




Tracheal/Laryngeal Infiltration in Thyroid Cancer: a Single-Centre Experience

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Abstract

Around 1/3 of patients of locally advanced carcinoma thyroid present with tracheal infiltration either alone or along with infiltration of other adjacent structures. Even though trachea is infiltrated, adequate resection is the main modality of treatment in these patients. We retrospectively analysed carcinoma thyroid patients who were operated at our institute, between January 2011 and December 2018, and underwent thyroidectomy with tracheal or laryngeal resection. Seventeen patients underwent tracheal/laryngeal resection with thyroidectomy. The mean age of patients was 57 years. Six and eleven were male and female, respectively, 0.14 (82%) patients had dyspnoea on presentation, 6 had hoarseness of voice, 6 had haemoptysis, and in 2 patients, neck swelling was the only complain. Two patients in our study presented with acute stridor, underwent emergency intubation and subsequently surgery. Two other patients had bulky pedunculated tumour in preoperative bronchoscopy and required tracheostomy for intubation before proceeding with surgery. In 11 patients, sleeve resection followed by end-to-end anastomosis was done, window resection was done in 3 patients, partial laryngectomy in 1, and total laryngectomy in 2 patients. In 10 patients (59%), the site of infiltration was in the lateral tracheal wall, with relatively small posterior primary (mean size 3.7 cm) in the thyroid lobe. Two patients developed postoperative complication, one patient with sleeve resection had secondary haemorrhage, and one patient who underwent window resection with myochondrial thyroid lamina flap reconstruction developed salivary fistula. These patients underwent re exploration with tracheostomy and were subsequently decannulated. Preoperative diagnosis of tracheal infiltration helps in better planning of surgery and counseling the patients of any possible complication. Clinical workup and pre-emptive diagnosis is therefore of paramount importance.

Keywords Carcinoma thyroid · Tracheal resection · Laryngeal resection

Introduction

Thyroid malignancies are known to have an indolent course, with most of the treated patients having a prolonged survival. However, the survival of patients decreases by almost half from 91 to 45% with extrathyroidal extension [1]. In trachea forming the bed of thyroid gland around, 1/3 of patients of locally advanced carcinoma thyroid present with tracheal infiltration either alone or in combination with other surrounding structures [2, 3]. In the TNM staging (8th edition) for thyroid cancers, gross extrathyroidal extension (ETE) has

been grouped under stage T3 and minor ETE has been excluded [4]. On the other hand, tracheal infiltration has been grouped as T4 without any stratification with respect to the depth of invasion. However, management of each patient may vary with the extent of laryngotracheal invasion. Symptoms on presentation may suggest locally advanced disease but does not always point towards tracheal infiltration. We present a review of 17 operated cases of carcinoma thyroid having tracheal/laryngeal infiltration with respect to their presentation and perioperative outcomes.

Methods

We retrospectively analysed operated cases of papillary carcinoma thyroid with tracheal resection at our institute between January 2011 and December 2018. Patients undergoing either

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total or completion thyroidectomy along with tracheal or laryngeal resection were included. Clinical assessment including investigations was done to look for locoregional and metastatic disease. Ultrasound neck and guided FNAC was done for all patients. Direct laryngotracheoscopy (70 degrees Hopkins rod lens examination) was done to look for functional status of vocal cords and visualise the tracheal lumen. Preoperative bronchoscopy was performed whenever feasible. Contrast-enhanced CT (computerised tomography) scan of neck and chest was performed in all patients. The extent of disease was assessed and surgery was planned accordingly with either curative or palliative intent. Metastatic disease on presentation was not a contraindication for surgery.

Anaesthesia Considerations

All the patients were jointly reviewed by an anaesthesiologist and surgeon regarding the plan of intubation preoperatively. In patients wherein bronchoscopy showed low-volume disease occluding less than third of trachea, transoral intubation was done. In patients with involvement of up to half of tracheal lumen, fiberoptic paediatric bronchoscopy was performed and an endotracheal tube was gently manipulated across the growth into the distal trachea. The endotracheal tube of appropriate size was then threaded along the bronchoscope. Two patients in our study presented with acute stridor and underwent emergency intubation and subsequent surgery. One patient underwent tracheostomy outside for stridor and came to us with the tracheostomy tube in situ. Two of the patients on preoperative bronchoscopy were found to have a bulky pedunculated tumour with a high risk of tumour dislodgment while attempting intubation. In these patients, tracheostomy was performed first under local anaesthesia for induction and surgery was completed.

