CLINICAL ANALYSIS OF 50 CASES OF DIABETIC MACULOPATHY

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ABSTRACT

To study age, incidence, sex incidence and relationship between Diabetic age and Maculopathy, Role of FFA and/or OCT in management.

MATERIALS AND METHODS

96 eyes of 50 patients were screened in the OPD. Using slit lamp biomicroscopy, FFA and OCT the relationship between Diabetic age and type of maculopathy was analysed.

RESULTS

32 patients were above 50 years of age and 18 less than 50. Ratio of males-to-females was 2.85:1. In our study 92% had bilateral involvement (Asymmetric), 14% with focal type of maculopathy had 6-10 years' duration; 33% of diffuse had 11-15 years of duration; 30% of ischaemic type had 20-25 years' duration.

CONCLUSION

Incidence of diabetic maculopathy was common after 50 years of age and with diabetes of longer duration. FFA is the most important diagnosing tool in classifying type of maculopathy and aids in management. Also focal maculopathy was common in early diabetics, diffuse type and ischaemic type were seen with longer duration of diabetes.

KEYWORDS

Focal Maculopathy, Fundus Fluorescence Angiography, Diabetic Age.

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INTRODUCTION

Diabetic retinopathy is a microangiopathy affecting precapillary arterioles, capillaries and venules.[1] The disease affects the young as well as the old, chronic and progressive in its course leading to blindness and is preventable. Diabetic maculopathy is defined as retinal thickening within 2 disc diameters of the center of the macula.[2] Macula has dual blood supply from choriocapillaries and capillary twigs from central artery of retina. Watershed zone of posterior ciliary artery meet at submacular area. Fundus lesions near the macula derive their form from the architecture of the retina, i.e. radial arrangement of Henle's fibres. Macular exudate is due to disturbance of circumfoveal capillary network and this gives rise to accumulation of fluid in the macula.[3]

Anatomy of Macula

Macula is an oval area at the posterior pole measuring about 5 mm in diameter. Its center is located at approximately 4 mm temporal and 0.8 mm inferior to the disc.[4] important clinical landmarks within the macula are fovea, foveola and foveal avascular zone. Fovea is a depression in the inner retinal surface at the centre of the macula. Its diameter is 1.5 mm. ophthalmoscopically, the fovea can be recognized by an oval light reflex arising from the increased thickness of the retina and inner limiting membrane in the parafoveal region. The parafoveal region is the thickest part of the retina containing 6-8 layers of retinal ganglion cells.

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Foveola

It forms the central floor of the fovea and has a diameter of 0.35 mm.[5] it is the thinnest part of the retina and is devoid of ganglion cells. Its entire thickness consists only of cones and their nuclei and it forms central vision. The umbo is a tiny depression in the very centre of the foveola. The exact location of the foveal avascular zone can be determined by fluorescence angiography. Histologically, in the fovea and the foveola there are no rod photoreceptors, but only tightly packed cones. All other retinal elements except Muller cells are largely absent.

Despite the displacement of bipolar and ganglion cells to the periphery of the fovea, the cones and rods retain the vertical orientation, but the inner and outer fibres of photoreceptors are inclined obliquely towards the periphery of the macula. The horizontal course of inner photoreceptors fibres at the outer plexiform layer forms the Henle's layer.[6]

The annular zone external to the fovea is divided into an inner parafoveal and outer perifoveal area. The parafoveal region has the greatest accumulation of bipolar cells and ganglion cells in the entire retina. In the perifoveal area, the density of cones decreases markedly and outer plexiform layer changes from Henle's layer to a more usual arrangement. The retinal pigment epithelium and adjoining choriocapillary bed and increased over the macular region. The external limiting membrane is pushed inward forming a depression, which faces the choroid and is called fovea externa.

Pathogenesis

The most common cause of visual impairment due to diabetic

retinopathy is macular oedema. Maculopathy causes reduced visual acuity due to macular oedema, hard exudates at the macula and haemorrhage.[7] The primary pathology occurs due to breakage of blood retinal barrier.[8] The sites of leakage are microaneurysms, intraretinal microvascular abnormalities and dilated retinal capillaries.[9] The vulnerability of macula is due to abundance of Henle's fibres that are hydrophilic, relative avascularity that limits fluid absorption and thin basal lamina that does not protect against the biochemical effects.[10]

Changes in Diabetic Maculopathy can be divided into 2 Main Categories

1. Intraretinal which includes macular oedema, macular hard exudates and macular ischaemia.
2. Pre-retinal and vitreoretinal which include thickened posterior hyaloid, thickened pre-retinal membrane and macular traction.

