VISUAL OUTCOME FOLLOWING PANRETINAL PHOTOCOAGULATION IN PROLIFERATIVE DIABETIC RETINOPATHY

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ABSTRACT

BACKGROUND

Diabetes mellitus can be called as a noninfectious pandemic and the incidence of diabetic retinopathy is also uncontrollable. This vision-threatening complication can be treated by early diagnosis and effective treatment like panretinal photocoagulation.

The aim of the study is to evaluate the effect of panretinal photocoagulation on visual acuity, colour vision, contrast sensitivity and severity of visual field changes.

MATERIALS AND METHODS

Prospective study of visual outcome following panretinal photocoagulation in patients with proliferative diabetic retinopathy conducted in Retina Clinic, RIO, Trivandrum, during the time period one year from April 2008.

Inclusion Criteria- Eyes with proliferative diabetic retinopathy, visual acuity better than or equal to 6/60, a follow up of at least 6 months after panretinal photocoagulation.

Exclusion Criteria- Eyes with cataractous changes in the lens, eyes, which would be undergoing or have undergone focal photocoagulation eyes, which undergone barrage or sectoral retinal photocoagulation, patients with colour blindness, eyes with vitreous haemorrhage and macular preretinal haemorrhage, glaucomatous patients with peripheral field loss.

RESULTS

The mean age of the patients was 52 years. Male patients (30) outnumbered the female patients (23). Mean duration of diabetes was 14.42 years. Though, there is a statistically significant reduction in visual acuity in the first followup, which was improved and stabilised by 6 months. There is a statistically significant reduction in the contrast sensitivity, which was stabilised after 3 months. Only, 9.5% patients had peripheral constrictions of visual field and no significant change in the colour vision.

CONCLUSION

We recommend panretinal photocoagulation for all patients with proliferative diabetic retinopathy.

KEYWORDS

Panretinal Photocoagulation, Proliferative Diabetic Retinopathy, Contrast Sensitivity, Visual Acuity.

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BACKGROUND

Diabetes is a major cause of blindness and is a leading cause of new cases of blindness for people between the ages of 20-64 years. Approximately, 25% of all diabetics have some form of retinopathy. The incidence and severity increase consistently overtime so that greater than 90% of diabetics develop retinopathy at some time during their lives.

India has 1/4th of the world's total blind population that is 12 million people have less than 6/60 in the better eye. Of this, diabetic retinopathy stands sixth among most frequent causes of blindness. WHO estimated that in India the number of adults with diabetes will be highest in the world, 19 million in 1995 to 80 million in 2030. The socioeconomic burden resulting from visual impairment due to diabetic retinopathy is a serious concern.

Multicentric studies such as DRS[1] (diabetic retinopathy study), ETDRS[2] (early treatment diabetic retinopathy study) and UKPDS (United Kingdom prospective diabetic study).[3] Developed specific recommendations for the management of diabetic retinopathy. Laser photocoagulation is the accepted treatment for the control of diabetic retinopathy. All the above studies have given specific guidelines for laser treatment in diabetic retinopathy.

Diabetes and Visual Loss- In diabetic patients having good vision (6/6-6/18), but without retinopathy, vision declined at an annual rate of 2% to a moderately-impaired level (6/24 to 6/60). When initial vision is in this moderately-impaired range, about 1.3% of the patients develop legal blindness (<6/60) each year. Only 0.3% of the patients in the good vision group deteriorated to the level of the legal blindness each year. Once established retinopathy is present, the annual rate of visual deterioration increases.

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Visual deterioration can also be correlated with age. In younger patients, the chance of legal blindness is only 3% in 5 years compared to 20% in patients over the age of 60 years at the time diabetes is diagnosed. The visual loss usually results from non-resolving vitreous haemorrhage, tractional retinal detachment or diabetic macular oedema. Also, the risk of visual deterioration is greater when there are retinal haemorrhages or exudation than when only microaneurysms are present. Proliferative retinopathy has a poorer prognosis than background retinopathy. It has been shown that the prognosis is worse when proliferative changes are near the disc. One year after the first significant vitreous haemorrhage, about one third patients maintain good vision (6/12 or better), one third develop moderately impaired vision and rest one third become legally blind. One third develop moderately impaired vision and rest one third become legally blind. If one eye becomes blind, the chance of the other eye becoming blind in the next one year is extremely high (60%). In brief, the interval from the onset of disease to the onset of severe blindness is an average of 17.4 years.

