Minimal access thyroid surgery in children: A retrospective study and literature review

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Abstract

Minimal access thyroid surgery (MATS) is a technique whereby a part of or whole of a thyroid lobe is removed through a small (3-4 cm) neck incision. Its use in the surgical management of thyroid disease in children has not been well elucidated. We present a retrospective case study of 12 patients over the period of 2007 to 2010 to assess the feasibility of MATS in the management of thyroid disease. Minimal access thyroid surgery is a safe and feasible approach for hemithyroidectomy/lobectomy in selected patients. There were no associated adverse events, complications or disease recurrence. We also reviewed the literature and discussed the use of MATS as a routine procedure in selected pediatric patients.

Introduction

Minimally invasive surgery has been adapted in all fields of surgery, including head and neck surgery, due to better outcomes.[1-5] Minimal access thyroid surgery (MATS) is a technique whereby a part of or the whole of a thyroid lobe is removed through a small (3-4 cm) neck incision (Figures 1 and 2).[5-7] It has become a safe and feasible approach in the management of thyroid diseases in selected patients.[8-11] Although the use of MATS in the surgical management of thyroid disease in adults has been explored, its use in children has not been well elucidated. We present a retrospective case study of 12 patients over the period of 2007 to 2010 treated in Princess Margaret Hospital for Children, Western Australia to assess the feasibility MATS in the management of benign thyroid disease. We also review the literature and discuss the use of MATS as a routine procedure in selected pediatric patients.

Materials and Methods

The study comprised all patients in Princess Margaret Hospital for Children, Western Australia undergoing thyroidectomy during the period of July 2007 to July 2010. The data was collected retrospectively and recorded patient demographics, indication for surgery, operation performed, nodule size, final pathology and complications such as post-op bleeding, vocal cord neuropraxia/palsy were recorded. Inclusion criteria included benign thyroid disease on fine needle aspiration (FNA), absence of enlarged lymph nodes, no evidence of thyroiditis, thyroid nodules lesser than 30 mm on ultrasound.[10,12-14] The Medline and PubMed database was used with subject heading search parameters looking for articles linking minimally invasive surgical procedures with benign thyroid neoplasms, thyroidectomy and minimal access surgery. Attention was given to related articles published in the last several years with older articles referenced and reviewed as required.

Surgical approach

We used a similar surgical technique to that described by Gosnell and colleagues (2004), which was utilized in adult hemithyroidectomies.[10] Minimal access thyroid surgery is carried out under general anesthesia using endotracheal tube intubation with ventilation, local anaesthetic infiltration and nerve integrity monitoring system. A small (3-4 cm) lateral incision is made directly over the thyroid nodule and subplatysmal mobilization is performed to allow an incisional window to be moved over the relevant area of dissection in the neck. Exposure is carried out in sequential stages and the hemithyroidectomy achieved without a formal collar incision.

The patient is positioned supine, with the neck held in extension by a shoulder roll and the head ring for support. Operating headlights are used by the surgeon and the first assistant for adequate illumination. The exact site of the incision depends upon the location of the nodule to be removed. The midline of neck, suprasternal notch, medial margins of the sternomastoid muscles, and a curvilinear line at the site of a standard collar incision, 2 cm above the clavicle are marked. For a high thyroid nodule a 2.5 cm incision, just large enough to introduce a finger for developing the working space, is marked 1 cm superior to the neck crease, lying almost entirely lateral to the medial margin of the sternomastoid. For a low thyroid nodule, the incision is placed 1 cm inferior to the neck crease and at the medial margin of sternomastoid muscle. Five to ten mL of local anaesthetic and adrenaline is infiltrated along the incision line in the subplatysmal plane.

Once the skin and platysma have been incised, a subplatysmal space is developed using a combination of blunt dissection and electro-cautery. Any vessels encountered are then divided with ligatures/ligaclips. The skin and platysma flaps are retracted and the medial margin of the sternomastoid muscle is defined. The sternomastoid muscle is dissected laterally to expose the lateral margin of the strap muscles and the sternomastoid muscle is then retracted laterally. The medial border of the strap muscles is dissected to reveal the inferior pole of the thyroid and the trachea. The strap muscles are retracted medially and the middle thyroid vein divided with ligaclips. The space medial to the common carotid artery is then dissected to define the pre-tracheal plane (Figure 3).

This dissection is continued laterally until the pre-vertebral fascia is reached. The space between the posterior aspect of the thyroid gland and prevertebral fascia is then further developed by gentle blunt dissection. This step in dissection is critical to the procedure as it exposes almost the entire anatomy of the recurrent laryngeal nerve (RLN) and parathyroid glands. The lateral surface of the thyroid lobe is exposed once the strap muscles are completely dissected

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and defined. Superior pole dissection is performed by moving the incisional window in a cranial direction and retracting the superior pole laterally to open up the avascular plane. In over 90% of cases this allows the external branch of the RLN to be identified and preserved (Figure 4). Upper pole vessels are then divided and haemostasis achieved with electro-cautery.

