

Sub-Tenon Anesthesia for Segmental Scleral Buckling and Assessment of Postoperative Pain

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Background: To evaluate the safety and efficacy of sub-Tenon anesthesia for segmental scleral buckling.

Methods: Thirty-two patients diagnosed with rhegmatogenous retinal detachment were treated with segmental scleral buckling under sub-Tenon anesthesia. After topical anesthesia, a buttonhole was made through the conjunctiva and Tenon's capsule 4 mm posterior to the limbus. Four milliliters of anesthetic solution was then delivered into the posterior sub-Tenon space using a blunt cannula. The buckling procedure was done immediately after the completion of anesthesia. We evaluated akinesia and recorded the pain with a visual analogue scale after surgery.

Results: There were no anesthesia related complications. Twenty-two patients (69%) reported no pain during surgery. Nine patients (28%) felt pain during surgery. However, the pain was tolerable and the surgeries were finished smoothly with or without a supplemental anesthetic solution. One patient (3%) experienced uncomfortable pain and needed an additional retrobulbar block. Five patients (16%) retained complete eye movement 5 min after anesthesia, and only 4 patients (13%) experienced total akinesia. At the end of the surgery, 16 patients (50%) had total akinesia and 2 patients (6%) retained complete eye movement.

Conclusions: Sub-Tenon anesthesia is efficient and safe in segmental scleral buckling. It can prevent the complications of peribulbar or retrobulbar anesthesia and is a good alternative to both methods of anesthesia, especially in highly myopic eyes.

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Key words: sub-Tenon anesthesia, scleral buckling, visual analogue scale.

Regional anesthesia including retrobulbar and peribulbar blocks is effective and preferable in surgery for retinal detachment. However, retrobulbar procedures involve using a sharp needle around the globe, and serious complications can occur.

These complications include globe perforation, retrobulbar hemorrhage, optic atrophy, and vascular occlusion.⁽¹⁻⁷⁾ Systemic complications can include cardiopulmonary arrest, convulsions, and loss of consciousness.⁽⁸⁻¹¹⁾ These systemic complications

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develop when the optic nerve is penetrated by the needle with subsequent injection into the subarachnoid space. Peribulbar block was introduced to reduce the incidence of these complications, but this procedure is also associated with globe perforation, retrobulbar hemorrhage, and extraocular paresis.⁽¹²⁻¹⁴⁾

Sub-Tenon irrigation with a blunt needle was initially used to supplement the anesthesia and proved to reduce the pain of ocular surgery.^(15,16) Recently, this method has been widely utilized in various ocular surgeries, including the vitreoretinal surgery.⁽¹⁷⁻¹⁹⁾ Sub-Tenon irrigation with anesthetic solution using a blunt needle can reduce the risks associated with blind placement of a sharp needle into the muscle cone of the eyeball, yet still allows rapid onset and long duration of the anesthesia.^(20,21)

In this study, we evaluate the safety and effectiveness of sub-Tenon irrigation for segmental scleral buckling during retinal detachment surgery. We determine whether this method can be satisfactorily used in segmental scleral buckling. To understand the course of pain, we recorded readings on a pain scale following surgery for 72 hours using a standard 10-point visual analogue scale (VAS).⁽²²⁾ We also assessed akinesia 5 minutes after sub-Tenon anesthesia and at the end of the surgery. To our knowledge, this is the first study to describe the postoperative pain course after a segmental buckle procedure under sub-Tenon anesthesia.

METHODS

Thirty-two consecutive patients who received segmental scleral buckling under sub-Tenon anesthesia between January and November 1998 at Chang Gung Memorial Hospital, Taipei, were recruited. All patients had fresh retinal detachment and were undergoing their first scleral buckling. Patients who refused local anesthesia, or who had heart disease, hypertension, major diseases, existence of a communication problem, or poor vision in the opposite eye were excluded. We also checked the intraocular pressure (IOP) prior to pain assessment. Patients were excluded if their IOP was higher than 21 mmHg. Patients were hospitalized for at least 3 days.

