SHORT COMMUNICATION

Alterations of Serum Electrolytes and Malondialdehyde in Cataract Patients Attending General Hospital Owerri

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Abstract:

Aim: This study was carried out to determine the level of serum electrolyte and malondialdehyde in cataract patients. *Material and Methods:* 80 cataract patients within the age of 55 years to 75 years attending General Hospital Owerri for routine blood glucose check were used in this study. Also 80 apparently healthy subjects without cataract within the age of 55 years and 75 years were used as control. The level of electrolytes particularly sodium and potassium were measured. The levels of glucose, urea, creatinine were measured in order to rule out diabetes and kidney malfunction respectively in both study and control groups. *Result:* It was observed that the level of sodium and Malondialdehyde (MDA) were significantly increased in cataract patients when compared with controls ($p<0.05$) while the difference in the level of potassium was not significant ($P>0.05$). *Conclusion:* This observation shows that increased sodium level in cataract patients could probably result in elevation of aqueous humor of the lens which contributes to osmotic disorder across the lens membrane. This could aggravate the progression of cataract as a result of MDA elevation. Therefore, salt restricted diet could be beneficial to cataract patients by preventing electrolyte disorder, hypernatremia and maintain the electrolyte balance.

Keywords: Cataract, Electrolyte, MDA, Owerri

Introduction:

Cataract is one of the main age related eye problems as a result of opacity of lens. Simply, it is the clouding of the eye's natural lens which lies behind the iris and pupil. Cataract in adults is associated with vision loss in individuals over the age of forty years [1]. In most cases it leads to blindness. It is characterized by blurred vision [2]. Generally, a cataract begins at first by having little effect on vision. The vision may be blurred a little like looking through a piece of glass. A hazy or blurred vision may reflect cataract [3]. For a person suffering from cataract the light from the sun or a lamp may appear too bright. Similarly, colours may not seem as bright as they once did. Cataract is categorized into three, Subscapular, Nuclear and Cortical cataract. A subcapsular cataract occurs at the back of the lens. Many people with diabetes or those taking high doses of steroid medications have a greater risk of developing a subcapsular cataract. While a nuclear cataract forms deep in the central zone of the lens. This is associated with aging [4, 5]. However, a cortical cataract is characterized by white, wedge-like opacities that start in the peripheriy of the lens and work their ways to the centre in a spoke-like fashion. This occurs in the

lens cortex which is the part of the lens that surrounds the central nucleus [6].

It is quite evident that the type of cataract one has affects exactly the symptoms. In nuclear cataract, when it first develops, it leads to temporary improvement in near vision. However, the improved vision is short lived. It disappears as cataract worsens. While a subcapsular cataract may not produce any symptoms until it is well developed [7].

Normally, the lens inside the eye seems to perform like a camera lens, in which it focuses light into the retina for clear vision. It also adjusts the eye's focus and hence letting things to be seen clearly both close and far away. This lens is mainly composed of water and protein. The protein is simply arranged in an exact way that keeps the lens clear and let light pass through it [8].

However, owing to age, most of the protein may clump together and start to cloud a small area of the lens. This is simply a cataract and over time may grow larger and cloud more of the lens making it difficult to see [9, 10].

One of the theories of formation of cataract could be linked to oxidative changes in the human lens. The oxidative changes affect the electrolyte which equally results in disorder in lens membrane permeability between the intracellular and extracellular. The membrane permeability maintains lens transparency. The major extracellular cation is sodium while potassium is the main intracellular cation. In the lens, the concentration of electrolytes (sodium and potassium) maintains osmotic pressure [11] and hence water balance across the lens membrane with the action of sodium potassium ATPase. It is viewed that changes in serum electrolyte level could affect aqueous humor electrolytes concentration of lens; and hence affects cataract patients.

In Imo State Nigeria, there is scarce information on some electrolyte and MDA concentration in cataract patient. However, it is deemed fit that providing information on this parameter could contribute in the management and possibly treating the cataract patients successfully. Hence, the need for this study.

Material and Methods

80 cataract patients between the ages of 55 to 75 years attending General Hospital Owerri were involved in this study. While apparently healthy subjects without cataract between the ages of 55 to 75 years were used as control. Additionally, their routine blood glucose, urea and creatinine were checked. All participants gave their informed consent to participate in this study. An ethical approval from the ethical committee of the hospital was also obtained.

Blood collection

In all subjects, 5ml of fasting venous blood was collected into plain bottles. The serum was separated by centrifuging the whole blood in a westerfuge (model 684) centrifuge at 5000g for 5 minutes.

Estimation of biochemical assay

Lipid peroxidation product that is malondialdehyde level was assayed based on MDA reaction with thiobarbituric acid (TBA) [12]. Serum Sodium and potassium were measured by Teco Diagnostic kits Glucose. Urea and creatinine were measured by Randox kits.

Statistical analysis:

The results were expressed as mean ± standard deviation and student 't' test was used to calculate the level of significance at $P<0.05$.

