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Stereotactic Awake Basal Ganglia Electrophysiological Recording and Stimulation (SABERS): A Staged Procedure for Personalized Targeting of Deep Brain Stimulation in Pediatric Movement and Neuropsychiatric Disorders

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Deep brain stimulation (DBS) has improved the lives of over 100,000 adult and pediatric patients in the US and similar numbers worldwide since FDA approval of ventral intermedial nucleus of the thalamus stimulation for essential tremor in 19971. However, growth in the field, both in terms of variety of indications and numbers of patients treated has been limited by multiple factors including the standard paradigm of a single deep brain target per patient. Due to the complexity of certain movement and neuropsychiatric disorders, multiple deep brain targets may provide optimal benefit for the patient. These targets vary not only by the disease entity but within a given patient population based on the phenotype of the patient. Also, these targets may not respond to stimulation due to the delayed plasticity effects required for observation of therapeutic benefits, but certain neurophysiological biometrics may guide target identification. Thus, in our study it is not only the effects of stimulation on motor movements or amelioration of abnormal postures but also recording of movement and use of evoked potentials which help identify permanent target locations. Herein, we describe our five-year experience involving a novel, staged procedure whose foundation requires multiple (8-12) simultaneous temporary deep brain electrode implantations for the recording and stimulation of potential targets during a subacute (less than 2 week) assessment period in a Neuromodulation Monitoring Unit (NMU) setting. We describe results from a case series of 30 children and young adults with movement disorders evaluated consecutively over a period of 5 years for Stereotactic Awake Basal Ganglia Electrophysiological Recording and Stimulation (SABERS) and subsequently implanted with DBS. Testing is performed in a NMU, and results of testing guide the decision to proceed and the choice of targets for permanent DBS implantation. We report results from 27 children with secondary dystonia, and 2 subjects with primary dystonia. All but one subjects were implanted with 4 permanent DBS leads each. Results were evaluated 3 to 6 months post-operatively on the Burke-Fahn-Marsden Dystonia Rating Scale (BFMDRS), and the Barry-Albright Dystonia (BAD) rating scale. Results showed significant improvement on both scales at postoperative follow-up compared to preoperative evaluation. No significant adverse events occurred. We conclude that the SABERS protocol with evaluation in the NMU results in significant patient benefit as compared with previously published results. The protocol provides personalized targeting that can predict benefit and effective stimulation targets in children with heterogeneous mechanisms of injury and in children with disorders for which the optimal target is not yet known. Our results also serve as a proof of concept for wider application among other movement and neuropsychiatric disorders that may benefit from DBS and where personalized targeting of multiple electrodes may be warranted.

Recent Publications

1. Mark A. Liker, Joffre E. Olaya Deep brain stimulation in children and young adults with secondary dystonia: the Children's Hospital Los Angeles experience Data in Brief, Volume 35: Issue 5 https://doi.org/10.3171/2013.8.FOCUS13300

2. Mark A. Liker, Eisha Christian Deep brain stimulation: a mechanistic and clinical update Volume 35: Issue 5 https://doi.org/10.3171/2013.9.FOCUS13383

Biography

Mark Liker had his undergraduate education in Mechanical and Aerospace Engineering at Princeton University, Princeton, NJ and obtained his Medical Degree summa cum laude with distinction in research from the State University of New York-Health Sciences Center at Brooklyn, NY. He did residency in Neurosurgery and received a fellowship certificate in complex Spine Surgery at the LA County/USC Medical Center in Los Angeles, CA. He has been involved professionally in several Hospitals in Los Angeles, Bakersfield and Valencia areas of California and is currently an Assistant Professor of Neurosurgery at the Keck School of Medicine at USC He is also the Director of Deep Brain Stimulation program.

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