

MAPPING THE DISTRIBUTION OF MELANOMA BRAIN METASTASES

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Background

Malignant melanoma is among the most common causes of brain metastases, characterized by a tendency for multiple lesions. A comprehensive understanding of the anatomical distribution of melanoma brain metastases can facilitate diagnostic efforts, particularly in cases where the primary tumor is unknown, and can inform targeted treatment strategies. The objective of this study was to evaluate the spatial patterns of melanoma brain metastases and to assess their preferred localization within the brain.

Methods

This study examined a 13 patients who presented with suspected brain metastases and a history of malignant melanoma. All patients underwent surgical resection for the purpose of histopathological examination and to alleviate neurological symptoms resulting from the metastasis's mass effect. To assess the distribution of brain metastasis, all lesions were manually segmented on post-contrast T1-weighted magnetic resonance imaging (MRI) image sets. Subsequent to this, all MRI data sets underwent co-registration to a standard brain template using SPM. This process enabled the creation of cumulative spatial probability distribution maps, facilitating an analysis of the frequency and location of metastases.

Results

A total of 84 metastases were identified, with a mean of 6.38 ± 13.25 (median: 3, minimum: 1, maximum: 50) metastases per patient. Of these, 39 metastases were located in the left and 45 in the right hemisphere. The majority of lesions was localized in the frontal (47.62 %) and parietal (27.38 %) lobe, in 11.90 % of cases metastasis were identified in the temporal lobe, and in 5.95 % in the occipital lobe. Within the cerebellum, 7.14 % of all lesions were located.

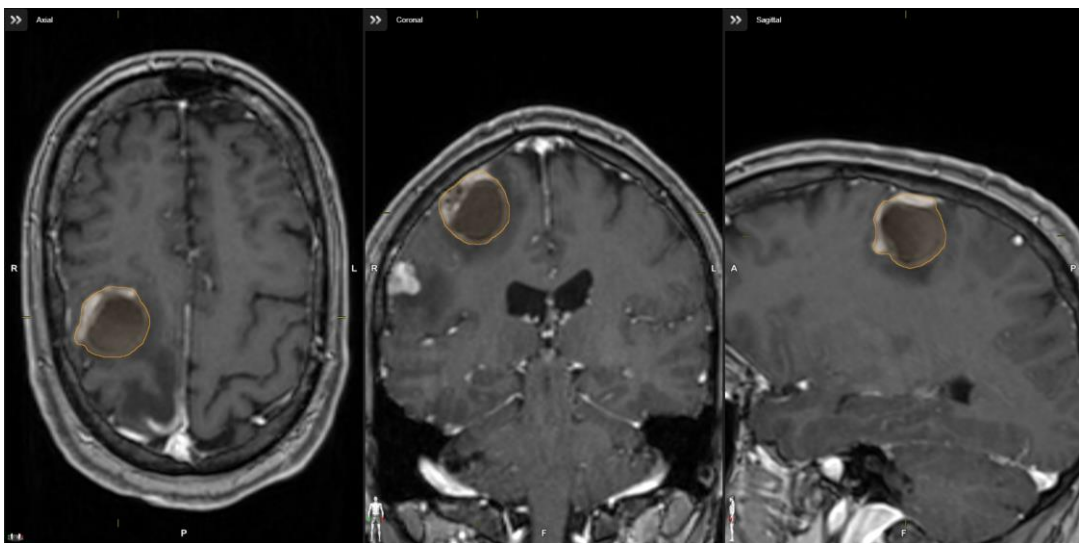


Figure 1. Manual segmentation of the lesion based on T1-weighted contrast enhanced MR imaging in axial (left), coronar (center) and sagittal view (right).

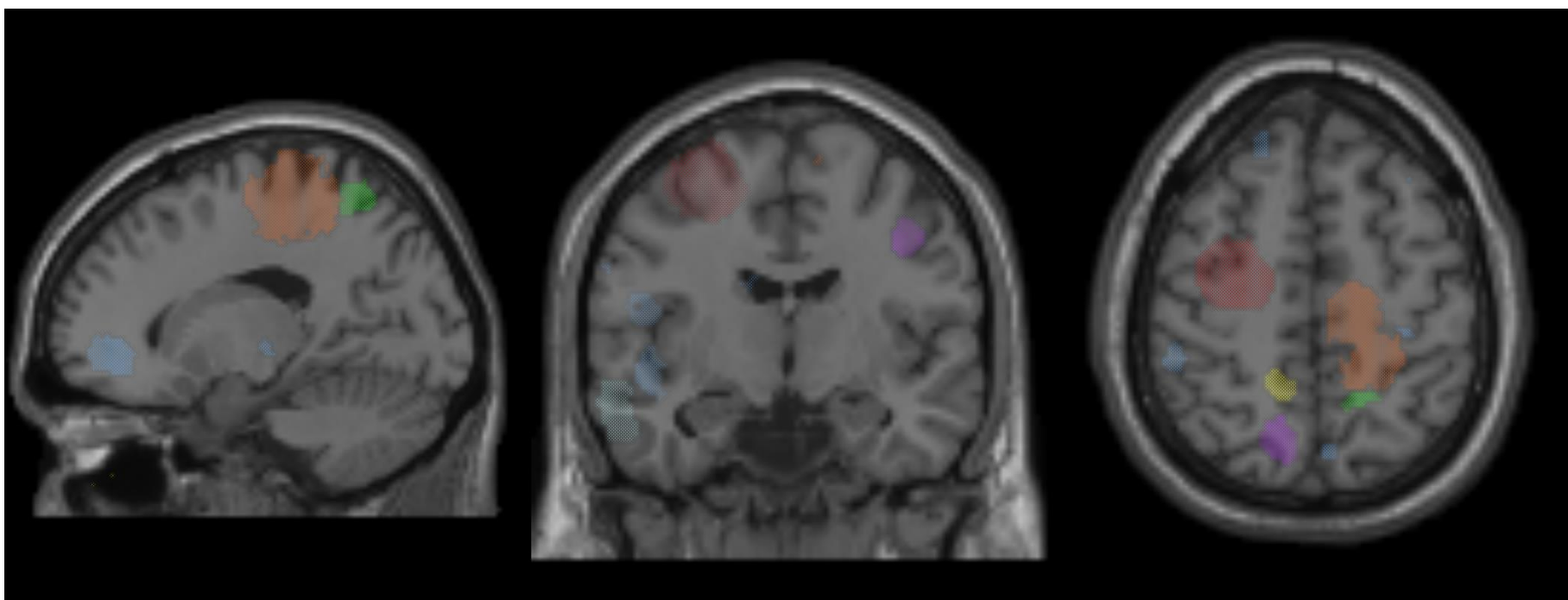


Figure 2. Visualization of metastases distribution after normalization of all patient data sets with color encoding of metastases according to the individual patients.

Conclusions

The spatial distribution of brain metastases from melanoma exhibited a distinct pattern, with a predilection for the frontal and parietal lobe. These patterns may reflect underlying biological mechanisms of metastasis formation and have potential implications for diagnosis and individualized treatment planning, especially in imaging-based prediction of primary tumor origin.