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Does the Recurrent Laryngeal Nerve Recover Function After Initial Dysfunction in Patients Undergoing Thyroidectomy?

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Objective: Total thyroidectomy with or without central compartment dissection is the treatment of choice for thyroid carcinoma. Extensive dissection along the recurrent laryngeal nerve (RLN) can lead to vocal cord fixity and hoarseness even without nerve sacrifice. Recovery rates after surgery for thyroid cancers have not been well documented. The aim of the study is to analyze the incidence of vocal cord palsy (VCP) and its recovery rates in patients operated for thyroid cancers.

Methodology: We performed a retrospective study on prospectively collected data in 152 thyroidectomy patients with 254 RLNs at risk. All patients underwent a laryngoscopic examination to document vocal cord function in the immediate postoperative period and on subsequent follow-up. Incidence of VCP, recovery rates, univariate and multivariate analysis to identify risk factors for permanent VCP were calculated using binary logistic regression.

Results: In our study, 28% patients underwent redo surgeries and 74% patients had dissection of the central compartment. The immediate postoperative RLN palsy rate was 11.2%, with a palsy rate of 9% and 16.2% in the per primum and redo surgery cohorts. On follow-up, there was complete recovery of VCP in 66.7% of these nerves. The incidence of permanent RLN palsy was 3.9%. The mean time to recovery was 9.6 months.

Conclusion: Vocal cord dysfunction recovered in most patients in this high-risk cohort. There was a significant recovery even in the redo surgery group and a policy of watchful waiting is recommended in the absence of severe symptoms.

Key Words: thyroidectomy, thyroid cancer, recurrent laryngeal nerve, function recovery.

Level of Evidence: III

INTRODUCTION

The incidence of the thyroid carcinoma has dramatically increased in the last few decades.[1] Total thyroidectomy with or without central compartment dissection is the treatment of choice for thyroid carcinoma. Vocal cord palsy (VCP) due to injury to the recurrent laryngeal nerve (RLN) is one of the most dreaded complications of this surgery. The symptoms associated with this complication include hoarseness of voice, voice fatigue, and aspiration. Vocal cord palsy can be either temporary or permanent. The reported incidence of temporary VCP varies from 0% to 12%.[2–4] However, the incidence of permanent VCP has been reported to be much lower varying from 0 to 3.5%.[4,5] Many patients may not present with symptoms of hoarseness and a postoperative laryngoscopic examination is required in all patients who have undergone surgery for thyroid cancer.[6] However, the morbidity associated with VCP significantly affects the quality of life of the patient and at times require intervention to prevent aspiration or to improve voice quality.[7] The knowledge of time to recovery of VCP is vital in deciding the need for either a short-term or a long-lasting intervention.[8] Although the incidence of temporary and permanent VCP has been reported in various studies, there is very sparse prospective literature on the recovery of vocal cord function in consecutively operated patients. The larger studies reporting recovery of vocal cord function have analyzed the same after surgery mainly for benign disease and multinodular goitres.[7,9]

The aim of our study was to analyze the incidence of VCP and its recovery rates, in patients operated for thyroid cancer in a tertiary referral centre, with a high volume of redo surgeries and advanced stage cancers. The secondary aim was to analyze the time to recovery of cord function after initial dysfunction.

METHODS

Study Design and Patient Characteristics

We performed a retrospective study on prospectively collected data of all patients undergoing hemi, total, or completion thyroidectomy with or without central compartment clearance for thyroid cancer, between January 2013 and December 2014 in a single surgical unit. All patients recruited in the study had a preoperative and postoperative evaluation of vocal cord (VC) function. Vocal cord palsy and recovery rates were calculated

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for nerves at risk. Recurrent laryngeal nerves which were fixed in the preoperative period because of involvement by tumor or due to iatrogenic injury from a previous surgery were not considered for analysis. Similarly, RLNs which were sacrificed intraoperatively, secondary to involvement by tumor were also excluded from analysis. Patients undergoing surgery for benign histologies and patients with incomplete data regarding the vocal cord evaluation in the preoperative or postoperative period were excluded.

Evaluation of the Patients

A preoperative laryngoscopic examination was done using the Hopkin's rod lens telescope to document vocal cord function. Postoperatively, all patients underwent a repeat laryngoscopic evaluation to document vocal cord function. Postoperative vocal cord dysfunction was defined as a fixed or restricted vocal fold, irrespective of voice change. A restricted VC was defined as decreased mobility of the VC without complete fixity. The side of the vocal cord fixity was recorded. All patients having VCP in the postoperative period were referred for speech therapy to a speech and voice pathologist.

