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THE EFFECTIVENESS OF THE USE OF NASAL IRRIGATION WITH PHYSIOLOGICAL SALINE SOLUTION IN CHRONIC RHINOSINUSITIS PATIENTS AFTER ENDOSCOPIC SINUS SURGERY AT RSPAL DR. RAMELAN SURABAYA PERIOD 2021-2024

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ABSTRACT

Chronic rhinosinusitis (CRS) is a prevalent condition affecting individuals across all age groups, often leading to symptoms such as fatigue, reduced work productivity, and sleep disorders. The CRS therapy management includes medical therapy and surgical procedures such as functional endoscopic sinus surgery (FESS). Current management of CRS involves both medical therapy and functional endoscopic sinus surgery. Postoperative nasal irrigation with normal saline, is crucial to optimise surgical outcomes. This retrospective cohort study aimed to evaluate the effectiveness of nasal irrigation using physiological saline in patients with CRS following FESS. Total 64 samples meeting the inclusion criteria. Evaluation demonstrated a significant improvement in symptoms, including nasal congestion (P = 0.006), rhinorrhea (P = 0.000), and facial pain (P = 0.001). Objective nasal endoscopy findings post-treatment also revealed significant reductions in nasal dischage (P=0.000), mucosal changes (P=0.011), and crust formation (P=0.001). These results confirm that nasal irrigation with physiological saline solution is more effective than no irrigation, as evidenced by the reduction of symptoms and improvement of endoscopic findings.

Keywords : Nasal irrigation, Physiological Saline Solution., Chronic Rhinosinusitis, FESS.

INTRODUCTION

Chronic rhinosinusitis (CRS) is an inflammation of the nasal mucosa and paranasal sinuses that can last more than 12 weeks.[1] Chronic rhinosinusitis is a common disease and can affect individuals of all ages.[2] Problems caused by CRS patients include depression, fatigue, decreased activity at work, and sleep disturbances.[3] The cost of treatment for CRS is very high, including the need for supporting examinations, medical therapy, and surgery. The length of therapy and recurrence of symptoms also increase the cost of treating patients with CRS. On the other hand, patients may experience financial difficulties due to reduced productivity and working hours.[4]

The prevalence of CRS is estimated to be 13% in China, 12.3% in the US, 10.9% in Europe, and as high as 28.4% in Asia.[2] Therapeutic management of CRS includes medical therapy and functional endoscopic sinus surgery (FESS). In cases of CRS with persistent symptoms after topical corticosteroids and nasal irrigation, FESS is required. FESS aims to improve ventilation of the paranasal sinuses and expand drainage pathways to reduce inflammation and sinusitis. This surgery also aims to facilitate the administration of treatment to reach the target organ.[3]

FESS action will not be optimal without the role of postoperative medical therapy, one of which is the use of nasal irrigation. Nasal irrigation can alleviate the symptoms of CRS by diluting and dissolving mucus, reducing debris, improving mucociliary transport, relieving edema, decreasing the number of antigens on the mucosal surface, disrupting biofilms, clearing inflammatory mediators, and hydrating the epithelial layer.[5] Currently, nasal irrigation using normal saline is the most commonly performed post-FESS.

The authors observed that nasal irrigation has a significant impact on patients with chronic rhinosinusitis. They are interested in researching its effectiveness using physiological saline after functional endoscopic sinus surgery. This study aims to describe the occurrence of CRS cases and analyze the effectiveness of nasal irrigation versus no irrigation with physiological saline after endoscopic sinus surgery at RSPAL Dr. Ramelan Surabaya from 2021 to 2024. The results may support theories on the effectiveness of physiological saline nasal irrigation after surgery.

MATERIALS AND METHODS

This study employed an analytical observational design with a retrospective cohort approach. The sampling technique utilised was non-probability sampling, specifically consecutive or purposive sampling. The study population comprised all patients diagnosed with chronic rhinosinusitis (CRS) documented in the medical records at Dr. Ramelan Naval Hospital, Surabaya, from 2021 to 2024. The study sample consisted of CRS patients who underwent functional endoscopic sinus surgery (FESS) at RSPAL Dr. Ramelan Surabaya during the same period and met the specified criteria. Inclusion criteria mandated patients with a diagnosis of CRS post-FESS who attended a minimum of one month of postoperative follow-up and had complete medical records detailing demographic data, symptoms, and examination findings. Patients were excluded if they responded well to medical therapy without undergoing FESS or if their medical records were incomplete. The primary variables in this study were the dependent variable (CRS patients following endoscopic sinus surgery) and the independent variable (nasal irrigation using normal saline versus no nasal irrigation). Secondary data were extracted from medical records, including demographic information (age, gender), clinical symptoms, and physical findings before and after FESS, with a minimum of four follow-up visits or one month post-surgery.

