THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

Original Article

Sonographic findings of recurrent disease at the thyroid bed in differentiated thyroid cancer

Pinyaporn On-Ekkasit, M.D.
Sorasich Subhadhirasakul, M.D.
Jalat Busaman, M.D.
Songklod Pakdeejit, M.D.
From Department of radiology, Hatyai Hospital, Songkhla, Thailand.
Address correspondence to P.O. (email: pinyaporn.one@gmail.com)

Received 25 March 2024; revised 3 September 2024; accepted 5 December 2024
doi:10.46475/asean-jr.v25i3.902

Abstract

Background: Neck ultrasonography (US) is an important tool for the surveillance of patients with differentiated thyroid cancer (DTC) after initial treatment.

Objective: To evaluate sonographic findings associated with recurrent disease at the thyroid bed in patients with DTC.

Materials and Methods: This was a retrospective cohort study. We reviewed the data of 26 patients with DTC who underwent thyroidectomy and had thyroid bed lesions detected by neck US between January 2013 and December 2023. Sonographic findings of recurrent and non-recurrent lesions were compared.

Results: A total of 26 thyroid bed lesions in 26 patients were identified, including 17 recurrent and nine non-recurrent lesions. The median size was 1.0 centimeter. Sonographic findings of recurrent versus non-recurrent lesions were hypoechoic in 58.8% versus 55.6%, wider-than-tall in 64.7% versus 100%, smooth margin in 82.4% versus 66.7%, and no calcification in 70.6% versus 88.9%. There was no significant difference in each sonographic finding and combination of sonographic findings between recurrent and non-recurrent lesions. All 13 available laboratory patients with recurrent lesions had elevated serum Tg and/or TgAb levels.

Conclusion: The sonographic findings alone could not be used to distinguish recurrent lesions from the non-recurrent ones at the thyroid bed in patients with DTC. Clinical and laboratory results should be correlated to determine the need for further investigations.

Keywords: Recurrent disease, Sonographic findings, Thyroid bed, Thyroid cancer.

Introduction

Differentiated thyroid cancer (DTC) comprises more than 90% of all thyroid cancers [1, 2]. The overall prognosis is good with a 10-year overall survival rate for middle-aged adults (about 80-95%) [3, 4]. The initial treatment of DTC includes surgery, postoperative radioiodine treatment (RAI) if indicated, and thyroid stimulating hormone (TSH) suppression. A major goal of long-term follow-ups for DTC is accurate surveillance for possible disease recurrence in patients with the disease-free status. Follow-up tools for DTC are serum thyroglobulin (Tg) measurement, neck ultrasonography (US), and other imaging techniques as needed [1, 2, 5, 6].

Neck recurrence is found in up to 20% of patients with DTC [3, 7, 8]. Although serum Tg monitoring plays an excellent role in raising suspicion of recurrent disease, it lacks specificity in the presence of remaining thyroid gland tissue and may have falsely low values in the presence of Tg antibodies (TgAb) [1, 5, 6, 9]. Neck US is an important and highly sensitive tool for evaluating neck recurrence [5, 6, 8, 10]. It provides anatomical details of the neck and has the ability to detect small-volume tumors [9]. The 2015 American Thyroid Association (ATA) guidelines recommended that neck US should be performed at 6-12 months after surgery and then periodically, depending on the patient's risk of recurrence and serum Tg level [1].

Thyroid bed lesions detected by neck US can be benign conditions such as a benign thyroid tissue remnant, postoperative fibrosis, suture granuloma, or a

THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

reactive lymph node; however, some of these lesions are malignancies [11-14]. There was conflicting data in the literature regarding sonographic findings associated with thyroid bed recurrence. Several studies proposed different sonographic findings of thyroid bed recurrence, including hypoechogenicity [11, 14-16], taller-than-wide [12, 13, 15, 17], irregular margin [12, 13, 15-17], microcalcification [12, 13, 15, 18], and increased vascularization [14, 15]. However, one study reported no statistical differences in sonographic findings between recurrent and non-recurrent lesions at the thyroid bed [11]. Thus, we aimed to identify sonographic findings associated with recurrent disease at the thyroid bed in patients with DTC.

