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# Pre-stroke Core Muscle Stability as a Predictor of Trunk Balance in Subacute Stroke Patients

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**Objective**
Postural core instability is associated with poor dynamic balance, and trunk control ability is a crucial component to perform activity of daily living (ADL). Previous studies presented that trunk control ability or sitting balance at an early stage could predict ADL outcome at a late stage in patients after a stroke. There have been some reports about the correlation between trunk balance and change of muscle thickness during core exercise. But, there has been no trial about the correlation between trunk balance and resting muscle thickness including back muscles and the abdominal balance in subacute stroke patients. The Objective of this study was to determine the relationship between trunk muscles thickness measured by ultrasonography and trunk balance of stroke patients during the subacute phase.

**Methods**
We enrolled 21 patients with first-ever stoke during the period of March, 2018 through June, 2018. All patients were admitted or transferred to our rehabilitation department within 6 months of onset. Patients with recent abdominal or spine surgical procedure were excluded from the study. The thickness of the abdominal muscles and back muscles was measured by ultrasonography with the patient in the hook-lying position and prone position on an examination table, respectively. Abdominal muscles such as external and internal oblique muscles (EO and IO), transverse abdominis (TrA), rectus abdominis (RA) and back muscle such as lumbar multifidus (LM), lumbar erector spinae (ES), quadratus lumborum (QL) were measured. Functional ability was evaluated with the functional independence measure (FIM) instrument, and balance was measured using the 14-item of Berg Balance Scale (BBS) and trunk impairment scale (TIS). All measures were assessed at the same day of inpatient rehabilitation. Partial correlation coefficient was used to analyze the correlation between trunk muscles thickness and trunk balance and functional outcome. Data analyses involved use of SPSS v18.0 for Windows. $P<0.05$ was considered statistically significant.

**Results**
Correlation analysis revealed that BBS showed significant positive correlation with the thickness of EO ($p=0.008$) and TrA. ($p=0.005$) in non-paretic side (Table 1). The functional outcome also revealed significant positive correlation with the non-paretic side EO thickness ($p=0.009$) and non-paretic side TrA thickness ($p=0.025$) (Table 2). There was no significant relationship between trunk balance and back muscles thickness.

**Conclusion**

This is the first study to investigate the correlation between resting trunk muscles thickness and trunk balance in stroke patients. Our Results reveal that abdominal muscle thickness of non-paretic side is significantly associated with trunk balance and functional outcome during subacute phase of rehabilitation. These findings suggest that prestroke core muscle stability including abdominal muscle thickness might influence the trunk balance in subacute stroke patients.

Table 1. Partial correlation coefficient (r) between the Trunk Muscles and Trunk Balance (BBS, TIS) adjusted for sex, age, height and weight (n=21)

| Variables | BBS | | TIS | |
|---|---|---|---|---|
| | Pearson coefficient : r | p-Value | Pearson coefficient : r | p-Value |
| p-EO | 0.168 | 0.519 | -0.134 | 0.608 |
| p-TrA | 0.305 | 0.235 | 0.074 | 0.777 |
| p-LM | -0.194 | 0.455 | -0.308 | 0.229 |
| n-EO | 0.616 | 0.008* | 0.318 | 0.213 |
| n-TrA | 0.647 | 0.005* | 0.356 | 0.161 |
| n-LM | -0.083 | 0.753 | -0.319 | 0.212 |

p-: paretic side, n-: non paretic side, EO: External oblique, TrA: Transverse abdominis, LM: Lumbar multifidus

*P <0.05

Table 2. Partial correlation coefficient (r) between the Trunk Muscles and Functional Outcome (FIM) adjusted for sex, age, height and weight (n=21)

| Variables | FIM | |
|---|---|---|
| | Pearson coefficient : r | p-Value |
| pEO | 0.265 | 0.305 |
| pTrA | 0.308 | 0.229 |
| pLM | 0.010 | 0.971 |
| nEO | 0.614 | 0.009* |
| nTrA | 0.540 | 0.025* |
| nLM | -0.027 | 0.919 |

p-: paretic side, n-: non paretic side, EO: External oblique, TrA: Transverse abdominis, LM: Lumbar multifidus

*P <0.05