

Comparison of 21 and 27 gauge needles for determining sample adequacy in the aspiration biopsy of thyroid nodules

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PURPOSE

To compare 21 and 27 gauge (G) needles used for fine-needle aspiration (FNA) of thyroid nodules to obtain better specimens for adequacy and cytological diagnosis.

MATERIALS AND METHODS

One hundred patients with thyroid nodules (100 nodules) were included in this study. Each nodule was aspirated with both 27 G and 21 G needles. The obtained aspirates were classified as adequate and inadequate by two separate cytopathologists. The results were analyzed by appropriate statistical methods.

RESULTS

There was no statistically significant difference between 21 G and 27 G needles in terms of adequacy, according to each pathologist ($P > 0.05$). After pathological evaluation with consensus, the adequacy prevalence was the same (84%) for both needle types in all study populations ($P > 0.05$). According to the ultrasound characteristics of nodules, the prevalence of inadequate samples in patients with hypoechoic or heterogeneous nodules was significantly higher compared with the prevalence of inadequate samples in patients with isoechoic or hyperechoic nodules for both types of needles ($P < 0.05$). However, according to the size of the needles, there was no significant difference between hypoechoic and heterogeneous nodules or between isoechoic and hyperechoic nodules with regard to the ability to yield adequate samples ($P > 0.05$).

CONCLUSION

The results of our study showed that FNA with 27 G needles can aspirate adequate material for cytopathological diagnosis. The probability of inadequate sample aspiration of hypoechoic and heterogeneous nodules is higher than that for other nodule types.

Key words: • biopsy • fine-needle • thyroid nodule • ultrasonography

Organs and tissues that are close to the skin surface, such as the thyroid gland, can be biopsied easily via an ultrasound (US) guided fine-needle aspiration (FNA) biopsy (1). US-guided FNA is a highly sensitive and specific diagnostic tool in the evaluation and differentiation of malignant and/or benign lesions of the thyroid gland (2, 3). Although large core needles were used in the past, the current FNA needles range from 21 to 27 gauge (G) (3–6). Larger needles have caused more complications (2). Approximately 20% of US-guided FNA procedures are nondiagnostic (2). Several mechanisms are responsible for this situation (such as inexperienced staff, inadequate and/or bloody aspiration material, incorrect and inadequate pathological specimens obtained by inexperienced pathologists (7). The core size of the needle might also be a factor for nondiagnostic specimens (2). Therefore, we designed a study to compare 21 G and 27 G needles with respect to the ability to provide better specimens for adequacy and cytological diagnosis of thyroid nodules.

Materials and methods

Study population

The study included 100 patients who underwent FNA for the evaluation of thyroid nodules between July 2007 and February 2009. Written informed consent was obtained from all of the participants. The study protocol was approved by the local ethics committee. The patients were between 26 and 71 years of age (mean, 48 years); there were 78 females and 22 males. One hundred nodules from 100 patients were evaluated. All FNAs were performed with the same US machine by using a 7.5-MHz multifrequency linear-array probe (GE, Logic 9, Milwaukee, Wisconsin, USA). Nodule echogenicity was registered as hypoechoic, isoechoic, hyperechoic or heterogeneous, according to the thyroid parenchyma.

FNA procedure

If a patient had more than one nodule, then the biggest, most suspicious nodule (such as hypoechoic nodules, nodules with microcalcification or irregular borders) was chosen. All biopsies were performed by the same radiologist. The skin overlying the nodule was prepared in a sterile manner with povidone-iodine solution (Batticon®, Adeka, İstanbul, Turkey). No local anesthesia was used. Two samples were taken from each nodule, using 27 G and then 21 G needles with 10 mL syringes. The sequence of needles was chosen randomly. Namely, a 21 G needle was used first in some procedures, whereas a 27 G needle was used first in the others. The needle was inserted into the nodule with the help of a holder, and the aspiration procedure was performed by moving the needle back and forth within the nodule, for approximately 5 to 10 oscillations, by creating an equal vacuum force. Biopsy specimens

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were directly smeared on glass slides and air-dried. One hour after the procedure, check US was performed to rule out complications.

