

ORIGINAL ARTICLE



OPEN ACCESS

An analysis of Clinical, Ultrasonological and Cytopathological findings of thyroid swellings at a teaching hospital in eastern Nepal

Thakur SK¹, Thakur R², Nepal N³, Khanal T⁴, Adhikari A⁴, Yadav RK⁴, Ghimire N⁵

¹Associate Professor, Department of ENT, Nobel Medical College, Biratnagar, Nepal, ²Lecturer, Department of ENT, Nobel Medical College, Biratnagar, Nepal, ³Associate Professor, Department of Pathology, Nobel Medical College, Biratnagar, Nepal, ⁴Resident, Department of ENT, Nobel Medical College, Biratnagar, Nepal, ⁵Associate Professor, Department of Physiology, Nobel Medical College, Biratnagar, Nepal.

Abstract

Background: Thyroid swelling can be benign or malignant. It is evaluated by clinical examination, Ultrasonography(USG) and Fine Needle Aspiration Cytology (FNAC). This study was conducted with the aim of comparing discrepancy of diagnosis by USG, considering FNAC as gold standard. **Methods:** A prospective observational study of thyroid swellings with convenient sampling was carried out over a year (20 October 2020 to 19 October 2021) at Outpatient department of Nobel Medical College, Biratnagar, eastern region of Nepal. Clinical, ultrasonological and cytological parameters were recorded. Sensitivity, Specificity, Positive predictive value (PPV) and negative predictive value (NPV) were calculated. **Results :** Out of 120 study population, with a mean age of 45.37 years, there was female preponderance, 110(91.66%). The commonest age group was 30-40 years, 28(23.33%). On Ultrasonography, non neoplastic lesions diagnosed were in 104 (86.7%) cases, as compared to FNAC, 113(94.2%). While, malignancy was diagnosed in 16 (13.7%) cases, by USG, only 7(5.8%) cases were malignant on FNAC. The Sensitivity of USG for malignancy detection was 100 %, Specificity was 92 %, Positive predictive value (PPV) was 43.75 % and Negative Predictive value (NPV) was 100 % as compared to FNAC. Accuracy was 92.5%. **Conclusions:** Ultrasonography has an excellent diagnostic sensitivity, specificity and accuracy compared to that of FNAC.

Key words: Thyroid, Cytology, Nodule, Neoplasm, Benign, Malignant.

Introduction

Thyroid disease is a common endocrine disorder, worldwide and in Indian subcontinent¹. The world's biggest goiter belt is the Himalayan goiter belt. Thyroid disease usually presents as a palpable midline neck swelling, with altered thyroid function. Thyroid nodules (TNs) are common and are found in 20% to 76% of the population². The prevalence of TNs has been reported to be 2-6% with palpation, 19-35% with ultrasonography (USG), and 8%-65% on autopsy³. Incidence of TNs is higher in females than in males and increases with age⁴.

The most common cause of thyroid swelling is

deficiency of iodine⁵. Thyroid diseases can be varied with various developmental, inflammatory and neoplastic disorders⁶.

Thyroid swelling can be benign or malignant. Thyroid disease include nodular abnormalities like diffuse goitre, multinodular goitre and tumors which include thyroid adenoma, papillary carcinoma, follicular carcinoma, medullary carcinoma etc. In middle age women Hashimoto's disease, follicular carcinoma and thyroid adenoma with toxic features is common. In young girls papillary carcinoma is more common. In later ages anaplastic carcinoma occurs⁷.

Among all thyroid carcinomas, papillary carcinoma is most common accounting for 81%, followed by follicular carcinoma, 10%, medullary carcinoma, 5%, anaplastic carcinoma, 3%, and lymphoma, 1% incidence⁷.

