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Pre and Post-Treatment Optical Coherence Tomography and Multifocal Electroretinography in Macular Edema in Branch Retinal Vein Occlusion

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Abstract: ***Retinal vein occlusion is a common form of retinal vascular disease, especially in middle-aged and older individuals. This is a study of 30 patients of BRVO in whom incidence according to age, sex, right or left eye, superior and inferior temporal quadrant have been evaluated and results of pre and post operative OCT and Multifocal ERG findings after injection avastin (bevacizumab) at 1 week and 1 month have been compared.***

Keywords: branch retinal vein occlusion, injection avastin (bevacizumab) in BRVO, OCT and multifocal ERG findings in BRVO with macular edema, age/sex incidence in BRVO.

1. Introduction

Retinal vein occlusion is a common form of retinal vascular disease, especially in middle-aged and older individuals. The diagnosis is based on the fundoscopic finding of retinal vein dilatation in association with retinal haemorrhages and cotton-wool spots. The pathology can involve the entire venous system or can be limited to a branch of the central retinal vein. Retinal vein occlusion can be distinguished clinically from diabetic retinopathy and other retinal diseases.

Treatment for the acute phase of retinal vein occlusion has been disappointing. However, some late complications, such as persistent macular edema and neovascularisation of the iris and retina, respond well to retinal photocoagulation, intravitreal injections of steroids and anti-VEGF. Spectral Domain OCT is very useful in demonstrating macular edema secondary to BRVO. Multifocal ERG is helpful in demonstrating functional changes occurring in thrombotic and on-thrombotic area in retina. The family physician has an important role in detecting and controlling risk factors for retinal vein occlusion, including hypertension, diabetes mellitus and hyper viscosity syndromes.

Generally, RVO tends to be considered as one disease which is not only incorrect but also cause of most of the confusion.

2. Material and methods

This study has been conducted in a tertiary eye care centre, between the period of September 2012 to August 2014.

In this study 30 eyes of 30 patients were included as per the inclusion and exclusion criteria mentioned below.

A detailed history and clinical examination was performed with necessary investigations as and when required. RVO was determined by grading Fundus photographs.

Inclusion Criteria:

1. Age ≥ 18 years of any gender
2. Ability and willingness to return for all scheduled visits and assessments Foveal center-involved macular edema secondary to BRVO
3. Media clarity, pupillary dilation, and participant cooperation sufficient to obtain adequate fundus photographs
4. Patient co-operation during OCT & Multifocal ERG Examinations

Exclusion Criteria:

1. Poor fixation during OCT & Multifocal ERG examination
2. Any media opacities that hinder visual function assessment Prior episode of retinal vein occlusion (RVO)
3. History of any anti-VEGF treatment in the study eye within 3 months prior to study
4. History of laser photocoagulation for macular edema within 4 months prior to study
5. History of intraocular corticosteroid use within 3 months prior to study Relevant ocular disease that may be associated with increased intraocular
6. VEGF levels (namely, uveitis, neovascular glaucoma, neovascular AMD, diabetic retinopathy, diabetic maculopathy, or ocular ischemic syndrome)
7. Patients who were not able to come for follow up examination were excluded from the study.

3. Observation & Results

3.1 Age wise distribution

	Total	*Percentage*
25-35	2	6.66
35-45	7	23.33
46-55	12	40

56-65	8	26.66
66-75	1	3.33
TOTAL	30	100

In age wise distribution, 2(6.66%) patient in 25-35years, 7 (23.33%) patients in 35-45years, 12 (40 %)patients in 46-55years, 8(26.66%) patients in 56-65years, while 1(3.33%)patients are in 66-75 years

So, most common group affected in our study is 46-55 years.

3.2 Sex Wise Distribution

Sex	*Total*	*%*
Male	14	46.6
Female	16	53.3
Total	30	100

In sex wise distribution, incidence is more common in female 16,(53.33%) than female 14(46.66%), but not significant.

3.3 Laterality of Eye Wise Distribution

Right eye	*Left eye*
17	13
56.66%	43.33%

Laterality wise, right eye -17,(56.66%) is more common than left eye - 13(43.33%)in our study.

3.4 Quadrant Wise Distribution

Upper temporal BRVO	***Lower temporal BRVO***
16	14
53.33%	46.66%

Upper temporal quadrant BRVO is seen in 16 patients
Lower temporal quadrant BRVO in 14 patients.

3.5 Pre- & post-inj. Avastin OCT central foveal thickness

No.	Pre-avastin	At 1 week	At 1 month
1	527	356	329
2	566	372	298
3	489	259	426
4	377	287	336
5	590	334	218
6	717	448	464
7	591	397	374
8	574	229	259
9	284	235	260
10	506	425	389
11	520	390	365
12	317	230	220
13	389	278	267
14	330	216	229
15	456	265	248
16	484	340	249
17	520	390	426
18	397	240	220
19	330	216	225
20	494	277	293
21	429	260	231
22	389	228	240
23	542	289	253
24	402	276	254
25	411	230	215
26	501	345	320
27	398	243	201
28	421	229	242
29	487	298	310
30	430	269	220

There is significant decrease in the central foveal thickness after inj. Avastin at 1 week and at 1 month of treatment compare to pre – treatment OCT in all 30 patients.

