Complications of Thyroid Surgery

Diderick B. W. de Roy van Zuidewijn, MD, PhD, Ilfet Songun, MD,
Job Kievit, MD, PhD, and Cornelis J. H. van de Velde, MD, PhD

Background: The morbidity of thyroid surgery is low. Despite this, some
authors advocate a subtotal thyroidectomy instead of a total thyroidectomy, to
avoid the higher morbidity associated with a total thyroidectomy.

Methods: We retrospectively evaluated the complications of thyroid surgery
in Leiden between January 1, 1982 and October 1, 1990. Three hundred forty-
one patients—261 women and 80 men—had 356 operations; 15 patients were
operated on twice; there were 152 total hemithyroidectomies, 3 subtotal
hemithyroidectomies, 33 total thyroidectomies, 122 bilateral subtotal hemith-
yroidectomies, 12 combinations of total and subtotal hemithyroidectomies, and
34 other operations.

Results: Calculated for the nerves at risk (n = 489), the percentage of per-
manent recurrent nerve lesions was 3.1 (in the 5 most recent years it was
1.2%). There was no significant difference between total or subtotal (hemi)th-
yroidectomies. Initial symptomatic hypocalcemia necessitating supplementa-
tion was encountered 42 times (12.5%). The occurrence of permanent symp-
tomatic hypocalcemia (6%) was not significantly different between total and
subtotal (hemi)thyroidectomies (p = 0.06). The duration of surgery was 137.8
min for bilateral subtotal thyroidectomies and 182.9 min for bilateral total
thyroidectomies (p < 0.0001). There was no difference in blood loss between
total and subtotal (hemi)thyroidectomies.

Conclusions: Because total thyroidectomy carries a risk of complications
similar to that for subtotal thyroidectomy, it is not logical to avoid total resec-
tions. If the number of total resections were increased, it is anticipated that
fewer reoperations, which involve a relatively high morbidity rate, would have
to be performed.

Key Words: Thyroid surgery—Morbidity—Complications.

Surgery of the thyroid gland is relatively safe; mortality is negligible. Morbidity, consisting of vocal cord paralysis and parathyroid hypofunction, although infrequent, still is a reason for concern. Recent literature data indicate that vocal cord paralysis occurs in 0–5% of nerves at risk, although only a part is permanent. Permanent hypoparathyroidism remains at <3% of cases (1–3). Wound healing problems are found in <1% of patients. These figures represent all kinds of thyroid operations; in the subgroup of total thyroidectomy for malignant tumors or reoperations for recurrent goiter, the percentage of recurrent nerve lesions is much higher: 9.5 and 10%, respectively (4).

Various modifications of thyroidectomy have been described to reduce or prevent the occurrence of complications. The two most common points of view are (a) staying away from the recurrent laryngeal nerve and the parathyroid glands if possible, but being able to recognize and spare them when they cannot be avoided; and (b) first identify and metic-

ulously dissect the recurrent nerve and the parathyroid glands.

Because of this morbidity, some authors advocate a subtotal thyroidectomy, if possible, to avoid the risk of a total thyroidectomy (5). A total thyroidectomy would seem to be preferable because with subtotal resection, malignant tissue may be left behind or residual tissue may be a source of recurrent disease. Therefore, a subtotal thyroidectomy can be recommended over total thyroidectomy only if the respective complication rates are known. In a retrospective analysis we evaluated the complications after thyroid surgery in Leiden between January 1, 1982 and October 1, 1990.

PATIENTS AND METHODS

From January 1, 1982 until October 1, 1990, 342 patients underwent thyroid surgery at the Department of Surgery of the University Hospital Leiden. One patient's chart was incomplete, so it was discarded. The remaining 341 patients underwent 356 operations; 15 patients were operated on twice. In this period of almost 9 years, all operations were performed by a team of 1 of 4 staff surgeons and 1 of ~20 surgical residents during their 5th or 6th (final) year of training.

