

Received: 2016.07.05
Accepted: 2016.07.22
Published: 2017.02.28

Risk Factors of Chronic Rhinosinusitis After Functional Endoscopic Sinus Surgery

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Source of support: Departmental sources

Background: Clinical data of 288 chronic rhinosinusitis patients were retrospectively analyzed to investigate the risk factors of clinical prognosis, aiming to provide clinical evidence for the diagnosis and treatment of chronic rhinosinusitis.

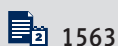
Material/Methods: A total of 288 patients diagnosed with chronic rhinosinusitis in the Department of Otolaryngology of the First Affiliated Hospital of Xinjiang Medical University were recruited. Among all participants, 177 were male and 111 were female, aged from 22 to 83 years, (52±14) years on average. Subsequent follow-up was conducted to evaluate surgical efficacy. Influencing factors of clinical prognosis were analyzed by univariate and multivariate logistic regression analyses.

Results: After functional endoscopic sinus surgery by Messerklinger technique, 187 (64.9%) patients were fully recovered, 72 (25.0%) presented with improvement, and 28 (10.1%) were untreated. Univariate logistic regression analysis revealed that 11 variables were correlated with the clinical prognosis of chronic rhinosinusitis. Multivariate logistic regression analysis demonstrated that age, history of allergic rhinitis, severity of dysosmia, history of nasosinusitis surgery, and long-term use of nasal decongestant were the risk factors, whereas comprehensive therapy after surgery was a protective factor.

Conclusions: More emphasis should be placed upon the factors associated with the clinical prognosis of patients with chronic rhinosinusitis following undergoing endoscopic sinus surgery, offering consolidated evidence for the prevention and treatment of chronic rhinosinusitis.

MeSH Keywords: **Endoscopy • Paranasal Sinus Diseases • Prognosis • Risk Factors**

Full-text PDF: <http://www.medscimonit.com/abstract/index/idArt/900421>



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Background

Chronic rhinosinusitis describes a variety of chronic inflammatory conditions of the nasal mucosa and paranasal sinuses accompanied by stuffy nose, rhinorrhea, dizziness, headache, and alternative symptoms [1]. Chronic rhinosinusitis is not only regarded as one of the most common chronic diseases in developed countries, but also imposes a substantial negative effect upon patient quality of life, daily work, and healthcare expenditure [2–4]. Along with the widespread application of endoscopic sinus surgery, the success rate of chronic rhinosinusitis surgery has been dramatically improved [5]. However, the risk factors affecting the clinical prognosis of chronic rhinosinusitis patients remain elusive. Maintaining and improving the clinical prognosis of chronic rhinosinusitis after endoscopic sinus surgery remains the focus of physicians. To resolve this challenge, clinical and epidemiological data of 288 patients diagnosed with chronic rhinosinusitis were retrospectively analyzed in the present clinical trial, aiming to identify risk factors affecting the clinical prognosis of chronic rhinosinusitis patients undergoing endoscopic sinus surgery.

Material and Methods

Baseline data

A total of 288 patients diagnosed with chronic rhinosinusitis undergoing endoscopic sinus surgery in the Department of Otolaryngology of the First Affiliated Hospital of Xinjiang Medical University were recruited as study subjects according to strict diagnostic criteria [6]. Exclusion criteria were: those with nasal papilloma, acute nasosinusitis, chronic paranasal sinus fungus disease, acute episode of chronic rhinosinusitis, and paranasal sinus malignant tumors. Eventually, 288 patients, who were diagnosed with chronic rhinosinusitis in the Department of Otolaryngology of the First Affiliated Hospital of Xinjiang Medical University, were recruited. Among all participants, 177 were male and 111 were female, aged from 22 to 83 years, (52 ± 14) years. The duration of disease ranged from 1 to 22 years, with a mean duration of $6.2 (\pm 1.9)$ years.

Surgical procedures

Prior to formal surgery, all patients received a computed tomography (CT) scan of the nose and nasal endoscopic examination to observe the intranasal morphology. Anti-inflammation and hormone medications were administered before surgery. All surgical procedures were accomplished by chief physicians under general anesthesia. Messerklinger technique was used in all cases. For patients with deviation of nasal septum, septoplasty was simultaneously performed to straighten the nasal septum along with endoscopic sinus surgery. Postoperatively, all patients were administered nasal decongestant, antibiotics,

and glucocorticoid. Subsequent follow-up was conducted for 10 months to 3 years. Informed consent was obtained from all patients prior to functional endoscopic sinus surgery.

