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Original Research Article

Effect of nasal irrigation with budesonide and normal saline on patients with chronic rhino-sinusitis surgery

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Abstract

Purpose: *To investigate the therapeutic effect of budesonide nasal irrigation and saline irrigation in patients undergoing surgery for chronic rhinosinusitis (CRS).*
Methods: *One hundred patients scheduled for functional endoscopic sinus surgery (FESS) in Shanghai Ninth People's Hospital, Shanghai Jiaotong University School of Medicine, China were enrolled. The patients were divided into study and control groups comprising 50 cases each. The study group received postoperative budesonide irrigation while control group received normal saline irrigation after surgery. Post-operative symptoms, signs, and adverse reactions of the patients were compared.*
Results: *Five weeks post-operation, the visual analogue scale (VAS) scores of nasal congestion, nasal discharge, nasal itching, sneezing, nasal pain, and the score of nasal endoscopy one week and 4-weeks after operation were significantly lower compared to control ($p < 0.05$). There was no significant difference in nasal bleeding when the packing was removed between the two groups ($p > 0.05$) after surgery. Within the first week after surgery, there was no significant difference in occurrence of nasal malodor ($p > 0.05$).*
Conclusion: *Application of budesonide nasal irrigation alleviates post-operative symptoms, reduces inflammation and improves treatment outcomes. Further studies will be required to comprehensively investigate the dose effect of budesonide.*

Keywords: *Chronic rhinosinusitis (CRS), Budesonide, Normal saline, Endoscopic sinus surgery*

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INTRODUCTION

Chronic rhino-sinusitis (CRS) refers to a chronic inflammatory disease of the nasal cavity and sinus mucosa that lasts for more than l2 weeks. It is a common disease in otorhinolaryngology [1], and it often manifests as nasal congestion, increased nasal discharge, and facial pressure pain, possibly accompanied by symptoms such as sore throat and headache, causing considerable distress to patients [2]. Pharmacological treatment typically includes antibiotics, corticosteroid nasal sprays, and antiallergic medications, aiding in inflammation relief and improving ventilation [3]. If conservative treatment proves ineffective, surgical intervention may be considered.

Among these, functional endoscopic sinus surgery (FESS) is the most common clinical

approach. In FESS, physicians use an endoscope to access the sinuses through the nasal cavity, removing polyps, secretions and inflamed tissues, so as to widen the sinus passages [4]. Although FESS eliminates obstruction of the sinus opening and improves drainage of the nasal cavity and sinuses, it still takes a long time to eliminate inflammation of the nasal cavity and sinuses, and epithelialization of the injured mucosa [5]. Therefore, during this period, management of mucosal recovery in surgical sites is vital, directly influencing the success of surgery and recovery of patients [6,7].

The nasal and facial nerve endings and capillaries are abundant, leading to unavoidable facial pain post-operatively. Prolonged pain negatively impacts the emotional and psychological state of patients [8]. Pain is not only related to the choice of packing material but is also influenced by factors such as local inflammation and edema. Hence, postoperative antibiotics and anti-inflammatory treatment are commonly administered to patients [9].

Currently, glucocorticoids (GC), especially intranasal glucocorticoids, are commonly used first-line medications in the treatment of CRS, with their efficacy and safety clinically validated [10]. Compared with traditional hormones such as dexamethasone which are no longer recommended for local use, new nasal glucocorticoids have been widely applied in practice because of their safety and reliability. As recommended by the guidelines, they have a strong non-specific anti-inflammatory and anti-allergic effect, which reduces the release of inflammatory active factors, vascular permeability, and tissue edema [11].

Budesonide, as a novel corticosteroid, possesses anti-inflammatory effects, promotes healing, and alleviates symptoms. Moreover, when used locally, it exhibits minimal systemic absorption, reduces the risk of systemic side effects and ensures high safety. Budesonide lowers post-operative inflammation recurrence and enhances surgical efficacy [12]. This study therefore investigated the effect of budesonide compared to saline irrigation in patients with CRS after surgery, thus providing a more suitable treatment option for patients and offering guidance for medical practice.

METHODS

Patients' data

A total of 100 patients with CRS who underwent FESS in the Department of Otorhinolaryngology of Shanghai Ninth People's Hospital, Shanghai, China were retrospectively selected as the study patients. The patients were randomly and equally grouped into study and control groups comprising of 50 cases each. Study group received budesonide irrigation and control group received normal saline irrigation. This study was approved by the Ethics Committee of Shanghai Ninth People's Hospital (approval no. SN-021). Signed written informed consents were obtained from the patients before the study.

