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Diagnosis of sinusitis in adults: History, physical examination, nasal cytology, echo, and rhinoscope

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The symptoms of sinusitis are common and overlap other diseases ranging from common colds to perennial rhinitis. When symptoms are prolonged and interfere with daily living, an appropriate set of investigations are indicated. The workup is designed to detect both the presence and extent of any disease in the paranasal sinus cavities. In chronic sinusitis, a constellation of nonspecific symptoms such as facial pressure, headache, nasal obstruction, and drainage may occur. Physical examination is important to exclude anatomic causes of symptoms. A negative physical examination does not rule out the diagnosis. Adjunctive tests in selected cases include nasal cytologic studies, ultrasound studies, and the use of flexible or rigid nasal endoscopes, in addition to imaging tests such as radiology and computed tomography. (J ALLERGY CLIN IMMUNOL 1992;90:436-41.)

Key words: Sinusitis, rhinorrhea, maxillary, ethmoid, nasal mucosa, sphenoid cytology, A-mode ultrasonography, flexible and rigid endoscopy

Almost everyone complains of "sinus." Patients frequently complain of chronic nasal congestion, post-

nasal drip, facial fullness, or headaches and are given a diagnostic label of "sinusitis." Depending on the practitioner, such patients may be treated empirically with antibiotics or antihistamines. Because there are no universally accepted criteria for the diagnosis of sinusitis, no population studies exist to determine the natural history of chronic sinusitis with and without intervention. Interventional studies have generally been restricted to antibiotic choice in acute sinus infections and surgical interventions in chronic disease. Acute sinusitis is generally a bacterial infection that occurs after a viral upper respiratory tract infection

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TABLE I. Sinus-related syndromes

Acute sinusitis
Recurrent or relapsing acute sinusitis
Chronic sinusitis
Acute or chronic (or exacerbation of chronic sinusitis)
Sinus-related headaches
Sinus-referred symptoms of 1-degree nasal origin

but may also follow physical trauma, barotrauma, or instrumentation of the upper respiratory tract. The symptoms of fever, facial pain increased on leaning forward, and purulent drainage are usually present. Chronic sinusitis has been listed as one of the most prevalent of the chronic diseases; more than 31 million cases have been reported in the United States.¹ Indeed, in this set of statistics it surpasses arthritis and hypertension. It is unknown how many of these patients were diagnosed empirically without direct confirmation of disease or without inferential information derived from an appropriate imaging test.

Because the symptoms of "sinusitis" are so common, I believe that patients who complain of recurrent episodes of sinus-associated symptoms deserve a more detailed evaluation under the following circumstances: (1) Symptoms interfere with activities of daily living (e.g., work or leisure pursuits). (2) Symptoms are recurrent (e.g., more than three to four severe episodes per year). (3) Symptoms are not adequately controlled by nonpharmacologic measures (e.g., steam inhalations or saline sprays) or over-the-counter medications. (4) Symptoms affect more than one anatomic site (e.g., sinus and ears; sinus and teeth; sinus and eye; sinus and brain). (5) Sinus disease is associated with distal problems (e.g., exacerbations of asthma or chest symptoms perceived by the patient as "bronchitis" or "pneumonia").

We plan the following workup for such patients: (1) to detect the presence of disease in the sinus cavities; (2) to detect anatomic abnormalities that would predispose to this condition; (3) to detect physiologic changes (e.g., prolonged nasal obstruction) that might predispose to sinus disease; (4) to differentiate nasal sinus, eustachian tube, middle ear, and brain processes; and (5) to accurately define the sinus-related syndrome (Table I).

