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Research Article

Age Related Macular Degeneration Among Patients Visiting Jimma University Department of Ophthalmology, South West Ethiopia

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Abstract

Objective: The aim of this study was to assess the proportion and associated risk factors of age-related macular degeneration in Jimma University Department of Ophthalmology, Southwest Ethiopia.

Design: Institution based cross sectional study was conducted from February 1 to April 30, 2018. **Subjects**: Total of 274 patient's age 50 years and above who visited Jimma University Institute of Health science, Department of Ophthalmology (JUDO) outpatient department.

Methods: Relevant history of patients was taken, and complete ophthalmic examination was performed in all cases. Retinal image was taken using Topcon 3D 1 optical coherence tomography. Data were cleaned, coded and entered into the EpiData version 3.1 and exported to SPSS version 20 for analysis. Bivariate and multivariable logistic regression analyses were carried out and P-value < 0.05 was considered statistically significant.

Main Outcome Measure: Proportion of age-related macular degeneration (AMD)

Results: From total of 274 patients, the proportion of AMD was 19.7%. From patients who had AMD the proportion of each grade was: early AMD 24 (8.8%), intermediate AMD 18(6.6%) and advanced AMD 12 (4.4%). Patients with age 80 and above (AOR = 15.227 (3.887 - 59.649)), history of smoking; current (17.244 (3.052 - 97.443)) and past (18.406 (4.110 - 82.417)), who have history of hypertension (4.628(1.449 - 14.779)) and who had cataract surgery (24.523 (7.507 - 80.112)) were independent predictors.

Conclusion: The proportion of AMD was 19.7%. Among factors affecting AMD ; age, history of smoking, history of hypertension and history of cataract surgery were found to be the independent predictors of AMD.

***Keywords**: Age-Related Macular Degeneration, Epidemiology and Risk Factor*

Introduction

Age-related macular degeneration is a degenerative disease characterized by specific pathologic changes which occur in various structures of the macula. There will be alteration of RPE, photoreceptor cells and formation new vessels in advanced stage of the disease [1,2]. AMD typically affects people who are aged 50 years and older. Currently the causes of AMD is unknown but it is associated with different risk factors such as older age, history of smoking, genetics, diet, light exposure, association with cardiovascular disease and its risk factors and cataract surgery [3-12].

AMD is classified into: No AMD (AREDS category 1) represented the control group; it is characterized by no or few small drusen (< 63 μm in diameter). Early AMD (AREDS category 2) is characterized by a combination of multiple small drusen, few intermediate drusen (63 - 124 μm in diameter), or mild RPE abnormalities. Intermediate AMD (AREDS category 3): characterized by either extensive drusen of small or intermediate size, or any drusen of large size (≥ 125 microns). Advanced AMD (AREDS category 4): Defined by the presence of either geographic atrophy or choroidal neovascular membrane (along with its sequelae, such as subretinal or sub-RPE hemorrhage or serous fluid, and subretinal fibrosis) [13]. Drusen is yellowish lipid-rich and protein-containing deposits which accumulate between the retinal pigment epithelium (RPE) and Bruch's membrane [1,14]. Optical coherence tomography (OCT) is now a routine examination for patients with AMD. OCT is a reliable tool for assessment of treatment response. In recent years, the development of antiangiogenic therapies has made OCT a fundamental tool in routine patient management, and several landmark studies have based the need for retreatment in OCT [15].

The estimated number of people visually impaired in the world is 285 million, 39 million blind and 246 million having low vision; 65% of people visually impaired and 82% of all blind are 50 years and older [16].This age group comprises about 20% of the world's population. With an increasing elderly population in many countries, more people will be at risk of visual impairment due to chronic eye diseases and ageing processes [16]. AMD accounts for 5% of global blindness and up to 1% as a cause of visual impairment globally [17].

