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ORIGINAL ARTICLE

Dyslipidemia: A risk factor for cataract.

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ABSTRACT… Objective: To determine lipid profile in patients of age-related cataract and compared them with age-matched controls. **Study Design:** Case Control study. **Setting:** Naseer Memorial Hospital, Dadyal. **Period:** January 2022 to December 2022. **Material & Methods:** A total of 300 patients were recruited using a consecutive non-probability sampling method and divided in two groups, one control and the other having cataract. The patients underwent a thorough ocular assessment and lipid profile evaluation. Inclusion criteria was age 40 years or older of any gender having senile cataracts of any morphological form. Exclusion criteria was history of ocular trauma, systemic disease, ocular surgery, oral steroids or cataract other than senile cause. The data was analyzed using SPSS version 23. The results showed that patients with senile cataracts had significantly higher levels of total cholesterol, triglycerides, and LDL cholesterol, and significantly lower levels of HDL cholesterol than the controls. The collected data was entered in the statistical package for social sciences (SPSS) version 21 for analysis. Independent t test was applied and p value ≤ 0.05 was considered as significant. **Results:** It was found that patients with senile cataracts had significantly higher levels of total cholesterol, triglycerides and LDL and significantly lower levels of HDL than the age-matched controls. **Conclusion:** The findings suggested that dyslipidemia is a modifiable risk factor for age-related cataract.

Key words: Cataract, Dyslipidemia, Lipid Profile.

INTRODUCTION

Cataract is the most common cause of blindness in developing countries, accounting for half of all cases.[1] In contrast, it accounts for only 5% of blindness in developed countries.[2] Cataract blindness rates reported in the literature vary widely by region, from 4.4% in China to 0.73% in India to 1.75% in Pakistan, with bilateral blindness being more common in Pakistan.[2] Cataract is among the leading causes of preventable and curable blindness, affecting an estimated 20 million people worldwide every year. The reported incidence of cataract ranges from 0.5% in the United States to 5% in India and Pakistan.[3]

Cataract can only be treated with surgery but researchers are looking for ways to delay or prevent them. This is important because people with cataracts in low-resource areas and developing countries often cannot afford surgery which increases their risk of blindness. Delaying the onset of cataracts by ten years could reduce the number of cataract surgeries by half, saving a significant amount of money in healthcare costs.[4]

While age is the most important risk factor for cataracts, there are other factors that can increase the risk of cataract, such as metabolic syndrome (a combination of risk factors for heart disease, stroke, and type 2 diabetes), diabetes, smoking and excessive exposure to sunlight.[5] Some of these risk factors, such as smoking and excessive exposure to sunlight, are modifiable. This means that the risk of developing cataracts can be reduced by making changes in the lifestyle.[6]

Lipid profile is a measure of the levels of different types of lipids in the blood including cholesterol and triglycerides. Cholesterol is a waxy substance that is essential for many bodily functions but

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high levels can lead to heart disease and stroke. Triglycerides are another type of lipid that is stored in the body's fat cells. High levels of triglycerides can also contribute to heart disease and stroke. Dyslipidemia is the term used for high levels of cholesterol and/or triglycerides in the blood and it may be a potential contributing factor in cataract formation.

The lens is made up of a variety of proteins, including crystallins. Crystallins are responsible for maintaining the transparency of the lens. Age-related changes in lipid composition may contribute to cataract formation by altering protein-lipid interactions. Lipids are essential structural components of cell membranes and play a critical role in membrane fluidity. Alterations in lipid composition can affect the structure and function of membrane proteins, including crystallins. This can lead to the aggregation of crystallins and the formation of cataracts.[7]Other possible mechanisms by which lipid profile may affect cataract development include: Oxidation of lipids and inflammation in the eye.[8]

Dyslipidemia, or high levels of cholesterol and/or triglycerides in the blood, is a potential risk factor for cataract formation or not, remains debatable. The exact role of dyslipidemia in cataract development is still unclear and most studies on this topic have been conducted in Western populations. There is a lack of information on this topic in the Pakistan and understanding the risk factors for cataract in this population could lead to new opportunities for prevention and treatment. Therefore, a study was conducted to determine lipid profile in patients of age-related cataract and compared them with age-matched controls. This information can be used to develop new screening programs and treatments for age-related cataract.

