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Original Research Article

Comparison of steroid nasal irrigation and normal saline irrigation following endoscopic sinus surgery in patients with chronic rhinosinusitis: a prospective randomized study

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ABSTRACT

Background: Postoperative nasal irrigation is an integral component of care following endoscopic sinus surgery (ESS) in patients with chronic rhinosinusitis. Although normal saline irrigation is routinely used, evidence regarding the additional benefit of steroid nasal irrigation in the Indian rural population remains limited. This study aimed to compare the effectiveness of steroid nasal irrigation with normal saline irrigation in the postoperative management of ESS.
Methods: This prospective randomized study was conducted over 18 months at a tertiary care center in rural Telangana. Eighty adult patients with chronic rhinosinusitis refractory to medical management who underwent ESS were randomized into two groups: normal saline irrigation (n=40) and steroid nasal irrigation (n=40). Postoperative outcomes were assessed at 2 weeks and 2 months using the Sino-Nasal Outcome Test-22 (SNOT-22) and the Lund–Kennedy endoscopic scoring system. Crust formation, compliance, and adverse effects were also evaluated. Statistical analysis was performed using chi-square and t-tests, with $p<0.05$ considered significant.
Results: Baseline demographic characteristics and disease duration were comparable between groups ($p>0.05$). Both groups showed significant postoperative improvement; however, the steroid group demonstrated significantly lower mean SNOT-22 scores at 2 weeks (24.95±8.38 vs 37.90±4.30; $p<0.001$) and 2 months (17.75±6.39 vs 28.53±3.57; $p<0.001$). Endoscopic assessment revealed significantly greater improvement in Lund–Kennedy scores and reduced crust formation in the steroid group at both follow-up intervals ($p<0.001$). Compliance was better in the steroid group, with no significant difference in adverse effects.
Conclusion: Steroid nasal irrigation following ESS offers superior symptomatic and endoscopic outcomes compared to normal saline irrigation, without increasing adverse effects, and may be considered an effective adjunct in postoperative management.

Keywords: Chronic rhinosinusitis, Endoscopic sinus surgery, Steroid nasal irrigation, Normal saline irrigation, SNOT-22, Lund–Kennedy endoscopic score, Postoperative care

INTRODUCTION

Chronic rhinosinusitis (CRS) is a widespread inflammatory disease affecting the nasal and paranasal sinus mucosa, placing a substantial health burden worldwide. It affects approximately 5–12% of the adult population globally and is clinically characterized by persistent nasal obstruction, nasal discharge, facial pain or pressure, and olfactory dysfunction.[1,2] Beyond its physical manifestations, CRS significantly impairs quality of life, contributing to sleep disturbances, reduced workplace productivity, social withdrawal, and psychological morbidity, including anxiety and depressive symptoms.[3,4] Owing to its chronic and relapsing nature, CRS imposes a

cumulative burden on healthcare systems through repeated outpatient visits, prolonged medical therapy, and frequent surgical interventions.[5] In the Indian context, CRS represents one of the most commonly encountered conditions in otorhinolaryngology practice, with a particularly high prevalence in rural and semi-urban regions.[6] Environmental pollution, exposure to biomass fuels, overcrowded living conditions, limited access to specialized healthcare services, and delayed health-seeking behavior are important contributory factors that promote disease chronicity and severity.[7,8] In rural populations, the impact of CRS extends beyond clinical morbidity, adversely affecting daily functioning, economic productivity, and overall well-being. These challenges underscore the importance of optimizing both pharmacological and surgical management strategies, particularly in resource-limited settings.

Management of CRS typically involves a combination of medical therapy and surgical intervention. Initial treatment is centered on pharmacotherapy, including saline nasal irrigation, intranasal corticosteroids, antihistamines, antibiotics, and short courses of systemic corticosteroids when clinically indicated.[9,10] ESS is recommended for patients who fail to respond adequately to maximal medical management and aims to restore sinus ventilation and mucociliary clearance.[11] However, postoperative management following ESS is critical for achieving favorable outcomes, as inadequate healing, persistent inflammation, crust formation, and synechiae can compromise surgical success and contribute to symptom recurrence.[12]

Corticosteroids occupy a central role in postoperative care because of their potent anti-inflammatory properties. Although topical steroid nasal sprays are widely used, their effectiveness may be limited by suboptimal penetration into the operated sinus cavities, variable patient compliance, and local adverse effects such as mucosal dryness, irritation, and epistaxis.[13] Systemic corticosteroids, while effective, are associated with well-documented adverse effects that restrict their long-term use.[14]

