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REPEATABILITY OF SUPRASPINAL RESPONSES TO AUTOMATED, REPETITIVE BLADDER FILLING - AN FMRI STUDY

Hypothesis / aims of study

Recent functional magnetic resonance imaging (fMRI) studies revealed supraspinal networks in response to bladder filling involved in perception and processing of bladder distension. However, repeatability of blood-oxygenation-level dependent (BOLD) signal changes during bladder filling has not been proven yet. Therefore, our aim was to investigate BOLD signal changes in response to bladder filling to provide evidence for repeatability using a standardised filling paradigm, i.e. a magnetic resonance (MR)-compatible and MR-synchronised infusion-drainage system.

Study design, materials and methods

20 right-handed healthy subjects, 10 women and 10 men, mean age 39 years (range 22-54) with no history of urinary urgency and/or urinary incontinence were included.

Visit 1: After catheterisation and bladder pre-filling with body warm saline until persistent desire to void, we performed in a 3T MR scanner automated, repetitive bladder filling of 100mL body warm saline over 15s, i.e. block design study. Visit 2: Within 8 weeks from visit 1, a second MR scan was performed in the same manner.

Using SPM8, BOLD signal changes during bladder filling were compared to rest, i.e. pre-filled condition. For within-group whole-brain (WB) analysis, a voxel-threshold was set at $p < 0.001$ using the false discovery rate (FDR) correction with a strict cluster threshold correction of $p < 0.05$ (cluster extend: $k > 42$ voxels) to adjust for multiple comparisons using Monte Carlo simulations. Differences between both visits were investigated using a paired t test. In addition, region of interest (ROI) analyses were computed. Thus, ROIs were included as a mask in order to restrict the voxel-by-voxel statistical analysis (including familywise error (FWE)-correction) to pre-specified brain areas. ROIs were generated using the WFU Pickatlas.

Results

Within-group WB analysis revealed activation in the following brain regions for visit 1: bilateral frontal and prefrontal gyrus; anterior, mid and posterior cingulate cortex; left insula; hippocampus; temporal and parietal gyrus; and for visit 2: bilateral frontal and prefrontal gyrus; anterior cingulate cortex; bilateral insula; bilateral basal ganglia. No statistical differences in BOLD signal changes were detected between visit 1 and 2. Using a more sensitive approach, ROI analyses detected repeatability of BOLD signal changes during bladder filling compared to rest within the frontal and prefrontal gyrus, cingulate cortex and insula.

Interpretation of results

Using a MR-compatible and MR-synchronised infusion-drainage system, automated, repetitive bladder filling of body warm saline elicited BOLD signal changes in both MR scans. These activations were present in specific areas, known from previous literature to be involved in supraspinal lower urinary tract control.

Concluding message

This study confirms repeatability of BOLD signal changes in response to bladder filling in specific areas known from previous literature to be involved in supraspinal lower urinary tract control.

Disclosures

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