

# Description of the Thyroid Biopsy with Fine Needle Guided with Ultrasound

Descripción de la biopsia de tiroides con aguja fina guiada con ecografía



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Thyroid gland  
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## Palabras clave (DeCS)

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## Summary

**Introduction:** Ultrasound-guided fine needle biopsy of the thyroid nodules (US-FNB) is frequent in our hospital and we do not know its performance. **Objective:** To know the overall performance and according to the method used (capillarity or capillarity combined with aspiration) of the US-FNB of the thyroid nodules. **Methods:** Retrospective cross-sectional study. All US-FNB of the thyroid nodules performed between January 2010 and June 2016 were collected from the digital archive. A total of 873 biopsies were obtained from 774 patients. A total of 11 radiologists with different years of experience were classified according to the operator. The biopsies of each operator were classified according to the Bethesda category found in the pathology report. 97 patients were taken to surgery. The results of the surgical biopsy were the gold standard for the performance of the method in this subgroup of patients. **Results:** The distribution of cytological adequacy was: 65 (7.4%) Bethesda 1, 694 (79.5%) Bethesda 2, 7 (0.8%) Bethesda 3, 11 (1.3%) Bethesda 4, 47 (5.4%) Bethesda 5.49 (5.6%) Bethesda 6. 97 patients were operated on at the institution. Taking Bethesda categories 1 to 4 as benign and categories 5 and 6 as malignant, results for the US-FNB of the thyroid nodules are: sensitivity 86,75% ; Specificity 85,71% ; PPV 97,29% ; NPV 52,17%. **Conclusion:** The number of biopsies performed influences the performance of US-FNB of the thyroid nodules. To do it with capillary technique or to combine the technique of capillarity with that of aspiration has no significant difference. The performance of cytology with respect to histopathology is good. The procedure at the hospital is within standards.

## Resumen

**Introducción:** La biopsia con aguja fina guiada con ecografía (BCAF-E) de nódulos tiroideos es frecuente en nuestro Hospital y no conocemos su desempeño. **Objetivo:** Conocer el desempeño global y según el método empleado (capilaridad o capilaridad combinada con aspiración) de la BCAF-E de tiroides. **Métodos:** Estudio de corte transversal retrospectivo. Se recolectaron del archivo digital todas las BCAF-E de tiroides realizadas entre enero de 2010 y junio de 2016. Se obtuvieron 873 biopsias realizadas en 774 pacientes. Se clasificaron según el operador, un total de 11 radiólogos con diferentes años de experiencia. Las biopsias de cada operador se clasificaron según la categoría Bethesda encontrada en el reporte de patología. Los resultados de la biopsia quirúrgica fueron la prueba de oro para el desempeño del método en este subgrupo de pacientes. **Resultados:** La distribución de suficiencia de la citología fue: 65 (7,4 %) Bethesda 1, 694 (79,5 %) Bethesda 2, 7 (0,8 %) Bethesda 3, 11 (1,3 %) Bethesda 4, 47 (5,4 %) Bethesda 5, 49 (5,6 %) Bethesda 6. A 97 pacientes se les realizó cirugía. Tomando como benignas las categorías Bethesda 1 a 4 y malignas las categorías 5 y 6 resulta para la BCAF-E: sensibilidad 86,75 %, especificidad 85,71 %, VPP 97,29 % y VPN 52,17 %. **Conclusión:** El desempeño de la BCAF-E de tiroides está influenciado por el número de biopsias realizadas. Hacerla con técnica de capilaridad o combinar la técnica de capilaridad con la de aspiración no tiene diferencia significativa. El desempeño de la citología con respecto a la biopsia quirúrgica es bueno. El procedimiento en el Hospital está dentro de los estándares.

## 1. Introduction

The thyroid nodule is a frequent diagnosis. Between 4-7% of the population has a palpable thyroid nodule

and it can be found in 50-60% of the autopsies (1, 2). If a thyroid ultrasound is performed on the entire population, 67% will have a thyroid nodule (3).

Ultrasound-guided fine-needle biopsy (US-FNB) of the thyroid nodule is a frequent procedure and is part of the guidelines for the diagnosis and management of the nodule (2,4-7).

The biopsy can be done by aspiration technique, by capillarity technique (not aspiration) or by combining these two modalities. All techniques are accepted and described in the literature (8-12). There is also a range in the number of punctures, with 1 to 12 punctures having been found in the literature (13,14). The choice of one or the other method is individual. Reports in the literature are few, but do not show inferiority of any of them (8-12). The Bethesda system that describes the results of thyroid cytopathology was created by consensus in the committees convened by the National Cancer Institute of the United States in October 2007 in the city of Bethesda, Maryland, and published in 2008 (6,7,15). According to this system, the results of thyroid cytopathologies are classified into six categories as follows: Bethesda 1 (B1) Non-diagnostic or unsatisfactory, Bethesda 2 (B2) Benign, Bethesda 3 (B3) Atypia or follicular lesion of uncertain significance, Bethesda 4 (B4) Follicular neoplasm, Bethesda 5 (B5) Suspicious of malignancy, Bethesda 6 (B6) Malignant (6,15). Category B1 (non-diagnostic or unsatisfactory) is used as an indicator of the quality of the procedure.

