ULTRASOUND IMAGING OF NECK MASSES AND CORRELATIONWITH HISTOPATHOLOGICAL FINDINGS

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ABSTRACT

BACKGROUND: Neck masses are quite common clinical presentation in general practice. Sonography in present scenario, has become the first imaging modality howeversystematic approach to neck swelling using high resolution sonography coupled with Doppler flowmetry and their correlation with FNAC/ Histopathological findings was done in our present study.**Methods**: This is a hospital based prospective observational study included total of 75 cases. The patients were referred to the department of Radio-diagnosis from indoor and outdoor departments of Guru Nanak Dev Hospital, Amritsar with history of neck swellings. **Results**: The most common age group to be involved were aged 13-56 yrs.In all age groups most of the patients were females.In the present study, maximum number of enrolled cases had involvement of thyroid and parathyroid glands (42.7%) followed by lymph nodes (32%) and salivary gland swelling (4%) and remaining 16 cases(21.3%) had congenital and others lesions. **Conclusion:**HR-USG/Doppler is highly efficacious tool in evaluation of neck swellings. HR-USG also helped in guiding FNAC from the most probable site of getting sample.

KEY WORDS: Neck masses,USG, FNAC,Thyroid,Salivary gland

INTRODUCTION

Neck masses are quite common clinical presentation in general practice, however, it could have variety of pathologic entities and use of efficient diagnostic methods helps to identify the precise nature and type of the concerned etiology and reason for neck mass.It is primarily observed in the area between the inferior border of mandible and clavicle and has traditionally been described based on age and location in the neck as inflammatory, congenital or developmental, neoplastic (benign versus malignant) and traumatic.

High resolution sonography has improved in the past few years and has become a very valuable tool in the diagnosis of the disease of the head and neck. Sonography in present scenario, has become the first imaging modality advised after clinical examination as it being non-invasive, involving non ionizing radiation and readily available.

USG is investigation of choice by otolaryngologists for initial evaluation of thyroid gland disease, cervical lymph nodes, salivary gland disease and few other conditions that involve neck swelling; however, a systematic approach to neck swelling using high resolution sonography coupled with Doppler flowmetry and their correlation with FNAC/ Histopathological findings is still awaited. The present study tries to fill this gap.

MATERIAL AND METHODS

This was ahospital based prospective observational studyandincluded a total of 75cases. The patients with history of neck swelling were referred to the department of Radio-diagnosis from indoor and outdoor departments of Guru Nanak Dev Hospital, Amritsar.

Imaging techniques

Patients of all the ages and both the sexes having history of neck swelling referred for USG neck from different departments were enrolled in the study after obtaining their consent. The demographic features and clinical history of each patient included in the study was noted down in a predesigned prescribed questionnaire. Before the procedure patients or relatives were explained about the procedure. In case of unconscious or minor patient, consent was taken from the relatives or guardian.

EQUIPMENT USED:
Patients were examined using ultrasound machine MINDRAY DC-8 with a linear array transducer of 7.5-10 MHz Doppler study was used whenever required to see for the vascularity. CDs or DVDs were used for recording the images

OBSERVATIONS AND RESULTS
A total of 75 cases with complaints of neck swelling were enrolled. On the basis of site of involvement, the cases were divided into following groups (Table 1):

Table 1: Group wise Distribution of cases (n=75)

SN	Group	Lesions on basis of site	No. of cases	Percentage
1.	I	Thyroid & Parathyroid	32	42.7
2.	II	Lymph nodes	24	32.0
3.	III	Salivary glands	3	4.0
4.	IV	Congenital and miscellaneous	16	21.3

Table 2: Distribution of cases according to Final diagnosis in each group

Groups	No of Patients	Percentage
Group I: (Thyroid & Parathyroid)	**(n=32)**	
Benign nodular goiter	12	37.5
Thyroid adenoma	9	28.1
Hashimoto's thyroiditis	3	9.4
Grave's disease	1	3.1
Follicular carcinoma	3	9.4
Papillary Carcinoma	3	9.4
Parathyroid adenoma	1	3.1
Group II: (Lymph Node)	**(n=24)**	
Reactive	6	25.0
Tubercular	13	54.1
Metastatic	4	16.7
Lymphomatous	1	4.2
Group III: (Salivary Glands)	**(n=3)**	
Sialadenitis	2	66.7
Sialolithiasis	1	33.3
Group IV: (Congenital and Others)	**(n=16)**	
Thyroglossal cyst	1	6.3
Branchial cleft cyst	1	6.3
Dermoid cyst	1	6.3
Cystic hygroma	1	6.3
Ranula	1	6.3
Fibromatosis coli	1	6.3
Lipoma	1	6.3
Hemangioma	2	12.6
Arterio-venous malformation	1	6.3
Hematoma	1	6.3
Tubercular abscess	3	18.7
Malignant mass lesion	2	12.6
Grand total	**75**	**100**

