ORIGINAL ARTICLE

Total Thyroidectomy for Bilateral Benign Multinodular Goiter

Effect of Changing Practice

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Hypothesis: That changing practices in a single institution toward performing total thyroidectomy as the preferred option for the treatment of bilateral benign multinodular goiter (BMNG) can alter attitudes and practice within an entire region (Australia and New Zealand).

Design: (1) Single-institution study of patients with bilateral BMNG treated by thyroidectomy over a 40-year period, examining the changing pattern of use of bilateral subtotal thyroidectomy and total thyroidectomy in the initial surgical treatment of nodular goiter. (2) Mail survey of all endocrine surgeons (n = 75) in Australia and New Zealand, seeking information on their changing practice in the surgical treatment of BMNG.

Setting: Tertiary academic referral center.

Patients: A group of 3468 patients who underwent thyroidectomy for bilateral BMNG during the study period. Of these, 1838 had a subtotal thyroidectomy performed and 1251 had a total thyroidectomy as the primary surgical treatment.

Main Outcome Measures: The changing incidence of each type of thyroid procedure each year over the study period.

Results: Within our unit, bilateral subtotal thyroidectomy was the principal procedure performed until 1984, when total thyroidectomy became the preferred procedure. Our unit now treats 94% of these patients with total thyroidectomy. Secondary thyroidectomy for recurrent goiter initially increased over the years (with a lag period of 13 years), reflecting the numbers of subtotal procedures previously performed, and is now declining. This pattern has been reflected throughout Australia and New Zealand; 60% of practicing endocrine surgeons now perform total thyroidectomy as the preferred treatment for bilateral BMNG.

Conclusions: Total thyroidectomy is a safe and effective treatment for bilateral BMNG, and it is now the routine procedure throughout Australia and New Zealand. Its use has corresponded to a reduction in the need for secondary thyroidectomy for recurrent goiter.

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IN A RECENT editorial, Wheeler[1(p1527)] stated that "total thyroidectomy for benign thyroid disease is likely to become an accepted component of the endocrine surgeon's armamentarium." This highlighted changes in the ongoing debate about the role of total thyroidectomy in the treatment of thyroid disease. Although there has been increasing acceptance for performing total thyroidectomy for well-differentiated thyroid carcinoma, surgeons still continue to debate whether the potential benefits outweigh the potential complications.[2,3] There are still some who argue that total thyroidectomy is an operation that is almost never justified.[4] The use of total thyroidectomy for benign thyroid disease is therefore even more controversial, although there are increasing numbers of reports recommending its use for bilateral benign multinodular goiter (BMNG).[5]

In 1984, we changed our longstanding policy of subtotal thyroidectomy for nodular goiter; since that time, total thyroidectomy has become the preferred option for the treatment of BMNG affecting both lobes of the thyroid.[6] This policy change was in response to the apparent increasing incidence of reoperative thyroid surgery for recurrent goiter in patients who had previously undergone bilateral subtotal thyroidectomy for that disease. With time, practice within the unit has stabilized, such that more than 90% of all patients with BMNG affecting both lobes of the thyroid are treated primarily by total thyroidectomy. The aim of this study was to examine the

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PATIENTS AND METHODS

PATIENT DATA

Information was obtained from a prospective thyroid surgery database maintained in the unit since 1957 and containing 11 214 records. Selection criteria for bilateral BMNG were as follows: all patients undergoing thyroidectomy whose preoperative clinical diagnosis was *multinodular goiter* and whose final pathologic process was consistent with BMNG. Patients were excluded if they had a final diagnosis of thyroid malignant neoplasm regardless of the indication for surgery or the preoperative clinical diagnosis, as were patients with a preoperative clinical diagnosis of single thyroid nodule whose final pathologic process demonstrated multinodular change. The study group thus represents a select group of patients with benign thyroid disease for whom the preoperative clinical intention was the surgical treatment of bilateral BMNG. For secondary thyroidectomy, selection criteria were the same as those for bilateral BMNG, except that a previous thyroid procedure of any sort had been undertaken.

Information obtained included age, sex, indications for surgery, operation performed, final pathologic process, and complications.

SURVEY DATA

A mail survey was sent on 2 occasions to all members of the Section of Endocrine Surgery, Royal Australasian College of Surgeons. This group (n = 75) includes almost every surgeon in Australia or New Zealand who practices thyroid surgery, either as a specialist endocrine surgeon or as a general surgeon with a special interest in thyroid surgery. The survey sought information on the individual's practice of thyroid surgery in 5-year intervals since 1980, as well as current practice. Information requested included the number of thyroid procedures performed each year, the number of those patients who were treated for multinodular goiter, and the percentage of cases treated with total thyroidectomy. Surgeons who did not have access to documented information were asked to provide estimated numbers.

effect of this change in practice on the treatment of BMNG, both in our unit and throughout Australia and New Zealand.

