

BACKGROUND

Deep brain stimulation (DBS) is a treatment option for movement disorders difficult to manage medically. DBS-related hardware complications, however, are associated with a loss of efficacy, which adversely impacts not only the quality of life but also health care costs.

METHODS

This is a retrospective review of all hardware complications that occurred between January 1996 to August 2010 and reasons for surgical revision in a large cohort of movement disorders patients treated with DBS implants and followed at the Parkinson's Disease Center and Movement Disorders Clinic (PDCMDC) at Baylor College of Medicine, in Houston TX. We sought to determine the frequency of each complication, timing after the implant, and clinical correlates.

RESULTS

Characteristics of the Cohort:

Distribution by diagnosis

Number of patients (%)
 Parkinson's disease (PD): 297 (58%)
 Essential tremor (ET): 127 (24.8%)
 Dystonia: 40 (7.8%)
 Other: 48 (9.37%)

The distribution of targets

Number of electrodes (%):
 VIM nucleus: 351 (41%).
 STN nucleus: 401 (46.8%).
 GPi nucleus: 97 (11.3%).
 Other targets: 7 (0.8%).

Hardware complications: 44 (8.6%) of 512 patients

The Complication rate per electrode: 56 (7%) of 856 electrodes

Complications (patients) number (%):

Lead fracture: 13 (2.5%)
 Infection: 10 (erosion, 4) (1.9%)
 Misplacement: 10 (1.9%)
 Migration: 9 (1.7%)
 Other: 2 (0.39%) short circuit, CSF leak.

The time distribution of complications did not differ among the different types of complications, (see box plots) $P=0.26$. Migrations were observed later compared to lead fractures and infections.

RESULTS (continued...)

Table 1. Distribution of hardware complications according to the anatomical target and neurological diagnoses.

	Misplacements n (%)	Migrations n (%)	Fractures n (%)	Infections n (%)	Other n (%)	Totals n (%)
Target (electrodes)						
STN (n=401)	7 (1.74)	3 (0.74)	3 (0.74)	6 (1.49)	0	19 (5)
VIM (n=351)	4 (1.13)	7 (1.99)	9 (2.56)	10 (2.84)	2 (0.56)	32 (9)
GPi (n=97)	0	0	3 (3.09)	2 (2.06)	0	5 (5)
Other (n=7)	0	0	0	0	0	0
Disorder (patients)						
Parkinson's disease (n=297)	6 (2.02)	3 (1.01)	5 (1.68)	5 (1.68)	2 (1.67)	21 (7)
Essential tremor (n=127)	4 (3.14)	5 (3.93)	5 (3.93)	3 (2.36)	0	17 (13)
Dystonia (n=40)	0	0	1 (2.5)	0	0	1 (3)
Other (n=48)	0	1 (2.08)	2 (4.16)	2 (4.1)	0	5 (10)

By Target

Total number of complications: VIM vs. STN DBS: 9% vs. 5%, OR: 2.06, 95% CI: 1.11 to 3.93; $P=0.019$.

Fractures: VIM vs. STN DBS, 2.56% vs. 0.74% OR: 3.49, 95% CI: 0.86 to 20.17; $P=0.047$.

Misplacements and migrations were observed only in patients with STN and VIM stimulation.

By Diagnosis

Patients with ET vs. PD: 13% vs. 7%, OR: 2.03, 95% CI: 0.96 to 4.2; $P=0.042$.

Higher proportion of misplacements and migrations, and lead fractures in patients with ET compared to PD: 3.93% vs. 1.68%, $P=0.173$.

A trend was observed when comparing the total number of complications between patient with ET and dystonia, 13% vs. 3%; $P=0.076$.