The incisional window is moved to the midline and the tracheal surface is identified above and below the isthmus. The isthmus is divided using a combination of diathermy and ligaclips (Figure 5).

This step allows for the thyroid lobe to be mobilized further laterally facilitating dissection.

The skin incision is then moved in a caudal direction and the lower pole of the thyroid lobe is dissected and mobilized (Figure 6).

A careful search for an inferior parathyroid gland is undertaken and any parathyroid glands that cannot be preserved with its blood supply intact is removed for subsequent auto-transplantation.

The skin incision is then retracted later-

Figure 1. A three-cm incision over the thyroid lobe.

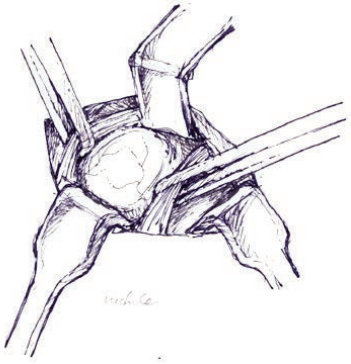

Figure 3. Dissection to expose nodule in left hemi-thyroid.

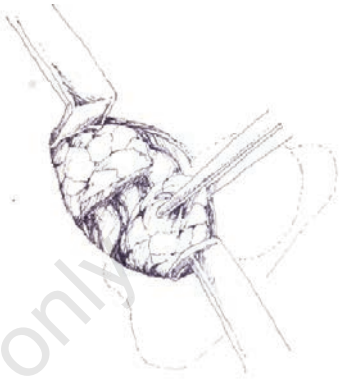

Figure 5. Dissection of thyroid isthmus.

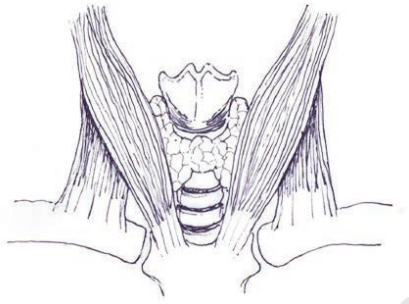

Figure 2. Anatomy of the thyroid gland in relation with the rest of the neck.

Figure 4. Dissection of superior pole of left hemi-thyroid with exposure of recurrent laryngeal nerve.

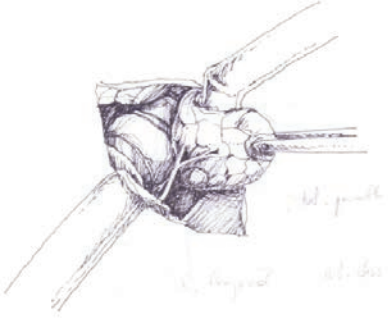

Figure 6. Dissection of inferior pole of left hemi-thyroid.

Table 1. Clinical data of the twelve patients undergoing minimal access thyroid surgery.

Patient no.	Age (years)	Sex	Size of lobe (mm)	Size of lesion (mm)	Histology
1	8.5	F	44	8	Follicular adenoma
2	3	M	22	6	Thymic nodule
3	10	F	30	15	Multinodular goitre
4	7	M	30	30	Nodular colloid goitre
5	14	F	30	3	Cystic colloid nodule
6	15	F	40	6	Follicular adenoma
7	14	F	45	16	Follicular adenoma
8	14	F	45	21	Follicular adenoma
9	13	F	37	13	Multinodular goitre
10	9	M	35	25	Cystic colloid nodule
11	6.5	M	20	10	Thyroid nodule
12	12	F	50	20	Follicular adenoma

ally and the thyroid nodule can often be delivered through the incision with the lobe being mobilization, allowing the critical lateral dissection to be undertaken close to the skin surface and better retraction. Dissection is continued until the RLN is defined and preserved with further definition via superior mobilization of the lobe (Figure 7).

At this stage, the superior parathyroid gland is defined and preserved. The ligament of Berry is then divided and the thyroid lobe removed through the incision window. Once haemostasis is achieved, the wound is closed in layers with deep subcutaneous sutures and subcuticular absorbable sutures of the skin.

Vocal cord function is evaluated and documented routinely both pre- and post-operatively with flexible nasoendoscopy.

