

Sedation and Anesthesia Care for Ophthalmologic Surgery during Local/Regional Anesthesia

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Anesthesia care for the patients undergoing ophthalmologic surgical procedures during local/regional anesthesia balances goals of patient comfort with safety and an optimal outcome in a highly cost-conscious environment. This article discusses current practices and trends in anesthesia care with respect to sedation for eye surgery during local/regional anesthesia. Although there is no evidence that one local/regional anesthesia technique or sedation analgesia regimen is superior to the others, this review highlights important differences between these varied approaches. The type of block used for the ophthalmologic surgery alters the sedation requirements. Changes in surgical techniques have increased the popularity of topical anesthesia, which reduces the need for sedation analgesia and may lessen the need for an anesthesia practitioner. The involvement of an anesthesia practitioner in eye surgery varies from facility to facility based on costs, anesthesiologist availability, and local standards. Anesthesia care choices are often made based on surgeon skill and anesthesiologist comfort, as well as the expectations and needs of the patient.

ANESTHESIA care for the patients undergoing ophthalmologic surgical procedures during local/regional anesthesia balances goals of patient comfort with safety and an optimal outcome. Regarding sedation, Hug¹ wrote: "generally speaking, the required doses of analgesic and sedative hypnotic drugs are proportional to the intensity of noxious stimulation." Therefore, any discussion of sedation for eye surgery must consider the type of surgical procedure and the local anesthetic technique used as well as patients' comorbidities. Newer surgical techniques for eye surgery have reduced the need for traditional injection eye blocks (*i.e.*, peribulbar and retrobulbar blocks) and increased the popularity of topical anesthesia. This has altered the need for sedation analgesia and the presence of an anesthesia practitioner during ophthalmologic surgery performed during local/regional anesthesia. This article discusses the anesthesia

care with respect to sedation for eye surgery performed during local/regional anesthesia, particularly cataract and vitreoretinal surgical procedures.

Ophthalmologic Procedures and Local/Regional Anesthetic Techniques

Cataract and vitreoretinal surgeries are the most frequently performed intraocular surgical procedures.^{2,3}§ The increased prevalence of cataract extraction by phacoemulsification has led to decreased use of injection eye blocks and more use of topical anesthesia. Topical anesthesia is applied as drops or gels and may be supplemented by intracameral injection by the surgeon for better intraoperative pain control.⁴ Vitreoretinal surgery usually requires at least a sub-Tenon block and, more frequently, injection anesthetic techniques. A sub-Tenon block consists of local anesthetic injected below the surface of the globe using a blunt cannula, with some of the local anesthetic diffusing to the retrobulbar space.⁵ Performance of conventional injection blocks involves delivery of local anesthetic into the periorbital space (peribulbar block) or within the eye muscle cone (retrobulbar block), individually⁶ or in combination.⁷ A separate facial nerve block may be performed to limit eyelid movement and sensation.

The variability among local/regional anesthesia techniques pertains to sensations, visual ability, extraocular movements, and eyelid function as well as associated complications. The type of block used for the ophthalmologic surgery alters the sedation requirements due to patient discomfort or fear, or by increasing surgical difficulties. Visual experiences occur in the majority of patients during phacoemulsification, although it varies with the local anesthetic technique. This has been described as frightening in 3-16% of patients.⁸ During topical anesthesia, patients more often perceive light and colors, or even the surgeon's hands and instruments,^{9,10} and subjectively feel pain during iris manipulation, globe expansion, and lens implantation.^{4,11} Patients undergoing cataract surgery during topical anesthesia have been found to have more intraoperative and postoperative discomfort than those given a sub-Tenon block.^{12,13} The retrobulbar and peribulbar blocks result in equivalent levels of pain control, which are

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Received from the Department of Anesthesiology and Pain Management, University of Texas Southwestern Medical Center at Dallas, Texas. Submitted for publication January 3, 2007. Accepted for publication April 20, 2007. Support was provided solely from institutional and/or departmental sources.

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§ <http://www.ahrq.gov/clinic/tp/anesttp.htm>. Accessed April 21, 2007.

