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Diabetic Retinopathy in Tessellated Fundus

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ABSTRACT

Background: Duration of diabetes, poor control, age of the patient, frequent hypoglycemia, hypercholesterolemia, over-weight, smoking, alcohol, renal failure and pregnancy have all been suggested as factors which may influence the onset of diabetic retinopathy.However, there are cases without retinopathy in spite of duration of 30 to 40 years of diabetes and presence of one or other above mentioned risk factors, suggesting role of local factors to prevent angiopathy.Our study aims to assess whether tessellated fundus is a protective factor for diabetic retinopathy.

Methods: This was hospital based descriptive study.The patients included in the study were40 years and above having diabetes for 10 years and beyond. Diabetic retinopathy was graded following Early treatment Diabetic retinopathy Study.

Results: Tigroid fundus was negatively associated with diabetic retinopathy (OR 0.49 with 95% confidence interval 0.21-1.11) and maculopathy (OR 0.43 with 95% confidence interval 0.15-1.3). Age 40-50 years (OR 0.67 with 95% confidence interval 0.24-1.83), female gender (OR 0.71 with confidence interval 0.31-1.61), HbA1c <6.5(OR 0.36 with confidence interval 0.99-1.31) and duration 10-15 years of onset of diabetes (OR 0.58 with confidence interval 0.22-1.37) was negatively associated with diabetic retinopathy in tigroid fundus diabetics. Age 40-50 years (OR 2.12 with confidence interval 0.43-10.5), female gender (OR 2.51 with confidence interval 0.38-10.88), HbA1c<6.5 (OR 3.12 with confidence interval 0.59-16.58) and duration 10-15 years of onset of diabetes (OR 1.5 with confidence interval 0.1-18.54) was positively associated with retinopathy in non-tigroid fundus.

Conclusions: Tessellated fundus was observed as decreased risk for the development of diabetic retinopathy and maculopathy.

Keywords: maculopathy;non-tessellated fundus;retinopathy; tessellated fundus.

INTRODUCTION

Tesselated or tigroid fundus is polygonal dark areas of choroid in between choroidal vessels attributed to atrophy of the retinal pigment epithelium layer and prominent choroid pigmentation.

There are not many studies related to tigroid fundus and diabetic retinopathy irrespective of the status of refractive error. But there are many studies revealing association of myopia and diabetic retinopathy with significant Odds ratio.[1-3] It has been explained that atrophy of retinal pigment epithelial layer and choroid helps in clearing waste products from the diseased retina and these atrophic changes decrease metabolic need, thereby increasing oxygen supply and avoiding retinopathy.[2]

This study was conducted to determine a role of physiological tessellated fundus in the development and progression of diabetic retinopathy.

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METHODS

This was descriptive hospital based study. Diabetic patients attending OPD of ophthalmology department of Kathmandu Medical College Teaching Hospital and Nepal Diabetes, Thyroid and Endocrine Centre from 27/7/2012 - 1/11/2013 were evaluated for this study.

Approval from the Ethical board committee of the Kathmandu Medical College Teaching Hospital was undertaken as per the rule of Helsinki Act before conducting this study. Informed consent was taken from all patients and those who allowed entering in the study were only included in the study.

Visual acuity was recorded with Snellen's chart. Anterior segment and posterior segment of the eyes of all cases were examined with slit lamp. Posterior segment of the eyes were examined with 90D lens after dilatation with tropicamide plain 1% drop. Diabetic retinopathy was defined by following the Early Treatment Diabetic Retinopathy Study (ETDRS) classification. Tesselated fundus was classified as follow for this study: Mild tigroid- barely detectable tessellation; moderate tigroid- just detectable tessellation; marked tigroid- highly tessellated fundus. All cases in our study were emmetropic, hyperopic and mild myopic with - 0.5 spherical D error only to avoid confounding role of myopia as a protective factor in diabetic retinopathy as shown by other studies.Diabetic was labeled controlled if HbA_{1c} was <6.5 and uncontrolled when >6.5.

Inclusion criteria for cases were cases with physiological tesselated and non-tigroid fundi having history of diabetes for 10 years and above; emmetropic, hyperopic and mild myopic with - 0.5 spherical D error only; non-smokers and non-alcoholics or who have quitted smoking and alcohol intake at least for 5 years.

Exclusion criteria for cases were those with glaucoma, optic neuropathy, optic atrophy and age related maculopathy; cases who had undergone any ocular surgeries and laser treatment; cases who were myopic with >0.5 D error, smokers, alcohol intakers, hypertensive, anaemic, renal failure, hypercholesteremia and pregnant women; cases who did not allow consent to enter in the study.

Data were recorded in SPSS 16 version programme and data were analysed calculating Odds ratio. Data were analysed for both eyes separately and also as individual patients.

