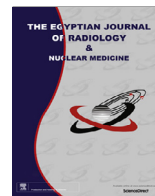


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Original Article

## Ultrasound elastography in pathological enlarged cervical lymph nodes compared to histopathology

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## ABSTRACT

**Objective:** To detect the diagnostic efficiency of ultrasound elastography in differentiation between benign and malignant enlarged cervical lymph nodes.

**Patient and methods:** This study included 27 patients, ranging in age from 21 to 70 years. Enlarged cervical lymph nodes were defined in this study as those nodes having short axis measuring more than 8 mm. Approval was taken from our hospital institutional review board and an informed consent was obtained from each patient before participating in the study. All patients were subjected to B-mode ultrasound and ultrasound elastography. **Results:** B-mode score had the highest sensitivity in this study (sensitivity = 100%) and the least specificity and positive predictive value. Ultrasound Elastography (UE) and strain ration (SR) showed higher specificity (75%) and PPV (81.3% and 82.4% respectively). There was a statistical significant difference between the diagnostic performance of ES and B-mode score ( $p = 0.034$ ), and a nearly significant difference between SR and B-mode score ( $p = 0.059$ ). ROC curve analysis for SR measurements (cutoff value  $\geq 1.62$ ) showed sensitivity = 93.3%, specificity = 75% and overall accuracy = 85.2%. However, no statistically significant difference was shown between the performance of ES and SR ( $p = 0.317$ ).

**Conclusion:** Hardness on more than 50% of the node surface and SR > 1.62 are fair to good indicators of malignancy.

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### 1. Introduction

Ultrasonography (US) is the first imaging technique for cervical lymph node evaluation due to good accessibility of the cervical region, high spatial resolution, and soft tissue discrimination. The development of new ultrasound techniques increased the utility of this imaging method for superficial lymphadenopathy [1].

As it's crucial to differentiate between benign and malignant lymphadenopathy [2], ultrasound elastography (UE) is a rather new, non-invasive imaging technique that can be used to depict tissue stiffness and elastic properties. Elasticity is a mechanical tissue characteristic that prevents tissue displacement under pressure. It varies in different types of tissue (fat, collagen, and so forth) and in the same tissue indifferent pathological states (inflammatory, malignant) [3].

Ultrasound elastography can be divided broadly into 2 groups depending on the type of tissue displacement: (a) Strain elastography (SE) measures tissue displacements along the axis of an applied force, and (b) Shearwave

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**Table 1**

B-mode criteria of benign and malignant groups.

	Value	Benign	Malignant	p-value
Long axis <sup>a</sup>	mm	20.55 ± 3.66	22.93 ± 6.68	0.252
Short axis <sup>a</sup>	mm	9.85 ± 3.39	13.05 ± 4.26	0.044
S/L ratio <sup>a</sup>		0.49 ± 0.18	0.62 ± 0.32	0.230
Hilum	Absent	4 (33%)	15 (100%)	0.000
	Present	8 (67%)	0 (0%)	
Borders	Ill-defined	5 (42%)	9 (60%)	0.288
	Well-defined	7 (58%)	6 (40%)	
Echogenicity	Heterogeneous	6 (50%)	15 (100%)	0.003
	Homogenous	6 (50%)	0 (100%)	
Shape	Irregular	4 (33%)	6 (40%)	0.519
	Regular	8 (67%)	9 (60%)	

<sup>a</sup> Expressed as means ± SD, rather than frequency.**Table 2**

B-mode scores of benign and malignant lymph nodes.

		B-mode score						Total
		5	6	7	8	9	10	
Benign	N (%)	3 (25)	2 (16.7)	0 (0)	6 (50)	1 (8.3)	0 (0)	12 (100)
Malignant	N (%)	0 (0)	0 (0)	3 (20)	5 (33.3)	4 (26.7)	3 (20)	15 (100)

elastography (SWE) measures a different type of waves that is also produced when tissues are mechanically stimulated. [4]. Assessment of nodal strain elastography information is done either by grading the appearance on a score system (elasticity score – ES) or by calculating a relative stiffness or strain ratio (SR) [5]. Ultrasound elastography (UE) is easy, rather cheap, non-invasive, and quick to perform, well tolerated by patients, repeatedly and offers a strong diagnostic power [4].

*Aim of work:* was to detect diagnostic efficiency of Ultrasound elastography in evaluation and differentiating between enlarged benign and malignant cervical lymph nodes.

## 2. Patients and methods

This study was carried out during the period from August 2014 to May 2015 in radio-diagnosis Department, Zagazig university hospitals and included 27 patients, ranging in age from 21 to 70 years. Enlarged cervical lymph nodes (LN)s were defined in this study as those nodes having short axis measuring more than 8 mm. Approval was taken from our hospital institutional review board and an informed consent was obtained from each patient before participating in the study.

Patients' inclusion criteria:

1. Any age group and sex.
2. Patients were referred for sonography of enlarged cervical lymph nodes.
3. At least one conventional ultrasound feature of abnormality (i.e. size, shape, margin, hilar echogenicity or vascular pattern), that warranted core biopsy or fine needle aspiration biopsy (FNAB).

Patients were subjected to:

1. Complete history taking and full clinical examination performed by the clinician.
2. Imaging that included:

### 2.1. Ultrasound B-Mode assessment

Ultrasound was performed using a Toshiba Aplio MX (Tokyo, Japan) with a 7–12-broadband linear array transducer. Eight regions in the neck were delineated: (1) submental, (2) submandibular, (3) parotid, (4) upper cervical, (5) middle cervical, (6) lower cervical, (7) supraclavicular fossa, and (8) posterior triangle.

All LN)s will be examined in B mode-US for the criteria and scores are to be determined as follows: (1) the short-axis diameter (diameter ≤ cutoff value (8 mm), score of 1; diameter > cutoff value, score of 2), (2) the S/L axis ratio (ratio ≤ 0.6, score of 1; >0.6, score of 2), (3) the border (regular, 1; irregular, 2), (4) echogenicity (homogeneous, 1; inhomogeneous, 2), (5) hilum (present, 1; absent, 2), determined according to Alam et al. and Teng et al. [3,6]. The total B-mode score of five gray-scale criteria was evaluated.

### 2.2. Ultrasound elastography assessment

The most suspicious lymph node was examined by ultrasound Elastography. Mechanical stimulation was done using free-hand multiple compressions technique. A region of interest (ROI) was chosen, encompassing the target lymph node in the center of ROI with surrounding reference soft tissue. The lymph node occupied about one third of the region of interest (ROI) in order to have enough

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