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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 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.

Number of Subjects	18	
Gender	Female = 12 (67%)	Male = 6 (33%)
Race	White = 17 (94%)	African American = 1 (6%)
Age of Onset	Mean 41.5 (SD 12.3, Range 25-69)	
Age at MRI	Mean 49.5 (SD 12.1, Range 33-77)	
Disease Duration	Mean 8.4 (SD 2.2, Range 4-12)	

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

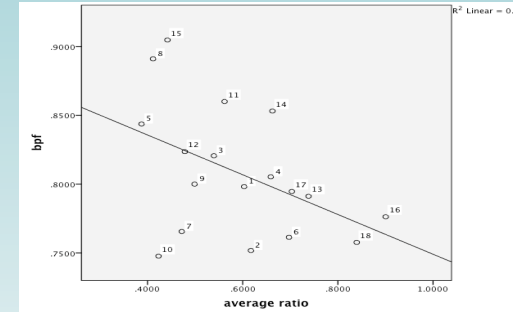


Figure 1. Outline of a partially empty sella on patient #8

Brain Parenchymal Fraction vs. Pituitary/Sella Turcica V Ratio

We also observed a nearly significant correlation between BPF and pituitary-to-sella turcica ratio, $r = -0.457$, $p = 0.057$.

Mean BPF: 0.808 ± 0.047



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 MPRAGE 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 MPRAGE 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 represent 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 a normal size (De Marinis 2005).
- Bivariate correlations utilizing pituitary-to-sella turcica ratio and CSF or BPF were conducted with SPSS.

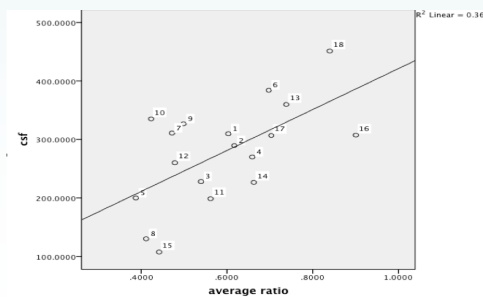
Results

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: $278 \text{ mm}^3 \pm 86$



Discussion

- Our results indicate that pituitary volume is significantly positive 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 directly result in 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 prevented us from dividing subjects into groups with partially empty sella (ratio and normal pituitary volume (ratio of >0.5) and investigating the characteristics of each of these groups
- Although the results contradicted our initial hypothesis, they still warrant further investigation on the influence of pituitary in multiple sclerosis. Future studies should include larger samples and compare subgroups of MS and healthy controls

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