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"To Study Visual Outcome after Cataract Surgery in Diabetics And Non-Diabetics"

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Abstract : Objectives: *To compare visual outcome after cataract extraction in diabetics and non- diabetics*
Method: *Prospective observational hospital based study. Minimum of 50 diabetic patients and age and sex matched non- diabetic patients admitted for cataract extraction were selected. Visual acuity and fundus examination was done pre- operatively and post- operatively on day 1, day 7 and after 1 month*
Result: *Visual outcome in diabetic patients after cataract extraction is comparable to the results in non-diabetic patient if the diabetics have no retinopathy and have good glycemic control.*
Conclusion: *This study was carried out to investigate outcome of cataract surgery in diabetic cases and with intention of making recommendations for improved care.*

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I. Introduction

Cataract is the most common treatable cause of blindness in the world[(1)]. The prevalence of cataract increases with the age. Although cataract surgery is the mainstay of treatment, its delivery in developing countries has many problems.

Diabetes mellitus earlier was being present in about 3 % adult population. The global prevalence of type 2 diabetes mellitus is expected to increase twice by 2025 and will reach 300 million people. In India due to urbanization, lifestyle modification changes, there is increase in diabetes incidence.

Higher prevalence of lens opacities is seen in patients with diabetes mellitus as compared to non-diabetics and they also develop cataract at an earlier age than non diabetics [(2)]. This is due to altered lens metabolism. It has been observed that the intracellular accumulation of sorbitol leads to osmotic changes which results in hydropic lens fibres that degenerate and form cataract.

In diabetic patients cataract reduces the visual acuity, making the media opaque and hence making fundus examination difficult for diabetic retinopathy. Treatment of diabetic retinopathy which is photocoagulation also becomes difficult due to cataract. In developed countries, cataract surgery is performed at an earlier age for diagnosis and treatment of diabetic retinopathy and maculopathy.

However in developing countries, like India, larger number of patients do not have ophthalmic examination till advanced cataract develops, which prevents preoperative assessment or treatment of diabetic retinopathy. Therefore it is very necessary to carry out cataract extraction early for visual rehabilitation and for diagostic and therapeutic purposes.

According to a case control study by Oluwatoyin H. Onakpoya and others improvement in postoperative visual acuity after cataract surgery was noted in 84.2% diabetics and 90% non-diabetics. Poor visual prognosis in diabetic patients was chiefly due to diabetic retinopathies , maculopathies or diabetes related surgical complications[(3)].

Improvement in surgical technique from intracapsular cataract extraction technique to extracapsular cataract extraction has improved outcome after cataract surgery.

Earlier intervention i.e cataract surgery, better surgical technique and newer and better IOL help in improving visual outcome after cataract extraction in diabetic patients.

As there is increase in prevalence of diabetes mellitus in India[(4)], there is also increase in cataract patients with diabetes. So evaluation of post operative visual outcome after cataract surgery in diabetics is necessity.

II. Materials And Method

The study was carried out in the Department of Ophthalmology and Department of Medicine at Acharya Vinoba Bhave Rural Hospital attached to Jawaharlal Nehru Medical College, Sawangi (Meghe) Wardha, a constituent college of DattaMeghe Institute of Medical Sciences (Deemed University), Nagpur. It was Rural hospital based observational study of 50 eyes of patients with cataract with type II diabetes and age

and sex matched eyes of controls attending eye OPD , admitted in ophthalmology department for cataract surgery. Duration of study was from August 2017 to August 2018.Patients who were biochemically proven cases of type II Diabetes mellitus with Good glycemic control preoperatively either by insulin or by oral hypoglycemic drugs.

Patients with cataract who were known cases of type II Diabetes Mellitus visiting ophthalmology OPD and willing for cataract extraction underwent investigations-

Post meal blood sugar

Fasting blood sugar

They underwent detailed ophthalmic examination –

Visual acuity recording

Calculation of K1 and K2 by Autorefractometer and Keratometer

The IOL power was calculated by contact A-scan biometry by using the SRK II formula

Tonometry by goldmann applanation

Blood pressure recording

Syringing

Fundus examination using a direct ophthalmoscope, indirect ophthalmoscope and slit lamp biomicroscopy.

A pre-operative informed consent was taken from the patients.

Patients underwent cataract extraction by phacoemulsification under local anesthesia.

Patients were observed on 1st day, 7th day and after 1 month after surgery for vision, for slit lamp examination and fundus examination.

