

Reoperative surgery for bilateral multinodular goitre in the era of total thyroidectomy

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Background: Total thyroidectomy, rather than bilateral subtotal thyroidectomy, is now accepted as the preferred management for bilateral benign multinodular goitre (BMNG) in order to reduce the need for reoperative surgery. The aim of this study was to examine whether this approach has had an impact on presentation for bilateral reoperative thyroid surgery.

Methods: This was a retrospective cohort study. The study group comprised patients presenting with recurrent BMNG who underwent bilateral reoperative thyroid surgery following previous bilateral subtotal or partial thyroidectomy. They were compared with patients undergoing unilateral reoperative thyroid surgery following previous lobectomy, and those undergoing primary total thyroidectomy for BMNG.

Results: Between 1 January 1987 and 31 December 2009, 12 354 consecutive thyroid procedures were undertaken. Among those with BMNG, primary total thyroidectomy was undertaken in 3298 patients, unilateral reoperative thyroidectomy in 337 and bilateral reoperative thyroidectomy in 191. Presentations of patients with recurrent BMNG declined gradually over the study period following the change in policy from subtotal to total thyroidectomy; only five patients (representing less than 0.5 per cent of all thyroid surgery) underwent bilateral reoperative surgery for BMNG in the last year of the study. Four of these patients had their initial operation before 1987 and in another unit, whereas the remaining patient initially had surgery overseas.

Conclusion: The introduction of a policy of initial total thyroidectomy for bilateral BMNG has essentially eliminated the need for bilateral reoperative surgery for recurrent goitre.

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Introduction

Bilateral reoperative thyroidectomy is reported to be associated with a significantly increased risk of complications, including permanent hypoparathyroidism, recurrent laryngeal nerve (RLN) palsy, or even tracheostomy if both RLNs are injured. The British Association of Endocrine and Thyroid Surgeons 2009 audit of thyroid surgery in the UK demonstrated that, for revisional thyroid surgery, the rate of permanent hypoparathyroidism was three times, and the rate of permanent RLN palsy twice, that of primary thyroid surgery¹. However, bilateral reoperative surgery for benign goitre should be completely avoidable, as it almost always follows bilateral subtotal thyroidectomy. When surgery is indicated as definitive management, current guidelines and evidence-based reviews now recommend

total thyroidectomy for both bilateral benign multinodular goitre (BMNG)² and toxic multinodular goitre³. If an initial total thyroidectomy is carried out for these conditions, recurrent nodular goitre should be an extremely uncommon occurrence, less than 1 per cent of operations, and related largely to undetected embryological remnants in the pyramidal tract, tubercle of Zuckerkandl or thyrothymic region⁴.

In the early 1980s the University of Sydney Endocrine Surgical Unit was among the first to champion total thyroidectomy as the preferred option for the management of BMNG⁵, a position that was not generally accepted worldwide at that time. The aim of the present study was to test whether, three decades later, this approach has had an impact on presentations for recurrent bilateral nodular goitre.

Methods

This was a retrospective cohort study. Patients who presented with bilateral BMNG between January 1987 and December 2009 were identified from the University of Sydney Endocrine Surgical Unit database. This database contains the records of more than 22 000 consecutive thyroid and parathyroid procedures⁶. Since 1993, all patients have provided written informed consent for the storage and use of such data. Before then, all data were collected and stored as part of routine clinical follow-up.

The study group, comprising patients who underwent bilateral reoperative thyroid surgery for recurrent BMNG following previous bilateral subtotal or partial thyroidectomy, were compared with those who underwent unilateral reoperative surgery (following previous lobectomy) and those who had initial total thyroidectomy for benign nodular goitre. Indications for surgery included compressive symptoms, thyrotoxicosis due to a toxic multinodular goitre, or an atypical fine-needle biopsy on a dominant nodule within a multinodular goitre. Patients were excluded if they had a final diagnosis of thyroid malignancy (including microcarcinoma), regardless of whether this was suspected before surgery or was an incidental post-operative finding. Although the unit began to advocate total thyroidectomy as opposed to subtotal thyroidectomy for BMNG from the early 1980s, January 1987 was selected as the starting point of the present study as this change in policy was adopted uniformly only at this time, corresponding with the initial publication on the topic⁵.

