ORIGINAL ARTICLE

Clinical, Ultrasonography and Histopathological Evaluation of Solitary Thyroid Nodules: A Multicentre Experience from Dhaka, Bangladesh

Zereen Sultana Deepa[1], Md. Nazrul Islam Mollah[1], Farhana Sultana[2], Shahara Begum[3]

ABSTRACT

A cross-sectional, descriptive study was conducted from July 2023 to June 2024, in three tertiary level teaching hospitals in Dhaka city, Bangladesh, to evaluate the diagnostic accuracy of ultrasound in patients with solitary thyroid nodules. A total of 200 patients were included in this study, who were diagnosed clinically with solitary thyroid nodules and referred to the Department of Radiology & Imaging of the corresponding institution for ultrasonographic evaluation. Each patient received a preoperative evaluation that included history-taking, physical examination, thyroid function tests and ultrasonogram. The following data was collected for all patients: age, sex, any history of exposure to radiation, family history of thyroid disorders, clinical features of the thyroid nodules, and thyroid hormone profile and ultrasound findings. After operation, we collected the histopathological report as well for comparison. Out of 200 patients, most of the patients were in the 21–40 years age group (41.5%), followed by 41–60 years age group (35.5%). The mean age was 36.82±11.37 years. A female predominance (83.5%) was observed; male-female ratio was 1:5. Among presenting complaints, all the participants had complaints of thyroid swelling (100%), followed by pain (22%), dysphagia (17.5%) and hoarseness of voice (9.5%). Thyroid function tests revealed that 38% had euthyroid state, while 56.5% had hypothyroidism and 5.5% had hyperthyroidism. Ultrasonography findings revealed that the most of the thyroid nodules were at the right side (54.5%); most of the benign lesions had regular margins (91.4%), while most of the malignant nodules had irregular margins (85.7%). Microcalcification was present in 16% cases, while comet tail sign was present in 10.5% cases. However, presence of Halo was observed only in benign lesions (14.5%). Histopathological examination revealed that among benign lesions, most of them (57.7%) were nodular goiter, followed by follicular adenoma (19.4%) and thyroiditis (12.9%), while among malignancy, papillary (64.3%) and follicular (35.7%) carcinomas were found. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of ultrasonography in the diagnosis of the malignancy of thyroid gland were found 97.85%, 71.43%, 97.85%, 71.43% and 96.0%, respectively.

Keywords: Solitary thyroid nodule, thyroid malignancy, ultrasonography, histopathology

International Journal of Human and Health Sciences Vol. 10 No. 03 July'26

DOI:https://doi.org/10.31344/ijhhs.v10i3.961

INTRODUCTION

Solitary thyroid nodules are characterized clinically as localized enlargements of the thyroid gland, with the surrounding tissue appearing normal. These nodules result from the abnormal proliferation of thyroid cells, forming a lump within the gland.[1] While most thyroid nodules are benign, a small fraction may harbor thyroid cancer. To ensure early diagnosis and treatment of thyroid cancer, it is generally necessary to evaluate thyroid nodules. These atypical growths are often situated along the edges of the thyroid gland, making them palpable as lumps in the front of the neck. In larger nodules or among very slender individuals, they may even be visibly prominent.[1,2] Thyroid nodules are quite common, with their prevalence and incidence rising with age; spontaneous nodules develop at an estimated rate of 0.08% per year, starting early in life and

1. Department of Radiology & Imaging, Bangladesh Medical University (BMU), Dhaka-1000, Bangladesh.
2. Department of Radiology & Imaging, Shaheed Suhrawardy Medical College & Hospital, Dhaka-1207, Bangladesh.
3. Department of Biochemistry, Mugda Medical College, Dhaka-1214, Bangladesh.