Clinical Features

It occurs in older age group and increases with the duration of diabetes. It can be divided into.

Focal Macular Oedema

Localised area of retinal thickening results from microaneurysms and IRMA. They are differentiated from normal retina by complete or partial ring of exudates.[11] Subretinal deposits occur in severe cases. Visual acuity is reduced due to oedema at the fovea and hard exudates at the macula. It can be divided into.

1. Discrete hard exudates Single - Extrafoveal or parafoveal.
2. Multiple hard exudate rings.
3. Hard exudates with subretinal fibrous plaque.

Rings of hard exudates usually start lateral to the macula and advance towards the fovea. The centre of rings have microaneurysms, which leak and cause perimacular oedema.

Circinate Retinopathy

This is preceded by macular and perifoveal capillary disturbance of a longer period.[12] Stages of hard exudate formation include Capillary leakage with possibly differentiation of exudates and deposition of lipid and accession of macrophages to the plasma situated in the outer molecular layer. They take four months to form clusters and three years to form rings. They can appear and disappear during the course of the disease.[13]

Diffuse Macular Oedema

It occurs from dilated vessels at the posterior pole of the retina. Patent capillaries dilate and leak to cause diffuse oedema. It is not usually associated with hard exudates. Bilateral symmetry is a common feature. Systemic fluid retention due to fluid retention can cause increase in the level of macular oedema.[14] The disturbance of permeability at the capillaries or at endothelium or even at the level of retinal pigment epithelium can cause retinal oedema to form.[15] It can follow after panretinal photocoagulation as well.[16]

Clinically Significant Macular Oedema

The early treatment of diabetic retinopathy study defined clinically significant macular oedema and it included,

1. Retinal oedema of about 500 microns from the centre of the fovea.
2. Hard exudates 500 microns from the centre of the fovea that is associated with retinal thickening.
3. Retinal oedema that is one disc diameter area that is I500 microns or larger, any portion of which is 1 disc diameter from the centre of the fovea.[17]

Macular Ischaemia

Inadequate blood supply may cause decrease in visual acuity associated with and oedematous macula.[18] Clinical features include enlarged foveal avascular zone, which is normally 300-500 microns and this is indicated by the presence of increased capillary dropouts on FFA.[19], thread-like arteries and large retinal haemorrhages. This is associated with visual loss and a positive scotoma.

AIM

To study the age incidence, relationship between diabetic age and type of maculopathy, the role of FFA in management of diabetic macular oedema.

MATERIALS AND METHODS

The study was conducted from July 2015 to March 2016; 96 eyes of 50 patients were evaluated. Emphasis was placed on the findings of FFA to decide the therapeutic modality.

Best corrected visual acuity was noted using Snellen's chart. Intraocular pressure was measured using Goldmann Applanation Tonometry. Evaluation of anterior segment was done using slit lamp and fundus examination was done using Welch Allyn direct ophthalmoscope. Neitz indirect ophthalmoscope was supplemented by +90D lens. The status of angle and vitreous cavity was assessed using Goldmann's 3-mirror gonio lens. Amsler's grid was used to assess macular function. Central visual field was tested using Humphrey's 24-2 perimetry.

Fundus photograph and fundus fluorescein angiography was done using Zeiss fundus photo camera.

Exclusion Criteria

1. Patients with diabetic retinopathy with no macular involvement.
2. Other retinal vascular disease.
3. Glaucoma.
4. Uveitis.
5. Grade 3 and 4 Hypertensive retinopathy.

Inclusion Criteria

Patients who have Type 2 diabetic retinopathy associated with any form of diabetic macular oedema.

The pupil was dilated with 1% tropicamide and 10% phenylephrine drops. Fundus examination was performed using direct and indirect ophthalmoscopy and slit lamp examination with 90D lens. FFA was done using Zeiss fundus camera.

FFA was done using 5 mL of 10% sodium fluorescein. The dye is injected into the antecubital vein and patient is seated in front of the camera. Observations made include Leaking microaneurysms – number and distribution, Focal leaks from vessels, Presence of diffuse leak and Presence of ischaemia. Other areas of fundus were also examined and documented with importance given to the type of maculopathy and to distinguish ischaemic from other types of maculopathy.

RESULTS

In our study group, the predominant age group affected is the 51-60 years–32% followed by 61-70 years-26% and 41-50 years–22%. In our study, 54% cases are aged between 41-60.

Table 1/Sex Incidence

The ratio of males-to-females in our study 2.85:1. The predominant age group in which males and females were affected was between 51-60.

