

Review Article

Risk factors associated with senile cataract causes blindness and management practices in humans: An overview

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Abstract

Cataract is a condition in which lens visualization decreases. In Pulverulent cataract nuclear opaqueness varies among individuals. Blue dot cataract is non-hereditary and extends in earlier stage. Ralliform is an unusual type, like corals, show finger like projections. In severe cataract, methionine, about 60% or more have been originated in membrane in form of methionine sulfoxide and ionine sulfone. Cortical and posterior subcapsular cataracts are strongly associated with the environment, for example, UV exposures, diabetes, and use of medicines. Nuclear cataract is linked with smoking. In normal and cataractous lens, oxidation of methionine and cysteine was described. Cataract is caused by different abnormalities during development, metabolic disorders, and variations by taking drugs and trauma. Age is the main factor contributing to cataract in developed countries. Education, blood pressure, sex, tobacco usage, alcohol consumption, nutrition, UV exposure, diarrhea, diabetes and some medications are some age-related factors. Cataract increases as the age progresses. Light and oxygen is vital to regulate functions of eye. The only cure is the removal of lens by surgery. Globally, intraocular lens (IOL) surgery is used. Cataracts threat can be reduced by avoiding smoking and limiting exposure to UV-B radiations. It is concluded that some risk factors in cataract includes education, blood pressure, sex, tobacco usage, alcohol consumption, nutrition, UV radiations exposure, diarrhea, diabetes and medications. There is no an effective treatment for cataract. Currently, lens surgery is the main treatment included (IOL).

Keywords: Pulverulent, Surgery, IOL, UV, Cataract, Diabetes, Diarrhea, Smoking, Lens, Risk factors, Education.

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Introduction

The situation in which the lens becomes the dull and visualization decreases is

cataract [1 - 2]. The Lens becomes opaque. This might occur in one part, be mobile, or can grow and vary in its structure. Globally, the main reason for blindness is

cataracts, which affect a significant portion of the population [3]. It occurs more in developing countries and can start in the premature stage [4]. The earlier progression shows that it is the result of unusual genes affecting the nucleus. A pulverulent cataract is the type in which nuclear opaqueness varies among individuals in the family and also in the eyes of similar patients [5]. Initially, it was explained that blue dot cataract, is non-hereditary, it extends in earlier stages and proceeds throughout life [6]. [7] demonstrated that coralliform is an unusual and uncommon type, which is identical to corals, and enlarges from the nucleus as finger-like projections [8, 9]. The vision is changeable, so it is necessary to remove it in the initial stage of life. The nucleus and cortical areas are affected in those families who have autosomal dominant and X-linked recessive hereditary cataract is "Total" cataracts [10]. Additionally, 50 thiol protein groups flake in a disulfide structure and remain in cystic acid in cataract membrane fractions. Similarly, methionine flakes into methionine sulfoxide and methionine sulfone [11]. In lens, oxidative change is related to opaqueness sites. The disulfide link aggregates have high molecular weight and contain membrane ingredients in nuclear and cortical cataracts [12]. The ingredients in the cytoplasm are linked with the membrane by disulfide bonds in the dense regions of the eye in nuclear cataracts [11, 13].

Literature study to explore cataract

On a global scale, it is estimated that almost 16 million inhabitants are affected by cataract and the most common cause is the darkness of the lens. Greying, exposure to UV lights, genetics, and diabetes are the major cataract risk factors for cataract. Though, there is not any efficient procedure available yet to inhibit the development of cataract. However, the use

of advanced surgical methods has made recovery very quick and efficient by removing the cataract surgically, using viscoelastic substances, small incision surgery, and intraocular lens expansion. But cataract is still the leading cause of health problems regardless of these advances as the population rises and hope for life will increase the risk [1].

In normal and cataractous lenses, methionine and cysteine oxidation state was described. Protein fraction examination shows no detection of oxidation in the young lens. At the age of 60-65 years, there is proof of oxidation only in the inherent membrane fraction and membrane-related components in a normal lens. However, with the growth of cataracts, continuous and remarkable alterations in the same age groups were seen. For people having severe cataract, methionine, about 60 percent or more originates in the membrane in the form of methionine sulfoxide, and ionine sulfone was reported in one case. Disulfide appearance or putative cystic acid which is the oxidized form of cysteine. The mixture of disulfide with glutathione was also seen in one study. Alterations during oxidation in soluble ingredients show crystalline occurs slowly. With cataract the general oxidation of lens proteins starts at lens fiber membranes [14].