Examples of hardware related complications

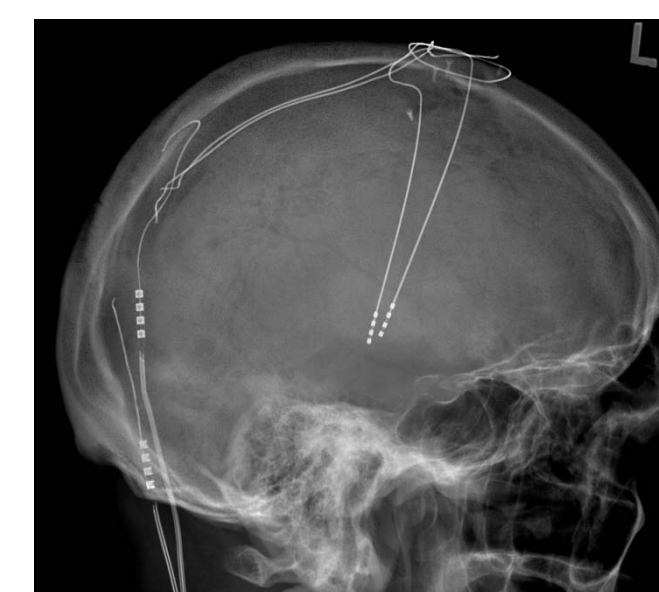
Table 2. Distribution of electrodes according to the main direction of misplacement or migration.

	Misplacements n=11	Migrations n=10
Anterior	2	0
Medial	2	4
Lateral	3	3
Upward	0	1
Downward	1	0
Unspecified	3	2

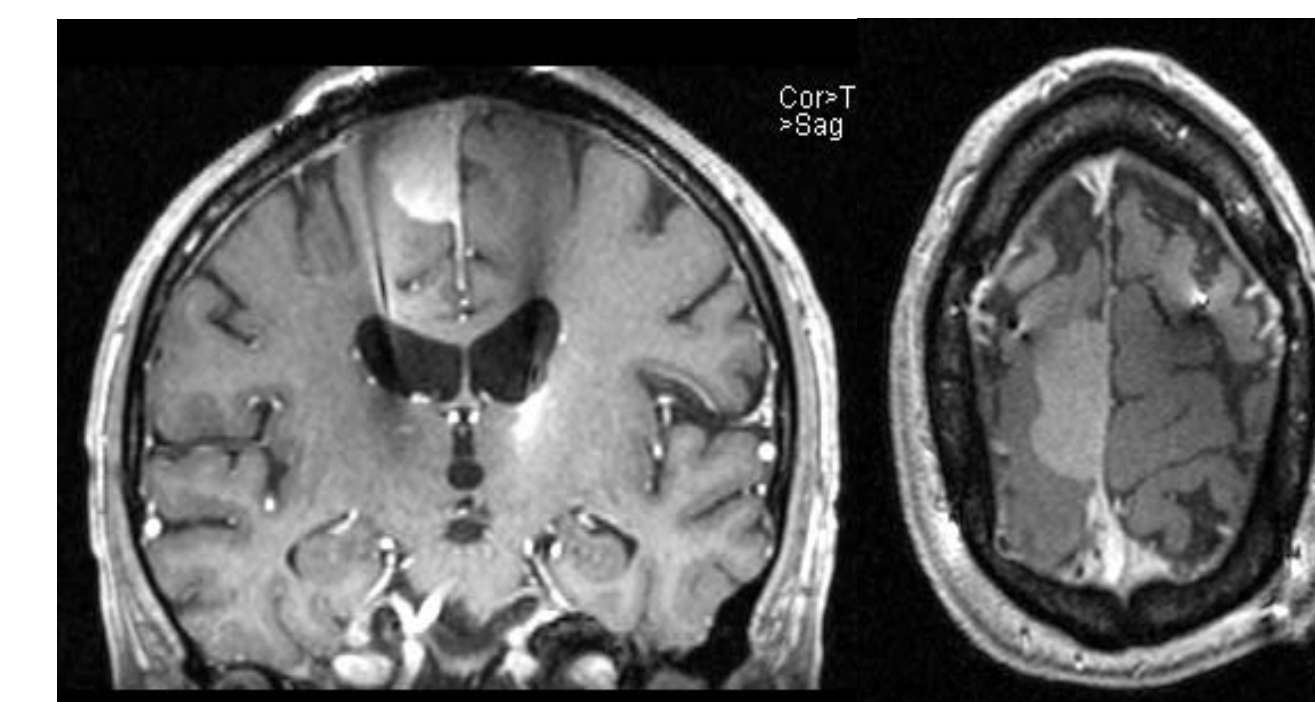
Determined by brain MRI, comparing with baseline imaging studies or target location.



