Patterns of Macular Edema in Branch Retinal Vein Occlusion Diagnosed by Optical Coherence Tomography

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ABSTRACT

Introduction: Branch Retinal vein occlusion is the most common retinal vascular disease after diabetic retinopathy in elderly populations.

Objectives: To describe morphological patterns of macular edema in branch retinal vein occlusion using optical coherence tomography**.**

Materials and methods: It is a hospital based; descriptive, cross-sectional study. All patients with macular edema secondary to branch retinal vein occlusion diagnosed by optical coherence tomography and fulfilling the inclusion criteria from 2017 July 1 to 2018 July 1 were studied.

Results: A total of 84 eyes of 84 patients were enrolled. The mean age of the patient was 68.0833 ± 11.22 years (range, 35-74 years). Forty-five (53.57%) were male. Forty-four eyes had right eye involvement. Major and macular branch retinal vein occlusion was found in 50 and 34 eyes respectively. Forty eight eyes had superior and 36 eyes had inferior branch retinal vein occlusion. Morphological patterns of macular edema were classified: cystoid macular edema, cystoid macular edema with serous retinal detachment, diffuse macular edema and diffuse macular edema with serous retinal detachment of which 68 (80.95%) had cystoid macular edema. Out of 84 eyes, 30 (35.71%) had inner and outer segment (IS/OS) junction disruption.

Conclusion: Optical coherence tomography is a safe and noninvasive technique. Serous retinal detachment and photoreceptors disruption may go unnoticed unless OCT is performed. It can measure the changes in retinal thickness and thus predict the visual outcomes in patients with macular edema.

Key words: Branch retinal vein occlusions; cystoid macular edema; diffuse macular edema; inner and outer segment; optical coherence tomography; serous retinal detachment.

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INTRODUCTION

Branch retinal vein occlusion (BRVO) is the most common retinal vascular disease after diabetic retinopathy in elderly population (Adil et al, 2013). The BRVO is divided into two types: major and macular BRVO, depending on which venous branch and quadrants are involved, although often groups of quadrants can be considered together. (Rehak et al, 2010; Hayreh et al, 2005). The exact pathogenesis of BRVO remains unclear. The condition may be due to a combination of compression of veins at arterio-venous crossings, hemodynamic changes (venous stasis), degenerative changes of the vessel wall and blood hypercoagulability (Yau et al, 2008). The overall prevalence of BRVOs was 0.6% (Klein R et al., 2000). Classical risk factors are systemic hypertension, diabetes mellitus, hyperlipidemia, smoking (Lim et al., 2008). Hyperopia and glaucoma have been reported as local ophthalmic risk factors (David R et al, 1988). Macular edema is a common sight-threatening complication of BRVO. Macular edema in BRVO is a consequence of a number of underlying mechanisms including the disruption of the inner blood-retinal barrier due to inflammation, vitreous traction, choroidal inflammation and pigment epithelial dysfunction (Markomichelakis et al, 2007). Macular capillary blood flow is found to be reduced in BRVO. So prolonged hypoxia associated with the edema can result in irreversible reduction of visual acuity (Noma et al, 2009. Macular edema secondary to BRVO is a leading cause of vision loss, can be associated with various morphological changes such as cystic spaces, sponge-like retinal swelling, and serous retinal detachment (SRD) (Battaglia Parodi, 1994). In SRD, fluid accumulates between the neurosensory retina and the retinal pigment epithelium, and seen as hypo reflective spaces on optical coherence tomography (OCT). It is said that pathophysiology of SRD is due formation of foveal cystoid spaces which would lead to traction on Müller cell and the inner and outer segments of the foveal photoreceptors along with loss of the barrier function of the external limiting membrane. Formation of SRD causes damage to photoreceptors in the outer segment and impairment of VA (Tsujikawa et al, 2010). Integrity of foveal photoreceptors is an important predictor for visual acuity in macular edema secondary to BRVO. BRVO and macular edema can resolve spontaneously within a year in 50% of cases (Hayreh et al, 1983). In some cases there might be limited visual acuity in spite of complete resolution of macular edema. OCT is a vivo optical biopsy, has an axial resolution of 6-7 microns for better visualization of retinal pathology. It is safe and noninvasive technique has the potential of measuring the changes in retinal thickness and extent of retinal edema.

