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A Basic Review on Cataract

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Abstract
Cataracts are a clouding of the lens, which can be caused by various eye diseases, including glaucoma, ablation, uveitis, retinitis pigmentosa, and other intraocular disorders. By the age of 70, over 90% of the population shows signs of cataracts, which remains the leading cause of blindness. About 3.38% of the world's population suffers from visual impairment, with China, India, Pakistan, Indonesia, and the United States being the most visually impaired countries. The most common causes of vision disorders are uncorrected refractive error, cataracts, and age-related macular degeneration. Cataracts can affect productivity and mobility, leading to a decrease in people's quality of life. Early detection and treatment are crucial for predicting cataracts. Diabetes complications have been the leading cause of vision loss since 1968, with cataracts being a common cause of vision impairment in patients with diabetes. Congenital cataracts are a rare eye disease with a prevalence ranging from 0.6 to 9.3/10,000 live births and are considered preventable but can lead to irreversible deprivation and severe permanent visual impairment.

Keyword: Cataract, lens, blindness, vision, etc

I. Introduction

A cataract is a clouding of the lens. As hair tends to turn gray with age, the lens, which is a derivative of the epidermis, tends to turn gray and dark. By the age of 70, more than 90% of the population shows signs of cataracts, although the visual impairment is often very mild and its progression extremely slow. Cataract remains the leading cause of blindness (15.83 million people). The number of unoperated cataracts has increased compared to the number estimated in 1990 by a WHO consultation (13.6 million people). In 1998, approximately 19.4 million people worldwide had bilateral blindness due to age-related cataracts.1 Surgery, including lens extraction and intraocular lens implantation, is the only treatment currently available. . In general, cataract is a disease that affects the elderly, but birth defects and eye diseases can also cause cataracts. Eye diseases that cause cataracts include glaucoma, ablation, uveitis, retinitis pigmentosa, and other intraocular disorders. Clinically, cataracts become important when they interfere with vision. They can be classified according to the age of onset: congenital or infantile cataract during the first year of life; juvenile cataracts in the first decade of life; cataract present before 45 years; and senile or age-related cataracts.

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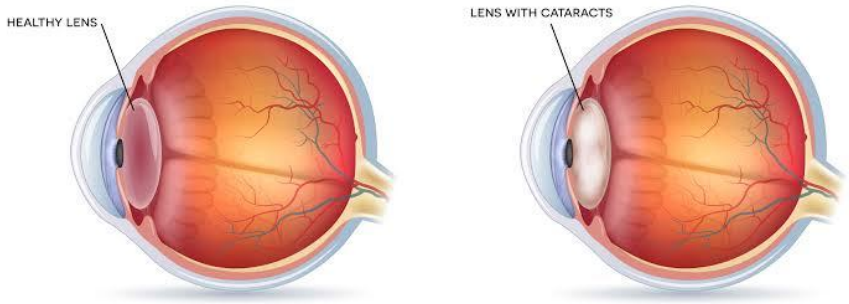

Fig.1: (i)normal lens (ii)lens with cataract

About 3.38% of the world's population, or 253 million people, suffer from visual impairment, of which 36 million are blind and 217 million have moderate to severe visual impairment. The five countries with the most visually impaired population are China, India, Pakistan, Indonesia and the United States. The most common causes of vision disorders are uncorrected refractive error (48. 99%), followed by cataracts (25.81%) and age-related macular degeneration (4.1%).The most common cause of blindness is cataract (34.47%). The impact of cataracts can affect the productivity and mobility of those affected, leading to a decrease in people's quality of life. Cataract can be predicted by early detection when the eye begins to suffer. Cataracts were evaluated with a detailed slit-lamp examination of the anterior and posterior segments. Pharmacologic augmentation was performed (tropicamide 1% and phenylephrine hydrochloride 2.5%).before cataract evaluation.

Since 1968, eye complications related to diabetes have been the leading cause of vision loss in the United States and other developed countries. A common cause of vision impairment in patients with diabetes is the presence of cataracts, or clouding of the natural lens. The coexistence of cataract and diabetes is a common sight-threatening phenomenon, and cataract surgery is a common procedure performed on diabetic patients. The increasing number of patients with type 1 and 2 diabetes in the world and an increased risk of cataracts in diabetic patients compared to non-diabetic patients.

