

Progression of diabetic retinopathy after cataract extraction with intraocular lens implantation

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Abstract

Aim of the study is to observe the progression of diabetic retinopathy in patients after cataract extraction and placement of intraocular lens implantation. Diabetes affects both the anterior as well as the posterior segment of the eyes. In this study we observed the progression of the diabetic retinopathy following uncomplicated cataract surgery with intraocular lens implantation over a one year period and found that the maximum progression was seen at the end of 1 year in patients of age group 56-65 with no gender predilection. Cataract surgery in diabetic patients can be performed with an acceptable risk of complications and worsening of diabetic retinopathy seems to be correlated not with the cataract surgery but with the natural course of diabetic vascular disease.

Keywords: Cataract, Diabetic retinopathy, Intraocular lens implantation, Maculopathy, Progression.

Introduction

Diabetes mellitus (DM) is a systemic disorder of carbohydrate metabolism in which the main finding is chronic hyperglycaemia. The cause is due to either impaired insulin secretion or impaired insulin action or both. Uncontrolled DM affects many organs and one of the most important one to be affected are the eyes which can lead to blindness due to diabetic retinopathy (DR) and maculopathy. It also leads to true diabetic cortical cataract called as the snow flake cataract.

Diagnostic Criteria¹

1. HbA1c $\geq 6.5\%$ (≥ 48 mmol/mol)
2. Random plasma glucose ≥ 200 mg/dl (≥ 11.1 mmol/l)
3. Fasting plasma glucose ≥ 126 mg/dl (≥ 7.0 mmol/dl)
4. OGTT 2-hour glucose in venous plasma ≥ 200 mg/dl (≥ 11.1 mmol/l)

The eye is one of the most important target organ affected by DM and it causes various complications leading to significant vision loss and blindness. Among these, cataract and diabetic retinopathy (DR) is the most common manifestation and important cause of preventable and avoidable blindness in patients aged between 50-65 years. It is estimated that around 72 million of the global adult population (around 8.2%) has diabetes and about one-fifth of all adults with diabetes lives in the South-East Asia. In India, around 65 million people have diabetes.² It is estimated that 65 million (17%) of 382 million persons with diabetes mellitus (DM) globally reside in India. While globally 35% persons with DM have diabetic retinopathy.³

Materials and Methods

A total of 90 patients with significant cataracts with or without diabetic retinopathy were included in

the study. All these patients underwent cataract surgery in one eye and the operated eye was considered as study eye and the fellow eye as the control eye. All the patient's thorough history and clinical examination were done to assess the presence of DR and the staging were done and grouped in the study with informed consent from all patients and enrolled for the study. This prospective case control study was conducted at Aravind eye hospital, Tirunelveli between August 2004 and September 2006 and was approved by the institutional ethics committee and review board.

Both the eyes were followed up at 1 month, 3 months, 6 months and 12 months after the surgery. At every visit best corrected visual acuity (BCVA) with refraction, Intraocular pressure (IOP) and dilated fundus evaluation was done. The assessment and classification of DR was done using the modified Early Treatment Diabetic Retinopathy Study (ETDRS) guidelines.⁴

Inclusion Criteria: All patients with type 1 or 2 Diabetes mellitus (DM) with or without diabetic retinopathy (DR) and cataract in one or both eyes who underwent a complicated or an uncomplicated cataract surgery with artificial intraocular lens implantation (IOL).

Exclusion Criteria: Patients with other systemic diseases which also affect the retina like hypertension, dyslipidemia, nephropathy and those patients with retinal pathologies like hereditary retinal dystrophies, macular dystrophies, age related macular degeneration. Patients with co-existent glaucoma, uveitis, prior ocular trauma or any previous intraocular surgeries were also excluded.

All the patients in the study after the history taking regarding the duration and treatment of DM were subjected to standard ocular examination consisting of best corrected visual acuity for distance and near, slit

lamp biomicroscopy, intra ocular pressure (IOP) measurement and dilated fundus evaluation with classification of the presence of DR and maculopathy according to the ETDRS classification and grouped for the study and underwent cataract surgery with IOL implantation in one eye which became the case eye and the fellow eye became the control eye. These patients were followed for a period of 12 months after the surgery at end of 1 month, 3 months, 6 months and 12 months of their post operative period. Fundus fluorescein angiography (FFA) and optical coherence tomography (OCT) were done whenever indicated for the further management of DR in the follow up period and laser photocoagulation were done in patients requiring them. In patients with poor vision and vision loss not corresponding to the amount of lens opacity were evaluated with OCT-macula to rule out any macular pathology prior to surgery and the macular thickness were documented.

