

Comparison of Topical Versus Sub-Tenon's Anesthesia in Phacoemulsification at a Tertiary Care Eye Hospital

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Abstract

Purpose: To compare the effectiveness of topical and sub-Tenon's anesthesia in providing pain relief during phacoemulsification.

Methods: This randomized controlled trial was carried out at a tertiary eye care hospital, Coimbatore, Tamil Nadu, India. Patients who underwent phacoemulsification through self-sealing clear corneal incision with foldable intra-ocular lens implantation were randomized into two groups. Group 1 ($n = 100$) received topical anesthesia with 0.5% proparacaine (Paracaine, Sunways India Pvt. Ltd., India) drops. Group 2 ($n = 100$) received sub-Tenon's infiltration with 2% lignocaine (Xylocaine, AstraZeneca Pharma India Pvt. Ltd., India). As per study criteria, patients graded the pain during administration of anesthesia, during surgery and after surgery on a visual analogue pain scale. The surgeon graded overall patient co-operation. The complications were also noted. Data analysis was performed using Statistical Package for Social Sciences version 11. Student's *t*-test and Chi-square test were used for comparison of variables between the groups.

Results: Sub-Tenon's anesthesia provided statistically significant better intra-operative pain relief and patient satisfaction than topical anesthesia. No statistically significant difference was noted between the two groups regarding pain during administration, postoperative pain, and surgeon satisfaction.

Conclusion: Sub-Tenon's anesthesia provides better pain relief than topical anesthesia during phacoemulsification.

Keywords: Phacoemulsification; Sub-Tenon's Anesthesia; Topical Anesthesia

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INTRODUCTION

There has been a dramatic change in anesthetic practice for ophthalmic surgery over the last decade. Newer techniques such as topical and sub-Tenon's anesthesia, which avoid sharp needle placement into the orbit, have obvious advantages over traditional peribulbar and retrobulbar blocks. These techniques are not only less painful on administration, but also as effective in pain control during surgery as sharp needle blocks. However, prerequisites for these techniques are a well-informed, motivated, and cooperative patient and a skilled competent surgeon.^[1]

Between the two techniques, topical anesthesia has some advantages over sub-Tenon's block; such as saving time in administration, shorter duration of action, allowing the patient to rapidly regain sight after surgery and less pain during administration of anesthesia. However, there is evidence that patients report more pain intra-operatively under topical anesthesia when compared with sub-Tenon's anesthesia.^[1]

This study aimed to compare the effectiveness of topical anesthesia and sub-Tenon's anesthesia in providing pain relief during phacoemulsification.

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The objectives of this study were to compare the patient's comfort levels during the administration of anesthesia, as well as intraoperatively and postoperatively. It also noted overall patient co-operation and any surgical complication following topical and sub-Tenon's anesthesia for phacoemulsification.

METHODS

This is a randomized controlled trial carried out between September 2009 and August 2010 at a tertiary care eye hospital in Coimbatore city, South India. Two hundred patients who underwent phacoemulsification through self-sealing clear corneal incisions and foldable intra-ocular lens implantation were enrolled in this study. One hundred patients received topical anesthesia (Group 1) and 100 (Group 2) received sub-Tenon's anesthesia. Patients were allocated randomly using a random number table to receive topical anesthesia with 0.5% proparacaine (Paracaine, Sunways India Pvt. Ltd. India) in Group 1 and sub-Tenon's infiltration with 2% lignocaine (Xylocaine, AstraZeneca Pharma India Pvt. Ltd. India) in Group 2.

Patients who had sensitivity to lignocaine, poor mydriasis <5 mm, history of epilepsy, excessive anxiety, inability to lie flat, inability to understand the pain scale or to comply with instructions (deafness, people suffering from psychiatric disorders, mentally challenged subjects) were excluded from the study.

Data collection was performed by means of interviews; a predesigned semi-structured questionnaire was used to collect the data. Written consent was obtained from the respondents after explaining the procedure in the local language (Tamil). The study protocol was submitted for ethical clearance to the Institutional Ethics Committee of the hospital and clearance was obtained before commencement of the study.

Patients were asked to grade pain on a visual pain scale (Grade 0 - no pain, Grade 1 - slight irritation, Grade 2 - mild pain, Grade 3 - significant pain) during administration of the anesthetic, during surgery, immediate postoperatively and 30 minutes postoperatively. Visual pain scale used in the study is depicted in Figure 1.

