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Association of serum lipid level with age related cataract in north western Rajasthan

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ABSTRACT

Aim: The aim of the study was to evaluate whether serum lipids levels are associated with incidence and type of age related cataract (ARC).
Materials and Methods: This was a analytical observational study conducted at Department of Ophthalmology of S.P. Medical College and Associated Group of Hospitals, Bikaner, Rajasthan, India. A random sample size of 200 subjects who met the inclusion criteria was recruited.
Statistical Analysis: Data were analyzed and statistically evaluated using SPSS-PC-25 version.
Results : In the present study we found that mean age for control group was 50.84 years and 60.91 years for case group. In control group 69% male patients were seen while in case group 53% male patients were present. The mean Serum CHO level was found to be 204.66 ± 50.76 mg/dl in control subjects and it was found to be 226.63 ± 59.63 mg/dl in the subjects with age-related cataract (ARC). The mean Serum TG level was found to be 113.70 ± 59.92 mg/dl in control subjects and it was found to be 149.35 ± 68.12mg/dl in the subjects with age-related cataract (ARC). The mean Serum HDL level was found to be 58.65 ± 15.25 mg/dl in control subjects and it was found to be 53.12 ± 11.28 mg/dl in the subjects with age-related cataract (ARC).
Conclusion: Our study found association between serum lipid profiles with age related cataract in the population. Our findings indicate a need for health promotional activities and health care access for controlling this modifiable factor among the ageing population of the country.

1. Introduction

Cataract is defined as opacity in the crystalline structure of lens which results in loss of transparency and causing generalised loss of reversible loss of visual function. This result in change in refractive index at various positions of lens.[1] This result in variation in the refractive index resulting in loss of transparency and visual function of lens. This change occurs due to alteration in cell anatomy, protein content or water content.[2] Cataracts are generally associated with breakdown of the lens micro architecture. Based on age of onset, cataract subtypes are defined. They can be a congenital type cataract or infantile onset, juvenile and senile cataract. Infantile cataract are symptomatic before 1 year of age. Juvenile cataract develops in first 10 years of life. Senile or age-related cataract are defined as cataract occurring after 40 years of age.

Congenital cataracts can occur due to maternal, intrauterine or fetal factors. Congenital cataract can occur secondary to micronutrient deficiency or they can be a sequelae to an intrauterine infection like rubella.

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Systemic or genetic diseases can predispose to cataract formation at early age. Many manifest around or before third decade of life. Eg. There is predisposition to early cataract formation in retinitis pigmentosa. Development of senile cataract is thought to be dependent on genetics. Some genetic makeup predispose individual to certain insults. These multiple insults are collected over many years. The mutation that cause change in crystalline protein or lens structural protein can result in aggregation and agglutination of lens protein which can cause formation of cataract at early age.

Senile cataract occur due to susceptibility resulting in damage to oxidant anti oxidant activity of lens. Hyperglycemia is also one of the factor resulting in early senile cataract.[3]

Many environmental factors predisposes to senile cataract. Smoking, obesity, hyperglycemia, alcoholism are implicated.[4] Genetic study like linkage analysis and individual gene mapping have found varios mutation causing congenital cataract.

Hypercholesterolemia, hypertriglyceridaemia, high LDL cholesterol and high fasting glucose are associated with cataract. Also, lower plasma antioxidant levels and higher levels of oxidative stress were seen in cataract patients than healthy controls. These findings indicate a need for health promotional activities aimed at controlling these preventable factors among high risk populations.[5] We aimed to evaluate whether serum lipid levels are associated with the incidence of age related cataracts (ARC).

2. Materials and Methods

This was a analytical study conducted at Department of Ophthalmology, S.P. Medical College and Associated Group of Hospitals, Bikaner, Rajasthan, India. After getting ethical clearance a random sample size of 200 subjects who met the inclusion and exclusion criteria was recruited.

2.1. Inclusion criteria

Patients aged ≥ 40 years with visually significant cataract willing to participate in the study were included. Following were exclusion criteria.

1. History of diabetes, hypertension or any cardiovascular diseases.
2. Any history of cholesterol lowering drug use.
3. Any old history of ocular trauma or ocular surgery (Other than cataract.
4. Use of vitamin D supplements or steroids drugs.

2.2. Statistical analysis

Data were analysed and statistically evaluated using SPSS-PC-25 version. P value less than 0.05 was considered statistically significant.

3. Results

In the present study we found that mean age for control group was 50.84 years and 60.91 years for case group. In control group 69% male patients were seen while in case group 53% male patients were present.

