

Thyroglossal duct cyst imaging: Thyroid scintigraphy versus Ultrasound

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Abstract

The two imaging modalities most frequently used in thyroglossal duct cyst (TDC) are thyroid scintigraphy and ultrasound. The imaging is mainly used to exclude the cyst from being the only functioning ectopic thyroid tissue. The main objective of this study is to compare the results of scintigraphy and ultrasound.

Methods: A total of 56 patients referred to the National Cancer Institute (NCI), University of Gezira in the period from Jan 2007 to Dec 2009 were included in this study, 30 females and 26 males patients; with median of 12.5 years. Data were analyzed by SPSS software.

Results: Both thyroid scintigraphy and ultrasound reached the same imaging findings *i.e.* 53 patients with TDC and 3 patients with ectopic thyroid tissues. The Fisher exact test revealed no significant difference between the two modalities final results (P- value = 1). In addition, Pearson correlation showed complete correlation between the final ultrasound and scintigraphy results ($R^2 = 1$, P-value < 0.0001). Furthermore, ultrasound has provided detailed cyst characterization.

Conclusion: Both modalities revealed almost identical results. Ultrasound has the additional advantages of being non-ionizing radiation and accurately localizes and characterizes the TDC.

Keywords: thyroid scan, thyroid ultrasound.

The thyroglossal duct cysts (TDC) is the most common congenital neck mass, accounting for 70% of all congenital neck anomalies¹. Most TDCs are located in the midline of the neck adjacent to the hyoid bone, although they can occur anywhere along the course of the thyroglossal tract^{2, 3}. Malignant lesions are rare in thyroglossal duct cysts (about 1%) and most of them develop from ectopic thyroid remnants⁴⁻⁶. In most circumstances a meticulous clinical history and physical examination are sufficient to make a correct preoperative diagnosis⁷.

The common reasons for imaging the TDC are to confirm the presence of normal thyroid gland, confirm and characterize the cystic lesion, detect the presence of the ectopic thyroid tissue, and finally to exclude the presence of malignancy in the TDC.

Many types of imaging modalities are used in the work up of the TDC preoperatively such

resonant imagining (MRI). However, the most frequently used are thyroid scintigraphy and ultrasound.

Thyroid scintigraphy usually performed to document a normal thyroid and to exclude an ectopic thyroid mimicking a TDC which is the patient's only functioning thyroid tissue, and its removal will result in hypothyroidism⁸. However, the scintigraphy result should be interpreted in the context of anatomic and biochemical data⁹. The thyroid scintigraphy exposes patients to ionizing radiation with longer Imaging time and requires intravenous access. It is also costly and may not be available. On the other hand the preoperative sonographic identification of a normal thyroid gland in patients with thyroglossal duct cyst confirms a source of thyroid hormone separate from the thyroglossal duct cyst and thus excludes ectopic thyroid^{8, 10}. Routine thyroid scintigraphy is therefore not necessary if a normal thyroid gland can be identified on routine preoperative US¹¹. Because of its superficial location, thyroid gland is ideally situated for high frequency ultrasound^{12, 13}.

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It is easily available, completely noninvasive, does not require sedation or intravenous access and relatively fast.

Objectives: To compare the final outcome result of Ultrasound to that of Scintigraphy and to determine if ultrasound can be the sole diagnostic study in TDC preoperative work up.

Methodology: A total of 56 patients were diagnosed clinically by surgeons as having thyroglossal duct cysts and referred to Nuclear Medicine and Radiology Department, National Cancer Institute, University of Gezira for thyroid scintigraphy and neck ultrasound during the period from January 2007 to December 2009.

The thyroid scintigraphy obtained 10-20 minutes after intravenous injection of 37-111MBq of sodium pertechnetate Tc-99m using a five mm single-hole collimator-equipped gamma-scintillation camera. All thyroid scintigraphies were interpreted by one Nuclear Medicine Physician (the author). All patients were scanned supine with their necks hyperextended using a 7.5-10-MHz transducer. All patients underwent neck ultrasound by one expert radiologist. The data analyzed using the SPSS program.

Results: Out of 56 patients 30 were females with female-to-male ratio of 1.3:1.

The median age is 12.5 years.

