Photostress test as a predictor of macular dysfunction in patients with asymmetrical Age-related maculopathy

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Abstract

Background: Age related maculopathy causes irreversible central visual loss in elderly population. Photo stress recovery time and Amsler grid evaluation are the tests used to assess the functional integrity of macula.

Aim of Study: 1. To determine the Photo stress recovery time (PSRT) in patients with asymmetrical age-related macular maculopathy (ARM)

2. To find out the prevalence and the relation between risk factors, visual acuity, Amsler evaluation and photo stress recovery time.

Settings and Design: Hospital based Case series study.

Materials and Methods: Out of the 2104 participants above 50years, 37 patients presented with features of age related maculopathy. The systemic and ocular risk factors of ARM was observed. Relevant clinical examination, photo stress test and amsler grid monitoring was done in all patients.

Statistical analysis was done using SPSS Version 18.

Results: The overall prevalence of age related maculopathy in the study population was 1.76%, and it increases with age. Mean age was 62.84 years ± 7.97. Males were more affected by the disease. Smoking, dyslipidemia, cortical cataract and hyperopia were the most common risk factors. Photo stress recovery time was prolonged in all patients with reduced visual acuity. Even in eyes with good vision it was abnormal in the early stage of the disease before visible change occurred in the macula. Abnormal recovery time was also noted in patients with normal Amsler grid.

Conclusion: PSRT helps in early detection of macular dysfunction in better eye, as well as progression in worse eye in patients with asymmetrical age related maculopathy.

Keywords: Age related maculopathy-visual acuity- Amsler grid-abnormal PSRT

Introduction

Age related maculopathy (ARM) is a gradually progressive degenerative disorder affecting the macula causing impairment of central vision, in the elderly and may affect the quality of life. Age-related macular degeneration is reserved for the late form of the disease.[1] The disease is considered to have multi factorial aetiology Photo stress test reflects the efficiency with which the visual system recovers from light exposure, and may decline with age.[2,3,4] It is an indicator of the functional status of the macula and will be abnormal in macular diseases even before the clinical findings are evident.[5,6] Amsler grid evaluation of central 20^0 of visual field helps in screening as well as monitoring patients with macular diseases. This study intends to analyze the role of photo stress test and amsler grid evaluation in prognosticating visual acuity and severity of age-related maculopathy. Identification of the risk factors and early detection of the disease may lead to preventive strategies to delay the development of late stages of AMD and associated visual loss.

Materials and Methods

This was a hospital based case series descriptive study to know the prevalence and to identify the relation between ocular and systemic risk factors, visual acuity, Amsler grid abnormalities and photo stress recovery time in subjects with clinical features of age-related maculopathy. A written informed consent was obtained from all patients taking part in the study, after approval from institutional ethics committee.

Patients above the age of 50years attending the out-patient department with complaints of reduced vision or for routine eye check-up who had ophthalmoscopic features of age related maculopathy were taken up for the study. ARM was graded according to the international classification and grading system.[1] Patients with other retinal or optic nerve pathology causing reduced vision, those with media opacities hampering fundus view were excluded.

A detailed history regarding the diet, smoking or other addictions was taken. History of or the presence of systemic hypertension, diabetes, cardiovascular disease, dyslipidemia was enquired. Ocular examination included slit lamp biomicroscopy, indirect ophthalmoscopy, testing visual acuity for distance and near, Amsler grid evaluation for absence or distortion of mires. Snellen acuity for distance and near was converted into log MAR. Photo stress test was done by shining a bright torch in front of each eye at a distance of 3cm for 10seconds, and the time taken to read the line above the pre-test acuity was noted. Duration of more than 30 seconds was considered as abnormal.

Eyes were grouped into better eye and worse eye based on the severity of macular lesions. Statistical analysis was done with SPSS 18 version. Paired t test and one way ANOVA test were used to compare means and chi square test was done to test variance. P value of <0.05 was considered significant.

