

Study of serum sodium and potassium levels in senile cataract patients versus normal controls at tertiary center

Abstract

Aims: Senile cataract is a common eye condition that affects many older people and can lead to blindness if not treated. It is caused by the gradual thickening of the lens of the eye, which reduces the clarity of vision. One of the factors that may contribute to the development of senile cataract is the imbalance of serum electrolytes, which are minerals that help regulate the fluid balance in the body.

Study Design: Hospital based prospective cross-sectional study.

Methodology: The aim of this study was to compare the levels of serum sodium and potassium in senile cataract patients and healthy controls. The study involved 200 participants aged 50 to 80 years, 100 of whom had senile cataract and 100 of whom did not. The levels of serum electrolytes were measured using standard laboratory methods.

Results: Senile cataract patients had significantly higher levels of serum sodium and potassium than healthy controls, while there was no significant difference in serum potassium levels between the two groups.

Conclusion: The high levels of serum sodium and potassium may affect the concentration of these electrolytes in the aqueous humor, which is the fluid that fills the eye. This may overwhelm the ability of the lens to regulate its volume and lead to lens opacities. Therefore, serum sodium and potassium levels may be useful indicators of senile cataract risk. The study also suggested that reducing salt intake may help prevent or delay the onset of senile cataract.

Key words: Senile cataract, Serum electrolytes, Sodium levels, Potassium levels, Cataract patients

Introduction

The process of cataractogenesis involves various potential risk factors that have been investigated in different studies. Some of these factors are genetic[1,2], UV B-rays exposure[3], occupational, geographic, and dietary factors. Senile cataract is a prevalent ocular disorder that affects many elderly individuals and can result in blindness if left untreated. It occurs due to the progressive opacification of the lens of the eye, which impairs the quality of vision. One of the possible risk factors for the onset of senile cataract is the disturbance of serum electrolytes, which are essential minerals that maintain the fluid homeostasis in the organism. We conducted a study to examine the levels of serum sodium and serum potassium, which may affect the electrolyte composition of aqueous humor and consequently alter the lens metabolism and cause cataract formation.

MATERIALS AND METHODS: It was a cross-sectional comparative study done in T.N.M.C & B.Y.L.Nair Hospital Mumbai. The study was done after getting sanction from the Institutional Ethics Committee. The study was conducted for 1 year.

We conducted this study at our institution between Jan 2021 and December 2021. We included 200 individuals who were 50 years or older and who came for eye examination. We divided them into study groups based on the type of cataract they had: nuclear, cortical, or posterior subcapsular. We used LOCS III classification to grade the cataract. We also selected age- and gender-matched controls who did not have any cataract. We excluded individuals who had diabetes mellitus, hypertension, or other systemic diseases or medications that could affect serum sodium and serum potassium levels. We also excluded individuals who had cataract due to secondary causes such as inflammation or steroid use and having

renal insufficiency and chronic diarrhoea cases. We performed a comprehensive eye examination including slitlamp and fundus examination. We only included individuals who had bilateral cataract of the same type as cases to avoid data duplication. We collected 2 ml of blood from each participant under aseptic conditions and measured serum sodium and potassium levels using the ion selective electrode method.[4]

This study included 200 individuals, of which 150 eyes had cataract and 50 did not. The cataract group was divided into three subgroups: 50 with nuclear cataract (group 1), 50 with mixed cataract (group 2), and 50 with posterior subcapsular opacification (group 3). The cataract group had 78 males and 72 females, while the control group had 35 males and 15 females. The average age in the cataract group was 64.4 years and in the control group was 63.6 years, which was not a significant difference (P value 0.30).

The mean serum sodium levels were higher in the cataract group (135.5meq/l) than in the control group (133.1 meq/l), and this difference was statistically significant (P value 0.000) [Table 1]. The same pattern was observed for the subgroup with nuclear cataract (group 1), which had a mean serum sodium level of 135.1 meq/l, significantly higher than the control group (P value 0.001). The subgroup with mixed cataract (group 2) also had a higher mean serum sodium level (135.9meq/l) than the control group, and this difference was statistically significant (P value 0.000). However, the subgroup with posterior subcapsular opacification (group 3) did not show a significant difference in mean serum sodium level (134.8meq/l) compared to the control group (P value 0.404). All the mean serum sodium levels were within the normal range.

