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Hemithyroidectomy for benign euthyroid asymmetric nodular goitre



Marcin Barczyński, MD, PhD, FEBS-ES, Professor, Consultant Surgeon ^{a, b, *},

Małgorzata Stopa-Barczyńska, MD, PhD, Consultant Surgeon ^b

^a Department of Endocrine Surgery, Third Chair of General Surgery, Jagiellonian University Medical College, 37 Prądnicka Str., 31-202 Krakow, Poland

^b Clinical Department of General Surgery and Oncology, G. Narutowicz Specialist Municipal Hospital of Krakow, 37 Prądnicka Str., 31-202 Krakow, Poland

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Background: There is no consensus on the optimal surgery extent for patients with benign euthyroid asymmetric nodular goitre (AMNG).

Methods: We reviewed medical literature using the PubMed engine to address the following issues: definition and prevalence, rationale for hemithyroidectomy, long-term outcomes, follow-up, revision surgery and image-guided thermal ablation of contralateral benign thyroid nodules following hemithyroidectomy for AMNG.

Results: In total, 102 articles were found in MEDLINE using a keyword search strategy; subsequently, we selected 36 articles with clinical pertinence.

Conclusions: AMNG is a common clinical and surgical problem. Depending on the extent of the disease and individual surgeon preferences, either unilateral or bilateral thyroidectomy can be performed. Hemithyroidectomy can be considered for some patients with AMNG and the low risk of recurrent disease as a safer alternative to total thyroidectomy but it requires life-long follow-up, is associated with a higher recurrence risk and a need for revision thyroidectomy in selected subjects.

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* Corresponding author. Department of Endocrine Surgery, Third Chair of General Surgery, Jagiellonian University Medical College, 37 Prądnicka Str., 31-202 Krakow, Poland.

E-mail address: marcin.barczyński@uj.edu.pl (M. Barczyński).

Introduction

Multinodular non-toxic goitre (MNG) represents one of the most common indications for thyroid surgery (30–60% of all indications), particularly in case of progressive enlargement of the thyroid nodules, retrosternal or secondary mediastinal goitre extension and the occurrence of clinical symptoms related to compression, deviation or narrowing of the trachea [1,2]. The majority of patients with MNG present with bilateral nodules and require bilateral thyroid surgery. For many years, less than total thyroidectomy (partial or subtotal thyroidectomy) was the preferred surgical approach aiming at elimination of benign thyroid nodular disease and avoiding postoperative hypothyroidism and the need for thyroid replacement medication [3,4]. However, long-term outcome of less than total thyroidectomy turned out to be unsatisfactory, as many patients experienced nodular transformation of residual thyroid tissue on ultrasound performed as part of the postoperative follow-up and too many subjects required revision thyroid surgery, which was potentially more hazardous for the parathyroid glands and recurrent laryngeal nerves than the initial thyroid surgery in a virgin neck [4,5]. Hence, total thyroidectomy was proposed as a radical alternative to less than total thyroidectomy for the initial treatment of bilateral MNG [6]. This surgical strategy has been repeatedly shown to be extremely effective in eliminating the risk of recurrent nodular disease, but involved a substantial risk of surgical morbidity, which was variable and dependant on the surgical volume and expertise [6–9]. Total thyroidectomy proved to be safe at the hands of expert high-volume thyroid surgeons, showing a permanent complication rate lower than 1–2%, but at the hands of low-volume thyroid surgeons, the safety of total thyroidectomy defined as the prevalence of permanent morbidity was reported to be much worse [5–10]. Thomusch et al. analysed a cohort of 5195 patients treated for benign goitre by primary bilateral resection in 45 hospitals offering various levels of care and found that total thyroidectomy was associated with an increased rate of recurrent laryngeal nerve palsy and hypoparathyroidism in comparison to less extensive thyroid surgery [9]. Nawrot et al. analysed a cohort of 401 patients who underwent thyroid surgery at community hospitals and were followed up at a Regional/District Endocrine Clinic and found that permanent hypothyroidism was more frequent following total thyroidectomy (20.2%) than near-total thyroidectomy (6.7%) or subtotal thyroidectomy (4.2%); $p < 0.0001$. The multivariate statistical regression analysis demonstrated that primary total thyroidectomy was a significant risk factor for permanent hypoparathyroidism (OR 6.5; 95% CI: 2.9–14.4; $p < 0.0001$) [10]. However, an exact threshold number of cases defining a “high-volume” thyroid surgeon remains unclear. Adam et al. addressed this issue in a study comprising 16,954 patients undergoing total thyroidectomy and including 47% patients with thyroid cancer and 53% with benign thyroid disease. The median annual surgeon volume was seven cases and 51% surgeons performed only one case per year. After adjustment, the likelihood of experiencing some complication decreased with an increasing surgeon volume up to 26 cases per year ($p < 0.01$). Among all the patients, 81% had surgery by low-volume surgeons (≤ 25 cases/y). With the adjustment, the patients undergoing surgery by low-volume surgeons were more likely to experience complications (odds ratio 1.51, $p = 0.002$) and longer hospitalization (+12%, $p = 0.006$). The patients showed an 87% increase in the odds of developing complications if the surgeon performed one case per year, 68% for 2–5 cases per year, 42% for 6–10 cases per year, 22% for 11–15 cases per year, 10% for 16–20 cases per year, and 3% for 21–25 cases per year [11]. As surgery for benign thyroid conditions is oftentimes undertaken by low-volume surgeons at community hospitals, it should be taken into consideration that safety issues aiming at avoiding an increased risk of permanent morbidity are of a paramount importance for the clinical outcome of thyroidectomy. Hence, total thyroidectomy as the initial treatment of bilateral MNG can be justified particularly in patients with an increased risk of recurrent goitre, less than total thyroidectomy may still be the recommended initial treatment for low-volume surgeons [12].