In our patient population the mean age was 45.8 years (SD = 15.5, range 12.5–92.4). There were 261 women with a mean age of 44.0 years (SD = 14.8, range 12.5–89.0) and 80 men with a mean age of 51.6 years (SD = 16.3, range 15.2–92.4). In the female group, 11 patients were operated on twice (4%), whereas 4 men were operated on a second time (5%). In 12 of these 15 patients reoperation was performed because paraffin histology demonstrated the presence of thyroid cancer after intraoperative frozen section had been inconclusive. In two patients, during the first operation that was performed for hyperparathyroidism, a hemithyroidectomy was performed and reintervention was necessary because of persistent hyperparathyroidism. Another patient was reoperated for a lymph node metastasis 2 months after the first operation.

In Leiden, during thyroid surgery the recurrent laryngeal nerve is usually identified and followed to its entry in the larynx. Parathyroid glands are not specifically sought after, but are spared when identified. If a parathyroid gland seems to be at risk of ischemia it is removed, sliced, and transplanted into the ipsilateral sternocleidomastoid muscle. During less extensive thyroid operations such as isthmus

resections and tumor enucleations, the recurrent nerves and the parathyroids are not sought after because they are not at risk.

A total of 152 total hemithyroidectomies, 3 subtotal hemithyroidectomies, 33 total thyroidectomies, and 122 bilateral subtotal hemithyroidectomies were performed. In addition, in 12 cases total hemithyroidectomy on one side was combined with a subtotal hemithyroidectomy on the contralateral side. The remaining operations were isthmus resections, tumor enucleations, and cervical explorations (for parathyroid pathology) with partial thyroidectomies (n = 34). A total thyroidectomy is performed for thyroid cancer, if necessary in two separate operations. A unilateral total hemithyroidectomy is performed as a diagnostic procedure for possible malignant disease, for unilateral benign hypertrophy, or as one side in a subtotal resection for benign disease. A bilateral subtotal procedure is performed for diffuse benign hypertrophy, in which case a unilateral subtotal resection with a contralateral total hemithyroidectomy also may be performed.

The most frequent preoperative diagnosis in women was (multi)nodular goiter (42.3%), Graves' disease (18.0%), and malignancy (16.2%). In men this was (multi)nodular goiter (48.8%), malignancy (21.4%), and Graves' disease (9.5%).

A postoperative vocal cord inspection was performed at extubation and in patients with any degree of hoarseness. If a vocal cord dysfunction was seen, these patients had repeated indirect larygoscopies between 6 weeks and 6 months postoperatively unless vocal cord function had recovered earlier. A persisting dysfunction after 6 months was considered permanent.

Postoperative (phonoaudiological) evaluation of superior laryngeal nerve function was not performed.

Hypoparathyroidism in this report is defined as a state of biochemical hypocalcemia with symptoms or a relatively rapid decrease in serum calcium levels with clinical symptoms, in both cases necessitating calcium treatment. If calcium supplementation was not documented as no longer necessary within 6 months postoperatively, hypoparathyroidism was considered permanent.

RESULTS

An initial vocal cord dysfunction was found in 30 patients of a total of 356 operations (8.4%), three

times bilateral. In 322 operations—155 (sub)total hemithyroidectomies (*n1*) and 167 bilateral (sub)total hemithyroidectomies (*n2*)—489 nerves were at risk (*n1* + 2 × *n2*), and early vocal cord paralysis occurred in 29 instances (5.9%), 25 unilateral and 2 bilateral. In 14 cases, vocal cord function had recovered by 6 weeks to 6 months postoperatively. The remaining 15 (none bilateral) cases of vocal cord dysfunctions were assumed to be permanent (3.1%). In a subgroup of 177 patients having 192 operations performed between 1986 and 1990, 275 nerves were at risk. In thyroid operations not combined with a (modified) radical neck dissection, 255 nerves were at risk with 3 nerve lesions (1.2%). In a subgroup of 15 patients having had a neck dissection (10 times unilateral and 5 times bilateral) there were two recurrent nerve lesions. There was no significant difference in recurrent nerve lesions between total or subtotal (hemi)thyroidectomies either directly postoperatively or at a later stage.

In 34 operations, partial thyroidectomy was performed and the recurrent nerve was not considered at risk. However, a transient unilateral vocal cord dysfunction occurred in two patients and a bilateral one occurred in one patient.

Postoperative calcium levels were measured in 336 patients. In the initial postoperative period, symptomatic hypocalcemia necessitating calcium supplementation was encountered 42 times (12.5%). In 20 patients (6%), no documentation of termination of calcium medication could be found 6 weeks to 6 months postoperatively. Here the hypoparathyroidism may have been permanent.

