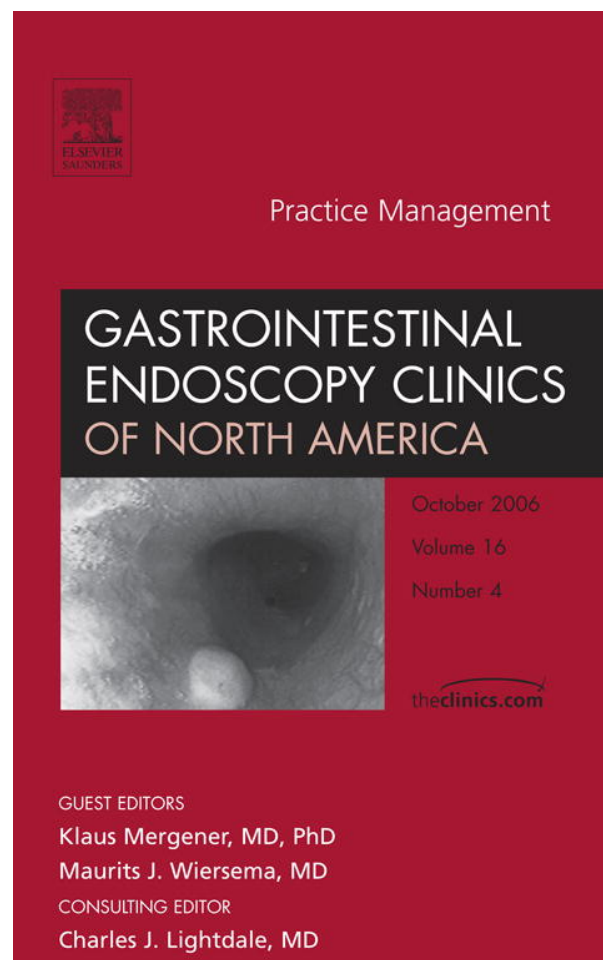


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Sedation in Endoscopic Practice

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Sedation impacts every aspect of endoscopy practice—the quality of the examination, the satisfaction of the endoscopist and of the patient, the efficiency and cost of delivering services, and the compliance of patients with surveillance guidelines. Despite its pivotal role, the field of endoscopic sedation has been relatively overlooked. As recently as 2004, authorities wrote that sedation “has remained ... a poorly studied entity that [is] rife with historical uncontrolled data and extrapolations” [1]. That same year, only 2.8% of the abstracts published by the American Society for Gastrointestinal Endoscopy pertained to sedation [2]. Consequently, until recently the practice of endoscopic sedation looked much as it had in the 1980s: a benzodiazepine and narcotic were administered by a gastroenterologist using a syringe and unsophisticated monitoring [3].

Today, the sedation landscape is changing. New sedation agents and improved patient-monitoring and drug-delivery technologies are challenging traditional practices. Increasing demand for endoscopic services, shrinking reimbursements, and competing diagnostic technologies are prompting recognition that new approaches to sedation can improve practice efficiency and patient outcome. At one end of the spectrum is unsedated endoscopy; at the other is monitored anesthesia care with propofol administered by an anesthesiologist. This article discusses new developments in endoscopic sedation and their implications for practice management.

Sedation and practice efficiency

Efficiency is defined as “the ratio of the...useful output to the total input in any system”[4]. In endoscopy, “total input” includes time input (namely, physician, nurse, and technician time) and cost input (drugs, facility,

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personnel, and equipment cost); “time efficiency” and “cost efficiency” refer respectively to the time and cost inputs necessary to accomplish a particular output. In endoscopy, “useful output” equals the volume of high-quality procedures performed.

There is limited research measuring the impact of sedation on cost and time efficiency in endoscopy [5]. Observational studies suggest that sedation accounts for approximately three fourths of the total time that a patient spends in the endoscopy unit [6] and for 40% of the procedure cost [7]. Both procedure room and recovery room turnover rate have been shown to drive endoscopic practice efficiency [8]. Therefore, improvements in sedation have the potential to decrease the time and expense required to deliver endoscopic services.

