



Comparative analysis of Glucose and Electrolytes Concentrations in Serum and Aqueous humour in Diabetic and non-diabetic patients with Cataract

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Abstract

Aims and Objective: To compare the changes in serum and aqueous sodium, calcium levels and glucose levels in diabetic cataracts. To estimate the Serum and Aqueous glucose concentration in non-diabetic cataract apart from electrolyte concentration.

Material and Methods: Study design: prospective Analytical studies. **Place of study:** Dept. Of ophthalmology(Tertiary health center) **Duration** : 3 months. **Setting:** The present study was conducted in the department of ophthalmology in a tertiary care teaching hospital. **Ethical clearance** :The study has been cleared by the undergraduate review committee of the institute and the Institutional Human Ethics Committee. The study was initiated after Institutional Human Ethics Committee clearance. **Consent** :Study protocol was explained to every prospective participant individually and they were also provide with printed format . Enough opportunity was given to them to get their doubts cleared. The participants were enrolled in the study after getting signature in the consent form. The method used for statistics is Chi square test by SPSS-version-23 used for Descriptive statistics to find frequency and percentage. **Inclusion criteria:** Age more than 50 years.Patients with senile cataracts with or without diabetes mellitus. **Exclusion criteria:** Patients with history of glaucoma. Patients with history of uveitis. Patients on chronic topical medications. Patients undergone previous intraocular surgeries. Patients on diuretics. Traumatic

cataract. **Methods:** After informed consent and detailed history, systemic and ocular examinations was done as per routine pre-operative protocol and to fulfill the inclusion and exclusion criterias. Patients were divided into 3 groups. Senile Cataract with Diabetes GROUP 1 and Senile cataract without Diabetes GROUP 2. Under aseptic precautions with peri-bulbar/topical anesthesia 0.2cc of aqueous humour was collected using a 26 gauge needle and an insulin syringe intra-operatively and the cataract surgery was completed. The serum and aqueous sample collected was sent for biochemical analysis on the same day and the levels of sodium,calcium and glucose was estimated by using Dimensions RXL. **Results:** The following were the observed results: The mean aqueous level of sodium and glucose in senile cataract patients with Diabetes was found to be higher than normoglycemic cataract patients and also from the normal reference values. The serum levels of calcium in cataract patients with diabetes were slightly lower than normal which was found to be statistically significant. **Conclusion:** To conclude, the mean aqueous level of sodium and glucose in senile cataract patients with Diabetes was found to be higher than normoglycemic cataract patients and also from the normal reference values. The serum levels of calcium in cataract patients with diabetes were slightly lower than normal which was found to be statistically significant.

Keywords: **Glucose and Electrolytes Concentrations, Diabetic.**

Introduction:

Cataract is the development of opacity in the lens fibers. Though the precise pathogenesis of cataract formation is not clear, the biochemical changes¹ have been studied extensively. Cataract is considered as a major cause of visual impairment in diabetic patient as the progression of cataract is elevated in patient with diabetes. Increased sorbitol² levels inside the lens secondary to increase in aqueous glucose concentrations may be implemented in pathogenesis of diabetic cataract. Hypocalcemia is associated with increased risk of development of pre-senile cataract. Raised serum sodium, low levels of serum calcium³ and increased serum glucose is implicated in development of cataract. Our study aims to determine the aqueous levels of sodium, calcium and glucose in cataractous patients with diabetes and without diabetes. Many studies have compared serum level of electrolytes among cataract and non-cataract groups but only few have compared the aqueous levels of different electrolytes and glucose in diabetic and Non diabetic patients with cataract

Aims and Objective:

- 1) To compare the changes in serum and aqueous sodium, calcium levels and glucose levels in diabetic cataracts.
- 2) To estimate the Serum and Aqueous glucose concentration in non-diabetic cataract apart from electrolyte concentration.

Material and Methods:

Study design: prospective Analytical studies.

Place of study: Dept. Of ophthalmology(Tertiary health center)

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Setting : The present study was conducted in the department of ophthalmology in a tertiary care teaching hospital.

