DOI: 10.4274/tjo.42.26056

Original Article / *Özgün Araştırma*

Impact of Phacoemulsification Surgery on Intraocular Pressure in Primary Angle-Closure Glaucoma

Primer Açı Kapanması Glokomunda Fakoemülsifikasyon Cerrahisinin İntraoküler Basınç Üzerine Etkisi

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Summary

Purpose: To investigate whether primary phacoemulsification in acute primary angle closure glaucoma (APACG) and chronic primary angle closure glaucoma (CPACG) will lower intraocular pressure (IOP) or not.

Material and Method: This retrospective, non-comparative, consecutive, interventional case series includes 22 eyes of 20 patients with APACG and 31 eyes of 23 patients with CPACG. All eyes had undergone phacoemulsification surgery without any reference to the presence of cataract. Data about IOP, number of antiglaucoma medications and best corrected visual acuity (BCVA) were collected.

Results: In APACG mean IOP (95% CI), number of antiglaucoma medications and Snellen visual acuity changed at last preoperative evaluation from 30.9±15.6 mmHg (23.0-38.0), 2.6±1.4 boxes and 0.4±0.2 lines to 15.5±3.9 mm Hg (p<0.000, 13.8-17.0), 0.6±0.9 boxes (p<0.000) and 0.6±0.3 lines (p=0.001) at last follow-up. Same parameters in CPACG changed from 18.0±7.8 mmHg (15.1-20.8), 1.6±1.1 boxes and 0.5±0.2 lines at last preoperative evaluation to 14.7±3.6 mmHg (p<0.023, 13.4-16.0), 0.5±0.8 boxes (p<0.000) and 0.6±0.3 lines (p=0.007) at last follow-up. Mean follow-up (95% CI) for APACG and CPACG were 554±646 (268-841) and 747±820 (438-1041) days respectively. In APACG and CPACG groups 19 eyes (86%) and 16 eyes (52%) had lower IOP respectively at last follow-up. 59% of the eyes with APACG and 61% of the eyes with CPACG were classified as complete success when it was defined as IOP ≤18mmHg without any antiglaucoma medications.

Discussion: Primary phacoemulsification without any reference to cataract is a safe and effective procedure in terms of IOP control and reducing the number of antiglaucoma drops in APACG and CPACG. *(Turk J Ophthalmol 2012; 42: 438-42)*

Key Words: Angle closure, phacoemulsification, intraocular pressures

Özet

Amaç: Akut primer açı kapanması glokomu (APAKG) ve kronik primer açı kapanması glokomunda (KPAKG) primer fakoemülsifikasyonun intraoküler basıncı (İOB) düşürüp, düşürmeyeceğini araştırmak.

Gereç ve Yöntem: Bu retrospektif, karşılaştırmasız, ardışık, girişimsel vaka serisi APAKG'u olan 20 hastanın 22 gözünü ve KPAKG'u olan 23 hastanın 31 gözünü içermektedir. Kataraktın varlığından bağımsız olarak tüm gözlere fakoemülsifikasyon cerrahisi uygulanmıştır. İOB, antiglokomatöz ilaç sayısı ve en iyi düzeltilmiş görme keskinliği (EDGK) ile ilgili data elde edildi.

