

Thyroid Surgery

Safety of Same Day Discharge in Patients Undergoing Sutureless Thyroidectomy: A Comparison of Local and General Anesthesia

William B. Inabnet, M.D., Alexander Shifrin, M.D., Leaque Ahmed, M.D., and Prashant Sinha, M.D.

Background: The thyroid gland is one of the most vascular organs in the body and surgical resection mandates meticulous surgical technique and hemostasis. The aim of this study was to assess the safety and efficacy of the electrothermal bipolar vessel sealing system in permitting ambulatory thyroid surgery under local anesthesia.

Methods: From January 1, 2004, to December 31, 2005, 224 consecutive patients underwent thyroid surgery using the LigaSure for hemostasis. Whenever possible, local/regional anesthesia with conscious sedation was utilized during the procedure. A descriptive analysis was performed to evaluate patient characteristics and outcome measures.

Results: Eighty-two percent ($n = 184$) of all unselected patients presenting for thyroid surgery had their procedure performed under local/regional anesthesia with conscious sedation whereas 18% ($n = 40$) received general anesthesia. When comparing these two groups, the local anesthesia patients were more likely to be female (85% vs. 68%, $p \leq 0.05$) and younger (mean age = 50 vs. 61 years, $p \leq 0.05$). Forty percent of the local anesthesia patients underwent a total thyroidectomy compared to 58% in the general anesthesia group ($p \leq 0.05$). The mean duration of surgery was shorter in the local anesthesia patients (71 minutes vs. 101 minutes, $p \leq 0.05$) and the mean gland weight was also less (26.9 g vs. 63.9 g, $p \leq 0.05$). There was one hematoma in the local anesthesia group, but overall the morbidity was not different. Eighty-eight percent of the local anesthesia patients were discharged same day of surgery compared to 45% of the general anesthesia patients.

Conclusions: The electrothermal bipolar vessel sealing system permits safe, same day discharge in patients undergoing thyroid surgery with a low complication rate irrespective of the type of anesthesia.

Introduction

THE THYROID GLAND IS one of the most vascular organs in the body. Early in the history of thyroid surgery, the pioneers of endocrine surgery such as Billroth and Kocher experienced greater than 50% mortality due to bleeding complications (1,2). Since that time, the technique of thyroidectomy has evolved to a safe and hemostatic operation. Conventional thyroidectomy mandates meticulous surgical technique requiring a transverse cervical incision, the creation of myocutaneous flaps, identification and preservation of pertinent anatomy, and specimen excision. Complications in thyroid surgery are infrequent, especially when the procedure is performed by an experienced thyroid surgeon (2).

During conventional thyroid surgery, hemostasis is achieved with a combination of conventional knot tying, suture ligation, small hemostatic clips, and electrocautery (3). Typically, the incision is placed low in the neck to optimize the postoperative cosmetic outcome. Advances in technology have permitted the development of new hemostatic devices that allow sutureless vessel ligation (3–6). The use of these devices has greatly facilitated minimally invasive thyroid surgery, including video-assisted, complete endoscopic, and mini-open techniques. By avoiding the use of conventional knot tying, which requires wide exposure, surgeons are able to perform thyroid surgery through the smallest possible incision. These hemostatic devices permit vessel ligation and thyroid resection a safe distance from the target tissue with a

complication rate that is similar to that of conventional thyroidectomy (7). Moreover, numerous studies have demonstrated less blood loss and a shorter duration of surgery (3–6,8,9).

The use of local anesthesia during thyroid and parathyroid surgery was commonplace in the late 19th and early 20th centuries (2,10,11). Improvements in the administration of anesthesia led to the common use of general anesthesia during most thyroid and parathyroid operations, however, the use of local anesthesia during endocrine neck surgery was popularized in the latter part of the 20th century (12–14). Most patients undergoing thyroid surgery are admitted to the hospital for an overnight stay to monitor for hematoma formation and hypocalcemia, but same day discharge has been shown to be feasible, safe, and cost effective especially when surgery is performed under local anesthesia (15–17). The aim of the retrospective analysis was to assess the safety of same day discharge in patients undergoing thyroid surgery using a sutureless technique for thyroid resection.

