Age-related macular degeneration: Prevalence and Risk factors in elderly population (aged >60 years) in Central India

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Abstract- Objectives: Age-related macular degeneration (AMD) is a leading cause of irreversible blindness in elderly population. The purpose of the present study was to estimate the prevalence and identify risk factors and covariates of AMD in a hospital population of Central India.

Materials and methods: This cross sectional study was carried out at tertiary eye institute at Nagpur, Central India. Study was conducted between October 2012 and September 2013. Institutional ethics clearance was sought. Newly registered patients of both the sex, with ≥50 years of age attending the study hospital were selected for detailed ophthalmic examinations and evaluation.

Results: Out of the (n= 4.638) study sample; 107 subjects were diagnosed with age related macular degeneration in some form (i.e. dry or wet), thereby yielding a crude prevalence rate of 2.31% (95% Confidence Interval 1.95% - 2.66%). Significant associations were found between AMD and Age >60 years (Odds ratio= 2.37, 95% CI 1.49-3.77, p=0.0001), Gender (OR= 1.49, 95% CI 1.03-2.18, p=0.0366), etc.

Conclusion: Majority of the risk factors belong to non-modifiable category hence little can be done but early detection of AMD is utmost important. Smoking, CVD, and prior cataract surgery have shown it significant role as a predictors of AMD.

Index Terms- Macular degeneration, blindness, elderly

I. Introduction

In elderly population causes of irreversible blindness are cataract, glaucoma, metabolic diseases, etc. Some of the important morbid contributing to irreversible blindness is age-related macular degeneration (AMD). Available literature also reveals that 8.7% of all cases of blindness globally contributed by AMD. It is the primary cause of visual impairment in industrialized countries. [1,2] It has been estimated that eight million people will be affected with AMD worldwide by the year 2020; from that 10 to 20% will be late AMD responsible for approximately 90% of vision loss.[3] Although, there is considerable information on visual impairment in the Western world, to date there are only few studies on the prevalence and risk factors of AMD in Indian subcontinent.[4] It has therefore been included in the action plan of the World Health Organization, to address avoidable blindness in VISION 2020 program.[5]

Recent studies from India account the prevalence of AMD among 70 years and above as 2% and 3.7% which was comparable to Western countries.[4,6] Therefore, the investigation of risk factors of AMD is important in comprehending the disease and to suggest preventive measures that can retard or control AMD progression. Risk factors, such as hypertension, smoking, diabetes mellitus, cardiovascular disease, obesity, female sex and positive family history [6, 7, 8, 9, 10, 11] and their contributions to AMD had already been documented in literature in other settings and populations. The purpose of the present study was to estimate the prevalence and identify risk factors and covariates of AMD in a hospital population of Central India.

II. Materials and Method

A present cross sectional study was carried out at tertiary health care centre at Nagpur, Central India. Study was conducted between October 2012 and September 2013 by consecutive sampling technique among ≥50 years of group of both sex. Institutional ethics clearance was sought before initiation of the study. Those study participants consented to participate, ≥50 years of age, and newly registered were included in the study. However, patients with follow up visit and any ocular surgery were excluded from the study.

Before screening and definitive examination, the study was explained in detail to all the participants. Verbal or written consent was obtained from all the participants. The study population included 5725 new patients visited the eye hospital, of whom 4,638 subjects (81.00%) participated in the study. Data pertaining to socio-demographic, personal medical history and lifestyle factors was collected by interview technique and documented in predesigned data collection tool. Self-reported hypertension or diabetes and its duration from diagnosis were recorded. Height and weight of all subjects were measured and documented to find out the body mass index (BMI). [12] Lifestyle factors like smoking and alcohol consumption were explored by means of interview and were categorised as never smokers and smokers. If duration of smoking less than one year were categorised as non-smokers. Cumulative smoking dose was determined by frequency of number of cigarettes/cigars per day. The pack year was calculated by multiplying the number of packs of cigarettes or cigars smoked per day by the number of year's person had smoked. Based on cigarettes pack year's smokers were categorised as light and heavy smokers.

