e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2022; 14(12); 393-398

Original Research Article

Fine Needle Aspiration Cytology Evaluation of Thyroid Lesions in Children and Youth by the Bethesda System for Reporting Thyroid Cytopathology

Akanksha Singh[1], Abhilasha Pallavi[2], N. K. Bariar[3]

[1]Tutor, Department of Pathology, Patna Medical College, Patna, Bihar.
[2]Tutor, Department of Pathology, Patna Medical College, Patna, Bihar.
[3]Professor and Head of Department, Department of Pathology, Patna Medical College, Patna, Bihar.

Received: 15-10-2022 / Revised: 20-11-2022 / Accepted: 09-12-2022
Corresponding author: Dr Abhilasha Pallavi
Conflict of interest: Nil

Abstract

Background: Children and young people rarely develop thyroid lesions. They have a higher malignancy rate than adults. Between the ages of 20 and 24, the incidence peaks.

Objectives: To assess the usefulness of "The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC)" in reporting thyroid lesions in children and adolescents.

Materials and Methods: An investigation that was prospective was carried out between October 2021 and September 2022. 106 children and youth between the ages of 1 and 24 who were categorised using the TBSRTC underwent FNAC.

Results: 18.9 years old was the median. The majority (57.5%) of those in the 20- to 24-year-old age group were female. 4.7%, 85.8%, 4.7%, 1.9%, 0.9%, and 2% of the 106 patients fell into the TBSRTC diagnostic categories I, II, III, IV, V, and VI, respectively. Surgery was performed on six (5.6%) individuals, and histological research was conducted. The percentages for accuracy, sensitivity, and specificity were 100%, 97.8%, and 98%, respectively.

Conclusion: A definitive diagnostic test called TBSRTC for FNAC of the thyroid is used to classify patients according to whether surgery is necessary and to distinguish between malignant and non-malignant lesions in children and adolescents.

Keywords: Thyroid lesions, FNAC, Children, Youth, TBSRTC.

Introduction

The thyroid gland is a significant endocrine gland that is located in front of the neck. It is capable of responding to physiological stimuli like too much stress, puberty, pregnancy, etc. and has the highest hormone reserve of any endocrine organ. In addition to lesions brought on by inflammatory and neoplastic processes, it is prone to developing a variety of pathological lesions at a younger age [1]. In studies conducted on children and youth, thyroid nodules ranged from 5% to 33% of all thyroid nodules, whereas adults and elderly people had an incidence of less than 1% [2]. Thyroid lesions in children and youth are less common than those in adults, but they are more dangerous.

Children are people under the age of 14

according to the Child Labor (Prohibition and Regulation) Act of 1986 in India. According to the World Health Organization, "Youth" refers to people between the ages of 15 and 24 [3].

One of the best techniques for assessing thyroid lesions in children and adolescents is fine needle aspiration cytology (FNAC). It produces effects that are comparable to those seen in adults, is inexpensive, simple to perform, and safe.

Greig and Grey first described thyroid FNAC in 1904, and Martin used it to make a tumo diagnosis for the first time in 1930. The National Cancer Institute, Bethesda, Maryland, USA, published the System for Reporting Thyroid Cytopathology (TBSRTC) in January 2010. It was developed to standardise the terminology for FNAC results to enable better and more efficient communication among pathologists, endocrinologists, radiologists, surgeons, and other healthcare professionals in terms of better cyto-histopatholgical correlation, epidemiology, molecular biology, and thyroid disease diagnosis. With a false positive rate of less than 1% and a false negative rate of 1% to 11%, FNAC has a high diagnostic accuracy of 90% to 100%.

As a result, TBSRTC is now frequently used to avoid ambiguity while reporting FNAC of thyroid nodules.

In the current study, the cytomorphology of lesions in children and young adults was analysed.

Material and Methods

Between October 2021 and September 2022, the current prospective was conducted at the Patna Medical College and Hospital in the Department of Pathology, Patna, Bihar. After receiving approval, patients with thyroid swelling who had a clinical need for FNAC underwent the procedure in the Department of Pathology. On a thyroid surgery specimen that was received from the Department of Surgery at PMCH, Patna, Bihar, histopathological correlation was performed. The treating physician included 106 patients who presented with thyroid lesions for thyroid FNA and were referred for FNAC in the age range of 1 year to 24 years in this study. Patients with bleeding disorders and expectant women under 24 years old were excluded.

