Anesthesiology 2002; 96:855–9

Perioperative Visual Changes

Mary E. Warner, M.D., Paul J. Fronapfel, M.S.,† James R. Hebl, M.D.,* David C. Herman, M.D.,‡ David O. Warner, M.D.,§ Paul Decker, M.S.,‖ Mark A. Warner, M.D.§*

Background: **The goal of this project was to describe the frequency and natural history of perioperative changes in vision.**

Methods: **The authors performed a prospective evaluation of changes in visual accommodation and acuity in adult patients undergoing various surgical procedures. Patients were evaluated preoperatively and at 1 and 3 days postoperatively. For patients who had persistent blurring of vision on the third postoperative day, surveillance was extended to 1.5 yr to determine how long the visual changes persisted and if the patients required eye-care provider attention for the condition.**

Results: **Twenty-eight of 671 patients (4.2%) reported new onset of blurred vision lasting at least 3 days after surgery. Seven of these 28 patients (1% of total) required either new corrective lens or changes in eyeglass or contact prescriptions because of persistent blurry vision. Most of the remaining patients reported resolution of blurry vision within 1 to 2 months. No significant risk factors for this problem were identified.**

Conclusions: **In this surgical population, changes in visual acuity manifest primarily by blurred vision were reported at a surprisingly high frequency. For many of these patients, the blurring resolved within 2 months without complication, but 25% of patients who had blurred vision for 3 days or longer required visits to eye-care providers and either new corrective lens or changes in existing prescriptions.**

OVER a period of 2 yr, Mayo Clinic ophthalmologists identified several healthy surgical patients who developed sustained postoperative accommodative changes and blurred vision that required corrective lens. These men and women shared several common characteristics: they were between 40–50 yr of age, had plano-to-slightly hyperopic vision, and underwent general anesthetics. No causes for these changes were readily apparent.

Based on the clinical observations of our ophthalmologists, it appeared that sustained blurring of vision might be a perioperative visual complication that has not previously been reported. Therefore, we performed a prospective study of a large cohort of surgical patients undergoing a variety of surgical procedures to describe and determine the frequency and natural history of postoperative changes of accommodation and visual acuity. Specifically, we were interested in identifying patients with new-onset, sustained blurred vision and, if possible, any risk factors for this problem.

Methods

Patient Selection

With Mayo Institutional Review Board approval, patients 18 yr of age and older undergoing elective surgical procedures at Rochester Methodist Hospital (Rochester, MN) between June 1 and August 31, 1999 were asked to participate. The first 10–15 patients to enter the preoperative area on any day were queried, with the number determined by projected study workload and timing restraints. Only patients receiving general or central axis neural blockade anesthetics were included. Patients undergoing ocular procedures and those receiving any other anesthesia services (*i.e.*, monitored anesthesia care, sedation, labor analgesia, or peripheral neural block) were excluded, as were patients who could not provide appropriately informed consent, those who had worn contact lenses within 1 h of preoperative evaluation, and those who ordinarily used corrective lens but were not wearing them at the time of preoperative evaluation. Patients who were taking ocular medications and those undergoing emergency surgical procedures also were excluded. The anesthetic techniques used for these study patients was not standardized, but a consistent set of data was captured for all patients (table 1). No eye ointment was used in the perioperative period for any of these patients.

Study Procedure

All measurements were performed in rooms in which the illumination power ranged from 80–100 foot-candles. A standard light meter was used to measure the light intensity before each of the following examinations:

1. Accommodation–acuity checks with a standard American Medical Association Near Vision Test Card (distance in centimeters), repeated three times for each eye.
2. Measurement of pupil sizes (millimeters) by standard technique. The aperture of the pupil was measured because the size of the pupil can affect the depth of focus. This characteristic may make determination of the near point of accommodation difficult.

This limited ocular examination was chosen for several reasons. First, complete ocular examination, including determination of refractive error and examination for the presence or absence of disease, could not be performed reliably on a large number of patients in the short time period between admission to the hospital facility and surgery. In the past, patient complaints for this possible phenomenon have been limited to visual acuity disturbances. Therefore, determination of visual acuity was the primary focus of the study examination. Near point

* Assistant Professor, † Medical Student, § Professor, Department of Anesthesiology, ‡ Associate Professor, Department of Ophthalmology, ‖ Statistician, Department of Biostatistics.