Epidemiological work on the threat of cataract has been continuous considerably over the last ten years. Cataract due to age is a multifactorial disorder, and various threat factors play important functions in various types of cataracts. Cortical and posterior subcapsular cataracts appear to be more strongly associated with the environment, for example, ultraviolet exposure, diabetes, and the use of medicines. A nuclear cataract is linked with smoking. All type of cataracts is linked to Alcohol consumption. Reliable facts show that the occurrence of this type of cataracts is lower in highly educated

people. Currently, antioxidants are linked with the reduced rate of type of cataracts. However, more work is required for this. Information is required to find the link, if present, of diarrhea, blood pressure, allopurinol, and phenothiazine usage with age-related cataracts [15].

As individuals age, changes occur in the lens of the eye. These changes include an increase in lens mass, modifications in the incorporation point of lens zonules, and a shortening of the radius of curvature of the frontal surface of the lens. Age-related alterations lead to increased scattering of light, lens fluorescence, and spectral inclusion, contributing to a reduction in the dispersion of light by the lens. Additionally, external factors such as exposure to ultraviolet (UV) rays and certain medications can lead to densitometric changes, further influencing the quality of the lens. Modern tools are now utilized to examine both qualitative and quantitative changes in the lens associated with aging. These tools help assess the visual quality of the crystalline lens, providing valuable insights into age-related changes and contributing factors such as environmental exposures [2].

Risk factors associated with cataract

Abnormalities during development

Cataract is caused by different abnormalities during development, metabolic disorders, variations caused by taking drugs, and trauma [1]. It might be the result of hereditary disease, maybe because of a visual abnormality or a syndrome. In developed countries, age is the main factor contributing to cataract, though it occurs in the early stage of life. In the coming 20 years, one-third of the world's population will increase the cases of cataract. Mainly it increases in developed countries. It is more common in people of age more than 65 years [16]. This occurs more in developed and

underdeveloped countries. Secondary cataract is uncommon and occurs early after distress, intraocular inflammations; exposure to ionized radiation, and other actions induced in the body. Efforts made in the lab show that lens proteins initially affect the cataract contract formation. In adolescents, the proteins' cytoplasm is not oxidized, but a report shows that in adults oxidation occurs in the lens proteins cell membrane [11, 14]. On the contrary, both membrane and cytoplasmic protein oxidation occurs in the lens of cataract-affected people.

Environmental factors

Education, blood pressure, sex, tobacco usage, alcohol consumption, nutrition, UV radiation exposure, diarrhea, diabetes, and some medications are some of the cataract age-related factors [15]. On a global scale, tobacco use is the main issue and leads to curable illness, dysfunction, and earlier death. The report shows a high death rate among middle-aged mature people [17]. It is calculated that tobacco usage is more in India including one third of all females and two third of males smoking cigarettes, bidis and cheroots, and smokeless tobacco like snuff or chewing tobacco [17 - 18]. In South Asia, tobacco which does not have smoke is frequently used. Its different kinds are munch, suck, and used to teeth or gums. Its inexpensive kind varies in various regions of India. In Tamil Nadu, tobacco that does not have smoke is packed and sold in the form of packs and used through betel leaf, areca nut, and lime. Its powder form is taken in through the nose as dehydrated snuff [19]. The report shows that smoking proves as a threat for eye infections like cataracts, glaucoma, and age-associated macular degeneration [20].

The causes of humans inherited cataract vary. In the case of genetically induced diseases, there is extensive phenotypic and genetic heterogeneity. Research has been

made to bring about the cause of the disorder using the gene map. The study has been made possible by the cataract models which occur naturally or genetically invented mice and plenty of human contestant genes. In cataract genesis, eight genes had been involved resulting from genetic changes that cause autosomal dominant inherited cataract. Generally, there is an association among recognized genetic changes, resulting in lens phenotype. It is seen that changes on one point may result in the same type of cataract. The mechanism of cataract genesis could be better understood by gene recognition that causes hereditary cataracts and will help in the future for the further comprehension of lens physiology and normal growth. Similarly, it can be expected that in senile cataract, genes causing early onset cataract may be involved [21].

