ORIGINAL ARTICLE

Internal Limiting Membrane (ILM) Peeling for Macular Edema Secondary to Branch Retinal Vein Occlusion (BRVO)

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ABSTRACT

Purpose: To find out the anatomic and functional outcomes of pars plana vitrectomy (PPV) and internal limiting membrane (ILM) peeling in patients with refractory macular edema associated with branch retinal vein occlusion (BRVO).

Study Design: Interventional case series.

Place and Duration of Study: Ophthalmology Department, Lahore General Hospital, Lahore from 2015 to 2019.

Methods: Fifty-five eyes of patients presenting with refractory macular edema associated with branch retinal vein occlusion (BRVO) were recruited for this study. They were treated using 23-gauge pars plana vitrectomy and Brilliant Blue Green assisted internal limiting membrane peeling. Pre-operative and post-operative best-corrected visual acuity (BCVA) and macular edema were assessed by fluorescein angiography and optical coherence tomography (OCT). Monthly follow up was continued for one year.

Results: In 46 (83.6%) eyes, central macular thickness improved from 465 ± 91 µm at baseline to 295 ± 103 µm post-operatively, ($P < 0.003$) at one year follow up. In nine (16.3%) eyes, there was no improvement in central macular thickness. Improvement in best-corrected visual acuity (BCVA) was seen in 43 (78.1%) eyes. Out of these 43 eyes, 37 (86%) eyes had mean 3 Snellen lines improvement while six (13.9%) eyes had 2.4 Snellen lines improvement. In 12 eyes (21.8%) BCVA did not improve. No statistically significant difference was seen in post-operative BCVA between ischemic and non-ischemic BRVO ($p > 0.05$).

Conclusion: Twenty-three gauge vitrectomy with Brilliant Blue Green (BBG) assisted ILM peeling is effective in reducing refractory macular edema and improves visual acuity in ischemic and non-ischemic BRVO.

Key Words: Internal limiting membrane, Macular edema, Retinal vein occlusion, Brilliant Blue Green.

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INTRODUCTION

Brach retinal vein occlusion (BRVO) is a common vascular condition that leads to significant vision loss.[1] It is the second only to diabetes as a cause of vision loss and is three times more common than central retinal vein occlusion (CRVO). BRVO can be caused by both systemic factors, e.g. diabetes, high blood pressure and local factors such as raised intraocular pressure.[2] Numerous factors are associated with vision

loss in BRVO, the most common of which is macular edema.[3] Macular edema in BRVO is caused by break down of the blood-retinal barrier and increased vascular permeability. Vascular occlusion leads to the expression of interleukin 6 (IL-6) and vascular endothelial growth factor (VEGF), both of which lead to the development of macular edema which reduces vision.[4]

Treatment has evolved significantly over the past few years with the aim of treating macular edema in branch retinal vein occlusion (BRVO). Grid laser photocoagulation was used to treat macular edema in a specific group of patients with BRVO, while promising results were observed with intravitreal injections of anti-VEGF (vascular endothelial growth factor) or steroids.[5-6]A conventional treatment for chronic or refractory macular edema (CME) with BRVO is pars plana vitrectomy (PPV) with hyaloid removal, based on the hypothesis that vitreous traction on the macula causes fluid to accumulate. Recently, the role of internal limiting membrane (ILM) peeling has been introduced as an adjunctive procedure to PPV.[7]

ILM peeling in BRVO associated macular edema is a new surgical technique that focuses on the hypotheses about the role of vitreoretinal interface abnormalities in the pathogenesis of macular edema. In recent years, PPV has been proved to be an effective technique for the management of macular edema. Mandelcorn et al. have shown promising results from ILM peeling in cases of severe visual impairment due to macular edema caused by retinal vein occlusion. They proposed that vitrectomy along with ILM peeling resulted in dispersion of retained intraretinal extracellular fluid and blood into the vitreous through the retina from where ILM has been removed.[8]

The purpose of our study was to find out the anatomic and functional outcomes of pars plana vitrectomy (PPV) and internal limiting membrane (ILM) peeling in patients with refractory macular edema associated with branch retinal vein occlusion (BRVO).

