

COST ANALYSIS IN VITRECTOMY: MONITORED ANESTHESIA CARE AND GENERAL ANESTHESIA

Introduction

Healthcare has become increasingly focused on cost reduction. Methods of cost reduction include decreasing inpatient length of stay, conversion of inpatient procedures into outpatient procedures, and cost-conscious changes in hospital formularies.¹ Recently, attention has been paid to anesthesia technique as an area where cost reductions may be made.

Vitrectomy is a commonly performed retinal surgical procedure, for which either general anesthesia or monitored anesthesia care with retrobulbar block (MAC/RBB) can be performed. Patients receiving RBB for extraocular surgery experience less immediate postoperative discomfort, have greater levels of activity while in the hospital, and are discharged from the hospital sooner than those receiving general anesthesia.² However, there are no data regarding the relative charges associated with MAC/RBB vs general anesthesia for vitrectomy. The aim of the present study was to compare the charge differences between MAC/RBB and general anesthesia for vitrectomy.

Materials and methods

After our institution's Human Studies Committee approval, a retrospective record review was undertaken of 128 consecutive patients undergoing vitrectomy and membrane peeling during a 1-year period at Barnes-Jewish Hospital, Washington University Medical Center (St. Louis, Mo). To limit charge variance by the length of surgery, only patients whose surgical duration was less than 2 hours were included in the study. For each patient, demographic data and ASA classification were recorded. Additionally, the number of patients receiving intravenous narcotic postoperatively in each group was recorded. The itemized charges (anesthesia, postanesthesia

care unit [PACU], operating room [OR], and total charges) for each patient were obtained. The data for patients receiving general anesthesia (group 1) were compared with data for patients receiving MAC/RBB (group 2).

Retrobulbar block was administered by the ophthalmologist in the holding area with an anesthesiologist in attendance. There was no standardized protocol for administering intravenous narcotic analgesics and sedatives. All group 2 patients were awake and responsive throughout the surgical procedure. Standard monitors were applied for all patients. After the operation, patients were transported to the surgical floor for overnight observation.

Group 1 patients received intravenous midazolam, fentanyl, propofol or sodium thiopental, and rocuronium. They were then intubated, and anesthesia was maintained with isoflurane. As in group 2, standard monitors were applied for all patients. Postoperatively, group 1 patients were transferred to the PACU, and they were subsequently moved to the hospital's surgical floor for overnight observation.

Data were analyzed with unpaired 2-sample *t* test for age, weight, and hospital charges; chi-square test; and Fisher exact tests for other demographic data.

Results

The records of 128 consecutive patients were reviewed. Of the 100 patients included in this study, 41 patients received general anesthesia (group 1); 59 patients had MAC/RBB (group 2). Twenty-eight patients were excluded due to procedure length exceeding 2 hours.

There were no significant differences in gender, age, weight, and ASA physical status between patients in the 2 groups (Table 1). There were more elderly patients (age > 65 years) and more patients with coronary artery dis-

A retrospective study was performed to compare differences in hospital charges between monitored anesthesia care with retrobulbar block and general anesthesia among patients having vitrectomy. Of 128 consecutive patients undergoing vitrectomy between July 1996 and July 1997, group 1 received general anesthesia (n = 41), group 2 received monitored care anesthesia with retrobulbar block (n = 59), and 28 patients were eliminated from the study. There were significant differences in anesthesia charges, operating room charges, pharmacy charges, and total hospital charges between groups 1 and 2. Charges associated with monitored care anesthesia with retrobulbar block are 20% less than charges associated with general anesthesia. Fewer patients in group 2 required postoperative intravenous narcotics than in group 1.

Key words: Charges, cost, general anesthesia, monitored anesthesia care.

