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Original Research Article

A Study of Analysis of Factors Affecting Progression of Diabetic Retinopathy Post Cataract Surgery in Patients with Type II Diabetes Mellitus

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Abstract:

Aim: To analyze the progression of diabetic retinopathy during the first year post-cataract extraction in operated and non- operated eyes.

Method: This hospital based Prospective study conducted in 100 patients with diabetes mellitus who underwent cataract surgery (CS) at Department of Ophthalmology, Govt. medical college, Anantapuramu during study period of 2021 to 2022. Outcome variables include assessment of visual acuity, Slitlamp examination, direct and indirect Ophthalmoscopy.

Results: Mean age of the study participants was 68.5± 12.5 yrs. Females were outnumbered i.e. 56%. The mean duration of DM was recorded as 13.5 ± 7.5 yrs. Mean fasting blood sugar in the study subjects was 170.1± 40.5 mg/dl. Pre-operative Visual acuity in fellow eye was >6/12, 6/12-6/18, 6/24-6/36 and ≤6/60 in 13%, 42%, 31% and 14% of the cases. Pre-operative visual acuity was 6/12-6/18, 6/24-6/36 and ≤6/60 in 29%, 38% and 33% of operated eye cases. Pre-operative cataract analysis shows 29% of the cases had immature cataract, and 71% of the cases had no cataract in the fellow eye. Pre op Diabetic retinopathy (DR) assessment in the operated eye shows 35% had no signs of DR, 44% cases had mild Non Proliferative Diabetic Retinopathy (NPDR) and 21% had moderate NPDR. Whereas in fellow eye, 49% had no NPDR, 38% had mild NPDR and 13% had moderate NPDR. Post- operative DR was progressed in 31% in fellow eye and 45% in Operated Eye whereas DR status was static among 69% in fellow eye and 55% in Operated Eye.

Conclusion: Diabetic Retinopathy progression was high in the operated eye compared to the fellow eye. Progression of Diabetic Retinopathy was significantly associated with HbA1c. Progression of Diabetic Retinopathy was not associated with hypertension, dyslipidaemia, smoking and duration of DM.

Keywords: Diabetic retinopathy, Cataract surgery, Visual outcome, Intraocular Lens.

Introduction

Cataract is the primary cause of blindness globally. Patients with diabetes mellitus are two to five times more likely to develop cataracts, and they often do so earlier. Clinical signs of diabetic retinal neurodegeneration include the reduction of the retinal nerve fiber layer, ganglion cell layer, and Muller cells, colour vision loss, and alterations in spatial frequency in electrophysiology. [1,2]

Retinal neurodegeneration in diabetes has already been identified, and it has been suggested that it might precede or develop simultaneously with retinal vasculopathy. Diabetes results in structural and morphological alterations in the cornea tear film, and crystalline lens in addition to retinal abnormalities, which impair the diabetic eye's optical quality. [3] Cataract is the major cause of blindness, affecting around 18 million people globally. As cataract's development and progression speed up with age, it is believed to be a substantial cause of vision impairment in diabetic patients.

According to some studies, performing CS on diabetic patients may cause DR to progress relatively quickly, trigger vitreous haemorrhage, cause iris neovascularization, and finally impair or impair vision.[4] The presence, severity, and potential aggravation of diabetic retinopathy following CS in diabetic patients all affect the visual prognosis. The postoperative start of CMO, which can happen even without the onset or exacerbation of diabetes retinopathy, may particularly affect the visual result. Diabetes duration, diabetes start at a younger age, the existence of SBP, cholesterol, and HbA1C,

among others, are risk factors for DR. Cataract removal has also been recognized as a significant ocular component related with DR advancement in addition to these systemic variables. [5]

Due to hyperglycemia and the impaired BA or BRB, cataracts may appear sooner in life, mostly in people with diabetes. Breakdown of all these obstacles may also make post-CS inflammation worse, and this vicious loop may lead to the advancement of DR. [6,7] The pattern of DR's worsening following CS was reported. [8]

Inpatients with DM, stopping the retinopathy progress and maculopathy progress after CS is crucial for enhancing visual prognosis, but the best way to do so is still unclear. According to reports, patients who receive PE have a low chance of postop retinopathy advancement than those who undergo extracapsular cataract extraction, however 20%–30% of patients still experience postop progression after PE. Systemic variables, the preop stage of retinopathy, the natural course of the disease and surgical procedures are some of the factors that contribute to the advancement following CS. [9,10]

Current study examined the effect of CS on the visual outcome and progression and it's pattern of diabetic retinopathy.

