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New classification of thyroid FNAB results — a three-year observation from one clinic

Nowa klasyfikacja wyników biopsji tarczycy — 3-letnia obserwacja jednego ośrodka

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Abstract

Introduction: Fine needle aspiration biopsy (FNAB) is the main examination in diagnostics of thyroid nodules. Yet, it does not allow the differentiation of follicular lesions (FL). A new classification of thyroid biopsy results (newC) might improve pre-operative diagnostics mainly due to the introduction of a new subcategory of 'follicular lesion of undetermined significance', as well as the clarification of definitions of other categories.
The aim of this study was to analyse the impact of the newC on the distribution of the cytological results among main diagnostic categories and on the values of the parameters describing the effectiveness of FNAB in detecting malignancy.
Material and methods: 34,371 FNABs outcomes and 3,557 results of surgical follow up were analysed. The frequencies of five main diagnostic categories in two periods: before (years: 2000–2009, 24,271 FNAB) and after the newC had been introduced (years: 2010–2012, 10,100 FNAB) were compared, as well as parameters describing the biopsy effectiveness, with a special focus on FL.
Results: In the second analysed period, the frequency of the 'suspicious for malignancy' results was three times lower, while diagnoses of 'malignant neoplasm' were 33% more frequent and the results corresponding to FL decreased by 10%. In respect to FL, specificity of FNAB increased (22.6% *vs.* 57.4%), but sensitivity decreased (78.8% *vs.* 50.0%). In respect to other diagnostic categories considered jointly, the sensitivity of FNAB (61.2% *vs.* 85.7%) and PPV (57.4% *vs.* 77.8%) increased, and the specificity was similar (95-97%) for both periods. NPV exceeded 95% irrespective of applied classification.
Conclusions: Separation of FL with low risk of malignancy affects the values of the parameters describing the effectiveness of FNAB. The improved diagnostic effectiveness of FNAB is also a consequence of epidemiological changes and better selection of thyroid lesions for biopsy. **(Endokrynol Pol 2014; 65 (6): 431–437)**

Key words: *thyroid; fine needle aspiration biopsy; thyroid cancer; follicular lesion of undetermined significance*

Streszczenie

Wstęp: Biopsja aspiracyjna cienkoigłowa (BAC) jest podstawowym badaniem stosowanym w diagnostyce guzków tarczycy, jednak jej wyniki są często niejednoznaczne, szczególnie dotyczy to zmian pęcherzykowych. Nowa klasyfikacja wyników BAC tarczycy (newC), w której wyodrębniono podkategorię „zmiana pęcherzykowa bliżej nieokreślona" oraz uściślono definicje pozostałych kategorii, miała poprawić skuteczność tego badania. Jednak dotąd nie ma wystarczających analiz następstw jej wprowadzenia.
Celem pracy była analiza wpływu wprowadzenia nowej klasyfikacji wyników biopsji tarczycy na częstość formułowania głównych kategorii diagnostycznych oraz wartości parametrów opisujących skuteczność BAC w ujawnianiu nowotworów złośliwych.
Materiał i metody: Analizowano wyniki 34371 BAC. Porównano częstość formułowania pięciu głównych kategorii diagnostycznych w dwóch okresach: przed (lata 2000–2009, 24271 BAC) oraz po wprowadzeniu newC (lata 2010–2012, 10100 BAC). Przeprowadzono weryfikację histopatologiczną wyników biopsji 3557 pacjentów. Porównano parametry opisujące skuteczność BAC w odniesieniu do ujawniania nowotworów złośliwych dla dwóch powyższych okresów, ze szczególnym uwzględnieniem zmian pęcherzykowych.
Wyniki: W drugim z okresów doszło do 3-krotnego zmniejszenia częstości formułowania wyników „podejrzenie nowotworu złośliwego", 33% wzrostu częstości rozpoznań „nowotwór złośliwy" oraz 10% spadku częstości wyników odpowiadających FL. W odniesieniu do zmian pęcherzykowych wzrosła swoistość badania (22.6% *vs.* 57.4%), zaś obniżyła się czułość (78.8% *vs.* 50.0%). W odniesieniu do pozostałych kategorii diagnostycznych łącznie — czułość (61.2% *vs.* 85.7%) i PPV (57,4% *vs.* 77,8%) wzrosły, swoistość była podobna (95-97%) dla obu okresów. NPV niezależnie od stosowanej klasyfikacji przekraczała 95%.
Wnioski: Wydzielenie podgrupy zmian pęcherzykowych o niskim ryzyku złośliwości istotnie zmienia wartości parametrów określających skuteczność BAC. Poprawa efektywności BAC wynika także ze zmian epidemiologicznych i trafniejszej selekcji ognisk do BAC. **(Endokrynol Pol 2014; 65 (6): 431–437)**