The surgeon also graded overall patient co-operation during surgery on a scale of 0-3 with 0 being the least co-operation and 3 being the greatest. Surgical satisfaction depended on patient co-operation (eye movement, lid squeezing) and time taken for surgery. The intra-operative complications in the two groups were also recorded.



Figure 1. Visual analog pain scale.

The data was statistically analyzed by SPSS 11.0 (SPSS Inc., Chicago, IL, USA) for descriptive statistics and tests of significance. Student's *t*-test was used to compare mean age of the patients in each arm of the trial. Chi-square test was used to compare the pain felt by the patients during various phases of assessment and also patient co-operation during surgery as graded by the operating surgeon between the two arms of the trial. The statistical level of significance was fixed at $P < 0.05$.

Technique of Topical Anesthesia

Local anesthetic (proparacaine 0.5% drops) was instilled in the conjunctival sac 10 minutes and 5 minutes before surgery and if needed, during surgery.

Technique of Sub-Tenon's Anesthesia

A single drop of topical anesthetic (proparacaine 0.5%) was instilled in the eye. A tuberculin syringe with 26 gauge needle or loaded with local anesthetic solution (2% xylocaine, Dispo Van, Single use needle, India. 0.45 x 13 mm). Patient was asked to look up and out to expose the inferonasal quadrant. The 26 gauge needle was inserted below the conjunctiva and Tenon's capsule and 0.25 mL of local anesthetic (2% xylocaine) was injected into the sub-Tenon's space.

Conventional technique: a small incision was made in the conjunctiva and Tenon's fascia. Local anesthetic was injected using a small blunt sub-Tenon's cannula inserted through this hole. However, the selection of a cannula or needle depended on availability, cost and preference of the surgeon.^[2]

RESULTS

A total of 200 patients who underwent clear cornea phacoemulsification were assessed. One hundred surgeries were performed under topical and 100 under sub-Tenon's anesthesia.

The mean age of the patients in topical and sub-Tenon's group was 61.64 years and 62.87 years respectively ($F = 2.56$, $P = 0.11$). Under among the topical group, 55 were male and 45 were female subjects. The sub-Tenon's group comprised of 47 male and 53 female subjects. Fifty-four right eyes and 46 left eyes were operated under topical anesthesia whereas 64 right eyes and 36 left eyes were operated under sub-Tenon's anesthesia. The majority (79%) of patients in both groups were operated for senile immature cataract. Other causes included senile mature cataract, posterior subcapsular cataract, hypermature cataract, brown cataract, near mature cataract and presenile immature cataract.

During administration of anesthesia, the pain scores did not show any statistically significant difference (Pearson's $\chi^2 = 5.658$ and $P = 0.059$) between the topical and sub-Tenon's groups. No patient in either group reported severe pain [Table 1].

Pain scores during the surgery were compared between the two groups and the difference was statistically significant (Pearson's $\chi^2 = 9.437$, $P = 0.009$). Nearly 65% of patients felt no pain, 18% felt slight irritation, and 17% felt mild pain under topical anesthesia, whereas corresponding figures in the sub-Tenon's group were 79%, 17%, and 4%, respectively thus confirming that sub-Tenon's provides better pain relief during surgery than topical anesthesia [Table 1].

There was no statistically significant difference (Pearson's $\chi^2 = 5.410$, $P = 0.067$) between the two groups regarding immediate post-surgical pain. Similarly, no statistically significant difference (Pearson's $\chi^2 = 4.790$, $P = 0.0915$) between the two groups was seen in pain scores graded 30 minutes following surgery [Table 1].

The surgeon observed that in the topical group, 67% of patients had no eye movement and 33% showed minimal eye movement during surgery, whereas these figures were 78% and 22% respectively in the sub-Tenon's anesthesia. However, this difference was not statistically significant (Pearson's $\chi^2 = 3.034$, $P = 0.082$), [Table 2].

The surgeon also observed that in the topical group, 67% of patients in the topical group, did not exhibit lid squeezing, 32% had minimal lid squeezing and one patient squeezed the lids significantly during surgery. With sub-Tenon's anesthesia, 87% of patients did not have any lid squeezing and 13% had minimal lid squeezing. This difference observed between the two groups was statistically significant (Pearson's $\chi^2 = 11.620$, $P = 0.003$), [Table 2].

