

Research Article

Study of serum sodium and potassium concentration in cataract patients

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ABSTRACT

Background: The present study was aimed to study alterations in levels of sodium and potassium in age-related cataract patients.

Methods: 50 senile cataract patients in age group of 50 to 80 years and 50 control group were included for the study. Serum sodium and potassium levels were determined by flame photometry.

Results: Significant (<0.0001) increased levels of plasma Na^+ in cataract patients ($145.06 \pm 5.84\text{mEq/lit}$) were found as compared with controls ($141.18 \pm 2.67\text{mEq/lit}$). While Plasma K^+ the conc. in cataract patients ($4.18 \pm 0.34\text{mEq/lit}$) was not significantly ($P = 0.002$) increased when compared with controls ($4.13 \pm 0.32\text{mEq/lit}$).

Conclusion: Na, K-ATPase is responsible for maintaining the correct concentrations of sodium and potassium in lens cells. In ageing, lens fibers undergoes oxidation, and glycation may decrease Na, K-ATPase activity. The asymmetrical distribution of Na, K-ATPase activity in the epithelium and fibers may contribute to ionic currents that flow in and around the lens. So, abnormal elevation of lens sodium can be used as a marker in the opacification of the lens cortex in age-related human cataract.

Keywords: Na, K-ATPase, Cataract

INTRODUCTION

Amongst five senses vision is the most evolved sense in the human being. The eye is a complex organ composed of many small parts, but each vital to normal vision.¹ The ability to see clearly depends on how well these parts work together. Cataract is the clouding or opacity that develops in the lens of eye. A cataract forms when bounding or folding of protein changes and clump together. Eventually, these clumps cloud the lens and block the light.² Senile cataract is one of the major cause of visual impairment /disability leading eventually to blindness. In developing countries like India, the magnitude of the problem is overwhelming. The term senile refers to the fact that no specific ophthalmic or

metabolic diseases are known to involved in this type of cataract.³ It should be mentioned that cataract surgery is the commonest case of surgery in the field of ophthalmology.⁴

For the importance of cataract, research for clarifying its etiology is a necessity, so that many future disabilities can be prevented, surgical costs reduced and quality of life improved. Multiple mechanisms such as osmotic graduation, protein aggregates, oxidative stress, post translational protein changes, phase separation are proposed for cataract formation, though the exact pathogenesis is not known yet. Combined factors of heritage, UV light exposure, diet, some metabolic disorders, quality of life, cationic pump malfunction and

lens metabolism disorder are believed to have a role in cataract formation.⁵

Since the lens metabolism is associated with aqueous humor^{6,7} and this thin fluid itself is produced from blood secretions, serum electrolytes concentration directly affects electrolytes of aqueous humor and in turn lens metabolism.⁸ Biochemical studies have shown significant difference (meaningful) in some serum electrolytes concentration in those suffering from age related cataract versus those not.^{8,9}

Given the extend of disability caused by cataract it is important that some measures are to be taken to slow down the development of the cataract, as we cannot prevent it for occurring. A delay in cataract formation for 10 years will reduce the prevalence of cataract by 50%, such delay will enhance the quality of the life for much of the older population and reduces the economic burden due to visual disability and surgery.¹⁰

So the present study was undertaken to evaluate the status and the contribution of plasma level of Na⁺, K⁺ in age-related cataract cases and compared with control group, without cataract.

METHODS

The present study was carried out in the department of biochemistry, at central clinical laboratory, Dr. Vasantrao Pawar medical college and hospital, Adgaon, Nasik. The patients were selected from those who were admitted for cataract extraction in the ophthalmology department, Dr. Vasantrao Pawar medical college and hospital, Adgaon, Nasik.

The study was conducted on the serum of 50 individuals between age group of 50 to 80 years who were distributed in two groups. Study group includes senile cataract patients. Control group comprised of 50 persons aged 50-80 years with visual activity of 6/6 or better in both eye and no lens opacities in either eye on slit lamp or ophthalmoscopic examination and to whom antioxidant medicines were not given.

All the subjects with chronic liver diseases, kidney diseases, cardiovascular disorders, rheumatoid arthritis, carcinomas or patients affected by other local or systemic pathologies or drug treatments that may influence the redox state of the lens and oxidative stress were not included in the scope of present study. Patients with ocular surgery, trauma, infection, inflammation of the eye were also excluded from the study.

Then a fasting-state blood sample was obtained from both case & control group and sent to the laboratory. Serum Na⁺, K⁺ levels were measured with flame photometry method.

Statistical analysis

All results were expressed in mean \pm SD. One way analysis of variance (ANOVA) was used to test the significance of difference and "t" test to test significance of difference between two groups.

RESULTS

The levels of plasma Na⁺ in cataract patients (145.06 \pm 5.84mEq/lit) were found to be significantly higher (<0.0001) in controls (141.18 \pm 2.67mEq/lit). While plasma K⁺ the conc. in cataract patients (4.18 \pm 0.34 mEq/lit) was not significantly (P = 0.002) increased when compared with controls (4.13 \pm 0.32mEq/lit). These results are consistent with earlier studies showing significant increase in plasma Na⁺ in study group subjects when compared with controls.^{9,11} In contrast with these results, some of the studies such as the Italian - American cataract study,¹² no relation between blood biochemical elements and cataract has been shown.

Table 1: Shows levels plasma Na⁺, K⁺ of study group and control group.

	Cataract group	Control group	P value
Plasma Na ⁺ (mEq/lit)	145.06 \pm 5.84	141.18 \pm 2.67	<0.0001
Plasma K ⁺ (mEq/lit)	4.18 \pm 0.34	4.13 \pm 0.32	0.002

DISCUSSION

One of the risk factors for cataract formation is serum Na⁺ level.^{13,14} Lens has high content of potassium and low content of sodium.¹⁵ These two cations are keep in balance with each other mainly due to Na⁺-K⁺ ATP-ase pump. Na⁺ pump activity in lens is as in other cells and it is related to intracellular Na⁺, extracellular K⁺ and eventually to serum concentrations of these ions.¹⁶ Alteration in either of these ions leads to cation imbalance in lens which in turn results in cataract formation.¹⁵

In the lens, different cells appear to be specialized such that some have a high capacity for energy-dependent ion transport while others do not. This short review describes the distribution of functional Na,K-ATPase activity and Ca-ATPase activity in the lens. Movement of ions in the extracellular space between lens fibers, a topic studied by David Maurice 25 years ago, is discussed together with cell-to-cell movement of ions which is facilitated by extensive coupling in the lens cell mass. The expression of different Na,K-ATPase and Ca-ATPase isoforms in lens epithelium and fiber cells is considered along with mechanisms that potentially regulate the activity of these transport proteins.¹⁷

Zil'fian et al. studied the roles of the broken ion exchange in hydrostatic systems of an eye, in particular, potassium-sodium pump in mechanisms of ophthalmohypertension induction.¹⁸

Hence alteration in cation concentration of aqueous humor which is attributed to alterations in serum cation concentration can be known as a risk factor for cataract formation.

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