Pearson Chi square test was used to analyze the distribution of age, gender and laterality versus progression of DR in the control and case group. Mann-Whitney U test was used to analyze the duration of DM versus progression in the control and case group. Fisher's exact test was used to analyze the presence of Clinically Significant Macular Edema (CSME) in both the groups and a P-value of less than 0.05 was considered to be of statistical significance.

Results and Discussion

A total of 90 patients were enrolled in the study and followed up for a period of 12 months. Maximum progression of diabetic retinopathy was seen at the end of 12 months of follow up in both the groups among patients in the age group of 56-65 years which was 48.9% and 47.1% respectively. We did not find any statistically significant difference among the gender even though there was a slight male predominance as well as between the right eye and the left eye. The duration of the presence of diabetes significantly affected the post operative progression of DR. The eyes which underwent cataract surgery with IOL implantation showed more progression of DR as compared to the non operated eyes and were statistically significant. More number of patients progressed to proliferative DR from severe NPDR or from moderate NPDR in operated eyes as compared to non operated eyes and were statistically significant. There was also statistically significant progression with respect to clinically significant macular edema (CSME)

among the operated eyes while none had CSME in the non operated eyes. We found that more the pre-operative baseline DR more the progression of DR in the post-operative period after cataract surgery with IOL implantation over an observed period of 12 months in this study. Diabetic patients have an increased risk of cataract development and Cataract extraction (CE) in diabetic patients as compared to non-diabetic patients is associated with higher risks of complications such as capsular contraction and early posterior capsule opacification as well as post-surgical worsening of macular edema (ME) and DR.⁵

In this paper, we analyzed the DR progression following cataract surgery and found that eyes which underwent cataract surgery showed more progression of DR when compared to non operated eyes and even though significant statistically cannot be taken as a contraindication for cataract surgery as the cataract itself will preclude the treating physician/ophthalmologist to look at the fundus for screening and staging of DR for follow up of these patients. Cataract surgery in diabetic patients can be performed with an acceptable risk of complications and worsening of diabetic retinopathy seems to be correlated not with the cataract surgery but with the natural course of diabetic vascular disease was the conclusion in a study done by Wagner et al⁶ and in another study done by Ostri et al they concluded that the cataract surgery improved the final visual outcome in patients with DR and cataract regardless of the degree of DR and the apparent progression of DR reflect the masking of low grades of diabetic retinopathy by preoperative lens opacities.⁷ Progression of DR and development of rubeotic glaucoma was reported by Sadiq et al following cataract surgery in DM and DR patients.⁸ A similar study involving 50 patients was studied by Krepler et al in 2002 which concluded that cataract surgery have no influence on the progression of diabetic retinopathy and visual improvement was achieved in the majority of patients with NPDR, but poorer visual outcome was observed in patients developing macular edema following the cataract surgery.⁹ This study did not take into consideration and compare the different types of intraocular lens used in these patients who underwent cataract surgery but compared the type of surgery (Phacoemulsification versus small incision sutureless cataract surgery) with the progression of DR (Table 5 and 6).

Table 1: (Age vs DR status in operated and non operated eyes)

A. Age vs DR status for operated eyes-(p=0.029) pearson chi-square test				
Age	details	DR Status-final		Total
		No change	Progression	
< 45	count	2		2
	% within age	100%		100%
	% within DR status-final	4.4%		2.2%

45-55	count	2	11	13
	% within age	15.4%	84.6%	100%
	% within DR status-final	4.4%	24.4%	14.4%
55-65	count	28	22	50
	% within age	56%	44%	100%
	% within DR status-final	62.2%	48.9%	55.6%
65-75	count	13	12	25
	% within age	52%	48%	100%
	% within DR status-final	28.9%	26.7%	27.8%
Total	count	45	45	90
	% within age	50%	50%	100%
	% within DR status-final	100%	100%	100%