Table 1. Comparisons of Local/Regional Anesthesia Techniques

	Topical	Sub-Tenon Block	Peribulbar Block	Retrolbulbar Block
Pain on administration	0 or –	+ or ++	++ or +++	+++
Surgical pain prevented	--	+++	++	++
Eye akinesia	---	0 or +	++	++
Eyelid sensation blocked	---	+	+	+
Visual sensations experienced	+++	++ or +	+	+

+ represents strength of affirmative evidence; 0 represents insufficient evidence; – represents strength of contrary evidence.

From references 2, 8, 14, and 17.

superior to that of topical anesthesia.¹⁴ It has been reported that additional sedation or analgesia was required intraoperatively more often in patients having topical anesthesia *versus* retrobulbar block.¹⁵ The use of injection blocks was associated with lower systolic blood pressures, even in hypertensive patients, as compared with topical anesthesia.¹⁶

Surgeons have reported better surgical conditions in patients during retrobulbar or peribulbar blocks as compared with topical anesthesia.^{15,17} A survey conducted at the Congress of the International Council of Ophthalmology in 2002 illustrated the wide variability in anesthesia techniques from country to country.¹⁸ Among ophthalmologists from the United States, topical anesthesia was used by 23%, retrobulbar blocks were used by 46%, and peribulbar blocks were used by 23%. Compared with the other countries represented at the Congress, the American ophthalmologists used topical anesthesia with equal frequency, but administered more retrobulbar blocks and fewer peribulbar blocks.

The Agency for Healthcare Research and Quality evidence report reviewed articles pertaining to cataract surgery from 1968 to 1999 and determined the strengths of evidence for the effectiveness of the various local anesthesia techniques.² There was strong evidence that globe akinesia is equivalent in retrobulbar and peribulbar techniques. They found weak evidence that the pain on injection is slightly less with peribulbar blocks as compared with retrobulbar techniques. There was moderate evidence that the administration of a sub-Tenon block causes less discomfort than a retrobulbar block. As far as intraoperative pain is concerned, they found strong evidence that retrobulbar blocks result in far less surgical pain than topical anesthesia, moderate evidence that peribulbar blocks result in less pain than topical anesthesia, and weak evidence that sub-Tenon block patients experience less pain than those who have topical anesthesia. The Agency for Healthcare Research and Quality report remarked that the rates of ocular perforation complicating the injection blocks are sufficiently low (1 in 1,000 to 1 in 10,000) and that they were rarely addressed.

In two studies, one of which administered combination peribulbar/retrobulbar blocks⁷ and the other of which administered sub-Tenon blocks,¹⁹ the patients

indicated that the placement of the intravenous cannula was the worst discomfort during their cataract surgery, thus suggesting that the eye blocks were not uncomfortable. When 98 patients underwent bilateral cataract surgery 1 week apart with differing anesthesia techniques for each eye, topical *versus* peribulbar/retrobulbar block, 70 patients preferred peribulbar/retrobulbar, 10 patients preferred topical (all had topical anesthesia for the first eye), and 18 patients indicated no preference.²⁰ The authors suggested that they could predict the patient's suitability for topical anesthesia based on their response to preoperative eye measurements performed in the ophthalmologist's office (*e.g.*, tonometry, the measure of intraocular pressures and A-scan, the ultrasound measurement of eye length). Therefore, if the patient cannot tolerate these painless examinations where contact with an anesthetized eye is required, it is unlikely that he or she will tolerate a surgical procedure during topical anesthesia.

There is wide variability in operative conditions, sensations, and pain relief dependent on the type of local anesthesia administered for intraocular surgery.^{2,8,14,17} Using published data that present the strength of evidence as "strong evidence," "weak evidence," or "no evidence," the differences between local/regional anesthetic techniques for variables such as pain (during placement of the block and during the surgery), eye akinesia, eyelid sensation, and visual sensations were quantified on a + or – scale, and the conflicts of evidence are presented as a range (table 1).^{2,8,14,17} Of note, surgeon use of, as well as patient suitability and expectations for, eye blocks may differ based on geographic locale in addition to other demographic factors, such as age, income, and location of care (*e.g.*, community hospital *vs.* tertiary center).

