



Transoral endoscopic and ablative approaches for management of benign and malignant thyroid disease: a narrative review

Stacy M. Sebastian, Leena Hani, Preeti K. Farmah, Yassmen Hammam, Alexander Vu, Jason D. Prescott

Department of General Surgery, New York University Langone Health Brooklyn, Brooklyn, NY, USA

Contributions: (I) Conception and design: SM Sebastian, JD Prescott; (II) Administrative support: A Vu, PK Farmah, L Hani, Y Hammam; (III) Provision of study materials or patients: A Vu, SM Sebastian, JD Prescott; (IV) Collection and assembly of data: SM Sebastian, JD Prescott; (V) Data analysis and interpretation: SM Sebastian, JD Prescott; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Stacy M. Sebastian, MD; Jason D. Prescott, MD, PhD. Department of General Surgery, New York University Langone Health Brooklyn, 150 55th Street, Brooklyn, NY 11220, USA. Email: stacy.sebastian@nyulangone.org; jason.prescott@nyulangone.org.

Background and Objective: Several novel endoscopic and ablative approaches for the management of thyroid disease are becoming more prevalent in the United States, offering an alternative to traditional open thyroidectomy in select patient groups. Two of those techniques include transoral endoscopic thyroidectomy via vestibular approach (TOETVA) and ultrasound (US)-guided radiofrequency ablation (RFA). The primary objective of this review is to provide an evaluation of two of the most common alternative approaches to open thyroidectomy: TOETVA and US-guided RFA.

Methods: A comprehensive PubMed literature search was employed using the following search strategy: (“transoral” OR “transoral endoscopic thyroidectomy”) AND ((“Thyroid Neoplasms”[MeSH]) OR (“Thyroid Cancer, Papillary”[MeSH]) OR (“Thyroid Carcinoma, Anaplastic”[MeSH]) OR “thyroid cancer” OR “thyroid malignancy”). Filters applied: clinical trial, meta-analysis, randomized controlled trial, review, systematic review. A total of 34 articles were identified and screened for applicability, with a total of 12 meeting criteria for review.

Key Content and Findings: We evaluated techniques and indications for the two most common alternative approaches to open thyroidectomy for the management of surgical thyroid disease, namely TOETVA and US-guided RFA.

Conclusions: Although novel, both TOETVA and RFA are alternative techniques to traditional open thyroidectomy in select patient groups. The advantage afforded by these alternative approaches is avoidance of visible scarring at the procedure access site, which is a common cause of concern for post-operative patients. However, further research regarding the management of potential complications and disease recurrence rate while using both techniques is needed, particularly when they are employed for the management of thyroid malignancy.

Keywords: Thyroidectomy; transoral endoscopic thyroidectomy via vestibular approach (TOETVA); radiofrequency ablation (RFA); thyroid cancer

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Introduction

Thyroid disease is extremely common and treatment for both benign and malignant thyroid pathology may involve partial or total thyroid gland resection (thyroidectomy).

The preferred approach for thyroidectomy is through an anterior transcervical, or Kocher, incision. This incision, also called a collar incision, allows direct exposure of the midline structures of the anterior neck. This incision is

Table 1 Summary of search strategy

Items	Specification
Date of search	February 25, 2023
Database searched	PubMed
Search terms used	("transoral" OR "transoral endoscopic thyroidectomy") AND (("Thyroid Neoplasms"[MeSH]) OR ("Thyroid Cancer, Papillary"[MeSH]) OR ("Thyroid Carcinoma, Anaplastic"[MeSH]) OR "thyroid cancer" OR "thyroid malignancy")
Timeframe	January 1, 2001–February 25, 2023
Inclusion criteria	Study type: clinical trial, meta-analysis, randomized controlled trial, review, systematic review Language restrictions: English
Selection process	Primary author, independent selection with group consensus

easily extendable, allowing enhanced access into central and lateral neck fields for additional neck exploration and dissection, when needed. Direct visualization of the recurrent laryngeal nerve (RLN), cervical arteries/veins, parathyroid glands, and in the context of malignant disease, cervical lymph nodes, is critical during thyroidectomy. The open thyroidectomy approach grants clear visualization of these structures, allowing the surgeon to minimize potential associated intraoperative complications and optimize intraoperative decision making. For patients with malignant thyroid disease, the traditional open approach remains the standard of care, as exploration and visualization of neck structures are crucial for accurate disease staging and thus for optimal oncologic outcome.

