Does diazepam influence the BOLD response?

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Introduction

FMRI has been used primarily to investigate brain function in healthy volunteers. However, there is an increasing interest in using fMRI as a clinical tool. The most obvious application is to use fMRI for pre-surgical planning and intra-operative guidance in neurosurgery. One complication when examining patients is the fact that many patients feel uneasy in the unfamiliar imaging environment and may need sedatives to be able to undergo the examination. The use of sedatives may influence the results in several different ways; by making the patient less focused on the task, or by influencing the brain functions themselves by affecting the signal submission systems. This may in turn affect the amplitude and shape of the hemodynamic response.

Materials and methods

To examine the effects of diazepam on the BOLD response twenty healthy young adults (10 women and 10 men, age 22-30, mean: 25, sd: 2.1) underwent two fMRI examinations. On one occasion the subjects received a capsule containing five milligrams of diazepam and on the other occasion a placebo. The order of substance administration was randomized. The subjects performed a simple finger-tapping task. They were instructed to press the buttons of a response pad at a given visual cue. There was a total of 25 events with a mean inter-stimulus interval of 16 s.

Analysis

MR images were acquired on a Philips Achieva 1.5 T scanner. A BOLD sensitive EPI-sequence with the following imaging parameters: data matrix 80x80, FOV 230 mm, TE 40 ms, TR 1300 ms, slice thickness 3 mm, number of slices 16. Functional data were analyzed using SPM2 and MarsBar. The images were realigned, normalized and smoothed (FWHM, 8 mm) prior to statistical analyses. Each subject's data were analysed individually and a one-sample t-test was used to identify common areas of activation. To test for activation differences between sessions and substance received an ANOVA analysis was performed. For each subject and session the percent signal change and time to peak for the BOLD response was calculated within a spherical ROI (radius 5 mm) around the most significant activation obtained from a random effects group analysis.

Results

The ANOVA analysis revealed no statistically significant ($p > 0.05$) differences in the activation patterns. In addition, there were no statistically significant changes of BOLD amplitude or time to peak either between scanning sessions or between diazepam/placebo conditions, see table 1.

Conclusions

Based on the results of this study, clinically relevant doses of diazepam have no statistically significant effect on the results of fMRI studies on young adults. If the same is true for elderly and patients remains to be investigated.

Table 1. Time to peak and percent signal change (± standard deviation) for the BOLD response following a motor task.

	Session 1	Session 2	Placebo	Diazepam
Time to peak	4.65 ± 0.34	4.54 ± 0.32	4.61 ± 0.30	4.58 ± 0.37
% signal change	0.94 ± 0.28	0.86 ± 0.29	0.89 ± 0.30	0.91 ± 0.28