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Original Article

Minimally invasive surgery using mini anterior incision for thyroid diseases: a prospective cohort study

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Abstract: Aim: Minimally invasive surgical techniques have attracted interest in all surgical specialties since 1980. The thyroidectomy technique requires meticulous surgical dissection, absolute hemostasis, en bloc tumor resection and adequate visualization of the operative field, all of which can be accomplished with minimally invasive techniques. Methods: The study group comprised all patients undergoing MITS from its introduction in 2010 until July 2012. All data were prospectively recorded in the Elbistan Hospital and Suleyman Demirel University in Turkey. This study was designed to demonstrate our experience with mini-incision-technique in thyroidectomy. Results: Over the 2-year period, 37 patients underwent bilateral MITS procedures. The procedure made with a small (2.5 cm) anterior incision made above the isthmus. The final diagnoses were benign multinodular goitre (37%), follicular adenoma (28%) incidental carcinoma (11%), Hashimoto's thyroiditis (15%), Hurtle cell adenoma (5%), subacute thyroiditis (3%), residual thyroid-non carcinoma (2%), simple cyst (1%), diffuse hyperplasia (1%) and other (1%). Of the carcinomas, 80% were papillary thyroid cancer, 13% were follicular, and the remaining 7% were Hurtle cell carcinomas. We dont need to extend our incision in any cases. Two patients had temporary recurrent laryngeal nevre paresis and one patient had temporary hypocalcemia. Conclusions: It is not easy to demonstrate the advantages of MIT over conventional and video-assisted surgery. The main complications, such as nerve injury, hypoparathyroidism, or hemorrhage, are the same as in other surgical approaches. MIT has demonstrated advantages over conventional open approaches for both hemi- and total thyroidectomy and the benefits do not depend on the open or video-assisted approach. The anterior mini-incision approach can be performed with an operative time and postoperative complication profile equivalent to conventional thyroidectomy while providing excellent cosmesis with a 2 cm scar in both total thyroidectomy and lobectomies.

Keywords: Minimal invasive thyroid surgery, anterior mini insicion, thyriodectomy, thyroid disease

Introduction

Although the first thyroidectomy was performed in 1850, it did not become widespread and was forbidden due to high mortality rates and serious morbidity. Theodore Kocher was successful in reducing mortality and morbidity rates through the use of sensitive dissection and antisepsis techniques. Currently, centres with high numbers of patients report mortality rates close to zero and morbidity of 1% in thyroid surgery. Surgeons have focussed on excellent cosmesis, short hospitalisation and reduced postoperative pain. With these objectives, minimally invasive thyroidectomy techniques have been developed. However, there is currently no single accepted technique in minimally invasive thyroidectomy (MIT). This description includes open surgery with a midline or lateral approach, video-assisted with cervical or extra-cervical incision and endoscopic thyroidectomy techniques [1-5].

When MIT is planned, patients must be selected carefully with evaluation of the thyroid gland size and volume, the thyroid nodule size and histology. Most authors accept the limits of MIT as thyroid nodule of 4 cm, a malignant nodule of 2 cm diameter and thyroid volume of 30 cc [6]. Especially in patients with a thyroid history, such as parathyroid and nervus recurrens with restricted visualisation, haemorrhage and diffi-

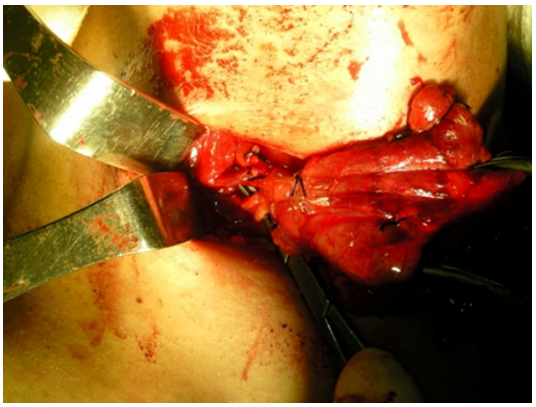

Figure 1. Critical view of N. Recurrens.

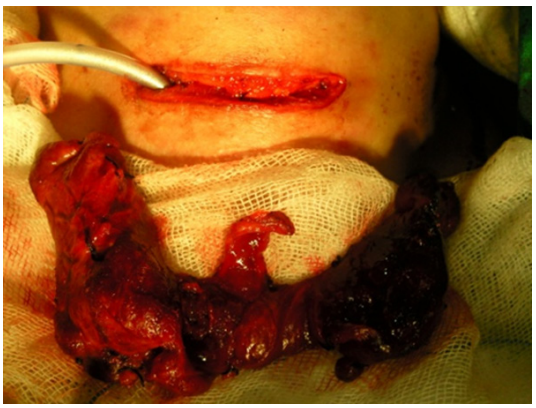

Figure 2. View of insicion.

cult dissection, standard thyroidectomy should always be considered. Other contra-indications for MIT are previous neck surgery, head-neck irradiation and palpable lymphadenopathy. MIT is particularly recommended for small diffuse goitre, Graves disease and low-risk thyroid papillary cancer.