Correspondence to: Dr. Zereen Sultana Deepa, Department of Radiology & Imaging, Bangladesh Medical University (BMU), Dhaka-1000, Bangladesh. Email: zereensultanadeepa@gmail.com

persisting into the eighth decade. Approximately 5% of individuals around the age of 60 have palpable thyroid nodules, and advancements in imaging technologies, particularly ultrasound, have significantly increased the detection rate of thyroid nodules to about 20% - 60%.[3-5]

Nodules are more prevalent in women than men, occurring in about one in 12 to 15 young women compared to one in 40 young men. More than 95% of thyroid nodules are benign (not cancerous). Despite this high proportion, the broader incidence of thyroid cancer in the general population is relatively low, reported at around 1%. Approximately 5% to 15% of all thyroid nodules may be cancerous, irrespective of their size.[6]

Recent studies indicate a rising incidence of thyroid malignancy over the years. This increase can be attributed to improved detection methods through ultrasound and other imaging techniques, as well as a genuine rise in the occurrence of papillary thyroid carcinoma (PTC).[7] Malignancy is more often found in solitary thyroid nodules compared to multinodular goiters.[1,8] Therefore, preoperative assessment of thyroid nodules to differentiate between benign and malignant forms is crucial. This process helps prevent unnecessary extensive surgical procedures and reduces the risk of complications such as hypothyroidism, hypocalcemia, and recurrent laryngeal nerve injury. Preoperative evaluations classify nodules as benign, suspicious, or malignant based on patient history, clinical findings, thyroid function tests, ultrasound characteristics, and histopathological examination as the gold standard.[9,10]

Thyroid ultrasound is essential for distinguishing true solitary thyroid nodules from those occurring in multinodular glands and for classifying nodules as solid, cystic, or mixed. However, this imaging method provides limited assistance in identifying the specific pathology of the nodules. Evidence showed that ultrasonography is capable of finding solitary nodules in approximately 25% to 50% of asymptomatic individuals, but occult lesions <1 cm in diameter are rarely malignant.[7] The importance lies in the fact that most of the patients with asymptomatic occult nodules can be followed up conservatively without intervention.[11]

The purpose of this study was to evaluate the diagnostic accuracy of ultrasound in patients with solitary thyroid nodules.

METHODS

This cross-sectional, descriptive study was conducted from July 2023 to June 2024, in three tertiary level teaching hospitals in Dhaka city, Bangladesh. A total of 200 patients were included in this study, who were diagnosed clinically with solitary thyroid nodules and referred to the Department of Radiology & Imaging of the corresponding institution for ultrasonographic evaluation. We adopted a purposive sampling technique, based on our selection criteria. Each patient received a preoperative evaluation that included history-taking, physical examination, thyroid function tests, ultrasonogram. The following data was collected for all patients: age, sex, any history of exposure to radiation, family history of thyroid disorders, clinical features of the thyroid nodules, and thyroid hormone profile and ultrasound findings. After operation, we collected the histopathological report as well for comparison.

In most cases, a surgical plan was established in advance. For patients diagnosed clinically with a solitary thyroid nodule, the plan included total thyroidectomy or near total thyroidectomy. During surgical procedures, the choice of incision site and type was determined, with careful attention given to hemostasis and the preservation of the recurrent laryngeal nerve, parathyroid glands, and other vital structures. Appropriate measures were implemented to manage postoperative hypocalcemia, and drain care was ensured. Treatment plans were adapted based on the final histopathology report. If the report indicated benign findings, patients were monitored for hormone levels, with or without thyroid hormone supplementation, while hypocalcemia was treated with calcium and vitamin D supplementation. For patients whose final histopathology reports confirmed either follicular or papillary carcinoma, recommendations included an I-131 whole-body scan, ideally within 4 to 6 weeks post-surgery, along with radioactive iodine ablation for any remaining thyroid tissue. All patients were instructed to have regular follow-ups.[12,13]

Statistical analysis was conducted using IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, NY, USA). Data was expressed as frequency and percentage. The results of the ultrasonographic findings were compared to the histopathological reports. The sensitivity,

specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of ultrasonography in the diagnosis of the malignancy of thyroid gland were estimated.

