뇌신경재활

게시일시 및 장소 : 10 월 18 일(금) 13:15-18:00 Room G(3F)

질의응답 일시 및 장소 : 10 월 18 일(금) 15:45-16:30 Room G(3F)

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Multimodal MRI correlates of motor outcome after stroke using machine learni

Jong Hyuk Lee[1*], Dae Hyun Kim[1†]

Veterans Health Service Medical Center, Seoul, Department of Physical Medicine and Rehabilitation[1]

Objective
The objective of this study is to apply machine learning regression to predict motor outcome after stroke based on multimodal magnetic resonance imaging.

Methods
Fifty-four stroke patients, who underwent T1 weighted (T1), diffusion tensor (DTI), and resting state functional magnetic resonance imaging (rfMRI) were retrospectively included. All patients were assessed using the Fugl-Meyer motor assessment (FM) score for motor outcome after stroke (Table 1). The kernel rigid regression machine algorithm was applied to gray and white matter maps in T1, fractional anisotropy and mean diffusivity maps in DTI, and two motor related independent component analysis maps in rfMRI to predict FM scores with the covariate as the onset duration after stroke. The results were validated using the leave-one-subject-out cross-validation method. To the best of our knowledge, this is the first attempt at applying machine learning in this area using multimodal MRI data and forms the main novelty of this study.

Results
We found that multimodal magnetic resonance imaging correctly predicted the FM score in 72% cases with a normalized mean squared error of 5.93 (p value = 0.0020, Fig 1). The ipsilesional premotor, periventricular, and contralesional cerebellar areas were shown to be of relatively high importance in the prediction (Fig 2).

Conclusion
Machine learning using multimodal magnetic resonance imaging data after stroke enables a prediction of motor outcome.

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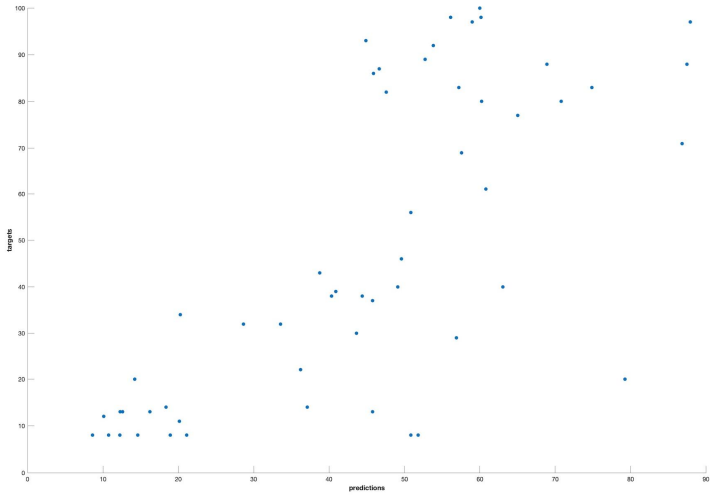

Figure. 1 Scatter plot of predictions of Fugl-Meyer motor assessment scores of 54 patients modeled using a kernel ridge regression. This plot represents the predicted values (x-axis) against the real values (y-axis). A perfect prediction is represented by the diagonal on this plot.

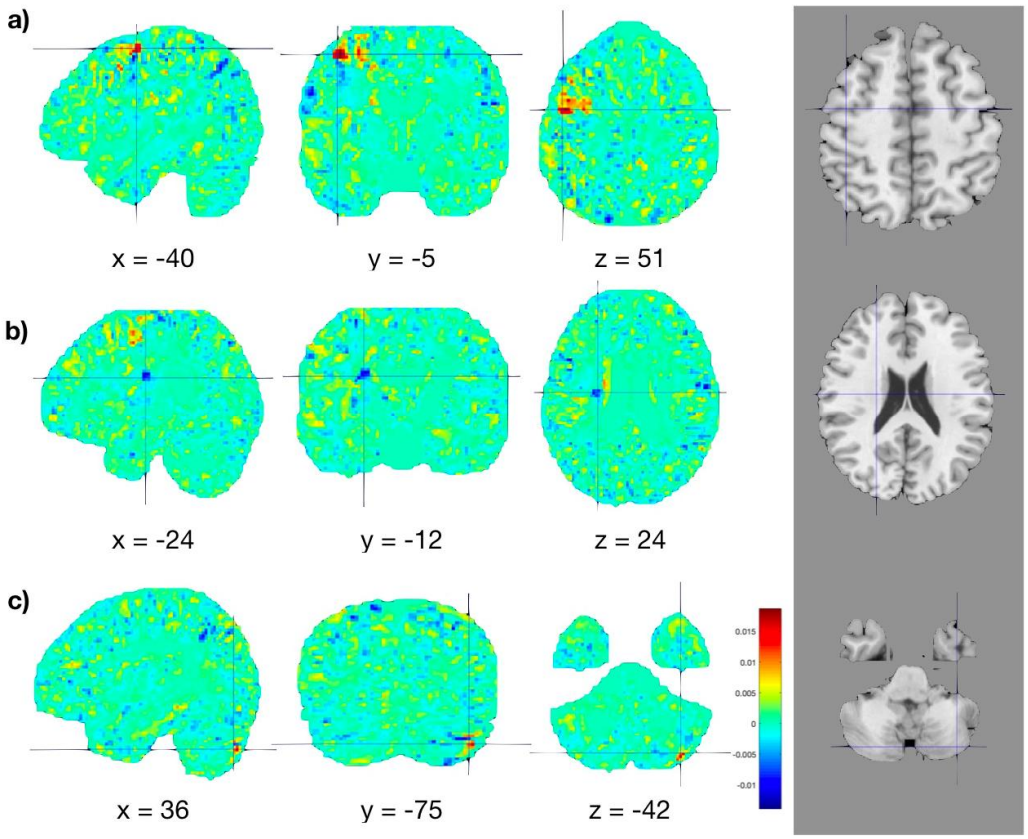

Figure. 2 Weights map at the voxel level for the prediction of Fugl-Meyer motor assessment. The cross-hair was positioned at the region with high contribution toward the outcome. The T1 weighted images are presented in the gray box while the x, y, and z-axes are based on the Montreal Neurological Institute space.

Table 1. General characteristics of included patients

	Patients
Demographic characteristics	
Age (years)	73.6 ± 8.4
Sex (male : female)	54 : 0
Duration post-stroke (months)	27.3 ± 47.7
Stroke type	
Middle cerebral artery infarction	35
Anterior cerebral artery infarction	5
Posterior cerebral artery infarction	2
Lacunar infarction	6
Intracerebral hemorrhage	6
Lesional hemisphere (Rt : Lt)	28 : 26
Fugl-meyer motor assessment	47.4 ± 33.3