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ORIGINAL ARTICLE

Laryngotracheal Resection in Thyroid Cancer — Experience from a Single Centre Series of 22 Cases

N. Siddhartha Chakravarthy[1] · Varghese Thomas[1] · Thomas Shawn Sam[2] · Supriya Sen[2] · Anish Jacob Cherian[2] · Deepak Thomas Abraham[2] · Paul Mazhuvanchary Jacob[2]

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Abstract

Involvement of the aerodigestive tract is reported in one-third of patients with locally invasive thyroid cancer. It is associated with significant morbidity and mortality, with airway obstruction being the immediate cause of death in 50% of patients who die of thyroid cancer. Management is challenging and includes the risks of extensive surgery as well as decisions regarding the type of surgery and adjuvant therapy. Retrospective cohort study, reporting institutional experience with patients who underwent laryngotracheal resection for invasive thyroid cancer over the past 10 years. Twenty-two patients were included in the study. All patients had Shin stage 4 disease. The median follow-up was 18 months. Five patients had systemic metastasis at diagnosis. Nineteen patients underwent tracheal resection and end to end anastomosis, and 3 underwent laryngectomy. The mean length of the resected trachea was 2.94 cm. Tracheal releasing manoeuvres were utilized in 11 patients. Three patients required a tracheostomy postoperatively. Other complications included a temporary vocal cord palsy in 5 patients, temporary hypocalcemia in 6 and permanent hypocalcemia in 1 patient. Adjuvant radiotherapy was utilized in 9 patients and I-131 therapy in 13 patients. Three patients died during follow-up. Two patients developed thyroid bed recurrence, two patients developed systemic metastasis on follow-up. Most patients survived for a prolonged period with only biochemical evidence of disease persistence and three with no evidence of disease. Laryngotracheal resection with primary anastomosis is a safe and effective option, providing adequate symptomatic relief as well as prolonged survival in carefully selected patients with invasive Shin stage 4 disease.

Keywords Thyroid cancer · Tracheal resection · Extrathyroidal extension · Laryngotracheal involvement

✉ Paul Mazhuvanchary Jacob
mjpaul@cmcvellore.ac.in

N. Siddhartha Chakravarthy
sidhu80@gmail.com

Varghese Thomas
varghese999@yahoo.com

Thomas Shawn Sam
shawnthomas@cmcvellore.ac.in

Supriya Sen
supriyaspeedie@gmail.com

Anish Jacob Cherian
anish@cmcvellore.ac.in

Deepak Thomas Abraham
deepakabraham@cmcvellore.ac.in

[1] Department of Endocrine Surgery, CMC, Vellore, Tamil Nadu, India

[2] Department of Endocrine Surgery, Christian Medical College & Hospital, Vellore, Tamil Nadu 6320004, India

Introduction

Most patients with thyroid cancer have an excellent prognosis and long-term survival [1, 2]. Factors affecting prognosis include age, tumour size, extra-thyroidal extension, presence of metastatic disease and tumour histology [3]. Extra-thyroidal extension is reported in 6 to 13% of thyroid cancer patient series [3–6] and portends a poorer prognosis, with a decrease in 10-year survival rate to 45% [4]. Laryngotracheal invasion is reported in about one-third of patients with invasive thyroid cancer [5]–[7] and may present with features of airway obstruction, haemorrhage or vocal cord paralysis [8]. An asymptomatic presentation can also occur, and was observed in 9.8% of patients in a series by Gaissert et al. Airway obstruction is the immediate cause of death in 50% of patients with thyroid cancer who die of their disease [9]. In addition, the morbidity associated with airway invasion makes management of laryngotracheal disease a

priority in these patients. Management options range from conservative "shave" procedures to segmental resection and adjuvant therapies. Shave procedures, especially in patients with deep tracheal invasion are associated with an increased local recurrence rate and decreased survival compared with airway resection [8, 10]. The recommended extent of surgery for superficial tracheal invasion is still controversial [5, 11, 12]. Based on these factors, primary laryngotracheal resection along with thyroidectomy has been recommended for advanced invasion with transmural involvement.

In this study, we report our experience with laryngotracheal resection in patients with thyroid cancer involving the upper aerodigestive tract and review relevant literature.

Materials and methods

The study was conducted on a retrospective cohort of patients with thyroid cancer treated by the department of endocrine surgery in the institution. Data was collected from the hospital information system after getting institutional review board (IRB) clearance with IRB NO 11325 dated 18/04/2018. We identified 22 patients who underwent laryngotracheal resection for thyroid carcinoma, from March-2008 to November-2017. The outcomes analysed include operative complications, loco-regional recurrence, distant metastasis, overall survival, and disease-specific mortality.

