Randomized trial of superficial peribulbar compared with conventional peribulbar anesthesia for cataract extraction

Abdul Kader M Mahfouz[1, 2]
Hassan M Al Katheri[2]

[1]Faculty of Medicine, Alexandria University, Egypt; [2]Al Nahdha Hospital, Muscat, Sultanate of Oman.

Purpose: Evaluate efficacy of superficial peribulbar anesthesia for cataract extraction compared with conventional peribulbar anesthesia.

Setting: Department of Ophthalmology, Al Nahdha Hospital (Tertiary Ophthalmic and ENT Hospital) and Magraby Eye & Ear Center, Muscat, Sultanate of Oman.

Methods: Patients scheduled for cataract extraction with intraocular lens implantation were randomly divided into two groups according to anesthetic technique used. The first group patients were anesthetized using superficial peribulbar anesthesia, while second group patients were anesthetized using conventional peribulbar block. The efficacy of the blockade was judged by onset and degree of akinesia and volume of local anesthetic needed to obtain acceptable akinesia, sensation of pain during surgery, effect on intraocular pressure, degree of patient satisfaction, and incidence of complications.

Results: Nine hundred patients scheduled for cataract extraction with intraocular lens implantation during the period of June 2003 and October 2006 were included in this study. Five hundred cases were anesthetized using superficial peribulbar anesthesia and four hundred cases were anesthetized using conventional peribulbar block. The two groups were comparable as regards age, weight, gender, duration of surgery, and degree of analgesia. Superficial peribulbar anesthesia provided faster onset, higher degree of akinesia with less volume of local anesthetics used, no need for supplementary reinjection, no effect on intraocular pressure, and better patient satisfaction score compared with conventional peribulbar anesthesia. There were no serious complications in both groups. The incidence of subconjunctival hemorrhage was significantly higher in superficial peribulbar group (18%) compared with conventional peribulbar block (0.5%).

Conclusion: Superficial peribulbar anesthesia is a safe, simple, quick to perform, and effective method of anesthesia for cataract surgery with better patient satisfaction, better akinesia, and comparable analgesia compared with conventional peribulbar block. Subconjunctival hemorrhage is a self-limited complication associated with this technique.

Keywords: regional anesthesia, cataract surgery, peribulbar block.

Introduction

Regional anesthesia is commonly used for ophthalmic surgery. Cataract surgery requires a potent motor blockade of the eyeball and eyelids (Di Donato et al 2006). Retrobulbar and peribulbar anesthesia were the only techniques used for many years. Rare but serious complications were associated with blind needle insertion such as globe perforation, brainstem anesthesia, retrobulbar hemorrhage, optic nerve injury, postoperative strabismus, intravascular injection, etc (Gunja and Varshnev 2006). These complications are unfortunately inevitable when needles are placed into orbital cavity without an implicit understanding of orbital anatomy. Even in experienced hands, variations in orbital anatomy, especially the presence of a posterior staphyloma, may lead to inadvertent needle-related injury (Alwitry et al 2001).

Correspondence: Abdul-Kader M Mahfouz
Sultanate of Oman, Muscat, PO 937,
PC 112 Ruwi
Tel +96899360867
Fax +96824695036
Email abdulkaderm2000@hotmail.com

Although the use of topical anesthesia was associated with minimal risks, patients may complain of pain or discomfort during manipulation of iris and/or intolerance to microscope light (Makulolwa and Dharmarathna 2000). The use of topical anesthesia may not be preferred by some surgeons for cases of dense cataract with hard nucleus, sub-laxated lens, or in uncooperative patients who cannot self-fixate light during the procedure. Advanced age and language barriers make the cooperation of patients during topical anesthesia rather difficult.

The use of superficial peribulbar anesthesia may have the advantages of both regional and topical anesthesia while avoiding the complications of both techniques.

Aim

The aim of this work was to evaluate efficacy of superficial peribulbar anesthesia for cataract extraction compared with conventional peribulbar anesthesia.

Patients and methods

This work was carried out in Al Nahdha Hospital (Tertiary Ophthalmic Hospital) and Magraby Eye and Ear Hospital, Muscat, Sultanate of Oman between the period of June 2003 and October 2006. After approval from Al Nahdha Hospital ethical committee, a written informed consent was obtained from all patients included in the study. The patients were subjected to preoperative evaluation, which included history, physical examination, and relevant laboratory investigations. Exclusion criteria included: deafness, dysphasia, psychiatric disorders, dementia, dysfunction ocular motility, coagulation disorders, or allergy to any of the local anesthetic drugs used. Also, patients with previous ocular surgery in the same eye to be operated were excluded from the study. All patients fasted for 8 hours before surgery.

