Content available at: iponlinejournal.com

Indian Journal of Clinical and Experimental Ophthalmology

Journal homepage: www.innovativepublication.com

Original Research Article

# Relationship of diabetic retinopathy and systemic complications of diabetes

**Vishnu Priya N[1], Ramya Deepthi P[1], Kumar Amruth C[1,*], P Sowmya[1]**

[1] *Dept. of Ophthalmology, Narayana Medical College, Nellore, Andhra Pradesh, India*

ARTICLE INFO

*Article history:*
Received 13-10-2019
Accepted 11-11-2019
Available online 17-03-2020

*Keywords:*
Diabetesmilletus
Diabetic foot
Neuropathy
Nephropathy
Retinopathy

ABSTRACT

**Aim**: To study the relationship of diabetic retinopathy with systemic complications of diabetes.
**Materials and Methods**: Study was conducted on 310 diabetic patients attending to Narayana medical college ophthalmology opd in Nellore between August 2017and June 2018. Patients are categorized into five groups based on the duration and severity of DR into No DR, Mild NPDR, ModerateNPDR, Severe NPDR, PDR according to the ETDRS classification. All the above patients evaluated clinically, and required investigations were done for the presence of systemic complications like nephropathy, neuropathy, cardiovascular, cerebrovascular, and diabetic foot. The relation between the duration of diabetes mellitus and stage of diabetic retinopathy and also with systemic complications assessed.
**Results :** A total of 310 diabetic patients with a mean age of 56.5 + 11.8 years and males 211(31.7%) and females99(31.7%). Prevalence of Diabetic retinopathy was 108(34.8%) of which mild NPDR44(41.9%), moderate NPDR35(34.5%), severe NPDR 19(18.3%)and PDR10(11.4%). A significant association ($P<0.001$) was observed between the duration of diabetes and the presence and severity of diabetic retinopathy. The overall prevalence of nephropathy, neuropathy, diabetic foot, CVS, CAD was 52.6%and they were significantly ($p<0.05$) more common in patients with DR (64.8%) as compared to those with no DR (43.5%) and complications increased with severity of retinopathy.



## 1. Introduction

Diabetic retinopathy is a microvascular complication affecting the eyes of both type 1 and type 2 diabetes mellitus.[1] Diabetic retinopathy is 4.8% of the 37 million cases of blindness throughout the world,[2] according to the World Health Organisation. India harbors 31.7 million diabetics, and the number is going to rise to an alarming 79.4 million by 2030.[3]

DM is a heterogeneous group of a syndrome in which not only carbohydrate metabolism but metabolism of lipids and proteins are also deranged. The associated metabolic deregulation causes subsequent pathophysiological changes in multiple organ systems, and the risk of complications increases with disease duration.

After 20 years, some grade of retinopathy develops in nearly 99 percent of patients of type 1 and about 60 percent of type 2 diabetes mellitus. Approximately 25 to 40 percent of patients with DM type I, and 20-30 percent of DM type II ultimately develop diabetic nephropathy.[4] About 60-70% of people with diabetes have some form of neuropathy.[5]

Diabetes is also a significant risk factor for cardiovascular disease.[6] Systemic complications of diabetes increases morbidity, as well as the risk of mortality. The presence of diabetic retinopathy indicates the development of these complications, thus putting the ophthalmologist in the front line in detecting these complications for the first time.

## 2. Materials and Methods

This study was carried out on 310 patients of diabetes coming to the Department of Ophthalmology. A complete history including the age of onset, duration, treatment for DM, any ocular treatment, and any other systemic illness

* *Corresponding author*.
*E-mail address*: amruth.chavan@gmail.com (K. Amruth C).

https://doi.org/10.18231/j.ijceo.2020.021

taken. A complete ophthalmic examination is done.

The severity of DR was determined by fundus biomicroscopy and graded according to the ETDRS classification into five groups. 1. No DR, 2. Mild NPDR, 3. Moderate NPDR, 4. Severe NPDR, and 5. PDR. For the study purpose, the eye with a more severe form of diabetic retinopathy taken into consideration. Nephropathy was diagnosed by the abnormal serum creatinine and presence of microalbuminuria. Diabetic neuropathy was diagnosed clinically by testing for pain, touch, temperature, and vibration sensation as well as eliciting superficial and deep tendon reflexes. The presence of coronary artery disease (CAD) determined by history and previous records, as well as ECG and ECHO. Cerebrovascular disease diagnosed by a history of stroke.

