

Comprehensive overview of cataract disease

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Introduction

According to the World Health organization, cataract is responsible for 51% of world blindness. Cataract is a significant cause of visual impairment in both low-income and high-income countries. However, there is an effective treatment for cataract, which is surgical removal of the lens opacity with implantation of an artificial intraocular lens. The most common cause of cataract is advancing age. It also is associated with numerous conditions. Cataract is defined as the loss of lens transparency because of clouding of the lens.

Definition

A cataract is an ocular disease in the lens of the eye. Hence, we should talk about the lens briefly. The crystalline lens is a biconvex, avascular and completely transparent structure that helps to focus light on the retina. It is composed of lens capsule, lens epithelium and lens fibers, and is suspended by zonules on either side, which connects it with the ciliary body. The lens fibers are produced continuously from the lens epithelium and migrate from the periphery towards the center. Therefore, the older lens fibers are compressed into a lens nucleus and being harder than the cortex.

A cataract is any opacity in the lens. It has various types but the most common one is age-related cataract. Cataractous lenses are characterized by accumulation of proteins that disseminate light rays and reduce transparency. Additional findings may include vesicles between lens fibers or migration and aberrant enlargement of epithelial cells. A cataract can occur in both eyes. It cannot spread from one eye to the other. The effective

treatment for cataract is surgical. However, rare surgical complications may occur. Secondary opacity of the lens tissue remaining after the surgical procedure may occur and this called secondary cataract or posterior capsular opacification. Age-related cataract can be divided into three types: nuclear, cortical and posterior subcapsular cataracts. Epithelial cells of the lens proliferate and differentiate into fiber cells. Fiber cells then migrate into the center and results in lens nuclear opacity. A cortical cataract begins in the outer third of the lens and extending along the fiber cells toward the optic axis. A posterior subcapsular cataract is a plaque-like opacity develops in the axial posterior cortical layer. Cataract may occur congenitally.

Types

There are different types of cataract. However, most cataracts are related to the aging. Age-related cataract is three diseases. Each type occurs in different regions of the lens and involve various pathological mechanisms. The three types are nuclear, cortical and posterior subcapsular cataracts. In nuclear cataracts, the opacity occurs in the central region of the lens. It is caused by aggregation of lens proteins. Cortical cataracts are in a peripheral of the lens, cortex. Cortical opacities are associated with disruption of the fiber cells. Posterior subcapsular cataracts occur in adjacent to the posterior capsule. These opacifications often rapidly degrade vision. Plaque are formed in the optic axis.

A cataract is divided into another types. Diabetic snowflakes are usually white subcapsular opacities. Posterior polar cataracts are white opacities in the central portion of the posterior capsule. These opacities often penetrate

the posterior cortex and typically they are congenital. In addition, there is a traumatic cataract which develops to the effected eye after an injury. There is also polychromatic cataract. It is a rare type of opacification of the lens. It is identified by needle-shaped polychromatic cortex. As a conclusion of the types,

1. Age-related cataract:

- nuclear cataract
- cortical cataract
- posterior subcapsular cataract.

2. Childhood cataract:

- congenital: present at birth.
- acquired: occur with childhood.

3. Cataract associated with systemic disease: such as diabetes, hypocalcemia, myotonic dystrophy and atopic dermatitis.

4. Drug-induced cataract: The most common cause of the opacity in this type is administration pf corticosteroids.

5. Traumatic cataract: due to a foreign body injury to the lens.

6. Radiation cataract: due to exposure to UV rays.

Risk factors

We will identify the risk factors for cataract formation in order to know who at risk. Firstly, individual factors. They involve increasing age especially after 50 years, female sex, Racial and ethnic groups. Asian people have higher

prevalence than European people. Secondly, genetic factors. Thirdly, lifestyle factors. They involve ultraviolet-B exposure, cigarette smoking and alcohol consumption. Fourthly, diet. It involves consumption of carbohydrates with high-glycaemic index and malnutrition. Fifthly, systemic disorders. For example, diabetes, hypertension, metabolic syndrome, renal impairment and hypocalcemia. Sixthly, ocular diseases such as myopic refractive error and large retinal drusen. In addition, maternal infection, obesity and uveitis are considered significantly risk factors for cataract. As a summary of the risk factors:

1. Congenital: maternal infection.
2. Age: elderly.
3. Metabolic: diabetes, galactosaemia, hypocalcaemia and Wilson disease.
4. Drug-induced: corticosteroids, phenothiazines, miotics and amiodarone.
5. Traumatic: eye injury.
6. Inflammatory: Uveitis.
7. Disease associated: Down syndrome and dystrophia myotonica.
8. Eye surgery: surgery for a retinal disease may lead to cataracts in the affected eye in the future.

Sign and symptoms

The typical presentation of cataract patient is slow decreasing in vision ability over long period of time which the patients usually don't recognize

until they have visual damage (they cannot do their daily activities). Patients may come with blurry vision and glare.

Cataract creation is classically affecting both eyes, although it is often asymmetrical. Patients commonly find difficulties while driving at night specially with reading road signs. Before there is opacity of the lens that damages vision, patients may complain about an increase in shortsightedness that called a “ myopic shift, ” it caused by an increase in the refractive power of a lens that is gradually becoming diseased by cataract and it could continue with the development of opacity. The patient may complain about developing sensitivity to sunlight or any bright light and sometimes it can reach to falling and getting injured. A sudden improvement in the vision without a glasses for short period of time is another sign of cataract, it is due to changing in the refractive power of the lens.

