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Outcomes of Endoscopic Sinus Surgery of Adult Chronic Rhinosinusitis in First Central Hospital of Mongolia

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Objective: Evaluate the outcome of endoscopic sinus surgery among chronic rhinosinusitis (CRS) patients and assess the quality of life. **Methods:** 200 CRS patients aged between 17 to 73 who were operated endoscopic sinus surgery at the Otorhinolaryngology department of First Central Hospital between November 2019 and November 2020, were involved in this study. Subjects were divided into 2 groups: 1) CRS with nasal polyp; 2) CRS without nasal polyp. CT changes were evaluated according to Lund-Mackay, Hoover score, and Hounsfield unit before and after surgery. **Results:** Of the total subjects analyzed, 56 % were male and 44 % were female. The average age of subjects was 38.4 ± 13.9. The tissue radiodensity of the maxillary sinus decreased in both groups significantly. The mean value of 21.3 ± 6.9 HU preoperatively dropped to 13.5 ± 3.9 HU postoperative in the CRSsNP group, while the CRSwNP group had similar results. The preoperative mean value of 20.3 ± 3.9 HU declined to 12.0 ± 2.2 HU after the procedure. For assessment of paranasal sinus mucosal thickness, the mean value of preoperative imaging study in the CRSsNP group measured as 5.5 ± 1.7mm, and then it reduced by 3.8mm to reach 1.7 ± 1.4 mm after the surgery ($p < 0.000$). Consequently, the CRSwNP group shows similar outcomes such as the preoperative mean value assessed with a thickness of 5.8 ± 1.4 mm, declined by 4.4 mm and reached an almost normal mucosal thickness of 1.5 ± 1.0 mm after the procedure ($p < 0.000$). **Conclusion:** ESS for CRS is effective according to the evaluation of the Lund-Mackay, Hoover, and Hounsfield unit, and it was statistically significant ($p < 0.000$).

Keywords: Chronic Rhinosinusitis, Hounsfield Unit, Lund-Mackey Score, Otorhinolaryngology, Hoover Score

Introduction

Chronic rhinosinusitis (CRS) is one of the most common chronic diseases with high healthcare costs and has a significant negative impact on the quality of life and work productivity [1]. According to a study conducted in the USA, CRS prevalence stands at 12 % among adults [2]. It has been estimated that the average cost of antibiotic treatment is $150 million per year and 350000 - 500000 patients undergo endoscopic sinus surgery per year [3]. The prevalence of CRS in 19 countries of Europe was estimated at 11 % by a questionnaire survey that was applied in the European Position Paper on Rhinosinusitis and nasal Polyps (EPOS) criteria [4]. In South Korea, the overall prevalence of CRS was 6.95 % [5]. In China, a total of 10636 subjects from 7 cities shows that the overall prevalence of CRS was 8 % and affected around 107 million people [6].

According to the report of the Mongolian Health Development Center, the prevalence of CRS increased by 54.6 % between 2014 - 2018, and endoscopic sinus surgery escalated from 46 to 207 at the Department of ENT in First Central Hospital of Mongolia. Chronic rhinosinusitis (CRS) can be classified as CRS with nasal polyps, CRS without nasal polyps, and allergic fungal rhinosinusitis. Based on the endotype inflammatory pattern, CRS may also be divided into eosinophilic CRS (ECRS) and non- ECRS subtypes Eosinophilic CRS is associated with loss of olfactory function, allergy, asthma, and many other diseases. Clinically, eosinophil plays a significant role in CRS diagnosis. Biopsy from the nasal during endoscopic sinus surgery allows revealing inflammatory cells and detecting cancer. Besides, morphological changes in tissue help to determine the treatment plan and duration of monitoring, etc [7].

