ROLE OF CALCIUM ON DEVELOPMENT OF SENILE CATARACT

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ABSTRACT:

Background: Cataract is the leading cause of blindness. Any electrolyte imbalance causes cataract. This study was done to know the impact of serum calcium on senile cataract patients in tertiary care centre.

Methodology: A cross sectional study conducted in the Department of Ophthalmology, Basaveshwara Medical College and Hospital, Chitradurga, Karnataka among 25 cases who were admitted for cataract extraction between the age of 60 to 80 years from March 2020 to May 2020. Cases with chronic liver diseases, kidney diseases, cardiovascular disorders, rheumatoid arthritis, carcinomas or patients affected by other local or systemic pathologies or drug treatments were excluded from the study. Serum calcium levels were studied. Each patient was subjected to various ophthalmic measurements. All results are expressed as frequency, percentage, mean $\pm$ SD. Chi square test and paired t test is used to test the significance of difference. P value of less than 0.05 is considered as significant.

Results: Among 25 cases with senile cataract 22 (88%) were between 60-70 years and only 3 (12%) were in the age group of 71-80 years. Majority were males (56%). When far vision was

tested among these cases, it was seen that 24% had a vision of only counting fingers in right eye and in left eye 20% had a vision of 6/24 and 6/36 each. 18 cases had nuclear sclerosis of different grades. Hypermature cataract was present in 2(8%) cases and senile mature cataract among 5(20%) cases. Mean calcium levels between different grades were statistically different with p value of <0.001. Calcium levels between age groups, gender and vision in both eyes were not statistically significant.

Conclusion: Calcium levels had significant effect on development of cataract. Need to have further research to know the significant influence on cataract so that early intervention can be made to prevent further complications.

Key Words: Blindness, Calcium, Cataract, Senile.

INTRODUCTION:

Cataracts are a major cause of blindness worldwide, and they are more common in poorer countries like India.[1] The anterior lens of the eye is held in place by suspensory ligaments.[2] One-third of the eye's refractive strength comes from the transparency of the lens, which is also essential to the organ's normal physiological functions. It can alter the focal range of a species. This ability diminishes with age in the human eye and is virtually gone by the time one reaches their sixth decade of life.[3,4]

The International Agency for the Prevention of Blindness defines a cataract as the clouding or opacification of the normally clear lens or capsule of the eye, which stops light from passing through the lens and into the retina.[5,6] This illness continues to rank among the most prevalent ocular public health problems in developed and emerging countries, and it has the capacity to significantly reduce patients' quality of life.[7.]

Cataracts are responsible for more than 50% of vision loss worldwide, which includes 18.4% of people with moderate to severe visual impairment and 33.4% of blind people. Globally,

there were 10.8 million blind individuals and 35.1 million visually impaired due to cataracts in 2010.[8] Furthermore, this number will increase to 40 million in 2025 due to an older population and increased life expectancies, according to estimates from the World Health Organization (WHO).[9] Studies[10,11] have indicated that approximately 50 million people globally suffer from senile cataracts, with developing countries having a higher incidence than industrialized ones.[12] In India, the over-50 age group had an 8% incidence of cataract-related blindness, per the National Blindness Survey.[13] The WHO/NPCB (National Programme for Control of Blindness) survey indicates that cataracts account for 80.1% of the 22 million blind individuals in India.[14]

Nuclear cataract (NC), cortical cataract (CC), posterior sub capsular (PSC) cataract, acquired cataract, and congenital cataract are the basic categories of cataracts. One of the most prevalent forms of acquired cataract that results from aging is senile cataract. It is distinguished by the lens's initial opacity, which is followed by lens enlargement and, finally, lens shrinkage and total loss of transparency. A dilated eye exam, slit lamp exam (SLE), and visual activity test are all part of an eye examination that helps identify cataracts.[1,15]

