

The Reliability of Ultrasonography in Neck Masses Evaluation.

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Abstract: The diagnosis of neck masses has long been a challenge to radiologists. Many small but critical structures pass from the head to the thorax through a region that is compact, yet remarkably flexible, i.e., the neck. A thorough understanding of the gross anatomy of the neck is needed to communicate findings precisely & generate meaningful differential diagnosis. High resolution B-mode sonography has improved and has become a very valuable tool in the diagnosis of neck masses. Sonography is commonly the first imaging modality after clinical examination as it is cost effective procedure. It provides valuable diagnostic information with high degree of diagnostic accuracy. Ultrasound is also useful in all needle aspirations, since it can guide the position of needle in relation to lesion. Ultrasound is an ideal modality for evaluating a palpable paediatric neck masses as it is non-invasive procedure, has no radiation, requires no sedation or intravenous contrast, it is easily accessible and can be helpful in characterizing congenital, inflammatory, vascular, and neoplastic lesions. In our study, we describe the usefulness and reliability of sonographic findings combined with FNAC findings for the selection of additional imaging modalities like CT & MR which can be applied more judiciously.

Keywords: B-mode: Brightness mode, FNAC: Fine needle aspiration cytology, CT: Computed tomography, MR: Magnetic resonance imaging.

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I. Introduction

Various modalities for the evaluation of neck masses are described in the literature by many authors i.e X-ray, Ultrasound, Doppler, CT, MRI and Scintigraphy. Ultrasound has achieved wide clinical use over the past half century. The equipment used has evolved from large expensive B-mode gantry systems with coarse, static, bi-stable displays, which only demonstrated organ boundaries, to convenient handheld machines with high resolution, real-time imaging with colour Doppler facility making use of digital technology.

Ultrasound: Detection of the nature of lesion, either solid, cystic or mixed. We can identify the location of the mass, confirm whether the lesion is solid or cystic and also detect non palpable masses. Differentiation of benign and malignant lesions is possible. It is useful for guiding FNAC.

Doppler: It is helpful to differentiate benign and malignant lesions by their flow pattern. Malignant lesions have peripheral / mixed vascularity with high RI (Resistive Index) and PI (Pulsatility Index) values. It is useful for confirmation of vascular tumors. In this study Ultrasonographic assessment is considered as an initial investigation of choice in investigating neck masses. Literature has been generated about the utility of ultrasound in assessing the neck masses and effective next step in proper assessment, also it is found to be non-invasive and repeatable, more reliable and economic and can be used as a primary investigation of choice in neck mass evaluation.

Review of Literature:-

Imaging plays an important role in the diagnosis of neck masses and subsequent management. High-resolution ultrasound is the ideal initial imaging modality of choice as diagnosis can be made in most cases, and cross-sectional imaging such as magnetic resonance imaging and computed tomography serve a supplementary role. Thyroid nodules are common and occur in up to 50% of the adult population; however, less than 7% of thyroid nodules are malignant. High-resolution ultrasonography is commonly used to evaluate the thyroid gland, but Ultrasound is frequently misperceived as unhelpful for identifying features that distinguish benign from malignant nodules. Micro-calcifications are one of the most specific ultrasonography findings of a thyroid malignancy. Other useful Ultrasound features include a marked hypo-echogenicity, irregular margins, and the absence of a hypoechoic halo around the nodule. Lymphadenopathy and local invasion of adjacent structures are highly specific features of thyroid malignancy but are less commonly seen.

Ultrasound is capable of documenting tumor size, location and relationship to the adjacent structures. It also demonstrates routes of tumor spread and provide clues supporting a specific diagnosis. A thorough knowledge about normal cross sectional anatomy of the neck and meticulous tomographic technique are mandatory. The examination should be planned on the basis of the clinical presentation. Intravenous contrast material given as a rapid infusion during the examination provides the best enhancement of the vessels, and thereby improves recognition of key vascular structures. Colour Doppler ultrasound is also helpful in preoperative diagnosis of parathyroid adenoma in patient with hyperparathyroidism, the sensitivity and specificity of ultrasonography in detection of parathyroid adenoma and differentiating it from other cervical masses reached up to 97% and 100% respectively by combining colour Doppler ultrasonography with grayscale evaluation of parathyroid adenoma. Considering these backgrounds, we have done the present study “The reliability of Ultrasonography in Neck Masses evaluation” in the department of Otorhinolaryngology, Guntur Medical College, Guntur.

