

## Original Article

## Association of Diabetic Retinopathy with Diabetic Foot in a Tertiary Care Centre

Debnath PR<sup>1\*</sup>, Mohammuddunnobi<sup>2\*</sup>**Abstract**

Diabetic retinopathy (DR) is one of the most common causes of blindness in developed countries.

**Objective:** Early detection of diabetic retinopathy (DR) is crucial for preventing irreversible blindness. A cross-sectional study was carried out at Department of Ophthalmology and Surgery, BIRDEM General Hospital, Dhaka from January 2017 to September 2017. Patients were included, who were known diabetic. New cases of type-2 diabetes were also included because they might have complications at the time of diagnosis because of the nature of disease. Mean duration of diabetes was significantly higher in DFU with DR group. BUN and diabetes retinopathy were statistically significant ( $p < 0.05$ ) between two groups. Mean HbA1c, pre-prandial glucose, C-peptide, cholesterol, triglyceride, HDL, LDL, hematocrit, creatinine, ABI, TBI and DM foot ulcer were not statistically significant ( $p > 0.05$ ) between two groups. Most patients (33.3%) had a grade I ulcer in DF with DR group and 33.3% in DF without DR group. Medication taking was significantly high patients who were DF without DR. Combined agents was 11(36.7%) and 11(36.7%) in DF with DR and DF without DR group respectively. Insulin was taken 16(53.3%) in DF with DR group and 19(63.3%) in DF without DR group. Maximum patients had a grade I ulcer in diabetes foot ulcer. Medication taking was significantly high patients who were diabetes foot ulcer than without diabetes foot ulcer. Mean insulin, BUN and diabetes retinopathy was found statistically significantly higher in diabetes with diabetes foot ulcer.

**Conclusion:** Mean insulin BUN and diabetic retinopathy was significantly higher in diabetes with diabetes foot ulcer.

**Key word :** Diabetes foot ulcer, diabetes retinopathy, type 2 diabetes.

(Both authors are equally contributed)

1. Dr. Purabi Rani Debnath, Associate Prof. of ophthalmology & Unit Head, BIRDEM, Dhaka. Email: debnathpurabi@yahoo.com.
2. Dr. Mohammuddunnobi, Resident Surgeon, BIRDEM, Dhaka. Email: drskfiroz2005@yahoo.com

\*For correspondence

**INTRODUCTION**

Diabetes mellitus (DM) is the most common endocrine disorder in the world and is known to affect 8.3% of the population.<sup>1</sup> Diabetic retinopathy (DR) is one of the most common causes of blindness in developed countries.<sup>2</sup> Early detection of diabetic retinopathy (DR) is crucial for preventing irreversible blindness. The prevalence of retinopathy in diabetic inpatients was significantly higher than in an outpatient population and one quarter of inpatients with diabetes were noted to have previously undiagnosed retinopathy.<sup>3</sup> Evidence indicates that with timely diagnosis and appropriate care, 50–70% of vision loss from diabetes can be prevented.<sup>4</sup> Diabetes is one of the foremost causes of death in many countries and a leading cause of blindness, renal failure, and non traumatic amputation. Diabetes is also associated with numerous complications such as retinopathy, nephropathy, and neuropathy.<sup>5</sup>

**MATERIAL AND METHODS**

A cross-sectional study was carried out Department of ophthalmology and Surgery, BIRDEM General Hospital, Dhaka from January 2017 to September 2017. Patients were included, who were known diabetic. New cases of type-2 diabetes were also included because they might have complications at the time of diagnosis because of the nature of disease. For type-1 diabetics, only those patients were selected who have duration of diabetes of more than five years, because in type-1 diabetics complications usually starts after five years of duration, in accordance to the criteria of American Diabetes Association. Digital fundus photographs of the posterior pole were taken of each eye after pharmacological dilation. Presence, absence and severity of diabetic retinopathy and macular edema were graded on the basis of internationally accepted criteria. An investigator administered questionnaire and review of the medical record were used to obtain data about patient demographics, clinical characteristics and barriers to ophthalmic care. The association between these data and the presence of diabetic retinopathy was tested.

**RESULTS**

Out of 60 patients, the mean age was found 56.6±9.3 years in DF (Diabetic foot) with DR (Diabetic retinopathy) group and 54.8±10.1 years in DF without DR group. Male was predominant in both groups (73.3% vs 67.4% respectively).

Mean duration of diabetes was significantly higher in DF with DR group ( $p < 0.05$ ). In both groups majority patients had history of HTN (76.6% vs 73.3%). Mean systolic and diastolic blood pressure and BMI were not statistically significant ( $p > 0.05$ ) between two groups. History of smoking was found 10(33.3%) in DF with DR group and 12(40%) in DF without DR group. Which was not statistically significant ( $p > 0.05$ ) between two groups (Table 1).

