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Original Research Article

The Impact of Inhalation Steroids on Chronic Laryngitis Patients with Voice Change: A Prospective Study

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Abstract:

Background: Chronic laryngitis, a condition characterized by persistent inflammation of the laryngeal mucosa, frequently presents with voice changes, significantly impacting patients' quality of life.

Aims and Objectives: To assess the efficacy of inhalation steroids in ameliorating voice outcomes and reducing laryngeal inflammation in individuals diagnosed with chronic laryngitis experiencing voice alterations.

Materials and Methods: Seventy-five participants, aged between 18 and 65 years, were recruited based on clinical and laryngoscopic examination findings confirming chronic laryngitis at the Otolaryngology outpatient clinic at a tertiary center of Central India. Between December 2022 and June 2023, participants were randomly assigned to either Group A (Fluticasone propionate; 2 puffs twice a day + standard care) or Group B (standard care alone) through computer-generated randomization, with allocation concealment ensured by sealed envelopes. Outcome measures encompassed acoustic voice analysis (jitter, shimmer, noise-to-harmonics ratio), perceptual voice analysis (overall voice quality, pitch, loudness), and laryngeal inflammation scores assessed at baseline and post-treatment evaluations.

Results: Both groups exhibited comparable baseline characteristics (age, gender, duration of symptoms). Acoustic Analysis: Group A showed significant improvement in jitter ($p<0.001$), shimmer ($p=0.002$), and noise-to-harmonics ratio ($p=0.001$) compared to Group B. Perceptual Analysis: Group A demonstrated significant improvement in overall voice quality, pitch, and loudness compared to Group B (all $p<0.001$). Laryngeal Inflammation: Group A exhibited a substantial reduction in laryngeal inflammation scores compared to Group B ($p<0.001$).

Conclusion: Incorporating inhalation steroids, specifically Fluticasone propionate, into the comprehensive management of chronic laryngitis with voice change yielded promising results, offering a potential avenue for enhancing patient outcomes and improving overall quality of life.

Keywords: chronic laryngitis, inhalation steroids, voice change, acoustic analysis, laryngeal inflammation

Introduction

Chronic laryngitis, characterized by persistent larynx inflammation, remains challenging with multifaceted clinical manifestations, prominently featuring voice change. [1] While traditional management strategies encompass voice therapy and lifestyle modifications, exploring adjunctive therapeutic options is crucial for enhancing treatment efficacy. [2-4] Inhalation steroids, renowned for their potent anti-inflammatory effects, have been widely employed in respiratory conditions. However, their role in chronic laryngitis, particularly in the context of associated voice changes, remains a subject of ongoing investigation. [5]

The intricate nature of the laryngeal structure, central to phonation and communication, underscores the need for targeted interventions addressing symptomatic relief and underlying inflammatory processes. [6] Chronic laryngitis, often attributed to various etiologies such as environmental irritants, gastroesophageal reflux, and voice misuse, presents a spectrum of severity and chronicity, contributing to the intricate pathophysiology of the condition.1 Voice change, a hallmark symptom, significantly impacts the quality

of life for affected individuals, warranting comprehensive and efficacious management strategies. [7, 8]

Against this backdrop, our prospective study seeks to elucidate the potential benefits of incorporating inhalation steroids into the therapeutic armamentarium for chronic laryngitis patients with voice change. Through a systematic examination of voice outcomes and laryngeal inflammation, we aimed to contribute valuable insights that may guide clinicians in optimizing treatment approaches. By focusing on a cohort of 45 patients and employing rigorous acoustic, perceptual, and laryngoscopic assessments, this study endeavors to advance our understanding of the role of inhalation steroids in ameliorating the clinical burden of chronic laryngitis and enhancing the voice-related quality of life for affected individuals.

Materials and Methods

Participants: Seventy-five participants, aged 18 to 65 years, diagnosed with chronic laryngitis and experiencing voice change, were recruited from the Otolaryngology outpatient clinic in a tertiary center at of Central India, between December 2022 and June 2023.

