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Original Research Article

To Study the correlation between fundus fluorescein angiography and optical coherence tomography patterns in clinically significant macular oedema

Neeti R. Sheth, Sushilkumar G. Chaudhari*, Hiren D. Matai

Department of Ophthalmology, PDU Government Medical College, Rajkot, Gujarat, India

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***Correspondence:**
Dr. Sushilkumar G. Chaudhari,
E-mail: sushil1307@live.com

ABSTRACT

Background: To Study the correlation between Fundus Fluorescein Angiography and Optical Coherence Tomography patterns in Clinically Significant Macular Oedema.
Methods: This is a retrospective study which compares patterns in FFA and OCT in patients with CSME.
Results: A total of 54 eyes were examined. Participants included 64.81 % males and 34.85% females. On Fundus Fluorescein Angiography (FFA) 37.03% eyes showed diffuse leak, 27.77% eyes showed focal leak, 35.18 % eyes showed CME, 53.7% eyes showed macular ischemia. Maximum pattern is macular ischemia type in FFA. On OCT 42.6 % eyes showed spongy oedema, 68.51% eyes showed combined pattern, 48.15 % eyes showed ERM/Traction, 46.3 % eyes showed CME, 40.7 % eyes showed hard exudates 14.8 % eyes showed serous detachment.
Conclusions: Both FFA and OCT are indispensable tools for diagnosis and management of Diabetic macular oedema. Measurement of central foveal thickness, tractional, ERM was possible with OCT but large number of patients showed macular ischemia on FFA which was not possible to diagnose with OCT. So, both FFA and OCT are necessary for management of Diabetic macular oedema.

Keywords: Clinically significant macular oedema, Cystoid macular oedema, epiretinal membrane, Fluorescein angiography, optical coherence tomography

INTRODUCTION

Macular oedema is responsible for a significant degree of visual loss in diabetic patients. Clinically significant diabetic macular oedema is diagnosed with ophthalmoscopy, stereoscopic biomicroscopy as defined by Early Treatment of Diabetic Retinopathy Study as thickening of the retina <500 µm from the centre of the macula, hard exudates with thickening of the adjacent retina located 500 µm from centre of macula or a zone of retinal thickening, 1 disc area or larger in size located 1 disc diameter from centre of macula. Macular thickening which is picked up by clinical examination does not reflect severity and extent of edema, source of fluid leakage, and affected layer of retina.[1,2] Fluorescein angiography is used to assess vascular leakage qualitatively in macular edema, whereas optical coherence tomography offers high-resolution cross-sectional images of the retina and thus aids in quantitative measurement of the retinal thickness.

Thus, FA offers the physiological aspect of macular edema, and OCT provides the anatomical extent of macular edema such as extent of thickening and retinal layer involved. OCT can objectively measure retinal thickness and thus is an indispensable instrument in the

diagnosis and management of macular edema.[3,4] The aim of the study was to determine, if any, the correlation between FA and OCT in CSME and to find any association between foveal thickness as measured by OCT. Patients selected at random from the out-patient attendance in P.D.U Government Hospital, Department of Ophthalmology during March 2014 to August 2016.

METHODS

From the outpatient attendance of Department of Ophthalmology in Pandeet Deendayal Upadhyay Govt. Hospital and medical College, Rajkot, Gujarat, India. This is a retrospective study which compares patterns in FFA and OCT in patients with CSME. All diabetic patients with CSME and media clear enough to allow OCT and FA were included in the study. Furthermore, eyes with persistent CSME despite laser photocoagulation were included in the study. Exclusion criteria included any surgical intervention or any other vitreoretinal pathology. After taking written informed consent, a detailed history was taken.

They underwent an ophthalmic examination in the form of BCVA, slit-lamp examination, and dilated fundus examination. Fundus was examined by slit-lamp biomicroscopy using +90 diopter (D) Volk lens and indirect ophthalmoscopy using +20D Volk lens. FA and OCT were done for patients diagnosed of CSME. Retinal photography and FA were performed using Topcon fundus camera. Photographs of the fundus were taken of all quadrants up to 10 min following injection of the dye.

