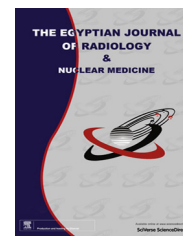




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ORIGINAL ARTICLE

Value of combined real time sonoelastography and apparent diffusion coefficient value measurement in differentiation of enlarged neck lymph nodes



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KEYWORDS

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Abstract *Purpose:* To evaluate the role of real-time sonoelastography (UE) and apparent diffusion coefficient (ADC) value measurement in differentiating benign versus malignant enlarged neck lymph nodes.

Materials and methods: This study included 26 patients presented with 32 enlarged neck lymph nodes (LNs), underwent real-time UE and diffusion weighted MRI (DWI). ADC maps are generated from DWI and ADC values were calculated. Both UE and ADC findings were compared with histopathological results.

Results: The LNs were 12 benign lymphadenopathy (37.5%, seen in 10 patients), 10 metastatic (31.25% seen in 8 patients) and 10 lymphoma (31.25%, seen in 8 patients) including 4 LNs with Hodgkin's lymphoma (HL, seen in 3 patients) and 6 LNs with non Hodgkin's lymphoma (NHL, seen in 5 patients). On UE 10 of the 12 benign LNs had pattern of 1–2 (83.3%) and 18 of 20 neoplastic LNs (90%) had pattern of 4–5. The mean ADC values of the benign, metastases and lymphoma groups were 1.52 ± 0.37 , 0.90 ± 0.15 and $0.72 \pm 0.12 \times 10^{-3}$ (mm²/s), respectively.

Conclusion: Combined real-time UE and ADC value measurement are non invasive techniques useful for differentiation of enlarged neck lymph. The combination potentially could reduce unnecessary biopsy especially for elasticity pattern 1–2.

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1. Introduction

Detection of neck lymph nodes (LNs) and their differentiation into benign or malignant are important especially in patients with head and neck cancer for staging, treatment planning and follow-up of cancer (1–5). Conventional imaging depends

upon the morphologic criteria of the LN including the maximum short axial diameter, presence of necrosis, loss of LN hilum, heterogeneous enhancement, and perinodal infiltration (6–10). Ultrasound (US), computed tomography (CT) and magnetic resonance (MR) can be used in the detection of enlarged cervical nodes; however, they cannot accurately differentiate benign from malignant lymph nodes.

Ultrasonographic elastography is a noninvasive imaging technique that can be used to depict relative tissue stiffness or displacement (strain) in response to an imported force (11).

It varies in different types of tissue (fat, collagen, and so forth) and in the same tissue in different pathologic states (inflammatory, malignant) (12).

The application of UE for imaging tissues was first described in 1987 by Krouskop et al. (13). UE has been used to examine several organs: the breast, thyroid, prostate, cervix, liver, and so forth (12).

Diffusion-weighted MRI (DWI) is a non-invasive functional technique which allows the characterization of tissues and lesions by difference in microstructure based on the analysis of water motion as architectural changes in the water molecule movement will alter the apparent diffusion coefficient and the signal intensity in DWI and apparent diffusion coefficient maps (7–10,14,15).

2. Subjects and methods

2.1. Patients

This prospective study was conducted during the period from June 2011 till January 2013 and included 26 consecutive patients (15 males and 11 females). Their age ranged from 28 to 53 years with mean age of 48 ± 7.6 years. All the 26 patients who had 32 enlarged cervical lymph node (s) were included in the study according to the inclusion and exclusion criteria. All underwent B-mode US, real time UE and MRI

Table 1 The final pathological diagnosis of the studied lymph nodes.

Pathology	Number of LNs	Percentage (%)
Benign (reactive) (10 patients)	12	37.5
Lymphoma (8 patients)	10	31.5
Non-Hodgkin lymphoma (NHL, 5 patients)	6	60
Hodgkin lymphoma (HL, 3 patients)	4	40
Metastatic (8 patients)	10	31.25
Total	32	100

followed by histopathological examination (HPE) by either neck dissection ($n = 8$ patients), surgical ($n = 10$ patients) or US core biopsy ($n = 8$ patients). Institutional review board approval and informed consent were taken from all patients.

Inclusion criteria enlarged cervical LNs:

1. Patient with history of primary malignancy or lymphoma.
2. Diameter of LNs > 10 mm LNs with central necrosis were excluded.

2.2. B-mode US and real time US elastography

For each node, B-mode images were obtained first followed by real-time UE using the same probe by the same operator. B-Mode US and UE were performed using a real time ultrasound (GE LOGIQ P6, using linear high frequency probe with frequency of 10 MHz, GE Medical Systems, USA). The probe was placed on the neck with light pressure, and a box was highlighted by the operator that included the LN to be evaluated. The principle of US elastography is to acquire two ultrasonic images (before

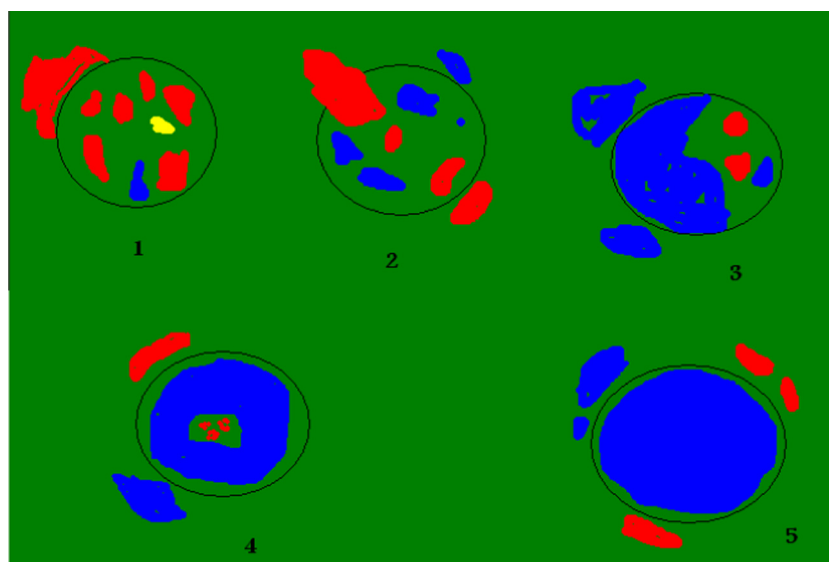


Fig. 1 Drawings show diagrammatic appearance of five patterns of lymph nodes. Elastographic patterns were determined on distribution and percentage of LN area having high elasticity (hard): pattern 1, absent or small hard area; pattern 2, hard area $< 45\%$ of lymph node; pattern 3, hard area $\geq 45\%$; pattern 4, peripheral hard and central soft areas; pattern 5, hard area occupying entire lymph node. Quoted and modified from Alam (12).

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