

Original Research Article

Assessing the Resistive Index of Ophthalmic Artery, Central Retinal Artery, and Short Posterior Ciliary Arteries in Diabetic Retinopathy Patients: A Comparative Study

Dr. Girish Dutt Chaturvedi, Dr. Ritu Chaturvedi², Dr. Shubham Upadhyay³

M.S. Ophthalmology, PGMO, District Hospital, Shivpuri¹

M.S., Associate Professor, Department of Ophthalmology, SRVS Medical College, Shivpuri (M.P.)²

M.D., Senior Resident, Department of Medicine, G.R. Medical College & J.A. Group of Hospitals, Gwalior (M.P.)³

Corresponding Author: Dr. Girish Dutt Chaturvedi

Abstract:

Introduction: Diabetes Mellitus (DM) is associated with metabolic disorders in various organs, including intraocular tissues. Diabetic Retinopathy (DR) is a common ocular complication in diabetic patients, affecting 80-85% of individuals with Type I and Type II DM. The severity of hyperglycemia and duration of diabetes are considered key risk factors for developing DR. DR leads to various complications, including diabetic macular edema, vitreous hemorrhage, and retinal detachment. Despite extensive research, the role of hemodynamics in DR remains unclear, with conflicting data from different studies. This study aims to assess the Resistive Index (RI) in the Ophthalmic artery (OA), Central retinal artery (CRA), and Short posterior ciliary artery (SPCA) in patients with and without Diabetic Retinopathy using Color Doppler imaging (CDI).

Methodology: A case-control study was conducted on 80 patients referred from outpatient departments of ophthalmology, medicine, and surgery. The study included 40 male and 40 female patients aged between 39 and 73 years. The sample size was determined based on previous research, and patients with moderate and severe non-proliferative diabetic retinopathy and proliferative diabetic retinopathy were included. Patients with certain conditions were excluded from the study.

Results: The study found that the RI was significantly increased in the CRA, OA, and SPCA of patients with Diabetic Retinopathy compared to those without ($p < 0.01$). The increased RI in these vessels indicates potential progression of diabetic retinopathy.

Conclusion: The findings suggest that RI can be a useful indicator for assessing the progression of diabetic retinopathy in patients and post-panretinal photocoagulation. CDI provides valuable information about orbital blood flow velocities, helping in understanding the pathophysiology of diabetic retinopathy.

1. INTRODUCTION

The course of Diabetes Mellitus (DM) is associated with metabolic disorders in various organs, including intraocular tissues. Diabetic Retinopathy (DR) is a form of microangiopathy, and is the most common ocular complication seen in diabetic patients these days. On average, Duration of 5-10 years is the time needed for this complication to occur. Diabetic retinopathy affects 80% of patients affected with Type I DM and nearly 85% of patients with Type II DM time.

Almost all patients with type 1 DM and over 60% of the patients with type 2 DM will develop DR in 20 years (2)

As life expectancy increases the incidence of also DR has increased. It is a major cause of new-onset visual loss in adults. The reported prevalence of DR varies between studies, but it is probably upto 40% in diabetic patients.

The severity of hyperglycaemia is considered , the key risk factor for developing retinopathy. Duration of diabetes is known as the next possible risk factor. The complications of diabetic retinopathy includes diabetic macular edema , vitreous hemorrhage, tractional retinal detachment , retinal capillary blood obstructions, capillary dropouts, microaneurysms, venous abnormalities, neovascularization in the orbital vessels.

Despite extensive research, the knowledge of the effects of diabetes on the ocular circulation is still incomplete. Vascular changes that occurs in diabetic patients and subsequent ocular hemodynamic alterations is the basic pathophysiology that occurs in DR. DR the most common microvascular complication of diabetes and the microangiopathy which will ultimately result in retinal ischaemia. Retinal ischemia acts a stimulus for neovascularisation and thereby progresses to the morbid complications like vitreous haemorrhage, glaucoma and tractional retinal detachment

However, the role of haemodynamics in diabetic retinopathy has not been clearly defined in the literatures that differs from studies to studies. The data obtained from the studies done on DR present with conflicting data.

Only few studies in the literature that have assessed changes in the ocular blood flow in DR by color Doppler imaging (CDI)(4)

Out of few studies , few follow up studies utilized techniques other than CDI.(5–7)

Orbital colour Doppler imaging presents an excellent method for assessment of orbital blood vessels. Doppler information is gathered from a cross-section of tissue combined with B scan recording. Pulsatile blood flow velocity profiles are then obtained and analysed. It allows us to easily assess blood flow velocity information. The purpose of this study is to to compare the Resistive Index of OA, CRA and SPCA in patients with and without Diabetic retinopathy.

2. METHODOLOGY

This study was conducted in Tertiary Care Hospital in Shivpuri among patients referred from outpatient departments like ophthalmology, medicine and surgery to department of Radiology

with complaints of diabetes and diabetic retinopathy. A total of 80 patient were included among which 40 male and 40 female patients were taken into this study. The age group is 39-73 years. Study design was a case control study .Sample size calculated based on the reference study titled “Orbital Doppler Evaluation of Blood Flow Velocities in Patients with Diabetic Retinopathy” by Mehdi Karami.

In the study, the percentage of change of Resistivity index in Diabetes with retinopathy and in Diabetes without retinopathy estimated to be around 7%.

Sample size calculated by using $N=4PQ/(d)^2$

$P=7\%$, $Q=93\%$ ($1-P$), $d=8\%$ (Margin of error)

Minimum sample size calculated for this study is 39.08 based on the above formula, so approximately 40.

So sample size for cases-40, Sample size for controls-40.

