

Management of a 35-Year-Old Man with Acute Nasal and Sinus Complaints

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Introduction

Sinusitis is an extremely common condition affecting almost 2 million patients chronically¹ and 32 million patients acutely each year.² Sinusitis is the most frequently reported chronic disease in the United States, with a higher incidence than arthritis, hypertension, and allergies.³ Sinusitis is one of the most prevalent medical disorders in primary care practice⁴—the disease affects approximately 15% of the United States population and is responsible for 11.6 million patient visits to physician offices annually.⁵ Further, the incidence of sinusitis appears to be increasing.⁶ Patients spend more than \$2 billion each year on nonprescription medications in an effort to obtain symptomatic relief from this disorder.⁶

As illustrated in this case study, antibiotic treatment is an appropriate therapeutic approach to a patient with sinusitis; the diagnosis of sinusitis represents the fifth highest use of antibiotic treatment.⁷ Both sinusitis and upper respiratory infection (URI) have a similar constellation of symptoms on patient presentation, however, and sinusitis must be distinguished from URI because the two entities are easy to confuse. As previously indicated, sinusitis is appropriately treated with antibiotics,^{8–10} whereas antibiotic therapy is not generally prescribed for URI. Without accurate differentiation between sinusitis and URI, unnecessary use of antibiotics can occur leading to iatrogenic morbidity, development of resistant strains of common respiratory pathogens,¹¹ potential increase in the incidence of chronic sinusitis,¹² and increased costs associated with diagnosis and treatment.¹³ The distinction between sinusitis and URI is particularly important to emphasize because physicians often use incorrect and unreliable criteria when attempting to distinguish between these diagnoses.¹⁴ In addition, in context of the high incidence of sinusitis in patients with AIDS, accurate diagnosis is imperative because of the risks associated with immunocompromised status.¹⁵

The potential for severe complications of sinusitis further emphasizes the need for accurate diagnosis. The most common complications of sinusitis involve the orbit, including cellulitis, abscess, and cavernous sinus thrombosis.² In addition, other abscess formation, mucocele formation, and osteomyelitis can also occur as complications of sinusitis.⁵ Although antibiotics have stemmed the overall incidence of sinusitis complications, inappropriate use of antibiotics has increased the potential for drug-resistant bacteria to infect patients, particularly immunosuppressed patients.

When assessing a patient for chronic sinusitis or recurrent acute sinusitis, diagnostic imaging can incur significant costs. Computed tomography (CT) scans appear to be more accurate than plain sinus films; corroboration of findings on plain films can usually be made using a screening coronal CT scan.^{16,17} The use of screening coronal CT scans alone has been noted to be cost-effective,¹⁸ the use of full coronal and axial full-cut CT scans are appropriate to evaluate extensive disease, complicated sinusitis, or recurrent infection for patients who have previously undergone surgery.¹⁹ However, URI can also cause symptoms visualized on CT that resolve in 10 to 14 days; thus, the use of CT is only appropriate if symptoms or complications occur after this period.¹⁹ Magnetic resonance imaging (MRI) is not cost-effective

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when diagnosing uncomplicated sinusitis. MRI should only be considered in the evaluation of brain, nasal, or sinus tumors; fungal sinusitis; or complicated sinusitis.¹⁹

For all of the reasons just described—the high and increasing incidence of sinusitis, the significant ramifications of a proper diagnosis and misdiagnosis, and the cost incurred by health care delivery and by patients purchasing nonprescription medications—accurate and prompt diagnosis and treatment of sinusitis is an important area of focus for the primary care practitioner. Appropriate assessment of clinical factors and radiologic studies can lead to proper diagnosis and treatment.

CASE PRESENTATION

Initial Presentation

A 35-year-old man presents to his primary care physician's office with complaints of nasal stuffiness with yellow nasal drainage, watery eyes, nonproductive cough, sore throat, and muscle aches for 7 days' duration. He requests a course of antibiotics.

History

The patient describes mild right facial discomfort for which acetaminophen has provided no relief. He has no toothache. Medical history is significant only for hypertension. The patient is married and has been working as a sales manager in a department store for the past 3 years. He and his wife each smoke two packs of cigarettes per week. He takes no medications other than the acetaminophen and atenolol for the hypertension.

Physical Examination

On physical examination the patient appears healthy. His blood pressure is 146/92 mm Hg and temperature is 37.1°C. His conjunctivae are injected. He has minimal maxillary sinus tenderness on the right, and bilateral yellow nasal discharge. On transillumination he has normal light transmission through both maxillary sinuses. His oropharynx appears mildly erythematous and is without exudate. His external ear canals are without edema or erythema. The tympanic membranes are neither bulging nor retracted; the ear landmarks are easily identifiable. He has no lymphadenopathy.

QUESTION

- **What are the most likely causes of this patient's symptoms?**

DISCUSSION

This patient presents with the common complaints of stuffy nose and facial discomfort in addition to several other familiar upper respiratory symptoms. Nasal

symptoms account for one of the most frequent complaints encountered in primary care practice and encompass a broad differential diagnosis. At the outset of this patient's illness, several entities could account for his symptoms. Common causes include seasonal allergic rhinitis (hay fever), perennial allergic rhinitis, vasomotor rhinitis, acute viral URI, and sinusitis. If the patient reports a history of excessive use of nose drops, rhinitis medicamentosa also needs to be considered.

QUESTIONS

- **What is sinusitis?**
- **How prevalent is sinusitis?**

DISCUSSION

Definition of Sinusitis

No uniform definition of sinusitis exists in the medical literature, which may present some confusion to clinicians, patients, and researchers. Many common upper respiratory symptoms are increasingly recognized as part of the continuum of an inflammatory process involving the nares and the sinuses. The nasal epithelium is continuous with the mucosa that lines the cavities of the sinuses.²⁰ Thus, the term *rhinosinusitis* has evolved to reflect the inflammation of both nasal and sinus mucosa.²⁰

The different subgroups of rhinosinusitis are classified according to the duration of symptoms and signs.²⁰ *Acute rhinosinusitis* lasts less than 4 weeks, *subacute rhinosinusitis* lasts 4 to 12 weeks, and *chronic rhinosinusitis* lasts more than 12 weeks. *Recurrent acute rhinosinusitis* is more than four episodes of acute rhinosinusitis per year with each episode lasting 7 to 10 days before completely resolving. The final subgroup, *acute exacerbations of chronic rhinosinusitis*, is the sudden worsening of chronic rhinosinusitis with return to baseline after treatment. The duration of symptoms and signs varies with the specific underlying pathogen and the pathologic processes occurring in the sinuses. These processes and differing pathogenic organisms have treatment implications.

