

Long-term cosmetic results after minimally invasive video-assisted thyroidectomy

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Abstract

Background Minimally invasive video-assisted thyroidectomy (MIVAT) has been performed in the authors' department since 2004. Many authors have described some of its advantages over conventional surgery in terms of cosmetic results. The published literature on this topic variously describes the average central incision as 1 to 3 cm. The end point of the cosmetic results (e.g. the question of keloids) cannot be documented during the inpatient stay. This report describes the long-term cosmetic results for this method and analyzes the subjective and objective outcomes after MIVAT.

Methods From January 2004 until March 2010, 116 patients underwent MIVAT in the authors' department. The authors included 96 patients in their subsequent examination, with a follow-up period of 22.4 months (range, 1–64 months).

Results The measurable cervical scar length was 1.9 cm (range, 1–3 cm). The measurable wideness of the cervical scar was 0.17 cm (range, 0.05–1.5 cm). Keloids in 10 female patients (10.4%) had diverse proliferation. Of the 116 patients, 93 (96.8%) were very satisfied or satisfied with the cosmetic result. The Patient Scar Assessment Scale score was 9.7, and of the Observer Scar Assessment Scale score was 8.1.

Conclusion In terms of long-term results, MIVAT appears to provide excellent cosmetic outcomes. The

problem with the development of keloids in the region of the cervical incision, especially in female patients, remains unresolved. The satisfaction of patients with the long-term outcome of MIVAT is high.

Keywords Cosmetic results · Long-term results · Minimally invasive video-assisted thyroidectomy

Minimally invasive video-assisted thyroidectomy (MIVAT) is the dominant minimally invasive surgery of the thyroid. The original papers on video-assisted thyroidectomy were published in 1998 and 1999 by Kazuo Shimizu. He termed his technique “video-assisted neck surgery” (VANS). His procedure reduced neck wounds to a minimum, using one 1.5-cm incision below the clavicle and two 0.5-cm incisions on the lateral part of neck [1, 2]. The operative scar is one of the most important aspects endocrine surgeons consider when performing thyroid surgery because the neck is always an exposed area.

The MIVAT procedure was introduced in 1998 and published in 2001 by Professor Miccoli [3] from the University of Pisa. It has advantages over conventional thyroidectomy in terms of postoperative pain and cosmetics [3–5]. The length of the cervical incision cannot be declared very precisely. The published literature on this topic describes the average length of the central incision variously as 1–3 cm [6–9]. Minimally invasive nonendoscopic thyroidectomy uses an incision 2.5–3 cm long and no endoscopic equipment [10].

We have no data on the quality of the cervical scar after healing, the long-term outcome for MIVAT, or the keloid rate. The keloid is an important argument used by supporters of cervical scarless thyroid surgery [11–13].

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The procedures developed for cervical scarless thyroid surgery show a wide spectrum of techniques. Some authors have described an access from outside the region about the throat via a chest, axillary, or combined axillary bilateral breast approach [11, 14, 15]. One evidence-based review described the extracervical approaches as not minimally invasive because they include extensive dissection of the chest and neck region [16]. The latest publications describe experimental and first clinical experiences with the totally transoral video-assisted thyroidectomy (TOVAT) [12, 17].

In the daily routine of the thyroid surgery, especially in Germany, with 120,000 thyroid operations per year, cervical scarless thyroid surgery plays a tangential role. The most common minimally invasive technique to date is MIVAT by Miccoli et al. [3] using endoscopic equipment.

This study aimed to acquire results from a longer follow-up investigation of the minimally invasive video-assisted technique and to check the validity of the hypothesis that the change in this procedure provides excellent cosmetic results. It also aimed to evaluate the benefit of this technique for patients in terms of subjective and objective factors.

Methods

Patients and study design

Between January 2004 and March 2010, 116 patients underwent surgery of thyroid using a minimally invasive video-assisted technique. The patients who met the inclusion criteria had thyroid nodules without any storage at the thyroid scintigraphy, thyroid cysts, or benign thyroid adenomas with local complaints. The maximum size of the thyroid nodules was 35 mm, and the maximum size for a lobe of the thyroid gland was 25 cm³ on preoperative thyroid sonography. The exclusion criteria ruled out patients with a larger goiter, recurrence after thyroid surgery, or preoperative evidence of a neoplasma.