MATERIAL & METHODS

A comparative observational study was conducted at Naseer Memorial Hospital spanning one year from January 2022 to December 2022. This study received ethical approval from the review committee and adhered to the principles outlined in the Declaration of Helsinki (NMH/HRC/2021/11). The study entailed the selection of 300 patients through a consecutive non-probability sampling method. Before participating in the study, patients were given consent forms in straightforward and easily understandable Urdu language, and their consent was obtained both verbally and through written documentation. The patients underwent a thorough ocular assessment that encompassed a range of critical evaluations. Visual acuity was measured using the Snellen chart, assessment of pupillary reflexes was done to determine neurological and eye health. A slit lamp examination provided detailed illumination and magnification of ocular structures, allowing for a comprehensive evaluation of both anterior and posterior eye segments. Additionally, intraocular pressure was measured using applanation tonometry. Furthermore, a detailed biomicroscopic fundoscopy enabled scrutiny of the retina, optic nerve, and other ocular structures, aiding in the detection of any anomalies or pathologies. Cataract diagnosis and grading were conducted meticulously using the standardized Lens Opacity Classification System (LOCS) on a slit lamp equipped with a retro illumination technique, ensuring precise assessment and classification of cataracts, which served as crucial data for the study's analysis of cataract severity and characteristics among the participants.

Subsequently, the subjects were categorized into two distinct groups. Group I consisted of individuals aged 40 years or older, of any gender, with senile cataracts presenting in various morphological forms. Exclusion criteria for this group included history of ocular trauma, any systemic disease, smoking, alcohol consumption, presence of glaucoma, any retinal conditions, prior ocular surgeries, steroids usage and cataracts resulting from ocular or systemic diseases. Group II was selected from the outpatient clinic, consisting of individuals in the same age range as Group I, with the same exclusion criteria applied. Unlike Group I, these participants did not have cataracts.

The study encompassed the evaluation of the lipid profile of participants in both groups. To facilitate this assessment, a standardized procedure was followed. Specifically, 5 milliliters of blood were

collected from the median cubital vein of each subject following a rigorous 12-hour overnight fast. These collected blood samples were then meticulously transferred into serum separator tubes (SSTs). To ensure precise identification, each SST was carefully labeled with the subject's name, age, gender, and medical record number. The primary focus of the research was to thoroughly examine and analyze the serum lipid profiles of individuals in both study groups, thereby contributing to a comprehensive understanding of lipid-related factors in the context of the study. The assessment of lipid parameters, including total cholesterol (with a required level of < 200 mg/dL), HDL-cholesterol (with a required range of 30-60 mg/dL), LDL-cholesterol (with a required level of < 100 mg/dL), and triglycerides (with a required level of < 150 mg/dL), was conducted using Cobas Dimension RXL Auto analyzer, manufactured in Germany.

The gathered data underwent rigorous statistical scrutiny using SPSS version 23. Descriptive statistical methods were utilized to assess the distribution of categorical variables, such as gender, in terms of frequency and percentages. Gender distribution was represented in terms of percentages and frequencies, offering insights into the composition of the study population. For continuous variables, such as age and the lipid profile, descriptive statistics were applied to express these measures as means along with their corresponding standard deviations. To gauge disparities between the control and patient groups, an independent t-test was applied, setting the threshold for statistical significance at a P-value of less than 0.05.

RESULTS

The study spanned over 1 year, involving the examination of a total of 24,759 patients. Among them, 1,874 individuals, constituting 7.5% of the total examined patients, were diagnosed with cataracts. Within this cataract patient cohort, 956 were males, accounting for 51.01%, with an average age of 57 ± 11.4 years, while 918 were females, representing 48.9%, with an average age of 55 ± 8.4 years.

