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Surgical Results of 23G Pars Plana Vitrectomy Combined with Phacoemulsification and Intraocular Lens Implantation

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ABSTRACT:

Surgical results of 23G pars plana vitrectomy combined with phacoemulsification and intraocular lens implantation

Objective: To present the surgical results of pars plana vitrectomy and phacoemulsification (phacovitrectomy) plus IOL implantation in eyes with vitreoretinal pathology

Material and Method: This retrospective study included 91 eyes of 80 (44 female/36 male) consecutive patients undergoing phacovitrectomy plus IOL implantation during a 3-year period. Baseline and last best corrected visual acuity (BCVA), retinal pathologies, presence of systemic disease, preoperative lens status, history of any therapeutic intervention prior to surgery, type of intravitreal tamponade used, need for additional intervention, complications and the latest ocular examination results were considered.

Results: Mean age was 64.8±9.5 years. Diabetes mellitus (DM), hypertension (HT), DM+HT and coronary artery disease (CAD) were the accompanying systemic diseases, observed in 74%, 56%, 45% and 18.7% of the patients, respectively. Indications for phacovitrectomy were macular surface disease in 52%, vitreus hemorrhage (VH) in 31%, tractional retinal detachment (TRD), diabetic retinopathy or proliferative vitreoretinopathy (PVR) in 11% and rhegmatogenous retinal detachment (RRD) in 5.5% of the eyes. Mean preoperative and postoperative BCVA were 0.10±0.14, 0.22±0.22, ($p<0.001$), respectively. BCVA increased in 61%, remained stable in 24% of the eyes. The most common anterior and posterior segment complications were related to IOL in 16.5% and VH in 11% eyes, respectively. At the last visit, retina was attached with functional macula in 63 eyes. Foveal atrophy, macular hole formation, optic atrophy, VH, phthisis and recurrent RD were the causes of decrease or loss of vision.

Conclusion: Phacovitrectomy with IOL implantation is a safe and effective surgery providing good visualization during vitrectomy and preventing a cataract operation in another session in such a patient group with serious systemic diseases.

Keywords: Cataract, phacoemulsification, posterior segment pathologies, vitrectomy

ÖZET:

Yirmi üç gauge pars plana vitrektomi ile birlikte fakoemülsifikasyon ve göz içi lens implantasyonu ameliyatlarının cerrahi sonuçları

Amaç: Vitreoretinal patoloji nedeniyle pars plana vitrektomi ve fakoemülsifikasyon (fakovitrektomi) ile birlikte göz içi lens (GİL) implantasyonu yapılan ameliyatların cerrahi sonuçlarını sunmak

Gereç ve Yöntem: Bu retrospektif çalışma 3 yıllık süre zarfında fakovitrektomi ve GİL implantasyonu ameliyatı yapılan ardışık 80 hastanın (44 kadın/36 erkek) 91 gözünü içermektedir. Ameliyat öncesi ve sonrası düzeltilmiş en iyi görme keskinlikleri (DEİGK), fakovitrektomi nedenleri, eşlik eden sistemik hastalık, ameliyat öncesi lens durumu, daha önce geçirdiği ameliyatlar, kullanılan tamponad cinsi, komplikasyonlar, ilave tedavi girişimleri ve son göz muayene bulguları incelendi.