We performed the first follow-up examination after the treatment of 94 patients in June 2009, with a follow-up period of 2–64 months. Between April 2009 and March 2010, 22 patients underwent this operative technique. We performed the second follow-up examination of these patients in April 2010. From January 2004 to March 2010, 96 patients were included in the study and followed up for 1–64 months. One patient died a natural death, and three patients underwent a conversion to open thyroid surgery. Nine patients had thyroid cancer. Two patients had a papillary microcarcinoma. Seven patients had thyroid cancer with an indication of lymphadenectomy.

We performed a second surgery using the conventional technique. The thyroid cancer was not in evidence before we performed the first minimally invasive surgery. Nine patients did not comply with the order for a follow-up examination and thus could not be used for further studies.

At the follow-up examination, we interviewed the patients, asking detailed questions about their current complaints and their satisfaction with the cosmetic result. We performed a physical examination using sonography of the thyroid and scar assessment. The physical examination was performed to assess the recurrent goiter and the patients' complications. The aim of the sonographic examination was to locate the goiter.

Laboratory testing of blood samples from the patients evaluated the hormone level of the thyroid (thyroid-stimulating hormone [TSH], fT3, fT4) and the calcium level of the blood serum. The laboratory testing evaluated whether the patients had sufficient medicamentous hormone substitution for euthyrosis. Euthyrosis is a foundation for subjective assessment of patients.

Surgical technique

The goiter was repaired using minimally invasive video-assisted technique. A laryngoscopy was performed preoperatively. All the operations were performed with the patient under general anesthesia. For perioperative antibiotic prophylaxis, we used cefuroxime 1.5 g administered intravenously. For perioperative prophylaxis against thrombosis, we applied heparin (Clexane).

The surgery was performed by two general surgeons using a small retractor (Condor; GmbH Medicaltechnik, Salzkotten, Germany) or a second assistant. A 5-mm laryngoscope (Karl Storz GmbH & Co. KG, Tuttlingen, Germany) was used. The standard incision length was 2 cm. For preparation and vessel sealing, a 5-mm ultrasonic scalpel (CS14; Ethicon Endosurgery, Johnson & Johnson, Cincinnati, OH, USA) was used.

The next step was division of the isthmus. The gland was separated from the trachea, followed by division of the adjacent lamella and the vessels of the upper pole. The recurrence nerve then was visualized under the adjacent lamella. Neuromonitoring was performed using a needle electrode (Neurosign; Inomed Medizintechnik GmbH, Emmendingen, Germany). The parathyroid glands were detected. Finally, the lower pole was detached.

We recovered the gland through the incision and placed a drain for about 24 h, then closed the wound with an absorbable suture (Dexon 4x0, Dexon; B. Braun Melsungen AG, Germany). The serum calcium level was determined on postoperative day 2. A laryngoscopy was performed postoperatively.

Scar analysis

Scar assessment with measurement of cervical scar length and cervical scar wideness was performed, and patient satisfaction was assessed. Additionally, we evaluated the height of the scar in relation to the level of the skin. Analysis was performed using a digital photo of the scar. The Patient and Observer Scar Assessment Scale (POSAS) was used as a second objective assessment tool. The POSAS is a complete scar evaluation tool developed by plastic surgeons (Table 1) [18].

The POSAS consists of two numeric scales. The first part is the Observer Scar Assessment Scale (OSAS), and the second part is the patient-directed Patient Scar Assessment Scale (PSAS). The OSAS score includes five domains, each graded on a 10-point scale ranging from 1 (normal skin) to 10 (worst scar result). The best summary score has 5 points, and the worst possible scar result has 50 points. The PSAS has 6 domains with the same 10-point scale. A summary score of 6 points indicates the best scar result, and 60 points indicates the worst result.

As a second part of the study, we performed a patient interview at the follow-up examination asking detailed questions about current complaints and the patient's satisfaction with the cosmetic result. The following questions were posed:

1. Do you have any postoperative wound-healing complications?
2. Do you have a keloid?
3. Do you have any complaints about the scar area now?
4. Do you have any difficulties swallowing?

5. Do you have a feeling of pressure in the scar area?
6. Do you cover the cervical scar?
7. Do you have any complaints regarding the thyroid surgery or medication?
8. Are you satisfied with the surgery result?

Questions 1–7 could be answered with “yes” or “no.” The scale for answering question 8 was 1 (very satisfied), 2 (satisfied), 3 (unsatisfied), or 4 (very unsatisfied).

Statistical analysis

The statistical analysis was performed using the Microsoft Office Access database. The results were stated as medians and ranges.

