

# Analysis of Disease Patterns in Patients with Unilateral Sinonasal Diseases

Hsiung-Kwang Chung, Chih-Jaan Tai, Pa-Chun Wang<sup>1,2</sup>, Chia-Der Lin, Ming-Hsui Tsai

Department of Otorhinolaryngology, Head and Neck Surgery, China Medical University Hospital, Taichung;

<sup>1</sup>Department of Otolaryngology, Cathay General Hospital, Taipei,

<sup>2</sup>School of Medicine, Fu-Jen Catholic University, Taipei, Taiwan.

**Background/Purpose.** To elucidate the clinical characteristics of patients with unilateral sinonasal diseases in Taiwan.

**Methods.** A descriptive analysis of the clinical manifestations, and the clinical pathology, microbiology, and radiography results in 54 patients with computed tomography (CT)-documented unilateral sinonasal opacification who underwent endoscopic sinus surgery from August 2004 to July 2005. The severity of opacification was based on the Lund-Mackay scoring system.

**Results.** Nasal obstruction, rhinorrhea, and postnasal drip were the most commonly observed clinical presentations. The presence of extranasal symptoms, such as facial numbness and visual complications, was suggestive of fungal sinusitis or neoplasm. More than 60% of the patients had chronic rhinosinusitis with or without polyposis. *Staphylococcus* was the most common pathogen (56%) encountered, and 22% of patients had fungal sinusitis caused by *Aspergillus*. Bacteriology revealed the existence of resistance to first-line antibiotics. There was a significant correlation between nasal septal deviation and ipsilateral sinusitis ( $p < 0.05$ ). The average Lund-Mackay grading score was  $6.4 \pm 2.0$ .

**Conclusion.** The most common postoperative diagnosis of unilateral sinonasal diseases was chronic rhinosinusitis. Nasal septal deviation was an important factor for ipsilateral sinusitis. *Staphylococcus* was the most common pathogen causing unilateral sinonasal disease. A notable degree of resistance to first-line antibiotics was observed. (Mid Taiwan J Med 2008;13:82-8)

## Key words

antibiotic resistance, chronic rhinosinusitis, endoscopic sinus surgery, unilateral sinusitis

## INTRODUCTION

Unilateral sinonasal disease is frequently encountered in rhinology practice. The most common causes of this disease are bacterial or fungal infection and malignant neoplasms [1-3]. However, patients with unilateral pathological lesions in sinonasal cavities may present with ordinary nasal complaints, such as nasal blockage, nosebleed, and postnasal drip. The subtle nature of unilateral sinonasal disease may

easily result in a missed diagnosis at initial presentation. The objective of this study was to demonstrate the characteristics of unilateral sinonasal diseases by analyzing the clinical manifestations, computed tomography (CT) findings, and the clinical, pathological, and culture results in order to better understand the clinical pattern of this disease.

## MATERIALS AND METHODS

In this study, we enrolled patients in whom sinus CT imaging documented the presence of unilateral sinonasal opacification. All patients underwent endoscopic sinus surgery at a tertiary

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Correspondence to : Chih-Jaan Tai, Department of Otorhinolaryngology, Head and Neck Surgery, China Medical University Hospital, 2 Yuh-Der Road, Taichung 404, Taiwan.

care center from August 2004 to July 2005. The symptoms typically persisted for at least 3 months and were refractory to medical therapy. Patients who had undergone nasal procedures prior to undergoing endoscopic sinus surgery, those with immunocompromised conditions, and those below 18 years of age were excluded from the study.

