Review Article

Indications and contraindications to transoral thyroidectomy

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Contributions: (I) Conception and design: All authors; (II) Administrative support: JO Russell; (III) Provision of study materials or patients: All authors; (IV) Collection and assembly of data: CR Razavi; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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Abstract: Patient motivation to avoid neck scarring has been a strong impetus in the development of remote access approaches to the thyroid, including transoral robotic or endoscopic thyroidectomy vestibular approach (TOR/ETVA). TOR/ETVA continues to become more prevalent given its early success in North America and the demonstration of its safety and efficacy in Asia. As more surgeons perform this procedure, it is important that specific and uniform indications and contraindications exist to prevent surgical complications due to poor patient selection. In this article, we review the existing English literature regarding TOR/ETVA and compile the inclusion and exclusion criteria of individual authors for both robotic and endoscopic techniques to date. We then resolve differences in the existing literature to provide recommended indications and contraindications to TOR/ETVA based on both our review and our own experience with TOR/ETVA to date. The following are our resultant recommended indications for TOR/ETVA: patient history of hypertrophic scarring or motivation to avoid a cervical neck incision with a maximal thyroid diameter ≤10 cm and dominant nodule ≤6 cm, with one of the following pathologic criteria; benign lesion, multinodular goiter, indeterminate nodule, or suspicious lesions/well-differentiated thyroid carcinomas ≤2 cm. Recommended contraindications to TOR/ETVA are as follows: history of head & neck surgery, history of head, neck, or upper mediastinal irradiation, inability to tolerate general anesthesia, evidence of clinical hyperthyroidism, preoperative recurrent laryngeal nerve palsy, lymph node metastasis, extrathyroidal extension including tracheal or esophageal invasion, oral abscesses, substernal thyroidal extension, or failure to meet inclusion criteria as above. Relative contraindications include smoking and other oral pathology, and surgeons should be aware that morbid obesity may make it difficult to raise skin flaps.

Keywords: Transoral thyroidectomy vestibular approach; robotic thyroidectomy; endoscopic thyroidectomy

Received: 10 August 2017; Accepted: 26 September 2017; Published: 31 October 2017.
doi: 10.21037/aot.2017.10.01
View this article at: http://dx.doi.org/10.21037/aot.2017.10.01

Introduction

Operations on the central neck, including thyroid surgery, are some of the most common surgical procedures in the United States (1,2). The transcervical approach has been the primary route of access to the thyroid gland since its description by Kocher in the late 1880's (3). While it provides excellent exposure and a direct access to the central neck, it can lead to unsightly neck scarring, negatively impacting patient quality of life (4-6). The increasing volumes of thyroid pathology especially in young females and a societal emphasis on physical appearances has encouraged the development of aesthetically favorable alternative approaches (7,8). As a result, many minimally invasive techniques and remote access approaches have been proposed, which aim to minimize surgical trauma and avoid visible scarring (9-11). Each attempts to obtain equipoise between exposure and aesthetics, necessitating either a

small but visible scar (12) or extensive tissue dissection with a remote but hidden scar (13-20).

A transoral vestibular approach avoiding the floor of mouth was first described by Richmon *et al*. (21) and modifications of this technique have gained favor with refinement of incision placement via both robotic and endoscopic approaches (22-25). Transoral robotic or endoscopic thyroidectomy vestibular approach (TOR/ETVA) offers access to the bilateral thyroid beds via a gingivobuccal incision without a permanent cutaneous scar (22-28). As such, the frequency at which this approach is being utilized continues to increase (22-36). Although there has been a significant amount of early success with TOR/ETVA, it is important to note that not all patients are candidates. In this review we highlight the indications and contraindications to performing TOR/ETVA as per existing literature from high volume surgeons to date, and aim to resolve differences between authors to provide formal recommendations moving forward.

Methods

The English literature was reviewed for articles describing transoral thyroidectomy either via the robotic or endoscopic vestibular approach. Authors whom had completed ten or more cases endoscopically were considered to be high volume, while all articles with human robotic cases were reviewed given the relatively limited amount of literature. Publications that did not give formal inclusion or exclusion criteria for their cohort were excluded (33,37). Inclusion and exclusion criteria for each of these studies were then reviewed and compiled.