After oral premedication with midazolam (3.75–7.5 mg) 45 minutes before expected time of surgery, intravenous cannula was inserted. In the operating theater, monitoring was done using electrocardiogram, noninvasive arterial blood pressure and pulse oximetry. Intravenous infusion of Ringer's lactate was started in a dose of 6 $ml.kg^{-1}.hr^{-1}$. All the patients received continuous nasal oxygen at a rate of 4 L/min.

Technique of superficial peribulbar anesthesia

A 25-gauge half-inch needle connected to a syringe containing an equal mixture of 2% lignocaine and 0.5% bupivacaine and 30 IU/ml hyaluronidase was used to perform the block. After instillation of one or two drops of benoxinate hydrochloride (Novesin 0.4%), the surgeon separated the two eyelids by left hand and asked patients to look upwards. Then he directed the needle under vision under the conjunctiva about 5 mm from the limbus inferiorly towards inferior wall of the orbit. If the periosteum was touched, the needle was withdrawn 1–2 mm and injection started slowly till the local anesthetic solution (range between 7–10 ml) spread all around the perilimbus. No ocular compression but gentle message was applied for 2 min to allow distribution of local anesthetic injected to the peribulbar space.

Technique of conventional peribulbar anesthesia used

Skin infiltration with 0.5 ml lidocaine with half-inch 25-gauge needle at the junction of medial two thirds and lateral one third of lower eyelid was done. Then one inch 25-gauge short bevel needle was inserted at the same site in a strictly posterior direction. Depth of insertion of needle was limited to 25 mm. The local anesthetic solution (an equal mixture of 2% lignocaine and 0.5% bupivacaine and 30 IU/ml hyaluronidase) was injected after an aspiration test. The injected volume was not predetermined, but adjusted to each patient. The injection continued until proptosis and lid fullness appeared with sensation of full orbit. Compression was applied for 15 to 20 minutes using Honan's balloon set at 40 mmHg to lower intraocular pressure. If after 15 min, the degree of akinesia was not accepted, a second injection with the same anesthetic mixture was given in a similar way.

Randomization was done using random allocation software (Dr. Saghaei, Isfahan University of Medical Sciences, Iran). Superficial peribulbar anesthesia was done by the same surgeon in all cases, while conventional peribulbar block was done by the same anesthesiologist in all cases.

Measurements

Masked observers, unaware of the anesthetic technique used, have taken the following measures.

1. Testing ocular motility in all direction and testing orbicularis oculi muscle, which determined onset of akinesia. Globe and eyelids akinesia was scored from 0–3, where: 0 = no block, 1= partial akinesia not sufficient to perform surgery, 2 = partial akinesia sufficient to perform surgery, and 3 = total akinesia.
2. Assessment of pain during surgical procedure using 4 point scale where 1 = no pain, 2 = mild pain, 3 = moderate pain, and 4 = severe pain. Management of break-through

pain was as follows: fentanyl 10 μg increments to a maximum dose of 0.5 μg/kg and propofol 10 mg increments (maximum dose 0.5 mg/kg).

3. Time to onset of blockade (time elapsed from the end of injection to the time when best akinesia was reached).
4. Duration of surgical procedure (the time the eye was draped to the time the drape was removed).
5. Intraocular pressure measured by Schiotz tonometer (Gulden Ophthalmic, New York, USA) after one and 10 minutes after performance of block compared with preoperative value.
6. Total volume of local anesthetic solution used.
7. Recording of complications.
8. The patient was asked after two hours from the end of surgery to complete a Likert 5-point satisfaction scale (Fitzpatrick et al 2004) (with 1 representing the least and 5 the highest degree of satisfaction). For statistical purposes, a degree from 3 to 5 was considered "satisfied" and degrees from 1 to 2 "dissatisfied".

Statistical analysis

Parametric data were expressed as mean ± standard deviation, while categorical variables were presented as number (%). The data were analyzed using analysis of variance single factor, Student's t test, Chi square analysis, and Fisher exact test. $P < 0.05$ was considered statistically significant.

