Voxel based lesion symptom mapping

Voxel-based lesion-symptom mapping (VLSM) is the term coined by Bates and colleagues (2003, Nat. Neurosci., 6, 448-450) for whole brain, voxel-by-voxel analysis of the relation between lesion data and behavioral data. This state-of-the-art approach to lesion analysis takes advantage of advanced brain imaging technologies to obtain 3-dimensional lesion maps for each patient, co-register the lesions to a common template, and calculate a statistic for each voxel that measures the strength of the association between lesion status (presence/absence of lesion) and the behavioral measure. Typically, the statistic is thresholded to some standard of statistical significance and the results are visualized on a colorized map showing the location of voxels that carry a significant association with the behavioral variable. VLSM is a power-intensive method (Kimberg et al., 2007, J. Cognitive Neurosci., 19(7), 1067-1080) that is best done with a large group of patients. MRRI, with its effective patient-recruitment infrastructure and collaborative ties to UPenn's Center for Functional Neurimaging, is at the forefront of basic and applied research using VLSM.

VLSM mini courses have been video recorded and are available on the MRRI YouTube Channel.

Voxel-based lesion-symptom mapping (VLSM) analysis was applied to define the brain regions associated with occurrence of 1p19q co-deletion in a cohort of 206 AO tumor patients (discovery set) treated between May 2009 and September 2013. Retrospectively, the acquired clusters and radiological features were subjected to Kaplan-Meier survival analysis using data from the Chinese Glioma Genome Atlas (validation set) to evaluate their prognostic role in AO patients. The institutional review board approved this study. The right frontal lobe and right anterior insular lobe were specifically associated with high occurrence of 1p/19q co-deletion. For AO tumors not involving these areas, the absence of contrast enhancement predicted longer progression-free ($p = 0.018$) and overall survival ($p = 0.020$); moreover, in patients with contrast enhancement, edema could stratify the survival outcome ($p = 0.013$ for progression-free survival, $p = 0.016$ for overall survival). For AO tumors located in the VLSM-identified regions, edema was also able to stratify the survival outcome of patients without contrast enhancement ($p = 0.025$ for progression-free survival, $p = 0.028$ for overall survival). The 1p/19q co-deletion showed predilection for specific brain regions. According to the tumor involvement of VLSM-identified regions associated with 1p/19q co-deletion, radiological features were predictive for AO patient survival outcomes [1)].

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Wang K, Wang Y, Fan X, Li Y, Liu X, Wang J, Ai L, Dai J, Jiang T. Regional specificity of 1p/19q co-deletion combined with radiological features for predicting the survival outcomes of anaplastic oligodendroglial tumor patients. J Neurooncol. 2017 Dec 11. doi: 10.1007/s11060-017-2673-8. [Epub ahead of print] PubMed PMID: 29230668.