

Total or less than total thyroidectomy for multinodular goiter long term follow-up

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ABSTRACT

Objective: Multinodular goiter is a common surgical disease. There is no common consensus regarding the extent of thyroidectomy for multinodular goiter. This study aims to present personal experience on treating patients with multinodular goiter and to compare complication rates and results of total and partial thyroidectomy for multinodular goiter.

Material and Method: Three hundred fifty patients underwent thyroidectomy for multinodular goiter between May 2003 and October 2010. All patients were diagnosed as multinodular goiter and were referred to surgery by one endocrinologist. All operations were also performed by one surgeon using microsurgical techniques. Partial thyroidectomy (bilateral subtotal or unilateral total thyroidectomy and contralateral subtotal thyroidectomy) was performed in 65 patients (Group-1) and extracapsular total thyroidectomy was performed in 285 patients (Group-2). All patients are being followed followed from the day they were diagnosed until now by the same endocrinologist. Fisher exact test was used for statistical analysis.

Results: In Group-1, one patient had transient vocal-cord palsy and but none had hypoparathyroidism. On the other hand, in Group-2, two patients had transient vocal-cord palsy, five had hypocalcemia (one was permanent), and one had a hematoma. Mortality and wound infection were absent in both groups. The histopathological studies showed that 40 incidental thyroid carcinomas occurred among Group-2 patients. During long-term follow-up, 13 patients had goiter recurrence (n = 65, 20%) in Group-1, whereas none had goiter recurrence in Group-2.

Conclusion: There were no statistically significant differences in the complication rate between subtotal and total thyroidectomy groups ($p>0.05$). However, the recurrence rate was higher (statistically significant) after subtotal thyroidectomy than after total thyroidectomy ($p<0.05$). Total thyroidectomy eliminated future recurrence of the disease and is also curative in incidental thyroid carcinomas. In addition, it can be safely performed using microsurgical techniques.

Keywords: Total thyroidectomy, partial thyroidectomy, microsurgical technique

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INTRODUCTION

Multinodular goiter is one of the most common surgical diseases. It was reported that goiters affect 5% of the world population (1), and 10%-15% of goiter patients eventually require thyroidectomy (2). Thyroidectomy is frequent surgical procedure worldwide, and severe complications, such as recurrent laryngeal nerve (RLN) palsy and hypoparathyroidism, may occur postoperatively. These complications may account for various serious medicolegal cases. In many patients, it is very hard to distinguish whether recurrent laryngeal nerve palsy or hypoparathyroidism occurs due to a complication or negligence. In private practice, many surgeons prefer to perform subtotal or partial thyroidectomy to avoid complications and medicolegal problems. Subtotal thyroidectomy has long been the preferred treatment for multinodular goiter (MNG). This is because of the common belief that subtotal thyroidectomy is easier to perform and causes fewer complications than total thyroidectomy. However, subtotal thyroidectomy has a high recurrence rate of up to 50% (3, 4).

In recent years, total thyroidectomy has increasingly replaced subtotal thyroidectomy (5). We present our experience with 350 cases and compare and discuss the results

MATERIAL and METHODS

Between May 2003 and October 2010, 350 patients with multinodular goiter were referred to surgery by one endocrinologist. All operations were performed by one surgeon using microsurgical techniques. were operated on by one surgeon in private practice.

They are being followed by the same endocrinologist since then. There were 271 women and 79 men. The age distribution (mean \pm standard deviation (SD)) was 44 ± 13 years (range 15–78 years). Preoperative work-up, such as thyroid function tests, serum calcium levels, and routine biochemistry, were performed in all patients. Vocal-cord functions were examined routinely before and after operations by an otolaryngologist.

The routine surgical procedure between May 2003 and November 2005 was partial thyroidectomy along with frozen section for patients with MNG. Patients with positive or suspicious frozen-section results were excluded from the Group-1 patients (Partial thyroidectomy group). 70 patients underwent partial thyroidectomy.

During this period, five patients had false-negative frozen-section results. These patients were excluded from Group-1; thus, the study included 65 such patients, including bilateral subtotal thyroidectomy in 16 cases and Dunhill procedure in 49 cases. Before November 2005, only 30 patients with MNG underwent total thyroidectomy.

After the November 2005, the surgical procedure was changed, and extracapsular total thyroidectomy was performed on a routine basis for patients with MNG. 285 patients underwent total thyroidectomy. Total thyroidectomy or total lobectomy was always performed by extracapsular dissection under the inferior and lateral traction of the upper pole by an Allis clamp.

All terminal vessels were ligated or sealed in close proximity to the thyroid capsule. This maneuver helps the surgeon to identify and protect the superior laryngeal nerve and upper parathyroid gland.