We have hypothesised that as we live in the era of personalised medicine, one type of surgery may not fit all the patients with MNG and an individualised extent of thyroid resection should be taken into consideration as a new standard of care instead of routine performing total thyroidectomy [12]. In this review, special attention was focused on various aspects of tailoring the thyroid surgical resection with special emphasis placed on the role of hemithyroidectomy in the treatment of benign euthyroid asymmetric nodular goitre (AMNG).

Definition and prevalence of benign euthyroid asymmetric nodular goitre

Benign euthyroid AMNG is a common clinical and surgical problem. Patients with AMNG most commonly present with a solitary dominant thyroid nodule or a conglomerate of multinodular disease predominant within one thyroid lobe, but on ultrasound examination, subclinical nodular disease is discovered in the contralateral thyroid lobe. This scenario happens in approximately 50% of patients with a presumably benign single thyroid nodule or MNG [1,2]. Nevertheless, the exact incidence of AMNG is difficult to assess due to the few reports on the subject. Sancho et al. presented a surprisingly high incidence of patients with AMNG who represented 84% of all prospectively assessed patients referred for thyroid surgery for MNG in their institution in Spain [13]. Among patients living in endemic goitre areas of the world, MNG is most commonly bilateral, whereas in patients living in countries with sufficient dietary iodine intake, a unilateral thyroid nodule or AMNG is more often encountered [1,2].

There is no uniform agreement on the exact definition of AMNG or on the most optimal extent of surgical treatment for the affected patients. However, there are two most common scenarios which can be considered as AMNG:

1. Multinodular thyroid disease limited to one thyroid lobe, whereas the contralateral thyroid lobe is not enlarged and free of any nodular lesions (evaluated on palpation and on ultrasound).
2. Multinodular thyroid disease with the predominant clinical presentation on one side of the neck, which requires surgical resection or ablation, and the subclinical course on the other side of the neck, which in itself would not be a sole indication for treatment.

