EFFICACY EVALUATION OF ULTRASONOGRAPHY AND COMPUTERIZED TOMOGRAPHY IN PALPABLE NECK MASSES

Vijai Pratap[1], S.K. Jain[2], A.K. Choudhary[3], Om Prakash[4]

HOW TO CITE THIS ARTICLE:
Vijai Pratap, SK Jain, AK Choudhary, Om Prakash. "Efficacy evaluation of ultrasonography and computerized tomography in palpable neck masses". Journal of Evolution of Medical and Dental Sciences 2013; Vol. 2, Issue 41, October 14; Page: 7891-7898.

ABSTRACT: There is wide range of pathological neck masses from benign inflammatory conditions to frankly malignant lesions, which may be congenital or acquired. These neck mass may be an incidental finding on the general physical examination. The close proximity of various structures in the neck creates a diagnostic problem. The precise anatomical location and imaging appearances are important for accurate diagnosis and formulating the differential diagnoses of neck masses. Ultrasonography (US) and computed tomography (CT) enable radiological characterization of normal and diseased structures in the neck in ways that were previously not possible. With the advent of high frequency ultrasound (US) probes, superficial structures are visualized very conveniently and with great spatial solution. Ability of CT to give tissue attenuation values gives a fair insight into the nature of the lesion. **AIMS & OBJECTIVE:** In this study we planned to evaluate palpable neck masses with US and CT, and comparing their efficacy. **MATERIAL & METHOD:** The present study was conducted in the Department of Radio-diagnosis, TMMC & RC, TMU, Moradabad. Patients under study were referred from the department of Surgery, ENT, Medicine and Pediatrics. Patients included for study were evaluated by Clinical and Radiological examination .The age range in the present study was from 3 to 80 years and total number of patients were 40 (including both male and females). **RESULT:** 1. On examination distribution of lesions was found to be Inflamatory-17.5%, Developmental- 7.5%, Thyroid masses-30%, Mesenchymal-10%, Neural 5%, Vascular-5%, Bone5%, Lymph nodes-10%, & Salivary gland mass-10%. 2. The Male to Female ratio in the present study = 1.22:1 **CONCLUSION:** Ultrasound complimented coupled with Computed Tomography is of immense help in the diagnosis and better management of palpable neck masses.
KEY WORDS: Ultrasonography, Computed tomography, Malignancy.

INTRODUCTION: A palpable neck mass is a commonly encountered clinical problem. Detailed clinical history and physical examination may clinch the clinical diagnosis. Imaging is increasingly performed to confirm the clinical diagnosis and assess the anatomical extent of involvement before any form of treatment. Although there are overlapping features, differentiation between the lesions can usually be made based on specific imaging findings and relevant clinical information.

High-resolution ultrasound is an ideal initial imaging investigation for neck tumors (1). It is readily available, relatively inexpensive, and does not involve ionizing radiation. Modern ultrasound machines equipped with high-resolution transducers provide excellent spatial and contrast resolution. Ultrasound also has the unique advantage over other imaging techniques in providing reliable, real-time guidance for fine-needle aspiration cytology (FNAC) or core biopsy.

Cross-sectional imaging techniques, such as magnetic resonance imaging (MRI) and computed tomography (CT), serve a supplementary role in work-up of neck masses. Multi detector CT allows precise preoperative anatomical localization, particularly for more deep-seated and

locally extensive lesions; moreover proximity to vital structure such as nerve bundles & the airway necessitates accurate delineation of these masses.

The use of ultrasound (US) for the initial diagnosis of neck masses in adults and children continues to increase. Sonography is an easily available, cost effective modality. However, is it unable to visualize skeletal structures and intrathoracic and intracranial extension of neck lesion. Sometimes it may fail to delineate fascial planes and the extent of large neck masses with respect to surrounding structures. US is useful in differentiating solid from cystic neck lesions in both adults and children, in recording the size of nodes (at least in the upper neck), and in discriminating high-flow from low-flow vascular malformations (2-5).