In the case group, distribution of cataract was found to be: 43 subjects in cortical (43%), 35 subjects had nuclear (35%), 10 subjects had PPC (10%) and 12 subjects had PSC type cataracts. Table 1 showed that the mean Serum CHO level was found to be 204.66 ± 50.76 mg/dl in control subjects and it was found to be 226.63 ± 59.63 mg/dl in the subjects with age-related cataract (ARC). The mean Serum TG level was found to be 113.70 ± 59.92 mg/dl in control subjects and it was found to be 149.35 ± 68.12mg/dl in the subjects with age-related cataract (ARC).the mean Serum HDL level was found to be 58.65 ± 15.25 mg/dl in control subjects and it was found to be 53.12 ± 11.28 mg/dl in the subjects with age-related cataract (ARC). The Total cholesterol, TG, HDL, LDL, VLDL and Total Lipid Profile levels was found to be associated significantly as evident by p-value.

Table 2 shows the association of various lipid parameters in serum with cortical versus control group. Serum TG, HDL, VLDL, and Total Lipid Profile showed significant association with cortical type of cataract (p-value < 0.05).

Table 3 shows the association of various lipid parameters in serum in PPC group and control group. Total Cholesterol, TG, LDL, VLDL, and Total Lipid Profile showed significant association with PPC type of cataract (p value < 0.05).

In Table 4 shows the association of various lipid parameters in serum in PSC case group and control group. No significant association was noted here.

4. Discussion

Cataract remains the most common treatable cause of visual function loss in population.[6] Cataract removal by surgery remains the best management strategy. Long standing cataract can lead to poor visual outcome after surgery. Lack of awareness, poverty and poor access to health care remain the main reasons, for patients with long standing cataract.

We conducted the study to show association between serum lipid profile and cataract types at our tertiary centre. A total of 200 subjects between 40-80 years were evaluated, 100 healthy controls and 100 subjects of age related cataract visiting the Department of Ophthalmology, S.P. Medical College and associated group of hospitals, were studied after taking informed consent. Cataract was graded into sub types: cortical, nuclear, posterior polar and posterior sub-capsular cataracts groups. Blood samples were taken and analysed for lipid profiles.

The cataract subtypes observed in our study was cortical (43%), nuclear (35%) PPC (10%), and PSC (12%).

Table 1: Laboratory investigations

Parameter	Control Group		Case Group		P Value
Total Cholesterol	204.6	50.7	226.63	59.63	0.006
TG	113.7	59.92	149.35	68.12	0.0001
HDL	58.65	15.25	53.12	11.28	0.004
LDL	123.2	41.7	143.6	51.1	0.002
VLDL	22.74	11.98	29.87	13.62	0.0001
Total Lipid Profile	640.58	148.77	726.1	179.3	0.0001

Table 2: Cortical cataract group

	Total CHOL.	TG	HDL	LDL	VLDL	Total Lipid Profile
			Cortical Case Group (n=43)			
Mean	218.77	155.35	50.88	136.81	31.07	714.25
SD	47.67	75.51	10.61	42.54	15.10	159.92
			Control Group (n=100)			
Mean	204.66	113.70	58.65	123.27	22.74	640.58
SD	50.76	59.92	15.25	41.70	11.98	148.77
p value	0.123	0.0001	0.003	0.079	0.001	0.009
			All values in mg/dl			

Table 3: Posterior polar cataract (PPC) group

	Total CHOL.	TG	HDL	LDL	VLDL	Total Lipid Profile
			PPC Case Group (n=10)			
Mean	256.10	185.50	51.80	167.20	37.10	829.15
SD	36.67	39.75	9.22	30.97	7.95	83.59
			Control Group			
Mean	204.66	113.70	58.65	123.27	22.74	640.58
SD	50.76	59.92	15.25	41.70	11.98	148.77
p value	0.002	0.0001	0.166	0.002	0.001	0.0001

• All values in mg/dl

Table 4: Posterior sub capsular cataract (PSC) Group

	Total CHOL.	TG	HDL	LDL	VLDL	Total Lipid Profile
PSC			**PSC (n=12)**			
Mean	221.58	147.08	52.58	139.58	29.42	712.38
SD	54.03	55.33	11.55	40.42	11.07	174.71
			Control Group			
Mean	204.66	113.70	58.65	123.27	22.74	640.58
SD	50.76	59.92	15.25	41.70	11.98	148.77
p value	0.281	0.069	0.186	0.202	0.069	0.124

• All values in mg/dl

Yating Tang et al[7] in their study reported prevalence of various cataract types. The prevalence of cortical, nuclear and PSC were 28.6%, 24.3% and 4.4% respectively. In their study, combined nuclear and cortical cataract was the most common cataract type.

