The Egyptian Journal of Radiology and Nuclear Medicine (2014) 45, 715–722

Egyptian Society of Radiology and Nuclear Medicine

The Egyptian Journal of Radiology and Nuclear Medicine

www.elsevier.com/locate/ejrnm
www.sciencedirect.com

ORIGINAL ARTICLE

Can ultrasound elastography distinguish metastatic from reactive lymph nodes in patients with primary head and neck cancers?

Mohamed Mohamed Hefeda *, **Manal Ezat Badawy**

Radiology Department, Tanta University, Egypt

Received 22 February 2014; accepted 27 April 2014
Available online 21 May 2014

KEYWORDS

Cervical lymph node;
Elastography;
Metastasis;
Reactive lymph nodes

Abstract *Objectives:* The purpose of this study was to evaluate the diagnostic utility of real-time elastography (RTE) in differentiating between reactive and metastatic cervical lymph nodes (LN) in patients with primary head and neck cancer in comparison with the conventional B mode and power Doppler parameters.

Methods: A total of 127 lymph nodes in 78 patients with primary head and neck cancer were examined by B-mode sonography, power Doppler ultrasound and elastography. Elastographic patterns were determined on the distribution and percentage of the lymph node area with low elasticity (hard), with pattern 1 being an absent or very small hard area to pattern 5, a hard area occupying the entire lymph node. Patterns 3–5 were considered metastatic. Ultrasound guided aspiration cytology was done for 57 lymph nodes. Excision biopsy was done for 52 lymph nodes. Eighteen lymph nodes responded to conservative treatment, and were considered reactive.

Results: The majority (85.3%) of the metastatic lymph nodes had elastography pattern 3–5. This finding was observed in only 5% of the benign lymph nodes ($P < 0.001$). The elastography pattern had sensitivity of 85.3%, specificity of 95.5%, PPV of 97.2%, NPV of 78.1% and overall accuracy of 88.9% in differentiation between benign and malignant lymph nodes. On the other hand, for the B mode criteria, the best accuracy was given to abnormal hilum (83%). The accuracy of power Doppler ultrasound pattern was 70.8%.

Conclusions: The accuracy of sonoelastography is higher than usual B mode and power Doppler ultrasound parameters in differentiation between benign and malignant nodes. The integration of

* Corresponding author. Tel.: +20 124569391.
E-mail addresses: mohamedhefeda@yahoo.com, mohamedhefeda@gmail.com (M.M. Hefeda).

Peer review under responsibility of Egyptian Society of Radiology and Nuclear Medicine.

 http://dx.doi.org/10.1016/j.ejrnm.2014.04.019

lymph node sonoelastography in the follow up of patients with known head and neck cancer may reduce the number of biopsies.

1. Introduction

Metastatic cervical lymph nodes are common in patients with head and neck and non-head and neck cancers (1,2). In patients with squamous cell carcinoma of the head and neck, the presence of a metastatic node reduces the 5-year survival rate to 50%, and the presence of another metastatic node on the contralateral side further reduces the 5-year survival rate to 25% (3). Therefore, evaluation of cervical lymph nodes is important in patients with cancers because it aids in the assessment of patient prognosis and helps in planning treatment (1).

High-frequency sonography has become the examination method of choice for the diagnosis of superficial lymph nodes in clinical practice. The commonly used high frequency sonography includes B-mode sonography, color Doppler sonography and power Doppler sonography, which can display the size, location, shape and blood flow distribution of the lesion and play important roles in the differential diagnosis of lymph nodes. However, the indices, given by these methods and reflecting the benign or malignant lesions, always overlap in large measure (4–7), therefore causing difficulties in the judgment.

Elastography is based on a principle similar to manual palpation, in which the examiner detects tumors because they feel neoplatic tissues harder than surrounding tissues (8). In elastography, a mechanical force (compression or vibration) is applied to the soft tissues, and a conventional imaging technique such as US or MR imaging is used to create a map of soft-tissue deformation (8). The results are displayed on an image called an elastogram, on which hard areas appear dark and soft areas appear bright. Elastography has been shown to be useful in the diagnosis of breast, thyroid, and prostate cancers (9–11).

The purpose of this study was to evaluate the diagnostic utility of real-time elastography (RTE) in differentiating between reactive and metastatic cervical lymph nodes (LN) in patients with primary head and neck cancer in comparison with the conventional B mode and power Doppler parameters.

2. Patients and methods

2.1. Patients

From April 2011 to March 2013 a total of 78 patients with primary head and neck cancers were included in the study. Before enrollment, each patient gave written informed consent. The largest lymph nodes (maximum 2 lymph nodes for each patient) were included in the study, depending on size, loss of hilum, or presence of degeneration.

The exclusion criteria included patients who received specific treatment (chemotherapy–radiotherapy) prior to the examination and patients who refused to give written consent.

2.2. Ultrasound examination

Both conventional ultrasound imaging and real-time ultrasound elastography were done by using compatible linear probe of 10–12 MHz frequency (Voluson E8; GE Healthcare Technologies, Milwaukee, WI, USA).

For all patients, the US examination started with gray-scale imaging. The positioning of the patients for imaging was identical to that used for standard clinical neck US: The patient was positioned on his or her back with the neck slightly extended over a pillow. At gray-scale US, the following US characteristics of the examined lymph nodes were evaluated: short-axis diameter and short-to-long-axis diameter ratio in the longitudinal plane. Lymph nodes were assessed for echogenicity with respect to the surrounding muscles and classified as hypoechoic, isoechoic, or hyperechoic. The lymph node hilum, which normally appears as a hyperechoic region was classified either as normal (central), or abnormal (absent of eccentric).

2.3. Power Doppler ultrasound

At power Doppler US, the type and intensity of nodal blood flow were evaluated for all examined lymph nodes. Two types of lymph node vascularity were identified: In type 1, flow signals were absent or the blood flow was limited to the lymph node hilum. In type 2, there was increased peripheral (parenchymal) blood flow (12).

2.4. Real time elastography (RTE)

After changing the system into the elastography mode, real-time freehand elastography was performed using the same probe for an additional 1–2 min. For elastography, compression with light pressure followed by decompression was repeated until a stable image was obtained. Grade of compression appeared on a 0 scale on the monitor. Real-time elastographic and B-mode images simultaneously appeared as a two-panel image. Figs. 1–5 show a typical image displayed on the monitor during elastography, in which the elastogram appears in a region-of interest (ROI) box. We avoided tissues (bone, blood vessel) that might disturb the appropriate analysis of the relative hardness of the target lymph node. The patient was asked to avoid swallowing and hold their breath during the examination to minimize motion of lymph node.

The elastography images were obtained with the elasticity color map, superimposed on the B-mode images, and displayed on the left side of a dual-display image while the corresponding B-mode image was on the right in order to maintain continuous real-time visualization. The region of interest (ROI) was set within a box highlighted manually. Each ROI included the lymph node and sufficient surrounding adjacent tissue. To maintain a constant level of pressure throughout the examination, a standardized external compression was