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Shedding light on cataracts:

causes, symptoms, diagnosis, treatment and prevention

By Lisa Farrell MScOptom

Cataract is classed as one of the world's primary causes of blindness[1-3] with the prevalence of cataracts growing with age. Understanding cataracts, including their causes, symptoms, diagnosis, treatment options and prevention strategies, is crucial for supporting the maintenance of ocular health and the patient's quality of life.

Due to the natural crystalline lens's avascular structure, it is transparent by nature. It is encased by a basement membrane known as the capsule and is biconvex in shape. The loss of lens transparency, whether from a congenital or an acquired cause is known as a cataract[4]. Cataracts are a common but treatable eye condition that can impact upon quality of life.

The main reason to undergo cataract surgery is predominantly for visual enhancement – especially in cases where the individual is having problems in carrying out everyday essential functions, such as driving or for specific occupational duties.

Other indications to have cataract treatment is to improve the clarity of the media to allow monitoring of retinal pathologies, such as diabetic retinopathy and/or for cosmetic indications, i.e. to restore a black pupil. The patient will primarily have the decision on whether they wish to be referred for treatment and ultimately the suitability to undergo surgery will rest with the ophthalmologist[5].

RISK FACTORS AND AETIOLOGY

Multiple risk factors are associated with the formation of cataracts[4,6,7,9,10]. Understanding these risk factors is essential for identifying individuals who may be at higher risk of developing cataracts. First and foremost, older age is the most common association. As people age, the proteins in the lens of the eye breakdown, leading to the formation of lens opacities.

Genetics play a significant role in predisposing individuals to cataracts[4,7,1]. Certain medical conditions can also increase the risk of cataracts. These include diabetes, hypertension, obesity and metabolic syndrome. Individuals with these conditions may be more prone to developing cataracts due to oxidative stress and inflammation.

Several lifestyle factors have been linked with an increased risk of cataracts. Smoking, excessive alcohol consumption, poor nutrition, ultraviolet exposure (UV) or the long-term use of steroids increase the risk of lens opacities. Other factors associated with cataract formation are ocular trauma, radiation exposure and therapy from X-rays or cancer treatment[9,10].

At first, the visual symptoms caused by a cataract may affect only a small portion of the crystalline lens and the patient may be unaware of any visual disturbance or loss. As the cataract matures, it distorts the light passing through the lens resulting in an increased cloudiness to the vision, leading to more noticeable symptoms[4,8].

Cataracts often develop slowly, however, as the condition progresses, individuals may experience blurred or faint vision with an increased sensitivity to glare, particularly when driving at night, which results in spoking of headlights. A difficulty seeing in low-light conditions is commonly reported and extra lighting is required, especially for near tasks. A reduction in contrast and brightness of colours, monocular diplopia and frequent changes in refractive correction are commonly encountered. The types of refractive changes noted are a myopic shift, an increase in astigmatism or an anisometropia[7,12].

Factors that can help reduce the risk of cataracts are keeping systemic conditions in check, such as blood sugar levels and blood pressure, protecting from UV rays, changing lifestyle; by maintaining a healthy weight, reducing alcohol consumption and ceasing smoking. Being proactive and having regular eye examinations can help keep the patient informed of the cataract progression and when treatment is required[4,17,18].

