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Original Research Article

Relationship between Diabetic Retinopathy and Diabetic Nephropathy in Patients with Type 2 Diabetes Mellitus: A Cross Sectional Study

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Abstract:

Background: Diabetes mellitus is a multisystm disease. Diabetic retinopathy is most common and serious ocular complication. Multiple risk factor associated with development of retinopathy one of them is nephropathy. It shown that treating nephropathy may be associated with the improvement of retinopathy. The two highly prevalent microvascular complication diabetic nephropathy and retinopathy have become the leading cause of end stage renal disease and blindness in adult's patients. The present study is to ascertain the correlation between diabetic nephropathy and retinopathy.

Method: A cross- sectional study was conducted in the department of ophthalmology,M.K.C.G. Medical college and hospital, berhampur which lasted 1year 9months (2023 to 2025). 220 patients included in the study,after calculating using statistical formula.Patients more than 30 year of age with type 2 DM included and those are having ocular disfigurment, media opacity,pregnancy, collagen vascular disease, glomeruolonephritis due to other systemic disease, h/o ocular trauma and retinopathy due to other condition were not included in the study. All the detailed ocular examination were conducted and all the detailed routine blood investigation were carried. Depending on the severity of diabetic retinopathy, the nephropaathy association was studied.

Results: Maximum patients belongs to 60-69 year of age.patients with mild NPDR 20.3% had microalbuminuria,moderate NPDR 16.3% with microalbuminuria and 0.8% had macroalbuminuria. Sever NPDR 11.6% microalbuminuria and 6.25% had macroalbuminuria. Patients with vere sever NPDR 1.6% microalbuminuria and 3.7% had macro albuminuria and patients with DME all were presented with macroalbuminuria. This shows progression of DR asociated with progression of Nephropathy.Study shows associated hypertension exacerbate Diabetic nephropathy. Derranged serum urea and creatinine level shows positive association between severity of Diabetic retinopathy.

Conclusion: This study shows increaes in duration of diabetes causes complication like retinopathy and nephropathy and hence diagnosis should always be followed up with checkup for complication. High prevalence of microalbuminuria in diabetic patients and its positive association with blood pressure suggests that screening for microalbuminuria and strict control of blood pressur is essential for prevention of dreaded complication like blindness and End stage renal disease.

Keywords: Diabetic Retinopathy, Nephropathy, Microalbuminuria, Macroalbuminuria.

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Introduction

Diabetis mellitus comprises heterogenous group of disorder of carbohydrate, protein and fat metabolism manifesting hyperglycemia.[1] It is due to absolute or relative deficiency in insulin action or secretion. Uncontrolled diabetes can lead to microvascular complications like diabetic nephropathy, neuropathy, and retinopathy being the most common among them.

The international diabetes federation(IDF) diabetes map 2021 shows that the worlds adults diabetes population has reached 537 milion, expected to reach 783 milion by 2045.[2] Diabetic retiopathy remains the leading cause of blindes in working population. No of people with DR will grow from126.6 million in 2010 to 191 million by 2030, and the number with vision threatening DR will increase from 37.3 to 56.3 million, if prompt action is not taken.[3]

Multiple risk factors associated with the development and progression of retinopathy like

the duration of disease and age is the strongest predictors. Other risk factors like hypertension, pregenancy, poor glycemic control and presence of nephropathy shown to have strong association.[4] Diabetic nephropathy(DN) is a clinical syndrome that include low glomerular filtration rate (GFR), hypertension, and proteinuria. Generally 25-45% of patients with DM type 1 develop nephropathy, on average,between 10 and 15 years of onset of the disease.[5] Nephropathy develop in approximately 50% of type 2DM patients.[6]

Diabetes and uncontrolled hyperglycemia play a significant role in the development of long term complications, such as diabetic nephropathy and retinopathy.

The aim of the study was to ascertain the correlation and quantitatively assess the nephropathy with severity of retinopathy.

Materials & Methods

A cross- sectional study was conducted in the department of ophthalmology,M.K.C.G. Medical college and hospital, berhampur which lasted 1 year 9 month (2023 to 2025). 220 patients included in the study, after calculating using statistical formula.Patients presents to OPD and referred from endocrinology deparment were evaluated and considered for the study. The study protocol was approved by the Ethics committee of MKCG medical college and hospital Berhampur.

Inclusion and Exclusion Criteria: Patient's of age more than 30 years with type 2DM included in the study. Those patients denied for the study,any ocular disfigurment and opacity obstructing fundus picture, pregnancy, UTI, collagen vascular diseases, glomerulonephiritis due to other systemic diseases, history of ocular inflammation or trauma, patients with retinopathy other than diabetic retinopathy were not included in the study.