Clinical information, including gender, age, anterior rhinoscopic and endoscopic findings; roentgenological readings; final histopathological reports; and microbiological culture results was documented in a standardized form. CT findings of the mucosal conditions of the maxillary, anterior ethmoid, posterior ethmoid, sphenoid, and frontal sinuses, and the ostiomeatal complex were evaluated using the Lund-Mackay grading system. This assessment tool has been extensively validated [4]. The system quantifies the radiographic findings on sinus CT with a numerical score ranging from 0 to 2. A score of 0 implies that there is no mucosal thickening; a score of 1 indicates partial mucosal thickening, and a score of 2 is indicative of total sinus opacification. A score of 0 or 2 indicates obstruction of the ostiomeatal complex. The mean Lund-Mackay score was derived by adding the scores derived from CT images of the left and right sides of the sinus and then dividing that value by the number of patients. Since the score of the healthy side of the sinus was negligible, the overall CT score only represents ipsilateral severity. The existence of anatomical variants, including nasal septal deviation, concha bullosa, Haller cells, agger nasi cells, and Onodi cells, was also noted. The direction of the deviation was defined as an abnormal convexity of the septal curvature, resulting in a relatively narrow air channel. The incidence of existing anatomical variants in patients with sinonasal disease was compared with that in patients without sinonasal disease using the chi-square test. A *p* value of less than 0.05 was considered statistically significant.

Before surgery, the face, nasal vestibule and nasal cavity were disinfected with a povidone-iodine solution. Under endoscopic visualization, a microtip culture swab was placed through the

common meatus and directed into the nidus. Care was taken to avoid contamination from the nasal ala, vestibular skin, septum, and lateral wall. All samples were sent for culture and antibiotic sensitivity testing. In the event that fungal infection was suspected, culture specimens were stored in an environment that permitted fungal growth. If a lesion was suspected of being malignant, biopsy specimens were obtained carefully to reduce the risk of intranasal tumor seeding. Patients with infection were advised to self-administer topical steroid spray and nasal lavage in order to hasten the recovery of the sinus mucosa. Fiberoptic endoscopy was performed as a postoperative follow-up procedure for outpatients. Postoperative therapies were administered depending on the pathological diagnosis and culture results. For example, patients in whom nasopharyngeal carcinoma (NPC) were diagnosed received radiotherapy with or without chemotherapy.

## RESULTS

The patient group comprised 31 (57%) men and 23 (43%) women. The median age was 52 years (18 to 82 years). No gender or age difference was observed.

### Clinical manifestations

Forty-seven (87%) patients presented with nasal obstruction and 39 (72%) presented with persistent rhinorrhea (Table 1). Other intranasal symptoms included postnasal drip (*n* = 31, 57%), hyposmia or anosmia (*n* = 10, 19%), and epistaxis (*n* = 9, 17%). The extranasal symptoms remained undefined until accurately diagnosed by a

**Table 1. Clinical manifestations of unilateral sinonasal diseases (N = 54)**

Intranasal symptoms	n (%)
Nasal obstruction	47 (87)
Rhinorrhea	39 (72)
Postnasal drip	31 (57)
Anosmia	10 (19)
Epistaxis	9 (17)
Extranasal symptoms	
Facial neuralgia	9 (17)
Visual problems	5 ( 9)
Otologic complaints	3 ( 6)

rhinologist. Nine (17%) patients presented with facial neuralgia, 5 (9%) suffered from visual problems, and 3 (6%) had otologic complaints such as aural fullness caused by otitis media with effusion. Intraoperative findings of these three patients with otologic complaints revealed nasal polyps (n = 2) and NPC (n = 1) obstructing the eustachian tube orifice.

### Pathology

Chronic rhinosinusitis (CRS) was diagnosed in 34 patients (62%); of these, 15 had nasal polyps, a condition characterized by eosinophil infiltration and immunoglobulin E overproduction. Twelve (22%) patients had fungal sinusitis with evidence of numerous entangled hyphae. Benign tumors were found in 3 (6%) patients; 2 (4%) had inverted papilloma and 1 (2%) had schwannoma. Malignant neoplasms were found in 4 patients; 2 (4%) had squamous cell carcinoma; 1 (2%) had olfactory neuroblastoma, and 1 (2%) had NPC. One patient (2%) experienced an episode of acute bacterial rhinosinusitis resulting from a frontal mucocele (Table 2).

