Original Article

Minimally Invasive Thyroid Surgery for Diagnostic Excision of Solitary Thyroid Nodules

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OBJECTIVE: Various techniques for minimally invasive thyroid surgery (MITS), including endoscopic and video-assisted procedures, have now been described. Based on our unit's experience with minimally invasive parathyroidectomy via a lateral incision, a similar technique for minimally invasive thyroid lobectomy has been developed and assessed.
METHODS: The last 203 consecutive thyroid procedures using the MITS technique, performed between July 2002 and June 2006, comprised the study group. Inclusion criteria for initial surgery were: initial nodule < 3.0 cm; no preoperative evidence of malignancy; absence of clinical multinodular change. A 2.5-cm lateral incision, using a headlight illumination, provided optimal exposure.
RESULTS: A total of 202 patients underwent 203 MITS procedures over the 4-year period, with one patient undergoing bilateral MITS. The procedures included 155 thyroid lobectomies and 48 nodule excisions; 31 of the patients underwent a minimally invasive parathyroidectomy (MIP) during which an ipsilateral thyroid nodule was removed. The mean tumour size was 17.3 mm, but the mean size of the thyroid lobe removed was 39.5 mm. Final diagnoses included benign multinodular goitre (26%), follicular adenoma (22%) and carcinoma (20%). The complication rate was low, with one permanent recurrent laryngeal nerve (RLN) palsy (anterior division only) (0.5%), four RLN neuropraxias which recovered (2%), and one haematoma not requiring re-operation (0.5%). The rate of complications was not significantly different from 819 conventional open hemithyroidectomies performed over the same period.
CONCLUSION: MITS is a safe and feasible alternative to open thyroid surgery in appropriately selected cases. It offers a valuable option for diagnostic excision biopsy in patients with thyroid nodules demonstrating an "atypical" fine-needle biopsy whilst avoiding the need for a standard cervical "collar" incision.
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Key Words: complications, follicular adenoma, hemithyroidectomy, minimally invasive surgery, thyroid surgery

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Introduction

Thyroid lobectomy via a formal cervicotomy has long been held to be the minimum standard of care for the solitary thyroid nodule requiring diagnostic excision.[1] The recent introduction of techniques for minimally invasive thyroidectomy (MITS) has led to this basic tenet being challenged. MITS is defined as a thyroid procedure performed through an incision of less than 3 cm,[2] whether that uses the mini-incision approach,[3] video-assisted techniques,[4]

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or a true lateral endoscopic procedure.[5] It does not include extracervical approaches (axillary or chest wall) that often require extensive dissection and longer incisions, albeit avoiding a visible scar in the neck.

Whilst most descriptions of minimally invasive techniques still emphasize the role of a complete lobectomy as the minimum procedure, the issue of nodule excision with a margin of surrounding thyroid tissue via a minimal approach for the purposes of diagnosis, although controversial, is now the subject of discussion and it may well find a (somewhat limited) place in the endocrine surgeon's armamentarium in the future. The advantage of such a surgical approach, either complete lobectomy or nodule excision, is that it provides a diagnostic excision biopsy, with complete removal of the lesion, without the requirement for a formal "collar" thyroidectomy scar. The commonest clinical situation in which such an approach may be applicable is the patient with a small solitary thyroid nodule where the fine-needle biopsy reports an "atypical", "indeterminate", "follicular pattern", "consistent with a follicular neoplasm", result requiring excision to confirm the histological diagnosis even though only 15% of such lesions will eventually turn out to be a follicular carcinoma.[6,7]

Another common clinical situation is the patient undergoing a minimally invasive parathyroidectomy (MIP) who has an incidental small ipsilateral thyroid nodule. In both of these situations, the ability to remove the nodule with a small scar, minimal dissection, and, if technically appropriate, minimal removal of normal thyroid tissue, clearly represents a significant clinical advance. The aim of this study was to report the initial experience of this unit with MITS in these situations.

Patients and methods

This was a retrospective cohort study. The study group comprised all patients undergoing MITS from its introduction in 2002 until July 2006. The control group comprised patients who underwent conventional open hemithyroidectomy over the same period. All data were prospectively recorded in the University of Sydney Endocrine Surgical Unit database. Information documented included patient demographics, tumour pathology, tumour size, specimen size and complications. All patients underwent routine pre- and postoperative laryngoscopy by an independent ENT surgeon. MITS was performed by the technique previously described,[2,8] employing a 2.5-cm incision placed laterally over the medial border of the sternomastoid, mobilizing the subcutaneous tissues, dividing the lateral edge of the strap muscles whilst preserving the ansa cervicalis, then undertaking appropriate dissection of each component of the thyroid lobectomy, or local excision, by moving the incision around the neck to allow full visualization of (in order) the upper pole, isthmus, lower pole, and finally lateral lobe with recurrent nerves and parathyroid glands.

