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Impact of COVID-19 on Glycemic Control in Diabetic Retinopathy of the Central Rural Population of India

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ABSTRACT

The COVID-19 pandemic has disrupted healthcare systems worldwide and posed significant challenges for individuals with chronic diseases. Diabetic Retinopathy, a common microvascular complication of Diabetes, requires consistent and timely management to prevent vision loss and impairment. This study aims to investigate the Impact of COVID-19 on glycemic control in Diabetic Retinopathy of rural populations. Our study reported the potential direct and indirect effects of COVID-19 on the development and progression of DR, including the impact of glycemic control, due to altered healthcare access, changes in lifestyle, potential viral involvement, and vaccinations. By examining existing literature, analyzing patient data, and conducting surveys, this study provides valuable insights into the intersection between COVID-19 and DR. Results of this study had been contributed to a deeper understanding of the complex interplay between COVID-19 and Diabetic Retinopathy, offering a foundation for future research and guiding clinical practice to improve patient outcomes.

Conclusion: In this study, we concluded that there was a significant change in the glycemic control between groups and within groups of Diabetic Retinopathy due to the breakthrough of covid-19. No significantly changed had observed in the glycemic control pattern of individuals with diabetic Retinopathy. However, the number of cases increased dramatically toward the progression of Diabetes to Diabetic Retinopathy with significantly reduced age and Duration of Diabetes concerning before the breakthrough of COVID-19.

Keywords: COVID-19 pandemic, glycemic control, Diabetic Retinopathy, vaccination, World Health Organization, severe acute respiratory syndrome coronavirus 2

INTRODUCTION

Diabetes mellitus (DM) is an increasing epidemic in the world today. Globally, the number of people with type 2 diabetes mellitus (T2DM) had projected to rise to 439 million by 2030, which denotes 7.7% of the world's total adult population aged 20-79 years(1).It had characterized by a person having excessive blood sugar levels due to insufficient insulin secretion, inappropriate body cells responses to insulin, or both. It can affect multiple organ systems and is responsible for the morbidity and mortality associated with the disease. It isassociated with a sedentary lifestyle, being overweight, aging, and poor eating habits. The prevalence of Diabetes is increasing exponentially as the average lifespan is increasing. With 116 million individuals

who haveDiabetes, china has the most significant number of diabetes cases in the world. China is followed by India (77 million people) and the United States (31 million people), according to the International Diabetes Federation (IDF, 2019). The IDF 2020 statement predicts that globally, by 2045, approximately 700 Diabetic eye diseases (DED).

Diabetic eye disease (DED)is one of the resultant products of neglected and untreated Diabetes, which can cause permanent vision loss. It had observed that the leading cause of vision impairment and blindness in the working age groups. It has comprised of Diabetic Retinopathy (DR), Diabetic macular edema (DME), glaucoma (Gl), and cataract (Ca)(2–7).

Severe diabetic Retinopathy (DR) was independently associated with poorer outcomes of COVID-19, including the need for critical care or death (8).The World Health Organization (WHO) lists DR as a chronic eye disease. Researchers established the risk of DR with glycemic regulation, arterial Hypertension, and the disease duration, with type 1 diabetes being the most significant risk. After a decade of type 2 diabetes, DR impacts approximately 80% of suffered(9).

Early detection and treatment of sight-threatening DR can halve the risk of sight loss. Some highly effective DED therapies have developed in medical sciences. These include corticosteroids, laser photocoagulation, and the intravitreal injection of anti-vascular endothelial growth factor (VEGF) agents. However, the efficacy of these approaches in preventing vision loss depends on early diagnosis and glycemic control over a while. In particular, in the preliminary stage, individuals experience no symptoms. That's why screening for DED in diabetic patients is highly recommended worldwide, as illustrated in international and regional guidelines(10).The COVID-19 pandemic has impacted every individual's life. It has shown that mortality in people with underlying diseases, including Diabetes, has been very high.A study report on nationwide analysis in England shows that type 1 and type 2 diabetes were independently associated with significantly increased odds of in-hospital death with COVID-19(11).