Prevalence

Thirty million adults in the United States report signs and symptoms of acute or chronic sinusitis and spend more than \$2 billion annually on nonprescription medications.^{21,22} The 1992 National Ambulatory Medical Survey reported that sinusitis was the fifth leading diagnosis for which health care providers prescribed an antibiotic.⁷ Given the widespread prevalence of this disorder and the enormous resources utilized to provide symptomatic relief to patients, it is important to properly diagnose and treat sinusitis.

QUESTIONS

- **What pathophysiologic factors give rise to acute rhinosinusitis?**
- **What conditions predispose adult outpatient primary care patients to acute rhinosinusitis?**

DISCUSSION

Pathophysiology

Two concepts are fundamental in understanding the pathophysiology of acute rhinosinusitis: 1) multiple sinuses drain into one narrow space that is easily obstructed, and 2) cilia are important in clearing the sinuses.

The sinus cavities drain into the nasal cavity via small openings, or *ostia*. Obstruction of sinus ostia can occur secondary to mechanical obstruction (eg, from a deviated nasal septum or mass) or inflammation leading to mucosal edema (eg, from URI or allergic rhinitis).

Ciliated epithelium, which lines the inside of the sinuses, serves the important function of trapping bacteria and other foreign matter and transporting them toward the ostia. The maxillary, frontal, and anterior ethmoidal sinuses drain into the ostiomeatal complex, which is located above the roof of the maxillary sinus; thus, the ciliated epithelium of the maxillary sinus must be able to move foreign matter upward.^{23,24} Decreased mucociliary activity is associated with disorders such as Kartagener's syndrome and cystic fibrosis. The ensuing stasis of secretions can lead to superinfection with bacteria.

Predisposing Conditions

In the outpatient primary care population, the most common factors that predispose patients to acute rhinosinusitis include an antecedent viral URI and allergic rhinitis.²⁵ The maxillary sinus is the most common sinus involved.^{26,27} In a study of patients with the common cold and no other complicating factors, CT detected abnormalities of the ostiomeatal complex of the nose and the sinus cavities in almost all patients.²⁸ These abnormalities consisted of acute reversible occlusion of the infundibulum of the maxillary sinus, thickened nasal walls, and engorged turbinates. Acute reversible abnormalities were also detected in the cavities of the ethmoidal, frontal, and sphenoidal sinuses. These findings support the theory that viral rhinitis can initiate obstruction of sinus drainage and lead to sinus disease.²⁸

The exact role that allergy plays in the pathogenesis of rhinosinusitis has yet to be determined. Indirect evidence suggests that patients with allergic rhinitis are more likely to have sinus disease; however, no large prospective well-controlled studies support this hypothesis.²⁹ Although not definitively proven, strong indirect evidence demonstrates that environmental

pollutants or allergens (eg, cigarette smoke) can lead to a change in mucociliary action or incite inflammation, thus leading to thickened mucous secretions and establishing a milieu for proliferation of viruses and/or bacteria.³⁰

Tooth infections account for up to 10% of cases of acute sinusitis.^{31,32} The roots of the upper (maxillary) teeth are in close proximity to the floor of the maxillary sinus. Dental infections at these sites can spread contiguously to the maxillary sinus cavity.

QUESTION

- **What are the effects of rhinosinusitis on quality of life and function?**

DISCUSSION

Impact of Sinusitis on Health Status

Both acute and chronic rhinosinusitis can have a profound impact on the physical, functional, and emotional aspects of patients' lives. Several studies have reported the impact of rhinosinusitis on general function and well-being and disease-specific function.³³⁻³⁷

Gliklich and Metson³³ used the Medical Outcomes Study Short Form-36 (SF-36) to measure general health status and functional well-being.³⁸⁻⁴⁰ The SF-36 contains 36 items measuring function in eight domains: physical function, physical role, bodily pain, general health, vitality, social function, emotional role, and mental health. Scores in each domain range from 0 to 100, with 100 representing perfect health. Because the SF-36 has been used in a wide variety of settings, comparisons between rhinosinusitis patients and normative data from the general population and patients with other chronic conditions are possible.³⁵

Although there are no specific data on the effects of acute rhinosinusitis on health status and function, the data on chronic rhinosinusitis is informative. To demonstrate the impact of sinusitis on function and well-being, Gliklich and Hilinski⁴¹ compared SF-36 scores for 158 patients with symptoms of sinusitis for more than 3 months with national normative scores. As shown in **Figure 1**, the patients with rhinosinusitis scored significantly worse ($P < 0.05$) on the physical role, bodily pain, general health, vitality, and social function subscales.

To further demonstrate the impact of chronic sinusitis, Gliklich and Hilinski compared SF-36 scores for these same 158 patients with scores for patients with congestive heart failure and scores for patients with chronic obstructive pulmonary disease (Figure 1). There are significant differences between the sinusitis cohort and the two other cohorts. Patients with congestive heart failure or chronic obstructive pulmonary

