Risk of Tract Recurrence with Stereotactic Biopsy of Brain Metastases: an 18-year Cancer Center Experience

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Objective

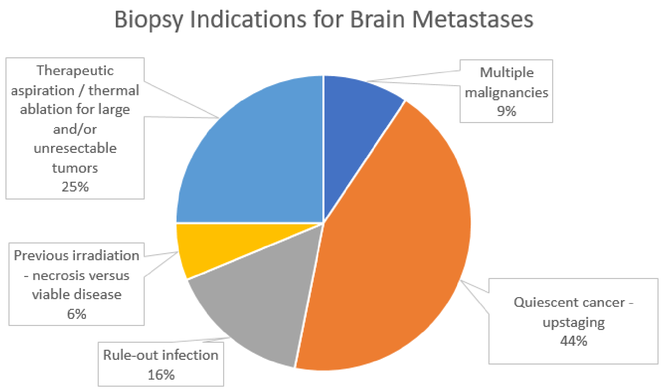
Stereotactic biopsy is increasingly performed on brain metastases (BrM) as improving cancer outcomes drive aggressive multimodality treatment including laser interstitial thermal therapy, however the risk of tract recurrence is poorly defined in an era defined by focused-irradiation paradigms. As such, the tract recurrence rate was evaluated.

Methods

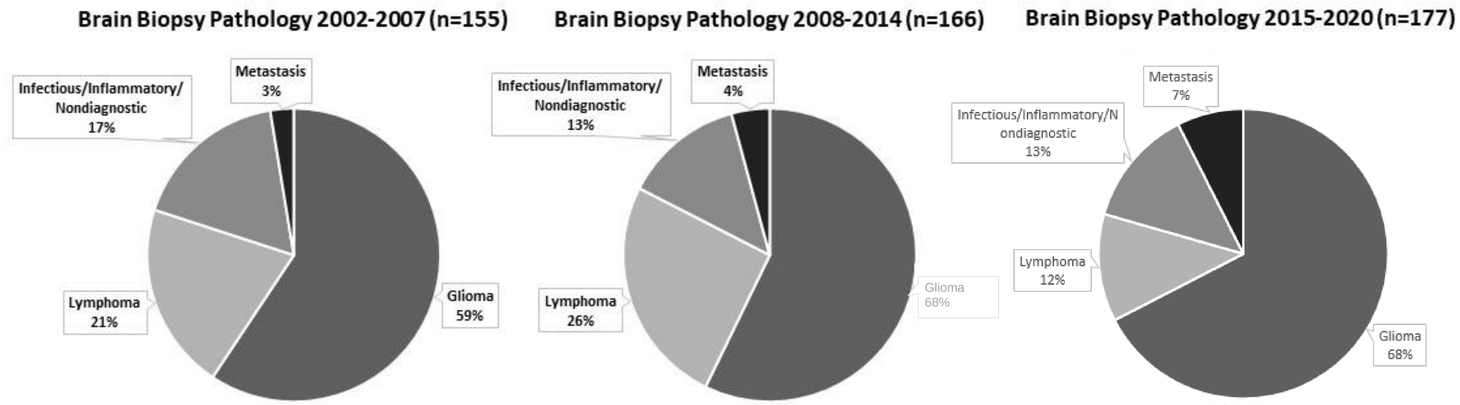
A single-center retrospective review identified stereotactic BrM biopsies performed from 2002-2020. Data including surgical indications, histology, radiographic characteristics, stereotactic planning, dosimetry, pre- and post-operative CNS-directed and systemic treatments, and clinical courses were collected. Recurrence was evaluated using RANO-BM criteria.

