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# Cataract Origin, Diagnosis and Modern Clinical Diagnostic Methods

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**Abstract**: **General Background:** The most common cause of vision loss on a global scale, affecting individuals mostly over the age of 40, is cataracts. This condition leads to clouding of the eye's lens, resulting in gradual vision deterioration and eventual blindness if left untreated. While aging is the primary contributing factor, genetic predisposition, metabolic disorders, and external influences such as prolonged UV exposure and smoking can accelerate its onset.

**Specific Background:** Cataracts can be classified based on their cause and presentation, including age-related (senile), traumatic, congenital, and drug-induced types. The International Classification of Diseases (ICD-10) provides a systematic framework for diagnosing and managing the condition. Despite its widespread prevalence, early symptoms of cataracts often go unnoticed, leading to delays in diagnosis and treatment.

**Knowledge Gap:** While extensive research has been conducted on the biochemical mechanisms and risk factors contributing to cataract formation,

gaps remain in understanding its precise pathogenesis. The role of environmental and lifestyle factors in accelerating lens opacity is not yet fully understood. Additionally, while surgical interventions are highly effective, non-surgical treatments have shown limited success.

**Aims:** This study aims to explore the causes, diagnostic methods, and progression of cataracts while highlighting the latest advancements in clinical diagnosis and treatment.

**Results:** Our findings underscore the importance of early detection through modern ophthalmologic techniques such as slit-lamp examination and ophthalmoscopy. Ultrasonic phacoemulsification, a minimally invasive surgical procedure, remains the preferred treatment, boasting a success rate of over 99%.

**Novelty:** This research provides a structured classification of cataracts and highlights emerging diagnostic techniques that have the potential to enhance early detection and treatment effectiveness.

**Implications:** The study emphasizes the necessity of regular eye examinations for individuals at higher risk, along with preventive measures such as UV protection and effective management of metabolic disorders to reduce cataract incidence. Future research should focus on developing pharmacological treatments to slow disease progression and improve surgical outcomes.

**Keywords:** Cataract, General information, stages of development, causes, risk factors

## Introduction:

Cataracts are an eye disease and are one of the leading causes of vision loss in people over the age of 40. Cataracts cause cloudy spots to form in the eyes, and vision may appear blurry or hazy, as if a person is looking through a fogged mirror.

Most often, the disease develops gradually due to physiological changes in the eyes, but sometimes it can occur spontaneously during childhood. Vision can deteriorate so much that vision is completely lost.

Poor diet, smoking, eye injuries and burns, as well as chronic diseases can accelerate the development of cataracts.

Cataracts are one of the leading causes of vision loss and reversible blindness, diagnosed in one in six people over the age of 40 worldwide. In addition, women are twice as likely to develop the disease as men.

In the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10), cataracts are classified as diseases of the lens and are designated by codes H25 ("Senile cataract") and H26 ("Other cataracts"). [1]

**Methods**

Cataract groups according to ICD-10:

H25.0 - primary senile cataract;

H25.1 - senile nuclear cataract;

H25.2 - Senile Morgani cataract;

H25.8 - Other senile cataracts;

H25.9 - Senile cataract, unspecified;

H26.0 - Childhood, adolescent and presenile cataract;

H26.1 - traumatic cataract;

H26.2 - complex cataract;

H26.3 - Drug-induced cataract;

H26.4 - secondary cataract;

H26.8 - other specified cataract;

H26.9 - Cataract, unspecified.

Cataracts cause cloudy spots to form in the lens, causing people to see objects blurry.

The crystalline lens is a transparent lens that focuses light that falls on the retina of the eye, allowing a person to see a clear image.[2]

The lens consists mainly of water and protein fibers. The fibers grow throughout life and over time they become denser, as a result of which the mass and thickness of the lens increase. In addition, its chemical structure also changes: the microelement composition of the lens is disturbed, sodium, calcium, zinc and water accumulate in it. With age, the lens turns yellow, is filled with aqueous fluid from the blood vessels that nourish the eye, its transparency decreases and cataracts develop.[3]

In the early stages, the disease may appear as a small cloudy spot on the posterior capsule of the lens. Over time, it can grow in size and fill the entire nucleus, causing improper refraction of light passing through it and worsening vision.

