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A PROSPECTIVE STUDY TO ASSESS THE EFFECT OF PANRETINAL PHOTOCOAGULATION ON MACULAR THICKNESS AND MORPHOLOGY IN PATIENTS OF PROLIFERATIVE DIABETIC RETINOPATHY

ABSTRACT

Background: The purpose of this study was to assess the effect of panretinal photocoagulation (PRP) on macular thickness and morphology in patients of proliferative diabetic retinopathy.

Methods: This was a prospective study including 67 eyes of 50 patients diagnosed to have proliferative diabetic retinopathy without clinically significant macular edema. Baseline and post PRP visual acuity, morphological changes on optical coherence tomography (OCT), and central foveal thickness were evaluated at one week and 3 months.

Results: The mean age of our study population was 55.23 years (range 40-75 years). Fifty two eyes (77.61%) had stable or improved vision, while 15 eyes (22.38%) had worsened visual acuity at 3 months. Mean preoperative vision was 0.23 ± 0.11 log units, which worsened significantly to 0.36 ± 0.20 log units (P = 0.001) at one week, and 0.24 ± 0.21 log units at 3 months , this change was not statistically significant. Mean preoperative central foveal thickness was 273.69µm which reduced to 259.73 µm at three months follow up. Twelve percent of eyes with a normal macula showed morphological changes following PRP. The common morphological changes on OCT after PRP were spongy edema, vitreomacular traction, epiretinal membrane and subretinal fluid.

Conclusion: We conclude that in patients of proliferative diabetic retinopathy, PRP reduces the risk of visual loss and complications associated with progression of neovascularization.

Keywords: panretinal photocoagulation (PRP), proliferative diabetic retinopathy (PDR), macular morphology, central foveal thickness (CFT).

INTRODUCTION

Diabetic retinopathy (DR) is the most common blinding microvascular complication of diabetes mellitus and its prevalence is expected to rise significantly over the next 15 years. The worldwide prevalence of diabetes was 6.4% in 2010 and the expected prevalence is 7.7% by the end of the year 2030. Two main reasons for visual loss in diabetic patients are diabetic maculopathy and complications associated with proliferative diabetic retinopathy (PDR). [1,2]

PDR is characterized by the hallmark feature of pathologic preretinal neovascularization. The gold standard treatment for PDR is panretinal laser photocoagulation (PRP) which is required to be performed soon after detection of retinal neovascularization.[3] The mechanism of PRP is to convert the ischemic peripheral retina to anoxic state, thus eliminating the ischemic drive for retinal neovascularization and reducing the intravitreal VEGF levels.[4,5]

The visual and clinical outcome of patients after PRP is dependent upon the surface area of retina over which the laser is applied. [6,7] Although laser PRP reduces the risk of visual loss in patients with PDR, it may be associated with complications such as visual field loss, macular edema and serous retinal detachment. The incidence of macular edema after PRP has been found in 25% - 43% of the eyes and it is considered to be secondary to retinal inflammation and increased vascular permeability that is triggered by laser PRP, however in long term there is thinning of nerve fibre layer. [8,9]

Optical coherence tomography (OCT) is a widely utilized option for imaging the diabetic neural retina to create cross-sectional images of the retina in which individual retinal layers can be distinguished. OCT allows quantitative measurements of retinal thickness, as well as evaluation of morphologic changes in eyes with DR and DME. [10]

MATERIALS AND METHOD

A prospective study was conducted in the out patient department of ophthalmology from February 2020 - September 2021. The study was conducted in accordance with the tenets of the Declaration of Helsinki. A total of 67 eyes of 50 patients who were diagnosed with proliferative diabetic retinopathy were included and written consent were taken from them. Patients with non proliferative diabetic retinopathy, clinically significant macular edema, retinal detachment, retinal hemorrhage, macular scar and cataract were excluded from this study. Examination included assessment of visual acuity using a Snellen chart , anterior segment examination by slit lamp bio microscopy and fundus examination using direct and indirect ophthalmoscope and baseline OCT were carried out for all patients before PRP . Patients went through 2-3 sittings of PRP. After completion of PRP, patients were followed up for a period of three months and detailed ophthalmological examination including visual acuity, fundus examination and OCT Macular cube and 5 line raster scan were done. Comparison of visual acuity and macular changes with regards to morphology and thickness were done. Student t-test was used in statistical analysis.

RESULTS

The mean age of our study population was 55.23 years (range 40-75 years).There were 32 males and 18 females. Twenty six of the 50 patients (52%) were on oral hypoglycemic agents for diabetes, 15 (30%) were on insulin, and nine (18%) were on both types

of agents. Concomitant systemic diseases included hypertension in 29 patients (58%), dyslipidemia in 10 (20%), nephropathy in 8(16%) and cardiac disease in 17(34%).

