Journal of Academic Inquiry and Knowledge Volume 2023 (2) 290-307

ISBN 979-8-9888908-0-5

PEDIATRIC GLIOMAS: SYMPTOMS, TREATMENTS, AND ADVANCES

Ellen Park

Los Angeles, CA, USA

Pediatric Gliomas: Symptoms, Treatments, and Advances

Gliomas are a type of brain tumor that develops from glial cells that provide neurons in the brain with support and nourishment (*Glioma | Boston Children's Hospital*, n.d.). Although most gliomas are treatable and curable, they can still be dangerous. Many treatments have been used to treat pediatric gliomas, along with recent advancements in the area. There are both traditional ways

and newer, advanced techniques to help improve treatment and outcomes for patients with pediatric glioma. Doctors and everyone need to stay updated on these treatments to understand the risks of pediatric gliomas and know about the progress made with new therapies. While most pediatric glioma types are treatable, others still pose dangers that may respond to new treatment developments.

Gliomas Grades

There are four grades of gliomas. Grades 1 and 2 are low-grade and slow-growing. Two-thirds of all pediatric gliomas are low-grade. High-grade gliomas are grades 3 and 4, fast-growing, and harder to treat as they spread quickly throughout the brain tissue. The most common type of glioma is astrocytomas, which are responsible for approximately half of all pediatric brain tumors. These brain tumors, which are the most common in children between 5 and 8, develop from astrocytes, a type

of glial cell, and are found most often in the cerebrum (*Glioma | Boston Children's Hospital*, n.d.-b).

Astrocytoma

Most of these tumors in children are low-grade, but the child's treatment is based on whether the astrocytoma is low or high-grade. Children have four types of astrocytomas: pilocytic astrocytoma, diffuse astrocytoma, anaplastic astrocytoma, and glioblastoma multiforme. Pilocytic astrocytomas, grade 1, is the most common pediatric tumor, and when it develops in the cerebellum, the only treatment is surgery. With grade 2 gliomas, diffuse astrocytoma infiltrates the normal brain tissue. This makes surgery more difficult and may cause complications like seizures. Anaplastic astrocytoma, grade 3 glioma, is malignant and requires a combination of treatments. Grade 4 tumors, glioblastoma multiforme, are the most malignant astrocytoma and also need a mix of treatments due to their fast-growing nature (*Brain Tumors in Children*, 2023).

Survival Rate and Causes

Low-grade gliomas have a cure rate of over 90 percent, and high-grade gliomas have a 40-50% rate. Brain and spinal cord tumors are the second most common cancers in children. Twenty-five percent of childhood cancers are gliomas, and over 4,000 of these tumors are diagnosed annually in children and teens; 75% of children with gliomas survive five years after their diagnosis (*Key Statistics for Brain and Spinal Cord Tumors in Children*, n.d.).

It is not confirmed what the exact cause of glioma in children is, but there are different types of genetic conditions that children have that put them at risk for developing these brain tumors. The genetic factors include Li-Fraumeni syndrome, neurofibromatosis, nevoid basal cell carcinoma syndrome, tuberous sclerosis, Turcot syndrome, and von Hippel-Lindau disease. Approximately 5% of brain tumors are linked to these genetic conditions.

Although it is not certain what the causes and risks of pediatric gliomas are, it is important to look out for the symptoms, as early diagnosis can help save a child's life (*Brain Tumor - Risk Factors*, 2023).

Symptoms

The tumor's size and location heavily affect the symptoms of pediatric gliomas. Headaches, severe or frequent vomiting, vision problems like double vision, blurry vision, or loss of vision, difficulty walking or balancing, seizures, weight loss or gain, premature puberty, clumsiness, confusion, and sleepiness are some of the most common symptoms of pediatric brain tumors (*Glioma | Boston Children's Hospital*, n.d.-c).

Diagnosis

Doctors take neurological and physical exam tests to diagnose pediatric gliomas, including magnetic resonance imaging (MRI), biopsy or tissue sample, electroencephalogram (EEG), and lumbar puncture.

Magnetic resonance imaging stands out as the most sensitive medical imaging method for detecting all types of brain tumors. Low-grade gliomas typically manifest as minor lesions without contrast enhancement. Conversely, high-grade gliomas exhibit varying degrees of enhancement and manifest as irregular, unmarked masses accompanied by angioedema and a necrotic core (Haydar et al., 2022).

A small tissue sample is taken for microscopic examination in biopsy or tissue sampling. This procedure is crucial for obtaining a conclusive diagnosis of a brain tumor, even if other tests may indicate the presence of cancer. Following the biopsy, a pathologist carefully examines the sample(s) (*Brain Tumor - Diagnosis*, 2023). Individuals with brain lesions, whether caused by tumors or strokes, may exhibit abnormally slow EEG waves. The speed and location of these waves depend on the size and location of the lesion (*Electroencephalogram (EEG)*, 2021). Although lumbar punctures are not typically used to

detect brain tumors, they can be used to look for cancer cells in the CSF, which can help determine the size of a tumor. They are frequently employed in cases where a tumor has been identified as one that often spreads through the CSF (*Tests for Brain and Spinal Cord Tumors in Adults*, n.d.).