Results

The study enrolled 116 patients including 105 women (90.5%) and 11 men (9.5%) with an average age of 48.8 years (range, 19–80 years). Their demographic and perioperative data are reported in Table 2. The MIVAT operations included 14 total thyroidectomies, 22 nearly total thyroidectomies (Dunhill procedure), and 80 lobectomies. The mean operating time was 99 min (range, 50–200 min) for the lobectomies, and 134 min (range, 55–210 min) for the nearly total or total thyroidectomies.

We performed a contemporary revision for postoperative hemorrhage in five cases (4.3%). The locations of the bleeding were paratracheal or muscular. Early postoperative complications involved wound seromas in five cases

Table 1 Patient and observer scar assessment results

Observer scar assessment scale (OSAS)											
	1	2	3	4	5	6	7	8	9	10	
Normal skin											Worst scar imaginable
Vascularization	○	○	○	○	○	○	○	○	○	○	
Pigmentation	○	○	○	○	○	○	○	○	○	○	
Thickness	○	○	○	○	○	○	○	○	○	○	
Relief	○	○	○	○	○	○	○	○	○	○	
Pliability	○	○	○	○	○	○	○	○	○	○	
OSAS summary score (minimum 5; maximum 50)											
Patient Scar Assessment Scale (PSAS)											
	1	2	3	4	5	6	7	8	9	10	
No complaints											Yes, worst imaginable
Is the scar painful?	○	○	○	○	○	○	○	○	○	○	
Is the scar itching?	○	○	○	○	○	○	○	○	○	○	
No, as normal skin											Yes, very different
Is the color of the scar different?	○	○	○	○	○	○	○	○	○	○	
Is the scar stiffer?	○	○	○	○	○	○	○	○	○	○	
Is the thickness of the scar different?	○	○	○	○	○	○	○	○	○	○	
Is the scar irregular?	○	○	○	○	○	○	○	○	○	○	
PSAS total score (minimum 6; maximum 60)											

Table 2 Demographic data

Male:Female ratio	1:105	1/9.5
Mean age: years (range)	48.8	(19–80)
Mean operating time (one side): min (range)	99	(50–200)
Mean operating time (both sides): min (range)	143	(55–210)
Mean postoperative follow-up: months (range)	22.4	(1–64)

(4.3%), which were treated using nonoperative therapy. Another early postoperative complication was transient monolateral recurrent nerve palsy, diagnosed in three cases (2.6%). The patients in all three cases had a positive sign on intraoperative neuromonitoring. Mild hypoparathyroidism (serum calcium, 2.00–2.19 mmol/l vs. normal serum calcium, 2.2–2.5 mmol/l) was exhibited by 42 patients and moderate hypoparathyroidism (serum calcium, 1.80–1.99 mmol/l) by 4 patients. The latter patients were asymptomatic. Two patients manifested severe hypoparathyroidism (serum calcium, ≤ 1.79) with symptoms.

Our follow-up examination included 96 patients. The mean follow-up period was 22.4 months (range, 1–64 months). One patient died a natural death, and three patients had a conversion to open thyroid surgery. Nine patients had thyroid cancer. Two patients had a papillary microcarcinoma, and seven patients had thyroid cancer with an indication for lymphadenectomy. We performed a second surgery using the conventional technique.

The scar results from MIVAT and the summary scores for the POSAS are depicted in Table 3. The postoperative scar length after a standard 2-cm incision was 1.9 cm (range, 1–3 cm) (Fig. 1). The postoperative scar width was 1.7 mm (range, 0.5–15 mm). The scar with a width of 15 mm was experienced by a woman with a keloid and wideness scar extension (Fig. 2). The results of POSAS included both OSAS and PSAS components. The score of the OSAS was 8.1 (range, 5–23), and the score of the PSAS was 9.7 (range, 6–37).

The patient interview in our further examination allowed multiple designations. The results of the patient interview showed that nine patients (9.3%) reported postoperative wound-healing complications. Five patients had a prolonged swelling of the wound, and four patients had a postoperative wound seroma. Ten women with an average age of 38 years (10.4% of all the MIVAT-patients) had a keloid. Only five of these women reported traction of the scar or a feeling of pressure. The keloid in these patients had length of 1.7 cm (range, 1.2–2.3 cm) and a width of 3 mm (range, 1–15 mm).

Occasional problems with the scar area were reported by 18 patients (18.7%). These problems included pruritus, pulling pain, swelling, meteoropathy, and the feeling of a lump in the throat.

