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Original Article

Effect of glucocorticoids infiltration on CRSwNP after endoscopic sinus surgery and the curative efficacy of nasal ventilation function and mucociliary clearance

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Abstract: Objectives: This study investigated and analyzed the effects of glucocorticoid infiltration on chronic rhinosinusitis with nasal polyps (CRSwNP) after endoscopic sinus surgery (ESS) and its curative efficacy on nasal ventilation function and mucociliary clearance (MCC). Methods: 126 CRSwNP patients admitted to the hospital from March 2018 to May 2020 were enrolled and randomly divided into observation group (n=65) and control group (n=61) based on random number table. The control group received ESS, and the observation group was given glucocorticoids treatment after ESS. The changes of nasal ventilation function, MCC and quality of life between the two groups of patients before and after treatment were compared. Results: The overall effective rate of clinical therapy was critically higher in observation group than in control group (*P<0.05*). In addition, NMCA and NCV in observation group were critically higher than those in control group (*P<0.05*), and nasal airway resistance (NAR) in observation group was notably lower than that in control group (*P<0.05*). In addition, the Saccharin removal time in observation group after treatment was remarkably lower than that in control group (*P<0.05*), while the speed and rate of MCC were critically higher than those in control group (*P<0.05*). Finally, the scores of each dimension of WHOQOL-100 scale in two groups of subjects after treatment were critically higher than those before treatment (*P<0.05*), and the scores in observation group were notably higher than those in control group (*P<0.05*). Conclusion: The treatment of glucocorticoid infiltration on CRSwNP after ESS can effectively improve the curative effect. It improves the patient's function of nasal ventilation and MCC, thus beneficial to promoting the sufferers' living quality and is worthy of clinical promotion.

Keywords: Nasal endoscopy, glucocorticoids, chronic sinusitis with nasal polyps (CRSwNP), curative effect

Introduction

Chronic sinusitis with nasal polyp (CRSwNP) is a common disease in otolaryngology head and neck surgery [1, 2]. Most CRSwNP patients were accompanied by clinical symptoms such as hypoosmia, headache, dizziness, suppurative nasal discharge, nasal congestion, etc., and had unclear root nasal polyps and hyperplasia of nasal mucosa, which affected the nasal sphenoid and ethmoid mucosa [3, 4]. The histopathological features of patients were primarily the eosinophilic infiltration of mucosa [5]. The development of nasal endoscopy in recent years has greatly improved the curative rate of the disease [6], and the functional nasal endoscopy is currently the most common and effective surgical method in treating chronic sinusitis [7]. While achieving the removal of lesions, endoscopic sinus surgery could impose less damage to the basic structure of the nasal cavity and paranasal sinuses, thus protecting the basic functions of the nasal cavity and paranasal sinuses to the maximum extent [8]. However, as the emergence and progression of chronic sinusitis are affected by a variety of factors and jointly led by multiple results, sole surgical treatment cannot reach the curative effect completely [9]. Therefore, the comprehensive treatment of the disease should be adopted. As glucocorticoids have inhibitory effect on inflammatory cytokines, the adoption of which in treating CRSwNP can effectively inhibit the inflammatory response around the patient's diseased tissues, thus improving the edema of mucosal tissues. In order to further

improve the therapeutic efficacy of CRSWNP, this study investigated and analyzed the effect of glucocorticoid infiltration on CRSwNP after ESS, and its efficacy on nasal ventilation function and MCC of the patients.

Material and methods

Clinical materials

126 CRSwNP patients admitted to the hospital from March 2018 to May 2020 were enrolled and randomly divided into observation group (n=65) and control group (n=61) based on random number table. The study obtained the approval from the hospital's ethics committee.

Inclusion/exclusion criteria

Inclusion criteria: (1) Patients had clinical symptoms such as runny nose, nasal congestion, rhinodynia, and headache, with the symptoms duration ≥12 weeks and the medicine treatment ≥4 weeks which was ineffective; (2) Endoscopic examination showed enlargement of mucosa of inferior and middle turbinate, and middle meatus, and the obstruction of nasal meatus. CT examination indicated changes of single or multiple sinus mucosa; (3) Patients aged ≥18 years; or (4) Patients had voluntarily signed the informed consent forms.

Exclusion criteria: (1) Patients with other diseases such as hypertension or diabetes; (2) Patients with nasal allergy; (3) Patients with contraindications to the medicine used and the surgical treatment; or (4) Patients with diseases of hemangioma or papilloma.

