Original Article

Evaluation of Risk Factors for Age-related Macular Degeneration

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ABSTRACT

Aim: The aim of the study was to identify the risk factors such as smoking, alcohol, tobacco chewing, dietary habits, obesity, sunlight exposure, and other systemic diseases such as diabetes mellitus and hypertension for age-related macular degeneration (ARMD). **Design:** Cross-sectional Case–control study of 450 patients above 55 years of age. **Materials and Methods:** They were given a questionnaire asking about occupation, smoking, tobacco chewing, alcohol consumption, diet, and other illnesses. Record of their body mass index and blood pressure was made. A detailed ophthalmic examination revealed 21 patients of ARMD, which were placed in study Group A and the rest 429 were placed in control Group B. **Statistical analysis used:** The Chi-square Analysis. **Results:** Association of ARMD was found with smoking, sunlight exposure, and hypertension. Fish eating was found to be a protective factor. **Conclusion:** We found that avoidance of smoking, control of hypertension by lifestyle modification, consumption of food rich in 3-omega fatty acids, and using sunglasses in early life will help in long run to prevent the development of ARMD later in life.

Key words: Smoking, Ultraviolet radiation, Age-related macular degeneration, Luteal pigments

INTRODUCTION

Age-related macular degeneration (ARMD) is a debilitating eye disease which affects central vision of people above 55 years of age. It accounts for 8.7% of blindness worldwide.[1] It occurs in two forms - dry and wet ARMD.

Dry or geographic ARMD is responsible for 90% of cases. It causes mild-to-moderate gradual loss of vision. It is characterized by the occurrence of macular drusen, focal hyperpigmentation, and pale area of retinal pigment atrophy. Macular drusen are well-defined, yellowish white, slightly elevated spots.[2,3]

Wet or neovascular ARMD is responsible for only 10% cases of ARMD but is associated with comparatively rapidly progressive marked loss of vision. Typical lesions of wet ARMD are drusens with retinal pigment epithelial detachment, choroidal neovascularization, hemorrhagic pigment epithelial detachment, hemorrhagic detachment of neurosensory retina, and disciform subretinal scarring.[2,4]

The prevalence of ARMD might increase as the elderly population becomes proportionally larger and with increasing life expectancy. Environment and other factors including changing lifestyle, dietary habits, and addictions interfere with the disease progression. An early identification of the risk factors pertaining to the population of India is essential for the implementation of the preventive measures.

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Currently, there is no effective treatment that can stop the progression of dry ARMD. Measures to be tried are the preventive interventions.[2]

Although there is considerable information on this topic in the Western countries, till today, there are only few studies on the prevalence and risk factors of ARMD in Indian subcontinent. The investigation of risk factors such as smoking, alcohol consumption, tobacco chewing, dietary habits, obesity, sunlight exposure, hypertension, and diabetes mellitus is important in comprehending the disease and to suggest preventive measures that can retard or control its progression.[1,3-5]

Through this case–control study, we intend to analyze the suggested risk factors of ARMD and their strength if association in the Indian population so that appropriate and timely preventive measures can be adopted to control the disease progression in the Indian population.

Review of Literature

ARMD is found to be more prevalent in smokers as revealed from the earlier studies of Age-related Eye Disease Study Report Number 3,[1] Rotterdam Study,[6] Hammond Jr,[7] and US Twin Study.[8] Schick *et al*.[9] in 2016 have found in their studies that sunlight exposure is a risk factor for ARMD, whereas the study by Delcourt *et al*.[10] does not support a deleterious effect of sunlight exposure in ARMD. Cohort studies of Zhu *et al*.[11] and the US Twin Study[8] have reported that fish consumption can reduce the risk of developing ARMD.

Studies done by the AREDS Report Number 3,[1] Hyman *et al*.[12] and Sperduto and Hiller[13] also provide evidence of association of hypertension with ARMD. Jaisankar *et al*.[14] found no significant association between any obesity indices and presence or severity of ARMD.

Table 1: Risk factors: ARMD

S. No.	Risk factors	Study group A	Control group B
1	Smoking	6	51
2	Alcohol	5	46
3	Tobacco chewing	8	133
4	Sunlight exposure (outdoor)	11	131
5	Frequent fish-eater	4	175
6	Obesity	8	103
7	Diabetes mellitus	7	115
8	Hypertension	10	119

Table 2: Statistical analysis: Risk factors

S. No.	Risk factors	Chi-square	P	Odds ratio
1	Smoking	5.0372	0.0248	2.9647
2	Alcohol	3.4121	0.0647	2.6019
3	Tobacco chewing	0.4681	0.4939	1.3696
4	Sunlight exposure	4.4233	0.0355	2.5023
5	Frequent fish-eater	3.9517	0.0468	2.9281
6	Obesity	2.1376	0.1437	1.9477
7	Diabetes mellitus	0.4316	0.5112	1.3652
8	Hypertension	3.8693	0.0492	2.3682

Aim

To identify the risk factors for ARMD.