After data compilation, results had statistically analyzed

## 3. Results

A total of 310 patients of diabetes mellitus enrolled for the study. The age of the patients ranges 45 to 75 years, with a mean age of 56.5 + 11.8 years with males 211(68.3%) and females 99 (31.70%).

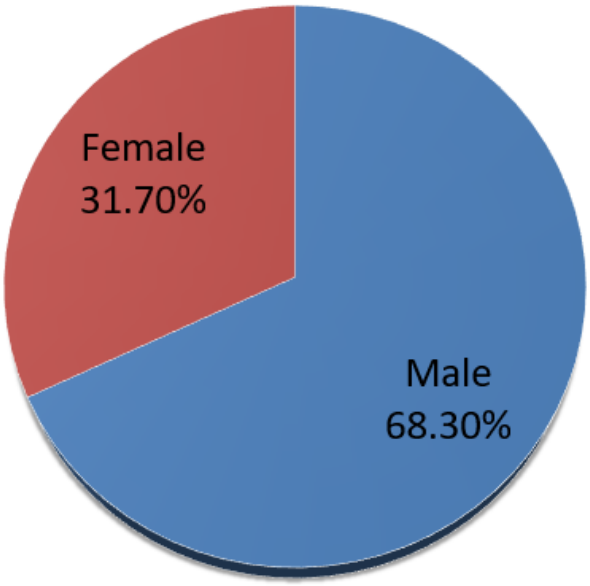


**Fig. 1:** Gender distribution

Diabetic retinopathy was present in 108 (34.8%) patients, of which 44 (41.9%) patients had mild NPDR, 35(34.5%) had moderate NPDR, 19(18.3%) had severe NPDR, and 10(11.4%) patients were of PDR.

As the duration of diabetes increases, the presence of retinopathy increases significantly.

As the duration of diabetes increases the severity of retinopathy increases significantly

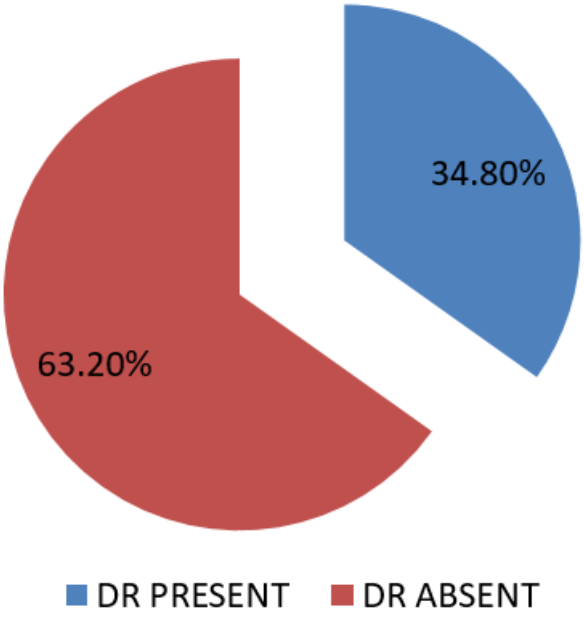


**Fig. 2:** Distribution in terms of diabetic retinopathy

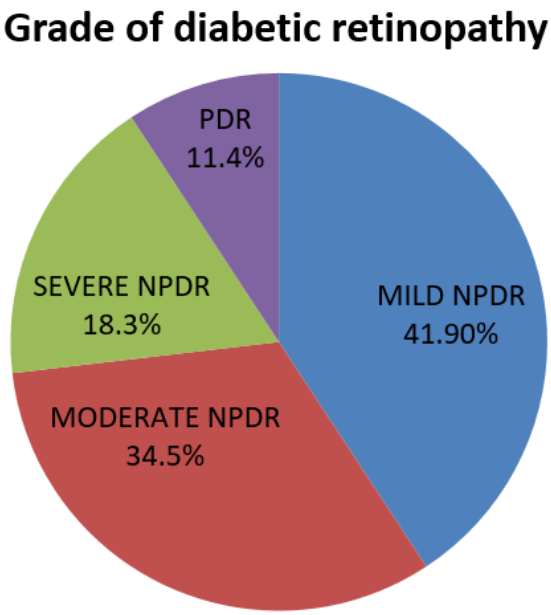


**Fig. 3:**

The overall prevalence of systemic complications was 52.6%, and they were significantly ($p<0.001$) more common in patients with DR (64.8%) as compared to those with no DR (43.5%).

PN (27.7%) is the most common systemic complication associated with diabetes followed by CKD (23.1%), CAD (13.8%), DF(12.9%), CVA(9.25%).

Systemic complications are significantly associated with diabetic retinopathy patients than in patients with no DR.

