Mini Review
Volume 16:03, 2024

Journal of Cancer Science and Therapy

ISSN: 1948-5956 Open Access

Emerging Therapies in Brain Tumor Treatment: A Comprehensive Review

Jinan Behnan*

Department of Neurosurgery, University of Oslo, 0027 Oslo, Norway

Abstract

Brain tumors remain a significant challenge in oncology, with high morbidity and mortality rates. Recent advancements in the understanding of tumor biology and technological innovations have led to the development of novel therapeutic strategies. This comprehensive review examines the latest emerging therapies in brain tumor treatment, including immunotherapy, precision medicine, and advanced surgical techniques. We discuss the mechanisms, efficacy, and potential of these therapies, as well as their integration into current clinical practice. By analysing recent clinical trials and research findings, this review aims to provide a thorough understanding of the current landscape and future directions in brain tumor treatment. Traditional treatment modalities, such as surgery, radiotherapy, and chemotherapy, often yield limited success and can be associated with significant side effects. However, recent advances in molecular biology, immunology, and medical technology have paved the way for novel therapeutic approaches. This review aims to provide an in-depth analysis of emerging therapies for brain tumors, highlighting their mechanisms of action, clinical efficacy, and potential to improve patient outcomes.

Keywords: Tumor cells • Brain tumor treatment • Oncology

Introduction

Immunotherapy has emerged as a promising avenue for brain tumor treatment, leveraging the body's immune system to target and eliminate tumor cells. Immune checkpoint inhibitors, such as nivolumab and pembrolizumab, have shown potential in treating glioblastomas by blocking proteins that prevent T cells from attacking cancer cells. Additionally, CAR-T cell therapy, which involves modifying a patient's T cells to recognize and attack tumor-specific antigens, has demonstrated encouraging results in preclinical studies and early-phase clinical trials [1].

Precision medicine tailors treatment based on the genetic profile of an individual's tumor. Advances in genomic sequencing have identified specific mutations and molecular markers in brain tumors that can be targeted with drugs. For example, BRAF V600E mutations in gliomas can be targeted with BRAF inhibitors like vemurafenib. Similarly, IDH1 and IDH2 mutations have led to the development of targeted inhibitors, which are currently undergoing clinical evaluation. Innovations in surgical technology, such as Fluorescence-Guided Surgery (FGS) and intraoperative MRI, have significantly improved the precision of brain tumor resections. FGS uses fluorescent markers to delineate tumor boundaries, enabling more complete resections while sparing healthy tissue. Intraoperative MRI provides real-time imaging, allowing surgeons to adjust their approach during surgery to maximize tumor removal [2].

Literature Review

The integration of these emerging therapies into clinical practice presents both opportunities and challenges. Immunotherapy has shown promise but also faces hurdles such as immune-related adverse effects and the tumor microenvironment's immunosuppressive nature. Precision medicine offers personalized treatment but requires comprehensive genetic profiling, which may not be accessible to all patients. Advanced surgical techniques improve outcomes but depend heavily on available technology and surgical expertise. Moreover, the combination of these therapies holds significant potential. For instance, combining immunotherapy with precision-targeted treatments could enhance efficacy by simultaneously targeting multiple tumor pathways. Clinical trials exploring such combinations are underway, aiming to optimize therapeutic regimens and improve survival rates for brain tumor patients [3].

Brain tumors, encompassing primary tumors such as gliomas and meningiomas as well as metastatic brain tumors, pose a significant challenge in clinical oncology due to their complex biology and critical location within the central nervous system. Traditional treatment modalities, including surgery, radiotherapy, and chemotherapy, have had limited success and often come with severe side effects. However, recent advancements in molecular biology, immunotherapy, and precision medicine have heralded a new era in brain tumor treatment, offering hope for more effective and personalized therapies.

Immunotherapy has revolutionized cancer treatment by harnessing the body's immune system to target and destroy cancer cells. In brain tumors, immune checkpoint inhibitors such as nivolumab and pembrolizumab have shown potential in treating glioblastomas by blocking proteins like PD-1 and PD-L1 that prevent T cells from attacking tumor cells. Another promising approach is CAR-T cell therapy, where a patient's T cells are genetically engineered to Express Chimeric Antigen Receptors (CARs) that specifically target tumor antigens. Early clinical trials have demonstrated the potential of CAR-T cells in treating recurrent glioblastomas, although challenges such as the immunosuppressive tumor microenvironment and neurological side effects remain significant hurdles [4].