The purpose of the present study was to assess the morphological characteristics of macular edema in patients with BRVO verified by Spectral domain-OCT.

MATERIALS AND METHODS

This is a descriptive, cross-sectional; a hospital-based study conducted from 1 July, 2017 to 1 July, 2018 at Tilganga Institute of Ophthalmology, Kathmandu, Nepal. A total of 84 eyes of 84 patients of BRVO with macular edema diagnosed by OCT and fulfilling the inclusion criteria were studied. This study was carried out in adherence to the tenets of the Declaration of Helsinki, and was approved by the institutional review

board of Tilganga Institute of Ophthalmology (Ref. No – 11/2017). Main inclusion criteria for the study were all patients of with macular edema (ME) secondary to BRVO diagnosed by OCT and adequate media clarity for fundus visualization. The exclusion criteria were diabetes, any previous treatment for BRVO like laser photocoagulation, intravitreal steroid or anti vascular enodothelial growth factor (Anti-VEGF), current use of systemic steroids and/ or immunomodulators, old BRVO of more than 3 months, co-existing ocular diseases like mature cataract, corneal opacities etc. limiting fundus visualization and patient not willing to participate in the study

Detailed anterior segment examination was performed with the help of a slit lamp bio-microscope (Haag-Streit 900 Ag, Switzerland). Under mydriasis with tropicamide 0.5% and phenylephrine 2.5% posterior segment examination was done using direct ophthalmoscope, indirect ophthalmoscope with +20D Volk lens (USA) and the Haag Streit slit lamp with +90D Volk lens (USA) .

All patients underwent a fast mode macular scanning with the commercially available spectral domain Ziess Cirrus HD OCT for analysis with maximum pupil dilatation as possible. The scan was performed over a 6X6 mm^2 area in the posterior pole to achieve a high-quality image. The subjects were asked to focus on the target. The center point of each scan direction represented minimum foveal thickness (central minimum thickness, or foveola). A traditional Early Treatment Diabetic Retinopathy Study (ETDRS) grid, which contains three concentric, rings of diameters 1, 3, and 6mm, and two reticules to divide the macula into nine sections were employed. The scanning results were then analyzed by using the OCT version 11.5.1 software.

Routine laboratory investigations including total leucocyte count with differential leucocyte count, erythrocyte sedimentation rate, lipid profiles and cardiac evaluation were done. In suspected cases, fundus fluorescein angiography was done when indicated.

The data were analysed with IBM SPSS Statistics, version 20, (IBM Corporation, Aronk N. Y., USA.)

RESULTS

A total of 84 eyes of 84 patients with macular edema secondary to BRVO met the inclusion criteria and were enrolled in the study. The mean age of the patient was 68.0833 ± 11.22 years (range, 35-74 years). Forty-five (53.57%) were male and 39(46.43%) were female. (Figure 1)

All patients had unilateral involvement. This study did not find any bilateral involvement of BRVO with macular edema.

Major BRVO was seen in 50 (59.52%) eyes and macular BRVO in 34 (40.48%) eyes. (Figure 2)

Forty-eight (57.14%) eyes had superior quadrant and 36 (42.86%) eyes had inferior quadrant involvement. (Figures 3, 4 and 5)

Out of 84 eyes examined, the morphological patterns of macular edema secondary to BRVO detected on OCT imaging were classified: cystoid macular edema (68, 80.95%), cystoid macular edema with serous retinal detachment (16, 23.52%), diffuse macular edema (16, 19.05%)

