Criteria Used by Clinicians to Differentiate Sinusitis from Viral Upper Respiratory Tract Infection

William J. Hueston, MD; Chris Eberlein; Deanna Johnson; and Arch G. Mainous III, PhD
Madison, Wisconsin, and Lexington, Kentucky

BACKGROUND. Acute sinusitis and upper respiratory tract infections (URIs) share many common symptoms and signs. Objective criteria have been identified that are valid for distinguishing between these two clinical problems. The objective of this study was to determine how often clinicians use these validated criteria and how often they rely on clinical cues that are less valuable for differentiating sinusitis from URI.

METHODS. We performed a retrospective review of 734 patients with a diagnosis of acute sinusitis (n=367) or URI (n=367) at a family practice residency training site over a 3-year period. Charts were reviewed to ascertain patient demographics, past history, current symptoms, physical findings, and treatment prescribed.

RESULTS. Patients with sinusitis were likely to be older, female, smokers, have a history of allergic rhinitis, and have longer symptom durations. Complaints of sinus pressure or discolored nasal discharge and the finding of sinus tenderness were strongly associated with the diagnosis of sinusitis. In multivariate analysis, eight factors were independently associated with the diagnosis of sinusitis. Four clinical cues alone (sinus tenderness, sinus pressure, postnasal drainage, and discolored nasal discharge) were highly associated with the diagnosis of sinusitis and explained 60% of the variation in the diagnosis between sinusitis and URI.

CONCLUSIONS. Physicians tend to rely on four factors to differentiate sinusitis from URIs. Only one of these has been shown to be a reliable predictor of acute sinusitis. This use of unreliable criteria may lead to misdiagnoses and inappropriate prescriptions for antibiotics.

KEY WORDS. Sinusitis; upper respiratory infections; diagnosis; antibiotics; physicians, family. *(J Fam Pract 1998; 46:487-492)*

Acute sinusitis is a common condition that affects approximately 2 million patients each year.[1] Despite the frequency with which this diagnosis is made, the clinical characteristics of the problem have considerable overlap with nonspecific upper respiratory tract (URI) infections. In 300 patients who presented with a URI, 19% had radiographic evidence of maxillary sinusitis, but had no symptoms of sinus infection.[2] Further confusing the diagnosis is the fact that URIs are often a precursor of sinusitis and at some point symptoms from each condition may overlap. Sinus inflammation from a URI without bacterial infection is also common. In a series of 60 children undergoing computerized tomography (CT) for non–sinus-related diagnoses, 47% had evidence of sinus inflammation with no clinical signs of sinusitis and with complete resolution following their viral illness.[3]

Several investigators have attempted to identify criteria that would increase the likelihood of correctly identifying the presence of bacterial sinusitis. Williams et al[4] described five clinical features that help to distinguish sinusitis from URIs. Using data from their own study and two other prospective trials, Williams and Simel[5] found that three symptoms (maxillary toothache, poor response to nasal decongestants, and a history of discolored nasal discharge) along with two clinical signs (purulent nasal secretions and abnormal transillumination) could be used to predict sinusitis. The absence of any of these five factors appears to effectively rule out sinusitis. In another study from Norway, Lindbaek and colleagues[6] examined clinical and laboratory factors associated with CT-confirmed sinusitis. Only two clinical factors were indepen-

Submitted, revised, January 12, 1998.
From the University of Wisconsin-Madison Medical School and Eau Claire Family Practice Residency (W.J.H., C.E., D.J.), and the Department of Family Practice, University of Kentucky, Lexington (A.G.M.). Requests for reprints should be addressed to William J. Hueston, MD, Department of Family Medicine, Medical University of South Carolina, 295 Calhoun Street, Charleston, SC 29403. E-mail: huestowj@musc.edu

dently associated with sinusitis: purulent secretions and "double sickening," a term investigators used to describe an illness that began to abate but then worsened. However, a third study did not show that any clinical signs or symptoms could reliably predict sinusitis,[7] and another study showed that more than 70% of patients with sinusitis responded to decongestants alone.[8]

