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Optical Coherence Tomography in Branch Retinal Vein Occlusion At Tertiary Care Center- A Cross Sectional Study

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Abstract:
Aim*: To study Optical Coherence Tomography (OCT) characteristics of macular edema in Branch retinal vein occlusion (BRVO) at Tertiary care hospital.*
Methods: *A prospective cross-sectional study was conducted at Department of Ophthalmology, Sri Ram Narayan Ruia Government General Hospital attached to Sri Venkateswara Medical college, Tirupati. 64 eyes of 64 patients with BRVO fulfilling the inclusion criteria were examined as per protocol and results were analyzed.*
Results: *Majority of the patients were in the age group of 60-70 yrs accounting for 41% and 38(59%) were males and 26 (41%) were females. All 64 cases (100%) were found to have central macular thickness (CMT) >250µm, serous retinal detachment (SRD)was found in 18 (28.12%)cases and cystoid macular edema was found in 60(93.75%) cases.*
Discussion: *In our study cystoid macula edema was clinically detectable in only 24 (37.5%) cases, whereas OCT helped in identifying even minimal CME 64(100%), which was undetectable clinically. study data revealed that ophthalmoscopy and +90 D lens examination alone was not sufficient to detect CME and SRD and differentiate SRD from cystoid macular edema*
Conclusion: *Optical Coherence Tomography, a noninvasive modality provided additional information on the macular changes in BRVO. It also aids in the quantification of macular edema due to BRVO.*
Keywords: *Branch retinal vein occlusion, central macular thickness, cystoid macular edema, Optical coherence tomography, serous retinal detachment,*

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I. Introduction

Retinal vein occlusion (RVO) is a significant cause of visual loss, second to diabetic retinopathy among the retinal vascular disorders. They are of two types: Central Retinal Vein Occlusion (CRVO) and Branch Retinal Vein Occlusion (BRVO). Branch retinal vein occlusion is defined as a segmental intraretinal haemorrhage not exceeding the midline caused by obstruction in the vein draining the corresponding retinal area. [1]

BRVO is divided into three distinct entities:

1.Major BRVO- when one of the major branch retinal veins is occluded and is subdivided into:-

a) First order temporal branch at the optic disc

b) Firs order temporal branch away from the disc but involving branches to macula,

2. Macular BRVO- when the macular branch is occluded.

3. Peripheral BRVO-where a peripheral branch is occluded.

The prevalence of RVO has been shown to vary from 0.6 % to 1.1 %. BRVO constitutes about 2/3rd of these cases with the remaining 1/3rd being CRVO. A 10 years incidence rate of 1.2 % and 0.4 % for BRVO and CRVO, respectively was seen in a population based study of 3654 participants in Australia.[2] In the Beaver Dam Eye study, RVO accounted for 12 % of cases with visual acuity worse than 20/200.[3] In India, RVO was detected in 0.8% of adults, and BRVO was approximately seven times more common than CRVO with a prevalence of 0.66% ± 0.12% per subject. BRVO is a disease of the elderly, most commonly occurring between 60 and 70 years of age. Risk factors associated with retinal vein occlusion include Diabetes mellitus, Hypertension, Glaucoma, Hyper viscosity, Hyper hyperhomocysteinaemia and advanced age. Macular edema is common sequalae and major cause of visual disturbance associated with BRVO. It is usually a unilateral condition. The

purpose of this study is to diagnose and analyze macular edema in eyes with BRVO using optical coherence tomography (OCT).

OCT is a noninvasive, noncontact, transpupillary imaging technology that can image retinal structures in vivo. It allows observation of morphological changes in the retina caused by BRVO. OCT can detect even subtle macular edema in the presence of hemorrhages, which is not evident by fluorescein angiography. OCT is useful in quantitative assessment of macular edema. Its role in BRVO is to identify and quantify macular edema and also to evaluate the response to treatment.

II. Aims And Objectives

To Study the fundus finding and OCT characteristics of macular edema in patients of BRVO.

III. Materials And Methods

The present study is a prospective cross sectional study conducted in the Outpatient department and wards of Department of Ophthalmology, Sri Venkateswara Medical College (SVMC), Tirupati between December 2012 to November 2016.