II. Material And Methods

A total of 100 patients with neck masses referred from ENT OP / General surgery OP with neck masses were subjected to ultrasonography along with FNAC in our institute for over 2 year period (2015 to 2017) were included in the study. Patients with neck masses are evaluated on outpatient basis and admitted as and when necessary between the age groups 1yr to 70yrs. Only those who are willing for follow-up for a period for 6 months were included. Patients with previous neck surgery and who are not willing for follow-up were excluded. Cases selected for study were subjected to detailed history, clinical and radiological examination. They are assessed and followed subjectively and objectively by ultrasonography. The procedure of ultrasonography is explained to the patient to make him relax and cooperative to examiner while performing ultrasound. Those selected patients who need neck surgery and underwent surgery will be followed up for a period of six months with USG for identification of any residual disease. The role of USG in the diagnosis of various neck masses was evaluated and the outcome of USG in the management of neck masses is shown in this study. High resolution ultrasound examination of neck was done by 7.5MHz linear array transducer on **ESAOTE SA 250A**. On ultrasound examination, the patients were thoroughly examined to localize the mass and confirm the nature of mass, either solid, cystic or mixed. The size, shape of the lesion and its relation to adjacent structures noted. Note of normal structures and any other non-palpable lesions is done. Presence of calcification, necrosis in solid lesions, septations, debris or solid areas in cystic lesions is documented. The findings of ultrasound were compared with FNAC/Histopathology.

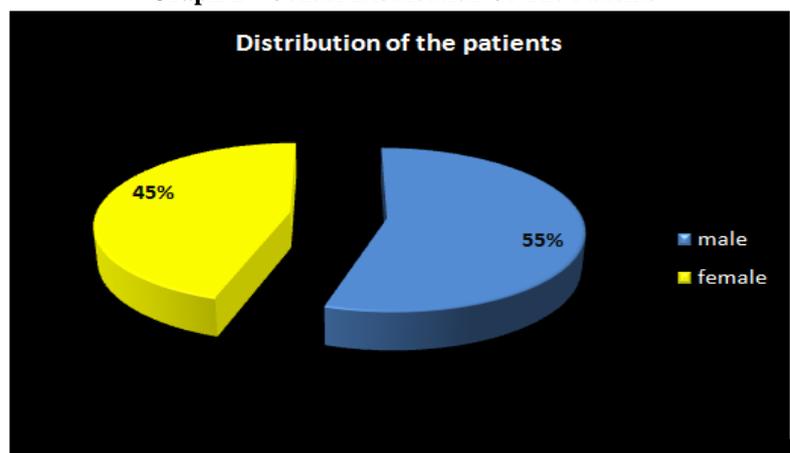
III. Results

Table 1: Distribution Of Patient As Per Age Categories

Years	Male(N)	Female(N)	Percentage%
<1	6	4	10
1-20	10	8	18
21-40	20	16	36
41-60	9	10	19
61-80	10	7	17

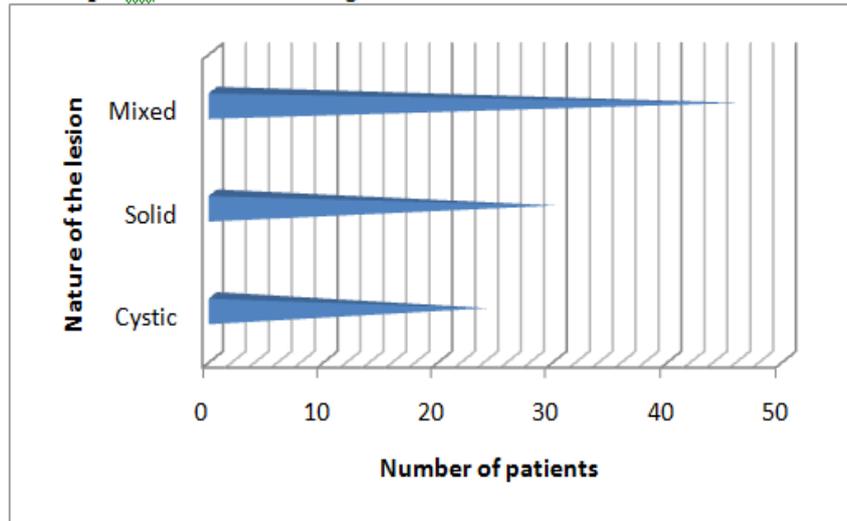
Out of 100 patients, most common age group was 21-40 years and next common age group was 41-60 year old.

