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Surgery on Children

Review

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Surgery preferences for thyroid diseases in childhood: review of the literature due to a case experience

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ABSTRACT

The authors have not decided well about the requirement of thyroid surgery in childhood. There are reasons for this controversy. Some of these controversies are various diseases, differences in evaluations of the diseases, and various follow-ups. So, treatments in different institutions are most diverse. All these things may confuse surgeons who perform surgery in this age group. A patient was operated on a 17-year-old girl whom the pediatric endocrinology department followed up for three years with a thyroid nodule diagnosis. Thyroid function tests were regular. In ultrasonography, a nodule in the left thyroid lobe was detected. The nodule had grown over the years and reached a size of 2×1.5×1.4 cm. E×cision was planned when a definitive result could not be reached after fine-needle aspiration biopsies were repeated three times in our hospital. Since the entire fine needle aspiration examinations were inconclusive, only a left lobectomy was performed. After pathology examination resulted in follicular carcinoma, right lobectomy with isthmectomy was added to the procedure. As a result, a total thyroidectomy in 2-stage was performed. Because of this surgical course of the patient, it was decided to examine the surgical choices of thyroid diseases in children like Graves' disease and benign and malignant nodules. Literature was evaluated to understand if there is an algorithm for decision-making on pediatric thyroid surgery.

Keywords: Children, thyroid, disease, nodule, adenoma, surgery

INTRODUCTION

Thyroid diseases are less common in childhood than in adults.[1-3] Among thyroidal diseases, girls are generally affected.[4] Most pediatric patients are asymptomatic and often discovered by their family or pediatrician.[5] Children with thyroid disease are mostly diagnosed with Graves' disease, nodules, or thyroid malignancies.[3] Thanks to developing drug protocols, surgery is rarely needed nowadays. Nevertheless, when surgery is needed, making the decision is controversial for surgical preferences among subtotal, near-total, or total excisions. This review was planned after the case was operated on in two stages.

As a non-tumor disease, Graves' disease is the most common cause of hyperthyroidism in children, which may indicate surgery.[6,7] Thyrotoxicosis is a clinical indicator of hyperthyroidism, and, luckily, it is not usually seen clinically in children.[6,7] In these types of diseases, scintigraphy is a useful method to decide about the function of lesions.[5] Nodules captured radioiodine could be benign beyond the expected malignity rates.[5] In contrast, nodules that do not capture radioactive material may be malign disease in the range of 20% to 60%.[5] So, scintigraphy is mainly used to locate lesion.[5]

Graves' disease can be treated with multiple methods.[7] The first choice in treating Graves' disease is anti-thyroid drugs, but relapse in children is 20-30%.[6,8] Therefore, surgical treatment can be required.[7] The indications for surgery for Graves' disease are often related to the preferences of parents or, sometimes, patients.[7] Parents usually accept surgery considering the costs of medication or the possibility of drug inefficacy.[7] When surgery is decided, the optimum choice seems to be total thyroidectomy in Graves' disease older than five years.[6]

The rate of benign nodular thyroid diseases in children is 1.5%.[9] As benign diseases are rare in childhood, the surgical criteria for this group of diseases are lacking. Therefore, with all the available data, the American Thyroid Association (ATA) published about pediatric treatment guide in 2015.[10] In the guideline, fine needle aspiration (FNA) is strongly advised.[10] If surgery is needed, conservative surgery is gradually preferred in nodule treatments.[3,10] Depending on size, compressive symptoms, cosmetic concerns, or parents'/patients' choice, surgery may be partial thyroidectomy, lobectomy-isthmectomy, or nodular resection in unilateral and benign pathology.[8-10] Therefore, treatment modalities in benign thyroid nodules may include clinical, surgical, or both applications, as in adults.[11]

Thyroid cancers represent 0.5-3% of childhood tumors.[5] However, among the thyroidal disease population in childhood, cancer is seen between 14% and 40%.[12] Thyroid carcinomas are most seen with endocrine neoplasms in childhood, and their incidence is 4-7 / million.[13] Compared with all age groups, childhood thyroid cancers constitute 10% of total thyroid cancers.[4]

Many studies show that thyroid carcinomas in childhood differ from carcinomas in adulthood in terms of formation and process.[14] Papillary carcinomas are seen in 90% of malignant thyroid cancers.[2,13] Follicular carcinomas are the second seen carcinomas in adults, but it is rare in childhood.[2,13] The most common causes of carcinomas are iodine deficiency and exposure to ionizing radiation.[13,15] The probability of developing thyroid cancer within 3-4 years is between 1-7% in those exposed to 100 to 700 cGray radiation.[15]