Methods

Approval to conduct a retrospective review of the Columbia University Thyroid Registry was obtained by the Institutional Review Board of Columbia University. From January 1, 2004, to December 31, 2005, 224 consecutive patients underwent thyroid surgery by the same surgeon (WBI). The LigaSure Precise electrothermal bipolar vessel sealing system (Valley Lab, Boulder, CO) was used in all cases.

All patients underwent standard evaluation for thyroid surgery including one or more of the following as indicated on a case by case basis: thyroid function tests, fine needle aspiration, ultrasonography, and computed tomography of the neck and chest. Perioperative flexible transnasal laryngoscopy was performed in all patients. During the patients' preoperative consultation, the Columbia University protocol for ambulatory thyroid surgery was discussed in detail with each patient. An ambulatory thyroid surgery brochure was reviewed with all patients, a brochure with information on calcium supplementation, contact numbers, and warning signs for possible complications such as hypocalcemia and hematoma formation.

General anesthesia was recommended in patients in one or more of the following situations: large multinodular goiter, substernal goiter, widely invasive cancer, lateral cervical lymph node metastases (level II to V), a language barrier (deaf or non-English speaking), severe claustrophobia or anxiety, history of panic attacks, or a patient preference for general anesthesia. In all other patients, local/regional anesthesia was recommended. The Columbia University protocol for administering local/regional anesthesia has been well described in previous publications (13,16). Using a 1:1 mixture of 0.5% lidocaine and 0.25% bupivacaine, 40 to 60 mL of local or regional anesthesia was administered under light sedation with propofol. For patients undergoing thyroid lobectomy, an ipsilateral deep/superficial field block and a contralateral superficial field block was performed, whereas patients undergoing total thyroidectomy received a bilateral deep/superficial field block. For the deep block, 10 mL of the local anesthesia solution was administered at the posterior border of the sternocleidomastoid muscle at the level of C2 and again at C4 (respectively, two and four finger breadths inferior to the mastoid process). The superficial field block is

performed along the anterior border of the sternocleidomastoid muscle where 5–10 mL of the local solution was injected. In each case the local anesthesia was administered by the surgeon immediately before prepping the surgical field. An ether screen was used to keep the surgical drapes off the patients face and prior to beginning the procedure, the level of sedation was lessened to permit communication between the patient and the surgical team.

A small incision was made in a natural skin crease high in the neck near the cricoid cartilage. Without raising myocutaneous flaps, the strap muscles were separated at the midline to permit exposure of the thyroid gland. A headlamp was used to illuminate the surgical field. Using blunt dissection, the lateral aspect of the thyroid lobe was mobilized to expose the carotid artery. Next, the superior pole vessels were isolated and if possible, the external branch of the superior laryngeal nerve (EBSLN) was identified and preserved. If the EBSLN was not visualized, the superior pole vessels were isolated by sweeping the adjacent tissue medially and superiorly. The electrothermal bipolar vessel sealing system was used to divide the superior pole vessels in all cases. Following mobilization of the superior pole and preservation of the superior parathyroid gland, the thyroid lobe was delivered through the small incision by gently elevating the inferior portion of the thyroid lobe. This maneuver permitted identification of the recurrent laryngeal nerve inferior to the thyroid lobe. The tissue between the recurrent laryngeal nerve and trachea was then dissected, taking care to preserve the inferior parathyroid gland. The electrothermal bipolar vessel sealing system was used to dissect the recurrent laryngeal nerve to its insertion site as well as to divide the ligament of Berry and isthmus, assuring a minimum distance of 2–3 mm from the recurrent laryngeal nerve. For patients undergoing total thyroidectomy, the same technical maneuvers were utilized to resect the contralateral lobe. A single absorbable suture was used to reapproximate the strap muscles whereas the platysma was closed in layers. A subcuticular 5.0 prolene suture and collodium were used to close the skin. The patient was observed for 5–6 hours, at which time the wound was evaluated and the prolene suture removed by a member of the surgical team. If the patient was deemed stable by the surgical team, they were then discharged with instructions to take calcium supplementation (4 g per day for 5 days, followed by 2 g per day). Patients returned to the clinic for a postoperative evaluation 2–3 weeks following surgery at which time the calcium supplementation was discontinued.

For the purpose of this analysis, patients were divided into two groups: patients that received local anesthesia (local group) and those that received general anesthesia (general group). A descriptive analysis was conducted to determine mean values of patient characteristics and outcome variables. Chi-square analysis and analysis of variance were performed to determine differences in categorical and continuous variables respectively.