Rationale for hemithyroidectomy for benign euthyroid asymmetric nodular goitre

Surgery for AMNG may involve either unilateral or bilateral thyroidectomy, depending on the extent of the disease and individual surgeon's preferences; hence, the extent of surgery remains controversial [3–8]. Unilateral thyroid lobectomy was advocated owing to lower surgical morbidity and no risk of permanent hypoparathyroidism or bilateral recurrent laryngeal nerves injury [14]. But on the other hand, it is associated with a higher recurrence rate because the potential goitrogenic tissue remains in situ. This may necessitate reoperation in patients with recurrent symptoms, which may result in increased morbidity [15].

Long-term outcomes following hemithyroidectomy

The recurrence rate for unilateral thyroidectomy has been reported from 2% to 61% and to a high extent is dependent on the duration of postoperative follow-up – the longer it is, the higher recurrence rate can be expected [15–17]. Recurrence can be subclinical, which occurs in the majority of cases and is defined as the sonographic appearance, after the primary surgery, of new lesions (>5 mm) in the contralateral thyroid lobe, or can be clinically apparent with a palpable nodule or nodules and sometimes development of compressive symptoms. The latter usually requires further work-up and treatment.

Zatelli et al. evaluated retrospectively a cohort of 413 patients undergoing lobo-isthmectomy for MNG with a minimum follow-up of 1 year. Recurrent disease occurred in 80 patients (23%), with a median time to relapse of approximately 5 years (range 0.3–34.5 years) after lobo-isthmectomy. Recurrence was significantly associated with younger age (<46 years) and number of pregnancies in women. Development of hypothyroidism was not rare either (approximately 10%) and appeared in 3–19 months; preoperative TSH serum level > 2.43 mIU/L was associated with the need of l-thyroxin replacement therapy after surgery. The most frequent surgical complication was transient hypoparathyroidism (4.6%), while the rate of permanent hypoparathyroidism significantly increased in patients submitted to completion thyroidectomy (5.3%) [18]. These data would support a role for oestrogens in thyroid nodule development, also taking into consideration that menopausal women had a lower chance of developing recurrent disease. It is well known that oestrogens are potent growth factors, affecting normal and cancer thyroid cell proliferation both via genomic and non-genomic activity, as well as by affecting tumour microenvironment, angiogenesis and metastasis [19,20].

Lytrivi reviewed the records of 270 patients who underwent lobectomy for unilateral MNG and after a median follow-up of 78 months (range, 12–277 months), the total recurrence rate was found to be 42% and the recurrence of nodules sized 1 cm or more occurred in 19% of the patients. The reoperation rate was 1.1%. Ninety percent of the patients were treated postoperatively by levothyroxine. The median time to nodular recurrence was 4 years. The preoperative contralateral lobe volume and resected thyroid weight were identified as significant predictors of recurrence ($p = 0.045$ and $p = 0.03$, respectively). In addition, family history of thyroid disease was also a potential predictive factor of nodular recurrence [21].

Bauer et al. reviewed a cohort of 683 patients who underwent thyroidectomy for MNG. Of these patients, 420 (61%) underwent unilateral resection and 263 patients (39%) – total thyroidectomy. The mean age was 52 ± 17 years, and 542 patients (79%) were female. The mean follow-up time was 46.1 ± 1.9 months. The rate of recurrent disease was similar between unilateral (2%, $n = 10$) and bilateral (1%, $n = 3$) resections ($p = 0.248$). Unilateral resection patients had a lower total complication rate than patients with bilateral resections (8% vs. 26%, $p < 0.001$); however, there was no difference in the rate of permanent complications (0.2% vs. 1%, $p = 0.133$). Thyroid hormone replacement was rare in unilateral resection patients, but necessary in all patients with bilateral resection (19% vs. 100%, $p < 0.001$) [22].

