CLINICAL CHARACTERISTICS AND PROGNOSIS OF PAPILLARY THYROID CARCINOMA IN ADOLESCENT PATIENTS

ABSTRACT

Background and objective : Influence patient management strategies. However, the clinical characteristics of ptc in adolescents (ages 10-19 years) have not been widely studied. This study aims to provide an initial understanding of the clinical features and prognosis of ptc in adolescent patients, which could inform the development of appropriate management policies for this age group.**Methods :** This research is a quantitative descriptive study utilizing secondary data**. Result :**The study involved 7 cases of ptc in adolescents. The data revealed that all cases were female, at least 15 years old, and classified as stage 1 with no distant metastasis. There were variations in tumor size, regional lymph node metastasis (based on tnm staging), treatment responses, risk stratification according to the american thyroid association (ata), and recurrence rates. The findings indicate differences between the characteristics of adolescent patients and those of pediatric patients. **Conclusion** : Despite these differences, the life expectancy for adolescents with ptc appears favorable, similar to that of pediatric patients, with 3 out of 7 cases experiencing recurrence.Further research is needed to explore the relationships between these variables and prognosis in order to optimize the management of adolescent patients with papillary thyroid carcinoma.

Keywords:Papillary Thyroid Carcinoma (PTC), Adolescent Patients, Clinical Characteristics, Risk Stratification

1. INTRODUCTION

Papillary thyroid carcinoma (PTC) is the most common endocrine malignancy in both pediatric and adult populations. Among pediatric thyroid cancers, approximately 90% are papillary thyroid carcinoma[1]. Thyroid carcinoma in children has distinct characteristics compared to adults. It is often asymptomatic in its early stages and is typically diagnosed at a more advanced stage, particularly in children under the age of 10, when widespread metastasis is already present[2]. The diagnosis of papillary thyroid carcinoma is made based on the characteristic histological features of the tumor, including clear or grooved nuclei, papillary or follicular architectural patterns, and the presence of fibrosis and psammoma bodies.[3]

Although the prognosis for thyroid carcinoma is generally favorable, with low mortality even in metastatic cases, the management of pediatric patients with advanced disease presents significant challenges[4]. The clinical characteristics of thyroid carcinoma, specifically in

adolescents aged 10 to 19 years according to the World Health Organization (WHO), have not been extensively studied. Most existing research combines data from pediatric and adolescent groups or uses age classifications that do not align with the WHO's definition of adolescence[5]. Some studies, for instance, consider patients up to 18 years old as adolescents. Given that the incidence of thyroid carcinoma increases with age, the adolescent population warrants focused investigation.[6]

This article aims to examine the clinical characteristics and prognosis of papillary thyroid carcinoma in adolescent patients to determine whether these differ from those observed in younger children (under 10 years old) or adults.

2. RESEARCH METHODOLOGY

This research is a quantitative descriptive study using secondary data in the form of a public dataset on differentiated thyroid cancer recurrence, sourced from https://archive.ics.uci.edu/dataset/915/differentiated+thyroid+cancer+recurrence. The dataset consists of 383 data entries and contains 17 variables, which are: Age, Gender, Hx Smoking (smoking history), Hx Radiotherapy (history of radiotherapy), Thyroid Function, Physical Examination (presence of thyroid nodule), Adenopathy (presence of lymph node enlargement), Pathology (subtype of carcinoma based on pathology results), Focality, Risk (based on the American Thyroid Association guidelines), TNM Stage (scores for T, N, M, and stage), Response (response to initial therapy), and Recurrence (thyroid cancer recurrence). The data was collected from the Hamadan University of Medical Sciences and Healthcare Services Hospital in Iran[7]

3. RESULT

The total 383 patients in the dataset, 7 adolescent patients (1.83%) were diagnosed with differentiated thyroid carcinoma. All adolescent patients in the study were found to have Papillary Thyroid Carcinoma based on their pathological examination, with an average age of 17.42 ± 1.29 years and a minimum age of 15 years. All of these patients were female, non-smokers, had no history of radiotherapy, and had normal thyroid function (euthyroid). At the time of diagnosis, no metastasis was detected, and all patients were classified as Stage I. The variations in clinical characteristics, prognosis, and recurrence events are presented in Tables 1 and 2.