Results

The study group included 37 patients with ARM out of the 2104 patients screened over a period of 1 year, with an overall prevalence of 1.76%. The prevalence of ARM based on the type of ARM and age group is given in Table 1. The mean age was 62.84 years ± 7.97 with youngest at 50yrs and oldest at 75yrs. There were 23 males and 14 females. 26 patients had Dry ARM and 11 had wet ARM. Among the systemic risk factors implicated, dyslipidemia was seen in 54.1% and smoking in 45.9%.Main ocular risk factors noted were cortical cataract (43.2%) and hyperopia (27.3%) The distribution of cases based on demographic features and risk factors is given in Table 2.Distant vision (log MAR) in the better eye ranged from 0-1.4 with a mean value of 0.367 ± 0.343 and near vision 0.357 ±1.42 (range 0.3-1.1). In the worse eye it was 0.805 ±0.667 (range 0-2) and near acuity 0.541 ± 0.298(range 0.3—1.1). The mean Photo stress recovery time (PSRT) in the better eye was 26.03 ± 26.2 and in the worse eye it was 55.59 ± 47.62. Paired t test was used to find the correlation between visual acuity (both

distance and near) in better and worse eye, and p value was <0.05 in all cases. The relation between visual acuity and PSRT is shown in the scatter plot Fig. 1 & 2. There was a prolongation in recovery time with the reduction in visual acuity. Amsler grid evaluation was abnormal in 13.5% in better eye and 43.2% in worse eye. Comparison of Amsler grid and PSRT is shown in Table 3. Photostress recovery time was abnormal even in eyes with normal amsler grid. In the better eye, in dry ARM the mean PSRT was 21.27±16.5 and in wet ARM it was 37.27±40.27. In the Worse eye, mean PSRT in dry ARM was 34.65 ± 34.46 and wet ARM .105.09 ±36.87 (Table 4). Thus PSRT was prolonged in all patients in the worse eye, and even in the better eye in wet ARM.

Table 1: Prevalence of Age-related Maculopathy

	Total ARM No. Prevalence	Dry No. Prevalence	Wet No. Prevalence
Study group No.			
2104	37 1.76 %	26 1.23%	11 0.52%
Age group in years			
50-60	16 1.4%	10 0.88%	6 0.53%
61-70	13 2.3%	12 2.1%	1 0.17%
71-80	8 2%	4 1%	4 1%

Prevalence of ARM increases with age

Table 2: Distribution of case based on Demographic features and risk factors

Variable		No.	Percentage	No.	Percentage
Type of ARM	Dry	26	70.3%		
	Wet	11	29.7%		
Systemic risk factors	Dyslipidemia	20	54.1%		
	Smoking	17	45.9%		
	Hypertension	11	29.7%		
	Diabetes	7	18.9%		
	Cardiac disorders	7	18.9%		
Ocular risk factors	**a)Refractive error**				
	Emmetropia	7			
	Myopia	3			
	Hyperopia	27			
	b)Cataract	**Better Eye**		**Worse Eye**	
	Nil	12	32.4	12	32.4
	Cortical	16	43.2	19	51.4
	Nuclear	2	5.4	3	8.1
	Postr.subcapsular	6	16.2	3	8.1
	Pseudophakia	1	2.7	0	

Table 3: Photostress recovery time and Amsler grid

| PSRT	Normal		Abnormal	
	Better Eye	**Worse Eye**	**Better Eye**	**Worse Eye**
Mean+SD	19.31+14.83	21.95+13.42	69+42.48	99.75+39.23
Cases No. (%)	28(75.7%)	17(45.9%)	9(24.3%)	20(54.1%)
Amsler Grid	32(86.5%)	21(56.8%)	5(13.5%)	16(43.2%)
p value	*0.000		*0.000	

*Statistically significant
PSRT is abnormal even in cases that showed normal Amsler grid