**Table 1:** Association between duration of DM and diabetic retinopathy

| Duration of Diabetes | No DR | DR Present | P-value |
|---|---|---|---|
| 1-10YRS | 110(91.6%) | 10 (8.3%) | |
| 10-20YRS | 86(61.4%) | 54(38.5%) | <0.001 |
| >20YRS | 6(12%) | 44(88%) | |

**Table 2:** A ssociation between duration and stage of DR

| Duration of Diabetes | No DR (202) | Mild NPDR (44) | Moderate NPDR(35) | Severe NPDR(19) | PDR(10) | P-value |
|---|---|---|---|---|---|---|
| 1-10YRS(120) | 110(91.6%) | 5(4.16%) | 3(2.5%) | 1(0.8%) | 1(0.8%) | |
| 10-20YRS(140) | 86(61.4%) | 32(22.8%) | 12(8.5%) | 6(4.2%) | 4(2.8%) | <0.001 |
| >20YRS(50) | 6(12%) | 7(14%) | 20(40%) | 12(24%) | 5(10%) | |

**Table 3:** Relationship of diabetic retinopathy with systemic complications of diabetes

| Diabetic retinopathy | Chronic Kidney Disease (46) | Peripheral Neuropathy (54) | Diabetic Foot (27) | Cerebro Vascular accident (17) | Coronary Artery Disease (23) |
|---|---|---|---|---|---|
| Present (108) | 25(23.1%) | 30(27.7%) | 14(12.9%) | 10(9.25)% | 15(13.8%) |
| Absent (202) | 21(10.5%) | 24(11.8%) | 13(6.4%) | 7(3.4%) | 7(3.46%) |
| P Value | 0.003 | <0.001 | <0.05 | 0.03 | 0.001 |

**Table 4:** Relationship between severity of diabetic retinopathy with systemic complications

| Systemic Complications | Mild NPDR 44 | Moderate NPDR 35 | Severe NPDR 19 | PDR 10 | P-Value |
|---|---|---|---|---|---|
| CKD(46) | 10(22.7%) | 10(28.5%) | 3(15.7%) | 2(20%) | 0.26(NS) |
| PERIPHERAL NEUROPATHY(54) | 9(20.4%) | 10(28.5%) | 7(36.8%) | 4(40%) | 0.68(NS) |
| DF(27) | 5(11.3%) | 2(5.7%) | 3(15.7%) | 2(20%) | 0.72(NS) |
| CVA(17) | 5(11.3%) | 2(5.7%) | 2(10.5%) | 1(10%) | 0.65(NS) |
| CAD(23) | 6(13.6%) | 7(20%) | 1(5.2%) | 1(10%) | 0.39(NS) |

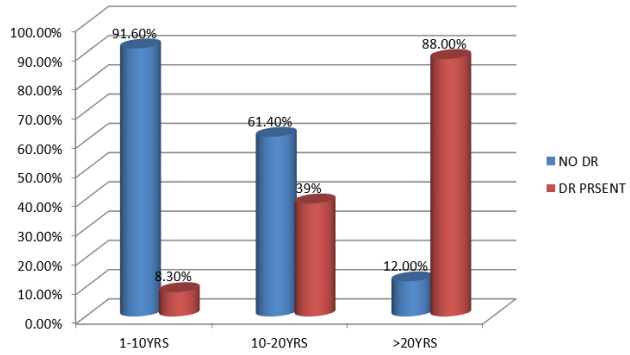


**Fig. 4:**

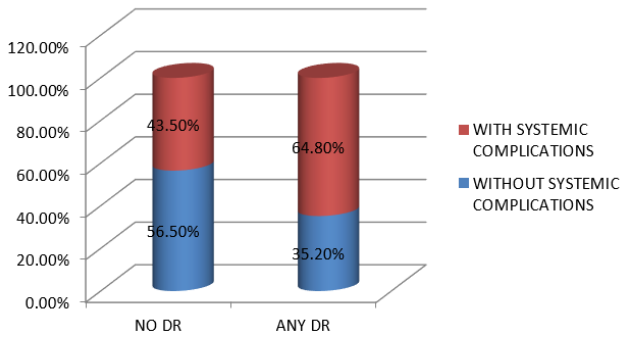


**Fig. 5:** Association of systemic complications

The maximum percentage of patients with systemic complications has seen amongst PDR patients (99.8%), followed by Severe NPDR (95.0%) moderate NPDR (88.40%) and mild NPDR (79.3%).

