EFFECTIVENESS OF RADIAL OPTIC NEUROTOMY FOR ISCHEMIC CENTRAL RETINAL VEIN OCCLUSION

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ABSTRACT

Objective: To determine the effectiveness of radial optic neurotomy as a treatment modality for ischemic central retinal vein occlusion.

Methodology: This was an interventional study of 15 patients with ischemic central retinal vein occlusion (CRVO) who had severe loss of visual acuity. The study was carried out prospectively from July 2015 to June 2017. These patients underwent radial optic neurotomy (RON) within six months of disease onset. Patients were followed postoperatively with standard ocular examination including visual acuity and fundus examinations after 07, 30 and 90 days. Analysis of data was carried out using SPSS version 22.

Results: Our findings showed that best-corrected visual acuity before surgery ranged from hand movements(HM) to 6/60 or 2.10-1.00 log MAR (mean 1.72 log MAR). Pre-operatively 6 (40%) patients had visual acuity of HM, 4 (26.7%) had 1/60, 2 (13.3%) had 3/60 and 3(20%) patients had a visual acuity of 6/60. On the last post operative follow up at three months, 2 (13.3%) patients had a visual acuity of HM, 6 (40%) had 6/60, 4 (26.7%) had 6/36 and 3(20%) had 6/24. At 03 months, one patient's (6.66%) had deterioration of vision whereas one patient's (6.66%) visual acuity remained unchanged and 13 (86.66%) patient's had some improvement in vision. One patient had intra operative bleeding due to injury to the central retinal artery caused by micro-vitreoretinal (MVR) blade.

Conclusion: Radial optic neurotomy improved both the visual function and macular edema in ischemic central retinal vein occlusion.

Key Words: Central retinal vein occlusion, Radial optic neurotomy, Visual acuity

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INTRODUCTION

Retinal vascular occlusive disorders constitute one of the principal causes of visual impairment and blindness. In order of prevalence, these include diabetic retinopathy, branch retinal vein occlusion followed by central retinal vein occlusion[1,2]. Open-angle glaucoma and systemic hypertension are considered as major risk factors for development of CRVO[2,3].

The proposed mechanism of CRVO is related to thrombus formation at the cribriform plate. Retinal vein occlusions can occur due to a variety of reasons involving local and systemic risk factors along with anatomical anomalies leading to narrowing of the venous lumen, increase in turbulence, endothelial damage and ultimately formation of thrombus[4-6]. Due to this bottleneck effect CRVO is also considered as a compression or compartment syndrome. It can result in tissue ischemia and dysfunction subsequent to the pressure in the restricted space. It has been further suggested that compromised blood flow in both the central retinal artery and vein may lead to a non-perfused CRVO[7]. The prognosis of CRVO is related to visual acuity and the severity of ischemia at time of presentation. Visual improvement was documented in 6.5% cases having presenting vision better than 20/40. On the other hand, presentation visual acuity of <20/200 was associated with poor prognosis at 04 months as well as at 03 years[1,8].

No effective management has been developed for CRVO until now. Panretinal photocoagulation is one of the suggested treatment modality when iris neovascularization complicates the CRVO[9]. However, Macular grid photocoagulation was not shown to improve the final visual acuity in patients with CRVO and persistent macular edema[10]. Opremcak et al[11] have proposed a surgical procedure for CRVO known as radial optic neurotomy (RON). It involves opening of the narrow space within the scleral tunnel so that the pressure on the central retinal vein is relieved. The reported success rate of the procedure in terms of improvement or stabiliza-

tion in visual acuity is 82%[11]. We therefore conducted this study to determine the effectiveness of radial optic neurotomy as a treatment modality for ischemic central retinal vein occlusion in our setup.

METHODOLOGY

This was an interventional study of 15 eyes of 15 patients with central retinal vein occlusion (CRVO) who had severe loss of visual acuity. The study was carried out prospectively from July 2015 to June 2017. All patients of any age and both genders with central retinal vein occlusion and visual acuity of 6/60 or less due to macular oedema or four quadrant extensive intra-retinal haemorrhages of less than one-year duration were included in this study. While those CRVO patients who had vision of 6/36 or better, associated vasculopathies, vitreous haemorrhage, retinal neovascularization and previous laser photocoagulation were excluded from the study.

