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Clinical Insights and Surgical Considerations

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Abstract

Thyroid disorders encompass a spectrum of conditions affecting pediatric patients, ranging from autoimmune diseases like Hashimoto's thyroiditis to infectious entities such as acute suppurative thyroiditis. This article provides a comprehensive review of Hashimoto's thyroiditis, De Quervain's thyroiditis, acute and silent thyroiditis, and multinodular goiter in pediatric populations, focusing on clinical manifestations, diagnostic approaches, and therapeutic interventions. While surgical management plays a crucial role in certain scenarios, such as symptomatic goiter or suspected malignancy, medical therapy remains the cornerstone for many thyroid disorders. Understanding the nuances of these conditions is essential for pediatricians and endocrinologists to optimize patient care and outcomes.

Key Words: thyroiditis; neck pain; gland destruction

Introduction

In general, thyroiditis is defined as an inflammation of the thyroid gland. There are several kinds of thyroiditis, and they can be associated with either increased, decreased, or normal thyroid function. Furthermore, they can be classified as painful or painless, depending on the etiology. Differentiating between the different kinds is dependent on the clinical setting, medical and family history, how fast the symptoms progressed, and most importantly, the presence or absence of neck pain. [1]

Hashimoto's thyroiditis:

Hashimoto's thyroiditis (HT), the most frequent autoimmune thyroid disorder (AITD), is the leading cause of hypothyroidism in the iodine-sufficient areas of the world. About 20-30% of patients suffer from HT, whose cause is thought to be a combination of genetic susceptibility and environmental factors that causes the loss of immunological tolerance, with a consequent autoimmune attack on the thyroid tissue and the appearance of the disease. [2] A diffuse, lymphocytic inflammatory process characterizes Hashimoto's thyroiditis, and clinical manifestations are variable due to differing amounts of gland destruction. [3] In itself, HT is not an indication for surgery but the co-existence of thyroid nodular disease creates diagnostic and management difficulties. [4]

Most patients with Hashimoto's thyroiditis are asymptomatic and require no specific treatment. Those who develop hypothyroidism will receive thyroid hormone replacement, and surgery is rarely indicated. [5]

The treatment of hypothyroidism, as a result of AIT, consists of daily assumption of synthetic levothyroxine. It serves to counteract the symptoms but does not cure the disease. [6] The different formulations consent to personalize the therapy with the personal characteristics of each patient. [7- 14] Rarely thyroidectomy is recommended in patients with AIT. The reasons for thyroidectomy are manifold: severe signs or symptoms of local compression, a nodular disease with "suspicious" cytology for malignancy, or sometimes cosmetic reasons for a goiter. [2]

As in our experience and other surgical series, the incidence of HT has been up to 13% but surgery is seldom needed insubacute (de Quervain's) thyroiditis.]26[

The cardinal making the diagnosis because of the characteristic clinical and laboratory findings. [15]The currently accepted indications for surgery are suspicion of malignancy, tracheal/esophageal compression, and pain. [16] Large, euthyroid, and asymptomatic HT occasionally needs surgical intervention. [16]

Dominant nodules and pseudo nodules in Hashimoto's thyroiditis are commonly benign, but nodules may be firm on examination and adherent to adjacent structures. [17, 18] Those patients with the nodular type of Hashimoto have a 60% increased risk of developing papillary thyroid cancer.[19]

Once malignancy is confirmed in patients with Hashimoto's thyroiditis, thyroidectomy is recommended due to the high risk of multicentricity, difficulty in accurate imaging, and lower accuracy of FNA surveillance. [19, 20] The prevalence of malignancy in HT in various surgical series ranges from 0.4% [21] to 28%. [20]

Compressive symptoms secondary to a large goiter are the second most common indication for thyroidectomy in patients with Hashimoto's thyroiditis. [16, 20] Because of significant inflammatory and fibrotic changes to the thyroid gland in patients with Hashimoto's thyroiditis, a difficult thyroidectomy may be anticipated. [18]

Complications of thyroidectomy are more common in patients with Hashimoto's thyroiditis. [3]

Transient hypocalcemia secondary to hypoparathyroidism from surgical retraction occurs at a more frequent rate in patients with Hashimoto's thyroiditis ranging from 20% to 38% of the time. [16,