Mean insulin, BUN and diabetes retinopathy were statistically significant ( $p < 0.05$ ) between two groups. Mean HbA1c, pre-prandial glucose, C-peptide, cholesterol, triglyceride, HDL, LDL, hematocrit, creatinine, ABI, TBI and DM foot ulcer were not statistically significant ( $p > 0.05$ ) between two groups (Table 2). Most patients (33.3%) had a grade I ulcer in DF with DR group and 33.3% in DF without DR group (Figure 1).

Most of the patients (86.7%) taking medication in DF with DR group and 30(100%) in DF without DR group. Medication taking was significantly high patients who were DF without DR. Combined agents was 11(36.7%) and 11(36.7%) in DF with DR and DF without DR group respectively. Insulin was taken 16(53.3%) in DF with DR group and 19(63.3%) in DF without DR group (Table 3).

**Table I: Socio-demographic characteristics of the patients (n=90)**

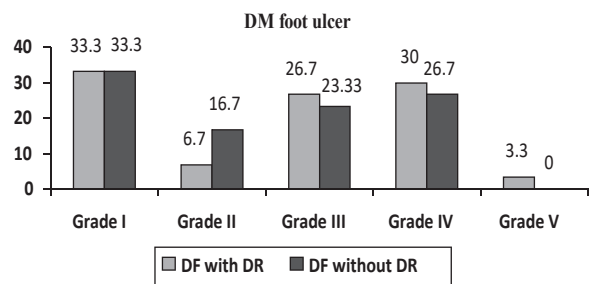
Characteristics	DF with DR (n=30)	DF without DR (n=30)	P value
Age (years)	56.6±9.3	54.8±10.1	0.381
Sex (Male)	34 (72.3%)	29(67.4%)	0.612
Diabetes duration (year)	18.7±10.3	13.4±8.7	0.010
History of HTN	23 (76.6%)	22(73.3%)	0.799
Blood pressure (mmHg)			
Systolic	131.6±18.6	127.6±19.0	0.315
Diastolic	70.2±10.4	69.8±11.1	0.860
BMI (kg/m <sup>2</sup> )	22.9±3.7	23.1±3.5	0.793
History of smoking	10(33.3%)	12(40%)	0.328

DF-Diabetic foot, DR-Diabetic retinopathy  
P value was done from Student's t-test as shown mean±SD and Chi square test as shown categorical variables

**Table II: Biochemical characteristics of the patients (n=60)**

Characteristics	DF with DR (n=30)	DF without DR (n=30)	P value
HbA1c (%)	8.1±1.7	8.0±1.6	0.775
Preprandial glucose (mg/dL)	149.7±87.3	145.4±94.5	0.823
C-peptide	2.3±1.1	1.9±1.4	0.133
Insulin	19.7±12.0	33.2±23.7	0.001
Cholesterol (mg/dL)	150.5±42.3	152.3±36.7	0.830
Triglyceride (mg/dL)	136.7±98.7	137.3±66.3	0.973
HDL (mg/dL)	38.9±11.4	43.1±11.2	0.081
LDL (mg/dL)	81.6±32.9	82.2±33.1	0.931
Hematocrit (%)	33.7±5.8	35.9±5.2	0.062
BUN (mg/dL)	31.3±16.3	22.7±12.1	0.005
Creatinine (mg/dL)			
ABI	0.95±0.35	0.96±0.30	0.881
TBI	0.57±0.28	0.61±0.31	0.521
DM foot ulcer			
Grade I	10(33.3%)	10(33.3%)	0.515
Grade II	2(6.7%)	5(16.7%)	
Grade III	8(26.7%)	7(23.33%)	
Grade IV	9(30.0%)	8(26.7%)	
Grade V	1(3.3%)	0	
Diabetic retinopathy (DR)			
No DR	0	7(23.3%)	
Mild NPDR	0	5(16.7%)	
Moderate NPDR	0	11(36.7%)	0.001
Severe NPDR	0	7(23.3%)	
PDR	30(100%)	0	

DF-Diabetic foot, DR-Diabetic retinopathy  
P value was done from Student's t-test as shown mean±SD and Chi square test as shown categorical variables



**Figure 1: Bar diagram showing diabetes mellitus foot ulcer.**

**Table III: Methods of glycemetic control (n=60)**

Methods of glycemetic control	DF with DR (n=30)	DF without DR (n=30)	P value
No medication	4(13.3)		0.015
Medication	26(86.7)	30(100)	
Combined agents	11(36.7)	11(36.7)	0.918
Insulin	16(53.3)	19(63.3)	0.357

P value was done from Chi square test as shown categorical variables

## DISCUSSION

The demographics for the population studied are likely to differ from those of the general outpatient diabetic population in several ways. It is likely to be an older population with a greater duration of diabetes, poor diabetic control, medical comorbidities and lower socioeconomic status. This was a major motivation for us to undertake this work.

