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ORIGINAL RESEARCH ARTICLE

SONOGRAPHIC EVALUATION OF THE CERVICAL LYMPHADENOPATHY WITH PATHOLOGICAL CORRELATION

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ABSTRACT

Background: Enlarged cervical nodes are very common presentation in radiology department. The accurate diagnosis of the cervical lymphadenopathy is very crucial for further management. The aim of this study was to evaluate the cervical lymphadenopathy by sonography and see the effectiveness of B mode ultrasound and color Doppler ultrasound in differentiation between the benign and malignant lymph nodes.

Methods: A retrospective study was conducted in the Department of Radiology, College of Medical sciences, Bharatpur from 2019 to 2021 among 40 patients with clinically palpable cervical nodes. The sonographic findings and FNAC/biopsy correlation were done with calculation of the p value, sensitivity, specificity, positive and negative predictive values. SPSS 20.0 and Microsoft Excel were used for the data analysis and presentation.

Results: Among 40 patients the most common diagnosis was tuberculosis nodes followed by reactive nodes, metastatic nodes and lymphomatous nodes. The sensitivity and specificity for reactive nodes is very high 92% and 89% respectively for B-mode and for color Doppler ultrasound it is 82% and 90%. For TB nodes and metastatic nodes B-mode and color Doppler ultrasound has low sensitivity and high specificity 72% and 71% sensitivity for TB and metastatic nodes respectively and 91% and 94% specificity for TB and metastatic nodes respectively.

Conclusions: B mode and color Doppler sonography is very helpful to accurately diagnose the cause of cervical lymphadenopathy with high specificity and sensitivity. However, the differentiation between the tubercular, metastatic and lymphomatous nodes by sonography is very difficult and requires FNAC/biopsy correlation.

INTRODUCTION

Normal and reactive lymph nodes are usually found in submandibular, parotid, upper cervical, and posterior triangle regions. On gray-scale sonography, normal and reactive nodes tend to be hypoechoic compared with adjacent muscles and oval (short axis–to–long axis ratio [S/L] < 0.5) except for submandibular and parotid nodes, which are usually round (S/L ≥ 0.5), and to have an echogenic hilus.[1] The upper limit in minimal axial diameter of normal and reactive nodes is 9 mm for subdigastric and submandibular nodes and 8 mm for other cervical nodes.[2]

Clinical assessment of the cervical nodes remains the first tool to evaluate the enlarged nodes, however it is not effective method to differentiate into the benign and malignant cervical nodes which is very important for further management and treatment planning. Metastatic cervical nodes are common in both head and neck and non-head and neck cancers.[3,4,6,7] In patients with squamous cell carcinoma in head and neck, the presence of a metastatic node reduces the 5-year survival rate to 50%.[5]

Among the various imaging modalities available for evaluation of enlarged cervical nodes, the USG is first choice because it includes wider accessibility, availability of high frequency probes with greater resolution, no radiation issues and real time examination in multiple planes with feasibility for USG guided aspiration cytology/histopathology whenever needed.[8] B-mode (Gray-scale) sonography has also been used for evaluation of cervical lymph nodes. Comparing with clinical examination it is more sensitive (96.8% and 73.3% respectively) in patients with previous head and neck cancer with post-radiation neck fibrosis.[9] Although the CT and MRI are also useful, the internal architecture of small cervical nodes (<5mm) are difficult to assess. MRI may also not identify the intranodal calcification.[5,10-12] On contrast-enhanced CT, MRI and PET the reported sensitivity and specificity in the evaluation of metastatic cervical lymph nodes are 90.2% and 93.9%, 86% and 94% and 85 and 95% respectively.[13] Among all the modalities USG has the highest sensitivity and PET has lowest sensitivity.

The objective of our study was to evaluate the different causes of the enlarged cervical nodes and to find the effectiveness of the grey scale and color Doppler study to accurately differentiate into the different causes of enlarged cervical nodes including both benign and malignant causes.

