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BIOCHEMICAL STUDY OF SERUM MDA AND VITAMIN E IN PATIENTS OF SENILE CATARACT

Biochemistry

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ABSTRACT

Objective:- This study was planned to estimate the level of Serum Malondialdehyde (MDA) and Vitamin E in patients with senile cataracts and compare these with healthy controls.
Methodology:- A total number of 100 pre-diagnosed senile cataract cases and 100 controls of age group 45 to 70 years were included in the study. Statistical analysis was done using t-test. Significance was set at $p < 0.05$.
Results:- Significantly increased levels of serum lipid peroxide in the form of Malondialdehyde (MDA) ($p<0.0001$) were observed in the cataract patients as compared to the controls. Significantly decreased levels of Vitamin E ($p<0.0001$) were observed in all the patients.
Conclusion:- This suggests that oxidative stress and reduced antioxidant defense mechanism play an important role in the pathogenesis of Senile cataract which needs further studies.

KEYWORDS

senile cataract, serum MDA, antioxidant vitamin E, spectrophotometer.

Introduction-

Cataract is a complete or partial opacification of sufficient severity on or in the human lens or capsule to impair vision. Cataract is one of the major causes of visual impairment leading eventually to blindness. In developing countries like India, the magnitude of the problem is overwhelming. Age- related cataract is the most common variety of cataract. Usually, some degree of cataract is present after the age of 50 years[1]

According to WHO, approximately 90% of the visually impaired people come from low resources countries such as Africa and Asia, mostly in rural places and of those around 80% of them are avoidable either preventable or curable. [2,3]

Age-related (or senile) cataract is defined as cataract occurring in people >50 years of age, unrelated to known mechanical, chemical, or radiation trauma.[4]

The pathophysiology behind senile cataracts is complex and yet to be fully understood. In all probability, its pathogenesis is multi-factorial involving complex interactions between various physiologic processes modulated by environmental, genetic, nutritional, and systemic factors. As the lens ages, its weight and thickness increase while its accommodative power decreases.[5] Oxidative stress is a term used to describe any challenge in which pro-oxidants predominate over antioxidants. It may be due to either increased production of reactive oxygen species is implicated in the etiopathogenesis of a variety of diseases.[6]

Effective removal of the reactive oxygen species can be achieved by a number of enzymatic and non-enzymatic antioxidant mechanisms. [7]

Although the precise etiopathogenesis is not clear, oxidative stress is thought to play a crucial role in the development of age related cataracts.[8]

The present study tried to find out the possible role of oxidative stress by estimation of serum levels of lipid peroxidation product Malondialdehyde (MDA) and the non- enzymatic antioxidant Vitamin E in age related cataract and compared these parameters with control group.

Material and Methods-

The study group consisted of 100 patients with senile cataracts. The control group consists of 100 healthy subjects. Both the study and control groups were of same socio-economic status with similar diet habits. Patients were randomly selected irrespective of their caste and creed. The patients having a medical condition that is likely to involve the free radicals or influence the oxidative process were excluded from the study. These were the patients on antioxidant drug therapy, chronic smokers, alcoholics, rheumatoid arthritis, hypertension, toxic cataract trauma, ocular surgery, ischemic heart disease, infections, inflammatory conditions ,etc.

Measurements:-

Blood samples were obtained by vein puncture and collected in a clean dry centrifuge tube. Standard precautions were taken and hemolysed samples were discarded. The blood was centrifuged at 3000rpm for 10 minutes and serum was separated and analyzed for Malondialdehyde (MDA) and Vitamin E.

MDA was estimated by thiobarbituric acid (TBA) assay method described by **Buege and Aust (1978).**[9] Values were expressed in nmol/ml. Vitamin E was estimated in serum according to the method of Baker and Frank using dipyridyl reagent. [10] Values were expressed in mg/dl.

Statistical analysis

The data for biochemical analysis were expressed as mean ±SD. Student t-test was used to determine the significance of biochemical parameters between the patient and control groups. p value of <0.05 was considered as significant.

