



## PATTERNS, TREATMENT STRATEGIES, AND OUTCOMES OF ADULT LARYNGEAL PAPILLOMATOSIS: INSIGHTS FROM A THREE YEAR STUDY IN AN ENT DEPARTMENT OF TERTIARY CARE HOSPITAL

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### Abstract

**Background:** Adult laryngeal papillomatosis is a recurrent benign laryngeal disorder caused by human papillomavirus, frequently associated with significant voice morbidity and repeated surgical interventions. The disease follows an unpredictable clinical course with frequent recurrences, leading to cumulative laryngeal trauma and impaired quality of life. Despite advances in microlaryngeal surgical techniques, optimal management remains challenging due to variability in disease severity, recurrence patterns, and functional voice outcomes. Incorporation of validated clinical severity and voice-related quality-of-life measures is essential for comprehensive assessment and outcome evaluation. Regional data from South India addressing these parameters remain limited.

**Objectives:** To evaluate the clinical patterns, treatment strategies, disease severity, and voice-related outcomes of adult laryngeal papillomatosis over a three-year period in a tertiary care hospital.

**Methods:** This observational study was conducted in the Departments of ENT of tertiary care Hospitals of Pune, Hyderabad and KMCH, Bihar over three years from March 2022. Adult patients diagnosed with laryngeal papillomatosis were included. **Ten variables** were analyzed: **age, gender, site of involvement, symptom burden, Modified Severity Score (MSME), Voice Handicap Index (VHI) score, number of surgical interventions, and type of surgical treatment, recurrence rate, and functional voice outcome.** Diagnosis was confirmed by laryngoscopy and histopathology. Disease severity was graded using MSME, and voice-related quality of life was assessed using VHI. Surgical management included microlaryngeal excision using cold instruments or microdebrider. Statistical analysis was performed using appropriate tests, with  $p < 0.05$  considered significant.

**Results:** Most patients were males (68%), with a mean age of  $45 \pm 12$  years. Hoarseness was the predominant symptom (92%), and glottic involvement was observed in 74% of cases. Higher

MSME scores were significantly associated with multisite disease and increased recurrence ( $p = 0.03$ ). Multiple surgical interventions were required in 61% of patients. Postoperative improvement in VHI scores was observed in 79% of patients; however, those undergoing  $\geq 3$  surgeries demonstrated poorer voice outcomes and persistently higher VHI scores ( $p = 0.04$ ). **Conclusion:** Adult laryngeal papillomatosis is associated with high recurrence rates and significant functional voice morbidity. Higher disease severity (MSME) and multisite involvement significantly increase recurrence risk ( $p = 0.03$ ), while repeated surgical interventions adversely affect voice-related quality of life as reflected by VHI scores ( $p = 0.04$ ). Early diagnosis, objective severity grading, structured voice assessment, and long-term follow-up are crucial for optimizing functional outcomes and disease control.

**Keywords:** Adult laryngeal papillomatosis; Human papillomavirus; Microlaryngeal surgery; Modified Severity Score (MSME); Voice Handicap Index (VHI); Recurrence

## INTRODUCTION

Adult laryngeal papillomatosis (ALP) is a benign epithelial disorder of the larynx characterized by the development of recurrent exophytic papillomatous lesions caused predominantly by human papillomavirus (HPV) types 6 and 11. Despite its benign histopathology, ALP poses a significant clinical challenge due to its recurrent nature, variable disease severity, and considerable impact on phonatory function and quality of life. In adults, the disease often follows an unpredictable clinical course, with periods of remission interspersed with frequent recurrences requiring repeated surgical interventions (Derkey & Wiatrak, 2022), (1)

Globally, adult-onset laryngeal papillomatosis is less common than juvenile-onset disease; however, it is associated with a distinct disease behavior, including later age of onset, male predominance, and a tendency toward localized glottic involvement. Nevertheless, a subset of adult patients exhibit aggressive disease with multisite laryngeal spread, rapid recurrence, and significant voice morbidity (Seedat et al., 2023). (2) The burden of disease is not only clinical but also psychosocial, as voice impairment directly affects professional performance, social interaction, and emotional well-being.

The pathogenesis of ALP is closely linked to persistent HPV infection of the laryngeal epithelium. Recent molecular studies have highlighted the role of host immune response, viral load, and epithelial microtrauma in determining disease persistence and recurrence (Best et al., 2022), (3) While HPV vaccination has shown promise in reducing disease severity and recurrence, particularly as an adjuvant therapy, its role in established adult disease remains an area of ongoing research (Rosenberg et al., 2024), (4) In many low- and middle-income countries, including India, vaccination coverage remains suboptimal, limiting its impact on disease epidemiology.

