뇌신경재활

발표일시 및 장소 : 10 월 18 일(금) 14:05-14:15 Room B(5F)

**OP2-1-6**

## Temporal Change in Corticospinal Integrity and Motor Outcome after Stroke: A 6-month follow-up Study

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**Objective**

Recovery of motor function is important for regaining independence after stroke, but difficult to predict for individual patients. Corticospinal tract (CST) changes with time after stroke. However, few studies have investigated longitudinal change of CST and its relationship with motor outcomes. Our primary goal was to evaluate dynamic changes in axonal integrity along bihemispheric CST after stroke using diffusion tensor image (DTI). We also investigated relationship between CST changes and the functional motor outcome in upper and lower extremities at 6 months after onset of stroke.

**Methods**

We collected data from the STroke Outcome Prediction (STOP) database that is prospective data collecting system for functional recovery prediction after stroke based on neuroimaging study. Fifty-five patients with first-ever stroke who performed functional assessment and underwent DTI at 30 days and 6 months poststroke were included. Clinical evaluation included Fugl-Meyer Assessment (FMA), Manual Function Test (MFT), Berg Balance Scale (BBS), Functional Ambulation Category (FAC), Medical Research Council (MRC) scale of muscle strength test. For the prognostic factor prediction by Classification and Regression Tree (CART) analysis, each evaluation was classified into good and poor outcome group based on pre-designated functional levels. DTI values investigated were fiber number (FN), average fiber length (AL), fractional anisotropy (FA), axial diffusivity, mean diffusivity, radial diffusivity (RD), laterality index (LI) and delta (Δ) changes of these values. Also type of CST by diffusion tensor tractography was included for analysis (Fig. 1).

**Results**

Thirty-seven ischemic and 18 hemorrhagic stroke patients were included. FA decreased and diffusivity indices (AD, MD, RD) increased in ipsilesional hemisphere; Decrease of FA and increase of RD were also noted in contralesional side (Table 1). Type of CST were changed in 19 patients (34.6%). Spearman correlation analysis showed strong correlations between DTI values (FN, AL, FA, RD) and motor outcomes (FMA, MFT, BBS, FAC, MRC) at 30 days and 6 months. However, ΔFA or ΔRD did not show significant correlation with Δ

changes of motor outcomes. The CART analysis produced four decision trees. FA was the first decision point in FMA (upper and lower limbs) (Fig. 2); patients with higher FA at 30 days were more likely to have good motor outcome. AL longer than 114.83 mm was second decision point in FMA (upper limb) decision tree for those who had higher FA (> 0.4486). Lower LI (more symmetric) of FA and lower RD were decision points for MFT and FAC, respectively. Overall prediction accuracy ranges from 81.8 to 90.9 %.

**Conclusion**

The integrity of CST is constantly changing even during the late-subacute stage of stroke. This change in CST is observed not only on the lesion side but also on the contralateral side. DTI taken at first month are useful for predicting 6-month motor outcome after stroke.

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Table 1. Changes of diffusion tensor imaging values in the lesion side and the contralateral side

| | Median (Interquartile range) | | | |
|---|---|---|---|---|
| | 30 days | 6 months | Δ | p-value |
| Ipsilesional | | | | |
| FN | 395 (608) | 388 (575) | -11 (305) | 0.795 |
| AL | 118.07 (35.05) | 116.25 (39.79) | -2.77 (28.48) | 0.181 |
| **FA** | .492500 (.089100) | .484900 (.124400) | **-.017100 (.038000)** | **0.005**** |
| **AD** | .001295 (.000153) | .001362 (.000147) | **.000035 (.000105)** | **0.011*** |
| **MD** | .000806 (.000103) | .000846 (.000096) | **.000036 (.000087)** | **0.006**** |
| **RD** | .000564 (.000123) | .000597 (.000150) | **.000036 (.000108)** | **0.001**** |
| Contralesional | | | | |
| FN | 830 (633) | 873 (590) | 22 (264) | 0.217 |
| AL | 131.52 (15.77) | 130.60 (14.57) | -0.45 (8.47) | 0.172 |
| **FA** | .554700 (.036600) | .548300 (.036400) | **-.008700 (.023200)** | **0.000**** |
| AD | .001371 (.000087) | .001361 (.000086) | -.000003 (.000057) | 0.224 |
| MD | .000802 (.000078) | .000816 (.000068) | .000008 (.000038) | 0.327 |
| **RD** | .000521 (.000069) | .000533 (.000062) | **.000012 (.000034)** | **0.006**** |