As the age progresses, the occurrence of cataract increases. Blindness and visual disorders induced by cataract increase as the population increases globally. On a global scale cataract is a major issue. The cataract formation is caused by the Genetic and environmental factors and the challenge is to stop it and cure those who are affected. The risk of cataract can be reduced by inhibiting smoking and less exposure to UV-B radiation. Surgery for cataract exists but the result shows that this is not always the same for all and does not show the same results. Willingly, the surgical facilities present can provide a high-quality image to patients and should be accepted and reachable to all those who are needy, no issue what their conditions are. For the establishment and sustainability of these facilities, an extensive strategy moves away from focusing on surgical methods. The government must set new priorities, educate individuals, and surgical and manage instruction approaches. This includes capital equipment availability, surgical inspection, and mechanism of

expenditure revival. There is a need for improvement in this field [16].

Tobacco usage

The effect of tobacco usage on cataract development was seen in the rural South Indian population. 3924 patients were observed from Chennai Glaucoma Study carried out in rural south India undergoes extensive eye analysis which includes lens opaqueness cataloging System II grading. Data regarding tobacco usage, their period, and its amount was collected. A total of 1707 males: females, 1106: 599 uses tobacco and were older (mean (standard deviation (SD)) age 55.80 (10.64) years) than those who do not use tobacco (52.23 (10.51); $p, 0.001$). 731 (M: F 730:1), 900 (M: F 302:598), they use smokeless tobacco and 74 (M: F, 74:0) use tobacco equally. The familiar and unfamiliar odd ratio for positive detail people and cataracts was 1.72 (95% confidence interval (CI) 1.51 to 1.96) and 1.39 (95% CI 1.15 to 1.68), respectively. The unfamiliar odd ratio for those who smoke and use smokeless tobacco was 1.04 (95% CI 0.88 to 1.23) and 2.74 (95% CI 2.31 to 3.26), respectively. The familiar odd ratio was 1.19 (95% CI 0.89 to 1.59) and 1.54 (95% CI 1.22 to 1.95), respectively. No significant relationship was observed between smoke and any specific kind of cataract. Smokeless tobacco shows a significant link with nuclear cataract following changes for age and sex (OR 1.67, $p = 0.067$, 95% CI 1.16 to 2.39). Tobacco use show a significant link with cataract. smokeless tobacco is linked with the development of cataract despite smoking [22].

Cytosol protein oxidations

Cataract results from membrane and cytosol protein oxidations. H_2O_2 might be the oxidant. The level of H_2O_2 in vitro in cataract-affected individuals shows broad series of 10 to 660 μm levels in the

aqueous humor. In the aqueous solution of 7 out of 17 cataract individuals, a higher concentration of H_2O_2 was observed as compared to the putative normal case. The mass of H_2O_2 obtained from the case study of cataract twisted accurately and distributed normally. The mass of watery H_2O_2 solution in patients of cataract is $69 \mu\text{m}$ ($n = 17$), while $24 \mu\text{m}$ ($n = 5$) in normal patients. The normal moist value in primates is $27 \mu\text{m}$ ($n = 6$) and bovine $25 \mu\text{m}$ ($n = 12$) are like those of normal patients. The mean value of human primate's watery H_2O_2 mass was $26 \mu\text{m}$, an important association was seen between highly aqueous H_2O_2 and prominent lens H_2O_2 is ($P < 0.1$). Although it is small but significant. The ($P > 0.1$) shows no association with watery ascorbate levels at the same time. The exogenous source of H_2O_2 is unidentified [23].

Light and oxygen are important for the regulation of the functions of the eye. But if these are present in more than the required amount cause cataract to develop. Compromise on functions of lens and retina with age worsens by depleting and reducing initial antioxidants, its enzyme capability, and reducing secondary resistance for example proteases. Excess smoking reduces the effects of antioxidants and increases the risks for cataract development. Less education and socio-economic rank are linked with poor nutrition and are considerably connected with increasing threats for these diseases. Improving nutrition, by adding food rich in fruits and green plants, proves less expensive and very feasible to control cataracts [24].

