CRVO: OPTIC NERVE DIAMETER ALONG WITH VARIABLE EJECTION FRACTION A RISK FACTOR?

Sanjoy Chowdhury¹, Hitesh Patel², Pratik Bhosale³, Nilanjan Chowdhury⁴

¹Joint Director (Medical & Health Services, SAIL/BGH 4C/3020 Bokaro Steel City, Jharkhand, India; ²DNB Residents, Bokaro General Hospital, Jharkhand, India; ³Final MBBS, Sikkim Manipal Institute of Medical Sciences, Sikkim, India.

ABSTRACT

Background: Retinal vein occlusion is second commonest retinal vasculopathy. Narrow optic nerve diameter is a risk factor. A variation in ventricular ejection fraction can alter pressure inside any blood vessel.

Purpose: To study ejection fraction in all cases of Retinal Vein Occlusion

Methods: Prospective nonrandomised cohort study since 1997 to 2012. Standard protocol was followed in all cases of RVO A/B Scan and echocardiography was done to assess optic nerve diameter and ejection fraction respectively. Equal number of matched controls was registered.

Results: 82 cases of RVO, mean age 48.5, male preponderance in below 40 years. Variable ejection between preserved (pEF>50%) and reduced (rEF<50%) was significantly associated with RVO. Multivariate regression analysis shows RVO’s significant association between narrower optic nerve diameter, shorter axial length and variable ejection fraction

Conclusion: Variable Ejection fraction is a risk factor in RVO.

Key Words: Retinal vein occlusion, Optic nerve diameter, Ejection fraction

INTRODUCTION

Obstructions in the retinal venous flow by thrombus formation, external compression or disease of wall of the veins lead to Retinal vein occlusion. This is the second commonest retinal vasculopathy exceeded only by diabetic retinopathy.¹

Engorgement and dilation of retinal vein with secondary intraretinalhaemorrhages along with intraretinal edema, retinal ischemia, retinal exudates and macular edema are the main features of the disease.²

Engorgement and dilation of retinal vein with secondary intraretinalhaemorrhages along with intraretinal edema, retinal ischemia, retinal exudates and macular edema are the main features of the disease.²

Conclusive pathogenesis of this disorder with visually distressing consequences is still a matter of research. Histopathological studies have shown thrombus formation at or near lamina cribrosa.³ Presumably eyes with shorter lamina cribrosa and narrow scleral canal are vulneraetbus thrombus formation.⁴ This anatomical risk factor combined with alteredcardiovascular haemodynamic can be the reason behind CRVO. A variationin ventricular ejection fraction can alter pressure inside any blood vessel⁴. The aim of the study is to evaluate optic nerve diameter and cardiac ejection fraction in CRVO.

MATERIALS AND METHODS

All the cases with central retinal vein occlusion attending Bokaro General Hospital from 1997 to 2012 were included in this study. Methods comprised of detailed history including that of any systemic disease in each case along with proper demographic data. Routine ophthalmic examination was performed and documented properly. Ophthalmic ultrasound (A/B Scan) was the tool to assess optic nerve diameter and cardiac ejection fraction was measured by echocardiography during this study. Equal number of age and sex matched controls that came for refraction was registered. Optic nerve diameter was measured with A and B scans at the level of lamina cribrosa. Methodology is elaborated in Figure 2, 3, 4. Axial length of each eye was measured by biometry as shown in figure 4a. Echo cardiac parameters were recorded by echocardiography specialist who was unaware of the case. Ejection fraction was measured on each follow up.

Difference between Lowest Efr and highest Efr was calculated and statistically analysed by univariate regression. Other
covariates were also recorded e.g. Blood pressure was measured once, in a seated position, after at least 5 minutes rest. Hypertension was defined as known treated hypertension confirmed by current use of antihypertensive medications and/or a systolic blood pressure (BP) of 140 mmHg and/or diastolic blood pressure of 90 mmHg. Diabetes was defined as a self-reported history of diabetes confirmed by current anti-diabetic therapy and/or fasting blood glucose of 7 mmol/L. Body mass index (BMI) was defined as weight/height2 in kg/m2. A BMI between 25 and 30 kg/m2 was classified as overweight, and a BMI greater than 30 kg/m2 as obese. Fasting blood samples were obtained for the measurement of serum creatinine and plasma glucose. Plasma triglycerides and total cholesterol levels were measured by routine enzymatic methods. Renal function was assessed from estimates of glomerular filtration rate using Modification of Diet in Renal Disease (MDRD) formula, based on plasma creatinine.