* denotes $p < 0.05$; ** denotes $p < 0.01$

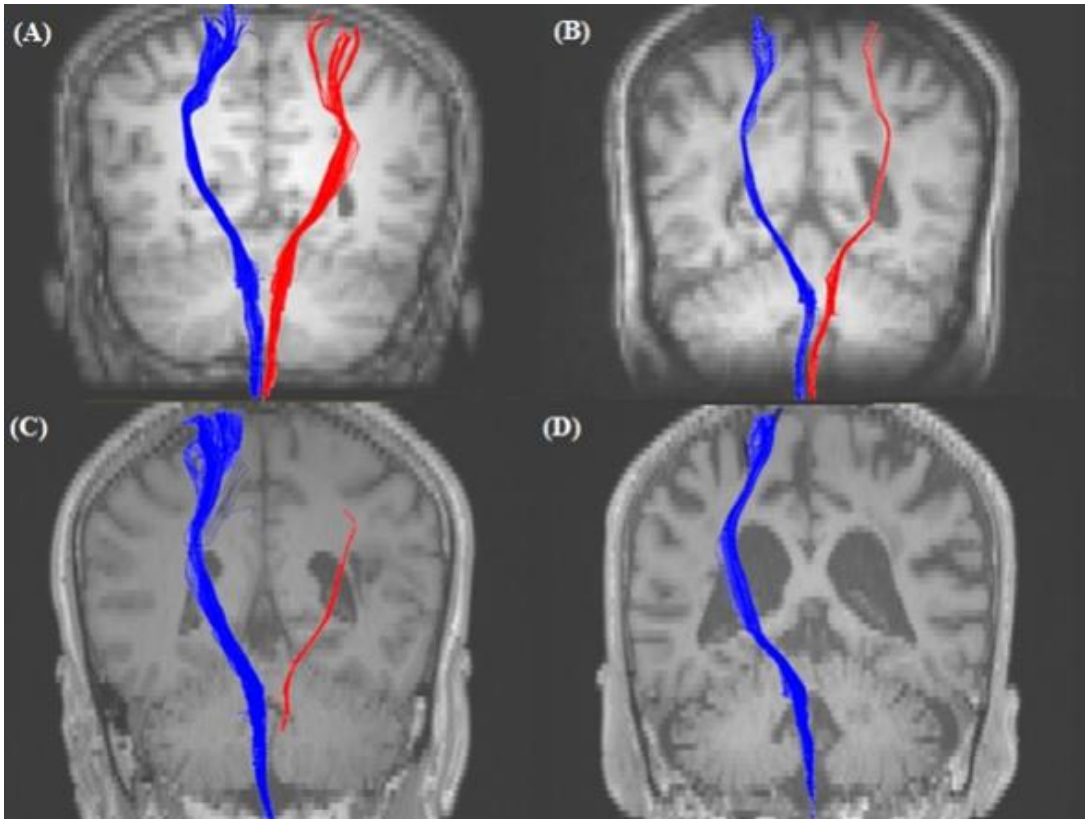

Fig. 1. Corticospinal tract (CST) type of diffusion tensor tractography. Type A, CST symmetrically preserved; type B, CST preserved, but asymmetric; type C, CST interrupted at the lesion; and type D, CST not constructed due to degeneration