Results

A total of 224 consecutive patients underwent thyroid surgery using the electrothermal bipolar vessel sealing system (LigaSure) for hemostasis. Eighty-two percent of the patients were female (184 women, 40 men) with a mean age of 52 years (15–88 years). For the entire study population, the mean

TABLE 1. DEMOGRAPHIC AND OPERATIVE CHARACTERISTICS

	Local (n = 184)	General (n = 40)	All cases (n = 224)
Anesthesia (%)			
Local			82
General			18
Conversion to general (%)	1.8	NA	NA
Gender (% female)*	85	68	82
Mean age in years (range)*	50 (15–82)	61 (20–88)	52 (15–88)
Operation (%)*			
Lobectomy	60	42	57
Total thyroidectomy	40	58	43
Re-operations (%)	12	16	13
Mean operative time in minutes (range)*	71 (20–170)	101 (40–420)	77 (20–420)

**p* < 0.05.

operating time was 77 minutes (20–420 minutes) with 80% of patients being discharged within 6 hours of surgery (Table 1). Final pathology revealed thyroid cancer in 40% of patients (Table 2). The overall complication rate was 1.4% (Table 3).

One hundred eighty-four patients (82%) underwent surgery under local/regional anesthesia with conscious sedation, whereas 40 patients received general anesthesia (18%). Four patients (1.8%) undergoing thyroidectomy under local/regional anesthesia required conversion to general anesthesia due to the need for a deeper state of sedation. In the local anesthesia group, patients were more likely to be female and younger compared to patients in the general anesthesia group (Table 1).

There were no differences between anesthesia groups in terms of primary or reoperative surgery (13% reoperative overall) or in final pathology composition (Table 2). In cases of malignant pathology, there was no significant difference in mean tumor size or MACIS scores between the two groups.

Local anesthesia patients were more likely to undergo thyroid lobectomy compared to general anesthesia patients (60% vs 42%, respectively, *p* < 0.05) (Table 1). Mean specimen weights were significantly larger in those receiving general anesthesia (63.9 g; range 2.8–360 g) versus local anesthesia (26.9 g; range 4–175 g, *p* < 0.05).

There was no difference in the rate of complications between the anesthesia groups. Major complications included one hematoma in the local/regional anesthesia group and one permanent recurrent laryngeal nerve injury in each anesthesia group (Table 3). One recurrent nerve injury occurred during delivery of a massive substernal nodular goiter whereas the other arose during a directed sacrifice of the recurrent nerve due to invasive cancer. The one hematoma, which occurred within 1 hour of arrival to the recovery room, was immediately evacuated in the operating room under local anesthesia with no airway compromise or long-term adverse consequences. There were no cases of permanent hypocalcemia.

TABLE 2. PATHOLOGY DETAILS

	Local (n = 184)	General (n = 40)	All cases (n = 224)
Mean weight (g) (range)*	26.9 (4–175)	63.9 (2.8–360)	33.8 (2.8–360)
Pathology (%)			
Carcinoma	43	40	40
Adenoma/neoplasm	10	18	17
Goiter	38	31	32
Other benign	5	9	8
Unremarkable tissue	5	2	3
Carcinoma details			
Papillary			
Mean size (cm)	1.2 ± 0.9	2.5 ± 2.1	1.4 ± 1.2
Mean MACIS score	7.1	6.2	6.9
Follicular			
Mean size (cm)	3.6 ± 1.2	NA	3.6 ± 1.2
Mean MACIS score	5.4	NA	5.4
Medullary			
Mean size (cm)	NA	5.6 ± 4.2	5.6 ± 4.2
Anaplastic			
Mean size (cm)	3.3	7.0 ± 4.0	6.1 ± 4.0

**p* < 0.05.

TABLE 3. COMPLICATIONS

	Local (n = 184)	General (n = 40)	All cases (n = 224)
Complications (n)			
Bleeding	1	0	1
Wound infection	0	0	0
Permanent nerve injury	1	1	2
Temporary nerve injury	4	0	4
Permanent hypocalcemia	0	0	0
Temporary hypocalcemia	3	0	3
Total major complications	2 of 172 (1.2%)	1 of 37 (2.7%)	3 of 209 (1.4%)

Four cases of transient nerve injury and three cases of temporary hypocalcemia were noted in the local anesthesia group. One of the patients with transient hypocalcemia required a brief emergency room visit for intravenous calcium but was discharged with no additional episodes. One patient with unresectable anaplastic carcinoma underwent an elective tracheostomy while already under general anesthesia.

