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# Thyroid Fine Needle Aspiration Cytology in Children and Adolescents

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## ABSTRACT

*Thyroid fine needle aspiration cytology (FNAC) is the most accurate and cost effective method in the evaluation of the thyroid nodule and has been commonly used in adults. Thyroid nodules are uncommon in younger patients (1–2%). Our aim was to determine some relevant clinical and cytological parameters in this demographic group. Ultrasound-guided thyroid FNACs performed from May 1995 to June 2008 in patients under 18 years of age were retrospectively reviewed. The following clinical parameters were retrieved: age and gender, number of nodules, and nodule size. Cytological parameters included cytologic diagnosis and cyto-pathohistological correlation. Total of 236 cases, representing 206 patients under 18 years of age, were retrieved from a total of 11748 thyroid FNAC cases (2.0%). The patient's age ranged from 2 to 18 years (mean 14). There were 180 (87.4%) females and 26 (12.6%) males with a female/male ratio 4:1. For 56 patients data concerning the number of nodules were recorded. 20 (35.7%) patients did not have any nodules, 20 (35.7%) patients had solitary thyroid nodule and 16 (28.6%) patients had multiple nodules. The size of nodules ranged from 0.4–5.4 cm (mean 1.4 cm). The cytologic diagnoses were: unsatisfactory (9), cyst fluid (7), benign (204), cellular follicular lesion/follicular neoplasm (9) and papillary thyroid carcinoma (7). The prevalence of malignancy among cytologic diagnoses was 3.4%. 21 patients had surgical follow up. 5 patients (23.8%) had thyroid malignancies (all papillary carcinomas). The remainder had benign thyroid lesions; follicular adenomas (8), multinodular goiters (5), diffuse goiters (2) and Hashimoto thyroiditis (1). There were no false negative or false positive cytologic diagnoses. The prevalence of thyroid malignancies among cytologic diagnoses was similar to those reported in adults. In limited number of patients with surgical follow up there were no false negative or false positive cytologic diagnoses.*

**Key words:** thyroid, cytology, children, adolescents

## Introduction

Fine needle aspiration cytology (FNAC) is the most important modality in the evaluation of thyroid nodules because it is rapid, inexpensive and has high diagnostic accuracy. The main goal of thyroid FNAC is to distinguish nodules that require surgery from those that do not, thereby decreasing the number of diagnostic surgical procedures<sup>1–5</sup>.

Thyroid nodules are uncommon in children compared with adults<sup>6–10</sup>. Some authors found the higher risk of thyroid malignancy in children compared with adults, and therefore recommend more aggressive diagnostic approach, some of them even recommending surgery for all thyroid nodules<sup>11–13</sup>. Others found the malignancy rate similar as in adults and recommend FNAC as safe and

highly accurate in the evaluation of thyroid nodules in children<sup>14</sup>.

In this study we analyzed clinical and cytological parameters in the children and adolescents underwent thyroid FNAC. Our objective was to investigate the rate of malignancy, nodule characteristics and thyroid FNAC accuracy in this demographic group.

## Materials and Methods

Our study included 236 cases, representing 206 children and adolescents who underwent ultrasound-guided thyroid FNAC. Those cases represented 2% from a total of 11748 thyroid FNAC cases. There were 180 (87.4%) fe-

males and 26 (12.6%) males. The patient’s age ranged from 2 to 18 years (mean 14 years). Routine FNAC was performed by a cytopathologist, with or without topical anesthesia, using a 23-gauge needle attached to a 10-mL syringe. Aspirates were smeared for conventional cytology (MGG staining), and interpreted by cytopathologist. In operated patients (N=21), FNAC results were compared with the pathohistological diagnoses, which were used as »gold-standard« when determining the accuracy of FNAC. False-positive and false-negative diagnosis were defined as described in The Guidelines of the Papanicolaou Society of Cytopathology Task Force on Standards and Practice<sup>15</sup>.

FNAC diagnoses were classified into 1 to 4 categories: unsatisfactory, benign, indeterminate and malignant. Benign category includes mostly FNAC diagnosis of nodular goiter, thyroiditis or, in few cases, pseudocystic fluid. Indeterminate category includes mostly FNAC diagnosis of cellular follicular lesion or follicular neoplasm, and the malignant category includes thyroid carcinomas (in our study all were papillary carcinomas).

**Results**

*Age and gender*

Results regarding the distribution by age *versus* benign, indeterminate and malignant cytologic categories are presented in Table 1. The age of patients with malignant FNAC diagnoses was higher than in patients with benign FNAC diagnoses (p=0.0277). All patients with malignant FNAC were older than 14 years.