An average of 170 US-FNB are performed annually in our hospital. The procedure is concentrated in two radiologists who have different techniques: radiologist 1 combines the aspiration technique with the capillarity technique and performs six punctures, while radiologist 2 performs only the capillarity technique with three punctures.

We want to know the general performance of US-FNB, according to the modality of the techniques used.

## 2. Methodology

Retrospective cross section study. With the endorsement of the Ethics Committee of the institution, the entire thyroid US-FNB performed between January 2010 and June 2016 were collected from the digital archive. 873 biopsies were obtained in 774 patients, 650 women and 124 men, for an average of 13.2 biopsies per month. A total of 11 radiologists with different years of experience (between 1 and 25 years) were classified according to the operator.

To obtain the samples, a 24 needle is used. In the capillarity technique, the needle is passed alone and forward-backward movement is made inside the nodule. In the aspiration technique, the needle is connected to a 10 cm<sup>3</sup> syringe. When the needle is inside the nodule a vacuum is created in the syringe plunger, which ranges between 3 and 5 cm<sup>3</sup>, and is suspended to remove the needle from the nodule. The needle is changed at each puncture. The material obtained is spread on plates, taken to the pathology laboratory and colored with Diff Quik®. For the capillarity only technique, the number of plates ranges from 7 to 12 and for the combined technique of capillarity and aspiration, between 10 and 16. A pathologist expert in thyroid cytology, with more than 20 years of experience, reads the biopsies, but is not present during the procedure.

The biopsies of each operator were classified according to the Bethesda category registered in the pathology report.

In the review of the medical records, it was found that 97 nodules have histological verification with surgical biopsy. We then made a subgroup with these 97 nodules that were compared with the gold standard (the result of histopathology) to see the performance of the method. Hav-

ing no comparison with the gold standard of the other nodules, they are excluded from this analysis. The totality of the nodules (873) is used for the description of the test and to compare the two techniques used in the Hospital to perform the biopsy.

## 2.1 Statistical analysis

Excel and SPSS systems are used. Percentages of qualitative variables are obtained. In order to evaluate the performance of the two modalities studied, a  $\chi^2$  analysis is performed and, in addition, Fisher's exact test.

## 3. Results

A total of 774 patients, 650 women and 124 men were found in the Hospital's digital file, with an average age of 60.8 years, with a total of 873 US-FNB. Table 1 shows the characteristics of the population studied.

Table 1. Characteristics of the target population

Variables	Surgery n (%)		P value
	Yes 97 (11,1)	No 776 (88,9)	
Sex: Female	74 (76,3)	660 (85,1)	0,026
Age: Median $\pm$ SD	52 $\pm$ 13	55 $\pm$ 15	0,030
Radiologists			0,885
1	44 (45,4)	300 (38,7)	
2	46 (47,4)	417 (53,7)	
3	2 (2,1)	17 (2,2)	
4	2 (2,1)	16 (2,1)	
5	-	7 (0,9)	
6	2 (2,1)	8 (1,0)	
7	-	3 (0,4)	
8	-	2 (0,3)	
9	-	2 (0,3)	
10	1 (1,0)	3 (0,4)	
11	-	1 (0,1)	
Bethesda			<0,001
1	3 (3,1)	62 (8,0)	
2	11 (11,3)	683 (88,0)	
3	1 (1,0)	6 (0,8)	
4	8 (8,3)	3 (0,4)	
5	34 (35,0)	13 (1,7)	
6	40 (41,2)	9 (1,2)	

In the overall performance of the procedure, 65 cases were found, 7.4%, of the Bethesda 1 category (non-diagnostic or insufficient). The radiologist number 1, who combines the technique by aspiration and the technique by capillarity and makes 6 punctures, has 6.7% of category Bethesda 1. The radiologist 2, who only performs capillarity technique and performs 3 punctures, has 7.8 % of this category Bethesda.

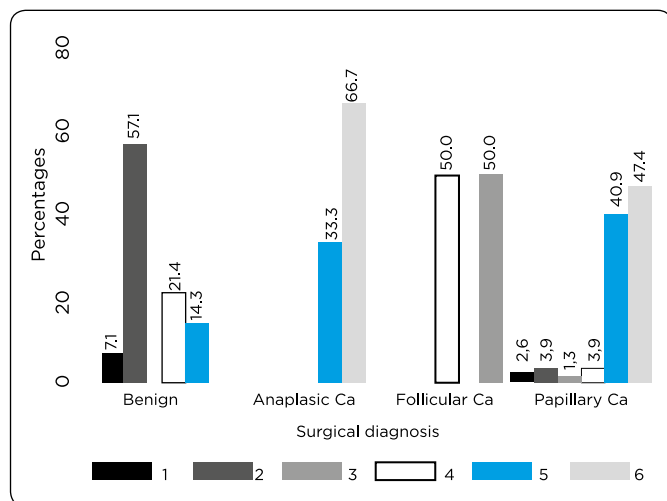
In the institution, 97 nodules were operated, 11.1%. The distributions of the surgical diagnoses correlated with the Bethesda classification are shown in Table 2.

