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Indications, Risks, and Acceptance of Total Thyroidectomy for Multinodular Benign Goiter

PETER E. MÜLLER[1], STEFFEN KABUS[2], ELISABETH ROBENS[3], and FRITZ SPELSBERG[3]

[1]Department of Orthopaedics and Orthopaedic Surgery, Universitätsklinikum Rostock, Rostock, Germany
[2]Department of Internal Medicine, Klinik im Alpenpark, Bad Wiessee, Germany
[3]Department of Surgery, Martha-Maria Hospital, Munich, Germany

Abstract Selective morphology- and function-adapted resection is generally regarded as the surgical treatment of choice for benign goiter causing iodine deficiency. This procedure aims to reduce the need for patients to undergo reoperations for recurrence by completely removing all nodules. However, to achieve this sometimes requires a total thyroidectomy, the option of which is often rejected because of a presumed higher rate of complications. In this study, 324 patients who underwent total thyroidectomy were evaluated retrospectively. The patients were interviewed about their postoperative course and their acceptance of the procedure performed. The complications were compared with those associated with subtotal resection or hemithyroidectomies performed in our collective experience. The rate of complications associated with total thyroidectomy, namely, recurrent nerve palsy in 0.9%, hypocalcemia in 0.9%, wound infection in 0.9%, and secondary hemorrhage in 0.6%, did not differ significantly from that associated with subtotal resections/hemithyroidectomies. Moreover, 88.3% of the patients who underwent total thyroidectomy were satisfied with the results of surgery. These findings indicate that total thyroidectomy is an acceptable surgical alternative for benign multinodular goiters.

Key words Total thyroidectomy · Goiter · Complications · Recurrent nerve injury · Hypocalcemia

Introduction

Benign nodular goiter is the most common endocrine disorder requiring surgical treatment, especially in countries where iodine deficiency is prevalent. In fact, according to reports of the WHO, 7% of the world's population is affected by a goiter.[1] In Germany alone it is estimated that about 20 million people suffer from a pathologic transformation of their thyroid gland. In fact, every year over 100000 patients undergo thyroid surgery at a total cost of about 2.5 billion German marks, for investigations and surgical treatment.[2]

The extent of resection has changed over time. In recent years, function- and morphology-oriented surgery has become favored. The aim of selective resection is to remove all nodular tissue, being the source of recurrence, while leaving a remnant of the gland which will provide as much function as possible and does not contain any nodes. Thus, the extent of resection ranges from minimal unilateral resection to a complete resection of the whole gland in cases where there is no healthy tissue available. Accordingly, classic subtotal resection for benign euthyroid goiter is carried out in 15%–30% of our patients, but 40% of the nodules are localized in the dorsal parts of the gland, which are usually left during normal subtotal resection.[3] These nodes can grow independent of thyroid-stimulating hormone (TSH) secretion and should therefore not be left to T_4-suppressive therapy. The rate of hemithyroidectomies, completed by subtotal resection of the contralateral lobe, has increased in the last few years and is now the surgical treatment carried out most frequently, accounting for more than 50% of these operations.

The percentage of recurrences after surgery is extremely high. Pappalardo et al. reported a rate of recurrence of up to 14.5% after subtotal resection in their study, even though pharmacological prophylaxis was given.[4] Without prophylaxis, the rates can be as high as 43%. The extent of the first operation is the parameter which has the strongest influence on the recurrence rate. Piraneo et al. reported recurrent disease in 39% of cases after enucleation, in 27% after lobectomy and contralateral enucleation, and in 4% after subtotal

Reprint requests to: P.E. Müller, Am Hütter Wohld 7, 18209 Hütten, Germany
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resection.[5] Consequently, in young patients who have a longer life expectancy and hence a higher risk of recurrence, complete resection of all nodular tissue should be mandatory at the first surgical intervention.