Degeneration and opacification of the already developed lens fibers are the causes of cataracts. Opacity is typically caused by anything that throws off the vital intra- and extracellular balance of water and electrolytes or modifies the colloid system inside the fibers.[16] Numerous investigations have been conducted to clarify the risk factors that lead to the development of cataracts. Numerous studies have determined that age, ion imbalance, altered calcium levels, diabetes, and UV light exposure are causative risk factors for cataract development. However, more recent research has revealed additional potential risk factors that may contribute to the development of cataract, including exogenous estrogen, nutrition, dietary fat, and genetics.[17] Even though cataracts can afflict people of any age, their frequency rises with passing years.[18] People of both genders are equally affected by senile cataract, which often affects those over 50.[19]

Any electrolyte imbalance causes cataract development.[20] When it comes to cataracts, calcium is quite important. Several mechanisms involved in the metabolism of lens fiber cells depend on this cation.[21] Changes in serum calcium concentration may have a significant role in

the formation of cataracts, as evidenced by the correlation between the calcium content of the lens and opacity in human cataracts that has been demonstrated.[22,23]

Owing to speculations about the relationship of various biochemical markers and cataract formation this study was conducted to know the impact of serum calcium on senile cataract patients in tertiary care centre.

MATERIALS AND METHODS:

This was a cross sectional study conducted in the Department of Ophthalmology, Basaveshwara Medical College and Hospital, Chitradurga, Karnataka. The patients were selected from those who were admitted for cataract extraction. This study was conducted among 25 cases between the age of 60 to 80 years from March 2020 to May 2020. This study group included senile cataract patients. Cases 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 excluded from the study.

Ethical clearance was obtained from IEC and detailed informed consent was obtained before collecting the data from the study participants. Serum calcium levels were studied. Each patient was subjected to various ophthalmic measurements. Uncorrected visual acuity was measured with Snellen chart. Refraction was done and the best corrected visual acuity was noted. Intraocular pressure (IOP) measurement was done with non-contact tonometer. Corrected IOP was calculated after measuring central corneal thickness by ultrasonic pachymetry. Detailed anterior segment examination using slit lamp was done to rule glaucoma and associated ocular pathology. Detailed fundus examination under full mydriasis was done with direct ophthalmoscopy.

All results are expressed as frequency, percentage, mean $\pm$ SD. Chi square test and paired t test is used to test the significance of difference. P value of less than 0.05 is considered as significant.

RESULTS:

This study was conducted among 25 cases with senile cataract. Among them 22 (88%) were between 60-70 years and only 3 (12%) were in the age group of 71-80 years. Majority were males (56%) compared to females (44%). When far vision was tested among these cases, it was seen that 24% had a vision of only counting fingers in right eye and in left eye 20% had a vision of 6/24 and 6/36 each. [Table 1]

Table 1: Distribution of study participants with senile cataract

Variables		Frequency (%)
Age	**60 to 70 years**	22 (88%)
	71 to 80 years	3 (12%)
Gender	**Males**	14 (56%)
	Females	11 (44%)
RE vision	**6/6**	1 (4%)
	6/9	1 (4%)
	6/12	2 (8%)
	6/18	1 (4%)
	6/24	2 (8%)
	6/36	3 (12%)
	6/60	4 (16%)
	CF	6 (24%)
	HM	3 (12%)
	PL+PR	2 (8%)
LE vision	**6/9**	4 (16%)
	6/12	3 (12%)
	6/18	2 (8%)
	6/24	5 (20%)
	6/36	5 (20%)
	6/60	1 (4%)
	CF	3 (12%)
	HM	2 (8%)

Table 2: Grading of the senile cataract among the study participants

Cataract grading	Frequency	Percentage
Nuclear Sclerosis (NS 2)	06	24%
Nuclear Sclerosis (NS 3)	06	24%
Nuclear Sclerosis (NS 4)	06	24%
Hypermature Cataract (HMC)	02	8%
Senile Mature Cataract (SMC)	05	20%
Total	**25**	**100%**

Cataract was graded among these patients and it was seen that 18 cases had nuclear sclerosis of different grades. Hypermature cataract was present in 2(8%) cases and senile mature cataract among 5(20%) cases. [Table 2]

Table 3: Serum calcium levels of the study participants according their cataract grading

Cataract Grading	Serum Calcium (mg/dl)		P value
	Mean	**SD**	
NS 2	7.78	0.12	<0.001
NS 3	8.08	1	
NS 4	9.67	0.186	
HMC	9.91	0.283	
SMC	9.8	0.255	