Table 2/Duration of Diabetes

In our study, 28% of patients had diabetes of 6-10 years' duration followed by 24% patients of 11-15 years' duration; 26% had duration of 5 or less than 5 years.

Table 3/Laterality

In our study, 92% have bilateral involvement emphasising that diabetic maculopathy affects both eyes equally.

Table 4

Relationship between visual acuity at presentation and the type of maculopathy: 44% of the patients with focal type of lesion had visual acuity in the rage of 6/12 - 6/18. Most of the patients with focal type of lesion had visual acuity between 6/6-6/36; 45.6% of patients with diffuse type had visual acuity between 4/60-6/60. Mainly the visual acuity of patients was between 6/24- 4/60; 40% of patients with ischaemic type visual acuity range between 6/24 - 6/36.

Table 5/Fundus Fluorescein Angiography

In our study, 44.8% patients had focal type of maculopathy; 34.4% had diffuse type and 20.5% had ischaemic lesion.

Table 6/Type of Maculopathy

In our study, 18.7% cases were found to have clinically significant macular oedema.

Table 7

Analysis of type of maculopathy and duration of maculopathy showed 35% focal with 6-10 years of diabetes, 33% diffuse with 11-15 years of diabetes and 30% ischaemic with 21-25 years of diabetes.

Table 8

Sl. No.	Age Group (Years)	No. of Patients	Percentage
1.	21-30	3	6%
2.	31-40	4	8%
3.	41-50	11	22%
4.	51-60	16	32%
5.	61-70	13	26%
6.	71-80	3	6%

Table 1

Sl. No.	Age Group (Years)	No. of Males	No. of Females	Males	Females
1.	21-30	3	-	6%	-
2.	31-40	4	-	8%	-
3.	41-50	9	2	18%	4%
4.	51-60	9	7	18%	14%
5.	61-70	11	2	22%	4%
6.	71-80	1	2	2%	4%

Table 2

Duration of Diabetes	No. of Patients	Percentage
<1	3	6%
2-5	10	20%
6-10	14	28%
11-15	12	24%
16-20	7	14%
21-25	4	8%

Table 3

	Right Eye	Left Eye	Both Eyes
Number	2	2	46
Percentage	4%	4%	92%

Table 4

	RE	LE	Total	Percentage	RE	LE	Total	%	RE	LE	Total	%
6/6-6/9	5	6	11	25.6	-	-	-	-	-	-	-	-
6/12-6/18	8	11	19	44	2	2	4	12	1	1	2	10
6/18-6/24	6	3	9	21	6	6	12	36.4	3	5	8	40
6/60-4/60	2	-	2	4.7	8	7	15	45.6	3	3	6	30
<4/60	1	1	2	4.7	1	1	2	6	2	2	4	20

Table 5: Focal Diffuse Ischaemic

Type of Maculopathy	Right Eye	Left Eye	Total	Percentage
Focal	22	21	43	44.79%
Diffuse	17	16	33	54.3%
Ischaemic	9	11	20	20.83%

Table 6

Sl. No.	Type	Number	Percentage
1	CSME	18	18.7%
2	Non-CSME	78	81.3%

Table 7

Incidence of Type of Maculopathy	Focal 35%	Diffuse 33%	Ischaemic 30%
Duration of Diabetes	6-10 Years	11-15 Years	21-25 Years

Table 8

DISCUSSION

Diabetic macular oedema is a vision threatening complication of diabetes mellitus. It is defined as retinal thickening of 2 DD from the centre of the macula. It is the commonest cause of decreased vision due to diabetic retinopathy. It is said to be influenced by a number of factors including age of the patient, sex of the patient, duration of diabetes and control of blood sugars.

Classification of Diabetic Retinopathy

There were various type of classifications available. Currently, ETDRS classification is used because it gives better understanding of the progression and helps deciding regarding management.

ETDRS Classification

In this classification, retinopathy is classified into Non-Proliferative Diabetic Retinopathy (NPDR): NPDR is characterized by presence of retinal haemorrhages, exudates and configurational changes in the veins. It is divided into Mild, Moderate, Severe and Very Severe NPDR.

Proliferative Diabetic Retinopathy (PDR) is further classified into PDR with high risk characteristics and PDR with no high risk characteristics. Maculopathy can occur in both NPDR and PDR.