Data normality was assessed using the Shapiro-Wilk test prior to statistical analysis. Data processing was conducted using SPSS software, and results were presented in tabular format using Microsoft Excel and Word. Ethical approval for this study was obtained from the Research Ethics Committee of the RSPAL, Dr. Ramelan, under approval number 95/EC/KEP/2024.

RESULTS

Description of CRS Case Event

Based on the data collected from 2021 to 2024, the incidence of chronic rhinosinusitis (CRS) cases at Dr. Ramelan General Hospital, Surabaya, was analyzed and categorized according to patients' age and gender.

In Table 1, the demographic characteristics in general and FESS patients were most prevalent in patients aged 51-64 years, with 73 (28.3%) and 69 (28.28%) patients, respectively.

Table 1 Distribution of CRS cases by age

Age	CRS		CRS +FESS	
	N=258	%	N=244	%
21-30	54	20.90	51	20.90
31-40	47	18.20	43	17.62
41-50	60	23.30	60	24.59
51-64	73	28.30	69	28.28
>65	24	9.300	21	8.610
Total	258	100	244	100

Table 2 shows that the highest gender in patients with CRS and patients who had undergone FESS was male, with 134 (51.95%) and 126 (51.64%) patients, respectively.

Table2 Distribution of CRS cases by gender

Gender	CRS		CRS + FESS	
	N=258	%	N=244	%
Male	134	51.9	126	51.64
Female	124	48.1	118	48.36
Total	258	100	244	100

Effectiveness Analysis of Nasal Irrigation and without Nasal Irrigation in Hospitalized Patients with Functional Endoscopic Sinus Surgery

In this study, 64 patient samples were obtained that met the inclusion criteria.

Table 3. Symptom distribution of patients with and without nasal irrigation after FESS

Symptoms	Control (C)	Nasal Irrigation		Without Nasal Irrigation		P-Value
		N	%	N	%	
Nasal Congestion	C1	10	31.3	21	65.6	*0.006
	C2	6	18.8	12	37.5	0.098
	C3	5	15.6	9	28.1	0.230
	C4	6	18.8	8	25	0.549
Nasal discharge	C1	12	37.5	29	90.6	*0.000
	C2	11	34.4	26	81.3	*0.000
	C3	6	18.8	24	75	*0.000
	C4	6	18.8	21	65.6	*0.000
Pain	C1	6	18.8	16	50	*0.009
	C2	9	28.1	17	53.1	*0.043
	C3	5	15.6	13	40.6	*0.027
	C4	3	9.4	15	46.9	*0.001
Anosmia	C1	3	9.4	5	15.6	0.453
	C2	3	9.4	5	15.6	0.453
	C3	5	15.6	4	12.5	0.721
	C4	2	6.3	7	21.9	0.074

According to the data presented in Table 3, from the second to fourth control visits (C2 to C4), the incidence of nasal congestion was higher in the non-nasal irrigation group compared to the nasal irrigation group; however, this difference did not reach statistical significance ($p > 0.05$). Nasal discharge were consistently more prevalent in the non-nasal irrigation group across all controls, with these differences showing statistical significance ($p < 0.05$). Notably, at the fourth control (C4), 65.6% of patients in the non-nasal irrigation group experienced rhinorrhea, compared to only 18.8% in the nasal irrigation group.

Regarding facial pain, at C4, 46.9% of the non-nasal irrigation group reported pain, significantly higher than the 9.4% observed in the nasal irrigation group ($p = 0.001$). This trend was consistent across all control visits (C1 to C4), with the non-nasal irrigation group showing significantly higher pain prevalence at each time point. In terms of anosmia, the third control visit (C3) showed a slightly higher prevalence in the nasal irrigation group (15.6%) relative to the non-nasal irrigation group (12.5%). At C4, anosmia was more prevalent in the non-nasal irrigation group (21.9%) than in the nasal irrigation group (6.3%); however, this difference did not reach statistical significance ($p = 0.074$).

