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ASSESSMENT OF SERUM LIPID PROFILE IN SENILE CATARACT PATIENTS ATTENDING A TERTIARY CARE TEACHING HOSPITAL OF TRIPURA: A CROSS-SECTIONAL STUDY

Biochemistry

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ABSTRACT

Background: Cataracts rank as the second leading cause of visual impairment globally after refractive errors, and are the primary cause of preventable blindness. Aim of our study was to evaluate lipid profiles in patients with senile cataracts compared to age-matched controls, with an objective of guiding new screening programs and treatment strategies. **Materials And Methods:** A hospital-based, cross-sectional study was conducted in the Department of Biochemistry in collaboration with Department of Ophthalmology at Agartala Government Medical College and Govind Ballabh Pant Hospital, Tripura, from January 2023 to June 2024. The study included 100 senile cataract patients over 50 years old and 100 age-matched healthy controls. Serum total cholesterol, triglyceride, high-density lipoprotein (HDL), low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) were measured. The Student's t-test was used to compare means, with a p-value < 0.05 considered statistically significant. **Results:** A statistically significant increase ($p<0.001$) was observed in serum levels of total cholesterol, triglyceride, LDL, and VLDL among cases compared to controls. In contrast, serum HDL levels were significantly lower ($p<0.001$) in cases than in controls. **Conclusion:** Our findings reveal that hyperlipidemia may play a significant role in the development of senile cataract. Further research may be conducted to uncover the role and molecular mechanisms of antioxidant protection in patients of senile cataract having hyperlipidemia.

KEYWORDS

Senile cataract, Hyperlipidemia, Lipid profile

INTRODUCTION:

A cataract refers to any clouding of the lens or its capsule, whether present at birth or developed later. The most common type is senile cataract, typically affecting those over 50 years of age. They progress from lens opacity to swelling, shrinkage, and loss of transparency.[1] Cataracts are the second leading cause of global visual impairment (33%) after refractive errors (43%) and the most common cause of avoidable blindness (51%).[2] In India, they account for 66.2% of blindness and 71.2% of visual impairment in people over 50 years of age, according to a 2015–2019 National Program for Control of Blindness & Visual Impairment survey.[3] Cataracts are treatable only with surgery, but research aims to delay or prevent them. This is crucial for low-resource areas where surgery is often unaffordable, increasing blindness risk. Delaying cataract onset by 10 years could halve surgeries and significantly reduce healthcare costs.[4] Age is the main risk factor for cataracts, but other factors include metabolic syndrome, diabetes, smoking, and excessive sunlight exposure. Modifiable risk factors like smoking and sunlight exposure can be addressed through lifestyle changes to reduce cataract risk.[5, 6] A lipid profile measures blood levels of cholesterol and triglycerides. While essential, high levels of these lipids, termed dyslipidemia, can increase the risk of heart disease, stroke, and possibly cataract development.[7] The role of dyslipidemia in cataract formation remains uncertain, with most research conducted in Western populations. Limited data exists for India, where understanding cataract risk factors could aid prevention and treatment. Aim of our study was to evaluate lipid profiles in patients with senile cataracts compared to age-matched controls, with the goal of guiding new screening programs and treatment strategies.

MATERIALS AND METHODS:

A hospital based observational cross-sectional comparative study was conducted in the Department of Biochemistry in collaboration with Department of Ophthalmology, Agartala Government Medical College & Govind Ballabh Pant Hospital. Agartala, Tripura from January, 2023 to June, 2024. The study population was 100 senile cataract patients aged above 50 years attending the outpatient department (OPD) of Department of Ophthalmology, Agartala Government Medical College & Govind Ballabh Pant Hospital, Agartala; and 100 age-matched healthy individuals. Sample size was calculated in Openepi software with confidence interval of 95%, power of 80% and ratio of 1:1 between two groups with a dropout rate of 10%. The study was conducted after obtaining approval from Institutional Ethics Committee (IEC) of Agartala Govt. Medical College. Written informed consent was obtained from all the study participants.

Inclusion Criteria:

a) 100 patients with cataract attending the OPD of Department of Ophthalmology, Agartala Government Medical College & Govind Ballabh Pant Hospital, Agartala.
b) Patients aged above 50 years.
c) 100 age-matched healthy individuals.
d) Both sexes were included.
e) Those who were willing to take part in this study.