In general, cervical thyroidectomy incisions heal well, leaving only asymptomatic and imperceptible transverse scars (especially when plastic surgical technique is used during wound closure). Occasionally, however, the oblique scar associated with a transcervical incision will be unsightly or cause discomfort, especially among patients for whom hypertrophic or keloid scarring occurs. The open approach thyroidectomy collar incision scar may be painful, long (up to 8 cm in length), discolored relative to the surrounding skin, and, in the absence of preexisting transverse cervical skin creases, may be difficult to hide. Such scarring may produce significant postoperative patient distress and, as such, the potential for unsightly and/or painful scarring merits consideration when contemplating thyroid surgery. We present this article in accordance with the Narrative Review reporting checklist (available at <https://ales.amegroups.com/article/view/10.21037/ales-23-27/re>).

Methods

A comprehensive PubMed literature search was employed using the following search strategy: ("transoral" OR "transoral endoscopic thyroidectomy") AND (("Thyroid Neoplasms"[MeSH]) OR ("Thyroid Cancer, Papillary"[MeSH]) OR ("Thyroid Carcinoma, Anaplastic"[MeSH]) OR "thyroid cancer" OR "thyroid malignancy"). Filters applied: clinical trial, meta-analysis, randomized controlled trial, review, systematic review. A total of 34 articles were identified and screened for applicability, with a total of 12 meeting criteria for review. The summary of the search strategy is provided in *Table 1*.

Endoscopic and ablative techniques

Endoscopic, or alternative approach, thyroid surgery was developed, and has evolved, in order to avoid the unsightly or painful scarring potentially associated with open thyroidectomy (1). The underlying goal of such approaches is thus to avoid associated negative impacts on patient quality of life. These remote access and minimally invasive techniques are often reserved for patients with small volume benign disease, as procedural management of such pathology generally does not require, or potentially require, the degree of exposure afforded by an open approach. Use of these techniques for management of malignant thyroid disease is controversial and represents an active area of research, as long-term data validating the equivalence of these techniques to the open approach are not yet available. Use of transoral endoscopic thyroidectomy via vestibular approach (TOETVA) or radiofrequency ablation (RFA) for

management of thyroid malignancy thus often occurs in the context of associated research protocols and is generally limited to small, well-localized, unifocal, well-differentiated thyroid malignancies for which there is no evidence of local invasive or metastatic disease. RFA has also been employed for debulking of malignant thyroid disease.

TOETVA

Several distinct endoscopic techniques for thyroid resection have been developed over the last several decades, including trans-areolar, trans-axillary, and face-lift approaches. Of these, the most contemporary and widely employed is TOETVA. This technique, which allows access to the thyroid gland via small incisions in the oral mucosa, has largely supplanted other remote thyroid surgery approaches, as the transoral approach readily affords access to the bilateral thyroid lobes, may involve less tissue dissection, and/or is associated with fewer potential complications relative to other endoscopic thyroidectomy options.

TOETVA may be performed using standard laparoscopic equipment or using the Da Vinci robotic system. In general, most thyroid surgeons employ laparoscopic or endoscopic technology when performing this surgery, as the robotic approach is significantly more expensive. In addition, specialized robotic instruments have not yet been developed for transoral thyroid surgery. Further, regulatory agency approval for robotic transoral surgery (e.g., the United States Food and Drug Administration) may remain to be established for some health care systems (1). Contemporary data also suggest longer operating times for the robotic approach, as well as a more significant learning curve (2). Finally, both endoscopic and robotic TOETVA require specialized training, which generally remains limited to tertiary care academic centers, and may thus not be accessible to many thyroid surgeons (2).

