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# Minimally Invasive Video-Assisted Thyroidectomy for Treatment of Benign Solitary Thyroid Nodules in Pediatric Patients

**Jason Durel, MD, Evelyn Kluka, MD, Rohan R. Walvekar, MD**

*Department of Otolaryngology Head & Neck Surgery, Louisiana State University Health Sciences Center and Children's Hospital, New Orleans, LA*

## ABSTRACT

**Objective:** To review our experience with minimally invasive video-assisted thyroid (MIVAT) surgery for solitary thyroid nodules in the pediatric population.

**Study Design:** Case series.

**Methods:** A chart review of pediatric patients with a solitary thyroid nodule who underwent a MIVAT procedure from July 2008 to December 2009. Eligible patients had a solitary thyroid nodule less than 3.5 cm. Endpoints of the study included completion of the procedure, an assessment of related complications, and subjective patient satisfaction with respect to cosmesis.

**Results:** Two female patients (ages 12 and 17) underwent a MIVAT for right-sided solitary thyroid nodules (2.1 cm and 3.3 cm, respectively). Technical success was 100% with no conversions to open thyroidectomy. The operative times were 180 minutes and 150 minutes, respectively. Pathology was benign in both cases (follicular adenoma and nodular hyperplasia, respectively). Neither patient had a surgical drain placed, and both were discharged home after a 23-hour observation. A postoperative flexible laryngoscopy confirmed bilateral vocal cord mobility. There were no major complications, and the patients and parents were satisfied with the cosmesis.

**Conclusion:** MIVAT is a feasible and safe option for the management of solitary thyroid nodules in children.

*Address correspondence to*
*Rohan R. Walvekar, MD*
*Assistant Professor*
*LSU Health Sciences Center*
*Department of Otolaryngology Head & Neck Surgery*
*533 Bolivar Street, Suite 566*
*New Orleans, LA 70112*
*Tel: (504) 568-4785*
*Fax: (504) 568-4460*
*Email: rwalve@lsuhsc.edu*

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## INTRODUCTION

Thyroid nodules seldom occur in children, with an incidence on physical examination of 1% to 1.5%. Although rare, these nodules carry a fourfold greater risk of harboring malignancy than their adult counterparts.[1] The management of thyroid nodules in children is very similar to that in adults. Definitive management of such lesions is generally considered to be surgical removal of the thyroid gland. In recent years, there has been a move toward the use of minimally invasive surgical approaches for removal of thyroid lesions. Minimally invasive video-assisted thyroidectomy (MIVAT) is possibly the most common minimal access thyroid surgery performed in the United States. Multiple studies in the adult population have documented its safety and efficacy.[2-8] However, its use in pediatric patients is underreported. Our literature review revealed only 1 study specifically discussing the MIVAT approach in pediatric patients.[4] Consequently, we report our experience with MIVAT for the treatment of solitary thyroid nodules in our pediatric population.

## METHODS

We retrospectively reviewed charts of pediatric patients with solitary thyroid nodule who underwent a MIVAT procedure from July 1, 2008, to December 1, 2009, at the Department of Otolaryngology Head & Neck Surgery, Louisiana State University Health Sciences Center and Children's Hospital of New Orleans, New Orleans, LA. Our institutional review board exempted the study from review given the limited patients in our series. Patients considered eligible for a MIVAT procedure had solitary thyroid nodules less than 3.5 cm and fulfilled eligibility criteria as recommended for the procedure in adult patients and in the 1 study by Spinelli et al[4] reporting results in pediatric patients. Informed consent was obtained for a MIVAT approach for removal of the thyroid mass with a possible need for conversion to an open procedure. All patients were followed up for at least 3 months. Endpoints of our study included technical success defined as completion of the procedure, an assessment of related complications (recurrent laryngeal nerve paresis or palsy, ability to identify and

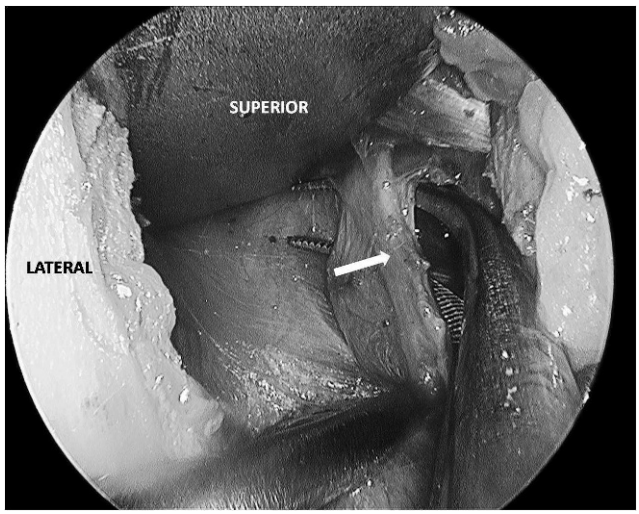


**Figure 1. Endoscopic view of superior pole vessels displayed during a right hemithyroidectomy using a 5-mm, 30-degree laparoscope (white arrow points to the superior pole vessels).**

