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Comparison of Subtenon Anaesthesia with Peribulbar Anaesthesia for Phacoemulcification Cataract Surgery

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ABSTRACT

Purpose: To compare the safety and efficacy of subtenon anaesthesia with peribulbar anaesthesia in phaco emulsification cataract surgery using a randomised control clinical trial. **Method:** One hundred patients were divided in two groups, 50 cases subtenon and 50 cases peribulbar with preset criteria after informed consent. All surgeries were performed by one surgeon in the period of one and a half years January 2015 till June 2016 at Giza memorial institute of Ophthalmology. Pain during administration of anaesthesia, during surgery and 4 h after surgery was graded on a visual analogue pain scale and compared for both the techniques. Sub-conjuntival haemorrhage, chemosis, akinesia after administration of anaesthesia and positive pressure during surgery were also compared. Patients were followed up for 6 weeks postoperatively. **Results:** About (86.9%) of patients completed the six-week follow-up. About (35.2%) patients of peribulbar group (77.5%) of subtenon group experienced no pain during administration of anaesthesia. There was no significant difference in pain during and 4 h after surgery. Subtenon group had slightly more sub-conjunctival haemorrhage. About (64.8%) patients of the peribulbar group had absolute akinesia during surgery as compared to none (0%) in sub-tenon group. There was no difference in intraoperative and postoperative complications and final visual acuity. **Conclusion:** Sub-tenon anaesthesia is safe and as effective as peribulbar anaesthesia and is more comfortable to the patient at the time of administration.

Key words: phacoemulsification cataract surgery; peribulbar anaesthesia; sub-tenon anaesthesia.

Introduction

Peribulbar anaesthesia for cataract surgery was the most popular technique in the previous decade, (Davis and Mandel, 1994) but it is not completely free from complications (Mount and Seward, 1993). Retrobulbar anaesthesia, which was used for almost a century, was associated with a number of potentially sight-threatening complications (Murdoch, 1990). Alternative anaesthesia procedures have been developed to reduce the risk of injuring intraorbital structures (Stevens, 1992 ;De La Marnieere *et al.,* 2002; Hansen *et al.,* 1990).

Advances in cataract surgery including the use of a smaller,self-sealing incision have shortened the duration of surgery (Gogate *et al.,* 2003) resulting in the use of shorter acting anaesthetic agents with less invasive methods of administration.

Sub-tenon anaesthesia (Stevens, 1992; Hansen *et al.,* 1990; Briggs *et al.,* 1997) involves transconjunctival infiltration of local anaesthetic agent directly to the subtenons space, after instillation of local anaesthetic drop in the conjunctiva which takes away the pain from, the needle prick. This technique has been used for and phacoemulsification and implantation of (PCIOL) (Briggs *et al.,* 1997 ; Davis *et al.,* 1998)

This study aimed to compare the two methods of subtenon anaesthesia with the more popular peribulbar anaesthesia for phacoemulsification with respect to pain, akinesia, intraocular pressure control, surgeon comfort and complications, using a randomised control clinical trial.

Materials and Methods

All the patients admitted for cataract surgery, were asked to participate in the trial. They agreed and informed consentwas done , and randomised to either subtenon or peribulbar technique.

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The exclusion criteria were:

1. Age < 30 or > 90 years,
2. Sensitivity to Xylocaine,
3. History of convulsion, epilepsy,
4. Inability to give informed consent,
5. Previous intraocular injury, inflammation or surgery,
6. Pupil <5 mm in diameter,
7. Inability to understand the visual analogue pain scale.

They were operated upon by one surgeon of reasonably good experience (minimal experience of 3 years) Assuming that there would be no pain by either technique (difference of proportions), Assuming loss of 20% to follow-up,. Permission was obtained from the ethical committee.

Both techniques of anaesthesia are acceptable standards of care and have been in use for more than a decade. The consent form and information sheets for all the patients were obtained from all the patients who participated.

The randomisation schedule for each patient was randomly assigned by opening an envelope on entering the recovery (preanaesthetic) room. The peribulbar anaesthesia was administered by the anaesthetist and the subtenon anaesthesia was given by the surgeon on table. Any extra anaesthetic needed was noted. The patients were masked till 10 min before surgery.

The patient was asked to gauge for the pain during administration of the anaesthetic, pain during surgery and after it was completed. Postoperative pain after 4 h was also recorded. After each surgery the surgeon was asked to score for akinesia and to grade for positive pressure during surgery, chemosis, subconjunctival haemorrhage and overall 'discomfort'. Intraoperative complications were noted. All patients underwent phacoemulsification; any change in technique, if needed, was noted.

The patients were followed on the first postoperative day, first week and sixth week after surgery. The postoperative complications were noted, as also the best corrected postoperative visual acuity and refraction.

