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Imaging analysis of superficial soft tissue lymphomas

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ABSTRACT

Purpose: To describe imaging findings in superficial soft tissue lymphomas, especially those located in the skin and subcutaneous layer.
Materials and methods: This study included 44 pathologically confirmed superficial lymphoma lesions. Imaging analysis included the size, margin, location, morphology, homogeneity and multiplicity.
Results: A nodular form was the most common (21/44, 47.7%) morphology, and of them, 18 demonstrated a streaky appearance. Most of the lesions demonstrated ill-defined margins (26/44, 59.1%) and homogeneous patterns (35/44, 79.5%).
Conclusions: The imaging findings of superficial soft tissue lymphomas were non-specific. However, if images show multiple nodular lesions with ill-defined margins, we should consider this diagnosis.

1. Introduction

Lymphomas are the most common blood cell cancers that develop in the lymphatic tissue or organs, including the lymph nodes, spleen, bone marrow, and blood. They can also arise in organs or tissues outside of the lymphatic system and are then referred to as extranodal lymphomas. Superficial soft tissue lymphomas are a subgroup of extranodal lymphomas that originate in the skin, subcutaneous layer, and muscles. They account for ~1.4% of all malignant lymphomas [1].

Superficial soft tissue lymphomas can occur primarily or secondarily, similar to whole-body lymphomas. If a superficial lymphoma occurs in a cutaneous or subcutaneous area at the time of the initial diagnosis, it is referred to as a primary lymphoma. Secondary lymphomas occur by hematogenous or lymphatic extension from a primary lymphoma in other organs. Superficial soft tissue lymphomas are also divided into non-Hodgkin (NHL) and Hodgkin lymphomas. They can be further subdivided according to cell type: B cell and T cell lineages and others.

The imaging findings of superficial soft tissue lymphomas are not well known and are typically variable and non-specific [2,3]. Thus, superficial soft tissue lymphomas may be misidentified, and a definite diagnosis still relies on the histological and clinical findings.

Choiou et al. suggested that the main ultrasonographic (US) findings of superficial soft tissue lymphomas are multiple nodules or masses and subcutaneous and muscle infiltration [4]. Several previous studies reported computed tomography (CT) findings in superficial soft tissue lymphomas, which included multiple ill-defined enhanced nodules and streaky densities in the subcutaneous layer, with thickening or masses in the skin [3,5,6]. On magnetic resonance imaging (MRI), cutaneous T-cell and B-cell lymphomas show non-specific cutaneous and subcutaneous lesions, appearing as discrete masses or thickening of the skin and subcutaneous tissue with low signal intensity on T1-weighted images (T1WIs), high signal intensity on T2-weighted images (T2WIs), and enhancement after intravenous contrast administration [7].

To date, there have been few reports on superficial soft tissue lymphomas located only in the skin and subcutaneous fat layer, although few retrospective studies and case reports associated with histological classifications have been conducted. The purpose of this study was to evaluate imaging and clinical findings of superficial soft tissue lymphomas located in the skin and subcutaneous layer using imaging modalities such as MRI, CT, and US.

2. Materials and methods

2.1. Patients

This retrospective study was approved by our institutional ethics review board. The need for informed consent was waived.

We reviewed our histopathological electronic medical record database between 2004 and 2014 using the search terms skin lymphoma,

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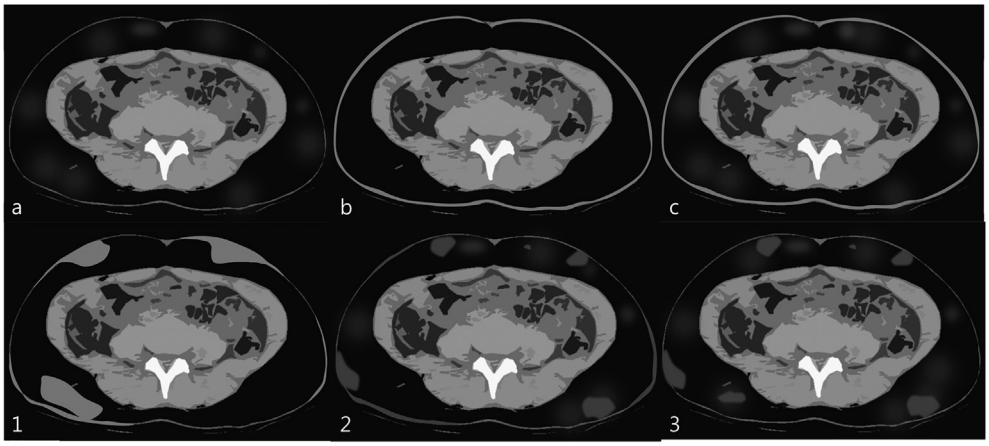

Fig. 1. Scheme for the lesion morphology
(a) reticular, (b) skin thickening, (c) union of reticular and skin thickening
(1) nodular or mass forming with skin thickening, (2) nodular or mass forming with reticular and skin thickening, (3) nodular or mass forming with reticular forms

cutaneous or subcutaneous or soft tissue lymphoma. In total, 164 superficial soft tissue lymphomas were found, and all cases had been confirmed by surgery or biopsy. They were classified according to the clinical, histopathological, immunophenotyping, and molecular criteria of the World Health Organization (WHO) classification system (2008) [8].

