 2001, and July 31, 2002, were reviewed. All patients who received a propofol-based sedation regimen were included. This study was reviewed and approved by the institutional review board of our institution.

Preparations for endoscopist-directed use of propofol began in January 2001. All published information related to endoscopy and the use of propofol was reviewed. All procedures initially were performed in conjunction with an anesthesiologist. A standardized written protocol was then developed for administration of propofol ([Appendix](#)), and, as of June 1, 2001, propofol was administered without an anesthesiologist present.

All endoscopy assistants (registered nurses and medical assistants) underwent training, which consisted of didactic sessions and a 2-week period of observation with one-on-one preceptorship. An assistant was permitted to work independently with the approval of an endoscopist and the supervising endoscopy nurse. All physicians and endoscopy nurses were certified in basic and advanced cardiac life support. Typically, procedures were performed by an endoscopist and a single endoscopy assistant. If a complex therapeutic procedure that required the intense focused attention of the endoscopy assistant was encountered, a second assistant was then brought into the procedure room. Procedures were reviewed at monthly intervals for safety and complications.

Exclusion criteria were the following: age under 18 years; allergy to soybean or eggs; history of seizure disorder or sleep apnea; a short, thick neck; inability to open widely the mouth; and a history of difficult intubation. Patients scheduled to have more than one endoscopic procedure during a single session also were excluded.

Patient monitoring

All patients were monitored for heart rate, blood pressure, Sao_2 , and electrocardiograph by using an automated device (Datascopie 3000; Datascopie Corp, Montvale, N.J.). A graphic representation of respiratory activity and end-tidal carbon dioxide (TCO_2) were recorded by using an automated carbon dioxide detector (Poet TE; Criticare Systems, Inc., Waukesha, Wis.).^[25] Heart rate, Sao_2 , and TCO_2 were monitored continuously, while the blood pressure was assessed at 3-minute intervals. The endoscopy assistant monitored chest excursion, respiratory effort, and respiratory rate visually. A log was maintained to document all episodes in which one or more of the following parameters were outside of acceptable limits: oxygen saturation (Sao_2) less than 90%, pulse less than 60 or greater than 110 beats per minute, and systolic blood pressure less than 90 mm Hg. All episodes in which the TCO_2 exceeded 45 mm Hg were recorded. Supplemental oxygen was not administered routinely unless the Sao_2 declined to less than 90% for a minimum of 30 seconds despite the use of jaw or chin thrust maneuvers.

Drug administration

The sedation protocol is outlined in the [Appendix](#). Patients less than 70 years of age were initially given meperidine (50 mg) and midazolam (1 mg) by intravenous bolus injection, whereas, those 70 years of age and older were given a reduced dose of meperidine (25 mg). At times, fentanyl (75 mcg) was substituted for meperidine. In some instances, the dose of midazolam also was reduced to 0.5 mg. Propofol (Diprivan; AstraZeneca, Wilmington, Del.) was prepared in 5- or 10-mL syringes (depending upon the examination and patient age) that were attached to an indwelling catheter. An initial intravenous bolus of 5 to 10 mg of propofol was administered, followed by boluses of 5 to 15 mg administered with a minimum of 30 seconds between doses.

Patient assessment and discharge

After completion of the endoscopic procedure, patients were transferred for continued hemodynamic monitoring. The criteria for discharge from the endoscopy unit were the following: ability to respond appropriately to questions, sitting upright for 5 minutes, and dressing without assistance. All patients were permitted to remain in the recovery area as long as they felt it was necessary. Patients were offered coffee/tea or juice and a light snack. The nursing staff made no effort to speed the recovery process or discharge time. Recovery time was measured from the time the patient entered the recovery area until departure. Written discharge instructions were provided to all patients. Patients were requested to abstain from driving a vehicle or operating heavy equipment for 4 hours after the procedure. The signs and symptoms of potential complications were described in the handout; steps to follow in the event of a complication were detailed.

Statistical analysis

All statistical analyses were performed with statistical software (SAS version 8.2; SAS Institute Inc., SAS Campus Drive, Cary, N.C.). Descriptive statistics and frequency distributions were calculated for specific variables. The degree of association among specified study variables and the propofol dose was assessed by using the one sample *t* test for a correlation coefficient. Correlation coefficients and *p* values are reported. Results were considered significant for *p* values less than 0.05. Bonferroni adjustments for multiple testing were incorporated when appropriate. Confidence levels of 95% were noted for all categorical variables.

