International Journal of Otorhinolaryngology and Head and Neck Surgery
Gauri HA et al. Int J Otorhinolaryngol Head Neck Surg. 2024 Dec;10(6):627-633
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

DOI: https://dx.doi.org/10.18203/issn.2454-5929.ijohns20242981

Original Research Article

Correlative evaluation of findings between ultrasonography, fine needle aspiration cytology and histopathology in cases of goitre

Huma Akbar Gauri[1]*, Navneeta Gangwar[1], Anju Singh[1], Naresh N. Rai[2], Rajeev Mudkavi[3]

[1]Department of otorhinolaryngology, Jaipur National University Institute for Medical Sciences and Research Centre, Jaipur, Rajasthan, India
[2]Department of Pathology, Jaipur National University Institute for Medical Sciences and Research Centre, Jaipur, Rajasthan, India
[3]Department of Radiodiagnosis, Jaipur National University Institute for Medical Sciences and Research Centre, Jaipur, Rajasthan, India

Received: 17 September 2024
Revised: 20 September 2024
Accepted: 24 September 2024

***Correspondence:**
Dr. Huma Akbar Gauri,
E-mail: humagauri1@gmail.com

ABSTRACT

Background: Thyroid imaging reporting and data system (TIRADS) criteria is followed in ultrasonography (USG), based on the risk of malignancy depending on the presence of suspicious ultrasound features. Patients in the high-risk category of TIRADS undergo fine needle aspiration cytology (FNAC), with the Bethesda classification used to determine the risk of malignancy. There is dearth of data comparing sonographic classification of thyroid nodule and its cytological association with respect to final histopathological diagnosis in India.
Methods: Prospective observational study on correlation of USG, FNAC and HPE of thyroid swellings conducted in department of otolaryngology at Jaipur national university institute for medical science and research centre, Jaipur, Rajasthan from June 2022 to April 2024 on 50 patients with palpable thyroid lump.
Results: In the present study, USG has a sensitivity of 63.63%, specificity of 97.44%, a positive predictive value (PPV) of 87.5%, a negative predictive value (NPV) of 90.4% and an overall accuracy of 84.00%. FNAC shows a sensitivity of 72.7%, specificity of 89.7%, PPV of 66.7%, NPV of 92%, and an overall accuracy of 86%.
Conclusions: Benign lesions on both FNAC and USG were almost in concurrence with HPE in our study. The results of FNAC for diagnosing malignancy in our study were almost at par with the results of HPE and outweighed the results of USG. Surgical management should be based on FNAC finding even if USG shows benign features. It should be essential part of armamentarium of evaluation of thyroid swelling. This combined approach provides a robust framework and enhances the accuracy for distinguishing between benign and malignant thyroid lesions, ultimately contributing to improved patient care and outcomes. However, the histopathological examination will remain the gold standard.

Keywords: High resolution USG, TIRADS, Bethesda classification, FNAC, HPE

INTRODUCTION

Thyroid disease indicated by the presence of single or multiple nodules within the thyroid gland remains a common clinical problem and has a reported prevalence of 4-7% in the general population.[1] The incidence of thyroid diseases is increasing in recent years due to goitrogens and changing food habits. Thyroid gland is afflicted by various pathologies ranging from diffuse enlargement (goitre) to nodular lesions, thyroiditis and malignancies.[1]

Thyroid USG should be performed as a screening test for all patients with a palpable thyroid nodule. This examination can help differentiate between benign and malignant nodules based on certain characteristics such as reduced echogenicity, micro calcifications, irregular margins, central hyper vascularity, incomplete halo and a shape that is taller rather than wide.[2]

FNAC is now a well-established, first line, simple and quick screening test as well as the diagnostic tool for surgical and non-surgical goitres. Limitation of FNAC is mainly because of inadequate sampling, inexperience of the pathologist and over lapping cytological features. Bethesda classification is followed in FNAC. The Bethesda system classifies thyroid FNAC into six categories. Each category is linked to a malignancy risk and has a recommended clinical management.[3]

