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Original Research Article

Thyroidectomy in laryngectomy-rationale and extent

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ABSTRACT

Background: To study the incidence of thyroid gland invasion by laryngeal carcinoma (LC) and the risk factors that may predispose to thyroid gland involvement, aiding the surgeons to develop an evidence-based plan for the management of the thyroid gland during total laryngectomy.
Methods: A retrospective analysis of patients with carcinoma larynx treated at government Royapettah hospital, Chennai between January 1, 2013, and December 31, 2020, was done. The total number of final pathology reports retrieved from our hospital system for patients who met the inclusion criteria within the specified time frame was 43.
Results: The thyroid gland was found to be invaded by LC in 13 patients (30.2%). Three patients (3/13) had only microscopic involvement while 9 patients showed gross extension. Four pathological features were found to have Statistically significant association with the incidence of thyroid gland invasion by laryngeal carcinoma. Patients with primary tumor pathological stage T4a were 30/43, with 11 patients showing thyroid gland invasion. 20 patients had subglottic invasion by the LC, with 10 patients showing thyroid gland invasion. Poorly differentiated carcinoma incidence was 13, with 9 patients showing thyroid gland infiltration.
Conclusions: Several risk factors are associated with higher incidence of invasion of the thyroid gland by laryngeal carcinoma. Identification of these factors can help surgeons develop a surgical strategy for the management of the thyroid gland during total laryngectomy.

Keywords: Thyroid gland, Laryngeal carcinoma, Invasion, Thyroidectomy, Laryngectomy

INTRODUCTION

Ipsilateral hemithyroidectomy or total thyroidectomy is considered mandatory in many patients undergoing total laryngectomy for squamous cell carcinoma (SCC) of the larynx.[1] This is because the anatomic location of the thyroid gland renders it vulnerable to get involved often in advanced laryngeal cancers. Thyroid gland being an adjacent organ to larynx, may be contiguously invaded due to the porous barrier of cricothyroid membrane along with resistance of laryngeal cartilages or a non-contiguous spread lympho-vascularly. This explains why laryngeal carcinomas may be often associated with thyroid gland involvement.[1-4]

It is also well documented that patients are susceptible to hypothyroidism as a consequence of treatment of head and neck cancer in general and laryngeal cancer in particular. Additionally, patients are at the risk of other complications of thyroidectomy when thyroidectomy is included in the definitive surgery.[5-7] This study examines preoperative clinical, radiological and preoperative histopathologic characteristics that can be used to predict thyroid gland invasion in the setting of squamous cell carcinoma of the larynx so that they can guide surgeons whether thyroid gland excision is necessary or not.

METHODS

A retrospective analysis of patients with carcinoma larynx treated at government Royapettah hospital, Chennai between January 1, 2013, and December 31, 2020, was done. Our institute gets a relatively heterogeneous population that is representative of the

south Indian population. An institutional review board approval was obtained for the study. Patients were identified through the Institute's tumour registry.

Inclusion of thyroidectomy in total laryngectomy, type of thyroidectomy, incidence of pathological gland involvement, possible routes of spread, and positive predictors of spread analyzed and reported. Preoperative clinical and radiological assessment, intra-op and post-op histopathological findings, and the follow-up data analyzed.

Patients with carcinoma larynx who candidate for total laryngectomy upfront/salvage after chemoradiotherapy included in study. Patients with metastatic disease, previous benign/malignant thyroid disorders, H/O previous thyroidectomy and co-morbidities precluding surgery excluded from study.

Comparison between groups was performed using chi square and Fisher's exact test for qualitative variables. $P<0.05$ considered statistically significant.

RESULTS

The total number of final pathology reports retrieved from our hospital system for patients who met the inclusion criteria within the specified time frame was 43.

Table 1 describes the rates of associated study variables. The thyroid gland was found to be invaded by LC in thirteen patients (30.2%). Four patients (4/13) only microscopic involvement while nine patients showed gross extension. Four pathological features found to have statistically significant association with the incidence of thyroid gland invasion by laryngeal carcinoma. Patients with primary tumor pathological stage T4a were 30/43, with 11 patients showing thyroid gland invasion. The 20 patients had subglottic invasion by laryngeal carcinoma, with 10 patients showing thyroid gland invasion. Poorly differentiated carcinoma incidence was thirteen, with nine patients showing thyroid gland infiltration. Two patients had all adverse features had thyroid gland involvement. Detailed analysis of correlation of all variables and incidence of thyroid gland invasion by the laryngeal carcinoma.

Table 1: Patient characteristics.