OCT was done using Carl Zeiss cirrus photo 800 OCT. Based on OCT, diabetic macular edema can be classified as:

- Cystoid oedema
- Spongy oedema
- Tractional/ERM
- Hard exudates
- Serous detachment.

Ischemic maculopathy was considered in the presence of an enlarged foveal avascular zone >500um, loss of perifoveal capillary network.

RESULTS

A total of 54 eyes were examined. Participants included 64.81% males and 34.85% females. On Fundus Fluorescein Angiography 37.03% eyes showed diffuse leak, 27.77% eyes showed focal leak, 35.18 % eyes showed CME, 53.7% eyes showed macular ischemia. Maximum pattern is macular ischemia type in FFA.

On OCT 42.6% eyes showed spongy oedema, 68.51% eyes showed combined pattern, 48.15% eyes showed ERM/Traction, 46.3% eyes showed CME, 40.7% eyes showed hard exudates 14.8 % eyes showed serous detachment.

Most common type of oedema seen on OCT was of the combine type (68.51%). Average Central Macular Thickness was 331.78 micrometre; the maximum value recorded being 670 micrometre associated with tractional oedema and the minimum value was 166 micrometre associated with only hard exudates. The range of CFT was therefore between 166 to 670 micrometres.

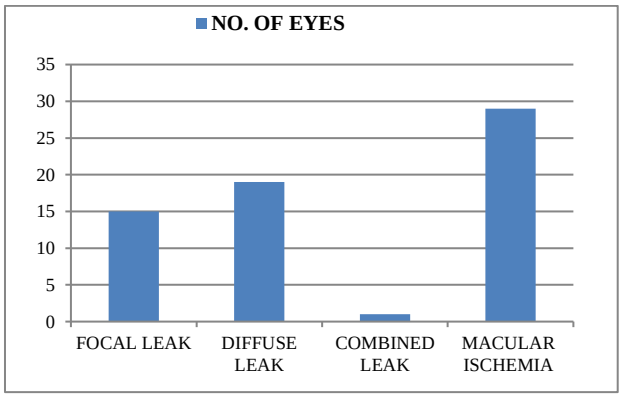

Figure 1: FFA patterns of macular oedema in CSME.

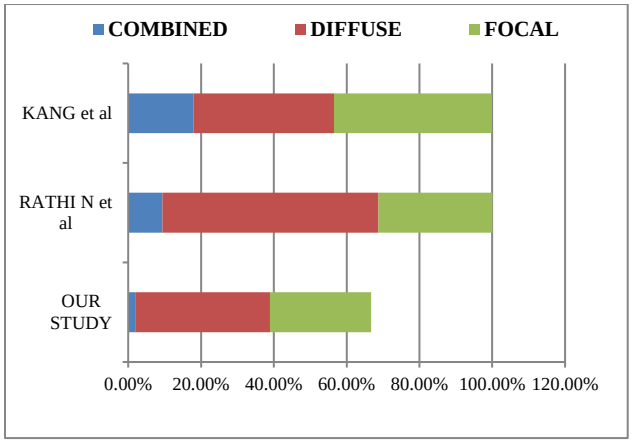

Figure 2: Comparisons of FFA patterns with other studies.

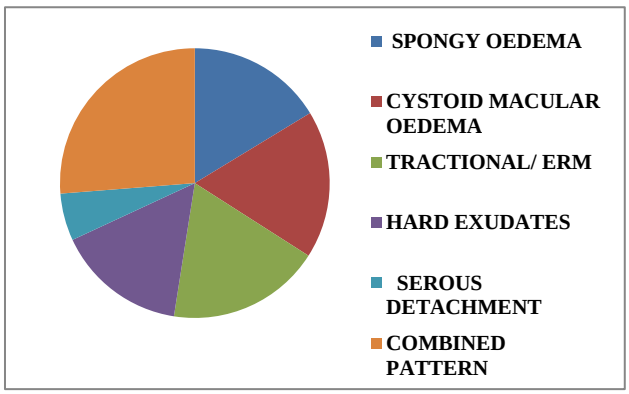

Figure 3: OCT Patterns of macular oedema.