Results

There were 202 patients who underwent 203 MITS procedures over the 4-year period, with one patient undergoing bilateral MITS. The procedures included 155 thyroid lobectomies and 48 nodule excisions, either partial thyroidectomy or isthmectomy. Thirty-one of those patients underwent an MIP during which an ipsilateral thyroid nodule was removed.

The mean tumour size was 17.3 mm (range, 0.3–46 mm). However, the mean size of the thyroid lobe removed was 39.5 mm (range, 3–75 mm) with a mean tissue weight of 9.6 g (range, 0.4–27.6 g). The size of the tumour and the size of the thyroid tissue removed did not change significantly over the time period.

The final diagnoses were: benign multinodular goitre (26%), follicular adenoma (22%), carcinoma (20%), single colloid nodule (11%), Hashimoto's thyroiditis (7%), Hurtle cell adenoma (5%), subacute thyroiditis (3%), residual thyroid–non carcinoma (2%), simple cyst (1%), diffuse hyperplasia (1%) and other (2%). Of the carcinomas ($n = 40$), 80% were papillary thyroid cancer, 13% were follicular, and the remaining 7% were Hurtle cell carcinomas. Only one of these had a suggested papillary carcinoma on the fine-needle aspiration biopsy (FNAB), and all the rest had an atypical or inconclusive follicular pattern preoperatively. Of the group of carcinomas, 40% ($n = 16$) were incidental papillary microcarcinomas (10 mm), and for 12 of these, no further surgical intervention was undertaken. For the remaining patients with carcinoma, completion thyroidectomy was performed, either as a contralateral MITS procedure ($n = 1$) or as a formal open completion thyroidectomy ($n = 27$).

The number of cases performed each year increased from 46 in the first 12 months to 120 in the last 12-month period. The complication rate was low and did not change

Table. Complications in patients who underwent minimally invasive thyroid surgery (MITS) compared to conventional open hemithyroidectomy (HT) between 2002 and 2006*

	MITS (n = 203)	Open HT (n = 819)
Temporary hypocalcaemia	1 (0.5)	9 (1.0)
Permanent hypoparathyroidism	0 (0)	0 (0)
Temporary RLN paresis	4 (2.0)	12 (1.5)
Permanent RLN palsy	1 (0.5)	3 (0.4)
Haematoma	1 (0.5)	5 (0.6)
Re-operation for bleeding	1 (0.5)	9 (1.0)
Wound infection	2 (1.0)	4 (0.5)
Death	0 (0)	0 (0)

*Data are presented as n (%). RLN = recurrent laryngeal nerve.

over the time period with increasing experience with the procedure. The complications are shown in the Table. Four patients had temporary recurrent laryngeal nerve paresis and one patient had permanent partial recurrent laryngeal nerve palsy (anterior branch division). Two patients had a wound infection and one patient was re-operated on for haemorrhage.

During the same period, 819 patients underwent conventional open hemithyroidectomy, generally for larger tumours. There was no significant difference in the complication rate compared to the study group as shown in the Table.

Discussion

In this retrospective study of 202 cases, we show that MITS is a safe and feasible alternative to open thyroid surgery in appropriately selected cases. Our unit has developed MITS using a lateral mini-incision approach within the framework of an already well established technique of MIP, which has been performed at our unit since 1999.[9] Treating both diseases simultaneously allowed us to study the feasibility of thyroid surgery through small incisions. Our previous preliminary study[2,8] reported no increase in complications compared to open hemithyroidectomy, and this larger study confirms that the procedure is safe and feasible for thyroid nodules up to 3 cm in diameter.

