TRIPLEX ULTRASONOGRAPHIC ASSESSMENT OF CERVICAL LYMPH NODES

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Abstract- Detection of lymph nodes (LNs) involvement by various pathological processes has great therapeutic and prognostic implications. The purpose of this study was to evaluate the usefulness aud accuracy of triplex sonography (gray scale, color mapping and spectral Doppler) in differentiating benign from malignant cervical LNs. We used triplex sonography to evaluate 120 LNs in 50 patients. The gray scale features which were considered included LNs margin, nodal shape (length/width ratio) and echotexture. Vascular patterns and arterial resistive index (RI) of the LNs were assessed by color mapping and spectral Doppler. Finally sonographic findings were compared with pathologic results. There was significant difference between benign and malignant LNs in shape, echotexture, RI and vascular pattern. Study results showed that malignant LNs, especially metastatic nodes, are accompanied with significantly high RI, rounded shape, heterogenous echotexture and peripheral vascularity. Among these sonographic findings, nodal shape (L/W ratio) and RI were more accurate for differentiating benign from malignant LNs. LNs with ill-defined margin were all metastatic. In this study triplex sonographic findings had relatively high accuracy in differentiating benign from malignant cervical LNs, however, because of some overlapping in triplex sonographic appearances of benign and malignant nodes, this modality may not have definite diagnostic value.
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Key words: Triplex ultrasound, Color mapping, Spectral Doppler, Cervical lymph nodes

INTRODUCTION

Most lymph nodes (LNs) in the human body are in the cervicofacial area. Many pathologic processes involve the LNs, so that detection of LNs involvement has great therapeutic and prognostic implications. It is in this context that imaging modalities such as computed tomography (CT) scan, magnetic resonance imaging (MRI) or ultrasound play a fundamental role in detecting clinically undetectable involvement of LNs (1). While examination by means of MRI and CT scan is very useful for detection of cervical LNs involvement, ultrasound, particularly by using high resolution probes (7.5 to 15 MHz) has always been considered as a powerful tool for assessment of cervical LNs. In fact not only ultrasonography can locate LNs, but it also characterizes them by evaluating their number, shape, dimensions, margins and internal structure (2). Sonography is a known modality for staging head and neck tumors and its sensitivity is greater than clinical examination and even CT scan for detection of cervical LNs involvement (3). By displaying their vascularity and internal structure, triplex sonography (gray scale, color mapping and spectral Doppler) is more accurate than CT scan, MRI and clinical examination for LNs characterization (4-8).

The purpose of our study is to demonstrate whether triplex sonographic characterization of cervical LNs could, with acceptable degree of certainty, differentiate malignant from benign LNs, in order to prevent invasive diagnostic procedures.

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MATERIALS AND METHODS

All patients who were referred to the ENT department of Amiralam hospital from Feb 2002 to Feb 2003, and had clinically palpable cervical lymph nodes, were assessed in radiology department of the hospital. We obtained informed consent from all patients.

All cervical regions of these patients were scanned by three experienced radiologists seperately, with Aloka SSD-1700 system (Tokyo-Japan) using a linear 7.5 MHZ probe and all findings were properly registered. All patients were in supine position and their neck hyperextended. The radiologists were unaware of pathology results during examination. The parameters which were considered for our study included: length (L), width (W), shape index (L/W ratio), echotexture, margins, vascular pattern and mean arterial resistive index (RI). These parameters are defined as follows:

1) Length (L): the greatest dimension of LNs.

2) Width (W): the greatest dimension perpendicular to the length.

3) Shape index: the ratio of L/W. LNs were divided in two groups, L/W≤ 2 and L/W> 2.

4) Echotexture: the LNs were divided in two groups, those with homogenous and those with heterogenous echotexture.

5) Margin: based on their margins LNs were divided in two groups, those with well-defined and those with ill-defined margins.

6) Vascular pattern: the LNs vascular pattern were assessed by color mapping and classified as central, peripheral and mixed types.

7) Arterial resistive index (RI): this parameter was defined as the mean RI of two to three arterial vessels within LNs.

Finally, 120 LNs in 50 patients with definite pathologic diagnosis, consisting of reactive, lymphomatous and metastatic LNs, were included in our study. Definite pathologic diagnosis was made by FNA and excisional biopsy. Lymphomatous and metastatic LNs were classified as malignant and reactive LNs as benign cervical nodes.

All data collected in SPSS software and analysed by Chi square test. *P* value less than 0.05 was considered significant.

RESULTS

From 120 lymph nodes which were assessed, involvements of 32 cases (26.6%) were reactive, 44 cases (36.2%) lymphomatous, and 44 cases (36.2%) metastatic. From 44 lymphoma cases, 26 cases (59.09%) were Hodgkin's disease and 18 cases (40.9%) non Hodgkin type. From 44 metastatic LNs, 29 cases (65.90%) were laryngeal SCC, 3 cases (6.81%) lip SCC, 2 cases (4.54%) tongue SCC, 5 cases (11.36%) nasopharyngeal SCC, 3 cases (6.81 %) parotid malignancy and 2 cases (4.54%) of unknown source. Tuberculous LNs were not found in our series.

Results of triplex ultrasonographic assessment of LNs are shown in table 1. L/W ratio > 2 was seen in 42 LNs (36.66%) and L/W ratio ≤ 2 in 78 cases (65%). In 25 (78.12%) reactive LNs, 9 lymphomatous LNs (20.45%) and 36 metastatic LNs (81.81 %), L/W ratio was less than 2. Statistically significant difference between L/W ratio of malignant and benign LNs was observed. L/W ratio ≤ 2 had statistically significant association with malignancy (*P* value <0.000005).

