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A comparative analysis of computed tomography and ultrasonography in diagnosis of neck masses

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ABSTRACT

Background: Neck swellings constitute the chief complaint of many patients coming to ENT outpatient department. Adequate evaluation of all cases with assistance from radiological, cytopathological, and histopathological is necessary. **Aims and Objectives:** The present study aims to evaluate the role of clinical, radiological, and cytopathological evaluation to reach the diagnosis and the accuracy of these tools. **Materials and Methods:** The study was conducted in the Department of Otorhinolaryngology and Head and Neck Surgery and the Department of Radiodiagnosis, AMU, and included 100 patients with neck swelling. **Results:** Maximum number of patients were of lymph node masses (44%), followed by thyroid masses (26%) and salivary gland pathologies, congenital neck masses, and others. 78% were benign masses while only 22% were malignant. Out of all cases, the maximum were reactive lymphadenitis (16%), followed by metastatic lymph nodes (12%) and pleomorphic adenoma (10%). The correlation between clinical diagnosis and ultrasound (USG) was 70.93 with a diagnostic accuracy of 86%; with fine-needle aspiration cytology (FNAC) accuracy being 82%. 91% of metastatic lymph node swellings were accurately diagnosed by these two modalities alone. The sensitivity and specificity of FNAC with computed tomography (CT) were 62.25% and 98.59%, respectively; while with biopsy were 84.63% and 97.10%. **Conclusion:** Clinical evaluation remains the utmost important step in the management of patients with neck swellings. USG provides the necessary information to guide further management, followed by FNAC. Although CT and histopathological evaluation provide detailed information, it was rarely needed in our study to reach the clinical diagnosis however their need in the management of pathology could not be ruled out.

Key words: Neck masses; Ultrasound; Fine-needle aspiration cytology; Computed tomography; Biopsy

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INTRODUCTION

A neck mass is a frequently encountered entity in clinical practice. Due to its complex anatomy and physiology, neck diseases manifesting as neck swelling can vary from etiological, pathological, and prognostic points of view.[1]

The common pathologies encountered as neck swellings are lymphadenopathies (specific and non-specific, acute and chronic), metastatic carcinoma, lymphoma, thyroid swellings (goiter, nodules, and cysts), and salivary gland swellings (sialadenitis, cysts, adenomas, and carcinoma). The less common causes of neck swellings are carotid body tumors, bronchial cysts, thyroglossal cysts, cystic hygroma, pharyngeal pouch, and lumps arising from skin appendages.

Neck swellings can be classified according to the triangles of the neck. The various triangles of the neck are anterior, digastric, carotid, muscular, and posterior triangles. The anatomical knowledge of these triangles is very important for understanding the differential diagnosis of various pathologies presenting as neck swellings.[2]

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Imaging studies form an integral part of the diagnostic workup of neck masses. Ultrasound is a useful screening modality because of the lack of ionizing radiation and is noninvasive. Ultrasound (USG) can define the location, size, and extent of the mass, its relation to surrounding normal structures, and the internal characteristics of the mass. However, sonography of the neck lacks specificity in certain instances. The differentiation between inflammatory and malignant ultra-lymphadenopathy cannot always be made.[3] Hence, the development of cross-sectional imaging techniques has substantially altered the treatment and management of neck masses. Computed tomography (CT) is now readily available in most health institutions and is currently the imaging modality most commonly used for head-and-neck masses. CT is extremely useful in defining both the osseous and soft tissue extent of the lesion. Owing to the complex anatomy of the neck a comprehensive knowledge of regional anatomy and recognition of the pattern of disease presentation is vital to arriving at a meaningful differential diagnosis. To permit early recognition of neck pathology, a detailed anatomic correlation is mandatory. Current imaging permits a detailed analysis of the complex anatomy in this region and is the key to understanding many of its disorders including mass lesions.[4]

In this study, we will evaluate the role of clinical, cytopathological, and radiological imaging in evaluating neck masses and the accuracy of diagnostic tools in finding a definitive diagnosis.

Aims and objectives

The present study aims to evaluate the role of clinical, radiological, and cytopathological evaluation to reach the diagnosis and the accuracy of these tools.

