Fractionated SRT for brain metastases with large cumulative volume: data from a single institution 5-year cohort

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Introduction

3-5 fraction (fx) stereotactic radiotherapy (fSRT) is often used to treat intracranial metastases. Single fractions (SRS) remain widely used but typically exclude large target volumes or significantly reduce dose to reduce risk of severe radionecrosis (RN). Decision not to treat, or whole brain radiotherapy (WBRT) have low median overall survival[1] but are common triage pathways. Literature on survival and necrosis risk in high cumulative target volume fSRT is limited.

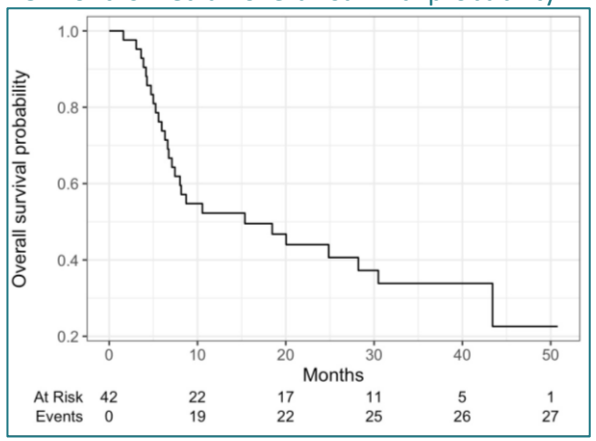
Clinical Series

A small intracranial metastases patient series treated by linac-based fSRT from 2020-2025 was reviewed as ongoing QA/QI of our intracranial stereotactic cohort. 55 patients, ECOG 0-2, cumulative PTV >20 cc. (max 91.5), were identified. 25 or 30 Gy in 5 fx (n=35), or 27 Gy in 3 fx (n=7) were used. Volumes include intact metastases and resection cavities. 13/55 were excluded for mixed prescriptions; disease extending extracranially; or insufficient follow-up (< 6m post-treatment, alive; no follow-up). 6/42 had previous intracranial RT.

Results

V20 (3fx) ranged from: 35.8- 97.4cc; and V24 (5fx): 25.4 - 218.5cc.

Survival analysis was from diagnosis date, as predicted survival and treatment decisions occur at this time point. All data is now analysed using R to most recent 3-month follow-up (April 2026). Kaplan-Meier plot (below), gave overall survival probability at 6-months 0.738, 1-yr 0.523; and 15-months median overall survival probability.



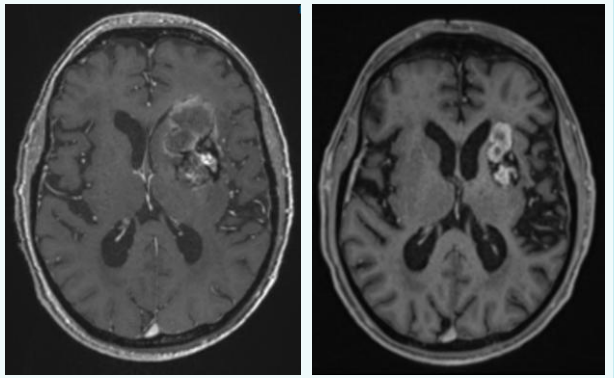
15/42 patients remain alive at April 2026 review, survival range 9.2 - 50.8 months (avg. 30.3). Data is preliminary with continued tracking intended; new patients added when follow-up sufficient; and systemic therapy data to be assessed.

15/42 patients had no metastatic intracranial disease progression/recurrence. 2/42 had one further intracranial treatment, then no further progression (ongoing survivals 18m; 4 yr).

14 of these 17 patients had long-term survival >20 months ([range:20.0 - 50.9], 11/12 still alive) with no significant long-term neurological symptoms developing post-treatment.

5 cases of symptomatic RN (sRN) were confirmed [*imaging* (2); *clinical* (1); *histology* (2)], 2/5 with prior RT. Time to sRN was 3-27 months. 5 more patients had possible sRN, with conclusive differentiation from progression not possible. One patient had progressive disease resection show progression + RN. Symptoms reduced, but cause (RN/progression) and success of non-surgery alternative treatment cannot be known.

sRN treatment was by corticosteroids (5), bevacizumab (2), surgery (1). Bevacizumab resolved symptoms radiologically and clinically; with rapid reduction of oedema (MR below).



Discussion

For this series, all patients exceeded ASTROs V20/24Gy<20cc guideline [2], however sRN incidence was low, affecting only 5/42 patients (12%), with effective treatment options available such as bevacizumab. Only 1/42 (2.4%) required surgery, making reported sRN rates similar to published rates.

HyTEC authors noted they had low data over 20cc in their model, which was used for the ASTRO recommendations [3]. Further publication of data from centres treating fSRT for large cumulative metastatic volumes could add to the literature and should be reported.

Conclusion

Large cumulative target volume fSRT did not lead to high sRN or low patient median overall survival. Carefully selected patients should be offered hypofractionated SRS, even when V20/24Gy exceeds 20cc. Close surveillance and prompt treatment for symptomatic radionecrosis is mandatory.

References

[1] Yri et al. *doi:10.1016/j.lanepe.2024.101181*
[2] Gondi et al. *doi:10.1016/j.prro.2022.02.003*
[3] Milano et al. *doi:10.1016/j.ijrobp.2020.08.013*