The importance of TNs lies in need to exclude

Correspondence Author

Sanjeev Kumar Thakur, Department of ENT, Nobel Medical College and Teaching Hospital, Biratnagar, Nepal. Email ID : sanjeevkr055@gmail.com, Contact Number: 9842089844

ORIGINAL ARTICLE



OPEN ACCESS

thyroid cancer, which occurs in 7-15% of cases⁸. Diagnostic modalities for thyroid swellings include detailed history, clinical examination, thyroid function test, radiological examination, surgical intervention and microscopic examination. Ultrasonography (USG) is safe and cost effective investigation of choice for determining the extent and to characterize the thyroid nodule. It will help to differentiate between benign and malignant nodules. Thyroid USG is more sensitive than clinical palpation in identifying multiple nodules^{9,10}. Fine Needle Aspiration Cytology (FNAC) is a widely accepted diagnostic modality of thyroid nodules. It is the most sensitive, rapid, safe, precise, and economical procedure than sonological studies to evaluate thyroid nodules from neoplastic and non-neoplastic lesion. In preoperative evaluation of thyroid swelling, FNAC has replaced other Investigation⁹.

Benign TNs are grouped according to cytological features into adenomatous nodules (nodular goiter), colloid nodules, and cystic nodules¹¹.

This study was intended to study clinically, the relative occurrence of various pathological conditions presenting as thyroid swelling and the ultrasonological and cytopathological analysis of examination findings of the swelling.

The objective of this study is to diagnose the nature of thyroid swelling clinically and perform ultrasonography and Fine needle aspiration cytology of the swelling and to find out the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of ultrasonography (USG) to diagnose the malignancy as compared against the diagnosis by fine needle aspiration cytology (FNAC).

Methods

A prospective observational study was carried out over a year (20 October 2020 to 19 October 2021) at Outpatient department of Nobel Medical College, Biratnagar, eastern region of Nepal.

Convenient sampling method was applied. All the cases presenting to Outpatient Department, with midline neck, thyroid swelling were included in the study. Informed consent was obtained from all the

patients, after ethical clearance from Institutional review board. The cases underwent detailed history taking and physical examination. They were subjected to ultrasonography (USG) of the neck. The needy cases, underwent further fine needle aspiration cytology (FNAC) examination. All the cases who underwent both USG and FNAC, were included in the study. Patients with non thyroid swelling and those who refused informed consent were excluded. Patients with incomplete data were also excluded.

Ultrasonography was done using 8–12 Mega Hertz linear probe which is adjusted to operate at clinically highest appropriate frequency along with real time Color Flow Doppler technology. Patients in which deeper penetration is needed low frequency probe was used. Ultrasound neck was done to know the anatomy and nodularity of gland and to look for findings suggestive of malignancy like hypoechoic, calcification, irregular margins, solid component, taller than wider¹².

With all aseptic precautions, FNAC was done in all patients, in the pathology department by using 23 gauge needles. Smears were prepared from aspirated material and were stained with Haematoxylin and Eosin. A cytological diagnosis was made¹³.

The data obtained were tabulated and analysed. SPSS software version 16.0 was used. The observations were expressed in number and percentage. Mean age was calculated. Sensitivity, Specificity, Positive predictive value (PPV) and negative predictive value (NPV) were calculated to compare the diagnosis of malignancy by USG against the FNAC diagnosis of malignancy.

Results

Out of a total of 120 study subjects, with midline neck thyroid swelling, 110 (91.66%) were females, which outnumbered the male, 10(8.3%), as shown in table 1. The mean age was 45.37 years, with an age range of 11-76 years. The maximum number of patients were in the age group of third to fourth decade, 28(23.33%) followed by fifth to sixth decade, 26(21.66%). 21(17.5%) cases were in the age group of fourth to fifth decade.

ORIGINAL ARTICLE



OPEN ACCESS

Table 1. Age and Gender distribution of study population

Age range (years)	Male number (percentage)	Female number (percentage)	Total number (percentage)
10-20	1 (0.83)	3 (2.5)	4 (3.33)
21-30	3 (2.5)	15 (12.5)	18 (15)
31-40	3 (2.5)	25 (20.83)	28 (23.33)
41-50	2 (1.6)	19 (15.83)	21 (17.5)
51-60	0	26 (21.66)	26 (21.66%)
61-70	0	14 (11.66)	14 (11.66)
71-80	1 (0.83)	7 (5.83)	8 (6.66)
81-90	0	1 (0.83)	1 (0.83)
Total	10 (8.3)	110 (91.66)	120 (100)

All of the patients complain was swelling in the neck, which was for 2 to 4 years duration in maximum number of patients, 92 (76.7%), as shown in table 2. 18(15%) cases presented early, less than 24 months, while, 10(8.3%) cases had duration of more than 48 months.

