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Pituitary Volume Measurements in Malignant Multiple Sclerosis
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Introduction

- **Objective**: To investigate a possible relationship between pituitary volume and Cerebrospinal Fluid (CSF) as well as Brain Parenchymal Fraction (BPF) in a cohort of patients with malignant multiple sclerosis.
- Pituitary volume can be measured as the ratio of pituitary to sella turcica volume on an MRI mid-sagittal plane. Low pituitary volume has been associated with hyperprolactinemia (De Marinis 2005).
- Recent findings suggest that certain sub-groups of patients with MS are in a hyperprolactinemic state (Moshirzadeh et al., 2012).
- Prolactin has been shown to accelerate autoimmune disease expression. Thus, increased release of prolactin in hyperprolactinemia may increase immune sensitivity (McMurray 2001).
- Since hyperprolactinemia, which often occurs with low pituitary volume, has been associated with multiple sclerosis, we hypothesized that low pituitary volume would correlate with measures of brain atrophy, such as CSF volume and BPF.

Methods

- Subjects were enrolled in CLIMB (Comprehensive Longitudinal Investigation of Multiple Sclerosis at the Brigham & Women’s Hospital) at Partners MS Center and were categorized as having a “malignant” course of the disease (Gholipour et al., 2012).
- Inclusion Criteria were having MPRIAGE images and malignant MS. 18 subject satisfied the inclusion criteria. Their demographic information is presented in Table 1.
- Manual tracing was performed using Slicer 3 software manual segmentation tool on the mid-sagittal MPRIAGE slice and was cross-checked in axial and coronal view.
- Pituitary and sella turcica volumes were each segmented twice by the same rater and the average of each measurement was used to calculate a pituitary-to-sella turcica volume ratio. A ratio of less than 0.5 is considered to be a flattened pituitary, and therefore increased risk of hyperprolactinemia (De Marinis 2005), while a ratio of more than 0.5 is considered to represent a pituitary of normal size (De Marinis 2005).
- Bivariate correlations utilizing pituitary-to-sella turcica ratio and CSF or BPF were conducted with SPSS.

Results

<table>
<thead>
<tr>
<th>Number of Subjects</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>12 (67%)</td>
</tr>
<tr>
<td>Male</td>
<td>6 (33%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>17 (94%)</td>
</tr>
<tr>
<td>African American</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>Age of Onset</td>
<td>Mean 49.5 (SD 12.1, Range 25-60)</td>
</tr>
<tr>
<td>Age at MRI</td>
<td>Mean 49.5 (SD 12.1, Range 33-77)</td>
</tr>
<tr>
<td>Disease Duration</td>
<td>Mean 8.4 (SD 2.2, Range 4-12)</td>
</tr>
</tbody>
</table>

Table 1. Subjects demographic characteristics reflecting characteristics of the malignant population, such as older age of onset

![Figure 1. Outline of a partially empty sella on patient #8](image)

Cerebrospinal Fluid Volume vs. Pituitary/Sella Turcica Volume Ratio

We observed a significant positive correlation between pituitary-to-sella turcica ratio and CSF volume, \( r = 0.605, p = 0.008 \)
Mean pituitary/sella turcica ratio: 0.59 ± 0.15
Mean CSF volume: 278 mm³ ± 86

![Graph of Cerebrospinal Fluid Volume vs. Pituitary/Sella Turcica Volume Ratio](image)

Discussion

- Our results indicate that pituitary volume is significantly positively correlated with CSF and nearly significantly negatively correlated with BPF. These two relationships contradict our hypothesis that increased CSF volume, and thus accelerated brain atrophy will will directly responsible for flattening of the pituitary.
- Pituitary volume may relate more to neuroendocrine dysfunction than brain atrophy.
- One limitation of our study was the small sample size, which precluded subjects into groups with partially empty sella (ratio and normal pituitary volume (ratio >0.5) and investigating the characteristics of each of these groups.
- Although the results contradicted our initial hypothesis, their sign warrants further investigation on the influence of pituitary in multi sclerosis. Future studies should include larger samples and compare subgroups of MS and healthy controls.

References