To compose Group I for the study, 150 patients who met the specified inclusion and exclusion criteria were selected from the pool of diagnosed cataract patients. Within Group I, it was noted that cataracts were predominantly found in the right eye in 32.6% of males and 21.3% of females, with bilateral cataracts observed in 18.6% of males and 8.6% of females. In terms of cataract morphology, the majority of patients displayed nuclear cataracts (40% in males vs. 32% in females), followed by posterior subcapsular cataracts (11.3% in males vs. 14.6% in females).

Regarding gender distribution, Group I comprised 65.33% females and 35.66% males, while in Group II, these proportions were 68% females and 32% males. The mean age of patients in Group I was 63.20 ± 9.5 years, while in Group II, it was 65.5 ± 8.9 years. It's noteworthy that both groups exhibited a similar age and gender distribution, with no significant variations observed. In terms of lipid profiles, notable findings emerged (Table-II). Cataract patients displayed a substantial increase in mean serum total cholesterol compared to the control group (Mean mg/dL ± SD: 195.25 ± 10.63 vs. 162.05 ± 17.39, $p<0.05$). Specifically, the mean serum total cholesterol of cataract patients exceeded that of the control group by 33.2 mg/dL. Furthermore, a significant reduction in mean HDL-Cholesterol values was observed among cataract patients in comparison to the control group (Mean mg/dL ± SD: 48.11 ± 4.62 vs. 53.85 ± 6.55; $p<0.05$). In fact, the mean HDL-Cholesterol levels in cataract patients were 5.74 mg/dL lower than those in the control group. Moreover, there was a marked elevation in mean serum LDL-Cholesterol levels among cataract patients as compared to the control group (Mean mg/dL ± SD: 126.79 ± 22.24 vs. 93.70 ± 14.58; $p<0.05$). Specifically, the mean serum LDL-Cholesterol in cataract patients surpassed that of the control group by 33.09 mg/dL.

Cataract Classification		Males	Females
Nuclear		40%	32%
Posterior Subcapsular		11.3%	14.6%
Cortical		1.3%	1.3%
Bilateral		18.6%	8.6%
Unilateral	Right Eye	32.6%	21.3%
	Left Eye	6%	12%

Table-I. Cataracts in Group I (N = 150)

Serum Lipid Profile in mg/dL	Group-I (Cataract Patients)	Group-II (Control)	P-Value
Total Cholesterol	195.25 ± 10.63	162.05 ± 17.39	<0.05
Triglycerides	140.29 ± 17.69	111.25 ±18.82	<0.05
LDL-Cholesterol	126.79 ± 22.24	93.70 ± 14.58	<0.05
HDL-Cholesterol	48.11 ± 4.62	53.85 ± 6.55	<0.05

Table-II. Assessing Dyslipidemia Risk (n=300)

Lastly, a significant increase in mean serum triglyceride levels was observed in cataract patients in contrast to the control group (Mean mg/dL ± SD: 111.25 ± 18.82 vs. 140.29 ± 17.69; $p<0.05$) (Table-II).

DISCUSSION

Cataracts are furthermost common in older adults, but they can also arise in children and young adults.[7] The causes of cataract are numerous and oxidative stress is believed to play a major role too. Oxidative stress is caused by the production of free radicals, which are unstable molecules that can damage cells and tissues.[8] Light exposure is a foremost source of free radicals, and cataracts are therefore found more common in individuals who spend a lot of time outdoors.