Inclusion criteria

Patients who met the diagnostic criteria for CRS, abnormalities in sinus ostiomeatal complex and/or inflammatory lesions of the sinus mucosa visible on nasal sinus CT scan, those who met the surgical indications, symptoms not satisfactorily improved after standard drug treatment, anatomical abnormalities or obstruction of sinus ostiomeatal complex or individual sinuses affecting drainage (such as polyps), occurrence of intracranial or orbital complications, those who understood the study design, voluntary participation, and signed informed consent.

Exclusion criteria

Pregnant or lactating women, individuals with a history of nasal surgery or nasal tumors, allergic to the experimental drugs, and individuals requiring other medications that may affect the experiment due to their medical condition.

Treatments

Pre-operation

All patients received pre-operative anti-infection treatment for 1 week after diagnosis and stopped smoking and alcohol for more than 1 week. After admission, they were given intravenous antibiotics, with second-generation cephalosporins as the first choice. Levofloxacin injection was adopted for allergic patients and was administered oral eucalyptol enteric soft capsule, levocetirizine capsule, and budesonide nasal spray twice daily. Nasal endoscopy, sinus CT examination, and pre-operative examination were completed, and unqualified cases were excluded.

Surgical treatment

The surgeries were performed under general anesthesia with endotracheal intubation and intermittent positive pressure ventilation. Experienced surgeons opened each sinus based

on actual conditions of the nasal cavity, clearing diseased tissues and eliminating obstructive factors such as correcting deviated nasal septum, removing pneumatized middle turbinate, and addressing nasal polyps. Intra-operatively, efforts were made to minimize trauma and preserve the normal structure of the nasal mucosa. Gelatin sponge (Nanjing Jinling Pharmaceutical Factory, China, size 6 cm × 2 cm × 0.5 cm) and expanded sponge (Jiande Kanghua Medical Device Co., Ltd., Jiande, China) were filled according to specific conditions of the surgical cavity post-operation. Following filling, patients in two groups were injected with 4 mL budesonide suspension (AstraZeneca Pharmaceutical Co., LTD., Shanghai, China) and 4 mL normal saline on each side of the expanded sponge.

Post-operation

All patients received routine treatment, and nasal packing was removed within 48 h after surgery. Study group received nasal irrigation with budesonide suspension, twice daily for three months. Control group received nasal irrigation with normal saline, twice daily for three months.

Evaluation of parameters/indices

Visual analogue scale (VAS)

Subjective condition assessment was carried out using the visual analogue scale (VAS) [13] at admission, 1 week, 1 month, 2 months, and 3 months after surgery (Table 1). Clinical manifestation was classified as painless (a score of 0), slight pain which patients may tolerate (score of 1 - 3), pain affecting sleep which patients may tolerate (score of 4 - 6), and unbearable pain affecting sleep (score of 7 - 10). Patients were asked to score and record nasal congestion, nasal discharge, nasal itching, sneezing, cough, nasal and facial pain, and anosmia.

Lund-Kennedy evaluation

Lund-Kennedy evaluation table [14] was adopted to observe the surgical cavity under nasal endoscopy for objective scoring, and the total bilateral score was recorded (Table 2) before surgery. Scores were also recorded at 1 week, 1 month, 2 months, and 3 months after surgery (Table 1).

Pre-operative paranasal sinus CT scan

Pre-operative paranasal sinus CT scan was carried out, and the Lund-Mackay scoring system was used for assessment (Table 2).

Bleeding

The bleeding situation during removal of packing within 48 h after the operation was recorded. Nasal bleeding was classified with a semi-quantitative system as mild bleeding (+), indicating a small amount of oozing when removing the expanded sponge, which did not require treatment or stopped with simple compression; moderate bleeding (++), indicating more bleeding when removing the packing, which could not be stopped with simple compression and required temporary packing of the middle or total nasal cavity with 1 % ephedrine cotton pads; severe bleeding (+++), referring to active bleeding that persisted after temporary packing with cotton pads and required re-packing with delayed removal. Presence or absence of nasal malodor in patients was assessed one week after review using reports from both patients and others.

