

## Department of Rehabilitation Medicine

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### General Summary

The main research topics of our department are as follows: (1) repetitive transcranial magnetic stimulation (rTMS) for stroke, (2) dysphagia, (3) analysis based on a database, and (4) image analysis for brain injury.

### Research Activities

#### *Use of rTMS for treating stroke*

1. Effects of low-frequency rTMS combined with intensive speech therapy on cerebral blood flow in poststroke aphasia

The results suggest the possibility that functional magnetic resonance imaging-guided low-frequency rTMS combined with intensive speech therapy may affect cerebral blood flow and contribute to the improvement of language function of patients with poststroke aphasia.

2. Role of brain-derived neurotrophic factor in beneficial effects of rTMS for upper-limb hemiparesis after stroke

The combination therapy of rehabilitation plus low-frequency rTMS seems to improve motor function in the affected limb, by activating the processing of brain-derived neurotrophic factor (BDNF). Both BDNF and its precursor, proBDNF, are potentially suitable biomarkers for poststroke motor recovery.

3. Therapeutic administration of atomoxetine combined with rTMS and occupational therapy for upper limb hemiparesis after stroke: a study of 3 patients

Our protocol of triple therapy of atomoxetine, low-frequency rTMS, and occupational therapy is safe and feasible for patients with upper-limb hemiparesis after stroke.

#### *Dysphagia*

1. Assessment of feeding and swallowing in children: Validity and reliability of the Ability for Basic Feeding and Swallowing Scale for Children

Significant correlations of the total Ability for Basic Feeding and Swallowing Scale for Children score, Fujishima's Grade of Feeding and Swallowing Ability, and the Functional Independence Measure for Children suggest the need for comprehensive assessments rather than assessments of individual feeding and swallowing functions.

2. Effect of tube feeding method on establishment of oral intake in patients with dysphagia after stroke: Comparison of intermittent tube feeding and nasogastric tube feeding

The results of this study suggest that managing tube feeding by performing it intermittently achieves better outcomes for dysphagia rehabilitation than does nasogastric tube feeding.

3. A test of swallowing a citric acid solution is useful for screening for aspiration at the bedside and for detecting swallowing dysfunction at an early stage

The results suggest that a test of swallowing a citric acid solution is more sensitive for detecting dysphagia with laryngopharyngeal sensory dysfunction than is a modified water-swallowing test.

4. rTMS with intensive swallowing rehabilitation for poststroke dysphagia: An open-label case series

The 6-day in-hospital protocol of rTMS and intensive swallowing rehabilitation seems safe and feasible for patients with poststroke dysphagia and improves swallowing function.

5. Effect of dysphagia rehabilitation on oral intake in elderly patients with aspiration pneumonia

The data suggest that dysphagia rehabilitation has a positive effect on total oral intake in elderly patients with aspiration pneumonia and shows greater benefit if the pneumonia is mild rather than more severe.

#### *Analysis based on database*

1. Very early versus delayed rehabilitation of patients with acute ischemic stroke with intravenous recombinant tissue plasminogen activator: A nationwide retrospective cohort study

Patients with acute ischemic stroke undergoing very early rehabilitation after thrombolysis were more likely to achieve functional independence without an increase in adverse outcomes.

2. Effects of ankle-foot orthoses on functional recovery after stroke: A propensity score analysis based on a Japan rehabilitation database

These data suggest that the use of ankle-foot orthoses is a feasible option for improving the functional recovery of patients after stroke.

3. Clinical management provided by board-certificated physiatrists in early rehabilitation is a significant determinant of functional improvement in patients with an acute stroke: a retrospective analysis of a Japan rehabilitation database

These data demonstrated that clinical management provided by board-certificated physiatrists in early rehabilitation can lead to good functional recovery of patients with an acute stroke.

#### *Image analysis for brain injury*

1. Evaluation of regional white-matter volume reduction after diffuse axonal injury using voxel-based morphometry

The data showed that the volume of white matter decreased markedly in several regions of interest and correlated significantly with performance IQ and the processing speed index. The results indicate that this application can be used to evaluate diffuse axonal injury.

## 2. White matter structure and clinical characteristics of patients after stroke: A diffusion tensor magnetic resonance imaging study

Differences in generalized fractional anisotropy between hemispheres with lesions and hemispheres without lesions varied depending on the affected brain region, the patients' age at the onset of paralysis, and whether paralysis occurred in the dominant or nondominant hand.