Corticosteroids imbalance

It was seen that Corticosteroids cause cataract, though the effect of other drugs on the lens opacity is not clear. The association between cataracts and drugs was observed in which allopurinol, aspirin, chloroquine, diuretics, phenothiazines, and

simvastatin were included. 3654 people of 49 to 97 years old from a city area near Sydney, Australia were observed. Images of the lens were taken to know the harshness of cortical, nuclear, and posterior subcapsular cataract. Following frequent possibility in the ordinal failure model, phenothiazine usage is linked with nuclear cataract, aspirin usage results in posterior subcapsular cataract than those who do not use it, and antimalarial medicine mepacrine was linked with posterior subcapsular cataract. It was suggested that the usage of chloroquine-like medicines above 1-year shows the link with posterior subcapsular cataract. Cholesterol-reducing medicines and allopurinol are not linked with any kind of cataract. Only Potassium-sparing drugs show proof of link with cataract i.e., posterior subcapsular cataract. Amiodarone was linked with cortical cataract. Several medicines do not show any association with cataract. It was observed that in response to cataract aspirin is not a useful drug [25].

Allopurinol intake

Many studies recommended the link between persistent allopurinol intake and cortical and subcapsular cataract development. To analyze this, they identified 51 people using allopurinol and compared these with 79 people who do not use it. The continuation of lens opacities and the level of sight acuteness were assessed by analysis of medical reports or by probable ophthalmic assessment; it was observed that both were blind. Three various results were obtained, development of any type of cataract, development of posterior subcapsular cataract, and development of cataract which contributes to sight acuteness of 20/30 or poorer. The threat ratio for the development of cataracts was 1-3 (95% confidence interval: 0.8, 2.0), for posterior subcapsular cataract was 09 (0.3, 2.0), and for cataract which contribute to

the reduction of sight acuteness was 1.3 (0.6, 2.9). No one ratio alters noticeably after controlling for age, sex, hypertension, or diabetes. Consequently, 6-9 years of allopurinol use shows that there is no proof for allopurinol that it is hazardous for cataract development [4].

Cataract management practices

Corticosteroid drugs are associated with cataract, though other drugs' involvement in cataract is not known [26]. Many studies suggested that allopurinol might cause cataract though epidemiological work is not consistent [4, 27 - 28]. An institutional study on one patient suggested that phenothiazine is linked with cataract formation [29 - 30], though one study on people observe these drugs [31]. Though chloroquine retinopathy is documented that it may cause cataract has no consideration [32]. Work on diuretics and cataract suggested that many have shown protective effects and many show risks on using [33]. One study shows the use of a high amount of amiodarone was linked [34], though this is not observed by other scientists. Some biological causes are why many medicines used to reduce cholesterol levels in patients cause cataracts, though results have not been revealed yet [35]. It was thought that aspirin lowers the threat of cataracts recently, but the result is not consistent [36].

At present, the only cure for the cataractous lens is the removal of the lens by surgery. In the US, \$3.4 billion per year is the financial estimation of surgery [15]. At an early age, the most common cause of vision disorder is cataract which could be cured [37, 38] with a live births frequency of 1-6/10,000. Avoiding smoking and reduction of UV-B radiation exposure to the eyes is the only way to reduce the threat of cataract [26]. As the advancements in the cellular and molecular changes related to cataract become enlarged, there is an option to

inhibit it during the beginning. Mainly, it is proved that aspirin usage is not preventive. There has been no emergence of serious preventive medicines so far, exceptions include vitamins A, C, and E antioxidants [24].

Globally, the most general ophthalmic clinical method used is the implantation of the intraocular lens (IOL) surgery. For the correction of refractive errors, this method is used more regularly than corneal refractive surgery [39]. In developing areas of the world, the leading form of cataract surgery is Phacoemulsification used up to 90%. Femto second laser constitutes significant scientific advancement in ophthalmic surgery. Combined with a visual deliverance system, it can create an exact incision without harming nearby organs. Previously, epidemiologic work was presented in 1983 [40]. Though several probable factors that cause threat have been recommended, there is no possible procedure to prevent the development of cataracts [1]. Since its inauguration, cataract has been a major issue worldwide but are not predictable yet. Nowadays, its importance is known. There is a need to resolve this issue by the next century.

Conclusion

It is concluded that some environmental factors contribute to senile cataract including education, blood pressure, sex, tobacco usage, alcohol consumption, nutrition, UV radiation exposure, diarrhea, diabetes, and medication. There is no effective cataract treatment. Currently, the only cure for the cataract is the removal of the lens by (IOL) surgery. Further research is necessary to conduct for the drug designing to manage it properly.

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Abbreviations

(IOL) Intraocular lens, (UV) Ultraviolet radiation, (IOL) Intraocular lens surgery.

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