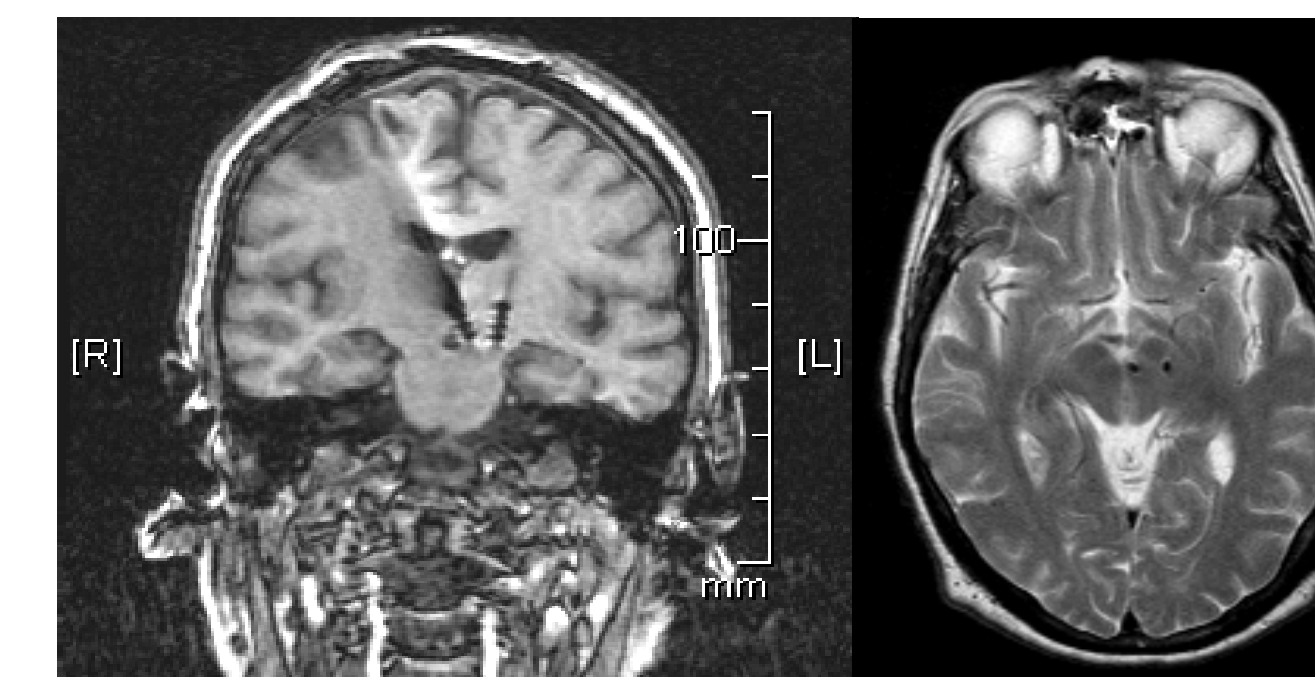
Primary electrode migration



Lead fracture

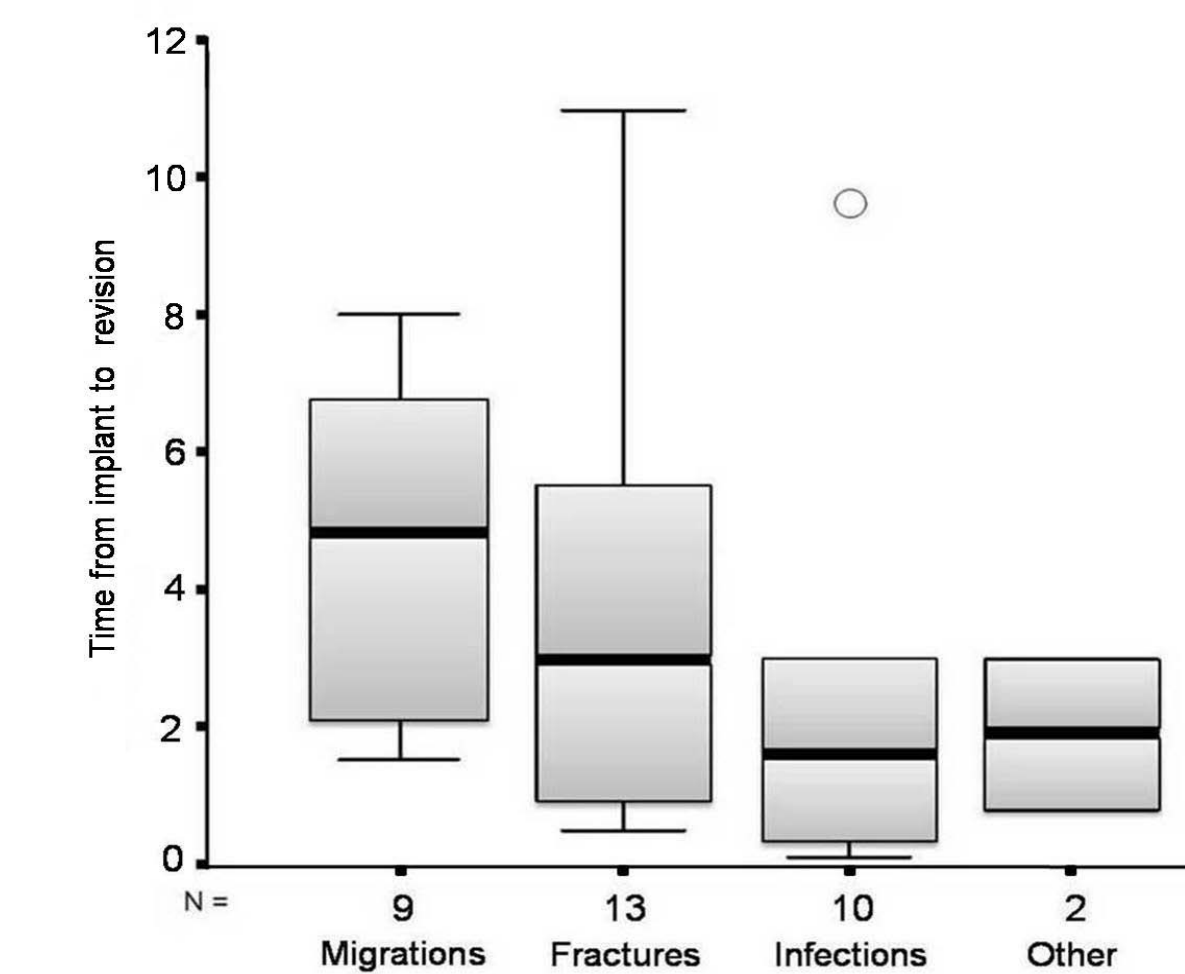


Secondary electrode migration to parasagittal meningioma

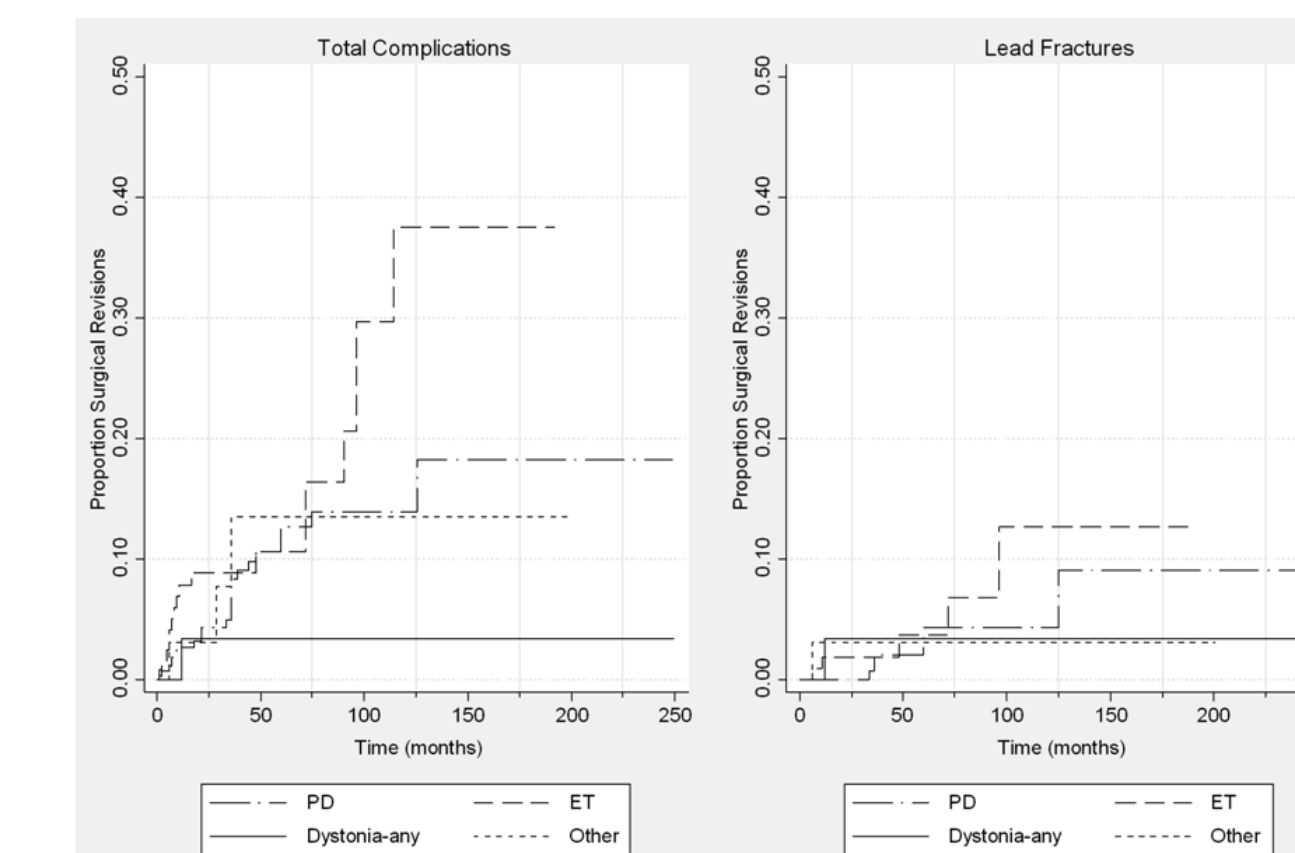


Electrode misplacement crossing the midline

RESULTS



Box plots indicating the time distribution of hardware complications. Electrode misplacement were excluded as by definition they were detected in the first 6 months after surgery.



Kaplan-Meier plot showing the distribution of all complications and lead fractures during follow up. PD: Parkinson's disease; ET: essential tremor.

CONCLUSIONS

- DBS hardware complications occurred in 8.5% of 512 patients, 7% of 856 electrodes.
- The most common complication was lead fracture.
- The rate of complications was highest among patients with ET and in those with VIM nucleus stimulation.
- There was no significant difference in the time distribution of complications.
- Comparisons among previous published studies is difficult due to different surgical techniques, definition of complications, follow-up periods, and other factors.

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