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Voice Changes After Thyroid Surgery: A Prospective Evaluation of Vocal Cord Function

Adil Shah Roghani[1], Bakht Taj[2], Arifullah[3], Muhammad Jamil[4], Muhammad Hafeez[5], Azam Khan[6]

[1]Assistant Professor Department of Surgery Kabir Medical College Peshawar

[2]Assistant Professor ENT dept Swat Medical College Saidu Sharif Swat

[3]Associate professor ENT Kabir Medical College, Peshawar

[4]Assistant professor ENT BAHRIA University college of medicine, Islamabad

[5]Associate professor Ent department Khyber Medical college/Khyber teaching hospital Peshawar

[6]Associate Professor Peshawar Medical College, Peshawar.

Corresponding Author:

Arifullah

Associate professor ENT Kabir Medical College, Peshawar

Email Id: drmrfub@gmail.com

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ABSTRACT

Background: Voice changes resulting from thyroid surgery complications due to recurrent laryngeal nerve injury or superior laryngeal nerve neuropraxia are common. These complications may hinder communication and significantly affect quality of life. Assessing the voice during the initial stages of postoperative rehabilitation assists in recognizing postoperative voice dysfunction so that rehabilitation potential may be optimized.

Objectives: To evaluate incidence, patterns, and recovery of postoperative voice changes and vocal cord paralysis after thyroidectomy through voice analysis, laryngoscopy examination, and pre- and postoperative assessments.

Methodology: this study conducted at Department Of ENT Kabir Medical College, Peshawar from july 2024 to dec 2024 a prospective study involving a cohort of 100 patients who underwent thyroid surgery. Preoperative and postoperative evaluations of vocal cord mobility, on the 7th day and 3 months, were conducted using fiber-optic laryngoscopy. The postoperative voice quality of the patients was assessed both perceptively and acoustically. The analyses were conducted using SPSS 24.0, and a significance level of $p < 0.05$ was applied.

Results: Of the 100 studied patients, aged on average 42.6 years (SD 11.3), 22% had temporary changes in their voice, while 4% had voice dysfunction that was permanent. Laryngeal nerve paresis recurred within 6% of the cases (4 were unilateral, 2 were bilateral). On average Voice Handicap Index scores were significantly higher 7 days' post op, then almost returning to baseline in 3 months' post op ($p=0.07$). This score evaluated the handicap attributable to the voice. Injury to the superior laryngeal nerve impacted 8% of patients by removing the pitch of their voice, while the subjective increase in voice concern was perceived statistically significantly more in females ($p=0.03$).

Conclusion: Thyroid surgeries are likely to induce temporary voice changes which resolve spontaneously. Routine preoperative and postoperative laryngoscopy are performed to mitigate the risk of permanent voice dysfunction, alongside meticulous surgical dissection and timely rehabilitation. Including voice evaluations as part of the thyroidectomy protocol has proven to enhance postoperative patient safety and satisfaction, particularly for patients whose occupation relies on voice use...

Keywords: *Thyroidectomy; Recurrent Laryngeal Nerve; Voice Disorders; Vocal Cord Paralysis*

1. INTRODUCTION

In assessing the thyroid gland, these benign syndromes, multinodular goiter, thyroiditis, and thyroid malignancies are some of the common conditions of the endocrine system to remember. [1].Over the years, improvements in surgical methods and postoperative care systems have been adopted in the medical field; however, the postoperative voice change phenomenon remains highly concerning, with estimates ranging from 10 to 60 percent depending on the extent of surgery and the method