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METHODS

The study was a retrospective study conducted in Department of Radiology, College of Medical sciences, Bharatpur, Chitwan from 2019 to 2021. All USG examinations were done using Aplio 500 Toshiba Machine with superficial probe of frequency 7-10MHZ. The patients with visible or clinically palpable neck nodes referred for ultrasound examination from both inpatient and outpatient department are included in our study. The sample size was 40 patients, because the patients with FNAC or pathology reports are must, only those patients who were willing to go through FNAC or biopsy are included in our study. All those patients who were lost in follow up or did not undergo for FNAC/biopsy were excluded from study. Consent of all patients were taken before examination.

The sonographic parameters studied in B mode examinations are size, shape, hilum (present or absent), nodal echogenicity (hypo/hyper/mixed), nodal calcification (present or absent), central necrosis (present or absent) and cystic changes (present or absent) and same way the sonographic parameters included in color Doppler study are vascularity (central/peripheral/mixed) and resistive index (RI).

The criteria of node on USG/Doppler study of reactive node is oval shape, hypoechoic with presence of the echogenic hilum, no nodal calcification, central necrosis or cystic changes and normal central vascularity. Same way for metastatic node is round shape, hyper or hypoechoic with loss of central echogenic hilum and had central necrosis, nodal calcification or cystic changes with loss of central vascularity in color Doppler study and shows peripheral vascularity. For tuberculosis nodes if nodes had absent hilum, hypoechoic echotexture, central necrosis with peripheral vascularity and absent central vascularity. And for Lymphomatous nodes if nodes were round shape with absent central hilum, hypoechoic ecotexture, absent central necrosis, calcification or cystic changes and showing mixed vascularity.[14-16]

Data obtained were compiled and analyzed using standard statistical analysis. SPSS 20.0 and Microsoft Excel were used for the data analysis and presentation. The research protocol was submitted and approved by the ethical review committee of College of Medical sciences, Bharatpur, Chitwan

RESULTS

A total 40 patients with FNAC/biopsy proven cervical nodes were included in this study with clinically evident cervical nodes. Detail B-mode and Color Doppler Ultrasound was performed and evaluated in the different features of the cervical nodes. The features included are shape of node, hilum, nodal echogenicity, nodal calcification, central necrosis, cystic changes and nodal vascularity. The different causes of the enlarged cervical nodes and their ultrasound features including both B-mode and color Doppler are shown in Table 1.

Table 1: B-mode and Color Doppler features of different causes of enlarged cervical nodes

B-mode and Color Doppler features	Reactive (n=12)	TB (n=18)	Metastasis (n= 7)	Lymphoma (n= 3)
Shape	Oval (11)	Round (14)	Round (7)	Round (3)
	p<0.001	p<0.089	p<0.001	p<0.001
Hilum	Present (11)	Absent (15)	Absent (7)	Absent (3)
	p<0.001	p<0.001	p<0.001	
Nodal echogenicity	Hypoechoic (12)	Hypoechoic (15)	Hypoechoic (7)	Hypoechoic (3)
Nodal calcification	Absent	Absent	Present (2)	Absent
Central necrosis	Absent	Present (17)	Present (6)	Absent
	p<0.001	p<0.001	P=0.089	p=0.091
Cystic changes	Absent	Absent	Present (1)	Absent
Nodal vascularity				
Central	11	2	1	1
Peripheral	0	8	5	1
Mixed	1	4	0	0
Absent	0 p<0.001	6 p<0.001	1 p<0.001	1 P=0.076

Out of total 40 patients enrolled in our study, TB was the most common diagnosis on the basis of the ultrasound features followed by reactive nodes, metastasis and lymphomatous nodes. Reactive nodes showed typical features with oval shape, present hilum, hypoechoic echogencity with absent nodal calcification, central necrosis and cystic changes and there was central vascularity in 11 cases out of 12 and only one cases showed mixed vascularity. The TB nodes showed round shape with absent central hilum with hypoechoic echogencity and all showed central necrosis with absent nodal calcification and cystic changes with around 14 cases showed absent and peripheral vascularity and rest 6 case showed central and mixed vascularity. Similarly, the metastatic nodes showed round shape with absent central hilum, hypoechoic echogenicity, present nodal calcification, central necrosis and cystic changes with almost all case showed peripheral vascularity with only one case showing absent vascularity. At last the lymphomatous nodes showed round shape with absent hilum with hypoechoic echogenicity, absent nodal calcification, central necrosis and cystic changes and showing all features of the vascularity except for mixed vascularity.