Identification of parathyroid glands was specifically mentioned in 236 operative reports. In patients needing calcium supplementation (n = 12), the average number of parathyroid glands reported to have been identified and spared was 2.1 (SD 0.3), whereas in the remaining 224 patients who needed no calcium supplementation a mean of 1.3 (SD 0.1) parathyroid glands was mentioned. This difference is significant (0.001 < p ⩽ 0.005, χ^2). Although lowest serum calcium levels were significantly lower after bilateral total lobectomy than after bilateral subtotal resection (p = 0.0016, Table 1), the occurrence of symptomatic hypocalcemia was not significantly different (p = 0.06, χ^2, Table 2). The mean lowest calcium level was not different from normal values after unilateral resections (Table 1). Five patients having a total thyroid resection in two operations needed calcium supplementation after the second, contralateral total lobectomy, which was

performed after thyroid cancer was proven in the first total lobectomy specimen (Table 2).

Complications other than vocal cord paralysis and symptomatic hypoparathyroidism occur even less frequently; postoperative hemorrhage needing reintervention was encountered only once as were a wound hematoma, hypertrophic scar formation, hypergranulation in the wound/scar, and leakage of the thoracic duct needing reoperation.

Both the duration of surgery and hospital stay were affected by the nature of the thyroid disease. With a malignancy, the duration of a total hemithyroidectomy was 127.5 min (SEM 8.3), whereas for a benign lesion the same operation took only 97.6 min (SEM 3.5). This difference, which is statistically significant (p = 0.0012), is explained by the waiting time for the peroperative frozen section result. Although the duration of a total hemithyroidectomy for a benign lesion (97.6 min) was less than that for a subtotal hemithyroidectomy (115 min), this difference was not statistically significant. If bilateral subtotal thyroidectomies are compared with bilateral total thyroidectomies, the duration of surgery is 137.8 min (SEM 4.3) and 182.9 min (SEM 8.3), respectively (p < 0.0001), again explained by peroperative waiting for the frozen section result. The blood loss, irrespective of the type of operation, correlated with the duration of surgery (*r* = 0.5, p < 0.0001), but did not differ between total and

TABLE 1. *Lowest serum calcium level*

	No. of operations after which Ca^{2+} was registered	Mean lowest Ca^{2+}	Std error	p value
Subtotal lobectomy	3	2.14	0.12	N.S.
Total lobectomy	139	2.16	0.02	
Bilateral subtotal lobectomy	117	2.05	0.02	0.0016
Bilateral total lobectomy	33	1.92	0.04	

TABLE 2. *Permanent hypoparathyroidism*

	No. of operations	Ca^{2+} suppl.	p value
Subtotal lobectomy	3	0	N.S.
Total lobectomy	152	5[a]	
Bilateral subtotal lobectomy	122	6	N.S. (0.06)
Bilateral total lobectomy	33	5	
Other operations	46	4	
Total	356	22	

[a] Secondary interventions to complete a bilateral resection after the diagnostic lobectomy showed a malignancy.

subtotal (hemi)thyroidectomies nor between primary operations and reexplorations.

Mean hospital stay, defined as the time from the day of admission until the day of discharge (included), was 8 days (SD 4.2 days). With benign disease (7.7 days, SD 2.8) it was significantly shorter than with malignant disease (9.3 days, SD 7.2, p < 0.0001, Mann–Whitney test). If a patient had a postoperative complication, the mean hospital stay was significantly longer (9.5 days, SD 4.3) than with uncomplicated convalescence (7.7 days, SD 4.1, p < 0.0001, Mann–Whitney test).

DISCUSSION

Thyroid surgery generally means total or subtotal (hemi)thyroidectomy. Although less extensive thyroid operations may be performed, they do not seem to have fewer complications (we had 3 patients with vocal cord dysfunction after 34 such operations). A total thyroidectomy is performed if thyroid cancer has been proven, because in more than one-third of cases cancer is also found in the contralateral lobe (6). A total hemithyroidectomy is usually done as a diagnostic procedure. If the final diagnosis was a malignancy, thyroidectomy of the remaining part was performed; in 5 of 12 of our patients who had a subsequent resection, malignant tissue was found in the residual tissue. This is in agreement with results of other authors (6,7).

