

## ORIGINAL RESEARCH

## The occurrence of various grades of diabetic retinopathy in patients with end stage renal disease in a tertiary hospital

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### ABSTRACT

**Background:**International Diabetes Federation (IDF) predicts an increase in the number of patients with diabetes to 643 million by 2030 and to 784 million by 2045. Present study was aimed to study occurrence of various grades of diabetic retinopathy in patients with end stage renal disease in a tertiary hospital. **Material and Methods:** Present study was hospital based, cross-sectional, observational study, conducted patients of type 2 DM, admitted with end stage renal disease (ESRD) due to diabetic nephropathy, underwent evaluation for diabetic retinopathy. **Results:** In present study, 56 patients of diabetic ESRD were included. Majority patients had Best-corrected visual acuity (BCVA) as good vision (42.86 %) followed by impaired vision (28.57 %), blind (<3/60) (23.21 %) & legally blind (5.36 %). In present study, incidence of diabetic retinopathy was 60.71 %. Majority had Mild non-proliferative diabetic retinopathy (NPDR) (26.79 %) followed by Moderate non-proliferative diabetic retinopathy (13.39 %), Proliferative diabetic retinopathy (PDR) (11.61 %) & least had Severe non-proliferative diabetic retinopathy (8.93 %). Higher incidence of diabetic retinopathy as well severity of diabetic retinopathy, was noted with increasing age of patients, association was statistically significant (p- 0.022). Higher incidence of diabetic retinopathy as well severity of diabetic retinopathy, was noted with increasing duration of diabetes, association was statistically significant (p- 0.018). **Conclusion:** The risk of Diabetic retinopathy as well as severity of Diabetic retinopathy increase in age of patient & duration of diabetes in patients of ESRD.

**Keywords:** Diabetic retinopathy (DR), end stage renal disease (ESRD), diabetic nephropathy, ophthalmic examination

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### INTRODUCTION

Diabetes is characterized by metabolic abnormalities and long term microvascular and macrovascular complications. With the increase prevalence of diabetes, there is a significant increase in the microvascular complication like retinopathy, nephropathy, neuropathy, coronary heart diseases and cerebrovascular accidents.<sup>1</sup>

International Diabetes Federation (IDF) predicts an increase in the number of patients with diabetes to 643 million by 2030 and to 784 million by 2045.<sup>2</sup> Worldwide Diabetic nephropathy (DN) is considered as a leading cause of chronic renal failure and it is also estimated that nearly 20 % of the patients with Type 2 Diabetes Mellitus (T2DM) reach End Stage Renal Disease (ESRD) during their lifetime.<sup>3</sup> Diabetic retinal disease and pathology is the commonest cause of visual impairment in patients with diabetes. Poor glycemic control,

raised blood pressure (BP), duration of diabetes, and microalbuminuria or proteinuria are the main risk factors which initiates and then complicates this pathology.<sup>4</sup>

In a systematic review and meta-analysis, Manasi G et al., suggested that presence of DR is a strong predictor of risk of kidney disease progression in DKD patients. Furthermore, the risk of DKD progression increases with DR severity. Screening for retinal vascular changes could potentially help in prognostication and risk-stratification of patients with DKD.<sup>5</sup> Present study was aimed to study occurrence of various grades of diabetic retinopathy in patients with end stage renal disease in a tertiary hospital.

## MATERIAL AND METHODS

Present study was hospital based, cross-sectional, observational study, conducted at Apollo Spectra, C P Ramaswamy road, Chennai, India. Study duration was of 2 years (January 2020 to December 2021). Study approval was obtained from institutional ethical committee.

### Inclusion criteria

Known patients of type 2 DM, admitted with end stage renal disease (ESRD) due to diabetic nephropathy. ESRD diagnosis was based on the KDOQI 2007 criteria,<sup>6</sup> and was deemed present if: (i) biopsy diagnosis of DN was present, (ii) macroalbuminuria (albumin to creatinine ratio > 300 mg/g) was present or (iii) microalbuminuria (30–300 mg protein/g creatinine). Patient willing to participate in present study.

### Exclusion criteria

Patients with reversible kidney injury. Patients with end stage renal disease with causative factor other than diabetes e.g. hypertension, glomerulonephritis, renal calculi. Patients underwent any form of retinal surgery/laser therapy.

Study was explained to patients in local language & written consent was taken for participation & study. Descriptive data of the participants, such as name, age, gender, and detailed history, were obtained by interviewing the participants, and clinical examination and necessary investigations were recorded case record proforma. All patients underwent history taking, general physical examination, systemic examination, and ocular examination.