Materials & Methods

Study Design: Prospective hospital based observational study.

Study Setting: Department of Ophthalmology, Dept. of Ophthalmology Govt. medical college, Anantapuramu.

Study Subject: Diabetic patients undergoing CS in the department of Ophthalmology at Govt. medical college, Anantapuramu.

Study period: 2021 to 2022.

Sample Size: The sample size was calculated using the formula $n=4pq/d^2$, where p = prevalence of dry eye in patients with Pterygium, 50% by the study of

q = 100-p

d = clinically allowable error which is 20% of prevalence. Power of study at a significance level of 0.05 is 80%.

N=100.

Study Material:

- Pre-tested questionnaire
- External eye examination under torchlight
- Schirmer test with anesthesia & without anesthesia
- Slit lamp examination and direct ophthalmoscopy
- Tear film Break–up Time test.
- Marginal tear film Meniscus Height.

Inclusion criteria

Patients with

- Type-2 diabetes mellitus for > 5 years.
- No or mild or moderate NPDR without CSMO.
- Immature cataract in the study eye.
- Either no cataract or immature cataract in the fellow eye.

Exclusion criteria:

- Patients with severe NPDR and PDR.
- Pseudophakic patients.
- Corneal opacity.
- Mature cataract.
- Patients having undergone previous laser treatment.

Method:

Informed consent and proforma-wise information collected from each patient. The following details were arbitrarily taken.

Data collection:

The lead investigator used a pre-structured proforma to evaluate participants' demographic and clinical presentation after obtaining written informed consent. The lead researcher then evaluated the participants' full medical history and conducted a clinical examination of the patients. Outcome includes assessment of visual acuity, Slitlamp examination, Direct & indirect Ophthalmoscopy.

Data Analysis:

Collected data was entered in a Excel sheet and data was analysed using SPSS ver 20.0 software. Descriptive statistics with mean, standard deviation and proportions (%) were calculated for quantitative variables. To test the hypothesis Chi Square test, Mann Whitney U test were used. P value of $\leq$ 0.05 is considered as statistically significant.

Results

Majority cases were between 61-80 years accounts 68%. The mean age of the study participants was 68.5± 12.5 yrs. Females were outnumbered i.e. 56%. The duration of DM was higher in 11-15 years, which accounts 32%, followed by 28% in 6-10 years. There were 19% of cases had the history of DM since > 15 years. The mean duration of DM was recorded as 13.5 ± 7.5 yrs. Hypertension noted in 38% patients, Dyslipidemia in 35% cases, smoking habit in 22%, and alcohol drinking habit in 26% cases respectively. Mean FBS value among the study subjects was 170.1± 40.5 mg/dl, mean PPBS was 245.5 ± 70.7 mg/dl while mean HbA1c is 8.5 ± 2.8%. According to medication taken for DM 59% cases were on OHA,

4% were on Insulin whereas 37% were on both OHA and Insulin. Left eye was operated among 47% of the cases, while for 53% of the cases right eye was operated. Pre-operative visual acuity in the operated eye was 6/12-6/18, 6/24-6/36 and ≤6/60 in 29%, 38% and 33% of the cases respectively. Visual acuity in fellow eye was >6/12, 6/12-6/18, 6/24-6/36 and ≤6/60 in 13%, 42%, 31% and 14% of the cases respectively.

On assessing the pre-operative cataract status 29% of the cases had immature cataract while 71% of the cases had no cataract in the fellow eye.