Congenital cataract

Congenital cataract is a rare eye disease whose prevalence ranges from 0.6 to 9.3/10,000 live births. It remains one of the main causes of vision loss in children worldwide. Congenital cataract is considered a preventable cause of blindness. However, late diagnosis and treatment lead to irreversible deprivation amblyopia and severe permanent visual impairment or blindness. Congenital or neonatal cataract is defined as a cataract observed during the first year of life. Hereditary congenital cataracts show all types of syndromic and non-syndromic inheritance patterns. Recent innovations, including DNA sequencing, high-resolution imaging, and new tools in pediatric surgery, have improved the screening, detection, and management of congenital cataracts. Congenital cataracts are usually classified morphologically as total, anterior polar, nuclear, posterior polar, posterior subcapsular, lamellar, powder, zonular, sutural, cerulean, rota, coraliform, or polymorphic. Genes involved in congenital cataract can be divided into four main subgroups, including genes consistently involved in syndromic congenital cataract; genes involved in syndromic congenital cataract, which can also cause isolated congenital cataract; genes responsible for congenital cataracts and other eye abnormalities; and finally, genes associated with non-syndromic congenital cataract without other associated ocular abnormalities. Congenital cataract phenotype associated with the different known genes are very complex, including a wide variety of morphological configurations and different gravities.

To date, 30% to 40% of congenital cataracts are considered to have a genetic cause, and mutations in more than 35 genes have been

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significantly associated with nonsyndromic congenital cataracts with or without additional ocular abnormalities. Among cataract families with a known mutant gene, about 45% have mutations in lens crystals, 16% in connexins, about 12% in growth or transcription factors, 5% in protein degradation machinery, 5 % in membrane, 5% in intermediates. Filament proteins,and about 8% in other divergent functional genes, including those for lipid metabolism. Mutations in the MAF gene have been reported in patients with various eye abnormalities, including congenital cataracts. Mutations in the MAF gene have also been associated with Aymé-Gripp syndrome, which combines congenital cataracts, flat facial features resembling Down syndrome, brachycephaly, seizures, intellectual disability and deafness. Crystallins are divided into crystallins α, β and ϒ accordingtheir order of elution in gel exclusion chromatography. It is therefore assumed that they are essentially stable and that they are synthesized in fibrous cells, which do not have a nucleus; so there is no possibility of it being repeated. One of the most serious complications that occurs after pediatric cataract surgery is glaucoma. Rabiah said 37% of children undergoing cataract surgery at 9 months of age or younger develop glaucoma, compared to only 6% of children undergoing surgery later.

Age related cataract

Age-related cataracts, including nuclear, cortical and posterior subcapsular (PSC) cataracts, are one of the leading causes of visual impairment worldwide. Although age-related cataract appears to increase the risk of death, the relationship between different subtypes of cataract and mortality is unclear. Age-related cataracts almost certainly result from various combinations of genetic predisposition and cumulative damage from environmental insults to the proteins and cells of the lens. Lens proteins are known to undergo a variety of changes with age, and many of them are accelerated in the presence of oxidative, osmotic or other stress, which are known to be associated with cataractogenesis. Changes in the crystals include proteolysis, increased disulfide bonds, phosphorylation, non-enzymatic glycosylation, carbamylation, deamidation of asparagine and glutamine residues, and racemization of aspartic acid residues, among others. (In age-related cataracts, the lensit is clear during early childhood and remains clear until the age of 45 or 50 years, when progressive lens opacities begin to form. Age-related cataracts almost certainly result from various combinations of genetic predisposition and cumulative damage from environmental insults to the proteins and cells of the lens. Lens proteins are known to undergo a variety of changes with age, and many are accelerated in the presence of oxidative, osmotic or other stress, which are known to be associated with cataractogenesis.. Since the crystallines are the main soluble structural proteins of the lens, they have been the subject of most studies on lens aging. In humans, crystallins comprise three major classes encoded by several genes: crystallins α, β and γ, the last two being part of a large gene family . Recent reports of cell death in lens epithelial cells obtained during cataract surgery and in lenses exposed to hydrogen peroxide and other toxic agents have provided additional support. Reduce cataract formation . Apoptosis (programmed cell death) occurs during embryonic development, in the maintenance of tissue homeostasis, and in response to viral infection or toxic injury . Failure to distinguish between the three types of age-related cataracts would be analogous to trying to study chronic cough or lung disease without distinguishing between tuberculosis, bronchitis, and carcinoma. In the last 10-15 years, a number of systems have been developed to specifically classify age-related cataracts by type and severity.

Causes

Cataracts are a leading cause of vision impairment and blindness in the elderly, placing a huge financial burden on governments and individuals. Risk factors are conveniently grouped under the term “old age.” To identify external contributing risk factors, each hypothesis is relevant and quantitative analyzes of the various potential risk factors are necessary. However, when the cataract is associated with certain diseases such as diabetes, the effects of a genetic predisposition, the disease itself and its treatment are closely related, and it can be difficult to determine whether the risk is extrinsic or intrinsic.

