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Sensitivity and Specificity of B Mode Ultrasonography, Ultrasound Elastography Vs Histopathology in Diffrentiation of Benign & Malignant Cervical Lymph Node

KEYWORDS

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ABSTRACT *Background : The purpose of our study was to evaluate Sensitivity and specificity of B mode Ultrasonography , Ultrasound elastography Vs Histopathology in diffrentiation of benign & malignant cervical lymph node METHODS. 40 individual cases of wide age group from 4-69 years (mean age 40 years) were studied.These patients are subjected to sonoelastography in the same sitting. The enlarged lymph nodes were evaluated with histopathology. All these patients were examined with Voluson E6 ultrasound machine equipped with elastography software with a linear array transducer of frequency 5- 12 MHz. Results. We found sensitivity 78.57 % (Confidence Interval 49.21% - 95.09%) and specificity 84.62 % (Confidence Interval 65.11% - 95.55%) with Diagnostic Accuracy 0.83 of B mode Ultrasonography Vs Histopathology. Also sensitivity71.43% (Confidence Interval 41.92% - 91.43%) and specificity92.31% (Confidence Interval 74.83% - 98.83%) of ultrasound elastography Vs Histopathology with Diagnostic Accuracy of 0.85. Conclusion. The combination of highly specific elastography with highly sensitive conventional B-mode sonography has the potential to further improve the diagnosis of cervical lymph node*

Introduction

Evaluation of cervical lymph nodes is an important procedure for patients with head and neck cancers because the results influence the prognosis and the choice of therapy. In these patients, ultrasonography (US) can be used to assess the location, number, size, internal characteristics, and vascularity of cervical lymph nodes. However, the ultrasound criteria for metastatic lymph nodes are controversial. [1,2.3]

Sonoelastography is an imaging modality used to map the elastic properties of examined soft tissues [4,5]. Because the elasticity of biologic tissues cannot be measured directly, the majority of the proposed elastographic techniques involve an indirect approach to estimating tissue stiffness. Briefly,mechanical stimuli of some kind (compression or vibration) are propagated into the tissue, and the resultant strain distribution is detected and characterized by using a conventional imaging technique such as ultrasound. [6,7] The results of the tissue compression are displayed as an image called an elastogram, on which stiff areas appear dark and soft areas appear bright. Although sonoelastography is not yet used in routine clinical practice, it has been shown to be useful in the differential diagnosis of breast, thyroid, and prostate cancers [8]. Study results showed that sonoelastography is a promising imaging technique that can provide assistance in the differentiation of benign and metastatic thyroid tumors [9] However, sonoelastography has not been applied widely in lymph node characterization.

Neck lymph nodes are well positioned for elastographic examination: They are easily accessible and can be efficiently compressed against underlying anatomic structures with use of a US probe. [3] The information on lymph node stiffness would seem to be clinically useful for guidance of percutaneous biopsy and/or nodal dissection. [10]Use of this information can also improve patient follow-up by enabling detection of cancer recurrence (depicted as stiffness) at early stages. Thus, the aim of study is to prospectively differentiate benign and malignant cervical lymph nodes based on B-mode ultrasonography &sonoelastography pattern with histological nodal findings as the reference standard. [4]

Of the 400–450 lymph nodes in the human body, the head and neck contain 60–70. These nodes show reactive enlargement due to infection (e.g., infection of upper aerodigestive tract). They also undergo enlargement when they are secondarily involved in head and neck cancer. Sometimes metastatic cervical lymphadenopathy appears as the first symptom in patients having malignancy in the head and neck, lung, breast, and so forth. Differentiation between reactive and metastatic lymphadenopathy is vital, and one of the differentiating criteria is hardness (elasticity) of the lymph node . The purpose of this study was to study sensitivity and specificity of B mode Ultrasonography , Ultrasound elastography Vs Histopathology.

Material & Methods

It is a prospective type of study .All patients presenting with enlarged cervical lymph nodes, with or without known infectious disease or malignancy, are assessed with B-mode ultrasonography. 40 individual casesof wide age group from 4-69 years (mean age 40 years) were studied. These patients are subjected to sonoelastography in the same sitting. The enlarged lymph nodes were evaluated with histopathology. All these patients were examined with Voluson E6 ultrasound machine equipped with elastography software with a linear array transducer of frequency 5- 12 MHz.