### Microbiology

In the CRS group (n = 34), colonization with more than 1 microbe was observed in 9 patients. Coagulase negative staphylococcus (CNS) species were the most common pathogens observed (n = 12, 35%), followed by streptococci (n = 8, 24%) and *Staphylococcus aureus* (n = 7, 21%). Anaerobes such as peptostreptococci and

*Prevotella intermedia*, were found in 6 isolates. Twenty-two (65%) isolates exhibited resistance to antibiotics. The sensitivity analysis of several first-line antibiotics revealed resistance to penicillin (n = 12, 35%), erythromycin (n = 9, 26.4%), clindamycin (n = 7, 21%), and cephadrine or cefazolin (n = 4, 8.5%). As mentioned previously, 12 patients (22%) were positive for fungal sinusitis, and 7 (58%) specimens yielded positive isolates (*Aspergillus* species, 100%). In the one patient with acute bacterial rhinosinusitis, bacterial culture yielded *Streptococcus viridans*. The microbiological results of the infectious group of unilateral sinonasal disease, including CRS, fungal sinusitis, and acute sinusitis are listed in Table 3.

### Radiography

The most common anatomical variants detected on sinus CT imaging in patients without evidence of neoplasms (n = 47) were nasal septal deviation and concha bullosa. Of these patients, 35 (74%) patients had nasal septal deviation; among them, 25 (53%) had septal deviation toward the diseased side, and 10 (21%) had septal deviation toward the normal side. The correlation between unilateral sinus disease and ipsilateral nasal septal deviation was significant ( $p < 0.05$ ). Eleven (23%) patients had concha bullosa; 6 (13%) on the affected side, 4 (8%) on the normal

**Table 2. Postoperative histopathology of unilateral sinonasal diseases (N = 54)**

Histopathology	n (%)
Chronic rhinosinusitis	
CRS without polyps	19 (35)
CRS with polyps	15 (27)
Fungal sinusitis	12 (22)
Inverted papilloma	2 ( 4)
Squamous cell carcinoma	2 ( 4)
Acute sinusitis with mucocele	1 ( 2)
Schwannoma	1 ( 2)
Olfactory neuroblastoma	1 ( 2)
NPC	1 ( 2)

CRS = chronic rhinosinusitis; NPC = nasopharyngeal carcinoma.

**Table 3. Microbiological results in patients with infections, classified according to histopathology (N = 47)\***

Microorganisms	n (%)
Chronic bacterial rhinosinusitis, n = 34	
Coagulase negative staphylococci	12 ( 35)
Streptococci	8 ( 24)
<i>Staphylococcus aureus</i>	7 ( 21)
Peptostreptococci	5 ( 15)
<i>Klebsiella pneumoniae</i>	3 ( 9)
<i>Haemophilus parainfluenzae</i>	1 ( 3)
<i>Prevotella intermedia</i>	1 ( 3)
Corynebacterium spp.	1 ( 3)
<i>Fusobacterium necrophorum</i>	1 ( 3)
Chronic fungal sinusitis, n = 12	
<i>Aspergillus</i> spp.	7 ( 58)
Acute sinusitis, n = 1	
<i>Streptococcus viridans</i>	1 (100)

\*Patients with neoplasms were excluded (n = 7).

side, and 1 (2%) on both sides. Table 4 demonstrates the incidence rates of the other anatomical variants. Unilateral sinonasal disease involved the maxillary sinuses in 52 (96%) patients and the anterior ethmoid sinuses in 37 patients (69%). Other paranasal locations are summarized in Table 5. The average Lund-Mackay grading score was 6.4. (standard deviation, 2.0; range, 1-12)

### DISCUSSION

Anatomical variants may play a role in the development of unilateral sinonasal diseases [5,6]. Stallman et al and Aktas et al indicated that

