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Clinical Study of Macular Oedema

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Abstract

Aim: **To study the clinical profile, etiology and various patterns of Macular Oedema.**

Materials & Methods: **A cross sectional case study was done from December 2018 to May 2020 at Krishna institute of medical sciences, Karad. Detailed history and examination of the patients done including Amsler Grid, Color Vision using Ishihara's Chart and Slit lamp 90D examination and dilated fundoscopy. Pattern of macular oedema was evaluated and subsequently documented using Fundus camera, OCT and FFA.**

Depending on history, clinical findings and investigations cases classified based on etiology and presenting patterns.

Result:

Amongst the 60 participants there was a male to female ratio of 2.53 :1 with a mean age of 60 years.

Most common etiology in unilateral cases was BRVO (31%) and in bilateral cases was DM (62%)

Most common OCT pattern found was CYSTOID (62%) with most common cause was DIABETES in 22 eyes (44%). Most common FFA pattern in diabetic patients was found to be MIXED in 18 eyes (64.29%)

Most cases with retinal vein occlusion had Hypertension as an associated risk factor (93%)

Conclusion:

Damage to the macula has an immediate effect on the central visual acuity and may substantially affect a patients quality of life. It is reversible if diagnosed early and

treated. If left untreated, its scar can cause permanent vision loss. By correlating results from fundoscopy, optical coherence tomography and fluorescein angiography fluid accumulation within the macula can be confirmed.

Keyword: Macular oedema, Diabetes mellitus, Optical coherence tomography, Fluorescein angiography

I. Introduction

Macula is a round area at the posterior pole of 5 – 6 mm diameter, and corresponds to central 15–20° of the visual field. [1]

Macular oedema is the accumulation of fluid in the OPL and the INL of the retina due to abnormal permeability of the retinal capillaries.[2]

ECF can infiltrate retinal layers, accumulate in cavities commonly referred to as “cysts” or collect in the subretinal space, where it is referred to as subretinal fluid.

An increase of ICF volume (cell swelling) may also occur often associated with ECF. [3]

In physiologic conditions, fluid entry and exit are tightly regulated to maintain a balanced hydration state compatible with retinal homeostasis, necessary for tissue transparency and light transmission. [3]

Macular oedema results from an imbalance between fluid entry and exit, two multi-factorial processes frequently deregulated in retinal diseases. [4]

Changes in retinal hydration state interfere with photon transmission and disturb vision.

Macular oedema is often painless and may display certain symptoms when it develops which includes blurred or wavy central vision and/or colours appear "washed out" or changed.[5]

The swelling may distort a person's central vision, as the macula is near the centre 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 colour that is directly in the direction of gaze.[6]

Diabetic retinopathy is the major cause of macular oedema. Macular oedema sometimes appears for a few days or weeks after cataract surgery and it is also caused by retinal venous occlusions. Other causes of retinal oedema include hypertension, inflammatory uveitis, exudative retinal detachment, renal failure, retinal surgery, retinitis pigmentosa, radiation exposure and drugs like latanoprost, epinephrine and nicotinic acid. [7]

The clinical evaluation of macular oedema has been difficult to characterize, but evaluation has become more precise with the help of modern imaging such as Fluorescein Angiography and optical coherence tomography (OCT).[8]

It is reversible if diagnosed early and treated.[9]

Long-standing oedema may lead to permanent retinal structural damages and visual disturbance. [10]

II. Materials and Methods:

A cross sectional case study on patients with macular oedema and analysis on the various clinical patterns of macular oedema depending on the etiology was conducted in the department of Ophthalmology, Krishna hospital, Karad.

Source of data:
All eligible macular oedema patients according to inclusion criteria, who came to the Ophthalmology OPD or were undergoing treatment at Krishna Hospital from December 2018 to May 2020 were included in the study.
Sample size : 60 cases

Inclusion criteria:

All patients diagnosed with macular oedema.