Table 1: Lund-Kennedy nasal endoscopic scale

Physical sign	Score		
	0	1	2
Polyps (left/right)	None	There was a polyp only in the middle meatus	The polyp extended beyond the middle nasal meatus
Edema (left/right)	None	Mild	Severe
Rhinorrhea (left/right)	None	Clear and thin	Thick and purulent
Scar (left/right)	None	Mild	Severe
Crusting (left/right)	None	Mild	Severe

Table 2: Lund-Mackay CT score table

Tissue	Score		
	0	1	2
Sinus (left/right)	No abnormalities	Partial turbidity	Completely cloudy
Ostiomeatal complex (left/right)	No blockage	Partial blockage	Completely clogged

Statistical analysis

Statistical analysis was performed using SPSS version 22.0 (IBM, Armonk, NY, USA). Descriptive statistics for continuous variables were presented as mean ± standard deviation (SD). Independent sample *t*-tests were used for comparisons between two groups, and one-way analysis of variance (ANOVA) was employed for comparisons among multiple groups. Post-hoc pairwise comparisons following ANOVA were conducted using *q*-test. $P < 0.05$ was considered statistically significant.

RESULTS

Baseline characteristics

There was no significant difference in baseline characteristics between study and control groups ($p > 0.05$; Table 3).

Table 3: Basic information of patients

Characteristic	Study group	Control	*P*-value
Male	28	24	0.178
Female	22	26	0.142
Age (years)	44.3±7.6	45.8±8.1	0.075
Course of disease (years)	6.4±1.2	6.6±1.4	0.092
CT score	13.2±1.3	12.9±1.6	0.183

Pain analysis of patients

There was no significant difference in VAS scores between the two groups before surgery ($p > 0.05$). However, the study group had significantly lower VAS scores for nasal congestion (Figure 1), runny nose (Figure 2), nasal itching (Figure 3), sneezing (Figure 4), and nasal pain (Figure 5) at 1 week, and 1 month after surgery compared to control group. At two and three months after surgery, there was no significant difference in VAS scores in the two groups ($p > 0.05$).

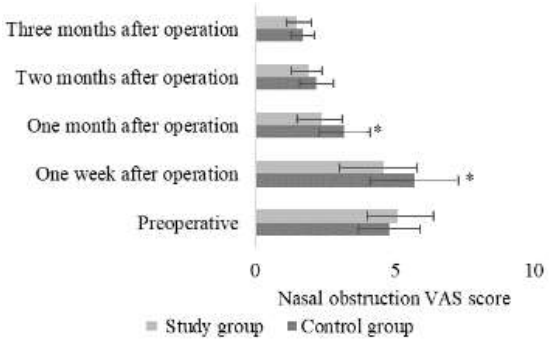

Figure 1: Nasal congestion in study and control groups. *$P < 0.05$ vs. study group

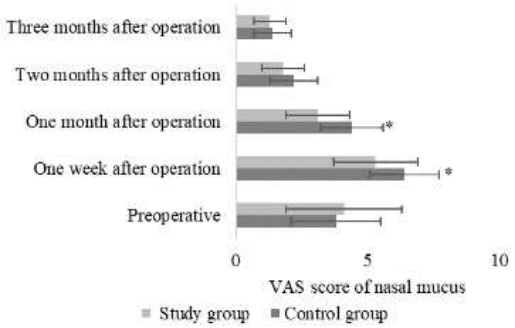

Figure 2: Nasal discharge in both study and control groups. *$P < 0.05$ vs. study group

