BRIEF REPORT: A Red Streak in the Lateral Recess of the Oropharynx Predicts Acute Sinusitis

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OBJECTIVE: To evaluate the oropharyngeal red streak sign for diagnosing acute sinusitis.

DESIGN: Exploratory cohort study.

SETTING: A Veterans Affairs medical center urgent care center.

PARTICIPANTS: Sixty consecutive subjects presenting with nasal symptoms lasting 4 weeks or less.

MEASUREMENTS AND MAIN RESULTS: Each subject underwent a structured history and physical examination, followed by a sinus computed tomography (CT) scan. Acute sinusitis was defined by an air-fluid level or opacification of 1 or more sinuses on CT imaging. Twenty-seven subjects were diagnosed with sinusitis. A localized red streak in the lateral recess of the oropharynx was associated with sinusitis, with a positive likelihood ratio (LR+) and 95% confidence interval (CI) of 2.11 (1.23, 3.63) and a negative likelihood ratio (LR-) and 95% CI of 0.44 (0.24, 0.83). Opacity on maxillary or frontal sinus transillumination was also associated with sinusitis (LR+ of 1.89; CI 1.03, 3.32 and LR- of 0.56; CI 0.32, 0.96). Symptom duration > 10 days was associated with acute sinusitis with an LR+ of 1.89 (1.06, 3.59). A history of facial pain (LR+ of 0.59; CI 0.39, 0.90 and LR- of 2.85; CI 1.27, 6.41) and the finding of sinus percussion tenderness (LR+ of 0.22; CI 0.05, 0.90 and LR- of 1.88; CI 1.17, 3.03) were inversely associated with sinusitis.

CONCLUSIONS: The oropharyngeal red streak may be an accurate physical sign for diagnosing acute sinusitis. This sign should be included in future studies of clinical diagnostic criteria for acute sinusitis.

KEY WORDS: sinusitis; physical examination; signs; symptoms; sensitivity; specificity.

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The National Center for Health Statistics estimates that over 30 million physician visits occur annually for evaluating acute upper respiratory infections, and an additional 28 million visits are made for chronic sinusitis and allergic rhinitis.¹ In clinical practice, sinusitis is most often diagnosed by history and physical examination; yet, the symptoms and signs of sinusitis, viral upper respiratory infection, and allergic rhinitis often overlap. Confirmatory radiographic tests for sinusitis are expensive, inconvenient, and used primarily to evaluate the extent of sinus disease in patients who are candidates for surgical intervention.² A few clinical findings have emerged from studies of acute sinusitis. However, some of these findings have limited utility because they are inconvenient to perform, like transillumination, or are infrequent findings with limited sensitivity, like maxillary toothache. Others, like cough with purulent sputum, are nonspecific.^{3,4} Identifying additional history or physical exam findings that can dis-

tinguish between acute sinusitis and other nasal conditions would be useful to the practicing clinician.

Highly organized mucociliary drainage from the sinuses and nasal mucosa results in collection of nasal secretions in the lateral recess of the oropharynx.⁵ Mucopurulent drainage can sometimes be visualized on examining the posterior pharynx; however, even when the secretions are absent, oropharyngeal red streaks are often seen on the mucosa.⁶ The diagnostic accuracy of this finding for acute sinusitis has not been evaluated. Because primary care providers can readily detect the oropharyngeal red streak, it is a very practical clinical sign to evaluate. The objective of this study was to characterize the diagnostic accuracy of the oropharyngeal red streak for acute sinusitis.

METHODS

Consecutive subjects were recruited from the VA San Diego Healthcare System (VASDHS) urgent care center. The institution's human subjects committee approved the study protocol. During the recruitment period between December 15, 2000 and February 28, 2001, the investigators reviewed the presenting symptoms recorded by the triage nurse for patients waiting to be seen in the urgent care center. Subjects were considered for inclusion if they were presenting with symptoms of nasal discharge, nasal congestion or obstruction, facial pain, or self-suspected sinusitis. Subjects were excluded for symptoms present greater than 4-weeks duration, antibiotic use within the past month, presentation for evaluation of multiple medical problems, pregnancy, and inability to position their head for coronal CT imaging. Subjects were recruited in the order they presented to the urgent care center to a maximum of 2 to 3 per day based on availability of the CT scanner.