All the ophthalmic examination was performed by investigating ophthalmologists. The examination was conducted according to a standardized protocol that included visual acuity, autokeratometer refractometer (KR-8100; Topcon, Tokyo, Japan), computerized tonometer (CT-80; Topcon, Tokyo, Japan) and slit lamp biomicroscopy (SL-IE; Topcon, Tokyo, Japan) with 90 D and 78 D lens through a dilated pupil with tropicamide (0.8%) and phenylephrine (5%). For grading lens opacity, each eye was compared with the Lens Opacities Classification System (LOCS III) photographs.[13] A modified classification of diabetic retinopathy was used in our study.[14] Anterior segment was photographed with a camera (Nikon Corporation, Tokyo, Japan) mounted to slit lamp with a fundus camera (Kowa VX-10, Japan). Photographs were classified according to an international classification and grading system of age related macular degeneration. [15] The features were examined for hard and soft drusens, changes in the retinal pigment epithelium (RPE), geographic atrophy, choroidal neovascular membrane, and disciform scar. AMD was classified as late (neovascular or geographic atrophy) or early (soft drusen or retinal RPE abnormalities), they were combined for analysis in the present study. The cases of AMD, thus, detected were also confirmed by the principal ophthalmologist. When both the eydes of participants had lesions of different severity, the grade assigned for the participant was that of the more severely involved eye.

Statistical analysis: The data were analysed using the Microsoft excel (version MS 2013) software packages. Descriptive statistics was used to determine mean, and percentages. Categorical data were analysed and the association of AMD with risk factors was assessed by bivariate analysis. Significance was derived by using Chi Square Test and Fisher's Exact Test. P value <0.05 was considered statistically significant. Strength of association was established by deriving Odd ratios (ORs) and 95% confidence interval (CI). Effect of each factors independently on dependent variable (AMD) were calculated using logistic regression with variance calculation.

III. Results

Out of the (n= 4.638) study sample; 107 subjects were diagnosed with age related macular degeneration in some form (i.e. dry or wet), thereby yielding a crude prevalence rate of 2.31% (95% Confidence Interval 1.95% - 2.66%). As the age of the subjects increased, the prevalence of AMD also increased (Figure 1), the prevalence being almost double in 70-79 years and triple in 80+ years as compared to 60-69 years subjects.