Treatment Options

The treatment to cure gliomas usually starts with surgery to remove as much of the tumor as possible. A subtotal resection, which is the resection of part of a tumor, may be necessary if the tumor does not separate from healthy brain tissue, and it can help to decrease the symptoms that patients face. Surgeries like this may be successful but do not come without risks. Infection and bleeding is a major risk in these surgeries. Surgery usually cannot remove a malignant tumor because the tumor cells spread to the healthy cells in the body. Radiation therapy may be used before or after surgeries. Post-surgery

radiation is used to kill any remaining glioma cells, and if surgery is not an option, radiation is used as the first treatment option. Chemotherapy and radiation therapy are usually used in combination to treat these brain tumors. Chemotherapy is the use of drugs to kill tumor cells, and these medicines are often injected into the vein or in pill form. Some side effects from these medicines include nausea, vomiting, hair loss, tiredness, and fever, but medicine can mitigate side effects (*Glioma - Diagnosis and Treatment - Mayo Clinic*, 2023).

Recent Developments in Treating Pediatric Gliomas

One recent development involves targeting vulnerabilities in brain tumors, such as a common vulnerability in diffuse midline gliomas and primary central nervous system tumors, which are a rare subtype of glial tumors. This has led to the planning of clinical trials to test new drugs in people with this type of glioma. Children are more likely to get this tumor, and people with diffuse

midline glioma have an average survival of less than one year (*Researchers Identify Potential Treatment for Gliomas*, 2022). Additionally, recent advances in sequencing have allowed for the development of subtype-specific multimodal therapy for pediatric high-grade gliomas (Chatwin et al., 2021).

However, there has been a lack of progress in developing new treatments for pediatric gliomas. Dr. Haas-Kogan, chair of the Department of Radiation Oncology at Dana-Farber, and her colleagues led a recent study of pediatric gliomas using CRISPR screening to uncover genes required for specific cell survival. The researchers discovered that the de novo pyrimidine nucleotide synthesis route, which depends on certain glioma cells, appears critical for some diffuse midline gliomas. They think this reliance might develop due to alternative pathway-producing pyrimidines ceasing to function properly.

Researchers tested the drug BAY 2402234 in mouse models of diffuse midline gliomas, and the results were that although the tumors shrank, they grew back eventually, and the mice died. Sharmistha Pal, Ph.D., of Dana-Farber, a co-author of the study, said, "The drug prolonged survival in the mice, but it is not a cure." Researchers plan to test the drug on patients with diffuse midline gliomas through the Pacific Pediatric Neuro-Oncology Consortium (*Researchers Identify Potential Treatment for Gliomas*, 2022b).

Public Awareness Importance

Being aware and understanding pediatric gliomas are crucial for public health efforts. Educational programs can inform the public about the signs, symptoms, and risk factors associated with pediatric brain tumors. Early detection and intervention can significantly improve outcomes for affected children. Families of children diagnosed with gliomas often face emotional, financial, and

logistical challenges. Knowledge about pediatric gliomas helps healthcare professionals and support organizations provide better guidance and support to these families. It can also contribute to the development of resources and networks for families dealing with pediatric brain tumors. Awareness of pediatric gliomas is crucial for advocacy efforts and the development of policies related to childhood cancer. Advocacy can help allocate resources for research, improve access to quality healthcare, and promote policies that support families dealing with pediatric gliomas. Additionally, knowledge gained from research on pediatric gliomas may have implications for understanding and treating adult gliomas.

Support Systems

Understanding and addressing the needs of families dealing with pediatric gliomas contribute to the overall well-being of the affected children. Support systems help families navigate the complexities of treatment and foster

resilience and strength in the face of adversity. Families coping with pediatric gliomas often experience heightened emotional distress. Establishing counseling services and support groups can provide a safe space for parents, siblings, and other family members to share their feelings, fears, and coping strategies. Moreover, the financial burden of pediatric glioma treatment, including medical bills and other related expenses, can be overwhelming. Exploring available financial assistance programs, insurance options, and community resources can help alleviate some financial difficulties.

Managing the day-to-day logistics of caring for a child with gliomas, including hospital visits, appointments, and possible lifestyle adjustments, can be challenging. Support systems that offer practical assistance, such as transportation services, meal deliveries, and childcare support, can significantly ease the burden on families. Providing families with access to educational programs

about pediatric gliomas can empower them with knowledge about the disease, its treatment options, and potential challenges. Informed families are better equipped to make decisions and advocate for their child's well-being. Establishing networks and communities for families dealing with pediatric gliomas can create a sense of belonging and shared understanding. Connecting families with similar experiences allows for mutual support, information exchange, and the formation of lasting bonds.

Conclusion

The prevalence of gliomas is relatively high for children. Although there is a high cure rate, gliomas still pose dangers. Pediatric glioma research and treatment have made great strides in recent years, and ongoing studies and clinical trials contribute to pediatric glioma research. Continued dedication to research and innovation promises a brighter outlook for children diagnosed with gliomas. Support systems for families dealing with pediatric gliomas

are critical. As medical advancements continue, it is crucial to build effective support networks so affected families receive the comprehensive care and assistance they need. Integrating cutting-edge technologies and a personalized medicine approach is the key to further improving outcomes and ensuring a better quality of life for young glioma patients.

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