NeuroImage 13, Number 6, 2001, Part 2 of 2 Parts IDEAL®

ATTENTION

Onset of Meditation Explored with fMRI

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Meditation is an ancient spiritual practice that has recently been studied due to its potential health promoting effects, and its status as a special form of consciousness, different from ordinary waking and sleep. While a considerable number of studies has been carried out with EEG, only few studies have used PET and fMRI (1-4). In these studies brain structures active during prolonged continuous meditation were identified.

It has been argued that two complementary neural networks may underlie meditation. One network functioning as a "neural switch" mediating the shift from normal consciousness to meditation, and the other as a "homeostatic threshold regulation mechanism" maintaining the restful state of mind during meditation (5). We report an investigation with fMRI of the initial stages of meditation, in an effort to localize brain structures involved in the neural switch function.

Method

Five normal right handed subjects, two females and three males, (mean age 51, range 46-56), with experience in meditation ranging from 7 to 23 years, were scanned twice during onset of meditation using a blocked on-off design with 45 sec. epochs (meditation = on, normal relaxation = off). Four subjects meditated for 15 min. continuously in between the on-off sessions. One extra on-off meditation scan was included in the analysis, yielding a total of 11 scans. The present report only consider the on-off meditations. Scans were made on a GE Signa 1.5 T scanner, (Spiral Imaging, TE= 40 msec. TR= 4.5 sec. 25-30 axial slices). Data were analyzed with SPM99.

Results

Random effect analysis showed significant activations in left lateral Globus pallidus, right inferior parietal lobe and right precentral gyrus (Brodman 4 & 6), while no significant deactivations were found.

Fixed effect analysis revealed significant activations in the left frontal (B11), paracentral (B4), inferior parietal (B40) and lateral temporal (B22) cortex. Activation was also seen in the anterior cingulate (B24), Hippocampus and central areas of the brain. Activations were especially prominent in the right temporal lobe (B21), the superior parts of the right gyrus paracentralis (B4 & B6) and prefrontal cortex (B10 & B11).

Significant decreases in activation were found in the visual cortex (B 17, 18 & 19), especially in the right hemisphere. Deactivation was also found in the posterior cingulate (B31), parts of left prefrontal lobe (B10) and the right central cortex (B2, B5, B4).

Conclusion

Various cortical and subcortical structures that are activated and deactivated during onset of meditation were identified. The findings partially overlap those from other studies, and support the notion of a predominantly frontal cortical-subcortical system for the initiation of meditation. The findings may however not be generalizable due to the small number of subjects, variations in methods of meditation, and methodological problems for research on meditation in MR scanners.

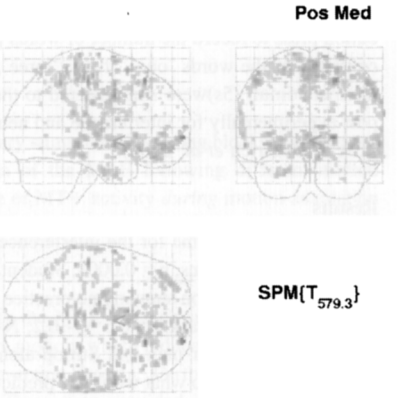

Fig. 1. Activation during meditation onset

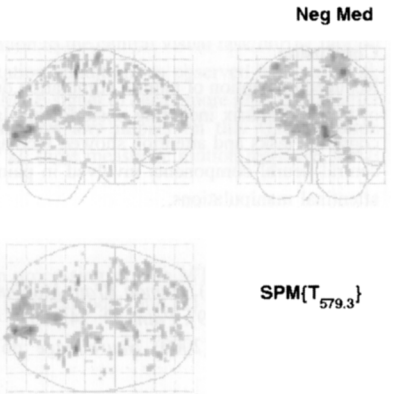

Fig. 2. Deactivations during meditation onset

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