Comparison of Anesthesia Techniques in Patients Undergoing Cataract Surgery

Katarakt Ameliyatında Lokal Anestezi Tekniklerinin Karşılaştırılması

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ABSTARCT

Purpose: The aim of this study is to compare the topical, retrobulbar and subtenon anesthesia techniques in patients undergoing phacoemulsification surgery.

Materials and Methods: In this study, one hundred and thirty eyes of 130 (63 Female, 67 Male) cataract patients were divided into topical anesthesia, retrobulbar anesthesia and subtenon anesthesia group. Ocular complications due to the anesthesia technique, the degree of limitation of perioperative ocular movements and postoperative pain using a visual analogue pain scale.

Results: In the topical anesthesia group 2 patients continued to have capsulorexis problem and 1 patient had vitreous loss due to posterior capsule rent. In the retrobulbar anesthesia group, retrobulbar hemorrhage was observed in 1 patient, and palpebral subcutaneous hemorrhage in 8 patients. In the subtenon anesthesia group, subconjunctival hemorrhage was observed in 28 patients and chemosis in 3 patients. The ocular movement limitation scores in the topical anesthesia, retrobulbar anesthesia and subtenon anesthesia groups were 8.00±0.00, 3.18±1.32 and 4.88±1.26 respectively. This results were found to be statistically significant. When pain scores of the goups were compared, a statistically significant low score was found at the end of the surgery in the subtenon anesthesia group and at the 4th hour in the retrobulbar anesthesia group; no significant differences were found among groups at the 2nd and 24th hours.

Conclusion: This study shows that subtenon anesthesia is a good alternative to retrobulbar and topical anesthesia in patients undergoing phacoemulsification surgery; by providing fewer ocular complications.

Key Words: Phacoemulsification surgery, topical anesthesia, retrobulbar anesthesia, subtenon anesthesia.

ÖZ

Amaç: Çalışmanın amacı fakoemulsifikasyon geçiren hastalarda topikal, retrobulber ve subtenon anestezi tekniklerinin karşılaştırılmasıdır.

Gereç ve Yöntem: Bu çalışmada 63 kadın, 67 erkek olmak üzere 130 katarakt hastası topikal, retrobulber ve subtenon anestezi yöntemi uygulanmak üzere 3 gruplara ayrıldı ve katarakt cerrahisi uygulandı. Anestezi tekniğinden dolayı gelişen okuler komplikasyonlar, perioperatif okuler hareketlerde azalma ve postoperatif Vizüel Analog Skala (VAS) kullanılarak ağrı skorlaması yapıldı.

Bulgular: Topikal anestezi grubundan 2 hastada kapsuloreksis problemi gelişti ve bir hastada posterior kapsüler problemlerden dolayı vitreus kaybı görüldü. Retrobulber anestezi grubundan 1 hastada retrobulber hemoraji gelişti ve 8 hastada palpebral subkutanöz hemoraji görüldü. Subtenon anestezi grubundan 28 hastada subkonjonktival hemoraji ve 3 hastada kemozis izlelendi. Okuler hareket kısıtlam skoru sonuçları ise; the topical anestesi grubunda:8.00±0.00, retrobulbar anestesi grubunda:3.18±1.32 ve subtenon anestezi grubunda:4.88±1.26 idi. Gruplar arasında istatistiksel olarak anlamı fark saptandı. Gruplar ağrı skoru yönünden kıyaslandığında: subtenon anestezi uygulanan grupta hemen cerrahi sonunda ve retrobulber anestezi uygulanan grupta 4.saatte anlamlı derece düşük skorlar elde edilirken 2. ve 24. Saatlerdeki ağrı skorlarında gruplar arasında anlamlı fark saptanmadı.

Sonuç: Bu çalışma gösteriyor ki subtenon anestezi uygulanması düşük okular komplikasyonlara neden olmasından ötürü ve cerrahi aşamasında yeterli anestezi sağlamasından dolayı fakoemulsifikasyon cerrahisinde retrobulber ve topikal anesteziye göre iyi bir alternatiftir.

Anahtar Kelimeler: Fakoemülsifikasyon cerrahisi, topikal anestezi, retrobulber anestezi, subtenon anestezi.

