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Immature Senile Cataract: Case Report

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Abstract. *Senile cataract is a degenerative ocular condition characterized by lens opacity that leads to progressive visual impairment and remains the leading cause of blindness globally, particularly in developing countries. Aging is the primary cause, while systemic conditions such as hypertension significantly accelerate cataract formation through oxidative stress and metabolic disruption in the lens. This study employed a descriptive literature-based approach by reviewing relevant scientific articles, clinical reports, and epidemiological data related to cataract pathophysiology, risk factors, classification, diagnosis, and management, with emphasis on the role of hypertension and surgical interventions. The findings indicate that cataractogenesis is multifactorial, involving protein aggregation, lens hydration, and oxidative damage. Hypertension contributes through inflammatory pathways and impaired ion transport in lens epithelial cells. Cataracts are classified based on age of onset, morphology, and etiology, with senile cataracts being the most prevalent. Clinical manifestations include blurred vision, glare, and gradual vision loss. Diagnostic approaches include visual acuity testing and slit-lamp examination. Surgical management, particularly phacoemulsification and delayed sequential bilateral cataract surgery (DSBCS), provides effective visual restoration with minimal complications. Senile cataracts significantly impact quality of life, and hypertension is an important modifiable risk factor. Early detection, risk control, and appropriate surgical intervention are essential to prevent blindness and improve patient outcomes.*

Keywords: *Senile Cataract, Hypertension, Visual Impairment, Phacoemulsification, Cataract Surgery*

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INTRODUCTION

Aging is an inevitable biological process characterized by gradual structural, cellular, and physiological decline across multiple organ systems. As individuals grow older, cumulative degenerative changes affect not only systemic health but also sensory function, including vision. The eye is particularly vulnerable to aging because its transparent optical structures depend on highly organized cellular architecture, metabolic stability, and continuous maintenance of tissue clarity. Age related changes may involve the retina, cornea, ocular surface, and crystalline lens, resulting in progressive reduction in visual function and increased susceptibility to ocular disease (Chader & Taylor, 2013; Luu & Palczewski, 2018). Among the ocular disorders associated with aging, senile cataract is one of the most clinically important because it develops gradually, affects daily functioning, and remains a major cause of preventable visual impairment. Senile cataract occurs when the normally transparent crystalline lens becomes progressively opaque due to metabolic disturbance, structural alteration, and degeneration of lens fibers. This opacity interferes with the passage and refraction of light into the retina, causing blurred vision, glare, reduced contrast sensitivity, and, in advanced stages, severe visual impairment.

The significance of senile cataract extends beyond its biological mechanism because the disease represents a major public health concern, particularly in countries where access to early eye examination and surgical care remains uneven. The World Health Organization (WHO) states that by 2023, approximately 18 million people will experience bilateral blindness due to cataracts, and the majority of these cases, around 90%, occur in developing countries, including Indonesia. This situation indicates that cataract blindness is not merely a consequence of aging, but also reflects disparities in health service access, delayed diagnosis, limited awareness, and insufficient surgical coverage. In Indonesia, the burden is especially concerning because blindness remains a serious national health problem, with cataracts contributing to a dominant proportion of cases. Previous studies have reported that Indonesia has the highest blindness rate in Southeast Asia, and cataracts account for 81.2% of all blindness cases (Rif'Ati et al., 2021; Simamora et al., 2024; Paqih et al., 2026). These data demonstrate that cataract should be understood not only as an ophthalmological disorder but also as a condition with social, economic, and quality of life implications. Visual impairment caused by cataracts can reduce independence, limit work capacity, increase dependence on family members, and lower overall well being among elderly patients.

Although senile cataract is primarily associated with aging, its development is not determined by chronological age alone. Cataractogenesis is a multifactorial process influenced by systemic disease, metabolic imbalance, oxidative stress, inflammation, medication exposure, environmental factors, and individual health behavior. Among these factors, hypertension is increasingly recognized as a clinically relevant systemic condition associated with cataract formation in older adults. Research by Luh Putu et al. showed that hypertension is significantly associated with the occurrence of senile cataracts in elderly patients. This relationship is important because hypertension is highly prevalent in aging populations and may remain uncontrolled for long periods, thereby contributing to chronic vascular and metabolic stress. According to Beyer et al. (2022); Khan et al. (2016) and Choudhary & Bodakhe (2016) Hypertension can influence the development of cataracts by disrupting the ion transport process in the lens fibers. Disruption of ion transport may interfere with lens homeostasis, alter lens hydration, disturb electrolyte balance, and contribute to the loss of lens transparency. In this context, hypertension should not be viewed only as a cardiovascular problem, but also as a systemic risk factor that may accelerate ocular degeneration through mechanisms that affect lens metabolism and structural integrity.

The relationship between hypertension and senile cataract is clinically meaningful because it highlights the importance of risk factor assessment in elderly patients presenting with visual complaints. In cataract patients with a history of hypertension, progressive lens opacity may reflect not only age related degeneration but also the cumulative effect of systemic vascular dysregulation. Chronic elevation of blood pressure can contribute to oxidative stress, endothelial dysfunction, inflammatory activity, and microvascular changes that may affect ocular tissues. These processes may indirectly influence the biochemical environment of the lens and increase vulnerability to protein aggregation, hydration imbalance, and opacity formation. Therefore, recognizing hypertension as part of the clinical background of senile cataract is important for comprehensive patient evaluation. It also emphasizes the need for blood pressure control, patient education, and integrated management between general medical care and ophthalmological services.

