

Combined Phacoemulsification, Vitrectomy and Endolaser Photocoagulation in Patients with Diabetic Retinopathy and Cataract

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ABSTRACT

Objective: To determine the outcomes of early vitrectomy and endolaser photocoagulation effects during phacoemulsification in cataractous eyes with diabetic retinopathy.

Study Design: Descriptive study.

Place and Duration of Study: Ophthalmology Department Unit-II, DUHS, Civil Hospital, Karachi, and Al-Noor Eye Clinic, Karachi, from February 2009 to December 2010.

Methodology: Consecutive 54 patients with 7 - 15 years duration of type II diabetes with severe non-proliferative diabetic retinopathy (NPDR) and early proliferative diabetic retinopathy (PDR) who had cataract grade I and II underwent vitrectomy, endolaser photocoagulation and phacoemulsification with IOL implantation. Best corrected visual acuity was main outcomes measure assessed till 6 months follow-up.

Results: Out of 54 eyes, 32 patients were females and 22 were males. Majority 47 (87%) eyes gained significant ($p < 0.001$) improvement of best corrected visual acuity of four lines or better while 5 (9.3%) eyes retained stable visual acuity. In only 2 eyes, vision declined to 3/60 or less.

Conclusion: Early vitrectomy with phacoemulsification in severe NPDR and early PDR patients, if assisted or augmented with endolaser photocoagulation, maximizes, early visual rehabilitation with less morbidity and may retard progression of retinopathy.

Key Words: *Early pars plana vitrectomy. Endolaser photocoagulation. Early diabetic cataract surgery. Diabetic retinopathy. Early visual rehabilitation.*

INTRODUCTION

Early cataract formation is a well known phenomenon in diabetic patients. Vitreo-retinal disease and cataract occurs simultaneously in elderly patients with uncontrolled diabetes. Operating cataract alone in diabetic patients usually accelerate the progression of Diabetic Retinopathy (DR).¹ Performing vitrectomy alone in Proliferative Diabetic Retinopathy (PDR) cases results in early development of cataract.² Challenges and risks related to phacoemulsification in previously vitrectomized eyes includes extremely deep anterior chamber, zonular dehiscence, more chances of posterior capsular rent due to increased capsular mobility and nucleus drop.^{3,4} In each type of separate surgical strategy, further reduction of vision ensues and subsequently another surgery is ultimately required.

Both the high rate of cataract formation associated with vitrectomy and risks of cataract surgery in vitrectomized eyes has evolved the combined technique.^{5,6} Cataract surgery in diabetic patients with macular edema and

systemic hypertension has a good visual outcome if prior macular grid laser or intravitreal anti-VEGF (vascular endothelial growth factor) injected during phacoemulsification surgery.⁷ Performing endolaser photocoagulation in addition to combined phaco-vitrectomy surgery in eyes with severe NPDR and early PDR will help greatly not only in treating retinopathy but also halt its progression.

In diabetic patients, co-morbidities including hypertension, coronary artery disease, hyperlipidemia, prolong duration of diabetes, higher levels of glycosylated hemoglobin, high Body Mass Index (BMI) and smoking had adverse effects on progression of DR.⁸ Paradigm shift in thinking for early surgical intervention is essentially required not just to treat the disease but to promote the health of an individual as well. Combined surgical strategy with endolaser is particularly beneficial in patients with high risk of developing complications, patients with poor compliance, uncontrolled diabetics and those with co-morbid which will accelerate retinopathy. Combined surgery results in early good visual recovery. It is cost effective and minimizes additional morbidity in terms of preventing multiple surgeries.

The objective of this study was to determine the outcomes of early vitrectomy and endolaser photocoagulation effects during phacoemulsification in cataractous eyes with diabetic retinopathy.

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METHODOLOGY

This descriptive study of consecutive 54 eyes operated at Ophthalmology Department Unit II, Dow University of Health Sciences, Civil Hospital, Karachi, and Al-Noor Eye Clinic, Karachi, was conducted from February 2009 to December 2010.

