

**DIAGNOSTIC PERFORMANCE OF DOPPLER ULTRASOUND IN THE
DIFFERENTIATION OF BENIGN AND MALIGNANT SUPERFICIAL CERVICAL
LYMPHADENOPATHY****Dr. Soheli Parvin^{1*}, Prof. Dr. S. M. Rokonzaman², Dr. Syed Shamsul Arephen³,
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ABSTRACT

Background: Cervical lymphadenopathy is a common presenting symptom and sign for a variety of diseases, ranging from subtle infections to life threatening Head & Neck malignancies. **Objective:** In this study our main goal is to assess the diagnostic performance of Doppler ultrasound in the differentiation of benign and malignant superficial cervical lymphadenopathy. **Methods:** This cross-sectional study was carried out initially on 72 clinically suspected superficial cervical lymphadenopathy patients from aged between 11-65 years, referred for Doppler ultrasound to Radiology and Imaging Department of Dhaka medical College Hospital, Dhaka from January 2014 to December 2015. All these patients were evaluated with details history and clinical examination and then underwent Doppler ultrasound. Patients were followed up upto histopathological diagnosis. Total 05 patients were excluded from the study. So finally 67 patients were included in the study. **Result:** Maximum patients (32.8%) were in age group 41-50 years followed by 22.4%, 19.4%, 11.9%, 10.4% and 3.0% were in age group 21 – 30 years, 51 – 60 years, 31 – 40 years, ≤20 years and >60 years respectively. 67 clinically suspected superficial cervical lymphadenopathy patients were studied January 2014 to December 2015. A total of 150 nodes were detected and examined with the aid of 7.5 MHz ultrasound unit having the color Doppler facility and the findings were noted. **Conclusion:** In overall outcome, doppler ultrasound is an useful procedure in the evaluation and differentiating malignant from benign superficial cervical lymphadenopathy.

KEYWORDS: Doppler ultrasound, cervical lymphadenopathy, malignant, morphologic.**INTRODUCTION**

Lymphadenopathy is defined as an abnormality in the size of lymph node, caused by the invasion or propagation of either inflammatory cells or neoplastic cells into the node. It results from a vast array of disease processes, whose broad categories are easily recalled using the mnemonic acronym "MIAMI," representing malignancies, infections, autoimmune disorders, miscellaneous and unusual conditions, and Iatrogenic causes. Among the serious illnesses that can present with lymphadenopathy, perhaps the most concerning to the patient and physician is the possibility of underlying malignancy (Bazemore and Smucker, 2002).^[1] Cervical lymphadenopathy is a common presenting symptom and sign for a variety of diseases, ranging from subtle infections to life threatening Head & Neck malignancies.^[2]

Ultrasound is a useful imaging modality in assessment of soft tissue lesions. It is an easy, reproducible, non-invasive, no risk procedure, radiation free imaging modality to examine the lymph nodes. It is a known modality for staging head and neck tumors and its sensitivity is greater than clinical examination and even CT scan. The addition of color Doppler sonography to the well-established practice of grey-scale sonography increases the amount of information obtained by sonography, with significant increase in sensitivity and specificity.^[3]

Colour Doppler ultrasound is a non-invasive procedure that can define the morphologic and vascular characteristics of lymphadenopathies. Both the angioarchitecture and the haemodynamics differ among various cervical nodal diseases. Blood vessel morphology in metastatic nodes is usually deranged as the internal nodal architecture is destroyed by neoplastic

infiltration, whereas inflammation causes dilatation of intranodal vessels due to local humoral agents. All these intranodal vascular alterations aid in differentiating benign from malignant lymph nodes (Na *et al.*, 1997; Brnic and Hebrang, 2003).^[4]

Many studies have evaluated the vascular pattern of malignant nodes only very few have evaluated the efficacy of color Doppler ultrasonography in differentiating malignant and nonmalignant lymph nodes. Hence aim of this study is to assess the performance of color Doppler ultrasonography in differentiating benign & malignant cervical lymphadenopathy through analysis of accuracy sensitivity, specificity, positive predictive value, negative predictive value of the Doppler ultrasound against histopathology as the gold standard.

