

Pattern of Childhood Thyroid Malignancy Referred to INMAS, Dhaka, for Radioiodine Ablation in A Decade

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ABSTRACT

Objectives: Thyroid cancer is the third most common cancer in children. It represents 1% to 1.5% of all pediatric cancers. Papillary thyroid cancer is common thyroid malignancy in children. This study is designed to see the pattern of thyroid malignancy in children in our institute.

Patients and Methods: This retrospective study was carried out in INMAS, Dhaka, from January 2005 to December 2014. Data from case files of thyroid cancer patients of pediatric age group were recorded.

Results: Total 40 pediatric patients, 35 females and 5 males (F: M: 7:1, age range-9-18 years, mean age-13±1years) in this study came after total thyroidectomy for thyroid malignancy. Among them 24 patients (F-21, M-3,60%) had papillary thyroid carcinoma (PCT), 3 patients (F-2 M-1, 7.5%) had follicular thyroid carcinoma (FCT), 12 patients (F-11, M-1,30%) had PCT with lymph node metastasis, and one patient had medullary thyroid carcinoma. One patient had PCT with hashimoto's thyroiditis, another had PCT with pulmonary tuberculosis and one had FCT with diabetes with hyperparathyroidism. Radioiodine ablation therapy was given to all patients according to staging and grading of tumor.

Conclusion: The prognosis for thyroid carcinoma in children is excellent. Proper treatment and regular follow up are needed for this disease.

Keywords: Childhood thyroid malignancy, Papillary thyroid cancer, follicular thyroid carcinoma.

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INTRODUCTION

According to the Surveillance, Epidemiology, and End Results Program, thyroid carcinoma is extremely uncommon in children and makes up 1.8% of all thyroid malignancies (1). Pediatric thyroid cancer is predominant in female patients (2). Differentiated thyroid carcinoma (DTC), which accounts for 90–95% of all pediatric thyroid carcinomas, is the most prevalent endocrine thyroid cancer in children (1-3). 90% of all cases of DTC are papillary thyroid

carcinoma, whereas follicular thyroid carcinoma is an uncommon histological form (1,4). Thyroid carcinoma in pediatric patients usually manifests as an asymptomatic neck mass. Solitary thyroid nodules in children have a 20-73% incidence of malignancy. A painless, non-inflammatory, metastatic cervical mass is the presenting symptom in 40-80% of pediatric patients. Surgery and postoperative treatment, such as radioactive iodine therapy and thyroid-stimulating hormone suppression, are typically used to treat pediatric DTC (1).

Thyroglobulin levels may be elevated in differentiated thyroid carcinoma and may help in postoperative monitoring. Ultrasonography, radioisotope scanning, and CT scans of the thyroid gland help to diagnose pediatric thyroid carcinoma. Fine needle aspiration cytology and histological findings help to confirm the diagnosis. This study was done to see the pattern of thyroid carcinoma present in our study population and treatment efficacy, including radioiodine therapy in children.

PATIENTS AND METHODS

This retrospective study was carried out in the institute of Nuclear Medicine Allied Sciences (INMAS), Dhaka, from January 2005 to December 2014. The study population is 40 referred to the thyroid division for radioiodine ablation therapy after total thyroidectomy for thyroid cancer. Data were collected from the case files of the patients using a pre-designed data collection form. Sex, types of thyroid cancer, radioiodine ablation dose, extension of cancer were recorded from case files of thyroid cancer patients of pediatric age group.

All patients referred to INMAS, Dhaka were diagnosed with differentiated thyroid cancer. They came here after total thyroidectomy for radioiodine ablation therapy. Radioiodine ablation dose was given to them according to their age, weight, and extension of cancer.

