

Efficacy and Safety of Phacoemulsification with Intraocular Lens Implantation under Topical Anesthesia

Lan-Hsin Chuang, MD; Chi-Chun Lai¹, MD; Wan-Chen Ku, MD; Ko-Jen Yang, MD;
Hu-Shien Song, MD

Background: To eliminate complications of peribulbar and retrobulbar anesthesia and to achieve efficacy and safety for topical anesthesia with cataract surgery.

Methods: We performed clear corneal phacoemulsification with foldable intraocular lens (IOL) implantation under topical anesthesia using preservative-free 2% lidocaine drops, without intracameral anesthetic supplementation. The exclusion criteria were anxiety, small pupil, baseline endothelial count 1500 cells/mm², uncontrolled glaucoma, other ocular entities affecting corneal endothelium, and allergy to the relevant medications. We used a specular microscope to evaluate the effect on the endothelium and employed a 10-point visual analog pain scale to assess the discomfort experienced during the operation.

Results: Totally, 29 eyes of 29 patients were enrolled in this series. The mean age was 71.5 ± 8.5 years. Twenty-three of 29 (79.3%) cases achieved a best-corrected visual acuity (BCVA) equal to 20/40 or better at an interval of 3 months post-operatively. Most patients (86.5%) felt mild or no pain during surgery. Pre- and postoperative endothelial counts were 2072.6 ± 104 and 1927.4 ± 196 cell/mm², respectively. One in 29 cases developed vitreous loss due to involuntary eye movements intraoperatively.

Conclusions: Topical anesthesia with preservative-free 2% lidocaine drops is an effective and safe modality for clear corneal phacoemulsification with IOL implantation. On the other hand, for patients with small pupil or those who are anxious, the procedure may be time-consuming, and it is challenging for physicians to perform cataract surgery merely using topical anesthesia.
(*Chang Gung Med J* 2004;27:609-13)

Key words: topical anesthesia, phacoemulsification, specular microscope, 10-point visual analog pain scale.

Complications of retrobulbar and peribulbar anesthesia for cataract surgery have been reported, such as inadvertent globe perforation, retinal vein occlusion, and brain stem anesthesia.⁽¹⁻⁶⁾ Postoperative ptosis is an unexpected cosmetic effect

as well. To avoid the above complications, the trend is to adopt topical anesthesia with preservative-free lidocaine drops combined with intracameral lidocaine for small-incision phacoemulsification and implantation of a foldable intraocular lens (IOL).⁽⁷⁻¹³⁾

From the Department of Ophthalmology, Chang Gung Memorial Hospital, Keelung; ¹Department of Ophthalmology, Chang Gung Memorial Hospital, Taipei.

Received: Jan. 4, 2004; Accepted: Jun. 14, 2004

Address for reprints: Dr. Chi-Chun Lai, Department of Ophthalmology, Chang Gung Memorial Hospital, 5, Fushing Street, Gueishan Shiang, Taoyuan, Taiwan 333, R.O.C. Tel.: 886-3-3281200 ext. 8666; Fax: 886-3-3287798; E-mail: ccl404@cgmh.org.tw

Nevertheless, there is little literature related to induced endothelium loss with topical anesthesia without intracameral anesthesia.⁽¹⁴⁻¹⁶⁾ Since the efficacy and safety of this modality are concerns for most clinicians, the object of this investigation was to evaluate pain and endothelial cell loss during phacoemulsification with IOL implantation under topical anesthesia with preservative-free 2% lidocaine drops.

METHODS

This study consisted of a prospective, clinical series at Chang Gung Memorial Hospital, Taoyuan, Taiwan from April to September 2003. Participants in this study were recruited from patients with marked cataracts. The same surgeon performed all operations. Best-corrected visual acuity prior to surgery and 3 months postoperatively was documented. For evaluation of corneal toxicity, we used a contact specular microscope (Tomey EM-1000, Nagoya, Japan) and adopted an average endothelial cell count after 3 measurements. Any decrease in the central endothelial count after phacoemulsification with IOL implantation under topical anesthesia was documented. As a consequence, endothelial cell counts preoperatively and 3 months postoperatively were estimated.

After providing informed consent, all patients underwent phacoemulsification under topical anesthesia using preservative-free 2% lidocaine (AstraZeneca AB, Sodertalje, Sweden). Exclusion criteria were anxiety, a small pupil which was unable to be fully dilated due to posterior synechia, a baseline endothelial count of less than 1500 cells/mm², uncontrolled glaucoma, other ocular entities affecting the corneal endothelium, and allergy to the relevant medications.

