A CASE CONTROL STUDY TO COMPARE SERUM TOCOPHEROL LEVEL IN PRESENILE PATIENTS WITH AND WITHOUT CATARACT AT GMCH,UDAIPUR, RAJASTHAN

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ABSTRACT

AIM
In developing countries like India, cataracts evolve earlier in life and are three times more prevalent than developed countries. This study aims to determine significance of serum tocopherol level and its relation with early development of cataract.

MATERIAL AND METHOD
This study was carried out in the Departments of Ophthalmology and Biochemistry of Geetanjali Medical College and Hospital, Udaipur, Rajasthan during the period 2015-2016. For the study, 51 cases of presenile cataract and 51 presenile patients without cataract were included.

RESULT
There is significant difference in mean serum tocopherol level in presenile patients with and without cataract (P<0.001) and serum tocopherol level had no association with type of cataract, age and gender which lead to progression of cataract.

CONCLUSION
In this study population, serum tocopherol level was substantially lower in presenile cataract patients as compared with patients without cataract. Further long-term study is warranted to recommend monitoring of serum tocopherol level as it is inversely related to cataract.

KEYWORDS
Cataract, Presenile, Serum Tocopherol, Lipid Peroxidation, Reactive Oxygen Species, Antioxidant.

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INTRODUCTION: Complete or partial opacification in the lens or its capsule is considered as cataract.1 Worldwide, nearly 50% of the cases of blindness are due to cataract which is the leading cause of reversible visual impairment.1,2 In developing countries like India, cataract is 3 times more prevalent as compared to developed countries. In our country, cataract also evolves earlier in life as compared to developed parts of the world.1 Senile or age-related cataract is the most common type of cataract.3,4 Thus, reduction in its prevalence by 50%, improving quality of life and reducing the economic burden due to disability and surgery will be possible if there is delay of 10 years in the development of cataract.5 Although possible mechanisms responsible for development of cataract have been suggested, still pathogenesis of cataract is not clear. Excessive tissue sorbitol concentration, increased permeability of the lens membrane, increased free radical production and lipid peroxidation, low antioxidant defence capacity and non-enzymatic glycosylation of lens proteins are possible mechanisms for its development.1,2

Role of Tocopherol in Cataract Formation: Oxidative stress is one of the most common initiating factors in the development of age-related cataracts.1 Free radicals are the most important oxidants.6 Oxidative damage to cellular membranes is represented by Lipid peroxidation (LPO). Non-enzymatic antioxidants like Ascorbic acid (Vitamin C), α-tocopherol (Vitamin E), Uric acid and reduced Glutathione are included in lens antioxidant defence system.7,8,9 Low serum concentration of vitamin E is thought to be associated with increased risk of cataract.10,11 α-tocopherol is thought to be an important chain breaking antioxidant and can directly scavenge reactive oxygen species (ROS). It is a major lipid soluble antioxidant present in cellular membranes, which protects against lipid peroxidation (LPO). LPO is implicated in human cataractogenesis because the toxic peroxidation products induce fragmentation of soluble lens proteins and damage vital membrane structures, correlating with an increase in lens opacity and changes in the refractive properties of the lens.12-14

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MATERIAL AND METHOD: This study was carried out in the Departments of Ophthalmology and Biochemistry of Geetanjali Medical College and Hospital, Udaipur, Rajasthan during the period 2015-2016. For the study, 51 cases of presenile cataract and 51 presenile patients without cataract were included. Patients of age up to 50 years were considered as presenile patients.

Patients with lenticular opacity without secondary cataract in one or both eyes were included in the study. Complete ophthalmologic examination of patients including refractive error and visual acuity measurement, Schiotz tonometry and slit lamp examination with full mydriasis was done. The cataract cases were subdivided into 4 groups i.e. Mixed, Posterior Subcapsular cataract (PSC), Nuclear and Cortical cataract on the basis of type of lenticular opacity as seen on slit-lamp examination.

Serum Tocopherol level was measured by the reduction of ferric to ferrous ion which leads to formation of red complex α-α’ dipyridyl at maximum absorption of 520 nm.

For the analysis, mean value and standard deviation was calculated and unpaired t test and one way ANOVA was used to find significance. P<0.05 was taken as significant and P>0.05 was considered as insignificant.

RESULTS: In the study, total of 62 (60.78%) male and 40 (39.22%) female presenile patients were studied. Out of this, 28 (45.16%) males were cataract patients and 34 (54.84%) did not have cataract. Out of 40 females, 23 (57.5%) were cataract patients and 17 (42.5%) were without cataract, which shows that both groups were comparable in terms of age and gender ratio.