Generally, in Africa, population based studies on AMD are scarce. Compared with African ancestry populations, people of European ancestry had higher prevalence of early, late, or any age-related macular degeneration [18]. In Kenya early AMD accounts for 11.1% and late AMD is 1.2% [19]. In Ethiopia there is limited population based study on AMD but in the national survey on blindness, low vision and trachoma, macular degeneration accounts for 4.8% [20]. As per the author knowledge there is no any population based as well as hospital based published report in the southwest of Ethiopia. Thus, this study identified the proportion of AMD and important risk factors for AMD in the southwest of Ethiopia.

Methodology

An institution based cross-sectional study was conducted in Jimma University department of ophthalmology from February 1 to April 30, 2018. From a total of 950 patients aged 50 and above, who visited the clinic during the period, a sample of 274 was selected using systematic random sampling. Single population proportion formula was used to determine the sample size. Patients with media opacity which prevent evaluation of posterior segment of the eye were excluded from the study. Data were collected using interview, clinical examination and laboratory investigation. Questionnaire and recording format were used for the interview and recording clinical examination findings. Each patient, after completing an interview by ophthalmic nurses and ophthalmology residents, went to the ophthalmic examination by a senior resident and retina specialist. Evaluation includes best corrected visual acuity and dilated slit lamp biomicroscopic examination using 90D and 78D VOLK lenses. Retinal image was taken using Topcon 3D 1 optical coherence tomography which is integrated with PC ANALYSIS SOFTWARE VERSION 8.4X and image was interpreted by retinal specialist and principal investigator. The image was used to classify AMD into no AMD, early AMD, intermediate AMD, and advanced AMD.

All the data were checked for completeness, accuracy, and consistency by one supervisor and principal investigator daily. After data collection, the data were checked for completeness and consistency and coded manually and entered to prepared template scheme on Epi Data version 3.1 by controlling legal values.

Data were entered into Epi Data version 3.1 and then exported to SPSS version 20, where recoding, computing, counting and other statistical analysis of the variables were done. First univariate analysis was conducted to see frequency distribution, central tendency and shape of the overall distribution of independent variables.

Bivariate logistic regression was done to select candidate variable (p = value < 0.25) for multivariable logistic regression. To identify independent risk factors of AMD and to control confounder, multivariable logistic regression model was fitted using backward method. In multivariable logistic regression, adjusted odds ratio with its 95% Confidence Interval were computed for variables those maintained in the final model and statistical significance were declared by the P-value < 0.05. Model fitness was checked by using Hosmer and Lemeshow test. Model is fit with 4 degree of freedom and 0.799 significance level.

Ethical clearance was obtained from Institutional review board of Jimma University institute of health science, Research and Community Service Office. By assuring the confidential nature of responses and informed verbal consent was obtained from the study participant's and data collection was conducted.

Result

Socio-demographic characteristics

A total of 274 patients were seen in our study, with 100% response rate, and all patients participated in interview and physical examination. Majority of the patients were in the age range of 50 - 59 (35%) and 60 - 69 (34%) years old and two third of the participants were male. The majority of the participants were Oromo (50.7%). Religious affiliations are broken down as follows: Muslim 121 (44.2%), Orthodox 124 (45.3%), protestant 27 (9.9%), and others 2 (0.9%). The majority (73.4%) of the participants did not have formal education and three quarter of the them had monthly income of two thousand birr and above. Two third of the of participants were from rural area (Table 1).

