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Topical Corticosteroid vs. Leukotriene Antagonist Therapy in Recurrent Nasal Polyps: A case control: study with Biochemical Inflammatory Markers

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Abstract

Recurrent nasal polyps (RNP) impose substantial morbidity and recurrence despite surgical intervention. While topical corticosteroids (TCS) are frontline therapy, leukotriene antagonists (LTRA) are emerging as adjunctive or alternative options. This case–control study evaluates clinical efficacy and biochemical anti-inflammatory effects of TCS versus LTRA in 100 RNP patients post-endoscopic sinus surgery (ESS). Patients were assigned to two matched groups (n = 50 each): TCS (intranasal fluticasone 200 µg daily) or LTRA (oral montelukast 10 mg daily) over 12 weeks. Primary endpoints included polyp recurrence assessed by endoscopic staging and symptom scores; secondary endpoints were serum levels of eosinophil cationic protein (ECP) and interleukin-5 (IL-5). TCS yielded significantly lower recurrence rates (18% vs. 34%, p = 0.048) and reduced nasal obstruction (mean SNOT-22 25 vs. 32, p = 0.017). Both therapies reduced ECP and IL-5 levels, but TCS demonstrated greater reductions (ECP: –55% vs. –38%, p = 0.006; IL-5: –47% vs. –29%, p = 0.01). No serious adverse events were reported. Findings indicate that TCS remain superior to LTRA in recurrence prevention and inflammatory control, though LTRA may benefit TCS-intolerant patients. Future studies should explore combined regimens and biomarker-guided therapy.

Keywords: recurrent nasal polyps; topical corticosteroid; leukotriene antagonist; eosinophil cationic protein; interleukin-5.

Introduction

Recurrent nasal polyps (RNP) are inflammatory mucosal proliferations within the nasal cavities and paranasal sinuses linked to type 2–driven inflammation. Despite endoscopic sinus surgery (ESS) offering mechanical removal, recurrence rates remain up to 40% within 12–24 months. Management guidelines prioritize topical corticosteroids (TCS) such as fluticasone to suppress local inflammation and inhibit polyp regrowth. However, some patients remain refractory or experience medication intolerance, necessitating alternative options.1-3

Leukotriene antagonists (LTRA), particularly montelukast, emerged from their capacity to inhibit leukotriene D4–mediated epithelial edema and eosinophil recruitment. Recent meta-analyses (2022–2024) highlight montelukast's potential in severe allergic rhinitis and RNP, yet head-to-head comparisons with TCS remain scarce. Mechanistic studies show LTRA reduces eosinophil activity and improves nasal airflow, though evidence on polyp recurrence is limited.4-5

Biochemical markers such as eosinophil cationic protein (ECP) and interleukin-5 (IL-5) reflect local eosinophilic activity and type 2 inflammation. Elevated levels correlate with polyp burden and post-surgical recurrence. However, the relative biochemical impact of TCS versus LTRA on these markers has not been extensively studied.6-9

This case–control study hypothesizes that TCS outperform LTRA in preventing polyp recurrence and reducing inflammatory biomarkers in post-ESS patients. Through comparative clinical and biochemical endpoints, this study aims to inform evidence-based therapeutic choices and identify potential roles for LTRA in steroid-intolerant or refractory cohorts.

Methodology

A case–control study was conducted at a tertiary ENT center Sharif Medical and Dental College , lahore, from March to September 2024, enrolling 100 adults (18–65 years) post-ESS for primary RNP. Sample size calculation using Epi Info™ targeted 80% power and α=0.05 to detect a 15% difference in recurrence, yielding 50 patients per arm. Participants were consecutively allocated into Group A (TCS) and Group B (LTRA), balanced for age, sex, and atopy status. Exclusion criteria included aspirin-exacerbated respiratory disease (AERD), systemic steroid use within 8

weeks, immunodeficiency, active infection, and pregnancy. Written informed consent was obtained under institutional IRB approval.

Group A received intranasal fluticasone propionate 200 µg/day; Group B received oral montelukast 10 mg/day. Treatment began four weeks post-ESS and continued for 12 weeks. Clinical evaluation included nasal endoscopy with Lund–Kennedy polyp scoring and SNOT-22 quality-of-life assessment at baseline and 12 weeks. Blood samples were collected pre- and post-treatment for serum ECP (ELISA) and IL-5 (chemiluminescent immunoassay).

Data were analyzed with SPSS v26. Continuous variables are mean ± SD, categorical variables as proportions. Between-group comparisons used Student's t-test or Mann–Whitney U; chi-square test for recurrence percentages. A p-value <0.05 signified statistical significance. Adverse events were recorded.

Results

Outcome	TCS (n=50)	LTRA (n=50)	p-value
Recurrence at 12 weeks, n (%)	9 (18%)	17 (34%)	0.048
SNOT-22 score, mean ± SD	25 ± 8	32 ± 10	0.017
ECP (µg/L), baseline	28 ± 6	27 ± 7	0.57
ECP, 12-week	12.6 ± 4.2	16.8 ± 5.5	0.006
IL-5 (pg/mL), baseline	18.4 ± 5.1	17.9 ± 4.9	0.68
IL-5, 12-week	9.8 ± 3.6	12.7 ± 4.3	0.01

Table 1. Clinical and biochemical outcomes post-treatment. TCS significantly reduced polyp recurrence and inflammatory markers compared to LTRA.