The global burden of the disease has been enormous. Vaccination against severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) is a pivotal step in eradicating the worldwide pandemic. India started COVID-19 vaccination in the country onJan 16, 2021.(12) Two vaccines were granted emergency use authorization by the Central Drugs Standard Control Organization (CDSCO) in India, Covishield® (AstraZeneca's vaccine manufactured by Serum Institute of India) and Covaxin® (manufactured by Bharat Biotech Limited). Sputnik - V has been granted EUA in the month of April 2021.(12) Now,multiple vaccines with varying efficacy and safety have been developed against COVID-19 and also include candidates for the under-18 age group as the DCGI gave its nod to Biological E's Corbevax for emergency use in the 5-12 age group and the Serum Institute's Covovax in the national vaccination drive for the 12-17 age group(13).

However, during COVID-19, vaccine trials, particularly in DR-vulnerable populations, did not include sufficient. Many studies have highlighted that several high-risk population groups should be at the top of the priority list for receiving a vaccination and also demonstrated that a significant research gap in this topic requires more studies to determine whether these populations should receive COVID-19 vaccines. There is a need to assess the effectiveness of the vaccination with the various complications and side effects of several high–risk populations.

This study showsa report on glycemic control afterthe breakthrough of COVID-19 with T2D and eye health-the aim of the study, Investigating the Impact of COVID-19 on glycemic control in Diabetic Retinopathy.

HYPERGLYCEMIA AND HBA1C

Hyperglycemia is a substantial factor in the development and progression of DR. Benefits of better control continue tomanifest even after nonproliferative and proliferative DR has developed. According to evidence, in patients with well-controlled blood sugar, the risk of Retinopathy and microvascular diseases is significantly lower than in patients with uncontrolled blood glucose levels (14).

Elevated glycosylated hemoglobin (HbA1C) is a decisive factor inprogressing to high-risk PDR. Hence it is used asa biomarker for monitoring glycemic control. Some studies have demonstrated that HbA1c levels can be considered an independent risk factor for DR. The higher the level of HbA1C, the higher the risk of developing complications related to Diabetes. Lachin et al. found that for every 1% increase in HbA1c, the risk of DR increases by 22%, although the elevated HbA1c reflects weakly controlled Diabetes correlated with DR development (15). Recent studies suggest that the ideal HbA1c levels are below 7.6% (60 mmol/mol), and keeping this level can be considered a treatment target to prevent proliferative DR for up to 20 years in type 1 diabetic cases (16). Of course, the American Diabetes Association recommitted a goal of treatment target of 7.0% (17). In addition, the action to control cardiovascular risk in diabetes trial demonstrated that the risk of DR progression in diabetic patients with intensive blood sugar control programs, which had a target HbA1c level of 6.0%, was significantly lower than patients with an HbA1c level of 7.0 - 7.9% (18).

Nevertheless, this result emphasized that optimal glycemic control in diabetic patients had an essential role in preventing DR. Mohamed et al. suggested that an HbA1c level of 7% in existing Retinopathy in diabetic patients is ideal for preventing the progression of DR (19). Some studies found that fasting plasma glucose (FPG) can also be a biomarker for predicting DR progression. The level of FPG was significantly higher in cases with DR (20). Patients with DR are more likely to take insulin or oral hypoglycemic drugs to control their Diabetes. Recently, some studies found a relationship between the effect of diabetes treatment programs and the reduction of risk factors for DR. In other words, diagnosed and treated Diabetes have a better prognosis for DR and can be considered a predictor of DR (21).

Evidence showed that late insulin or antidiabetic therapy in DM2 patients could be considered a risk factor for accelerating the development of DR. Thus, well-controlled blood glucose can reduce the risk of DR progression. Other new therapeutic methods are directly related to a reduced risk of DR.

MATERIALS & METHODS

Cross-Sectional Analytical, Hospital Based study, Study Population: The Patients / Subjects of DM selected who are attending the OPD & IPD or medical camp of Index Medical College gram Khudel Indore and AmaltasInstitute of Medical Science gram Banger Dewas Surroundings Rural population Approximately 15 KM.The total sample size of 100 Randomly selected individuals with DR. Assuming the expected population standard deviation to be five and employing t-distribution to estimate sample size, the study would require a sample size of- 100 to calculate a mean with 95% confidence and a precision of 0.5.The sample size refers to the number of observations in a study. The determination of Sample size calculation for power analysis Based on the "India Diabetes Report 2000-2045," the prevalence of Diabetes was 9.6% in 2021. (4) Among them, 16.9% Prevalence of diabetic Retinopathy in India: Results from the National Survey 2015-19 by Praveen Vashist etal.(22) People had a 1.62 % prevalence of Diabetes.The minimum sample size of 98 subjects had estimated, assuming the prevalence of DR is 1.62 % of the population at a 95% confidence interval, 5% significance level, and 2.5% allowable error in the estimate.

