

## A comparative study of sub-tenons anaesthesia versus peribulbar anaesthesia- In manual small incision cataract surgery

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### Abstract

**Aim:** To compare the efficiency of sub-Tenon's versus peribulbar anaesthesia in Manual small incision cataract surgery with respect to Pain during administration of block, analgesia intraoperatively, akinesia, effect on intraocular pressure, volume of the anaesthetic agent, surgeon's comfort during surgery and Complications of block.

**Materials and Methods:** A prospective study of 100 cases who underwent manual small incision cataract surgery (MSICS) divided into two groups namely peribulbar group and sub-Tenon's group. The two techniques were compared with respect to pain at administration, analgesia, akinesia, intraocular pressure (IOP), volume, surgeon's comfort and complications.

**Results:** Sub-Tenon's anaesthesia was relatively less painful at administration, providing good analgesia with incomplete akinesia. It needed significantly lesser volume of anaesthetic agent, with minimal rise in IOP, good comfort to surgeon and had only minor complications in the form of subconjunctival haemorrhage, chemosis.

**Conclusion:** Sub-tenon's anaesthesia is relatively less painful to deliver, effective and safe technique for MSICS.

**Keywords:** Akinesia, Anaesthesia, Analgesia, Cataract surgery, Lignocaine.

### Introduction

Cataract is the leading cause of treatable blindness in the world. Cataract surgery is the most commonly performed procedure in ophthalmology services. In cataract surgeries, various types of anaesthesia were used in the past but were associated with many disadvantages and complications. The traditional demand for total akinesic anaesthesia decreased with the advancement in techniques of cataract surgeries, while the safety and analgesia are still the basic requirements.

General anaesthesia (GA), earlier used for cataract surgery was discontinued because it had its own risks associated. GA still remains the anaesthesia of choice for Infants and young children, patients with poor comprehension and cooperation, patients objecting to local anaesthesia.

Peribulbar anaesthesia was a popular technique until past decade.<sup>1</sup> Due to separated multi-compartmental anatomy of orbit, spread of the local anesthetic drug is sometimes non homogeneous and incomplete.<sup>2</sup> This may lead to imperfect blocks or need for multiple injections or sometimes large injectable volumes.<sup>3</sup> Peribulbar block requires use of sharp needles for administration. It is also associated with the risk of retrobulbar hemorrhage, globe perforation, neuromuscular damage prevails even with best safety precautions.<sup>3-5</sup>

In due concern about safety with use of sharp needles, a novel technique of using blunt needle came into scenario, which was popularized by Hansen and Stevens as Sub-Tenon's anaesthesia which was found to be equally effective yet safe. Sub-Tenon's anaesthesia is also popular as pinpoint anaesthesia, parbulbar block and episcleral block.<sup>6</sup> Sub-Tenon's anaesthesia can be employed in all type of cataract surgeries.<sup>7</sup> Without the drawbacks of topical

anaesthesia, sub-Tenon's anaesthesia eliminates the risk involved in sharp needle usage and provides better anaesthesia to iris and anterior segment. Hence an attempt is made in this study to compare the efficacy of sub-Tenon's anaesthesia versus peribulbar anaesthesia for cataract surgery under various aspects.

### Materials and Methods

Ethical clearance was obtained from the "institutional ethical committee" assigned. This prospective study was conducted between January 2014 and December 2014 at Shri Hanagal Kumareswar Hospital and Research Centre, S. Nijalingappa Medical College, Bagalkot. 100 patients posted for cataract surgery were selected randomly, excluding patients with sensitivity to anaesthetic agent, Pre-existing ocular muscle paresis, neurological deficits and Co-existing inflammatory conditions in eye.

They were randomly divided into group A (n=50) who underwent manual small incision cataract surgery under peribulbar anaesthesia and group B (n=50) who underwent manual small incision cataract surgery (MSICS) under sub-Tenon's anaesthesia.

All patients were in-patients of the hospital. Informed consent was obtained from all the patients for the surgery and anaesthetic procedure. Detailed history was taken and complete ocular examination was done. Systemic evaluation and medical fitness prior to the procedure was obtained. Test dose of the anaesthetic agent was given to all patients. During the procedure the efficacy and safety of the above mentioned two methods of anaesthesia in MSICS with respect to following objectives were documented and evaluated.