of assessment. Voice alterations can significantly and negatively impact one's life [2]. Unlike other body parts, voice is the primary means of communication, social interaction, and a profession. The magnitude of the impact depends on the degree of variation, and the primacy of the surgical procedure does not exclude the variation from occurring. The variation can also be viewed as a complication, as it relates to the injury of the recurrent laryngeal nerve (RLN), the external branch of the superior laryngeal nerve (EBSLN), the cricothyroid muscle, or other associated laryngeal structures and vascular layers, the laryngeal muscle, and the strap muscles [3]. The close association of the RLN with the thyroid and the tracheoesophageal groove is a primary reason it is most frequently injured. Even neuropraxia without transection can lead to temporary vocal cord paresis, resulting in hoarseness, breathiness, poorer projection, and early postoperative voice fatigue [4]. Similarly, damage to the EBSLN lowers the voice. It impairs pitch elevation, which can be especially debilitating for professions that depend on the voice, such as teaching, singing, and public speaking [5]. Recent reports suggest that even when laryngeal nerve function is intact, some voice changes may occur after endotracheal intubation, laryngeal trauma, reduced laryngeal mucosal fluid, surgical manipulation, and postoperative swelling and inflammation [6]. This necessitates a more comprehensive voice evaluation that incorporates patient-reported outcome measures, a combination of perceptual and acoustic analyses, and laryngoscopy assessment. Work of a prospective nature using fiber-optic laryngoscopy has shown that early postoperative evaluations may incorrectly assess the level of dysfunction, as many changes will resolve over the weeks due to recovery from neuropraxia and a reduction of local edema [7]. With the increasing focus in the literature on the quality of life and patient-centered outcomes, it is critical to assess the actual impact of voice loss on patients. The distinction between transient and persistent neurologic injury will guide prognosis and rehabilitation and may become important for legal concerns [8]. The literature suggests that organized postoperative voice evaluations can help identify voice dysfunction earlier and make appropriate speech therapy referrals, thereby improving voice recovery and minimizing long-term disability [9]. Voice assessment is instrumental in high-resource settings, and prior studies suggest it should also be routinely implemented in low-resource settings where voice-related disabilities remain prevalent. In Pakistan and similar developing settings, however, post-thyroidectomy voice assessments are common. They are documented due to under-appreciation, lack of standardization, and the absence of preoperative notes, making it challenging to determine whether any voice changes are due to the operation or were present to begin with. Prospective studies that combine objective and subjective assessments demonstrate the value of this study.

Study Objectives

The primary aim was to assess the incidence of, and patterns and duration of recovery from, voice changes after thyroid surgery. The secondary aim was to identify risk factors for voice paralysis and to assess acoustic and laryngoscopic findings.

2. MATERIALS AND METHODS

Study Design & Setting:

A prospective observational study was conducted in the Department Of ENT Kabir Medical College, Peshawar from july 2024 to dec 2024 .

Participants:

Adults having total or hemithyroidectomy for benign or malignant thyroid disorders were included in this study. All patients had preoperative and postoperative laryngoscopy and voice evaluations performed in a standardized fashion on days 7 and 3 months after surgery. Those patients with previous neck surgery, documented vocal cord palsy, and professional voice users needing specific assessments were managed differently per the division's policy.

Sample Size Calculation:

Anticipating a 20% rate of postoperative transient vocal cord dysfunction, we calculated the minimum sample size necessary for a 95% confidence level and 8% margin of error to be 96 patients. Considering possible attrition, a final sample size of 100 individuals was established.

Inclusion Criteria:

We included patients between the ages of 18 and 70 years who were undergoing elective thyroid surgery for benign nodules, multinodular goiter, Graves' disease, and differentiated thyroid carcinoma. All patients provided preoperative consent and underwent preoperative and postoperative voice assessment and laryngoscopy.

Exclusion Criteria:

To minimize confounding influences on postoperative voice outcomes, patients with pre-existing vocal cord paralysis, laryngeal disease, neck surgery, chronic voice-affecting neurological disorders, emergency procedures, professional singing with tool specialization, or incomplete follow-up were excluded.

Diagnostic and Management Strategy:

Every patient underwent preoperative fiber-optic laryngoscopy and postoperative inspection, as well as perceptual voice

assessments and acoustic voice analyses. Managed vocal fold paresis involved voice rest and steroid treatment. Patients also received speech-language pathology services and rehabilitation.

Statistical Analysis:

The data analysis was conducted using SPSS version 24.0. Continuous variables were described as mean ± standard deviation. Categorical variables utilized frequency and percentage. To evaluate the differences at the specified time points, both paired t-tests and chi-square tests were utilized. Statistical significance was attributed to p-values below the threshold of 0.05.

Ethical Approval:

The study obtained Ethical Clearance from Kabir Medical College, Peshawar Institutional Review Board .All participants provided written informed consent. Confidentiality, autonomy, and safety were maintained per the Declaration of Helsinki 2013.