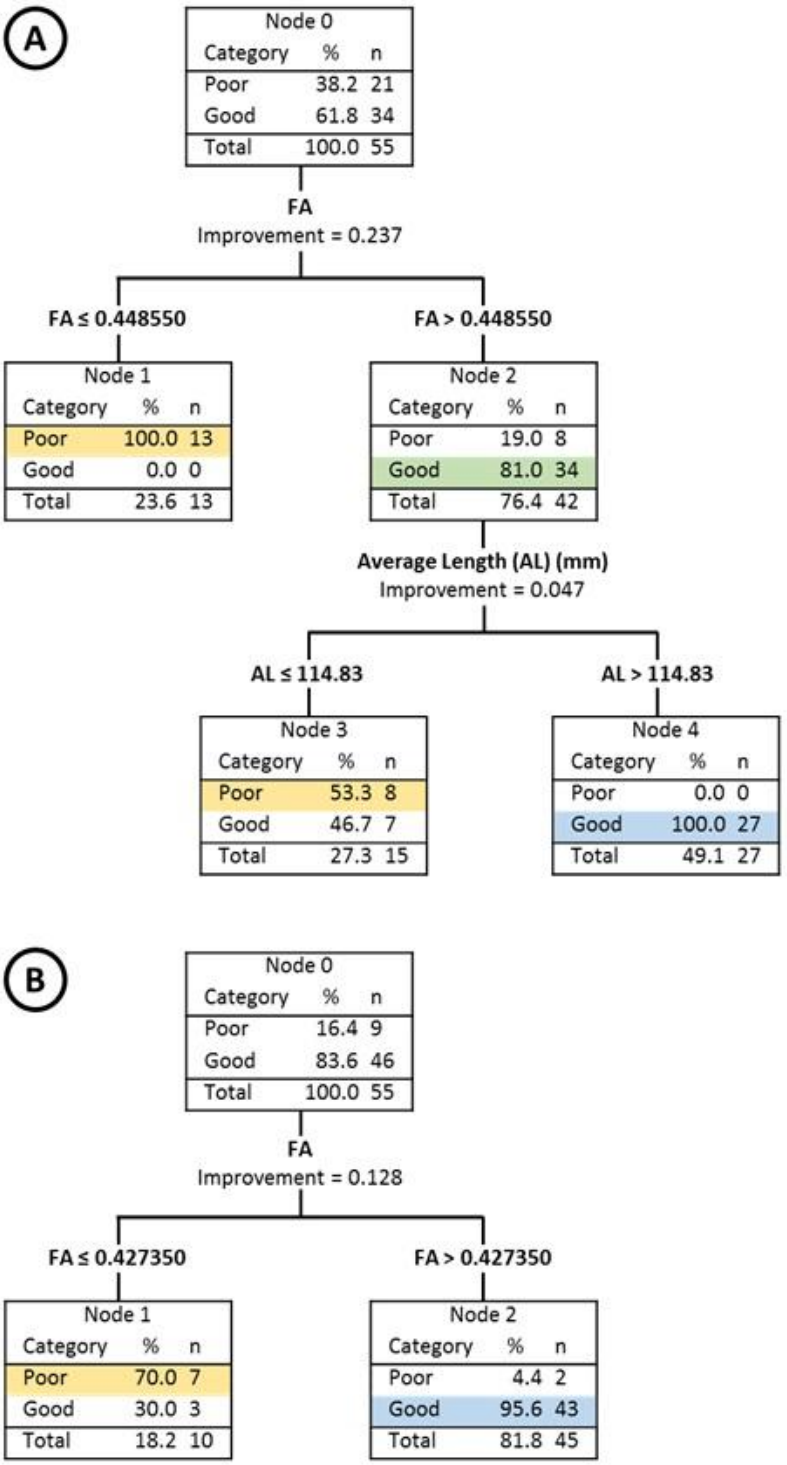


Fig 2. Classification and Regression Tree (CART) analysis. CART analysis identified neuroanatomical factors that predict motor function at 6 months after stroke. A, Fugl-Meyer Assessment (upper limb); B, Fugl-Meyer Assessment (lower limb)