III. Results

In our study, 100 patients were enrolled, of which 50 were cases (diabetic) and 50 were control (non-diabetic).

Age

Table : Mean Age

Parameter	Cases		Controls		p-value*
	Mean	SD	Mean	SD	
Age (in years)	65.12	5.94	65.24	6.15	0.9211
*Calculated using t test. The P-value of <0.05 was considered statistically significant					

The mean ± SD age among the cases was 65.12 ± 5.94 years while that of the controls was 65.24 ± 6.15 years. The t-test revealed no statistically significant difference (p=0.9211) between the mean age of patients in the 2 groups.

Of the 50 cases in each group, 50% each were males and 50% were females. Out Of the 50 cases, 10% (5/50) patients had NSI, 64% (32/50) patients had NSII, 20% (10/50) patients had NSIII, while 6% (3/50) patients had only PSC and/or CC. Among the 50 controls, 10% (5/50) patients had NSI, 64% (32/50) patients had NSII, 22% (11/50) patients had NSIII, while 4% (2/50) patients had only PSC and/or CC.Among the 50 patients with diabetes (cases), the duration of diabetes was as follows: 24% (12/50), less than one year; 50% (25/50), 1-5 years; 20% (10/50), 6-10 years; and 6% (3/50), >10 years. The mean ± SD fasting blood sugar level among the cases was 104.88 ± 12.60 g/dL while that of the controls was 106.22 ± 12.00 g/dL.The mean ± SD post-meal blood sugar level among the cases was 151.76 ± 17.71 g/dL while that of the controls was 146.70 ± 16.47 g/dL.

Table : Blood sugar levels

Blood sugar levels	Cases		Controls		p-value*
	Mean	SD	Mean	SD	
FBS	104.88	12.60	106.22	12.00	0.5873
PMBS	151.76	17.71	146.70	16.47	0.1422
*Calculated using unpaired t-test. the P-value of <0.05 was considered statistically significant					

Among the 50 patients with diabetes (cases), diabetic retinopathy was diagnosed preoperatively in 28% (14/50), while no diabetic retinopathy was seen in 72% (36/50). Of the patients with diabetic retinopathy, 14% (7/50) had the very mild form, 10% (5/50) had the mild form, while 4% (2/50) had moderate diabetic retinopathy. Postoperatively, there were no changes in findings of diabetic retinopathy at either day 1, day 7 or day 30, in the 28% (14/50) cases, while no diabetic retinopathy was seen in 72% (36/50). Of the patients with diabetic retinopathy, 14% (7/50) had the very mild form, 10% (5/50) had the mild form, while 4% (2/50) had moderate diabetic retinopathy.

Table: BCVA

BCVA	Cases		Controls		p-value*
	No.	%	No.	%	
Pre-operative					
Poor (5/60)	14	28	17	34	
Moderate (6/60 to 6/24)	35	70	32	64	0.8087
Normal (6/18 to 6/12)	1	2	1	2	
Good (6/9 to 6/6)	0	0	0	0	
Post-operative Day 1					
Moderate	17	34.0	10	20.0	
Normal	19	38.0	31	62.0	0.0555
Good	14	28.0	9	18.0	
Post-operative Day 7					
Moderate	8	16.0	4	8.0	
Normal	8	16.0	14	28.0	0.2198
Good	34	68.0	32	46.0	
Post-operative Day 30					
Moderate	2	4.0	0	0	
Normal	6	12.0	2	4.0	0.0455
Good	42	84.0	48	96.0	
*Calculated using chi-square test. P-value <0.05 considered statistically significant					

In our study, the best corrected visual acuity (BCVA) was assessed pre-operatively, and post-operatively on Day 1, Day 7 and at Day 30. A vision of 5/60 was considered poor, vision of 6/60 to 6/24 was considered moderate, 6/18 to 6/12 was considered normal, while 6/9 to 6/6 was considered good.None of the patients had good BCVA (6/9 to 6/6), 1/50 patient in each group, i.e. 2%, had normal BCVA (6/18 to 6/12), 70% (35/50) cases and 64% (32/50) controls had moderate BCVA (6/60 to 6/24), whereas 28% (14/50) cases and 34% (17/50) controls had poor BCVA (5/60 or below).Post-operatively, on Day 1, good BCVA (6/9 to 6/6) was seen in 28% (14/50) cases and 18% (9/50) controls, normal BCVA (6/18 to 6/12) was noted in 38% (19/50) cases and 62% (31/50) controls, and moderate BCVA (6/60 to 6/24) in 34% (17/50) cases and 20% (10/50) controls. Post-operatively, on Day 7, good BCVA (6/9 to 6/6) was seen in 68% (34/50) cases and 46% (23/50) controls, normal BCVA (6/18 to 6/12) in 16% (8/50) cases and 28% (14/50) controls, and moderate BCVA (6/60 to 6/24) in 16% (8/50) cases and 8% (4/50) controls. Post-operatively, on Day 30, good BCVA (6/9 to 6/6) was seen in 84% (42/50) cases and 96% (48/50) controls, normal BCVA (6/18 to 6/12) in 12% (6/50) cases and 4% (2/50) controls, and moderate BCVA (6/60 to 6/24) in 4% (2/50) cases.

