CHILDREN'S TUMOR FOUNDATION
ENDING NF THROUGH RESEARCH

OPTIC PATHWAY GLIOMAS
IN NEUROFIBROMATOSIS TYPE 1

This resource is for individuals with neurofibromatosis type 1 (NF1) who are suspected or confirmed to have an optic pathway glioma (OPG). This resource is to be used as general information only and is not considered medical advice. Please consult with your NF care provider for additional information. To begin to understand optic pathway gliomas, some background knowledge is helpful.

WHAT ARE TUMORS?

A tumor is an abnormal growth or mass of tissue. Tumors vary in size, can appear anywhere in the body, and may or may not pose a health threat. Tumors are often classified as either benign or malignant.

A ***benign tumor*** is a mass that lacks the ability to invade neighboring tissue or spread to other areas of the body. Benign tumors typically have a slow growth rate; however, they may cause symptoms due to pressure on nerves, blood vessels, or other neighboring structures which can cause pain or other symptoms.

A ***malignant tumor*** is a cancerous type of growth. Malignant tumors can grow and spread to other areas of the body such as the lungs, liver, bones, or brain. This process is called metastasis and is potentially life-threatening.

WHAT IS AN OPTIC PATHWAY GLIOMA?

The *optic nerves* carry the visual information from the retina of each eye to the vision center in the back of the brain. *Optic pathway gliomas* (OPGs) are benign (non-cancerous) tumors that occur along this visual pathway. The left and right optic nerves meet at a junction called the *optic chiasm*. Then the nerves travel through the optic tracts and optic radiations to the visual cortex (Figure 1). Most often in NF1, OPGs only affect the optic nerves and/or chiasm (Figure 2), but they can also extend further back in the brain (Figure 3).

OPGs occur in 15-20% of individuals with NF1 and are the most common brain tumor in children with NF1. Many OPGs remain stable in size and some even shrink without ever causing an impact on vision; however, approximately ⅓ of these tumors cause symptoms requiring treatment. The most common age for an OPG to cause symptoms is between 2 and 6 years of age. In adolescents or adults with NF1, OPGs rarely grow or become symptomatic.

FIGURE 1. Anatomy of the Visual Pathway

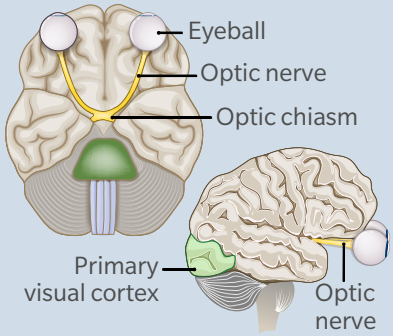


FIGURE 2. Magnetic resonance imaging shows an optic nerve glioma (arrow) in a child with NF1. The nerve on this side is thicker than the nerve on the other side.

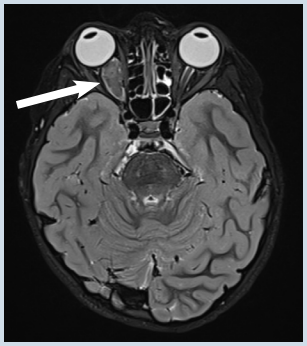
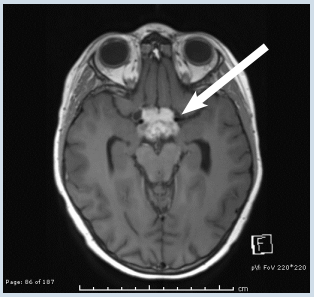


FIGURE 3. Magnetic resonance imaging shows an optic pathway glioma with more extensive involvement including the optic chiasm (arrow) in a child with NF1.



WHAT COMPLICATIONS CAN ARISE FROM AN OPTIC PATHWAY GLIOMA?

The most common symptoms of an OPG include decreased vision/vision loss, swelling or paleness of the optic nerve (seen during an eye examination), abnormal eye movements (strabismus), and/or bulging of the eyeball (proptosis).