Half an hour before the operation, all patients received 1 drop of 1% mydriacyl and 10% phenylephrine to dilate the pupil. They took acetazolamide (250 mg) and diazepam (5 mg) orally at the same time. At the beginning of the surgery, preservative-free 2% lidocaine was administered 3 times. We fixed the globe with a cotton-tipped applicator or teathed forceps. Clear cornea paracentesis of 1.5 mm with a metal keratome was created from the temporal site. We then injected the viscoelastics (Healon GV, Pharmacia Company, Stockholm, Sweden) to form

the anterior chamber. We made a sideport at 12 o'clock and enlarged the temporal wound to 2.65 mm with the keratome. Complete capsular capsularhexis was performed with capsule forceps. After hydrodissection with a balanced salt solution, phacoemulsification was performed with a modified stop-and-chop technique. The residual cortex was removed with irrigation and aspiration. We recorded the phaco time as well. Following implantation of the foldable IOL (Acrysof; Alcon Surgical, Fort Worth, TX, USA), we injected 0.01% carbachol for pupil constriction. At the end of the surgery, the wound was closed with a stitch using 10-0 nylon. Consequently, the eye was subconjunctivally injected with gentamycin (12 mg/0.3 ml) and patched with maxitrol ointment. The questionnaire, a 10-point visual analog pain scale, standardized by Stevens in 1992,⁽¹⁷⁾ was given in the recovery room. The degree of discomfort during surgery was rated from 0 (no pain) to 10 (worst pain). A verbal response was allowed for patients unable to read.

RESULTS

In total, 29 eyes of 29 consecutive patients were enrolled from April to September 2003. Demographic data are illustrated in Table 1. The mean age was 71.5 ± 8.5 years. All participants underwent uneventful phacoemulsification with IOL implantation and topical anesthesia using preservative-free 2% lidocaine. Among the 29 patients, 23 (79.3%) achieved a best-corrected visual acuity (BCVA) equal to 20/40 or better at an interval of 3

Table 1. Demographic Characteristics of Patients, and Preoperative and Postoperative Evaluations

Age (yr) (mean ± SD)	71.5 ± 8.5
Gender (F : M)	18 : 11
Systemic or ocular disease	DM 7, HTN 2, GL1, EM 2
Mean PHACO time (s)	96.9 ± 34.3
Score of pain (on a 10-point VAS)	1.2 ± 1.1
Pre-op endothelium count (cells/mm ²)	2072.6 ± 104
Post-op endothelium count (cells/mm ²)	1927.4 ± 196
Pre-op BCVA	20/111
Post-op BCVA	20/ 33
Intraoperative complications vitreous loss	1

Abbreviations: DM: diabetic mellitus; HTN: hypertension; GL: glaucoma; EM: excessive myopia; PHACO: phacoemulsification; BCVA: best-corrected visual acuity.

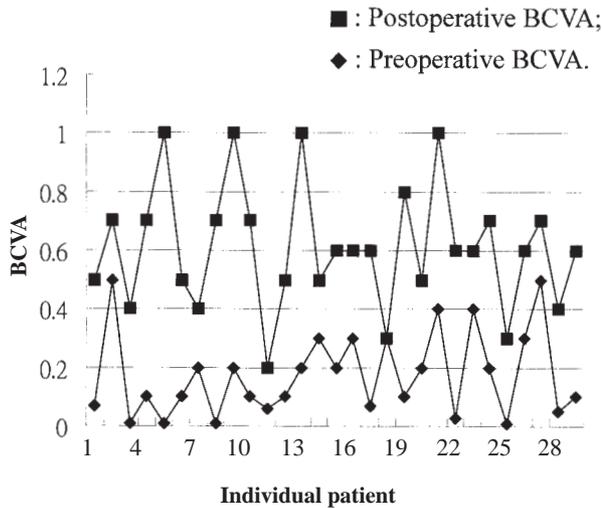


Fig. 1 Visual improvement after phacoemulsification and intraocular lens (IOL) implantation under topical anesthesia: change of best-corrected visual acuity.

months postoperatively. The visual improvement is illustrated in Fig. 1. The mean score of intraoperative pain was 1.2 ± 1.1 (range, 0 to 3). Most patients (86.5%) felt mild or no pain during the operation. The mean preoperative endothelial cell count was 2072.6 ± 104 cells/mm², and 3 months postoperatively, it was 1927.4 ± 196 cells/mm². The mean reduction in the endothelial cell count was 7.0%. The endothelial cell count decreased more than 10% in 2 cases with diabetic mellitus and controlled glaucoma. Fortunately, no persistent corneal edema was identified under slit-lamp biomicroscopic examination.