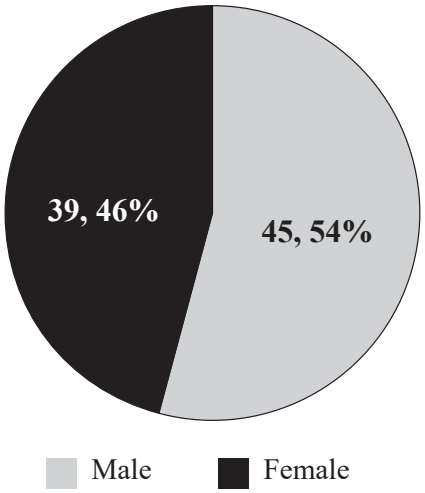

Figure 1: Pie chart showing gender distribution of the cases.

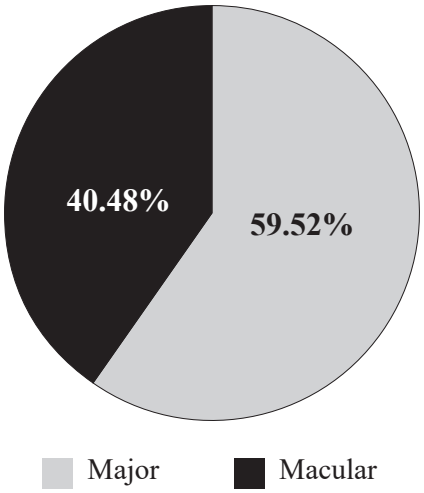

Figure 2: Pie chart showing types of Branch Retinal Vein Occlusion

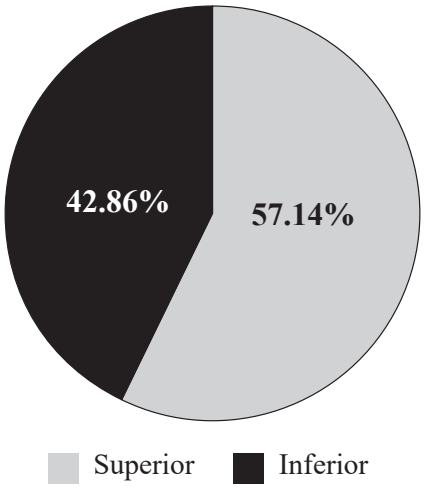

Figure 3: Pie chart showing quadrant involvement

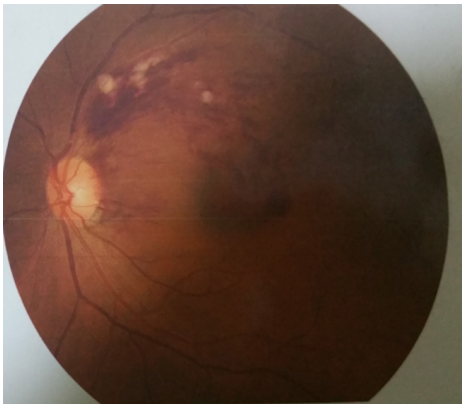

Figure 4: Fundus of Right eye showing superior macular Branch Retinal Vein Occlusion.

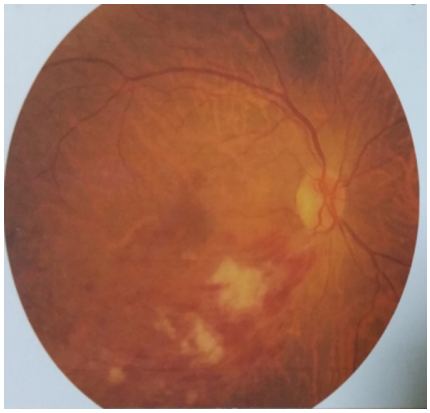

Figure 5: Fundus of left eye showing inferior major Branch Retinal Vein Occlusion.