Patient management was decided by a multidisciplinary team (MDT) headed by endocrine surgery with inputs from the departments of endocrinology, radiology, pathology, ENT, pulmonology, anaesthesia, nuclear medicine and radiotherapy. All patients were evaluated with an ultrasound of the neck, contrast enhanced computer tomography (CECT) scan of the neck and thorax or MRI, vocal cord assessment and bronchoscopy (Fig. 1). Additionally, bronchoscopy was performed to assess the extent of luminal involvement of the trachea. Nineteen patients underwent tracheal resection while the remaining three underwent laryngectomy. For tracheal sleeve resection, the tumour was first mobilized, separating the oesophagus posteriorly and encircling the trachea. The mediastinal trachea was routinely mobilized by blunt dissection taking care not to injure the tracheal supplying vessels entering at the postero-lateral aspect. Superior mobilization was effected by Dedo's technique of laryngeal drop by dividing the thyrohyoid muscle or Montgomery's suprahyoid drop when required for longer segments of involvement up to 4 cm. The trachea was transected above

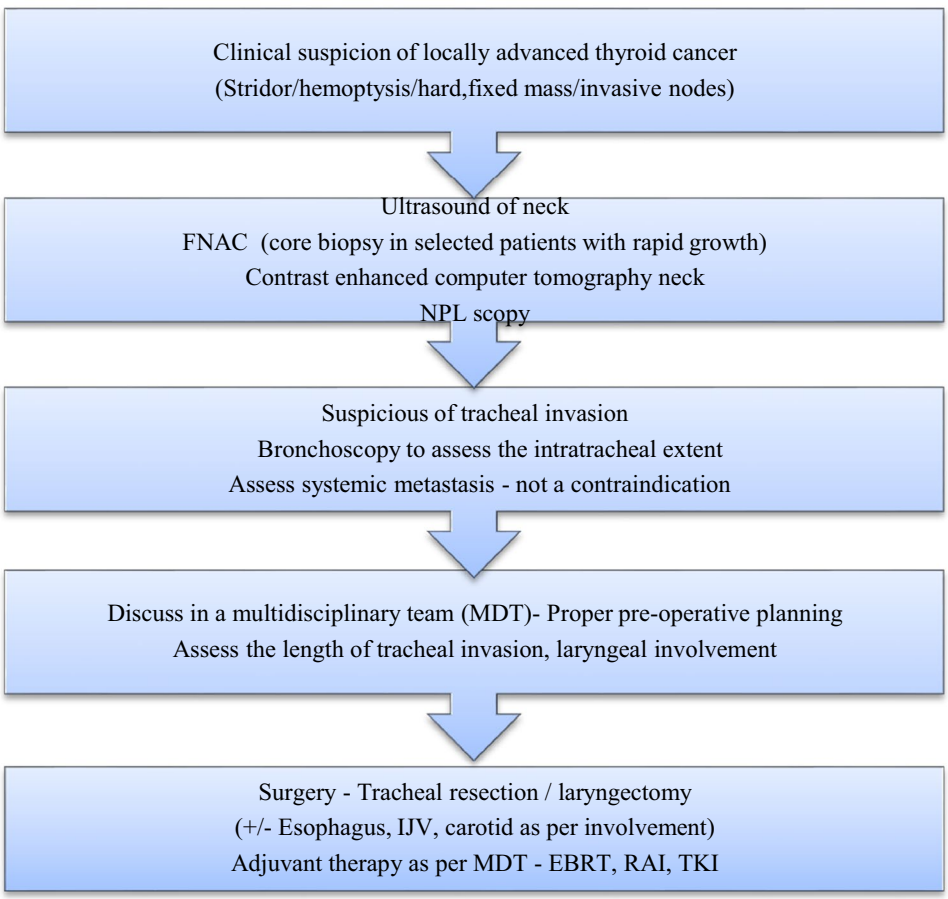

Fig. 1 Algorithm for pre-operative evaluation of a patient with tracheal invasion EBRT- External beam radiotherapy, RAI — radioactive iodine ablation, TKI — tyrosine kinase inhibitors

and below the involved segment (Fig. 2). Two anterior stay sutures with 2–0 polyglactin were then applied to the anterior surface of the lower segment. A sterile endotracheal tube was inserted into the distal trachea in the surgical field and the anastomosis of the membranous trachea was first done using 2–0 or 3–0 polyglactin interrupted sutures with knots on the external surface (Fig. 3). The endotracheal tube was then removed and the oral endotracheal tube pushed beyond the anastomotic site to complete the sutures anteriorly (Fig. 4). An air leak test was done by covering the anastomotic site with saline and allowing positive breathing pressure. The patients head was kept in a flexed position following surgery. The extent of invasion of the trachea was described using the Shin staging system [13]. Appropriately selected patients then underwent adjuvant therapy in the form of radioactive iodine therapy and/or external beam radiotherapy. Initial follow-up was at three months following surgery, subsequently at six months and then annually. Patients with well differentiated thyroid cancer were considered to be in remission if the post-operative stimulated thyroglobulin (TG) levels were less than 2 ng/ml and two successive diagnostic iodine scans were negative.