Results

Patients and endoscopic variables

A total of 819 patients (mean age, 59 years, range 18-97 years) underwent endoscopic procedures ([Table 1](#)). Most were healthy; 720 (89%) were classified as ASA class I or II, and 91 (11%) as ASA III or IV. Two patients classified as ASA IV are included. Both were initially considered to be ASA III, but were reclassified as ASA IV

during analysis of the data.

	No. (%)
Age (y)	59 (18–97) [*]
Women	447 (54)
Weight (kg)	70 (39–108) [*]
ASA [†]	
I	502 (62)
II	218 (27)
III	89 (11)
IV	2 (0.002)

^{*} Data expressed as mean (range).
[†] ASA class not available for 8 patients.
 ASA, American Society of Anesthesiologists.

Endoscopic procedures performed are listed in [Table 2](#). The majority (78%) were colonoscopies. The mean duration of colonoscopy was 17 minutes (range 4-47 minutes); the mean duration of EGD was 11 minutes (range 3-38 minutes). Mean recovery time for colonoscopy was 25 minutes (range 6-65 minutes); mean recovery time for EGD was 28 minutes (range 8-58 minutes). All EGDs and all but 15 colonoscopies were completed successfully. The incomplete procedures were all because of the presence of a stricture or long sigmoid loop. No colonoscopy was terminated because of inadequate analgesia/sedation.

	No. (%)
Colonoscopy	638
With biopsy	85 (13)
With polypectomy	155 (24)
Complete examination	623 (98)
Duration of examination (min)	
Mean	17 (6.9) [*]
Range	4–47
Recovery time (min)	
Mean	25 (12.6) [*]
Range	6–65
EGD	181
With biopsy	108 (60)
With dilation	20 (11)
Duration of examination (min)	
Mean	11 (6.1) [*]
Range	3–38
Recovery time (min)	

Mean	28 (13)*
Range	8–58
* Parentheses indicate standard deviation.	

Medication administration

A combination of propofol, meperidine or fentanyl, and midazolam was used for all endoscopic examinations (Table 3). The most common combination was propofol, meperidine, and midazolam (726 patients). In 94 patients, fentanyl was used in place of meperidine.

Medication	Colonoscopy		Gastroscopy	
	No.	Dosage*	No.	Dosage*
Meperidine(mg)	553	48 (6.1; 25–75)	164	48 (9.9; 25–100)
Midazolam (mg)	631	0.99 (0.1; 1–2)	178	0.98 (0.13; 0.5–2.0)
Fentanyl (mcg)	80	70 (9.8; 50–75)	14	69 (10;50–75)
Propofol (mg)	638	66 (34; 5–230)	181	52 (29; 10–150)

* Data expressed as mean (SD, range).

The mean dose of propofol was 66 (34) mg for colonoscopy and 52 (29) mg for EGD. The mean dose of propofol by demographic group is shown in Figure 1. The ASA class was inversely correlated with the total dose of propofol necessary for sedation ($r = -0.32$; $p < 0.0001$). Similarly, there was an inverse relationship between patient age and the dose of propofol ($r = -0.44$; $p < 0.0001$). Conversely, patient weight and duration of procedure were positively correlated with the total dose of propofol ($r = 0.41$; $p < 0.0001$, $r = 0.37$; $p < 0.0001$). Patient gender had no influence on the dose of propofol given during the endoscopic procedure ($p = 0.11$).

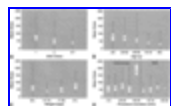


Figure 1. Mean dose of propofol by demographic variable: ASA class (a) and age (b) were inversely correlated with total dose of propofol required for sedation. Patient weight (c) and duration of examination (d) were positively correlated with total dose of propofol administered. + and ? symbols indicate mean; shaded boxes represent quartiles (25%, 50%, and 75%); outer lines indicate range of values.