The patients were assessed and their demographics (e.g. age, gender, and address) were recorded. A complete history was obtained regarding medical illnesses (such as diabetes, hypertension, hyperlipidaemia) and ophthalmic conditions (e.g. open-angle glaucoma). Duration of symptoms and laterality was also noted. Visual acuity was assessed and recorded to the smallest line seen by the patients using best corrected Snellen's visual acuity. They were allowed only one error. Anterior segment was examined with slit lamp. Measurement of intraocular pressure (IOP) was performed. Indirect ophthalmoscopy as well as slit lamp biomicroscopy was used to examine the fundus. Patients were followed postoperatively with standard ocular examination, including visual acuity and fundus examinations at one week, one month and three months postoperatively. The patients were explained the purpose of study. They were briefed about their participation in this research and details of the surgical procedure. An informed written consent was obtained and the patients were booked for surgery.

In all cases vitrectomy was performed as 03-port pars plana vitrectomy using wide angle vitrectomy viewing system. Using a vitreous cutter in the aspiration mode, a posterior vitreous detachment was created. The IOP was raised by elevating the bottle height to minimize potential retinal bleeding arising from the incision site of the optic nerve head due to RON. The incision site was chosen on the nasal side of the optic disc, radial to the optic disc and parallel to the nerve-fiber pattern. A standard micro-vitreo retinal (MVR) blade was used to perform RON in the first six cases whereas a RON spade was used for the remaining cases when it became available. Precautions were taken to avoid injury to retinal vessels and their tributaries or branches. In case of any intra-operative bleeding, the IOP was raised temporarily to 75mm of Hg to achieve haemostasis and any residual blood was aspirated by a flute needle. After the procedure (RON), the patients were given a single day stay in the hospital and were then discharged home. They were advised to come for follow up after 07, 30 and 90 days of surgery. The parameters checked clinically were best corrected visual acuity(BCVA) using a Snellen's chart, optic disc appearance, decrease or resolution of intra retinal haemorrhages, appearance of retinal veins and improvement in macular oedema.

All data were analyzed using IBM SPSS version 22 statistical software for Windows. For qualitative variables frequency and percentages were calculated while means and SD were calculated for quantitative variables. Data was compared before and after the intervention and at follow-ups. For quantitative variables paired sample t test was used. A p value <0.05 was considered significant. Chi square test was used for comparing qualitative variables.

RESULTS

Out of 15 patients, there were 08 males and 07 females. Mean age was 68.13 ±6 years. Before surgery, the mean duration of symptoms was 4.0 ±1.46 months. Seven of our patients had no treatment prior to RON. Seven patients were hypertensive (46.7%, Table 1).

Intra-operatively vitreous haemorrhage occurred in one patient due to injury to the central retinal artery which was managed by raising the intraocular pressure and using heavy liquid intra operatively. On postoperative ophthalmoscopic examination, macular oedema and intra retinal haemorrhages improved significantly during the follow up period.

Preoperatively BCVA ranged from HM to 6/60 (2.10-1.00 log MAR, mean 1.72 log MAR). Postoperatively, BCVA at one week ranged from HM to 6/36 (2.10- 0.77 log MAR, mean 1.38 log MAR); BCVA at one month ranged from HM to 6/36 (2.10- 0.77 log MAR, mean 1.28 log MAR); and BCVA at three months ranged from HM to 6/24 (2.10- 0.6 log MAR, mean 1.0 log MAR). Comparison of visual acuity is shown in Table 2.

At the end of the follow up one patient (6.66%) had deterioration of visual acuity from 6/60 to HM, whereas one patient (6.66%) with a visual acuity of HM, remained unchanged. Thirteen patients (86.66%) had some improvement in their visual acuities. The one sample 2-tailed t test of 0.005 is highly significant as shown in Table 3.

