

Usefulness of contrast color Doppler ultrasonography in preoperative diagnosis between malignant and benign of soft tissue tumor

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Background:

Soft tissue tumors are not rare findings in daily orthopedic practice. Several imaging modalities have been applied to assess these tumors, including plain radiography, nuclear medicine, computed tomography (CT), magnetic resonance imaging (MRI), ultrasonography (US), angiography and positron emission tomography. Most general practitioners, however, find it difficult to distinguish benign from malignant lesions. Although MRI and CT are the most common modalities for evaluating soft tissue masses, many patients have difficulty undergoing these examinations. Additionally, their cost may be prohibitive. Resolution of ultrasonography (US) has undergone marked development. Additionally, a new-generation contrast medium (Sonazoid) used for US is newly available. Contrast-enhanced US has been widely used for evaluating several types of cancer.

Purpose: The aim of the present study was to elucidate the usefulness of contrast enhanced color Doppler (CD) ultrasonography for preoperative differential diagnosis between benign and malignant soft tissue tumors.

Material and Methods: Between January 2010 and December 2013, a total of 180 patients (87 male, 93 female) were enrolled in the present study. The patient ages ranged from 1 to 91 years (mean 58.1±20.0 years). The patients were treated at Osaka City University Hospital in Osaka, Japan. The institutional Ethics Review Board of Osaka City University Graduate School of Medicine approved the protocol of the present study.

The maximum size, depth, tumor margins, shape, echogenicity and textural pattern were measured on gray-scale images. CDUS was used to evaluate the intratumoral blood flow, using conventional criterion according to classical Giovanglio classification with and without contrast medium, Sonazoid. Peak systolic flow velocity (Vp), mean flow velocity (Vm), resistivity index (RI) and pulsatility index (PI) of each detected intratumoral artery were automatically calculated with power Doppler US (PDUS). The elasticity of tumor was also measured, compared to a normal fat tissue using the elastography.

Quantitative data are presented as the means ± standard deviation. The Mann-Whitney U, Fisher's exact and χ^2 tests were used for unpaired comparisons between the quantitative parameters. Statistical analysis was performed using Excel statistics software for Windows (version 2012; SSRI Co., Ltd., Tokyo, Japan). A value of $p < 0.05$ was considered to indicate a statistically significant difference.

Result: A total of 118 benign and 62 malignant tumors were included in the present study.

Statistical significances were found in size, depth, tumor margin and textural pattern but not in shape or echogenicity on gray-scale images. Before Sonazoid injection, CDUS findings showed 55% sensitivity, 77% specificity and 69% accuracy, whereas contrast-enhanced CDUS showed 87% sensitivity, 68% specificity and 74% accuracy. There were no statistically significant differences between malignant and benign tumors regarding the mean Vp, Vm, RI and PI values determined on PDUS. Elastography was performed 124 masses (87 benign and 37 malignant). Elastic ratio average was 0.58 in benign and 0.25 in malignant tumor (P=0.004).

Conclusion: The tumor size, depth, textural pattern and tumor margin proved to be positive parameters on gray-scale US images for differentiating benign from malignant tumors. From the standpoint of vascularity within the tumor, CDUS showed lower sensitivity (54.8%) and lower accuracy (69.4%). Contrast medium administration enhanced sensitivity and accuracy up to 86.8 and 74.4%, respectively. PDUS provided no useful information. Contrast-enhanced CDUS proved to be a reliable diagnostic tool with which to screen for malignant potential in soft tissue tumors.