**Research Article**

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# ULTRASONOGRAPHY AS A DIAGNOSTIC TOOL TO DIFFERENTIATE CANCEROUS AND NON CANCEROUS CERVICAL LYMPHADENOPATHY IN WEST BENGAL POPULATION

**Dr. Chandan Kumar,[1] Dr. Vishal Bhuva Kishorbhai[2*]**

[1]Assistant Professor, Department of Radio-Diagnosis , Gouri Devi Institute of Medical Sciences & Hospital, Durgapur, West Bengal
[2*]Associate Professor, Department of Pathology, Gouri Devi Institute of Medical Sciences & Hospital, Durgapur, West Bengal

**Adress for Correspondence**

**Dr. Vishal Bhuva Kishorbhai**

Email Id- vishalbhuva@yahoo.com

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**ABSTRACT**

**Background**: Cervical lymph nodes are often affected by a wide range of medical conditions. Thyroid cancer, distant metastases, and tuberculosis are the three most common causes of cervical lymphadenopathy.

**Objective**: To assess the role of ultrasound in the differential diagnosis of cervical lymphadenopathy.

**Methods**: The cervical lymph nodes were imaged using a real-time linear scanner with a 7.5- or 11-MHz probe. Retrospective analysis of ultrasonography results was done for the lymph nodes of 432 patients. When required, FNAC, CECT neck, MRI, and core needle biopsy were used to reassess the USG results.

**Results**: Of the 432 lymph nodes, 108 had tuberculosis-related lymphadenitis, 46 had metastasized lymph nodes, 59 had lymphomas, 114 had inflammatory lymph nodes, and 105 had normal lymph nodes. Greater ultrasonography features were found in lymphomatous, metastatic, and tubercular lymph nodes. There was a noticeable hypoechoic center in both the tubercular and metastatic types. A lymph node excision biopsy was carried out to confirm the diagnosis because the FNAC result was uncertain in most of the individuals. To diagnose lymphadenitis, 100% specificity and 100% sensitivity were employed.

**Conclusion**: According to ultrasonography criteria like round form, absence of hilar echo, sharp nodal boundaries, hypoechoic internal echogenicity, and presence of intranodal necrosis, the cervical group of lymph nodes had a high likelihood of developing into metastatic cervical lymph nodes. When combined with other radiographic and histological features, ultrasonography can be a very helpful technique for identifying high-risk diseases early on.

***Keywords:*** Ultrasonography; Tuberculous Lymphadenitis; Malignant Lymphoma, Metastatic Node.

## INTRODUCTION

Of the approximately 600 lymph nodes in the body, only those in the inguinal, axillary, and submandibular regions may normally be palpable in healthy individuals. Lymphomadenopathy is the term used to describe a node that is abnormal in side, consistency, or quantity. While there are several ways to classify lymphadenopathy, labelling it as "localized" or "generalized" depending on whether it affects one location or multiple noncontiguous locations, respectively, is a simple and therapeutically useful approach.[1]

Developing a differential diagnosis requires being able to distinguish between localized and generalized lymphadenopathy. Localized lymphadenopathy affects about 74% of primary care patients with unexplained lymphadenopathy, whereas generalized lymphadenopathy affects 14% of patients. Cervical lymphadenopathy is the term used to describe lymphadenopathy of the cervical lymph nodes, or the neck glands. The term "lymphadenopathy" really refers to sickness of the lymph nodes, however it is commonly used to signify swelling of the lymph nodes. Though the terms are often used interchangeably, lymphadenitis and lymphadenopathy both refer to inflammation of a lymph node.[2]

Cervical lymphadenopathy is a sign or symptom rather than a diagnosis. The causes could be inflammatory, degenerative, or neoplastic. It is possible to feel healthy lymph nodes in the adult groin, neck and axilla. In children under the age of twelve, cervical nodes as small as 1 cm may be felt; however, this may not always be a sign of an illness.[3] Nodes that resolve or leave scars after becoming inflamed could still be felt. In children, reactive or infectious cervical lymphadenopathy predominates. In individuals over 50, it is important to assess the possibility of metastatic growth from head and neck and aerodigestive tract tumours.[4] Rubella, cat scratch fever, bacterial infections, mycobacterial infections, syphilis, cytomegalovirus, HIV, histoplasmosis, primary herpes simplex infection, infectious mononucleosis, viral respiratory infections, toxoplasmosis, tuberculosis, brucellosis, and primary herpes simplex infection are six to ten different infections Ultrasonography can be used to define the size, form, borders, internal architecture, vascularity, and perinodal soft tissues of a lymph node, as well as to identify an aberrant lymph node.[3] Two benefits of ultrasonography are its ability to identify solid or cystic lymph nodes and its lack of ionizing radiation. Contrast-enhanced CT and MRI can be used to better characterize the extent of illness.[5]