**TABLE 1**  
DISTRIBUTION BY AGE VERSUS BENIGN, INDETERMINATE AND MALIGNANT CYTOLOGIC CATEGORIES

Age (years)	Cytologic categories			Total
	Benign	Indeterminate	Malignant	
Mean	13.5	13.4	16.5	14.46
Median	10	13	16	13
Range	2–18	7–18	14–18	2–18

Results regarding the distribution by gender *versus* benign, indeterminate and malignant cytologic categories are presented in Table 2. All 7 patients with malignant FNAC were females although it was not statistically significant (p=0.1414).

**TABLE 2**  
DISTRIBUTION BY GENDER VERSUS BENIGN, INDETERMINATE AND MALIGNANT CYTOLOGIC CATEGORIES

Gender	Cytologic categories			Total
	Benign	Indeterminate	Malignant	
Male	23	3	0	26
Female	168	5	7	180

*Nodule characteristics*

The data concerning the number of nodules were recorded for 56 patients.

Results regarding the distribution by nodule characteristics *versus* benign, indeterminate and malignant cytologic categories are presented in Table 3. The median diameter of nodules in all diagnostic FNAC categories was about 1 cm. The size of benign nodules did not differ statistically from the size of malignant nodules (p=0.0902).

**TABLE 3**  
DISTRIBUTION BY NODULE CHARACTERISTICS VERSUS BENIGN, INDETERMINATE AND MALIGNANT CYTOLOGIC CATEGORIES

Nodule characteristics	Cytologic categories			Total
	Benign	Indeterminate	Malignant	
Mean diameter (cm)	2.08	1.02	1.1	1.4
Median diameter (cm)	1.4	1.1	0.9	1.1
Range (cm)	0.7–5.4	0.9–1.3	0.4–2.8	0.7–5.4
Solitary/Total (%)	16/29 (55.2%)	2/3 (66.7%)	2/4 (50%)	20/36 (55.6%)

Twenty (35.7%) patients did not have any nodules, 20 (35.7%) patients had solitary thyroid nodule and 16 (28.6%) patients had multiple nodules. Patients with solitary thyroid nodules did not have higher risk of malignancy compared with patients with multiple nodules (p=0.1161).

*FNAC – malignancy rate and accuracy*

The distribution of FNAC diagnoses was: 9 (3.8%) unsatisfactory, 211 (89.4%) benign, 9 (3.8%) indeterminate for malignancy, and 7 (3.0%) malignant diagnoses (all papillary carcinomas). Accordingly, the rate of malignancy in patients underwent thyroid FNAC was 3%. Twenty-one (10%) patients out of 206 patients with thyroid FNAC underwent thyroid surgery. The distribution of pathohistological diagnoses was: 8 (38.1%) follicular adenomas, 5 (23.8%) nodular goiters, 2 (9.5%) diffuse goiters, one (4.8%) thyroiditis, and 5 (23.8%) carcinomas (all papillary). Two patients with FNAC diagnosis of papillary carcinoma were lost from follow-up.

Accordingly, the rate of malignancy in patients underwent thyroid surgery was 23.4%.

Correlation between cytology and pathohistology in operated patients is presented in Table 4.

All five patients with FNAC diagnosis of papillary thyroid carcinoma were confirmed histologically. Of 8 patients with FNAC diagnosis indeterminate for malignancy (cellular follicular lesion or follicular neoplasm), 4 were histologically diagnosed as follicular adenomas, and 4 as nodular goiters. Of 8 patients with benign FNAC diagnosis, 4 were histologically diagnosed as follicular ade-

**TABLE 4**  
CORRELATION BETWEEN CYTOLOGY AND PATHOHISTOLOGY  
IN OPERATED PATIENTS

FNAC	PHD			Total
	Non-neoplastic	FA	Malignant	
Benign	4	4	0	8
Indeterminate	4	4	0	8
Malignant	0	0	5	5
Total	8	8	5	21

FNAC – fine needle aspiration cytology, PHD – pathohistological diagnosis, FA – follicular adenoma

nomas, 2 were diagnosed as diffuse goiters, one as nodular goiter and one as thyroiditis.

There were neither false-positive nor false-negative FNAC diagnoses. The FNAC accuracy in limited number of surgically treated patients was 100%.

