

# Ten Commandments of Endoscopic Thyroid Surgery

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## ABSTRACT

**Introduction:** At many centers across the world, endoscopic thyroid surgery has become a well-established and safe alternative in selected patients at present. In this review, we have described the “Ten Commandments” for safe endoscopic thyroid surgery.

**Materials and surgical techniques:** This review is based on our own experience and review of literature related to endoscopic thyroid surgery. Patients and techniques should be selected wisely while performing endoscopic thyroid surgery. Crucial steps are the creation of sufficient working space, and the identification of superior laryngeal nerve, parathyroids, and recurrent laryngeal nerve (RLN).

**Conclusion:** As the surgical field keeps advancing, many more commandments will keep on adding to the armamentarium of surgeons and hence our 11th commandment is that thou shalt keep learning, unlearning, and re-learning. The bottom line however is to master the surgical anatomy and the correct way of doing endoscopic thyroid surgery.

**Keywords:** Endoscopic thyroidectomy, Thyroid surgery, Thyroidectomy.

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## INTRODUCTION

As early as the mid-19th century, thyroid surgery was thought to be a “Foolhardy performance” and “Horrid butchery.” It was said that “no honest and sensible surgeon would ever engage in it” and “one could not cut the thyroid gland out of the living body in its sound condition without risking the death of the patient from hemorrhage.”<sup>1</sup> However, by the mid-20th century, because of the efforts of many great surgeons, thyroid surgery became one of the safest surgeries. As the arena of minimally invasive surgeries expanded, attempts started to develop an alternative esthetically better technique to avoid cutaneous cervical scar.<sup>2</sup> At many centers across the world, endoscopic thyroid surgery has become a well-established and safe alternative in selected patients at present.

In this review, we have described the “Ten Commandments” for safe endoscopic thyroid surgery.

## MATERIALS AND SURGICAL TECHNIQUES

1. Thou shalt master open thyroid surgery first: Open thyroid surgery is considered as the triumph of the determination of thyroid surgeons and its evolution spreads through the length and breadth of evolution of surgery itself. Thyroid surgery can be performed today with a mortality as little as that of a hernia surgery. However, morbidity in terms of recurrent laryngeal nerve (RLN) palsy and hypoparathyroidism is still a challenge, especially in the hands of low-volume surgeons.<sup>3</sup>

Studies have identified that a surgeon volume threshold (>25 total thyroidectomies) is associated with improved patient outcomes.<sup>4,5</sup>

Hence, to be able to perform endoscopic thyroid surgery safely, a surgeon should become a master of open thyroid surgery first and have outcomes similar to high-volume surgeons.

2. Thou shalt choose patients and techniques wisely: Advancement in the technology of minimally invasive surgery has led to the development of many approaches for remote

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access thyroidectomy. Bilateral breast and axillary approach (BABA), axillary breast approach (ABA), transaxillary gasless approach, face-lift approach, and transoral endoscopic vestibular approach (TOETVA) are being utilized at present (Fig. 1).<sup>6,7</sup> Any surgeon who wishes to venture into this territory, must have a thorough knowledge of each of the approaches (Table 1).

A study conducted by Chitresh et al. found that the ABA should be preferred when starting to learn endoscopic thyroidectomy, as it is easier and safer than the TOETVA.<sup>8</sup> Patient selection is also important as a particular approach is not “One size fits all.” Multiple criteria have been proposed to select the patients so that the best outcomes are obtained (Table 1).<sup>9,10</sup>

3. Thou shalt respect the learning curve: Due to limited working space and vital structures in the neck, endoscopic thyroid surgery is associated with a high learning curve and skillful handling of various instruments. The reported learning curve for TOETVA is 40–58 cases after which mean operative time is stabilized.<sup>11,12</sup>

For the transaxillary gasless approach, 38 have been reported in one series.<sup>13</sup>

A similar learning curve has been reported for thyroid carcinoma also. Central compartment neck dissection is mastered after around 30 cases.<sup>14</sup>

It is also important to master hemithyroidectomy/lobectomy first before proceeding with total thyroidectomy. One study has also found that performing open thyroid surgery by standing at the patients' cranial end helps in performing TOETVA more easily.<sup>8</sup>

4. Thou shalt create sufficient working space: The major challenge of endoscopic thyroid surgery starts from the first step itself, that is, working space. Irrespective of the type of approach, the subplatysmal working space should always be from one sternocleidomastoid to the other sternocleidomastoid. Cranio-caudal extent should be from the suprasternal notch to the thyroid cartilage. The subplatysmal plane is an avascular plane

