Fine-Needle Aspiration Cytology and 99mTc-pertechnetate Scintigraphy Together in Patients with Differentiated Thyroid Carcinoma*

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Abstract. The aim of this study was to evaluate the usefulness of fine-needle aspiration cytology (FNAC) and 99mTc-pertechnetate scintigraphy (TS) together in patients with differentiated thyroid carcinoma. Data from a series of 357 patients (284 women and 73 men, median age 43 years, range 19-73) with solitary thyroid nodule and no signs of hyperfunction, who had undergone both FNAC and TS prior to surgery, were retrospectively reviewed. FNAC distinguished 3 groups of TN (benign, follicular neoplasm, cancer), while patients with ‘cold’ TN were considered at risk of having a thyroid tumor. The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were: 95%, 21%, 20%, 95% and 34% for TS; 82%, 99%, 96%, 96% and 96% for FNAC; 98%, 99%, 97%, 98%, and 99% for TS and FNAC together, respectively. In conclusion, patients with ‘cold’ TN and FNAC suggesting follicular neoplasm should be considered at risk of having cancer.

Thyroid carcinoma (TC) accounts for more than 90% of all endocrine malignancies and for fewer than 1% of all cancer cases (1). In the USA, the estimated new cases and deaths by TC in 2009 were 37200 and 1630, respectively, while the prevalence of thyroid nodules (TN) has been estimated to be 4% of the population, with an incidence of more than 5% in people over the age of 60 years (1, 2).

The majority of the patients with TN do not have cancer, but the diagnosis of TC should be obtained prior to surgery and subsequent histological examination of the removed gland. The aim of this study was to evaluate the usefulness of fine-needle aspiration cytology (FNAC) and 99mTc-pertechnetate scintigraphy (TS) together in patients with differentiated thyroid carcinoma.

Patients and Methods

Study design. The data from a series of 357 patients with solitary TN of 10 mm or more in the greatest diameter (size) and no signs or symptoms of thyroid hyperfunction, who had undergone both FNAC and TS prior to surgery, were retrospectively reviewed. There were 284 (79.5%) women and 73 (20.5%) men, with a median age of 43 years (range 19-73 years). Figure 1 shows the age distribution of the population. The size of the TN on removal (Figure 2) was measured by the pathologist at final histology.

Fine-needle aspiration cytology. The material was prepared by the cytopathologist, who supervised the entire process according to the methods described in (3). The equipment required for aspiration included: (a) standard disposable 21-gauge needles (0.8 mm x 40 mm), (b) standard disposable plastic syringes (20 ml capacity) and (c) disposable extension lines (1.5 mm x 25 cm). The needle was then positioned into the target TN under ultrasound (US) guidance. The following considerations should be made when undertaking this procedure: (a) move the needle back and forth inside the lesion keeping negative pressure applied, (b) when the aspiration process is completed, release the plunger and detach the needle and (c) draw air into the syringe and spread the sample on the slide. One slide was evaluated immediately, using the material already prepared by the cytopathologist, in order to verify the adequacy of specimen with ‘rapid’ Giemsa stain. The smear was fixed in 95% ethanol for 15 seconds, stained in Giemsa solution for 30 seconds, rinsed in tap water for 5 seconds and covered with a coverslip. The process was
Accuracy as (TN+TP)/overall patients. TP/(TP+FP), negative predictive value (NPV) as TN/(TN+FN), and (TN)/TN+false-positives (FP), positive predictive value (PPV) as

Results

The size of the TN was 21.1±8.1 mm (range 10-55 mm). A weak inverse correlation (R=–0.16, p=0.003) between patient age and TN size was found (Figure 3). At final pathology there were 61 (17.1%) patients with TC, of which 42 (68.8%) cases were papillary and 12 (16.4%) were follicular carcinomas. The sensitivity, specificity, positive predictive value, negative predictive value, and accuracy are reported in Table I. Both the sensitivity and specificity increased when FNAC and TS were used in combination, but the difference was not significant with respect the results of FNAC and TS alone (p=NS, χ² test).

Discussion

Thyroid cancer is a rare malignancy, but its incidence increased from 8,000 to 26,000 cases per year in the USA from 1975 to 2006 (4). Adenocarcinoma is the most common histological type seen in the thyroid gland and about 15% are follicular or Hürthle cell carcinomas (5). Patients with follicular carcinoma have a higher incidence of metastasis than those with papillary carcinoma (6). As many as 95% of thyroid tumors present as a solitary TN, and up to 30% may harbor malignancy (7, 8).

Which diagnostic tests are preferred depends on the local experience of the medical team and the prevalence of iodine deficiency disorders in the patients investigated (9). In contrast to early observations, the lesion echogenicity on high resolution US alone does not permit differential diagnosis between benign and malignant TN, and thus other diagnostic procedures should be considered (9, 10). Despite the discussed role of TS in the initial workup of patients with a solitary TN, TS is frequently ordered by family physicians. In addition there are significant differences between endocrinologists and endocrine surgeons in the management of the TN (11, 12). The sensitivity of FNAC in palpable nodules without a ‘hot’ appearance on TS is about 90-95%, while the specificity is more than 75% (9, 13). Results from this study show that the combination of US-guided FNAC and TS reaches 98% sensitivity and 99% specificity, respectively. In a study comparing the cost-effectiveness of FNAC and TS, the diagnostic strategy using initial FNAC was found the most cost-effective initial test to distinguish between benign and malignant TN (14). More recently, the same group confirmed that US-guided FNAC is more effective than traditional FNA, encouraging its use by the physician as a frontline diagnostic method (15). However, other studies recommend the use of TS

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TP, True positive; FP, false positive; TN, true negative; FN, false negative; PPV, positive predictive value; NPV, negative predictive value.

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before FNAC, since cytological examination of TN is necessary in "cold" nodules only, reducing the percentage of nodules to be biopsied to approximately 30% (16, 17). According to the American Thyroid Association 2009 guidelines, if the FNAC discloses follicular neoplasm, a thyroid scintigraphy should be considered, if not already done (18).

In conclusion, TS has low specificity (21% vs. 99%) but a higher specificity with respect to FNAC (95% vs. 82%), while the sensitivity and specificity of the combination of TS and FNAC reach 98% and 99%, respectively. Thus, patients with 'cold' TN and FNAC reading follicular neoplasm should be considered at risk of having TC.

References