Variables	Description, n (%)
Gender	
Male	43 (100)
Female	0 (0)
Age(years)	
<50	14 (32.5)
51-60	14 (32.5)
61-70	13 (30.2)
>70	2 (14.6)
T stage	
T1	0 (0)
T2	2 (4.6)
T3	11(25.6)
T4a	30 (69.7)
N stage	
N0	8 (18.6)
N1	10 (23.2)
N2	23 (53.5)
N3	2 (4.6)
Degree of differentiation	
Well	4 (9.3)
Moderate	26 (60.5)
Poor	13 (30.2)
Site of the tumor involvement	
Supraglottis	13 (30.2)
Glottis	10 (23.2)
Subglottis	20 (46.5)
Thyroid cartilage invasion	
Microscopic	30 (69.8)
Gross	20 (46.5)
Thyroidectomy	
Hemi	17 (39.5)
Total	26 (60.4)

Continued.

Variables	Description, n (%)
Thyroid gland involvement	
Gross	9 (20.9)
Microscopic	4 (9.3)
Vascular invasion	4 (9.3)
Perineural invasion	3 (6.9)

Table 2: Analysis of the correlation of all variables and the incidence of thyroid gland invasion by the LC (p<0.05 is significant).

Description	Thyroid gland invasion, n (%)		P value
	Yes	No	
Gender			
Males	13 (30.2)	30 (69)	0.65
Females	0 (0)	0 (0)	
Age (Years)			
<50	3 (6.9)	11 (25.6)	0.89
51-60	5 (11.6)	9 (20.9)	
61-70	4 (9.3)	9 (20.9)	
>70	1 (2.3)	1 (2.3)	
T stage			
T2	0 (0)	2 (4.6)	0.004
T3	2 (4.6)	9 (20.9)	
T4a	11 (25.6)	19 (44.2)	
N stage			
N0	2 (4.6)	6 (14)	0.12
N1	4 (9.3)	6 (14)	
N2	6 (14)	17 (39.5)	
N3	1 (2.3)	1 (2.3)	
Degree of differentiation			
Grade I	1 (2.3)	3 (7)	0.0001
Grade II	3 (7)	23 (53.5)	
Grade III	9 (20.9)	4 (9.3)	
Site of primary tumor			
Supraglottic	1 (2.3)	12 (27.9)	<0.003
Glottic	2 (4.6)	8 (18.6)	
Subglottic	10 (23.2)	10 (23.2)	
Thyroid cartilage invasion			
Microscopic	9 (20.9)	21 (48.8)	0.4
Gross	4 (9.3)	16 (37.2)	
Vascular invasion	1 (2.3)	3 (7)	0.6
Perineural invasion	1 (2.3)	2 (4.6)	0.7

DISCUSSION

The thyroid gland is specifically vulnerable to invasion by laryngeal cancer due to its proximity to the cricothyroid membrane which represents a weak barrier between the primary tumor and the gland.[8-10]

The thyroid gland is located in the lymphatic drainage pathway of the larynx which adds to the risk of lymphatic invasion of the gland by malignant laryngeal tumours. Pre-laryngeal lymph nodes which overlie the cricothyroid membrane can harbour metastatic tumor foci and hence represents an additional risk of the invasion of the thyroid gland by carcinoma larynx. For these reasons, it has been routinely practiced performing hemi or total thyroidectomy together with laryngectomy for the management of carcinoma larynx.

Despite being oncologically sound, thyroidectomy comes at the cost of transient or permanent hypocalcaemia and/or permanent hypothyroidism. The risk of developing such morbidities is particularly higher with salvage surgery, re-operative neck surgery, associated thyroid gland pathology, and devascularization of the preserved contralateral thyroid lobe during total laryngectomy. Arslanoglu and his colleagues reported that laryngeal tumours with thyroid cartilage invasion, anterior commissure extension, and subglottic extension were indicative of thyroid gland invasion and required thyroidectomy.[11-15]

Mourad et al concluded that laryngeal carcinoma with thyroid cartilage involvement and subglottic extension, particularly through the posterior and lateral cricothyroid space have been considered risk factors for likely thyroid gland involvement.[16] In their report, Ho et al indicated that for patients who were treated with total laryngectomy and irradiation for laryngeal carcinoma, 19.9% of patients developed hypothyroidism at 3 years, 38.6% at 6 years, and at 10-year follow-up, 93.3% of them had hypothyroidism.[6]