RESULTS

THYROID PROCEDURES

In our Endocrine Surgical Unit, 3468 patients underwent thyroidectomy from January 1957 to December 1997 for the treatment of bilateral BMNG as defined. The age distribution (mean ± SD) was 53 ± 14 years and the sex distribution was 1:7 (male-female). Of these patients, 3089 underwent thyroidectomy for the initial treatment of BMNG; 379 presented with a recurrent goiter and required secondary thyroidectomy. Of the latter group, 174 had a hemithyroidectomy as their initial procedure and were excluded, leaving 205 who had had a bilateral procedure performed previously.

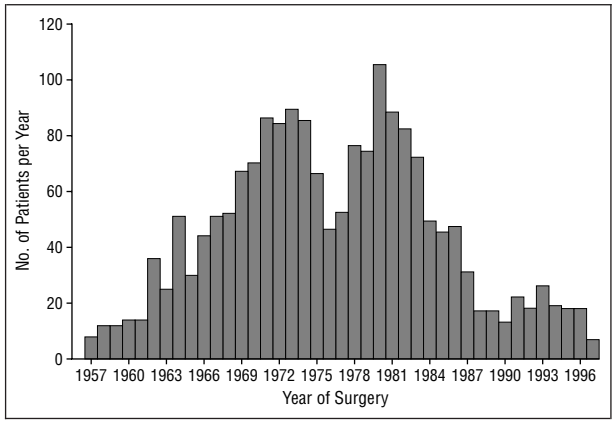

Figure 1. *The number of patients per year who had a bilateral subtotal thyroidectomy for bilateral benign multinodal goiter from 1957 to 1997.*

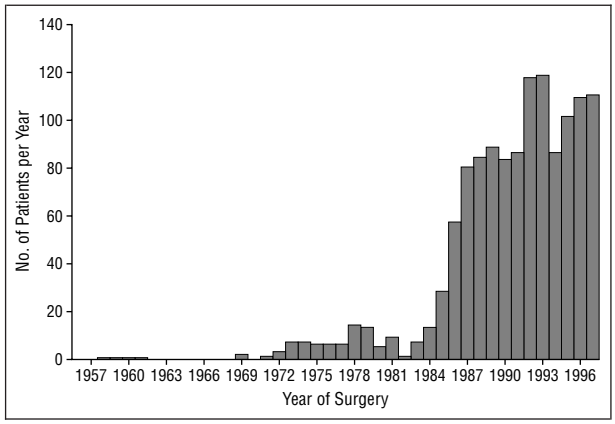

Figure 2. *The number of patients per year who had a total thyroidectomy for bilateral benign multinodal goiter from 1957 to 1997.*

In the group undergoing primary thyroid surgery, 1838 (59.5%) had a subtotal thyroidectomy as their initial procedure and 1251 (40.5%) underwent total thyroidectomy.

Figure 1 shows the number of patients who had a bilateral subtotal thyroidectomy for BMNG from 1957 to 1997. **Figure 2** shows similar data for patients who underwent a total thyroidectomy. It can be seen that total thyroidectomy was performed infrequently until 1984. Over that same period, the number of subtotal thyroid procedures progressively increased, reflecting the overall growth of numbers of cases referred to the unit in its early years. In 1984, the number of total thyroidectomies performed as an initial procedure began to increase rapidly and in the 1990s reached an average of 85% of all procedures. In 1997, total thyroidectomy constituted 94% and subtotal thyroidectomy only 6% of initial procedures performed for bilateral BMNG.