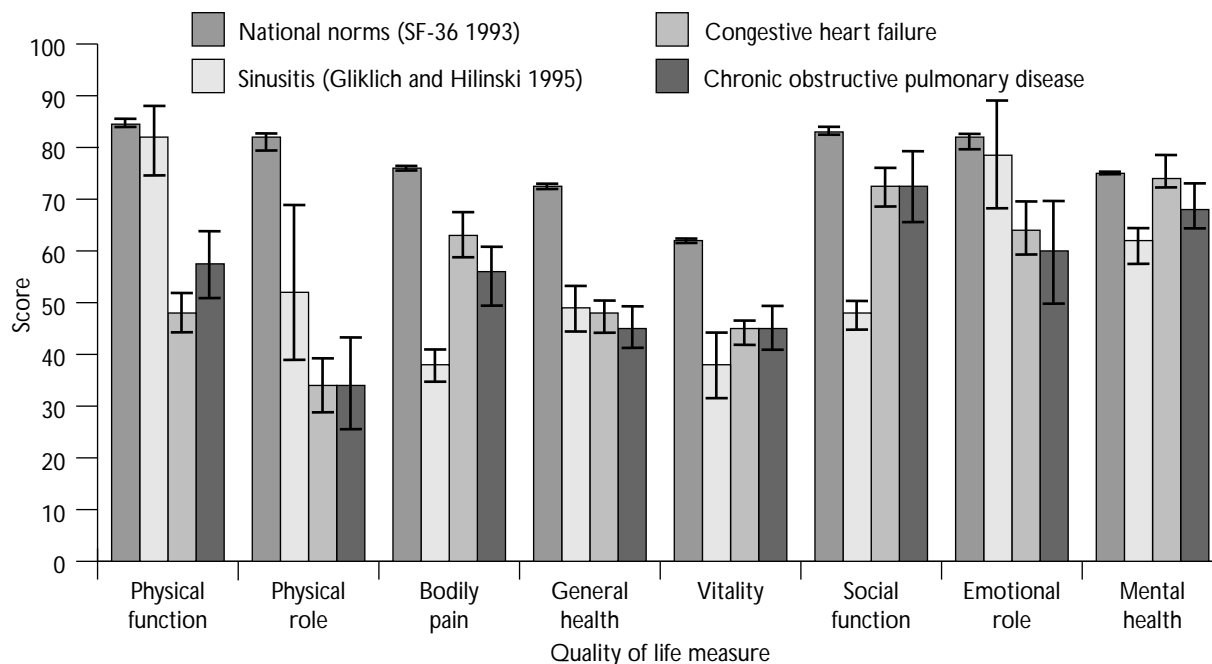


Figure 1. Medical Outcomes Study Short Form-36 (SF-36) scores for patients with chronic sinusitis, congestive heart failure, and chronic obstructive pulmonary disease compared with normative data from the general population. Adapted with permission from Gliklich RE, Hilinski JM: Longitudinal sensitivity of generic and specific health measures in chronic sinusitis. *Qual Life Res* 1995;4:27-28.

disease scored significantly worse on physical function, physical role, and emotional role. These differences might be expected because the mean age of the sinusitis cohort was much younger than the mean ages of the other two cohorts (40 years versus 67 and 62 years, respectively). However, the sinusitis cohort scored significantly lower on bodily pain and social function, indicating that sinusitis patients had more pain and were more limited in their social functioning.

The use of a standard index allows investigators to demonstrate the relative impact of rhinosinusitis on function and general well-being compared with national norms and other chronic conditions. As the figure clearly shows, rhinosinusitis has a significant impact on quality of life. Given the large number of patients affected with this condition, the health impact of chronic sinusitis is great.

QUESTION

- **What clinical findings are most useful for making the diagnosis of acute rhinosinusitis?**

DISCUSSION

Historical Findings

A common challenge for clinicians is determining if a bacterial infection of the sinuses is present amidst

multiple upper respiratory complaints. Acute sinusitis should be suspected when a patient has a “cold” that is prolonged (greater than 7 to 10 days) or unusually severe. In most cases, the patient is afebrile or has a low-grade fever and does not appear very ill. Six studies, including four in primary care settings, have examined the accuracy of clinical findings for acute maxillary sinusitis.⁴²⁻⁴⁷ Mucopurulent nasal discharge, pain in the upper teeth, and lack of response to nonprescription decongestants or antihistamines are characteristic symptoms. Facial pain that increases when the patient is bending over or is unilateral increases the likelihood of sinusitis. Ethmoidal sinusitis may be associated with orbital symptoms (eg, edema of the eyelid, chemosis).

Physical Examination Findings

Inspection of the nasal mucosa and transillumination of the sinuses are useful diagnostic maneuvers. A limited examination of the nasal mucosa can be performed using a nasal speculum mounted on a hand-held otoscope. The nasal mucosa should be examined for erythema or pallor, edema, character of nasal secretions, and polyps. Purulent fluid, particularly when secreted from the middle meatus, suggests bacterial sinusitis.⁴⁸ However, the middle meatus is difficult to visualize unless the examiner shrinks the nasal mucosa

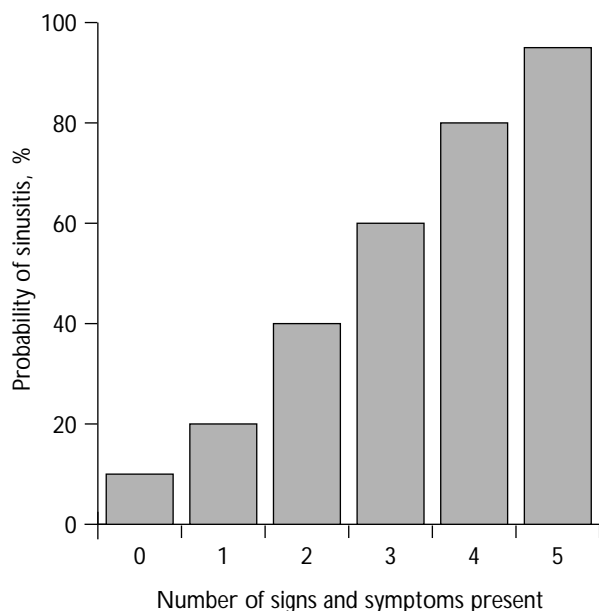


Figure 2. Relation of number of signs and symptoms present to probability of sinusitis. Factors that predict sinusitis include maxillary toothache, history of purulent nasal discharge, history of poor response to decongestants, abnormal transillumination findings, and mucopurulence on physical examination. Adapted with permission from Williams JW, Simel DL, Robert L, Samsa G: Clinical evaluation for sinusitis: making the diagnosis by history and physical examination. *Ann Intern Med* 1992;117:708.

with a topical decongestant and uses a nasal speculum to enhance visualization. Facial tenderness elicited by palpation does not distinguish between acute sinusitis and other causes of nasal symptoms.

Transillumination of the sinuses is not often used by primary care physicians but is relatively easy to learn, offers useful diagnostic information, and anecdotally seems to enhance patient confidence in the diagnosis. Transillumination must be performed in a completely darkened, windowless room (close the door, turn off the lights, and allow time to adapt to the darkness). The maxillary sinuses are transilluminated by placing a Welch-Allyn Finnoff transilluminator or Mini-MagLite (Mag Instrument, Inc., Ontario, CA) over the infra-orbital rim and judging light transmission through the hard palate. Normal light transmission through both maxillary sinuses indicates that sinusitis is a much less likely diagnosis. Decreased or no light transmission on either side indicates that sinusitis is a more likely diagnosis, but false-positive results caused by intrasinus polyps or a hypoplastic sinus are possible. The ability to detect abnormalities improves with practice. Frontal sinuses

can also be transilluminated by placing a light against the floor of the frontal sinus at the superior medial edge of the orbit. A glow should be transmitted through the anterior wall of the sinus. When interpreting this test, the clinician should remember that in approximately 5% of patients, one or both frontal sinuses have not developed, and in many patients the frontal sinuses develop asymmetrically. Transillumination of the frontal sinuses has not been studied systematically and, hence, the accuracy of this maneuver is unknown.