Sancho et al. published in 2012 data from the randomized controlled trial of patients with AMNG defined in their study as a benign unilateral dominant nodule and contralateral nodule(s) with a diameter of less than 10 mm detected on neck ultrasonography. The subjects were randomly assigned to hemithyroidectomy or the Dunhill operation (unilateral total lobectomy with contralateral subtotal lobectomy). Long-term follow-up of 55 ± 35 months was available in 47 patients in the hemithyroidectomy arm and 43 patients in the Dunhill operation arm. The mean nodule size was 38 and 6 mm for the dominant and contralateral nodules, respectively. No differences were found in operative time, accidental parathyroidectomy, parathyroid autotransplantation, or wound complications. Transient hypocalcaemia was more common in the Dunhill arm (30% vs. 8%; $p < 0.001$). No permanent complications were observed. At the last follow-up visit, thyroid-stimulating hormone levels were similar in both groups. The remnant growth (20 vs. 0%; $p < 0.001$), appearance of new nodules (55 vs. 14%; $p < 0.001$), and overall reoperation rate (9.2 vs. 1.8%, $p = 0.2$) were more common in the hemithyroidectomy arm, mostly because of undiagnosed cancer requiring completion thyroidectomy. Thirty percent of patients developed hypothyroidism after hemithyroidectomy and required long-term thyroxine replacement therapy [13].

Yetkin et al. reported the outcomes in a cohort of 104 patients undergoing thyroid lobectomy for unilateral, nontoxic, benign nodular goitre. The average duration of follow-up was 39.7 ± 21.7 months (range, 5–87 months). Recurrence was seen in 63 patients (60.6%). Histopathologic characteristics of the lobectomy material – adenoma or colloid nodular disease ($p < 0.001$), higher preoperative volume of the thyroid gland ($p < 0.006$) and multinodularity ($p < 0.011$) – were significant predictors of recurrence [17].

Barczyński et al. presented a randomized trial comprised of 150 patients who underwent unilateral thyroid lobectomy for unilateral MNG; during the 5-year follow-up, recurrent goitre within the contralateral thyroid lobe was found in 9.3% of all patients and when stratified to levothyroxine therapy versus no therapy, it was found in 1.4% vs. 16.7% of patients, respectively ($p = 0.001$) [14].

Olson et al. analysed a cohort of 237 patients at their institution in the USA who underwent either thyroid lobectomy ($n = 140$) or total thyroidectomy ($n = 97$) for symptomatic unilateral MNG. With up to 145-month follow-up (mean follow-up around 10 years), there was a higher recurrence rate in the lobectomy group (11% vs. 3%; $p = 0.029$). However, patients in the lobectomy group had a much lower complication rate (2% vs. 9%; $p = 0.007$). Importantly, in patients who underwent reoperation for recurrent MNG after lobectomy, the complication rate was low (5.5%) and not significantly higher than in the initial surgery [15].

Bellantone et al. analysed retrospectively a cohort of 268 consecutive patients who underwent hemithyroidectomy for unilateral MNG in an endemic area and found that the incidence of recurrence was 33.9% (91/268 patients) after the mean follow-up time of 79.9 months (range, 12–251 months). On the multivariate analysis, predictive factors for recurrence were female sex ($p = 0.016$), multiple nodules ($p = 0.017$), and lack of postoperative L-thyroxine therapy ($p = 0.0009$). Reoperation was

performed in 20 patients (7.4%). Factors that were predictive of reoperation included the presence of multiple nodules ($p = 0.008$), resected thyroid weight ($p = 0.00006$), and lack of postoperative hormonal therapy ($p = 0.0005$) [16].

The recurrence rate after hemithyroidectomy for largely benign euthyroid asymmetric nodular goitre in various published series is shown in Table 1, whereas the benefits and risks of total thyroidectomy versus hemithyroidectomy for benign euthyroid AMNG are summarized in Table 2.

