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Original Research Article

A Comparative Study on the Effectiveness of Budesonide Nasal Irrigation vs. Saline Nasal irrigation in Post-Operative Patients following Functional Endoscopic Sinus Surgery in Cases of Chronic Rhinosinusitis

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Abstract

Aim: To determine the effectiveness of Budesonide nasal irrigation compared to saline irrigation alone in post-operative patients who underwent Functional Endoscopic Sinus Surgery (FESS) in cases of Chronic Rhinosinusitis.

Materials & Methods: A total of 50 patients who underwent FESS surgery were randomly allocated into two groups. Group 1 (Budesonide group) comprised of 25 patients who received Normal Saline + Budesonide respule nasal irrigation twice daily continuously starting from 48 hours after surgery. Group 2 (Normal saline group) comprised of 25 patients who received Normal Saline + Similar amount respule of distilled water nasal irrigation twice daily continuously starting from 48 hours after surgery. Pre-operative and post-operative evaluation of all patients were done using 22-item SNOT-22 score and Lund-Kennedy Endoscopic score at 10th Post-operative day, 1 month and 3 month Post-operative day.

Result: Post-operative overall SNOT-22 scores and Total Lund-Kennedy scores improved significantly compared to pre-operative scores in all patients at 10th post-operative day, 1 month post-operative period and 3 month post-operative period.

But improvement of Total SNOT-22 score was higher among Group 1 compared to Group 2 patients (p=0.00) at 10th post-operative day, 1 month and 3 month post-operative periods respectively. When individual parameters of SNOT-22 was compared among two groups, there was statistically significant difference for 11 parameters at 10th post-operative day, 19 parameters on 1 month post-operative period & 17 parameters at 3 month post-operative period.

Improvement of Total Lund-Kennedy Endoscopic score was also higher among Group-1 than Group 2 patients (p=0.00) at 10th post-operative day, 1 month and 3 month post-operative periods respectively. When individual parameters of LKE score was compared among two groups, it was found that there was statistically significant difference for 4 out of 5 parameters at 10th post-operative, 1 month and 3 month post-operative periods.

Conclusion: Budesonide nasal irrigation is a good option in post-operative FESS patients. The difference of reduction in overall SNOT-22 score and Total Lund-Kennedy Endoscopic score among two groups was found to be statistically highly significant.

Keywords: Functional Endoscopic Sinus Surgery, Chronic Rhinosinusitis, Pre and Post Operative Evaluation.

Introduction

Chronic Rhinosinusitis represents a significant disease burden worldwide, affecting at least 11% of the population and consequently carrying with it a substantial economic burden to healthcare systems, to patients and to the economy from loss of productivity in the workplace. Approximately, 12.5 million work days are missed annually secondary to rhinosinusitis. An impressive 58.7 million days are marked by depressed productivity secondary to restricted activity.[1]

Patients diagnosed with Chronic rhinosinusitis with or without nasal polyposis, refractory to medical treatment undergo Functional Endoscopic Sinus Surgery for restoration of ventilation and functioning of paranasal sinuses. Functional Endoscopic Sinus Surgery creates a corridor that allows the topical medicines to reach the sinus cavities. Therefore post-operative management following Functional Endoscopic Sinus Surgery is crucial to attain optimum outcome. Long term systemic therapy is associated with adverse effects and therefore efforts are made to replace systemic therapy with topical nasal therapy to achieve optimized control of Chronic rhinosinusitis. Conventionally normal saline nasal irrigation and topic steroid sprays are being used during the post-operative period. But topical steroid sprays are unable to deliver its adequate dose beyond the nasal cavity into the depth of sinus cavities due to the presence of edema, mucosal secretions, scarring and crusting. This issue can be addressed by the usage of steroid nasal irrigation by delivering the adequate dosage of drug in high-volume, high-pressure system. One of such topical steroid used for nasal douching is Budesonide- daily dose ranging from 250µg to 2mg for nasal irrigation. This off-label use of Budesonide nasal irrigation is introduced recently for post-operative management of patients with Chronic Rhinosinusitis. The focus of present study is to analyse whether addition of budesonide to normal saline for nasal irrigation in patients subjected to FESS is more effective subjectively and objectively compared to normal saline nasal irrigation.