20, 22]
Nonetheless, cervical pain from Hashimoto's thyroiditis can be successfully treated with total thyroidectomy. ,19 ,16[
]23The effect of surgery on discomfort in swallowing and tightness in the neck has not been properly evaluated.
The most important factor in preventing operative complications is treatment at a high-volume center with a high-volume surgeon.
To conclude, patients with euthyroid, large but asymptomatic Hashimoto's goiters, occasionally need surgical intervention. Symptoms like discomfort in swallowing and tightness in the neck are relieved after surgery and can be considered indications for surgery. [16]

Silent thyroiditis:

Silent or painless thyroiditis is a frequent cause of transient hyperthyroidism, which is characterized by the recent onset of symptoms in a patient with a normal to modestly enlarged and firm thyroid gland. [24]
Silent thyroiditis is a transient form of hyperthyroidism characterized by a painless, non-tender thyroid gland, elevated blood levels of thyroxine (T4) and triiodothyronine (T3), a low radioactive iodine uptake, and spontaneously resolving hyperthyroidism. [25]
Silent thyroiditis is most often confused with the disease entity with which it shares most of its clinical features-feature which differentiates the two processes is the absence of thyroidal pain in silent or painless thyroiditis. [24]
Long-term lithium therapy has been reported to cause a variety of thyroidal abnormalities including euthyroid goiter, hypothyroidism, and thyrotoxicosis.]27[
Histologically, the gland is characterized by an important lymphocytic infiltration, occasionally to the point of lymphoid follicle formation. [24]
This disease is also called painless thyroiditis, transient hyperthyroidism with lymphocytic thyroiditis, atypical subacute thyroiditis, lymphocytic thyroiditis with spontaneously resolving hyperthyroidism, or chronic lymphocytic thyroiditis, thyrotoxicosis, and low radioactive iodine uptake. [25]
Because the hyperthyroidism of silent thyroiditis results from inflammatory disruption of follicular cell function and the liberation of the stored hormone, it is evident that the usual therapy of hyperthyroid Graves' disease (antithyroid drugs or radioactive iodine) is not appropriate. β- adrenergic blocking agents (e.g., propranolol) may be very helpful in controlling thyrotoxic symptoms. Anti- inflammatory agents have not proved to be useful. [28] Occasionally patients may experience a prolonged period of hypothyroidism before recovery. Under these circumstances, short-term therapy with thyroid hormones may be warranted. [24]
The remainder has mild to severe symptoms requiring some form of therapy. Different modes of therapy known to be effective in the treatment of hyperthyroidism and thyroiditis are being used by physicians to treat these patients. These have consisted of sedatives, tranquilizers, propranolol hydrochloride, propylthiouracil, and prednisone or combinations of these medications. [29]
According to the research, no evidence of surgery was found to treat this disease.

Subacute thyroiditis:

subacute granulomatous thyroiditis, a self-limiting inflammatory disease of the thyroid gland[30], is an infrequent cause of hyperthyroidism. It is also known as subacute thyroiditis(SAT), painful thyroiditis, subacute nonsuppurative thyroiditis, giant cell thyroiditis, or de Quervain thyroiditis. [31] The common symptoms are neck pain or discomfort, tenderness to palpation, and a predictable course of hyperthyroidism followed by euthyroidism, hypothyroidism, and back to euthyroidism. The thyroid gland might be slightly enlarged or normal with a diffuse or focal hypoechogenic appearance on ultrasonography. [31] SAT can be confused with the common sore throat and the rare acute bacterial thyroiditis leading to delayed confirmation of diagnosis. [32, 33] De Quervain thyroiditis is the most common cause of thyroid/neck pain.
Viral infections are presumed to be a cause of subacute thyroiditis. [34, 35] Autoimmunity is not significant in subacute thyroiditis. [36]
The overall age and sex-adjusted incidence of subacute thyroiditis during this period were 4.9 cases per 100,000/year. This disease affects women almost 4 to 5 times as often as men and typically occurs between 25 to 35 years. With increasing age, the incidence of subacute thyroiditis decreases. The prevalence of subacute thyroiditis appears to be seasonal, as most cases occur in the summer and fall. [1, 37, 38]
The goals of subacute thyroiditis treatment are pain relief and symptom control.

