Endoscopic Thyroid Surgery Through Trans-oral Vestibular Approach (TOVA): A Case Series and Review of Literature

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Abstract Endoscopic surgery is now standard of care for different Endocrine Disorders; the endoscopic thyroid surgery is becoming more popular and different approaches has been practice by many thyroid surgeon worldwide. Trans-oro-vestibular approach, based on the principle of natural orifice transluminal surgery is truly scar free thyroid surgery and has minimal dissection. We are presenting here three cases of benign solitary thyroid nodule operated endoscopically through trans-oro-vestibular approach in one male and two female patients. Described about the approach, challenges during surgery and outcome. These surgeries documented very few in literatures in live human patients. Transoral endoscopic thyroid surgery through vestibular approach is shortest and direct remote access approach. The need of limited dissection in this approach provides less complication and excellent cosmetic outcome in strictly selected patients.

Keywords Endoscopic thyroid surgery · Natural orifice thyroid surgery · Transoral thyroid surgery

Introduction

The endoscopic surgery in the neck has been introduced by Gagner [1], when he performed first endoscopic parathyroidectomy. The endoscopic thyroid surgery was introduced in literature by Hüscher et al. [2]. Since then there is continuous evolution in the technology and approaches in endoscopic thyroid surgery. These different approaches of endoscopic thyroid surgery have been classified as direct or cervical and indirect or extra cervical approach [3]. The direct or cervical approach (anterior [4, 5] or lateral [6, 7]) is carried out directly by inserting the small endoscopic instrument in the neck and dissecting the thyroid through conventional manner. The indirect or extra cervical approach is carried out through remote access to reach into the neck, either through chest wall [7, 8], breast [9], axilla [10–12] or combination of approaches [13–16].

These different approaches of endoscopic thyroid surgery allow the neck for small scars or invisible scars or totally scar free neck. However the dissection is more than conventional open thyroid surgery in remote access approaches and sometime scar is more prominent. Recently natural orifice trans luminal endoscopic surgery (NOTES) has been developed as a new surgical technique for the scarless abdominal surgery. Witz et al. [17] reported transoral access for thyroid resection in animal model and Benhidjeb et al. [18] reported trans oral experimental thyroidectomy in human cadavers.

There are few case reports and small series of trans-oral endoscopic thyroid surgery have been published recently on live human patients. This is shortest and direct remote access approach to thyroid gland, therefore minimal dissection is required and practically no scar is visible over skin. It also has limited postoperative complications. Here we are presenting three cases of trans-oro-vestibular

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approach thyroid surgery in one male and two female patients. Describe about the method, challenges during surgery and outcome.

Case-1

Thirty-one years male presented with thyroid swelling in the neck for four months which was progressive increasing in size. There was no history of difficulty in breathing or swallowing and no hypothyroidism or hyperthyroidism. On clinical examination, he was thin built with long neck; the right lobe of thyroid was enlarged with 3×2 cm firm nodule in lower pole, mobile, non-tender and move with deglutition. Left lobe was just palpable. Trachea was central, bilateral carotids were palpable at normal place and there was no cervical lymphadenopathy. Biochemically he was euthyroid and the thyroid ultrasound revealed, that right lobe of thyroid was enlarged, measured $4.6 \times 2 \times 1.8$ cm and having $2.38 \times 1.78 \times 1.4$ cm nodule in lower pole. It was colloid nodule with cystic degeneration on fine needle aspiration cytology.

Case-2

Twenty-three years female presented with painless swelling in front of neck for one year, which was gradually progressing in size. There were no symptoms suggestive of hyperthyroidism or hypothyroidism and no compressive symptoms. She does not have family history of goiter. On examination she was thin built with long cylindrical neck and she had 3×3.5 cm firm nodule in the right lobe of thyroid, move with deglutition. Opposite lobe was normal. Trachea was central and no cervical lymphadenopathy.

Biochemically she was euthyroid and ultrasound neck revealed left lobe of thyroid was enlarged measuring $3.16 \times 1.47 \times 1.48$ cm with 1.51×2.87 cm heteroechoic, predominantly hyperechoic nodule with few hypoechoic areas and has peripheral vascularity, no evidence of calcification. The lesion was seen to be extended into isthmus. The right lobe was $2.9 \times 2.09 \times 0.9$ cm, normal echogenicity. On ultrasound guided fine needle aspiration cytology it was colloid nodule with cystic degeneration.

Case-3

A 46 years female presented with swelling in the front of neck since two months, no history suggestive of hypothyroidism or hyperthyroidism and no compressive symptoms. On examination there was swelling in the right lobe of thyroid 4×3 cm, firm move with deglutition, trachea central, bilateral carotid palpable at normal places.