Forty five of the 67 eyes (67.16%) had stable vision following PRP. There was improvement in vision in seven eyes (10.44%) and vision worsened in fifteen eyes (22.38%) three months following PRP. Patients with diabetes for less than 10 years had less worsening in visual acuity as compared to patients with diabetes for more than 10 years. Mean preoperative central foveal thickness was 273.69µm which reduced to 259.73µm at three months follow up. Mean preoperative vision was 0.23 ± 0.11 log units, which worsened significantly to 0.36 ± 0.20 log units (P = 0.001) at one week, and 0.24 ± 0.21 log units at 3 months , this change was not statistically significant.

OCT features at baseline were normal in 44 eyes (65.6%). The common abnormalities seen were spongy edema in 5 eyes (7.4%), epiretinal membrane in six eyes (8.9%), subretinal fluid in four eyes (5.9 %) and vitreomacular traction in eight eyes (11.9%). After PRP at three months follow up, only 36 eyes (53.73%) had normal OCT and the most common abnormality seen was spongy edema. Nineteen eyes (28.35%) had vision better than and equal to 0.47 log units before PRP which increased to twenty eyes (29.85 %) after PRP.

FIGURE 1- MORPHOLOGICAL CHANGES SEEN ON OCT BEFORE AND AFTER PRP

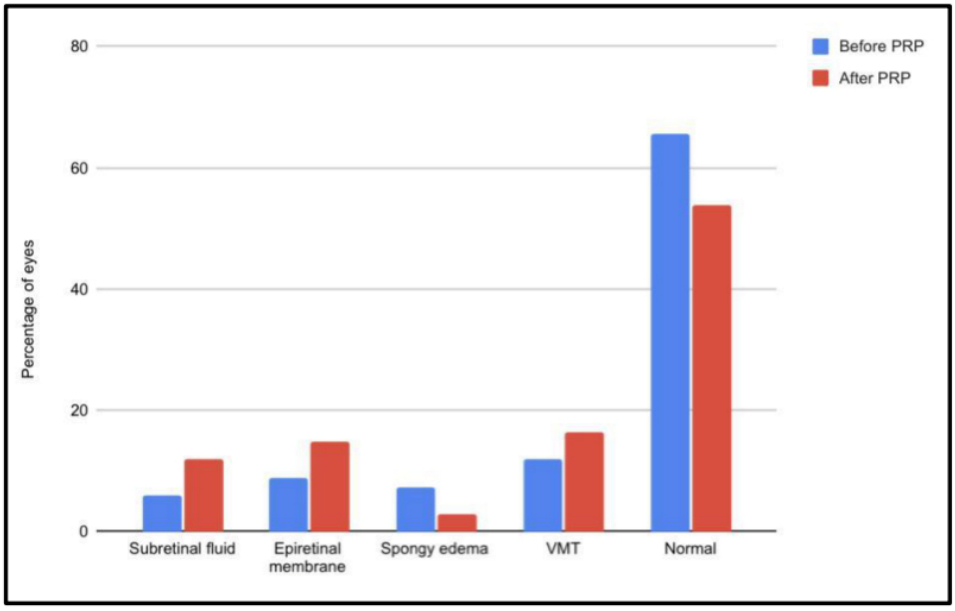
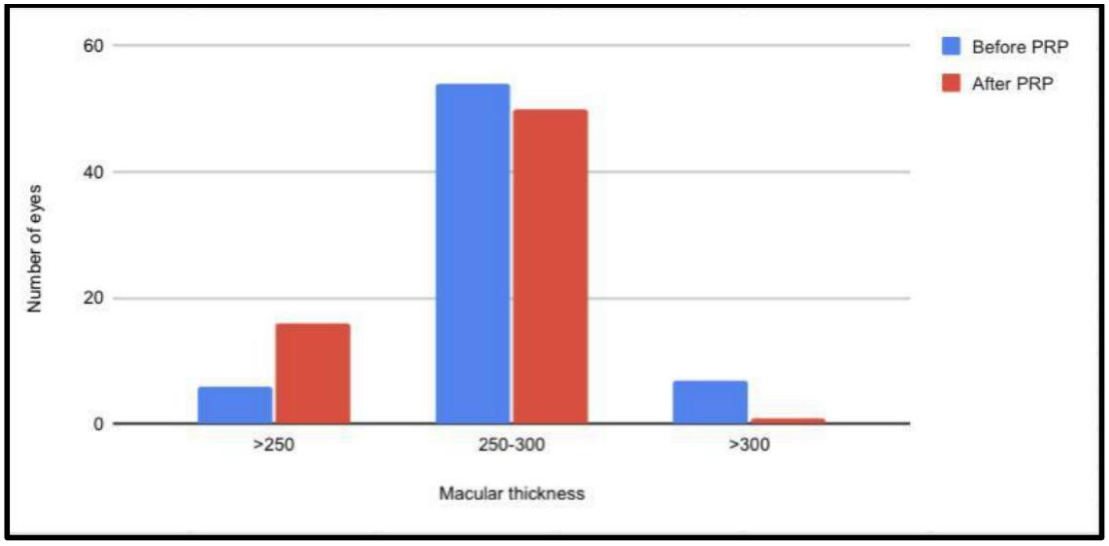