Materials and Methods

1. **Study Design:** Prospective, single blinded randomized controlled trial study.
2. **Study Duration:**18 Months (From 1st March 2021 to 31st August 2022).
3. **Study Population:** 50 Patients presenting with symptoms and signs of Chronic.

Rhinosinusitis (matching the diagnostic criteria of EPOS) who are refractory to medical treatment.

Inclusion criteria: Patients above 18 years of age suffering with chronic rhinosinusitis, not responding to medical treatment (in the form of topical steroids for 12 weeks with or without antibiotics) and willing to proceed for functional endoscopic sinus surgery.

Exclusion criteria: Patients with co-morbid conditions like diabetes, hypertension, morbidly obese, history of pituitary disease, on oral contraception, pregnancy, chronic

liver disease, chronic renal disease, known hypersensitivity to corticosteroid and immunocompromised patients.

50 Patients with diagnosis of CRS who underwent FESS were randomly allocated into Group 1 (Budesonide group) and Group 2 (Normal saline group). Each group comprised of 25 patients. 22 parameters SNOT-22 response and 5 parameters Lund-Kennedy endoscopic scoring was done 48 hrs before surgery. FESS surgery was then undertaken by the same team of surgeons. 1 mg of Budesonide respule + 120 ml Normal saline in squeeze bottles. Such formulation nasal irrigation was used by Group 1 patients twice daily continuously starting from 48 hours after surgery.

Results

AGE: Mean age of the study population was 38.76 ± 14.64 years. Maximum patients belonged to 29-39 years age group. Minimum

120 ml Normal Saline + Similar amount respules of distilled water in squeeze bottles was prepared. Group 2 patients received similar formulation nasal irrigation twice daily continuously starting from 48 hours after surgery.

In addition both groups received oral antibiotics for 5 days, Intranasal Fluticasone Furoate nasal sprays twice daily. SNOT-22 assessment and Lund-Kennedy Endoscopic scoring was done at 10th post-operative day, 1 month & 3 month post-operative period for patients of both the groups Comparison of SNOT-22 score and Lund-Kennedy Endoscopic score between two groups were done using Independent sample Mann Whitney U-test.

age of the study population was 18 years while maximum age was 77 years.

Gender: 22 patients (44%) were male and 28 patients (56%) were female.

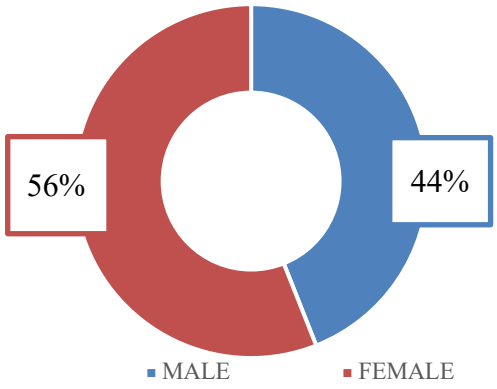

Figure 1: Gender distribution of study population.

POLYP: 33 patients (66%) had no polyp, 9 patients (18%) had Unilateral nasal polyp and 8 patients (16%) had Bilateral nasal polyp.