HISTORY

The classic presentation of acute sinusitis is the "cold that doesn't go away." Patients have fever, nasal congestion, clear rhinorrhea, nasal irritation, and frequently constitutional symptoms of fatigue and malaise.² Over 3 to 5 days these symptoms evolve. Facial

TABLE II. Factors leading to production of sinus-related symptoms

Sinus ostial obstruction
Barotrauma
Mucosal hypertrophy
Vasomotor rhinitis
Allergic rhinitis
Viral upper respiratory tract infection
Defects in mucociliary clearance
Kartagener syndrome
Cystic fibrosis
IgA deficiency
Ciliary dysmotility
Idiopathic
Colonization by abnormal organisms
Immunodeficiency (including AIDS)
Collagen vascular disease
Instrumentation
Sepsis
Mechanical obstruction
Choanal atresia
Nasal polyps
Deviated nasal septum
Foreign body
Tumors
Trauma

AIDS, Acquired immunodeficiency syndrome.

pain above and/or below the eyes is intensified by leaning forward or straining. Nasal secretions turn from clear to cloudy and then to yellow or green. The secretions may drain posteriorly into the throat causing pooling at night, with production of cough. The post-nasal secretions may cause nausea or a sensation of upper chest congestion that patients interpret as bronchitis. There may also be complaints of popping or clicking in the ears, muffled hearing, nasal congestion, and halitosis. The senses of taste and smell may be reduced.

In chronic sinusitis any combination of the above symptoms may be present. When only one symptom is present, such as chronic headache or postnasal drainage, it is more difficult to make the diagnosis.³ Adjunctive tests are warranted as will be described.⁴ In chronic disease patients may also complain of a chronic nonproductive cough.

In addition to the usual questions regarding the severity and temporal pattern of each symptom, special attention should be paid to the factors that lead to the production of sinus-related symptoms (Table II).

PHYSICAL EXAMINATION

Patients who have active sinus infections may have pus either in the nares or the nasopharynx. In infection

of the frontal sinuses, purulent exudate may be seen in the middle or superior meatus if drainage is not prevented by swelling of the nasal turbinates. In maxillary infection, the pus is visible in the middle meatus. For ethmoid infection, pus is visible in the middle meatus when the anterior cells of the sinus are involved and in the superior meatus if the posterior cells are affected. In most cases both areas of the sinus are involved, and exudate is present in both meati.⁵ However, the absence of visible pus does not rule out active infection, because drainage from the sinuses may be impeded or may be intermittent. Only a small proportion of the surface area of the upper respiratory tract is seen through the nasal speculum, and decongestion with a topical α -adrenergic agonist spray, such as 1% phenylephrine, is useful to shrink the mucosa to permit a view further back into the nasal cavity. However, the entire area cannot be visualized through the speculum, even with the use of a head mirror and indirect supplemental lighting.

Irritation of the nasal mucosa by infected nasal secretions leads to inflammation with a bright red, irregular appearance. Also, primary nasal inflammation, which blocks the sinus ostia, may lead to secondary sinusitis. Purulent secretions may also be deposited in the nasal cavity as crusts. Dehydration of secretions may occur after airway heating or cooling or inhibition of ciliary activity. Prolonged nasal inflammation may lead to the formation of nasal polyps or polypoid degeneration of nasal mucosa. This latter finding is frequently seen in the middle turbinates. The association of nasal polyposis, hyperplastic rhinosinusitis, asthma, and aspirin sensitivity is well recognized.⁶ Frequently the sinusitis component may be relatively asymptomatic and thus ignored.

Facial tenderness over the affected sinus is a poor indicator of underlying sinus infection. In fulminant sinusitis, there may be swelling of the periorbital tissues or proptosis.⁷ In some cases of sinusitis, the skin overlying the affected sinus may be reddened and tender. In maxillary sinusitis, pain may be referred to the upper teeth. In severe cases these may become loosened, and hemorrhage may be present in the surrounding tissues. Infection in the sphenoid sinus may lead to pain and tenderness over the vertex of the skull, the mastoid bones, and the occipital portion of the head.

NASAL CYTOLOGY

Two studies have evaluated the role of nasal cytology in predicting the presence of an abnormal radiograph. Wilson et al.⁸ reported a 79% correlation between sinus x-ray films and nasal cytology reports in 55 patients. When the cytology report was positive

with greater than 6 neutrophils per high-power field, the radiograph was positive 90% of the time.