Graph 1 - Gender Distribution Of The Patients



In this study, 55 patients were males and 45 patients were females.

Graph 2 : Ultrasonic Findings And Nature Of The Lesion In 100 Patients

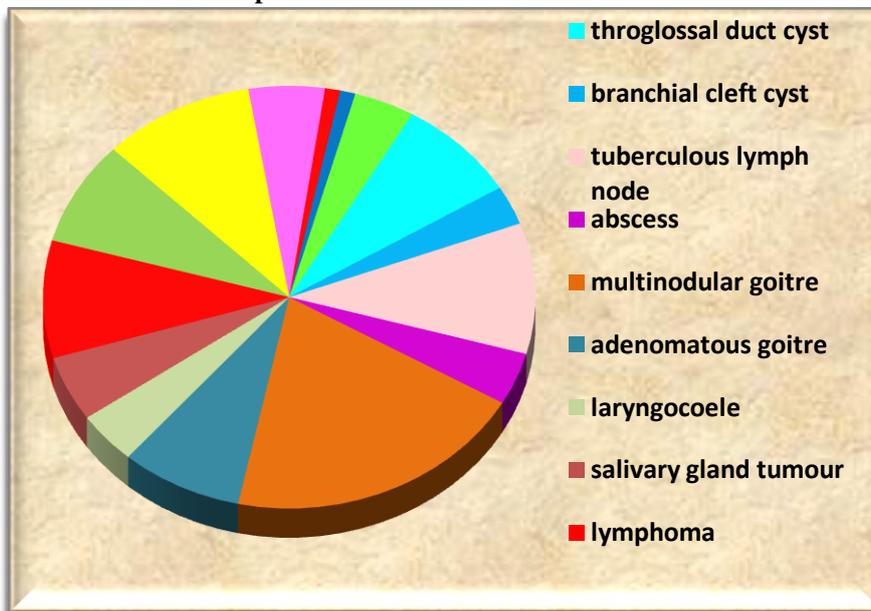


Out of the 100 patients, mixed echogenic lesion was commonest type.

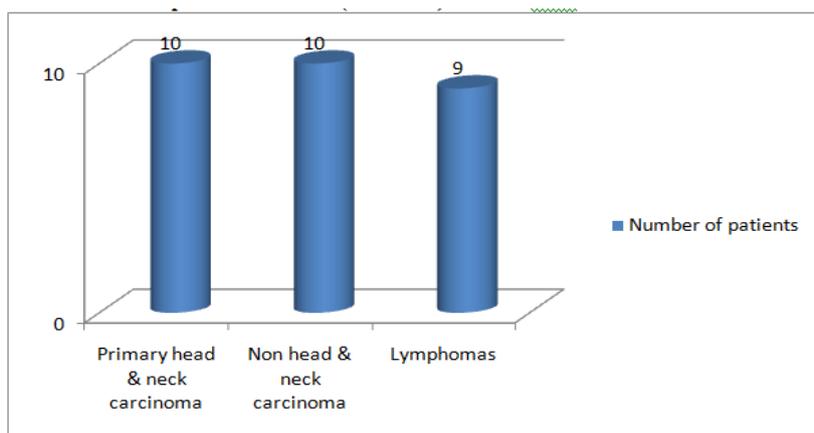
Table 2: Individual Lesions On Ultrasound

S.No	Type Of Lesion	No. Of Patients
1	Thyroglossal Duct Cyst	8
2	Branchial Cleft Cyst	3
3	Tuberculous Lymph Nodes	10
4	Abscess	4
5	Multinodular Goitre	20
6	Adenomatous Goitre	8
7	Laryngocoele	4
8	Salivary Gland Tumour (Pleomorphic Adenoma)	5
9	Lymphoma	9
10	Carcinoma Thyroid	8
11	Metastasis	10
12	Cystic Hygroma	5
13	Paraganglioma	1
14	Neurogenic Tumour	1
15	Lipoma	4