Ethical clearance :The study has been cleared by the undergraduate review committee of the institute and the Institutional Human Ethics Committee.The study was initiated after Institutional Human Ethics Committee clearance.

Consent : Study protocol was explained to every prospective participant individually and they were also provide with printed format . Enough opportunity was given to them to get their doubts cleared. The participants were enrolled in the study after getting signature in the consent form.

Statistical Analysis: The method used for statistics is CHI-square test by SPSS-version-23 used for Descriptive statistics to find frequency and percentage.

Inclusion criteria:

- Age more than 50 yrs
- Patients with senile cataracts with or without diabetes mellitus.

Exclusion criteria:

1. Patients with history of glaucoma.
2. Patients with history of uveitis.
3. Patients on chronic topical medications.
4. Patients undergone previous intraocular surgeries.
5. Patients on diuretics.
6. Traumatic cataract

Methods

- A profoma was used to collect the baseline data and written informed consent was taken to perform cataract surgery and also for the sampling studies.
- Detail history, systemic and ocular examinations was done as per routine pre-operative protocol and to fullfill the inclusion and exclusion criterias.
- Patients were divided into 2 groups. Senile Cataract with Diabetes GROUP 1, Senile cataract without Diabetes GROUP 2
- Under aseptic precautions with peri-bulbar/topical anesthesia 0.2cc of aqueous humour was collected using a 26 gauge needle and an insulin syringe intra-operatively and the cataract surgery was completed.
- The serum and aqueous sample collected was sent for biochemical analysis on the same day and the levels of sodium,calcium and glucose was estimated by using Dimensions RXL.

Observation and Results

TABLE 1

S No	Type of Cataract	Total No. Of Patients
1.	Senile with diabetes	24
2	Senile without Diabetes	48

-The total number of patients in our study is 72.

-Senile cataract without diabetes is 48.

-Followed by senile cataract with diabetes is 24.

TABLE 2 : SENILE CATARACT WITH DIABETES - ONE SAMPLE STATISTICS (GROUP 1)

Electrolyte/Glucose Concentration	N	Mean	Std. Deviation	Std.Error Mean
Sodium	24	139.000	3.23	0.65
Calcium	24	8.46	0.79	0.16
Glucose	24	131.91	35.27	7.20
Sodium AQ	24	147.66	3.69	0.75
Calcium AQ	24	5.65	0.39	0.08

Glucose AQ	24	61.25	18.56	3.78
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- Total no patients were 24 of which 12 males and 12 females.
- The maximum age was 69years and minimum age was 52 years.
- Average age was 60.5 years.
- The mean aqueous level of sodium was 147 mEq/L.Normal values(140 -144 mEq/L)
- The maximum value of sodium was 155 and minimum was 137 mEq/L.
- The mean aqueous level of calcium was 5.65 mg/dl.Normal values(5.5 mg/dl)
- The maximum value of calcium was 6.5 and the minimum value was 4.9mg/dl.
- The mean aqueous level of glucose was 61.25 mg/dl.Normal value (50-55 mg/dl)
- The maximum value of glucose was 109 and minimum value was 31 mg/dl.
- The mean aqueous concentration of sodium were higher than normal.
- Calcium was almost normal and the glucose was higher than normal in this group.
- The mean Serum concentration of sodium was slightly below normal. Normal values(135-145 mEq/L)
- The mean serum concentration of calcium was below normal.Normal values(8.5-10.5mg/dl)
- The mean serum glucose was higher than normal.

TABLE 3 : SENILE CATARACT WITHOUT DIABETES (GROUP 2) - ONE SAMPLE STATISTICS

Electrolyte/Glucose Concentration	N	Mean	Std. Deviation	Std.Error Mean
Sodium	48	139.000	3.326	0.480
Calcium	48	8.9250	0.68681	0.09913
Glucose	48	95.3271	28.21896	4.07306
Sodium AQ	48	141.542	22.7484	3.2834
Calcium AQ	48	5.8521	0.80873	0.11673
Glucose AQ	48	53.7917	17.09791	2.46787