Experienced thyroid surgeons performing thyroidectomy with an anterior incision shortening the classic Kocher incision by 2-3 cm or with a lateral incision, without the need for additional complex instruments with simple preparation and minimal costs have obtained better cosmetic results compared to open surgery [7-9]. This prospective study aimed to present the surgical results and benefits of anterior mini-incision thyroidectomy applied for a diagnosis of multi-nodular goitre.

Patients and methods

This was a prospective study. The study group comprised all patients undergoing MITS from its introduction in 2010 until July 2012. All data were prospectively recorded in the Elbistan State Hospital and Suleyman Demirel University by the same surgeon. The documented information included patient demographics, size and histology of thyroid nodules, specimen size and complications. All patients underwent routine pre- and postoperative laryngoscopy by an independent doctor.

The procedure started with a small (2.5 cm) anterior incision made above the isthmus. Myocutaneous flaps were not prepared. With sharp dissection initially and blunt dissection thereafter, the strap muscles on each side were retracted and the middle thyroid vein was divided. The skin incision was then moved in a cephalad direction and attention was directed to the upper pole, which was retracted laterally to open up the avascular plane. A clamp pulled the upper pole inferiorly and laterally, opening up the space between the cricothyroid muscle and the thyroid, where particular attention was paid to protect the external branch of the superior laryngeal nerve. In > 90% of cases, this allows the external branch of the superior laryngeal nerve to be identified. The vessels of the upper pole were cut and ligated selectively using sutures. At this point, the superior parathyroid gland could be easily observed, and the recurrent laryngeal nerve was indentified as it enters the larynx. The superior parathyroid was dissected gently away from the thyroid capsule on its vascular pedicle The next step was the mobilization of the inferior pole. The inferior parathyroid gland was specifically sought and protected. If necessary, the tracheal surface could be identified above and below the isthmus, which was then divided to maximize the mobility of the lobe. The dissection was completed between the lower and superior poles with direct vision of the recurrent laryngeal nerve in exactly the same manner as described for open thyroidectomy (**Figure 1**) [10]. The ligament of Berry was divided. Similar steps were followed for the opposite lobe; this dissection was much easier because half of the thyroid gland was lying outside the small incision (**Figure 2**). The skin incision was closed using subcuticular absorbable sutures.

Over the 2-year period, 37 patients underwent bilateral MITS procedures. The mean specimen size was 42.4 mm (range, 10-75 mm). The size of the tumour and the size of the thyroid tissue removed did not change significantly over the time period.

Table 1. Complications in patients who underwent minimally invasive thyroid surgery (MIT)

Temporary hypocalcaemia	1
Permanent hypoparathyroidism	0
Temporary RLN paresis	2
Permanent RLN palsy	0
Haematoma	0
Re-operation for bleeding	0
Wound infection	1

Figure 3. Keloid.

The final diagnoses were benign multinodular goitre (37%), follicular adenoma (28%) incidental carcinoma (11%), Hashimoto's thyroiditis (15%), Hurtle cell adenoma (5%), subacute thyroiditis (3%), residual thyroid-non carcinoma (2%), simple cyst (1%), diffuse hyperplasia (1%) and other (1%). Of the carcinomas, 80% were papillary thyroid cancer, 13% were follicular, and the remaining 7% were Hurtle cell carcinomas. There were incidental papillary microcarcinomas (< 10 mm), and for 4 of these, no further surgical intervention was undertaken. The complications are shown in **Table 1**.

Two patients had temporary recurrent laryngeal nevre paresis and one patient had temporary hypocalcaemia. One patient had a wound infection. Keloid scar has been detected in one patient after 3 month postaoperative (**Figure 3**).

Discussion

After the first complete endoscopic thyroidectomy was performed with serious complications in 1997 by Hurscher [11], known endoscopic and classic open techniques were combined with a small horizontal cervical incision for the application of minimally invasive video-assisted thyroidectomy (MIVAT) in 1998 [12, 13]. The pure endoscopic technique was later described with an axillary and clavicular border approach without an incision in the neck [14-16]. Following the description of a series of 31 cases of total endoscopic thyroidectomy with a breast approach applied by a Da Vinci Robot by Ohgami [17], robot-assisted endoscopic thyroidectomy using a gasless transaxillary approach [18] was applied. All these techniques have been applied to selected patients with determined indications (**Table 2**).

MIT is classified into 2 major categories based on whether a skin incision is made in the neck or away from the neck (**Table 3**).