Table 1. Demographics of patients undergoing general endotracheal anesthesia (group 1) vs monitored anesthesia care (group 2)*

	Group 1 (n = 41)	Group 2 (n = 59)
Sex		
M	20 (49)	31 (53)
F	21 (51)	28 (47)
Age (y) (mean ± SD)	59 ± 17	66 ± 13
Weight (kg) (mean ± SD)	80 ± 24	80 ± 20
Age > 65 yr †	16 (39)	38 (64)
ASA physical status		
I	3 (7)	5 (8)
II	20 (49)	28 (47)
III	18 (44)	26 (44)
IV	0	0
Prevalence of diseases		
Hypertension	22 (53)	31 (52)
Diabetes mellitus	11 (26)	12 (20)
Coronary artery disease†	1 (2)	10 (17)
Chronic obstructive pulmonary disease	3 (7)	6 (10)

* Data are presented as number (percentage) unless otherwise indicated.
† $P < .05$

eases in group 2 than in group 1 (see Table 1). Patients in group 2 had lower charges than patients receiving general anesthesia (Table 2). Fewer patients in group 2 received postoperative intravenous narcotics in than those in group 1 (8/59 vs 21/41, $P < .05$). No patients in group 2 required conversion to general anesthesia.

Discussion

The requirements of ophthalmic surgery include safety, akinesia, profound analgesia, minimal bleeding, avoidance or obtundation of the oculocardiac reflex, prevention of intraocular hypertension, and smooth emergence.^{3(pp911-928)} Both MAC/RBB and general anesthesia are used for intraocular surgery. There is no significant difference in complications, such as iris prolapse or vitreous loss, between local and general anesthesia for cataract surgery.⁴

Knowing the actual costs of providing care to surgical patients will assist hospital managers in developing targets for reducing and improving usage of

Table 2. Hospital charges (\$): general endotracheal anesthesia (group 1) vs monitored anesthesia care (group 2)*

Charges	Group 1 (n = 41)	Group 2 (n = 59)
Operating room	3,942 ± 395	3,545 ± 325†
Postanesthesia care unit	386 ± 79	N/A
Pharmacy	1,243 ± 338	930 ± 263†
Anesthesia	985 ± 47	541 ± 35†
Total hospital	7,177 ± 644	5,469 ± 514†

* Data are presented as mean ± SD.
† $P < .05$

healthcare resources.⁵ Traditionally, any decision regarding anesthetic technique is focused solely on patient and physician needs and preference. Little if any consideration was ever given to cost. Indeed, few published studies compare cost effectiveness of different anesthesia techniques.⁶⁻⁹

A prospective study by Cheng et al² showed that the use of retrobulbar anesthesia for strabismus surgery has great advantages over the use of general anesthesia with respect to cost reduction. Similarly, our study demonstrates that MAC/RBB results in a 20% decrease in charges, primarily due to reduced OR, PACU, anesthesia, and pharmacy charges. Our data agree with that of Trieshmann,⁶ Lintner et al,⁷ Godin et al,⁸ and Bredenkamp et al,⁹ who showed that the use of local or regional anesthesia is associated with lower cost than the use of general anesthesia.

We acknowledge that the results of our study may not be applicable to all institutions, and we recognize that there are differences between costs and charges. The cost-to-charge ratios are often used to convert charges to costs. However, the cost-to-charge ratio varies widely from institution to institution, and even within an institution. Cost shifting makes it more difficult to identify the true cost.^{3(p105)} Therefore, charges were used as proxies for cost in this study.

Billing and charging methods in other institutions may differ from ours, and therefore cost analyses may differ as well. At our institution, the PACU is charged by time in half-hour increments plus a setup fee. The OR is charged as per item for equipment and per minute for time spent in the OR. Our study demonstrated that OR charges contributed 55% to the total hospital charge, and that reduction in OR time appeared to be related to anesthetic technique. It is important to note, however, that in our institution

RBB is administered in the holding area. Patients are therefore ready for surgery when they arrive in the OR. Induction for patients having general anesthesia is performed in the OR rather than in an induction area outside of the OR.