METHODOLOGY

Type of study	It was a cross sectional observational study.
Place of study	Department of Radiology & Imaging in collaboration with Department of Medicine, Department of Surgery, Department of ENT and Department of Pathology in Dhaka Medical College Hospital, Dhaka, Bangladesh.
Study period	The present study was conducted between the periods of 1 st January 2014 to 31 st December 2015.
Study population	Clinically suspected superficial cervical lymphadenopathy patient of all ages & both sexes referred to the Department of Radiology & Imaging of Dhaka Medical College Hospital for Doppler study.
Sampling technique	Non random purposive sampling.

Selection criteria

Inclusion criteria

- Clinically suspected superficial cervical lymphadenopathy patient of all ages & both sexes who were referred to the department of Radiology & Imaging DMCH for Doppler study.

Exclusion criteria

- Patients unwilling for lymph node biopsy
- Non availability of biopsy report.
- Patient not having detectable cervical lymph node in ultrasonography

Data collection

Data were collected by using a pre-designed data collection sheet. All relevant information was collected from history sheet and investigation papers. Histopathology reports were also collected and recorded.

Data analysis

After meticulous checking and rechecking data compilation and statistical analysis was done using computer based statistical software SPSS (Statistical package for social science).

RESULT

In this cross-sectional study, 67 clinically suspected superficial cervical lymphadenopathy patients were studied January 2014 to December 2015. A total of 150 nodes were detected and examined with the aid of 7.5

OBJECTIVE

General objective

- To assess the diagnostic performance of Doppler ultrasound in the differentiation of benign and malignant superficial cervical lymphadenopathy.

Specific Objective

- To evaluate grey scale and Doppler ultrasound findings in clinically suspected cases of superficial cervical lymphadenopathy.
- To compare the Doppler ultrasound diagnosis of superficial cervical lymphadenopathy with that of histopathology.
- To find out the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of Doppler ultrasound for differentiation of superficial cervical lymphadenopathy.

MHz ultrasound unit having the color Doppler facility and the findings were noted. The cervical lymph node level, lymph node size (maximum axial diameter), L/S ratio (longitudinal by short axis diameter), marginal regularity, hilar echogenicity, internal echogenicity, flow pattern, Pulsatility index, resistivity index values were recorded. The lymph nodes were then surgically removed and histopathological results were collected. The results of Doppler ultrasound and histopathology were then compared.

Table I: Distribution of the patients by age (n=67)

Age (years)	Frequency	Percentage
≤20	7	10.4
21 - 30	15	22.4
31 - 40	8	11.9
41 - 50	22	32.8
51 - 60	13	19.4
>60	2	3.0
Total	67	100.0
Mean ± SD	39.71 ± 14.43	

Table I shows distribution of patients according to age. Maximum patients (32.8%) were in age group 41-50 years followed by 22.4%, 19.4%, 11.9%, 10.4% and 3.0% were in age group 21 – 30 years, 51 – 60 years, 31 – 40 years, ≤20 years and >60 years respectively.

Table II: Distribution of the patients by age and gender (n=67)

Gender	Number	Percentage
Male	38	56.7
Female	29	43.3
Total	67	100.0

Table II shows gender distribution of the patients. Among the 67 patients who underwent Doppler ultrasound examination for cervical lymphadenopathy 38 (56.7%) patients were male and the remaining 29 (4.37%) were female.

Table III: Gender distribution of the detected enlarged lymph nodes (n=150)

Gender	Frequency of detected enlarged lymph nodes	Percentage of detected enlarged lymph nodes
Male	81	54.0
Female	69	46.0
Total	150	100.0

Table III shows gender distribution of the detected enlarged lymph nodes. Out of 150 detected enlarged lymph nodes 81 (54.0%) nodes were detected in male and 69 (46.0%) nodes were detected in female.