Sonuçlar: APAKG'da son preoperatif değerlendirmedeki ortalama İOB (%95 CI), antiglokomatöz ilaç sayısı ve Snellen görme keskinliği 30,9±15,6 mmHg (23,0-38,0), 2,6±1,4 kutu ve 0,4±0,2 sıradan son takipte 15,5±3,9mm Hg (p<0,000, 13,8-17,0), 0,6±0,9 (p<0,000) kutu ve 0,6±0,3 (p=0.001) sıra olarak değişti. KPAKG'da son preoperatif değerlendirmedeki aynı parametreler 18,0±7,8 mmHg (15,1-20,8), 1,6±1,1 kutu ve 0,5±0,2 sıradan son takipte 14,7±3,6 mmHg (p<0,023, 13,4-16,0), 0,5±0,8 (p<0,000) kutu ve 0,6±0,3 (p=0,007) sıra olarak değişti. APAKG ve KPAKG'u için ortalama takip süresi (95% CI) sırasıyla 554±646 (268-841) ve 747±820 (438-1041) gün idi. Son takipte APAKG ve KPAKG gruplarında sırasıyla 19 (%86) ve 16 gözde (%52) İOB düşüktü. Başarı kriteri olarak antiglokomatöz ilaç kullanmaksızın İOB≤18 mmHg olarak tanımlandığında, APAKG olan %59 gözde ve KPAKG'u olan %61 gözde tam başarı saptandı.

Tartışma: Primer fakoemülsifikasyon kataraktan bağımsız olarak APAKG ve KPAKG'da İOB kontrolü ve antiglokomatöz damla sayısını düşürmek açısından güvenli ve etkili bir yöntemdir. *(Turk J Ophthalmol 2012; 42: 438-42)*

Anahtar Kelimeler: Açı kapanması, fakoemülsifikasyon, intraoküler basınç

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Received/Geliş Tarihi: 20.06.2012 **Accepted/Kabul Tarihi:** 23.07.2012

Introduction

Primary angle closure glaucoma (PACG) results from appositional or synechial adhesion of the peripheral iris that is extensive enough to cause an increase in intraocular pressure (IOP). If the rise in IOP is sudden and symptomatic it is termed as acute , if it is of insidious onset it is termed as chronic which can also be a sequel of acute angle closures. Both types can damage the optic nerve head leading to visual field loss.

The traditional first stage intervention for acute primary angle closure glaucoma (APACG) is a Nd: YAG laser peripheral iridotomy or a peripheral iridectomy following medical treatment of the acute IOP rise. In cases of chronic primary angle closure glaucoma (CPACG) medical treatment is usually the first choice and when it is insufficient to control IOP surgical measures directed at lowering IOP are employed. Trabeculectomy is usually the first choice, however, it is associated with potentially serious complications, such as shallow or flat anterior chamber, malignant glaucoma, suprachoroidal hemorrhage, and endophthalmitis.[1] Other surgical options as goniosynechialysis, glaucoma drainage implant, and cyclodestructive procedures have also been employed in various stages of PACG, all having their own shortcomings.[1]

Removal of the thick and anterior positioned lens increases the width and depth of anterior chamber angle and decreases IOP significantly.[3-5] Some of the ocular parameters that differentiate angle closure from control subjects as shorter corneal diameter, flatter keratometry, thicker lens, shorter axial length, shallower anterior chamber and more anterior lens position may present challenge during lens removal.[6] The aim of this retrospective study is to determine the effect of lens extraction by phacoemulsification on IOP in PACG irrespective of the amount of the lens opacity.

Material and Methods

This retrospective, non-comparative, consecutive, interventional case series includes 53 eyes of 39 patients between November 2002 and February 2009 who were diagnosed with APACG (22 eyes of 20 patients) or CPACG (31 eyes of 23 patients) and were offered phacoemulsification as the first line of treatment without any reference to the amount of lens opacity at Adnan Menderes University, Department of Ophthalmology, Glaucoma Unit. All patients signed an informed consent for phacoemulsification surgery. An approval was obtained from Adnan Menderes University Medical School Clinical Research Advisory Commission.

APACG was defined as patients who had typical symptoms of severe eye pain, conjunctival hyperemia, headache, tearing, blurred vision and/or seeing colored rings around lights and occasional nausea and vomiting with typical signs of microcystic corneal edema, narrow anterior chamber, middilated pupilla, intraocular pressure in the range of 50-60 mmHg and sometimes glaucomflecken. APACG patients were either referred to us after an attack or presented to the emergency department during an attack. In the former cases the angle closure attack was already treated and the eye was on antiglaucoma medications.