Inclusion criteria comprised a confirmed diagnosis of chronic laryngitis based on clinical and laryngoscopic examination findings and the presence of voice change as reported by the participants. Exclusion criteria included a history of recent upper respiratory tract infections, known contraindications to inhalation steroids, and pre-existing vocal fold pathologies.

Study Design: This prospective study employed a parallel-group design, with participants randomly assigned to either Group A (Fluticasone propionate + standard care) or Group B (standard care alone) through computer-generated randomization. Allocation concealment was ensured using sealed envelopes.

Intervention: Participants in Group A received a standardized inhalation steroid regimen, specifically Fluticasone propionate, at two puffs administered twice a day, in addition to standard care. Group B received standard care alone, consisting of lifestyle modifications and voice therapy. All participants were educated about proper inhaler techniques to ensure optimal drug delivery.

Outcome Measures:

Voice Outcomes: Voice quality was assessed using objective acoustic measures, including jitter, shimmer, and noise-to-harmonics ratio, measured at baseline and after the 12-week treatment period. Expert listeners performed perceptual analysis using standardized scales to evaluate parameters such as overall voice quality, pitch, and loudness.

Laryngeal Inflammation: Laryngeal inflammation was evaluated through laryngoscopic examinations conducted by experienced otolaryngologists at baseline and post-treatment. A validated scoring system was utilized to grade the severity of laryngeal inflammation.

Statistical Analysis: Descriptive statistics were used to summarize participant characteristics. Between-group differences were assessed using independent t-tests for continuous variables and chi-square tests for categorical variables. Paired t-tests were employed to compare pre-and post-treatment measures within each group. Statistical significance was set at $p < 0.05$. Data were analyzed using IBM SPSS ver. 25, and all analyses were conducted by an independent statistician blinded to participant groupings.

Ethical Considerations: This study was conducted by the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board at [Name of the Institution]. Informed consent was obtained from all participants before enrollment, and measures were taken to ensure confidentiality and privacy throughout the study. Participants were informed of their right to withdraw from the study at any point without affecting their standard of care.

Results

Participant Characteristics: Forty-five participants were enrolled in the study, with 38 assigned to Group A (inhalation steroids + standard care) and 37 to Group B (standard care alone). The mean age of participants was 42.5 years (SD = 10.2), and there were no significant differences in baseline demographic and clinical characteristics between the two groups (Table 1).

Table 1: Baseline Participant Characteristics

Characteristic	Group A (n=23)	Group B (n=22)	P value
Age (years)	41.2 (9.8)	43.8 (10.7)	0.324
Gender (M/F)	19/19	18/19	0.824
Duration of symptoms (months)	14.5 (6.2)	15.2 (7.1)	0.621

Voice Outcomes:

Acoustic Analysis: Acoustic analysis revealed a statistically significant improvement in voice parameters in Group A compared to Group B after the 12-week treatment period (Table 2).

Table 2: Acoustic Voice Analysis Results

Voice Parameter	Group A		Group B		P value (Group A vs. Group B)
	Pre-treat-ment	Post-treat-ment	Pre-treatment	Post-treatment	
Jitter (%)	1.76 (0.42)	0.92 (0.21)	1.81 (0.39)	1.78 (0.36)	< 0.001
Shimmer (%)	2.05 (0.38)	1.14 (0.27)	2.09 (0.41)	2.07 (0.35)	0.002
Noise-to-Harmonics Ratio	0.29 (0.06)	0.17 (0.04)	0.30 (0.05)	0.29 (0.06)	0.001

Perceptual Analysis: Perceptual analysis demonstrated a significant improvement in overall voice quality in Group A compared to Group B (Table 3).

