ABSTRACT: INTRODUCTION: Diabetes mellitus is one of the most common metabolic disorders of multiple etiology. The multisystem effects of diabetes such as retinopathy, nephropathy, neuropathy and cardiovascular diseases have an important impinging on the working age individuals in our country. Diabetic Retinopathy (DR) is one of the leading causes of blindness in the world that increases the chance of losing vision to about 25 times higher compared to normal individuals. Diabetic Nephropathy (DN) is the major life-threatening complication which develops in approximately 20% to 40% of type 1 and less than 20% of type 2 diabetic patients. DN is the leading known cause of End stage renal disease (ESRD). AIM AND OBJECTIVE: A systematic cross-sectional study was conducted in Sarojini Devi eye hospital to assess the correlation between Diabetic Retinopathy and Diabetic Nephropathy in Type II Diabetes Mellitus patients. METHODS AND MATERIALS: A study was conducted on 108 Type II DM patients presenting to Sarojini Devi Eye hospital, Hyderabad and were assessed for Retinopathy and Nephropathy and Correlation between Retinopathy and Nephropathy was studied from December 2011 to December 2014. RESULTS: Out of 54 Diabetic Retinopathy patients, 28 (51.8%) patients had DN, 26 patients (48.2%) had no evidence of DN. Out of 54 Diabetic Nephropathy patients, 36(66.6%) had DR; 18(33.4%) had No evidence of DR. CONCLUSION: The results of our study suggest that Diabetic Nephropathy has a positive association with the presence of Diabetic Retinopathy in persons with Type II DM. KEYWORDS: Type 2 Diabetes mellitus, Diabetic Retinopathy, Diabetic Nephropathy.
Diabetic Retinopathy is a microangiopathy that exhibits features of both microvascular occlusion and leakage with characteristic picture in the fundus. The common precipitating factors of retinopathy are duration and type of diabetes, hyperglycemia, pregnancy, change in hormonal level, genetics and microalbuminuria. Duration of disease is the most important risk factor, type 1 DM patients demonstrate diabetic retinopathic changes after an average period of 3-5 years of onset of systemic disease. In patients with type 2 DM, the time of onset and therefore duration have been more difficult to determine precisely, so patients with newly diagnosed type 2 DM occasionally present with retinopathy as initial sign of DM.

**Classification of Diabetic Retinopathy:** Broadly classified as NPDR in the presence of only intraretinal microvascular changes and PDR when new vessels, fibrous tissues or both form on the retina or Optic disc with or without extension into the vitreous cavity.

**Non Proliferative Diabetic Retinopathy (NPDR):** Further classified based on the severity of intra retinal microvascular abnormalities (IRMA), venous abnormalities and hemorrhages. (i) Mild NPDR: Micro aneurysms (MA) along with hard exudates (HE) and retinal hemorrhages. No IRMA or significant bleeding. (ii) Moderate NPDR: MA along with HE, retinal hemorrhages, cotton wool spots or (IRMA). (iii) Severe NPDR: Presence of at least one of the below said features in four mid-peripheral retinal quadrants. (a) More than 20 severe intraretinal hemorrhages and MA in all four quadrants. (b) Venous beading in at least two quadrants. (c) Moderate IRMA in at least one quadrant. (iv) Very Severe NPDR: Presence of at least two of the above said features.

**Proliferative Diabetic Retinopathy (PDR):** Further classified as i) Early PDR without high risk characteristics (HRC): New vessels and or fibrous proliferation; or preretinal hemorrhage and or vitreous hemorrhage. ii) Severe PDR with high risk characteristics (HRC): NVD more than one-third disc diameter or less extensive NVD if vitreous hemorrhage or pre-retinal hemorrhage is present or NVE more than half disc area with VH or pre-retinal hemorrhage. (iii) Advanced PDR: Extensive VH, Retinal detachment involving the macula or Phthisis bulbi secondary to complications of Diabetic Retinopathy.

Diabetic Nephropathy is a clinical syndrome characterized by persistent albuminuria, arterial blood pressure elevation, a relentless decline in Glomerular filtration rate (GFR), and a high risk of cardiovascular morbidity and mortality. This major life-threatening complication develops in approximately 20% to 40% of type 1 and less than 20% of type 2 diabetic patients. DN is the leading known cause of End stage renal disease (ESRD) in the United States, accounting for an estimated 28,000 new cases of ESRD per year.