Many patients have small thyroid nodules with follicular pathology (atypical) on FNAB. FNAB is unable to distinguish between a follicular adenoma, follicular hyperplasia and follicular carcinoma. The standard recommended procedure for thyroid nodules with atypical follicular cytological findings is a hemithyroidectomy via a formal cervicotomy, so that a definitive histological diagnosis can be obtained. A hemithyroidectomy in these circumstances amounts to a diagnostic excision biopsy with a malignant yield of approximately 15%. MITS offers a valuable option for diagnostic excision biopsy in patients with thyroid nodules demonstrating an "atypical" fine-needle biopsy whilst avoiding the need for a standard cervical "collar" incision. While our unit initially used an endoscopic approach for MIP, our technique has now evolved into using a small lateral incision, a headlight and movement of the skin incision over the relevant areas of dissection (Figure). When good illumination and retraction are available,

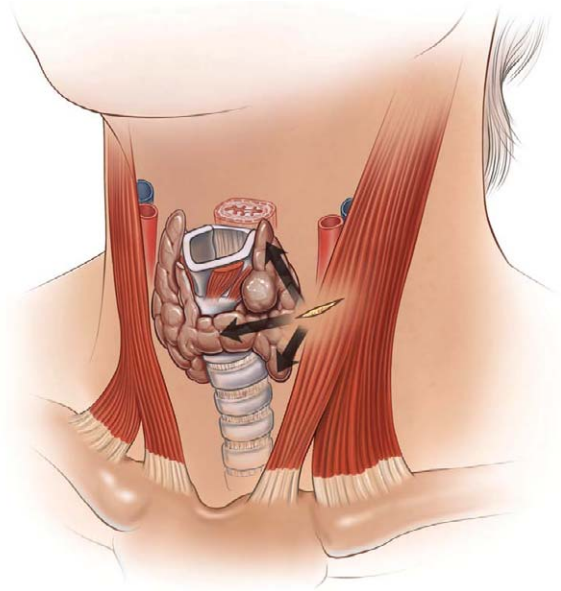

Figure. Incision placement for minimally invasive thyroid surgery, showing how the incision can be moved around the neck to facilitate specific dissection of the upper pole, isthmus and lower pole prior to final dissection in the region of the Ligament of Berry directly under the original incision site.

key anatomical structures in the neck are as easily seen through such incisions as they are with video magnification. The manipulation of the skin and platysma allows small frames to be visualized in sequences given a precision and identification to the anatomical structures as in open thyroidectomy.

However, it is of great importance to select patients appropriately for this procedure. Our policy is to only include patients with a nodule of less than 3 cm, no preoperative evidence of malignancy and absence of clinical multinodular change. The demonstration of meaningful advantages for MITS over conventional surgery is not easy.[9–11] The overall complication rates are similar and only the mini open approach is more favourable than conventional operation in terms of surgical time.[12] MITS does not reduce the length of hospital stay, and whether it is less costly than traditional surgery is difficult to quantify. Nonetheless, the reduced dissection required certainly leads to reduced discomfort on the first postoperative day. Likewise, the reduction in the length of the scar to less than 3 cm is regarded as a positive factor by patients and referring endocrinologists alike.

Just under a quarter of patients had local excision of their nodule rather than formal thyroid lobectomy. Whilst some authors claim that lobectomy is the minimal and standard surgical treatment for a thyroid nodule, we believe that it is more important to address the underlying surgical and oncological principles rather than to mandate a specific procedure. The long-standing policy of our unit has been that the minimal treatment for a thyroid nodule is: an oncologically sound procedure with removal of the nodule intact with surrounding normal thyroid tissue (for the purposes of accurate histological examination), with no breach of capsule (in case a final diagnosis of thyroid cancer is provided), and performed in a way that minimizes risk to the recurrent/external laryngeal nerves and parathyroid glands.[13] Whilst in the majority of cases that will be a thyroid lobectomy, as in this report, such a procedure is not always required either with open or minimally invasive surgery. For example, an isthmic or pyramidal nodule is best removed locally; a formal lobectomy exposes the patient to unnecessary risk. Likewise, a nodule confined solely to the upper pole can be more safely removed by local upper pole excision than by a complete lobectomy. It is no more difficult to perform a lobectomy than a local nodule excision using the mini-incision technique, than for the other types of MITS such as endoscopic or video-assisted techniques. Thus, our standardized protocol for MITS is identical to what has been practiced in our unit for over a decade in relation to thyroid lobectomy *vs.* local excision for single thyroid nodules. What is of interest, however, is that local nodule excision now essentially never appears in the open thyroidectomy cohort because, by definition, all such nodules will be small and thus suitable for MITS.

We accept that no specific benefit to MITS has been established and that only randomized studies will demonstrate any such differences. It must be pointed out, however, that as for MIP,[14] the advantages of a smaller scar and minimal tissue dissection are self-evident, at least to the patient. The demonstration that there are no disadvantages or poor outcomes to the procedures themselves is sufficient evidence to support the continued performance of the procedures. As such, it is likely that minimally invasive and conventional thyroidectomy will remain complementary procedures into the future.

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