Investigating the Anatomical Distribution of Spinal Metastases within the Vertebral Body in Patients Receiving Radiotherapy

Jason Kessler BS, Jonah Yousif BS, Marissa Guo BS, Kristen Kolberg BS, Joseph Linzey BA, Eleanor Smith BS, Brandon Smith MD, Alexandra Calinescu MD/PhD, Daniel Spratt MD, Gregory A. Clines MD/PhD, and Nicholas J Szerlip MD/FACS

Poster: 42037
DISCLOSURES

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INTRODUCTION

• Nearly 300,000 patients in the US currently have osseous metastatic disease with the spine being the most common site affected.

• Seed and Soil Hypothesis: Colonization and spread of malignant cells are determined by their ability to migrate to different tissues of the body (“seed”) and by their interactions with the local microenvironment (“soil”).

Cancer cells (Seeds)  Tumor microenvironment (Soil)
HYPOTHESIS

• Previous findings in our spine oncology research lab have shown that releasable factors from the dura mater directly impacts tumor growth and invasion.

• Furthermore, we believe that the dura mater creates a local microenvironment that may be beneficial for tumor growth.

• As a result, we hypothesize that if the dura is heavily involved, there may be an anatomical predilection for tumors to be closer to the dura in the posterior aspect of the vertebral body.
METHODS

• We performed a retrospective study of 89 patients with metastatic spine cancer before they received stereotactic body radiation therapy (SBRT) at the University of Michigan from 2015 - 2017.

• We then identified the anatomical location and distribution of lesions within the vertebral body using axial and sagittal MRI scans.
Spinal metastases predominantly localized to the posterior aspect of the vertebral body.

Total Number: 203
P-value: <0.0001
Lesions predominantly localized to the posterior vertebral body within the thoracic and lumbar spine.

Distribution of Lesions by Spinal Level

- **Cervical**
  - Total Number: 27
  - P-value: 0.2444
- **Thoracic**
  - Total Number: 96
  - P-value: <0.0001
- **Lumbar**
  - Total Number: 61
  - P-value: 0.0017

Legend: Anterior, Anterior + Middle, Middle, Posterior + Middle, Posterior
This posterior predominance was consistent for the five most common primary tumor histologies observed.
DISCUSSION

• Szerlip et al. (2017) demonstrated that within the spine, releasable factors from the dura, a tissue lying directly in contact with the posterior aspect of the vertebral body, caused various cancer histologies to increase in proliferation and invasion.

• In addition, they showed that dural fibroblasts expressed an enriched molecular signature for secreted factors involved in metastatic pathways.

• This supports our hypothesis that there is an anatomical predilection for growth of spinal metastases. This may be due to alterations in the local microenvironment caused by tissues such as the dura.
SUMMARY POINTS

• There is an increased tendency for metastatic spinal lesions to localize within the posterior third of the vertebral body.

• This distribution is consistent across the thoracic and lumbar spinal levels and across the most common primary tumor histologies.

• It is possible that within the posterior vertebral body, the adjacent dura mater produces a favorable milieu for the invasion and proliferation of metastases.

• Future studies are necessary to investigate changes within the local microenvironment across the vertebral body that can contribute to this tendency for permissive growth of metastases posteriorly.