Diffusion-weighted Imaging and Apparent Diffusion Coefficient Values for Differentiation of Residual or Local Recurrent Tumor from Posttreatment/Postbiopsy Changes in Patients with Primary Head and Neck Squamous Cell Carcinoma

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Purpose:

To evaluate the role of diffusion-weighted imaging (DWI) and ADC measurement for differentiation of residual or recurrent tumor and posttreatment/postbiopsy changes in patients with primary head and neck squamous cell carcinoma (HNSCC).

Materials and Methods:

Ten patients with HNSCC (mean age 50 years, range: 30 – 75 years) underwent MRI with DWI for staging for planned surgery after biopsy (n=2) or chemo/radiation therapy (n=3), or suspicion of tumor recurrence (n=5). In addition to the conventional MRI sequences, axial echo-planar DWI with parallel imaging technique was performed using b-factor of 0 and 1000sec/mm^2. Coronal and axial images were reconstructed with 3–4 mm slice thickness from MIP image of the axial DWI data set, and were displayed with inversion of the signal intensity scale. Two experienced radiologist performed qualitative analysis of the conventional and DW images and reached a consensus about the presence of tumor and its size on conventional and DW images with 4-point scale. In the quantitative analysis, after measurement of the signal intensities of tumor (SI_T), surrounding background with abnormal signal intensity area (SI_P), and brachial plexus (SI_B) on DW images and their ADC values (ADC_T, ADC_P, ADC_B), the relative signal intensities and the relative ADC values of tumor (rSI_T, $rADC_T$) and surrounding background with abnormal signal intensity area (rSI_P, $rADC_P$) over those of brachial plexus were calculated. The results of analysis were compared with the clinicopathologic reference standard.

Results:

Seven patients with residual/recurrent tumor were confirmed by surgery. There was no tumor in 3 patients, which was confirmed by surgery (n=2), or follow-up (n=1). Qualitative analysis revealed complete agreement of DW images with the pathology for the presence of tumor mass. But, the conventional images had a tendency to overestimate the presence or size of residual or recurrent tumor in 5 patients. On quantitative analysis, the mean of SI_T was higher than SI_P and SI_B, and the mean of ADC_T was lower than ADC_P and ADC_B (Fig. 1). When SI and ADC values were corrected by those of brachial plexus, the overlapped values were more clearly separated between each other (Fig. 2).

Conclusion:

Using DW images and ADC values, residual/recurrent tumor could be differentiated from posttreatment/postbiopsy changes in patients with HNSCC either by qualitative and quantitative analysis.

Fig. 1 – Results of quantitative analysis: distribution of DWI-SI and ADC values of tumor, abnormal SI background and brachial plexus (Numbers on bar indicate mean ± SD)

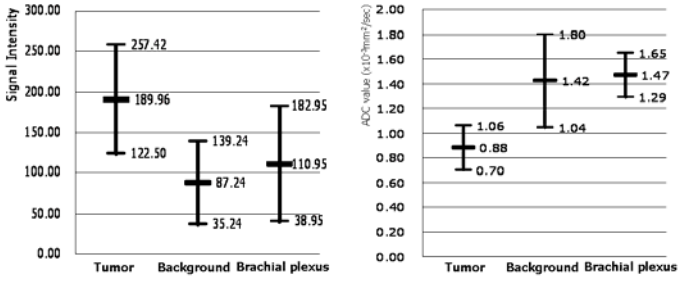

Fig. 2 – Results of quantitative analysis: distribution of rSI on DWI and ADC values of tumor and abnormal SI background (Numbers on bar indicate mean ± SD)

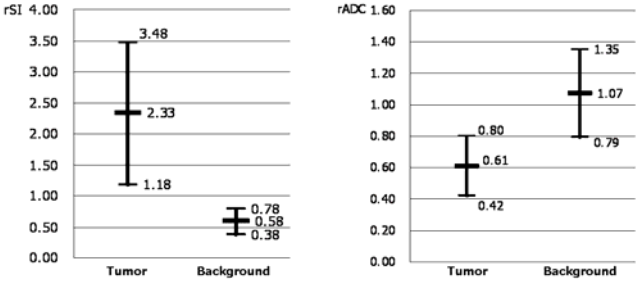

Fig. 3 – Thirty-year-old female with tongue cancer (on the right). *A,* Initial coronal T2WI shows hyperintense mass in left side of mobile tongue invading genioglossus muscle. *B,* After neoadjuvant chemotherapy, follow-up MRI was performed at our institution. Coronal STIR image demonstrates marked reduction of the mass (cT4aN0M0 → cT2N0M0). *C,* On DWI performed at the same day, most of the lesion shows slight hypointensity (yellow arrow) with internal marked hypointense focus (red arrow), measuring about 5mm. *D,* Corresponding coronal image of FDG-PET shows similar finding with DWI, but with larger area of hypermetabolism than internal hypointense focus of DWI (red arrow). Histopathologic examination of the specimen after surgery revealed residual tumor at the lateral border of the tongue with 3mm in long diameter (pT1N0M0).