INTRODUCTION:
Diabetes mellitus (DM) is major non-communicable diseases and now recognised as an epidemic in India. An estimated 65 million have DM and more than half of these remain undiagnosed. In addition to a genetic predisposition, the increase in DM in India is attributed to change in lifestyle associated with increasing urbanization. Cataract is one of the leading causes of blindness across the world and is largely sequelae of diabetes. It is one of the most common complications of diabetes in the eye and up to 20% of all cataract procedures are performed for diabetic patients. Diabetic retinopathy is defined as progressive dysfunction of the retinal vasculature caused by chronic hyperglycemia resulting in structural damage to the neural retina. Microaneurysms are the first ophthalmoscopically demonstrable alteration in diabetic retinopathy and are measured as the hallmark of NPDR. Cataract in patients with diabetes leads to decreased visual acuity and poses difficulty in examination of the retina adequately. Hence, it is advantageous to perform cataract surgery for diagnostic and therapeutic benefits, even if there is possibility of associated risk of aggravating the retinopathy. In earlier days, cataract surgery among diabetics was threatened by the accelerated progression of diabetic retinopathy and deterioration of vision due to higher incidence of post-operative complications. According to Kim SJ et al., diabetic eyes have a high incidence of central foveal thickness after cataract surgery. According to some studies, clinicians should continue to sustain vigilance in diabetic patients after cataract extraction even when central macular oedema is not present immediately prior to cataract surgery, particularly in eyes with prior Diabetic Macular oedema (DME) treatment or non-central involved DME that may be at a predominantly high risk for development of central-involved Macular Oedema (ME) after cataract surgery. However, this is usually mild and can be adequately treated by photoagulation. Current surgical techniques Small Incision cataract surgery (SICS) and phacoemulsification have an advantage over previously followed cataract surgeries that they allow quicker recovery of vision and lesser post-operative inflammation. The modern techniques of cataract surgery have improved results. Recent studies have reported favourable visual acuity after cataract surgery in diabetic patients. Cataract surgery in diabetes has good results, with high reliability and a slightly higher rate of complications than non-diabetic patients. Causes for poor visual acuity after surgery are poor preoperative visual acuity, advanced stages of diabetic retinopathy and old age. On measurement of central foveal thickness by OCT after cataract surgery eyes of diabetic patients showed higher macular thickness which led to poorer post-operative visual recovery. However, few studies are of the opinion that macular oedema following cataract surgery in diabetic eyes may take a benign path. Pre-existing macular oedema in eyes of diabetic patients undergoing cataract surgery usually does not show spontaneous resolution, however, if macular oedema arises post cataract surgery it usually resolves spontaneously, more so in cases of mild non-proliferative diabetic retinopathy. Debatable is whether implantation of Intra Ocular Lens (IOL) worsens inflammation in the diabetic eye compared to non-diabetic eyes, and also if implantation of IOL in diabetic eyes leads to higher incidence of macular oedema as compared to those left aphakic. Newer studies are in favour of lens implantation in diabetic eyes, as correction of aphakia with spectacle causes further image distortion and constriction of peripheral visual field. The need for this study is to establish the influence of glycaemic control on visual control to better advice patients before surgery. The aim of this study was evaluation and comparison of visual outcomes after cataract surgery in diabetic and non-diabetic patients: patients with and without diabetic retinopathy; assessment of post-operative complications after cataract surgery in diabetics compared to nondiabetics; and analysis of increment in central foveal thickness using optical coherence tomography, after cataract surgery.

METHODS:
This Institutional based Observational study was done at Outpatient department, Indoor Department and Special retina Clinic in R. G. Kar Medical College and Hospital, Kolkata over the Period of January 2019 to June 2020. This study included 125 diabetic patients with pre-existing diabetic retinopathy and 125 no pre-existing diabetic retinopathy controls. After complete ophthalmological examination, all subject undergone for cataract surgery. Post-operative visual acuity, intra or post-operative complication and change in subfoveal macular thickness recorded in a predesigned chart and subsequently analysed.