B. Age vs DR status for unoperated eyes-(p-0.582) pearson chi-square test				
AGE	Details	DR status-final		Total
		No change	Progression	
< 45	Count	2		2
	% within age	100%		100%
	% within DR status-final	2.7%		2.2%
45-55	count	9	4	13
	% within age	69.2%	30.8%	100%
	% within DR status-final	12.3%	23.5%	14.4%
55-65	count	42	8	50
	% Within age	84%	16%	100%
	% Within DR status-final	57.5%	47.1%	55.6%
65-75	count	20	5	25
	% within age	80%	20%	100%
	% Within DR status-final	27.4%	29.4%	27.8%
Total	count	73	17	90
	% within age	81.1%	18.9%	100%
	% Within DR status-final	100%	100%	100%

Table 2: (DR status Vs Gender in operated and non operated eyes)

A. DR status vs gender for operated eyes-(p-0.667) pearson chi-square test				
Gender		DR status-final		Total
		No change	Progression	
Male	Count	26	28	54
	% Within gender	48.1%	51.9%	100%
	% Within DR status-final	57.8%	62.2%	60%
Female	Count	19	17	36
	% Within gender	52.8%	47.2%	100%
	% Within DR status-final	42.2%	37.8%	40%
Total	Count	45	45	90
	% Within gender	50%	50%	100%
	% Within DR status-final	100%	100%	100%

B. DR status vs gender for unoperated eyes-(p-0.995) pearson chi-square test				
Gender		DR status-final		Total
		No change	Progression	
Male	count	43	10	53
	% within gender	81.1%	18.9%	100%
	% within DR status-final	58.9%	58.8%	58.9%
Female	count	30	7	37
	% within gender	81.1%	18.9%	100%
	% within DR status-final	41.1%	41.2%	41.1%

Total	count	73	17	90
	% within gender	81.1%	18.9%	100%
	% within DR status-final	100%	100%	100%

Table 3: (DR status Vs Laterality in operated and non operated eyes)

A. DR status vs laterality for operated eyes-(p-0.670) pearson chi-square test				
Eye		DR Status-Final		Total
		No change	Progression	
Right	Count	27	25	52
	% Within eye	51.9%	48.1%	100%
	% Within DR status-final	60%	55.6%	57.8%
Left	Count	18	20	38
	% Within gender	47.4%	52.6%	100%
	% Within DR status-final	40%	44.4%	42.2%
Total	Count	45	45	90
	% Within eye	50%	50%	100%
	% Within DR status-final	100%	100%	100%

B. DR status vs laterality for unoperated eyes-(p-0.346) pearson chi-square test				
Eye		DR Status-Final		Total
		No change	Progression	
Right	Count	35	6	41
	% Within eye	85.4%	14.6%	100%
	% Within DR status-final	47.9%	35.3%	45.6%
Left	Count	38	11	49
	% Within gender	77.6%	22.4%	100%
	% Within DR status-final	52.1%	64.7%	54.4%
Total	Count	73	17	90
	% Within eye	81.1%	18.9%	100%
	% Within DR status-final	100%	100%	100%

Table 4: DR status vs duration of DM in operated and non operated eyes

A. DR status vs duration of DM for operated eyes-(P<0.01) Mann Whitney U test						
DR Status-Final	N	Range	Minimum	Maximum	Mean	Std. Deviation
No Change Duration (in months)	34	168	12	180	52.06	47.925
Progression Duration (in months)	41	294	6	300	124.76	66.337

A. DR status vs duration of DM for operated eyes-(P-0.015) Mann Whitney U test						
DR Status-Final	N	Range	Minimum	Maximum	Mean	Std. Deviation
No Change Duration (in months)	60	294	6	300	84.75	68.032
Progression Duration (in months)	15	216	24	240	128	63.606

Table 5: (DR status vs Surgery type in operated eyes)