Patients and Methods:

64 patients of Branch retinal vein occlusion with decreased visual acuity attending the Department of Ophthalmology, S.V.R.R.G.G.H, Tirupati from December 2012 to November 2016 were included. Written and informed consent was obtained from all patients included in the study. Detailed history was taken regarding the demographics, chief complaints including the duration of problem, presence of systemic diseases like hypertension, diabetes mellitus and hyperlipidemia. Visual acuity and best corrected visual acuity in all patients recorded using Snellen's chart. All patients were examined by using slit lamp examination, recorded intraocular pressure with Goldman applanation Tonometer, Gonioscopy. Detailed fundus examination was done with 90D lens. Fundus Fluorescein Angiography (FFA) done in indicated patients. OCT was done in all patients. Systemic risk factors evaluated in all patients.

Inclusion Criteria:

Subjects with BRVO fulfilling the following criteria were included in the study:
1. Best Corrected Visual Acuity of less than 6/12.
2. Macular involvement secondary to vein occlusion on clinical examination.
3. Pupillary dilatation and subject cooperation sufficient for adequate fundus photography and OCT .

Exclusion Criteria:

1.Macular edema due to a causes other than branch retinal vein occlusion.
2.Substantial cataract causing significant reduction in visual acuity and interfering with FFA and OCT interpretation.

Procedure:

Fundus photographs were taken with Digital fundus camera (CF-1 Camera-Canon Inc,Tokyo,Japan.).All OCT scans were performed using the Spectral Domain Optical coherence Tomography (SD OCT). (RTVue RT 100, Software version 6.1.0.4 Optovue Inc, Fermont, CA, USA.) After dilating pupil with mydriatics the macular scan protocol was followed first with fast macular thickness scan protocol and then line scan protocol in horizontal and vertical meridians as appropriate. The scans were taken with 6 mm length centered through the fovea as confirmed by the red free image on the computer monitor of the OCT scanner. The central macular thickness was taken from the central 1mm of the OCT scans. The signal intensity should be > 60 to get good quality retinal images.

The following findings were noted in OCT:
a) Central Macular Thickness (CMT)
b) Presence of Serous Retinal Detachment (SRD) or Spongy thickening of macula

IV. Results

In the present study majority of the patients were in the age group of 60-70 yrs accounting for 41% and 38(59%) were males and 26 (41%) were females.(table 1) The male: female ratio was 1.5:1. In 42(66%) cases superotemporal quadrant was involved and inferotemporal quadrant involved in 22 (34%) cases.(table 2) The most common risk factor was found to be hypertension in 38 cases (59.37%) followed by diabetes in 22 cases(34.37%). Both hypertension and diabetes were present in 16 (25%) cases. (table 3)All 64 cases (100%) were found to have CMT >250 µm. SRD(Fig 1) was found in 18 (28.12%)cases and CME (Fig 2)was found in

60(93.75%) cases. 30 cases (46.87%) had an increased central macular thickness in the range of 400-599µm followed by 28(43.75%) cases in the range of 250-399 µm.

V. Discussion

The first case of BRVO was reported by Leber in 1877, and now it is well established that the site of occlusion in BRVO is invariably at the arteriovenous crossing.[5] Retinal branch vein occlusion is a common cause of retinal vascular disease and macular edema is a frequent complication.From these investigations, suggested factors with prognostic significance have been the, extent of the macular edema, and serous retinal detachment. Age wise distribution showed that 12 (18.8%) patients between 41-50 years, 20 (31.25) patients between 51-60 years, 26 (40.6%) patients between 61-70 years and 6 (9.3%) patients between 71-80 years age group were affected. The most common group affected in our study was 61-70 years.

This was in accordance to Hayreh et al., study where 51 % had the first episode at age ≥ 65 years.[1] The mean age in the study group was 60.1±5 years. This was the same as the Hisayama study in which the mean age group of the patients was 67±7 years.[6]

In the present study branch retinal vein occlusion was more common among males 38 cases (59.4%) than females 26 (40.6%).The male: female ratio being 1.5:1 .This closely corresponded to Hayreh et al., study[1] in which male: female ratio was 1.2:1 In the present study the most common risk factor was found to be hypertension in 38 (59.37%) cases. This was similar to that found in Hayreh et al., and.[7] Eye Disease Case-Control Study[8].

In the present study, the prevalence of diabetes mellitus is 34.37% (22/64). This was almost similar to that found by Hayreh et al.[7] Many studies have shown association between retinal vein occlusion and hyperlipidemia. [8,9,10]. In the present study the prevalence of hyperlipidemia in patients with BRVO was 18.75% (12/64) which was similar to other studies. In the present study hyperhomocysteinemia was present in 16 (25%) patients .These patients also had other risk factors, however among them 10 (15.62%) patients had solely hyperhomocysteinemia. The mean age group of patients with hyperhomocysteinemia was 54 years. Thus hyperhomocysteinemia was proved to be an independent risk factor for the occurrence of BRVO in this study.
This was in accordance with Lahiri et al., study (2013) on hyperhomocysteinemia, as an independent risk factor for retinal venous occlusion in an Indian population.[11] The meta-analysis by Janssen et al., also showed an overall OR of 8.9 (95 % CI, 5.7–13.7) for homocysteine.[12.]