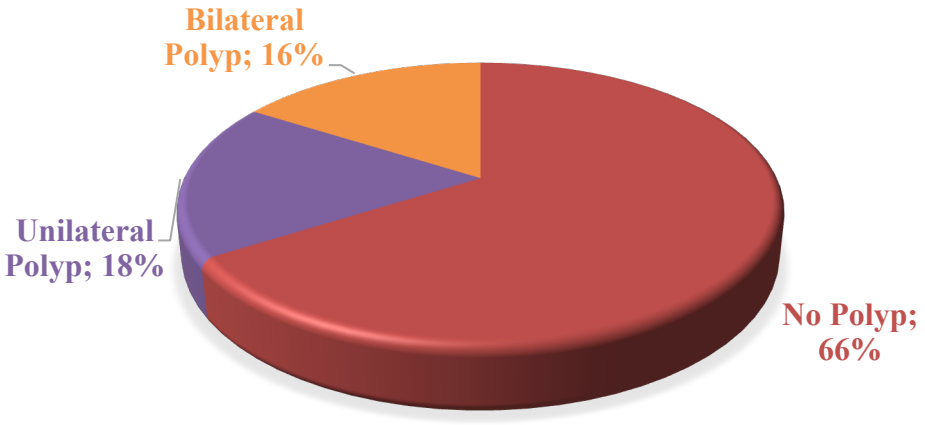

Figure 2: Pie-chart demonstrating distribution of study population depending on nasal endoscopic finding on presence/ absence of nasal polyp

Comparison of SNOT-22 Score:

Table 1: Table showing Mean ± Standard deviation scores of Total SNOT-22 scores in two comparative groups.

	Group-1 (Budesonide irrigation group)	Mean Rank	Group- 2 (Normal saline irrigation group)	Mean Rank	Significance (Mann-Whitney U test)
Preoperatively	75.16 ± 10.888	25.94	75.04 ± 10.139	25.06	0.831
10th post-operative day	50.00 ± 6.292	17.70	58.84 ± 7.398	33.30	0.000
1 month Post-operative day	22.88 ± 5.495	13.96	38.20 ± 6.764	37.04	0.000
3 month Post-operative day	7.24 ± 1.480	14.00	16.88 ± 4.246	37.00	0.000

Table 1 shows that the mean SNOT-22 score was almost similar in both the groups pre-operatively. Total SNOT-22 reduced significantly from pre-operative scores in both the group. But the reduction was more pronounced in Group 1 (Budesonide irrigation group) than in Group 2 (Normal saline irrigation group) in all the post-operative observation periods and this reduction was also significant by Mann- Whitney U test .

Table 2: Comparison of individual parameters of 22 parameters SNOT-22 score between two groups at post-operative observation periods using Mann-Whitney U test

	Parameters which showed significant decrease in Mean ranks for Group 1 as compared to Group 2	**Parameters which showed No significant decrease in Mean ranks for Group 1 as compared to Group 2**
10th Post-operative day	Need to blow nose, Nasal blockage, Sneezing, Running nose, Cough, Post-nasal discharge, Thick nasal discharge, Ear fullness, Dizziness, Facial pain/pressure, Difficulty falling asleep	Decreased sense of smell/ taste, Ear pain,Wake up at night, Lack of good night's sleep, Fatigue, Wake up tired, Reduced productivity, Reduced concentration, Frustrated/restless/irritable, Embarrassed, Sad.
1 month Post-operative day	Need to blow nose, , Sneezing, Nasal blockage, Running nose, Post-nasal discharge, Cough, Thick nasal discharge, Ear fullness, Dizziness, Ear pain, Decreased sense of smell/taste, Difficulty falling asleep, Lack of good night's sleep, Wake up at night, Wake up tired, Fatigue, Reduced productivity, Frustrated/restless/irritable, Reduced concentration.	Facial pain/ pressure, Sad, Embarrassed
3 month Post-operative day	Nasal blockage, Need to blow nose, Sneezing, Running nose, Cough, Facial pain/pressure, Post-nasal discharge, Thick nasal discharge, Ear fullness, Difficulty falling asleep, Wake up at night, Sad, Lack of good night's sleep, Wake up tired, Fatigue, Reduced productivity, Frustrated/restless/irritable.	Dizziness, Ear pain, Decreased sense of smell/taste, Embarrassed, Reduced concentration.

Table 2 shows that on comparison of individual parameters of SNOT-22 among two groups, there was statistically significant decrease of Mean ranks in Group 1 (Budesonide irrigation group) as compared to Group 2 (Normal saline irrigation group) for 11 parameters at 10th post-operative day, 19 parameters on 1 month post-operative period & 17 parameters at 3 month post-operative period.