Słowa kluczowe: *tarczyca; biopsja aspiracyjna cienkoigłowa; rak tarczycy; zmiana pęcherzykowa bliżej nieokreślona*

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Introduction

Morphological lesions of the thyroid are among the most common disorders of the endocrine system. In postendemic areas such as Poland, due to long-term insufficient iodine prophylaxis, lesions are common among elderly and middle-aged people [1]. In general these lesions are non-neoplastic, however, differentiation between them and malignant neoplasms is required. The main examination applied for this purpose is fine needle aspiration biopsy (FNAB). But this has some limitations, the main one being that it is not possible to identify each type of follicular lesion [2]. A new classification of thyroid biopsy results has been introduced to reduce this limitation by describing a new subcategory: 'follicular lesion of undetermined significance' (FLUS). This category is supposed to be an indication for control FNAB in order to clarify the diagnosis [3, 4]. Our previous analyses demonstrated that FLUS mainly allows the extraction from the group of follicular lesions ones that are associated with a lower risk of cancer [5]. However, the definition of FLUS is wider. It includes not only the borderline microscopic image of benign lesions and follicular neoplasms, but also the borderline results suspicious for malignancy (when characteristic features of benign and malignant lesions coexist in smears and the cellularity of aspirate is scant) [3].

As a result, the introduction of this subcategory concerning follicular lesions could have a significant impact on the distribution of cytological outcomes among other diagnostic categories as well (benign lesions and suspicious for malignancy or even non-diagnostic results). Thus, the aims of our study were: the analysis of the impact of the new classification of the thyroid biopsy results on the frequency of formulating main diagnostic categories and the comparison of FNAB's effectiveness in detecting malignancy using both the new (newC) and the old (oldC) cytology classification systems, with special focus on 'follicular lesions'.

Material and methods

The analysis included the outcomes of FNABs performed at the Department of Ultrasonography and Thyroid Biopsy, University Hospital in Lodz between 2000 and 2012. The examinations were carried out in patients referred by endocrinologists from outpatient clinics. All the biopsies were US-guided. FNABs were performed on nodules with a diameter of at least 5 mm, which were palpable or had at least one malignancy risk factor (intranodular microcalcifications, ratio of anterior–posterior dimension to the transverse dimension ≥ 1, hypoechogenicity, presence of irregular, blurred margins, intranodular vascular pattern). Smears were fixed in 95% ethanol solution and stained with hematoxylin and eosin. A detailed description of the FNAB procedure was presented in our earlier work [5].

The frequency of formulating five main diagnostic categories of FNAB results (non-diagnostic — ND; benign lesions — BL; follicular lesions — FL; suspicious for malignancy — SM; and malignant neoplasm — MN) was compared for two periods: before (2000–2009) and after (2010–2012) introducing the newC. This classification divides diagnoses of FL into FLUS and 'suspicious for follicular neoplasm' (SFN) subcategories [3, 4]. A diagnosis of FLUS was made when the specimen showed features of both benign thyroid nodule and follicular neoplasm or showed low cellularity with the presence of architectural or nuclear atypia. Before 2010, in some cases, the cytopathologist also tried to determine more precisely the benign character of the follicular lesion by formulating the result as 'follicular neoplasm probably benign' (FN-pB). The categories SFN (which has been used since 2010) and 'follicular neoplasm' (FN – which had been used up to 2010) were defined according to similar criteria.

