Endoscopic neck surgery

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Abstract

Endoscopic surgery in the neck was attempted in 1996 for performing parathyroidectomy. A similar surgical technique was used for performing thyroidectomy the following year. Most commonly reported endoscopic neck surgery studies in literature have been on thyroid and parathyroid glands. The approaches are divided into two types i.e., the total endoscopic approach using CO2 insufflation and the video-assisted approach without CO2 insufflation. The latter approach has been reported more often. The surgical access (port placements) may vary-the common sites are the neck, anterior chest wall, axilla, and periareolar region. The limiting factors are the size of the gland and malignancy. Few reports are available on endoscopic resection for early thyroid malignancy and cervical lymph node dissection. Endoscopic neck surgery has primarily evolved due to its cosmetic benefits and it has proved to be safe and feasible in suitable patients with thyroid and parathyroid pathologies. Application of this technique for approaching other cervical organs such as the submandibular gland and carotid artery are still in the early experimental phase.

Key words: Endoscopic surgery, neck surgery, parathyroid, thyroid

INTRODUCTION

The cervical region comprises a plethora of well-defined anatomical structures systematically arranged in layers with minimal or negligible vascular overlap these well-defined layers form the vascular anatomical planes, which have been exploited by the endoscopic surgeon to create a working space for surgical manipulation. Reported initially in 1996,[1] endoscopic neck surgery has evolved in its application especially due to cosmetic benefits. The primary target organs have been the parathyroid and the thyroid glands,[2-9] although few studies have reported on its application to other cervical structures, such as the sub-mandibular gland and cervical spine.[9,10]

Furthermore the approaches may be classified into total (pure) endoscopic (CO2 insufflation).[3-6] video-assisted endoscopic[7-12] and minimally invasive mini incision approaches.[13-18] The total endoscopic approach has been further sub-classified into a supraclavicular, anterior chest wall, axillary, and periareolar breast approach. The latter three have also been attempted in the video assisted endoscopic approach.

ENDOSCOPIC PARATHYROIDECTOMY

Reported in 1996 by Gagner,[1] the parathyroid glands especially due to their size are amenable to the endoscopic approach. The drawback is their variable position. Minimally invasive parathyroidectomy has evolved due to a parallel progress in imaging and localizing techniques making a targeted approach possible.

The commonly performed localization studies are the 99TC sestamibi scan and cervical ultrasound.[19-24] A combination of the sestamibi scan along with a radiological investigation has been described as equivalent to an open conventional bilateral exploration of the neck for localizing the parathyroid lesion. High-resolution cervical ultrasonography alone has reported a high success rate of 94% for pre-operative specific side localization of the parathyroid lesion.[20] The sensitivity was reported as 89% with a 98% positive predictive value.
The most popular minimally invasive approach for performing parathyroidectomy is the focused minimally invasive mini incision approach.\[25,26\] Few reports are available for total endoscopic parathyroidectomy, reporting on limited number of patients. Currently just below 50% of all parathyroidectomies are being performed by the minimal access approach popularly known as minimally invasive parathyroidectomy (MIP).\[27\] Restrictions in its applicability are selection criteria such as unilateral disease, (preferably a single adenoma), absence of thyromegaly, no previous neck surgery and no previous history of irradiation to the neck region.\[28-30\]

Techniques to ensure complete removal of the hyperfunctioning parathyroid tissue in MIP reported are intra-operative rapid parathormone assays,\[29,31-34\] frozen section and good clinical judgment followed by post-operative S.Ca\(^{++}\) and PTH level monitoring. Several studies have also reported day care MIP using local/regional anesthesia.\[26\] Such centers apply techniques, such as chemiluminescent assay for intact PTH level (quick PTH) giving a success rate of 95-98% to ensure a cure for the patient before discharge.\[35-38\]

However, these results are best observed in patients with uniglandular disease. Provided a careful preoperative patient selection is performed, an MIP will cure the patient whether or not an intra operative QPTH assay is done [Table 1].\[25\]

Carbon dioxide embolization, a potential life threatening complication has so far not been reported.

Our own experience spans 8 years with 18 patients of primary hyperparathyroidism (PHPT) subjected to total endoscopic parathyroidectomy. About 17 of these patients were diagnosed with a single parathyroid adenoma on 99\(^{TC}\) sestamibi scan corroborated by an ultrasonography neck or an magnetic resonance imaging scan. One patient was diagnosed to have parathyroid hyperplasia. Ten procedures (7 procedures with CO\(_2\) insufflation and three procedures video-assisted) were performed by a supraclavicular approach, four by an anterior chest wall approach, and four by a periareolar breast approach. Carbon dioxide insufflation was maintained at 10 mm of Hg. Post-operative monitoring of S Ca\(^{++}\) and S PTH levels were done to confirm complete removal of all hyper functioning parathyroid tissue. There was one conversion due to non-localization of the parathyroid adenoma. The tumor was identified in the tracheo-esophageal groove. Although the number of patients in our experience is small, the results conform to those reported in literature in terms of safety and feasibility.

Our progress from a supraclavicular approach to a periareolar approach is strongly driven by superior cosmetic results, as the dissection involved in this approach is much more than a focused mini-incision approach.

### ENDOSCOPIC THYROIDECTOMY

Unlike parathyroidectomy, endoscopic thyroidectomy has progressed toward more remote sites of access to improve cosmesis and provide patients with a scar less neck. This has been more on patient demand as thyroid disease predominantly affects women. Endoscopic thyroidectomy was first reported in 1997\[2\] since then several reports have been published describing novel ways (neck, chest wall, axilla, and breast)\[2,4,6,8,40,41\] of access to this gland. Indications for endoscopic thyroidectomy in various studies include solitary, benign thyroid nodules, follicular and oxyphilic cell tumors, papillary micro carcinomas (<1 cm in size and no evidence of clinical or radiological lymphadenopathy) and Grave’s disease.\[3,13,42\] The latter has been reported only sporadically [Table 2].

