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Research Article

The Clinical and Histopathological Characteristics of Thyroid Gland Diseases in Adolescents Requiring Surgical Treatment

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ABSTRACT
Aim: The present study aimed to assess the clinical and histopathological characteristics of thyroid gland diseases in adolescents requiring surgical treatment.
Materials and methods: This prospective observational study was conducted from 2024 to 2025. The study covered 40 patients from the population of adolescents aged 16 to 20 years with various malignant and benign thyroid gland diseases. All patients were surgically treated. All patients were presented to the thyroid disease counseling board to decide on the optimal mode of surgical treatment, as previously described.
Results: The present study included a total of 40 patients. There were 75% of females and 25% of males. The majority of the study sample (65%) were 19–20 years of age, while 35% were 16–18 years of age. The most common diagnosis was nodular goiter, found in 15 patients (37.5%). It is followed by diagnoses of Graves' disease, struma polynodosa and Multiple endocrine neoplasia (MEN) 2A. The majority of patients were asymptomatic (37.5%). Biochemical parameters of the thyroidal function are presented in Table 4. The mean value of T4 was 94.21 ± 40.81, while FT4 was 13.38 ± 6.65. Oppositely, the ratio of T3 and FT3 was more favorable (4.00 ± 10.45 vs. 3.01 ± 2.12), while the mean value of TSH was 1.13 ± 1.70. The majority of patients, 23 (53.67%), underwent total thyroidectomy or thyroidectomy combined with another procedure or hemithyroidectomy. The second most common approach was lobectomy of various types, while a central dissection was performed in fewer patients.
Conclusion: The results of the current investigation indicate that papillary carcinoma is the sole form of well-differentiated tumor that is observed in adolescents. Furthermore, this research is groundbreaking in that it has demonstrated that the clinical presentation of cancer in adolescents is nearly identical to that of adults, a phenomenon that has never been observed in this field.

Keywords: Histopathological Characteristics, Thyroid Gland Diseases, Adolescents, Surgical Treatment.

INTRODUCTION

Thyroid carcinomas are a rare disease in adolescents and constitute 1.5–3% of all malignancies in the United States and Europe.[1] The prevalence of thyroid nodules in the prepubertal period is 1–1.5%, as evidenced by literature data, whereas it can reach 13% in the postpubertal period.[1,2] The global increase in the incidence of thyroid cancer in adolescents suggests that the number of patients with this condition will increase significantly in the future decades.[3] Thyroid cancer is exceedingly uncommon in early infancy. Nevertheless, the literature contains a few isolated cases of differentiated thyroid cancers in neonates and infants aged one year or older.[4]

It has been reported that the prevalence of these forms of malignancy is significantly higher in women than in males. The distribution between sexes in the prepubertal period is equal, whereas these differences pertain to the postpubertal period.[5]

Ionizing radiation is one of the primary etiological factors that contribute to the development of thyroid cancer in adolescents. This is applicable to children who have been exposed to head and neck radiation in the past as a result of the treatment of a variety of benign and malignant conditions. Patients who have been treated for Hodgkin's disease are at an increased risk of developing thyroid cancer.[6]

Hoarseness, dyspnea, and a neck nodule are the most prevalent symptoms of thyroid cancer in adolescents, necessitating additional diagnostic testing.[7] The detection of thyroid nodules in adolescents is a warning sign that the observed changes may be malignant, an occurrence that occurs in 10–50% of cases, which is significantly more frequent than in maturity. Patients under the age of 20 typically have a higher incidence of thyroid cancer than those between the ages of 20 and 50.0.8 Research has demonstrated that 36% of the youthful population is affected by cancers with a diameter exceeding 4 cm. In adults, this percentage is 15%, whereas in young individuals, cancers smaller than 1 cm in diameter are detected in 9% of the population.[8] Papillary cancer is diagnosed in approximately 95% of malignant nodules, while the remaining 5% have a follicular form, as indicated by their histopathological characteristics. In the pediatric population, medullary, anaplastic, and poorly differentiated thyroid malignancies are uncommonly diagnosed.[8]