In the case of examining more than one nodule by the same FNAB, cytologic outcomes were always classified to the category corresponding to the highest risk of malignancy. All performed FNABs were included in the analysis — also multiple control ones carried out in patients with benign lesions, ordered by some physicians every 1–2 years. The percentage of repeat FNABs was similar in subsequent years. In cases of multinodular goitre, other lesions were usually biopsied during repeat examination.

At the next stage, the surgical follow-up was analysed. In those analyses, all the cases of malignant neoplasms were considered, including very small lesions and neoplasms revealed in a lesion other than the biopsied one. The post-operative outcomes were classified into two groups: malignant neoplasms and others. The diagnostic value of FNAB (with the exclusion of non-diagnostic outcomes) was assessed in terms of sensitivity, specificity, positive and negative predictive values (PPV, NPV). We also compared the parameters describing the effectiveness of FNAB in the two mentioned periods. MN and SM cytology outcomes were treated as positive for malignancy and BL was treated as negative. As far as FL was concerned, they were classified into two subgroups. The diagnoses of FLUS and FNpB were considered negative with regard to malignancy, and consequently as an indication to conservative treatment. The categories SFN and FN were classified as positive for malignancy, which meant an indication for surgery. We also analysed the sensitivity, specificity, PPV, and NPV exclusively for FL as well as

for other cytological diagnostic categories jointly after exclusion of FL.

The comparison of frequency distributions was performed with Chi-square test. Continuous variables (the age of patients) were analysed with ANOVA and Newman-Keuls test. The comparison of diagnostic value of FNABs in detecting malignancy with the use of oldC and newC was performed by evaluation of the areas under ROC curves. The value of $p < 0.05$ was assumed as the level of significance.

The study design was approved by the Bioethical Committee of the Medical University of Lodz.

Results

In the whole examined period (2000–2012), 34,371 FNABs were performed. The mean age of all patients was 57.4 ± 15.5 years (mean ± SD, min: 10, max: 91). Table I shows the distribution of all the diagnostic results to each of the main diagnostic categories in the two analysed periods. It was found that after the introduction of the newC of FNAB results, MN were formulated more often (0.6% *vs.* 0.8%, $p < 0.005$) and at the same time FL (7.3% *vs.* 6.6%, $p < 0.05$) and SM (1.2% *vs.* 0.4%, $p < 0.0001$) were formulated less often.

When analysing groups of SM and MN more closely, it was found that in the period 2000-2005, the percentage of SM results was three times higher than that of the MN category in every year, while in the next four years the results of both categories had a similar frequency. In the last three years, the initial relationship was reversed and MN outcomes were formulated two times more often than a diagnosis of SM. In 2000–2009, the MN category accounted for 31.9% of all the results classified as SM or MN, while 2010–2012 — it was 66.7%, $p < 0.0001$ (Fig. 1). In 2000–2005, 32.4% of MN diagnoses were related to lesions < 1 cm in diameter, and in the next years that number amounted to 40.2%. In the last three examined years — 2010–2012 — as much as 45.6% of MN diagnoses were related to such small lesions ($p = 0.07$ *vs.* 2000–2005).

Among MN, papillary thyroid cancer prevailed — (59.3% — 131 patients); in two cases (1.0%) follicular cancer was revealed of oxyphillic type, yet in one person it was a recurrent cancer; in 16 patients (7.2%) medullary cancer was diagnosed; in 12 (5.4%) — anaplastic cancer was found and in five (2.3%) malignant lymphoma. In 11 patients (5.0%), a metastasis to the thyroid was found — (from: breast cancer, oat-cell bronchial cancer, renal clear-cell cancer, and in some cases the primary localisation was impossible to determine). In 44 (19.8%) smears, a malignant tumour of unknown histogenesis was found. In 35.3% of SM results (118 cases) there were single features of papillary thyroid cancer present in the smear, in others a considerable anisocytosis was found that was not justified by clinical data.

