RESEARCH ARTICLE

Analysis and Prevention of Voice Morbidity in Thyroidectomy Patients: A Prospective Study

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Abstract

Background: Preservation of voice is an important concern for patients undergoing thyroidectomy. The objective of our study was early identification of the voice-related problems in postthyroidectomy patients and starting voice therapy as early as possible, in order to prevent faulty voice production techniques in them.

Materials and methods: One hundred and eighteen patients who underwent thyroidectomy in our study period were included for study. Voice evaluation was done preoperatively and postoperatively with videolaryngoscopy (VLS), maximum phonation duration (MPD), and fundamental frequency of voice (Fo). Voice therapy was initiated in patients who had voice disorders.

Results: Thirty-three patients in early postoperative period had voice disorders. Among these 33 patients, four patients had recurrent laryngeal nerve (RLN) paresis, 22 patients had external branch of superior laryngeal nerve (EBSLN) paresis, and 7 patients had normal vocal fold mobility. Four patients had voice changes in the late postoperative period. Voice rehabilitation therapy was started in these 33 patients. All the patients recovered well with voice therapy and without surgical intervention.

Conclusion: Early identification of voice disorders and initiation of voice rehabilitation therapy will considerably reduce the voice morbidity in thyroidectomy patients.

Keywords: Recurrent laryngeal nerve, Thyroidectomy, Vocal fold, Voice disorders, Voice rehabilitation.

Otorhinolaryngology Clinics: An International Journal (2019): 10.5005/jp-journals-10003-1309

Introduction

Altered voice is a common problem after thyroid surgery. Previous studies demonstrate that 25–90% of patients report abnormal voice within the first few weeks after operation and 11–15% of patients report persistent voice problems 3–6 months after thyroidectomy.[1,2] Major laryngeal nerve injuries account for a large portion of this incidence and are well-established and feared complications of thyroidectomy.[3,4] But many patients suffer long-term negative voice outcomes (NVOs) and have no evidence of laryngeal nerve injury.[5] Various non-neurogenic mechanisms have been postulated to account for postthyroidectomy voice changes, including the effects of endotracheal intubation[6] and other alterations in normal anatomy and mechanical factors.[7]

Our study was aimed at the ability to identify early changes in voice indicative of durable dysfunction (both neurogenic and non-neurogenic). This would facilitate early referral for comprehensive voice evaluation aimed to improve quality of life, prevent secondary injuries, and identify patients who might benefit from vocal fold augmentation.[8,9] All patients in this study were subjected to videolaryngoscopic examination, assessment of fundamental frequency of voice, and maximum phonation duration preoperatively and postoperatively.[10–12] Patients with voice change were subjected to early voice therapy and the outcome was assessed.

Material and Methods

This study is a prospective study conducted in a tertiary care teaching hospital, from December 2011 to May 2013. Patients of both sexes of all age groups with preoperative normal vocal cord mobility undergoing thyroidectomy were included for study. Patients with vocal cord paralysis preoperatively and patients with a past history of neck surgeries were excluded from the study. One hundred and eighteen patients who fulfilled the inclusion criteria were enrolled in the study after getting the informed consent during the study period.

Preoperative voice assessment was done for all the study patients with videolaryngoscopy, analysis of maximum phonation duration (MPD), and fundamental frequency (Fo). Postoperatively, VLS, MPD and Fo were repeated at the second and sixth month in patients with voice change. Videolaryngoscopic examinations were done for all patients using an Atmos stroboscopic unit. Voice was recorded using a microphone, by asking the patient to say constant syllable and the fundamental frequency was evaluated. Maximum phonation duration was measured by asking the patient to take a deep breath and say a constant syllable.

Subjective voice change is assessed by GRBAS (Grade, Roughness, Breathiness, Asthenia, and Strain), an auditory–perceptual evaluation method for hoarseness. Voice therapy given by voice pathologists following eclectic approaches which include vocal hygiene, abdominal support/breath control, intrinsic

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How to cite this article: Velayutham P, Murugaiyan S. Analysis and Prevention of Voice Morbidity in Thyroidectomy Patients: A Prospective Study. Int J Otorhinolaryngol Clin 2019;11(2):45–48.

Source of support: Nil

Conflict of interest: None

laryngeal muscle exercises, accent method, head and neck relaxation, and resonant voice/humming. Data regarding age, sex, final diagnosis, malignant nature of tumors, type of surgery, and percentage of EBSLN were collected. Distribution of the sample according to subjective voice change, cause of subjective voice change, and voice rehabilitation was also studied. VLS, Fo, MPD were compared at different intervals of time.