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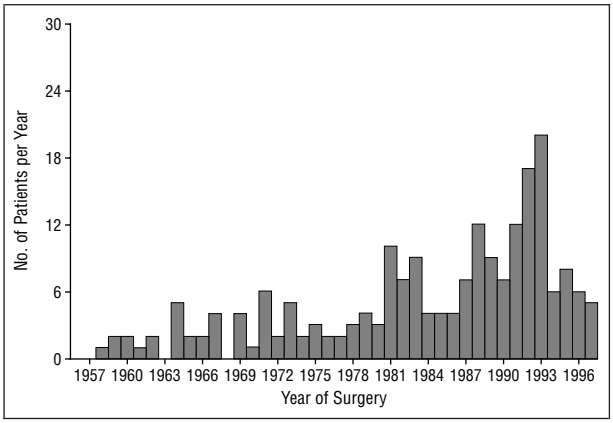

Figure 3. *The number of patients per year who had a secondary thyroidectomy for recurrent goiter from 1957 to 1997 and whose previous operative procedure had been a bilateral procedure for benign multinodal goiter.*

Table 1. Permanent and Major Complications After Thyroidectomy

	Thyroidectomy, No. (%)		
Complication	Subtotal (n = 1838)	Total (n = 1251)	Secondary (n = 205)
Permanent recurrent laryngeal nerve palsy	4 (0.2)	6 (0.5)	2 (1)
Permanent hypoparathyroidism	4 (0.2)	5 (0.4)	0 (0)
Reoperation for hemorrhage	26 (1.4)	13 (1)	4 (2)
Wound infection	44 (2.4)	12 (0.9)	3 (1.5)
Hematoma	26 (1.4)	13 (1)	3 (1.5)
Death*	0 (0)	0 (0)	0 (0)

*There were no deaths in this sample.

Figure 3 shows the same data for the 205 patients undergoing a secondary thyroidectomy for recurrent nodular goiter in whom the previous operation had been a bilateral procedure. The number of subtotal thyroidectomies performed peaked in 1980 (105 per year) and fell after that time; the number of secondary thyroidectomies performed also slowly rose, but reached a peak 13 years later in 1993 (20 per year) and has been slowly trailing off. This lag period of a decade or so represents the expected time course for the development of recurrent nodular goiter after previous incomplete or subtotal surgery.

COMPLICATIONS

Table 1 demonstrates the incidence of permanent complications (recurrent laryngeal nerve palsy and permanent hyperparathyroidism) or major complications (hemorrhage, wound infection, or death) in each of the 3 groups of patients. Temporary complications, such as a temporary drop in calcium level that required calcium supplementation but that recovered, were not reliably recorded in earlier years. There was no significant difference in the incidence of permanent complications when primary total thyroidectomy was compared with subtotal thyroidectomy.

SURVEY OF ENDOCRINE SURGEONS

Survey questionnaires were sent to 73 surgeons in Australia and New Zealand (75 members of the Section of Endocrine Surgery, Royal Australasian College of Surgeons, excluding us) and responses were received from 44 surgeons (60% response). Of the 44, not all were in practice in all years of the survey (some had retired, others had not commenced practice) and so not all surgeons are represented in each time group. The group represented a range of experience: in the last 12 months, for example, the average number of thyroidectomies performed by the endocrine surgeons who responded (excluding us) was 48 (range, 4-190).

Responses received were grouped according to whether the surgeons never performed a total thyroidectomy for BMNG, sometimes performed a total thyroidectomy in that situation (<50% of the time), frequently performed a total thyroidectomy (50%-75% of the time), or performed total thyroidectomy as their usual practice (≥75% of the time). **Table 2** summarizes those data for each of the groups for each period of the survey. In 1980, total thyroidectomy was uncommonly performed for bilateral BMNG (72% of surgeons never or only sometimes performed the procedure). By 1990, the numbers had reversed; most endocrine surgeons had performed total thyroidectomy. In the last 12 months, 60% of surgeons indicated that it was their usual practice to perform total thyroidectomy in this situation.

Table 2. Endocrine Surgeons Performing Total Thyroidectomy for Benign Multinodular Goiter for Each Year of Survey

	Endocrine Surgeons, No. (%)			
	Never	Sometimes (<50)	Frequently (50 to 75)	Usual Practice (>75)
1980 (n = 18)	9 (50)	4 (22)	3 (14)	3 (14)
1985 (n = 21)	9 (44)	4 (17)	1 (6)	7 (33)
1990 (n = 27)	5 (18)	7 (27)	1 (5)	14 (50)
1995 (n = 30)	4 (14)	4 (13)	4 (14)	18 (59)
Last 12 mo (n = 29)	4 (13)	4 (14)	4 (13)	17 (60)

Table 3 compares clinical practice with the individual experience and volume of surgery of the surgeons who responded to the survey (our data were included this time for comparison). The first group of endocrine surgeons performed 100 or more thyroidectomies each year (n = 7). In this group, the average number of thyroidectomies performed in the last 12 months was 169 (range, 100-408); of that group, 86% performed total thyroidectomy as their usual practice. Another group of endocrine surgeons had a lower volume of work, performing fewer than 25 thyroidectomies per year (n = 11). In this group, most surgeons either never (36%) or only sometimes (19%) performed total thyroidectomy for BMNG.