RESULTS

The majority of 40 patients (87.5%) were females and the male to female ratio was 1:7. The average age of the patients was 13 ± 1 years, ranging from nine to eighteen. 60% of the patients (24 cases F-21, M-3,) had papillary thyroid carcinoma (PCT). 7.5% of the patients (3 cases F-2, M-1) had follicular thyroid carcinoma (FCT). 30% of the patients (12 cases F-11, M-1) had PCT

with lymph node metastasis (others) and one patient had medullary carcinoma. Among them one patient had PCT with hashimoto's thyroiditis, another had PCT with pulmonary tuberculosis and one had FCT with diabetes and hyperparathyroidism. Figure 1 shows the number of yearly pediatric thyroid cancer patients enrolled for the study and Figure 2 shows status of yearly number of patients according to gender.

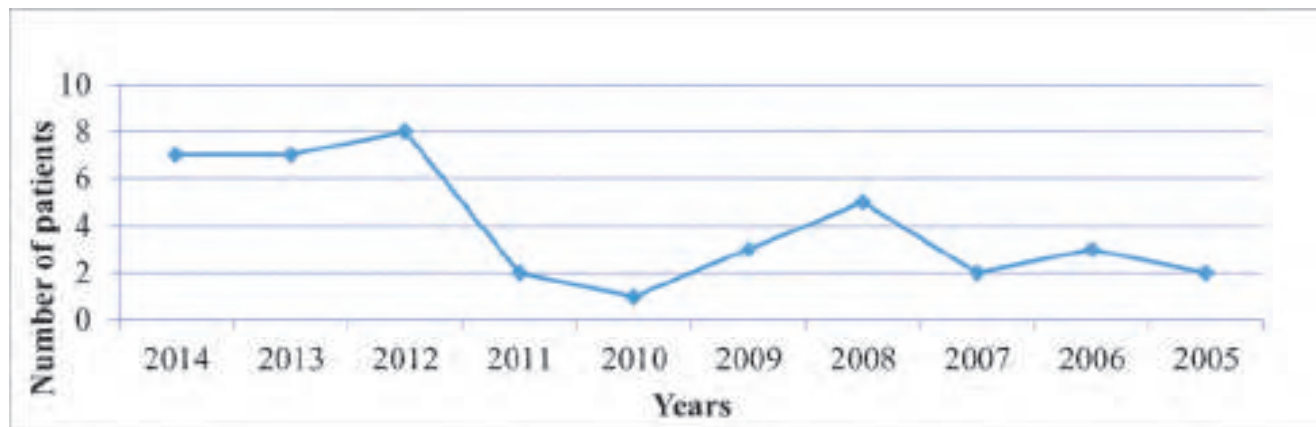


Figure 1: Status of yearly number of pediatric cancer patients

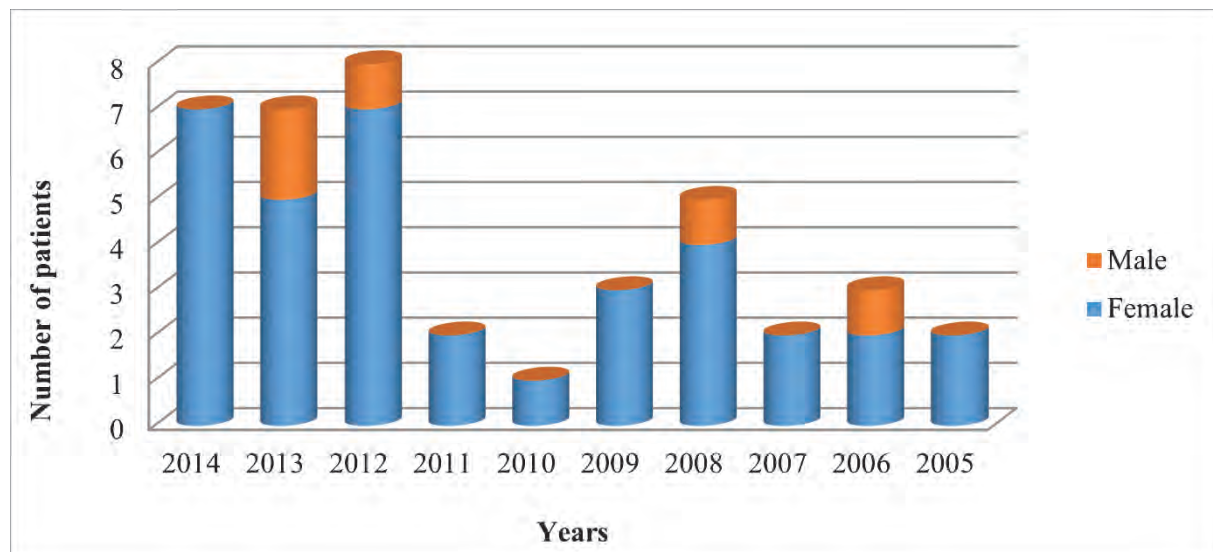