Graph 3: Individual Lesions On Ultrasound



Graph 4: Involvement (Metastasis) Of Neck from Various Sites

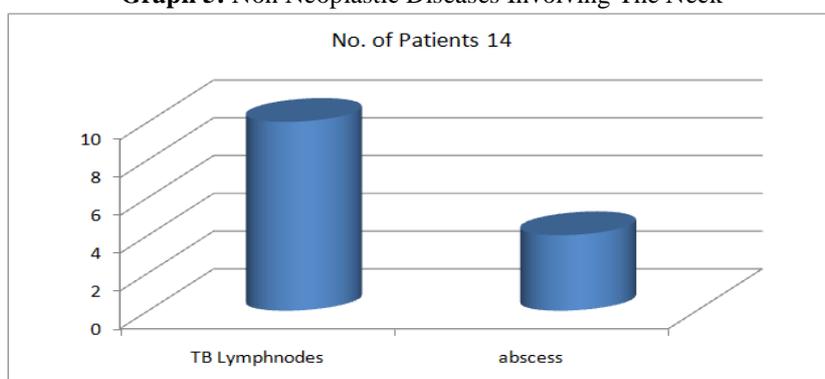


Neck masses secondary to head and neck carcinoma were seen in 10 patients and another 10 patients (6 carcinoma of stomach, 3 carcinoma of bronchus and 1 carcinoma of testis) presented with left supraclavicular neck mass. 9 patients had neck masses as a part of lymphoma.

Table 3: Non Neoplastic Diseases Involving The Neck

S. No.	Site Involved	Number Of Patients
1	Tuberculous Lymph Nodes Of Neck	10
2	Abscess Of Neck	04
	Total	14

Graph 5: Non Neoplastic Diseases Involving The Neck



Non Neoplastic diseases with involvement of neck were seen in 14 patients, out of these, 10 patients had Tuberculosis with neck nodes and 4 patients had Abscess with neck involvement.

Table 4: Differentiation of Tuberculous And Metastatic Nodes On Ultrasound

S.No	Us Feature	Remarks	Tuberculous Nodes	Metastatic Nodes
1	Shape	Round	7	10
		Oval	3	-
2	Soft Tissue Edema	Present	10	-
		Absent	-	10
3	Intra Nodal Necrosis	Present	7	10
		Absent	3	-
4	Matting	Present	10	-
		Absent	-	10

Table 5: Ultrasound Features Of Metastatic And Non Metastatic Lymph Nodes

S.No	Ultrasound Feature	Remarks	Non Specific L.N	Tuberculous L.N	Lymphomatous L.N	Metastatic L.N
1	Shape	Round	-	7	9	10
		Oval	3	3	-	-
2	Echogenic Hilum	Present	3	-	-	-
		Absent	-	10	9	10
3	Calcification	Present	-	-	-	-

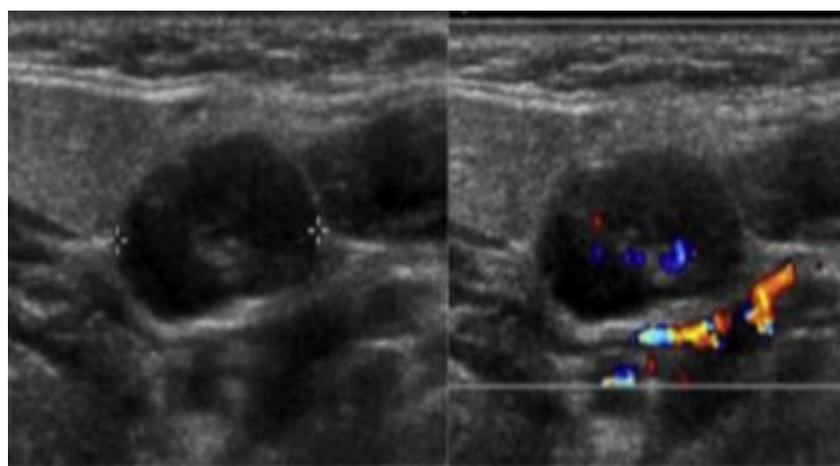
		Absent	3	10	9	10
4	Necrosis	Present	-	7	-	10
		Absent	3	3	9	-

