In children, thyroid disorders have a range of presentations, including asymptomatic thyromegaly, behavioral disturbances, lassitude, and growth retardation. The hyperthyroid state is often much more symptomatic than the hypothyroid state, although physical abnormalities are apparent in both conditions. Surprisingly, thyroid disorders are often insidious in onset and difficult to recognize, even in the face of gross biochemical disturbances. Detection of thyromegaly and thyroid masses can also be elusive if time is not taken to properly examine the thyroid. Recognizing thyroid disorders in children thus requires a keen eye and a strong element of suspicion.

**EVALUATION OF THYROID FUNCTION**

**Physical Evaluation of the Thyroid Gland**

Because thyroid disease can present with isolated thyromegaly, evaluation of the thyroid should be included in routine examinations and can be accomplished rapidly. Evaluation of the thyroid also provides important clues about causes of hyper- and hypothyroidism.

The thyroid can be visualized by having the patient look to the ceiling and swallow. As the thyroid moves, the margins of the gland are viewed to estimate size and symmetry. Next, the thyroid should be palpated to assess size, consistency, and symmetry. This is best done while standing behind the patient and palpating with the finger tips, starting in the midline and moving laterally.
The texture of the thyroid should also be assessed to determine if it is smooth or irregular. Attention should also be directed to determine if there are any nodules, which may be firm or soft. If any asymmetry or abnormal thyroid fullness is noted, ultrasonographic evaluation is recommended (1), as pathological thyroid nodules may feel like normal tissue.

To assess gland size, one may estimate the size of each thyroid lobe relative to that of a teaspoon (5 gm) or a tablespoon (15 gm). Generally, until the end of puberty, gland size (in gms) approximates the patient’s age in years × 0.5–0.7 (2). Thus, each thyroid lobe of a 10-yr-old will be about one-half of a teaspoon for a total gland size of 5-7 gms (2).

To follow changes in thyroid size, the outline of the thyroid gland can also be traced. This is done by drawing on the patient’s neck with a felt-tipped marker, rubbing an alcohol pad on a small sheet of paper, and then placing the paper on the neck. The outline of the thyroid will then be transferred to the paper, which can be kept in the medical record.

For newborns and young infants, the thyroid can be examined by placing the infant spine on the parent’s lap, with the head toward the parent’s knees. The head can then be gently tipped backward exposing the neck, allowing the thyroid to be palpated.

If the examiner can palpate each ring of the trachea from the sternal notch to above the larynx, this suggests the absence of pretracheal thyroid tissue, which occurs if there is failure of thyroid formation or migration. Failure to detect pre-tracheal thyroid tissue in older children warrants visual examination of the base of the tongue for ectopic thyroid tissue. When a sublingual thyroid gland is discovered late in childhood or in adolescence, the tissue should be palpated with a gloved finger during regular office visits since nodules and malignancies may develop in ectopic thyroid glands (3,4). In contrast, when an ectopic thyroid is detected in infancy and replacement therapy is started, the residual thyroid tissue becomes atrophic and does not present long-term problems.

**Interpretation of Thyroid Function Tests**

Approximately 97% of the thyroid hormone released from the thyroid gland is thyroxine (T4) (5). After its release, less than 1% of T4 remains free, whereas the remainder circulates bound to the proteins thyroglobulin (TBG, 70%), prealbumin (transthyretin, 10%) and albumin (15–20%) (5). Thyroid function can therefore be assessed by measurement of total-T4 and total-T3 and levels, along with indices that reflect thyroid hormone-binding proteins (T3- or T4- resin uptake) (5). Measurement of free T4 (FT4; or unbound T4 levels) is used to assess thyroid hormone status without confounding influences of carrier proteins.

When FT4 values are normal, yet total T4 values are high, familial dysalbuminemic hyperthyroxinemia (FDH) needs to be considered (6,7). This autosomal dominant disorder is most commonly seen in Hispanic individuals and can be diagnosed by thyroid hormone binding protein electrophoresis. If FT4 values are normal, but total T4 values are low, TBG deficiency needs to be considered. TBG deficiency is an X-linked disorder that may be associated with color-blindness (8). In these and other conditions affecting thyroid hormone binding, treatment is not needed and the patient should be educated about the condition to avoid treatment by unsuspecting practitioners.

Whereas T4 is much more abundant in the circulation, triiodothyronine (T3) is the more metabolically active thyroid hormone. T3 is produced peripherally from T4 and can be secreted by the thyroid. A metabolically inactive form of T3, reverse T3, is also produced and is elevated in conditions such as the “euthyroid-sick syndrome” (9).