Table 1. Variations in Clinical Characteristics and Prognosis of Papillary Thyroid Carcinoma in Adolescent Patients

Case	Age	Nodul	Risk based on ATA	T	N	Response	Recurrence
1	15	Normal	Moderate	T3a	N1b	Incomplete	Yes
2	17	Solitary in right lobe	Low	T1b	N0	Good	No
3	17	Multinodular	Moderate	T2	N1b	Indeterminate	No

4	17	Solitary in right lobe	High	T2	N0	Incomplete	Yes
5	18	Solitary in right lobe	Moderate	T1b	N1b	Incomplete	Yes
6	19	Solitary in right lobe	Low	T2	N0	Good	No
7	19	Multinodular	Low	T3a	N0	Good	No

Table 2. Descriptive Analysis of Variation in Clinical Characteristics and Prognosis of Papillary Thyroid Carcinoma in Adolescent Patients

Variable	Mean	n	%
Age	17,42 ± 1,29		
Nodule			
Normal		1	14,29
Solitary in right lobe		4	57,14
Multinodular		2	28,57
APA Risk			
Low		3	42,86
Moderate		1	14,29
High		3	42,86
T (TNM)			
T1b		2	28,57
T2		3	42,86
T3a		2	28,57
N (TNM)			
N0		4	57,14
N1b		3	42,86
Response			
Good		3	42,86
Incomplete		3	42,86
Indeterminate		2	28,57
Recurrence			
Yes		3	42,86
No		4	57,14

DISCUSSION

This descriptive study explores the characteristics of papillary thyroid carcinoma in adolescents. The incidence of well-differentiated thyroid carcinoma in adolescents in this dataset is 1.83%, with the incidence of papillary thyroid carcinoma specifically at 2.44% among patients with papillary thyroid carcinoma across all age groups. In this study, there were no patients under the age of 10. This figure is lower than that reported in previous studies.(5)This difference may be due to variations in policies across the countries where the research was conducted. The incidence of subclinical papillary thyroid carcinoma has significantly increased in countries that perform screening to detect subclinical papillary thyroid carcinoma. This practice remains controversial, as some experts argue that early

detection and screening for subclinical papillary thyroid carcinoma may lead to overdiagnosis. Furthermore, in this study, all adolescent patients with papillary thyroid carcinoma had no history of radiotherapy. Radiation exposure, such as from radiotherapy, is considered a significant factor in the development of papillary thyroid carcinoma at a young age, with a latency period of 5-10 years. This group of patients may carry BRAF mutations, which are commonly found, or less frequently, RET/PTC fusions, but confirming the diagnosis would require genetic testing to confirm the presence of genetic alterations[8] The absence of a history of radiotherapy may also explain the very low incidence in this study compared to previous research, especially studies conducted in areas with radiation exposure.[5][9]

All adolescent patients with papillary thyroid carcinoma in this study were female, which is consistent with previous research[10] and existing literature, which states that papillary thyroid carcinoma is found three times more often in females than in males[11] although according to the WHO, this carcinoma subtype can occur in both males and females (1). The small sample size may explain the absence of male adolescent patients with papillary thyroid carcinoma in this study. Several efforts have been made to determine the prognosis of patients with papillary thyroid carcinoma. The staging system by the American Joint Committee on Cancer (AJCC) 8th edition uses the TNM system to predict the survival of cancer patients, while risk stratification based on the American Thyroid Association (ATA) classification is used to predict recurrence. According to the AJCC 8th edition staging system, tumor size categories are as follows: T1a for tumors 1 cm or smaller and confined to the thyroid; T1b for tumors larger than 1 cm but not exceeding 2 cm, confined to the thyroid; T2 for tumors larger than 2 cm but not exceeding 4 cm, confined to the thyroid; T3a for tumors larger than 4 cm, confined to the thyroid; T3b for tumors with macroscopic extrathyroidal extension to any of the sternohyoid, sternothyroid, thyrohyoid, or omohyoid muscles, regardless of tumor size; T4a for tumors with macroscopic extrathyroidal extension to subcutaneous soft tissue, the larynx, trachea, esophagus, or recurrent laryngeal nerve, regardless of tumor size; and T4b for tumors with macroscopic extrathyroidal extension to the prevertebral fascia or encasing the carotid artery or mediastinal blood vessels, regardless of tumor size. The regional lymph node categories (N) include N0a, N0b, N1a, and N1b. N0a means at least one lymph node is free of malignant cells, both cytologically and histologically. N0b means no regional lymph node metastasis is detected either radiologically or clinically. N1a indicates metastasis to lymph nodes at levels VI or VII (pretracheal, paratracheal, prelaryngeal, and superior mediastinal), either unilaterally or bilaterally. N1b indicates metastasis to lateral cervical lymph nodes (levels I, II, III, IV, or V) or retropharyngeal nodes, either unilaterally, bilaterally, or contralaterally[12].