The variables for this study were age, gender, duration of diabetes, HbA1c<6.5 and >6.5, tesselated and non-tesselated fundus, non-proliferative diabetic retinopathy, proliferative diabetic retinopahty and maculopathy.

RESULTS

Total patients included in the study were 149 ranging from 40 to 85 years having diabetes for 10 years and above. Majority of patients were males 61(51.7%) out of 118 tigroid casesin both tigroid and non-tigroid 16 (51.6%) out of 31 non-tigroid cases group.

Our study found not much difference in the distribution of retinopathy in mild, moderate tesselated and non-tessellated fundi. But marked tigroid fundus showed decrease number of retinopathy and total absence of proliferative retinopathy, revealing its protective role. Proliferative diabetic retinopathy was observed only in mild 2(3.5%) both eyes and moderate 1(2%) tigroid group.

Table 1. Right eye Tesselated fundus and Diabetic retinopathy.

Tessellated fundus	Diabetic retinopathy n(%) within tessellated and non-tessellated group				
	Mild	Moderate	Marked	Non-tigroid	Total
Mild NPDR	4 (6.9%)	5 (9.3%)	0 (0%)	4 (12.9%)	13 (100%)
Moderate NPDR	4 (6.9%)	3 (5.6%)	0 (0%)	6 (19.4)	13 (100%)
Severe NPDR	5 (8.6%)	6 (11.1%)	1 (16.7%)	2 (6.5%)	14 (100%)
Early PDR	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Advanced PDR	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Burnt out PDR	0 (0%)	1 (1.9%)	0 (0%)	0 (0%)	1 (100%)
No retinopathy	44 (75.9%)	39 (72.2%)	5 (83.3%)	19 (61.3%)	107 (100%)
Total	58 (100%)	54 (100%)	6 (100%)	31 (100%)	149 (100%)

Tigroid fundus when compared with non-tigroid revealed negative association with retinopathy (OR 0.49 with 95% confidence interval 0.21-1.11) though statistically not significant.

Vision threatening retinopathy was found in mild 4(6.9%) right eye, 5(8.6%) left eye), moderate 7 (31.5%) right eye, 4(7.4%) left eye and non-tigroid group 1(3.2%) both eyes but absent in marked tigroid showing marked tigroid as a protective factor for the development of severe form of retinopathy and maculopathy.

Table 2. Left eye Tesselated fundus and Diabetic retinopathy.

Tessellated fundus	Diabetic retinopathy n (%) within tessellated and non-tessellated group				
	Mild	Moderate	Marked	Non-tigroid	Total
Mild NPDR	8 (13.8%)	2 (3.7%)	0 (0%)	5 (16.1%)	15 (100%)
Moderate NPDR	2 (3.4%)	4 (7.4%)	0 (0%)	4 (12.9%)	13 (100%)
Severe NPDR	5 (8.6%)	4 (7.4%)	1 (16.7%)	2 (6.5%)	12 (100%)
Early PDR	0 (0%)	1 (1.9%)	0 (0%)	0 (0%)	1 (100%)
Advanced PDR	1 (1.7%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Burnt out PDR	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
No retinopathy	42 (72.4%)	43 (79.6%)	5 (83.3%)	20 (64.5%)	110 (100%)
Total	58 (100%)	54 (100%)	6 (100%)	31 (100%)	149 (100%)

Tigroid fundus was found to be positively associated with vision threatening retinopathy with Odds Ratio 3.71(0.47-29.55) though statistically insignificant.

Diabetic retinopathy was observed more in age group 51-60 years 16 (34%) right eye; 14 (29.8%) left eye in tigroid group. In non-tigroids, maximum diabetic retinopathy was in age group 40-50 years 9(42.9%) in both eyes. Age 40-50 years as compared to >40-50 years was negatively (OR 0.67 with 95% confidence interval 0.24-1.83) associated with retinopathy in tigroids though statistically insignificant while in non-tigroid group, age 40-50 years (OR 2.12 with 95% confidence interval 0.43-10.5) was positively associated but was statistically insignificant.

Diabetic retinopathy was more common in males 18(29.5%) right eye, 17(27.9%) left eye intigroidsbut proliferative retinopathy was observed 2(3.5%) both eyes in females only whereas in non-tigroid group, retinopathy 8(53.3%) right eye, 7(46.7%) and severe type of retinopathy was seen more in females but proliferative retinopathy was absent. Female gender was negatively (OR 0.71 with 95% confidence interval 0.31-1.61) associated with retinopathy in tigroid fundus but statistically insignificant while in non-tigroid, female gender (OR 2.51 with 95% confidence interval 0.38-10.88) was positively associated with no statistical significance.