The influence of the surgical method on the rate of complications remains a controversial issue. For example, temporary recurrent nerve palsy is found in about 3%–5% of patients who have undergone subtotal resection of a euthyroid goiter, whereas permanent damage occurs in 0.2%–2%.[6,7] The percentage following hemithyroidectomy for the same medical reason are 5% and 0.2%–3%, respectively.[7] After surgery to remove recurrent goiters, the incidence of recurrent nerve damage is reported to be eightfold higher.[8] The incidence of remnant hypocalcemia also increased from less than 1% after the first intervention up to 11% after the second operation.[4,9,10] Similarly, other complications such as wound infections and secondary hemorrhages are far more common after intervention for a recurrence, contributing to a higher mortality. Therefore, it is not sufficient for morphology- and function-adapted surgery of the thyroid to focus on the extent of resection, but it must also be performed to minimize the risk of complications. Ever since the first operations for thyroid disease were performed, the most appropriate procedure has been a matter of debate. Some authors prefer subtotal resection for benign nodular goiter because of its low complication rate.[5,11] Conversely, others regard total thyroidectomy as the therapy of choice for nodular goiter because it is the only way to significantly diminish the necessity of reoperations.[3,4,12,13] We attempt to define the place of total thyroidectomy in the treatment of goiter by presenting this report on the indications, complications, and patient acceptance in our own patient collective.

Patients and Methods

This study was carried out retrospectively from January 1, 1992 to September 4, 1998 during which time 10276 patients with thyroidal disease underwent surgical treatment. The preparation for surgical treatment in every patient included the following investigations: ultrasound, radioisotope scan, determination of fT_3, fT_4, TSH, and the calcium blood concentration, and a laryngoscopic check of the vocal cords. Total thyroidectomy was carried out by specialist surgeons or senior surgical residents under the guidance of surgeons. Patients with thyroiditis, thyroid cancer, Graves' disease, or recurrent goiter were excluded from the analysis. During surgery, both the recurrent laryngeal nerve and all the parathyroid glands were identified if possible. When the blood supply of the parathyroid glands was compromised, the glands were transplanted in the sternocleidomastoid muscle. The inferior thyroid arteries were ligated and if no healthy tissue was detected, a total thyroidectomy was performed. This was necessary in 324 patients with benign goiter. After surgery, patients were commenced on levothyroxine, first on a rising drug scheme, and later, levothyroxine doses were adjusted according to the fT_3, fT_4, and TSH levels. All of the patients had their blood calcium levels checked, and their vocal cords were examined by laryngoscopy in the first days after surgical treatment. Even if no substitution was necessary, each hypocalcemic episode and each reduction of the mobility in the vocal cord was noted as a pathological finding. In the same way, disturbances in wound healing which required reopening of the wound and secondary hemorrhage necessitating surgical revision were registered. Additionally, all patients who underwent total thyroidectomy were given a questionnaire about their satisfaction with the results of surgery, graded as "satisfied," "partially satisfied," or "unsatisfied." The number of long-term complications was determined by blood tests and by the function of the vocal cords. If there was no complete restitution within 1 year, the recurrent nerve palsy or hypocalcemia was classified as permanent. The rate of complications in this survey was compared with the rate among our own patients treated with subtotal thyroidectomy for benign goiter and with the rate documented in the literature.

Statistical analysis was carried out using the unpaired Student *t*-test, the Mann-Whitney *U*-test, or the χ^2-test ($p < 0.05$).

Results

During the period of this study, a total of 10276 operations for goiters were carried out in our department. According to the study protocol, the subjects included 324 patients who underwent total thyroidectomy for a benign goiter (3.5%). The average age of the patients was 62 years, with a range of 24–93 years, and female predominance was seen, with 243 women (75%) and 81 men (25%). The average goiter volume determined by ultrasound was about 102 ml (16–380 ml) which was not significantly different to the volume in all surgically treated patients in our hospital. A goiter with retrosternal parts was found in 229 patients (70.7%). Postoperatively, 28 patients (8.6%) suffered from a transient recurrent nerve palsy. In 92 patients (28.4%), hypocalcemia was evident immediately after surgery. Secondary hemorrhage occurred in two patients (0.6%), after 2 h in one and after 12 h in the other, both of whom required surgical revision. Three patients (0.9%) required a wound revision because of wound-healing problems. Of the 324 questionnaires, including interviews by phone, 265 (82%) were available for