Safety data

There was no serious adverse event related to any of the 819 procedures. Sustained bradycardia was not observed. A transient decrease in blood pressure was common. In 218 (27%) patients, blood pressure declined 20 mm Hg or more. However, in no case was intervention for hypotension required. There were 75 episodes (9%) of sustained oxygen desaturation (SaO_2 was $< 90\%$ for > 30 seconds), requiring the use of supplemental oxygen. In all cases, the SaO_2 promptly rose above 90% by using the chin thrust maneuver and supplemental oxygen. No patient required administration of a benzodiazepine or opioid antagonist. Airway support, endotracheal intubation, and hospitalization were not required. Localized pain at the site of propofol administration was noted only rarely.

Discussion

Sedation, in addition to a readily apparent contribution to overall patient satisfaction with an endoscopic procedure, also can significantly impact the cost and efficiency of endoscopic services. The added costs largely

are related to the need for either additional equipment (e.g., infusion pumps, monitoring devices) or personnel (e.g., a second nurse or gastroenterologist, anesthesiologist). Zamir and Rex^[26] demonstrated that the efficiency of an endoscopy unit is related most closely to the length of recovery from endoscopic sedation.

The “ideal” sedative agent for endoscopic procedures should have a rapid onset of action, produce a level of sedation/analgesia sufficient for patient comfort, and have a brief duration of action. It also must be safe for use by nonanesthesiologists. Thus, there is a growing interest in the use of propofol. The Standards of Practice Committee of the American Society for Gastrointestinal Endoscopy recently concluded, “propofol has faster onset and deeper sedation than standard benzodiazepines and narcotics, as well as faster recovery ...”^[27]

Propofol may be given alone or in combination with a benzodiazepine or/and an opioid, with which it has synergistic effects.^{[19] [21] [23]} Carrasco et al.^[19] found that midazolam potentiated the action of propofol, thereby reducing the dosage requirement by as much as 44%. The combination of propofol with an opioid, such as alfentanil or fentanyl, has been evaluated in various settings, including ambulatory endoscopy.^{[18] [28]} In most studies, the dosage of propofol required to produce sedation was reduced when combined with an opioid or a benzodiazepine.

The present report describes our experience with endoscopic sedation using propofol, combined with small doses of an opioid and a benzodiazepine. Patient selection and monitoring, and the dose and administration of medication were as delineated in a written protocol. The majority of the patients were healthy (89% ASA I or II) and undergoing screening or surveillance for colorectal cancer. Supplemental oxygen was not administered routinely. The endoscopist directed the administration of propofol with the assistance of an endoscopy nurse. The endoscopy staff are all well trained, with at least 3 years of endoscopy experience, and were certified in advanced cardiac life support. In addition, the staff observed the use of propofol by an anesthesiologist before administering the drug independently.

The mean dose of propofol administered was 63 mg (colonoscopy 66 mg, EGD 52 mg), which is substantially lower than the doses reported in most series (Table 4). In most published studies, the dose of propofol per procedure ranges from 40 to 1100 mg. In the study of Rex et al.,^[13] the average dose of propofol, used alone, for 2000 procedures was 248 mg; other investigators have reported comparable doses for propofol given alone.^{[8] [10] [14] [29] [30]} Clarke et al.^[22] evaluated a 7-year experience with the use of propofol combined with an opioid and a benzodiazepine in more than 28,000 patients. Although the protocol differed in several respects from that of the current study, the basic findings are similar. The mean dose of propofol in the series of Clarke et al.^[22] was 73 mg vs. 63 mg in the present series, and there was no serious complication in either trial.

Author (y)	Patients (n)	Endoscopic procedure (s)	Propofol [±] (mg)	Other agents
Monotherapy				
Wehrmann et al. ^[8] (1999)	198	ERCP	388 (90–1100)	
Rex et al. ^[13] (2002)	2,000	Colonoscopy	242 (40–810)	
		EGD	190 (30–760)	
Sipe et al. ^[15] (2002)	80	Colonoscopy	218 [±]	
Combination therapy				
Koshy et al. ^[10] (2000)	150	Colonoscopy	40 (20–120) [±]	Fentanyl
		EGD		
Clarke et al. ^[22] (2002)	28,472	Colonoscopy	60 (10–220)	Fentanyl and midazolam

		EGD	25 (5–120)	
Paspatis et al. ^[24]	64	Colonoscopy	80 (40–150)	Midazolam
(2002)				
Cohen et al.	819	Colonoscopy	66 (5–230)	Midazolam and meperidine/fentanyl
		EGD	52 (10–150)	
<p>* Data expressed as mean (range). † Dosage range not provided. ‡ Mean doses of propofol not analyzed separately for colonoscopy and EGD.</p>				