Clinically, hoarseness remains the most common presenting symptom in adult laryngeal papillomatosis, often leading to delayed diagnosis due to its overlap with more common benign voice disorders. Other symptoms may include vocal fatigue, throat discomfort, chronic cough, and, in severe cases, airway compromise. Laryngoscopic examination typically reveals sessile or pedunculated papillomatous lesions, most frequently involving the true vocal cords. Supraglottic, subglottic, and multisite involvement, though less common, are associated with increased disease severity and recurrence (Heman-Ackah et al., 2023), (5)

The management of adult laryngeal papillomatosis is primarily surgical, aimed at removing visible lesions while preserving normal laryngeal architecture and function. Advances in microlaryngeal surgical techniques—including cold steel excision, microdebrider-assisted removal, and laser ablation—have significantly improved disease control and reduced perioperative morbidity. However, no surgical modality has proven curative, and recurrence remains the hallmark of the disease (Liu et al., 2022), (6). Repeated surgical interventions, while necessary, may result in cumulative laryngeal trauma, scarring, anterior commissure synechiae, and long-term voice deterioration.

In recent years, there has been increasing emphasis on moving beyond lesion clearance alone toward comprehensive outcome assessment that includes disease severity, recurrence patterns, and functional voice outcomes. Objective severity grading systems such as the Modified Severity Score (MSME) allow standardized assessment of disease extent based on anatomical involvement and lesion burden. Studies have demonstrated that higher severity scores correlate with increased recurrence rates and need for multiple surgeries (Carroll et al., 2023), (7). Such scoring systems are particularly useful in predicting prognosis and guiding follow-up strategies.

Equally important is the assessment of voice-related quality of life. The Voice Handicap Index (VHI) is a validated, patient-reported outcome measure that captures the functional, emotional, and physical impact of voice disorders. Recent literature emphasizes that objective laryngeal findings do not always correlate with patient-perceived voice disability, making tools like VHI indispensable in routine clinical practice (Francis et al., 2024), (8). In adult laryngeal papillomatosis, repeated surgeries and disease chronicity have been shown to adversely affect VHI scores, even when anatomical disease appears controlled.

From an Indian perspective, data on adult laryngeal papillomatosis remain limited, particularly with respect to standardized severity scoring and voice outcome assessment. Most available studies are retrospective, focus primarily on surgical techniques, and lack structured evaluation of functional outcomes. Furthermore, variations in healthcare access, late presentation, and limited availability of voice therapy services may influence disease outcomes in the Indian population (Ramakrishnan et al., 2023), (9). There is a pressing need for region-specific data to inform evidence-based management strategies.

The COVID-19 pandemic further highlighted the challenges faced by patients with chronic laryngeal conditions. Delayed presentations, interrupted follow-up, and postponement of elective surgeries may have contributed to increased disease severity and recurrence in some patients with laryngeal papillomatosis (Kumar et al., 2022), (10). These factors underscore the importance of long-term follow-up and structured disease monitoring.

Emerging research between 2022 and 2025 has also explored adjuvant therapies such as intralesional antivirals, immunomodulators, and therapeutic HPV vaccines. While some studies report reduced recurrence rates, results remain variable, and standardized protocols are lacking (Maturro & Hartnick, 2024), (11). Consequently, surgery remains the cornerstone of management in most tertiary care settings.

Given the recurrent nature of adult laryngeal papillomatosis, its impact on voice-related quality of life, and the lack of robust regional data, comprehensive studies integrating clinical patterns, severity assessment, treatment strategies, and functional outcomes are essential. Understanding the relationship between disease severity, recurrence, and voice outcomes can aid clinicians in optimizing management, counseling patients realistically, and minimizing long-term morbidity.

The present study was therefore undertaken to evaluate the clinical patterns, treatment strategies, disease severity using MSME, recurrence rates, and voice-related outcomes assessed by VHI in adult patients with laryngeal papillomatosis over a three-year period in a tertiary care ENT department. This study aims to contribute meaningful regional data and reinforce the importance of structured severity and functional assessment in the management of this challenging condition.

