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

Prabu Velayutham¹, Sathiyan Murugaiyan²

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.

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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. Major laryngeal nerve injuries account for a large portion of this incidence and are well-established and feared complications of thyroidectomy. But many patients suffer long-term negative voice outcomes (NVOs) and have no evidence of laryngeal nerve injury. Various non-neurogenic mechanisms have been postulated to account for postthyroidectomy voice changes, including the effects of endotracheal intubation and other alterations in normal anatomy and mechanical factors.

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. All patients in this study were subjected to videolaryngoscopic examination, assessment of fundamental frequency of voice, and maximum phonation duration preoperatively and postoperatively. 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...
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. The outcomes of injury to RLN and EBSLN are well known and preservation of these nerves is the major point in modern thyroid surgery. However, the etiology of postthyroidectomy voice
Voice Morbidity in Thyroidectomy Patients

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, and asymmetrical mucosal folds vibration were considered as EBSLN palsy. 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.

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.
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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