



# Prevalence and causes of macular edema and its correlation: an observational study

Ishtpreet Mann<sup>1</sup>, Rajwinder Kaur<sup>2</sup>, Balbir Khan<sup>2</sup>, Prithpal S Matreja<sup>3\*</sup>, R N Bhatnagar<sup>2</sup>

<sup>1</sup>Undergraduate, Gian Sagar Medical College and Hospital, Patiala, Punjab, India

<sup>2</sup>Department of Ophthalmology, Gian Sagar Medical College and Hospital, Patiala, Punjab, India

<sup>3</sup>Department of Pharmacology, Gian Sagar Medical College and Hospital, Patiala, Punjab, India

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## Abstract

**Background:** Macular edema occurs when fluid and protein deposits collect on or under the macula of eye and causes it to thicken and swell. If left untreated, macular edema can cause severe vision loss and even blindness. Diabetic retinopathy is the major cause of macular edema. The data on Indian populations is lacking hence we have designed this study to find out the prevalence and causes of Macular edema and to study its correlation.

**Methods:** This prospective, observational study was conducted in the Department of ophthalmology. The patients with best corrected visual acuity loss within the last 6 months of evolution, caused by the macular edema as stated by investigator's judgement and those who gave informed consent were included in the study. A total of 50 patients were included in the study after signing the informed consent.

**Results:** The results showed that macular edema occurs mostly in old age and diabetes mellitus is the most common cause of macular edema followed by a combination of hypertension and diabetes. The least common causes include ARMD, glaucoma, CSME and frosted branch angiitis. Diabetics showed a greater problem of floaters as compared to non diabetics. Diabetics showed a gradual and partial vision loss which was more common in right eye. Rests of the results were statistically insignificant.

**Conclusion:** It was observed in our study that diabetes is the most common cause of macular edema. It causes gradual and partial vision loss.

### \*Corresponding author:

Dr Prithpal S Matreja, Associate Professor, Department of Pharmacology, Gian Sagar Medical College and Hospital, Village Ram Nagar, Tehsil Rajpura, District Patiala, Punjab 140601 India  
Mobile No.: +91-9855001847, Fax No.: +91-1762-520024; Email: drpsmatreja@yahoo.co.in

## Introduction

Macular edema occurs when fluid and protein deposits collect on or under the macula of eye and causes it to thicken and swell (1). Macular edema is often painless and may display few symptoms when it develops which includes blurred or wavy central vision and/or colors appear "washed out" or changed (2). If left untreated, macular edema can cause severe vision loss and even blindness. (The swelling may distort a person's central vision, as the macula is near the center of the retina at the back of the eyeball. This area holds tightly packed cones that provide sharp, clear central vision to enable a person to see detail, form, and color that is directly in the direction of gaze) (1). Clinically significant macular edema includes any one of the following lesions: retinal thickening at or within 500 microns from the center of macular; hard exudates at or within 500 microns from the center of macular associated with thickening of adjacent retina; an area or areas of retinal thickening at least 1 disk area in size, at least part of which is within 1 disk diameter of the center of the macular (3).

Diabetic retinopathy is the major cause of macular edema. Macular edema sometimes appears for a few days or weeks after cataract surgery and it is also caused by central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO) (1). BRVO over a period of 1 year causes macular edema in 5-15% (4, 5). Other causes of retinal edema include hypertension, inflammatory uveitis, exudative retinal detachment, renal failure, retinal surgery, retinitis pigmentosa, radiation exposure and drugs like latanoprost, epinephrine and nicotinic acid (5-8). Data was compared between a cohort of 8,368 diabetic (type 1 or 2) patients, who were  $\geq 18$  years old and had diagnosis of Diabetic macular edema with visual impairment (visual acuity  $< 20/40$  in Snellen equivalent), and 76,077 age- and gender-matched subjects representing a healthy population. Among diabetic patients, prevalence of DME was 15.7% (3). The data on Indian populations is lacking hence we have designed this study to find out the prevalence and causes of Macular edema and to study its correlation.