CPACG was defined as an eye that had closed angles on gonioscopy that could or could not be opened with indentation gonioscopy and no history of APACG symptoms. The use of antiglaucoma medications was irrelevant for the decision of phacoemulsification surgery.

Consecutive APACG and CPACG patients were offered phacoemulsification surgery irrespective of lens opacity, visual acuity, extent of peripheral anterior synechiae, the state of IOP control or presence of peripheral iridotomy/iridectomy. None of the patients were offered a peripheral YAG iridotomy before phacoemulsification surgery.

All phacoemulsification surgeries were performed by a single surgeon (VD). A facial block and retrobulbar anesthesia was employed with 2% lidocaine hydrochloride (Jetmonal, Adeka, Samsun) and the ocular surface was irrigated with 5% povidone solution. A 2.8 mm clear corneal incision was made with steel blade from 11:30 o'clock position. Following phacoemulsification of the cataract, a foldable intraocular lens that was available at the moment was implanted. Care was given to completely aspirate the ophthalmic viscosurgical device. A 0.1 ml cefuroxime (Multisef, Mustafa Nevzat, Istanbul) was injected intracamerally before speculum removal.

Postoperatively the patient was prescribed rimexolone 1% (Vexol, Alcon, Texas, USA) q6h that was tapered one drop per week for 4 weeks, and ofloxacin 0.3% (Exocin, Allergan, Ireland) q6h for 10 days. Patients were examined next morning of surgery, at 3 days, at first week and first month; then were sent to the Glaucoma Unit for further follow-up. All preoperative antiglaucoma medications were discontinued following phacoemulsification. If IOP was found to be high any time during the first postoperative month then an antiglaucoma medication was commenced. When the rimexolone was discontinued at the end of 4 weeks of postoperative follow-up, all antiglaucoma medications were also discontinued and office hours diurnal IOP measurements were employed after allowing the wash out period of antiglaucoma medications. If office hours diurnal IOP measurements was judged to be high for the patient then glaucoma medications were started as for any open angle glaucoma patient.[7] At the last follow-up, an IOP ≤18 mmHg without any antiglaucoma drops was considered as a complete success, an IOP ≤18 mmHg with one or more antiglaucoma drops was considered as a qualified success and an IOP >18 mmHg despite antiglaucoma drops or need for glaucoma surgery was considered as a failure.

All patients had full ophthalmological evaluation including best corrected Snellen visual acuity with decimal notation, IOP measurement with Goldmann applanation tonometer, detailed slit lamp examination and fundus examination. Main outcome measures were IOP and number of glaucoma medications needed.

Statistical analysis was done by SPSS 14.0. Results are given as mean ± standard deviation as well as 95% confidence intervals (CI) and ranges are provided where appropriate. Wilcoxon test was used for pair wise comparisons and a p value of 0.05 was considered as statistically significant.

Results

A total of 53 eyes of 39 patients had undergone phacoemulsification surgery. Of these, 22 eyes of 20 patients had APACG and 31 eyes of 23 patients had CPACG. In 4 patients one eye was diagnosed with APACG while the other eye was diagnosed with CPACG. Of the 53 eyes 29 eyes (55%) had a previous peripheral YAG laser iridotomy and 3 eyes (6%) had pseudoexfoliation. Data for ultrasonic pachymetry in 26 eyes (49%), keratometry in 48 eyes (91%), axial length in 46 eyes (87%) and intraocular lens power in 51 eyes (96%) could be retrieved. Mean follow-up (95% CI) for APACG and CPACG were 554±646 days (268-841) and 747±820 days (438-1041) respectively. Characteristics of the APACG and CPACG groups are given in Table 1.