The operating surgeon also felt that the majority of patients in both groups (79% and 77% in topical and sub-Tenon's, respectively) were significantly co-operative. Neither the surgery, nor the surgical time was affected by patient comfort levels in both groups. As a result, there was no statistically significant difference (Pearson's $\chi^2 = 1.541$, $P = 0.463$) between the two groups regarding the co-operation levels [Table 2].

No complications were noted in the topical group either during administration of anesthesia or during surgery. In the sub-Tenon's group, six patients out of 100, had chemosis and one had subconjunctival hemorrhage during administration of anesthesia. There were no intra-operative complications in either group.

DISCUSSION

Stevens was the first to introduce sub-Tenon's anesthesia for cataract surgery.^[3] Ever since, there have been several reports confirming the efficacy and safety of sub-Tenon's anesthesia during cataract surgery.^[4-6]

Fichman was the first to report the technique of topical anesthesia^[7] following which it has rapidly gained popularity for clear cornea phacoemulsification.

Table 1. Comparison of the patient comfort levels during the various stages of phacoemulsification under topical vs. sub-Tenon's anesthesia (as graded by patients)

| | Type of anesthesia n=100 (%) | | Pearson's χ^2 value | P value |
|--|---------------------------------|---------------------------|-----------------------------|---------|
| | Topical anesthesia | Sub-Tenon's anesthesia | | |
| Pain level during administration of anesthesia | | | | |
| No pain | 84 (84) | 71 (71) | 5.658 | 0.059 |
| Slight irritation | 12 (12) | 25 (25) | | |
| Mild pain | 4 (4) | 4 (4) | | |
| Pain level during surgery | | | | |
| No pain | 65 (65) | 79 (79) | 9.437 | 0.009* |
| Slight irritation | 18 (18) | 17 (17) | | |
| Mild pain | 17 (17) | 4 (4) | | |
| Pain level immediately after surgery | | | | |
| No pain | 71 (71) | 84 (84) | 5.410 | 0.067 |
| Slight irritation | 18 (18) | 8 (8) | | |
| Mild pain | 11 (11) | 8 (8) | | |
| Pain level 30 minutes following surgery | | | | |
| No pain | 72 (72) | 84 (84) | 4.790 | 0.091 |
| Slight irritation | 14 (14) | 10 (10) | | |
| Mild pain | 14 (14) | 6 (6) | | |

*Statistically significant

Table 2. Comparison of patient's co-operation during phacoemulsification under topical vs. sub-Tenon's anesthesia (as graded by surgeon)

| | Type of anesthesia n=100 (%) | | Pearson's χ^2 value | P value |
|--------------------------------|---------------------------------|---------------------------|-----------------------------|---------|
| | Topical anesthesia | Sub-Tenon's anesthesia | | |
| Eye movement | | | | |
| No | 67 (67) | 78 (78) | 3.034 | 0.082 |
| Minimal | 33 (33) | 22 (22) | | |
| Lid squeezing | | | | |
| No | 67 (67) | 87 (87) | 11.620 | 0.003* |
| Minimal | 32 (32) | 13 (13) | | |
| Significant | 1 (1) | Nil | | |
| Overall patient co-operation | | | | |
| Nonco-operative to some extent | 12 (12) | 9 (9) | 1.541 | 0.463 |
| Significantly co-operative | 79 (79) | 77 (77) | | |
| Greatest co-operation | 9 (9) | 14 (14) | | |

*Statistically significant

Topical anesthesia and sub-Tenon's infiltration are both accepted methods of providing local anesthesia for small incision self-sealing phacoemulsification cataract surgery.

Although topical anesthesia is less invasive and quicker to administer than sub-Tenon's infiltration, acceptable cataract surgery under local anesthesia depends to a large extent on the patients comfort during the procedure.^[5]

Chittenden et al,^[5] in their study comparing topical oxybuprocaine with sub-Tenon's lidocaine 2%, showed that sub-Tenon's infiltration produced less pain and more comfort as compared to topical anesthesia in patients undergoing phacoemulsification through a self-sealing scleral tunnel incision. They reported a significantly higher median pain score in the topical group which made the operative procedure more stressful for both the patient and surgeon.^[5] They recommended topical anesthesia only if the cataract surgery was performed through a clear corneal incision. Similarly, Manners and Burton^[6] have reported a higher pain score in the topical group despite the fact that patients in this group received an additional sub conjunctival injection of lidocaine 2% to facilitate scleral cautery, as the surgery was performed through a scleral incision.