Analysis of Optical Coherence Tomography Findings:

OCT findings in the present study of showed that all patients had an increased central macular thickness (CMT). The CMT was >250µm in all 64 (100%) cases. (Table 4) The maximal height of central macular thickness was 895µm and the minimal height was 250µm. Both cystoid macular edema and serous retinal detachment contribute to an increase in the foveal thickness.(Fig3 Fig4) All patients with increased central foveal thickness had CME except in 4 (6.25%) patients where serous retinal detachment caused an increase in thickness. In our study the maximum and minimum CMT was 895 µm and 250µm respectively. Out of 64 patients 30 patients (46.87%) had an increased CMT in the range of 400-599µm,followed by 28 patients (43.75%) in the range of 250-399µm and 6 had more than 600µm.(Table50. The results showed a slight difference from that of Zhang etal., (2005) study where the minimal and maximal height of intraretinal cystoid space was 94µm and 1317µm, respectively and averaged (668.18 +/- 245.58µm).[13]
The results were similar to the Shroff et al., study (2008) where the mean CMT at presentation. Similar results were also seen in Aggarwal et al., study (2013) where the average central retinal thickness was 363.84 µm. [14]

In the present study serous retinal detachment was noted in18 (28.21%) cases with its maximal height of 337µm and the minimal height of 229µm (Table 4). Only SRD as a cause for increased CMT was seen in 4 (6.25%) cases.The results were similar to the Spaide et al., study where the incidence of SRD secondary to BRVO was found in 4/14 eyes (42.9%).[15] The results showed a slight difference from that of Zhang et al., (2005) study where the maximal height of subretinal fluid space was 1377µ or even beyond the detective limit of OCT and was seen in only 15.38% cases.[16] Similar results were seen in a larger study by Yamaguchi et al., comprising 109 patients (70 major BRVO and 39 macular BRVO) in which serous detachment was present in 63% patients with major BRVO and in 21% eyes with macular BRVO.[17] Aggarwal et al., study (2013) also showed similar results of SRD in 20.5% patients.[14] The results of this study differed from Shroff et al., study (2008) where the SRD only was seen in 15%, CME only in 40%, and a combined form with both SRD and CME was seen in 45%.[18]

In the present study, macular edema of the cystoid type was seen in 58 (90.62 %) cases and spongy type of edema was seen in 2 (3.13%) patient (Fig5). (Table 4)The results showed a slight difference from that of Zhang et al., (2005) study where cystoid macular edema by OCT was seen in 71 eyes (78.0%).[16] In the our study cystoid macula edema was clinically detectable in 24 (37.5%) cases and was undetectable in the remaining 40 (62.5%) cases due to the presence of associated intraretinal hemorrhages.(table 6) OCT was useful in

identifying even minimal CME, which was undetectable clinically. It was also found that a significant proportion of patients with BRVO had OCT evidence of not only CME, but also SRD.

This study data revealed that ophthalmoscopy and +90 D lens examination alone was not sufficient to detect CME and SRD and differentiate SRD from cystoid macular edema.The findings of this study also suggest that because SRD was associated with BRVO more often, it is important to distinguish macular edema from SRD when examining patients. Not only is this distinction important in accurately assessing the clinical picture, but also treatment options may have to be reevaluated because they may prove to respond differently to current modalities.

Age	40-50 yrs	51-60 yrs	61-70 yrs	71-80 yrs
Number	12	20	26	6
Percentage	19	31	41	9

VI. Conclusion

OCT is a noninvasive technique providing additional information on macular changes in BRVO.It aids in quantification of macular edema and response to treatment. It is a useful adjunct in causes of BRVO with macular hemorrhages where FFA may not provide useful information.