Sedation Analgesia Techniques

Both the types of eye procedures, including surgical techniques, and the local anesthetic technique (*e.g.*, topical *vs.* block) may determine the need for sedation analgesia. Sedative analgesic techniques have evolved with the availability of newer shorter-acting sedation-hypnotic and analgesic drugs. There are several drugs

and regimens for sedation and analgesia during eye surgery, but perhaps propofol may be the most familiar. This section will focus on propofol sedation for eye surgery as well as some of the newer agents and techniques for sedation and analgesia such as remifentanyl, dexmedetomidine, and patient-controlled sedation analgesia.

Propofol

Propofol has been commonly used for sedation because of its unique recovery profile as well as its antiemetic properties and rapid emergence. Habib *et al.*²¹ reported that a single bolus dose of propofol (15–75 mg, intravenously) administered 2–3 min before peribulbar block effectively reduced recall of the eye block without major systemic side effects or need for airway support. Almost 88% of patients did not recall the peribulbar block. The dose of propofol used in this study was based on the formula of Hocking and Balmer,²² based on the patient's weight and age ($56 + [0.25 \times \text{weight in kg}] - [0.53 \times \text{age in yr}]$). In a retrospective study, Ferrari and Donlon²³ compared the efficacy of propofol, methohexital, and midazolam during and after administration of retrobulbar block. They found that propofol was equal to both midazolam and methohexital in providing adequate sedation and postoperative amnesia but had the added advantages of reduced postoperative vomiting, lower intraocular pressure, and earlier return-to-home readiness. Interestingly, they did not find verbal response or grimacing during the block to correlate with or predict patient recall. Patient movement is a common undesirable response to stimulation seen in eye surgery patients during propofol sedation. A recent study reported that titration of propofol to Bispectral Index or middle-latency auditory evoked potentials did not reduce patient head movement when compared with propofol sedation guided by an experienced anesthesia practitioner.²⁴

Remifentanyl

Analgesia is an important part of sedation, anxiolysis, and immobility during the performance of an eye block. Remifentanyl is an ultrashort-acting opioid with a context-sensitive half-time of approximately 3 min and elimination half-time of approximately 10 min. It has a rapid onset, with a blood-brain equilibration time of 1 min. The efficacy and safety of remifentanyl have been evaluated in patients receiving local/regional anesthesia for eye surgery. A prospective randomized double-blind study compared intravenous propofol (0.5 mg/kg) and remifentanyl (0.3 $\mu\text{g}/\text{kg}$) for sedation and immobility during peribulbar/retrobulbar block.²⁵ Remifentanyl was found to be superior to propofol with respect to limita-

tion of movement and did not cause any clinically significant respiratory depression. Patient movement and sneezing during injection occurred more frequently after propofol. Although 27% in the remifentanyl group had recall of block administration compared with 15% in the propofol group, none of these patients reported that it was an unpleasant experience.