Table 2. Duration of neck swelling

Duration in months	Number	Percentage
Less than 24	18	15
24-48 months	92	76.7
More than 48 months	10	8.3

The comparative table of diagnosis by clinical,ultrasonological and cytoathological (fine needle aspiration cytology, FNAC) is given in the table 3.

Table 3. Comparative table of Clinical diagnosis, USG(Ultrasonography) and FNAC (Fine needle aspiration Cytology).

Clinical Diagnosis	Number	Percentage	USG	Number	Percentage	FNAC	Number	Percentage
Diffuse Goitre	34	28.3	Adenomatous Nodule	10	8.3	Adenomatous nodule	5	4.2
Multinodular goitre	69	57.5	Multinodular goitre	48	40	Colloid nodule	53	44.2
Solitary Nodular Goitre	12	10	Indeterminate	9	7.5	Follicular neoplasm/Suspicious of Neoplasm	8	6.7
			Cystic lesion	24	20	Colloid Goitre	21	17.5
			Thyroiditis	13	10.8	Thyroiditis	26	21.7
Malignancy	5	4.2	Malignancy	16	13.3	Malignancy	7	5.8

ORIGINAL ARTICLE



OPEN ACCESS

On clinical examination, non- neoplastic lesions were diagnosed in 115 (95.83%) cases, while, malignancy was suspected in 5(4.27 %) cases. Out of non neoplastic lesions, most of the patients were diagnosed to have multinodular goitre,69(57.5%), followed by diffuse goitre,34(28.3%) and solitary nodular goitre, 12 (10%).

On Ultrasonography, non neoplastic lesions diagnosed were in 104 (86.7%) cases, while malignancy was diagnosed in 16 (13.7%) cases. Out of non neoplastic lesions, maximum number of cases were diagnosed with multi nodular goitre, 48

(40%). 10 (8.3%) cases had adenomatous nodule, while, 9 (7.5%) cases had indeterminate features. Also, 24 (20%) cases had cystic lesions and 13 (10.8%) cases were those of thyroiditis. FNAC diagnosed most of the cases to be non neoplastic in nature, 113(94.2%) , while 7 (5.8%) cases were of malignant in nature. Most of the cases were those of colloid nodule, 53 (44.2%). Other diagnosis were adenomatous nodule, 5(4.2%), follicular neoplasm ,8(6.7%), and colloid giotre, 21(17.5%). There were 26 (21.7%) cases of thyroiditis.

The sensitivity of ultrasonography for malignancy detection was 100 %, as compared to FNAC, as shown in table 4.s The specificity was 92 %, Positive predictive value (PPV) was 43.75 % and Negative Predictive value (NPV) was 100 %.The accuracy was 92.5%.

Table 4. Sensitivity, Specificity, Positive predictive value (PPV) and Negative Predictive value (NPV) calculation of diagnosis by Ultrasonography (USG) compared against Fine Needle aspiration Cytology(FNAC) diagnosis.

Sensitivity	100 %
Specificity	92 %
PPV	43.75 %
NPV	100 %
Accuracy	92.5%

Discussion:

There are several radiological and pathological methods of diagnosing the nature of thyroid swellings. The most important point is to exclude malignancy. Among them, Ultrasonography(USG) is an important modality for the diagnosis. The fine needle aspiration cytology (FNAC) remains the gold standard for confirming the diagnosis. Our findings confirm a strong compatibility for the diagnosis by USG and confirmation by FNAC.

Our study finds thyroid swelling to be more common in female (91.66% vs 8.3%) than male. Previous studies have also shown the disease occurring predominantly in females^{14,15}.This was due to the fact that females have higher hormonal requirement

especially during puberty, lactation, and during menopause. The Estrogen and Progesterone may contribute to this difference in incidence.

The mean age was 45.37 years, with an age range of 11-76 years, in our study. This result is in accordance to the previous studies by Cesur M et al. and Ram N and co-authors, who reported a mean age of 43±9.4 and 43±13 years, respectively^{11,16}.

