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Prospective Study on the Characteristics and Postoperative Improvement of Rhinogenic Headache

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ABSTRACT

Background and Objectives : Headache secondary to sinonasal disease can improve after surgery, but few prospective studies have investigated this outcome. We aimed to evaluate the characteristics of headaches, such as clinical features, underlying disease, and postoperative improvement in patients who underwent nasal surgery, and to identify the characteristics that reliably predict rhinogenic headache. **Materials and Method** : Of 356 patients who underwent nasal surgery between March and December 2009, 41 patients with headaches were enrolled in this prospective study. Clinical features of headache, such as onset, time of day, duration, frequency, nature, side and location, existence of aura, aggravating and relieving factors and accompanying nasal symptoms, underlying diseases, endoscopic findings, and computed tomography scans of the paranasal sinuses were evaluated. Headache intensity was graded based on a 10-point visual analog scale (VAS) pre- and post-operatively. **Results** : The most common characteristics of rhinogenic headache included a stabbing or squeezing nature, frontal area location, accompanying nasal obstruction or rhinorrhea, and underlying sinusitis or septal deviation. The subjective intensity of the headache, measured using the VAS score, improved in 80% (33/41) of the patients after surgery. **Conclusion** : Nasal surgery should be considered when rhinogenic headache is suspected and there are definite nasal pathologies.

KEY WORDS : Headache · Nasal disease · Prospective study · Nasal surgery · Postoperative pain.

INTRODUCTION

Headache associated with rhinogenic symptoms presents a diagnostic dilemma that commonly confronts physicians. Diagnostic clarity is essential because primary headache disorders, such as migraine, and secondary headaches, such as rhinosinusitis, require very different treatments. Headaches secondary to inflammatory sinus disease can be treated surgically. Both the International Headache Society (IHS) and the American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) have described conditions that can cause headaches of rhinogenic origin.[1)] However, these criteria represent the consensus of expert opinion rather than scientific evidence-based evaluation, and focus on acute rhinosinusitis and do not consider chronic rhinosinusitis, as a cause of headache or facial pain.[2)]

Few prospective studies have investigated the improvement of headaches after nasal or sinus surgery. Mariotti and Setliff[3)] evaluated patient history and computed tomography (CT) scans in a prospective study designed to predict the outcome of headaches after surgery. They reported that history and CT parameters could not distinguish between the patients who improved and those who did not.

The present prospective study was performed to exam-

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ine the characteristics of headache, such as clinical features, underlying disease, and postoperative improvement in patients with headache who underwent nasal surgery, and to identify characteristics that reliably predict rhinogenic headache.

MATERIALS AND METHODS

We screened 356 patients scheduled for nasal surgery at the Seoul National University Hospital between March and December 2009. Of the 356 patients, 41 who had accompanying headaches were enrolled in our prospective study. The patients were 21 men and 20 women with a mean age of 40.2 years (range, 14−73 years). Inclusion criteria were an age of at least 14 years, a history of headache that had never been satisfactorily relieved by any treatment, and no obvious cause of the headache. Exclusion criteria included a history of nasal or sinus surgery, sinonasal neoplasm, pregnancy, and a history of migraine or other definitive cause of the headache.

Prior to surgery, all patients were asked to complete a questionnaire on the clinical features of their headache including onset, time of day, duration, frequency, nature, side of the head and location, existence of an aura, aggravating and relieving factors, and accompanying nasal symptoms. Furthermore, underlying diseases, nasal endoscopic findings, and CT scans of the paranasal sinuses were evaluated. An endoscopic examination was performed to detect the presence of septal deviation, septal spur, inferior turbinate hypertrophy, nasal discharge, contact point, nasal polyp, and postnasal drip. The CT scan was performed to reveal concha bullosa, paradoxical middle turbinate, and rhinosinusitis. The Lund-Mackay score[4] was calculated for patients who had rhinosinusitis, and the correlation between the side of the lesion and side of the headache was determined.

Preoperative headache intensity was graded based on a 10-point visual analog scale (VAS), in which 0 indicated the absence of headache and 10 represented the most intense pain.