The impact of senile cataract on patients is substantial because visual impairment affects multiple dimensions of life. Cataract related visual decline may reduce reading ability, mobility, occupational performance, self care, and social participation. In elderly patients, poor vision may also increase the risk of falls, functional dependence, anxiety, and reduced confidence in daily activities. For this reason, cataract management should not be understood merely as treatment of an ocular opacity, but as an intervention that restores visual function and improves quality of life. Surgical intervention remains the most effective treatment for visually significant cataracts because no medical therapy has been established as a definitive method for reversing lens

opacity. Cataract surgery can restore vision, reduce disability, and improve functional outcomes when performed at the appropriate time (Elliott et al., 2000; Owsley et al., 2007; Błachnio et al., 2024; Walker et al., 2006). In bilateral cataract cases, surgery is often performed on separate days through Delayed Sequential Bilateral Cataract Surgery (DSBCS). This approach allows clinicians to assess the visual outcome, refractive result, and possible complications of the first eye before operating on the second eye. Such staged management is particularly relevant for elderly patients and patients with systemic comorbidities because it provides a safer and more cautious pathway for visual rehabilitation.

In the broader clinical care pathway, general practitioners have an essential role in the early identification and management of cataract patients. As the first point of contact in many health systems, general practitioners are responsible for recognizing visual complaints, identifying risk factors, assessing systemic conditions such as hypertension, providing health education, and facilitating timely referral to ophthalmologists. Their role is especially important in communities where patients may underestimate gradual vision loss or delay treatment because cataract symptoms progress slowly. Early counseling can help patients understand that cataract is treatable, that uncontrolled systemic conditions may influence ocular health, and that timely surgical referral can prevent avoidable blindness. General practitioners also contribute to preoperative readiness by supporting blood pressure control and ensuring that patients receive appropriate medical evaluation before surgery. Therefore, their involvement strengthens continuity of care from early detection to definitive ophthalmological management (Budiono, 2019; Vijan et al., 1997; Moser et al., 2006; Epstein et al., 2012).

Based on these considerations, this case report focuses on immature senile cataract as a clinically relevant stage of cataract development in which lens opacity has already affected vision but has not yet reached complete maturation. The immature stage is important because it provides an opportunity for timely diagnosis, risk factor evaluation, patient counseling, and planned surgical intervention before more severe complications or greater visual disability occur. By discussing immature senile cataract in relation to aging, hypertension, visual impairment, and surgical management, this study aims to strengthen clinical understanding of the condition and highlight the importance of early recognition, systemic risk control, and appropriate referral in preventing cataract related blindness.

METHODS

This study used a descriptive case report design supported by a literature based clinical review. The case report approach was selected because the study aimed to describe the clinical features, risk factors, diagnostic considerations, and management of an elderly patient with immature senile cataract, without modifying the nature of the clinical condition or applying an experimental intervention. The focus of the study was placed on the relationship between the patient's clinical presentation, the degenerative nature of senile cataract, the presence of hypertension as a relevant systemic risk factor, and the rationale for cataract surgery as the definitive management.

Clinical information was obtained from the patient's medical history, ophthalmological examination, and relevant clinical documentation. The assessment included demographic characteristics, presenting complaints, history of visual impairment, systemic comorbidities, previous ocular treatment, and planned surgical management. Ophthalmological evaluation included visual acuity assessment and anterior segment examination to identify the degree of lens opacity and support the diagnosis of immature senile cataract. The patient's systemic condition, particularly the history of hypertension, was also considered because hypertension has been associated with cataract development through oxidative stress, inflammatory activity, and disruption of lens homeostasis.

To strengthen the clinical interpretation of the case, a literature based review was conducted using relevant scientific articles, clinical references, epidemiological reports, and ophthalmology texts related to senile cataract. The reviewed literature covered the definition of

cataract, epidemiology, etiology, risk factors, pathophysiology, clinical manifestations, classification, diagnosis, management, surgical approaches, prognosis, and possible complications. Particular attention was given to literature discussing age related cataract, hypertension as a systemic risk factor, and surgical management through phacoemulsification and Delayed Sequential Bilateral Cataract Surgery.

The data were analyzed descriptively by organizing the clinical findings and literature evidence into thematic sections. The patient's condition was interpreted in relation to established concepts of senile cataract pathophysiology, risk factor mechanisms, and clinical management. No statistical analysis was performed because the study was not designed to test a hypothesis or measure association between variables. Instead, the analysis emphasized clinical reasoning, integration of patient findings with existing literature, and explanation of the relevance of timely diagnosis and surgical intervention.

Ethical attention was given to patient confidentiality. Identifying information was not disclosed, and the case was presented for academic and clinical learning purposes. The study was conducted in accordance with the principles of respectful clinical reporting, ensuring that the discussion remained focused on the medical condition, diagnostic process, and management considerations without exposing personal patient identity.

RESULT AND DISCUSSION

Definition

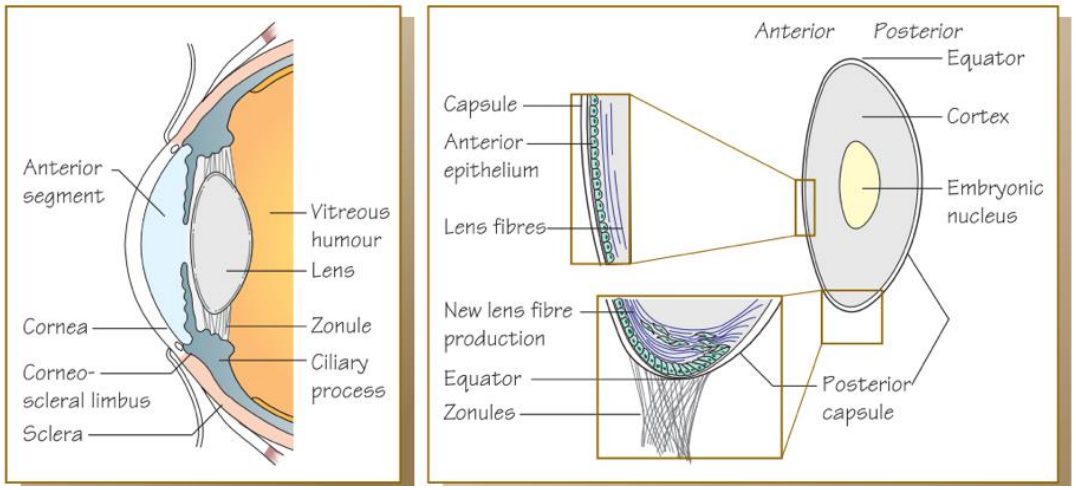

Figure 1. Anterior Segment and Cross-Section of a Normal Lens (Olver et al., 2014)

