AN ANALYTICAL STUDY TO EVALUATE SEVERITY OF DIABETIC RETINOPATHY AND INCIDENCE OF NEUROPATHY, NEPHROPATHY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

Karupputhevar Senthil¹, Pandiaraj Saravanasankar², Mohan Bagavathshalani³, Madhavan Hemmanthraj⁴, Rethy Sreekumar Sruthi⁵, Francis Xavier Rajan Cinushamasilthilakraj⁶, Abdullah Haroon Shaminabegum⁷

¹Professor, Department of Diabetology, Madurai Medical College.

²Assistant Professor, Department of Ophthalmology, Madurai Medical College.

³Senior Resident, Department of Ophthalmology, Madurai Medical College.

⁴Junior Resident, Department of Ophthalmology, Madurai Medical College.

⁵Junior Resident, Department of Ophthalmology, Madurai Medical College.

⁶Junior Resident, Department of Ophthalmology, Madurai Medical College.

⁷Junior Resident, Department of Ophthalmology, Madurai Medical College.

ABSTRACT

BACKGROUND

Diabetes mellitus is one of the major health problems that have a significant impact on the socioeconomic life of the individual. According to the International Diabetes Federation, 381 million people worldwide suffer due to diabetes. In India, 62 million suffer from diabetes and 1 million die every year due to diabetes. Diabetic patients, during the course of disease, develop microvascular and macrovascular complications. Glycaemic control is of utmost importance in the preventing death due to microvascular and macrovascular complications.

The aim of our present study is to analyse the diabetic complications - nephropathy and neuropathy depending on the severity of retinopathy in type 2 diabetic patients.

MATERIALS AND METHODS

An analytical study conducted among 100 type 2 DM patients who attended the outpatient department and as inpatients admitted to the wards of the Department of Ophthalmology, Government Rajaji Hospital, Madurai, and who satisfied the eligibility criteria for over a period of 5 months. Assessment of diabetic retinopathy was done as per Early Treatment of Diabetic Retinopathy Study (ETDRS) classification. Diabetic Nephropathy was assessed by albuminuria, serum creatinine and blood urea. Diabetic Neuropathy was assessed by Neuropathy Disability Score which includes Vibration perception test, Temperature perception test, Pinprick test, Ankle jerk. Analysis of nephropathy and neuropathy was done depending on severity of Retinopathy in type 2 diabetic patients.

Observation-Patients with mild NPDR showed 100% subclinical albuminuria, patients with moderate NPDR showed 97.6% microalbuminuria and 2.4% showed macroalbuminuria and in those patients with severe NPDR, very severe NPDR, early PDR, high-risk PDR and diabetic maculopathy, showed 100% macroalbuminuria. Lower limb assessment for diabetic neuropathy, showed neuropathy in 29% cases.

RESULTS

Diabetic retinopathy has a significant association with blood urea and serum creatinine with significant 'p' value of 0.0001. Neuropathy was 100% absent in mild and moderate NPDR and 100% present in severe NPDR, very severe NPDR, early PDR, high-risk PDR and diabetic maculopathy.

CONCLUSION

Among patients presented in our study, the severity of diabetic retinopathy correlates well with significant incidence and severity of nephropathy and peripheral neuropathy.

KEYWORDS

Diabetes Mellitus Complications, Diabetic Nephropathy, Diabetic Neuropathy.

HOW TO CITE THIS ARTICLE: Senthil K, Saravanasankar P, Bagavathshalani M, et al. An analytical study to evaluate severity of diabetic retinopathy and incidence of neuropathy, nephropathy in patients with type 2 diabetes mellitus. J. Evolution Med. Dent. Sci. 2016;5(93):6875-6878, DOI: 10. 14260/jemds/2016/1554

Financial or Other, Competing Interest: None.

Submission 12-10-2016, Peer Review 10-11-2016,

Acceptance 16-11-2016, Published 21-11-2016.

Corresponding Author:

Dr. Karupputhevar Senthil,

7/478, Theni Road,

Checkanurani,

Madurai-625514, Tamilnadu.

E-mail: doctorksenthil@gmail.com

DOI: 10. 14260/jemds/2016/1554

BACKGROUND

Diabetes mellitus (DM) is a metabolic disorder with a disturbance in carbohydrate, protein, and fat metabolism because of partial or complete deficiency of insulin secretion or its action. DM is one of the major health problems that have a significant impact on the socioeconomic life of the individual. According to the International Diabetes Federation, 381 million people worldwide suffer due to diabetes. In India, 62 million suffer from diabetes and 1 million die every year¹ due to diabetic complications.