3.6 Multifocal ERG

Mf-ERG parameters	Normal range	Affected eyes
Central p1 amplitude	50-100	5-25
Central p1 implicit	22-30	30-35
Time		

The central implicit times of P1 wave is abnormal in almost all affected eyes .the amplitudes of the central P1 response of the affected eyes are abnormal in all affected eyes with BRVO. In pathological quadrants, in BRVO although the response densities are abnormal in all affected eyes, latency of P1 wave is prolonged in 20 eyes. The latencies are significantly prolonged compared with normal eyes. At 1 week after treatment, there is significant improvement in p1 implicit time and p1 amplitude in all eyes .After 1 month of treatment, 2 patients have shown improvement in both amplitude and p1 implicit time. In rest 10 patients, the findings are same as 1 week after treatment. There is significant improvement in central p1 implicit time before treatment and after 1 week & 1 month interval of giving treatment. There is significant increase in the amplitude of central p1 wave before treatment and after 1 week & 1 month of giving treatment.

4. Discussion

This study has been conducted at a tertiary care centre, between the period of September 2012 to August 2014.

In this study 30 eyes of 30 patients were included as per the inclusion and exclusion criteria mentioned earlier.

The present study analyzed different techniques for interpretation of retinal injury in patients with retinal vein occlusion. Whereas OCT measures thickening and morphologic changes of the retina. MF-ERG, on other hand, is a functional method that reflects the actual function of the retinal neurons.

The study is designed to determine pre- and post-avastin effects on macular edema on spectral domain OCT & effects on Multifocal ERG parameters in similar settings. It also determines correlation between central foveal thickness on OCT and multifocal ERG parameters.

On OCT findings,
The central foveal thickness was significantly increased compared to normal parameters in all affected eyes with BRVO before the treatment.
At 1 week,

There is significant decrease in macular edema after 1 week of inj. Avastin treatment in all affected eyes with BRVO.

After 1 Month of treatment,
11 out of 30 patients have shown mild increase in central foveal thickness (CFT) compare to the CFT at 1 week after post avastin inj.

This study designed to determine the effects of RVO on MF-ERG parameters. The MF-ERG first-order responses obtained from an eye with BRVO were significant different from those derived from fellow unaffected eye. Also, the P amplitudes were reduced in a large percentage of the fellow eyes to lesser extent. There was significant correlation between MF-ERG P1 amplitudes and latencies in the affected eyes and there was good correlation between central retinal thickness measured by OCT and MF-ERG P wave amplitudes in the central area.

In this study, there is statistically significant improvement in central p1 implicit time before the treatment and after 1 week of treatment with p value less than 0.0001 and also statistically significant improvement after 1 month of giving treatment ($p<0.0001$)

In this study, there is statistically significant increase in the amplitude of central p1 wave after 1 week of treatment($p<0.0001$) and also statistically significant increase in amplitude after 1 month of treatment($p<0.0001$).

The results showed that BRVO markedly affected MF-ERG parameters, there was subnormal P amplitudes and P implicit time delay in eyes with BRVO. This finding is in keeping with a previous report of MF-ERG response in subgroup of patients with CRVO, in whom P amplitudes were reduced and implicit times were delayed in affected eyes (Kretscmann et al., 1997).

Also, Dolan et al. found decreased in P amplitude and delayed P implicit times in patients with CRVO (Dolan et al., 2003).

There was delay in implicit time of P with subnormal amplitude in affected quadrant in this study. The same as, in Ikeda et al. who observed abnormal response densities in the pathological quadrants and in the central area with delay in implicit times (IKeda et al., 2004).

In cases of hemi centric retinal vein occlusion, Dolan et al. found that MF-ERG P implicit time was greater for the affected hemi retina than for the unaffected hemi retina. MF-ERG P implicit time was prolonged ($P < 0.05$) and MF-ERG reduced ($P < 0.05$) for affected eyes when compared with fellow eyes (Dolan et al., 2006).

MF-ERG abnormalities noted in the fellow eyes probably reflect abnormal retinal function in a patient population with underlying systemic disease, including hypertension and diabetes mellitus and supports previous ERG studies of patients with RVO which found 36% of fellow eyes to have abnormal response (Sakaue et al., 1989).

In this study, there were significant correlation between central retinal thickness measured by OCT and MF-ERG amplitude in the central region. There was decrease in central MF-ERG amplitude with increase central retinal thickness.

Also, Ikeda et al. found significant correlation between foveal retinal thickness and MF-ERG P1 response density (IKeda et al., 2005).

In contrast, Hvarfner et al. reported that no significant correlation between MF-ERG and OCT finding. Also, Hvarner et al. reported that macular ischaemia as measured by fluorescein angiography correlated well with prolonged implicit time of MF-ERG (Hvarfner et al., 2006).

5. Conclusion

1) There is significant improvement in central foveal thickness after 1 week of treatment compare to pre-treatment findings.
2) There is still improvement in central foveal thickness after 1 month of treatment, though some patients have shown increase in central foveal thickness.
3) In case of multifocal ERG, central p1 implicit time is increased and p1 amplitude were markedly decreased before the treatment.
4) Also p1 implicit time and p1 amplitude are affected in pathological quadrants of BRVO.
5) After 1 week of treatment, there is significant improvement in both p1 implicit time and p1 amplitude.
6) After 1 month, though some patients have shown findings similar to previous test, others have shown improvement in mf ERG parameters.
7) As the macular edema decreases, there is significant improvement in vision after the treatment.
8) There is significant correlation between central foveal thickness and multifocal ERG parameters.
9) Therefore we can say that both OCT and multifocal ERG has same prognostic value.

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