Risk factors

Smoking

The results of various studies examining smoking as a risk factor for nuclear cataract were reviewed by West and Valmadrid. This analysis shows the consistency of this association in eight of the ten studies included in the analysis. The strength of the association, a lower cataractogenic effect in ex-smokers compared to current smokers, which addresses the issue of reversibility, and a clear dose-response effect has been demonstrated. The cataract can be up to 17%.

Diabetes

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"Sugar cataracts" were observed long ago through case studies, before medical treatment was available. The higher prevalence and early onset of cortical cataract and posterior subcapsular opacity in diabetic patients has been confirmed by clinical studies. It has been suggested that about 4% of all cataracts are attributed to diabetes.

UV-B exposure

A detailed analysis by McCarty and Taylor of epidemiologic data from 22 human studies and analysis of ecological studies previously conducted by West showed that lifetime exposure to ultraviolet radiation is directly related to the prevalence of cortical. Cataract Sun exposure poses a risk of 10% of the population of cortical cataract . The WHO estimates that 20% of global cataract blindness may be due to exposure to UV rays. Wearing a wide-brimmed hat and UV-B protective glasses and avoiding direct sunlight during peak UV-B hours have been suggested as effective primary prevention measures for cortical cataracts.

Alcohol

Although many studies have shown that alcohol is a risk factor for many types of cataracts, and in particular for posterior subcapsular opacity , the most important is that a large number of studies have not. Reported this association, despite the fact that information on alcohol consumption is regularly collected. It is likely that there was no connection. The participants did not always provide accurate information on this question, considering it unpleasant. A mixed effect, detrimental for heavy alcohol consumption and protective for moderate alcohol consumption, was observed in the Beaver Dam Eye Study. In two studies based on the Australian population, it was not found an increased risk of alcohol consumption in the development of cataracts.

Use of steroids

Reviews by Hodge et al and West and Valmadrid show that the strength of the association, biological reliability and consistency in all studies indicate that systemic and topical steroids are important risk factors in the formation of posterior subcapsular cataract. Inhaled steroids have also been shown to increase the risk of cataracts.

Treatments

Early diagnosis remains essential in congenital cataract, since the timing of surgery is one of the main factors affecting the visual outcome . Early detection of congenital cataracts has been developed worldwide to optimize the care of affected children. Prenatal ultrasound diagnosis and, if necessary, genetic tests can be performed on fetuses in the early stages of pregnancy . For significant visual cataracts that lead to a high risk of amblyopia, surgical intervention is recommended at the age of 6 weeks for unilateral cases and before 8 weeks for bilateral cases. Cataract treatments include medical treatment and surgical

Medical treatment

Multivitamins supplement

Compared to the plasma level, vitamin C or ascorbate is present in a significantly higher concentration in the human lens and in the aqueous humor. In addition to preventing the aggregation of crystals by inhibiting disulfide cross-linking, ascorbate also acts as a scavenger of reactive oxygen species and also a sequestrant of unfolded proteins. The protective role of ascorbate was demonstrated by an in vitro study on rat lenses incubated in an environment that generates oxygen radicals. Ascorbate administered exogenously has been shown to protect the lens from oxidative damage. In vivo, diabetic rats supplemented with 1% ascorbate were significantly protected from lens coagulation. The Age-Related Eye Disease Study (AREDS) was a multicenter, double-blind clinical trial. 4629 participants aged 55 to 80 years were randomly assigned to receive daily oral tablets containing antioxidants or no antioxidants during a mean follow-up period of 6.3 years. Main outcomes measured were an increase from baseline in the grades of posterior nuclear, cortical, or subcapsular opacity or cataract surgery, and at least a moderate loss of visual acuity from baseline. The study did not find a statistically significant effect of antioxidant intake on the development or progression of age-related cataracts. Long-term use of antioxidant supplements has been shown to be of limited benefit in well-nourished elderly populations.

Aspirin, Ibuprofen and paracetamol

A reduced frequency of cataracts has been observed in patients treated with aspirin for their rheumatoid arthritis. The results suggest that aspirin can delay the onset of cataracts or the progression of cataracts to a stage requiring surgical intervention by 43%, although the exact mechanism of action is unknown. Aspirin, ibuprofen, and acetaminophen delay diabetic cataract in rats and other experimental cataracts in vivo. Aspirin, an acetylating agent, is designed to prevent the various mechanisms of lens protein denaturation by acetylating proteins to protect against the attack of cyanates, sugars and steroids. It may also have an indirect effect by maintaining glutathione levels in the lens. Three case-control studies have shown that aspirin

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analgesia can prevent cataracts. In their study of 300 cataract patients and 609 controls in England, van Heyningen et al. found that the use of aspirin analgesics is associated with a 50% reduction in the risk of cataracts

Aldose reductase inhibitors

Aldose reductase, which is the key enzyme in the polyol pathway, has been a major target for the potential prevention of diabetic cataracts. By inhibiting AR, sorbinil also prevents the oxidation of NADPH, which is essential to maintain glutathione in a reduced state. Sorbinil showed a promising protective effect in preventing and slowing the progression of experimental cataracts. In vivo, it reduced the progression of cataracts in diabetic rats. ARIs have also been shown to be low efficiency and selectivity. Recent efforts have revealed a new series of ARI led by compound-lidorestat 9-which has been shown to be more effective , although more work is still needed before its role as and an agent can be established.

