Optimization of DBS Outcome: Probability of Hemorrhage and Number of Trajectories and Anticoagulation

Daxa M Patel MD; Harrison Walker MD; Rebekah Brooks; David F. Bauer MD; Barton L. Guthrie MD
University of Alabama at Birmingham

Introduction

Deep brain stimulation (DBS) efficacy can be defined as a balance between good and adverse effects. As part of a comprehensive program to optimize DBS outcome, we evaluate the risk of hemorrhage as it relates to the number of electrode trajectories and use of blood thinners.

Methods

We queried our DBS database from January 2003 and March 2013 for patients who underwent DBS placement. Records were searched for hemorrhage, number of electrode trajectories, use and type of antiplatelet and anticoagulation therapy. All patients received imaging within 24 hours of the procedure. Statistical analysis using linear regression and conditional probability was performed.

Results

Complete records were found for 510 patients. Overall intracranial hemorrhage rate was 2.94% and subdural hemorrhage (SDH) rate was 1.76%. GPi DBS procedure was associated with hemorrhage in 4.0% (4/100) of patients, STN DBS was associated with hemorrhage in 2.2% (6/270) of patients, and Vim DBS was associated with hemorrhage in 3.6% (5/140) of patients. The overall conditional probability of a hemorrhage was 0.62% for the second electrode pass, 1.0% for the third pass, 1.8% for the fourth pass, and 10% for the fifth electrode pass. 19% of patients were on blood thinners, including 13.5% on Aspirin, 4.1 % on Coumadin, 3.9% on Plavix, and 0.6% on Pradaxa. 3.3% of patients were on multiple blood thinners. The only correlation found between blood thinners (individually and combined) and development of ICH, SDH, or a combined variable ICH/SDH was the use of coumadin and subdural hemorrhage (p value = 0.0068).

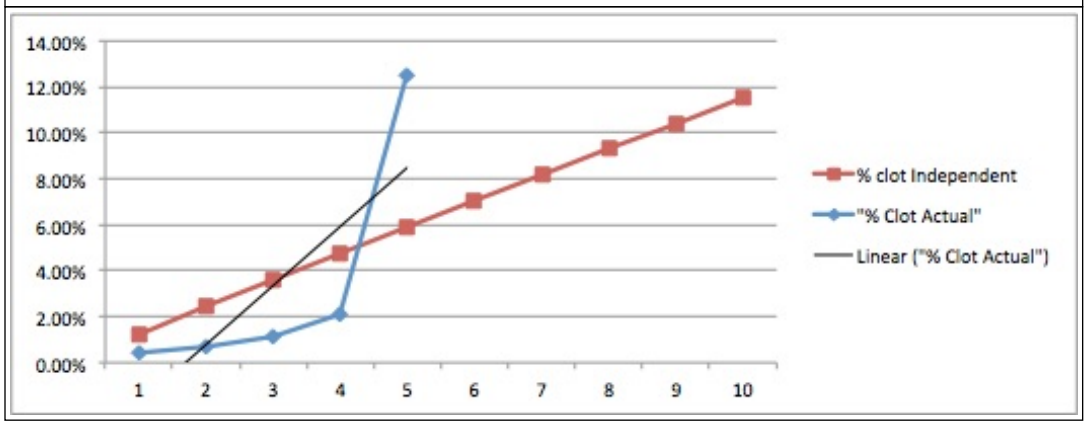
Table 1: Demographics

		Target		
	Total	GPI	STN	VIM
Number of cases n (%)	510 (100.0)	100 (19.6)	270 (52.9)	140 (27.5)
Male	313 (61.4)	42 (42.0)	179 (66.3)	92 (65.7)
Female	197 (38.6)	58 (58.0)	91 (33.7)	48 (34.3)
Age at Surgery mean ± std	59.1 ± 14.3	48.2 ± 19.4	60.7 ± 9.8	63.8 ± 13.5

Table 2. Use of blood thinners and ICH and/or SDH procedure related adverse events

Variable	Total	Intracranial hemorrhage (ICH)	p-value	Subdural hemorrhage (SDH)	p-value	ICH/SDH	p-value
	(N=510)						
Procedure-related event							
ICH	15 (2.9)						
SDH	9 (1.8)						
ICH and/or SDH	22 (4.3)						
Any blood thinner, n(%)	97 (19.0)	2 (13.3)	0.7	3 (33.3)	0.38	5 (22.7)	0.6
ASA, n (%)	69 (13.5)	2 (13.3)	1.0	1 (11.1)	1.0	3 (13.6)	1.0
Plavix, n (%)	20 (3.9)	0 (0.0)	1.0	0 (0.0)	1.0	0 (0.0)	1.0
Coumadin, n (%)	21 (4.1)	0 (0.0)	1.0	2 (22.2)	**0.048**	2 (9.1)	0.2
Lovenox, n (%)	1 (0.2)	0 (0.0)	1.0	0 (0.0)	1.0	0 (0.0)	1.0
Aggrenox, n (%)	1 (0.2)	0 (0.0)	1.0	0 (0.0)	1.0	0 (0.0)	1.0
Pradaxa, n (%)	3 (0.6)	0 (0.0)	1.0	0 (0.0)	1.0	0 (0.0)	1.0
One blood thinner, n (%)	80 (15.7)	2 (13.3)	1.0	3 (33.3)	0.2	5 (22.7)	0.4
Two blood thinners, n (%)	16 (3.1)	0 (0.0)	1.0	0 (0.0)	1.0	0 (0.0)	1.0
Three blood thinners, n (%)	1 (0.2)	0 (0.0)	1.0	0 (0.0)	1.0	0 (0.0)	1.0

*Fisher's exact test; p-values in bold font are statistically significant at p <0.05



Conclusions

The incidence of hemorrhagic complication appears higher when targeting the GPi versus targeting VIM or STN. The risk if hemorrhage increases incrementally with the number of electrode trajectories. Additionally, the SDH risk was associated with coumadin, but the risk of overall hemorrhage did not correlate with anticoagulation or antiplatelet therapy.