All specimens were examined at different time-points by two experienced pathologists blinded to the study. The specimens were graded as to whether they were adequate or inadequate for diagnosis; this was done for both types of needles. For inconsistent results, the final decision was obtained by the consensus of the two pathologists. The first pathologist also described the microscopic diagnosis but did not describe the adequacy of the specimen. Criteria for adequacy are listed in Table 1, and criteria for inadequacy are listed in Table 2 (8). The presence of at least one of four criteria described in the tables for either adequacy or inadequacy was accepted as adequate or inadequate, respectively.

Statistical analysis

Data were analyzed with a commercially available software (Statistical Package for Social Sciences, SPSS Inc., Chicago, Illinois, USA). Continuous variables are presented as means, and categorical variables are presented as frequency and percentage. The chi-square test was used to compare categorical variables. A P value of < 0.05 was considered statistically significant.

Results

Major complications were not encountered during or after FNA with either 21 G or 27 G needles, but minor complications were observed in three patients (3%) (minor hematoma in one patient and minor postprocedural pain in two patients). The nodule diameters ranged from 10 to 30 mm (mean, 18 mm). According to the nodule features observed during the US examination, 30 (30%) of the nodules were isoechoic, 16 (16%) were hyperechoic, 24 (24%) were hypoechoic, and 30 (30%) were heterogeneous.

There was no statistically significant difference between 21 G and 27 G needles in terms of adequacy, according to each pathologist (for the 1st pathologist, 78% and 80%, respectively, and for the 2nd pathologist, 84% and 82%, respectively, all $P > 0.05$) (Table 3). After pathological evaluation with consensus, the adequacy prevalence was the same (84%) for both needle types in all study populations. Therefore, the cytopathological results of specimens obtained with both types of needles were very similar in terms of adequacy ($P > 0.05$). For 21 G and 27 G needles, the adequacy prevalence was 67% and 67% for hypoechoic nodules, 93% and 100% for isoechoic nodules, 100% and 100% for hyperechoic nodules, and 73% and 80% for heterogeneous nodules, respectively.

According to the US characteristics of the nodules, the prevalence of inadequate samples in patients with hypoechoic or heterogeneous nodules was significantly higher compared with the prevalence of inadequate samples in patients with isoechoic or hyperechoic nodules for both types of needles ($P < 0.05$). However, in terms of the size of the needles, there was no significant difference between hypoechoic and heterogeneous nodules or between isoechoic and hyperechoic nodules with respect to the ability to obtain adequate samples ($P > 0.05$) (Table 4, Table 5). In addition, subgroup analysis (according to the US characteristics of the nodules) revealed no significant difference between 21 G and 27 G needles with respect to adequacy.

The observed microscopic characteristics were classified as benign in 68 specimens (68%), as Hashimoto's thyroiditis in eight specimens, as papillary carcinoma in two specimens, as Hurthle cells in four specimens, and as follicular adenoma in two cases. There was no statistically significant difference between 21 G and 27 G needles used for FNA in terms of adequacy for pathological diagnosis in any study population ($P > 0.05$).

Discussion

Thyroid nodules are common and are increasingly identified by scan-

Table 1. Criteria for adequacy

The presence of six groups of well-visualized follicular cells, with at least ten cells per group on all slides.
The presence of follicular cells with significant cytological atypia. A minimum number of follicular cells is not required.
The presence of numerous inflammatory cells. A minimum number of follicular cells is not required.
The presence of abundant thick colloid. A minimum number of follicular cells is not required if easily identifiable colloid predominates.

Table 2. Criteria for inadequacy

The presence of fewer than six groups of well-visualized follicular cell groups with ten cells each on all slides.
The presence of poorly prepared, poorly stained, or obscured follicular cells.
The presence of cyst fluid, with or without histiocytes, and fewer than six groups of ten benign follicular cells.
The presence of only abundant red cells, with rare lymphocytes and monocytes.

