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Comparison and evaluation by USG and CT with histological findings of cervical lymphadenopathy in head and neck malignancies

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Abstract
Purpose: Comparing and evaluating cervical lymph nodes by USG and CT with Histopathological correlation in patients with head and neck malignancy. To assess the diagnostic accuracy of both Ultrasonography [USG] and Computed Tomography [CT] in preoperative evaluation of the cervical nodal status in patients with head and neck malignancy.
Materials and Methods: A prospective study was done from October 2017 to march 2019 on all patients with suspected primary or recurrent head and neck malignancy who are referred to Department of Radio-Diagnosis, Siddhartha Medical College Hospital and Research centre, Tumkur. After obtaining the consent, we analyze cervical lymph nodes (metastatic and nonmetastatic) from patients with head and neck malignancy. All these nodes will be examined on gray-scale and power Doppler sonography and also on CT. Topographic correlations, between dissected nodes and sonograms and between dissected nodes and CT images, will be performed for each node.
Results: Our study out of 36 subjects evaluated for head and neck malignancy USG had a high sensitivity of 96%, Specificity of 49%, positive predictive value of 87% and also a negative predictive value of 66% with accuracy of 86%, CT had a high sensitivity of 96%, Specificity of 56%, positive predictive value of 90% and also a negative predictive value of 75% with accuracy of 88%. The above table has a p value of 0.001 which is considered as very highly significant. Kappa Statistics was calculated and it was found to be 0.712, which is considered as good agreement.
Conclusion: Ultrasonographic examination is very sensitive in differentiating between cystic/necrotic foci and solid swellings. Colour Doppler Sonography provides additional information on vasculature of the lymph nodes and plays an important role in differentiating between the benign, reactive and malignant cervical lymphadenopathy. Multidetector CT provides improved localisation and characterization of cervical lymph nodes.

Keywords: USG-ultrasonography, CT-computed tomography, HPE-histopathological examination

Introduction
Cancer of the head and neck, excluding cancer of the skin and lymphoma is the sixth most frequent cancer worldwide with a current estimation of incidence being about 600,000 per year and deaths resulting in about 300,000 per year [1]. The reported incidence rate in 2008 was 6.8% [2]. There is a geographical variation in the distribution of different head and neck cancers due to differences in genetic susceptibility, cultural risk factors like smoking, drinking, betel nut chewing, prevalence of nutritional deficiencies, difference in diet, socioeconomic status and presence of infectious agents, particularly the human papillomavirus (HPV particularly type 16), the Epstein Barr virus and human immunodeficiency virus (HIV). Certain tumours also show a gender difference with squamous cell cancers being more common in males and thyroid tumours more common in females [1, 2, 3]. Radiation exposure is an established risk for development of thyroid cancer and for mucoepidermoid carcinoma of the salivary glands [2, 4]. There have been reported associations with environmental toxins like formaldehyde [4].
Patients with head and neck squamous cell cancer can have synchronous and metachronous primary cancer of the upper aerodigestive (AE) tract. They are also at risk of developing lung cancer, oesophageal and gastric cancer usually due to combined smoking and alcohol consumption. The annual incidence of second primary cancer following successful therapy of a tumour has been reported as 3-7% [2].

Staging of neck metastasis is a crucial step in treating patients with head and neck squamous cell carcinoma [6]. An increase in nodal size was found to be an effective imaging criterion for the detection of metastatic cervical nodes with CT and MR imaging [7, 8]. However, size determination alone is not effective enough for detecting metastatic nodes. Therefore, several studies have attempted to improve diagnostic accuracy by assessing the internal architecture of the node and using other tissue-specific imaging techniques such as sonographically guided fine-needle aspiration biopsy and [18] F-fluorodeoxyglucose positron emission tomography [6]. Recently, Curtin *et al.* [9] showed that combined information on the size and internal architecture of the node facilitated the detection of nodes that were metastatic from squamous cell carcinoma of the head and neck, confirming, at least in part, the significance of the assessment of the internal architecture of a node for the detection of metastatic nodes.