An ASA Taskforce recently revised its Practice Guidelines for Sedation and Analgesia by Non-Anesthesiologists.^[31] Opioid/benzodiazepine combinations are now categorized as “moderate” sedation. In contrast, propofol-based sedation is categorized as “deep” sedation, which is defined as that which requires repeated or painful stimulation to provoke a purposeful response and in which spontaneous ventilation may be inadequate and require airway intervention. The ASA guideline recommends that during deep sedation, “a designated individual, other than the practitioner performing the procedure, should be present to monitor the patient...” and that “practitioners administering these drugs should be qualified to rescue patients from any level of sedation, including general anesthesia.” In the current study, relatively low doses of propofol were required for adequate sedation, patients were easily aroused, and adequate ventilation and cardiovascular function were maintained. Based upon the experience described by the present study, it is believed that administration of propofol in low doses in conjunction with small doses of meperidine and midazolam produces a level of sedation that more closely meets the ASA criteria of “moderate” instead of “deep” sedation. Consequently, it is felt that patients can be adequately monitored without a dedicated individual with advanced airway training.

Only one study has directly compared the combination of propofol and a benzodiazepine with propofol alone for endoscopic sedation, and no study has directly compared propofol with propofol plus a benzodiazepine and an opioid. Seifert et al.^[20] randomized 239 patients undergoing therapeutic endoscopy or ERCP to sedation with propofol and midazolam or propofol alone. Patients in the propofol group received an intravenous bolus of 40 to 60 mg, followed by 20 mg boluses, while those in the propofol plus midazolam group were given 2.5 or 3.5 mg of midazolam intravenously (based upon body weight) followed by 20 mg boluses of propofol. The propofol group received a mean dose of 420 mg, compared with 385 mg plus 2.9 mg of midazolam in the group receiving both agents. Mean procedure time was 23 to 24 minutes. The two sedation regimens were comparable with respect to patient comfort and adverse effects. The mean recovery time was faster (19 vs. 25 minutes) in the group that received propofol alone.

How do the findings of Seifert et al.^[20] differ from those of the current study? The study populations differed; the present study evaluated the use of propofol for routine EGD or colonoscopy (mean procedure times, respectively, 11 and 17 minutes), whereas Seifert et al.^[20] evaluated its use for therapeutic EGD or ERCP (mean procedure time 23-24 minutes). In the current study, the mean dose of midazolam was 1.0 mg, vs. 2.9 mg in that of Seifert et al.^[20] The regimen in the present study also included a small dose of an opioid, either meperidine or fentanyl. The mean dose of propofol was significantly lower in the current study (63 mg vs. 385-420 mg), possibly reflecting shorter procedure times; the use of gastroenterologist-directed, instead of anesthesiologist-directed, sedation; the addition of meperidine; and/or differences in sedation requirements between routine endoscopic examinations and advanced therapeutic procedures. Recovery times were comparable; and there was no significant adverse event in either study.

It is believed that small doses of midazolam and meperidine potentiate the action of propofol, thereby providing sedation comparable with that of propofol alone but with a marked reduction in the dosage of propofol. However, randomized, controlled trials of propofol compared with various combinations of propofol plus a benzodiazepine and an opioid are required before this concept can be accepted.

The endoscopist, assisted by an endoscopy nurse, directed the administration of propofol in the present series. This required continuous communication between the nurse and the endoscopist concerning the patient's level of sedation and comfort. The nurse was responsible for advising the physician when the patient appeared to become aware of the examination, usually indicated by opening of the eyes, talking, or facial grimace. If the clinical parameters permitted, another bolus of propofol was given. In many other published studies, propofol

administration was by continuous infusion or under patient control. It is believed that bolus dosing allows the endoscopist to precisely titrate drug dosage (e.g., giving a bolus of propofol before stretching out a loop of sigmoid colon), so that each patient receives a dose of medication sufficient for comfort, while keeping the total dosage of propofol to a minimum.