Comparison of Lund-Kennedy Endoscopic Score:

Table 3: Table showing Mean ± Standard deviation scores of Total Lund-Kennedy Endoscopic scores in two comparative groups.

	Group-1 (Budesonide irrigation group)	Mean Rank	Group- 2 (Normal saline irrigation group)	Mean Rank	Significance (Mann-Whitney U test)
Pre-operatively	7.36 ± 0.907	27.78	7.04 ± 1.207	23.22	0.249
10th Post-operative day	4.24 ± 0.779	13.72	6.52 ± 0.714	37.28	0.000
1 month Post-operative day	2.48 ± 0.653	13.40	4.80 ± 0.577	37.60	0.000
3 month Post-operative day	1.44 ± 0.583	13.54	3.88 ± 1.013	37.46	0.000

Table 3 shows that the mean Lund-Kennedy Endoscopic score was almost similar in both the groups pre-operatively. Total Lund-Kennedy Endoscopic score reduced significantly from pre-operative scores in both the group. But the reduction was more pronounced in Group 1 (Budesonide irrigation group) than in Group 2 (Normal saline irrigation group) at all the post-operative observation periods and this reduction was also found to be siginificant by Mann-Whitney U test .

Table 4: Comparison of individual parameters of Lund-Kennedy Endoscopic score between two groups at post-operative observation periods using Mann-Whitney U test

	Parameters which showed significant decrease in Mean ranks for Group 1 as compared to Group 2	Parameters which showed No significant decrease in Mean ranks for Group 1 as compared to Group 2
10th Post-operative day	Edema, Discharge, Scarring, Crusting	Polyp
1 month Post-operative day	Edema, Discharge, Scarring, Crusting	Polyp
3 month Post-operative day	Edema, Discharge, Scarring, Crusting	Polyp

Table 4 shows that when individual parameters of LKE score was compared among two groups, it was found that there was statistically significant difference for 4 out of 5 parameters at 10th post-operative, 1 month and 3 month post-operative periods.

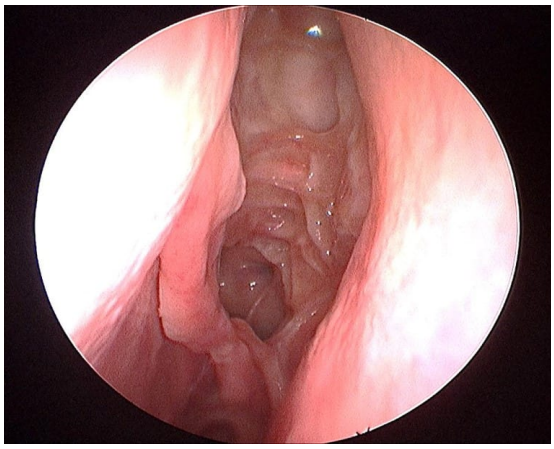

Figure 3: Endoscopic picture of a patient of Group-1 (Budesonide irrigation group) at 3 months

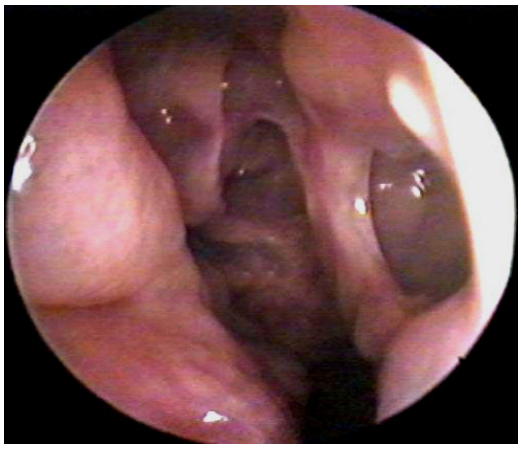

Figure 4: Endoscopic picture of a patient of Group-2 (Normal saline irrigation group) at 3 months