Figure 2: Status of yearly number of patients according to gender

A total of 39 patients received radioiodine therapy (RAI). Among them, 5 patients (13%) received 150 mCi of radioiodine, 13 patients (33%) received 100 mCi of radioiodine, 10 patients (26%) received 75 mCi of radioiodine, 11 patients (28%) received 50 mCi of radioiodine, and 6 patients received a second dose of radioiodine therapy. Selection of the radioiodine therapy

dose depends on several factors, including the patient's age, weight, type, and stage of thyroid cancer. Association of other malignancy or any other diseases was not found. Figure 3 shows the status of yearly number of patients according to type of thyroid carcinoma, and Figure 4 shows the status of radioiodine dose distribution among the patients.

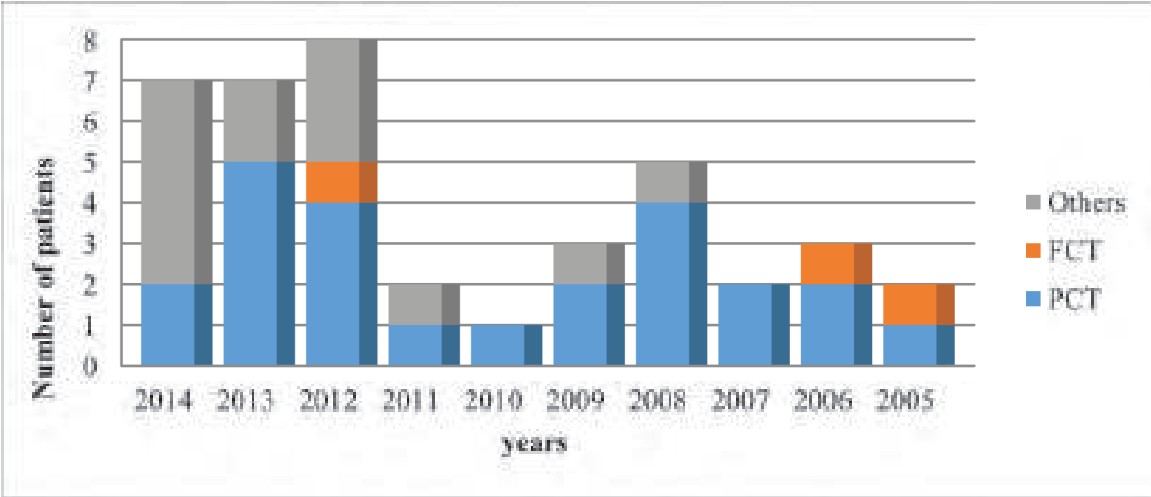


Figure 3: Status of yearly number of patients according to type of thyroid carcinoma