Table 3. Adequacy of samples obtained by two pathologists (1st and 2nd) with both types of needles (21 G and 27 G)

Adequacy	1st pathologist 21 G	1st pathologist 27 G	2nd pathologist 21 G	2nd pathologist 27 G
Adequate	78%	80%	84%	82%
Inadequate	22%	20%	16%	18%

Table 4. Adequacy of samples obtained from hypoechoic, isoechoic, hyperechoic, and heterogeneous nodules with a 21 G needle

Adequacy	Hypoechoic	Isoechoic	Hyperechoic	Heterogeneous
Adequate	16%	30%	16%	22%
Inadequate	8%	0%	0%	8%

Table 5. Adequacy of samples obtained from hypoechoic, isoechoic, hyperechoic and heterogeneous nodules with a 27 G needle

Adequacy	Hypoechoic	Isoechoic	Hyperechoic	Heterogeneous
Adequate	16%	28%	16%	24%
Inadequate	8%	2%	0%	6%

ning modalities, especially by US. Depending on their size and US features, further investigation methods are required, such as pathological diagnosis (9). FNA of the thyroid gland is the diagnostic and predominant method used to obtain tissue for microscopic analysis when evaluating nodules for malignancy (9). FNA can be applied with the guidance of US or palpation. According to recent guidelines, it is recommended that all palpable nodules undergo US examination (10, 11). The reported articles have shown that FNA with US evaluation and US guidance has reduced the rate of nondiagnostic specimens and false-negative aspirates (12, 13). Therefore, the number of biopsies performed with the guidance of US has increased (14).

FNA is the most cost-effective procedure, with nearly no morbidity. Twenty-five percent of thyroid FNA examinations provided inadequate cellular material for cytopathological diagnosis (2). The current FNA needle sizes range from 21 G to 27 G. However, a well-accepted guideline for a suitable needle size for FNA has not been established. Therefore, in this study, we aimed to evaluate the most appropriate core diameter for FNA of the thyroid gland; 21 G and 27 G needles were compared with respect to which could provide better specimens, in terms of adequate cytopathology.

US-guided FNA with 21 G needles can aspirate much more cellular material. However, the increased cellularity from biopsies performed with large-bore needles (such as the 21 G needle) did not result in an increased sufficiency rate (2). One of the reasons for this is obscured cellularity by red blood cells (2). In the literature, FNA

with large-core needles may yield more hemorrhagic specimens, as observed in our study (2). Therefore, small-core needles were recommended for FNA of thyroid nodules (15). Another advantage of small-core needles is that they are more comfortable for patients (2, 15). In our study, there was no significant difference in adequacy between 21 G and 27 G needles. This is because the latter yields aspirates with less cellular material but without apparent bleeding.

Twenty-seven gauge needles seem more appropriate because they cause less trauma and pain to the patient; the aspiration material obtained can be applied to several slides. This property can shorten the time wasted for each patient. Thus, the cytopathologist's workload can be reduced. The main limitation of our study was the inability to demonstrate this issue.

Another important result of our study is that the inadequate sample rates of hypoechoic and heterogeneous nodules were relatively higher than for other types of nodules. This situation may be related to the fibrotic, hemorrhagic, and increased cellular structure of hypoechoic and/or heterogeneous nodules. As far as we know, there is no published study addressing this situation. This condition must be evaluated with comprehensive studies in the future.

In conclusion, FNAs performed with 21 G and 27 G needles showed that the 27 G lumen diameter can also aspirate adequate material for cytological diagnosis. In hypoechoic and heterogeneous nodules, the probability of inadequate sample aspiration is higher than for other types of nodules. Therefore, in the biopsies of certain nodules, pro-

cedures might be performed with different needles during the same session, or sample size and vacuum force might be increased when the 27 G needle is used. Further studies are required to solve this problem with small-core needle biopsies. In addition, FNA with the 27 G needle may be more comfortable for patients with thyroid nodules.

Conflict of interest

The authors declared no conflicts of interest.

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