Table-2 showed combined B-mode features of a reactive nodes had sensitivity of 92%, specificity of 89%, PPV of 79% and NPV of 96%. Color Doppler Ultrasound features had a sensitivity of 82%, specificity of 90%, PPV of 75% and NPV of 93%. The p-value for both B-mode and color Doppler ultrasound for diagnosis of reactive nodes is significant (P-value <0.001).

Table 3 showed combined B-mode features of TB nodes had a sensitivity of 72%, specificity of 91%, PPV of 87% and NPV of 80%. Color Doppler Ultrasound features had a sensitivity of 59%, specificity of 65%, PPV of 56% and NPV of 68%. The p-value for both B-mode ultrasound for diagnosis of TB nodes is significant (P-value <0.001).

Table 2: Correlation of reactive nodes with B-mode and color Doppler ultrasound

Reactive nodes	FNAC/Biopsy proven		Total	Sensitivity	Specificity	PPV	NPV	p-value
	Positive	Negative						
B-mode ultrasound								
Positive	11	3	14	92	89	79	96	<0.001
Negative	1	25	26					
Color doppler ultrasound								
Positive	9	3	12	82	90	75	93	<0.001
Negative	2	26	28					

Table 3: Correlation of TB nodes with B mode and color Doppler ultrasound

TB nodes	FNAC/biopsy proven		Total	Sensitivity	Specificity	PPV	NPV	p-value
	Positive	Negative						
B mode ultrasound								
Positive	13	2	15	72	91	87	80	<0.001
Negative	5	20	25					
Color doppler ultrasound								
Positive	10	8	18	59	65	56	68	0.2
Negative	7	15	22					

Table 4 showed combined B-mode features had a sensitivity of 71%, specificity of 94%, PPV of 71% and NPV of 94%. Color Doppler Ultrasound features had a sensitivity of 83%, specificity of 68%, PPV of 31% and NPV of 96%. The p-value for both B-mode ultrasound for diagnosis of metastatic nodes is significant (P-value <0.001).

Table 5 showed combined B-mode features of lymphomatous node had a sensitivity of 67%, specificity of 95%, PPV of 50% and NPV of 47%. Color Doppler Ultrasound features had a sensitivity of 25%, specificity of 86%, PPV of 17% and NPV of 91%. The p-value for both B-mode and color Doppler ultrasound for diagnosis of lymphomatous nodes is not significant.

Table 4: Correlation of metastatic nodes with B mode and color Doppler ultrasound

Metastatic TB nodes	FNAC / biopsy proven		Total	Sensitivity	Specificity	PPV	NPV	p-value
	Positive	Negative						
B mode ultrasound								
Positive	5	2	7	71	94	71	94	<0.001
Negative	2	31	33					
Color doppler ultrasound								
Positive	5	11	16	83	68	31	96	0.29
Negative	1	23	24					

Table 5: Correlation of lymphomatous nodes with B mode and color Doppler ultrasound

Lymphomatous nodes	FNAC/biopsy proven		Total	Sensitivity	Specificity	PPV	NPV	p-value
	Positive	Negative						
B mode ultrasound								
Positive	2	2	4	67	95	50	47	0.2
Negative	1	35	36					
Color doppler ultrasound								
Positive	1	5	6	25	86	17	91	0.4
Negative	3	31	34					

DISCUSSION

Enlarged cervical nodes is very common clinical presentation. The causes of enlarged nodes could be benign reactive and infective nodes and malignant condition like metastasis and lymphoma. The B mode and color Doppler ultrasound features are very helpful to differentiate the different pathology of cervical nodes.