Ultrasound B-mode imaging gives information on lymph node morphology, and power Doppler can assess vascular pattern. Distinguishing lymphoma from metastases can be aided by characteristics seen on B-mode imaging, including size, shape, calcification, absence of hilar architecture, and intranodal necrosis. On B-mode imaging, soft tissue edema with nodal matting suggests either tuberculous cervical lymphadenitis or radiation therapy history.[6]

A lymph node's size, shape, boundaries, internal architecture, vascularity, and perinodal soft tissues can all be determined by ultrasonography, which can also be used to spot abnormal lymph nodes. The capacity to detect solid or cystic lymph nodes and the absence of ionizing radiation are two advantages of ultrasonography. To more accurately assess the severity of the disease, contrast-enhanced CT and MRI scans can be utilized.5. Power Doppler can evaluate vascular pattern, and Ultrasound B-mode imaging provides details on lymph node morphology.11 Features observed on B-mode imaging, such as size, shape, calcification, lack of hilar architecture, and intranodal necrosis, can help distinguish lymphoma from metastases. Soft tissue edema on B-mode imaging with nodal matting may indicate a history of radiation therapy or tuberculous cervical lymphadenitis.[7]

When lymphadenopathy is found in individuals receiving primary care, it usually results from benign microbiological sources, although this does not always raise worries about a serious infection. Most patients can be diagnosed based on a complete medical history and physical examination. In order to rule out generalized lymphadenopathy, localized adenopathy should stimulate a search for a nearby precipitating lesion as well as an assessment of other nodal regions. Any lymph node more than one centimeter in diameter is often considered abnormal. Supraclavicular nodes are the most concerned when it comes to malignancy.[8]

Those with localized nodes and a benign clinical picture should be monitored for a period of three to four weeks. In all circumstances, further clinical study ought to be done when there is generalized adenopathy. When the most aberrant node is excised by excisional biopsy, the pathologist will have the best opportunity to diagnose when a node biopsy is required. The etiology of lymphadenopathy is often obvious when a patient presents with both axillary lymphadenopathy and a hand infection, or when a child has painful cervical nodes, a sore throat, and a positive rapid strep test. In some cases, the diagnosis is not as clear. The only clinical finding could be lymphadenopathy, which could be accompanied by a variety of nonspecific symptoms.[9]

An increased risk of a serious illness such as lymphoma, acquired immunodeficiency syndrome, or metastatic cancer is often associated with larger lymph nodes. It is the physician's responsibility to distinguish between the vast majority of patients with self-limited illness and the tiny percentage of patients with serious illness. The goal of our research was to assess how well high-frequency transducer ultrasonography might be used to distinguish cervical tuberculous lymphadenitis from metastatic lymph nodes and malignant lymphoma. The assessment of patients with lymphadenopathy as a significant clinical finding is examined in this article, along with the identification of those with severe disease.

## MATERIAL AND METHODS

Patients who were sent to the Department of Radiology for ultrasonography due to cervical edema were the subjects of this observational retrospective study. The patients' ages ranged from 20 to 70. Before the study started, institutional ethical committee approval was obtained.

A Performa that had been pre-designed was used to record pertinent information, such as the patient's history, clinical results, and investigative reports from certain cases. During the local intra- and extraoral assessment of the neck for organ-specific drainage, much attention was paid to the position, size, amount, and apparent connection of each neck node to the surrounding anatomy. The research encompassed cases of cervical lymphadenopathy that were consistently monitored during treatment, irrespective of prior medical or surgical interventions for the same ailment.

7.5 MHz or 11 MHz linear transducer was employed for the ultrasound scanning. In a supine position, the patient's neck was hyperextended and there was a pad or cushion under the shoulders to maximize exposure. Scan images were obtained by positioning the transducer longitudinally and transversely, and measurements were made in the plane with the largest cross-sectional area. High Doppler gain, low wall filter setting, narrow gate, slow frame rate, low pulse repetition frequency, and high Doppler gain were used during the color Doppler evaluation of the cervical nodes in order to maximize Doppler sensitivity and detect even minute flow in the enlarged nodes. The elements considered and defined in this study are as follows:

Site: Different sets of lymph nodes were created based on the cervical nodal chain classification. Many lymph nodes were defined as more than two lymph nodes involved. Node fusion between two lymph nodes was defined as the partial or complete lack of a border echo.

A tendency towards fusion, an internal echo, an irregular margin, the presence of strong echoes, posterior enhancement, and the presence of hyper echoic echogenicity were the characteristics of ultrasonography that were used to evaluate the internal echo of lymph nodes.

