Longitudinal Change in Apathy Following Deep Brain Stimulation for Parkinson’s Disease

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INTRODUCTION

Apathy, a mood symptom common in Parkinson’s disease, causes lack of initiative/productivity, loss of energy, and emotional indifference. Mixed findings suggest that Deep Brain Stimulation (DBS) may lead to a worsening in apathy. To date, five studies report an average worsening of chronic apathy post-DBS and two studies do not show a change.

A major limitation is the lack of longitudinal data, with most studies comparing apathy once pre- and once post-surgery. Also, studies have not examined site or laterality because they were all bilateral STN.

We used a longitudinal approach to model progression of apathy and examined pre- and post-DBS trajectory of apathy after unilateral Subthalamus Nucleus (STN) or Globus Pallidus interna (GPi) DBS. We modeled apathy at pre-surgery, 2, 4, and 6 mo. post-surgery. We then tested predictors to examine individual differences in apathy trajectory.

Two current theories propose that apathy after DBS is due to: a) stimulation of non-motor circuits surrounding the STN, or b) reduction in levodopa medications (LED) after successful surgery. We sought to examine both of these theories.

HYPOTHESES:
1. Apathy will increase significantly and linearly after DBS.
2. Older age, increased disease severity, increased depression pre-surgery will predict a higher pre-surgical level of apathy and a steeper incline in apathy after DBS.
3. STN (vs. GPi) implantation and greater reduction in LED after surgery will be related to a steeper incline in apathy after DBS.

METHODS

Path diagram: Intercept and Slope of Apathy after DBS

Modeling Latent Growth:
Several unconditional models were tested. Linear growth best fit the data. Homogeneity of variance was relaxed. The unconditional linear model had a significant mean apathy intercept of 10.19 (p < .001) and significant mean apathy slope of rise of 0.66 points bimonthly (p = .014). See unconditional model fit indices below.

Predictors of Pre-DBS Apathy:
- Significant positive relationship between BDI-II score and the intercept (b = .538, SE = .085, p < .001), indicating higher depression score pre-DBS is related to higher apathy score pre-DBS
- No relationship between pre-DBS apathy and age, disease severity, but trend for younger adults to have lower apathy preDBS than older adults (p = .077)

Predictors of Post-DBS Apathy Trajectory:
- Trend for relationship between being a younger adult (< 65 yrs) and faster rate of increase in apathy (b = -1.987, SE = .527, p = .06)
- No relationship between pre-DBS depression, disease severity and rate of apathy change after DBS
- No relationship between site of implantation (STN vs. GPi) and apathy trajectory or percent reduction in LED and apathy trajectory

RESULTS

This study adds to the literature through its use of latent growth curve modeling to investigate apathy post-DBS. It is the first study to examine the relationship between apathy and implantation site and laterality. Consistent with our hypotheses, we found that apathy (AS scores) increased linearly from pre-surgery to 6 mo. post-DBS. We ran a mixed 2 x 2 ANOVA with IVs of time and side (right vs. left). We found a significant main effect of time, indicating that apathy increased from pre- to 6 mo., F(1, = 4.29, p = .048. There was no main effect for side or interaction between time and side.

CONCLUSION

Overall, our results corroborate studies that report DBS may lead to a worsening of apathy after surgery. With treatments for apathy being developed, understanding post-DBS apathy progression will aid clinicians in treating this impairing mood symptom.