Materials and methods

Study design

This was a retrospective cohort study conducted at a tertiary care center. The study protocol was approved by the institutional review board of our hospital.

Patients

We used the ultrasonographic reporting database from our institution to identify patients with DTC aged 18 years and older who underwent thyroidectomy and had thyroid bed lesions between January 2013 and December 2023. Medical records and sonographic images of eligible patients were retrospectively reviewed. Patient data including sex, age, type of surgical procedure, type of DTC, history of RAI treatment, serum Tg and TgAb levels within 1 year from the time of neck US, and sonographic findings of thyroid bed lesions were recorded. Thyroid bed lesions were categorized into recurrent and non-recurrent lesions. Patients were considered to have recurrent lesions if surgical pathology or fine needle aspiration (FNA) cytology (if absent surgical pathology) were malignancy. The criteria for non-recurrent lesions were: (1) Surgical pathology or FNA cytology (if absent surgical pathology) was benign, or (2) In case of absent surgical pathology and FNA cytology, patients were considered to have non-recurrent lesions if iodine-131 total body scan (I-131 TBS) showed no abnormal uptake, low serum Tg levels

(< 1 ng/mL with TSH-stimulation [1]), and negative serum TgAb levels. We excluded thyroid bed lesions that were inconclusive to categorize into groups.

Neck ultrasonography

Neck US was performed with Toshiba Aplio 500 or Canon Aplio a550 using a 14-Megahertz linear transducer. Sonographic images of each thyroid bed lesion were reviewed independently for size, composition, echogenicity, shape, margin, and echogenic foci by two radiologists blinded to the diagnosis. In case of disagreement, the final result was decided by consensus.

The size of thyroid bed lesions was recorded in the longest diameter. Echogenicity was characterized relative to thyroid tissue, except for very hypoechoic in which the strap muscles were used for comparison. A taller-than-wide shape was evaluated in the transverse plane. An irregular margin was referred to as a spiculated edge. Microcalcifications were defined as punctate echogenic foci without acoustic shadowing equal to or less than 1 millimeter (mm) in diameter. Macrocalcifications were defined as coarse echogenic foci with acoustic shadowing larger than 1 mm. Peripheral calcifications were defined as calcifications that lie along all or part of the margin [19, 20].

Statistical analysis

The data analysis was performed using the Statistical Package for Social Sciences software version 21. Continuous data were presented as the median and interquartile range (IQR) or the mean and standard deviation. Categorical data were presented as numbers and percentages. We compared the size of thyroid bed lesions between the two groups using the Mann-Whitney U test. We compared other sonographic findings between the two groups using the Fisher exact test. A p-value < 0.05 was considered statistically significant.

THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

Results

Of 26 patients with DTC, there were 23 with papillary thyroid cancer (88.5%), two with follicular thyroid cancer (7.7%), and one with poorly differentiated thyroid cancer (3.8%). Twenty-four patients were females (92.3%) and two were males (7.7%) with a mean age of 47 ± 15.7 years. Twenty-four patients underwent total thyroidectomy (92.3%) and the remaining two patients underwent left and right lobectomy. Postoperative RAI was performed in 23 patients (88.5%).

Serum Tg and/or TgAb levels were available in 22 out of 26 patients. All 13 patients with recurrent lesions had elevated serum Tg (> 0.2 ng/mL without TSH-stimulation or > 1 ng/mL with TSH-stimulation [1]) and/or TgAb levels. Among nine patients with non-recurrent lesions, three had elevated serum Tg and/or TgAb levels.

A total of 26 thyroid bed lesions were identified, including 17 recurrent and nine non-recurrent lesions. The median size was 1.0 centimeter (cm) with an IQR of 0.7 to 1.4 cm. Seventeen recurrent lesions were diagnosed by surgical pathology (n=8) and FNA cytology (n=9). Nine non-recurrent lesions were diagnosed by surgical pathology (n=1), FNA cytology (n=3), and I-131 TBS with serum Tg and TgAb levels (n=5).