Strong echoes were defined as one or more coarse, high-echo patches that are focally located in the center or periphery of the node. The morphology of the lymph node was ascertained by calculating the L/S (long axis/short axis) ratio; a ratio of less than two implies a round node, whereas a ratio of more than two indicates an oval or elongated node. Echo texture and homogeneity: the lymph nodes were categorized as hyper, isoechoic, or hypoechoic with respect to the surrounding muscles, and they had a homogenous or heterogeneous echo pattern.

Margin: Lymph nodes with distinct, sharp edges and those with fuzzy, unsharp edges were divided into two categories according to their margins. Ancillary features include things like extranodal necrosis, posterior enlargement, matting, and calcification.

Venous pattern: classified as peripheral, mixed, or hilar based on color flow mapping. Looking back, all of the pictures were reviewed by the same two experienced radiologists who were mentioned earlier. They all worked together to analyze the photos in blind fashion. Between the time of the picture acquisition and the retrospective imaging analysis, at least three months elapsed.

Readers were advised to annotate the target lymph node on the images of US representatives. After six months, each reader independently misinterpreted the imaging results of the target lymph node. Microsoft Excel 2010 and the SPSS software trial version 21.0 were used to achieve the statistical analysis's results.

**RESULTS**

Among the 120 patients, 432 lymph nodes in all were evaluated ultrasonographically. Among the various features that were looked at were the boundaries, the hypoechoic center, the long axis to short axis ratio (L/S ratio) of the lymph nodes, fusion propensity, peripheral halo, absence of a hilus, and strong internal echoes. The most visible node had FNAC after ultrasonography.

Based on the demographic data shown in Table 1, there was a male prevalence in cervical lymphadenopathy. Three age groups of patients were evaluated: those under 35, those between 36 and 50, and those 51 years of age and above. There were 61 people in the 51–70 age range, or the highest frequency of lymphadenopathy (50.83%). Areas with lower incomes and middle classes showed higher incidence.

Table 2 compares all aspects of lymph node pathology, primarily inflammatory, metastatic, tubercular, and lymphoma, with normal lymph nodes. Given that the length of a typical lymph node is higher than its breadth, the long axis to short axis ratio was greatest in this type of node. An oval or elongated lymph node was determined to be the typical form. Lowest L/S ratio reported in Hodgkin's lymphoma and metastases, with spherical or irregularly shaped lymph nodes. It was discovered that lymph nodes with tuberculosis had wildly uneven margins. Because they contain more fluid, the borders of inflammatory lymph nodes are smoother. Since tubercular lymph nodes exhibit liquefaction foci, hypoechoic centres are most common in these nodes, whereas they are least common in inflammatory lymph nodes. It was shown that 57 (52.77%) fused tubercular lymph nodes were more prevalent.

Internal echo and peripheral halo 72 (66.66%) were the most often observed features in tubercular lymph nodes. There was no internal echo, peripheral halo, or fusion in either inflamed or normal lymph nodes. It was found that Hilus was absent from a normal lymph node. The differential diagnosis for lymphadenitis is shown in the atlas at the end of this article. (A) A typical lymph node. Images (b), (c), (d), (e), (f), (g), and (e) show, in that order, reactive lymph nodes, malignant lymphoma, inflammatory lymph nodes, lymphomatous lymph nodes, metastatic lymph nodes, and tubercular lymphadenitis.

Since the FNAC result was unclear in the majority of the patients, a lymph node excision biopsy was performed to confirm the diagnosis. Since it is difficult to perform on lymph nodes smaller than 1.5 cm and there is a chance of damaging underlying vascular systems, a core needle biopsy was not tried. MRI and CECT neck scans verified certain lymph node pathology.

## DISCUSSION

Among the 120 patients, 432 lymph nodes in all were evaluated ultrasonographically. Among the various features that were looked at were the boundaries, the hypoechoic center, the long axis to short axis ratio (L/S ratio) of the lymph nodes, fusion propensity, peripheral halo, absence of a hilus, and strong internal echoes. The most visible node had FNAC after ultrasonography.

The largest frequency of lymphadenopathy (50.83%) was seen in the third group, which consisted of 61 people in the 51–70 age range. The frequency was higher in economies with lower and middle classes. This result was also observed in Lenghel LM et al.'s research.

Most of the normal and reactive nodes were hypoechoic when compared to the surrounding muscles. Most metastatic nodes exhibited hyperechoic behavior. Ying and Hyu J et al. have therefore shown that hyperechogenicity is a useful marker for the identification of metastatic nodes.7. A similar feature was also seen in a recent study by Alam F et al.11 The absence of a hilus, a hypoechoic center, and a reduced long axis to short axis ratio (L/S ratio) are ultrasonographic traits of metastatic nodes. This type of lymph node had the largest long axis to short axis ratio because the length of a normal lymph node is greater than its breadth. For lymph nodes, an oval or longer shape is normal. Hodgkin's lymphoma and its metastases had the lowest L/S ratio when the round or irregular shape of the lymph node was identified.