Exclusion criteria:

All patients where fundus examination (macular examination) is difficult will be excluded from the study like

- Patients with central corneal opacities
- Patients with media opacities like vitreous degenerations or vitreous haemorrhages
- Patients with dense central cataract
- Patients who are under treatment for macular oedema

Examination methods:
Examination methods included:-

- Visual acuity tested by using Snellens Distant Vision chart and Jaegers Near Vision chart
- Amslers grid
- Slit lamp (90 D)
- Fundoscopy (Direct and Indirect)
- Fundus Photography
- Optical Coherence Tomography (OCT)
- Fluorescein Angiography

III. Result

There were 43 males (71.67%) and 17 females (28.33%) out of 60 participants in our study, with a male to female ratio of 2.53 : 1. Mean age was 60 years with a range of 23-85 years

21 patients (35%) were having DM followed by BRVO in 12 patients (20%). There were 39 cases with unilateral macular oedema and 21 cases with bilateral presentation.

Majority of the unilateral cases had Branch Retinal Vein Occlusion (BRVO) in 12 out of 39 patients (30.77%) and bilateral cases had Diabetes mellitus in 13 of 21 cases (61.90%)

A. OCT pattern in macular oedema patients:

Most common OCT pattern found was CYSTOID in 50 out of 81 oedematous eyes (61.73%).

Most common cause of CYSTOID pattern is DIABETES in 22 eyes (44%).
Macular Thickness was 351-500µ in 43 oedematous eyes (53.09%), 250-350µ in 27 oedematous eyes (33.33%), > 501µ in 11 oedematous eyes (13.58%).

B. Diabetic Macular Oedema

Moderate NPDR was seen in 41.67% diabetic macular oedema (n=10) patients, Severe NPDR in 33.33% (n=8), PDR in 16.67% (n=4) and Mild NPDR in 8.33% (n=2)

Most common OCT pattern is CYSTOID type which is 62.5% and most common FFA pattern was found to be mixed (focal and diffuse) (64.29%).
14 eyes with Cystoid macular oedema had Mixed pattern on FFA; 3 eyes had Focal pattern and 1 eye had Diffuse pattern
10 eyes with cystoid macular oedema had vision <6/60 (40%), 11 eyes had 6/60-6/24 (44%) and 4 eyes had vision 6/18-6/12 (16%)
5 eyes with Moderate NPDR had Cystoid macular oedema, 3 eyes had severe NPDR and 1 had PDR and 1 Mild NPDR
14 patients with Retinal vein occlusion had Hypertension (93.33%), 7 patients were Smokers (46.67%), 5 patients had Glaucoma (33.33%) and 4 patients had Diabetes Mellitus (26.67%).

IV. Discussion

- This cross-sectional study was carried out on 60 macular oedema patients
- On analysing the data, 43 were males (71.67%) and 17 were females (28.33%) with a male to female ratio of 2.53:1 which correlates with the findings of the Wisconsin Epidemiological study of Diabetic retinopathy[2] which suggested a male to female ratio of 1.5:1
- The participants were made into 7 groups with age interval of 10. Most common age group being 61-70 years with 22 patients (36.67%)
- Mean age was 60 years, average age was 62 years with a range of 23-85 years. The Wisconsin Epidemiological study[2] of Diabetic retinopathy showed that middle aged population are more affected and have a higher prevalence of DR. Our findings correlate with this study findings.
- Majority of the patients, 21 out of 60 (35%) were having Diabetes Mellitus (DM) followed by 12 patients had BRVO (20%), 5 patients had ARMD (8.33%)
- Majority of the unilateral cases had BRVO in 12 out of 39 patients (30.77%); followed by DM in 8 patients (20.51%) and ARMD and IGS was found in 4 patients each (10.26%)

