Effects of electroconvulsive therapy on white matter integrity
- a diffusion tension imaging study

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Introduction

Reduced fractional anisotropy (FA) in white matter in depressed subjects compared to healthy controls have repeatedly been shown, but little is known about possible individual dynamic changes in white matter integrity during recovery from a depressed state.

Objective

The most effective treatment in severe depression is electroconvulsive therapy (ECT). In a longitudinal study by Nobuhara et al 2004, a significant increase in FA values in frontal white matter was found in 8 patients with late-life depression after ECT. Another study by Szabo et al 2009, showed no changes with diffusion weighted imaging in 10 patients treated with ECT. The purpose of this study was to evaluate if the regional white matter fractional anisotropy (FA) changes in patients recovering from depression treated with ECT.

Method

MRI data and clinical ratings were acquired from 14 consecutively recruited inpatients with a depressive episode referred for ECT. Clinical ratings and MRI were performed within a week before ECT and within two weeks after ECT. DTI was performed with a 3T scanner with spin echo EPI in 12 directions, b=0, 300, 1000 (5 averages b=1000), TR 5.4 s, TE 131 ms, slice thickness 5mm, FOV=256, matrix128x128, 23 slices.

Transverse FA maps were calculated and used for the analysis. All individual FA maps were normalized to a standard template. The statistical differences in FA before and after ECT were estimated by paired t-tests in Regions of Interest (ROIs). In an FA map template, 21 multislice ROIs were manually drawn by an experienced neuroradiologist in the right and left frontal, parietal and temporal lobes, in the genu, body and splenium of the corpus callosum and in the right and left thalamus and hippocampus.

Results

We found a significant FA decrease in the splenium of corpus callosum (p=0.013, family wise error corrected for multiple comparisons). We could not confirm earlier findings of an increase in FA-values in frontal regions in depression treated with ECT.

ECT also had a significant antidepressive effect (MADRS score mean reduction: 26, SD 12, confidence interval 19 – 33, p < 0.001), without correlation to the decrease in FA values in the splenium of corpus callosum.

Conclusions

- Treating depression with ECT reduce FA-values in the left splenium of corpus callosum.
- Our result diverge from earlier studies of depression treated with ECT as we found no changes in white matter integrity in any other region.
- There is a lack of knowledge how FA-values correspond to health and disease in depression, making the implication of findings difficult, which emphasize the need for future longitudinal studies in this field.

Demographic and clinical data (n=14)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
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<tbody>
<tr>
<td>Female: Male</td>
<td>10:4</td>
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<tr>
<td>Age at inclusion (year)</td>
<td>44 (18-85), SD 19</td>
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<tr>
<td>Unipolar:Bipolar</td>
<td>Depression 8:6</td>
</tr>
<tr>
<td>Numbers of ECT</td>
<td>9 (5-15), SD 3</td>
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<tr>
<td>Interval assessments (days)</td>
<td>29 (16-42), SD 8</td>
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</tbody>
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References