Patients with tender lymphnodes, ulcerated lesions,not willing for consent ,patients lost for follow up , patients for whom histopathology reports are not available. Lymph Nodes abutting the carotid artery to avoid artifacts due to carotid pulsations were excluded from the study. Patients were subjected for B-mode ultrasonography in supine position, neck well exposed with pillow underneath the shoulders to extend the neck. B-mode characteristics of enlarged lymph nodes were assessed to document short axis dimension, short axis to long axis dimension ratio. The hilum of the lymph node was evaluated for its normal hyper- echoic fatty appearance and vascularity. The lymph node was also evaluated for echo characteristics, whether

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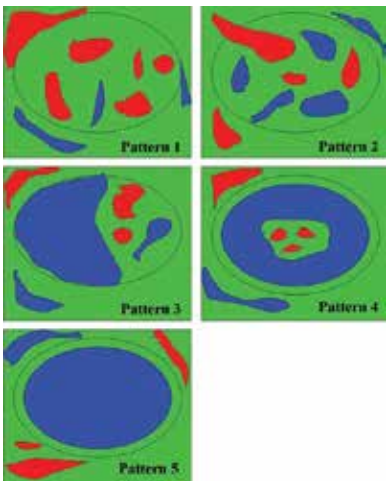
hypoechoic, necrotic or others. Further the presence or absence of calcifications within lymph node was also noted. The lymph node was then evaluated for presence of vascularity which was further classified as hilar, peripheral, mixed or absent. Ancillary features like matting of lymph nodes was also looked for and documented.

In our study,when more than three parameters were positive, then the lymph node was classified as malignant. After detailed B-mode ultrasound examination, the cervical lymph nodes were evaluated on sonoelastography with a linear probe. The lymph node was then compressed with the ultrasound probe and slowly released.[11] During the compression probe was kept perpendicular to the skin surface. The adequacy of compression was indicated by the side bar showing green color. Images were considered optimum when maximum possible height of the green bar is achieved. The sonoelastographic pattern of lymph node after adequate compression was evaluated and categorized according to five groups as categorized above in table and color diagram .The procedure was repeated at least once to avoid spurious result.

The strain was calculated as an independent parameter irrespective of B mode or elastographic pattern characteristics. The strain ratio was calculated as surrounding tissue to nodal ratio i.e. strain of surrounding tissue is calculated first followed by lymph node. At the time of calculation of strain ratio, the ROI (region of interest)was kept as wide as possible (not more than 10mm), to encompass the target lesion and the surrounding reference tissue. The reference tissue was used at the same depth with the lesion or with difference in depth of not more than 10 mm to avoid strain decay. 5-6 images per patient were taken for calculation of strain ratio, image with optimum compression indicated by maximum height attained by the green bar on right side of the image is chosen for evaluation.The most representative image obtained with optimal compression-factor is stored for further assessment.

Patterns and Scoring System on Elastographic Findings [3]:

Pattern	Score	Description	Elastographic Diagnosis
1	2	Absent or very small blue area(s)	Reactive
2	4	Small scattered blue areas, total blue area < 45%	Reactive
3	6	Large blue area(s), total blue area ≥ 45%	Malignant
4	8	Peripheral blue area and central green area, suggesting central necrosis	Malignant
5	10	Blue area with or without a green rim	Malignant



Drawings show typical diagrammatic appearance of five patterns of lymph nodes. Elastographic patterns were determined on distribution and percentage of lymph node area having high elasticity (hard): pattern 1, absent or small hard area; pattern 2, hard area < 45% of lymph node; pattern 3, hard area ≥ 45%; pattern 4, peripheral hard and central soft areas; pattern 5, hard area occupying entire lymph node. Increasing tissue hardness appears in ascending order as red, yellow, green, and blue**.**

Then the patients were followed up by histopathology.The results of B-mode ultrasonography and sonoelastography were compared with histopathology.

