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Regional and systemic complications following glioma resection: a systematic review and meta-analysis

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Abstract

Gliomas represent a heterogeneous group of primary brain tumors with variable biological behavior. High-grade variants, notably glioblastomas, exhibit aggressive growth and a poor prognosis. Although surgical resection is central to management, it may lead to systemic and regional postoperative complications that adversely affect outcomes. While neurological complications have been extensively studied, comprehensive analyses of non-neurological sequelae remain limited. This study aimed to estimate the pooled proportion of postoperative systemic and regional complications following glioma resection and to identify factors influencing these proportions. A systematic review and meta-analysis was conducted per PRISMA guidelines. PubMed, Web of Science, and Embase were searched for English-language articles published between January 2000 and November 2024 reporting postoperative complications in glioma resection patients. Pooled proportion were calculated using a random-effects model, and meta-regression assessed the impact of covariates including patient age, gender, publication date, geographical location, and sample size. Seventy-seven studies were included. The pooled proportions for postoperative complications were as follows: venous thromboembolism, 4.92% (95% CI: 1.51-10.05%); deep vein thrombosis, 4.75% (95% CI: 2.86-7.05%); urinary tract infection, 3.77% (95% CI: 0.81-8.47%); hydrocephalus, 2.53% (95% CI: 1.37-3.97%); pulmonary infection, 2.39% (95% CI: 1.15-3.99%); cerebrospinal fluid leak, 2.22% (95% CI: 0.99-3.87%); surgical site infection, 2.21% (95% CI: 1.48-3.07%); meningitis, 1.49% (95% CI: 0.47-2.96%); pulmonary embolism, 1.33% (95% CI: 0.74-2.06%); and sepsis, 1.12% (95% CI: 0.08-3.02%). Significant heterogeneity was observed across studies, with meta-regression revealing that geographical location, publication date, and patient age were significant moderators influencing certain complication rates. This meta-analysis demonstrates that, while systemic and regional complication rates following glioma resection are relatively low, they remain clinically significant. In particular, venous thromboembolism and deep vein thrombosis are notably prevalent. Moreover, significant heterogeneity-shaped by geography, publication date, and patient age-underscores the need for tailored perioperative strategies and further research.

Keywords: Clinical outcomes; Epidemiology; Neurosurgery; Patient management; Resection.