AUDITORY GABA CONCENTRATION IS RELATED TO AUDITORY GAMMA-BAND POWER IN NORMAL CONTROLS AND IN AUTISM

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Target Audience

Researchers and neuroscientists interested in the role of neurotransmitters in healthy subjects and in psychiatric illnesses.

Purpose

Brain gamma band (30-80 Hz) oscillatory activity, measured via EEG and magnetoencephalography (MEG), is thought to be associated with higher brain functions which may become disrupted in psychiatric illnesses. Previously published data demonstrated reduced auditory gamma band power in persons with autism spectrum disorders (ASD)[1,2] and their first degree relatives.[3,4] Gamma band activity has also been shown to correlate with levels of γ-aminobutyric acid (GABA) in animal model studies and in human studies combining MRS and MEG.[5,6] Independently, prior MRS work has suggested reduced GABA in persons with autism.[7-9] Other previous, preliminary work suggested a relationship between auditory gamma-band response and auditory GABA.[10] The relationship between GABA concentration and auditory gamma-band activity has not yet been studied in autism. Here, we examine the relationship between auditory GABA concentration and gamma-band power in individuals with autism and in healthy control subjects.

Methods

Auditory transient and steady-state gamma-band responses and auditory cortical GABA concentration were measured in in 2 groups of children and adolescents: a) healthy controls (N=25) and b) people with autism spectrum disorders (N=24). Auditory response data were acquired using a 248-channel whole head magnetoencephalography (MEG) system (Magnes 3600 WH), GABA concentrations were obtained via J-edited ^{1}H-MRS using a MEGA-PRESS[11] sequence on a GE 3T/94 MRI system (GE Healthcare) as previously described.[8] Measurements were restricted to the left hemisphere due to time constraints of the spectroscopy sequence.

Results

Transient gamma-band power was significantly higher in the control group compared to individuals with autism ($p < .01$). GABA concentration was significantly lower in the autism ($p < .05$) compared with controls. GABA concentration was correlated with transient gamma-band power in the control group ($r = .45$, $p < .002$) and approached significance in the autism group($r = .35$, $p = .08$). No correlations with steady-state response power and GABA were observed.

Discussion

These results are consistent which our previous preliminary findings of a relationship between gamma band power and GABA levels.[10] They reinforce the suggestion that reduced GABA levels may be related to reductions in stimulus related gamma-band power frequently reported in autism. The finding that the obligatory transient auditory gamma response was associated with GABA while the steady state response was not implies different mechanisms of generation for the two responses. This is consistent with earlier literature suggesting that the steady-state responses reflect the superimposition of mid-latency auditory evoked responses.

Conclusions

GABA concentration and gamma-band power may both be related endophenotypes in autism that are related to an underlying change in inhibitory function.

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