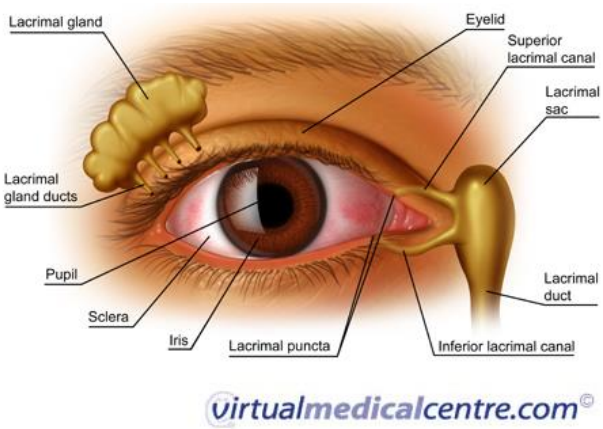
Cancer Association of South Africa
(CANSA)

Fact Sheet
on
Cancer of the Eye

Introduction

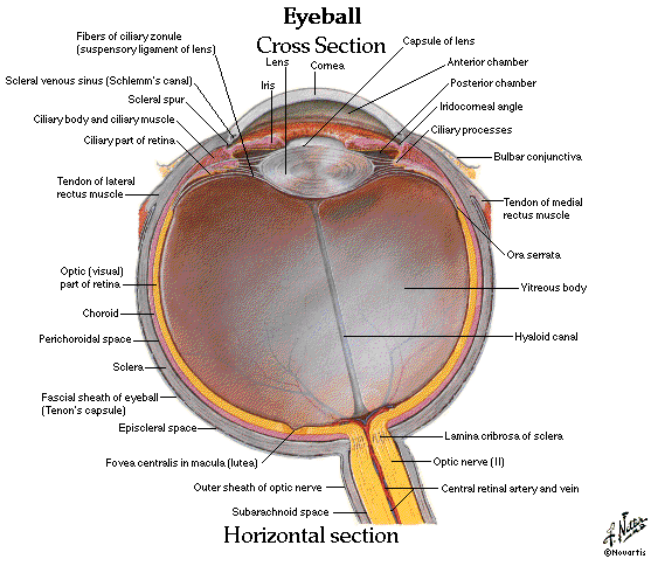
The human eye is an organ which reacts to light for several purposes. As a conscious sense organ, the mammalian eye allows vision. Rod and cone cells in the retina allow conscious light perception and vision including colour differentiation and the perception of depth. The human eye can distinguish about 10 million colours (Judd & Wyszecki).



[Picture Credit: Eye 1]

In common with the eyes of other mammals, the human eye's non-image-forming photosensitive ganglion cells in the retina receive the light signals which affect adjustment of the size of the pupil, regulation and suppression of the hormone melatonin and chronobiology of the body clock (Zimmer).

The eye is not shaped like a perfect sphere, rather it is a fused two-piece unit. The smaller frontal unit, more curved, called the cornea is linked to the larger unit called the sclera. The corneal segment is typically about 8 mm in radius. The sclerotic chamber constitutes the remaining five-sixths; its radius is typically about 12 mm. The cornea and sclera are connected by a ring called the limbus.



[Picture Credit: Eye 2]

The iris – the colour of the eye – and its black center, the pupil, are seen instead of the cornea due to the transparency of the cornea. To see inside the eye, an ophthalmoscope is needed, since light is not reflected out. The fundus (area opposite the pupil) shows the characteristic pale optic disk (papilla), where vessels entering the eye pass across and optic nerve fibers depart the globe (Wikipedia).

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Cancer of the Eye
An eye cancer is a cancer that starts in the eye. Different types of cancers can be found in the eye.

Primary intraocular cancers - are cancers that start inside the eyeball. In adults, melanoma is the most common primary intraocular cancer, followed by primary intraocular lymphoma. In children, retinoblastoma (a cancer arising from cells in the retina) is the most common primary intraocular cancer, and medulloepithelioma is the next most common (but is still extremely rare).

Secondary intraocular cancers - start somewhere else and then spread to the eye. These are not truly 'eye cancers', but they are actually more common than primary intraocular cancers. The most common cancers that spread to the eye are breast and lung cancers. Most often these cancers spread to the part of the eyeball called the uvea. The uvea consists of the middle layer of tissue surrounding the eye and is made up of the iris, ciliary body, and choroid.

Intraocular melanoma (melanoma of the eye) - Intraocular melanoma is the most common type of cancer that develops within the eyeball in adults, but it is still fairly rare. Melanomas of the skin are much more common than intraocular melanomas.

Melanomas develop from pigment-making cells called *melanocytes*. When melanoma develops in the eyeball, it is usually in the uvea, which is why these cancers are also called *uveal melanomas*. About 9 out of 10 intraocular melanomas develop in the choroid (which is part of the uvea). Choroid cells make the same kind of pigment as melanocytes in the skin, so it is not surprising that these cells sometimes form melanomas.

Nearly all of the remaining intraocular melanomas start in the iris (also part of the uvea). These are the easiest for the patient and doctor to see because they often start in a pigmented spot on the iris that has been present for many years and then begins to grow. These melanomas usually are fairly slow growing, and they rarely spread to other parts of the body. For these reasons, people with iris melanomas generally have a good prognosis (outlook).