Sonographic evaluation of enlarged nodes is also based on assessment of the internal architecture of the node as well as size determination of the node, and abnormalities in the node may be reflected by increased parenchymal echogenicity or loss of hilar echogenicity in malignant disease of the node. In addition, the recent development of Doppler sonography technology has shed light on the diagnostic significance of changes in nodal blood flow in differentiating metastatic from nonmetastatic nodes. These studies have shown that, albeit some controversies, the assessment of nodal blood flow patterns had some impact on improving the performance of sonography in depicting metastatic nodes in the neck [6].

Therefore, in this study, we compare the performance of gray-scale sonography, power Doppler sonography, and CT in staging metastatic nodes in the necks of patients with head and neck carcinoma. Our focus was on the diagnostic performance of two imaging criteria-namely, the size and internal architecture of the node-on sonography and CT.

Materials and Method

All patients with suspected primary or recurrent head and neck malignancy who are reffered to Department of Radio-Diagnosis, Siddhartha Medical College Hospital and Research centre, Tumkur are inclued in the study. The participants were given liberal verbal explanations and description about the topic of research. Informed consent was obtained. There will be guaranteed confidentiality. After obtaining the consent, we analyze cervical lymph nodes (metastatic and nonmetastatic) from patients with head and neck malignancy. All these nodes were examined on gray-scale and power Doppler sonography and also on CT. Topographic correlations, between dissected nodes and sonograms and between dissected nodes and CT images, was performed for each node. The indications for surgery include the presence of a clinically palpable, indurated node or nodes; or the presence of an enlarged node or nodes that are 1 cm or larger, that exhibited rim enhancement on CT images, or both. We facilitate the correlation between dissected nodes and the respective images by adding a report as a reference, describing the data concerning the approximate location relative to the surrounding anatomic structures, such as vessels, salivary glands, bones, and muscles. During surgery, surgeons identify the lymph nodes that are imaged on sonography and CT with the aid of the report. Thereafter, the nodes excised en bloc with the adjacent tissue to ascertain more easily the spatial relationship between the excised nodes and the surrounding structures. The excised nodes that matched those on sonograms and CT images were then be examined histopathologically. The nodes were grouped into six levels (levels I, II, III, IV, V and VI).

Sonographic Imaging

The following sonographic criteria were used in this study: short axial diameter of the node measured with a calliper on sonograms; the presence or absence of hilar echoes; and the presence or absence of hilar blood flow. Previous reports have shown that an increase in short axial diameter but not the long axial diameter is an efficient indicator for metastatic nodes. A preferential increase in short-axis diameter results in a round or oval node, so these features are suggestive of metastatic nodes. The hilum is identified as a highly echogenic structure in the central part of the node. Metastatic tumor cells frequently invade this part of the node and, in that case, the echogenicity of the hilum may be lost. Multivariate feature analysis showed that the presence or absence of hilar echoes, an increase in the short-axis diameter, and the presence of normal hilar flow were the sonographic features that were predictive of nonmetastatic (presence of hilar echoes and hilar flow) and metastatic (increases in short-axis diameter) lymph nodes.

Helical CT

We use two CT criteria, both of which were deemed to be important indicators for differentiating benign from metastatic nodes in the preceding studies: short-and long-axis diameters of the node measured with a caliper on CT images and the presence or absence of abnormal staining patterns of the node, such as rim enhancement and irregularly increased staining of the node.

Results

A total of 36 patients with cervical lymphadenopathy in suspected cases of Head and neck malignancies who were referred to the Department of Radio-diagnosis in SSMC Hospital, Tumkur were included in this prospective study. They were examined using Grey Scale ultrasound Doppler Sonography, CECT and the final diagnosis was confirmed by

HPE correlation.