In our study it was observed that the mean age was found 56.6±9.3 years in DF (Diabetic foot) with DR (Diabetic retinopathy) group and 54.8±10.1 years in DF without DR group. In study of Hwang et al.<sup>6</sup> observed that the mean age was found 66.7±8.8 years in DFU with DR group and 66.8±12.6 years in DFU without DR group. The difference was not statistically significant ( $p>0.05$ ) between two groups. Girisha and Viswanathan<sup>1</sup> study showed the mean age of the population in our study was 58.28 years ± 11.36. AlGoblan et al.<sup>7</sup> study also reported that the average age of the patients included in the study was 56 years (standard deviation [SD] ±9.7).

In current study observed that Male was predominant in both groups (73.3% vs 67.4% respectively). Mean duration of diabetes was significantly higher in DF with DR group ( $p<0.05$ ). In this Hwang et al.<sup>6</sup> male was found 75.0% in DF with DR group and 73.0% in DF without DR group. Mrozikiewicz-Rakowska et al.<sup>2</sup> study observed that male was found 77.0% in DR group and 54.0% in control group. Girisha and Viswanathan<sup>1</sup> study showed among the 145 cases studied, 95 (65.51%) were males and 50 (34.48%) were females with a male to female ratio of 1.9:1. Al Goblan et al.<sup>7</sup> study revealed male found 59.3% and female 40.7%.

In this study mean duration of diabetes was found 18.7±10.3 years in DFU with DR group and 13.4±8.7 years in DF without DR group. Mean duration of diabetes

was significantly higher in DFU with DR group ( $p<0.05$ ). Similar observation was found different studies Hwang et al. showed that the mean duration of diabetes was found 20.6±10.4 years in DFU with DR group and 15.8±10.3 years in DF without DR group. The difference was statistically significant between two groups ( $p=0.022$ ). Mrozikiewicz-Rakowska et al.<sup>2</sup> study showed the mean duration of diabetes was found 16.97±9.2 years in DR group and 17.1±9.48 years in control group. AlGoblan et al.<sup>7</sup> study on the length of the disease, 45% of the patients had diabetes for ,10 years, 38.6% for 10–20 years, and 16.4% for .20 years

In our study in both groups majority patients had history of HTN (76.6% vs 73.3%). Mean systolic and diastolic blood pressure and BMI were not statistically significant ( $p>0.05$ ) between two groups. Mrozikiewicz-Rakowska et al.<sup>2</sup> study observed that the mean BMI was found 32.24±5.0 kg/m<sup>2</sup> in DR group and 30.24±5.42 kg/m<sup>2</sup> in control group. Hwang et al. study showed that history of HTN was found in 75.0% in DFU with DR group and 69.0% in DFU without DR group. Mean blood pressure and BMI were not statistically significant ( $P>0.05$ ). History of smoking was found 10(33.3%) in DF with DR group and 12(40%) in DF without DR group. Which was not statistically significant ( $p>0.05$ ) between two groups. Girisha and Viswanathan<sup>1</sup> study showed hypertension was the most common among the associated comorbid illness. AlGoblan et al.<sup>7</sup> the mean body weight of the patients was 81 kg (STD ±13). BMI measurements showed that 12.9% patients had normal BMI, whereas 30.7% were overweight and 56.4% were categorized as obese with BMI .30. None of the patients included in the study had underweight BMI.

In present study the mean insulin, BUN and diabetes retinopathy were statistically significant ( $p<0.05$ ) between two groups. Mean HbA1c, pre-prandial glucose, C-peptide, cholesterol, triglyceride, HDL, LDL, hematocrit, creatinine, ABI, TBI and DM foot ulcer were not statistically significant ( $p>0.05$ ) between two groups. AlGoblan et al.<sup>7</sup> study comparing patients with controlled highly elevated HbA1c, only 23% of patients had healed foot ulcers within 3 months, 28% between 3 and 6 months, and 48% > 7 months ( $P=0.024$ ). A similar association was observed between the process of healing and HbA1c levels in our patients. While studying the healing process in relation to HbA1c levels, we observed that 68% of patients with normal HbA1c had completely healed foot ulcers, whereas 20% showed partial healing

and 4% had uncured foot ulcers. The remaining 8% of patients required graft placement. Among the patients with high HbA1c, 45.9% showed complete healing, whereas 33.8% had partial healing, 5.4% progressed to grafting process, and 14.9% had unhealed foot ulcers. Hwang et al.<sup>6</sup> study observed in terms of DR, 90 patients (90%) had DR and 55 patients (55%) had proliferative diabetic retinopathy (PDR). Eight patients (8%) had mild non-proliferative diabetic retinopathy (NPDR) and 17 patients had moderate NPDR (17%). Severe NPDR was observed in 10 patients (10%).