Results -

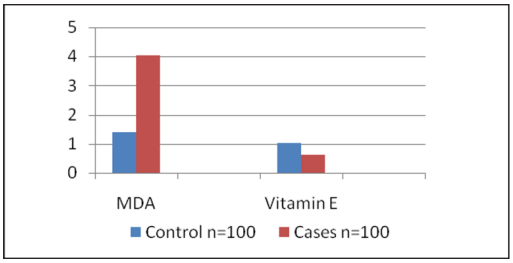
Serum lipid peroxide concentration in the form of MDA was significantly increased in the senile cataract patients ($p<0.0001$) as compared with controls. The level of non-enzymatic antioxidant Vitamin E was significantly decreased in cataract patients ($p<0.0001$) compared to that in the controls (Table1).

Table1: Levels of MDA, Vitamin E in Senile cataract patients and healthy subjects

Parameter	Control n=100	Cases n=100	p -value
MDA (nmol/ml)	1.40±0.54	4.04±0.94	<0.0001
Vitamin E (mg/dl)	1.04±0.27	0.62±0.18	<0.0001

n= Number of cases or control groups
All values are expressed in mean ± SD

Figure1-Mean values of MDA and Vitamin E in controls and cases.



Discussion:-

The pathophysiology behind the age- related cataract is complex and it has yet to be fully understood. It is believed that oxidation is a very early or initial event in the overall process in the sequence of events that lead to cataracts.[11]

In our study, the levels of MDA were significantly increased in cataract cases compared to controls. The observations of present study are in agreement with previous studies Mundra et al [12], Ghazala et al [13], and Panwar et al [14]. As age advances, there is increased peroxidative damage to lenticular membranes by oxygen free radicals in eye fluids and tissues. Thus, the continuing oxidation damage to the lens results in increased levels of MDA in cataract patients.

LPO is initiated by free radical attack on membrane lipids, generating large amounts of reactive products, which have been strongly implicated in the mechanisms of cataractogenesis [15]

The ocular lens is continuously exposed to light and is at a high risk of photooxidative damage which can result in cataract. Photo oxidative stress has important consequences in the lens because the lens never sheds its cells and there is no turnover of lens proteins throughout the life. Photo oxidative stress results essentially from light absorption by the constituents of the lens like structural proteins, enzymes, DNA and membranes. With aging components involved in protecting the lens from stress appear to decrease in activity [16]. Also the ROS generated in photo oxidation damages not only the normal crystalline lens proteins but also antioxidant defense enzymes [17].

Plasma vitamin E levels were significantly lowered in senile cataract. Vitamin E is thought to be an important chain breaking antioxidant and can directly scavenge reactive oxygen species. It is a major lipid soluble antioxidant present in cellular membranes, which protects against lipid peroxides. As demonstrated by Jacques et al, low serum concentration of vitamin E was associated with an increased risk of cataracts.[18]

Similar results were showed by Katta et al.,[19] and Madhusmita et al. [20] But the studies conducted by Olmedilia et al [21] and Gale et al [22] reported no significant correlation between serum or plasma levels of Vitamin E and age- related cataract.

Also Vitamin E, particularly α-tocopherol, functions in vivo as a chain breaking antioxidant and it is also a potent peroxyl radical scavenger. So, maybe, during the process of the free radical scavenging , vitamin E is used up and the level of vitamin E decreases in the lens [23]

Conclusion-

The present study showed decrease in the levels of Vitamin E and an increase in the levels of MDA in Senile cataract patients compared to controls. This suggests increased oxidative stress with a weakening of the body's antioxidant enzymes defense mechanism and increase in lipid peroxidation, which play important role in the etiopathogenesis of age related cataracts.

The individuals with abnormal serum levels can be subjected to further investigation to identify pre cataract changes or early cataract changes. Further studies are required to establish the role of estimation of serum antioxidants in this regard.

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