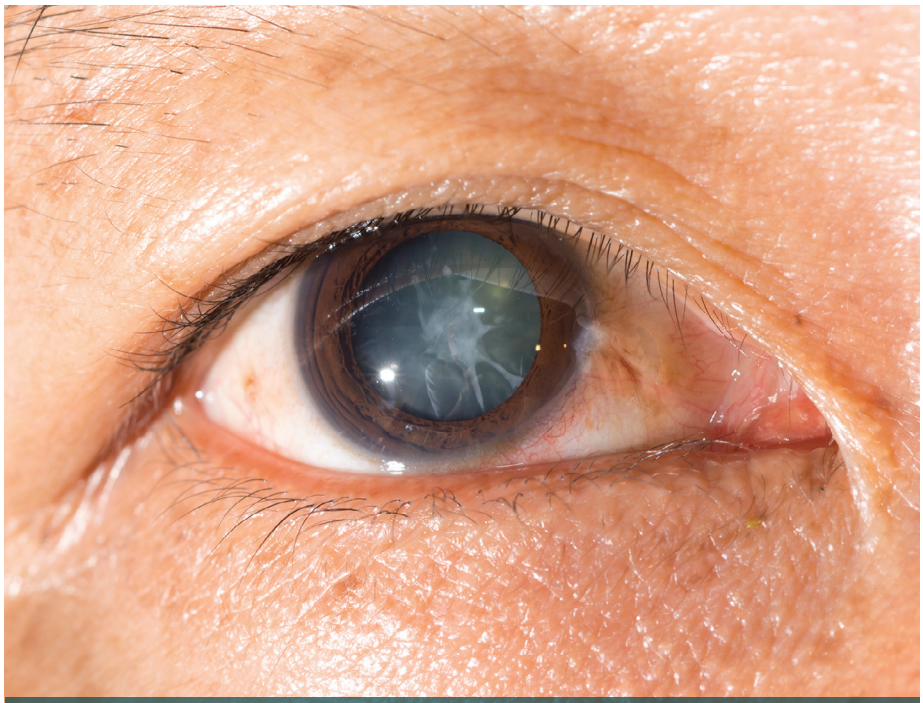

FIGURE 1. Cortical cataract

CLASSIFICATION OF CATARACTS

CONGENITAL CATARACTS

Cataracts are classified as either congenital or acquired. Congenital cataracts are a less common form of cataract compared to age-related cataracts. They are present at birth or develop within the first year of life[4,14]. The incidence of congenital cataract is approximately 3:10.000[4]. Two-thirds of cases are bilateral. Unilateral congenital cataracts are typically sporadic as they occur without the presence of systemic disease or family history. In around only 10 per cent of cases the cause can be ascertained[4,14].

In the case of bilateral congenital cataracts, autosomal dominant (AD) is the most common genetic mutation that gives rise to their formation[4,14]. Rubella infection, chromosomal anomalies such as Down syndrome and metabolic disorders such as galactosaemia are other causes linked with congenital cataracts forming. Aniridia can also be linked with the development of congenital cataract[4].

When treating congenital cataracts, an intraocular lens (IOL) is not implanted immediately. Regular check-ups are required to monitor visual acuity and if it is developing normally, no surgery is required. In cases where visual development is not progressing normally, surgical intervention is necessary. Congenital cataracts, when visually significant are operated on within the first six to eight weeks of life to prevent amblyopia[15].

ACQUIRED CATARACTS

Acquired cataracts can be sub-divided based on where and how they develop in the eye[4]. Nuclear sclerotic, cortical, subcapsular and Christmas tree cataracts are all age-related opacities. Nuclear sclerotic cataracts form in the middle of the lens, resulting in the nucleus taking on a distinguishing yellow appearance. This occurs due to the deposition of urochrome pigment. As it progresses, the colour deepens to a brown hue known as brunescence[4,12,13].

Brunescent cataracts are harder which is surgically relevant as they can be more challenging to treat resulting in longer surgical times[4,12,13]. As the refractive index of the nucleus increases, an increase in spherical aberrations occurs resulting in a myopic shift. This is commonly known as the second sight of the aged, as some elderly patients are able to read again without spectacles[4]. Nuclear sclerotic cataracts can be best observed with oblique slit lamp biomicroscopy[4].

Cortical cataract (**Figure 1**) can form on the anterior, posterior or equatorial cortex. In between the lens fibres, clefts and vacuoles begin to form, progressing to the characterised radial spoke-like opacities around the nucleus' perimeter. They usually begin in the infero-nasal quadrant. Due to the light scatter from cortical opacities, patients typically report glare as their most problematic symptom[4,12,13].

Subcapsular cataract can be either anterior or posterior. From fibrous metaplasia of the lens epithelium, an anterior subcapsular cataract forms directly under the lens capsule[4,11,13]. Posterior subcapsular opacities form in front of the posterior capsule (**Figure 2 - *next page***). They appear vacuolated or plaque like when viewed by oblique slit lamp biomicroscopy or black on observed by retroillumination[4].

Posterior subcapsular cataracts result in more notable visual effects than those reported by nuclear or cortical cataracts due to their location. Near vision tends to be more affected than distance vision[4,16]. In miotic conditions, such as in direct sunlight or from oncoming headlights, patients are most symptomatic. Posterior capsular opacities also develop faster than other types of cataracts[16].

