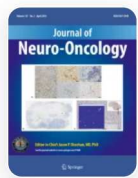



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Neoadjuvant gamma knife surgery for metastatic brain tumor: clinical use and impact on leptomeningeal seeding

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Abstract

Purpose

This study aimed to compare leptomeningeal seeding (LMS) incidence, local failure rates, and survival outcomes between neoadjuvant and adjuvant gamma knife surgery (GKS) in patients with brain metastases.

Methods

We retrospectively analyzed 120 patients treated at a single institution from 2008 to 2022. Overall survival (OS), progression-free survival (PFS), LMS occurrence, local failure, and key clinical prognostic variables were compared between the neoadjuvant and adjuvant GKS groups.



Results

Seventy patients received neoadjuvant GKS, while 50 received adjuvant GKS. Baseline differences in

primary tumor origin, preoperative Karnofsky Performance Score, and extracranial metastasis were statistically significant. No significant differences were observed in OS ($p = 0.21$), PFS ($p = 0.27$), radiation induced edema ($p = 0.219$) or local failure ($p = 0.19$) between groups. LMS incidence was significantly lower in the neoadjuvant group ($p = 0.043$), with this advantage maintained after propensity score matching ($p = 0.046$).

Conclusions

Neoadjuvant GKS yields survival and local failure outcomes comparable to adjuvant GKS, while significantly reducing the risk of LMS. These findings support the potential clinical advantage of neoadjuvant GKS in the management of brain metastases.

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Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Contributions

JY, I-H.J: Contributed to data collection, analysis, and interpretation. Drafted the initial version of the manuscript and was involved in manuscript review and editing.; WSC, HHJ, HHP: Assisted with data collection and analysis. Participated in manuscript drafting and critically revised the manuscript.; JHM, EHK, S-G.K: Provided supervision and contributed to the conceptualization and design of the study. Assisted with data interpretation and reviewed the manuscript for important intellectual content.; JHC: Led the conceptualization and design of the study. Provided overall supervision, secured funding, and critically reviewed the final manuscript.

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Ethics declarations

Ethical approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Institutional Review Board of Severance Hospital, Yonsei University College of Medicine (IRB 4-2023-0105). Patient information was anonymized and de-identified before the analysis.

Consent to participate

Consent from participants was waived due to the retrospective nature of the study.

Consent to publish

Consent to publish was waived as this was a retrospective study with all patients anonymized.

Competing interests

The authors declare no competing interests.

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