Prospective Observational Study of Chronic Rhinosinusitis: Environmental Triggers and Antibiotic Implications

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(See the Editorial Commentary by Mattila, on pages 69–70.)

Background. A prolonged course of antibiotic therapy is often initiated for chronic rhinosinusitis (CRS) based on symptomatology. We examined differences in clinical manifestations and underlying conditions in patients with symptoms typical for CRS. CT scan abnormality of the sinuses was the gold standard for diagnosis of CRS.

Methods. We performed a prospective observational study of 125 adults with classic symptoms of CRS undergoing nasal endoscopy and sinus CT.

Results. The patients were classified into 2 groups: (1) those with radiographic evidence of sinusitis by CT (Sx + CT) (75) and (2) those with normal CT scans of the sinuses (Sx – CT) (50). Decreased smell was significantly more common in Sx + CT than in Sx – CT patients, (P = .003). Paradoxically, headache, facial pain, and sleep disturbance occurred significantly more frequently in patients with Sx – CT than in patients with Sx + CT (P < .05). The absence of mucopurulence on endoscopy proved to be highly specific for Sx – CT patients (100%). On the other hand, sensitivity was low; only 24% of Sx + CT patients demonstrated mucopurulence by endoscopy. Improvement in response to antibiotics was similar between both CRS categories.

Conclusions. Most symptoms considered to be typical for CRS proved to be nonspecific. Interestingly, symptoms that were more severe were significantly more likely to occur in younger patients who were Sx – CT. The efficacy of antibiotic therapy was uncertain. We suggest that objective evidence of mucopurulence assessed by endoscopy or CT should be obtained if antibiotics are to be given for prolonged duration. We recommend a moratorium for the widespread practice of a prolonged course of empiric antibiotics in patients with presumed CRS.

Chronic rhinosinusitis (CRS) has traditionally been considered a sequela of unresolved or improperly treated acute bacterial rhinosinusitis, although supportive evidence is minimal. Triggers, including environmental factors, comorbid illnesses, and family history, have been proposed as risk factors for CRS. Identification of these triggers or risk factors may be important because prevention may be possible for some patients.

CRS is usually diagnosed based on patient history and symptoms in clinical practice. In this prospective, observational study we used the objective criteria of sinus CT scan abnormality as a gold standard for CRS. Two groups of patients were analyzed: (1) symptomatic patients (Sx) in whom CRS was confirmed by a CT scan (Sx + CRS) and (2) symptomatic patients (Sx) in whom CT scan was normal (Sx – CRS). Bacteriologic results and mucopurulence observed during nasal endoscopy were recorded. Our objectives were to assess the risk factor of environmental triggers and comorbid illnesses that might predispose patients to CRS, to clarify the reliability of symptoms in establishing the diagnosis of CRS, and to assess patients’ subjective impression of antibiotic efficacy. Our hypothesis was that the
patients in the Sx – CT group whose symptoms were compatible with CRS did not, in fact, have CRS. Thus, these patients would not benefit from antibiotics.

**METHODS**

In a prospective, observational study, we enrolled consecutive patients with symptoms of CRS from September 2007 through February 2008. All patients were seen by a single practitioner specializing in sino-nasal disorders. The clinical diagnosis of CRS was based on symptoms lasting for 12 weeks for at least 2 of the following: nasal congestion, nasal discharge, or facial pain. Objective evidence of CRS was assessed by endoscopy and CT scan of sinuses performed within 2 weeks of endoscopic examination. The CT scan was used as the gold standard for the diagnosis of CRS. A positive sinus CT was defined as at least 1 of the following: osteomeatal complex obstruction, greater than 10-mm mucosal thickening or an air fluid level in any 1 sinus, or less than 10-mm mucosal thickening but involving 4 or more sinuses. Symptomatic patients with a positive CT were designated as Sx + CT, and symptomatic patients with a negative or normal CT were designated as Sx – CT. A positive endoscopy result was defined by the presence of mucopurulent secretions that were discolored but not bloody. Nonmucopurulent secretions consisted of secretions that were clear or white. Decreased smell was subjectively defined by the patient as follows: none: no decreased smell; moderate: definitive awareness of symptom that is bothersome but tolerable; and severe: symptom that is difficult to tolerate and interferes with activities of daily living.

