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

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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 andmacular edema are the main features of the disease.(Figure 1,1a) .Conclusive pathogenesis of thisdisorder with visually distressing consequences is still a matter of research. Histopathological studieshave shown thrombus formation at or near lamina cribrosa. [2]Presumablyeyes with shorter lamina cribrosa and narrow scleral canal are vulnerableto thrombus formation [3]. 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 vessel [4].The aim of the study is to evaluate optic nerve diameter and cardiac ejectionfraction in CRVO.

MATERIALS AND METHODS

All the cases with central retinal vein occlusion attending Bokaro GeneralHospital from1997 to 2012were 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 numberof age and sex matched controls that came for refraction was registered.Optic nerve diameter was measured with A and B scans at the level oflamina cribrosa. Method ology is elaborated in Figure 2, 3, 4. Axial length of each eye was measured by biometry as shown in figure 4a. Echo cardiacparameters were recorded by echocardiography specialist whowas unaware of the case. Ejection fraction was measured on each follow up.

Difference between Lowest Efr and highest Efr was calculated and statisticallyanalysed by univariate regression. Other

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covariates were also recorded e.g. Blood pressure was measured once, in a seated position, after at least 5 minutesrest. Hypertension was defined as known treated hypertension confirmed bycurrent use of antihypertensive medications and/or a systolic blood pressure(BP) of 140 mmHg and/or diastolic blood pressure of 90 mmHg. Diabeteswas defined as a self-reported history of diabetes confirmed by current antidiabetic 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 creatinineand plasma glucose. Plasma triglycerides and total cholesterol levels weremeasured by routine enzymatic methods. Renal function was assessed fromestimates of glomerular filtration rate using Modification of Diet in RenalDisease (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%) wassignificantly associated with RVO. Multivariate regression analysis showsRVO's significant association between narrower optic nerve diameter, shorteraxial length and variable ejection fractionTotal 82 cases of CRVO were registered during 1997-2012 in Bokaro GeneralHospital. Mean age is 48.5 years, Male: Female ratio was 1.2:1 but below 40years 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 aperiod of 3 months in 52 cases of CRVO which was significant (p<0.05) inFisher's test when compared with other CRVO cohorts. All the cases hadhighly significant difference with age and sex matched control. Mean optic nerve diameter in CRVO cases was 2.92 mm as compared to 3.30mm OND in controls (p<0.05) and 3.10 mm in the contralateral eyes of thecohorts.Mean axial length in CRVO cohorts was 22.2mm as compared to 23.1mm ofcontrols which was significant .Axial length was 0.66mm shorter than theircontrols (p<0.05).

DISCUSSION

Shorter OND may be a risk factor for CRVO. [3] Lack of autonomic innervation(Figure 5,6) and high metabolic needs, auto-regulation of retinal blood flow is not presentwhich along with variable ejection fraction may be involved in pathogenesis ofCRVO.[4] 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 heartfailure with normal ejection fraction (HFNEF) or HF with preserved ejectionfraction. Preserved ejection fraction (HFpEF) – also referred to as diastolicheart failure. The heart muscle contracts normally but the ventricles do notrelax as they should during ventricular filling (or when the ventricles relax). This may give rise tovenous stasisand subsequentCRVO. Reducedejection fraction(HFREF) – alsoreferred to assystolic heartfailure. Theheart muscledoes not contracteffectively andless oxygen-richblood is pumpedout to the body.(A normal heart'sejection fractionmay be between55 and 70).[4]

Depending on the diameter of optic nerve and variation of cardiac ejection fraction different types (Ischemic or haemorrhagic) of central vein occlusion may occur. [5] However larger studies using advanced rheological assessment system is further required for confirming this.