IV. Discussion

Amongst all the cataract surgeries performed, about 20 % of cataract surgeries are performed on patients with diabetes mellitus. Cataract among diabetics reduces visual acuity (VA), makes satisfactory retinal examination more difficult or at times impossible, and renders photocoagulation of diabetic retinopathy more difficult. It is thus vital to perform cataract surgeries to ensure visual rehabilitation. In diabetic patients, cataract extraction at an early stage, before the development of macular oedema, may perhaps assist in alleviating retinopathy oedema thereby improving long-term visual prognosis(5).

In the present study, a total of 100 patients were enrolled, of which 50 were cases (diabetics) and 50 were control (non-diabetics). Until now, as per our knowledge, four studies have been conducted on similar lines. Zaczek A et al studied 52 consecutive patients with diabetes mellitus (27 no / mild to moderate diabetic retinopathy and 25 moderate to severe diabetic retinopathy) and 22 controls, who underwent uncomplicated, standardised phacoemulsification surgery to follow visual acuity and advancement of diabetic retinopathy after cataract surgery in diabetic patients with different stages of diabetic retinopathy and controls(6).

Mozaffarieh M et al assessed visual outcomes after phacoemulsification cataract surgery in 67 eyes of 67 patients with diabetic retinopathy, and evaluated patient contentment with the final surgical result. Based on the stage of retinopathy, they divided their patients into: Group 1- comprising of 17 patients with no evident retinopathy, Group 2- including 19 patients with mild non-proliferative diabetic retinopathy, Group 3- consisting of 16 patients with severe non-proliferative diabetic retinopathy , and Group 4 that included 15 patients with proliferative diabetic retinopathy (7). Shaikh AR and associates conducted a comparative, cross sectional, observational study to assess visual outcomes of phacoemulsification surgery with an intraocular lens in individuals with and without DM. They included 92 patients with 92 eyes, i.e. 48 diabetic eyes and 44 non-diabetic eyes aged ≥30 years(8). Very recently, Chavan OB and colleagues conducted a prospective study to assess the clinical outcome and progression of DR after phacoemulsification cataract surgery in 40 diabetics vs. 80 non-diabetics(5).

In the present study, the mean ± SD age among cases was 65.12 ± 5.94 years while that of controls was 65.24 ± 6.15 years. Previous studies have observed that the average age of patients with cataract are aged >55 years. In the study by Zaczek A et al, the median age of diabetics was 73 (range: 49-86) and of non-diabetics

was 76 (range: 48-88) years(6).Similarto our results, Mozaffarieh M et al reported the mean age of their study patients as 57.8 (range: 42-68) years(7). The mean age of patients included by Chavan OB et al was similar to that noted by us, i.e. 60.05 years among cases and 60.34 years among controls(5). Asnoted in our study, in the above-mentioned studies too, there was no statistically significant difference in the mean age between their diabetic and non-diabetic population.

In our study, of the 50 cases in each group, 50% each were males and 50% were females. Of the patients treated by Zaczek A et al, the gender distribution among the diabetics was 20 males and 32 females, while the non-diabetics comprised of 12 males and 10 females(6). In the study by Chavan OB et al, of the 80 non-diabetics, 46.25% were females and 53.75% were males, whereas of the 40 diabetics, there were 47.5% females and 52.5% males(5).

In the present study, of the 50 cases, 10% had NSI, 64% had NSII, 20% had NSIII, while 6% had only PSC and/or CC. Among the 50 controls, 10% had NSI, 64% had NSII, 22% had NSIII, while 4% had only PSC and/or CC.

