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Vaccine-based cancer immunotherapy in newly diagnosed glioblastoma: a time-to-event meta-analysis of phase II and III randomized controlled trials

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Abstract

Background: Glioblastoma remains highly lethal despite current standards, driving interest in vaccine-based immunotherapy to improve survival. Given variability in outcomes and uncertainty regarding optimal vaccine platforms, we conducted a time-to-event meta-analysis.

Methods: We conducted a database search for head-to-head phase II and III trials published through July 9, 2025, that assessed vaccine-based cancer immunotherapy in adults with newly diagnosed glioblastoma. Pseudo-individual data were digitized and reconstructed with the IPDfromKM method from survival curves. Primary endpoints of this study were overall survival (OS) and progression-free survival (PFS). This study was registered with PROSPERO, CRD420251231284.

Results: Initial search yielded 1248 articles, of which 5 randomized trials (696 patients: 358 vaccine and 338 control) met inclusion. Mean age ranged from 56.6-61.6 years, and 53.7% of participants had a Karnofsky Performance Status ≥ 90. In the primary analysis, vaccination did not significantly reduce the risk of death (HR 0.95; 95%CI 0.81-1.13) or disease progression (HR 0.96; 95%CI 0.82-1.12). In subgroup analyses, patients who underwent gross total resection and received vaccinations had improved OS compared with similarly resected controls (HR 0.50; 95%CI 0.31-0.81), and dendritic cell vaccines were associated with a PFS advantage (HR 0.73; 95%CI 0.56-0.96).

Conclusion: In this study, vaccinations did not significantly improve survival in adult patients with newly diagnosed glioblastoma. Gross total resection, however, seems to be associated with OS benefit of vaccinations. There is a need for more head-to-head clinical trials to supplement the available evidence.

Keywords: Cancer vaccines; Glioblastoma; High-grade glioma; IDH wildtype; Immunotherapy.