US is also very helpful for image-guided biopsies of non palpable or small lesions that are relatively superficial and for biopsies of indeterminate soft tissue in the treated neck. Studies have shown that US-guided fine-needle aspiration of lymph nodes can be useful in staging (6, 7). The positive predictive value of this technique is high; however, its negative predictive value and its inability to exclude micrometastases remain problematic issues. Some studies have suggested that color Doppler US can distinguish between metastatic and inflammatory neck nodes (8, 9, 10) Although these results are promising, the results appear to be user dependent. Also, novel techniques such as US elastography are being explored for possible future clinical applications (11).

CT gives a greatly improved soft tissue detail and air space definition. With contrast enhanced scans the vascularity of the lesion as well as its relation to vascular structures can be determined. Also the ability of CT to give tissue attenuation values gives a fair insight into the nature of the lesion. It is most useful for large masses where it can show the entire extent of the lesion in the neck and an extension outside the neck.

Skeletal involvement is also well depicted on CT. It does expose the patients to radiation but the improved visualization of the neck structures far outweighs the radiation risk. There is extensive documentation of sonographic and CT evaluation of other parts of the body but the neck imaging has received relatively less attention.

The aim of this study is to evaluate palpable neck masses with US and CT, and also comparing their efficacy.

MATERIAL & METHOD: The present study was conducted in the Department of Radio-diagnosis, TMMC&RC, TMU, Moradabad. Patients under study were referred from the department of Surgery, ENT, Medicine and Pediatrics. Patients included for study were evaluated by Clinical and Radiological examination .The age range in the present study was from 3 to 75 years and total number of patients were 40 (including both male and females).

PATIENT EVALUATION: Patients were evaluated along the following lines.

A. CLINICAL EXAMINATION: A detailed clinical history was taken from all cases and through general physical and local examination was carried out. Relevant laboratory investigations like ESR, Serum calcium, Thyroid function Tests, were done as required.

B. RADIOLOGICAL EVALUATION:

ULTRASONOGRAOHY: High-resolution real time sonography of the neck was done in all patients. Scanners with 7-10 MHz transducers on MEDISON Diagnostic ultrasound system installed in Department of Radio-diagnosis, TMMC&RC, TMU, Moradabad. The sonographic examination of the

neck was performed in supine position, with the neck hyper extended and a pillow place under the shoulders for optimal exposure of the neck. Examination was done in both longitudinal and transverse planes to evaluate the mass for its size, shape, consistency (solid / cystic), echogenicity. Internal architecture, presence of septae, calcifications necrosis, margins and compressibility were also made note of. In all cases we tried to find out the site of origin, the extent of the lesion and its relation to surrounding structures.

COMPUTED TOMOGRAPHY: A CT scan was carried out in all patients, on a Hi Speed Spiral CT scan (PHILIPS) unit. Serial axial sections were taken from the base of the skull to the thoracic inlet with a 1 second scan time and 5 mm collimation at the interval of 5 mm. Thin collimation (3 mm) and 3 mm interval was used in areas where high spatial resolution was required. 60% Sodium and Meglumine salts of Urograffin contrast was used in quantities varying with the body weight.

The site, size and extent of the lesion were evaluated. The margins, relation to adjacent structures and the tissue attenuation values were also made note of Intra-cranial and intra-thoracic extension of lesion was carefully looked for.

RESULTS:

Nature of lesion	No. of Cases
Inflammatory	
Abscess	7
Adenopathy	5
Benign neoplasm	
Haemangioma	5
Parathyroid adenoma	2
Epidermoid inclusion cyst	2
Lymphangioma	2
Plexiform neurofibroma	2
Chemodectoma	1
Ectopic Thyroid rest	1
Malignant Neoplasms	
Poorly differentiated carcinoma	5
Sq. Cell carcinoma	2
Lymphoma	3
Miscellaneous	
Encephalocele	1
Parotitis	1
Normal lymph node	1
Thyroglossal duct remnant	1
Total	40

Table-1: Ultrasonic finding in 40 Masses in Head and Neck

Age group (In years)	Male	Female	Total
0-10	2	1	3
11-20	1	3	4
21-30	4	8	12
31-40	3	3	6
41-50	5	2	7
51-60	3	1	4
61-70	3	-	3
71-80	1	-	1
Total	22	18	40

Table 2: Age and Sex distribution of patients with Neck Masses.