In our study, we found a cataract prevalence of 7.5%. This is lower than the 20.9% reported in a survey[9] of the general population in Pakistan, but it is higher than the prevalence reported in some other countries.[10,11] In our study, the prevalence of cataracts was 16.8% in men and 8% in women aged 65 and older. The prevalence of cataracts also varies depending on the type of cataract. Nuclear cataracts are the most common type, followed by posterior subcapsular cataracts and cortical cataracts.[12] In our study, nuclear cataracts were the most common type in both men and women. We found bilateral cataract in 16.8% males and 8% females compared to a study conducted in Chakwal[13] district reporting prevalence of bilateral cataract in 5.1% of the study group. Similarly, different prevalence of cataract has been reported according to morphology. Jan N. et al[14] reported that posterior subcapsular cataracts were the most common type of cataract, followed by nuclear cataracts and then cortical cataracts. We found nuclear cataract to be the commonest followed by posterior subcapsular cataract. The variation in cataract prevalence may be due to a number of factors, including differences in study methods, use of different definitions of cataract, differences in study populations and difference in climates.[15]

Our study found that cataract patients had significantly higher levels of total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) than controls. These findings are consistent with those of several recent studies that have examined the relationship between serum lipids and cataract. Li S et al[16] found that higher serum LDL-C and TG levels were significantly associated with an increased risk of age-related cataract. Our study also found a significant association between high serum LDL-C levels and cataract, but we did not find a significant association between high serum TG levels and cataract in men. This may be due to the different populations studied or the different methods used to assess cataract. A study by Mundra MR[17] found that serum triglycerides and VLDL were significantly higher in cataract patients than normal controls, while serum cholesterol, LDL and HDL were not significantly different. Our study found a significant increase in mean serum triglyceride levels in cataract patients, but we also found a significant decrease in mean serum HDL-C levels. This suggests that both high serum triglycerides and low serum HDL may be risk factors for cataract.

Khataminia G et al[18] also found that cataract patients had significantly higher levels of total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) than controls. They also found that cataract patients with pseudo exfoliation syndrome (PEX) had significantly higher levels of TC, TG, and LDL-C than cataract patients without PEX. A study by Hiller R et al[19] found that a high level of TG was associated with an increased risk of posterior

subcapsular cataract (PSC) in men, and this result was significant after age and multivariable adjustment were made. They also found that men with low HDL-C levels were at increased risk of PSC, although this result was at a borderline level of significance.

Some studies have shown that gender differences exist in the association between serum lipids and cataract. For example, a study by Garg P [20] found that elevated TG levels were significantly associated with cataract in women, but not in men. This may be due to the fact that women have lower levels of HDL-C than men.[21] HDL-C is thought to play a protective role against cataract formation.[22]

Dyslipidemia may contribute to cataract development through a variety of mechanisms. Elevated serum lipids can lead to the formation of free radicals, interfere with the lens' ability to produce antioxidants, and accumulate in the lens.[23] These changes can all damage the lens epithelial cells, impair the lens' ability to clear harmful substances, and lead to cataract formation. More research is needed to fully understand these mechanisms and to develop effective strategies for preventing cataracts in people with high serum lipids.

Although it was a comparative case-control design study, it has several limitations. It has a relatively small sample size, lacks of long-term follow-up data and fails to account for dyslipidemia incidence in the study population. Furthermore, it was observational and cannot prove that only dyslipidemia causes senile cataracts. However, the results do suggest that there is a link between the two conditions and that further research is warranted. Larger studies with longer follow-up and consideration of dyslipidemia incidence are needed to confirm the findings and elucidate the underlying mechanisms of the association between lipid profile and age-related cataract. Despite its limitations, this study provided valuable insights into the association between lipid profile and age-related cataract in a Pakistani population.

CONCLUSION

We concluded that dyslipidemia is a modifiable risk factor for age-related cataract. Screening and management of dyslipidemia may help to reduce the risk of cataract development and progression.

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2	Aqsa Malik	Design, Data analysis, Manuscirpt preparation.	
3	Masooma Talib	Literature search, Manuscirpt preparation.	
4	Iqra Anwar	Daa acquisition, Manuscirpt preparation.	
5	Sohail Zia	Data analysis, Statisitcal analysis, Manuscirpt preparation.	
6	Usman Arshad Qureshi	Statisitcal analysis, Manuscript Editing, Manuscript review.	