Neurochemical-structural changes evaluation of brain in patients with obstructive sleep apnea syndrome

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Authors: O. N. N. N. Algin; Ankara/TR  
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Purpose

To evaluate neurochemical and structural changes in the newly diagnosed obstructive sleep apnea syndrome (OSAS) patients by MR spectroscopy (MRS), T2 relaxometry, and diffusion weighted imaging (DWI).

Methods and Materials

After examination with MRS, DWI, and T2 relaxometry methods, metabolite ratios, ADC and T2 relaxometry values of the thalami, hippocampi, frontal white matter (FWM) and frontal cortex of 24 OSAS patients and 9 controls were statistically compared. The relationship between two groups was evaluated with Mann-Whitney test. The level of statistical significance was set at P < 0.05.

Results

The frontal cortex measurements among the OSAS group revealed significantly lower NAA/Cr and NAA/Cho ratios compared with those of the controls (P=0.004 and P=0.006, respectively). Measurements in the FWM exhibited significantly lower NAA/Cho ratios in the OSAS group compared with those of the control group (p=0.005). Measurements in the FWM showed significantly lower NAA/Cho ratio in the OSAS group than in the control group (p=0.005). Thalamic Cho/Cr ratios in the OSAS group were significantly higher than those of the controls (p=0.002) (Table 1). In terms of the ADC-T2 relaxometry values, there was no significant relationship between the patient and the control groups (p>0.05) (Table 2).

Table 1 MR spectroscopy findings of patients with OSAS and controls. WM: white matter, *: statistically significant

<table>
<thead>
<tr>
<th>MRS ratios</th>
<th>Frontal cortex (OSAS/controls)</th>
<th>Frontal WM (OSAS/controls)</th>
<th>Thalamus (OSAS/controls)</th>
<th>Hippocampus (OSAS/controls)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAA/Cr</td>
<td>1.5±0.4/1.8±0.1 (P=0.004*)</td>
<td>1.72±0.8/2.15±0 (P=0.006*)</td>
<td>1.74±0.03/1.64±0 (P&gt;0.05)</td>
<td>1116±0.1/1.24±01 (P&gt;0.05)</td>
</tr>
<tr>
<td>Cho/Cr</td>
<td>1±0.04/1±0.06 (P&gt;0.05)</td>
<td>1.23±0.1/1.05±0 (P&gt;0.05)</td>
<td>1.05±0.03/0.79±0 (P=0.002*)</td>
<td>1009±0.1/1.15±0 (P&gt;0.05)</td>
</tr>
</tbody>
</table>
Table 2 ADC and T2 relaxation time values of patients with OSAS and controls (WM: white matter).

<table>
<thead>
<tr>
<th></th>
<th>Frontal cortex (OSAS/controls)</th>
<th>Frontal WM (OSAS/controls)</th>
<th>Thalamus (OSAS/controls)</th>
<th>Hippocampus (OSAS/controls)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADC values</strong></td>
<td>82±2/83±3 (P&gt;0.05)</td>
<td>78±1/81±1 (P&gt;0.05)</td>
<td>82±1/81±2 (P&gt;0.05)</td>
<td>90±2/95±7 (P&gt;0.05)</td>
</tr>
<tr>
<td><strong>T2 relax. times</strong></td>
<td>116±2/110±3 (P&gt;0.05)</td>
<td>103±1/102±1 (P&gt;0.05)</td>
<td>103±2/99±2 (P&gt;0.05)</td>
<td>116±2/118±3 (P&gt;0.05)</td>
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</table>

Images for this section:

**Fig. 1:** Representative proton MR Spectra in the patient with OSAS. N-acetylaspartate (NAA), choline (Cho), and creatine (Cr) peaks were observed (A). NAA/Cho and NAA/Cr ratios (respectively, 1.26 and 1.34; B) in this patient decreased comparing to control (respectively, 1.66 and 2; C).
Conclusion

MRS is a useful and non-invasive modality in showing neurochemical changes in various regions of the brain but our data does not show any change on diffusion weighting or T2 quantification in the OSAS group. DWI and T2 relaxometry appear to be not effective techniques to evaluate the brain structural changes of the patients with newly diagnosed OSAS.

References

3. Cross RL, Kumar R, Macey PM, Doering LV, Alger JR, Yan-Go FL. Neural alterations and depressive symptoms in obstructive sleep apnea patients. Sleep 2008; 31: 1103-1109

Personal Information

Oktay ALGIN, MD.

Ataturk Training and Research Hospital, Radiology Department, Bilkent-Ankara/Turkey, E-mail: droktayalgin@gmail.com