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Research Article

Dyslipidemia and Cataract in Adult Iraqi Patients

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Received: February 21, 2017; **Published:** March 10, 2017

Abstract

Background: Dyslipidemia has been directly or indirectly linked to a wide range of eye diseases, including cataract with taking into account associations between dyslipidemia and other systemic disorders, such as body mass index and fasting blood sugar.

Aim of the study: To find out if there is a true relationship between dyslipidemia and cataract.

Materials and Method: A cross-sectional hospital-based study was performed at Al-Sader Medical city in Al-Najaf. A total of 117 patients with age range between 45 - 82 years old were included in this study for a period started from January, till September 2013. Each patient was interviewed and underwent full ophthalmological examination and all the data were collected in a form of a questionnaire designed for this purpose. Dyslipidemia was defined as any of the following: Hypercholesterolemia (total cholesterol concentration ≥ 5.72 mmol/L or hypertriglyceridemia (triglyceride concentration ≥ 1.70 mmol/L or low high-density lipoprotein-cholesterol (HDL-C concentration ≤ 0.91 mmol/L or the patients were on treatment of hyperlipidemia. Cataract diagnosis was made by clinical examination of patients in ophthalmology department.

Results: The study included one hundred seventeen patients with cataract (70 men and 47 women) for whom serum lipids measurements were available. The age range of the patients was between 45 – 82 years (Mean 64 ± 10). Regarding the lipid status of those who were included in the study, it was found that 82 (70%) patients had dyslipidemia, and 35 (30%) had no dyslipidemia. With respect to ophthalmic parameters, the prevalence of dyslipidemia was associated significantly (< 0.05) with nuclear and cortical cataract, but it was not significant (> 0.05) for posterior subcapsular cataract.

Conclusion: Dyslipidemia as a direct or indirect cause for nuclear and cortical cataract was significant, and may be considered to have an important association with cataract that needs further assessments.

Keywords: *Dyslipidemia; Cataract*

Introduction

Dyslipidemia, a major systemic disorder, is one of the most important risk factors for cardiovascular disease which is a major cause of morbidity and a leading contributor to mortality worldwide [1-4]. Due to its pronounced impact on many organs of the body, dyslipidemia has also been indirectly or directly linked to a wide range of eye diseases, including cataract, age-related macular degeneration, glaucoma, retinal vein occlusions and hypertensive and diabetic retinopathy [5,6].

Lipoproteins are complexes of lipids and proteins that are essential for the transport of cholesterol, triglycerides, and fat-soluble vitamins [7].

The plasma lipoproteins are divided into five major classes based on their relative density:

Chylomicrons, very low density lipoproteins (VLDLs), intermediate-density lipoproteins (IDLs), low-density lipoproteins (LDLs), and high-density lipoproteins (HDLs). Each lipoprotein class comprises a family of particles that vary slightly in density, size, migration during electrophoresis, and protein composition [7-9].

Disorders of lipid metabolism result from genetic and acquired defects in the production and removal of lipoproteins.

A total cholesterol, triglyceride, or LDL level above the 90th percentile or an HDL level below the 10th percentile for the general population defines dyslipidemia [9-11].

Lipid Measurement

Abnormalities of lipid metabolism most commonly come to light following routine blood testing. Measurement of plasma cholesterol alone is not sufficient for comprehensive assessment. Levels of total cholesterol (TC), triglyceride (TG) and HDL cholesterol (HDL-C) should be obtained after a 12-hour fast to permit the calculation of LDL cholesterol (LDL-C) according to the Friedewald formula (LDL-C = TC - HDL-C - (TG/2.2) mmol/l). (Before the formula is applied, lipid levels in mg/dl can be converted to mmol/l by dividing by 38 for cholesterol and 88 for triglycerides.) The formula becomes unreliable when TG levels exceed 4 mmol/l (350 mg/dl) [10-22].

Elevated TG, which is common in obesity, diabetes and insulin resistance, is frequently associated with low HDL and increased 'small, dense' LDL. Under these circumstances, LDL-C may underestimate risk. This is one situation in which measurement of apolipoprotein B may provide additional useful information.

Cataract

Aging Changes

A very common cause of visual impairment in older adults is age-related cataract, the pathogenesis of which is multifactorial and not completely understood. There are 3 main types of age-related cataracts: nuclear, cortical, and posterior subcapsular. In many patients, components of more than one type are present.