Data Analysis

The data were analyzed using the statistical software SPSS version 11.0. Wilcoxon matched-pairs signed rank test was used to analyze the video-strobo-laryngoscopic findings preoperatively and postoperatively. A *p* value of <0.05 was considered significant. Fundamental frequency of voice and MPD were analyzed using paired *t* test and Chi-squared test; a *p* value of <0.01 was considered significant.

Results

The results are as follows after analysis of data (Tables 1 to 12).

Table 1: Percentage distribution of the sample according to age

Age	*Number of patients*	*Percentage*
20–29	12	10.2
30–39	31	26.3
40–49	36	30.5
50–59	29	24.6
≥60	10	8.5
Mean ± SD	43.7 ± 10.7	

Maximum number of participants belongs to the age group 40–49 years
Average age of the participants was 43.7 ± 10.7 years

Table 2: Percentage distribution of the sample according to sex

Sex	*Count*	*Percentage*
Male	27	22.9
Female	91	77.1

Majority of the participants were women: 77.1%

Table 3: Percentage distribution of the sample according to final diagnosis

Final diagnosis	*Count*	*Percentage*
Colloid nodule	2	1.7
de Quervain thyroiditis	1	0.8
Follicular adenoma	4	3.4
Follicular carcinoma	2	1.7
Hashimoto's thyroiditis	2	1.7
Hürthle cell adenoma	2	1.7
Hürthle cell tumor	1	0.8
Hyperplastic nodule	1	0.8
Left colloid nodule	3	2.5
Left follicular adenoma	1	0.8
Lymphocytic thyroiditis	2	1.7
Multinodular goiter	78	66.1
Papillary carcinoma thyroid	14	11.9
Papillary microcarcinoma	1	0.8
Right colloid adenoma	1	0.8
Right follicular adenoma	1	0.8
Right Hürthle cell adenoma	2	1.7

Majority of thyroidectomies were done for multinodular goiter (66.1%)

Table 4: Percentage distribution of the sample according to malignant or nonmalignant nature

Final diagnosis	*Count*	*Percent*
Malignant	17	14.4
Nonmalignant	101	85.6

Maximum number of thyroid pathology is nonmalignant, which is 85.6%

Table 5: Percentage distribution of the sample according to surgery

Surgery	*Count*	*Percent*
Left hemithyroidectomy	5	4.2
Right hemithyroidectomy	8	6.8
Total thyroidectomy	105	89.0

Total thyroidectomy carried out was for 89% of patients, while hemithyroidectomy was for 11%

Table 6: Percentage distribution of the sample according to course of external branch of superior laryngeal nerve

Course of EBSLN	*No. of patients*	*Percentage*
Type I	85	72
Type IIA	12	10
Type IIB	11	9.5
Not identified	10	8.5

In our study, the most common course of EBSLN is Cernea type I (72%)

Table 7: Percentage distribution of the sample according to subjective voice change

Subjective voice change	*Count*	*Percent*
Yes	33	28.0
No	85	72.0

Subjective voice change following thyroidectomy was observed in 33% of patients

Table 8: Percentage distribution of the sample according to cause of subjective voice change

Causes of subjective voice change	*No. of patients*	*Percentage*
RLN palsy	4	3.4
EBSLN palsy	22	18.6
Normal vocal cords	7	5.9

EBSLN palsy was observed in 18.6% of the patients and 4% had RLN palsy

Table 9: Percentage distribution of the sample according to voice rehabilitation

Voice rehabilitation	*Count*	*Percent*
Started	33	28.0
Not done	87	72.0

Voice rehabilitation therapy started in all patients with voice change (28%)

Discussion

Preservation of voice is an important concern for patients undergoing thyroid surgery. However, vocal and laryngeal symptoms appear to be common following thyroidectomy.[13] The outcomes of injury to RLN and EBSLN are well known and preservation of these nerves is the major point in modern thyroid surgery.[14] However, the etiology of postthyroidectomy voice

Table 10: Comparison of VLS at different intervals of time

VLS	*Normal*	*Abnormal*	*Pair*	*Z#*	*p*
Preoperative (A)	118 (100)	0 (0)	–	–	–
Postoperative 1–2 weeks (B)	92 (78)	26 (22)	A vs B	5.1*	0.000
Follow-up, 2 months (C)	111 (94.1)	7 (5.9)	A vs C	2.65*	0.008
Follow-up, 6 months (D)	114 (96.6)	4 (3.4)	A vs D	2**	0.046

*Significant at 0.01 level; **significant at 0.05 level. VLS findings shows 3.4% of abnormal findings after 6 months of surgery, compared to 22% in the early postoperative period

Table 11: Comparison of fundamental frequency of voice at different intervals of time

