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Stereotactic and Functional Neurosurgery

XXth Congress of the European Society for Stereotactic and Functional Neurosurgery

Cascais/Lisbon, Portugal, September 26–29, 2012

Abstracts

Guest Editors:
António J. Gonçalves Ferreira, Lisbon
Joachim K. Krauss, Hannover
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Jean Régis, Marseille
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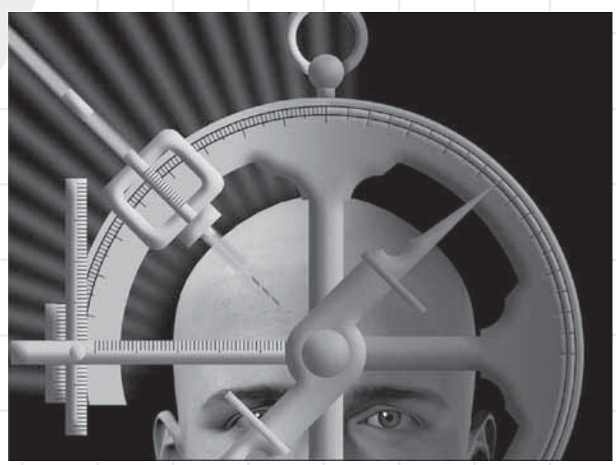

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A VASCULAR SAFETY INDEX FOR STEROTACTIC TARGETING OF DEEP BRAIN STRUCTURES

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Background: One major problem in the stereotactic placement of electrodes in deep brain structures is the avoidance of major blood vessels present along the trajectory.

Objective: To define a trajectory safety index (SI), based on a maximum intensity projection (MIP) algorithm, that would represent an objective measure of the proximity of the blood vessels.

Methods: Contrast-enhanced MRI's were filtered using 3D Frangi vesselness filter and co-registered with the other scans (CT, MRI) in the surgical planning software (Waypoint Navigator, Neurotargeting, Nashville, US). Using Matlab (Mathworks, Natick, MA, USA), a 3D model of the vasculature was generated by thresholding the Frangi-filtered MRI. Initial trajectories were planned and the information, including co-registration matrices, was exported to Matlab. The thresholded volume was normalized and smoothed using a 3D Gaussian. SI was defined as the maximum intensity value along the trajectory intersecting this volume. Alternate trajectories were suggested by calculating the trajectory safety index for a grid of entry points surrounding the original one.

Results: We have applied the calculation of the safety index to the targeting of subthalamic nucleus (STN) for deep brain stimulation (DBS) of Parkinsonian patients and to the implantation of depth electrodes for stereoencephalographic (SEEG) monitoring of epileptical patients. A retrospective analysis on n=18 STN targets, resulted in a SI = 0.95±0.07 (mean±sd). The method was prospectively used for 7 SEEG electrodes implantation (SI = 0.83±0.22), suggesting alternate trajectories having a higher safety index.

Conclusions: The trajectory safety index we have defined may represent a useful tool for minimizing risks of brain haemorrhage when targeting deep brain structures. Supported by PN-II-ID-PCE-2011-3-0240.

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ACCURACY OF AN INNOVATIVE DEVICE FOR STEREOTACTIC AND FUNCTIONAL NEUROSURGERY: A CADAVER STUDY

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Introduction: Classic stereoactic frames have been used for decades and have shown to be accurate for stereotactic procedures. However, they may show some limitations concerning their use with intraoperative MRI or to perform simultaneous bilateral procedures. We present a new device fulfilling these criteria (StereoPod, StereoTools, Neuchâtel, Switzerland). The objective of this study is to test the accuracy of the Stereopod on cadaver heads.

Methods: The procedure was performed on 5 cadaver heads. A pre-op 3D CT-Scan (voxel size: 0.488x0.488x0.625 mm3) was performed with the image localizer of the device. A deep seated target (generally thalamus) was defined on the dedicated software. After calibration of the system, the tripod was installed on the cadaver's skull. A biopsy needle was inserted into the brain to the target. An intraoperative CT-Scan was acquired. Several rigid registration algorithms were used to measure the 3D distance between the planned target and the extremity of the biopsy needle.

Results: 5 procedures were performed with the device fixed to the skull on the right frontal area (coronal region). The mean 3D calculated distances were 0.63 +/- 0.10mm (x: 0.39+/-0.25mm; y: 0.14+/-0.32mm; z: 0.21+/-0.25mm). The measurements were performed by 3 different persons and 3 different algorithms. The results were not influenced by the measuring person and/or the used algorithm.

Conclusions: This cadaver study using intraoperative imaging shows a submillimetric accuracy of the Stereopod, which is (at least) comparable to the classic frames. Further clinical studies are planned for stereotactic biopies and DBS electrode implantation, in order to confirm these results.