Bulgular: Yaş ortalaması 64.8±9.5 yıl idi. Diyabetes mellitus (DM), hipertansiyon (HT), DM+HT, koroner arter hastalığı sırasıyla hastaların %74, %56, %45 ve %18.7'sinde mevcuttu. Fakovitrektomi ameliyatı yapılma endikasyonlarını %52 olguda maküla yüzey hastalığı, %31 olguda vitreus hemorajisi (VH), %11 olguda diyabete bağlı traksiyonel retina dekolmanı (TRD), diyabetik retinopati ya da proliferatif vitreoretinopati (PVR) ve %5.5 olguda regmatojen retina dekolmanı (RRD) oluşturdu. Ortalama takip süresi 14.2±10.7 (2-39) ay idi. Ortalama DEİGK değerleri preoperatif ve postoperatif dönemlerde sırasıyla 0.10±0.14 ve 0.122±0.22 (0.001-0.9) idi ($p<0.001$). DEİGK olguların %61'inde arttı, %24'ünde değişmedi. En sık komplikasyonlar ön segmentte %16.5 oranında GİL ile ilgili, arka segmentte ise %11 oranında VH idi. Son muayenede makülanın fonksiyonel olduğu 63 gözde retina yatışık idi. Takip süresi sonunda görme azalması ya da kaybı foveada atrofi, maküladaki delik oluşması, optik atrofi, VH, nüks RD ya da fitizise bağlı olarak görüldü.

Sonuç: Fakovitrektomi+GİL implantasyonu ameliyat esnasında ortamın iyi görülebilmesini sağlayarak ve sonradan oluşacak katarakt için gerekecek başka bir cerrahi işlemin önüne geçerek özellikle sistemik hastalıkları olan hastalar için etkili ve güvenli bir tedavi yaklaşımıdır.

Anahtar kelimeler: Katarakt, fakoemülsifikasyon, arka segment patolojileri, vitrektomi

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INTRODUCTION

Addressing cataract and vitreoretinal pathology simultaneously by a single surgery minimizes the surgical and economic burden of multiple surgeries, also provides faster visual rehabilitation and patient recovery (1,2). Removal of cataract allows better visualization during vitrectomy especially for macular surface pathologies. Several studies have demonstrated the efficacy and safety of combined surgery (pars plana vitrectomy + phacoemulsification) for a variety of indications, including macular hole (MH), epiretinal membrane (ERM), proliferative diabetic retinopathy (PDR), and other complex vitreoretinal pathologies (3-6).

Combined surgery have some advantages as follows: In cases with diabetic retinopathy (DR) and proliferative vitreoretinopathy (PVR), following lens removal, visualization and lasering of the retina periphery is made possible as well as avoidance of lens touch during the vitrectomy. Cataract progression is usually seen after vitrectomy, and it can be thought that combined approach helps prevention of probable cataract surgery complication in vitrectomized eyes (7). In this study we present our results of combined phacovitrectomy and intraocular lens (IOL) implantation in eyes with various vitreoretinal pathologies and analysis of different variables affecting the results.

MATERIAL AND METHOD

This retrospective, single center study included 91 eyes of 80 consecutive patients undergoing transconjunctival 23 Gauge (G) pars plana vitrectomy (PPV) combined phacoemulsification (phacovitrectomy) and acrylic IOL implantation during a 3-year period. Demographic characteristics of patients, diagnosis, baseline and last best corrected visual acuity (BCVA), presence of systemic disease [diabetes mellitus (DM), hypertension (HT), etc.], preoperative lens status, type of intravitreal tamponade, types of complications, need for additional intervention and the latest ocular examination results were considered.

Best corrected visual acuity is recorded in decimals. Best corrected visual acuity was accepted as 0.0 decimal when there is no light perception, 0.001 decimal when between light perception to seeing hand movements and 0.01 decimal when the patient is counting fingers at ½ meters to 3 meters to make the data analysis easier.