Surgery

We prefer to start the surgery on the normal thyroid lobe if the disease is localised to one side and try to preserve RLN. Care was taken to identify and preserve the ipsilateral recurrent laryngeal nerve in all patients; 0.12 patients had ipsilateral infiltration of RLN, which was sacrificed. Parathyroids were preserved on at least one side. Four patient's parathyroids were transplanted in ipsilateral sternocleidomastoid due to vascular compromise.

Surgical Techniques

Circumferential Resection Circumferential sleeve of tracheal rings were resected with an end-to-end anastomosis of trachea (Figs. 1, 2, and 3). Both the proximal and distal ends of the trachea were mobilised as much as possible without disturbing much of posterior membranous part to avoid vascular

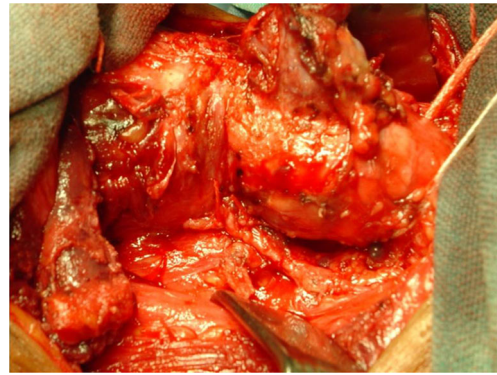


Fig. 1 Tracheal mobilisation before resection

compromise. Suprahyoid release was performed in all patients with sleeve resection to achieve a tension-free anastomosis. Care was taken to avoid injury to the superior laryngeal nerve.

Window Resection In patients with focal invasion of the trachea, a window of infiltrated trachea rings was resected, and primary closure or reconstruction performed.

Laryngectomy Total laryngectomy was performed, if it was a non-functional larynx or both the cricoarytenoid units were involved. In one patient vertical partial laryngectomy was performed with strap muscle reconstruction.

Postoperative

Patients were extubated on next postoperative day. In some patients, 2 stitches were placed between the chin and manubrium (Grillo stitch) and kept for 1 week to prevent inadvertent extension and tension on anastomosis (Fig. 4). Patients were discharged when fit and asked to follow-up with final histopathology report to decide on adjuvant treatment. Radioactive iodine therapy and/or postoperative radiotherapy were administered selectively after discussion in multidisciplinary tumour board.

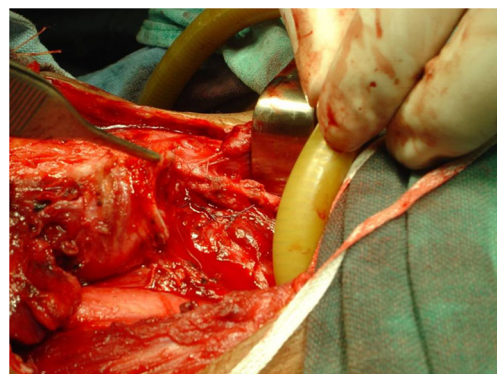


Fig. 2 Post sleeve resection defect

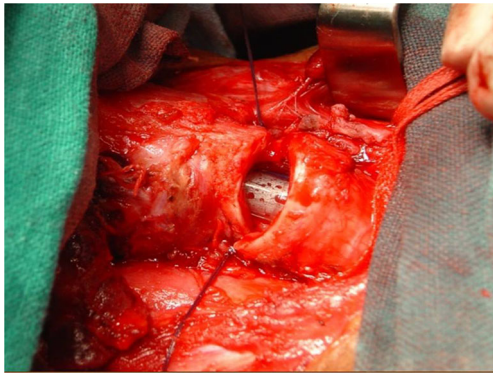


Fig. 3 Anastomosing the proximal and distal ends following sleeve resection

Results

Table 1 shows the demographic profile and clinicopathological features. Fourteen patients had dyspnoea on presentation, 6 patients had hoarseness of voice, 6 had haemoptysis, and in 2 patients, neck swelling was the only complaint. In all patients, preoperative imaging with either CT scan or MRI had evidence of tracheal involvement. Twelve patients presented primarily with thyroid tumour and rest, 5 came with recurrence, 4 after total thyroidectomy, and one after hemithyroidectomy. One patient with medullary carcinoma had only lymph nodal recurrence.