From 120 LNs, 65 cases (54.16%) had homogenous echotexture and 55 cases (45.83%) inhomogenous echotexture. 30 cases (93.75%) of reactive LNs, 24 cases (54.54%) of lymphomatous LNs and 11 cases (25%) of metastatic LNs had homogenous echotexture. 2 cases (6.25%) of reactive LNs, 20 cases (45.45%) of lymphomatous LNs and 33 cases (75%) of metastatic LNs had inhomogenous echotexture. Statistically significant difference between echotexture of malignant and reactive LNs was observed. Inhomogenous echotexture had statistically significant association with malignant LNs.

All of the reactive and lymphomatous LNs had well-defined margins. 17 (14.16%) LNs had ill-defined margins, which were totally metastatic. Ill-defined margin had statistically significant association with metastatic LNs (*P* value < 0.0001).

Some degree of vascularity detected in all of LNs by color Doppler assessment. 31 cases (96.87%) of reactive LNs had central vascularity and only one of them (3.12%) had mixed pattern. Vascular patterns in 19 cases (43.18%) of lymphomatous LNs were

Table 1. Distribution of triplex sonographic parameters in 120 studied cervical lymph nodes *

		Type of lymph nodes involvement			
Parameters		**Metastatic**	**Lymphoma**	**Reactive**	**Total**
Arterial RI		80.11±6.43†	65.04±5.77†	56.96±5.23†	-
L/W ratio	> 2	8	35	7	50
	≤ 2	36	9	25	70
Echotexture	homogenous	11	24	30	65
	heterogenous	33	20	2	55
Margins	well-defined	27	44	32	103
	ill-defined	17	-	-	17
Vascular pattern	peripheral	44	19	-	63
	central	-	9	31	40
	mixed	-	16	1	17

Abbriviations: RI, resistive index; L/W, length/width.
* Data are presented as number unless specified otherwise.
† mean± SD.

peripheral, 16 cases (36.36%) of them were mixed and 9 cases (20.45%) of them were central. Metastatic LNs had only peripheral vascular pattern. Peripheral vascular pattern had statistically significant association with malignant LNs (*P* value < 0.000005). Mean arterial RI in reactive LNs was 56.96 with SD= 5.23 and its range was between 49 to 72. Mean arterial RI in lymphomatous LNs was 65.04 with SD= 5.77 and its range was between 58 to 84. Mean arterial RI in metastatic LNs was 80.11 with SD= 6.43 and range= 66-91. Statistically significant difference between mean arterial RI of malignant and benign LNs was observed (P value <0.05). Maximum mean arterial RI was observed in metastatic LNs (Table 1).

DISCUSSION

In our study the majority of LNs with a ratio of L/W> 2 were benign and the majority of those having a ratio of L/W ≤ 2 were malignant. Sensitivity and specificity of L/W> 2 for the diagnosis of benignity were 78% and 80.7%, respectively. Sensitivity and specificity of L/W ≤ 2 for the diagnosis of malignancy were 80.7% and 78.1%, respectively. Sensitivity and specificity of L/W ≤ 2 for malignancy have been reported to be respectively 85% and 61 % in one study (9) and 10% and 60% in another one (10). The mean L/W ratio of malignant LNs is significantly less than that of benign LNs, and metastatic LNs seem to be more spherical (11, 12). In our study, the majority of LNs with inhomogenous echotexture were malignant. Sensitivity and specificity of inhomogenous echotexture for the diagnosis of malignancy were 60.2% and 93.8%, respectively. In one study these values have been reported as 62% and 89%, although in another one, authors reported that the inhomogenicity of echotexture is not a valuable criterion for differentiating benign from malignant LNs (4). In our study the margin of the majority of LNs, was well-defined. All of the metastatic LNs had well-defined margins. Sensitivity and specificity of ill-defined margin for the diagnosis of malignancy were 38.7% and 100%, respectively. This finding is confirmed in other studies (4, 5).

In our study the vascular pattern of the LNs was assessed by color mapping. Vascular pattern was of peripheral type in the majority of malignant LNs and of central type in all of the reactive LNs. Sensitivity and specificity of the peripheral vascular pattern for diagnosis of malignancy were 68.2% and 97.4%, respectively. Vascularity of malignant LNs is higher than benign LNs (13), and malignant LNs have exuberant blood flow in color mapping assessement (14), therefore color doppler is reported to be usefull for differentiation of malignant from benign LNs (2), although some authors reported that LNs without any visible blood flow are usually malignant (2).

In our series the mean arterial resistive index (RI) was significantly higher in malignant LNs than in benign LNs. In malignant LNs, the arterial RI was significantly higher in metastatic LNs. Also in other studies arterial RI= 90 has been reported to be seen only in metastatic LNs (13, 15). In our study, if a threshold RI value of 75 is used, arterial RI has a sensitivity of 79.5% and a specificity of 94.7% for the diagnosis of metastatic LNs. However some authors have reported that pulsed Doppler is not useful to differentiate malignant from benign LNs (2).

In conclusion, mean arterial RI > 75, L/W ratio ≤ 2, inhomogenous echotexture and peripheral vascular pattern are in favour of metastatic LNs. For differentiation of the metastatic LNs from the others, the mean arterial RI and the L/W ratio had higher diagnostic accuracy. However, these parameters, because of some overlapping, may not have a definite value.

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