A correct diagnosis of acute sinusitis is important because sinusitis is generally treated with antibiotics while a URI is not. Three of four randomized trials have supported the use of antibiotics in the treatment of acute sinusitis.[8-11] Since it is unclear which clinical cues physicians use to differentiate sinusitis from URIs, sinusitis may be over- or underdiagnosed and may lead to inappropriate prescribing of antibiotics. The overuse of antibiotics for URIs is common[12] and expensive, since antibiotics can compose up to 25% of the cost of a patient encounter.[13] Further, the development of resistant strains of common respiratory pathogens such as *Streptococcus pneumoniae* has forced a reevaluation of the use of antibiotics in the ambulatory setting.[14]

The purpose of this study was to examine which historical and physical findings physicians use to differentiate acute sinusitis from URIs. Additionally, we sought to determine whether physicians treated patients with acute sinusitis differently from those with URIs. If physicians rely on cues that have been found to have little predictive value in differentiating sinusitis from URIs and if they prescribe antibiotics more frequently or for longer duration than necessary, then focusing attention on the overdiagnosis of sinusitis may be an effective strategy for reducing unnecessary antibiotic use.

METHODS

We conducted a retrospective case-control study of patients seen over a 3-year period at a family practice training program in the upper Midwest. The practice uses an electronic medical record, and all diagnoses in the record show ICD-9-CM codes that are available from a preloaded list that includes one code for acute sinusitis (461.9) and one for URIs (460.0) All patient visits since July 1994 identified with either of these diagnosis codes were recorded and reviewed for this study.

From a pilot study conducted on a different sample of patients, we found that 38% of patients with URIs had clear nasal discharge and that a smaller percentage of patients with sinusitis had clear discharge. Because purulent discharge was one of the criteria found by Williams and colleagues[4] that predicted sinusitis, we selected this variable to use in calculating a projected sample size. To detect a 33% difference in the rate of clear discharge between URI and sinusitis patients, we required a sample size of 337 in each group to achieve a power of 80% at an alpha of 0.05. We then identified a sample of 367 patients with each diagnosis using a random number generator. When patients had a diagnosis of both sinusitis and a URI, the patient was assigned to the sinusitis group.

Excluded from the study were any patients who (1) had a secondary diagnosis at the time of service that was an indication for antibiotics; (2) were in an immunocompromised state, including long-term users of immunosuppressant drugs such as prednisone or those infected with the human immunodeficiency virus; or (3) took prophylactic antibiotics for other conditions. When a patient was excluded, another patient was randomly chosen for inclusion in the study so the sample size remained constant.

Two medical students performed detailed chart reviews of the subjects. Information regarding demographics, symptoms, physical examination findings, previous health and smoking status, and treatment for the problem were documented. Ten percent of the charts were analyzed by both reviewers. Interrater reliability was excellent on all data ($\kappa = 0.79$ to 1.00).

Data for sinusitis and URI patients were compared using chi-square for categorical data and Student's t test for continuous variables. To evaluate for confounding, a stepwise backward logistic regression was performed including all variables with an association of $P < .05$.

RESULTS

Table 1 shows the demographics and illness and health histories of two groups of patients, one with a diagnosis of sinusitis and the other with URIs. Patients with sinusitis were older and more likely to be women, smokers, and have a past history of sinusitis or allergic rhinitis.

When we studied the symptoms and physical findings of the current illness, we found several differences in sinusitis and URI patients. First, patients

with a diagnosis of sinusitis had a longer duration of illness than those with URI (13.1 ± 13.0 days compared with 6.8 ± 7.4 days, $P<.001$). Sinus tenderness (relative risk [RR] for the diagnosis of sinusitis compared with URI = 24.3), maxillary toothache (RR = 18.0) and sinus pressure (RR = 15.6) were the conditions that appeared to influence clinicians the most in diagnosing sinusitis (Table 2). Other clinical cues associated with a higher likelihood of the diagnosis of sinusitis included discolored nasal discharge, postnasal drainage, headache, abnormal ear examination findings and abnormal transillumination of the sinuses. The presence of three clinical cues, abnormal lung examination (RR = 0.47), sore throat (RR = 0.75), and cough (RR = 0.76), made a diagnosis of URI more likely.

Physical examination findings showed that individuals with sinusitis were also more likely to have sinus tenderness and abnormal findings on ear examinations and transillumination, although the latter was performed on only a small number of patients. Patients with URIs were more likely to have an abnormal lung examination.