The frequencies with percentages and means with standard deviation were computed using SPSS-20. Additionally, the following formulas were used to compute specificity, sensitivity, diagnostic accuracy, positive predictive value, and negative predictive value.

Sensitivity = TP/TP+FN × 100.

Specificity = TN/TN+FP × 100.

Positive Predictive Value = TP/TP+FP × 100.

Negative Predictive Value = TN/TN+FN × 100

Diagnostic Accuracy = TP+TN/TP+FN+FP+TN×100.

False Positive Rate=FP/FP+TP×100.

False Negative Rates=FN/FN+TP×100.

TP = True Positive, TN = True Negative, FN = False

Negative, FP = False Positive.

Results

387 thyroid lesions from patients of all ages were treated to the FNAC method in the Pathology Department as part of this prospective investigation. There were 106 patients (28.9%) in the 1 year to 24 year age range. With a male to female ratio of 1:10.8, there were 106 patients, with 15 (14.15%) being minors and 91 (85.85%) being young adults. The patients in this study ranged in age from 7 to 24. The age group between 20 and 24 years saw the most thyroid lesions

(57.5%), followed by the age group between 15 and 19 years (28.3%). In our study, a 7-year-old was the youngest age. As people aged, thyroid lesions became more common. The Mean age of distribution is 18.5±1.5 years. According to the current study, the majority (14.2%) of patients had their illnesses discovered when they were 20 years old, followed by 21 years (13.3%), 24 years (12.3%), and 22 years (11.3%).

Between the ages of 1 year and 6 years, as well as 8 year and 9 year, no patients were diagnosed. The study found that 14.15 percent of children and 85.85% of adolescents had thyroid lesions. All 106 patients had a painless swelling in front of the neck, which was the most frequent presenting complaint. Out of 106 patients, 10 patients came with swallowing issues, 30 patients with anxiousness and palpitations, 6 patients with breathing issues, and 1 patient with hoarseness of voice. Clinically, 82 patients had normal thyroid function, 18 had hypothyroidism, and 6 had hyperthyroidism.

According to Table 1, the current study revealed that benign lesions made up 85.8%, AUS/AFUS 4.7%, nondiagnostic/inadequate 4.7%, malignancy 2%, SFN 1.9%, and suspected for malignancy 0.9% of all lesions. Goitre was the most prevalent benign condition (n=49), followed by Lymphocytic/thyroiditis Hashimoto's (n=42). Five patients were classified as having atypia, of which three fell into the AUS category and two into the AFUS category. Papillary carcinoma accounted for two out of the two cases of malignancy.

Table 1: TBSRTC Category wise distribution in percentage

Nondiagnostic/Not satisfactory	4.7%
Benign	85.8%
AFUS/AUS	4.7%
SFN/FN	1.9%
SM	0.9%
Malignant	1.9%

In the categories of Non-Diagnostic, Benign, AUS/FLUS, SFN/FN, SM, and Malignant lesions, the male to female frequency distribution ratios are 0:5, 1:10.5, 0:5, 0:2, 0:1, and 1:1, respectively. The study revealed that the majority of lesions were found in females across all diagnostic categories. The distribution of the malignant category is the same for both sexes.

In the categories of Non-Diagnostic, Benign, AUS/FLUS, SFN/FN, SM, and Malignant, the ratio of children to youth in the frequency distribution of lesions is 0:5, 1:5.5, 1:4, 0:2, 0:1, and 0:2, respectively. The study revealed that the majority of lesions were seen in young people across all diagnostic groups.

Calculations were made for the diagnostic accuracy, specificity, and sensitivity. FNA samples classified as DC II were thought to be genuine negative samples, whereas DC IV, DC V, and DC VI were seen to be true positive samples since they resulted in a firm indication of the necessity for surgical intervention. Patients who had received a follicular neoplasm diagnosis or one that was considered malignant or suspected of malignancy but whose histological analysis ultimately revealed to be benign fell under the false positive category.

