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Original Research Article

Endoscopic thyroidectomy: a single institute prospective observational study in India

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ABSTRACT

Background: Endoscopic thyroidectomy (ET) is now an accepted treatment for benign and certain malignant thyroid diseases. It is clearly evident that ET is mainly done to lessen pain and avoid scar in the neck. Any procedure which involves using the endoscope to remove thyroid is often collectively called "endoscopic thyroidectomy." In this article, we would like to share our institute experience in doing ET.
Methods: We did ET on 85 patients from November 2014 to October 2019 mostly by the three-port technique. Preoperative assessment was done and surgery was done on those who met the inclusion criteria. All the cases were done with the insufflation of carbon dioxide gas. Per operative events were noticed and all the patients were followed up at least for 3 to 6 months postoperatively.
Results: The mean age of the patient is 38 years and the majority are females (92.94%). Out of 85 cases, one case was converted to an open method (1.18%). The average operative time to complete the procedure was 67 minutes. Most of the cases were discharged on 2nd to 3rd postoperative days. Few patients had complications like hematoma/seroma formation, paresthesia over the infraclavicular region, skin thermal injury, vascular injury, and tracheal injury.
Conclusion: ET gives excellent cosmesis and lessens the post-operative pain and thus lesser hospital stay even though the extent of the dissection is more than the conventional method. It has variable complications according to the techniques adopted and the size/volume of the surgically excised thyroid gland.

Keywords: Complications, Endoscopy, Techniques, Thyroidectomy

INTRODUCTION

The minimally invasive procedures for thyroidectomy are being performed since the late 1990s. Since then thyroidectomy by various minimally invasive techniques has come up and is being increasingly performed worldwide for benign and malignant conditions.[1] These procedures are accepted by many committed surgeons for three gross reasons: cosmesis, lesser pain and reduced hospital stay.

There are different types of thyroidectomies performed by minimally invasive methods. They are broadly classified into the cervical and extra cervical approach, each having its advantages and disadvantages.[2]

The presence of scar in front of the neck, particularly in females is not cosmetically acceptable nowadays. Due to the marked developments in endoscopic equipment and techniques, thyroidectomy is frequently performed

through remote sites without creating a scar in front of the neck.

Although this minimally invasive procedure is frequently done in many centers in different parts of the world, there is no single well-adopted standard technique for the learner to follow and perform independently. We initially performed Endoscopic thyroidectomy (ET) procedure which was adopted by different surgeons and after a few modifications we, ultimately performed our technique on these selected patients under study.

In our study, we observed the feasibility along with reproducibility of the endoscopic procedure for thyroidectomy in patients with benign thyroid swelling and its difficulties during procedure. We also observed the effects of this procedure (ET) during and after this minimally invasive thyroidectomy.

METHODS

Our study was carried in our institute with proper ethical approval from our ethical committee along with informed consent from each patient involved in this prospective observational study. The period of study was from November 2014 to October 2019 and we selected 100 consecutive patients with nodular swelling of thyroid subjected to Endoscopic thyroidectomy.

The exclusion criteria are: patient having thyroid swelling more than 5 cm in the largest dimension or volume more than 50 ml, Fine needle aspiration cytology (FNAC) showing The bethesda system for reporting thyroid cytology (TBSRTC) V category, hyperthyroidism, presence of neck node in ultrasound examination, history of the previous neck radiation/surgery, not fit for general anesthesia, retrosternal extension of thyroid gland. All the 85 patients are examined clinically, investigated for the functional status of the thyroid, radiologically evaluated by high-resolution ultrasound neck to identify the presence of lymph node in the cervical region and tissue diagnosis by fine-needle aspiration from the nodule with or without ultrasound guidance.

The inclusion criteria are: thyroid swelling size less than 5 cm in its maximum dimension or volume less than 50 ml by ultrasound, benign thyroid nodules by FNAC, fit for general anesthesia, euthyroid status. Based on the exclusion and inclusion criteria 85 patients were selected for the study. Out of eighty-five cases 79 patients were female then six patients were male moreover the age ranged from 17 years to 78 years. None of the cases were diagnosed as malignancy in the preoperative workup done.