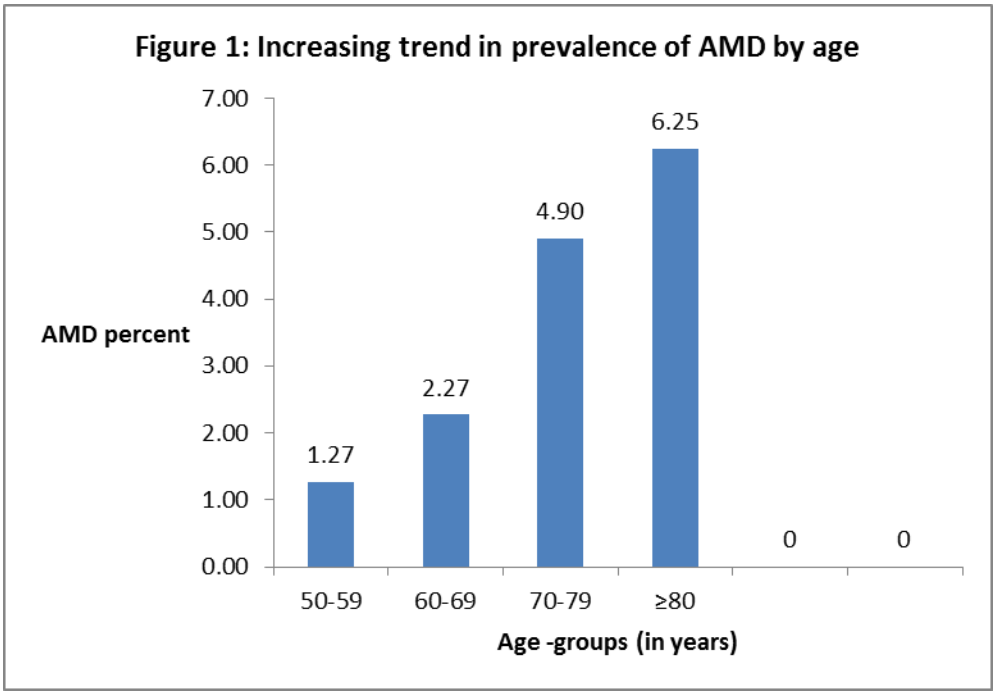

Table 1 reveals that majority of the subjects were below 70 years of age, females, non-obese, non-smokers and non-alcoholic with high proportion reporting with hypertension (47.11%), some with cardio-vascular morbidity (6.22%)z and diabetes (9.84%) as well. Some (7.15%) had already undergone cataract surgery.

Table 1. Demographic and behavioral characteristics and morbidity profile of study subjects (N=6954)

Characteristics	Number	%
Age in years		
50-59	1805	38.92
60-69	2154	46.44
70-79	551	11,88
≥80	128	2.76
Gender		
Male	2224	47.96
Female	2414	52.04
Smoking status		
Smokers	650	14.01
Non-smokers	3988	85.99
Alcohol Consumption		
Alcoholic	904	19.50
Non-alcoholic	3734	80.50
Morbidity profile		
Hypertension		
Present	2185	47.11
Absent	2453	52.89
Diabetes		
Present	288	6.22
Absent	4350	94.80
CVD		
Present	456	9.84
Absent	4182	90.16
Obesity/Overweight		
Obese	423	9.11
Non-obese	4215	90.89

Cataract Surgery		
Yes	332	7.15
No	4306	92.85

Table 2 presents the results of bivariate analyses done to examine association of AMD with some potential risk factors. Significant associations were found between AMD and Age >60 years (Odds ratio= 2.37, 95% CI 1.49-3.77, p=0.0001), Gender (OR= 1.49, 95% CI 1.03-2.18, p=0.0366), Smoking (OR= 2.17, 95% CI 1.37-3.43, p=0.0001), Alcohol (OR = 1.71, 95% CI 1.11- 2.63, p=0.0134), CVD (OR = 1.96, 95% CI 1.21- 3.06, p=0.0020), CVD (OR = 2.00, 95% CI 1.21- 3.31, p=0.0058) and Prior Cataract Surgery (OR = 4.95, 95% CI 3.16- 7.76, p=0.0001). However, some other factors like hypertension, diabetes, obesity and family history of AMD were not found to be significantly associated with AMD in our study population.

Table 2. Potential risk factors of AMD identified in bivariate analyses

Correlates	No	Subjects with AMD No. (%)	OR (95% CI)	P value
Age in years				
>60	2833	84 (2.97)	2.37 (1.49-3.77)	0.0001
≤60	1805	23 (1.27)		
Gender				
Female	2435	72 (2.97)	1.49 (1.03-2.18)	0.0366
Male	2203	44 (2.00)		
Smoking status				
Smokers	616	25 (4.06)	2.17 (1.37-3.43)	0.0001
Non-smokers	4022	77 (1.91)		
Alcohol Consumption				
Alcoholic	890	30 (3.37)	1.71 (1.11-2.63)	0.0134
Non-alcoholic	3748	75 (2.00)		
Morbidity profile				
Hypertension				
Present	2261	55 (2.43)	1.21 (0.82-1.79)	0.3398
Absent	2377	48 (2.02)		
Diabetes				
Present	242	2 (0.83)	0.27 (0.07-1.09)	0.0497
Absent	4396	132 (3.00)		
CVD				
Present	430	19 (4.42)	2.00 (1.21-3.31)	0.0058
Absent	4208	95 (2.27)		
Obesity/Overweight				
Obese	579	12 (2.07)	0.93 (0.51-1.72)	0.8242
Non-obese	4059	90 (2.22)		
Prior Cataract Surgery				
Yes	346	28 (8.01)	4.95 (3.16-7.76)	0.0001
No	4292	75 (1.75)		
Family history of AMD				
Present	11	1 (9.09)	4.24 (0.54-33.31)	0.1366

Absent	4627	107 (2.31)		