On assessing the pre op DR status in the operated eye 35% of the cases had no signs of DR, while 44% of the cases had mild NPDR and 21% of the cases had moderate NPDR. In fellow eye 49 of the cases had no NPDR, 38% of the cases had mild NPDR and 13% of the cases had moderate NPDR.

Diabetic maculopathy at the time of surgery was recorded to be dry among 57% of the cases, Macular edema but not CSMO among 34% of the cases and treated CSMO among 9% of the cases.

Post-operative DR was progressed in 31% of the cases in fellow eye and 45% of the cases in operated eye. There was significant association noted for post- operative DR between operated eye and fellow eye.

In this present study the association between DR progressed cases and DR static cases in the operated eye based on pre- operative HbA1c was statistically significant, whereas the association between DR progressed cases and DR static cases in the fellow eye for HbA1c was also significant.

On assessing the duration of DM the association between DR progressed cases and DR static cases in the operated eye were insignificant. Similarly the association for duration of DM in the fellow eye among DR progressed and DR static cases were also insignificant.

Depending on the type of medication for DM in the operated eye significant association was recorded between DR progressed and DR static patients with p value of <0.05 whereas in the fellow eye, the association between DR progressed and DR static patients was significant with p value noted as <0.05.

There was insignificant association noted between DR progressed cases and DR static cases in operated eye and fellow eye for dyslipidaemia status.

In this present study the association between DR progressed and static cases was not significant for smoking habit in the fellow eye, while the association between DR progressed and static cases in operated eye was insignificant for smoking habit.

In this present study the association between DR progressed and static cases was not significant for alcohol consumption in the fellow eye, while the association between DR progressed and static cases in operated eye was insignificant for alcohol consumption.

Post-operative visual acuity was found to be >6/12, 6/12-6/18, 6/24-6/36 and ≤6/60 among 28%, 35%, 29% and 8% of the cases respectively in the operated eye while visual acuity was >6/12, 6/12-6/18, 6/24-6/36 and ≤6/60 among 5%, 37%, 34% and 24% of the patients in the fellow eye respectively.

On assessing the post-operative cataract status in the operated eye Pseudophakia was seen visualized among 100% of the cases while in the fellow eye 41% of the cases had immature cataract and 59% of the cases had no cataract.

Based on the post-operative DR in the operated eye no DR was noted among 19% of the cases, mild NPDR among 43% of the cases and moderate NPDR among 38% of the cases. In the fellow eye 38% of the cases had no DR, 42% of the cases had mild NPDR and 20% of the cases had moderate NPDR.

In this study, there was significant association noted for grades of DR between patients with pre-operative and post-operative DR condition. The p value was recorded as 0.02.

Progression of Retinopathy during the First Year after Cataract Extraction in Operated and None Operated Eyes is shown below. The percentage of patients who had their eyes operated on showed the fastest progression of retinopathy, from two weeks to three months, at >50%.

The postoperative progression of retinopathy and the final visual status were affected by the posterior capsular rent, one of the intraoperative complications, which was found in three eyes (3% of cases).

CMO and PCO were two of the late post-operative problems that affected patients' 18 (18%) and 8 eyes (8%), respectively.

Table 1: Pre op VA, Cataract status, and DR status

Pre op VA	Operated Eye	Fellow Eye
>6/12	0	13
6/12-6/18	29	42
6/24-6/36	38	31
≤6/60	33	14
Pre op cataract status		
Immature cataract	100	29
No cataract	0	71
Pre op DR status		
None	35	49
Mild NPDR	44	38
Moderate NPDR	21	13

Table 2: Factors affecting diabetes retinopathy

Factors		Operated Eye		p value	Fellow Eye		p value
		DR progressed	DR static		DR progressed	DR static	
Pre Op HbA1c	≤ 7.5%	10	35		7	38	
	>7.5%	35	20	0.0002	24	31	0.0019
Duration of DM	≤ 10 years	21	28	0.7	17	32	0.4
	>10 years	24	27		14	37	
DM Treatment	Insulin	32	9	<0.05	22	19	<0.05
	OHA	13	46		9	50	
Hypertension	Present	20	18	0.3	14	24	0.5
	Absent	25	37		17	45	
Dyslipidemia	Present	15	20	0.7	11	24	0.78
	Absent	30	35		20	45	