Data Collection tool and Procedure: Data were collected using a strurcted and predisened case record performa.The tools included clinicial history sheet, examination format and ophthalmic instrument. The tools included are slitlamp biomicroscopy, direct and indirect ophthalmoscopy, OCT, fundus photography and FFA. All the baseline demographic data like age,sex, duration of diabetes and treatment taking for diabetes recorded.Blood pressure were recorded.

Laboratory investigation done such as FBS, PPBS, HbA1C done to estimate the glycemic control. Serum urea and creatinine and urine sample collected for quantitative assment of urine albumin level.

All the data were recorded systematically to analyse the associtation between nephroprhy and retinopathy.

Results

After analysing all the data of 220 patients(440eyes) the results obtained summarised in the table.

Table 1: Demographic data

Age Group in Years	Male	Female	Percentage (For both male and female)
30-39	5	3	3.64
40-49	20	23	19.55
50-59	29	32	27.73
60-69	43	24	30.45
70-79	27	9	16.36
80 and above	2	3	2.27
Total	126	94	100

The maxium no of patients belongs to the age group 60-69 i.e.30.45%,majority were male i.e.43 cases, where as females were more no. seen in age group 50-59 i.e. 32 cases.

Table 2: Duration of Diabetes Mellitus

Duration (Years)	Frequency	Percentage (%)
<5	40	18.1
6-10	82	37.3
11-15	68	31
>15	30	13.6
Total	220	100

The above table shows out of total 220 cases, 82 caes were diabetic for 6-10 years followedby 68 cases were diabetic for 11-15 years and >15 years diabetic were only 30 cases.

Table 3: Distrubtion of HBA 1c

HBA 1C	Range	Frequency	Percentage (%)
Good control	<7	65	29.5
Poor control	7 to10	112	51.0
Very poor control	>10	43	19.5
Total		220	100

The above table shows status of HBA1C level in our study patients. 29% were in good control of blood sugar while 51% were in poor control of blood sugar and 19.5% were in very poor control of blood sugar.

Table 4: Distrubtion of Grading of DR(For total no of eyes)

Distrubtion of DR (Grading)	Frequency	Percentage(%)
No DR	17	3.8
Mild NPDR	153	34.8
Moderate NPDR	124	28.2
Severe NPDR	59	13.4
Vere severe NPDR	48	10.9
PDR	33	7.5
DME	6	1.4
Total	440 eyes	100

The above table shows maxium no of cases found in mild NPDR in 34.8%, moderate NPDR in 28.2% and PDR in 7.5% cases.

Table 5: Distribution of urine albumin excretion(UAE) and grade of DR(BE)

Grade of DR	Normal (<30) RE	LE	Microalbuminuria (30-299) RE	LE	Macroalbuminuria (>300) RE	LE
No DR and mild DR	45	47	40	38	0	0
Moderate DR	20	18	39	43	3	1
Sever NPDR	0	0	18	16	12	13
Vere sever NPDR	0	0	9	10	14	15
PDR	0	0	6	5	11	11
DME	0	0	0	0	3	3
TOTAL	65	65	112	112	43	43

The above table shows relationship of urine albumin excretion with grading of DR.

It was found that in 78 eyes with no DR and mild NPDR associated with microalbuminuria and no macroalbuminuria, 82 eyes having moderate NPDR associated with microalbuminuria and 4 eyes associated with macroalbuminuria. Sever NPDR in 34 eyes microalbuminuria and 25 eyes with macroalbuminuria.22 eyes with macroalbuminuria and 11 with microalbuminuria in PDR. 6 eyes with DME shows macroalbuminuria.

Out of 220 patients 112 patients were microalbuminuria and 43 patients have macroalbuminuria.

Table 6: Distribution of Hypertension and severity of UAE

Albuminuria	Normotensive & Prehypertensive	Hypertensive	Total
Normal	37	28	65
Microalbuminuria	25	87	112
Macroalbuminuria	7!	36	43
Total	69	151	220

The above table shows out of 112 microalbuminuria 87 patients associated with hypertension and out of 43 macroalbuminuria cases 36 cases having hypertension.

Table 7: Serum urea and creatinine level in different grades of DR

DR Severity	No of Patients (RE)	No of Patients (LE)	Serum Urea (mg/dl)	Serum Creatinine (mg/dl)
No DR or mild DR	85	85	15-40	0.6-1.2
Moderate NPDR	62	62	30-60	0.8-2.0
Severe NPDR	30	29	50-80	1.4-2.5
Very severeNPDR	23	25	70-100	2.0-3.0
PDR and DME	20	19	>100	2.6-3.2

The above table shows serum urea and creatinine level in different grade of DR. Serum urea and cratinine value higher in PDR & DME,followed by very severe NPDR. Serum urea and creatinine value normal in no DR or mild NPDR.