Inclusion criteria: All COVID-19 vaccinated Diabetic population.Above18 years in both male and female diabetic.

Exclusion criteria: Non-diabetic subjects. Patients with hypolipidemia, known cases of hypothyroidism, and Cushing's syndrome. Kidney disease, hepatic diseases. Type 1 Diabetes Mellitus, Known / suspected pregnancy, complications other than obesity, and who are not willing to participate in the study.

WHO criteria diagnose Diabetes.(23)

Diabetic Retinopathy is diagnosed by ICO criteria with a final diagnosis by Ophthalmologist.

Four stages are described by the International Council of Ophthalmology (ICO)(10), as indicated below:

Mild Nonproliferative Retinopathy (NPDR): In this stage, a few microaneurysms, defined as small outpouching in the walls of the tiny blood vessels (called capillaries), appear in the retina.

Moderate Nonproliferative Retinopathy (NPDR): More lesions appear in this stage as more capillaries that nurture the retinal tissue become damaged, and the retina becomes more ischemic (lack of blood flow and oxygen).

Severe Nonproliferative Retinopathy (NPDR): Many blood vessels are affected at this level of DR. Blood vessel supply of oxygen to the retina is severely compromised due to accumulated vessel damage. When this occurs, certain areas of the retina start sending biochemical signals to the body that they need oxygen.

Proliferative Retinopathy (PDR): In response to the need for oxygen, new vessels (neovascularization) begin to grow within the retina. These new vessels are an aborted attempt of the retina to regain its oxygenation need, but these vessels are compromised and fragile. These vessels "break" easily, causing severe bleeding into the eye's vitreous gel and consequent vision loss. Also, these new vessels can attach themselves to the vitreous gel and cause traction on the retinal plane, causing retinal detachments.

Laboratory Procedure: 5 milliliters of venous blood had taken with the standard method from the forearms of the subjects participating in the study. The collected blood sample was centrifuged and separatedinto serums. Serum samples were stored in a −20°C freezer until the study had done. Before the analysis, the serum samples had brought to room temperature and kept until thawed and, each serum sample was rendered ready for analysis by vortexing for 20 s, and for biochemical investigation had been using standard clinical laboratory protocol and SOP of EM-360 fully auto analyzer and investigated parameters.

A sodium fluoride vacutainer was used to conduct fasting and postprandial plasma glucose samples from interventional, whereas EDTA vacutainers wereused for HbA1c calculation.

Quality Control: Validation of calibration Multical-XL and control Erba Path and Erba Norm result weredone before processing the sample.

Data collection procedure: Ethical approvalwas obtained from hospital authorities and the institutional ethics committee (IEC) beforethe commencement of the study.Based on the eligibility inclusion and exclusion criteria, the participants were screened and selected from the above mention study population places after informed consent. The investigator interviewed chosen participants and one trained interviewer using a pretested semi-structured questionnaire. Information was obtained on the socio-demographic background and clinical history using a semi-structured questionnaire followed by a brief clinical examination with covid -19 related information.

Statistical Analysis: Data were gathered, entered, and analyzed using IBM SPSS Statistics 20 software. Appropriate statistics (either student t-test if two groups or one-

way ANOVA if more) tests had used to compare the outcome between groups with Correlation.

OBSERVATION AND RESULTS

In evaluatingbiochemical parameters RBS and HbA1c, the baseline values above the following levels are considered abnormal.

Random blood glucose = >126mg / dl
HbA1c - 6.5%

Table 1 Shows the Demographic and clinical characteristics of Distributions with Glycemic control of Diabetic Retinopathy. In terms of percentage, 41% were female, and 59% were male HbA1c level was 10.31±2.51% and 09.97±2.66%, respectively. The two-tailed P value equals 0.52. The difference is bound to be insignificant. There is no significant change in the serum HbA1c level in males and females.