Received from the Departments of Anesthesiology, Health Science Research, and Ophthalmology, Mayo Foundation, Rochester, Minnesota. Submitted for publication April 27, 2001. Accepted for publication November 8, 2001. Supported by a grant from the Anesthesia Patient Safety Foundation, Boston, Massachusetts.

Address reprint requests to Dr. Warner: Department of Anesthesiology, Mayo Clinic, 200 First Street SW, Rochester, Minnesota 55905. Address electronic mail to: warner.mary@mayo.edu. Individual article reprints may be purchased through the Journal Web site, www.anesthesiology.org.

Table 1. Patient and Surgical Characteristics of Patients with and without Vision Changes

Characteristic	No Vision Change (n = 643)			Vision Change (n = 28)		
	%	Median	Mean ± SD	%	Median	Mean ± SD
Age, years		55.0	53.5 ± 16.2		54.5	53.8 ± 14.9
Gender						
Female	61.4			64.3		
Male	38.6			35.7		
Race						
White	97.7			100.0		
Hispanic	1.1			0		
Black	0.6			0		
Asian	0.2			0		
American Indian	0			0		
Other	0.5			0		
Smoking status						
Never	65.9			53.6		
Former (>6 months)	20.8			32.1		
Current	13.2			14.3		
Diabetes	4.7			7.1		
Corrective lens, %	85.2			89.3		
Type of corrective lens (N = 573)*						
Reading glasses	19.1			4.4		
Single lens	22.3			21.7		
Bifocal	42.0			47.8		
Trifocal	16.6			26.1		
Anesthesia duration, min		144.0	167.2 ± 100.9		194.5	190.1 ± 92.1
Anesthesia type, %						
Spinal/Epidural	12.6			17.9		
General	79.9			71.4		
Combined	7.5			10.7		
Neuromuscular Block	75.7			82.1		
Succinylcholine	57.5			57.1		
Nondepolarizer	46.8			42.9		
Both	18.2			20.1		
Reversal of neuromuscular block, %	40.0			46.4		
Antimuscarinics used without neuromuscular reversal agents, %	1.1			0.0		
Antimuscarinics used overall, %†						
Atropine	2.2			3.6		
Glycopyrrolate	40.0			42.9		

N = 671.

* For those who had corrective lenses, data were missing for 36 patients in the no vision change group and 2 patients in the vision change group; † Percent of patients receiving these drugs. Includes antimuscarinics used alone and as part of reversal of neuromuscular block.

accommodation also was measured to determine the adequacy of patients' accommodative amplitude or correction for near vision.

Information regarding potential risk factors was collected on each patient. Because this problem had not been reported previously, the authors reviewed the literature[1–11] to derive a "best guess" of potential risk factors. The information collected included surgical procedure, anesthetic type and duration, and type of neuromuscular blocking and reversal agents. Demographic information gathered included age, race, height, weight, smoking and diabetes history, and corrective lens history. On the third postoperative day, or as soon as practical thereafter, patients were contacted and asked to report any visual symptoms. Patients who had visual changes or symptoms at that time were contacted 16–18 months later to ascertain the long-term outcomes of their vision changes.

Statistical Methods

Because this problem had not been previously reported, we performed a pilot study with 20 Mayo Clinic surgical patients who were undergoing general anesthesia to estimate the frequency of perioperative accommodation changes and symptoms of blurred vision. We found 2 of the 20 patients (10%) to have changes in accommodative amplitudes of greater than 30% on the day after surgery.

Based on our previous experience with risk factor analysis of infrequent perioperative events, we estimated that we would need 50 patients with positive changes to detect strong risk factors. Using the frequency of changes detected in the pilot study and adding a 40% supplement to increase the chance of detecting a sufficient number of positive events, we determined that we would need to enroll 700 patients to find 50 or more

Table 2. Summary of Study Population

Event	No. of Patients
Initially enrolled	701
Able to complete third postoperative day surveillance	671
New-onset blurred vision at initial postoperative visit	46
Persistent blurred vision at third postoperative day visit	28
Of the 28 patients with blurred vision at third postoperative day, available with information for 18-month postoperative interview	19
Of the 19 patients with 18-month data, sought postoperative vision care and received new or changed corrective eyewear	7

patients who experienced accommodative changes resulting in perceptible blurred vision.