3. RESULTS

Outcomes from the study indicated that voice changes, temporary and permanent, were seen in 22% and 4% of cases, respectively. There were significant improvements in the voice handicap index and acoustic outcomes by three months' post-surgery ($p < 0.001$). Indications are that significant improvements occurred within the early postoperative period. Most of the improvements occurred by three months. Recurrent laryngeal nerve (RLN) palsy and external branch of the superior laryngeal nerve (EBSLN) dysfunction occurred in 6% and 8% of cases respectively.

Intervention Outcomes

It is remarkable how postoperative voice change trends can positively shift when these changes are identified and managed early. Of the patients who had transient vocal cord paresis and conservatively managed with voice rest, hydration, short tapering corticosteroid therapy, speech therapy, and 3 therapy sessions, 82% had full mobility return within 3 months. EBSLN dysfunction patients had pitch control recovery progress at a slower pace with only 65% of patients attaining the pronator pitch range. Patients with unilateral RLN palsy compensated voice rehabilitation and recovery that was voice rehabilitated compensatory improvement in their voice and, in 2 cases, the bilateral RLN palsy had a prolonged recovery course needing closer supervision of the airway. No cases in the study required surgical medialization. Early organized assessment and intervention clearly enhanced postoperative voice outcomes.

Table 1: Baseline Demographic and Clinical Characteristics of Patients (n = 100)

displays demographic details, thyroid pathology, comorbidities, and types of surgeries in the sample population.

Variable	Frequency (%) / Mean ± SD
Age (years)	42.6 ± 11.3
Gender	
• Male	32 (32%)
• Female	68 (68%)
Type of Thyroid Disorder	
• Multinodular goiter	48 (48%)
• Solitary thyroid nodule	32 (32%)
• Graves' disease	10 (10%)
• Thyroid carcinoma	10 (10%)
Type of Surgery	
• Total thyroidectomy	58 (58%)
• Hemi thyroidectomy	42 (42%)
Common Comorbidities	
• Hypertension	22 (22%)

• Diabetes mellitus	18 (18%)

Table 2: Perioperative Voice and Laryngoscope Findings

demonstrates transformations in vocal cord function and self-reported symptoms during three assessment periods: preoperative, early postoperative, and after three months.

Parameter	Preoperative	Postoperative Day 7	Postoperative 3 Months
Normal vocal cord mobility	100%	72%	94%
Transient RLN paresis	0%	6%	3%
Permanent RLN palsy	0%	–	4%
EBSLN dysfunction (pitch loss)	0%	8%	4%
Subjective hoarseness	0%	22%	6%
Breathiness	0%	18%	5%

Table 3: Voice Handicap Index (VHI) and Acoustic Analysis Scores

Summarizes objective acoustic measures and VHI results during three intervals. Illustrates pronounced postoperative regression with notable improvement by three months.

Variable	Preoperative Mean ± SD	Day 7 Mean ± SD	3 Months Mean ± SD	p-Value
VHI total score	13.2 ± 4.1	28.6 ± 7.3	15.1 ± 4.8	<0.001
Fundamental frequency (F0, Hz)	198 ± 22	183 ± 27	195 ± 20	0.04
Jitter (%)	0.62 ± 0.14	1.08 ± 0.22	0.70 ± 0.18	<0.001
Shimmer (%)	3.1 ± 0.9	5.4 ± 1.2	3.3 ± 1.0	<0.001
Maximum phonation time (seconds)	15.8 ± 3.6	11.2 ± 3.1	14.9 ± 3.2	<0.001

Table 4: Distribution of Postoperative Nerve Injuries and Recovery Outcomes (n = 100)

Illustrates the frequency of postoperative nerve injuries and the recovery rates in addition to the permanent deficits, stressing the clinical significance of the RLN and EBSLN involvement.

Variable	Frequency (%)	Recovery by 3 Months	Permanent Deficit
Recurrent laryngeal nerve palsy	6 (6%)	2 (33%)	4 (4%)
EBSLN dysfunction	8 (8%)	6 (75%)	2 (2%)
Transient voice change (overall)	22 (22%)	20 (91%)	2 (2%)
Bilateral RLN palsy	2 (2%)	0	2 (2%)
Speech therapy referral required	18 (18%)	–	–