FO	*Mean*	*SD*	*Pair*	*Paired t*	*p*
Preoperative (A)	214.3	13.1	–	–	–
Postoperative 1–2 weeks (B)	207.1	14.8	A vs B	10.32*	0.000
Follow-up, 2 months (C)	210.5	13.6	A vs C	10.14*	0.000
Follow-up, 6 months (D)	211.9	13.1	A vs D	10.44*	0.000

Mean Fo in the late postoperative period (after 6 months) was higher than that of the early postoperative period, not reaching the preoperative value. *Significant at 0.01 levels

Table 12: Comparison of maximum phonation duration at different intervals of time

MPD	*Mean*	*SD*	*Pair*	*Paired t*	*p*
Preoperative (A)	16.2	2.5	–	–	–
Postoperative 1–2 weeks (B)	15.6	2.6	A vs B	4.88*	0.000
Follow-up, 2 months (C)	15.7	2.5	A vs C	4.75*	0.000
Follow-up, 6 months (D)	15.9	2.4	A vs D	4.83*	0.000

Mean MPD observed in our study preoperatively is 16.2 seconds and is 15.9 seconds after 6 months. *Significant at 0.01 level

disturbances for patients with preserved nerve function has not been widely studied.[15] The objective of our study was early identification of the voice related problems in postthyroidectomy patients and starting voice rehabilitation as early as possible, in order to prevent faulty voice production techniques in them.[16,17]

Out of 118 patients, 13 patients who underwent hemithyroidectomies had no voice changes. Thirty-three of the 105 patients (31.43%) underwent total thyroidectomy and had subjective voice change in the early postoperative period. Only 4 patients (3.4%) out of 105 underwent total thyroidectomy and had voice change after 6 months. In all patients, recurrent laryngeal nerve (RLN) was identified and was well preserved. In spite of the proper preservation, 4 patients (3.3%) had RLN palsy postoperatively. Patients with postoperative videolaryngoscopic (VLS) features like posterior glottic rotation, bowing of vocal folds, asymmetrical mucosal folds vibration were considered as EBSLN palsy.[18] Twenty-two patients had EBSLN palsy. Seven patients had voice change without any obvious abnormality in VLS. Their fundamental frequency increased after two months. Voice change in these patients may be due to forceful retraction, the application of cautery near cricothyroid muscle.[19]

The most common course of EBSLN observed in our study is type I which was 72%, followed by IIA in 10% and IIB in 9.5% of patients. EBSLN could not be identified in 8.5% of patients. It was observed that patients with type IIB course of nerve are more prone for injury. Hence, postoperative vocal cord examination is advisable for patients with type IIB course and in patients for whom EBSLN is not identified.[20]

The preoperative video-strobo-laryngoscopic examination of vocal cords of all patients was normal. Early postoperative period shows abnormality in 26 patients which includes complete immobility of the vocal cords, restricted vocal cord mobility, anterior glottis rotation, bowing of vocal folds, and absent or asymmetrical mucosal folds vibration. Early postoperative videolaryngoscopic findings are statistically significant as p value is less than 0.05. After postoperative initiation of voice rehabilitation therapy, VLS examination after 2 months showed abnormal findings in 7 patients. Late postoperative evaluation after 6 months showed abnormal findings in 4 patients, including restricted vocal mobility of vocal cord which was completely immobile previously in 2 patients and minimal bowing of vocal cord in 2 patients.

The mean fundamental frequency (Fo) of voice was 214.3 Hz preoperatively. The preoperative value of each patient was considered to be their normal value. Early postoperative mean Fo was 207.1 Hz. Mean Fo at the 2-month postoperative period was 210.5 Hz. The late postoperative mean Fo was 211.9 Hz. The value was more than that of the early postoperative mean Fo but did not equal the preoperative value. The improvement was statistically significant as $p < 0.01$.

Maximum phonation duration was 16.2 seconds preoperatively. Early postoperative value was 15.6 seconds. Late postoperative values were 15.7 and 15.9 seconds at 2-month and 6-month periods,

respectively. This change was statistically significant as the *p* value was less than 0.001. At 6 months, only 4 patients had subjective voice change, compared to 33 in early postoperative period. The changes in fundamental frequency and maximum phonation duration compared to preoperative period were statistically significant ($p < 0.01$). None of our patients was in need of vocal fold augmentation therapy. This study shows there was improvement in subjective voice and fundamental frequency and maximum phonation duration of the patients with voice therapy.

Conclusion

Voice change in early postoperative period after thyroidectomy is a common problem. Early identification of the problem and initiation of voice rehabilitation therapy will considerably reduce the voice morbidity in thyroidectomy patients.

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