Patient and procedure characteristics of participants who developed visual symptoms were compared with patients without symptoms using the rank sum test or Fisher exact test for continuous and discrete variables, respectively. When appropriate, exact 95% confidence intervals were calculated for the frequency of symptoms. In all cases, two-tailed tests with P values ≤ 0.05 were used to denote significance. All calculated measures are reported as mean ± SD.

Results

Of the 701 patients initially enrolled in the study, only 671 were able to complete the initial 3-day postoperative surveillance. Of the 30 patients who did not complete this initial period of the study, the reasons for their disenrollment included changes in anesthetic plans that did not qualify for the study (n = 24), low levels of alertness 3 days after surgery (n = 3), and losses to postoperative surveillance (n = 3). Data for these 30 patients are not included in the analyses. Table 1 provides demographic data and perioperative characteristics for the 671 patients included in the study. The mean age was 53.6 ± 16.2 yr (range, 18–86 yr), and 61% were women. They underwent a wide variety of elective surgical procedures: orthopedic (27%), urologic (18%), intraabdominal (16%), gynecologic (14%), otorhinolaryngologic (11%), plastic (10%), and other miscellaneous procedures (4%). The mean duration of anesthesia for these procedures was 167 ± 101 min.

At the initial postoperative visit, 46 of the 671 patients (6.9%) were found to have new-onset blurred vision (table 2). Twenty-eight patients (4% of the total) had blurred vision persisting at least 3 days after surgery. All other patients (96%) reported normal vision 3 days after their surgical procedures. None of the characteristics that we collected and analyzed (table 1) were significant risk factors contributing to this outcome.

Four of the 28 patients who had new-onset blurred vision 3 days after their procedures were unavailable 18 months later for long-term surveillance. Three had died, and one could not be contacted. Five additional patients could not remember enough information to assist with the study. For the remaining 19 patients available for long-term surveillance interviews, 6 reported resolution of their blurred vision within 1 week, and another 6 noted improvement between 1 week and 2 months. None required examinations by their eye-care providers.

Seven of the 28 patients with blurred vision lasting 3 days or longer reported long-term blurred vision that was sufficiently troublesome to prompt one or more visits to their eye-care providers and result in either the prescription of initial corrective lens or changes in existing lens to resolve the blurred vision. One of these seven patients reported having undergone seven previous surgeries and experiencing blurred vision after each one. Another reported that even though her blurred vision resolved with a prescription change, her eyes seemed to tire more easily than before the study.

Postoperative examination data were available for six of these seven patients. The best corrected visual acuity of all of these patients was either 20/20 (four of six patients) or was unchanged from preoperative visual acuity (two of five patients). One patient was correctable to only 20/30 in each eye because of nuclear sclerotic cataract. The other patient whose vision was less that 20/20 had a documented preoperative visual acuity of 20/50. The patient had subsequent cataract extraction and intraocular lens placement with a final post–cataract surgery visual acuity of 20/20.

Preoperative and postoperative surgical refraction information was attainable for three of these six patients. All patients had less than a 0.50 diopter change in their refractive error, and all were corrected to 20/20. There was no trend toward increasing hyperopia, myopia, or presbyopia. This small change in refraction was deemed to be of minor clinical significance and likely not attributable to the surgical procedure.

Discussion

Visual changes can occur during the perioperative period. Perioperative changes range in severity from transient blurring of vision to irreversible blindness.[1–11] Transient blurring of vision often is associated with the intraoperative use of ocular ointments, excessive drying of the cornea, or corneal trauma. Complete or partial visual loss after neurovascular, cardiopulmonary bypass, and ocular procedures is well recognized as a potential complication that is likely related to direct surgical trauma, embolic events, acute anemia, hypotension, or other undefined etiologies.

