AbstractID: 8119 Title: Atlas-based Functional Radiosurgery: Early Results

Purpose: Functional disorders of the brain, such as dystonia and neuropathic pain, may exhibit poor response to medical therapy. The Globus Pallidus pars interna (GPi) and the medial-thalamus are potential targets for surgical or stimulation interventions in these two pathologies, respectively. Radiosurgery is an attractive non-invasive technique to treat dystonia or pain through a radio-induced lesion to create the internal pallidotomy (IP) and medial thalamotomy (MT), respectively, but does not provide the possibility of confirming the target location through microelectrode recording. Computer-aided atlas-based target identification may provide a tool to maximize the anatomic detection of the target. The aim of this work is to show the feasibility of atlas-based functional radiosurgery and evaluate the early results. **Method and Materials:** The coordinates of GPi, centro-median (CMN) and medio-dorsal (MD) nuclei were identified in the Talairach-Tournoux atlas and transformed to the corresponding regions of the Montreal Neurological Institute (MNI) electronic atlas. Binary masks describing the target nuclei were created. The MNI electronic atlas was deformed onto the patient T1-MRI by applying an affine transformation followed by a local nonrigid registration. The obtained deformation field was then applied to the target masks, which were superimposed on patient T2-MRIs. The radiosurgical targets were thus identified on the patient T2-MRI registered on the treatment CT. **Results:** Two patients affected by dystonia and neuropathic pain were treated through IP and MT (120 Gy prescribed at 65% and at 77%, respectively) delivered by the CyberKnife. Six month after the treatment, T2- and contrast-enhanced-T1-MRIs showed edematous regions around the targets, whose correct lesion placements were confirmed through DW-MRIs. Complete resolution of dystonia and pain was obtained within 6 months with consequent discontinuation of medical therapy so far required. **Conclusion:** This work shows that atlas-based target reconstruction is a valid tool to maximize target detection during functional radiosurgery.