Location of recovery is another institution-specific factor that may have contributed to lower charges associated with MAC/RBB. It is our practice that patients having MAC/RBB go from the OR directly to the surgical floor. Patients having general anesthesia recover in the PACU, thereby generating additional charges. Bypassing the PACU may not be widely accepted. Our experience has demonstrated the safety of this approach because there were no postoperative surgical or anesthetic complications in group 2. Apfelbaum¹⁰ recently showed that important cost savings can be achieved without compromising patient safety after implementing a bypass PACU paradigm.

Fewer patients received postoperative intravenous narcotics in group 2 than in group 1. Reductions in administration of intravenous narcotics also have contributed to lower charges associated with MAC/RBB.

The results of a retrospective study must be interpreted with caution, because it is impossible to control all sources of bias, such as selection bias, which may have distorted the sample. The choice of technique was based on the individual surgeon's and anesthesiologist's preference, patient's medical conditions, and pathology. We believe that selection bias is not a significant source of bias. The similar demographic data between groups support our belief that the choice of technique was largely random.

We must emphasize that we limited our analysis to procedures that are less than 2 hours in duration. The time required for retinal surgery ranges from 30 minutes to many hours, depending on pathology and surgeon. In our institution, general anesthesia is often elected when the surgical procedure is anticipated to be longer than 2 hours. In order to eliminate this bias we limited our analysis to surgical procedures that were less than 2 hours in duration.

Our patient population was not demographically the same for both groups. There were a greater num-

ber of elderly and high-risk patients in group 2. A bias of this nature would tend to increase costs. Instead, charges associated with MAC/RBB were lower than charges associated with general anesthesia.

Conclusion

We conclude that when the surgical procedure is no longer than 2 hours, hospital charges are 20% less for patients having vitrectomy under MAC/RBB than for patients having general anesthesia. Institution-specific practices, however, may have an equal or greater impact than actual anesthetic technique.

REFERENCES

1. Cannon CS, Gross JG, Abramson I, Mazzei WJ, Freeman WR. Evaluation of outpatient experience with vitreoretinal surgery. *Br J Ophthalmol*. 1992;76:68-71.
2. Cheng, KP, Larson CE, Biglan AW, D'Antonio JA. A prospective, randomized, controlled comparison of retrobulbar and general anesthesia for strabismus surgery. *Ophthalmic Surg*. 1992; 23:585-590.
3. McGoldrick K. Anesthesia and the eye. In: Barash PG, Cullen BF, Stoelting RK, eds. *Clinical Anesthesia*, 3rd ed. Philadelphia, Pa: Lippincott-Raven Publishers. 1997.
4. Lynch S, Wolf GL, Berlin I. General anesthesia for cataract surgery: a comparative review of 2217 consecutive cases. *Anesth Analg*. 1974;53:909-913.
5. Hudson R, Friesen R. Health care "reform" and the costs of anesthesia. *Can J Anesth*. 1993;40:1120-1125.
6. Triesmann HW. Knee arthroscopy: a cost analysis of general and local anesthesia. *Arthroscopy*. 1996;12:60-63.
7. Lintner S, Shawen S, Lohnes J, Levy A, Garrett W. Local anesthesia in outpatient knee arthroscopy: a comparison of efficacy and cost. *Arthroscopy*. 1996;12:482-488.
8. Godin MS, Bell W, Schwedler M, Kerstein MD. Cost effectiveness of regional anesthesia in carotid endarterectomy. *Am Surg*. 1989;55:656-659.
9. Bredenkamp JK, Abemayor E, Wackym PA, Ward PH. Tonsillectomy under local anesthesia: a safe and effective alternative. *Am J Otolaryngol*. 1990;11:18-22.
10. Apfelbaum JL. Bypassing PACU: a cost effective measure. *Can J Anaesth*. 1998;45:5 R91-92.

AUTHORS

Jeffrey Jian-Hong Huang, MD, MS, is a resident physician, Department of Anesthesiology, Washington University, St Louis, Mo.

Steven Fogel, MD, is clinical assistant professor, Department of Anesthesiology, St Louis University, St Louis, Mo.

Michael Leavell, MD, is clinical associate professor, Department of Anesthesiology, Washington University, St Louis, Mo.