On follow-up, vocal cord function and/or recovery of the function was recorded in the medical records. This was recorded on all subsequent follow-up visits till there was recovery of function or until completion of the study. VCP which had not recovered till the completion of the study with a minimum follow-up of 12 months, were considered as permanent VCP. Univariate and multivariate analysis to predict risk factors for permanent palsy was performed. The factors analysed, were T stage, redo versus per primum surgery, dissection of the central compartment, node positivity in the central compartment, and type of dysfunction of the temporary VCP (restricted vs. fixed). Univariate analysis was done using the chi square test to evaluate the individual factors predicting recovery of VCP. The factors analyzed were T stage (T1–T4), central compartment dissection (yes or no), central compartment nodal positivity (yes or no), type of surgery (per primum vs. redo) and type of dysfunction of the VC (restricted mobility vs. fixity). Multivariate analysis was done using binary logistic regression analysis on the above mentioned factors. All statistical analysis was done using IBM SPSS 21.0.Armonk,NY:IBM Corp. software.

RESULTS

One hundred eighty-one patients underwent surgery for thyroid cancer in the above mentioned period. Of these, 29 patients were excluded from the analysis. Two patients underwent surgery for parathyroid carcinoma, one patient had a thyroglossal cyst excision and six patients underwent only a lateral neck dissection for thyroid carcinoma. Twenty patients had incomplete information regarding the vocal cord status either postoperatively or on follow-up.

One hundred fifty-two patients meeting the inclusion and exclusion criteria were analyzed in the study. The demographics of the patients included are shown in Table I. Of the patients evaluated, 44 (28.9%) underwent redo surgeries. There were a total of 273 RLNs at risk in the entire study. The RLNs at risk in the per primum cohort of patients was 199. In the redo surgery cohort, 14 patients had a unilateral dissection and 30 patients underwent a bilateral dissection. The total RLNs at risk in the redo surgery cohort was 74.

TABLE I.
Demographic Details of Patient in the Study.

Gender	
• Male	63
• Female	89
Median Age	37.5 years
cT Stage	
• TX	7
• T1	37
• T2	48
• T3	38
• T4	22
Node status	
• N0	79
• N1a	17
• N1b	56
• Type of surgery Total thyroidectomy	91
• Hemithyroidectomy	17
• Completion Thyroidectomy/ Revision Surgery	44
• Timing of surgery Per primum surgery	108
• Redo surgery	44

Of the total 273 RLNs at risk, 12 were fixed preoperatively. Five RLNs in the per primum group were fixed due to disease involvement and 7 in the redo group were involved because of previous surgical injury/sacrifice. Intraoperatively, six RLNs in per primum group and three RLNs in the redo surgery group were sacrificed due to disease involvement. Two of the nerves that were sacrificed in the redo surgery group had preoperatively fixed vocal cords. These 19 RLNs were not included in analysis. The total RLNs analyzed for dysfunction and recovery in the study were 254.

Vocal Cord Dysfunction and Recovery

In the postoperative period, the first laryngoscopic examination was done between the first to fifteenth day, postsurgery. The mean time to first laryngoscopic evaluation was four days. This showed vocal cord dysfunction in 25 patients. Five patients had bilateral dysfunctional vocal cords. In the immediate postoperative period, the total number of VCs with dysfunction were 30 (11.8%). Of these, 5 VCs had restricted mobility while 25 were fixed. VCP was seen in 9% of the RLNs at risk in the per primum cohort and in 16.2% of the RLNs at risk in the redo surgery cohort.

With a median follow-up of 23.5 months, 20 of the 30 dysfunctional cords (66.7%) recovered function. The overall permanent VCP rate was 3.9% in the entire cohort of RLNs at risk. Permanent VCP rates in the per primum and redo surgery cohorts were 2.6% and 7.6% respectively. The mean duration of recovery of the vocal cord function after initial palsy was 9.6 months. The mean duration of recovery of function in the per primum and redo surgery cohorts was 7.3 and 14.7 months,

TABLE II.
Details of Patients Having Persistent Vocal Cord Dysfunction.

S. No	Age/Gender	Tumor stage	Extra Thyroidal Extension	Type of Surgery	Central Compartment Dissection	Central compartment Node status
1	44/Female	T4	Yes	Redo	Dissected	Negative
2	26/Female	T4	Yes	Redo	Dissected	Positive
3	41/ emale	T4	Yes	Redo	Dissected	Positive
4	44/Male	T4	Yes	Redo	Dissected	Positive
5	53/Male	T4	Yes	Redo	Dissected	Positve
6	23/Female	T3	Yes	Per primum	Not done	-
7	27/Female	T3	Yes	Per primum	Dissected	Positive
8	31/Female	T3	Yes	Per primum	Dissected	Positive
9	34/Female	T4	Yes	Per primum	Dissected	Positive
10	19/Female	T3	Yes	Per primum	Dissected	Positive

respectively. Recovery of the RLNs was seen in 72.2% as compared to 58.3% in the per primum versus redo surgery cohorts.

Characteristics of all Patients with Persistent Palsy

Ten RLNs had persistent palsy that did not recover at last follow-up. The characteristics of these 10 patients, with regard to the stage and type of surgery performed are shown in Table II. Except in one patient, all patients with a permanent palsy had either extensive primary disease or positive metastatic nodal disease which mandated an extensive dissection around the nerve.

Risk Factors for Permanent Palsy

The univariate and multivariate analysis did not reveal any significant risk factors predicting recovery of RLN after initial paralysis.