QUESTION

- **What is the probability of sinusitis in this patient?**

DISCUSSION

Sinusitis in This Patient

A rule developed in a primary care population used maxillary toothache, history of colored rhinorrhea, a history of poor response to nonprescription nasal decongestants or antihistamines, abnormal transillumination, and mucopurulent or purulent discharge on nasal inspection to predict the likelihood of sinusitis.⁴⁵ When none of these key symptoms or signs was present, the probability of sinusitis was less than 10%; when all were present, the probability of sinusitis exceeded 90% (**Figure 2**). Based on this predictive rule, the probability of acute rhinosinusitis in the patient in this case study is intermediate. The patient has purulent nasal discharge by history and examination but normal transillumination and no maxillary toothache. He has not tried a decongestant. A radiograph might be helpful in elucidating the etiology of the patient's signs and symptoms.

QUESTION

- **What role do radiographic studies play in diagnosing acute rhinosinusitis?**

DISCUSSION

Utility of Radiography

Most primary care physicians rely on their clinical evaluation to make the initial diagnosis of acute rhinosinusitis.⁴⁹ Is this apparent confidence in clinical diagnosis well founded, or should radiographs be used more frequently? The answer hinges on the accuracy of the clinical evaluation, the accuracy of radiographs, and the threshold at which the probability of acute rhinosinusitis favors treatment. From the previous discussion, it is apparent that individual signs and symptoms can be used to estimate the probability of disease with reasonable accuracy. Similarly, a physician's overall impression or "gestalt" is useful. In five studies examining this issue,

the sensitivity of a positive clinical evaluation ranged from 62% to 85% and the specificity ranged from 64% to 78%.^{26,42,43,46,50}

A radiograph is only useful in settings of clinical uncertainty. If a focused clinical evaluation leaves a physician uncertain about the diagnosis, a positive radiograph (ie, air-fluid levels, mucosal thickening, or opacification of the sinuses) increases the likelihood of disease sufficiently to warrant antibiotic therapy; a negative radiograph decreases the likelihood of disease sufficiently to justify symptomatic treatment. Studies comparing radiographs to sinus aspiration have demonstrated radiographs to be somewhat more sensitive (range, 61% to 93%) and specific (range, 62% to 94%).²³ Using data similar to these, a decision analysis concluded that empiric antibiotic therapy for patients with a greater than 30% likelihood of disease and symptomatic treatment for those with a less than 10% probability of disease maximized patient outcomes.⁵² In primary care settings, a positive clinical evaluation or positive radiograph results in a probability of disease exceeding 50%, justifying empiric antibiotic therapy, whereas a negative clinical evaluation or radiograph decreases the probability of disease below the treatment threshold. **Figure 3** presents an algorithm to aid clinicians in the diagnosis of acute rhinosinusitis.

Role of Computed Tomography

The role of CT in the initial diagnosis of acute bacterial rhinosinusitis in the primary care setting has not been fully evaluated. Standard contiguous coronal sinus CT (standard sinus CT) appears to be more sensitive than plain films in detecting sinus abnormalities; however, standard sinus CT is lacking in specificity and often detects sinus abnormalities in patients with the common cold.^{23,28} Also, standard sinus CT has not been compared with sinus aspiration.²³ Limited CT (ie, four noncontiguous slices sampling the paranasal sinuses and ostiomeatal units) is emerging as an alternative modality. Limited CT is similar in sensitivity and specificity to the standard sinus CT⁵² and in some areas may be similar in cost to conventional radiography. If readily available to a primary care physician, limited CT may be a viable option.

DIAGNOSIS AND COURSE OF THERAPY

The physician's differential of the patient in this case study includes an acute viral infection, allergic rhinitis, and acute rhinosinusitis. The physician elects to order plain sinus films to aid in the evaluation and treatment of the patient's symptoms. The radiographs reveal an air-fluid level in the patient's right maxillary sinus, confirming the diagnosis of acute rhinosinusitis. The physician prescribes a 10-day course of amoxicillin

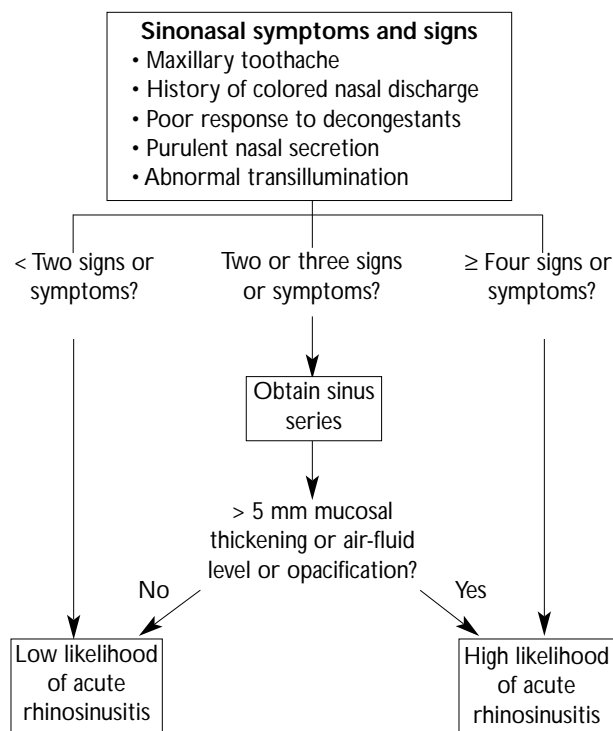


Figure 3. Approach to the diagnosis of acute rhinosinusitis.

and a decongestant. The patient's symptoms begin to abate after 5 days and he has resolution of symptoms after completing his therapy.

QUESTION

- Which bacteria are the common culprits in acute bacterial rhinosinusitis?

DISCUSSION

Numerous studies have confirmed *Streptococcus pneumoniae* and *Haemophilus influenzae* as the etiologic agents in more than 70% of cases of acute rhinosinusitis; *Moraxella catarrhalis* is also a potential causative agent.⁵³⁻⁵⁶ Bacteria isolated from nasal cultures have no correlation with bacteria isolated from sinus cultures; therefore, nasal cultures are not useful for guiding therapy.^{23,53}

QUESTIONS

- What is the efficacy of antibiotic therapy for acute rhinosinusitis?
- Do antibiotics alter the natural history of acute rhinosinusitis in the primary care setting?