Data Collection

A structured evaluation of each study subject, including 12 history and 10 physical examination findings (online appendix), was completed by a trained, 4th-year medical student and verified by an internal medicine attending physician or performed directly by an internal medicine attending physician. Transillumination of the maxillary and frontal sinuses was performed in a darkened exam room using a Finoff Transilluminator (product #41100 Welch Allyn®, Chicago, IL) following standard methods.⁷ A second attending physician independently performed sinus transillumination and evaluated the presence of a red streak in the lateral recess of the oropharynx (Fig. 1). The findings of the second examiner were

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FIGURE 1. A localized red streak in the lateral recess of the oropharynx (white arrow).

used only to estimate interrater reliability. Smell was assessed using the alcohol sniff test,⁸ a technique where an alcohol pad is slowly raised toward the nares while the patient breathes normally, with eyes closed, and identifies when the smell of alcohol is detected. Coronal CT images of the sinuses were performed for all study participants within 90 minutes after completing the structured history and physical examination. A neuroradiologist, blinded to the clinical findings, interpreted the CT images. Acute sinusitis was determined to be present if 1 or more sinuses contained an air-fluid level or was completely opacified. Because sinus mucosal thickening is commonly seen on CT scan in viral upper respiratory infections,⁹ this finding was not considered to be diagnostic for acute sinusitis.

Statistical Analysis

Concordance between the principal examiners for transillumination and the oropharyngeal red streak was estimated with the κ statistic. The accuracy of history and physical exam find-

ings compared with the reference standard CT scan was estimated by sensitivity, specificity, and LR+ and LR−.¹⁰ We also calculated 95% confidence intervals (CI) for these test characteristics. Sample size was estimated assuming a sensitivity of 0.67 and a specificity of 0.67 for the oropharyngeal red streak. This would yield a positive likelihood ratio (LR+) of 1.94 and would require 19 subjects each with and without sinusitis to produce a confidence interval that would not overlap 1. A recruitment target of 50 to 70 subjects was set for the study.

RESULTS

Patient Characteristics

Seventy-three subjects were screened for study participation. Three refused consent because of time constraints and 10 withdrew before completing their CT scan. Sixty subjects (6 women and 54 men) completed the study and were included in the analysis. Subjects ranged in age from 25 to 83 years, with a mean $\pm$ SD age of 51 ± 12.6 years. Symptoms were present for a mean $\pm$ SD of 12 ± 7.8 days and a median (interquartile range) of 7 days (6 to 21 days). Twenty-seven subjects were diagnosed with acute sinusitis: 10 with air-fluid levels, 8 with sinus opacity, and 9 with both.

Diagnostic Accuracy of Clinical Findings

Frequency sensitivity, specificity, and likelihood ratios for the history and physical examination findings with diagnosis of acute sinusitis by CT scan are shown in Table 1. A red streak in the lateral recess of the oropharynx was seen in 30 patients and was associated with acute sinusitis on CT scan with an LR+ of 2.11 (1.23, 3.63) and a negative likelihood ratio (LR−) of 0.44 (0.24, 0.83). Opacity of a frontal or maxillary sinus on transillumination was also associated with acute sinusitis with an LR+ of 1.89 (1.03, 3.32) and an LR− of 0.56 (0.32, 0.86). The presence of facial pain or percussion tenderness was inversely associated with acute sinusitis with an LR+ of 0.59 (0.39, 0.90), an LR− of 1.88 (1.17, 3.03), and an LR+ of 0.42 (0.21, 0.86), LR− of 1.88 (1.17, 3.03), respectively. Symptom duration > 10 days was associated with acute sinusitis with an LR+ of 1.89 (1.06, 3.59). Inter-rater agree-

Table 1. Frequency, Sensitivity, Specificity, and Likelihood Ratios for Clinical Findings in Acute Sinusitis

	Frequency	Sensitivity	Specificity	LR+ (95% CI)	LR− (95% CI)
History					
Duration of symptoms (> 10 d)	25	0.71	0.62	1.89 (1.06,3.39)	0.46 (0.14,1.51)
Pain in face	40	0.48	0.18	0.59 (0.39,0.90)	2.85 (1.27,6.41)
Purulent nasal secretions	33	0.67	0.55	1.47 (0.93,2.32)	0.61 (0.33,1.13)
Cough exacerbated when supine	52	0.81	0.09	0.90 (0.73,1.11)	2.04 (0.53,7.76)
Sneezing	30	0.44	0.45	0.81 (0.48,1.38)	1.22 (0.74,2.02)
Post nasal drip	47	0.74	0.18	0.91 (0.69,1.19)	1.43 (0.54,3.74)
Cough with purulent sputum	22	0.33	0.61	0.85 (0.43,1.67)	1.10 (0.75,1.61)
Impaired smell	32	0.52	0.45	0.95 (0.59,1.53)	1.06 (0.62,1.82)
Nasal obstruction	45	0.74	0.24	0.98 (0.73,1.31)	1.07 (0.44,2.57)
Fever	31	0.52	0.48	1.01 (0.62,1.69)	0.99 (0.59,1.68)
Physical examination					
Oropharyngeal red streak	30	0.70	0.67	2.11 (1.23,3.63)	0.44 (0.24,0.83)
Sinus tenderness	27	0.26	0.39	0.43 (0.21,0.86)	1.88 (1.17,3.03)
Transillumination	28	0.63	0.67	1.89 (1.08,3.32)	0.56 (0.32,0.96)
Abnormal alcohol sniff test	30	0.59	0.58	1.40 (0.84,2.32)	0.71 (0.41,1.22)
Purulent nasal secretions	12	0.22	0.82	1.22 (0.44,3.36)	0.95 (0.73,1.23)
Otitis media	2	0.04	0.97	1.22 (0.08,18.64)	0.99 (0.90,1.09)