Holas *et al.*²⁶ compared the efficacy and safety of using infusions of remifentanyl ($0.05 \pm 0.03 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$), propofol ($1.5 \pm 0.5 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$), or both remifentanyl ($0.03 \pm 0.01 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) and propofol ($0.7 \pm 0.2 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$) for sedation during eye surgery under retrobulbar block. Superior pain relief was achieved with remifentanyl used as a sole agent when compared with propofol. The incidence on postoperative nausea and vomiting in the remifentanyl alone group was 27% compared with 0% in the propofol alone and propofol with remifentanyl groups.²⁶ Of note, in contrast to the current practice in which the sedation/analgesia is provided by a single dose, these authors used a continuous infusion of the hypnotic and analgesic drugs, which may explain the high incidence of postoperative nausea and/or vomiting in the remifentanyl only group. Rewari *et al.*²⁷ compared remifentanyl (1 $\mu\text{g}/\text{kg}$), remifentanyl (0.5 $\mu\text{g}/\text{kg}$) plus propofol (0.5 mg/kg), remifentanyl (1 $\mu\text{g}/\text{kg}$) plus propofol (0.5 mg/kg), and saline (control group) in patients undergoing eye surgery. They found that all treatment groups were superior to the control group with respect to improved pain relief and lack of movement during the block. The combination of remifentanyl (0.5 $\mu\text{g}/\text{kg}$) with propofol (0.5 mg/kg) provided excellent anxiety and pain relief with the least adverse effects. Significant respiratory depression was maximal in the remifentanyl (1 $\mu\text{g}/\text{kg}$) plus propofol (0.5 mg/kg) group, whereas recall was greatest in the remifentanyl (1 $\mu\text{g}/\text{kg}$) group. Another study found that remifentanyl (0.3 $\mu\text{g}/\text{kg}$) significantly reduced pain during injection of a retrobulbar block compared with placebo. Bradycardia and nausea and/or vomiting each occurred in 7% of patients receiving remifentanyl compared with 0% and 2%, respectively, in patients receiving placebo; however, there was no statistically significant difference between the groups.²⁸ Remifentanyl is safe and effective to use as a sole agent to provide acceptable conditions for injection eye blocks, although recall may occur with this technique.

Dexmedetomidine

Dexmedetomidine is a highly selective α_2 agonist that surpasses the potency of clonidine. It had sedative, anxiolytic, and analgesic properties without respiratory depression.^{29,30} Its actions are similar to those of benzodiazepines when used for premedication. Virkkilä *et al.*³¹ conducted a study to determine the optimal dose of

intramuscular dexmedetomidine for premedication in ambulatory cataract surgery during block anesthesia. Five groups of American Society of Anesthesiologists physical status I–III patients (7 patients per group) were given different doses of intramuscular dexmedetomidine (0.25, 0.5, 0.75, 1.0, and 1.5 $\mu\text{g}/\text{kg}$) approximately 1 h preoperatively. The 1- $\mu\text{g}/\text{kg}$ dose produced a 32% reduction in intraocular pressure and provided moderate sedation but was not associated with significant hemodynamic changes, whereas the 1.5- $\mu\text{g}/\text{kg}$ dose caused significant decreases in heart rate and systolic blood pressure. The authors suggested that the 1- $\mu\text{g}/\text{kg}$ dose was optimal for intramuscular premedication for cataract surgery. Another study by the same authors compared intramuscular dexmedetomidine (1 $\mu\text{g}/\text{kg}$), midazolam (20 $\mu\text{g}/\text{kg}$), and placebo as premedication for cataract surgery.³² Although both drugs produced similar sedative effects of short duration, dexmedetomidine decreased intraocular pressure whereas midazolam did not. Dexmedetomidine also produced a decrease in blood pressure and heart rate.

A recent study compared intravenous sedation with dexmedetomidine to midazolam for patients having cataract surgery during peribulbar block.³³ The investigator administered a dexmedetomidine bolus (1 $\mu\text{g}/\text{kg}$) followed by infusion (0.1–0.7 $\mu\text{g} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$) to one group, and midazolam in boluses, 20 $\mu\text{g}/\text{kg}$ to start followed by 0.5 mg as needed, to the other. Dexmedetomidine sedation at this dosage provided slightly higher patient satisfaction, but at a cost of cardiovascular depression and prolonged recovery room stays not found with midazolam. Lower doses, which may have less effect on blood pressure and recovery times, have not been investigated for use in cataract surgery. The role of dexmedetomidine for sedation during eye blocks needs further evaluation.

Patient-controlled Sedation Techniques

Patients undergoing eye surgery may benefit from patient-controlled sedation to provide comfort and anxiolysis with minimal drowsiness. Janzen *et al.*³⁴ evaluated patient acceptability and comfort of cataract surgery in elderly patients ($n = 20$) during peribulbar block by self-administration of propofol at a bolus dose of 0.25 mg/kg with a lockout interval of 3 min. Ninety percent of participants found the patient-controlled sedation “useful” and would choose the same sedation again. Pac-Soo *et al.*³⁵ evaluated patient-controlled bolus doses (without a lockout interval) of midazolam, propofol, or saline in patients undergoing cataract surgery during peribulbar block. They found that the level of anxiety was significantly reduced by patient-controlled sedation with both propofol and midazolam.

