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Original Research

Is ultrasonographically detected nodule diameter concordant with pathological tumor size?

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HIGHLIGHTS

- US diameter is higher than histopathological size in 73.1% of thyroid cancers.
- Difference between US diameter and tumor size is correlated with nodule diameter.
- Discordance between US and tumor size might be important for surgical extent .
- Marginal irregularity is related with lower size in US than histopathology.
- Presence of halo is related with higher size in US than histopathology.

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ABSTRACT

Introduction: We aimed to compare preoperative ultrasonographical and postoperative histopathological diameters of differentiated thyroid cancer (DTC) lesions and investigate possible factors that can predict the discordance between two measurements.

Methods: Data of patients with histopathologically confirmed DTC were reviewed retrospectively. Nodules evaluated by preoperative US were matched with histopathologically examined nodules. Incidental tumors and nodules that can not be matched in US and histopathology reports were excluded. Preoperative US diameter and postoperative histopathological size were compared and percentage difference between two measurements was calculated for each lesion.

Results: There were 607 DTC foci in 562 patients. Mean US diameter was significantly higher than histopathological diameter (21.0 ± 15.6 mm vs 17.3 ± 13.6, $p < 0.001$). US diameter was higher than tumor size in 444 (73.1%), equal in 15 (2.5%) and lower in 148 (24.4%) nodules. Marginal irregularity was observed in 253 (57%) lesions with US diameter > tumor size and 108 (73%) lesions with US diameter < tumor size ($p = 0.010$). Rate of nodules with peripheral halo was higher in lesions with US diameter > tumor size (30.6% vs 20.3%, $p = 0.015$). In nodules with US diameter > tumor size, percentage difference was lower in nodules with microcalcification ($p = 0.020$) and higher in cytologically benign nodules ($p < 0.001$). Among nodules with US diameter < tumor size, <1 cm nodules had significantly higher percentage difference compared to 1–1.9, 2–3.9 and ≥ 4 cm nodules ($p = 0.005$).

Conclusion: Ultrasonographically determined diameter is higher than histopathologically determined size in a considerable ratio of DTCs. It might be helpful to consider this discordance while deciding surgical extent in these patients.

1. Introduction

Ultrasonography (US) is the most widely used method for the evaluation of quality and quantity of thyroid nodules and plays a critical role in the management of nodular thyroid diseases [1].

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Abbreviations

AUS/FLUS	Atypia of undetermined significance/follicular lesion of undetermined significance
DTC	Differentiated thyroid carcinoma
FNAB	Fine needle aspiration biopsy
FN/SFN	Follicular neoplasia/suspicious for follicular neoplasia
FTC	Follicular thyroid cancer
PTC	Papilllary thyroid cancer
US	Ultrasonography
WDT-UMP	Well differentiated thyroid tumor of unknown malignant potential

Solid component, marked hypoechogenicity, microlobulated or irregular margins, microcalcifications, and taller-than-wide shape in US are the features that were shown to have predictive value in the differentiation of malignant nodules. Malignancy risk increases in paralel with the number of these suspicious features [2–5]. Diameter in US is an important parameter that is used to select nodules for fine needle aspiration biopsy (FNAB). In the American Thyroid Association guideline released in 2015, FNAB is recommended in moderate-high risk nodules ≥1 cm and low-risk nodules ≥1.5 cm [6]. Malignancy potential of small nodules is very low and even malignant, they are accepted to carry low risk of morbidity and mortality in long term. Dominant nodule size was presented to have a significant role in the determination of surgical approach in a patient who will undergo thyroidectomy [6]. Accordingly, initial approach should be total or near total thyroidectomy when cancerous lesion is ≥ 4 cm in diameter. When the lesion is < 1 cm and has low risk papillary or follicular carcinoma characteristics, lobectomy can be preferred as the initial surgical procedure. For tumors 1–4 cm in size, any of these surgical approaches might be chosen considering other clinical features. Thus, it is important to find out whether there is an association between preoperative nodule diameter in US and postoperative tumor size in histopathological examination. In a study including 172 nodules, ultrasonographically detected nodule size was reported be higher than pathological size in 88.3% of patients [7]. In another trial, it was shown that as the size of the nodule increased, there was a tendency to increased discrepancy between preoperative and postoperative nodule diameters [8]. Particularly, the difference was significant in tumors larger than 15 mm.

