Unexpected outcome (positive or negative) including adverse drug reactions

Bilateral deep brain stimulation of the nucleus accumbens for comorbid obsessive compulsive disorder and Tourette's syndrome

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Summary

We present the case of a 32-year-old Caucasian woman with severe treatment-refractory obsessive compulsive disorder (OCD) and Tourette's syndrome. Both conditions were present prior to age 5 and impacted significantly on the patient's functioning. Multiple trials of evidence-based pharmacological and behavioural therapies had not achieved remission of symptoms. Bilateral deep brain stimulation of the nucleus accumbens was undertaken to treat both illnesses but with a particular focus on OCD, as the patient identified this as the more debilitating of the two disorders. Following surgery there was an immediate improvement in OCD and tic severity. At follow-up 8 months later, there was a 90% improvement in OCD symptoms and a 57% improvement in tic severity. No intraoperative or postoperative complications or adverse events occurred and there were no undesired effects of stimulation.

BACKGROUND

Deep brain stimulation (DBS) is currently being investigated as an experimental therapy for severe treatment-refractory neuropsychiatric disorders including obsessive compulsive disorder (OCD) and Tourette's syndrome (TS) with published literature indicating positive outcomes for both.^{1 2} OCD and TS commonly occur together in the same patient but research is limited in relation to the most appropriate anatomical target site for DBS when the conditions co-occur. Published case reports detailing bilateral DBS of the nucleus accumbens (NA) for TS and OCD have yielded conflicting results with some studies even reporting a worsening of tic symptoms.³

This is an interesting case because it illustrates that bilateral DBS of NA is not only effective in the treatment of OCD but can also lead to some improvement in tics when there is comorbid TS.

CASE PRESENTATION

A 32-year-old Caucasian woman with a diagnosis of severe treatment-refractory OCD presented to St Andrews Hospital in Brisbane, Australia. Her obsessions were characterised by overvalued concerns about dirt and germs as well as the hoarding of items. Compulsions included excessive hand washing, ritualised cleaning, and grooming and checking behaviours. In addition, she had an excessive need for order and symmetry and would perform mental rituals 'to avoid disorder'. The patient's OCD consumed greater than 8 h per day and she described her symptoms as 'incapacitating'. She was unable to resist the obsessions or compulsions, and they impacted on her family life and ability to work to a significant degree.

The patient first developed symptoms of OCD at age 4 but was not diagnosed until age 9. She had undergone therapeutic trials of five different evidence-based treatments including sertraline and clomipramine. Each medication trial led to a partial improvement in symptoms but never achieved remission. The patient experienced side-effects to medication including sedation, weight gain and constipation. Behavioural therapy including response inhibition had been tried without improvement in symptoms.

The patient also suffered from TS. Both motor and phonic tics occurred from age 5 and had a fluctuating course over time. Tics were exacerbated by stress and caffeine.

Other relevant medical history included recurrent major depression; however, at the time of assessment, the patient was not depressed. There was a history of bacterial meningitis at age 7. There was no history of head injury, seizures or other neurological disorder. There was no substance use disorder.

There was a strong family history of both OCD and TS. The patient's mother, brother and son have a diagnosis of both OCD and TS as do multiple members of her mother's family.

Neurological examination and cerebral imaging was normal. Causes of secondary OCD and tics were excluded and the diagnosis of severe treatment-refractory OCD and TS was confirmed.

Yale-Brown Obsessive Compulsive Scale (Y-BOCS)⁴ score was 39/40 with a breakdown of 19/20 for obsessions and 20/20 for compulsions. Yale Global Tic Severity Score (YGTSS)⁵ was 63/100.

INVESTIGATIONS

MRI of the brain revealed no abnormalities.

TREATMENT

The patient elected to undergo DBS. DBS is reversible and can be modulated. She decided that the risks of surgery and unwanted stimulation effects were justified. She made this decision based on the residual burden of symptoms despite medication therapy and the side effects of medication therapy that she endured. As the OCD was the most severe and disabling of the two disorders, a decision was made to target an anatomical site with evidence for efficacy for OCD. The NA was targeted because the literature to date demonstrated that this target provided the greatest reduction in OCD severity⁶ and because there is evidence of dysfunction of the reward system in OCD supporting its role in the disorder.

The patient gave written informed consent and surgery was undertaken at St Andrews Hospital in Brisbane, Australia in August 2010. A Medtronic Active RC quadripolar DBS system was implanted under general anaesthetic using a stereotaxic procedure (Medtronic, Inc, Minneapolis, Minnesota, USA). There were no intraoperative complications. Stimulation parameters were 3 V, pulse-width 60 μ s and frequency 130 Hz.

