

# INVESTIGATING THE CENTRAL CONTROL OF RESPIRATION IN ALS – A PILOT fMRI STUDY

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## BACKGROUND

How the brain controls breathing is still not completely understood (1). In recent years, functional magnetic resonance imaging (fMRI) has been used to study voluntary breathing in healthy subjects (2). Respiratory failure due to progressive respiratory muscle weakness is the usual cause of death in ALS. Maximal sniff nasal pressure measurement was the single respiratory test combining linear decline, sensitivity in mild disease, and feasibility in advanced disease. Therefore it appears well suited to assess the decline of respiratory muscle strength, the risk of respiratory failure and to provide prognostic information in ALS patients (3). Upper motor neuron abnormalities could add to the respiratory dysfunction in ALS.

## HYPOTHESES

We hypothesised that fMRI during sniffing would reveal sniffing-associated brain activation patterns both in healthy subjects and in ALS patients, and that ALS patients would show reduced cortical activation compared to healthy subjects.

## METHODS

Six ALS patients and five healthy subjects were studied. Static inspiratory and expiratory mouth pressure and maximal sniff nasal pressure were measured. Imaging was performed on a 3T Siemens Trio scanner. In each subject, 221 functional scans were acquired. Nasal pressure and chest movements were measured during scanning. An event-related experimental design was used. A submaximal sniff manoeuvre was performed every 20 s. Image pre-processing and statistical analysis were done using the SPM5 software. A random effects group analysis was performed ( $p < 0.01$  uncorrected).

## RESULTS

A bilateral cortical and subcortical sensorimotor network was found to be activated during sniffing in both groups.

Compared to healthy subjects, ALS patients showed reduced activation bilaterally in the prefrontal cortex, and to a lesser extent also in temporal and occipital lobes and cerebellum. Increased activation in ALS patients was found in left temporal lobe only.

## CONCLUSIONS

Using fMRI during sniffing, it is possible to visualise the cortical sensorimotor network associated with voluntary control of breathing both in healthy subjects and in ALS patients. The reduced prefrontal activation suggests that a central neural component to the respiratory dysfunction could exist in ALS. Some clinical observations support this hypothesis (4). Reduced prefrontal activation was also described in ALS patients using fMRI during hand movements (5).

## References:

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