## Discussion

The aim of our investigation was to determine some relevant clinical and cytological parameters in children and adolescents. The diagnostic approach to thyroid nodules depends on the differentiation between benign and malignant lesions to avoid surgery for benign nodules. Despite its proven accuracy in adults, use of FNAC in pediatric thyroid nodules has been limited<sup>7-9,16-19</sup>.

Some authors consider that FNAC has limited usefulness in children because of its discomfort and high rate of

side-effects such as endothelial hyperplasia, hemorrhage, vascular proliferation, vascular thrombosis, fibrosis, cystic change, infarction and abscess formation<sup>11,20-23</sup>. However, our pediatric patients who underwent FNAC did not develop any complications, what is in agreement with some other authors<sup>16,17</sup>.

In our study, nodule characteristics were not related to malignancy, since the median diameter of nodules in all diagnostic FNAC categories was about 1 cm, and patients with solitary thyroid nodules did not have higher risk of malignancy compared with patients with multiple nodules.

Lugo-Vicente et al. reported on FNAC of nodules in 18 children, 5 of which were malignant as determined by histological examination<sup>18</sup>. They had 2 false-negative FNAC results; both patients were found to have papillary carcinoma as determined by histological examination. Accordingly, they concluded that although most pediatric thyroid nodules are benign, surgery is indicated to rule out malignancy. Al-Shaikh et al. reported none of the benign FNAC lesions to be malignant on histological examination<sup>14</sup>. In our study, the rate of malignancy in patients underwent thyroid FNAC was 3%, and there was neither false-positive nor false-negative FNAC diagnoses.

In conclusion, our study found thyroid FNAC in children and adolescents as a highly accurate and safe method in the evaluation of the thyroid nodules. Although we found the most of pediatric thyroid nodules as benign, our results indicate that FNAC has a crucial role in determining whether the child with a thyroid nodule require surgery or clinical follow-up.

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## CITOLOŠKA PUNKCIJA ŠTITNJAČE U DJECE I ADOLESCENATA

### SAŽETAK

Punkcija štitnjače je najtočnija i najracionalnija metoda u diferencijalnoj dijagnostici čvora štitnjače koja se rutinski izvodi kod odraslih pacijenata. Pojava čvora u štitnjači je rijetka kod mladih osoba i javlja se u 1–2% mladih osoba. Cilj istraživanja je naći relevantne kliničke i citološke pokazatelje u navedenoj demografskoj grupi pacijenata. Učinjena je retrospektivna analiza ultrazvučno navođenih punkcija štitnjače u razdoblju od svibnja 1995. do lipnja 2008. u pacijenata mladih od 18 godina. Praćeni su klinički parametri: dob, spol, broj i veličina čvorova u štitnjači i citološki parametri (citološka dijagnoza i cito-patohistološka korelacija). Od ukupno učinjenih 11748 punkcija štitnjače, 236 (2%) je zadovoljilo dobni kriterij (aspiracija u 206 pacijenata mladih od 18 godina). Starost pacijenata bila je 2–18 godina (prosjek 14), od toga 180 (87,4%) djevojčica i 26 (12,6%) dječaka (odnos djevojčice:dječaci =4:1). Za 56 pacijenata bili su poznati podaci o nalazu i broju čvorova u štitnjači, od toga 20 (35,7%) pacijenata nije imalo čvorove, 20 (35,7%) pacijenata je imalo jedan čvor u štitnjači a 16 (28,6%) pacijenata je imalo više od jednog čvora u štitnjači. Veličina čvora varirala je od 0,4 do 5,4 cm (prosjek 1,4 cm). Citološke dijagnoze bile su: nezadovoljavajuće za interpretaciju (9), cistična tekućina (7), benigno (204), celularna folikularna promjena/folikularna neoplazma (9) i papilarni karcinom štitnjače (7). Učestalost maligne promjene u citološkoj dijagnozi bila je 3,4%. Za 21 operiranog pacijenta bila je poznata patohistološka dijagnoza: 5 pacijenata (23,8%) imalo je malignu bolest štitnjače (papilarni karcinom), ostali su imali benigne promjene u štitnjači: folikularni adenom (8), multinodularna struma (5), difuzna struma (2) i Hashimoto tireoiditis (1). Nije bilo lažno pozitivnih niti lažno negativnih citoloških dijagnoza. Prevalencija malignih bolesti štitnjače u postavljenim citološkim dijagnozama slična je prevalenciji u odraslih. Kod pacijenata za koje je postojala patohistološka dijagnoza, dijagnostička točnost citološke metode bila je 100%.