

Early Phacoemulsification in Diabetic Cataract for Early Recognition and Management of Diabetic Macular Oedema

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ABSTRACT

Objective: To get optimal visualization of fundus by early phacoemulsification in diabetic cataract for early recognition and management of diabetic macular oedema.

Study Design: Interventional study.

Place and Duration of Study: Ophthalmology Unit III, Sindh Government Lyari General Hospital and Dow University of Health Sciences and Al-Noor Eye Hospital, Karachi, from July 2008 to June 2009.

Methodology: Patients with uncontrolled type-II diabetes mellitus of more than 10 years of duration were selected. Patients with clinical significant macular oedema (CSME), non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR) were excluded. Follow-up was done on day 1, 1 week, 1 month, 3 months and 6 months.

Results: The male to female ratio was 1:1.44. Out of 218 patients; 129 (59.2%) were males and 89 (40.8%) were females. CSME was found in 82 patients (37.6%) at first postoperative week which declined to 29 cases (13.3%) at first month follow-up. Three subjects developed mild to moderate NPDR. In majority of the subjects, best corrected visual acuity (BCVA) gradually improved in each subsequent follow-up visit.

Conclusion: Early phacoemulsification in diabetic cataract offers optimal posterior pole visualization and clears the ambiguity of decreased vision either caused by cataract or macular oedema. Uncomplicated phacoemulsification does not accelerate diabetic macular oedema or retinopathy provided glycemic control and co-morbidities are well addressed.

Key words: Early phacoemulsification. Diabetic cataract. Diabetic macular oedema recognition. Optimal fundus visualization.

INTRODUCTION

Diabetic patients develop cataract earlier than non-diabetics. The presence of cataract may be a marker for greater severity of diabetic maculopathy / retinopathy. It is clinically difficult to decide exactly about the cause of reduced vision in elderly diabetic and hypertensive patients with cataract. Decreased vision can either be due to cataract or the result of diabetic maculopathy. Mild diabetic macular oedema may easily be overlooked in patients with early lenticular changes; so deferring early cataract surgery may augment clinical difficulty in recognition of diabetic maculopathy leading it to convert in chronic stage where it becomes difficult to treat with advancing cataractous changes.

Recent advances in cataract surgery have greatly improved the visual outcomes with minimal tissue trauma and early rehabilitation. Earlier, Pollack *et al.* and Schatz *et al.* related progression of diabetic retinopathy (DR) with cataract surgery and deferred it till dense cataract developed.^{1,2} On the other hand, Wagner *et al.* and others found that worsening of DR reflected the natural course of the disease rather than attributing it to cataract surgery.³⁻⁵

Early interventional approach in diabetic cataracts has helped to optimize postoperative outcome in modern cataract surgery.⁶ Early cataract surgery helps to get rid of frequent spectacle changes in patients with poor glycemic control due to changes in refractive status of lens. It also helps in peripheral fundus examination and early detection of macular oedema. Cataract surgery may initiate posterior vitreous detachment (PVD) which halts the progression of DR.^{7,8} Argon laser photocoagulation induces cataractous changes in crystalline lens⁹ thereby visualization of posterior pole further declines, hence, its efficacy can theoretically be better in pseudophakic patients. Intensive control of blood glucose and systemic hypertension greatly reduces the risk of new onset DR and slows the progression of existing DR.¹⁰ Hence, planning for surgery sets target for good control of diabetes and hypertension particularly in poor compliant individuals; thereby initiating patient's will to overcome the disorder and lays future grounds to maintain the same for better management of their blood glucose level. Once diabetes is controlled, patient and physician recognize the optimal dosage of medication as well as other necessary means (diet and exercise etc.) required to maintain good diabetic control.

To the best of our knowledge, no such research have been conducted to clear the ambiguity of decreased vision caused either by cataract or macular oedema in diabetics of Asian origin and there is a paucity of data from developing countries like Pakistan. The purpose of this study was to get optimal visualization and early

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recognition of diabetic macular oedema by early phacoemulsification of diabetic cataract.

METHODOLOGY

This hospital based interventional study was carried out between July 2008 to June 2009 at Ophthalmology Department, Unit III, Sindh Government Lyari General Hospital, DUHS and Al-Noor Eye Hospital, Karachi.

Type-II diabetic patients of either gender with a history of diabetes of 10 years duration or more with poor compliance for hypoglycemic agents were enrolled. Patients with systemic co-morbid conditions like hypertension, anemia, hypercholesterolemia and obesity were also recruited in this study. Patients older than 40 years with the diagnosis of cataract grade-I or II according to Lens Opacification Classification System-III (LOCS III) and who provided informed consent for participating in the study were included. Patients with clinical significant macular oedema (CSME), non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR) along with any corneal or vitreo-retinal pathology, glaucoma, traumatic cataract, and eyes with previous intraocular surgeries were not the subjects of this study. Data were collected by convenience sampling method. Patients who lost follow-up were not included in this study. Patient's were operated only when their glycosylated haemoglobin (HbA1c) was less than 7.0, blood pressure was controlled (< 140/90 mmHg). All surgeries were performed by a single experienced surgeon using the same surgical technique.