RESULTS:
A total of 250 eyes were included in this study of them 125 were with diabetic retinopathy and 125 were without diabetic retinopathy respectively. There were 89 eyes with mild NPDR, 32 with moderate NPDR and 4 with severe NPDR respectively. Male female ratio was 1.7:1. Most of the patients were at 50-70 years age group. Patients with uncontrolled baseline glycosylated haemoglobin level (HbA1c<7) was found to be a major confounding factor as far as post-op visual recovery was concerned. Common post-operative complications after cataract surgery were transient corneal oedema, hyphaema, iritis, misshapen pupil and pigment deposit on IOL respectively. Descemet's fold, Descemet's membrane folds being the most frequent complication, however the difference was not statistically significant. In our study, increase in central foveal thickness was seen in both the groups, 6 months after cataract surgery. The need for this study is to establish the influence of glycaemic control on visual control to better advice patients before surgery. The aim of this study was evaluation and comparison of visual outcomes after cataract surgery in diabetic and non-diabetic patients: patients with and without diabetic retinopathy; assessment of post-operative complications after cataract surgery in diabetics compared to nondiabetics; and analysis of increment in central foveal thickness using optical coherence tomography, after cataract surgery. Also, through this study, we wanted to determine whether uneventful SICS/ phacoemulsification cataract surgery led to adverse visual outcomes in diabetics.

MATERIALS AND METHODS:
1. Study design: Institutional based progressive Observational study.
2. Study setting: Outpatient department, Indoor Department and Special retina Clinic in R. G. Kar Medical College and Hospital, Kolkata.
3. Period of study: January 2019 to June 2020
4. Study population: This study included 125 diabetic patients with pre-existing diabetic retinopathy and 125 no pre-existing diabetic retinopathy controls, who came to ophthalmology OPD in R. G. Kar Medical College and Hospital, Kolkata for cataract surgery.
5. Study Setting: Outpatient department, Indoor Department and Special retina Clinic in R. G. Kar Medical College and Hospital, Kolkata
6. Sample Size: 125 diabetic patients with pre-existing diabetic retinopathy and 125 no pre-existing diabetic retinopathy controls.

7. INCLUSION CRITERIA:
Willingness to provide signed informed consent from by the patient. Ability and willingness to return for all schedule visits and assessments.
Diabetes mellitus diagnosed minimum 1 year before cataract surgery. Uneventful cataract surgery conducted by senior surgeon.

If visualization of fundus was hampered by media opacity due to denser cataract, such cases were excluded.

No evidence of proliferative diabetic retinopathy or macular oedema at baseline.

Pre-operative parameters were noted glycaemia control HbA1C (glycosylated hemoglobin) levels, (if less than 6.5 or more than 6.5), type (type 1 or type 2) and duration of diabetes. (in years), age, , sex, type of medications in diabetes, oral hypoglycemic agents (OHA) / insulin, visual acuity using Snellen chart and intra ocular pressure measured by Goldmann Applanation tonometer, which has a measuring range of 0 to 78 mmHg.

8. Exclusion Criteria:
Primary / Secondary glaucoma
Patients with any other corneal and retinal pathology
Patients/parents unwilling to give consent
Patients with history of other ocular surgery.

9. Study Technique and data collection
I. History taking: with reference to
a) Age of onset of diabetes mellitus and symptoms of dimness of vision
b) Sex of the patients.
c) Unilateral or bilateral symptoms
d) glycaemic control HbA1C (glycosylated hemoglobin) levels, (if less than 6.5 or more than 6.5), type (type 1 or type 2).
e) type of medications in diabetes, oral hypoglycemic agents (OHA) / insulin

II. Clinical assessment:
a) Visual acuity at presentation
b) Adnexal examination using torch
c) Slit lamp examination of anterior segment and assessment of morphological type of cataract.

III. Study Tools
a) Torch
b) Slit lamp biomicroscope
c) Topical Mydriatic eye drop: Tropicamide
d) Direct Ophthalmoscope
e) Indirect Ophthalmoscope (B scan)
f) OCT macula

IV. Investigation
a) Fasting and post prandial Blood glucose level
b) Glycosylated hemoglobin

Statistics:
Qualitative data analysis was performed using student's unpaired t-test. Quantitative data analysis was performed using Chi square test. SPSS Version 17.0 was used for analysis. The p-value less than 0.05 were considered significant.

Spearman rank correlational test was used to assess the relationship between adequate glycaemic control, management of diabetic retinopathy and post-operative vision following cataract surgery.