**Table 1:** Complications reported in endoparathyroidectomy\[39\]

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<th>Complication</th>
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<tr>
<td>Recurrent laryngeal nerve palsy</td>
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<td>Failed surgery (persistent - hyper calcemia/increase PTH)</td>
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<tr>
<td>Hemorrhage</td>
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<td>Seroma</td>
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<td>Hypocalcemia</td>
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**Table 2:** Exclusion criteria for endothyroidectomy\[43-50\]

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<th>Exclusion Criteria</th>
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<tr>
<td>Family history of Ca thyroid</td>
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<tr>
<td>History of neck irradiation</td>
</tr>
<tr>
<td>Significant thyroiditis</td>
</tr>
<tr>
<td>MNG</td>
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<tr>
<td>Thyroid nodule &gt;35 mm (relative)</td>
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However, few reports describing the video assisted approach have reported removing tumor up to 74 mm in size.\[12\]

The aim of most studies apart from being cosmetically superior has been to be minimally invasive offering all associated advantages such as minimal post-operative pain, rapid recovery, and low analgesic requirement.\[51-53\]

In terms of invasiveness none of the distant sites of access prove to be truly minimally invasive as extent of invasion is much more compared to a focused, direct approach. The popularity has however persisted and increased due to improvement in cosmesis.

The supraclavicular approach has other advantages such as rapid access to thyroid (in the event of a vascular mishap), the advantage of applying external pressure for hemostasis.\[54\] The video-assisted focused approach using conventional instruments has a shorter learning curve.\[55-58\]

The size of the thyroid lobe removed has varied between 20-80 mm and the volume where recorded has ranged 15-73 grams in most studies.\[16,42,58,59\] A thyroid size beyond 70 mm or 70 grams becomes too voluminous to provide an adequate safe working space.

Studies reporting total endoscopic thyroidectomy with carbon dioxide insufflation have reported using ultrasonic shears for dissection and excision of the specimen.\[5,6,40,58\] The size and volume of tissue removed by either method is similar. The use of harmonic scalpel has been shown to reduce operative time in thyroid surgery [Table 3].\[60\]

All complications save the last have been reported with both video assisted and total endoscopic thyroidectomy, the latter results due to CO\(_2\) insufflation. Studies comparing intra operative pain and speed of recovery (return to normal activity) have all reported results in favor of the endoscopic approach\[6,11,45,62\] reaching statistical significance although analgesic requirement was not different.\[52\]

Both video-assisted and total endoscopic approaches have been reported for operating on thyroid cancer. The prerequisite are papillary tumors <1 cm in size with a negative clinical and radiological lymph node status.\[11,12,45,55\] Overall about 8% patients undergoing endoscopic thyroid surgery had papillary carcinoma. Patients of follicular carcinoma less than 5 cm may undergo endoscopic thyroidectomy. This surgery may also be recommended as a prophylaxis\[63\] to patients of multiple endocrine neoplasia with medullary carcinoma.

Our experience comprises 25 patients operated since 1997. About 21 patients had a solitary thyroid nodule and four patients had small multi-nodular goiter. In three patients a supraclavicular approach was adopted and 22 patients were operated by a periareolar approach. The surgery in one of the three patients of the supraclavicular approach was converted to a conventional exploration due to abnormally high vascularity of the gland, which turned out to be a multi-centric papillary carcinoma on histopathology. The patient subsequently underwent a completion thyroidectomy. Three patients developed subcutaneous emphysema which resolved over 24 hours and five patients showed bruising in the presternal region which resolved in 2 weeks. There were no other complications. It was easier operating from the periareolar approach as a larger working space was available. In 21 patients of solitary thyroid nodule a hemi thyroidectomy was performed and in three patients of multinodular goiter the excision extended to a little more than half the opposite lobe. The size of the resected specimen varied from 2 x 2.4 cm\(^2\) to 5 x 4.1 cm\(^2\) (the specimen were not weighed).

### Table 3: Post-operative complications with endothyroidectomy\[55,58,60\]

<table>
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<tr>
<th>Rec. laryngeal n palsy</th>
<th>Hypocalcemia</th>
<th>Seroma</th>
<th>Hematoma</th>
<th>Wound infection</th>
<th>Subcutaneous emphysema (with CO(_2) insufflation)</th>
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The sub-mandibular gland and other structures

A few reports have been published over the past 2 years about an endoscopic approach to the sub-
mandibular gland. It has been demonstrated in cadaveric models to be possible. Initial attempts, reported injury to facial artery and lingual nerve. Video-assisted approach deploying the harmonic scalpel has also been reported with a 15-20 mm skin incision. Endoscopic sentinel lymph node biopsy in oral malignancy is another area where this potential is being explored. These reports are all in the very early phase and may at the most be described as experimental. The cervical spine is another region where endoscopy is being commonly practiced, but since it involves a specialty branch that is neurosurgery, it has not been discussed here.

CONCLUSION

Endoscopic neck surgery offers a definite cosmetic advantage over its conventional counterpart. With increasing skill and patient demand, this surgery is going to be performed in more centers. However careful patient selection is advocated. Though few centers are reporting good results in thyroid malignancy, the role of endoscopy in thyroid malignancy is as yet controversial. Endoscopic approach to other neck structures such as the submandibular gland is as yet in the experimental stage.

REFERENCES