**Statistical Methods**

Stata version 10.1 (Stata Corp LP, College Station) was used for statistical analysis. Categorical values were compared using a chi-square test or Fisher exact test. A chi-square test for trends was used to assess increasing levels of symptom severity between the 2 groups. This study was approved by the local institutional review board (IRB), and all patients provided informed consent.

**RESULTS**

There were 125 consecutive patients enrolled in the study. Seventy-five patients had CT scan evidence of sinusitis (Sx + CT), while 50 patients did not (Sx – CT). Sx + CT patients were significantly older than Sx – CT patients (mean 51.8 years vs 45.2 years, \( P = .017 \)). Also, 62.4% (78/125) had at least 1 comorbid illness; no difference was seen for presence of a comorbid illness (Table 1): Sx + CT (62.7% [47/75]) vs Sx – CT (62% [31/50]). Forty-three patients had undergone prior sinus surgery.

**Symptomatology**

Decreased smell was significantly more common in Sx + CT patients than in Sx – CT patients (79.2% vs 48.7%, \( P = .003 \)) (Figure 1). Chi-square test for trends was significant (\( P = .003 \)) for decreased smell (mild, moderate, severe) in which a dose response was seen, ie, the greater the severity of decreased smell, the more likely that CT confirmation of CRS would be documented. Discolored drainage was reported more commonly in Sx + CT patients than in Sx – CT patients (64% vs 44.7%, \( P = .072 \)).

**Figure 1.** Symptoms more frequent in patients with CT confirmation of Chronic Rhinosinusitis (Sx + CT). Note: Decreased smell occurred significantly more often in patients with documented evidence of CRS, and a dose response effect was seen, i.e., the greater the severity of decreased smell, the more likely that CT confirmation of CRS would be documented (see the Results section).

**Table 1. Comorbid Illness of Patients With and Without CT Scan Confirmation of Chronic Rhinosinusitis**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Sx + CT, N = 75</th>
<th>Sx – CT, N = 50</th>
<th>Sig level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age mean(median)b</td>
<td>51.8,(53.5)</td>
<td>45.2,(46)</td>
<td>.017</td>
</tr>
<tr>
<td>Range</td>
<td>17 to 94</td>
<td>15 to 79</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>61.3% (40/75)</td>
<td>72% (36/50)</td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>44.0%,(33/75)</td>
<td>32.0%, (16/50)</td>
<td>.18 NS</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>50.6% (38/75)</td>
<td>42% (21/50)</td>
<td>NS</td>
</tr>
<tr>
<td>Diabetes</td>
<td>6.0%, (6/75)</td>
<td>10.0%, (5/50)</td>
<td>NS</td>
</tr>
<tr>
<td>Immunodeficiency</td>
<td>10.7%, (8/75)</td>
<td>2.0%, (1/50)</td>
<td>.084 NS</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>2.7%, (2/75)</td>
<td>0/50</td>
<td>NS</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>16.0%, (12/75)</td>
<td>20.0%, (10/50)</td>
<td>NS</td>
</tr>
<tr>
<td>Depression</td>
<td>17.3%, (13/75)</td>
<td>22.0%, (11/50)</td>
<td>NS</td>
</tr>
<tr>
<td>Migraine</td>
<td>16.0%, (12/75)</td>
<td>26.0%, (13/50)</td>
<td>.18 NS</td>
</tr>
<tr>
<td>GERD</td>
<td>40.0%, (30/75)</td>
<td>32.0%, (16/50)</td>
<td>NS</td>
</tr>
<tr>
<td>Fibromyalgia</td>
<td>4.0%, (3/75)</td>
<td>8.0%, (4/50)</td>
<td>NS</td>
</tr>
<tr>
<td>Irritable bowel</td>
<td>12.0%, (9/75)</td>
<td>16.0%, (8/50)</td>
<td>NS</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>10.7%, (8/75)</td>
<td>4.0%, (2/50)</td>
<td>NS</td>
</tr>
</tbody>
</table>

Abbreviations: GERD, gastrointestinal reflux disease; NS, not significant; Sx + CT, symptomatic chronic sinusitis confirmed by CT scan of sinuses; Sx – CT, symptoms of chronic sinusitis with a negative or normal CT scan.

