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● *Original Contribution*

COMPARATIVE STUDY OF ULTRASOUND AND COMPUTED TOMOGRAPHY FOR INCIDENTALLY DETECTING DIFFUSE THYROID DISEASE

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Abstract—The aim of this study was to compare the diagnostic values of thyroid ultrasound (US) and neck computed tomography (CT) in incidentally detecting diffuse thyroid disease (DTD). A single radiologist made US and CT diagnoses of incidentally detected DTD in 130 consecutive patients before thyroidectomy for various malignancies. Histopathologic examinations confirmed normal thyroid (n = 80), Hashimoto thyroiditis (n = 20), non-Hashimoto lymphocytic thyroiditis (n = 28) and diffuse hyperplasia (n = 2). Receiver operating characteristic curves revealed that the best diagnostic indices of both imaging methods were achieved on the basis of two or more abnormal imaging findings. The sensitivity, specificity and accuracy of US and CT in incidentally detecting DTD by this classification were 72% and 72%, 87.5% and 91.3% and 81.5% and 83.8%, respectively. Thyroid US and neck CT have similar diagnostic values for differentiating incidental DTD from normal thyroid. (E-mail: dwultra@lycos.co.kr or dwultra@naver.com) © **2014 World Federation for Ultrasound in Medicine & Biology.**

Key Words: **Thyroid, Diffuse thyroid disease, Autoimmune thyroiditis, Computed tomography, Ultrasound.**

INTRODUCTION

Thyroid disease is classified into the nodular type and diffuse type. Diffuse thyroid disease (DTD) includes autoimmune and non-autoimmune thyroid diseases (Loevner 2011). DTD is a main cause of thyroid dysfunction: Graves' disease is usually associated with thyroid hyperfunction, whereas Hashimoto thyroiditis and silent thyroiditis are typically associated with thyroid hypofunction (Loevner 2011). Early detection of subclinical DTD can be helpful for the appropriate management of thyroid dysfunction (Rosario et al. 2009). However, the routine thyroid autoantibody and thyroid function tests for the incidental detection of DTD have not been established in our country because of the socioeconomic burden (Rho et al. 2012).

The known sonographic features of DTD include decreased or increased parenchymal echogenicity, coarse echo texture, decreased or increased vascularity, decreased or increased anteroposterior diameter of the thyroid gland, presence of marginal nodularity, presence of scattered microcalcifications, "thyroid inferno" and "micronodulation" (Lai et al. 1990; Marcocci et al. 1991; Pedersen et al. 2000; Ralls et al. 1988; Schiemann et al. 2003; Yeh et al. 1996). However, the role of imaging-based diagnosis of incidentally detected DTD has not been established.

At present, thyroid ultrasound (US) is the first choice for diagnosing thyroid lesions, and neck computed tomography (CT) is limited to evaluation of tumor-node-metastasis (TNM) staging of thyroid cancer. Nevertheless, neck CT is a popular imaging tool for various neck lesions because of such advantages as wide field of view, objectivity and detailed display of bone or air-containing organs (Gayler et al. 1985; Rumboldt et al. 2006). To the best of our knowledge, no comparative study of US and CT for the incidental detection of DTD has been published. The purpose of this study was to evaluate the sonographic and tomographic features of incidentally detected DTD

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and to compare the related diagnostic values of thyroid US and neck CT.

METHODS

Study population

This study was approved by the institutional review board (Approval No. 12-107), and written informed consent from the patients was waived. From January to April 2013, thyroid US and neck CT were performed in consecutive patients before thyroidectomy for thyroid malignancies. The exclusion criteria were thyroid US and neck CT images revealing previous thyroidectomy or other neck operations, inappropriate imaging protocol and poor image quality; patients previously diagnosed with DTD were excluded. Ultimately, 130 patients (113 women and 17 men, age range: 23–78 y, mean [SD] age: 46.5 [10.5] y) were enrolled in this study.

