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SERUM TOCOPHEROL LEVEL IN SENILE CATARACT

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ABSTRACT

Aetiopathogenesis of senile cataract is multifactorial. Serum tocopherol is proposed to be one of the factors in the complex process of cataract formation. The objective of the study is comparison and evaluation of serum tocopherol levels in elderly patient suffering from cataract to healthy controls. For the study, fifty one successive elderly patients with cataract together with fifty one healthy controls were considered. The estimation of serum tocopherol was measured by the formation of a red colour complex with α - α' -dipyridyl at an absorption maximum 520 nm. The red complex is formed during the process of reduction of ferric to ferrous ions. The statistical analysis was done using unpaired t-test and ANOVA. The mean serum tocopherol levels in 31 (60.8%) male patients having cataract, with mean age of 68.37 ± 6.04 years was estimated to be 0.79 ± 0.15 mg/dl. Whereas the mean serum tocopherol levels in 30 (58.8%) healthy controls with mean age of 67.37 ± 6.37 years was 0.87 ± 0.15 mg/dl. The serum tocopherol levels of both the groups depicted a marked difference ($p < 0.05$). Serum tocopherol is inversely related to cataract. Elderly patients with cataract have lower serum tocopherol level than healthy controls. However, further studies in future with large randomized group are warranted to study this factor.

Key Words: Serum tocopherol, Cataract.

INTRODUCTION

Senile cataract is actually a result of multiple mechanisms and affected by multiple risk factors [1]. It is the common cumulative response to various damaging influences attacking the capsule, epithelium and constituent fibres of the lens of the eye. The oxidation of lens proteins by free radicals plays an important part in the process leading to lens opacification [2]. This is modified by micronutrients with an antioxidant capacity, such as tocopherol, B carotene, ascorbic acid and selenium. Some experimental and cross sectional case-control studies support this hypothesis [3-5].

We examined the association between serum tocopherol and presence of senile cataract by comparing serum tocopherol level between cataract patients and healthy controls.

AIM

The objective of the study is comparison and evaluation of serum tocopherol levels in elderly patient suffering from cataract to healthy controls.

MATERIALS AND METHODS

Fifty-one consecutive elderly patients with cataract and fifty-one healthy controls were enrolled. Informed consent was taken from all subjects prior to inclusion into the study. Patients of more than 40 years age with one or both eyes having lenticular opacity without history of secondary cataract were included as senile cataract and none of the eyes having any obvious lenticular opacity as control.

All the patients underwent complete ophthalmologic examination including refractive error and visual acuity measurement, schiottz tonometry and slit lamp examination with full mydriasis. The cataract cases were further sub divided into 4 study groups (Posterior subcapsular cataract only, Nuclear cataract only, Cortical

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cataract only, Mixed) based upon the type of lenticular opacity as seen on slit lamp examination.

The estimation of serum tocopherol was measured by the formation of a red colour complex with α - α' -dipyridyl at an absorption maximum 520 nm. The red colour complex is formed during the process of reduction of ferric to ferrous ions [6]. In addition to unpaired t-test, statistical research was performed using ANOVA. $P < 0.05$ is statistically significant.

RESULTS

Cases: 31(60.8%) males and 20(39.2%) females were included. The age of patients ranged from 50 - 82 years with a mean of 68.37 ± 6.04 years. The cataract cases were further subdivided into 4 groups according to the type of cataract seen in each (Mixed Cataract, Posterior Subcapsular Cataract, Nuclear Cataract, Cortical Cataract)

Controls

There were 32(62.7%) males and 19(37.3%) females were included. The age of patients ranged from 55 - 81 years with a mean of 67.37 ± 6.37 years.

Between the two age groups ($p > 0.05$, Unpaired t-test) there was no significant difference in the mean age. In terms of gender ratio also both groups were comparable too.

The mean serum Tocopherol levels were 0.79 ± 0.15 mg/dl and 0.87 ± 0.15 mg/dl in cataract and control patients respectively. There was a marked statistical

difference of serum Tocopherol levels in both groups ($p < 0.05$).

SUBGROUP ANALYSIS

There were 18 patients (35.2%) with mixed Cataract, 6 patients (11.8%) with Posterior Subcapsular Cataract, 13 patients (25.5%) with nuclear Cataract and 14 patients (27.5%) with Cortical Cataract (Table-1). There was no statistical difference of serum tocopherol levels between these subgroups of cataracts ($p > 0.05$, Table-1).

All the cataract and control cases were further divided into 2 subgroups each (according to age) of 40 – 55 yrs and 56 – 70 yrs respectively for sub group analysis. So, there were four subgroups, 2 in each (Cases and controls) (Table-2).

Group A: Cataract cases in the age 50 – 65 yrs

Group B: Cataract cases in the age 66 – 85 yrs

Group C: Control cases in the age 50 – 65 yrs

Group D: Control cases in the age 66 – 85 yrs

Serum tocopherol levels were compared between Group A and B, Group C and D, Group A and C, Group B and D. There was no statistical significant difference between Group A Vs B, Group C Vs D ($p > 0.05$). However, a significant difference was noted between Group A and C ($p < 0.05$). In contrast, mean serum tocopherol level was high in Group D in comparison to that of group B without reaching statistical significance (Table-2)

The serum tocopherol levels between male and female subgroups of both cases and controls showed no significant statistical difference ($p > 0.05$).