Results

A total of 900 patients scheduled for cataract extraction with intraocular lens implantation during the period of June 2003 and October 2006 was included in this study. Five hundred cases were anesthetized using superficial peribulbar anesthesia and four hundred cases were anesthetized using conventional peribulbar anesthesia. The two groups were comparable as regards age, weight, gender, and duration of surgery. The onset of akinesia was significantly faster in superficial peribulbar group $P < 0.001$ (Table 1). The total volume of local anesthetic used to perform adequate block was significantly higher in conventional peribulbar block $P = 0.0241$ (Table 1). The percentage of patients with total akinesia after first injection was significantly higher in superficial peribulbar group (66%) compared with conventional peribulbar group (45%) (Figure 1). There were no serious complications in the two groups as regards global perforation, retrobulbar hemorrhage or severe pain, which necessitated conversion to general anesthesia. However, the percentage of patients in conventional peribulbar group (18.75%) who required supplementary reinjection of local anesthetic to achieve acceptable akinesia was higher ($P < 0.001$) and this was the main cause of dissatisfaction in this group (Table 2; Figure 2). No patient in the superficial peribulbar group required supplementary reinjection, but the cause of dissatisfaction in the superficial peribulbar group was that patients would like to undergo the surgery under general anesthesia to be unaware but this was not related to type of block (Figure 2). There was no significant difference as regards changes in intraocular pressure in superficial peribulbar group at any time of measurement. However, there was significant transient increase in intraocular pressure in the conventional peribulbar group after one minute from block which returned to near preoperative value after 10 minutes (Table 2). There was an insignificant difference between both groups with regard to pain assessment as a high percentage of patients had no pain during procedure (Figure 3). The incidence of subconjunctival hemorrhage was significantly higher in the superficial peribulbar anesthesia group (18%) compared with the conventional peribulbar block (0.5%; $P < 0.001$) (Table 2).

Discussion

This study demonstrated that superficial peribulbar anesthesia for cataract surgery provided a more constantly effective block than conventional peribulbar anesthesia, with shorter time to onset of blockade, better akinesia, and no need for supplemental injection. No serious complications occurred with better patient satisfaction compared with conventional peribulbar block.

The rapid onset of block in superficial peribulbar anesthesia could be explained by diffusion of local anesthetic with the help of hyaluronidase to sub-Tenon's space where the extraocular muscles, sensory and motor nerves of the eye are located. The circumferential distribution of local anesthetic around the limbus helped in homogenous diffusion of local anesthetics to this space and this explains the better akinesia in this group. Wong and colleagues (1991) stated that after peribulbar block, local anesthetic must spread from the extraconal space into intraconal space. Because the corpus adiposum of the orbit is separated into multiple compartments by a small network of septa, this spread of local anesthetics is sometimes heterogeneous and incomplete. This irregular spreading accounted for imperfect blockade (even with experienced hands) in up to 50% of cases in some series or for the need for multiple injections or very high volumes to obtain effective block (Ripart et al 1998, 2000). In this

Table 1 Demographic and operative data

	Superficial peribulbar anesthesia N = 500	Conventional peribulbar anesthesia N = 400	P value
Age (years)	63.95 ± 4.957	61.75 ± 7.29	0.1835
Weight (Kg)	63.8 ± 11.790	67 ± 12.439	0.2045
Gender (male/female)	165/335	182/218	0.2314
Type of surgery			
ECCE	465	319	
Phacoemulsification	35	81	
Onset of akinesia (min)	7.05 ± 3.509*	10.6 ± 3.265	<0.001
Total volume of local anesthetic used (ml)	7.38 ± 1.385*	9.642 ± 1.812	0.0241
Duration of surgery (min)	41.75 ± 10.005	39.75 ± 7.643	0.1466

Note: *Means significant.
Abbreviations: ECCE, extracapsular cataract extraction.

study, the percentage of patients in conventional peribulbar block who needed supplementary reinjection was 18.75%. This need of reinjection despite the skills of the experienced anesthesiologist who performed these blocks could be explained by presence of these septa, which interfere with homogenous spread of local anesthetic resulting in partial or no akinesia.

