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Research Paper

Study of Serum Sodium And Potassium Levels In Patients of Senile Cataract And Control Group.

Medical Science

KEYWORDS : Age-related cataract, K+, Na+, risk factors

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ABSTRACT

Background: Recent reports suggest an association between deranged metabolism and age-related cataracts (ARC). Aim: This study was planned and carried out to evaluate some biochemical variables as possible risk factors for ARC. Materials and Methods: We compared serum Na+ and K+ in 120 cases of ARC and 120 age- and gender-matched controls. Statistical analysis was done using t-test.Signifi cance was set at P ≤ 0.05. Results: Although within normal range, the overall mean serum levels of Na+ were signifi cantly higher (P < 0.001) in the cases (142.94 ± 4.24 mEq/L) as compared to controls (138.84 ± 2.81 mEq/L). There was no signifi cant difference in serum K+ levels. Conclusion: This study suggests that there is a tendency to have higher Na+ levels in ARC as compared to non-ARC subjects, although within normal reference values.

INTRODUCTION

Cataract is a major cause of blindness and low vision worldwide. It is estimated that 44.1% of blind cases and 51.6% of patients with low vision suffers from cataract.[2,3] Age is the most important risk factor and about 85 percent of involved patients have age-related cataract. This type of cataract is called "senile cataract". It has been shown to be the main cause of blindness in patients over 50 years of age.[4]

In India cataract has been reported to be responsible for 50-80% of the bilateral blindness in general.[5,6] It is presumed that population above 60 years of age which was around 56 million in 1991 may rise twice by 2016.[5,7]

It is estimated that a ten-year delay in the onset of cataracts could decrease the number of cataract surgeries by 45 per cent, thus considerably diminishing cost of care. Also, Patients with cataracts in low resource areas and developing countries have a poor chance for surgery due to economic reasons. This results in an increased risk of blindness in such population.[2,8]

The development of senile cataract is a complex multifactorial process. Several factors such as genes, gender, diabetes, geographic location, UV light exposure, level of education, occupational status, nutritional factors and raised Body mass index have been found to be associated with cataract formation.[2] Some risk factors for cataract are modifiable; and the disease can be prevented by the elimination of these factors.

The metabolism occurring in lens tissue are very much influenced by the status and composition of aqueous humor.[9] Owing to the fact that aqueous humor is produced from blood, the plasma electrolyte concentrations directly affect electrolyte composition of aqueous humor and also affect metabolic processes in lens tissue thereof[10,11]. Certain studies have exhibited significant differences in serum electrolyte concentrations in subjects with age related (senile) cataract than those without the disease.[10]

MATERIAL AND METHODS

This study was conducted in the Department of Biochemistry, with the help of Ophthalmology Department during the period of May 2013 to October 2014 in our institute. The study population consisted of total 240 participants aged between 50 to 80 years and they were divided in two groups viz cases and controls. Cases consisted of patients suffering from senile cataract and controls consisted of normal healthy individuals.

Inclusion criteria:1) Patients diagnosed as a case of senile cataract

2) Normal healthy individuals as control group

3) Age group of 50 to 80 years.

Exclusion criteria: 1) Not willing to participate in study

2) Cataract due to any other etiology like trauma, metabolic diseases, radiation therapy etc.

3) Any systemic disease like diabetes, hypertension etc. 4) Acute or chronic diarrhea 5) Patients of acute or chronic renal failure

6) Any H/O drug intake like steroid, antipsychotic, chemotherapy etc

5 ml venous blood samples were collected after an overnight fast (10-12 hours) from all cases and controls and serum was separated by centrifugation and was analyzed for electrolyte by ISE Electrolyte Analyzer. The plasma was analyzed for sugar and serum was analyzed for urea and creatinine on ICON WP Semi-Automatic Analyzer. Investigations were carried out using commercially available ready to use reagent kits.