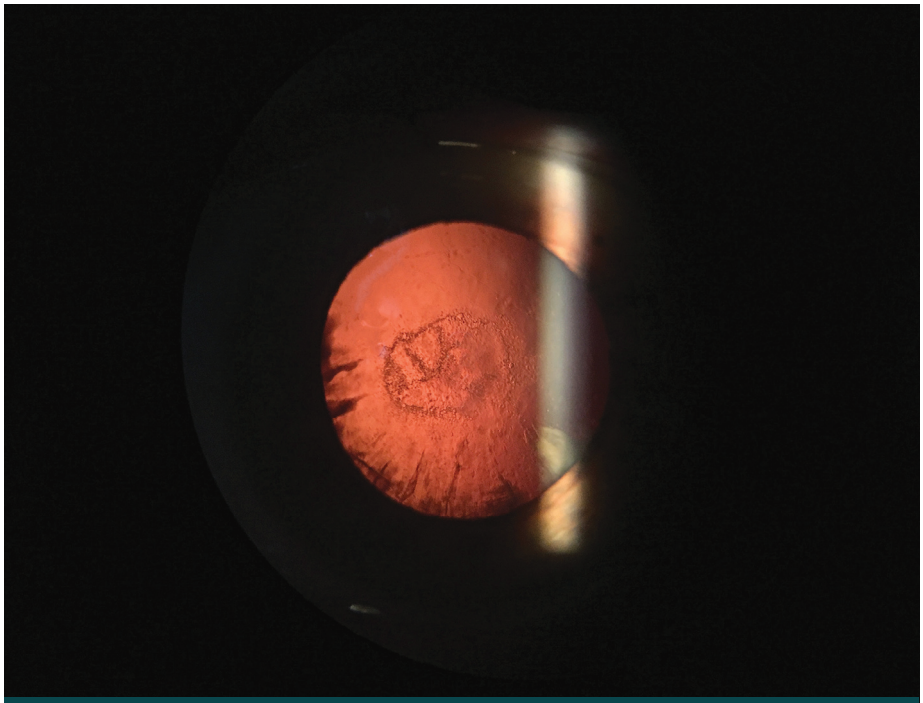

FIGURE 2: Posterior subcapsular cataract

The rarest form of cataract is the Christmas tree cataract. Classic presentation is needle-like deposits in the deep cortex and nucleus. They are non-uniform and multi-coloured. The opacities result from elevated calcium levels causing an accelerated breakdown of membrane-associated denatured proteins. Blurred vision, reduced night vision, glare and diplopia are the symptoms reported[10]. Myotonic dystrophy has been linked with Christmas tree cataract formation. In this case, it is classed as a secondary type cataract[4,11].

Secondary cataracts are caused by systemic or ocular disease and can result from certain types of medications, trauma or from surgery. Myotonic dystrophy, diabetes mellitus, hypertension, glaucoma, dermatitis and uveitis are commonly linked with the formation of secondary cataracts with chronic anterior uveitis being the primary cause[4].

The chance of developing a cataract increases with chronic anterior uveitis due to the duration of intraocular inflammation[17]. The prolonged use of steroids to treat this condition can typically accelerate a cataract's development[16,26]. In the nascent, at the posterior pole of the lens a multi-coloured opacity can be observed. If the inflammation can be stopped, this opacity may not progress but if it persists, posterior and anterior cataracts develop[16]. In the presence of posterior synechiae, cataract formation is more likely[4].

Steroid based medications can be associated with the formation of subcapsular cataracts. They firstly affect posteriorly and can mature to affect the anterior capsule[4,16]. Other medications related to the development of cataracts are chlorpromazine, busulphan and gold[4]. For chlorpromazine, which treats psychotic disorders, stellate lens opacities can develop on the anterior capsule[27].

Blunt trauma can result in lens opacification due to damage to the lens fibres. Posterior subcapsular opacities are most likely to form in a rosette or stellate shape. After trauma, a cataract can take years to form, and remain stable or progress to maturity. In cases where cataract surgery is required, good visual outcome is probable in circumstances without global rupture[4,24].

Cataracts can also be surgically induced. Most commonly after pars plana vitrectomy (PPV). Nuclear sclerotic cataracts occur in approximately 80 per cent of cases within two years of the operation[20,22,23]. Post localised, ocular radiation treatment, posterior sub-capsular cataracts can present[9].

Iridescent, cortical opacities present in the third decade of circa 90 per cent of people with myotonic dystrophy. It is not until the fifth decade that they progress to radial, posterior subcapsular cataracts that are visually impacting.

With regards to diabetes mellitus, in the presence of hyperglycaemia, a raised glucose level also occurs in the aqueous humour, which diffuses into the lens[4,12]. Snowflake cortical opacities are the typical presentation of a diabetic cataract. Age-related cataract occurs earlier in diabetics. Nuclear opacities are common and tend to progress rapidly. For the young diabetic, snowflake cortical cataracts can resolve naturally or mature rapidly depending on the control of their blood sugars. Cataract formation is four times more likely in individuals who have both diabetes and hypertension[18,19].

Approximately 10 per cent of patients with severe atopic dermatitis develop bilateral cataracts between their second and forth decades[4]. Typically, a dense, anterior subcapsular plaque can be seen which puckers the anterior capsule. Posterior subcapsular opacities may also form[20].

Nuclear sclerotic and posterior subcapsular cataracts can be linked with patients who have high myopia. This is due to the increased axial length and nutrients having further to travel through the vitreous to the crystalline lens. In the presence of nuclear sclerosis, a further increase in myopia occurs[25].

In individuals with hereditary retinal dystrophies, posterior subcapsular cataracts are associated; Stickler syndrome, retinitis pigmentosa, Leber congenital amaurosis and gyrate atrophy are some the dystrophies correlated with cataract formation[4].