Nonspecific lymphadenopathy showed an echogenic hilum and an oval shape. Tuberculous nodes were rounded in 7 cases, without echogenic hilum and no calcification. Lymphomatous nodes were rounded, with no areas of necrosis/calcification/echogenic hilum. Metastatic nodes were rounded, without echogenic hilum / calcification they had areas of intra-nodal necrosis. The Other investigations like CT-scan of neck is carried out in 15 patients, where in 10 patients had metastases and showed features of rounded shape, intra nodal necrosis, give the accurate level lymphadenopathy which helped in staging the disease. CT helped to localize the primary site of involvement in 5 patients. One case had branchial cleft cyst and CT showed a cystic lesion with good delineation of the extent of the lesion. Of the 10 patients who underwent MRI, 5 patients had cervical and mediastinal adenopathy which were hypointense on T1WI and hyperintense on T2WI, confirming that they are of tuberculous origin and also gave the extent of disease. The other 5 patients had lymphangioma and MRI was done to delineate the extent of disease.

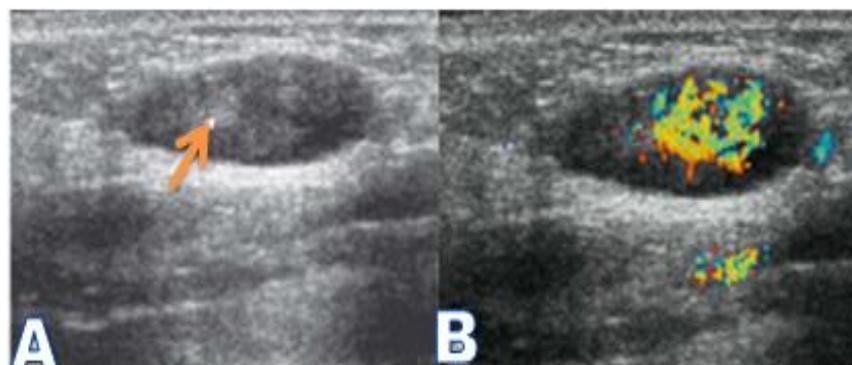
IV. Discussion

In this prospective study of 100 patients with neck masses, all underwent ultrasonography examination after thorough clinical examination and routine blood investigations. The patients in the age group between 1yr to 70 years of both genders are included and these patients were evaluated by ultrasound and correlation of ultrasound findings with FNAC was done. Some patients were further evaluated with CT and MRI. On ultrasound the nature of lesions ranged from solid, cystic and cystic to mixed. 30 patients had solid nature of neck mass, 24 patients with neck masses showed cystic in nature, 46 patients showed mixed pattern. Most of the cases were unilateral neck masses i.e., unilateral masses were seen in 46 patients, bilateral neck masses in 36 patients and midline masses in 18 patients. Out of 100 cases, multiple neck masses were predominant and seen in 57 patients and solitary neck masses seen in 43 patients. In this study, the most common neck mass is multinodular goitre in 20 patients. In multinodular goitre thyroid hyperplasia is the most common abnormality encountered (44%). Hyperplasia is recognized as either a diffuse or nodular form. The nodules are separated by normal parenchyma and are mostly isoechoic or hyperechoic with well-defined margins. Diagnostic pit falls include cystic or calcified lymph node metastases adjacent to the thyroid gland may be mistaken for benign nodule in multinodular thyroid disease. Incomplete rim of thyroid parenchyma around the mass and lack of movement of the mass with the thyroid gland during swallowing favours extra thyroid lymph nodal metastasis. Next common neck mass were metastases and tuberculous lymph nodes seen in each 10 patients respectively. The features of metastatic lymphadenopathy on ultrasound are rounded shape, sharp borders with central areas of necrosis. However in this study metastases had features of rounded shape and showed intra-nodal necrosis. Tubercular nodes showed features of soft tissue oedema and matting in all 10 cases. Features like round shape and intra-nodal necrosis were seen in only 7 cases. In this study, round shape and intra-nodal necrosis were seen in metastases whereas echogenic hilum and calcification were not seen in metastases.