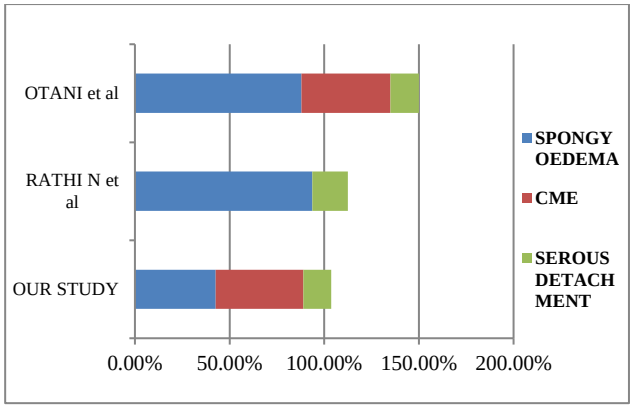

Figure 4: Comparison of OCT patterns with other studies.

DISCUSSION

The aim of this study was to determine which was the most common FA finding and OCT finding in CSME and correlation between them. Based on Optical Coherence Tomography, there are 5 types of Diabetic Macular Oedema viz., Cystoid oedema, Spongy oedema, Tractional, Hard exudates and serous detachment. In our study, 42.6% eyes showed spongy oedema, 48.15% eyes showed ERM/Tractional, 46.3% eyes showed CME, 40.7 % eyes showed hard exudates, 14.8 % eyes showed serous detachment and 68.51% eyes showed combined pattern. So most common pattern in OCT was combined pattern followed by tractional oedema. On Optical Coherence Tomography, Cystoid Macular Oedema (CME) was seen in 46.3% eyes while on Fundus Fluorescein Angiography 35.18% eyes showed CME which is demonstrating importance of OCT in early detection of foveal involvement which is not seen on FFA.

Serous detachments at fovea 14.8% on OCT not seen on FFA, 48.15% VMT on OCT not seen on FFA. Macular ischemia 53.7% seen in FFA not seen in OCT which is explains severe loss of vision in diabetic macular oedema. So FFA with sever diffuse leak masks CME and serous detachments. Measurement of CFT was possible in OCT which is important cause of centre involving Macular oedema not possible to diagnose by FFA. FA is known to be a sensitive method for qualitative assessment of fluid leakage in diabetic macular edema; FA is an invasive procedure, with side effects ranging from nausea to its rare complication of anaphylaxis and death.

OCT is non-invasive, comfortable, safe, and fast and can be repeated as often as is required and offers an alternative to FA in the follow-up of changes in retinal thickness after laser photocoagulation and intravitreal steroid injections. FA is still essential for the assessment of the foveal perfusion state which cannot be demonstrated by OCT. After an initial FA, OCT seems to be a useful non-invasive tool in the close follow-up of the effectiveness of treatment modalities in diabetic maculopathy.

CONCLUSION

Both FFA and OCT are indispensable tools for diagnosis and management of Diabetic macular oedema. Measurement of central foveal thickness, tractional, ERM was possible with OCT but large number of patients showed macular ischemia on FFA which was not possible to diagnose with OCT. So, both FFA and OCT are necessary for management of Diabetic macular oedema.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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ANNEXURE

Annexure 1: Master chart.