Table IV: Distribution of histopathological diagnosis of detected enlarged lymph nodes according to location

Cervical Lymph node level	Histopathology		Total
	Malignant	Benign	
Ia	5 (5.2)	9 (16.7)	14 (9.3)
Ib	5 (5.2)	10 (18.5)	15 (10.0)
II	17 (17.7)	10 (18.5)	27 (18.0)
III	18 (18.8)	9 (16.7)	27 (18.0)
IV	13 (13.5)	4 (7.4)	17 (11.3)
V	25 (26.0)	7 (13.0)	32 (21.3)
VI	13 (13.5)	5 (9.3)	18 (12.0)
Total	96 (100.0)	54 (100.0)	150 (100.0)

Table IV shows: According to histopathological diagnosis maximum malignant lymph node were found in level V 25 (26.0%) followed by level III 18(18.8%)

and level II 17 (17.7%). Maximum benign lymph nodes were found in level Ib 10 (18.5%) and level II 10 (18.5%).

Table V: Distribution of ultrasonogram findings of detected enlarged lymph nodes

	Frequency	Percentage
Size (cm)		
≤1	52	34.7
>1	98	65.3
L/S ratio		
<2	106	70.7
≥2	44	29.3
Hilar echo		
Present	60	40.0
Absent	90	60.0
Internal echo		
Homogenous hypoechoic	62	41.3
Heterogenous	88	58.7
Margin		
Regular	73	48.7
Irregular	77	51.3
Pattern of flow		
Central	50	33.3
Peripheral	100	66.7
RI		
<0.8	51	34.0
≥0.8	99	66.0
PI		
<1.6	48	32.0
≥1.6	102	68.0

Table V shows ultrasonogram diagnosis of lymph nodes. Regarding size of node, 98 (65.3%) lymph nodes size was >1 cm and 52 (34.7%) nodes size was <1 cm, 106 (70.7%) nodes had L/S ratio <2 and 44 (29.3%) had ≥ 2 , hilar echo was present in 60 (40.0%) nodes, homogenous hypoechoic internal echo was in 62 (41.3%) nodes whereas heterogenous internal echo was in 88 (58.7%) nodes, 77 (51.3%) nodes had irregular margin, 73 (48.7%) nodes had regular margin peripheral flow was in 100 (66.7%) nodes whereas 50 (33.3%) nodes had central flow. RI <0.8 was detected in 51 nodes and RI >0.8 was detected in 99 nodes. PI <1.6 was detected in 48 nodes and PI >1.6 was detected in 102 nodes.

Table VI: Distribution of PI of the lymph nodes compared to histopathological findings (n=150)

PI	Histopathology		Total
	Malignant	Benign	
<1.6	13 (13.5)	35 (64.8)	48 (32.0)
≥ 1.6	83 (86.5)	19 (35.2)	102 (68.0)
Total	96 (100.0)	54 (100.0)	150 (100.0)

Table VI shows distribution of PI compared to histopathological findings. Of the 96 malignant nodes PI of ≥ 1.6 was observed in 83 (86.5%) nodes and PI <1.6 was seen in 13(13.5%) nodes. Among 54 benign nodes 19(35.2%) had PI ≥ 1.6 and 35(64.8%) had PI <1.6

Table VII: Distribution of Doppler ultrasonogram diagnosis of enlarged lymph nodes

Doppler USG diagnosis	Frequency	Percentage
Malignant	99	66.0
Benign	51	34.0
Total	150	100.0

Table VII shows Doppler USG diagnosis of enlarged lymph nodes. Maximum 99 (66.0%) lymph nodes were malignant and 51 (34.0%) lymph nodes were benign.

DISCUSSION

In the present study out of 67 patients Maximum patients (32.8%) were in age group 41-50 years followed by 22.4%, 19.4%, 11.9%, 10.4% and 3.0% were in age group 21 – 30 years, 51 – 60 years, 31 – 40 years, ≤ 20 years and >60 years respectively. Mean \pm SD of age of the patients was 39.71 ± 14.43 years with a range of 11 to 65 years.