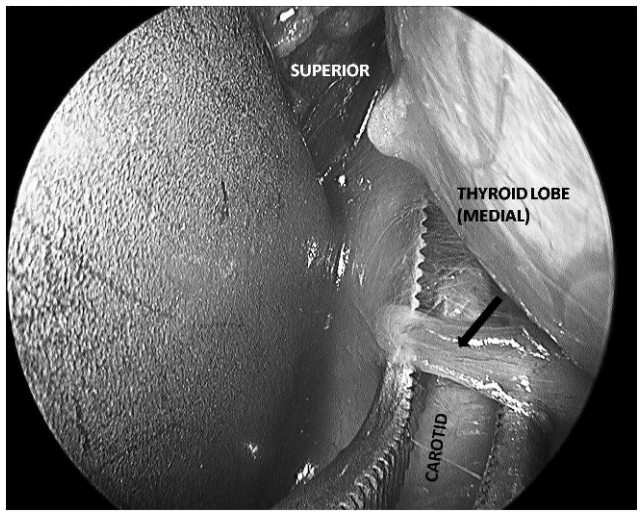


**Figure 2. Endoscopic view displaying the middle thyroid vein during a right hemithyroidectomy using a 5-mm, 30-degree laparoscope (black arrow points to the middle thyroid vein).**

preserve parathyroid glands, postoperative hypocalcemia, postoperative hematoma, and wound infection or dehiscence), and also an assessment of subjective patient satisfaction with respect to cosmesis at follow-up. Specific questions asked by telephone and in follow-up included the subjective satisfaction with respect to (1) the appearance of the scar to patients and (2) the overall surgical experience for pain and recovery from surgery.

## Surgical Procedure

The surgical procedure can be divided into an open and an endoscopic component. The patient is positioned supine with slight neck extension. The open component consists of a 20-mm horizontal cervical incision in a cervical crease usually about a fingerbreadth below the lower edge of the cricoid cartilage. The incision is carried through the skin and subcutaneous tissue to the superficial glistening layer of the deep cervical fascia. Neck flaps are not raised. This is followed by identification and vertical dissection of the strap muscles at the median raphe. With blunt dissection, a surgical space is obtained between the thyroid gland and the sternothyroid muscle. This marks the beginning of the endoscopic portion of the procedure. With a 30-degree, 5-mm laparoscope bevel down, the superior pole is visualized. The first assistant holds and maneuvers the endoscope, and a second assistant provides measured traction to create the surgical space for endoscopic release of the superior pole vessels and attachment (Figure 1) as well as the lateral attachments, including the middle thyroid vein, while identifying the superior parathyroid glands (Figure 2). The endoscope is then directed inferiorly, and the inferior pole of the thyroid gland is retracted superiorly with a blunt instrument to facilitate an endoscopic identification and dissection of the recurrent laryngeal nerve while also identifying and preserving the inferior parathyroid glands. Once the nerve is identified and dissected, the rest of the operation can be performed as an open procedure with surgical loupes and use of the endoscope as needed. The released thyroid gland can be now delivered via the 2-cm incision, which often stretches temporarily to 2.5 cm by the end of the procedure. Once the gland is delivered, surgical closure can be performed with a single figure eight stitch to approximate the strap muscles. We routinely use 4-0 polyglactin 910 for deep stitches to approximate the skin edges. The skin can be approximated with a subcuticular stitch or surgical adhesive glue (eg, DERMABOND, Ethicon, Inc., Somerville, NJ). Surgical dissection, release of connective tissue, and division of vessel pedicles are performed with the Harmonic ACE device (Ethicon Endo-Surgery, Cincinnati, OH).

## RESULTS

We identified 2 patients who underwent MIVAT for the treatment of a solitary thyroid nodule.

### Patient 1

A 12-year-old girl presented with an asymptomatic thyroid mass present for approximately 1 year. Prior to presentation to our clinic, the patient had undergone 2 ultrasound examinations demonstrating a stable mixed mass with solid and cystic components in the right thyroid lobe measuring $2.1 \times 1.3 \times 0.8$ cm. Fine needle aspiration biopsy (FNAB) revealed that the

mass had the histology of a follicular adenoma. Thyroid function ($T_3$, $T_4$, and thyroid-stimulating hormone [TSH]) was within normal limits.

### Patient 2

A 17-year-old girl presented with an asymptomatic right thyroid mass noted 2 years prior to presentation on routine physical examination by a school nurse. Ultrasound examination revealed a large cystic nodule in the right thyroid lobe measuring 3.3 × 1.5 cm. FNAB was inconclusive with innumerable histiocytes and no evidence of malignancy. Thyroid function ($T_3$, $T_4$, and TSH) was within normal limits as well.