evaluation. All patients who suffered from postoperative hypocalcemia or a recurrent nerve palsy were included in the final analysis. During the follow-up period, 3 patients died from a cause unrelated to surgery, 234 patients (88.3%) were satisfied with the results of the treatment, 24 (9.1%) were only partly satisfied, and 7 (2.6%) stated that they were unsatisfied. The reasons for dissatisfaction included postoperative disturbances of the voice, the necessity for taking oral calcium, and dysphagia. These patients also described symptoms which were most likely due to insufficient hormonal substitution, such as a lack of motivation, tiredness, indigestion, and an increase in weight. On the other hand, 194 patients (73.2%) reported an improvement in their physical condition, and 150 (56.6%) felt psychologically better. From these data, we could not conclude that the rest felt worse, because many had not experienced problems with their condition before surgery. All patients were given thyroid hormone replacement therapy. According to blood levels, they were substituted with levothyroxin-natrium at doses ranging from 75 to 225 μg per day, resulting in a median dose of 127 μg. In all patients with temporary hypocalcemia, calcium supplements were started in hospital and continued by general practitioners. The average dose was 1150 mg for a median period of 2 months. Hypocalcemia, which required oral substitution with calcium and dihydrotachysterol, developed in three patients who had undergone surgery 1 year or more earlier. Thus, permanent hypocalcemia was found in 0.9%. Of the 28 patients with a recurrent nerve palsy 25 had complete restitution after an average of 5.7 months, the rate of permanent recurrent nerve palsies being 0.9%.

For a comparison we analyzed the rate of complications following 4571 subtotal resections for benign goiter in the same series. The average size of the gland was not statistically different from those treated by total thyroidectomy. This group included patients with uninodular transformations, but predominantly multinodular goiters, and was therefore comparable to the total thyroidectomy group. In the group treated by subtotal thyroidectomy, there were 83 secondary hemorrhages (1.8%), 32 cases of permanent hypocalcemia (0.7%), 32 recurrent nerve palsies (0.7%), and 73 wound infections (1.6%). The mortality was 0% in both groups. A comparison of the complication rates of total thyroidectomy and subtotal resection in our own collective revealed no statistically significant difference.

Discussion

Surgery for benign thyroid diseases aims to remove all the nodular structures and tissue working and growing autonomously, while preventing surgical risks and treatment-related morbidity. This aim can only be achieved if the surgical proceedures are adapted to each individual case. In some cases, it is difficult to leave healthy tissue intact because the nodular alterations reach the dorsal capsule making it likely that nodular tissue would be left behind. Remaining nodular tissue can be regarded as the main cause of recurrent disease. According to our review of the literature, recurrences develop in up to 14.5% of cases after subtotal resections despite drug prophylaxis. Without this suppressive therapy, the rate of recurrence rises to 43%.[4,5]

In consideration of these facts, total thyroidectomy is performed in our hospital whenever the whole gland shows nodular transformation. The decision is based not only on the results of preoperative investigations but, more importantly, on the intraoperative macroscopic findings. Thus, the indication for performing total thyroidectomy for benign goiter is multinodular transformation of the whole gland, extending to the dorsal capsule. Our study shows that a greater extent of resection is not linked to a higher rate of complications. The injury of the recurrent nerve can undoubtedly be seen as the major surgical problem. In the present series, the rate of temporary paralysis was 8.6%, but the palsy of one vocal cord persisted in only 0.9% (three patients). There was no case of nerve palsy on both sides. In our group of patients who underwent subtotal resection, permanent nerve palsy occurred in 0.7%, so both groups lay within the range of complications related to function of the vocal cords, quoted in the literature, of 0.1%–3.2%.[14–16] If we relate the rate of recurrent nerve palsies to the number of "nerves at risk," temporary and permanent lesions were found in only 43% and 0.5%, respectively, of the 324 patients who underwent total thyroidectomy.

The risk of damaging the nerve is far higher during a second intervention. This is caused by the anatomic disturbance with scar tissue left behind after the first operation and degenerative changes.[17] High rates of temporary (15.5%–23.6%) and permanent (2.6%–15.5%) damage have been reported.[13,18–21] Considering that the rate of recurrences after subtotal resection can be as high as 23%, a comparison of those facts to our low 0.9% incidence of nerve injuries caused by total thyroidectomy highlights the necessity for complete removal of all nodular tissue.