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Table 1: Age wise distribution of patients

Table 2: Quadrant Distribution

Quadrant	Superotemporal	Inferotemporal	Total
Number	42	22	64
%	66	34	100

Table 3: Risk Factors in BRVO

Risk Factors	Hypertension	Diabetes Mellitus	Hyperlipidemia	Hyper-homocysteinemia
Number	38	22	12	16
%	59.37	34.37	18.75	25

Table 4: OCT Findings in BRVO

OCT Findings	CMT>250 µm	SRD	CME
Number	64	18	60
%	100	28.12	93.75

CMT = Central macular thickness in
SRD = Serous retinal detachment
CME = Cystoid macular oedema

Table 5: Central macular thickness in BRVO

Central Macular Thickness (microns)	Number	%
250-399	28	43.75
400-599	30	46.87
>600	6	9.37

Table 6: Cystoid Macular Edema in BRVO

Detection of macular edema	Positive for macular edema	Negative for macular edema	Total
Clinically	24(37.5%)	40(62.5%)	64
OCT	64(93.75%)	0(0)	64

OCT = Optical coherence tomography

Legends For Figures

Fig1: OCT image showing serous detachment of macula

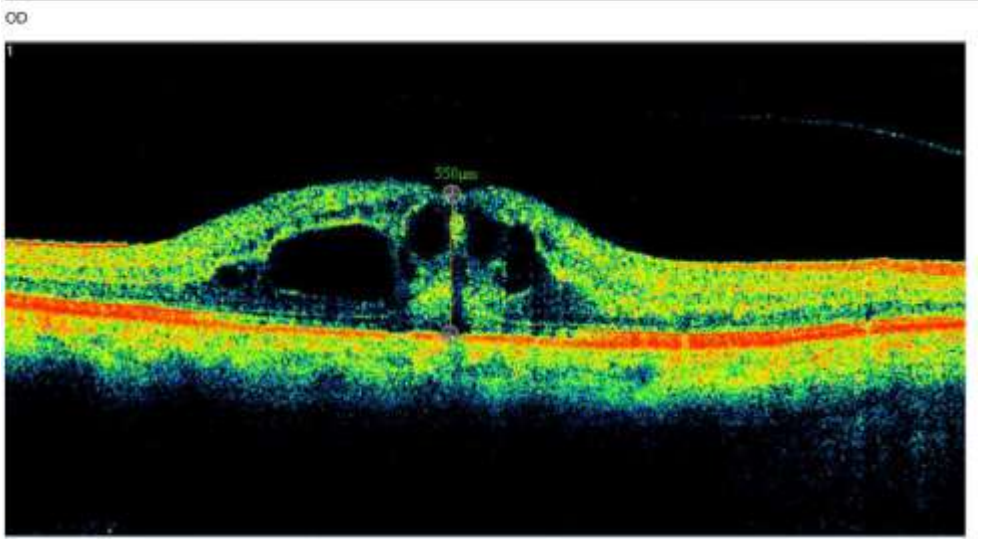


Fig 2 OCT image showing posterior vitreous detachment with cystoid macular edema CMT 550 microns

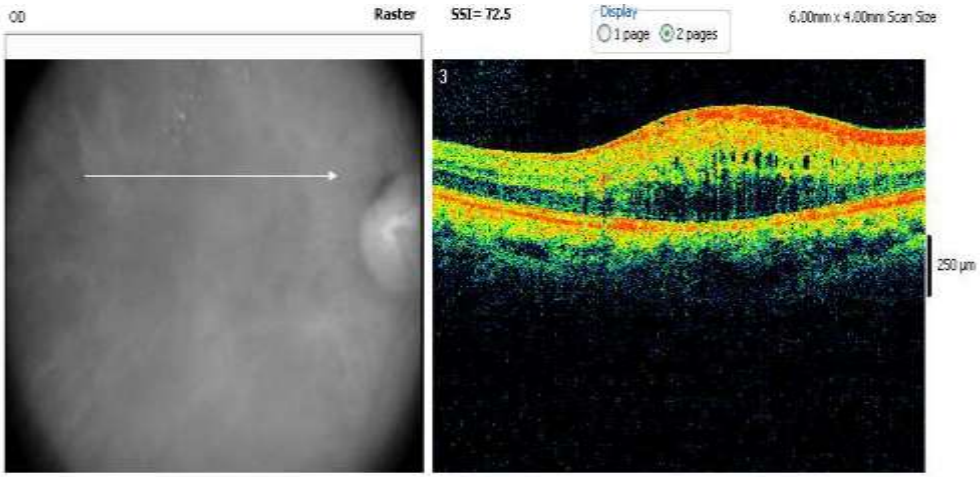


Fig 3 OCT image showing combined serous detachment and cystoid macular edema of macula