In APACG group, mean IOP (95% CI) at the first application to the outpatient clinic, at the last preoperative evaluation and at the last follow-up were 47.0±13.5 mmHg (41.0-53.0), 30.9±15.6 mmHg (23.0-38.0) and 15.5±3.9 mm Hg (13.8-17.0) respectively. The number of antiglaucoma medications required at the three time points were 0.8±1.2 boxes, 2.6±1.4 boxes and 0.6±0.9 boxes. Preoperatively all eyes required antiglaucoma eye drops. Postoperatively 14 (64%) eyes did not need any, 6 (27%) eyes needed less and 2 eyes (9%) needed the same number of antiglaucoma medications. None of the eyes needed more than what was given preoperatively. Accordingly, 59% of the eyes was classified as complete success, 23% qualified success and 18% failure. The mean best corrected Snellen visual acuity at last preoperative evaluation (minimum-maximum, 95% CI) improved from 0.4±0.2 lines (0.1-1.0, 0.3-0.5) to 0.6±0.3 lines (0.1-1.0, 0.5-0.7) at last follow-up (Table 2).

In CPACG group, IOP (95% CI) decreased from a mean last preoperative evaluation of 18.0±7.8 mmHg (15.1-20.8) to 14.7±3.6 mmHg (13.4-16.0) at last follow-up. The number of antiglaucoma eye drops required dropped from a mean preoperative evaluation of 1.6±1.1 boxes to 0.5±0.8 boxes at last follow-up. Preoperatively all except 9 eyes (29%) required antiglaucoma eye drops. Postoperatively 21 (68%) eyes did not need any, 4 (13%) eyes needed less, 3 (10%) eyes needed the same, and 2 (6%) eyes needed more number of antiglaucoma eye drops. 1 (3%) eye did not have the preoperative eye drop information. 61% of the eyes were complete success, 23% qualified success and 16% failure. The mean best corrected Snellen visual acuity at last preoperative evaluation (minimum-maximum, 95% CI) increased from 0.5±0.2 lines (0.05-0.9, 0.4-0.6) to 0.6±0.3 lines (1.6-1.0, 0.5-0.7) at last follow-up (Table 2).

Figure 1 compares IOP at the last preoperative evaluation to that of at the last follow-up in both APACG and CPACG groups. In the APACG group 19 eyes (86%) had lower IOP at last follow-

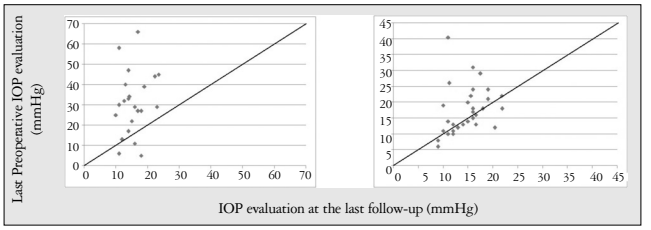

Figure 1. Scattergram comparing preoperative IOP to final postoperative IOP in APACG (left) and CPACG (right) groups

Table 1. Characteristics of the APACG and CPACG groups

	APACG†	CPACG‡	Total
Age, mean±SD (95% CI§)	64±14 (58-70)	68±13 (63-72)	66±13 (62-70)
Sex (M/F)	9/13	8/23	17/36
Eye (R/L)	9/13	13/18	22/31
YAG Laser peripheral iridotomy	10 (46%)	19 (61%)	29 (55%)
Pachymetry, mean±SD µm	584±63	552±32	562±45
Keratometry, mean±SD diopters			
Flat axis	43.43±1.63	43.94±1.49	43.75±1.55
Steep axis	44.01±1.48	44.91±1.41	44.58±1.49
Axial length, mean±SD mm	22.03±0.90	21.42±1.28	21.67±1.16
Intraocular lens power, mean±SD diopters	24.7±2.6	26.5±4.3	25.7±3.8
Presence of pseudoexfoliation	3 (14%)	0 (0%)	3 (6%)
Follow-up, mean±SD days (95% CI§)	554±646 (268-841)	747±820 (438-1041)	667±752 (455-870)