To understand the impact of sedation on endoscopic efficiency, it can be compared with unsedated endoscopy, a situation in which input related to sedation is eliminated. One study suggested that eliminating sedation during esophageal endoscopy shortened recovery time from 75 to 12 minutes and total procedure time from 112 to 29 minutes [6]. This reduction in turn eliminated 36% of the procedure’s cost (\$183 per case). In another study, eliminating sedation during colonoscopy saved \$104 per case because of the reduction in medication, monitoring, and facility requirements [9]. Mean time from completion of colonoscopy to discharge was reduced from 54.6 to 10.1 minutes. Despite this potential for improved efficiency, more than 98% of all endoscopists in the United States use intravenous sedation for esophageal endoscopy and colonoscopy [10], and only 15% contemplate incorporating unsedated colonoscopy into their practice in the near future [11].

Propofol offers the potential to improve endoscopic efficiency because its pharmacokinetics (onset of action, 30 seconds; half-life, 1.5–4 minutes) [12] are better suited to short procedures than those of the slower-acting conventional agents. Although the effect of conventional agents may be shortened with reversal agents, this strategy is not used routinely in the United States [10]. In many observational studies, patient recovery after propofol sedation requires only 10 to 15 minutes [13–15], a period that is similar to unsedated endoscopy [9]. In a randomized, controlled study, patients undergoing colonoscopy with propofol recovered significantly faster than those receiving benzodiazepine/narcotic (40 minutes versus 71 minutes) [16]. A second study from the same group reported similar findings [17]. In a randomized study that compared sedation with propofol with meperidine/midazolam during endoscopic retrograde cholangiopancreatography and endoscopic ultrasound, the average recovery time was shorter (18.6 minutes versus 70.5 minutes), and hence the recovery room costs were lower (\$9 versus \$38 per case) in the propofol group than in the benzodiazepine/opioid group [18]. When the cost of an anesthesiologist (typically required when propofol is used) was included in the analysis, total sedation costs were higher in the propofol group (\$180 versus \$67). If a nurse administered the propofol, however, the two strategies cost roughly the same amount.

Anesthesia providers and endoscopy

The introduction of propofol

Propofol emulsion was approved by the Food and Drug Administration in 1989 for induction and maintenance of general anesthesia, with a warning in bold face in the package insert stating that propofol was to be administered only by persons trained in the administration of general anesthesia and not involved in the conduct of the surgical/diagnostic procedure [19]. Because of its unique pharmacokinetic profile, propofol rapidly became the intravenous agent most widely used for procedural sedation by anesthesiologists worldwide. Compared with conventional endoscopic sedation, propofol offers faster and cleaner patient recovery, greater endoscopist and patient satisfaction, and better success with the hard-to-sedate patient.

A survey of 5000 American College of Gastroenterology members in 2004 showed that 26% of United States endoscopists now use propofol-based sedation [10], a marked increase from 1 decade earlier when benzodiazepine/narcotic-based sedation was almost universal. Between 2001 and 2003, the use of propofol during colonoscopy doubled [20]. The use of propofol varies widely by geographic region in the United States and even within a single urban area (Figs. 1 and 2). Ninety-two percent of endoscopists who use propofol use an anesthesiologist or a certified registered nurse anesthetist to administer the drug. Predictably, therefore, anesthesiologist services and propofol use vary in parallel (see Fig. 1).

Anesthesiology providers and the economics of endoscopy

As the demand for endoscopic services grew and reimbursements declined in the 1990s, endoscopists searched for ways to improve their efficiency. The addition of an anesthesiologist to the endoscopy team and the use of an ultra-short-acting sedative provided an attractive option—particularly if it was covered by the payors! Potentially, an anesthesiologist could reduce the endoscopist's work (for example, by obtaining the preprocedure history, positioning the patient, starting the intravenous administration, and monitoring vital signs and patient recovery) and the endoscopist's costs (by providing the intravenous supplies, medications, and in some cases, physiologic monitoring devices).

In fact, anesthesia providers seeking contracts with gastroenterologists invoke this argument [21]. Although it may be valid in some environments, the argument that an anesthesiologist improves efficiency in the endoscopy suite is not bolstered by data. Anecdotal experience also illustrates how an anesthesiologist might decrease throughput (eg, by requesting extra preprocedure testing or by delaying or even canceling scheduled cases). More importantly, an anesthesiologist-based model ultimately could reduce the volume of endoscopies being performed. The reasons for this deserve careful consideration.