Sonographic findings of recurrent and non-recurrent lesions at the thyroid bed were demonstrated in Table 1. Sonographic findings of recurrent lesions were solid or completely solid in 100%, hypoechoic in 58.8% (Figure 1), wider-than-tall in 64.7%, a smooth margin in 82.4%, and no calcification in 70.6%. Microcalcifications were seen in 11.8%. The median size of recurrent lesions was 1.1 cm with an IQR of 1.0 to 1.5 cm. Sonographic findings of non-recurrent lesions were solid or completely solid in 100%, hypoechoic in 55.6% (Figure 2), wider-than-tall in 100%, smooth margin in 66.7%, and no calcification in 88.9%. The median size of non-recurrent lesions was 0.6 cm with an IQR of 0.5 to 1.2 cm. There was no significant difference in each sonographic finding and combination of sonographic findings between recurrent and non-recurrent lesions (Table 1-2).

Table 1. *Sonographic findings of recurrent and non-recurrent lesions at the thyroid bed.*

Sonographic findings	Recurrent lesions (n=17) number (%)	Non-recurrent lesions (n=9) number (%)	p-value
Size (cm), median (IQR)	1.1 (1.0 - 1.5)	0.6 (0.5 - 1.2)	0.65
Composition			
Solid or almost completely solid	17 (100)	9 (100)	N/A
Echogenicity			
Anechoic	0 (0)	0 (0)	0.095
Hyperechoic	1 (5.9)	3 (33.3)	
Isoechoic	1 (5.9)	1 (11.1)	
Hypoechoic	10 (58.8)	5 (55.6)	
Very hypoechoic	5 (29.4)	0 (0)	
Shape			
Wider-than-tall	11 (64.7)	9 (100)	0.063
Taller-than-wide	6 (35.3)	0 (0)	
Margin			
Smooth	14 (82.4)	6 (66.7)	0.535
Ill-defined	1 (5.9)	2 (22.2)	
Irregular	2 (11.8)	1 (11.1)	
Echogenic foci			
None	12 (70.6)	8 (88.9)	0.851
Macrocalcifications	2 (11.8)	1 (11.1)	
Peripheral calcifications	1 (5.9)	0 (0)	
Microcalcifications	2 (11.8)	0 (0)	

cm = centimeter, IQR = interquartile range, N/A = not applicable

THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

Table 2. *Combination of sonographic findings of recurrent and non-recurrent lesions at the thyroid bed.*

Sonographic findings	Recurrent lesions (n=17) number (%)	Non-recurrent lesions (n=9) number (%)	p-value
Hypoechoic + Taller-than-wide	6 (35.3)	0 (0)	0.063
Hypoechoic + Irregular margin	2 (11.8)	1 (11.1)	1.000
Hypoechoic + Microcalcifications	2 (11.8)	0 (0)	0.529
Taller-than-wide + Irregular margin	1 (5.9)	0 (0)	1.000
Taller-than-wide + Microcalcifications	2 (11.8)	0 (0)	0.529
Irregular margin + Microcalcifications	0 (0)	0 (0)	N/A
Hypoechoic + Taller-than-wide + Irregular margin	1 (5.9)	0 (0)	1.000
Hypoechoic + Taller-than-wide + Microcalcifications	2 (11.8)	0 (0)	0.529
Taller-than-wide + Irregular + Microcalcifications	0 (0)	0 (0)	N/A