The pathohistological tissue examination is the gold standard for the diagnosis of thyroid cancer. Lesions of follicular origin (follicular adenomas, follicular carcinomas, and follicular variants of papillary carcinoma) are the most prevalent issue in postoperative diagnosis. These lesions are difficult to differentiate due to their overlapping morphological characteristics. The sole distinction between follicular carcinomas and adenomas is the presence of either capsular or vascular invasion, which is indicative of metastatic tumor characteristics. The primary therapy for well-differentiated thyroid tumors is based on surgical treatment, which is essential for the verification of the diagnosis and the removal of tumour tissue.[9]

However, adolescents are uncommonly subjected to surgical procedures for benign and malignant thyroid gland disorders, and there is an inadequate amount of literature on this subject. Consequently, the objective of this investigation was to provide critical information regarding the clinical and pathohistological characteristics of thyroid gland diseases in adolescents who underwent surgical treatment over a two-year period.

MATERIALS AND METHODS

This prospective observational study was conducted from 2024 to 2025. The study covered 40 patients from the population of adolescents aged 16 to 20 years with various malignant and benign thyroid gland diseases. All patients were surgically treated. All patients were presented to the thyroid disease counseling board to decide on the optimal mode of surgical treatment, as previously described.

Inclusion Criteria

- Adolescents aged 16 to 20 years of both sexes.
- Patients with the following benign and malignant thyroid gland diseases (nodular goiter, Graves' disease, polynodular goiter, multiple endocrine neoplasia (MEN) 2a, papillary carcinoma, follicular carcinoma, medullary carcinoma, toxic adenoma, cyst) must be included.
- The absence of any other comorbidity.

Exclusion Criteria

- Data that is either irrelevant or incomplete.
- Existence of any other comorbidity.

The Following Patient Data Were Analyzed

- Demographic characteristics.
- Diagnosis and symptoms.s
- Biochemical parameters of thyroidal function: triiodothyronine free fraction (FT3), thyroxine free fraction (FT4), thyroxine (T4), triiodothyronine (T3) and thyroid stimulating hormone (TSH).
- Cytological findings.
- Surgical intervention type.
- Disease stage.
- Definite path histological findings.

Statistical Analyses

Data were analyzed using statistical software (e.g., SPSS). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square (χ^2) test or Fisher's exact test was used for categorical data, and the independent t-test or ANOVA for continuous data. A p-value <0.05 was considered statistically significant.

Observations and Results

Table 1 summarized the characteristics of the 40 patients who participated in the current investigation. Males comprised 25% of the population, while females comprised 75%. The study cohort was primarily composed of individuals aged 19–20 (65%), with 35% being between the ages of 16 and 18.

Table 2 displayed the diagnoses of the patients who were examined at the time of admission. Nodular goiter was the most prevalent diagnosis, identified in 15 patients (37.5%).

Graves' disease, struma polynodosa, and multiple endocrine neoplasia (MEN) 2A are the subsequent diagnoses.

Table 3 illustrated the most prevalent symptoms of the patients under investigation. The preponderance of patients (37.5%) were asymptomatic. Thyrotoxic disturbances (12.5%) and difficulty inhaling and swallowing (10%) were reported by patients who expressed symptoms. In four patients (7.5%), mechanical disorders were observed, while lymphadenopathy and fatigue were observed in one patient each (2.5%). One patient reported all other symptoms.

Table 4 displayed the biochemical parameters of thyroid function. The average value of T4 was 94.21 ± 40.81, and FT4 was 13.38 ± 6.65. In contrast, the ratio of T3 and FT3 was more favorable (4.00 ± 10.45 vs. 3.01 ± 2.12), and the mean value of TSH was 1.13 ± 1.70.

The patients examined were presented in Table 5, which delineates the various surgical treatment methods. The preponderance of patients, 23, underwent a total thyroidectomy, a thyroidectomy combined with another procedure, or a hemithyroidectomy (53.67%). Lobectomy of various varieties was the second most frequently employed method, while central dissection was performed on a smaller number of patients.