Data management and analysis
The data forms were checked for accuracy and completeness in the field before data entry. Continuous variables were presented as mean ± SD. Differences in continuous variables among the cases and controls were compared with independent samples t-test. Differences in categorical variables between cohorts and controls were compared with chi-square test. p value <0.05 was considered to be statistically significant.

RESULTS
82 cases of RVO, mean age 48.5, male preponderance in below 40 years were included in this study. Variable ejection between preserved (pEF>50%) and reduced (rEF<50%) was significantly associated with RVO. Multivariate regression analysis shows RVO’s significant association between narrower optic nerve diameter, shorter axial length and variable ejection fraction. Total 82 cases of CRVO were registered during 1997-2012 in Bokaro General Hospital. Mean age is 48.5 years, Male: Female ratio was 1.2:1 but below 40 years age group male predominance was significant (M: F: 3:1) p<0.01. Ejection varied between rEF<50% and pEF>50% at least 4 follow ups over a period of 3 months in 52 cases of CRVO which was significant (p<0.05) in Fisher’s test when compared with other CRVO cohorts. All the cases had highly significant difference with age and sex matched control. Mean optic nerve diameter in CRVO cases was 2.92 mm as compared to 3.30 mm OND in controls (p<0.05) and 3.10 mm in the contralateral eyes of the cohorts. Mean axial length in CRVO cohorts was 22.2 mm as compared to 23.1 mm of controls which was significant. Axial length was 0.66 mm shorter than their controls (p<0.05).

DISCUSSION
Shorter OND may be a risk factor for CRVO. Lack of autonomic innervation (Figure 5, 6) and high metabolic needs, auto-regulation of retinal blood flow is not present which along with variable ejection fraction may be involved in pathogenesis of CRVO. A significant proportion of patients with heart failure happen to have anormal ventricular ejection fraction at echocardiography during examination. Previously called diastolic heart failure, it is nowadays referred to as heart failure with normal ejection fraction (HFNEF) or HF with preserved ejection fraction. Preserved ejection fraction (HFpEF) – also referred to as diastolic heart failure. The heart muscle contracts normally but the ventricles do not relax as they should during ventricular filling (or when the ventricles relax). This may give rise to venous stasis and subsequent CR.

CONCLUSION
Depending on the diameter of optic nerve and variation of cardiac ejection fraction different types (Ischemic or hemorrhagic) of central vein occlusion may occur. However larger studies using advanced rheological assessment system is further required for confirming this.

ACKNOWLEDGEMENT
I acknowledge my juniors Nilanjan Chowdhury and Dr Pratik Bhosale for preparing slides, preparing manuscript during All India Ophthalmological conference 2014 which was mentioned in AIOC2014 Proceeding (http://www.aiosedu.org/uploads/OB_14_9.pdf)

REFERENCES


Abbreviations used:
RVO: Retinal Vein Occlusion
pEF: preserved ejection fraction
rEF: reduced ejection fraction
CRVO: Central Retinal Vein Occlusion
HFNEF: Heart failure with normal ejection fraction
HFpEF: Heart Failure with preserved ejection fraction
OND: Optic Nerve Diameter
Chowdhury et. al.: CRVO: Optic Nerve Diameter along with variable ejection fraction a risk factor?

**Figure 6:** Optic nerve section at lamina cribrosa

**Figure 7:** Schematic presentation of Central retinal vein entering optic nerve: common site of obstruction.

<table>
<thead>
<tr>
<th></th>
<th>CRVO</th>
<th>Contralateral eye</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.92</td>
<td>3.10 (p&gt;0.05)</td>
<td>3.31(p&lt;0.05)</td>
</tr>
</tbody>
</table>

**Figure 8:** Mean OND: comparison between CRVO and control is statistically significant. But it is not significant when compared to contralateral eye.