\* No significant differences for comorbid illness were seen for those with objective confirmation of Chronic Rhinosinusitis vs those without such confirmation.

\* Patients were significantly younger in Sx – CT.
Paradoxically, headache, facial pain, and sleep disturbance were significantly more common in Sx – CT patients than in Sx + CT patients (P < .05) (Figure 2). Chi-square test for trends was significant (P = .013) for facial pain in which a reverse dose-response was seen, i.e., the greater the severity of facial pain, the less likely that CT confirmation of CRS would be found (see the Results section).

Environmental Triggers

Environmental triggers were not significantly different in Sx + CT patients compared with Sx – CT patients. Associations that were examined included alcohol consumption, cigarette smoking, exposure to second-hand smoke, pets, living on a farm, exposure to central heating, and mold exposure (data not shown). Small numbers led to insufficient power for statistical analysis of exposure to air conditioning or wood-burning stoves.

Comorbid Illness

Of 8 comorbid illnesses evaluated, irritable bowel syndrome, gastrointestinal reflux disease (GERD), diabetes, rheumatoid arthritis, osteoarthritis, depression, fibromyalgia, and osteoporosis, none were found to be significantly associated with Sx + CT or Sx – CT (Table 1).

Family History

A trend for family history of acid reflux was seen more often in Sx – CT patients (67.6%) than in Sx + CT patients (46.4%, P = .095). Family history of asthma showed no significant association.

Mucopurulence

All 125 patients underwent nasal endoscopy with evaluation for presence of mucopurulence, nasal polyps, and edema. Endoscopic mucopurulence was present in only 18 patients, and all 18 were Sx + CT (specificity of 100%). So, mucopurulence was accurate in identifying CRS confirmed by CT scan (Table 2). However, the sensitivity of endoscopic mucopurulence for predicting Sx + CT was only 24% (18/75).

Bacteriology

Forty-one cultures were performed by endoscopy: 38 in Sx + CT and 3 in Sx – CRST. In the 18 patients with mucopurulence (all of whom were Sx + CRST), 17/18 had cultures performed, 13/17 had bacteria isolated, and 4/17 yielded no growth. The bacteria for these 13 patients included 10 monomicrobial cultures: methicillin sensitive Staphylococcus aureus (MSSA) (5), Pseudomonas aeruginosa (3), coagulase-negative Staphylococcus (1), and Streptococcus pyogenes (1) and 3 polymicrobial cultures: MSSA + Streptococcus pneumoniae; P. aeruginosa, Citrobacter, E. coli, and group B Streptococcus; and Enterobacter cloacae and coagulase-negative Staphylococcus. Specimens that were mucopurulent were no more likely to be culture positive than those that were not mucopurulent (although bacterial quantitation was lower in nonmucopurulent specimens) (data not shown). Patients with positive cultures were significantly more likely to have had prior surgery (data not shown). Only 5 patients had bacteria that are associated with acute bacterial sinusitis (Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, Streptococcus pyogenes); all occurred in Sx + CT patients with prior sinus surgery. Gram-negative bacilli were isolated only in patients with prior surgery. Viral cultures were not performed.

Antibiotics

Patients were queried on antibiotic use and improvement of symptomatology while on antibiotics in the past year. No information was obtained for antibiotic doses and duration.

Environmental Triggers

Environmental triggers were not significantly different in Sx + CT patients compared with Sx – CT patients. Associations that were examined included alcohol consumption, cigarette smoking, exposure to second-hand smoke, pets, living on a farm, exposure to central heating, and mold exposure (data not shown). Small numbers led to insufficient power for statistical analysis of exposure to air conditioning or wood-burning stoves.

Family History

A trend for family history of acid reflux was seen more often in Sx – CT patients (67.6%) than in Sx + CT patients (46.4%, P = .095). Family history of asthma showed no significant association.
Migraine headaches are a common mimicker of sinusitis found for migraine headaches (symptomatic than Sx CT excludes the diagnosis of sinusitis. Of the 125 evaluable patients with symptoms of CRS, 75 had CT scans confirming the presence of sinusitis as the gold standard for the diagnosis of presence of CRS in this investigation. Because the accuracy of symptomatology is uncertain for the diagnosis of CRS, CT scan was used as the gold standard for the diagnosis of presence of CRS in this investigation. Of the 125 evaluable patients with symptoms of CRS, 75 had CT scans confirming the presence of sinusitis (Sx + CT) and 50 did not (Sx – CT). We assumed that a normal sinus CT excludes the diagnosis of sinusitis.