In 11 patients, trachea was repaired by an end-to-end anastomosis, 3 patients had tracheal window resection with strap muscle or local flap repair, and three patients underwent laryngotracheal resection with thyroidectomy. In 10 patients, the tumour was mainly located posteromedially within the thyroid lobe without any anterior involvement; in 5 patients, infiltration was present both laterally and anteriorly. In 2 patients, the tumour involved the entire laryngotracheal unit. On final histopathological examination (HPE), most of the patients had classic papillary carcinoma and there was only one patient with medullary carcinoma.

Two patients developed postoperative complication. One patient developed secondary haemorrhage on the 4th and 9th postoperative days (POD). He was re-explored and



Fig. 4 Two stitches between the chin and manubrium skin (Grillos stitch)

Table 1 Demographic profile and clinicopathological features

Patients	17
Mean age	57 years
Gender	
Female	11
Male	6
Thyroidectomy	
Completion	5
Total	12
Resection	
Sleeve	11
Window	3
Partial laryngectomy	1
Total laryngectomy	2
RLN involvement	
Unilateral	12
Bilateral	2
None	3
Final histopathology	
1. Papillary	
Classical	12
Follicular	2
Columnar	1
Tall cell	1
2. Medullary	1
Tumour size less than 3.5 cm	9 (52%)
Tracheal margin involved	1
Postoperative complication	2

tracheostomy was done after securing haemostasis. The second patient underwent window resection with myochondrial thyroid lamina flap reconstruction and shaving of esophageal wall, and developed a salivary leak from neck wound on the 3rd POD. He was managed conservatively and the Ryles tube was placed for feeding, since the fistula was persistent the patient was re-explored on the 15th POD. Small fistulous opening was identified near pyriform fossa due to impingement of thyroid cartilage over mucosa. The fistula was closed primarily and reinforced with sternocleidomastoid muscle flap. At the same time, the Montgomery T tube was placed which was subsequently replaced by a cuffed tracheostomy tube. One patient with doubtful integrity of B/L RLN nerves intraoperatively was found to have B/L vocal cord palsy following extubation and underwent prophylactic tracheostomy. These three patients were subsequently decannulated on follow-up. Another patient who had undergone window resection for local recurrence developed second recurrence after 4 years and presented with difficulty in breathing. As the disease was unresectable, he underwent tracheal stenting. Subsequently, he developed dysphagia and underwent PEG (percutaneous endoscopic gastrostomy) tube placement.

Twelve patients underwent lateral neck dissection, out of which 11 patients had positive nodes. Mean hospital stay was 7 days (3–14). Six patients received postoperative adjuvant external beam radiation ranging from 45 to 60 Gy. Hypocalcaemia was noticed in 7 out of 17 patients, being transient in 6 patients, whereas 1 patient required prolonged calcium administration (more than 3 months). All patients received radioactive iodine therapy. Two patients had lung metastasis on diagnosis and 4 other patients developed distant metastasis on follow-up radioactive iodine scan.

Discussion

Well-differentiated thyroid carcinomas have an excellent prognosis with 10-year survival exceeding 80% after adequate treatment [5]. However, as the tumour grows, it invades into surrounding structures resulting in extrathyroidal extension. This is more commonly associated with poor cellular differentiation [5]. Once there is extrathyroidal extension, the prognosis worsens and so does survival [6]. In fact, one of the most common causes of cancer-related death in these patients is local recurrence causing asphyxia and haemorrhage [7].

The primary modality of treatment in these patients is surgery involving complete removal of the tumour followed by adjuvant treatment. Shin and colleagues have classified tracheal invasion based upon depth of invasion. Stage I disease abuts but does not invade the external perichondrium of the trachea. Stage II disease invades into the cartilage or causes cartilage destruction. Stage III disease extends into the lamina propria of the tracheal mucosa with no elevation or penetration of the mucosa. Stage IV disease is full-thickness invasion with expansion of the tracheal mucosa [8]. All patients in our study had documented invasion of trachea (Shins stage 4) on either a CT scan or bronchoscopy and hence underwent partial or complete excision of 3 to 4 tracheal rings depending upon extent of tracheal invasion.

The surgical options available include shave resection, window resection, and sleeve resection of the trachea with an end-to-end anastomosis based on extent of invasion [9]. Window resection can be attempted in patients with anterior or laterally located tumour occupying less than one-third of tracheal circumference [3, 10]. Smaller defects can be closed primarily. Larger defects require local flap reconstruction or a temporary tracheostomy and delayed closure [11]. Very often, patients have a small site of invasion in trachea but a proliferative intraluminal component; such cases can be considered for window resection after careful evaluation. Although less complicated, the drawbacks of window resection include kinking or stenosis of trachea after repair [12], reoperation in patients requiring secondary closure and inability to close larger defects [9]. Three patients in our study underwent tracheal window resection. In one of these patients, the defect was closed

primarily; one patient underwent myochondrial thyroid lamina flap repair while in the third patient, strap muscles were used to close the defect. Postoperative complication following sleeve resection range from 15 to 39% and include anastomotic dehiscence, airway stenosis, infections, and bleeding [13].

