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The Role of Ultrasound Guided Fine Needle Aspiration Biopsy in the Evaluation of Thyroid Nodules

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Abstract

Objective: Thyroid nodules are one of the most common pathologies among the general population, but there are still some challenges regarding to their treatment and follow up. The aim of this study was to determine the role of Ultrasound guided Fine Needle Aspiration Biopsy (US-guided FNAB) in the evaluation of patients with thyroid nodules.

Methods: The 472 patients whose thyroid nodules have been detected was performed US-guided FNAB. The specimens were evaluated and classified as such: unsatisfactory material for proper cytological diagnosis, benign, suspected of malignancy and malignant. 146 of the patients were operated.

Results: The accuracy of US-guided FNAB was 95.9%, the specificity 100%, the sensitivity 53.8%, the positive predictive value 100%, the negative predictive value 95.6%, the false positive rate 0% and the false negative rate 4.3%. When the cases of suspected of malignancy were evaluated as malignant, the accuracy was 84.6%, the specificity 85.7%, the sensitivity 84.6%, the positive predictive value 36.6%, the negative predictive value 98.2%, the false positive rate 63.3% and the false negative rate 1.7%.

Conclusion: US-guided FNAB had quite high diagnostic accuracy and the use of preoperative US-guided FNAB singles out a patient who needed surgery and avoided unnecessary surgery.

Keywords: Fine needle aspiration biopsy; Thyroid nodules; Ultrasonography

Introduction

Although thyroid nodules are one of the most common pathologies among the general population there are still some challenges regarding to their treatment and follow up. Incidence of palpable nodule is reported as 4% to 7% in general population, but the rate increases up to 30% to 50% after the ultrasound examinations [1-11]. Only less than 5% of these nodules carries the risk of malignancy [1,2,6,12,13]. However, there are several reports indicating 20 to 36% of malignancy incidence in the case of presence of cold nodules [5,9,11]. Benign nodules are also operated because of the possibility of malignancy. In order to differentiate malignant nodules from the benign ones before the operation and thus avoid unnecessary operations several examinations are performed within the clinical settings. Ultrasound and radionuclide scanning examinations may only differentiate if the nodules are cystic or solid and hot or cold, but differentiation between malign and benign conditions is not possible by these techniques.

Fine Needle Aspiration Biopsy (FNAB) has been described considerably long time ago but didn't arouse any interest until recently. Current developments in ultrasound and cythopathological examinations and increasing experience related with the technique give way to more frequent use of the technique in differentiation of malignant and benign thyroid nodules. More than 90% of malignant cases was determined by using FNAB and thus number of operated cases with benign nodules has reportedly tended to decline [14]. However, low diagnostic accuracy rate of FNAB in non-palpable or very tiny nodules is a shortcoming of the method [14]. It has been reported that in FNAB, false negative results are mostly stemming from sampling error, namely collection of the samples from an inappropriate site [15]. Recently it has been emphasized in several publications that Ultrasound (US)-guided FNAB has increased the accuracy rate in differential diagnosis of thyroid nodules [2,3,9,14,16,17]. This study was planned to determine the role of US-guided FNAB) in the evaluation of patients with thyroid nodules.

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Subjects and Methods

The 472 patients whose thyroid nodules have been detected by physical exam and US and included into our study were assembled from within the patients referred to our outpatient clinics. Skin of the patients was cleaned with povidone iodine and US-guided FNAB was performed by using 10cc disposable syringe and 23-gauge needle. Samples prepared in accordance with wet film technique during aspiration procedure were assessed under the light microscope for understanding whether the samples are satisfactory or not, and whether aspiration was done repeatedly. Obtained material was sprayed over a microscopic slide. At least two slides were used for assessment of each case. Half of the slides were fixed by 96% alcohol and they were stained by Haematoxylen-Eosin. Other slides were dried up in air and examined after staining by May Grünwald Giemsa method. Cases were classified into 4 categories: unsatisfactory material, benign, suspected of malignancy and malignant. Pathological examination results of the operated cases were compared with the previous FNAB results of the same cases.

Statistics

The accuracy rate, positive predictive value, negative predictive value, specificity, sensitivity, false positive results and false negative results of US-guided FNAB was calculated.

Results

325 of the cases were female and 147 male. 98 of the 146 operated cases were female and the remaining 48 were male. Pre-operative FNAB results: unsatisfactory in 9 cases, benign in 442, suspected of malignancy in 23 and malignant in 7. The percentage of unsatisfactory material was 1.9%. Pathological examinations of the 146 operated cases were revealed 13 malignant cases. Five of them were papillary carcinoma, 2 follicular and 3 medullary carcinoma. However, preoperative cytological examinations of these 13 cases were as follows: malignant in 7 of them, suspected of malignancy in 4, benign in 1 and unsatisfactory material in 1. The results are presented in Table 1. If the cases suspected of malignancy were considered as benign the accuracy rate was 95.9%, the positive predictive value 100%, the negative predictive value 95.6 %, the specificity 100%, the sensitivity 53.8%, the false positivity ratio 0% and the false negativity ratio 4.3%. If the cases suspected of malignancy were considered as malignant the accuracy rate was 84.6%, the positive predictive value 36.6%, the negative predictive value 98.2%, the specificity 85.7%, the sensitivity 84,6%, the false positivity ratio 63.3% and the false negativity ratio 1.7%.