Overall survival was calculated using the Kaplan–Meier procedure. The survival period was calculated from the date of surgery.

Results

Twenty-two patients with thyroid cancer and laryngotracheal infiltration were included in this study. Fourteen patients were females and 8 were males. The mean age was 51.95 years (range, 23–68). Twelve patients were less than 55 years of age.

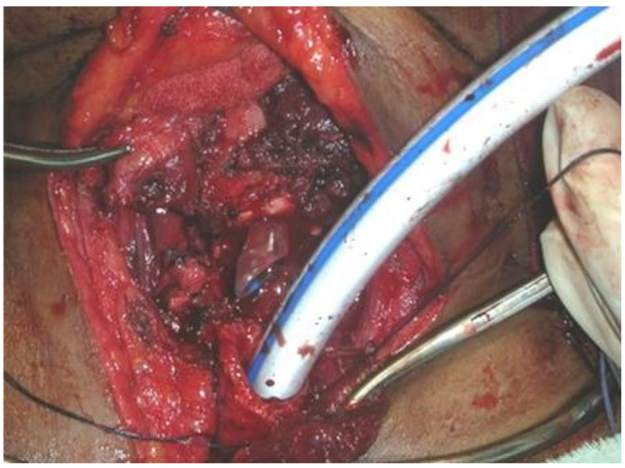

Fig. 3 Insertion of Endotracheal tube in distal trachea

Patient characteristics

The most common symptom noted was stridor (64%). Other presenting symptoms included hemoptysis (40%), dysphagia(23%) and voice change (50%). Laryngoscopic examination pre-operatively showed vocal cord palsy in 45.5% (10/22) of patients. Cervical lymph node metastasis was present in 15 patients (68%).

All patients underwent contrast enhanced computer tomography (CT) scan of the neck and thorax as a part of initial evaluation. Distant metastasis was detected in 5 patients (22.7%) — all to the lung. Preoperative tracheostomy was avoided in all patients at our centre. One patient presented with a tracheostomy done at a peripheral centre

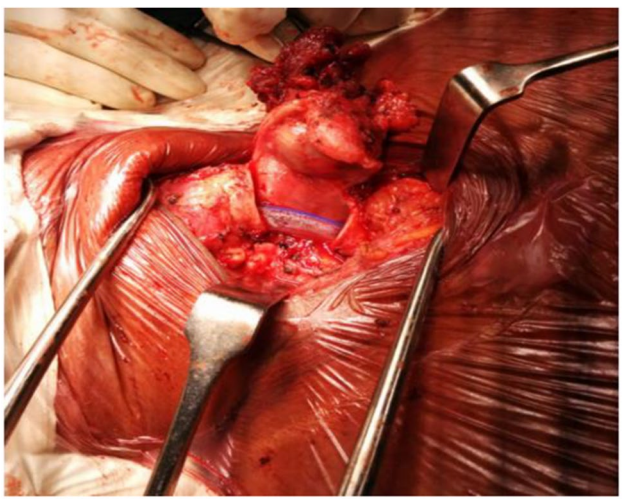

Fig. 2 Excision of segment of trachea with the tumour

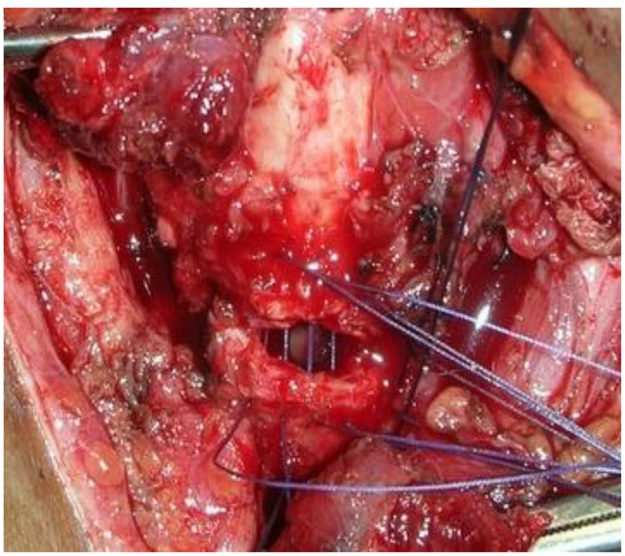

Fig. 4 Anterior tracheal sutures

Table 1 Patient characteristics

Clinical characteristics	'n' = 22
Mean duration of swelling in months (range)	28(1–336)
Stridor	14 (64%)
Voice change at presentation	11 (50%)
Hemoptysis	9 (40%)
Dysphagia	5 (23%)
Preoperative vocal cord palsy (NPL-scopy)	12 (54.5%)

in view of respiratory distress. Patient characteristics are summarized in Table 1.