**Table 2. Surgical diagnoses correlated with the Bethesda classification**

Surgery	Valid	Frequency	Percentages	Valid percentage	Accumulated percentage
Benign	1	1	7,1	7,1	7,1
	2	8	57,1	57,1	64,3
	4	3	21,4	21,4	85,7
	5	2	14,3	14,3	100,0
	Total	14	100,0	100,0	33,3
Anaplastic Ca	5	1	33,3	33,3	100,00
	6	2	66,7	66,7	
	Total	3	100,0	100,0	
Follicular Ca	4	2	50,0	50,0	50,0
	6	2	50,0	50,0	100,0
	Total	4	100,0	100,0	2,6
Papillary Ca	1	2	2,6	2,6	6,6
	2	3	3,9	3,9	7,9
	3	1	1,3	1,3	11,8
	4	3	3,9	3,9	52,6
	5	31	40,8	40,8	100,0
	6	36	47,4	47,3	
	Total	76	100,0	100,0	

Figure 1 shows the distribution of surgical diagnoses, according to the Bethesda category reported in US-FNB.

**Figure 1. Distribution of surgical diagnoses according to the Bethesda category reported in US-FNB**



Taking as benign the categories Bethesda 1 to 4 and malignant categories 5 and 6, of the 97 nodules that have confirmation with surgical biopsy, sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for cytopathology were analyzed: sensitivity 86.75%; specificity 85.71%; PPV 97.29%; NPV 52.17% (Table 3).

**Table 3. Table 2 x 2 of the operated nodules**

Classification	True	False	Total
+	72	2	74
-	11	12	23
Total	83	14	97
Test	Condition present	Condition absent	Total
- + Test (Bethesda 5 and 6)	72	2	74
- Test (Bethesda 1 to 4)	11	12	23
Total	83	14	97

The behavior of the test in the hands of radiologists 1 and 2 is shown in Table 4. With the  $\chi^2$  test, there is a p of 0.162, and when Fisher's exact test is applied, a p-value of 0.157 is obtained, which indicates that there are no statistically significant differences.

#### 4. Discussion

The performance of thyroid biopsy guided by ultrasound guided fine needle depends on the number of procedures performed by the operator. It is considered that a 7.4% of Bethesda 1 category is a good performance for the number of procedures we perform. This result is within what is recommended in the Bethesda system guide, which indicates that it should be less than 10% (15).

**Table 4. Performance of the test in radiologists 1 and 2**

Radiologists	Bethesda						Total
	1	2	3	4	5	6	
1	23 6,69 %	264 76,74 %	3 0,87 %	8 2,33 %	24 6,98 %	22 6,40 %	344 100 %
2	36 7,78 %	377 81,43 %	3 0,65 %	3 0,65 %	21 4,54 %	23 4,97 %	463 100 %

Concentrating the procedure on a low number of radiologists can be an adequate strategy to improve the performance of the procedure.

The difference of 1.1% of Bethesda 1 categories (non-diagnostic or insufficient) between radiologist 1 (combined technique and 6 punctures) and radiologist 2 (capillary technique and 3 punctures) is statistically non-significant and may be due more to the number of punctures than technique. Bearing in mind that the capillarity technique is simpler, easier, simpler and faster, this work allows us to recommend it to all those who perform the procedure, and to continue implementing it.

In some studies it is recommended to perform the procedure with the pathologist present (14). This may decrease the Bethesda 1 category results, but it lengthens the procedure and slows the workflow. In our institution it has not been implemented.

The performance of US-FNB is excellent with good sensitivity, specificity and PPV. The NPV found is affected by including the category Bethesda 4 (follicular neoplasia) within the benign ones. Its good PPV makes it useful as a cost-effective method in the diagnosis of thyroid malignancy.

Surgery was performed on 14 nodes with Bethesda category 1 and 2, due to the concomitant manifestation of another malignant nodule. Of these, five were papillary cancer and are false negatives of the fine needle biopsy.

## 5. Conclusion

The US-FNB of thyroid nodules is a procedure whose performance is influenced by the number of biopsies performed by the operator. Concentrating the procedure on a small number of operators can improve the performance of the test.

Doing it only with capillary technique or combining the capillary technique with the aspiration technique shows no significant difference. Because it is simpler and with fewer punctures, we recommend doing it with the capillarity technique.

The performance of cytology with respect to surgical biopsy is good.

The performance of the procedure in the Hospital is within the established standards.

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