Observations:

The age of the patients ranged from 4 to 69 years . The mean age was 40 years. 52% of them were male and 48% female patients. The final diagnosis of all cases were confirmed by histopathology i.e FNAC—Fine Needle Aspiration Cytology or biopsyexamination. Table 1: To calculate sensitivity and specificity of B mode Ultrasonography Vs Histopathology.

Benign		Histopathology (Gold standard)		Total
		Metastasis		
USG based diagnosis	Benign	22	3	25
	Metastasis	4	11	15
Total		26	14	40

Sensitivity = 11/14 = 78.57 % (Confidence Interval 49.21% - 95.09%)

Specificity = 22/26 = 84.62 % (Confidence Interval 65.11% - 95.55%)

Positive predictive value = 73.33% (Confidence Interval 44.91% - 92.05%)

Negative predictive value= 88.00% (Confidence Interval 68.75% - 97.31%)

Diagnostic Accuracy =0.83

Table 2 : To calculate sensitivity and specificity of ultrasound elastography Vs Histopathology

Benign		Histopathology (Gold standard)		Total
		Metastasis		
Elastography based diagnosis	Benign	24	4	28
	Metastasis	2	10	12
Total		26	14	40

Sensitivity = 71.43% (Confidence Interval 41.92% - 91.43%)

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Specificity = 92.31% (Confidence Interval 74.83% - 98.83%)
Positive predictive value = 83.33% (Confidence Interval 51.58% - 97.42%)
Negative predictive value = 85.71% (Confidence Interval 67.32% - 95.88%)
Diagnostic Accuracy = 0.85

Discussion:

In our study, we found sensitivity, specificity of B-mode ultrasonography of 78.57% (confidence interval 49.21% - 95.09%), 84.62% (confidence interval 65.11% - 95.55 %) respectively for malignant lymph nodes . The diagnostic accuracy was 83% The study conducted by F. Alam and colleagues [5] showed sensitivity, specificity and diagnostic accuracy of 98%, 59% and 84%respectively. The sensitivity in our study is lower to that of F. Alam and colleagues. The specificity is higher in our study as compared to that of F. Alam and colleagues. However diagnostic accuracy was nearly similar to that of F. Alam and colleagues. These differences can be attributed to following factors. F. Alam and colleagues categorized benign lymphadenopathy only on follow up; however our study is based on histopathology finding for final diagnosis. We found that cases of tuberculosis and chronic granulomatous inflammation gave spurious results. In our study group, we have more cases of tuberculosis and granulomatous inflammation whereas no proven case of tuberculosis was noted in the study of F. Alam and colleagues. The study of F.Alam and colleagues did not encounter any case of lymphoma whereas in our study we had 4 cases of lymphomaout of which 2 resulted in spurious finding on B-mode sonography. A case each of squamous cell carcinomawas reported as benign.

In our study, the specificity& diagnostic accuracy was nearly same as compared to the study of F. Alam and colleagues. However the sensitivity is slightly less than that of F. Alam and colleagues. These differences can be attributed to following factors. Compared to study of F. Alam and colleagues, our study had more cases of tuberculosis and chronic granulomatous inflammation which were falsely reported as metastatic lymphadenopathy. However we could not find any specific feature on histopathology to suggest hardness in cases of tuberculosis.Since criteria for benign lymph nodes in the study of F. Alam and colleagueswas based on follow up and not on histopathology which might have given high specificity. Further, we had 4 cases of lymphomaout of which 2 appeared spuriously benign on elastography. The study conducted by F. Alam and colleagues did not have any case of lymphoma.

Tan et a [12] calculated the strain ratio cut off value of 1.5 for benign & malignant cervical lymph node with sensitivity & specificity of 92.8 & 53.4 respectively. Tan et al documented mixture of malignant &non-malignant conditions, including tuberculosis andprimary and secondary malignancies as in our study. Choi et al [13]calculatedthe strain ratio of the lymph node and subcutaneous fat tissue with strain ration of > 2.3 as cut off value for differentiating benign & malignant axillary lymph nodes. Thus the combination of highly specific elastography with highly sensitive conventional B-mode sonography has the potential to further improve the diagnosis of cervical lymph node.

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