Deep Brain Stimulation Can Diminish Depression in Treatment-Resistant Patients

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Treatment-resistant depression exhibits varying degrees of refractoriness. After not responding to medications, psychotherapy, and neuromodulatory interventions like vagus nerve stimulation or transcranial magnetic stimulation, some people with treatment-resistant depression experience debilitating illness and have few further treatment options. Electroconvulsive therapy is another potentially effective treatment, but it commonly induces unpleasant memory impairment and connotes social stigma. Some patients still do not gain or sustain recovery despite all these attempts.[1]

Experimental treatments such as deep brain stimulation (DBS), an invasive neurosurgical intervention, could be considered for individuals with treatment-resistant depression. DBS is a well-established therapeutic option in patients with movement disorders.[2] DBS was discovered to diminish affective symptoms serendipitously and is undergoing investigation for applications in patients with psychiatric illness, especially those with refractory obsessive-compulsive disorder or affective illness. DBS involves implanting leads in selected brain areas to deliver focal electrical pulses of adjustable frequency and intensity, targeted for involvement in the pathophysiology of the depression. The anatomic targets include the subgenual cingulate cortex, ventral capsule/ventral striatum, nucleus accumbens, and superolateral branch of the medial forebrain bundle. These locations are involved in cortico-basal-thalamic mood-regulatory circuits.[1,3]

Understanding of the neurobiology of depression is limited. Advances in neuroimaging research provide findings that lead to more clinical investigations.[4] Despite encouraging open-label trials, some studies were discontinued early due to DBS results that did not significantly differentiate from those in subjects receiving sham stimulation. One meta-analysis[5] of 12 trials documented that DBS improves mood and suggests that more research should focus on determining optimal stimulation parameters. Neuroengineering advancements might improve DBS efficacy with "a closed-loop system" that self-adjusts to feedback by the subject's own neuronal activity.[6]

The mechanism of DBS action is unclear but might include a combination of interconnected processes. These processes may include synaptic fatigue leading to a functional lesion or direct inhibition of neurons reducing chaotic signals and improving the flow, while activating other pathways. Transient effects initially range from inducing tranquility and relaxation to euphoria. Long-term, repeated administrations of DBS are required for lasting therapeutic effects. Anxiety and hypomania are the main side effects of DBS, and they are avoidable through adjustment of stimulation parameters. However, procedural risks like intracranial hemorrhage, seizures, or infection are also documented.[1]

More study is needed before considering DBS for psychiatric indications. Surgical neuromodulation may offer therapies to attenuate neuropsychiatric disorders by influence on brain function.[3] Ethical considerations are paramount, especially given the counter-productive, shameful history of surgical interventions in psychiatry.[2] DBS remains a promising therapy that might help individuals recover from prolonged emotional suffering.

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