Altered patterns of functional connectivity of posterior cingulate cortex on resting-state magnetic resonance imaging in children with attention-deficit or hyperactivity disorder.

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Abstract

OBJECTIVE:

To explore the pathophysiological changes in the functional connectivity of posterior cingulate cortex (PCC) with other brain regions in children with attention-deficit or hyperactivity disorder (ADHD) on resting-state functional magnetic resonance imaging(fMRI) and explore the neural mechanisms of ADHD at the point of relationships between brain regions.

METHODS:

Thirty children with ADHD from the Third Affiliated Hospital of Soochow University from June 2008 to April 2010 and another 30 age-and-gender-matched controls from a normal primary school over the same period underwent resting-state fMRI scans. And blood oxygenation level dependent (BOLD) signal was acquired to calculate the functional connectivity of PCC with other brain regions controls. Singnificant differences of connectivity between groups were analyzed with REST software.

RESULTS:

The pattern of functional connectivity of PCC for the ADHD group was similar to that of the control group. Significant positive functional connectivity with PCC was observed in the default mode of network (DMN) while negative functional connectivity was present in dorlateral prefrontal cortex, anterior cingulate, parietal cotex and basal ganglia(all $P < 0.05$, corrected). Compared to the controls, the ADHD group exhibited decreased positive connectivity with PCC in bilateral medial prefrontal cortex (0.07 ± 0.20 vs 0.33 ± 0.23, $t = -5.47$), right posterior cingulate gyrus(0.25 ± 0.28 vs 0.48 ± 0.30, $t = -3.44$), right inferior temporal gyrus (-0.05 ± 0.19 vs 0.22 ± 0.22, $t = -4.61$) and cerebellar posterior lobe (-0.04 ± 0.21 vs 0.17 ± 0.16, $t = -3.99$), while decreased negative functional connectivity with PCC was observed in left insula ($-0.10 \pm$

0.26 vs -0.30 ± 0.19, t = 3.71), right inferior parietal lobule (0.02 ± 0.18 vs -0.23 ± 0.17, t = 5.20), left postcentral gyrus (0.08 ± 0.26 vs -0.17 ± 0.25, t = 4.06), left superior temporal gyrus (-0.04 ± 0.25 vs -0.27 ± 0.17, t = 4.27), right superior temporal gyrus (-0.08 ± 0.25 vs -0.31 ± 0.21, t = 3.80) and left fusiform gyrus (-0.01 ± 0.25 vs -0.18 ± 0.17, t = 3.57)(all P < 0.05, corrected).

CONCLUSIONS:

The connectivity of DMN between brain regions is abnormal in ADHD group. And the strengthen of negative relationship between DMN and task activated network becomes reduced. It is surmised that the decreased internal synchronization of default network and disrupted balance between DMN and prefrontal-parietal attentional networks may be important neural mechanisms of ADHD.