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Short communication

Contrast-enhanced ultrasound examination of lymph nodes in different types of lymphoma

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Abstract

Background: Since the tumor growth depends on the formation of feeding vessels, color/power Doppler ultrasonography (US) has been used to evaluate the vascular flow images of lymph nodes (LNs) in order to differentiate benign LNs from malignant LNs or lymphoma from metastatic carcinoma. *Methods:* We performed color/power Doppler ultrasonography (US) using Levovist (LV) to evaluate the vascular patterns in the LNs of 10 patients with different types of lymphoma. The patterns were classified as central, peripheral, or avascular type. *Results:* Vascular flow was identified in 9 of 10 LNs and it was enhanced with LV in all cases. The vascular pattern of the LNs was of the central type in all seven B-cell lymphoma patients and one of two T-cell lymphoma patients and of the peripheral type in the remaining T-cell lymphoma patient. The avascular type pattern was observed in one Hodgkin lymphoma patient even with LV. *Discussion:* Typical vascular patterns might be associated with certain subtypes of lymphoma, and LV appears to improve the diagnostic value of Doppler US.

Keywords: Color/power Doppler ultrasonography; Levovist; Lymphoma; B-cell lymphoma; Follicular lymphoma; Hodgkin lymphoma; Vascularity

1. Introduction

Since the tumor growth depends on the formation of feeding vessels, color/power Doppler ultrasonography (US) has been used to evaluate the vascular flow images of lymph nodes (LNs) in order to differentiate benign LNs from malignant LNs or lymphoma from metastatic carcinoma [1–6]. Although the histological structure of lymphoma differs conspicuously among the immunological phenotypes or pathological subtypes [7], reports focusing on the relationship between the nodal angioarchitecture and pathological subtypes are not available. In this study, we evaluated whether color/power Doppler US using a contrast agent Levovist (LV) [8,9] contributes to the recognition of the different subtypes of lymphoma.

2. Patients and methods

Ten untreated patients (eight men and two women; age: 36–75 years, mean age: 67 years) with lymphoma were examined (Table 1). The pathological subtypes in these patients were classified according to the WHO classification as follows: diffuse large B-cell lymphoma (DLBCL) in six patients; peripheral T-cell lymphoma (PTCL), two patients; follicular lymphoma (FL), one patient; and lymphocyte depletion Hodgkin lymphoma (HL), one patient. The diagnosis was made based on the biopsies of enlarged peripheral LNs in nine patients (six DLBCL, two PTCL, and one HL) and bone marrow in one patient (FL). After obtaining informed consent, the patients were examined using a diagnostic ultrasound system (Toshiba SSA-380A or Aloka SSD-5500, Tokyo, Japan). The cervical LN was examined in six patients (four DLBCL, one PTCL, and one HL); the inguinal LN, one patient (PTCL); the shin LN, one patient (DLBCL); and the intraabdominal LN, two patient

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Table 1
Vascular patterns in different lymphomas

Patient no.	Age	Gender	Phenotype	Subtype	Examination site	Vascular pattern	Enhancement
1	71	Male	B	DLBCL	Intraabdominal LN	I	(+)
2	64	Female	B	DLBCL	Shin LN	I	(+)
3	75	Female	B	DLBCL	Cervical LN	I	(+)
4	73	Male	B	DLBCL	Cervical LN	I	(+)
5	70	Male	B	DLBCL	Cervical LN	I	(+)
6	69	Male	B	DLBCL	Cervical LN	I	(+)
7	75	Male	B	FL	Intraabdominal LN	I	(+)
8	63	Male	T	PTCL	Cervical LN	II	(+)
9	36	Male	T	PTCL	Inguinal LN	I	(+)
10	75	Male	–	HL	Cervical LN	III	(−)

DLBCL, diffuse large B-cell lymphoma; FL, follicular lymphoma; PTCL, peripheral T-cell lymphoma; HL, Hodgkin lymphoma.

(one DLBCL and one FL). We used a 3.75-MHz convex transducer for the intraabdominal LN examination and a 7.5 MHz linear transducer for the examination of LNs at other sites. The machine settings were as follows: pulse repetition frequency, 4.5 kHz; color gain, 23; and wall filter, 101. LNs measuring more than 2 cm in longitudinal diameter were evaluated. As a contrast agent, 7 ml of LV at a concentration of 300 mg/ml, containing microbubbles composed of a mixture of galactose and palmitic acid, was administered intravenously as a single bolus at a rate of 1 ml/s. Based on the vascular pattern, we classified the nodal vascular flow images into three types: type I, central LN perfusion with or without peripheral perfusion; type II, peripherally localized perfusion; type III, avascular. The vascular pattern of echogenic hilum of LNs was included in the type I. When the size of vessels enlarged or the number of vessels detected increased after the administration of LV, the procedure was judged positive for enhancement.

3. Results

Table 1 shows the nodal vascular patterns and the results of image enhancement with LV in relation to the immunological phenotypes and pathological subtypes of lymphoma. No obvious discrepancies in the nodal vascular patterns were detected between the color and power Doppler US for each patient. None of the patients suffered from adverse effects of LV, such as heat, pain at the injection site, or other allergic reaction. Vascular flow images were obtained from 9 of 10 LNs, and all were enhanced with LV. In B-cell lymphoma, all seven LNs, i.e., from six DLBCL patients and one FL patient showed the type I pattern. In T-cell lymphoma, the LN from one PTCL patient showed the type I pattern (Fig. 1) and that from the other showed the type II pattern (Fig. 2). However, the LN from the lymphocyte depletion HL patient showed the type III pattern and could not be imaged even with the use of LV (Fig. 3).

4. Discussion

Color/power Doppler US studies have demonstrated that vascular flow imaging of lymphomatous LNs is possible, and they mainly show the central perfusion pattern [4,6,9–11]. Giovagnorio et al. [11] reported that vessels could be identified in all the LNs studied from 87 patients with lymphoma, and most LNs showed hilar vascularity. Further, they reported that the presence of peripheral subcapsular vessels, which is typical of metastatic cancer, was definitely rare. The explanation offered for such a pattern is that

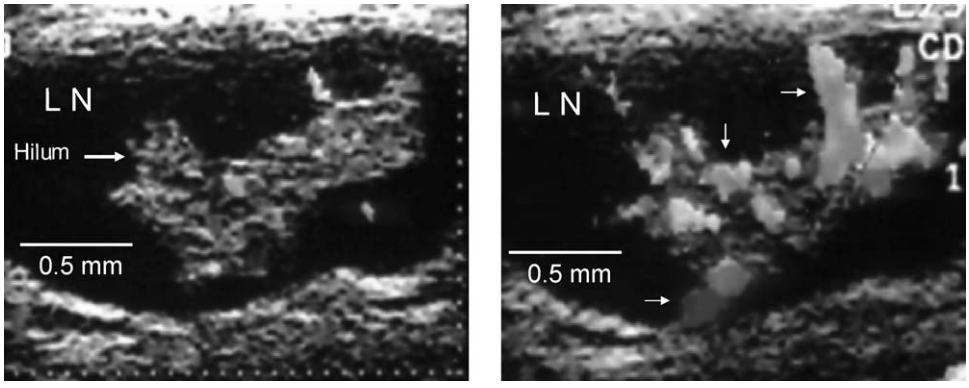

Fig. 1. Doppler ultrasonogram of the inguinal lymph node (LN) of patient no. 9 with peripheral T-cell lymphoma (type I). Vessels were slightly detected in the echogenic hilum of the LN (left). The number and size of vessels increased after the administration of Levovist. Arrows indicate the enhanced vessels (right).