To examine the independent effects of these symptoms, signs, and demographic factors, we performed a stepwise logistic regression using the diagnosis of sinusitis as the dependent variable. Symptoms, signs, and demographic factors were the independent variables. After adjustment, eight of these variables remained associated with the diagnosis of sinusitis and explained 66% of the variance in the diagnosis of sinusitis compared with URI. Of the factors independently associated with sinusitis, sinus tenderness was the strongest predictor of the diagnosis of sinusitis (odds ratio [OR] = 47.61, 95% confidence interval [CI], 21.41-111.11). Postnasal drainage, sinus pressure, and the history of a past sinus infection treated with antibiotics were also

TABLE 1

Demographic and Health History of Two Groups of Study Patients: Diagnosing Sinusitis (n=367) Versus URI (n=367)

	URI Group (n=367)	Sinusitis Group (n=367)	*P*
Mean age, years (SD)	22.3 (19.9)	36.0 (16.4)	<.001
Sex, female, no. (%)	216 (59)	265 (72)	<.001
Smoker, no. (%)	83 (23)	136 (37)	<.001
History of sinusitis, no. (%)	2 (1)	75 (20)	<.001
History of asthma, no. (%)	27 (7)	17 (5)	.12
History of allergic rhinitis, no. (%)	11 (3)	25 (7)	.02

URI denotes upper respiratory infection; SD denotes standard deviation.

TABLE 2

Symptoms and Physical Findings of Two Groups of Study Patients: Diagnosing Patients with Sinusitis Versus Patients with URI

Symptom/Finding	URI (n=367)	Sinusitis (n=367)	*P*
Days of symptoms, mean (SD)	6.8 (7.4)	13.1 (13.0)	<.001
No. (%) of patients with:			
Nasal congestion	161 (44)	158 (43)	.82
Discolored nasal drainage	25 (7)	120 (33)	<.001
Postnasal drainage	20 (5)	132 (36)	<.001
Sinus pressure	13 (4)	203 (55)	<.001
Cough	279 (76)	211 (57)	<.001
Maxillary toothache	1 (0)	18 (5)	<.001
Earache	68 (19)	67 (19)	.92
Sore throat	132 (36)	99 (27)	.009
Headache	48 (13)	140 (38)	<.001
Fatigue	23 (6)	29 (8)	.38
Nausea	11 (3)	35 (10)	.002
Poor response to decongestant	29 (8)	55 (15)	.003
Sinus tenderness	10 (3)	243 (66)	<.001
Abnormal ear examination	25 (7)	49 (13)	.003
Abnormal lung examination	34 (9)	16 (4)	.008
Abnormal transillumination	0 (0)	12 (3)	<.001

URI denotes upper respiratory infection; SD denotes standard deviation.

TABLE 3

Results of Logisitic Regression Model for Predicting the Diagnosis of Sinusitis

Variable	Adjusted Odds Ratio*	95% CI
Sinus tenderness	47.61	21.41-111.11
Sinus pressure	11.24	4.90-45.52
Postnasal drainage	13.35	5.95-30.30
History of sinus infection	10.75	1.89-61.72
Discolored nasal drainage	5.87	2.56-12.98
Nausea	4.78	1.35-16.95
Headache	2.16	1.06-4.41
Duration	1.07	1.04-1.11

*Adjusted odds ratio represents the rate at which sinusitis would be diagnosed as opposed to URI when the variable is present.
R^2= 65.7%.

strong predictors of sinusitis (Table 3). These four factors alone accounted for 60% of all the variance in the diagnosis of sinusitis compared with URI. Four other variables were also statistically significant (discolored nasal drainage, nausea, headache, and duration of symptoms), although their contribution to the model was much smaller.

We also looked at treatment variations for sinusitis and URIs. Antibiotics were prescribed for 98% of patients with sinusitis and 15% of patients with URIs. Sulfamethoxazole/trimethoprim was prescribed more often for sinusitis; erythromycin was the only antibiotic used significantly more often in URIs (Table 4).

TABLE 4

Differences in Treatment for Sinusitis and URI

	URI (n=367)	Sinusitis (n=367)	*P*
Antibiotic prescribed, no. (%)	56 (15)	359 (98)	<.001
Duration, mean days (SD)	9.1 (2.8)	12.4 (3.6)	<.001
Type of Antibiotic, %			<.001
Amoxicillin	38	30	
Sulfamethoxazole/trimethoprim	13	51	
Erythromycin	27	5	
Other macrolide	13	7	
All others	9	7	

DISCUSSION

Physicians in our residency practice tended to place a great deal of weight on four cues (sinus tenderness, sinus pressure, postnasal discharge, and discolored nasal drainage) to differentiate sinusitis from URIs. With the exception of discolored nasal discharge, none of these three signs or symptoms has been shown to be sensitive or specific for sinusitis.[4-6] Additionally, clinicians often did not seem to examine for factors that have been shown to increase the probability that a patient has bacterial sinusitis.

