Modulation of the Neural Circuitry Underlying Obsessive-Compulsive Disorder

OCD Awareness Day
October 14, 2017

NOLAN WILLIAMS, M.D.
Instructor
Department of Psychiatry
Stanford University
Disclosures

• None
Goals of the Talk

• To discuss OCD as a ‘Circuit Disorder’

• To discuss the historical context for the assessment and treatment of circuit disorders.

• To discuss the known and emerging circuit abnormalities seen in OCD.

• To discuss novel treatment approaches being studied in OCD.
OCD can be understood at different levels:

- Dysfunction at output level
- Dysfunction at synapse level
- Dysfunction at circuit level
- Dysfunction at macroelectrical level
- Dysfunction at macroanatomical level
OCD as a Circuit Disorder

Dystonia
Tourette Syndrome

OCD
Depression
Severe Circuit Disorders Require Circuit-Level Intervention
Jean Talairach: Obsessive-Compulsive Disorder Can Be Localized

Figure 1 (left) anterior capsulotomy, Figure 2 (middle) Talairach atlas, and Figure 3 (right) Jean Talairach, psychiatrist and functional neurosurgeon.

Mahlon Delong: Frontal-Subcortical Circuitry has a General Structure

Figure 1 (left) frontal-subcortical circuitry has a general structure, is recordable and measurable. Figure 2 (center) several cortico-striatal loops, Figure 3 (right) Mahlon Delong.

Transcranial Magnetic Stimulation: A Neuropsychiatric Tool for the 21st Century
Obsessive-Compulsive Disorder Can Be Functionally Localized on a Circuit and Modulated with Treatment


Figure 1 (left) PET for OCD, Figure 2 (right) PET pre-/post- treatment. After treatment, the metabolic activity of the head of the right caudate nucleus, can be decreased.
rTMS Can Change Circuit Activity

Figure 1 (left): first case of rTMS to the L DLPFC with pre/post PET. Figure 2 (right): Mark George.

TOOLS FOR UNDERSTANDING CIRCUIT DISORDERS
The Neural Circuits Underlying OCD Can Be Imaged
OCD has a Neurophysiological Signature

CIRCUIT DISORDERS AND NEUROMODULATION
Known Brain Targets for Modulating Obsessive-Compulsive Disorder Circuitry

- **rTMS and Implanted Cortical Stim**
- **OFC and ACC**
- **Striatum**
  - **Direct pathway**
  - **Indirect pathway**
- **Thalamus**
- **GPi and SNr**
- **STN**

DBS


International OCD Foundation
July 8, 2017

Implanted Cortical Stimulation of ACC for OCD

Different Node, Same Condition, Same Effect

DBS targeted at the nucleus accumbens (NAc) as well as rTMS targeted at the DMPFC normalizes NAc activity and reduces excessive connectivity between the NAc and prefrontal cortex.


Thank you
Acknowledgement of Research Support

- National Institutes of Health
- BRAIN & BEHAVIOR RESEARCH FOUNDATION
- Spectrum
- STANFORD BIO-X