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Pediatric Population Thyroid Cancer

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Abstract

Children with thyroid cancer frequently appear with advanced illness, which may be explained by the fact that the thyroid gland in children is more vulnerable to radiation and carcinogenesis. Children with thyroid cancer had higher rates of distant metastases and lymph node metastases at the time of diagnosis than adults do, as well as recurrence. Despite these traits, thyroid carcinoma in children often has a favourable prognosis. Compared to adults, children and adolescents have a lower incidence of thyroid cancer, with 4-5 incidences per 100,000 people annually. Teenage girls are thought to be the group in which thyroid cancer is most often detected in paediatrics, where it is thought to be the second most prevalent malignancy. Childhood thyroid malignancies have greater risks of metastasis and recurrence than do adult thyroid cancers. Thyroid cancer is relatively curable for the majority of children and adolescents, though, and the prognosis for kids with thyroid cancer is typically quite good. The aim of treatment is to eradicate cancer while causing as few side effects as possible.

Keywords: Pediatric thyroid Cancer; Molecular Testing; Gene Rearrangement; Targeted Cancer Therapy

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Introduction

Cancer that originates in the tissues of the thyroid gland is known as thyroid cancer. It is a condition where cells develop improperly and are susceptible to spreading to different bodily regions. Bumps in the neck or swelling are examples of symptoms. Thyroid cancer is not always diagnosed because it can move from other parts of the body to the thyroid. Young age radiation exposure, having an enlarged thyroid, family history, and obesity are risk factors. Papillary thyroid cancer, follicular thyroid cancer, medullary thyroid cancer, and anaplastic thyroid cancer are the four primary kinds. Ultrasound and tiny needle aspiration are frequently used in diagnosis. As of 2017, it is not advised to screen those without symptoms and at a low risk of contracting the illness. Surgery, radiation therapy with radioactive iodine, chemotherapy, thyroid hormone, targeted therapy, and observation are all possible forms of treatment. The thyroid may be completely or partially removed during surgery. In the US, the five-year survival rate is 98%.

Only 0.7% of all paediatric cancers are thyroid tumours, making them an uncommon form of childhood cancer. Only 1.8% of thyroid tumour diagnoses in individuals under the age of 20 occur in the United States, with Caucasians, women, and teenagers having the highest frequency. Hashimoto's thyroiditis, genetic conditions such multiple endocrine neoplasia type 2, Carney's syndrome, Werner's syndrome, and DICER1 syndrome, as well as a history of ionising radiation exposure, are only a few of the risk factors that have been associated to the development of thyroid cancer. In patients after the Chernobyl nuclear catastrophe in 1986, the link between radiation exposure and an elevated incidence of juvenile thyroid cancer was established. It is important to keep in mind that cancer patients who get therapeutic radiation (total-body radiation for leukaemias and lymphomas, external beam for neck tumours) are apparently "at risk" for developing secondary thyroid cancers (which account for about 2% of cases). In fact, compared to the healthy general population, people who survive Hodgkin's lymphoma have an 18.3-22 times higher risk of developing papillary thyroid cancer [1-5].

Although thyroid cancer is uncommon in children, thyroid cancers that do develop in young patients have distinct clinical, pathologic, and molecular features. Children more frequently exhibit severe, advanced-stage disease as compared to adults. This is caused, at least in part, by the fundamental biological and molecular variations between thyroid cancer in children

and adults. In particular, papillary thyroid carcinoma (which makes up about 90% of paediatric thyroid cancer) has a high rate of gene fusions that affect the histologic subtypes seen in paediatric thyroid tumours, are linked to more severe extra thyroidal disease, and present special opportunities for targeted medical therapies. Although there are few studies of non-papillary paediatric thyroid tumours published in the literature due to their rarity, differences are also seen in paediatric follicular thyroid cancer and medullary carcinomas, which are most frequently, diagnosed in the paediatric population in the context of prophylactic thyroidectomies for known multiple endocrine neoplasia syndromes. It's crucial to understand how the spectrum of histotypes and underlying molecular changes that are typical of paediatric thyroid cancer have changed overall because this could have a direct impact on the choice of diagnostic procedures and suggested treatments.

Discussion

Over 6% of all paediatric malignancies between 2012 and 2016 were caused by thyroid cancer, which is the primary cause of paediatric endocrine cancer. This number indicates the rise in paediatric thyroid cancer incidence during the last 40 years. Pediatric thyroid cancer had an annual percent change (APC) of +0.8% from 1975 and 1995, which increased to +4.6%/year from 1996 to 2016. Papillary thyroid carcinoma, the most prevalent subtype of thyroid cancer, accounts for the majority of this increase (PTC). However, follicular thyroid cancer has also been observed to be on the rise (FTC). Given their rarity in children, the contributions of medullary (MTC), anaplastic (ATC), and poorly differentiated (PDTC) thyroid carcinomas are minimal. According to several studies, surveillance and improved detection only partially explain the rising frequency of papillary and follicular thyroid carcinoma because there is also a rise in the discovery of big tumours and advanced-stage disease. A "reservoir of clinically silent tumours," greater use of medical imaging, and improved imaging sensitivity, according to Chen et al., may be the causes of the rising thyroid carcinoma rate.