## 4. Discussion

The present study conducted on 310 diabetic patients of diabetes, of whom 108 (34.8%) had diabetic retinopathy of varying severity. According to the present study, DR may appear as early as 1-10 years of having diabetes, and more than 88% of patients develop DR after 20 years of having the disease. With the increasing duration of diabetes, the incidence of DR as well as the severity of retinopathy increases. Association of DR with the duration of diabetes is well known.[7] In the CURES Eye study, 41.8 percent had DR after 15 years of diabetes and severity of DR proportionally increased with longer duration of diabetes.[8]

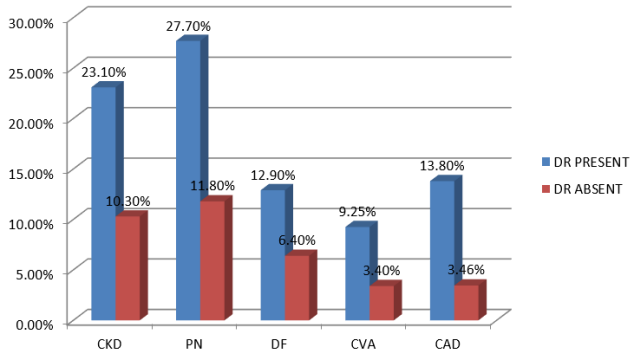


**Fig. 6:** Diabetic retinopathy and individual systemic complications

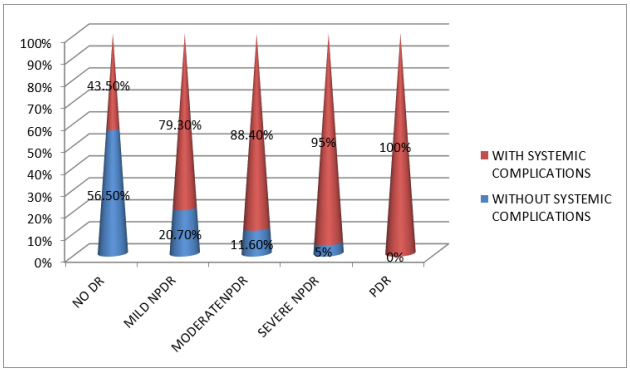


**Fig. 7:** Relationship between severity with systemic complications

Evaluating the relationship of diabetic retinopathy with systemic complications of diabetes, we found that out of 108 patients with DR, 64.8 % of patients were affected with systemic complications, while only 43.5 % of patients with no DR had systemic involvement. This was statistic ally significant (p value=0.001).

Diabetic kidney disease is found in 23.1% of patients with DR as compared to 10.30% in patients with no DR. This difference is statistically significant (p-value 0.003). Similar results were documented by Venkatesh P et al[9] and Tajunisah I et al,[10] who showed DR to be positively associated with overt nephropathy.

Peripheral neuropathy was more frequently associated with the patient having DR (27.7%) as compared to patients without DR (11.8%), and this difference was statistically significant (p-value <0.001). Similar results were seen in the study by Venkatesh P et al[9] and Dyck et al[11] where neuropathy was significantly associated with patients of diabetic retinopathy.

The diabetic foot was found in 12.90% of diabetic patients with retinopathy, while in those with no DR, it was seen only in 6.40%, the difference between both being statistically significant (p-value <0.05). A study by Ahmati I et al[12] also reported DR to be a significant risk factor for the development of the diabetic foot. CVA was also found to be significantly (p<0.05) more common in patients with DR (9.25%) than those without DR (3.4 %). Presence of retinopathy is associated with stroke, particularly in persons with associated hypertension as reported by Nakayama et al.[13]

CAD was also more commonly asso ciated with patients of DR (13.8%) than in those with no DR (3.4 6%), the difference being statistically significant as studied by Gadkari SS[14] et al. According to Cheung et al.,[15] 2007e, the presence of retinopathy was associated with a two-fold higher risk of incidnt coronary heart disease and a three-fold higher risk of fatal coronary heart disease.

Analyzing the relationship of these systemic complications with DR we found complications increases with the severity of DR. Studies by Venkatesh P et al,[9] Klein et al.,[16] 1999b reported a significant association of overt nephropathy and neuropathy with the severity of DR. A significant association between CAD and severity of DR was reported by Gerstein HC et al[17] and Cheung et al. Studies by Klein et al., reported PDR was associated with stroke mortality, independent of diabetes duration, glycemic control, and other risk factors in both type 1 and 2 diabetes.