Surgical technique

Three patients underwent total laryngectomy. Two of these patients were operated for disease recurrence following prior thyroidectomy. The third patient underwent laryngectomy at the time of initial thyroidectomy. Nineteen patients underwent tracheal resection and end to end anastomosis. Crico-tracheal anastomosis was performed in 12 patients. Two patients underwent partial cricoid resection. Lengthening procedures were used in 11 patients. These included a Dedo's infrahyoid release in 10 patients, and a Montgomery's suprahyoid release in one patient. Five patients (22.7%) had associated infiltration of the oesophagus; since only the muscularis propria was involved, a partial thickness/tangential excision was performed. The mean length of the resected tracheal segment measured 2.94 cm (1.7 to 5 cm). Residual gross disease was left behind in 1 patient.

Patients were extubated as early as possible, twelve at the end of the procedure and the remaining 10 on the day after surgery when the procedure was prolonged with hypothermia or it was late in the day. None were ventilated for more than 12 h post op. Prophylactic antibiotic (amoxicillin and clavulanate) was given for 48 h in all patients. A chin to sternal stitch was applied for 5–7 days in the first six patients (31%) in our series; thereafter, we found this to be a superfluous addition with significant discomfort for patients and no added advantage. We feel the patients limit their own neck movement on account of pain, and normal straightening of the neck does not place significant strain on the tracheal suture line. There was no intraoperative or perioperative mortality. Surgical details are summarised in Table 2.

Postoperative complications

Three patients required a tracheostomy in the immediate postoperative; two of these patients were operated for a thyroid bed recurrence after initial thyroidectomy. Both these patients had a preoperative unilateral vocal cord palsy and developed a contralateral vocal cord palsy postoperatively necessitating a tracheostomy. The third patient developed bilateral vocal cord dysfunction after surgery and was managed with a temporary tracheostomy which was decanulated after 6 months.

Table 2 Details of surgery

Surgical procedure (n = 22)	
Tracheal resection	19 (86.4%)
Laryngectomy	3 (13.6%)
Sternotomy for access	2 (9.1%)
Mean tracheal length excised in cm (range)	2.94 (1.7 to 5)
Esophageal partial thickness excision	4 (18.2%)
Manoeuvres to increase tracheal length	
Infrahyoid release	10/19 (52.6%)
Suprahyoid release	1/19 (5.3%)
Post-operative complications	
Post op new temporary vocal cord palsy	5 (5/32NAR = 15.6%)
Temporary hypocalcemia	6(27.2%)
Permanent hypocalcemia	1 (4.5%)
Wound hematoma	1 (4.5%)
Chin to manubrium stitch	6/19 (31.6%)
Post-operative extubation	
Immediate post op	12 (54.5%)
By next day	10 (45.4%)

NAR, nerves at risk.

Postoperative temporary hypocalcemia was seen in 6 patients, while 1 patient developed permanent hypocalcemia. One patient who underwent laryngectomy developed a hematoma postoperatively necessitating surgical evacuation. Other serious complications like wound dehiscence, tracheal leak, aspiration or wound infection did not occur in our cohort.

Histopathology

The average tumour size was 3.6 cm (range 0.3 to 6.7 cm). The tracheal involvement was Shin stage 4 in all our patients. The mean length of trachea excised was 2.94 cm (range 1.7 to 5 cm). Histopathological examination revealed papillary thyroid carcinoma (PTC) in 72.7% of patients of which 7 (50%) were multifocal tumours. Eight of these patients (36%) were found to have aggressive variants, most commonly the tall cell variant. Histopathological examination also revealed poorly differentiated cancer in three and anaplastic thyroid carcinoma in one patient; this patient had a pre-operative FNAC suggestive of PTC. One rare case of familial medullary cancer thyroid presented with voice change and tumour infiltrating the trachea. Details of histopathology are summarized in Table 3. Microscopic positive margins were present in 63.3% of patients with involvement