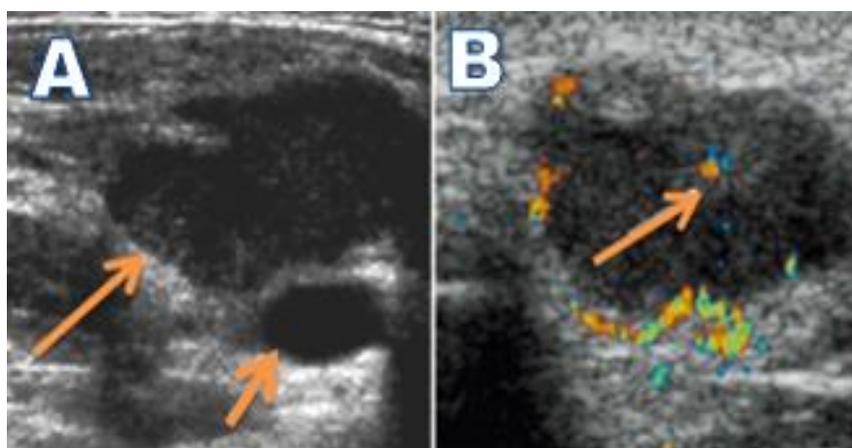
Reactive lymph nodes are typically elongated, oval and have smooth margins, predominantly hypoechoic with an eccentric echogenic fatty hilum. The upper limit of size of a reactive lymph node in the upper jugular chain is 10 mm in the short axis. However, this carries the caveat that in the paediatric population, larger hyperplastic nodes may be encountered.



Normal lymph node on ultrasound: The image on the left demonstrates a normal reniform lymph node, with a central area of hyper echogenicity representing the fatty hilum. Colour Doppler investigation is shown in the image on the right, demonstrating vascular flow in the region of the hilum.



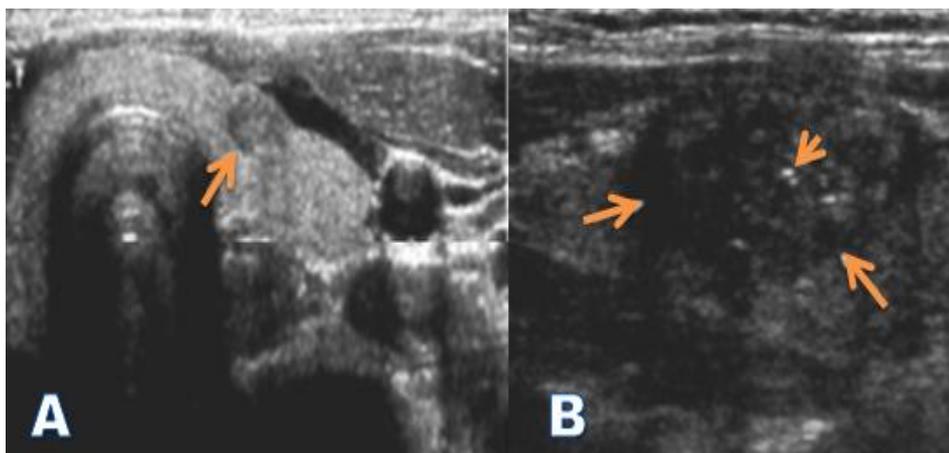
Reactive lymph node: (A) An oval-shaped, low reflective lymph node with an echogenic hilum (arrow), in keeping with a reactive lymph node. (B) Florid colour Doppler flow to the central hilum consistent with a benign reactive lymph node.



Lymph node showing squamous cell carcinoma metastasis: An enlarged low reflective mass with an irregular border (A. long arrow), displacing the surrounding soft tissues, anterior to the carotid artery (A. short arrow), in keeping with a squamous cell metastasis from a primary laryngeal tumour. Lymph node showing adenocarcinoma metastasis: Colour Doppler images of a low-reflective, irregular, rounded lymph node with an eccentric echogenic hilum (B. Arrow), infiltrated by adenocarcinoma.