Patients of either gender having type-II diabetes with duration between 7 to 15 years who developed grade-I and II cataract according to Lens Opacification Classification System,⁹ were enrolled. Controlled and uncontrolled (HbA1c > 7.0) diabetic patients who had severe Non-Proliferative Diabetic Retinopathy (NPDR) (any one of blot hemorrhage in 4 quadrants, venous beading in 2 quadrants or intra-retinal micro-vascular abnormalities [IRMA] in 1 quadrant i.e. 4:2:1) and early PDR (neovascularization on disc NVD or neovascularization elsewhere NVE of retina) as defined by ETDRS were the subjects for early intervention. Patients with systemic co-morbid of diabetes like uncontrolled hypertension (blood pressure > 130/90 mmHg), hyperlipidaemia, smoking and obesity (raised Body Mass Index [BMI > 25]) were included in our study. Along with above selection criteria those individual were enrolled who upon thorough history showed poor compliance for diet control, drug dosage and missed follow-up visits with physician. Their socio-economic and educational status was also a consideration for early combined phaco-vitrectomy and endolaser surgery. Those who had already one or more session of laser photocoagulation (macular grid or PRP) were also included. Patients with macular ischemia, advanced diabetic eye disease like vitreous hemorrhage and retinal detachment excluded who had developed complete Posterior Vitreous Detachment (PVD) were also excluded from this study.

A written consent was obtained after explaining/ counselling about the disorder, its consequences and pros and cons of the surgery. Color and red free fundus photographs were recorded and Fundus Fluorescein Angiography (FFA) was done in each subject pre-operatively. Surgery was scheduled after good control of blood sugar and blood pressure. Cases were operated under general anesthesia or retrobulbar anesthesia. Clear corneal incision was given for phacoemulsification and Intraocular Lens (IOL) was implanted in each eye. Pars plana vitrectomy followed by Argon endolaser photocoagulation as per required retinal area was done on every patient. Postoperatively topical medication included combination of Moxifloxacin and Prednisolone drops starting two hourly and gradual tapering dosages for 6 weeks and NSAID eye drops for 12 weeks were prescribed to each patient. Follow-up was scheduled on day 1, first week, first month, 3rd month and finally on 6th month. On each visit Best Corrected Visual Acuity (BCVA), thorough slit lamp examination and careful biomicroscopic fundus examination were recorded. Postoperatively FFA was recorded at 12 weeks of follow-up for comparison.

Statistical analysis was done through Statistical Package for Social Sciences (SPSS) version 17. The results were presented in terms of frequencies and percentages. Wilcoxon Signed Ranked test was applied to compare proportions of pre-operative and post-operative visual outcomes. P-value < 0.05 was considered statistically significant.

RESULTS

Out of 54 patients, 22 (40.7%) were males and 32 (59.3%) were females. Youngest patient was 39 years of age while the eldest was 62 years old. All patients had type-II diabetes mellitus. Duration of diabetes was between 7 - 9 years in 06 (11.1%) patients, 10 - 12 years in 22 (40.7%) while in rest of the 26 (48.1%) patients duration of diabetes was more than 13 years. Pre-operatively severe NPDR was found in 23 (42.6%) and early PDR in 31 (57.4%) subjects. Grade-I cataract was found in 34 (62.9%) while other 20 (37.0%) subjects had grade-II cataract.

Majority of patients 43 (79.6%) had uncontrolled diabetes and 23 (42.5%) had uncontrolled hypertension. Hyperlipidemia was found in 16 (29.6%) patients, obesity (raised Body Mass Index) was observed in 13 (24.1%) and 12 (22.2%) individuals had smoking habits. In 26 (48.1%) patients, there was no retinal laser photocoagulation pre-operatively while rest of the patients already had laser photocoagulation before surgery (Table I). Fifteen cases were operated under general anesthesia while 39 cases under retrobulbar anesthesia.