Chemical modification and proteolytic cleavage of crystallins (lens proteins) result in the formation of high-molecular-weight protein aggregates. These aggregates may become large enough to cause abrupt fluctuations in the local refractive index of the lens, thereby scatted ring light and reducing transparency. Chemical modification of lens nuclear proteins also increases pigmentation, such that the lens increasingly takes on a yellow or brownish hue with advancing age.

Other age- related changes include decreased concentrations of glutathione and potassium and increased concentrations of sodium and calcium in the lens cell cytoplasm [24-28].

Aim of the study

To find out if there is a true relationship between dyslipidemia and cataract.

Materials and Methods

A cross-sectional hospital-based study was performed at Al-Sader Medical city in Al-Najaf. A total of 117 patients who were in a range 45 - 82 years old were included in this study for a period started on January, till September 2013.

Since our research is intended to find out the relationship between cataract and dyslipidemia and both of these variables are closely related in elderly patients so we took our sample with their age ranged (45 - 82) years old.

Detailed history was obtained from each patient who underwent full ophthalmologic examination.

We measured the body weight (in Kg) and the height (In Cm) for each patient by using a regular body weight scale and a length scale respectively. By measuring both the weight and the height we calculate the body mass index (BMI) according to this equation:

$$\text{Body weight (Kg)}/\text{Height}^2 \text{ (In meter)}$$

The biochemical tests including blood glucose and lipid profile were send to the standardized lab in Al-Sader medical city in Al-Najaf governorate.

Fasting blood samples were taken and the fresh blood samples were biochemically analyzed within at maximum four hours.

In the fasting blood samples, the serum concentrations of total cholesterol, triglycerides, high-density lipoprotein-cholesterol (HDL-C) and low-density lipoprotein-cholesterol (LDL-C) were measured using the enzymatic method with an Abbott C4000 autoanalyzer (Abbott Laboratories, Abbott Park, Illinois, USA).

All these data were recorded on a questionnaire form. And the form was used as a source for data entry and analysis.

Dyslipidemia was defined as any of the following

Hypercholesterolemia (total cholesterol concentration ≥ 5.72 mmol/L (220 mg/dL)) or hypertriglyceridemia (triglyceride concentration ≥ 1.70 mmol/L (150 mg/dL)) or low high-density lipoprotein-cholesterol (HDL-C concentration ≤ 0.91 mmol/L (35 mg/dL)) or the patients were on treatment of hyperlipidemia. Treatment of dyslipidemia was defined as the use of a pharmacological treatment to lower blood lipids during the previous 2 weeks.

Patients were considered as diabetic if they already had documented history of DM or their fasting blood sugar readings were ≥ 126 mg/dl (7.0 mmol/L).

Cataract diagnosis was made by the ophthalmologist using slit-lamp biomicroscopy and retro-illumination.

Patients aged < 45 years old, those with traumatic or congenital cataract were excluded from the study.

The parameters used in this study includes

1. **Age:** We included patients older than 45 years old (range was 45 - 82 years old).
2. **Gender:** To have an idea if there is any sex difference concerning dyslipidemia and cataract.
3. **BMI (Body mass index):** Important to be included in the study because it's direct and indirect relationship with dyslipidemia

Analysis of data was performed using Chi square and T-Tests. *P* values less than 0.05 has been taken to indicate statistical significance.

Statistical analyses were performed by using statistical package for social Sciences (SPSS; Version 18.0) software.

Using the T-Test profile, the results were expressed as mean ± standered deviation (SD), with p-value of less than (< 0.05) was considered to indicate statistically significant difference or association.

Results

The study included one hundred seventeen patients with cataract (70 men and 47 women) for whom serum lipids measurements were available.

The sex and age distribution for the total sample included in the study is illustrated in (Table 1). The age range of the patients was between 45 - 82 years (Mean 64 ± 10) (Table 1 and Figure 1).