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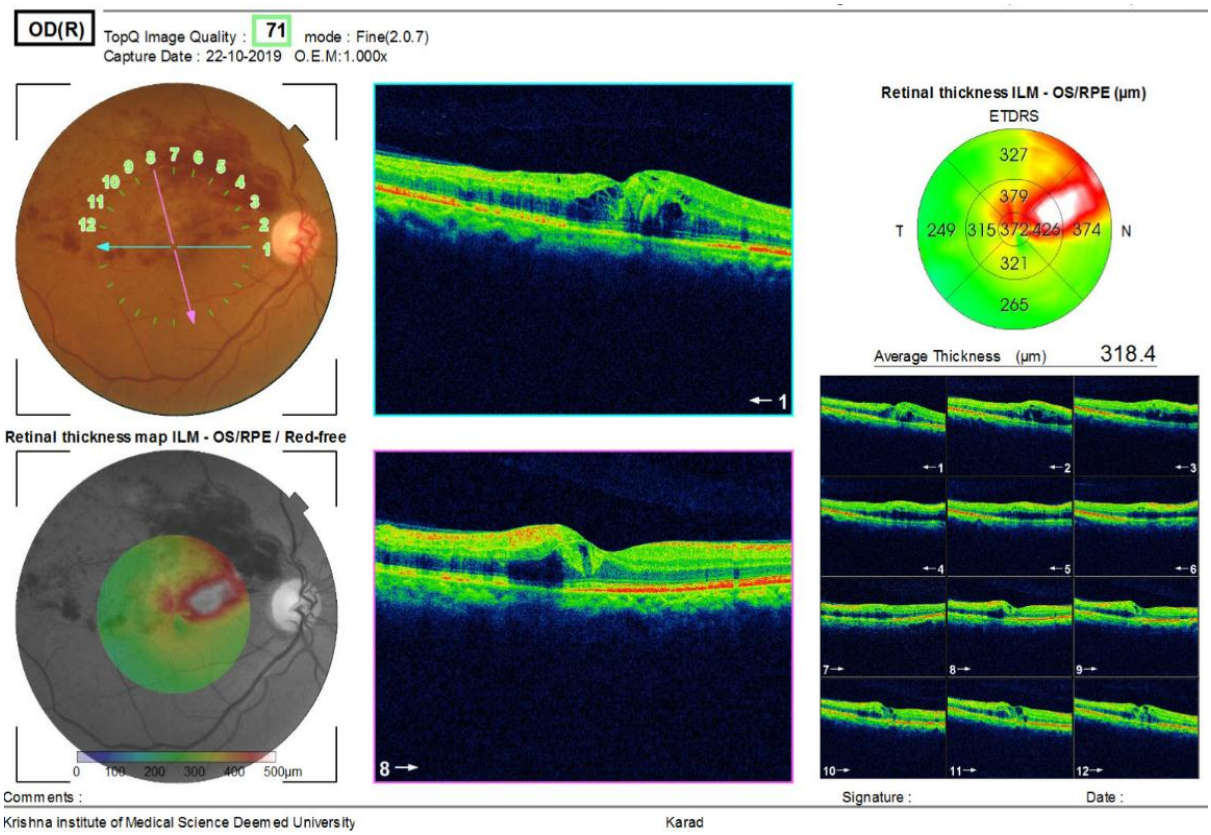

Figure 1: This figure shows Right eye ST-BRVO with macular oedema

- Majority of the bilateral cases had DM in 13 of 21 bilateral cases (61.90%); followed by patients with only Hypertension and patients with both Hypertension and DM (14.29% each)
- There were 31 eyes with near vision <N36 (38.27%)
- There was no significant difference found in near vision in patients of macular oedema (Chi square statistic = 4.059, p value = 0.2552)
- 39 out of 50 oedematous eyes showed metamorphopsia (78%) on Amslers grid test.
- There was no statistical significance found with occurrence of metamorphopsia in patients with macular oedema (Chi square statistic = 1.332, p value = 0.2484)
- In our study, most common OCT pattern is CYSTOID seen in 50 eyes with macular oedema (61.73%), 22 eyes had diffuse retinal thickening (27.16%)
- 2 patients had Post Hyaloid traction (2.47%), 2 patients had Subfoveal fluid (3.7%), 4 patients had tractional retinal detachment (4.94%).
- Most common cause of CYSTOID pattern is DIABETES in 22 eyes (44%), followed by BRVO and ARMD in 6 eyes each (12%)
- Most common cause of DIFFUSE RETINAL THICKENING is DIABETES and BRVO in 6 eyes each (30%)
- There was no significant association found when correlating macular oedema and OCT patterns (Chi square statistic = 7.299, p value = 0.1209)
- Amongst the 24 diabetic patients there were 19 males (79.17%) and 5 females (20.83%) with a male to female ratio of 3.8:1.
- Most common age group in Diabetic macular oedema patients was seen age 61-70 years with 10 patients (41.67%), followed by 51-60 years of age with 7 patients (29.17%)