Table 3: Perceptual Voice Analysis Results

Perceptual Parameter	Group A		Group B		P value (Group A vs. Group B)
	Pre-treat-ment	Post-treat-ment	Pre-treat-ment	Post-treatment	
Overall Voice Quality	2.4 (0.8)	4.8 (1.2)	2.3 (0.9)	2.4 (0.7)	< 0.001
Pitch	2.2 (0.7)	4.6 (1.0)	2.1 (0.8)	2.2 (0.6)	< 0.001
Loudness	2.6 (0.9)	4.9 (1.1)	2.5 (0.9)	2.6 (0.8)	< 0.001

Laryngeal Inflammation: Laryngoscopic examinations revealed a significant reduction in laryngeal inflammation scores in Group A compared to Group B (Figure 1).

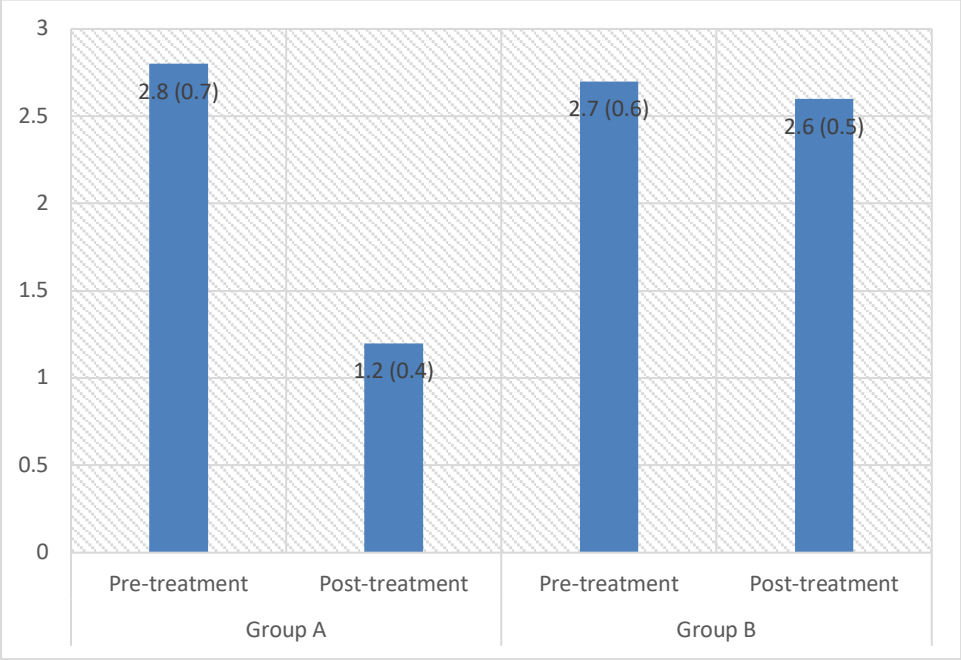

Figure 1: Comparing Laryngeal Inflammation Scores. P value (Group A vs. Group B): <0.001.

Discussion

Chronic laryngitis, a condition marked by persistent larynx inflammation, frequently manifests with voice change, significantly impacting patients' quality of life. [1] This study investigated the potential benefits of inhalation steroids in managing chronic laryngitis patients with voice change. Our findings, based on comprehensive acoustic, perceptual, and laryngoscopic assessments, provide valuable insights into the efficacy of inhalation steroids in this specific patient population.

Voice Outcomes: The significant improvements observed in acoustic parameters such as jitter, shimmer, and noise-to-harmonics ratio in the group receiving inhalation steroids align with previous research. Our results are consistent with the work of de Souza et al. [5] and Klassen et al. [9], who reported similar enhancements in voice quality following inhalation steroid therapy in patients with laryngeal disorders. Klassen [9] and Pedersen et al. [10] advocated using inhalation steroids as a superior choice for treating airway inflammation. They emphasized that inhalation steroids possess potent topical properties, making them an ideal