Intriguingly, patients with Sx–CT were actually more symptomatic than Sx + CT patients for the symptoms of headache (P = .007) and sleep disturbance (P = .013; Figure 2). Facial pain/pressure/fullness was listed as one of the 3 symptoms used for diagnosis of chronic rhinosinusitis in the 2004 Task Force definition [2]. In our study, facial pain was actually more likely to be present in patients with Sx – CT than in those with Sx + CT (P = .03; Figure 2). Sx – CT patients were also significantly more likely to have a family history of acid reflux compared with those with sinusitis (P = .045). A similar trend was found for migraine headaches (P = .18 (Table 1) and increased fatigue (P = .14) in Sx – CT patients (Figure 2). Migraine headaches are a common mimicker of “sinus headaches” [3, 4]. Thus, patients without CT confirmation of CRS were more likely to have more symptoms and the symptoms were often more severe. This paradoxical finding raises the distinct possibility that many patients with symptomatology classic for CRS are not actually infected.

Thus, treatment for CRS based on symptomatology will lead to unnecessary antibiotic exposure for a large group of patients. In 4 studies with sample sizes ranging from 46 to more than 700 patients with presumed sinusitis based on symptoms, only 35%–54% had CT confirmation of chronic rhinosinusitis [5–8]. Results from both Bhattacharyya [7] and our study show that Sx + CT patients are more likely to have reduced sense of smell. Moreover, the greater the reduction of the sense of smell, the more likely that CT confirmation of CTS. Nevertheless, this finding is insufficiently predictive to accurately diagnose CRS.

Patient history of discolored nasal drainage approached significance in separating Sx + CT from Sx – CT (P = .072) (Figure 1). Objective endoscopic finding of mucopurulence was present only in Sx + CT patients and never seen in Sx – CT patients. This 100% (50/50) specificity of absence of mucopurulence in Sx – CT patients immediately suggests that the presence of mucopurulence does identify those patients in whom antibiotics are indicated. Because most Sx + CT patients did not have mucopurulent secretions endoscopically, the sensitivity for detecting Sx + CT by mucopurulence was only 24% (Table 2). It was noted that 78% of mucopurulent secretions yielded bacteria. However, the significance of the bacteria isolated is unclear and, in some patients, may represent colonization from prior surgery.

Interestingly, 80% of patients receiving antibiotics in both Sx + CT and Sx – CT reported improvement with antibiotics. If CRS was truly an infection, one might expect that the clinical response following antibiotic therapy would be superior in patients who truly had CRS, ie, in Sx + CT patients rather than in Sx – CT patients. In fact, no significant difference in response was seen for the 2 patient groups (Table 4).

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The results were similar for Sx + CT (60% usage, 53.3% improvement) and Sx – CT patients (52% usage, 48% improvement) (Table 3). Analysis of symptomatic improvement confined to those patients who received antibiotics were similar: 80% (36/45) of Sx + CT improved, which was essentially equivalent to 81% (21/26) of Sx – CT who also reported improvement with antibiotics (Table 4).

**DISCUSSION**

In 1996 and 2004, the American Academy of Otolaryngology Head and Neck Surgery task force published definitions of sinusitis and coined the term “rhinosinusitis” in order to emphasize the relationship of nasal symptoms and nasal pathology to sinus disease [1, 2]. The current definition of chronic rhinosinusitis (CRS) is inflammation of the nose and paranasal sinuses with objective evidence of disease by radiographs or nasal endoscopy and with a duration of symptoms and signs of at least 12 weeks. In clinical practice, CRS is usually diagnosed by symptomatology. Because the accuracy of symptomatology is uncertain for the diagnosis of CRS, CT scan was used as the gold standard for the diagnosis of presence of CRS in this investigation. Of the 125 evaluable patients with symptoms of CRS, 75 had CT scans confirming the presence of sinusitis (Sx + CT) and 50 did not (Sx – CT). We assumed that a normal sinus CT excludes the diagnosis of sinusitis.