In our study, the predominant age affected is 51-60 years (52%), followed by 41- 50 years (24%). The result showed that the retinopathy rate increased in 41-50 Years, followed by the predominant age group was 51-60 years. The estimated mean result was below 40 years (09%) 12.36 ± 3.08% was higher than the entire age category. The difference is bound to be significant (p-value- 0.05). There is a significant change in the serum HbA1c level in the age categories of study participants.

In less than five years duration of Diabetes, 47 (47%) had Retinopathy in 100 individuals with Retinopathy, one third 33 (33%) presented with Retinopathy in 6-10 years of Diabetes, almost one fourth 16 (16%) presented with Retinopathy in 11-15 years of Diabetes. However, the estimated results of HbA1c (p-value, 0.05) between the groups and within the Groups with a duration of Diabetes were to be statistically insignificant.

In our study, 83 (83%)of most patients did not show a positive family history, whereas only 17 (17%) of diabetics had a family history of Diabetes. Out of the 17 diabetics having a family history, 9 (9%) had mild NPDR, 5 (5%) had Moderate NPDR, only 3 (3%) had severe NPDR, and there is no PDR patients in our study had a family history of Diabetes. The estimated results of HbA1c (p-value, 0.937) between the groups and within the Groups with a Family History of Diabetes were to be statistically insignificant.

In our study, most of the patients, 91 (90%), had antidiabetic medication, only 9 (9%) didn't take any antidiabetic medicines, and all of them had an early diagnosis of Diabetes with Mild NPDR. This difference (p-value, 0.642) was not statistically relevant between the groups.

In a total of 100 Patients with Diabetic Retinopathy, 90 (90%), the mean score of HbA1c was 9.79 ± 2.26% had NonproliferativeRetinopathy, and only 10 (10%), 13.02 ± 2.25% had proliferative Retinopathy. Of the NPDR, the prevalence of mild, moderate, and severeRetinopathy is 57 (57%), 22 (22%), and 11 (11%), respectively. Only 10 (10%) had PDR patients. Their HbA1c level was 9.47±2.26%, 10.35±2.70% 10.26±2.69%, and 10.02±2.25% respectively. The difference is bound to be significant (p-value- 0.000). There is a significant change in the serum HbA1c level, with the severity of DR extremely significant for study participants.

Table: 2. Covid-19characteristics with Glycemic control of Diabetic Retinopathy. In our study, 78% of Covisheld with a mean of HbA1C was 10.27 ± 2.72,and 22% with a mean of HbA1c was 9.52 ± 2.03 of Covaxin were Administered covid-19 Vaccines among the study populations.However, the estimated mean value of HbA1c was higher than Covisheld. But their p-value, 0.229 with the administered vaccine, was to be statistically insignificant.

This study shows that 78% of individuals had No Positive history of Covid-19 (RTPCR), and only 22% of were Positive History of covid-19 (RTPCR). The difference is bound to be significant (p-value- 0.048). A significant change in the

serum HbA1c level with H/O Covid-19 (RTPCR) is extremely significant for study participants.

The study also shows significant changes in glycemic control with H/O Covid-like Symptoms (p-value- 0.013), H/O Covid-positive Person contact (p-value- 0.05), and the Type of mask used usually (p-value- 0.013) between the study participants.

Table: 3

It shows that out of 100% of DR individuals, 88% of individualswith a mean value of HbA1c level was 10.25 ± 2.66% didn't associate any risk factors like Hypertension, cardiovascular and Both 08% of individuals their mean value of HbA1c level was 8.5 ± 1.74% hadHypertension, only 01%, a mean value of HbA1c level was 12.00 ± 0.0% of patient suffered from CVD and 3%, their mean value of HbA1c level was 9.66 ± 0.76% of patients had suffered from HTN and CVD. However, the estimated mean value of HbA1c was higher in CVD. But their p-value, 0.268 with Associated Risk Factors, was to be statistically insignificant in study participants.

The majority of the individuals 75%, with a mean value of HbA1c level was 9.99 ± 2.57% had no associated bad habits; most of the females amongst, 10% of individuals with a mean value of HbA1c level was 10.74 ± 2.55% associated with Smoking, 06% of individuals their mean value of HbA1c level was 9.18 ± 1.77% had Alcohol and 09% of individuals their mean value of HbA1c level was 11.03 ± 3.26% reported from Smoking with Alcohol. However, the estimated mean value of HbA1c was higher in Smoking with alcoholic participants. But their p-value, 0.456, with Associated Bad Habits, was to be statistically insignificant in study participants.