In the procedure for total thyroidectomy, upper pole dissection was always terminated before reaching the lower edge of the cricothyroid muscle, because it is the entry area of the recurrent laryngeal nerve to the larynx. After the procedure on the upper pole, the attention was turned to the lower pole.

Once again, all terminal vessels close to the thyroid capsule were ligated and sealed. During this part of the procedure, the second parathyroid gland was usually visualized and was preserved in situ with its own blood supply. The thyroid was suspended from both upper and lower poles, using two Allis clamps, and the median thyroid vein was then ligated. Extracapsular dissection was advanced down to the tracheoesophageal groove.

During this period, the microsurgical technique was always used with a 2.5 \times magnification surgical loupe and microsurgical instruments (jewelry forceps, detectable peanut sponge, and right-angle clamp) and RLN was usually identified posterior or anterior to the inferior thyroid artery. (Figure 1, 2)

Whenever RLN was exposed, it was dissected and protected until its entry point to the larynx. If the parathyroid glands were inadvertently damaged, they were implanted in the sternocleidomastoid muscle.

The Fisher exact test was used for statistical analysis, and $P < 0.05$ was considered to indicate statistical significance.

RESULTS

In Group-1, 65 patients underwent partial thyroidectomy. Patient age was (mean \pm SD) 40 ± 11 years (range 20 – 70 years); there were 15 males and 50 females. All these patients were followed up for ≤ 14 years (median 11 years, range 9 – 14 years).

In this group, only one patient had transient vocal-cord palsy, and none had hypocalcemia or wound infection. In the long-term follow-up, 13 patients who underwent subtotal thyroidectomy had recurrent thyroid nodules >1 cm. Twelve of these patients were recommended for or underwent a secondary thyroidectomy procedure and one patient with recurrent toxic multinodular goiter received radioactive iodine therapy.

In Group-2, 285 patients underwent total thyroidectomy. Patient age was 45 ± 13 (range 15 – 78 years); there were 64 males and 221 females. All these patients were followed up for ≤ 16 years (mean 7 years). After total thyroidectomy, two patients had transient vocal-cord palsy. Five patients had postoperative hypocalcemia, one showed permanent hypocalcemia and one had a hematoma that required additional surgery.

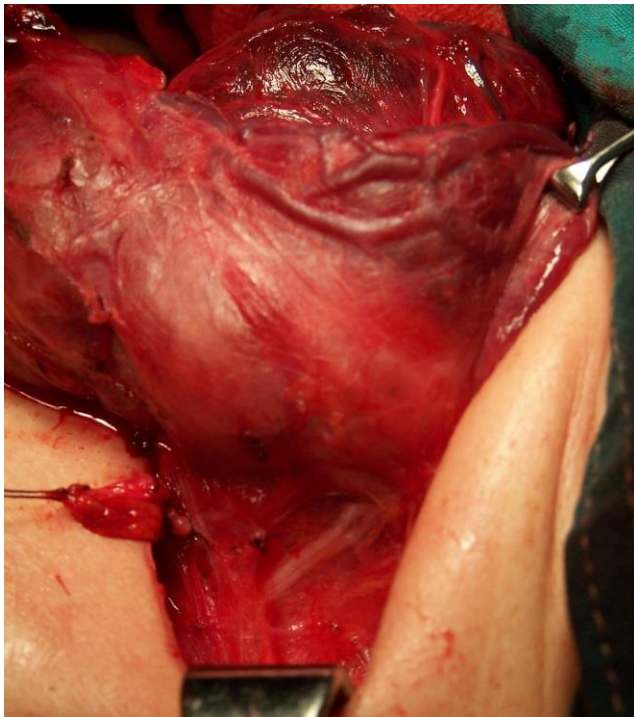
Among Group-2 patients, there was no mortality, wound infection, disease recurrence, or bilateral vocal-cord palsy, but incidental thyroid carcinomas were found in 40 cases (14.0%) (33 papillary, 3 follicular, 2 medullary, 1 well-differentiated and 1 hurthle cell carcinoma). 10 of 40 thyroid carcinomas were multicentric, 7 of them had bilobar tumor and 16 of 40 thyroid carcinomas were smaller than 10 mm.

The incidence of vocal-cord palsy was 1.5% in Group-1 patients and 0.7% in Group-2 patients; the difference between the groups was not statistically significant ($p > 0.05$). Although the incidence of hypocalcemia was higher in Group-2 patients than in Group-1 patients (1.75% vs. 0.0%, respectively), there was no statistically significant difference between the two groups.