The Male to Female ratio in the present study = 1.22:1

DISCUSSION: Neck masses form a wide pathologic spectrum. These lesions because of their superficial location are easily accessible but complicated by the fact that structures of multiple organ systems are in such close proximity in the neck there is often a diagnostic dilemma.

Radiological imaging thus becomes a mainstay in diagnosing and in planning the management of these lesions.

Neck masses are therefore evaluated by clinical examination, conventional radiography, Ultrasonography, Computed tomography and Magnetic, resonance imaging.

Clinical examination alone does not reliably indicate the true nature and extent of a neck lesion. Imaging plays an essential role in the management of neck disease (12). It allows us to identify true disease versus pseudo masses and to show exact location and extent of a lesion and to predict the nature of the lesion (13).

Plain radiography is not sufficient to delineate the extent of disease process and substantiate proper diagnosis. Conventional films consisting of antero-posterior and lateral views can only be used for a preliminary evaluation especially of the retropharyngeal space when there is a question of a retropharyngeal phlegmon or abscess (14).

Conventional tomography allows laryngeal soft tissues to be seen clearly and can allow compressed ventricles to be distinguished from infiltration. Small laryngocele can be demonstrated (15).

Angiography can detect nutrient vessels and help differentiate tumors with profuse vascularity from aneurysms. Paragangliomas are well visualized with angiography. Angiography is diagnostic in almost all cases of haemangiomas seen as a mass with intense persistent tissue stain in lobular pattern (16).

MRI imaging has become a prominent imaging method in the cervical region. The well known advantages (superior tissue contrast and multi planner capabilities are to be balanced with technical limitations. Further motion artifacts, swallowing, respiratory and blood motion artifacts are especially troublesome in the neck region.

High resolution B-mode sonography has improved in the past few years and has become a very valuable tool in the diagnosis of head and neck disease. Sonography is commonly the first imaging modality after clinical examination. It is inexpensive and well tolerated by patients and

allows guidance for fine needle aspiration.

US of superficial soft tissue structures was first started by Howry et al (17). They predicted an important role of sonography in visualization of benign and malignant tumors of the neck. Sackler et al (18) showed usefulness of to distinguish thyroid from extra thyroid lesions. Itzchak Y et al (19) evaluated 26 patients of with neck masses with ultrasound and achieved accurate diagnosis of solid and fluid filled masses, both with and without pulsatile components.

Sonography however, at times fails to delineate fascial planes and the extent of the lesions with respect to surrounding structure. It does not explore deep structures. Sonography alone was not sufficient for a reliable diagnosis about nature of space occupying lesions in the neck.

Computed Tomography can provide useful information in the evaluation at patients with clinical masses. CT is extremely useful in defining both the osseous and soft tissue extent of the lesion. In several instances CT was able to show the relationship of the tumor to the spinal canal. When combined with angiography, CT demonstrated the relationship of the major cervical vascular channels to the lesions (20).CT can be particularly helpful in cases with bone involvement. CT is also valuable in the diagnosis as well as in determining the extent of involvement in neonatal neck masses (21).

CT was helpful in correctly predicting the etiology by determining the exact location of cystic neck masses in relation to normal anatomic structure in the neck.

CONCLUSION: Most of the soft tissues in head and neck can be easily evaluated by ultrasonography. The advantages of US include good availability, multiplanar visualization, repeatable (no ionizing radiation), fast, and it provides real-time imaging. Superficial soft tissues such as floor of the mouth, salivary glands, surrounding structures of the cervical visceral region, buccal, occipital and supraclavicular regions can be evaluated by B-mode ultrasonography. In the neck, thyroid gland, carotid and jugular vessels and lymph nodes can be examined by US. US can determine whether a mass is cystic or solid, and therefore able to differentiate between cellulitis and abscess. With Doppler function, direction and velocity of flow in neck vessels can be determined. Doppler-US also can provide information about the vascularization of a neck mass. Contrast-enhanced US are not part of the diagnostic modalities used routinely; however, it is capable of demonstrating vascularity, enhancement pattern and cystic or necrotic areas of a mass.

