

## Neuro-Oncology Frontiers: From Diagnosis to Treatment of Gliomas

Adelino Canario\*

Department of Psychiatry, NFB–University of Pisa, Italy

### Introduction

Gliomas are among the most common and aggressive types of brain tumors, originating from glial cells that support and protect neurons in the central nervous system. These tumors account for about 30% of all brain and spinal cord tumors and nearly 80% of all malignant brain tumors [1]. Due to their complexity, gliomas represent a major challenge in the field of neuro-oncology, a specialized branch of medicine that combines neurology and oncology to diagnose and treat cancers of the brain and spinal cord. Recent advancements in neuro-oncology have led to better diagnostic tools, more effective treatments, and a deeper understanding of the molecular characteristics of gliomas. This article will explore the current state of glioma diagnosis, innovative treatment approaches, and the promising future of personalized therapies.

### Understanding gliomas: types and grades

Gliomas are classified based on the type of glial cells they originate from and their level of malignancy. The main types include:

1. **Astrocytomas:** These tumors arise from astrocytes, star-shaped glial cells that provide support to neurons. The most aggressive form of astrocytoma is glioblastoma multiform (GBM), a highly malignant and fast-growing tumor [2].
2. **Oligodendrogliomas:** These develop from oligodendrocytes, which produce the myelin sheath that insulates neurons. Oligodendrogliomas tend to grow more slowly than astrocytomas but can still be invasive.
3. **Ependymomas:** These tumors originate from ependymal cells, which line the ventricles of the brain and the central canal of the spinal cord. Ependymomas are more common in children than in adults.

Gliomas are also graded based on their aggressiveness:

- **Grade I (Low-Grade):** These tumors grow slowly and are less likely to spread. An example is pilocytic astrocytoma, a common low-grade glioma in children.
- **Grade II (Intermediate):** These tumors grow more quickly than Grade I tumors and have a higher chance of recurrence.
- **Grade III (High-Grade):** These are malignant tumors that grow rapidly and often recur after treatment.
- **Grade IV (Glioblastoma):** This is the most aggressive and deadliest type of glioma, with a poor prognosis even with treatment [3].

### Diagnosis of gliomas

Early diagnosis is crucial for improving the prognosis of gliomas, but detecting these tumors can be challenging due to their often subtle symptoms. The most common initial symptoms include persistent headaches, seizures, cognitive changes, and neurological deficits such as weakness or vision problems.

#### 1. Imaging techniques

Imaging is the first step in diagnosing gliomas. Magnetic resonance

imaging (MRI) is the gold standard for identifying brain tumors, offering detailed images of the brain's structure and the tumor's location, size, and relationship to surrounding tissue. Specific MRI techniques, such as functional MRI (fMRI) and diffusion tensor imaging (DTI), help neuro-oncologists assess how the tumor affects brain function and plan surgical interventions.

**Positron emission tomography (PET)** scans are also useful for determining the metabolic activity of a tumor, which can help distinguish between benign and malignant lesions. These imaging techniques play a key role in preoperative planning and in monitoring tumor progression during and after treatment.

#### 2. Biopsy and molecular profiling

While imaging can suggest the presence of a glioma, a definitive diagnosis requires a biopsy, where a small sample of the tumor is surgically removed for analysis. The tissue is examined under a microscope to determine the tumor type and grade. In recent years, molecular profiling has become an essential part of the diagnostic process.

By analyzing the genetic mutations and molecular markers within the tumor cells, neuro-oncologists can identify specific alterations that drive tumor growth. For example, mutations in the IDH1 gene are common in lower-grade gliomas and are associated with a better prognosis. The MGMT promoter methylation status is another important biomarker, particularly in glioblastoma, as it can predict how well a patient will respond to certain chemotherapy treatments.

### Treatment approaches in neuro-oncology

Treating gliomas is challenging due to their invasive nature and their location within the brain, which limits the extent to which tumors can be safely removed. However, advances in neurosurgery, radiation therapy, chemotherapy, and emerging therapies offer hope for patients with gliomas.

#### 1. Surgical resection

Surgery is typically the first step in treating gliomas, particularly for accessible tumors. The goal of surgery is to remove as much of the tumor as possible without damaging surrounding healthy brain tissue. The extent of resection is a key factor in determining patient outcomes, with more complete removal associated with longer survival times.

\*Corresponding author: Adelino Canario, Department of Psychiatry, NFB–University of Pisa, Italy; E-mail: Canario@gamil.com

**Received:** 01-July-2024, Manuscript No. jcen-24-151264; **Editor assigned:** 03-July-2024, Pre QC-No. jcen-24-151264; (PQ); **Reviewed:** 17-July-2024, QC No: jcen-24-151264; **Revised:** 24-July-2024, Manuscript No. jcen-24-151264; (R); **Published:** 31-July-2024, DOI: 10.4172/jcen.1000254

**Citation:** Adelino C (2024) Neuro-Oncology Frontiers: From Diagnosis to Treatment of Gliomas. J Clin Exp Neuroimmunol, 9: 254.