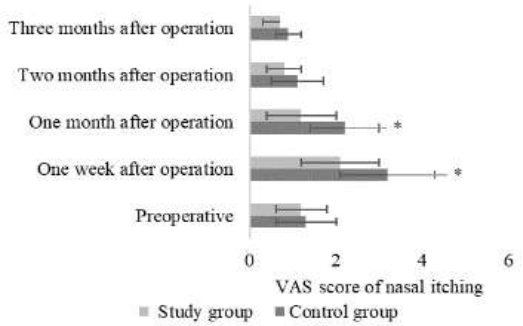

Figure 3: Nasal itching in study and control groups. *$P < 0.05$ vs. study group

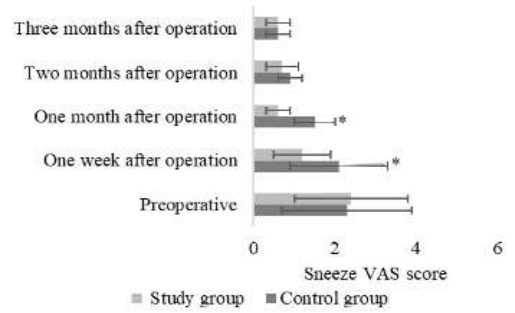

Figure 4: Sneezing in study and control groups. *$P < 0.05$ vs. study group

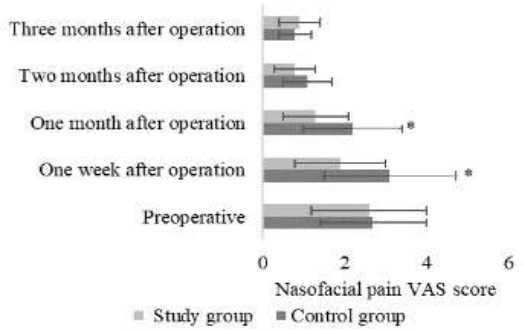

Figure 5: Nasal pain in study and control groups. *$P < 0.05$ vs. study group

Analysis of endoscopic evaluation of patients

The results of the nasal endoscopy Lund-Kennedy scores showed no significant difference between the two groups (p > 0.05) before surgery. At one week and one month after surgery, Lund-Kennedy score was significantly lower in study group compared to control group (p < 0.05; Figure 6).

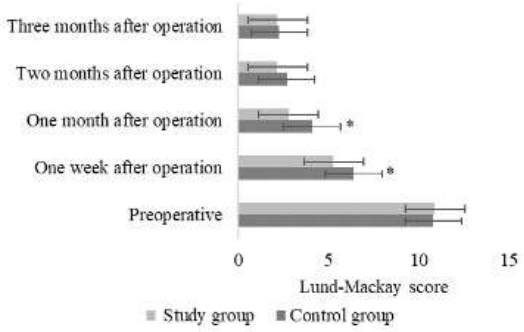

Figure 6: Lund-Kennedy scores of study and control groups. *P < 0.05 vs. study group

Analysis of postoperative tamponade removal in patients

After removal of the packing in the study group, 30 patients had minor bleeding, 16 had moderate bleeding, and 4 had significant bleeding. In the control group, 28 patients had minor bleeding, 18 had moderate bleeding, and 4 had significant bleeding. There was no significant difference between the two groups (p > 0.05) (Figure 7).

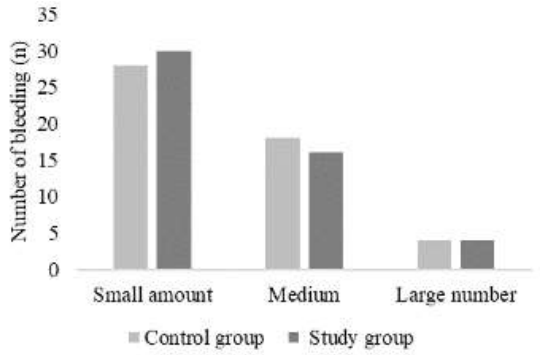

Figure 7: Degree of bleeding in study and control groups

Post-operative nasal odor of patients

One week after surgery, 7 cases (14 %) in study group and 9 cases (18 %) in control group experienced nasal malodor. There was no significant difference between the two groups (p > 0.05) (Figure 8).

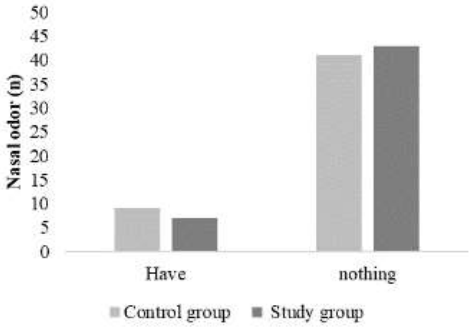

Figure 8: Incidence of nasal odor

DISCUSSION

Chronic rhinosinusitis (CRS) is a common chronic condition in otolaryngology. Many patients have experienced intermittent treatments but still struggle with the condition. Currently, for patients who do not respond to conservative treatment, FESS is often employed. However, prolonged postoperative mucosal recovery intervention is equally vital for the disease outcome [15]. Even though the surgical methods have become more and more conservative and surgery is now minimally invasive, complete avoidance of local discomfort in the nasal cavity after surgery remains challenging. Regarding postoperative packing, a study suggested that to some extent, avoiding packing after surgery alleviates subjective discomfort in patients [16]. However, its applicability is mainly focused on surgeries involving opening of a single or a small number of sinuses.