Local (Retrobulbar or peribulbar) or general anesthesia (for young or uncooperative patients) was used and initially phacoemulsification (through 3 mm corneal incision) and implantation of IOL with 6 mm optical diameter was performed following insertion of three-port valved trocars with the infusion off. Superior approach to the eye is preferred providing easy transition from anterior part to posterior part of the eye without changing the position of the surgeon. Valved cannulas were used to provide a closed system and stable globe. Following phacoemulsification using standard procedure, immediate IOL implantation was performed to improve surgical time and avoid risky implantation on gas, air or silicone tamponade since these may have entered to the anterior chamber during IOL implantation. IOL haptics were placed horizontally and stromal hydration of the incisions were made. Main port was sutured if there was leakage using one 10-0 monofilament suture. Stabilisation of anterior chamber was checked before proceeding to PPV. At the end of the vitreoretinal procedure, scleral incisions were sutured if there was leakage using 7-0 vicryl suture. Injection of 0.1 cc moxifloxacin into the anterior chamber completed the combined surgery. After the operation face-down positioning for 3 days was recommended in cases with gas or silicone tamponade. The study was conducted with the tenets of the Declaration of Helsinki by obtaining written consent from the patients.

Statistical analysis was performed with SPSS 15.0 Windows program. Descriptive statistics were given as number and percentage for categorical variables, and mean, standard deviatpion, minimum and maximum for numerical variables. Comparison between two independent groups was done using Mann-Whitney U test and comparison of more than two groups was done using Kruskal Wallis test because numerical variables did not meet normal

distribution condition. Subgroup analysis of multiple group comparisons was done by Mann-Whitney U test and interpreted by Bonferri correction. Relations between numerical variables were evaluated by Spearman correlation analysis since parametric condition was not met. Ratio of categorical variables on the groups was compared using chi-square analysis. When the conditions were not met Monte Carlo simulation was applied. Statistical significance level was accepted as $p<0.05$.

RESULTS

A total of 91 eyes of 80 patients underwent combined phacoemulsification plus IOL implantation and 23G PPV. Both eyes were operated in 10 patients. Average age of the patients was 64.8±9.5 (29-85) years (Table-1). There were 44 female and 36 male patients. Mean follow-up was 14.2±10.7 (2-39) months, (Table-2). Systemic diseases the patients had included; DM in 74%, HT in 56%, DM+HT in 45%, coronary artery disease in 18.7% and chronic kidney insufficiency in 3.3%.

Indications for operation were categorized as macular surface disease in 52.7%, vitreous hemorrhage (VH) in 31%, rhegmatogenous retinal detachment (RRD) in 5.5% and tractional retinal detachment (TRD) or DR or PVR in 11% of the eyes, (Table-1). Fifty-four eyes had previous interventions with 6 eyes having PPV. Preoperative biomicroscopic examination showed nuclear sclerosis in 49%, corticonuclear cataract in 18.5% and posterior subcapsular opacity in 12% of the eyes. The diagnosis and indications for vitreoretinal surgery are summarized in Table-1. Macular surface disease (in 48 eyes) was the most common indication for surgery. While 37 eyes had no need for previous ocular therapy, the rest of the eyes had received a combination of laser, intravitreal drug injection and vitrectomy (Table-1).

Table-1: Demographic characteristics and clinical findings of patients

Parameter		N (eyes)	%
Eye	Right	45	49.5
	Left	46	50.5
Age mean.±SD (min-max)	64.8±9.5 (29-85)		
Sex	Female	44	55
	Male	36	45
Diagnosis	Macular surface disease:MH/ERM/VMT	48	52.7
	VH	28	30.8
	Tractional RD-VH RD PVR/PDR	10	11
	Rhegmatogenous RD	5	5.5
Systemic disease	Diabetes mellitus	68	74.7
	Hypertension	51	56
	Diabetes mellitus + Hypertension	41	45.1
	Coronary artery disease	17	18.7
	Chronic renal failure	3	3.3
	None	13	14.3
Preoperative lens status	Nuclear sclerosis	45	49.5
	Corticonuclear cataract	17	18.7
	Posterior subcapsular cataract	10	11
	Clear	9	9.9
	Combined	8	8.8
	Traumatic	2	2.2
Previous intervention	PRP+focal laser	32	35.2
	IV+PRP	10	11
	IV	6	6.6
	PPV+PRP+IV	6	6.6
	None	37	40.7