In this study most patients (33.3%) had a grade I ulcer in DF with DR group and 33.3% in DF without DR group. Hwang et al. study observed that among 100 patients with DFUs, only one patient (1%) had a grade 5 ulcer. Girisha and Viswanathan<sup>1</sup> the number of patients with mild nonproliferative diabetic retinopathy were 95 (65.5%) and those with moderate nonproliferative diabetic retinopathy were 45 (31.03%). Severe nonproliferative diabetic retinopathy was seen in 5 patients who accounted for 3.44% of the total.

In this study Most of the patients (86.7%) taking medication in DF with DR group and 30(100%) in DF without DR group. Medication taking was significantly high patients who were DF without DR. Combined agents was 11(36.7%) and 11(36.7%) in DF with DR and DF without DR group respectively. Insulin was taken 16(53.3%) in DF with DR group and 19(63.3%) in DF without DR group. Hwang et al. was observed that no medication was found 10.0% in DFU with PDR group and medication used 90.0% in DFU with PDR group and 100% in DFU without PDR group. Combined oral agents was 35.0% in DFU with PDR group and 36.0% in DFU without PDR group. Insulin was 55.0% and 64.0% in DFU with PDR and DFU without PDR group respectively. The difference was not statistically significant ( $p>0.05$ ) between two groups. Sharma et al.<sup>8</sup> correlate the diabetic foot disease to the treatment history for the diabetes, the dreaded problem of diabetic foot was highest in patients who have not had any treatment (33.64%), followed by insulin users (21.99%), and then followed by oral hypoglycemic agents (14.43%). Surprisingly, another study has shown insulin to be a known risk factor diabetic foot disease.<sup>9</sup> Perhaps untreated patients were left out in this study.

## CONCLUSIONS

Maximum patients had a grade I ulcer in diabetes foot ulcer. Medication taking was significantly high patients

who were diabetes foot ulcer than without diabetes foot ulcer. Mean insulin, BUN and diabetic retinopathy was found statistically significantly higher in diabetes with diabetes foot ulcer.

## REFERENCES

1. Girisha BS, Viswanathan N. In search of cutaneous marker for retinopathy in diabetic patients: A pilot study. *Clin Dermatol Rev* 2017; 1: 52-5.
2. Mrozikiewicz-Rakowska B, Łukawska M, Nehring P, Szymański K, Agnieszka Sobczyk-Kopciół A, Krzyżewska M, et al. Genetic predictors associated with diabetic retinopathy in patients with diabetic foot. *Pol Arch Intern Med.* 2018; 128 (1): 35-42
3. Kovarik JJ, Eller AW, Willard LA, et al. Prevalence of undiagnosed diabetic retinopathy among inpatients with diabetes: the diabetic retinopathy inpatient study (DRIPS). *BMJ Open Diabetes Research and Care* 2016;4: e000164.
4. Klein R, Klein B. Vision disorders in diabetes. In: National Diabetes Data Group, ed. *Diabetes in America*. 2nd edn. Bethesda, MD: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, 1995:293-337.
5. Aziz KMA. Association between high risk foot, retinopathy And hba1c in saudi diabetic population. *Pak J Physiol* 2010;6(2):22-28
6. Hwang DJ, Lee KM, Park MS, Choi Sh, Park JI, Cho JH, et al. (2017) Association between diabetic foot ulcer and diabetic retinopathy. *PLoS ONE* 12(4): e0175270
7. AlGoblan AS, Alrasheedi IM, Basheir OH, Haider KH. Prediction of diabetic foot ulcer healing in type 2 diabetic subjects using routine clinical and laboratory parameters. *Research and Reports in Endocrine Disorders* 2016;6 11-16
8. Sharma R, Kapila R, Sharma AK, Mann J. Diabetic Foot Diseases-Incidence and risk factors: A Clinical Study. *J Foot Ankle Surg (Asia-Pacific)* 2016; 3(1): 41-46.
9. Boyko EJ, Ahroni JH, Stensel V, Forsberg RC, Davignon DR, Smith DG. A prospective study of risk factors for diabetic foot ulcer: The Scattle Diabetic Foot Study. *Diabetes Care* 1999; 22(7): 1036-4.