**Table 4. Common anatomical variants of sinus CT in surgically treated cases (N = 47)**

Anatomical variants	n (%)
Nasal septal deviation	35 (74)
Toward the affected side	25 (53)
Toward the normal side	10 (21)
Concha bullosa	11 (23)
At the affected side only	6 (13)
At the normal side only	4 ( 8)
Both sides	1 ( 2)
Haller cells	9 (20)
At the affected side only	4 ( 8)
At the normal side only	4 ( 8)
Both sides	1 ( 2)
Agger nasi cells	16 (34)
At the affected side only	4 ( 8)
At the normal side only	6 (13)
Both sides	6 (13)
Onodi cells	4 ( 8)
At the affected side only	2 ( 4)
At the normal side only	2 ( 4)
Both sides	0 ( 0)

unilateral concha bullosa was associated with contralateral nasal septal deviation [6,7]. The likelihood of a maxillary inflammatory disease can be predicted by observing the contact between the mucosal surface of the ostiomeatal complex in the presence of anatomic variants [8]. Calhoun et al found a significant association between ethmoid sinusitis and the convex side of septal deviation [9]. Perez-Jaffe et al proposed that the convex side of the septum has a space-occupying mass effect on the adjacent air channel, resulting in tissue hypoxia and the blockage of mucociliary drainage which prevents the affected nasal mucosa from being repaired [10,11]. There is also evidence that Haller cells, agger nasi cells, and Onodi cells may play a role in unilateral sinonasal diseases, although the association of these cells with the occurrence of these diseases remains unclear [12-14].

The maxillary sinus is considered to be a sterile environment under normal circumstances even though potential bacterial pathogens have been found in more than 75% of adult nasal cavities. As in our study, the most common pathogenic bacterial species isolated from the maxillary sinus are staphylococcal and streptococcal species and many of them show resistance or decreased sensitivity to various antibiotics [15,16]. We believe that blind antimicrobial treatment, which is not based on culture results, is responsible for this distressing situation because the normal flora in the nasal cavity is simultaneously affected. In this study,

**Table 5. The affected sinuses and Lund-Mackay mean scores in 54 patients with unilateral sinonasal diseases**

Site	Score 0 n	Score 1 n	Score 2 n	Diseased n (%)	Mean score
Maxillary sinus	2	14	38	52 (96)	1.7 ± 1.0
Anterior ethmoid sinus	17	12	25	37 (69)	1.1 ± 1.0
Posterior ethmoid sinus	29	6	19	25 (47)	0.8 ± 0.0
Frontal sinus	37	4	13	17 (31)	0.6 ± 0.0
Sphenoid sinus	44	3	7	10 (11)	0.3 ± 0.0
Ostiomeatal complex	4	-	50	50 (93)	1.9 ± 1.0
					6.4 ± 2.0*

Lund-Mackay sinus radiological staging system: Each component of the paranasal sinus was scored according to the degree of opacification observed on sinus CT. A score of 0 implied that there was no mucosal thickening; 1, indicated partial mucosal thickening; 2, total sinus opacification. A score of 0 or 2 indicated obstruction of the ostiomeatal complex. [4] \*The sum of all the scores obtained from the 54 patients divided by 54 constituted the mean score of the Lund-Mackay grading system.

bacteriology revealed the existence of first-line antibiotic resistance. Some of the species cultured were resistant to more than one first-line antibiotic. We did not encounter methicillin-resistant *S. aureus* or multidrug-resistant bacteria.

Fungal sinusitis was another prominent infectious unilateral sinonasal disease in our study, although all patients with fungal sinusitis had a noninvasive form, such as fungal ball and allergic fungal sinusitis. Several authors have stated that fungal sinusitis has a tendency to occur unilaterally, with various presenting symptoms. Ryan et al proposed that the patients with allergic fungal sinusitis develop unilateral intranasal symptoms such as nasal congestion and obstruction, postnasal drip, and anosmia [17]. Dufour et al reported that asymmetrical facial pain was the second most common clinical presentation in patients with fungal sinusitis, following postnasal drip [18]. Therefore, the unilaterality of sinonasal disease is predictive of fungal sinusitis regardless of intranasal or extranasal symptoms.