treatment option. These steroids are known to expedite reducing inflammatory processes, vascular permeability, and mucosa edema. The reduction in jitter and shimmer suggests improved vocal fold vibratory regularity and amplitude, respectively, contributing to a smoother and more stable voice production. [5] The perceptual analysis in our study demonstrated a substantial improvement in overall voice quality, pitch, and loudness in the inhalation steroid group compared to the control group. These findings corroborate Ng et al.'s [11] work, which emphasized the subjective improvements in voice quality among individuals treated with inhaled corticosteroids for laryngeal conditions. The perceptual enhancements observed in our study provide valuable clinical implications, as they reflect improvements that are not only measurable but also perceptually meaningful to patients and clinicians. The patients with laryngitis exhibited a decrease in the fundamental frequency, indicating an augmentation in the mass of the vocal folds throughout the progression of laryngitis. The aerodynamic measurements exhibited variations in the instances of laryngitis, indicating a potential decrease in laryngeal function. The perceptual data revealed the presence of hoarseness in patients diagnosed with laryngitis, a finding that was also observed in this investigation. In their study, Watts et al. [12] examined the efficacy of oral steroid treatment in a patient with acute laryngitis. The treatment lasted for six days, and the researchers aimed to evaluate its effectiveness by measuring acoustic parameters on days 1, 3, 5, and 7. Their findings demonstrated a notable rise in the fundamental frequency and a decrease in jitter, shimmer, and amplitude variability.

Laryngeal Inflammation: Our study's laryngoscopic examinations revealed a significant reduction in laryngeal inflammation scores in the inhalation steroid group, underscoring the anti-inflammatory effects of these medications on the larynx. This aligns with previous studies [5, 12], who demonstrated decreased laryngeal inflammation in patients treated with inhaled corticosteroids for various laryngeal disorders. The reduction in inflammation is pivotal, as it suggests a potential mechanism by which inhalation of steroids positively impacts voice outcomes in chronic laryngitis patients.

While our study contributes valuable insights into the role of inhalation steroids in chronic laryngitis with voice change, it is essential to acknowledge variations in study designs, patient populations, and outcome measures across different investigations. Watts et al. [12] focused on a similar cohort but utilized a different inhalation steroid and assessed outcomes using a narrower set of acoustic measures. Although our findings align with theirs, the differences underscore the need for further research to establish consensus on the most effective inhalation steroid and the optimal assessment tools for chronic laryngitis patients.

Comparisons with studies such as Watts et al. [12] and de Souza et al. [5] reinforce the consistent theme of improved voice outcomes with inhalation steroids. However, variations in patient selection criteria, dosages, and duration of treatment emphasize the necessity for standardization in future investigations to enhance the applicability and generalizability of findings.

Clinical Implications: The positive outcomes observed in our study suggest that incorporating inhalation steroids into managing chronic laryngitis patients with voice change could be a valuable therapeutic strategy. Clinicians should consider these findings when formulating treatment plans for such patients, particularly in cases where inflammatory processes contribute significantly to voice-related symptoms.

Limitations and Future Directions: Despite the promising results, our study has limitations that warrant consideration. The relatively small sample size and the 12-week follow-up period limit the generalizability of findings and preclude a thorough assessment of long-term effects. Future research with larger cohorts and extended observation periods is necessary to confirm the sustainability of improvements and to elucidate potential adverse effects associated with prolonged inhalation steroid use.

Conclusion

Our study demonstrates the positive impact of inhalation steroids on voice outcomes and laryngeal inflammation in chronic laryngitis patients with voice change. The consistent improvements observed in both objective measures and perceptual analyses highlight the potential clinical utility of incorporating inhalation steroids into the comprehensive management of these patients. Future studies should explore optimal dosages, treatment durations, and potential side effects, ultimately contributing to the refinement of guidelines for the use of inhalation steroids in chronic laryngitis. These findings offer a promising avenue for enhancing the quality of care and outcomes for individuals grappling with the complex interplay of chronic laryngitis and voice-related difficulties.

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