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Targeted Radionuclide Therapy in Glioblastoma

Xiaobin Zhao [1 2 3 4 5], Vivianne Jakobsson [1 2 3 5], Yucen Tao [1 3 5], Tianzhi Zhao [1 2 3 5], Jingyan Wang [6], Pek-Lan Khong [1 2], Xiaoyuan Chen [1 2 3 5 7 8], Jingjing Zhang [1 2 3 5]

Affiliations

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Abstract

Despite the development of various novel therapies, glioblastoma (GBM) remains a devastating disease, with a median survival of less than 15 months. Recently, targeted radionuclide therapy has shown significant progress in treating solid tumors, with the approval of Lutathera for neuroendocrine tumors and Pluvicto for prostate cancer by the US Food and Drug Administration (FDA) and the European Medicines Agency (EMA). This achievement has shed light on the potential of targeted radionuclide therapy for other solid tumors, including GBM. This review presents the current status of targeted radionuclide therapy in GBM, highlighting the commonly used therapeutic radionuclides emitting alpha, beta particles, and Auger electrons that could induce potent molecular and cellular damage to treat GBM. We then explore a range of targeting vectors, including small molecules, peptides, and antibodies, which selectively target antigen-expressing tumor cells with minimal or no binding to healthy tissues. Considering that radiopharmaceuticals for GBM are often administered locoregionally to bypass the blood-brain barrier (BBB), we review prominent delivery methods such as convection-enhanced delivery, local implantation, and stereotactic injections. Finally, we address the challenges of this therapeutic approach for GBM and propose potential solutions.

Keywords: alpha therapy; antibodies; cancer theranostics; drug delivery; glioblastoma (GBM); peptides; radiopharmaceuticals; targeted radionuclide therapy.