The crystalline lens is an avascular structure located behind the iris, composed of a nucleus (old, inactive cells) and an outer cortex enclosed by a lens capsule. Çankaya (2023) said that, beneath the capsule lies a metabolically active epithelial layer that produces proteins, transports amino acids, and maintains the cation pump to maintain lens clarity. At the equator, these epithelial cells differentiate into lens fibers, which lose their organelles and aerobic metabolic capabilities (Olver et al., 2014).

The lens functions to focus light onto the retina through the process of accommodation (Charman, 2008). This process is enabled by the zonular filaments that suspend the lens from the ciliary muscle. When the ciliary muscle contracts, the zonular filaments relax, making the lens more convex with a shorter focal length for near vision (Olver et al., 2014).

With age, the elasticity of the lens tends to decrease, leading to presbyopia. Furthermore, the risk of cataracts, a clouding of the lens caused by fluid accumulation between the lens fibers, also increases (Pescosolido et al., 2016; Michael & Bron, 2011; Meyer, 2001). These changes alter the refractive index and trigger irregular light reflection, thus obstructing light entry and resulting in blurred vision (Kaštelan et al., 2018; Mainster & Turner, 2012).

Cataracts are a condition where the lens of the eye becomes cloudy, causing decreased clarity and impaired vision. The term comes from the Greek word "Katarrhakies," meaning waterfall, because cataracts were once thought to occur due to frozen fluid originating from the brain and flowing in front of the lens.

Cataracts can be caused by aging (age-related), trauma, systemic diseases such as diabetes, and even genetic factors in children (congenital cataracts). Cataract diagnosis is generally made through a Snellen visual acuity test and physical examination of the lens using a slitlamp or ophthalmoscope with the pupil dilated (Munteanu et al., 2024; Chen et al., 2025).

Epidemiology

Cataracts are the leading cause of blindness worldwide, characterized by a sharp decline in vision that disrupts daily activities. According to WHO data, this disease is responsible for approximately 51% of global blindness, with the number of sufferers increasing from 17 million in 2002 to approximately 18 million in 2023. This phenomenon has a more severe impact in developing countries, where approximately 90% of blindness cases are due to cataracts. The prevalence of cataracts is also known to increase sharply with age, particularly in the population over 60 years of age (senile cataracts) (Asbell et al., 2005; Hashemi et al., 2020; Song et al., 2018; Erdurmuş et al., 2019).

In Indonesia, the incidence of cataracts remains a major public health challenge as life expectancy increases. Currently, the prevalence of cataract sufferers reaches approximately 1.5% of the total population, with an estimated 210,000 new cases (0.1%) per year. This situation places Indonesia in a quite alarming position; Data from the Indonesian Ophthalmologist Association (Perdami) shows that Indonesia has the highest number of blindness cases in Southeast Asia and the third highest in the world (2024), with 81.2% of total cases caused by cataracts.

Etiology and Risk Factors

Generally, the most common cause of cataracts is old age, also known as senile cataracts. Many other factors are also involved, including trauma, drug toxicity (steroids), metabolic diseases (diabetes, hypertension, hyperparathyroidism), and eye diseases (uveitis and retinal detachment). Generally, the cause of cataracts is a degenerative process related to age. Other contributing factors include metabolic factors, trauma, inflammation, malnutrition, and the effects of corticosteroids (Şimşek et al., 2014; Moore et al., 2017; Annane et al., 2017; Williams et al., 2009).

Age

The normal aging process causes the lens to become hard and cloudy, which often occurs from age 50 onward. With age, the lens size increases as new lens fibers form. The fibers that formed earlier are pushed toward the center, forming the nucleus. This nucleus solidifies and dehydrates, resulting in sclerosis. This sclerosis causes the lens to lose elasticity, resulting in decreased accommodative capacity (Cheng, 2024; Koopmans et al., 2003).

Gender

There are indications that cataracts are more common in women than in men, especially those over 65, as indicated by a survey conducted by the Framingham Eye Study (NHANES).

Diabetes Mellitus

Cataracts are generally a problem for the elderly, but in people with poorly controlled diabetes mellitus, cataracts can occur at a younger age. It is thought that cataracts develop due to the accumulation of waste products from sugar metabolism by the lens cells of the eye. Under normal blood sugar levels, this buildup of waste products does not occur. When blood sugar levels rise, the conversion of glucose by aldose reductase to sorbitol increases. Furthermore, the conversion of sorbitol to fructose is relatively slow and unbalanced, resulting in increased

sorbitol levels in the lens of the eye. It has been hypothesized that sorbitol increases intracellular osmotic pressure, resulting in increased water uptake and, subsequently, directly or indirectly, cataract formation.

Hypertension

Hypertension plays a significant role in cataract formation through several complex pathophysiological mechanisms. Structurally, hypertension causes conformational changes in the lens of the eye, leading to impaired potassium ion transport within the lens epithelial cells and increased nitric oxide levels. This condition is closely associated with intense systemic inflammation in hypertensive patients, characterized by increased pro-inflammatory cytokines such as TNF-α, interleukin-6, and C-Reactive Protein (CRP). It is through this inflammatory pathway that cataracts form, which is mechanistically different from age-related cataracts, which are dominated by purely oxidative stress factors (Mario, 2025).

