Heart rate variability is associated with upper extremity recovery after stroke

Among the 795,000 individuals who sustain a stroke annually in the United States, almost 65% are unable to use their affected upper extremity (UE) in daily activities. Individuals who do not regain affected UE function in the acute phase require costly resources to support long-term independence. UE rehabilitation is most effective when likely responders (i.e. patients with good potential for UE recovery) can be identified early in the rehabilitation process. Unfortunately current predictors such as location and volume of stroke and initial UE impairments are poor predictors of UE recovery after stroke. Identifying novel biomarkers of UE recovery will allow clinicians to more accurately predict individuals with potential for UE recovery and provide targeted interventions to enhance long-term independence.

Heart rate variability (HRV) or the temporal variations between consecutive heartbeats could predict UE recovery after stroke. HRV, which can be easily detected by the activity of the vagus nerve, a cranial nerve that controls the autonomic functions of the heart, is a plausible proxy marker for the integrity of cortical pathways controlling UE function. We examined whether HRV upon admission to acute inpatient rehabilitation is associated with UE recovery three months after stroke. We hypothesized that individuals with optimal HRV at acute inpatient rehabilitation admission will exhibit greater UE recovery after 3 months. This is the first step in developing a prediction model using HRV to predict UE recovery after stroke.

A 12-lead Holter monitor was attached for 24-hours in 10 patients [mean age = 61 years (±12)] with stroke within three days of admission to acute inpatient rehabilitation. Seven out of 10 patients were females, and 7 had ischemic stroke. Standard deviation between the consecutive heartbeats (SDNN) was used to compute HRV. Fugl Meyer Upper Extremity Subscale (FMUE) was used to assess UE recovery at three months after stroke. In our sample, HRV upon admission was strongly (r^2= .80) and significantly (p =.009) associated with three month FMUE scores such that individuals who had higher HRV showed greater UE recovery three months after stroke.

Our preliminary findings suggest that HRV seems to be a plausible biomarker to predict UE recovery after stroke. Using HRV will be novel, inexpensive, and easy to administer. Future studies with a large sample size are warranted to examine whether HRV can predict UE recovery after controlling for potential covariates (age, stroke location and volume, time since stroke and amount and type of rehabilitation).