

Modifying Effects to the Autonomic Cardiovagal Responses by Globus Pallidus Interna Deep Brain Stimulation in Patients with Parkinson's Disease.

Jyhong Gabriel Hou, MD, PhD^{1,2}, Shawna Johnson, RN¹, Joseph Davis, BS¹ and Eugene C. Lai, MD, PhD^{1,3}

Parkinson's Disease Research, Education and Clinical Center (PADRECC),

¹Michael E. DeBakey Veterans Affairs Medical Center, ²Baylor College of Medicine, ³The Methodist Neurological Institute, Houston, Texas, USA

Objective:

To examine the autonomic cardiovagal responses affected by globus pallidus interna deep brain stimulation (GPi-DBS) in patients with Parkinson's disease (PD).

Background:

Autonomic dysfunctions are common in PD. Theoretically, DBS may affect nearby autonomic nuclei or circuits to modify the effects of sympathetic and parasympathetic systems. Several studies reported various results of autonomic responses by subthalamic nucleus (STN) DBS. There are, however, no published reports on such effects of GPi-DBS.

Design/Methods:

Five patients with PD who had GPi-DBS were recruited at our center. We tested cardiovagal effects by performing heart rate variability on deep breathing (expiration/inspiration; E/I ratio), valsalva maneuver (Valsalva ratio) and tilt-table test (30:15 ratio) when DBS was turned "off" or "on". We also measured blood pressure (systolic, SBP; diastolic, DBP), pulse rate (PR) before and three minutes after the head up tilt (HUT). Each test was repeated twice per patient.

Patients with GPi-DBS (n = 5)

	E/I Ratio	Valsalva's Ratio	30:15 Ratio	BP Changes on HUT (Systolic / Diastolic) (Pulse Rate)
DBS Off	1.07	1.29	1.05	-4.2/ +6.7 mmHg +9.3 beats / min
DBS On	1.11*	1.32	1.06	+5.8* / +11.8* mmHg +9.2 beats /min

*p < 0.05, compared to their respective variables when DBS is off

Patients with STN DBS (n = 8)

	E/I Ratio	Valsalva's Ratio	30:15 Ratio	BP Changes on HUT (Systolic / Diastolic) (Pulse Rate)
DBS Off	1.23	1.48	1.16	-10.9 / -1.1mmHg +5.0 beats / min
DBS On	1.27	1.40	1.11	-14.3 / -4.2mmHg +10.4 beats / min

Results:

- The mean age was 64.0 years. Mean duration of PD symptoms was 14.8 years and of DBS placement was 52 months.
- When GPi-DBS was turned off, the E/I, Valsalva, and 30:15 ratios were 1.07, 1.29, 1.05; and SBP, DBP, PR at three minutes after head tilt changed by -4.2mmHg, +6.7mmHg, +9.3 pulses/minute from the baseline, respectively.
- When DBS was turned on, the ratios were 1.11*, 1.32, 1.06, respectively. Three minutes after head tilt, SBP, DBP, PR changed by +5.8mmHg*, +11.8mmHg* and +9.2 pulses/minute, respectively. (*p < 0.05; t-test compared to "DBS-off")

Conclusions:

- When GPi-DBS was turned on, there was a slight increase in the E/I ratio, and better recovery of SBP and DBP three minutes after HUT, compared to when DBS was turned off. This is also in contrast to the result from STN-DBS in our other study, which had shown no beneficial effects on cardiovagal responses.
- This mildly positive cardiovagal benefits of GPi-DBS may help clinical decision in choosing anatomical sites for DBS treatment on PD patients. Larger sample size, though, are needed to demonstrate the clinical significance.