Diabetic Nephropathy (DN) and Diabetic Retinopathy (DR) are arguably the two most dreaded complications of diabetes. Together they contribute to serious morbidity and mortality. As they progress to end-stage renal disease (ESRD) and blindness, they impose enormous medical, economic, and social costs on both the patient and the health care system.

In study conducted by Kasper Rossing et al a clinical diagnosis of Diabetic Nephropathy can be made in a patient with diabetes on the basis of persistent albuminuria, the presence of Diabetic Retinopathy can be made on the basis of Fundus Examination. Hans-Henrick Parving et
al\cite{10} conducted a prospective observational cohort study and concluded that the greater rate of decline in renal function in patients with increasing severity of Diabetic Retinopathy may be explained by the more severe renal lesions, since the degree of retinopathy has been correlated to renal structural abnormalities and functional impairment. Boelter M.C et al\cite{11} concluded that type II diabetic patients with proliferative Diabetic Retinopathy more often presented with renal involvement, including urinary albumin excretion within the microalbuminuria range. Therefore all patients with proliferative Diabetic Retinopathy should undergo an evaluation of renal function including urinary albumin measurements.

In a study conducted by Ali Jawa et al,\cite{12} Type 2 diabetics with marked proteinuria and retinopathy most likely have DN, whereas those without retinopathy have a high incidence of non-diabetic glomerular disease. The purpose of this study is to determine the association between Diabetic Retinopathy and nephropathy in type 2 diabetes mellitus.

**AIM OF THE STUDY:** To assess the correlation between Diabetic Retinopathy and Diabetic Nephropathy in Type II Diabetes Mellitus patients.

**MATERIALS AND METHODS:** A cross-sectional study was conducted on Type 2 DM patients presenting to Sarojini Devi Eye hospital, Hyderabad and were assessed for Retinopathy and Nephropathy and Correlation between Retinopathy and Nephropathy. Visual acuity, Slit Lamp Bio microscopy, Fundoscopy using Direct and Indirect ophthalmoscope, Blood Parameters, 24 hours urinary protein, Urine albumin FFA and Renal Biopsy were the investigations done. All patients of Type II Diabetes Mellitus patients with Diabetic Retinopathy and Diabetic Nephropathy were included in the study. Patients with (1) Type 1 Diabetes Mellitus, (2) Retinopathy due to other causes, (3) Nephropathy due to other causes were excluded from the study. Sample of more than 100 cases were studied over 3 years

**OBSERVATION AND RESULTS:** Study was carried from Dec 2011 to Dec 2014. In the present study out of 108 patients, 54 patients with Diabetic Retinopathy and 54 patients with Diabetic Nephropathy were included in the study.

| Age in yrs. | Diabetic Retinopathy (Total 54 pts) | Diabetic Nephropathy (Total 54 pts) |
|------------|-----------------------------------|-----------------------------------|
| <50        | 10(18.5%)                         | 8(14.8%)                          |
| 50-65      | 28(51.9%)                         | 32(59.3%)                         |
| >65        | 16(29.6%)                         | 14(25.9%)                         |

Table 1: Age grouped frequency distribution

Out of 54 Diabetic Retinopathy patients, 10(18.5%) are <50 yrs., 28(51.9%) are in 50-65 yrs., 16(29.6%) are >65 yrs. Out of 54 patients of Diabetic Nephropathy patients, majority of patients 32(59.3%) belonged to age group of 50-65 years, 8 patients (14.8%) were<50yrs and 14 patients (25.9%) were >65yrs.
Out of 54 patients Diabetic Retinopathy patients, 34 were males and 20 were females with male to female ratio of 1.7:1. More than 50% were Males. Out of 54 Diabetic Nephropathy patients, 38 patients (70.3%) were Males, 16(29.7%) are Females with Male to Female ratio of 2.3:1. More than 50% were Males.