She was diagnosed clinically as right solitary thyroid nodule probably benign. She was investigated and found to be euthyroid, the ultrasound revealed multiple hypoechoic lesions noted in the right lobe of thyroid, largest measuring 1.34×1.49 cm, left lobe and isthmus was normal. Ultrasound guided fine needle aspiration cytology from the nodule revealed papillary hyperplasia.

These patients were concerned about the appearance and psychological concern about malignancy; they were requested to have the nodule removed to rule out, malignancy and/or prevent malignant transformation. Therefore they underwent further investigations for surgical fitness along with serum calcium and indirect laryngoscopy examination to see the function of bilateral vocal cords.

In view of small benign euthyroid nodule they were planned for endoscopic thyroid surgery through trans-oral vestibular approach, they were advised for mouth wash after every major meal one week before thyroid surgery.

Operative Technique

Fully informed consent had been obtained from all the patients, before shifting into Operation Theater. General anesthesia through nasal intubation in supine position was given; oral cavity was packed with betadine gargle soaked gauze pack, the vestibule was cleaned twice with betadine gargle. The head end was elevated 15° with extension over the neck by putting pillow under the shoulder and both arms were kept in the side of the body.

Skin marking of thyroid cartilage, thyroid gland along with nodule, suprasternal notch and both side sternocleidomastoid muscle was done. About 50 ml of 1:20,000 adrenal saline solution was infiltrated in the subplatysmal plane vertically in the midline of the neck, from lower lip and chin superiorly to sternal notch inferiorly; horizontally from lateral border of one sternocleidomastoid muscle to another sternocleidomastoid muscle.

Three small incisions were made over the vestibular surface of lower lip (Fig. 1). First central 12 mm transverse incision in the center and two 5 mm vertical incisions at the level of both canine teeth to prevent the injury of mental nerve.

Blind subplatysmal space was created by using long artery forceps through 12 mm incision and 12 mm port was placed through this central incision. Two 5 mm ports were inserted under vision through two lateral 5 mm vertical incisions. The CO₂ insufflation was connected to one of the 5 mm port at 6 mm Hg and 10 mm 30° 3D telescope (Viking® Germany) was inserted through 12 mm port. Adequate subplatysmal space was created by using ultrasonic device (SonoSurg® Olympus, Japan), from hyoid bone to sternal notch vertically and right lateral border to left lateral border of sternocleidomastoid horizontally.

Fig. 1 Vestibular incision for the ports

The mid line of strap muscle is opened with the help of hook cautery and SonoSurg, and two layers of strap muscles were dissected on affected side. The silk 2–0 anchor suture passed from skin into Sternohyoid muscle and retracts it laterally from outside. Identify the isthmus of thyroid and bisected it in the midline by using ultrasonic device.

The sternothyroid muscle was dissected from the superior surface of the affected thyroid lobe. Then the superior pole of thyroid was dissected and polar vessels were coagulated and cut by SonoSurg near the thyroid lobe. Further dissected laterally, identified superior parathyroid and middle thyroid vein. The middle thyroid vein was divided with ultrasonic device. After lifting the superior pole of thyroid medially, the inferior thyroid artery and recurrent laryngeal nerve was visible. The inferior thyroid artery was bisected with SonoSurg and preserved the recurrent laryngeal nerve. Further dissected on tracheal surface at ligament of berry and specimen was removed through central 12 mm incision by using the endobag. The strap muscles were approximated in midline by using interrupted vicryl 3–0 suture. Homeostasis was secured and ports sites were closed in two layers with interrupted 3–0 and 4–0 vicryl without any drain (Fig. 2). The incision site was covered with gauze wet with povidone iodine gargle.

There was no postoperative complication, voice was clear, excellent cosmetic outcome on 1st post operative day (Fig. 3) and they were discharge on second postoperative day with satisfactory condition.

Discussion

The aesthetic demand by the patients in surgery is rapidly increasing and that pushes to surgeon for thinking beyond the boundary of conventional surgery. The natural orifice

Fig. 2 Sutured incision site at vestibular surface of lower lip

Fig. 3 Postoperative day-1 with no scar in the neck

transluminal surgery (NOTES) was invented for totally scar free approach. It was successfully practiced for abdominal surgery but for thyroid surgery it is still in primitive stage.