The observations have been described for different groups:
1. **GROUP I: THYROID AND PARATHYROID SWELLINGS (n=32)**
A total of 26 (81.2%) cases were females & remaining 6 (18.8%) cases were males. Female to male ratio of cases was 4.3:1(Fig 2.1).

Age of patients ranged from 13 to 56 years. Mean age of patients was 35.95±9.57 years. Mean age of males was 34.50±15.22 years whereas mean age of females was 37.0±8.23 years.

Table 3: Thyroid function test for group I

USG Diagnosis	Euthyroid	Hyperthyroidism	Hypothyroidism
Nodular goiter (n=12)	1(8.3%)	2(16.7%)	9(75.0%)
Thyroid adenoma (n=9)	7(77.8%)	2(22.2%)	0
Hashimoto's thyroiditis (n=3)	0	0	3(100%)
Grave's disease (n=1)	0	1(100%)	0
Follicular carcinoma (n=3)	0	1(33.3%)	2(66.7%)
Papillary Carcinoma (n=3)	1 (33.3%)	1(33.3%)	1(33.3%)

χ^2=29.4 (df=8); p<0.001
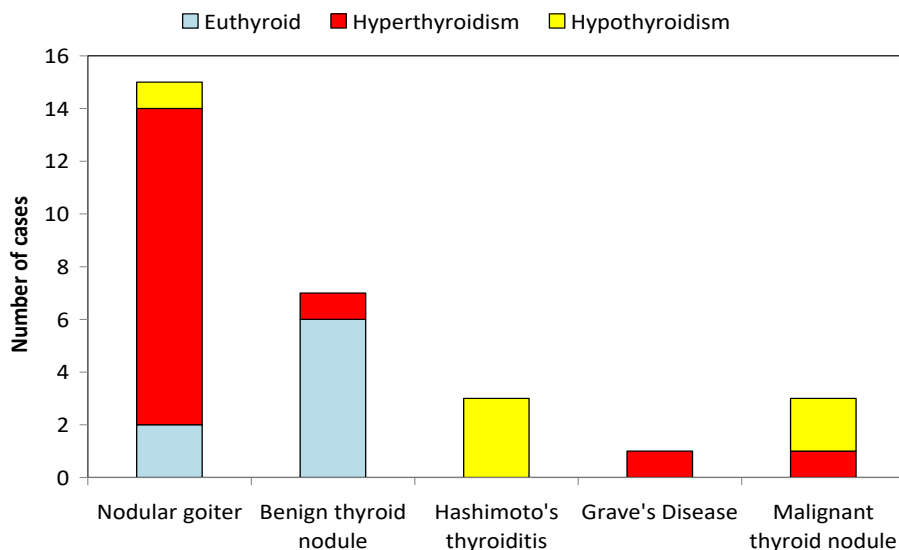
Fig. 3: Thyroid function test for group 1

Table 4: Correlation between USG and FNAC/ Histopathological Findings for group I

Final Diagnosis	FNAC done	Histopathology done	Correlation present	Correlation not present	Correlation %
Nodular goiter (n=12)	11	0	11	0	100
Thyroid adenoma (n=9)	7	0	5	2	71.4
Hashimoto's thyroiditis (n=3)	3	0	3	0	100
Grave's disease (n=1)	_	_	_	_	_
Follicular carcinoma (n=3)	2	1	2	1	66.7
Papillary Carcinoma (n=3)	1	2	3	0	100
Parathyroid adenoma (n=1)	1	_	1	_	100
Total (n=32)	25	3	25	3	89.2

2. GROUP II: LYMPH NODE SWELLING (n=24)

A total of 16 (66.7%) cases were females and remaining 8 (33.3%) were males. Female to male ratio of cases was 2:1. Age of patients ranged from 5 to 65 years. Mean age of patients was 29.92±16.34 years. Mean age of males was 41.63±15.83 years whereas mean age of females was 24.06±13.54 years.