Table 4: Correlation bet. Photo stress recovery time & Type of ARM
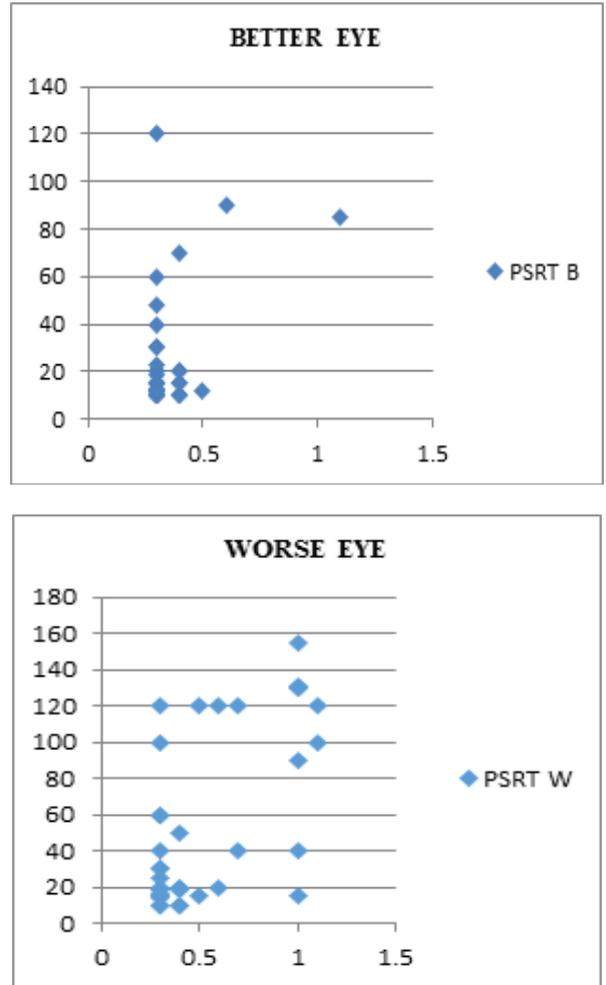
Type of AMD	PSRT Better eye Mean SD	PSRT Worse eye Mean SD
Dry	21.27 16.15	34.65 34.46
Wet	37.27 40.27	105.09 36.87
P value	0.090	*0.000

*Statistically significant

  PSRT was prolonged in the worse eye of all patients with ARM as well as in the better eye of those with Wet ARM
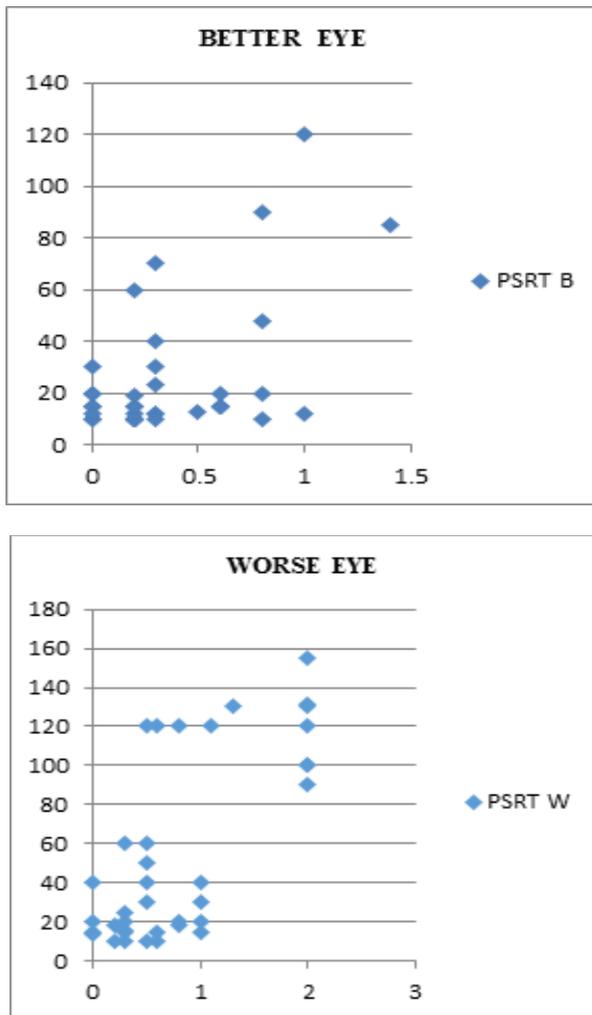
Fig. 1: PSRT VS Distant visual acuity
PSRT is prolonged as Visaul acuity decreases

Fig. 2: PSRT VS Near vision
PSRT is prolonged with reduction in near acuity

Discussion

    There are several studies describing the prevalence and risk factors for age-related maculopathy.[7-12] Non modifiable risk factors implicated for the disease include advancing age, family history, female sex, hyperopia, white race and iris colour. Modifiable risk factors include smoking.[13] Lack of nutrients and antioxidants[14,15] obesity, blood pressure, cholesterol levels[5,16] cardiovascular disease[16,17] and exposure to solar radiation. Dry AMD is diagnosed by retinal pigmentary abnormalities and soft drusen in the early stages and retinal pigment epithelial degeneration and geographic atrophy in the late stage. Wet AMD is characterized by the development of choriodal neovascular membrane and related manifestations like retinal pigment epithelial detachment, retinal pigment epithelial tears, sub retinal haemorrhage, fibrovascular disciform scarring and vitreous haemorrhage.