DR Status vs surgery type for operated eyes-(p-0.197) pearson chi-square test				
Surgery Type		DR status-final		Total
		No change	Progression	
PHACO	Count	24	30	54
	% within surgery type	44.4%	55.6%	100%
	% within DR status-final	53.3%	66.7%	60%
SICS	count	21	15	36
	% within surgery type	58.3%	41.7%	100%
	% within DR status-final	46.7%	33.3%	40%
Total	count	45	45	90
	% within surgery type	50%	50%	100%
	% within DR status-final	100%	100%	100%

Table 6: (Course of DR vs surgery type)

Course of DR vs surgery type-(P-0.769) pearson chi-square test				
Course of DR	Details	Surgery type		Total
		PHACO	SICS	
No DR to NPDR	Count	13	8	21
	% Within course of DR	61.9%	38.1%	100%
	% Within surgery type	43.3%	53.3%	46.7%
Aggravation of DR	Count	11	7	18
	% Within course of DR	63.6%	36.4%	100%
	% Within surgery type	23.3%	26.7%	24.4%
No DR to PDR	Count	1	0	1
	% Within course of DR	100%	0%	100%
	% Within surgery type	3.3%	0%	2.2%
NPDR to PDR	Count	9	3	12
	% Within course of DR	75%	25%	100%
	% Within surgery type	30%	20%	26.7%
Total	Count	30	15	45
	% Within course of DR	66.7%	33.3%	100%
	% Within surgery type	100%	100%	100%

Table 7: (Course of DR vs group)

roup vs course of DR-(p-0.091) pearson chi-square test				
Course of DR	Details	Group		Total
		Cases	Control	
No DR to NPDR	Count	21	10	31
	% Within course of DR	67.7%	32.3%	100%
	% Within group	46.7%	58.8%	50%
Aggravation of DR	Count	11	7	18
	% Within course of DR	61.1%	38.9%	100%
	% Within group	24.4%	41.2%	29%
No DR to PDR	Count	1	0	1
	% Within course of DR	100%	0%	100%
	% Within group	2.2%	0%	1.6%
NPDR to PDR	Count	12	0	12
	% Within course of DR	100%	0%	100%
	% Within group	26.7%	0%	19.4%
Total	Count	45	17	62
	% Within course of DR	72.6%	27.4%	100%
	% Within group	100%	100%	100%

Table 8 (Group vs clinically significant macular edema-CSME in cases and control eyes)

Group vs CSME-(P-0.014) Fisher's exact test				
Presence of CSME		Group		Total
		Cases	Control	
CSME-Absent	Count	83	90	173
	% Within CSME	48%	52%	100%
	% Within group	92.2%	100%	96.1%
CSME -present	Count	7	0	7
	% Within CSME	100%	0%	100%
	% Within group	7.8%	0%	3.9%
Total	Count	90	90	180
	% Within CSME	50%	50%	100%
	% Within group	100%	100%	100%

Table 9: (DR status vs cystoid macular edema-CME in operated eyes)

DR Status vs CME for operated eyes-(p-0.157) fisher's exact test				
Presence of CSME		Group		Total
		Cases	Control	
CME-Absent	Count	43	38	81
	% Within CME	53.1%	46.9%	100%
	% Within DR status	95.6%	84.4%	90%
CME-Present	Count	2	7	9
	% Within CME	22.2%	77.8%	100%
	% Within DR status	4.4%	15.6%	10%
Total	Count	45	45	90
	% Within CME	50%	50%	100%
	% Within DR status	100%	100%	100%

Conclusion

Presence of DR is not a contraindication for cataract surgery with IOL implantation however those patients DR should be closely monitored in the post operative period for early signs of progression and whenever necessary laser photocoagulation should be done to avoid blindness. The most important factor in the progression of DR and development of maculopathy is the age and the duration of the diabetes. In cases of suspicious posterior segment in patients with DM and cataract, prior to undergoing cataract surgery, nowadays an optical coherence tomography (OCT) can be documented for analyzing the progression of maculopathy in these patients in the follow up period and treated early to prevent vision loss.^{10,11} This study found there is significant progression of DR after cataract surgery irrespective of gender and right or left eye with increase in age and the duration of Diabetes. DM affects both the anterior and posterior segment of the eye,¹² so it is recommended to keep adequate control of the DM with the physician and a regular yearly dilated fundus or as recommended by the ophthalmologist to prevent/avoid blindness or vision loss due to diabetes.

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