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To Study the Progression of Diabetic Retinopathy after Phacoemulsification in Diabetic Patients

Dr. Krishna Kuldeep[1*], Dr. Tirupati Nath[2], Dr. Anupriya Mehrotra[3], Dr. Mahendra Pratap Singh[4]
[1]Associate Professor, Department of Ophthalmology, S.N.M.C. Agra, Uttar Pradesh, India
[2]Assistant Professor, Department of Ophthalmology, S.N.M.C. Agra, Uttar Pradesh, India
[3]Junior Resident, Department of Ophthalmology, S.N.M.C. Agra, Uttar Pradesh, India
[4]Junior Resident, Department of Medicine, S.N.M.C. Agra, Uttar Pradesh, India

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***Corresponding author**
Dr. Krishna Kuldeep

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Abstract: To study the progression of diabetic retinopathy (DR) after Phacoemulsification in diabetic patients. 80 eyes of 80 patients with or without DR were evaluated prospectively following cataract extraction with PCIOL implantation between Dec.2015 to May 2017.Of the 80 patients 42 were women and 38 were men. Of the 80 eyes, 18 eyes (22.5%) had Mild DR and 2 eyes (2.5%) had moderate DR at baseline and remaining 60 eyes (75%) had no diabetic retinopathy. The ocular findings were recorded on each follow -up visit for at least 6 months. The degree of glycemic control was assessed by measurement of HbA1c. Progression of the retinopathy in diabetic eyes occurred in 22 eyes (27.5%) in the follow-up period. Out of 22 eyes, 12 eyes (15%) with mild NPDR progressed to moderate NPDR and 2 eyes (2.5%) of moderate NPDR progressed to severe NPDR.and 8 eyes (10%) without retinopathy developed mild non-proliferative diabetic retinopathy . Worsening of retinopathy was more in eyes with preexisting DR. Most of the patients obtained improved visual acuity. We found that most of the patients obtained good visual acuity, even those with mild to moderate NPDR. This study indicate that diabetic retinopathy worsen after cataract surgery. This worsening is higher in patient having preoperatively diabetic retinopathy, poor glycemic control and hard nuclear cataract which require more phaco time.

Keywords: HbA1C (Glycosylated haemoglobin), NPDR (Nonproliferative diabetic retinopathy), Phacoemulsification, PCIOL (Posterior chamber intraocular lens).

INTRODUCTION

Diabetes along with its fatal complications is one of the leading causes of mortality and morbidity. Chronic complications of DM includes macrovascular complications like coronary artery disease, cerebrovascular disease and peripheral vascular disease along with microvascular complications like retinopathy, nephropathy and neuropathy.The Retinovascular complications of diabetes are collectively called diabetic retinopathy(DR). It is the fourth major cause of blindness worldwide [1]. It is a Microangiopathy which primarily affects the precapillary arterioles, capillaries and post-capillary venules.

Diabetes is the most common risk factor for cataract development in underdeveloped countries. Furthermore, diabetic patient suffers lens opacity at an earlier age than individual without diabetes. The rate of cataract was 3-4 folds higher in diabetic patients who were younger than 65 and up to 2 fold higher in patients older than 65 compared with patients who were non diabetic.cataract surgery in diabetic patients may become necessary ,not only to improve vision but also to allow assessment and treatment of diabetic retinopathy. Cataract surgery in diabetic has been associated with a higher incidence of postoperative complication, including fibrinous uveitis, posterior capsular opacification, neovascularization of anterior segment, accelerated progression of retinopathy and macular edema.Some studies have reported that cataract surgery cause progression of retinopathy with new haemorrhage ,exudates and macular odema,and that progression is associated with poor visual prognosis [2-9], In another study, however, no increase in progression of retinopathy was observed after cataract surgery [10]. This progression may be due to increased breakdown of blood –retinal barrier or the enhanced inflammation that is seen in diabetic patients after cataract extraction and prolonged surgical time which is also associated with increased postoperative inflammation would effect a higher retinopathy progression rate.while progression of retinopathy has been shown to be related to the degree of glycemic

control [11,12]. With the progress of surgical techniques, the modern phacoemulsification is well known to have smaller incisions, quicker recovery of vision and less postoperative inflammation.