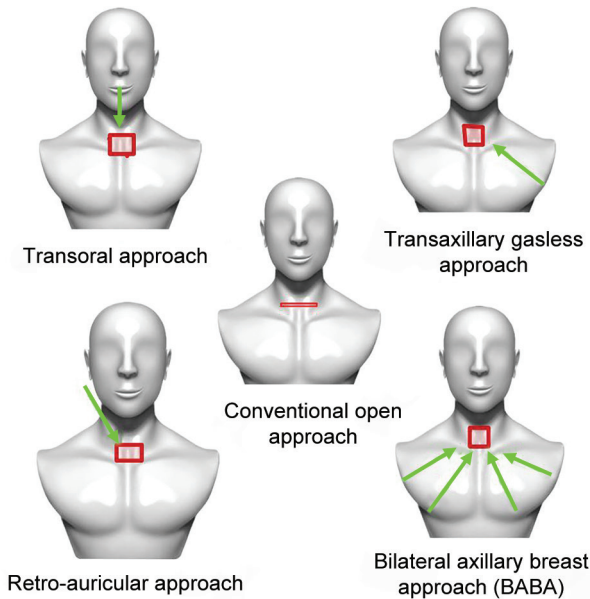


Fig.1: Various approaches available for endoscopic thyroidectomy

and all efforts should be made to remain in this plane. For this purpose saline solution either with epinephrine or without can be used for hydrodissection. During the early phases of the learning curve, one can use an extra amount of saline without worrying much about the smoke during diathermy dissection. Working space is maintained by CO<sub>2</sub> insufflation in TOETVA and BABA. The pressure should not be more than 6–8 mm Hg with a flow rate of 12–15 L/min. Both anesthetists and surgeons should know the potential hazards of air embolism.<sup>15</sup>

5. Search for midline and divide isthmus: The next step is the identification of linea alba and its division to expose the trachea and isthmus. Unlike open thyroid surgery, where the division of the isthmus is the last step, in TOETVA and BABA it is done in the initial steps. To do this, the trachea should be identified caudal to the isthmus, and then the isthmus should be divided craniocaudally. Utmost caution should be kept to not injure the trachea.<sup>16</sup>

Early division of isthmus in endoscopic thyroid surgery has two distinct advantages: facilitates dissection of the sternothyroid-laryngeal triangle, otherwise called Jolles space, and helps in visualization of superior pole structures.

6. Separate straps from the lobe and apply retractor early in the surgery: After the division of the isthmus, the lobe is mobilized off the strap muscles. We have found that applying a muscle retractor early in this phase of surgery is very helpful. Many muscle retractors have been described including a low-cost muscle retractor.<sup>17</sup> We also use pre-operative hydro-dissection between the strap muscle and lobe to make this step easier.<sup>18</sup> Silk sutures can also be used for the retraction.<sup>19</sup>
7. Identify the middle thyroid vein. Identifying the middle thyroid vein (MTV) is very crucial at this juncture as any bleeding from MTV decreases the visibility and makes further dissection difficult. MTV can routinely be ligated with ultrasonic energy devices.<sup>19</sup> Alternatively ligaclips can be applied.
8. Identify the external branch of the superior laryngeal nerve (EBSLN) and superior pole vessels in TOETVA: During TOETVA,

Table 1: Endoscopic thyroid surgery: Different techniques

S. No.	Approach	Advantages	Disadvantages
1	Transoral endoscopic thyroidectomy vestibular approach (TOETVA)	Type of natural orifice endoscopic surgery so truly scarless Total thyroidectomy feasible Central compartment lymph node dissection is feasible	Large nodules > 4 cm difficult to operate Learning curve Best suitable for long neck with euryprosopic jaw
2	Bilateral axillary breast approach (BABA)	Large nodules up to 6–8 cm can be operated Total thyroidectomy feasible	Large dissection area Central compartment lymph node dissection is not feasible
3	Axillary breast approach (ABA)	Large nodules up to 6–8 cm can be operated	Only hemi-thyroidectomy feasible Large dissection area Central compartment lymph node dissection is not feasible
4	Transaxillary gasless approach	Large nodules up to 6–8 cm can be operated	Only hemi-thyroidectomy feasible Large dissection area Central compartment lymph node dissection is not feasible
5.	Retro-auricular facelift approach	Large nodules up to 6–8 cm can be operated Patient with a short and slender neck	Large dissection area Only hemi-thyroidectomy feasible