† - APACG : Acute Primary Angle Closure Glaucoma, ‡ - CPACG : Chronic Primary Angle Closure Glaucoma, § - CI : Confidence Interval.

up. The IOP of the 3 eyes (14%) that had a higher last follow-up IOP was under control with a mean of 4 boxes of antiglaucoma medications during last preoperative evaluation whereas there was no need for antiglaucoma medication at the last follow-up. In the CPACG group 16 eyes (52%) had lower, 1 eye (3%) had same, and 13 eyes (42%) had higher IOP at the last follow-up. The last preoperative and last follow-up mean IOP, and mean number of antiglaucoma medications of these 13 eyes that had higher IOP postoperatively were 12.15±3.26 mmHg and 0.9±1.3 boxes, and 14.35±3.96 mmHg and 0.4±0.7 boxes respectively.

There were no intraoperative or postoperative complications including posterior capsule rupture. None of the eyes required any pressure lowering surgery during the follow-up.

Discussion

Phacoemulsification surgery by itself has been shown to be a safe and effective way of controlling IOP in angle closure glaucoma. Most such reports had been performed by taking the presence of uncontrolled IOP5,8-11 peripheral anterior synechiae,[8] cataract[12-16] and/or following peripheral iridotomy/iridectomy[17] as a criterion. However, in this retrospective, non-comparative, consecutive, interventional case series primary phacoemulsification was offered as an initial management option for both acute and chronic angle closure glaucoma without any reference to cataract, visual acuity, extent of peripheral anterior synechiae, the state IOP control or presence of peripheral iridotomy/iridectomy. Our results confirm that phacoemulsification surgery by itself is safe and effective in terms of IOP control and decreasing the number of antiglaucoma medications.

Some patients in the APACG group were sent to our outpatient clinic through the emergency department, hence had no antiglaucoma medications while others were referred to us from neighboring hospitals after being provided medical care. That is why the mean IOP at first application was 47.0±13.5 mmHg with a mean number of 0.8±1.2 box antiglaucoma medications. Providing treatment to all patients increased mean number of antiglaucoma medications boxes to 2.6±1.4 boxes and decreased mean IOP to 30.9±15.6 mmHg at last preoperative evaluation. After a mean follow-up of 554±646 days, a mean IOP of 15.5±3.9 mmHg ($p<0.000$ when compared with last preoperative follow-up; 95% CI; 13.8-17.0) with a mean antiglaucoma medications boxes of 0.6±0.9 was achieved. There was a mean of 2 Snellen line improvement in best corrected visual acuity. When phacoemulsificaiton was offered as an initial treatment option, the IOP was reduced from 23.3 mmHg to 13.2 mmHg but the follow-up was 7 days.[18] Lai et al found a decrease of IOP from 19.7±6.1 mmHg to 15.5±3.9 mmHg and of antiglaucoma medications from 1.91±0.77 to 0.52±0.87 in primary angle-closure glaucoma patients who underwent phacoemulsification for cataract.[13] Similarly in another study phacoemulsification for cataract decreased IOP from 53.25±18.78 mmHg preoperative untreated, 12.9±7.6 mmHg preoperative treated to 8.15±3.91 mmHg at final follow-up; none of the patients required antiglaucoma medications after surgery.[14] Lee et al found a drop from 19.5±2.5 mmHg to 15.0±2.2 mmHg in IOP and from 1.9±1.1 boxes to 0.9±0.8 boxes in antiglaucoma medications in patients undergoing cataract surgery; 20.8% of the eyes had previous trabeculectomy.[15] The classic concept of lowering IOP in a disease state where there is high IOP by means of a pressure lowering surgical intervention such as trabeculectomy is not considered as the procedure of choice in APACG due to high risk of surgical failure and complications.[19]

There were 4 eyes (18%) in the APACG group those were considered as failure where the failure criteria was an IOP >18mmHg despite antiglaucoma drops or need for glaucoma