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INTRODUCTION

Cataract surgery is the most performed surgery in ophthalmology and its incidence increases with age.[1-2] Modern cataract surgery may be performed under intracameral or topical anesthesia (TA) using the phacoemulsification technique, which leads to a high success and a low complication rate. In routine cataract cases, the surgery is very short but this anesthesia technique does not provide akinesia and appropriate analgesia.[2-3] It has been suggested that perioperative ocular akinesia makes the surgical manipulations safer and easier to perform; the postoperative analgesia provides peri/postoperative patient comfort. Some pathologies such as glaucoma, corneal disease, hard cataract, and zonular weakness with pseudo-exfoliation are frequently seen in the older population.[2] These pathologies may increase perioperative and postoperative surgical complications and prolong the length of surgery.[4-5] Moreover, the older population is more prone to surgical complications because of other conditions such as hearing loss, posture problems, tremor, dementia and other systemic conditions making the surgery more challenging.[2] In the literature many serious complications of retrobulber anesthesia (RA), among them, globe perforation, peri/retro-bulbar hematoma, and central nervous system involvement, have been reported.[6] Because of these complications Subtenon anesthesia (SA) and TA may be a valuable alternative to RA with less serious complication rates, but comparative studies are lacking. To our knowledge, this is the first study in which these anesthesia techniques were compared with each other. The aim of this study was to compare the ocular complications of TA, RA and SA techniques as well as their effectiveness on peroperative ocular akinesia and postoperative analgesia in patients undergoing phacoemulsification surgery. Visual Analogue Pain Scale(VAS) scores were compared between male and female patients in the groups separately.

MATERIALS AND METHODS

In this study, 130 eyes of 130 healthy patients with unilateral cataract who underwent phacoemulsification surgery by the same surgeon (ME) at the Kafkas University Eye Clinic between 2011 and 2012 were included. The experimental protocol and informed consent procedure complied ithe the Helsinki Convention; approval for the research was obtained from the Research Ethics Committee of Kafkas University.

The patients were divided into three groups, TAG, RAG and SAG; patients received either TA, RA or SA, according to their random assignment to the TAG, RAG or SAG group. In each group, ocular complications due to the anesthesia technique were noted. The degree of limitation of ocular movements (akinesia) was compared among the three groups and scored.

The amount of postoperative pain was also scored using the visual analogue pain scale (VAS) at the end of the surgery (it is wanted to evaluate the time from beginning and finishing of surgery), postoperative 2nd, 4th and 24th hours. There were 63 female (48.5%) and, 67 male patients (51.5%). In the TAG, there were 18 female and 32 male patients with a mean age of 63.84±7.34 (48-82). In the RAG, there were 26 female and 14 male patients with a mean age of 76.53±6.00 (65-92). In the SAG, there were 19 female and 21 male patients with mean age of 77.62±6.54 (70-91), (Table 1). Patients suffering from acute, chronic or neurotonic neuralgia, blood dyscrasia, those using analgesics or anticoagulants were excluded from this study.

Topical Anesthesia Procedure: Proparacain 0.5% (Alcaine®, Alcon, USA) was used for topical anaesthesia. One drop was instilled in the anaesthetic bay 10 min before surgery with a second drop instilled immediately prior to the commencement of surgery. A final drop was instilled at the completion of the procedure prior to the use of betadine-iodine wash. Intracameral anaesthetic was not used.

Retrobulbar Anesthesia Procedure: A topical anesthesia with 0.5% Proparacain (Alcaine®, Alcon, USA). and periocular skin aseptia with povidon iodide 10% were applied in both groups before the local anesthesia procedures were performed. The RA was performed when the eye was in primary position using an Atkinson's needle (25 gauge 38 mm length).

The needle was introduced from the 1/3 inferotemporal part of the orbit and advanced parallel to the lateral orbital wall until the middle of the needle reached the equator of the globe oculi (the projection of iris plane) where its direction was changed inwards and upwards and 2ml Lidocain HCl 20mg/ml (Jetokain®,Adeka, Turkey) +2 ml Bupivacain HCl 0.5% (Marcaine®, Astra-Zeneca, Turkey) combination was injected slowly for 30 seconds in the intraconal space after an initial aspiration in order to check for a potential vascular trauma.[7]

Table 1: *Patients' demographic characteristics: Topical, retrobulbar and subtenon groups.*

	TAG(n=50)	RAG (n=40)	SAG (n=40)	Total (n=130)
S ex distribution (F/M ratio)	18/32 36%/64%	26/14 65%/35%	19/21 47.5%/52.5%	63/67 48.5%/51.5%
Age distribution (mean ±SD)	63.84±7.34	76.53±6.00	77.62±6.54	

Table 2: Ocular akinesia scoring.