Our findings imply that physicians often use varied historical and physical examination criteria when attempting to differentiate sinusitis from URI. Studies attempting to identify signs and symptoms associated with sinusitis have identified a limited number of factors that are associated with sinusitis. Williams and colleagues found 5 criteria that could predict sinusitis.[5] Lindbaek and coworkers[6] found only three clinical factors ("double sickness" and purulent rhinorrhea, or the presence of purulent secretions on examination) were associated with sinus infection. Clinicians in our study rarely used any of these criteria in their assessment of patients with potential sinusitis and appeared to rely on factors that have not been validated as independent predictors of bacterial sinus infection.

The lack of precise objective clinical criteria to define bacterial sinusitis and the reliance of clinicians on poor predictors have important implications for the use of antibiotics. Because the diagnosis of sinusitis is strongly associated with the use of antibiotics, the reliance on poor predictors of bacterial infection may result in antibiotics being prescribed inappropriately. In our study, the variability of the clinical cues used to classify patients as having sinusitis and the infrequency with which any of the validated criteria for sinusitis were met suggests that many patients had URIs, not sinusitis. To prescribe antibiotics for presumed sinusitis cases that are actually URIs tends to reinforce this misclassification over time. If a physician

misdiagnoses sinusitis on the basis of sinus tenderness or pressure and prescribes antibiotics, the patient recovers anyway. The physician will never see any indication that his or her treatment plan was unnecessary.

Antibiotics are overprescribed for several reasons. Many physicians believe that patients expect antibiotics for their illnesses[15-17] and that the prescription of antibiotics will lead to greater patient satisfaction.[16] However, patients often misinterpret common symptoms or signs of viral illnesses and this can lead to inappropriate expectations.[18] Even some physicians may believe that common viral signs such as discolored discharge indicate that antibiotics are necessary.[18] Our study suggests that the inappropriate diagnosis of sinusitis when the patient has a URI may be another potentially significant cause of unnecessary antibiotic use.

In our patient sample, it is also possible that patients may have had their condition diagnosed as sinusitis more often so as to justify antibiotic use. Only 15% of the patients who received a diagnosis of URI received antibiotics, a number much lower than that observed in Medicaid,[12] managed care,[19] or European primary care practices.[20] The low rate of antibiotic use for URIs in our population may reflect that care is being delivered by residents and is subject to faculty review. Residents may have been more hesitant to prescribe antibiotics injudiciously, since they knew their actions would be reviewed. In other studies in which antibiotics were used more commonly for URIs, physicians were not subject to secondary review.

The majority of patients with sinusitis in our study were treated with antibiotics for periods ranging from 10 days to 3 weeks. Ninety-five percent of patients in this sample received 10 or more days of antibiotics for their presumed sinusitis. One quarter of all patients received antibiotics for 3 weeks or more. However, evidence from a small study[21] suggests that the use of sulfamethoxazole/trimethoprim for 3 days produced outcomes equal to 10 days of therapy. Only one patient in our study received a 3-day course of medication. If further research confirms that a 3-day course of antibiotics is effective for most cases of acute sinusitis, it is possible that prescriptions for shorter durations of antibiotic use could reduce costs and the potential development of resistance.

CONCLUSIONS

This study should be interpreted in light of the limitations of the design. First, the majority of visits were made to family practice residents. The relative lack of experience of residents in dealing with ambulatory patients could have contributed to the use of inappropriate clinical cues. Second, we relied on information available in the medical records. Physicians may not have included all the information they received in the medical record. However, it would be unlikely that physicians would include information that they knew was not predictive of their diagnosis and exclude information regarding symptoms and signs that were associated with their diagnosis.

We found that clinicians appeared to rely on sinus tenderness and sinus pressure as the major signs and symptoms to differentiate acute sinusitis from URIs. Neither of these have been found to be reliable predictors of sinusitis. This reliance on clinical clues may result in an overdiagnosis of sinusitis and an excessive use of antibiotics.

ACKNOWLEDGMENTS

This work was partially supported by a Robert Wood Johnson Generalist Scholar Award to Dr Hueston.

