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Ultrasound-Guided Fine-Needle Aspiration Biopsy of the Thyroid: Methods to Decrease the Rate of Unsatisfactory Biopsies in the Absence of an On-Site Pathologist

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Abstract

Purpose: The rate of unsatisfactory samples from ultrasound-guided fine-needle aspirations of thyroid nodules varies widely in the literature. We aimed to evaluate our thyroid ultrasound-guided fine-needle aspiration biopsy technique in the absence of on-site microscopic examination by a pathologist; determine factors that affect the adequacy rate, such as the number of needle passes and needle size; compare our results with the literature; and establish an optimal technique.

Materials and Methods: We performed a retrospective review of cytopathology reports from 252 consecutive thyroid ultrasound-guided fine-needle aspiration biopsies performed by a radiologist between 2005 and 2010 in our hospital's radiology department. Sample adequacy, the number of needle passes, and needle size were determined. There was an on-site cytologist who prepared slides immediately after fine-needle aspiration but no on-site microscopic assessment of sample adequacy to guide the number of needle passes that should be performed. Cytopathology biopsy reports were classified as either unsatisfactory or satisfactory samples for diagnosis; the latter consisted of benign, malignant, and undetermined diagnoses.

Results: Seventy-seven biopsies were performed with 1 needle pass, 124 with 2 needle passes, and 51 with 3 needle passes. The rates of unsatisfactory biopsies were 33.8%, 23.4% (odds ratio [OR] 0.599 [95% confidence interval {CI}, 0.319-1.123]; $P = .110$), and 13.7% (OR 0.312 [95% CI, 0.124-0.788]; $P = .014$), respectively.

Conclusion: In a hospital in which there is no on-site pathologist, a 3-pass method increases the specimen satisfactory rate by 20% compared with 1 pass, achieves similar rates to the literature, and provides a basis for further improvement of our practice.

Résumé

Objet : La documentation fait état de taux d'échantillons insatisfaisants très variables en ce qui concerne la cytoponction sous échoguidage de nodules thyroïdiens. Notre objectif visait à évaluer la technique de cytoponction sous échoguidage de la thyroïde que nous employons lorsqu'aucun pathologiste n'effectue d'examen microscopique sur les lieux, à définir les facteurs qui influent sur le taux de succès, notamment le nombre de passages et la taille de l'aiguille, à comparer nos résultats à ceux présentés dans la documentation et à établir une technique optimale.

Matériel et méthode : Nous avons effectué un examen rétrospectif du rapport de cytopathologie de 252 cytoponctions sous échoguidage de la thyroïde consécutives, réalisées par les radiologistes du service de radiologie de notre hôpital entre 2005 et 2010. La validité des échantillons, le nombre de passages et la taille de l'aiguille ont été déterminés. Le cytologiste préparait les lames immédiatement après la cytoponction, mais personne ne réalisait d'examen microscopique pour évaluer la conformité de l'échantillon et déterminer le nombre de passages à effectuer. Les rapports de cytopathologie ont ensuite été classifiés selon qu'ils présentaient des échantillons insatisfaisants ou satisfaisants à des fins diagnostiques, les échantillons satisfaisants menant surtout à des diagnostics de nature bénigne, maligne et indéterminée.

Résultats : Soixante-dix-sept biopsies ont été prélevées en un passage, 124 en deux passages et 51 en trois passages. Les taux de biopsies insatisfaisantes s'élevaient à 33,8 %, à 23,4 % (rapport de cotes de 0,599 [intervalle de confiance de 95 %, de 0,319 à 1,123]; $P = 0,110$) et à 13,7 % (rapport de cotes de 0,312 [intervalle de confiance de 95 %, de 0,124 à 0,788]; $P = 0,014$) respectivement.

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Conclusion : Dans un hôpital où aucun pathologiste n'effectue d'examen microscopique sur les lieux, la méthode à trois passages accroît le taux d'échantillons satisfaisants de 20 % par rapport à la méthode à un passage, affiche un résultat semblable à celui indiqué dans la documentation et constitue un premier pas vers l'amélioration de nos pratiques.