Table 1: Comparison of USG diagnosis with HPE diagnosis

HPE LN status	USG LN status		Total
	Benign	Malignant	
Benign	2 (33.3%)	4 (66.7%)	6 (100.0%)
Malignant	1 (3.3%)	29 (96.7%)	30 (100.0%)
Total	3 (8.3%)	33 (91.7%)	36 (100.0%)

Chi-Square= 5.891, Kappa: 0.775, P-value=0.005.

Table 2: Comparison of CT diagnosis with HPE diagnosis

HPE LN status	CT LN status		Total
	Benign	Malignant	
Benign	3 (50.0%)	3 (50.0%)	6 (100.0%)
Malignant	1 (3.3%)	29 (96.7%)	30 (100.0%)
Total	4 (11.1%)	32 (88.9%)	36 (100.0%)

Chi-Square= 11.025; Kappa: 0.638; P-value=0.001

Table 3: Comparison of Sensitivity, Specificity, PPV, NPV and Accuracy between USG and CT

Method	Sensitivity	Specificity	PPV	NPV	Accuracy
USG	96.7%	49.3%	87.9%	66.7%	86.1%
CT	96.7%	56.7%	90.6%	75.0%	88.9%
	PPV-Positive Predictive Value	NPV-Negative Predictive Value			

Our study USG had a high sensitivity of 96%, Specificity of 49%, positive predictive value of 87% and also a negative predictive value of 66% with accuracy of 86%, CT had a high sensitivity of 96%, Specificity of 56%, positive predictive value of 90% and also a negative predictive value of 75% with accuracy of 88%. The above table has a p value of 0.001 which is considered as very highly significant. Kappa Statistics was calculated and it was found to be 0.712, which is considered as good agreement.

Discussion

The aim of our study is Comparing and evaluating cervical lymph nodes by USG and CT with Histopathological correlation in patients with head and neck malignancy with the objective to assess the diagnostic accuracy of both Ultrasonography [USG] and Computed Tomography [CT] in preoperative evaluation of the cervical nodal status in patients with head and neck malignancy.

The diagnosis of presence of metastatic lymph nodes is crucial for therapeutic planning in patients with suspected malignancy.

The presence or absence of such metastasis has great impact on the treatment, risk of recurrence and the survival.

Head and neck malignancies are very aggressive and usually infiltrates the surrounding tissue and lymph vessel, producing metastasis in the cervical region.

Cervical metastasis plays a major role in the staging and management of head and neck carcinomas.

The aggressiveness of the primary tumor is determined by the rate of metastasis and is an important prognostic factor.

Treatment protocol in head and neck malignancies need accurate radiological imaging and could potentially allow for more conservative management.

Cervical metastasis plays a major role in the staging and management of head and neck carcinomas.

Possible chances of occult metastasis indicates for prophylactic neck dissection. Prophylactic neck dissection is indicated if more than 15% involvement is noted. An investigating modality with high sensitivity and accuracy is required to detect neck metastasis to avoid unnecessary stress to the patient by performing prophylactic neck dissection. The study we have done was to search for an appropriate modality in detecting cervical lymphadenopathy in cases of suspected head and neck malignancy by comparing the results of CT and USG.

Table 4: Comparison of sensitivity, specificity, positive predictive value, negative predictive value, and accuracy between the present study and the study by Geetha *et al*. and rawson *et al*.

Parameter	USG			CT		
	Rawson *et al.* (2016)	Geetha *et al*. (2010) [7]	Present study	Rawson *et al.* (2016)	Geetha *et al*. (2010) [7]	Present study
Sensitivity (%)	94.1	100	96.7	89.4	50	96.7
Specificity (%)	100	25	49.3	100	100	56.7
PPV (%)	94.4	67	87.9	83.3	100	90.6
NPV (%)	33.3	100	66.7	25	57	75
Accuracy	91.4	70	86.1	85.7	70	88.9

The accuracy of lymph node detection between USG and CT was evaluated, the sensitivities, specificities, and diagnostic accuracies were 97%, 50%, 84% for CT and 88%, 59%, 83% for USG, respectively, with a significant difference in the sensitivities (p = 0.002).