A comparison of anesthetist-administered midazolam

with patient-controlled sedation with propofol for vitreoretinal surgery by Morley *et al.*³⁶ did not find any significant outcome differences between the two techniques, except that anesthetist-administered midazolam produced more amnesia for the eye block. Aydin *et al.*³⁷ investigated the effects of patient-controlled analgesia with fentanyl for cataract surgery during topical anesthesia. One group received patient-controlled analgesia with 5- μg fentanyl boluses and lockout intervals of 5 min after an initial loading dose of 0.7 $\mu\text{g}/\text{kg}$. The control group received saline solution instead. They found that during the earlier part of surgery, at 5 and 10 min, sedation scores were significantly higher in the fentanyl group when compared with the control group, but the scores became similar for the remainder of the intraoperative period. Patient and surgeon satisfaction was higher in the fentanyl group. The role of patient-controlled sedation for patients undergoing eye surgery remains unproven.

Sedation Analgesia Techniques and Outcome

Although a number of drugs and regimens are used for sedation analgesia for eye blocks, the question remains whether there are measurable differences in outcomes such as pain, adverse events including surgical complications, and patient satisfaction, which make one technique superior to another. According to the American Society of Anesthesiologists Closed Claim database, patient movement during ophthalmologic surgery was the second most common cause of eye injury associated with anesthesia, all of which resulted in blindness.³⁸ One-fifth of monitored anesthesia care claims in a recent review of the American Society of Anesthesiologists closed claims database occurred during eye surgery.³⁹ Three quarters of patients injured during sedation received a combination of two or more drugs.

Among a large cataract surgery population ($n = 19,250$) in a study of nine eye centers, 26% of surgeries were accomplished with topical anesthesia, and the remainder were accomplished with injection blocks.⁴⁰ Although adverse medical events occurred infrequently, administration of any intravenous sedation increased the incidence of adverse events as compared with topical anesthesia without sedation. The use of short-acting hypnotics during injection blocks increased the incidence of adverse events when used solely (1.4%) or when combined with opioids (1.75%), sedatives (2.65%), or both (4.04%). Administration of more than one sedative agent significantly increased the odds ratio for an adverse event, from 9.8–12.3 for one agent to 16.6–30.2 for two agents and 30.7 when three categories of drugs were combined. Most of the adverse events in this study were minor, such as treatment of bradyarrhythmias or hypertension. Interestingly, no sedation regimen increased the risk of death or hospitalization.

Table 2. Options for Ophthalmologic Surgery

Local/regional technique
Topical anesthesia
Sub-Tenon block
Peribulbar block
Retrolbulbar block
Combination of peribulbar and retrolbulbar block
Sedation analgesia technique
None
Oral sedation
Intravenous hypnotic-sedatives and/or analgesics
Patient monitoring personnel
None
Registered nurse (surgeon supervised)
Anesthesia-trained personnel (registered nurse or respiratory therapist)
Anesthesia practitioner available
Anesthesia practitioner present in the operating room

Another publication analyzing this same population reported that the strategy associated with the lowest reports of pain, dissatisfaction, drowsiness, or nausea and vomiting was injection block technique and administration of sedatives and diphenhydramine.⁴¹ In this study, 5% of patients experienced pain (9% in the topical group), 16% experienced drowsiness, and 4% experienced nausea and/or vomiting. The group receiving opioids with sedatives had fewer reports of pain but an increased incidence of nausea and/or vomiting. No differences in patient satisfaction scores or levels of drowsiness were noted.

The Agency for Healthcare Research and Quality evidence report found only weak evidence that sedation improved anxiety control, pain relief, or patient satisfaction.² There was insufficient evidence that any class of sedative agent was associated with improved outcome over other agents. The authors remarked that surgeon specific factors such as duration of surgery might greatly influence the anesthesia needs and patient outcomes.