In 1978, Austrian scientist Walter Messerklinger discovered the mucociliary flow of the paranasal sinuses which revolutionized the maxillary, ethmoidal infundibulum, and frontal recess operation based on his discovery, endoscopic sinus surgery has been progressively developing for the past 40 years [8]. Endoscopic sinus surgery is a minimally invasive procedure that maintains the patient's nasal anatomical structure and function and has low post-operative pain, length of stay in the hospital, and quicker recovery after surgery [9]. The measure of the surgery outcome can be determined by VAS (Visual Analogue Scale) or SNOT-22 (22 Sinonasal Outcome Test) tests [10]. The VAS is widely used by rhinologists both in research and in daily practice. Patients quantify the severity of their symptoms on a 10 cm scale, with 0 meaning total absence of symptom(s) and 10 being the worst thinkable severity [11]. On the other hand, SNOT-22 consists of 22 questions specifically designed to evaluate the quality of life after endoscopic sinus surgery. Each question is assessed by 0-5 points and the highest points indicate the worst quality of life [12]. In the study of Pirola et al, SNOT-22, VAS scores, OCS intake, and endoscopic Nasal Polyp Score (NPS) were collected pre and postoperatively in the patients with refractory chronic rhinosinusitis with nasal polyposis. RFS difference resulted significantly (log-rank test = 4.16; $p = 0.04$). Differences between pre- and post-operative total and single-item scores of SNOT-22 were significant ($p = 0.001$), as well as VAS scores ($p = 0.001$) [13]. A multi-centre study of Sahlstrand-Johnson revealed that the SNOT-22 score diminished from 51.8 (48.7 - 55.0) pre-operatively to 33.0 (29.2 - 36.8) at 6 months. 64% achieved a clinically important improvement in the SNOT-22. SF-36 scores improved statistically significantly in all domains except Role Emotional. The VAS score halved from 68 (65 - 71) to 34 (29 - 39) at 6 months postoperatively. A pre-operative SNOT-22 score over 20 implied a greater chance of score improvement after 6 months. CRS-related absenteeism dropped from 8 - 14 days to 1 - 7 days 12 months after ESS [14]. On the other hand, numerous studies demonstrated different scales to assess attitudes, techniques as well as outcomes in chronic rhinosinusitis surgery. For post-operative management, Lund–Mackay (L–M) scoring system has been widely employed after ESS. This scoring is evaluated radiologically, thus needs the examination by computed tomography (CT). In the study of Gholam et al, the mean score of the Lund Mackay had a significant positive relationship with the severity of patients' clinical symptoms and the severity of sinusitis, and thus considered as a suitable criterion in diagnostic and therapeutic evaluations of patients [15]. However, other studies revealed that there was no statistically significant correlation between Sino-Nasal Assessment Questionnaire and Lund-Mackay scores ($p = 0.5$). It has been concluded that morbidity of patients with CRS cannot be predicted from the magnitude of changes in their CT scans [16].

As mentioned above, numerous studies have been attempted to define suitable methods for easy evaluation of intranasal physical findings using different techniques. Also, the positive and negative effects of smoking, depression, drug

sensitivity, and disease severity must have been considered. Unfortunately, such the conflicting information regarding which of these characteristics are important is prevalent. In the present study, we have aimed to evaluate the outcome of endoscopic sinus surgery among chronic rhinosinusitis (CRS) patients and assess the quality of life in Mongolia. Here, two-hundred CRS patients who were operated endoscopic sinus surgery at the Otorhinolaryngology department of First Central Hospital between November 2019 and November 2020, were involved.

Materials and Methods

Research design

We conducted a retrospective study as pre-post design. A total of 200 CRS patients, who were operated endoscopic sinus surgery at the department of ENT of First Central Hospital between November 2019 and November 2020, were involved in this study.

The inclusion criteria of subjects are met with diagnostic criteria "European Position Paper on Rhinosinusitis and Nasal Polyps 2020", which includes a nasal blockage, nasal secretion, pain around the face, reduction of the sense of smell, etc. If patients have had 2 symptoms and if symptoms last more than 12 weeks, will be diagnosed with CRS. However, all types of immune system disorders, cystic fibrosis, pregnant women, and nasal cancers were considered as exclusion criteria.

CT changes were evaluated according to Lund-Mackay's score before and after surgery. We graded each sinus as 0-completely clear, 1-partly opacified, and 2-completely opacified. Subjects were divided into 2 groups: 1) CRS with NP and 2) CRS without NP. Additionally, we used the "VAS" questionnaire which consists of 1 - 5 points of 6 questions, and the SNOT- 22 questionnaire which consistscores of 22 questions. Totally, 20 minutes were spent taking questionnaires for each participant, and questionnaires were taken before surgery and 1 month after the surgery.