It has been assumed that, with topical anesthesia, phacoemulsification and intra-ocular lens implantation were less painful when performed through a clear corneal incision than when performed through a scleral tunnel incision, as the former has the advantage of preserving the conjunctiva and avoiding cautery.^[8-10] However, a study by Srinivasan et al^[8] shows that even with clear cornea incision, patients undergoing topical anesthesia had significantly higher mean pain score immediately and 30 minutes after surgery. This was reported in their double blind randomized placebo controlled trial comparing topical and sub-Tenon's anesthesia for routine cataract surgery.

Zafirakis et al^[11] were the first to compare topical and sub-Tenon's anesthesia for phacoemulsification and intra-ocular lens implantation through a clear cornea incision. They recruited 100 patients in whom randomization was satisfied so that half of the first-eye surgeries and half of the second eye-surgeries were assigned to each anesthetic group. They concluded that patients having cataract surgery under topical anesthesia had more intra-operative and postoperative discomfort than patients receiving sub-Tenon's anesthesia. However, patients having topical anesthesia reported less pain during its administration and had fewer complications. Both anesthesia methods provided high levels of pain control without additional sedation.^[11]

In our study, phacoemulsification was performed through a clear cornea incision. It was found that patients undergoing surgery under topical anesthesia had more pain than sub-Tenon's anesthesia intra-operatively.

The literature review of intra-operative pain^[5,8,9,11] reveals that topical method results in higher pain levels during surgery as compared to sub-Tenon's which is consistent with our results. However, one should note the differences in pain scores in all these studies although statistically significant, are not necessarily clinically significant.^[1] The increased pain could be due to the application of speculum to the eyelid or pain from the ciliary body, both of which would not be anesthetized under topical anesthesia,^[1] pain in the surgical technique may reduce pain felt under topical anesthesia.^[1]

Regarding, pain during administration of anesthesia, studies^[8,9,11] provided slight evidence of higher pain during administration of sub-Tenon's anesthesia. This could be due to the fact that the pain of anesthetic administration was measured after the operation^[11] and so patients could have confused the pain of the procedure with the pain of administration.^[1] As this is a comparison between a procedure that just requires instillation of drops with a more invasive one using a blunt cannula, there is always going to be some degree of discomfort involved in sub-Tenon's, but usually this is short lived.^[1] Hence, the pain scores may not be clinically significant. It is possible that pain during the administration of sub-Tenon's could be reduced by different techniques, which could include changing the speed of delivery, volume delivered, concentration used and warming of the anesthetic drugs.^[1] In our study, pain scores in sub-Tenon's were slightly higher than topical, but there was no statistically significant difference between the two.

Similar to the study by Srinivasan et al,^[8] our study also measured postoperative pain immediately and 30 minutes after surgery. Their study showed higher pain scores in the topical group than in sub-Tenon's group whereas in our study, no difference was found in postoperative pain scores between two types of anesthesia. Zafirakis et al^[11] measured pain 24 hours postoperatively and reported that all patients in topical anesthesia group had a statistically significant pain score versus the sub-Tenon's group 24 hours postoperatively.

Our study also recorded intra-operative eye movements, lid squeezing and complications. There was difference in eye movement between two groups. More lid squeezing was noted in the topical group than the sub-Tenon's group. No complications were seen in the topical group whereas few cases of minor complications such as chemosis and subconjunctival hemorrhage were noted in sub-Tenon's group. Other studies which noted complications are by Srinivasan et al,^[8] Vielpeau et al^[12] and Zafirakis et al^[11] Chemosis and sub conjunctival hemorrhage were noted in sub-Tenon's group by Vielpeau et al^[12] and Zafirakis et al,^[11] while there was more eye squeezing and less akinesia in topical group.^[11] This may be due to less effective block in topical group as compared to the sub-Tenon's group. In Srinivasan

et al^[8] study, more serious complication such as posterior capsule tear and vitreous loss occurred in the topical group, more than twice as often as in the sub-Tenon's. This could be potentially due to the fact that topical anesthesia provides no akinesia, which makes surgery more risky.

