Usefulness of real-time tissue elastography for detecting lymph-node metastases in squamous cell carcinoma

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Summary

We report a case of invasive SCC arising from multiple lesions of Bowen’s disease with right inguinal lymph-node metastasis. Assessment of superficial lymph-node involvement by real-time tissue elastography before surgery was found to be more useful than other noninvasive conventional methods. Histologically, the metastatic tumour cells were located asymmetrically in a small section of the cortical area of the right node, and this result was comparable with the elastographic findings. Additionally, we found that the presence of an asymmetrical cortical area with high elasticity should be included in the determination of metastatic involvement in small lymph nodes. It has high predictive values in the differentiation of benign and malignant superficial lymph nodes in patients with clinically node-negative skin cancer. More cases are needed to validate this efficiency in differentiating benign from malignant lymph-node status, but if confirmed, it may have an important role in the diagnosis of high-risk cutaneous squamous cell carcinoma.

Assessment of superficial lymph-node involvement in patients with cutaneous malignancies before surgery is often difficult. In the inguinal lymph node particularly, swelling from secondary inflammation is often seen in carcinoma arising from the leg. It would be beneficial if differentiation between reactive and metastatic lymph nodes could be made through noninvasive methods. We report the novel use of real-time tissue elastography for the assessment of lymph-node involvement in a patient with invasive squamous cell carcinoma (SCC), and discuss the potential advantages of this technology over other diagnostic techniques.

Report

An 80-year-old Japanese woman presented with a 15-year history of an asymptomatic keratotic plaque on her right lower leg. The lesion had been gradually enlarging, and new small lesions had been arising on her right dorsal foot, thigh and left leg over several months. There was no history of immunosuppression, arsenic exposure or internal malignancy.

On physical examination, a large, red to dark-brown, keratotic plaque measuring 100 mm in diameter was seen on the right pretibial site of the lower leg, with similar multiple small scaly plaques, up to 20 mm in diameter, on both legs (Fig. 1a). The central area of the plaque in the main lesion was markedly raised, with thickened scales and crusting (Fig. 1b). Although there was regional lymphadenopathy in both groins, the clinical appearance suggested secondary inflammation from the regional area, because the nodes felt soft and flat.

A punch biopsy was taken from the large plaque on the right lower leg. The initial histological examination found an intraepidermal neoplasm of atypical keratinocytes characterized by dyskeratotic and mitotic cells. There was no evidence of dermal invasion by tumour cells, indicating a diagnosis of Bowen’s disease. Additionally, no evidence of metastasis was found in a computed tomography scan of the whole body including regional lymph nodes at the time of presentation.
Figure 1 (a) Large, red to dark-brown keratotic plaque measuring 100 mm in diameter on the right pretibial area, with similar multiple small scaly plaques, up to 20 mm in diameter, on both legs; (b) the central area of the lesion on the right pretibial area was markedly raised by thickened scale and crust.

Figure 2 (a–c) Right inguinal lymph node visualized by (a) elastography, showing asymmetrical areas of high elasticity appearing as deep blue in the cortical area (arrows); (b) B-mode sonography; and (c) power Doppler sonography, showing presence of peripheral flow. (d,e) Left inguinal lymph node visualized by (d) elastography, showing several small areas of high elasticity appearing as blue; (e) B-mode sonography; (f) power Doppler sonography, showing weak central hilar and perihilar flow. FA, femoral artery; FV, femoral vein; LN, lymph node.
The patient underwent ultrasonography (US) examination with a digital sonography scanner (HI VISION 900; Hitachi Medical Corp., Tokyo, Japan) equipped with real-time tissue elastography software (Hitachi Medical). Presence of peripheral flow was seen on Doppler US and an asymmetrical cortical area with high elasticity (appearing as deep blue) on the real-time tissue elastography scan (Fig. 2a–c). These findings were detected only for the right and not the left inguinal lymph node (Fig. 2d–f).