Table 5: Correlation of USG and FNAC/ Histopathological Findings for group II

Final Diagnosis	FNAC done	Histopathology done	Correlation present	Correlation not present	Correlation %
Reactive (n=6)	4	0	3	1	75
Tubercular (n=13)	12	0	9	3	75
Metastatic (n=4)	4	0	4	0	100
Lymphomatous (n=1)	1	0	1	0	100
Total (n=24)	21	0	17	4	80.9

3. GROUP III: SALIVARY GLAND SWELLING (n=3)

A total of 2 (66.7%) cases were males and remaining 1 (33.3%) was female. Male to female ratio of cases was 2:1 (Table 5.1).

Age of patients ranged from 24 to 29 years. Mean age of patients was 26±2.9 years. Mean age of males was 24.5±0.5 years. There was only one female in this group who was 29 years of age

Table 6: Correlation of USG and FNAC/ Histopathological Findings in group III

USG Diagnosis	FNAC done	Histopathology done	Correlation present	Correlation not present	Correlation %
Sialadenitis(n=2)	0	0	-	-	-
Sialadenitis&Sialolithiasis (n=1)	0	0	-	-	-
Total (n=3)	0	0	-	-	-

4. GROUP IV: CONGENITAL AND OTHERS (n=16)

Table 7: Correlation of USG and FNAC/ Histopathological Findings in group IV (n=16)

USG Diagnosis	FNAC done	Histopathology done	Correlation present	Correlation not present	Correlation %
Thyroglossal cyst	1	0	1	0	100
Branchial cleft cyst	0	1	1	0	100
Dermoid cyst	0	1	1	0	100
Cystic hygroma	0	1	1	0	100
Ranula	0	1	1	0	100
Fibromatosis coli	_	_	_	_	_
Lipoma	_	_	_	_	_
Hemangioma(2)	_	_	_	_	_
AV malformation	_	_	_	_	_
Hematoma	_	_	_	_	_
Tubercular abscess(3)	3	0	3	0	100
Malignant mass(2)	1	1	2	0	100
Total (n=16)	**5**	**5**	**10**	**0**	**100**

Table 8: USG correlation with FNAC/ Histopathological Findings

USG Diagnosis	FNAC done	Histopathology done	Correlation present	Correlation not present	Correlation %
Group 1 Thyroid & Parathyroid (n=32)	25	3	25	3	89.2
Group 2 Lymph nodes (n=24)	21	0	17	4	80.9
Group 3 Salivary glands(n=3)	0	0	-	-	-
Group 4 Congenital & others(n=16)	5	5	10	0	100
Total (n=75)	51	8	50	9	84.7

DISCUSSION

Ultrasonography is the initial investigation modality opted by clinicians for the evaluation of superficial structures of neck. It does not require injection of radioactive contrast material and has no side effects[1]. Our study has shown reliability and sensitivity of the Ultrasound in diagnosis of soft tissue cysts, deep neck abscesses, salivary gland diseases, vascular neoplasms, head and neck cancer and nodal metastases.

Its sensitivity and specificity for some lesions have been found comparable to those of computerized tomography and magnetic resonance imaging[2,3]. Considering these characteristics, the present study was carried out with an aim to evaluate role of high resolution ultrasonography and colour Doppler in neck swelling and its correlation with FNAC/Histopathology wherever necessary.

In present study, maximum number of enrolled cases had involvement of thyroid and parathyroid glands (42.7%) followed by lymph nodes (32%) and salivary glands (4%). In remaining 16 cases, tubercular abscess was seen in 18.7%, malignant mass lesion in 12.6% and hemangioma in 12.6%. There was 1 (6.3%) case each of thyroglossal cyst, branchial cleft cyst, dermoid cyst, cystic hygroma, ranula, lipoma, Arterio-venous malformation and hematoma. The profile of abnormalities diagnosed in present study was similar to that reported by Tilak et al. (2002)[4]

In present study, cases with thyroid swellings were aged 13-56 yrs (Mean age 35.95±9.57 yrs). The mean age of patients in present study was relatively younger than that reported by Agha et al. (2013)[5]who in their study reported the median age of cases with suspicious thyroid adenomas to be 54 years.Thyroid abnormalities, particularly those related with thyroid functions, are generally reported to be more common in females as compared to males [6,7].Similar to our study, where 81.2% patients of thyroid masses were females and 72.7% patients were aged <40 years of age, Garg et al. (2015)[8] also found 92% of their cases to be female and 62% to be <40 years of age.