**Stages of cataract development:**

Initial - clouding of the lens begins at its edges, characteristic dark lines are formed, visual acuity is practically not reduced;

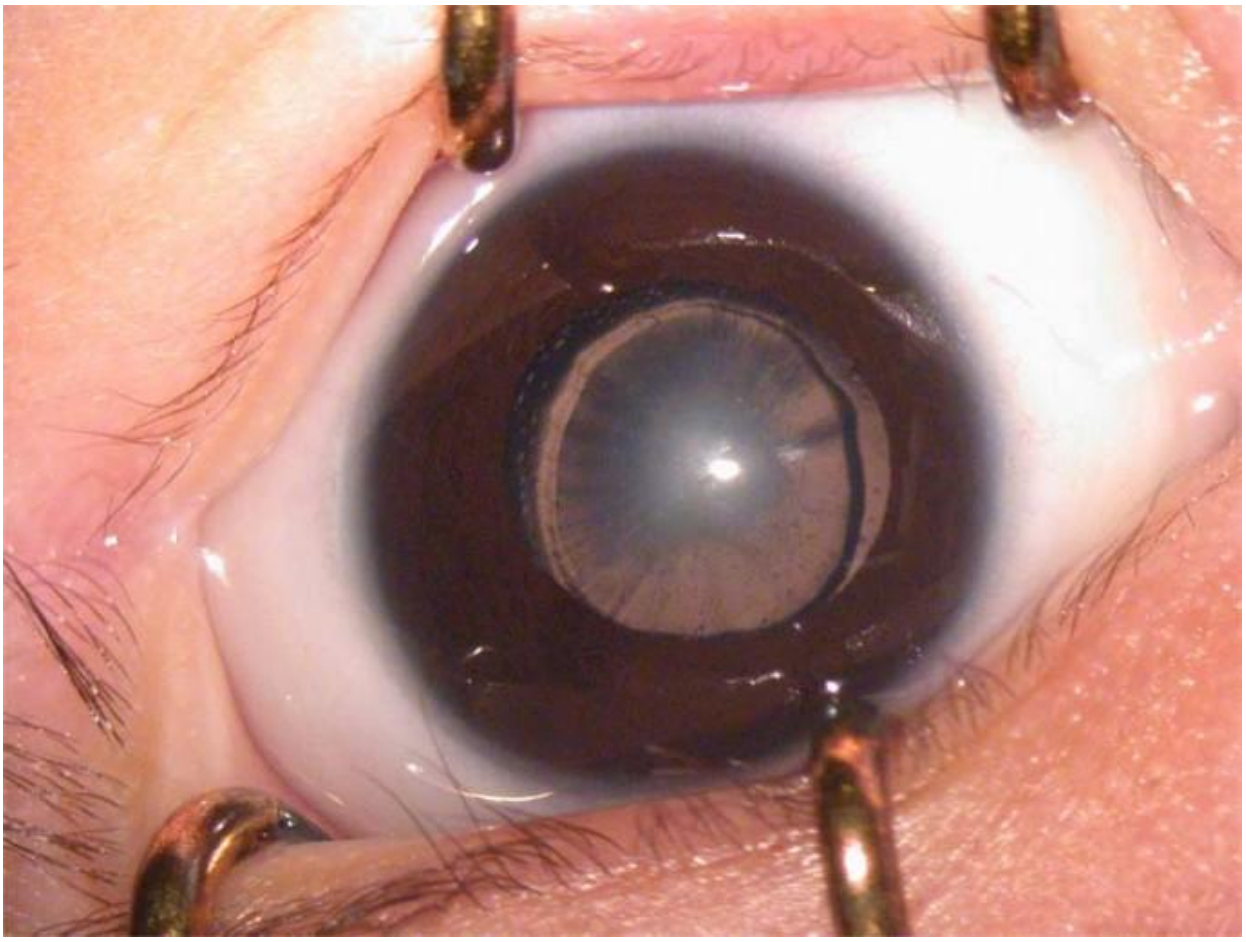
a) immature - the irregularities are unevenly distributed along the edges and core, the person sees objects blurry, the pupil may have a pearly hue;

b) mature - cloudiness affects the entire lens, visual acuity is significantly reduced;

c) Overripe - the lens is destroyed, vision is lost, and the pupil acquires an uneven milky color.

d) How quickly does a cataract mature?

e) The destruction of the protein fibers of the lens is an individual process that takes an average of 4 to 15 years;[4]