Objectives

1. To identify the association of smoking, alcohol, and tobacco chewing with ARMD
2. To identify the association of dietary habits with ARMD
3. To identify the association of obesity with ARMD
4. To identify the association of sunlight exposure with ARMD
5. To identify the association of ARMD and other systemic diseases such as diabetes mellitus and hypertension.

MATERIALS AND METHODS

Type

This was a prospective, case–control study.

Place

This study was conducted at ophthalmic outpatient department (OPD) of a tertiary care hospital.

Period

The study was conducted from May 1, 2018–June 30, 2018.

Sample Size

Sample size was 450 patients.

As per the formula, n = $z2(SD)2l2$, considering 8.7% prevalence from previous studies at type 1 error $\alpha = 0.1$ and type 2 error $\beta = 0.2$, that is, power of test = 80%.

Inclusion Criteria

All patients of 55 years and above attending ophthalmic OPD were included in the study.

Exclusion Criteria

Patients with hazy ocular media interfering with detailed fundus examination.

The study was approved by the institutional ethics committee.

Informed consent, attached as Appendix A, was taken from all the patients. They were subjected to a questionnaire, attached as Appendix B.

In all patients, a record was made of their height, weight, and blood pressure. Based on the height and weight, body mass index was calculated.

Patients were examined by:

- Snellen's drum for visual acuity
- Amsler's grid
- Slit-lamp biomicroscopy (+78 D)
- Direct ophthalmoscopy
- Binocular indirect ophthalmoscopy
- Optical coherence tomography (OCT) in selected cases
- Fundus fluorescein angiography (FFA) in selected cases.

Informed consent for FFA is attached as Appendix C.

The 21 patients diagnosed as ARMD comprised the study Group A [Figures 1 and 2], whereas the rest 429 were placed in the control Group B.

Statistical data were collected and analyzed for the evaluation of risk factors of ARMD.

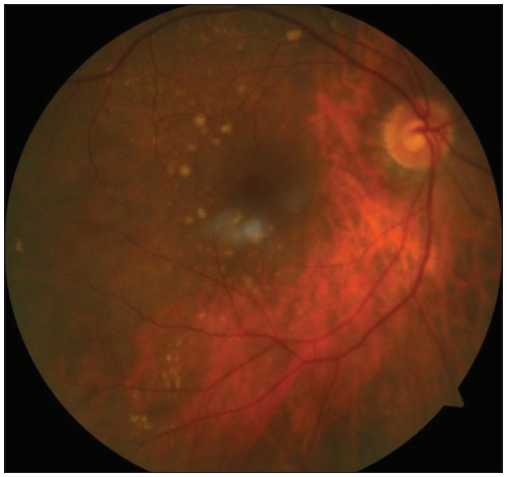

Figure 1: Dry ARMD(Drusens Macula)

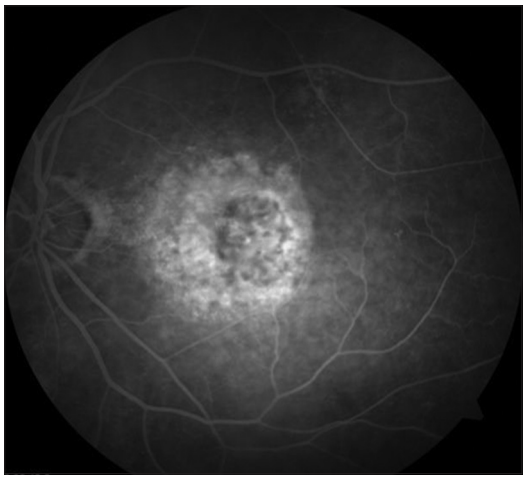

Figure 2: Wet ARMD(Disciform Macular Scarring)

RESULTS

The statistical data collected were analyzed to check for the association of risk factors with ARMD and its strength of association if any, by applying the Chi-square test and odds ratio.

The test results of the association of proposed risk factors with ARMD were as follows:

1. Smoking: The odds ratio was 2.9647 and Chi-square = 5.0372 with $P = 0.0248$

Thus, a statistically significant association was found between smoking and ARMD.

