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Stereotactic Radiosurgery for Ependymoma in Pediatric and Adult Patients: A Single-Institution Experience

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Abstract
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Kelly H. Yoo [1], Neelan J. Marianayagam [2], David J. Park [3], Aroosa Zamarud [4], Elaheh Shaghaghian [5], Xuejun Gu [6], Quoc-Anh Ho [7], Scott G. Soltys [8], Steven D. Chang [9]

1. Neurosurgery, Stanford University School of Medicine, Palo Alto, USA 2. Neurosurgery, Stanford University, Stanford, USA 3. Neurosurgery, Stanford University School of Medicine, Palo alto, USA 4. Neurosurgery, Stanford Health Care, Palo Alto, CA, USA 5. Neurosurgery, Stanford University, Palo Alto, USA 6. Radiation Oncology, Department of Radiation Oncology, Stanford University, Stanford, USA 7. Radiation Oncology, Stanford University Medical Center, Stanford, USA 8. Department of Radiation Oncology, Stanford University School of Medicine, Stanford, USA 9. Department of Neurosurgery, Stanford University School of Medicine, Stanford, USA

Corresponding author: Kelly H. Yoo, kellyyoo@stanford.edu

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Abstract

Objectives:

Ependymoma is a neoplasm commonly classified as WHO grade II with the anaplastic variant categorized as grade III. Despite standard treatments, incomplete resection or anaplastic features can lead to unfavorable prognostic outcomes. Stereotactic radiosurgery (SRS) offers a minimally invasive approach for recurrent ependymomas following surgery and radiation therapy. Our study aims to assess the efficacy and safety of CyberKnife radiosurgery in treatment of WHO grade II and III ependymomas in pediatric and adult populations.

Methods:

We conducted a retrospective analysis on 34 patients with 75 ependymomas who underwent CyberKnife SRS between 1998 and 2023. Among them, 14 were pediatric (aged 3-18 years), and 20 were adult (aged 19-75 years) patients. The median age was 21 years, and the median tumor volume was 0.64 cc. The median single-fraction equivalent dose (SFED) was 16.6 Gy, with SRS administered at 77% of the median isodose line.

Results:

Following median follow-up of 42.7 months (range: 3.8-438.3), 22.7% ependymomas progressed, 8% regressed, and 69.3% remained stable. The 5-year local tumor control (5-yrs-LTC) rate was 78.1%, with 59.6% for children and 90.2% for adults. For grade II ependymomas, 5-yrs-LTC rate was 85.9%, whereas it was 58.5% for grade III tumors. The 5-year overall survival (5-yrs-OS) rate was 73.6%, significantly higher in adult patients (94.7%) compared to children (41%). 5-yrs-OS rate was 100% for grade II patients, while it decreased to 35.9% for grade III patients. The 5-year progression-free survival (5-yrs-PFS) rate was 68.5%, higher in adults (78.3%) than children (49.2%). 5-yrs-PFS rate for grade II patients was 88.8%, whereas it declined to 32.6% for grade III patients. SRS improved tumor-associated symptoms in 85.3% patients. Adverse radiation effects occurred in 21.4% pediatric patients.

Conclusion(s):

Our study demonstrates compelling evidence for the efficacy of SRS as a treatment modality for pediatric and adult patients with WHO grade II and III ependymomas, despite challenges posed by lower LTC in pediatric cases and grade III tumors. The incorporation of SRS in ependymoma management shows promising potential in improving LTC and survival, particularly when combined alongside adjuvant chemotherapy or conventional EBRT. Careful patient selection, individualized treatment planning, and long-term follow-up are crucial for optimal outcomes. Accurate tumor grading and multidisciplinary approaches are advocated to advance personalized treatment strategies and SRS techniques in neurosurgery.