Methos and Material

Treatment for de Quervain thyroiditis is pretty straightforward, with anti-inflammatory treatment being the key. Patients with mild to moderate pain are generally treated with rest and salicylic acid, naproxen, and ibuprofen. For more severe neck pain, oral corticosteroids (Prednisone). Usually, symptoms improve in 2 to 3 days with NSAIDs. Recurrent pain should require up-titration of prednisone dose. Palpitations, anxiety, and tremors need to be treated with propranolol or atenolol with close follow-up. [36, 39]
Subacute thyroiditis usually resolves, and patients return to a normal euthyroid state in 3 or 4 months.]31[Symptomatic treatment in rare cases includes surgery. [40]
As you can see, surgery is not one of the main ways to treat this disease.

Acute suppurative thyroiditis:

Acute suppurative thyroiditis (AST) is an infection in the thyroid gland progressing to an abscess.
AST is most often described in children with anatomic aberrations or patients with immunosuppression such as transplant recipients or after chemotherapy. [41]
Acute suppurative thyroiditis (AST), accounting for 0.1–0.7% of all thyroid diseases, is a rare infectious disease. [42] Only 8% of AST occurs in adults. [41] The incidence of metastatic spread of malignancies to the thyroid is also relatively low at about 1.4–3.0% of all thyroid malignant tumors. [42]
Typically, symptoms in AST are similar to those in patients with subacute or chronic thyroiditis. [43]
When a patient presents to a hospital because of fever, neck pain, swelling [42], sore throat which can be painful during swallowing, dysphagia, increased C-reactive protein (CRP), measurable thyroglobulin, and positive cultures from drainage or blood [41], AST should be considered. [42]Other differential diagnoses are hemorrhage in the thyroid, amiodarone-induced thyrotoxicosis, infarction of a thyroidnodule, and rapidly growing thyroid cancers. [41]
The diagnosis of AST should be based on high clinical suspicion.
For those who are highly suspected of AST, glucocorticoids should be avoided, and antibiotic therapy should be prescribed as soon as possible. [42]
Treatment is drainage and/or thyroid surgery together with antibiotic therapy, as inadequate treatment of abscesses can result in mortality rates of 12% or more.]45 ,44[
If antibiotic treatment fails, surgery such as an incision with drainage can be necessary. Drainage has in multiple reports been successful and can be repeated if the abscess persists, or if there is a deterioration. [46, 47] Open surgery, with total, near-total, or hemithyroidectomy can in severe cases be deployed to relieve pressure symptoms, and later in patients that do not respond to adequate antibiotic treatment and drainage. [48-50] Complications to surgery are damage to tissues in the area as the parathyroid glands and the recurrence nerve. If there is an anatomic defect, surgery could wait until the abscess has been treated with antibiotic therapy, and often also drainage. [41]

Multinodular goiter:

Multinodular goiter (MNG) is the most common of all the disorders of the thyroid gland. Careful examination discloses their presence in at least 4% of the general population.

In areas of iodine deficiency, goiter prevalence may be very high and especially in goiters of longstanding, multinodularity develops frequently. [51]
In a comprehensive population survey of 2,749 persons in northern England, Tunbridge et al found obvious goiters in 5.9% with a female/male ratio of 13:1. [52]
Such goiters characteristically present a variegated appearance, with the normal homogeneous parenchymal structure deformed by the presence of nodules. The nodules may vary considerably in size, outline, and architecture.
As the gland grows it characteristically enlarges the neck, but frequently the growth occurs in a downward direction, producing a substernal goiter. There may be dysphagia, cough, and hoarseness. Paralysis of the recurrent laryngeal nerve may occur when the nerve is stretched taut across the surface of an expanding goiter, but this event is very unusual.
These nodules may be only the growth and fusion of localized colloid-filled follicles, or more or less discrete adenomas, or cysts. [51]

Clinical symptoms of MNG
Often a family history of benign thyroid disease
Slowly growing anterior neck mass
Uni- or multinodularity on examination
Asymmetry, tracheal deviation, and/or compression
Cosmetic complaints
Rarely upper airway obstruction, dyspnea, cough, and dysphagia
Sudden transient pain or enlargement secondary to hemorrhage
Gradually developing hyperthyroidism
Superior vena cava obstruction syndrome (rare)
Recurrent nerve palsy (rare)
Horner´s syndrome (rare)