The operative procedures were as follows. The pupil was dilated and acetazolamide (250 mg) and valium (5 mg) were given orally 1 hour prior to the

operation. Topical 0.4% Novesin (CIBA Vision, Ltd., Hettlingen, Switzerland) was installed into the eye being operated on, standard aseptic procedures were followed, and the eye was draped. A lid speculum was inserted to open the lids. A cotton-tipped applicator soaked with topical 0.4% Novesin was then pressed against the exposed bulbar conjunctiva about 4 mm posterior to the limbus for 2 minutes. A buttonhole was made using Westcott scissors through the conjunctiva and Tenon capsule 4 mm posterior to the limbus. The sub-Tenon space was extended by scissors as far as possible. The anesthetic solution was a mixture of 2% lidocaine (7.5 ml), 0.75% bupivacaine (12.5 ml), and hyaluronidase 300 U. A 5-ml syringe was connected to a curved 19-gauge blunt irrigation cannula. The tip of cannula was passed gently into the sub-Tenon space beyond the equator of the eyeball and through the small hole in the conjunctiva. The injection site was located at the quadrant on which the explant was placed. Four milliliters of anesthetic solution was initially injected. The hole was kept closed after the injection with fine-toothed forceps for 2 minutes to prevent leakage of solution. The IOP was assessed digitally after infiltration, and the fundus was checked with indirect ophthalmoscopy to exclude vascular insufficiency.

A peritomy was performed through the previous hole, the rectal muscles were isolated, and the muscles were then looped with #1 silk. Patients were encouraged to tell the surgeon of any pain or discomfort. If the patients felt pain during the procedure, we inserted a cannula along the sclera to the bottom and added another 2 ml of anesthetic each time. We repeated the procedure if necessary.

Breaks were localized and treated with cryotherapy. The subretinal fluid was drained under microscopy. The scleral buckle surgeries were done with a split 505 or 506 silicone sponge and secured with a holding suture of 5-0 Dacron. The conjunctiva was closed with 7-0 Vicryl. A subconjunctival injection of gentamicin (12 mg/0.3 ml) and topical Maxitrol (Alcon) ointment was given before patching. The Maxitrol ointment and 1% atropine solution were used twice per day following surgery. Patients took acetaminophen 500 mg orally every 6 hours for at least 3 days.

Pain was assessed using a standard 10-point VAS. Patients were asked to indicate their perceived level of pain by pointing to a location on a 10-cm

line where the left side indicated no pain (pain score of 0) and the right side indicated maximal pain (pain score of 10). At the end of retinal detachment surgery, each patient was asked to report the amount of intraoperative pain experienced during the procedure. After surgery, we asked patients to report the amount of pain at 30 minutes, 1, 2, 4, 6, 12, 24, 48, and 72 hours postoperatively. Uncomfortable pain was defined as a VAS score greater than or equal to 5 (pain score ≥ 5) and mild pain as less than or equal to 4 (pain score ≤ 4).

We also assessed akinesia after 5 minutes, after sub-Tenon's anesthesia and at the end of surgery. The scale of akinesia was as follows: 0=complete movement, 1=moderate movement, 2=slight movement, and 3=no movement.

RESULTS

Thirty-two patients took part in this study. There were 15 (47%) men and 17 (53%) women; ages ranged from 18 to 63 years (mean \pm standard deviation, 38 \pm 15 years). The duration of surgery ranged from 38 minutes to 2 hours 15 minutes (mean