The scintigraphy showed that out of 56 patients, 55 have normal thyroid glands with no cold or hot nodules and one patient have ectopic lingual thyroid gland with complete absence of normal thyroid gland. Two out of 55 patients in addition to their normal thyroid, have a solitary ectopic thyroid tissue noted cranial to the thyroid. All 56 patients have normal radiotracer uptake (normal range 0.5-4.5%). No any radioactivity detected at the thyroglossal duct cyst regions except in the three patients in whom ectopic thyroid tissue were detected. Ultrasound of neck has revealed a normal size and shape thyroid gland in its normal expected location in the lower neck, in 55 out of 56 patients. The remaining patient, ultrasound showed ectopic lingual thyroid with a complete absence of normal thyroid gland. Ultrasound of the neck also confirmed the presence of thyroglossal duct cysts clearly separate from normal thyroid glands in 53 patients, while three have ectopic thyroid tissue with no cysts detected in the neck. The cysts mean diameter was 2.1 cm with minimum of 0.6 and maximum of 3.8cm. No solid component was detected in any cystic lesion in this series.

Both thyroid scintigraphy and ultrasound reached the same imaging findings (Table 1).

Table 1: Shows the identical outcome results by both scintigraphy and ultrasound.

Ultrasound report	Scan report			Total
	Normal thyroid	Ectopic tissue and normal thyroid	Ectopic tissue only	
Normal Thyroid	53	0	0	53
Ectopic tissue and normal thyroid	0	2	0	2
Ectopic tissue only	0	0	1	1
Total	53	2	1	56

The Fisher exact test revealed no significant difference between the scintigraphy and ultrasound final results regarding the diagnosis of normal thyroid gland and TDC (P- value = 1). Indeed, Pearson correlation showed complete correlation between the

final Ultrasound and scintigraphy results ($R^2 = 1$, P-value < 0.0001).

Furthermore, ultrasound provided detailed cyst characterization by localizing the mass and demonstrating its relationship to the thyroid gland, trachea and major neck vessels.

The borders and extent of the lesions were well outlined, as well as their internal consistency.

Discussion:

In this study thyroid scintigraphy showed that 53 patients with thyroglossal duct cysts have normal thyroid glands and all of them showed normal radiotracer uptake and correlate well with the clinically euthyroid patients and this is in complete agreement with the literature¹⁴⁻¹⁶. In addition there was no radiotracer uptake seen at the area of TDCs (Fig.1).

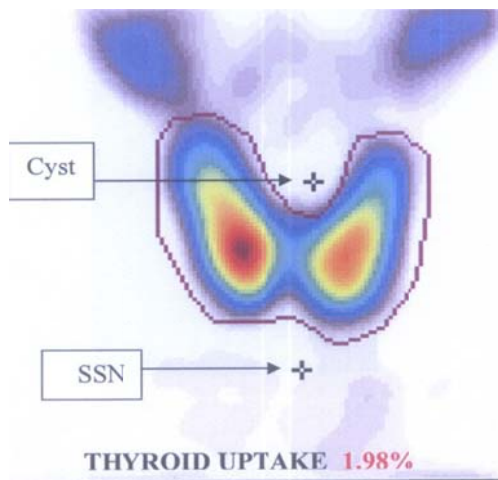


Figure 1: Thyroid scintigraphy showing normal thyroid gland with two markers (+) one at the cyst and another one at the suprasternal notch (SSN) and also showing normal thyroid radiotracer uptake (1.98%).

Three patients out of 56 in this study were correctly diagnosed by scintigraphy as having ectopic thyroid tissue instead of the clinical TDC. Two of these cases showed ectopic thyroid tissue cranially in addition to a normal thyroid gland (Fig.2) and one have only ectopic lingual thyroid gland, (Fig.3). TDCs are by definition associated with a normal thyroid gland in a more distal location¹⁷. This study is in concordance with literature and showed that 53 patients with TDCs have normal thyroid scintigraphy and normal radiotracer uptake.