Data collected included patient demographics, indication for surgery, complication rates and pathology. All patients underwent routine preoperative and postoperative laryngoscopy as well as postoperative measurement of calcium and parathyroid hormone levels. Permanent RLN palsy was defined as the absence of vocal cord function 6 months after surgery. Permanent hypoparathyroidism was defined by the requirement for ongoing calcium and vitamin D supplementation to avoid hypocalcaemia 6 months after surgery.

Statistical analysis

Continuous data are presented as median (range) and were analysed by the Student's *t* test. Fisher's exact test was used for analysis of categorical variables. Statistical significance was set at $P < 0.050$. Statistical analysis was performed using SPSS[®] software version 17.0 (SPSS, Chicago, Illinois, USA).

Results

Between 1 January 1987 and 31 December 2009, a total of 12 354 thyroid procedures were performed. Some 5934 patients had a total thyroidectomy, 3298 for BMNG. Additionally, 1055 patients elected, for a variety of reasons, to have a less than total thyroidectomy for BMNG; 1024 underwent hemithyroidectomy and 31 bilateral subtotal thyroidectomy. Over this 23-year period, thyroid surgery

Table 1 Demographics of patients who underwent thyroid surgery for primary and recurrent benign multinodular goitre

	No. of patients	Age (years)*	Sex ratio (F:M)
All thyroid procedures	12 354	51 (2–105)	6:1
Primary total thyroidectomy	3298	55 (8–93)	7:1
for BMNG			
Reoperative surgery for BMNG	528	58 (23–87)†	17:1‡
Unilateral thyroidectomy	337	57 (29–81)	15:1
Bilateral thyroidectomy	191	60 (23–87)	20:1

*Values are median (range). BMNG, benign multinodular goitre.

† $P = 0.002$ versus primary surgery (Student's *t* test); ‡ $P < 0.001$ versus primary surgery (Fisher's exact test).

Table 2 Numbers of patients undergoing bilateral and unilateral reoperative procedures each year

Year	Bilateral reoperative procedures	Unilateral reoperative procedures	Initial total thyroidectomy for BMNG	Overall thyroid workload
1987	12 (3.5)	39 (11.4)	92 (26.8)	343
1988	15 (4.6)	32 (9.7)	99 (30.1)	329
1989	15 (5.0)	19 (6.3)	92 (30.6)	301
1990	10 (3.4)	24 (8.3)	93 (32.1)	290
1991	15 (4.6)	21 (6.4)	97 (29.8)	326
1992	19 (4.6)	36 (8.7)	124 (30.0)	414
1993	20 (4.9)	27 (6.6)	134 (32.6)	411
1994	7 (2.0)	25 (7.1)	86 (24.4)	353
1995	9 (2.6)	26 (7.5)	99 (28.5)	347
1996	7 (2.1)	17 (5.0)	108 (32.0)	338
1997	5 (1.4)	38 (10.4)	101 (27.6)	366
1998	12 (2.7)	41 (9.1)	125 (27.8)	449
1999	27 (6.9)	13 (3.3)	95 (24.2)	393
2000	12 (2.6)	18 (3.9)	103 (22.2)	465
2001	10 (2.1)	41 (8.5)	138 (28.6)	482
2002	13 (2.5)	49 (9.6)	142 (27.8)	511
2003	13 (2.3)	50 (8.9)	114 (20.2)	563
2004	14 (2.0)	44 (6.2)	160 (22.5)	710
2005	7 (0.8)	83 (8.9)	228 (24.4)	933
2006	12 (1.3)	66 (7.0)	157 (16.6)	947
2007	18 (1.9)	90 (9.4)	323 (33.6)	962
2008	12 (1.1)	63 (6.0)	306 (29.1)	1052
2009	5 (0.5)	105 (9.8)	282 (26.4)	1069

Values in parentheses are percentages. BMNG, benign multinodular goitre.