## Aims & Objectives

- To study the causes of macular edema in patients of our region
- To study the prevalence of causes of macular edema in patients of our region
- To study the correlation of various causes with the prevalence of macular edema in patients of our region

## Materials and Methods

This prospective, observational study was conducted in the Department of Ophthalmology, Gian Sagar Medical College and Hospital, Patiala for 2 months from April to August 2014. Patients visiting Gian Sagar Medical College and Hospital in a period of 2 months between April to August, 2014 with diabetic retinopathy, cataract surgery, central retinal vein occlusion, branch retinal vein occlusion, hypertension, inflammatory uveitis, exudative retinal detachment, renal failure, retinal surgery, retinitis pigmentosa, radiation exposure and on drugs like latanoprost, epinephrine and nicotinic were recruited in the study. The study was approved by the Institutional Ethics Committee and only those patients who gave written informed consent were included in the study.

Patient, male or female 18 years old or more, with best corrected visual acuity loss within the last 6 months of evolution, caused by the macular edema as stated by investigator's judgement, best corrected visual acuity tested by ETDRS within 20/40 and 20/400 in the study eye and willing to give written informed consent were included in the study.

Patients with any ocular illness that may be associated to increased/high levels of VEGF (Uveitis), systemic illnesses that may be associated to increased/high levels of VEGF (e.g. tumors), medical history of brain vascular episodes (stroke), icterus, angina pectoris or myocardial infarct within 3 months before study inclusion were excluded from the study.

Patients with pregnancy or nursing; previous medical history of ocular illnesses as: viral infections, inflammatory pathology, serous central choroidopathy, retinal detachment or any other illness that may have an influence in visual acuity and media opacities that don't allow correct eye exploration and fundus examination/photographs were also excluded from the study.

A thorough history and physical examination was done for patients enrolled in the study.

**Statistical Analysis:** The data was tabulated as mean  $\pm$  standard deviation (SD). Results were analyzed using non parametric tests (Chi-Square Test), parametric tests (two tailed student t- test) and correlation (Pearson correlation coefficients) analysis. A  $p < 0.05$  was considered statistically significant.

## Result

A total of 50 patients were included in the study after signing the informed consent. All the patients completed the study. The baseline demographic characteristics of the patients are shown in table 1. The mean age of patients was  $54.46 \pm 12.09$  with a range from 21 to 77 years.

**Table 1: Baseline characteristic of patients reporting with macular edema**

Characteristics		N=50
Age (years) (Mean±SD)		54.46±12.09
Sex (M:F)		42:8
Blurred Vision (%)		50(100)
Floaters:	Yes	25 (50)
	No	25(50)
Vision Loss:	Complete	1(2)
	Partial	49 (98)
	Sudden	17 (34)
	Gradual	31 (62)
	Unilateral (L)	14 (28)
	Unilateral (R))	17 (34)
	Bilateral	19 (38)
Improvement:	Yes (Day)	8 (16)
	Yes (Night)	2 (4)
	No	40 (80)
Shadow Across Visual Field	Yes	9 (18)
	No	41 (82)
Pain:	Yes	10 (20)
	No	1 (2) 39 (78)
Redness:	Yes	3 (6)
	No	47(94)
Photophobia:	Yes	32 (64)
	No	18 (36)
Diplopia:	Yes	5 (10)
	No	45 (90)
Optical Coherence Tomography (Mean±SD)		447.81±170.5

A total of 42 males and 8 females were enrolled in the study, all the patients complained of blurred vision and 50 % also had accompanying floaters. Majority of patients reported of partial loss in vision which was gradual in 62% of patients, with 38% reporting of Bilateral loss of vision. Eighty percent of patients had no improvement in vision and 9% had shadow across visual fields. Other symptoms reported by patients were; 22% patients complaint of pain, 6% complaint of redness, 64% reported with photophobia and 10% had complaint of diplopia.

Etiology of Macular Edema: Figure1 shows the various causes of macular edema in patients enrolled at our center, the most common cause was diabetes mellitus accounting for 38% of causes of macular edema followed by 26% in patients with hypertension and diabetes mellitus.

A comparison between macular edema due to diabetes mellitus alone and diabetes mellitus with hypertension is shown in table 2. The patients were of comparable age group and there were more number of females in group with diabetes with hypertension but not statistically significant. One patient in diabetes group reported of complete loss of vision, more number of patients had gradual loss of vision, bilateral loss of vision, no improvement in day time symptoms, greater photophobia and higher values in optical coherence tomography. Although there was no statistically significant ( $p>0.05$ ) correlation found for symptoms within the group.