In majority of cases statistically significant ($p < 0.001$) improvement in BCVA was noticed postoperatively after 06 months of follow-up period (Table II). Seventeen patients gained BCVA better than 6/12 at the end of follow-up. In 5 (9.3%) cases, postoperative BCVA remained same as pre-operative level while in 2 (3.7%) cases vision declined to 3/60 or less (Table III). Diabetic retinopathy was found to be arrested in majority of cases where significant improvement of BCVA was also

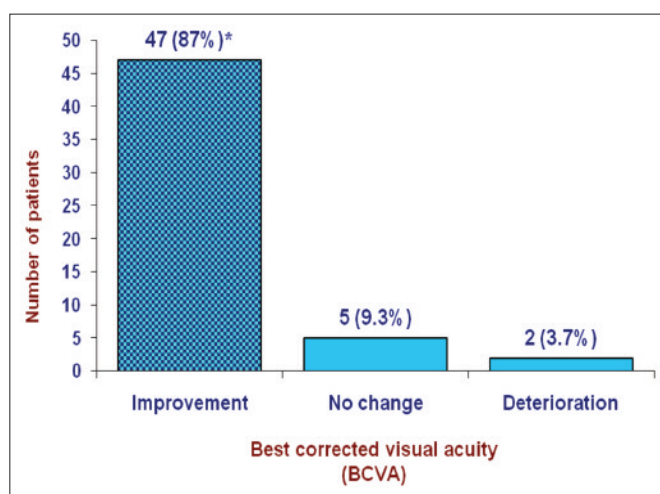


Figure 1: Postoperative BCVA.

Table I: Pre-operative data.

Gender	
Male	22 (40.7%)
Female	32 (59.3%)
Age group	
39 - 44 years	8 (14.8%)
45 - 49 years	10 (18.5%)
50 - 54 years	16 (29.6%)
55 - 62 years	20 (37.0%)
Duration of diabetes	
07 - 09 years	06 (11.1%)
10 - 12 years	22 (40.7%)
13 - 15 years	26 (48.1%)
Risk factors	
Uncontrolled DM	43 (79.6%)
Uncontrolled HTN	23 (42.6%)
Hyperlipidemia	16 (29.6%)
Smoking	12 (22.2%)
Obesity	13 (24.1%)
Pre-operative	
Pan retinal photocoagulation	11 (20.4%)
Macular grid	14 (25.9%)
Focal laser	03 (5.6%)
No laser	26 (48.1%)
Severe NPDR	23 (42.6%)
Early PDR	31 (57.4%)
Cataract Grade I	34 (62.9%)
Cataract Grade II	20 (37.0%)

Table II: Comparison of Best Corrected Visual Acuity (BCVA) 6 months after intervention.

Best Corrected Visual Acuity (BCVA)	Mean ranked values	p-value
Pre-operative	25.00	< 0.001*
Postoperative	23.43	

Wilcoxon Signed Ranked Test was applied (Z = 0.015)
 * P-value < 0.05 was considered as significant.

Table III: Pre-operative and postoperative comparison of best corrected visual acuity (BCVA).

Best Corrected Visual Acuity (BCVA)	Number of cases	
	Pre-operative n = 54 (%)	Postoperative n = 54 (%)
< *3/60	00 (0%)	2 (3.7%)
3/60 - 6/60	26 (48.1%)	5 (9.3%)
6/36 - 6/24	22 (40.7%)	15 (27.7%)
6/18 - 6/12	6 (11.1%)	15 (27.7%)
> **6/12	00 (0%)	17 (31.4%)

*Less than; **Better than

observed (Figure 1). No complication like posterior capsular opacification (PCO), neovascular glaucoma (NVG) was observed for 6 months of follow-up. No patient developed retinal tear, retinal detachment, vitreous hemorrhage or endophthalmitis during the whole follow-up period.