MATERIALS AND METHODS

80 diabetic patients with or without diabetic retinopathy underwent Phacoemulsification between December 2015 to may 2017, with foldable posterior chamber intraocular lens implantation in our department of ophthalmology. A full medical and ocular history was taken for each patient. We noted the number of year of diabetes had been present, the type of diabetic control and medication used other data collected forms medical chart Including – Age**,** sex**,** Duration of diabetes mellitus, type of diabetic therapy (insulin or oral), presence or absence of renal and heart disease and hypertension, Best corrected Visual acuity, tonometry, slit lamp examination and Stage of retinopathy at the time of surgery by indirect ophthalmoscopy and mean Glycosylated hemoglobin level (HbA_1c) with in 3 to 6 month, duration of surgery and intraoperative complication.

Inclusion Criteria

- All patients with type2 diabetes undergoing cataract surgery at department of ophthalmology.

Exclusion Criteria

- Type2 diabetic with associated systemic disease like Ischemic heart disease, Renal failure etc.
- Associated ocular diseases like glaucoma uveitis, corneal pathology, trauma etc.
- Uncontrolled blood sugar level, CSME
- Previous ocular surgery, previous laser treatment.
- Who develop intraoperative complications such as posterior capsular rupture.

The stages of retinopathy were examined using indirect ophthalmoscopy and were recorded on the charts and classified according to ETDRS classification

- No retinopathy,
- MildNPDR,
- ModerateNPDR,
- SevererNPDR,and
- PDR.

NON-PROLIFERATIVE DIABETIC RETINOPATHY (NPDR)

Mild non-proliferative retinopathy

At least one microaneurysm, and definition not met for moderate nonproliferative retinopathy, severe nonproliferative retinopathy, mild-moderate PDR or high risk PDR.

Moderate non-proliferative retinopathy

Haemorrhage and/or microaneurysm; and/or soft exudates, venous beading, or intraretinal microvascular abnormalities definitely present; and definition not met for severe NPDR, mild-moderate PDR, or high risk PDR were classified as a Moderate NPDR.

Severe Non-proliferative diabetic retinopathy-

The 4-2-1 rule; one or more of

- Severe haemorrhage in all 4 quadrants
- Significant venous beading in 2 or more quadrants
- Moderate Intraretinal microvascular anomalies in 1 or more quadrants

PROLIFERATIVE DIABETIC RETINOPATHY

Mild –moderate proliferative diabetic retinopathy

New vessels on the disc (NVD) or new vessels elsewhere (NVE), but definitiom not met for high risk proliferative retinopathy.

High risk proliferative diabetic retionopathy-

- New vessels on or with in one disc diameter of optic disc (NVD) greater than ETDRS standard photograph 10A (about one third disc area),
- Any NVD with vitreous or preretinal haemorrhage
- NVE greater than ½ disc area with vitreous haemorrhage.

Progression was defined as deterioration by one or more levels or the occurrence of CSME.

All of the phacoemulsificaion surgeries were performed by one experienced surgeon.The operative procedures consisted of peribulbar anesthesia, clear corneal incision, continuous curvilinear capsulorrhexis,hydrodisection, phacoemulsification with a bimanual divide-and-conquer technique, removal of cortex with irrigation/aspiration, implantation of foldable intraocular lens, and All of the cataract surgeries were uncomplicated.

All patients were follow up for 6 months (minimum period of follow up): at weekly for first month and fortnightly for next 2 months and 4weekly for the next 3 month. A complete ocular examination was perform at each follow-up visit, including

- VA
- BCVA
- Intraocular pressure,
- Slit-lamp examination
- Indirect ophthalmoscopy
- OCT (Optical coherence tomography)
- Fundus photo

RESULTS

Of the 80 patients 42 were female and 38 were male patients. Most of the patients (43.18%) presented with age between 51 to 60 years and mean age at the time of surgery was 58.68±56.65 years and mean duration of diabetic mellitus 10.84±7.75 years. 76 patients (95%) were treated with oral hypoglycemic

agents only four patients (5%) were on insulin treatment. All patients were follow up at least for 6 month.

Table-1: Preoperative status of diabetic retinopathy

Diagnosis	Total	
	N0.	%
WNL	60	75
Mild	18	22.25
Moderate	2	2.5
Severe	0	0
Total	80	100

In 10 eyes, cataract was advanced and preoperative assessment of retinopathy was not possible.immediately after lens removal the retinopathy was judged and recorded.60 eyes (75%) had no preoperative retinopathy. 18 eyes (22.25%) had mild nonproliferative diabetic retinopathy and 2 eyes (2.5%) had moderate nonproliferative diabetic retinopathy.