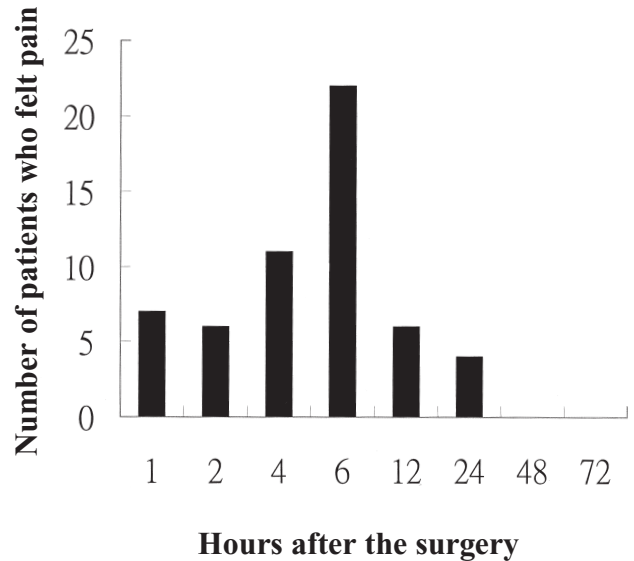


Fig. 1 The number of patients who felt pain peaked 6 hours following surgery. At the peak, 22 patients (69%) felt pain and 4 patients (13%) felt uncomfortable pain 6 hours after surgery. No patient felt pain at 48 hours after surgery.

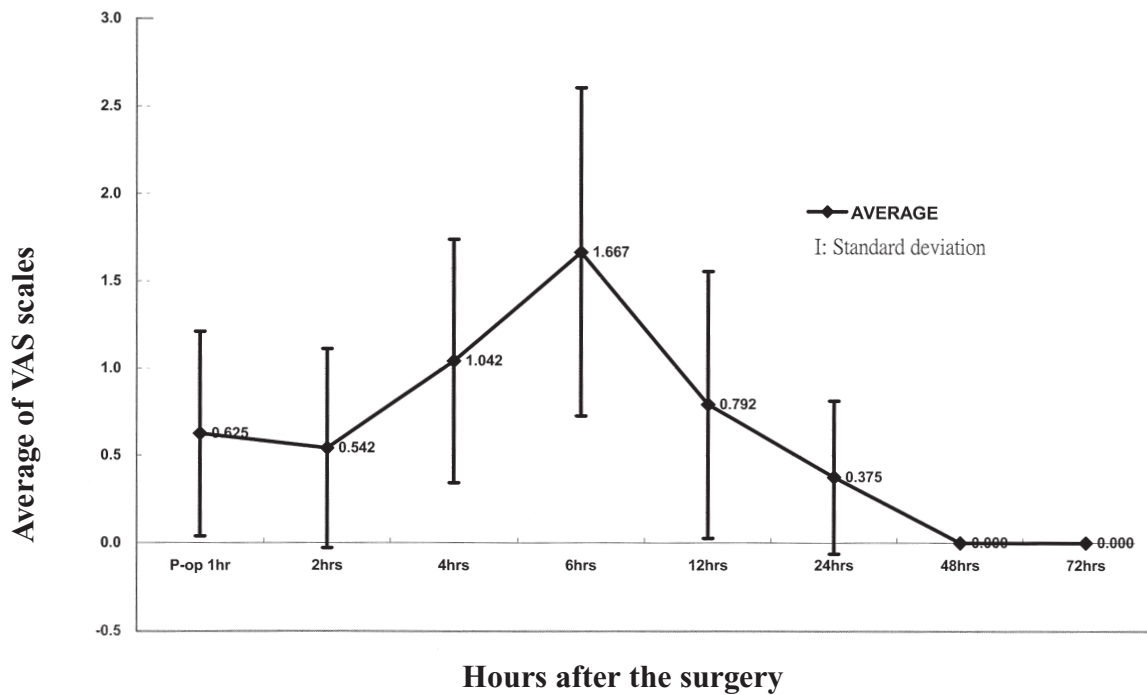


Fig. 2 Mean of pain scales after surgery. The mean peaked at 6 hours, and level slowly decreased until 48 hours postoperatively.

; standard deviation, 59; 23 minutes). Patients remained conscious during surgery, and all surgeries were completed without complications.

In 22 cases (69%), the anesthesia was sufficient with one preoperative sub-Tenon block. In the other 10 cases (31%), another sub-Tenon irrigation was needed during surgery, and the pain decreased after the 2 ml of anesthetic supplement was given. Four of the 10 patients felt pain again and were uncomfortable later, so we gave them an additional 2-ml supplement of anesthesia. Following augmentation, the pain became mild and tolerable but did not totally disappear. One of the 4 patients experienced severe pain and needed another retrobulbar block.