Based on tumor size, the patients in this study's dataset fall into a range between minimal T1b and maximal T3a categories. There were two patients classified as T1b, one with N0 and the other with N1b. The patient in case 2, with T1bN0M0 (stage 1), showed a good treatment response and did not experience recurrence, while the patient in case 5, with

T1bN1bM0 (stage 1), showed an incomplete response and experienced recurrence. Although two out of three patients with recurrence had regional lymph node metastasis (N1b), the lymph node category alone does not guarantee recurrence, as seen in case 3, where the patient with T2N1bM0 (stage 1) did not experience recurrence. The minimum category found was T1b, suggesting that early detection or screening for subclinical thyroid tumors was likely not conducted in this study.

Papillary thyroid carcinoma is classified as a well-differentiated thyroid carcinoma. The 8th edition of the AJCC introduces a new classification specifically for patients under the age of 55. [12][13]Thus, adolescent patients can use this classification. All T and N categories will be included in stage 1 if no distant metastasis is found, as observed in the data of this study.

Papillary thyroid carcinoma has an overall good prognosis, with a 5-year survival rate approaching 90%. The presence of metastasis in the lymph nodes does not alter the prognosis. The prognosis becomes poor if malignant cells have spread and metastasized to distant site[11][14]The patients in this study all had no distant metastasis (M0), with a good prognosis and high survival rate, as no mortality was observed during the 15-year data collection period..

The pediatric and adolescent patients with well-differentiated thyroid cancer, including papillary thyroid carcinoma, the risk classification is divided into the same categories: low, moderate, and high risk. According to the ATA classification for children and adolescents, low risk is defined as disease limited to the thyroid macroscopically with N0/Nx status, or patients with small N1a. Moderate risk is assigned when extensive N1a status or minimal N1b is found. High risk is identified when there is extensive N1b status, accompanied by extrathyroidal extension, with or without distant metastasis..[15]Sapuppo et al. proposed that small N1a be defined as low risk, which occurs when the number of lymph nodes containing metastatic cancer cells is 5 or fewer. High risk is defined when N1b involves more than 5 lymph nodes with metastasis greater than 3 cm. Moderate risk applies to cases where the status falls between low and high risk. [10][16]

The data of this study, no adolescent patients experienced metastasis. This finding is somewhat inconsistent with other studies, which have stated that, compared to papillary thyroid carcinoma in adults, papillary thyroid carcinoma in children tends to be more extensive, with spread including metastasis to regional lymph nodes or distant metastasis[10][17] This may also be a factor contributing to the high survival rate observed in this study.

The limitation of the TNM system from the 8th edition of the AJCC is that it does not account for histological subtypes or treatment response, and it is unable to predict recurrence. Meanwhile, the ATA system only considers histopathological data without factoring in treatment response. Another classification system that can be utilized is Dynamic Risk Stratification (DRS). This system categorizes patient responses to treatment into four categories: good, biochemically incomplete, structurally incomplete, and indeterminate

[15][10]The data was obtained from radiological results and thyroid markers (TSH, Thyroglobulin, and anti-Thyroglobulin antibodies) (18). In this study's data, the incomplete data refers to structural incompleteness, which may be due to the small sample size..

Recurrence occurred in 3 patients out of a total of 7 adolescent patients with papillary thyroid carcinoma. The risk of recurrence tends to be low in patients with N0 status, but increases in those with N1a and N1b status. Lymph node status-related recurrence risk is an important factor to consider in the treatment of patients.[10].One limitation of this study is the very small number of cases. Additionally, the data used is secondary data, which may contain variations in characteristics due to factors such as location-related management policies, availability of facilities, and environmental factors like radiation exposure.Early detection and thyroid tumor screening in children and adolescents, including the use of ultrasonography in asymptomatic adolescent patients, are not recommended due to the risk of radiation exposure for diagnostic and therapeutic purposes. The effects of such exposure are considered more harmful compared to waiting until clinical symptoms appear, as papillary thyroid carcinoma is usually indolent. Therefore, diagnosis in young adulthood still provides a good prognosis.[8][5]

CONCLUSION AND SUGGESTIONS

The characteristics of papillary thyroid carcinoma in adolescents show slight differences compared to those in children under 10 years old and adults. In this study, only a few adolescent patients with papillary thyroid carcinoma experienced extensive spread, with a good survival rate; however, recurrence occurred in some cases. Further research is needed with an adequate sample size to better understand the relationship between each variable, including clinical and histopathological characteristics such as stage, as well as treatment response, in predicting recurrence and mortality. This will help optimize the management of papillary thyroid carcinoma in adolescents**.**

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

The authors hereby state that no generative AI tools such as large language models (ChatGPT, COPILOT, etc.) or text-to-image generators were utilized in the creation or editing of this work.

DATA AVAILABILITY

All relevant data are included in the paper and its supporting information files. This study will assist researchers in identifying critical areas for Clinical Characteristics and Prognosis of Papillary Thyroid Carcinoma in Adolescent Patients.

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