

Regional spontaneous brain activity in male ADHD revealed by amplitude of low frequency fluctuation

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Introduction:

Most previous resting-state fMRI studies about attention deficit hyperactivity disorder (ADHD) focused on abnormal functional connection in different brain areas (1, 2). Only one study investigated the amplitude of LFF (ALFF) (3). Using this new resting-state fMRI index, ALFF (4) and rapid sampling rate (TR = 400 ms), the current study was to investigate the spontaneous activity in boys with ADHD.

Material and Method:

The study was approved by the local ethical committee and written informed consent was obtained from all subjects. Twenty-one boys with ADHD were included based on DSM-IV criteria but four patients were excluded due to excessive head motion (> 3 mm). The remaining 17 patients (aged 10.03±1.96 years, range 8-14 years) were compared with 17 gender-, age- and education-matched controls (aged 9.73±1.57 years, range 7.4-13.8 years). All subjects are right handed. Six oblique axial slices covering frontal areas were acquired using a 3T MR imaging system (EXCITE, General Electric, Milwaukee, USA) with an 8 channel phase array head coil (TR/TE 400/30 ms, flip angle 30°, matrix 64 × 64, FOV 24 cm, thickness/gap 5/1mm, total 1200 volumes). Data processing was performed using AFNI (analysis of functional neuroimaging) software. Data preprocessing included slice timing, head-motion correction and spatial normalization. Further analyses included band-pass filtering (0.01 - 0.08 Hz), linear-trend removing, power spectrum calculation, mean square root (0.01 – 0.08 Hz), spatial smoothing (FWHM = 6 mm), and standardization by dividing global mean ALFF . Two sample t-test was used to compare the ALFF differences between the two groups.

Result:

Significant decreased ALFF ($p < 0.05$, corrected) was found in the right inferior frontal gyrus (IFG, BA 44), left supplementary motor areas (SMA, BA 6) and left anterior cingulate gyrus (ACG, BA 24/33) in male ADHD patients compare to controls. Significant increased ALFF ($p < 0.05$, corrected) was found in the bilateral superior frontal gyrus (SFG, BA9/10), the left precentral gyrus (BA 6) and right ACG (BA 32) in ADHD

patients compared with controls (Fig.1).

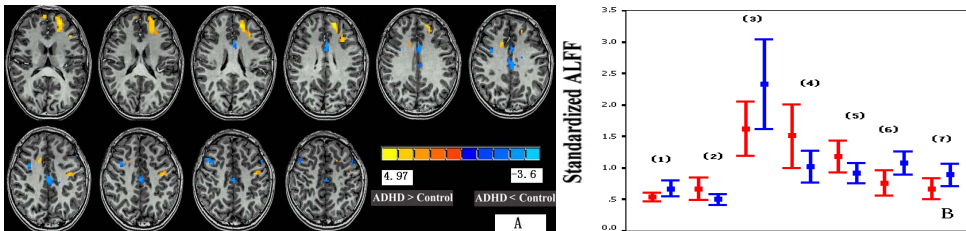


Fig.1 ALFF differences between ADHD and control groups. (A) Blue indicates that ADHD subjects had decreased ALFF compared with the controls and the yellow indicates the opposite. Left in the figure indicates the right side of the brain. (B) The mean and standard deviation of

standardized ALFF at the peak voxels. The numbers (1)–(7) indicate: right ACG, right IFG, right SFG , left ACG, left SMA, left SFG, left PG. Normal:red, Patient:blue

Conclusion:

The decreased spontaneous prefrontal activity is in line with the decreased response control function in prefrontal lobe of boys with ADHD. Further investigation could focus on the relationship of the decreased spontaneous prefrontal activity with the behavior deficits.

References:

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