Among our diabetics, the duration of diabetes noted was: 24% had DM since <1 year, 50% had DM for 1-5 years, 20% had DM for 6-10 years, while 6% had DM for >10 years. Similar duration of diabetes has been reported by other authors. Among the 52 diabetics evaluated by Zaczek A et al, the median duration of diabetes in those with no or mild DR was 15 years (range: 5-50) while that in patients with advanced DR was 20 years (range: 8-55)(6). In the study by Mozaffarieh M et al, patients who had no/mild diabetic retinopathy had been diagnosed for diabetes mellitus for on an average >13.1 years', whereas patients who had severe non proliferative diabetic retinopathy and proliferative diabetic retinopathy had been diagnosed for diabetes mellitus on an average for >26.9 years' (7). The duration of diabetes as noted by Chavan OB et al were as follows: 87.5% had DM for <5 years, 7.50% had DM for 6-10 years, and 5% had DM for more than 10 years(5).

In our study,the mean ± SD fasting blood sugar (FBS) level among cases was 104.88 ± 12.60 g/dL while that of the controls was 106.22 ± 12.00 g/dL. The mean ± SD post-meal blood sugar (PMBS) level among cases was 151.76 ± 17.71 g/dL while that of controls was 146.70 ± 16.47 g/dL. Compared to our study, the mean FBS and PMBS levels were comparatively lower in the study conducted by Chavan OB et al among the cases as well as the controls. The mean FBS among their cases was 97.73 g/dL while that of their controls was 95.71 g/dL, and the PMBS among cases was 119.23 g/dL and that among controls was 119.58 g/dL(5).

In the present study, Of the 50 cases, 48% patients had cataract in right eye (24/50), while 52% patients had cataract in left eye (26/50). Among the 50 controls, 54% (27/50) patients had cataract in right eye, while 46% (23/50) patients had cataract in left eye. The mean ± SD IOP among the cases was 15.92 ± 2.86 mm Hg while that of the controls was 14.92 ± 2.63 mm Hg.

Among our 50 diabetics, DR was diagnosed in 28%, while no DR was seen in 72%. Of the patients with DR, 14% had the very mild form, 10% had the mild form, while 4% had moderate diabetic retinopathy. Chavan OB et al reported mild NPDR in 5% patients, moderate NPDR in 5% patients, and no DR in 90% patients, prior to surgery(5). In the study by Zaczek and associates, the VA in patients with no/mild-to-moderate DR was almost similar than that of non-diabetics, however patients with advanced diabetic retinopathy had notably worse visual acuity than in the controls and with mild-to-moderate diabetic retinopathy before surgery and 1 week, 3 months, and 1 year after surgery(6).

In the present study, prior to surgery, none of the patients had good BCVA, 2% patients in each group, had normal BCVA, 70% cases and 64% controls had moderate BCVA, whereas 28% cases and 34% controls had poor BCVA. Post-operatively, on Day 1, good BCVA was seen in 28% cases and 18% controls, normal BCVA was noted in 38% cases and 62% controls, and moderate BCVA in 34% cases and 20% controls. Post-operatively, on Day 7, good BCVA was seen in 68% cases and 46% controls, normal BCVA in 16% cases and 28% controls, and moderate BCVA in 16% cases and 8% controls. Post-operatively, on Day 30, good BCVA was seen in 84% cases and 96% controls, normal BCVA in 12% cases and 4% controls, and moderate BCVA in 4% cases. A statistically significant difference ($p=0.0455$) between the type of BCVA at post-operative day 30 between diabetics and non-diabetics.

In the study by Zaczek A et al, all non-diabetics had improved BCVA at 1 year after surgery compared to their preoperative BCVA. The BCVA at 1 year after surgery improved in 88% diabetics, only 6 % had eventual BCVA worse than before cataract extraction while in 6 % there was no change in final BCVA. 79% diabetics achieved BCVA ≥0.5, and 21% had a final BCVA <0.5(6).At three months after surgery, 94.2% patients had improved VA that decreased with an increase in the retinopathy level. Improvements in visual acuity was notibly high in patients with no/mild diabetic retinopathy, compared to those with more severe diabetic retinopathy in groups 3 and 4 ($p<0.001$)(7).

