IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 10 Ser.4 (October. 2023), PP 47-52
www.iosrjournals.org

USG Neck Imaging: A Cost Effective Essential Tool To Be Used Before Biopsy To Depict Benign And Malignantpotential Of Lymph Nodal Lesions.

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ABSTRACT
BACKGROUND*: Neck swellings need quick diagnostic & therapeutic approach. USG has proven to be a diagnostic modality of choice in this condition.*
AIM: *This study aims to evaluate the efficacy of the USG to depict benign and malignant potential of lymph nodal lesions.*
MATERIALS &METHODS*:*
A prospective analytical study was done. USG findings of 40 patients who presented with neck swelling, throat pain, difficulty in swallowing and fever were analyzed. This data for morphology of lymphnodes on USG was compared with biopsy findings.
RESULTS*: USG has detected 32 patients having benign and 8 patients having malignant nodal lesions in comparison to the biopsy findings which showed 31 patients to have benignity and 9 patients to have malignant potential with 1 false negative. Thus, having a sensitivity of 90.0 %& specificity of 100 %;*
CONCLUSION*: USG is best diagnostic tool in the patients presenting with lymph nodal lesions with a good sensitivity and decent diagnostic accuracy.*

Date of Submission: 08-10-2023 Date of Acceptance: 18-10-2023

I. INTRODUCTION:

High resolution ultrasonography of the neck had become one of the major diagnostic tools available. It provides excellent and reproducible images, while being safe, moderately priced and non- invasive. It provides important data like pathology, volumetry, vascular status, size of the lymphnode and can be used for guided fine needle biopsy. It ensures rapid investigation, and does not require any specific preparation prior to scanning. Ultrasonography also plays an important role in treatment evaluation and follow up. A new approach uses the small ultrasound transducer for intra- operative navigation.

Cervical lymph nodes are distributed along the lymphatic vessels of the neck. Each solitary lymph node is encased in dense connective tissue known as the capsule. Branching directly from the lymph node capsule toward the interior are the medullary trabeculae that give the lymph node internal structural support and help to convey its internal vessels. The periphery of the lymph node is known as the cortex that houses lymphoid follicles. The medulla is the inner part of the lymph node and is made up of medullary cords and sinuses where lymph flows freely, entering through afferent lymphatic vessels. At the lymph node hilum can be found its artery and vein along with the efferent lymphatic vessel where lymph exits into larger draining veins. [2,3]

Metastatic lymph nodes are predominantly spherical (87%), hypoechoic(80%), sharply marinated (87%) with cystic necrosis (62%) and absent hilum (100%).Few may show calcification (37%) and great vessels encasement (25%). [1]

Tubercular lymph nodes were predominantly longitudinal (66%), hypoechoic (83%), heterogeneous (83%), matted (100%) with calcification (66%) and absent hilum (100%).

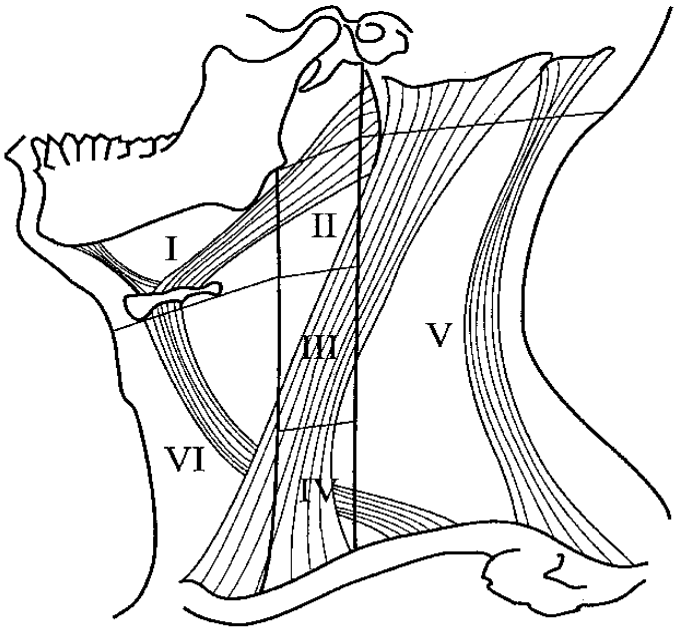
Reactive and nonspecific lymph adenitis was predominantly longitudinal, hypoechoic, and sharply marginated.