However, the 5-year risk of Severe Visual Loss (SVL) can be reduced to less than 5%, if a person with diabetic retinopathy (defined later), undergoes scatter (panretinal) photocoagulation. Furthermore, people with Clinically Significant Macular Oedema (CSME) can have the risk of Moderate Visual Loss (MVL) reduced to approximately 50% or less if they undergo appropriate laser surgery. Since, diabetic retinopathy is often asymptomatic in its most treatable stages, its early detection through regularly scheduled examination becomes critical.

Aims and Objectives- To evaluate the effect of panretinal photocoagulation on-

- Visual acuity.
- Colour vision.
- Contrast sensitivity.
- Severity of visual field changes.

MATERIALS AND METHODS

Prospective study of visual outcome following panretinal photocoagulation in patients with proliferative diabetic retinopathy conducted in Retina Clinic, RIO, Trivandrum, during the time period one year from April 2008. Subjects who satisfied the inclusion criteria were selected for the study. A written consent from the patients included in the study was taken. A thorough history regarding duration, nature of treatment, type of diabetes and associated systemic diseases like hypertension, cardiovascular and renal disease was taken. All patients enrolled in the study underwent a standard ocular examination.

After objective and subjective refraction, Best Corrected Visual Acuity (BCVA) was determined using standard Snellen's charts. Colour vision was determined using Ishihara's pseudoisochromatic chart. Contrast sensitivity was measured using Pelli-Robson chart at one meter distance. Visual field was examined with automated Humphrey field analyser using full field 81 program.

A complete slit-lamp examination of the anterior segment was done. Intraocular pressure was measured in every case by Goldmann applanation tonometry.

A detailed fundus evaluation was performed with an indirect ophthalmoscope using +20D lens and slit-lamp biomicroscopy using +90D lens. Each fundus was subsequently graded as per classification and extent and location of hard exudates was accurately recorded.

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After explaining the procedure and informed consent from the patient, photocoagulation using diode laser with a wavelength of 810 nm with a slit-lamp delivery system was done in 4 sittings at one-week interval.

Follow up was done at 1, 3 and 6 months after last sitting of panretinal photocoagulation during each follow up, routine ocular examination was done, then best corrected visual acuity, contrast sensitivity, colour vision and fundus examination was done and at 6 months visual field was analysed by FF81.

Inclusion Criteria-

1. Eyes with proliferative diabetic retinopathy.
2. Visual acuity better than or equal to 6/60.
3. A follow up of at least 6 months after panretinal photocoagulation.

Exclusion Criteria-

1. Eyes with cataractous changes in the lens.
2. Eyes, which would be undergoing or have undergone focal photocoagulation.
3. Eyes, which undergone barrage or sectoral retinal photocoagulation.
4. Patients with colour blindness.
5. Eyes with vitreous haemorrhage and macular preretinal haemorrhage.
6. Glaucomatous patients with peripheral field loss.

Statistical Analysis- All the data were computed and statistical analyses were done using the SPSS PC Windows version 17.0.

Statistical Methods- Univariate analysis- Quantitative variables were summarised as means.

OBSERVATION AND RESULTS

A total of 60 patients with proliferative diabetic retinopathy were included in the study at its beginning. Of these, 1 patient died and 6 patients lost follow up. Finally, a total of 95 eyes of 53 patients fulfilled the inclusion criteria of the study. Follow up data were available for 95 eyes of 53 patients who were studied prospectively. The demographic

factors and diabetic characteristics were studied in each patients. The clinical features and effect of panretinal photocoagulation on visual acuity, colour vision, contrast sensitivity and visual field were studied subsequently by following them up at 1 month, 3 months and 6 months respectively following panretinal photocoagulation.