The false-negative patients included individuals whose benign diagnoses on FNA were later proven by surgical excision and histology to be malignant. The term "positive" is used solely for statistical

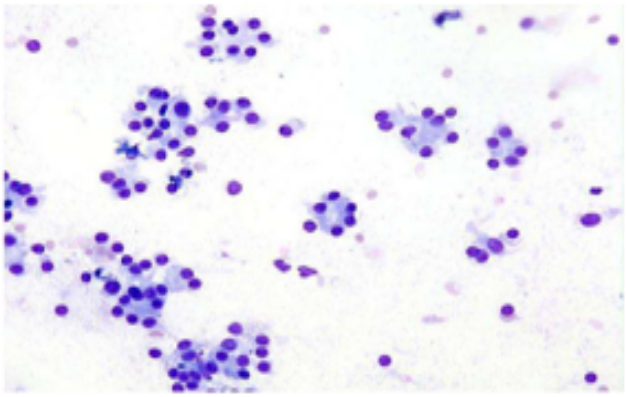
purposes and does not imply "malignant." Due to the fact that these diagnoses typically resulted in a repeat FNA rather than a surgical excision, the DC I group was left out of the statistical analysis [5].

Six (5.6%) of the 106 patients received thyroid surgery and a histological analysis. In the benign group, histology revealed two individuals with colloid goitre (33.3%), one with multi nodular goitre, and one with Hashimoto's thyroiditis. In the SFN/FN group, histology determined that both patients had follicular adenoma (33.3%). In every patient, the histology diagnosis and the TBSRTC diagnosis were in good agreement.

The FNAC has 100% and 97.8% sensitivity and specificity in predicting diagnosis, respectively. The positive and negative predictive values are also similar, coming in at 71.4% and 100%, respectively. Accordant to Table 2, the accuracy value was 98%.

Table 2: Diagnostic indicators

Sensitivity	100%
Specificity	97.8%
Positive predictive value	71.4%
Negative predictive value	100%
Accuracy	98%



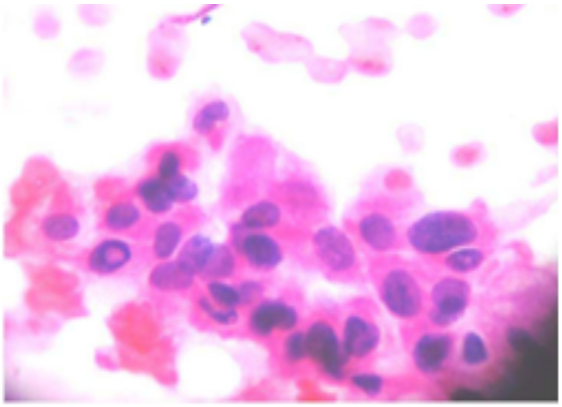


Figure 1: Showing featuresFollicular Neoplasm. (MGG, 40X)
Figure 2: Intra nuclear inclusion and white arrow showing the nuclear groove in Papillary Carcinoma. (H&E,40X)

Discussion

The only type of study that can reliably differentiate between neoplastic and non-neoplastic thyroid lesions and efficiently triage patients is fine needle aspiration cytology. Adult patients who underwent surgery for benign thyroid disease were treated less frequently thanks to the use of FNAC employing TBSRTC, and the yield of malignancy in surgical specimens rose from 5% to 10% to as high as 30% to 50%. However, FNAC of the thyroid gland has not been widely employed in children, despite the fact that it is as safe and capable of being used to evaluate thyroid nodules in adults [4-6]. 3207 thyroid nodules in 2468 patients received FNA as part of a 2008 study by Constantine G.A. Theoharis, et al. In these 3207 nodules that were assessed, the

distribution of lesions was as follows: 11.1% unsatisfactory, 73.8% benign, 3.0% uncertain, 5.5% FN, 1.3% suspicious, and 5.2% malignant. 378 (or 15%) of the 2468 patients in the sample who underwent thyroidectomy. 10% of surgical patients had unsatisfactory diagnoses, 4.6% had benign diagnoses, 30.3% had undetermined diagnoses, 61.4% had FN diagnoses, 76.9% had suspicious diagnoses, and 77.2% had malignant diagnoses. In predicting benign vs malignant thyroid nodules, the study found that there was a high connection between the categories ($p<0.0001$) [7].