Indications & inclusion criteria

TOR/ETVA was deemed appropriate for discussion with patients whom had a history of hypertrophic scarring or were motivated to avoid a cervical neck incision. Additional inclusion criteria across authors accounted for diameter and/or volume of the thyroid, size of the dominant nodule, and preoperative pathology (22-24,27,30,31). Specific inclusion criteria varied some between authors, most notably in regard to size limitations as per preoperative ultrasonography.

Anuwong *et al*. and Jitpratoom *et al*. define a maximum allowable thyroid diameter as 10 cm, while Wang *et al*. utilize an 8-cm maximum thyroid diameter value in addition to a 2-cm maximum nodule size (22,28,38,39). Dionigi *et al*. additionally limit the size of the dominant nodule to no larger than 5 cm, and the total thyroid volume to no more than 45 mL as per preoperative ultrasonography (28). Other authors have used only maximum diameter of the tumor/nodule as a size indication, with Yang *et al*. setting a cutoff of no larger than 5 cm, while Russell *et al*. and Wang *et al*. have used a 6-cm maximum nodule size in their respective series (23,36,40). Richmon *et al*. utilize a 6-cm maximum nodule size for benign or suspicious lesions and 1-cm maximum nodule size for well-differentiated thyroid cancer in their series of transoral robotic thyroidectomies. Conversely, Kim *et al*. utilized a 4-cm nodule maximum, regardless of suspected pathology in their robotic series (24,25).

Most groups have also included pathologic criteria as an indication for TOR/ETVA. The indicated preoperative pathology cited to date is as follows; benign lesions (cyst, goiter), follicular neoplasms, Bethesda III or IV lesion, suspicious for malignancy, and papillary microcarcinoma or well-differentiated thyroid cancer without evidence of metastasis. Jitpratoom *et al*. expanded this to include patients with Grave's disease with at least one of the following: suspicious nodules, toxic multinodular goiter, failure or recurrence after 2 years of anti-thyroid medication, local compressive symptoms, and patients with side effects from anti-thyroid medication. Of note, all patients in this series were euthyroid at the time of the procedure (38). Each group's inclusion criteria have been summarized in *Table 1* (22-25,27,36,38-40).

Contraindications and exclusion criteria

Patients with a history of head and neck surgery and/or head and neck or upper mediastinal irradiation were not considered for TOR/ETVA. Patients whom were deemed unfit for surgery or could not tolerate general anesthesia were also excluded (22-24,27,30,38). Most high-volume authors additionally note that lymph node metastasis and evidence of extrathyroidal extension such as tracheal or esophageal invasion should be contraindications (24,25,27,36,39,40). Dionigi *et al*. also recommend exclusion of patients with evidence of preoperative recurrent laryngeal nerve palsy, those with recurrent goiter, and those with any evidence of hyperthyroidism (27). Conversely, Yang *et al*. did not exclude patients with subclinical hyperthyroidism, but did exclude patients whom were younger than 18 or older than 50, a criterion that no other authors utilized per our review (40). Anuwong *et al*. excluded patients with dental braces in his initial series, though subsequent publications he has authored do not include this as a contraindication,

Table 1 Summary of author indications for TOR/ETVA

Authors	Cases	Thyroid size (cm)	Nodule size (cm)	Thyroid volume	Pathology	Other
Wang *et al.* 2014	12	–	≤6	–	Benign tumor confirmed by cytopathology	–
Yang *et al.* 2015	41	–	≤5	–	Benign, MNG, grade II or less hyperthyroidism, suspicious for cancer, PTC	Age, 18–50 years
Anuwong. 2016	60	≤10	–	–	Cyst, MNG, follicular neoplasm, Grave's, mPTC	–
Wang *et al.* 2016	10	≤8	≤2	–	Benign, MNG, follicular neoplasm, Grave's	–
Jitpratoom *et al.* 2016[+]	46	≤10	–	–	Grave's with suspicious nodules, toxic MNG	Failed pharmacotherapy
Dionigi *et al.* 2017	60*	≤10	≤5	≤45 mL	Cyst, MNG, follicular neoplasm, Bethesda III, IV mPTC	–
Russell *et al.* 2017	13	–	≤6	–	–	–
Richmon *et al.* 2017[++]	17	–	≤6 (benign/ suspicious); ≤1 (dTC)	–	Benign, suspicious, well-differentiated thyroid cancer	–
Kim *et al.* 2017[++]	24	–	≤4	–	Benign, suspicious, follicular neoplasm	–