The pain course peaked 6 hours after surgery. Twenty-two patients (69%) felt pain and 4 patients (13%) felt uncomfortable pain. At 24 hours after surgery, 4 patients (13%) still felt pain but no one felt uncomfortable (Fig. 1). The pain scores also peaked 6 hours after surgery. The level slowly decreased until 48 hours postoperatively (Fig. 2). No patient felt pain 48 hours after surgery. Five patients (16%)

retained complete eye movement 5 minutes after anesthesia administration. Only 4 patients (13%) had total akinesia. At the end of the surgery, sixteen patients (50%) had total akinesia, and 2 patients (6%) retained complete eye movement (Fig. 3).

DISCUSSION

Local anesthesia has recently become accepted as routine for retinal detachment surgery.^(23,24) Retrobulbar and peribulbar anesthesia are effective in ophthalmologic surgery. However, many complications of retrobulbar and peribulbar anesthesia have been reported, including ocular problems and fatalities.⁽¹⁻¹⁴⁾ Complications of retrobulbar and peribulbar anesthesia are related to the blind insertion of a needle into the intraconal space near the optic nerve. During needle insertion, perforation of the globe can occur, especially in highly myopic patients who are at higher risk. Perforation occurs more easily in those patients during retrobulbar anesthesia because of the long axial length.⁽²⁵⁾ For peribulbar anesthesia, although the needle is placed away from the globe, the cone, and the optic nerve, risks of complication are still high.⁽¹²⁻¹⁴⁾

Previously, the use of sub-Tenon anesthesia was mainly for supplementation of other anesthesia during vitreoretinal procedures.^(15,16) The effect of the supplementation was promising. Therefore, sub-Tenon anesthesia is now widely used in various ocular procedures.⁽¹⁷⁻¹⁹⁾ This sub-Tenon anesthesia uses a blunt cannula to inject the anesthetic solution. Complications such as perforation and injection of the optic nerve do not occur. Sub-Tenon anesthesia is superior to other ophthalmic procedures for scleral buckling. The conjunctiva and sub-Tenon space are supposed to open during scleral buckling.

There were no complications in our study, and sub-Tenon anesthesia proved an adequate anesthesia for segmental and radial buckling. Anesthesia was sufficient and stable throughout surgery in 31 cases (97%) with 9 cases requiring additional augmentation. One of the patients developed intolerable pain during the operation. An additional retrobulbar block resolved this problem.

The intraocular pressure increased when we injected the sub-Tenon anesthetic solution. No tight orbit or vascular insufficiency developed in this

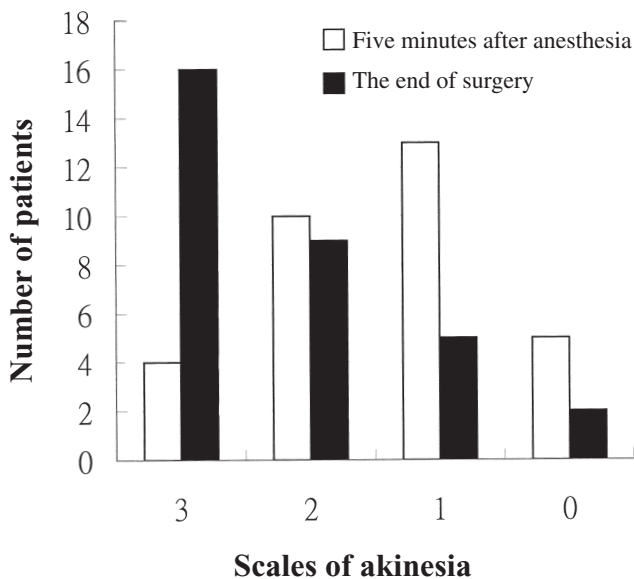


Fig. 3 Akinesia scales. Levels of akinesia was graded as follows: 0=complete movement, 1=moderate movement, 2=slight movement, 3=no movement. Five patients (16%) retained complete eye movement 5 minutes after the anesthesia. At the end of the surgery, 16 patients (50%) had total akinesia, and 2 patients (6%) retained complete eye movement.

study. This is because we used only 4 ml of solution. The intraocular pressure could be reduced by gentle massage. Chemosis occurred to various degrees after the injection, but it never severely disturbed the operation.