N/A = not applicable

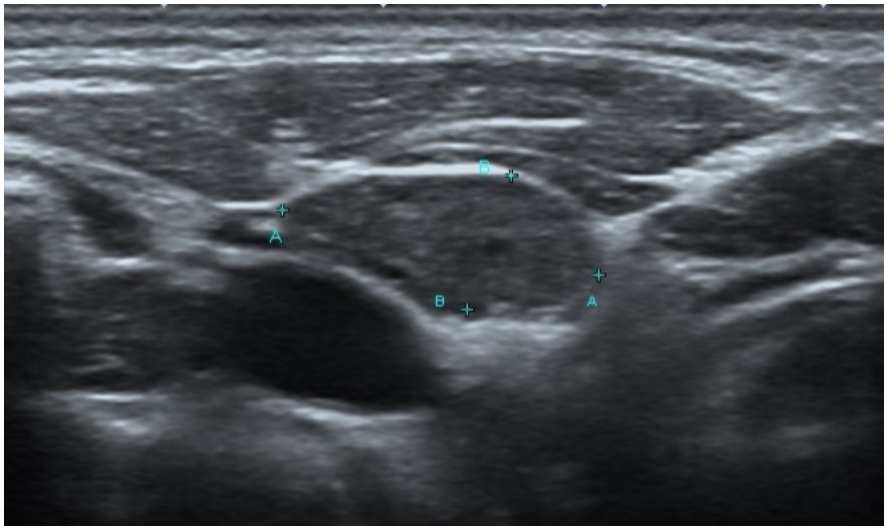

Figure 1. *Recurrent lesion at the thyroid bed in a 60-year-old woman; a transverse sonographic image showed a 1.5-cm almost solid hypoechoic wider-than-tall nodule with a smooth margin. Surgical excision revealed metastatic papillary carcinoma of a cervical lymph node.*

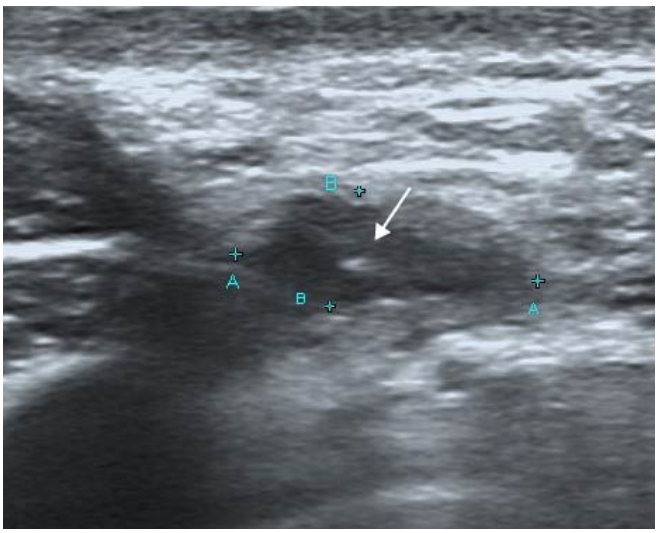

Figure 2. *Non-recurrent lesion at the thyroid bed in a 53-year-old woman; a transverse sonographic image showed a 1.0-cm solid hypoechoic wider-than-tall nodule with an irregular margin and macrocalcification (arrow). FNA cytology revealed granulomatous inflammation.*

THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

Discussion

In our study, most recurrent lesions were solid or completely solid (100%), hypoechoic (58.8%), wider-than-tall (64.7%), smooth margin (82.4%), and no calcification (70.6%). The minority of these lesions had taller-than-wide (35.3%), irregular margins (11.8%), and microcalcifications (11.8%). However, we found no significant difference in each sonographic finding and combination of sonographic findings between recurrent and non-recurrent lesions. The reason for these results may be due to the small size of the lesions (median size of 1.0 cm), which made it hard to characterize the sonographic findings. Our findings suggested that sonographic findings alone could not be used as a means to distinguish recurrent disease from benign conditions at the thyroid bed. Similar to our study, the study by Shin et al. showed that most recurrent lesions were hypoechoic (70%). Taller-than-wide and microcalcifications were seen in only 5% and 10% of recurrent lesions, respectively. They also reported no statistical differences in sonographic findings between recurrent and non-recurrent lesions at the thyroid bed [11]. On the contrary, several studies proposed different sonographic findings of thyroid bed recurrence, including hypoechogenicity [11, 14-16], taller-than-wide [12, 13, 15, 17], irregular margin [12, 13, 15-17], microcalcification [12, 13, 15, 18], and increased vascularization [14, 15].