Name	Age/Sex	Eye	FFA	OCT	CFT
Prabhaben Mandli	/F	RE	Focal CSME	Spongy oedema	209
		LE	Focal CSME	Spongy oedema + Hard exudates	211
Jayshriben Vasantbhai	/F	RE	Diffuse oedema + Macular Ischemia	Tractional oedema + spongy oedema	235
		LE	Diffuse oedema + Macular Ischemia + CME	Tractional CME	303
Otiben Chhaganbhai	/F	RE	Diffuse oedema + Macular Ischemia	Spongy oedema + Traction + Hard exudates	309
		LE	Diffuse oedema + Macular Ischemia	CME + Traction+ Diffuse oedema + Serous detachment	455
Kiritbhai Ashar	/M	RE	Diffuse leak	Spongy oedema + Drusens	246
		LE	Focal leak in UTQ + Macular ischemia	CME + Drusens	228
Nitinbhai Popatbhai	/M	RE	Macular ischemia	Spongy oedema + Hard exudates	183
		LE	Diffuse temporal leak	Spongy oedema + ERM	196
Laxmanbhai Parmar	/M	RE	Focal leak	Spongy oedema + Hard exudates	219
		LE	CME + Focal leak	Traction	221
Vinodbhai Samjibhai	/M	RE	Diffuse leak + Macular Ischemia	Spongy oedema + Serous detachment + CME	443
		LE	Diffuse leak	CME + Hard exudates	305
Shamjibhai Gagjibhai	/M	RE	Diffuse leak + Macular Ischemia + CME	Serous detachment + Traction + CME	443
		LE	Diffuse leak + Macular ischemia	Spongy oedema + Hard exudates	260
Vasudevbhai Manglani	/M	RE	Occasional Microaneurysmal leak + Scar	Scar + ERM + Hard exudates	235
		LE	Diffuse keak	CME + Hard exudates	318
Satendrabhai Tiwari	/M	RE	Focal leak	Spongy oedema + Hard exudates	226
		LE	Focal leak + Macular Ischemia	Spongy oedema + Hard exudates + Serous detachment	404
Binduben Parmar	/F	RE	Diffuse leak	Spongy oedema + ERM	391
		LE	Diffuse leak	Spongy oedema + CME + PVD	391
Chimanbhai Jadav	/M	RE	Macular ischemia + Focal leak	Traction + CME	280
Arunaben Bachugiri	/F	RE	Macular ischemia + Diffuse leak	CME + Traction	357
		LE	Macular ischemia + Diffuse leak	CME + Traction	355
Jenuben Hasambhai	/F	RE	CRVO + Diffuse Leak + CME	CI CME + Traction	457
		LE	Focal leak	Spongy oedema	259
Jikubhai Gokuldas	/M	RE	Macular ischemia + Hard exudates	Occasional cystoid oedema + Spongy oedema + ERM	247
		LE	Macular ischemia + Microaneurysms in all 4 quadrants + CME	CME CE + ERM	390
Laxmanbhai Mavjibhai	/M	RE	Macular ischemia + CME	CME + ERM	535
		LE	Macular ischemia + Diffuse leak + CME	CME + Traction	625

Ramjibhai Polabhai	/M	RE	Macular ischemia + Diffuse leak	Hard exudates	199
		LE	Macular ischemia +Focal leak + late Diffuse leak	Hard exudates	166
Ratilal Sangani	/M	RE	Focal Laser + Focal leak	ERM	208
		LE	Grid laser + Macular ischemia + Focal leak	Spongy oedema	243
Shantaben Ramjibhai	/F	RE	Diffuse leak + CME	CME + Hard exudates + ERM	444
Bhavanbhai Arjanbhai	/M	LE	CME	CME + Serous detachment	563
Taraben Pandya	/F	RE	Diffuse leak	CME	391
		LE	Subhyaloid hemorrhage + Diffuse leak	CME + ERM	284
Govindbhai Parshottambhai	/M	RE	Macular ischemia + Focal leak + CME	CME + ERM + Hard exudates + Spongy oedema	325
		LE	Macular ischemia + CME	Hard exudates	256
Sirajali Lotia	/M	RE	Diffuse leak + Grid laser	Hard exudates	477
		LE	Focal leak + Macular ischemia + Grid laser	ERM + Hard exudates	272
Razakbhai Aamadbhai	/M	RE	Focal leak + Macular ischemia + CME	ERM + Spongy oedema	228
		LE	Focal leak + Macular ischemia + CME	Spongy oedema	289
Khimiben Saraiya	/F	RE	Macular ischemia + Diffuse leak	Spongy oedema	328
		LE	Diffuse leak	Spongy oedema + PED + Hard exudates	317
Jyotsnaben	/F	RE	CME	CME + Serous detachment	465
		LE	CME	CME + Serous detachment	542
Premjibhai Vashrambhai	/M	RE	CME	Hard Exudates + ERM	213
		LE	CME	Hard Exudates	218
Pravinbhai Durlabhjibhai	/M	RE	CME + Diffuse leak + Macular ischemia + Microaneurysms	CME	647
Mavjibhai Laxmanbhai	/M	RE	CME + Diffuse oedema + Macular ischemia	Spongy oedema + Traction + Hard exudates + CME	235
Bhalabhai Alabhai	/M	RE	Focal leak + Macular Ischemia	CME + ERM + Serous detachment + Hard exudates	670