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Nanoradiosensitizers in glioblastoma treatment: recent advances and future perspectives

Mingxi Liu [1], Taiping Li [2], Mengjie Zhao [2], Chunfa Qian [1], Ran Wang [1], Liang Liu [1], Yong Xiao [1], Hong Xiao [2], Xianglong Tang [1 2], Hongyi Liu [1]

Affiliations

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Abstract

Glioblastoma (GBM), a highly invasive type of brain tumor located within the central nervous system, manifests a median survival time of merely 14.6 months. Radiotherapy kills tumor cells through focused high-energy radiation and has become a crucial treatment strategy for GBM, especially in cases where surgical resection is not viable. However, the presence of radioresistant tumor cells limits its clinical effectiveness. Radioresistance is a key factor of treatment failure, prompting the development of various therapeutic strategies to overcome this challenge. With the rapid development of nanomedicine, nanoradiosensitizers provide a novel approach to enhancing the effectiveness of radiotherapy. In this review, we discuss the reasons behind GBM radio-resistance and the mechanisms of radiotherapy sensitization. Then we summarize the primary types of nanoradiosensitizers and recent progress in their application for the radiosensitization of GBM. Finally, we elucidate the factors influencing their practical implementation, along with the challenges and promising prospects associated with multifunctional nanoradiosensitizers.

Keywords: glioblastoma; nanoradiosensitizers; radiosensitization; radiotherapy; synergistic therapy.