CONCLUSION

Shorter optic nerve diameter at level of lamina cribrosa can predispose to central retinal vein occlusion due to compressive effect due to crowding. Variable cardiac ejection fraction in these eyes could be the immediate haemodynamic event leading to second commonest retinal vasculopathy. Howevermulticentre study with advanced haemodynamic measurements can help to arrive at conclusive aetiopathology of retinal vein occlusion.

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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

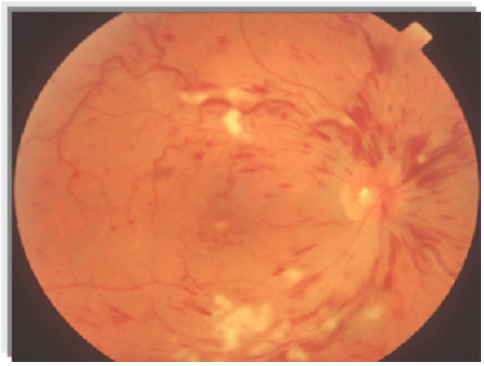

Figure 1: Fundus photograph showing fresh CRVO.

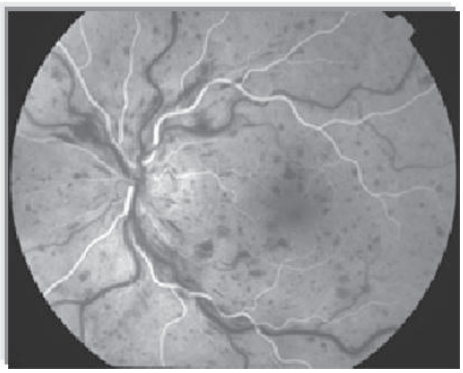

Figure 1a: Fluorescin angiogram of same patient with variable ejection fraction.

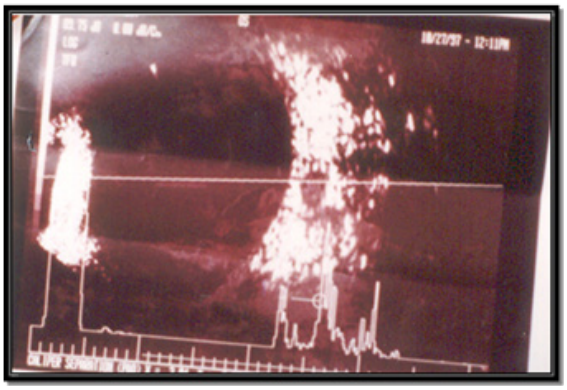

Figure 2: Combined A and B scan measuring OND(arrow showing optic nerve cross section)

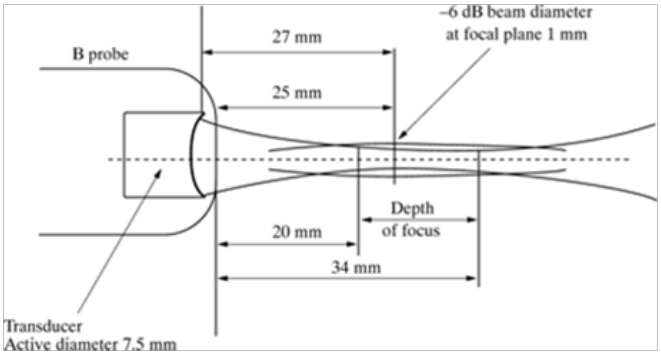

Figure 3: Basic mechanism of B scan probe.

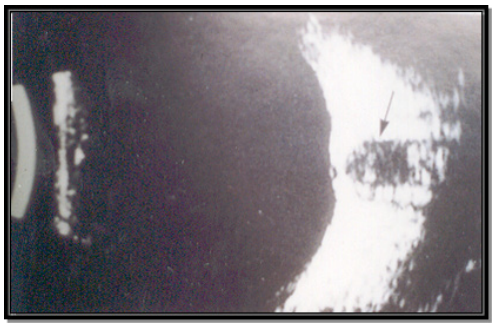

Figure 4: B scan picture of Optic nerve: arrow showing lamina cribrosa.