US-guided FNA (US-FNA) is recommended for nodules ≥10 mm; US-FNA is suggested for nodules <10 mm only if clinical information or US features are suspicious.[4] For thyroid enlargement ultrasound guided FNAC can be taken for avoid injury of nearby vessels or nerve and for more accuracy of taking tissue for cytopathology examination.[5]

Ultrasound of thyroid gland is equally important as FNAC for diagnosis of any thyroid enlargement which may be benign, malignant or inflammatory.[6]

Surgery is a definitive treatment option and indications include goitres that are obstructive or large, malignancy, coexistent primary hyperparathyroidism or need for immediate or definitive correction of hyperthyroidism. Surgery consists of total or partial thyroidectomy.[7]

After a total thyroidectomy, thyroid hormone replacement should be initiated. In those that underwent a hemi-thyroidectomy, TSH and free T4 should be checked 4-6 weeks post-surgery and thyroid hormone replacement should be initiated if needed.[8]

Thyroid surgery has many complications like haemorrhage, change in voice due to injury to recurrent laryngeal nerve, respiratory obstruction due to bilateral vocal cord palsy, laryngeal oedema, tracheal injury, thyroid storm, thyrotoxicosis, tetany due to injury to parathyroid glands etc. It is necessary to choose patients who genuinely need surgery especially in small thyroid swellings to avoid the risk of such dreadful complications.[9]

The purpose of present study was to find the sensitivity, specificity of both USG and FNAC and correlate it with histopathology report so as to find out which test out of the two is more sensitive and specific in predicting the nature of the pathology in thyroid swelling. This will help in avoiding unnecessary thyroid surgery for benign pathology.

METHODS

After obtaining institutional ethics committee approval and valid informed consent from all the patients, this prospective observational study was carried out in the Dept. of ENT at Jaipur national university institute for medical sciences and research centre, Jaipur during a period of June 2022 to April 2024. Total of 50 patients of either sex, presented with clinically palpable thyroid swellings detected by USG, euthyroid patients with confirmed pathological reports, patient fit for general anaesthesia. Patients who presented in OPD with thyroid swelling underwent thyroidectomies after USG and FNAC diagnosis was confirmed, were included in the study. Patients who were diagnosed with carcinoma of the thyroid and were on follow-up for residual disease or recurrence, post-operative patients and those with physiological goitre during adolescence and pregnancy were excluded from the study. The final data collected were analyzed using SPSS software version 23.

A brief history and physical examination were carried out. Euthyroid patients underwent USG examination, and any suspected lesions were subsequently evaluated with FNAC. Patient subjected to surgical excision were included in study and histopathological examination report collected for correlation. The Ultra sound machine used was GE LOGIQ P5 with a 4 to 12 MHz linear probe will be used. The acoustic power in the Doppler mode was limited to that recommended by the current U.S food and drug administration guidelines for thyroid scanning.

Technique of USG neck

We have high frequency transducers (3.5 MHZ) currently providing both deep ultrasound penetration up to 5 cm and high definition images with a resolution of 0.7-1.0 mm were used. Linear array transducers are preferred to sector transducers because of wider near field of view.

Technique of FNAC of thyroid lesion

FNAC was performed using a 24-gauge needle attached to a 10 cc disposable syringe. Both aspiration and non-aspiration techniques were employed after cleaning and draping the patient. Material was aspirated from the swelling, and two smears were prepared. The first slide was air-dried and fixed in ethanol, while the second slide was wet-fixed in ethanol. The air-dried smear was stained using May-Grünwald-Giemsa (MGG) stain and the wet-fixed smear was stained with haematoxylin and eosin (H and E).

USG-guided FNAC was also conducted as part of the study. Based on the findings from the USG and FNAC reports, the patient was scheduled for a thyroidectomy. The excised sample was sent for histopathological analysis. The USG and FNAC results were then compared with the histopathology findings of the thyroid swelling.

RESULTS

Study comprises of 50 patients of thyroid pathology among which 43 (86.0%) were females and 7 (14.0%) were males. Study had more number of females than males at the ratio 6:1. In present study out of 50 patients 6 patients (12%) belonged to <25 years age group, 18 patients belonged to 25-39 years, 18 patients belonged to 40-54 years, and 8 patients belonged to ≥55 years i.e. maximum patients belonged to middle age. Mean age of cases is 40±14.07 shown in Table 1.