When OPGs involve the optic chiasm where the two optic nerves meet, they can also involve the hormone center of the brain (the hypothalamus) that sits below the chiasm. If the hormone center is affected, children can show signs of early puberty (precocious puberty) or accelerated height (growing faster than expected for a child's age).

WHAT MONITORING IS RECOMMENDED FOR OPTIC PATHWAY GLIOMAS?

Published guidelines recommend that young, asymptomatic children with NF1 be evaluated by an ophthalmologist (eye doctor) familiar with NF1 starting at initial diagnosis and at least once every 12 months until puberty. Surveillance eye examinations may be done more frequently if recommended by a patient's NF providers or in younger children.

It is also important that NF providers monitor children at their clinic visits for signs of early puberty and accelerated height, which might indicate that there is an OPG involving the brain's hormone center. Therefore, children with NF1 should have their height measured at each visit with the pediatrician and at their NF clinic visits.

If an ophthalmologist or other NF provider has concerns about changes in vision or any of the symptoms described above, an MRI of the brain and orbits is typically recommended. A contrast dye is given intravenously during the MRI procedure to help better define an OPG if it is present. Many parents ask if their child should have a baseline or routine follow-up MRI scan. Although practices vary among NF doctors, most agree that doing an MRI on a child with a normal eye exam is not necessary.

Once an OPG has been diagnosed, children are followed closely by their ophthalmologist for changes in their vision. They may also need to have follow-up MRIs to monitor for further growth. The schedule or follow-up for visual and imaging assessments is different for every patient and determined by the NF team.

Recommended Monitoring for Optic Pathway Gliomas during Childhood

Yearly eye examinations through early childhood until puberty

Regular monitoring for signs of early puberty

Regular monitoring for accelerated height

When an OPG involves the hypothalamus or causes signs of hormone dysfunction, an endocrinologist (hormone doctor) is frequently consulted. Hormone levels are monitored in the blood over time. In addition, the endocrinologist helps the medical team follow the child's pubertal development and height.

HOW ARE SYMPTOMATIC OPTIC PATHWAY GLIOMAS TREATED?

Approximately ⅓ of OPGs require treatment with chemotherapy, and the goal of treatment is to preserve vision. The decision to start treatment takes into account multiple factors, including the age of the patient, presence of visual loss, and change or growth of the OPG seen on MRI scans.

Traditional chemotherapy has long been considered the first approach to treating OPGs in children with NF1. The most frequently used treatment plans use either monthly carboplatin, weekly vinblastine, or a

combination of two drugs, carboplatin and vincristine. More recently, medications that specifically target the the biologic pathways known to be disrupted in individuals with NF1 have been used to treat OPGs; these drugs are being tested in clinical trials to compare the effectiveness to stabilize and/or improve vision compared to traditional chemotherapy.

Surgery is rarely used to treat OPGs because surgical intervention can further damage the optic pathway or surrounding structures, potentially worsening vision loss.

Radiation is typically avoided in children with NF1, as there is a risk to develop secondary cancers. In addition, radiation may lead to injury to the blood vessels in the brain.

WHAT IS THE PROGNOSIS FOR OPTIC PATHWAY GLIOMAS?

At this time, it is not possible to reliably predict which OPGs will cause symptoms and require treatment. In general, OPGs isolated to the optic nerves have the best prognosis and are the least likely to cause vision loss or hormone problems. OPGs involving the chiasm or the visual pathways leading to the back of the brain are more likely to cause symptoms and require treatment. However, it is clear that the majority of OPGs will remain benign and asymptomatic. Thus, the long-term prognosis for most individuals with NF1 and an OPG is excellent.

Research focusing on which individuals may be more at risk for progression of their OPG is currently underway and hopes to eventually provide useful information for decision-making of clinical care and treatments.

Summary:

- Optic pathway gliomas occur in approximately 15-20% of children with NF1.
- Approximately ⅓ of individuals with known OPGs develop symptoms such as vision loss and require treatment.
- The goal of OPG treatment is to preserve vision.
- It is important that children with NF1 are evaluated regularly to assess visual acuity, height, and pubertal development.
- MRI scans are likely not necessary in children with normal eye examinations.

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