Table-2: Grades of Nuclear hardness and Avg phaco time

Nucleus grading	No.of cases	Avg phaco time(min)
NG-1	18	9
NG-2	28	13
NG-3	24	18
NG-4	10	25

Postoperative data

22 eyes (25%) demonstrated retinopathy progression over the follow-up period. 8 eyes (9.09%) without retinopathy preoperatively developed Mild nonproliferative diabetic retinopathy (Mild NPDR). 12 eyes (13.6%) with Mild retinopathy preoperatively progressed to moderate NPDR. 6 eyes of mild NPDR shows no changes and 2 eyes (2.27%) of moderate NPDR progressed to severe NPDR .Worsening of retinopathy in eyes with DR was higher than eyes with no-DR. Most of the Patients achieve good visual acuity

Table-3: Comparison of baseline and 1 month status of diabetic retinopathy

NPDR	WNL	Mild	Moderate	Severe	Total
Baseline	N=60(75%)	N=18(22.5%)	N=2 (2.5%)	N=0	80
After 1 month	58(72.5%)	20(25%)	2 (2.5%)	0	
progression	2	0	0	0	2

Table4. Comparision of baseline and 3rd month status of diabetic retinopathy

NPDR	WNL	Mild	Moderate	Severe	Total
Baseline	N=60(75%)	N=18(22.5%)	N=2(2.5%)	N=0	80
After 3 month	56 (70%)	18 (22.5%)	6 (7.5%)		
progression	4	4	0		8

Table-5: Comparision of baseline and 6th month status of diabetic retinopathy

	WNL	Mild	Moderate	Severe	Total
Baseline	N=60(75%)	N=18(22.5%)	N=2 (2.5%)	N=0	N=80
After 6 month	52 (65%)	14 (17.5%)	12(15%)	2(2.27%)	
Progression	8	12	2		22(27.5%)

Table-6: Progression of DR after 6 month

Progression	Total	
	N0	%
No change	58	72.5%
Normal to Mild DR	8	10 %
Mild to Mod.DR	12	15 %
Mod to Severe DR	2	2.5%
Total	80	100%

Table-7: Mean HbA1C

	Baseline HbA1C	3rd month HbA1c	6th month HbA1C
No DR	6.4	6.37	6.5
DR	6.84	7.6	8.1

Table-8: Postoperative visual acuity

LogMAR VA	Distribution	
	NO.	%
≤ 0.1	28	35
0.2 – 0.4	34	42.5
0.5 -0.7	16	20
≥ 0.8	2	2.5
Total	88	100%

Most of the patient obtained good visual acuity. A visual acuity better than 0.5 was achieved in 62 eyes (77.5%).
No patient developed complication of anterior eye segment (e.g. significant pressure rise, fibrin exudation, posterior synechia formation, pupillary block, or neovascularisation of iris).

Of the 80 eyes, 22 eyes (27.5%) shows progression of retinopathy. 8 eyes (10%) without retinopathy preoperatively developed Mild nonproliferative diabetic retinopathy (Mild NPDR). 12 eyes (15%) with Mild retinopathy preoperatively progressed to moderate NPDR and 2 eyes (2.5%) of moderate NPDR progressed to severe NPDR. 6 eyes of mild NPDR shows no changes we found that progression was related to Poor glycemic control (higher level of mean HbA1C) and prolonged surgical duration

DISCUSSION

Diabetes mellitus (DM) is a common condition of great public health importance.In DM cataract occurs earlier in diabetics than in non diabetics and both cataract and retinopathy are related to the age of the patients and the duration of the diabetes. Cataract surgery in diabetic patients may be performed to improve vision or to allow assessment of retinopathy. However, retinopathy also increases with age and duration of diabetes, Iris vessels have been shown to be more permeable in diabetics and diabetic iridopathy is usually associated with significant retinopathy. Subsequent studies have shown that use of procedure for diabetic patients provides a good visual rehabilitation

In our study most of the operated patients achieve good visual acuity and improved vision. The visual acuity was 0.5 or better was in 77.5% of the eyes.

Our result constrast with those of some studies, which have shown an increased risk of progression of retinopathy and worsening of vision after cataract surgery [2-9]. Progression in these studies included an exudative response. Patients with preoperative retinopathy were at greater risk [2,3]. Continuing neovascularization was a threat to vision [7]. Old age predicted low postoperative visual acuity in one previous study [9]. The degree of glycemic control, a known risk factor for retinopathy progression [11,12].