The University of Virginia Health System in Charlottesville's Jo VY, Stelow EB, Dustin SM, and Hanley KZ analysed 3,080 thyroid FNA samples in 2009 and recorded interpretations using the suggested standardised 6-tier nomenclature of TBSRTC, as well as follow-up cytology and histology. This study's findings regarding the risk of cancer were similarly consistent with those of previous studies using the TBSRTC [8].

The 2009 study by Cibas and Baloch on the diagnostic efficacy of the NCI categorization of TBSRTC. They came to the conclusion that this classification had excellent diagnostic value. The installation of the TBSRTC, according to Bongiovanni and Cibas, improved thyroid FNA repeatability and predictive value by standardising the reporting method.

In a review of the use of FNA in the treatment of thyroid nodules in 41 children and adolescents by Adnan Al-Shaikh et al, the cytological findings were malignant in 30, suspicious in 2, benign in 6 and insufficient in 3 cases. There were no false-negative results, and the malignancy rate was 5%. FNA has an 87% diagnostic accuracy and an 88% inter-observer reliability. They came to the conclusion that FNA is quite safe and accurate for assessing thyroid nodules in children [9]. In a 16-year study conducted between January 1993 and December 2008 by Kapila K. et al., they came to the conclusion that FNA of children's and adolescents' thyroid nodules is feasible and reliable based on the cytology reports of 792 FNA performed on children and adolescents at Mubarak Al-Kabeer Hospital, Kuwait. The majority of the thyroid nodules in this trial were benign, and FNA helped patients avoid needless procedures [10].

A total of 387 thyroid lesions from patients of all ages underwent the FNAC technique at the Department of Pathology during the study period. In this study, 106 patients (28.9%) in the age range of 1 year to 24 years were included. 15 (14.15%) of the 106 patients were children, and 91 (85.85%) were adolescents. For the reasons listed below, patients with thyroid lesions between the ages of 1 year and 24 years were included in the current investigation. Although thyroid cancer is rare, it is frequently discovered in adolescents and young adults [11].

Thyroid carcinoma made up about 7.8% of all cancers diagnosed in patients between the ages of 15 and 19 years, 11.5% in patients between the ages of 20 and 24, and 10.1% in patients between the ages of 25 and 29 years, according to a study conducted in the USA between the years 1975 and 2000 [11]. It is extremely uncommon in children under the age of 15 years. For the majority of children and young people with thyroid cancer, the long-term prognosis and result are favourable [11].

Due to the small number of individuals diagnosed with thyroid cancer, research on this condition in adolescents and young adults is lacking[11]. Younger patients have a different tumour biology and clinical appearance than older adult patients[11]. One of the most treatable cancers is thyroid cancer, provided it is detected early and given the right care. The 5-year survival rate is

99%, and the mortality rate for those between the ages of 15 and 24 is 0.1 per year per million [11]. The current investigation demonstrated that women are more adversely affected than men. With a M: F ratio of 1: 18.8, the incidence was 8.5% in males and 91.5% in females.

Conclusion

Thyroid FNAC is a straightforward, affordable, outpatient technique with few risks and high rates of sensitivity, specificity, and accuracy. The same results apply to children and young people as they do to adults. In order to prevent needless thyroid surgery, the TBSRTC offers a six-tiered, globally recognised reporting system for FNAC of thyroid. This approach offers clear clinical care guidelines for each diagnostic category. Compared to adults, thyroid lesions in children and adolescents are less common, but they are more likely to be malignant in form.

They therefore require early examination. In conclusion, compared to other modalities of diagnostic tests, FNAC interpreted by TBSTRC is the most significant diagnostic test to distinguish malignant lesions from non-malignant lesions, not only in adults but also in children and youth. It not only provides a clear advantage in the preoperative distinction between malignant and non-malignant thyroid lesions, but it also facilitates early non-surgical treatments and reduces needless thyroid surgeries in children and adolescents.

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