2. Alcohol: the odds ratio was 2.6019 and Chi-square = 3.4121 with $P = 0.0647$

Thus, no statistically significant association was found between alcohol consumption and ARMD.

3. Tobacco chewing: The odds ratio was 1.3696 and Chi-square = 0.4681 with $P = 0.4939$

Thus, no statistically significant association was found between tobacco chewing and ARMD.

4. Sunlight exposure (Outdoor work): The odds ratio was 2.5023 and Chi-square = 4.4233 with $P = 0.0355$

Thus, a statistically significant association was found between sunlight exposure (outdoor work) and ARMD.

5. Frequent fish-eater: The odds ratio was 2.9281 and Chi-square = 3.9517 with $P = 0.0468$

Thus, a statistically significant inverse association was found between frequent fish-eater and ARMD; frequent fish-eating found to be a protective factor.

6. Obesity: The odds ratio was 1.9477 and Chi-square = 2.1376, with *P* = 0.1437

Thus, no statistically significant association was found between obesity and ARMD.

7. Diabetes Mellitus: The odds ratio was 1.3652 and Chi-square = 0.4316 with *P* = 0.5112

Thus no statistically significant association was found between diabetes mellitus and ARMD.

8. Hypertension: The odds ratio was 2.3682 and Chi-square = 3.8693 with *P* = 0.0492

Thus, a statistically significant association was found between hypertension and ARMD.

DISCUSSION

Incidence of smoking is found to be 28.57% in ARMD patients and 11.89% in the control group. It is significantly associated with ARMD and is consistent with the findings from earlier studies of Age-related Eye Disease Study Report Number 3,[1] Rotterdam Study,[6] Hammond Jr,[7] and US Twin Study.[8]

Smoking is known to lower levels of circulating antioxidants and decrease the luteal pigments in human retina. The decreased availability of compounds with antioxidant capabilities could decrease defenses against oxidative damage to the macula.

Incidence of alcohol intake is found to be 23.81% in ARMD patients and 10.72% in control group. Thus, it is not found to be a statistically significant association.

Incidence of tobacco chewing is found to be 38.1% in ARMD patients and 31% in control group. Thus, it is not found to be a statistically significant association.

In ARMD patients, the incidence of sunlight exposure is found to be 52.38%, whereas in the control group, it is 30.54%. Thus, sunlight exposure is significantly associated with ARMD, and the findings are in corroboration with the study conducted by Schick *et al*.[9] UV rays of sunlight cause more damage to macula due to photochemical mechanism, especially in people who work outdoor. However, few studies such as Delcourt *et al*.[10] have found not much significant association. The explanation for discrepancy may be different methods used and difficulties in the assessment of ultraviolet radiation (UVR) exposure.

About 19.05% of ARMD patients and 40.79% of control group were frequent fish-eaters. The main dietary source of 3-omega-fatty acids is fish. Fish eating is significantly a protective factor in ARMD as also reported by the studies of Zhu *et al*.[11] and US Twin Study.[8]

Incidence of obesity is 38.1% in ARMD patients and 24.01% in the control group. No statistically significant association is seen as also stated by study of Jaisankar *et al*.[14]

Incidence of diabetes mellitus is 33.33% in ARMD patients and 26.81% in the control group. No statistically significant association is seen.

Hypertension is about 47.62% in ARMD patients and 27.74% in the control group. Hypertension is significantly associated with ARMD. It affects choroidal perfusion and RPE pump causing accumulation of metabolic debris in retina. Previous studies done by AREDS Report Number 3,[1] Leslie Hyman *et al*.,[12] and Sperduto and Hiller[13] also provide evidence of association of hypertension with ARMD.

CONCLUSION

1. People with habit of smoking have been found to have a higher association with ARMD
2. Patients of hypertension are more prone to develop ARMD
3. People having more sunlight exposure due to outdoor work like farmers and laborers have increased chances of developing ARMD
4. Inclusion of fish in diet is a protective factor against ARMD.

SUMMARY

450 patients above 55 years of age were studied for evaluating risk factors for ARMD. They were given a questionnaire asking about occupation, smoking, tobacco chewing, alcohol consumption, and diet. Patients were also asked about associated illnesses such as diabetes mellitus and hypertension. A detailed ophthalmic examination revealed 21 patients of ARMD, which were placed in study group A and the rest 429 were placed in control group B. Results revealed the association of ARMD with smoking, sunlight exposure, and hypertension. Fish eating was found to be a protective factor. We found that avoidance of smoking, control of hypertension by lifestyle modification, consumption of food rich in 3-omega fatty acids, and using sunglasses in early life will help in long run to prevent the development of ARMD later in life.

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