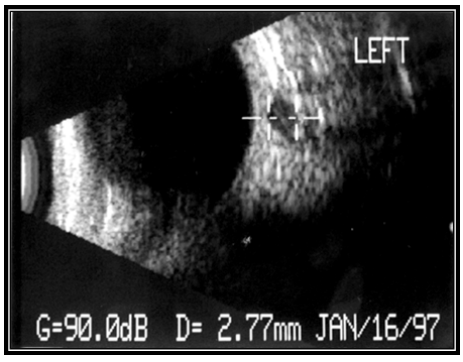

Figure 5: Measuring OND by B scan: cursor showing 2.77 mm OND.

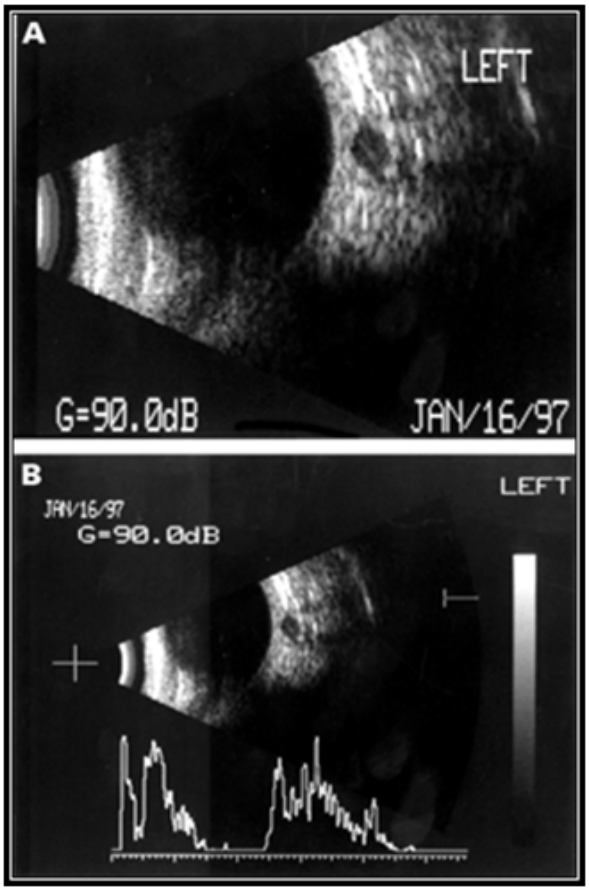

Figure 6: Optic nerve section at lamina cribrosa

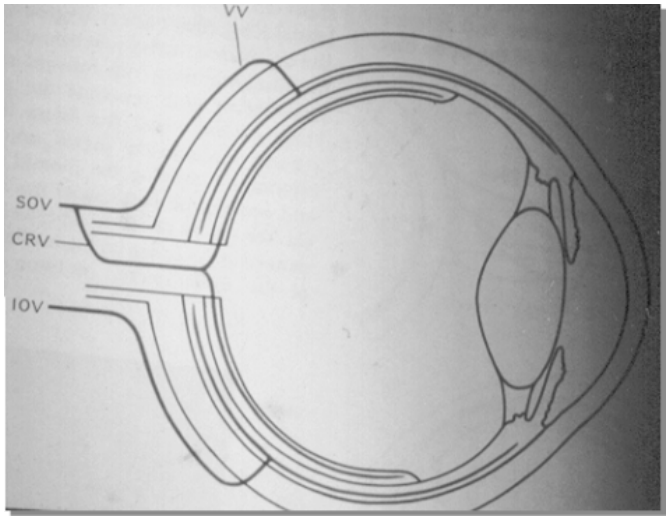

Figure 7: Schematic presentation of Central retinal vein entering optic nerve:common site of obstruction.

CRVO	Contralateral eye	Control
2.92	3.10 (p>0.05)	3.31(p<0.05)

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