A subtotal (hemi)thyroidectomy can be performed for benign thyroid disorders. It is unclear whether a subtotal procedure is associated with fewer complications or has a significant influence on the amount of thyroid medication patients have to take postoperatively. On the other hand, the morbidity of a reoperation may very well be affected by the type of primary operation that had been performed.

One of the most serious complications of thyroid surgery is a paralysis of the recurrent laryngeal nerve, either temporarily or permanently. The risk of recurrent nerve lesions indeed depends on the experience of the operating team (8). Thyroid surgery in the University Hospital Leiden is mostly being performed by residents, supervised by qualified general surgeons and general surgeons with a special interest in endocrine surgery. Because we perform approximately three thyroid operations each month, of course our team has less experience compared with teams that perform four thyroid operations per week (6).

Morbidity is also affected by the nature of the underlying disease; surgery for endemic goiters yields fewer recurrent nerve lesions than do resections for thyroid carcinoma (6,9,10), whereas with reinterventions the number of nerve lesions can be as high as 27% (11). We have demonstrated that even in a teaching hospital like our University Hospital, the number of recurrent nerve lesions can be small: 3.1% of all nerves at risk but not more than 2.8% if only thyroid surgery has been performed. In an analysis of a subgroup of our patients, operated on between 1986 and 1990 (n = 177), the rate of recurrent nerve lesions was 1.2% of the nerves at risk. This might be attributed to a surgeon especially interested in head and neck surgery, including thyroid surgery, joining our group of staff surgeons in 1986.

It has to be stipulated that an in-hospital indirect laryngoscopy was performed only in patients with hypofunctioning vocal cords at extubation after surgery or with an immediate postoperative change of voice of any kind. Other authors have demonstrated that a checkup of the vocal cords several months postoperatively (6 months–1 year) revealed a remaining vocal cord dysfunction in only 25–50% of the patients who were diagnosed as having a recurrent nerve lesion immediately postoperatively (8, 12,13). In our series a total thyroidectomy does not yield a higher rate of recurrent nerve lesions (2.75%) than a subtotal resection does (2.83%). The external branch of the superior laryngeal nerve is not specifically sought for when dissecting the superior thyroid vessels, but the vessels are ligated separately. A lesion of this nerve may be responsible for voice weakness and may impair the use of high tones. We performed no postoperative phonoaudiological evaluation of our patients to identify an impaired nerve function. The frequency of a lesion of this nerve may be as high as 28%, which may be reduced by using magnification glasses and a nerve stimulator (14). In our practice magnification glasses are not used routinely.

Postoperative symptomatic hypocalcemia needing calcium supplementation has been reported in 2–11% of the cases (6,15,16), although transient biochemical hypocalcemia may occur much more often (25%) (15). Our 6% of cases with symptomatic hypocalcemia needing calcium supplementation and assumed to be permanent after 6 months appears to be rather high. Interestingly, in the subgroup of patients with a (transient) hypoparathyroidism, a significantly greater number of parathyroids was "identified and spared" according to the surgeon's

report. Probably parathyroids that are identified and separated from the thyroid when encountered are unintentionally compromised in their vascularization resulting in (temporary?) ischemia and hypofunction. More careful separation of the parathyroid glands that appear "spontaneously" in the operative field and not explicitly searching the (not directly visible) glands might reduce the frequency of symptomatic postoperative hypocalcemia. In later years we adopted a more liberal approach toward autotransplantation of apparently ischemic parathyroid glands to the sternocleidomastoid muscle, which may further reduce the rate of postoperative hypoparathyroidism. Although postoperative lowest calcium levels were significantly different after a bilateral total thyroidectomy as compared with those after subtotal thyroidectomy, symptomatic hypoparathyroidism needing supplementation was not encountered more often.

Duration of hospitalization was 7.7 days for benign thyroid diseases and 9.3 days for thyroid carcinoma, which is almost twice as long as mentioned in the literature. We were surprised by this finding because we had the impression that most patients were discharged on the 2nd or 3rd day postoperatively, which means that duration of hospitalization was supposed to be 4 or 5 days. Although we do not have a very clear explanation for this longer stay of our patients, some speculations can be made. From the literature it is not always clear whether the total duration of hospitalization was mentioned or just the postoperative period. In some institutions it may even be possible that patients do not stay in the hospital for a longer period but go to some paraclinical institution in the convalescence period. On the other hand, if we perform surgery on Mondays, patients are admitted the Friday before and although they may leave the hospital for the weekend, in this analysis these additional 2 days are included in the total hospital stay. Development of a complication significantly affected the duration of hospital stay.