After obtaining written informed consent, surgery was performed under general anesthesia. One surgeon operated on all patients. At the end of the surgical procedure, the nasal cavity was packed with Merocel and gauze. Antibiotics and analgesics were administered for 7 days following surgery.

Postoperative follow-up evaluations were scheduled at 2 weeks, 1, 2, 3, and 6 months. The evaluations included an endoscopic examination of the nasal cavity and VAS score grading of headache intensity. During the follow-up period, the patients were examined for the development of other diseases and whether a neurological evaluation was necessary.

For further analysis, we classified the patients into four categories. The 'resolved' group consisted of patients who rated headache pain as 0 on the VAS, the 'improved' group was defined as patients whose postoperative VAS score was lower than their preoperative score. The 'no change' group comprised patients who showed no change in the VAS score, and the 'worsened' group included patients whose postoperative VAS score was higher than their preoperative score. The VAS scores of the four groups were compared using a non-parametric Wilcoxon signed-rank test. The SPSS 12.0 software (SPSS Inc., Chicago, IL) was used to conduct the statistical tests. p values <0.05 (2-sided) were deemed to indicate statistical significance.

The Institutional Review Board of the Clinical Research Institute at Seoul National University Hospital approved this study protocol (H-1012-081-344).

RESULTS

Of the 356 patients who underwent nasal surgery, 41 (11.5%) complained of headache. Underlying diseases in the 41 patients are summarized in Table 1. The follow-up duration averaged 10.7 months (range, 7−16 months). Of the 41 patients, five visited the neurology clinic after the surgery: none was diagnosed with migraine headaches by the neurologist, but two were diagnosed with tension-type headaches, and one patient was diagnosed with depression. No definite diagnosis could be made in the remaining two patients.

The average initial onset of headaches was 16 months, ranging from 2 weeks to 8 years. The mean headache duration was 6.85 hour per headache, ranging from 40 sec to 24 hour, and the frequency of headaches ranged from one episode per month to every day. The headache occurred on both sides of the head in 14 patients, on the right side in 11 patients, centrally in 8 patients, and on the left side in 8 patients. Two patients experienced photophobia as an aura of headache and no patient reported phonophobia.

Table 1. Underlying disease

	Number of patients	Percentage (%)
Sinusitis	20	48.8
Sinusitis with DSN	12	29.3
DSN	8	19.5
ITH with synechia	1	2.4

DSN: Deviated nasal septum, ITH: Inferior turbinate hypertrophy

Table 2 summarizes the clinical features of the participants' headaches. The nature of the headache most commonly reported was stabbing or squeezing, and the most common location was the frontal area of the head. The time of the attack varied. Stress was the most common aggravating factor, and nasal obstruction and rhinorrhea were commonly accompanied by headache.

The endoscopic examination of the nasal cavity revealed septal deviation in 76% (31/41) of patients, septal spur in 61% (25/41), hypertrophy of the inferior turbinate in 51% (21/41), nasal discharge in 49% (20/41), contact point in 42% (17/41), nasal polyp in 27% (11/41), and postnasal drip in 10% (4/41). Of the 35 patients who had a CT scan, bilateral concha bullosa was revealed in 4, right concha bullosa was found in 4, and left concha bullosa in 5 patients. Paradoxical middle turbinate was observed bilaterally in 1 patient, on the right side in 2 patients and on the left side in 1 patient. Sinusitis was observed bilaterally in 14 patients, on the right side in 10 patients, and on the left side in 8 patients. The mean preoperative CT scan Lund-Mackay score was 8.15 (range, 2−21). The surgery was well tolerated and no patient experienced postoperative complications.

Table 3 shows the correlation between the side of the lesion and that of the headache. The lesion and headache were on the same side of the head in 65.6% (21/32) of the patients with sinusitis and in half of the patients with paradoxical middle turbinate. However, no correlation was found between lesion side and headache side in patients with concha bullosa, septal deviation, septal spur, or contact point. When groups were divided same and different (opposite and nonspecific) side of the lesion and headache, complete relief from headache showed in 61.9% (13/21) of same side group and 36.4% (4/11) of the different side group.