Scoring	
0	immobile eye
1	partially mobile eye
2	normal ocular motility

Subtenon Anesthesia Procedure: When the eye was in primary position, under the operative microscope, an inferonasal conjunctiva and underlying Tenon's capsula was grasped with atraumatic forceps and an incision was made using Westcott scissors down to the sclera. A specifically designed curved SA canula (Visitec-5176) was introduced into the subtenon space and 2ml Lidocain HCl 20mg/ml (Jetokain®, Adeka, Turkey) was injected slowly for 30 seconds.[8]

Ocular Motility Evaluation: The evaluation of the ocular motility limitation was made by an ophthalmologist other than the surgeon 10 minutes after the local anesthesia procedures using ocular akinesia scoring as described by Frow.[9] Eye movements were scored in 4 quadrants from 0 to 2 (0=immobile eye; 1=partially mobile eye and 2=normal ocular motility) and these scores were collected (Table 2).

Analgesia Evaluation: The effectiveness of the analgesia obtained by TA, RA or SA was evaluated at the end of surgery and at the 2nd,4th and 24th hours postoperatively using the VAS scale. Additionally VAS scores were compared between male and female patients in all groups separately.

Statistical Evaluation: To compare the differences between the independent groups t test and analysis of variance were used. To detect the source of any difference between the groups; LSD (Least Significant Difference) analysis preformed for homogen variances and Dunnett C analysis for nonhomogen variances. Probability (p) values under 0.05 were considered statistically significant. Calculations were performed using the Statistical Package for the Social Sciences (SPSS) version 18.0 system for personal computers (SPSS, Chicago, IL, USA).

Table 3: Preoperative akinesia scores.

Groups	Akinesia score (mean±SD)	Statistical results
TAG	8.00±0.00	F=265.404 p=0.00
RAG	3.18±1.32	
SAG	4.88±1.26	

RESULTS

The complications observed were a continuing capsulorexis problem in 2 patients and vitreous loss due to posterior capsule rent in 1 patient in the TAG, retrobulbar hemorrhage in 1 patient, and palpebral subcutaneous hematoma in 8 patients in the RAG. Subconjunctival hemorrhage at the incision site in 28 patients that disappeared in 10 days and, chemosis in 3 patients in the SAG. None of these complications interfered with the course of the surgery.

The ocular akinesia scores were 8.00±0.00, 3.18±1.32 and 4.88±1.26 in the TAG, RAG and SAG respectively. A statistically significant difference was found among the groups. The akinesia was the most effective in the RAG, and the akinesia was more effective in the SAG than the TAG (Table 3), (t= -5.886, p=0.00).

VAS scores for the TAG, were 3.220±1.34 at the end of surgery, 2.340±1.70 at the 2nd hour, 2.380±1.41 at the 4th hour and 1.320±1.62 at the 24th hour postoperatively. VAS scores for the RAG were 2.950±1.36 at the end of surgery, 1.850±1.89 at the 2nd hour, 1.200±1.09 at the 4th hour and 1.250±1.79 at the 24th hour postoperatively.

For the SAG, VAS scores were 2.000±1.20 at the end of surgery, 2.00±1.63 at the 2nd hour, 2.350±1.56 at the 4th hour and 1.250±1.48 at the 24th hour postoperatively. When VAS scores were compared among TAG, RAG and SAG, very low and statistically significant scores were identified at the end of surgery in the SAG and at the 4th hour postoperatively in the RAG. At the 2nd and 24th postoperative hours there were no statistically significant differences between the RAG and SAG (Table 4).

Table 4: Postoperative VAS scores.

Group	At the end of surgery	2nd hour	4th hour	24th hour
TAG	3.220±1.34	2.340±1.70	2.380±1.41	1.320±1.62
RAG	2.950±1.36	1.850±1.89	1.200±1.09	1.250±1.79
SAG	2.000±1.20	2.000±1.63	2.350±1.56	1.250±1.48
p	F=10.304 P=0.00	F=0.950 P=0.389	F=10.008 P=0.000	F=0.028 P=0.972

p values <0.05 were considered statistically significant.