Results

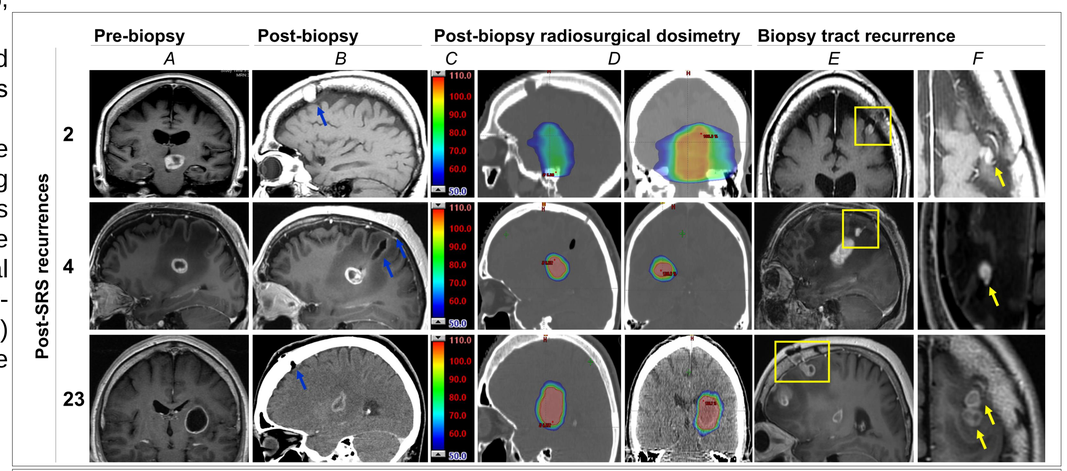
- 498 patients underwent stereotactic intracranial biopsy for any diagnosis including 80% for glioma or CNS lymphoma.
- 24 (4.8%) were for pathologically-confirmed viable BrM, of which 80.8% (21/24) underwent postoperative stereotactic radiotherapy (15/21, 71%; SRS), or whole-brain irradiation (6/21, 29%; WBRT).
- The proportion of biopsies performed for brain metastases increased from 2.6% in 2002-7 to 4.2% in 2008-14 to 7.3% in 2015-2020 (Fisher's exact test for earliest to latest time period, p=0.04).
- 11 patients had >/=3 months radiographic follow-up (median 11.9; range 4.5-30.6), of which five (45%) developed discontinuous recurrence along the biopsy tract and outside the radiation field at a median 6.4 months (2.3-17.1) post-biopsy. Of these, 2 previously-irradiated BrM were sampled for diagnostic ambiguity and underwent laser interstitial thermal therapy (LITT) intraoperatively post-biopsy. The remaining, previously-untreated BrM were treated with SRS+/-LITT (n=2 and 1, respectively) post-biopsy. Biopsy tracts were not included in any post-operative radiation treatment plans.
- Tract recurrences were treated with resection, re-irradiation, or observation/systemic therapy.



Biopsy indications for pathologically-confirmed viable brain metastases, 2002-2020 (n=24/498).



Pathologically-proven viable brain metastases represent an increasing proportion of all diagnoses evaluated with stereotactic biopsy at MSKCC over time. 2.6% in 2002-2007, 4.2% in 2008-2014, and 7.3% in 2015-2020.



Radiographic highlights of the five biopsy tract recurrences. Each row reflects a different patient organized by whether tract failure was post-SRS (patients 2, 4, 23) or post-salvage LITT (patients 3, 7). Columns A and G reflect representative pre-biopsy contrast enhanced T1 MRI. Columns B and H show representative MR or CT post-biopsy imaging with blue arrows highlighting either the Burr hole or stereotactic biopsy tracts. Column C shows a color wash legend of the relative radiation dose delivered to the metastases as a percentage of the prescribed dose (i.e., 90% is 90% of the prescribed radiotherapy dose). Columns D show the dosimetry distributions in the sagittal and coronal planes. Of note, the tract failures all subsequently developed outside of the high dose radiation volume. Columns I are representative intraoperative MRI from the LITT sessions with the red dotted line approximating the treatment tracts. Columns E and J show the biopsy tract recurrences on T1 post contrast MRI with the yellow boxes focused on the area of recurrence. Columns F and K show the tract recurrence enlarged in the axial plane denoted by yellow arrows.

Conclusions

In this largest reported series, we identify a nontrivial and higher-than-previously-described rate of stereotactic BrM-biopsy tract recurrence. As BrM are commonly treated with SBRT centered on enhancing tumor margins, consideration should be made to include biopsy tracts where feasible.

Acknowledgements

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