## 5. Conclusion

Our observations support that diabetic retinopathy increases the risk of both micro and macrovascular complications of diabetes. Retinopathy may therefore represent vascular damage and injury not only in the eyes but also in other vital organs such as the brain, heart, and kidneys in people with diabetes. However, a thorough search must be done to detect concurrent systemic co-morbidities in all patients of diabetic retinopathy irrespective of the severity, which will surely help in reducing the morbidity and mortality associated with late detection of diabetic end-organ damage.

## 6. Conflict of Interest

None.

## 7. Source of Funding

No financial interest in study.

## References

1. Mani K, Davy RC. Prevalence of diabetic retinopathy in type 2 diabetes mellitus patients attending medicine out-patient department of a tertiary care hospital in Alappuzha. *Int J Res Med Sci*. 2017;5(4):1532–1536.
2. Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, et al. Global data on visual impairment in the year 2002. *Bull World Health Organ*. 2004;82(11):844–851.
3. Wild S, Roglic G, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Dia Care*. 2004;27(5):1047–1053.
4. Clark CM, Lee DA. Prevention and Treatment of the Complications of Diabetes Mellitus. *N Engl J Med*. 1995;332(18):1210–1217.

5. Aring AM, Jones DE, Falko JM. Evaluation and prevention of diabetic neuropathy. *Am Fam Physician*. 2005;71(11):2123–2128.
6. Kannel WB, Hjortland M. Castelli WP Role of diabetes in 8. Congestive heart failure: the Framingham study. *Amjcardiol*. 1974;34:29–34.
7. Jenchitr W. Prevalence of diabetic retinopathy to the duration of diabetes mellitus in community hospitals of Lampang. *J Med Assoc Thai*. 2004;87(11):1321–1326.
8. M R. Prevalence of diabetic retinopathy in urban India: the Chennai Urban Rural Epidemiology Study (CURES) eye study, I. *Invest Ophthalmol Vis Sci*. 2005;46(7):2328–2333.
9. Venkatesh P, Tibrewal S, Bhowmik D, Tripathi M, Ramakrishnan S, Vashist N. Prevalence of systemic comorbidities in patients with various grades of diabetic retinopathy. *Indian J Med Res*. 2014;140(1):77–83.
10. Tajunisah I, Nabilah H, Reddy SC. Prevalence and Risk Factors for Diabetic Retinopathy A Study of 217 Patients from University of Malaya Medical Centre. *Med J Malaysia*. 2006;61(4):451–456.
11. Dyck PJ, Davies JL, Wilson DM, Service FJ, Melton LJ, O'Brien PC. Risk factors for severity of diabetic polyneuropathy: intensive longitudinal assessment of the Rochester Diabetic Neuropathy Study cohort. *Diabetes Care*. 1999;22(9):1479–1486.
12. Ahmeti N, Laban-Guceva B, Jovanovska, Milenkovc, Adamova. Diabetic foot with risk for ulcer formation associated with diabetic retinopathy in type 2 diabetes. *Endocrine Abstracts*. 2011;26:693–693.
13. Nakayama T, Date C, Yokoyama T, Yoshiike N, Yamaguchi M, Tanaka H. A 15.5-Year Follow-up Study of Stroke in a Japanese Provincial City. *Stroke*. 1997;28(1):45–52.
14. Gadkari SS, Maskati QB, Nayak BK. Prevalence of diabetic retinopathy in India: The All India Ophthalmological Society Diabetic Retinopathy Eye Screening Study. *Indian J Ophthalmol*. 2014;64(1):38–44.
15. Cheung N, Wang JJ, Klein R, Couper DJ, Sharrett AR, Wong TY. Diabetic Retinopathy and the Risk of Coronary Heart Disease: The Atherosclerosis Risk in Communities Study. *Diabetes Care*. 2007;30(7):1742–1746.
16. Klein R, Klein BE, Moss SE, Cruickshanks KJ, Brazy PC. The 10-year incidence of renal insufficiency in people with type 1 diabetes. *Diabetes Care*. 1999;22(5):743–751.
17. Gerstein HC, Ambrosius WT, Danis R, Ismail-Beigi F, Cushman W, et al. Diabetic Retinopathy, Its Progression, and Incident Cardiovascular Events in the ACCORD Trial. *Diabetes Care*. 2013;36(5):1266–1271.

## Author biography

**Vishnu Priya N** Final Year Post Graduate

**Ramya Deepthi P** Associate Professor

**Kumar Amruth C** Associate Professor

**P Sowmya** Final Year Post Graduate

**Cite this article:** Priya N V, Deepthi P R, Amruth C K, Sowmya P. **Relationship of diabetic retinopathy and systemic complications of diabetes**. *Indian J Clin Exp Ophthalmol* 2020;6(1):94-98.