Diabetic patients during the course of disease develop microvascular and macrovascular complications. Glycaemic control is of utmost importance in preventing death due to microvascular and macrovascular complications.² The aim of our present study is to analyse the diabetic complications – presence of nephropathy and or neuropathy depending on the severity of retinopathy in type 2 diabetic patients.

MATERIALS AND METHODS

An analytical study conducted among 100 type 2 DM patients who attended the outpatient department and inpatients admitted in the wards of the Department of Ophthalmology, Government Rajaji Hospital, Madurai, and who satisfied the eligibility criteria for over a period of 5 months. Inclusion criteria were: Patients diagnosed with type 2 diabetes, on treatment; duration of diabetes > 5 years and age of the patient ≥40 years. Exclusion criteria were patients with known history of thyroid disorder, pregnant women, patients in whom fundus cannot be examined, glaucoma patients, patients who had undergone laser photocoagulation, patients on dialysis, patients on treatment for hypertension and patients not consenting for the study. Assessment of diabetic retinopathy was done as per Early Treatment of Diabetic Retinopathy Study (ETDRS)³ classification. Diabetic Nephropathy was assessed by albuminuria, serum creatinine and blood urea levels. Diabetic Neuropathy was assessed by Neuropathy Disability Score⁴ which includes Vibration perception test, Temperature perception test, Pinprick test, Ankle jerk. Analysis of Nephropathy and Neuropathy depending and severity of Retinopathy in Type 2 diabetic patients was done using Epidemiological Information Package (EPI 2010) developed by Centre for Disease Control, Atlanta and 'p'- value less than 0.05 is taken to denote significant relationship.

OBSERVATION AND RESULTS

The average age group of patients presenting with diabetic retinopathy in our study was 50-70 years, among them 55% were male and 45% were female, showing male preponderance. Patients with diabetes for >5 years showed some stage of diabetic retinopathy; 34% with mild NPDR, 41% moderate NPDR, 8% severe NPDR, 75% very severe NPDR, 4% early PDR, 3% high risk PDR, 3% diabetic maculopathy (Fig: 1) with the mean duration as 8 years. Visual acuity was normal 6/6 in 41 eyes, 6/6p to 6/12 in 98 eyes and 6/18 to 6/60 in 61

eyes. The defective vision in these patients were due to lens changes, posterior capsular opacification following cataract surgery with Posterior Chamber Intraocular Lens (PCIOL) implantation and diabetic retinopathy. On the assessment of renal function for diabetic nephropathy; 66% of patients showed abnormally elevated blood urea level, 70% patients had abnormally elevated serum creatinine level, 41% patients showed microalbuminuria and 25% patients showed macroalbuminuria. Patients with mild NPDR showed 100% subclinical albuminuria, patients with moderate NPDR showed 97.6% microalbuminuria and 2.4% showed macroalbuminuria and in those patients with severe NPDR, very severe NPDR, early PDR, high-risk PDR and diabetic maculopathy, showed 100% macroalbuminuria (Table 1). On the assessment of right and left leg for diabetic neuropathy, 29% showed neuropathy. Neuropathy was 100% absent in mild and moderate NPDR and 100% present in severe NPDR, very severe NPDR, early PDR, high-risk PDR and diabetic maculopathy (Table 2).

Study patients with various stages of diabetic retinopathy were divided into two groups: Group 1 includes mild and moderate NPDR and Group 2 includes severe NPDR, very severe NPDR, early PDR, high-risk PDR and diabetic maculopathy. The available data in the two groups showed a statistically significant correlation between severity of retinopathy with incidence of nephropathy and retinopathy with incidence of neuropathy with a 'p'- value, p less than 0.0001 (Table 3).

Figure 1. Graph showing the Stage of Retinopathy in our Study Subjects

Stage of Retinopathy	No. of Study Patients with Retinopathy	Nephropathy					
		Normo Albuminuria		Micro Albuminuria		Macro Albuminuria	
		No.	%	No.	%	No.	%
Mild NPDR	34	34	100	-	-	-	-
Moderate NPDR	41	-	-	40	97.6	1	2.4
Severe NPDR	8	-	-	-	-	8	100
Very severe NPDR	7	-	-	-	-	7	100
Early PDR	4	-	-	-	-	4	100
HR PDR	3	-	-	-	-	3	100
DM	3	-	-	1	33.3	2	66.7

Table 1. Showing the Presence of Retinopathy and Nephropathy

Stage of Retinopathy	No. of Study Patients with Retinopathy	Neuropathy			
		Present		Absent	
		No.	%	No.	%
Mild NPDR	34	-	-	34	100
Moderate NPDR	41	-	-	41	100
Severe NPDR	8	8	100	-	-
Very severe NPDR	7	7	100	-	-
Early PDR	4	4	100	-	-
HR PDR	3	3	100	-	-
DM	3	3	100	-	-