METHODS

A prospective study was conducted at Ophthalmology department of Lahore General Hospital, Lahore, from 2015 to 2019. A total of 55 eyes with BRVO (both ischemic and non-ischemic) with associated refractory macular edema of more than 6 months duration and confirmed by optical coherence tomography (OCT) were included in the study. Eyes with visually significant media opacities and evident macular traction on OCT were excluded. Eyes which required cataract surgery during PPV were also excluded. Refractory macular edema was defined as edema in which all therapeutic options including grid laser photocoagulation (at least 3 months before vitrectomy) and three intravitreal injections of anti-VEGF on monthly basis (with last injection at least one month before vitrectomy) had failed to reduce macular edema. Patients were observed for one year post-operatively. The study was approved from the institutional ethical committee and informed consent was taken from every patient. Twenty-three–gauge sutureless PPV with Brilliant Blue Green (BBG) assisted removal of the ILM was performed. Preoperative and post-operative complete eye examination including BCVA, fundoscopy, fluorescein angiography, and OCT were done in all patients.

All surgeries were performed by the same surgeon. Three ports 23-Gauge PPV with ILM peeling assisted with brilliant blue green (BBG) was performed. After core vitrectomy, posterior vitreous detachment was done. Air-fluid exchange was carried out after which, BBG was injected into the vitreous cavity on the macula and allowed to stain ILM for 3 minutes. Under the fluid infusion, stained ILM was removed by ILM peeling forceps and isolated from the surface of the internal retina on the macular area to a point just outside the foveal avascular zone. None of the eyes was sutured to close the sclerotomy. Postoperative follow up was performed every 4 weeks for one year.

RESULTS

In 46 (83.6%) eyes the central macular thickness improved from 465 ± 91 µm at baseline to 295 ± 103 µm ($P < 0.003$). In nine (16.3%) eyes, there was no improvement in central macular thickness. In 43 (78.1%) eyes, improvement in BCVA was seen ($P < 0.05$). Out of these 43 eyes, 37(86%) eyes gained 3 Snellen lines of BCVA while six (13.9%) eye gained 2.4 Snellen lines. However, no statistically significant difference was seen in improvement of visual acuity between ischemic and non-ischemic BRVO ($p > 0.05$). No eyes had recurrence of macular edema during the

follow-up period. There were no intraoperative complications. Pre-operative and post-operative OCT of two patients is shown below in figure 1 and 2.

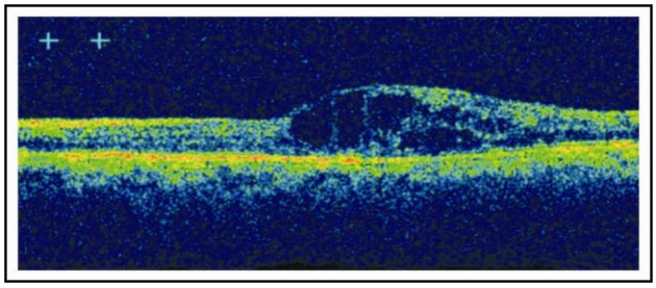

Fig. 1a: Pre-operative OCT of a patient with branch retinal vein occlusion (BRVO) associated with macular edema.

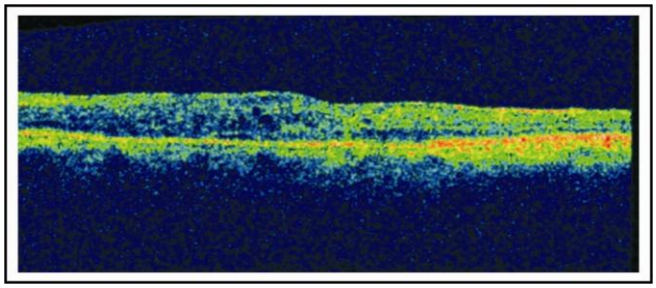

Fig. 1b: Post-operative OCT of the patient in "A".

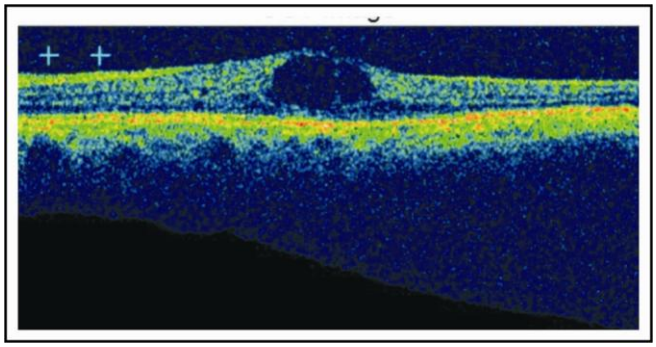

Fig. 2a: Pre-operative OCT of a patient with BRVO associated with macular edema.