Methods

All patients enrolled received routine examinations and basic treatments before surgery, including chest X-ray, electrocardiogram, blood routine, lipid, blood glucose, function of liver and kidney, and other routine checks. After operation, they were given with treatments of anti-infection, nasal douche, maintenance of electrolytes and acid-base balance. The inner diameter surgery was adopted for the control group. During the operation, the subjects were placed in supine position, provided with general anesthesia and removed of the polyp tissues by Messerklinger. The patient's uncinate process was removed according to the disease conditions, and part or entire group of sinus cavities were opened. The pathogenic microorganisms, the metabolites in sinus cavity, and ostium of patients were removed, and the normal structure was not damaged as much as possible, while the recoverable mucosa was retained. After operation, the cavity was filled with absorbent cotton and macromolecule expansive sponge for hemostasis, and the polymer expanded sponge was removed 2 days later.

The observation group was given glucocorticoid infiltration treatment on the basis of the above treatment. The budesonide suspension (CTTQ PHARMA H20203063) was added to the absorbent cotton and macromolecule expansive sponge for filling. After the removal of tamponade, Budesonide Nasal Spray (Johnson & Johnson (Shanghai) Pharmaceutical Co., LTD., J20180023) was injected to the nasal cavity for local treatment. The patients were treated once a day for 3 months.

Evaluation of clinical efficacy

The classifications of clinical curative effect, referred to the literature standard, were as follows:

Highly efficacious: The patient's clinical symptoms disappeared, the nasal endoscopy showed that the sinus was open, the operative cavity was epithelialized, and purulent secretions disappeared. Efficacious: The clinical symptoms of patient basically disappeared, and the nasal endoscopy showed that the sinus orifice was not completely opened. In addition, most of the operative cavity was epithelialized, but there were a few purulent secretions and granulation or hypertrophic tissue formation. Invalid: The patient's clinical symptoms did not improve or even worsened. Nasal endoscopy showed adhesions in operation cavity or sinus atresia, and large purulent secretions. The overall effective rate = (highly efficacious + efficacious)/total number of cases × 100%.

Index observation

The primary observational indexes included nasal ventilation function and MCC, and the secondary observational index was the score of life quality. The specific observations were as follows:

Table 1. Comparison of baseline data between the two groups

Group	Number of Cases	Gender		Age (years, $\bar{x}$ ± sd)	Course of disease (years, $\bar{x}$ ± sd)	Classification of nasal polyps	
		Male	Female			I~II	III~IV
The observation group	65	31	34	35.97±3.89	6.95±2.33	36	29
The control group	61	30	31	36.41±4.22	7.27±1.95	35	26
t/x^2	-	0.028		0.609	0.833	0.051	
P	-	0.867		0.544	0.406	0.822	

Table 2. Comparison of clinical efficacy between the two groups [n (%)]

Group	Number of Cases	Highly efficacious	Efficacious	Invalid	The overall effective rate (%)
The observation group	65	34 (52.31)	27 (41.54)	4 (6.15)	93.85
The control group	61	23 (37.70)	27 (44.26)	11 (18.03)	81.97
x^2	-	-	-	-	4.234
P	-	-	-	-	0.040

(1) Comparison of nasal ventilation. The minimum cross-sectional area of the nasal cavity (NMCA), nasal cavity volume (NCV), and the distance from the minimum cross-sectional area of the nasal cavity to the anterior nostril (DCAN) were measured by nasal acoustic reflectometer before and after the treatment, and nasal resistance was measured by anterior nasal pressure gauge.

(2) Comparison of nasal mucociliary clearance (MCC). The saccharin clearance time, speed and rate of mucociliary clearance were measured by saccharin experiment.

(3) Comparison of scores of living quality. Whoqol-100 scale was adopted to evaluate the living quality of patients before and after treatment [10]. The scale contained 6 dimensions with independence ability, social relationship, body function, emotional state, psychological state and living environment. The range of each dimension was 0-100 points, and the higher the score, the better the living quality of patients.

Statistical analysis

Data processing and analysis were carried out by statistical software SPSS 23.0. The independent sample *t*-test was used for comparison of measurement data between the groups, and paired sample *t*-test was used for comparison of measurement data before and after surgery within the group. The comparison of enumeration data was done by x^2 test. The statistical significance was accepted by *P<0.05*.

