Cognition and Psychological Symptomology in Tourette's Syndrome Following Deep Brain Stimulation

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Introduction

- Tourette's syndrome (TS) is a neurodevelopmental condition that presents with motor and phonic tics.
- Common comorbidities include ADD/ADHD and OCD as well as mood disorders.
- TS is commonly treated with pharmacotherapy such as anti-dopaminergic drugs and adrenergic agonists, as well as botulinum toxin injections. Habit reversal training and cognitive behavioral therapy are highly recommended.
- For patients with treatment-resistant TS, the use of DBS is expanding.
- To date, research on cognition and mood post-TS is limited, with varying results and few studies analyzing long-term follow up.
- Studies have reported an improvement in mood symptoms[1-3] with no substantial differences on measures of cognitive function.[3,4]
- The objective of this study is to examine the effect of DBS on cognition and mood in treatment refractory TS patients.

Methods

- 4 case-series: Patients 18-36 years of age with treatment-refractory TS who underwent bilateral globus pallidus internus DBS (Table 1).
- Patients completed initial baseline neuropsychological assessment pre-DBS and at various follow up visits post-DBS ranging from 3-10 years.
- Patients completed a comprehensive neuropsychological assessment focused on frontal lobe mediated functions and self-report measures of mood, behavioral tendencies, and QOL.
- **Cognitive measures administered:** WASI, Digit Span (WAIS-IV), Symbol Digit Modalities, Rey-Osterrieth Complex Figure Test, Buschke Selective Reminding Test, Stroop Color Word Test, Verbal and Design Fluency subtests (D-KEFS), and Wisconsin Card Sorting Test-64.
- **Self-report measures:** Penn State Worry Questionnaire, State-Trait Anxiety Inventory, Gilles de la Tourette Syndrome-Quality of Life Scale, Obsessive Compulsive Inventory-Revised, Brown Attention-Deficit Disorder Scales, Beck Depression Inventory-II, and Yale-Brown Obsessive Compulsive Scale.

Table 1: Demographic Data of Participants

Patient Number	Baseline Assessment Date	Date of DBS Surgery	Age at Time of Baseline	Education Level	Number of Years Follow-up
1	08/03/2011	02/16/2012	18	12	3
2	12/16/2010	02/09/2011	19	12	8
3	03/19/2008	06/27/2008	32	14	10
4	06/20/2005	07/19/2005	16	10	13

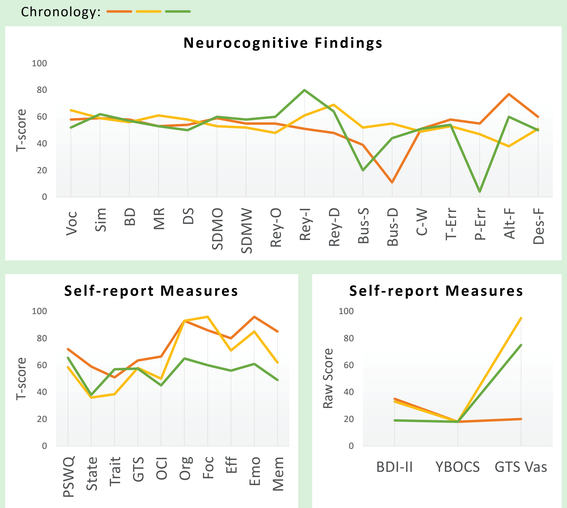
Figure Legend: Assessment Chronology

2005 2006 2008 2009 2010 2011a 2011b 2012 2014 2015 2016 2018

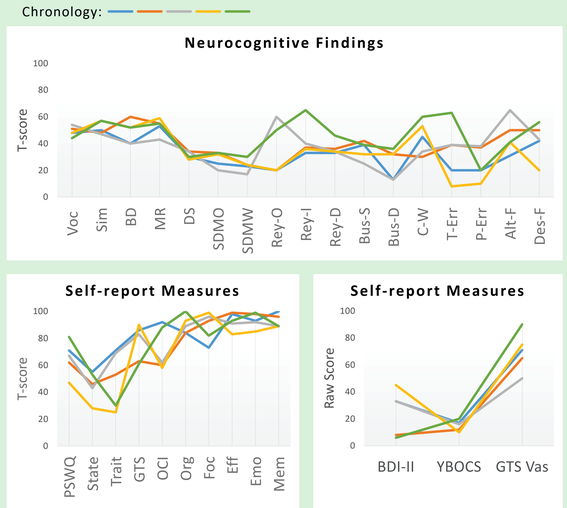
Results

- As a case series, cognitive profiles revealed impairments in frontal-subcortical mediated functions pre-DBS with subtle fluctuations over time post-DBS.
- While subtle variations revealed changes in clinical classifications over time, the overall neurocognitive pattern remained consistent.
- Anecdotally, changes in self-report mood measures appeared to be secondary to psychosocial life stressors and not associated with TS symptomatology.
- Subjective perceptions of quality of life and anxiety waxed and waned.
- Comorbid obsessive-compulsive symptoms fluctuated between mild and moderate (Y-BOCS).
- Symptoms of depression improved in general, with the greatest improvement seen in those with more severe preoperative depression scores (BDI-II).
- Subtle cognitive improvements were noted with amelioration of psychological distress.

