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Brief Reports

Correlation between Serum Lipids and Age-related Macular Degeneration: A Case-Control Study

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ABSTRACT

Background: Age-related macular degeneration (AMD) is one of the leading causes of visual loss among people aged 65 yr and older. The pathophysiology of AMD is poorly understood. The purpose of this study was to evaluate the relationship between serum lipid concentrations and age-related macular degeneration.

Methods: In this case-control study, total cholesterol (TCH), low density lipoprotein (LDL), high density lipoprotein (HDL) and triglyceride (TG) of 32 patients with AMD were compared with 32 subjects without AMD that were matched for age. Data were analyzed using Independent *t* and Chi-Square Tests.

Results: TCH, LDL, and TG serum concentrations were significantly higher in AMD patients compared with control group ($P < 0.001$, $P < 0.001$ and $P < 0.017$ respectively). There was no difference in HDL concentration between two groups ($P = 0.781$).

Conclusion: High level of total cholesterol, TG and LDL were associated with increased risk of AMD. Results of this study suggest further research to better understand the underlying biological mechanisms of AMD related to serum cholesterol.

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Introduction

At present, the pathophysiology of age-related macular degeneration (AMD) is incompletely understood. It is a complex trait genetic disease modulated by various non genetic or “environmental” risk factors¹. In its early form, this disease is characterized by the presence of large and soft drusen and pigmentary abnormalities. Later, the disease develops into a dry or a wet form. The dry form involves atrophy of the retinal pigment epithelium and the overlying of retinal photoreceptors. The wet form (exudative macular degeneration) is manifested by the development of choroidal neovascularization. These late stages are associated with a profound decrease in visual acuity².

The pathogenesis of AMD is poorly understood. Dietary factors (antioxidants), cardiovascular disease, iris

color, cardiovascular disease risk factors, sun and UV light exposure and smoking have been postulated to be related to the incidence and progression of the disease³⁻⁶. Data have been accumulated to suggest the existence of an important genetic component to the disease⁷⁻⁹.

Soft drusen are associated with higher risk of exudative AMD and are characterized by protein and lipid deposits within the Bruch membrane^{10,11}. Several studies have investigated the relationship between cholesterol level and AMD but so far, not all results have been consistent. The Eye Disease Case-Control Study (EDCCS) reported a statistically significant fourfold increase odds of developing wet AMD in the group with the highest serum cholesterol level and a twofold

increased odds in the middle cholesterol level group compared with the lowest cholesterol group¹².

The different studies evaluating the possible relationship between serum lipid levels and AMD cited above provide conflicting results. Given that AMD is characterized by lipid deposits and that apolipoprotein E genotype could play a protective role^{7,8,13}, the present study was developed to evaluate the relationship between serum lipid concentrations and AMD.

Methods

This case-control study was conducted at the Eye Clinic of Valy-Asr Hospital in Birjand City, northeast of Iran, during October 2009 to August 2010. Thirty-two patients from 60 to 85 years without history of diabetes mellitus (FBS was less than 126 mg/dl) who were clinically and par clinically such as OCT (Optical coherence tomography), angiography diagnosed with AMD were included into the study as cases group. Diagnostic criteria for AMD were: (a) bilateral AMD feature, (b) drusen (minimum of five in each eye), (c) pigment epithelium, and (d) geographic atrophy or exudative maculopathy. Lesions considered to be the result of generalized vascular disease, such as a chorioretinitis, or high myopia, congenital diseases or photocoagulation, and for reasons other than the neovascular AMD were excluded.

The control group included 32 subjects selected from people came in for consultation in the Ophthalmology Department, without evidence of AMD and without history of diabetes. They were matched with the cases in terms of age, sex, iris color, smoking history and body mass index.

A sample of 5 ml of venous blood was collected from all subjects after 12-14 hours fasting from right cubital venous in prone position in heparin tubes and centrifuged for 20 min at 3000 rpm. Sera were aliquoted and stored at -20 °C until use. All measurements were performed on a Selectra 2 (HOLLANI) 2000 and PARS AZMON kit. Serum total cholesterol (TCH), Low density lipoprotein (LDL), triglyceride (TG), and high density lipoprotein (HDL) levels were determined.