Serious adverse events have been associated with propofol, including severe respiratory depression, hypotension, and bradycardia.^[32] In the current study, there was no significant adverse event, and administration of an antagonist was not required. Hypotension and bradycardia reportedly occur in, respectively, 16% and 5% of patients receiving propofol for general anesthesia.^[33] Relative hypotension is reported as occurring in 26% to 33% of patients receiving propofol for endoscopic sedation.^[24]^[30] These hemodynamic changes usually are transient and rarely require intervention. Hypoventilation requiring intervention is rare. Jung et al.^[11] encountered one episode of apnea in a relatively small series of patients randomized to sedation with either propofol or midazolam during ERCP. In the series of Wehrmann et al.,^[8] one instance of apnea was noted (details not provided). It is believed that the judicious use of propofol in small bolus doses, combined with midazolam and meperidine, can maximize its safety profile while maintaining efficacy as a sedative/hypnotic agent for endoscopic procedures.

It was not possible in the current retrospective study to determine the minimum time required for recovery after sedation. Recovery time was measured as the period between entry and departure from the recovery area. The staff made no effort to speed patient recovery, as for example by awakening patients from sleep. The recovery period also included the time required to dress, as well as the time needed to eat or drink before departure. Consequently, the recovery time (mean 25 minutes for colonoscopy) overestimates the actual time required for a patient to recover from the effects of the sedative drugs. It is not believed that the low dose of meperidine or midazolam appreciably delayed recovery, but this can only be proven by a prospective trial. The present study did not address patient satisfaction. However, the colonoscopy completion rate was 98%, suggesting that sedation was adequate.

Gastroenterologist-directed endoscopic sedation with propofol plus low doses of an opioid narcotic and midazolam can be effective and safe. It is believed that the synergistic effects provided by the addition of an opioid and a benzodiazepine permit a reduction in the dosage of propofol, compared with the use of propofol alone. The level of safety achieved in the present study may be the result of strict adherence to a sedation protocol, careful patient monitoring, experience for both nurses and endoscopists in the use of the drug, and extensive staff training. The use of propofol should not be undertaken by a nonanesthesiologist without this high level of preparation and caution. The optimal regimen for endoscopic sedation can only be determined by prospective randomized trials of propofol alone vs. the combination of propofol, an opioid, and a benzodiazepine. For gastroenterologist-directed administration of propofol to become an accepted form of endoscopic sedation, additional safety data are required. It is believed that in the future the use of propofol will make GI endoscopy more efficient and effective.

Acknowledgement

We thank Valerie Durkalski, PhD, MPH, for her helpful suggestions and statistical support.

APPENDIX Protocol for administration of propofol during endoscopic procedures

Patient selection

1. Patients should be ASA class I–II. Class III patients may be included at the discretion of the endoscopist.
2. Patients with a history of seizures or allergy to soybeans, eggs, or propofol are excluded.
3. Patients with a history of sleep apnea; short, thick neck; inability to widely open their mouth; or a history of difficult intubation are excluded.

Patient monitoring

1. All patients receiving propofol should be monitored for SaO_2 , heart rate, blood pressure,

electrocardiogram, CO₂ levels, and respiratory rate. It is the responsibility of both the endoscopist and endoscopy nurse/assistant to monitor these physiologic parameters during the examination.

2. Chest excursion and respiratory effort will be monitored by the endoscopy nurse.
3. Supplemental oxygen is not routinely administered. If the SaO₂ drops below 90%, jaw or chin thrust should be performed. If the SaO₂ remains below 90% for 30 seconds despite these maneuvers, supplemental oxygen should be provided at 4 L/minute.
4. Full resuscitation equipment must be available within easy reach in the endoscopy room.

Protocol for sedation

1. Administration of meperidine and midazolam.

Age 70 years and under: meperidine 50 mg (or fentanyl 75 mcg), and midazolam 1 mg IV.

Age > 70 years: meperidine 25 mg (or fentanyl 50 mcg), and midazolam 0.5 mg IV.

2. Administration of propofol.

Propofol (at a concentration of 10 mg/mL) should be drawn into a 5- or 10-mL syringe. In general, a 10-mL syringe is used for a healthy patient less than 70 years, and a 5-mL syringe for patients 70 years or older. Initial bolus of 10 mg (1 mL) IV. Additional boluses of 5-10 mg may be given at 30-60 second intervals until an adequate level of sedation is achieved. In some instances, a 15-mg bolus may be given, based upon the patient's previous response to a smaller size bolus (5-10 mg).