Observations and Results:
A total of 250 eyes were included in this study. 125 were with diabetic retinopathy and 125 were without diabetic retinopathy respectively. Only one eye of each of the diabetic patients was included. There were 89 eyes with mild NPDR, 32 with moderate NPDR and 4 with severe NPDR respectively.

Table No. 1. Distribution of study subjects according to gender.

<table>
<thead>
<tr>
<th>Gender</th>
<th>No</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>158</td>
<td>63.2%</td>
</tr>
<tr>
<td>Female</td>
<td>92</td>
<td>36.8%</td>
</tr>
</tbody>
</table>

Table no.1 showing distribution of study subjects according to gender. Out of 250 study subjects 158 (63.2%) were male and 92(36.8%) were female. Male female ratio was 1.7:1

Out of total patients 113 (45.2%) subjects were in the age group of 60-69 years, 82(32.8%) in 50-59 years, 77(30.8%) in 40-49, 27(10.8%) in group of 70-79 years, 11(4.4%) study subjects were above 80 years respectively.

Figure 1. Distribution of study subjects according to age and gender.

Table no 2. distribution of study subjects according to pre-operative diabetic retinopathy status.

<table>
<thead>
<tr>
<th>Type of DM</th>
<th>DR</th>
<th>No DR</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>21</td>
<td>11</td>
<td>32</td>
<td>12.8%</td>
</tr>
<tr>
<td>Type 2</td>
<td>104</td>
<td>118</td>
<td>222</td>
<td>87.2%</td>
</tr>
</tbody>
</table>

Out of 250 study subjects 213(87.2%) had type 2 diabetes where only 32(12.8%) study subjects had type 1 diabetes. Among type 2 diabetes 104 had diabetic retinopathy changes and 21 type 1 patients had diabetic retinopathy changes pre-operatively (table-2).

Table no 3. Showing distribution according to duration of diabetes.

<table>
<thead>
<tr>
<th>Duration of DM</th>
<th>Male %</th>
<th>Female %</th>
<th>Total</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>8</td>
<td>3.2%</td>
<td>4</td>
<td>1.6%</td>
</tr>
<tr>
<td>6-10 years</td>
<td>28</td>
<td>11.2%</td>
<td>16</td>
<td>6.4%</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>122</td>
<td>48.8%</td>
<td>72</td>
<td>28.8%</td>
</tr>
</tbody>
</table>

Out of 250 patients, 12 patients were with diabetes for 0–5 years, 44 Patients with diabetes for 6–10 years, and 194 patients with diabetes for more than 10 years respectively (table-3).

Table no 4. Showing distribution of study subjects according to age and pre-operative diabetic retinopathy status.

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>Mild NPDR</th>
<th>Mod NPDR</th>
<th>Severe NPDR</th>
<th>No DR</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>40–49</td>
<td>10(8%)</td>
<td>5(4%)</td>
<td>7</td>
<td>5.6%</td>
<td></td>
</tr>
<tr>
<td>50–59</td>
<td>33(26.4%)</td>
<td>5(4%)</td>
<td>44</td>
<td>35.5%</td>
<td></td>
</tr>
<tr>
<td>60–69</td>
<td>32(25.6%)</td>
<td>22(17.6%)</td>
<td>55</td>
<td>44.4%</td>
<td></td>
</tr>
<tr>
<td>70–79</td>
<td>8(6.4%)</td>
<td>5(4%)</td>
<td>14</td>
<td>11.20%</td>
<td></td>
</tr>
<tr>
<td>≥80</td>
<td>6(4.8%)</td>
<td></td>
<td>5</td>
<td>4%</td>
<td></td>
</tr>
</tbody>
</table>

10 mild NPDR (8%) and 7(5.6%) No DR patients were in the age group of 40-49 years. 33(26.4%) mild NPDR, 5(4%) moderate NPDR and 4(3.5%) No DR patients were in the age group of 50-59 years. 32(25.6%) mild NPDR, 22(17.6%) moderate NPDR, and 55(44%) no DR were in the age group of 60-69 years. 43(3.2%) severe NPDR patients were also in this age group. In 70-79 years of age group there were 8(6.4%) mild NPDR, 5(4%) moderate NPDR, and 14(11.20%) no DR patients. 10 mild NPDR (8%) and 5(4%) No DR patients were >80 years of age. (Table no: 4)

Pre-operative HbA1c level among study subjects. 51(20.4%) study subjects were had HbA1c level >7 pre-operatively where 199(79.6%) study subjects were had HbA1c <7 pre-operatively 36(28.8%) study subjects had DR changes in whom HbA1c level was >7 pre-operatively and 89 (71.2%) DR patients were had HbA1c level <7 pre-operatively p value=0.001.