On the other hand, hypertension also triggers oxidative stress, an imbalance between free radicals and the body's antioxidant capacity to neutralize them. The lens of the eye is highly sensitive to this condition, where the inability of antioxidants to neutralize free radicals causes damage to DNA, cell membranes, lysosomes, and even mitochondria in the lens fibers. The continuous accumulation of this oxidative stress results in impaired lens metabolic function, aggregation of lens proteins, and an increase in the amount of water-insoluble proteins. This combination of systemic inflammation and oxidative damage ultimately disrupts lens transparency, alters the refractive index, and causes the opacities known as cataracts (Mario, 2025).

Ultraviolet Light

Ultraviolet light from the sun can accelerate the opacity of the lens. Individuals with daily exposure to ultraviolet light increase the risk of cataracts.

Medications

Certain medications can stimulate cataract formation, including: amiodarone, chlorpromazide, corticosteroids, lovastatin, and phenytoin. The use of corticosteroids is a risk factor for the development of posterior subcapsular cataracts (Delcourt et al., 2000; Jobling & Augusteyn, 2002; Majure et al., 1989; Wang et al., 2009; Giuffrè et al., 2005).

Smoking

Individuals who smoke 20 or more cigarettes a day have a twofold increased risk of developing cataracts.

Nutrition

Nutritional factors are one risk factor for cataracts. A diet rich in lactose or galactose can cause cataracts, as can a diet low in riboflavin, tryptophan, and various other amino acids.

Pathophysiology

The pathogenesis of senile cataracts is multifactorial and related to degenerative processes, but it is not fully understood. With age, various factors accumulate that can facilitate cataract formation. The amount of water-soluble crystallin protein decreases with lens maturation. Chemical changes in lens proteins cause protein aggregation and produce excessive brownish-yellow pigment. Furthermore, with age, the lens becomes thicker and heavier. Continuous production of lens fibers leads to compression and hardening of the nucleus (nuclear sclerosis).

With age, the lens mass and thickness increase, and its accommodative capacity decreases. The cortical fiber layers become concentric, resulting in compression and displacement of the lens nucleus (nuclear sclerosis). Crystallization (of lens proteins) is a change that occurs due to chemical modification and protein aggregation into high-molecular-weight proteins. The result

of protein aggregation is sudden fluctuations in the lens' refractive index, scattered light, and decreased lens clarity.

Pathophysiologically, cataracts occur due to lens hydration (fluid buildup), denaturation of lens proteins, or a combination of both. In immature cataracts, increased osmotic pressure causes the lens to absorb fluid (intumescence), resulting in a convex lens and pushing the iris forward. A history of uncontrolled hypertension exacerbates this condition by disrupting the lens epithelial cation pump, which maintains lens clarity. Chronic high blood pressure can cause microvascular changes in the ciliary body, which then alter the chemical composition of the aqueous humor, the lens's primary nutrient source, accelerating the process of lens protein denaturation (Ilyas & Yulianti, 2014). Classification of visual impairment and blindness according to the World Health Organization (WHO) and the National Programme for the Control of Blindness (NPCB).8,9

Visual Acuity (Visus)	WHO Definition	Classification (NPCB/National)
≥ 6/18	Normal / Mild Impairment	Normal Vision
< 6/18 to 6/60	Moderate Impairment	Low Vision
< 6/60 to 3/60	Severe Impairment	Economic Blindness
< 3/60 to 1/60	Blindness	Social Blindness
< 1/60 to Light Perception (+)	Blindness	Manifest Blindness
No Light Perception (NLP)	Total Blindness	Absolute Blindness

Classification

Based on Age of Onset

Congenital Cataracts (age <1 year)

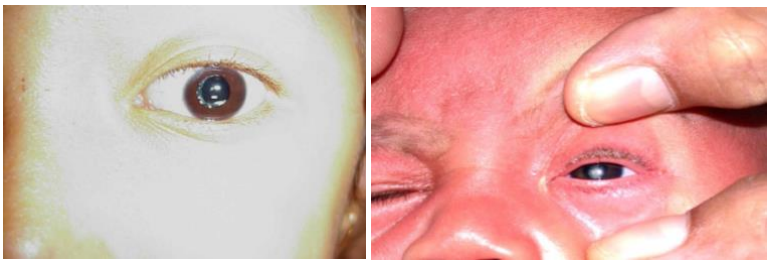

Figure 2. Congenital Cataract10

Cataracts in healthy neonates can occur due to inheritance (usually dominant). However, the cause is sometimes unknown. Congenital cataracts can be associated with other eye anomalies such as PHPV (Primary Hyperplastic Posterior Vitreous), aniridia, coloboma, microphthalmos, and buphthalmos (in infantile glaucoma). Causes of cataracts in unhealthy neonates include intrauterine infection and metabolic disorders. Intrauterine infections include rubella (the most common). Characteristics of neonates infected with rubella include small stature (small babies) due to incomplete intestinal absorption, cataracts, and congenital heart disease. Besides rubella, other conditions include toxoplasmosis, cytomegalovirus infection, and varicella. Metabolic disorders that can cause congenital cataracts include galactosemia, hypoglycemia, hypocalcemia, and Lowe's syndrome.

Juvenile Cataract (Age > 1 Year)

Juvenile cataracts are rare in young people. They are extremely rare. In some cases, they may be a form of congenital cataract with a rather delayed clinical manifestation. Juvenile cataracts are inherited in an autosomal dominant manner.