The maximum number of patients were in the age group of third to fourth decade, 28(23.33%) followed by fifth to sixth decade, 26(21.66%), in our study. A study conducted by Santosh and co authors found a maximum number of patients in 21–30 years (37.4%)¹⁷. Another study done by Kumari and Mrudula also found the commonest

ORIGINAL ARTICLE



OPEN ACCESS

incidence to be in third and fourth decade of life with an age range of 31–40 years (44.4%)¹⁸. This was because the thyroid swellings are more common in reproductive and perimenopausal age group women due to increased hormonal requirements¹².

All of the patients complaint was that of swelling in the neck, which was for 2 to 4 years duration in maximum number of patients, 92 (76.7%). 18(15%) cases presented early, less than 24 months, while, 10(8.3%) cases had duration of more than 48 months. Similar study conducted by Santosh and co authors found that 63.3% patients presented with neck swelling of 1 year. Swelling of 1 and 5 years duration was seen in 26% patients. The remaining 10% patients had swelling from 5 to 10 years¹⁷.

On clinical examination, non- neoplastic lesions (benign) were diagnosed in 115 (95.83%) cases, while, malignancy was suspected in 5(4.27%) cases, in our study. Saeed et al., in their study reported that benign lesions were in 87.4% in females and 12.6% in males, while malignant lesions were found in 87.5% in females and 12.5% in males¹⁹.

Out of the non neoplastic lesions, diagnosed on clinical examination, most of the patients were diagnosed to have multinodular goitre in 69(57.5%), followed by diffuse goitre,34(28.3%) and solitary nodular goitre, 12 (10%). Rathod and co authors found in their study, that the patients had solitary thyroid nodule (29%), diffuse thyroid swelling (38%), multi-nodular goiter (20%), cystic lesion (10%) and malignant thyroid lesion (3%)²⁰.

Tyagi and Chatterji in their study found that, the clinical diagnosis revealed multinodular goiter (60%) followed by solitary thyroid nodule in (34%) and diffuse goiter (6%)²¹.

On Ultrasonography, non neoplastic lesions diagnosed were in 104 (86.7%) cases, while malignancy was diagnosed in 16 (13.7%) cases, in our study. Out of non neoplastic lesions, maximum number of cases were diagnosed with multi nodular goitre, 48 (40%). 10 (8.3%) cases had adenomatous nodule, while, 9 (7.5%) cases had indeterminate features. Also, 24 (20%) cases had cystic lesions and 13 (10.8%) cases were those of thyroiditis.

Our study is similar to study done by Gupta and co authors in which 90 (90%) nodules were benign, 10

(10%) were malignant²².

In a study by Persichetti A and co authors, they reported a malignancy rate of 2.8% among benign US-appearing thyroid lesions²³.

FNAC diagnosed most of the cases to be non neoplastic in nature, 113(94.2%), while 7 (5.8%) cases were of malignant in nature, in our study. Most of the cases were those of colloid nodule, 53 (44.2%). Other diagnosis were adenomatous nodule, 5(4.2%), follicular neoplasm ,8(6.7%), and colloid giotre, 21(17.5%). There were 26 (21.7%) cases of thyroiditis.

Padmawar and co authors, on performing FNAC on 57 patients with thyroid swelling, 51 cases (89.47%) were benign and 6 cases (10.52%) were malignant²⁴. Hariprasad and co authors conducted a study on 159 patients with thyroid swelling, out of which 51 cases (73.58%) were benign and (26.42%) were malignant²⁵.

The sensitivity of ultrasonography for malignancy detection was 100 %, as compared to FNAC. The specificity was 92 %, Positive predictive value (PPV) was 43.75 % and Negative Predictive value (NPV) was 100 %.in our study.The accuracy was 92.5%.

In a study conducted by Shin et al the sensitivity, specificity, positive predictive value, negative predictive value and accuracy for overall malignancy were 94.5%, 26.8%, 27.5%, 94.3% and 42.2% respectively²⁶.Another study revealed that USG had a sensitivity of 98.38% in determining the nature of thyroid lesions. It had 98.38% PPV and 55.55% NPV for benign thyroid lesions, with 71.42% specificity²⁷.