The development of MIT techniques in nodular thyroid disease is still ongoing and as yet there is no consensus of superiority of one over the others. Low complication rates of the conventional thyroidectomy technique have been well-reported and new approaches should have similar or better postoperative morbidity rates. In this prospective study, the anterior mini-incision thyroidectomy which was applied to 37 cases is presented as a safe and applicable alternative to the conventional method with better cosmesis.

Of MIT techniques, the most frequently used are MIT with a neck incision and video-assisted transaxillary approach without a neck incision. In MIT with a neck incision, the aim is to achieve a better cosmetic result with a smaller incision and less postoperative pain [19]. In addition, it has come to the fore because the superior parathyroid gland and recurrent laryngeal are more safely protected with direct visualisation and there is the possibility of extending the incision according to need and the size of the thyroid gland, there is no need for additional equipment, with a shorter hospital stay no additional time or costs are incurred, there is a shorter recovery time and complication rates are similar to those of open thyroidectomy [20]. These factors have been shown in previous studies [21, 22]. The application of the video-assisted transaxillary approach is made diffiult by the need for a long learning curve, expensive endoscopic technology, additional staff, extended operating time and disposable instruments.

Table 2. Minimally Invasive Thyroidectomy

Indications	Contraindications
Size of thyroid nodule < 4 cm	History of thyroiditis
Thyroid volume of < 30 cc, small to med goitres	Large goitres
Thyroid cancer size of < 2 cm	Aggressive, high risk, poorly differentiated thyroid cancers, i.e., anaplastic, MTC
Low risk, well differentiated thyroid cancers	History of previous head/neck irradiation
Follicular neoplasm < 4 cm	History of previous neck surgery
Experienced thyroid surgeon	Presence of palpable lymphadenopathy

Table 3. Classification of the different minimally invasive thyroidectomy techniques

Incision in the neck	No incision in the neck
Complete endoscopic thyroidectomy with gas insufflation	Complete endoscopic thyroidectomy with gas insufflation
Anterior approach	Axillary approach
Lateral approach	Anterior approach
	Breast approach
	Bilateral axillo breast approach
	Axillo-bilateral breast approach
	Bilateral transaxillary approach
	Robot-assisted bilateral axillary breast approach
Video-assisted thyroidectomy without gas insufflation	Video-assisted thyroidectomy without gas insufflation
Anterior	Endoscopic axillary approach
Lateral	Robot-assisted axillary approach
	Robot-assisted bilateral transaxillary approach
	Anterior approach
Nonendoscopic minimally invasive thyroidectomy	Experimental approaches
Anterior approach	Transoral robotic-assisted approach
Lateral approach	Dorsal approach

That some patients require a longer operating time due to a large thyroid gland can also be included as a negative aspect of this technique [12, 13, 23, 24]. However, in patients with a known history of hypertrophic scar formation in the neck, endoscopic/robotic-assisted axillary and transmammary approach thyroidectomy may be selected to avoid this poor appearance [25].

Although the complication rates of our case series were similar to those in literature in respect of flap complications, we did not encounter any problems in the preparation of the flaps. Some aspects of minimally invasive thyroidectomy remain controversial. Although scar tissue does not form on the neck in transaxillary or transmammarian approaches, there is a wide dissection area, which is a reason for a longer postoperative hospital stay, more postoperative pain and complications. In addition, the operating time is longer. In the current case series, with thyroidectomy applied in an operating time comparable with conventional thyroidectomy, without a long postoperative hospitalisation period and with less dissection without creating a flap, results of lower postoperative pain and skin complications were obtained [26, 27].

In addition, both lobes can be reached at the same time from a midline approach, thus avoiding additional morbidity caused by an additional incision and time. The possibility of extending the same incision if required, removes the need for an incision in a different place. In other MIT techniques it is difficult to reach the contralateral lobe, especially of the upper pole. Although there are no long-term studies, removal of the thyroid from a long dissection line has the risk of seeding malignant cells [28].

It is not always easy to demonstrate the superiority of MIT over conventional surgery. In the

anterior approach in particular, the small dissection area and short incision increase the patient's comfort and satisfaction, especially on postoperative Day 1. In addition, scar tissue of less than 3 cm increases both patient satisfaction and that of the referring endocrinologist. Nevertheless, it is of great importance to use criteria determined by the clinic in patient selection [29-31].

Conclusion

Although there is no consensus on MIT techniques, which have attracted growing interest in recent years, patient and physician satisfaction of a high level can be obtained with careful patient selection. In the current series of MIT applied using an anterior mini-incision, the very low complication rates similar to those of conventional thyroidectomy and the satisfactory cosmesis obtained and high level of postoperative comfort make this a first choice not only compared to conventional thyroidectomy but also to other MIT techniques.

Disclosure of conflict of interest

None.

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