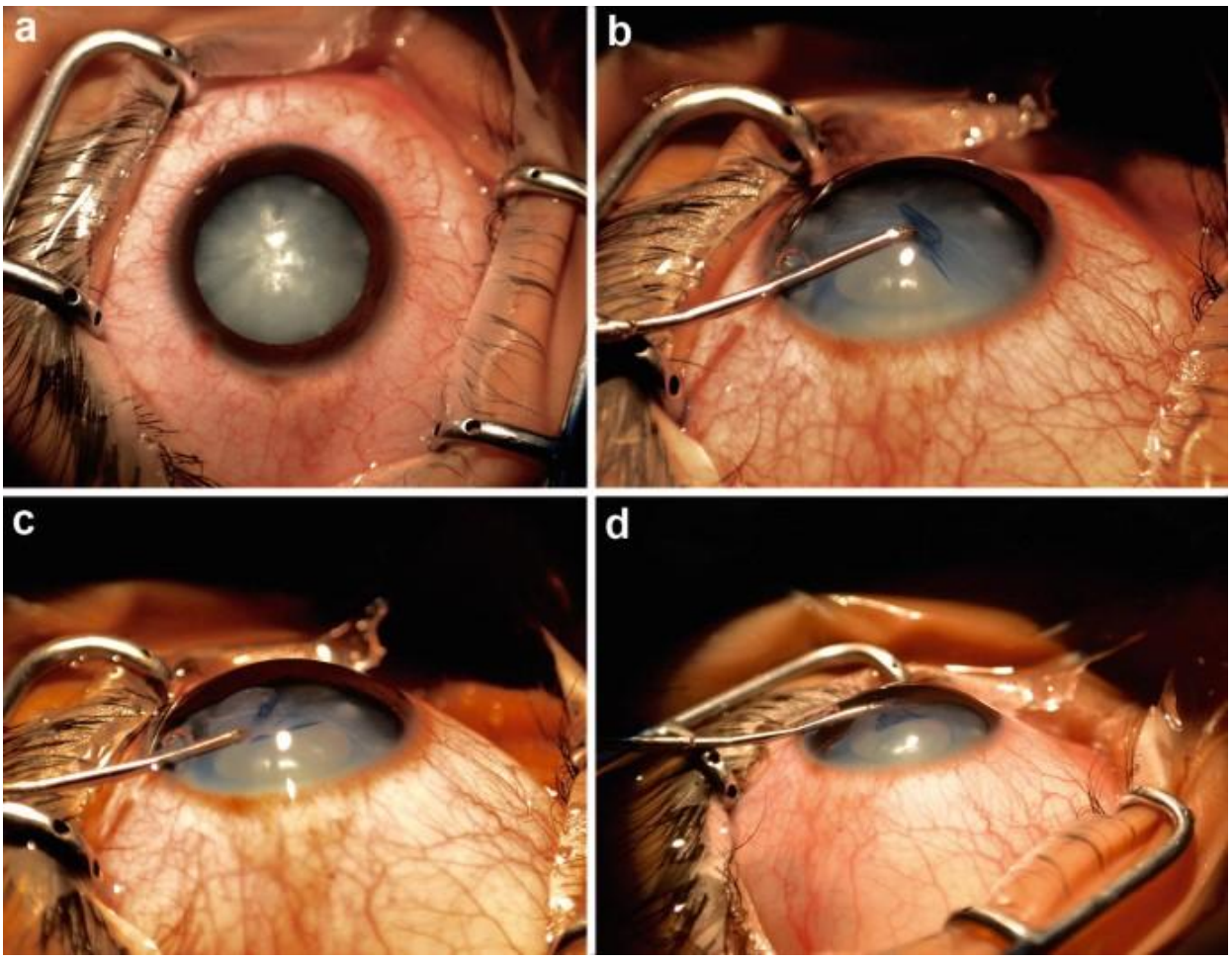


In the early stages of cataracts, a person usually does not feel pain or severe discomfort, and visual acuity is almost unchanged. Over time, as cloudiness enters the optical zone and interferes with the refraction of light, vision decreases significantly. If nothing is done, a person can completely lose vision, leaving only light perception.

The stage of cataract can only be determined by a doctor using ophthalmological equipment.

**Causes of cataracts**

Many studies investigating the causes of cataracts have not been able to reliably describe the causative agent of the disease. Some scientists believe that changes in the lens can be caused by eye injuries, retinal burns, or circulatory disorders in the vessels, such as diabetes or infectious diseases. In addition, genetic causes of the disease have been identified. Usually, a hereditary factor is responsible for congenital cases of cataracts.