Table 4: Shows a significant Correlation of HbA1c with RBS, Duration of Diabetes, Stages of DR, H/O Covid Positive (RTPCR), H/O of Covid-like symptoms, and Type of mask used usually. Their Pearson Correlation (r) value r= 0.416, -0.241, 0.369, -0.198, -0.247, and 0.259 respectively, lies between -1 to +1.

The Correlation of HbA1C with RBS is to be moderate, Positive relationship and significance ($p<0.000$) at the 0.01 level (2-tailed), Duration of Diabetes is to be weak, negative relationship and significant ($p<0.01$) at the 0.01 level (2-tailed), Stages of DR is to be moderate, Positive, relationship and significant ($p<0.000$) at the 0.01 level (2-tailed), H/O Covid Positive (RTPCR) is to be weak, Positive, relationship and significant ($p<0.04$) at the 0.05 level (2-tailed), H/O of Covid like symptoms is too weak, Negative, relationship and significant ($p<0.03$) at the 0.05 level (2-tailed) and H/O of Type of mask used usuallyis moderate, Positive, relationship and significant ($p<0.009$) at the 0.01 level (2-tailed).

Table .1 Demographic and clinical characteristics of Distributions with Glycemic control of Diabetic Retinopathy.

S. No.	Characteristics		Number (%)	HbA1C Mean ± SD	P-value Sig.
1	Gender	Female	41 (41%)	10.31 ± 2.51	.525
		Male	59 (59%)	9.97 ± 2.66	
2	Age	< 40	09 (09%)	12.367± 3.08	0.050
		41-50	24 (24%)	10.038± 2.50	
		51-60	52 (52%)	9.644± 2.41	
		61-70	12 (12%)	10.42± 2.54	
		>70	3 (03%)	10.833± 3.10	
3	Duration of DM	<5	47 (47%)	10.61± 2.78	0.222
		6-10	33 (33%)	9.95± 2.30	
		11-15	16 (16%)	9.29± 2.65	
		15-20	04 (04%)	8.85± 1.59	
4	Family History of DM	Absent	83 (83%)	10.10 ± 2.61	0.937
		Present	17 (17%)	10.15 ± 2.56	
5	DM medicine	No	09 (09%)	10.50 ± 2.25	0.642
		Yes	91 (91%)	10.07 ± 2.63	
6	DR groups	NPDR	90 (90%)	9.79 ± 2.43	0.000
		PDR	10 (10%)	13.02 ± 2.25	

Table no.1 continued……					
5	Diagnosis Stages of DR	Mild NPDR	57 (57%)	9.47 ± 2.26	0.000
		Moderate NPDR	22 (22%)	10.35 ± 2.70	
		Severe NPDR	11 (11%)	10.26 ± 2.69	
		PDR	10 (10%)	10.02 ± 2.25	

99% Confidence Interval, 1% level of significance (p< 0.001)
95% Confidence Interval, 5% level of significance (p< 0.05)