Demographic Characteristics

Age Distribution- Mean age of the study sample is 51.96 years (SD = 6.32; 95%, CI - 50.224 to 53). On extrapolating into general population, the mean age of population is 50 years.

	Number of Patients	Percentage	95%, CI
Male	30	56.6	56.46 to 56.70
Female	23	43.4	43.26 to 43.54
Total	**53**	**100.0**	

Table 1. Gender Distribution

Among 53 patients studied, 56.6% are males and 43.4% are females.

Duration of Diabetes- The mean duration of diabetes in our study group was 14.42 (SD = 3.65; 95% CI = 13.42 - 14.42). The mean duration of diabetes of population with proliferative diabetic retinopathy is 13.42 years to 14.42 years at 95% confidence interval.

	Frequency	Percentage	95%, CI
Right eye	50	52.6	52.5-52.7
Left eye	45	47.4	47.3-47.5
Total	**95**	**100.0**	

Table 2. Eyes Involved

Among our study population, 52.6% patients presented with right eye involvement, whereas 47.4% had left eye involvement.

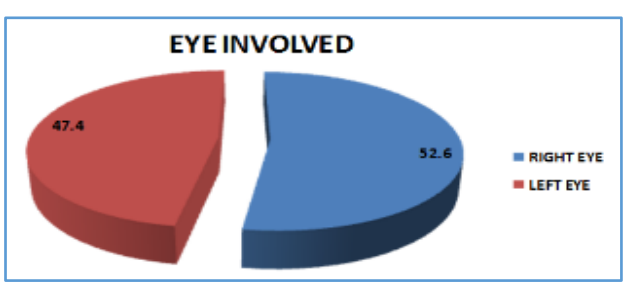

Chart 2. Eye Involved

Comparison of best corrected visual acuity of pre-PRP with follow ups.

	Number of Patients	Mean	Std. Error	Std. Deviation
Pre-PRP	95	0.80	0.028	0.275
1 month	95	0.76	0.030	0.288
3 months	95	0.77	0.028	0.277
6 months	95	0.79	0.034	0.327

Table 3. Comparison of Best Corrected Visual Acuity of Pre-PRP with Followups

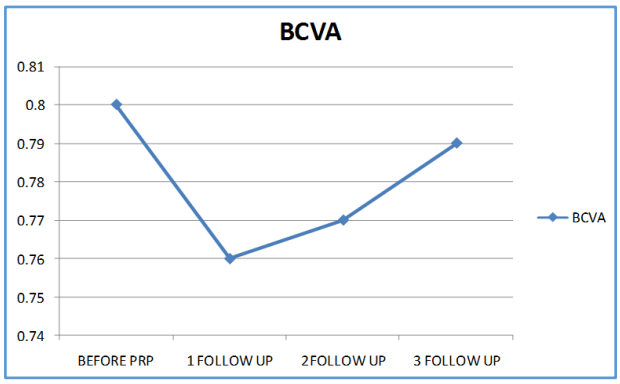

Chart 3. BCVA

The mean best corrected visual acuity before PRP was compared with mean BCVA post-PRP at 1 month, 3 months and 6 months later. There was a drop in the mean BCVA at first follow up at 1 month than pre-PRP BCVA, which was statistically significant (p=0.01). There was no statistically significant difference in BCVA at 2nd and 3rd follow up visits.

Paired t Test

1. Prelaser BCVA & BCVA at first follow up P =.01
2. BCVA at first follow up & BCVA at second follow up P =.15
3. BCVA at second follow up & BCVA at third follow up P =.13

Contrast Sensitivity

	N	Mean	Std. Error	Std. Deviation
Contrast sensitivity before PRP	95	1.4316	0.01729	0.16854
Contrast sensitivity at 1st followup after PRP	95	1.3674	0.01780	0.17348
Contrast sensitivity at 2nd followup	95	1.3389	0.01713	0.16698
Contrast sensitivity at 3rd followup	95	1.3389	0.01713	0.16698