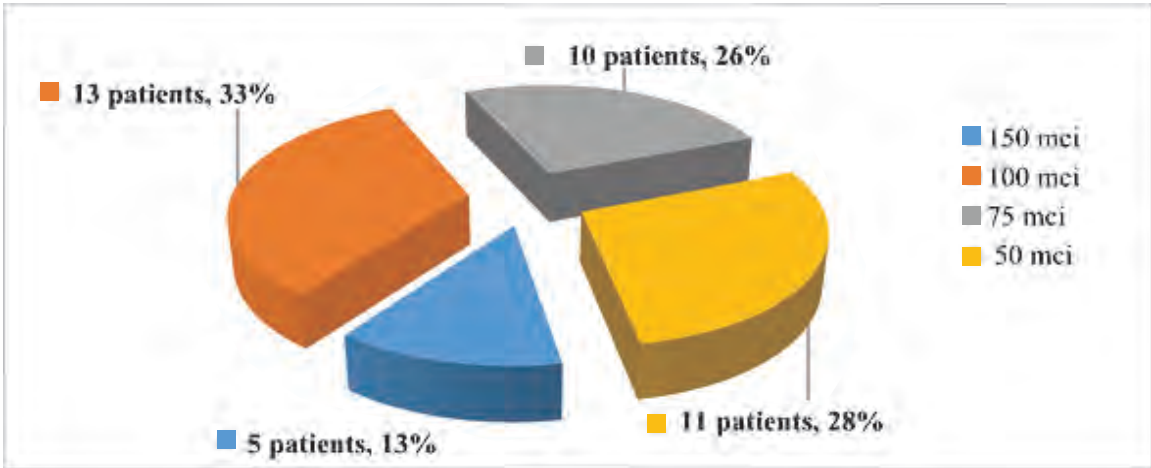


Figure 4: Status of radioiodine dose distribution among the patients

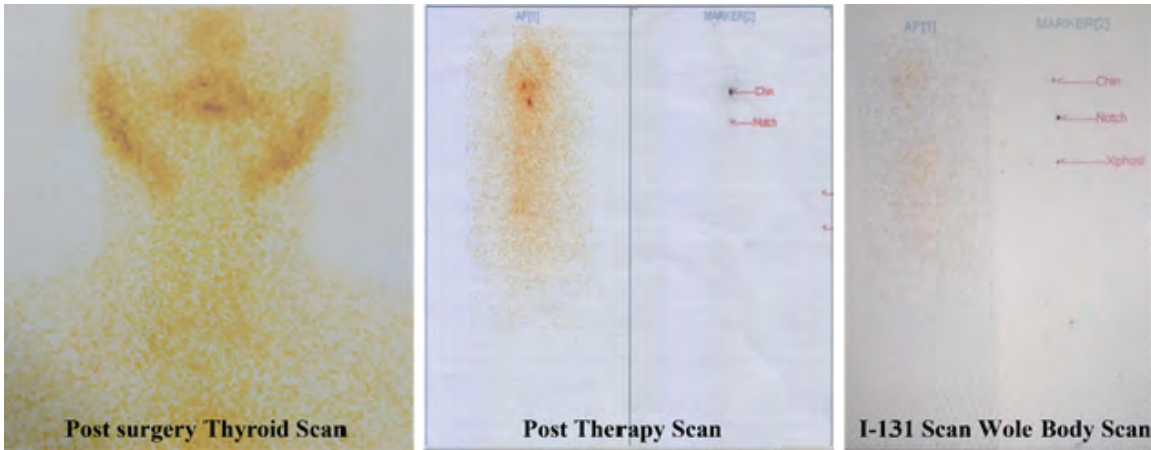


Figure 5: Images showing post-surgery scan, post-therapy scan, and I-131 whole-body scan (WBS) one year after therapy in a 16-year-old girl with metastatic papillary thyroid microcarcinoma involving multiple cervical lymph nodes. She underwent total thyroidectomy and neck nodes dissection followed by radioiodine ablation with 100 mCi I-131, considering her age. The initial metastatic survey, post-surgery thyroid scan, post-therapy scan, and follow-up I-131 WBS after one year revealed no residual disease, with stable biochemical parameters over time.

