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Targeted therapies for Glioblastoma multiforme (GBM): State-of-the-art and future prospects

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Abstract

Glioblastoma multiforme (GBM) remains one of the most aggressive and lethal forms of brain cancer, characterized by rapid growth and resistance to conventional therapies. The present review explores the latest advancements in targeted therapies for GBM, emphasizing the critical role of the blood-brain barrier (BBB), blood-brain-tumor barrier, tumor microenvironment, and genetic mutations in influencing treatment outcomes. The impact of the key hallmarks of GBM, for example, chemoresistance, hypoxia, and the presence of glioma stem cells on the disease progression and multidrug resistance are discussed in detail. The major focus is on the innovative strategies aimed at overcoming these challenges, such as the use of monoclonal antibodies, small-molecule inhibitors, and novel drug delivery systems designed to enhance drug penetration across the BBB. Additionally, the potential of immunotherapy, specifically immune checkpoint inhibitors and vaccine-based approaches, to improve patient prognosis was explored. Recent clinical trials and preclinical studies are reviewed to provide a comprehensive overview of the current landscape and future prospects in GBM treatment. The integration of advanced computational models and personalized medicine approaches is also considered, aiming to tailor therapies to individual patient profiles for better efficacy. Overall, while significant progress has been made in understanding and targeting the complex biology of GBM, continued research and clinical innovation are imperative to develop more effective and sustainable therapeutic options for patients battling this formidable disease.

Keywords: GBM; astrocytoma; glioblastoma; mAbs; monoclonal antibodies; targeted therapeutics.