The morbidity of surgery in patients with the extrathyroidal extension has made shave resection an attractive option. Studies trying to compare more conservative approaches like shave resection with tracheal ring excision have been contradictory. Carefully selected patients with only superficial invasion have shown comparable results with shave or radical tracheal resections [3, 14–16]. However, few studies have shown increased local recurrences [17, 18] and inferior survival [17, 19] with conservative resections. Moreover, salvage surgery after a local recurrence following shave resection is often difficult with poor outcomes [20]. Margin assessment following shave resections may be challenging with chances of residual microscopic disease [21].

Laryngeal involvement is relatively rare occurring in around 12% of patients of locally invasive thyroid cancer [2]. Options besides simple shaving of cricoid or thyroid cartilage include partial or total laryngectomy. Laryngeal conservation surgeries such as vertical partial laryngectomy may be feasible due to the lateral location of tumours [6]. Unlike primary laryngeal malignancies wherein disease spreads from inside out, site of laryngeal invasion in thyroid tumours is variable depending on the location of the tumour within thyroid. The goal should be to tailor our surgery for each patient and preserve as much as laryngeal function as possible. One patient in our study with lateral invasion of larynx and preserved contralateral cricoarytenoid joint underwent vertical partial laryngectomy with strap muscle reconstruction. In two other patients, total laryngectomy was performed as they had extensive laryngeal invasion with B/L vocal cord palsy. Other indications of total laryngectomy include airway obstruction, luminal haemorrhage, or loss of laryngeal function [22, 23].

Patients with extrathyroidal extension may present with symptoms suggestive of the site of infiltration like hoarseness of voice, stridor, haemoptysis, and dysphagia [4], besides fixed cervical mass, involvement of skin, and aspiration [24]. Sometimes, superficial tracheal infiltration may be discovered intraoperatively without any prior symptoms. In one of the reviews of 82 thyroid carcinoma patients with tracheal infiltration who underwent segmental tracheal resection, presenting symptoms included haemoptysis (24%), dyspnoea/wheezing (30%), and vocal cord paralysis (35%) with 10% of patients being asymptomatic [20]; 0.14 (82%) patients in our study had dyspnoea on presentation. Dyspnoea in carcinoma thyroid patients may be suggestive of vocal cord palsy, extrinsic compression, tracheal infiltration, mucosa oedema, or extensive lung metastasis. Six (35%) patients in our study had hoarseness of voice but direct laryngoscopy showed unilateral vocal cord palsy in 10 patients indicating compensation

from the opposite vocal cord. Nevertheless, any patient with dyspnoea warrants examination of the trachea in addition to vocal cords to rule out tracheal involvement. Haemoptysis (35% in our study) on the other hand is more specifically related to tracheal infiltration.

Symptoms alone cannot be used to predict tracheal invasion as most patients presented with dyspnoea/hoarseness of voice which may only suggest locally advanced nature of disease. In 10 patients (59%), the site of infiltration was in the lateral tracheal wall with relatively small primary (mean size 3.7 cm) located predominantly on the posteromedial side of thyroid lobe. Thus, it is essential to take into consideration the location of the tumour within the gland (irrespective of size) in addition to symptoms for predicting tracheal involvement and planning treatment accordingly. As few patients may be asymptomatic for tracheal infiltration, the surgeon should be aware of various options available and tailor his approach for each patient. Although most patients underwent transoral intubation, 2 patients required preoperative tracheostomy anticipating tumour dislodgment while attempting intubation. Thus co-ordination between anaesthesiologist and surgeon is a must while planning surgery. The overall survival in our study was 81.2% with a median follow-up of 41 months. The locoregional recurrence rate was 18.7% and the distant recurrence was 21.4% (excluding 2 patients with distant metastasis on presentation). All the local recurrences occurred in regional lymph nodes.

Conclusion

Preoperative diagnosis of tracheal infiltration helps in better planning of surgery and counseling the patients of any possible complication. Clinical workup and pre-emptive diagnosis is therefore of paramount importance.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

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