DISCUSSION

Evidence from Antibiotic Trials

Three randomized controlled antibiotic trials

examined acute sinusitis in adults.^{8,9,57} Two of the studies support the use of antibiotics. The first study by Axelsson et al⁵⁷ in 1970 compared four different treatments: a nasal decongestant alone ($n = 34$), decongestant plus irrigation of the maxillary sinus ($n = 44$), decongestant plus a 10-day course of penicillin V ($n = 38$), and decongestant plus an 8-day course of lincomycin ($n = 40$). The study population consisted of outpatients in an otolaryngology clinic. Patients who received additional treatment with antibiotics or sinus irrigation had greater radiographic improvement than patients treated with a decongestant alone. These patients also had greater clinical improvement/cure, although the change was not statistically significant (83% versus 72%).

The second study was conducted by Lindbaek et al⁹ in 1996. The three-arm randomized, double-blind trial compared penicillin V ($n = 41$), amoxicillin ($n = 45$), and placebo ($n = 44$) for treatment of acute sinusitis in an adult general practice population. The diagnosis of sinusitis was based on clinical suspicion and confirmed by CT. The medication was taken for 10 days. The clinical response rates of patients on penicillin (82%) and patients on amoxicillin (89%) were significantly greater than those of the control group (56%). The radiographic response rates were also similar. The treatment groups, however, were more likely to experience the side effects of diarrhea (penicillin = 37%; amoxicillin = 47%; placebo = 11%) and vaginal discharge (amoxicillin = 11%; placebo = 2%).

Van Buchem⁸ conducted the third treatment trial in 1997. Sinusitis was diagnosed in patients recruited from general medicine practices based on clinical suspicion and radiographic findings. Patients were randomized to 7 days of amoxicillin ($n = 108$) or placebo ($n = 106$). The clinical response rate after 2 weeks for the treatment group (83%) was not significantly higher compared with the placebo group (77%). The treatment group also experienced more nausea and vomiting (28% versus 9%).

Effect of Antibiotics on Natural History of Sinusitis

Effect on short-term course. Although more than half of the patients in the placebo groups reported cure or clinical improvement, antibiotic therapy does appear to affect the short-term course of acute rhinosinusitis. Antibiotic therapy leads to a modest increase in symptomatic improvement at 10 to 14 days. Additionally, antibiotics may lead to more rapid symptom resolution, but the available data do not provide a definitive answer. A disadvantage is that antibiotic therapy is associated with a small but clinically significant increase in minor adverse effects.

Effect on progression to chronic sinusitis. Theoretically, antibiotics may prevent progression from acute to chronic sinusitis. However, the only randomized trial addressing this issue showed no benefit. Van Buchem et al⁸ reported 1-year relapse rates of 17% and 21% in the placebo and antibiotic groups, respectively, and this difference was not statistically significant. As Van Buchem et al⁸ point out, this finding challenges the supposition that inadequately treated acute rhinosinusitis may evolve into chronic rhinosinusitis. Larger studies of longer duration may better answer this question.

Effect on incidence of complications. Theoretically, antibiotics may decrease the incidence of rare but serious complications, such as subperiosteal or orbital abscess, brain abscess, orbital cellulitis, and meningitis. In the controlled trials involving more than 400 patients collectively, no serious complications occurred in patients receiving placebo or antibiotics. Given the rarity of these events, very large studies would be needed to definitively answer this question.

The decision to use antibiotics involves a trade-off between a modest decrease in sinus symptoms and the potential but unproven protection against rare, serious adverse complications and the potential for minor adverse antibiotic-associated side effects. Existing data suggest a role for antibiotics in the treatment of acute rhinosinusitis, although antibiotic therapy for acute rhinosinusitis in the primary care setting may have limited efficacy. A larger study is clearly needed to evaluate the effects of antibiotic therapy on a range of important outcomes.

QUESTION

- **Which antimicrobial agents should be selected for treatment of patients with acute rhinosinusitis?**

DISCUSSION

Selection of Antimicrobial Therapy

First-line antibiotics include amoxicillin and trimethoprim/sulfamethoxazole. Second-line antibiotics include amoxicillin-clavulanate, azithromycin, cefpodoxime proxetil, cefprozil, cefuroxime axetil, and clarithromycin⁵⁸ (Table 1). The choice of a specific antibiotic depends on the resistance patterns of the pathogenic organisms within the community, dosing schedules, side effects, patient allergies, and previous response to antibiotics. DeBock et al⁵⁹ recently published a meta-analysis of antibiotics for the treatment of acute sinusitis in healthy patients. These researchers found that when comparing broad- and narrow-spectrum antibiotics (including antibiotics with and without β -lactamase inhibition), the differences in clinical cure/improvement

Table 1. Antibiotics for Treatment of Acute Rhinosinusitis

Antibiotic	Dose	Frequency	Duration, days	Pills, n	Cost, \$ *
First-line agents					
Amoxicillin (generic)	500 mg	tid	10	30	13.00
Trimethoprim/sulfamethoxazole (generic)	800 mg/160 mg	bid	10	20	7.20
Trimethoprim/sulfamethoxazole	1 tab	bid	10	20	25.03
Second-line agents					
Amoxicillin-clavulanate	500 mg	bid	10	20	56.05
Azithromycin	500 mg first day; 250 mg next 4 days	once daily	5	6	36.23
Cefpodoxime proxetil	200 mg	bid	10	20	64.67
Cefprozil	250 mg	bid	10	20	63.50
Cefuroxime axetil	250 mg	bid	10	20	66.61
Clarithromycin	500 mg	bid	14	28	89.89

bid = twice daily; tid = three times daily.

*Data from *Red Book*. Montvale, NJ: Medical Economics; 1997.

were small and not significant, and they concluded that the least expensive antibiotic could be selected.

Recommendations for duration of antibiotic use in acute sinusitis vary between 10 and 14 days. However, Williams et al⁶⁰ found that 3 days of trimethoprim/sulfamethoxazole was as effective as 10 days of therapy for acute sinusitis. The authors emphasize that this data should not be extrapolated to other antibiotics because trimethoprim/sulfamethoxazole has higher bioavailability and a longer half-life than other antibiotics such as amoxicillin. An algorithm to aid clinicians in the management of acute rhinosinusitis is presented in **Figure 4**.

QUESTION

- **Which ancillary therapies should be offered?**

DISCUSSION

Ancillary Treatment

In the placebo-controlled antibiotic trials, patients were offered ancillary treatment with a topical decongestant.^{8,9,57} Although no trials directly compare placebo to decongestants, topical or systemic decongestants should add some benefit. In animal models, obstruction of the sinus ostium precipitates sinusitis,⁶¹ and a natural osteotomy is as effective as antibiotics for treatment.⁶² Decongestants stimulate mucosal α -adrenergic receptors and can aid in the reduction of edematous mucosa and relieve obstruction.⁶³ Oral decongestants are theoretically superior to topical nasal preparations in pene-

trating the ostiomeatal complex.^{64,65} Use of nasal spray decongestants for longer than a few days can lead to rebound edema and obstruction. Chronic use can lead to rhinitis medicamentosa.