Table 3 Patient and observer scar assessment results

Scar length (mm)	19 (10–30)
Scar width (mm)	1.7 (0.5–15)
POSAS score ^a	
OSAS	8.1 (5–23)
PSAS	9.7 (6–37)
Overall patient satisfaction ^b	1.3 (1–3)

^a Patient and observer scar assessment scale (POSAS) broken down into OSAS (observer scar assessment scale) and PSAS (patient scar assessment scale) domain scores. For the OSAS, a score of 5 indicates normal skin, the best possible result, and a score of 50 indicates the worst possible result. For the PSAS, a score of 6 indicates normal skin, the best possible result, and a score of 60 indicates the worst possible result

^b Overall patient satisfaction is the result of a patient interview about current complaints with detailed questions at the time of the follow-up examination and about satisfaction with the cosmetic result. The scale used to answer was 1 (very satisfied), 2 (satisfied), 3 (not satisfied), and 4 (very dissatisfied)



Fig. 1 Female patient after minimally invasive video-assisted thyroidectomy (MIVAT) with a postoperative scar length of 1.9 cm. The scar length after a standard incision was 2 cm

Difficulties swallowing were experienced rarely or sometimes by 16 patients (16.6%), and 14 patients (14.6%) had a feeling of pressure in the scar area. Five women (5.2% of all the patients) covered the cervical scar. Problems related to thyroid surgery or thyroid medication were reported by 44 patients (45.8%). Their complaints included fatigue, unrest, rapid heartbeat, obstipation, and a gain in weight.

Overall patient satisfaction according to the patient interview at the follow-up examination with detailed questions about current complaints and satisfaction with the cosmetic result showed that 73 patients (76%) were very satisfied, 20 patients (20.8%) were satisfied, and 3 patients (3.1%) were not satisfied with the surgery and the cosmetic result. No patient was very dissatisfied with the



Fig. 2 Female patient with a keloid after minimally invasive video-assisted thyroidectomy (MIVAT) and a scar extension width of 15 mm

result. The analysis rated overall patient satisfaction at 1.3 points (range, 1–3).

The laboratory test in the further examination showed that eight patients (8.4%) had compensated hypothyroidism. The laboratory measurement of their TSH was 4.02–19.04 mIU/l (normal, 0.3–4.0 mIU/l). Seven of these patients had insufficient hormone substitution. Only the remaining patient was without any medicamentous hormone substitution.

The sonographic examination detected six patients with a thyroid cyst, size 1–3-mm, in the thyroid lobe we left. One of these patients had pathologic TSH. No patients had an enlargement of the thyroid gland. Definitive monolateral recurrent nerve palsy was evident in two cases (1.7%).

Discussion

Our study analyzed the long-term results of the MIVAT as the dominant procedure of minimally invasive thyroid surgery. The important criteria of the analysis were scar assessment outcomes and patient satisfaction. Multiple studies report increased patient satisfaction with scar appearance after a minimally invasive video-assisted technique [3, 19]. The advantages of MIVAT over conventional thyroidectomy are described in terms of postoperative pain and cosmetic results [3, 4, 19].

The findings of some studies are in contrast to the mentioned literature. For example, O’Connell et al. [20] showed no significant difference for virtually any parameters of scar analysis between minimal and conventional access surgery using validated tools for scar assessment. Böhm et al. [21] described his long-term cosmetic results after conventional thyroid resection as good or excellent

and indicated that it seems difficult to improve the results by minimally invasive techniques.

It seems that many factors have an influence on scar results. An advantage of minimally invasive video-assisted surgery is the minimal access. However, the published literature on this topic describes the cervical incision length variously as 1 to 3 cm [6–9]. Minimally invasive nonendoscopic thyroidectomy also uses an incision of 2.5–3 cm, and the smallest scar of conventional surgery also is 3 cm [10, 21]. The surgeons who operate with a 3-cm incision scar usually adapt the minimally invasive video-assisted technique to the conventional technique. This fact makes a shorter surgery time possible. We used a standard incision length of 2 cm.

Another fact is the time at which the postsurgery examination is performed. The cellular processes that underlie scar remodeling are most active during the first 6 months after the creation of a wound. The scar analysis needs a long-term follow-up period because the healing and remodeling process is a long procedure [22]. O’Connell et al. [20] used 8 months as the minimal postoperative follow-up period for formal scar analysis. Böhm et al. [21] performed the subsequent examination with a follow-up period of 18 months. In our study, the average follow-up period was 22.4 months (range, 1–64 months). Miccoli et al. [3] used a nonvalidated verbal response scale and a numeric scale to assess cosmetic results 1 month after surgery. Bellantone et al. [19] asked patients to rate their overall satisfaction with their scar using a nonvalidated 10-point scale 3 and 6 months after surgery.