		Male	Female
Age Group	45 - 55	12	7
	56 - 65	18	12
	66 - 75	29	10
	76 - 85	11	18
Total		70	47

Table 1: *Age and sex distribution for the total sample included in the study.*

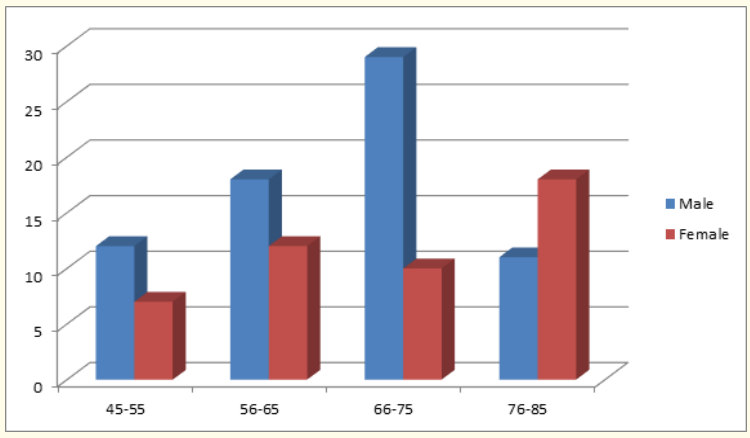

Figure 1: *Age and sex distribution for the total sample included in the study.*

The sex and age distribution according to the patients' lipid status involved in this study are illustrated in (Table 2 and Figure 2).

Parameter		No Dyslipidemia		Dyslipidemia		Total	
		N	%	N	%		
Sex	Males	16	13.6	54	46.1	70	117
	Females	19	16.2	28	23.9	47	
Age (Years)	45 - 55	7	5.9	12	10.2	19	
	56 - 65	11	9.4	19	16.2	30	
	66 - 75	12	10.2	27	23	39	
	76 - 85	5	4.27	24	20.5	29	
Total		35		82			117
		117					

Table 2: *Sex and age distribution of patients according to their lipid status.*

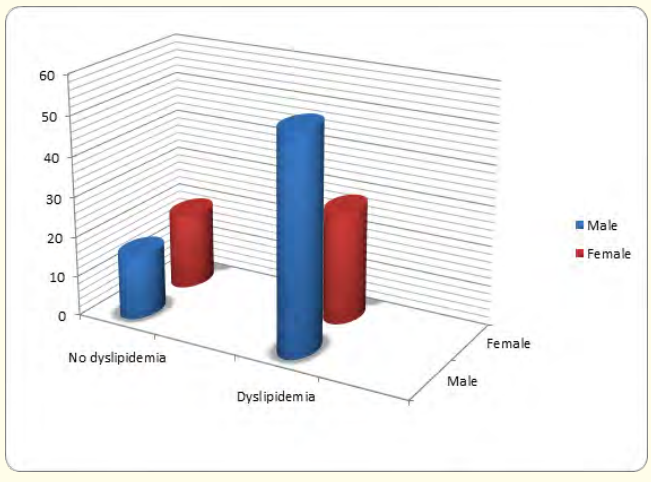

Figure 2: *Sex distribution of patients according to lipid status.*

Male: Female ratio for those whom lipid status was normal is 0.8:1, and for those with dyslipidemia was 1.9:1. An overall sex ratio was 1.4:1.

Regarding the lipid status of those who were included in the study, it was found that 82 (70%) patients had dyslipidemia, and 35 (30%) had no dyslipidemia (Table 2).

With respect to ophthalmic parameters, the prevalence of dyslipidemia was associated significantly (< 0.05) with nuclear and cortical cataract, but it was not significant (> 0.05) for posterior subcapsular cataract (Table 3 and Figure 3).

Parameter	No dyslipidemia (n = 35)		Dyslipidemia (n = 82)		P-value
	N	%	N	%	
Nuclear Cataract	9	7.69	42	35.89	< 0.05
Post-subcapsular Cataract	12	10.25	22	18.80	> 0.05
Cortcal Cataract	14	11.96	18	15.38	< 0.05

Table 3: *The relationship between cataract types and lipid status.*

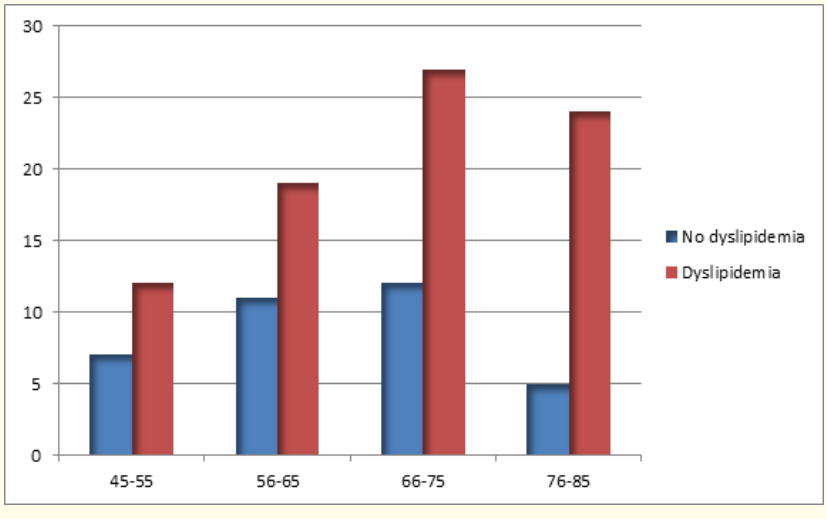

Figure 3: *Age distribution of patients regarding their lipid status.*

Regarding the association between types of cataract in term of body mass index and fasting blood sugar:

1. **Body mass index (BMI):** High BMI was significantly associated with cortical cataract, but not significant with nuclear and post-subcapsular cataracts.

2. **Fasting blood sugar (FBS):** High FBS was significantly associated with both nuclear and post-sucapsular cataract, but not with cortical cataract.

Parameter	Nuclear cataract (n = 51)			Post-subcapsular Cataract (n = 34)			Cortical Cataract (n = 32)		
	Mean	±SD	P-Value	Mean	±SD	P-Value	Mean	±SD	P-Value
Body mass index (BMI)[i]	26.2	0.43	> 0.05	24.6	1.32	> 0.05	29.3	0.32	< 0.05
Fasting Blood Sugar (FBS)[ii] (mg/dl)	204.5	2.3	< 0.05	196.4	1.03	< 0.05	113.5	0.38	> 0.05

Table 4: *Comparison between types of cataract in term of body mass index (BMI) and fasting blood sugar (FBS). Normal values [28]: i Body mass index (BMI): 18.5-25, iiFasting blood sugar: 72-126 mg/dl.*

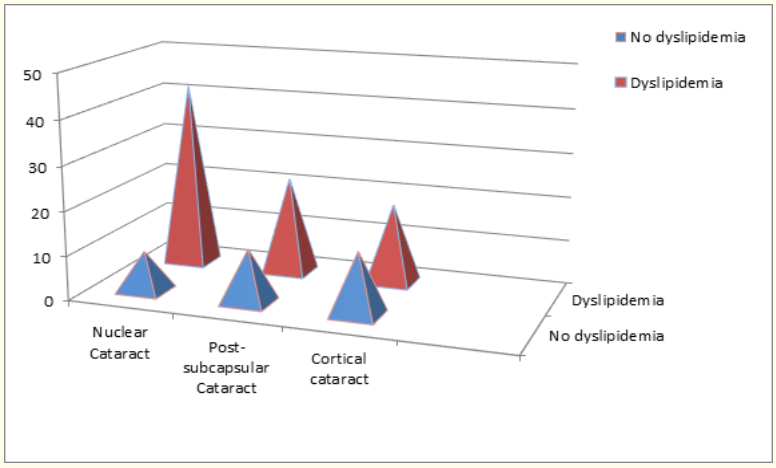

Figure 4: *The relationship between types of cataract and lipid status.*

By comparing the effect of dyslipidemia in terms of high body mass index and high fasting blood sugar, both of these variables were significantly associated with dyslipidemia (Table 5).

	No dyslipidemia		Dyslipidemia		p-Value
	Mean	± SD	Mean	± SD	
Body mass index (BMI)[i]	24.4	1.23	29.6	1.03	< 0.05
Fasting Blood Sugar (FBS)[ii] (mg/dl)	112.4	0.43	187	0.56	< 0.05

Table 5: *The comparison between patients with or without dyslipidemia in terms of body mass index and fasting blood sugar. Normal values [20]:i Body mass index (BMI) : 18.5-25, ii Fasting blood sugar: 72-126 mg/dl.*

The total number of diabetic patients who were included in this study was 68 (58.11%), out of this number; there were 54 (46.15%) patients diagnosed with dyslipidemia.

Parameter	Group 1 DM and No dyslipidemia (n = 14)		Group 2 DM and Dyslipidemia (n = 54)		P-value
	N	%	N	%	
Nuclear Cataract	8	11.76	32	47.05	< 0.05
Post-subcapsular Cataract	3	4.41	14	20.58	> 0.05
Cortcal Cataract	3	4.41	8	11.76	> 0.05

Table 6: *The comparison on between diabetic patients who had dyslipidemia (group 1) with those without dyslipidemia (group 2) (n = 68).*

Discussion

The main reason to perform this study was emerged from the large number of patients who were diagnosed with cataract and had a history of hyperlipidemia consulting an ophthalmology department.