Table 4 Distribution of physical findings of patients with and without nasal irrigation after FESS

Physical Findings	Control (C)	Nasal Irrigation		Without Nasal Irrigation		P-Value
		N	%	N	%	
Nasal discharge	C1	17	53.1	32	100	*0.000
	C2	12	37.5	27	84.4	*0.000
	C3	9	28.1	25	78.1	*0.000
	C4	6	18.8	24	75	*0.000
Mucosal Color	C1	3	9.4	23	71.9	*0.000
	C2	1	3.1	6	18.8	*0.047
	C3	0	0	6	18.8	*0.011
	C4	0	0	3	9.4	0.078
Debris/Crust	C1	32	100	32	100	1.000
	C2	20	62.5	26	81.3	0.098
	C3	10	31.3	19	59.4	*0.025
	C4	7	21.9	20	62.5	*0.001
Synechiae	C1	2	6.3	1	3.1	0.557
	C2	2	6.3	0	0	0.161
	C3	3	9.4	1	3.1	0.306
	C4	0	0	1	3.1	0.317
Polyp formation	C1	1	3.1	0	0	0.317
	C2	5	15.6	0	0	*0.021
	C3	4	12.5	1	3.1	0.166
	C4	1	3.1	2	6.3	0.557

Based on the data presented in Table 4, the findings related to nasal secretions indicate that the non-nasal irrigation group consistently exhibited a higher percentage of secretions compared to the nasal irrigation group across all follow-up visits (C1 to C4). This difference was statistically significant, with p-values less than 0.05. Similarly, alterations in mucosal coloration were more prevalent in the non-nasal irrigation group than in the nasal irrigation group, although this difference reached statistical significance only in controls C1 through C3.

Regarding crust formation, the non-nasal irrigation group demonstrated a higher percentage of crusts from C2 through C4 in comparison to the nasal irrigation group. Notably, at the fourth control (C4), the nasal irrigation group showed a marked reduction in crust presence, with only 21.9% of patients affected, compared to 62.5% in the non-nasal irrigation group; this difference was statistically significant ($p = 0.001$).In contrast, synechiae formation did not significantly differ between the nasal irrigation and non-nasal irrigation groups at any of the follow-up points (C1 to C4), as indicated by p-values greater than 0.05. The incidence of synechiae was relatively low and varied minimally between groups.

Statistical analysis of nasal polyp findings revealed that, during the second control (C2), the nasal irrigation group had a significantly higher percentage of nasal polyps compared to the non-nasal irrigation group ($p < 0.05$). However, by the fourth control (C4), the non-nasal irrigation group exhibited a slightly higher polyp percentage than the nasal irrigation group, though this difference was not statistically significant.

DISCUSSION

Description of CRS Case Event

Based on data from a total of 258 patients with CRS and 244 patients with CRS who have undergone FESS at Dr. Ramelan Naval Hospital Surabaya for the period 2021-2024, the demographic characteristics are most prevalent in patients with an age range of 51-64 years, namely 73 (28.3%) and 69 (28.28%) patients. The group with the second highest number of cases was 60 cases in the age range 41-50 years (23.3% and 24.59%). The results of this study are in line with the research of Krisna et al in 2018, the highest proportion of age diagnosed with CRS is the age group 46-60 years, with a total of 20 people (37.7%) of the 53 samples obtained.[6] However, the results of this study are not in

line with the research of Leslie et al 2022, with the age of patients with CRS in the range of 38-43 years, namely 14 (25%) patients.[7]

The high incidence of infections in adults is due to behaviors that involve exposure to air pollutants, such as cigarette smoke and motor vehicle fumes. These exposures increase the risk of viral and bacterial infections.[7] Adults are more susceptible to infections, due to the mucosal lining of the respiratory tract producing less secretion with age, as well as the degradation of support structures in the upper airway.[8] The gender distribution results indicated that CRS was observed in 134 male patients (51.9%) and 124 female patients (48.1%). In the subgroup of patients undergoing FESS for CRS, males also predominated, comprising for 126 patients (51.64%). These findings align with Anastasia's 2020 study, which reported a male predominance with 53 male patients (54.1%) out of 98 total cases.[9] Conversely, research by Dalimunthe et al. (2023) found a female predominance, with 18 female patients out of 32 cases.[10]