Table 1: Demographic Characteristics

Characteristic	**N (%)**
Gender	
Male	10(25%)
Female	30(75%)
Age (years) Average (SD)	16.84±2.82
Age (categories) 16–18 years of age 19–20 years of age	 14 (35%) 26 (65%)

Table 2: Patients Diagnosis at Admission

Diagnosis	**N (%)**
Struma nodosa	15 (37.5%)
Grave’s disease	6 (15%)
Struma polynodosa	4 (10%)
Multiple endocrine neoplasia (MEN) 2A	4 (10%)
Toxic adenoma	2 (5%)
Cysts	2 (5%)
Hyperthyroidism	2 (5%)
Ca papillare	1 (2.5%)
Lymphadenopathy	1 (2.5%)
Lymph nodes metastasis	1 (2.5%)
Malignant neoplasm	1 (2.5%)
Dermoid cysts	1 (2.5%)

Table 3: Distribution of Patients According to Symptoms

Symptoms	**N (%)**
Asymptomatic	15 (37.5%)
Thyrotoxic disturbances	5 (12.5%)
Difficulty breathing and swallowing	4 (10%)
Mechanical disorders	3 (7.5%)
Fatigue	2 (5%)
Lymphadenopathy	1 (2.5%)
Palpitations	1 (2.5%)
Palpitations, anxiety, stifling	1 (2.5%)
Content leakage	1 (2.5%)
Stifling, sweating, tremor, anxiety	1 (2.5%)

Feeling of tightness in the neck	1 (2.5%)
Feeling of a foreign body when swallowing	1 (2.5%)
Pain and difficulty swelling	1 (2.5%)
Palpitations, fatigue	1 (2.5%)
Difficulty swallowing	1 (2.5%)
Weakness, insomnia, tachycardia, anxiety	1 (2.5%)

Table 4: Biochemical Parameters of Thyroidal Function

Parameter (ref value)	Mean	SD
T4 (66–181 nmol/L)	94.21	40.81
FT4 (12–22 pmol/L)	13.38	6.65
T3 (1.3–3.1 nmol/L)	4.00	10.45
FT3 (3.1–6.8 pmol/L)	3.01	2.12
TSH (0.27–4.2 μIU/mL)	1.13	1.70

Table 5: Applied Surgical Interventions on Investigated Patients

Surgical Intervention	N (%)
Thyroidectomy	23 (53.67%)
Hemithyroidectomy	5 (12.5%)
Dissection	1 (2.5%)
Extirpation	4 (10%)
Lobectomy	7 (17.50%)

DISCUSSION

The current study was conducted to provide critical information regarding the clinical and pathohistological characteristics of thyroid gland diseases in adolescents, a sensitive population, as surgical treatment is uncommon. Special attention should be provided to thyroid cancers due to their nature and significance. The literature sources pertaining to the juvenile population are still scarce, in contrast to the adult population, whose thyroid cancer characteristics are well-documented.[10,11] Until now, it has been established that papillary carcinomas are most prevalent in the younger population, with a preponderance in females. They are typically found as a solid or cystic formation.[12]

This investigation demonstrated that papillary carcinoma was the sole well-differentiated cancer identified in adolescents during the follow-up period. These results demonstrated that papillary carcinoma is the most prevalent malignancy in adolescents, as it is in adults.[11] This information may be of significant significance in the context of diagnostic and predictive analysis. Our research findings are consistent with the empirical data and literature from preceding studies,[12,13] which demonstrate a substantially higher incidence of this carcinoma in female adolescents (approximately 75% of the study sample).

Recent research has revealed a rise in the prevalence of well-differentiated thyroid malignancies in the majority of countries, which has prompted apprehension regarding the clinical and epidemiological severity of this disease.[13] However, there are still no pertinent analyses of the incidence of thyroid cancer or metastasis to this organ in the countries of Southeastern Europe. A retrospective investigation conducted at the Center for Endocrine Surgery of the Clinical Center of Serbia from 1995 to 2015 revealed that 3344 patients who underwent thyroidectomy were diagnosed with thyroid malignancy.[14] Despite the fact that the ten-year survival rate of these cancers exceeds 90%, the prognosis is fatal in 5 to 10% of cases.[15]

