ARTICLE

Prediction of Long-term Cognitive Function After Minor Stroke Using Functional Connectivity

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Neurology® 2021;96:e1167-e1179. doi:10.1212/WNL.0000000000011452

Abstract

Objective

To determine whether functional MRI connectivity can predict long-term cognitive function 36 months after minor stroke.

Methods

Seventy-two participants with first-ever stroke were included at baseline and followed up for 36 months. A ridge regression machine learning algorithm was developed and used to predict cognitive scores 36 months poststroke on the basis of the functional networks measured using MRI at 6 months (referred to here as the poststroke cognitive impairment [PSCI] network). The prediction accuracy was evaluated in 4 domains (memory, attention/executive, language, and visuospatial functions) and compared with clinical data and other functional networks. The models' statistical significance was probed with permutation tests. The potential involvement of cortical atrophy was assessed 6 months poststroke. A second, independent dataset (n = 40) was used to validate the results and assess their generalizability.

Results

Based on the PSCI network, a machine learning model was able to predict memory, attention, visuospatial functions, and language functions 36 months poststroke (r^2: 0.67, 0.73, 0.55, and 0.48, respectively). The PSCI-based model was at least as accurate as models based on other functional networks or clinical data. Specific patterns were demonstrated for the 4 cognitive domains, with involvement of the left superior frontal cortex for memory, attention, and visuospatial functions. The cortical thickness 6 months poststroke was not correlated with cognitive function 36 months poststroke. The independent validation dataset gave similar results.

Conclusions

A machine learning model based on the PSCI network can predict long-term cognitive outcome after stroke.

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