Lymphoma cases that were located mainly in the cutaneous or subcutaneous layer and underwent imaging with at least one of MRI, CT, and US were included in this study. Superficially located lymph nodes, lesions located in the head and neck area, and lesions involving the pleura or peritoneum or mainly the muscle region were excluded. In total, 36 patients were included in this study.

2.2. Imaging techniques

MRI was performed in 16 (44%), CT scans in 21 (58%), and US examinations in 7 (19%) patients. Seven patients underwent two or more imaging examinations: CT and US were performed in four, MRI and US in one, MRI and CT in one, and all three in one patient. Because of the retrospective nature of this study and the lymphomas involving various body parts, a variety of imaging protocols were used for CT, MRI, and US.

All 21 CT scans were performed using multidetector CT units (SMS Definition or SMS Definition AS+, Siemens Medical Solutions, Erlangen, Germany) with 16, 64, or 128 detector rows. The imaging parameters were variable because of the diverse body parts involved, such as the chest, abdomen, and extremities. Only nine CT scans were performed using contrast materials.

MRI was performed using a 1.5-T or 3.0-T system (Avanto, Symphony, or Trio; Siemens, Erlangen, Germany) using a body, surface, or dedicated coil, depending on the lesion size and location. Typically, the MRI protocols included T1- and T2-weighted fast spin-echo sequences with or without fat suppression using axial planes typically and sagittal or coronal planes alternatively, as determined by consideration of the lesion location and shape. Field-of-view and matrix size were determined based on the lesion size. In the abdomen or chest MR examinations, several specific techniques, such as in-phase and out-of-phase or gradient-echo sequences were included, but we did not use these sequences for the imaging analyses. Delayed enhanced images were obtained in three planes by fat-suppressed, fast spin-echo T1WI.

B-mode US images of the lesions were obtained in both longitudinal (long-axis) and transverse (short-axis) views using a commercial ultrasound system equipped with a 12–5 MHz linear transducer (iU 22, Philips Medical System, the Netherlands). Color Doppler images were also examined.

2.3. Clinical data and imaging analysis

Through a chart review, we investigated the sex, age (at the time of the diagnosis), pathological diagnosis, and clinical diagnosis of the patients with lymphoma. The pathological diagnosis was determined in accordance with the 2008 WHO classification [8]. Superficial soft tissue lymphomas were classified clinically as primary, primary with other organ or tissue involvement, or secondary lymphoma at the time of the initial diagnosis.

The imaging evaluation of the lesions included size, margin, location, morphology, homogeneity, multiplicity, and extent (depth). Enhancement patterns on contrast-enhanced MR or CT images or the presence or absence of vascularity within the mass on US were also investigated. Lesion size was determined as the longest diameter from several measurements, regardless of the number of lesions.

Margins were classified as ill-, partially ill-, and well-defined according to the definition and sharpness of the interface between the lesion and surrounding normal tissue. A ‘partially ill-defined margin’ was defined as a margin that was mostly well-defined but not completely well-defined. A well-defined margin was determined as entirely sharply demarcated, with an abrupt transition between the lesion and surrounding normal tissue.

The location of the lesion was evaluated according to the anatomical site and classified as upper and lower extremities, chest wall, abdominal wall, hip and pelvic area, back area, and trunk. ‘Trunk’ involvement was defined as a case with many lesions without clear separation located in at least three body sites except the upper and lower extremities.

Lesion morphology was classified as diffuse, nodular or mass, and mixed types. The diffuse type was subdivided into (a) reticular, (b) skin thickening, and (c) union of reticular and skin thickening forms. The mixed type was divided into three subtypes: (1) nodular or mass forming with skin thickening, (2) nodular or mass forming with reticular and skin thickening forms, and (3) nodular or mass forming with reticular forms (Fig. 1).

Lesion homogeneity was simply classified as homogeneous or heterogeneous, based on T2WIs or contrast-enhanced images on MRI, the comparison of Hounsfield units or visual assessments on CT scans, and comparison of echogenicity on US images.

The multiplicity of a lesion was classified as single or multiple. Multiple was defined as more than one mass with similar natures in the subcutaneous and cutaneous layers within the scanned field. We counted the masses separately if the masses did not have a connection with one another regardless of morphology. However, if a lesion demonstrated unclear separation or a conglomerate pattern, we considered the lesion as single, not multiple. The extent of the mass was classified as follows: (1) cutaneous (dermis and epidermis), (2) subcutaneous fat, and (3) deep fascia involvement.