The accuracy of lymph node detection between USG and CT in present study was evaluated, the sensitivities, specificities, and diagnostic accuracies were 96%, 43%, 86% for CT and 96%, 50%, 88% for USG, respectively, with sensitivities correlating with HPE (p = 0.001).

Conclusion

- Ultrasonographic examination is very sensitive with high accuracy in differentiating between cystic/necrotic foci and solid swellings.
- Colour Doppler Sonography provides additional information on vasculature of the lymph nodes and plays an important role in differentiating between the benign, reactive and malignant cervical lymphadenopathy.
- Combination of gray scale Sonographic features and vascular pattern of the lymph nodes have a high accuracy and sensitivity in differentiating between malignant and benign cervical lymphadenopathy.
- Multidetector CT provides improved localisation and characterization of cervical lymph nodes.
- Cervical lymph node staging can be performed safely by ultrasound. It is a cheap, easy-to-handle and cost-effective diagnostic method. However, only the uppermost regions of the neck are accessible with a linear transducer. Despite this restriction, ultrasound is a reliable and valuable tool for screening lymph nodes in the case of a head or neck malignancy.
- The accuracy and sensitivity of USG in detection of cervical lymph node metastases make it a potentially promising and cheap preoperative tool for staging neck node metastases and optimizing the treatment plan for surgeons, especially in countries such as India.
- Accurate delineation of disease by CT scan provides a reliable pre-operative diagnosis with advantage over USG for its ability to detect bony lesions, staging and extent of the malignancy.

Illustrations

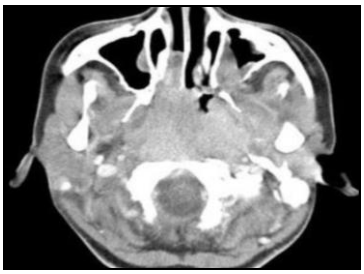

Fig 1a: Nasopharyngeal carcinoma in a 65 year old male. CECT images shows heterogeneously enhancing mass in the posterior nasopharynx

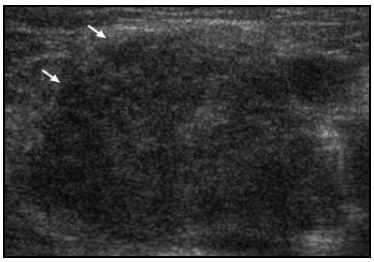

Fig 1b: Known case of carcinoma Nasopharynx with metastatic level IV lymph node with central necrosis

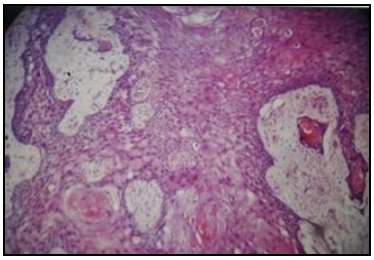

Fig 1c: Hyperplastic irregular acanthotic squamous epithelium invading fibrous stroma. NPC

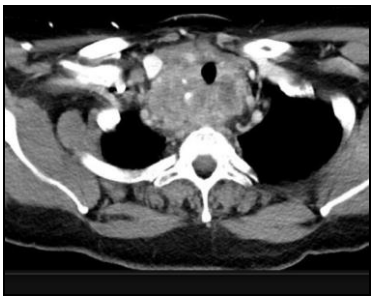

Fig 2a: CECT showing heterogeneously enhancing mass involving right thyroid gland with few specs of calcification. Biopsy proven Papillary CA Thyroid

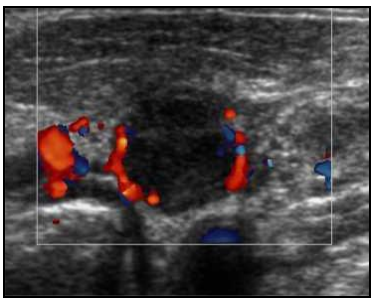

Fig 2b: Known case of carcinoma thyroid showed enlarged level II rounded lymph node with absent hilum and predominant subcapsular (peripheral) vascularity