**Copyright:** © 2024 Adelino C. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Technological advances have improved the precision of brain tumor surgery. Intraoperative MRI allows surgeons to visualize the tumor in real-time, enabling more complete resections. Additionally, awake craniotomy allows patients to remain conscious during surgery so that the surgeon can monitor critical brain functions such as speech or movement, minimizing the risk of neurological deficits.

## 2. Radiation therapy

Following surgery, patients often receive radiation therapy to target residual tumor cells and reduce the risk of recurrence. External beam radiation, where high-energy beams are directed at the tumor site, is the most common method. In some cases, stereotactic radiosurgery (SRS), which delivers highly focused radiation beams, is used for small, localized tumors.

Radiation therapy has evolved with techniques such as intensity-modulated radiation therapy (IMRT), which shapes the radiation beams to conform to the tumor, sparing healthy brain tissue and reducing side effects. These advanced techniques allow for higher doses of radiation to be delivered safely.

## 3. Chemotherapy and targeted therapies

Chemotherapy is often used in combination with surgery and radiation therapy, particularly for high-grade gliomas like glioblastoma. The most commonly used chemotherapy drug is temozolomide (TMZ), which can penetrate the blood-brain barrier and disrupt the DNA of cancer cells.

Recent advancements in neuro-oncology have focused on targeted therapies, which aim to interfere with specific molecular pathways involved in tumor growth. For example, bevacizumab, an anti-angiogenic drug, targets the formation of blood vessels that feed tumors, helping to slow their growth. PARP inhibitors, which block the repair of damaged DNA in cancer cells, are also being investigated for their potential to enhance the effectiveness of traditional treatments.

## 4. Immunotherapy and novel approaches

Immunotherapy has emerged as a promising approach in the treatment of many cancers, and it is now being explored for gliomas [4-8]. Checkpoint inhibitors, which remove the "brakes" on the immune system and allow it to attack cancer cells, have shown some success in other types of cancer but have been less effective in gliomas due to the unique environment of the brain. However, researchers are investigating novel ways to stimulate the immune system against gliomas, such as tumor vaccines and CAR-T cell therapy, which involves modifying a patient's immune cells to target and destroy tumor cells.

## The future of glioma treatment: toward personalized medicine

The future of neuro-oncology lies in personalized medicine, where treatments are tailored to the individual patient's tumor based on its genetic and molecular characteristics. By identifying specific mutations and molecular markers, neuro-oncologists can select therapies that are most likely to be effective for each patient. Liquid biopsies, which detect tumor DNA in a patient's blood, are an exciting new development in glioma diagnosis and monitoring. These non-invasive tests may allow for earlier detection of tumor recurrence and help guide treatment decisions in real-time.

## Conclusion

Neuro-oncology has made remarkable progress in understanding and treating gliomas, particularly with advances in surgery, radiation therapy, chemotherapy, and molecular profiling. Despite these strides, gliomas, especially high-grade gliomas like glioblastoma, remain some of the most challenging cancers to treat. The frontier of neuro-oncology is moving towards personalized medicine and innovative therapies, including immunotherapy and targeted treatments, offering new hope for patients facing these formidable brain tumors.

## References

- Casey D, Haupt D, Newcomer J, Henderson DC, Sernyak MJ, et al. (2004) Antipsychotic-induced weight gain and metabolic abnormalities: implications for increased mortality in patients with schizophrenia. *J Clin Psychiatry* 65(Suppl 7): 4–18.
- Schneider LS, Dagerman KS, Insel P (2005) Risk of Death with Atypical Antipsychotic Drug Treatment for Dementia. *JAMA* 294: 1934–1943.
- Meijer WEE, Heerdink ER, Nolen WA, Herings RMC, Leufkens HGM, et al. (2004) Association of Risk of Abnormal Bleeding With Degree of Serotonin Reuptake Inhibition by Antidepressants. *Arch Intern Med* 164: 2367–2370.
- Rasmussen K, Sampson S, Rummans T (2002) Electroconvulsive therapy and newer modalities for the treatment of medication-refractory mental illness. *Mayo Clin Proc* 77: 552–556.
- Hamilton M (1960) A rating scale for depression. *J Neurol Neurosurg Psychiatr* 23: 56–62.
- Cohen R, Brunoni A, Boggio P, Fregni F (2010) Clinical predictors associated with duration of repetitive transcranial magnetic stimulation treatment for remission in bipolar depression: a naturalistic study. *J Nerv Ment Dis* 198: 679–681.
- DigheDeo D, Shah A (1998) Electroconvulsive Therapy in Patients with Long Bone Fractures. *J ECT* 14: 115–119.
- Takahashi S, Mizukami K, Yasuno F, Asada T (2009) Depression associated with dementia with Lewy bodies (DLB) and the effect of somatotherapy. *Psychogeriatrics* 9: 56–61.