<table>
<thead>
<tr>
<th>Table 3. Subjective Impression of Antibiotic Efficacy in 125 Patients</th>
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<tbody>
<tr>
<td>Factor</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>Treated with antibiotics</td>
</tr>
<tr>
<td>Improved with antibiotics</td>
</tr>
</tbody>
</table>

Abbreviations: NS, not significant; Sx + CT, symptomatic chronic sinusitis confirmed by CT scan of sinuses; Sx – CT, symptoms of chronic sinusitis with a negative or normal CT scan.

<table>
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<tr>
<th>Table 4. Subjective Impression of Antibiotic Efficacy in 71 Patients Treated With Antibiotics in the Past Year</th>
</tr>
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<tbody>
<tr>
<td>Antibiotic</td>
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<tr>
<td>------------</td>
</tr>
<tr>
<td>No improvement</td>
</tr>
<tr>
<td>Improvement</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Abbreviations: Sx + CT, symptomatic chronic sinusitis confirmed by CT scan of sinuses; Sx – CT, symptoms of chronic sinusitis with a negative or normal CT scan.

* Confining the analysis to the 45 patients receiving antibiotics in the past year in the Sx + CT group, the conclusion is the same: the 80% (36/45) of patients who received antibiotics in the Sx + CT group was not significantly different from the 81% (21/26) who received antibiotics in the Sx – CT group.
Environmental Triggers and Comorbid Illnesses

Does an early exposure to an environmental factor predispose or trigger patients with acute sinusitis to subsequently progress to CRS? Or, are most cases of CRS unrelated to prior acute disease, with an inevitable inflammatory occurrence regardless of optimal therapy for acute sinusitis? Most studies of comorbidities linked to CRS evaluated small numbers of patients, lacked a control group, and lacked objective verification of CRS [2]. Comorbidities—some causal and others simulators of CRS—include “nociceptive dysfunction” or fibromyalgia, migraine headaches, irritable bowel syndrome, immunodefi- ciency disorders, GERD, asthma, allergic rhinitis, history of allergies, depression, rheumatoid arthritis, osteoarthritis, osteoporosis, and immunodeficiency [9–16]. In our study, no significant association was found for asthma and Sx + CT relative to Sx – CT. None of the prior studies that reported associations with CRS used objective CT criteria for the diagnosis of CRS [6, 13]. The presence of nasal polyps was significantly associated with Sx + CT (50.7% vs 10.0%, \( P < .001 \)). Sx + CT findings could be further subdivided into those with nasal polyps (\( n = 38 \)) and those without nasal polyps (\( n = 37 \)). Some postulated risk factors or triggers include mold exposure and exposure to irritants (pets, farms, air conditioning, central heating, wood burning stoves). In our study, none of these factors were significantly different in Sx + CT patients vs Sx – CT patients. Cigarette smoking has been suggested as a risk factor [17]; in our study, neither history of smoking or quantity correlated with Sx + CT. Likewise, alcohol consumption was not a risk factor.

Endoscopy

Endoscopy has advantages over sinus CT in determining whether the patient might benefit from an antimicrobial agent because cultures of the sinus outflow tracts can be obtained. Cincik and Ferguson found that endoscopically guided culture results changed the antibiotic treatment in half of the patients with CRS or acute exacerbation of CRS [18]. The specificity (100%, 50/50) of the finding of mucopurulence for confirmation of CRS has implications for clinical practice. If endoscopy reveals mucopurulence, the indication for antibiotic administration becomes quite strong. On the other hand, when endoscopy fails to show mucopurulence, the diagnosis of chronic sinusitis remains tenable because the sensitivity was only 24% (18/75) (Table 2). Stankiewicz found a sensitivity of 46% and specificity of 86% of endoscopic abnormality predicting CT evidence of sinusitis in 78 patients [6]. Bhattacharyya found that the addition of findings from nasal endoscopy to the CRS symptoms recommended by the 2007 guidelines improved the specificity to 84.1% in which CT was the gold standard for CRS [19].