Senile Cataract (Age > 50 Years)

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This type of cataract is also known as "age-related cataract," and is the most common type found after age 70 (approximately 90%). This condition usually occurs bilaterally, but symptoms are typically more severe and progress more rapidly in one eye than the other. The severity is divided into four stages:2,7 (1) Incipient Stage: Initial cloudiness with relatively good vision; (2) Immature Stage: The cloudiness has not yet affected the entire lens, there are still clear parts, marked by the presence of a positive iris shadow and visual acuity is usually still above 1/60.

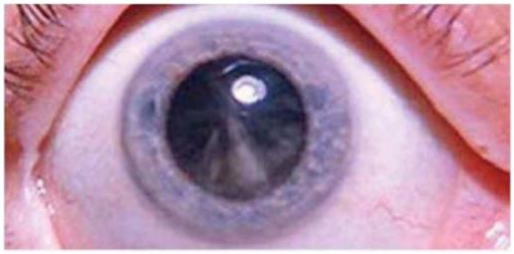

Figure 3. Immature Cataract2

Mature Stage: The cloudiness is complete, the iris shadow is negative, and the remaining vision is only light perception or hand movement.

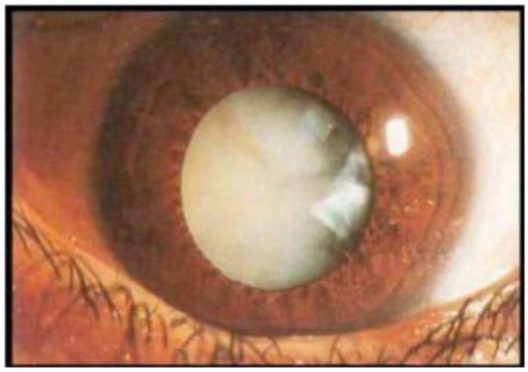

Figure 4. Mature Cataract

Hypermature Stage: Leakage of the lens mass occurs, causing the capsule to shrink, and sometimes the nucleus to sink (Morgagnian cataract).

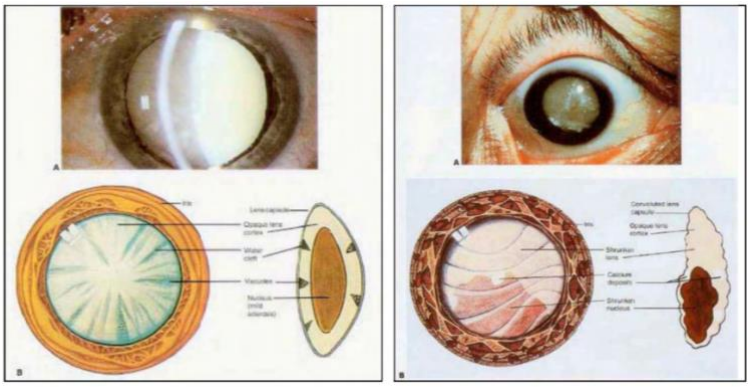

Figure 5. Hypermature Cataract 2

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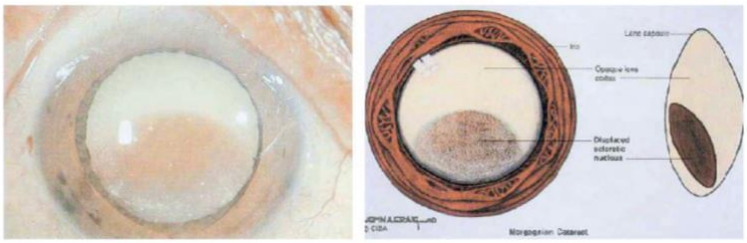

Figure 6. Morgagnian cataract 2

Intumescent Cataract: Lens opacification accompanied by lens swelling due to the degenerative lens absorbing water. Water entering the lens cavity causes the lens to swell and enlarge, pushing on the iris, making the eye chamber shallower than normal. This lens bulging can lead to glaucoma. Intumescent cataracts typically occur in rapidly progressing cataracts and result in lenticular myopia. In this condition, cortical hydration can occur, causing the lens to bulge and increase its refractive power, leading to myopia. Slitlamp examination reveals vacuoles in the lens, accompanied by stretching of the lens fiber lamellae.

Based on Location of Opacity (Morphology)

Nuclear Cataract

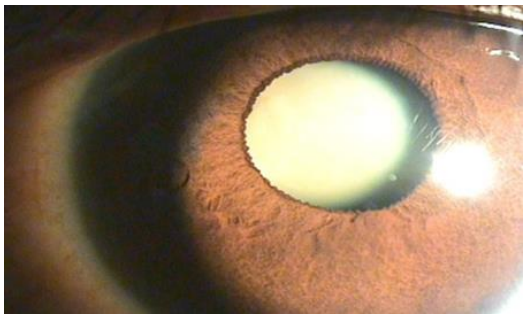

Figure 7. Nuclear Cataract10

Nuclear cataracts tend to progress slowly and typically result in greater impairment of distance vision than near vision. Early in the development of nuclear cataracts, myopization often occurs, i.e., sudden blurring of distance vision, with spherical correction of -5/-6 D. Increasing correction is required over time. This myopization occurs because the nucleus in nuclear cataracts progressively hardens, resulting in an increase in the refractive index. In some cases, myopization actually allows presbyopic individuals to read up close without glasses, a condition called "second sight." The sudden change in refractive index between the sclerotic nucleus and the lens cortex can result in monocular diplopia. The progressive lens yellowing seen in nuclear cataracts makes it difficult for patients to distinguish shades of color.

Cortical Cataracts

Cortical cataracts are usually bilateral but can also occur asymmetrically and affect visual function depending on the location of the opacity relative to the lens axis. The most common complaint in cortical cataract patients is glare when looking at a light source. Slit-lamp biomicroscopy examination is used to detect the presence of hydropic degeneration vacuoles, which are degeneration of the posterior epithelium and cause the lens to elongate anteriorly. This appearance resembles a "Christmas tree" (dew).