VAS scores were compared between male and female patients in the TAG, RAG and in SAG separately. No statistically significant differences were found between female and male patients at any time for any group.

DISCUSSION

The success of the local anesthesia technique in ophthalmic surgery is determined not only by the absence of ocular complications related to the technique itself but also by the presence of a good ocular akinesia during surgery and a lasting postoperative analgesia.

In this study, we compared the ocular complications of TA, RA and SA, considered to be the gold standard among local anesthesia techniques in ocular surgery. We evaluated their complicatons, effectiveness on perioperative ocular akinesia and on the quality of postoperative analgesia. It was suggested that perioperative ocular akinesia makes the surgical manipulations safer and easier to perform; the postoperative analgesia provides peri/postoperative patient comfort.

RA and SA are obviously more invasive when compared with topical or intra cameral anesthesia methods. They might be preferred in some pathologies frequently seen in geriatric patients such as pseudo exfoliation with zonular weakness, glaucoma and hard cataract making the surgery more challenging and leading to the prolongation of surgical time and causing a high rate of surgical complications.

When the ocular complications of TA were investigated; the only study declaretes that TA has advantages in terms of surgical complication rate one by Jacobi et al. This study reported only one significant difference between TA and RA, namely, a surprising decrease in vitreous issue rate in the TA group (0.4% vs 2.5%).[10] At the same time, Jacobi et al.,[10] observed a nonsignificant increase in iris prolapse (1.7% vs 0.4%), possibly reflecting eye hypertonia due to the lack of akinesia in the TA group. Shaw et al.,[11] observed an acceptably low rate of surgical complications of cataract surgery performed under TA. By contrast, a more recent meta-analysis has shown that, when compared with SA, TA is associated with a 2-fold increase in posterior capsule rupture requiring anterior vitrectomy.[12] Similarly, TA was identified as a risk factor for displacement of nuclear fragments into the vitreous.[13]

In our study we observed continued capsulorexis problem in 2 patients and vitreous loss due to posterior capsule rent complications in 1 patient.There were no pathology as pseudoexfoliaton in the patients and the complications were depending on inedaquate akinesia. Many ocular and extra ocular complications related to RA and SA techniques have been widely reported in the literature.

The reported ocular complications of RA were globe perforation, retinal vascular occlusion, retrobulbar hemorrhage, and optic nerve damage. The extra ocular and systemic complications occur when the anesthetics pass through the subarachnoid space causing brain stem cells lesions.[14] It has been reported that SA induces fewer complications.

This anesthesia technique is performed using a specific subtenon canula which leads to 2.5 times fewer complications than anesthesia techniques performed using a needle.[15] Gauba recommended the cauterization of the incision site before the injection in order to prevent subconjunctival hemorrhage which may interfere with surgical manipulations by disturbing the surgeon's visibility of the operation field.[16]

In our study, in accordance with the literature we observed more complications in RG than in SG. In RG, we observed a retrobulbar hemorrhage in 1 patient, and palpebral hematoma in 8 patients, while in SG we observed a subconjunctival hemorrhage in 28 patients and, chemosis in 3 patients. The course of our surgical interventions was not prevented by these complications. The relative safety of SA may be easily explained: the short and blunt tipped subtenon canula used for SA is much less traumatic when compared with a retrobulbar needle that is 35 mm in length, 25 gauge and with a perforating tip. Serious complications related to SA such as globe perforation, orbital/retrobulbar hemorrhage, retinal ischemic damage, optic nerve lesion, and extra ocular complications such as brain stem anesthesia that are rarely reported in the literature were not observed in our study groups.[6]