Results:

Table 1: Serum Electrolyte, Glucose, Urea, Creatinine and MDA Level in Cataract and Control Group

Parameters	Control (n=80)	Cataract (n=80)
Sodium (mmol/L)	136.39 ±4.86	148.15 ± 5.61*
Potassium (mmol/L)	4.10 ± 0.91	4. 02 ± 0.83
Glucose (mg/dl)	86.50 ± 4.6	90.16 ± 6.8
Urea (mg/dl)	36.91 ± 4.1	40.83 ± 5.2
Creatinine (mg/dl)	0.86 ± 0.02	1.02 ± 0.04
MDA (nmol/L)	1.41 ± 0.09	2.89 ± 0.08*

**Significantly different from control at P<0.05*

Discussion:

Cataract results in the clouding of lens inside the eye which yields to the reduction in vision. Globally, it is the most common cause of blindness and conventionally treated with surgery. In this study, it was observed that the level of sodium was significantly elevated in cataract when compared with the control. This elevated sodium could affect the sodium potassium pumps which make it difficult to maintain the low concentrations of intracellular sodium required for lens transparency. This is consistent with the work of Rewatkar *et al* [13]. Hence, the elevation in serum sodium can induce changes in aqueous humor. The increase in sodium concentration of the lens could probably worsens the formation of cataract. The serum sodium elevation directly affects its elevation in aqueous humor fluid which can alter lens membrane permeability, as well as osmotic imbalance [14]. Once there is disequilibrium with the sodium concentration, the sodium potassium ATPase is definitely affected which affect the osmotic pressure of the eyes. Sodium is the main extracellular fluid which regulates extracellular fluid volume. Sodium potassium pump maintains the extracellular sodium level in all the cells [11] when sodium and potassium are not balanced, the lens membrane permeability will be affected. The alteration in either sodium or potassium may lead to cationic imbalance in the lens which could result to cataract [15]. Also, it was observed that the level of potassium in cataract was not significant when compared with the control. However, the elevation of sodium and stability of potassium is dangerous to the eye lens. This is in line with the work of West and valmarid [16]. This elevation of sodium could be linked with age, as the lens protein denature and degrade over time. This process is increased by diabetes and hypertension. The environmental factors such as toxins and ultraviolet let light may have cumulative effects. Also, the changes in gene expression and chemical process within the eye could the important risk factors in the formation of cataract. Hence, the damage to the DNA could affect the lens cells. Also, heart injuries can denature the lens and thus affect the sodium potassium ATPase enzyme leading to alteration in sodium [17].

Furthermore it was observed that the levels of glucose, urea and creatinine were not significantly affected in cataract. However, they could be also risk factors in some cases. Therefore, it could be deduced probably from the study that the concentration of sodium is significantly increased in cataract and may be a marker in the determination of the risk involved in the progression of cataract. Therefore, it is advised that high salt diet should be avoided to reduce the risk of elevation of serum sodium levels, a possible risk factor for the development of cataract.

Similarly, it was observed that the level of Malon-dialdehyde was significantly increased in cataract. When compared with the control. This is in agreement with the work of Kaya *et al* [18]. The MDA is the end product of lipid peroxidation. The MDA is equally a measure of oxidative stress. The increase in MDA affects the lens membrane permeability and osmotic imbalance of the eyes. Therefore the elevation in the MDA may probably result in the development and progression of cataract.

References

1. Mathew MC, Ervin, AM, Tao J, and Davis RM. Antioxidant vitamin supplementation for preventing and slowing the progression of age related cataract. *Cochrane database Syst Rev* 2012.,6:4567-4569
2. Neale RE, Purdie JL, Hirst LW, and Green AC. Sun exposure as a risky factor for nuclear cataract. *Epidemiology* 2003; 14(16):707-712
3. Wang S, Wang J and Wong TY. Alcohol and eye diseases. *Surv Ophthalmol* 2008; 52(2):512-513
4. Allen D and Vasavada A. Cataract and Surgery for cataract. *BMJ* 2006;333(7559):128-132
5. Bollinger KE and Langston RH. What can parents expect from cataract surgery. *Clevel Clinic Journal of Medicine* 2008;75(3):193-196
6. Reddy SC. Electric cataract. A case report and review of the literature. *European Journal of Ophthamology* 2008; 9(2):134-136
7. Davis JC, McNeill H, Wasdell M, Chunick S, and Bryan S. Focussing both eyes on health outcomes. Revisiting cataract Surgery. *BMC Geriatrics* 2012; 12:50-52
8. Barker FM. Dietary supplementation, effects on visual performance and occurrence of AMD and cataracts. *Curr Med Res Opin* 2010; 26(8):2011-2023.
9. Olsen T and Jeppesen P. The incidence of Retinal detachment after cataract surgery. *The Open Ophthalmology Journal* 2012; 6:79-81.
10. Tom T, Morton J, Coxon J, and Elder MJ. Medical treatment of cataract. *Clin Experiment Ophthalmol* 2007; 35(7):664-667.
11. Nnodim JK, Meludu SC, Dioka CE, Onah C, Chilaka UJ, Obi PC. Altered Membrane Potential and Electrolyte in Sickle Cell Anemia. *JKIMSU* 2014, 3(1):70-73.
12. Nnodim JK and Emejulu. A Lipid profile and lipid peroxidation status in type 4 diabetes with Malaria in Owerri Nigeria. *Novel Sci J Med Sci* 2012; 1(2): 34-36.
13. Rewatkar M, Muddeshwar MG, Lokhande M, and Ghosh K. Electrolyte imbalance in cataract patients. *Indian Medical Gazette* 2012. 89-91.
14. Bunce GE, Kinoshita J. Nutritional factors in Cataract. *Annual Review of Nutrition* 1990; 10:233-254,
15. Benedek GB. Theory of transparency of the eye. *Ophthalmology*1971. 10:459-739
16. West SK and Valmarid CT. Epidemiology of risk factors for age related cataract. *Surv Ophthalmol* 1995; 39(4):323-34.
17. Klein BE, Klein R, Lee KE and Grandy LM. Statin use and incidence nuclear cataract. *Journal of American Medical Association* 2006; 295(23):2752-2754
18. Kaya NE, Bulent Y, Ulviye Y, Ahmet A and Ciham C. Variability of serum oxidative stress biomarkers relative to biochemical data and clinical parameters of glaucoma patients. *Molecular vision* 2010; 16: 1260-71.

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