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Table 3. Preference of the 31 Endocrine Surgeons Currently in Active Practice Compared With Experience

Procedures Performed*	Preference, No. (%) of Surgeons			
	Never	Sometimes (<50)	Frequently (50 to 75)	Usual Practice (>75)
>100 (n = 7)	0 (0)	0 (0)	1 (14)	6 (86)
50-100 (n = 5)	0 (0)	0 (0)	1 (20)	4 (80)
25-50 (n = 8)	0 (0)	2 (25)	1 (13)	5 (62)
<25 (n = 11)	4 (36)	2 (19)	1 (9)	4 (36)

*Number of thyroidectomies performed in the last 12 months.

COMMENT

Total thyroidectomy (completely removing both lobes of the thyroid gland) must be regarded as a logical surgical procedure for the treatment of BMNG affecting the entire thyroid gland. To do less than a total thyroidectomy in this situation leaves behind abnormal thyroid tissue and exposes the patient to the potential risks of either persistent symptoms or recurrent disease in the future. Persistent symptoms occur not infrequently after a subtotal procedure, as the dissection involved may leave the posteriorly placed nodules behind the esophagus (or between the trachea and the esophagus) and these nodules are frequently responsible for many of the patient's symptoms.[6]

Subtotal thyroidectomy may also lead to recurrent goiter in up to 23% of patients.[7] This fact may not be recognized unless long-term data are kept that document the incidence of secondary thyroidectomy. In this study, the peak incidence of secondary thyroidectomy for recurrent multinodular goiter occurred in 1993, 13 years after the peak incidence of subtotal thyroidectomy for benign multinodular goiter (1980), and—almost a decade after the introduction of total thyroidectomy—has now started to decline. Although it is recognized that, in this study, not all initial procedures for patients having a secondary thyroidectomy were performed in our unit, and that a number of patients with recurrence would have gone elsewhere for their further procedures, given the relative stability of Australasian populations, it is reasonable to assume that inflows and outflows would have balanced each other. At the peak in 1980, 105 subtotal thyroid procedures were performed in a year for BMNG and, just over a decade later, a peak of 20 secondary procedures were performed for recurrent goiter, indicating that approximately 19% of patients are at risk of developing recurrence after subtotal thyroidectomy.

The only real argument against total thyroidectomy is the potential for an increased risk of complications. However, there is good evidence to show that with increasing experience, the use of appropriate surgical technique, and, most important, the quality training of surgical residents, total thyroidectomy can be performed with minimal complications.[8,9] In this study, the incidence of permanent recurrent laryngeal nerve palsy after total thyroidectomy was only 0.5% (all patients underwent indirect laryngoscopy by an independent ear, nose, and throat surgeon before and after surgery). Likewise, the incidence of permanent hypoparathyroidism was only 0.4%. Interestingly, this incidence was little different from the complication rates recorded after subtotal thyroidectomy (0.2% for permanent recurrent laryngeal nerve palsy and 0.2% for permanent hypoparathyroidism).

We do not believe that subtotal thyroidectomy is necessarily a safer procedure, as claimed: encountering the recurrent laryngeal nerve by use of the capsular technique of dissection[10] and identifying the nerve close to the lateral thyrohyoid ligament is potentially safer than leaving it buried beneath residual posterior thyroid tissue while trying to achieve hemostasis of that residual tissue. There is no question that hemostasis is more assured after total thyroidectomy when all vessels have been individually ligated than when dealing with an intact mass of residual vascularized thyroid tissue. We also believe that parathyroid viability can be just as readily assured by a policy of aggressive parathyroid autotransplantation (or, in the case of our unit, the routine transplantation of at least 1 parathyroid gland in every case of total thyroidectomy) when compared with the technique of attempting to leave intact thyroid tissue in relation to the vascular supply of parathyroid glands.

Temporary hypocalcemia remains a treatment problem after total thyroidectomy. In our unit, 32% of patients require calcium supplements for up to 3 to 6 weeks after surgery. However, in the context of the need for early discharge from the hospital, temporary hypocalcemia should be regarded not as a complication but as a treatment problem arising from an expected outcome of bilateral thyroid surgery. Moore[11] has recommended that all patients having bilateral thyroid surgery, including total thyroidectomy, should have routine calcium supplementation prior to discharge from the hospital.