In present study, colloid nodule was seen in 40% cases. Thakkar et al. (2015)[9]in their study reported presence of colloid nodule in 30.3% cases. Similar to our study they also found multiple masses in majority of cases (75.76%). In present study 33.3% cases had calcification. However, Anderson et al. (2010)[10] found them to be more common in malignant as compared to benign or nodular goiter cases.In present study, for benign thyroid swellings correlation with FNAC/HPE was 77.8% which indicates a reasonable agreement between the two. Here, it would be pertinent to mentionthat in all these cases correlation was done with FNAC only, and the fact that FNAC itself does not hold absolute accuracy. The FNAC's sensitivity and specificity range from 80-90%[7,8,11] for different thyroid swellings and hence the usefulness of HR-USG and Doppler becomes more relevant, where tissue diagnosis not considered mandatory prior instituting the therapy.Overall USG showed accuracy of 85.7% cases in comparison to FNAC/HPE in group I cases.

In present study, a reasonably high correlation between FNAC and HR-USG/Doppler diagnoses was observed for lymph node swellings (80.9%).A typical US image of sialolithiasis involves: an echogenic, round or oval structure, producing an acoustic shadow[12,13]. The findings of present study coincided with these observations. Hyper vascularity is another identifying feature of sialadenitis[14] and the findings of present study confirmed that. Because of their locational and USG features, in present study FNAC was not required for final diagnosis in these cases.

Among congenital and otherlesions,USG was able to confirm the diagnosis in 6 cases and did not require further exploration. In remaining 10 cases where correlation with FNAC was done, there was absolute correlation (100%).

Although biopsy is considered to be a gold standard in evaluation of neck swellings, yet a skillful use of USG might reduce the need of invasive procedures like FNAC to a certain extent. The findings of present study underline this fact and show that a reasonable correlation between FNAC/HPE and USG diagnosis could be achieved in collaboration with experienced pathologists. In present study, USG was able to achieve final diagnosis in 71/81 (87.7%) cases and thus showed its significance in diagnosis of neck swellings. However, despite this large accuracy we once again would like to point out on the subjectiveness of these findings in view of high level of skill and knowledge required for evaluation of neck swellings and would recommend further studies to evolve some objective criteria and algorithm to address the problem of identification of etiology of neck swellings through USG.

SUMMARY AND CONCLUSION

The present study was carried out with an aim to evaluate the role of high resolution ultrasonography and colour Doppler in neck swelling and its correlation with FNAC/Histopathology. For this purpose, a total of 75 patients with neck swelling were enrolled in the study. A diagnostic workup including clinical, HR-USG, colour Doppler studies and FNAC/Histopathology/ post-surgery confirmation was done.

1. According to etiology, maximum number of enrolled cases had involvement of thyroid and parathyroid glands 40.74% followed by lymph nodes 29.62% and salivary glands 9.87%. In remaining 16 cases, tubercular abscess was seen in 3 cases, malignant mass lesion and hemangioma in 2 cases each. There was 1 case each of thyroglossal cyst, branchial cleft cyst, dermoid cyst, lipoma, cystic hygroma, ranula, Arterio-venous malformation and hematoma respectively.

2. **Thyroid & Parathyroid (n=32)**: 81.8% of total patients in this age group were females. Thyroid functions tests were done in all thyroid swelling cases. Among nodular goiter, 80% cases were hyperthyroid while 85.7% cases of benign thyroid nodule were euthyroid. All cases of Hashimoto's thyroiditis were hypothyroid. USG/Doppler characteristics of different diagnostic entities were as follows:

a) *Nodular goiter (n=15):* Characterized by diffuse thyroid swelling generally hypoechoeicechotexture& increased perinodular vascularity. Can have single colloid nodule or multiple small nodules. Colloid nodule showed comet tail artifact. FNAC/HPE was done in 12 cases, out of which 9 correlated with USG diagnosis. Accuracy of USG in relation to FNAC/HPE was 75%.

b) *Benign thyroid nodule (n=7):* Characterized by hypoechoeic or isoechoicechotexture with peripheral vascularity. Most of the cases had peripheral sonolucent halo. For these FNAC was done in all the cases and accuracy of USG in comparison to FNAC/ HPE was 85.7%.