Variable		Frequency	Percentage
Sex	Female	92	33.6
	Male	182	66.4
	Total	218	100.0
Age	50-59	96	35.0
	60-69	94	34.3
	70-79	55	20.1
	80 and above	29	10.6
Religion	Muslim	121	44.2
	Orthodox	124	45.3
	Protestant	27	9.9
	Other	2	.7
Ethnicity	Oromo	139	50.7
	Amhara	48	17.5
	Southern nation and nationalities	67	24.5
	Other	20	7.3

Educational status	No formal education	201	73.4
	Primary school	35	12.8
	Secondary school	18	6.6
	Higher education	20	7.3
Occupation	Indoor	137	50.0
	Outdoor	137	50.0
Income	2,000birr and above	207	75.5
	Less than 2,000birr	67	24.5
Place of residency	Urban	92	33.6
	Rural	182	66.4

Table 1: *Socio-demographic and economic characteristics of study participants, JUIH department of ophthalmology, Jimma, Ethiopia, 2018 (n = 274).*

Health related characteristics

History of systemic hypertension (HTN) was the most common medical condition reported by the patients and it was found on 25 (9.1%) patients. History of diabetes mellitus (DM) was reported by 5 (1.8%) patients and history of ischemic heart disease by 2 (0.7%) patients. Eleven (4%) patients were taking antihypertensive drugs. The body mass index of all participants was between 18 and 24.5 kg/m2. Only two patients report that they have had family history of blindness from unspecified cause. The blood pressure of 49 (17.9%) patients was above 120/80 mmHg (Table 2).

Variable		Frequency	Percent
History of DM	Yes	5	1.8
	No	269	98.2
History of HTN	Yes	25	9.1
	No	249	90.9
History of IHD	Yes	2	0.7
	No	272	99.3
History of Medication	Yes	18	6.6
	No	256	93.4
Type of Medication	Antihypertensive	11	4.0
	B-blockers	3	1.1
	Other	4	1.5
Family history of blindness	Yes	2	0.7
History of Cataract Surgery	Yes	27	9.9
	No	247	90.1
Blood pressure	80/60-120/80	225	82.1
	Greater than 120/80	49	17.9

Table 2: *Health related characteristics of study participants, JUIH department of ophthalmology, Jimma, Ethiopia, 2018 (n = 274).*

Lifestyle of participants

From a total of 274 participants, only 21 (7.7%) had history of smoking; 14 (5.1%) were past smokers and 7 (2.6%) were current smokers. All of them were light smokers and most of them were smoking for a total duration of 6 - 10 years 7 (2.6%) and 11 - 15 years 6 (2.2%). Only 5 (1.8%) patients had reported regular use of sunglass or cape.

Proportion of age related macular degeneration

From total of 274 patients, 54 (19.7%) patients had AMD. From those who had AMD 24 (8.8%),18 (6.6%), 12 (4.4%) had early, intermediate and advanced AMD respectively. Among those who had advanced AMD, geographic atrophy accounts 2 (16.7%) and wet AMD accounts 10 (83.3%).

Risk factors of AMD

On bivariate logistic regression six of variables (Age of Participant, Educational status, Occupation, Place of residency, History of cataract surgery, history of HTN and History of smoking) were candidate for multivariable logistic regression (Table 3).

Factors	Variables Categories	AMD Status		Total (274)	Crude Odds Ratio (95% C.I)	P-Value
		Yes	No			
Age of Participant	50-59	7(7.3%)	89(92.7%)	96	1	.000
	60-69	11(11.7%)	83(88.3%)	94	1.685(.624-4.552)	.303
	70-79	16(29.1%)	39(70.9%)	55	5.216(1.988-13.686)	.001*
	80 and above	20(69.0%)	9(31.0%)	29	28.254(9.401-84.912)	.000*
Educational status	No Formal Education	47(23.4%)	154(76.6%)	201	1	.172*
	Primary	2(5.7%)	33(94.3%)	35	.199(.046-.859)	.030*
	Secondary	5(27.8%)	13(72.2%)	18	1.260(.427-3.718)	.675
	Higher Education	0(0.0%)	20(100.0%)	20	.000(.000)	.998
Occupation	Indoor	17(12.4%)	120(87.6%)	137	1	
	Outdoor	37(27.0%)	100(73.0%)	137	2.612(1.387-4.917)	.003*
Place of residency	Urban	11(12.0%)	81(88.0%)	92	1	
	Rural	43(23.6%)	139(76.4%)	182	2.278(1.112-4.664)	.024
History of HTN	Yes	13(52.0%)	12(48.0%)	25	5.496(2.342-12.898)	.000*
	No	41(16.5%)	208(83.5%)	249	1	
History of cataract surgery	Yes	22(81.5%)	5(18.5%)	27	29.562(10.453-83.607)	.000*
	No	32(13.0%)	215(87.0%)	247	1	
History of smoking	No	40(15.8%)	213(84.2%)	253	1	.000*
	Past (quit)	10(71.4%)	4(28.6%)	14	13.312(3.979-44.541)	.000*
	Current	4(57.1%)	3(42.9%)	7	7.100(1.530-32.939)	.012*

