Department of Rehabilitation Medicine

Masahiro Abo, *Professor* Kazushige Kobayashi, *Associate Professor*

General Summary

The main research projects in our department have been focused on neurorehabilitation, stroke, brain injury, and cognitive science.

Research Activities

Ability for basic movement as an early predictor of functioning related to activities of daily living in stroke patients

Background: Early functional outcomes for activities of daily living after a stroke may enable clinicians to establish treatment-optimal training and goals. The objective of this study was to assess at the bedside the relationship between the ability to perform basic movements, which were measured using a new scale, the Ability for Basic Movement Scale, in the early stage after stroke and functional ability at discharge from the hospital.

Methods: A total of 142 stroke patients participated in this prospective study. In addition to the Ability for Basic Movement Scale score, other predictor variables examined were age, limb paresis as indicated with the Brunnstrom stage, and functional ability as measured with the Barthel Index.

Results: Pearson correlation coefficient analysis showed that the state of functional ability at discharge was positively correlated with the total score of the Ability for Basic Movement Scale and with the Brunnstrom stage at all stages of data collection. The results of linear stepwise regression analysis indicated that significant predictors (75.6%) of functional ability at discharge were "turn over from supine position," "remain sitting," and "sit up" of the Ability for Basic Movement Scale 10 days after onset; age at onset of stroke; the baseline Barthel Index; and the baseline Brunnstrom stage.

Conclusions: This study provides evidence for the predictive value of the Ability for Basic Movement Scale with regard to functional ability in stroke patients.

Cerebral blood flow in patients with diffuse axonal injury: Examination of the easy Z-score imaging system utility

To evaluate the utility of the easy Z-score imaging system (eZIS) in cases of diffuse axonal injury (DAI), 27 patients with DAI were examined with magnetic resonance imaging (MRI) T2*-weighted sequence and with eZIS (7 women and 20 men; age range, 19–35 years; median age, 26.6 years). In this investigation, we excluded patients who had complications, such as acute subdural hematoma, acute epidural hematoma, intracerebral hematoma, and brain contusion. We performed neuropsychological tests and correlated the results with the findings of MRI/eZIS. Furthermore, we evaluated the degree of ventricular enlargement with the bifrontal cerebroventricular index (CVI).

Patients were divided into 2 groups: those with ventricular enlargement (bifrontal CVI＞35%, 12 patients) and those without ventricular enlargement (bifrontal CVI＜35%, 15 patients). Neuropsychological testing showed that all patients had cognitive deficits. Findings were abnormal in 15 of 27 patients with MRI T1/T2-weighted images and fluid attenuated inversion recovery, in 22 of 27 patients with MRI T2*-weighted images, and in 24 of 27 patients with eZIS. On MRI T2*-weighted imaging, abnormal findings were present in the white matter of the frontal lobe, corpus callosum, and brainstem. With eZIS, blood flow degradation was found in the frontal lobe in 22 patients (81.5%) and in the cingulate gyrus in 12 patients (44.4%). Patients with ventricular enlargement had significantly lower scores on the Functional Independence Measure, Mini-Mental State Examination, Verbal IQ/Full Scale IQ, Trail Making Test-B, and Non-paired Miyake Paired Test. Among the 12 patients without ventricular enlargement who had no abnormal findings on MRI T1/T2-weighted images or fluid attenuated inversion recovery, 7 patients had abnormal findings on MRI T2*-weighted imaging and 10 patients had abnormal findings on eZIS. Results of MRI alone cannot fully explain DAI frontal-lobe dysfunction. However, the addition of eZIS-assisted analysis derived from single photon emission computed tomography data enabled us to determine where blood flow was decreased, *i.e.,* where neuronal functions conceivably might be reduced.

Activation of the prefrontal cortex during the Wisconsin Card Sorting Test (Keio Version) as measured with 2-channel near-infrared spectroscopy in patients with traumatic brain injury

To investigate brain activation in the prefrontal cortex during the Wisconsin Card Sorting Test (Keio Version) (KWCST), we examined changes in total hemoglobin volume in 8 patients with traumatic brain injury (TBI) and 20 healthy control subjects by means of 2-channel near-infrared spectroscopy. We found that the average total hemoglobin volume in the right prefrontal cortex during KWCST in patients with TBI (-0.131 ± 0.127 was significantly lower than that in control subjects (0.016 ± 0.135 2× 3 ANOVA; $p < 0.05$). These results demonstrate that patients with TBI have lower hemoglobin circulation in the right prefrontal cortex during the KWCST than do control subjects.

Publications

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