Table 4. Contrast Sensitivity

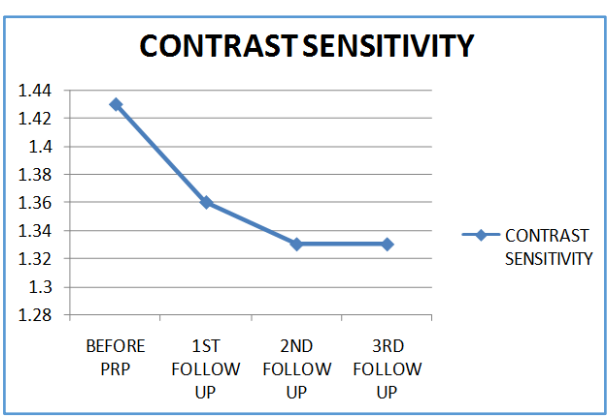

Chart 4. Contrast Sensitivity

Paired t-test was used to analyse changes in contrast sensitivity at each followups.

The mean pre-PRP contrast sensitivity was 1.43 and mean contrast sensitivity of 1st followup visit was 1.36. The mean contrast sensitivity at 2nd followup was 1.33 and mean

contrast sensitivity of 3rd follow up visit was 1.33. There is a statistically significant reduction in contrast sensitivity at 1st and 2nd follow up visits (p<0.001). But, the mean contrast sensitivity at 3rd and 4th follow up remained the same.

Visual Field- Among 95 eyes studied, significant peripheral constriction of visual fields was seen only in 9.5% of cases.

	Frequency	Percentage	95%, CI
Yes	9	9.5	9.44-9.56
No	86	90.5	90.44-90.56
Total	**95**	**100.0**	

Table 5. Visual Field

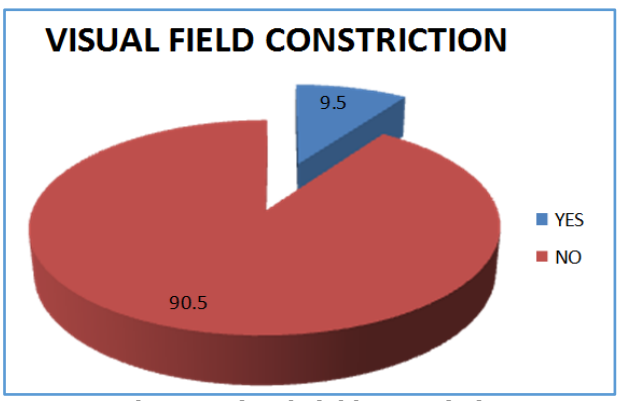

Chart 5. Visual Field Constriction

DISCUSSION

Diabetic retinopathy is an emerging public health problem with both medical and economic considerations involved. It is now considered as the commonest cause of new blindness among the working age adults. The Early Treatment Diabetic Retinopathy Study (ETDRS) and Diabetic Retinopathy Study (DRS) provided essential data for establishing guidelines for the timeless and effective treatment of diabetic retinopathy.

The ETDRS provided information regarding the timing of photocoagulation of eyes with NPDR and early PDR and conclusively proved that focal photocoagulation for eyes with Clinically Significant Macular Oedema (CSME) was beneficial in preventing Moderate Visual Loss (MVL) by 50%.

Current studies describe the beneficial and adverse effects of panretinal photocoagulation over visual functions. We studied the effect of panretinal photocoagulation on visual functions like visual activity, colour vision, contrast sensitivity and visual field following PRP in proliferative diabetic retinopathy cases.

- Our results showed there is a statistically significant reduction in visual acuity in the 1st follow up, which was stabilised in the next followups.
- There is a statistically significant reduction in contrast sensitivity in 1st and 2nd followups after PRP, but it was stabilised and no change was noticed in the subsequent followups.
- Only 9.5% of patients had a significant peripheral constriction of visual fields.
- No statistically significant change in colour vision following panretinal photocoagulation.

Age- Masahiko Shimura et al[4] and associates in their prospective study of patients with severe non-proliferative diabetic retinopathy showed that the mean age of the patients was 58.8 years.

Mohan Rema[5] et al in their retrospective study showed that the mean age of the patients who underwent panretinal photocoagulation was 53 years.