### Others

#### 1. Trailblazing introduction of a hospitalization-associated disability prevention system using electronic medical recording systems at our hospital: Systemic attempt for forgotten complications in hospitalized patients

Our proposed hospitalization-associated disability prevention system using an electronic medical recording system appears to facilitate early rehabilitation and to prevent hospitalization-associated disability.

#### 2. A reference value of higher brain function for resumption of driving in patients with brain injury

Results of a paper-based test serve as a guideline as to whether a patient is capable of resuming driving but do not represent an absolute standard. Therefore, the safety of resuming driving should be investigated on a case-by-case basis.

### Publications

**Hara T, Abo M, Kobayashi K, Watanabe M, Kakuda W, Senoo A.** Effects of low-frequency repetitive transcranial magnetic stimulation combined with intensive speech therapy on cerebral blood flow in post-stroke aphasia. *Transl Stroke Res.* 2015; **6**: 365-74.

**Niimi M, Hashimoto K, Kakuda W, Miyano S, Momosaki R, Ishima T, Abo M.** Role of brain-derived neurotrophic factor in beneficial effects of repetitive transcranial magnetic stimulation for upper limb hemiparesis after stroke. *PLoS One.* 2016; **11**: e0152241.

**Kinoshita S, Kakuda W, Yamada N, Momosaki R, Okuma R, Watanabe S, Abo M.** Therapeutic administration of atomoxetine combined with rTMS and occupational therapy for upper limb hemiparesis after stroke: a case series study of three patients. *Acta Neurol Belg.* 2016; **116**: 31-7.

**Kamide A, Hashimoto K, Miyamura K, Honda M.** Assessment of feeding and swallowing in children: validity and reliability of the ability for basic feeding and swallowing scale for children (ABFS-C). *Brain Dev.* 2015; **37**: 508-14.

**Sugawara H, Ishikawa M, Takayama M, Okamoto T, Sonoda S, Miyai I, Fujitani J, Tsubahara A.** Effect of tube feeding method on establishment of oral intake in stroke patients with dysphagia: comparison of intermittent tube feeding and nasogastric tube feeding. *Japanese Journal of Comprehensive Rehabilitation Science.* 2015; **6**: 1-5.

**Kobayashi K, Kobayashi M, Abo M.** A citric-acid-solution swallowing test is useful as a screening test for aspiration at bedside and for the early detection of swallowing dysfunction. *J Clin Trials.* 2015; **5**: 245.

**Momosaki R, Abo M, Watanabe S, Kakuda W, Yamada N, Kinoshita S.** Repetitive peripheral magnetic stimulation with intensive swallowing rehabilitation for poststroke dysphagia: an open-label case series. *Neuromodulation.* 2015; **18**: 630-4.

**Momosaki R, Yasunaga H, Matsui H, Horiguchi H, Fushimi K, Abo M.** Effect of dysphagia rehabilitation on oral intake in elderly patients with aspiration pneumonia. *Geriatr Gerontol Int.* 2015; **15**: 694-9.

**Momosaki R, Yasunaga H, Kakuda W, Matsui H, Fushimi K, Abo M.** Very early versus delayed rehabilitation for acute ischemic stroke patients with intravenous recombinant tissue plasminogen activator: a nationwide retrospective cohort study. *Cerebrovasc Dis.* 2016; **42**: 41-8.

**Momosaki R, Abo M, Watanabe S, Kakuda W, Yamada N, Kinoshita S.** Effects of ankle-foot orthoses on functional recovery after stroke: A propensity score analysis based on Japan rehabilitation database. *PLoS One.* 2015; **10**: e0122688.

**Kinoshita S, Kakuda W, Momosaki R, Yamada N, Sugawara H, Watanabe S, Abo M.** Clinical management provided by board-certificated physiatrists in early rehabilitation is a significant determi-

nant of functional improvement in acute stroke patients: a retrospective analysis of Japan rehabilitation database. *J Stroke Cerebrovasc Dis.* 2015; **24**: 1019-24.

**Uruma G, Hashimoto K, Abo M.** Evaluation of regional white matter volume reduction after diffuse

axonal injury using voxel-based morphometry. *Magn Reson Med Sci.* 2015; **14**: 183-92.

**Ueda R, Yamada N, Kakuda W, Abo M, Senoo A.** White matter structure and clinical characteristics of stroke patients: a diffusion tensor MRI study. *Brain Res.* 2016; **1635**: 61-70.