- Out of the patients with diabetic macular oedema 54.16% patients had a duration of 10-20 years, 37.5% had ≥ 20 years, 8.32% patients had <10 years.
- In our study, the associated risk factors in Diabetic macular oedema patients were Dyslipidaemia (70.8%), HbA1c > 6.7 (58.33%), Nephropathy (41.67%), Smoking (45.83%), Hypertension (12.5%)
- In our study; 2 patients had mild NPDR (8.33%), 10 patients had moderate NPDR (41.67%), 8 patients had severe NPDR (33.33%) and 4 patients had PDR (16.67%) with diabetic macular oedema

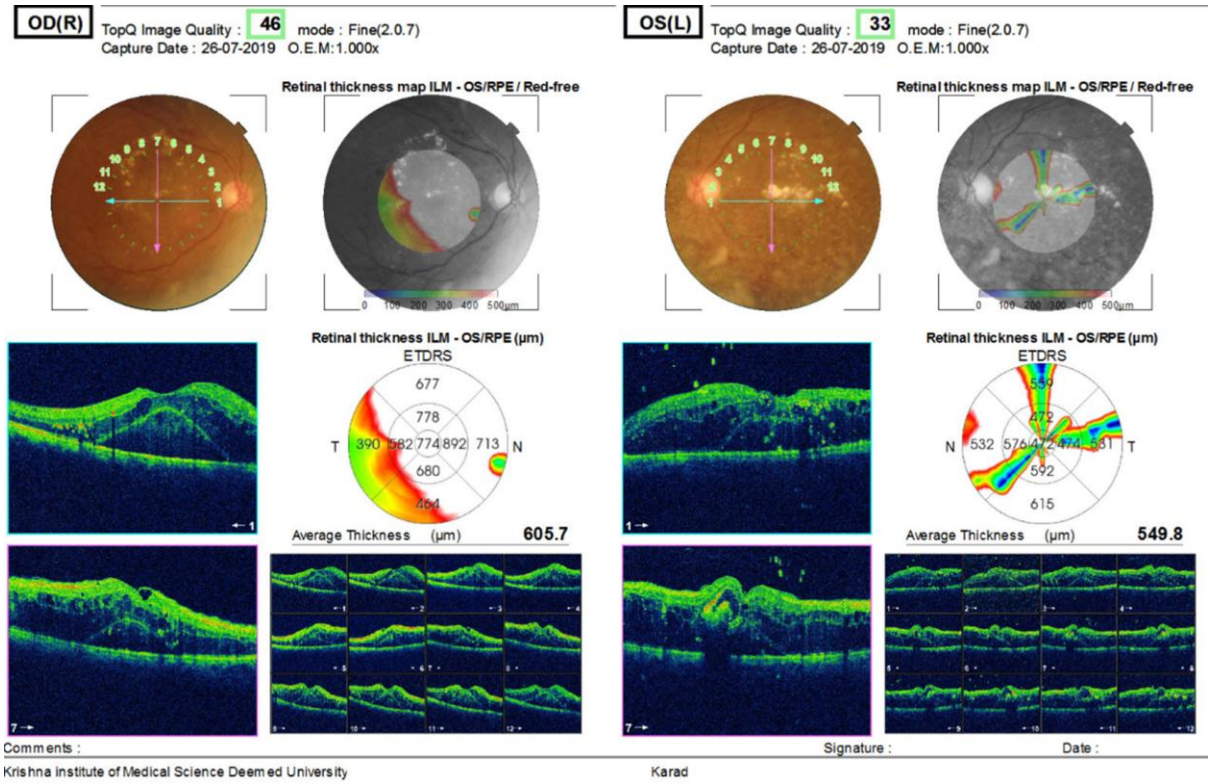

Figure 2: This figure shows Right eye Moderate NPDR and left eye Severe NPDR with both eye CSMO

- Most common OCT pattern is CYSTOID type which is 62.5% seen in 25 eyes, Diffuse Retinal Thickening was found in 20% that is 8 eyes.
- Usually Diffuse Retinal Thickening pattern is more common than Cystoid pattern like in those studies reported by Otani and Yamamoto[12]; but probably being a tertiary centre and due to availability of VR surgeons; in my study the end stage or resistant macular oedema cases were found to be more.
- Tractional Retinal detachment in 4 eyes (10%), Post Hyaloid traction in 2 eyes (5% cases) and Subfoveal fluid in 2.5% cases that is in one eye
- There was no significant association found when correlating Diabetic Macular Oedema and OCT patterns (Chi square statistic = 5.414, p value = 0.2474)
- Most common pattern was found to be Mixed (focal and diffuse) in 18 eyes (64.29%), 7 eyes (25%) had Diffuse pattern and 3 eyes (10.71%) had Focal pattern.

