Glutathione,Calcium and Glucose levels in lenses of Patients with Cataract

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Abstract

A cataract is an opacity of crystalline lens(congenital or acquired) .The lens works with the transparent cornea to focus light on the retina at the back of the eye.Fifteen patients with lens cataract who attended the department of ophthalmology at Al-Hilla Teaching Hospital were examined for some of the chemical contents of their cataractous lenses.Patients were eight females and seven males,presented with a mean age of (62±5.96)years old.

The mean calcium ion concentration in the cataracted lenses was(24.2±14.7)µmol/gm.Considering antioxidants,reduced glutathione concentration (GSH) in the lenses was analysed and found to be (6.88±3.57)µmol/L.As Monosaccharides D-glucose, D-galactose are know to be cataractogenic, glucose content of the catarctous lenses was estimated and it revealed a mean concentration of (27.62±11.5)mg/dl.

الخلاصة

الساد الابيض هو ضبابية جزء من العين يسمى العدسة البلورية.تعمل العدسة مع القرنية الشفافة التي تغطي سطح العين لتركيز الضوء في بؤرة على الشبكية في الجزء الخلفي من العين.

تم اخذ عينات ضمت خمسة عشر مريضا يعانون من ساد ابيض ادخلوا الى قسم العيون في مستشفى الحلة التعليمي،و قد تم فحصهم سريريا ثم اجريت لهم عملية استئصال عدسة العين التي تمت دراسة تركيبها الكيمياوي و تراكيز بعض مكوناتها.كان عدد الاناث من المرضى ثمانية بينما كان عدد الذكور من المرضى سبعة.بلغ معدل اعمار المرضى (62±5.96)سنة،و كان معدل تركيز الكالسيوم في عدسة العين(24.2±14.7)مايكرو مول/غم.

اما بخصوص مضادات الاكسدة فقد تم قياس تركيز مادة الكلوتاثايون المختزل في عدسات عيون المرضى و وجد ان تركيز الكلوتاثايون المختزل (27.62±11.5) ملغم/100مل.

Introduction

Cataract means loss of transparency of the lens of the eye and/or its capsule, resulting in partial or total blindness. The lens becomes clouded or opaque and is unable to transmit light properly or to focus[1].It is a common condition of later life affecting the lens of the eye and it will, if untreated, eventually lead to severe vision loss. Consequently, cataract has a large impact on the quality of life of many elderly people[2].Cataract is one of the often seen consequences of the aging process,a disease that affects one of our most precious gifts,that of sight.Approximately 75% of population over 75 years old suffer from cataract[3],so incidence of cataract increases with increasing age at baseline. These data will help in planning for future care (e.g. cataract surgery and change in spectacle correction) and in investigating the importance of risk factors [4] .

Calcium is elevated in most cataractous lenses and may contribute to cataractogenesis,supporting the hypothesis that increased intracellular calcium concentrations and a diminished capacity of lens lipids to bind to calcium initiate a cascade of events that culminates increased light-scattering from lipids and especially proteins[5].

Diabetes increases the risk three to four times galactose build-up due to high consumption of dairy products combined with inability to process galactose. Free radical attack is the base of the mechanism of cataract formation. For glaucoma, the researchers only give mild indications that free radicals may be partly involved. Let us first take a brief look at free radicals[6].

Glutathione attracts much attention because it destroys surplus free radicals in the body. Thorne Research Inc, Dover, USA, has concluded that deficient glutathione levels within the lens of the eye contribute to cataract formation. Nutrients that increase the levels of glutathione include vitamins E and C, selenium, lipoic acid and vitamin B2 (riboflavin)[7]. In cataracts, extensive evidence of oxidative damage has been detailed by the Department of Ophthalmology, Dokkyo University School of Medicine in Japan.In cataractous lenses they found decreased activity of antioxidant enzymes, increased oxidation of lipids and lipoproteins and a marked decrease in the ability to scavenge oxygen radicals, as well as ongoing generation of free radicals within the lens. Ions of the potentially oxidising metals, iron and copper, were found in lens tissue, and the researchers related this to the increased oxidation. An interesting consequence of oxidation was increased saturated fatty acids in the lenses[8].
Antioxidant supplementation may be able to reduce the progression of age-related cataracts, according to results from the Roche European American Cataract Trial (REACT)[9].

Materials and Methods

Patients admitted to the department of Ophthalmology-of Hilla Teaching Hospital complaining of poor vision who were diagnosed by ophthalmological examination to have cataract,surgey was done and the lens were analysed for some chemical composites.
Glucose was estimated by colorimetric test using a kit of (Biocon)[10].Reduced Glutathione was measured colorimetrically[11].Calcium was determined using a kit (Cromatest-Linear Chemicals), colorimetric testing[12].

Results

Mean age for those patients who were presented with cataract was (62±5.96)years old.The mean calcium ion concentration in the lens homogenate of patients with cataract was (24.2±14.7)µmol/gm.Reduced glutathione (GSH) has been estimated colorimetrically in the lens homogenate of cataract patients and it revealed a mean concentration of (6.88±3.57)µmol/L.
As Diabetes Mellitus one of the major risk factors and causes in cataract formation the glucose concentration in the cataract lens homogenate was analysed and found to be (27.62±11.5)mg/dl.

Discussion

The relation of age to cataract of the human lens was expressed in the study by a mean age of (62±5.96)years old,which goes in context with the hypothesis that being older is much more prone to have cataract not due to aging itself but rather from the harmful effects that had time to do more damage[6].

Previous studies showed that lens membrane permeability alters when the external calcium concentration falls below 1 mM, so it was interesting that values for human aqueous from cataract patients ranged from 0.45 to 2.0 mM. The mean value for the aqueous was one half that for the plasma. The calcium concentration in cataractous lenses ranged from 0.1 to 64 mM and lenses with a high calcium concentration also had a high sodium content. In lenses with near normal sodium content the highest calcium concentrations were associated with highly localized opacities, while nuclear cataracts had a low calcium content[13].

In conjunction with an active glutathione redox cycle located in the lens epithelium and superficial cortex,GSH detoxifies potentially damaging oxidants such as H_2O_2 and dehydroascorbic acid.Recent studies have indicatedan hydroxyl radical scavenging function for GSH in lens epithelial cells,indepencent on the cells ability to detoxify H_2O_2.The level of GSH in the nucleus of the lens is relatively low,particularly in the aging lens,and exactly how the compound travels from the epithelium to the central region of the organ is not known[14].

Diabetes is a common contributor to cataracts, increasing risk by 3 to 4 times. High sugar levels in the blood cause inceased sugar penetration into the crystalline lens. Once inside the lens, the glucose molecules are phosphorylated (chemically bound to a phosphorus group, making a larger molecule) and can then no longer diffuse back out of the lens even after sugar levels in the blood may have returned to normal. The increased sugar in the lens then osmotically draws in excess water to hydrate itself, leading to swelling and water pockets. Swelling of the lens can cause fluctuating vision, and the microscopic water pockets disrupt the crystal lattice structure of the lens making it cloudy and the vision hazy. Lactose, found in dairy products, can contribute to cataracts, destroying glutathione and vitamin C levels in the lens. Lactose is a disaccharide comprised of galactose and glucose. Galactose is known to cause cataracts, as in galactosemia[15,16]

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