DISCUSSION

The 5-year survival rates for teenagers with thyroid carcinoma have ranged from 97.5% to 99.6% since 1975 (5, 7). Only 0.1% of thyroid cancer patients under the age of 20 pass away from the disease (5). Despite having a high survival rate, pediatric DTC patients usually have local cervical lymph node metastases and distant metastatic disease, which most frequently affects the lungs (5). Rearrangements of RET/PTC1 are more frequent in children with papillary thyroid carcinoma (2).

When first diagnosed, pediatric thyroid carcinoma is more aggressive, more likely to have lymph node and lung metastases, and more likely to return after surgery (2, 8-10). The prognosis is good. Although there are several theories regarding pediatric thyroid cancer, the cause of this discrepancy is not yet known (2). Zimmerman et al. reported that the nondiploid DNA amount was 10% in pediatric thyroid cancer and 20% in adult thyroid cancer. The authors hypothesized that a low occurrence of nondiploid DNA was associated with a favorable prognosis in children with thyroid cancer (2,9). The thyroid gland may also be more sensitive to carcinogenic influences during childhood and adolescence. In younger individuals, TSH might function more prominently as a promoting element. As a result, postoperative TSH suppression with thyroid hormone replacement is more effective, and pediatric thyroid cancer seldom dedifferentiates from well-differentiated to poorly differentiated carcinoma (2, 10, 11).

In this study, PCT is dominant in pediatric thyroid malignancy (60%). It also shows female predominance (87.5%). 11 patients (27.5%) showed PCT with lymph node metastasis. No patients show lung metastasis. No other associated pediatric malignancy or development of any secondary malignancy after radioiodine ablation therapy was found in the study group. 6 patients (15.38%) received a second dose of radioiodine therapy due to recurrence. No baby passed away during the follow-up period.

For pediatric thyroid cancer, a thorough surgical procedure that includes lymph node dissection is required to lower the risk of recurrence after surgery. TSH suppression therapy is unquestionably necessary. The dose of ^{131}I is adjusted for age and extra safety parameters based on weight (2). In our study, 39 patients (97.5%) were treated with ^{131}I therapy. Among them, 13 patients (33%) received 100 mCi

radioiodine therapy, which is the highest number. The dose of radioiodine therapy depends on age, weight, and extent of disease. In patients with iodine-avid malignancies, RAI may reduce cancer-related mortality and tumor recurrence (6). If RAI is recommended, the TSH level must be higher than 30 IU/mL. This is typically brought on in patients who are at a high risk for the disease by withdrawing thyroid hormone for 14 days. Recombinant human TSH (rhTSH) may result in a reduced blood absorption dose when utilized for residual ablation in low-risk patients. A low-iodine diet is typically advised for two weeks before therapy to facilitate RAI uptake. Body weight alone should be used to determine ^{131}I dosages (1.0-1.5 mCi/kg). A post-therapy thyroid scan is also recommended after 5 to 7 days of RAI. To achieve and maintain a serum TSH level between 0.1 and 0.5 $\mu\text{IU/mL}$ in the absence of hyperthyroidism symptoms, most children should be treated with thyroid hormone suppression according to the ATA guidelines (6).

In this study, every three months during the first year following ^{131}I treatment, then every six months for five years, and finally once a year, were used to monitor thyroglobulin and thyroid-stimulating hormone levels. Approximately a year after the initial ^{131}I ablation, additional diagnostic ^{131}I whole-body studies (148 MBq [4 mCi]) were conducted. If ^{131}I uptake was normal and thyroglobulin levels were undetectable during the thyroid hormone withdrawal interval, the ablation was deemed effective.