**Analgesia**

1. Pain at the time of administration of block.
2. Intraoperative.

Grade 0: No pain.

Grade 1: mild pain or discomfort.

Grade 2: moderate pain.

Grade 3: severe or intense pain.

**Akinesia****Globe:**

Grade 0: Complete movement remaining.

Grade 1: Moderate movement.

Grade 2: Slight movement.

Grade 3: No movement.

**Lid:**

Grade 0: Normal movements.

Grade 1: Educated movements.

Grade 2: No movement

**IOP:**

Was recorded using Schiötz tonometer at end of 5 minutes, 10 minutes following administration of the block.

**Level of Comforts**

Grade 0: Comfortable.

Grade 1: Mild discomfort.

Grade 2: Moderate discomfort.

Grade 3: Severe discomfort or inability to operate.

**Materials used in the study:**

1. Lignocaine 2% with adrenaline 1 in 2,00,000.
2. Bupivacaine 0.5%.
3. Hyaluronidase 1500 IU.
4. Proparacaine. 0.5%.
5. 5 cc sterile disposable syringe.
6. 24 G needle with dimensions of 0.55 × 25 mm.
7. Schiötz tonometer with weights and scale.
8. Curved blunt tipped metal cannula.
9. Betadine 5%.
10. Cotton pads, gauges and buds.
11. Wire speculum.
12. Lim's forceps.
13. Westcott's spring conjunctival scissor.

**Preparations of Anesthetic Agents**

Lignocaine 2% with adrenaline 1 in 2,00,000 was mixed with Bupivacaine 0.5% solution. An ampoule of Hyaluronidase 1500 IU was added to it resulting in 15 IU / ml of the anesthetic mixture.

**Technique of Peribulbar Anaesthesia**

Under strict aseptic precautions in supine position a 26G needle mounted on a 5 cc syringe containing the above mentioned anaesthetic mixture is pierced at junction of middle and outer third of the lower orbital margin with the bevel of the needle towards the globe and the needle parallel to the floor of the orbit. Once the position is confirmed a slight aspiration is done to check for any accidental vascular access, if satisfactory then 3-4ml of the anaesthetic mixture is injected. Similarly 1-2 ml of the agent is injected at the supra orbital notch with needle directed towards the orbital

roof. The eyelid was then closed and pressure was applied for 5mins and massage was given to the eyeball and akinesia, analgesia and intra-ocular pressure recorded at 5 minutes and 10 minutes. Repeat injections of 1-2 ml were given at Infrero-temporal margin for patients in whom akinesia and analgesia were inadequate.

**Technique of sub-Tenon's Anaesthesia**

Under strict aseptic precautions in supine position patient's conjunctiva was anesthetized by instilling proparacaine eye drops 2-3 times. A lid speculum was inserted. The patient was asked to look upwards and outwards so as to get a better view of the inferonasal quadrant of conjunctiva. A button hole was made in the conjunctiva along with Tenon's capsule 3-4 mm from the limbus in the infero nasal quadrant. A path is created in the sub-Tenon's space by passing a scissor through the button hole. A 30mm, 23G curved blunt cannula was inserted with the sub-Tenon's space and the 2.5-3.0 ml anaesthetic solution was injected into the posterior sub-Tenon's space. Akinesia, analgesia and IOP (end of 5 min and 10 min) were recorded.

Complications if any, and surgeons comfort at the end of surgical procedure were also recorded.

All patients in the study underwent manual small incision cataract surgery under above mentioned anaesthesia after 10 minutes of administration of anaesthetic agent.

**Results**

Totally 100 patients were selected for the present study of which 50 patients received peribulbar anaesthesia (Group A) and 50 patients received sub-Tenon's anaesthesia (Group B) satisfying all inclusion and exclusion criteria.

All the 100 patients were aged between 50- 80 years of age. The mean age group in our study was  $65.35 \pm 9.08$  years (Table 1).