The overall success rate of the surgery in relieving headaches, measured by the VAS score, was approximately 80%. Complete relief from headaches was achieved in 24 of 41 patients (58.5%), and 9 patients (22.0%) reported a decrease in headache intensity after surgery. In contrast, 6 patients reported that headache intensity was unchanged after surgery (14.6%), and 2 patients (4.9%) found that their headaches were worse after surgery. Among 2 patients

Table 2. Clinical features of headache

Feature of headache	Number of patients*	Percentage (%)
Nature		
Stabbing	12	29.3
Squeezing	12	29.3
Pulsating	10	24.4
Dull	8	19.5
Location		
Frontal	19	46.3
Temporal	14	34.1
Parietal	9	21.9
Occipital	6	14.6
Periorbital	4	9.8
Time of attack		
Whole day	11	26.8
Afternoon	11	26.8
Morning	10	24.4
Evening	10	24.4
Sleep	0	0
Aggravating factor		
Stress	15	36.6
Routine daily activity	6	14.6
Allergy	4	9.8
Other	4	9.8
Light	1	2.4
Sound	0	0
None	11	26.8
Accompanying symptom		
Nasal obstruction	22	53.7
Rhinorrhea	17	41.5
Postnasal drip	14	34.1
Facial pain/pressure	14	34.1
Itching/sneezing	14	34.1
Hyposmia	8	19.5
Cough	5	12.2
Fever	1	2.4

*: Numbers are not mutually exclusive

Table 3. Correlation between the side of the lesion and side of the headache

Lesion	N*	Same (%)	Opposite (%)	Not specific (%)
Sinusitis	32	21 (65.6)	1 (3.1)	10 (31.3)
Paradoxical middle turbinate	4	2 (50.0)	2 (50.0)	0 (0)
Concha bullosa	13	4 (30.8)	3 (23.1)	6 (46.1)
Septal deviation	31	6 (19.4)	6 (19.4)	19 (61.2)
Septal spur	25	2 (8.0)	7 (28.0)	16 (64.0)
Contact point	17	6 (35.3)	1 (5.9)	10 (58.8)

*: Numbers are not mutually exclusive. N: number of patients

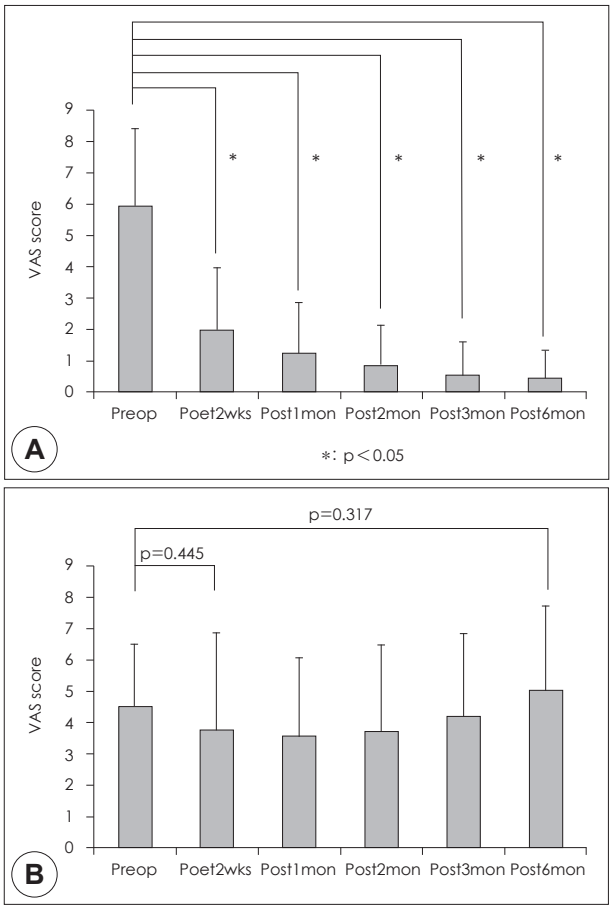

Fig. 1. Pre-and post-operative visual analog scale score for headache in the resolved and improved groups (A) and in the no-change and worsened groups (B). *: p<0.05. VAS: visual analog scale, Preop: Preoperative, Post: Postoperative, wks: weeks, mon: months.

diagnosed with tension type headache, one patient resolved and the other improved headaches. One patient with depression showed improvement. The pre- and post-surgery VAS scores are shown in Fig. 1. for the resolved and improved groups (A) and for the no change and worsened groups (B). The postoperative VAS score was significantly decreased in the resolved and improved groups compared with the preoperative score. However, the pre- and post-surgery VAS scores were not significantly different in the no change and worsened groups.