Discussion

Budesonide nasal irrigation is a non standardised formulation (off-label use) compared with normal saline & distilled water nasal irrigation alone. Budesonide has got approximately 1000 fold higher anti-inflammatory potency than cortisol. Budesonide exerts its anti-inflammatory effect by binding with glucocorticoid receptor and thus alters the release of arachidonic acid metabolites, decreases vascular permeability, inhibits the accumulation of leukocytes in the affected tissues, inhibits neuropeptide mediated reesponses and alters the secretion of glycoproteins from sub-mucosal glands.[2] In the present study, Total SNOT-22 score reduced significantly from pre-operative scores in both Group-1 (Budesonide irrigation) patients and Group-2 (Normal irrigation) patients. However, the Budesonide with normal saline irrigation group was superior in reducing the SNOT-22 score (from average of 75.16 ± 10.888 pre-operatively to 7.24 ± 1.480 at 3 months post-operative period) when compared to the normal saline irrigation group (from average of 75.04 ± 10.139 pre-operatively to 16.88 ± 4.246 at 3 months post-operative period).

Almost similar results are observed from studies by Thanneru *et al*. [2], Faruq *et al*. [3], Huang *et al*. [4]. When individual parameters of SNOT-22 was compared among two groups, there was statistically significant difference for 11 parameters at 10th post-operative day, 19 parameters at 1 month post-operative period & 17 parameters at 3 month post-operative period.

Patient's Lund-Kennedy endoscopic score also reduced significantly from pre-operative scores in both Group-1 (Budesonide irrigation) patients and Group-2 (Normal irrigation) patients. However, the Budesonide with normal saline irrigation group was superior in reducing the Lund-Kennedy endoscopic score (from average of 7.36 ± 0.907 pre-operatively to 1.44 ± 0.583 at 3 months post-operative period) when compared to the normal saline irrigation group (from average of 7.04 ± 1.207 pre-operatively to 3.88 ± 1.013 at 3 months post-operative period). Similar findings observed in other studies by Thanneru *et al*. [2], Kosugi *et al*. [5], Kang *et al*. [6]

A double-blinded randomized controlled trial by Rotenberg *et al*. [7] compared the outcomes of post-operative treatments with

saline irrigation, budesonide nasal spray, saline irrigation mixed with budesonide spray after endoscopopic sinus surgery in Samter's triad patients and found that budesonide nasal spray or irrigation is not superior to saline irrigation.In this study, when individual parameters of Lund-Kennedy endoscopic score was compared among two groups, there was statistically significant difference for 4 out of 5 parameters at 10th post-operative, 1 month and 3 month post-operative periods.

The safety of budesonide nasal irrigation has been studied by Bhalla *et al*. [8] that studied 1mg Budesonide/day for 8 weeks and Ethan Soudry *et al*. [9] that analysed safety of long term budesonide nasal irrigation in patients with chronic rhinosinusitis post endoscopic sinus surgery for 22 months and both have reported no significant suppression of HPA effects axis or any adverse effects related to Budesonide usage.

The benefit of high volume, high pressure Budesonide nasal irrigation over topical corticosteroid nasal spray is its wide spread distribution and ability to penetrate into the depth of sinus cavities. The benefit of Budesonide irrigation over normal saline nasal irrigation alone is due to the ability of budesonide molecules to adhere to the nasal mucosa and through reduction of inflammation, its ability to penetrate sinus cavities. It also helped in the wound healing process.

The limitations of the study are- i) Short duration of study i.e 18 months in which each patient was followed up only for 3 months. So the long-term effect of Budesonide could not be studied. ii) Compliance to nasal irrigation was assessed by patient's self report as we did not have formal compliance assessments. Thus we could not be certain whether patient regularly performed nasal irrigation in the manner described. iii) size of certain subgroups like nasal polyp was small and unequally divided between two treatment groups.

Conclusion

This study showed that Budesonide respule mixed with normal saline nasal irrigation at high volume and high pressure result in clinically meaningful benefit to post- FESS patients compared to normal saline nasal irrigation alone. Benefit is found to be statistically significant both subjectively (as analysed by SNOT-22 score) and objectively (as analysed by Lund-Kennedy endoscopic score).

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