**Risk factors for developing cataracts:**

a) Gender - women are diagnosed with the disease twice as often as men. It is not clear how gender affects the development of cataracts, but it is associated with hormonal differences;

b) Racial studies show that Africans are more likely to develop cataracts and vision problems than Europeans;

c) diabetes mellitus - an increase in the concentration of sugar in the blood provokes the destruction of the blood vessels of the eye, which disrupts the supply of nutrients to it;

d) obesity - early age-related changes in the lens are partly due to impaired fat metabolism;

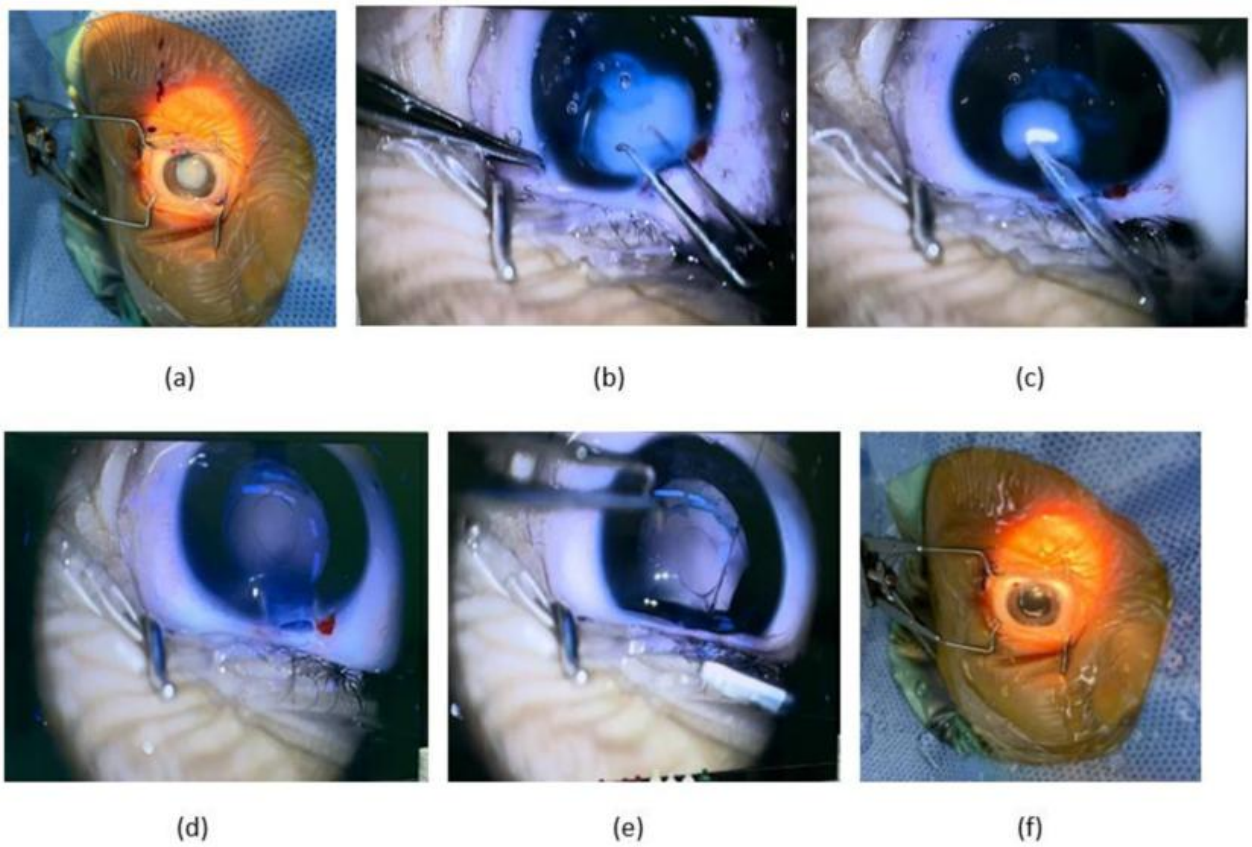
e) exposure to ionizing and ultraviolet radiation - excessive exposure to radiation destroys the protein fibers of the lens and can lead to its clouding;

f) smoking - substances contained in tobacco smoke disrupt the production of antioxidants in the body and lead to faster development of cataracts;

g) eye surgery and other mechanical injuries can accelerate the destruction of the protein fibers of the lens;

h) use of glucocorticosteroids - the development of cataracts is facilitated both by the use of high doses and the duration of treatment;[5]

i) Myopia - since the cause of myopia is the larger size of the fundus, retina and choroid, this worsens the blood supply to the eye and the nutrition of all its structures, including the lens.




**Complications of cataracts**

The main threat of cataracts is vision loss, even blindness. However, usually only in patients who are diagnosed late or are not treated, vision loss occurs. In addition, people with cataracts can develop phacogenic glaucoma, phacolytic iridocyclitis, and night blindness. [6]

Phacogenic glaucoma is an increase in intraocular pressure, which is associated with an increase in the volume of the lens due to its filling with aqueous humor. In this case, the circulation of intraocular fluid is disturbed and characteristic symptoms develop: eye pain, headache, a feeling of rainbow circles before the eyes.