Symptoms of age-related cataract are: pain, redness and visual loss. The signs depend on the severity and they are: severe inflammation, vitritis, corneal haze, discharge, afferent pupillary defect is also common. Changing the lens nucleus to brown color is a sign to detect nuclear sclerosis that happens because of urochrome pigment. Enlargement of abnormally positioned epithelium in case of posterior subscapular cataract. The lens cortex may liquefy in case of morgagnian cataract.

Diagnosis

Painless, progressive deterioration in vision is the characteristic that give a clue to suspect a cataract case. Cataract should be diagnosed after following a step by step diagnostic strategy. Starting with history taking, it needs to

check the presence of the risk factors such as: older than 65 years of age, previous trauma to the eye, smoking, diabetes. . .) and the cloudy vision in addition to changing in the vision color (yellow). Then moving to the physical examination, assessing the distance vision using the best-corrected spectacle prescription for distance and a formal eye chart. A slit-lamp examination should be done to assess the lens dilatation ability. Being unable to cooperate with slit-lamp examination, inspection and evaluation of the red reflex using direct ophthalmoscopy can help measure the severity of the cataract. Last step is the diagnostic tests: dilated fundus examination (to exclude any other abnormality that could be the cause of deteriorated vision), measurement of intra-ocular pressure, glare vision test. A diagnosis of cataract is confirmed if no other abnormality is discovered and the degree of lens opacity associates with the patient's history. In some cases. medication is given to dilate the pupil temporarily.

The clinical diagnosis of cataract in pediatrics consists of: medical history, ocular examination, Systemic examination, investigation. First of all, the history: the age of onset, the past medical history of any trauma (if the cataract suspicion was in one eye), the family history. The ocular examination: observation of the visual behavior and alignment of the eyes, the red reflex test and the visual assessment. In the systemic examination we look for any systemic disease or skeletal abnormalities. Finally, the investigation: Serum TORCHS titre screen, VDRL titre, urine test.

Treatment

the treatment of Cataract is mainly surgical and it has shown its effectiveness over the years in restoring the vision, the infected lens is replaced by an intraocular lens (IOS), but till this day its not widespread among the world, and a lot of people became blindness because of lack of access the eye care. Basically the surgery is done with small-incision extracapsular Cataract extraction, after this we remove the diseased lens and insert an intraocular lens (IOS), also there is a lot of advanced techniques that help the surgeon and make the procedure more easier. After the surgery, the patient can go on and do the everyday activities, but in some cases the vision become blurry and the healing eye must take time for adjusting so that can lead to focus more appropriately with the other eye. Also the period after the surgery is accompanied with intraocular lens (IOS), which help to make the colors more bright and clear. For instance, The Femtosecond Laser Assisted Cataract Surgery (FLACS), was established in 2012, this technique has made the surgery more easier and safer to the surgeon. Also the Refractive Cataract Surgery is modern and new advanced treatment of Cataract, its mainly focusing on replacing the natural lens with an advanced lens that designed for correcting the vision, also it could be used for Myopia or Hyperopia.

Progression

While development of cataract part of the lens degenerated from the lens making cleft which the material will accumulate in it that called (morgagnian corpuscles, incipient cataract) the material that will accumulate in this space is water because of the osmotic pressure is increased as consequence of

degenerated lens, accumulation of water will swollen the lens and may obstruct the pupil which cause glaucoma. Also the surgical treatment of cataract have some complications like: capsular rupture and vitreous loss and they happened not because of lack of surgical team experience or availability of the surgery tools but because of the complexity of the surgery and poor management of the outcomes after the surgery.

Prevention

Cataract prevention majors are not yet known but these some helpful tips:

- Eating a healthy diet based on a study done using US food pyramid that eating grains, milk vegetables, fruits, and saturated fat could lower the risk of nuclear cataract
- Fruits and vegetable diets that rich within lutein, zeaxanthin, and B vitamins are associated with a decreased risk of cataracts
- Non-smokers tend to have a lower risk of developing cataract
- Long-term use of estrogen may be harmful but may reduce the risk of cataract tempol is good protective agent it is showed to inhibit or slow down cataractogenesis and the reduced form of tempol (tempol-H) have antioxidant effects, also study on rats have shown that tempol H protects the lenses from loss of transparency, also a study of possible inhibition of cataract formation by caffeine in mice, and in pups they divided them into two groups, group treated with caffeine and group not treated with caffeine, the ones not treated developed advanced opacities and the treated pups showed attenuated cataractogenesis, unfortunately, no caffeine and its relation to cataracts have been done

in humans. vitamin E and C supplements have no role in cataract prevention.

Implication for self-care

As every disease cataract will harm the patient. Patient with cataract will give up night driving that because his eye cannot recognize the blue color as well as the glare and abrupt changes in light pose so, he sometimes cannot see the pedestrians when they cross the road which lead to a lot of accidents and casualties. He will give up not just the night driving also the reading and a lot of daily life activities. The patient cannot even walk because he afraid of falling and injuring himself which make him fully paralyzed.