Relationship Between Craniotomy and Survival for Primary Central Nervous System Lymphoma in NCDB-PUF, SEER and an Institutional Database.

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Purpose

Cytoreductive surgery is considered controversial and high-risk for primary central nervous system lymphoma (PCNSL). We investigated survival following craniotomy or biopsy for PCNSL in three complementary datasets.

Background

Surgery for cytoreduction is not considered standard for PCNSL, though it is occasionally performed for symptomatic relief of severe mass effect or if the lesion mimics other pathology on imaging studies. This treatment paradigm contrasts with the management of other intra-axial tumors including brain metastases and diffusely infiltrative gliomas, where surgery is thought to contribute to oncologic control and is associated with a survival advantage (1).

Many of the studies that contribute to the current treatment paradigm were conducted prior to the modern neurosurgical era, before the standardization of high-dose systemic methotrexate, and all had relatively small sample sizes (2, 3). Several technological advancements such as fluorescent tumor visualization techniques, magnetic resonance imaging, neuro-navigation, and intraoperative monitoring have contibuted to improved outcomes for intra-axial neurosurgery. Thus, the evaluation of the therapeutic benefit of cytoreductive surgery warrants further analysis in this context.

Conclusions

Craniotomy is associated with increased survival over biopsy for PCNSL in three retrospective datasets. Prospective studies are necessary to adequately evaluate this relationship. Such studies should focus on patients most likely to benefit from cytoreductive surgry, i.e. those with favorable RC and RPA.

Methods

We queried three retrospective datasets: the National Cancer Database (NCDB, n=8,936), Surveillance, Epidemiology, and End Results (SEER, n=5,615) database, and an Institutional Series (IS, n=132) to investigate the relationship between craniotomy and survival for patients with PCNSL.

We stratified patients based on the Memorial Sloan Kettering Recursive Partitioning Analysis (RPA) classes for PCNSL (4) and evaluated survival following craniotomy or biopsy after this stratification.

We also evaluated survival following craniotomy vs. biopsy for patients stratified by a novel Risk Category (RC), which was designed to incorporate operative selection factors. This RC uses the Modified Frailty Index, and adds one point each for age > 55, single vs. multiple lesions, and superficial vs. deep location.

Patients were grouped into low-RC (0-3) and high-RC (4-9) groups.

Statistical analysis was performed using STATA 14. Tests with two-tailed $p < 0.05$ were considered statistically significant.

Results

In NCDB, craniotomy was associated with increased median survival over biopsy (19.5 vs. 11.0 months), independent of subsequent radiation and chemotherapy (HR 0.83, $p<0.001$). We found a similar trend with survival for craniotomy vs. biopsy in the IS (HR 0.68, $p=0.15$). In SEER, gross total resection (GTR) was associated with increased median survival over biopsy (29 vs. 10 months, HR 0.68, $p<0.001$) (Figure 1).

Results (Continued)

The survival benefit associated with craniotomy was greater within RPA class 1 group in NCDB (95.1 vs. 29.1 months, HR 0.66, $p<0.001$), but was smaller for RPA 2-3 (14.9 vs. 10.0 months, HR 0.86, $p<0.001$) (Figure 2).

A surgical risk category (RC) considering lesion location and number, age, and frailty was developed. Craniotomy was associated with increased survival vs. biopsy for patients with low-RC (133.4 vs. 41.0 months, HR 0.33, $p=0.01$) but not high-RC n the IS (Figure 3).

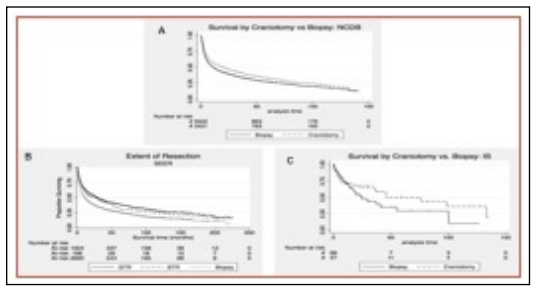

Figure 1: Kaplan-Meier plots comparing survival for biopsy vs. craniotomy in PCNSL patients in the NCDB (A), SEER database (B), and Institutional Series (C). GTR = gross total resection, STR = subtotal resection. Analysis time is in months.

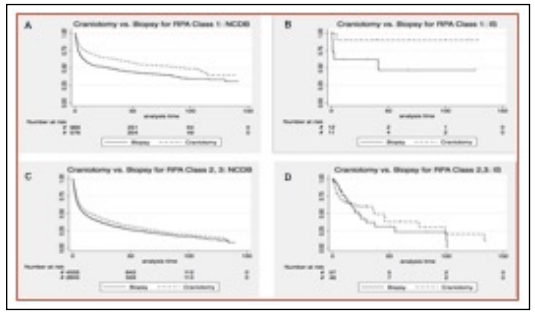

Figure 2: Kaplan-Meier plots comparing survival for biopsy vs. craniotomy in PCNSL patients for RPA class 1 in the NCDB (A) and IS (B). K-M plot comparing survival with craniotomy vs. biopsy for RPA class 2 and 3 patients in the NCDB (C) and IS (D). Analysis time is in months.

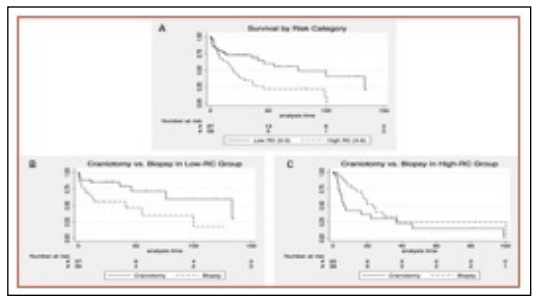

Figure 3: Kaplan-Meier plots comparing survival for biopsy vs. craniotomy in PCNSL patients stratified by risk category. (A) RC stratification of low-RC (score 0-3) vs. high-RC (score 4-9). (B) K-M plot comparing survival with craniotomy vs. biopsy for low-RC patients and (C) high-RC patients.

References

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