Pediatric Thyroid Nodules and Malignancy

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KEYWORDS

• Pediatric thyroid • Thyroid nodule • Thyroid cancer • Neck mass
• Pediatric thyroidectomy

KEY POINTS

- Pediatric thyroid cancer occurs more frequently than in the past, so an understanding of risk factors and available diagnostic testing is critical.
- Pediatric thyroid nodules behave differently than adult nodules, as the rate of malignancy in pediatric nodules may be as high as 25% compared with the rate of 5% in adult nodules.
- Fine-needle aspiration cytology can be helpful when definitive, but the diagnostic category "indeterminate" presents a clinical challenge.
- Experienced pediatric endocrinologists and thyroid surgeons should mange thyroid nodules in children.

INTRODUCTION

It has been reported that between 1973 and 2004, the incidence of thyroid cancer in patients younger than 20 years increased by 1.1% per year based on the Surveillance, Epidemiology, and End Results registry at the National Cancer Institute.[1]

Pediatric thyroid nodules exhibit several differences compared with nodules in adults. The prevalence of nodules in adults ranges from about 5% by physical examination to up to 35% by ultrasound scan and up to 65% in autopsy studies. However, there is limited knowledge of the prevalence of thyroid nodules in the pediatric population.[2] Although several studies have looked at this issue, many have used different diagnostic approaches, so it is difficult to know the true prevalence of malignant thyroid nodules. A study in the United States found that the prevalence of palpable thyroid nodules in children was 1.5%.[3] A recent ultrasound study in Japan found

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Abbreviations	
ETT	Endotracheal tube
FNA	Fine-needle aspiration
MEN	Multiple endocrine neoplasia
TSH	Thyroid-stimulating hormone

that thyroid cysts were present in 56.88% and thyroid nodules in 1.65%. Cysts and nodules with diameters greater than 5 mm occurred in 4.58% and 1.01%, respectively.[4] One factor affecting detection on physical examination is nodule location; a posteriorly located nodule may be missed in some patients and only found on ultrasound examination. Pediatric thyroid carcinoma incidence was higher in women, highest in the 15- to 19-year age group, and more common in whites compared with African Americans in the Surveillance, Epidemiology, and End Results database between 1973 and 2007. It has been reported that there is a distinct difference between the rate of malignancy of thyroid nodules in adults and children. Although approximately 5% of adult nodules are malignant, 26.4% (range, 9.2%–50%) of pediatric nodules are malignant.[5]

Pediatric thyroid malignancies are nearly all well-differentiated subtypes of papillary, follicular, and medullary. Anaplastic carcinoma is typically seen in older adults.

As in adults, papillary carcinoma is the most common subtype of thyroid carcinoma in the pediatric population. Follicular cancer is second in prevalence, and medullary is least prevalent. Pediatric patients with papillary thyroid cancer typically present at a more advanced stage than do adults. However, pediatric patients do have better outcomes.[6]

Pediatric thyroid surgery is extremely safe, especially when performed at a high-volume endocrine surgery center. Pediatric centers often select surgical treatment for benign nodular thyroid disease because of the less-intensive follow-up required with this approach. In addition, pediatric thyroid surgeons choose total thyroidectomy over limited resection. This may reflect increasing confidence in the safety and efficacy of surgery.[7]

The differential diagnosis for cystic thyroid lesions includes benign cystic degeneration, thyroglossal duct cyst, parathyroid cyst, branchial cleft cyst, follicular adenoma, chronic lymphocytic thyroiditis, multinodular goiter, and thyroid carcinoma.[8]

PATHOPHYSIOLOGY AND ETIOLOGY

Radiation

Radiation—especially for the treatment of primary pediatric malignancies—has been associated with a higher rate of thyroid cancer.[9] A fairly recent example of radiation effects on the thyroid come from Chernobyl when the incidence of thyroid cancer in younger children correlated to radiation exposure in the form of various radioactive isotopes of iodine. Typically, a papillary cancer was present in these patients. Radiation treatment to the head, neck, and upper chest for treatment of other childhood malignancies has been associated with the development of a secondary thyroid malignancy. The risk of thyroid cancer increases in proportion to increasing radiation doses up to 20 to 29 Gy but then decreases with higher doses. It is likely that higher radiation doses result in cell death rather than resulting in carcinogenic mutations. There is also some evidence that chemotherapy may be a contributing factor, but this has not been well elucidated in children.[10]