Mean serum Total CHO level in our control study group was 204.66 ± 50.76 mg/dl. In case group, it was 226.63 ± 59.63 mg/dl. The serum total CHO level showed significant association with subjects of case group with p value- 0.006. Mean serum TG level in case group was 149.35 ± 68.12 mg/dl. Mean serum TG level in control group was 113.70 ± 59.92 mg/dl. It showed significant association with p value - 0.0001.Similarly HDL cholesterol level in case and control group was found to be significantly associated with p value - 0.0004. Similarly LDL–level, VLDL level, total lipid profile were found to be significantly associated.

Tavani A et al.[8] in 1995 showed association between cataract extraction and hyperlipidemia. Park YH et al.[9] proved, low serum HDL level and elevated TG level are associated with increased rate of cataracts. Our findings reiterate the same.

In our study, 43 subjects belonged to cortical cataract case group. Our study showed significant association of serum TG, HDL, VLDL and total lipid profile with cortical type cataract.

Klein be et al.[10] showed higher serum HDL level was associated with decreased risk of cortical cataract. Sabanayagam C et al.[11] found association between low HDL and cortical cataract. Pushpa Kumariel al.[12] found dyslipidemia is associated with cortical cataract.

Our study included 12 subjects which belonged to PSC type cataract. No significant association was found between lipid profile and PSC type cataract in our study.

In a similar study, Hayder M Al-Talqani et al[13] found dyslipidemia was not associated significantly with posterior subcapsular cataract. Our study replicates similar results.

Pragati Garg et al (2020)[14] found higher cholesterol levels, increased sun exposure, and smoking habit and smoking habit in the development of senile cataract, and these are modifiable risk factors. Hence, control of these might help in delaying formation and progression of cataract. We found similar results.

Martina Tomic et al[15] found Cataract was positively associated with diabetes duration (p = 0.001), HbA1c (p = 0.035), LDL cholesterol (p = 0.042), and DBP (p = 0.009), while negatively with creatinine clearance (p = 0.005). Diabetes duration and various metabolic risk factors, particularly poor glycemic control, hypercholesterolemia, DBP, and diabetic nephropathy's coexistence, are associated with cataract development in T2DM. Our study found similar positive correlation.

Vaishali S. Pawar et al[16] in their study, found no significant difference in total cholesterol, HDL-c, VLDL-c, TG and Low Density Lipoprotein cholesterol (LDL-c) in various forms of cataract. Our study found significant association between lipid level and cataract incidence.

C E Jahn et al[17] determined the possible role of glucose and lipid metabolism in the formation of cataract in elderly people. Their results suggested that the association of hypertriglyceridemia and hyperglycemia favors the formation of a specific morphologic type of lens opacity, posterior subcapsular cataract, occurring at an early age. Our research found positive correlation between lipid profile and occurrence of PSC type cataract.

5. Limitations

The limitations of this study are small sample size and enablety to prove at biochemistry level how lipids predispose to cataract.

6. Conclusions

According to data which is evident from the previous information in the current study, eventually serum total cholesterol was significantly associated when age related cataract case group was compared with control group (p value- 0.006). And, serum TG level was significantly associated when age related cataract case group was compared with control group (p value- 0.0001). While, serum HDL level was significantly associated when age related cataract case group was compared with control group (p value 0.004). Mean of serum HDL level was 58.65± 15.25 mg/dl in control group while it was 53.12 ± 11.28 mg/dl in case group. This is in contrast to other lipid serum levels because HDL is a protective type of cholesterol.

Similarly, in case versus control group serum LDL, serum VLDL and serum total lipid profile were found to be significantly associated (pvalue-0.002, 0.0001 and 0.0001 respectively). Our study included 43 cortical cataract subjects. Significant association with serum TG, HDL, VLDL levels and Total Lipid profile with cortical case group (p value- 0.0001,0.003, 0.001 and 0.009 respectively).

The present study included 35 nuclear cataract subjects, Serum Total Cholesterol, LDL and Total Lipid profile were significantly associated in this group (p value-0.032, 0.016 and 0.025 respectively).

Our study included 10 PPC type case subjects. Serum Total Cholesterol, TG, LDL, VLDL level and Total Lipid profile were significantly associated in the group (p value-0.002, 0.0001, 0.002, 0.001 and 0.0001 respectively). No significant association was found with HDL level (p value-0.166).

Our study included 12 PSC type case subject. On comparing lipid profiles of these subjects with control group, no significant association was found with serum lipid profile. Our study found association between serum lipid profiles with age related cataract in the population. Our findings indicate a need for health promotional activities and health care access for controlling this modifiable factor among the ageing population of the country.

7. Consent for Publication

The study protocol was approved by the medical ethics committee of the Rajasthan University of Health Sciences, Jaipur, Rajasthan (State), India.

8. Disclosure Statement

This study is investigator initiated. The authors declare that they have no competing/conflict of interests in relation to this article.

9. Source of Funding

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