Table 2: *Neck palpation is notoriously imprecise concerning thyroid morphology and size estimation. [53] Several imaging methods are available in most settings: scintigraphy (with radioiodine, technetium), ultrasonography, computed tomography scans, magnetic resonance imaging, and, less frequently used, positron emission tomography (PET).*

If a clinical and biochemically euthyroid MNG is small and produces no symptoms, treatment is controversial. T4 given to shrink the gland or to prevent further growth is effective in about one-third of patients.
If the clinically euthyroid goiter is unsightly, shows subclinical hyperthyroidism, or is causing pressure symptoms, treatment with ^{131}I preceded by recombinant human TSH is successful but causes hypothyroidism in varying degrees. This treatment can lead to 45-65% shrinkage of the MNG.
A beneficial effect of L-T4 has been demonstrated in diffuse goiters in many controlled trials. A goiter reduction of 20- 40% can be expected in 3-6 months of therapy. the goiter returning to the pre-treatment size after L-T4 withdrawal. [51]
As indicated by Fast et al [54] it is time to consider radioiodine treatment for MNG as an alternative to surgery.
Surgery of the MNG, however, is equally effective and the choice among the two procedures depends largely on their availability, clinical features, and personal preference of the patient.
The preferred operation for MNG is a subtotal thyroidectomy. The frequency of complications due to surgery depends on several factors and well-trained and experienced surgeons will reduce the rates of such complications.
However, surgery is an acceptable option. The efficacy of T4 treatment after surgery, to prevent regrowth, is debatable although frequently used. [51]

When do we go to surgery for overactive and underactive (goiter and graves) thyroid?:

Hyperthyroidism refers to hypersecretion of thyroxine (T4) and triiodothyronine (T3). Rarely, this may result from excessive secretion of thyrotropin (thyroid-stimulating hormone, or TSH). The most common causes of hyperthyroidism are Graves' disease [55] and functionally autonomous (TSH-independent) multiple or solitary thyroid nodules. [56]
Graves' disease (GD) is an autoimmune condition[57] where thyrotropin receptor antibodies (TRAb) stimulate the TSH receptor leading to excess thyroid hormone production.
[55] its caused by the production of auto-antibodies against the thyroid-stimulating hormone receptor. [58] some individuals are genetically predisposed to this condition. [57]
Increased nervousness, heat intolerance, increased perspiration, palpitations, fatigue, and weight loss despite hyperphagia are the most common symptoms. Common signs include diffuse goiter, tachycardia, tremor, a staring gaze, exophthalmos, and eye and skin changes. [59]
Graves' disease is a common cause of thyrotoxicosis. [60]
Graves' disease can also occur in normal-sized thyroid glands [61], especially in the elderly. [59]
Currently, the prevalence of GD is 0.5 % of the population and is the underlying etiology for 50–90 % of cases of hyperthyroidism. [56, 62] and exhibits a female predominance. [63]
Understanding disease pathophysiology, diagnostic and treatment strategies, and prevention of disease relapse are important for all clinicians especially internal medicine specialists to give optimal and comprehensive management for GD patients. [64]
The essential goal in the management of thyrotoxicosis in Graves' disease is to reduce hypersecretion of thyroid hormone. [56]
The treatment remains empiric. Antithyroid medications, radioactive iodine ablation, and surgery (subtotal or near- total thyroidectomy) have all been used to treat patients with Graves' disease. [59, 65]
However, it is interesting to note that the treatment modalities of Graves' disease vary from country to country. [61]
Factors that influence these differences are (1) the tendency of GD to resolve spontaneously with time, often resulting in an end-stage hypothyroidism; (2) the degree of the disease with its associated varying risk of complications such as GO; and (3) socioeconomic factors, which vary in different parts of the world. [66]

The indications for thyroidectomy for Graves' disease depend strongly on the preferences and values of individual patients, physicians, and society. Most of these indications are relative and not absolute. [63, 67]

Antithyroid medication is less likely to achieve a permanent cure than radioiodine or thyroidectomy. In the United States, radioiodine is usually preferred over thyroidectomy for the majority of patients with Graves' disease (70%). In Japan and other Asian countries, thyroidectomy is used more often than radioiodine. [67]

Effective treatment of hyperthyroidism requires an accurate determination of the cause. [56] The choice of treatment is determined by clinical and social factors, patient preference, severity of the thyrotoxicosis, age, size of the goiter, availability of the modalities, response of the treatments, clinician recommendation, resource availability, and other comorbidities. [60, 64]