Phacolytic iridocyclitis is an inflammation of the iris and ciliary body of the eye. The disease manifests itself with headache and discomfort in the eye, a network of red or bluish vessels appears in it, the mobility of the pupils is impaired, and the color of the iris changes to green.[7]

Obscurative amblyopia is a decrease in visual acuity that often occurs in children with congenital cataracts.

**Types of cataracts according to the time of appearance:**

a) congenital - a rare form of the disease that can develop in a child after intrauterine infection due to hereditary diseases, maternal smoking or alcohol consumption during pregnancy;

b) Acquired - formed with age during the natural aging of the body, disruption of metabolic functions.

c) Types of cataracts depending on the location of the opacities in the lens substance:

d) nuclear - located in the central part;

e) cortical (cortical) - affects the edges, while the core itself remains transparent;

f) posterior subcapsular - the back part is affected;

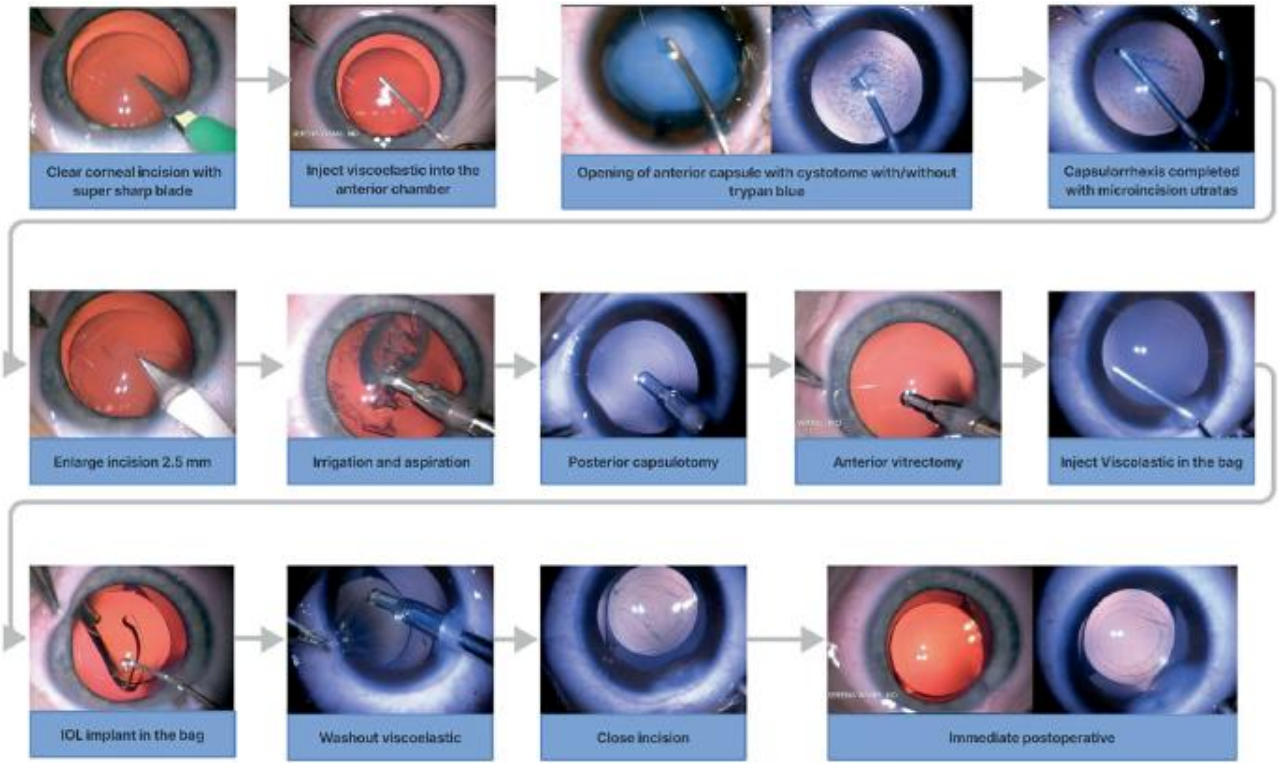
g) total (complete) - cloudiness of all layers.[8]

People over the age of 55 are usually diagnosed with nuclear, cortical, or subcapsular cataracts.

**Cataract symptoms**

A characteristic symptom of cataracts is the appearance of cloudy spots in the eye. Over time, they coalesce and block light from reaching the retina, causing vision to deteriorate.