We performed 100 biopsies on patients who underwent endoscopic sinus surgery and evaluated them according to the histological test instruction. The biopsy was performed during the operation and 10 % neutral buffered formalin was used for fixation and sent for the histopathological test. Further, the biopsy was performed again 1 month after the surgery for the histopathological test.

Histopathology variables assessed a number of eosinophils per high-power field (HPF; < 5/HPF, 5/HPF), neutrophil infiltrate (absent and present), basement membrane thickening (absent and present), subepithelial edema (absent, present (focal, perivascular, or distortion of mucosal structure)), hyperplastic/ papillary changes (absent and present), mucosal ulceration (absent and present), squamous metaplasia (absent and present), fibrosis (absent and present), Charcot-Leyden crystals (absent and present), and eosinophil aggregates (absent and present).

Small specimens are prepared by the automatic transmitter and converted into a solid using paraffin wax. Then preparation is sliced with 2 types of 3 microtome and mounted on glass slides. Olympus brand's 40 x 10 mm microscope is used for pathological evaluation.

The cross-sectional method was used for this study and Stata 12.1 was used for data analysis. T-test was used to identify the difference between groups of before and after the surgery. On the other hand, Wilcoxon matched paired signed ranked test was used to determine the morphological changes in tissues. When a p-value less than 0.05 is considered statistically significant.

Statistical analysis

We expressed continuous variables including body mass index, degree of axis correction, medial proximal tibial angle, and knee joint flexion and extension range as the mean and standard deviation and assessed normally distributed data using the Kolmogorov-Smirnov test. Categorical data such as sex, education level, and tobacco consumption were presented by frequencies and percentages. For categorical variables, a Chi-square test was carried out.

The repeated measurements within subjects were then compared to the previous time interval using two-way mixed ANOVA. A Bonferroni-type correction was applied to all test results resulting in a significance level set at $p < 0.017$ ($p = 0.05/3$). Statistical analysis was performed using STATA 13.0 software.

Ethical statement

The study was approved by the Research Ethics Committee of the Mongolian National University of Medical Sciences on June 21, 2019 (No. 2019/6-21). All patients signed an informed consent form before clinical examination and morphometric measurement.

Results

Of the total subjects analyzed, 112 (56 %) were male and 88 (44 %) were female. The average age of subjects was 38.4 ± 13.9. Male: female gender ratio of patients was 1.27:1.

By the type of endoscopic sinus surgery, antrostomy 198 (99 %), uncinectomy 197 (98 %), and frenectomy 74 (37 %) surgeries account for the majority. Septoplasty was operated 185 (92.5 %) times and inferior turbinoplasty was operated 117 (58.5 %) times (Table 1).

CT scan images were taken from subjects after the surgery and the LM score was 9.42 (Std.- 5.03) in the CRSsNP group and 11.66 (Std.- 5.12) in the CRSwNP group. 1 month after the surgery, the LM score was 3.21 (Std.-3.08) in the CRSsNP group and 3.33 (Std.- 2.74) in the CRSwNP group ($p < 0.000$) (Table 2).

We have taken 6 questions from the VAS questionnaire from the subjects. Questions were asked about nasal blockage,

Table 1. Nasal endoscopic surgeries' type of subjects.

Variables	Study Groups			p-value
	CRSsNP (n = 151)	CRSwNP (n = 49)	Total (n = 200)	
	N (%)	N (%)	N (%)	
Age group				
15 - 29	54 (35.8)	12 (24.5)	66 (33.0)	0.013
30 - 39	38 (25.2)	5 (8.2)	43 (21.0)	
40 - 49	32 (21.2)	13 (28.6)	45 (23.0)	
50 - 59	18 (11.9)	12 (24.5)	30 (15.0)	
60 - 69	9 (6.0)	7 (12.4)	16 (8.0)	
Gender (huis)				
Male	83 (54.9)	31 (63.2)	114 (57.0)	0.393
Female	68 (45.1)	18 (36.8)	86 (43.0)	
Uncinectomy				
1 Right	31 (20.8)	5 (8.3)	35 (17.8)	0.116
2 Left	24 (16.1)	10 (22.9)	35 (17.8)	
3 Both	94 (63.1)	33 (68.8)	127 (64.5)	
Maxillary antrostomy				
Right	31 (20.7)	5 (10.4)	36 (18.2)	0.263
Left	25 (16.7)	10 (20.8)	35 (17.7)	
Both	94 (62.6)	33 (68.8)	127 (64.1)	
Anterior erhmoidectomy				
Right	23 (20.2)	5 (10.8)	28 (17.5)	0.359
Left	22 (19.3)	9 (19.6)	31 (19.4)	
Both	69 (60.5)	32 (69.6)	101 (63.1)	
Posterior erhmoidectomy				
Right	10 (18.9)	5 (6.2)	12 (14.1)	0.236
Left	6 (11.3)	5 (9.4)	11 (10.6)	
Both	37 (69.8)	22 (84.4)	59 (75.3)	
Frontal surgery (frontectomy)				
Right	15 (30.0)	1 (0.4)	16 (21.6)	0.035
Left	13 (26.0)	7 (29.2)	20 (27.0)	
Both	22 (44.0)	16 (66.6)	38 (51.4)	