Table 3 Individual patient details

Sl. no/age/sex	Symptom duration in months	Histopathology	Nodal metastasis	Tum-our size (cm)	Positive margin	Distant metastasis initial	RT	^{131}I	Follow-up in months	TG (last) ng/ml	Outcomes
1/60/F	24	PTC	Y	2.2	N	N	N	Y	3	7.8	LTF
2/59/F	6	PTC	Y	2	N	N	N	Y	28	16.8	LTF
3/50/M	72	PTC	Y	5.9	N	N	N	Y	103	32.07	AWD
4/28/M	4	PTC	Y	2.2	Y	N	N	Y	4	6980	LTF
5/58/M	4	PTC	N	2	Y	N	N	Y	60	1404	AWD
6/62/F	36	PTC	N	4	N	N	N	LTF	1	LTF	LTF
7/66/F	2	PTC	Y	3.2	Y	Y	N	Y	46	88.14	AWD
8/49/F	10	PTC	Y	2.4	Y	N	Y	Y	29	0.19	NED
9/54/M	2	PTC	Y	3.5	Y	N	N	LTF	1	LTF	LTF
10/44/M	10	PTC	Y	3.5	Y	Y	N	Y	40	35	AWD
11/40/F	8	PTC	Y	4.5	Y	N	Y	Y	48	94.83	AWD
12/58/F	6	FVPTC	Y	5.5	Y	Y	Y	Y	3	4390	LTF
13/23/F	12	PTC (T)	N	4.7	Y	N	N	N	5	LTF	LTF
14/40/F	1	PTC (T)	N	4.8	N	N	N	N	66	NA	AWD
15/61/M	4	PTC (T)	Y	2.7	Y	N	Y	Y	52	0.301	NED
16/49/M	18	PTC (T)	Y	0.3	N	N	Y	Y	7	5.38	LTF
17/68/F	2	PTC	N	2	Y	N	Y	Y	72	2400	DOD
18/58/F	4	PDTC	N	4	Y	N	N	Y	86	0.1	NED
19/53/F	2	PDTC	Y		Y	Y	Y	Y	75	87,500	DOD
20/61/F	2	PDTC	N	1	Y	N	Y	Y	66	137.8	AWD
21/49/F	336	MTC	Y	6.7	N	N	Y	NA	36	Calcitonin 1183	AWD
22/53/M	60	ANAPLASTIC	Y	6.2	N	Y	N	NA	5	NA	DOD

RT, radiotherapy; *TG*, thyroglobulin; *PTC(T)*, Papillary cancer thyroid (Tall cell variant); *Y*, yes; *N*, no; *AWD*, alive with disease; *NED*, no evidence of disease; *DOD*, died of disease; *LTF*, Lost to follow-up; *NA*, not available.

of superior margin in 45%, both superior and inferior margins in 13.8% and inferior margin in 4.5% patients respectively. Nodal metastasis was found in 15 patients (68%).

Adjuvant therapy

Postoperative radiotherapy at a dose of 40 to 66 Gy to the anterior neck was administered in 9 patients. The indication for radiotherapy was microscopically positive resection margins in 6 patients, post R1 resection of tumour recurrence in 2 patients, and familial medullary carcinoma thyroid in 1 patient.

Postoperative whole body scan (WBS) with I131 was performed in 16 patients which showed residual thyroid in 8, lymph node metastasis in 5, systemic metastasis in 2 and no residual thyroid or functional metastasis in 1 patient. All the 15 patients received radioactive iodine ablation and post therapy scan did not reveal any additional lesions. On follow-up empirical therapy was given to 8 of these 15 patients in case of thyroglobulin elevated negative iodine scan (TENIS).

Follow-up

The mean patient follow-up period was 38 months (range, 1 to 103 months). Eight patients were lost to follow-up with the shortest follow-up of 1 month.

Local and systemic recurrence: Two patients developed thyroid bed recurrence. One of these patients, who had poorly differentiated thyroid carcinoma, developed a local recurrence after 50 months. She was managed with a tracheostomy and conformal radiotherapy and she is surviving without structural disease on regular follow-up. The other patient had an anaplastic carcinoma on final histopathology and developed local recurrence in 3 months. Two patients, one with papillary thyroid cancer and the other with poorly differentiated thyroid cancer developed systemic metastasis at 15 and 50 months postoperatively, the latter succumbing to respiratory failure from lung metastasis.

Deaths

Three patients expired during follow-up, all from progression of systemic disease; there was prolonged survival up to 75 months in a case of PDTC, 72 months in a case of papillary cancer but only 5 months as expected in anaplastic cancer.