However, the early manifestations of cataracts can be very diverse. It all depends on the form of the disease and individual characteristics. In some cases, distance vision deteriorates first, in others, close vision deteriorates. An important sign may be a rapid deterioration of vision in a person with myopia, if it was previously stable.




**Other common symptoms of cataracts include:**

a) blurred vision;

b) the image will have a yellowish tint;

c) twilight vision impairment;

d) rainbow circles in the eyes;

e) double vision when looking at objects;

f) the need to change glasses or lenses frequently;

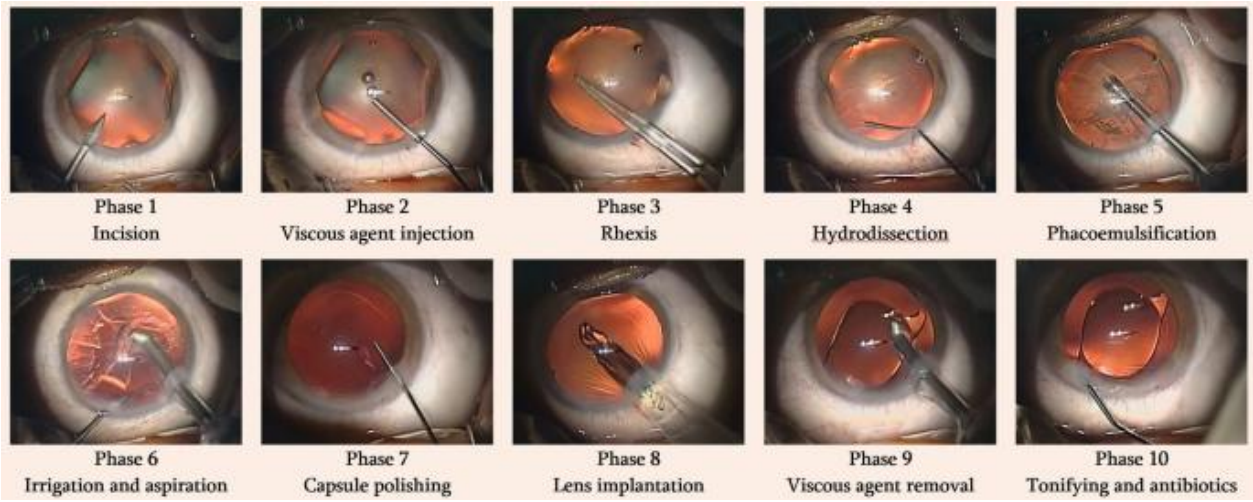
g) Hypersensitivity to light.

h) Cataract diagnosis

An ophthalmologist is a specialist in the field responsible for diagnosing and treating eye diseases. If you have impaired vision and blurred vision, you should see a doctor as soon as possible.[9]

**When to see a doctor**

There is no specific symptom that clearly indicates cataracts. Therefore, if you notice significant changes in your vision, you should consult an ophthalmologist. The earlier you start treatment, the greater the chance of successful treatment.




If you experience episodes of double vision, flashing or swimming, headaches, or eye pain, seek immediate medical attention.

To diagnose cataracts, a doctor will test your vision and examine the fundus of your eye.

Laboratory research methods

There are no laboratory tests to diagnose cataracts. However, your doctor may order a culture of eye discharge or a blood test to look for bacterial or viral infections that can cause vision loss.[10]

**Instrumental research methods**

To detect and confirm a cataract, your doctor will examine your eyes under a special ophthalmological microscope using a slit lamp. This test will show how much damage has occurred to the lens.

Your doctor may perform an ophthalmoscopy, which is an examination of the back of your eye. Before the procedure, drops are placed in your eyes to dilate the pupil. This test is usually used to evaluate the optic nerve and retina, but it can also be used to visually examine the lens.

Contrast sensitivity test to assess a person's ability to detect visual differences between similar colors;

Measuring intraocular pressure to distinguish cataracts from other vision problems that have similar symptoms, such as glaucoma.

A contrast sensitivity test assesses a person's ability to see objects that vary slightly in brightness. The only way to completely get rid of cataracts is to have a lens replacement surgery. However, until vision is completely impaired, a person may be offered eye drops and glasses to help manage the symptoms of the disease. Correcting vision with eye drops and glasses is not a cure for cataracts, but it can help relieve their symptoms. Thus, eye drops, such as artificial tears, moisturize the eye and eliminate dryness, while glasses and lenses correct vision.[11]

As a rule, eye drops for cataracts should be used 1-2 times a day. This should be done for a long time.