The operative procedure included peribulbar anaesthesia followed by 3.5 mm scleral tunnel incision, continuous curvilinear capsulorhexis, hydrodissection, phacoemulsification of the nucleus and cortical aspiration. Foldable acrylic IOL was implanted in the capsular bag and scleral wound was sutured where necessary. Postoperative topical Prednisolone and Moxifloxacin eye drops were used every two hourly with tapering dosage till 6 weeks and Polymyxin B with Neomycin eye ointment at night for 2 weeks. On each visit best corrected visual acuity (BCVA) by Snellen chart, thorough slit lamp examination, complete biomicroscopic fundus examination along with BMI according to Quetlet's formula, blood pressure, fasting blood sugar and HbA1c were recorded. Counselling was done on each visit for diet, glycemic control and regular exercise. Follow-up schedule was maintained strictly on day 1, 1 week, 1 month, 3 months and final visit at 6 months.

Data were entered in Statistical Package for Social Sciences (SPSS) version 17 and all the data was analyzed. In this study, all the data was collected on medical checkups. Analysis of the data was done using descriptive statistics. Descriptive statistics were computed according to the type of the variable. The

mean (standard deviation) was computed for continuous variables while categorical variables were assessed by computing frequencies.

RESULTS

A total of 218 subjects based on the inclusion criteria were recruited in this study. One hundred and twenty nine males (59.2%) and 89 females (40.8%) aged upto 40 years and above (mean 54.3 ± 1.3 years) were included in the study. The male to female ratio was 1:1.44. The mean duration of diabetes was 12.9 ± 2.8 years; majority of the patients (79.4%) had range between 10 – 13 years. Important co-morbids were also identified. Hypertension was observed in 82 patients (37.6%) and 28 candidates (12.8%) had increased levels of serum cholesterol while raised BMI in the obesity range was seen in 36 patients (16.5%). One hundred and two patients (46.8%) had poor glycemic control (HbA1c > 7.0) on presentation. The baseline characteristics of patients are shown in Table I.

Following uncomplicated phacoemulsification in all the patients, clinically significant macular oedema (CSME) was found in 82 patients (37.6%) at first postoperative week which declined to 29 cases (13.3%) at first month follow-up and at 6 months follow-up only 3 patients (1.37%) had macular oedema, which shows its transient nature. NPDR was not observed in any case till 3 months follow-up. Thereafter three subjects (1.37%)

Table I: Baseline characteristics of patients.

Variables	Number of patients (n = 218)	Frequency (%)
Age (mean \pm std. dev) (years)	54.3 ± 1.3	–
Gender		
Male	129	59.2
Female	89	40.8
Duration of DM* (years) (mean \pm std. dev)	12.9 ± 2.8	–
10 – 11	93	42.6
12 – 13	83	38.1
14 – 15	42	19.3
Co-morbids		
Hypertension	82	37.6
Hypercholesterolemia	28	12.8
Obesity (BMI > 25)	36	16.5
Anemia	23	10.6
Smoking	18	8.3
HbA1c level **		
≤ 7.0	116	53.2
> 7.0	102	46.8
BCVA*** (Pre-operative)		
6/6	NIL	NIL
6/9	13	5.9
6/12	26	11.9
6/18	56	25.7
6/24	95	43.7
6/36	28	12.8

* Diabetes mellitus; ** Glycosylated haemoglobin; *** Best corrected visual acuity

developed mild to moderate NPDR which was present at 6 months of follow-up. There was improvement in best corrected visual acuity (BCVA) in each subject at subsequent follow-up visits (Table II). At 6 months follow-up, 194 patients (88.9%) had a BCVA of 6/6 on standard Snellen chart; while, remaining 24 patients (11.1%) had BCVA of 6/12 or better (Table II). Glycemic control gradually declined during the 6 months follow-up period. However, as compared to pre-operative levels of 102 patients (46.8%) with uncontrolled diabetes; only 44 patients (20.18%) had poor control of diabetes at 6 months of follow-up. Similarly, 47 patients (21.55%) could not maintain good control of their blood pressure and in 13 patients (5.9%) serum cholesterol level was found more than normal range at 6 months follow-up period.

Table II: Follow-up results (n = 218).