The most common form of well-differentiated thyroid carcinomas is slow-growing, solid, and irregular nodules. Despite the fact that the disease is typically subclinical, regional lymphadenopathy may take place. More severe forms of cancer are indicated by clinical indications such as dyspnea, dysphagia, and hoarseness. Although a substantial number of patients do not exhibit functional disorders, there are documented instances of thyrotoxicosis.[16] The results of the present study suggest that nodular goiter was the most frequently diagnosed condition in our study population. This underscores the necessity of conducting additional diagnostic tests in these patients in a timely manner. Furthermore, the majority of patients (approximately 37.5%) did not exhibit symptoms; however, a small number of patients experienced dyspnea and dysphagia, which is consistent with the

aforementioned literature data.[16] These data are also noteworthy and indicate that the absence of symptoms in a substantial number of cases may be linked to the presence of thyroid disease. While ultrasound and scintigraphy are the primary diagnostic instruments, a physical examination remains an indispensable diagnostic procedure that identifies the presence of a thyroid nodule or enlarged lymph nodes.[17]

These results are significant, as all previous research has evaluated the mature population.[18] Moreover, this study is the first to demonstrate, to the best of our knowledge, that the clinical presentation of cancer in adolescents is nearly identical to that of adults. Conversely, the hormone status of our patients was analyzed, and it was determined that the average value of all examined hormones was within the acceptable range, with the exception of T3, which was slightly elevated. These data are consistent with previous findings and underscore the necessity of additional diagnostic tests in the event that the biochemical indicators of thyroid function remain unaltered. Furthermore, the fact that the majority of these patients were asymptomatic is equally significant and perilous, as it significantly exacerbates treatment and elevates the likelihood of complications. This finding is significant because it demonstrates that severe thyroid gland diseases in adolescents can manifest as asymptomatic conditions, in contrast to those in adults.

Over the past thirty years, there has been no consensus regarding the extent of surgery that should be performed on patients with thyroid cancer.[19,20] This predominantly pertains to instances in which the thyroid capsule is unaffected, the tumor tissue is less than 100 mm in size, and there is no cervical lymph node disease. Hemithyroidectomy, total thyroidectomy, or total thyroidectomy with prophylactic central lymph node dissection are the most frequently employed surgical solutions in these contexts. The Center for Endocrine Surgery of the Clinical Center of Serbia data indicates that the treatment of preoperatively verified or suspected thyroid cancer necessitates an individual approach, which is influenced by local findings, age, the presence of local lymph node disease, and distant metastases. Consequently, the majority of specialists regard total thyroidectomy as the optimal treatment for these malignancies. Conversely, when surgeries smaller than total thyroidectomy are necessary or when an unanticipated ex tempore histological finding is observed, it is advised to administer L-thyroxine and undergo a total thyroidectomy after three months.[21] Total thyroidectomy is the preferred treatment for thyroid cancers due to the minimal risk of specific postoperative complications, including hypoparathyroidism and paralysis of the lower laryngeal nerve. Furthermore, this procedure offers significantly improved patient monitoring through the use of radioactive iodine 131 scintigraphy and thyroglobulin measurement to identify cancer recurrence.[22]

Our study indicates that total thyroidectomy was the most used type of surgical intervention in adolescents in the ten-year follow-up period. This result entirely correlates with all literature data and empirical suggestions of the abovementioned Center. Based on these findings, it can be noted that the surgical method is the golden standard for all thyroid diseases presented in our research.

CONCLUSION

The results of the current investigation indicate that papillary carcinoma is the sole form of well-differentiated tumor that is observed in adolescents. Furthermore, this research is groundbreaking in that it has demonstrated that the clinical presentation of cancer in adolescents is nearly identical to that of adults, a phenomenon that has never been observed in this field. Ultimately, the most frequently employed surgical intervention in adolescents was total thyroidectomy during the follow-up period. The comprehension of all of this data can be of crucial significance in the context of diagnostic and predictive analysis. In order to verify and standardize the data of this research, it is imperative to implement a comprehensive multicenter study.

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