Boluses may be given at 30-60 second intervals with the following parameters:

SaO₂ > 90%

TCO₂ < 45 mm Hg

The physician is responsible for dosing decisions of all medication. The physician may request that the nurse administer medication. When this has been performed, the nurse should verbally confirm that the medication has been given by stating aloud "10 mg of propofol given."

Discharge criteria

1. Patient responds appropriately to questions.
2. Patient is able to sit upright for 5 minutes.
3. Patient is able to dress independently.

References

1. Keeffe EB, O'Connor KW. 1989 ASGE survey of endoscopic sedation and monitoring practices. *Gastrointest Endosc* 1990;36:S13-8. [Abstract](#)
2. Davila ML, Keeffe EB. Complications of gastrointestinal endoscopy. In: Feldman M, Friedman LS, Sleisenger MH, editors. *Sleisenger and Fordtran's gastrointestinal and liver disease* Philadelphia: Saunders; 2002. p. 539-48.
3. Sebel PS, Lowdon JD. Propofol: a new intravenous anesthetic. *Anesthesiology* 1989;71:260-77. [Citation](#)
4. Smith I, White PF, Nathanson M, Gouldson R. Propofol: an update on its clinical use. *Anesthesiology* 1994;81:1005-43. [Citation](#)
5. Shafer A, Doze VA, Shafer SL, White PF. Pharmacokinetics and pharmacodynamics of propofol infusions during general anesthesia. *Anesthesiology* 1988;69:348-56. [Abstract](#)
6. Nelson DB, Barkun AN, Block KP, Burdick JS, Ginsberg GG, Greenwald DA, et al. Propofol use during gastrointestinal endoscopy. *Gastrointest Endosc* 2001;53:876-9. [Full Text](#)
7. Carlsson U, Grattidge P. Sedation for upper gastrointestinal endoscopy: a comparative study of propofol and midazolam. *Endoscopy* 1995;27:240-3. [Abstract](#)
8. Wehrmann T, Kokabpik S, Lembcke B, Caspary WF, Seifert H. Efficacy and safety of intravenous propofol sedation during routine ERCP: a prospective, controlled study. *Gastrointest Endosc* 1999;49:677-83. [Full Text](#)
9. Walker JA, Schleinitz PF, Jacobson KN, Haulk AA, Adesman PW. Propofol: multiple advantages for endoscopy and colonoscopy in 1,424 consecutive patients. [abstract] *Gastrointest Endosc* 2000;51:AB59.
10. Koshy G, Nair S, Norkus EP, Hertan HI, Pitchumoni CS. Propofol versus midazolam and meperidine for conscious sedation in GI endoscopy. *Am J Gastroenterol* 2000;95:1476-9. [Abstract](#)
11. Jung M, Hofmann C, Kiesslich R, Brackertz A. Improved sedation in diagnostic and therapeutic ERCP: propofol is an alternative to midazolam. *Endoscopy* 2000;32:233-8. [Abstract](#)
12. Ng JM, Kong CF, Nyam D. Patient-controlled sedation with propofol for colonoscopy. *Gastrointest Endosc*