Discussion

Secondary pathophysiological systemic changes caused by metabolic imblance as a part of diabetes mellitius impose a great burden on both the affected person and his family, as well as health system.The aim `of our study is to determine the correlation between retinopathy and nephroparhy in patients with type 2 DM. In our study maximum patients belong to 60-69 age group minimum no of cases seen in above 80 years of age group. The descriptive staatistics for age in our study mean± SD is 58.78± 11.40.

Study conducted by Das et al[7] mean age group of presentation was 57±10 years.Similarly in the study savage et al mean age of presentation was 58.80±.8 years.The result s are constistent with our study. The most patients belong to this age group due to increse in work load,stress, unhealthy food habits and also uncontrolled DM and further complication.

In this study maximum cases from 6-10 years of duration of diabetes. The statistics shows mean SD was 9.93±4.56.

The study conducted by Oadi N Shrateh et al[8] a 5 year increase in duration of T2DM correlated with 45% higher odds having DR (P<0.001). similarly Abuhay et al[9] study it was found thatT2DM duration >5 years are 2.28 time more at risk of devloping DR In comparision to duration <5 years. These study are in constient with the present study.

The glycosylated haemoglobin(HbA1c) reflects the average blood glucose level in past 4months.For most diabetic patients the target HbA1c level was <6%.In past years studies connducted to find association of microvascular complication with elevated level of HbA1c.

In this study maximum patients belong to HbA1c between7-10, i.e., in poor controll group. Similar results found in Song et al study[10] the HbA1clevel at baseline were higher in the DR progessor than in DR non progressors. The UKPDS has shown the each %point reduction in HbA1c was associated with 35% reduction in microvascular complication.

Diabetic retinopathy is a microvascular complication of diabetes mellitus.Results of the wisconsin study Epidemologic study of diabetic retinopathy (WESDR) shows 3.6% of patients are blind from diabetes, that diabetic retinopathy is the cause of 86% of cases of blindess.[11,12] In our study 34.8% are mild NPDR, 28.2% are moderate NPDR, 10.9% are very sever NPDR while 7.5% are of PDR type.

Other studies have shown that in diabetics retinopathy develop before clinical nephropathy. It has shown that microalbuminuria is a risk indictator of proliferative retinopathy.

In present study patients with mild or mderate NPDR associated with more no. with microalbuminuria. Patients who had PDR associated with macroalbuminuria (61%) and microalbuminuria (39%) and no patients had normal urine albumin excretion and all patients who had DME had macroalbuminuria. These study showed development of one microvascular complication associated with development of another microvascular complication as they share common pathogenesis.

Tatsumi et al[13] showed progresion of normal to micro and macroalbuminuria associated more frequently with DR. Similarly Parvanova et al[14] and Rouf Rsb et al[15] showed in their study positive correlation between severity of diabetic retinopathy with severity of proteninuria. Padmaja etal[16] showed patients with macroalbuminuria more frequently with PDR.

83.7% patients from macroalbuminuria group associated with systemic hypertension. The p value is p< 0.001 highly significant suggestive of hypertension with increased urine albumin excretion. This is consistent with our study. Svenson et al[17] showed high blood pressure associated with nephropathy. Similar results were found in Pasko et al and Ahmedani et al studies.

The present study showed no derangment of serum urea and creatiine level in mild diabetic retinopathy and mild to moderate derangment in moderate and sever diabetic retinopathy. It showed positive association between severity of diabetic retinopathy with serum urea and creatinine level although it is a less sensitive marker than UAE to detect early diabetic nephropathy.

Study conducted by Ramchandran et al[17] showed abnormal renal parameters like serum creatinine level, abnormal macroalbuminuria, eGFR at baseline were associated with increased risk of progression to sight threatening diabetic retinopathy. In the present study we have seen that there was a positive correlation between diabetic retinopathy and diabetic nephropathy.

Our study suggested that early diagnosis of diabetic retinopathy can be a of prognostic indicator of DKD.

Conclusion

From our study we found that increase durarion of diabetes associated with more no. Of microvascular complication.So periodic check up in diabetes can

early detect retinopathy and nephropathy. In our study none of the patients with normal albumin level had a grade of diabetic retinopathy more than moderate NPDR. Macroalbuminuria found in all cases of sever and vere sever NPDR and PDR. Whether microalbuminuria can be used as early predictor of diabetic retinopathy remains inclonclusive.This study reinforces the observation that there is a strong association between macroalbuminuria and advanced grade of diabetic retinopathy and prevalance of nephropathy is more in sever grades of diabetic retinopathy.High prevalence of microalbuminuria in diabetic patients and its positive association with blood pressure suggest that screening for microalbuminuria and strict controll of blood pressure can prevent dreaded complication of blindess and end stage renal diseases.

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