The mean serum potassium levels of the cases and the controls were compared. The cases had a mean serum potassium level of 3.99meq/l, which was slightly lower than the controls, who had a mean serum potassium level of 3.97 meq/l. However, this difference was not statistically significant (P value 0.40).

Table 1. Mean Serum levels of electrolytes in different types of Cataract

Serum	Group 1	Group 2	Group 3	Total cataract	Group 4
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Electrolyte	Nuclear cataract (N=50)	Mixed cataract (N= 50)	Posterior Subcapsular opacification (N=50)	Group (N=150)	Control Group (N=50)
Sodium Concentration	135.5 meq/l	135.9meq/l	134.8 meq/l	135.1 meq/l	133.1 meq/l
Potassium Concentration	3.79 meq/l	4.02 meq/l	4.03 meq/l	3.99 meq/l	3.95 meq/l

The study collected blood samples from the participants and measured their serum sodium and potassium levels using the ion selective Electrode. The normal ranges for sodium and potassium were 130-143 meq/l and 3.5-5.5 meq/l, respectively, according to the reference values [4]. The data were entered and analyzed using Graph pad Prism 9 software. The study followed the ethical guidelines and obtained informed consent from the participants before the procedure. The data were not normally distributed, so nonparametric tests, such as Kruskal-Wallis and Mann-Whitney tests, were used to compare the groups.

Results and Discussion

Cataract is a multifactorial disease that involves various risk factors. Understanding these factors can help reduce the burden and cost of this condition. This study aimed to compare the serum sodium and potassium levels between cataract patients and healthy individuals of the same age group.

The results showed that cataract patients had significantly higher serum sodium levels than the controls. This difference was more pronounced in the nuclear cataract group and the mixed cataract group, but not in the posterior subcapsular cataract group. Previous studies have reported different associations of cataract types with age, race, geography, UV-B exposure, genetics, diabetes, and hypertension.[5]

The lens of the eye has more potassium and less sodium than other parts of the body. This is because of a special pump and the lens capsule that control the movement of these ions. As people get older, the pump

and the capsule become less effective, and more sodium enters the lens. This can make the lens cloudy and cause cataract. High levels of sodium in the blood can also increase the risk of cataract.

The aqueous humor, a thin fluid derived from serum, provides nourishment to the lens. The lens metabolism depends on the electrolytes in the aqueous humor, which are influenced by the electrolytes in the serum.[11] The ratio of sodium and potassium in the lens affects the osmotic pressure and the optical density of the lens.[12]

Our study is the first one, as far as we know, that links higher serum sodium levels with cortical and nuclear cataract, although this possibility cannot be excluded. Previous research has reported significantly elevated levels of bilirubin, alkaline phosphatase, and glutamyl transpeptidase in senile cataract patients compared to normal individuals.[6] Some earlier studies that compared serum sodium and potassium levels found similar results to ours.[7,8] Therefore, changes in the cation concentration of the aqueous humor, which are related to changes in the serum cation concentration, can be considered as a risk factor for cataract development.[9] Previous studies also indicate a significant difference between the serum sodium levels of those with age-related cataract and those without. However, this is not the case for serum potassium levels in their study or in ours. In summary, high-sodium diets could increase the risk of senile cataract formation. It seems that high serum sodium levels contribute to cataract development.[10]

Conclusion

This study found that cataract patients had higher serum sodium levels than healthy controls, and that this difference was more evident in nuclear and cortical cataract types. These findings suggest that serum sodium may be a risk factor for cataract formation, possibly by affecting the lens metabolism and osmotic pressure. Further studies are needed to confirm this association and to explore the underlying mechanisms. This study also highlights the importance of maintaining a balanced electrolyte level in the prevention and management of cataract.

Ethical Approval:

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

Consent

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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