Eleven patients are on regular follow-up. Three of these patients have no evidence of disease at 29, 66 and 86 months respectively following surgery. All three had microscopic positive resection margins at surgery and the WBS showed only residual thyroid and received ^{131}I therapy. Two of these patients received radiotherapy after surgery. The other 8 patients have elevated thyroglobulin levels; however, there is no other demonstrable systemic or local disease. Individual patient details are summarized in Table 3. Kaplan–Meier graphs for disease free and overall survival show most patients have evidence of biochemical residual disease with raised calcitonin, but only few systemic recurrences and deaths. (Figs. 5, 6) The graphs highlight the value of intervening aggressively in this rare condition.

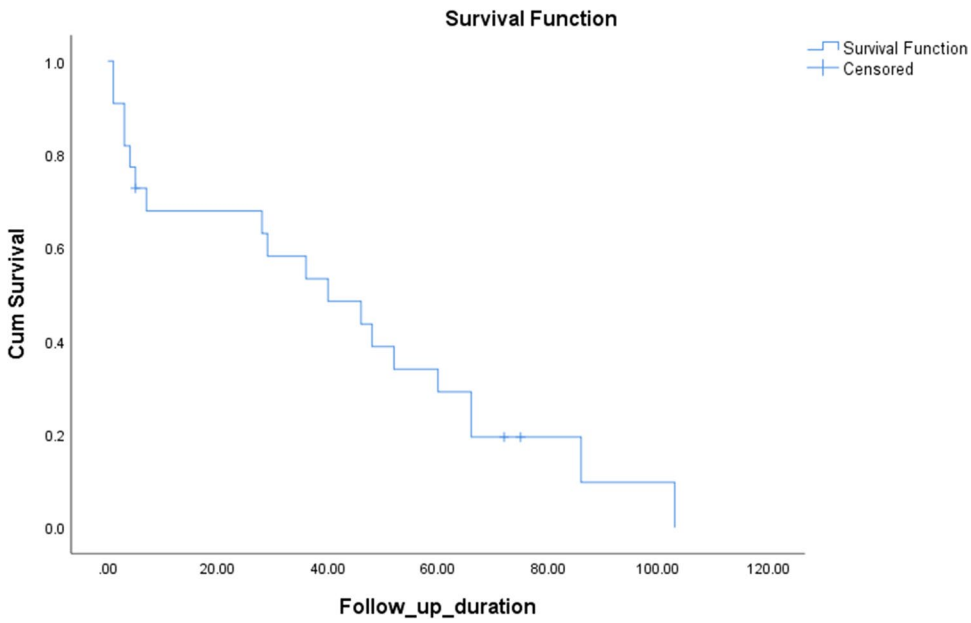

Fig. 5 Kaplan Meier Disease Free survival graph (months)

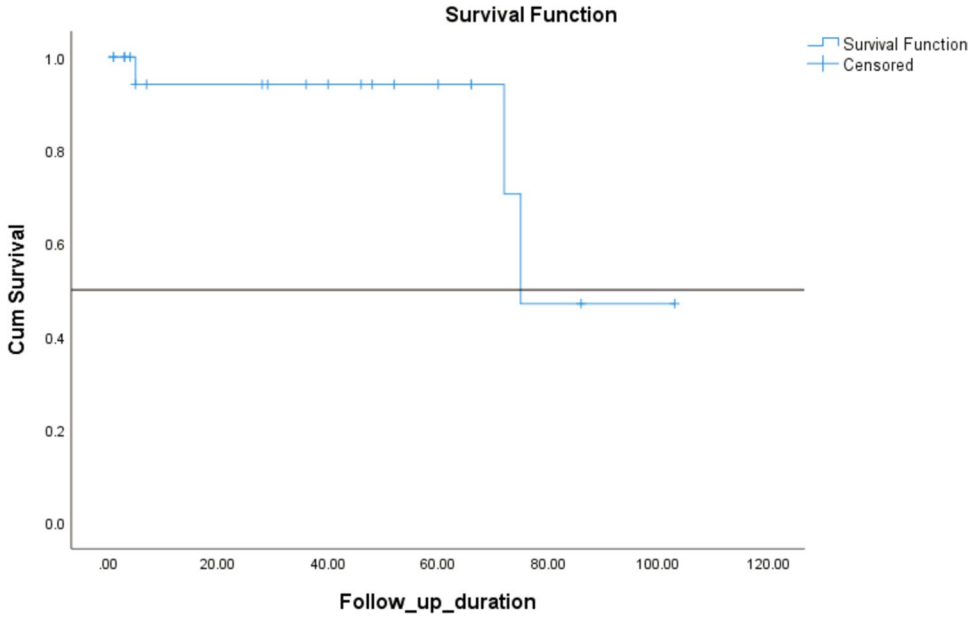

Fig. 6 Kaplan Meier Overall Survival graph (months)