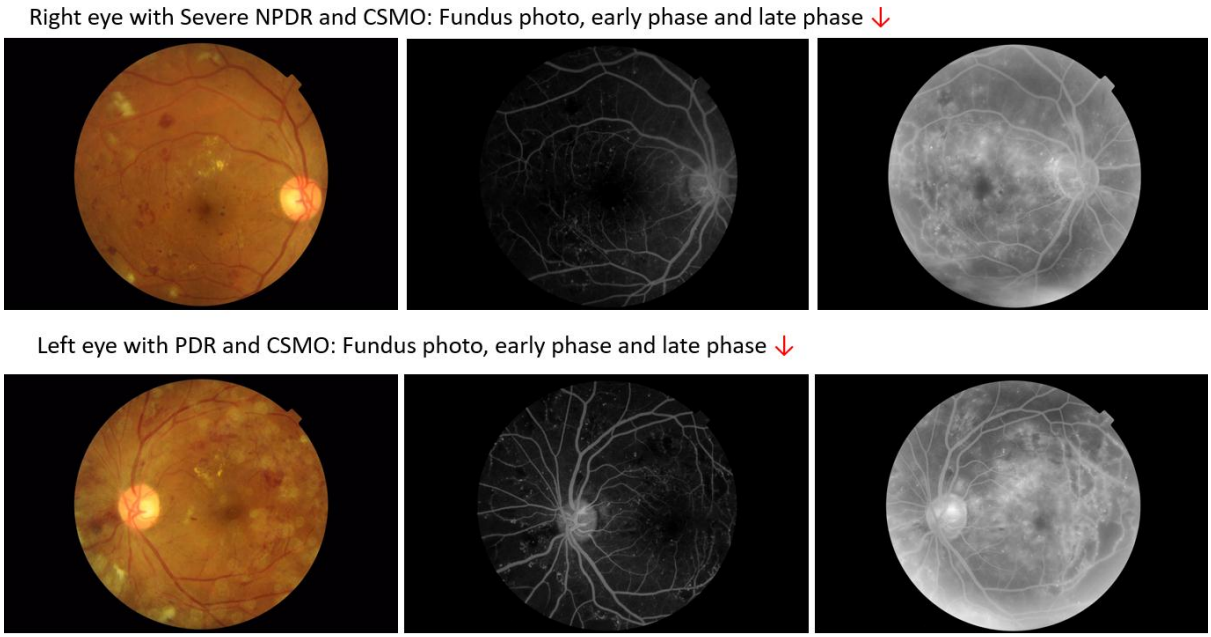

Figure 3: This figure shows FFA in a case of Diabetic Macular Oedema (Master chart serial no 24)

- ❑ 10 eyes with cystoid macular oedema had vision <6/60 (40%), 11 eyes had 6/60-6/24 (44%) and 4 eyes had vision 6/18-6/12 (16%)
- ❑ 5 eyes with Moderate NPDR had Cystoid macular oedema, 3 eyes had severe NPDR and 1 had PDR and 1 Mild NPDR

Conclusion:

- Macular Oedema is the leading cause of diminution of vision in common vitreoretinal conditions with diabetes being the most common cause in our study (35% cases). Its early diagnosis and intervention is essential to prevent blindness.
- There are many modifiable risk factors associated with diabetic macular oedema which might increase the likelihood of macular oedema such as poor glycemic, hypertensive control, dyslipidemia, anemia, nephropathy and so has to be controlled.
- Diagnosis is easy by examining the retina under slit lamp bio microscopy and confirming it by OCT. OCT helps to identify chronic macular oedema and different patterns of macular oedema to help guide the treatment.
- OCT has broadened our basic understanding and interpretation of macular oedema and vitreoretinal interface disorders. It allows early, precise diagnosis and better follow-up.
- OCT has become an routine, invaluable tool in assessing the response to treatment and for a qualitative and quantitative data of the retinal thickness that we can correlate with visual acuity.
- FFA also helps to determine whether the macular oedema will respond to treatment i.e. if its ischaemic making it resistant to treatment.
- Its therefore essential to determine the etiology, pattern, chronicity of the macular oedema to help personalise the treatment modality and monitor response to it.