Our study also showed that the mean age of the patients was 52 years, which was comparable with previous studies.

Gender- In the study by Masahiko Shimura et al,[4] 56.2% of patients were males and 43.8% were females. In our study, 56.6% were males and 43.4% were females, which was comparable with previous studies.

Diabetic Status- Mean duration of diabetes in our study was 14.2 years. This was comparable to study by Mohan Rema et al[5] who found the mean duration of diabetic to be 14 years.

Visual Acuity- Masahiko Shimura et al[4] and associates in a prospective study of 64 patients have shown that for eyes with severe diabetic retinopathy and good visual acuity, panretinal photocoagulations did not affect post-laser visual acuity in more than 80% of patients.

Though there is a statistically significant reduction in visual acuity in the 1st follow up, it was improved and stabilised in the next followups.

Diabetic retinopathy study showed that there is decrease in visual acuity of one line in 11% of eyes following panretinal photocoagulations using argon laser.

Colour Vision- Khosla PK et al[6] and associates have shown that colour vision error scores using Farnsworth munsell 100 hue test were significantly higher immediately after PRP.

In our study, there is no difference in the colour vision. This may be due to the type of test that we used due to non-availability of the sensitive colour vision tests.

Contrast Sensitivity- Khosla PK et al[6] and associates have shown that contrast sensitivity was significantly affected immediately after PRP, but stabilised to pre-laser level by the end of 3 months.

In our study, also there in statistically significant reduction in the contrast sensitivity following PRP in first followup and there is also further significant reduction in the 2nd followup. Then, the contrast sensitivity was stabilised to a level of 2nd followup, i.e. 3 months after PRP.

Visual Field- Henrickson M and Heigil et al[7] have shown that retinal sensitivity have shown depressed even before treatment, but was significantly lower 2 weeks after treatment. Visual fields remained stable 4 months later. In spite of considerable impairment of visual field, after treatment, subjective problem were small and visual field impairment seemed to have little influence on everyday life.

Diabetic retinopathy study shown that there is constriction of peripheral visual field due to treatment in some eyes, which was more severe with xenon photocoagulation.

Zaluski et al[8] and associates in their prospective study of 12 patients with pre-proliferative or proliferative diabetic retinopathy have shown that, though there is loss of retinal sensitivity after panretinal photocoagulation, no patients complained of it.

Unlike other studies, our study showed only 9.5% of cases with constriction of visual fields.

Limitations of the Study- Our study has few limitations, which includes-

1. Small sample size.
2. Short period of followup.
3. Unavailability of sensitive colour vision test.

Summary- 95 eyes of 53 patients were selected after meeting the inclusion and exclusion criteria who had proliferative diabetic retinopathy and they were evaluated at baseline for best corrected visual acuity, colour vision, contrast sensitivity and visual field. Panretinal photocoagulation using diode laser with a wavelength of 810 nm and slit-lamp delivery system was done in 4 sittings.

Patients were followed up at 1 month, 3 months and 6 months following panretinal photocoagulation comparison were made with old results.

The aim of our study was to evaluate the visual functions in patients who are undergoing panretinal photocoagulation for proliferative diabetic retinopathy.

The following were the various outcomes of the study.

1. The mean age of the patients was 52 years.
2. Male patients (30) outnumbered the female patients (23).
3. Mean duration of diabetes was 14.42 years.
4. Though there is a statistically significant reduction in visual acuity in the 1st follow up, which was improved and stabilised by 6 months.
5. There is a statistically significant reduction in the contrast sensitivity, which was stabilised after 3 months.
6. Only 9.5% patients had peripheral constrictions of visual fields.
7. No significant change in the colour vision.

CONCLUSION

Our study showed that there is significant reduction in the contrast sensitivity after panretinal photocoagulation. But, there is no difference in colour vision, no significant constriction of visual field. There is stabilisation of visual acuity by 6 months after panretinal photocoagulation. As there is 2 years risk of severe visual loss without treatment, side effects of panretinal photocoagulation outweighs the risk of harmful treatment effects.

Hence, we recommend panretinal photocoagulation for all patients with proliferative diabetic retinopathy.

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