Discussion

Well differentiated thyroid cancer rarely involves the upper airway. However, laryngotracheal invasion is found much more frequently in patients who eventually die of this disease [14]. Airway obstruction is the cause of death in nearly half of these patients [9]. Patients with invasion of the upper aerodigestive tract can present with a neck mass, hoarseness of voice, dyspnoea, stridor, haemoptysis or dysphagia. Patients with superficial involvement may be asymptomatic. Stridor was the most common clinical feature in this cohort, and was present in 64% of patients. All the patients were symptomatic; probably in view of the presence of locally advanced disease. The mean symptom duration was 28 months (1–336 months). However, patients with a final HPE diagnosis of poorly differentiated cancer (PDTC) were noted to have a shorter time to presentation, with average symptom duration of 4 months (2–8 months).

A staging system proposed by Shin et al. can be used to classify tracheal involvement into 4 stages based on the depth of invasion. Their study reported decreased survival in patients with stage IV [13]. A clinicopathological study by Ozaki et al. found that the mucosal extent of disease was greater circumferentially than the adventitial extent, even though the longitudinal extent of mucosal disease did not exceed the adventitial involvement. Circumferential tracheal resection could thus be more effective in attaining completeness of resection, as compared to wedge resection [15]. Additionally, well differentiated thyroid carcinomas invading the trachea are likely to show aggressive histological behaviour, and may not effectively concentrate radioactive iodine given as adjuvant therapy [16, 17].

Patients in this study group had aggressive disease with Shin stage IV tracheal involvement (100%) similar to Gupta et al. [18]. Aggressive histological variants were common, with 4 patients having the tall cell variant of PTC and 3 patients having poorly differentiated carcinoma (PDTC).

Current treatment guidelines recommend complete surgical resection for locally invasive thyroid cancer, when technically feasible [19]. However, radical resection may not always be achievable; with surgical skill and postoperative morbidity being important considerations. Residual tumour may also respond to radiotherapy or radioactive iodine. These aspects of therapy have led to considerable controversies regarding the ideal extent of surgery. A study by Mccaffrey et al. [5] noted that a significant reduction in survival was seen in the group undergoing conservative surgery, if gross tumour was left behind. Other studies have also found that shave procedures were associated with gross residual tumour in Shin stage III and IV disease, leading to poorer outcomes in spite of adjuvant therapies [8, 10, 20–22]. Patients with local recurrence following shave procedures also had worse subsequent overall and disease free survival [8]. However, a number of studies report similar outcomes in patients undergoing shave procedures, as compared to more radical surgery [23, 24].This discrepancy could be attributed to differences in degree of invasion, tumour type and adjuvant therapy. Appropriate investigation including bronchoscopy to look for tracheal mucosal or submucosal involvement is therefore a key factor in planning management with such patients benefiting from a complete resection. Studies have shown an overall 5-year survival rate of more than 80% in patients undergoing tracheal resection with end to end anastomosis [25–28]. The 2014 consensus guideline of the

American head and neck society recommends circumferential tracheal resection in patients with intraluminal or significant cartilage invasion [29]. Tracheal resection can also be considered for palliation of airway obstruction or haemorrhage in selected patients with distant metastasis as it improves quality of life and improve survival [12].

Patients with distant metastasis were found to have a mean survival of 6 years in a series by Gaissert et al. [8]. Five of our patients were found to have lung metastasis preoperatively. One of these patients, who had a poorly differentiated thyroid cancer died at 75 months, and a second patient with anaplastic carcinoma at 5 months of follow-up. Two patients are on follow-up at 46 and 40 months. One patient was lost to follow-up.

Esophageal involvement was found to be associated with locoregional recurrence and poorer prognosis in a series by Kim et al. [24]. Esophageal involvement was observed in 5 patients (22.7%) in this series. One patient in this sub-group died due to systemic disease progression, 2 patients were lost to follow-up and 2 patients were alive with disease at 46 and 36 months respectively.

Circumferential tracheal resection with end to end anastomosis is a challenging procedure, with results depending on a tension-free repair of the trachea. The longitudinal extent of disease determines the length of trachea which needs to be resected. About 5 to 6 cm of trachea can be safely resected and anastomosed [12]. Longer segments need releasing manoeuvres such as suprahyoid release or combined cervical and mediastinal release. We used an infrahyoid release in 10 patients, and a suprahyoid release in one patient. We found that a majority (82%) of patients needing resection of more than 2.8 cm of trachea required releasing manoeuvres. We used a chin to sternal stitch to keep the neck in a flexed position in the initial 6 of 19 patients who underwent tracheal resection. We did not use the stitch in later patients, but instructed them not to hyperextend the neck for a period of 7 to 10 days. Other authors have however suggested using the stitch in patients who need a tracheal resection of more than 4 cm or are undergoing repeat surgery [30].