In recent years, there has been growing interest in adjunctive therapies that are perceived as safer, more physiological, and better tolerated. High-volume nasal irrigation has gained widespread acceptance due to its ability to mechanically clear secretions, reduce crusting, and enhance mucosal healing.[15] While saline irrigation remains the standard of care, the addition of topical agents to irrigation solutions has been explored to augment therapeutic efficacy. Among these, steroid nasal irrigation has emerged as a promising modality, enabling improved delivery of corticosteroids to the sinonasal mucosa with minimal systemic absorption.[16,17] Despite encouraging results from international studies, comparative data evaluating steroid nasal irrigation against conventional normal saline irrigation in routine postoperative settings remain limited, particularly in the Indian population and rural healthcare environments. Differences in disease characteristics, patient adherence, and healthcare access highlight the need for region-specific evidence. Therefore, the present study was undertaken to compare the effectiveness of steroid nasal irrigation with normal saline nasal irrigation in the postoperative management of patients undergoing ESS for CRS. It was hypothesized that steroid nasal irrigation would result in superior symptomatic improvement and enhanced endoscopic healing without an increased risk of adverse effects.

METHODS

Study design and setting

This prospective, randomized comparative study was conducted over a period of 18 months from April 2024 to October 2025 in the Department of Otorhinolaryngology at Rajiv Gandhi Institute of Medical Sciences (RIMS), Adilabad, Telangana, a tertiary care center catering predominantly to a rural population. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrollment. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Study population

Adult patients aged more than 18 years diagnosed with CRS who failed to respond to optimal medical management and were planned for ESS were considered for inclusion. CRS was diagnosed based on clinical symptoms, diagnostic nasal endoscopy, and radiological evaluation. A total of 80 eligible patients were enrolled during the study period. Patients aged ≥18 years with CRS refractory to medical therapy and willing to undergo ESS were included. Exclusion criteria comprised patients unwilling for surgery, age <18 years, history of cerebrospinal fluid leak repair, presence of systemic comorbidities such as diabetes mellitus, hypertension, immunocompromised states or malignancy, concomitant use of oral corticosteroids, and known hypersensitivity to corticosteroids.

Randomization and intervention

Following ESS, patients were randomized into two equal groups (n=40 each) using a simple randomization method. Group A received postoperative nasal irrigation with normal saline, while Group B received postoperative steroid nasal irrigation. Both groups were instructed regarding the irrigation technique and advised to adhere to the prescribed regimen throughout the postoperative period. Standard postoperative care was provided to all patients apart from the assigned irrigation modality. Postoperative outcomes were evaluated at two follow-up intervals: 2 weeks and 2 months following surgery. Subjective symptom assessment was performed using the SNOT-22, a validated patient-reported outcome measure.

Objective assessment of mucosal healing was carried out using the Lund–Kennedy endoscopic scoring system during diagnostic nasal endoscopy. Additional outcomes included assessment of crust formation, patient compliance with irrigation therapy, and occurrence of adverse effects such as epistaxis or nasal irritation.

Data collection

Demographic data, duration of symptoms, clinical findings, and baseline endoscopic scores were recorded using a standardized proforma. Follow-up evaluations were conducted by the treating otorhinolaryngologist using uniform assessment criteria to minimize observer variability.

Statistical analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean±standard deviation. Intergroup comparisons of categorical variables were performed using the chi-square test, and continuous variables were compared using independent sample t-tests. Intragroup comparisons over time were analyzed using paired t-tests. A p value of <0.05 was considered statistically significant.

RESULTS

A total of 80 patients with chronic rhinosinusitis undergoing endoscopic sinus surgery were included in the analysis. Patients were equally allocated to the normal saline irrigation group (n=40) and the steroid nasal irrigation group (n=40). All enrolled patients completed the scheduled follow-up at 2 weeks and 2 months.

Baseline demographic and clinical characteristics

The two study groups were comparable with respect to baseline demographic and clinical parameters. The majority of patients belonged to the 31–40-year age group (40.0%), followed by 21–30 years (31.3%) and 41–50 years (28.7%).

Table 1: Baseline demographic and clinical characteristics of study participants (n=80).

Variable	Normal saline (n=40)	Steroid (n=40)	Test value	P value
Age (years), mean±SD	35.57±7.13	35.67±7.34	t=0.061	0.951
Age group (years), N (%)				
21–30	13 (32.5)	12 (30.0)	χ^2=0.083	0.959
31–40	16 (40.0)	16 (40.0)		
41–50	11 (27.5)	12 (30.0)		
Gender, N (%)				
Male	20 (50.0)	20 (50.0)	χ^2=0.000	1.000
Female	20 (50.0)	20 (50.0)		
Duration of symptoms (months), mean±SD	13.38±4.10	14.55±4.96	t=1.412	0.162

Table 2: Comparison of SNOT-22 scores between study groups.