Intraocular melanomas are generally made up of 2 different kinds of cells:
- spindle cells: these are long, thin cells
- epithelioid cells: these cells are almost round but with some straight edges

Most tumours are composed of both kinds of cells. The outlook is better if the tumours are mostly spindle cells as opposed to mostly epithelioid cells. Epithelioid tumours are more likely to metastasize (spread) to distant sites (such as the liver). If you have intraocular melanoma, your doctor can tell you which type of cells were found.

Primary intraocular lymphoma (lymphoma of the eye) - Lymphoma is a type of cancer that starts in immune system cells called lymphocytes. It usually starts in lymph nodes, which are bean-sized collections of immune system cells scattered throughout the body. Lymphomas can also start in internal organs such as the stomach, lungs, and rarely, in the eyes.

There are 2 main types of lymphoma: Hodgkin disease and non-Hodgkin lymphoma. Primary intraocular lymphoma is always a non-Hodgkin lymphoma. Most people with primary intraocular lymphoma are elderly or have immune system problems such as the acquired immunodeficiency syndrome (AIDS). Primary intraocular lymphoma is often seen along with lymphoma of the brain, known as *primary central nervous system (CNS) lymphoma*.

Rare cancers in children - There are 2 main types of cancers of the eyeball that develop in children. These are:

- retinoblastoma - a rare type of eye cancer that nearly always occurs in children under the age of 5
- medulloepithelioma - a very rare type of eye tumour found most often in young children. It does not usually spread. Treatment is surgery to remove the tumour. Occasionally, this will involve removing the eye

(American Cancer Society; Cancer Research UK; University of Iowa Clinics and Hospitals).

Cancer Affecting the Retina of the Eye

Cancers affecting the retina usually occur in the choroid, a dense layer of blood vessels that supplies the retina. The choroid is sandwiched between the retina and the sclera (the outer white layer of the eye). Because the retina depends on the choroid for its support and half of its blood supply, damage to the choroid by a cancer is likely to affect vision.

Choroidal melanoma: Choroidal melanoma is a cancer that originates from the pigment-producing cells (melanocytes) of the choroid. Choroidal melanoma is the most common cancer originating in the eye. It is most common among whites. It is less common among darker-skinned people. It occurs most frequently at age 55 to 60.

In its early stages, the cancer usually does not interfere with vision. Later, it may cause blurred vision or retinal detachment, with symptoms such as flashes of light, a veil or curtain across the visual field, or a sudden increase or change in floaters (objects that appear to move through a person's field of vision). Melanomas, particularly if large, may extend into the orbit or spread through the bloodstream (metastasize) to other parts of the body and may be fatal.

Early diagnosis is important because smaller tumours are easier to cure. The diagnosis is made using an ophthalmoscope and doing tests, which may include ultrasonography, fluorescein angiography and serial photographs.

If the melanoma is small, treatment with a laser, radiation, or an implant of radioactive materials may preserve vision and save the eye. If the cancer is large, the eye may have to be removed.

Choroidal metastases: Choroidal metastases are cancers that have spread to the choroid from other parts of the body. Because of its rich blood supply, the choroid is often a place to which cancers from other parts of the body may spread. In women, breast cancer is the most common cause. In men, cancers of the lung and prostate are the most common causes.

Often, these cancers cause no symptoms until they are advanced. Symptoms, when they develop, are often loss of vision or symptoms of retinal detachment. Vision loss may be severe.

Treatment is usually with chemotherapy, radiation therapy, or both (Merck Manual).

Choroidal Melanoma

Choroidal melanoma is a cancer that affects part of the eye. It develops in the choroid, the sponge-like membrane at the back of the eye between the sclera (the white of the eye) and

the retina. (The retina is the light-sensitive structure at the back of the eye. It sends visual information to the brain.) The choroid is rich in blood vessels and supplies nutrients to the retina.

Over time, many choroidal melanomas enlarge and cause the retina to detach. This can lead to vision loss. The tumours also can spread (metastasize) to other parts of the body. The liver is the most common site for metastasis. If it spreads, this cancer can be fatal.

Although choroidal melanoma is rare, it is the most common eye cancer in adults. It usually occurs in people who are middle-aged or older.

Melanomas usually occur in the skin. But they can also develop in places where certain cells contain the pigment melanin. The choroid is one such example (Intelihealth.Com).

Eye Melanoma

Melanoma is a type of cancer that develops in the cells that produce melanin — the pigment that gives the skin its colour. The eyes also have melanin-producing cells and can develop melanoma. Eye melanoma is also called ocular melanoma.

Most eye melanomas form in the part of the eye one cannot see when looking in a mirror. This makes eye melanoma difficult to detect. In addition, eye melanoma typically does not cause early signs or symptoms.

Treatment is available for eye melanomas. Treatments for some small eye melanomas may not interfere with vision. However, treatment for large eye melanomas typically causes some vision loss. Eye melanoma may not cause signs and symptoms. When they do occur, signs and symptoms of eye melanoma can include:

- a growing dark spot on the iris
- a sensation of flashing lights
- a change in the shape of the dark circle (pupil) at the centre of your eye
- poor or blurry vision in one eye
- loss of peripheral vision
- sensation of flashes and specs of dust in your vision (floaters)

(Mayo Clinic).

Lacrimal Gland Tumour

The lacrimal glands are the glands that secrete tears and are located above and to the side of the eye. When lacrimal gland cells become abnormal and multiply, they form a growth of tissue called a tumour. A lacrimal gland tumour can be benign (noncancerous) or malignant (cancerous, meaning it can spread to other parts of the body). There are four major types of lacrimal gland tumours:

Benign mixed epithelial tumour - A benign mixed epithelial tumour is a noncancerous tumour that does not spread to other parts of the body but will continue to grow if not treated. This type of tumour begins in the cells that line the lacrimal gland.