Of 22 available laboratory patients, all 13 patients with recurrent lesions had elevated serum Tg and/or TgAb levels. Among nine patients with non-recurrent lesions, three had elevated serum Tg and/or TgAb levels. The measurement of serum Tg is an important modality to monitor patients for recurrent disease. However, it lacks specificity in the presence of remaining thyroid gland tissue. Serum TgAb should be measured together with serum Tg because the presence of TgAb may falsely lower the serum Tg level. A rising serum Tg or TgAb level suggests recurrent disease [1, 5, 6, 9]. Therefore, elevated serum Tg or TgAb level should lead to further investigations such as neck US, diagnostic I-131 TBS, computed tomography (CT), magnetic resonance imaging, or fluorine-18 fluorodeoxyglucose positron emission tomography/ CT [1, 2, 5, 6].

Neck US is an important and highly sensitive tool for evaluating neck recurrence [5, 6, 8, 10]. According to the 2015 ATA guidelines, neck US should be performed at 6-12 months after surgery and then periodically, depending on the patient's risk of recurrence and the serum Tg level. In addition, the management of thyroid bed lesions without any other suspicious sonographic findings such as suspicious cervical lymph nodes, including low serum Tg level, may be followed up with neck US. FNA should be performed in cervical lymph nodes ≥ 0.8–1.0 cm in the smallest diameter with a cystic appearance, hyperechoic punctuations, or peripheral vascularization [1]. Our findings supported this recommendation. However, if clinical or laboratory findings suspect recurrent disease, further investigations such as FNA or diagnostic I-131 TBS should be considered to confirm the diagnosis.

The strengths of our study were a cohort design and the blinding of two radiologists who reviewed sonographic images. However, there were some limitations. First, our study had a small population, which may not be sufficient to detect a difference between the two groups. Second, many thyroid bed lesions without suspicious sonographic findings with low serum Tg levels were followed up with neck US. Therefore, those lesions were not included in our study resulting in a small number of non-recurrent lesions. Third, data on vascular flow signals within the lesions were not available. One study found that increased vascularity was associated with thyroid bed recurrence. However, another study reported that vascular flow signals were not related to thyroid bed recurrence. Fourth, all thyroid bed lesions had a solid or almost completely solid composition. Thus, we cannot compare the compositions between the two groups.

THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

Conclusion

The sonographic findings alone could not be used to distinguish the recurrent from non-recurrent lesions at the thyroid bed in patients with DTC. If clinical or laboratory findings suspect recurrent disease, further investigations such as FNA or diagnostic I-131 TBS should be considered to confirm the diagnosis.

Acknowledgments

The authors would like express sincere gratitude to the clinical research center for advice on this research study.

Conflicts of Interest and Source of Funding: None to declare.

References

1. 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;26:1-133. doi: 10.1089/thy.2015.0020.

2. Cabanillas ME, McFadden DG, Durante C. Thyroid cancer. Lancet 2016; 388:2783–95. doi: 10.1016/S0140-6736(16)30172-6.

3. Schlumberger MJ. Papillary and follicular thyroid carcinoma. N Engl J Med 1998;338:297-306. doi: 10.1056/NEJM199801293380506.

4. Mettler FA, Guiberteau MJ. Essentials of nuclear medicine and molecular imaging. 7th ed. Philadelphia: Elsevier; 2019.

5. Santhanam P, Ladenson PW. Surveillance for differentiated thyroid cancer recurrence. Endocrinol Metab Clin North Am 2019;48:239–52. doi: 10.1016/j.ecl.2018.11.008.

6. Schlumberger M, Leboulleux S. Current practice in patients with differentiated thyroid cancer. Nat Rev Endocrinol 2021;17:176–88. doi: 10.1038/s41574-020-00448-z.

7. Mazzaferri EL. An overview of the management of papillary and follicular thyroid carcinoma. Thyroid 1999;9:421-7. doi: 10.1089/thy.1999.9.421.

