

**SS 11 NR-11** 17:40

**Assessment of characteristics of diffuse low grade gliomas using voxel-based multiparametric analysis with relative cerebral blood volume(rCBV) and apparent diffusion coefficient(ADC)**

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**PURPOSE:** To find the characteristics of the distribution of voxel populations of diffuse low grade gliomas in terms of rCBV and ADC and to differentiate them into subtypes using voxel based multiparametric analysis.

**MATERIALS AND METHODS:** We retrospectively analyzed the perfusion and diffusion MRI of 23 consecutive patients with histologically proven diffuse low grade gliomas(5 diffuse astrocytoma(AC), 14 oligodendroglioma(OD), and 4 oligoastrocytoma(OA)). The voxel-based analyses were done on the entire tumor volume and 3D histograms were plotted based on rCBV ratio and ADC of each voxel. The following variables were used to compare the tumors: kurtosis and skewness of rCBV and ADC of whole voxel population, the values of rCBV ratio and ADC of major voxel population on 3D histogram, the mean values of ADC, kurtosis and skewness of voxels with upper 20% of rCBV ratio, and the mean values of rCBV ratio, kurtosis and skewness of voxels with lower 20% of ADC value.

**RESULTS:** The kurtosis and skewness of ADC value of whole tumor voxels were  $7.6 \pm 2.8$  and  $2.3 \pm 0.5$ (AC),  $4.9 \pm 1.7$  and  $1.7 \pm 0.4$ (OD),  $3.4 \pm 1.2$  and  $1.2 \pm 0.4$ (OA), respectively. The kurtosis and skewness of rCBV ratio were  $13 \pm 6.2$  and  $3.1 \pm 1.2$ (AC),  $7.6 \pm 3.8$  and  $2.3 \pm 0.7$ (OD),  $5.0 \pm 3.2$  and  $1.5 \pm 1.2$ (OA), respectively. In major voxel population, the rCBV ratio and, ADC were  $1.14 \pm 0.6$  and  $1205 \pm 148.3$ (AC),  $1.19 \pm 0.3$  and  $1335.7 \pm 154.6$ (OD),  $1.7 \pm 1.0$  and  $1562.5 \pm 314.6$ (OA), respectively. For the voxels with upper 20% of rCBV ratio, the mean ADC, kurtosis and skewness of ACs( $1155 \pm 97.5, 9.8 \pm 4.3, 2.6 \pm 0.7$ ) were lower than ODs( $1336 \pm 166.6, 5.6 \pm 1.9, 1.9 \pm 0.4$ ), and OAs( $1388 \pm 228.7, 3.3 \pm 1.3, 1.2 \pm 0.6$ ). The mean rCBV ratio, kurtosis and skewness of ACs( $1.3 \pm 0.5, 11.4 \pm 7.2, 2.7 \pm 1.2$ ) were lower than ODs( $1.3 \pm 0.3, 7.6 \pm 2.6, 2.3 \pm 0.5$ ), and OAs( $1.6 \pm 0.6, 4.1 \pm 1.4, 1.5 \pm 0.5$ ) in voxels with lower 20% of ADC.

**CONCLUSION:** In the tumor voxel distribution analysis using kurtosis and skewness, the OAs have more heterogeneity than ODs and ACs. In the major voxel population, OAs showed a higher ADC and rCBV ratio than ODs and ACs. The voxels with high rCBV ratio had lower ADC. However, the voxels with low ADC value didn't show high rCBV ratio. Therefore, the area of high cellularity in low grade gliomas does not necessarily correspondent to the area of high rCBV ratio.