Out of 50 patients, 27 (54%) were hyperechoic, 8 (16%) were anechoic, 15(30%) were hypoechoic. In our study, there were total 44 cases (88%) of wider than taller and 6 cases (12%) of taller the wider. The 29 cases (58%) were showing none echogenic foci, 31 cases (62%) have smooth margins, 29 cases (58%) have mixed composition and 10 cases (20%) shows vascularity shown in Table 2.

In present study, USG correctly diagnosed 7 malignant thyroid cases out of 11 and 4 were wrongly diagnosed as benign cases. On USG were able to correctly diagnose 38 benign cases out 39 and 1 was wrongly diagnosed. In present study, FNAC correctly diagnosed 8 malignant thyroid cases out of 11 malignant thyroid cases and 3 malignant cases were wrongly diagnosed as benign cases. FNAC correctly diagnosed 35 benign cases out of 39 benign cases and 4 benign cases were wrongly diagnosed as malignant case.

USG has 63.63% sensitivity, 97.44% specificity, has PPV of 80.00, has NPV of 84.44% and overall accuracy of USG was 84%.

FNAC has 72.73% sensitivity, 89.74% specificity, has PPV of 66.67%, has NPV of 92.11% and overall accuracy of FNAC was 86%.

In our study, out of 11 malignant cases (22%) on HPE, the majority were papillary carcinoma of the thyroid, accounting for 7 cases (58%). FNAC was able to diagnose 5 cases as Bethesda 5 (42.8%) and Bethesda 6 (28.5%), but we could not correlate 2 cases (28.5%) which were Bethesda 2 and 1 (colloid goiter). Out of total, the remaining two cases diagnosed as follicular carcinoma on HPE, one (50%) was correctly diagnosed as Bethesda 4 (follicular neoplasm) on FNAC but was missed on USG as TIRADS 3 (colloid goiter). The other follicular carcinoma (50%) was Bethesda 3 (atypia of undetermined significance) on FNAC and missed on USG as TIRADS 2 (multinodular goiter). Among the two cases of medullary thyroid carcinoma on HPE, both (100%) were correctly diagnosed as Bethesda 6 (medullary carcinoma thyroid) on FNAC. One (50%) was correctly identified by USG as TIRADS 4 (neoplastic etiology), while the other (50%) was missed as TIRADS 2 (cystic lesion).

Table 1: Gender and age category profile of cases vis-à-vis HPE diagnosis

Parameters		N	Percentage (%)
Sex	Female	43	86
	Male	7	14
	Total	50	100

HPE diagnosis		Benign		Malignant		Total		P value
		N	%	N	%	N	%	
Age category (in years)	<25	6	100	0	0	6	12	0.145
	25-39	12	66.7	6	33.3	18	36	
	40-54	16	88.9	2	11.1	18	36	
	≥55	5	62.5	3	37.5	8	16	
	Total	39	78	11	22	50	100	

Table 2: Various parameters of USG diagnosis along with taller than wider profile of cases.

Parameters	Subcomponents	N	Percentages (%)
Echogenicity	Anechoic	8	16
	Hyperechoic	27	54
	Hypoechoic	15	30
Echogenic foci	Macrocalcification	7	14
	None	29	58
	Peripheral rim calcification	6	12
	Punctate echogenic foci	8	16
Margins	Ill defined	8	16
	Irregular	11	22
	Smooth	31	62
Composition	Cystic	29	58
	Mixed	12	24
	Solid	9	18

Continued.

Parameters	Subcomponents	N	Percentages (%)
Vascularity	Absent	40	80
	Present	10	20
Taller than wider profile	Wider than tall	44	88
	Taller than wider	6	12

Table 3: Comparison of USG and FNAC diagnosis vis-à-vis HPE diagnosis.

Variables		HPE Diagnosis		
		Benign	**Malignant**	**Total**
USG diagnosis	Benign	38	4	42
	Malignant	1	7	8
	Total	39	11	50
FNAC diagnosis	Benign	35	3	38
	Malignant	4	8	12
	Total	39	11	50

Table 4: Sensitivity, specificity, PPV, NPV and accuracy of USG and FNAC diagnosis.