REFERENCES

1. Shappert SM. Vital and health statistics. National Ambulatory Medical Survey: 1991 Summary. Hyattsville, Md: Centers for Disease Control and Prevention. DHHS Publication No. 94-1777. National Center for Health Statistics, 1994, series 13, no. 116.
2. Kaiser L, Lew D, Hirschel B, et al. Effects of antibiotic treatment in the subset of common-cold patients who have bacteria in nasopharyngeal secretions. Lancet 1996; 347:1507-10.
3. Manning SC, Biavati MJ, Phillips DL. Correlation of clinical sinusitis signs and symptoms to imaging findings in pediatric patients. Int J Pediatr Otorhinolargyngol 1996; 37:65-74.
4. Williams JW Jr, Simel DL, Roberts L, Samsa GP. Clinical evaluation for sinusitis: making the diagnosis by history and physical examination. Ann Intern Med 1992; 117:705-10.
5. Williams JW Jr, Simel DL. Does this patient have sinusitis? Diagnosing acute sinusitis by history and physical examination. JAMA 1993; 270:1242-6.
6. Lindbaek M, Hjortdahl P, Johnsen ULH. Use of symptoms, signs, and blood tests to diagnose acute sinus infections in primary care: comparison with computed tomography. Fam Med 1996; 28:183-6.
7. Hansen JG, Schmidt H, Rosborg J, Lund E. Predicting acute maxillary sinusitis in a general practice population. BMJ 1995; 311:233-6.
8. Axelsson A, Chidekel N, Grebelius N, Jensen C. Treatment of acute maxillary sinusitis: a comparison of four different methods. Acta Otolaryngol (Stockh) 1970; 70:71-6.
9. Wald ER, Chiponis D, Ledesma-Medina J. Comparative effectiveness of amoxicillin and amoxicillin-clavulanate potassium in acute paranasal sinus infections in children: a double-blind,

placebo-controlled trial. Pediatrics 1986; 77:795-800.

10. Lindbaek M, Hjortdahl P, Johnsen ULH. Randomised, double-blind, placebo controlled trial of penicillin V and amoxycillin in treatment of acute sinus infections in adults. BMJ 1996; 313:325-9.
11. van Buchem FL, Knottnerus JA, Schrijnemaekers VJJ, Peeters MF. Primary-care-based randomised placebo-controlled trial of antibiotic treatment in acute maxillary sinusitis. Lancet 1997; 349:683-7.
12. Mainous AG III, Hueston WJ, Clark JR. Antibiotics and upper respiratory infection: do some folks think there is a cure for the common cold? J Fam Pract 1996; 42:357-61.
13. Mainous AG III, Hueston WJ. The cost of antibiotics in treating upper respiratory infections in a Medicaid population. Arch Fam Med 1998; 7:45-9.
14. Centers for Disease Control and Prevention. Defining the public health impact of drug-resistant *Streptococcus pneumoniae*: report of a working group. MMWR 1996; 45:No. RR-1.
15. Vinson DC, Lutz LJ. The effect of parental expectations on the treatment of children with a cough: a report from ASPN. J Fam Pract 1993; 37:23-7.
16. Hamm RM, Hicks RJ, Bemben DA. Antibiotics and respiratory infections: are patients more satisfied when expectations are met? J Fam Pract 1996; 43:56-62.
17. Mainous AG III, Zoorob RJ, Oler MJ, Haynes DM. Patient knowledge of colds: implications for antibiotic expectations and unnecessary utilization. J Fam Pract 1997; 45:75-83.
18. Mainous AG, Hueston WJ, Eberlein C. Color of respiratory discharges and antibiotic use. Lancet 1997;350:1077.
19. Hueston WJ, Mainous AG, Brauer N, Mercuri J. Evaluation and treatment of respiratory infections: does managed care make a difference? J Fam Pract 1997; 44:572-7.
20. Kuyvenhoven M, deMelker R, van der Velden K. Prescription of antibiotics and prescribers' characteristics: a study into prescription of antibiotics in upper respiratory infections in general practice. Fam Pract 1993; 10:366-70.
21. Williams JW Jr., Holleman DR Jr, Samsa GP, Simel DL. Randomized controlled trial of 3 vs 10 days of trimethoprim/sulfamethoxazole for acute maxillary sinusitis. JAMA 1995; 273:1015-21.