Potential surgical complications associated with TOETVA mirror those that may occur during open approach thyroid surgery, as both involve the same anatomic domains. Most commonly, these include RLN injury, hypoparathyroidism, postoperative expanding neck hematoma and infection. In addition, injury to the mental nerve, which may cause sensation changes including numbness or pain of the inferior lip and surrounding tissues, is a potential complication specific to TOETVA, as the mental nerves may be disrupted during creation of the oral dissection plane (3). Conversion from TOETVA to the standard open approach may also be required if unexpected

anatomic findings preclude safe and adequate transoral dissection. For this reason, careful anatomic assessment of the thyroid by preoperative imaging [high-resolution ultrasound (US) with or without computed tomography (CT) scanning] is required in all cases.

RLN injury is one of the dreaded complications of thyroidectomy, with unilateral injury resulting in possible temporary or permanent hoarseness and/or thin liquid aspiration, and bilateral injury potentially producing airway obstruction requiring tracheostomy. For this reason, direct visualization and meticulous preservation of these nerves are cardinal requirements of all thyroid surgery. Allowing for the initial learning curves for each thyroidectomy approach, published data thus far suggest that the risk of temporary and permanent RLN injury are similar for open, robotic, and endoscopic thyroid surgery (4,5).

Appropriate patient selection is critical for a successful TOETVA approach. Although specific published recommendations for the typical thyroid surgeon vary, TOETVA should be limited to initial thyroid surgery for operative candidates who have benign, low-volume unilateral or bilateral disease (where each thyroid lobe is ≤ 6 cm), without significant associated inflammation. Inflammation, as can occur in Graves' disease and in severe lymphocytic/Hashimoto's thyroiditis, may result in obscuration and scarring of normal tissue planes, as well as significant bleeding that impairs the operative view. TOETVA is also contraindicated for reoperative thyroid surgery and in cases for which a previous history of neck irradiation is identified, as operative field scarring associated with previous thyroid surgery or radiation therapy often obliterates normal tissue planes and distorts normal anatomic relationships.

Because TOETVA requires a midline approach to the thyroid, this technique necessitates dissection of the most scarred aspect of the reoperative or irradiated field, making this approach less safe than traditional open thyroidectomy (which allows a lateral approach to the scarred field and thus avoidance of the most scarred neck domains). Finally, the authors discourage us of TOETVA when thyroid malignancy is suspected or confirmed preoperatively (5). Although most thyroid cancer will be well-differentiated, completely contained within the thyroid parenchyma, and nonmetastatic, and thus safely resectable via TOETVA, these features are not always identifiable preoperatively (3). Thus, careful inspection and palpation of the prelaryngeal, paratracheal and pretracheal lymph node basins for nodal metastatic disease is a critical

component of all thyroid surgery, as is similarly meticulous inspection of the perithyroidal tissues for evidence of local invasion. Intraoperative identification of locally invasive or nodal metastatic disease alters operative decision making, necessitating *en bloc* resection of involved structures and/or comprehensive central neck dissection, respectively. Certainly, palpation and, in general, endoscopic inspection, cannot be performed to the same extent afforded by open approach thyroidectomy. Thus, the risk of an oncologically inadequate surgical outcome is potentially higher when TOETVA is performed for management of thyroid cancer (6).

US-guided thyroid nodule ablation

Multiple different percutaneous image-guided strategies have been trialed for thyroid nodule ablation, including chemo-destructive (ethanol), cryo-ablative and thermal-based techniques. Of these, RFA has become the most commonly used modality, given associated good safety, efficacy, reproducibility and expense profiles (7,8). This novel technique involves US guidance of a specialized needle into a target thyroid nodule, where focused radio wave delivery creates intense, but highly localized, cyto-destructive heat at the needle tip. Thyroid nodules treated in this way may entirely regress, with resolution of associated symptoms and, for toxic nodules, normalization of thyroid hormone levels. This technique avoids skin incision and surgical excision of the thyroid gland entirely, thus minimizing the operative risk and postoperative recovery inherent to thyroidectomy. Because RFA can be performed in the office setting, with local anesthetic or light sedation only, this technique also minimizes resource requirements for treatment of thyroid nodules, thus potentially expanding treatment opportunities to geographical areas for which the more significant resources required for thyroidectomy are not available. RFA is currently being investigated as an alternative to active surveillance in thyroid malignancy.