Operative technique

The surgical anatomy of endoscopic thyroidectomy is entirely different from that of the open technique. A surgeon should clearly understand the unfamiliar surgical anatomy and the unusual approach before proceeding for endoscopic thyroid surgical procedures. Unlike the conventional method, endoscopic thyroidectomy is approached from the axilla and breast region as shown in Figure-1A. Surgeon positioned on the side of surgery and camera holding surgeon besides the surgeon which depends on the side of surgery. One 11 mm optical port at the circum-areolar region, two 5 mm ports each at the ipsilateral anterior axillary fold and ipsilateral paramedian sternal region, 7-8 cm below sternal notch respectively are placed for working (Figure 1A,1B). All the cases were done with insufflation of carbon dioxide gas with 8-10 mmHg pressure. A subcutaneous tunnel is created with monopolar electrocautery, the pectoral fascia is lifted with gas and the infraclavicular part of pectoral major muscle exposed (Figure 1C). Dissection is proceeded craniomedially to visualize the clavicle and two heads of the Sternocleidomastoid muscle (SCM) and exposed it adequately for further dissection (Figure 1D).

The two heads of the SCM are separated apart so that the strap muscles covering the thyroid glands are exposed. The strap muscles are split and space is created all over the ipsilateral thyroid gland (Figure 1E). The superior thyroid vessels, the middle thyroid vein, and the branches of inferior thyroid vessels (Figure 1F,1G) are identified for thermal coagulation and transection with a harmonic scalpel or bipolar electrocautery. Recurrent laryngeal nerve and parathyroid glands are identified and preserved (Figure 1H,1I). The thyroid gland is dissected from the tracheal attachment and the isthmus is transected from the opposite lobe, in the case of hemithyroidectomy. The procedure is continued in a similar fashion on the opposite side in case of total thyroidectomy. We kept the closed suction drain tube for all cases at the end of the procedure. The complete elaboration of the procedure is not the aim of this paper.

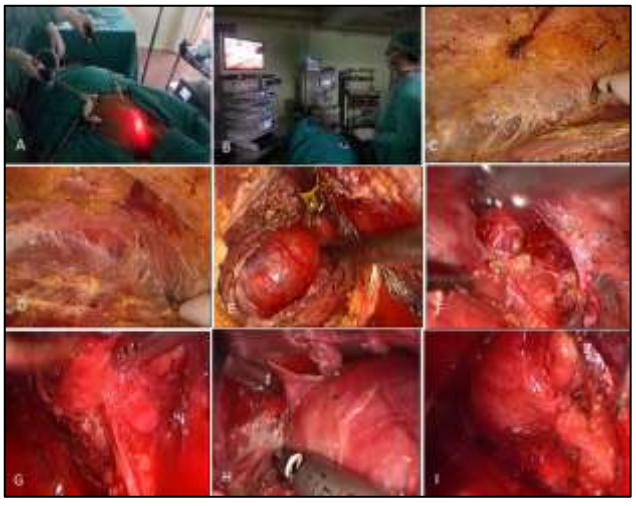

Figure 1: Steps of endoscopic thyroidectomy.

RESULTS

We have included 85 consecutive patients who underwent ET fulfilling the preoperative inclusion criteria in our

study. The majority of them were from agriculture backgrounds and they are predominantly females (92.94%). Baseline characteristics of the patients and the pattern of their disease assessed preoperatively included in the study are in Table 1.

Out of 85 cases, right-sided hemithyroidectomy was done in 48 cases and left-sided hemithyroidectomy was performed in 34 cases and total thyroidectomy was done in 3 cases. The average operative time for the initial 15 cases was much more than the average time due to the adaptation required for the new procedure for the surgeon along with his team and the overall mean procedure time for 85 cases was 67 minutes (ranges from 52 minutes to 124 minutes) excluding preparation and anesthesia time. The average size of the nodule was 3.7 cm (arrays from 1.7 cm to 4.8 cm) by ultrasound neck and most of them are having colloid goiter by fine-needle aspiration. The average length of hospital stay in our study was 2.63 days (ranges from 2-7 days). A surgeon is a right-handed person and here are the other observations made during the procedure and after follow-up for 3-6 months.