Results

Between July 2007 and July 2010, 14 pediatric patients underwent thyroid surgery and of these, 2 had the standard open thyroidectomy while the remaining 12 underwent MATS with hemithyroidectomy. Of the 12, 9 were females and 3 were males. Their age ranged from 3 to 15 years old with a mean of 10.5 years. One patient was clinically hyperthyroid while the remaining 11 were clinically euthyroid. The pathologies reported in the 12 patients were benign thyroid disease including 6 nodular thyroid tissues, 5 follicular adenomas and one intrathyroid thymic nodule. Size of the hemithyroidectomy specimens ranged from 22 to 50 mm with a mean size of 35.6 mm (Table 1). There was no malignancy found on further histopathological analysis of the specimens. Of the 12 patients, three had drains inserted and closed with skin stitches. The remaining 9 had Dermabond® for wound closure with no drains required. There was no major or permanent complication in our study group. There was no case of bleeding requiring return to the operating theatre, nor the development of a hematoma or seroma. There was also no associated RLN palsy.

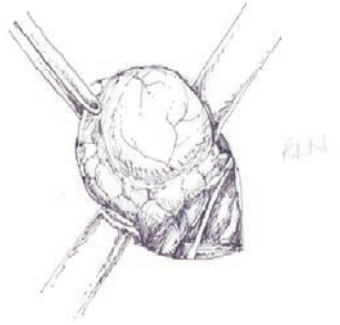

Figure 7. Dissection and mobilization of left hemi-thyroid with complete exposure of recurrent laryngeal nerve.

Discussion

Prior to the availability of minimally invasive surgery, incision size was determined solely by the surgeon's need for good exposure in order to perform a safe operation.[5] With the availability of better and more sophisticated instruments, minimally invasive surgical techniques in thyroid disease are more attractive because of the smaller incisions with lesser tissue trauma, better cosmesis, shorter hospital stay and less post-operative pain when compared with open procedures.[8,11-13,15-18] There has been an increased adaption of the minimal incision approach with better haemostasis obtained by the use of harmonic scalpel and more recently the Ligasure®. The introduction of the endotracheal tube electrodes for the intra-operative monitoring of the RLN has also improved the ease of dissection and preservation of RLN. There is also no significant difference in complication rates when comparing minimally-invasive techniques with conventional hemithyroidectomy.[9,10,12,13,17]

Endoscopic and video assisted techniques for the management of thyroid diseases have been used with cervical,[4,12,13,17] axillary[16] and mammary[18] approaches. However, in the presence of sufficient illumination and retraction, it is noted that key anatomical structures in the neck are as easily visualized through small incisions as they are with video magnification provided by video assisted techniques.[4,12,13,16-18]

Endocrine surgeons are increasingly employing both conventional thyroid surgery and endoscopic thyroid surgery in the management of benign and malignant thyroid diseases.[12,13,17] There have been numerous studies reviewing the safety and efficacy of minimally invasive video-assisted thyroidectomy (MIVAT) within the pediatric population.[4,12,13,16-18] In experienced hands, MIVAT has been shown to have similar outcomes and complication rates compared to conventional procedures.[13] MATS has been shown to be a good technique to complement both open and endoscopic approaches, especially for benign thyroid diseases.[5-10,14]

Other articles so far discussing the usage of MATS have been mainly focused on the adult population with thyroid nodules[8-11,15] and for adult patients with hyperfunctioning single thyroid.[15] In our study, all our patients had benign thyroid disease where hemithyroidectomy is a curative procedure. We were able to perform the procedure with a smaller incision, less dissection and comparable complication rate to conventional hemithyroidectomy. There were no cases where a conversion to complete thyroidectomy in the presence of thyroid malignancy was necessary.

Considering that the outcomes of MATS are not dissimilar to conventional cervicotomy or other minimal access thyroidectomy techniques,[9,12,13,17] it appears that patient selection is the key in determining the success of MATS.[9,10,15] Authors have proposed that MATS should only be undertaken in selected patients where the procedure should adequately treat the underlying disease and to guide ongoing therapy if necessary.[8,10-12,15] Exclusion criterion in these studies include no overt malignancy on FNA, single nodule size <30 mm, evidence of significant thyroiditis or a history of pervious head and neck irradiation.[8,10-12,15] In our study, we have demonstrated that thyroid nodules up to the size of 50 mm have been removed successfully with no complications.

Seybt and Terris (2011) has shown that malignant thyroid neoplasms can be managed using MATS.[14] It appears that MATS, MIVAT and conventional open thyroidectomy with combined lymph node clearance are all comparable surgical approaches for pediatric thyroid diseases.[13]

Conclusions

In summary, MATS appears to be a safe and technically feasible alternative to open thyroid surgery in selected pediatric patients with benign thyroid disease. There is also evidence that MATS can be utilized in malignant pediatric thyroid disease and this needs to be evaluated with further, larger studies.

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