Malignant mixed epithelial tumour - A malignant mixed epithelial tumour also begins in the cells that line the lacrimal gland. If it is not treated, it will spread to other parts of the body.

Lymphoma - Lymphoma can involve various structures of the eye, however, the conjunctiva (the mucous membrane lining the inner surfaces of the eyelids and the outer surface of the white of the eye) and lacrimal glands are the most common. Most ocular (eye-related) lymphoma is non-Hodgkin lymphoma, and may be associated with systemic (whole body) or central nervous system (brain and spinal cord) lymphoma.

Adenoid cystic carcinoma (AdCC) of the lacrimal gland - AdCC is a rare form of adenocarcinoma, which is a broad term covering any cancer arising from glandular tissues. An AdCC tumour is characterized by a distinctive pattern, in which bundles of epithelial cells surround and/or infiltrate ducts or glandular structures within the organ. When an AdCC tumour of the lacrimal gland grows, it commonly pushes the eye forward and causes it to bulge, a condition called proptosis. Another characteristic is pain, due to local nerves being invaded by the tumour (Cancer.Net).

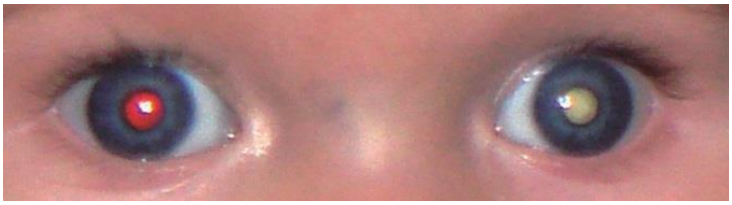
Retinoblastoma in Children

Retinoblastoma is a rare type of eye cancer which mainly affects children under 5 years of age. Around 98% of children are successfully treated.

The signs of retinoblastoma, such as a white reflection in the eye or white pupil, or a squint, as described below, can also be caused by other less severe conditions and can sometimes be a complete false alarm and not be anything at all. Although this may be the case it is always best to have a child's eyes checked just to rule out any serious illness.

The most important thing to do if you see any of the symptoms is to get the child's eyes examined quickly.

<u>The signs to look out for</u>



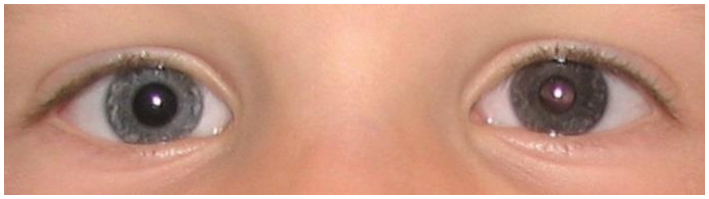
A white reflex: A white eye, white pupil or white reflection can be seen in a photograph where the flash has been used. Often one eye will have "red eye" which is normal but the other eye may look white, yellow or orange. This may be seen in just one or many photographs of the child. A white 'reflex' or white eye/pupil may also be seen when the child is in artificial light or a darkish room. Some parents say that it looks like a cat's eye caught in light or that they think they can see the back of their child's eye, other parents say it looks like jelly. This white reflex may only be seen every so often but in some cases it is present all the time.

An absence of ‘red eye’ in flash photographs: In a photograph where one eye has ‘red eye’ (which is normal) the other eye may look black or looks ‘wrong’. This can also be a sign that something is not right.

A squint: A squint can be a sign of retinoblastoma, although a squint can also be nothing more than a squint. It is always worth having it checked out quickly just to make sure. Some people call a squint a "lazy eye"; it is where one or both eyes look in or out.

Red, sore or swollen eye without infection: A child's eye may become very red and inflamed for no reason. This sign is usually linked with other signs.

A change in colour to the iris: The iris, the coloured part of the eye, can sometimes change colour in one eye, sometimes only in one area.



Deterioration in vision: A child may have deterioration in their vision or they may have had poor vision from birth. You may notice that your child does not focus or fix & follow as well as other children or babies of the same age.

If one or more of the above signs are noticed ***always*** take the child to have his/her eyes examined.
(Retinoblastoma Childhood Eye Cancer Trust – including picture credits).

Medulloepithelioma in Children

Medulloepithelioma is uncommon. Its precise incidence is also unknown. Based on relative prevalence data from multiple clinical and pathological case series, however, its incidence can be estimated at approximately one thirtieth to one fiftieth that of retinoblastoma. This would correspond to a cumulative lifetime incidence of approximately 1 case per 450 000 to 1 000 000 persons.

Intraocular medulloepithelioma is usually a congenital or infantile tumor, although juvenile- and even adult-onset cases have been reported. The average age of the affected individual at diagnosis is about 5 years in most series. Medulloepithelioma affects all ethnic groups and both sexes equally. It does not appear to be transmitted genetically. No known risk factors exist for this tumour.

<u>Ocular Manifestations</u>

The usual presenting symptoms of medulloepithelioma are a red eye, change in colour of the iris, visible mass in the iris, and (in adults and some older children) visual impairment. Medulloepithelioma of the ciliary body typically appears as a tan to white lesion of the extreme peripheral fundus. Because of its peripheral location, the tumour may be detectable only by binocular indirect ophthalmoscopy under anesthesia. A tumour of this type frequently appears intrinsically cystic or has prominent neuroepithelial cysts on its surface. In

occasional patients, localised absence of the zonule and resultant abnormalities of lens curvature (lens coloboma), lens subluxation, and cataract have been observed.
(Free Medical Textbook).