Variables	Sensitivity	Specificity	PPV	NPV	Accuracy
USG	63.63%	97.44%	80.00%	84.44%	84.00%
FNAC	72.73%	89.74%	66.67%	92.11%	86.00%

Table 5: Correlation of USG, FNAC and histopathology of goitre case.

USG diagnosis (N)	TIRADS (N)	FNAC diagnosis (N)	Bethesda (N)	Histopathological diagnosis (N)
Colloid goitre (12)	1 (2) 3 (1) 2 (9)	Colloid goitre (24)	2 (26)	Colloid goitre (29)
MNG (4)	2 (4)			
Cystic lesion (8)	2 (3) 4 (1) 3 (3) 1 (1)			
Cystic lesion (1)	6 (1)	Benign cystic thyroid lesion (2)		
Colloid goiter (1)	2 (1)			
MNG (1) **Colloid goiter (1)**	2 (2)	Colloid goitre (2)	1 (2)	
Cystic lesion (1)	3 (1)	Papillary carcinoma thyroid (1)	6 (1)	
Multinodular goitre (1)	2 (1)	Atypia of undetermined significance (1)	3 (1)	Follicular adenoma (1)
Thyroiditis (1)	2 (1)	Thyroiditis (1)	2 (1)	Hashimoto thyroiditis (4)
Colloid goiter (1)	4 (1)	Follicular neoplasm (1)	4 (1)	
Multinodular goiter (1)	2 (1)	Atypia of undetermined significance (1)	3 (1)	
Cystic lesion (1)	3 (1)	Benign cystic lesion (1)	2 (1)	
Thyroiditis (1)	2 (1)	Colloid goiter (1)	2 (1)	Thyroiditis (4)
Thyroiditis (1)	1 (1)	Benign cystic thyroid lesions (1)	2 (1)	
Thyroiditis (1)	2 (1)	Colloid goiter (1)	2 (1)	
Thyroiditis (1)	2 (1)	Colloid goiter (1)	1 (1)	
Neoplastic etiology (1)	4 (1)	Papillary carcinoma thyroid (1)	6 (1)	Papillary carcinoma thyroid (7)
Malignant etiology (1)	4 (1)	Papillary carcinoma thyroid (1)	5 (1)	
Cystic lesions (1)	2 (1)	Suspicious for malignancy (1)	5 (1)	
MNG (1)	2 (1)	Colloid goiter (1)	1 (1)	
Cystic lesion (1)	2 (1)	Colloid goiter (1)	2 (1)	
Suspicious of neoplastic etiology (1)	3 (1)	Papillary carcinoma thyroid (1)	6 (1)	
Cystic lesion (1)	3 (1)	Papillary carcinoma thyroid (1)	5 (1)	
Neoplastic etiology (1)	4 (1)	Medullary carcinoma thyroid (1)	6 (1)	Medullary carcinoma thyroid (2)
Cystic lesion (1)	2 (1)	Medullary carcinoma thyroid (1)	6 (1)	

Continued.

USG diagnosis (N)	TIRADS (N)	FNAC diagnosis (N)	Bethesda (N)	Histopathological diagnosis (N)
Colloid goiter (1)	3 (1)	Follicular neoplasm (1)	4 (1)	Follicular carcinoma (2)
Multinodular goitre (1)	2 (1)	Atypia of undetermined significance (1)	2 (1)	
Colloid goiter (1)	1 (1)	Follicular lesion of undetermined lesion (1)	3 (1)	Non-invasive follicular thyroid neoplasm with papillary like nuclear features (1)