Discussion

Depending on various risk factors, malignancy risk may increase up to 20% in thyroid nodules. Thus, planning its treatment becomes an important issue, especially because the benign nodules are operated most of the time not to miss a malignant case. The main issue here is to differentiate benign and malignant nodules. US, scintiscan and laboratory tests are not of any help in this differential diagnosis, however, FNAB has been reported as useful and helpful in diagnosis, follow up and treatment plans of the thyroid nodules [1-23]. Since it is easy to use and cost-effective there are reports advising that it should be preferred as the first choice in the examination of palpable thyroid nodules [11,15,21-23]. However it should be remembered that FNAB has some diagnostic shortcomings. For instance, well-differentiated follicular carcinoma cannot be easily differentiated from a benign follicular adenoma [5,15].

Table 1: Comparison of FNAB and histopathological results.

Histopatholojical Results	FNAB Results				
	Inadequate	Benign	Suspected of malignancy	Malign	
Papiller Carcinoma	1	-	2	5	8
Follicular Carcinoma	-	-	1	1	2
Medüller Carsinoma	-	1	1	1	3
Folliculer Adenoma	-	10	6	-	16
Adenomatous	12	92	13	-	117
Hyperplasia	13	103	23	7	146

In our series two cases that have been diagnosed as having benign disease by FNAB have come out to be medullary carcinoma and cystic papillary carcinoma after the histopathological examination. Moreover, it has been reported that cytological diagnosis is too difficult and almost impossible in medullary carcinoma in the absence of fusiform and polygonal cell clusters within the aspiration material. There are also some other reports suggesting the possibility of false negative diagnosis in cystic papillary carcinoma due to inadequate cells. In our series, FNAB has ended up with false negative result in two cases; one was found to be medullary and the other cystic papillary carcinoma after histopathological examination [24,25].

Although FNAB is increasingly used in the diagnosis of benign and malignant thyroid nodules, reported high number of false negative results in various studies still makes the method controversial. In recent years different approaches have been tried in order to decrease the number of false negative results like US guided FNAB. More reliable results have been reported after using US guided FNAB [16]. Unsatisfactory material rate, particularly in cystic nodules, were fairly high following FNAB, but much lower when it was performed under the guidance of US. While FNAB performed by palpation yielded a 3.8% to 30% of unsatisfactory material rate [2,8,9,14,17], it was reported as between 0 % to 17% in USG-guided biopsy [2,3,17]. Khurana has reported the figures as 0% in palpable and 4% in non-palpable nodules following US-guided FNAB [3]. In our series, unsatisfactory material rate was 3.2%. In various studies accuracy rate was 48% to 99%, sensitivity 37-98, specificity 51% to 100%, negative predictive value 70% to 99% and positive predictive value 44% to 100% in FNAB performed by palpation [2,9,14,16,17]. In our study sensitivity was calculated as 53.8%, specificity 100%, accuracy rate 97.9%, positive predictive value 100%, negative predictive value 95.6% after USG-guided FNAB. As it was observed in our study, in case direct microscopic examination of the obtained material by FNAB during the procedure was considered as unsatisfactory, the procedure was repeated until adequate material can be obtained. Thus efficacy of FNAB was further increased and the results approached to the best values.

The false negativity was found as 4.4% in our study. It was reported as 1.3% to 16% in the literature [5,8,15,18,19]. It had been suggested that sampling errors increased the false negative rates and therefore, FNAB and histopathological examination should be performed in the same individual [15,21]. It had also been reported that false negativity rates increased in the case of multinodular goiter, cystic nodule or nodules smaller than 1 cm and larger than 4 cm and intranodular bleeding [15,26]. Inadequate material and aspiration performed in non-target population might lead to high rate of negative results.

Additionally, difficulty in the differentiating follicular adenoma of the thyroid from follicular carcinoma limits the contribution of FNAB in diagnosing follicular neoplasms [11,15,21]. We thought that, in our study performing the procedure under US guidance and witnessing that the mass was penetrated through positively affected false negativity rate, which is within the lower range.

The cases of malignancy suspected were considered as malignant and operated. This was therefore displayed as high false positivity rates. Presence of malignancy in the cases suspected of malignancy (32%) had led us to conclude that these cases should also be operated. In the literature reported that 30% of malignancy had been determined in such cases and the operation for these cases has also been suggested [11,27].

Complication rate was very low in FNAB [11]. The most common complication was hematoma [11] and it was resolved without any discomfort. Other reported complications included local pain, transient tachycardia, tracheal perforation and transient involvement of nervus laryingeus [5]. In our study hematoma have occurred in 12 (8%) patients. No intervention was needed in all cases except the compression.

We have concluded that in diagnosing thyroid nodules US-guided FNAB was an effective method with the properties of high accuracy rate, easy-to-accomplish and complication free, and when routinely used it might significantly decrease the number of operated cases.

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