Key Words: Fine-needle aspiration cytology; Thyroid biopsy; ultrasound-guided

The prevalence of thyroid nodules in the general population is 4%-7% [1]; among these, approximately 5% are thyroid carcinomas [2]. Thyroid fine-needle aspiration cytology (FNAC) is the most accurate diagnostic procedure used to differentiate benign from malignant thyroid nodules [3] and is widely used by radiologists, surgeons, endocrinologists, and pathologists. Despite its accuracy in correctly identifying malignancy, the rate of unsatisfactory samples remains elevated in many practice settings, sometimes beyond 20%. Thus, it results in repeated biopsies, patient anxiety, and unnecessary surgeries. Recommendations differ among institutions in terms of the many factors that can affect the sample adequacy rate, such as ultrasound (US) vs palpation guidance, needle size, number of needle passes, requirement of on-site microscopic evaluation by a pathologist, preparation methods of cytology samples, and cytopathology reporting definitions [3]. To decrease the risk of scant or hypocellular unsatisfactory samples, the National Cancer Institute recommends performing 2-5 needle passes by using a 22- to 27-gauge needle and advises centers to have an efficient cooperation between the physician performing the biopsy and the cytopathology department to optimize proper preparation of slides and provide on-site microscopic evaluation of specimen adequacy [4]. The use of US guidance has been validated [5–7]; the presence of an on-site pathologist has been debated [8–10]; and the choice of needle size, number of passes, and aspiration or capillary technique frequently vary from one institution to another. The procedural technique is highly dependent on operator preference, available resources, and influence of other factors present. For these reasons, thyroid FNAC practice is not standardized worldwide. Because our clinical setting, among many others, does not have available resources for on-site microscopic examination by a pathologist to guide the number of needle passes, we sought to evaluate and improve our practice. In this retrospective observational study, we examined our thyroid US-guided fine-needle aspiration biopsy technique; we determined which factors affected our adequacy rates, particularly, the number of needle passes and needle size; we compared our results to the literature; and we established recommendations for optimal technique in our practice and in that of other clinics with similar settings.

Materials and Methods

This study was approved by our institution's research and ethics committee; patient informed consent for the review of medical records and images was not required. A retrospective review was performed for all ultrasound-guided FNACs performed by a single experienced radiologist (D.E. [with 10 years' experience]) at our hospital's radiology department between January 1, 2005, and September 30, 2010. Patients were referred for FNAC by their primary care physician or specialist within the Montreal region. Cytopathology reports for every biopsy were collected and classified according to the results of the report: an unsatisfactory (inadequate) or a satisfactory sample for analysis, the latter consisted of benign, malignant, and undetermined diagnosis (Table 1). Information was recorded on the year of biopsy, the number of needle passes for each biopsy, and the number of needle pass samples that were satisfactory. All the samples were evaluated and signed by the pathologists at our institution.

By using a 13-MHz real-time US scanner (Toshiba Aplio XG, SSA-790, Tochigi-ken, Japan), the thyroid lesion was identified and characterized. The patient's anterior neck was locally sterilized with povidone-iodine and was anesthetized

Table 1
Classification system for thyroid fine-needle aspiration cytology reports

Cytopathology category	Cytopathology definition
Unsatisfactory (or inadequate) sample	Hypocellular (<6 groups of 10-20 follicular cells)[a], poor fixation or staining, drying artifact, or blood obscuring cells
Positive or suspicious for malignancy	Presence of characteristics suggestive of malignancy (intranuclear cytoplasmic pseudoinclusions, psammoma bodies, etc). Hypocellular samples with malignancy characteristics fit under this category.
Undetermined diagnosis	Could be either benign or malignant: there is enough cellular material, but accurate diagnosis cannot be made. Examples include follicular and Hürthle cell neoplasms.
Benign	
Benign hyperplastic nodule (goiter)	Follicular epithelial hyperplasia with variable colloid content
Benign thyroiditis	Presence of lymphocytes
Benign cyst	Normal follicular cells and cystic structure
Benign, other	Atrophy, normal follicular cells, absence of atypia or neoplasia

[a] From Refs. 13–15.