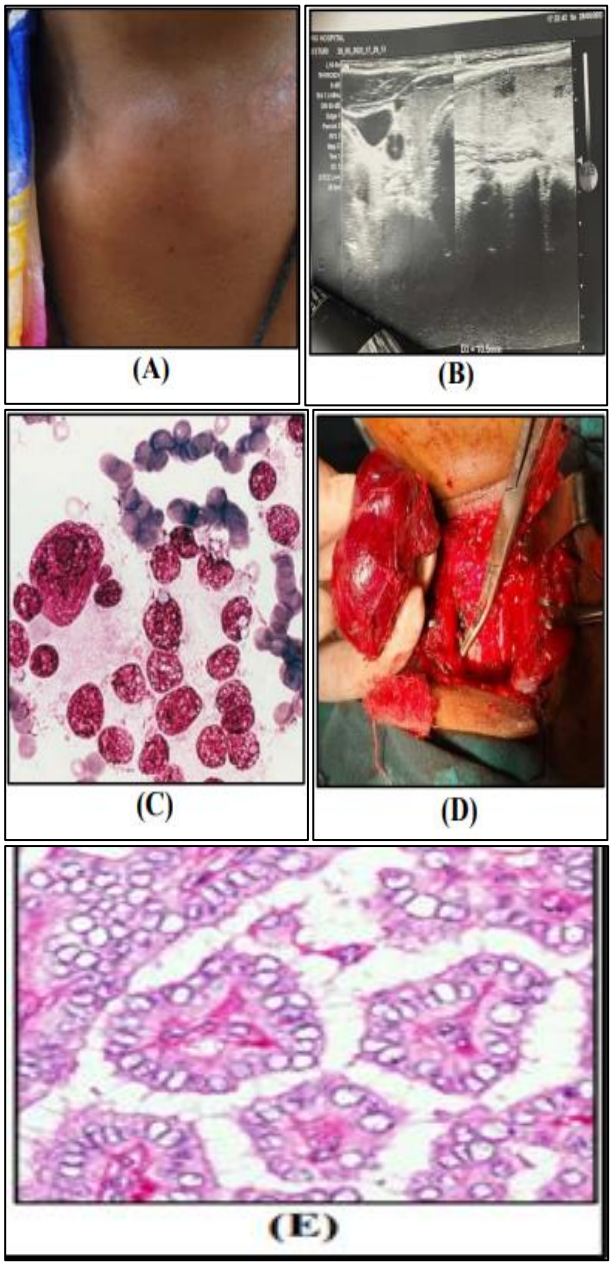

Figure 1 (A-E): Clinical picture showing thyroid swelling, USG Neck shows TIRADS 5 (large multilobulated, echogenic solid appearing, taller than wider, mass lesion 34×18×32 mm with internal vascularity). FNAC showing follicular epithelium with bland nuclei. Gross picture of thyroid swelling and HPE showing Annie eye appearance- papillary thyroid carcinoma.

DISCUSSION

In present study, out of 50 patients 43 patients (86%) were female and 7 patients (14%) were males i.e. there was dominance of female patients as compared to male patients of goiter. Most of the previous studies done in this field also found similar results to the present study. The high prevalence in females could be explained by the fact that thyroid disorders are often triggered by autoimmune responses which are more common in women than in men and secondly there is an interplay between thyroid hormones and the hormones that fluctuate during the menstrual cycle which make women more prone to thyroid disorders.[17]

In the present study, the maximum number of patients belonged to 25-54 years. Studies conducted by Shukla et al, Pawan et al and Bhise et al observed that the maximum number of patients belonged to 20-40 years which in accordance with the results of our study.[14-16] In 29 cases (58%) were showing none echogenic foci, 31 cases (62%) have smooth margins, 29 cases (58%) have mixed composition and 10 cases (20%) shows vascularity. There were total 44 cases (88%) of wider than taller and 6 cases (12%) of taller the wider. Out of 50 patients 27 (54%) were hyperechoic, 8 (16%) were anechoic, 15 (30%) were hypoechoic. Out of 50 patients, 21 (42%) were hyperechoic, 15 (30%) were hypoechoic, 8 (16%) had heterogenous echogenicity, 6(12%) were isoechoic in nature. The dominance of hyperechoic lesions in our study could be explained by fact that majority of the thyroid swellings were benign. Bhise et al in his study of total 75 cases of thyroid swellings found that highest number of patients have hyperechoic echogenicity which is consistent with results present study.[14] Majority of studies have found that hypoechoic texture is associated with a greater probability of malignancy which was also seen in our study where 54% of hypoechoic lesions were malignant. In study by Akhtar et al shows that most of the nodule were of benign features, with hyper echogenicity in 54 (100%) cases, internal content solid in 44 (86.24%) cases, wider than taller shape in 77 (91.67%) cases, well defined margin in 68 (98.55%) cases with radiological features which had 72 (98.63%) cases absent calcification and 55(98.21%) cases absent internal vascularity in benign which has similar findings like ours.[18]