*, Anuwong coauthored this article and case volume is reflective of his prior publication; [+], study specifically examined patients with Grave's disease; [++], robotic technique. TOR/ETVA, transoral robotic or endoscopic thyroidectomy vestibular approach; MNG, multinodular goiter; PTC, papillary thyroid carcinoma; mPTC, papillary microcarcinoma; dTC, differentiated thyroid carcinoma.

but instead exclude patients with oral abscesses (22,27). Yang *et al*. excluded patients with a history of jaw surgery and those where there was suspicion for substernal goiter on preoperative imaging (40). In addition to the above, patients whom did not meet the respective size or preoperative pathology inclusion criteria as previously summarized were also excluded (22-25,27,36,38-40).

Summary and recommendations

As the volume of TOR/ETVA continues to increase worldwide, it is important that formal indications and contraindications be established to prevent unnecessary complications due to poor patient selection. In reviewing the literature on TOR/ETVA, there was a lack of a definitive consensus between authors.

Authors agree that the primary indication to performing TOR/ETVA is patient motivation to avoid neck scarring (22-25,27,36,38-40). However, a great deal of variation in inclusion criteria exists. In reviewing each of these values, the case volume of the respective authors, and considering our own experience, it is our recommendation that the following size indications be utilized: thyroid diameter no more than 10 cm and dominant nodule size no more than 6 cm, when benign or indeterminate (Bethesda II, III, IV), and no more than 2 cm when Bethesda V, suspicious for malignancy or confirmed well-differentiated thyroid cancer. Similarly, for pathologic criteria, we recommend the following indications: benign lesions, multinodular goiter, cytologically indeterminate nodules. In carefully selected patients, a surgeon may also consider Grave's disease, lesions that are cytologically suspicious, and well-differentiated thyroid cancer with the above size caveat. A summary of our recommended indications for TOR/ETVA is found in *Table 2*.

Upon review of the exclusion criteria from high volume authors to date, we recommend the following contraindications; history of head and neck surgery—including mandibular surgery, history of head/neck/upper mediastinum irradiation, patients unfit for general anesthesia, evidence of acute clinical hyperthyroidism, preoperative recurrent laryngeal nerve palsy, lymph node metastasis, extrathyroidal extension such as tracheal or esophageal invasion, presence of oral abscesses, and evidence of substernal thyroidal extension. Chronic lymphocytic (Hashimoto's) thyroiditis and an elevated body mass index are also relative contraindications that merit extensive patient and surgeon preparation. This is due to the potential increased friability of the gland and greater difficulty with

Table 2 Recommended indications for TOR/ETVA

Indications for TOR/ETVA
Patient history of hypertrophic scarring or motivation to avoid a cervical neck incision
Thyroid diameter ≤10 cm
Dominant nodule/tumor ≤6 cm if benign or indeterminate pathology, or dominant nodule ≤2 cm if Bethesda V/suspicious or confirmed DTC
Benign lesions, multinodular goiter, cytologically indeterminate nodules
Carefully selected patients with Grave's disease, nodules that are suspicious for malignancy, or DTC

TOR/ETVA, transoral robotic or endoscopic thyroidectomy vestibular approach; DTC, well-differentiated thyroid carcinoma.

Table 3 Recommended contraindications to TOR/ETVA

Contraindications to TOR/ETVA
History of head & neck surgery
History of head/neck/upper mediastinal irradiation
Patient unfit for general anesthesia
Evidence of active clinical hyperthyroidism
Preoperative recurrent laryngeal nerve palsy
Lymph node metastasis, extrathyroidal extension including tracheal or esophageal invasion
Oral abscesses
Substernal thyroidal extension;
Failure to meet indications for TOR/ETVA

TOR/ETVA, transoral robotic or endoscopic thyroidectomy vestibular approach.