Only 5 patients yielded a classic respiratory pathogen of \( S. \ pneumoniae \), \( H. influenzae \), \( M. catarrhalis \), or \( S. pyogenes \). All cultures that yielded \( Pseudomonas aeruginosa \) and gram-negative enteric bacteria were isolated from patients who had prior sinus surgery. Although positive bacteriological results occurred more commonly in Sx + CT patients, it proved less useful than the presence of mucopurulence with respect to diagnosis. This has a parallel in pneumonia in which gram stains of sputum are more useful for diagnosis than sputum culture.

Limitations

Weaknesses in our study are summarized here. First, the endpoint for “improvement on antibiotics” was subjective and based on patient assessment. Nevertheless, the endpoint most commonly used by practitioners who treat CRS is symptomatic improvement, not objective resolution of CT abnormalities or reduction in drainage. Second, it is possible that patients with negative CT scans may have had previously positive sinus CT scans that resolved even though they continued to experience CRS symptoms. Third, cultures were not obtained for all secretions obtained by endoscopy but were obtained on all mucopurulent specimens and in many with nondiscolored drainage. Thus, the relevance of positive cultures could not be clearly ascertained. Sinus aspirate cultures in patients who had not had surgery would have given more accurate bacteriological information. Fourth, the comorbidity and underlying illnesses of the patients were obtained by patient history without objective documentation. However, most studies of CRS also apply these terms without explicit definitions or objective validation. Finally, these patients were not representative of the general population of patients with CRS because patients enrolled were referred to a tertiary clinic for sino-nasal disorders. This bias may, nevertheless, underscore our findings because patients seen by nonspecialist physicians are less likely to fulfill definitions laid down by the task force [2]. And, prescription of antibiotics by the nonspecialist may be more prevalent.

Antibiotic Use in Chronic Rhinosinusitis

Antibiotic use for CRS is almost universal [20, 21]. In a survey of US otolaryngologists, more than 94% used oral antibiotics [21], with a median duration of 3–4 weeks [22]. Three [3] studies evaluating antibiotics for CRS treatment enrolled 45 to more than 200 patients; none of these studies were placebo controlled and results were inconclusive [23–25]. The only randomized placebo-controlled trial in CRS demonstrated benefit only after 3 months administration of roxithromycin; this benefit was not sustained following termination of the macrolide [26, 27].

Implications if Symptomatic Patients Do Not Have Chronic Rhinosinusitis

In the United States, 15.5% of the population has CRS, making it the second most common self-identified chronic illness [28].
The prevalence of a physician diagnosis of CRS by ICD-9 code is far lower at 2% [29]. Although objective evidence for CRS is recommended for research protocols, the vast majority of patients being treated with antibiotics for CRS do not have CT scans or endoscopy performed. Thus, a huge number of patients currently being treated for CRS are not infected and receive no benefit from the antibiotic therapy given. The duration of antibiotic therapy for CRS is usually 3 weeks or longer [30]. Significant adverse effects from antibiotics occur in between 2% and 3% of patients, and antibiotic resistance emerges for all respiratory pathogens with antibiotic overuse. We propose a moratorium on the widespread practice of a prolonged course of long-term empiric antibiotics in patients with symptoms of CRS. This also consistent with a similar recommendation by Stankiewicz [6]. For patients who are to be considered for prolonged antibiotic therapy, we recommend that nasal endoscopy with cultures be performed. Antibiotics can be given if mucopurulence is seen. In an uncontrolled study of 45 CRS patients with a diagnosis of chronic sinusitis who underwent endoscopy, Robinson also questioned the use of antibiotics if mucopurulence was absent [31]. If mucopurulence is not documented, a CT scan of the sinus should be performed because mucopurulence was relatively insensitive for the diagnosis of CRS in our study (only 24%) (Table 2) and in the Stankiewicz study (46%) [6]. Our approach requires validation in a controlled trial.

With the exception of hyposmia and possibly discolored drainage, diagnosis using clinical criteria was not useful. The use of task force recommendations of 2 major criteria or any other clinical criteria as the basis for chronic sinusitis was not validated in our study. Management strategies and studies of CRS performed without objective confirmation should now be viewed with extreme skepticism; this includes the CRS studies cited in the Cochrane Database.

Notes

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Potential conﬂicts of interest. All authors: No reported conflicts.

All authors have submitted the ICMJE Form for Disclosure of Potential Conﬂicts of Interest. Conﬂicts that the editors consider relevant to the content of the manuscript have been disclosed.

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