Computed Tomography: CT has several advantages over traditional 2D medical imaging: provides cross-sectional imaging; eliminates the superimposition of images of structures outside the area of interest; provides good soft tissue resolution when intravenous contrast is administered; visualizes bony detail in complex fractures and bone destruction. Multidetector-row CT (MDCT) - with its sub millimeter spatial resolution - is also capable of creating multiplanar reformatted imaging. Disadvantages of CT include high radiation-dose (which is approx. hundred times higher than that of conventional radiographs), and artifacts related to dental fillings.

Paranasal CT – nowadays - is performed in supine position, which constructs primarily axial images. Coronal view – which has similar appearance to sinus radiography - can be later digitally reconstructed. Earlier, CT was performed in a position to primarily get the coronal view; however, the quality of this technique was not satisfactory due to artifacts caused by metal-containing dental fillings. Noncontrast paranasal CT plays important role to assess more complicated, recurrent

disorders, e.g. chronic sinusitis. Contrast-enhanced paranasal CT is a helpful imaging tool in soft tissue evaluation, e.g. in inflammation and tumours. However, in these cases, MRI provides an even better soft tissue resolution.

HRCT excels in the evaluation of air spaces and fine bone structures - including hearing ossicles - of the temporal bone. HRCT is primarily performed at sub millimeter intervals, which allows reconstructions in all three planes.

Non contrast orbit CT has an important role in the assessment of orbital bony injuries and localization of foreign bodies.

Contrast-enhanced orbit CT – if MRI is not available – can be indicated in inflammation and tumors. Contrast-enhanced head and neck CT (from the skull base to the aortic arch) can evaluate acute inflammation and tumors. It can be used for tumor staging; however, for that MRI is the first-line modality by providing better soft tissue resolution. One of the disadvantages of head and neck CT – especially in children - is the relatively high radiation dose to which the eye lenses are sensitive.

CT angiography is performed to evaluate neck vessels. Carotid arteries can be examined from aortic arch to skull base by bolus technique in arterial phase.

It is important to mention an emerging new technique: the cone-beam CT (CBCT). A CBCT scanner utilizes a 2D flat panel detector, and it can acquire the image of the whole volume in a single rotation around the patient. The scanning software collects the data and reconstructs it by a mathematical algorithm, producing 3D images. This method uses ten times less ionizing radiation than conventional CT, while provides all the same information. Length that can be imaged by CBCT is approx. 5-16 cm; however, C-arm equipments used in interventional radiology are also based on the cone-beam principles. CBCT's advantages are the lower cost and smaller size, which make this technique increasingly important. CBCT can be used to visualize anatomical detail of paranasal sinuses, in dental imaging and implantology.

ACKNOWLEDGEMENT: Authors wish to acknowledge all Head of departments of Surgery, ENT, Paediatrics & Medicine who were very kind enough to refer to patients to department of Radio-diagnosis for radiological evaluation.

REFERENCES:

1. Ahuja AT. Lumps and bumps in the head and neck. In: Ahuja AT, Evans RM, editors. Practical head and neck ultrasound. London: Greenwich Medical Media Limited; 2000. p. 87e104.
2. Ahuja AT, Richards P, Wong KT, Yuen EH, King AD. Accuracy of high-resolution sonography compared with magnetic resonance imaging in the diagnosis of head and neck venous vascular malformations. Clin Radiol 2003; 58(11):869-875.
3. Wong KT, Lee YY, King AD, Ahuja AT. Imaging of cystic or cyst-like neck masses. Clin Radiol 2008; 63(6):613-622.
4. Yang WT, Ahuja A, Metreweli C. Sonographic features of head and neck hemangiomas and vascular malformations: review of 23 patients. J Ultrasound Med 1997; 16(1):39-44.
5. Hohlweg-Majert B, Metzger MC, Voss PJ, Holzle F, Wolff KD, Schulze D. Preoperative cervical lymph node size evaluation in patients with malignant head/neck tumors: comparison between ultrasound and computer tomography. J Cancer Res Clin Oncol 2009; 135(6):753-759

