FUNDUS FLUORESCIN ANGIOGRAPHY PATTERNS OF BRANCH RETINAL VEIN OCCLUSION AT A TERTIARY CARE CENTRE- A CROSS-SECTIONAL STUDY

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ABSTRACT

BACKGROUND

Retinal vein occlusion (RVO) is a significant cause of visual loss, second to diabetic retinopathy among the retinal vascular disorder and is a disease of the elderly, most commonly occurring between 60 and 70 years of age causing visual morbidity which has got public health significance.

The objective of our study is to study the Fluorescein Angiography patterns (FFA) characteristics of macula in Branch retinal vein occlusion (BRVO) at a tertiary care hospital.

MATERIALS AND METHODS

A descriptive study was conducted at Department of Ophthalmology, Sri Venkata Ramnarayan Ruia Government General Hospital (SVRRGGH) attached to Sri Venkateswara Medical College (SVMC), Tirupati from December 2012 to November 2016. 64 eyes of 64 patients with BRVO fulfilling the inclusion criteria were examined as per protocol and results were analysed.

RESULTS

Majority of the patients were in the age group of 60-70 years accounting for 41% and 38 (59%) were males and 26 (41%) were females. 32 (50%) patients had capillary non-perfusion areas of >1/2 DD but less than 5 DD. Perifoveal capillary network distortion of >3 clock hours was noted in 44 (68.75%) of the cases. Cystoid macular oedema was seen in 24 (37.5%) of cases.

CONCLUSION

Fundus Fluorescein Angiography is an indispensable tool and is useful in differentiating ischaemic from non-ischaemic macular oedema which plays a major role in plan of treatment.

KEYWORDS

Branch Retinal Vein Occlusion (BRVO), Cystoid Macular Oedema (CME), Fundus Fluorescein Angiography (FFA), Perifoveal Capillary Network Distortion (PCND).

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BACKGROUND

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). BRVO can be considered a major BRVO or a macular 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⁾ 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. BRVO is an ocular condition that has public health significance. Recognition of retinal vein occlusions is of particular importance because

their complications and significant visual morbidity. 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.⁽⁴⁾ Risk factors associated with retinal vein occlusion include Diabetes mellitus, Hypertension, Glaucoma, Hyperviscosity, Hyperhomocysteinaemia and advanced age. Macular oedema is a common sequela and major cause of visual disturbance associated with BRVO. It is usually a unilateral condition. Fundus Fluorescein Angiography is an invasive imaging modality which evaluates the angiographic pattern of choroidal and retinal vasculature. It helps in identifying macular oedema, Capillary non-perfusion areas (CNP), Perifoveal capillary network distortion (PCND) and differentiates ischaemic type from non-ischaemic type. Due to these reasons, the present study was taken up.

Objectives

The purpose of this study is to diagnose macular oedema in eyes with BRVO, location and pattern of the occlusion effects, the clinical picture in BRVO, fundus fluorescein angiography

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(FFA) patterns, extent of macular oedema and ischaemia. Its role in BRVO is in the evaluation of retinal capillary non-perfusion areas, posterior segment neovascularisation, and macular oedema.

MATERIALS AND METHODS

The present study is a descriptive study conducted in the Outpatient Department and wards of Department of Ophthalmology, Sri Venkata Ramnarayan Ruia Government General Hospital (SVRRGGH) attached to Sri Venkateswara Medical College (SVMC), Tirupati from December 2012 to November 2016.

Patients and Methods

64 patients of Branch retinal vein occlusion with decreased visual acuity attending the Department of Ophthalmology, SVRRGGH, 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 hyperlipidaemia. 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 90 D lens. Fundus Fluorescein Angiography (FFA) done in all patients. Optical coherence tomography was done wherever necessary. 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 FFA.

Exclusion Criteria

1. Hazy media interfering with FFA interpretation.
2. Patients not willing to participate in the study.

Procedure

Fundus photographs and Fundus fluorescein angiography were performed with Digital fundus cameras (Topcon, TRC 50DX, Topcon Corporation, Tokyo, Japan and CF-1 Camera-Canon Inc, Tokyo, Japan respectively). 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, Fremont, CA, USA.)

Patient is instructed to come for angiography with 3 hours fasting period before the procedure to reduce the incidence of nausea and vomiting. Patient is advised to come along with an attendant. After taking written informed consent which also includes permission for using the details in medical journals and books, FFA was done.

Colour, red-free photography was taken. Control picture of the uninvolved eye was taken first, then the involved eye concentrating on the area of interest. Fluorescein

angiography with fluorescein filters was started with flash intensity set for it.

2 mL of 25% fluorescein dye followed by 5 mL of distilled water was injected into the antecubital vein after simultaneously starting timer from zero. As the normal arm to retina circulation time is 10-12 seconds, the first photograph was taken 10-12 seconds after the injection of dye.

Photographs were then taken at an interval of 1-2 seconds for 10 seconds, 2 seconds interval for 30 seconds. Late photographs were then taken after 3, 5 and 10 minutes.

The following Findings were Noted and Evaluated in FFA

- Capillary non-perfusion area.
- Perifoveal capillary distortion.
- Serous detachment of retina.
- Cystoid macular oedema.

RESULTS

In the present study, majority of the patients were in the age group of 60-70 years accounting for 41% and 38 (59%) were males and 26 (41%) were females. (Chart 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 1). 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 2).