Exclusion Criteria:

a) Patients with congenital cataract, traumatic cataract, complicated cataract.
b) Patients operated for cataract (pseudophakia, surgical aphakia).
c) Patients with pre-existing ocular diseases like glaucoma, uveitis, corneal opacity.
d) Patients with diabetes mellitus, hypertension, cardiac diseases, hepatic disorders or renal disorders.
e) Patients with a history of drug intake such as statins, steroids and chemotherapy.
f) Patients with a history of smoking and alcohol consumption.
g) Those who were not willing to take part in this study.

Collection Of Blood Sample For The Study:

Under aseptic conditions, 6 ml of blood was drawn from the antecubital vein using a sterile needle and syringe. The collected blood was transferred into pre-labelled clot activator containers and left to clot at room temperature. The serum was then separated by centrifugation at 3000 rpm for 3-5 minutes, and the samples were appropriately labelled and coded. Whenever feasible, the tests were conducted immediately. If any delay occurred, aliquots of the samples were stored at a temperature of 2–8°C until analysis.

Methods:

a) Estimation of serum total cholesterol by cholesterol oxidase-p-aminophenazone (CHOD-PAP) method in XL-640 full auto-analyzer.

b) Estimation of serum triglyceride by glycerol phosphate oxidase-trinder (GPO-trinder) method in XL-640 full auto-analyzer.
c) Estimation of serum high-density lipoprotein (HDL) by modified polyvinyl sulfonic acid (PVS) and polyethyleneglycol-methyl ether (PEGME) coupled classic precipitation method in XL 640 full autoanalyzer.
d) Estimation of serum low-density lipoprotein (LDL) & very low-density lipoprotein (VLDL) by Friedwald's formula.

Statistical Analysis:
Data entry and analysis were conducted using SPSS version 29.0 on a Windows PC. Categorical data were presented through text, tables, and charts. The Student's t-test was employed to assess the significance of differences between two means. A p-value of less than 0.05 was considered statistically significant.

RESULTS:

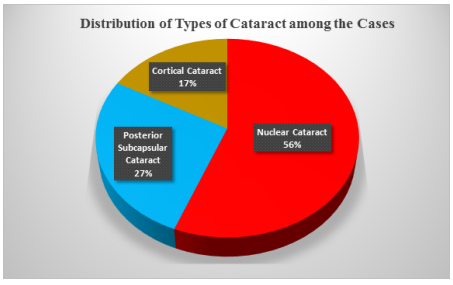

Fig 1: Distribution of Types of Cataract among the Cases

Table 1: Baseline characteristics of the study population

Parameters	Cases (n=100)	Controls (n=100)	'p' value
Age (Years)	62.4 ± 4.16	61.9 ± 4.84	>0.05
Sex	Male- 44% Female- 56%	Male- 47% Female- 53%	-
Body mass index (Kg/meter^2)	21.84 ± 1.26	22.16 ± 0.84	>0.05
Systolic blood pressure (mm Hg)	116.4 ± 10.84	117.14 ± 9.86	>0.05
Diastolic blood pressure (mm Hg)	78.24 ± 4.16	77.76 ± 4.88	>0.05

Table 2: Biochemical parameters among the study population

Parameters	Cases (n=100)	Controls (n=100)	't' value	'p' value
Serum Total Cholesterol (mg/dl)	188.26 ± 36.58	152.14 ± 24.48	28.06	<0.001**
Serum Triglyceride (mg/dl)	152.48 ± 11.16	132.64 ± 12.14	22.62	<0.001**
Serum HDL (mg/dl)	38.42 ± 6.14	48.68 ± 5.24	-10.26	<0.001**
Serum LDL (mg/dl)	120.46 ± 27.92	77.84 ± 16.76	28.94	<0.001**
Serum VLDL (mg/dl)	30.44 ± 2.24	26.48 ± 2.42	6.12	<0.001**