Table 2. Comparison of intraocular pressure and number of antiglaucoma medications

	First Application	Last Preoperative Evaluation	Last Follow-up
Intraocular Pressure (mmHg)			
APACG†	47.0±13.5 ($p<0.000$§)	30.9±15.6 ($p<0.000$§)	15.5±3.9
CPACG‡		18.0±7.8 ($p<0.023$§)	14.7±3.6
Number of antiglaucoma medications			
APACG†	0.8±1.2 ($p=0.505$§)	2.6±1.4 ($p<0.000$§)	0.6±0.9
CPACG‡		1.6±1.1 ($p<0.000$§)	0.5±0.8
Best Corrected Visual Acuity (Snellen, decimal notation)			
APACG†		0.4±0.2 ($p=0.001$§)	0.6±0.3
CPACG‡		0.5±0.2 ($p=0.007$§)	0.6±0.3

† - APACG : Acute Primary Angle Closure Glaucoma, ‡ - CPACG : Chronic Primary Angle Closure Glaucoma, § - All comparisons are made with the last follow-up

surgery. The IOP at the last preoperative and last follow-up evaluation for these particular 4 eyes dropped from 44 mmHg to 22 mmHg, 45 mmHg to 24 mmHg, 39 mmHg to 19 mmHg and 29 mmHg to 23 mmHg respectively. Of these 2 eyes were on 2 boxes, 1 eye was on 1 box , and 1 eye was free of antiglaucoma medications. Although these eyes are classified as failure due to our criteria, we believe that they are clinically successful results.

There was a mean of 2.8 mmHg ($p<0.023$) drop in CPACG patients at the last follow-up. Most of these patients were already under satisfactory IOP control where 95% confidence interval for IOP at last preoperative evaluation was 15.1-20.8 mmHg. But the state of IOP control was even better with a 95% confidence interval for IOP was 13.4-16.0 mmHg at the last follow-up. The use of antiglaucoma medications also decreased from a mean of 1.6 boxes to 0.5 boxes ($p<0.000$). Best corrected visual acuity increased by a mean of 1 Snellen line. Zhuo et al found a decrease in IOP from 32.00±6.00 mmHg preoperative untreated, 15.8±7.4 mmHg preoperative treated to 16.70±6.48 mmHg at final follow-up in patients undergoing cataract surgery.14 When phacoemulsification and phacotrabeculectomy were compared in patients having cataract and medically controlled chronic angle closure glaucoma both procedures resulted in similar IOP levels, phacotrabeculectomy group required less drops but was associated with more postoperative complications.12 In case of medically uncontrolled chronic angle closure glaucoma, phacotrabeculectomy group reached lower IOP and antiglaucoma drops but again was associated with more postoperative complications.20

There were 5 eyes (16%) in the CPACG group those were considered as failure. The mean IOP at the last preoperative and last follow-up increased from 19.40±4,67 to 20.42±1.43 mmHg and the number of mean antiglaucoma medications decreased from 1.6±1.5 to 1.2±1.3 boxes. Overall, we can say that the condition of these five eyes did not change.

Our study has several limitations. The study is retrospective with variable follow-up. Visual field data were not present. The outcome parameters, i.e. IOP, visual acuity and number of antiglaucoma medications, are not ideal to determine success for surgical intervention in glaucoma. But the criteria used are suitable to make comparisons with similar studies.

The ideal treatment algorithm for angle closure glaucoma is trying to be established. Both groups of diagnoses, namely APACG and CPACG, had benefited from phacoemulsification as an initial treatment option in terms of IOP control and number of antiglaucoma medications used. Although results for APACG are more striking, both groups had statistically significant reduction in IOP and number of antiglaucoma medications. In the view of the results of this study, primary phacoemulsification without any reference to the presence of lens opacity is a safe and effective surgical procedure in angle closure glaucoma.

Acknowledgements/Disclosure

Authors have no acknowledgement to declare.

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