Alterations of Visual Functional Network after Chiasmatic Compression in Pituitary Adenoma Patients

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Introduction

- Pituitary adenomas (PAs): 10% to 25% of all intracranial neoplasms, prevalence rate is approximately 17%.

- Patients suffer from visual impairment due to chiasmatic compression.

- Structural damage to optic nerve fiber have been revealed to be responsible for vision loss.

- This study analyzed the primary visual resting-state network using both independent component analysis (ICA) and seed based analysis (SBA).

- The authors hypothesized that structural deformation due to tumor compression could lead to functional compensation of visual networks.
Materials and Methods

- **PA group**: 25 macroadenomas patients with visual impairment (scanned within 1 week before surgery).
- **HC group**: 19 age and gender matched normal controls (scanned on the day of enrollment).
- **MRI Scanner**: Siemens Prisma 3.0T
- **Quality control**: data quality was controlled by using visual inspection and SPM toolbox.
- **ICA analysis**: performed using GIFT toolbox (v3.0b). [https://trendscenter.org/software/gift/](https://trendscenter.org/software/gift/). The primary visual network was selected.
- **ROI-wise SBA analysis**: performed using restplus toolbox (v1.2). 6 pairs of ROIs related to visual function were selected according to previous research. [http://findlab.stanford.edu/functional ROIs.html](http://findlab.stanford.edu/functional ROIs.html)
- **Statistics**: group t-test and FDR correction was applied in both ICA and SBA analysis.
Results

ICA analysis
20 components were estimated for each group.

- **Figure A** group network t-map for HC group.
- **Figure B** group network t-map for PA group.
- **Figure C** significant differences between groups.

- PA GROUP showed enhanced functional connectivity in Middle Occipital Gyrus (MOG) and Brodmann 18 area while reduced functional connectivity in Superior Occipital Gyrus (SOG) and Brodmann 19 area (p<0.05), in comparison with controls.
ROI-wise SBA analysis

Functional Connectivity (FC) calculated between ROIs was used to form the FC matrix.

- **Figure D** showed the selected ROIs. **Figure E** showed Significant ROI-wise FC differences between groups. Node size demonstrated the voxel size of ROIs, line thickness demonstrated the significance of p-values.
F) Significant functional connectivity increase in PA group

Figure F  PA group showed increased functional connectivity between primary visual (PV) and left MT, PV and right EV, left MT and both left and right LIP region.
Discussion

• Due to loss of visual acuity and visual field, functions of dorsal stream pathway, which is in charge of motion, representation of object locations, and control of the eyes and arms, were affected. This leads to the reduction of functional connectivity.

• Functional connectivity of ventral stream pathway area increased, which potentially enhances functions for recognition, object representation, and storage of long-term memory.

• This study needs further investigation in larger sample size to test visual functions at higher level.
Summary Points

- When the optic chiasm is compressed by pituitary adenoma, the functional connectivity of primary visual network altered. This suggests a compensatory mechanism under pathological condition.
References


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