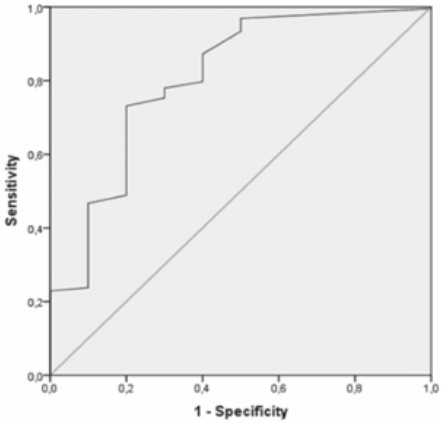

Fig 2: Area under curve for cholesterol. ROC- Receiver Operating Characteristic Curve

DISCUSSION:

Senile cataract is a significant public health issue that, if left undetected and untreated, can result in permanent vision-threatening complications. Extensive research has been conducted and continues to focus on identifying both modifiable and non-modifiable risk factors. This study aims to explore serum lipids as a biochemical risk factor for senile cataract in a small group of Indian patients. Understanding these factors could aid in modifying the lens ageing process and improving the prognosis and management of senile cataracts.

Our study revealed that the most common type of senile cataract is nuclear cataract (56%), followed by posterior subcapsular cataract (27%) and cortical cataract (17%) [Fig: 1]. These findings align with the study by Iqbal Y et al.[8], which also reported that nuclear cataracts were the most prevalent, followed by posterior subcapsular and cortical types.

We observed a statistically significant increase ($p<0.001$) in serum levels of total cholesterol, triglycerides, LDL, and VLDL in cases compared to controls. Conversely, serum HDL levels were significantly lower ($p<0.001$) in cases than in controls. Figure-2 shows a receiver operator characteristic (ROC) curve for serum cholesterol as a marker of senile cataract. The area under the curve (AUC) is 0.81 (95% CI: 0.65–0.96, $p < 0.001$), indicating moderate to good accuracy. The results of our study align with the findings of several previous studies. Recently, Iqbal Y et al.[8] conducted an observational comparative study in Naseer Memorial Hospital, Pakistan from January, 2022 to December, 2022; and observed that patients with senile cataracts exhibited significantly elevated levels of total cholesterol, triglycerides, and LDL cholesterol, along with significantly reduced levels of HDL cholesterol compared to the controls. This suggests that elevated levels of serum total cholesterol, triglyceride, LDL & decreased levels of HDL may be risk factors for senile cataract.

In a cross-sectional, case-control study conducted by Li S et al.[9] in China, it was found that serum levels of low-density lipoprotein cholesterol (LDL-C), triglycerides, and cholesterol were significantly higher ($p<0.05$) in the senile cataract group compared to the control group. Similar findings were observed when serum lipid levels were analyzed separately in male and female subgroups.

Khataminia G et al.[10] reported that cataract patients exhibited significantly elevated levels of total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) compared to the control group.

Lipid peroxidation in cataracts damages lens proteins, membranes, and epithelial cells, increasing lens opacity and altering refractive properties. Dyslipidemia, characterized by abnormal lipid levels, may contribute to cataract formation by generating free radicals, disrupting antioxidant defences, and damaging epithelial cells. Cholesterol, which constitutes 40% of lens lipids, can oxidize into harmful oxysterols due to UV light and ozone exposure, further exacerbating cataract risk. High-density lipoprotein (HDL) normally protects the lens from oxidative damage, but dyslipidemia impairs this defence, leaving the lens more vulnerable to free radical damage and promoting cataract progression.[8,11,12]

The primary limitation of our study was the selection bias associated with its hospital-based design, which may limit the generalizability of our findings to the broader population. Additional limitations include a small sample size and the cross-sectional nature of the study. We recommend conducting larger, community-based prospective studies that incorporate key covariates to address these limitations.

CONCLUSION:
While ageing can contribute to oxidative stress, our findings clearly demonstrate that hyperlipidemia is emerging as a contributing factor to the development of senile cataract. The study emphasizes the importance of limiting dietary lipid intake to delay the onset and slow down the progression of senile cataract. Further research is needed to explore the molecular mechanisms through which antioxidants exert their protective effects, with the aim of identifying potential pathways and, more importantly, discovering new protective factors in patients of senile cataract with hyperlipidemia.

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