The lesion was excised widely including the underlying fascia and a bilateral inguinal lymph-node biopsy was taken. The surgical specimen showed neoplastic proliferation of differentiated squamous tumour cells with dyskeratotic and atypical keratinocytes throughout the epidermis and into the dermis. The nuclei of the atypical cells were large, pleomorphic and hyperchromatic, with aberrant mitotic nuclei. Invasion of tumour cells into the dermis was seen only in the centre of the lesion. Histological examination of the inguinal lymph-node biopsies confirmed the presence of metastatic tumour cells located asymmetrically in a small section of the cortical area in the right node only (Fig. 3). The left inguinal node was histopathologically confirmed as reactive enlargement.

The final diagnosis of invasive SCC arising from multiple Bowen’s disease with right inguinal lymph-node metastasis was made. Because of the right inguinal lymph-node involvement, lymph-node dissection was added to the treatment. The patient was free of disease 4 months after surgery with no recurrence or metastasis.

The development of easy and objective noninvasive methods for the assessment of superficial lymph-node metastasis from cutaneous malignancies would be beneficial in cancer treatment. In evaluating lymph-node metastases, US has several advantages over other conventional imaging methods such as computed tomography, magnetic resonance imaging, scintigraphy and positron emission tomography. The characteristic findings for lymph-node metastasis are a low longitudinal and transverse axis ratio (indicating that the shape of the node is round), absence of echogenic

Figure 3 (a) Metastatic area located in a small section of the cortical area, with (b) replacement of the fatty tissue in the centre of the node. (c) Keratinizing squamous differentiation and cell atypia. Haematoxylin and eosin, original magnification (b) × 100 (c) × 200.
hilum, asymmetrical cortical thickening on usual B-mode US scans, and presence of peripheral flow on Doppler US. However none of these findings is sufficient to replace histopathological examination.

Elasticity is one of the differentiating criteria for metastatic and reactive lymph nodes. In accordance with the hypothesis that solid tumour cells differ in their consistency from adjacent normal tissue, real-time elastography is a new technology for measuring tissue elasticity, using US. It visualizes the differences in tissue strain produced by freehand compression, with tissue appearing on the elastogram as red, yellow, green and blue in ascending order of tissue hardness. Diagnostic use of tissue elastography in breast cancer, thyroid tumour, and lymph-node enlargement in head and neck cancers has already been reported, but to our knowledge, there has been no previous report of diagnostic evaluation of lymph nodes in cases of cutaneous SCC.

According to the previous literature, elastographic patterns are determined by the distribution and percentage of the lymph-node area, with increased tissue hardness appearing as blue areas. The elastographic pattern of our patient shows the blue area corresponding to a reactive node, consistent with this evaluation system (blue area < 45%). The metastatic area was located in a small section of the cortical area and the loss of fatty tissue was seen in the centre of the node, therefore, the lymph node presented as a flattened ring-shaped lesion with an asymmetrical cortical area, with high elasticity appearing as blue and the central low elasticity appearing as red on the elastogram. This finding was not seen in the contralateral inguinal lymph node, which was histopathologically confirmed as a reactive enlargement. Therefore, we suggest that the presence of an asymmetrical cortical area with high elasticity should be included in the elastographic pattern evaluation system for the determination of metastatic involvement in small lymph nodes.

Currently, preoperative determination of metastatic involvement in nonpalpable or small lymph nodes from cutaneous SCC is difficult, and it is still unclear whether surgeons should carry out a lymph-node biopsy or proceed directly to lymph-node dissection. Real-time tissue elastography is a noninvasive and convenient method, especially when combined with Doppler US, which could increase the accuracy of evaluation of metastatic lymph nodes, thus eliminating unnecessary lymph-node biopsy. It also has the potential to detect early metastasis. Further studies are warranted to confirm the usefulness of this technique in tumour evaluation.

References