Table 3: *Risk factors of AMD among patients age 50 and above who visited JUIH department of ophthalmology, Jimma, Ethiopia, 2018. *Candidate for Multivariable Logistic Regression, 1 – reference.*

Independent predictors of AMD

Four variables were identified in final model of multivariate logistic regression (Age of Participant, History of hypertension, History of cataract surgery and History of smoking) to be as independent predictors of AMD in patients aged 50 and above who visited JUHI department of Ophthalmology outpatient department (Table 4).

Patients who were aged 80 and above were15 times more likely to develop age related macular degeneration than patients who were aged between 50 and 59. Patients with history of hypertension were 4.6 times more likely to develop AMD than patients with no history of hypertension. Odds of occurrence of AMD was 24.5 times inpatient who had history of cataract extraction than phakic eyes. Patients with history of current smoking and past smoker were respectively 17.2 and 18.4 times more likely to develop AMD than patient who never smoked (Table 4).

Factors	Variables Categories	AMD Status		Odds Ratio (95% C.I)	
		Yes	No	COR	AOR
Age of Participant	50-59	7(7.3%)	89(92.7%)	1	1
	60-69	11(11.7%)	83(88.3%)	1.685(.624-4.552)	1.810(.578-5.675)
	70-79	16(29.1%)	39(70.9%)	5.216(1.988-13.686)	3.057(.928-10.077)
	80 and above	20(69.0%)	9(31.0%)	28.254(9.401-84.912)	15.227(3.887-59.649)**
History of HTN	Yes	13(52.0%)	12(48.0%)	5.496(2.342-12.898)	4.628(1.449-14.779)*
	No	41(16.5%)	208(83.5%)	1	1
History of smoking	No	40(15.8%)	213(84.2%)	1	1
	Past	10(71.4%)	4(28.6%)	13.312(3.979-44.541)	18.406(4.110-82.417)**
	Current	4(57.1%)	3(42.9%)	7.100(1.530-32.939)	17.244(3.052-97.443)*
History of Cataract surgery	Yes	22(81.5%)	5(18.5%)	29.562(10.453-83.607)	24.523(7.507-80.112)**
	No	32(13.0%)	215(87.0%)	1	1

Table 4: *Independent predictors of AMD among patients age 50 and above who visited JUIH department of ophthalmology, Jimma, Ethiopia, 2018.*

***Statistically significant p< 0.01,* statistically significant p< = 0.05, 1-Reference.*

Discussion

The overall proportion of AMD in this study was 19.7% where 8.8% of them are early AMD, 6.6% of them are intermediate AMD and 4.4% of them are advanced AMD. This finding is comparable with study done in northwest American Indians and Alaska natives where the prevalence of AMD was 18.3% [21]. Also study done in South Africa where they compared the proportion of AMD in blacks and Caucasians, the proportion of AMD in blacks were 17.4% and in Caucasians 36.3% [22]. In Singapore Malay eye study the proportion of AMD was 4.9% and 0.7% early and late AMD respectively [23]. Study done in Alexandria main hospital, Egypt, the proportion of AMD was 6.6% while in Nigeria Guinness eye hospital it was 3.2% [24,25]. In Kenya early AMD accounts for 11.1% and late AMD is 1.2% [19]. Among patients who have follow up at retina clinic, the proportion of AMD in Menelik II hospital in Ethiopia was 2.7% [26]. The proportion AMD in our study is higher, because we have used different methodology.