CRSsNP: Chronic rhinosinusitis without nasal polyp; CRSwNP: Chronic rhinosinusitis with nasal polyp.

Table 2. Result of Lund-Mackey evaluation.

Operation	Study Groups			
	CRSsNP[a] (n = 151)	CRSwNP (n = 49)	Total (n = 200)	
	Mean ± SD	Mean ± SD	Mean ± SD	*p-value
Pre-operation	9.42 ± 5.03	11.66 ± 5.12	21.08 ± 10.15	0.000
Post-operation	3.21 ± 3.08	3.33 ± 2.74	6.54 ± 5.82	0.000

CRSsNP: Chronic rhinosinusitis without nasal polyp; CRSwNP: Chronic rhinosinusitis with nasal polyp.

Table 3. Result of Visual analogue scale /VAS/ before surgery and 1 month after surgery.

Variables	Study Groups			*p-value
	CRSsNP[a,b,c] (n = 151) Mean ± SD	CRSwNP[d,e] (n = 49) Mean ± SD	Total (n = 200) Mean ± SD	
Nasal blockage				
Pre-operation	4.07 ± 1.01	4 ± 1.09	4.05 ± 1.02	0.682
Post-operation	1.55 ± 0.93	1.19 ± 0.40	1.47 ± 0.85	0.005
Facial pain				
Pre-operation	2.75 ± 1.49	2.67 ± 1.23	2.74 ± 1.43	0.000
Post-operation	1.53 ± 0.95	1.15 ± 0.46	1.44 ± 0.87	0.000
Reduction of sense of smell				
Pre-operation	2.81 ± 1.51	3.20 ± 1.40	2.91 ± 1.49	0.000
Post-operation	1.77 ± 1.14	1.54 ± 1.03	1.72 ± 1.11	0.000
Health condition				
Pre-operation	3.04 ± 1.18	2.90 ± 1.16	3.01 ± 1.17	0.000
Post-operation	1.61 ± 1.01	1.31 ± 0.55	1.54 ± 0.93	0.000

Two-way mixed ANOVA results: Interaction of time and treatment $F(1.829, 312.41) = 21.184$, $p < 0.041$; Main effect of time $F(1.518, 239.41) = 321.121$, $p < 0.042$; Main effect of treatment $F(1,284) = 0.512$, $p = 0.184$; *Independent t-test: CRSsNP vs. CRSwNP; [a,b,c,d,e]Paired t-test: [a]Nasal blockage, $p < 0.011$; [b]Reduction of sense of smell, $p < 0.042$; [c]Health condition, $p < 0.043$; [d]Nasal blockage, $p < 0.001$; [e]Facial pain, $p < 0.024$.

headache, facial pain, reduction of the sense of smell, nasal secretion, and health conditions. Statistically, significant improvement was observed after surgery in each question ($p < 0.000$). Especially, nasal blockage and secretion were more improved than other symptoms (Table 3).

Before surgery in the CRSsNP group, the VAS score was 19.8 ± 5.06 and dropped 1 month after the surgery to 9.9 ± 3.7 ($p < 0.000$). Besides, this score was 18.7 ± 4.1 before surgery in the CRSwNP group and it decreased 1 month after the surgery to 7.9 ± 2.3 ($p < 0.000$) (Figure 1).