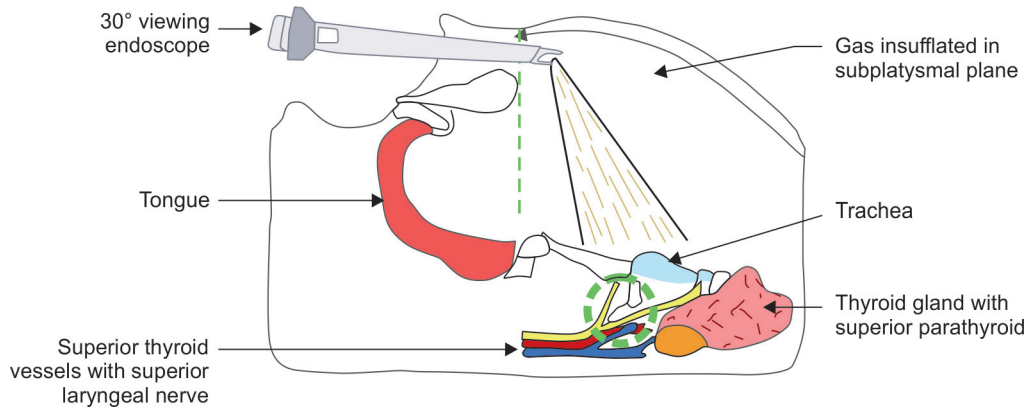


Fig. 2: Schematic representation of superior pole dissection

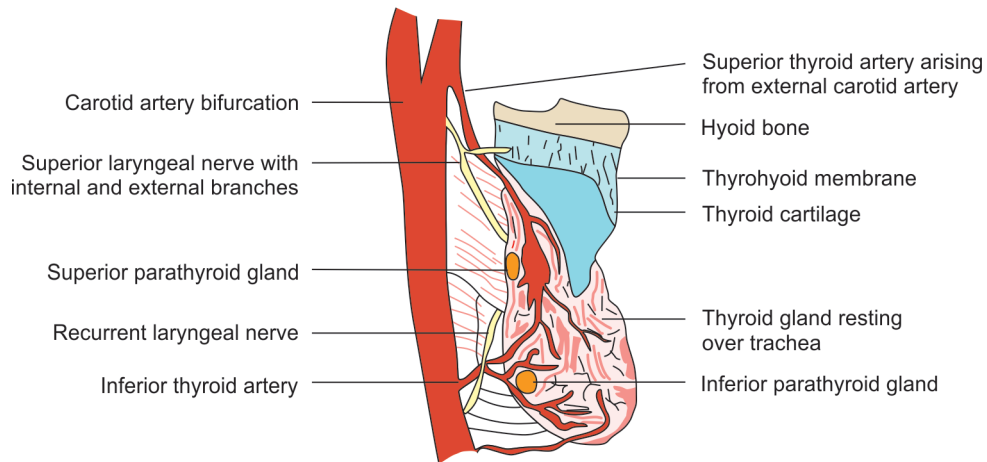


Fig. 3: Lateral view of thyroid gland anatomy

the next step is the identification of the EBSLN and superior pole vessels. Division of sternothyroid muscle in the cranial direction for up to 1–1.5 cm helps in this step.<sup>17</sup> The sternothyroid muscle is incised to expose the superior pole of the thyroid gland and the anterior branch of the superior thyroid artery will be identified first (Fig. 2). Then, dissect the medial surface of the superior pole from the cricothyroid muscle to expose the medial thyroid space and a similar step to expose the lateral thyroid space. Now, hold the thyroid gland with a grasper and retract it superolaterally exposing the vessels. The external branch of the superior laryngeal nerve crosses the superior thyroid artery superiorly or inferiorly.<sup>19</sup> Vessels are then ligated with ultrasonic energy devices.

9. Identify RLN at its entry point: For lateral view endoscopic thyroid surgeries, a critical view of safety (CVS) has been proposed.<sup>20</sup> The butterfly CVS can be identified as follows: the upper and lower poles of the lobe will be floating like the upper wings of a butterfly and the berry's ligament the body of the butterfly. Superior and inferior parathyroids represent lower wings with RLN seen running toward the attached berry's ligament.<sup>20</sup>

During TOETVA, after the division of the superior pole vessels, continued lateral and upward traction of the lobe will lead to the visualization of the superior parathyroid gland. Careful dissection of the gland is performed with preservation

of the delicate blood supply to it. Further craniocaudal dissection of the lobe is performed to visualize the inferior thyroid artery. The lobe is gently lifted and retracted to improve the visibility of the tracheo-esophageal groove. The RLN runs in the tracheoesophageal groove and can be identified here after careful dissection. Alternatively, RLN can be identified at the entry point just posterior to the berry's ligament (Fig. 3).

10. Thou shalt dissect the lobe from the trachea and review the surgical cavity before closure: The suspensory ligament of the berry is now divided and the lobe is separated from the trachea keeping the RLN in sight all the time. Lower pole dissection is performed by medial traction of the upper part of the lobe and leads to visualization of the inferior parathyroid gland. Lateral traction will lead to the identification of inferior thyroid veins just lateral to the trachea, which are sealed off. The specimen is taken out and the surgical cavity is inspected for any bleeding. Routine drainage of the thyroid bed is not recommended.

## CONCLUSION

As the surgical field keeps advancing, many more commandments will keep on adding to the armamentarium of surgeons and hence our 11th commandment is that thou shalt keep learning, unlearning, and re-learning. The bottom line however is to master the surgical anatomy and the correct way of doing endoscopic thyroid surgery.

## AUTHORS' CONTRIBUTIONS

BS and SKY: Literature search, figures, study design, data collection, data analysis, data interpretation, writing. DS: Revision and editing of manuscript.

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