Ophthalmoscopic examination included best-corrected visual acuity testing, intraocular pressure, and detailed examination of anterior and posterior segments. Pupil dilatation was performed with tropicamide for indirect ophthalmoscopy with 20D lens. Other investigations such as fundus fluorescein angiography, perimetry, fundus photography, and Schirmer's test were carried out wherever indicated. Diabetic retinopathy was classified according to international classification of diabetic retinopathy<sup>7</sup>.

Table 1: International classification of diabetic retinopathy<sup>7</sup>.

Proposed disease severity level	Findings observable on dilated ophthalmoscopy
No apparent retinopathy	No abnormalities
Mild non-proliferative diabetic retinopathy (NPDR)	Microaneurysms only
Moderate non-proliferative diabetic retinopathy	More than just microaneurysms but less than severe non proliferative diabetic retinopathy
Severe non proliferative diabetic retinopathy	Any of the following: <ul style="list-style-type: none"> <li>• More than 20 intraretinal hemorrhages in each of four quadrants,</li> <li>• Definite venous beading prominent intra retinal microvascular abnormalities in 1 quadrant</li> </ul> And <ul style="list-style-type: none"> <li>• no signs of proliferative retinopathy</li> </ul>
Proliferative diabetic retinopathy (PDR)	One or more of the following: Neovascularisation: Vitreous or preretinal haemorrhage

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

## RESULTS

In present study, 56 patients of diabetic ESRD were included. Majority patients had Best-corrected visual acuity (BCVA) as good vision (42.86 %) followed by impaired vision (28.57 %), blind (<3/60) (23.21 %) & legally blind (5.36 %).

Table 1: Best-corrected visual acuity (BCVA) in the eyes of patients

WHO criteria BCVA	Total eyes	Percentage
Good vision 6/6-6/18	48	42.86%
Impaired vision 6/24-6/60	32	28.57%
Legally blind 6/60-3/60	6	5.36%
Blind <3/60	26	23.21%

In present study, incidence of diabetic retinopathy was 60.71 %. Majority had Mild non-proliferative diabetic retinopathy (NPDR) (26.79 %) followed by Moderate non-proliferative diabetic retinopathy (13.39 %), Proliferative diabetic retinopathy (PDR) (11.61 %) & least had Severe non proliferative diabetic retinopathy (8.93 %)

Table 2: Severity of diabetic retinopathy

Severity of diabetic retinopathy	Total eyes	Percentage
No apparent retinopathy	44	39.29%
Mild non-proliferative diabetic retinopathy (NPDR)	30	26.79%
Moderate non-proliferative diabetic retinopathy	15	13.39%
Severe non proliferative diabetic retinopathy	10	8.93%
Proliferative diabetic retinopathy (PDR)	13	11.61%

Higher incidence of diabetic retinopathy as well severity of diabetic retinopathy, was noted with increasing age of patients, association was statistically significant (p- 0.022).

Table 3: Age group distribution & diabetic retinopathy

Age group	No apparent retinopathy	Mild non-proliferative diabetic retinopathy (NPDR)	Moderate non-proliferative diabetic retinopathy	Severe non proliferative diabetic retinopathy	Proliferative diabetic retinopathy (PDR)
41-50	19 (16.96 %)	2 (1.79 %)	0	0	0
51-60	14 (12.5 %)	9 (8.04 %)	4 (3.57 %)	2 (1.79 %)	2 (1.79 %)
61-70	7 (6.25 %)	12 (10.71 %)	7 (6.25 %)	5 (4.46 %)	6 (5.36 %)
>70	4 (3.57 %)	7 (6.25 %)	4 (3.57 %)	3 (2.68 %)	5 (4.46 %)

Higher incidence of diabetic retinopathy as well severity of diabetic retinopathy, was noted with increasing duration of diabetes, association was statistically significant ( $p=0.018$ ).

Table 4: Duration of diabetes & diabetic retinopathy

Duration of diabetes (years)	No apparent retinopathy	Mild non-proliferative diabetic retinopathy (NPDR)	Moderate non-proliferative diabetic retinopathy	Severe non-proliferative diabetic retinopathy	Proliferative diabetic retinopathy (PDR)
0-5	0	0	0	0	0
6-10	12 (10.71 %)	2 (1.79 %)	1	0	0
11-15	17 (15.18 %)	17 (15.18 %)	8 (7.14 %)	6 (5.36 %)	6 (5.36 %)
>15	15 (13.39 %)	11 (9.82 %)	6 (5.36 %)	4 (3.57 %)	7 (6.25 %)

## DISCUSSION

India being a developing country and undergoing socioeconomic growth on fast pace is at a higher risk of catering diabetic population owing to the unhealthy lifestyle with a significant fraction belonging to the urban population.<sup>2</sup> Diabetic nephropathy (Kimmelstiel-Wilson syndrome) is the leading cause of end-stage renal disease (ESRD) worldwide, and it is estimated that 20% of type 2 diabetic patients reach ESRD during their lifetime.<sup>7</sup>

Diabetic retinopathy (DR) and diabetic nephropathy (DN) (now called diabetic kidney disease (DKD)) are the most common microvascular complications of diabetes. DR and DKD are major causes of social and economic burden to individuals with diabetes and the healthcare system due to the risk of blindness and end-stage renal disease.<sup>8</sup> These microvascular complications have common risk factors, such as long duration of diabetes, poor glycemic control and hypertension.