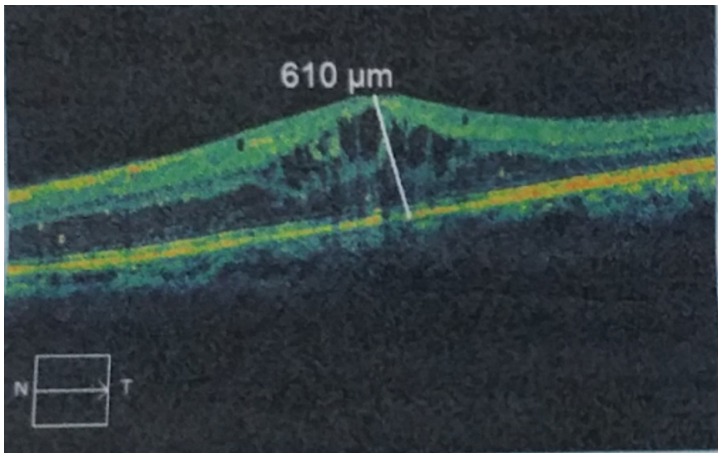

Figure 6: CME: low-reflective intraretinal spaces, clearly defined and separated by thin, high-reflective retinal tissue IS/OS disruption.

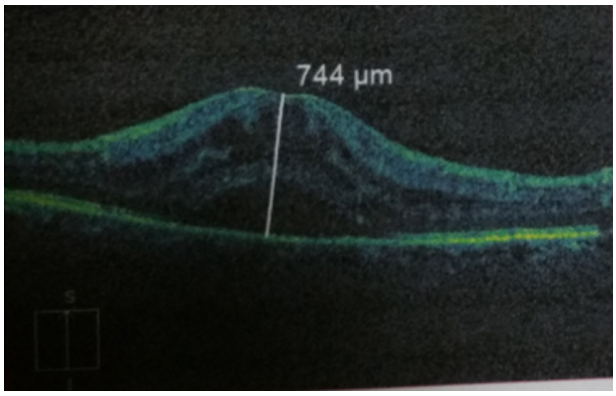

Figure 7: CME associated with serous detachment of the neuroepithelium: low-reflective intraretinal spaces and clear separation of the neuroretinal layer from the retinal pigment epithelium

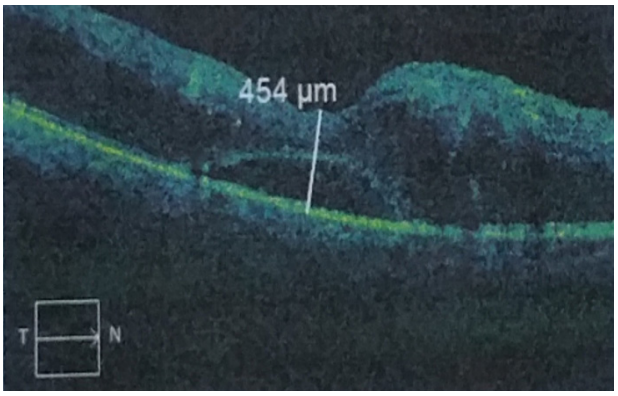

Figure 8: Diffuse macular edema: consisting of increased macular thickness, small low-reflective areas with spongy appearance of the retinal layers with serous retinal detachment.

Table1. Pattern of macular edema, n(%).

	CME	CME and SRD	DME	DME and SRD
Eyes	68(80.95)	16(23.52)	16(19.05)	4(25)

and diffuse macular edema with serous retinal detachment (4, 25%). Twenty eyes (23.80 %) had SRD which was always associated with other forms of edema (Table 1 and Figures 7, 8).

Out of 84 eyes, 30 (35.71%) had disturbed photoreceptors integrity (IS/OS junction) (Figure 6)

DISCUSSION

This is a descriptive; cross-sectional, a hospital based study conducted from 1 July, 2017 to 1 June, 2018 at Tilganga Institute of Ophthalmology. A total of 84 eyes of 84 patients were included in our study. The mean age of the

patient was 68.083 ±11.22 (range 35-74) years. Male accounted for 45 (53.57%) of patients and female were 39(46.43%). In a study done by Yamaguchi et al. (2006), 45 were male and 64 females with mean age of 60 years (range 32-84) in 109 eyes of 109 patients. Tsujikawa et al. (2010) included 91 eyes of 91 patients, the mean age of the patient was 66.3 ± 10.7 years, 34 were male and 57 were female._Out of 73 eyes of 73 patients, a study done by Lee et al. (2013) the mean age was 62.6 ±10.3, male were 36 and female were 37 respectively.