DISCUSSION

The exact cause of proliferative retinopathy is still not fully clear. In diabetic patients, increased vascular

permeability, hemodynamic alterations and vaso-occlusive insult causing hypoxia, result in release of vasoproliferative factors which play an important role in pathogenesis of diabetic retinopathy and neo-vascularization. Contraction of proliferative tissue causes traction on the vitreous, retina and vessels. New vessels themselves in some way cause contraction. Traction on vessels results in hemorrhage and other sequelae. PDR is characterized by outgrowth of new vessels on disc and elsewhere in retina and fibroblast activity into the scaffold provided by attached posterior vitreous. In some aspects, role of vitreous is still ill defined. Fibrovascular proliferation and its changes in vitreous gel can cause blinding sequelae in patients with PDR. Therefore, surgical removal of all vitreous scaffolds by vitrectomy seems to eliminate the development of this vicious cycle.¹⁰ Pan Retinal Photocoagulation (PRP) is frequently required in PDR cases to reduce the risk of neovascularization of retina and iris. Surgically removing vitreous scaffolds before it causes blindness in a highly susceptible study population was the basic idea for early surgical intervention. In this study, all three procedure were combined i.e. phacoemulsification for cataract, vitrectomy to dissect vitreous scaffolds and relieving traction and endolaser for neovascularization in the selected patients of DR. By this, visual outcomes can be improved with less morbidity and less number of follow-up visits.

This study showed 47 (87%) eyes achieved improvement in BCVA of four lines or more of Snellen's acuity chart (p < 0.001) and no progression of DR while 05 (9.2%) eyes retained stable vision after combined procedure (Figure 1). These values are slightly higher than a study done by Rivas-Aguino and colleagues where they found visual improvement by combined phacovitrectomy surgery in 60.7% cases and pre-operative and postoperative stable vision in 25% of cases.¹¹ This might be due to the reason that endolaser was done in these cases and the study subjects did not have advanced PDR. Cataract removal with IOL implant improved vision postoperatively in this study subjects but stable visual outcomes can also be attributed to the combined early surgical intervention strategy with endolaser. This strategy eliminates all possible mechanisms for further proliferation to take place which might lead to deterioration of vision at later period particularly in a population that had poor compliance for treatment and follow-up visits.¹² At places where modern Ultra-Wide-Field Fluorescein Angiography (UWFFA) facility prevails, early intervention can be deferred.

Posterior Capsular Opacification (PCO) is a common complication in combined surgery.¹³ Posterior synchiae and anterior segment fibrin reaction especially in diabetic patients was observed in a study and cystoid macular edema was also a complication described in combined surgery.¹⁴ Heiligenhaus *et al.* found that PCO

and anterior segment inflammation was less in clear corneal incision as compared with scleral tunnel incision in combined surgery.¹⁵ The authors did not find any of these complications possibly because of postoperative aggressive use of topical steroids and NSAIDs and we had clear corneal incision in all our cases. Neovascular glaucoma (NVG) was reported by some researchers in diabetic patients while others did not find such complication in combined surgery.^{16,17} This NVG was not observed in this follow-up as intraoperative endolaser was applied in these subjects. Vitreous hemorrhage was observed by some surgeons in combined surgery¹¹ but such situation was not observed in this study.

To the best of the authors' knowledge, none of the studies done so far had focused on systemic co-morbid in combined surgery for diabetic patients, which is an important aspect while selecting patients. In one study, prevalence of retinopathy was found much higher in patients with higher levels of glycosylated hemoglobin and BMI.¹⁸ In this study, 02 (3.7%) eyes shows visual deterioration with progression of DR. These were the patients who were obese smokers with uncontrolled diabetes and hypertension. Further controlled studies should be conducted with special focus on systemic co-morbid so that their association on final visual outcome can be recognized.

Surgeons working on combined strategy had proved that phaco combined with PPV is safe and effective with quick visual recovery.^{19,20,21} This study also endorsed their observations. Further large scale studies will be helpful in understanding of surgical management of complex diabetic retinopathy and ophthalmic surgeons could better decide for early combined intervention in underserved poor diabetic population to reduce their economic burden and morbidity.

CONCLUSION

Early vitrectomy with phacoemulsification in severe NPDR and early PDR patients if assisted or augmented with endolaser photocoagulation maximizes early visual rehabilitation with less morbidity and may retard the progression of retinopathy.

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