Leon et al reported a fifty-two percent of patients treated with total laryngectomy developed either clinical or subclinical hypothyroidism. The triad of hemithyroidectomy, total laryngectomy and radiotherapy was a risk factor for the development of hypothyroidism.[17] Sinard et al found that up to 20% of patients treated for advanced-stage head and neck cancer with surgery and radiotherapy will develop hypothyroidism. It is estimated that 60% of those who received total laryngectomy, thyroid lobectomy, and radiotherapy will develop hypothyroidism.[7] As per our report, it was found that the primary tumor pathological stage of T4a, subglottic involvement by the tumor, and poorly differentiated carcinoma were all associated with a significantly higher risk of thyroid gland invasion by laryngeal carcinoma. Hypothyroidism represents a common postoperative morbidity that can be easily missed after hemithyroidectomy with the false sense of having a preserved contralateral lobe. After total thyroidectomy, the problem is inevitable.[18]

Managing this disease carries the financial burden because of the need for frequent monitoring of the TSH levels and the lifelong need for thyroid hormone replacement. More problematic after total thyroidectomy is the management of temporary or permanent hypocalcaemia. Patients manifest with clinically bothering frequent symptoms of tingling, numbness, and painful cramps. Treatment requires multiple pills and doses throughout the day which is always inconvenient. Every effort should be made to prevent the development of such complications. Because our study is based on the final pathology reports for data collection, reports which indicated absence of evidence of gross invasion of the thyroid gland by the laryngeal carcinoma were considered to have preoperative clinically negative thyroid gland. In a total of 13 patients with pathological evidence of thyroid gland invasion, 9 patients had evidence of gross invasion of the thyroid gland by the carcinoma larynx. In other means, our study reported 30 patients without evidence of gross invasion of the thyroid gland; of them, only 1 patient (3%) were found to have microscopic extension of the carcinoma larynx into the thyroid gland. Li et al used the term extension by metastasis to describe microscopic metastasis to the thyroid gland by LC.[19] They reported a cohort of 196 patients with 10 patients showing extension of the tumor to the thyroid gland. In their report, only one patient had extension by metastasis. Their low rates run in accordance with our reported low rates of thyroid gland involvement. By reviewing the final pathology reports, we were able to meticulously identify definitive pathological features that were associated with higher risk of thyroid gland invasion. These factors can be identified during preoperative planning and hence can guide surgeons to develop an oncologically sound plan regarding the management of the thyroid gland during laryngectomy. Another advantage is that the use of the final pathology reports to determine the preoperative status of the thyroid gland-despite being impractical-provided the most accurate way to confirm the thyroid gland status.

This study is not without drawbacks. Our study lacks follow up of patients who actually had hemithyroidectomy to exactly determine the incidence of postoperative hypothyroidism with a preserved thyroid lobe. Another non-existent important clinical factor was the postoperative calcium level whenever total thyroidectomy was performed. Patients may develop parathyroid glands stunning after total thyroidectomy even with surgery for benign pathology and hence they require calcium taper regimen over 3 weeks. The unavailability of this information made it impossible for the research team to identify the true incidence of postoperative hypocalcaemia after total thyroidectomy either temporary or permanent. This incidence is reported to be common according to various reports. In their review, Paduraru et al reported a variable incidence of postoperative hypocalcaemia ranging from 1.2% to 40%.[20] Another pitfall is the presence of 12 patients (27%) of our study population with primary tumor pathological stage T2 who underwent total laryngectomy due to presence of residual disease after chemoradiation. Surgeons can argue against the need for total laryngectomy in such tumor stage. Our data is mainly stemmed from the final pathology reports. Most patients with carcinoma larynx are chronic heavy smokers with poor pulmonary reserve making partial laryngectomy unfeasible for them. Finally, some patients can be upstaged based on clinical and radiological findings then eventually become down-staged with the final pathology report.

CONCLUSION

Revisiting the practice of doing routine concurrent hemi or total thyroidectomy along with total laryngectomy in this study showed that the incidence of thyroid gland invasion by carcinoma larynx is low (13/43; 30.2%). Patients, in preoperative clinically negative thyroid glands, showed 3% incidence of harbouring microscopic foci of the LC (1/30; 3%). Several pathological features showed significantly higher risk of association with thyroid gland invasion by carcinoma larynx like tumor pathological stage T4a, poorly differentiated carcinoma, thyroid cartilage invasion and invasion of the sub-glottis. These four factors may be determined in imaging or histopathology before commencing to definitive total

laryngectomy and hence can provide an aid to surgeons develop their plan for the management of thyroid gland during total laryngectomy thus, minimizing morbidity and optimizing outcome.

Recommendations

We suggest further large prospective trials for confirmation these findings.

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