Role of Anesthesia Practitioner for Sedation during Eye Surgery

With changes in the surgical techniques, the need for anesthesia care for eye surgery is increasingly being questioned. Several studies have examined the role of an anesthesia practitioner during eye surgery performed during local/regional anesthesia, and whether their presence is cost effective. The local/regional anesthesia, sedation analgesia technique, and patient monitoring options for eye surgery are included in table 2. Rosenfeld *et al.*⁴² investigated the interventions of anesthesia personnel in 1,006 cataract patients. The authors noted that in light of “increased scrutiny” of health care expenditures, “It is of more than academic interest to justify the need for Monitored Anesthesia Care.” They found that 37.4% of patients having cataract surgery at their freestanding surgery center in Florida required some intervention. These surgeries were performed after a peribulbar block

by the anesthesiologist, which was conducted under sodium pentothal sedation. If nonmedical interventions (hand holding, physical restraint, or verbal reassurance) were excluded, 33.9% of cases still required some interventions. Four medical conditions were identified as having increased need for interventions: systolic hypertension, pulmonary disease, renal disease, and previous or current cancers. Patients younger than 60 yr required interventions 61% of the time, as opposed to 36.5% for older patients. When questioned, anesthesia personnel believed their presence was either vital or helpful to the success of operation 25% of the time.⁴² The authors commented that they were unable to identify in advance which patients would benefit from anesthesia presence during the surgery. They concluded that “monitored anesthesia care by qualified anesthesia personnel is reasonable and justified and contributes to the quality of patient care.”

A retrospective review of 560 charts of cataract patients in a teaching hospital in Iowa by Pecka and Dexter⁴³ found at least one anesthesia intervention occurred after block placement in 33% of 560 cataract cases. These authors commented that there is “no justification to decreasing the amount of time that anesthesiologist or nurse anesthetists spend caring for patients undergoing cataract extraction with a retrolbulbar block.”

A report of 1,957 cases from Canada using anesthesia-trained registered respiratory care practitioners questioned the need for anesthesiologists during cataract surgery performed during topical anesthesia.⁴⁴ They reported anesthesiologist interventions in only 4% of cases, but the registered respiratory care practitioners administered sedation under anesthesiologist guidelines. These registered respiratory care practitioners had at least 2 yr of critical care experience and were certified in advanced cardiac life support. They underwent a 30-day anesthesiologist-supervised training program that ended with both a clinical evaluation and a written examination. They administered intravenous sedation with midazolam (97.9% of patients) and fentanyl (83.1% of patients) in stepwise doses, per the evaluating anesthesiologist’s plan determined at the preoperative visit, and additional agents at the discretion of the operating surgeon. The consulting anesthesiologist also covered another operating room, supervising a resident in that room, and a backup anesthesiologist was available. Of note, patients were enrolled in the study after a visit to a preoperative clinic, which may have led to the exclusion of sicker patients. Although these authors did not perform a formal cost-benefit analysis, they thought that the use of “Registered Respiratory Care Practitioners instead of anesthesiologists to provide monitored anesthesia care during cataract surgery could confer significant cost savings to the health care system.”

In a retrospective review of 270 cataract operations monitored by registered nurses at a veterans administra-

tion medical center,⁴⁵ only 24 cases (8.9%) required consultations with an available anesthesiologist. In just one case, the anesthesiologist took over the patient's care. In 23 of 24, cases the consulting anesthesiologist left after providing assistance. Consultations were required more frequently for patients with American Society of Anesthesiologists physical status III (16%) as compared with American Society of Anesthesiologists physical status II (3.3%). The most common reasons for consultations were electrocardiogram interpretation (10 cases) and help with intravenous catheter placement (5 cases). The authors attributed their adoption of registered nurse monitoring for cataract surgery to the veterans administration system's limited resources and difficulty in obtaining "sufficient anesthesia personnel." The article described the anesthesiologist as "readily available" for consultation but did not specify whether they had other duties during the time of the cataract surgeries. They also noted that the small sample size ($n = 270$) would not necessarily allow detection of infrequent events.

