

Functional MRI study in patients with traumatic brachial plexus injury

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PURPOSE

The aim of this study is to assess plastic changes of the primary motor cortex (M1) in patients with traumatic brachial plexus injury (BPI).

METHODS

Ten patients with traumatic BPI underwent functional MRI (fMRI) using blood oxygen level-dependent (BOLD) technique with echo-planar imaging (EPI) before intercostal nerve transfer (approximately three months after injury) and approximately nine months after the operation (approximately one year after injury). The subjects performed two tasks: a flexion-extension task of the affected elbow and a task of the unaffected elbow. They were asked to have the intention to move as much as possible if their motor functions were impaired. The movement task was presented in 30s movements alternating with 30s rest periods for a total of four paired blocks. After activation maps were generated for preoperative and follow-up studies with statistical parametric mapping 99 (SPM99), the number of significantly activated voxels in M1 contralateral to the elbow movement in the affected elbow task study (N_{af}) and that in the unaffected task study (N_{unaf}) were counted. Ten healthy volunteers were also included in this fMRI study, and they performed flexion-extension tasks of each elbow. As to volunteer studies, the average of activated voxels in M1 contralateral to the elbow movement (N_{norm}) was calculated from the number of activated voxels in left M1 in the right elbow task study and that in right M1 in the left elbow task study.

RESULTS

N_{af} in the follow-up study was significantly smaller than N_{norm} ($p < 0.05$, Dunnett's multiple comparison test), while the difference between N_{af} in the preoperative study and N_{norm} was not significant. Significant difference was found neither between preoperative N_{unaf} and N_{norm} , nor between postoperative N_{unaf} and N_{norm} .

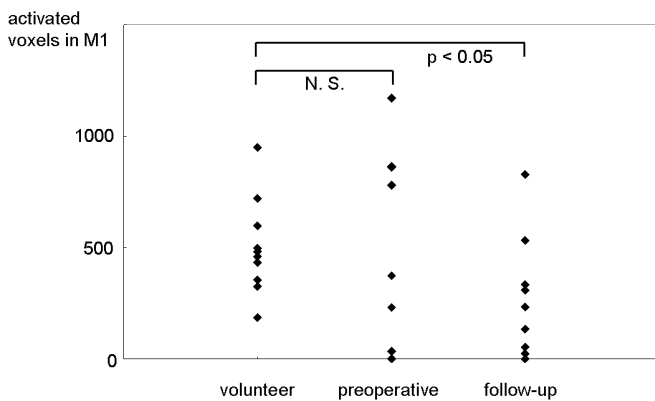


Fig.1

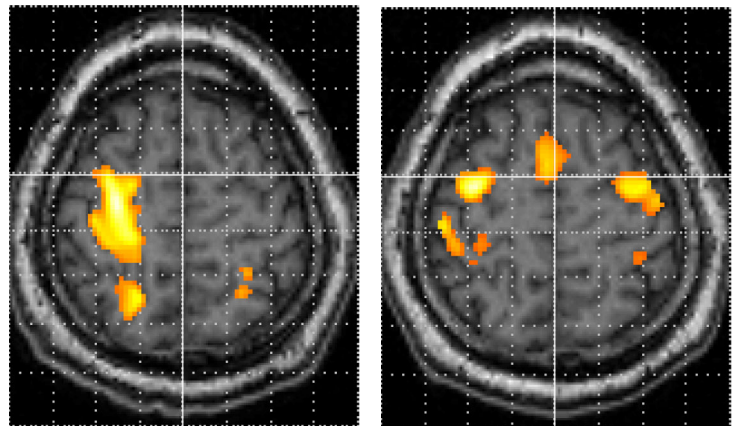


Fig.2A

Fig.2B

Fig.1 The numbers of activated voxels in M1 contralateral to the affected elbow movement. The number of activated voxels in the postoperative study was significantly smaller than that in volunteer studies ($p < 0.05$), while the number of activated voxels in the preoperative study did not show significant change.

Fig.2 Functional activation maps of the left elbow movement task in a patient with left brachial plexus injury before (A) and nine months after (B) the operation. Extent of activation in the right M1 had reduced.

CONCLUSION

Plastic changes in the primary motor cortex take several months to reflect impairment of elbow movement in patients with traumatic brachial plexus injury. Postoperative recovery of activation in the primary motor cortex has not essentially made approximately nine months after the operation of intercostal nerve transfer.