Table I. ***The distribution of main diagnostic categories in the years 2000–2009 and 2010–2012 — i.e. before and after the introduction of the new classification of thyroid biopsy results***

Tabela I. ***Rozkład głównych kategorii diagnostycznych FNAB w latach 2000–2009 i 2010–2012 — przed i po wprowadzeniu nowej klasyfikacji wyników FNAB***

FNAB results (No/%)	2000–2009	2010–2012	p
ND	1,941/8.0	847/8.4	NS
BL	20,136/82.9%	8,461/83.8%	NS
FL	1,765/7.3%	666/6.6%	$p < 0.05$
SM	292/1.2%	42/0.4%	$p < 0.0001$
MN	137/0.6%	84/0.8%	$p < 0.005$
Total	24,271/100%	10,100/100%	

ND — non-diagnostic results; BL — benign lesions; FL — follicular lesions; SM — suspicion for malignancy; MN — malignant neoplasms

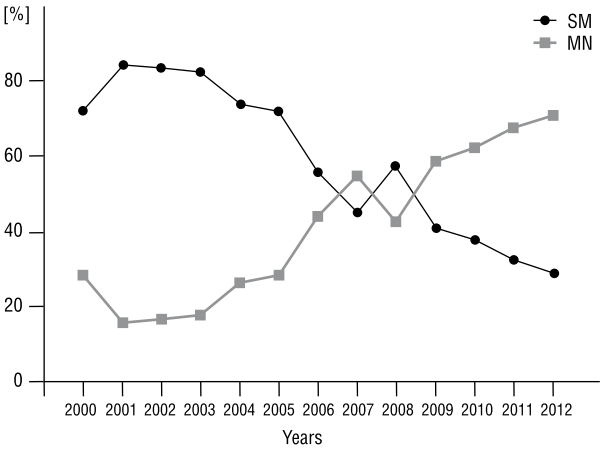

Figure 1. *Mutual percentage rate of categories: 'suspicion for malignancy' and 'malignant neoplasm'. SM — suspicion for malignancy; MN — malignant neoplasm*

Rycina. 1. *Wzajemny udział procentowy kategorii „podejrzenie nowotworu złośliwego" i „nowotwór złośliwy". SM — podejrzenie złośliwości, MN — nowotwór złośliwy*

Table II summarises the results of thyroid FNABs with the results of histopathology in the two analysed periods. In the group of operated patients, it was found that the percentage of individuals with BL FNAB category decreased from 79.6% in the first period to 57.1% in the second one ($p < 0.0001$), while the percentage of persons with FL category and MN category increased — from 11.7% to 26.2% ($p < 0.0001$) and from 2.9% to 10.2% ($p < 0.0001$), respectively. Consequently, in the second period, thyroid cancers were more frequently revealed in postoperative histopathological examination (14.4% *vs.* 6.9%, $p < 0.0001$) than in the first one. Moreover, in patients with thyroid cancer the frequency

Table II. *Comparison of histopathological results with the FNAB outcomes in the period before and after the introduction of the new classification of thyroid biopsy*

Tabela II. *Zestawienie badań histopatologicznych z wynikami FNAB tarczycy w okresie przed i po wprowadzeniu nowej klasyfikacji wyników biopsji*

