

Retinoblastoma

Subjects: Genetics & Heredity

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Retinoblastoma is a rare type of eye cancer that usually develops in early childhood, typically before the age of 5. This form of cancer develops in the retina, which is the specialized light-sensitive tissue at the back of the eye that detects light and color.

Keywords: genetic conditions

1. Introduction

In children with retinoblastoma, the disease often affects only one eye. However, one out of three children with retinoblastoma develops cancer in both eyes. The most common first sign of retinoblastoma is a visible whiteness in the pupil called "cat's eye reflex" or leukocoria. This unusual whiteness is particularly noticeable in dim light or in photographs taken with a flash. Other signs and symptoms of retinoblastoma include crossed eyes or eyes that do not point in the same direction (strabismus), which can cause squinting; a change in the color of the colored part of the eye (iris); redness, soreness, or swelling of the eyelids; and blindness or poor vision in the affected eye or eyes.

Retinoblastoma is often curable when it is diagnosed early. However, if it is not treated promptly, this cancer can spread beyond the eye to other parts of the body. This advanced form of retinoblastoma can be life-threatening.

When retinoblastoma is associated with a genetic change (mutation) that occurs in all of the body's cells, it is known as hereditary (or germinal) retinoblastoma. People with this form of retinoblastoma typically develop cancer in both eyes and also have an increased risk of developing several other cancers outside the eye. Specifically, they are more likely to develop a cancer of the pineal gland in the brain (pineoblastoma), a type of bone cancer known as osteosarcoma, cancers of soft tissues (such as muscle) called soft tissue sarcomas, and an aggressive form of skin cancer called melanoma.

2. Frequency

Retinoblastoma is diagnosed in 250 to 350 children per year in the United States. It accounts for about 4 percent of all cancers in children younger than 15 years.

3. Causes

Mutations in the *RB1* gene are responsible for most cases of retinoblastoma. *RB1* is a tumor suppressor gene, which means that it normally regulates cell growth and stops cells from dividing too rapidly or in an uncontrolled way. Most mutations in the *RB1* gene prevent it from making any functional protein, so cells are unable to regulate cell division effectively. As a result, certain cells in the retina can divide uncontrollably to form a cancerous tumor. Some studies suggest that additional genetic changes can influence the development of retinoblastoma; these changes may help explain variations in the development and growth of retinoblastoma and other types of tumors in different people.

A small percentage of retinoblastomas are caused by deletions in the region of chromosome 13 that contains the *RB1* gene. Because these chromosomal changes involve several genes in addition to *RB1*, affected children usually also have intellectual disability, slow growth, and distinctive facial features (such as prominent eyebrows, a short nose with a broad nasal bridge, and ear abnormalities).

3.1. The genes and chromosome associated with Retinoblastoma

- MYCN
 - RB1
 - chromosome 13
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4. Inheritance

Researchers estimate that one-third of all retinoblastomas are hereditary, which means that *RB1* gene mutations are present in all of the body's cells, including reproductive cells (sperm or eggs). People with hereditary retinoblastoma may have a family history of the disease, and they are at risk of passing on the mutated *RB1* gene to the next generation. The other two-thirds of retinoblastomas are non-hereditary, which means that *RB1* gene mutations are present only in cells of the eye and cannot be passed to the next generation.

In hereditary retinoblastoma, mutations in the *RB1* gene appear to be inherited in an autosomal dominant pattern. Autosomal dominant inheritance means that one copy of the altered gene in each cell is sufficient to increase the risk of cancer. A person with hereditary retinoblastoma may inherit an altered copy of the *RB1* gene from one parent, or the altered gene may be the result of a new mutation that occurs in an egg or sperm cell or just after fertilization. For retinoblastoma to develop, a mutation involving the other copy of the *RB1* gene must occur in retinal cells during the person's lifetime. This second mutation usually occurs in childhood, typically leading to the development of retinoblastoma in both eyes.

In the non-hereditary form of retinoblastoma, typically only one eye is affected and there is no family history of the disease. Affected individuals are born with two normal copies of the *RB1* gene. Then, usually in early childhood, both copies of the *RB1* gene in certain retinal cells acquire mutations. People with non-hereditary retinoblastoma are not at risk of passing these *RB1* gene mutations to their children. However, without genetic testing it can be difficult to tell whether a person with retinoblastoma in one eye has the hereditary or the non-hereditary form of the disease.

5. Other Names for This Condition

- Glioma, retinal
- RB

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