FIGURE 2- DISTRIBUTION OF PATIENTS ACCORDING TO THE CENTRAL MACULAR THICKNESS BEFORE AND AFTER PRP



DISCUSSION

Panretinal photocoagulation is the mainstay treatment in PDR. However, not much improvement in visual acuity was noticed post PRP. In our study, out of 67 eyes, 45 eyes (67.16 %) had maintained their baseline vision, 7 eyes (10.44%) had improved their vision and 15 eyes (22.38%) had deteriorated their vision at 3 months follow-up after PRP. This was in accordance with the results found in studies done by Masahiko Shimura et al., Sheth HK et al., MostafaSaad Sayed Ahmed et al. and Soman M et al. Sheth HK et al.[11] found 40 patients (50%) showed improvement in best corrected visual acuity (BCVA) by 1 line, 21 patients (26.25%) showed improvement in BCVA by 2 lines, 1 patient (1.25%) showed improvement in BCVA by 3 lines, 2 patients (2.5%) showed improvement in BCVA by 4 lines, 14 patients (17.5%) showed no change in BCVA, 2 patients (2.5%) showed deterioration in BCVA by 1 line. Masahiko Shimura et al. [12] also found that more than 80% of the eyes treated with PRP maintained preoperative visual acuity, 11% had decrease in their preoperative visual acuity. Mostafa Saad Sayed Ahmed et al.[13] found that fifteen of the 20 eyes (75%) had stable or improved vision, while 5 eyes (25%) had worsened following PRP. Soman M et al. [14] found in their study that sixty-two eyes (81.58%) had stable or improved vision, while 14 eyes (18.42%) had worsened visual acuity.

In our study, we also considered the various morphological changes seen on OCT before and after PRP. Forty four eyes (65.6%) had normal macula before PRP whereas only 36 eyes (53.73%) had normal macula after PRP. Only 4(5.9%) eyes had subretinal fluid before PRP and it increased to 8(11.9%) eyes after PRP .Similarly, 6(8.9%) eyes had epiretinal membrane, 5(7.4%) patients had spongy edema, 8(11.9%) patients had VMT (vitreo-macular traction) before PRP whereas 10 (14.9%) patients had epiretinal membrane, 2(2.9%) patients had spongy edema, 11(16.4%) patients had VMT (vitreo-macular traction) after PRP.

This was in accordance with the study done by Soman M, Ganekal S et al. [14] who found 34% of eyes with a normal macula showed morphological changes following

PRP. The most common morphological change on OCT after PRP was spongy edema, seen in 24 eyes, followed by cystoid macular edema in 36 eyes (23.7%), vitreomacular traction in 28 eyes (18.4%), epiretinal membrane in 24 eyes (15.8%), and subfoveal serous detachment in 16 eyes (10.5%).

In our study, average central foveal thickness before PRP was 273.69 µm and average central foveal thickness after PRP was 259.73µm. Similar results were obtained by Ahsan Mukhtar et al.[15] who found that mean central foveal thickness (CFT) as measured by OCT was 391.93 ± 170.43µm before treatment and 316.91 ± 90.42µm after treatment. Similarly, Dimple Modi et al. [16] also found that CFT improved in 71% (15/21) eyes. Contrary to this , Lee Sung bok et al. [17] found an increase in central foveal thickness from 199±20.9µm to 220±17.3µm at 12 months.

The Diabetic Retinopathy Clinical Research Network 19 has reported that foveal thickness on OCT does not correlate with visual acuity, particularly in eyes with macular edema undergoing focal laser treatment, and even shows paradoxical responses. Characteristics of macular edema correlate better with visual outcome. [14]

CONCLUSION

We conclude that in patients of proliferative diabetic retinopathy, PRP reduces the risk of visual loss and complications associated with progression of neovascularization. PRP may cause a temporary drop in vision in the early post laser phase. This may be seen as early as one week after PRP and can normalize by 3 months. Macular edema is the commonest cause of this drop in vision. Therefore, it is prudent to warn patients of this potential outcome. Nonetheless, timely applied treatment helps to maintain good visual acuity in cases of diabetic retinopathy. Early diagnosis leads to early treatment and a better outcome, which in turn improves the quality of life.

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