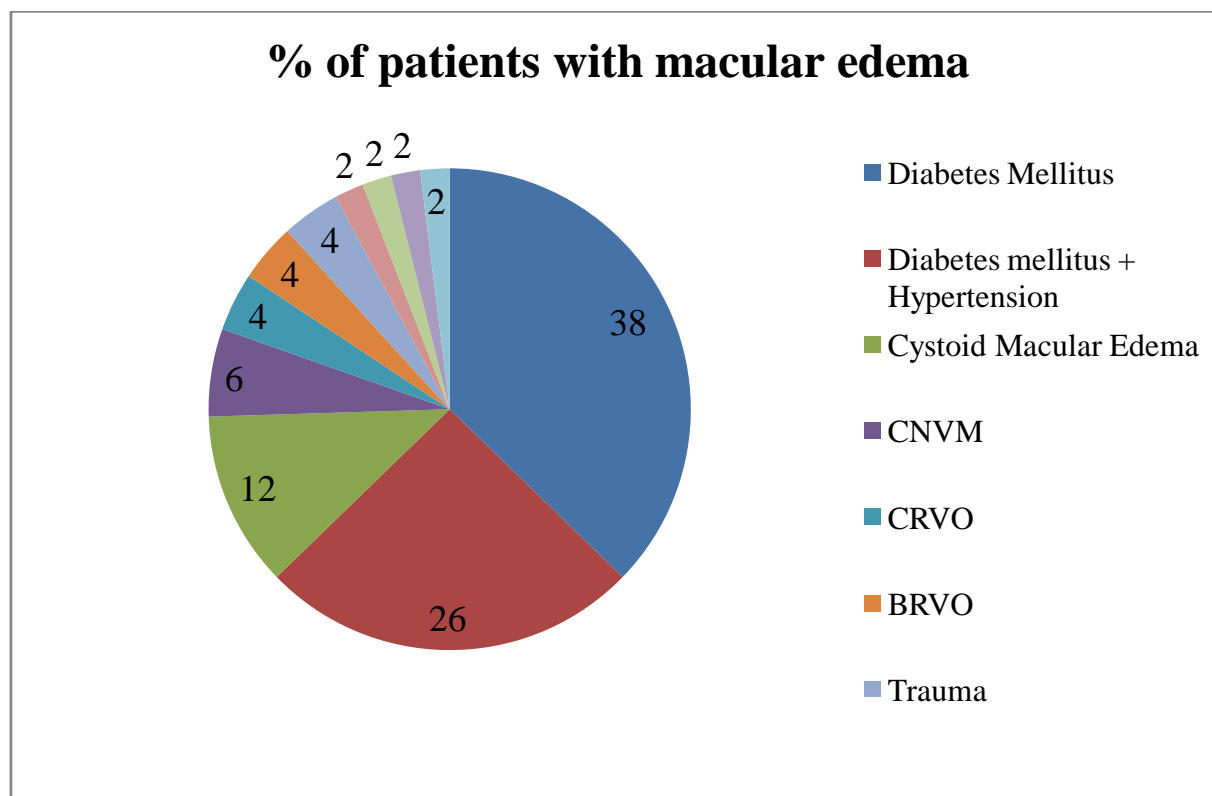


Figure 1: shows the various causes of macular edema in patients

**Table 2: Comparison between macular edema due to diabetes mellitus alone and diabetes mellitus with hypertension.**

Characteristics		Diabetes mellitus (n=19)	Diabetes mellitus with hypertension (n=13)	p value
Age (years) (Mean±SD)		56.16±9.53	56.08±12.39	>0.05#
Sex (M:F)		18:1	10:3	>0.05*
Floaters:	Yes	6	6	>0.05*
	No	13	7	
Vision Loss:	Complete	1	0	>0.05*
	Partial	18	13	
	Sudden	4	3	>0.05*
	Gradual	15	10	
	Unilateral (L)	2	5	>0.05*
	Unilateral (R))	5	4	
	Bilateral	12	4	
Improvement:	Yes (Day)	3	2	>0.05*
	Yes (Night)	0	1	
	No	16	10	
Shadow Across Visual Field	Yes	1	3	>0.05*
	No	18	10	
Pain:	Yes	5	3	>0.05*
	No	14	10	
Redness:	Yes	1	1	>0.05*
	No	18	12	
Photophobia:	Yes	12	10	>0.05*
	No	7	3	
Diplopia:	Yes	2	3	>0.05*
	No	17	10	
Optical Coherence Tomography (Mean±SD)		462.61±152.82	427.04±143.01	>0.05#
No statistically significant difference between the groups; *using Chi-Square Test; #using Student 't' Test				