Hajeketal has showed USG has showed all inflammatory nodes as oval shaped and all malignant lesions as round shaped.

Classification of cervical lymph nodes is commonly done through the American Joint Committee on Cancer (AJCC) classification. [2]

Level I includes the submental and submandibular nodes.

Level II is made up of the anterior cervical and internal jugular lymph node chain from the skull base to the level of the hyoid bone.
Level III is composed of the internal jugular chain nodes from the hyoid bone to the cricoid cartilage.
Level IV is the internal jugular chain between the cricoid cartilage and the clavicle.
Level-V nodes are along the spinal accessory chain posterior to the sternocleidomastoid muscle.
Level-VI nodes are from the hyoid bone to the suprasternal notch with the medial border of the carotid sheath bilaterally forming its lateral borders.
Level-VII nodes are located in the superior mediastinum.



The AJCC classification of cervical lymph nodes is not always relevant to ultrasonography[2].

SONOGRAPHIC COMPARISON OF NORMAL AND ABNORMAL CERVICAL NODES

Number and distribution:

Normal cervical lymph nodes are predominantly found in 4 regions divided up very closely between the parotid, submandibular, and upper cervical regions at nearly 20% each, whereas the posterior triangle has the most at 35% to 37%.[2,4]

The location of metastatic lymph nodes in the neck can offer clues as to where the primary malignancy is located. A primary malignancy from the tongue and larynx, for example, most commonly metastasizes to lymph nodes in the internal jugular chain. The same applies to metastases from papillary thyroid carcinoma. For non-Hodgkin lymphoma, metastatic lymph nodes are typically located in the submandibular and upper cervical regions. [3,4]

Size

Cervical lymph node size has traditionally been used to help differentiate malignant and abnormal lymph nodes from the normal ones. This however is not considered to be a reliable sole criterion of pathology. Cervical lymph nodes in older patients tend to be larger compared with those in younger patients most likely because of increased fat content with increasing age. The best approach is not in defining absolute size criteria but in the judicious use of careful follow-up ultrasounds.[2]

Shape

The shape of cervical lymph nodes can be used to help distinguish between malignant and normal nodes. Shape is usually quantified using the short axis-long axis ratio (S:L). An S:L of greater than or equal to 0.5 means that a node is abnormal and more round. An S:L of less than 0.5 usually means that a lymph node is normal and more oval.[2]

Nodal shape transformation from oval to round is most likely because of the malignant infiltration changing the architecture of the lymph node. [2,4]

Nodal Border

Malignant lymph nodes usually have sharp borders because of the increased acoustic impedance difference that results from not only tumor infiltration but also loss of intranodal fat[2].

Malignant nodes with unsharp borders can represent extracapsular spread of the tumor. Tuberculous nodes are usually found to also have unsharp borders from surrounding edema and inflammation of the soft tissues. [2,3]

Echogenic Hilus

The echogenic hilus represents the collecting sinuses of a normal lymph node. It is usually continuous with the surrounding connective tissue of the node. The larger the lymph node and the older the patient, the more obvious is the echogenic hilus. Larger lymph nodes allow for improved separation to see the hilus.[2]

The absence of an echogenic hilus could mean that it has been obliterated by infiltrating tumor or even represent a tuberculous node. Hilar vascularity should be evaluated with Doppler ultrasonography. [2,3,4]

Echogenicity

Normal lymph nodes tend to be hypoechoic compared with the adjacent muscle, as do other malignant lymph nodes and tuberculous nodes. Exceptions are metastatic papillary thyroid carcinoma which is hyperechoic and lymphomatous nodes which can display intranodal reticulation. [2,4]

Calcification

Calcifications in general are rare, but can signify the presence of metastatic papillary thyroid carcinoma and medullary thyroid carcinoma (punctate calcification).Most egg shell type calcification signifies a non-malignant cause. Other reported causes for calcifications in cervical lymph nodes include granulomas, fat necrosis and previously treated lymphomas. [3]

Intranodal necrosis

Manifests as either cystic changes or as echogenic areas of coagulation necrosis. Coagulation necrosis is rare but may be seen in both inflammatory and malignant nodes. Cystic changes characteristically occur in metastatic squamous cell carcinomas and papillary thyroid carcinomas. Tuberculous nodes can also demonstrate cystic changes.[2,5]

Vascular pattern

The vascular patterns of lymph nodes were classified into four main categories according to the location of the vascularity:

a. Hilar: flow signals branching radially from the hilus, regardless of whether the signals originate from the central region or from the periphery.

b. Capsular (or peripheral): flow signals around the periphery of the lymph nodes, with branches perforating the periphery of the node and not arising from the hilar vessels.

c. Mixed: presence of hilar and capsular flow.

d. Avascular: absence of vascular signals within the lymph nodes.

On colour and power Doppler normal and reactive lymph nodes generally are either avascular or have vascularity confined to the hilum. Metastatic nodes have characteristically had more peripheral vascularity or a mixed pattern. [2,5]

Vascular resistance

On Doppler spectral analysis, malignant nodes have higher vascular resistance as malignant nodes are infiltrated by tumour which compress the intrinsic structure and vasculature. Normal and reactive nodes that have higher flow requirements without any disruption of nodal structure have low resistance.[5]

According to Bruneton and co–workers[7], ultrasound is of primary value in providing information of an anatomical nature, including the distribution of subclinical nodes, volumetric evaluation and determination of vascular connections particularly detecting internal jugular vein thrombosis. For patients whose neck has been thickened as a result of radiotherapy, ultrasound shows assessment of local status.

Hajeck and co- workers[8] found that ultrasound allows the differentiation of recurrent lymph node enlargement within post – operative scar tissue. A major advantage of ultrasound is the potential to differentiate normal from abnormal vessels. Ultrasound depicts an arterial wall as an isolated echodense band which can be distinguished from adjacent structures including lymph nodes and scars. Ultrasound, waves are partially reflected by the vessel wall owing to the differences of acoustic impedence between vessel wall and lymph node, Times New Rom thereby a normal vessel wall clearly becomes visible.

According to Anand and co- workers[8], on comparison of clinical exam, CT scan and ultrasound for cervical lymph node metastasis in head and neck cancer the sensitivity was 7.4%, 77.5% and 82% respectively. The specificity was 90.1%, 92.4% and 92.5% and the overall accuracy was 7%, 83% and 85.9%. They found ultrasound advantageous in having low cost, minimum stress to the patient, ease of application and possibility of frequent repetition with no exposure to radiation. But ultrasound is a dynamic investigation which is highly operator dependent with nodes near to the mandible or nodes smaller than 1 cm likely to be missed.

II. Material and methods:

SOURCE OF DATA: Patients who were referred to the Department of Radiodiagnosis with complaints of swelling and fever & neck pain.
STUDY DESIGN: This was a descriptive study carried out in the Department of Radio-diagnosis. This study included all the patients indoor and outdoor of all the age groups.
In this study we included all the patients of both sex, irrespective of their socioeconomic status.
USG was performed on the patients with neck in the hyperextension position using ultrasound machines with a linear array transducer of 7.5 – 10 MHZ.

INCLUSION CRITERIA:
1. Ultrasonography of the patients who are referred being clinically suspected to have the primary neck lesions.
2. Ultrasonography on the known cancer patients in whom metastases (primary elsewhere) is being suspected to the neck region.

STASTICAL ANALYSIS:
Patient's clinical data, age, sex, findings found in the USG like size, shape, site, margins, appearance (solid/cystic), and presence of calcifications, echotexture and vascularity as well as the HPE data was taken.
This data is subjected to analysis through STATA
(14.1) various bar charts & pie charts were made and the sensitivity, specificity as well as the negative predictive value, positive predictive value along with accuracy was made out.

III. Results:

ECHOGENICITY
HALF OF THE LESIONS ARE HYPERECHOIC AND HYPOECHOIC IN THE MALIGNANT AND UNDECIDED NODAL LESIONS.

FREQUENCY	PERCENT	VALID PERCENT
HYPERECHOIC	3	50.0
HYPOECHOIC	3	50.0
Total	6	100.0

MARGINS
50 PERCENT OF THE MALIGNANT AND UNDECIDED NODAL LESIONS SHOW WELL DEFINED AND ILL DEFINED MARGINS RESPECTVELY.

FREQUENCY	PERCENT	VALID PERCENT
WELL DEFINED	3	50.0
ILL DEFINED	3	50.0
Total	6	100.0

MATTING
MATTING IS PRESENT IN 3/4TH OF THE MALIGNANT AND UNDECIDED NODAL LESIONS.

FREQUENCY	PERCENT	VALID PERCENT
ABSENT	2	33.3
PRESENT	4	66.7
Total	6	100.0

CALCIFICATION
ALMOST ALL THE MALIGNANT AND UNDECIDED NODAL LESIONS SHOW CALCIFICATIONS.

FREQUENCY	PERCENT	VALID PERCENT
PRESENT	6	100.0

NECROSIS

NECROSIS IS PRESENT IN 3/4TH OF THE MALIGNANT AND UNDECIDED NODAL LESIONS.

FREQUENCY	PERCENT	VALID PERCENT
ABSENT	2	33.3
PRESENT	4	66.7
Total	6	100.0

VASCULARITY

50 PERCENT OF THE MALIGNANT AND UNDECIDED NODAL LESIONS SHOW VASCULARITY AND LOSS OF VASCULARITY RESPECTVELY.

FREQUENCY	PERCENT	VALID PERCENT
NORMAL	3	50.0
RAISED	3	50.0
Total	6	100.0

SATELLITE NODES

ALMOST ALL MALIGNANT AND UNDECIDED NODAL LESIONS SHOW SATELLITE NODES.

FREQUENCY	PERCENT	VALID PERCENT
PRESENT	6	100.0

IV. Discussion

Ultrasound showed hypoechoic echotexture lymphnodes in all cases of benign lesions being whether infective or inflammatory in etiology.

Cases of metastatic lymphadenopathy showed both hyperechogenecity & hypoechogenicity in 50-50 % ratio.

Majority of benign nodes displayed oval shape, while malignant nodes showed rounded and oval shape both. Round shape on USG, is more likely suggestive of malignancy. Matting was seen in 30 (81%) benign nodes & 66.7 % of the malignant as well as undecided lesions. The above findings were consistent with those described by Chan et al[3] and Hajek et al [4].

According to Bruneton et al [7] ultrasound is of primary value in providing information of an anatomical nature including the distribution of subclinical nodes, volumetric evaluation and determination of vascular connection.

Sumi et al[81] ultrasound has a great potential in detecting metastatic nodes from squamous cell carcinoma in the head and neck region because of its ability to delineate changes in internal architecture. Our study revealed similar results. According to Anand et al [8] the sensitivity and specificity in detecting metastatic nodes was 82% and 92.5%.

USG showed 100% sensitivity and 89.5% specificity in detecting benign etiology lymphnodes based on well-defined borders, matting and clinical features of pulmonary / extrapulmonary tuberculosis. These findings have also been described by Asai et al[6] and Chan et al[3]. Nearly 80% of benign nodes shown no significant raised hilar vascularity and 50% of malignant nodes showed raised vascularity. According to Ahuja al[10], type II vascularity (activated Hilar) was more frequently associated with malignant nodal lesions.

Peripheral subcapsular vessels, typical of metastasis, are rare in lymphoma (exception- high grade lymphomas). The differential diagnosis between lymphoma and lymphadenitis is frequently possible with sonographic and Doppler patterns.

ACKNOWLEDGEMENT: none

CONFLICT OF INTEREST: authors declared no conflict of interest.

FUNDING/SUPPORT: none.

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