There is a diverse range of materials used for local packing, each with its advantages and disadvantages. Considering factors such as applicability, cost, convenience, and effectiveness, expandable sponges are currently widely utilized in practice. The pliability, solubility, and ability to serve as a locally-sustained release carrier of gelatin sponge, combined with the even pressure, water retention, and hemostatic properties contribute to the effective local action of medications over time. Therefore, these two kinds of personalized packing materials were used in postoperative packing in this study based on the local sustained release of the different drugs adopted. The postoperative nasal application of local glucocorticoids is widely recognized as a safe and effective approach. However, it is not without side effects. When applied conventionally to the nasal cavity, the drug may not distribute uniformly, and duration of action may be relatively insufficient, preventing the medication from exerting a sustained therapeutic effect on the nasal mucosa.

This study revealed that, compared to control group, patients in the study group demonstrated significantly faster recovery in postoperative nasal congestion symptoms. This is likely attributed to the vasoconstrictive effects of budesonide, which alleviates congestion by stabilizing the microvascular endothelial barrier, reducing permeability, and mitigating inflammatory reactions. These effects improve symptoms such as nasal itching and sneezing in patients. Zhao *et al* [17] combined endoscopic sinus surgery with budesonide, and found that it effectively improves clinical symptoms, reconstructs nasal cavity function, and improves the level of inflammation. The Lund-Kennedy score of nasal endoscopy in the control group was significantly higher compared to study group.

Studies have also shown that large amounts of budesonide irrigation are safe and superior to saline irrigation, which effectively alleviates symptoms, and decreases intranasal score, which is consistent with this current finding [18]. Relevant studies have found that postoperative epistaxis is not only related to local vasoconstriction and mucosal necrosis but also may be correlated with nasal spray head contact [19]. The results of this study revealed that there was no significant difference in nasal bleeding between budesonide and the normal saline groups when the postoperative tamponade was removed. Considering that the local tamponade plus budesonide had less risk of bleeding and lower systemic bioavailability, there was no systemic side effect of local application. Furthermore, control group had more patients with nasal odor one week after surgery. This was likely because the nasal malodor is associated with postoperative early local blood clot obstruction, leading to local hypoxia. Budesonide does not have a direct bactericidal effect against anaerobic bacteria, hence, its effectiveness in this regard is similar to that of saline solution.

Limitations of this study

The sample size included in this study is relatively small, and it remains unknown whether different doses of budesonide irrigation would lead to different intervention effect.

CONCLUSION

Postoperative irrigation with budesonide suspension effectively relieves early postoperative nasal symptoms, reduces postoperative nasal mucosal inflammation, and improves the prognosis of patients with CRS compared to physiological saline. Further studies are required to establish the effect of different doses of budesonide.

DECLARATIONS

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None provided.

Ethical approval

This study was approved by the Ethics Committee of Shanghai Ninth People's Hospital (approval no. SN-021).

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

No conflict of interest associated with this work.

Contribution of Authors

The authors declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by them.

REFERENCES

1. *Awan NU, Cheema KM, Naumeri F, Qamar S. Allergic fungal rhino-sinusitis frequency in chronic rhino-sinusitis patients and accuracy of fungal culture in its diagnosis. Pak J Med Sci 2020; 36(3): 555-558.*
2. *Alshoabi SA, Binnuhaid AA, Gameraddin MB, Alsultan KD. Histopathological analysis of sinonasal lesions associated with chronic rhinosinusitis and comparison*

with computed tomography diagnoses. Pak J Med Sci 2020; 36(2): 146-150.