Out of 100 patients enrolled in our study sub-Tenon's group had 44% (22) males whereas peribulbar group had 48% (24) males. Among females it was 56% (28) in sub-Tenon's group and 52% (26) in peribulbar group. There was no statistically significant difference in age and sex between the two groups.

Out of 100 cases in our study 75% were SIMC and remaining 25% were SMC. Sub-Tenon's group had 74% of SIMC and 26% SMC. Peribulbar group had 76% SIMC and 24% SMC. Chi-square test revealed p value > 0.05 indicating no statistically significant difference between the two groups.

In the sub-Tenon's group, out of 50 cases, 26 (52%) of them did not experience any pain and 24(48%) had mild pain during administration of the anaesthesia. None of them experienced moderate or severe grade of pain during administration of anaesthesia (Table 2).

Whereas in the peribulbar group, all the patients experienced pain, of varying severity, during administration of anaesthesia. Out of 50 cases, 33 (66%) had experienced moderate pain while 15 (30%) of them had mild degree of pain. 2(4%) patients had experienced severe degree of pain during administration of anaesthesia.

Upon statistical analysis using Fisher's exact test it was found that p value was < 0.001, making it highly statistical significant difference.

#### Intra-operative Analgesia

In the sub-Tenon's group out of 50 patients, none of the patients experienced severe grade of pain. Only 12 patients reported of having pain of mild-moderate grade. Mild grade in 8 (16%) cases and moderate grade in 4 (8%) cases. Majority of the patients i.e 38 (76%) didn't feel pain during the surgical procedure.

Whereas in peribulbar group only 25(50%) patients were comfortable having no pain during the surgical procedure. In the remaining 50%, 18 (36%) had mild grade of pain, 6 (12%) had moderate grade of pain. one patient complained of severe pain during surgical procedure which accounts to 2% (Table 3).

Chi-square test revealed p value- 0.048 which is < 0.05, making it a statistical significant difference.

#### Akinesia of Eyelid

In sub-Tenon's group 34 (68%) had grade 2 akinesia, 13 (26%) had grade 1 akinesia, and only 3 (6%) had complete eyelid movements (grade 0). In peribulbar group 44 (88%) patients had grade 2 akinesia, 5 (10%) had grade 1 and only 1 case had complete lid movements. (Grade 0) (Table 4).

#### Akinesia of Globe

In sub-Tenon's group 28(56%) patients had grade 0 akinesia, 11(22%) had grade 1 akinesia, 8(16%) had grade 2 akinesia and only 3 (6%) had grade 3 akinesia. Whereas in peribulbar group 30(60%) patients had grade 3 akinesia, 10(20%) had grade 2 akinesia, 8(16%) had grade 1 akinesia and only 2(4%) had grade 0 akinesia (Table 5).

#### Effect on IOP

**Pre op IOP:** In the sub-Tenon's group, mean IOP was 14.64(SD 2.68) mm Hg whereas in peribulbar group mean IOP was 14.35(SD 2.60) mm Hg. There was no significant statistical difference in the pre-op IOP level among the two study groups.

**IOP at 5 min:** In the sub-Tenon's group, mean IOP was 16.85(SD 2.68) mm Hg whereas in peribulbar group mean IOP was 19.37(SD 2.89) mm Hg. P value was <0.001 indicating that there was statistically significant difference in observation.

**IOP at 10 min:** In the sub-Tenon's group, mean IOP was 15.89(SD 2.70) mm Hg whereas in peribulbar group mean IOP was 16.59(SD 2.53) mm Hg. There was no significant statistical difference in the IOP level at 10 min among the two groups.

#### Volume of Anaesthetic Agent

In peribulbar group the mean volume of anaesthetic agent needed was 5.88 ml (SD 0.32) with additional volume of 0.32 ml. And in sub-Tenon's group it was 2.67 ml (SD 0.44) with negligible additional volume. chi-square test showed p value < 0.05 making the observation statistically significant.

#### Comfort to Surgeon

The surgeon's comfort score in both the groups were recorded with aforementioned comfort scale. The operating

surgeon was most comfortable in 82% and 86% for sub-Tenon's group and peribulbar group respectively. Mild discomfort scores were noted in 12% and 10% cases of sub-Tenon's group and peribulbar group respectively. Moderate discomfort was seen in 4% cases of both the groups. No event of severe discomfort leading to termination/discontinuity of surgery was seen in either groups. P-value > 0.05 was noted from statistical analysis indicating no significant difference (Table 6).