Subconjunctival hemorrhage was the main side effect of superficial peribulbar anesthesia, which subsided within 3 days to one week after surgery. However, the incidence of subconjunctival hemorrhage, which amounted to 18% in this study, was less compared with other studies using subconjunctival anesthesia in cataract extraction. Wasee and colleagues (2006) reported subconjunctival hemorrhage in 23% of the patients, while Stan and colleagues (1997) reported subconjunctival hemorrhage in 56% of cases. The low incidence of subconjunctival hemorrhage in this study could be explained by selection of site of entry of needle under conjunctiva to be free from apparent vessels with slow rate of injection. In addition, authors observed that the cases that had subconjunctival hemorrhage after the block had relatively more vascularized conjunctiva.

One of the advantages of the superficial peribulbar anesthesia was absence of significant change in intraocular pressure. The transient increase in intraocular pressure after one minute from performing the conventional peribulbar block was due to injection of local anesthetics in a limited space and returned back to near normal value after 10 minutes by effect of ocular compression using Honan's balloon.

Patient satisfaction was higher in superficial peribulbar anesthesia. Patient dissatisfaction in this group (4%) was due to the fact that patients would prefer to undergo surgery

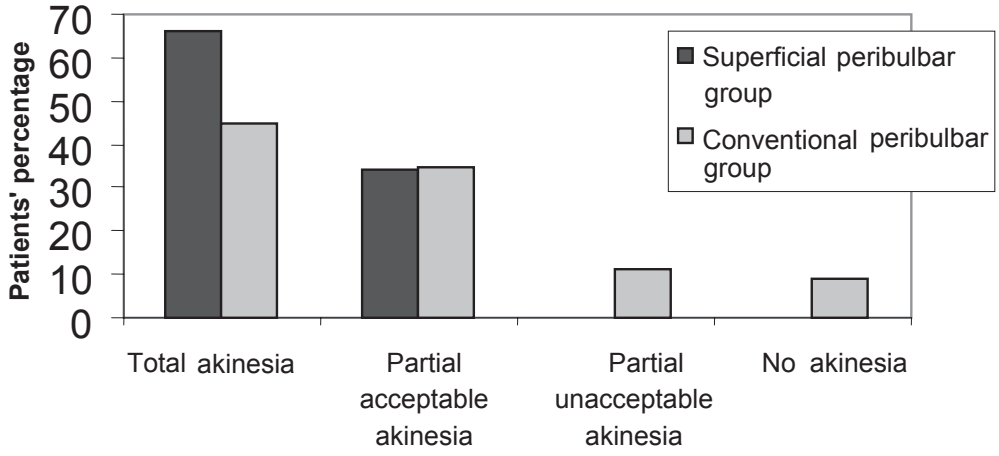

Figure 1 Comparison of best akinesia between both groups after first injection.

Table 2 Recorded complications (number of patients and percentage)

	Superficial peribulbar anesthesia N = 500	Conventional peribulbar anesthesia N = 400	P value
Eye perforation	0 (0%)	0 (0%)	1
Peribulbar or subconjunctival hemorrhage	90 (18%)*	2 (0.5%)	<0.001
Severe pain shifting to general anesthesia	0 (0%)	0 (0%)	1
Patients required supplementation of local anesthetics	0 (0%)	75 (18.75%)*	<0.001
Intraocular pressure (mmHg)			
Preoperative	14.5 ± 1.265	15.1 ± 2.315	
After 1 min from anesthesia	14.2 ± 2.013	19.35 ± 3.745*	0.0123
After 10 min from anesthesia	14.5 ± 3.127	14.1 ± 4.723	
Cases cancelled because of hemorrhage or increased IOP	0 (0%)	0 (0%)	1

Note: *Means significant.
Abbreviations: IOP, intraocular pressure.

under general anesthesia to be unaware during surgery. The dissatisfaction was not due to a defect in the technique but due to patient apprehension, which could be avoided by spending more time with the patient preoperatively to explain the procedure to him, in addition to better use of anxiolytic drugs prior to surgery. The percentage of dissatisfaction was higher in conventional peribulbar group (15%). Dissatisfaction was mainly due to repeated injections and needle pricks.

Previous studies (Wong et al 1991; Stan et al 1997; Wood et al 1999; Makuloluwa and Dharmarathna 2000; Ripart et al 1998, 2000; Wasee et al 2006) failed to have total akinesia with subconjunctival anesthesia. The total or partially acceptable akinesia achieved with superficial peribulbar anesthesia in the present work could be attributed to the large volume of local anesthetic used compared with these studies.