Inflammatory nodes are enlarged (> 10 mm), round or oval in shape with well-defined borders and in which the hilum is not readily identified. Colour Doppler ultrasound shows hilar vascularization with smooth branching of the intra-nodal vessels. Ultrasound may assess for the presence of an abscess formation (hypoechoic or anechoic area with no colour Doppler flow) within a mass of inflammatory nodes that may require surgical intervention. Assessment of cervical lymph nodes, the number, level in the neck and the presence of extra nodal spread are important prognostic indicators and determine therapeutic options. . Ultrasound imaging has a sensitivity of 84 percent, a specificity of 68 percent and an accuracy of 76 percent in detecting abnormal nodes, improved further with the combination of ultrasound-guided fine-needle aspiration cytology (FNAC) to 97 percent sensitivity and 93 percent specificity.

TDC's (Thyroglossal duct cyst) in this study were most commonly in midline. TDC's are located in the region of the hyoid bone. Contrary to previous reports, we found that TDC's in adults are more likely to be infra-hyoid in location, decreasing in frequency with ascension up the neck, with only small percentage in suprahyoid location none of the TDC's in this study had a solid component. The presence of a solid component should alert the sonologist to the possibility of a TDC carcinoma, as malignant degeneration of the epithelial lining of a TDC (usually into a papillary carcinoma) has been reported as a rare complication.



(A) Solitary thyroid adenoma, a transverse section through the thyroid gland at the level of the thyroid isthmus, with a left lobe solitary adenoma present as a well circumscribed isoechoic lesion (arrow). (B) Papillary cell carcinoma solitary nodule (long arrows) in the right lobe of the thyroid demonstrating an irregular margin and punctate areas of calcification (short arrow).

Carcinoma of thyroid was noted in 8 cases, females are involved with average age of 35 years. On FNAC they proved out to be papillary carcinoma. Salivary gland tumours were noted in 5 cases, on sonography, they have typical appearance as smooth, round, hypoechoic masses with distal acoustical enhancement like pleomorphic adenoma. Neck lipoma was noted in 4 cases, they appeared were well-defined, compressible, elliptical masses with the longest diameter parallel to the skin surface. Neck abscess was noted in 4 cases, dimensions of abscess cavity, amount of pus collected, and depth of the centre of the abscess cavity from the skin surface were recorded. Laryngocoele is noted in 4 cases, the ultrasound study demonstrated a superficial mass, just below the subcutaneous plane, in the right submandibular para-median region, medial to the carotid bulb. Branchial cleft cyst in 3 cases, most branchial anomalies arise from the second branchial apparatus. Paraganglioma is noted in 1 case, neurogenic tumour in 1 case except the 2 patients with Paraganglioma and neurogenic tumour, all other patients had FNAC / histopathological examination. In 93 patients ultrasound findings correlated with FNAC /histopathological findings. Five patients are diagnosed as lymphangioma and FNAC is inconclusive. The patients were not subjected to surgery and hence the follow up is not available.

CT scan: 15 patients had further evaluation with CT, 10 cases had metastases and showed features of rounded shape, intra nodal necrosis, give the accurate level lymphadenopathy which helped in staging the disease. CT helped to localize the primary site of involvement in 5 patients. One case had branchial cleft cyst and CT showed a cystic lesion with good delineation of the extent of the lesion.

MRI: Of the 10 patients with MRI, 5 patients had cervical and mediastinal adenopathy which were hypointense on T1WI and hyperintense on T2WI confirming that they are of tuberculous origin and also gave the extent of disease. Other 5 patients had lymphangioma and MRI was done to delineate the extent of disease.

V. Conclusion

Ultrasonography is a quick and simple procedure. It has a good diagnostic accuracy. It helps to follow up examinations of neck masses. Because of its high resolution and relatively cheap cost, it is valuable in the diagnosis and management of thyroid disorders, it is reliable in differential diagnosis of tumours in the pre-auricular, submandibular area and cheek. It enables precise localization, measurement and assessment of the structure of the lesions. It is very helpful in differentiating between solid and cystic neck swellings. It also differentiates between benign and malignant lesions of salivary glands and thyroid gland. It is very useful in evaluating metastatic lymph nodes cost effectively. It is very useful in detecting the site, extent, consistency and relationship of neck swellings to adjacent structures. Ultrasound guided FNAC is useful in confirming the diagnosis. Hence we conclude that Ultrasound with high resolution probe and FNAC is highly accurate and sufficient to diagnose and manage neck masses. Our study suggested that CT and MRI are required only in selected difficult cases for staging purpose and extension of diseases.

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