

BRAIN ACTIVITY UNDERLYING CONTINENCE CONTROL IN OLDER WOMEN WITH URGENCY INCONTINENCE – A POTENTIAL MARKER OF FUNCTIONAL STATUS

Hypothesis / aims of study

To investigate the relationship between brain activity during bladder filling and continence control outcomes in older women with urgency incontinence.

Study design, materials and methods

We studied 30 functional, community-dwelling older women with urgency incontinence. Brain activity was assessed using method that combines fMRI with simultaneous urodynamic monitoring in a session consisting of repeated cycles of bladder filling/emptying. Although all subjects had incontinence on bladder diary, they differed in response to bladder filling during the scanning session. As the bladder was filled after reported urgency, one third exhibited detrusor overactivity (DO) and incontinence (the 'DO group', n=9) while the rest remained without DO (the 'non-DO group', n=21), possibly suggesting two different functional phenotypes. We then tested whether these two groups differed in brain activity during urgency (without DO), and/or in clinical characteristics related to continence (e.g. age, structural brain damage, and urodynamics).

Results

The DO group exhibited greater brain *activations* during urgency (preceding DO), especially in the supplemental motor area (SMA) and adjacent regions, which also remained strongly activated during DO. (**Figure 1**) In contrast, the non-DO group had strong *deactivations* in areas of parahippocampus and hippocampus. (**Figure 2**) Clinically, the DO group was older, had more structural brain damage and tolerated smaller filling volumes during standard urodynamics.

Interpretation of results

Our findings showed that subjects with more easily elicitable DO in the scanner exhibited different brain activity during bladder filling than those with similar complaints who suppressed DO and remained continent in the scanner. In particular, they exhibit neural activity related to an effort to control pelvic floor muscles and urethra. This may be the consequence of impaired voluntary control of micturition reflex, since the no-DO group showed stronger inhibitory deactivations in parahippocampal cortex that are associated with cognitive activity in prefrontal cortex. Although the no DO group also showed deactivations in prefrontal cortex, differences between groups were not significant, perhaps reflecting inadequate sample size for subtle changes in this executive region.

Concluding message

Brain activity (e.g. in SMA) during bladder filling is related to continence control and detrusor overactivity in older women with urgency incontinence, and is promising as a marker of more advanced functional impairment. The study confirms the heterogeneous phenotypes within a large group of patients reporting urgency and urine leakage. Study also suggests that functional brain imaging, combined with urodynamics, may be useful for distinguishing severity of functional impairment and clinical phenotypes within urgency incontinence.

Figure 1. Brain activity during bladder filling in DO group: **A.** bladder nearly empty; **B.** urgency preceding DO; **C.** DO with incontinent episode.

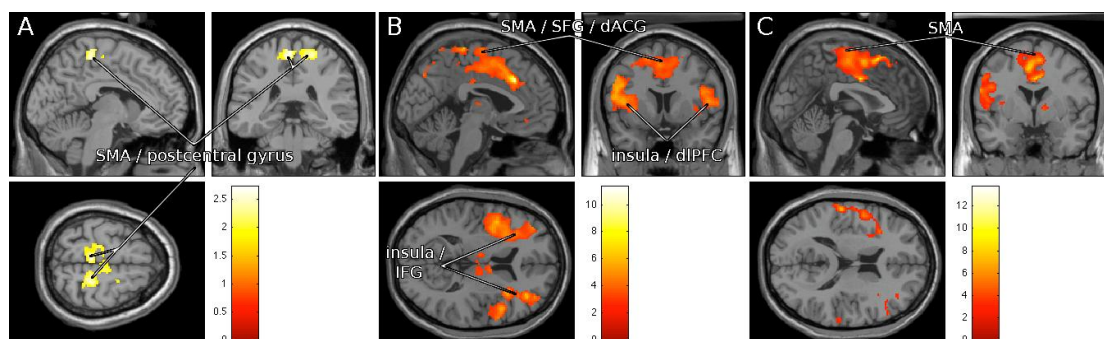
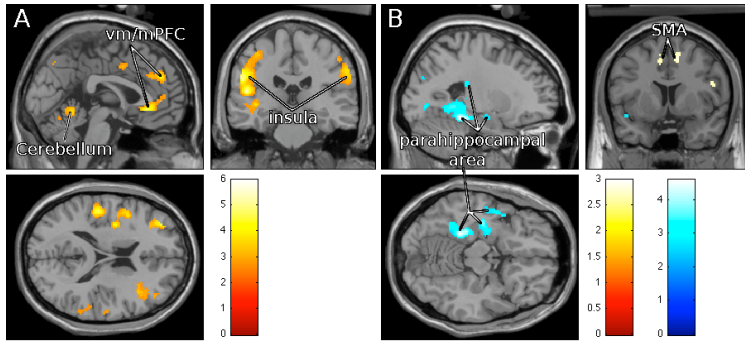


Figure 2. Brain activity during bladder filling in no-DO group: **A.** activation at nearly empty bladder; **B.** deactivations during urgency.



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Is this a clinical trial?	No
What were the subjects in the study?	HUMAN
Was this study approved by an ethics committee?	Yes
Specify Name of Ethics Committee	Institutional Review Board University of Pittsburgh
Was the Declaration of Helsinki followed?	Yes
Was informed consent obtained from the patients?	Yes