One of the 29 patients developed tear of the posterior capsule during phacoemulsification due to involuntary eye movements. As a result, anterior vitrectomy was performed, and the final BCVA was 20/50. Furthermore, even though all patients were satisfied with the anesthesia, 17.2% needed various amounts of supplementary topical instillation of 2% lidocaine during the operation.

DISCUSSION

Although peribulbar and retrobulbar anesthesia is sufficient for nerve blockage during cataract surgery, complications related to the anesthesia can

be sight-threatening or even life-threatening.⁽¹⁻⁶⁾ These complications can be prevented by the use of topical anesthesia with or without intracameral anesthesia, and the trend is to adopt this technique as a standard procedure.⁽⁷⁻¹³⁾

First of all, to investigate any discomfort associated with the surgery, we evaluated the degree of pain using the 10-point visual analog pain scale. Most patients felt mild or no pain during the procedure, and the mean score of pain was 1.2 ± 1.1 , although 17.2% needed supplemental instillation of 2% lidocaine drops.

Mild endothelial cell loss (7.0%) revealed the safety of phacoemulsification with IOL implantation under topical anesthesia. According to the prior literature related to induced endothelial cell loss in phacoemulsification,⁽¹⁹⁻²¹⁾ the effect was similar to that of topical anesthesia combined with either intracameral or peribulbar anesthesia. Additionally in a prior animal study related to the effect on the endothelium, scanning electron microscopy of the eyes intracamerally injected with a high concentration of 2% lidocaine revealed morphological changes including irregular hexagonal endothelial cells and significant loss of microvilli.⁽¹⁸⁾ In this series, no additional complications related merely to the topical anesthesia, without the combined intracameral injection, were identified.

Unfortunately, 1 of the 29 cases developed vitreous loss resulting from involuntary eye movements during the operation. Owing to the extra time needed for further manipulation, this modality of anesthesia for phacoemulsification to prevent inadvertent complications might not be suitable for patients with small pupils, or those who are anxious. Apart from this, topical anesthesia is effective and safe for cataract surgery.

REFERENCES

1. Edge R, Navon S. Scleral perforation during retrobulbar and peribulbar anesthesia: risk factors and outcome in 50000 consecutive injections. *J Cataract Refractive Surg* 1999;25:1237-44.
2. Duker JS, Belmont JB, Benson WE, Brooks HL, Brown GC, Federman JL, Fischer DH, Tasman WS. Inadvertent globe perforation during retrobulbar and peribulbar anesthesia. Patient characters, surgical management, and visual outcome. *Ophthalmology* 1991;98:519-26.
3. Sullivan KL, Brown GC, Forman AR, Sergott RC,

