

Asleep DBS for essential tremor using dual targeting of the Ventral Intermediate Nucleus and Caudal Zona Incerta.

V. Matthijs MD (1 2) , S. Vandamme (2 3), D. Vanhauwaert MD PhD (3 4), W. Maenhoudt MD (3), J. Van Lerbeirghe MD (2 3), S. Du Four MD PhD (3), O. Van Damme MD (2 3)

- 1 Neurosurgical training programme, Ghent University Hospital
2 Movement Disorders Team, AZ Delta, Roeselare-Menen-Torhout, Belgium
3 Department of neurosurgery, AZ Delta, Roeselare-Menen-Torhout, Belgium
4 Academic consultant, Department of Human Structure and Repair, Ghent University

Introduction

Deep brain stimulation (DBS) targeting the ventral intermediate nucleus (VIM) and the caudal zona incerta (cZi) has demonstrated excellent efficacy in medication-refractory essential tremor(1). Targeting the posterior subthalamic area (PSA), including the caudal zona incerta (cZi), has been proposed as an alternative or complementary target(2,3). Recent advances in image-guided, asleep DBS enable precise anatomical targeting while improving patient comfort and workflow. We report our experience with asleep dual-target DBS of the VIM and cZi.

Surgical Approach

All patients underwent asleep, image-guided DBS with dual targeting of the VIM and cZi. The cZi was directly targeted on T2-weighted MRI at the junction located one-third of the distance between the posterior border of the subthalamic nucleus and the red nucleus in the axial plane. VIM targeting was performed using patient-specific anatomical reconstruction with Elements©(Brainlab). Bilateral directional electrodes (Boston Scientific Cartesia©) were implanted under general anesthesia. Intraoperative imaging (O-arm©, Medtronic) was used to confirm lead placement.

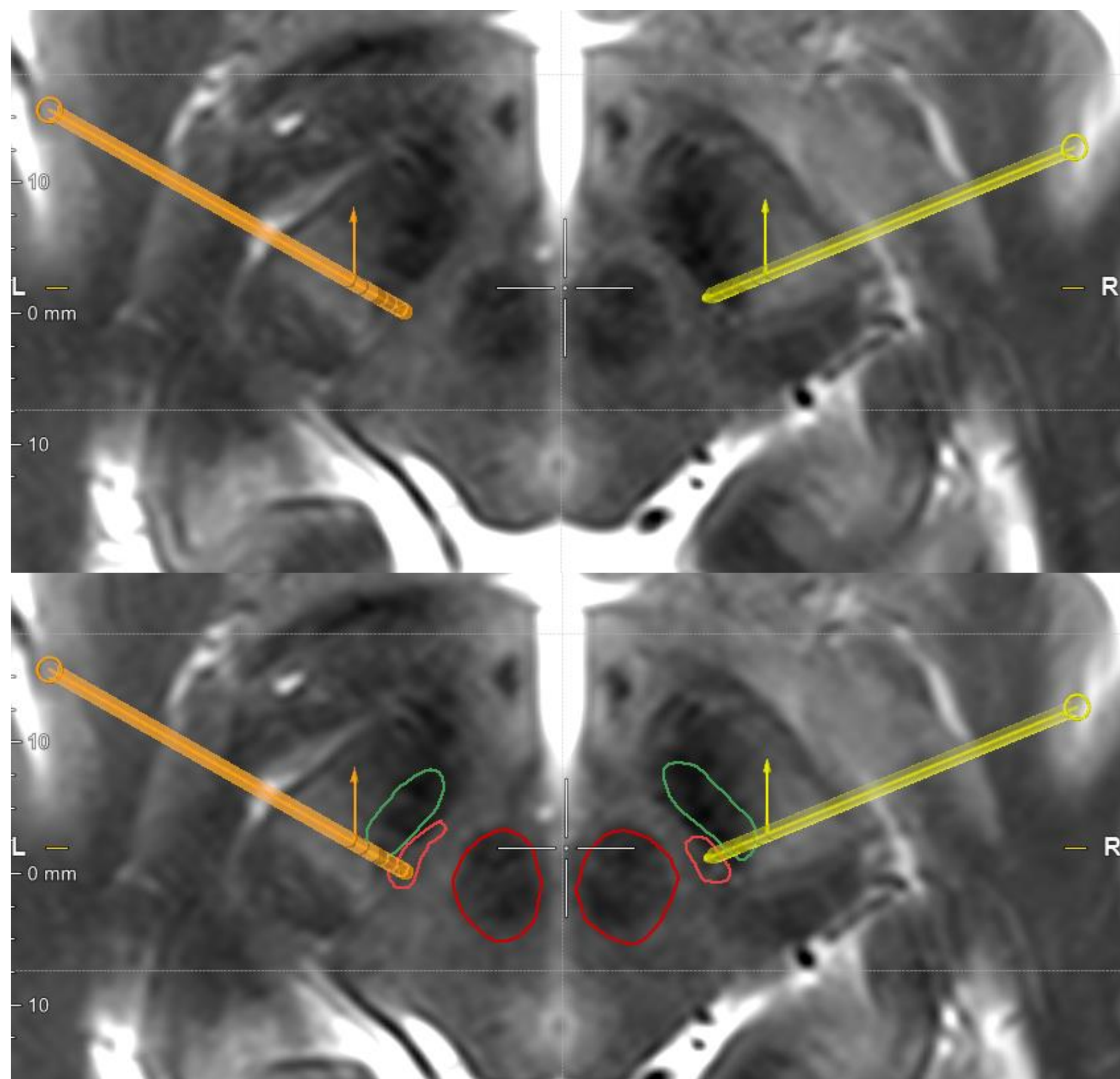


Fig. 1 Axial image showing targeting of the cZi. Red: Nucleus Ruber; Green: subthalamic nucleus