- Total no patients were 48 of which 21 males and 27 females.
- The maximum age was 80years and minimum age was 52 years.
- Average age was 66 years.
- The mean aqueous level of sodium was 141 mEq/L.
- The maximum value of sodium was 157 and minimum was 84 mEq/L
- The mean aqueous concentration of sodium was in normal limits..
- The mean aqueous level of calcium was 5.85 mg/dl.
- The maximum value of calcium was 8.8 and the minimum value was 4.6 mg/dl.
- The mean aqueous concentration of calcium was in normal limits.
- The mean aqueous level of glucose was 53.79 mg/dl.
- The maximum value of glucose was 122 and minimum value was 32 mg/dl.
- The mean aqueous concentration of glucose was in normal limits.

TABLE-4: SENILE CATARACT WITHOUT DIABETES SERUM SODIUM CHI-SQUARE TEST

CHI-Square test			
	Values	df	Asymptotic Significance (2-Sided)
Pearson Chi-Square	8.914 ^a	2	.012
Likelihood Ratio	6.388	2	.0041

N of valid Cases	48		
a. 3 cells (50.0%) have accepted count less than 5. The minimum expected count is 75.			

TABLE 6: AVERAGE SERUM AND AQUEOUS CONCENTRATION IN ALL 3 GROUPS

Type of Cataract	No	Mean Serum			Aqueous		
		Sodium	Calcium	Glucose	Sodium	Calcium	Glucose
Senile Cataract with Diabetes	24	139.0	8.4	131.9	147.6	5.6	61.2
Senile cataract without diabetes	48	139	8.92	95.3	141.5	5.8	53.7

Discussion

IN GROUP 1-SENILE CATARACT WITH DIABETES

-Though Aqueous level of mean sodium (147 mg/dl) and mean glucose (61.25 mg/dl) were marginally higher than normal aqueous concentration, it was not statistically significant (P-value being for sodium 0.22 and for glucose P-value being 0.51)

Reference - Similar to study done by Prof.Tasneem⁶ from bangalore which showed Aqueous sodium levels were higher in cataract patients and calcium was found to be lower.

-The same in comparison to group-2 (Senile Cataract without Diabetes), again aqueous sodium was found to be higher in concentration (group-1 sodium 147 mg/dl and group-2 sodium 141 mg/dl)

Reference- Similar study was done by Dr.Reepa Bhora⁷, which showed significant changes in serum aqueous sodium levels between diabetic and non-diabetic.

The mean aqueous glucose concentration were higher in group-1 compared to group-2 (ie , 61.2mg/dl in group-1 and 53.79mg/dl in group-2)

The mean aqueous concentration of calcium was comparable with normal values in this group.

The mean serum sodium levels were normal but the calcium was slightly lower than normal (8.4 mg/dl , which was found to be statistically significant P value being 0.04)

Reference- Similar study was done by QL Huang¹¹ reduced calcium levels were associated with cataracts.

The mean serum glucose was higher than normal as this group had patients with diabetes.The mean value was 131mg/dl.

IN GROUP 2 - SENILE CATARACT WITHOUT DIABETES

-All the parameters except calcium which was tested in serum and aqueous was found to be lower than in Group-1

-The values were comparable with normal serum and aqueous concentration values except for serum sodium which was found to be statistically significant (P value being 0.012)

Reference- Similar to study done by Mansoor Mirsamadi³ which showed serum levels were significant difference between the cataract and normal patients.

Establishment of reference values of aqueous glucose in normoglycaemic senile cataract patients was done by Kapil Deb lahiri⁴ in westbengal found the values were 50 mg/dl. This was similar to a study done by Davies et al⁵ who showed aqueous glucose concentration in non diabetic patients were 3.2 mM and in diabetic patients was 7.8 mM.

“A comparative study of Serum Sodium and Potassium levels in cataract patients and normal individuals “ done by Mansoor Mirsamadi³ in August 2004 showed serum sodium level showed significant difference between normal and cataractous patients.

A comparative study of serum and Aqueous electrolyte levels in cataractous patients done by Prof. Tasneen⁶ from Bangalore showed aqueous sodium levels were higher compared to serum in patients with cataract where as aqueous calcium levels were low compared to serum.