Statistical analysis

Comparison of parameters was done between case and control group by using

unpaired t- test. Interpretation was done according to p-value.

RESULTS

Table No. 1: serum sodium, potassium, creatinine and plasma glucose level in cataract and control group

Parameter	Cases (n=120) [mean ± SD]	Controls (n=120) [mean ± SD]	P value	
Serum sodium (meq/L)	142.94 ± 4.24	138.84 ± 2.81	<0.001	Highly Significant
Serum potassium (meq/L)	3.90 ± 0.54	3.87 ± 0.42	0.6316	NS
Serum Glucose (mg/dL)	90.8 ± 14.2	87.5 ± 13.2	0.073	NS
Serum Creatinine (mg/dL)	1.005 ± 0.14	0.95 ± 0.14	0.11	NS

NS: Non significant

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Table No. 2

Odds Ratio	Cataract	Control
Elevated Serum Sodium level	36 (a)	3 (b)
Normal serum sodium level	84 (c)	117 (d)
Total No.	120	120

ODDS RATIO = ad / bc
= 36 x 117 / 3 x 84
= 16.7

Prevalence of CATARACT is 16.7 times more in persons with Higher serum sodium compared to normal healthy controls.

DISCUSSION

Multiple studies have been done to clarify the relationship between human biochemical elements and cataract formation. Different mechanisms such as osmotic

graduation, protein aggregates, oxidative stress, nutritional factors like vitamins are proposed for cataract formation by certain workers in recent past. Result of this study shows elevated serum sodium level in cataract pts i.e. mean 142.94 ± 4.24 compared to control 138.84 ± 2.81 which is statistically significant (pvalue < 0.001). In this study increased Na level in cataract patients if persists, may progress the disorder. Because higher level of serum Na might make it more difficult for sodium pumps to maintain the low level of intracellular Na which is required for lens transparency (Table 1).

Reasons for the association between raised serum Na+ and senile cataract could be that the aqueous humour is the main source of nourishment for the lens. This thin fluid, is produced from the blood plasma. Therefore, serum electrolytes concentration directly affects the electrolyte concentration of aqueous humor and in turn regulates lens metabolism.9,10

There occurs some major changes to the cellular junctions and cation permeability with age. The major gap junction protein MIP26 loses some of its amino acids to form new variants with inhibited functions.[11,12] Due to this the membrane potential of an isolated, perfused human lens changes from approximately −50mV at the age of 20 years to −20 mV by the age of 80 years.

The K^+ levels remain constant at approximately 150 mmol/L, but the Na^+ content of the lens increases from 25 meq/L at the age of 20 years to 40 meq/L by the age of 70 years. Thus, the Na^+:K^+ permeability ratio increases approximately six-fold, which results in a proportionately greater increase in the sodium content of the lens.[13] The change in the ratio of these two ions correlates with the increase in optical density of the lens.[14] The change in ion permeability with increasing fiber age may occur due to a decrease in membrane fluidity as a result of the age-related increase in the cholesterol-to-phospholipid ratio. The lens, therefore, becomes more dependent on the Na+,K+-ATPase in the epithelial cells. But, with aging the activity of Na^+-K^+ ATPase pump is also reduced, which leads to an increase in internal Na^+. So, higher levels of extracellular Na^+ might make it more difficult for Na^+-K^+ ATPase pump to maintain the low levels of intracellular Na^+ required for lens transparency. The resulting osmotic imbalance may lead to lens fiber damage and results in formation of lenticular opacities.[10,15]

The raised level of serum sodium could be due to high salt intake in diet. The role of high salt diet in the causation of cataract has been documented by **Cumming R et al.**[16]

CONCLUSION:

Biochemical parameters such as serum electrolytes i.e. Sodium level can be used as marker to determine the risk involved in progression of cataract.

To prevent further progression of cataract, salt restricted diet may be advised in such patients after evaluating serum sodium level which may delay maturation and progression of Cataract.

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