MH: macular hole, ERM: epiretinal membrane, VMT: vitreomacular traction, VH: vitreus hemorrhage, RD: retinal detachment, PVR: proliferative vitreoretinopathy, PDR: proliferative diabetic retinopathy, PRP: panretinal photocoagulation, IV: intravitreal drug injection, PPV: pars plana vitrectomy

Table-2: Operative and postoperative characteristics of the eyes undergoing phacovitrectomy

Parameter	Per/postoperative data	n	%
IOL diopter mean±SD (min-max)	22.7±2.1 (17.5-28)	91	100
Tamponade	C_3F_8	55	60.4
	SF_6	18	19.8
	Silicone oil	16	17.6
	Lactated Ringer's solution	2	2.2
Follow-up time (month) mean±SD (min-max)	14.2±10.7 (2-39)		
Complication	PCO/ IOL decentration/ Pupil capture	15	16.5
	VH	10	11
	Glaucoma/Increased intraocular pressure	6	6.6
	MH /tear-hole formation/ Retinal redetachment	6	6.6
	None	54	59.3
Additional therapeutic intervention	Antiglaucoma medication	16	17.6
	Intravitreal drug injection	15	16.5
	Laser application	5	5.5
	Intravitreal drug injection -antiglaucoma medication	5	5.5
	IOL reposition	1	1.1
	None	34	37.4
Last fundus status	Attached retina without macular pathology	42	46.2
	Macular edema	21	23.1
	Foveal atrophy/Drusen/CNVM/Optic atrophy/Phthisis	14	15.4
	ERM-Lamellar hole/Macular hole	10	11
	Recurrent RD (RRF/TRD)/VH	4	4.4

IOL: intraocular lens, C_3F_8: perfluoropropane gas, SF_6: sulfur hexafluoride gas, PCO: posterior capsule opacification, VH: vitreus hemorrhage, MH: macular hole, CNVM: choroidal neovascularization, ERM: epiretinal membrane, RD: retinal detachment

All phacoemulsification and single piece hydrophobic IOL implantation procedure went uneventfully except for 3 eyes who were implanted with 3-piece IOL due to posterior capsule rupture. There was no peroperative iris prolapse. Average IOL diopter was 22.7 (17.5-28). Types of intraocular tamponades used were 15% perfluoropropane (C3F8) in 60.4%, 20% sulfur hexafluoride (SF6) in 19.8%, silicone oil in 17.6% and lactated ringer solution in 2.2% of the eyes (Table-2).

Mean preoperative BCVA was 0.10 ± 0.14 (0.001-0.5). The range was between only light perception to 0.5 decimal. Thirty-two eyes had 0.001 vision, 12 eyes had 0.01 vision. Postoperatively last mean BCVA was 0.22±0.22 (0-0.9). Five eyes lost light perception, 5 eyes had 0.001 vision and 15 eyes had 0.01 vision.

Last ocular examination revealed attached retina with normal foveal contour in 46.2%, macular edema in 23.1%, foveal atrophy, choroidal neovascular membrane, optic atrophy or phthisis in 15.4% and recurrent RD (rhegmatogen or tractional) or VH in 4.4% of the eyes.

BCVA change was significant postoperatively ($p<0.001$). BCVA increased in 61%, remained stable in 24% and decreased in 15% of the eyes. BCVA changes after surgery were analyzed with respect to the diagnosis. There was no significant relation between baseline or last BCVA or change in BCVA, and either patients' ages or follow-up time. Mean preoperative BCVA was higher in macular surface disease group when compared with VH and RRD groups ($p<0.05$). When the relationship between BCVA and the presence of systemic disease was assessed, preoperative and postoperative BCVA in patients with DM were significantly higher than patients without DM ($p<0.001$, $p=0.009$), respectively. Eyes with silicone oil tamponade had lower postoperative BCVA than eyes with gas tamponade ($p<0.001$). Change of BCVA was significantly higher in eyes with C3F8 when compared with eyes with silicone oil ($p=0.011$). Type of previous therapeutic intervention was found to have no significant effect on preoperative or

postoperative last BCVA.