Study	Shaikh AR et al		Present study	
	Cases	Controls	Cases	Controls
Prior to surgery				
Poor BCVA	22.9%	4.5%	28%	34%
Moderate BCVA	68.8%	63.6%	70%	64%
Normal BCVA	8.3%	31.8%	2%	2%
1 day after surgery				
Moderate BCVA	12.5%	8%	34%	20%
Normal BCVA	87.5%	92%	66%	80%
6 weeks after surgery				
Normal BCVA	100%	100%	100%	100%

In the study by Shaikh AR et al, among the diabetics prior to surgery, poor BCVA (<6/60) was observed in 22.9% patients, moderate BCVA (6/24 to 6/60) was noted in 68.8% patients, and normal BCVA (≥6/18) was seen in 8.3% patients; this improved on Day 1 after surgery with 12.5% with moderate BCVA and 87.5% with normal BCVA, which further improved to 100% patients with normal BCVA at 6 weeks. Among the non-diabetics, prior to surgery, poor BCVA was seen in 4.5% patients, moderate BCVA in 63.6% patients, and normal BCVA in 31.8% patients, which improved on Day 1 post-surgery with 8% with moderate BCVA and 92% with normal BCVA, and further improvement was seen at 6 weeks with 100% patients showing normal BCVA(8).

Chavan OB et al observed the following BCVA findings in their study: at 1 month of follow-up, 95% cases had 6/9-6/6 vision, whereas 5% patients had BCVA of ≤6/12. In 97.5% cases, there was no significant deterioration in BCVA after 6 months, except for in 2.5% cases where BCVA deteriorated from 6/12 to 6/36 as a result of DR progression(5).

None of our study patients, i.e. neither cases nor controls, had macular edema. In the study conducted by Zaczek A et al, cystoid macular oedema was found in 15% diabetic eyes one week after surgery(6).

In our study, before surgery, mean ± SD astigmatism among cases was 1.06 ± 0.67 while that in controls was 1.04 ± 0.67, which reduced to 0.95 ± 0.52 in cases and 0.79 ± 0.47 among controls after surgery. When compared to the present study findings, lesser astigmatism was reported by Shaikh AR and colleagues; they observed pre-operative BCVA of 0.81 ± 0.18 in diabetics as compared to 0.66 ± 0.31 in non-diabetics, which reduced post-surgery, at 6 months to 0.18 ± 0.14 among diabetics and to 0.08 ± 0.10 among non-diabetics, and was statistically significant (p=0.001)(8).

V. Conclusion

The mean ± SD age among the cases was 65.12 ± 5.94 years while that of the controls was 65.24 ± 6.15 years.Out of 50 cases, 25 were males and 25 were females, similarly out of 50 controls, 25 were males and 25 were females.Of the 50 cases, 5 patients had NSI grade cataract, 32 patients had NSII, 10 patients had NSIII, while 3 patients had only PSC and/or CC. Among the 50 controls, 5 patients had NSI, 32 patients had NSII, 11 patients had NSIII, while 2 patients had only PSC and/or CC.Among the 50 patients with diabetes (cases), 12 patients had diabetes for less than one year; 25 patients had diabetes for a period of 1-5 years; and 10 patients had diabetes for 6-10 years; and 3 patients for >10 years. The mean ± SD fasting blood sugar level among the cases was 104.88 ± 12.60 g/dL while that of the controls was 106.22 ± 12.00 g/dL.The mean ± SD IOP among the cases was 15.92 ± 2.86 mm Hg while that of the controls was 14.92 ± 2.63 mm Hg.Post-operatively, on Day 1, BCVA of 6/9 to 6/6 was seen in 28% (14/50) cases and 18% (9/50) controls, BCVA of 6/18-6/12 was noted in 38% (19/50) cases and 62% (31/50) controls, and BCVA of 6/60-6/24 was seen in 34% (17/50) cases and 20% (10/50) controls. Post-operatively, on Day 7, BCVA of 6/9 to 6/6 was seen in 68% (34/50) cases and 46% (23/50) controls, BCVA of 6/18-6/12 was seen in 16% (8/50) cases and 28% (14/50) controls, and BCVA of 6/60 to 6/24 was seen in 16% (8/50) cases and 8% (4/50) controls.Post-operatively, on Day 30, BCVA of 6/9 to 6/6 was seen in 84% (42/50) cases and 96% (48/50) controls, BCVA of 6/18 to 6/12 was seen in 12% (6/50) cases and 4% (2/50) controls, and BCVA of 6/60 to 6/24 was seen in 4% (2/50) cases.

Post-phacoemulsification, visual outcomes in diabetics is comparable to that in non-diabetics, when diabetics have no/mild-to-moderate diabetic retinopathy and good glycaemic control. In patients with less severe preoperative diabetic retinopathy, greater is the chance of an improvement in visual acuity. The progression of diabetic retinopathy is related to the duration of diabetes and the uncontrolled diabetic status.

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