elevating skin flaps respectively. These are in addition to those patients whom fail to meet the inclusion criteria as defined above. These contraindications to TOR/ETVA are summarized within *Table 3*. Of note, we do not recommend contraindications due to patient age or sex. Furthermore, American Thyroid Association (ATA) Guidelines should be used as an adjunct to the proposed indications and contraindications to determine which patients should undergo total thyroidectomy versus thyroid lobectomy.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the Guest Editors (Anuwong Angoon, Hoon Yub Kim, Ralph P. Tufano and Gianlorenzo Dionigi) for the series "Transoral Thyroidectomy" published in *Annals of Thyroid*. The article was sent for external peer review organized by the Guest Editors and the editorial office.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/aot.2017.10.01). The series "Transoral Thyroidectomy" was commissioned by the editorial office without any funding or sponsorship. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the manuscript and ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Sun GH, DeMonner S, Davis MM. Epidemiological and economic trends in inpatient and outpatient thyroidectomy in the United States, 1996-2006. Thyroid 2013;23:727-33.
2. Al-Qurayshi Z, Robins R, Hauch A, et al. Association of Surgeon Volume With Outcomes and Cost Savings Following Thyroidectomy: A National Forecast. JAMA Otolaryngol Head Neck Surg 2016;142:32-9.
3. Adam MA, Speicher P, Pura J, et al. Robotic Thyroidectomy for Cancer in the US: Patterns of Use and Short-Term Outcomes. Ann Surg Oncol 2014:21:3859-64.
4. Choi Y, Lee JH, Kim YH, et al. Impact of postthyroidectomy scar on the quality of life of thyroid cancer patients. Ann Dermatol 2014;26:693-9.
5. Arora A, Garas G, Sharma S, et al. Comparing transaxillary robotic thyroidectomy with conventional surgery in a UK

population: A case control study. Int J Surg 2016;27:110-7.
6. Arora A, Swords C, Garas G, et al. The perception of scar cosmesis following thyroid and parathyroid surgery: A prospective cohort study. Int J Surg 2016;25:38-43.
7. Berber E, Bernet V, Fahey TJ 3rd, et al. American Thyroid Association Statement on Remote-Access Thyroid Surgery. Thyroid 2016;26:331-7.
8. Davies L, Welch HG. Current thyroid cancer trends in the United States. JAMA Otolaryngol Head Neck Surg 2014;140:317-22.
9. Benhidjeb T, Wilhelm T, Harlaar J, et al. Natural orifice surgery on thyroid gland: totally transoral video-assisted thyroidectomy (TOVAT): report of first experimental results of a new surgical method. Surg Endosc 2009;23:1119-20.
10. Richmon JD, Pattani KM, Benhidjeb T, et al. Transoral robotic-assisted thyroidectomy: a preclinical feasibility study in 2 cadavers. Head Neck 2011;33:330-3.
11. Clark JH, Kim HY, Richmon JD. Transoral robotic thyroid surgery. Gland Surg 2015;4:429-34.
12. Miccoli P. Minimally invasive surgery for thyroid and parathyroid diseases. Surg Endosc 2002;16:3-6.
13. Bärlehner E, Benhidjeb T. Cervical scarless endoscopic thyroidectomy: Axillo-bilateral-breast approach (ABBA). Surg Endosc 2008;22:154-7.
14. Jackson NR, Yao L, Tufano RP, et al. Safety of robotic thyroidectomy approaches: meta-analysis and systematic review. Head Neck 2014;36:137-43.
15. Kandil EH, Noureldine SI, Yao L, et al. Robotic transaxillary thyroidectomy: an examination of the first one hundred cases. J Am Coll Surg 2012;214:558-64; discussion 564-6.
16. Lee J, Yun JH, Nam KH, et al. The learning curve for robotic thyroidectomy: a multicenter study. Ann Surg Oncol 2011;18:226-32.
17. Ohgami M, Ishii S, Arisawa Y, et al. Scarless endoscopic thyroidectomy: breast approach for better cosmesis. Surg Laparosc Endosc Percutan Tech 2000;10:1-4.
18. Shimazu K, Shiba E, Tamaki Y, et al. Endoscopic thyroid surgery through the axillo-bilateral-breast approach. Surg Laparosc Endosc Percutan Tech 2003;13:196-201.
19. Terris DJ, Singer MC, Seybt MW. Robotic facelift thyroidectomy: patient selection and technical considerations. Surg Laparosc Endosc Percutan Tech 2011;21:237-42.
20. Kim HY, d'Ajello F, Woo SU, et al. Robotic thyroid surgery using bilateral axillo-breast approach: personal initial experience over two years. Minerva Chir 2012;67:39-48.
21. Richmon JD, Holsinger FC, Kandil E, et al. Transoral robotic-assisted thyroidectomy with central neck dissection: preclinical cadaver feasibility study and proposed surgical technique. J Robot Surg 2011;5:279-82.
22. Anuwong A. Transoral Endoscopic Thyroidectomy Vestibular Approach: A Series of the First 60 Human Cases. World J Surg 2016;40:491-7.
23. Russell JO, Clark J, Noureldine SI, et al. Transoral thyroidectomy and parathyroidectomy - A North American series of robotic and endoscopic transoral approaches to the central neck. Oral Oncol 2017;71:75-80.
24. Richmon JD, Kim HY. Transoral robotic thyroidectomy (TORT): procedures and outcomes. Gland Surg 2017;6:285-9.
25. Kim HY, Chai YJ, Dionigi G, et al. Transoral robotic thyroidectomy: lessons learned from an initial consecutive series of 24 patients. Surg Endosc 2017. [Epub ahead of print].
26. Russell JO, Noureldine SI, Al Khadem MG, et al. Transoral robotic thyroidectomy: a preclinical feasibility study using the da Vinci Xi platform. J Robot Surg 2017. [Epub ahead of print].
27. Dionigi G, Lavazza M, Wu CW, et al. Transoral thyroidectomy: why is it needed? Gland Surg 2017;6:272-6.
28. Dionigi G, Tufano RP, Russell J, et al. Transoral thyroidectomy: advantages and limitations. J Endocrinol Invest 2017. [Epub ahead of print].
29. Park JO, Kim CS, Song JN, et al. Transoral endoscopic thyroidectomy via the tri-vestibular routes: results of a preclinical cadaver feasibility study. Eur Arch Otorhinolaryngol 2014;271:3269-75.
30. Park JO, Sun DI. Transoral endoscopic thyroidectomy: our initial experience using a new endoscopic technique. Surg Endosc 2017. [Epub ahead of print].
31. Dionigi G, Bacuzzi A, Lavazza M, et al. Transoral endoscopic thyroidectomy: preliminary experience in Italy. Updates Surg 2017;69:225-34.
32. Dionigi G, Lavazza M, Bacuzzi A, et al. Transoral Endoscopic Thyroidectomy Vestibular Approach (TOETVA): From A to Z. Surg Technol Int 2017;30:103-12.
33. Lee HY, You JY, Woo SU, et al. Transoral periosteal thyroidectomy: cadaver to human. Surg Endosc 2015;29:898-904.
34. Udelsman R, Anuwong A, Oprea AD, et al. Trans-oral Vestibular Endocrine Surgery: A New Technique in the United States. Ann Surg 2016;264:e13-6.
35. Nakajo A, Arima H, Hirata M, et al. Trans-Oral Video-Assisted Neck Surgery (TOVANS). A new transoral