This was a result of the larger spherical form that metastatic nodes often take on. The earlier research by Alam F et al[11] and Liao LJ et al.[12] likewise showed these results. Normal lymph nodes and metastatic nodes showed a hilus, while tubercular and lymphomatous nodes did not. The bigger spherical shape that metastatic nodes frequently adopt is the cause of this. In 95% of metastatic nodes, the L/S ratio was less than 2, according to Dude SM, et al.[13] Additionally, in 78 (72.22%) of the tubercular lymph nodes, we found a hypoechoic center, which may indicate core necrosis. Ying M et al.[14] demonstrate that 3D ultrasonography is a useful tool for measuring the number of cervical lymph nodes. It was found that reactive lymphadenopathy and metastatic lymphadenopathy could be distinguished with 80% sensitivity and 90% specificity using a cut-off volume of 0.7 $cm^3$.

The pulsatility index, vascular resistance, displacement of vascularity, and vascular pattern can all be evaluated using Doppler ultrasonography. As per the research, these features provide 88% sensitivity in identifying metastatic nodes and 67% specificity with 100% accuracy rate for lymphoma diagnosis. Sonographic signs that help identify sick nodes include shape, absence of a hilus, intranodal necrosis, calcification, matting, peripheral halo, and substantial vascularity.

It is difficult to identify a cut off number that separates the three categories because of case overlap, however this feature can be considered in addition to other data when diagnosing. Fused tubercular lymph nodes were found to be more common in 57 (52.77%) cases.

In tubercular lymph nodes, internal echo and peripheral halo 72 (66.66%) were the most frequently observed results. Peripheral halo, internal echo, and fusion were absent from both inflamed and healthy lymph nodes. These results corroborated those of investigations by Abdullah N et al. and Ishibashi N et al. which discovered that hilus was missing in a normal lymph node. It is not useful to differentiate between the three main causes of cervical lymphadenopathy; however, other features such as uneven margin, hypoechoic core, fusion propensity, and peripheral halo can be used to identify abnormal from normal nodes.

## CONCLUSION

Using a variety of radiological modalities, including CT, MRI, PET, and radionuclide imaging, cervical lymphadenopathy can be assessed. As all these are expensive and not easily available, one such effort to demonstrate the effectiveness of ultrasound—which is readily accessible, inexpensive, non-ionizing, and noninvasive was the current study.

This study concluded that the cervical group of lymph nodes, which showed high sensitivity and specificity of 100%, were highly suggestive of metastatic cervical lymph nodes based on ultrasonography features such as round shape, absence of hilar echo, sharp nodal borders, hypoechoic internal echogenicity, and presence of intranodal necrosis. When used in conjunction with additional radiographic and histological characteristics, ultrasound can be a highly useful tool for early detection of high-risk illnesses.

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**TABLES**

| Demographic variables | Group | Number of patients | % |
|---|---|---|---|
| Gender | Male | 72 | 60 |
| | Female | 48 | 40 |
| Age group (years) | 20-35 | 30 | 25.0 |
| | 36-50 | 29 | 24.16 |
| | 51-70 | 61 | 50.83 |
| Social status | Low economy | 46 | 38.33 |
| | Middle class | 23 | 19.16 |
| | Higher middle class | 51 | 42.07 |

Table 1: Demographic variables (n=120)

| Characteristics | Tubercular | Metastatic | Hodgkin's Lymphoma | Inflammatory | Normal | p-value |
|---|---|---|---|---|---|---|
| L/S Ratio | 1.7 ± 0.7 | 1.3 ± 0.3 | 1.5 ± 0.5 | 2.3 ± 1.0 | 2.3±1.9 | <0.01 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Irregular margins | 63 (59%) | 24 (52.17%) | 13 (22.03%) | 9(7.89%) | Nil | >0.01 |
| Hypoechoic center | 78 (72.22%) | 29 (63.04%) | 11 (18.64%) | 10(8.77%) | Nil | >0.01 |
| Fused | 57 (52.77%) | 32 (69.56%) | 8 (13.56%) | Nil | Nil | >0.01 |
| Peripheral halo | 72 (66.66%) | 26 (56.52%) | 4 (6.77%) | Nil | Nil | <0.01 |
| Internal echo | 52 (48.14%) | 5(10.87%) | Nil | Nil | Nil | <0.001 |
| Absent hilus | 16 (14.81%) | 37 (80.43%) | 15(25.42%) | 11 (9.65%) | Nil | <0.01 |
| Total nodes(432) | 108 (25.0) | 46 (10.65) | 59 (13.65) | 114 (26.38) | 105(24.30%) | |

Table 2: Ultrasonography findings correlated with tissue diagnosis
The ‘p values’ compare the significance of difference between all lymphadenopathy