8. Frasoldati A, Pesenti M, Gallo M, Caroggio A, Salvo D, Valcavi R. Diagnosis of neck recurrences in patients with differentiated thyroid carcinoma. Cancer 2003;97:90–6. doi: 10.1002/cncr.11031.

9. Johnson NA, Tublin ME. Postoperative surveillance of differentiated thyroid carcinoma: rationale, techniques, and controversies. Radiology 2008;249:429-44. doi: 10.1148/radiol.2492071313.

10. Rondeau G, Fish S, Hann LE, Fagin JA, Tuttle RM. Ultrasonographically detected small thyroid bed nodules identified after total thyroidectomy for differentiated thyroid cancer seldom show clinically significant structural progression. Thyroid 2011;21:845–53. doi: 10.1089/thy.2011.0011.

11. Shin JH, Han BK, Ko EY, Kang SS. Sonographic findings in the surgical bed after thyroidectomy: comparison of recurrent tumors and nonrecurrent lesions. J Ultrasound Med 2007;26:1359–66. doi: 10.7863/jum.2007.26.10.1359.

12. Lee JH, Lee HK, Lee DH, Choi CG, Gong G, Shong YK, et al. Ultrasonographic findings of a newly detected nodule on the thyroid bed in postoperative patients for thyroid carcinoma: correlation with the results of ultrasonography-guided fine-needle aspiration biopsy. Clin Imaging 2007;31:109-13. doi: 10.1016/j.clinimag.2006.11.001.

13. Ko MS, Lee JH, Shong YK, Gong GY, Baek JH. Normal and abnormal sonographic findings at the thyroidectomy sites in postoperative patients with thyroid malignancy. AJR Am J Roentgenol 2010;194:1596–609. doi: 10.2214/AJR.09.2513.

14. Kamaya A, Gross M, Akatsu H, Jeffrey RB. Recurrence in the thyroidectomy bed: sonographic findings. AJR Am J Roentgenol 2011;196:66–70. doi: 10.2214/AJR.10.4474.

15. Leenhardt L, Erdogan MF, Hegedus L, Mandel SJ, Paschke R, Rago T, et al. 2013 European Thyroid Association guidelines for cervical ultrasound scan and ultrasound-guided techniques in the postoperative management of patients with thyroid cancer. Eur Thyroid J 2013;2:147–59. doi: 10.1159/000354537.

16. Choudhary C, Wartofsky L, Tefera E, Burman KD. Evaluation of thyroid bed nodules on ultrasonography after total thyroidectomy: risk for loco-regional recurrence of thyroid cancer. Eur Thyroid J 2015;4:106–14. doi: 10.1159/000431317.

17. Hahn SY, Shin JH, Han BK, Ko EY, Kang SS, Chung JH, et al. Predictive factors related to the recurrence at US-guided fine needle aspiration in postoperative patients with differentiated thyroid cancer. Clin Endocrinol (Oxf) 2011;74:270-5. doi: 10.1111/j.1365-2265.2010.03915.x.

18. Frates MC, Parziale MP, Alexander EK, Barletta JA, Benson CB. Role of sonographic characteristics of thyroid bed lesions identified following thyroidectomy in the diagnosis or exclusion of recurrent cancer. Radiology 2021;299:374-80. doi: 10.1148/radiol.2021201596.

19. Kwak JY, Han KH, Yoon JH, Moon HJ, Son EJ, Park SH, et al. Thyroid imaging reporting and data system for US features of nodules: a step in establishing better stratification of cancer risk. Radiology 2011;260:892-9. doi: 10.1148/radiol.11110206.

20. Tessler FN, Middleton WD, Grant EG, Hoang JK, Berland LL, Teefey SA, et al. ACR Thyroid Imaging, Reporting and Data System (TI-RADS): white paper of the ACR TI-RADS committee. J Am Coll Radiol 2017;14:587-95. doi: 10.1016/j.jacr.2017.01.046.