Incidence of Cancer of the Eye in South Africa
According to the National Cancer Registry (2008) the following number of eye cancer cases were histologically diagnosed in South Africa during 2008:

Group - Males 2008	No of Cases 2008	Lifetime Risk 2008
All males	271	1:983
Asian males	1	-
Black males	238	1:839
Coloured males	8	1:5 136
White males	25	1:1 215

Group - Females 2008	No of Cases 2008	Lifetime Risk 2008
All females	433	1:763
Asian females	3	-
Black females	405	1:617
Coloured females	13	1:2 824
White females	11	1:4 525

The frequency of histologically diagnosed cases of cancer of the eye in South Africa for 2008 were as follows (National Cancer Registry, 2008):

Group - Males 2008	0 – 19 Years 2008	20 – 29 Years 2008	30 – 39 Years 2008	40 – 49 Years 2008	50 – 59 Years 2008	60 – 69 Years 2008	70 – 79 Years 2008	80+ Years 2008
All males	24	20	91	73	26	17	2	5
Asian males	0	0	1	0	0	0	0	0
Black males	18	18	71	65	21	9	1	4
Coloured males	1	2	3	0	0	0	1	0
White males	3	0	6	5	1	7	0	1

Group - Females 2008	0 – 19 Years 2008	20 – 29 Years 2008	30 – 39 Years 2008	40 – 49 Years 2008	50 – 59 Years 2008	60 – 69 Years 2008	70 – 79 Years 2008	80+ Years 2008
All females	37	61	180	96	18	10	8	4
Asian females	0	0	0	0	1	1	1	0
Black females	27	54	153	89	14	9	6	2
Coloured females	5	1	4	2	0	0	0	0
White females	0	1	5	1	0	0	1	2

N.B. In the event that the totals in any of the above tables do not tally, this may be the result of uncertainties as to the age, race or sex of the individual. The totals for 'all males' and 'all females', however, always reflect the correct totals.

Risk Factors for Cancer of the Eye
The following risk factors were identified:

<u>Risk factors for primary intraocular melanoma</u>

Race/ethnicity - the risk of intraocular melanoma is much higher in whites than in African Americans or Asian Americans

Eye colour - People with light coloured eyes have an increased risk of intraocular melanoma. People with blue eyes are somewhat more likely to develop melanoma of the eye than are people with brown eyes

Certain inherited conditions – The following inherited conditions are of importance:

- *dysplastic nevus syndrome:* in which people have abnormal moles of the skin and an increased risk of skin melanoma, may also increase the risk for developing melanoma of the eye

- people with abnormal brown spots on the uvea (known as *oculodermal melanocytosis* or *nevus of Ota*) also have an increased risk of developing eye melanoma
- eye melanomas can run in some families who do not have these conditions, but this is very rare

Sun exposure - Although too much exposure to sunlight (or sunlamps) has been proposed as a possible risk factor for melanoma of the eye, it has never been proven

Certain occupations - Some studies have suggested that welders, farmers, fishermen, chemical workers, and laundry workers may have a higher risk of eye melanoma, but none of these links has been proven conclusively

Risk factors for primary intraocular lymphoma

The only known risk factor for primary lymphoma of the eye is having a weakened immune system. Examples include patients with the acquired immunodeficiency syndrome (AIDS) as well as people who take anti-rejection drugs after organ or tissue transplants.
(Medline Plus).

Signs and Symptoms of Eye Cancer

Many patients with eye melanoma don't have symptoms unless the cancer grows in certain parts of the eye or becomes more advanced. Signs and symptoms of eye melanomas can include:

- problems with vision (blurry vision or sudden loss of vision)
- floaters (spots or squiggles drifting in the field of vision) or flashes of light
- visual field loss (losing part of your field of sight)
- a growing dark spot on the iris
- change in the size or shape of the pupil
- change in position of the eyeball within its socket
- bulging of the eye
- change in the way the eye moves within the socket
- pain is rare except in cases of massive spread outside the eye. In such cases, bulging or a change in the position of the eye may also be noted

Other, less serious conditions can also cause many of these symptoms. For example, floaters may occur as a normal part of the aging process. Still, if any of these symptoms are experienced, it is important to see a doctor right away so the cause can be found and treated, if needed.
(American Cancer Society).

Diagnosis of Eye Cancer
Leading-edge diagnostic tools and methods for diagnosing eye cancer include:

- sentinel lymph node biopsy to detect early microscopic metastasis
- ultrasound biomicroscopy to diagnose intraocular tumors
- confocal biomicroscopy
- optical coherence tomography (OCT) for more accurate diagnosis of conjunctival cancers

Other Eye Cancer Diagnostic Tests
In addition to damaging vision, eye tumours can spread to the optic nerve, the brain and the rest of the body. Therefore, early diagnosis and treatment are extremely important. Melanoma tends to spread via blood vessels to distant organs.

Usually an examination by an ophthalmologist or other eye care provider can diagnose ocular cancer. Tests may include:

- dilated retinal exam to help diagnose intraocular tumours
- ultrasound of the eye for intraocular tumours
- careful inspection of the outside of the eye and eye movements for orbital, eyelid and conjunctival tumours
- imaging tests, such as:
    - CT or CAT (computed axial tomography) scans
    - MRI (magnetic resonance imaging) scans
    - surgical biopsy to confirm cancers of the orbit, eyelid or conjunctiva

(MD Anderson Cancer Center; Johns Hopkins Medicine).