Intraoperative pain was mostly felt during traction of the muscles. In our series, we diminished this pain by reducing the number of isolated muscles. We used the bridle suture method rather than isolating muscles. Therefore, if retinal breaks were located too posteriorly, the traction of the muscles would be more difficult and the incidence of intraoperative pain would increase.

Postoperative pain in this study was mild, but little information exists concerning postoperative pain after local anesthesia.^(26,27) In our study we used a combination of lidocaine, bupivacaine, and hyaluronidase. Bupivacaine provides for prolonged anesthesia with an analgesic action of 6-12 hours. A slower onset of action is the major disadvantage of bupivacaine, but lidocaine can be used to compensate for this.⁽²⁸⁾ The mean onset of analgesia and akinesia is approximately 3 minutes for 2% lidocaine.⁽²⁹⁾ Hyaluronidase also improves the onset time and akinesia of extraocular muscles.⁽³⁰⁾

The onset of akinesia for sub-Tenon anesthesia is slower than for retrobulbar block. Only 4 patients (13%) reached total akinesia by 5 minutes after the injection. Sixteen patients (50%) experienced total akinesia by the end of surgery. Although total akinesia is not necessary for scleral buckling, it is related to the degree of anesthesia.

The number of the patients who felt pain and the pain scores peaked at 6 hours and declined thereafter. The duration of analgesic action was shorter when compared with that of retrobulbar anesthesia using bupivacaine.^(28,29,31,32) Some authors who reported using postoperative augmentation with retrobulbar block successfully decreased postoperative pain for 6 hours.^(15,16) An anesthetic solution with a longer half-life could be given with sub-Tenon irrigation after the conjunctival wound is closed allowing most patients to eliminate postoperative pain. No patients felt pain 48 hours after the surgery. If patients experience uncomfortable pain after 48 hours, there could be other problems.

In conclusion, sub-Tenon anesthesia is a safe and efficient method for segmental or radial scleral

buckle surgery. We recommend using this technique to reduce the complications from retrobulbar anesthesia. On the other hand, understanding the postoperative pain course of this procedure will help treat postoperative pain better.

REFERENCES

1. Grizzard WS, Kirk NM, Pavan PR, Antworth MV, Hammer ME, Roseman RL. Perforating ocular injury caused by anesthesia personnel. *Ophthalmology* 1991;98:1011-6.
2. Ramsay RC, Knobloch WH. Ocular perforation following retrobulbar anesthesia for retinal detachment surgery. *Am J Ophthalmol* 1978;86:61-4.
3. Ellis PP. Retrobulbar injections. *Surv Ophthalmol* 1974;18:425-30.
4. Shiver PA, Sinha S, Galusha JH. Prospective study of the effectiveness of retrobulbar and peribulbar anesthesia for anterior segment surgery. *J Cataract Refract Surg* 1992;18:162-5.
5. Feibel RM. Current concepts in retrobulbar anesthesia. *Surv Ophthalmol* 1985;30:102-10.
6. Morgan CM, Schatz H, Vine AK. Ocular complications associated with retrobulbar injection. *Ophthalmology* 1988;95:660-5.
7. Cowley M, Campochiaro PA, Newman SA, Fogle JA. Retinal vascular occlusion without retrobulbar or optic nerve sheath hemorrhage after retrobulbar injection of lidocaine. *Ophthalmic Surg* 1988;19:859-61.
8. Nicoll JM, Acharya PA, Ahlen K, Baguneid S, Edge KR. Central nervous system complications after 6000 retrobulbar blocks. *Anesth Analg* 1987;66:1298-302.
9. Brookshire GE, Gleitsman KY, Shenk EC. Life-threatening complication of retrobulbar block. *Ophthalmology* 1986;93:1476-8.
10. Javitt JC, Addiego R, Friedberg HL, Libonati MM, Leahy JJ. Brainstem anesthesia after retrobulbar block. *Ophthalmology* 1987;94:718-24.
11. McGalliard JN. Respiratory arrest after two retrobulbar injections. *Am J Ophthalmol* 1993;105:90-100.
12. Duker JS, Belmont JB, Benson WE, Brooks HL Jr., Brown GC, Federman JL, Fischer DH, Tasman WS. Inadvertent globe perforation during retrobulbar and peribulbar anesthesia. *Ophthalmology* 1991;98:519-26.
13. Puustjarvi S, Purhonen S. Permanent blindness following retrobulbar hemorrhage after peribulbar anesthesia for cataract surgery. *Ophthalmic Surg* 1992;23:450-2.
14. Esswein MB, Von Noorden GK. Paresis of a vertical rectus muscle after cataract extraction. *Am J Ophthalmol* 1993;116:424-30.
15. Mein CE, Flynn HW Jr. Augmentation of local anesthesia during retinal detachment surgery. *Arch Ophthalmol* 1989;107:1084.

