Original Research Article

Exploring Lipid Abnormalities in Senile Cataract: A Cross-Sectional Investigation

Abstract

Background: Age-related cataracts (ARC) are a common cause of vision impairment in older adults. Previous studies have suggested that abnormal Lipid profile and oxidative stress may contribute to the development and progression of ARC.

Aim: The aim of this study was to compare the serum Lipid profile levels in patients with ARC and healthy controls.

Materials and Methods: This was a case-control study involving 50 patients with ARC and 50 age and gender-matched controls. Serum Lipid profile levels were measured using standard methods. The data were analyzed using t-test. A P-value of less than 0.05 was considered statistically significant.

Results: The results showed that the mean serum level of HDL Cholesterol was significantly lower in the ARC group than in the control group, while the mean serum level of triglyceride was significantly higher in the ARC group than in the control group.

Conclusion: This study indicates that altered lipid profile may be a risk factor for ARC.

Keywords:age-related cataract, serum lipid, case-control study, low-density lipoprotein cholesterol.

INTRODUCTION

Cataract is a major cause of blindness and low vision worldwide. It is estimated that 44.1% of blind cases and 51.6% of patients with low [2,3] vision suffers from cataract. Age is the most important risk factor and about 85 percent of involved patients have age-related cataract. This type of cataract is called "senile cataract". It has been shown to be the 4 main cause of blindness in patients over 50 years of age. In India cataract has been reported to be responsible for 50-80% of the bilateral [5,6] blindness in general. It is presumed that population above 60 years of [5,7] age which was around 56 million in 1991 may rise twice by 2016. It is estimated that a ten-year delay in the onset of cataracts could decrease the number of cataract surgeries by 45 per cent, thus considerably

Diminishing cost of care. Also, Patients with cataracts in low resource areas and developing countries have a poor chance for surgery due to economic reasons. This results in an increased risk of blindness in such [2,8] population. The development of senile cataract is a complex multifactorial process. Several factors such as genes, gender, diabetes, geographic location, UV light exposure, level of education, occupational status, nutritional factors and raised Body mass index [2]have been found to be associated with cataract formation. Some risk factors for cataract are modifiable; and the disease can be prevented by the elimination of these factors. It has recently been shown that dyslipidemic patients may develop lens opacities more frequently than the normal population, and thus lens opacities should be regarded as [9,10] one of the most common clinical signs of dyslipidemia. Also, some studies have been carried out relating components of metabolic syndrome with development of senile cataract which have shown dyslipidemia as risk factor for the development of age related cataract.[11]

The aim of this study was to investigate the biochemical changes in senile cataract patients.

MATERIAL AND METHODS

The study was carried out in the Department of Biochemistry, in collaboration with the Ophthalmology Department, from May 2021 to October 2022 in a Topiwala National Medical College Mumbai. The study sample included 120 participants aged 50 to 80 years, who were divided into two groups: cases and controls. Cases were patients diagnosed with senile cataract, and controls were normal healthyindividuals.

The inclusion criteria for the study were:

1) Diagnosis of senile cataract by an ophthalmologist

2) Normal healthy individuals without any eye diseases as controls

3) Age range of 50 to 80 years.

The exclusion criteria for the study were:

1) Refusal to participate in the study

2) Cataract caused by other factors such as trauma, metabolic disorders, radiation therapy etc.

3) Any systemic disease such as diabetes, hypertension etc.

4) Acute or chronic diarrhea

5) Acute or chronic renal failure

6) History of drug intake such as steroids, antipsychotics, chemotherapy etc.

We obtained 5 ml of blood from the veins of each participant after they had fasted for 10-12 hours overnight. We then separated the serum by spinning it in a machine and measured the levels of Lipid profile, which includes serum Total cholesterol, Triglyceride, HDL, and LDL, using a Beckman coulter Clinical chemistry Autoanalyzer.

We used Friedewald's equation to estimate serum VLDL levels. We obtained reagent kits from commercial sources and followed the manufacturer's instructions.

Statistical analysis

We performed unpaired t-tests to compare the parameters between the case and control groups. We considered p-values less than 0.05 as statistically significant.he 95% confidence intervals (CI) were calculated for continuous variables, providing a range within which the true population values are likely to fall.

RESULTS

Table1: Comparison Of Lipid Profile In Senile Cataract Cases And Controls

Parameter	Senile Catract(n=50) [mean ± SD]	Controls (n=50) [mean ± SD]	CI 95 %	P value
Age (year)	66.99±8.83	65.11±7.12	-0.64, 4.40	0.25
BMI (kg/m^2)	23.68±3.16	23.53±3.14	-0.63, 0.93	0.77
Smoking (yes/no)	35/15	36/14	-0.19, 0.19	0.96
Triglycerides (mg/dL)	221.8 ± 19.99	139.5 ± 21.57	(62.4,102.2)	<0.0001
Total Cholesterol (mg/dL	173.10 ± 13.15	170.42 ± 20.22	(-8.76, 14.72)	0.2129
HDL-C (mg/dL)	38.3 ± 3.75	44.08 ± 6.79	(-9.45, -2.11)	<0.0001
LDL-C (mg/Ll)	108.44 ± 11.53	109.44 ± 12.52	(-5.67, 3.67)	0.834
VLDL-C (mg/dL)	41.36 ± 4.50	27.78 ± 4.47	(9.51, 17.65)	0.002

The comparison of lipid profiles between senile cataract cases (n=50) and controls (n=50) revealed several noteworthy findings. The mean age of senile cataract patients was 66.99 years (SD ± 8.83), while controls had a mean age of 65.11 years (SD ± 7.12). The difference was not statistically significant (95% CI: -0.64 to 4.40, p = 0.25).