Rüschen et al^[13] looked at patient satisfaction and reported that patients were more satisfied with sub-Tenon's anesthesia than topical anesthesia. The difference in the satisfaction scores was not huge and may not be clinically significant.^[1] In our study, surgeons noted the patient's co-operation and found that the majority in both groups were significantly co-operative.

The quality of anesthesia of different topical agents may vary in small incision cataract surgery, but no study appears to have compared the effectiveness of all available topical anesthetics.^[5] Although amethicone tends to be used in UK and tetracaine in USA,^[6,14,15] Chittenden et al^[5] preferred oxybuprocaine 0.4% as it is less irritant. Srinivasan et al^[8] used proxymethocaine 0.5%. In our study, proparacaine 0.5% was used.

The choice of anesthetic technique will always depend on a balance between the patient's wishes, the operative needs of the surgeon, the skills of the anesthetist and the facility where such surgery is being performed.^[16]

This study has shown that sub-Tenon's anesthesia provides better pain relief than topical anesthesia during phacoemulsification.

REFERENCES

- Davidson M, Padroni S, Bunce C, Ruschen H. Sub-Tenon's anaesthesia versus topical anaesthesia for cataract surgery (Review). The Cochrane Collaboration. No. 3. Chichester: John and Wiley Publishers, *The Cochrane Library*; 2009.
- Kumar CM, Williamson S, Manickam B. A review of sub-Tenon's block: current practice and recent development. *Eur J Anaesthesiol* 2005;22:567-577.
- Stevens JD. A new local anesthesia technique for cataract extraction by one quadrant sub-Tenon's infiltration. *Br J Ophthalmol* 1992;76:670-674.
- Roman SJ, Chong Sit DA, Boureau CM, Auclin FX, Ullern MM. Sub-Tenon's anaesthesia: an efficient and safe technique. *Br J Ophthalmol* 1997;81:673-676.
- Chittenden HB, Meacock WR, Govan JA. Topical anaesthesia with oxybuprocaine versus sub-Tenon's infiltration with 2% lignocaine for small incision cataract surgery. *Br J Ophthalmol* 1997;81:288-290.
- Manners TD, Burton RL. Randomised trial of topical versus sub-Tenon's local anaesthesia for small-incision cataract surgery. *Eye (Lond)* 1996;10:367-370.
- Fichman RA. Use of topical anesthesia alone in cataract surgery. *J Cataract Refract Surg* 1996;22:612-614.
- Srinivasan S, Fern AI, Selvaraj S, Hasan S. Randomized double-blind clinical trial comparing topical and sub-Tenon's anaesthesia in routine cataract surgery. *Br J Anaesth* 2004;93:683-686.
- Mathew MR, Williams A, Esakowitz L, Webb LA, Murray SB, Bennett HG. Patient comfort during clear corneal phacoemulsification with sub-Tenon's local anesthesia. *J Cataract Refract Surg* 2003;29:1132-1136.
- Sekundo W, Dick HB, Schmidt JC. Lidocaine-assisted xylocaine jelly anesthesia versus one quadrant sub-Tenon infiltration for self-sealing sclerocorneal incision routine phacoemulsification. *Eur J Ophthalmol* 2004;14:111-116.
- Zafirakis P, Voudouri A, Rowe S, Livir-Rallatos G, Livir-Rallatos C, Canakis C, et al. Topical versus sub-Tenon's anesthesia without sedation in cataract surgery. *J Cataract Refract Surg* 2001;27:873-879.
- Vielpeau I, Billotte C, Kreidie J, Lecoq P. Comparative study between topical anesthesia and sub-Tenon's capsule anesthesia for cataract surgery. *J Fr Ophthalmol* 1999;22:48-51.
- Rüschen H, Celaschi D, Bunce C, Carr C. Randomised controlled trial of sub-Tenon's block versus topical anaesthesia for cataract surgery: a comparison of patient satisfaction. *Br J Ophthalmol* 2005;89:291-293.
- Kershner RM. Topical anesthesia for small incision self-sealing cataract surgery. A prospective evaluation of the first 100 patients. *J Cataract Refract Surg* 1993;19:290-292.
- Duguid IG, Claoué CM, Thamby-Rajah Y, Allan BD, Dart JK, Steele AD. Topical anaesthesia for phacoemulsification surgery. *Eye (Lond)* 1995;9:456-459.
- Kumar CM, Dodds C. Ophthalmic regional block. *Ann Acad Med Singapore* 2006;35:158-167.

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