Follow-up in patients who underwent hemithyroidectomy

Based on the available data, Phitayakorn et al. recommended that patients undergoing thyroid lobectomy for benign nodular thyroid disease should be followed-up with an annual physical examination, neck ultrasonography and serum thyroid-stimulating hormone (TSH) determination performed. Routine thyroxine and/or iodine supplementation may be useful for preventing recurrence in patients from iodine-deficient regions [23]. These recommendations are supported by data from the randomized study reported by Barczyński et al. During the 5-year follow-up, among patients receiving vs. not receiving levothyroxine, recurrent goitre within the contralateral thyroid lobe was found in 1.4% vs. 16.7% subjects, respectively ($p = 0.001$). Moreover, 1.4% vs. 8.3%, respectively, of patients receiving vs. not receiving levothyroxine required contralateral thyroid lobe surgery ($p = 0.05$). Levothyroxine decreased the recurrence rate among iodine-deficient patients (3.4% vs. 36%, respectively; $p = 0.002$), but not among iodine-sufficient patients (0% vs. 6.4%, respectively; $p = 0.09$) [14]. However, this issue remains controversial, as some studies did not support the protective effect of levothyroxine treatment in the reduced risk of recurrence in the contralateral lobe following hemithyroidectomy [24,25].

Based on the meta-analysis of 32 studies, Verloop et al. estimated the overall risk of hypothyroidism after hemithyroidectomy to be 22% (95% confidence interval, 19–27%). A clear distinction between

Table 1

Recurrence rate after hemithyroidectomy for largely benign euthyroid asymmetric nodular goitre in various published series.

Author	Publication year	Type of study	Hemithyroidectomy (No. of patients)	Mean follow-up time (months)	Recurrence rate (%)
Zatelli MC et al.	2018	Retrospective	354	71.7	23.0
Lytrivi M et al.	2016	Retrospective	270	76.0	42.0
Bauer PS et al.	2013	Retrospective	420	46.1	2.0
Sancho JJ et al.	2012	RCT	47	55.0	55.0
Yetkin G et al.	2010	Retrospective	104	39.7	60.6
Barczyński M et al.	2010	RCT	150	60.0	9.3
Olson SE et al.	2007	Retrospective	140	120.0	11.0
Bellantone R et al.	2004	Retrospective	268	79.9	33.9

RCT – randomised controlled trial.

Table 2

Benefits and risks of total thyroidectomy versus hemithyroidectomy for benign euthyroid asymmetric nodular goitre.

	Total thyroidectomy	Hemithyroidectomy
Benefits	<ul style="list-style-type: none"> • Obliterated risk of recurrence • No need for completion thyroidectomy in case of incidentally diagnosed thyroid cancer after the operation 	<ul style="list-style-type: none"> • No need for thyroid replacement therapy (in 50–70% of patients) • Lower risk of RLN injury • No risk of permanent hypoparathyroidism after initial surgery
Risks	<ul style="list-style-type: none"> • Higher risk of RLN injury^a • Higher risk of hypoparathyroidism^a • Need for long-life thyroid replacement therapy • Impaired psychological well-being • Possible weight gain 	<ul style="list-style-type: none"> • Need for reoperation for goitre recurrence (in one-third of patients) • Need for completion thyroidectomy in case of incidentally diagnosed thyroid cancer after the operation (in one-third of patients)

RLN – recurrent laryngeal nerve.

^a At least at hands of low-volume surgeons.

clinical (supranormal TSH levels and subnormal thyroid hormone levels) and subclinical (supranormal TSH levels and thyroid hormone levels within the normal range) hypothyroidism was provided in four studies. These studies reported on an estimated risk of 12% for subclinical hypothyroidism and 4% for clinical hypothyroidism. The positive anti-thyroid peroxidase status was a relevant preoperative indicator of hypothyroidism after surgery [26].

Similar data were reported by Kandil et al. who published the meta-analysis on the postoperative need for hormone replacement therapy after hemithyroidectomy based on the cohort of 15,412 patients. Higher preoperative TSH serum levels ($>2.5 \mu\text{U/l}$) were associated with a relative risk (RR, 95% CI) of 3.16 (2.03–4.90), the presence of anti-thyroid antibodies had a RR of 3.52 (2.55–4.86) and thyroiditis in pathological report had a RR of 3.30 (2.49–4.36), which all predicted the postoperative need for treatment with levothyroxine following hemithyroidectomy [27].