Table 2: Post-operative VA, cataract status, and DR status in both

Post op VA	Operated Eye	Fellow Eye
>6/12	28	5
6/12-6/18	35	37
6/24-6/36	29	34
≤6/60	8	24
Post op cataract status		
Pseudophakia	100	0
Immature cataract	0	41
No cataract	0	59
Post op DR status		
None	19	38
Mild NPDR	43	42
Moderate NPDR	38	20

Table 3: Grades of diabetic retinopathy vs diabetic retinopathy status

Grades of DR	DR status		P value
	Pre op	Post op	
None	35	19	0.025
Mild NPDR	44	43	
Moderate NPDR	21	38	
Total	100	100	

Table 4: Progression of diabetic retinopathy at follow up visits

Follow up period	Operated Eye		Non-operated Eye	
	N	%	N	%
2 weeks-3 months	29	29	15	15
4-6 months	40	40	26	26
7-12 months	45	45	31	31

Discussion

In our study, on assessing the pre-operative cata-

ract status, 29% cases had immature cataract while 71% had no cataract in the fellow eye. On assessing the pre op DR status in the operated eye 35% had no signs of DR, while 44% had mild NPDR and 21% had moderate NPDR. Post-operative DR was progressed in 31% in fellow eye and 45% in operated eye whereas DR status was static among 69% in fellow eye and 55% in operated eye. There was significant association noted for post- operative DR between operated eye and fellow eye.

In our study, the association between DR progressed cases and DR static cases in the operated eye based on pre- operative HbA1c was statistically significant. The association between DR progressed cases and DR static cases in the fellow eye for HbA1c was also significant.

On assessing the post-operative cataract status in the operated eye Pseudophakia was seen visualized in total the cases while in the fellow eye 41% of the cases had immature cataract and 59% of the cases had no cataract.

Based on the post-operative DR in the operated eye, mild NPDR among 43% of the cases and moderate NPDR in 38% of the cases. In the fellow eye, 42% of the cases had mild NPDR and 20% of thecases had moderate NPDR. There was significant association recorded for grading of DR between patients with pre-operative and post-operative DR condition. Findings of the current study were comparable with the findings of Cheng H et al, [11] where they reported that in the lack of DR, the visual result following cataract surgery was good and did not differ significantly from that of non-DM patients. The prognosis was correlated with the severity of DR and considerably worse visual outcomes were seen in DR-affected eyes.

Clinical CMO occurred in eyes with DR much more frequently than in eyes without, and there were considerably more eyes with DR that went blind or lost some of their vision. Cunliffe et al [12] studied each and every DM who undergone ECCE with IOL implantation, along with a comparable number of non-DM matched controls. Following surgery, the eyes of 76% of cases with DM had an improvement of at least two lines in Snellen acuity. 68% of the patients' eyes and 83% of controleyes had vision that was 6/12 or better. The status of the DR, particularly the maculopathy, affected the visual prognosis in DM patients. Although postoperative inflammation was more common in the DM group, ongoing neovascularization was the main cause of problems. If a large, sufficient capsulotomy is undertaken for capsular thickening, early postop laser photocoagulation can help to minimize these proliferative problems. The existence of an IOL does not obstruct this photocoagulation.