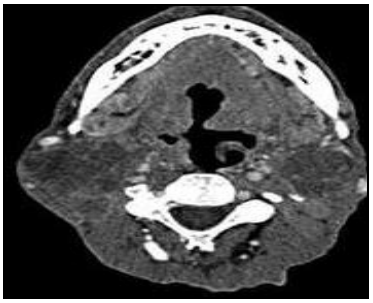

Fig 3: Metastatic level II lymph nodes in an elderly male patient: Axial CECT showing multiple heterogeneously enhancing hypodense lesions with central non enhancing hypodense areas suggestive of necrosis in bilateral parapharyngeal spaces

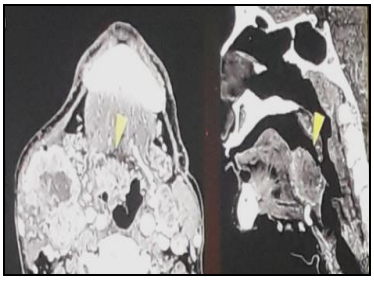

Fig 4a: CECT axial and sagittal images showing enhancing ulcerated lesion within posterior aspect of tongue on the right with multiple enlarged upper cervical lymph nodes suggestive Carcinoma tongue

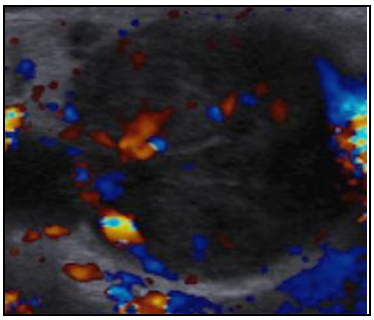

Fig 5: Metastatic level II node with absent hilum showing predominantly subcapsular vascularity with few areas of hilar vascularity

References

1. IARC. Head and neck cancers. In: Boyle P, Levin B, editors. World cancer report. Cancer site by site. 337: International Agency for Research on Cancer, 2008, 331.
2. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOSCAN 2008. Int. J Cancer. 2010; 127:2893-917.
3. Vander Poorten V. Introduction: Epidemiology, risk factors, pathology, and natural history of head and neck neoplasms. In: Hermans R, editor. Head and neck cancer imaging. Berlin Heidelberg: Springer, 2012, 1-17.
4. Vaughan TL, Stewart PA, Teschke K, Lynch CF, Swanson GM, Lyon JL *et al*. Occupational exposure to formaldehyde and wood dust and nasopharyngeal carcinoma. BMJ Global health, Occup Environ Med. 2000; 57:376-84.
5. Chikui T, Yonetsu K, Nakamura T. Multivariate analysis of sonographic findings of metastatic cervical lymph nodes: contribution of blood flow features revealed by power Doppler sonography for predicting metastasis. AJNR 2000; 21:561-567.

6. Misa Sumi, Masafumi Ohki, and Takashi Nakamura Comparison of Sonography and CT for Differentiating Benign from Malignant Cervical Lymph Nodes in Patients with Squamous Cell Carcinoma of the Head and Neck American Journal of Roentgenology. 2001; 176(4):1019-1024.
7. Geetha NT, Neelakamal Hallur, Gayathri Goudar BC, Sikkerimath Santhosh S. Gudi Cervical lymph node metastasis in oral squamous carcinoma preoperative assessment and histopathology after neck dissection, Journal of Maxillofacial and Oral Surgery. 2010; 9(1):42.
8. Ashraf M, Biswas J, Jha J *et al*. Clinical utility and prospective comparison of ultrasonography and computed tomography imaging in staging of neck metastases in head and neck squamous cell cancer in an Indian setup Int. J Clin. Oncol. 2011l; 16:686.