A "Y" or cross-shaped pattern is present. This is commonly found in the polychromatic opacities of myotonic dystrophy. Other causes include diabetes mellitus and atopic dermatitis. Cataracts are present in 2% of atopic dermatitis patients. These cataracts are caused by long-term (>6 months) and continuous use of corticosteroids for the treatment of dermatitis.

Posterior Subcapsular Cataract (PSC)

These cataracts occur in the cortex near the central posterior capsule. Early in their development, these cataracts tend to cause visual impairment due to involvement of the visual axis. Common symptoms include glare and decreased vision in bright light. Lens opacities here can arise due to trauma, use of corticosteroids (topical or systemic), inflammation, or exposure to ionizing radiation.

Based on Etiology

Metabolic Cataracts.

Cataracts that occur in people with diabetes mellitus can appear as fine white, pinpoint opacities (snow-flake cataracts).

Complicated Cataracts

Secondary lens opacities associated with other eye diseases. Several important eye conditions that can cause complicated cataracts are:5 (1) Inflammatory conditions. These include inflammation of the uvea (such as iridocyclitis, parsplanitis, choroiditis), corneal ulcers, hypopyon, and endophthalmitis; (2) Degenerative conditions such as retinitis pigmentosa and other dystrophies, and myopic chorioretinal degeneration; (3) Retinal detachment. Complicated cataracts can occur in older cases; (4) Glaucoma (primary or secondary); (5) Intraocular tumors such as retinoblastoma or melanoma can cause complicated cataracts in their late stages.

Latrogenic Cataracts

Cataracts induced by the use of medications containing corticosteroids, chlorpromazine, long-acting miotics, amiodarone, and busulfan.

Traumatic Cataracts

Radiation cataracts: Exposure to almost any type of radiant energy is known to cause cataracts by damaging the lens epithelium. Electromagnetic cataracts: These are known to occur after a strong electric current passes through the body. Cataracts typically begin as punctate subcapsular opacities that mature rapidly. The source of the current can be a live electrical wire or a lightning flash.

Cataract Grades According to the Burrato Criteria

Grade 1

The nucleus is soft, with visual acuity usually better than 6/18, appearing slightly cloudy with a whitish tinge. The fundus reflex is easily obtained, and the patient is usually under 50 years of age.

Grade 2

The nucleus is mildly hard, with a slightly yellowish tinge, and visual acuity is usually between 6/18 and 6/30. The fundus reflex is also easily obtained, and this type of cataract most often presents as a posterior subcapsular cataract.

Grade 3

The nucleus is medium hard, with a yellowish tinge and grayish cortical opacities. Vision is usually between 3/60 and 6/30.

Grade 4

The nucleus is hard, where the nucleus is already brownish-yellow, and vision is usually between 3/60 and 1/60, where the fundus reflex and fundus condition are difficult to assess.

Grade 5

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The nucleus is very hard, with the nucleus brownish, or even blackish in some cases. Vision is usually only 1/60 or worse, and the patient is over 65 years old. This cataract is very hard and is also called a brunescent cataract or black cataract.

Clinical Manifestations

Subjective Symptoms

Lens opacities can be present without causing any symptoms and can be detected during a routine eye exam. Common symptoms of cataracts include: Glare. One of the early symptoms of visual impairment in cataracts is glare, such as from direct sunlight or the headlights of an oncoming motorcycle. The degree of glare will vary depending on the location and size of the cloudiness. Uniocular polyopia (double vision). This is often an early symptom. It occurs due to irregular refraction by the lens, which causes varying refractive indices as the cataract progresses.

Colored halos. These are perceived by some patients as distorting white light across the color spectrum due to the presence of water droplets in the lens. Black spots on the front of the eye. Persistent black spots are perceived by some patients. Blurred images. Image distortion and cloudy vision occur in the early stages of cataracts.

Vision loss. Vision loss due to senile cataracts has several distinctive features. It is painless and gradually progressive. Patients with central opacities (cupuliform cataracts) experience earlier vision loss. These patients see better when the pupil is dilated, as light is typically dim at night (day blindness). Patients with peripheral opacities (cuneiform cataracts) experience later vision loss and improve in bright light when the pupil is contracted. In patients with nuclear sclerosis, distance vision is impaired due to progressive myopia, such that patients can read without presbyopic glasses. Improvement in near vision, known as "second sight," occurs due to the progression of the opacities. Vision decreases to only light perception and accurate projection of light rays, which is the stage of mature cataracts.

Objective Symptoms

Several examinations should be performed to identify various signs of cataracts: 5 Visual acuity examination. Depending on the location and maturity of the cataract, visual acuity ranges from 6/9 to light perception. Oblique illumination examination. This reveals the color of the lens in the pupillary area, which varies in different types of cataracts.

Iris shadow examination. When an oblique light shines into the pupil, a crescentic shadow from the pupillary border of the iris forms a grayish opacity in the lens, as long as a clear cortex is visible between the opacity and the pupillary border. When the lens becomes more transparent or completely opaque, no iris shadow is formed; therefore, the presence of an iris shadow is a sign of immature cataracts.

Direct ophthalmoscopy. A reddish-yellow fundus light is observed in the absence of opacities in the media. A partially cataractous lens shows a black shadow contrasting with the red light in the cataractous area. A completely cataractous lens does not show any red light. Slit lamp examination. This examination should be performed with a fully dilated pupil. The examination reveals the complete morphology of the opacity (location, size, shape, color, and hardness of the nucleus).

Differential Diagnosis

Congenital cataracts presenting with leukocoria need to be differentiated from various other conditions that may also cause leukocoria, such as retinoblastoma, retinomatous syndrome of prematurity, persistent primary vitreous hyperplasia (PHPV), and others.