Steroid preparations have the theoretical ability to alter the inflammatory response in rhinosinusitis and, therefore, decrease the ensuing edema and obstruction. Three trials examined the efficacy of intranasal steroid preparations.⁶⁶⁻⁶⁸ Only one trial showed clinical improvement after 3 weeks with intranasal flunisolide as an adjunct to antibiotic therapy.⁶⁸ There was, however, no significant clinical difference between the placebo group and intranasal flunisolide group after a total of 7 weeks of therapy. Because of the paucity of data, intranasal steroid preparations are not routinely recommended as ancillary measures.^{58,65}

Guaifenesin, a mucolytic-expectorant agent, can lessen mucus stasis and improve drainage. Drug efficacy in the general adult primary care population has not been studied. In a double-blind, placebo-controlled study, Wawrose et al⁶⁹ demonstrated the efficacy of guaifenesin in reducing nasal congestion and posterior nasal drainage in HIV-positive patients with rhinosinusitis.

Other potential ancillary therapies include nonsteroidal anti-inflammatory drugs, antihistamines, and immunotherapy. One double-blind placebo-controlled trial demonstrated greater relief of facial pain and nasal congestion with the combination of niflumic acid (a nonsteroidal anti-inflammatory agent) and

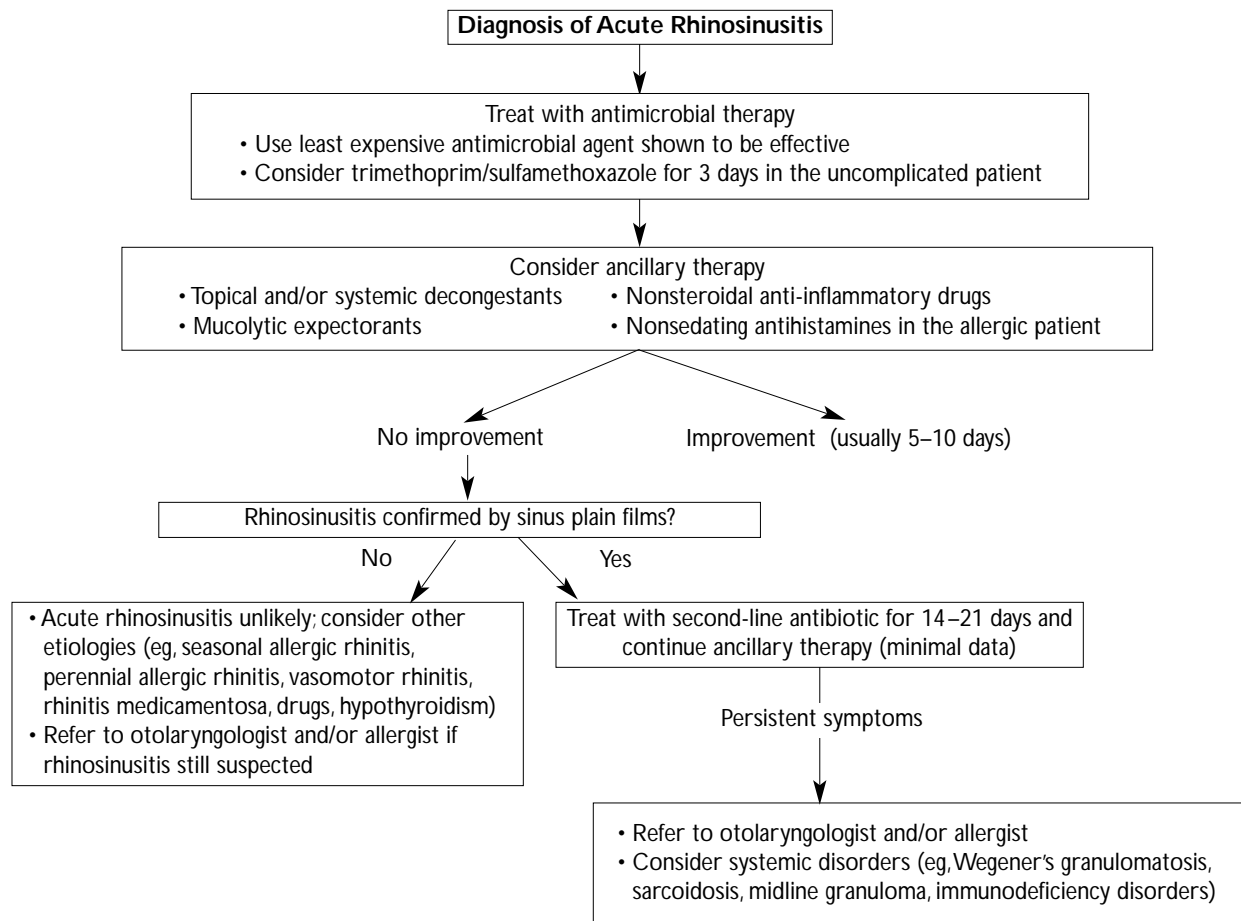


Figure 4. Approach to the management of acute rhinosinusitis.

antibiotic therapy than with antibiotic therapy alone.⁷⁰ Antihistamines have the potential to dry nasal and sinus secretions and exacerbate the symptoms of rhinosinusitis. Recently, however, Braun et al⁷¹ demonstrated that loratadine (a nonsedating antihistamine) in combination with antibiotics improved symptoms of sneezing and nasal obstruction in the allergic patient with rhinosinusitis. Immunotherapy has not been rigorously examined using a randomized controlled method.

Although there is no definitive proof, simple therapies (eg, warm aerosols, aromatic vapors, hot soups or teas) probably moisturize the nasal cavity and help clear thick mucus and nasal crusts and lessen symptoms. Saline nasal sprays have been shown to be effective in allergic and nonallergic rhinitis.⁷² These therapies are not expensive, complicated, or associated with side effects and may be reasonable to try.

QUESTION

- Are oral decongestants safe for patients with mild hypertension?

DISCUSSION

Two randomized placebo-controlled studies support the safety of decongestants in patients with stable mild hypertension.^{73,74} In one trial, phenylpropanolamine (25 mg) was administered every 4 hours; in the other trial, the sustained-release formulation of phenylpropanolamine (75 mg) and brompheniramine (12 mg) were administered. Both studies showed no clinically significant change in blood pressure readings with short-term use.

QUESTION

- What are the costs associated with the outpatient treatment of acute rhinosinusitis?