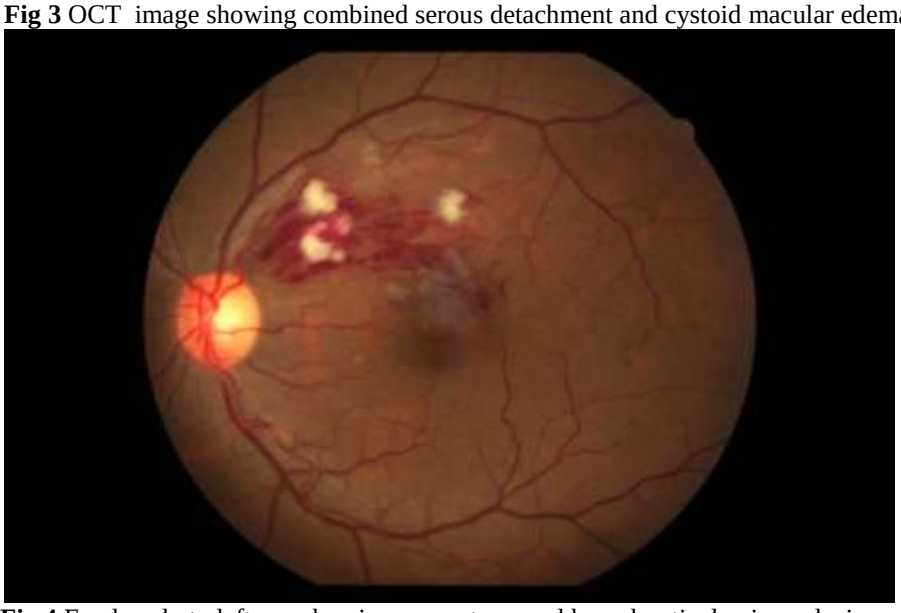


Fig 4 Fundus photo left eye showing superotemporal branch retinal vein occlusion with macular oedema

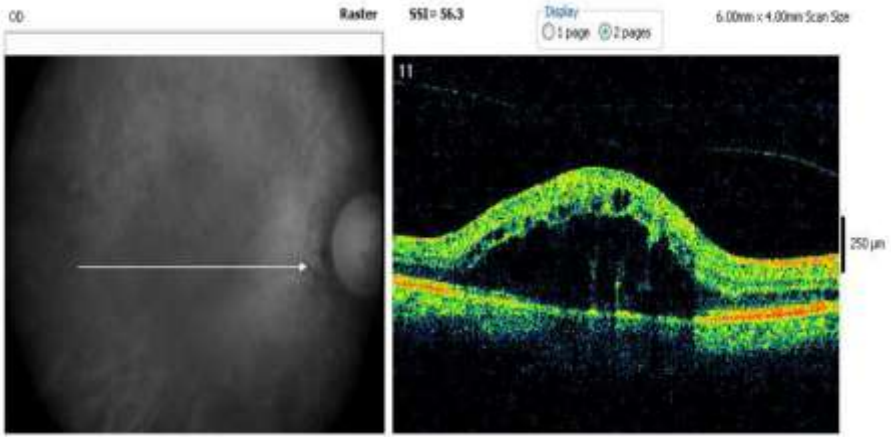
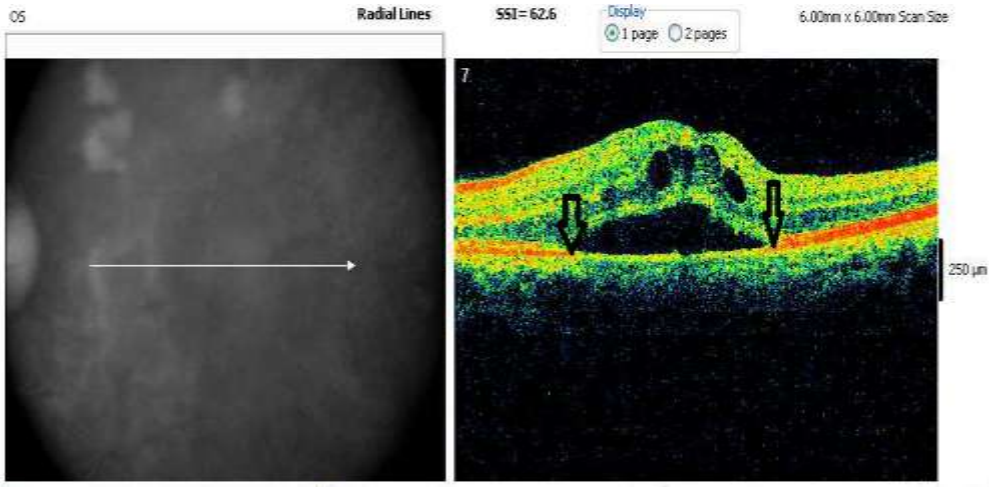


Fig 5 OCT image showing spongy thickening of macula



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