The use of Fundus fluorescein angiography to quantify and decide on the type of macular involvement is essential as it is an important factor in determining further management and treatment modality. The ETDRS group defined clinically significant macular oedema as Retinal oedema of about 500 microns from the centre of the fovea, Hard exudates 500 microns from the centre of the fovea that is associated with retinal thickening and retinal oedema that is one disc diameter area, any portion of which is 1 disc diameter from the centre of the fovea. Macular oedema can be divided as mild moderate and severe macular oedema with centre involving or centre non-involving.[20] Focal macular oedema is due to localised area of retinal thickening results from microaneurysms and IRMA. They are differentiated from normal retina by complete or partial ring of exudates. FFA in focal macular oedema shows hyperfluorescence in early and late phases. Diffuse type of macular oedema occurs from dilated vessels at the posterior pole.[21] Patent capillaries dilate and leak to cause diffuse oedema. Disturbance in permeability of either retinal capillaries, endothelium, retinal pigment epithelium results in retinal oedema and FFA shows late diffuse hyperfluorescence and macular ischaemia is due to reduced blood flow to the macular region and FFA shows increased foveal avascular zone with larger areas of capillary non-perfusion.

In our study, we studied 96 eyes of 50 patients and analysed the age incidence of maculopathy and found that 32% patients were between 51-60 years and 26% between 61-70 years and 22% between 41-50. The predominant finding was that majority of the patients were in the age group of 51-60 years and this correlates with the Wisconsin Epidemiological Study of Diabetic Retinopathy.[22] which revealed that diabetic retinopathy was more prevalent in the middle aged and elderly population affecting people aged 45 to 64 years.

We also analysed the sex incidence and found that the ratio of males-to-females in our study is 2.85:1. The predominant age group in which males and females were affected was between 51-60 years. This finding also correlated to the Wisconsin Epidemiological Study of Diabetic Retinopathy, which showed male-to-female ratio was 1.5:1.

The analysis of duration of diabetes revealed that 28% of patients had diabetes of 6-10 years' duration and 24% of patients had diabetes of 11-15 years' duration; 26% had duration of 5 or less than 5 years' duration. This also correlates with the Wisconsin Epidemiological Study of Diabetic Retinopathy, which showed 24% of patients have diabetes of 5 years or less duration and feature of diabetic maculopathy and 57.5% of patients have diabetes of 10 years and more duration showed features of diabetic retinopathy.

In our study, we found that 92% of patients exhibited bilateral involvement which showed that diabetic maculopathy affects both eyes symmetrically.

Our analysis of visual acuity and presentation to the type of maculopathy revealed that 44% of the patients with focal type of lesion had visual acuity in the range of 6/12 - 6/18. Most of the patients with focal type of lesion had visual acuity between 6/6-6/36; 45.6% of patients with diffuse type had visual acuity between 4/60-6/60. Mainly the visual acuity of patients were between 6/24-4/60; 40% of patients with ischaemic type visual acuity range between 6/24 - 6/36.[23]

As we analysed the type of maculopathy using fundus fluorescein angiography, we found that 44.8% patients had focal type of maculopathy; 34.4% had diffuse type and 20.5% had ischaemic lesion. The visual acuity was poorest when ischaemic maculopathy was detected and the best visual acuity was seen with focal type of maculopathy. Diffuse type of maculopathy was associated with metamorphopsia in the Amsler's chart and ischaemic type had a positive scotoma.[24] Analysis of type of maculopathy and duration of maculopathy showed 35% focal with 6-10 years of diabetes, 33% diffuse with 11-15 years of diabetes and 30% ischaemic with 21-25 years of diabetes. This is a unique feature of our study, as we compare the duration of diabetes to the type of macular oedema that presents in patients which is a useful prognostic factor that can aid in management and can assess visual prognosis.

Our series showed 18.7% cases having clinically significant macular oedema. It is correlated with Wisconsin Epidemiological Study of Diabetic Retinopathy report, which showed 17% maculopathy are CSME. In the CSME cases, 33.3% had focal type and 66.7% cases had diffuse type of maculopathy. In non-CSME cases, 25.6% cases had ischaemic type and 74.4% cases had non-ischaemic type of maculopathy.[25]

CONCLUSION

Incidence of diabetic maculopathy is common after 50 years with diabetes of longer duration. The disease affects both eyes symmetrically. Amsler grid is a useful diagnostic aid in assessing macular disease. FFA is the important diagnostic tool in classifying the type of maculopathy. Patients presented with decreased visual acuity with ischaemic type than diffuse. Focal type had a better visual acuity presentation than the other 2

types. FFA is needed to quantitate the extent of macular involvement and capillary dropout. The distinctive feature of our study is that we established that the duration of diabetes is related to the type of the maculopathy. It was found that focal maculopathy was more common with shorter duration of diabetes and ischaemic maculopathy was more common with prolonged duration of diabetes. Diabetic maculopathy is the commonest cause of visual loss in patients with diabetic retinopathy.

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