In a study by Manikantan and co authors, it was reported that ultrasonography is very effective in determining the nature of thyroid lesions, with an accuracy rate of about 84.5%²⁸.The results also consistent with a study by Popli MB et al., who reported 87.2% diagnostic accuracy using US for diagnosis of benign and malignant thyroid lesions²⁹. The specificity and sensitivity of FNAC has shown a wide variation in different studies. It could be because of performance bias of the clinician performing the FNAC procedure, also that multiple nodules may harvest benign and malignant disease

ORIGINAL ARTICLE



OPEN ACCESS

at the same time in a single goiter. It is suggested that USG guided FNAC can yield a better and accurate results for diagnosing malignant nodules¹³.

Conclusions :

Females between third to fourth decades of age suffered from thyroid swelling, more commonly. Most of them had swelling of neck for two to four years duration before seeking medical help. Most of them suffered from multi nodular goitre. Ultrasonography is a highly valuable mode of investigation to differentiate benign from malignant thyroid lesions and can almost always predict the true nature of thyroid lesions with excellent diagnostic sensitivity and specificity. Ultrasonography revealed a consistent diagnostic capacity comparable to that of FNA cytology for predicting malignant thyroid lesions.

List of Abbreviations

USG- Ultrasonography

FNAC- Fine needle aspiration cytology

TNs- Thyroid nodules

Ethics approval and consent to participate

Our study was conducted after obtaining institute ethical approval (IRC-NMCTH: 384 /2020), Nobel Medical College and Teaching Hospital. Participants were explained about the research detail, its significance, the benefit and harm in Nepali language before obtaining the consent. A statement indicating that the participants has understood all the information and is willing to participate voluntarily was obtained. The confidentiality of participants were assured and not mentioned anywhere.

Competing interests

The authors declare that they have no competing interests.

Authors' contribution

SKT- Conceptualized, collected data, analyzed and wrote the manuscript. RT,NN,TK,AA,RKY,NG- Involved in the study from the beginning and critically reviewed the manuscript.

Acknowledgements

We want to give special thanks to pathology department, radiology department, our departmental faculty,colleagues and residents. We also thank to all the participants.

References:

1. Park K (2009) Nutrition and health. In: Park K (ed) Park's textbook of preventive and social medicine, 20th edn. Bhanot, Jabalpur: 557.
2. Baig FN, Liu SYW, Yip SP, Law HKW, Ying MTC. Update on Ultrasound Diagnosis for thyroid Cancer. Hong Kong J Radiol. 2018;21:82-93.
3. Colakoglu B, Yildirim D, Alis D, Ucar G, Samanci C, Ustabasioglu FE, et al. Elastography in Distinguishing Benign from Malignant Thyroid Nodules. J Clin Imaging Sci. 2016;6:51.
4. Jiang H, Tian Y, Yan W, Kong Y, Wang H, Wang A, et al. The Prevalence of Thyroid Nodules and an Analysis of Related Lifestyle Factors in Beijing Communities. Int J Environ Res Public Health. 2016;13(4):442.
5. Krukowski Zygmunt J (2004) The thyroid and thyroglossal duct. Bailey and Love's short practice of surgery, 24th edn. London, pp 776–804.
6. Vander JB, Gaston EA, Dawber TR. The significance of nontoxic thyroid nodule: final report of a 15 year study of incidence of thyroid malignancy. Ann Int Med 1968;69(3):537–540.
7. Ramsden J, Watkinson J (2008) Thyroid cancer. In: Glesson M, Browning G, Burton M (eds) Scott Browns otorhinolaryngology, head and neck surgery, 7th edn. Hodder Arnold, London, pp 2663–2701.
8. Wong R, Farrell S, Grossmann M. Thyroid nodules: diagnosis and management. Med J Aust. 2018;209(2):92-98.
9. Burch HB, Burman KD, Reed HL, Buckner L, Raber T. Fine needle aspiration of thyroid nodules. Determinant of insufficiency rate and malignancy yield at thyroidectomy.