Examination of the Eye
Examination of the eye by an ophthalmologist (a medical doctor specialising in diseases of the eye) is often the most important step in diagnosing melanoma of the eye. The doctor will ask about any symptoms and check vision and eye movement. The doctor will also look for enlarged blood vessels on the outside of the eye, which can be a sign of a tumour inside the eye.

The ophthalmologist may also use special instruments to get a good look inside the eye for a tumour or other abnormality. Drops may be put in the eye to dilate the pupil before the doctor uses these instruments.

- An ophthalmoscope (also known as a *direct ophthalmoscope*) is a hand-held instrument consisting of a light and a small magnifying lens.

- An indirect ophthalmoscope and a slit lamp is more like a large microscope. For this exam, the patient sits down and rests his/her chin on a small platform, while the

doctor looks into his/her eye through magnified lenses. This examination can often provide a more detailed view of the inside of the eye than the direct ophthalmoscope.

- A gonioscopy lens is a specially mirrored lens that is placed on the cornea (after it is numbed). This lets the doctor see the deep structures in the angle of the front of the eye near the iris. It can provide information on tumour growth into areas of the eye that would otherwise be hard to see.

Most of the time, an eye examination alone can make the diagnosis. In some cases, imaging tests such as ultrasound may be required to confirm the diagnosis. Very rarely a biopsy will also be needed.

Many people have a benign tumour in the eye called a *choroidal nevus*, which can sometimes be mistaken for an eye melanoma. A small number of these will eventually turn into melanomas. If the ophthalmologist spots one of these, he or she will likely advise regular eye exams to see if it grows.

If symptoms and/or the results of the eye exam suggest eye cancer, more involved tests will likely be done. These might include imaging tests or other procedures.

Ultrasound scan - an ultrasound of the eye is usually done. A local anaesthetic will be put on to the surface of the eye. Then the doctor will move a small probe over the eye's surface to help find out more about the tumour, including its size. This might be a little uncomfortable, but should not be painful.

Angiogram - The doctor may take pictures of a suspected cancer with a special camera. This test is called a fluorescein angiogram. This means looking at blood vessels using a type of dye. The patient is given an injection of dye (called fluorescein) into the arm. The dye travels through the bloodstream to the blood vessels of the eye. The camera shows up the dye on photographs, which helps the doctor to find out more about the nature of any possible tumour.

Testing genetic information in the cells - If there is an ocular melanoma the surgeon may ask a pathologist to examine the biopsy sample or tumour for abnormalities of the chromosomes in the tumour cells. This is known as cytogenetic testing and it may help to show the stage of the melanoma.

Other tests – A patient may have blood tests to check his/her general health and see how well their liver and kidneys are working. Melanoma of the eye can spread to the liver so an ultrasound scan of the liver is quite likely to check for any spread of the cancer.
(American Cancer Society; Cancer Research UK).

Grading of Eye Cancer

Staging is a way of describing where the cancer is located, if or where it has spread, and whether it is affecting the functions of other organs in the body. Doctors use diagnostic tests to determine the cancer's stage, so staging may not be complete until all the tests are finished. Knowing the stage helps the doctor to decide what kind of treatment is best and can help predict a patient's prognosis. There are different stage descriptions for different types of cancer.

One tool that doctors use to describe the stage is the TNM system. This system judges three factors: the tumour itself, the lymph nodes around the tumour, and if the tumour has spread to other parts of the body. The results are combined to determine the stage of cancer for each person. The stage provides a common way of describing the cancer, so doctors can work together to plan the best treatments.

In addition to staging, doctors may use other information to help figure out prognosis and the risk of the cancer spreading. These findings may also be included on the pathology report and include:

- alterations to the cancer cell's chromosomes (as described in Diagnosis); for example, one copy of chromosome three, called monosomy 3, can indicate a higher risk of the cancer spreading
- gene expression profiles (as described in Diagnosis); these tests classify a tumour into class I (at lower risk for metastasis) and class II (at higher risk for metastasis)
- other characteristics of the cancer cells, such as the grade (see below for more details)

TNM is an abbreviation for tumour (**T**), node (**N**), and metastasis (**M**). Doctors look at these three factors to determine the stage of cancer:

- how large is the primary tumour, and where is it located? **(T, tumour)**
- has the tumour spread to the lymph nodes? **(N, node)**
- has the cancer spread to other parts of the body? **(M, metastasis)**

Some ophthalmologists may not use the TNM system to stage an intraocular tumour. However, they still consider the size of the tumour and how it is affecting a person's vision when deciding on a treatment plan.

Specific information about the TNM system is listed below. In eye cancer, T for an iris melanoma is described differently than T for choroidal and ciliary body melanomas. N and M are described the same for iris, choroidal, and ciliary body melanomas.

Tumour. Using the TNM system, the 'T' plus a letter and/or number (0 to 4) is used to describe the size and location of the tumour. Some stages are also divided into smaller groups that help describe the tumour in even more detail. The following classifications are the same for any type of intraocular melanoma:

TX: the primary tumour cannot be evaluated
T0: there is no tumour in the eye

Iris melanoma

An iris tumour is classified as T1, T2, T3, or T4. Some stages are divided into smaller groups that help describe the tumour in even more detail.