Table 3 Complication rates for primary total thyroidectomy compared with reoperative thyroidectomy

	Total thyroidectomy (<i>n</i> = 3298)	Reoperative bilateral thyroidectomy (<i>n</i> = 191)		Reoperative unilateral thyroidectomy (<i>n</i> = 337)	
		<i>n</i>	<i>P</i> *	<i>n</i>	<i>P</i> *
Permanent hypoparathyroidism	20 (0.6)	2 (1.0)	0.116	3 (0.9)	0.467
Permanent RLN paralysis	18 (0.5)	3 (1.6)	0.104	3 (0.9)	0.437
Transient RLN paralysis	67 (2.0)	8 (4.2)	0.064	9 (2.7)	0.314
Reoperation for haemorrhage	32 (1.0)	4 (2.1)	0.135	1 (0.3)	0.361
Wound infection	21 (0.6)	4 (2.1)	0.019	2 (0.6)	0.952
Death	1 (0.03)	0 (0)	1.000	0 (0)	1.000

Values in parentheses are percentages. RLN, recurrent laryngeal nerve. **Versus* total thyroidectomy (Fisher's exact test).

for BMNG represented 35.2 per cent of the workload for the unit.

Over the study interval, 528 patients underwent reoperative surgery (unilateral and bilateral) for BMNG, representing 12.1 per cent of the operative workload for BMNG. There were 191 bilateral reoperative thyroidectomies and 337 unilateral reoperative thyroidectomies for BMNG. The demographics of patients with BMNG who underwent primary and reoperative surgery are compared in *Table 1*. Patients with recurrent BMNG were significantly older. There was a highly significant difference in sex distribution between patients presenting with recurrent BMNG and those who underwent primary total thyroidectomy (female to male ratio 17 : 1 *versus* 7 : 1).

Table 2 shows the numbers of patients undergoing bilateral reoperative surgery for recurrent BMNG who had previously had a bilateral thyroid procedure, and unilateral reoperative surgery after previous lobectomy. The proportion of patients undergoing bilateral reoperative thyroidectomy progressively declined after the management change to total thyroidectomy. In 2009, only five of 1069 patients (less than 0.5 per cent of the overall thyroid workload) underwent bilateral reoperative thyroidectomy. These five patients had their initial surgery at other centres, either in Australia or overseas, with a median time lag of 35 (range 12–55) years. By the end of the study, there were no patients requiring bilateral reoperative surgery who had undergone initial thyroid surgery at any time previously in the University of Sydney Endocrine Surgical Unit.

Table 3 shows the incidence of complications after primary total thyroidectomy compared with bilateral or unilateral reoperative surgery for BMNG. There was only one death in this series. There was a significantly increased incidence of wound infection and a trend towards increased transient and permanent RLN palsy after bilateral reoperative thyroidectomy compared with primary total thyroidectomy. There was no difference between groups in rates of permanent hypoparathyroidism or reoperation for haemorrhage.

Discussion

Total thyroidectomy is the attempted removal of all visible thyroid tissue in the neck and, as such, should be associated with negligible recurrence rates⁴. By comparison, subtotal thyroidectomy, in which a variable remnant of tissue is left intentionally in the thyroid bed, is associated with a significant rate of recurrence. Over 100 years ago, Theodor Kocher initially performed total thyroidectomy for BMNG. However, he abandoned the procedure, describing a condition he called 'cachexia strumipriva', which is now known to be postoperative myxoedema. Despite the subsequent availability of thyroxine replacement, for most of the 20th century bilateral subtotal thyroidectomy was accepted as the standard procedure for BMNG. In the 1980s, within the University of Sydney Endocrine Surgical Unit the great majority of thyroid operations were bilateral subtotal thyroidectomy for BMNG and Graves' disease. However, the need for bilateral reoperative surgery, with its attendant increased complication rate, was becoming an increasing burden. In the early 1980s, bilateral reoperative thyroidectomy comprised a major part of the surgical activity. As it was self-evident that an initial total thyroidectomy would reduce the risk of recurrence to insignificant levels, a policy decision was made to change to total thyroidectomy for BMNG. In 1987, the initial results were published, which showed that total thyroidectomy could be performed safely and should thus be considered the preferred option for the management of BMNG⁵. Such a view was not generally accepted worldwide at that time, but since then numerous cohort studies^{7–15} and an evidence-based review³ have confirmed the role of total thyroidectomy for BMNG.

