The influence of cross-sex hormone therapy on stop-signal-task-related brain activation measured with 7T fMRI

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Background: The stop-signal task (SST) is widely applied as a functional magnetic resonance imaging (fMRI) paradigm as it specifically activates brain regions associated with motor inhibition. A possible sex-hormone effect on motor inhibition is suggested by sex differences in related brain activation patterns [1,2] and is further supported by an association between SST inhibitory control and estrogen levels [3]. This study aims to further investigate the effect of cross-sex hormone therapy in transsexuals on motor-inhibition-related regional brain activation using the SST and ultrahigh-field 7T fMRI.

Methods: Nine female-to-male (FtM) (mean age ± SD: 26.0 ± 6.0 years) and eight male-to-female (MtF) (29.5 ± 7.0 years) transsexual subjects participated in this study. Two 7T fMRI scans during which subjects performed an SST with an event-related design were acquired. The first and second scans took place at baseline and after approximately four weeks (range 23–51 days) of cross-sex hormone therapy, respectively. Transsexual subjects received cross-sex hormone treatment according to protocols routinely implemented at the Unit for Gender Identity Disorder at the Medical University of Vienna. Functional data were acquired using a Siemens Magnetom 7T scanner (EPI sequence, TE/TR = 23/1.4 s, 128 × 128 voxels, 32 slices). Standard preprocessing was carried out using SPM8. Statistics were calculated using SPM8 including repeated-measures ANOVA with group (MtF, FtM) as the between-subject and fMRI scan session as the within-subject factor, as well as post-hoc one-sample t-tests.

Results: Group and interaction effects were found within regions relevant to motor inhibition. FtM subjects exhibited greater activation than MtF within the precentral cortex (t = 5.92) while the supplementary motor area (SMA) showed an interaction effect (t = -4.17). Post-hoc one-sample t-tests revealed that MtF subjects showed activation within the SMA before cross-sex hormone therapy (t = 5.19), while FtM showed activation in this region after four weeks of hormone therapy (t = 4.89, all p < 0.001 uncorrected).

Discussion: The group effect found within the precentral cortex only allows for limited interpretation on the role cross-sex hormone therapy may play, as an effect of time and fundamental differences between subject groups cannot be excluded. The interaction effect found within the SMA, however, does point towards a possible cross-sex hormone influence. Testosterone modulation of motor-inhibition-related activation within this region is suggested by activation of the SMA in MtF during scan one, and in FtM in scan two. This is supported by evidence of greater motor-inhibition-related activity in the SMA in men than in women [1].

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References