c) *Hashimoto's thyroiditis (n=3):* Characterized by diffuse thyroid swelling with heterogenous echogenicity and multiple micronodules. For these FNAC was done in all three and correlation was 100%.

d) *Malignant thyroid nodule (n=3):* Characterized by irregular halo around a large lesion with internal vascularity. FNAC/HPE was done in all 3, and correlation was 100%.

e) *Papillary carcinoma (n=3)*: Most of the cases had characteristic honeycombing and microcalcification in with lymph nodes which had calcification. FNAC/HPE correlation was seen in all 3 (100%) cases.

f) *Grave's disease (n=1)*: This was a solitary case with diffuse thyroid swelling with heterogenous echogenicity and high vascularity. Diagnosis of Grave's disease was made by correlating with clinical examination and Thyroid profile findings which showed exophthalmos and hyperthyroidism respectively.

g) *Parathyroid adenoma (n=1):* Case presented as a solitary hypoechoeic mass lesion typically located at inferior margin of thyroid gland. Mild vascularity was increased within it. Diagnosis was confirmed by history as patient had elevated serum calcium levels. So FNAC was not done.

Overall USG showed accuracy of 85.7% cases in comparison to FNAC/HPE.

3.   **Lymph Node swellings (n=24)**: 66.7% patients were females. Most of the cases of tubercular lymphadenitis were PPD skin test positive. USG diagnosis was tubercular in 15 cases, reactive and metastatic in 4 cases each and 1 case was diagnosed as lymphoma. USG characteristics and correlation with FNAC/HPE findings for different diagnoses is as follows:

a) *Tubercular (n=13)*: Most of the cases were hypoechoeic in echotexture and showed no vascularity. Specific USG/Doppler findings included Intranodal necrosis, matted lymph node and surrounding inflammation. FNAC was done in 13 cases. Accuracy of USG findings compared to FNAC was 76.9%.

b)*Reactive (n=6)*: Generally all had hypoechoeicechotexture and increased hilar vascularity. FNAC was done in 3, of which accuracy of USG in comparison to FNAC was 66.7%.

c)*Metastatic (n=4)*: Generally 2-5 cm in size with hypoechoeicechotexture. Characteristic finding were round in shape, short to long axis ratio >0.5 and sharp borders. FNAC was done in all 4. Accuracy of USG in comparison with FNAC was 75%.

d)*Lymphomatous (n=1):* Generally large but difficult to diagnose separately from metastatic lymph nodes. Characteristic finding were intranodal reticulation. Accuracy of USG was 100% in comparison to FNAC. Overall in this group USG showed correlation with FNAC in 76.2% patients.

4. **Salivary Gland swelling (n=3):** 87.5% patients were males. USG Diagnosis was made as Sialadenitis and Sialolithiasis in 50% and tumor in remaining 50% cases. FNAC was not done in these cases as the diagnosis was confirmed by clinical and ultrasonographic examination. Following were the USG/Doppler characteristics:

a) *Sialadenitis (n=2):* 2 cases of acute sialadenitis had enlarged bilateral submandibular glands with hetrogenousechotexture and increased vascularity.

b)*Sialadenitis with sialolithiasis(n=1):* 1 case of sialadenitis with sialolithiasis had unilateral enlarged gland with heterogenousechotexture and increased vascularity. It was associated with calculus in Wharton's duct.

5.   **Congenitial and Others (n=16):** Among these 1 case each was thyroglossal cyst, branchial cleft cyst, dermoid cyst, Cystic hygroma, Ranula, Fibromatosis coli, Lipoma, AV malformation and Hematoma. There were 3 cases of tubercular abscess, malignant mass in 2 and hemangioma in 2. FNAC/HPE was done in 10 cases. All cases showed FNAC/HPE correlation therefore accuracy of USG was 100 %.

USG has a slightly low accuracy as compared to FNAC/HPE in lymph node swelling (76.2%) as compared to thyroid gland swelling (85.7%).

In 16 cases, USG findings alone confirmed the clinical diagnosis so no further evaluation was done.

Thus overall USG showed an accuracy of 84.4% in comparison to FNAC/HPE.

It can be concluded that HR-USG/Doppler was a highly efficacious tool in evaluation of neck swellings. It provided useful information and was helpful in achieving the final diagnosis. HR-USG also helped in guiding FNAC from the most probable site of getting sample for FNAC.

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