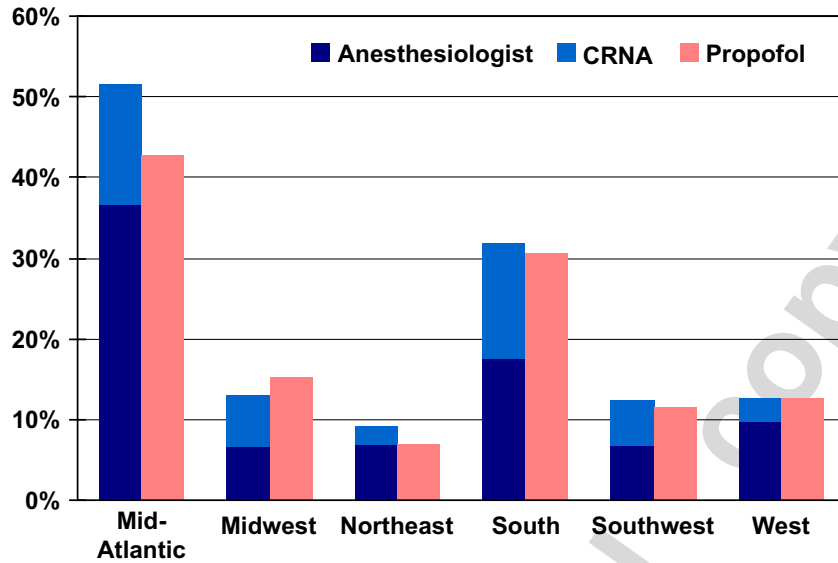


Fig. 1. The prevalence of propofol use for endoscopic sedation and involvement of anesthesiologist/certified registered nurse anesthetist by geographic region of the United States. CRNA, certified registered nurse anesthetist.

The first reason relates to the cost effectiveness of optical colonoscopy compared with other technologies used for screening colorectal cancer. If the total cost of optical colonoscopy is increased by adding an anesthesia provider, its competitiveness as a screening tool compared with CT colonography will be reduced. A recent cost-effectiveness analysis concludes that to

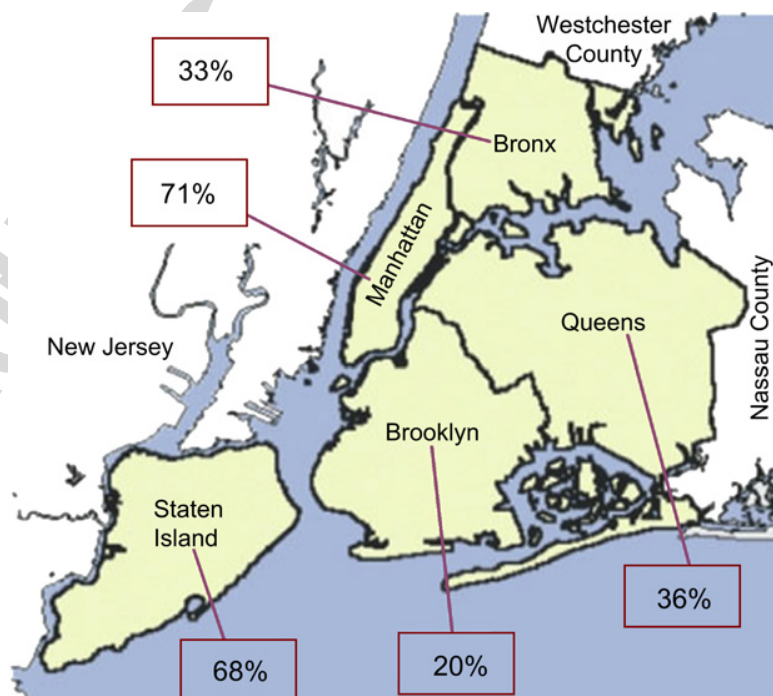


Fig. 2. Prevalence of propofol use in New York City by borough.

be economically reasonable CT colonography must cost 25% to 40% less than optical colonoscopy [20]. If the use of anesthesia increases the cost of optical colonoscopy by \$350 per case, optical colonoscopy becomes costly compared with CT colonography. Ultimately, it is likely that this difference in cost would increase the use of CT colonography and reduce the total number of optical colonoscopies performed.