LR+, positive likelihood ratio; LR−, negative likelihood ratio; CI, confidence interval.

ment for the red streak and sinus transillumination was found to be greater than expected by chance, with κ scores of 0.7 and 0.8, respectively.

DISCUSSION

In this exploratory cohort study, the oropharyngeal red streak was associated with acute sinusitis detected by CT scan. This physical finding has not been studied previously. The red streak is simple to evaluate, requires no special equipment, and was reproducible between independent examiners. Transillumination of the sinuses was associated with acute sinusitis, confirming previous studies.^{3,4} In contrast to a prior study,⁴ a history of facial pain and sinus percussion tenderness were associated with the absence of acute sinusitis. Methodological differences between the studies may account for the differences observed. In the prior study, the authors used plain radiography as the criterion standard and accepted the less specific finding of mucosal thickening as a diagnostic of acute sinusitis. Additionally, they evaluated 4 different historical findings related to cranio-facial pain, including maxillary toothache, headache facial pain, and painful chewing. We found it difficult for patients to reliably distinguish between these different types of facial pain, so we elected to evaluate a single finding of facial pain.

Sinus CT scan was selected as the reference standard for this study because it was available, noninvasive, and acceptable to patients presenting with relatively mild nasal complaints. Although some authorities³ state that sinus puncture and aspiration is the "most accurate" reference standard, the technique is variably defined in the literature, samples only the maxillary sinus, and is not well accepted by patients. The patient population was typical of a Veterans Affairs medical center, being somewhat older and predominantly male, limiting the generalizability of these findings. The study was powered to evaluate a single exam finding with superior performance

characteristics; therefore, nonassociations must be interpreted with caution.

The clinical diagnosis of acute bacterial sinusitis continues to be a challenge. Additional studies are needed to define the optimal clinical diagnostic criteria or a prediction rule. The findings from this study suggest that the oropharyngeal red streak should be included in future studies evaluating clinical diagnostic criteria for acute sinusitis.

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REFERENCES

1. **Woodwell DA, Cherry DK.** Hea: National Ambulatory Medical Care Survey 2002 summary. Advance Data from Vital and Health Statistics. Number 346, August 26, 2004.
2. **Low DE, Desrosiers M, McSherry J, et al.** A practical guide for the diagnosis and treatment of acute sinusitis. *Can Med Assoc J.* 1997;156(Suppl 6):S1-S14.
3. **Engels EA, Terrin N, Barza M, Lau J.** Meta-analysis of diagnostic tests for acute sinusitis. *J Clin Epidemiol.* 2000;53:852-62.
4. **Williams JW, 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. **Stammberger H.** Functional Endoscopic Sinus Surgery: The Messerklinger Technique. Philadelphia: B.C. Decker; 1991.
6. **Davidson TM.** Clinical Manual of Otolaryngology. 2nd ed. New York: McGraw-Hill, Health Professions Division; 1992.
7. **Evans FO, Sydnor JB, Moore WE, et al.** Sinusitis of the maxillary antrum. *N Engl J Med.* 1975;293:735-9.
8. **Davidson TM, Murphy C.** Rapid clinical evaluation of anosmia. The alcohol sniff test. *Arch Otolaryngol Head Neck Surg.* 1997;123:591-4.
9. **Gwaltney JM, Phillips CD, Miller RD, Riker DK.** Computed tomographic study of the common cold. *N Engl J Med.* 1994;330:25-30.
10. **Simel DL, Samsa GP, Matchar DB.** Likelihood ratios with confidence: sample size estimation for diagnostic test studies. *J Clin Epidemiol.* 1991;44:763-70.

Supplementary Material

The following supplementary material is available for this article online at www.blackwell-synergy.com

Appendix