USG has 36.36% sensitivity, 97.44% specificity, has PPV of 80%, has NPV of 84.44% and overall accuracy of

USG was 84.00%. FNAC correctly diagnosed 8 malignant thyroid cases out of 11 malignant thyroid cases and 3 malignant cases were wrongly diagnosed as benign cases. On FNAC, out of 38 benign cases, 35 (92%) were confirmed as benign on HPE while 3 (7.89%) turned out to be malignant on HPE. Out of 11 cases diagnosed as malignant on FNAC, majority i.e., 8 (72.72%) were confirmed malignant on HPE and 3 (27.27%) were misdiagnosed as they were suggestive of benign pathology. FNAC shows a sensitivity of 72.7%, specificity of 89.7%, PPV of 66.7%, NPV of 92%, and an overall accuracy of 86%. The sensitivity and specificity ratios for FNAC in published shows range between 65% and 98% for sensitivity and 73-100% for specificity which is in accordance to our study.[15]

FNAC was able to diagnose 5 cases as Bethesda 5 (71%), but we could not correlate 2 cases (28.5%) which were Bethesda 2 (colloid goitre). Out of total, the remaining two cases diagnosed as follicular carcinoma on HPE, one (50%) was correctly diagnosed as Bethesda 4 (follicular neoplasm) on FNAC but was missed on USG as TIRADS 1or 2 (colloid goitre). The other (50%) was Bethesda 3 (atypia of undetermined significance) on FNAC and missed on USG as TIRADS 2 (multinodular goitre). On USG, only 2 cases (28.5%) were reported as TIRADS 4 (neoplastic etiology), 1 case (14%) was TIRADS 3 (suspicious for malignant etiology), and 4 cases (57%) were TIRADS 2 (cystic lesions). Among the two cases of medullary thyroid carcinoma on HPE, both (100%) were correctly diagnosed as Bethesda 6 (medullary carcinoma thyroid) on FNAC. One (50%) was correctly identified by USG as TIRADS 4 (neoplastic etiology), while the other (50%) was missed as TIRADS 2 (cystic lesion).

This study had a relatively small sample, which may have led to over or underestimation of the study findings. Most of the lesions were found to be benign and thus the analysis of the study was limited. The percentage of malignant cases in our study was low, i.e., only 22%. As a result, we were unable to achieve strong sensitivity and specificity. Moreover, our study was time-bound. This study lacks inclusion of several risk factors including dietary factors, occupation, radiation history and clinical evaluation findings.