Table 1: Characteristics of the 85 patients and their disease patterns included in the study.

^Age (years)	**38 years**	**Alcoholic**	**5**
^BMI (kg/m^2)	23.7	Diabetes mellitus	2
^Systolic BP (mm/Hg)	118	®CAD/IHD/CVA	4/1/1
^Diastolic BP (mm/Hg)	76	Bronchial asthma	2
^Pulse rate (per minute)	74	Previous cancer (anywhere)	0
^TSH level (µIu/ml)	4.41	USG neck	
Occupation		Solitary nodule	63
Farmers	62	Cystic nodule	15
Fishermen	2	Multinodular	7
Vendor	4	Malignant	0
Teacher	3	FNAC report	
Others	14	Colloid goiter	38
Smokers	2	Adenoma	28
Hypertensive	5	Thyroiditis	5
Previous irradiation	0	Benign cystic lesion	14
Previous neck surgery	0	Malignancy	0

^average value from 85 patients; ®CAD-Cardiovascular disease, IHD-Ischemic heart disease, CVA-Cerebrovascular accident.

The important advantage observed in doing ET is excellent cosmetic (100% no scar in the neck) due to hidden small scars in breast and axilla by patients clothes and clear identification of recurrent laryngeal nerve and parathyroid gland due to the magnified vision and thereby better preservation of these structures than the conventional way. In our study, temporary recurrent laryngeal palsy was observed in 2.35% and the same patients did not have any permanent nerve damage even after 6 months follow up. We too observed one case of temporary hypoparathyroidism (1.18%) following total thyroidectomy. Mostly, these injuries are due to thermal heat energy that spreads all around during cutting/coagulation with electrocautery and also by manipulation while dissecting the gland.[14]

Despite the above-mentioned advantages of ET over conventional thyroidectomy, we came across specific complications pertaining to endoscopic thyroidectomy procedure like flap necrosis (2.35%) in thin built patients due to thermal burns (Figure 2), seroma (7.06%) formation particularly in obese patients and temporary paranesthesia (16.47%) over the infraclavicular region mostly due to the usage of electrocautery while creating the wide surgical field. The required surgical field is a relatively larger wound and is remotely placed than the conventional method. The paresthesia usually is seen to subside over a period of three to six months in a majority in our observation. Only 3.53% of cases still complain of paresthesia even after two years of follow up. The various observations of our study are listed in Table 2.

We had one case of internal jugular vein injury while dissecting for superior pole and that case was converted to open thyroidectomy along with the earlier repair of the vein. We too had bleeding from the superficial neck veins (Figure 3) while dissecting the flap particularly near the heads of SCM muscle which could have been avoided with bipolar cauterization. There was one case of tracheal perforation (Figure 4) while resecting the isthmus from trachea using harmonic scalpel which was successfully sutured endoscopically. Some of the complications like major vascular injury, tracheal injury, and skin flap burns are seen with in the first 15 cases (considered as preliminary learning curve cases) according to our observation. We had one case featuring a collection of pus under the flap over the pectoral region presenting to us after two weeks of surgery and this was treated with repeated aspiration using wide bore needle (18 G) and appropriate antibiotics. Hypercarbia (Figure 5) was one of the common problems faced per-operatively. Once we were alerted by our anesthetist for hypercarbia, we deflated the carbon dioxide for a while and then we waited for his word to continue the procedure. We did not observe any complications like pneumothorax and air embolism so far but few patients developed surgical emphysema (Figure 6) on the neck and face which was subsided once the wound was deflated. Per-operative blood loss in all our cases was very insignificant and immeasurable except one case of major vascular injury. Except for the cases of major vascular and tracheal injuries who stayed in the hospital for a week, the rest of the cases were discharged on 2nd or 3rd postoperative days.