## Objectives

1. To study the demographic and clinical patterns of adult laryngeal papillomatosis.
2. To assess disease severity using the Modified Severity Score (MSME).
3. To evaluate treatment strategies and recurrence rates.
4. To analyze voice-related outcomes using the Voice Handicap Index (VHI).
5. To correlate disease severity and frequency of surgery with functional voice outcomes.

## METHODS

### **Study Design and Setting**

This was a hospital-based observational study conducted over a period of three years in the Department of Otorhinolaryngology of a tertiary care teaching hospital in South India. 72 patients with laryngeal papillomatosis from three different centers were gathered and observed for their clinical pattern and outcome of surgery as a treatment strategy.

### **Study Population**

Adult patients ( $\geq 18$  years) diagnosed with laryngeal papillomatosis based on clinical, endoscopic, and histopathological findings were included.

### **Inclusion Criteria**

- Adults aged 18 years and above
- Confirmed diagnosis of laryngeal papillomatosis
- Willingness to participate and comply with follow-up

### **Exclusion Criteria**

- Juvenile-onset papillomatosis
- Malignant transformation at presentation
- Incomplete records or loss to follow-up

### **Study Variables**

Ten variables were analyzed:

1. Age
2. Gender
3. Site of involvement
4. Presenting symptoms
5. Modified Severity Score (MSME)
6. Voice Handicap Index (VHI) score
7. Number of surgical interventions
8. Type of surgical procedure
9. Recurrence rate
10. Functional voice outcome

### **Diagnostic Evaluation**

All patients underwent indirect or video laryngoscopy. Diagnosis was confirmed by histopathological examination following surgical excision.

### **Severity and Voice Assessment**

- **Disease severity** was graded using the Modified Severity Score (MSME), considering anatomical spread and lesion burden.
- **Voice-related quality of life** was assessed using the Voice Handicap Index (VHI) questionnaire pre- and post-operatively.

### **Treatment Protocol**

Patients were managed surgically using microlaryngeal techniques:

- Cold steel microlaryngeal excision
- Microdebrider-assisted excision

Adjuvant therapy was not routinely used.

### **Statistical Analysis**

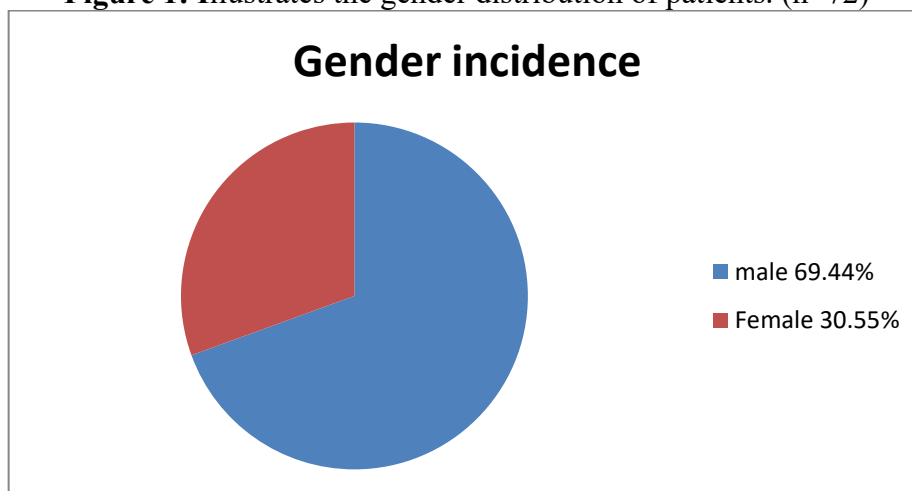
Data were analyzed using standard statistical software. Associations were tested using appropriate parametric or non-parametric tests. A p value  $< 0.05$  was considered statistically significant.

## RESULTS

### 1. Demographic Profile

The study population showed a male predominance (68.05%), with a mean age of  $45 \pm 12$  years. The majority of patients were in the fourth and fifth decades of life (**Fig 1**).