In our current study, on assessing the pre-operative cataract status 29% had immature cataract while 71% had no cataract in the fellow eye. On assessing the pre op DR status in the operated eye 35% had no signs of DR, while 44% of had mild NPDR and 21% had moderate NPDR. In fellow eye 49 had no NPDR, 38% of the cases had mild NPDR and 13% had moderate NPDR. Diabetic maculopathy at the time of surgery was recorded to be dry among 57% cases, Macular edema but not CSMO among 34% and treated CSMO among 9%. In consistent with this study, Hykin P G et al [13] figured out the visual prognosis, the incidence of complications, and the best management plan for PDR in isolated ECCE. In DM patients with PDR, final visual acuity following cataract removal is typically poor; however, in peoples with quiescent PDR and no maculopathy, visual acuity may be acceptable. Active proliferative DR during the surgery is related with postop deterioration of DR and fibrinous uveitis, which may prevent prompt post-operative panretinal photocoagulation was a poor prognostic sign for ultimate visual acuity. Dowler et al [14] compared to quiescent proliferative DR, maculopathy was a more effective predictor of postop visual acuity > 6/12. The main factors affecting post-operative visual acuity in diabetics are the stage of DR along with maculopathy before cataract surgery.

In the present study, Post-operative DR was progressed among 31% in fellow eye and 45% in operated eye whereas DR status was static among 69% in fellow eye and 55% in operated eye. There was significant association noted for post- operative DR between operated eye and fellow eye.

In this present study the association between DR progressed cases and DR static cases in the operated eye based on pre- operative HbA1c was statistically significant, whereas the association between DR progressed cases and DR static cases in the fellow eye for HbA1c was also significant. On assessing the duration of DM the association between DR progressed cases and DR static cases in the operated eye were insignificant. Similarly the association for duration of DM in the fellow eye among DR progressed and DR static cases were also insignificant.

However, Krepler K et al [15] stated that modern CS seems to have no influence on the progress of DR. A visual improvement is seen in the most of patients with NPDR, but poorervisual outcome is observed in patients developing MO.

In this study, based on the post-operative DR in the operated eye no DR was noted among 19%, mild NPDR among 43% and moderate NPDR among 38%. In the fellow eye, 38% had no DR, had mild NPDR and had moderate NPDR. In this study there was significant association noted for grading of DR between patients with pre-

operative and post- operative DR condition. Suto C et al [16] also examined how perioperative glucose management affected the development of DR and maculopathy.

They claimed that there was no appreciable variations in the rate at which DR progressed between the poor glycemic, excellent glycemic and control groups. However, compared to the other 2 groups, the group that received fast control had a considerably greater rate of DM maculopathy development. In the fast control group, patients with moderate- severe NPDR before to surgery had considerably greater rates of DR and maculopathy progression. They came to the conclusion that in patients with moderate to severe NPDR, fast preoperative glycemic control should be avoided since it may raise the risk of postop progression of DR and maculopathy.

In this study, depending on the type of medication for DM in the operated eye significant association was recorded between DR progressed and DR static patients whereas in the fellow eye, the association between DR progressed and DR static patients was significant.

In this present study the association between DR progressed and static cases was not significant for alcohol consumption in the operated eye, while the association between DR progressed and static cases was insignificant for alcohol consumption. However, Katsimpris et al [17] in their study, diabetic patients without DR and normal individuals' changes in CFT following CS were examined and compared. According to their findings, after CS, eyes of DM patients without DR exhibit higher CFT and a high rate of CME than eyes of healthy controls. This may help to explain why these individuals' post-cataract surgery visual acuity was inadequate. Liu L et al [18] evaluated the associations between preoperative HbA1c, DR severity, diabetes duration, insulin reliance, and visual prognosis in patients with DM after PE for cataract. Patients with DR and cataracts had a lower chance of having 20/20 vision, but they had the same number of lines of vision after PE as patients without diabetes. They were unable to find any proof that diabetic patients with high HbA1c levels should postpone CS.

The percentage of patients who had their eyes operated on showed the fastest progression of retinopathy, from two weeks to three months, at >50%

Conclusion

There was significant association noted for post-operative DR between operated eye & fellow eye. Diabetic Retinopathy progression was remarkably high in the operated eye than fellow eye. Progression of DR was significantly associated with HbA1c levels. Progression of DR was not associated with hypertension, dyslipidaemia, smoking and duration of diabetes. Pre and post op grades of DR were significantly associated one year post-CS-follow up. Other factors influenced post-operative visual outcome were the incidence of CMO and PCO in 18% and 8%.

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