Diabetic retinopathy was observed in higher number in 10-15 years group in both tigrod 19(21.1%) both eyes and non-tigroid patients 11(39.2%) right eye; 10 (35.7%) left eye]. There was decreasing number of retinopathy as the duration of diabetes increases but number of proliferative retinopathy increased with increasing age. Duration 10-15 years of onset of diabetes when compared with >10-15 years was (OR 0.58 with 95% confidence interval 0.22-1.37) negatively associated with retinopathy in tigroid diabetics though not statistically significant. In non-tigroids, duration 10-15 years of onset of diabetes (OR 1.5 with 95% confidence interval 0.1-18.54) was positively associated with retinopathy but was statistically insignificant.

Diabetic retinopathy was found higher in patients having glycosylated Hb (HbA_{1c}) >6.5

Table 3. HbA_{1c} and Right eye Diabetic retinopathy.

Tessellated fundus	Diabetic retinopathy n(%) within HbA_{1C} group				
	HbA_{1C} Tessellated fundus		HbA_{1C} Non-tessellated fundus		Total
	<6.5	>6.5	<6.5	>6.5	
Mild NPDR	3 (13%)	6 (6.3%)	1 (12.5%)	3 (13%)	13 (100%)
Moderate NPDR	0 (0%)	7 (7.4%)	2 (25%)	4 (17.4%)	13 (100%)
Severe NPDR	0 (0%)	12 (12.6%)	1 (12.5%)	1 (4.3%)	14 (100%)
Early PDR	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Advanced PDR	0 (0%)	1 (1.1%)	0 (0%)	0 (0%)	1 (100%)
Burnt out PDR	0 (0%)	1 (1.1%)	0 (0%)	0 (0%)	1 (100%)
No retinopathy	20 (87%)	68 (71.6%)	4 (50%)	15 (65.2%)	108 (100%)
Total	23 (100%)	95 (100%)	8 (100%)	23 (100%)	149 (100%)

in both tigroids 27 (28.4%) right eye; 25 (26.3%) left eye and non-tigroids 8(34.8%) right eye; 7 (30.4%) left eye. It also showed presence of proliferative retinopathy only in uncontrolled diabetic group.

HbA_{1c} <6.5 was negatively (OR 0.36 with 95% confidence interval 0.99-1.31) associated with retinopathy in tigroid group though insignificant statistically while HbA_{1c} <6.5 (OR 3.12 with 95% confidence interval 0.59-16.58) was positively associated in non-tigroid fundus but was statistically insignificant.

Maculopathy was present in higher number in non-tigroids 6(19.4%) followed by mild tigroids 5(8.6%) and moderate tigroids 5(9.3%). It was present in 1(16.7%) case only in marked tigroid. Vision threatening maculopathy was

present in mild 2 (3.5%) and moderate 3(5.6%) tigroid group. Our study showed not a single case of ischemic maculopathy which could be due to high selection of patients in this study. Tigroid fundus was found to be negatively associated with maculopathy with OR 0.43(0.15-1.27) but with statistical insignificance.

Table 4. HbA_{1c} and Left eye Diabetic retinopathy.

Tessellated fundus	Diabetic retinopathy n(%) within HbA_{1c} group				
	HbA_{1c} Tessellated fundus		HbA_{1c} Non-tessellated fundus		Total
	<6.5	>6.5	<6.5	>6.5	
Mild NPDR	2 (8.7%)	8 (8.4%)	1 (12.5%)	4 (17.4%)	15 (100%)
Moderate NPDR	1 (4.4%)	5 (5.3%)	3 (37.5%)	1 (4.4%)	10 (100%)
Severe NPDR	0 (0%)	10 (10.5%)	0 (0%)	2 (8.7%)	12 (100%)
Early PDR	0 (0%)	1 (1.1%)	0 (0%)	0 (0%)	1 (100%)
Advanced PDR	0 (0%)	1 (1.1%)	0 (0%)	0 (0%)	1 (100%)
Burnt out PDR	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
No retinopathy	20 (87%)	70 (73.7%)	4 (50%)	16 (69.6%)	110 (100%)
Total	23 (100%)	95 (100%)	8 (100%)	23 (100%)	149 (100%)

Maculopathy was more in age group 61-70 years 5(17.2%) both eyes in tigroid fundus and 40-50 years 3(14.3%) right eye; 2(9.5%) left eye] in non-tigroid.

Age 40-50 years when compared with >40-50 years was observed to be positively (OR 1.5 with 95% confidence interval 13.6-16.54) associated with maculopathy in tessellated fundus but female gender (OR 0.69 with 95% confidence interval 0.18-2.59) and duration 10-15 years of onset of diabetes (OR 0.43 with 95% confidence interval 0.11-1.64) was negatively associated though statistically insignificant. Association of HbA_{1c} <6.5 with maculopathy could not be calculated because of zero number of cases in this <6.5 group in tessellated fundus.