RESULTS

Table 1 shows that among 200 patients, most of the patients were in the 21–40 years age group (41.5%), followed by 41–60 years age group (35.5%). The mean age was 36.82±11.37 years. A female predominance (83.5%) was observed; male-female ratio was 1:5. Among presenting complaints, all the participants had complaints of thyroid swelling (100%), followed by pain (22%), dysphagia (17.5%) and hoarseness of voice (9.5%). The thyroid mass was found soft, firm and hard in 34%, 54.5% and 11.5% cases, respectively. Tenderness and cervical lymph nodes were observed in 13% and 8.5% cases, respectively. Thyroid function tests revealed that 38% had euthyroid state, while 56.5% had hypothyroidism and 5.5% had hyperthyroidism. Table 2 shows ultrasonography findings of the thyroid nodules. Most of them were at the right side (54.5%); most of the benign lesions had regular margins (91.4%), while most of the malignant nodules had irregular margins (85.7%). microcalcification was present in 16% cases, while comet tail sign was present in 10.5% cases. However, presence of Halo was observed only in benign lesions (14.5%). Table 3 shows the histopathological diagnosis of the thyroid nodules. Among benign lesions, most of them (57.7%) were nodular goiter, followed by follicular adenoma (19.4%) and thyroiditis (12.9%). Among malignancy, papillary and follicular carcinomas were found (64.3% and 35.7% respectively). The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy of ultrasonography in the diagnosis of the malignancy of thyroid gland were 97.85%, 71.43%, 97.85%, 71.43% and 96.0%, respectively, as estimated from Table 4.

Table 1: Demographic and clinical characteristics of the study participants (N=200)

Variables	Frequency	Percentage
Age group (in years)		
≤20	26	13.0
21–40	83	41.5
41–60	71	35.5
>60	20	10.0
Gender		
Male	33	16.5
Female	167	83.5
Presenting complaints		
Thyroid swelling	200	100
Pain*	44	22.0
Dysphagia*	35	17.5
Hoarseness of voice*	19	9.5
Local examination		
Enlarged thyroid	200	100.0
Consistency		
Soft	68	34.0
Firm	109	54.5
Hard	23	11.5
Tenderness		
Tender	26	13.0
Non-tender	174	87.0
Movement with deglutition		
Yes	200	100.0
No	-	-
Palpable cervical lymph nodes		
Yes	17	8.5
No	183	91.5
Thyroid function status		
Euthyroid	76	38.0
Hypothyroidism	113	56.5
Hyperthyroidism	11	5.5

*=multiple response or features along with thyroid swelling

Table 2: Sonographic findings of the solitary thyroid nodules (N=200)

Ultrasonograhic findings	Benign (n=186) Frequency (Percentage)	Malignant (n=14) Frequency (Percentage)
Position of the nodule		
Right lobe	101 (54.3)	8 (57.1)
Left lobe	85 (45.7)	6 (42.9)
Margins of the nodule		
Regular	170 (91.4)	2 (14.3)
Irregular	16 (8.6)	12 (85.7)
Microcalcification	26 (14.0)	6 (42.9)
Presence of Halo	29 (15.6)	-

Ultrasonograhic findings	Benign (n=186) Frequency (Percentage)	Malignant (n=14) Frequency (Percentage)
Comet tail sign	16 (8.6)	5 (35.7)

Table 3: Histopathoical findings of the solitary thyroid nodules (N=200)

Histopathological findings	Benign (n=186) Frequency (Percentage)	Malignant (n=14) Frequency (Percentage)
Nodular goiter	126 (67.7)	-
Thyroiditis	24 (12.9)	
Follicular adenoma	36 (19.4)	
Papillary carcinoma	-	9 (64.3)
Follicular carcinoma	-	5 (35.7)