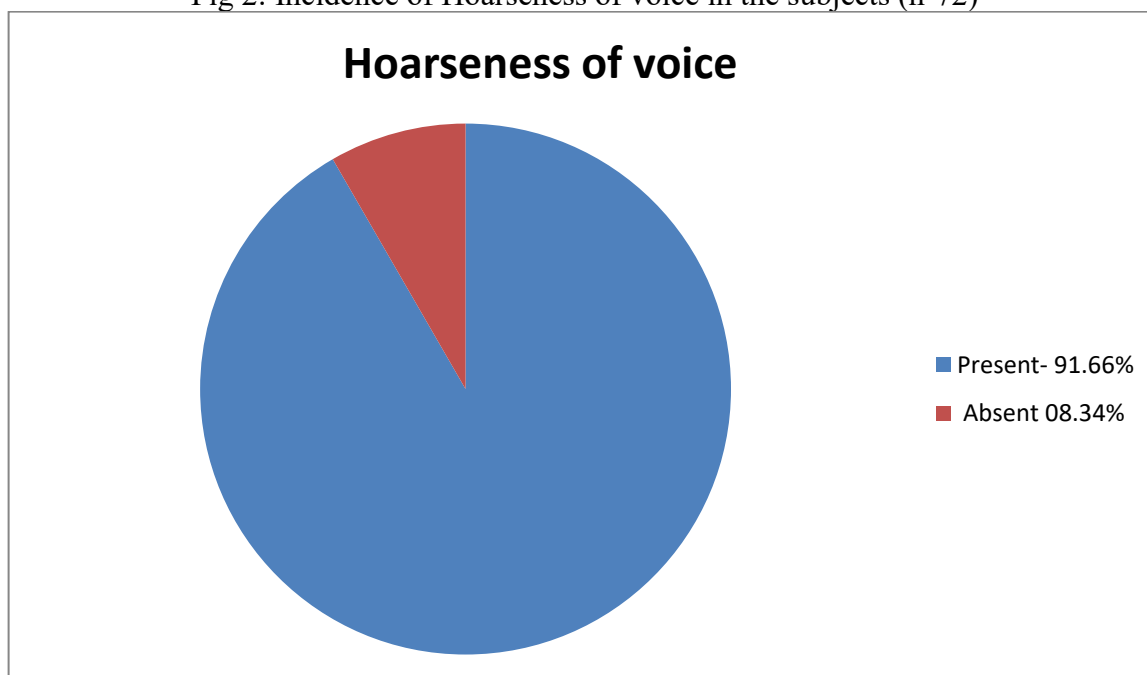
**Figure 1:** Illustrates the gender distribution of patients. (n- 72)



### 2. Clinical Presentation

Hoarseness was the predominant presenting symptom, reported by 91.66% of patients. Other symptoms included throat discomfort, voice fatigue, and occasional breathing difficulty (**Fig 2**).

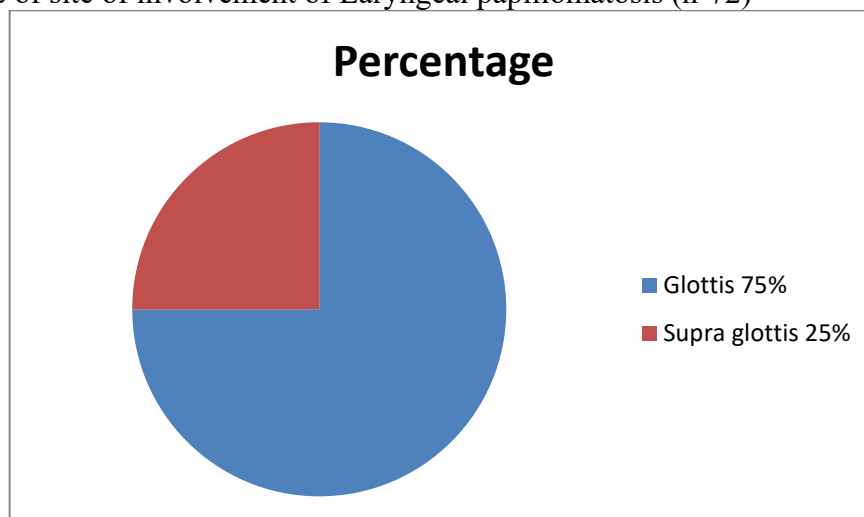
**Fig 2:** Incidence of Hoarseness of voice in the subjects (n-72)



### 3. Site of Involvement

Glottic involvement was the most common site (74%), followed by supraglottic and multisite disease accounting for 25% of the total cases. Multisite involvement was significantly associated with higher MSME scores (**Fig 3**).