Time point	Normal saline (Mean±SD)	Steroid (Mean±SD)	Test value	P value
2 weeks post-operative	37.90±4.30	24.95±8.38	t=7.812	<0.001
2 months post-operative	28.53±3.57	17.75±6.39	t=8.534	<0.001

Table 3: Distribution of Lund–Kennedy endoscopic scores at baseline and 2 weeks post-operative.

Score category	Normal saline N (%)	Steroid N (%)	Test value	P value
Baseline				
9–12	19 (47.5)	19 (47.5)	χ^2=6.929	0.031
13–16	20 (50.0)	13 (32.5)		
>16	1 (2.5)	8 (20.0)		
2 weeks post-operative				
≤5	1 (2.5)	20 (50.0)	χ^2=23.914	<0.001
6–9	19 (47.5)	12 (30.0)		
≥10	20 (50.0)	8 (20.0)		

Age distribution did not differ significantly between the groups (p=0.959). Gender distribution was equal in both groups, with males and females each comprising 50% of the study population (p=1.000). The mean age was 35.57±7.13 years in the normal saline group and 35.67±7.34 years in the steroid group, with no statistically

significant difference (p=0.951). The duration of symptoms prior to surgery was also comparable between groups, with a mean duration of 13.38±4.10 months in the normal saline group and 14.55±4.96 months in the steroid group (p=0.162).

Table 4: Improvement in Lund–Kennedy endoscopic scores at follow-up.

Follow-up	Improvement category	Normal saline N (%)	Steroid N (%)	Test value	P value
2 weeks	3–4	40 (100)	4 (10.0)	χ^2=56.000	<0.001
	≥5	0 (0)	36 (90.0)		
2 months	5–6	40 (100)	8 (20.0)	χ^2=52.571	<0.001
	≥7	0 (0)	32 (80.0)		

Table 5: Postoperative crust formation.

Time point	Severity	Normal saline N (%)	Steroid N (%)	Test value	P value
2 weeks	Mild	18 (45.0)	20 (50.0)	χ^2=4.109	0.043
	Minimal	0 (0)	7 (17.5)		
	Moderate	22 (55.0)	13 (32.5)		
2 months	Absent	0 (0)	11 (27.5)	χ^2=18.602	<0.001
	Mild	25 (62.5)	12 (30.0)		
	Minimal	4 (10.0)	17 (42.5)		
	Moderate	11 (27.5)	0 (0)		

Table 6: Compliance and adverse effects.

Parameter	Normal saline N (%)	Steroid N (%)	Test value	P value
Compliance				
Excellent	2 (5.0)	7 (17.5)	χ^2=6.207	0.045
Good	26 (65.0)	26 (65.0)		
Fair	12 (30.0)	7 (17.5)		
Adverse effects				
Epistaxis	3 (7.5)	3 (7.5)	χ^2=0.394	0.821
Mild irritation	1 (2.5)	3 (7.5)		
None	36 (90.0)	34 (85.0)		

Subjective symptom outcomes (SNOT-22)

Both groups demonstrated significant postoperative improvement in SNOT-22 scores over time. In the normal saline group, mean SNOT-22 scores decreased from 37.90±4.30 at 2 weeks postoperatively to 28.53±3.57 at 2 months (p<0.001). Similarly, the steroid irrigation group showed a significant reduction in scores from 24.95±8.38 at 2 weeks to 17.75±6.39 at 2 months postoperatively (p<0.001). Between-group comparison revealed significantly lower mean SNOT-22 scores in the steroid irrigation group at both follow-up intervals (p<0.001 at 2 weeks and 2 months).

Endoscopic outcomes (Lund–Kennedy Scores)

Baseline Lund–Kennedy endoscopic score distribution differed significantly between groups, with a higher proportion of patients in the steroid group presenting with scores >16 (p=0.031). At 2 weeks postoperatively, patients in the steroid irrigation group demonstrated significantly better endoscopic outcomes. A higher proportion achieved scores ≤5, whereas higher scores (≥10) were more common in the normal saline group (p<0.001).

Improvement in endoscopic scores

Marked differences were observed in the degree of improvement in Lund–Kennedy scores. At 2 weeks postoperatively, 90.0% of patients in the steroid group achieved an improvement score ≥5, compared to none in the normal saline group (p<0.001).