Two-way mixed ANOVA results: Interaction of time and treatment $F(1.718, 327.59) = 22.195$, $p < 0.021$; Main effect of time $F(1.616, 237.59) = 345.31$, $p < 0.031$; Main effect of treatment $F(1,176) = 0.631$, $p = 0.325$; *Independent t-test, CRSsNP vs. CRSwNP; [a]paired t-test $p < 0.031$

22 questions of the SNOT-22 questionnaire evaluate local and general health condition. The average SNOT-22 score was 46.6 ± 20.1 in the CRSsNP group and 14.3 ± 13.0 1 month after surgery ($p < 0.000$). Otherwise, the average SNOT-22 score was 48.4 ± 19.7 before surgery and 15.2 ± 16.3 1 month after surgery in the group of the CRSwNP ($p < 0.000$) (Figure 2).

According to the outcome of the SNOT-22 questionnaire, symptoms were improved after the surgery except for ear pain, and it was statistically significant (Table 4).

We performed a histopathological examination on the subjects before the surgery and 1 month after surgery. Before

Table 4. Result of SNOT-22 questionnaire.

Variables	Study Groups			*p-value
	CRSsNP[a,b] (n = 151)	CRSwNP[c] (n = 49)	Total (n = 200)	
	Mean ± SD	Mean ± SD	Mean ± SD	
Need to blow nose				
Pre-operation	2.92 ± 1.53	2.94 ± 1.43	2.93 ± 1.51	0.000
Post-operation	1.19 ± 1.05	0.92 ± 0.95	1.13 ± 1.03	0.000
Nasal Blockage				
Pre-operation	3.62 ± 1.31	3.86 ± 1.17	3.67 ± 1.28	0.000
Post-operation	0.98 ± 1.25	0.64 ± 0.99	0.89 ± 1.20	0.000
Sneezing				
Pre-operation	1.95 ± 1.52	2.02 ± 1.40	1.97 ± 1.49	0.000
Post-operation	1.04 ± 1.08	0.96 ± 1.06	1.02 ± 1.07	0.000
Runny nose				
Pre-operation	2.57 ± 1.48	2.84 ± 1.50	2.64 ± 1.48	0.000
Post-operation	0.90 ± 1.11	0.6 ± 0.82	0.83 ± 1.05	0.000
Cough				
Pre-operation	1.72 ± 1.54	1.71 ± 1.50	1.72 ± 1.52	0.000
Post-operation	0.48 ± 0.85	0.54 ± 0.65	0.53 ± 0.80	0.000

Two-way mixed ANOVA results: Interaction of time and treatment $F(1.919, 343.11) = 24.194$, $p < 0.059$; Main effect of time $F(1.678, 241.31) = 331.133$, $p < 0.031$; Main effect of treatment $F(1,731) = 0.467$, $p = 0.731$; *Independent t-test: CRSsNP vs. CRSwNP; [a,b,c]Paired t-test: [a]Nasal blockage, $p < 0.042$; [b]Runny nose, $p < 0.031$; [c]Cough, $p < 0.002$.

Table 5. Result of SNOT-22 questionnaire.

Variables	Study Groups			*p-value
	CRSsNP[a] (n = 151)	CRSwNP[b,c] (n = 49)	Total (n = 200)	
	Mean ± SD	Mean ± SD	Mean ± SD	
Post-nasal discharge				
Pre-operation	2.04 ± 1.70	2.20 ± 1.73	2.08 ± 1.7	0.000
Post-operation	0.73 ± 1.07	0.56 ± 0.92	0.70 ± 1.04	0.000
Thick nasal discharge				
Pre-operation	2.70 ± 1.56	2.53 ± 1.57	2.66 ± 1.56	0.000
Post-operation	1.00 ± 1.13	0.56 ± 0.96	0.90 ± 1.10	0.000
Ear fullness				
Pre-operation	2.00 ± 1.59	1.67 ± 1.55	1.92 ± 1.58	0.000
Post-operation	0.61 ± 0.97	0.60 ± 0.91	0.61 ± 0.95	0.000
Dizziness				
Pre-operation	1.91 ± 1.73	1.65 ± 1.56	1.85 ± 1.69	0.000
Post-operation	0.71 ± 1.09	0.84 ± 1.28	0.74 ± 1.10	0.000
Ear pain				
Pre-operation	1.58 ± 1.56	0.90 ± 1.34	1.42 ± 1.53	0.000
Post-operation	0.51 ± 0.80	0.40 ± 0.86	0.49 ± 0.82	0.000