Assessment of the scar with a minimal follow-up period of 1 month after surgery or generally during the first 6 months after surgery has a possible default for the reviewer because the scars are actively remodeling. The scars do not have their final appearance at this time.

The POSAS is a validated tool for complete scar assessment developed by plastic surgeons [18]. The advantage of POSAS is that its complete scar assessment is suitable and reliable. The POSAS is used by plastic surgeons and surgeons performing otolaryngology and head and neck surgery [18, 20].

The disadvantage of the studies evaluating the POSAS is the small number of patients ($n = 20$ – 22). The OSAS score of 8.1 was better than the PSAS score of 9.7 points. The PSAS score in our study was comparable with the results for minimal access parathyroidectomy in the Canadian study, which reached 9.1 points. The mean scar length of the minimal access in the Canadian study was 33 mm. The scar with a mean length of 75 mm and a PSAS score of 7.4 points for conventional access thyroidectomy and parathyroidectomy in the Canadian study was better than our study result for MIVAT [20]. The OSAS score of 8.1 points in our study was better than the Canadian study

score, which reached 10.1 points for minimal access surgery and 9.9 points for conventional access surgery [20].

In their conclusion, O'Connell et al. [20] reported that a validated assessment scale used to examine overall patient satisfaction and long-term scar cosmetic results showed no cosmetic advantage of the minimal access techniques over the conventional access techniques. Böhm et al. [21] reached the same conclusion. Their study examining the long-term scar cosmesis after conventional access thyroid surgery showed a median scar length of 41 mm. They rated their long-term cosmetic results after conventional thyroid resection as good or excellent, indicating that it seemed difficult to improve on the results by using minimally invasive techniques.

Our very good results with MIVAT rated by the OSAS at 8.1 points and by the PSAS 9.7 points are to be regarded in the context of the very good overall patient satisfaction. This context shows that 73 patients (76%) were very satisfied, 20 patients (20.8%) were satisfied, and 3 (3.1%) patients were not satisfied with the surgery and cosmetic results. No patient was very dissatisfied with the results. The analysis of overall patient satisfaction resulted in 1.3 points (range, 1–3 points) on a 4-point scale. The Canadian study reported its best overall patient satisfaction with the conventional technique at 1.1 points compared with 2.1 points for the minimal access technique on a 10-point scale [20].

A problem with MIVAT is the occurrence of keloids in the long-term cosmesis, which is an important argument of those supporting cervical scarless thyroid surgery [11–13]. The primary risk factor for keloids is darkly pigmented skin. Black, Hispanic and Asian individuals are far more likely to experience keloids than white persons [23]. Keloids contain excessive quantities of collagen, fibronectin, and chondroitin sulfate. The increased risk for keloids reflects a racially specific response of skin fibroblasts, whose abnormal growth factor production and responsiveness are expressed as keloids [24, 25]. Keloids are more common among persons younger than 30 years with elevated hormone levels and throat or sternal skin wounds [23]. The cervical incision by the MIVAT procedure is susceptible to the development of keloids.

In our study, 10 white female patients (10.4% of all the MIVAT patients) experienced a keloid. The average age of these patients was 38 years. Only five of these women reported traction of the scar or a feeling of pressure. The long-term cosmetic results of conventional thyroid surgery showed 4.1% patients with a keloid [21].

Another problem is the ambulatory treatment of patients after thyroid surgery. The laboratory test in the further examination showed that eight patients (8.4%) had compensated hypothyroidism. Seven of these patients had an insufficient hormone substitution, and only the

remaining patient was without a medicamentous hormone substitution.

The patient interview at the follow-up examination with detailed questions about current complaints showed that 18 patients (18.7%) sometimes had problems with the scar area and that 44 patients (45.8%) had various complaints regarding the thyroid surgery or the thyroid medication. These problems were not reflected in the very good overall patient satisfaction with MIVAT results.

Conclusion

The current study represents the first attempt to use validated assessment scales to examine overall patient satisfaction and the long-term cosmesis of patients undergoing MIVAT. The assessment after MIVAT showed very good overall patient satisfaction and very good results, with a postoperative scar length of 1.9 cm after a standard incision length of 2 cm. The problem of keloid development in the region of the cervical incision, especially for female patients, remains unresolved.

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