Brain Structure and Function Associations In Stroke

UNC SCHOOL OF MEDICINE

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INTRODUCTION

- Stroke involves the loss of blood flow to the brain which often results in a loss of motor function.
- Electroencephalography (EEG) is a non-invasive method of directly capturing neural activity from underlying brain.
- Neural activity in the high beta frequency range (20-30 Hz), generated from underlying thalamocortical connections, subserves motor behavior.
- MRI is a non-invasive brain imaging technique that captures structural properties of the brain such as volume and thickness of cortex.

PURPOSE: to determine associations between brain structure (motor cortex thickness and volume and thalamus volume) and brain function as measured with EEG in individuals with stroke.

METHODS

PARTICIPANTS: 19 participants with stroke recruited in an inpatient rehabilitation facility following stroke

Table 1. Subject Demographics (N=19)

Measure	Value	Range
Stroke lesion side, right/left	8/11	
Dominant hemisphere injured, yes/no	11/8	
Stroke type, ischemic/hemorrhagic	15/4	
Sex, male/female	15/4	
Time poststroke, days	12.4(6.8)	3-25
Age, years	57.5(12.4)	27-79

Values are listed as Mean(SD)

Figure 1. Brain function was assessed using a 256-lead dense array EEG system

Figure 2. MRI scan of a representative participant with the Desikan Killiany atlas overlaid on image. Orange and purple arrows denote areas of interest including motor cortical and thalamic regions, respectively.

METHODS

- Participants completed a three-minute resting-state EEG (**Figure 1**).
- Stroke lesions were flipped to the left hemisphere so that the left hemisphere was the stroke hemisphere for all participants.
- EEG recordings were processed and source-localized to the Desikan Killiany atlas.
- EEG power from the ipsilesional and contralesional motor (iM1, cM1) regions were computed in the high beta (20-30 Hz) frequency band.
- MRIs were processed with FreeSurfer to ensure gray and white matter were accurately defined and skull segments eliminated (**Figure 2**).
- Measures of iM1 and cM1 thickness and volume and and bilateral thalamus volumes were obtained from processed MRIs normalized to the Desikan Killiany atlas.

RESULTS

Table 2. Ipsilesional Correlations and p-values

EEG Power Measure	Ipsilesional Thalamic Volume	Ipsilesional M1 Thickness	Ipsilesional M1 Volume
High Beta iM1 Power	-0.30, p=0.25	-0.25, p=0.36	-0.17, p=0.54

Table 3. Contralesional Correlations and p-values

EEG Power Measure	Contralesional Thalamic Volume	Contralesional M1 Thickness	Contralesional M1 Volume
High Beta cM1 Power	-0.17, p=0.48	0.16, p=0.51	0.24, p=0.31

CONCLUSIONS

- There were no significant associations observed between structure and high beta power within the thalamic nor the motor cortex region.
- Our findings indicate that within post-stroke motor patients, the size of the motor cortex and thalamic regions are not affected by motor function.
- Further work should examine structure-function associations in a control (non-stroke) group and investigate additional regions of interest such as the supplementary and premotor cortices.

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