When calcium levels were compared between different grades of cataract, it was found that mean calcium levels between these groups were statistically different with p value of <0.001. Total mean calcium level was 8.84mg/dl with SD of 0.509 among the study participants. [Table 3]

Table 4: Association of the serum calcium levels with different variables

A mean serum calcium level in the age group of 60 to 70 years was 8.86 with SD of 0.54 and among 71 to 80 years it was 8.77 with SD of 0.058. This mean difference was not statistically significant between these two groups. Among males mean level was 8.74 with SD of 0.22. These calcium levels were compared between the groups with different visions in both eyes and these differences were not statistically significant. [Table 4]

Variables		**S calcium (mg/dl)**	**P value**
Age	**60 to 70 years**	8.86±0.54	0.775
	71 to 80 years	8.77±0.058	
Gender	**Males**	8.74±0.22	0.252
	Females	8.98±0.72	
RE vision	**6/6**	8.8±0	0.777
	6/9	9.1	
	6/12	8.75±0.07	
	6/18	8.9	
	6/24	8.8±0.14	
	6/36	8.6±0.2	
	6/60	9.33±1.19	
	CF	8.77±0.21	
	HM	8.53±0.06	
	PL+PR	9.2	
LE vision	**6/9**	8.84±0.17	0.432
	6/12	9.5±1.36	
	6/18	8.7±0.14	
	6/24	8.72±0.29	
	6/36	8.74±0.21	
	6/60	8.7	
	CF	8.6±0.1	
	HM	9.05±0.71	

DISCUSSION:

Senile cataracts, characterized by the opacification of the eye lens, significantly contribute to vision impairment among the elderly. While various risk factors for cataracts have been identified, the role of calcium levels in the pathogenesis of senile cataracts remains a subject of ongoing research. Understanding this relationship is crucial for advancing preventive and therapeutic interventions.

Any imbalance between the electrolytes leads to cataract formation. Calcium is of particular concern in cataract. This cation is essential for various lens fiber cell metabolism processes. It has been shown that lens calcium content correlates with opacity in cataractous human lenses and subsequent changes in serum calcium concentration might be an important factor in the development of cataract.[1]

In our study we have considered only patients more than 60 years and majorities were males (56%) compared to females (44%) as aging itself is a major risk factor for the development of cataract in both women and men,[24] In a similar study by Rashid T et al, to study the impact of clinic-biochemical variations on cataract, 21% were in the age group of less than 50 years, 79% were more than 50 years and 52% were males. It has been suggested that with aging the alteration in membrane permeability of the lens epithelium coupled with the changes in sodium and potassium ion levels in aqueous humor may accentuate ionic imbalance within the lens and lead to the development of cataract.[25] In our study, a slightly higher percentage of men population was affected compared to women. According to different studies, women are more prone to getting most types of cataract than men. This is most likely due to lower estrogen levels after menopause in women.[26]

In our study 18(72%) cases had nuclear sclerosis of different grades. In a study by Rashid et al[1] 25% had cortical cataract whereas 75% had posterior subscapular cataract. 55% had grade I and II cataract with 91% normal IOP and mean Calcium levels among cataract cases was 8.3 with SD of 1.7 compared to our findings where mean calcium levels were 8.84 mg/dl with SD of 0.509. In a study by Deokar S et al,[27] mean calcium levels among cataract cases was 11.58 with SD of 1.65. Low serum calcium levels in cataract patients were seen in other populations, clearly supporting our results.[28] Cataract is the most common ocular symptom of hypocalcemia.[29]

Seemingly, because of deposition of calcium in soft tissues producing reduced vision/cataract or calcification of basal ganglia, calcium gets depleted in human serum.[30]

The relationship between calcium levels and senile cataracts is a complex and evolving area of research. Understanding the influence of calcium homeostasis on cataract development may contribute to the development of targeted interventions aimed at preventing or mitigating the progression of this common age-related ocular condition.

CONCLUSION:

Calcium levels had significant effect on development of cataract. Need to have further research to know the significant influence on cataract so that early intervention can be made to prevent further complications.

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