DISCUSSION

Central retinal vein occlusion, especially with severe decrease in visual acuity (less than 6/60) is a frustrating situation for the patients as well ophthalmologists. McAllister et al[12] proposed high intensity laser photo-

Table 1: Baseline characteristics of study participants (n=15)

S/No	Age/yrs	Gender	Etiology	Duration Months	Pre op Treatment	v/a Pre0p	v/a post 01wk	v/a post 01m	v/a post 03m
1	65	M	HTN	4	Observa-tion	HM	3/60	6/60	6/36
2	72	M	HT-N&DM2	6	Observa-tion	HM	HM	HM	HM
3	67	M	DM2	3	Observa-tion	1/60	3/60	3/60	6/60
4	75	F	DM2	6	Observa-tion	HM	HM	1/60	6/60
5	62	M	HTN	3	Avastin	HM	6/60	6/60	6/36
6	64	F	HTN	4	Avastin	3/60	6/36	6/36	6/24
7	76	M	H&DM2	5	2 Avastin	6/60	6/36	6/36	6/24
8	66	M	HTN	3	Avastin	1/60	6/60	6/60	6/36
9	70	F	H&DM2	2	Avastin	6/60	HM	HM	HM
10	69	F	HTN	4	2 Avastin	1/60	6/60	6/60	6/36
11	60	M	HPL	4	Avastin	HM	6/60	6/60	6/60
12	73	M	H&DM2	6	Avastin	3/60	3/60	3/60	6/60
13	75	F	H&DM2	1	Observa-tion	6/60	6/36	6/36	6/24
14	61	F	HTN	5	Observa-tion	HM	1/60	3/60	6/60
15	61	F	HTN	4	Avastin	1/60	1/60	3/60	6/60

Note: HTN=(hypertension), DM2=(diabetes mellitus type 2), HPL (hyperlipidemia)

Table 2: Comparison of visual acuity (n=15)

Visual acuity		HM	1/60	3/60	6/60	6/36	6/24
Pre-operatively		6 (40%)	4 (26.7%)	2 (13.3%)	3 (20%)	0	0
Post- oper-atively	At Week 1	3 (20%)	2 (13.3%)	3 (20%)	4 (26.7%)	3 (20%)	0
	At month 01	2 (13.3%)	1 (6.7%)	4 (26.7%)	5 (33.3%)	3 (20%)	0
	At months 03	2 (13.3%)	0	0	6 (40%)	4 (26.7%)	3(20%)

Table 3: Paired Samples Test

Visual acuity	Paired Differences					t	Sig. 2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
				Lower	Upper		
Pre-op/ Post- op: Visual Acuity	-.22233333	.25732183	.06644021	-.36483341	-.07983325	-3.346	.005

coagulation for chorioretinal anastomosis to ameliorate obstructed retinal venous return. Although it is successful in one-third of patients with CRVO, but it is associated with increased frequency of complications with resultant choroidal neovascularisation, branch vein occlusion, retinal and/or vitreous haemorrhage, fibrosis and tractional retinal detachment.

Elman[13] introduced systemic infusion of tissue plasminogen activator (tPA) to treat CRVO. However, it was largely abandoned because of its 1% mortality rate. Lahey et al[14] used intra-vitreal tPA to treat CRVO and 35% of CRVO eyes receiving intra-vitreal tissue plasminogen activator (tPA) recovered to 20/40 acuity or better. Direct administration of t-PA into the affected retinal vein was described by Weiss and Bynoe[15]; however serious ocular complications can occur with this procedure. These may include vitreous haemorrhage, retinal tear formation or detachment, endophthalmitis and neovascular glaucoma.

Our procedure (RON) was similar to the one proposed by Opremcak et al[16]. Over the last decade, several researchers showed interest in RON and investigated this treatment modality regarding its effectiveness. Some authors observed improvements in visual acuity[17] while significant functional improvement could not be demonstrated by others[18]. In our study one patient (6.66%) maintained the pre RON visual acuity where as one patient's (6.66%) visual acuity deteriorated, while 13 (86.66%) eyes showed an improvement in vision. Opremcak et al[16] reported similar results of equal or better postoperative visual acuity in 82% and improvement in 73% patients. The minor variations in our result from that of Opremcak et al[16] could be due to difference in inclusion criteria, duration of symptoms, exclusion of eyes with retinal neovascularisation, neovascular glaucoma, vitreous haemorrhage, history of previous laser photocoagulation and intravitreal avastin injections in some patients.

CONCLUSION

Radial optic neurotomy improves both the visual function and macular edema in patients with ischemic central retinal vein occlusion. Larger studies and randomized controlled trials assessing the efficacy and safety of RON are needed.

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CONTRIBUTORS

MAS conceived the idea, planned the study and drafted and critically revised the manuscript. FN and BK did data collection, statistical analysis and drafted the manuscript. AA did literature search and drafted the manuscript. All authors contributed significantly to the submitted manuscript.