Table 2. Cost and Performance of Imaging Modalities

Imaging Technique	Cost, \$*	Sensitivity, % (range, %)	Specificity, % (range, %)
Waters' view radiography	32.13	85 (61-93)	80 (62-94)
Radiography (three views)	42.90	85 (61-93)	80 (62-94)
Ultrasonography	86.13	76 (44-92)	84 (70-91)
Computed tomography	269.88	Unknown but probably \geq 95	61 (58-84)
Magnetic resonance imaging	494.07	Unknown but probably \geq 95	Unknown

*Costs reported are national averages for Medicare-allowable charges.

DISCUSSION

Treatment Costs

The direct costs of outpatient treatment are based primarily on the costs of antibiotic therapy (Table 1). If the initial diagnosis of acute rhinosinusitis is uncertain, the cost of sinus plain films must also be considered (Table 2). Other diagnostic modalities (eg, CT scan or ultrasound) are not indicated for the initial evaluation of the patient with acute rhinosinusitis in the primary care setting. Direct aspiration for sinus culture is generally not needed unless the patient is immunocompromised and precise identification of organism and antibiotic sensitivity is desired.

QUESTION

- **Is antimicrobial resistance a concern?**

DISCUSSION

The Problem of Drug-Resistant Organisms

Penicillin-resistant pneumococcus was first identified in 1967 and its prevalence has been gradually increasing.⁷⁵ Prevalence rates from 33% to 58% have been reported outside the United States.⁷⁶ In the United States, prevalence rates for penicillin-resistant pneumococcus vary by region, with some areas reporting prevalence rates of almost 30%.^{76,77} β -Lactamase-producing strains of *H. influenzae* resistant to ampicillin and *M. catarrhalis* strains resistant to the penicillins are also increasing.⁶⁵

The inappropriate use of antibiotics has contributed to the emergence of drug-resistant organisms.⁷⁸⁻⁸³ Ideally, empiric antibiotic therapy for pneumococcal infections should be based on regional susceptibility patterns to control and prevent penicillin-resistant pneumococcus.⁸² Regional susceptibility patterns, however, are not known because penicillin-resistant pneumococcus is not a reportable condition.⁸³ Also, guidelines are not readily available on the use of antimicrobial agents in the ambulatory setting in the United States.⁷ The

Centers for Disease Control and Prevention convened a working group in 1994 to develop a strategy for surveillance, investigation, prevention, and control of infections caused by drug-resistant pneumococcus isolates obtained from blood and cerebrospinal fluid,⁸³ but current regional antibiotic susceptibility patterns are not readily available to clinicians.

Judicious use of antibiotics is a necessity to control and prevent the emergence of drug-resistant organisms. Colds, URI, and bronchitis typically do not require therapy with antibiotics, but a recent survey of United States physicians disclosed that antibiotics are frequently prescribed for these disorders.⁷⁸ Guidelines on the use of antibiotics may be helpful to clinicians. Seppala et al⁸⁴ reported that a national policy to quell the emergence of erythromycin resistance in group A streptococci in Finland resulted in both decreased antibiotic use and decreased antimicrobial resistance. The improved ability of physicians in diagnosing acute rhinosinusitis and more prudent use of antibiotics may decrease the emergence of drug-resistant *S. pneumoniae* and perhaps other drug-resistant organisms.

RETURN OF SYMPTOMS

The patient returns to his primary care physician approximately 2 months after the initial presentation complaining of similar symptoms: nasal stuffiness with yellow nasal discharge, right facial discomfort, and a non-productive cough. The patient responds well to another course of amoxicillin but has three more episodes over the next 6 months; each time, the patient responds well to antibiotics. With the last episode, however, his symptoms persist despite a 14-day course of amoxicillin. He returns to the physician's office frustrated, asking why he continues to have so many "sinus problems."

QUESTION

- **What factors may account for this patient's recurrent symptoms?**

DISCUSSION

Recurrent Acute Rhinosinusitis

The patient in this case study fits the diagnosis of recurrent acute rhinosinusitis. The patient has had at least four episodes of rhinosinusitis in 1 year with a symptom-free interval between the acute episodes. In recurrent acute rhinosinusitis, each sinus infection responds to appropriate medical therapy but may be associated with symptoms of paranasal sinus inflammation for up to 4 weeks. In the last episode, the patient's symptoms are taking longer than usual to improve despite antibiotic therapy. While recurrent sinus infections may be caused by viral illnesses, other predisposing etiologies should be explored.

A careful and detailed history and physical examination may provide further insight into underlying systemic or anatomic factors that could contribute to recurrent sinus infections. Several questions should be considered by the physician: Are manifestations of allergy present or have there been any new exposures that may be temporally related to the change in the patient's sinus health? (The patient indicated that he and his wife smoke, and tobacco smoke may be a predisposing factor.) Has the patient recently had a change of employment that could be associated with chemical or particulate irritants? Are there any clinical factors to suggest systemic illnesses such as an immunodeficiency state (eg, HIV or hypogammaglobulinemia), cystic fibrosis, Wegener's granulomatosis or other autoimmune disorders, a mucociliary transport abnormality, or sarcoidosis?

Anatomic reasons for recurrent acute sinusitis should also be considered. Primary care physicians can perform only a limited examination of the nasal mucosa and may need to refer a patient to a specialist for a more thorough examination to evaluate for any anatomic abnormalities (eg, crowding of the middle meatus by mucosal thickening, nasal polyps, nasal turbinate hypertrophy, or septal deviation). Surgical correction may be necessary.

QUESTION

- **What diagnostic tools are useful when assessing the patient with recurrent acute sinusitis?**

DISCUSSION

Diagnostic Tools

Consideration should be given to obtaining a routine plain film sinus series if this test was not already performed to confirm the diagnosis of acute rhinosinusitis. However, in patients with chronic sinus symptoms or repeated episodes of recurrent acute rhinosinusitis, the extent of mucosal disease may not be well imaged by plain film radiography.⁸⁵

The standard sinus CT is the study of choice for patients with suspected anatomic abnormalities, neoplasms, or chronic sinus disease. The sinus CT serves two purposes.⁸⁵ The test can demonstrate the extent of the mucosal disease in a patient suffering from sinusitis. Sinus CT also provides anatomic information about the patency of the sinus ostia and a "road map" should surgical therapy be recommended.