If nodules with suspicious US findings are growing, then nodules may be evaluated as malign.[10] The guideline reported that nodules greater than 4 cm could be considered malign tumors.[10] American Thyroid Association (ATA) recommended total thyroidectomy and radioiodine ablation for papillary thyroid carcinoma in 2009.[16] In the 2015 guideline, operation preference is not as confident as in 2009, but lobectomy seemed to be the main suggestion. In Japan, while lobectomy is recommended for papillary carcinoma, there is an opinion that radioiodine ablation is not required.[16] In general opinion, total thyroidectomy is not recommended.[14]

Since malignant thyroid nodules in childhood are less common than in adults, the reported FNA results are also fewer.[12] In addition, fine-needle aspiration biopsies performed to evaluate follicular carcinomas are generally insufficient.[13] FNA biopsy (FNAB) is the first choice in patients with thyroid nodules due to its simplicity, effectiveness, and cost-performance appropriateness.[15] In some clinics, the preferred application size is 1 cm.[15]

Surgery may be performed for malignancy, drug unresponsiveness, and some benign diseases.[1] In these diseases, the preferences for the form of thyroidectomies, such as total or almost total, may differ.[1,2]

In this report, we evaluated the decision-making criteria of the authors regarding different types of thyroid diseases. Also, we compared our patient's surgical history with the literature to strengthen our evidence-based medical practice.

METHOD

English literature is evaluated by using google scholar. Keywords consisting of "Children," "Thyroid," "Disease," "Nodule," "Adenoma," and "Surgery" were decided to be the leading search points in the literature. The main keywords were children and thyroid, and articles that did not have information related to these two keywords were excluded. After this, filtration surgery was searched in the remaining literature. This group of articles was classified according to "Disease," "Nodule," and "Adenoma" keywords.

Articles containing discussions on surgical procedures were selected and added to the reference list.

Google Scholar was searched in a month. As this database is extensive, enough sources other than English were not evaluated.

In the literature, systematic information about decision-making for thyroid surgery in children is among the least evaluated subjects. Thyroid surgeries were usually defined in different protocols. Also, various diseases were defined on this subject. As a result of these circumstances, finding a systematized conclusion was difficult. Unclarity had to be why the authors left the subject open-ended.

The data collection process was performed by only one person (A.S.). All the data was correlated with keywords. When articles were eligible, descriptions of diseases were classified, and surgeons' experiences were read. Treatment modalities that the authors preferred were evaluated. Especially if different thyroidectomy types were defined, they were noted. There were small groups with various findings, so accountability for the conclusions was impossible. Descriptive information without trying to make a statistical comparison was preferred.

CASE

The pediatric endocrinology outpatient clinic consulted a seventeen-year-old girl because of a thyroid nodule. The patient had palpated a mass in the thyroid gland region. She had no complaints about swallowing or breathing. She did not have complaints such as sweating at night or other complaints that would suggest hyperthyroidism. On examination of the patient, there was an apparent and palpable nodule on inspection in the left thyroid lobe. The right lobe was normal. There was no lymphadenopathy on the neck examination. Thyroid function tests were regular. Complete Blood Count (CBC) and blood biochemistry values were also average. The most recent ultrasonography examination showed a 2×1.5×1.4 cm diameter nodule in the left lobe. Thyroid scintigraphy was unremarkable except for the hypoactive nodule appearance. Three FNAB trials were not definitive, but hypoactive nodule or follicular adenoma was a possible diagnosis. Thereupon, a left-lobe thyroidectomy was done. A frozen biopsy was not performed during surgery. A Jackson-Pratt drain was inserted, and the operation was ended. There was no vocal cord problem, bleeding, or calcium level change after the surgery. The patient was discharged the next day without any problem. A week later, specimen evaluation was concluded as angio-invasive type follicular carcinoma. Therefore, a second operation was done to remove the remaining right lobe. Right lobe thyroidectomy and isthmectomy were performed three weeks later. The right lobe was seen as entirely usual in surgery. The patient was discharged one day later without any complications. Pathology diagnosis resulted in nodular goiter for the right lobe.

Two months later, the patient's control examination and analysis were regular, and radioiodine ablation treatment was applied. Follow-up was routine in the postoperative 11th month. She has hormone replacement therapy regularly.