A survey of international ophthalmologists conducted in 2002 illustrated significant differences in the reported use of an anesthesia-trained personnel for monitoring of patients undergoing eye surgery during local/regional anesthesia.¹⁸ Ninety-seven percent of Australian ophthalmologists and 96% of American ophthalmologists indicated routine use of monitoring by an anesthesia-trained professional. The lowest uses of anesthesia monitoring were reported by ophthalmologists from Malaysia (31%) and Thailand (18%). An expert panel of surgeons and anesthesiologists was convened to assign preference values to anesthesia care and outcomes as well as to perform cost analyses of these strategies.¹⁷ The preferred strategy was intravenous sedation with block anesthesia and presence of an anesthesiologist during the case. The estimated costs of this strategy (\$324) were considerably greater than the second most preferred strategy: oral sedation, block anesthesia, anesthesiologist available but not physically present (\$42).

Perhaps the utilization of anesthesia care during ophthalmologic surgery can be justified solely by the improvement of patient and surgeon satisfaction. The subjective patient experience during eye surgery may vary greatly between locales and population subgroups based on expectations and preferences. Prospective eye surgery patients were given theoretical choices of eye anesthesia (topical *vs.* block) and types of sedation (intravenous *vs.* oral) with estimations of expected pain, side effects, and recovery time in a study by Friedman *et al.*⁴⁶ Patients chose the combination of oral sedation and injection block over topical anesthesia and intravenous sedation, although this regimen is used infrequently in most practices.

The Agency for Healthcare Research and Quality's extensive review of the literature discovered a high level of

patient satisfaction with anesthesia care regardless of sedation strategy or the local anesthesia technique.² Fung *et al.*⁴⁷ published satisfaction scores for patients in a Canadian community hospital undergoing cataract surgery during topical anesthesia. Although two thirds of the patients in this study requested only to be kept calm during surgery, all but 1 of 306 patients received bolus sedation with midazolam, 70% received fentanyl, 24% received propofol, and less than 5% received remifentanyl. Interestingly, they found that the patients' regard for the role of the anesthesiologist was higher in the postoperative interview. After surgery, 87.6% of patients indicated that the anesthesiologist was important or very important, as compared with 69.9% in the preoperative period. In addition, 92% of patients indicated that there was nothing about their care that they would have changed. The most important predictors of patient satisfaction were the incidence of postoperative pain, the level of preoperative anxiety, and the surgeon. Low satisfaction scores were also noted for younger patients and those in the middle-income group (\$60–90K). The authors concluded that "Our findings provide support for the continued availability of sedation during cataract surgery" and "until its surgical causes become clearer, minimizing perioperative pain may well require more sedation and more, not less, vigilance during cataract surgery." Also, they made this editorial statement: "If quality of care means meeting the needs of patients, then our findings provide support for the continued availability of sedation during cataract surgery."

Summary

Newer surgical procedures and the increasing popularity of topical anesthesia have altered the considerations for the anesthesia practitioner, but they do not seem to have abolished the need for one. The involvement of anesthesiologists in eye surgery varies from facility to facility based on costs, anesthesiologist availability, and local standards. There is no evidence that one local/regional anesthesia technique or sedation analgesia regimen is superior to the others. Instead, anesthesia management choices are often made based solely on surgeon skill and anesthesiologist comfort and, in many venues, the expectations and needs of the local patient population.

We would like to note some controversial issues emerging for ophthalmologic surgery patients in the 21st century. Will patient expectations for anesthesia care correlate with payment for these services? In an age of sedation dentistry, increasing patient education resources, and greater anesthesia presence throughout the hospital, will anesthesia care for most ophthalmologic surgery patients be eliminated? Will hospitals, anesthesiologists, and surgeons adopt varying standards of care

for their patients based on the type of local anesthetic technique, patient age, or American Society of Anesthesiologists physical status? Is it possible that someday patients may have to pay out-of-pocket expenses for anesthesia services for eye surgery in the same manner as cosmetic surgery?

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