No standard laboratory diagnostic test strategy exists for the evaluation of recurrent acute and chronic rhinosinusitis. The findings on history and physical examination can direct the subsequent evaluation as clinically indicated. For example, the role of allergy in patients suffering from recurrent acute sinusitis can be obtained from the history and physical examination as well as a trial of a nonsedating antihistamine when indicated. Specific skin testing can be obtained in patients with a strong allergic history.⁸⁶ As previously discussed, the role of allergy in the pathogenesis or prevention of rhinosinusitis is not definitively proven, and neither is the role of immunotherapy. A relationship between allergy and rhinosinusitis may conceivably exist; thus, immunotherapy has been accepted by otolaryngologists and allergists as offering potential benefits in the allergic patient with coexisting chronic sinus problems.⁵⁸

QUESTION

- **Should a standard sinus CT be performed prior to referral?**

DISCUSSION

A standard sinus CT should be obtained in a patient in whom orbital and cranial complications are suspected.⁸⁷ In a patient with a history of nasal polyps, anatomic obstruction is more likely, thus increasing the yield of the sinus CT scan. For patients who have a history of trauma or persistent unilateral symptoms, a CT scan can facilitate the referral process and speed treatment planning. Because sinus abnormalities on CT scan can be present in many patients who simply have the common cold,²⁸ sinus CT should probably not be obtained during an acute rhinosinusitis episode in patients with recurrent acute rhinosinusitis and should instead be reserved for evaluation of the sinuses during the baseline state.

QUESTION

- **When should primary care physicians refer sinusitis patients to a specialist?**

DISCUSSION

Indications for Referral

Complications of sinusitis. Complications of sinusitis

are quite rare but can be of serious consequence. Complications include periorbital or orbital cellulitis or abscess, meningitis, and intracranial spread.⁸⁸ The initial manifestations of periorbital or orbital cellulitis include erythema and edema of the eyelid. Orbital cellulitis presents as conjunctival edema, proptosis, ocular pain and tenderness, and restriction of extraocular muscles. Cellulitis may progress to subperiosteal or orbital abscess. Symptoms include intense pain (including headache), visual disturbance, and alteration in level of consciousness. Sinus infection may extend into the skull causing infection of the bones and possible spread to the brain and nervous system. If this occurs in a diabetic patient, mucormycosis should be strongly considered as a potential etiology.

CT is the diagnostic test of choice to describe the extent of infection and to differentiate cellulitis from abscess. Surgical intervention is indicated if there is progressive proptosis, abscess on CT scan, decrease or loss of visual acuity, or no improvement in symptoms despite 24 to 48 hours of intravenous antibiotics.

In the absence of complications, referral to an otolaryngologist for the following list of conditions is appropriate.^{89,90} Referral to an allergist for the patient with a significant allergic history may also be considered.

Recurrent symptoms. Patients who experience four or more episodes of sinusitis in a 12-month period despite treatment with antibiotics and adjunctive therapies should be referred to an otolaryngologist for further diagnostic testing. Surgery may be indicated if anatomic abnormalities, such as ostiomeatal obstruction, can be identified.

Chronic symptoms. Patients who have persistent symptoms of sinusitis despite 28 days of antibiotics and use of adjunctive therapies should be referred to an otolaryngologist. Surgery may be recommended if anatomic abnormalities are evident.

Nasal polyps. Nasal polyps may predispose a patient to more severe sinus disease. Patients with a history of nasal polyposis and recurrent or chronic sinusitis should be referred to an otolaryngologist.

Asthma. Patients with asthma may have a worsening in their pulmonary condition in association with their sinusitis. Therefore, asthmatic patients who have continued exacerbation of their pulmonary status or persistent symptoms of sinusitis, despite adequate medical therapy, should be referred to an otolaryngologist.

QUESTION

- **What can the patient and the primary care physician expect from an otolaryngologist consultation?**

DISCUSSION

Otolaryngology Evaluation

A complete history and physical as it pertains to nasosinal symptoms should be the first step of an otolaryngology evaluation. A thorough examination of the ears, nose, and throat should also be performed. Specifically, the otolaryngologist performs nasal endoscopy using a rigid nasal endoscope after spray application of a local anesthetic and nasal decongestant. The endoscope allows direct visualization of the sinus drainage pathways and anatomy of the nasal cavity. If mucopus is noted, a directed aspirate of the pus can be obtained and sent for microbiological culture, which can help tailor the antimicrobial therapy if necessary.

If available, a CT scan of the sinuses is reviewed in detail and correlated with the findings on nasal endoscopy. Consideration will be given to the most appropriate course of therapy given the patient's history of nasosinal symptoms and findings on the physical examination. Treatment recommendations may include a prolonged antibiotic course, nonsedating antihistamines, mucolytics, nasal steroids, and (possibly) oral steroids. If the patient has an anatomic deformity or changes consistent with chronic sinus disease, sinus surgery may be recommended.

QUESTION

- **How should this patient's recurrent sinusitis be managed?**

DISCUSSION

The evidence is insufficient on the best course of action for managing this patient's recurrent sinusitis. If the patient's history suggests a significant allergic component, referral to an allergist might be warranted. Referral from the primary care physician to an otolaryngologist for further evaluation is also reasonable (Figure 4). The patient has had five episodes of acute rhinosinusitis in an 8-month period; thus, earlier referral would have been reasonable. In the absence of correctable anatomic lesions, it is unclear how to prevent recurrent episodes or subacute rhinosinusitis or if the prevention of acute rhinosinusitis somehow affects the development of chronic rhinosinusitis. Clinical trials will need to be designed to further address these complex interrelationships.

TREATMENT AND FOLLOW-UP

The physician conducts a careful history and physical examination to assess for possible systemic disorders. In light of no significant findings and sinus plain films consistent with acute rhinosinusitis, the physician prescribes a second-line antibiotic and systemic decongestants to

be taken for 14 days. Because of the presence of a cough and facial discomfort, the patient is offered guaifenesin and a nonsteroidal anti-inflammatory agent.

The patient's physician informs him that this most recent episode of acute rhinosinusitis may take a bit longer than usual to resolve. They discuss the impact of these repeated bouts on the patient's daily life and explore possible environmental irritants that may be contributing to these episodes. They target tobacco smoke and, after counseling, the patient decides to engage in a smoking cessation program and hopes to convince his wife to do the same. In addition, because the patient has had five recurrent episodes within an 8-month period, the physician suggests further evaluation by an otolaryngologist. HP

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ACKNOWLEDGEMENT

Wayne State University School of Medicine acknowledges Steven C. Marks, MD, Assistant Professor, Department of Otolaryngology, and Chief of Otolaryngology, Grace-Sinai Hospital, for his review of this case study.

Adapted from Conde MV, Williams JW, Witsell DL, Piccirillo JF: Management of a 35-year-old man with acute nasal and sinus complaints. JCOM J Clin Outcomes Manag 1998;5(3):63–76.

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