In conclusion, in teaching hospitals thyroid surgery can safely be performed by supervised residents. A total thyroidectomy does not yield a higher rate of vocal cord paralysis or symptomatic hypocalcemia needing calcium supplementation than does subtotal thyroid surgery. With a more liberal attitude toward autotransplantation of parathyroid glands that seem ischemic, the frequency of post-

operative hypoparathyroidism may be further reduced. Because total thyroidectomy does not yield more complications than subtotal thyroid surgery does, this is no argument to avoid total resections. If the number of total resections increases it is likely that fewer reoperations, with a relatively high morbidity rate, will have to be performed.

REFERENCES

1. Schroder DM, Chambors A, France CJ. Operative strategy for thyroid cancer: is total thyroidectomy worth the price? *Cancer* 1986;58:2320–8.
2. Schwartz AE, Friedman EW. Preservation of the thyroid glands in total thyroidectomy. *Surg Gynecol Obstet* 1987; 165:327–32.
3. Harness JK, Fung L, Thompson NW, Burney RE, McLeod MK. Total thyroidectomy: complications and technique. *World J Surg* 1986;10:781–6.
4. Horch R, Dahl HD, Jaeger K, Schäfer T. Zur Häufigkeit der Rekurrenzparese nach Schilddrüsenoperationen. *Zentralbl Chir* 1989;114:577–82.
5. Friedman M, Pacella BM Jr. Total versus subtotal thyroidectomy: arguments, approaches, and recommendations. *Otolaryngol Clin North Am* 1990;23:413–27.
6. Clark OH. Total thyroidectomy: the treatment of choice for patients with differentiated thyroid cancer. *Ann Surg* 1982; 196:361–70.
7. Levin KE, Clark AH, Duh QY, Demeurse M, Siperstein AE, Clark OH. Reoperative thyroid surgery. *Surgery* 1992; 111:604–9.
8. Weitensfelder W, Lexer G, Aigner H, Fellinger H, Trattnig J, Grünbacher G. Die passagere und permanente Rekurrenzparese nach Schildrüsenoperationen. Beeinflussende Faktoren: der Ausbildungsstand des Cirurgen. *Zentralbl Chir* 1989;114:583–9.
9. Mårtensson H, Terins J. Recurrent laryngeal nerve palsy in thyroid gland surgery related to operations and nerves at risk. *Arch Surg* 1985;120:475–7.
10. Bay V, Engel U. Komplikationen bei Schilddrusenoperationen. *Chirurg* 1980;51:91–8.
11. Weitensfelder W, Lexer G, Aigner H, Fellinger H, Trattnig J, Grünbacher G. Die langfristige laryngoskopische Nachkontrolle bei Einschrankung der Stimmbandmotilitat nach Strumaoperation. *Chirurg* 1989;60:29–32.
12. Rieger R, Pimpl W, Riedl E, Boeckl O, Waclawiczek HW. Der Einfluss einer modifizierten Strumaresektionstechnik auf die Rate von Lasionen des Nervus Laryngeus Rekurrens. *Chirurg* 1985;58:255–60.
13. Reeve TS, Delbridge L, Cohen A, Crummer P. Total thyroidectomy: the preferred option for multinodular goiter. *Ann Surg* 1987;206:782–6.
14. Cernea CR, Ferraz AR, Furlani J, et al. Identification of the external branch of the superior laryngeal nerve during thyroidectomy. *Am J Surg* 1992;164:634–9.
15. Cusick EL, Krukowski ZH, Matheson NA. Outcome of surgery for Graves' disease re-examined. *Br J Surg* 1987;74: 780–3.
16. Vara-Thorbeck R, Tovar JL, Rosell J, et al. Die Komplikationen bei blander Strumenoperation: Retrospektive Studie anhand von 2035 eigenen Fallen. *Zentralbl Chir* 1989;114: 571–6.