Two-way mixed ANOVA results: Interaction of time and treatment $F(1.134, 152.22) = 23.171$, $p < 0.047$; Main effect of time $F(1.568, 251.21) = 241.121$, $p < 0.042$; Main effect of treatment $F(1,842) = 0.516$, $p = 0.812$; *Independent t-test: CRSsNP vs. CRSwNP; [a,b,c]Paired t-test: [a]Thick nasal discharge, $p < 0.009$; [b]Post-nasal discharge, $p < 0.041$; [c]Dizziness, $p < 0.041$.

Table 6. Result of SNOT-22 questionnaire.

Variables	Study Groups			*p-value
	CRSsNP [a, b] (n = 151)	CRSwNP [c, d] (n = 49)	Total (n = 200)	
	Mean ± SD	Mean ± SD	Mean ± SD	
Facial pain/pressure				
Pre-operation	2.12 ± 1.73	2.37 ± 1.64	2.18 ± 1.71	0.000
Post-operation	0.66 ± 0.98	0.36 ± 0.76	0.59 ± 0.94	0.000
Loss of smell/taste				
Pre-operation	2.25 ± 1.68	2.65 ± 1.55	2.35 ± 1.65	0.000
Post-operation	0.62 ± 0.98	1.12 ± 1.39	0.74 ± 1.10	0.000
Difficulty falling asleep				
Pre-operation	2.49 ± 1.62	2.73 ± 1.68	2.55 ± 1.64	0.000
Post-operation	0.65 ± 0.99	1.12 ± 1.54	0.76 ± 1.15	0.000
Wake up at night				
Pre-operation	2.79 ± 1.46	2.92 ± 1.57	2.82 ± 1.49	0.000
Post-operation	0.72 ± 1.05	1.28 ± 1.59	0.85 ± 1.21	0.000
Lack of a good night's sleep				
Pre-operation	2.87 ± 1.47	2.96 ± 1.54	2.90 ± 1.48	0.000
Post-operation	0.87 ± 1.03	1.32 ± 1.55	0.97 ± 1.18	0.000
Wake up tired				
Pre-operation	2.59 ± 1.52	2.96 ± 1.51	2.68 ± 1.52	0.000
Post-operation	0.63 ± 0.97	1.00 ± 1.47	0.71 ± 1.11	0.000

Two-way mixed ANOVA results: Interaction of time and treatment F(1.154, 161.21) = 24.351, $p < 0.006$; Main effect of time F (1.519, 352.33) = 272.132, $p < 0.061$; Main effect of treatment F(1,912) = 0.671, p = 0.021; *Independent t-test: CRSsNP vs. CRSwNP; [a,b,c,d] Paired t-test: [a]Difficulty falling asleep, $p < 0.010$; [b]Wake up at night, $p < 0.001$; [c]Facial pain/pressure, $p < 0.022$; [d]Wake up tired, $p < 0.000$.

Table 7. Result of SNOT-22 questionnaire.

Variables	Study Groups			p-value
	CRSsNP[a, b, c] (n = 151)	CRSwNP[d, e] (n = 49)	Total (n = 200)	
	Mean ± SD	Mean ± SD	Mean ± SD	
Fatigue 17				
Pre-operation	2.48 ± 1.54	2.76 ± 1.49	2.55 ± 1.53	0.000
Post-operation	0.76 ± 1.03	0.88 ± 1.48	0.79 ± 1.14	0.000
Reduced productivity				
Pre-operation	2.38 ± 1.65	2.35 ± 1.63	2.36 ± 1.64	0.000
Post-operation	0.60 ± 1.06	0.68 ± 1.25	0.62 ± 1.10	0.000
Reduced concentration				
Pre-operation	1.62 ± 1.53	1.82 ± 1.60	1.67 ± 1.54	0.000
Post-operation	0.43 ± 0.95	0.48 ± 1.00	0.44 ± 0.96	0.000
Frustrated/restless/irritable				
Pre-operation	1.61 ± 1.63	1.94 ± 1.69	1.69 ± 1.65	0.000
Post-operation	0.37 ± 0.88	0.36 ± 0.95	0.36 ± 0.89	0.000
Sad				
Pre-operation	1.58 ± 1.56	0.90 ± 1.34	1.42 ± 1.53	0.000
Post-operation	0.61 ± 0.97	0.60 ± 0.91	0.61 ± 0.96	0.000