Bilateral subtotal thyroidectomy had in the past been undertaken with the expectation of 'curing the disease', addressing the cosmetic and compressive symptoms of BMNG as well as being perceived to minimize the operative risks. However, subtotal thyroidectomy can

result in recurrent goitre, which has been reported in up to 67 per cent of patients during long-term follow-up^{10,16}. Total thyroidectomy should virtually eliminate the risk of recurrence as well as treating any incidental finding of thyroid carcinoma, which is reported in 3–17 per cent of thyroidectomy specimens at histological examination from patients with presumed BMNG¹⁷. The present study has confirmed that an initial total thyroidectomy essentially eliminates the need for bilateral reoperative thyroid surgery.

One of the limitations of the study is that the database does not record long-term follow-up of patients having surgery for benign nodular goitre. As such, the denominator, namely patients who present anywhere with recurrent nodular disease, cannot be reported. For this reason the incidence of unilateral reoperative surgery following previous thyroid lobectomy is reported. Although no long-term follow-up data are available for this group either, the incidence of this surgery did not change over the study period (from 11.4 per cent in 1987 to 9.8 per cent in 2009), in contrast to the significant reduction in bilateral reoperative surgery (from 3.5 per cent in 1987 to 0.5 per cent in 2009). If patients requiring reoperative surgery had elected to go preferentially to other units for their operations, both unilateral and bilateral reoperative presentations would have been affected equally. This was not the case, as the proportion of patients presenting for unilateral reoperative surgery did not decrease. In fact the most reoperative surgery since 1987 has been unilateral reoperative thyroidectomy following a previous lobectomy. There remains a role for thyroid lobectomy in patients with BMNG when the contralateral lobe has minimal multinodular change^{18,19}. Many such patients will avoid the need for lifelong thyroxine supplementation, and unilateral completion thyroidectomy can be undertaken easily with minimal risk of complications if the contralateral side subsequently becomes symptomatic. Furthermore, previous studies have reported clinical recurrence in the contralateral lobe in only 12 per cent of such patients with long-term follow-up²⁰.

Although it is not possible to calculate the true recurrence rate for BMNG requiring reoperation from the data reported, other studies have reported reoperation rates as high as 26 per cent^{21,22}. Some 23 years after the change of policy to total thyroidectomy as the treatment of choice for BMNG, the incidence of secondary thyroidectomy in the authors' unit has declined such that less than 0.5 per cent of the total thyroid clinical workload is bilateral reoperative surgery for BMNG. In 2009, only five patients required bilateral reoperative thyroidectomy following

previous bilateral subtotal thyroidectomy, all of whom had their initial procedure elsewhere or well before the 1980s when the surgical policy for BMNG changed. The time interval to reoperation in this group ranged between 12 and 55 years, showing that the time to recurrence may be decades.

The predominant argument against total thyroidectomy for BMNG is the potentially increased risk of complications such as RLN palsy, permanent hypoparathyroidism and reoperation for haemorrhage. However, with quality training, experience and sound surgical technique, these risks can be reduced to a minimum^{23,24}. Furthermore, there is a body of literature reporting no significant differences in complication rates between subtotal, near-total and total thyroidectomy^{25,26}. Acceptable rates of permanent RLN palsy, permanent hypoparathyroidism and reoperation for haemorrhage should be in the vicinity of 1–2 per cent²⁷. In the present study, rates of these complications in patients who underwent initial total thyroidectomy for BMNG were 0.5, 0.6 and 1.0 per cent respectively. These were about half the rates in patients undergoing bilateral reoperative surgery, although the differences were not statistically significant as the incidence of these complications was low and the study was underpowered in this respect. With such low complication rates, the potential risks of bilateral reoperative surgery in the University of Sydney Endocrine Surgical Unit are of no real concern. These results, however, have been achieved in a tertiary referral unit with a long-standing focus on reoperative surgery and may not be achieved in other, less specialized centres. Most other published series have reported that rates of permanent RLN palsy are increased by twofold to fivefold, and those of permanent hypoparathyroidism by threefold to eightfold, after reoperative thyroid surgery compared with primary total thyroidectomy^{28–33}.

Disclosure

The authors declare no conflict of interest.

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