The most interesting finding of this study is that perioperative blurred vision of at least 3 days' duration occurred in 4% of these study patients. Subsequently, 7 of the 28 patients with blurred vision lasting 3 days or

longer required new corrective lens or changes to existing corrective lens. This finding has not been reported or studied previously. Why? We speculate that blurred vision after surgery is (1) underreported by patients, (2) commonly considered to be transient and therefore unimportant by surgeons and others during postoperative visits soon after procedures, and (3) underreported by eye-care providers who often are widely dispersed in communities and usually seeing these patients long after their surgical procedures.

We were unable to find any significant factors for the outcome of sustained perioperative blurred vision among the characteristics we collected. With no previous reports of this event to suggest specific etiologic factors, we sought input from earlier reports of perioperative vision changes[1–11] and our Mayo ophthalmologists. We hypothesized several possibilities based on these observations. For example, degradation of accommodation often is associated with blurred vision. The most common cause for a decrease in accommodation is increased age.[12] With increased age, the crystalline lens adds inflexible fibers and, subsequently, becomes less able to change its shape. Although this degenerative process starts early in life, the gradual loss of accommodative ability does not become clinically symptomatic until the age of 40 yr or older. By 65 yr of age, the increasingly rigid lens has lost most of its accommodative ability. Dysfunction of the ciliary muscle as a result of trauma also may decrease the accommodative power of the lens, as does cholinergic blockade by anticholinergic medications such as atropine and toxins such as botulinum toxin.[13] If the tonic contraction of the ciliary muscle is impaired, the loss of its action on the lens may reduce the accommodative power of the eye.

Assuming a loss of accommodative ability to be a potential cause, we evaluated factors such as age, diabetes, use of muscle relaxants and their reversal agents, and others that might impact accommodation. None of these factors, including anesthetic agents or techniques, was found to be a significant risk factor in this study population. Therefore, this study opens more questions than it answers. It will be important for future studies to confirm the high frequency of sustained blurred vision in additional study populations and to seek other risk factors for this outcome to postulate and test preventive interventions.

There are potential factors that may have influenced the results of this study. First, we used standard accommodation and acuity tests, but their accuracy and reproducibility have not been verified in the immediate postoperative period for surgical patients. Surgical patients often receive analgesics and other drugs that may alter alertness and decrease the reliability of these effort-required tests. We checked each patient for altered level of alertness before administering the tests. We also measured their pupil diameters at the time of assessment, using miosis as an indicator of potential narcosis. Still, our study showed no differences of these tests between patients with and without sustained blurred vision. Therefore, either our techniques for administering these simple tests were flawed, our ability to accurately determine higher levels of alertness was faulty, or the tests are unreliable in the immediate postoperative period for other reasons. We compensated for potential problems with these tests by also checking our patients for blurred vision, a common symptomatic result of impaired accommodation or decreased visual acuity. Second, our study may have been markedly undersized. Without previous reports to assist a power analysis for study size, we relied on a small initial study of 20 patients to obtain pilot data. Third, some proportion of our study population may have required new corrective lens or changes to existing lens in the month after surgery as part of the natural evolution of their vision with aging (*e.g.*, presbyopia) or other causes. Unfortunately, the rate of prescription changes for a general population has not been previously described and was beyond the scope of this study. Fourth, patients often have little to do in the postoperative period. Contact with people is limited, as is patient mobility. Therefore, patients commonly are using their eyes for prolonged periods of time for simple tasks such as watching television or reading. This focus on simple visual tasks with few distractions may cause patients to aggressively appraise changes in their vision. Finally, the study patients were very aware that their vision was being studied. This awareness may have increased their potential to report short-term vision changes, although it is unlikely that this phenomenon would have impacted their long-term findings.

In conclusion, 28 of the 671 patients in our study (4%) undergoing elective surgery and general or central axis anesthetics experienced new-onset blurred vision of at least 3 days' duration after their procedures. Seven of these 28 patients (25%) required one or more visits to their eye-care providers and either new corrective lens or changes to existing lens to improve their blurred vision. We found no significant risk factors for this previously unreported perioperative phenomenon. Further studies are needed to confirm that sustained blurred vision is present in other surgical populations and, if present, to seek risk factors for it.

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