Surgical treatment

In Russia, the operation to replace the lens with an artificial lens in cataracts - ultrasonic phacoemulsification - can be performed free of charge under the compulsory health insurance program. To do this, you need to consult a doctor, who will conduct the necessary tests and, if the diagnosis is confirmed, will give a referral for surgery.[11]

**Contraindications to surgery:**

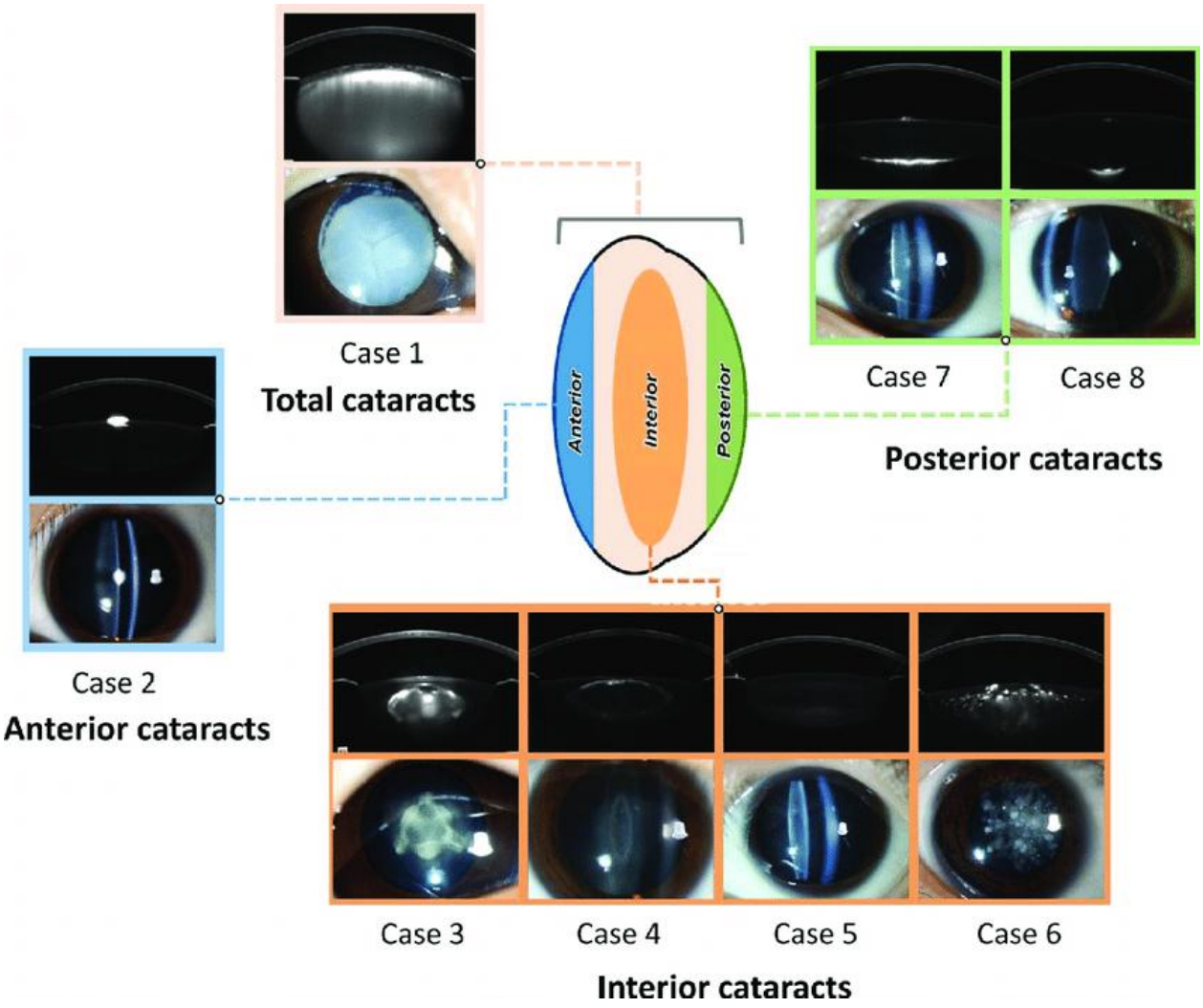
a) acute inflammatory diseases,

b) acute cardiovascular diseases,

c) exacerbation of chronic diseases,

d) Acute mental illnesses.

Standard preoperative preparation is required for cataract surgery: a person must undergo a clinical blood test, a general urine test, blood tests for syphilis, HIV, hepatitis B and C, and a coagulogram.