In previous studies, the progression of retinopathy occurred at the rate of 42% in 70 eyes [13], 13% in 91 eyes [14], 21% in47 eyes [15], and 20.4% in 93 eyes [16]. Studies [17,18] carried out previously suggested that the removal of the lens contributes to worsening of diabetic retinopathy. Many patients including those with diabetic retinopathy may have very high expectations from surgery.For this reason, patients with diabetic retinopathy and cataract need to be advised preoperatively that retinopathy and vision may worsen after cataract extraction .In most cases, retinopathy progression was characterized by worsening of non-proliferative retinopathy. Risk factors associated with worsening retinopathy after cataract surgery include pre-existing severely treated or untreated retinopathy,poor glycemic control,increasing age,and posterior capsular disruption .

In present study on ocular examination at baseline. 60 eyes (75%) had no preoperative retinopathy.18 eyes (22.5%) had mild nonproliferative diabetic retinopathy and 2 eyes (2.5%) had moderate nonproliferative diabetic retinopathy. After 6 month follow up of the 80 eyes, 22 eyes (27.5%) shows progression of retinopathy. 8 eyes (10%) without retinopathy preoperatively developed Mild nonproliferative diabetic retinopathy (Mild NPDR). 12 eyes (15%) with Mild retinopathy preoperatively progressed to moderate NPDR. 6 eyes of mild NPDR shows no changes and 2 eyes (2.5%)of moderate NPDR progressed to severe NPDR. We found that progression was related to higher level of mean HbA1C or poor glycemic control and prolonged surgical duration. This progression was more evident particularly in patients with pre-existing diabetic retinopathy.

Flanagan [23] pointed out that cataract surgery in diabetics with little or no retinopathy has the same

good prognosis as cataract surgery in non-diabetics. Eyes with minimal background retinopathy or no retinopathy have an excellent prognosis after cataract surgery with intraocular lens implantation [20,21]. However, in the presence of significant diabetic retinopathy the results can be disappointing [23]. The results of our present study confirmed that the patients with preexisting diabetic retinopathy have a worse visual prognosis than those without retinopathy. In our series 0.5 or better visual acuity (Snellen lines) was achieved in 77.5% of eyes. Raskauskas *et al*. [20] reported that visual acuity improved by two Snellen lines or more in 40% with eyes in DR and worsened in 25% of eyes with DR.

Some studies have reported an increased incidence of neovascular glaucoma and continuing retinal neovasculrisation following cataract surgery. This was not observed in any of our patients.

In our study, progression of retinopathy following cataract surgery was related to degree of glycemic control as assessed by the mean level of HbA1C before surgery and during the follow up period. Glycemic control for retinopathy progression are in accordance with those found in other studies [11,12] the finding of our study should be interpreted cautiously because of the small no. of patients and the short follow up time.

One might conclude that in the current study visual prognosis after cataract surgery was good .Those patients whose retinopathy progressed most had preoperative retinopathy and poorer glycemic control and hard nuclear cataract which require more phaco time. It is possible that these factors in conjunction with the trauma of surgery in some patients caused the increased progression of retinopathy after cataract surgery.

CONCLUSION

We found that most of the patients obtained good visual acuity, even those with mild to moderate NPDR. This study indicates that diabetic retinopathy worsens after cataract surgery. This worsening is higher in patient having diabetic retinopathy preoperatively and poor glycemic control.and hard nuclear cataract which require more phaco time.

It should be emphasized that the present study was based on a small number of patients and short follow up,while our result are encouraging a larger study with a longer follow up.

DR is one of the major causes of incurable blindness. Proper management of diabetic mellitus and Diabetic Retinopathy before and after cataract surgery is helpful to preserve the vision from its deterioration.

Some of the important recommendations are summarized as follows

- It is better to postpone cataract surgery as late as possible till the patient demands clear vision or surgeon have difficulty in fundus examination or laser treatment due to cataract.
- If laser is indicated it is better to perform this treatment before cataract surgery and if it is not possible, do laser after cataract extraction.
- Preoperative good control of blood sugar (glycelated hemoglobin level) and hypertension (130/80 mm of Hg) is necessary.
- It is better to perform cataract surgery by an experienced surgeon.
- Regular follow up after cataract surgery to evaluate progression of DR and for early laser treatment if indicated

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