Table 2: Observations during endoscopic thyroidectomy to three months of follow up.

Observations	Right hemithyroidectomy	Left hemithyroidectomy	Total thyroidectomy
Number of cases	48 (56.47%)	34 (40%)	3 (3.53%)
Per op difficulty	7 cases	3 cases	3 cases
RLN injury (p#)	nil	nil	Nil
RLN injury (t*)	1	nil	1
External LN injury	nil	nil	nil
Parathyroid injury (p#)	nil	nil	nil
Parathyroid injury (t*)	nil	nil	1
Seroma	3	2	1
Hematoma	1	nil	nil
Skin burns	2	nil	nil
Infection	1	nil	nil
Bleeding	2	1	nil
Paraesthesia	8	5	1
Tracheal injury	nil	1	nil
Oesophageal injury	nil	nil	nil
Hypercarbia	3	3	1
Major Vascular injury	2	nil	nil
Malignancy in HPE	2	nil	1
Hypertrophied scar	3	2	Nil
Surgical emphysema	2	1	1
Procedure time**	65 minutes	54 minutes (minimum 52 minutes)	82 minutes (maximum 124 minutes)
Length of hospital stayµ	2.6 days	2.2 days	3.1 days

#permanent nerve injury, *temporary nerve injury, ** average operative time- 67 minutes (ranges from 52 minutes to 124 minutes), µaverage length of hospital stay- 2.63 days.

Figure 2: Skin burns by electrocautery.

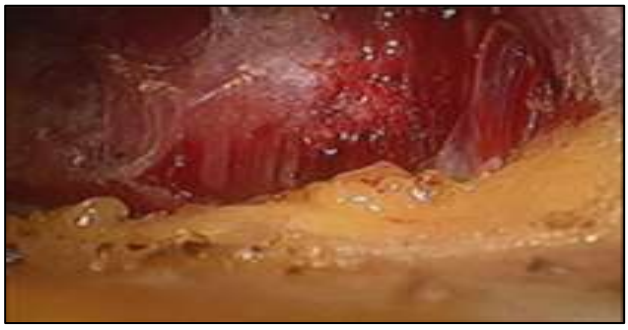

Figure 3: Vascular injury near heads of SCM muscle.

Figure 4: Tracheal injury during ET.

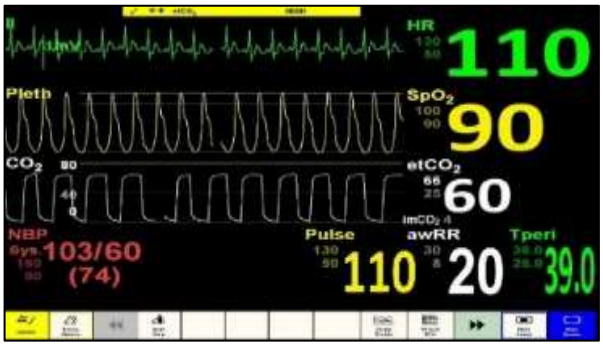

Figure 5: Hypercarbia during ET.

Figure 6: Emphysema face and periorbital region.

Tube drains were removed on the 1st postoperative day in all cases except the tracheal injury case which was removed on the 5th post-operative day. Hypertrophied scar over the medial aspect of the chest also observed in 5 cases. Out of the 85 specimens sent for histopathological examination, 3 cases were found to be malignant (2.55%) and they were referred to an oncologist for further evaluation and management.

DISCUSSION

ET is now routinely adopted procedure by many surgeons. We started doing this procedure since 2014 and are still performing. ET is performed for the following indications: tumor size is less than 3.5 cm, papillary thyroid carcinoma (T1) without the evidence of local and distant metastases, the volume of gland less than 30 ml.[1] Due to the advancement in technology and also better familiarization of the endoscopic anatomy of myo-cutaneous flap over pectoral region and neck facilitated by the availability of superior endoscopic gadgets, ET for tumors of size 5 cm or volume up to 50 ml can be safely operated.[3,4] Similarly, ET with central nodal dissection can be safely performed for anteriorly located well-differentiated thyroid cancer (T3).[5] The contraindications for endoscopic thyroidectomy are in table 3.