Management

Cataract therapy essentially consists of surgical removal of the clouded lens. If visual acuity is greater than 6/24, the pupil can be dilated with 2.5% phenylephrine, or the use of refractive

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glasses can assist with daily activities, then surgery is not necessary. Cyclopentolate and atropine can be used. Recent research has also found cataract eye drops that can dissolve cataracts. However, for mature cataracts, no medical treatment is effective. If a cataract is found, the patient should be referred immediately to an ophthalmologist. Some agents that may slow cataract growth include lowering sorbitol levels, aspirin, and the antioxidant vitamins C and E. Treatment is surgical (Supradnya et al., 2022).

Indications for Cataract Surgery

Improving visual acuity. This is the most common indication for cataract surgery, although individual needs vary. Surgery is indicated only if and when the cataract has progressed to a level sufficient to cause difficulty in performing daily activities. 5 Medical indication. This is a condition in which the cataract causes adverse health effects to the eye. Examples include phacolytic glaucoma or phacomorphic glaucoma. Cataract surgery to improve visual acuity is necessary in the context of a pathological process in the fundus (e.g., diabetic retinopathy) that requires monitoring or treatment with laser photocoagulation. Cosmetic indication. This is rarely performed, such as when the cataract is mature. This is when the blindness is removed to restore a black pupil.

Preparation for Cataract Surgery

Biometry: Ultrasound measurement of the eye length and keratometry to measure the corneal curvature and then calculate the power of the implant to be inserted into the eye during surgery.

Ensuring that general health problems are stable, such as hypertension, respiratory disease, and diabetes. Some medications increase the incidence of bleeding. Warfarin discontinuation is not recommended, but the INR should be below. Aspirin should be discontinued one week after surgery. Informed consent is obtained from the patient regarding expected outcomes and complications of surgery.

Type and Choice Oof Surgical Technique

Intracapsular Cataract Extraction (ICCE)

This surgical technique involves removing the entire lens, including the capsule. It can be performed on fragile or degenerated zonules that are prone to breakage. For this reason, this technique is not suitable for younger patients with strong zonules. ICCE can be performed between the ages of 40 and 50 using the enzyme alpha-chymotrypsin (which breaks down the zonules). ICCE has been tested over time and has been generally performed worldwide for the past 50 years. Currently, its indication is only for lens subluxation and dislocation. Removal of the entire lens requires a 12-14 mm incision, which requires a longer healing time and a greater risk of astigmatism. Bilateral surgery is required to minimize aniseikonia in the patient's eyes.

Extracapsular Cataract Extraction (ECCE)

The lens contents (epithelium, cortex, and nucleus) are removed through a ruptured anterior capsule (anterior capsulotomy), leaving the posterior capsule intact. Currently, ECCE is the surgical technique of choice for all types of patients, from adults to children, unless contraindications exist. Absolute contraindications for ECCE are significant lens subluxation and dislocation. In this method, the posterior lens remains intact, while the nucleus and cortex are extracted. An intraocular lens implant is then placed inside the lens to replace the removed nucleus. This technique is considered the best method for achieving normal vision with minimal magnification. The small incision ECCE technique was developed by making a small incision at the limbus. This technique requires no suturing, resulting in faster healing, a lower risk of astigmatism, and greater cost effectiveness.

Small Incision Cataract Surgery (SICS)

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This modification of extracapsular cataract extraction is one of the preferred techniques used in cataract surgery with intraocular lens implantation. This technique offers numerous patient benefits. SICS is performed with a 6 mm incision in the sclera to extract the lens cortex and nucleus. The scleral incision heals spontaneously and does not require suturing. Astigmatism is also minimal, and the cost is more effective.

PhacoEmulsification

Phacoemulsification is the most commonly used extracapsular cataract extraction technique. This technique uses a handheld ultrasonic vibrator to crush the hard nucleus until the nuclear substance and cortex can be aspirated through an incision measuring approximately 2-3 mm at the 2-3 o'clock position. This incision is large enough to insert a visible intraocular lens. If a rigid intraocular lens is used, the incision needs to be widened by approximately 5 mm. The advantages of small-incision surgery include more controlled intraoperative conditions, the avoidance of sutures, spontaneous wound healing, normal astigmatism, and improved wound strength with lower corneal distortion and reduced postoperative intraocular inflammation.

The patient was scheduled for right ocular pro-phaco emulsification under local anesthesia and intraocular lens implantation after cataract surgery on the left eye one month earlier. Cataract surgery on both eyes is usually performed on different dates, a procedure commonly known as Delayed Sequential Bilateral Cataract Surgery (DSBCS). When both eyes undergo cataract surgery on the same day but as separate procedures, it is called Immediate Sequential Bilateral Cataract Surgery (ISBCS), which has proven to be economically beneficial.

Concerns about the potential risk of bilateral infection/endophthalmitis and early bilateral corneal decompensation requiring corneal transplantation have hampered the widespread acceptance of ISBCS, along with government regulations, medical-legal implications, economic disincentives, and malpractice insurance coverage regulations (Viberg et al., 2024).

On the other hand, proponents argue that strict adherence to recommended protocols reduces these risks. Other benefits include a reduced backlog of treatable blindness and faster visual recovery. Several studies have found no significant differences in postoperative visual acuity, refractive error, or the risk of endophthalmitis between DSBCS and ISBCS. A recent Cochrane systematic review from 2022 indicated no clinically important differences in outcomes between the two approaches. However, these results were not compared taking into account ocular comorbidities, and none of the included studies were conducted in low-income countries.