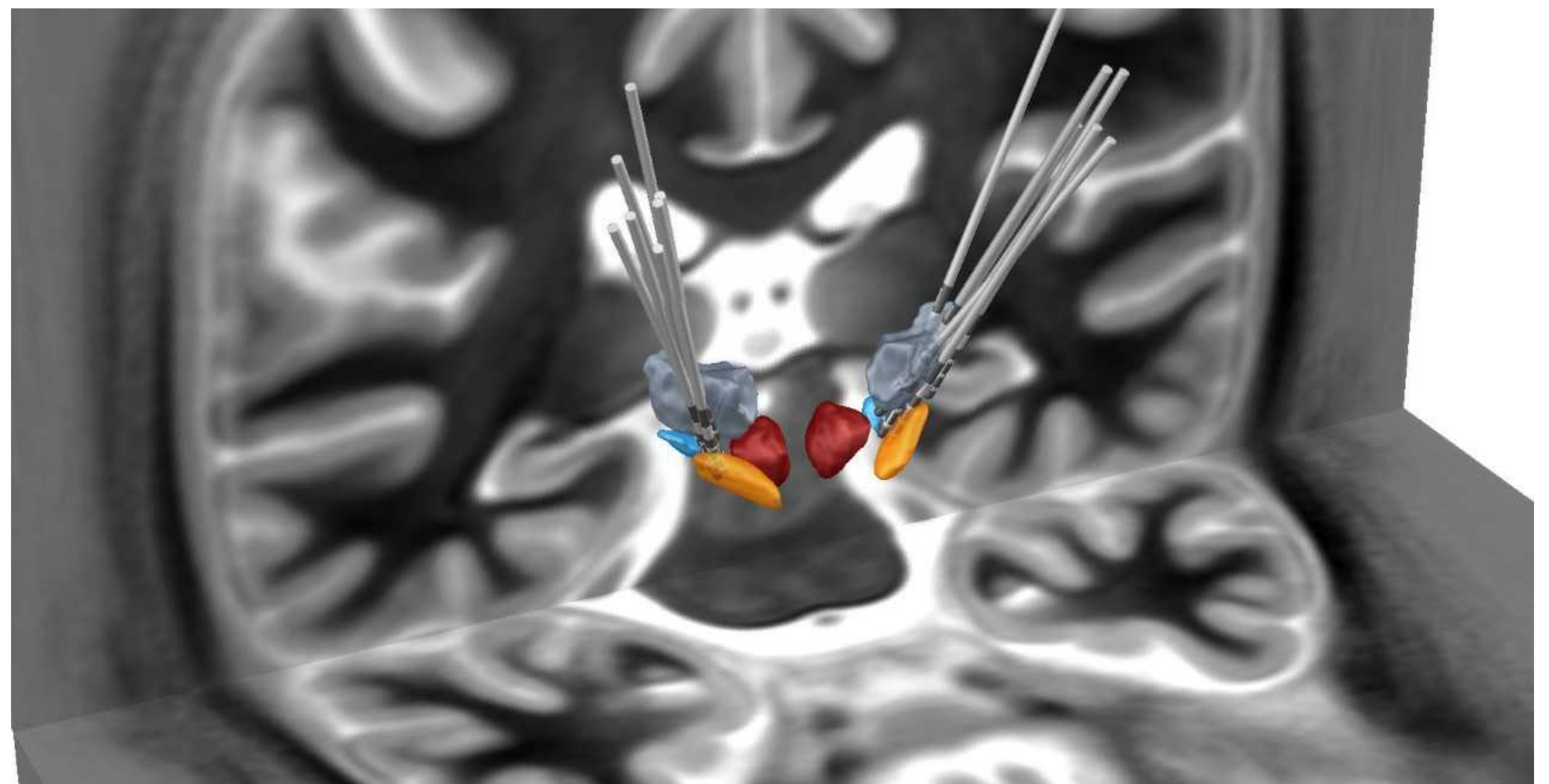


Fig. 2 Visualisation of the entire VIM-cZi cohort in LEAD DBS. Red: Nucleus Ruber; Light blue: Ventral Intermediate Nucleus; Dark blue: Subthalamic Nucleus, Orange: Caudal Zona Incerta.

Results

Ten patients (6 female) with medication-refractory essential tremor underwent asleep bilateral DBS with dual VIM–cZi targeting. No intraoperative complications occurred. Postoperative imaging showed limited edema in a single case, without associated clinical deficits. No infections, wound complications, or hardware-related adverse events were observed. All patients underwent postoperative stimulation programming and demonstrated clinically meaningful tremor improvement.

Conclusion

Several studies have suggested that stimulation of the caudal zona incerta, may offer advantages over conventional VIM stimulation in essential tremor(4–6). PSA/cZi stimulation appears to provide tremor suppression at least equivalent to VIM, often at lower stimulation amplitudes, likely due to closer proximity to the dentatorubrothalamic tract(3,5). This may translate into improved stimulation efficiency, reduced stimulation-induced side effects, and more durable tremor control over time(5). Furthermore, PSA/cZi DBS has been associated with improved control of head and proximal tremor components, which are often less responsive to VIM stimulation alone(5). Asleep DBS with dual targeting of the VIM and cZi is a safe and accurate surgical approach for essential tremor. Direct MRI-based targeting combined with intraoperative imaging allows precise electrode placement and are essential for minimizing complications and optimizing surgical outcomes.

References

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