A second reason relates to the valuation of the endoscopy codes. In the original valuation, health care economists did not provide specific information regarding the “conscious” sedation portion of the endoscopy service [20]. Subsequent guidance from Medicare has made it clear that conscious sedation is valued as part of the “practice expense” component. Over time, many payors disallowed separate reimbursement to gastroenterologists for providing sedation. During the past decade, a number of insurance carriers also enacted policies restricting reimbursement to anesthesiologists during endoscopy to circumstances in which the patient is hard to sedate or clinically unstable. Propofol, which typically is given by an anesthesiologist, has complicated this reimbursement structure. In the 2005 edition of *Current Procedural Terminology (CPT)*, the American Medical Association identified virtually all endoscopic procedures as “target” codes, wherein the administration of sedation is “inherent to” the service [22]. In conjunction with this publication, the three major gastroenterology societies in the United States wrote that “the routine assistance of an anesthesiologist/anesthetist for average risk patients undergoing standard upper and lower endoscopic procedures is not warranted” [23]. Therefore, a risk exists that if practices evolve so that most routine endoscopies are performed with an anesthesiologist, Medicare would decrease procedural reimbursement to gastroenterologists, reasoning that their “practice expense” has decreased [24].

Growing scrutiny of anesthesiology services

Inevitably, as the number of anesthesia services during endoscopy grows, health economists and health insurers are scrutinizing the resulting expense more closely. An analysis of the magnitude of the costs involved reveals why. The mean Medicare payment for anesthesia care during colonoscopy is \$109, the commercial payment is around \$400 in New York City [20], and the mean commercial payment nationwide is \$279 [25]. Approximately 18 million endoscopic procedures are performed per year in the United States [26]. Therefore, if anesthesiologists participated during all endoscopic procedures, the costs accrued would equal more than \$5 billion annually. Current data emphasize that this projection is reasonable: using an economic model, one analysis suggests that the cost of anesthesia service in gastroenterology in 2005 had already reached approximately \$1.3 billion [27].

In the absence of clinical evidence, cost-effectiveness analysis helps evaluate the relative return on this investment. Conventionally, economists use

a threshold of \$50,000 per life-year saved as a measure of reasonable cost effectiveness; as a reference point, colon cancer screening costs \$25,000 to \$45,000 per life-year saved [28]. Assuming that an anesthesiologist costs \$250 per case and that 25 life-years (colonoscopy at age 50 years; life expectancy equals 75 years) can be saved by avoiding an anesthesia-related death, then adding an anesthesiologist needs to save one life in 5000 procedures to remain below the \$50,000/life-year-saved threshold. By any published measure, this degree of benefit is highly unlikely. Moreover, if (as is customary) one discounts the value of life-years in older age, the cost effectiveness of the investment becomes even less plausible.

The Centers for Medicare and Medicaid Services has delegated to local Medicare contractors the decision about whether to pay for propofol-related anesthesia services during gastrointestinal endoscopy. The response to this issue has varied among carriers. Empire Blue Cross of New York allows payment to anesthesiologists, whereas Noridian, the Medicare contractor for 13 Western states, disallows it unless the case meets high-risk criteria [20]. As anesthesiologist-related costs rise, as information systems allow payors to link anesthesia and endoscopy claims, and as organizations like the American Medical Association and the gastroenterology professional societies support the “inherent-to” position, more payors are disallowing the service. For example, in a policy change dated September 2005, Blue Cross of California, a division of Wellpoint, which provides insurance coverage to more than 26 million individuals, wrote: “The routine assistance of an Anesthesiologist...for average risk patients undergoing...standard gastrointestinal endoscopic procedures is considered **not medically necessary**” [29]. In December 2005, the American Society for Gastrointestinal Endoscopy sent members an alert, stating, “A number of insurance carriers are likely to implement a policy of non-payment for anesthesiologist-assisted sedation in routine endoscopy procedures” [30]. Claims are being denied, and inevitably this trend will continue. Gastroenterologists who are using propofol with the assistance of anesthesiologist will need to ask, “Do I revert back to conventional sedation or do I learn to give propofol myself?”

Propofol use by gastroenterologists

Economics and politics

During this time, while a billion-dollar ambulatory anesthesia industry has grown based on providing services for gastrointestinal endoscopy, there has been no immediate economic incentive for gastroenterologists to learn propofol-based sedation. Incentives and practice patterns are changing, however, as the payors are beginning to disallow anesthesiologist payment during endoscopy. The motivation for gastroenterologists to learn to give propofol will be heightened if data show a marketing advantage for

practices that offer propofol-based sedation or if third-party payors consider decreasing professional fees to those gastroenterologists who use anesthesiologists.