Discussion

Precision medicine aims to tailor treatment based on the genetic and molecular profile of an individual's tumor. Advances in genomic sequencing have enabled the identification of specific mutations and pathways that drive brain tumor growth. For example, BRAF V600E mutations, present in some gliomas, can be targeted with BRAF inhibitors like vemurafenib. Similarly, IDH1 and IDH2 mutations, common in lower-grade gliomas, have led to the development of targeted inhibitors currently under clinical investigation. This personalized approach not only enhances treatment efficacy but also minimizes side effects by sparing normal tissues [5].

***Address for Correspondence:** Jinan Behnan, Department of Neurosurgery, University of Oslo, 0027 Oslo, Norway; E-mail: Jinan.bahnan10@med.lu.se*

Received: 29 April, 2024, Manuscript No. jcst-24-138782; **Editor assigned:** 01 May, 2024, PreQC No. P-138782; **Reviewed:** 15 May, 2024, QC No. Q-138782; **Revised:** 20 May, 2024, Manuscript No. R-138782; **Published:** 27 May, 2024, DOI: 10.37421/1948-5956.2024.16.639

Surgical resection remains a cornerstone in the management of brain tumors. Recent innovations such as Fluorescence-Guided Surgery (FGS) and intraoperative MRI have significantly improved surgical outcomes. FGS involves the use of fluorescent markers that selectively accumulate in tumor tissues, providing real-time visualization of tumor margins and enabling more complete resections. Intraoperative MRI offers real-time imaging during surgery, allowing surgeons to adjust their approach and ensure maximal tumor removal while preserving critical brain structures. These advancements have translated into better survival rates and reduced postoperative neurological deficits. Combining different treatment modalities has shown promise in enhancing therapeutic efficacy. For instance, combining immunotherapy with precision-targeted therapies could potentially overcome resistance mechanisms and improve patient outcomes. Ongoing clinical trials are exploring various combinations, including immune checkpoint inhibitors with targeted therapies and conventional treatments like radiotherapy and chemotherapy [6].

Conclusion

The rationale behind these combinations is to attack the tumor on multiple fronts, thereby increasing the likelihood of treatment success. Despite these advances, several challenges remain. The Blood-Brain Barrier (BBB) poses a significant obstacle to drug delivery, limiting the efficacy of many systemic therapies. Innovative strategies such as nanoparticle-based delivery systems are being developed to enhance drug penetration across the BBB. Additionally, the heterogeneity of brain tumors necessitates a multidisciplinary approach to treatment, involving neurosurgeons, oncologists, radiologists, and researchers. Emerging therapies in brain tumor treatment offer hope for improved patient outcomes through innovative approaches like immunotherapy, precision medicine, and advanced surgical techniques. While challenges remain in their implementation and integration, ongoing research and clinical trials continue to refine these strategies. The future of brain tumor treatment lies in a multidisciplinary approach that leverages the strengths of each modality, paving the way for more effective and personalized care. Continued advancements in this field are essential to overcoming the complexities of brain tumors and enhancing the quality of life for affected patients.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Das, Riku, Maureen A. Jakubowski, Jessica Spildener and Yu-Wei Cheng. "Identification of novel MET exon 14 skipping variants in non-small cell lung cancer patients: A prototype workflow involving *in silico* prediction and RT-PCR." *Cancers* 14 (2022): 4814.
2. Heydt, Carina, Michaela Angelika Ihle and Sabine Merkelbach-Bruse. "Overview of Molecular Detection Technologies for MET in Lung Cancer." *Cancers* 15 (2023): 2932.
3. Jie, Guang-Ling, Lun-Xi Peng, Mei-Mei Zheng and Hao Sun, et al. "Longitudinal plasma proteomics-derived biomarkers predict response to MET Inhibitors for MET-Dysregulated NSCLC." *Cancers* 15 (2023): 302.
4. Kumaki, Yuichi, Goshi Oda and Sadakatsu Ikeda. "Targeting MET amplification: Opportunities and obstacles in therapeutic approaches." *Cancers* 15 (2023): 4552.
5. Jørgensen, Jan Trøst and Jens Mollerup. "Companion diagnostics and predictive biomarkers for MET-targeted therapy in NSCLC." *Cancers* 14 (2022): 2150.
6. Feldt, Susan L. and Christine M. Bestvina. "The role of MET in resistance to EGFR Inhibition in NSCLC: A review of mechanisms and treatment implications." *Cancers* 15 (2023): 2998.

How to cite this article: Behnan, Jinan. "Emerging Therapies in Brain Tumor Treatment: A Comprehensive Review." *J Cancer Sci Ther* 16 (2024): 639.