Surgical treatments

Cataract surgery, the most common surgical procedure in the United States, has evolved in recent years, mainly with the introduction of phacoemulsification. Phacoemulsification became the procedure of choice in the 1990s, resulting in shorter procedure times and faster recovery of vision than previous methods of extra- or intracapsular cataract extraction. Cataract surgical coverage (CSC) can serve as a marker of the availability of eye care services and is defined as a percentage of individuals (or eyes) with operable cataracts who have undergone cataract surgery. Operable cataract can be defined at different visual acuity thresholds. Inadequate coverage may be due to various barriers to patient care. In the Pakistan survey, people left blind by operable cataracts were asked why they had not undergone cataract surgery; 76.1% identified cost and 11.5% identified lack of awareness . Similar reasons were cited in surveys conducted in the Philippines, Botswana, Cameroon and Kenya .

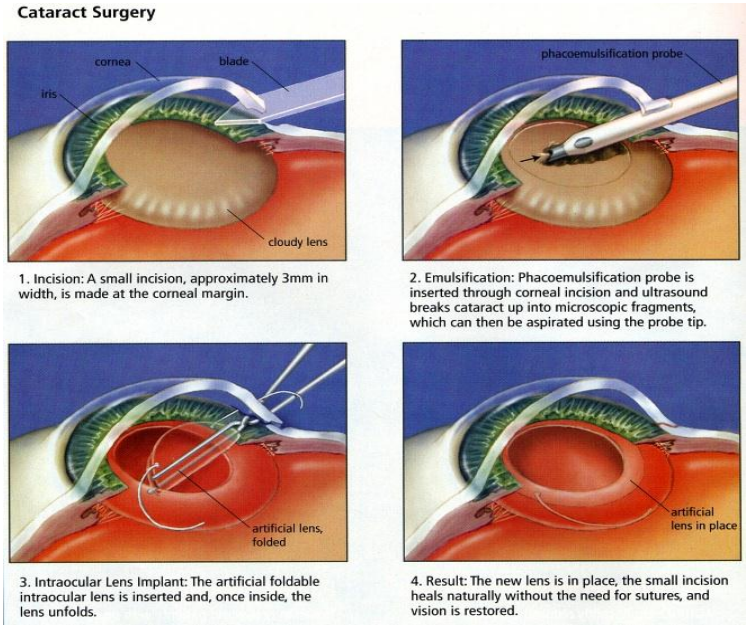

Fig 2: Cataract surgery

Indications

Senile cataracts usually need to be removed when the patient can no longer see well enough in each eye to continue normal activities. In most civilizations, this point is reached when it becomes difficult to read normal characters at a normal reading distance – roughly corresponding to 6/18 acuity – so the cataract is usually removed from the worse eye when the another eye can barely read at 6 / 18.

A congenital cataract, if uniocular, should generally be removed, unless the opacities are very localized; but there is little need to operate before school age, especially since 50% of patients have associated developmental abnormalities that result in a poor visual outcome. If congenital cataracts are present on both sides, they must be removed at an early stage to allow the development of good macular function, unless there is enough space around the opacity of the lens to allow useful vision.

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Methods of Cataract removal

In adults, the crystalline substance is soft, and if released into the aqueous humor by puncturing a hole in the intermediate capsule, it will be gradually absorbed and distributed in the blood. At the age of 35, the fibers in the center of the lens have become too difficult for the aqueous humor to dissolve. Then, after tearing the lens capsule, this hard nucleus must be extracted through a large incision in the eyeball (an "extracapsular extraction"). Despite this, many technical complications of cataract surgery, especially postoperative hemorrhage and prolapse of the iris or vitreous, can spoil the result. The final vision may deteriorate after perfect surgery due to some degenerative changes in the retina, quite common in these elderly patients, which could not be detected before.

Restoration of sight

It must be admitted that the restoration of sight is not always as gratifying to the cataract patients as one might expect. Without their glasses they may see less than they did before the operation; and the thick "pebble" lenses that are necessary to give clear vision are at first both uncomfortable and confusing. Through these heavy spectacles objects seem magnified and straight lines curved, so that their distorted world squirms about with every movement of the eyes. But in the end the great majority of cataract patients triumph over these difficulties; and they can drive their cars, play their rounds of golf, and re-live the full life that had started receding from them when opacities first started to cloud the sight.

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