- 2001;54:8-13. [Full Text](#)
13. Rex DK, Overley C, Kinser K, Coates M, Lee A, Goodwine BW, et al. Safety of propofol administered by registered nurses with gastroenterologist supervision in 2000 endoscopic cases. *Am J Gastroenterol* 2002;97:1159-63. [Abstract](#)
14. Vargo JJ, Zuccaro G, Dumot JA, Shermock KM, Morrow JB, Conwell DL, et al. Gastroenterologist-administered propofol versus meperidine and midazolam for advanced upper endoscopy: a prospective, randomized trial. *Gastroenterology* 2002;123:8-16. [Abstract](#)
15. Sipe BW, Rex DK, Latinovich D, Overley C, Kinser K, Bratcher L, et al. Propofol versus midazolam/meperidine for outpatient colonoscopy: administration by nurses supervised by endoscopists. *Gastrointest Endosc* 2002;55:815-26. [Full Text](#)
16. McClune S, McKay AC, Wright PMC, Patterson CC, Clarke RSJ. Synergistic interaction between midazolam and propofol. *Br J Anaesth* 1992;69:240-5. [Abstract](#)
17. Short TG, Plummer JL, Chui PT. Hypnotic and anaesthetic interactions between midazolam, propofol and alfentanil. *Br J Anaesth* 1992;69:162-7. [Abstract](#)
18. Roseveare C, Seavell C, Patel P, Kimble J, Jones C, Shepherd H. Patient-controlled sedation and analgesia using propofol and alfentanil during colonoscopy: a prospective randomized controlled trial. *Endoscopy* 1998;30:768-73. [Abstract](#)
19. Carrasco G, Cabre L, Sobrepere G, Costa J, Molina R, Cruspina A, et al. Synergistic sedation with propofol and midazolam for intensive care patients after coronary artery bypass grafting. *Crit Care Med* 1998;26:844-51. [Full Text](#)
20. Seifert H, Schmitt TH, Gultekin T, Caspary WF, Wehrmann T. Sedation with propofol plus midazolam versus propofol alone for interventional endoscopic procedures: a prospective, randomized study. *Aliment Pharmacol Ther* 2000;14:1207-14. [Abstract](#)
21. Reimann FM, Derad IS, Fuchs M, Schiefer B, Stange EF. Synergistic sedation with low-dose midazolam and propofol for colonoscopies. *Endoscopy* 2000;32:239-44. [Abstract](#)
22. Clarke AC, Chiragakis L, Hillman LC, Kaye GL. Sedation for endoscopy: the safe use of propofol by general practitioner sedationists. *Med J Aust* 2002;176:158-61. [Abstract](#)
23. Bhardwaj G, Conlon S, Bowles J, Baralt J. Use of midazolam and propofol during colonoscopy: 7 years of experience. [letter] *Am J Gastroenterol* 2002;97:495-6. [Citation](#)
24. Paspatis GA, Manolaraki M, Xirouchakis G, Papanikolaou N, Chlouverakis G, Gritzali A. Synergistic sedation with midazolam and propofol versus midazolam and pethidine in colonoscopies: a prospective, randomized study. *Am J Gastroenterol* 2002;97:1963-7. [Abstract](#)
25. Vargo JJ, Zuccaro G, Dumot JA, Shay SS, Conwell DL, Morrow B. Gastroenterologist-administered propofol for therapeutic upper endoscopy with graphic assessment of respiratory activity: a case series. *Gastrointest Endosc* 2000;52:250-5. [Full Text](#)
26. Zamir S, Rex DK. An initial investigation of efficiency in endoscopy delivery. *Am J Gastroenterol* 2002;97:1968-72. [Abstract](#)
27. American Society for Gastrointestinal Endoscopy. Guidelines for the use of deep sedation and anesthesia for GI endoscopy. *Gastrointest Endosc* 2002;56:613-7. [Full Text](#)
28. Kulling D, Fantin AC, Biro P, Bauerfeind P, Fried M. Safer colonoscopy with patient-controlled analgesia and sedation with propofol and alfentanil. *Gastrointest Endosc* 2001;54:1-6. [Full Text](#)
29. Munoz-Navas M, Garcia-Pedrajas F, Panadero A, Macias E, Corella C, Lopez L, et al. Midazolam-flumazenil (MF) versus propofol (P) for ambulatory colonoscopy (C). Preliminary results of a randomized single blinded study. [abstract] *Gastrointest Endosc* 1994;40:P29.
30. Heuss LT, Schnieper P, Drewe J, Pflimlin E, Beglinger C. Safety of propofol for conscious sedation during endoscopic procedures: a prospective study. [abstract] *Gastrointest Endosc* 2002;55:AB144.
31. American Society of Anesthesiologists. Practice guidelines for sedation and analgesia by non-anesthesiologists. *Anesthesiology* 2002;96:1004-17. [Full Text](#)
32. Graber RG. Propofol in the endoscopy suite: an anesthesiologist's perspective. *Gastrointest Endosc* 1999;49:803-6. [Full Text](#)
33. Hug CC, McLeskey CH, Nahrwold ML, Roizen MF, Stanley TH, Thisted RA, et al. Hemodynamic effects of propofol: data from over 25,000 patients. *Anesth Analg* 1993;77:S21-9. [Abstract](#)