Bacterial rhinosinusitis was the most common diagnosis in our series. Partial bone erosion of the sinus wall and heterogenous opacities with or without hyperdensity in the involved sinus cavity were characteristic of fungal sinusitis. In the event of delayed diagnosis and treatment, the diagnosis was confirmed based on histopathological results. In some cases, negative fungal culture was probably due to slow in vitro fungal growth. In this study, 58% of fungal cultures were positive. Perez-Jaffe et al studied 26 cases of allergic fungal sinusitis (AFS) using molecular analysis; the fungus *Aspergillus* was detected in half of these cases [10]. The rates of positive fungal cultures reported by Meltzer et al ranged from 64% to 100%. These rates varied depending on the techniques used for fungal culture and detection [19].

Chronic bacterial rhinosinusitis was the preliminary diagnosis in all patients with unilateral or bilateral sinonasal diseases; it was the definitive diagnosis in 62% of patients. The incidence was significantly higher than that

of fungal sinusitis and that of benign and malignant neoplasms. Surgery should be reserved for patients who cannot be treated with medication, such as those with neoplasms or fungal rhinosinusitis.

It is well-known that the Lund-Mackay grading system has a higher reproducibility than other scales designed to describe the severity of rhinosinusitis. However, the severity of maxillary sinus diseases is usually underestimated by this grading system. This is because the maxillary sinus is the largest paranasal sinus and a score of 2 cannot be achieved unless the maxillary sinus is opaque. For example, a CT scan showing mild involvement of the frontal, anterior ethmoid, and posterior ethmoid sinuses and the ostiomeatal complex is graded as "5", while total maxillary opacification is graded as "2"; however, the degree of diseased mucosa might be equal. In our study, the average Lund-Mackay score was 6.4, which is lower than that reported in similar studies. The high prevalence of maxillary sinus diseases may be the reason underlying the low Lund-Mackay scores in our study.

In conclusion, symptoms of unilateral sinonasal diseases manifest early during the course of this disease, thus enabling timely diagnosis. Anatomical variants, especially ipsilateral nasal septal deviation, can cause unilateral sinonasal diseases because they can interfere with aeration. In this study, the most common postoperative histopathological diagnosis of unilateral sinonasal diseases was chronic rhinosinusitis. Staphylococci was the most common species isolated, and a notable degree of resistance to first-line antibiotics was observed among all bacterial isolates.

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## 術後分析單側鼻竇炎之疾病型態

鍾雄光 戴志展 王拔群<sup>1,2</sup> 林嘉德 蔡銘修

中國醫藥大學附設醫院 耳鼻喉部

國泰綜合醫院 耳鼻喉科<sup>1</sup>

輔仁大學 醫學系<sup>2</sup>

**背景/目的** 這篇文章的主旨是描述國內單側鼻竇病變(unilateral sinonasal diseases)病人的臨床特徵。

**方法** 共54位病患於2004年8月到2005年7月，經由電腦斷層診斷為單側鼻竇病變且以Lund-Mackay grading score計分並接受鼻竇內視鏡手術。分析其臨床表徵、病理、微生物學及放射線學的特徵。

**結果** 常見的主要臨床表徵包括有鼻阻塞、流鼻涕和鼻涕倒流。少數的隱性鼻外徵狀如臉部神經痛卻時常被忽略，但這是有可能合併黴菌鼻竇炎或腫瘤。大於60%的病人患有慢性鼻炎-鼻竇炎，鼻中膈彎曲和單側鼻竇炎有密切關聯( $p < 0.05$ )。Lund-Mackay grading score平均為6.4。葡萄球菌是最常見的病源體(56%)，且有第一線抗生素抗藥性的存在。黴菌性鼻竇炎22%，主因為麴黴屬真菌。

**結論** 慢性鼻竇炎是單側鼻竇病變最常見的病因，且鼻中膈彎曲與單側鼻竇炎相關。葡萄球菌是最常見的單側鼻竇炎之病原體，第一線抗生素之抗藥菌株的產生，值得臨床醫師留意。(中台灣醫誌 2008;13:82-8)

### 關鍵詞

抗生素抗藥性，慢性鼻竇炎，鼻竇內視鏡手術，單側鼻竇炎

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聯絡作者：戴志展

地址：404台中市北區育德路2號

中國醫藥大學附設醫院 耳鼻喉部

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