Predicting antidepressant response to transcranial magnetic stimulation with heart rate variability

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Introduction

• Treatment resistant depression (TRD): a form of depression where patients do not respond to ≥ 2 antidepressant treatments. Occurs in ~20% of people with depression.
• Repetitive transcranial magnetic stimulation (rTMS) is an effective intervention for TRD (~40% efficacy).
• We are unable to predict treatment outcome. This would allow for a personalized-medicine approach to treat TRD.
• Heart rate variability (HRV) measures the balance between sympathetic and parasympathetic nervous system processes because by measuring the temporal variability between successive heart beats (Figure 1).

Hypothesis

• Baseline HRV would increase following successful rTMS treatment.
• HRV would be inversely correlated with depression scores.
• Baseline and HRV reactivity would predict subsequent treatment outcome.

Methods

• Present analysis: 17 individuals with TRD receiving rTMS treatment at UIHC between 2018 and 2020. Demographics are displayed in Tables 1 and 2.
• Participants sat at rest for 5 minutes and while watching a clip from Funniest Home Videos while electrocardiogram data was collected with BIOPAC MP150 before and after a full clinical treatment course of TMS.

Results

Figure 2 and 3. No significant changes in Rest or Happy RMSSD before and after treatment for treatment non-responders and responders. Figure 4 and 5: No significant correlations between percent change in Rest or Happy RMSSD and percent change PHQ-9. Their regression lines are plotted. Figure 6: There was a significant difference in pre-treatment Reactivity between responders and non-responders; non-responders had greater HRV Reactivity. There was also a significant decrease in HRV reactivity from pre to post treatment in non-responders, and no significant change for responders. Figure 7: No significant relationship between percent change in Reactivity RMSSD and PHQ-9 scores.

Discussion

• In contrast to expected outcomes, Rest and Happy HRV was not significantly associated with depression scores or treatment response.
• Low HRV may be a trait, rather than state marker of depression and may not be a useful predictor of treatment response.
• Greater Reactivity was found in non-responders compared to responders.
• High pre-treatment Reactivity may indicate a subsequent treatment non-responder, contradicting our expected results.
• A preliminary power analysis indicates that these analyses are extremely underpowered.
• Concurrent medications such as SSRIs, tricyclics, and benzodiazepines may drive most of the relationships between depression and HRV.
• Over 40% of our participants were taking these medications and had comorbid cardiovascular conditions.
• A meta-analysis suggests that there may not be a change in HRV after antidepressant treatment, possibly due to heterogeneous sample characteristics and HRV measurements between studies.
• In conclusion, the relationship between depression treatments and HRV remain unclear.
• Going forward, we will assess the effects of demographics, comorbidities, and medications on these relationships, as well as other measures of HRV.

References