### Surgical Data

Both patients underwent a right hemithyroidectomy using the MIVAT approach. The length of the incision was 2.0 cm (2.1 and 3.3 cm nodules) (Figure 3). The 5-mm, 30-degree laparoscope provided excellent visualization of key structures, such as the superior pole vessels, middle thyroid vein, and inferior pole vessels. Recurrent laryngeal nerve and parathyroid glands were identified. The operative times for each case were 180 minutes (2.1 cm nodule) and 150 minutes (3.3 cm nodule), respectively. Final pathology was follicular adenoma (12-year-old patient with 2.1-cm nodule) and nodular hyperplasia (17-year-old patient with 3.3-cm nodule).

### Complications Data

No major complications, such as recurrent laryngeal nerve injury or postoperative hypocalcemia were seen, nor were there any incidences of postoperative infection, wound dehiscence, or hematoma. Both patients were discharged home on postoperative day 1.

### Patient Satisfaction and Cosmesis

The patients were seen in follow-up at 2 and 6 weeks postoperatively and then were contacted at 3 months by telephone. Patients and parents were extremely satisfied with the cosmetic result at postoperative follow-up visits and with the overall surgical experience.

## DISCUSSION

The use of an endoscopic approach and laparoscopic techniques to surgery in the neck, specifically in thyroidectomy, has been slow but is becoming an accepted alternative to traditional open thyroidectomy. A number of minimally invasive approaches to the thyroid have been proposed, varying from true endoscopic approaches with distant surgical port placements and $CO_2$ insufflations to minimally invasive video-assisted techniques. Recent literature now supports some of these newer approaches as safe and effective alternatives to traditional thyroidectomy. Although many of these surgical innovations have emerged from centers in Europe and other parts of the world,[3] their acceptance and incorporation into practices within the United States are rising steadily.

**Figure 3. Postoperative incision at 2 weeks following a minimally invasive video-assisted thyroid procedure.**

The literature does reveal a surprising lack of data on the use of MIVAT approaches in the pediatric population. In fact, our PubMed search of the English language literature resulted in only 1 published article by Spinelli et al.[4] They recommended MIVAT in pediatric patients who met the following criteria: thyroid volume of less than 30 mL, thyroid nodule less than 35 mm, absence of enlarged lymph nodes, absence of biochemical signs of thyroiditis, and absence of previous surgery in the neck. The authors also recommended this approach for low-risk early-stage papillary thyroid cancer restricted to pT1N0. In their review, they describe a successful case of MIVAT in a patient who required total thyroidectomy and central neck dissection. The neck dissection was successfully accomplished without need for conversion to open procedure. The authors reported 22 total thyroidectomy and 13 lobectomy procedures in a pediatric population with no cases of permanent or transient recurrent laryngeal nerve paralysis. No surgical drains were used, and no episodes of postoperative hematoma were reported. One episode of transient hypocalcemia after total thyroidectomy resolved with oral calcium supplementation over 21 days. Mean operative time for thyroid lobectomy was 38.5 minutes and 54.1 minutes for total thyroidectomy. These operative times are lower than those in our series and reflect the learning curve associated

with the procedure. In their study of 92 MIVAT procedures, Vaysberg and Steward[3] noted a significant decrease in mean operative time during the 18-month study period (67 to 42 minutes for hemithyroidectomy, $P = .0005$; 110 to 77 minutes for total thyroidectomy, $P = .02$). This decrease was attributed to the learning curve that is apparent with the use of virtually any endoscopic technique.[3] In our series, operative length decreased by 30 minutes from the first to the second case.

The next question is obvious: What advantage does this technique offer over traditional open removal of the thyroid gland? Multiple studies now show statistically significant improvement in cosmesis and postoperative pain when using the MIVAT approach.[6-8] Dobrinja et al[6] assessed this 1 month after surgery using a verbal response scale, with a score of 1 being a poor cosmetic result and 4 being an excellent result. The average result for the MIVAT group was 3.35, while the mean for the open thyroidectomy group was 2.88 ($P < .015$). The perceived improvement in cosmesis comes as no surprise when considering that the size of the incision is reduced by approximately 2 to 3 cm when using this approach. Spinelli et al[4] describe a median transverse skin incision of 1.5 to 2 cm located 2 cm above the sternal notch. Vaysberg and Steward[3] describe a similar technique in an adult population in which a skin incision is limited to 2 to 3 cm. The improvement in postoperative pain is somewhat less intuitive. It is hypothesized that this improvement is the result of a significant decrease in the amount of dissection needed when using the MIVAT approach.

The only article on the MIVAT approach in a pediatric population is from an institution that has pioneered this approach.[4] Consequently, we believe our series, although limited by small numbers, provides additional evidence regarding the feasibility of incorporating the MIVAT approach in pediatric patients in settings outside institutions with large experiences with this procedure.

## CONCLUSION

MIVAT is a feasible and safe option for the management of solitary thyroid nodules in children.

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