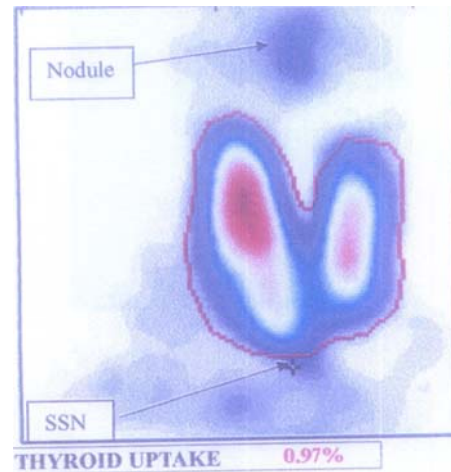


Figure 2: Thyroid scintigraphy showing a normal thyroid gland in addition to radioactive thyroid tissue noted more cranially as an ectopic thyroid tissue as marked by the nodule and another marker point to the suprasternal notch (SSN) and also showing normal thyroid radiotracer uptake (0.97%).

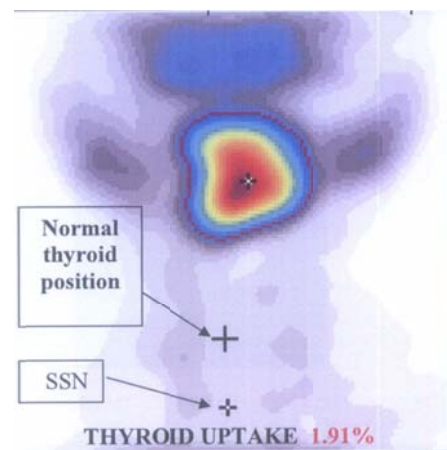


Figure 3: Thyroid scintigraphy showing absent normal thyroid gland and instead radioactive thyroid tissue noted in the sublingual region as an ectopic thyroid gland with two markers (+) one at ectopic region and another one at the suprasternal notch (SSN) and also showing normal thyroid radiotracer uptake (1.91%).

Ultrasound of neck has revealed that the normal-appearing thyroid gland was in the

expected location in the lower neck, in a total of 55 out of 56 patients. However, in one patient only ectopic lingual thyroid was detected with absence of normal thyroid gland (Fig.4).

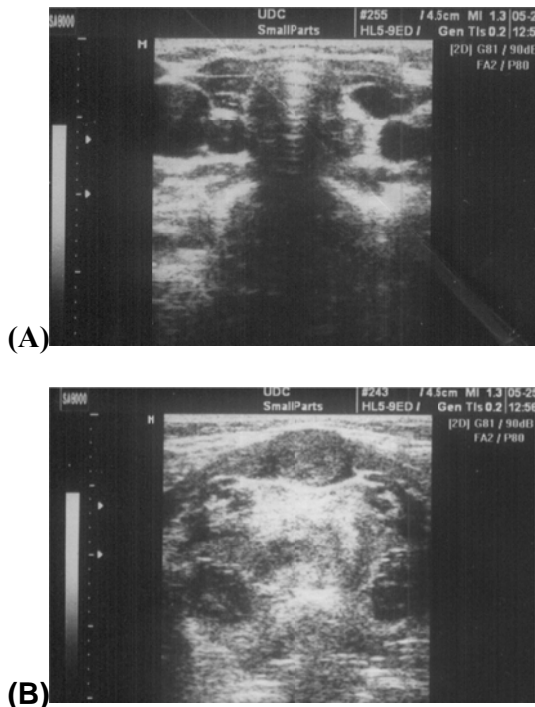


Figure 4: Ultrasound showing (A) absent normal thyroid gland in its normal anatomic position and (B) soft tissue nodule slightly echogenic to overlying strap muscle. (This is the same patient seen in Fig. 3).

This agrees with the study of Baatenburg de Jong et al., in which a normal thyroid gland was seen by ultrasound in all 24 patients with TDC¹⁸. Although ultrasound provides only anatomic information about the thyroid gland, it is extremely unlikely that a thyroid gland with normal echogenicity, contour, size, and location would be nonfunctioning⁸.

Ultrasound of the neck in this study confirmed the presence of thyroglossal duct cysts clearly separate from normal thyroid glands in 53 patients (Fig 5), while three have ectopic thyroid tissue with no cysts detected in the neck. (Fig. 6).