At 2 months, 80.0% of patients in the steroid group demonstrated an improvement score ≥7, whereas all patients in the normal saline group remained within the 5–6 range (p<0.001).

Crust formation

At 2 weeks postoperatively, moderate crusting was more common in the normal saline group, whereas minimal crusting was observed only in the steroid group (p=0.043).

At 2 months, absence of crusting was observed in 27.5% of patients in the steroid group, while none in the normal saline group showed complete absence. Moderate crusting persisted only in the normal saline group. These differences were statistically significant ($p<0.001$).

Compliance and safety

Treatment compliance was significantly better in the steroid irrigation group, with a higher proportion of patients demonstrating excellent compliance ($p=0.045$). Adverse effects were minimal and comparable between groups, with no statistically significant difference observed.

DISCUSSION

In the present prospective randomized study, the efficacy of steroid nasal irrigation was compared with conventional normal saline irrigation in the postoperative management of patients undergoing ESS for CRS in a rural Indian population. By incorporating both patient-reported outcome measures and objective endoscopic findings, this study provides a comprehensive assessment of postoperative recovery following ESS. Although saline irrigation remains the conventional standard of care, the role of steroid-enhanced nasal irrigation is still evolving. In this context, the present study contributes region-specific evidence supporting steroid nasal irrigation as an effective adjunct in postoperative management, particularly in settings where delayed presentation, disease chronicity, and environmental risk factors are common.[1,9]

The primary objective of this study was to compare postoperative symptomatic improvement between steroid and normal saline nasal irrigation using the SNOT-22 questionnaire. The superior symptomatic improvement observed with steroid nasal irrigation aligns with previous literature. Snidvongs et al demonstrated significant improvement in SNOT-22 scores following high-volume corticosteroid nasal irrigation after ESS.[16] Similarly, Jang et al. reported worsening of SNOT-20 and Lund–Kennedy scores during periods of discontinuation of budesonide nasal irrigation when compared with periods of active use, confirming the therapeutic contribution of topical corticosteroids beyond mechanical saline lavage alone.[17] The improved symptom control observed with steroid irrigation may be attributed to enhanced corticosteroid delivery to surgically opened sinus cavities, leading to more effective suppression of residual mucosal inflammation, edema, and eosinophilic activity, which are central to CRS pathophysiology.[13]

The secondary objective of the study focused on objective endoscopic outcomes, including mucosal healing, crust formation, and improvement in Lund–Kennedy endoscopic scores. The findings of superior endoscopic recovery and reduced crusting with steroid nasal irrigation are consistent with existing evidence. Kang et al demonstrated significant improvement in both SNOT-22 and Lund–Kennedy scores with high-volume budesonide nasal irrigation in CRS patients with comorbid bronchial asthma following ESS, along with a reduced requirement for systemic corticosteroids.[10] Similarly, Kosugi et al reported marked improvement in endoscopic scores in postoperative CRS patients refractory to topical steroid sprays following high-volume budesonide irrigation.[11] These findings support the concept that steroid irrigation enhances mucosal healing by attenuating postoperative inflammation, minimizing excessive crust formation, and promoting epithelial regeneration.

Overall, the findings of this study suggest that steroid nasal irrigation is a safe, effective, and clinically meaningful adjunct in the postoperative management of ESS, particularly in rural and resource-limited settings where optimization of surgical outcomes is critical. Improved symptom control, enhanced endoscopic healing, and favorable safety and compliance profiles indicate potential real-world benefits, including reduced need for revision interventions and improved quality of life. However, certain limitations should be acknowledged. The study was conducted at a single center with a relatively short follow-up duration, and biochemical assessment of systemic steroid absorption was not performed. Despite these limitations, the prospective randomized design and use of validated outcome measures strengthen the reliability of the findings. Larger multicentric studies with longer follow-up may further elucidate the long-term efficacy and safety of steroid nasal irrigation across diverse patient populations.

CONCLUSION

In this prospective randomized study, steroid nasal irrigation demonstrated superior postoperative symptomatic relief and endoscopic healing compared to conventional normal saline irrigation following endoscopic sinus surgery for chronic rhinosinusitis, without an increased incidence of adverse effects. These findings support the use of steroid nasal irrigation as an effective adjunct in postoperative care, particularly in rural and resource-limited settings where optimizing surgical outcomes is crucial. Larger multicentric studies with longer follow-up are warranted to further validate these findings and assess long-term safety and sustainability of this approach.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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