Among the 67 patients who underwent Doppler ultrasound examination for cervical lymphadenopathy 38 (56.7%) patients were male and the remaining 29 (4.37%) were female.

Out of 150 detected enlarged lymph nodes 81 (54.0%) nodes were detected in male and 69 (46.0%) nodes were detected in female.

Out of 150 enlarged node 14 (9.3%) were detected in level Ia, 15 (10.0%) in level I b, 27 (18.0%) in level II,

27 (18.0%) in level III, 17 (11.3%) level IV, 32 (21.3%) in level V and 18 (12.0%) in level VI.

Larger size nodes (>1 cm) were considered malignant sonographically (Saleh, 2001).^[5] In this study, 98 (65.3%) lymph nodes size was >1 cm and 52 (34.7%) nodes size was <1 cm. Previous studies have shown some contrasting picture regarding the the validity of the size criteria as a parameter for predicting lymph node pathology.

Next criterion assessed was with high resolution ultrasonography was presence or absence of hilar echogenicity. Hilar echo was present in 60 (40.0%) nodes, Hilar echo was absent in 90 (60.0%) nodes. Compared to histopathology out of 96 malignant nodes hilar echogenicity was absent in 82.3 % nodes and present in 17.7 % lymph nodes. Croce and Solbaiti (1993) found ecogenic hilus was absent in 40% of the primary malignancy and 48% of the metastatic malignancy and on the other hand hilus was absent in 8 % benign nodes.^[6]

Marginal regularity is another parameter, in this study 77 (51.3%) nodes had irregular margin and 73(48.7%) lymph nodes had regular margin. Among the malignant nodes 62.5 % had irregular margin and 37.5 % were regular margin. Of the benign nodes 68.5 % were regular margin and 31.5 % had irregular margin. Komma et al (2014) reported that the metastatic node may show a clearer regular margin on sonogram but marginal irregularity is attributed to extra nodal infiltration.^[7] So it is difficult to distinguish a metastatic node from a benign one when the margin is regular.

Peripheral flow was seen in 100 (66.7%) nodes whereas 50 (33.3%) nodes had central flow. Among the malignant nodes 91.7 % had peripheral flow pattern and 8.3 % were central flow pattern. Of the benign nodes 22.2 % were peripheral flow pattern and 77.8 % had central flow pattern. Komma et al. (2014) stated that there is a clear correlation between tumour angiogenesis and nodal metastasis.^[7] Saleh (2001) stated that benign lymph nodes have a central pattern of vascularity and malignant nodes have a peripheral vascular pattern.^[5]

Gritzmann et al. (2002) stated that the L/S ratio less than two suggest malignant condition of the node, in this study 106 (70.7%) nodes had L/S ratio <2 and 44 (29.3%) had ≥ 2 and 64.0% nodes were malignant and among malignant nodes L/S ratio <2 was found in 90.6% malignant nodes and 9.4% had L/S ratio > 2.^[8] In benign nodes L/S ratio > 2 was found in 64.8% nodes and L/S ratio < 2 was found in 35.2 % lymph nodes.

Out of 150 lymph nodes 99 were diagnosed as malignant node by Doppler ultrasound and among them 93 were confirmed by histopathological evaluation. They were true positive. Six cases were diagnosed as malignant node by Doppler ultrasound but not confirmed by

histopathology diagnosis. They were false positive. Out of 51 cases of benign nodes which were confirmed by Doppler ultrasound, 3 were confirmed as malignant nodule and 48 were benign nodes by histopathology diagnosis. They were false negative and true negative respectively. This study results were similar and in some instances more promising than the study results of previous researchers.^[9]

CONCLUSION

This study revealed high sensitivity, specificity and accuracy of the Doppler ultrasound in the differentiating benign and malignant superficial cervical lymphadenopathy. So Doppler ultrasound is an useful procedure in the evaluation and differentiating malignant from benign superficial cervical lymphadenopathy.

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