In our current patient-centered healthcare environment, it is important to consider patient preferences and values when discussing treatment options. For adults with Graves' disease, the decreasing complication rates and increasing access to high-volume surgeons, the rapid and predictable resolution of hyperthyroid symptoms, and the low recurrence risk have made surgery a more attractive first- line option in recent years. [68]

Thyroid surgery, when performed by a high-volume thyroid surgeon, appears to be a safe and effective definitive treatment option for Graves' disease with a low risk of morbidity. [60] surgery remains an important option for treating multinodular goiter and therefore is one of the most performed operations by surgeons, especially in endemic areas. [69]

The risk of postoperative complications such as hypocalcemia, hematoma, or recurrent laryngeal nerve palsy (RLNP) following total thyroidectomy (TT) is classically elevated in case of hyperthyroidism, but surgery provides faster [63] and more stable remission of endocrine disorder than conservative strategies. [63]

Also, Surgery allows early diagnosis of 12.5% of papillary carcinomas. [63]

Total thyroidectomy (TT) and subtotal thyroidectomy (ST) are worldwide treatment options for multinodular non-toxic goiter in adults. [70]

The management of Graves' disease (GD) in the US is shifting towards increased use of anti-thyroid drugs (ATD). If patients fail to achieve remission after a standard course of therapy of 12–18 months, long-term treatment with ATD (≥24 months) may be chosen over definitive therapy with radioiodine (RAI) or surgery. Clinicians will need to contrast this strategy to ablative therapies as they help patients in decision-making. [55]

Although the majority of patients with Graves' disease in the U.S. are treated with radioactive iodine, surgery still plays an important role when patients cannot tolerate antithyroid drug therapy, when medical treatment is rejected by patients, or when surgery is deemed the fastest and safest route in managing the patient. [61]

When considering the three treatment modalities for Graves' disease, it is clear that there is no perfect treatmen and one must weigh the advantages and disadvantages. [61]

Discussion:

Indications for thyroidectomy are currently not well defined. [55] but some researches categorized important ones.

According to one survey, endocrinologists are more likely to recommend surgery as a treatment for Graves' disease to a younger patient than an older patient. [71] Some studies have found lower remission rates in patients younger than 40 treated with medical and RAI therapy. [72] This is particularly true for children where medical treatment has a failure rate of up to 80% in some series. [59] In addition, there may also be a higher incidence of recurrence, hyperparathyroidism, and hypothyroidism after RAI therapy in children compared to adults. [61] So Children should undergo thyroidectomy. [60] several groups have reported acceptably low rates of thyroidectomy-specific complications in children when performed at high-volume centers. [73, 74]

Pregnancy and Lactation

Pregnancy is an absolute contraindication to radioactive iodine therapy, because radioactive iodine may cross the placenta and cause profound hypothyroidism, neonatal goiter, and asphyxia in the newborn. Thus, for pregnant women whose hyperthyroidism is not easily controlled using anti-thyroid drugs, surgery is the treatment of choice. [72, 75] So Pregnant patients who are not readily controlled by antithyroid medications or in whom serious allergic reactions develop while being treated medically are candidates for surgery. Thyroidectomy is usually performed during the second trimester. [59, 76]

Females planning pregnancy within 6–12 mo Intolerance to ATD [62, 77] Patients who wish to become pregnant soon after treatment are surgical candidates because most physicians advise patients not to get pregnant for at least 1 year after radioactive iodine ablation. [59, 78]

Sex

Men with Graves' disease have a lower remission rate than women after a single dose of radioactive iodine (47% versus 74%) or with ATD treatment. [72] Therefore, surgery may be the treatment of choice for young men with Graves' disease. [61]

Conclusion:

In summary, thyroid disorders in pediatrics present unique challenges, requiring a multidisciplinary approach for optimal management. While surgery is indicated in specific cases, such as severe compressive symptoms or suspected malignancy, medical therapy often suffices for many thyroid conditions. By integrating clinical expertise with evidence-based practices, healthcare providers can deliver personalized care tailored to the individual needs of pediatric patients with thyroid disorders. Ongoing research and collaboration are essential to further enhance our understanding and treatment strategies for these complex conditions in pediatric populations

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