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Clinically significant cancer rates in incidentally discovered thyroid nodules by routine imaging

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ABSTRACT

Background: With widespread use of diagnostic imaging modalities, incidental thyroid nodules are frequently identified in patients for unrelated reasons. If underlying thyroid cancer risk in such patients is significant, further evaluation becomes imperative. This study evaluates the malignancy rate of incidentally discovered compared to clinically apparent thyroid nodules in surgical patients.

Methods: A retrospective review of prospectively collected data of 809 patients who underwent thyroidectomy at a tertiary referral center was performed. The association between incidental discovery of thyroid nodules, malignancy rates, and clinicopathologic characteristics was assessed.

Results: Of 809 patients, 12% ($n = 98$) had incidental thyroid nodules, where malignancy was found in 65 (66%) of these patients. The overall rate of malignancy identified incidentally by routine imaging was 14% (65/466). Most common imaging modalities leading to detection were ultrasound (32%), computed tomography (29%), and magnetic resonance imaging (23%). Of patients with incidental thyroid nodules harboring malignancy, follicular variant papillary thyroid cancer (PTC) (48%), classical variant PTC (18%), tall cell variant PTC (12%), and diffuse sclerosing variant PTC (12%) were most commonly found. Patients with malignant incidental thyroid nodules had more lymphovascular invasion and positive lymph nodes compared to nonincidental malignant thyroid nodules (53% *versus* 41% and 47% *versus* 33%, $P < 0.05$, respectively).

Conclusions: Incidentally discovered thyroid nodules by imaging represent an important group of surgical patients with clinically significant rates of underlying malignancy. Patients with incidentally discovered thyroid nodules by imaging should undergo appropriate evaluation and counseling for further surgical treatment.

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Introduction

With the advent of quality diagnostic imaging modalities over recent years, there has been a rise in the detection of radiologic findings unrelated to the reason for diagnostic imaging.[1,2] Incidental thyroid nodules are discovered by imaging studies obtained for diagnostic reasons unrelated to thyroid symptoms or disease. The most common imaging modalities related to discovery of incidental thyroid nodules include ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET).

The clinical significance of incidental thyroid nodules remains unclear. Numerous studies have demonstrated varying rates of malignancy in incidental thyroid nodules ranging from 12% to 63%.[3-6] Clinical relevance of these thyroid nodules is related to the concern of underlying malignancy that may lead to further evaluation, which may include US, fine needle aspiration (FNA), and/or ultimately diagnostic thyroid lobectomy.[7]

The incidence of thyroid cancer has increased substantially in the past decades.[8] Increased health care utilization and imaging studies as well as environmental risk factors have been linked to the rising diagnosis of thyroid cancer.[9-11] However, incidental detection of thyroid nodules has not significantly changed thyroid cancer mortality.[12] Nonetheless, the clinical significance of incidental thyroid nodules remains an important topic as the identification of underlying malignancy allows for the effective and appropriate management of this group of patients.

The purpose of this study is to describe the incidence of incidental thyroid nodules discovered by imaging in surgical patients seen at a tertiary academic medical center and to compare thyroid carcinoma in incidentally identified nodules to those in clinically apparent thyroid nodules.

Materials and methods

A retrospective review of prospectively collected data of 809 patients who were referred for evaluation of thyroid nodules between January 2010 and June 2016 at a single large academic institution was performed. Patients were identified by surgical Current Procedural Terminology codes for thyroid procedures. All patients underwent US examination of the thyroid gland, and FNA biopsy was performed when nodules met criteria for FNA. Thyroid surgery was performed on all patients, and additional management was based on final pathology. Patients were excluded from the study if they had previous history of thyroid cancer, previous thyroid surgery, or a known history of thyroid disease.

Medical records were reviewed for demographic information, including age, gender, race/ethnicity, body mass index, and insurance status. Clinical characteristics evaluated included reason for referral, symptoms, risk factors for thyroid cancer, thyroid nodule features, and cytopathologic findings categorized according to the Bethesda system. Pathology characteristics including histology, tumor size, and extrathyroidal and lymphovascular invasion were reviewed.[13,14]

A clinically apparent thyroid nodule was defined as a palpable thyroid nodule, one discovered in the workup of abnormal thyroid function tests or in the context of suspicion for thyroid cancer. An incidental thyroid nodule was defined as an asymptomatic thyroid nodule identified on imaging studies performed for other reasons in patients without any clinical symptoms, physical examination findings, or suspicion for thyroid disease. Indications for imaging studies included cancer surveillance, carotid artery evaluation, trauma evaluation, neck pain, and chest pain. Nonpalpable thyroid nodules detected on US workup for thyroid-related symptoms or thyroid cancer risk factors were not considered to be incidental on imaging studies. Final diagnosis of thyroid cancer was based on pathologic examination of the surgical specimen. All patients in the study underwent either total thyroidectomy or thyroid lobectomy with isthmusectomy. Indications for thyroid surgery included confirmed diagnosis of thyroid cancer, suspicion of thyroid cancer, indeterminate nodules, symptomatic multinodular goiter, and/or patient preference.

The proportion of incidentally discovered thyroid nodules by imaging was initially determined. The rate of malignancy in these incidentally discovered thyroid nodules was then compared to clinically apparent thyroid nodules. Data were compiled in Research Electronic Data Capture (REDCap) database for analysis.[15] The study protocol was approved by the local institutional review board including waiver of informed consent based on the retrospective nature of the study with deidentified patient data.

Statistical analyses were carried out using SAS University Edition (SAS Institute Inc, Cary, NC). The data were reported as the mean and standard deviation. Continuous data were assessed using Student *t*-test, and categorical data were assessed using chi-square test or Fisher's exact probability test as appropriate. A P value < 0.05 was considered statistically significant.

Results

Among 809 patients, 98 (12%) had incidentally discovered thyroid nodules, whereas 711 (88%) had clinically apparent thyroid nodules. Most of the patients were women (82%), of Hispanic origin (56%), and insured (93%). The mean age at diagnosis was 51 y. Of note, 75% of patients with incidental thyroid nodules were aged ≥45 y compared to 65% of patients with clinically apparent thyroid nodules. Patients with incidental thyroid nodules were more likely to be men (33% *versus* 16%, $P < 0.01$). Similarly, there were more Caucasian patients with incidental thyroid nodules compared to patients with clinically apparent thyroid nodules (35% *versus* 25%, $P = 0.02$; Table 1).

The imaging modalities identifying incidental thyroid nodules were US (32%), CT (29%), MRI (23%), PET (15%), and chest X-ray (1%). PET scan identified incidental thyroid nodules with the highest rate of malignancy (87%), followed by US (71%; Table 2).

Overall, 98% of patients had an US performed either as the initial study or a follow-up in the evaluation of the nodule.