T1: the tumour is limited to the iris
T1a: the tumour is in one quadrant (one-fourth) or less of the iris
T1b: the tumour is in more than one quadrant of the iris
T1c: the tumour is only in the iris, but there is melanomalytic glaucoma. This means that a build-up of certain cells in the eye blocks the flow of fluid in the eye, causing pressure

T2: the tumour has joined or grown into the ciliary body and/or choroid
T2a: the tumour has joined or grown into the ciliary body and/or choroid with melanomalytic glaucoma
T3: the tumour has joined or grown into the ciliary body and/or choroid and extends to the sclera (outer wall of the eyeball)
T3a: the tumour has joined or grown into the ciliary body and/or choroid and extends to the sclera in association with melanomalytic glaucoma
T4: the tumour has spread to the outside of the eyeball, the optic nerve, or to the eye socket. This is called extraocular extension
T4a: the tumour has spread is less than 5 millimeters (mm) outside of the eye
T4b: the tumour has spread more than 5 mm outside of the eye

Ciliary body and choroid melanoma

A tumour in the ciliary body and choroid is also classified as T1, T2, T3, or T4 based on the size of the tumour, which is measured in optic disc diameters or millimeters (mm). The tumour is measured for both width and height (also called thickness). A tumour is given a classification according to the table below, based on its width and height.

Doctors may use and refer to this classification, called a category, even more than the stage. This is because the size and thickness of the tumour (the T) is most important for finding out a patient's prognosis.

Size Category Classification Table for Ciliary Body and Choroid Melanoma

Thickness (mm)	**Category**						
Thicker than 15 mm					4	4	4
12.1 to 15.0				3	3	4	4
9.1 to 12.0		3	3	3	3	3	4
6.1 to 9.0	2	2	2	2	3	3	4
3.1 to 6.0	1	1	1	2	2	3	4
Less than 3.0	1	1	1	1	2	2	4
Largest basal diameter (mm)	Less than 3.0 mm	3.1 to 6.0 mm	6.1 to 9.0 mm	9.1 to 12.0 mm	12.1 to 15.0 mm	15.1 to 18.0 mm	Larger than 18.0 mm

Used with permission of the American Joint Committee on Cancer (AJCC), Chicago, Illinois.

T1: the tumour is size category 1
T1a: the tumour is size category 1 and does not involve the ciliary body or other parts of the eye
T1b: the tumour is a category 1 and involves the ciliary body
T1c: the tumour is size category 1 that does not involve the ciliary body. But, there is a very small area (5 mm or less in diameter) of visible spread beyond the eyeball (called extraocular spread)
T1d: the tumour is a size category 1 that involves the ciliary body with extraocular spread less than 5 mm
T2: the tumour is size category 2
T2a: the tumour is size category 2 and does not involve the ciliary body or other parts of the eye
T2b: the tumour is size category 2 and involves the ciliary body
T2c: the tumour is size category 2 that does not involve the ciliary body. But, there is a very small area (5 mm or less in diameter) of visible spread beyond the eyeball

T2d: the tumour is size category 2 that involves the ciliary body with extraocular spread less than 5 mm
T3: the tumour is size category 3
T3a: the tumour is size category 3 and does not involve the ciliary body or other parts of the eye
T3b: the tumour is size category 3 and involves the ciliary body
T3c: The tumour is size category 3 that does not involve the ciliary body. But, there is a very small area (5 mm or less in diameter) of visible spread beyond the eyeball
T3d: the tumour is size category 3 that involves the ciliary body with extraocular spread less than 5 mm
T4: the tumour is size category 4
T4a: the tumour is size category 4 and does not involve the ciliary body or other parts of the eye
T4b: the tumour is size category 4 and involves the ciliary body
T4c: the tumour is size category 4 that does not involve the ciliary body. But, there is a very small area (5 mm or less in diameter) of visible spread beyond the eyeball
T4d: the tumour is size category 4 that involves the ciliary body with extraocular spread less than 5 mm
T4e: the tumour is any size category with extraocular spread of more than 5 mm in diameter

Node. The 'N' in the TNM staging system stands for lymph nodes, the tiny, bean-shaped organs that help fight infection. Lymph nodes near the eye are called regional lymph nodes. Lymph nodes in other parts of the body are called distant lymph nodes. N is described the same for melanomas of the iris, ciliary body, and choroid.

NX: the regional lymph nodes cannot be evaluated.
N0 (N plus zero): there is no regional lymph node metastasis.
N1: there is regional lymph node metastasis.

Distant metastasis. The "M" in the TNM system indicates whether the cancer has spread from the eye to other parts of the body. M is described the same for iris, ciliary body, and choroidal melanomas.

MX: distant metastasis cannot be evaluated

M0 (M plus zero): there is no distant metastasis

M1: there is metastasis to other parts of the body

M1a: there is metastasis to other parts of the body and the largest metastasis is 3 centimetres (cm) or less in diameter

M1b: there is metastasis to other parts of the body and the largest metastasis is between 3.1 cm and 8 cm in diameter

M1c: there is metastasis to other parts of the body and the largest metastasis is larger than 8 cm in diameter

Cancer Stage Grouping
Doctors assign the stage of the cancer by combining the T, N, and M classifications.

