

Optimization of MR Guided Focused Ultrasound Parameters and Location for the Treatment of Essential Tremor and Tremor Dominant Parkinson's Disease: A Comprehensive and Comparative Analysis of 60 FUS Thalamotomies for ET and PD

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Introduction

Transcranial MR guided focused ultrasound (MRgFUS) thalamotomy has been proposed as a new treatment for essential tremor and Parkinson's disease. The optimal parameters and technique used during the sonication process is currently under investigation for this new technology. We reviewed the procedural data from our clinical trials of thalamotomy to assess the precision of the MRgFUS system in creating a lesion at a defined location and of a defined size, and reviewed the procedural parameters and their impact on outcomes.

Lesion Analysis of PD and ET MRgFUS Pts ET001 Pivotal / Non Randomized / 15 02/2011-12/2011 Unblinded ET002 Randomized/Sham/Blinded 14 10/2013-10/2014 Non Randomized / Unblinded ET002-05/2015-04/2016 Extended 10/2012-03/2015 PD001 Randomized/Sham/Blinded 25 Unilateral ViM Thalamotomies • 63 Total lesions over 4 years Data Collection Retrospective review of all lesions using playback mode on InSightec system Serial evaluation of each sonication manually For sonication's which reached an average (background corrected) max temperature of at least 50°C the following was recorded: Target location relative to PC
Power, Time, Energy
Max peak Temp and avg Temp with background corr
S1¹C and 5⁴C contours at peak Temp time points Final 54°Cx3sec and 240CEM43 contours for each patient at the end of the final T2 MRI's were reviewed on POD0, POD1, 1M, 3M, 1Y Region 1 and Region 2 contours in the axial plane at the AC-PC plane were recorded Lesion center relative to the posterior commissure recorded Pre-lesion DTI calculations performed with seeds placed in the primary and premotor cortex to identify connections, then 3D T1 lesion volumes overlapped from PD patients Lesion Size over Time D0 3 9x3 2mm D1 5.3x5.2mm 1M 5.1x5.1mm 1Y 4.1x3.3mm +78% Mean change (SD 79%) in Zone 2 lesion size from day of procedure to POD1 Percentage Change -11% Mean change (SD 24%) in Zone 2 lesion size from POD1 to 1M Day of procedure MRI's not correlative of actual lesion at 1M, POD1 significantly closer to 1M lesion size • 7 -1 1Yr T2 MRI's highly variable

