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Clustering of Recovery Patterns after First-ever Stroke Using Artificial Intelligence

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Objective

There have been trials to perform the cluster analysis of functional recovery pattern and predictors of functional outcome in stroke patients. However, there was no report to achieve the clustering with multi-facet functional recovery patterns with longitudinal follow up of stroke patients. The objective of this study was to apply the clustering approach of multi-facet functional recovery pattern with bid data of in the Korean Stroke Cohort for Functioning and Rehabilitation (KOSCO) using artificial intelligence, and to provide valuable prediction models for clinically use.

Materials and Methods

This study was an interim analysis of the KOSCO designed as 10 years long-term follow-up study of stroke patients. All patients who admitted to the representative hospitals in 9 distinct areas of Korea with their acute first-ever stroke (from August 2012 to May 2015) were recruited. In this study, we analyzed data of participants who completed functional assessments from 7 days to 12 months year after stroke onset. Functional assessments included Korean modified Barthel Index (K-MBI), Korean Mini-Mental State Examination (K-MMSE), Fugl-Meyer Assessment (FMA), Functional Ambulatory Category (FAC), the American Speech-Language-Hearing Association National Outcome Measurement System Swallowing Scale (ASHA-NOMS), and Short Korean Version of Frenchay Aphasia Screening Test (Short K-FAST). The cluster analysis using artificial intelligence was performed for multi-facet functional recovery patterns of independency, motor, ambulation, cognition, language, and swallowing functions. After the cluster analysis, a group of rehabilitation specialists reviewed the clinical meaningfulness with clustered population, whether the groups had high homogeneity and representativeness of the clinical stroke recovery patterns. After these clustering approaches, a prediction model using deep learning was performed. The accuracy of classification of this prediction model was evaluated by comparing how much the prediction was equivalent to the actual clustering result.

Results: After the deep learning in supervised manners on artificial intelligence, multi-facet functional recovery patterns after stroke could be classified into ten groups. Each group showed a different multi-facet functional recovery pattern from 7 day to 12 months, and this clustering showed a clinically acceptance. In addition, the accuracy in classification with clinical characteristics at 7 days showed more than 73.0%. This result showed a higher prediction value compared with results of conventional statistical analysis.

Conclusion
The results of this study demonstrated the potentials of the clustering and predicting functional recovery patterns of stroke patients using artificial intelligence. These results might be useful for establishing patient-tailored rehabilitation strategy after stroke.

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