During the duration of this study, no presenile patients were found to have cataract below age of 30 years. Thus, age of presenile patients was found to be in the range of 30–50 years with the mean age of 44.85±0.71 in cataract patients and 40.15±1.13 in patients without cataract.

The mean serum tocopherol level was 0.77±0.15 mg/dL in presenile cataract patients and 0.89±0.13 mg/dL in patients without cataract, which shows that presenile patients with cataract have significantly lower serum tocopherol level compared to presenile patients without cataract (t value = 4.315, P<0.001). (Table 1).

<table>
<thead>
<tr>
<th>Presenile Patients</th>
<th>Serum Tocopherol level (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>With cataract</td>
<td>51</td>
</tr>
<tr>
<td>Without cataract</td>
<td>51</td>
</tr>
</tbody>
</table>

Table 1: Comparison of Serum Tocopherol level between Presenile Patients with and without Cataract

Out of a total of 51 cataract patients, 17 (33.33%) had mixed cataract, 8 (15.69%) had PSC, 11 (21.57%) had nuclear and 15 (29.41%) had cortical cataract which is shown in Table 2. It was found that there was no significant difference in serum tocopherol level in presenile patients with cataract (F value= 1.16, P = 0.337 > 0.05) on the basis of type of cataract.

<table>
<thead>
<tr>
<th>Type of cataract</th>
<th>Serum Tocopherol Level in Presenile Patients with Cataract (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Mean±SD</td>
</tr>
<tr>
<td>PSC</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Mean±SD</td>
</tr>
<tr>
<td>Nuclear</td>
<td>N</td>
</tr>
<tr>
<td>Cortical</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>Mean±SD</td>
</tr>
<tr>
<td>F value (ANOVA)</td>
<td>1.16</td>
</tr>
</tbody>
</table>

Table 2: Distribution of Type of Cataract and Serum Tocopherol level in Presenile Patients with Cataract

Serum tocopherol levels in both groups were further compared on the basis of age and gender.

From Table 3, according to age no significant difference in serum tocopherol level was found in presenile cataract patients (t value = 1.415, P > 0.05) and in presenile patients without cataract (t value = 1.428, P > 0.05).

<table>
<thead>
<tr>
<th>Age</th>
<th>Serum Tocopherol level in presenile patients (mg/dL)</th>
<th>Serum Tocopherol level in pre-Senile Patients with and without Cataract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With cataract</td>
<td>Without cataract</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>30-35</td>
<td>2</td>
<td>0.73 ± 0.16</td>
</tr>
<tr>
<td>35-40</td>
<td>2</td>
<td>0.76 ± 0.13</td>
</tr>
<tr>
<td>40-45</td>
<td>17</td>
<td>0.79 ± 0.14</td>
</tr>
<tr>
<td>45-50</td>
<td>30</td>
<td>0.80 ± 0.15</td>
</tr>
</tbody>
</table>

Table 3: Age wise Distribution of Serum Tocopherol level in Pre-Senile Patients with and without Cataract
DISCUSSION: Oxidative damage of the lens proteins is believed to play a major role in development of cataract, but its mechanism of development related to age is still not clear.

In the current study, we considered presenile subjects with and without cataract. For the purpose, subjects up to 50 years of age were considered as presenile and no adult patients were found to have cataract below the age of 30 during the study period. Only 7.84% of the cataract patients were in age group of 30-40 years and majority (92.16%) belonged to the age group of 40-50 years.

In our study, there was significant difference in mean serum tocopherol level between patients with and without cataract in presenile group (t = 4.317, P<0.001), and there are a number of studies suggesting the association of serum tocopherol level and cataract. 

Cataracts appear to be the result of protein oxidation in the lens of the eye; antioxidants like α-tocopherol may protect the lens against oxidative damage from reactive oxygen species. In this case control study, tocopherol concentrations were found to be significantly lower in the serum of presenile patients with cataract when compared with presenile patients without cataract. 

The results of various studies that explored the association between vitamin E consumption and the incidence or severity of cataracts are also mixed. Some reported that increase in intake of vitamin E plays a protective role against cataract development, while others found no association.

This study suggests an association of low serum tocopherol levels with early development of cataract. Further research is thus required to regulate the dietary intake of vitamin E and establish its protective role in the development of presenile cataract.

REFERENCES