Usefulness of segmented leads in anatomical variants of the brain

Philipp J. Slotty, Yousef Abusabha, Jan Vesper
Department of Stereotactic and Functional Neurosurgery, Heinrich-Heine-University, Düsseldorf, Germany

Introduction

Deep Brain Stimulation is an established treatment modality in various movement disorders including dystonia. Due to the close proximity of the most common target point (GPi) to critical functional structures as the optic tract and the internal capsule, therapeutic yield might be limited by side effects.
Recently, segmented DBS leads have been made available. This technique comes with the promise of increased efficacy and side effect reduction. We hereby report on the first case of dystonia treated with directional lead deep brain stimulation.

Material and Methods

A 31 year old female presented with a 20 year history of generalized dystonia. The severe additional ataxic component left her wheelchair bound and she suffered from severe dysarthria. The neurological complex was thought to be caused by a proven isolated Vitamin E deficiency syndrome. MRI revealed structural changes of the basal ganglia anatomy with anatomical distortions pronounced on the left (Image 1). Standard coordinates did not match the individual anatomy of the patient. She therefore underwent bilateral GPi DBS surgery using direct targeting of the left GPI. Directional leads were implanted in both hemispheres.

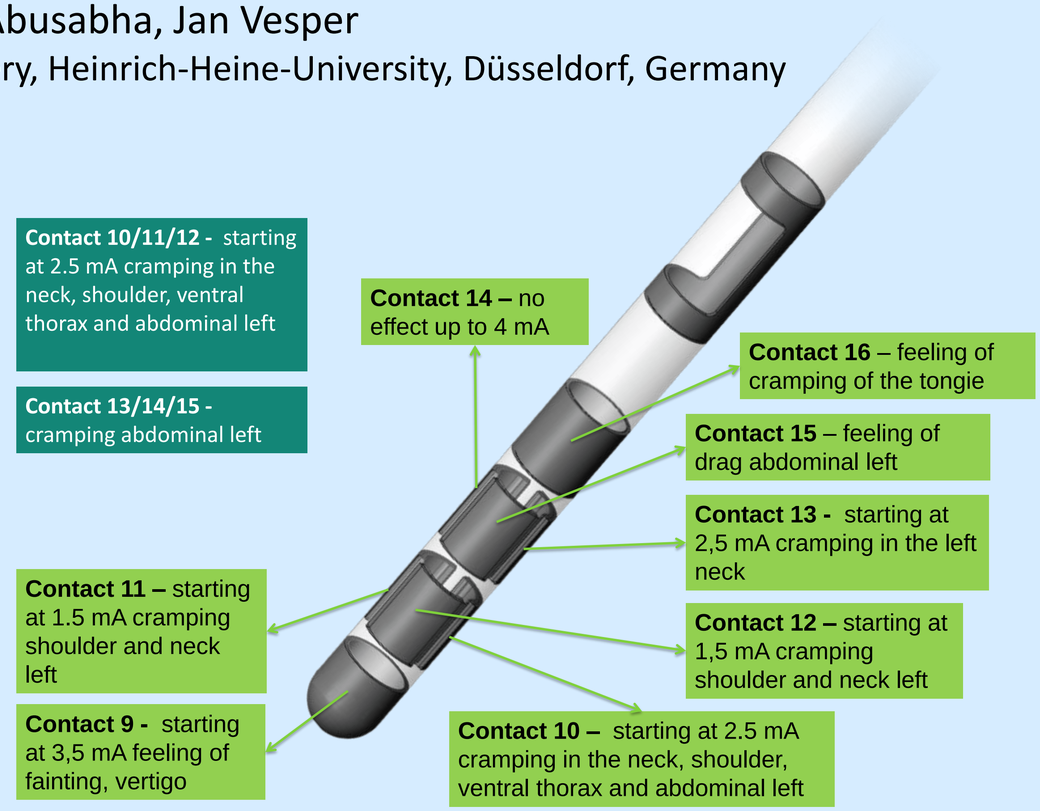

Figure: effects and side-effects observed per contact for the right hemisphere during early post-surgery clinical testing

Results

Targeting was guided by three micro electrode recording tracts and a directional lead system (Vercise DBS, Boston Scientific) was implanted in an all-in-one GA setting. Conventional stimulation caused a fast worsening of the dysarthria and painful stimulation induced side effects. The segmented contacts were intensively tested at 90µs and 130 Hz in the postoperative course. Distinct effect/side-effect patterns for each contact were observed. A significant clinical improvement including dysarthria was observed at three month follow-up with the patient being able to ambulate without additional support.

Conclusions

Segmented leads allowing current steering offer new perspectives for DBS and will likely result in increased treatment efficacy while reducing side effect at the same time. While this is true for well known disorders and their targets (PD, generalized dystonia) this technique also yields the potential to treat disorders currently not amendable to DBS as no good benefit/side-effect ratio could be achieved with conventional DBS. This includes diseases as described here with complex and basically unknown changes in basal ganglia functionality and structure.

c/o: slotty@hhu.de