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Correlation between Diffusion Tensor Fractional Anisotropy and Functional Outcomes in stroke

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Objective
Fractional anisotropy (FA) measured by diffusion tensor imaging (DTI) represents neural fiber integrity and directionality of white matter tract. This study aimed to determine whether fractional anisotropy of the corticospinal tract is useful to predict functional outcome at a month after stroke onset.

Subject & Method
Medical records of 75 subacute stroke patients who admitted to rehabilitation center from August 2017 to February 2018 were reviewed retrospectively. Patients were classified into 2 groups by whether the FA value of affected side is measured or not : incompletely disrupted group and completely disrupted group. The FA ratio (the FA of affected side divided by that of unaffected side) and fiber number (FN) ratio of corticospinal tract were calculated to determine the correlation with functional outcome in incompletely disrupted group. Functional outcomes from a month after stroke onset were measured by functional independence measure (FIM), Fugl Meyer assessment (FMA) of upper extremity and lower extremity, trunk impairment scale (TIS), berg balance scale (BBS), and length of stay (LOS). In addition, incompletely disrupted group was compared with the group with completely disrupted group for functional outcome differences.

Result
The motor component of FIM, FMA of upper extremity, and BBS were positively correlated and LOS was negatively correlated with FA ratio (Table 2). Table 3 showed that incompletely disrupted group was significantly higher in FMA of upper extremity, TIS and BBS at one month after stroke onset and lower in LOS than in completely disrupted group.

Conclusion
This study found that the FA value of corticospinal tract can be a good predictor of functional outcomes and LOS for subacute stroke patients. Further prospective study should be needed for determining the predictability of diffusion tensor imaging for functional recovery in stroke patients.

Table 1. Demographic and clinical characteristics

	incompletely disrupted group (n=69)	completely disrupted group (n=6)
Age (years)	66.51±11.46	71.83±12.32
Sex (male/women)	38/31 (55.1/44.9%)	4/2 (66.7/33.3%)
Interval time to DTI (days)	15.49±8.74	24.33±10.42
Etiology (cerebral infacrtion/ cerebral hemorrhage)	56/13 (81.2/18.8%)	4/2 (66.7/33.3%)
Lesion side (right/left)	25/44 (36.2/63.8%)	4/2 (66.7/33.3%)
Lesion location (supratentorial/infratentorial/cerebellum)	56/12/1 (81.2/17.4/1.4%)	4/2/0 (66.7/33.3/0%)

Table 2. Correlation between functional outcome and functional anisotropy ratio (rFA) and fiber number ratio (rFN) of corticospinal tract

		rFA	rFN
LOS_total	pearson correlation coefficient	-.355**	-.035
	p value	.003	.778
FIM_motor	pearson correlation coefficient	.249*	.151
	p value	.039	.217
FIM_cognitive	pearson correlation coefficient	-.025	.047
	p value	.839	.700
FIM_total	pearson correlation coefficient	.176	.127
	p value	.147	.300
FMA_U/E	pearson correlation coefficient	.415**	.190
	p value	.000	.119
FMA_L/E	pearson correlation coefficient	.234	.212
	p value	.053	.080
TIS	pearson correlation coefficient	.000	.139
	p value	.276	.254
BBS	pearson correlation coefficient	.261*	.171
	p value	.030	.160

Table 3. Comparison of functional outcome at one month after stroke onset between incompletely disrupted group and completely disrupted group

	incompletely disrupted group (n=69)	completely disrupted group (n=6)	p value
LOS_total	52.54±13.30	78.83±20.41	.024
FIM_motor	50.71±21.58	29.67±24.87	.094
FIM_cognitive	23.25±9.17	19.00±11.70	.422
FIM_total	73.96±29.13	48.67±34.78	.138
FMA_U/E	48.16±22.13	18.33±23.54	.025
FMA_L/E	25.41±9.08	12.33±11.70	.136
TIS	17.16±6.90	10.17±9.58	.065
BBS	35.71±18.97	15.17±21.32	.040