

# Evaluation of Cerebral Cortices Associated with Sexual Arousal in Healthy Male Using BOLD-based Functional MRI

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## Introduction

Sexual arousal is a complex series of psycho-neuro-vascular events. There have been few clinical studies on the central control of male sexual arousal. Recently, a preliminary study was performed to identify brain areas activated in healthy males with visual sexual stimulation using PET. However, there is no clinical report to use fMRI in evaluating the brain region associated with sexual arousal. The purpose of this study was to identify cerebral cortices related with sexual arousal from visual sexual stimulation in healthy males using BOLD-based functional MR imaging.

## Materials and Methods

Twelve male volunteers with sexually potent (mean age: 23) were examined for this study. Functional MRI was performed on a 1.5T MR scanner (GE Signa Horizon) with a birdcage head coil. In this study, blood oxygenation level dependent (BOLD) technique was utilized to create fMR image reflecting local brain activities. The BOLD-based fMRI data were obtained from 7 oblique planes using gradient-echo EPI with 50ms TE, 6000ms TR, 26 cm x 26 cm field-of-view, 128 x 128 matrix, and 10mm slice thickness.

Two sets of activation stimuli were used for this study. In the sexual arousal condition, subjects viewed an erotic video film. In the neutral condition, subjects viewed a documentary video film. The video film was presented to the subjects through a mirror located at the top of the head coil which receives video-images from the outside of the magnetic room. Real-time visual stimulation was performed with an alternatively combined erotic and non-erotic film to identify the activated brain regions associated with sexual responses. The sexual stimulation paradigm consisted of two alternating periods of rest and activation; and it began with a 1 minute rest with a documentary video film, followed by a 2 minute stimulation by an erotic video film. Brain activation maps were generated by cross-correlation of images acquired during rest and activation periods using a software developed by Cho et al. The activated pixels were calculated on the basis of the correlation coefficient; 0.4 threshold for this study, and were subsequently overlaid on a matching T1 or T2-weighted anatomical image. The index of activation was used to compare the number of pixels activated by each task in each volunteer, where the significance of the differences was evaluated by using Student's t-test. In addition, perceived sexual arousal and penile erection responses were assessed using 5 point scales ranging from 1, no change to 5, maximum increase.

## Results

In normal volunteers, the score on subjective sexual arousal with erotic film covered 2-3 (3.0  $\pm$  0.4, mean  $\pm$  SD), whereas none were sexually aroused by the documentary film. During the visual stimulation in fMRI, occipital cortex was activated by either an erotic or non-erotic film. However, erotic film gave 1.5-2.0 times stronger activation. More than 7 of 12 healthy subjects were significantly activated in the areas of inferior frontal lobe, cingulate gyrus, insula gyrus, corpus callosum, thalamus, caudate nucleus, globus pallidus, and inferior temporal lobe by erotic stimulation. With the erotic visual stimulation, inferior temporal lobe was activated symmetrically in both hemispheres of all subjects. Thalamus was activated bilaterally in 10 of the 12 subjects. The basal ganglia, such as caudate nucleus and globus pallidus, were weakly activated compared to other areas. Paralimbic areas such as inferior frontal lobe, insula, and corpus callosum were activated at least 9 out of the 12 subjects. The cingulate gyrus was activated in 11 out of 12 subjects, where 8 subjects showed anterior activation and 8 subjects were in the posterior part. The intensity of activation was highest in the inferior temporal lobe and was lowest in the basal ganglia.

## Conclusion

In this study, we have shown the functional neuroanatomy of the brain associated with sexual arousal by visual sexual stimulation using BOLD-based fMRI. However, further correlative studies with other

technique are needed to verify that fMRI provides an important new tool for evaluating the cerebral center of sexual arousal

## References

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