HOW TO MANAGE CATARACTS AND WHEN TO REFER

When optical correction with spectacles or contact lenses no longer gives optimal visual correction, cataract surgery will be required. Optimal vision for each patient will vary depending on lifestyle and their everyday tasks. The level of visual acuity recorded in the testing room does not always reflect how it impacts upon the patient's day to day visual capabilities.

Within the referral letter; visual acuity, pupillary responses, ocular motility and ocular health should be recorded. Visual acuity is best measured using LogMAR and, if possible, measure contrast sensitivity as these give a better understanding of the quality of vision.

Normal contrast sensitivity for patients over 60 years of age range, from 1.52-1.76 log contrast sensitivity units. For individuals under 60 years of age, 1.72-1.92 log contrast sensitivity units is typical[28].

When contrast sensitivity is reduced, it can be enhanced through the use of yellow filter lenses and the patient may be advised on extra lighting to enhance the contrast. Disability glare is often a symptom reported by patients with cataracts, and brightness acuity testing gives a useful indication of how this is impacting the patient[4].

Pupillary responses should be noted as a pupillary anomaly such as an afferent pupillary defect implies ocular pathology, which may affect post-operative visual outcome. If performing a dilation prior to referral, note how well the pupils dilate as a poorly dilating pupil can increase the difficulty of performing cataract surgery such as in diabetic cases.

Assessing ocular motility, and noting if any strabismus is present, is important information to include on a referral letter as post-operatively, decompensation can occur subsequently causing diplopia as a result from the improvement in sight. The health of the ocular adnexa should be recorded as any anomalies can predispose to endopthalmitis. Such examples that may require pre-operative treatment are tear film deficiencies, blepharitis, conjunctivitis, dacryocystitis, ptosis, ectropion or entropion[4].

Depth of the anterior chamber is important to note as shallow depth can make cataract surgery more complex. Pseudoexfoliation can also cause complications during surgery as it can be evidence of a weak zonule[4]. Ocular pathology, such as macular degeneration, should be mentioned as this can impact upon the visual outcome post treatment.

Cataract surgery is typically carried out on one eye at a time in case a complication arises during surgery, and thus there is a second eye to rely on. The eye with the weaker vision will be operated on first. There are instances where bilateral phacoemulsification will be carried out. This can happen when a patient requires general anaesthetic to undergo treatment, and can be coincided with another treatment when under sedation. Bilateral cataract surgery may be carried out on the same day if the ophthalmologist deems the patient at a low risk of complications arising[29].

There are multiple referral pathways that the patient can opt for. Under the NHS, patients can be referred via their GP to their local hospital or via other healthcare providers such as NewMedica, SpaMedica or ACES. The latter accept NHS patients and have shorter waiting times. These health care clinics also carry out private treatments, which gives the patient more choice regarding the type of intraocular lens (IOL) implanted.

Under the NHS, single-focus IOLs are used but, privately, various options are discussed with the patient, from single vision, monovision to multifocal IOLs (**Figure 3**). Multifocal and accommodating IOLs can give a good level of vision but there are instances where patients will need optimal visual correction for their lifestyle and hence require glasses. These can be for either distance or near[30].

FIGURE 3: Multifocal intraocular lens

In the case of NHS treatments, if a patient has previously had monovision correction – either naturally occurring or through contact lens correction – the surgeon may implement this in the IOL calculation[29]. Typically, emmetropia is the aim for long distance and the patient will only require near vision glasses. This, however, is not always the outcome, especially in cases of high astigmatism.

Where each eye is being treated separately, the time gap between the second eye treatment will vary depending upon the outcome of the first eye – and if the patient wishes to undergo treatment for the second eye. Usually, a gap of eight to 12 weeks is given between treatments. This can vary depending upon waiting times. However, four to six weeks post-cataract treatment, a refraction and new spectacles can be dispensed[29].

After studying optometry at the Ulster University Coleraine, LISA FARRELL graduated in 2010. She then practised in various clinical settings from High Street independent practice, to hospital and domiciliary eye health care. In 2017, Lisa returned to study and completed her Masters in cataract and refractive surgeries. Currently, she works for the committees of CORU, Ireland's multi-profession health regulator, and as a locum optometrist between the UK and Ireland.

REFERENCES

References can be found when completing this CPD module. For a PDF of this article with references, email abdocpd@abdo.org.uk

LEARNING OUTCOMES FOR THIS CPD ARTICLE

DOMAIN: Communication

1.3, 1.7, 2.2: *Communicate effectively with patients who present with signs and or symptoms of cataract and enable them to understand their condition including referral pathways and treatment options.*

DOMAIN: Clinical Practice

5.3, 7.5: *Demonstrate an understanding of patient risk factors for cataract, how cataracts are classified and managed and patient options for referral and treatment.*

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