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Lesions Responsible for Visual Perception in Post-stroke Patients

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Introduction
Visual perception (VP) is a process that involves 'visual acceptance' and 'visual cognition' through interaction between multiple areas in the human brain. About 35-75% of patients with brain damage have particular impairments in VP that influence the activities of daily living. We aimed to clarify the clinical characteristics that affects on VP and elucidate the lesion location correlated with impaired VP such as visual discrimination, form consistency, visual short term memory, visual closure, spatial orientation assessed with 3rd version of motor-free visual perception test (MVPT-3).

Methods
We reviewed 91 patients with stroke. Clinical assessments such as Korean version of Mini-mental status exam (K-MMSE), MVPT-3, functional independence measure (FIM) were used to evaluate the impairment and limitation of patients after stroke. The patients were divided into 2 groups according to lesioned hemisphere, and we analyzed the differences in characteristics such as demographic factors, lesion factors, cognitive function, and visual perception. Regression analyses were performed to examine the predictors of impaired VP. Lesion location and volume were measured on brain magnetic resonance images. We generated statistic maps of lesions related to impaired VP in swallowing using voxel-based lesion symptom mapping (VLSM).

Result
The group of patients who have right hemispheric lesion had significantly low VP function, especially in subscore of visual discrimination and visual short-term memory. Also, in a regression model, impaired VP was predicted with low K-MMSE, age, and lesioned hemisphere. Using VLSM, we found the lesion location to be associated with impaired VP after adjusting for age and K-MMSE score. The results showed a lesion pattern with predominant distribution in the right parietal lobe and deep white matter.

Conclusion
Impaired VP in post-stroke patients was not negligible clinically. Patients' age and cognitive impairments affect the result of VP test. Even when adjusting it, we found a trend that the lesion responsible for impaired VP was located in the right parietal lobe and deep white matter. It confirms the right hemispheric dominance for VP using VLSM. The deficits in white matter lesion might be related to disconnection of fibers.
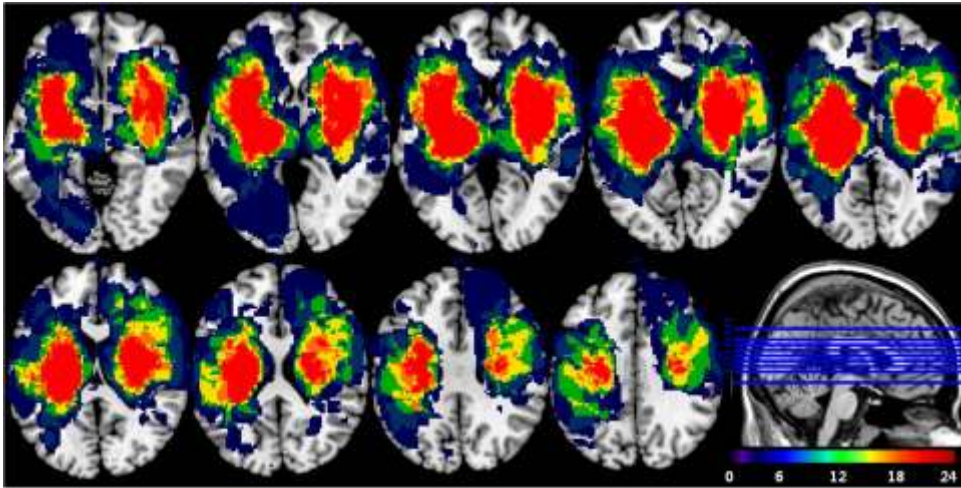
Fig 1. Lesion overlay map of 91 patients. Lesion overlay map of 91 patients showing bilateral coverage of most of the hemispheres. Lesions appear to be uniformly distributed in both hemispheres.

Table. 1. Predictors of MVPT score using regression analysis

Dependent Variable	Predictors	β	OR	CI	p-value
Total MVPT score	K-MMSE	0.514	6.408	0.569-1.080	0.000
	Age	-0.333	-4.160	-0.314~-0.111	0.000
	Lesion laterality	-0.234	-2.956	-5.908~-1.158	0.004

Abbreviation: K-MMSE, Korean version of mini mental status exam; MVPT, motor-free visual perception test
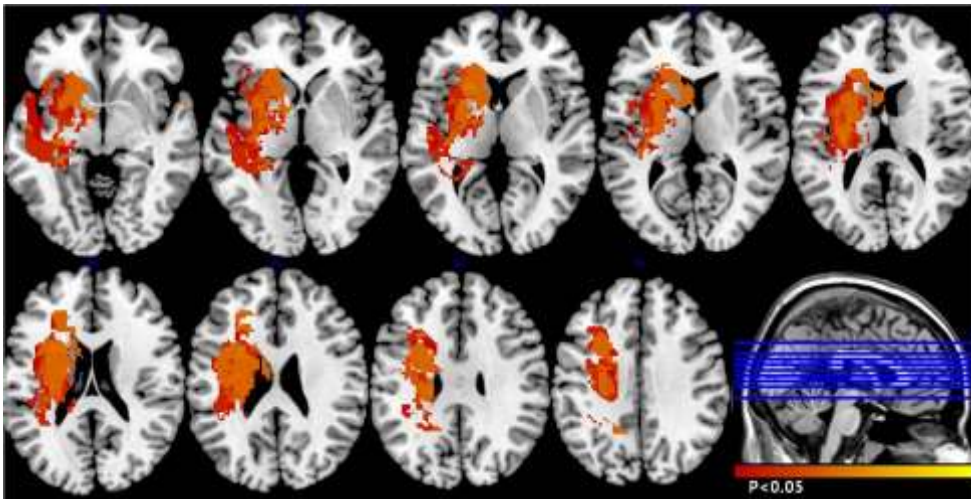

Fig 2. Lesion patterns associated with low MVPT score. Voxel-based lesion symptom mapping analysis shows the relationship between MVPT score and brain lesions. Only voxels significant at p < 0.05 FWE corrected, controlling age, cognitive function assessed with K-MMSE as nuisance covariates, are color-coded, ranging from red to yellow. Numbers are the z-coordinates of the MNI space, with the patient's right hemisphere on the left side of the figure.