16. Ducker JS, Nielsen J, Vander JF, Rosenstein RB, Benson WE. Retrobulbar bupivacaine irrigation for postoperative pain after scleral buckling surgery. *Ophthalmology* 1991;98:514-8.
17. Mein LC, Woodcock MM. Local anesthesia for vitreoretinal surgery. *Retina* 1990;10:47-9.
18. Friedberg MA, Spellman FA, Pilkerton AR, Perraut LE, Stephens RF. An alternative technique of local anesthesia for vitreoretinal surgery. *Arch Ophthalmol* 1991;109:1615-6.
19. Kwok AH, Newkirk MR, Lam DS, Fan DS. Sub-tenon's anesthesia in vitreoretinal surgery. *Retina* 1999;19:291-6.
20. Stevens JD, Franks WA, Orr G, Leaver PK, Cooling RJ. Four -quadrant anesthesia technique for vitreoretinal surgery. *Eye* 1992;6:583-6.
21. Sharma T, Gopal L, Parikh S, Shanmugam MP, Badrinath SS, Mukesh BN. Parabolbar anesthesia for primary vitreoretinal surgery. *Ophthalmology* 1997;104:425-8.
22. Harms-Ringdahi K, Carlsson AM, Ekhoim J, Raustrop A, Svensson T, Toresson HG. Pain assessment with different intensity scales in response to loading of joint structures pain. *Pain* 1986;27:401-11.
23. Timothy LR, Neva PA, Isaac B. Bupivacaine anesthesia in retinal detachment surgery. *Arch Ophthalmol* 1979;79:109-11.
24. Anjali DN, Preetam S. Peribulbar anesthesia for primary vitreoretinal surgery. *Ophthalmic Surg* 1992;23:657-61.
25. Berglin L, Stenkula S, Algvere PV. Ocular perforation during retrobulbar and peribulbar injection. *Ophthalmic Surg Lasers* 1995;26:429-34.
26. Chung F, Westerling D, Chisfolm LDJ. Postoperative recovery after general anesthesia with and without retrobulbar block in retinal detachment surgery. *Anaesthesia* 1988;43:943-6.
27. Lai C, Yang P, Yang K, Chuang L, Chen T. Evaluation of peribulbar anesthesia in encircling scleral buckle surgery and its postoperative pain course. *Chang Gung Med J* 1999;22:609-14.
28. Chin GN, Almquist HT. Bupivacaine and lidocaine retrobulbar anesthesia. *Ophthalmology* 1983;90:369-72.
29. Smith PH, Kim JW. Etidocaine used for retrobulbar block: a comparison with lidocaine. *Ophthalmic Surg* 1980;11:268-73.
30. Abelson MB, Mandel E, Paradis A, George M. The effect of hyaluronidase on akinesia during cataract surgery. *Ophthalmic Surg* 1989;20:325-6.
31. Gills JP, Loyd TL. Bupivacaine in cataract surgery. *Ophthalmic Surg* 1974;5:67-70.
32. Gottfreosdottir MS, Gislason I, Stefansson E, Sigurjonsdottir S, Nielsen NC. Effects of retrobulbar bupivacaine on post-operative pain and nausea in retinal detachment surgery. *Acta Ophthalmol Scand* 1993;71:544-7.

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