Results

Comparison of baseline information

There was no significant difference in the baseline information between the two groups of subjects (*P>0.05*), as shown in **Table 1**.

Comparison of clinical efficacy

The overall effective rate of the observation group (93.85%) was remarkably higher than that of the control group (81.97%) (*P<0.05*), as shown in **Table 2**.

Comparison of nasal ventilation

NMCA and NCV of the two groups of subjects after treatment were critically higher than those before treatment (*P<0.05*), and the nasal resistance decreased remarkably compared to that before treatment (*P<0.05*). In addition, the indexes of NMCA and NCV in observation group were critically higher than those in control group (*P<0.05*), and nasal resistance in observation group was notably lower than that in control group (*P<0.05*), as shown in **Table 3**.

Comparison of MCC

The saccharin removal time of the two groups of subjects after treatment was dramatically lower than that before treatment (*P<0.05*), and the speed and rate of MCC in the two groups increased remarkably compared to those be-

Table 3. Comparison of nasal ventilation between the two groups before and after treatment ($\bar{x}$ ± sd)

Group	Time	DCAN (cm)	NMCA (cm^2)	NCV (cm^3)	Nasal resistance/ [kPa/(s·L)]
The observation group (n=65)	Pre-treatment	1.78±0.21	0.48±0.07	11.68±0.77	2.84±0.60
	Post-treatment	1.71±0.26	0.60±0.09*,#	12.83±0.95*,#	1.98±0.44*,#
	t	1.689	8.485	7.582	9.319
	P	0.094	0.000	0.000	0.000
The control group (n=61)	Pre-treatment	1.76±0.19	0.45±0.08	11.72±0.79	2.81±0.56
	Post-treatment	1.69±0.28	0.54±0.07*	12.42±0.63*	2.31±0.32*
	t	1.618	6.613	5.412	6.055
	P	0.109	0.000	0.000	0.000

Note: *$P<0.05$, compared with before treatment; #$P<0.05$, compared with the control group.

Table 4. Comparison of MCC function between two groups before and after treatment ($\bar{x}$ ± sd)

Group	Time	Saccharin removal time (min)	Speed of MCC (mm/min)	Rate of MCC (%)
The observation group (n=65)	Pre-treatment	35.74±3.10	3.48±0.61	45.97±6.42
	Post-treatment	27.20±2.84*,#	5.25±0.55*,#	62.37±7.48*,#
	t	16.377	17.374	13.414
	P	0.000	0.000	0.000
The control group (n=61)	Pre-treatment	35.18±2.77	3.51±0.70	45.37±5.83
	Post-treatment	30.22±3.58*	4.89±0.47*	57.69±6.94*
	t	8.552	12.783	10.616
	P	0.000	0.000	0.000

Note: *$P<0.05$, compared with that before treatment; #$P<0.05$, compared with the control group.

Table 5. Comparison of living quality between the two groups before and after treatment (points, $\bar{x}$ ± sd)

Group	Time	Independence Ability	Social Relationship	Body function	Emotional State	Psychological State	Living Environment
The observation group (n=65)	Pre-treatment	55.74±6.48	52.83±5.60	54.03±5.77	51.82±5.44	52.07±6.13	58.46±4.76
	Post-treatment	75.60±7.58*,#	76.94±7.94*,#	75.27±7.66*,#	80.93±8.42*,#	76.93±6.75*,#	79.86±7.33*,#
		16.056	20.006	17.856	23.412	21.981	19.741
		0.000	0.000	0.000	0.000	0.000	0.000
The control group (n=61)	Pre-treatment	56.28±7.32	53.02±6.12	54.63±5.89	51.64±6.03	53.18±6.44	59.75±6.98
	Post-treatment	67.39±8.33*	70.22±4.53*	68.42±7.05*	71.26±8.11*	69.84±6.02*	71.64±7.25*
		7.825	17.643	11.724	15.163	14.760	9.227
		0.000	0.000	0.000	0.000	0.000	0.000

Note: *$P<0.05$, compared with prior-treatment; #$P<0.05$, compared with the control group.

fore treatment ($P<0.05$). In addition, the saccharin removal time in observation group after treatment was remarkably lower than that in control group ($P<0.05$), while the speed and rate of MCC were critically higher than those in control group ($P<0.05$), as shown in **Table 4**.