CONCLUSION

USG being non-invasive and FNAC minimally invasive, are cost effective outpatient basis modalities for diagnosing thyroid gland swellings and provide rapid results. Benign lesions on both FNAC and USG were almost in concurrence with HPE in our study. The results of FNAC for diagnosing malignancy in our study were almost at par with the results of HPE and outweighed the results of USG. This combined approach provides a robust framework and enhances the accuracy for distinguishing between benign and malignant thyroid lesions, ultimately contributing to improved patient care and outcomes. However, the histopathological examination will remain the gold standard.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Gupta KP, Gupta A, Gupta A. Radiopathological Correlation of Thyroid Masses: a Prospective Study. Int J Sci Stud. 2019;7(3):89-93.
2. Horvath E, Majlis S, Rossi R, Franco C, Niedmann JP, Castro A, et al. An ultrasonogram reporting system for thyroid nodules stratifying cancer risk for clinical management. J Clin Endocrinol Metab. 2009;94:1748-51.
3. Al-Ghanimi IA, Al-Sharydah AM, Al-Mulhim S, Faisal S, Al-Abdulwahab A, Al-Aftan M, et al. Diagnostic Accuracy of Ultrasonography in Classifying Thyroid Nodules Compared with Fine-Needle Aspiration. Saudi J Med Med Sci. 2020;8(1):25-31.
4. Kim EK, Park CS, Chung WY, Oh KK, Kim DI, Lee JT, et al. New sonographic criteria for recommending fine-needle aspiration biopsy of nonpalpable solid nodules of the thyroid. AJR Am J Roentgenol. 2002;178:687-91.
5. Ilahi A, Muco E, Ilahi TB. StatPearls. StatPearls Publishing; Treasure Island (FL): Anatomy, Head and Neck, Parathyroid. 2023.
6. Horvath E, Majlis S, Rossi R, Franco C, Niedmann JP, Castro A, et al. An ultrasonogram reporting system for thyroid nodules stratifying cancer risk for clinical management. J Clin Endocrinol Metab. 2009;94:1748-51.
7. Smithson M, Asban A, Miller J, Chen H. Considerations for Thyroidectomy as Treatment for Graves Disease. Clin Med Insights Endocrinol Diabetes. 2019;12:1179551419844523.
8. Schäffler A. Hormone replacement after thyroid and parathyroid surgery. Dtsch Arztebl Int. 2010;107(47):827-34.
9. Zakaria HM, Al Awad NA, Al Kreedes AS, Al-Mulhim AM, Al-Sharway MA, Hadi MA, Al Sayyah AA. Recurrent laryngeal nerve injury in thyroid surgery. Oman Med J. 2011;26(1):34-8.
10. Goellner JR, Gharib H, Grant CS, Johnson DA. Fine needle aspiration cytology of the thyroid. Acta Cytol. 1987;31:587-90.
11. Melo-Uribe MA, Sanabria Á, Romero-Rojas A, Pérez G, Vargas EJ, Abaúnza MC, et al. The Bethesda system for reporting thyroid cytopathology in Colombia: Correlation with histopathological diagnoses in oncology and non-oncology institutions. J Cytol. 2015;32:12–6.
12. Kim EK, Park CS, Chung WY, Oh KK, Kim DI, Lee JT, et al. New sonographic criteria for recommending fine-needle aspiration biopsy of

nonpalpable solid nodules of the thyroid. AJR Am J Roentgenol. 2002;178:687-91.
13. Horvath E, Majlis S, Rossi R, Franco C, Niedmann JP, Castro A, et al. An ultrasonogram reporting system for thyroid nodules stratifying cancer risk for clinical management. J Clin Endocrinol Metab. 2009;94:1748-51.
14. Bhise SV, Shaikh A, Hippargekar PM, Kothule S. A Prospective Study of Ultrasonographic and FNAC Correlation of Thyroid Swellings with Histopathology. Indian J Otolaryngol Head Neck Surg. 2022;74(2):1942-8.
15. Shukla S, Patel BP, Shukla S, Patel VK, Vaidya K, Rathore D, et al. Clinicopathological study of thyroid swellings and it's correlation with ultrasonography. Int Surg J. 2021;8(4):1218-25.
16. Kumar EP, Namratha S, Pakanati SSR, Pokala U. Int J Otorhinolaryngol Head Neck Surg. 2021;7(8):1227-30.
17. Yang Q, Kennicott K, Zhu R, Kim J, Wakefield H, Studener K, et al. Sex hormone influence on female-biased autoimmune diseases hints at puberty as an important factor in pathogenesis. Front Pediatr. 2023;11:1051624.
18. Akhtar MK, Sah D, Acharya R, Jha AK, Mahato RK, Rimal BM, Hussain A. Correlation between Ultrasonography and Fine Needle Aspiration Cytology (FNAC) Findings in Patients with Thyroid Lesions. Int J Med Sci Diagnosis Res. 2021;5(8):10.

Cite this article as: Gauri HA, Gangwar N, Singh A, Rai NN, Mudkavi R. Correlative evaluation of findings between ultrasonography, fine needle aspiration cytology and histopathology in cases of goitre. Int J Otorhinolaryngol Head Neck Surg 2024;10:627-33.