DISCUSSION

A rhinogenic headache can mimic primary headaches such as migraine, tension-type, and cluster headaches[5]; however, headaches secondary to nose and sinus disorders can be treated by correcting the disorder.[6] Schonsted-Madsen et al.[7] followed 157 patients who had headache and were treated with septoplastic surgery, reconstruction of the nasal pyramids, or submucosal conchotomy. Chronic headache was relieved in 60% of the patients who underwent surgery. Low and Willatt[8] reported that 63% of 116 patients who underwent submucous resection for a deviated nasal septum experienced complete or partial relief from headaches. In 1998, Parsons and Batra[9] reported a 91% improvement in headache intensity in 19 adults and 15 children after endoscopic sinus surgery. Ramadan[10] showed their success rate to be 60%. Our overall surgical success rate of 80% in patients with headache is consistent with the rates reported in these previous studies.

Several studies have examined contact point, a well-known cause of rhinogenic headache. Stammberger and Wolff[11] suggested that intranasal mucosal contact released substance P, causing pain and headache. Substance P, which is associated with the inflammatory process, has a potent vasodilator effect. Vasodilatation and perivascular inflammation are the final common pathways in pain. Surgical treatment for contact point-induced headaches has had good success. Clerico et al.[12] found that after endoscopic nasal surgery, 79% of the patients reported a decrease in pain severity or headache frequency. Mohebbi et al.,[6] Tosun et al.,[13] and Welge-Luessen et al.,[14] Lee et al., reported 83%, 90%, 85%, and 80% success rates, respectively, following surgery to correct contact point-induced headaches. Furthermore, Parsons and Batra[9] reported an 85% success rate following surgery to correct contact point-induced headaches. However, a number of patients with obvious contact points revealed on the CT scan do not complain of headaches. Contact points revealed by an endoscopic examination or by a CT scan are not believed to be pathognomonic for headache.[9] Contact points can induce concurrent chronic sinusitis in addition to headache. The cause of headache in the presence of contact point can be attributed to malventilation of the sinuses resulting in hypoxia, reduced pH, reduced ciliary beat, thick viscous mucus, and increased vulnerability to infections.[16] In our study, 17 of 41 patients (42%) had contact point and complained of headaches. The headaches improved in 14 of the 17 patients (82%) after surgery. We found no correlation between side of contact point and side of the headache in 59% (10/17) of the patients. Thus, the mechanism by which headache improved after surgery may be related to other factors. The patients had lesions other than contact point, such as sinusitis. The headache and sinusitis were on the same side of the head in eight of the 17 patients (47.1%) with contact point. The pathogenesis of rhinogenic headache may not be limited to mucosal contact, but rather, may be related to poor sinus ventilation.[3]

Stammberger and Wolf[11] suggested that hypoxia secondary to pressure differentials within the sinuses was a possible mechanism for the release of substance P.

Anatomical abnormalities in the nasal cavity such as septal deviation, concha bullosa, and paradoxical middle turbinate have been reported to cause headaches.[10] However, few studies have investigated a correlation between side of the lesion and side of the headache. Tarabichi[17] examined the correlation between the severity and site of pain and the extent or location of mucosal disease. The results showed that the pain score did not correlate with the preoperative Lund-Mackay score, and the site of pain did not correlate with the location of the disease. In contrast, the present study demonstrated a 66% concordance rate between the side of sinusitis and the side of the headache.

