

## THE THERAPY COMMUNITY

# Deep Brain Stimulation for Highly Treatment-Resistant OCD

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While most patients with obsessive compulsive disorder (OCD) eventually respond to treatment with medication and/or behavioral therapy, a small minority do not improve following all conventional treatments. For this small minority, one of the few remaining options is neurosurgery, including lesion procedures (cingulotomy or capsulotomy) or deep brain stimulation (DBS). Cingulotomy involves drilling through the skull (called a craniotomy) and using a thermal (heated) probe to lesion an area within the anterior cingulate cortex of the brain.

Neuroimaging studies aimed at seeing what parts of the brain are involved in OCD have found that this area, the anterior cingulate cortex, is repeatedly involved (Deckersbach et al, 2006). Studies examining the outcome for patients following cingulotomy for treatment-resistant OCD have shown that almost one-half of patients who did not respond to conventional treatment achieve some benefit from the procedure (Dougherty et al, 2002). Another neurosurgery procedure that has been used for treatment resistant OCD is called capsulotomy. This procedure is named after another structure in the brain: the anterior limb of the internal capsule. Again this procedure makes lesions (holes) in a part of this brain structure (technically this is an "ablative" or lesion procedure). Positive outcomes following an anterior capsulotomy for OCD are approximately 50-60% (Greenberg et al., 2003; Ruck et al, 2008). While the original capsulotomy procedure also involved a craniotomy, the use of the "gamma knife" has more recently allowed for capsulotomy procedures that do not require opening the skull. The gamma knife capsulotomy involves passing multiple gamma rays through the skull. No single gamma ray poses any danger to brain tissue. However, where the gamma rays intersect, the energy level is high enough to destroy (or ablate) the targeted tissue. The most recent version of this procedure is called gamma ventral capsulotomy, in which the lesions are limited to the ventral (bottom) half of the anterior capsule. Responses to this procedure appear to be seen in about 60% of patients (Greenberg et al., 2003; Lopes et al., in press 2009).

Another important development for treatment-resistant OCD is deep brain stimulation (DBS). DBS has been used since the mid-1980s to treat movement disorders such as severe tremor or Parkinson's disease. DBS involves placing electrodes in targeted areas of the brain. In Parkinson's disease, electrical stimulation of the targeted brain region (such as the subthalamic nucleus) usually results in a significant decrease in some of the disabling symptoms of the illness, such as tremor. Once the electrodes are in place, they are connected by wires under the skin to pulse generators under the skin (usually just below the collarbone). The pulse generator or "implantable neurostimulator" contains a battery for power and a microchip to regulate the stimulation. The treating physician uses a hand-held wand and small computer to communicate with the pulse generator through the skin. In doing so, the treating physician can determine how much electrical stimulation is delivered in which manner through the stimulating electrodes. These pulse generators are very similar to those implanted under the skin (also usually just below the collarbone) for patients with cardiac pacemakers. The treating physician even uses a similar device to communicate with the pulse generator through the skin. The biggest difference is that in DBS the electrodes are in the brain instead of in the heart (as is the case with cardiac pacemakers).

Given the encouraging response rates following capsulotomy for highly treatment refractory OCD, investigators decided to test DBS in this area of the brain and first implanted electrodes in the anterior capsule in patients with treatment-resistant OCD in the late 1990s (Nuttin et al, 1999). The early results were promising as three of these first four patients experienced benefit. Since then, larger scale trials have been conducted and the target site has moved slightly to an overlapping part of the brain called the ventral capsule/ventral striatum (VC/VS). A recent report by Greenberg (2008) describes the current

worldwide experience with DBS for OCD. For the 26 patients with treatment-resistant OCD described in the Greenberg manuscript, 61.5% were considered responders to DBS. This response rate is comparable to or slightly higher than the response rates for the other neurosurgical options described above (cingulotomy and capsulotomy), but comparisons must be tentative since the numbers of patients treated with DBS are still relatively small. In addition, while DBS does require opening the skull, it does not require destroying any brain tissue. Lastly, DBS allows for a wider range of stimulation parameters (different amounts of electrical charge) than an ablative procedure.

Based on these results, the FDA recently approved DBS for treatment-resistant OCD under a Humanitarian Device Exemption (HDE). The HDE approval assumes that a relatively small number of patients will receive the treatment. Because DBS for treatment-resistant OCD is a very specialized procedure, it is recommended that treatment be rendered at institutions that have experience with this intervention. Appropriate patient selection is vitally important. Typically, patients eligible for DBS will have had minimal or no response to all currently available medication and behavioral treatments for OCD. It is also critically important that a neurosurgeon with expertise in "Stereotactic and Functional Neurosurgery" perform the procedure. Of course, treatment begins after electrode placement. Determination of optimal stimulation parameters and longitudinal treatment are crucial. It is crucial that a psychiatrist with expertise in DBS be directly involved in a patient's care over the months and years following surgery. At this point it appears that DBS needs to continue indefinitely for continued benefit. One of the most interesting clinical observations after lesion procedures (capsulotomy or cingulotomy) or DBS is that behavior therapy may become effective for a patient who was unable to improve with such treatment before surgery (Greenberg et al., 2006).

While the field of neurosurgery for treatment-resistant OCD has advanced considerably in recent years, further research is needed to both optimize DBS treatment and to better understand how DBS works (which areas of the brain are affected and how). Currently, four institutions are funded by the National Institutes of Health to conduct further studies of DBS for OCD. They are listed below. It is recommended that if a patient or treater is interested in learning more about these clinical trials that they contact one of these institutions. While these are exciting times for OCD treatment, there is still much to be learned.

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