Table .2 Covid-19 characteristics with Glycemic control of Diabetic Retinopathy

S. No.	Characteristics		Number (100%)	HbA1C Mean ± SD	P-value Sig.
1	Administered Vaccine	Covisheld	78 (78%)	10.27 ± 2.72	0.229
		Covaxin	22 (22%)	9.52 ± 2.03	
2	H/O Covid positive (RTPCR)	No	78 (78%)	10.38 ± 2.65	0.048
		Yes	22 (22%)	9.15 ± 2.17	
3	H/O Covid like Symptoms	No	68 (68%)	18.55 ±2.67	0.013
		Yes	32 (32%)	9.18 ± 2.19	
4	H/O Provided Treatment	No Treatment	62 (62%)	10.38 ± 2.62	0.247
		Isolation	19 (19%)	10.07 ± 2.46	
		Hospitalization	19 (19%)	9.24 ± 2.56	
5	H/O Covid positive Person Contact	No	70(70%)	10.43 ± 2.66	0.062
		Yes	30 (30%)	9.37 ± 2.29	
6	H/O Covid Death in Family	No	93(93%)	10.13 ± 2.64	0.800
		Yes	07 (07%)	9.87 ± 2.05	
7	H/O foreign travel	No	100 (100%)	10.11 ± 2.59	Nil
		Yes	00 (00%)	0.0 ± 0.0	
8	H/O attending gathering	No	74 (74%)	10.09 ± 2.52	0.919
		Yes	26 (26%)	10.15 ± 2.84	
9	Rate use of sanitizer/Hand wash	No Use	02 (02%)	8.20 ± 0.98	0.348
		rarely	09 (09%)	9.38 ± 2.49	
		occasionally	30 (30%)	10.80 ± 2.46	
		Frequently	43 (43%)	9.81 ± 2.72	
		Very Frequently	16 (16%)	10.26 ± 2.55	
10	Rate use of mask	no use	02 (02%)	8.20 ± 0.98	0.627
		rarely	10 (10%)	9.71 ± 2.92	
		occasionally	39(39%)	9.94 ± 2.27	
		frequently	25 (25%)	10.15 ± 2.64	
		very frequently	24 (24%)	10.67 ± 3.00	
11	The Type of mask used usually	cloth	40 (40%)	9.28 ± 2.23	0.047
		N-95	34 (34%)	10.42 ± 2.63	
		cloth+N-95	21 (21%)	11.09 ± 2.96	
		surgical+N-95	01 (01%)	7.90 ± 0.0	
		surgical+cloth	04 (04%)	11.15 ± 1.58	

99% Confidence Interval, 1% level of significance (p< 0.001)
95% Confidence Interval, 5% level of significance (p< 0.05)

Table 3 Associated Risk Factors and Bad Habits with Glycemic Control of Diabetic Retinopathy

S. No.	Characteristics		Number (100%)	HbA1C Mean ± SD	Sig. P-value
1	Associated Risk Factor	No Risk	88 (88%)	10.25 ± 2.66	0.268
		HTN	8 (08%)	8.5 ± 1.74	
		CVD	1 (01%)	12.00 ± 0.0	
		HTN+CVD	3 (03%)	9.66 ± 0.76	
2	Associated Bad Habits	No	75 (75%)	9.99 ± 2.57	0.456
		Smoking	10 (10%)	10.74 ± 2.55	
		Alcohol	6 (06%)	9.18 ± 1.77	
		Smoking+Alcohol	9 (09%)	11.03 ± 3.26	

99% Confidence Interval, 1% level of significance (p< 0.001)
95% Confidence Interval, 5% level of significance (p< 0.05)

Table .4 Correlation of variables with Glycemic control of Diabetic Retinopathy

S.No.	Variables	Pearson Correlation	Sig. (2-tailed)
1	Random blood glucose	.416**	0.000
2	Gender	-.064	0.525
3	age	-.091	0.365
4	Type of vaccine	-.121	0.229
5	F/H/O DM	.008	0.937
6	Dur_DM	-.241*	0.010
7	Dur_Medication	.047	0.642
8	Diagnosis stages of DR	.369**	0.000
9	H/O covid Positive (RTPCR)	-.198*	0.048
10	H/O covid like symptom	-.247*	0.013
11	H/O contact covid + person	-.187	0.062
12	H/O Treatment Process	-.164	0.103
13	H/O covid death in Family	-.026	0.800
14	H/O attending gathering	.010	0.919
15	Rate use of sanitizer/Hand wash	.026	0.795
16	Rate use of mask	.151	0.134
17	The Type of mask used usually	.259**	0.009
18	Associated Risk Factors with DR	-.086	0.398
19	Associated Bad Habits with DR	.081	0.423
	**. Correlation is significant at the 0.01 level (2-tailed).		
	*. Correlation is significant at the 0.05 level (2-tailed).		

DISCUSSION

The Predominant age group affected with DR was 51-60 Years. Retinopathy rates were higher (52%) in 51-60 years, 12% in 61-70 years and 24% retinopathy occurred in the 41-50 years age group. This study shows after covid broke through there Prevalence of Diabetic Retinopathy increased in Diabetic Population in low age groups.

The Gender wise distribution showed preponderance for the male sex. The ratio being 1.6:1 most of the male sex was associated with severe forms of Retinopathy.(24)Major changes have already been observed in the Healthcare systems and the risk of complications may be increased due to reduced access to medication, diabetic-related supplies (syringes, glucose strips) medical consultations, and timely laboratory results during the pandemic.(25)Our study shows after the Covid breakthrough both genders increased mild NPDR cases in Diabetic populations. There are many factors like medical facility, DM medication, Economical, and other psychological factors that were associated with this.

