Cureus
Part of SPRINGER NATURE

Cureus

Comparative Outcomes of Standard Radiotherapy and 5-Fraction Adaptive Stereotactic Radiation Therapy in Newly Diagnosed Glioblastoma: A Propensity Score-Matched Analysis

Luiza G. Schmitt [1], Soummitra Anand [2], Michael Youssef [3], Nawal Shaikh [4], Toral R. Patel [5], Ankur Patel [6], Samuel Barnett [5], MinJae Lee [7], Jill B. De Vis [1], Xin Cai [1], Robert Timmerman [8], Tu Dan [9], Zabi Wardak [10], Michael Dohopolski [11]

1. Radiation Oncology, University of Texas Southwestern Medical Center, Dallas, USA 2. School of Medicine, University of Texas Southwestern Medical Center, Dallas, USA 3. Neuro-Oncology, University of Texas Southwestern Medical Center, Dallas, USA 4. Neurology and Neuro Oncology, Neuro Oncology Clinic, UT Southwestern Medical Center,at Cancer Care Outpatient Building 6202 Harry Hines Blvd. 7th Floor, Dallas, Texas 75235, USA 5. Neurosurgery, UT Southwestern, Dallas, USA 6. Neurosurgery, University of Texas Southwestern Medical Center, Dallas, USA 7. Biostatistics, University of Texas Southwestern Medical Center, Dallas, USA 8. Radiation Oncology, University of Texas Southwestern Medical Center, Dallas, TX, USA 9. Radiation Oncology, UT Southwestern, Dallas , USA 10. Radiation Oncology, UT Southwestern Medical Center, Dallas, USA 11. Department of Radiation Oncology, UT Southwestern Medical Center, Dallas, USA

Corresponding author: Michael Dohopolski, luiza.schmitt2019@gmail.com

Abstract

Purpose

Glioblastoma Multiforme (GBM) is the most common and aggressive primary brain tumor in adults, with poor survival despite treatment advancements. Focal stereotactic radiation therapy (FSRT) is an emerging adjuvant treatment for newly diagnosed GBM, traditionally delivered using static radiotherapy plans. Our approach utilizes adaptive FSRT with an MRI-linear accelerator (MRI-Linac) for patients eligible for conventional fractionation. We hypothesize that adaptive FSRT yields outcomes comparable to conventional fractionation, potentially reducing treatment burden for patients and families.

Methodology

We retrospectively reviewed 110 adults with newly diagnosed GBM treated at our institution (2018–2024). Inclusion criteria included age >18, confirmed GBM diagnosis, and completed treatment, excluding prior brain irradiation, other malignancies, or incomplete follow-up. Data on demographics, tumor characteristics, and treatment protocols were collected. Propensity-score matching (PSM) enhanced comparability between patients receiving 5-fraction adaptive FSRT, 15-fraction hypofractionation, and 30-fraction treatments, based on age, tumor volume, performance status, resection type, MGMT, and IDH status, using one-to-one nearest neighbor matching with a 0.1 caliper. Fisher's exact test and Mann-Whitney U test compared categorical and continuous variables. Competing risk regression analyzed local control and grade 3+ toxicity (cerebral edema, blood toxicity), with Gray's test for significance. Cox proportional hazards models evaluated time to local failure and grade 3+ vasogenic edema. Kaplan-Meier curves with log-rank tests compared OS and PFS. Analyses used SPSS 28.0.0.0 and R 4.3.3.

Results

After PSM, 17 pairs were matched for 5 vs. 30 fractions, and 14 pairs for 5 vs. 15 fractions. Median OS was 21.1 vs. 18.2 months (5 vs. 15 fractions, p=0.77) and 11.7 vs. 14.6 months (5 vs. 30 fractions, p=0.5). Median PFS was 9.0 vs. 7.9 months (5 vs. 15 fractions, p=0.89) and 8.9 vs. 9.7 months (5 vs. 30 fractions, p=0.97). Local failure and grade 3 toxicity rates were similar across groups. MGMT unmethylated status, higher ECOG scores, and age 60 were associated with worse PFS and OS. Median travel distances was lower in the 5-fraction group, with a median of 220 miles compared to 877.5 (15 fractions) and 1,638 miles (30 fractions). Adaptive RT allowed for real-time tumor monitoring but volumetric changes did not correlate with clinical outcomes.

Conclusions

For newly diagnosed GBM patients, 5-fraction therapy with MR-LINAC emerges as a promising alternative,

demonstrating similar survival outcomes compared to traditional 15- and 30-fraction treatments, with potential benefits in reducing treatment burden even in younger patients. Prospective studies are warranted to validate these findings and advance the understanding of FSRT in the management of newly diagnosed GBM in patients who traditionally would be eligible for conventional fractionation only.

2025 Schmitt et al. Cureus 17(3): a1532.

Page 2 of 2