Poster ME-1

Development of a New Algorithm for Quantitative Analysis in Functional and Anatomical Brain Activation Maps

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목적 : The purpose of this study is to develop a new algorithm for quantitative information on the brain activity(%) and lateralization ratio(%) from the functional & anatomical index images combined with pixel differentiation method.

대상 및 방법 : The functional MR images related with visually evoked sexual arousal were processed by statistical parametric mapping package(SPM99) and the resulting functional map was overlaid on a high-resolution single-subject T1-weighted MR image(Montreal Neurological Institute), subsequently the image was converted image file format. Using a pixel differentiation method, activation areas are derived and are transformed to RGB value, giving B/W differentiation image. The B/W differentiation image is compared with template image representing Brodmann's and anatomical areas, where a difference of RGB value indicates regional activation area. The final 3-dimensional activities corresponding to the functional and anatomical areas were obtained from the total sum of the axial activation maps. We estimated accuracy of our software by comparison of the regional activation and error from the manually counted pixels.

결과 : For a test of our FALBA software, brain activation was induced by visually evoked sexual stimulation from a volunteer to obtain the pixel-based brain activity and lateralization. In functional area(BA), the total sum of pixels is 608,273, where 68,269 pixels are counted from the activation area, giving 11.2% activity. BA-37 gave greatest activation area(9,318 pixels) with occupation ratio(21.8%), while BA-23 gave smallest activation area(6 pixels) with occupation ratio(0.1%). In anatomical area(AA), the total sum of pixels is 612,531, where 72,483 pixels are measured from the activation area, giving 11.9% activation ratio. Middle occipital gyrus(MOG) gave greatest activation area(14,431 pixels) with occupation ratio(59.8%), while hypothalamus(HTHAL) and inferior parietal gyrus(IPG) gave smallest activation area(37, 65 pixels). Compared with IPG, HTHAL(6.2%) shows more higher occupation ratio than IPG(0.5%). The manual accounting method currently used is time consuming and is limited in accurate and reliable quantification of the activated cerebrocortical regions. The FALBA program was 240 times faster than manual counting method: ~10 hours for manual accounting and ~2.5 minutes for the FALBA program under a Pentium IV processor. Compared with FALBA program, the manual counting method showed 0.92% and 0.98% average errors in counting activated pixels from anatomical and functional images, respectively.

결론 : FALBA program is capable of providing accurate quantitative results including identification of the brain activation region and lateralization index with respect to functional and

anatomical areas. Also, the processing time was dramatically shortened as comparison with the manual counting method. However, FALBA needs automatic file conversion procedure, improvement of GUI and data handling.