Implantation of DBS Electrodes into GPi in Parkinson's Patients Under General Anesthesia; A Clinical Outcome Analysis

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Introduction

Deep Brain Stimulation (DBS) is an FDA-approved therapy for the treatment of Parkinson's disease (PD). Two areas of the brain are approved for the placement of DBS electrodes, the subthalamic nucleus (STN) and the Globus Pallidus internus (GPi). More recently, it has been favored that the target selected tends to be individualized to the specific patient. Implantation of DBS electrodes, while patients are awake or under general anesthesia is used, but the clinical outcome for patients who undergo the surgery while under general anesthesia using electrophysiology and radiographic mapping, is not fully documented. Our objective was to evaluate the effectiveness of "asleep" standardized GPi surgery with electrophysiological recording in PD patients, by assessing postoperative clinical outcomes and technical accuracy of lead placement through computer mapping.

Methods

The authors prospectively collected and retrospectively reviewed data of 16 individuals with PD who underwent bilateral GPi lead placement with implantation methods utilizing a standardized technique at our home institution by one neurosurgeon. The patients were selected from surgical dates between 2013-2015 and assessed 6-18 months after DBS surgery. Neuropsychological exams, medication regimen, UPDRS, non-motor symptom evaluations, post operative DBS system settings, clinical reports of efficacy and side effect profiles, functional measurements obtained as part of standard clinical care, and DBS electrode targeting and mapping were analyzed. Participants underwent UPDRS testing in both the "OFF therapy" state (medication and stimulation) and "ON therapy" state (medication and stimulation). These results were then compared to their pre-surgery assessments.

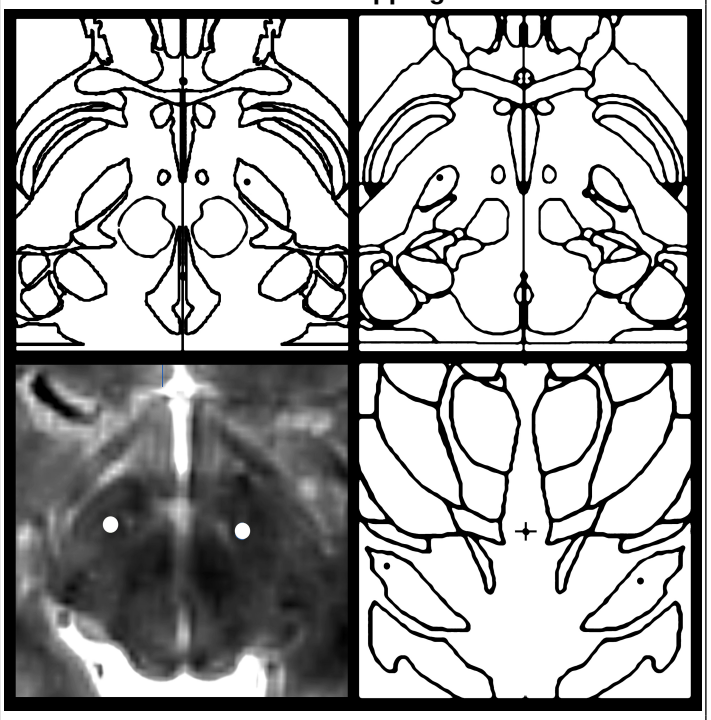
Patient Pre- and Postoperative Data

PATIENT	AGE	PREOP UPDRS OFF	PREOP UPDRS ON	POSTOP UPDRS OFF STIM/OFF MEDS	POSTOP UPDRS ON STIM/OFF MEDS	POSTOP UPDRS ON STIM/ON MEDS	LED REDUCTION POSTOP	DAYS BETWEEN SURGERIES	TOTAL OPERATIVE TIME (MIN)
A	70	51	37	NA	45	17	33.3	7	324
B	76	47.8	13	35	29	28	62.7	4	331
C	67	67	55	NA	77	51	54.9	3	226
D	71	81	65	83	61	55	21	3	278
E	62	51	37	51	24	21	47.72	4	269
F	75	51.4	32.2	73	35	30	41.3	3	286
G	64	53.8	43	56	42	35	65.87	5	245
H	76	80	47	NA	31	20	18	3	245
I	78	46.6	28.6	53	29	13	10	3	257
J	60	40.6	14.2	42	19	20	48	4	259
K	71	55.2	31	NA	28	15	59.1	5	245
L	62	93	30	59	31	21	50	3	271
M	66	55	41.8	74	33	23	66.67	5	245
N	77	49	16	66	36	19	19.6	4	240
O	77	69	63	72	49	39	42.8	5	283
P	58	30	NA	64	NA	34	43.4	3	305

AGE	PREOP UPDRS OFF	PREOP UPDRS ON	POSTOP UPDRS OFF STIM/OFF MEDS	POSTOP UPDRS ON STIM/OFF MEDS	POSTOP UPDRS ON STIM/ON MEDS	LED REDUCTION POSTOP	DAYS BETWEEN SURGERIES	TOTAL OPERATIVE TIME (MIN)
69	57.6	36.9	60.7	37.9	27.4	42.9	4.1	269.3

PREOP OFF VS POSTOP OFF/OFF	PREOP OFF VS POSTOP ON STIM/OFF MEDS	PREOP ON VS POSTOP ON/ON
5.382% ↑	34.2% ↓	25.745% ↓

Brain Mapping



Mapped postoperative location of electrode placement

Results

Our results include 16 participants (11 males, 5 females) who had a mean age of 69 years at implantation. The mean time of postoperative testing was 11.26 months. The patients demonstrated improvements in the postoperative mean off-medication/on-stimulation UPDRS motor score (37.9) compared to the preoperative mean off-medication (57.6). Additionally, the postoperative on-medication/on-stimulation (27.4) improved in all patients when compared to the mean preoperative on-medication motor score (36.9) preoperatively assessed. The levodopa equivalent daily dose was reduced on average 42.9%. One pass was taken on each hemisphere for all participants. No adverse events attributable to electrode placement (one urinary tract infection, one bowel ileus reported).

Conclusions

GPi leads were placed while the patient was under general anesthesia using a standard frame-based technique, direct visualized targeting, electrophysiological recording and intraoperative test stimulation. Our results demonstrated clinical outcomes that were consistent with the level of improvements reported previously for GPi electrode placements under awake conditions. This demonstrates that DBS can be performed under asleep conditions using standard intraoperative approaches that can result in consistent clinical outcomes equivalent to those of awake procedures

Learning Objectives

By the conclusion of this session, participants should be able to 1.) appreciate the effectiveness of "asleep" standardized GPi surgery with electrophysiological recording in PD patients 2.) Discuss in small groups surgeon's preference for intraoperative target confirmation strategies

References

Tomlinson et al. 2010, Williams et al. 2014