Patients undergoing thyroidectomy under local anesthesia were more likely to be discharged within 6 hours of surgery compared to general anesthesia recipients (88% vs 45%, respectively, $p < 0.05$) (Table 4).

Discussion

This report is the first to describe the use of sutureless hemostatic techniques in patients undergoing ambulatory thyroid surgery. There were few major complications (overall rate of 1.4%) demonstrating the safety of sutureless electrothermal hemostasis in thyroid surgery under general or local anesthesia. Specifically, there was no difference in major complications between the local and general anesthesia groups despite significantly larger average weights and longer length of stay in the general anesthesia group. Others have reported a decrease in hypocalcemia, reduction in scar size and operative time, or no differences in major complications (4,18–22). Most importantly, hemostasis of the upper and lower pole vessels is particularly important in the prevention of postoperative bleeding and hematoma formation. The one case of postoperative hematoma occurred within 1 hour with the patient still in the recovery room; the patient was promptly re-explored under local anesthesia and found to be bleeding from a branch of the inferior thyroid artery. The use of the tissue sealer in this study compares favorably with the other studies listed as well as this institution's previously reported rates of postoperative hematoma using a cut and tie tech-

TABLE 4. LENGTH OF STAY

	Local (n = 184)	General (n = 40)	All cases (n = 224)
Length of stay (%)*			
Outpatient	88	45	80
Admission	12	55	20

* $p < 0.05$.

nique (23). These results mirror the findings of others with respect to the use of electrothermal bipolar cautery while building on the foundation of an already mature locoregional anesthesia program. Moreover, the complication rate and duration of surgery of the current study are similar to a recently published large retrospective review of our institutions' results with the standard cut and tie technique under both local and general anesthesia (24).

Differentiated thyroid cancer accounted for 40% of the pathology in both general and local anesthesia groups, and had a typical distribution with papillary cancer accounting for the majority of cases. Preoperative evaluation including ultrasound detected all cases requiring lateral lymphadenectomy, and the choice of general anesthesia in these cases allowed for safe lymphatic neck dissection with an overnight hospitalization. MACIS score and mean size did not predict postoperative complications nor the choice of anesthesia. Finally, the electrothermal cautery provided a useful adjunct in the performance of central and lateral neck dissections for regional nodal disease with a seroma rate equal to zero.

The four conversions to general surgery were performed electively without incident. All cases were for patient comfort where local anesthesia was either insufficient, tracheal pressure resulted in coughing, or for patient anxiety. The factors affecting conversion in this study are similar to those previously reported (23), with patient comfort being the most significant. There were no cases in which conversion was required for nerve injury or previously undetected nodal metastasis requiring lymphadenectomy. None of these conversions resulted in increased morbidity or inpatient stay. The choice of general versus local anesthesia in this cohort does correlate with larger thyroid volume, likely indicating a surrogate marker for the inability to achieve patient comfort with local anesthesia only. The use of the bipolar tissue sealer did not contribute to either patient discomfort or intraoperative complication requiring conversion to general anesthesia.

Six-hour outpatient management for 80% of all patients in this study is a goal that is reasonable to achieve in a well-developed thyroid program as previously reported by our institution (25). The contribution of electrothermal tissue sealing cautery is synergistic with achieving a high same day discharge goal. The direct contribution of the LigaSure to outpatient management is in its facilitation of short operative times when combined with locoregional anesthesia and very reasonable operative times with general anesthesia. It is not unexpected that patients with larger thyroid masses, particularly extensive multinodular goiters with substernal extension, undergo general anesthesia with a larger percentage being discharged following an overnight stay. Multiple factors contribute to an overnight stay in this population including postoperative nausea, longer operative times and slower emergence from anesthesia, and a need for observation for hematoma, however this study was not sufficiently powered to perform a detailed intergroup analysis. It is possible that the bipolar vessel sealer has also aided in liberalizing the applicability of locoregional anesthesia to larger masses and in reducing the learning curve for trainees while maintaining the excellent outcomes already established in this program.