The gastroenterology and the anesthesia societies have publicly debated the appropriateness of non-anesthesiologist-administered propofol. Much of the debate reflects economic rather than clinical concerns [20,31]. In March 2004, the American College of Gastroenterology, the American Gastroenterological Association, and the American Society for Gastrointestinal Endoscopy released a tri-society document stating, "There are data to support the use of propofol by adequately trained non-anesthesiologists" [23]. Soon thereafter, the American College of Gastroenterology petitioned the Food and Drug Administration to remove the warning from the product label for propofol, arguing that "substantial clinical evidence establishes that propofol can be administered safely, effectively, and cost-effectively by gastroenterologists and by nurses working under their supervision" [32]. The American Society for Anesthesiology (ASA) countered that the use of propofol should be restricted to those experienced in the skills (such as endotracheal intubation) that are required during general anesthesia [33]. This rebuttal drew on arguments made in a 2004 ASA publication entitled "Statement on Safe Use of Propofol" [34]. In oral point-counterpoint debates anesthesiologists have also characterized non-anesthesiologist-administered propofol as risky and ill conceived and in some instances have depicted it as irresponsible.

The political actions of the anesthesiology community have influenced both policy and gastroenterologists' attitudes, discouraging most endoscopists (despite their acknowledgment of the shortcomings of conventional sedation) from learning to give propofol themselves [10]. For example, 12 state nursing boards have prohibited the administration of propofol by non-anesthesiologists [35]. Likewise, in many local hospital and ambulatory surgery centers sedation committees (usually chaired by an anesthesiologist) have prohibited the administration of propofol by non-anesthesiologists. Nearly 60% of the endoscopists who are not interested in learning to administer propofol are dissuaded by medico-legal concerns or regulatory restrictions [10].

The American Society for Gastrointestinal Endoscopy recently published guidelines for training and certification of gastroenterologists in the administration of propofol [36]. The implementation of programs designed to provide this training will require a large-scale effort and support from the gastroenterology societies. Preparation and training must involve both the endoscopist and the endoscopy support staff. The principles of propofol use can be taught in didactic courses offered at the local or regional level, but adequate training also should involve a one-on-one, hands-on tutorial at a center that has expertise in the use of propofol. In parallel with these efforts, training in propofol administration will need to be integrated into gastroenterology fellowship programs.

Safety

The use of propofol for procedural sedation raises safety concerns because of its rapid action, pharmacokinetic and pharmacodynamic variability, and lack of a pharmacologic antagonist. To date, at least 30 reports exist in the English-language literature regarding propofol use by non-anesthesiologists during endoscopy (Table 1). These reports encompass approximately 200,000 procedures, 18 first authors, four continents, eight countries, 17 full-length peer-reviewed papers, and 13 abstracts. There have been no reported deaths.

Critics have suggested that even 200,000 is an insufficient number to demonstrate safety, because sedation-related death is rare during endoscopy [37]. It is not clear what death rate should be used as a benchmark. Anesthesiology-related death rates vary widely in the literature, ranging from more than 2 per 10,000 cases to less than 1 per 200,000 [38]. Furthermore, most experts agree that monitored anesthesia care is more dangerous than general anesthesia [39]. Thus, in comparison with any published anesthesiologist benchmark, non-anesthesiologist-administered propofol has an outstanding safety record. When compared with the published safety record of “conscious” sedation administered by gastroenterologists [40,41], the safety record of non-anesthesiologist propofol is also reassuring. A meta-analysis of the literature comparing the complication risks of propofol with those of conventional sedation agents concluded that propofol use by

Table 1

Published reports of propofol utilization by non-anesthesiologists for gastrointestinal endoscopy

First Author	No. Patients	Intubations	Deaths
Heuss [15,46,52–58]	94,889	0	0
Walker [14]	13,855	0	0
Hansen [59]	182	0	0
Gonzalez-Huix [60]	2,839	0	0
Fatima [61]	806	0	0
Tohda [62]	25,200	0	0
Baptista [63]	7,000	1	0
Yusoff [64]	500	0	0
Koshy [13]	150	0	0
Dubois [65]	100	0	0
Wehrmann [66,67]	179	0	0
Seifert [68]	239	0	0
Sinnott [69,70]	3,728	0	0
Clarke [71]	28,472	0	0
Kulling [72]	300	0	0
Cohen [73]	4,213	0	0
Vargo [18,45,74,75]	9,830	0	0
Rex [76]	12,483	0	0
Total	204,965	1	0

gastroenterologists was associated with a lower risk of cardiopulmonary complications [42].