Ethical Approval: All procedures performed on human participants were in agreement with ethical
standards of the Institutional and/or National Ethics Committee.

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Conflict of Interest: None
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Tables:

Table I: Etiological classification of all cases

Classification	**Number**	**Percentage (%)**
Hypertension (HTN)	6	10%
Diabetes Mellitus (DM)	21	35 %

Hypertension (HTN) and Diabetes Mellitus (DM)	3	5.00 %
Tuberculosis (TB)	2	3.33 %
Central Retinal Vein Occlusion (CRVO)	3	5.00 %
Branch Retinal Vein Occlusion (BRVO)	12	20.00 %
Age Related Macular Degeneration (ARMD)	5	8.33 %
Central Serous Chorioretinopathy (CSCR)	1	1.67 %
Retinitis Pigmentosa (RP)	1	1.67 %
BERLINS	2	3.33 %
IRVINE – GASS	4	6.67 %
Total Number of Patients	**60**	**100%**

Table II: OCT pattern in macular oedema patients

OCT - RIGHT EYES		
Classification	**Number Of Eyes**	**Percentage (%)**
DIFFUSE RT	16	32.66 %
CYSTOID MO	25	51.02 %
POST HYALOID TRACTION	2	4.08 %
SUBFOVEAL FLUID	3	6.12 %
TRACTIONAL RD	3	6.12 %
Total Number of EYES	49	100.00 %

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OCT - LEFT EYES		
Classification	**Number Of Eyes**	**Percentage (%)**
DIFFUSE RT	6	18.75 %
CYSTOID MO	25	78.12 %
TRACTIONAL RD	1	3.13%
Total Number of EYES	32	100.00 %

Table III: OCT pattern based on etiology

CLASSIFICATION	**DIFFUSE RT**		**CYSTOID MO**		**OTHERS**	
	RIGHT EYE	LEFT EYE	RIGHT EYE	LEFT EYE	RIGHT EYE	LEFT EYE
Hypertension (HTN)	1	3	2	2	1	0
Diabetes Mellitus (DM)	5	1	8	14	5	1
Hypertension (HTN) and Diabetes Mellitus (DM)	0	2	2	1	1	0
Tuberculosis (TB)	0	0	2	0	0	0
Central Retinal Vein Occlusion (CRVO)	2	0	1	0	0	0
Branch Retinal Vein Occlusion (BRVO)	6	0	3	3	0	0
Age Related Macular Degeneration (ARMD)	0	0	3	3	0	0
Central Serous Chorioretinopathy	0	0	0	0	1	0

(CSCR)						
Irvine Gass	0	0	3	1	0	0
Retinitis Pigmentosa	0	0	1	1	0	0
TOTAL	**20**		**50**		**9**	

Table IV: OCT pattern in diabetic macular oedema patients

Classification	Right Eye	Left Eye	Percentage (%)
DIFFUSE RT	5	3	20 %
CYSTOID ME	10	15	62.5 %
POST HYALOID TRACTION	2	0	5 %
SUBFOVEAL FLUID	1	0	2.5 %
TRACTIONAL RD	3	1	10 %
Total Number of Patients	**21**	**19**	**100%**

Table V: FFA pattern in diabetic macular oedema patients

Classification	Right Eye	Left Eye	Percentage (%)
FOCAL	2	1	10.71%
DIFFUSE	5	2	25 %
MIXED	7	11	64.29%
Total Number of Eyes	**14**	**14**	**100%**

Table VI: Correlation between OCT and FFA pattern in diabetic macular oedema patients

OCT / FFA	DIFFUSE RT	CYSTOID MO	POSTHYALOID TRACTION	SUBFOVEAL FLUID	TRAC RD
FOCAL	0	3	0	0	0
DIFFUSE	5	1	0	1	0

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MIXED	3	14	0	0	1
ISCHAEMIC	0	0	0	0	0