Comparison of living quality

The scores of each dimension of WHOQOL-100 scale in two groups of subjects after treatment were critically higher than those before treatment ($P<0.05$), and the scores in observation group were notably higher than those in control group ($P<0.05$), as shown in **Table 5**.

Discussion

There are many factors that cause formation of nasal polyps and chronic sinusitis [11]. Based on the previous therapeutic experience, the use of antibacterial medicine can impose a cer-

tain therapeutic effect on sinusitis, but it is not obvious [12-14]. With the development of modern medical technology, endoscopic sinus surgery has been widely used in the treatment of sinusitis [15]. The operation can correct the abnormal structures that affect the ventilation and drainage of the nasal cavity and sinuses, remove the irreversible lesions, and retain the structure and the recoverable mucosa as much as possible [16-18]. Nasal endoscopic surgery has the superiorities of wide surgical field, multiple angles and strong light conductivity, which can be carried out under direct vision [19]. The surgeon can magnify the diseased tissue 500 times to make the diseased area more clearly visible, facilitating the implementation of precise surgery, thereby improving the treatment effect [20]. Many studies have shown that the treatment of CRSwNP by nasal endoscopic surgery has tangible connections, which can improve the ventilation of the nasal cavity and sinuses by removing the diseased tissues [21, 22].

However, patients with CRSwNP after ESS are prone to mucosal edema and increased cellulose secretion due to the presence of wounds, which may lead to the re-blocked of sinus mouth. Such inflammatory reaction usually occurs within one week and become the primary reason for the prolonged disease after endoscopic nasal surgery [23]. Therefore, scholars have proposed that effective control of the inflammatory response of surgery can improve the treatment effect of the disease [24]. The application of glucocorticoids in this field has attracted increasing attention from scholars, and is believed to be able to effectively relieve mucosal edema and excessive cellulose secretion [25]. Glucocorticoid has a crucial anti-infection effect, which can be achieved by inhibiting the activity of immune cells and reducing the release of inflammatory mediators [26]. Meanwhile, it can also promote vasoconstriction, reduce vascular permeability, and relieve mucosal congestion and edema [27]. Therefore, the application of glucocorticoids postoperatively is considered to be an effective response to the inflammatory reaction caused by wound injury after endoscopic sinus surgery [28]. This study investigated and analyzed the effects of glucocorticoid infiltration on chronic rhino-sinusitis with nasal polyps (CRSwNP) after ESS and its curative efficacy on nasal ventilation and MCC.

The research findings suggested that the overall effective rate of clinical therapy was critically higher in observation group than in control group, and the improvement of nasal ventilation and MCC of the observation group were critically superior to those of the control group. The combinative use of glucocorticoids after ESS was similar to the results reported by other scholars, which can effectively improve patients' clinical symptoms, accelerate postoperative recovery, and improve nasal ventilation and MCC of them [29]. The possible mechanism is considered that Budesonide exerts a corresponding anti-inflammatory effect after surgery, inhibits the secretion of inflammatory cytokines, and thus effectively alleviating symptoms such as nasal obstruction. The inflammatory reaction around the lesions, however, can not only reduce the olfactory function of CRSwNP patients, but may also lead to the dysfunction of MCC and aggravation in secretions, nasal obstruction and other symptoms [30]. Moreover, dimension scores of WHOQOL-100 scale in two groups of subjects after treatment were critically higher than those before treatment, and the scores in observation group were notably higher than those in control group. This suggested that the combination of ESS and glucocorticoid infiltration can effectively improve the clinical symptoms of patients and help improving their living quality.

The results of this study, which was similar to those reported by other scholars [31], reveals that the possible mechanism is that the application of glucocorticoids can help reducing the release of postoperative inflammatory mediators. Meanwhile, it promotes the patients' vasoconstriction, reduce vascular permeability, mucosal congestion and edema, thereby promoting the recovery of postoperative nasal function, and improving the clinical symptoms and quality of life in patients.

Although the results of this study illustrated the superiorities of combinative application of glucocorticoids after ESS, the sample size included in this study was limited, and no in-depth analysis of the specific mechanism of glucocorticoids was conducted.

To conclude, the treatment of glucocorticoid infiltration on CRSwNP after ESS can effectively improve the curative effect. It improves the patient's function of nasal ventilation and MCC,

thus beneficial to promoting the sufferers' living quality and is worthy of clinical promotion.

Disclosure of conflict of interest

None.

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