Opponents of non-anesthesiologist-administered propofol also have expressed concern that the experience in centers of excellence may not be transferable to community-based endoscopists [37]. Experience, however, has shown that non-anesthesiologist propofol administration can be learned at expert centers and then instituted locally. For example, Sipe [43] reported on his experience learning to administer propofol at a training site and successfully implementing a similar program at a community hospital.

Ideally, a prospective, randomized study of anesthesiologist- versus non-anesthesiologist-administered propofol would be undertaken to address the issue of safety, although practical and political considerations make it unlikely that such a study will ever be undertaken. A second approach would use centralized adverse-event reporting to compare sedation-related deaths between the two groups. In the United States, however, reporting of complications to registries is limited, and access to data is restricted. Complications generally do not enter the public domain unless they are reported by the lay press or result in a legal trial, often at an appellate level [44]. Left are indirect historical comparisons, often involving dissimilar populations. Anecdotal reports circulate in the physician community of sedation-related deaths or serious adverse events related to both anesthesiologist- and endoscopist-administered propofol.

Models of administration

Two models have emerged for non-anesthesiologist propofol use during gastrointestinal endoscopy. Both models stress careful patient selection, rigorous training of physicians and nurses, strict adherence to protocols for drug administration, and graduated propofol dose titration. State-of-the-art physiologic monitoring, such as real-time capnography, is believed by many investigators to improve safety [45]. The models differ in who has the primary responsibility for drug dosing, in whether propofol is used as monotherapy or combination therapy, and in the depth of sedation targeted.

In nurse-administered propofol sedation [14,15,17], specially trained nurses make dosing decisions, and propofol is used as monotherapy. Originally pioneered by Walker [14], nurse-administered propofol sedation was the first model for non-anesthesiologist-administered propofol and has accumulated the largest experience to date. Because propofol has no analgesic properties, relatively large doses (150–300 mg) are required when it is administered alone, and most patients are deeply sedated at some point during the endoscopic procedure. Nonetheless, the safety of this approach was demonstrated in a recent report of more than 36,000 cases performed at three endoscopy units, two within the United States and one in Switzerland [46].

In gastroenterologist-directed propofol, the dosing responsibility is shared between the physician and nurse, and propofol is combined with very small doses of a benzodiazepine and an opioid narcotic [47]. The potential advantages of combination propofol result in part from the positive drug interaction between propofol and opioids that has been demonstrated in several models [48,49]. These studies have shown that when small doses of an opioid and propofol are combined, the analgesic synergism is greater than the hypnotic synergism. This effect theoretically expands propofol's therapeutic window and makes its use safer. Recent experience seems to support these observations. Two studies have shown that combining low doses of propofol (mean, 98 mg) with very small doses of fentanyl (50–75 μ g) and midazolam (0.5–1 mg) minimizes the risk of deep sedation while preserving the benefits associated with the use of propofol during endoscopy [43,50]. In these studies, patients were minimally or moderately sedated during more than 98% of assessments, and the few episodes of deep sedation that were encountered lasted less than 2 minutes. Illustrating the same point, a double-blind study using a crossover design in which patients underwent two upper gastro-intestinal endoscopies showed that adding very small amounts of a narcotic and benzodiazepine to propofol significantly reduced the mean propofol dose (98 mg versus 58 mg) while prolonging recovery time only slightly (16 minutes versus 12 minutes) [51]. Patient satisfaction was comparable with the two regimens, but physician satisfaction was greater with the combination method.

Summary

Today's endoscopist must make important practice-management decisions regarding sedation. The options range from unsedated endoscopy to deep sedation given by an anesthesia specialist. Although unsedated endoscopy enhances operational efficiency, it has not been widely embraced in the United States. Data indicate that propofol represents an improvement over benzodiazepine/narcotic-based sedation. Newer medications and new endoscopic, monitoring, and drug-delivery technologies will continue to change sedation practices. If the use of anesthesia services in endoscopy continues to grow, there is a significant risk that payors will disallow them or will decrease professional fees to endoscopists who involve anesthesia providers. Despite unfavorable regulatory and economic incentives, non-anesthesiologist propofol administration has accumulated a large experience and an excellent safety record. Ideally, both anesthesiologist-based and non-anesthesiologist-based solutions will be developed cooperatively by the anesthesiology and gastroenterology communities and will become available to endoscopists. This outcome will best accommodate differences in professional style, practice characteristics, and local culture. For this outcome to occur, economic incentives for physicians must align with risk, work, and costs.

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