Chart 1. Showing Age wise and Sex wise Distribution

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

Table 1. Showing Quadrant Distribution

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

Table 3. Showing Risk Factors in BRVO

In the present study, 32 (50%) patients had capillary non-perfusion areas of $>1/2$ DD but less than 5 DD. CNP areas >5 DD were seen in 24 (37.5%) patients. These patients require careful monitoring as they have higher chances of developing neovascularisation of optic disc or elsewhere.

In the present study, perifoveal capillary network distortion of >3 clock hours was noted in 44 (68.75%) of the cases. Neovascularisation of the disc (NVD) and neovascularisation elsewhere (NVE) were seen in 2 patients as evidenced by the late leakage of the dye from disc. Cystoid macular oedema was seen in 24 (37.5%) of cases. No case of serous retinal detachment was noted. (Table 4).

FFA Findings	CNP $>1/2$ DD	PCN Distortion	CME
No	56	44	24
%	87.5	68.75	37.5

Table 4. Showing FFA Findings

DISCUSSION

Retinal vein occlusion was first described in 1855 by Liebreich as retinal apoplexy and in 1878 was recognised as thrombosis by Michel.⁽⁵⁾ Venous occlusive diseases are among the most common retinal diseases. Retinal vein occlusion including both central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO) represents the largest group of vascular retinal affections after arteriosclerotic hypertensive changes and diabetic retinopathy and a frequent cause of macular oedema.⁽⁶⁾ The prognostic factors in these cases have been closely studied. From these investigations, suggested factors with prognostic significance have been the site of occlusion, extent of the macular oedema, disruption of the foveal arcade and serous retinal detachment.

Age wise distribution showed that 8 (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 the study on retinal vein occlusion by Hayreh et al., where in the onset of the first episode of RVO occurred anywhere between the ages of 14 and 92 years, with 51% having 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.⁽⁷⁾

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 in which male: female ratio was 1.2:1.⁽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⁽⁸⁾ Eye Disease Case-Control Study.⁽⁹⁾ 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.⁽⁸⁾ Many studies have shown association between retinal vein occlusion and hyperlipidaemia.^{(9),(10),(11)} In the present study, the prevalence of hyperlipidaemia in patients with BRVO was 18.75% (12/64) which was similar to other studies. In the present study, hyperhomocysteinaemia was present in 16 (25%) patients. The superotemporal quadrant was most commonly

involved in 42 (65.6%) cases followed by the inferotemporal quadrant in 22 (34.4%) cases in the present study.

This was in close relation to a number of studies which show that the BRVO occurs most frequently in the superotemporal quadrant.⁽¹²⁾ This may be due to the frequent AV crossings in the superotemporal quadrant and the high frequency of the retinal arteriole found lying anterior to the vein toward the vitreous cavity. The superotemporal quadrant occlusion causes more macular oedema than vein occlusion elsewhere and are more symptomatic leading to a presentation bias. (Fig. 1).

Figure 1A. Colour Fundus Image showing Superotemporal BRVO Involving Macula

Figure 1B. Colour Fundus Photo showing Site of Occlusion in BRVO (Black Arrow)

Figure 2A 2B. FFA image (Late Phase) Showing CNP Areas >5 DD

In the present study, 32 (50%) patients had capillary non-perfusion areas of $>1/2$ DD but less than 5 DD. CNP areas >5 DD were seen in 24 (37.5%) patients. (Fig. 2A, B) These patients require careful monitoring as they have higher chances of developing neovascularisation of optic disc or elsewhere.

In the present study, perifoveal capillary network distortion of >3 clock hours was noted in 44 (68.75%) of the cases (Fig 3). Neovascularisation of the disc (NVD) and neovascularisation elsewhere (NVE) were seen in 2 patients as evidenced by the leakage of the dye from disc. Cystoid macular oedema was seen in 24 (37.5%) of cases. No case of serous retinal detachment was noted. (Fig. 4).

Figure 3. FFA Late Venous Phase showing PCN Distortion more than 3 Clock Hours (Between Black Arrows)

Figure 4. FFA Late Phase showing Cystoid Macular Oedema

The results were also similar to the Lang et al study (1992), which showed that cystoid macular oedema was present in 46.4% cases.⁽¹³⁾ However, this was not in accordance with the Spaide et al, study (2003) where capillary non-perfusion was evident in 7 patients (50%), and SRD was less common in patients with capillary non-perfusion than in those without capillary non-perfusion. The perifoveal capillary network was involved in 2 (14.28%) patients, and the limited number of patients involved obviated any statistical evaluation. 4 (28.5%) eyes were found to have cystoid macular oedema by fluorescein angiography.⁽¹⁴⁾ The difference in results were probably due to the small sample size (14 cases) in their study compared to the present study (32 cases) and it needs further evaluation.

Limitations

Interpretation of FFA findings are difficult when done in patients with haemorrhages in the involved quadrant in early stages of BRVO (Fig. 5). FFA cannot be done in persons of known hypersensitivity to the dye.

CONCLUSION

In the present study, a detailed evaluation of patients with BRVO was done clinically and by FFA for early diagnosis with high sensitivity to detect the cause for decreased visual acuity. The most common complication of BRVO is cystoid macular oedema and thus it is essential to detect it at the earliest. FFA is a useful imaging technique available at present for objective assessment of the types, extent of CME,

macular ischaemia and followup of cases with CME. Although FFA is an invasive procedure, it is very useful in differentiating ischaemic from non-ischaemic macular oedema. It is also useful in differentiating NVD from collaterals. It helps in identifying patients who require long-term follow-up.

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