During the last visit, as expected, the eyes with either attached retina or macular edema had significantly higher BCVA compared with BCVA of the eyes with recurrent RD or VH (p=0.003, p=0.002) respectively. In 15 eyes there were complications related to IOL which included posterior capsule opacification (PCO) in 11 eyes, IOL decentration in one eye and IOL pupil capture in three eyes. Other complications were posterior synechiae, hyphema, corneal edema, anterior fibrinoid reaction and subconjunctival silicone oil migration which were encountered in 16.5%, VH in 11% and glaucoma in 6.6% of the eyes (Table-2). Posterior synechia, hyphema, corneal edema and anterior fibrinoid reaction were seen during the first postoperative week and resolved by medication. In 59.3% of the eyes no postoperative complication was reported. When effect of diagnosis, presence of systemic disease, preoperative crystalline lens characteristics and history of previous ocular treatment on the occurence of complication were analyzed, no significant relationship was found. Only complication rate was found to be significantly lower in patients with C3F8 tamponade (p=0.017).

During the follow-up after combined surgery 57 eyes needed additional therapy (Table-2). Anti-glaucomatous treatment was needed in 17.6% of the eyes. Silicone oil removal and/or reoperation of PPV were performed in 16.5%, intravitreal drug injection in 16.5% and IOL reposition in 1.1% of the eyes (Table-2).

DISCUSSION

Vitreoretinal pathologies can coexist with cataract frequently. In some cases cataract preclude posterior segment visualization during PPV. Cataract occurs after PPV in a short time so a second surgery is usually needed for better visual acuity and posterior segment evaluation (8). Phacovitrectomy is important for the patients who have retinal pathology with cataract or have no compliance for cataract surgery that occurrs after vitrectomy (8-14). Phacovitrectomy provides faster patient recovery and visual rehabilitation, as well as is more cost-effective than sequential approach (15,16). In a retrospective study preoperative BCVA values of patients were reported as light perception to 0.6 and postoperative BCVA values ranged from no light perception to 1.0 at the end of 6-72 months (17). Another study revealed 3 or more lines of BCVA increase in 85.9% of patients who had preoperative BCVA ranging from light perception to 0.6 and postoperative BCVA of no light perception to 1.2 (18). Another study reported an increase in BCVA in 87.5% of the patients (19). In our series BCVA increased in 60.9% and remained stable in 23.9% of the eyes and preoperative BCVA ranged from light perception to 0.5 whereas postoperative BCVA was found to be no light perception to 0.9 after 2-39 months' follow-up. Interestingly 68% of our patients had DM and both preoperative and postoperative BCVA were found to be significantly better in their eyes than those without DM. We thought that it was logical to have better postoperative BCVA in eyes with better preoperative BCVA and that patients with DM may have been referred to eye examination earlier routinely or these patients were more alert to seek for medical help that their surgery was indicated just on time.

A cases series reported the indications for combined surgery as ERM in 62% of the cases, VH in 23.8% and MH in 14.3% of cases (19). The causes of phacovitrectomy presented for VH in 58%, TRD in 36%, premacular hemorrhage in 5% of diabetic patients, and RRD in 43%, MH in 24%, ERM in 21.7% and vitreomacular traction syndrome in 10.8% of nondiabetic patients (20). In our series indications for phacovitrectomy were categorized as macular surface diseases in 52.7%, VH in 30.8%, PDR in 11% and RRD in 5.5% of the eyes. Combined surgery may cause intense postoperative inflammation, higher incidence of PCO, posterior synechiae formation, hyphema, corneal edema, narrowing of angle, shallow anterior chamber and increased intraocular pressure (IOP) (17,20-22). Use of either gas tamponade or silicone oil may cause additional problems like pupillary capture, IOL decentration and silicone oil migration to anterior chamber. Rate of posterior capsule rupture during combined surgery ranges between 0.82-8% (21-24). The rate of rupture of capsule was 3.2% in our series.