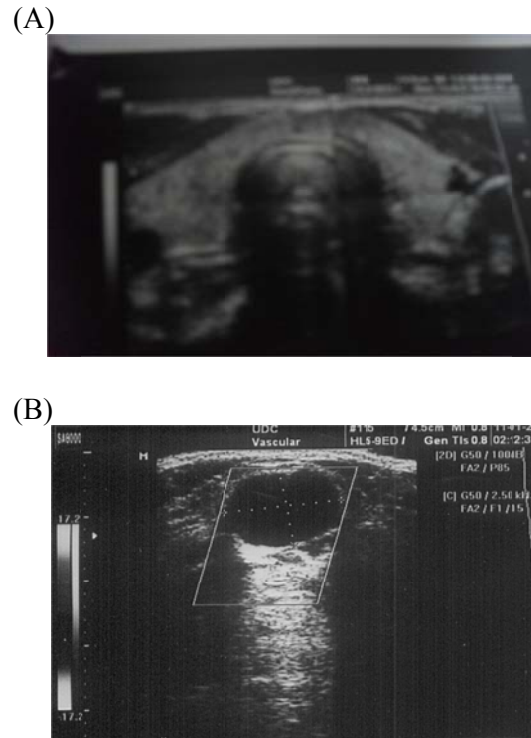


Figure 5: Ultrasound showing (A) a normal thyroid gland in its normal anatomic position and (B) TDC as simple cyst with clear fluid and posterior acoustic enhancement. This is the same patient seen in (Fig. 1).

These three patients with ectopic thyroid tissue were the same patients diagnosed by thyroid scintigraphy.

In our series the cysts mean diameter was 2.1 with minimum of 0.6 and maximum of 3.8cm but the vast majority (76%) lesions were ranging from 1-3cm. This is in complete agreement with what have been found elsewhere^{3,19}.

The majority of ectopic thyroid foci and carcinomas within thyroglossal duct cysts are not recognized prospectively and are only diagnosed at histological examination²⁰. Rarely, these lesions are sufficiently large to be identified as solid masses within the TDCC on imaging²¹. None of the TDCs in this study had a solid component that has been detected by ultrasound.

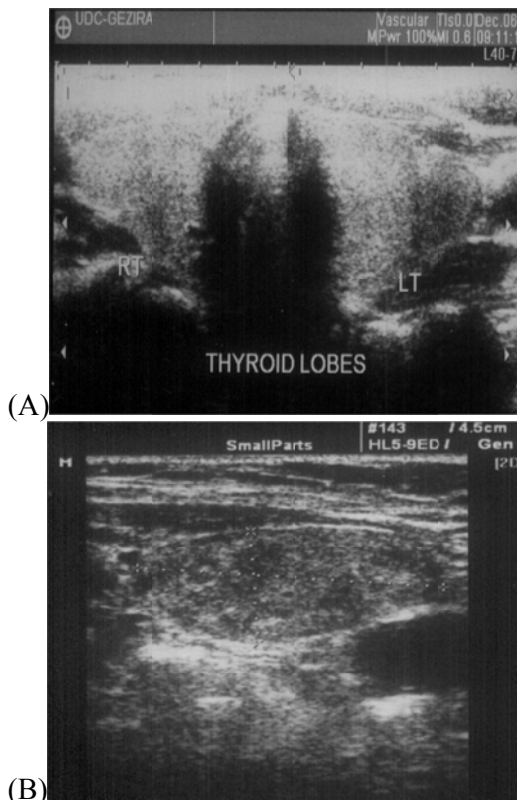


Figure 6: Ultrasound showing (A) a normal thyroid gland in its normal anatomic position and (B) soft tissue nodule seen cranial to normal thyroid gland with similar echotexture. This is the same patient seen in (Fig. 2).

Both thyroid scintigraphy and ultrasound reached the same imaging findings i.e. 53 patients with thyroglossal duct cyst and 3 patients with ectopic thyroid tissue, with no statistical differences. Furthermore, ultrasound confirmed the presence and details of the TDC such as cyst's relationship to the thyroid gland, trachea, and major neck vessels. In contrary, scintigraphy has indirectly diagnosed the cyst by confirming that the "clinically diagnosed cyst" is not taking any radiotracer but did not comment on the presence of the cyst itself or its relationship with thyroid. Even though scintigraphy showed radiotracer uptake in all three patients with ectopic thyroid tissue, it failed to show whether this is a part of a cyst or a purely solid soft tissue, but ultrasound confirmed that there is soft tissue of similar echogenicity with no associated cystic

component and suggested the diagnosis of ectopic tissue.