4. DISCUSSION

Improvements in surgical techniques as well as in preoperative and postoperative patient care and nerve monitoring still do not resolve the issue of voice quality changes following surgery. The current prospective study found that 22% of the study participants had temporary changes in voice quality and 4% had changes that persisted for 3 months. Such findings are certainly in line with the global literature, which cites rates of transient and permanent recurrent laryngeal nerve (RLN) injury

in the range of 5-30% and 1-5%, respectively [10]. The incidence in the observed cohort falls within the said range, indicating that local surgical outcomes are in line with global standards. The increase in Voice Handicap Index (VHI) scores in the first 3 months post-surgery and the temporary worsening of voicing acoustic measures, which subsequently improved, indicate the mostly reversible nature of the voice problems post-surgery [11]. A recovery pattern with similar temporal dynamics was reported by Jung et al. (2021). They noted dramatic recovery of acoustic parameters and improvement in patient-reported outcomes by the third month of postoperative recovery, especially in neuropraxia cases [12]. This, defined by goal, the early phase of the postoperative course, in serial assessment, reinforces the need to be patient in serial evaluations. In our study, 6% of patients experienced recurrent laryngeal nerve paresis or palsy. One third of that group recovered in the first 3 months [13]. Similar outcomes have been reported in recent meta-analyses, including a 2022 systematic review, which reported recovery rates for RLN injuries of 25% to 70% based on the level of nerve injury [14]. The differences in recovery reported across studies may be due to variations in surgical skill, intraoperative nerve monitoring, and postoperative rehabilitation. The variability in recovery documented in the studies highlights the importance of systematic postoperative evaluation and surgeon experience. EBSLN dysfunction, as failure to elevate the pitch, occurred in 8% of our study patients. Contemporary studies report EBSLN injury rates of 4-20% in the literature, especially among high-risk patients, such as those with large multinodular goiters and malignant conditions [15,16]. A 2023 multicenter study showed that EBSLN injury was frequently missed during laryngoscopy and stressed the need to record and analyze voice and pitch range to assess and diagnose EBSLN dysfunction, which we adopted and thereby improved diagnostic accuracy [17]. There were greater differences among the other gender. Female patients showed greater degrees of voice impairment. A Korean 2020 prospective cohort study reported similar findings and suggested this might be explained by a greater sensitivity toward pitch and greater voice-related communicative demands. This reinforces the importance of individualized voice rehabilitation and voice counseling for these patients [18]. The impact of speech-language therapy on rehabilitation during this period is highly encouraging. The contemporary body of literature is consistent in the provision of early intervention; for example, a 2021 randomized controlled trial reported that specifically designed voice therapy during the postoperative period considerably improved recovery from vocal fatigue and pitch instability. The improvement pattern shown in our study is consistent with this body of work and strongly suggests the integration of voice specialists into the postoperative period 19]. This study also contributes important geographically specific data from a low-resource environment where structured pre- and postoperative voice evaluations are not the norm. Variability in reported rates of nerve injuries, as cited in a 2023 South Asian review, arises primarily from a lack of objective evaluation and standardized protocols [20]. The current study design, specifically the use of laryngoscopy and acoustic analysis during the three intervals, attempts to address this deficit and the need to develop standardized protocols for voice assessments. The study results confirm that voiced postoperative changes are common and, in most cases, completely reversible. With respect to thyroidectomy, the technique of the surgical procedure, the early rehabilitation, and the organized voice assessment have the most influence on achieving the best voice results.

5. LIMITATIONS

The limitation of this study is due to concentrating on a single center, a limited participant group, a relatively short three-month follow-up period, which might overlook late recovery and prolonged peripheral nerve dysfunction. The study also noted the lack of advanced diagnostic tools, specifically laryngeal electromyography. Future studies with appropriately widened scope and increased duration will provide the necessary data for more fitting generalizations.

6. CONCLUSION

Changes in voice quality after thyroid surgery are not uncommon, primarily as transitional shifts which can be expected to resolve with appropriate postoperative measures and rehabilitation. Every effort has been made in promoting the appropriate pre and postoperative laryngoscope and acoustic evaluations with an adequate surgical technique to improve the early recognition and functional outcomes. This will enhance the early postoperative satisfaction and improve quality of life.

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Authors Contributions

Concept & Design of Study: **Adil Shah Roghani**[1]

Drafting:**Bakht Taj**[2]

Data Analysis:**Arifullah**[3]

Critical Review:**Muhammad Jamil**[4]**, Muhammad Hafeez**[5]**,Azam Khan**[6]

Final Approval of version: **All Mentioned Authors Approved the Final Version.**

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