In a study comparing surgical outcomes using single-piece and multipiece foldable intraocular lenses in a group of 184 patients undergoing phacovitrectomy and intraocular lens implantation, single-piece acrylic IOLs were associated with low rate of surgical complications (25). In our study the most of IOLs were single-piece, while 3 IOLs were three-piece. Three-piece IOLs were only implanted to the sulcus when posterior capsule rupture was encountered during surgery without additional difficulty.

Intraocular lens decentration after PPV combined with cataract surgery was recorded between 0-2.7% in the studies (19,21,22). In our series only one (1.1%) eye needed repositioning due to IOL decentration. Elevation in IOP after phacovitrectomy was reported to be between 1.9-15.3% in the literature (17,22,26). In our study 6 eyes developed glaucoma and 21 eyes needed antiglaucomatous therapy during an average of 14 months follow-up time. Posterior capsule opacification was among the most common anterior segment complications in several studies (20). Posterior capsule opacification developed in 20.8% of the cases and major risk factors were stated as RRD, axial length greater than 24.5mm, intraoperative and postoperative complications, longer acting gas use and postoperative posturing (27). Posterior capsule opacification rate was found in 12.1% in our study. Increased intraocular pressure and anterior segment complications were caused due to more intense postoperative inflammation, narrowing of angle and shallow anterior chamber. Fibrinous exudation in the anterior chamber was found significantly to be more frequent after combined surgery, particularly in cases of proliferative diabetic retinopathy (28). There are some recommendations in order to decrease anterior segment complications such as small curvilinear capsulorrhexis, intracapsular IOL implantation, use of IOLs with larger optics and avoidance of long acting pupil dilating eye drops or use of miotics when gas tamponade is used (29). Intraocular lens implantation was suggested to be delayed until the end of posterior segment surgery to avoid disturbing light reflexes from the IOL rim causing difficulties in visualization of the far retinal periphery and insertion of the IOL prior to intraocular tamponade to reduce the risk of anterior chamber shallowing (30). In our series we preferred IOL insertion just after phacoemulsification as in the study by Özgönül et al. (31) who evaluated 64 eyes, and we are convinced with the usability of this approach. The rim of the 6 mm IOL optic did not cause any disturbing light reflex and visualization of the periphery was possible by scleral depression.

Type of vitreoretinal pathology effects the anatomical and functional outcome, and it also indicates which intraocular tamponade to be used. Use of either gas or silicone oil may cause problems like pupillary capture, IOL decentration, and silicone oil migration to anterior chamber, necessitating additional intervention. In cases with silicone oil tamponade a central thick posterior capsular plaque formation may be encountered. It is possible to do the posterior capsulotomy during silicone removal in these cases. On the other hand gas bubble causes forward displacement of the capsular bag and IOL but causes less complications as seen in our series. Our data analysis revealed that silicone oil was preferred more in the eyes with less preoperative BCVA with respect to gas tamponade, which can be explained by need for silicone oil tamponade in more complicated cases as PDR and tractional RD. Posterior segment complications included VH, MH or retinal break formation and recurrent RD in our series, and they were similar to the literature. Foveal atrophy, MH formation, optic atrophy, VH, phthisis and recurrent RD (RRD or TRD) were found to be the reasons for functional and anatomical failure. In order to prevent anterior segment complications, an uneventful phacoemulsification with IOL implantation, appropriate control of inflammation and probable intraocular pressure increase are mandatory. Surgeons should consider benefits and risks for the patient as well as their clinical knowledge and experience when deciding to perform combined surgery. Phacovitrectomy with IOL implantation is a safe and effective surgery providing good visualization during vitrectomy and preventing a cataract operation in another session especially in patients with serious systemic diseases.

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