Continued

Embarrassed				
Pre-operation	2.00 ± 1.59	1.67 ± 1.55	1.92 ± 1.58	0.000
Post-operation	0.66 ± 0.98	0.36 ± 0.76	0.59 ± 0.94	0.000

Two-way mixed ANOVA results: Interaction of time and treatment F(1.911, 172.32) = 21.362, p < 0.051; Main effect of time F (1.648, 362.21) = 291.141, p < 0.052; Main effect of treatment F(1,821) = 0.582, p = 0.084; *Independent t-test: CRSsNP vs. CRSwNP; [a, b, c, d, e] Paired t-test: [a]Fatigue, p < 0.023; [b]Reduced productivity, p < 0.011; [c]Reduced concentration, p < 0.001; [d]Fatigue, p < 0.012, [e]Reduced productivity, p < 0.041.

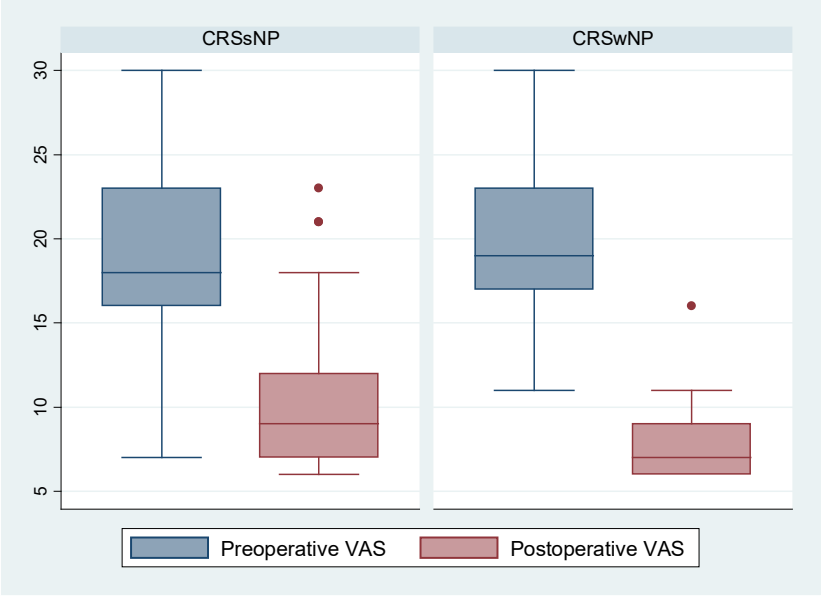

Figure 1. Preoperative and postoperative median VAS (Visual Analogy Scale) scores by operation.

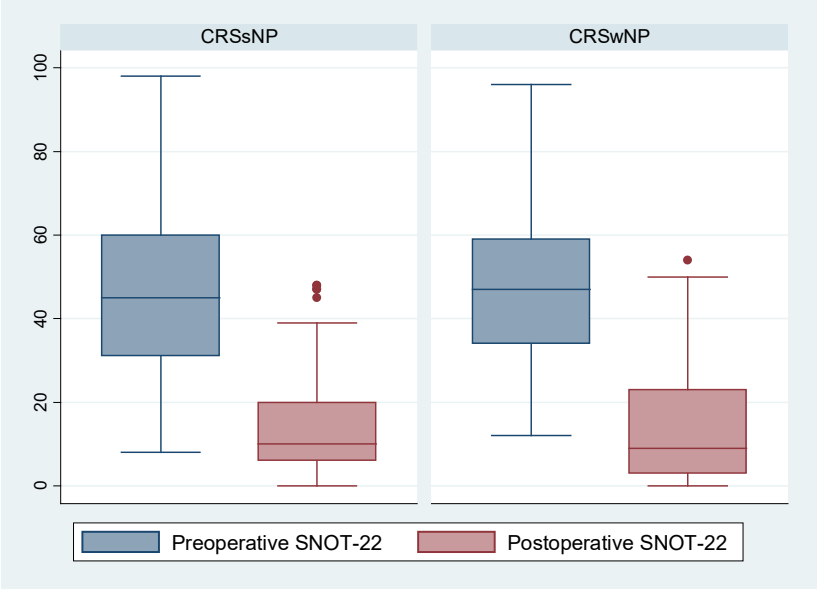

Figure 2. Preoperative and postoperative median SNOT-22 (Sino Nasal Outcome Test-22) scores by operation.