FNAB results		Histopathological results				Total	
		Benign lesion		Malignant neoplasms			
		oldC	newC	oldC	newC	oldC	newC
ND		79 96.3% 2.7%	9 90.0% 2.8%	3 3.7% 1.4%	1 10.0% 1.8%	82 100% 2.6%	10 100% 2.6%
BL		2457 97.2% 83.1%	211 96.8% 64.7% a	71 2.8% 32.4%	7 3.2% 12.5% b	2,528 100% 79.6%	218 100% 57.1% a
FL	(–)	76 91.6% 2.6%	54 94.7% 16.6% a	7 8.4% 3.2%	3 5.3% 5.4%	83 100% 2.6%	57 100% 14.9% a
	(+)	261 80.9% 8.8%	40 94.1% 12.3% d	26 9.1% 11.9%	3 5.9% 5.4%	287 100% 9.0%	43 100% 11.3%
SM		81 81.0% 2.7%	10 66.7% 3.1%	19 19.0% 8.7%	5 33.3% 8.9%	100 100% 3.1%	15 100% 3.9%
MN		2 2.1% 0.07%	2 5.1% 0.6% c	93 97.9% 42.5%	37 94.9% 66.1% b	95 100% 2.9%	39 100% 10.2% a
Total		2,955 93.1% 100%	326 85.6% 100%	219 6.9% 100%	56 14.4% a 100%	3,175 100% 100%	382 100% 100%

ND — non-diagnostic results; BL — benign lesions; FL — follicular lesions; SM — suspicion for malignancy; MN —malignant neoplasms; (–) — FL 'negative'; (+) — FL 'positive' in respect to revealing malignancy; oldC — previous classification of thyroid biopsy results; newC — new classification of thyroid biopsy results; a — $p < 0.0001$ *vs.* oldC; b — $p < 0.005$ *vs.* oldC; c — $p < 0.01$ *vs.* oldC; d — $p < 0.05$ *vs.* oldC

Table III. *The values of the parameters describing FNAB effectiveness in respect to revealing malignancy before and after the introduction of the new classification of thyroid biopsy*

Tabela III. *Wartości parametrów opisujących skuteczność diagnostyczną FNAB przed i po wprowadzeniu nowej klasyfikacji wyników*

Parameter	FNAB outcomes					
	All FNAB		FL only		FL excluded	
	oldC	newC	oldC	newC	oldC	newC
TP	138–4.5%	45–12.1%a	26–7.0%	3–3.0%	112–4.1%	42–15.4%a
TN	2,533–81.9%	265–71.2%a	76–20.5%	54–54.0%a	2,457–90.2%	211–77.6%a
FP	344–11.1%	52–14.0%	261–70.5%	40–40.0%a	83–3.1%	12–4.4%
FN	78–2.5%	10–2.7%	7–1.9%	3–3.0%	71–2.6%	7–2.6%
Total	3093	372	370	100	2723	272
Sensitivity	63.9%	81.8%	78.8%	50.0%	61.2%	85.7%
Specificity	88.0%	83.6%	22.6%	57.4%	96.7%	94.6%
Accuracy	86.4%	83.3%	27.6%	57.0%	94.3%	93.0%
PPV	28.6%	46.4%	9.1%	6.9%	57.4%	77.8%
NPV	97.0%	96.4%	91.6%	94.7%	97.2%	96.8%

TP — true positive; TN — true negative; FP — false positive; FN — false negative; PPV — positive predictive value; NPV — negative predictive value; oldC — previous classification of thyroid biopsy results; newC — new classification of thyroid biopsy results; a — $p < 0.0001$ *vs.* oldC

of MN FNAB results significantly increased from 42.5% to 66.1% ($p < 0.005$) and BL results became less common (from 32.4% to 12.5%; $p < 0.005$).

Table III presents the parameters describing FNAB's effectiveness with regard to revealing cancer in the two mentioned periods. In the second period, the incidence of true positive (TP) outcomes significantly increased from 4.5% to 12.1% ($p < 0.0001$), while the number of true negative (TN) results decreased: from 81.9% to 71.2% ($p < 0.0001$). As a result, the sensitivity of FNAB increased from 63.9% to 81.8% as well as PPV: from 28.6% to 46.4% ($p < 0.05$ in both cases). Differences

in specificity were smaller (88.0% in the first period and 83.6% in the second one). NPV exceeded 95% in both periods. The area under ROC curve in the case of newC of FNAB results applied for dichotomic division of the results into benign and malignant was higher than in the case of the oldC: 0.902 (SE: 0.030; Cl 95%: 0.842–0.961) *vs.* 0.790 (SE: 0.022; Cl 95%: 0.746–0.833).