Prognosis

With advanced surgical techniques, complications are extremely rare. Good surgical outcomes can reach 95%. In cataract surgery, this risk is small and rare. Successful, uncomplicated surgery with ECCE or phacoemulsification offers promising prognosis, with vision improvements of up to 2 lines on a Snellen chart. Patients who have retinal damage or serious postoperative complications that prevent significant visual improvement, such as glaucoma, retinal detachment, intraocular hemorrhage, or infection, may require a more accurate correction. Custom-made intraocular lenses (IOLs) are much easier to adjust after cataract surgery than thick cataract glasses or readily available aphakic contact lenses.

Complications

Complications of Cataracts

Phacoanaphylactic uveitis. Hypermature cataracts can cause leakage of lens proteins into the anterior chamber. These proteins can act as antigens and induce an antigen-antibody reaction that subsequently causes uveitis. Lens-induced glaucoma. This can occur due to different mechanisms.

Immature cataract (intumescent lens) Phacomorphic glaucoma. The lens receives relatively large amounts of fluid during cataractous changes, causing it to increase in size. This disrupts the anterior chamber, causing pupillary block and a narrowing of the angle, leading to

acute angle closure. Treatment is lens extraction once intraocular pressure is medically controlled.

Hypermature cataract Phacolytic glaucoma. Some advanced cataracts can cause leakage in the anterior lens capsule, allowing liquefied lens proteins to enter the anterior chamber. This leads to an inflammatory reaction in the anterior chamber, trabecular meshwork edema, and lens protein obstruction, which in turn causes an acute increase in intraocular pressure. Lens extraction is the definitive treatment after intraocular pressure has been consistently managed and intensive topical steroid therapy has reduced intraocular inflammation. Lens subluxation or dislocation. This may occur due to degeneration of the zonules in the hypermature stage.

Complications of Cataract Surgery

Over 200,000 cataract operations are performed annually in the UK, and despite the safety of modern surgical techniques, complications still occur. Patient expectations for cataract surgery are very high. All patients should be informed of the potential risks of surgery before consenting to surgery. Cataract complications can be divided into intraoperative, early postoperative, operative, and late postoperative complications.

Intraoperative Complications: (1) Suprachoroidal hemorrhage. Severe intraoperative bleeding can cause serious and permanent visual impairment; (2) Ocular perforation. Sharp needles are used for many forms of intraocular anesthesia, and perforation of the globe is highly unlikely. Modern forms of ocular anesthesia have replaced many sharp needle techniques; (3) Iridodialysis. Iridodialysis is a condition in which the iris tears due to manipulation of the intraocular tissue. The damage to the iris is caused by the insertion of the phaco tip or IOL; (4) Cyclodialysis. A condition in which the ciliary body is detached from its insertion in the sclera, which is also caused by surgical manipulation of the intraocular tissue; (5) Conjunctival Ballooning. Occurs in cases of surgery using incision techniques on the conjuctiva or peritomy, where irrigation fluid can collect under the conjuctiva and Tenon's capsule and cause the conjuctiva to swell. This condition will interfere with the operation because the collected fluid will produce reflections from the microscope light which will disturb the operator; (6) Descement's membrane ablation. This condition will cause swelling in the stromal. This complication occurs when the instrument or IOL is inserted and can also be caused by irrigation fluid being inserted near the corneal stromal layer and Descement's membrane; (7) Posterior capsule rupture and loss of vitreous humor. If the delicate capsule is damaged during surgery or the delicate ligaments (zonules) that hold the lens in place become weak, the vitreous humor will prolapse into the anterior chamber. This complication means that an intraocular lens cannot be inserted during surgery, and the patient is also at high risk of postoperative retinal detachment.

Early Postoperative Complications

Infectious endophthalmitis. This devastating infection is extremely rare (approximately 1 in 1,000 operations) but can cause severe, permanent vision loss. Many cases of postoperative infection occur within 2 weeks of surgery, usually with patients presenting with decreased vision and a painful, red eye. This is an ophthalmic emergency. Low-grade infections with pathogens such as Propionibacterium can cause patients to present within weeks of surgery with refractory uveitis (Sehu & Lee, 2012).

Corneal edema. This complication occurs due to a combination of mechanical trauma, prolonged surgery, inflammation, and increased IOP. Uveitis. Postoperative inflammation is more common in various eye types, for example, in patients with a history of diabetes or previous inflammatory eye disease (Sehu & Lee, 2012).

Late Postoperative Complications

Retinal detachment. This is a serious and rare postoperative complication, but it occurs more frequently in myopic patients following intraoperative complications. Postoperative refractive errors. Many surgeries aim to make the patient emmetropic or slightly myopic, but in

rare cases, biometric errors can occur or an intraocular lens with the wrong power can be used. Cystoids macular edema. Accumulation of fluid in the macula postoperatively can reduce vision in the first few weeks after successful cataract surgery. In many cases, this can be treated with management of postoperative inflammation. Glaukoma. Peningkatan tekanan intraokuler secara persisten akan membutuhkan penanganan post operatif.

CONCLUSION

Immature senile cataract is a stage of lens degeneration characterized by partial opacification and a positive shadow test, significantly reducing visual acuity and quality of life. Age remains the primary etiology, but uncontrolled hypertension plays a significant role as a systemic risk factor accelerating cataractogenesis through oxidative stress and disruption of aqueous humor homeostasis. This pathophysiological relationship suggests that chronic blood pressure fluctuations can exacerbate lens protein denaturation. Delayed sequential bilateral cataract surgery (DSBCS) using phacoemulsification is a highly effective and safe strategy for an elderly female patient diagnosed with immature senile cataract. Successful visual acuity restoration in the left eye, which had become pseudophakic, followed by planned surgery in the right eye, demonstrates that the time interval between DSBCS offers significant clinical benefits. These advantages include the opportunity for clinicians to evaluate the stability of functional outcomes in the first eye and minimize the risk of severe bilateral complications, such as endophthalmitis or cystoid macular edema, which are crucial for maintaining quality of life in elderly patients.

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