Subtenon anaesthesia technique

The eye to be operated was painted with povidone iodine. After draping, a lid speculum was applied and two drops of topical 4% lignocaine were instilled. The patient was instructed to look upwards and outwards. Blunt Westcott's scissors were used to make a small nick on the conjunctiva and the tenons capsule in the inferonasal quadrant, 4 mm from limbus. The scissors were then skewed through the nick to create a path in the subtenons space. Conjunctival forceps were used to grip the conjunctiva and a curved subtenon cannula was then inserted on to bare sclera and glided along the contour of the globe. One ml of 2% lignocaine with 1:10 000 adrenaline was injected slowly in the posterior subtenon space.

Peribulbar anaesthesia technique

Four ml of 2% lignocaine with 1:10 000 adrenaline was injected using a 24G needle at junction of middle and outer third of the lower orbital margin with the needle directed towards floor of orbit. A supplementary injection of 1 ml. was given at the supra orbital notch with needle directed towards orbital roof. The eyelid was then closed and pressure was applied for 5 min.

Visual analog pain scale

The patients were asked to grade the pain they felt on a linear scale of 0–4 (No pain = grade 0, mild pain= grade 1, moderate pain =grade 2, severe pain = grade 3 and maximum pain imaginable = grade 4). Patients were asked to grade separately for pain during administration of anaesthesia, pain during surgery and pain 4 h after surgery. The last was taken when the patient was shifted to the wards.

The ophthalmologists also graded for chemosis, subconjunctival haemorrhage after administration of anaesthesia and positive pressure during surgery on a scale of 0–4, of increasing severity. 'Akinesia' was scored on a scale designed to measure ocular movements in each quadrant

(no movement = score 0, mild = 1, moderate = 2, severe = 3 in each quadrant, minimum score possible = 0, maximum score possible = 3 x 4 = 12).

The surgeon also graded for the 'discomfort' he felt during surgery (grade 0 = no discomfort, grade 1 = mild discomfort, grade 2 = moderate, grade 3 = severe, grade 4 = surgery not possible).

Results

About (86.9%) patients completed the six-week follow-up. 100 patients underwent phacoemulsification; between January 2015 and June 2016 and were operated upon by one Surgeon

Group 1 peribulbar (52%) were males, (48 %) are females,and group 2 subtenon (58. %) were males and (32 %) were females. Average age in the two groups was 52and 67 years,respectively. There was no statistically significant difference between the two groups with respect to age ($p = 0.133$) and sex. ($p = 0.213$).

The various grades of pains during anaesthesia are depicted in [Table 1]. Chi square test shows that there is a significant difference between both the groups with regards to pain on administration of the anaesthesia for grades 0 and 1 ($p < 0.0001$). $p = 0.09$ for grade 2, $p = 2$ for grade 3 by figure exact test, there being no statistically significant difference for grade 2 or more. The average for pain during anaesthesia was grade 0.82 for the peribulbar group and 0.26 for subtenon group on a range of 0–4.

Table 1 : Pain during anaesthesia

	Peribulbar : 95 % CL	Subtenon 95 % CL	Total
Grade 0 (no pain)	35 .2 %	77.5 %	55.3 %
Grade 1 (mild pain)	53.4 %	20 %	37.5 %
Grade 2 (moderate)	7.1 %	1.3 %	4.7 %
Grade 3 (severe)	2. 3 %	1.3 %	1.7 %
Grade4(max imaginable)	1.1 %	0 %	0.5 %
Total	100 %	100 %	100 %

CI = Confidence Interval

Table 2. shows the various grades of pain during surgery in both the groups. Average for pain during surgery was 0.15 for peribulbar and 0.07 for subtenon on a range 0–4.[Table 4] describes the various scores of ocular movement after anaesthesia. Eighty-five out of 88 (96.6%) of patients in peribulbar group had scores of 4 or less; 72/80 (90%) of patients of subtenon group scores of 6 or more, with the mode score of 10. The mode for peribulbar group was 0. This was statistically very significant ($p < 0.0001$). Average score for akinesia was 1.2 in peribulbar group and 8.4 in subtenon group on a range0–12.

Table 2: Pain during surgery

	Peribulbar: 95%	CI Subtenon: 95% CI	Total
Grade 0 (no pain)	(88.6%)	(91.3%)	(89.8%)
Grade 1 (mild pain)	(9.1%)	(8.8%)	(8.9%)
Grade 2 (moderate)	0	0	0
Grade 3 (severe)	(2.3 %)	0	(1.1%)
Grade 4 (max imaginable)	0	0	0
Total	(100 %)	(100 %)	(100 %)

About 50/50 (100%) patients of peribulbar group and 49/50 (98.8%) patients of subtenon group did not have any positive pressure during surgery. Only one patient of subtenon group had minimal pressure rise. Various grades of subconjunctival haemorrhage in both the groups is described in [Table 4] whereas [Table 5] describes various grades of conjunctival chemosis in both the groups.

