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Original Research

Tumor treating fields utilization and efficacy for glioblastoma at a large multicenter academic practice

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Abstract

Purpose

Despite Tumor Treating Fields (TTF) being included in NCCN guidelines as standard treatment for GBM after improving overall survival in a prospective randomized trial, adoption has been limited. We sought to describe utilization, validate the efficacy, and compare patterns of failure after TTF for GBM patients in a real-world dataset.

Methods

We identified patients with newly diagnosed GBM between 2014–2023 who received standard fractionation external beam radiotherapy (EBRT). Data collected included extent of resection, radiotherapy dose fractionation and modality, utilization of tumor treating fields, and presence and location of progression based on radiographic findings. Kaplan-Meier (KM) curves were generated for progression-free and overall survival. Patient/disease characteristics in relation to TTF utilization were evaluated between the two groups.

Results

Three-hundred and ninety-three (393) patients were included in this study. 74 patients were treated with TTF (18.8%). The adoption of TTF utilization increased in 2019 by 10%. The rate of TTF utilization was approximately 20% from 2019 to 2023. 2-year OS was improved with the addition of TTF after EBRT (58% versus 41%, $p<0.006$). On multivariable adjustment, TTF use remained associated with improved OS ($p=0.038$). There was a trend towards increased marginal failures and decreased in-field failures with the addition of TTF ($p=0.099$).

Conclusion

Widespread adoption of TTF in the treatment of GBM has been generally met with hesitation with less than one-fourth of modern patients receiving TTF. TTF was associated with improved OS, consistent with previously published prospective clinical trial results. Our results also suggest there may be an interplay between TTF and EBRT, affecting pattern of failure, with decreased rates of in-field failure among the TTF group.

Introduction

Glioblastoma (GBM) is the most common primary brain tumor in adults, with inevitable recurrence despite trimodality therapy [1]. Standard-of-care (SOC) consists of maximal safe resection followed by chemoradiation which historically resulted in a median overall survival of approximately 15 months [2]. Tumor treating fields (TTF) improved progression-free survival (7.1 versus 4.0 months) and overall survival (20.9 months versus 16.0 months) in a phase III clinical trial [3]. Further analysis found that compliance with therapy above 75% correlated with improved overall survival (OS) [4]. These publications led to National Comprehensive Cancer Network (NCCN) guidelines including TTF as SOC for first-line treatment of GBM [5].

Despite evidence in support of TTF there remains hesitation within the oncology community to accept this new treatment modality due to generalizability of the study data, patient quality of life, and poorly understood mechanism of action of this therapy [6]. For example, a German

study demonstrated only 30% of patients diagnosed with GBM were ever informed about TTF [7]. A United States survey of physician practice patterns demonstrated that 31% of the oncology practices had no TTF-certified physician [8].

Given the skepticism regarding the generalizability, mechanism, adoption, and effectiveness of TTF, many single institutional retrospective studies have been published [[9], [10], [11], [12], [13], [14], [15], [16]]. A *meta*-analysis looking at 9 comparative and single-cohort studies suggest that overall survival may be improved with addition of TTF to SOC versus SOC alone. In the same study, among real-world post-approval studies, the pooled median OS was 22.6months (95% CI 17.6–41.2) with TTF, and 17.4months (95% CI 14.4–21.6) without TTF [17].

In the current study, we sought to modernize this body of literature by studying the utilization rate and efficacy of TTF in the treatment of GBM at our large cancer center with multiple TTF-certified physicians. Additionally, we sought to further analyze patient factors influencing TTF utilization, including socioeconomic status. Finally, we aimed to understand the impact of TTF on the natural history and patterns of failure of GBM.

Section snippets

Methods

After institutional review board approval, records of patients with GBM (defined by World Health Organization [WHO] criteria at the time of diagnosis) who subsequently underwent external beam radiotherapy (EBRT) were collected data retrospectively over 10years (2014–2024) from a cohort of patients obtained through searching through diagnosis codes [18]. Initially all patients with broad criteria were included. However to minimize patient heterogeneity, patients were only included if they were …

Patient demographics

Three-hundred and ninety-three (393) patients were included in this retrospective study (Table 1). The median follow-up interval of patients in this study was 2.2years (95% CI 2.0–2.3years). Median age was 63.0years. 62.1% were male, and 37.9% were female. 86.2% of patients were ECOG 0–1, and 13.7% were ECOG 2–4. 99.5% of patients underwent surgical resection with extent of resection classified as 51.1% GTR, 27.5% STR, and 21.4% biopsy alone. 100% were Grade IV, and 93.9% were …

Discussion

These results demonstrate that in a real-world dataset of patients with GBM, only 15–20% of patients were treated with TTF with modestly increasing utilization since 2019. Younger patients were more likely to be treated with TTF, but there were no other predictors of TTF utilization. In

this cohort, there was a trend towards improved PFS with the addition of TTF after EBRT but this was not statistically significant (median 9.7 months versus 8.1 months) and OS was significantly improved with …

Conclusion

Our results demonstrate that in a real-world dataset of patients with GBM, approximately 20% were treated with TTF with increasing utilization over time. The previously published benefit to OS persisted in this cohort. This data also suggests there may be a shift from local to marginal progression in patients treated with TTF. …

CRediT authorship contribution statement

David Crompton: Writing – review & editing, Writing – original draft, Validation, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Shelby Kern:** Data curation. **Aaron Bogan:** Validation, Software, Methodology, Formal analysis, Data curation. **Bobby Do:** Data curation. **Sujay Vora:** Writing – review & editing, Validation, Supervision, Conceptualization. **Alfredo Quinones-Hinojosa:** Writing – review & editing, Supervision, Investigation, Formal analysis, …

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. …

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