6. Van den Brekel MW. US-guided fine-needle aspiration cytology of neck nodes in patients with N0 disease. Radiology 1996; 201(2):580-581.
7. Van den Brekel MW, Reitsma LC, Quak JJ, et al. Sonographically guided aspiration cytology of neck nodes for selection of treatment and follow-up in patients with N0 head and neck cancer. AJNR AmJ Neuroradiol 1999; 20(9):1727-1731.
8. Ahuja A, Ying M. Sonography of neck lymph nodes. Part II: abnormal lymph nodes. Clin Radiol 2003; 58(5):359-366.
9. Ahuja AT, Ying M, Ho SY, et al. Ultrasound of malignant cervical lymph nodes. Cancer Imaging 2008; 8:48-56.
10. Ying M, Ahuja A, Brook F. Accuracy of sonographic vascular features in differentiating different causes of cervical lymphadenopathy. Ultrasound Med Biol 2004; 30(4):441-447.
11. Bhatia KS, Cho CC, Yuen YH, Rasalkar DD, King AD, Ahuja AT. Real-time qualitative ultrasound elastography of cervical lymph nodes in routine clinical practice: interobserver agreement and correlation with malignancy. Ultrasound Med Biol 2010;36(12):1990-1997
12. Sigal R Imaging of cervical masses. J Radiol Dec 1999; 30 (12): 1807-15.
13. Robert Sigal, Infrahyoid Neck: Radiologic Clinics of North America, Sep. 1998; 36(5):781-799.
14. Weber AL: Radiology of the larynx, Otolaryngol Clin North Am 1934;17:13-28.
15. Wholy M, Bruwer A, Baker H. The lateral roentogenogram of the neck Radiology 1958; 71:350-356.
16. Lloyd: Larynx Techniques in diagnostic imaging by white house GH, Worthington BS; 1996; 3rd ed 245-249.
17. Sadick M, Sadick H, Hormann K, Duber C, Diehl SJ. Cross sectional imaging combined with 3D-MR angiography (3D-MRA): diagnostic tool for preoperative vascular assessment of head andneck tumors. Onkologie 2005; 28(10):477-481.
18. Howry DH, Stott DA Bliss WR. The ultrasonic visualization of carcinoma of the breast and other soft tissue structures. Cancer 1954 March; 351-358.
19. Sackler JP, Passalaqua AM, Blum M et al. a spectrum of disease of the thyroid as imaged by gray scale water bath sonography. Radiology 1977; 125:467-472.
20. Yacov Itzchak and Rina Tadmor : Evaluation of lateral neck masses by ultrasound and other modalities Israel Journal of Medical Sciences 1980;16:748-751.
21. Edward M Miller and David Norman. The Role of Computed Tomography in the Evaluation Neck Masses. Radiology 1979; 133:145-149.
22. Reger KM, Leininger RG, Bjelland JC et al. Computed Tomography evaluation of neonatal neck masses, Computerized Radiology Jan-Feb 1984;8 (1):17-19.

AUTHORS:

1. Vijai Pratap
2. S.K. Jain
3. A.K. Choudhary
4. Om Prakash

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Radiodiagnosis, TMMC & RC, Moradabad.
2. Professor, Department of Anatomy, TMMC & RC, Moradabad.
3. Assistant Professor, Department of Anatomy, SGRRIMHS, Dehradun.
4. Professor and Head, Department of Radiodiagnosis, TMMC & RC, Moradabad.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. S.K. Jain,
Professor of Anatomy,
TMMC & RC, Moradabad.
Email – drskjain2005@rediffmail.com

Date of Submission: 01/10/2013.
Date of Peer Review: 03/10/2013.
Date of Acceptance: 05/10/2013.
Date of Publishing: 09/10/2013