The resurgence of locoregional anesthesia in thyroid surgery has resulted in a significant programmatic shift of postoperative care to the outpatient arena. We have found that

the use of electrothermal cautery fits in well with a mature outpatient practice. Evidence outside this center indicates a beneficial contribution of this device to decreasing operative times and in reducing hypocalcemia. This study effectively demonstrated that a variety of thyroid pathologies may be managed safely and effectively without affecting other aspects of the perioperative, intraoperative, or postoperative care. The use of electrothermal cautery may aid in improving various aspects of a developing or already mature thyroid program. While this hemostatic device should not be substituted for meticulous surgical technique and systematic program development, it is a useful tool that has established itself in terms of its convenience, its reduction of incision size, and as demonstrated in this paper, its ability to manage a wide variety of thyroid pathologies and sizes under both local and general anesthesia in order to permit safe same day discharge.

Acknowledgment

This paper was presented at the New York Surgical Society, April 18, 2007.

References

- Chigot JP 2000 Theodor Emil Kocher, modern surgery pioneer. *Ann Chir* **125**:884–892. [In French.]
- Mittendorf EA, McHenry CR 2004 Complications and sequelae of thyroidectomy and an analysis of surgeon experience and outcome. *Surg Technol Int* **12**:152–157.
- Siperstein AE, Berber E, Morkoyun E 2002 The use of the harmonic scalpel vs conventional knot tying for vessel ligation in thyroid surgery. *Arch Surg* **137**:137–142.
- Kiriakopoulos A, Dimitrios T, Dimitrios L 2004 Use of a diathermy system in thyroid surgery. *Arch Surg* **139**:997–1000.
- Sandonato L, Cipolla C, Graceffa G, Fricano S, Li Petri S, Prinzi G, Latteri S, Latteri MA 2003 Bipolar electrothermic coagulation (ligasure bipolar vessel sealing system) in thyroid surgery. *Chir Ital* **55**:411–415. [In Italian.]
- Shemen L 2002 Thyroidectomy using the harmonic scalpel: analysis of 105 consecutive cases. *Otolaryngol Head Neck Surg* **127**:284–288.
- Yeung GH 2002 Endoscopic thyroid surgery today: a diversity of surgical strategies. *Thyroid* **12**:703–706.
- Petrakis IE, Kogerakis NE, Lasithiotakis KG, Vrachassotakis N, Chalkiadakis GE 2004 LigaSure versus clamp-and-tie thyroidectomy for benign nodular disease. *Head Neck* **26**:903–909.
- Ortega J, Sala C, Flor B, Lledo S 2004 Efficacy and cost-effectiveness of the UltraCision harmonic scalpel in thyroid surgery: an analysis of 200 cases in a randomized trial. *J Laparoendosc Adv Surg Tech A* **14**:9–12.
- Niederle BE, Schmidt G, Organ CH, Niederle B 2006 Albert J and his surgeon: a historical reevaluation of the first parathyroidectomy. *J Am Coll Surg* **202**:181–190.
- Taylor S 1997 Sir Thomas Peel Dunhill (1876–1957). *World J Surg* **21**:660–662.
- Chapuis Y, Icard P, Fulla Y, Nonnenmacher L, Bonnichon P, Richard B 1991 Excision under local anesthesia of parathyroid adenomas. Criteria of selection and control of effectiveness. 35 cases. *Presse Med* **20**:2090–2094. [In French.]
- Lo Gerfo P, Ditkoff BA, Chabot J, Feind C 1994 Thyroid surgery using monitored anesthesia care: an alternative to general anesthesia. *Thyroid* **4**:437–439.
- Saxe AW, Brown E, Hamburger SW 1988 Thyroid and parathyroid surgery performed with patient under regional anesthesia. *Surgery* **103**:415–420.
- Lo Gerfo P, Gates R, Gazetas P 1991 Outpatient and short-stay thyroid surgery. *Head Neck* **13**:97–101.
- Lo Gerfo P 1998 Local/regional anesthesia for thyroidectomy: evaluation as an outpatient procedure. *Surgery* **124**:975–978; discussion 978–979.
- Snyder SK, Roberson CR, Cummings CC, Rajab MH 2006 Local anesthesia with monitored anesthesia care vs general anesthesia in thyroidectomy: a randomized study. *Arch Surg* **141**:167–173.
- Franko J, Kish KJ, Pezzi CM, Pak H, Kukora JS 2006 Safely increasing the efficiency of thyroidectomy using a new bipolar electrosealing device (LigaSure) versus conventional clamp-and-tie technique. *Am Surg* **72**:132–136.
- Kirdak T, Korun N, Ozguc H 2005 Use of ligasure in thyroidectomy procedures: results of a prospective comparative study. *World J Surg* **29**:771–774.
- Lachanas VA, Prokopakis EP, Mpenakis AA, Karatzanis AD, Velegarakis GA 2005 The use of Ligasure Vessel Sealing System in thyroid surgery. *Otolaryngol Head Neck Surg* **132**:487–489.
- Parmeggiani U, Avenia N, De Falco M, Parmeggiani D, Pisanelli D, d'Ajello M, Monacelli M, Calzolari F, Sanguinetti A, Sperlongano P 2005 Major complications in thyroid surgery: utility of bipolar vessel sealing (Ligasure Precise). *G Chir* **26**:387–394.
- Shen WT, Baumbusch MA, Kebebew E, Duh QY 2005 Use of the electrothermal vessel sealing system versus standard vessel ligation in thyroidectomy. *Asian J Surg* **28**:86–89.
- Spanknebel K, Chabot JA, DiGiorgi M, Cheung K, Lee S, Allendorf J, LoGerfo P 2005 Thyroidectomy using local anesthesia: a report of 1,025 cases over 16 years. *J Am Coll Surg* **201**:375–385.
- Spanknebel K, Chabot JA, DiGiorgi M, Cheung K, Curty J, Allendorf J, LoGerfo P 2006 Thyroidectomy using monitored local or conventional general anesthesia: an analysis of outpatient surgery, outcome and cost in 1,194 consecutive cases. *World J Surg* **30**:813–824.
- Tartaglia F, Sgueglia M, Muhaya A, Cresti R, Mulas MM, Turriziani V, Campana FP 2003 Complications in total thyroidectomy: our experience and a number of considerations. *Chir Ital* **55**:499–510.

