

Morbidity from minimally invasive video-assisted thyroidectomy: a general review

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Abstract: Minimally invasive video-assisted thyroidectomy (MIVAT) is known and used worldwide, it combines the advantages associated with endoscopic magnification with those due with traditional surgery. In selected patients, it should be considered a safe and valid alternative. Indeed, a lot of comparative studies have demonstrated the advantages of MIVAT in terms of low rate of complications, reduced postoperative pain, improved cosmetic results and higher patient satisfaction over traditional surgery. Anyway, for obtaining the best results, with similar or even less complication rate than traditional surgery, surgeons should be well trained, acquired confidence with a smaller surgical incision and with the use of endoscopic instruments.

Keywords: Minimally invasive video-assisted thyroidectomy (MIVAT); thyroidectomy; complications rate; cosmetic results

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Minimally invasive video-assisted thyroidectomy (MIVAT) was first described in 1998, and over the past two decades represents an evolution and a valid alternative to the conventional thyroidectomy technique (1,2). Its minimally invasive nature offers advantages over its conventional counterpart, by combining the benefits related to the endoscopic magnification with those due to its close similarity with traditional surgery. This completely gasless procedure is based on the same steps of the standard operation. The same intervention can be performed through a very minimal skin incision thanks to the use of the endoscope (2-5). The excellent visualization, due to the 2- to 3-fold endoscopic magnification, allows an easy and prompt identification of all anatomical structures. Ever since its introduction, MIVAT has been progressively evolving. Endoscopic thyroid surgery too requires an adequate knowledge of anatomy and a good experience in endocrine surgery. For a surgeon who approaches the

MIVAT technique, the learning curve takes a longer time than with conventional surgery, having to gain confidence with a smaller surgical incision and with the use of endoscopic instruments (6).

In order to obtain the best results, surgeons who perform this intervention, or even interventions with a lower complication rate than the conventional technique, should be well trained (6).

In our experience, 10 patients represent the early stage of the learning process, 30 patients are the minimal number of cases in order to move on to a higher level, and performing at least 100 times the same procedure allows a reduction of the complication rate (7).

In fact, the operative time for MIVAT decreases gradually as the surgeon's degree of experience increases (7). Since the time MIVAT was described, the technique has been adopted worldwide, and its indications expanded from the initial benign thyroid disease to low-risk and intermediate-

risk carcinoma, demonstrating a level of oncologic radicality comparable to that of the conventional technique. For a long time, the indications for MIVAT remained almost unchanged; however, over the years it has been found that some changes could be made in order to broaden the range of patients eligible for this technique.

With respect to the main works available in the literature (8-10), the main changes concern the length of the surgical incision (increased to 3–3.5 cm); other works mention also the underlying disease, the size of the nodules, and the overall volume of the thyroid gland (10,11).

Furthermore, the minimally invasive nature of the technique has not compromised its ability to accomplish its purpose both safely and effectively.

In order to ensure the success of a minimally invasive video-assisted approach, an accurate selection of the patients is important; however even minimally invasive surgery is not free from complications, which are the same as those at risk with traditional surgery. Therefore, they include major complications, such as permanent recurrent laryngeal nerve (RLN) dysfunction and expanding hematoma, while minor complications include temporary RLN dysfunction, temporary hypocalcemia, temporary superior laryngeal nerve dysfunction, cellulitis, nonsurgical hematoma, seroma, postoperative pain and hypertrophic scar. Although thyroid surgery is associated with significant complications, according to many studies their frequency has gradually decreased over the past century. Duke *et al.* (12) suggest that MIVAT is associated with fewer overall complications than conventional thyroidectomy because MIVAT is not appropriate for all patients. Patients for MIVAT are carefully selected; they tend to be younger and generally have normal-sized glands with small nodules, and no thyroiditis nor invasive cancer.

In the meta-analysis by Pisanu *et al.* (13), nine randomized prospective studies were included in the quantitative analysis, comparing the MIVAT technique with conventional surgery (CT). The primary outcome measures that were evaluated comprised the overall morbidity prevalence, transient and permanent RLN paralysis, transient hypocalcemia, the presence of postoperative hematoma, and infection of the surgical wound. The study clearly showed that there were no statistically significant differences between the two techniques; however, this result may be considered in favor of MIVAT, because despite the small surgical incision, thanks to the endoscope it allows an effective visualization of all anatomical structures, faithfully replicating all the steps of conventional surgery (6,14-16).

One of the early results in favor of the MIVAT technique is the randomized prospective study we published in 2008 (7). Our data show a reduced incidence in early voice and swallowing post-surgical problems among patients who undergo MIVAT. The smaller surgical trauma allowed by MIVAT accounts for this more positive outcome.