OUTCOME AND FOLLOW-UP

The patient reported improvement in both OCD and TS symptoms within a few days of the initiation of stimulation. Assessment after 1 month demonstrated a Y-BOCS score of 5/40 (90% improvement) and YGTSS score of 27/100 (57% improvement). Assessment at final follow-up (7 months postsurgery) demonstrated sustained improvement in Y-BOCS score of 6/40 and further improvement in YGTSS score of 13/100. There were corresponding improvements in the patient's mood, relationships and overall quality of life.

There were no postoperative complications or undesired effects from DBS stimulation. On one occasion the patient accidentally switched off the device for 5 days and during this time the OCD symptoms returned to baseline. Once the device was turned on again, the OCD symptoms improved within 48 h. Residual symptoms include obsessions relating to dirt and order and some checking compulsions but these consume less than 1 h per day and cause no distress. The patient can resist obsessions always and compulsions most of the time and no longer requires medication.

DISCUSSION

OCD is thought to arise from hyperactivity in the circuits connecting the orbitofrontal cortex and medial prefrontal cortex with the basal ganglia and thalamus.⁶ Approximately 10% of patients are treatment-refractory. Although the exact mechanism of action of DBS is not exactly understood, early research has shown promising results in a subset of patients with severe, treatment-refractory OCD for which treatment options are otherwise limited. It is plausible that DBS inhibits or functionally over-rides the pathological network hyperactivity of OCD and thus causes a reduction in symptoms. Although there have been five

different anatomical sites targeted for OCD, the NA was targeted here because to date it has yielded the most positive results in the published literature. In addition, studies have demonstrated that OCD patients have attenuated reward anticipation activity in the NA compared with healthy controls, implicating the NA in OCD.⁷

Published case reports on DBS for OCD have recently been summarised in a review¹ which concluded an overall responder rate (>35% improvement in Y-BOCS) of about 50%. NA DBS was associated with greatest improvements in Y-BOCS score, being as high as 78%. NA DBS for TS in one male patient yielded a 44% improvement in tic severity⁸ but in another case report detailing a patient with comorbid OCD and TS, the author illustrated that NA DBS resulted in deterioration in tics by 17% and no improvement in OCD symptoms.³

This report illustrates a case in which DBS of the NA was used successfully in the treatment of severe, treatment-refractory OCD with comorbid TS. Although the patient was not symptom free, substantial improvements in symptom load was achieved and this was associated with corresponding improvements in the patient's mood, relationships and quality of life. In addition, there were no complications relating to the procedure and no adverse stimulation effects.

Learning points

- Deep brain stimulation (DBS) is a promising experimental treatment for treatment-refractory Tourette's syndrome (TS) and obsessive compulsive disorder (OCD).
- Nucleus accumbens (NA) is an important anatomical target to date for DBS in the treatment of OCD but larger prospective studies are needed to determine the adequacy and true potential of DBS in this disorder.
- Although case reports of NA DBS for TS have yielded conflicting results,¹ this case illustrates that there is potential for improvement in tic severity when TS is comorbid with OCD.
- To date, no response predictors for DBS in OCD have been identified.

Competing interests None.

Patient consent Obtained.

REFERENCES

1. De Koning P, Figee M, van den Munckhof P, et al. Current status of deep brain stimulation for obsessive-compulsive disorder: a clinical review of different targets. *Curr Psychiatry Rep* 2011;**13**:274–82.
2. Hariz MI, Robertson M. Gilles de la Tourette syndrome and deep brain stimulation. *Eur J Neurosci* 2010;**32**:1128–34.
3. Burdick A, Foote K, Goodman W, et al. Lack of benefit of accumbens/capsular deep brain stimulation in a patient with both tics and obsessive-compulsive disorder. *Neurocase* 2010;**16**:321–30.
4. Goodman W, Price L, Rasmussen S, et al. The Yale-Brown Obsessive Compulsive Scale. *Arch Gen Psychiatry* 1989;**46**:1006–11.
5. Leckman J, Riddle M, Hardin M, et al. The Yale Global Tic Severity Scale: initial testing of a clinician-rated scale of tic severity. *J Am Acad Child Adolesc Psychiatry* 1989;**28**:566–73.

6. **Greenburg B**, Rauch S, Haber S. Invasive circuitry-based neurotherapeutics: stereotactic ablation and deep brain stimulation for OCD. *Neuropsychopharmacology* 2010;**35**:317–36.
7. **Le June F**, Verin M, N'Diaye K. Decrease of prefrontal metabolism after subthalamic stimulation in obsessive-compulsive disorder: a positron emission tomography study. *Biol Psychiatry* 2010;**68**:1016–22.
8. **Neuner I**, Podoll K, Lenzrtz D, *et al*. Deep brain stimulation in the nucleus accumbens for intractable Tourette's syndrome: follow-up report of 36 months. *Biol Psychiatry* 2009;**65**:e5–6.

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