There are many causes of cataract, but the effect of dyslipidemia as a direct or indirect cause of cataract, did not explained or studied thoroughly before.

The sex ratio indicated that more males than females were found in the study (Table 1).

In table 2, it is obviously clear that in comparison with normal lipid values, more males than females were found to have dyslipidemia, and this is may be due to larger sample of males patients versus females (Table 2).

The age distribution in our study revealed that age factor is directly related to abnormally high lipid profile, which is an acceptable fact where elderly people have dyslipidemia in comparison with younger people [8-10] (Table 2).

In this study, the large number of cataract patients including three types (nuclear, posterior-subcapsular, and cortical) cataracts were found to have dyslipidemia in comparison with those without dyslipidemia, but it was statistically significant for the nuclear and cortical cataract (Table 3).

Regarding nuclear cataract, it was found that they occupied the highest percent (35.89%) compared to other types of cataract.

This may be explained by the effect of diabetes as a cause [28], since large numbers of those with nuclear cataract were found to have DM (groupe1 in table 6), as shown in (Table 4, 6).

But according to a French study named POLA, it was found that diabetes was strongly associated with all types of cataract, except nuclear [38-41].

Furthermore, according to a study which was performed by Shalka MH to evaluate the possible association between diabetes and cataract formation, they concluded that diabetes was strongly associated with poster-subcapsular cataract, not nuclear one [42].

By taking the diabetic patients with cataract, it was found that comparing the effect of dyslipidemia and types of cataract (group2 in table 6), nuclear type was significantly associated, which is against what mentioned in the previous studies (mentioned above). This may be explained by the large number of diabetic patients seeking ophthalmological consultation, or by the fact that DM is a major risk factor for dyslipidemia [7-9].

Regarding cortical cataract, dyslipidemia was significantly associated with this type of cataract (table 3), and this may be explained by the effect of diabetes or may be due to dyslipidemia as a direct or indirect cause [28].

In a study carried out in China in 2006, named the Beijing study, which was performed to determine the association between dyslipidemia and ocular diseases; It was found that by comparing the types of cataract in terms of lipid status of 3251 patients that there is a significant association with cortical cataract, but not significant with that of nuclear nor posterior-subcapsular ones [43].

On the one hand, regarding cortical cataract this study had the same result, but on the other hand, it differs from our study concerning nuclear cataract.

This may be explained by three possibilities:

1. The Beijing study was included chines population whom their lipid status is totally differs from our population, in a lower level; and this may be resulted in these differences.
2. The effect of diabetes mellitus did not meticulously studied in the above mentioned study.
3. The large sample of this study in comparison with ours may decrease the total bias of the outcomes.

By referring to table 6, to compare between group 1 (DM with no dyslipidemia) and group 2 (DM with dyslipidemia), it was found that those with cortical cataract were not significantly associated with abnormal lipid profile; while as a whole sample, this comparison was significant (Table 3).

Supporting this fact, if we refer to table 4, there is no significant association between the abnormal level of FBS and cortical cataract, which in turn makes the effect of abnormally high lipid, is a strong possibility needs further evaluation.

Referring to table 4, there was a significant association between cortical cataract and high body mass index (BMI), which again support our hypothesis regarding the association of dyslipidemia with this type of cataract, since it was previously proven that patient with high BMI had abnormally high lipid profile especially dyslipidemia [7,9].

But regarding the other two types of cataract (nuclear and post-capsular), high BMI was not significantly associated, and this may be due to the small sample included in this study.

According to a study performed by Ning Cheung, MBBS and Tien Y Wong., *et al*. to find out the effect of obesity on ocular diseases, it was concluded that there is an important relationship between cataract and obesity and the study provided valuable insight for the potential use of weight loss strategies to reduce the burden of cataract in individuals with obesity [29].

Another study which was carried out by Ghaem Maralani H., *et al*. to investigate whether the effect of metabolic syndrome and its components on the incidence of different cataract sub-types (cortical, nuclear and posterior subcapsular) cataract change with time, it was found that low-HDL and high glucose were associated with an increased 10-year incidence of cortical and PSC cataract, respectively [44].

The results of this study, regarding cortical and post-subcapsular cataract, are consistent with the results of our study (Table3,4).

Conclusion

According to our study, dyslipidemia as a direct or indirect cause for nuclear and cortical cataract was significant, and should be considered as an important etiology for cataract and need further assessments.

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Volume 5 Issue 5 March 2017