In this study, 27% of the individuals had a family history of Diabetes with a majority (9%) belonging to Mild NPDR. Several studies showed individuals with a DM family history Higher risk of DR. This study shows only 27% of the individual's family history of DM. It could be due to a study based on a rural population and the majority of individuals' Family History not diagnosed.The magnitude of Retinopathy out of 100 DR individuals is 56% of Mild NPDR, 22% of moderate NPDR, 12% of Sever NPDR, and 10% of PDR. NPDR was the most common Retinopathy seen.(26)

Duration of Diabetes When the duration of Diabetes was less than 5 years 47% of individuals had DR with a duration of 6-10 years, 33% had DR, with a duration of 11-15 years, 33% had DR and with duration 16-20 Years only 4% individuals had DR of varying severity.In these study individuals with less than 5 years of Diabetes, 34 had Mild NPDR, 5% had Moderate NPDR3% had Sever NPDR and 5% had PDR. Studies show ata 6-10 years period NPDR was more, accounting and as the duration of Diabetes progressed, PDR wason the rise reaching a peak of 11-15 years. Most of the mild NPDRs hadless than 5 years of Diabetes and moderate NPDRs had 6-10 years of Diabetes.After 15 years of Diabetes, PDR was more than NPDR. Thiscorrelated with the WESDR by Klein et al 1989 which showed an increase inPDR when Diabetes is around 15 years.(26) In this study less than 5 years 34 % had Diabetics individuals' progression of DR

which was higher after the breakthrough of covid-19.

Hyperglycemia: In diabetics with DR, the mean baseline Random blood Glucose and HbA1c were 252.35 mg/dl and 10.11% respectively which was strongly significant with their abnormal ranges. The mean baseline RBS and HbA1C in Mild NPDR, Moderate NPDR, Severe NPDR, and PDR were 281.31 mg/dl, 262.30 mg/dl, 316 mg/dl, 354.53 mg/dl and 9.48%, 10.36%, 10.26%, 13.02% respectively. In this study, we observed there was a significant change between groups and within groups. Due to the breakthrough of covid, there is no change in pattern with an increasing number of individuals of diabetics toward the progression of DR.Hyperglycemia was an associated factor in all the groups.(27).In this study we observed there was a significant change between groups and within groups. Due to the breakthrough covid number of cases increased in DR but there is no major change in the glycemic control pattern of individual diabetics toward the progression of DR.

Hypertension, CVD, and Smoking alcohol are important risk factors for diabetic Retinopathy. A study has shown that a higher incidence of cardiac and pulmonary problems during COVID-19 results in adverse outcomes for diabetic patients(25,28) and an increased risk of DM progression on the severity of DR. Diabetic retinopathy causes a morbid decrease in vision. A common complication associated is vitreous hemorrhage and a common systemic disorder associated is systemic Hypertension followed by nephropathy.Periodic ocular examinations in all diabetics should be carried out. Diabetic Retinopathy is a preventable cause of blindness especially in developing countries.(9,29) Strict glycemic control, routine Biochemical investigation, and their good control, Early Diagnosis of DR, and Timely intervention with laser treatment save the individual from severe visual loss by controlling the progression of Retinopathy

CONCLUSION

There is a preponderance of males for diabetic Retinopathy and more common after 50 years of age.Although the number of cases significantly increased toward the progression of Diabetes to Diabetic Retinopathy in both genders with increased significantly low age and reduced Duration of Diabetes concerning before the breakthrough of COVID-19. Individuals having a positive family of Diabetes have progressive and severe retinopathy changes.33% of individuals had Retinopathy and among them, NPDR is the most common form of Retinopathy. Increased duration of Diabetes is associated with increased risk of developing Retinopathy. The study concluded that there was an observed significant change in the glycemic control and variables between groups and within groups of Diabetic Retinopathy, due to the breakthrough of covid-19, but there is no significantly changed observed in the glycemic control pattern of individuals with diabetic retina.

Limitation of the study:The study was limited to 100 patients only.The study is limited to only two rural populations around the two specific medical colleges, hence suffers from selection bias.

Benefits to the participants: No monetary benefits was given to the participants.

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