In our study, age was one of the main independent predictors of AMD. As the age of the patient increases the proportion of AMD significantly increases. At the age of 50 - 59 the proportion of AMD was 7.3% but at the age of 80 and above it increased to 69.0%. Also, the

severity of AMD rose as the age increase. Advanced AMD at the age of 50 - 59 was 0.0% but at the age 80 and above it rose to 31%. This finding is similar to many studies [19,23,27-29]. According to Barbados Eye Studies the incidence of early AMD was 10.7% between 40 to 49 years of age and 16.8% at age 70 and above years]. For late AMD, incidence increased from 0.1% to 2.3% in the same age groups [30]. Report from Age-Related Eye Disease Study Research Group on Risk Factors Associated with AMD, age > 70 years is associated with increased occurrence of both early and late AMD [31]. In US, the prevalence of AMD increased dramatically with age, with more than 15% of the white women older than 80 years having neovascular AMD and/or geographic atrophy [32]. Study done in Alexandria main hospital, there was a significantly higher percentage of patients with AMD in the 75 or more age group as compared with those free from AMD [25]. In central India also significant associations were found between AMD and Age > 60 years [33]. Both studies done in Kenya and Nigeria, AMD is common in older ages [19, 34].

In our study, smokers were more likely to develop AMD than non-smokers. The odds of AMD in current smokers and past smokers was high. In AREDS study smoking was associated with higher risk of large drusen and late AMD [31]. According to meta-analysis on smoking and the Risk of Age-related Macular Degeneration, smoking, especially current smoking, had increased association with AMD [35]. Current smokers had increased odds of neovascular AMD or GA when compared to ex-smokers in European study [10]. Also, in Andhra Pradesh Eye Disease Study in South India, history of prior cigarette smoking increased prevalence of AMD [36]. The Singapore Malay Eye Study showed strong association between smoking and late AMD prevalence in Malays [23]. According to this study current smokers were significantly more likely to have late AMD [11]. The Beaver Dam Eye Study showed that current smoking and a greater number of pack-years smoked increased the risk of the progression of AMD [37]. The possible explanation for the association between smoking and AMD is due to oxidative effects, effects in decreasing macular pigment density, alteration of choroidal blood flow, by impairing retinal pigment epithelium function or direct effect of nicotine to activate proinflammatory mediators [38].

In our study patients with history of hypertension were more likely to develop AMD. The odds of developing AMD were 4 times higher for patients with hypertension compared to patients with no history of hypertension. This finding was also seen in other studies. According to Rotterdam study, increased systolic blood pressure or pulse pressure was associated with a higher risk of AMD [9]. In AREDS participants, there was strong association between AMD and systemic hypertension especially patients who had large drusen and neovascular AMD [31]. Study done in Alexandria main hospital, AMD was seen in higher percentage among patients who had history of hypertension compared to those without history of hypertension [25]. This association might be due to the effect of hypertension on choroidal circulation [11,31].

Our study also showed prior cataract surgery as a risk factor for development of AMD. Among patients who had history of cataract surgery the proportion of AMD was 81.5%. This finding is also seen in other studies. Findings from the Andhra Pradesh Eye Disease Study in South India shows prior cataract surgery were significantly associated with increased prevalence of AMD [36]. Another study in India also showed prior cataract surgery as significant risk factor for development of AMD [33]. Also study done in Beaver dam shows eyes that undergone cataract extraction more likely to progress to AMD [39]. This association may be due to loss of protection from sunlight as the natural lens is removed from the eye [40].

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Conflict of Interest

No conflicting relationship exists for any author.

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