Revision surgery in patients who underwent hemithyroidectomy

It is well-documented in the published series that the risk of reoperative surgery for recurrent bilateral MNG following previous bilateral less than total thyroidectomy is substantial and a wider implementation and acceptance of initial total thyroidectomy for bilateral MNG in high-volume thyroid surgery centres have essentially eliminated the need for bilateral reoperative surgery for recurrent goitre [28–31]. Contrariwise, patients after hemithyroidectomy are at risk of contralateral revision thyroid surgery, which in principle is safer than bilateral reoperative surgery for recurrent goitre, but may be indicated in the following clinical situations:

1. It can be considered as completion thyroidectomy in patients who were postoperatively diagnosed with an incidental well-differentiated thyroid cancer and the staging of the disease required further radioiodine treatment.
2. In case when recurrent nodular disease in the contralateral thyroid lobe becomes clinically apparent with progression of compressive symptoms during follow-up.
3. In case of suspected or diagnosed thyroid malignancy based on the result of fine-needle aspiration cytology of the lesion or nodule within the contralateral thyroid lobe.

The surgical risks of two-stage thyroidectomy (lobectomy followed by completion thyroidectomy) are similar to those of near-total or total thyroidectomy [32]. If only ipsilateral lobectomy with isthmusectomy was performed at the initial operation and the contralateral lobe was not mobilized, dissection at completion thyroidectomy should be no different from that at the first hemithyroidectomy, as there is usually only minimal tissue reaction. Nevertheless, the technique of capsular dissection with careful identification of the recurrent laryngeal nerves and parathyroid glands is highly recommended, as it reduces the risk of complications in secondary thyroidectomy [31,32]. Several adjuncts to thyroid surgery, such as intraoperative nerve monitoring or intraoperative iPTH assay, may be of help in improving the outcomes of individual performance [33].

The criteria for and against hemithyroidectomy for benign euthyroid AMNG are listed in Table 3.

Image-guided thermal ablation of contralateral benign thyroid nodules following hemithyroidectomy

Patients with residual ultrasound-detectable thyroid lesions following hemithyroidectomy are most often completely asymptomatic and do not require any treatment. However, when thyroid nodules become symptomatic, surgical excision continues to be considered the standard treatment. Nevertheless, in the last few years, several authors reported their experience and encouraging results of the treatment of benign thyroid nodules through image-guided percutaneous thermal ablation, so that currently, these treatment modalities can be considered as the first-choice option for patients with symptomatic benign thyroid nodules and constitute an alternative for surgical resection for many patients, including subjects who previously underwent hemithyroidectomy. Among various techniques currently available for image-guided percutaneous ablation, particularly radiofrequency (RFA),

Table 3

Criteria for and against hemithyroidectomy for benign euthyroid asymmetric nodular goitre.

Criteria favouring hemithyroidectomy	<ul style="list-style-type: none"> • Low risk of clinically apparent recurrence (small contralateral lobe, one or just few contralateral subclinical lesions, no family history of nodular goitre, no iodine deficiency, no evidence of cancer) • Largely asymptomatic patient • Pre-existing ipsilateral RLN palsy • Impaired general medical status (cardiopulmonary disease, elder age, short life expectancy) • Personal risk factors (voice professional, low motivation for life-long thyroxine replacement therapy)
Criteria favouring total thyroidectomy	<ul style="list-style-type: none"> • High risk of clinically overt recurrence (large contralateral lobe, palpable contralateral thyroid nodules, family history of nodular goitre, iodine deficiency, risk of cancer, young woman with plans for several pregnancies) • Thyroiditis with subclinical or clinically overt hypothyroidism • Personal preferences (no acceptance for second-stage surgery in case of symptomatic recurrence or diagnosis of cancer)

RLN – recurrent laryngeal nerve.