Fig 3: Incidence of site of involvement of Laryngeal papillomatosis (n=72)



### 4. Disease Severity (MSME)

Disease severity assessed using the Modified Severity Score (MSME) showed a clear gradation in clinical behavior. Patients with higher MSME scores more frequently exhibited multisite laryngeal involvement, including combined glottic and supraglottic disease, compared to those with lower scores who predominantly had isolated glottic lesions. Among patients classified with moderate to severe MSME scores, a substantially higher proportion experienced recurrent disease during the follow-up period.

Recurrence was observed in a significantly greater number of patients with elevated MSME scores, necessitating repeated surgical interventions. Statistical analysis demonstrated a significant positive association between MSME score and recurrence rate ( $p = 0.03$ ), indicating that increasing disease severity was correlated with a higher likelihood of recurrence. Additionally, patients with higher MSME scores required a greater number of surgical procedures over the study period compared to those with mild disease severity.

### 5. Treatment and Recurrence

All patients in the study were managed surgically using microlaryngeal excision techniques, employing either cold steel instruments or microdebrider-assisted removal based on lesion extent and surgeon preference. Complete macroscopic clearance of papillomatous lesions was achieved in all cases during the initial surgical intervention.

Despite adequate surgical clearance, recurrence was common. Multiple surgical interventions were required in 61.11% (44/72) of patients during the three-year follow-up period. Among these, a notable subset required three or more procedures, reflecting a persistent and recurrent disease course. Patients with multisite involvement and higher MSME scores were disproportionately represented among those requiring repeated surgeries. The interval between surgeries tended to be shorter in patients with higher severity scores, further underscoring the association between disease burden and recurrence frequency.

Patients with higher MSME scores demonstrated:

- Multisite laryngeal involvement
- Increased frequency of recurrence
- Greater need for repeated surgical interventions

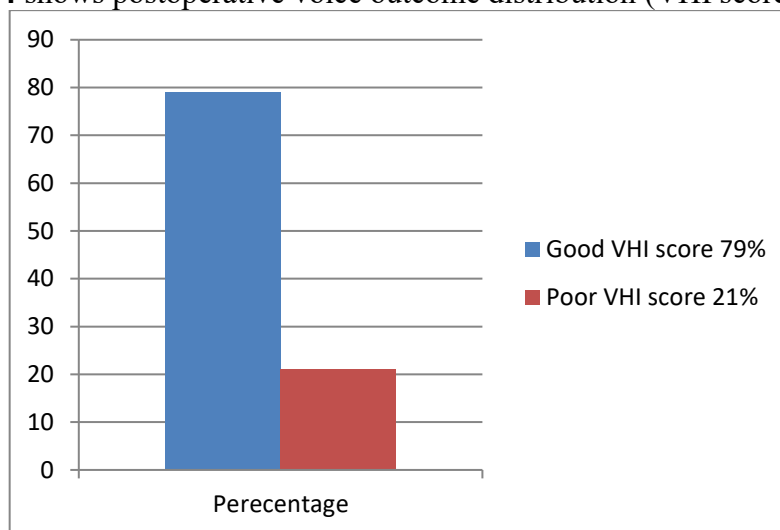
A statistically significant association was found between MSME score and recurrence rate ( $p = 0.03$ ). Micro-laryngeal excision using cold instruments or micro-debrider was performed in all patients. Multiple surgical interventions were required in 61.11% of cases.

## 6. Voice Outcomes (VHI)

Postoperative improvement in VHI scores was observed in 79% of patients, indicating significant improvement in perceived voice quality.

However, patients who underwent three or more surgeries demonstrated persistently higher VHI scores, reflecting poorer long-term voice outcomes. This association was statistically significant ( $p = 0.04$ ), (Fig 4).

**Figure 4** shows postoperative voice outcome distribution (VHI score), (n=72).



## DISCUSSION

Adult laryngeal papillomatosis (ALP) remains a clinically challenging entity due to its recurrent nature, unpredictable course, and disproportionate impact on voice-related quality of life despite benign histopathology. The present study adds meaningful regional evidence by correlating disease severity, recurrence, and functional voice outcomes using validated tools such as MSME and VHI, thereby aligning clinical assessment with patient-centered outcomes.

The observed male predominance and mean age in the mid-forties are consistent with recent epidemiological trends reported in adult-onset ALP [1, 2]. Several authors have suggested that occupational voice use, smoking, and gender-based immunological differences may contribute to this pattern [3]. Importantly, the disease affects individuals during their most productive years, amplifying its socioeconomic and psychosocial burden. Persistent dysphonia in this age group often leads to professional limitations and emotional distress, reinforcing the importance of functional outcome assessment alongside anatomical disease control.

