Research Article

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Diagnostic Efficacy of Greyscale Ultrasonography in the Differentiation of Reactive and Metastatic Cervical Lymph Nodes

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ABSTRACT

Background: To emphasize the sensitivity and specificity of greyscale ultrasonography (USG) in detecting the reactive and metastatic cervical lymph nodes and as a good indicator for diagnosis and treatment planning.

Materials and Methods: 30 patients divided into 3 Groups. Group I - 10 healthy individuals, Group II - 10 patients with head and neck infections, Group III - 10 patients with head and neck malignancy. Patients were subjected to clinical examination before USG and Fine needle aspiration cytology (FNAC) procedure. All sonographically detectable cervical lymph nodes in each region were assessed for size, shape, border, hilum, echogenicity and intranodal necrosis. Fine needle aspiration was done in the involved cervical lymph node for histopathological evaluation.

Results: The sensitivity and specificity of ultrasonography in differentiating reactive cervical lymph nodes from metastatic cervical lymph nodes were for size 86.1% & 68.8% respectively, for shape 92.2% & 86.5% respectively, for border 96% & 97 % respectively, for hilum 100% & 100% respectively, for internal echogenicity 77% & 100% respectively, for intranodal necrosis 41.2% &100% respectively.

Conclusion: This study helps to differentiate the reactive cervical lymph nodes from the metastatic lymph nodes by using Greyscale USG which was confirmed by FNAC. The ultrasonographic features of lymph nodes with round shape, absence of hilar echo, sharp nodal borders, hyperechoic internal echogenicity and presence of intranodal necrosis were highly suggestive of metastatic cervical lymph nodes whereas lymph nodes with oval shape, presence of hilar echo, smooth nodal borders, hypoechoic internal echogenicity and absence of intra nodal necrosis were suggestive of reactive cervical lymph nodes.

Keywords: Greyscale Ultrasonography, FNAC, Metastatic cervical lymph nodes, reactive cervical lymph nodes.

INTRODUCTION

About 300 lymph nodes are present in the neck. Clinically lymph nodes are difficult to palpate. The most common finding in the head and neck disorders is Cervical lymphadenopathy. In inflammatory condition and infection, the enlarged lymph node enlargement is noted along with pain whereas in neoplastic condition, it is painless. Infection in head and neck area results in reactive lymph node enlargement whereas metastatic lymph node is enlarged in case of malignant tumors .[1]

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Fig 1: Greyscale ultrasonographic scanning procedure on cervical lymph nodes.

Fig 2: Ultrasound images of normal cervical lymph nodes.

Fig 3: Armamentarium for FNAC Examination.

Fig 4: FNAC procedure on involved cervical lymph nodes.

Fig 5: Armamentarium for Greyscale Ultrasonography examination.

Fig 6: Clinical picture of squamous cell carcinoma in left buccal mucosa and alveolar mucosa.

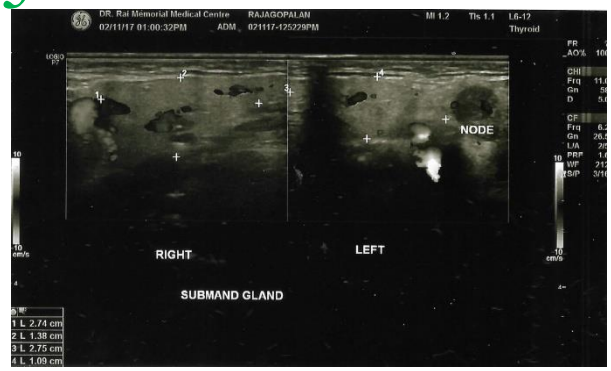


Fig 7: Ultrasound images of metastatic cervical lymph nodes.

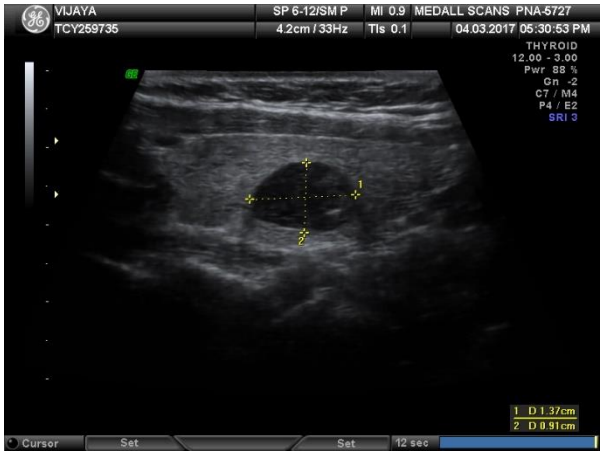


Fig 8: Ultrasound images of reactive cervical lymph nodes.

When cancer spreads, the cancer cells tend to appear first in the sentinel lymph node. Lymph nodes are usually fixed to underlying tissue. Assessment of the cervical lymph node status remains a problem. Clinical palpation is insufficient in determining the cause of nodal enlargement, nodal size, extra-capsular growth or vascular involvement. [2] Ultrasound has proved its efficacy for the lymph node metastasis detection.[3]

Normal cervical nodes show 5mm sized hilum which is avascular or sometimes show vascularity, round or elliptical in shape. The reactive nodes are more than 5 mm in size, elliptical in shape and has smooth border. The echogenic hilus is present and shows hilar vascularity. [4] The metastatic lymph nodes are more than 5 mm in size and it is round shape, has sharp border. The echogenic hilus is absent and shows peripheral vascularity. Intranodal necrosis is seen. Echogenicity of metastatic lymph nodes are predominantly hypoechoic.[5] Fine needle aspiration cytology (FNAC) is a simple, quick, diagnostic procedure used in the differentiation of reactive and metastatic lymph nodes, has almost no complication.[6] In case of metastasis in the head and neck region, the lymph nodes are clinically difficult in diagnosis, during such condition ultrasonography guided FNAC of sentinel lymph nodes give promising results in detecting metastasis.[7]

In this present study, the ultra-sonographic examination is conducted first because the pathology can be identified due to hyperechoic and hypoechoic structure and their vascular flow patterns of reactive and metastatic cervical lymph nodes, which signifies the type of lesion within the cervical lymph nodes and this is considered as non-invasive procedure. This is followed by FNAC which can actually present the nodal structures to have comparative and confirmative study.

MATERIALS AND METHODOLOGY

STUDY DESIGN

Aim of the study is to differentiate two categories of lymph nodes, whether metastic or reactive using Greyscale Ultrasonography which was confirmed with FNAC.

STUDY SAMPLE

Subject of this study consists of thirty patients reporting to Ragas Dental College and Hospital, and Dr. Rai Memorial Cancer Institute, Outpatient Department, divided into three groups Group I as healthy controls, Group II patient presenting with head and neck infections. Group III includes patients presenting with malignancy in head and neck region.

METHODOLOGY

Patients were subjected to clinical examination before Ultrasonography Scanning and FNAC procedure.

PROCEDURE FOR ULTRA SONOGRAPHIC SCANNING OF CERVICAL LYMPH NODES

For sonographic examination patient was laid supine in the bed with neck extended and turned to the side to be examined. The 7.5 MHz linear scanning probe (Figure 1) was positioned over the involved lymph node to search the minimal and

maximal diameter, presence of hilum, parenchymal echogenicity, calcification, nodal borders, shape and size. After this the frame was freezed on the screen and photograph was taken (Figure 2).

PROCEDURE FOR FNAC

Fine needle aspiration was done in the involved cervical lymph node for histopathological examination under aseptic condition. After local anaesthesia, sterile 19 G needle and 2 ml disposable sterile syringe 0.5 ml of lymph fluid was aspirated (Figure 3 and 4).

GREY SCALE SONOGRAPHIC FEATURES FOR DIAGNOSIS OF CERVICAL IMPHADENOPATHY

All sonographically detectable lymph nodes in each region were assessed for

1. Size (maximum transverse diameter)
2. Shape (short axis/long axis)
3. Echogenic hilus
4. Nodal borders
5. Internal Echogenicity
6. Nodal Necrosis

STATISTICS FOLLOWED

Statistical analysis using SPSS software V21.0 were done. The test used was Chi Square Test.

Table 1: Age Distribution In Relation To Group I, II, III.

Groups	Mean Age
I	25.9±4.22
Ii	36.9±5.17
Iii	61.2±13.49

P Value 0.01

Table 2: Gender Distribution In Relation To Group I, II, III.

Group	Male		Female		Total	
	N	%	N	%	N	%
I	4	40	6	60	10	100
Ii	6	60	4	40	10	100
Iii	10	100	0	0	10	100

P Value 0.01

Table 3: Distribution Of Hilar Echo In Relation To Group I, II, III.

Group	Present		Absent		Total	
	N	%	N	%	N	%
I	6	60	4	40	10	100
Ii	10	90	0	10	10	100
Iii	0	0	10	100	10	100

P Value 0.00

Table 4: Distribution Of Shape Of Lymph Nodes In Relation To Group I, II, III.

Group	Oval		Round		Total	
	N	%	N	%	N	%
I	9	90	1	10	10	100
Ii	8	80	2	20	10	100
Iii	2	20	8	80	10	100

Table 5: Distribution Of Border Of The Lymph Nodes In Relation To Group I, II, III.

Group	Smooth		Sharp		Total	
	N	%	N	%	N	%
I	10	100	0	0	10	100
Ii	10	100	0	0	10	100
Iii	0	0	10	100	10	100

P Value 0.000

Table 6: Distribution Of Echogenicity Of Lymph Nodes In Relation To Group I, II, III.

Group	Hypoechoic		Hyperechoic		Total	
	N	%	N	%	N	%
I	8	80	2	0	10	100
Ii	7	70	3	30	10	100
Iii	0	0	10	100	10	100

P Value 0.001

Table 7: Distribution Of Intranodal Necrosis In Relation To Group I, II, III.

Group	Present		Absent		Total	
	N	%	N	%	N	%
I	0	0	10	100	10	100
Ii	0	0	10	100	10	100
Iii	6	60	4	40	10	100

P Value 0.001

Table 8: Comparison Of Ultrasonography With Fnac In Patient With Reactive Cervical Lymph Node.

Group	Present		Absent		Total	
	N	%	N	%	N	%
I	0	0	10	100	10	100
Ii	10	100	0	0	10	100
Iii	0	0	10	100	10	100

P Value 0.000

Table 9: Comparison Of Ultrasonography With Fnac In Patients With Metastatic Lymph Nodes.

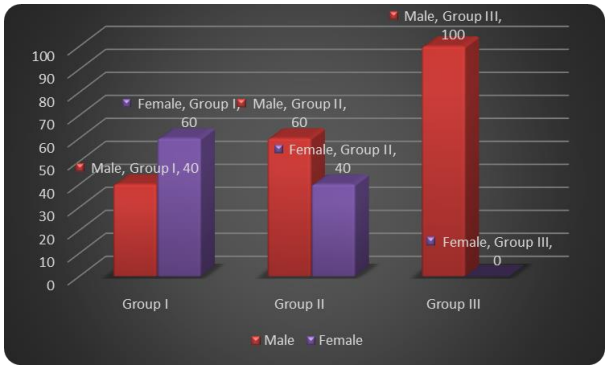
Group	Present		Absent		Total	
	N	%	N	%	N	%
I	0	0	10	100	10	100
Ii	0	0	10	100	10	100
Iii	10	100	0	0	10	100

P Value 0.000

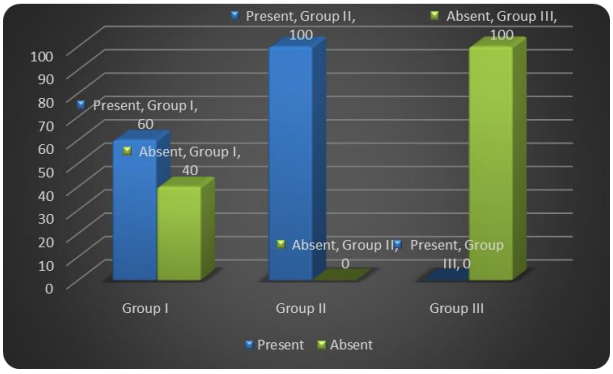
Table 10: Sensitivity And Specificity Of Ultrasonography In Differentiating Metastatic From Reactive Cervical Group Of Lymph Nodes.

Parameters	Sensitivity	Specificity
Size	86.1%	68.8%
Shape	92.2%	86.5%
Border	96%	97%
Hilum	100%	100%
Echogenicity	77%	100%
Necrosis	41.2%	100%

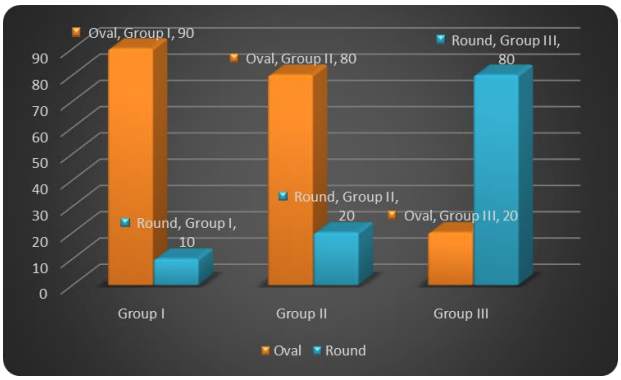
Graph 1: Gender Distribution In Relation To Group I, II, III.



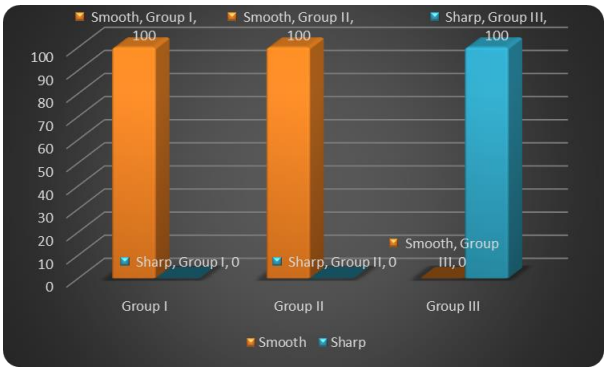
Graph 2: Distribution Of Hilar Echo In Relation To Group I, II, III.



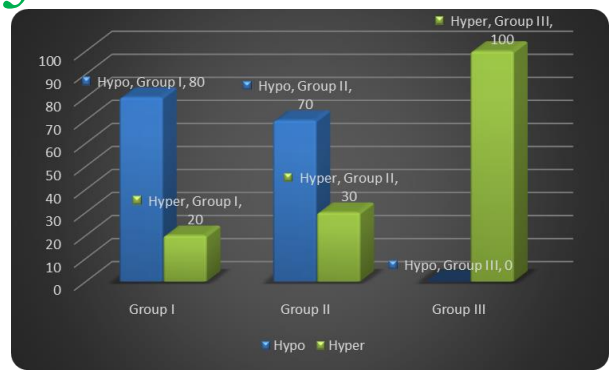
Graph 3: Distribution Of Shape Of Lymph Nodes In Relation To Group I, II, III.



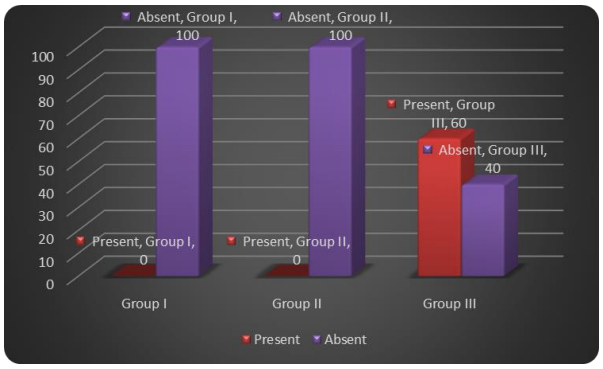
Graph 4: Distribution Of Border Of The Lymph Nodes In Relation To Group I, II, III.



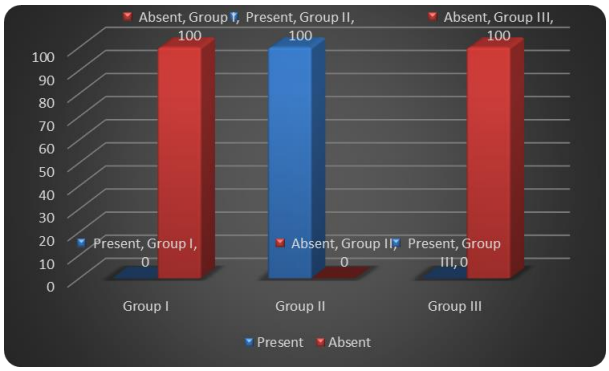
Graph 5: Distribution Of Echogenicity Of Lymph Nodes In Relation To Group I, II, III.



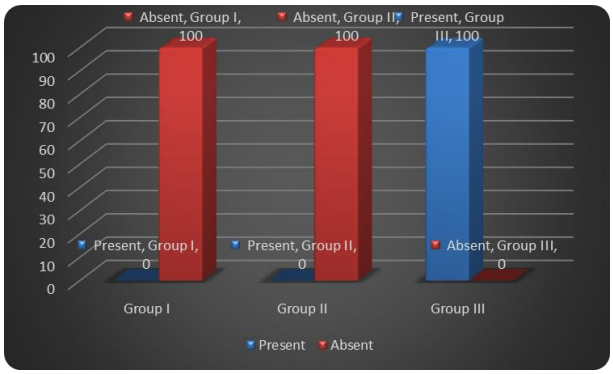
Graph 6: Distribution Of Intranodal Necrosis In Relation To Group I, II, III.



Graph 7: Comparison of Ultrasonography With Fnac In Patients With Reactive Lymph Nodes.



Graph 8: Comparison Of Ultrasonography With Fnac In Patients With Metastatic Lymph Nodes.



DISCUSSION

Head and neck malignancies have metastasis in the cervical lymph nodes.[8] In our study, Group I individuals none of them had any pathology in the head and neck region and there were no palpable lymph nodes ((Figure 5). Group II patients all of them had dental pathologies and had the presence of soft, mobile, tender unilateral submandibular lymph nodes. Group III 6 patients had squamous cell carcinoma of buccal mucosa among those 4 patients had metastatic, firm, fixed, non-tender unilateral submandibular lymph node and 1 patient had bilateral metastatic firm, fixed, non-tender submandibular lymph nodes and 1 patient had metastatic firm, fixed, non-tender unilateral submandibular and upper jugular cervical lymph nodes, 2 patients with squamous cell carcinoma of alveolus(Figure 6 and Figure 7) had metastatic firm, fixed, non tender unilateral submandibular cervical lymph node, 1 patient with squamous cell carcinoma of palate had metastatic firm, fixed, non-tender bilateral submandibular cervical lymph nodes, 1 patient with squamous cell carcinoma of the tongue had metastatic firm, fixed, non-tender unilateral submandibular and upper jugular cervical lymph nodes . Rajalakshmi et al.[9], reported, survival rate is 50% in case of ipsilateral metastaic cervical lymph nodes whereas 25% in case of bilateral involvement. Therefore, detecting cervical lymph node involvement is crucial in differentiating the reactive from metastatic cervical nodes for head and neck malignancy patients. It helps in the assessment of patients for proper diagnosis and treatment planning.

Battenburg de Jong RJ et al .[10], stated that ultrasound is an useful imaging modality in assessing the metastatic cervical lymph nodes. When the greyscale ultrasonography is combined with the fine needle aspiration cytology it has high

sensitivity and specificity of 98% and 95% respectively. The following authors, Toruchikui [11] Pedro Weslley souza Rosario [12], had advocated the greyscale ultrasonography criteria to differentiate reactive from metastatic cervical lymph nodes.

Micheal TC, et al.[13] in a literature, they have stated that metastaic lymph nodes are larger. However, the reactive cervical lymph nodes are larger than metastatic lymph nodes. Moreover, the metastatic deposit can be also found even in the smaller nodes. Thus, the size alone can be used in the differential diagnosis. We can also evaluate the size of the node in monitoring patient's response to the treatment.

Metastatic cervical lymph nodes are usually round whereas the normal and reactive cervical lymph nodes are usually oval. But it also has been reported that normal submandibular and parotid lymph nodes tend to be round. Thus, the nodal shape should also be considered in the diagnosis In reactive cervical lymph nodes, the smooth border is due to the edema and the inflammation of the surrounding tissues. In greyscale ultrasonography the presence of hilum is considered as a feature of reactive lymph nodes ((Figure 8) and sometimes also can be noticed in the normal lymph nodes. The hilum is completely absent in the metastatic lymph nodes.

Reactive lymph nodes are predominantly hypoechoic in nature whereas metastatic lymph nodes are hyperechoic and intranodal necrosis is most commonly seen. Types of intranodal necrosis are cystic and coagulation necrosis. The most common necrosis found in metastatic cervical lymph nodes from squamous cell carcinoma and papillary carcinoma of thyroid is cystic necrosis. The results were interpreted by using chi- square test with SPSS 21.0 Grayscale ultrasonography with relation to size revealed that in Group I patients 0.91 cm is the size of the lymph node. In Group II patients 1.37 cm is the size of the lymph node. In Group III patients 2.54 cm is the size of the lymph node.

Greyscale ultrasonography with respect to shape revealed that in Group I, 90% individuals had oval shape and 10% individual had round shape. In Group II 80% of the patients had oval shape and 20% had round shape. In Group III 20% had oval shape and 80% had round shape with significant p value (P=0.002) which is then compared with the findings given by Hiroshi Yusha.[14] who reported that metastatic lymph node was round while reactive lymph node were oval shape.

Greyscale ultrasonography of nodal borders of selected cervical lymph node revealed that in Group I 100% of the individuals had nodal borders which are smooth. In Group II 100% of patients showed smooth nodal border of the involved reactive cervical lymph node. In group III 100% of the patients showed nodal border which are sharp of the involved metastatic cervical lymph nodes with significant p value (p=0.000). Hiroshi Yusha [5], Ahuja et al [4] found round nodal borders in 74% of the metastatic cervical lymph nodes. Smooth borders in 100% of the reactive cervical lymph nodes.

Greyscale ultrasonography of hilar echo revealed that in Group I, hilar echogenicity is present in 60% individuals and hilar echogenicity is absent in 40% of the individuals In Group II hilar echogenicity is present in all the 10 patients. In Group III hilar echogenicity is absent in 100% of individuals with (P=0.00). This result was correlated with the results given by Hiroshi Yusha et al. [14] where in metastatic lymph nodes and reactive cervical lymph nodes, 97% and 73% absence of hilar echo is noted respectively with significant P value <0.001. According to Ying et al. [15] in 96% of cases echogenic hilum is an normal feature and stated that hilum can be noted in malignancy at the early stages and it has lost its pattern during the advanced stages.

Greyscale ultrasonography with regards to internal echogenicity revealed that in Group I, 80% and 20% of the individuals had hypoechoic pattern and hyperechoic pattern respectively of the selected cervical lymph nodes. Group II 70% and 30% of the individuals had hypoechoic pattern and hyperechoic pattern respectively of the involved reactive cervical lymph node. Group III 100% of the individuals had hyperechoic pattern with (P=0.001) as significant P value which was correlated with the results given by Hiroshi Yusha et al. [14] who found that internal echogenicity in case of metastatic cervical lymph nodes was 86% hyperechoic and 2% hyperechoic in case of reactive cervical lymph nodes.

Greyscale ultrasonography with regards to intranodal necrosis revealed that in Group I 100% of the individuals had absent intranodal necrosis of the selected normal cervical lymph node. In Group II 100% of the individuals had absent intranodal necrosis in the involved reactive cervical lymph nodes. In Group III 60% of the individuals had intranodal necrosis in the metastatic cervical lymph node and 40% of the individuals had absence of intranodal necrosis in the involved metastatic cervical lymph node with significant p value (P=0.001). This result was compared with report given by Rajalakshmi et al.[9] who found 26.67% of metastatic cervical lymph nodes had intranodal necrosis and there was absence of intranodal necrosis in reactive cervical lymph nodes.

The FNAC of given specimens from the Group II patients showed moderate cellularity composed of polymorphous population of lymphoid cells, few macrophages against a fibrinous and hemorrhagic background which confirmed reactive cervical lymph nodes. In Group III patients showed clusters and sheets of malignant cells having enlarged pleomorphic and hyperchromatic nuclei and moderate amount of eosinophilic cytoplasm in a hemorrhagic background which confirmed metastatic cervical lymph nodes. The sensitivity and specificity of greyscale ultrasonography in differentiating reactive cervical lymph nodes from metastatic cervical lymph nodes using six parameters were for size 86.1% and 68.8% respectively, for shape 92.2% and 86.5% respectively, for border 96% and 97% respectively, for hilum 100% for both the lymph nodes and for internal echogenicity 77% and 100% respectively, for intranodal necrosis 41.2% and 100% respectively. This results which is comparable with report given by Rajalakshmi et al. [9]

CONCLUSION

Ultrasonic features such as round shape, sharp nodal borders, absence of hilar echo, hyperechoic internal echogenicity and intranodal necrosis were highly suggestive of metastatic lymph nodes. FNAC can be used as a diagnostic modality for metastatic lymph nodes. This study helps to differentiate the reactive cervical lymph nodes from the metastatic lymph nodes by using Grey scale ultrasonography which was confirmed by Fine Needle Aspiration Cytology procedure. Thus, the early intervention and proper treatment planning can be implemented at the earliest.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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