In the current study, 44 and 40 eyes had right and left eye involvement respectively. There was no case of bilateral involvement. Lamichhane et al (2015) found 14 eyes with RE involvement and 16 eyes with LE involvement in out of 30 cases. Similarly right eye was involved in 20 patients and left eye in 19 patients by Aggrawal et al 2013.

Fifty (59.52%) eyes with major and 34 (40.48%) eyes with macular BRVO involvement were found in this study. Similarly a study by Yamaguchi Y et al. (2006), 70 had major and 39 had macular BRVO involvement in 109 eyes of 109 patients.

In this study, 48 (57.14%) eyes had superior BRVO and 36 (42.86%) had inferior BRVO. Dogan et al (2018) enrolled 52 eyes, out of which 35 had superior BRVO and 17 had inferior BRVO. Out of 109 eyes of 109 patients, a study by Yamaguchi et al. (2006), 54 eyes had superior BRVO and 55 had inferior BRVO.

We found cystoid macular edema (CME) in 68 eyes and both CME with serous retinal detachment (SRD) in 16 (23.52%) eyes

In a study by Noma et al (2011), 38 eyes had only CME, 14 eyes (out of 15) had both CME and SRD and one had SRD alone in total of 53 eyes. Lee et al (2013) included 73 eyes out of which 25 had SRD and 48 eyes had CME alone without SRD. Out of 22 eyes, 13 eyes with SRD and 9 eyes with CME and SRD was reported by Takahashi et al (2005).

In the present study, diffuse macular edema (DME) and DME along with SRD were seen in 16 and four eyes respectively. Out of 30 eyes enrolled, 3 eyes had DME and 4 eyes had both DME and SRD in a study done by Lee et al (2005). Eighty-four eyes of 60 patients examined, DME (46 eyes, 54.8%) and DME along with Retinal Detachment (5 eyes, 5.9%) was found in a study done by Markomichelakis et al. (2004). Iannetti et al. (2008), out of 43 eyes of 39 patients, 18 with DME (41.8%) and SRD with DME in seven eyes (38.8%) were found.

SRD was found in 20 (23.8 %) eyes. A total of 111 eyes, Takahashi et al (2005) reported 22 (19.81%) eyes of SRD in BRVO. Out of 14 patients, four cases had SRD secondary to BRVO in a study by Spaide et al (2003). Yamaguchi et al. (2006) found 52 (42.7%) patients having SRD in out of 109 patients

Thirty (35.71%) eyes with IS/OS junction disruption were found in the present study. Out of 39 cases included, 30 cases had IS/OS disruption been found in a study done by Aggrawal et al (2013). Kang et al (2012) noted 31 (52.54%) patients with disrupted photoreceptor integrity in out of 59 patients. A study by Gabriel et al (2011) reported an incidence of disrupted IS/OS junction of 66.6% (6 of 9 cases). Thirty-three (80.48%) had IS/OS disruption in out of 41

patients, a study by Xhan et al (2010). Out of 42 patients, Ota et al (2008) found disrupted IS/OS junction in 27 (64.28%) patients.

CONCLUSION

We found four types of macular edema: CME, CME with SRD, DME and DME with SRD. CME was the most common as detected by OCT. OCT is good diagnostic tool for measuring changes in retinal thickness. Serous retinal detachment and photoreceptor integrity was an important feature of macular edema that affects visual acuity and thus predict the visual outcomes. Development and advancement in SD –OCT evaluate such layers in detail that helps in treatment monitoring.

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