Conclusion

Superficial peribulbar anesthesia is a safe, simple, quick to perform, and effective method of anesthesia for cataract surgery with better patient satisfaction, better akinesia, and comparable analgesia compared with conventional peribulbar

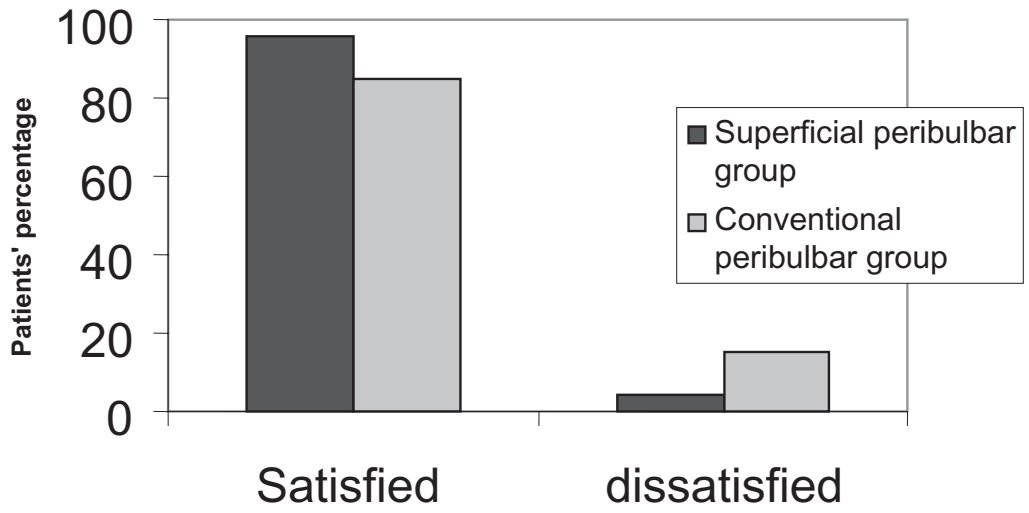

Figure 2 Patient satisfaction.

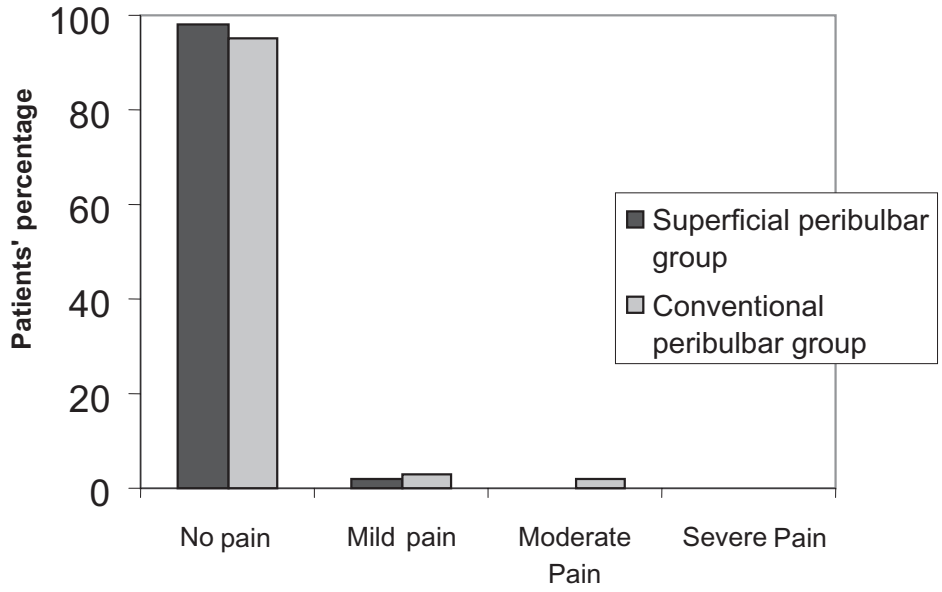

Figure 3 Pain assessment during surgery.

block. Subconjunctival hemorrhage is a self-limited complication associated with this technique.

Disclosure

This work was carried out in Al Nahdha Hospital and Magraby Eye & Ear Center, Muscat, Sultanate of Oman. This work was sponsored by Al Nahdha Hospital, Muscat, Sultanate of Oman. The authors have no financial interests in the drugs or equipment used in this study.

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