MATERIALS AND METHODS

This was a hospital-based prospective study carried out in the Department of Otorhinolaryngology and Head and Neck Surgery, and the Department of Radiodiagnosis of J.N. Medical College and Hospital, AMU., Aligarh, and included patients attending the out-patient department, indoor patients and in the emergency section who presented with clinically palpable neck masses for the period of 24 months (September 2019–September 2021). The assessment of the patients was done based on history, clinical examination, and radiological and cytopathological when required. A total of 100 cases were included. All the patients underwent ultrasonography while other investigations were done when required to reach the diagnosis. As most of the patients were diagnosed correctly clinically, on USG and fine needle aspiration cytology (FNAC) they were managed conservatively. Biopsy was performed on those patients whose FNAC report was inconclusive, therefore the total number of biopsy patients, as well as CT, was very few. A pre-designed pro forma was used to record relevant information (patient data, clinical findings, and investigation reports) from the patients selected. Prior informed consent was taken before evaluating each patient.

Inclusion criteria

Patients who presented with a clinically palpable neck mass of both sex with different age groups underwent radiological and cytopathological investigations when required.

Exclusion criteria

1. Patients who refused to give consent
2. Patients with contraindication to intravenous administration to contrast medium
3. Pregnant females
4. Patients not fulfilling the inclusion criteria.

RESULTS

The age group of patients in the study ranged from 1 to 70 years. The population group was divided into different age groups of 10 years. The maximum proportion of patients was in the age group of 31–40 years age group, comprising 24% of the total population; and the least number in the age group of 1–10 years, 4%.

Incidence of neck swellings was common in the male gender, comprising 71% of the total study population. The ratio of males to patients was 2.44:1.

Out of 100 patients, it was found that the maximum causes for neck swelling were lymph node masses (Table 1), consisting of 44% of the total study population; followed by thyroid masses, of 26%. Other causes apart from these included salivary gland pathology, congenital neck masses, and other pathologies. We found that majority of the patients (78%) had benign pathology. While only 22% had malignant pathology.

Different pathologies and different modalities used to reach a diagnosis are tabulated in the below table. The most common cause of neck swelling was tubercular lymphadenitis comprising 16% of the total population, and metastatic neck nodes being the next most common one.

DISCUSSION

Among the several methods available today for evaluating neck swellings clinical examination, ultrasonography,

and fine-needle aspiration cytology form the preliminary array of modalities. These are easily available, simple to perform, and minimally invasive. It forms an important triad in evaluating neck swellings. Clinical evaluation of neck swellings is the first line of screening available to the clinician. Ultrasonography has become the first line of imaging modality for evaluation of the neck swellings due to excellent visualization of the internal parenchyma. It is highly sensitive in detecting small swellings, calcification, septations, and cysts.

Age distribution in the study group

The age incidence of neck masses in this study ranged from 1 year to 70 years, the youngest was 4 years of age and the eldest was 70 years of age. The incidence of neck masses was highest among the 31–40 years age group, which is similar to the Choudhary et al.,[5] study, which found the highest incidence in the 3rd decade of life. However, Poorey and Tyagi, Agrawal et al., and Basista et al., reported that the maximum number of cases (24%) was between 21 and 30 years of the age group which was not in concordance with the conducted study.

Causes of neck mass distribution

Lymph nodes constituted 44% of all the cases, 26% were thyroid swellings (Table 2), 16% were salivary gland swellings (Table 3), 11% were congenital neck swellings (Table 4) and 3% were other swellings (Table 5). This was similar to the study done by Poorey and Tyagi and Agrawal et al. However, benign thyroid masses constituted the majority (47%) of neck masses in the study by Basista et al.[3]

Correlation of clinical diagnosis with USG, FNAC, CT

In the conducted study, the correlation between clinical diagnosis and USG came out to be 70.93%. On correlating the results of clinical diagnosis with USG, the percentage of accuracy was found to be 86% in the study conducted by Naaz et al. Also corroborating these findings was the study by Anand et al.,[9] where diagnostic accuracy was 85.9%. The above two studies were dissimilar from our study as they did not evaluate the diagnostic accuracy of individual neck masses. FNAC was able to make an accurate diagnosis of 50% lymphoproliferative and metastatic nodes. FNAC made a 90% accurate diagnosis of reactive lymphadenitis, and 83% of tubercular lymphadenitis. Here, diagnostic accuracy was seen at 94.1%. Hence, in the conducted study, the sensitivity of clinical diagnosis with FNAC was found to be 70.72%, specificity was 98.49%, positive predictive value 87.01%, negative predictive value 96.25% with an accuracy of 95.46%.