When the analysis was limited to FL only, it was found that after the newC was introduced, the number of false positive (FP) results was significantly lower (70.5% *vs.* 40.0%, $p < 0.0001$), while the number of TN results significantly increased (20.5% *vs.* 54.0%, $p < 0.0001$). The sensitivity of the test decreased (78.8% to 50.0%) as well as the PPV (from 9.1% to 6.9%), while the specificity and accuracy increased (from 22.6% to 57.4% and from 27.6% to 57.0%, respectively). NPV remained in this variant higher than 90% for both classifications. If the analysis comprised all the lesions except for FL, the number of TP results increased (4.1% *vs.* 15.4%, $p < 0.0001$), while the number of TN results decreased (90.2% *vs.* 77.6%, $p < 0.0001$). Consequently, the sensitivity of FNAB rose (from 61.2% to 85.7%) as well as PPV (from 57.4 % to 77.8%), the values of specificity, accuracy and NPV were similar: 95–97% for both analysed periods.

Discussion

Limitations of basic methods used in differentiation of pathological lesions of the thyroid gland — US and FNAB — make clinicians often interpret ambiguous results.

Thus, the introduction of the newC of thyroid biopsy was adopted readily, because it allows the identification of cases of a potentially lower risk of malignancy from the group of FL. However, the clinical significance of the newC has not yet been clearly formulated. Previously, we demonstrated that separation of FLUS subcategory noticeably reduced the percentage of FNAB outcomes of follicular nodules without the diagnostic conclusion [5]. It also lowered the incidence of FL regarded as positive with regard to revealing cancer. Such observations were also confirmed by other authors [6]. Our present analysis indicates that apparently the introduction of the newC only to a small extent influenced the distribution of the results among main cytological diagnostic categories. Benign lesions before, as well as after, applying the newC represented 90–91% of all diagnostic results, FL — 7–8%, SM and MN included approximately 2% of the FNAB results. But more thorough analysis shows that distinguishing FLUS class had an impact not only on FL category, but also on the ratio of SM and MN results. In consequence, it led to changes in the values of parameters describing the effectiveness of FNAB. With regard to malignancy and suspicion for malignancy, significant changes in the ratio of these two categories were found — the detection of MN increased by 33%, whereas SM were formulated three times less often. This shift could be produced by two causes. One is a better detection of thyroid cancer in recent years compared to the beginning of the 2000s, due to better use of ultrasound malignancy risk factors for selection of small lesions for FNAB [7]. The second cause is the change in classification of smears with scant cellularity and single features of cancer. Now such smears can be classified as FLUS and not SM. In consequence of the discussed changes, the number of TP results increased as well as their PPV, and in the case of FL the number of TN increased and FP decreased.

A high incidence of the benign category, in both examined periods, probably results from the epidemiological situation of the population, especially in older age groups. Another reason is probably a trend for annual monitoring of thyroid nodules with repeated FNAB, regardless of their potential ultrasound progress or previous benign cytology. On the other hand, fewer and fewer people with benign cytology are referred to surgical treatment (because of substantial enlargement of the thyroid). Accordingly, in the group of operated patients in the second period there was a significant increase in the percentage of patients with a positive FNAB result. It was also observed that the cytological category MN was about one third more frequent in patients with histopatologically confirmed malignant neoplasms for the last three years compared to the previous period, while the proportion of benign lesions decreased. As a result, the total sensitivity of FNAB significantly increased in the second period, despite its lowering for follicular lesions. According to our observations, the sensitivity and specificity of thyroid biopsy as well as PPV are significantly different for FL and other diagnostic categories. The specificity of FNAB with regard to lesions other than FL is about 95%. In the case of FL, it is significantly lower, but the introduction of the newC of the biopsy results led to a more than two-fold increase in the value of this parameter.