According to literature, postoperative complications with this procedure are seen in 15 to 39% of patients. A perioperative mortality of 1.2 to 15% is reported [8, 31–33]. Anastomotic dehiscence is the most frequently observed life threatening complication with an incidence ranging from 4 to 14% [34]. Tracheal resections of longer than 4 cm are found to be associated with a higher risk of dehiscence. Bilateral vocal cord palsy is seen in 4 to 10% of patients [8, 31] and necessitates a tracheostomy. Tracheostomy may in turn delay wound healing at the anastomotic site. Other complications include postoperative bleeding and surgical site infection. Risk of postoperative infection is increased in patients requiring preoperative tracheostomy [34].

Optimal endotracheal tube (ET) management is an important aspect of perioperative care. Although there is no consensus about the timing of extubation, early ET tube removal is suggested to decrease the effects of positive pressure ventilation on the suture line [34]. Postoperatively, 54.5% of patients in this series were extubated on table; and the remaining were extubated the day after surgery. Complications in the form of aspiration or dysphagia following surgery were not observed. In a series of 7 patients, reported by Sywak et al. [35], all the patients were supported by intubation for a minimum of 5 days. In another series that followed Yang et al. [36], all 8 patients were extubated on the third postoperative day.

Local airway recurrence after laryngotracheal resection is rare. Nakao et al. reported a local recurrence rate of 6.5% [37]. Gaissert et al. reported airway recurrence requiring tracheostomy in 12.3% of patients [8]. Factors associated with tumour recurrence include poorly differentiated histological type, presence of nodal metastasis, esophageal involvement and history of previous thyroid cancer surgery [20, 24, 31]. Locoregional recurrences were observed in 2 patients in this series, one of whom developed a local recurrence after 50 months and underwent tracheostomy and the second had local recurrence and systemic metastasis and succumbed to the disease. The factors associated with worse prognosis in this study were poorly differentiated histology/anaplastic thyroid carcinoma and metastasis at initial presentation. Adjuvant therapy in the form of ^{131}I therapy, especially when combined with EBRT appeared to improve prognosis. However, we could not draw definite conclusions in view of the small sample size and the retrospective nature of the study.

Conclusion

Extrathyroidal extension of cancer with involvement of the aerodigestive tract is indicative of aggressive tumour behaviour, and is associated with greater risk of recurrence and death. The extent of airway invasion is an important determinant of disease outcome. In our experience, tracheal resection with end to end anastomosis was found to be a reasonably safe and effective option in patients with invasive Shin stage III and IV disease. In the experience of this cohort of 22 patients, we can feel reassured that tracheal resection offers prolonged survival as well as rapid, significant symptomatic benefit in patients with airway obstruction, and we recommend this procedure to surgeons dealing with advanced thyroid cancers with the following management points of practical value.

1. Assessment with contrast CT, NPLscopy and bronchoscopy should be used when tracheal invasion is suspected in a fixed thyroid mass.

2. The procedure can be performed with safety in tumours with well differentiated, aggressive variants and poorly differentiated pathology.
3. The mean length of resection is 3 cm and partial resection of lower cricoid cartilage can be performed safely when needed for cricotracheal infiltration.
4. Simple mobilization of the larynx and trachea is sufficient to bring the tracheal ends together in shorter segments, while thyrohyoid muscle division is needed for further mobilization in longer segments. We do not recommend the more invasive suprahyoid release for routine use.
5. Esophageal partial thickness resection with primary repair may be needed in a minority and can be easily performed in the same procedure.
6. Lower segment tracheal intubation during anastomosis is a simple procedure using a sterile extension circuit with cooperation of the anaesthetist. Single layer, interrupted absorbable closure for tracheal anastomosis is sufficient and the crico-tracheal or trachea-tracheal anastomosis provides a strong airtight seal naturally.
7. Tracheostomy is best avoided as far as possible with tracheal resection and extubation should be done as early as possible, either postoperatively or early the next day.
8. Chin-sternal skin stay suture is found unnecessary in our experience.
9. Adjuvant radiation therapy and iodine therapy can be given safely.
10. In rare cases of laryngeal involvement, total laryngectomy can offer good symptomatic relief.

Data and material availability Yes.

Declarations

Ethics approval and consent to participate Institutional review board (IRB) clearance with IRB NO 11325 dated 18/04/2018.

Consent to participate Yes.

Consent for publication Yes.

Conflict of interest The authors declare no competing interests.

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