Address reprint requests to:

William B. Inabnet, M.D.

Chief, Section of Endocrine Surgery

Associate Professor of Clinical Surgery

161 Fort Washington Ave.

New York, NY 10032

E-mail: wbi2102@columbia.edu

This article has been cited by:

1. Ming-Lang Shih, Quan-Yang Duh, Chung-Bao Hsieh, Yao-Chi Liu, Chueng-He Lu, Chih-Shung Wong, Jyh-Cherng Yu, Chun-Chang Yeh. 2010. Bilateral Superficial Cervical Plexus Block Combined with General Anesthesia Administered in Thyroid Operations. *World Journal of Surgery* **34**:10, 2338-2343. [[CrossRef](#)]
2. Jeffrey C. Liu, Jatin P. Shah. 2010. Surgical technique refinements in head and neck oncologic surgery. *Journal of Surgical Oncology* **101**:8, 661-668. [[CrossRef](#)]
3. 2009. Endocrine surgery - a 23-hour specialty?. *ANZ Journal of Surgery* **79**:5, 320-322. [[CrossRef](#)]
4. Pierre Leyre, Thibault Desurmont, Louis Lacoste, Chiara Odasso, Gauthier Bouche, Anthony Beaulieu, Alexandre Valagier, Charalambos Charalambous, Hélène Gibelin, Bertrand Debaene, Jean-Louis Kraimps. 2008. Does the risk of compressive hematoma after thyroidectomy authorize 1-day surgery?. *Langenbeck's Archives of Surgery* **393**:5, 733-737. [[CrossRef](#)]
5. Andreas Manouras, Haridimos E Markogiannakis, Panagiotis B Kekis, Emmanuel E Lagoudianakis, Bill Fleming. 2008. Novel hemostatic devices in thyroid surgery: electrothermal bipolar vessel sealing system and harmonic scalpel. *Expert Review of Medical Devices* **5**:4, 447-466. [[CrossRef](#)]
6. Shamly V. Dhiman, William B. Inabnet. 2008. Minimally invasive surgery for thyroid diseases and thyroid cancer. *Journal of Surgical Oncology* **97**:8, 665-668. [[CrossRef](#)]