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Survival and neurological outcomes after stereotactic biopsy of diffuse intrinsic pontine glioma: a systematic review

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Abstract

Objective: Diffuse intrinsic pontine gliomas (DIPGs) are aggressive and malignant tumors of the brainstem. Stereotactic biopsy can obtain molecular and genetic information for diagnostic and potentially therapeutic purposes. However, there is no consensus on the safety of biopsy or effect on survival. The authors aimed to characterize neurological risk associated with and the effect of stereotactic biopsy on survival among patients with DIPGs.

Methods: A systematic review was performed in accordance with PRISMA guidelines to identify all studies examining pediatric patients with DIPG who underwent stereotactic biopsy. The search strategy was deployed in PubMed, Embase, and Scopus. The quality of studies was assessed using the Grading of Recommendations, Assessment, Development and Evaluation system, and risk of bias was evaluated with the Cochrane Risk of Bias in Nonrandomized Studies-of Interventions tool. Bibliographic, demographic, clinical, and outcome data were extracted from studies meeting inclusion criteria.

Results: Of 2634 resultant articles, 13 were included, representing 192 patients undergoing biopsy. The weighted mean age at diagnosis was 7.5 years (range 0.5-17 years). There was an overall neurosurgical complication rate of 13.02% (25/192). The most common neurosurgical complication was cranial nerve palsy (4.2%, 8/192), of which cranial nerve VII was the most common (37.5%, 3/8). The second most common complication was perioperative hemorrhage (3.6%, 7/192), followed by hemiparesis (2.1%, 4/192), speech disorders (1.6%, 3/192) such as dysarthria and dysphasia, and movement disorders (1.0%, 2/192). Hydrocephalus was less commonly reported (0.5%, 1/192), and there were no complications relating to wound infection/dehiscence (0%, 0/192) or CSF leak (0%, 0/192). No mortality was specifically attributed to biopsy. Diagnostic yield of biopsy revealed a weighted mean of 97.4% (range 91%-100%). Of the studies reporting survival data, 37.6% (32/85) of patients died within the study follow-up period (range 2 weeks-48 months). The mean overall survival in patients undergoing biopsy was 9.73 months (SD 0.68, median 10 months, range 6-13 months).

Conclusions: Children with DIPGs undergoing biopsy have mild to moderate rates of neurosurgical complications and no excessive morbidity. With reasonably acceptable surgical risk and high diagnostic yield, stereotactic biopsy of DIPGs can allow for characterization of patient-specific molecular and genetic features that may influence prognosis and the development of future therapeutic strategies.

Keywords: DIPG; brain tumor; diffuse intrinsic pontine glioma; neurosurgical oncology; pediatric; stereotactic biopsy.