Table 1. Cataract subgroups and serum tocopherol levels

Type of cataract	No. of cases	Serum tocopherol level (mg/dl)	
		Mean	S.D.
Mixed	18	0.82	0.12
PSC	6	0.70	0.19
Nuclear	13	0.81	0.15
Cortical	14	0.78	0.16

$p > 0.05$, ANOVA test

Table 2. Age subgroups and serum tocopherol levels

	Cataract Cases		Controls	
	Gr. A	Gr. B	Gr. C	Gr. D
No. of cases	19	32	24	27
Mean S. Tocopherol (mg/dl)	0.76	0.81	0.87	0.88
S.D.	0.14	0.15	0.16	0.14
p-value Unpaired t-test	Gr. A Vs Gr. B $p > 0.05$		Gr. B Vs Gr. D $p > 0.05$	

Table 3. Serum Tocopherol levels in cataract patients

Author	Year	Country	Tocopherol level
Knekt et al ⁶	1992	Finland	20.5 μ ml/L
Leske et al ⁷	1997	New York	1.48 \pm 0.5 mg/dl
Seth et al ⁸	1999	North India	6.73 \pm 1.15 μ gm/ml
Our study	2005	India	0.79 \pm 0.15 mg/dl

DISCUSSION

The mechanisms of development of cataracts related to age is nevertheless not clear, but oxidative damage of lens proteins is believed to play a major role. The resistance of the lens declines with age, as does its intrinsic defence system. Antioxidants such as vitamins C and E and β carotene may thus modify the antioxidant defence and age related development of cataracts [2].

The mean serum Tocopherol level of cataract patients in our study was 0.79 ± 0.15 mg/dl. Different workers estimated baseline serum Tocopherol levels without vitamin or nutritional supplementation. Table-3 summarizes serum Tocopherol levels of cataract patients of 3 other studies.

On subgroup analysis, the groups of cataract cases and controls were each further subdivided age wise into sub-groups of 40 - 55 and 56 - 70 years (Table-2). When the mean serum tocopherol levels of groups A and B those of groups B and D where compared, there did not seem to exist any statistical significance between them. However, the difference between the mean serum tocopherol level of groups A and C was statistically significant (Table-2). This shows that a significant difference exists between the antioxidant status (with reference to serum tocopherol level) of cataract patients and their age matched controls in the age group of 50 - 65years. Though, serum tocopherol level of older cataract patients was lower than older controls, this was not statistically significant. This is slightly odd, as, the antioxidant status of patients are more affected as age advances leading to various types of oxidative damages, one of which being damage to lens resulting in cataract formation. However, the division of subgroups was arbitrary and details nutritional status was not evaluated to reach this type of conclusion.

A number of studies related to association of serum tocopherol levels and senile cataract. [7-13] have yielded inconsistent results. But in our study, there were significant differences between the mean serum tocopherol levels between cataract group and controls ($P < 0.05$). Similar results have been published in number of studies. [9-11] An Italian study had established a report between plasma vitamin E, which was inversely associated with prevalence of cataract after adjusting for age and gender, but the relationship was no longer statistically significant after adjusting for other factors, such as education, sunlight exposure, and family history of cataract [9].

Leske and coworkers also demonstrated that individuals with high-plasma vitamin E levels had significantly lower prevalence of nuclear cataract but vitamin E was not associated with cataract at other lens sites [10]. Knekt and coworkers followed up a cohort of patients for 15 years and identified 47 patients and reported that persons with serum vitamin E concentrations above approximately 20 μ M had approximately one-half the rate

of subsequent cataract surgery as compared with persons with vitamin E concentrations below this concentration [6]. In another retrospective study, Vitale and coworkers observed the age, gender, and diabetes adjusted prevalence of nuclear cataract to be lower among persons with plasma vitamin E concentrations greater than 29.7 μ M [11]. However, in our study there was no correlation between different types of cataract and serum tocopherol levels (Table-1). Jacques and Chylack observed the prevalence of posterior subcapsular cataracts to be 67% lower among persons with plasma vitamin E levels above 35 μ M relative to persons with levels below 21 μ M [12]. On the other hand, a case-control study reported that there was no difference in Vitamin E level between cataract patients and controls [13].

In the recent control trials, the result of Vitamin E supplementation for cataract prevention are not encouraging. In a randomized control study, Age-Related Eye Disease Study (AREDS) Research Group concluded that use of a high-dose formulation of vitamin C, vitamin E, and beta carotene in a relatively well-nourished older adult cohort had no apparent effect on the 7-year risk of development or progression of age-related lens opacities or visual acuity loss [14]. Results of Vitamin E, Cataract and Age-related Maculopathy trial (VECAT) also showed no effect of vitamin E on the course of age-related cataract [15]. Results of both studies contrast with an extensive body of observational data that has linked the intake of antioxidants vitamins to reduced incidence of cataract. Earlier, the Roche European American Cataract Trial (REACT) showed Daily use of the mixture of antioxidants including Vitamin E for three years produced a small deceleration in progression of age related cataract [16]. Also, Mares-Perlman et al showed their data to add to an existing body of evidence suggesting lower risk for cataract among users of vitamin supplements and stronger associations with long-term use.

Taken this data together, these studies suggested that the effect of antioxidants on cataract development is very small. However, our small study shows a definite correlation between cataract patients and lower serum tocopherol levels in comparison to healthy controls. And there does exist a significant statistical difference of serum tocopherol level between senile cataract patients and age matched healthy controls. This may suggest serum tocopherol play a role in aetiopathogenesis of senile cataract.

In the light of the present knowledge it may be justified to use oral Vitamin E for raising their levels in serum thereby helping in prevention of cataract. However, long-term large, randomized control trials are needed to have a final word in the complex aetiopathogenesis of cataractogenesis and to establish a dose-response relationship between antioxidants and cataract.

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