

## IDENTIFYING A NEURAL CAUSE FOR THE SENSATION OF URGENCY IN OAB USING FUNCTIONAL BRAIN IMAGING

### Hypothesis / aims of study

Urgency is the cornerstone symptom of overactive bladder (OAB). It is defined as a sudden compelling desire to pass urine, which is difficult to defer. Urgency is an abnormal sensation and the neural cause is not known. No study has used 'conventional' urodynamics with fMRI to identify the sensation of urgency. We postulated a neural network involving the frontal orbital cortex (FOC), hippocampus and amygdala in the central mechanism of urgency. Our objectives were to identify brain regions correlating with ICS bladder sensation, first sensation of filling (FSF) and strong desire to void (SDV) and urgency and measure their respective BOLD (Blood Oxygen Level Dependent) signal changes in OAB patients.

### Study design, materials and methods

13 OAB had fMRI with repeated conventional urodynamics using a previously developed block paradigm of an infusion pause sequence. OAB LUTS questionnaire was used to assess the severity of their urgency symptom. After image acquisition and pre-processing, BOLD signal changes were calculated in those brain regions, which showed significant differences during infusion.

### Results

Table1: Mean %BOLD Signal Changes from FSF to SDV in OAB

	‘Occasional’ Urgency		Urgency ‘Some of the time’		Urgency ‘Most of the time’		Urgency ‘All the time’	
	FSF	SDV	FSF	SDV	FSF	SDV	FSF	SDV
Insula	0	0.23	0.16	0.07	0.08	0	0.55	0
ACC	0	0.09	0.22	0.36	0.35	0	0	0.02
FOC	0	0.41	0.49	0.68	0.24	0	0.31	0
Right Hippocampus	0.17	0	1.38	0.69	0.84	0	0.37	0.46
Left Hippocampus	0.30	0.42	1.37	0.83	1.19	0.11	0.14	1.42
Right Amygdala	0.19	0.02	1.34	0.86	0.47	0	0.47	0
Left Amygdala	0	0.62	2.32	1.19	2.24	0.66	0.73	0.14

Value expressed as %BOLD Signal Changes.

In regions known to be associated with unpleasantness (the insular cortex and anterior cingulate cortex, ACC), ‘fear’ (amygdala), anticipation and nociception (hippocampus), signal changes were greater at FSF in OAB patients with worsening symptom of urgency. In those with poor bladder control (FOC), these signal changes were weaker. The amygdala had greater signal changes at FSF and this could explain the ‘fear’ of leakage commonly found in OAB. The hippocampus showed greater signal changes at SDV in those with worsening urgency. This may play a pivotal role in the central mechanism of urgency.

### Interpretation of results

The neural cause of the abnormal sensation of urgency is complex and we are just beginning to identify the network of brain regions involved. Severe symptoms of urgency are associated with greater signal changes at FSF. The FOC (continence), amygdala (‘fear’ of leakage) and hippocampus (anticipation and nociception) all contribute to this extensive neural network with the hippocampus playing a pivotal role in the central mechanism of urgency.

### Concluding message

The neural cause of the abnormal sensation of urgency is complex and we are just beginning to identify the network of brain regions involved. The hippocampus may play a pivotal role in the central mechanism of urgency.

### Disclosures

**Funding:** None **Clinical Trial:** No **Subjects:** HUMAN **Ethics Committee:** NRES Committee South Central - Oxford C The ethics REC reference number for this study is 05/Q1606/167 **Helsinki:** Yes **Informed Consent:** Yes