Stage I: the tumour is size category 1 and does not involve the ciliary body or other parts of the eye, nor has it spread to the regional lymph nodes or to other areas of the body (T1a, N0, M0)

Stage IIA: the tumour is either a size category 1 that may or may not involve the ciliary body, with or without extraocular extension, or it is a size category 2 that does not involve the ciliary body. There is no spread to the regional lymph nodes or to other areas of the body (T1b, T1c, T1d, or T2a; N0, M0)

Stage IIB: the tumour is either a size category 2 that involves the ciliary body but has not spread beyond the eyeball, or it is a size category 3 that has not spread to the ciliary body or eyeball. It has not spread to the regional lymph nodes or to other areas of the body (T2b or T3a; N0, M0)

Stage IIIA: stage IIIA describes any one of these conditions:

- a tumour of size category 2 with extraocular spread to a diameter of 5 mm or less, with or without ciliary body involvement that has not spread to the lymph nodes or to other parts of the body (T2c or T2d, N0, M0)
- a tumour of size category 3 that may or may not involve the ciliary body, with or without extraocular spread to a diameter of 5 mm or less, but hasn't spread to the lymph nodes or to other parts of the body (T3b or T3c, N0, M0)
- a tumour of size category 4 that does not involve the ciliary body and has not spread to the lymph nodes or to other parts of the body (T4a, N0. M0)

Stage IIIB: stage IIIB describes any one of these conditions:

- the tumour is a size category 3 with ciliary body involvement and extraocular spread that has not spread to the lymph nodes or to other parts of the body (T3d, N0, M0).
- the tumour is a size category 4 with or without ciliary body involvement that may or may have spread outside the eyeball. It has not spread to the regional lymph nodes or to other areas of the body (T4b or T4c, N0, M0).

Stage IIIC: the tumour is a size category 4 that involves the ciliary body and has spread outside the eyeball. However, it has not spread to the regional lymph nodes or to other areas of the body (T4d or T4e; N0, M0).

IV: this stage describes a tumour of any size that has spread to the lymph nodes and/or to other parts of the body outside of the eye (any T, N1, M0; or, any T, any N, M1).

Recurrent Cancer of the Eye
Recurrent cancer is cancer that has come back after treatment. It may return in the eye or in another part of the body. If there is a recurrence, the cancer may need to be staged again (called re-staging) using the system above.
(Cancer.Net).

Treatment of Eye Cancer

Most people with eye cancers are referred to a specialist centre for their treatment. These centres provide a range of treatments and offer the one most suitable. For some types of eye cancer there may be only one treatment that is suitable. There may be several that are possible to have. The eye surgeon will explain treatment choices in detail. They will talk through the potential benefits and complications of each before a final decision is made. It may help to get a second opinion from another eye cancer specialist.

Treatment for melanoma of the eyeball

Treatment for eye melanoma is surgery or radiotherapy or both.
Whether a patient has surgery or radiotherapy depends on:

- where the tumour is
- the size of the tumour and
- how much it is affecting sight

If the tumour is already preventing the patient from seeing out of the eye, he/she will probably have surgery to remove the eye. This operation is called an enucleation. But if the patient can still see with that eye, the doctor may try to keep the sight and decide to:

- remove just the tumour
  or
- give radiotherapy

Treatment for iris melanoma

This type of cancer can be so slow growing that one does not need treatment, especially if there are no symptoms. The doctor will give request such a patient to report for regular check-ups to make sure the cancer is not getting bigger. If the tumour is growing, or if it is causing symptoms, the patient will normally have one of the following operations to:

- removal of the iris (iridectomy)
- removal of the iris and the tissues around the clear layer covering the front of the eye (the cornea) – this operation is called an iridotrabeculectomy
- removal of the iris and the ciliary body (the muscle that focuses the eye) – this operation is called a iridocyclectomy
- removal of the whole eye (enucleation)
- for some iris melanomas the doctor may suggest radiotherapy

Treatment for choroid or ciliary body melanoma

If melanoma of the choroid or ciliary body is not getting bigger the patient may not need treatment straight away. The patient will be requested to report for regular check-ups to make sure the tumour has not started to grow.

If the patient does need treatment, for small melanomas he/she may have one of the following:

- radiotherapy
- surgery to remove just the tumour
- surgery to remove the whole eye (enucleation)

- for medium sized melanomas you may have one of the above treatments or radiotherapy, followed by surgery to remove the eye
- surgery or radiotherapy are the treatments for large melanomas. If you need surgery, this will usually mean removing the eye (enucleation).

Treatment for melanomas that have spread outside the eye

If the tumour has spread outside the eye, to the optic nerve or the eye socket, it is called an extraocular melanoma. The doctor may refer to this as 'extraocular extension'. It is a more advanced stage and the patient will probably need surgery to remove the eye. This operation is called enucleation. The patient may need further surgery to the eye socket to make sure all the cancer is gone. The patient may have radiotherapy as well.

Treatment for recurrent eye melanoma

If the cancer has come back in the eyeball (intraocular) the patient will most likely have surgery to remove the eye (enucleation). The patient may also have radiotherapy after surgery to kill off any cancer cells left behind.

If the cancer has come back outside the eyeball (extraocular melanoma) the patient may have chemotherapy or biological therapy or both. Clinical trials are looking at how helpful biological therapy may be in treating melanoma of the eye.

Treatment for lymphoma of the eye

Doctors call lymphoma of the eye intraocular lymphoma. They treat intraocular lymphoma in a similar way as other types of non-Hodgkin's lymphoma. The patient may have radiotherapy, chemotherapy or both. For some types of non-Hodgkin's lymphoma biological therapy may be used. The patient is not likely to have surgery to treat intraocular lymphoma.

Radiotherapy to treat intraocular lymphoma

To treat lymphoma of the eye the doctor may suggest the patient has external radiotherapy to the eye and brain. This can get rid of the cancer in the eye and also helps to stop it coming back in the brain or spinal cord.

Chemotherapy to treat intraocular lymphoma

Most people with lymphoma of the eye will have chemotherapy. The patient may have chemotherapy injected into the fluid around the spinal cord (intrathecal chemotherapy). The patient might have this treatment along with radiotherapy.
(Cancer Research UK).