Table 3: Ocular movement during surgery

Akinesia (score)	Peribulbar: 95% CI	Subtenon: 95% CI	Total
0	(64.7%)	(0%)	(33.9%)
2	(14.7%)	(0%)	(7.7%)
4	(17%)	(10%)	(13.6%)
6	(2.2%)	(8.7%)	(5.3%)
8	(1.1%)	(37.5%)	(18.4%)
10	(0%)	(41.2%)	(19.6%)
12	(0%)	(2.5%)	(1.1%)
Total	(100%)	(100%)	(100%)

CI = Confidence Interval

Table 4: Subconjunctival haemorrhage after administration of anaesthesia

Subconjunctival haemorrhage	Peribulbar	Subtenon	Total
Grade 0	33 %	31.9 %	64.9 %
Grade 1	9 %	14.3 %	23.3 %
Grade 2	7.4 %	3.8 %	11.2 %
Grade 3	0.6 %	0	0.6 %
Grade 4	0	0	0
Total	50 %	50 %	100 %

Table 5: Chemosis after administration of anaesthesia

Chemosis	Peribulbar	Subtenon	Total
Grade 0	30.2 %	15 .3 %	45.5 %
Grade 1	8 . 8 %	12 .8 %	21.6 %
Grade 2	5. 4 %	10 .6 %	16 %
Grade 3	4 .1 %	6.9 %	11 %
Grade 4	1.5 %	4.4 %	5.9 %
total	50 %	50 %	100 %

In (96.6%) surgeries under peribulbar anaesthesia and in (87.5%) surgeries under subtenon anaesthesia, the surgeons experienced no discomfort. In (12.5%) experienced some discomfort under peribulbar anaesthesia, there being an intra operative variation accounting.

All patients of the peribulbar group reported no pain for 4 h after surgery compared to only one patient in the subtenon group. There were two posterior capsular rents in the peribulbar group. One patient in the subtenon group had buttonholing during scleral tunnel creation. The incidence of postoperative complication in both arms was similar. There was no significant difference in both the groups with regards to uncorrected and corrected visual acuity after 6 weeks postoperatively. (93.3%) of patients in peribulbar group and (92.71 %) in subtenon group had postoperative corrected visual acuity >6/9. No patient had visual acuity less than 6/60.

One patient in the peribulbar group needed additional anaesthesia of 3 cm3 of 2% xylocaine. One phaco emulsification in subtenon group was converted to ECCE due to difficulty in delivering the nucleus.

Discussion

Subtenon anaesthesia was more comfortable for the patient at the time of anaesthetic administration. They also had good analgesia intraoperatively, but the surgeons had to operate with incomplete akinesia, which some may find discomforting. The incidence of subconjunctival haemorrhage was also slightly more as compared to the peribulbar group. The surgery was started immediately after administration of anaesthesia in subtenon group. As lesser amount of the

anaesthetic agent was used for subtenon, the chances of adverse effects are also minimised. In a large hospital or in a community eye care setting, the cost would also be less. There was no difference in chemosis, positive pressure rise during surgery and postoperative pain between both the techniques of anaesthesia. An audit of subtenon and peribulbar anesthesia for cataract surgery in UK demonstrated sub-Tenon's methods to be more effective than the peribulbar technique, with significantly fewer patients experiencing unacceptable levels of pain (Briggs *et al.,* 1997) It was significantly less uncomfortable on administration than the peribulbar methods and reduced the interval between administration of anaesthesia and surgery. On the range of 1– 10, pain on administration of anaesthetic had a mean of 2.4 for the peribulbar group and 1.4 for the subtenon group. This correlated with results of our study.

The subtenon technique appeared to be the safest method of introducing anaesthetic fluid into the retrobulbar space without the potential complication of a sharp needle injection (Loinder *et al.,* 1949) But a single case of globe perforation was reported 12 in a patient who had underwent detachment surgery and had thinned sclera.It is likely that subtenons anaesthesia offers a significantly reduced risk of complication such as scleral perforation, retrobulbar haemorrhage, optic nerve injury and injection of anaesthetic solution into the subarachnoid space, as no sharp instrument is passed into the orbit. It should, however, be used with caution in patients with compromised sclera.

A randomized study in Denmark comparing retrobulbar,subtenon and topical anaesthesia for phacoemulcification found retrobulbar techniques had less discomfort/pain during surgery but patient preferred subtenon or topical anaesthesia, as it did not involve the needle prick during anaesthesia (Davis *et al.,* 1998).

Subtenon anaesthesia has also been used for optic nerve sheath fenestration. Rizzuto *et al.*(1996) Subtenon anaesthesia has been found to be more comfortable for the patient, reliable, long lasting and with deeper anaesthesia as compared to topical anaesthesia for phacoemulcification patients. It was also more comfortable for the surgeon with better pupillary dilatation (Vielpeau *et al.,* 1999) A randomised trial in the UK. Manner and Burton, (1997) found the difference between the pain score in the subtenon and topical groups to be highly statistically significant, with subtenon being more pain free, for phacoemulcification patients. Limitations of the study include subjective nature of the visual analog pain scales and that the field testing or optic nerve damage analysis was not done. But past studies and postoperative visual acuity results indicate that it would not be significant.

Conclusion

The subtenon's technique for administration of anaesthesia during phacoemulsification; is as safe as the peribulbar technique giving equally good analgesia during and after the surgery. It is recommended as a safe and effective alternative to peribulbar anaesthesia for phacoemulsification

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