3. *Wang M, Wang B, Wang L, Yan Y, Wang Q, Chang K. Research progress on quality of life in patients with chronic rhino sinusitis. Lin Chuang Er Bi Yan Hou Tou Jing Wai Ke Za Zhi 2021; 35(1): 84-87.*
4. *Ma S, Lei X, Tu J, Tian C, Lian G, Li W, Wang D. Effect of glucocorticoid infiltration on CRSwNP after endoscopic sinus surgery and the curative efficacy of nasal ventilation function and mucociliary clearance. Am J Transl Res 2021; 13(4): 3826-3832.*
5. *Zhang L, Zhang Y, Gao Y, Wang K, Lou H, Meng Y, Wang C. Long-term outcomes of different endoscopic sinus surgery in recurrent chronic rhinosinusitis with nasal polyps and asthma. Rhinol 2020; 58(2): 126-135.*
6. *Thanneru M, Lanke S, Kolavali S. The effectiveness of budesonide nasal irrigation after endoscopic sinus surgery in chronic allergic rhinosinusitis with polyps. Indian J Otolaryngol 2020; 72(3): 350-354.*
7. *Desjarlais EB, Jovanovic N, Teo H, Kahana A. Surgical management of a recurrent orbit-eroding mucocele associated with frontal-ethmoidal sinus inverted papilloma. Ophthal Plast Recons 2019; 35(6): e136-e138.*
8. *Li S, Ye M, Wang X. Evaluation of propofol and remifentanil combination for controlled hypotension during anesthesia in pediatric nasal endoscopic surgery. Trop J Pharm Res 2024; 23(2): 363-369. doi: 10.4314/tjpr.v23i2.16*
9. *Rudy SF, Kandathil C, Spataro EA, Moubayed SP, Most SP. Effect of nasal steroids on nasal obstruction in septal deviation: A double-blind randomized controlled trial. Facial Plast Surg Ae 2020; 22(4): 243-248.*
10. *Zhang L, Yu X, Wang J, Lu L, Shi Q. Effects of different dosages of oral glucocorticoids on short-term recovery and recurrence of eosinophilic chronic rhinosinusitis with nasal polyps. Lin Chuang Er Bi Yan Hou Tou Jing Wai Ke Za Zhi 2021; 35(9): 796-801.*
11. *Xu Z, Luo X, Xu L, Deng J, Gao W, Jiang L, Huang Z, Shi J, Lai Y. Effect of short-course glucocorticoid application on patients with chronic rhinosinusitis with nasal polyps. World Allergy Organ 2020; 13(6): 100131.*
12. *Talat R, Gengler I, Phillips KM, Caradonna DS, Gray ST, Sedaghat AR. Chronic rhinosinusitis outcomes of patients with aspirin-exacerbated respiratory disease treated with budesonide irrigations: A Case Series. Ann Oto Rhinol Laryn 2022; 131(10): 1130-1136.*
13. *Vieira RJ, Pham-Thi N, Anto JM, Czarlewski W, Sa-Sousa A, Amaral R, Bedbrook A, Bosnic-Anticevich S, Brussino L, Canonica GW, et al. Academic Productivity of Young People With Allergic Rhinitis: A MASK-air Study. J Aller Cl Imm-Pract 2022; 10(11): 3008-3017.*
14. *Wang M, Zhou B, Li Y, Cui S, Huang Q. Radical versus functional endoscopic sinus surgery for osteitis in chronic rhinosinusitis. Orl J Oto-Rhino-Lary 2021; 83(4): 234-241.*
15. *Shipman P, Highland J, Witt B, Alt J. Non-invasive fungal sinusitis as a complication of a steroid-eluting stent following endoscopic sinus surgery: A case report. Ann Oto Rhinol Laryn 2022; 131(6): 678-682.*
16. *Qu J, Ma J, Zhou B, Huang Q, Huang Z, Wang M, Li C, Xiao N, Chen H. Efficacy and safety of pulmicort repulas-impregnated nasal dressing following endoscopic sinus surgery: a randomized, single-blind, placebo-controlled study. Lin Chuang Er Bi Yan Hou Tou Jing Wai Ke Za Zhi 2020; 34(6): 541-545.*
17. *Zhao Y, Jiang C, Wu Q, Shi R. Effects of endoscopic sinus surgery combined with budesonide treatment on nasal cavity function and serum inflammatory factors in patients with chronic sinusitis. J Healthc Eng 2022; 2022: 4140682.*
18. *Kothiwala M, Samdani S, Grover M, Gurjar V. Efficacy of topical high volume budesonide nasal irrigation in post FESS patients of chronic rhinosinusitis with or without nasal polyposis. Indian J Otolaryngol 2022; 74(2): 1399-1407.*
19. *Laskaris S, Georgiou S, Cingi C, Alevizopoulos K. Efficacy and safety of a hypertonic nasal wash solution containing sea algae extracts in patients that underwent surgical correction of a deviated nasal septum and radiofrequency turbinate volume reduction. Eur Rev Med Pharmaco 2022; 26(2): 38-48.*