INCLUSION CRITERIA.

- Diabetic patients with duration of disease from 2-15 years.
- Diabetic patients with & without diabetic retinopathy (Grades of moderate and severe non-proliferative diabetic retinopathy and proliferative diabetic retinopathy according to Early Treatment Diabetic Retinopathy Study criteria).
- Age group of 39-73 years.
- Both sexes were included in the study.

EXCLUSION CRITERIA

- Patients with history of congenital orbit pathology, trauma, infections or inflammatory lesions, benign or malignant lesions in orbit and cerebrovascular insult.
- Patients with hypertension/ dyslipidaemia/ glaucoma.
- Patients with history of smoking
- Patients with intake of drugs causing vasodilatation.
- Patients with previous history of Intra Ocular Surgery
- Patients who underwent laser procedures.

3. RESULT

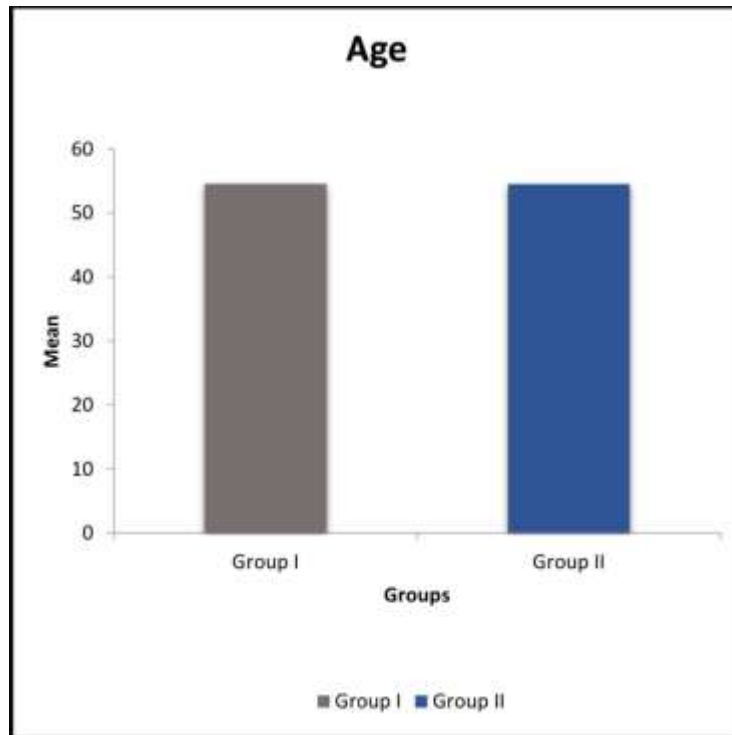


FIG1-AGE DISTRIBUTION OF PATIENTS IN THE PRESENT STUDY

Figure shows Out of 80 patients in the study, mean age group for group I is 54.53 years , mean age group for group II is 54.5 years.

TABLE 1-Mean duration of diabetes in group I &group II

	Groups	N	Mean	S.D	t-value	P – Value
DM duration yrs	Group I	40	6.75	3.61	1.74	0.086 #
	Group II	40	8.08	3.19		

Out of 80 patients in this study, duration of diabetes in group I is 6.75 yrs and in group II is 8.08 yrs.

TABLE 2- COMPARISON OF RI AMONG THE ORBITAL VESSELS IN EACH GROUP

Comparison of RI by Independent sample t-test						
Groups		N	Mean	S.D	t-value	P-value
CRARI	Group I	40	.7076	.01911	8.378	0.0005 **
	Group II	40	.7401	.01538		
OARI	Group I	40	0.75	0.00	29.475	0.0005 **
	Group II	40	0.77	0.00		
SPCARI	Group I	40	0.70	0.02	20.106	0.0005 **
	Group II	40	0.81	0.03		
** Highly Significant at P < 0.01 level						

In CRA, the RI is seen to be significantly increased in Group II (Mean-0.74), when compared to Group I (P < 0.01 level) (mean-0.70). The RI is found to be increased and it is statistically highly significant when compared between the two groups. In OA, the RI is seen to be increased in Group II (Mean-0.77) compared to Group I (P < 0.01 level) (mean-0.75). Therefore the RI is found to be increased and it is statistically highly significant when compared between the groups. In

SPCA, the RI is seen to be increased in Group II (Mean-0.81) compared to Group I (P < 0.01 level) (mean-0.70). The RI of SPCA is statistically significant and varies when compared to RI of OA and CRA. In Group II the RI of all three vessels are significantly different from each other. RI is a good indicator in the progress of diabetic retinopathy in a patient by using CDI.

TABLE 3- Mean RI of CRA,OA,and SPCA in Group I and Group II patients

RI VALUES			
	CRA	OA	SPCA
Group I	0.71	0.75	0.70
Group II	0.74	0.77	0.81

4. DISCUSSION

RI is significantly increased in patients with diabetic retinopathy in CRA ,OA and SPCA. The finding that the resistivity of the central retinal artery, posterior ciliary artery, and ophthalmic artery in patients with retinopathy was significantly greater than those of patients without retinopathy is also in agreement with certain other studies . It has been suggested that an increased resistivity index in the ophthalmic artery in the DR group may be due to downstream vascular changes related to diabetes in both retinal and choroidal vasculature. Our finding of an increased resistivity index in the ophthalmic artery is similar to that reported by MacKinnon et al.

5. CONCLUSION

Increased RI in CRA,OA,and SPCA showed that RI can be used to assess an index in the progression of diabetic retinopathy in patients or can also be used post panretinal photocoagulation.

6. REFERENCES

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