    The prevalence of ARM in this study is 1.76%. This is in accordance with a study by Krishnaiah et

al[18] where the prevalence is 1.82%. There are several other population based studies[19-21] describing the prevalence of age related maculopathy. The prevalence of ARM increased from 1.4% in 50-60yrs age group to 2% in the age group above 71yrs. The increase in prevalence was four fold with age in wet ARM. This finding is in accordance with various studies like Beaver Dam Study, Rotterdam study and Blue Mountains Eye Study, which show that advancing age is a major risk factor for development of AMD.[18-21] Majority of patients had dry ARM. Males were more affected in our study. This is in accordance with the study by Miyazuki et al.[22] Among the risk factors dyslipidemia, Smoking, cortical cataract and hyperopia was seen in this study as seen in many other studies.[13,18,23] None of the risk factors implicated for the disease had statistically significant correlation with photo stress recovery time. This is similar to a study by Saboci et al[24] where photo stress test was found to be normal in chronic smokers. Close apposition of macular photoreceptors and retinal pigment epithelial cells, which are an integral part of visual pigment regeneration and photoreceptor renewal is essential for normal macular function. Retinal pigment epithelial (RPE) abnormality occurs early in ARM leading to accumulation of lipofuschin resulting in drusen. In late stage, there is pigment epithelial atrophy in dry type and development of choriodal neovascular membrane in wet ARMD. These changes disrupt the normal pigment epithelial photoreceptor apposition resulting in RPE dysfunction. Correlation between visual acuity (distant and near) and photo stress recovery time in better eye and worse eye within the groups were statistically significant as seen in a study by Sandberg et al.[5] A prolonged PSRT was associated with a reduction in acuity of vision unlike a study by Little wood et al[25] where there was poor correlation. In the less severely affected eye, an abnormal PSRT was found even in those with good vision which indicates that this test helps in predicting early functional loss in the macula in ARM. Abnormal Amsler grid is an indicator of reduced macular function. Abnormalities in the Amsler grid varied from blurring of the mires in a small area to scotoma in the central part of the grids. Abnormal PSRT was found in all patients with abnormal amsler in either eye (p value 0.000). 24.3% patients had prolonged PSRT in the better eye whereas only 13.5% showed an abnormal Amsler grid. In the worse eye also 54.1% showed prolonged PSRT while Amsler abnormality was seen only in 43.2%. This indicates that Photo stress test may be helpful in detecting macular dysfunction earlier than Amsler grid in eye with less severe disease and or with better vision. Prolonged PSRT was seen in the worse eye of all patients irrespective of the type of AMD[5] and also in the better eye in wet AMD. Photo stress recovery time can be prolonged in other diseases affecting the macula like diabetes and drug induced maculopathy.[26,27] Recovery time is more prolonged in cases of ARMD than in diabetes as the pathology lies at the level of RPE-photoreceptor complex unlike in diabetes where it is in the inner retinal layers.[26]

At present there is no medical intervention that can prevent incidence or progression of age related maculopathy. In patients with exudative age-related macular degeneration (AMD), photocoagulation of the choroidal new vessels and intra vitreal anti VEGEF agents has been shown to reduce the incidence of severe visual loss. But in dry AMD there is no definitive treatment. For this reason detection of avoidable and modifiable risk factors may help to delay the progression of the disease. The definite risk factors for the disease can be clearly identified only by a case control study with a prolonged period of follow up. Since age- related maculopathy is not entirely preventable, awareness should be created regarding the importance of early detection of the disease. Preventive measures that people can take include eating a diet low in fat but rich in carotinoids (especially green leafy vegetables), life style modification[28] controlling blood pressure and cholesterol levels, wearing sunglasses at midday to protect the eyes and avoid smoking. First degree relatives of affected patients or those with a family history of the disease should undergo screening after the age of fifty.

Limitations

As the study comprises of a small subgroup, prevalence and correlation between systemic risk factors and AMD in the study population cannot be projected to the general population. Study group includes patients with Diabetes also which can lead to an abnormal PSRT. The photo stress recovery time is dependent on the speed of regeneration of photo pigments and there is no standardization for the procedure. OCT was not taken to confirm the type and stage of the disease.

Conclusion

Photo stress test is a simple, easy to perform test that can be used as a screening tool to detect early macular dysfunction in the better eye of patients with severe age-related macular degeneration, and to detect progression in the worse eye. This is important in a tropical country like India where there are abundant chances of ultraviolet exposure which can increase the risk of age- related maculopathy in the population.

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