When in the conducted study, a correlation of clinical diagnosis was made with CT, it was seen that metastatic lymph nodes were highly correlated (80%) with CT; the least correlation was with reactive lymphadenitis, i.e., 30%. Diagnostic accuracy was 57.5%. In our study, the diagnostic

Table 1: Lymph node masses presenting as neck mass

S.No	Neck mass causes	n	Clinical diagnosis	USG	FNAC	CT	HPE
	Lymph node masses						
1	Tubercular lymphadenitis	16	10	14	12	4	0
2	Reactive lymphadenitis	10	10	10	9	3	0
3	Lymphoproliferative lesion	12	3	4	3	4	6
4	Metastatic nodes	6	10	11	10	8	9

CT: Computed tomography, USG: Ultrasound, FNAC: Fine-needle aspiration cytology

Table 2: Salivary gland masses presenting as neck mass

S. No.	Thyroid masses	n	Clinical diagnosis	USG	FNAC	CT	HPE
1	Nodular goiter	8	3	7	7	2	0
2	Multinodular goiter	2	0	2	0	1	0
3	Colloid goiter	6	5	5	6	2	0
4	Follicular adenoma	8	1	8	7	4	0
5	Papillary carcinoma	2	0	0	2	1	0

CT: Computed tomography, USG: Ultrasound, FNAC: Fine-needle aspiration cytology

Table 3: Thyroid masses presenting as neck mass

S. No.	Salivary gland masses	n	Clinical diagnosis	USG	FNAC	CT	HPE
1	Pleomorphic adenoma of the parotid	10	5	9	10	9	1
2	Carcinoma ex pleomorphic adenoma	1	0	0	1	1	1
3	Ranula	2	2	2	2	0	0
4	Sialadenitis	2	1	2	1	0	0
5	Mucoepidermoid carcinoma of parotid	1	0	0	1	1	1

CT: Computed tomography, USG: Ultrasound, FNAC: Fine-needle aspiration cytology

Table 4: Congenital and other masses presenting as neck mass

S. No	Congenital masses	n	Clinical diagnosis	USG	FNAC	CT	HPE
1	Thyroglossal cyst	6	6	6	5	6	0
2	Branchial cyst	5	4	5	4	3	0
	Others						
1	Hemangioma	1	0	0	1	1	1
2	Keratinous cyst	2	1	1	1	0	0

CT: Computed tomography, USG: Ultrasound, FNAC: Fine-needle aspiration cytology

Table 5: Total causes of neck masses

Neck mass causes	n	Clinical diagnosis	USG	FNAC	CT	HPE
Total	100	61	86	82	50	19

CT: Computed tomography, USG: Ultrasound, FNAC: Fine-needle aspiration cytology

accuracy of CT came out to be very low, as the maximum number of patients were diagnosed either clinically, by USG, or by FNAC, and CT was done in very few cases, accounting for its low accuracy.

Correlation of USG with FNAC

In our study, when the findings of USG and FNAC were correlated, it was seen that 91% of all metastatic lymph nodes were accurately diagnosed by these two. Hence, in the conducted study, the sensitivity of USG with FNAC was seen 90.74%, specificity of 95.84%, with positive predictive value and negative predictive values of 87.79% and 97.90%, respectively; and diagnostic accuracy to be 95.53% which is very similar to the study done by Nguansangiam et al.[11]

Correlation of CT with FNAC

In the conducted study, the sensitivity of CT with FNAC was found to be 62.25%, specificity was 98.59%, positive predictive value 86.69%, and negative predictive value 93.76% with an accuracy of 93.2%. In the study by Srirangaprasad et al., the correlation between CT and FNAC was 61.5%, while 57.31% was found in our study.

Correlation of FNAC with biopsy

In the conducted study, the sensitivity of FNAC with biopsy was 84.63%, specificity was 97.10%, positive predictive value was 86.39%, and negative predictive value was 94.78%. Hence, the diagnostic accuracy was 93.74%.

Limitations of the study

The sample size was less, it would be better if the sample size is increased.

CONCLUSION

Clinical diagnosis remains an important part of patient workup. The first diagnosis made by history and clinical examination helps in dictating the further course of action, be it USG, FNAC, or CT. USG should not be considered superior to FNAC and FNAC should be never thought of as a replacement for histopathological diagnosis in all cases. Both USG and FNAC should be complemented with each other for optimal results and further management and to prevent unnecessary surgeries. Although histopathology remains the gold standard in arriving at a diagnosis, evaluation of neck swellings on a clinical, USG, and FNAC basis gives a comprehensive understanding of the nature of these swellings and helps the surgeons in their better management. Using all three, i.e., clinically, USG, and FNAC in the evaluation of neck swellings will help in better diagnosis and decision-making for the need for surgery.

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ZT- Concept and design of the study, prepared first draft of manuscript, **AR-** Preparation of the manuscript and revision of the manuscript, **KC-** Statistical analyisis and revision of manuscript.

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