

Comparison of Intraoperative CT with Postoperative MRI Coordinates in the Placement of Deep Brain Stimulation Electrodes

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Introduction

Deep brain stimulation (DBS) is an effective therapy for Parkinson's disease. Accurate lead placement in the subthalamic nucleus or globus pallidus is critical to ensure therapeutic effects and to minimize side effects. Intraoperative computed tomography (iCT) can be used to target and confirm lead position. The objective of our study is to compare the accuracy of lead placement using iCT relative to postoperative magnetic resonance imaging (MRI).

Methods

We conducted a retrospective study on 31 patients who underwent insertion of 57 DBS leads from August 2015 to December 2017 for Parkinson's disease, and who had iCT and postoperative MRI studies. Three patients had staged surgeries and the coordinates from each surgery were included in the analysis for the respective lead. Imaging studies were fused using Medtronic StealthStation™ S7. Lead position was calculated on iCT and postoperative MRI independently, and the absolute differences between the x, y, and z coordinates along with the Euclidean vectors were calculated.

Results

The mean absolute differences ± standard error of the mean for the x, y, and z coordinates were 0.013 ± 0.093 mm (p=0.89), 1.22 ± 0.14 mm (p<0.001), and 1.55 ± 0.15 mm (p<0.001), respectively. The average Euclidean vector was 2.44 ± 0.11 mm (p<0.001).

Conclusions

Based on this series, there exists a significant difference between iCT and post-operative MRI DBS lead coordinates. While the difference is small, further investigation is required to determine whether this difference is of clinical significance.

Learning Objectives

By the conclusion of this session, participants should be able to 1) Describe the importance of intraoperative CT and post-operative MRI in DBS placement; 2) Discuss, in small groups the correlation between intraoperative CT and post-operative MRI DBS lead coordinates.

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