

## EVALUATION OF THE BRAIN ACTIVITY DURING PELVIC FLOOR CONTRACTION USING FUNCTIONAL MAGNETIC RESONANCE IMAGING (fMRI)

### Hypothesis / aims of study

The pelvic floor plays a key role in provision of both fecal and urinary continence. The pelvic floor contraction is a very complex process several groups of pelvic muscles take part in. The functional definition of cortical and subcortical regions involved in voluntary pelvic floor muscle's control is essential for better understanding of the function of lower urinary tract. Previous reports regarding exact representation of the pelvic floor muscles in the brain cortex are scarce and inconsistent.

The study objective is a contribution to the knowledge of the pelvic floor cortical control.

### Study design, materials and methods

The total number of 17 female subjects with no history of neurological or psychiatric disease participated in the study. Detailed instruction about voluntary pelvic floor contraction was provided to each subject and briefly practiced prior to fMRI evaluation. To control quality of pelvic floor contraction we simultaneously evaluated abdominal pressure close to the anal sphincter by rectal catheter. To avoid inconsistencies caused by subject cooperation and manoeuvre performance, we identified 9 representative data sets that were used for the final evaluation.

All functional magnetic resonance imaging (fMRI) examinations were performed on 3T MR scanner (Siemens Trio) using gradient-echo EPI sequence with parameters: TE=30ms, TR=3s, voxel=2x2x2mm. The entire measurement was covered by 120 dynamics (volumes of 44 slices) and divided into 10 rest periods (10 dynamics each, 30s) and 10 stimulations (2 dynamics, 6s) when the subject was instructed to contract pelvic floor with the frequency 1 Hz for 6 seconds. Evaluation was done in SPM5 (pre-processing: realignment, slice timing, smoothing with kernel 8x8x8mm) using standard GLM. After first level individual statistics, nine subjects were included to second level group statistic with final threshold level  $p=0.05$  with FDR correction.

### Results

Cortical activation during pelvic floor contraction is demonstrated on fig.1. The largest cluster of activated voxels is located in the medial wall of gyrus precentralis (GPrC) representing primary motor area for pelvic floor muscles and supplementary motor area (SMA). However, we found also activation in left GPrC (-34,-14, 74), bilateral activation in gyrus frontalis medius (GFm) and right gyrus temporalis superior (62, -34, 22).

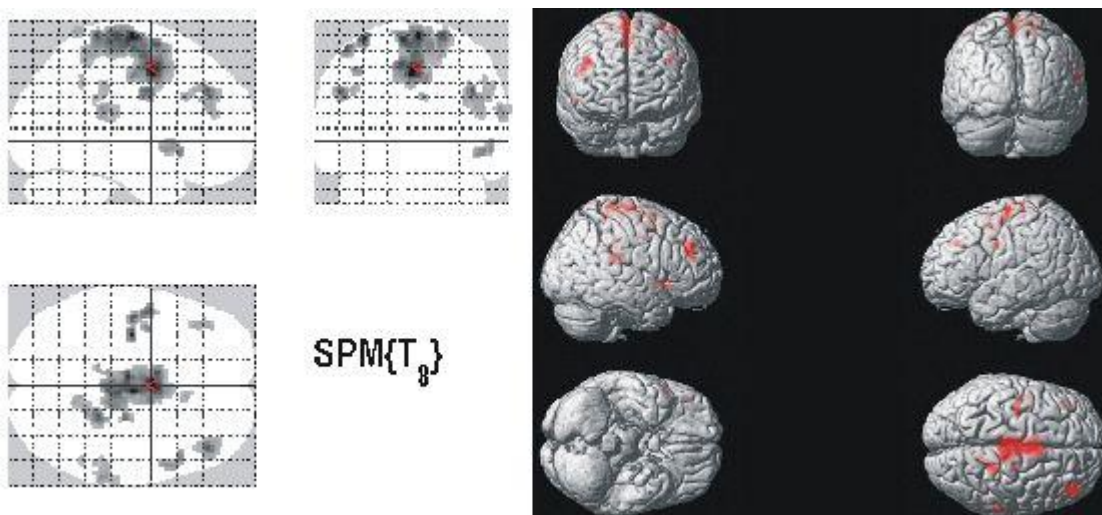


Fig. 1: Cortical activation during voluntary pelvic floor contraction

### Interpretation of results

In accordance with other authors (1,2) this fMRI evaluation demonstrated activation of both bilateral supplementary motor area (SMA) and primary motor area for pelvic floor muscles.

In contrast with di Gangi-Herms et al. (2), who identified the activation in the right precentral gyrus we demonstrated activation in the left precentral gyrus. In addition we also described frontal activation in Gfm.

### Concluding message

Pelvic floor muscles contractions are unambiguously associated with cortical activity in SMA. In addition we demonstrated activation in the gyrus frontalis medius and the left precentral gyrus.

### References

1. Kuhlitz – Buschbeck JP, van der Horst C, Wolff S, et al : Activation of the supplementary motor area (SMA) during voluntary pelvic floor muscle contractions - An fMRI study. Neuroimage 2007; 35: 449-457

2. Di Gangi Herms AMR, Veit R, Reisenauer C, et al: Functional imaging of stress urinary incontinence. Neuroimage 2006; 29:267-275

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<b><i>Is this a clinical trial?</i></b>	<b>No</b>
<b><i>What were the subjects in the study?</i></b>	<b>HUMAN</b>
<b><i>Was this study approved by an ethics committee?</i></b>	<b>Yes</b>
<b><i>Specify Name of Ethics Committee</i></b>	<b>Local Ethic Committee, Praha, Czech Republic</b>
<b><i>Was the Declaration of Helsinki followed?</i></b>	<b>Yes</b>
<b><i>Was informed consent obtained from the patients?</i></b>	<b>Yes</b>