Age 40-50 years (OR 0.75 with 95% confidence interval 0.15-3.75), HbA_{1c} <6.5 (OR 0.95 with 95% confidence interval 0.85-10.73) and duration 10-15 years of onset of diabetes (OR 0.24 with 95% confidence interval 0.02-3.5) was negatively associated with maculopathy in non-tigroids butfemale gender (OR 3.75 with 95% confidence interval 0.35-40.81) was positively associated with no statistical significance.

DISCUSSION

Our study revealed tigroid fundus as protective factor to prevent diabetic retinopathy. The result was similar to other international study revealing tigroid fundus as a local protective factor for the development of retinopathy and progression of retinopathy.[4] But our result was statistically not significant which could be due to small sample size and high patients' selection criteria of our study.

Proliferative diabetic retinopathy was not observed in non-tigroids in this study which could be because of the younger age group of patients and lesser number of the patients as we are looking for association of physiological tigroid fundus in the develpoment of diabetic retinopathy and severe form of retinopathy. There were only two cases of proliferative diabetic retinopathy in our study in tigroid group and zero in non-tigroid group to calculate odds ratio.

Tigroid fundus revealed positive association to vision threatening retinopathy though not significant which could be due to our small sample size which require further population-based study.

Diabetic retinopathy was observed high in patients with the onset of diabetes for 10-15 years. The result was similar to other various international studiesrevealing duration after 10 years as increased risk for the development of retinopathy.[5-9] There was increasing number of proliferative retinopathy with increasing age suggesting longer duration as increased risk factor for severe retinopathy which was same as studies by Nelson RG et.al and the Wisconsin Epidemiologic Study of diabetic retinopathy.[10,11] In tigroids, duration 10-15 years was found as decreased risk as compared to >10-15 years for the development of retinopathy. In non-tigroids, the same duration was revealed as increased risk for the retinopathy.

Diabetic retinopathy was observed more in age group 51-60 years in tigroidfundusshowing increased chances of retinopathy and severe form of retinopathy with increasing age after 50 years. In non-tigroid group, maximum diabetic retinopathy was observed in age group 40-50 years. Many studies have shown association of increasing age with the development of retinopathy.[6,7,9] Some studies contradict age as a lesser risk factor for retinopathy and progression of retinopathy.[12]Age 40-50 years in tigroid fundus was observed as low risk for retinopathy as compared to age >40-50 years in our study. In non-tigroids, age 40-50 years was found as high risk for retinopathy.

Many studies have shown gender as no risk factor for the development of retinopathy.[11,12] The Singapore-Malay

Eye study had revealed more severe diabetic retinopathy and all form of diabetic retinopathy more in females.[6] In other hospital based study with small number of cases like ours male gender was increased risk for diabetic retinopathy.[13] In our study, diabetic retinopathy was found to be more common in males in tigroids whereas in non-tigroids, retinopathy and severe type of retinopathy was found more in females. In tigroid fundus, female was seen as no risk for retinopathy but in non-tigroid group, female showed increased risk for retinopathy.

Diabetic retinopathy was found in increased frequency in patients having glycosylated Hb (HbA_{1c}) >6.5 in both tigroid and non-tigroidgroup It also showed presence of proliferative retinopathy only in group with increased HbA_{1c} unveiling hyperglycemia as increased risk for retinopathy and progression of retinopathy. This result was similar to other studies done in different parts of the world.[5,13] HbA_{1c} <6.5 was found protective for retinopathy in our study in tigroid diabetics whereas HbA_{1c} <6.5 was seen as increased risk in non-tigroidsshowing hyperglycemia as not an important risk for retinopathy or this could be due to small sample size which further needs study.

Tigroid fundus was found to have lesser risk for maculopathy as compared to non-tigroid in our study though it was not significant statistically. No study was found to compare our study results.

Our results showed different association of tigroid and non-tigroid fundus in relation to age, gender, duration and HbA_{1c} revealing different behaviour of tigroid and non- tigroid fundus. It does show role of tigroid fundus in the dvelopment of retinopathy. The statistically insignificant association in relation to fundus, age, gender, duration and HbA1c in our study might be due to small sample size and high exclusion criteria.

We do recommend further population based study in Nepal to further determine the role of tigroid fundus, prevalence and incidence of diabetic retinopathy and risk factors associated with it with less exclusive criteria.

CONCLUSIONS

Tigroid fundus was observed as a protective factor for the diabetic retinopathy and diabetic maculopathy though it was statistically insignificant.

Association of age 40-50 years, female gender, HbA_{1c}<6.5 and duration 10-15 years of onset of diabetes for the development of diabetic retinopathy in both tigroidand non-tigroidfundi was statistically insignificant.

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