Relevant variables

The factors probably affecting the clinical prognosis included age, sex, smoking, drinking alcohol, history of asthma, allergic rhinitis and nasosinusitis, accompanied by nasal polyp, nasal septum deviation, severity of diseases, severity of dysosmia, duration of nasal hormone use, duration of comprehensive treatment after surgery, and long-term use of nasal decongestant.

Efficacy evaluation

Healing was defined as alleviation of all clinical symptoms; the opening of the ostia was achieved; and epithelization was observed in the mucosa of sinus cavity, but no purulent secretion was observed. Treatment was regarded as effective when relevant symptoms were significantly mitigated; thickening, edema, and granulation tissue formation were documented in the mucosa of sinus cavity, and a slight quantity of purulent secretion was noted. Treatment was regarded as ineffective when clinical symptoms were not evidently alleviated; sinus cavity adhesion occurred after surgery; the opening of ostia was small and even closed; and signs of nasal polyp and purulent secretion were documented. The patients who were fully healed were assigned into the recovery group, and the others who presented with improvement and inefficacy were allocated into the untreated group.

Statistical analysis

All data were analyzed using SPSS 19.0 statistical software (SPSS Inc., Chicago, IL). Univariate and multivariate logistic regression analyses were used to identify the risk factors affecting the clinical prognosis of patients with chronic rhinosinusitis. The association between risk factors and the incidence of chronic rhinosinusitis was analyzed by Wald test. A *P* value of less than 0.05 was considered as statistically significant.

Results

CT scan findings

We used the Lund-McKay CT scoring system [7] to evaluate the opacification degree of the sinuses and ostiomeatal complex with a score range of 2, 1, and 0 if there was complete, partial, or no signs, respectively, of opacification. Scoring of the CT findings based upon the Lund-Mackey scoring system revealed that the maximum number of cases obtained the scores ranging from 5 to 8 and 9 to 12.

Table 1. Wald univariate logistic regression analysis of clinical variables related to postoperative prognosis.

Variables	$\bar{S}\bar{\chi}$	Wald value	P value	Odd ratio (OR)	
Age (≥ 60 years)	0.489	7.988	0.002	2.686	(1.788~3.547)
Sex	0.255	1.205	0.354	1.447	(0.525~1.558)
Smoking	0.258	1.655	0.250	1.548	(0.788~2.124)
Drinking	0.425	2.144	0.147	1.711	(0.955~2.521)
Asthma	0.353	7.588	0.005	2.478	(1.558~3.125)
Rhinosinusitis	0.625	14.252	0.000	4.225	(2.154~5.122)
Nasal surgery	0.885	21.255	0.000	4.258	(3.124~6.255)
Nasal polyps	0.458	9.255	0.002	2.845	(1.588~3.685)
Severity of diseases	0.785	8.125	0.004	4.525	(3.123~6.122)
Severity of smelling dysfunction	1.022	13.235	0.001	8.125	(6.022~10.121)
Nasal septum deviation	0.512	10.252	0.000	3.123	(2.124~4.256)
Long-term use of nasal decongestant	0.625	16.252	0.001	4.152	(2.445~5.252)
Use of nasal hormone	0.112	6.235	0.018	0.658	(0.124~0.901)
Comprehensive therapy	0.120	14.256	0.001	0.524	(0.211~0.785)

Table 2. Wald multivariate regression analysis of influencing factors of clinical prognosis.

Variables	$\bar{S}\bar{\chi}$	Wald value	P value	Odd ratio (OR)	
Age (≥ 60 years)	0.425	6.125	0.025	2.325	(1.745~3.525)
Nasal surgery	0.758	11.458	0.000	4.125	(2.152~6.258)
Rhinosinusitis	0.585	10.256	0.001	3.256	(2.125~4.156)
Severity of smelling dysfunction	0.758	9.256	0.002	5.258	(4.125~6.258)
Long-term use of nasal decongestant	0.623	11.258	0.000	3.112	(2.256~4.257)
Comprehensive therapy	0.186	12.254	0.001	0.528	(0.214~0.859)

Surgical efficacy

A total of 288 patients with chronic rhinosinusitis underwent endoscopic sinus surgery and were subjected to subsequent follow-up from 10 months to 3 years, with a mean duration of 12 months. Among all participants, 187 (64.9%) patients were fully recovered, 72 (25.0%) presented with certain improvement, and 28 (10.1%) were left untreated.

Univariate regression analysis

Univariate Logistic regression model was used to screen the variables related to the clinical prognosis. In total, 11 variables

were proven to be associated with the clinical prognosis, as illustrated in Table 1.