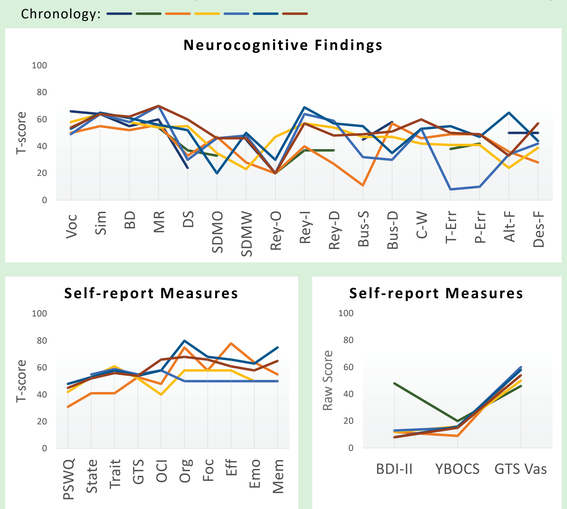
PATIENT 1: Right-handed, single, Caucasian female; history of ADD, OCD, depression and anxiety.



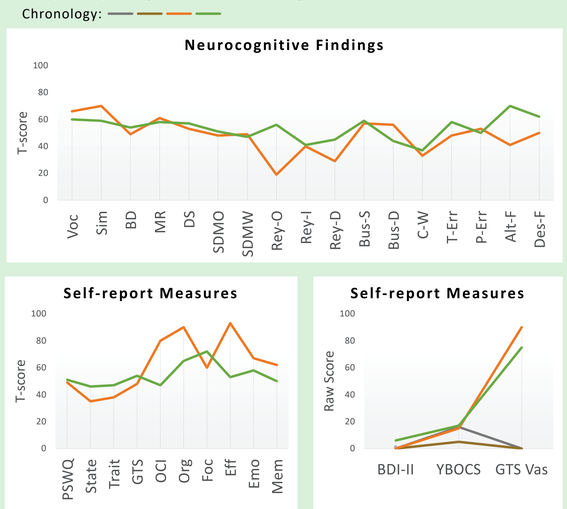
PATIENT 2: Right-handed, single, Caucasian female; history of ADHD, OCD, depression, anxiety and cutting.



PATIENT 3: Right-handed, single, Caucasian male; history of ADHD, OCD, severe depression with suicidal ideation and anxiety.



PATIENT 4: Right-handed, single, Caucasian male; history of ADHD, OCD, sleep disorder and depression.



Conclusions

- Bilateral globus pallidus internus DBS for medically refractory TS reduced tic severity without significant neuropsychological morbidity (YGTSS scores).
- This case-series highlights the clinically significant level of emotional distress experienced by TS patients.
- There is a need for continued psychological assessment in conjunction with cognitive evaluations for this population of patients.
- Providers should be aware of possible poor mood states even after reduction of tics. The reduction of TS symptoms allows practitioners the opportunity to focus on possible mood symptoms.
- It is difficult to disentangle the influence of mood symptoms on frontal lobe mediated tasks.
- Referrals for mental health services should be considered to assist the patient's course and improve patient/family adjustment.

Future Directions

- The impact of personal psychosocial stressors, underlying personality disorders and long-term use of psychotropic medications should be considered.
- Future studies that include a larger sample size, randomization, and control group should examine medications, psychological symptomatology and characterological traits in addition to electrode placement and programming parameters to better understand the impact of stimulation.[5,6]
- Examining other psychological constructs such as resiliency, self-esteem, and self-concept may reveal predictors for positive psychological outcomes.
- It is essential to study the neural mechanisms underlying cognitive change in patients with psychiatric symptoms to establish more detailed theories on the role of DBS in mood and cognitive functioning. Possible techniques include fMRI, EEG, and computer models in order to visualize specific changes in brain activity and the effect of electrode placement on cognition and mood.[2]

References

1. Ackermans L, Duits A, Temel Y, et al. Long-term outcome of thalamic deep brain stimulation in two patients with Tourette syndrome. *J Neurol Neurosurg Psychiatry*. 2010;81(10):1068-72.
2. Porta M, Brambilla A, Cavanna AE, et al. Thalamic deep brain stimulation for treatment-refractory Tourette syndrome: two-year outcome. *Neurology*. 2009;73(17):1375-80.
3. Shoenberg MR, Maddux BN, Riley DE, et al. Five-months-postoperative neuropsychological outcome from a pilot prospective randomized clinical trial of thalamic deep brain stimulation for Tourette syndrome. *Neuromodulation*. 2015;18(2):97-104.
4. Bergfeld IO, Mantione M, Hoogendoorn ML, Denys D. Cognitive functioning in psychiatric disorders following deep brain stimulation. *Brain Stimul*. 2013;6(4):532-7.
5. Ackermans L, Duits A, van der Linden C, et al. Double-blind clinical trial of thalamic stimulation in patients with Tourette syndrome. *Brain*. 2011;134(Pt 3):832-44.
6. Servello D, Porta M, Sassi M, Brambilla A, Robertson MM. Deep brain stimulation in 18 patients with severe Gilles de la Tourette syndrome refractory to treatment: the surgery and stimulation. *J Neurol Neurosurg Psychiatry*. 2008;79(2):136-42.

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