We noted a slight decrease in the total incidence of formulating FL cytology outcomes after the introduction of the newC system. This is, in our opinion, mainly due to the increase in iodine supply during the analysed period. As shown in our previous research on a detailed assessment of FL category, in the case of analysing these changes only in the years immediately preceding the introduction of the new classification and a similar period after its application (2009–2012), no significant difference in the total incidence of formulating FL results was found [5]. This issue undoubtedly requires further observation. The iodine prophylaxis has brought about

beneficial effects which are observed in young people, who are not, unlike the older generation, affected by non-neoplastic enlargement of the thyroid. The mean age of patients referred to our clinic is above 50.

The reports of other authors on the impact of the new FNAB classification system on the frequency of formulating each type of diagnostic categories are not very consistent. Crowe et al. observed that the application of the newC reduces the incidence of ambiguous diagnoses and frequency of surgical interventions, particularly with regard to benign lesions, but it does not affect the accuracy of cytology and the percentage of false positive outcomes [8]. In turn, Rabaglia et al. showed no impact of the introduction of the newC system on the number of surgeries performed, but noted the reduced risk of malignancy in respect to ambiguous results of FNAB (corresponding to the FLUS category in the newC system) [9].

Broome and Solorzano compared the frequency of formulating individual diagnostic categories in the two periods: before and after the introduction of the newC, including only operated patients, and found a significant decrease in the frequency of formulating benign and malignant lesions, whereas the observed frequency of FLUS was higher than it had been assumed by the NCI [10].

As shown above, the clinical significance of the newC of the FNAB results has not been established yet. It seems that its effect on improving the reproducibility of the results is as important as its influence on the accuracy of the cytology examination in respect to revealing malignancy. This has also been confirmed by the analysis carried out in a retrospective system, through the re-evaluation of previously acquired microscopic slides.

On the basis of such research, Richmond et al. found that the newC would probably help avoid certain surgeries of benign lesions, but it would not affect the accuracy of FNAB in revealing malignancy [11]. Song et al. observed that the application of the newC system reduces the number of ambiguous FNAB outcomes [12]. Jo et al. pointed out the advantages of improving the reproducibility of the cytology outcomes [13].

The newC system is still being modified in order to improve the accuracy of FNAB. These modifications include introducing another division (for example the further sub-division of FLUS) or merging two groups (like SFN and SM) [14, 15]. It seems, however, that these steps mainly modify the values of the parameters describing the effectiveness of FNAB, but are of less importance when interpreting a single outcome. The mentioned parameters are also markedly influenced by the epidemiological factors described above and the fact that the benign character of the majority of lesions (especially in areas rich in iodine) is never verified histologically [16].

Conclusions

In conclusion, the introduction of the newC of thyroid FNAB results caused slight changes in the distribution of the results among major diagnostic categories. However, the aforementioned changes have significantly affected the values of the parameters describing the effectiveness of cytology in respect to revealing malignancy. Those parameters were also markedly influenced by a simultaneous improvement in selection of the lesions for biopsy with the use of ultrasonographic malignancy risk features, which allowed more thyroid microcancers to be revealed. It should be remembered that parameters describing the efficiency of FNAB are influenced not only by factors specific for any given clinic such as the rules for selection of lesions for biopsy, adequacy of cytological material, reliability of microscopic analysis and classification of its results, but also by the inclusion or omission of microcancers incidentally found in postoperative histopathological examination during statistical analysis. There are also independent factors that include the epidemiology of thyroid diseases in the examined population, and most importantly the incidence of follicular lesions for which the efficiency of FNAB is markedly lower than for other lesions.

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