Diabetic retinopathy (DR) is one of the leading causes of sight threatening disease in the world. The most common cause of vision loss in patients with DR is diabetic macular edema (DME) found in 11.5%, followed by macular ischemia or complications of neovascularization like vitreous hemorrhage or retinal detachment.<sup>9</sup>

Ramya M et al.,<sup>10</sup> studied 74 patients with ESRD, 25% were females while 75% were males. 24% of the males had PDR while none of the females had PDR. 6 % of the males had mild to moderate NPDR, while 11% of females had mild to moderate NPDR. ( $P=0.043$ ). Younger patients with ESRD were found to have a higher propensity of having proliferative diabetic retinopathy ( $p=0.014$ ). Patients who were undergoing dialysis for  $\geq 5$  years, had an incidence of PDR of 30%, while those undergoing dialysis for  $\leq 5$  years had an incidence of PDR of 15% ( $p=0.468$ ). 10 % of those with  $\geq 5$  years of dialysis had mild-moderate NPDR, while 6.8% of those with less than 5 years of dialysis had mild-moderate NPDR. In our subset of patients, dialysis was performed either twice or thrice a week. Those with the former, had an incidence 10.9% of PDR, while those with the latter had an incidence of 31.8% of PDR. ( $p=0.156$ )

Bala B et al.,<sup>11</sup> studied 273 patients, average age of patients was 64.6 years with mean duration of diabetes mellitus was 7.4 years. Patients suffering from severe NPDR and PDR had association with poor control of blood glycosylated haemoglobin. Patients with mild NPDR 31.1 %, Moderate NPDR 52.3 %, severe NPDR 67.4 % and in PDR 65.2 % patient had blood urea more than 40 mg / dl. In mild NPDR group 32.2 %, moderate NPDR 55.4 %, severe NPDR 67.4 % and in PDR group 63.9 % patients had serum creatinine more than 1.5 mg / dl. They noted a statistically significant correlation between HbA1c level and severity of diabetic retinopathy. Prevalence of nephropathy increased with increments in the grade of retinopathy.

Sandhya CS et al.,<sup>12</sup> 105 diabetic patients undergoing hemodialysis for ESRD, prevalence of DR was 89.8% and prevalence of DME was 23%. Prevalence of Non-Proliferative Diabetic Retinopathy (NPDR) 61.4% was more than Proliferative Diabetic Retinopathy (PDR) 38.6 percent. The visual morbidity due to PDR and DME was high among the diabetic patients undergoing hemodialysis.

Chougule N et al.,<sup>13</sup> studied 50 patients with diabetes mellitus undergoing renal hemodialysis, male (74%) preponderance was observed, and 50% of the patients had age more than 60 years. Thirty-two (32%) of the patients had duration of renal dialysis <6 months. Twenty-six (26%) eyes had duration of vision loss within a year with duration of diabetes up to 4 years. Overall ocular changes seen in patients were diabetic retinopathy (48%), hypertensive retinopathy (12%), and cataract (9%). Proliferative diabetic retinopathy was the most common (50%) cause of visual impairment.

OCT provides a schematic histology like picture of layers of retina. It provides for thickness of retina to diagnose macular edema. Intraretinal cysts, vitreoretinal traction, epiretinal membranes, and other retinal macular pathologies of DR can be easily diagnosed.<sup>14</sup>

Ocular treatment revolves around four major strategies: Retinal laser photocoagulation, anti-VEGF drugs, steroids, and surgical intervention.<sup>15</sup>

Severity of diabetic retinopathy by assessing its different stages in relation to different stages of diabetic nephropathy. Data shows that severe forms of diabetic retinopathy is more linked to long standing history of diabetes causing kidney damage among those with good glycaemic control. Hence it is advisable to include fundoscopy & albuminuria as the screening tool in the evaluation of long-standing diabetes, so that we can predict the development of diabetic retinopathy and treat them in early stages.<sup>16</sup>

## CONCLUSION

Diabetic retinopathy (DR) is a well-known long term complication of diabetes mellitus. The risk of Diabetic retinopathy as well as severity of Diabetic retinopathy increase in age of patient & duration of diabetes in patients with end stage renal disease (ESRD) due to diabetic nephropathy. Thus, with the increase in the stage of CKD, early referral to an ophthalmologist for a close monitoring of diabetic retinopathy, for early diagnosis & treatment to prevent further complications.

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