Disadvantages of RFA include lower overall treatment success rates relative to thyroid surgery, the potential need for multiple serial treatment sessions when large thyroid nodules are targeted, the potential for nodule rupture (post-treatment delayed intranodular hemorrhage), and out-of-pocket expense (medical insurance plans do not currently reimburse patients for thyroid nodule RFA and associated out-of-pocket expense, although variable, is generally in the several thousand US dollar range). Nodule position is also an important consideration when thyroid nodule RFA is contemplated, as nodules located in the posterior lateral

thyroid (tracheoesophageal groove) at, or near, the surface of the thyroid may lie in close proximity to the RLN, which cannot be visualized by US. Although the relative heat distribution of RFA is well-localized (several millimeters adjacent to the delivering needle tip), closely apposed structures (the RLN in this case) may be inadvertently damaged.

The long-term efficacy of thyroid RFA as a management strategy for thyroid cancer also remains to be established. Given that any residual cancer cells remaining following treatment for thyroid cancer may proliferate and/or metastasize, and that the complete destruction of all such cells following RFA treatment cannot be verified, RFA should, in general, not be offered for management of thyroid malignancy among patients who would otherwise be able to tolerate thyroidectomy. Initial data suggesting RFA efficacy for management of single, well-differentiated thyroid cancers measuring <1 cm in maximal diameter have now been published, although associated long-term recurrence rates remain to be determined.

Conclusions

The pursuit of innovation leading to improved cosmesis, decreased invasiveness, faster recovery, expanded availability, decreased expense, etc., while maintaining or improving treatment outcomes, remains a critical goal for surgical thyroid disease management (9). In general, the use of innovative techniques must be considered in the context of safety and efficacy, relative to the appropriate standard of care. In this context, TOETVA and RFA, in their current and future forms, represent important options for thyroid disease management. Conservative and judicious application of these techniques to the thyroid disease spectrum for which treatment failure and treatment side effects would produce the fewest potentially dangerous outcomes (e.g., small benign nodular disease) has thus far yielded promising results. Graded expansion of TOETVA and RFA to more complex thyroid disease, e.g., small, well-differentiated thyroid cancers and larger benign nodular disease, is now cautiously proceeding, with associated clinical data being actively collected. Moreover, these innovations are actively being refined, with associated development of improved technology and technique, which, in turn, will improve associated outcomes. Whether or not these techniques, or future as yet undeveloped innovative treatments for surgical thyroid disease, ever completely supplant open thyroidectomy remains to be determined.

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References

1. Jongekkasit I, Jitpratoom P, Sasanakietkul T, et al. Transoral Endoscopic Thyroidectomy for Thyroid Cancer. *Endocrinol Metab Clin North Am* 2019;48:165-80.
2. Wang TS, Sosa JA. Thyroid surgery for differentiated thyroid cancer - recent advances and future directions. *Nat Rev Endocrinol* 2018;14:670-83.
3. Wang Y, Zhou S, Liu X, et al. Transoral endoscopic thyroidectomy vestibular approach vs conventional open thyroidectomy: Meta-analysis. *Head Neck* 2021;43:345-53.
4. de Vries LH, Aykan D, Lodewijk L, et al. Outcomes of Minimally Invasive Thyroid Surgery - A Systematic Review and Meta-Analysis. *Front Endocrinol (Lausanne)* 2021;12:719397.
5. Zhang Z, Sun B, Ouyang H, et al. Endoscopic Lateral Neck Dissection: A New Frontier in Endoscopic Thyroid Surgery. *Front Endocrinol (Lausanne)* 2021;12:796984.
6. Rossi L, Materazzi G, Bakkar S, et al. Recent Trends in Surgical Approach to Thyroid Cancer. *Front Endocrinol (Lausanne)* 2021;12:699805.
7. Wang Y, Fu Y, Wu G, et al. Initial Experience With Transoral Endoscopic Thyroidectomy via the Submental and Vestibular Approach for the Treatment of Thyroid Cancer: A Retrospective Cohort Study. *Front Surg* 2022;9:882150.
8. Tufano RP, Mohamed Ali K. The Year in Surgical Thyroidology: Recent Technological Developments and Future Challenges. *Thyroid* 2022;32:14-8.
9. Cohen O, Tufano RP, Anuwong A, et al. Transoral endoscopic vestibular approach for thyroidectomy and parathyroidectomy - From promise to practice. *Am J Otolaryngol* 2021;42:103022.