Multivariate regression analysis

Subsequently, these 11 variables were subjected to multivariate regression model analysis. As revealed in Table 2, age, history of nasosinusitis and allergic rhinitis, severity of dysosmia, and long-term use of nasal decongestant were identified as the risk factors affecting clinical prognosis, whereas comprehensive treatment after surgery was considered as a protective factor in clinical prognosis.

Discussion

Chronic rhinosinusitis consists of a variety of inflammatory and infectious diseases involved with the nose and paranasal sinus. It exerts a more severe impact upon quality of life compared with other chronic illnesses, including hypertension, mellitus diabetes, and cardiac failure [8–11]. Moreover, patients with chronic rhinosinusitis have significantly different etiology, pathology, clinical manifestations, severity of disease, and clinical prognosis. Currently, functional endoscopic sinus surgery, comprising several techniques, has become a well-established strategy for the treatment of refractory chronic rhinosinusitis untreated by medications. The management of ostiomeatal complex plays a pivotal role in surgical procedures of endoscopic sinus surgery. Through surgical management, the ostiomeatal complex can be established and restored to create ventilation and drainage channels for the paranasal sinus and to steadily restore the function of nasal mucosa. In addition, endoscopic sinus surgery has multiple advantages, such as explicit visual field, retaining the physiological function of nasal cavity, small trauma, fast recovery, and low recurrence rate [12,13]. However, due to the complex and elusive influence of varying factors, it remains a challenge to predict the clinical prognosis of patients with chronic rhinosinusitis after undergoing endoscopic sinus surgery. The long-term clinical efficacy and prognosis remain to be elucidated. Consequently, multiple potential factors likely affecting the clinical prognosis of chronic rhinosinusitis patients were retrospectively analyzed in this study, aiming to provide evidence-based data for the prevention, treatment, and prediction of clinical prognosis of chronic rhinosinusitis.

The findings in our study have demonstrated that the elderly population with chronic rhinosinusitis presented with a higher risk of poor prognosis compared with younger individuals. The main causes may include poor physical condition, low immunity, and high prevalence of severe complications, such as diabetes mellitus, cardiovascular diseases, kidney disease, and malignant tumors, which contribute to low efficacy and poor prognosis. Logistic regression analysis revealed that medical history of allergic rhinitis was another influencing factor. Allergic rhinitis exposes the nasal cavity mucosa to high reactive status for a long period, leading to mucosa swelling, evident exudate, and ostia stenosis and closure. All these conditions create a favorable proliferation environment for bacteria, viruses, and fungi.

Patients with chronic rhinosinusitis who had a history of nasosinusitis tended to have poor prognosis. Previous studies have indicated that chronic rhinosinusitis patients have a high risk

of pathological changes in the bone, which aggravates the progression of nasosinusitis. In addition, the severity of lesions in the ethmoid bone is significantly correlated with the clinical prognosis following endoscopic sinus surgery. Surgical procedures may cause trauma and injury to the nasal structure and function, often resulting in bone exposure, fibrous scarring, and ostia stenosis. All these symptoms are likely to induce the recurrence of chronic rhinosinusitis [14–17].

In this study, multivariate logistic regression analysis revealed that the severity of dysosmia is associated with more severe nasal mucosa pathological changes. Patients with chronic rhinosinusitis were constantly complicated with irreversible injuries in the nasal mucosa, which were difficult to thoroughly eliminate, thereby affecting the functional recovery of the smell sensation, which is consistent with previous findings [18–20].

Our investigation also demonstrated that long-term use nasal decongestant might induce the risk of exfoliated mucosa cilium, epithelial cell necrosis and distortion, enlarged intercellular space, stromal edema, inflammatory cell infiltration, thickening and fibrosis of epithelial tissue, and even the emergence of squamous metaplasia. In a rabbit study, the researchers also found that long-term use of ephedrine could cause evident damage to the nasal mucosa of rabbits, suggesting that nasal decongestant should be used very cautiously [21].

Previous investigations have indicated that comprehensive treatment includes clearance of lesions in the nasal cavity, as well as topical use of hormone, antibiotics and topical irrigation [22,23]. In this study, the patients were required to receive comprehensive therapies during subsequent follow-up, and relatively high efficacy was obtained, indicating the protective effect and clinical significance of comprehensive treatment after functional endoscopic sinus surgery.

Conclusions

We found that 11 variables were correlated with the clinical prognosis of chronic rhinosinusitis patients. Multivariate logistic regression analysis demonstrated that age, history of allergic rhinitis, severity of dysosmia, history of nasosinusitis surgery, and long-term use of nasal decongestant were risk factors affecting clinical prognosis. Comprehensive therapy after surgery was a protective factor.

Conflict of interest

None.

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