ORIGINAL ARTICLE



OPEN ACCESS

- Acta Cytol 1996;40(6):1176–1183.
10. Xie C, Cox P, Taylor N, LaPorte S. Ultrasonography of thyroid nodules: A pictorial review. *Insights Imaging*. 2016;7(1):77-86.
 11. Cesur M, Akcil M, Ertek S, Emral R, Bulut S, Gullu S, et al. Role of cytological characteristics of benign thyroid nodules on effectiveness of their treatment with levothyroxine. *Arch Med Sci*. 2013;9(6):1083-1089.
 12. Chaudhary M, Baisakhiya N, Gurchand Singh G. Clinicopathological and Radiological Study of Thyroid Swelling. *Indian J Otolaryngol Head Neck Surg*;2019: 893-904.
 13. Alshoabi SA, Binnuhaid AA. Diagnostic accuracy of ultrasonography versus fine-needle-aspiration cytology for predicting benign thyroid lesions. *Pak J Med Sci*. 2019;35(3):630-635.
 14. Wani KA, Mustafa GH, Wani RA, Hussain Z, Arif SH, Malik AA et al. Clinical study of neoplastic thyroid swellings with reference to surgical management. *JK Pract* 2007;14(1):19–21
 15. Rout K, Ray CS, Behera SK, Biswal R (2011) A comparative study of FNAC and histopathology of thyroid swellings. *Indian J Otolaryngol Head Neck Surg* 63(4):370–372
 16. Ram N, Hafeez S, Qamar S. Diagnostic validity of ultrasonography in thyroid nodules. *J Pak Med Assoc*. 2015;65(8):875-878.
 17. Santosh UP, Kumar SKB, Trupthi MC, Bobobalan S A comprehensive approach to thyroid swellings: clinical, cytological, sonological and histopathological correlation. *Otolaryngol Clin Int J*,2014; 6(1):5–8.
 18. Kumari K, Mrudula R. Solitary thyroid nodule: cytopathology and histopathology. *Eur J Biomed Pharmaceut Sci* 2014;1(2):482–490
 19. Saeed MI, Hassan AA, Butt ME, Baniyaseen KA, Siddiqui MI, Bogari NM, et al. Pattern of Thyroid Lesions in Western Region of Saudi Arabia: A Retrospective Analysis and Literature Review. *J Clin Med Res*. 2018;10(2):106-116.
 20. Rathod GB, Rai P, Rai S. A prospective study of ultrasonographic and FNAC correlation of thyroid pathology. *IAIM*, 2015; 2(11): 46-51.
 21. Tyagi M, Chatterji P. Clinico-pathological study of patients with thyroid swelling A clinico-pathological study of patients with thyroid swelling and their management in a tertiary care centre in western Uttar Pradesh. *Asian journal of medical Sciences*. 2021;12(1):95-99.
 22. Gupta A, Jaipal D, Kulhari S, Gupta N (2016) Histopathological study of thyroid lesions and correlation with ultrasonography and thyroid profile in western zone of Rajasthan, India. *Int J Res Med Sci* 4(4):1204–1208.
 23. Persichetti A, Di Stasio E, Guglielmi R. Predictive Value of Malignancy of Thyroid Nodule Ultrasound Classification Systems: A Prospective Study. *J Clin Endocrinol Metab*. 2018;103(4):1359-1368.
 24. Padmawar MR, Kher K, Kakade A. Clinicopathological study of multinodular goiter at AVBRH. *Int J Biomed Adv Res*. 2014;05(01):10–13
 25. Hariprasad S, Srinivas T. Clinicopathological study of thyroid swellings—a 2 year prospective study. *Indian J Basic Appl Med Res* 2017;6(3):152–160.
 26. Shin JH, Baek JH, Chung J, Ha EJ, Kim JH,

ORIGINAL ARTICLE



OPEN ACCESS

- Lee YH et al. Ultrasonography diagnosis and imaging-based management of thyroid nodules: revised Korean Society of Thyroid Radiology consensus statement and recommendations. *Korean J Radiol* 2016;17(3):370–395.
27. Alshoabi SA, Binnuhaid AA. Diagnostic accuracy of ultrasonography versus fine-needle-aspiration cytology for predicting benign thyroid lesions. *Pak J Med Sci*. 2019;35(3):630-635.
28. Manikantan G, Ravi RG, Chisthi MM. Diagnostic accuracy of ultrasonography in goiters: A tertiary centre experience. *Int J Res Med Sci*. 2017;5:4975-4979.
29. Popli MB, Rastogi A, Bhalla P, Solanki Y. Utility of grayscale ultrasound to differentiate benign from malignant thyroid nodules. *Indian J Radiol Imaging*. 2012;22:63-68.