There is still a small place for less than total thyroidectomy. In the last 10 years, 15% of patients with bilateral BMNG had less than a total thyroidectomy. Of that group, 59% had a hemithyroidectomy, leaving the opposite lobe intact. This was because the nodularity was predominantly unilateral, with minimal clinical disease evident on the contralateral side, and the patient had expressed a strong aversion to the requirement for lifelong thyroxine replacement. With hemithyroidectomy alone, the risk of complications should the contralateral lobe subsequently require surgery is minimal. Interestingly, in a recent study, we[12] demonstrated that among patients who had a hemithyroidectomy for an apparently clinically solitary thyroid nodule that subsequently was shown to be part of a multinodular goiter, only 12% required further thyroid surgery for recurrent goiter.

An alternative to total thyroidectomy for benign BMNG is *near-total thyroidectomy*: performing a total lobectomy on the dominant side and a subtotal lobectomy on the contralateral side. Whether a compromise operation such as this (leaving a small amount of abnormal tissue behind to potentially reduce the incidence of temporary hypocalcaemia) is justified in the long term will clearly require further study.

Quality training is clearly the key to achieving minimal complications after total thyroidectomy. We have pre-

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viously demonstrated that surgical residents can perform total thyroidectomy just as safely as experienced attending surgeons, provided they are appropriately supervised.[13] More importantly, we have also demonstrated that general surgeons who have been well trained in the techniques of thyroid surgery can continue to safely perform total thyroidectomy with minimal morbidity, even though they might have moved to practice in a provincial center.[14] What is arguable is whether a general surgeon who has had minimal exposure to thyroid surgery during his or her training can expect to be able to perform total thyroid surgery safely once in solo practice. Harness et al[15] have presented data to show that general surgeons completing residency training in programs in the United States have performed, on average, only 7 to 10 thyroid procedures in the entire duration of their training. Such training could be regarded as inadequate to ensure that total thyroidectomy for either benign or malignant thyroid disease can be performed with an acceptable complication rate. Clearly, surgical practice does differ around the world: in Australia and New Zealand total thyroidectomy is now the preferred treatment for BMNG affecting both lobes of the thyroid. However, the majority of such procedures are performed in these 2 countries by a small group of surgeons with appropriate training and expertise in thyroid surgery.

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Invited Critique

Delbridge and his colleagues should be complimented on a large series of patients who underwent both subtotal and total thyroidectomy with incredibly low complication rates. Although nearly one third of their patients required 3 to 6 weeks of calcium supplementation, fewer than 0.5% developed permanent hypoparathyroidism. They attribute this extraordinary record in part to routine autotransplantation of 1 parathyroid gland at the time of total thyroidectomy. While we employ liberal use of parathyroid autotransplantation in similar circumstances, a single autotransplanted gland as the only protection for hypoparathyroidism seems optimistic.

The central premise of this study lies in the balance of leaving a small quantity of thyroid tissue to resolve symptoms and prevent recurrence, yet minimize the risk of complications—principally, permanent recurrent laryngeal nerve paralysis and hypoparathyroidism. There is little question that if large thyroid nodules or nodular goiter is left behind, the risk of persistent symptoms or recurrence is high. This problem does result in thyroid reoperations with associated additional risk. However, if bilateral subtotal thyroidectomy remnants are reduced to a combined weight of 2 to 4 g, little risk of recurrent thyroid-related problems results. Because exposure and protection of the recurrent laryngeal nerves are less problematic, the principal risk of total thyroidectomy relates to the parathyroid glands and their blood supply. Leaving a small amount of thyroid tissue adjacent to the superior glands and their vascular pedicles may facilitate the safety of this procedure without compromising the end result. To elect a total thyroidectomy when the parathyroid glands have been positively preserved is entirely reasonable, a practice that seems feasible for surgeons they surveyed, whose practices average 48 thyroidectomies per year. However, to consider total thyroidectomy as the only acceptable alternative would probably risk causing more cases of troublesome hypoparathyroidism than it would prevent cases of goiter recurrence. Moreover, it seems difficult to assert total thyroidectomy as the only option for benign disease when many surgical authorities strongly disagree with its use even in most thyroid cancers.

In regard to the authors' increasing number of thyroid reoperations, inadequacy of the initial resection is one possible cause, but increasing referrals or other influences might also have accounted for the rising volume. Additionally, reports based on large surveys are not uncommon and can provide general impressions of practice trends, but data derived from survey questionnaires lacking precise data on elements such as complications and outcomes should be viewed cautiously. Nevertheless, this report provides us with an interesting perspective on the surgical practice for benign multinodular goiter in Australia.

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