The finding of a high number of patients with CRS in women is influenced by the role of the hormones estrogen and progesterone which contribute to the incidence of allergic rhinitis, which can then develop and trigger CRS.[11] Women are more susceptible to CRS due to the relatively smaller size of the ostium, which predisposes them to easier obstruction. Furthermore, passive exposure to tobacco smoke significantly contributes to the increased incidence of CRS in this population.[12]

Effectiveness Analysis of Nose Wash and No Nose Wash in Hospitalized Patients Undergoing Functional Endoscopic Sinus Surgery

The results of the study of nasal congestion symptoms, found a significant difference in the first control (C1) with a value of p = 0.006, while C2 (p = 0.098) to C4 (p = 0.549) did not show significant results. Meanwhile, research by Dawood and Mohammed 2022, showed that there was a significant improvement in nasal obstruction in the group that performed nasal irrigation with isotonic and hypertonic saline solution.[16] Postoperative nasal congestion is primarily attributed to unresolved inflammation following surgery. This inflammation commonly arises from surgical trauma inflicted during the FESS procedure and the subsequent excessive mucus production as part of the body's physiological response. In the early postoperative period, mucosal edema and accumulation of secretions predominantly contribute to nasal obstruction, which typically requires a gradual recovery phase for full resolution.[17]

The statistical analysis revealed that the symptom of rhinorrhea demonstrated significant p-values from C1 (p=0.00) to C4 (p=0.00), with all values below the threshold of 0.05. This finding aligns with the study by Dawood and Mohammed (2022), which reported a significant improvement in nasal discharge among patients who underwent nasal irrigation using isotonic or hypertonic saline solutions.[13] This evidence underscores the efficacy of nasal irrigation therapy in reducing inflammation, promoting clearance of sinus secretions, and facilitating recovery following FESS.[15] Nasal irrigation enhances mucociliary clearance partly by normalizing the nasal mucosa pH to an optimal range, particularly between pH 7 and 9, thereby maintaining the mucosa's physiological health and function.[16]

The analysis of pain symptoms in patients with CRS following FESS revealed statistically significant improvements across all postoperative evaluations ($p < 0.05$). These findings are corroborated by Dawood and Mohammed (2022), whose study demonstrated significant pain reduction in patients utilizing nasal irrigation with isotonic and hypertonic saline solutions on postoperative days 7 and 21.[13] This evidence underscores the vital role of physiological saline in alleviating pain symptoms. Furthermore, Arini and Simatupang (2021) elucidated the multifaceted therapeutic benefits of saline nasal irrigation, including attenuation of inflammatory processes, clearance of secretions and crusts, relief of nasal congestion, maintenance of mucosal hydration, enhancement of mucociliary clearance, prevention of mucosal adhesions, and acceleration of mucosal regeneration following FESS.[17]

The prevalence of anosmia was predominantly observed in the non-nasal irrigation cohort, although statistical analysis revealed no significant difference between groups. In the non-irrigation group, the incidence of anosmia notably increased to 21.9% at the fourth postoperative control (C4), compared to 12.5% at the preceding evaluation. Correspondingly, Raza et al. (2021) reported that 62.7% of patients experienced a 19.2% improvement in olfactory function following Functional Endoscopic Sinus Surgery (FESS), whereas 37.2% of patients demonstrated no change or deterioration in olfactory capacity. Despite physiological saline irrigation aiding in the clearance of nasal passages, residual inflammation within the olfactory epithelium persists during the observation period, thereby limiting olfactory recovery.[19] Anosmia may arise from either mechanical obstruction of the olfactory cleft or sensorineural impairment.[1] Inflammatory processes induce nasal passage narrowing via vasodilatation, augmented blood flow, and increased vascular permeability, contributing to olfactory dysfunction.[20]

The analysis of secretion findings demonstrated statistically significant differences between the nasal irrigation and non-irrigation groups ($p < 0.05$). This signifies that nasal irrigation effectively reduces mucus and crust formation, aids in the clearance of residual inflammatory material within the nasal airway, and promotes mucosal healing.[21] These results align with the study conducted by Verma et al. (2020), which reported that 86% of chronic rhinosinusitis patients undergoing FESS exhibited improvement in nasal secretions following postoperative nasal irrigation.[22]