Hypocalcemia became evident in the immediate postoperative period in 92 patients (28.4%); however, after 1 year, only three patients (0.9%) still required substitution. The literature reports rates of temporary hypocalcemia ranging from 1.6% to 22% after subtotal resection, and from 24% to 35% after total thyroidectomy.[4,9,13,22,23] At 28.4%, the rate of temporary hypocalcemia in the present series was high, although the rate of permanent hypocalcemias, at 0.9%, was not. The

figures in the literature range from 0.3% to 3%.[4,9,15,23] In our patients treated with subtotal resection, permanent hypocalcemia occurred in 0.7%. We believe that the relatively high rate of temporary hypocalcemias was caused by the technique of autotransplantation of the parathyroid glands. In our department, a replantation of these glands into the musculus sternocleidomastoideus is carried out if perfusion of the parathyroid gland may be compromised. Thus, among the total thyroidectomies in this series, one parathyroid gland was transplanted in 75 patients (24.1%), two in 60 (19.3%), three in 33 (10.6%), and all glands in 11 (3.5%). The rate of temporary hypocalcemias was higher after total thyroidectomy compared with subtotal resection, but the rate of permanent hypocalcemias was the same. In our survey, no substitution with calcium was necessary after a median period of 2 months according to blood tests carried out by the general practitioners. The incidence of permanent hypocalcemias after reoperations far exceeds the rates after the first operation, being as high as 11% according to our review of the literature.[4,9,10,19]

Two patients (0.6%) suffered from a secondary hemorrhage, requiring surgical intervention. This risk seems to be implicated in all extended operations of the thyroid, as it is in all general surgical treatments, despite careful surgical technique and hemostasis. Among the 4571 patients treated with subtotal resection, 81 (1.8%) required surgical intervention for secondary hemorrhage. In the literature, incidences of secondary hemorrhage ranging from 0.25% to 2.3% have been reported following resection of benign goiters.[9,15,23] Our rate of secondary hemorrhage was not increased compared with that following other common surgical procedures. Wound infection occurred in three (0.9%) of our patients, but we do not believe that this was directly related to the surgical technique.

The radical resection of all nodular tissue does not only diminish the risk of goiter recurrence, but it also reduces the incidence of carcinoma, because remaining nodes always harbor the possibility of malignant transformation and the risk of a microcarcinoma not being detected.[4,24,25] In fact, Wagner and Seiler reported a 9.2% incidence of newly diagnosed carcinomas among patients who underwent surgery for recurrent goiter.[26] According to the literature, 0.4%–5.4% of all nodes are malignant and a fine-needle biopsy does not exclude the possibility of a carcinoma.[27] Haid and coworkers reported that tumor cells were only able to be detected by preoperative cytological examination in 3 of 27 patients with carcinoma.[27] Moreover, Chonkich et al. noted a false-negative rate for malignancy of 10.4%.[15] Only complete resection of all nodes and subsequent histological examination can guarantee the exclusion of carcinoma.

An argument against total thyroidectomy is that patients must depend on lifelong drug substitution; however, patients who undergo subtotal resection also receive hormonal prophylaxis at least for the first few years, as well as lifelong iodine therapy. Furthermore, studies show that up to 35% of patients who have undergone a subtotal resection as well as those on a radioiodine therapy suffer from hypothyroid metabolic symptoms and need thyroxine replacement.[25,26] Intracapsular hemithyroidectomy does not offer a functional advantage compared with total thyroidectomy either, because these patients also require replacement therapy. According to long-term studies after surgical treatment, drug substitution with T_4 can be carried out without any appreciable problems, as has been done for years after total resection for malignant goiter and Graves' disease. Only one of our patients (0.4%) stated that they were completely discontented because of lifelong thyroidal replacement therapy. The average dose of substitution in this series was 127 μg L-thyroxine. Corresponding to our own experience and to the literature, a dose of 75–125 μg should be given to maintain a euthyroid metabolism and prevent goiter recurrence after subtotal resection or a remaining volume of less than 10 ml.[6] From time to time, individual problems with the drug substitution may occur, but this does not depend on the surgical treatment. Thus, only eight of our patients (3.0%) reported that their replacement therapy was complicated and protracted. In fact, patient acceptance of the surgical treatment was quite good, with 234 of the 265 patients (88.3%) reporting satisfaction with the result of their operation. Five patients (1.9%) were dissatisfied because of long-lasting calcium deficiency and a voice disturbance, which is quite understandable. On the other hand, our data indicate that subtotal resection has a comparable risk of complications.

In conclusion, total thyroidectomy seems to be a convenient alternative for benign multinodular thyroid transformation in an area of iodine deficiency. It has a low rate of complications and minimizes the need for surgery to treat recurrent diseases with its additional risks and morbidity. However, total thyroidectomy is only indicated if no healthy tissue is found or if tissue cannot be preserved due to technical problems. Total thyroidectomy was accepted by the vast majority of our patients.

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