Apparent Diffusion Coefficient of Benign and Malignant Salivary Gland Tumors and Histologic Correlation: Influence of Tumor Cellularity and Myxoid Matrix

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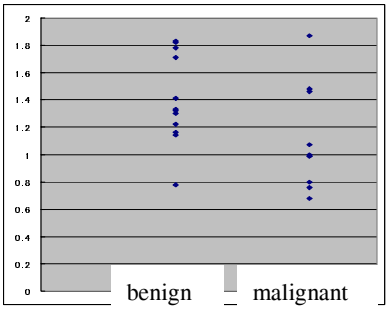
Purpose: It has been reported that diffusion-weighted imaging (DWI) might be useful for characterizing head and neck tumors, suggesting that malignant tumors have a lower apparent diffusion coefficient (ADC) than benign tumors. However, it remains uncertain if ADC is useful for distinguishing between benign and malignant salivary gland tumors. This study was intended to evaluate the ADC of benign and malignant salivary gland tumors in comparison with histologic findings.

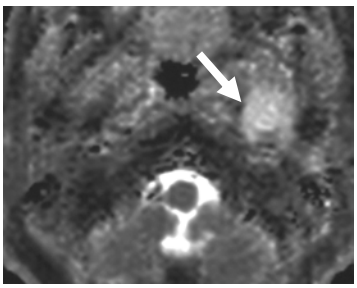
Materials and Methods: Twenty-three consecutive patients with salivary gland tumors (13 benign, 10 malignant) were studied prospectively. Benign salivary gland tumors included pleomorphic adenoma (n=10) and Warthin's tumor (n=3), whereas malignant salivary gland tumors included adenoid cystic carcinoma (n=2), squamous cell carcinoma (n=2), myoepithelial carcinoma (n=1), undifferentiated carcinoma (n=1), malignant lymphoma (n=2), malignant melanoma (n=1), and myxoid liposarcoma (n=1). Line scan DWI images were obtained using two different *b* values, as the maximum *b* value applied along the three orthogonal directions: one with a low *b* factor of 5 s/mm^2; the other with a maximum *b* factor of 1000 s/mm^2. The scan time per slice was 30-45 s. In all, three to five slices were obtained in the axial plane according to the lesion size. The ADC value was measured for tumors; on that occasion, special care was taken to include the solid-appearing regions of tumors and to exclude obviously necrotic or cystic regions. Histologic analyses were performed with regard to tumor cellularity and the presence or absence of myxoid matrix in salivary gland tumors.

Results: The mean ADC value was 1.11 ± 0.37 × 10^{-3} mm^2/s in malignant salivary gland tumors and 1.35 ± 0.34 × 10^{-3} mm^2/s in benign salivary gland tumors. No statistically significant difference was found between benign and malignant tumors (Fig. 1). The ADC values of Warthin's tumors (mean 0.93) were lower than those of pleomorphic adenoma (mean 1.48) in benign tumor cases, whereas ADC values of myxoid liposarcoma (1.87) and adenoid cystic carcinoma (mean 1.47) were higher than those of other malignant tumors (mean 0.89) in malignant tumor cases. Consequently, considerable overlap in ADC values existed between benign and malignant salivary gland tumors (Fig. 1). Histologic analyses revealed hypercellularity in some malignant tumors such as lymphoma and carcinomas, and hypercellular matrix composed of lymphoid tissue in Warthin's tumor. These histologic findings appeared to be associated with reduced ADC values. On the other hand, less cellularity with or without myxoid matrix was seen in pleomorphic adenoma (Fig. 2), myxoid liposarcoma, and adenoid cystic carcinoma. These histologic findings were presumed to be associated with increased ADC values.

Conclusion: Considerable overlap of ADC values was found for benign and malignant salivary gland tumors; therefore ADC alone might not contribute to differentiation between benign and malignant salivary gland tumors. Histologic findings suggested that myxoid matrix as well as tumor cellularity greatly influences ADC in salivary gland.

Fig. 1
Scatterplot of
ADC
(× 10^{-3} mm^2/s)





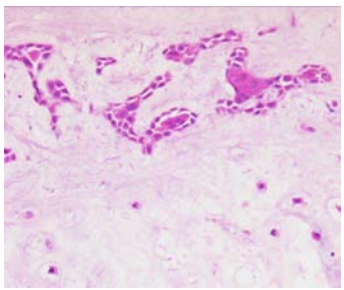


Fig. 2 pleomorphic adenoma

A. ADC map shows high ADC (1.83 × 10^{-3} mm^2/s) of the tumor (arrow).

B. Photomicrograph shows abundant chondromyxoid matrix of the tumor.