It has been stated that if the anesthesic solution is injected inside the muscular cone 2.5 ml should be sufficient for a good level of extraocular muscle akinesia.[17] Buttanri stressed the importance of ocular akinesia and stated that RA provides a very efficient akinesia during the surgery.[7] In challenging cases a good akinesia may avoid surgical complications. If the surgery is performed without obtaining a good akinesia only an experienced and skillful surgeon may prevent such complications.[7] On the other hand Pandey et al.,[18] claimed that the induction of ocular akinesia before cataract surgery is not so important because the phaco probe may be used to stabilize the eye during the surgery. In SA, it was suggested that a volume of 2 to 5 ml of anesthetic solution should be enough to obtain a good analgesia but a larger volume up to 11 ml extending to the extraocular muscles facia is needed for a good akinesia.[19] Ghali et al scored the degree of akinesia of their patients who underwent SA and declared that in 56% of cases the akinesia was successful (total score <3 was considered to be successful.[20]

Two ml of 2% lidocain were enough to provide suitable akinesia in SG patients but, in RG patients akinesia was statistically more significant than in TA and SG patients. These findings were in accord with the literature.

Analgesia may be incomplete in TA. In Boezaart's[21] study patients randomly subjected to RA or TA for one eye and the other technique for the other eye preferred RA (71% vs 10%). In the literature ıntraoperative comfort is more consistently reported with RA or SA.[21-24] A transitory burning sensation and pain in the subcutaneous palpebral area during RB injection was reported by RG patients.[25] Gombos studied the effectiveness of RA and reported that the analgesia was sustained until the end of the surgery in all of the patients except 2.[23]

The distension of the subtenon tissues during the SA injection may be painful. Slow injection of a little volume (2 ml) of anesthetic is helpful in decreasing the pain during the injection[25]. Rüschen obtained a successful analgesia in 96% of his patients with SA.[26] Allen scored the pain of his patients during SA and found a score of 5-7 (pain level: medium) in 23% of them, and a score of 8-10 (pain level: high) in 7% of them.[25] Nielsen et al.,[27] studied the pain of their patients during surgery and reported that 16% of them would not like to experience SA again while 40% of them would not like to experience RA.

It was reported that SA induced a good level of analgesia when complemented with postoperative antalgics.[28] In this study the pain scores were significantly lower at the end of surgery for SG patients and at the 4th postoperative hour for RG patients; no difference was found between groups at the postoperative 2nd and 24th hours.

High scores for RG at the end of surgery may be explained by the Gambos study; he asked his patients to score their pain and suggested that the reason for the patients' high scoring might be their reminiscence of pain during the injection of anesthetics.[23] In our study the reason for the high pain scores for SG at the 4th hour postoperatively may be explained by the short duration action of lidocaine (maximum 60 minutes), while for RA in addition to lidocaine there was a mixture of Bupivacaine, whose effectiveness lasts for 12 hours.[29]

It has been suggested that female patients are more sensitive to pain or that their pain tolerance is lower.[30] Gupta's study found that the pain sensation was higher in female patients operated on by phacoemulsification but this difference was not statistically significant.[31] In our study, VAS scores were compared between male and female patients in the TAG, RAG and SAG separately; none of the groups showed a significant difference between female and male patients at any time.

Poorly dilating pupils frequently encountered in older patients make the surgery more challenging. As reported by Vielpeau et al.,[32] because of the beneficial effect of SA on pupillary dilatation it may be preferred in this group of patients. Further the important advantage of TA that must be mentioned is, because TA does not require deep insertion of a sharp needle, this technique is very important for patients receiving anticoagulant or antiplatelet therapy,[33] and visual rehabilitation in the postoperative period is faster whereas the optic nerve and extraocular muscles may still be partially blocked by local anaesthetics in patients who have undergone' cataract surgery with other techniques. In the patients who have previously undergone ocular surgery, such as retinal detachment surgery including scleral buckling procedures scar formation in the orbit may limit the diffusion of peribulbar anaesthetics.[34]

Our study had some limitations: VAS scores were subjectivily determined by the patients themselves and our series involved a small number of patients in each group. To confirm our findings objective studies must be performed on bilateral cataract patients so that TA, RB and SA can be compared using the 3 parameters i.e. ocular/extraocular complications, and their effects on perioperative ocular akinesia and postoperative analgesia.

CONCLUSIONS

This study shows that in cataract patients who underwent phacoemulsification surgery, RA caused more serious complications than TA and SA, and, provided less ocular akinesia score and a better analgesia at the 4th hour postoperatively while SA induced fewer complications and, a better analgesia at the end of surgery. These findings suggest that SA is a good alternative to TA and RA when complications, akinesia and analgesia values are all considered.

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