#### Complication of Anaesthesia

Among the sub-Tenon's group 35 (70%) patients developed chemosis after administration of block where as it was 14 (28%) cases among the peribulbar group. 28 (56%) patients of sub-Tenon's group developed sub-conjunctival hemorrhage (SCH) whereas it was 8 (16%) cases in the peribulbar group. 3 (6%) patients of peribulbar group developed subcutaneous hemorrhage (SCT) compared to none in the sub-Tenon's group.

**Table 1: Age distribution of patients**

Age groups	Subtenons (ST)	%	Peribulbar (PB)	%
<50	0		3	6
50-59	9	18	7	14
60-69	21	42	21	42
70-79	15	30	17	34
>80	4	8	2	4

**Table 2: Pain during administration of anesthesia**

Grade	ST	%	PB	%
0	26	52	0	0
1	24	48	15	30
2	0	0	33	66
3	0	0	2	4

**Table 3: Intraoperative pain grading**

Grade	ST	%	PB	%
0	38	76	25	50
1	8	16	18	36
2	4	8	6	12
3	0	0	1	2

**Table 4: Akinesia of eyelid**

Grade	ST	%	PB	%
0	3	6	1	2
1	13	26	5	10
2	34	68	44	88

**Table 5: Akinesia of globe**

Grade	ST	%	PB	%
0	28	56	2	4
1	11	22	8	16
2	8	16	10	20
3	3	6	30	60

**Table 6: Comfort level for surgeon**

Grade	ST	%	PB	%
0	42	82	43	86
1	6	12	5	10
2	2	4	2	4
3	0	0	0	0

## Discussion

### Pain at the time of Administration of Analgesia

In our study, in sub-Tenon's group 52% patients had no pain while administration of anaesthesia while 66% of peribulbar group had moderate pain. 48% of sub-Tenon's group had mild pain compared to 30% of peribulbar group. Roman et al in their study reported that administration of subtenon's anaesthesia produced no pain in 55% of patients and rest of them had just sensation.<sup>42</sup> Briggs M C et al in their study reported that pain during administration of subtenon's anaesthesia was slightly less than that during peribulbar anaesthesia administration.<sup>7</sup>

### Intraoperative Analgesia

In our study we observed that 76% patients of sub-Tenon's group had no pain intraoperatively, whereas in peribulbar group 50% patients had no pain intraoperatively. 24% patients of sub-Tenon's group had mild-moderate pain while it was 48% patients of peribulbar group having mild-moderate pain. Azmon et al in their study observed that, there was no statistically significant difference between peribulbar and sub-tenon's groups in intraoperative analgesia and approximately the same intra-operative pain levels as that of peribulbar anaesthesia. 43% of patients in the sub-Tenon's group and 47% in peribulbar group reported no pain intraoperatively. 31% in sub-Tenon's group and 28% in the peribulbar group reported mild discomfort during surgery.<sup>30</sup>

The adequacy and intraoperative analgesia of both sub-Tenon's and peribulbar anaesthesia in cataract surgery are comparable.

In our study we found that 68% patients of sub-Tenon's group had complete akinesia of lid compared to 88% patients in the peribulbar group. Kumar C M in his study observed that the mean score of lid akinesia at the end of 25 min were 1.92 and 2 in sub-Tenon's group and peribulbar group respectively. Superior oblique muscle and lid movements also remained active in significant number of patients.<sup>46</sup> Rowley S A et al in their study found that with addition of hyaluronidase the reduction in eyelid movements were significantly better in the sub-Tenon's block with a mean score of 1.3.<sup>45</sup>