laser (LA), microwave (MWA), and high-intensity-focus ultrasound (HIFU) appear to be promising. According to the literature, good results have been obtained with RFA and LA. In case of RFA, volume reduction after ablative treatment has been found to range from 47 to 84% at 3–6 months, and from 62 to 93% at 1 year; LA also seems to be effective in achieving shrinkage of thyroid nodules, with volume reduction from 37 to 81% at 3–6 months, and from 13 to 82% at 1-year follow-up [34]. To date, a low number of patients were treated with HIFU and a recent systematic review presented by Lang et al. identified five original studies, which showed the nodule volume reduction rate ranging between 45% and 68% after a single session of HIFU ablation, with varying results depending on nodule size and length of follow-up [35]. An investigation carried out in 2017 by Sennert et al. on 19 benign nodules showed the volume reduction rate of 58% at 3-month follow-up, with ten out of 19 patients showing therapeutic success (defined as a volume reduction $\geq 50\%$) [36]. Hence, image-guided percutaneous ablations appear to be effective in obtaining volume reduction of benign solid nodules and in providing significant improvement in cosmetic and pressure symptoms; such procedures have a potential to be also employed in patients with benign nodular disease relapse in the contralateral lobe following hemithyroidectomy. However, due to the scarcity of the published data in the field, further studies are needed to validate the safety, efficacy and cost-effectiveness issues of these novel and promising minimally invasive radiological techniques.

Summary

Benign euthyroid AMNG is a common clinical and surgical problem. Patients with AMNG most commonly present with a solitary dominant thyroid nodule or a conglomerate of multinodular disease predominant within one thyroid lobe, but on ultrasound examination, subclinical nodular disease is detected in the contralateral thyroid lobe. This scenario happens in approximately 50% of patients with a presumably benign single thyroid nodule or MNG. There is no uniformly accepted consensus on the optimal extent of surgery for patients with AMNG. Depending on the extent of the disease and individual surgeon's preferences, either unilateral or bilateral thyroidectomy can be performed. Total thyroidectomy may be the preferred surgical approach for high-volume surgeons in order to reduce the risk of recurrent disease and the need for future thyroid reoperation. However, hemithyroidectomy can be considered for some patients with AMNG and a low risk of recurrent disease as a safer alternative to total thyroidectomy but it requires life-long follow-up, is associated with a higher risk of recurrence and the need for revision thyroidectomy in selected subjects. Patients undergoing thyroid lobectomy for AMNG should be followed-up with an annual physical examination, neck ultrasonography, and serum thyroid-stimulating hormone determination performed. Routine thyroxine and/or iodine supplementation may be useful for preventing recurrence in patients from iodine-deficient regions.

Image-guided thermal ablation of contralateral benign thyroid nodules following hemithyroidectomy for AMNG seems to have a potential of reducing the risk of goitre recurrence; however, this hypothesis needs to be tested in future studies.

Disclosures

None of the authors have anything to disclose.

Practice points

- There is no uniformly accepted consensus on the optimal extent of surgery for patients with benign euthyroid AMNG.
- Total thyroidectomy may be the preferred surgical approach for high-volume surgeons in order to reduce the risk of recurrent disease and the need for thyroid reoperation in the future.
- Hemithyroidectomy can be considered for some patients with AMNG and a low risk of recurrent disease as a safer alternative to total thyroidectomy since it is associated with a lower risk of surgical morbidity but requires life-long follow-up, involves a higher risk of recurrence and the need for revision thyroidectomy in selected patients.
- An individualised extent of thyroid resection for AMNG should be taken into consideration as a new standard of care rather than routine choosing total thyroidectomy.

Research agenda

- The surgical volume and outcome association for various thyroid resection modes for AMNG undertaken in various levels of care hospitals needs to be clarified based on data from large prospective multi-institutional quality control register programs.
- The concept of tailoring the extent of thyroid resection for AMNG depending on the assessment of the individualised risk of recurrence balanced against the safety issues and long-term outcomes of the procedure should be tested in various healthcare environments as a new standard of care rather than routine planning for total thyroidectomy.
- Image-guided thermal ablation of contralateral benign thyroid nodules following hemithyroidectomy for AMNG seems to have a potential to reduce the risk of goitre recurrence; however, this hypothesis needs to be tested in future studies. The increasing availability of these emerging techniques will most likely extend the treatment options for AMNG in the near future.

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