Comparative Study Of Serum And Aqueous Humour Electrolytes In Diabetic And Non-Diabetic Cataract Patients Reepa Borah Choudhury⁷ showed significant difference in serum and aqueous sodium levels between diabetic and non diabetic patients.

Serum Na⁺ and K⁺ as risk factors in age-related cataract: An Indian perspective done by Dr. Adeeb khan⁸ showed that serum sodium levels though within the normal range was found to be higher in cataract than normal individuals.

Serum Electrolytes in Cataract Patients with and without Diabetes Mellitus Usha Sachidananda Adiga⁹ and Adline Harris done in JIPMER pondicherry showed serum electrolyte levels of sodium, potassium and chloride were significantly raised in diabetic patients compared to non diabetics with cataract.

Conclusion:

To conclude, the mean aqueous level of sodium and glucose in senile cataract patients with Diabetes was found to be higher than normoglycemic cataract patients and also from the normal reference values. The serum levels of calcium in cataract patients with diabetes were slightly lower than normal which was found to be statistically significant.

Summary:

This study was conducted in tertiary care teaching hospital. Total 72 eyes of 72 patients were included for the study after taking consent. The patients were divided into three group namely Senile cataract with diabetes and Senile cataract without diabetes. Serum and aqueous level of sodium calcium and glucose were estimated for each group and compared with normal values and also within the study groups. The values were also analyzed based on stage of cataracts irrespective of the group studied.

The following were the observed results :

-The mean aqueous level of sodium and glucose in senile cataract patients with Diabetes was found to be higher than normoglycemic cataract patients and also from the normal reference values.

-The serum levels of calcium in cataract patients with diabetes were slightly lower than normal which was found to be statistically significant.

Reference:

1. Van Hevningaen R.-The lens metabolism and cataract.In(ed)Davson H.The Eye. Newyork:academic press.380-488,1995.
2. Jansirani, P. H. Anathanaryanan. A comparative study of lens protein glycation in various form of cataract. Indian J Clin Biochem.2004;19(1):1:110-2.
3. Mansour Mirsamadi, Issa Nourmohammadi, Manchehr Imamiam. Comparative study of serum sodium and calcium levels in senile cataract patients and normal individuals. Int J Med Sci. 2004;1(3):165-9.
4. Lahiri KD, Kundu A, Baruah M, Ghosh J. Establishment of reference interval of aqueous humor glucose concentration in normoglycemic senile cataract patients in a population of West Bengal. Current Indian Eye Research 2018; 5:10-3
5. P.D.DaviesG.Duncan,P.B.PynsentaDiana ,L.ArberaValerie A.Lucas.Aqueous humour glucose concentration in cataract patients and its effect on the lens.Exp Eye Res. 1984 Nov; 39(5): 605-9.
6. Comparative Study of serum & aqueous humour serum electrolytes level in Cataract patients. Dr. Tasneem A.F , Dr. Shwetha B.A , Dr. Mamata N International Journal of recent trends sciences and technology October 2014 :12(3):507-513
7. Reepa Borah Choudhury¹, Partha Sarathi Gayan ², Barnali Das³, Comparative Study Of Serum And Aqueous Humour Electrolytes In Diabetic And Non-Diabetic Cataract Patients Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 4 Ver. XIII (Apr. 2016)
8. Ali Solehudin, Theodorus, Junaidi, Accuration between Sodium and Potassium Serum Levels and Aquoeus Humour in Patient with Senile Cataract, J Res Med Dent Sci, 2017, 5 (3): 20-28, DOI: 10.24896/jrmds.201753
9. Usha S. Adiga, Adline Harris, T.N. Ezhilvathani³ and Sharbari Basu Serum electrolytes in senile cataract patients Al Am een J Med Sci 2014; 7(2):164-168 US National Library of Medicine enlisted journal
10. Andreas Pollreiz Review article- Diabetic cataract pathogenesis, epidemiology and treatment Journal of Ophthalmology Volume 2010, Article ID 608751, 8 pages
11. Huang QL, Clinical observation and calcium determination in hypocalcemic cataract zhonghua ,1989 Sep;25(5):268-70.