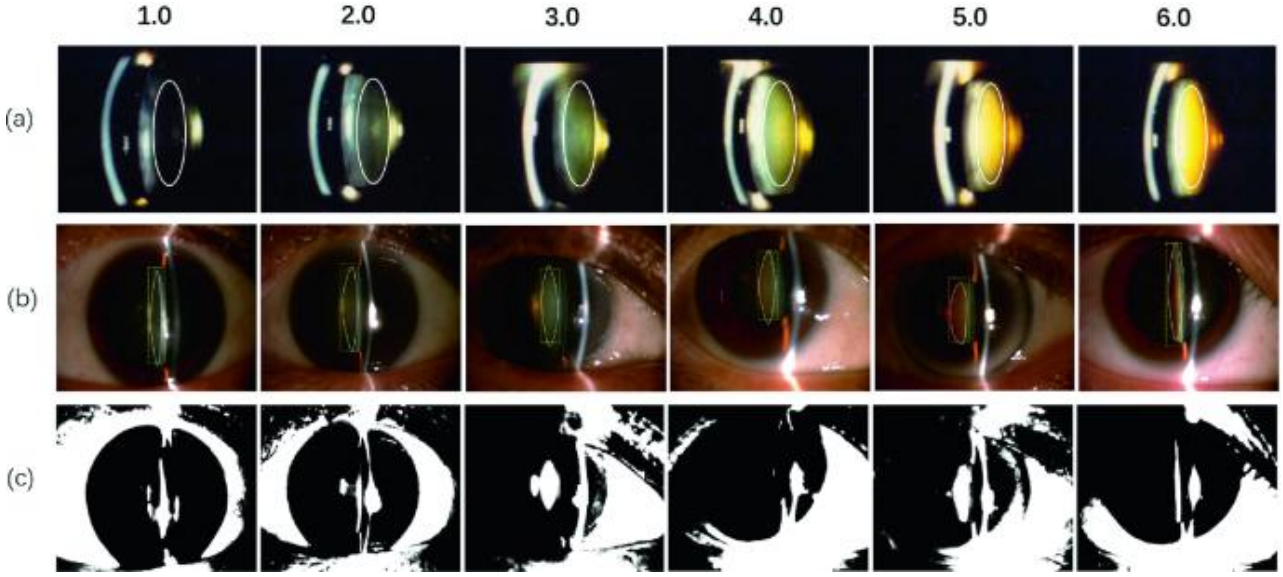

**Results:** Complete blood count with leukocyte formula and ESR, smear microscopy (venous blood) for pathological changes in the leukocyte formula Ultrasonic phacoemulsification is a quick and painless procedure, the whole process takes no more than 15 minutes. During this procedure, a special needle that conducts ultrasound is inserted into the eye through a microscopic incision. Ultrasound waves of a certain frequency destroy the lens, and its remains are removed with a syringe. An implant is placed in the vacated place.[12]

**This is what artificial lenses look like**

After the operation, the patient is usually observed for a day and then sent home. To prevent postoperative complications, he is prescribed antibiotics and anti-inflammatory drugs. In addition, in the first weeks after the operation, it is forbidden to rub your eyes, sharp bends and lifting heavy objects should be avoided.[13]

Complications associated with ultrasonic phacoemulsification are rare, occurring in less than 1% of cases. Some patients may develop recurrent cataracts over time, which are caused by

opacification of the posterior lens capsule that is not removed during ultrasonic phacoemulsification.




It is difficult to influence the development of cataracts, with an 80% chance of developing the disease in people over 80. However, there are some preventive measures.[14]

Possible ways to delay or slow down cataracts:

Quit smoking to avoid damaging the mucous membrane of the eye with cigarette smoke;

Wear sunglasses with dark lenses to protect your eyes from ultraviolet radiation;

To prevent cell damage from free radicals, include vitamins C and E in your diet. It is not necessary to take additional vitamins - it is enough to eat their natural sources: citrus fruits, strawberries, tomatoes, sweet peppers, eggs, avocados, nuts [15]

Control of chronic diseases such as diabetes and hypertension;

Protect the eyes from injury and infection;

Take glucocorticosteroid drugs only as directed and under the supervision of a doctor.

**Conclusion:** It is also important to monitor the condition of your eyes and regularly visit an ophthalmologist: a specialist can detect the disease at an early stage, when treatment is more successful.

Up to 40 years of age, if there are no vision problems, it is necessary to undergo a preventive ophthalmological examination every 5-10 years. After 40 years - every 3-5 years. After 55 years, the recommended interval is every 2 years, and after 65 years - every year.

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