Recently, Miccoli *et al.* (17) showed that the rate of complications involving the RLN is substantially similar to that already described in the literature; however, the study indicates that in tertiary referral centers, the incidence may prove slightly higher because of the large number of patients who undergo MIVAT, and of the frequently malignant nature of the underlying disease. Paradoxically, the use of advanced surgical instruments might further increase such rate, for instance due to heat transmission caused by the ultrasound scalpel that some surgeons use for coagulating and dividing vessels.

With regard to the incidence of hypoparathyroidism, causing hypocalcemia, the data found in the literature are discordant. However, Del Rio *et al.* (18) observed that the risk of postoperative hypocalcemia and the intraoperative identification of the parathyroid glands are more favourable than with conventional thyroidectomy, with a 7.58% rate of clinically symptomatic hypocalcemia.

The study by Neidich *et al.* (19) focuses on malignancy, finding remarkable differences between permanent and transient hypocalcemia and hypoparathyroidism. No case of permanent damage is reported, whereas the rate of transient complications recorded is, in fact, 10.7% for hypocalcemia and 25% for hypoparathyroidism. A further point of view can be found in the 2004 work by Miccoli *et al.* (20), which analyzed a cohort of 572 patients, recording a hypoparathyroidism rate of 0.2%, comparable to that of conventional surgery.

This is likely due to several factors. First, the enhanced visualization afforded by the endoscope aids in the early detection of the superior parathyroid glands. Second, the absence of thyroiditis in these patients may also contribute to the accurate detection of the parathyroid glands, and facilitate their dissection from the thyroid gland, without compromising their vascular supply. By means of two well-designed randomized trials (level II B), Gal *et al.* (14) and El Labban (21) reached the same conclusions. The studies show that the complication rate with the two approaches is similar, and that although conventional thyroidectomy involves a shorter operative time, the benefits of MIVAT are less scarring and more satisfactory cosmetic results, and reduced postoperative distress. Several comparative studies

Table 1 Summary of the major findings of our paper

Study	Transient laryngeal nerve palsy (%)	Permanent laryngeal nerve palsy (%)	Transient hypocalcemia (%)	Permanent Hypocalcemia (%)
Lombardi <i>et al.</i> , 2005 (15)	–	–	2/20 (10%)	–
El-Labban <i>et al.</i> , 2009 (21)	2/38 (5.3%)	1/38 (2.6%)	–	–
Del Rio <i>et al.</i> , 2010 (18)	12/497 (2.4%)	4/497 (0.8%)	–	1/497 (0.2%)
Neidich <i>et al.</i> , 2012 (19)	1/28 (3.6%)	0	7/28 (25%)	0
Zheng <i>et al.</i> , 2015 (24)	6/200 (3%)	1/200 (0.5%)	7/200 (3.5%)	–
Duke <i>et al.</i> , 2015 (12)	10/260 (3.9%)	0	6/260 (2.3%)	0

**Figure 1** Cosmetic's result 1 year after surgery.

showed that MIVAT offers some significant advantages over conventional surgery, mainly in terms of improved cosmetic result and reduced post-operative pain, with no additional morbidity (6,22). A prospective randomized study by Miccoli *et al.* (23) confirmed the most favourable postoperative outcome of MIVAT through the dosage of different biochemical pain mediators, before and after surgery. The authors reported that VAS scores were significantly higher in the open group, whereas TGF- β and MCP-1 levels were found to be significantly lower in the open group than in the MIVAT group (23). Also, Zheng *et al.* (24) demonstrated that MIVAT entails a lower degree of immunosuppression, by minimizing the trauma (Table 1).

The literature seems consistent with a better postoperative outcome of MIVAT (17). In particular, during the whole postoperative period, it has been found that patients take less pain medications. For patients who

undergo conventional surgery, the trauma, edema, the size of the surgical wound, represent some of the main causes of postoperative pain; this clearly represents an advantage of MIVAT (15,17). It is also obvious that from an aesthetic point of view, the patient prefers a smaller surgical incision (MIVAT 2–2.5 cm *vs.* CT 5–6 cm) (14) (Figure 1).

The less traumatic approach could also give reason for the reduced wound infection rate after MIVAT (6), and even the incidence of post-operative hematoma seems to be low. Actually, hematoma was never recorded in any of nine prospective randomized trials included in the meta-analysis by Pisanu (13). A precise selection of patients plays a significant role in ensuring the success of minimally invasive video-assisted approaches. At present, in selected cases and in experienced centers, MIVAT can be considered the standard treatment, having proven to be a feasible, practical, safe and effective surgical option. Its outcome equals that of conventional thyroidectomy, but with better cosmetic results.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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