Each patient had a complete ophthalmologic examination including: (a) visual acuity, (b) slit lamp examination, and (c) macular examination by direct and indirect ophthalmoscope after pupil dilatation. Eyes were dilated with 0.5% tropicamide. All enrolled subjects underwent a general examination by the recruiting physician. All participants of the study had fundus photographs of each eye enzymatically.

Statistical analysis was performed using statistical package of SPSS 15. Descriptive results are presented as mean ± standard deviation. Independent *t* and chi-square tests were used to compare variables in subjects with or without AMD at 0.05 significant levels.

Results

General characteristics of the cases and control groups are shown in Table 1. There was no statistically significant difference between age, sex distribution, iris color, and smoking habits between the two groups.

Table 1: General characteristics of the cases with age-related macular degeneration (AMD) (N=32) and control groups without AMD (N=32) using independent t-test and chi-square test

Characteristics	Cases		Controls		P value
	N	%	N	%	
Gender					0.802
Male	17	53.1	18	56.3	
Female	15	46.9	14	43.8	
Iris color					1.000
Clear	2	6.3	2	6.3	
Dark	30	93.7	30	93.7	
Smoking habit					1.000
Nonsmoker	27	84.4	27	84.4	
Smoker	5	15.6	5	15.6	
Age (year)					0.416
Mean (±SD)	75.8	±8.2	74.2	±7.4	

Comparison of the serum lipids concentrations in cases and control groups were shown in Table 2. TCH, LDL, and TG serum concentrations were significantly higher in cases with AMD compared to control group. However, there was no statistically significant difference in HDL concentration between the two groups (*P*=0.781).

Table 2: Comparison of serum lipids concentrations (mean and standard deviation) in cases with age-related macular degeneration (AMD) (N=32) and control groups without AMD (N=32) using independent *t*-test

Serum lipids (mg/l)	Cases		Controls		P value
	Mean	SD	Mean	SD	
Total cholesterol	209.90	33.00	174.40	43.20	0.001
Triglyceride	141.46	53.21	110.56	47.05	0.017
Low density lipoprotein	121.93	24.80	95.46	32.96	0.001
High density lipoprotein	44.12	9.24	45.12	18.06	0.781

Discussion

Contradictory results have been reported regarding AMD. Some studies have reported a higher risk of AMD for people with high cholesterol or LDL concentrations¹⁴. In contrast, however, other studies have not shown any correlation between AMD development and serum concentration of lipids¹⁵⁻¹⁷. In this study, we found a significant increase in TCH, LDL and TG concentration among cases compared to controls. However, we found no significant difference in HDL concentration between the two groups. A study was conducted in Spain in 2001 to investigate the relationship between blood lipids level with age related macular degeneration. The authors found correlation between AMD development and serum concentration of lipids. TCH concentration was 227.00 ±5.46 mg/dl in AMD patients compared to 200.18±18.89 mg/dl in control group (*P*<0.001). Furthermore, TG and LDL concentrations were markedly higher in AMD patients compared to control group¹⁸.

A cohort study conducted in USA in 2004 reported a significant correlation between AMD and TCH, LDL, and smoking¹⁹. Another study assessed 60 male patients with AMD in Iran in 2007 and reported serum levels of LDL was high among patients but no significant changes was reported in TCH, TG and HDL concentrations²⁰. We found no significant difference in HDL level among the studied groups. A similar result was reported by another study conducted in Iran²⁰.

A study was conducted on sixty women with AMD aged 55-71 yr (mean age 65.1±5.7) in an outpatient ophthalmologic clinic for more than two years. They evaluated TCH, TG, HDL, LDL, and lipoprotein (a). They found a significant increase of TCH, LDL and TG and a significant decrease of HDL in the AMD patients compared to the control group²¹. They found no significant difference in the average TG level between the two groups, apolipoprotein AI and apolipoprotein B²¹.

Higher TCH and LDL levels were associated with increased risk, whereas higher HDL levels tended to reduce the risk of AMD¹⁴. High levels of serum TCH are probably associated with an increase risk of development of exudative age related macular degeneration²².

Conclusion

Higher total cholesterol, T.G and LDL were associated with increased risk of AMD.

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Conflict of interest statement

There is no conflict of interest in this article.

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