Hoarseness was the predominant presenting symptom in over 90% of patients, a finding uniformly reported across contemporary studies [5, 9]. While hoarseness is an early and sensitive symptom, it is also nonspecific, frequently leading to delayed diagnosis. This delay may partly explain the proportion of patients presenting with higher MSME scores and multisite involvement in this study. Early endoscopic evaluation of persistent adult dysphonia has therefore been strongly advocated in recent clinical guidelines [8].

Glottic involvement was the most common anatomical site, reflecting the known affinity of HPV for the squamous epithelium of the true vocal cords. However, multisite disease was significantly associated with higher MSME scores and recurrence, supporting the concept that anatomical spread is a surrogate marker of aggressive disease behavior [7]. Recent molecular studies suggest that higher viral load and impaired host immune response may underlie this pattern, contributing to rapid re-growth and treatment resistance [1].

A key finding of this study is the statistically significant association between higher MSME scores and increased recurrence ( $p = 0.03$ ). This observation corroborates recent work emphasizing the prognostic utility of structured severity scoring systems in ALP [6]. MSME provides a reproducible framework for risk stratification, enabling clinicians to anticipate recurrence, plan closer surveillance, and counsel patients realistically regarding disease course. In resource-limited settings, such objective tools are particularly valuable for optimizing follow-up strategies.

Despite advances in microlaryngeal techniques, recurrence remained common, with over 60% of patients requiring multiple surgeries. This recurrence rate is comparable to recent series from tertiary centers worldwide [10]. While cold steel and microdebrider techniques are effective for lesion clearance and tissue preservation, none address the underlying viral persistence, explaining the inevitability of recurrence. The absence of routine adjuvant therapy in this cohort reflects prevailing practice patterns in many Indian centers, where cost and lack of standardized protocols limit their use.

The most clinically impactful observation relates to voice outcomes. Although 79% of patients demonstrated postoperative improvement in VHI scores, those undergoing three or more surgeries had persistently higher VHI scores ( $p = 0.04$ ). This finding highlights the cumulative detrimental effect of repeated surgical trauma on vocal fold microstructure and vibratory function. Recent literature increasingly recognizes ALP as a chronic functional voice disorder rather than merely a recurrent surgical disease [4]. The discordance between endoscopic disease control and patient-perceived voice handicap further underscores the indispensability of VHI in routine assessment.

These findings support a shift toward a balanced, patient-centered management approach that prioritizes voice preservation alongside disease control. Emerging evidence between 2021 and 2025 suggests a potential role for adjuvant modalities, including therapeutic HPV vaccination and immune-modulators, in reducing recurrence and surgical burden, particularly in high-severity disease [11, 12]. While not evaluated in the present study, such strategies may be especially relevant for patients with high MSME scores and repeated recurrences.

In summary, this study reinforces that adult laryngeal papillomatosis is a chronic, recurrent condition with significant functional consequences. Higher disease severity predicts recurrence, while repeated surgeries adversely affect voice-related quality of life. Incorporation of objective severity grading and patient-reported voice outcomes is essential for comprehensive care, realistic counseling, and long-term optimization of outcomes.

## CONCLUSION

Adult laryngeal papillomatosis is a recurrent benign laryngeal disorder associated with significant voice morbidity. Higher disease severity (MSME) and multisite involvement significantly increase recurrence risk ( $p = 0.03$ ), while repeated surgical interventions adversely affect voice-related quality of life ( $p = 0.04$ ). Early diagnosis, structured severity assessment, judicious surgical intervention, and long-term follow-up with voice outcome evaluation are essential for optimizing patient outcomes.

## Author Contributions

**Author 1:** Conceptualization and study design; patient recruitment and clinical evaluation; surgical management of cases; supervision of data collection; critical revision of the manuscript for important intellectual content.

**Author 2:** Data acquisition and organization; statistical analysis and interpretation of results; preparation of tables and figures; drafting of the Results section and assistance in manuscript writing.

**Author 3:** Literature review; development of methodology framework; voice outcome assessment using VHI; drafting of the Introduction and Discussion sections; final proofreading and formatting of the manuscript.

### **Limitations**

- Limited sample size
- Lack of HPV sub-typing and adjuvant therapy evaluation

### **Future Directions**

Prospective multicenter studies incorporating HPV typing, adjuvant therapies, and long-term voice rehabilitation outcomes are recommended.

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