The incidence of goiter recurrence was significantly higher in Group-1 patients than in Group-2 patients ($p < 0.05$). (see Table 1)

Table 1: Complications of partial thyroidectomy (Group-1) & total thyroidectomy (Group-2) patients (n = 350)

Complications	Group-1 (n = 65) Partial Thyroidectomy		Group-2 (n = 285) Total Thyroidectomy	
	Count	Rate (%)	Count	Rate (%)
Hypocalcemia	-	0.0%	5	1.75%
Temporary	-	0.0%	4	1.4%
Permanent	-	0.0%	1	0.35%
Recurrent laryngeal nerve palsy	1	1.5%	2	0.7%
Temporary	1	1.5%	2	0.7%
Unilateral	1	1.5%	2	0.7%
Bilateral	-	0.0%	-	0.0%
Permanent	-	0.0%	-	0.0%
Unilateral	-	0.0%	-	0.0%
Bilateral	-	0.0%	-	0.0%
Other	-	0.0%	1	0.35%
Hemorrhage	-	0.0%	1	0.35%
Wound infection	-	0.0%	-	0.0%
Total complications	1	1.5%	8	2.8%
Temporary	1	1.5%	7	2.45%
Permanent	-	0.0%	1	0.35%

**Figure 1:** RLN passes posterior to inferior thyroid artery **Figure 2:** RLN passes anterior to inferior thyroid artery

DISCUSSION

There are four main surgical options frequently used for multinodular goiter: bilateral subtotal thyroidectomy, near-total thyroidectomy, total thyroidectomy, and Dunhill procedure (unilateral total thyroidectomy plus contralateral subtotal thyroidectomy). In all options other than total thyroidectomy, surgeons intentionally leave some thyroid tissue to prevent complications, such as recurrent nerve injury and hypocalcemia.

Dralle et al reported that 43 of 75 thyroidectomy malpractice claims involved RLN palsy (21 unilateral and 22 bilateral RLN palsies), with a 45% tracheostomy rate for bilateral RLN palsy. Twenty-one claims involved permanent hypoparathyroidism (6). Is it in fact true that leaving residual tissue after partial thyroidectomy can prevent these complications?

Generally, it is believed that the extent of the thyroidectomy may affect the complication rate. Thomusch et al reported that total thyroidectomy was associated with an increased rate of RLN palsy and hypoparathyroidism; only 88 patients underwent total thyroidectomy, whereas 5,107 patients underwent subtotal thyroidectomy (7). On the basis of Thomusch et al's report, we can state that even some high-volume surgeons frequently perform partial thyroidectomy. Sosa et al reported that high-volume surgeons frequently performing total thyroidectomy procedures have lower complications rates (8). It is possible to speculate that high-volume surgeons who do not frequently practice total thyroidectomy may have higher complication rates in performing total thyroidectomy. On the other hand, an increasing number of studies recommend total thyroidectomy with a low complication rate for multinodular goiter (9, 10, 11, 12). Cao et al reported that the nodule recurrence rate after total thyroidectomy for multinodular goiter was lower than that after partial thyroidectomy, and that total thyroidectomy did not increase permanent complications (13). In his review of the literature, Agarwal concluded that total thyroidectomy is a safe procedure for benign multinodular goiter (14). In the present study, one patient had transient vocal-cord palsy and none had permanent complications among the partial thyroidectomy patients; on the other hand, two patients had transient vocal-cord palsy, four had transient hypocalcemia, and one had permanent hypocalcemia in the total thyroidectomy patients. In brief, only one patient had a permanent complication in the total thyroidectomy group. The present study showed that the complication rates were not statistically significant ($p > 0.05$) in the total and partial thyroidectomy groups. This study suggests that microsurgical technique, knowledge of thyroid anatomy, and the performance of total thyroidectomy on a routine basis is more important than the extent of thyroidectomy.

Routine RLN dissection was performed during the procedures. I used a surgical loupe with $2.5\times$ magnification and microsurgical instruments, using microsurgical techniques. Microsurgical dissection of RLN is one of the most important steps of the total thyroidectomy procedure. It has long been established that routine identification of the nerve decreases the risk of iatrogenic injury (15). Moreover, intraoperative neuromonitoring might be a supportive tool for the early detection and identification RLN (16). However, it has been reported that routine usage of intraoperative neuromonitoring does not decrease the incidence of RLN palsy (17). Many authors reported that using loupe magnification and microsurgical techniques during thyroidectomy improved the results and decreased the complication rate (18, 19, 20, 21). The RLN dissection technique I used in the total thyroidectomy procedure is similar to that used in the experimental orthotopic liver transplantation and heterotopic heart transplantation in hamsters and rats (except anastomosis), as described by Kamada (liver transplantation), Ono, and Lindsey (heart transplantation) (22, 23). These experimental transplantation procedures require a highly delicate technique performed at a brisk pace. Without the necessary pace and delicacy, heart or liver transplantation procedures performed on the subject rodent will be unsuccessful. Practicing these experimental transplantation procedures, the surgeon gains the necessary technique and knowledge to perform dissections in narrow