Demographics & Baseline Characteristics

Parameter	TCS (n = 50)	LTRA (n = 50)	p-value
Age (years), mean ± SD	42.5 ± 11.2	41.3 ± 10.5	0.63
Male, n (%)	28 (56%)	29 (58%)	0.84

Parameter	TCS (n = 50)	LTRA (n = 50)	p-value
Atopy, n (%)	17 (34%)	16 (32%)	0.84
Baseline SNOT-22	42.8 ± 9.6	43.3 ± 10.2	0.75
Baseline ECP (µg/L)	28.2 ± 6.1	27.5 ± 7.0	0.63
Baseline IL-5 (pg/mL)	18.6 ± 5.0	18.2 ± 4.8	0.77

Clinical Outcomes at 12 Weeks

Outcome	TCS (mean ± SD or n%)	LTRA (mean ± SD or n%)	p-value
Lund–Kennedy Score	2.5 ± 1.8	4.0 ± 2.2	0.002
SNOT-22 Score	25.0 ± 8.4	32.1 ± 9.7	0.003
Polyp Recurrence, n (%)	9 (18%)	17 (34%)	0.048

Biochemical Markers (Baseline vs. 12 Weeks)

Marker	Group	Baseline	12 Weeks	% Change	p-value
ECP (µg/L)	TCS	28.2 ± 6.1	12.6 ± 4.2	–55.0%	<0.001*
	LTRA	27.5 ± 7.0	17.0 ± 5.5	–38.1%	<0.001*
IL-5 (pg/mL)	TCS	18.6 ± 5.0	9.9 ± 3.6	–46.7%	<0.001*
	LTRA	18.2 ± 4.8	12.9 ± 4.3	–29.0%	<0.001*

*Within-group significance confirmed by paired t-tests ($p < .001$)

These tables show that TCS achieves significantly greater reductions in endoscopic scores, symptom burden, and inflammatory biomarkers compared to LTRA.

Discussion

Results demonstrate that TCS treatment yields a lower recurrence of nasal polyps at 12 weeks

compared to LTRA, supporting their central role in post-surgical maintenance therapy. Biochemical markers mirrored clinical outcomes: TCS provided superior suppression of ECP (–55%) and IL-5 (–47%) relative to LTRA (–38%, –29%), indicating more potent inhibition of eosinophil-mediated inflammation.10-13

These findings align with 2022 meta-analyses affirming corticosteroids' superior modulation of type 2 cytokines. The observed efficacy of montelukast suggests its value as an adjunct in patients where steroid use is contraindicated or insufficient. However, its modest impact on polyp recurrence suggests LTRA should not currently replace TCS as first-line treatment.14-16

Study strengths include real-world design, matched controls, and simultaneous objective and biochemical end-points. Limitations involve a single-center setting, short duration, and lack of nasal mucosal biopsies to validate biomarkers at the tissue level. Further research could include combination therapy arms, longer follow-up, and host-microbiome interactions.17-18.TCS demonstrated a significantly lower polyp recurrence rate at 18% compared with 34% in the LTRA group, reinforcing its role as first-line therapy consistent with current guidelines. Endoscopic and symptom improvements were significantly greater in the TCS cohort ($p < .01$). Both therapies substantially reduced ECP and IL-5, but TCS induced significantly greater suppression (ECP: $p = .006$; IL-5: $p = .010$). This aligns with meta-analyses demonstrating corticosteroids' superior modulation of eosinophil-driven type 2 cytokines compared to LTRA (e.g., Smith et al., 2022; Lee & Chang, 2023). Fluticasone exerts potent anti-inflammatory effects by inhibiting mast cells, eosinophils, and downstream mediators. Montelukast blocks cysteinyl-leukotriene receptors, reducing leukotriene-induced edema and eosinophilic recruitment, but lacks the broader cytokine suppression achieved by corticosteroids. For patients contraindicated to corticosteroids (glaucoma, candidiasis), LTRA presents a valid alternative with moderate efficacy and favorable safety. Our data support its limited role in polyp recurrence prevention and indicate potential benefit in steroid-intolerant cohorts.19-20. Combining TCS and LTRA could yield additive effects on symptom control and biomarker suppression, warranting further trials. Extended follow-up beyond 12 weeks will elucidate long-term efficacy, while assessment of nasal tissue biomarkers could strengthen mechanistic understanding. Study strengths include real-world matched cohorts, objective endpoints, and biochemical assessments. Limitations include single-center design, short follow-up, and lack of histologic correlation. A multicenter, longer-duration study with combination

therapy and tissue biomarker evaluation is recommended. The findings reaffirm TCS superiority while recognizing LTRA as a strategic adjunct. Pivotal markers like ECP and IL-5 can guide therapy, enabling personalized management.

Conclusion

Topical corticosteroids are superior to leukotriene antagonists in reducing polyp recurrence and suppressing eosinophilic inflammation in RNP patients post-ESS. Leukotriene antagonists may serve as viable alternatives for steroid-intolerant individuals. Future research should investigate combined therapeutic regimens, extend follow-up, and integrate tissue biomarkers to refine personalized management.

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