In a prospective, randomized, controlled study, Ragab et al.[18] reported significant subjective and objective improvements in headache with no significant difference between patients who received medical treatment and those who underwent surgery. The authors suggested using maximum medical therapy as the primary treatment for chronic rhinosinusitis, and reserving surgical treatment for cases refractory to medical therapy. Our study included only patients with headache that had not been satisfactorily relieved by any treatment, including medical therapy. Thus, according to the criteria of Ragab et al.,[18] our subjects would be classified as candidates for surgical therapy to relieve their headache. Previous studies have applied topical anesthetics to the lesion in the nasal cavity and observed whether this relieved the headache as a test to identify patients who would benefit from surgery. However, this test is not reliable because patients who failed the test have been reported to improve after surgery, whereas others who passed the test continued to have symptoms after surgery.[9][12] At present, no consensus exists as to whether surgery relieves the rhinogenic headache.

This study has some limitations. First, small numbers of patients were included. Therefore, the overall success rate of the surgery in relieving headaches was evaluated. Further studies including large samples are needed to obtain success rate according to the each underlying disease or to the correlation of the side of headache and lesion. Second, follow up duration was relatively short. In the no change and worsened groups, further evaluation for other cause of headache should be needed through longer follow up.

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REFERENCES

1) Cady RK, Dodick DW, Levine HL, Schreiber CP, Eross EJ, Setzen M, et al. Sinus headache: A neurology, otolaryngology, allergy, and primary care consensus on diagnosis and treatment. Mayo Clin Proc 2005; 80:908-16.
2) Chung SK. Headache and facial pain related to the paranasal sinuses. J Rhinol 2012;19:83-6.
3) Mariotti LJ, Setliff RC, Ghaderi M, Voth S. Patient history and CT findings in predicting surgical outcomes for patients with rhinogenic headache. Ear Nose Throat J 2009;88:926-9.
4) Lund VJ, Mackay IS. Staging in rhinosinusitus. Rhinology 1993;31: 183-4.
5) Blumenthal HJ. Headaches and sinus disease. Headache 2001;41:883-8.
6) Mohebbi A, Memari F, Mohebbi S. Endonasal endoscopic management of contact point headache and diagnostic criteria. Headache 2010; 50:242-8.
7) Schonsted-Madsen U, Stoksted P, Christensen PH, Koch-Henriksen N. Chronic headache related to nasal obstruction. J Laryngol Otol 1986; 100:165-70.
8) Low WK, Willatt DJ. Headaches associated with nasal obstruction due to deviated nasal septum. Headache 1995;35:404-6.
9) Parsons DS, Batra PS. Functional endoscopic sinus surgical outcomes for contact point headaches. Laryngoscope 1998;108:696-702.
10) Ramadan HH. Nonsurgical versus endoscopic sinonasal surgery for rhinogenic headache. Am J Rhinol 1999;13:455-7.
11) Stammberger H, Wolf G. Headaches and sinus disease: the endoscopic approach. Ann Otol Rhinol Laryngol Suppl 1988;134:3-23.
12) Clerico DM, Evan K, Montgomery L, Lanza DC, Grabo D. Endoscopic sinonasal surgery in the management of primary headaches. Rhinology 1997;35:98-102.
13) Tosun F, Gerek M, Ozkaptan Y. Nasal surgery for contact point headaches. Headache 2000;40:237-40.
14) Welge-Luessen A, Hauser R, Schmid N, Kappos L, Probst R. Endonasal surgery for contact point headaches: A 10-year longitudinal study. Laryngoscope 2003;113:2151-6.
15) Lee JH, Ahn TJ, Ahn SY, Bae WY. Surgical treatment of contact point headache. J Rhinol 2010;17:29-32.
16) Mahajan CS, Kochhar AC, Gupta AK. Sinugenic headache and nasal endoscopy. Armed Forces Med J India 2003;59:121-4.
17) Tarabichi M. Characteristics of sinus-related pain. Otolaryngol Head Neck Surg 2000;122:842-7.
18) Ragab SM, Lund VJ, Scadding G. Evaluation of the medical and surgical treatment of chronic rhinosinusitis: a prospective, randomized, controlled trial. Laryngoscope 2004;114:923-30.