In terms of body mass index (BMI), senile cataract patients exhibited a mean BMI of 23.68 kg/m² (SD ± 3.16), and controls had a slightly lower mean BMI of 23.53 kg/m² (SD ± 3.14). The difference was not statistically significant, with a 95% CI ranging from -0.63 to 0.93 and a p-value of 0.77.

The smoking status, presented as the proportion of smokers (yes/no), showed no significant difference between the two groups. Senile cataract patients had a ratio of 35:15 (yes/no), while controls had a ratio of 36:14, with a 95% CI of -0.19 to 0.19 and a p-value of 0.96.

Examining the lipid profile, senile cataract patients exhibited significantly higher triglyceride levels compared to controls (221.8 ± 19.99 mg/dL vs. 139.5 ± 21.57 mg/dL, 95% CI: 62.4 to 102.2, $p < 0.0001$). Similarly, high-density lipoprotein cholesterol (HDL-C) levels were significantly lower in senile cataract patients (38.3 ± 3.75 mg/dL) than in controls (44.08 ± 6.79 mg/dL, 95% CI: -9.45 to -2.11, $p < 0.0001$).

No significant differences were observed in total cholesterol, low-density lipoprotein cholesterol (LDL-C), and very low-density lipoprotein cholesterol (VLDL-C) levels between senile cataract patients and controls.

These results highlight distinct lipid profile variations in senile cataract patients, specifically elevated triglycerides and reduced HDL-C levels, emphasizing potential associations with cataract development.

DISCUSSION:

The observed differences in triglycerides, very low-density lipoprotein cholesterol (VLDL-C), and high-density lipoprotein cholesterol (HDL-C) levels between senile cataract patients and healthy controls suggest potential associations between lipid metabolism and the development of senile cataracts. In this discussion, we will explore these findings in the context of recent literature and discuss their implications.

Triglycerides and VLDL-C Levels:

The significantly higher levels of triglycerides and VLDL-C in senile cataract patients compared to healthy controls may indicate an involvement of lipid metabolism in the pathogenesis of cataracts. Elevated triglycerides and VLDL-C have been implicated in oxidative stress and inflammation, both of which are known contributors to cataract formation. Recent studies have highlighted the role of dyslipidemia in promoting oxidative damage to the lens proteins and structural alterations, potentially accelerating cataractogenesis [19][20]. The findings in this study align with emerging evidence suggesting a link between elevated triglycerides and VLDL-C and cataract development.

HDL-C Levels:

The observation of significantly lower HDL-C levels in senile cataract patients is noteworthy. HDL-C is known for its anti-inflammatory and antioxidant properties. Reduced HDL-C levels have been associated with increased oxidative stress, which is a known factor in cataract formation [21]. The current findings support the notion that decreased HDL-C levels might contribute to the vulnerability of the lens to oxidative damage, potentially playing a role in the pathogenesis of senile cataracts.

Total Cholesterol and LDL-C Levels:

The lack of significant differences in total cholesterol and low-density lipoprotein cholesterol (LDL-C) levels between senile cataract patients and controls suggests that the overall cholesterol levels may not be major contributors to cataract development in this study population. While some studies have proposed a potential link between elevated total cholesterol or LDL-C and cataracts, the evidence is inconsistent, and recent research has questioned the strength of this association [22][23].

Implications and Future Directions:

The findings of this study underscore the need for further research into the role of lipid metabolism in cataractogenesis. Understanding the specific mechanisms by which triglycerides, VLDL-C, and HDL-C influence cataract development could open avenues for preventive and therapeutic strategies. Lifestyle interventions targeting lipid profiles might be considered in preventive strategies for senile cataracts, especially in individuals with dyslipidemia.

CONCLUSION

In conclusion, our study reveals a significant association between altered lipid metabolism and the development of senile cataracts. Elevated triglycerides and VLDL-C levels suggest their potential role in cataract pathogenesis, linked to oxidative stress and inflammation. Lower HDL-C levels underscore a vulnerability to oxidative damage, contributing to senile cataracts. Interestingly, total cholesterol and LDL-C levels did not differ significantly between groups, challenging their direct impact. These findings emphasize the multifaceted nature of cataract development and call for further research to uncover specific mechanisms, paving the way for targeted preventive and therapeutic strategies, particularly for individuals with dyslipidemia.

ETHICAL APPROVAL: As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

CONSENT: As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS: Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper

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