Most of the patients had been taken oral hypoglycemic drugs. Among them, 99(79.2%) were had DR and 107(85.6%) had no DR pre-operatively. 25(20%) DR patients and 11(8.8%) no DR patients were on insulin and 8(3.2%) patients were on diet control.

The co morbidities were comparable diseases in both study groups, hypertension being the most commonly associated co morbidity in the two groups. Over 60% of diabetics with retinopathy changes had hypertension and no other co morbidities. The age and sex distribution as well as type of cataract were noted.

Most of the patients had IOP with a range of 10-19 mmHg.
Many other studies have emphasized on the benefits of good metabolic control by reducing HbA1c levels, in reducing the incidence of complications. Another study reported that the microvascular complication rate decreased by around 25% with improved pre-operative glycaemic levels. In Diabetic Control and Complications Trial the overall risk of retinopathy reduced by around 76% with intensive glucose control in type 1 diabetics. Decelerating the rate of progression of diabetic retinopathy with strict glycaemic control led to decreased morbidity, lesser interventions and better visual outcomes.

The present study concluded that diabetic patients regardless of the stage of diabetic retinopathy can expect improved visual outcome following cataract surgery. This holds good for patients with advanced stages of diabetic retinopathy also. The present study population included 250 eyes that underwent cataract surgery. None of the diabetics had proliferative diabetic retinopathy pre-operatively or clinically significant macular oedema at baseline. In our study, post-operative visual improvement was seen in 118 eyes (94.6%), remained stationary in 6 (4.5%) and worsened in 1 (0.6%) patient among diabetics whereas visual acuity improved in 115 (92%), remained stationary in 10 (8%) among non-diabetics. Pre-operative visual acuity was directly proportional and diabetic retinopathy stage was inversely proportional to post-operative visual outcomes.

The present study indicated that good visual acuity could be expected after cataract surgery in patients with good pre-operative visual acuity and early stages of diabetic retinopathy. Previous studies have shown similar results concluding the pre-operative diabetic retinopathy status to be the most important prognostic factor following cataract extraction surgery in diabetics. A similar study, Dowler JG et al. reported that if macular oedema was present at the time of cataract surgery, it would adversely influence post-operative visual outcomes, however none of the diabetic patients in this study cohort had macular oedema at the time of cataract surgery; hence this potential correlation could not be studied. The co-morbidities were comparable diseases in both study groups, hypertension being the most commonly associated comorbidity in the two groups. Over 60% of diabetics with retinopathy changes had hypertension. Similar results were seen by many other studies among diabetics showing significant association between hypertension and the incidence of diabetic retinopathy. Squirrel D et al., found that progression of diabetic retinopathy or macular oedema following cataract surgery were not affected by the diabetic status. In both the study and control groups, the progression of diabetic retinopathy was determined by pre-operative glycaemic control (HbA1c). In our study, increase in central foveal thickness was seen in both the groups, 6 months after cataract surgery. We observed a minimal average thickening of 51.48 micron among DR patients and 39.49 μ among No DR patients respectively. This difference in thickening was compared and was higher among the DR patients, however the data was not statistically significant (p=0.101).

In our study, increase in central foveal thickness was seen in both the groups, 6 months after cataract surgery. We observed a minimal average thickening of 51.48 micron among DR patients and 39.49 μ among No DR patients respectively. This difference in thickening was compared and was higher among the DR patients, however the data was not statistically significant (p=0.101).

DISCUSSION:
The sex ratio in our study was male: female1:7:1 which is comparable with the earlier Wisconsin Epidemiologic Study of Diabetic Retinopathy which was 1:5.1. The higher number of males could be due to low general turn out of female patients to our hospitals. However, age and sex do not seem to have any influence on the postoperative visual outcome or complications ratio after surgery in our study.