Conclusion:

From this study we can conclude that both US and thyroid scintigraphy have correctly diagnosed the normal thyroid gland and suggested the diagnosis of TDCs in all patients. Although thyroid scintigraphy had made the diagnosis of ectopic thyroid tissues with high certainty, US had suggested the same diagnosis.

Ultrasound has the additional advantages over scintigraphy of saving the patient from exposure to ionizing radiation and has the ability to accurately localize and characterize the TDC itself during the same study.

Ultrasound examination should be obtained routinely for patients with suspected TDCs and scintigraphy be reserved for selected cases.

References:

- Allard, R. The thyroglossal cyst. *Head Neck Surg*, 1982; 5: 134-46.
- Noyek AM, F.J. Thyroglossal duct and ectopic thyroid disorders. *Otolaryngol din North Am* 1981; 14: 187-201.
- Ahuja, A.T, King AD, King W et al., Thyroglossal duct cysts: sonographic appearances in adults. *AJNR Am J Neuroradiol*, 1999; 20(4): 579-82.
- Martins, A.S., Melo GM, Tincani AJ et al., Papillary carcinoma in a thyroglossal duct: case report. *Sao Paulo Med J*, 1999; 117(6): 248-50.
- Miccoli, P., Pacini F, Basolo S et al. Thyroid carcinoma in a thyroglossal duct cyst: tumor resection alone or a total thyroidectomy?. *Ann Chir*, 1998; 52(5): 452-4.
- Cannizzaro, M.A., Costanzo M, Fiorenza G et al., Papillary carcinoma in an isthmic thyroglossal duct cyst: clinical considerations. *Chir Ital*, 2006; 58(1): 105-11.
- Davenport, M. Lumps and swellings of the head and neck. *BMJ* 1996; 312: 368-71.
- Lim-Dunham, J.E, Feinstein KA, Yousefzadeh DK et al., Sonographic demonstration of a normal thyroid gland excludes ectopic thyroid in patients with thyroglossal duct cyst. *AJR Am J Roentgenol*, 1995; 164(6): 1489-91.
- Paltiel HJ, S.D., Treves ST. Iodine123 scintigraphy in the evaluation of pediatric thyroid disorders: a ten year experience. *Pediatr Radiol* 1992; 22: 251-256.
- Tucci, G. and Rulli F. Follicular carcinoma in ectopic thyroid gland. A case report. *G Chir* 1999; 20(3): 97-9.

11. Kovacic, M. Thyroglossal duct cysts. *Lijec Vjesn*, 1999; 121(4-5): 122-5.
12. Baskin, H., Thyroid ultrasonography—A review. *Endocrine Pract*, 1997; 3: 153–157.
13. Baskin, J., New applications of thyroid and parathyroid ultrasound. *Minerva endocrinol*, 2004; 29: 195–206.
14. Pinczower E, C.D., Atkinson JB, Kun S., Preoperative thyroid scanning in presumed thyroglossal duct cysts. *Arch Otolaryngol Head Neck Surg*, 1992; 118: 985-988.
15. Hung w, R.J., Sabatini D, winship T., Lingual and sublingual thyroid glands in euthyroid children. *Pediatrics*, 1966; 38: 647-651.
16. Strickland AL, M.J., Van Wyk JJ, French FS., Ectopic thyroid glands simulating thyroglossal duct cysts. *JAMA*, 1969; 208: 307-310.
17. Radkowski D, A.J., Healy GB, et al., Thyroglossal duct remnants. *Arch Otolaryngol Head Neck Surg*, 1991; 117: 1378-1381.
18. Baatenburg de Jong, R.J., et al., Ultrasound characteristics of thyroglossal duct anomalies. *ORL J Otorhinolaryngol Relat Spec*, 1993; 55(5): 299-302.
19. Shahin, A., et al., Thyroglossal duct cyst: a cytopathologic study of 26 cases. *Diagn Cytopathol*, 2005; 33(6): 365-9.
20. Jayalakshmi, P. et al., Papillary carcinoma arising in a thyroglossal duct cyst. *Malays J Pathol*, 2002; 24(1): 67-70.
21. Koch, B.L. Cystic malformations of the neck in children. *Pediatr Radiol*, 2005; 35: 463–477.