Parents had their consent in writing the patient's clinical progress with only the condition of not presenting her identity information. The patient's identity is not presented.

DISCUSSION

Total thyroidectomy is usually accepted as surgical treatment in adulthood.[1] In children, on the contrary, surgery preferences of the thyroid change according to circumstances.[1] Surgery can be planned according to general criteria or according to various specific criteria.[17] It is necessary to learn patient history and make examinations such as USG and fine-needle aspiration biopsy (FNAB); consequently, it is essential to understand the disease.[17] As American Thyroid Association (ATA) refers, total thyroidectomy may be performed for some differentiated malignancies.[8] Partial thyroidectomy may be the choice in cases that are strongly considered benign.[8] In this study, we evaluate which type of thyroid excision can be chosen in childhood for different thyroid problems and examine the thyroid disorders in 3 groups: Benign thyroid diseases, benign thyroid nodules, and malignant thyroid nodules.

Benign Thyroid Diseases

Graves' disease is the most operated benign disorder of the thyroid. Subtotal thyroidectomy was the first choice in the 90s for Graves, but later it was abandoned.[7] The reason to abandon subtotal thyroidectomy is the incidence of high recurrence. 65% of surgeons worldwide prefer near-total thyroidectomy for Graves' disease. To a lesser extent, total thyroidectomy was preferred. Authors who preferred total thyroidectomy reported that near-total thyroidectomy is insufficient to cure Graves' disease.

In making a proper decision, one follow-up criterion for the operation's success is the course of ophthalmopathy.[7]

Benign Thyroid Nodules

As in adults, nodular lesions are primarily seen in girls in childhood.[9] It can be easily thought that this situation may occur with the difference of genetically monoclonal or polyclonal origin.[9] Treatment of thyroid nodules is usually decided depending on the clinical evaluation and FNAB.[5] The basis of surgical excision also depends on histological evaluation.[5] Subtotal excision seems sufficient in benign lesions such as cysts, colloidal nodules, congenital anomalies, and nontoxic goiter.[5] A staged surgery method can be preferred in the surgical treatment of nodules, and it can prevent excessive surgery.[2] Most experts recommend that if the nodules are in a single lobe in pediatric patients, lobectomy and isthmectomy should be sufficient.[9] Millman et al.[5] reported 141 patients with different thyroid diseases in their series, and within the study, as a subgroup, there were 45 patients with benign nodules. Four had a total thyroidectomy, 41 had a partial thyroidectomy, and partial resections consisted of subtotal, lobectomy, and isthmectomy or lobectomy.[5] In their follow-ups, two patients with benign problems had recurrence.[5] Although some information about the treatments of nodular lesions seems to be tissue-protective, contrary to this information, surgical treatment in multinodular goiter is usually performed as total thyroidectomy in practice.[9] Unwanted nodular recurrence may be the reason for this, and it is essential in deciding surgical success. However, there are no specific criteria for predicting the occurrence of nodule recurrence.[9] The recurrence rate in nodular diseases is 7.2% for adults.[9] More than one nodule also causes a significant increase in recurrence rate compared to recurrence caused by a single nodule.[9] It is difficult to define the incidence because even simple variables such as volume increase or the presence of nodules are reported as a "recurrence".[9]

It is reported that the probability of hypothyroidism in adults after hemithyroidectomy is between 10.9% and 42.6%. In adults, hypothyroidism may be clinically asymptomatic, but growth, bone development, and cognitive development should be considered in children. Therefore, the importance of the remaining thyroid tissue volume after partial thyroidectomies has been discussed for thyroid functions. It has been reported that in the absence of goiter, nodules, and positive thyroid antibodies, hormone replacement is not necessary until the TSH level is 5-10 IU/L. Minimum of 7.3 ml of tissue might be enough for everyday functions. So, if there will be less than 10 ml of thyroid tissue after surgery, thyroid hormone functions should be followed carefully.[9] Complications other than hypothyroidism after partial excision in children may occur. These possible complications are recurrent laryngeal nerve damage, hematoma, and hypoparathyroidism.[9]

Total thyroidectomy is increasingly preferred in benign diseases, especially those who do not benefit from long-term treatments.[1]