areas with small structures. Successful RLN dissection requires the same delicacy required by those experimental transplantation procedures. In the present study, using this technique, only three patients showed transient RLN palsy. Two of them had the complication after total thyroidectomy and one had it after the Dunhill procedure, on the subtotal side, where RLN dissection was not performed. The same microdissection technique was used for in situ preservation of parathyroid glands. That is if the parathyroid glands were inadvertently damaged, they were implanted into the sternocleidomastoid muscle.

After partial thyroidectomy, nodule recurrences are always possible because of residual thyroid tissue. However, it was reported that thyroid nodule recurrences occurred not only after partial thyroidectomy but also after total thyroidectomy (24). Many surgeons believed that it was related to the completeness of the total thyroidectomy. D'Andrea reported that 66.7% total thyroidectomies were really total, whereas 33.3% were subtotal or near-total thyroidectomies (25). What, in fact, do surgeons actually leave behind after partial thyroidectomy? Karakoyun et al their study showed that residual tissue in 62% subtotal thyroidectomy patients and 56% near-total thyroidectomy patients had abnormal pathological findings, including conditions ranging from micronodules to thyroid carcinoma. There are high rates of microscopic pathological findings on residual tissues, after both subtotal and near-total thyroidectomy (26). Delbridge et al noticed that the peak incidence of secondary thyroidectomy for recurrent multinodular goiter occurred 13 years after that for subtotal thyroidectomy for multinodular goiter in Australia (27). In the current study, 13 of the 65 patients who underwent subtotal thyroidectomy had recurrent multinodular goiter, whereas no patients had recurrent goiter after having total thyroidectomy with a follow-up period of >10 years. This case series showed that subtotal thyroidectomy resulted in a higher recurrence rate than total thyroidectomy. ($n = 65$, $20\% \text{ v } n = 285$, 0%) ($p < 0.05$) Many authors reported a similar or higher recurrence rate after subtotal thyroidectomy (3,4,28,29).

Another important issue is the increased incidental thyroid carcinoma rate in patients operated on for benign thyroid disease. Although it is reported that the incidence of thyroid carcinoma in benign thyroid disease was approximately 5%, recent reports showed that the incidental thyroid carcinoma rate has increased dramatically (30). In this case series, incidental thyroid carcinoma after total thyroidectomy was seen in 40 patients. ($n = 285$, 14.0%) (Among these 40 patients with thyroid carcinoma, only one patient with medullary carcinoma had undergone secondary surgery after total thyroidectomy (bilateral neck dissection); the remaining patients had not undergone further thyroid surgery (31). During subtotal thyroidectomy, frozen section may be helpful in the diagnosis of incidental thyroid carcinoma. In this study, within the partial thyroidectomy group, five false-negative frozen section results were observed, and all of them underwent secondary thyroidectomy ($n = 70$, 7.1%) for completion of thyroidectomy. The declining role of frozen section during thyroidectomy was reported previously (31) and it carries high false-negative results risk (32). We discontinued performing routine frozen section examination to determine the extent of surgery for bilateral multinodular

goiter nearly 10 years ago, as frozen section carries false-negative result risk and does not prevent secondary thyroidectomy. In this paper 10 of 40 patients with thyroid carcinomas had multicentric tumors and 7 of 10 multicentric tumors were bilobar. Total thyroidectomy removes all pathologic thyroid tissue including incidental multicentric tumors.

Finally, an important issue remains: who should perform total thyroidectomy? Although many authors advocate high-volume endocrine surgeons should perform total thyroidectomy, surprisingly many high-volume endocrine surgeons frequently perform less than total thyroidectomy for multinodular goiter. We completely agree with Delbridge about this condition. With appropriate supervision, even surgical residents can perform total thyroidectomy just as safely as experienced surgeons (27). We believe surgical skill, knowledge of thyroid anatomy, and the quality of training are the most important prerequisites to safely perform total thyroidectomy. In this case series, total thyroidectomy had 2% transient complication rate and a 0.3% permanent complication rate, comparable with that for high-volume endocrine surgeons.

CONCLUSION

Microsurgical techniques during RLN dissection, and in situ parathyroid preservation, are safe ways to avoid RLN palsy and hypocalcemia. Total thyroidectomy is the procedure of choice for bilateral multinodular goiter, removing all pathological thyroid tissue, including incidental thyroid carcinoma, and preventing future goiter recurrence

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