Out of 54 Diabetic Retinopathy patients, 8(14.8%) were <5 yrs. of duration; 30(55.5%) were 5-15 yrs. of duration; 10(18.6%) were 16-25 yrs. of duration; 6(11.1%) were >25 yrs. of duration. Out of 54 DN patients, 8(14.8%) were <5 yrs.; 26(48.1%) were 6-15 yrs.; 16(29.6%) were 16-25 yrs.; 4 (7.5%) were >25 years of duration of diabetes.

Out of 54 patients of Diabetic Retinopathy, 26(48.2%) had good control with HbA1C<7%; 28(51.8%) had poor control with HbA1C>8%. Out of 54 Diabetic Nephropathy patients, 14(25.9%) had good control with HbA1C<7%; 40(74.1%) had poor control with HbA1C>8%.
Table 5: Distribution of Serum Lipids

| Serum Lipids | Diabetic Retinopathy (Total 54 pts) | Diabetic Nephropathy (Total 54 pts) |
|--------------|-------------------------------------|-------------------------------------|
| Normal       | 24 (44.4%)                          | 10 (18.5%)                          |
| Abnormal     | 30 (55.6%)                          | 44 (81.5%)                          |

Out of 54 patients, 30 (55.6%) had Abnormal lipid levels; 24(44.4%) had Normal Lipid levels. Out of 54 Diabetic Nephropathy patients, 44(81.5%) had Abnormal lipid levels; 10(18.5%) had Normal lipid levels.

Table 6: Distribution of severity of diabetic retinopathy

| DR            | No. of Patients | Percentage |
|---------------|-----------------|------------|
| Mild NPDR     | 12              | 22.3%      |
| Moderate NPDR | 16              | 29.6%      |
| Severe NPDR   | 16              | 29.6%      |
| PDR           | 10              | 18.5%      |

Out of 54 Diabetic Retinopathy patients, 12(22.3%) had Mild NPDR; 16(29.6%) had Moderate NPDR; 16(29.6%) had Severe NPDR; 10(18.5%) had PDR.

Distribution of CSME (clinically significant macular edema) in 54 Diabetic Retinopathy Cases: Of 54 DR patients, 12(22.2%) had CSME. Of these 8(14.8%) had NPDR with CSME; 4(7.4%) had PDR with CSME.

Table 7: Distribution of Retinopathy in Diabetic Nephropathy

| DR            | No. of Patients | Percentage |
|---------------|-----------------|------------|
| No DR         | 18              | 33.4%      |
| Mild NPDR     | 0               | 0%         |
| Moderate NPDR | 8               | 14.8%      |
| Severe NPDR   | 8               | 14.8%      |
| PDR           | 20              | 37%        |

Out of 54 Diabetic Nephropathy patients, 18(33.4%) had No DR; 8(14.8%) had Moderate NPDR; 8(14.8%) had Severe NPDR; 20(37%) had PDR.

Distribution of CSME in 54 Diabetic Nephropathy patients: Of 54 patients, 16(29.6%) had CSME; of which 10(18.5%) are PDR with CSME and 6(11.1%) are NPDR with CSME.
Out of 54 Diabetic Retinopathy patients, 26(48.2%) had Normoalbuminuria; 22(40.7%) had Microalbuminuria; 6(11.1%) had Macroalbuminuria.

| Albuminuria | No. of Patients | Percentage |
|-------------|-----------------|------------|
| Normo       | 26              | 48.2%      |
| Micro       | 22              | 40.7%      |
| Macro       | 6               | 11.1%      |

*Table 8: Distribution of Albuminuria in Diabetic Retinopathy*

Out of 54 patients of Diabetic Retinopathy, 28 patients had DN (51.8%), 26 patients (48.2%) had No evidence of DN.

Out of 54 Diabetic Nephropathy patients, 36(66.6%) had DR; 18(33.4%) had No evidence of DR.
DISCUSSION: The major debilitating complication of DM, in addition to DR is DN. In conformity with the previous studies carried out to determine prevalence of retinopathy and nephropathy which yielded different rates 50-56%.