Adjusted estimates of odds ratio from Multiple logistic regression analysis (Table 3) revealed that four factors together contributed significantly in causation of AMD namely Prior Cataract Surgery (AOR = 7.98, 95% CI 5.31- 12.25, p=0.0001), Age (AOR = 4.09, 95% CI 2.52- 6.48, p=0.0001), CVD (OR = 2.55, 95% CI 1.44- 3.79, p=0.001), and Smoking (OR= 2.51, 95% CI 1.39-3.67, p=0.0001). However, alcohol consumption which was found to have a significant association with AMD in bivariate analysis failed to retain the same in presence of other factors (in multivariate analysis).

Table 3: Multiple logistic regression analysis for assessment of association between potential risk factors and AMD

Risk Factors	Adjusted Odds Ratio (AOR)	95% CI	P value
Age	4.09	2.52-6.48	0.0001
Smoking	2.51	1.39-3.67	0.0001
Alcohol consumption	1.73	1.03-2.38	0.1498
CVD	2.55	1.44-3.79	0.001
Prior cataract surgery	7.98	5.31-12.25	0.0001

IV. Discussion

In this study overall estimated prevalence of AMD was 2.31%. Since, the study sample was consecutively selected from tertiary care attendees at the time of their first registration at hospital; it represents the prevalence rate of AMD of those registered. Although the registration and screening were done at different times the data should be considered as point prevalence. Our estimate of AMD (2.31%) from the hospital was similar to that reported in another India study [16] However; other Indian population as 1.82% in the Andhra Pradesh Eye Disease Study[6] and Western population as 1.51% in the Beaver Dam Eye Study [17] and 1.81% in the Blue Mountain Eye Study.[18] These slight differences in the prevalence of AMD among the studies could be due to the differences in environmental exposure among the population, genetic factors or perhaps to the difference in the methodology adopted.

The prevalence of AMD among >70 years found in this study was 11.15%. However; in earlier studies proportion MESA whites (13.3%), but was much lower than in the Beavers Dam whites (36.8%).[19] Results of the earlier study clearly demonstrated that prevalence of AMD in 70 + years is higher than that of less than 70 years. In the present study increasing age is associated with AMD. This finding is consistent with the other studies. Therefore, increasing age is strongly associated with AMD.[4,6,17,18, 19, 20,21] Data from this hospital based study demonstrated an association between age and AMD. Cigarette smoking, alcohol consumption and diabetes were also significantly associated with AMD.

The present study, no significant (OR 1.14; P=0.447) differences was observed in both the genders. However, previous studies, found that the prevalence AMD significantly increased in women as compared to men.[16, 19,20] Western white population, have shown a higher prevalence of AMD in women.[3,5,7] Present study also showed a strong association between heavy smoking (OR 2.26; P=0.0001) and AMD. Cigarette smoking was constantly been identified as a risk factor for AMD.[6,7,8,9,10,16] Alcohol consumption (OR 1.86) and risk of AMD showed a strong alliance, which was similar to Bhatiwada study [16] and Los Angles Latino Eye Study.[26]
We did not find hypertension and diabetes to be associated with AMD in the sample population. Similar findings reported by Bhatiwada et al. [16] There are conflicting reports relates to association of hypertension and AMD. [3] However; evidenced higher odds (1.22) in the hypertensive group and diabetes (OR 3.97) showed strong association with AMD, which was in line with European Eye Study.[22]

The current study showed no significant association between BMI and AMD, which is consistent with a number of other studies have recorded no relationship between BMI and AMD.[6, 23]

Presence of history of cataract surgery significantly (OR 4.97; 0.0001) associated with an increased risk of AMD.[24] Previous studies in which a higher prevalence of AMD was reported in the presence of cortical cataract or cataract surgery.[6,9,10]

Apart from dietary and lifestyle risk factors associated with AMD [16]; a series of special conditions imposed upon photoreceptors puts them in high risk pro-oxidant environment. Oxidative damage in the retina has been hypothesized as a key process involved in the development of early age related macular degeneration [25]. In another study it has highlighted the role of oxidative stress in the pathogenesis of AMD.[26]

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