Shape of the node is defined by S/L ratio. The ratio < 0.5 is oval in shape and >0.5 indicates round node. Oval nodes are indicative of benign pathology where as round nodes are indicative of malignant pathology.[17-22] Our study showed statistically significant correlation between the oval shape and reactive nodes and round shape and metastatic, lymphomatous and TB nodes.

Our study showed statistically significant correlation between the absent hilum and metastatic, lymphomatous and TB nodes and present hilum and reactive nodes. There are several studies which showed absent hilum in metastatic nodes and lymphomatous nodes.[23-26] There are some studies that showed echogenic hilum may be found in the malignant nodes.[18,21,27] In our study no one of the reactive nodes show absent hilum and non of the malignant nodes and lymphomatous nodes showed present hilum, however few cases of TB nodes show present hilum similar to study conducted by Ahuja et al and Ishii et al.[23,24]

Metastatic nodes are normally hypoechoic relative to muscle plane so does lymphomatous nodes.[18,27] In our study all reactive nodes, TB nodes, metastatic nodes and lymphomatous nodes all showed hypoechoic echogenicity. Only on this echogencity features it is not possible to differentiate between the various causes of the cervical nodes.

Intra-nodal necrosis has been described as a feature of the metastatic and TB nodes.[27,28] Our study showed significant association between the present of necrosis and TB nodes and absent necrosis and reactive and lymphomatous nodes. There was no statistically significant correlation between the metastatic nodes and central necrosis. There are various studies that suggest complete cystic degeneration of nodes predominantly occurs in young adults, and that the detection of it showed be suspicious for the occult thyroid carcinoma.[29] Our case showed only one case of metastatic node with cystic changes. Study conducted by Ahuja et al.[30] showed that in histologically proven 20 cases of papillary carcinoma of thyroid showed punctuate calcification was seen in the 68.7% cases. In our study also metastatic carcinoma showed calcification.

Benign and reactive nodes show central vascularity or may be avascular but peripheral vascularity in not common features. Whereas metastatic nodes show peripheral or mixed vascularity and approximately 60-90% lymphomatous nodes showed mixed vascularity.[3,15,27,31] Our study shows similar results with significant correlation with the central vascularity and reactive nodes and peripheral vascularity and peripheral and absent vascularity in metastatic nodes. No significant association between the mixed vascularity and lymphomatous node.

Our study shows sensitivity and specificity for the diagnosis of the reactive nodes by B-mode ultrasound are 92% and 89% with PPV and NPV of 71% and 94% and by color Doppler ultrasound 82% and 90% with PPV and NPV 75% and 93%. There is significant correlation found between the reactive nodes and B-mode and color Doppler ultrasound. This study is similar to the study conducted by Pattanayak et al.[32] From our study it is shown that combined B-mode and color Doppler ultrasound diagnosis of the reactive nodes can reduce the need of FNAC/Biopsy correlation.

For TB nodes and metastatic nodes our study shows high specificity, however it has low sensitivity similar to the study conducted by Pattanayak et al.[32] so need of FNAC/ biopsy cannot be replaced by ultrasound examination. At last, for the lymphomatous nodes our study showed low both sensitivity and specificity by B-mode and color Doppler ultrasound, FNAC/biopsy is must to diagnose the lymphomatous node.

CONCLUSION

There are various causes of enlarged cervical nodes. The clinical diagnosis of the cervical nodes is not enough to differentiate between the different causes, so ultrasound is first modality of the diagnosis of the cervical nodes. Combined B-mode and color Doppler can accurately diagnose the reactive nodes and need for FNAC/biopsy is significantly reduced. The ultrasound can also diagnose the TB nodes and metastatic nodes with high specificity, but it has low sensitivity. For the lymphomatous nodes it shows low both sensitivity and specificity so FNAC/ biopsy correlation plays crucial role for the accurate diagnosis of TB, metastatic and lymphomatous nodes.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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