Reliable volumetry of the cervical spinal cord in MS patient follow-up data with cord image analyzer (Cordial)

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Spinal cord (SC) atrophy is an important contributor to the development of disability in many neurological disorders including multiple sclerosis (MS). To assess the spinal cord atrophy in clinical trials and clinical practice, largely automated methods are needed due to the sheer amount of data. Moreover, using these methods in longitudinal trials requires them to deliver highly reliable measurements, enabling comparisons of multiple data sets of the same subject over time. We present a method for SC volumetry using 3D MRI data providing volume measurements for SC sections of fixed length and location. The segmentation combines a continuous max flow approach with SC surface reconstruction that locates the SC boundary based on image voxel intensities. Two cutting planes perpendicular to the SC centerline are determined based on predefined distances to an anatomical landmark, and the cervical SC volume (CSCV) is then calculated in-between these boundaries. The development of the method focused on its application in MRI follow-up studies; the method provides a high scan-rescan reliability, which was tested on healthy subject data. Scan-rescan reliability coefficients of variation (COV) were below 1ă%, intra- and interrater COV were even lower (0.1-0.2ă%). To show the applicability in longitudinal trials, 3-year follow-up data of 48 patients with a progressive course of MS were assessed. In this cohort, CSCV loss was the only significant predictor of disability progression (pă=ă0.02). We are, therefore, confident that our method provides a reliable tool for SC volumetry in longitudinal clinical trials.
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