Table 2. Showing the Presence of Retinopathy and Neuropathy

Retinopathy	No. of Study Patients	Nephropathy			Neuropathy
		No. of Patients with Normoalbuminuria	No. of Patients with Microalbuminuria	No. of Patients with Macroalbuminuria	No. of Patients with Neuropathy
Group 1	75	34	40	1	0
Group 2	25	-	1	24	100
'P' value		<0.0001	<0.0001	<0.0001	<0.0001

Table 3. Showing the Statistical Analysis between Group 1 and Group 2 of Diabetic Retinopathy, Nephropathy and Neuropathy

DISCUSSION

It is known that diabetes mellitus result in microvascular and macrovascular complications. The microvascular disease tends to occur predominantly in vascular endothelium of kidney, retina and vasa nervorum where glucose uptake is independent of insulin activity. The underlying driver of microvascular disease is tissue exposure to chronic hyperglycaemia⁵ and relationship between microvascular disease and glucose control is established by United Kingdom Prospective Diabetes Study⁶ (UKPDS) and Diabetes Control of Complications Trial⁷ (DCCT). The pathophysiological process occurring in vessels of the retina, peripheral nerve and kidney are very similar, results in increased basement membrane thickening, loss of pericytes and smooth muscle cells of retinal vessels, microaneurysm formation and mesangial nodule formation in kidney and endothelial hyperplasia in vasa nervorum. There are two aspects of vascular damage⁸ in microvascular complications namely underperfusion and overperfusion that leads to retinal haemorrhages and epineural haemorrhage seen in nerve biopsies. These common pathways lead to damage in target organ namely retina, peripheral nerves and kidneys in our study. Study by Valensi et al showed the correlation of presence of clinical neuropathy with presence of retinopathy, arterial hypertension, macroangiopathy, and biological signs of nephropathy. All the electrophysiological parameters were significantly more abnormal in patients with retinopathy.⁹ A prospective case control study conducted at Aravind Eye Hospital in 2001 showed that macular ischaemia is an important marker for nephropathy in type 2 DM which was explained by ischaemic microangiopathy in both end organs of retina and kidney.¹⁰ This study showed a significant correlation between severity of retinopathy and severity of neuropathy and/or nephropathy.

CONCLUSION

Among patients presented in our study, the severity of diabetic retinopathy correlates well with significant incidence and severity of nephropathy and peripheral neuropathy. Patients diagnosed with diabetic retinopathy of any stage should be referred to diagnose neuropathy and nephropathy to prevent life-threatening complications.

REFERENCES

- Wild S, Roglic G, Green A, et al. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004;27(5):1047-53.
- Moore DJ, Gregory JM, Kumah-Crystal YA, et al. Mitigating micro and macro-vascular complications of diabetes beginning in adolescence. *Vasc Health Risk Manag* 2009;5:1015-31.
- Venkatesh P, Sharma R, Vashist N, et al. Detection of retinal lesions in diabetic retinopathy: comparative evaluation of 7-field digital color photography versus red-free photography. *Int Ophthalmol* 2015;35(5):635-40.
- Weintrob N, Amitay I, Lilos P, et al. Bedside neuropathy disability score compared to quantitative sensory testing for measurement of diabetic neuropathy in children, adolescents and young adults with type 1 diabetes. *J Diabetes Complications* 2007;21(1):13-9.
- Kawahito S, Kitahata H, Oshita S. Problems associated with glucose toxicity: role of hyperglycemia-induced oxidative stress. *World J Gastroenterol* 2009;15(33):4137-42.
- UK Prospective Diabetes Study (UKPDS) Group. Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications with type 2 diabetes. (UKPDS 33). *Lancet* 1998;352(9131):837-53.
- Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long term complications in adolescents insulin dependent diabetes mellitus. *N Eng J Med* 1993;329:977-86.

8. Chiu JJ, Chien S. Effects of disturbed flow on vascular endothelium: pathophysiological basis and clinical perspectives. *Physiol Rev* 2011;91(1):327-87.
9. Valensi P, Giroux C, Seebach-Ghalayini B, et al. Diabetic peripheral neuropathy: effects of age, duration of diabetes, glycemic control and vascular factors. *J Diabetes Complications* 1997;11(1):27-34.
10. Shukla D, Kolluru CM, Singh J, et al. Macular ischaemia as a marker for nephropathy in diabetic retinopathy. *Indian J Ophthalmol* 2004;52(3):205-10.