The mean age at presentation in our study of 54 DR patients was 59.8yrs and in 54 DN patients was 59.2yrs. In a study conducted by Masoud. R. Manaviat,[13] mean age of presentation was 54.9±10.2 years. In a study conducted by Looker HC et al,[14] the mean age of presentation was 41.9 years. In a study conducted by Wirta O et al,[15] the mean age of presentation was 49 years.

Male to female ratio in 54 DR patients was 1.7: 1 and 54 DN patients was 2.3:1 in our study; i.e., >50% were males in both DR and DN patients showing male preponderance. In a study conducted by Mohan Rema et al,[16] male to female ratio was 3:2, with male preponderance. In a study conducted by Pradeep et al,[16] male to female ratio was 2:1 with male preponderance.

In our study, the mean duration of diabetes in 54 DR patients was 16.5yrs and in 54 DN patients was 13.4yrs. In a study conducted by Koji Harada et al[17] mean duration of diabetes was 10.1±8.5 years, in a study by Naem et al, the mean duration of diabetes was 15.4 yrs. In a study by Masoud R Manaviat et al,[13] it was 10.2+/−6.6 yrs.

In our study, out of 54 DR patients 48.1% of these had good control with Hb A1C <7% and 51.8% had poor control with Hb A1C >8%. In 54 DN patients 25.9% had good control with HbA1C<7% and 74% had poor control with HbA1C>8%. In a study conducted by Aynina Cisse et al,[18] 33% patients with retinopathy had HbA1C >10%.

In our study of 54 DR patients 55.5% had abnormal lipid levels. In a study conducted by ETDR [5] and DCCT showed that there was a direct relation to elevation of Serum Lipids with grades of retinopathy. In 54 DN patients 81% had abnormal lipid levels. In a study conducted by Gall MA et al[19] elevated serum lipids was a risk factor for the development of DN.

In our study of 54 DR patients 22.2% had mild NPDR, 29.6% had moderate NPDR, 29.6% had severe NPDR, 18.4% had PDR and 22.2% had CSME. In a study conducted by V Narendran et al, 15.4% had mild NPDR, 8.1% had moderate NPDR, 1.2% had severe NPDR, 1.5% had PDR, and 7.7% had CSME.

In our study of 54 DR patients, 26 patients (48.2%) had Normoalbuminuria, 22 patients (40.7%) had Microalbuminuria and 6 patients (11.1%) had Macro albuminuria. In a study conducted by Manaviat et al[13] prevalence of microalbuminuria was 25.9% whereas macro albuminuria was 14.5%. In a study conducted by Mohan et al[16] the prevalence of Normoalbuminuria was 80%, microalbuminuria was 16 % and macro albuminuria was 3%.

In our study among 54 patients with DN, 36(66.6%) patients had DR and 18(33.4%) patients had no evidence of DR. Of 36 patients with DR, 8% had Mild NPDR, 10% had Moderate NPDR, 13% had Severe NPDR and 35% had PDR and of 36 DR patients 16 had CSME. In a study conducted by Koji Harada et al,[17] 58.33% of patients of DN had DR.

In our study, Out of 54 patients of DR, 28 patients had DN (51.8%), 26 patients (48.2%) had no evidence of DN. In a study conducted by J Prakash et al[20] noted that 4 of 8(50%) cases without DR had DN. It should be pointed out that absence of retinopathy cannot exclude the presence of Diabetic Nephropathy.
CONCLUSION: Diabetic Retinopathy is the leading cause of blindness.
1. The results of our study suggest that Diabetic Nephropathy has a positive association with the presence of Diabetic Retinopathy in persons with Type II DM.
2. About 66% of Diabetic Nephropathy patients in our study had Diabetic Retinopathy.
3. About 51% of Diabetic Retinopathy patients in our study had Diabetic Nephropathy.
4. Diabetic Nephropathy can occur in absence of retinopathy in Type 2 proteinuric diabetic patients.
5. There has been much progress in understanding pathogenesis and pathophysiology of DR and DN. This has resulted in significant advances in treatment.
6. Impact of these complications remain significant and clinicians should remain vigilant.
7. Since the sequence of development Nephropathy and Retinopathy has not been established it is suggested that all patients with Type II DM are to be monitored by Eye examination and by Kidney Function tests as well; to better prevent microangiopathic complications.

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