Variables	1 week (%)	1 month (%)	3 months (%)	6 months (%)
Macular oedema (CSME) *	82 (37.61)	29 (13.3)	05 (2.29)	03 (1.37)
NPDR** (mild to moderate)	NIL	NIL	03 (1.37)	03 (1.37)
BCVA				
6/6	42 (19.26)	96 (44.03)	183 (83.94)	194 (88.99)
6/9	80 (36.69)	83 (38.07)	20 (9.17)	16 (7.33)
6/12	64 (29.35)	35 (16.05)	15 (6.88)	08 (3.66)
6/18	23 (10.55)	04 (1.83)	NIL	NIL
6/24	09 (4.12)	NIL	NIL	NIL
6/36	NIL	NIL	NIL	NIL
Uncontrolled DM (HbA1c > 7.0)	NIL	07 (3.21)	31(14.22)	44 (20.18)
Uncontrolled BP*** (> 140/90 mmHg)	23 (10.55)	26 (11.92)	34 (15.59)	47 (21.55)
Altered cholesterol (> 200 mg/dl)	NIL	07 (3.21)	13 (5.96)	13(5.96)

*Clinical significant macular odema; ** Non-proliferative diabetic retinopathy; *** Blood pressure.

DISCUSSION

Visual outcomes are often worse when cataract surgery is deferred till CSME is identified or treated before cataract extraction. Contrary to it, visual outcome may be improved considerably if surgery is done before lens changes prevent the recognition of CSME.¹¹ Various clinical trials present different opinion about whether cataract surgery itself might influence the risk of maculopathy or retinopathy progression. The retinopathy after cataract surgery is influenced by age, severity of pre-operative DR, duration of diabetes and level of HbA1c. Dowler *et al.* and Squirrell *et al.* concluded in their studies that uncomplicated phacoemulsification does not accelerate the course of DR and any observed progression is the natural course of the disorder.^{11,12} On the contrary, Hong observed that progression rate of DR doubled in patients 12 months after surgery compared with non-operated diabetic eyes.¹³ After 6 months follow-up period in the present study, only 3 cases develop CSME and another 03 had

mild to moderate NPDR. These findings were observed among those individuals who had poor glycemic control (elevated HbA1c level). This observation strengthens the conclusion made by Dowler and Squirrell regarding the progression of DR being the natural course of the disease and not due to early cataract extraction.

Hypertension is a recognized co-morbid which badly affects the progression of DR. Ocular rennin angiotensin system plays a role in the development of DR independent of systemic blood pressure. Mauer *et al.* proved in their study that angiotensin converting enzyme (ACE) inhibitors prevented progression of DR.¹⁴ Renal diseases, hyperlipidemia, anemia and smoking are also well known co-morbids that accelerate DR.¹⁵ In this study, 6 patients with poor control of their co-morbids developed maculopathy or retinopathy. This supports the facts presented by Aiello *et al.* in their study.¹⁵

Altered levels of angiogenic and other growth factors after cataract surgery may induce sub-clinical or clinically visible worsening of maculopathy or retinopathy till 3 months.¹⁶ The present results showed more cases of clinically observed macular oedema in first postoperative week which eventually subsided in majority cases till 6 months period. This correlates subsequent improvement in visual outcome as well. Patel and colleagues provided rationale for this change.¹⁷ On day one, after uneventful phacoemulsification, levels of Vascular Endothelial Growth Factor (VEGF), hepatocyte growth factor, interleukin 1 and pigment epithelium derived factor concentration increases but then declines to pre-operative levels after one month.

Macular oedema is common after cataract surgery but it follows a benign course rather than a direct effect of surgery itself. It is important to differentiate diabetic macular oedema from pseudophakic cystoids macular oedema (Irvine Gass Syndrome). Postoperative fundus fluorescein angiography (FFA) may be helpful for distinction between the two.¹⁸ Even it may help to diagnose sub-clinical macular oedema as well. Treating postoperative diabetic macular oedema with Argon laser is controversial. Pollack and Dowler suggested that early laser treatment of all postoperative cases is unnecessary.^{1,11}

Patient's specific demographic and surgical factors may also influence the risk of DR progression. Poor glycemic control, male sex and prolonged surgical duration were all found to accelerate retinopathy in diabetic patients.^{19,20} In this study, glycemic control was optimized prior to surgery as well as patients with prior DR were excluded to eliminate any bias due to prevalent and progressing DR due to these factors.

However, there remain certain limitations due to hospital based nature of the study as well as the non-availability of fundus fluorescein angiography (FFA) and optical

coherence topography (OCT) in this setup. A large scale prospective study with larger sample size and a longer follow-up time is recommended for further evaluating the course of DR in diabetic cataract after phacoemulsification.

CONCLUSION

The study results fulfilled the objective set by the study protocol for this project of getting optimal visualization of posterior segment and clearing the ambiguity of decreased vision in diabetic patients caused either by cataract formation or macular oedema and advocates the use of early phacoemulsification in diabetic cataract. Furthermore, uncomplicated phacoemulsification does not accelerate diabetic macular oedema or retinopathy provided glycemic control and other co-morbidities are well addressed.

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