DISCUSSION

RLN palsy is a well-documented complication after thyroid surgery. The incidence of temporary and permanent palsy varies in a wide range from 0% to 12% and 0% to 3.5%, respectively.[2–5] This wide variation in palsy rates is because of the varied type of surgery performed for patients with thyroid disorders. There is a higher risk of developing RLN palsy when surgery is performed for malignancy, redo surgeries, large goiters and with the use of central compartment dissections.[10,11] In a study by Palestini et al., a high incidence of a temporary palsy rate of 7.8% was reported in patients who underwent central compartment clearance along with thyroidectomy.[12] In our study, the incidence of immediate postoperative VCP in the per primum and redo surgery group was 9.5% and 16.2%, respectively. Permanent VCP rates in the same two cohorts were 2.6% and 7.6%, respectively. Similar rates of nerve palsy have been observed in high-risk cases undergoing surgery for thyroid carcinoma. Taylor et al. reported an incidence of 8% and 5.9% RLN dysfunction in patients undergoing surgery for follicular and papillary carcinomas.[13] Nishida et al., studied palsy rates in a high-risk population of patients with intraoperative involvement of the RLNs. The authors reported an immediate RLN palsy rate of 60.9% in this very high-risk cohort.[14] Our center is a high-volume tertiary referral center for thyroid cancers with a high incidence of surgeries being performed for advanced and recurrent cancers. Thirty percent of patients in our series underwent redo surgeries. Also, central compartment clearance was done in 74% of the patients for high risk tumor characteristics or presence of nodal metastases. Of the patients who underwent central compartment clearance, 59% of patients had positive nodes in the central compartment.

Few studies have prospectively documented the course of recovery of the RLN after temporary palsy.[2,10] The majority of studies have reported the incidence of overall temporary and permanent palsy in case series. Individual recovery has not been well documented. Some studies have documented recovery of RLN nerves after surgery for MNGs.[10,15] Enomoto et al. found a 85% recovery after surgery for benign diseases.[15] Lo et al. demonstrated recovery in 93% of patients developing VCP.[10] Nishida et al. have reported a recovery rate of more than 60% within 6 months in dysfunctional nerves, after surgery for high-risk thyroid cancer.[14] In our cohort of patients, the incidence of functional recovery was seen in 72.2% in the per primum cohort and in 58.2% in redo surgery cohort. The mean duration of recovery was 7 and 14.7 months in per primum and redo surgery cohorts, respectively. On comparing with the existing literature, the majority of the nerves recover function within the first 6 months after surgery.[15,16] However in our cohort, patients undergoing redo surgery had a longer recovery interval with some recovering function as late as 26 months. A similar finding was seen in a study by Steurer et al., where recovery was seen as late as two years after VC dysfunction.[16]

Attempts have been made to investigate predictive factors for permanent VCP. In a study by Sevim T, risk factors for permanent VCP were analyzed for patients undergoing surgery for thyroid cancers. They found use of nodal dissection, presence of extrathyroidal extension

and >11 metastatic lymph nodes to be significant factors affecting permanent VCP rates.[17] In another study by Dralle et al., a multivariate analysis was done to evaluate risk factors for permanent RLN palsy after thyroid surgery for both benign and malignant thyroid disease. They found recurrent surgery for benign disease, surgery for malignant disease and subtotal resections as significant factors predicting permanent RLN palsy.[18] We performed a univariate and multivariate analysis to investigate the factors influencing the recovery of VC function. The factors which were analyzed were tumor stage, central compartment dissection, node positivity in the central compartment, per primum versus redo surgery, and the type of original dysfunction of the cord (fixed or restricted). However, we did not find any correlation between these factors and recovery of the vocal cord function. This could probably be because of a small sample of dysfunctional RLNs in whom this analysis was carried out. A larger sample size would probably yield a significant result in demonstrating factors influencing recovery of the nerve.

Our study has shown a high incidence of vocal cord dysfunction followed by a significant percentage of recovery of RLN function. A high initial VCP rate could be because of the high-risk surgery that has been studied in this cohort of patients. Intraoperative neuro monitoring (IONM) is not routinely used in our institution and could be another reason for increased rates of temporary VCP. However the routine use of IONM is debatable with several meta-analysis and systematic reviews not showing significant difference in outcome between nerve visualisation and IONM.[4,19] However there has been some benefit seen with the use of IONM in redo surgeries.[4] Since there is a definitely higher incidence of both temporary and permanent palsy in the redo surgery cohort with a longer time to recovery, IONM maybe a useful adjunct in the redo surgery cohort of patients.

CONCLUSION

There is a high incidence of vocal cord dysfunction in surgery performed for advanced stage and redo thyroid cancers. However, there is a significant recovery of VC function even after extensive dissection of nerves in the central compartment. This recovery may be seen after prolonged durations post thyroidectomy. Thus, in absence of debilitating symptoms, a policy of watchful observation rather than immediate intervention is advisable even in a high risk cohort of patients undergoing surgery for thyroid cancers.

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