**Table 3: Comparison between macular edema due to diabetes mellitus alone and diabetes mellitus with hypertension.**

Characteristics		Diabetes mellitus with/without hypertension (n=32)	Other causes of macular edema (n=18)	p value
Age (years) (Mean±SD)		56.13±10.59	51.5±14.22	>0.05#
Sex (M:F)		28:4	14:4	>0.05*
Floaters:	Yes	12	13	<0.05*
	No	20	5	
Vision Loss:	Complete	1	1	>0.05*
	Partial	31	17	
	Sudden	7	10	<0.05*
	Gradual	25	6	
	Unilateral (L)	7	7	>0.05*
	Unilateral (R))	9	8	
	Bilateral	16	3	
Improvement:	Yes (Day)	5	3	>0.05*
	Yes (Night)	1	1	
	No	26	14	
Shadow Across Visual Field	Yes	4	5	>0.05*
	No	28	13	
Pain:	Yes	7	4	>0.05*
	No	25	14	
Redness:	Yes	2	1	>0.05*
	No	30	17	
Photophobia:	Yes	22	10	>0.05*
	No	10	8	
Diplopia:	Yes	5	0	>0.05*
	No	27	18	
Optical Coherence Tomography (Mean±SD)		447.69±147.42	448±209.1	>0.05#
A statistically significant difference between the groups in terms of floaters and gradual loss of vision was observed *using Chi-Square Test; #using Student 't' Test				

A comparison between macular edema due to diabetes mellitus with/without hypertension versus macular edema due to other causes is shown in table 3. The patients were of higher age group in macular edema due to diabetes mellitus with/without hypertension and there were equal number of females in both groups.

A significantly higher ( $p < 0.05$ ) number of patients complained of floater in the edema due to other causes and had lesser number of patients with gradual loss of vision. One patient in both groups reported of complete loss of vision. More number of patients had gradual loss of vision, bilateral loss of vision, no improvement in day time symptoms, greater photophobia and higher values in optical coherence tomography in diabetes group. Although there was no statistically significant ( $p > 0.05$ ) correlation found for symptoms within the group.

## Discussion

Macular edema occurs when fluid and protein deposits collect on or under the macula of eye and causes it to thicken and swell. Diabetic retinopathy is the major cause of macular edema. Macular edema sometimes after cataract surgery and it is also caused by central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO). Other causes of retinal edema include hypertension, inflammatory uveitis, exudative retinal detachment, renal failure, retinal surgery, retinitis pigmentosa, radiation exposure and drugs like latanoprost, epinephrine and nicotinic acid (1, 2, 5).

BRVO over a period of 1 year causes macular edema in 5-15%. Among diabetic patients, prevalence of DME was 15.7%. If left untreated, macular edema can cause severe vision loss and even blindness (1, 2, 4).

The present study was undertaken to study the various causes and prevalence of macular edema and the correlation between the two. The results showed that macular edema occurs mostly in old age and diabetes mellitus is the most common cause of macular edema followed by a combination of hypertension and diabetes. The least common causes include ARMD, glaucoma, CSME and frosted branch angiitis. Diabetics showed a greater problem of floaters as compared to non diabetics. Diabetics showed a gradual and partial vision loss which was more common in right eye. Only a few patients with diabetes showed pain and redness in their eyes. 32 patients had photophobia out of which 22 were diabetics. Most of the diabetics did not have diplopia.

Other comparisons were made between diabetics and DM + hypertension, DM+HTN and others, but no significant difference in values was found.

A study was conducted in which data was compared between a cohort of 8,368 diabetic (type 1 or 2) patients,

who were  $\geq 18$  years old and had diagnosis of Diabetic macular edema with visual impairment (visual acuity  $< 20/40$  in Snellen equivalent), and 76,077 age- and gender-matched subjects representing a healthy population. Among diabetic patients, prevalence of DME was 15.7%. Our study showed that diabetes is the major cause of macular edema (4, 9, 10).

There are certain limitations in our study. Firstly, the sample size could have been larger but, the duration of study was only two months hence we tried to include patients who fulfilled the eligibility criteria. Secondly, a comparison with the intervention arm could be done, but any intervention would have prolonged the study and we would not have been able to complete the study in the allotted two months.

## Conclusion

It was observed in our study that diabetes is the most common cause of macular edema. It causes gradual and partial vision loss. Also, patients with diabetes had greater complaint of floaters. Pain and redness in eye were not significant and also diplopia was less in comparison to non diabetics

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## Competing Interests

None declared.

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