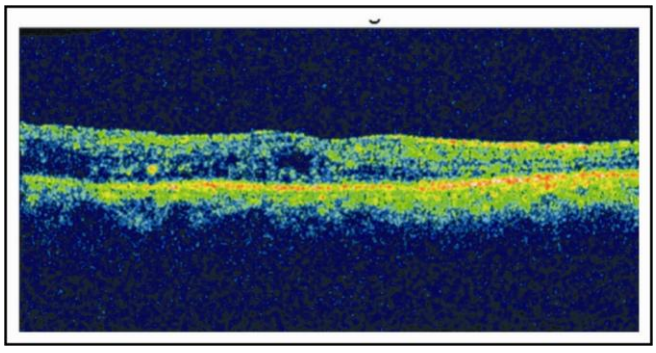

Fig. 2b: Post-operative OCT of the patient in "A".

DISCUSSION

A number of treatment options have been proposed for the management of macular edema including macular grid laser photocoagulation, anti-vascular endothelial growth factor (VEGF) and intravitreal steroids.[9-11] It takes time for macular edema to get resolved after treatment. This persistent macular edema can cause apoptosis of photoreceptors and can result in permanent vision loss. Rapid regression of macular edema is necessary for visual acuity preservation.[12]

PPV with ILM peel is based on the belief that by activating the release of extracellular fluid and blood into the vitreous, the normal thickness of the retina can be restored. This surgery also helps to reduce the intra-retinal pressure around adjacent retinal capillaries that would help to reopen the occluded blood vessels. It is also documented that with PPV cytokines such as interleukin 6 (IL-6) and vascular endothelial growth factor (VEGF) are cleared from the eye and thus their adverse effects are canceled.[13-16] PPV also increases pre-retinal oxygen tension. In addition, ILM peeling helps in the absorption of the macular edema. Eventually all of these events increase the pre-retinal oxygen stress and further stimulate the vasoconstriction, thereby reducing the hydrostatic vascular pressure and reducing edema.[17-20]

Previous studies have shown reduction in macular thickness after PPV in patients with BRVO. Sato et al conducted a study to find out the anatomical and functional outcomes of micro-incisional vitrectomy (MIVS) surgery on 101 eyes of 101 patients to treat macular edema secondary to branch retinal vein occlusion (BRVO). They also categorized the patients into ischemic and non-ischemic BRVO. Patients were evaluated at1, 3, 6 and 12 months after surgery. They concluded that MIVS was effective in improving visual acuity and morphology of fovea with low recurrence rate of macular edema.[21] In another study, a 25-Gauge PPV with intra vitreal triamcinolone acetonide and ILM peeling was done in 38 eyes with chronic cystoid macular edema and retinal vein occlusion. The study concluded that refractory macular edema in BRVO was significantly reduced after surgery.[22]

Hariri et al reported that PPV with ILM peeling resulted in decreasing macular edema but the improvement in BCVA was not statistically significant.[4] Mandelcorn reported decrease in macular thickness within an average of 39 days after PPV and

ILM peeling.[20] Long-term effects of ILM peeling were also reported by Kumagai et al. There was no recurrence of macular edema at one year follow-up which is consistent with our study.[23] Other researchers have also shown similar results.[24]

Outcomes of PPV with ILM peel were similar when macular edema in ischemic and non-ischemic BRVO was compared.[12,20] This was observed in our study as well.

Sometimes visual acuity does not improve after PPV, which could be due to damage to the photoreceptor layer even after the resolution of macular edema. Ota et al reported lack of high-reflectance band on high-resolution OCT, which correlated with a poor final visual acuity.[25]

Limitation of this study was small sample size. Diabetic and hypertensive status of the patients were also not taken into account.

CONCLUSION

Twenty-three– gauge vitrectomy with Brilliant Blue Green (BBG) assisted ILM peeling is effective in reducing refractory macular edema and improving visual acuity in ischemic and non-ischemic BRVO.

Ethical Approval

The study was approved by the Institutional review board/ Ethical review board. **(AMC/PGMI/LGH/00-159-20)**

Conflict of Interest

Authors declared no conflict of interest

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Authors' Designation and Contribution

Hussain Ahmad Khaqan; Professor: *Concepts, Design, Literature search, Data acquisition, Data analysis, Statistical analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Usman Imtiaz; Vitreo Retinal Fellow: *Data acquisition, Data analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Hasnain Muhammad Baksh; Vitreo Retinal Fellow: *Data acquisition, Data analysis, Manuscript preparation, Manuscript editing, Manuscript review.*

Hafiz Ateeq-ur-Rehman; Post Graduate Resident: Literature search, Statistical analysis.

Raheela Naz; Post Graduate Resident: *Literature search, Statistical analysis.*