In this study, we aimed to evaluate concordance between ultrasonographical nodule diameter and pathological tumor size in a large series of differentiated thyroid carcinoma (DTC) patients. We also tried to find out possible clinical and ultrasonographical features that might influence the difference between these two measurements.

2. Materials and methods

Data of patients who underwent thyroidectomy and diagnosed with DTC between January 2009 and November 2015 in our institution were reviewed retrospectively. Local ethical committee approval was obtained in accordance with the ethical standards of the Declaration of Helsinki.

Demographical features, laboratory results, thyroid US and histopathological findings in patients with nodules were recorded. The lobe (right/left/istmus), transverse localization (superior, middle, inferior, isthmic junction), longitudinal localization (anterior, middle, posterior), and contiguity to carotid artery or trachea were defined in US reports. Ultrasonographically defined nodules were matched with histopathologically evaluated nodules. Incidentally detected carcinomas and nodules that did not match in US and histopathology were excluded.

2.1. Ultrasonography and fine needle aspiration biopsy

US was performed by experienced endocrinologists (MCB, DO, RE) using Esaote color Doppler US (Model 796 FDII; MAG Technology Co. Ltd., Yung-Ho City, Taipei, Taiwan) and a superficial probe (Model LA523 13-4 5.5–12.5 Mhz). The number, diameters, exact localization, component (solid/mixed/cystic), echogenity (isoechoic, hypoechoic, iso-hypoechoic), marginal regularity (regular/irregular), presence of peripheral halo, microcalcification and macrocalcification of nodules were recorded. The diameters of each nodule were given in 3 dimensions (transverse, sagittal and longitudinal) and the largest diameter was accepted as the US diameter of that nodule. Peripheral halo was included in the US diameter measurement. Nodules were grouped as <1 cm, 1–1.9 cm, 2–3.9 cm and ≥4 cm.

All nodules ≥1 cm in diameter and nodules <1 cm with suspicious US features (hypoechogenity, presence of microcalcificaiton, marginal irregularity, absence of peripheral halo, increased intranodular vascularization and taller-than-wide shape) were evaluated by FNAB. Informed consent was taken from all patients prior to the procedure. FNAB was performed under US (Logic Pro 200 GE and 7.5 MHz probe; Kyunggigo, Korea) guidance with a 27-gauge needle and a 20-ml syringe. Bethesda classification system was used for cytological diagnosis [9]. Accordingly, there were 6 groups of cytological result which were nondiagnostic, benign, atypia of undetermined significance/follicular lesion of undetermined significance (AUS/FLUS), follicular neoplasia/suspicious for follicular neoplasia (FN/SFN), suspicious for malignancy and malignant [10].

2.2. Histopathology

For macroscopic evaluation, anterior and posterior thyroid surfaces were stained with different colors after specimen was soaked in formaldehyde for about 24 h. Right and left lobes and istmus were evaluated seperately. 5 mm axial sections were obtained from posterior to anterior. When a nodule was encountered, the diameter including the capsule was measured by a ruler. Histopathologically, type and variant, growth pattern, necrosis, mitotic activity, distance to surgical margins, lymphatic, vascular and capsular invasion, angioinvasion, perineural and intraneural invasion and extrathyroidal extension were determined for each cancer foci. The histopathological evaluation was made according to the 2004 World Health Organization criteria [11].

2.3. Statistical analysis

All statistical analyses were performed with the SPSS 15.0 software package (SPSS Inc., Chicago, IL, USA). Descriptive analyses were presented as mean±standard deviation (SD) for normally distributed variables, median and range (min-max) for non-normally distributed variables and as number of cases and (%) for nominal variables. Categorical variables were evaluated by Pearson's chi-square. Wilcoxon test and paired *t*-test were used to compare means in non-normally distributed and normally distributed dependent variables, respectively. In non-dependent variables without normal distribution, Mann-Whitney U and Kruskal-Wallis tests were performed where applicable. Spearman analysis was used to determine correlation between interval variables that were not normally distributed.