Purpose: This study provides evidence of basal ganglia neurometabolite concentration alteration in adolescents with attention-deficit hyperactivity disorder (ADHD) using a high-speed magnetic resonance spectroscopic imaging pulse sequence with spatial-spectral encoding.
Methods: Spectroscopy data were acquired on a Siemens Trio 3T scanner with 12-channel phased-array head coil, automatic shimming and outer volume suppression. Raw spectral data were reconstructed with an in-house processing pipeline written in IDL. Spectra data were analyzed with a prior knowledge based fitting software LC Model. To ensure that differences in tissue concentration did not account for metabolite differences between subject groups, the gray, white and CSF compositions of each imaging voxel was determined by registering FSL segmented whole brain tissue masks with spectroscopic voxels via an in-house processing program in IDL. FreeSurfer software was used for automatic brain segmentation at the basal ganglia region. Statistical analysis of neurometabolites was carried out in R.
Results: Compounds that can be identified using PEPSI acquisition include N-acetylaspartate (NAA), creatine/phosphocreatine (Cr+PCr), glycerophosphorylcholine/phosphorylcholine (GPC+PC), glutamate/glutamine (Glx) and myo-inositol (Ins). Compared with healthy controls, adolescents with ADHD had a significantly lower mean choline level in the left putamen ($P = 0.016$) and higher mean NAA level in the right putamen ($P = 0.032$). There were no significant differences in any other metabolite measured at the putamen and thalamus.
Conclusions: In our efforts to investigate the pathobiochemical processes of ADHD by using fast short TE PEPSI acquisition method, we have found possible evidence of metabolite level differences between ADHD subjects and healthy controls in left putamen choline and right putamen NAA.