In the past, recommendations for the diagnosis and treatment of thyroid cancer in children have been extrapolated from recommendations for adults. However, the clinical presentation, aetiology, and long-term prognoses of thyroid malignancies in the paediatric population are distinct from those in adults. In order to manage children with thyroid nodules and differentiated thyroid carcinoma (DTC), the American Thyroid Association (ATA) developed guidelines in 2015. Here, we examine the morphomolecular discoveries that have the most bearing on clinical care as well as the clinicopathologic presentation and management of paediatric thyroid cancer.

Background and epidemiology

According to the Surveillance, Epidemiology, and End Results programme, children and adolescents account for 1.8% of thyroid cancer diagnoses in the US. The majority of paediatric thyroid cancer instances happen in the second decade, while rare incidences of newborn thyroid carcinoma have also been reported. As people become older, there are also disproportionately more women affected than men, reaching almost a 6:1 ratio by the time people are 15 to 19 years old. These thyroid tumours are almost exclusively PTC (80–90%), followed by FTC (10%), MTC (3-5%), and infrequently ATC and PDTC. Children with thyroid disease (such as autoimmune thyroid disorders), dietary (iodine deficit), and radiation exposure in the past have all been linked to the development of follicular-cell derived thyroid cancer. Based on an incidence rate of 1.14/100,000 per year over a period of 19 years, it has been reported that the frequency of malignancy in paediatric patients with Hashimoto's thyroiditis ranges from 0.67% to 3%, which is higher than the background risk of 0.02% in the general paediatric population. The overproduction of thyroid stimulating hormone (TSH) or chronic inflammation leading to proliferation, angiogenesis, and/or decreased apoptosis are two proposed reasons for the link between Hashimoto's thyroiditis and PTC. Regarding the likelihood of malignancy, paediatric Graves' disease data are scarcer. Reports of follicular-cell derived thyroid cancer in patients receiving definitive surgical therapy range from 1% to 22%; this number falls even lower if non-surgically treated Graves patients are included in the denominator. However, of the few research published in the juvenile population, several have demonstrated that iodine intake may be protective in the context of radiation exposure and the development of PTC. The relationship between iodine shortage and FTC has also been more thoroughly explored in adults. The risk of DTC is further increased by radiation exposure, whether it occurs naturally, as part of diagnostic procedures, or after irradiation for a past cancer (most frequently Hodgkin lymphoma or cancers of the central nervous system). Indeed, among those who have survived childhood cancer, thyroid cancer is one of the most prevalent subsequent malignancies [6-10].

Clinical presentation

A thyroid nodule in a child often presents as an asymptomatic neck lump, with or without cervical lymphadenopathy. It may also be accompanied by breathing difficulties and/or hyperthyroidism. Due to its heightened malignant potential in the juvenile population, the diagnosis of a nodule is crucial from a clinical standpoint. Nodules in the adult population are rather prevalent, affecting 19–68% of people, however they are rarely malignant (5–10% of all thyroid nodules in adults, according to most series). Children and teenagers exhibit the opposite behaviour. One to three percent of kids have thyroid nodules, and more than quarters (22 to 26 percent) of thyroid nodules in young patients are malignant.

Treatment

Due to the higher incidence of bilateral (30%) and multifocal (65%) disease, total thyroidectomy is the preferred course of treatment for paediatric PTC and FTC. However, a near-total thyroidectomy is also an option, in which a small portion of thyroid tissue close to the superior parathyroid glands or the recurrent laryngeal nerve may be spared to lessen the risk of damaging those structures. Less invasive surgery may have a place in some clinical settings for adults with thyroid cancer, according to statistics, but paediatric thyroid cancer patients are less likely to have such a procedure since lobectomy patients have a higher risk of local recurrence. Thyroidectomy should be

followed by a central or lateral neck dissection if there are central or lateral neck metastases. Based on the size and focality of the tumour, neck dissection can also be considered as a preventative measure; however, its usage must be balanced against potential risks. The ATA task force also advises adjuvant radioactive iodine (RAI), which may also be determined by post-operative thyroglobulin levels, for unresectable iodine-avid persistent locoregional illness (owing to invasion of important structures) and/or distant metastases. In contrast to the guidelines published by the National Comprehensive Cancer Network for adults with PTC, which list a number of clinical characteristics as indications for adjuvant RAI, including primary tumour size >2-4 cm, gross extrathyroidal extension, and extensive or bulky regional nodal involvement.

Conclusion

In conclusion, paediatric thyroid carcinoma is the most prevalent carcinoma in children while being an uncommon malignancy. Recognizing the higher frequency of gene fusions in paediatric thyroid cancer compared to adult thyroid cancer is crucial because it may have effects on the choice of molecular diagnostic tests (such as indeterminate FNA diagnosis) and opens up new therapeutic possibilities. Targeted medicines have proven very effective in treating juvenile thyroid carcinoma that is refractory, but more information is required to identify whether alternative therapeutic approaches should be investigated.

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