surgery, 23.8 % of subjects had mild inflammation, and 62,8 % had moderate inflammation in a group of CRSsNP. However, after surgery, 50 % of the subjects had mild inflammation and 42.6 % of them had moderate inflammation ($p < 0.01$). The number of eosinophils, subepithelial edema, and hyperplastic/ papillary changes were statistically improved. Hyperplasia was not detected in 51.8 % of subjects before surgery and it was enhanced, and hyperplasia was not found in 100 % of the group of CRSwNP subjects ($p < 0.01$) (Table 5).

Discussion

Chronic rhinosinusitis (CRS) is one of the common, high costed disease that decreases the quality of life and works productivity, yet the number of patients receiving surgical treatment has been growing.

Chronic and acute rhinosinusitis have significant negative health consequences and it decreases the quality of life and general health condition. Therefore, Eq-5D, SF36, and SNOT22 are most used for evaluation [17].

The overall severity rating of symptoms is obviously highly dependent upon the population being studied. Patients in secondary care awaiting surgery report mean symptom severity scores in the moderate to severe range, with a mean SNOT-22 score of 42.0 compared with a control group where a mean score of 9.3 was reported. CRSsNP patients had higher preoperative baseline scores (44.2) compared with CRSwNP (41.0) [18].

In our study, the average SNOT-22 score was 46.6 ± 20.1 in CRS without the NP group of subjects and 48.4 ± 19.7 in the CRS with the NP group of subjects.

As a result of the ThiagoFriere Pinto Bezerra et al. study, SNOT-22 was 35 before surgery and it was diminished to 18 after surgery ($p < 0.001$) [13]. Moreover, Nikakhlagh et al. reported 26.67 scores before surgery, and it dropped to 4.82 after surgery and it was statistically significant ($p < 0.001$) [19]. These studies showed similar results to our study.

Furthermore, Andrews, P.J et al study showed 52.8 ($\pm$ 26.3) scores before surgery and 32.5 ($\pm$ 25.4) scores after surgery ($p < 0.01$) in the CRS without NP group of subjects. Also, CRS with the NP group of subjects showed 54.0 ($\pm$ 23.7) scores before surgery and 25.8 ($\pm$ 22.2) after surgery ($p < 0.01$). These results were also like our study [20 - 22].

Magdy E. Saafan et al reported 18.8 ± 8.8 average VAS scores before surgery and 10.2 ± 8.8 scores after surgery, which showed similar results to our study ($p < 0.001$) [23].

In despite, there is no comprehensive study done in Mongolia on CRS due to geography and individual features and it is complicated to follow up on the subjects for more than 1 month. We performed the histopathological examination of the subjects before and 1 month after surgery. Subjects in the group of CRS without NP showed improvement in the number of eosinophils and submucosal edema and it was statistically significant ($p < 0.05$). On the other hand, hyperplastic changes were improved in the group of patients with CRS with NP ($p < 0.05$). However, Michael J. Marino et al. reported their improvement in inflammation, the number of eosinophils, and submucosal edema 6 months after the surgery. Unfortunately, the study reported no improvements in neutrophil infiltrates, eosinophils, mucosal wounds, metaplasia, and fibrosis [24].

Our study has limitations. The present study had a short follow-up period. Therefore, more than a 1-month follow-up is necessary after surgery to prevent complications and recurrence. Moreover, we did not perform biochemical analysis in the present study, thus further study should focus on more detailed analysis such as an evaluation of the number and function of neutrophil infiltrates, and eosinophils.

Conclusion

Endoscopic sinus surgery for CRS is effective according to the evaluation of Lund-Mackay, VAS, and SNOT-22, and it was statistically significant ($p < 0.05$). The histological test showed us the surgery is effective for certain signs including inflammatory process, the number of eosinophils, and submucosal edema ($p < 0.05$).

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