- Flanagan JC. Retrobulbar anesthesia and retinal vascular obstruction. *Ophthalmology* 1983;90:373-7.
4. Smith JL. Retrobulbar bupivacaine can cause respiratory arrest. *Ann Ophthalmol* 1982;14:1005-6.
 5. Javitt JC, Addiego R, Friedberg HL, Libonati MM, Leahy JJ. Brain-stem anesthesia after retrobulbar block. *Ophthalmology* 1987;94:718-24.
 6. Nicoll JMV, Acharya PA, Ahlen K, Baguneid S, Edge KR. Central nervous system complication after 6000 retrobulbar blocks. *Anesth Analg* 1987;66:1298-302.
 7. Stevens JD. A new local anesthesia technique for cataract extraction by one quadrant sub-Tenon's infiltration. *Br J Ophthalmol* 1992;72:670-4.
 8. Grabow HB. Topical anesthesia for cataract surgery. *Eur J Implant Refract Surg* 1993;5:20-4.
 9. Novak KD, Koch DD. Topical anesthesia for phacoemulsification: initial 20-case series with one month follow-up. *J Cataract Refract Surg* 1995;21:672-5.
 10. Fichma RA. Use of topical anesthesia alone in cataract surgery. *J Cataract Refract Surg* 1996;22:612-4.
 11. Koch PS. Anterior chamber irrigation with unpreserved lidocaine 1% for anesthesia during cataract surgery. *J Cataract Refract Surg* 1997;23:551-4.
 12. Tseng SH, Chen FK. A randomized clinical trial of combined topical- intracameral anesthesia in cataract surgery. *Ophthalmology* 1998;105:2007-11.
 13. Pang MP, Fujimoto DK, Wilkens LR. Pain, photophobia, and retinal and optic nerve function after phacoemulsification with intracameral lidocaine. *Ophthalmology* 2001; 108:2018-25.
 14. Patel BC, Burns TA, Crandall A, Shomaker ST, Pace NL, van Erd A, Clinch T. A comparison of topical and retrobulbar anesthesia for cataract surgery. *Ophthalmology* 1996;103:1196-203.
 15. Crandall AS, Zabriskie NA, Patel BC, Burns TA, Mamalis N, Malmquist-Carter LA, Yee R. A comparison of patient comfort during cataract surgery with topical anesthesia versus topical anesthesia and intracameral lidocaine. *Ophthalmology* 1999;106:60-6.
 16. Bardocci A, Lofoco G, Perdicaro S, Ciucci F. Lidocaine 2% gel versus lidocaine 4% unpreserved drops for topical anesthesia in cataract surgery. *Ophthalmology* 2003;110: 144-9.
 17. Stevens JD. A new local anesthesia technique for cataract extraction by one quadrant sub-tenon's infiltration. *Br J Ophthalmol* 1992;76:670-4.
 18. Kazuaki K, Ito N, Yazama F, Nishide T, Sugita M, Sawada H, Ohno S. Effect of intracameral anesthesia on the corneal endothelium. *J Cataract Refract Surg* 1998; 24:1377-81.
 19. Kim T, Holley GP, Lee JH, Broocker G, Edelhauser HF. The effect of intraocular lidocaine on the corneal endothelium. *Ophthalmology* 1998;105:125-30.
 20. Elvira JC, Hueso JR, Martinez-Toldos J, Mengual E, Artola A. Induced endothelial cell loss in phacoemulsification using topical anesthesia plus intracameral lidocaine. *J Cataract Refract Surg* 1999;25:640-2.
 21. Heuermann T, Hartmann C, Anders N. Long-term endothelial cell loss after phacoemulsification: peribulbar anesthesia versus intracameral lidocaine 1%. *J Cataract Refract Surg* 2002;28:639-43.

局部滴注麻醉劑進行晶體乳化術及人工水晶體植入之 效果及安全性

莊蘭馨 賴旗俊¹ 古婉珍 楊克仁 宋湖仙

背景：為減少球週或球後麻醉引起的併發症及評估局部滴注麻醉劑進行白內障手術。

方法：我們以局部滴注無防腐劑之2% lidocaine來施行經角膜晶體乳化及折疊式人工水晶體植入，術中並未追加前房內麻醉劑注射。凡焦慮性病人，小瞳孔症，基礎內皮細胞少於每平方毫米一千五百個，青光眼控制不佳，其他影響內皮細胞之眼疾，及對相關藥物過敏者皆須排除。我們以角膜內皮細胞顯微鏡來分析手術對內皮細胞的影響，並以10-point visual analog pain scale來評估術中的疼痛程度。

結果：此研究共包括29位病人之29隻眼睛。平均年齡為71.5±8.5歲。29眼中有23眼其術後3個月之最佳矯正視力大於或等於零點五。大部份(86.5%)病人在術中感覺輕微甚至無痛感。術前及術後之角膜內皮細胞分別為2072.6±104 cell/mm²及1927.4±196 cell/mm²。29眼中其中1例在手術時因不自主眼球移動造成vitreous loss。

結論：以局部滴注無防腐劑之2% lidocaine麻醉劑來進行經角膜晶體乳化及折疊式人工水晶體植入是有效且安全的。另一方面，對於小瞳孔症或焦慮性病人，手術可能較費時？僅以局部滴注麻醉劑進行白內障手術對醫師而言則是一項挑戰。
(長庚醫誌 2004;27:609-13)

關鍵字：局部麻醉，晶體乳化術，角膜內皮細胞顯微鏡，10-point visual analog pain scale。

長庚紀念醫院 基隆院區 眼科；¹台北院區 眼科

受文日期：民國93年1月4日；接受刊載：民國93年6月14日。

索取抽印本處：賴旗俊醫師，長庚紀念醫院 眼科。桃園縣333龜山鄉復興街5號。Tel.: (03)3281200轉8666; Fax: (03)3287798; E-mail: ccl404@cgmh.org.tw