CONCLUSION

The findings of the study provide valuable insights into the prevalence and characteristics of childhood thyroid malignancy in a single center. Thyroid cancer is not uncommon in pediatric patients. Proper treatment and regular follow up are mandatory for its excellent prognosis. According to the data, complete thyroidectomy with the proper neck lymph node dissection is followed by radioiodine therapy is the best course of treatment for most of the children's patients with differentiated thyroid cancer. Even though children with DTC frequently have localized metastases and a high rate of distant metastases when they are first diagnosed, they seldom pass away from the disease.

REFERENCES

- 1 Kim, K., Lee, C.R., Kang, S.-W., Lee, J., Jeong, J.J., Nam, K.-H. and Chung, W.Y. (2020). Clinical Assessment of Pediatric Patients with Differentiated Thyroid Carcinoma: A 30-Year Experience at a

- Single Institution. *World Journal of Surgery*, 44(10), pp.3383–3392. doi:<https://doi.org/10.1007/s00268-020-05598-9>.
2. Park, S., Jeong, J.S., Ryu, H.R., Lee, C.-R., Park, J.H., Kang, S.-W., Jeong, J.J., Nam, K.-H., Chung, W.Y. and Park, C.S. (2013). Differentiated Thyroid Carcinoma of Children and Adolescents: 27-Year Experience in the Yonsei University Health System. *Journal of Korean Medical Science*, 28(5), p.693. doi:<https://doi.org/10.3346/jkms.2013.28.5.693>.
3. Holmes, L., Hossain, J. and Opara, F. (2012). Pediatric Thyroid Carcinoma Incidence and Temporal Trends in the USA (1973–2007): Race or Shifting Diagnostic Paradigm? *ISRN Oncology*, [online] 2012, pp.1–10. doi:<https://doi.org/10.5402/2012/906197>.
4. Demidchik, Y.E., Demidchik, E.P., Reiners, C., Biko, J., Mine, M., Saenko, V.A. and Yamashita, S. (2006). Comprehensive Clinical Assessment of 740 Cases of Surgically Treated Thyroid Cancer in Children of Belarus. *Annals of Surgery*, 243(4), pp.525–532. doi:<https://doi.org/10.1097/01.sla.0000205977.74806.0b>.
5. Avram, A.M. and Shulkin, B.L. (2014). Thyroid Cancer in Children. *Journal of Nuclear Medicine*, 55(5), pp.705–707. doi:<https://doi.org/10.2967/jnumed.113.136077>.
6. Waguespack, S.G. and Francis, G. (2010). Initial Management and Follow-up of Differentiated Thyroid Cancer in Children. *Journal of the National Comprehensive Cancer Network*, 8(11), pp.1289–1300. doi:<https://doi.org/10.6004/jnccn.2010.0095>.
7. SEER. (n.d.). SEER Cancer Statistics Review, 1975–2017. [online] Available at: https://seer.cancer.gov/csr/1975_2017 [Accessed 22 May 2023].
8. La Quaglia Mp, Corbally, M.T., Heller, G.V., Exelby, P.R. and Brennan, M.J. (1988). Recurrence and morbidity in differentiated thyroid carcinoma in children. 104(6), pp.1149–56.
9. Zimmerman, D.W., Hay, I.D., Gough, I., Goellner, J.R., Ryan, J.J., Grant, C.S. and McConahey, W.M. (1988). Papillary thyroid carcinoma in children and adults: long-term follow-up of 1039 patients conservatively treated at one institution during three decades. 104(6), pp.1157–66.
10. Koo, J.S., Hong, S. and Park, C.S. (2009). Diffuse Sclerosing Variant Is a Major Subtype of Papillary Thyroid Carcinoma in the Young. *Thyroid*, 19(11), pp.1225–1231. doi:<https://doi.org/10.1089/thy.2009.0073>.
11. Buckwalter, J.A., Thomas, C.G. and Freeman, J.B. (1975). Is Childhood Thyroid Cancer a Lethal Disease ? 181(5), pp.632–639. doi:<https://doi.org/10.1097/00000658-197505000-00018>.