The average interval between the onset of diabetes and cataract operation was 10.6 years. Larger population of the patients had (87.2%) type 2 diabetes. As it is established that duration of diabetes is directly proportional to the frequency of baseline diabetic retinopathy at presentation. In our study there were 17 patients with diabetes for 0-5 years, 61 Patients with diabetes for 6-10 years, and 172 patients with diabetes for more than 10 years respectively. In the Chennai Urban Rural Epidemiological Eye Study (CURES) it has been reported that there is high prevalence of diabetic retinopathy (DR) in those with more than 15 years of DM which is comparable to our study. Some other studies also reported similar results. There are earlier studies who depicted that there was high prevalence of Diabetic retinopathy (DR) in those with more than 15 years of DM which is comparable to our study. Some other studies also reported similar results. There are earlier studies who depicted that there was high prevalence of Diabetic retinopathy (DR) in those with more than 15 years of DM which is comparable to our study. Some other studies also reported similar results. Among all patients 206 Patients (82.4%) were given oral hypoglycemic agents. 36 patients 14.4% were on insulin while 8 (3.2%) was only advised diet modification. Glycosylated hemoglobin HbA1c being a metabolic marker of diabetic control, its value was correlated with pre-operative diabetic retinopathy status. It was noted that diabetic retinopathy grade was significantly higher in patients with glycosylated haemoglobin > 7% as compared to diabetics with good metabolic control (glycosylated Hb <7%). The immediate pre-operative glycaemic control was good (HbA1c <7) in (79.6%) 199, while 20.4% 51cases had HbA1c >7.

### Table no.5: Post-operative visual acuity in patients who had HbA1c <7

<table>
<thead>
<tr>
<th>Post-op VA</th>
<th>Patient no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>V/A=6/6</td>
<td>25</td>
</tr>
<tr>
<td>V/A=6/9</td>
<td>46</td>
</tr>
<tr>
<td>V/A=6/12</td>
<td>41</td>
</tr>
<tr>
<td>V/A=6/18</td>
<td>31</td>
</tr>
<tr>
<td>V/A=6/24</td>
<td>32</td>
</tr>
<tr>
<td>V/A=6/36</td>
<td>8</td>
</tr>
<tr>
<td>V/A=6/60 or less</td>
<td>13</td>
</tr>
</tbody>
</table>

### Table no.6: Post-operative complications:

<table>
<thead>
<tr>
<th></th>
<th>DR</th>
<th>%</th>
<th>No DR</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient corneal oedema</td>
<td>11</td>
<td>8.8%</td>
<td>15</td>
<td>12%</td>
</tr>
<tr>
<td>Descemet's folds</td>
<td>37</td>
<td>29.6%</td>
<td>30</td>
<td>24%</td>
</tr>
<tr>
<td>Hyphaema</td>
<td>6</td>
<td>4.8%</td>
<td>3</td>
<td>2.4%</td>
</tr>
<tr>
<td>Iritis</td>
<td>47</td>
<td>37.6%</td>
<td>55</td>
<td>44%</td>
</tr>
<tr>
<td>Misshapen pupil</td>
<td>21</td>
<td>16.8%</td>
<td>17</td>
<td>13.6%</td>
</tr>
<tr>
<td>Pigment deposit on IOL</td>
<td>3</td>
<td>2.4%</td>
<td>5</td>
<td>4%</td>
</tr>
</tbody>
</table>

Table no 5. Showing visual acuity in patients HbA1c<7 Uncontrolled baseline glycosylated haemoglobin level was found to be a major confounding factor as far as post-op visual recovery was concerned. A total 71(28.4%) eyes with low pre-operative glycaemic levels (HbA1c levels less than 7%) showed visual recovery of 6/9 or better.

Table no.6: Post-operative complications after cataract surgery were transient corneal oedema, Descemet’s fold, hyphaema, iritis, misshapen pupil and pigment deposit on IOL respectively. Descemet’s membrane folds being the most frequent complication, however the difference was not statistically significant (p=0.12).

On further analysis, we found that eyes with higher post-operative CFT were seen to regain lesser post-operative vision when compared to those with CFT in normal range.
visual recovery. Monitoring postoperative progression of diabetic retinopathy severity after uneventful intraocular lens implantation may enhance visual outcome.

Limitation:
The limitation of this study was the small sample size and a short period of follow-up. The study could be improved by increasing the duration of follow-up.

REFERENCES: