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Original Article

Evaluation of cervical lymphadenopathy by ultrasound in comparison with FNAC

Sindhoori Komma^a, Munirathna.N^b, TN Suresh^c, Purnima Hegde^d, Navin Kumar^e

Professor, Radiodiagnosis, Sri Devaraj Urs Medical College, Kolar, Karnataka. pin code-563101

Professor, Pathology, Sri Devaraj Urs Medical College, Kolar, Karnataka pin code-563101

Professor & HOD, Radiodiagnosis, Sri Devaraj Urs Medical College, Kolar, Karnataka. pin code-563101

Associate Professor, Radiodiagnosis, Sri Devaraj Urs Medical College, Kolar, Karnataka pin code-563101

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ABSTRACT

AIMS AND OBJECTIVES: 1. To study and differentiate neoplastic (malignant) and nonneoplastic (reactive and tubercular) cervical lymph nodes by High resolution ultrasonography. 2. To correlate the diagnostic accuracy of ultrasound with FNAC in differentiating neoplastic (malignant) and nonneoplastic (reactive and tubercular) cervical lymphadenopathy. **MATERIAL AND METHODS:** Data was collected from a total of 83 cases referred for ultrasound of neck to the Department of Radiodiagnosis, Sri R.L. Jalappa Hospital and Research Center over a period of 16 months from December 2011 to April 2013, with 5-10 MH linear transducer using SEIMENS G 40 / G 50 / Acuson Ax 300 ultrasound equipment. 90 Lymph nodes were assessed using grey scale and colour Doppler parameters like: nodal level and site, nodal size, nodal Shape, nodal L/S ratio, nodal border, nodal hilum, nodal echotexture, nodal necrosis, nodal matting and nodal angioarchitecture [hilar vessels, focal absence of perfusion, capsular vessels (peripheral), displacement, mixed flow]. A provisional diagnosis was suggested after the ultrasound examination and these findings were correlated with Fine Needle Aspiration Cytology / Histopathological findings. **RESULTS:** A our study out of 41 non neoplastic nodes (reactive and tubercular) only 37 nodes were identified as nonneoplastic (reactive / tubercular) on ultrasound prior to FNAC / histopathology. Out of 49 possible neoplastic (malignant nodes) detected on ultrasound only 38 lymph nodes turned out to be neoplastic on FNAC / histopathology. Lymph node with oval shape (L/S ratio > 2) echogenic hilum, homogenous echotexture and hilar vascularity were considered as significant parameters in detecting non neoplastic (reactive) lymph nodes, which showed matting with soft tissue edema were considered nonneoplastic lymph nodes (tubercular lymph nodes). Nodes which were Round shape (L/S ratio < 2), absent hilum, heterogeneous echotexture, capsular vessels, mixed vessels, displacement of vessels and focal absence of perfusion were considered as significant parameters in detecting neoplastic (malignant) lymph nodes. Correlation of sonographic findings with Fine Needle Aspiration Cytology / Histopathological findings. Sensitivity and Specificity of ultrasound in differentiating neoplastic from non neoplastic cervical lymphadenopathy was found to be 90% and 74% respectively. **CONCLUSIONS:** This study concludes that: 1) High resolution ultrasonographic examination proved as a valuable primary investigation to identify lymph nodes and differentiate nonneoplastic and neoplastic lymphadenopathy. 2) Combination of ultrasonographic features and vascular pattern of the lymph nodes have a high sensitivity, specificity in differentiating neoplastic and non neoplastic lymphadenopathy.

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DISCUSSION

The present study is done to show the high resolution ultrasonography, colour and power Dopplers efficacy and usefulness in differentiating malignant, tubercular and reactive cervical lymphadenopathy.

The diagnosis of metastatic lymph nodes helps in therapeutic planning, as the presence or absence of metastasis also helps in planning treatment, risk of recurrence and the survival.

Ultrasound is preferred over CT and MRI in evaluation cervical lymphadenopathy because

* Corresponding Author : **Dr Sindhoori komma,**

Post graduate department of Radiology,

Sri Devaraj Urs Medical College,

Kolar, Karnataka. pin code-563101

Email address- sindhoorikomma@gmail.com.

1. In differentiating benign and malignant lymph nodes the size cannot be considered as sole criteria.
2. The presence of central nodal necrosis is thought to be one of the most specific sign of metastatic involvement with a specificity of 95% - 100%. In CT the nodal necrosis is observed as central low attenuation. The infection and other causes can also appear as a central nodal necrosis in CT.⁵
3. CT sometimes cannot detect cervical lymph nodes that are smaller than 0.5cms as most cervical nodes are aligned with their long axis parallel to the long axis of the body and because CT demonstrates only the transverse plane of the nodes in which plane all nodes appears to be round.⁶
4. Increased fatty deposition in the lymph nodes of the elderly can appear as central nodal necrosis in the CT.
5. Finally, CT and MRI are expensive and not readily accessible for repeated use during follow up of the patients.

Ultrasonography is cost effective, easily available, radiation free, non invasive, safe and is primary investigation to differentiate malignant, tubercular, and reactive cervical lymphadenopathy.⁵ Ultrasound examination of the lymph nodes can be done in all planes so that exact nodal size and shape can be evaluated.⁷

The criteria considered in this study to evaluate the differentiation between benign and malignant cervical lymphadenopathy are :

1. Level and site
2. L/S ratio
3. Nodal border : sharp / unsharp
4. Hilum : widened / narrow / absent
5. Echotexture: Homogenous / heterogenous
6. Necrosis : cystic / central
7. Matting.
8. Angioarchitecture: hilar vessels, focal absence of perfusion, capsular vessels (peripheral), displacement, mixed flow.

Ultrasound correlation with FNAC / histopathology:

In a study done by Danniger et al⁸ Ultrasonography sensitivity and specificity for detecting malignant nodes was 96% and 69% respectively.

In another study done by Ahuja et al⁹ sonographic sensitivity and specificity was 95% and 83% for characterization of cervical lymph nodes.

Ahuja et al¹⁰ concluded that ultrasound was 95% sensitive and 83 % specific for classifying metastatic / non metastatic lymph nodes.

On USG 49 lymphnodes were malignant, 16 were tubercular and 25 were reactive lymphnodes.

On FNAC/ histopatholgy 42 lymphnodes were malignant , 23 were tubercular and

25 were reactive lymphnodes

In our study out of 90 nodes , 41 non neoplastic nodes (reactive and tubercular) only 37 nodes were identified as on ultrasound prior to FNAC/histopathology. Out of 49 possible malignant nodes detected on ultrasonography only 38 lymph nodes turned out to be neoplastic (malignant) on FNAC/ histopathology . There was a slight amount of over diagnosis by our study particularly with regard to neoplastic (malignant) nodes. The reason for this was mainly due to inclusion of all grey scale and colour Doppler parameters in diagnosis of neoplastic (malignant) and nonneoplastic nodes (reactive and tubercular) cervical lymphadenopathy. Certain parameters like cystic / central necrosis and borders were considered as not significant parameters at end of study.

In our study the Ultrasonography sensitivity, specificity, positive and negative predictive values are 90%, 74%, 77% and 92% respectively for differentiating neoplastic from non neoplastic cervical lymphadenopathy.

Thus our study Confirmed the reliability of ultrasound sensitivity and specificity in evaluating cervical lymph nodes on ultrasound as reported in literature.

SHAPE AND L/S RATIO

In one study done by Vasallo et al⁴, out of the 26 benign/ reactive nodes, 85% showed L/S ratio >2 and 15% showed L/S ratio <2. Of 68 malignant nodes 85% of nodal metastasis showed L/S ratio <2 and 15% were L/S ratio >2.

In another study done by Na DG et al¹¹, in 64 malignant lymph nodes, 85% of the nodes showed L/S ratio < 2 and 15% were L/S ratio >2.

Toriyabe et al¹² 68% of reactive/ benign lymph nodes are S/L < 0.6 (oval) and in 81 % of malignant lymph nodes are more round in shape S/L > 0.6

In our study 79% of malignant nodes showed L/S < 2, 80% of reactive nodes showed

L/S > 2 and 60% of tubercular nodes showed L/S < 2, the p value for the L/S ratio was 0.001, which showed the association to be highly significant

LYMPH NODE BORDER- sharp and unsharp border.

Ahuja et al² Sharp borders in malignancy is due to the infiltrating tumour cells which replaces normal lymphoid tissues and it causes an increasing acoustic impedance difference between lymph nodes and surrounding tissues where as unsharp borders in malignant nodes indicate invasion into adjacent structures. But in benign because of edema or active inflammation of the surrounding

tissues, they will have unsharp borders. In their experience, border sharpness is not helpful in differential diagnosis.

In our study out of 42 malignant nodes 22(52%) shows sharp border, out of 25 reactive 17 (68%) shows unsharp border, out of 23 tubercular 16 (69%) shows unsharp border. In this study the p value for the border was 0.09, which showed the association to be not significant.

LYMPH NODE HILUS – Widened, Narrow and Absent:

In malignancy/metastases infiltration of the malignant tissue result in early distortion of internal nodal architecture with invasion of hilum, resulting in narrowing or absence of hilum. In case of reactive nodes pathogen reaches nodal cortex in early stages induces lymphocyte proliferation and if inflammatory stimulus still persists, causes formation of new germinal centre resulting in widening of hilum.

In one study done by Vasallo et al⁴, 26 of benign nodes 58% showed a wide central hilus, 35% showed a narrow hilus and 8% no hilus. Of 68 Malignant nodes only 6% of nodal metastasis exhibited a wide central hilus, 48% exhibited no hilus and 46% of malignancies/metastasis showed narrow hilus.

In our study 83% of malignant nodes showed absent hilus, 12% of malignant nodes showed narrow hilus, 64% of tubercular nodes showed absent hilus, 21% with narrow hilus, 48% of reactive nodes showed wide hilus. The p value <0.01 shows significant association.

ECHOTEXTURE OF THE LYMPH NODES- homogenous and heterogenous :

In one study done by Toriyabe et al¹², 17 of 19 nodes showed heterogeneous echotexture were proved as malignant and 30 out of 33 lymph nodes which are homogenous echotexture were proved benign/reactive by histopathology study.

Our study shows 84% of reactive lymph nodes are homogenous and 73% of the malignant lymph nodes are heterogeneous correlating with previous study.

The p value for this criterion was 0.0015, which showed the association to be significant.

INTRANODAL NECROSIS (Cystic & Central / Coagulation) :

Intranodal necrosis may be seen as a cystic (cystic or liquefaction necrosis) or echogenic (coagulation necrosis) area within the node. Cystic necrosis is the more common form of intranodal necrosis which appears as an echolucent area within the nodes. Coagulation necrosis is a less common sign, and appears as an echogenic focus within lymph nodes but is not continuous with the surrounding fat and does not produce acoustic shadowing. Intranodal necrosis may be found in metastatic and tuberculosis nodes, and regardless of nodal size, the presence of intranodal necrosis should be considered pathologic².

In our study, out of 90 nodes 35 showed necrosis. 28 nodes showed cystic necrosis of which 17 were malignant and 8 were tubercular. 8 nodes showed central (coagulative) necrosis and all of them were malignant (100%). In our study 40% of malignant nodes showed cystic necrosis which were all malignant on FNAC correlation. whereas 40% of tubercular nodes showed cystic necrosis.

Benign/reactive nodes showed 12% cystic necrosis. The p value for this criterion was 0.083, which showed the association to be not significant.

MATTING :

Ying et al¹² stated that Matting is the important criteria to diagnose tubercular lymph nodes. Because of the soft tissue edema surrounding the affected lymph nodes results in matting of the lymph nodes.

Ahuja et al⁹ stated that matting and adjacent soft tissue oedema are common in tuberculous nodes, however they can be seen rarely in malignancy.

In our study out of 90 nodes 16 showed matting all of which are tubercular (100%). Reactive and malignant lymph nodes show no matting.

VASCULAR PATTERN:

Hilar vascular pattern :

Benign / Reactive nodes tend to have a prominent hilar vascularity due to increase in the vessel diameter and blood flow as the infection progresses.

In a study done by NaDG et al¹¹, 97% of benign / reactive and 18% of malignant lymph nodes showed hilar vessels.

In our study of 90 lymph nodes: Malignant 10%, tubercular 13% and reactive 76% showed hilar vessels. The p value for this criterion was less than 0.01, which showed the association to be very significant.

Capsular (Peripheral) Flow :

In a study done by Na DG et al¹¹ there is peripheral vascularity with loss of central nodal vascularity in tubercular nodes (24%) and metastatic (6%).

Our study shows malignant (8%) and tubercular (17%) lymph nodes showed only capsular vascularity which was statistically significant.

Mixed vascular pattern:

In our study of 90 lymph nodes : malignant 76%, reactive 8% and tubercular 60% showed mixed vascularity. The p value for this criterion was less than 0.001 showed the association to be statically significant.

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In a study done Na DG et al 11 85% of malignant and 76% of tubercular nodes showed mixed vascular pattern

This mixed vascularity flow is usually seen in tubercular and more of malignant nodes.

Limitations of Doppler:

According to Na et al 11 It is very difficult to detect superficially located, slow flow signals,

There is significant overlap in Doppler findings between inflammatory nodes, tubercular and neoplastic nodes.

It is difficult to obtain Doppler spectral wave forms in non cooperative patients.

CONCLUSION

THIS STUDY CONCLUDES THAT:

1. High resolution Sonographic and color Doppler examination proved as a valuable primary investigation to identify lymph nodes and helps to differentiate neoplastic (malignant) and non neoplastic (reactive and tubercular) lymph nodes
2. Ultrasound evaluation proved as a radiation free, cost effective, noninvasive and safe method for cervical lymphadenopathy.
3. Ultrasound evaluation is very sensitive in differentiating between cystic / necrotic foci and solid swellings.
4. Adjacent soft tissue edema and matting are particularly useful to identify Tuberculosis, as malignant and tubercular lymph nodes almost same characteristics expect matting.
5. Ultrasound helps in identifying abnormal nodes and useful for guided FNAC.
6. Finally all ultrasound diagnosis must be correlated with FNAC/histopathology study not only to determine whether the nodes are malignant, reactive, tubercular, nodes and also to determine the histology of the neoplasm.

At the end of our study we present evaluation criteria that help for differentiating Nonneoplastic and neoplastic cervical lymph nodes:

1. Grey scale findings of size, shape, long axis/ short axis ratio, nodal Echogenic hilum, lymph node Echogenicity, matting and nodal necrosis.
2. Doppler findings of focal absence of perfusion, capsular vessels, displacement, hilar vascularity and mixed vascularity.

PHOTO GALLERY

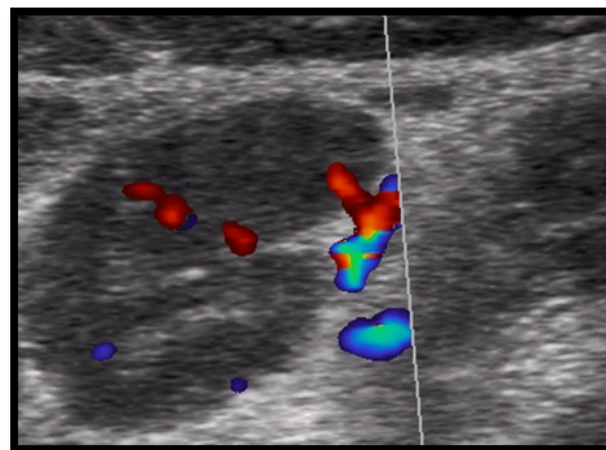


Image 1 : 15yrs old male presented with swelling in neck

On usg at level I an oval lymph node with maintained Hilum and hilar vascularity suggestive of reactive lymph node confirmed on FNAC.

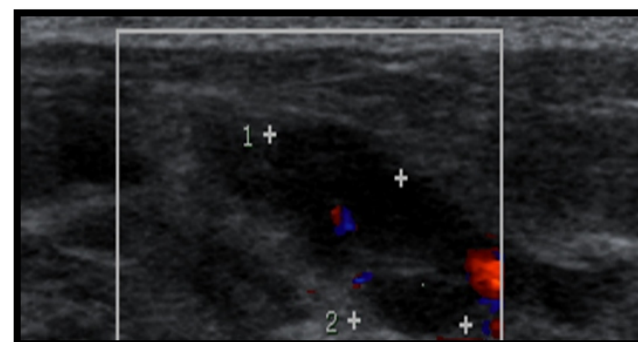


Image 3 : 18 yrs old male presented with swelling in neck

On usg at level I oval lymph node with maintained Hilum and increased hilar vascularity suggestive of reactive lymph node confirmed on FNAC.

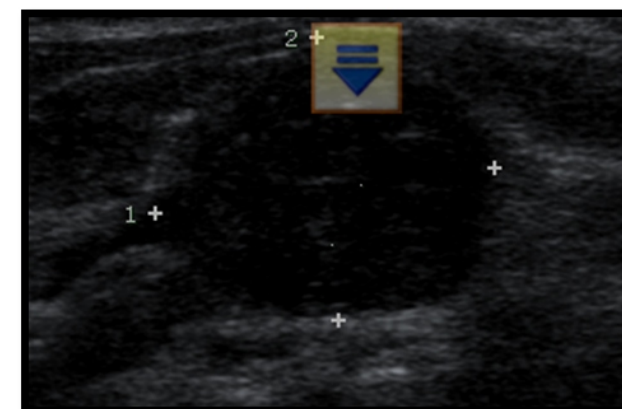


Image 4- 57yrs old male known case of ca of buccal mucosal mucosa on USG at level III an enlarged round lymphnode with absent hilum , sharp borders, heterogeneous echo texture and cystic necrosis (arrow)- suggestive of metastatic lymph node proved on FNAC.

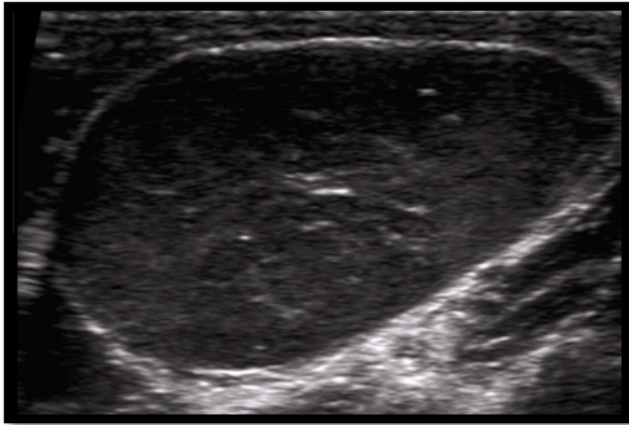


Image 5 : 15yr old male ,Known case of lymphoma onUSG there is enlarged level I lymph node with absent hilum , sharp borders and heterogeneous echo texture proved on histopathology

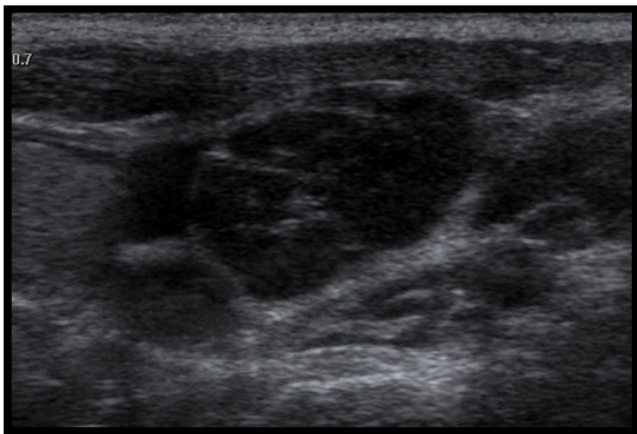


Image 6 : 19 yr old male ,Known case of lymphoma on USG there is enlarged level II round lymph node with absent hilum , sharp borders and heterogeneous echo texture proved on FNAC .

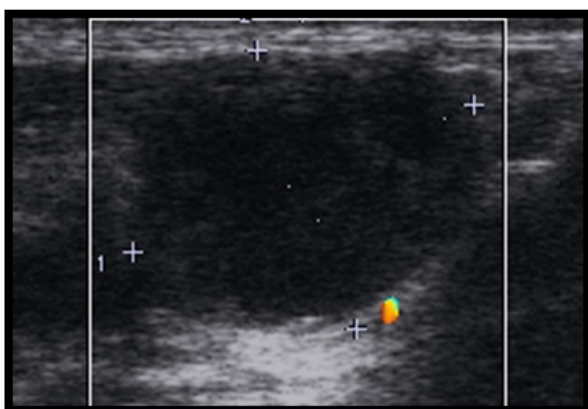


Image 7- 42 yrs old male with swelling in neck on USG at level IV an enlarged round lymphnode with absent hilum , illdefined border with extracapsular spread heterogeneous echo texture and cystic necrosis (arrow)- suggestive of metastatic lymph node proved on USG guided FNAC.

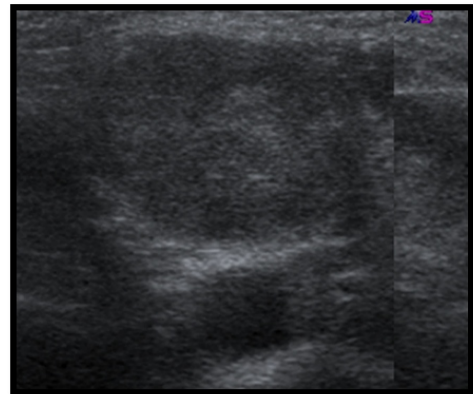


Image 8- 52 yrs old male known case of papillary ca of thyroid on USG at level II an enlarged round hyper echoic lymphnode with absent hilum , sharp borders, heterogeneous echo texture and coagulative necrosis (arrow)- suggestive of metastatic lymph node proved on histopathology.

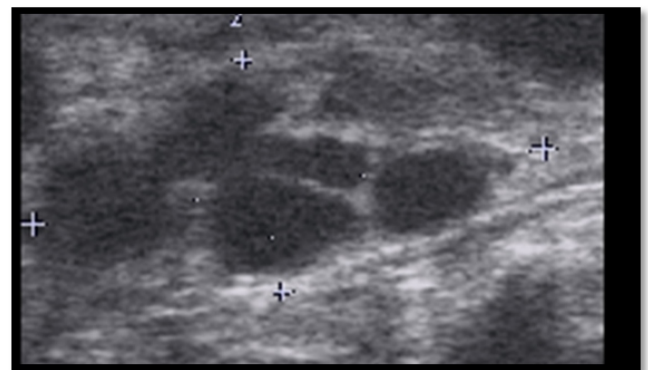


Image 9- A 40 yrs old female with swelling in neck on USG at level V there are multiple enlarged lymph nodes with matting and adjacent soft tissue edema - suggestive tubercular lymphadenopathy proved on FNAC

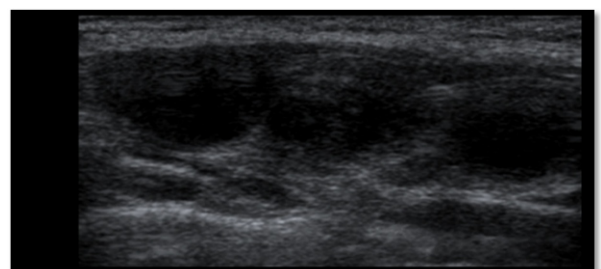


Image 10 - A 35yrs old female with swelling in neck on USG at level IIthere are multiple enlarged lymph nodes with matting and adjacent soft tissue edema - suggestive tubercular lymphadenopathyproved on USG guided FNAC

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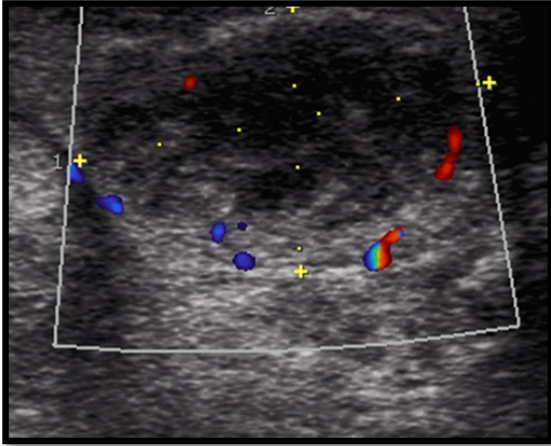


Image 11- 52 yrs old male a known case of ca of buccal mucosa on USG at level III an enlarged round hyper echoic lymphnode with absent hilum , sharp borders, heterogeneous echo texture and capsular vascularity (peripheral vascularity)- suggestive of metastatic lymph node proved on histopathology.

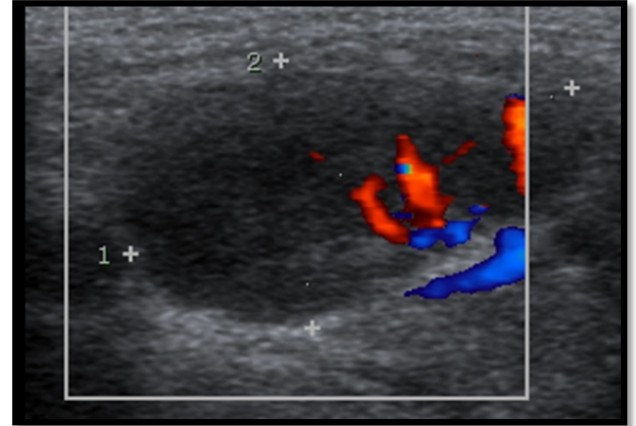


Image 2 :65 yrs old male presented with swelling in neck On USG oval lymph node with maintained Hilum and hilar vascularity suggestive of reactive lymph node but on FNAC it was proved to be malignant.

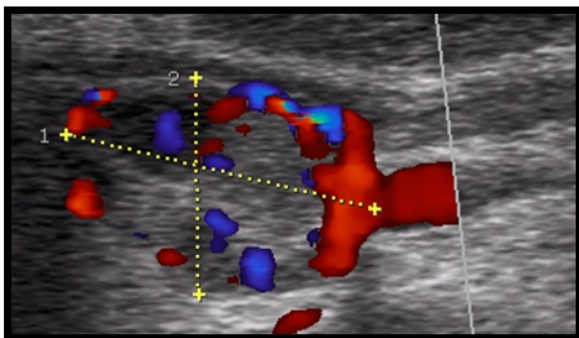


Image 13- Tubercular lymph node with absent hilum showing capsular and hilar vascularity (mixed) on Doppler evaluation.

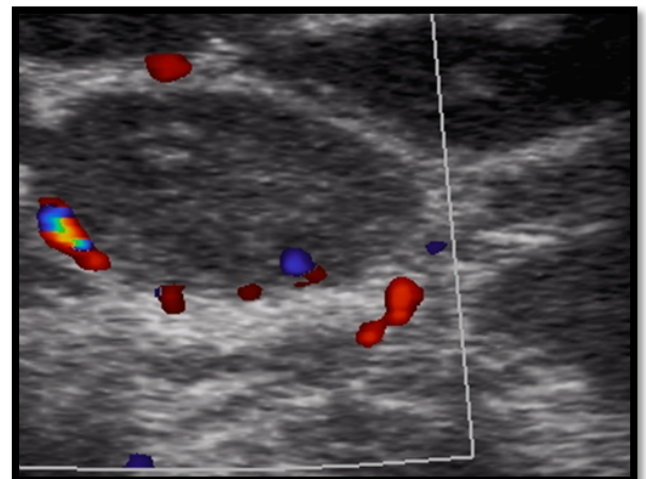


Image 12- 24 yrs old male with swelling in neck on USG at level II an enlarged round hyper echoic lymphnode with absent hilum , sharp borders, heterogeneous echo texture and capsular vascularity (peripheral vascularity)- suggestive of metastatic lymph node on histopathology it was proved to be reactive.

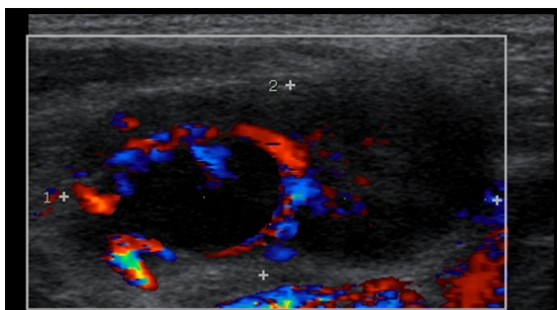
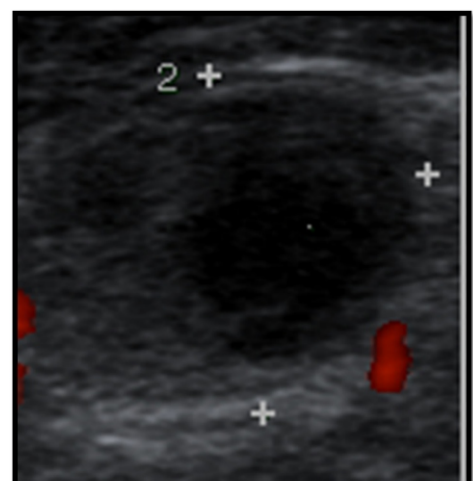


Image 14- Tubercular lymph node with absent hilum and cystic necrosis showing Mixed vascularity with focal absence of perfusion and displacement of hilar vessels on Doppler evaluation.



CONCLUSIONS:

Image 13 65yrs old male with neck swelling on USG at level V there was an enlarged round lymphnode with hetrogenous echotexture and cystic necrosis with no matting on usg, thought to be malignant but proved as tubercular lymphadenitis on FNAC.

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