Table 4: Comparison of ultrasound evaluation with histopathological diagnosis of thyroid nodules (N=200)

Ultrtasonographic findings	Histopathological diagnosis		Total
	Benign	Malignant	
Benign	182	4	186
Malignant	4	10	14
Total	186	14	200

Sensitivity = 97.85%, specificity-71.43%, PPV = 97.85%, NPV=71.43% , accuracy=96.0%

DISCUSSION

In the present study, the most of the patients were in the 21–40 years age group (41.5%), followed by 41–60 years age group (35.5%). The mean age was 36.82±11.37 years. A female predominance (83.5%) was observed; male-female ratio was 1:5. Mughir et al.[13] found that out of 108 patients, 88(81.5%) were females and 20(18.5%) were males. The highest incidence occurred in those aged <30 years 56(51.9%). Rahman et al.[14] found that the mean age was 32.26±9.01 years. Highest age incidence 67.3% was found in 25-45 years age group. Among the patients male and female were 21.2% and 78.8% respectively. Quadir et al.[15] found that the mean age was 37.02±10.67 years. The majority of the patients (49.3%) were found in 31–40 years age group. Six (8%) patients were found below 20 years. There were male 10(13.3%) and female 65(86.7%).

Our histopathological examination revealed 93% benign lesions and 7% malignancy. Among benign lesions, most of them (57.7%) were nodular goiter, followed by follicular adenoma (19.4%) and thyroiditis (12.9%), while among malignancy, papillary (64.3%) and follicular (35.7%) carcinomas were found. Mughir et al.[13] found that 7.4% had malignancy. Akhtar et al.[16] found that 24% cases of follicular adenoma and 12% cases of papillary carcinoma, while Khan et al.[17] found 44% colloid nodule, 2.54% thyroiditis and 12.71% papillary carcinoma. Uyar et al.[18] reported 52(36.9%) malignancies out of 141 patients; 49(94.2%) of those lesions were papillary carcinoma.

In the present study, the sensitivity, specificity, positivepredictivevalue(PPV),negativepredictive value (NPV) and accuracy of ultrasonography in the diagnosis of the malignancy of thyroid gland were found 97.85%, 71.43%, 97.85%, 71.43% and 96.0%, respectively. Mughir et al.[13] found sensitivity 70% and specificity 94%. Rahman et al.[14] found that the sensitivity, specificity, PPV, NPV and accuracy of ultrasonography in the diagnosis of the carcinoma of thyroid gland were 90.9%, 87.8%, 66.7%, 97.5% and 88.5%, respectively. Quadir et al.[15] found that the sensitivity was 95.71%, while specificity 80%, PPV 98.52%, NPV 57.14% and accuracy 94.7%.

Our study had a small sample size and from only one city of Bangladesh; further studies on a larger representative sample from different regions of the country could provide a clearer picture on the epidemiologic prevalence solitary thyroid nodules especially in the goiter endemic zones. Moreover, we acknowledge the fact that specialist sonographers' efficiency and experience may influence study results based on inter-rater variability.

CONCLUSION

To conclude, thyroid ultrasound is a widespread technique that is used as a first-line diagnostic procedure for detecting and characterizing nodular thyroid disease. we observed that ultrasonographic diagnosis of the solitary thyroid nodule was comparable with histopathology findings. As the validity test results are higher, the ultrasonographay could be a useful diagnostic

modality in the evaluation of solitary thyroid nodule, especially in our low-resources settings (upazila and district hospitals).

Conflict of interest: None declared by the authors.

Funding statement: This research received no external funding.

Ethical approval: This study was approved by the Institutional Review Board (IRB) of Mugda Medical College, Dhaka, Bangladesh.

Authors' contribution: Conceptualization and design of the study: ZS Deepa; data collection, compilation and analysis: ZS Deepa, MNI Mollah, F Sultana, S Begum; manuscript writing, editing and final submission: ZS Deepa, MNI Mollah, F Sultana, S Begum.