technique of endoscopic thyroidectomy with gasless premandible approach. Surg Endosc 2013;27:1105-10.
36. Wang C, Zhai H, Liu W, et al. Thyroidectomy: a novel endoscopic oral vestibular approach. Surgery 2014;155:33-8.
37. Wilhelm T, Wu G, Teymoortash A, et al. Transoral endoscopic thyroidectomy: current state of the art—a systematic literature review and results of a bi-center study. Transl Cancer Res 2016;5:S1521-30.
38. Jitpratoom P, Ketwong K, Sasanakietkul T, et al. Transoral endoscopic thyroidectomy vestibular approach (TOETVA) for Graves' disease: a comparison of surgical results with open thyroidectomy. Gland Surg 2016;5:546-52.
39. Wang Y, Yu X, Wang P, et al. Implementation of Intraoperative Neuromonitoring for Transoral Endoscopic Thyroid Surgery: A Preliminary Report. J Laparoendosc Adv Surg Tech A 2016;26:965-71.
40. Yang J, Wang C, Li J, et al. Complete Endoscopic Thyroidectomy via Oral Vestibular Approach Versus Areola Approach for Treatment of Thyroid Diseases. J Laparoendosc Adv Surg Tech A 2015;25:470-6.

doi: 10.21037/aot.2017.10.01
Cite this article as: Razavi CR, Russell JO. Indications and contraindications to transoral thyroidectomy. Ann Thyroid 2017;2:12.

