Docket #: S22-270

Neurological Biomarker for Efficacy of Depression Treatment

Stanford scientists developed a novel strategy that uses resting-state functional connectivity magnetic resonance imaging (rs-fMRI) to determine whether a person will respond to treatment for depression.

Major depressive disorder (MDD), a leading cause of disability worldwide, is likely a product of abnormal communication patterns within brain-wide networks. An inability to detect biomarkers of MDD in the human brain has slowed progress in MDD treatment. Mechanism-based MDD biomarkers have eluded us due to conceptual and experimental barriers. First, it is difficult to assign a causal relationship between biomarkers and MDD because causal tests are rarely performed on seemingly MDD-related differences identified in patients. Second, although MDD arises from aberrant communication in the brain, many neuroimaging studies evaluate either tonic activity levels in individual brain regions or functional connectivity between brain regions. The latter comes with a major caveat that signaling directionality is not assigned, with possibly significant physiological implications.

Stanford researchers sought to address these problems by examining how directed communication patterns in the human brain relate to the neurobiology of MDD using repetitive transcranial magnetic stimulation (rTMS) and rs-fMRI. They found that active rTMS modulates the directional flow of rs-fMRI activity between different brain regions and that variance in the temporal effect's magnitude corresponds to treatment efficacy. Additionally, they found that rTMS corrects a baseline aberrancy in neural flow patterns. They also showed that the baseline temporal structure of individual patients with MDD can predict treatment response. Hence, they developed a novel biomarker for depression treatment efficacy.

Note: This docket is related to S22-390, which describes neuromodulation targeting based on lag-based resting state functional connectivity.

Stage of Development
Research - in vivo

Applications

- Biomarker for efficacy of depression treatment

Advantages

- No other such biomarker exists on the market.

Patents

- Published Application: WO2024015998
- Published Application: 20260021317

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