Malign Thyroid Nodules

The prognosis of malignant tumors is excellent in childhood.[4] However, rare occasions may cause fatal neoplasms in children.[4] Tumors in children are usually and paradoxically larger.[14] Also, lymph and lung metastases are more detected in children than adults.[14] Genetic factors, immunity disorders, peritumoral fibrosis, angiogenic reactions, body responses to ionizing radiation, late diagnosis, and unknown causes are some of the main reasons for this difference.[4,14] High dependency on Thyroid Stimulating Hormone (TSH) in children has also been attributed to childhood predisposition.[14]

With the introduction of FNAB, the rate of thyroid surgeries has decreased to 25-50%.[12] The specificity of FNAB in children is between 65-90%.[12] However, FNAB is not much used in children because there are potential complications and may require sedation.[12] Although the patient's characteristics may be helpful in the choice of surgery, the histological evaluation will be effective in the final decision.[12]

The optimal surgical treatment of malignant thyroid diseases is not yet precise.[4,18] In the study by Podda et al.[15,27] of 36 patients with thyroid cancer had a total thyroidectomy, and 9 had hemithyroidectomy. In the same study, four total thyroidectomy treatments were performed in two stages.[15]

In another study, it was stated that 7 of 26 malignant patients underwent total thyroidectomy, and 19 of them had a subtotal thyroidectomy. Although the authors performed mostly subtotal thyroidectomy in this study, they concluded that total thyroidectomy appears to be the most appropriate treatment. Total excision is due to the possibility of a tumor in the contralateral thyroid lobe.[5] Other studies report different opinions on malignant tumors' Hemi- or total

thyroidectomies[4,13,15] Insisting on subtotal thyroidectomy is an excellent postoperative result in malignant conditions. Some authors also find that subtotal excision is more appropriate for preventing hypoparathyroidism.[5]

An advantage of total thyroidectomy is radioiodine ablation therapy after surgery. By using radioiodine therapy, the possibility of recurrence in the thyroid bed according to the development of the tumor or the nodule involvement will be reduced.[5,18]

As different studies demonstrated variable recurrence rates between 22% and 49%, it can be easily understood that there are significant differences in treatment modalities. Clinical tumor detection in cervical lymph nodes in 29% of the cases and then finding tumor cells in 73% of cases is another strong evidence for the different recurrence rates in different studies.[14]

Follicular Adenoma and Carcinoma

A follicular adenoma is a particular form of thyroidal malignancy for children. There are not enough studies in the literature on follicular tumors in pediatric patients.[13] In addition, diagnosis of follicular adenoma with FNAB usually remains in the "gray zone." As follicular adenoma is very similar to Hashimoto's thyroiditis, nodular hyperplasia, or Hurtle cell adenoma, differential diagnosis can be confusing. There is a 20-30% chance of defining malignancy because of needle biopsy in all these circumstances. The differences among these diseases can be efficiently made by surgical excision and examination of the entire nodule.[12]

Spinelli et al.'s[13] study reported no recurrence with partial thyroidectomy in the follow-up of the remaining thyroid tissues of patients with follicular carcinoma. In their series, follow-up processes of 90% of follicular carcinomas in children are unproblematic. To succeed in an effective postoperative period, Spinelli et al.[13] stated that size, localization, multifocality, lymph node metastasis, and extrathyroidal extension should be demonstrated by precise ultrasonography evaluation. Some authors advocated that those tumors smaller than 4 cm without extra-thyroid extension could be followed up after conservative surgery. Total thyroidectomy is recommended if the tumor spreads over 3 cm.[13] In another study, experts preferred total thyroidectomy in the presence of lesions larger than 1 cm.[4] Despite these significantly different opinions, the difficulty of conducting a prospective study makes it hard to make a definitive decision.[2]

CONCLUSION

If well-differentiated thyroid cancers are detected, surgical methods other than total thyroidectomy may be preferred. However, total and near-total surgeries can be performed for widely invasive carcinoma with central lymph node dissection. Completion of thyroidectomy and radioiodine ablation therapy reduces recurrence and mortality by removing microscopic residuals. Nevertheless, despite appropriate surgical treatment, relapses can occur even after a long time.

Surgical complications may be more likely in children than adults. However, in the case of a disease requiring thyroid surgery, total thyroidectomy may be preferred over other methods, or at least with a few stages. If thyroidectomy is performed other than total excision, the treatment should be managed by predicting that the procedure can be transformed into total thyroidectomy.

ETHICAL DECLARATIONS

Referee Evaluation Process

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The authors have no conflicts of interest to declare.

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All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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