The indication of endoscopic thyroid surgery includes motivated patients, dominant benign euthyroid nodule less than six centimeter in size, or follicular neoplasm and node negative papillary thyroid cancer less than two centimeter [19–21]. The contraindication includes thyroid cancer with lymphadenopathy, compression over trachea, retrosternal extension, previous neck surgery and invasive cancer. The usual complications of endoscopic thyroid surgical approach is hypoparathyroidism and recurrent laryngeal nerve injury however some unusual complications includes hyperesthesia and paresthesia over neck and upper chest, skin perforation, tracheal injury and injury to carotid vessels have also been reported [22, 23]. The trans-oro-vestibular approach have all the advantages of minimally invasive surgery like less pain, less bleeding, faster recovery and better cosmetic outcome. In 2007 Witzel et al. [17] assessed the possibility of sublingual transoral access. They published their work on human cadaver and animal model. They describe the feasibility of this procedure safely. Wilhelm et al. [24], published first trans-oral endoscopic minimally invasive thyroid surgery (eMIT) in

eight patients. He placed the optic trocar sublingually in the mid line and the working trocars were placed bilaterally in the oral vestibule behind the canine teeth. It was a direct, fast and safe approach to reach avascular subplatysmal plain and working pretracheal space. Nkajo et al. [25] reported gasless transoral-video assisted neck surgery (TOVANS) in eight patients. They also used this procedure in follicular tumor, symptomatic large nodular goiter, Grave's disease and papillary carcinoma without evident of lymph node metastasis. In this approach they used single 2.5 cm incision in the center of the inferior lip. A subcutaneous tunnel in front of mandible was created and reached up to subplatysmal plane. The anterior neck skin was lift by Krischner wire and a mechanical lifting system without CO₂ insufflation. The operating time was 151–233 min, average amount of blood loss was 97 ml, orally allowed one day after surgery and drain was removed on same day. Hospital stay was 4–5 days after surgery. Recurrent laryngeal nerve palsy was noted in one patient, none of patient had mental nerve palsy and no infection was developed with use of perioperative antibiotics. Wang et al. [26] published a prospective randomized comparative study of 24 patients equally divided between oral vestibular approach (ETOVA) with complete areola approach for endoscopic thyroidectomy to evaluate the feasibility, safety, efficacy and cosmetic outcome. They enter into the subplatysmal plane through 10 mm vestibular incision and two 5 mm incision on both side of mucus membrane of buccal cavity. Three port techniques were used for the thyroid surgery. The operative time, cost of surgery, blood loss and total hospital stay was not significantly different in both the groups. Skin ecchymosis was noted in two patients in ETOVA group, none of patient developed recurrent laryngeal nerve injury and hypocalcemia in both the groups. After 6 months of follow-up the patient satisfaction score in ETOVA group was better than areolar group. The Recently published largest series of 60 human cases operated through transoral endoscopic total vestibular approach (TOETVA) by Anuwong et al. [27]. He had used three laparoscopic ports and conventional laparoscopic instruments with CO₂ insufflation. He included the patients with less than 10 cm benign nodule, follicular neoplasm, Grave's disease and papillary micro carcinoma without metastasis. He made 10 mm incision in the center of oral vestibule and lateral 5 mm incision vertical at the level of canine teeth. He performed hemithyroidectomy, total and near total thyroidectomy through this techniques. His median operating time was 115.5 min in hemithyroidectomy and 135.5 min in total thyroidectomy. Temporary hypoparathyroidism was developed in 5% of patients that was managed with oral calcium and vitamin-D supplementation. 3.33% patient develops temporary recurrent laryngeal nerve palsy that was recovered after 2 months

spontaneously. One patient develops late hematoma on post operative day three and managed conservatively and discharged on 7th postoperative day.

The Transoral thyroid surgery is becoming popular in our country, only few case reports are published in literature till date [28]. We had selected small benign, euthyroid nodule in thin built with long neck patients for our initial experience. The thyroid was approached directly and little dissection was required, therefore no drain was placed and postoperative emphysema and swelling was subsided spontaneously.

The complication of these technologies over conventional open thyroid surgery is almost similar in both the groups [19]. The postoperative pain was not much; there was hyperesthesia around the neck in all our patients however there was no voice change and hypoparathyroidism during postoperative follow up. Our male patient was a chronic tobacco chewer so oral antibiotics and antiseptic mouth wash was prescribed for longer period then female patients. All three were satisfied with their surgery; soft and liquid diet was advised on first postoperative day and was discharged on second post operative day.

Conclusion

Transoral endoscopic thyroid surgery through vestibular approach is shortest and direct remote access approach. The need of limited dissection in this approach provides less complication and excellent cosmetic outcome in strictly selected patients with small benign, euthyroid thyroid nodule.

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