### Akinesia of Globe

In our study we found that 60% patients of peribulbar group had complete akinesia of globe, compared to 6% patients of sub-Tenon's having complete akinesia of globe evaluated just after administration of block. After few minutes the globe akinesia in both groups were comparable. 36% patients in either group had mild-moderate globe movements. Kollaritis et al reported complete akinesia in 82% of cases in peribulbar and 80% in subtenon's anaesthesia.<sup>4</sup> This difference in akinesia could be due to

time at which it was assessed, we in our study assessed akinesia after 2-3 minutes of block. Khurana et al in their study found that 52% of patients had complete akinesia with sub-tenon's anaesthesia after 15 min of administration.<sup>48</sup>

### Effect on IOP

In our study the mean pre-op IOP levels among the two groups were comparable with no significant statistical difference. Both the groups were recorded of having rise in IOP at 5 min and 10 min interval after administration of anaesthesia. At 5 min interval the rise in IOP was much greater in peribulbar group than sub-Tenon's group with significant statistical difference. Khan SA et al in his study also noted the immediate rise in IOP after the administration of sub-Tenon's and peribulbar block with significant statistical difference between the two groups.<sup>50</sup> Alwirty et al, Pianka et al in their study noticed that the rise in intraocular pressure after administration of sub-Tenon's block is small or even non-significant.<sup>51,52</sup>

The mechanism of rise in intraocular pressure after administration of local ocular anaesthesia has been attributed to the mechanical compression of the eye caused by large volume of solution injected in the small orbital space.

### Volume of Anaesthetic Agent

In our study mean volume of anaesthetic agent required in peribulbar group was 5.88 ml (SD 0.32), and in sub-Tenon's group it was 2.67 ml (SD 0.44). Yoshihiro Tokuda et al compared analgesic effect of different doses of subtenon's anaesthesia and reported that 3 ml of sub-tenon's anaesthesia was significantly more effective than lower doses.<sup>53</sup> Our study was comparable with similar studies in assessing the volume of anaesthetic agent needed.

### Surgeon's Comfort during Surgery

In our study, surgeon did not face any discomfort while operating under both the anaesthesia techniques in more than 80% of cases. In 4% of cases of either group surgeon had moderate discomfort.

### Complications of Peribulbar and sub-Tenon's block

Chemosis, subconjunctival hemorrhage and subcutaneous hemorrhage were the noted complications in our study. 70% of the sub-Tenon's group developed chemosis in one or more quadrant compared to 28% in peribulbar group. Subconjunctival hemorrhage was seen in 56% cases of sub-Tenon's group. Subcutaneous hemorrhage was seen only in peribulbar group accounting to 6% of cases.

Stan J Roman et al in their study found that 39% had chemosis involving more than 1 quadrant in subtenon's anaesthesia.<sup>42</sup> C M Kumar et al in his review article on complications of sub-Tenon's block mentioned that the incidence of chemosis with posterior metal cannula is 23% and increases to 100% with shorter cannula. Guise et al examined retrospectively, 6,000 patients who underwent sub-Tenon's block between the years 1995 and 2000. The only serious ocular complication reported was one large subconjunctival hemorrhage which was not sight threatening.<sup>43</sup>

## Conclusion

Administration of peribulbar anaesthesia is not free from pain, hence sub-Tenon's provides a better alternative in this aspect. Also, the intraoperative analgesia were comparable with both techniques. Akinesia obtained with sub-Tenon's anaesthesia was not a major problem which could be dealt with proper instructions to patients and use of fixation forceps. Moreover, the amount of anaesthetic agent needed for sub-Tenon's technique is significantly lesser than that of peribulbar anaesthesia, making it an appropriate choice especially in large hospitals and community based setups for being cost effective. The rise in IOP following administration of anaesthesia was less significant in the sub-Tenon's group. Also, the operating surgeon was equally comfortable while performing surgery, even the complications observed were mostly minor which did not interfere the surgery per se.

In this study we have observed that sub-Tenon's anaesthesia is equally effective, comfortable, relatively safer and with lesser learning curve, hence making it a better alternative to peribulbar anaesthesia for cataract surgery.

**Conflict of Interest:** None.

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**How to cite this article:** Jayashree MP, Anandi VK, Hiremath S, Dasar LV. A comparative study of sub-tenons anaesthesia versus peribulbar anaesthesia- In manual small incision cataract surgery. *Indian J Clin Exp Ophthalmol* 2019;5(2):246-51.