Thyroid ultrasound

Thyroid US was performed by a single radiologist using a high-resolution ultrasound instrument (iU 22, Philips Healthcare, Andover, MA, USA) equipped with a 5- to 12-MHz linear probe; this radiologist has routinely evaluated thyroid US for the presence of incidentally detected DTD since 2010. The following features were investigated with real-time US: echogenicity (iso-echoic, hypo-echoic, markedly hypo-echoic or hyper-echoic); echotexture (even, coarse or micronodulative); anteroposterior diameter of the thyroid gland (normal [1–2 cm], increased [>2 cm] or decreased [<1 cm]); glandular margin (smooth, microlobulated and macrolobulated); and vascularity (normal, decreased, mildly increased or markedly increased) (Kim et al. 2010). The strap muscles were used as a reference for determining echogenicity. Vascularity of the thyroid gland was evaluated on color Doppler US.

Neck computed tomography

Neck CT was conducted using a contrast medium (slice thickness = 3 mm, reconstruction increment = 3 mm) and a 64-channel multidetector CT scanner (Aquilion One, Toshiba Medical Systems, Otawara, Japan) or a 128-channel multidetector CT scanner (LightSpeed, General Electric Medical Systems, Milwaukee, WI, USA). Non-enhanced axial, contrast-enhanced axial and contrast-enhanced coronal reformatted CT images were acquired in all cases.

The same radiologist with 11 y of experience in head and neck CT interpretation retrospectively analyzed the CT images using a picture archiving and communication system. Blinded to the sonographic data, he performed all CT image analyses. The following features were retrospectively investigated: degree and pattern of parenchymal attenuation and enhancement, anteroposterior diameter of the thyroid gland and glandular margin.

To determine the degree of parenchymal attenuation, Hounsfield unit (HU) values of both thyroid lobes were measured in regions of interest (ROIs) in all images and averaged. The size and shape of the ROIs were not standardized; if possible, the largest ROI was used. The pattern of parenchymal attenuation in non-enhanced images was classified as homogeneous, inhomogeneous and heterogeneous. Anteroposterior diameters of both thyroid

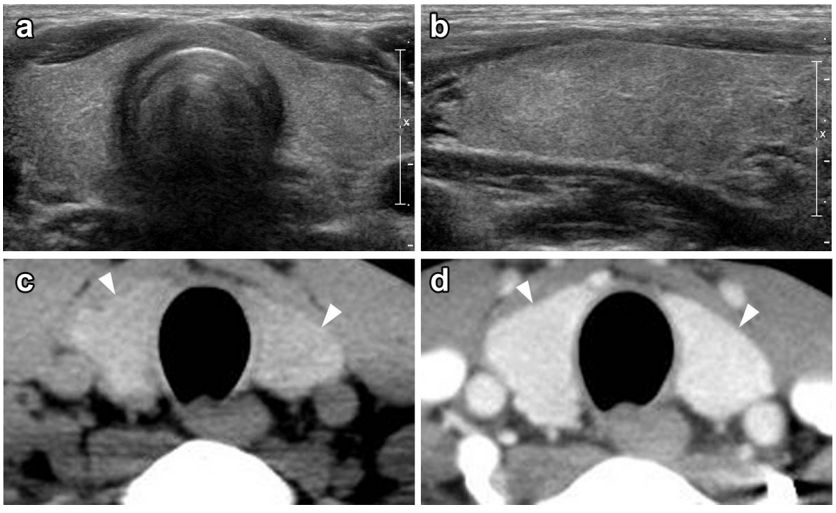

Fig. 1. A 35-y-old man with a normal thyroid diagnosed as "normal" by both ultrasound and computed tomography. Transverse (a) and longitudinal (b) gray-scale sonograms of the thyroid gland reveal iso-echogenicity, fine echotexture, a smooth margin, normal anteroposterior diameter and normal vascularity. The non-enhanced (c) and contrast-enhanced (d) computed tomography images of the thyroid gland (*arrowheads*) reveal iso-attenuation, homogeneous attenuation, normal anteroposterior diameter, a smooth margin and homogeneous parenchymal enhancement.