Doing endoscopic thyroidectomy in the initial stage (learning curve) is quite cumbersome even for well-trained endoscopic/laparoscopic surgeons. This is because of the new surgical domain and operative field through which thyroid surgery is performed. The learning curve is considerably more than any other endoscopic procedure done in the abdomen. In our study, we observed that the time taken for the right-handed surgeon to do left-sided endoscopic hemithyroidectomy is significantly less than the right side (table 2). Moreover, the ET complications and their management are different when compared to conventional thyroid surgery.

Some of the specific complications that happen during and after ET are flap necrosis, seroma formation, tracheal and vascular injuries, paresthesia, etc., (table 2). At the same time, there are many advantages in doing thyroidectomy by an endoscopic method like a magnification of surgical field, easy identification of nerves and parathyroid gland hence, can be preserved better than open surgery.[10,11] Moreover, cosmetic is the highlight of thyroidectomy performed endoscopically because the scar goes behind the clothes worn and concealed for others. Still, there is no clear consensus about the indications, contraindications, and the type of procedure that one should follow regarding endoscopic thyroidectomy.[11] Presently, totally endoscopic thyroidectomy is indicated for benign thyroid diseases and malignant thyroid conditions without local or distant metastasis with a volume less than 30-50 ml.

Table 3: Contraindications for Endoscopic thyroidectomy.[5,6,7,8,9]

Relative contraindications	Absolute contraindications
Nodules >5 cm	Substernal and retropharyngeal extension of tumour.
Volume >50 ml	Previous neck surgery or radiation.
Obese with a short neck	Well-differentiated thyroid cancer with evidence of local invasion.
Signs of thyroiditis	Medullary carcinoma thyroid.
Uncontrolled grave's disease	Coagulation disorders
Well-differentiated thyroid cancer >2 cm without evidence of invasion	
Patients with severe cardiorespiratory disease	

CONCLUSION

In conclusion, minimally invasive surgery for thyroid diseases are being performed for nearly three decades by many general surgeons, ENT surgeons, cancer surgeons, and endocrine surgeons from various parts of the world. It is performed not to replace the conventional open procedure but to reduce its drawbacks like a scar in the neck, chronic pain due to cicatrized scar, and a long stay in the hospital. Minimally invasive procedures for thyroidectomy is a dynamically evolving procedure which was started with less scar procedure minimally invasive video-assisted thyroidectomy (MIVAT) in the neck to no scar procedure like totally endoscopic thyroidectomy. Due to the development of electronics and other surgical gadgets, this evolution may continue and force the surgeons to learn and improve the standards of minimally invasive procedures for thyroidectomy. It is evident that our way of doing ET is reproducible, can be performed safely and it gives better cosmetic results than the other minimally invasive procedures like MIVAT and gasless trans-axillary procedures. Even though ET is assistant dependent, more invasive, and difficult to approach to the

opposite side, yet it is less expensive than the robotic thyroidectomy and there is no difference between them in dealing with papillary microcarcinoma of thyroid. Even though ET is performed for well-differentiated thyroid cancer along with nodal dissection in many advanced cancer centers, it has to be evaluated further to consider it as a standard mode of treatment. ET is now performed for excellent cosmetic acceptance among patients than open methods and it should be performed by an experienced surgeon with adequate practical knowledge in minimally invasive surgery.

Limitations of our study

Due to the single center prospective observational study it has its own limitations like lack of comparison with other methods of endoscopic thyroidectomy performed in different parts of the world. The study lacks ability to find the cause and effect relationship. The procedure done in our study was performed by single group of surgeons so, the study has to be performed with different group of surgeons with same eligibility criteria and should be statistically compared to see the consistency and reproducibility of the procedure and its effects on patients in future.

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