Prognosis (Outlook)

An important thing to remember for those diagnosed with eye cancer is that every cancer case, no matter how common or rare it may be, is unique. While the tumour of one person may progress very slowly, providing plenty of time to treat the disease, the tumour of another may grow at a much faster- and far more deadly- rate. What it comes down to, essentially, is the makeup of each individual body, and that body's ability to respond to cancer treatments.

An eye cancer prognosis is generally referred to as the outlook or outcome of eye cancer. An eye cancer prognosis usually takes into account factors, such as the exact type of cancer, how long the cancer has been present, which parts of the eye are affected, the possibility that complications are likely to occur during the treatment period, and the typical rate of recovery, survival rate, and death rate.

As a basic rule, the survival rate of any cancer is far better when the cancer is found and treated in its earliest stages. While many cancers will often have a specific survival rate attached to the different stages of the cancer, the survival rate for eye cancer is predominantly based on an overall history of success, since eye cancers are so rare to begin with. For intraocular melanoma, the most common of eye cancers, the survival rate is currently set at five years. This number is based on cancers which are confined to the eye, and also on the percentage of patients who live at least five years after been diagnosed (studies show that about 84% survive at least 5 years after diagnosed, specifically).

For melanomas which are more advanced and have spread extensively to other parts of the body, however, the 5-year survival rate can drop down anywhere from 15% to 45%, depending on the stage of the cancer. For intraocular lymphoma, which is even more rare, certain studies have shown that if lymphoma is confined to the eye and does not spread, roughly 50% of patients survive five years, or more, after being diagnosed. If the lymphoma has spread, especially to the brain, the survival rate is far lower.

A survival rate should not, by any means, turn an eye cancer prognosis in a death-sentence, though. Again, the information which supplies doctors with a survival rate is often reflective of broad, older studies, and especially if a cancer is very rare, as with eye cancer, the number may not necessarily be all that accurate in relation to a new eye cancer patient's outlook.

Other factors, such as the exact type of cancer cells which are present, also effect a cancer prognosis. Tumour cells which are long and thin are often less serious and have a better overall cancer prognosis than rounder cells, for instance. Age and overall health, as with many diseases, will also affect the successful treatment of a cancer.
(Disease.Com).

Life Changes Following a Diagnosis of Eye Cancer
The following are some of the life changes that can be expected:

- Changes in your sight after eye cancer - Eye cancers do not always cause problems with your sight. It will depend on the type of eye cancer you have. The more advanced the cancer, the more likely it is to affect your sight. Problems can range from very minor changes in your vision to complete loss of sight in one eye.

- Coping practically with sight changes - Sight changes can affect reading, driving, work, and how one gets around. If one has had an eyeball removed (enucleation) the main thing one will notice is that it is a lot harder to judge the distance between
- objects. One eventually gets used to this and adjust. It is also noticed that one cannot see so well to one side without turning one’s head.

- Changes in your appearance after eye cancer - Surgery that involves the eye may change the way one looks. Modern surgical techniques and reconstructive surgery means that one is less likely to have much scarring, even with very big operations.

With time, many scars will fade and be far less visible. So even though one may be aware of them, others may not notice.

- Using an artificial eye - If one has had an eye removed this means adjusting to having an artificial eye. Even if other people don't notice it, the person him/herself will still be aware of looking different. The change in appearance can be hard to get used to.

- How surgery may affect one's self-esteem - It can be difficult to accept sudden changes to one's looks. It is not unusual for people who have had surgery to their face to feel very angry, confused and upset for some time afterwards.

- Changes in your sex life with eye cancer - Any changes in one's appearance and sight may make one feel less confident about sex. If one has had an eye removed and have an artificial eye one may worry about how this looks to one's partner. If surgery has affected other parts of one's face and one is not happy with how he/she looks, further surgery may be of help to correct this.

(Cancer Research UK).

Clinical Trials

Clinical trials are research studies that involve people. They are the final step in a long process that begins with research in a lab. Most treatments used today are the results of past clinical trials.

Cancer clinical trials are designed to test new ways to:

- treat cancer
- find and diagnose cancer
- prevent cancer
- manage symptoms of cancer or side effects from its treatment

Every trial has a person in charge, usually a doctor, who is called the principal investigator. The principal investigator prepares a plan for the trial, called a protocol. The protocol explains what will be done during the trial. It also contains information that helps the doctor decide if this treatment is right for a particular patient.

The protocol includes information about:

- the reason for doing the trial
- who can join the trial (called "eligibility requirements")
- how many people are needed for the trial
- any drugs that will be given, how they will be given, the dose, and how often
- what medical tests will be done and how often
- what types of information will be collected about the people taking part

For some patients, taking part in a clinical trial may be the best treatment choice. Clinical trials are part of the cancer research process. Many of today's standard treatments for cancer are based on earlier clinical trials. Patients who take part in a clinical trial may receive the standard treatment or be among the first to receive a new treatment.

Patients who take part in clinical trials also help improve the way cancer will be treated in the future. Even when clinical trials do not lead to effective new treatments, they often answer important questions and help move research forward. Patients can enter clinical trials before, during, or after starting their cancer treatment.

Some clinical trials only include patients who have not yet received treatment. Other trials test treatments for patients whose cancer has not gotten better. There are also clinical trials that test new ways to stop cancer from recurring (coming back) or reduce the side effects of cancer treatment.
(National Cancer Institute).

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