Statistical analysis showed significant crustal findings in C3 and C4 with p-values of 0.025 and 0.001 ($p<0.05$). In the fourth control, the nasal irrigation group showed a significant reduction in crusts, only 21.9% remaining, much lower than the non-nasal irrigation group which still reached 62.5%. The results of this study are in line with Dawood and Mohammed 2022, on the 21st

postoperative day, 90% of patients who performed nasal irrigation using hypertonic saline solution had no crusts. Meanwhile, in patients who used isotonic saline solution, crusts were not found in 75% of patients.[13] The decrease in the number of crusts in this study explains that nasal irrigation with physiological saline can help clear the nose of accumulated secretions, crusts, and irritants, thereby improving mucociliary clearance function.[16]

The results of the study on the findings of mucosal hyperemia between patients who performed nasal irrigation and non-nasal irrigation, showed that in controls 1 (p=0.000) to 3 (p=0.011), there was a significant difference with a p-value <0.05. Hyperemia occurs due to increased blood flow as part of the inflammatory and wound healing process. Hyperemia is the body's normal response to repair mucosal damage caused by surgery. Physiological saline solution helps remove debris, mucous secretions, and inflammatory mediators from the mucosal surface. This supports the improvement of mucosal hyperemia in patients who wash their nose regularly compared to patients who do not wash their nose.[1]

The study results on synechiae formation during the second postoperative follow-up revealed a higher incidence in the nasal irrigation group (6.3%) compared to none in the non-irrigation cohort, though the difference was not statistically significant (p = 0.161). This finding is consistent with Atshan et al. (2020), who reported that synechiae formation persisted in 5.5% of patients after FESS.[23] Similarly, Verma et al. (2020) documented a 13.33% incidence of synechiae during postoperative surveillance.[22] Synechiae develop as a consequence of incomplete mucosal healing, characterized by adhesions formed when adjacent mucosal surfaces with microlesions undergo fibrotic bridging during repair. The likelihood of synechiae is influenced by surgical factors including the type and technique of the procedure, the materials used for dressing, and postoperative wound management protocols. Nasal irrigation serves as an effective adjunctive therapy by mitigating mucosal edema, preventing mucosal dryness, reducing intranasal adhesions, and alleviating nasal obstruction, thus promoting optimal healing conditions.[24]

The statistical analysis of nasal polyp findings at the second postoperative follow-up demonstrated a significant difference (p=0.021), with the nasal irrigation group exhibiting a higher incidence of nasal polyps (15.6%) compared to none in the non-irrigation group. This disparity may be attributed to persistent chronic inflammation that remains refractory despite surgical intervention. Lima (2024) observed that nasal polyps were present on postoperative day 7 but showed progressive reduction on days 14 and 21 among patients adhering to nasal irrigation, culminating in significant improvement by days 30 to 45.[25] Similarly, Verma et al. (2020) reported residual nasal polyps in a subset of patients at six months post-surgery.[22]

The etiology of nasal polyps is multifactorial, involving persistent activation of eosinophils and neutrophils alongside heightened immunological responses to allergens or unresolved infections. Polyps may also originate from preexisting chronic rhinosinusitis with nasal polyps (CRSwNP), a condition predisposed to recurrent polypogenesis due to sustained underlying inflammation and immunopathological dysregulation.[1] Surgical manipulation may induce anatomical alterations within the nasal mucosa, potentially facilitating polyp regeneration if inflamed tissue is incompletely resected or cleared.[26] Given the elevated incidence of postoperative polyp recurrence, comprehensive management frequently necessitates multiple revision surgeries and adjunct corticosteroid therapy to mitigate inflammation and inhibit polyp growth.[27]

CONCLUSIONS

This study underscores the importance of promoting patient education on nasal irrigation, especially in the postoperative period following FESS, to optimize clinical outcomes. It is recommended that healthcare providers at hospitals emphasize the procedural benefits and patient adherence to nasal irrigation regimens. Furthermore, future research should focus on comparative analyses of different nasal irrigation devices or techniques to identify the most comfortable and efficacious methods for patients. Additionally, investigating any potential side effects or patient-reported discomfort associated with various nasal irrigation modalities will contribute to refining clinical recommendations and patient care protocols.

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