REFERENCES

1. Sherman SI, Gillenwater AM. Diagnostic Evaluation of the Solitary Thyroid Nodule. In: Kufe DW, Pollock RE, Weichselbaum RR, Bast Jr. RC, Gansler TS, Holland JF, Frei III, E. eds. Holland-Frei Cancer Medicine. 6th ed. Hamilton, ON, Canada: BC Decker; 2003.
2. Ness C, Duxbury B, Van Hove L, Halseth W, Tacl E. Approach to solitary thyroid nodules in adults. South Dakota Med. 2022;75(12):569-72.
3. Mu C, Ming X, Tian Y, Liu Y, Yao M, Ni Y, et al. Mapping global epidemiology of thyroid nodules among general population: a systematic review and meta-analysis. Front Oncol. 2022;12:1029926.
4. Uppal N, Collins R, James B. Thyroid nodules: global, economic, and personal burdens. Front Endocrinol (Lausanne). 2023;14:1113977.
5. Yeung MJ, Serpell JW. Management of the solitary thyroid nodule. Oncologist. 2008;13(2):105-12.
6. Tai JD, Yang JL, Wu SC, Wang BW, Chang CJ. Risk factors for malignancy in patients with solitary thyroid nodules and their impact on the management. J Cancer Res Ther. 2012;8(3):379-83.
7. Rago T, Vitti P. Role of thyroid ultrasound in the diagnostic evaluation of thyroid nodules. Best Pract Res Clin Endocrinol Metab. 2008;22(6):913-28.
8. Freitas JE. Therapeutic options in the management of toxic and nontoxic nodular goiter. Semin Nucl Med. 2000;30(2):88-97.
9. Ezzat S, Sarti DA, Cain DR, Braunstein GD. Thyroid incidentalomas. Prevalence by palpation and ultrasonography. Arch Intern Med. 1994;154(16):1838-40.
10. Tan GH, Gharib H. Thyroid incidentalomas: management approaches to nonpalpable nodules discovered incidentally on thyroid imaging. Ann Intern Med. 1997;126(3):226-31.
11. Unnikrishnan AG, Kalra S, Baruah M, Nair G, Nair V, Bantwal G, et al. Endocrine Society of India management guidelines for patients with thyroid nodules: a position statement. Indian J Endocrinol Metab. 2011;15(1):2-8.
12. Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid. 2016;26(1):1-133.
13. Mughir Al-Doghan IE, Ameer Jasim HA, Hussein FM. Evaluation of solitary thyroid nodule at AL-Yarmouk teaching hospital. J Pak Med Assoc. 2019;69(Suppl 3)(8):S45-9.
14. Rahman MH, Das S, Rahman M, Kayes MT, Saha SK. Role of ultrasonography in the diagnosis of carcinoma of thyroid gland with histopathological correlation. Shaheed Syed Nazrul Islam Med Coll J. 2017; 2(2):86-91.
15. Quadir S, Quadir S, Uddin MM, Salam KS, Hossain MS, Hossain MR. Ultrasonographic evaluation of solitary thyroid nodule with histopathological comparison. Bangladesh J Otorhinolaryngol 2019;25(2):76-84.
16. Akhtar N, Buzdar MU, Khan MA. Frequency of malignancy in solitary thyroid nodule. Pak J Med Health Sci. 2015;9(3):983-5.
17. Khan SA, Gafur MA, Khan MK, Karim MR, Mohiuddin M, Islam MS. Pattern of malignancy in clinically solitary thyroid nodule. Mymensingh Med J. 2012;21(1):1-7.
18. Uyar O, Cetin B, Aksel B, Dogan L, Beksac K, Akgul GG, et al. Malignancy in solitary thyroid nodules: evaluation of risk factors. Oncol Res Treat. 2017;40(6):360-3.