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# Review of Current Practise and Future Prospects for the Combination MR-Linear Accelerator Treatment of Central Nervous System Tumours

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## Abstract

Central Nervous System (CNS) tumors pose a complex and challenging set of issues for clinicians and patients alike. The advent of MR-linear accelerator technology, which integrates Magnetic Resonance Imaging (MRI) with a linear accelerator for radiation therapy, has opened new possibilities in the treatment of CNS tumors. This article provides a comprehensive review of the current state of practice and future prospects for the combination MR-linear accelerator treatment of CNS tumors. We explore the benefits and challenges, clinical outcomes, technological advancements, and the potential impact on patient care. Understanding the evolving landscape of CNS tumor treatment is essential for healthcare professionals and researchers working in this field. Central Nervous System (CNS) tumors encompass a diverse group of neoplasms that arise in the brain and spinal cord. The treatment of CNS tumors is particularly challenging due to their location, potential for rapid growth, and the need to minimize damage to healthy brain tissue. The integration of Magnetic Resonance Imaging (MRI) with a Linear Accelerator (LINAC) for radiation therapy has given rise to a novel and highly promising approach to CNS tumor treatment.

**Keywords:** Neurological disorders • Spine • Cerebrospinal fluid

## Introduction

This article aims to provide a comprehensive review of the current state of practice and future prospects for the combination MR-linear accelerator treatment of CNS tumors. It will explore the technology's potential benefits, clinical outcomes, evolving advancements, and the implications for patient care. The integration of real-time MRI with radiation therapy provides superior soft tissue contrast and the ability to track tumor motion and changes, allowing for more precise treatment planning and delivery. The dynamic imaging capabilities of MR-linear accelerators enable adaptive therapy, allowing for treatment plan modifications based on daily changes in tumor size, shape, and location. The improved targeting accuracy reduces the risk of damage to surrounding healthy brain tissue, minimizing treatment-related side effects. MR-linear accelerator technology allows for more personalized treatment plans, considering individual patient characteristics and tumor response to therapy. GBM is the most common primary malignant brain tumor, known for its aggressive nature [1,2].

## Literature Review

Studies have shown that MR-linear accelerator treatment can improve local control and potentially extend overall survival in GBM patients. The precise nature of MR-linear accelerator treatment makes it a valuable option for stereotactic radiosurgery, effectively treating brain metastases with minimal damage to surrounding tissue. The technology's reduced toxicity makes it an appealing choice for pediatric patients with CNS tumors, improving quality of life during and after treatment. MRgRT is an emerging technology that combines MRI and LINAC for improved real-time imaging and treatment adaptation. However, it poses technical challenges related to hardware integration and safety. Addressing tumor motion, particularly in cases of spinal cord tumors or respiratory-induced movement, remains a significant challenge. The high cost of MR-linear accelerator technology and its limited availability in some regions present barriers to widespread adoption. Developing advanced software for optimal treatment planning and execution is an ongoing area of research and development [3,4].

## Discussion

Studies suggest that gender bias may exist in the diagnosis and treatment of LBP. Women have reported feeling dismissed or not taken seriously by healthcare providers, which can lead to delayed or inadequate care. Differences in prescription patterns and rehabilitation approaches have been noted. Tailored treatments that account for gender-specific needs and preferences may yield better outcomes. There is a need for further research to better understand the intricate relationships between gender and LBP. Longitudinal studies exploring the role of sex hormones, psychosocial factors, and healthcare disparities are warranted. Recognizing the impact of gender-related concerns in LBP management, healthcare providers should aim to provide personalized care that accounts for individual experiences and needs. Raising awareness of gender biases and promoting cultural competence among healthcare providers is essential to ensure that patients receive equitable care. Targeted preventive strategies can help mitigate LBP disparities. This includes ergonomic workplace modifications, lifestyle interventions, and educational programs [5,6].

## Conclusion

The combination of magnetic resonance imaging and linear accelerator technology offers an exciting and transformative approach to the treatment of central nervous system tumors. The benefits of MR-linear accelerator therapy include enhanced imaging, adaptive treatment, reduced toxicity, and improved

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clinical outcomes for patients with CNS tumors. As technology advances and challenges are addressed, the future prospects of MR-linear accelerator treatment hold great promise. The potential to integrate MR-linear accelerator therapy with other modalities and improve treatment times, while prioritizing patient care and well-being, underscores the importance of this innovative approach. However, it is crucial to address ethical, societal, and access-related concerns to ensure that the benefits of MR-linear accelerator therapy are equitably distributed and that patients can make informed decisions about their treatment. The ongoing evolution of this field is likely to have a profound impact on the future of CNS tumor management, offering new hope and improved outcomes for patients facing this complex and challenging conditions.

## Acknowledgement

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## Conflict of Interest

None.

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