Gill and Neiburger⁹ compared the results of nasal cytology with the results of sinus radiography in 300 patients with allergic rhinitis who had both tests performed as part of their initial allergy evaluation. Radiography was significantly more likely to be positive when more than 5 neutrophils per high-power field or more than 5 eosinophils per high-power field on nasal cytologic studies were present. Although these findings were sensitive, they were nonspecific as predictors of radiographic disease. The authors concluded that nasal cytology should not be considered an adequate alternative to sinus radiography. Unfortunately no comparison of nasal cytology to sinus aspiration has been reported.

Jeney et al.¹⁰ studied nasal glandular secretory responses in 14 patients with recurrent sinusitis. After provocation with either methacholine or histamine, nasal washings were analyzed for albumin, IgG, IgA, lactoferrin, and lysosome. The authors found that the patients had a blunted cholinergic response with decreased secretion of the proteins. They hypothesized that the inability to secrete glandular proteins normally may predispose to recurrent infections. Further research may lead to a diagnostic role for nasal secretions in sinusitis.

USE OF ULTRASONOGRAPHY IN SINUSITIS

In several recent studies investigators have evaluated A-mode ultrasonography. The advantages of ultrasonography include absence of ionizing radiation, rapid test time, and patient convenience. Two monographs have reported on the experience with the technique in Finland¹¹ and Sweden.¹² In both reports, high correlations were reported between positive echoes on ultrasound examinations and the presence of fluid on maxillary antral puncture. A statistically significant correlation between presence of mucosal thickening on ultrasound imaging and radiographs was also reported.¹¹ Good correlation was also reported in a paper from Germany,¹³ but poor correlation was found in another Swedish study¹⁴ and in an English report.¹⁵

Experience in the United States with two commercially available instruments has also been mixed. Early reports were encouraging, but data were not evaluated critically.^{16, 17} Shapiro et al.¹⁸ correlated Waters' radiographic views and A-mode ultrasonography in 75 subjects with allergic rhinitis who had signs and symptoms that suggested sinus disease. The sensitivity of ultrasound imaging compared with the radiographs varied from 44% to 61%, depending on which criteria were applied to the radiograph. The population

studied was mainly pediatric and had a median age of 10 years (range, 2 to 72 years).

In a study by Rohr et al.,¹⁹ 99 subjects were evaluated by two different commercial instruments, and the findings were correlated with radiographs taken the same day. Both instruments had high specificities (about 93%) in the diagnosis of maxillary sinusitis, but the sensitivities for both were low (61% and 29%). Ultrasonography is less helpful in diagnosing frontal sinusitis. The authors concluded that one instrument tested was a useful screening device because of the high specificity of a positive result. It was, however, of limited value in diagnosing mucosal thickening.

In our laboratory we studied the use of ultrasonography specifically to evaluate mucosal thickening, because this is the most common radiographic finding seen in chronic sinusitis.²⁰ Ultrasound tracings were read by a representative of the company that manufactured the ultrasound instrument and the radiographs by an attending radiologist. Both observers were blinded to the clinical history. We obtained a total specificity of 61% and sensitivity of 34%. Thus although a positive result suggests that presence of mucosal thickening and/or opacification, a negative result does not rule out the diagnosis. Patients with positive ultrasound findings may be spared radiography.

One report described the use of gray-scale (B-mode) sonography.²¹ Twelve patients with maxillary sinus disease were studied, and fluid, mucosal thickening, and soft tissue masses were detected. The value of this technique remains to be seen. Data presented to date on the evaluation of frontal sinuses are limited, and incomplete data have been presented on serial tests correlating resolution of ultrasound images with radiologic resolution.²² This is especially important if the device is to be used to follow cases of chronic sinusitis.

More important, in cases of chronic sinusitis that do not respond to an intensive medical regimen of antibiotics, intranasal steroids, oral decongestants, steam inhalations, and saline nasal sprays, it is necessary to visualize the sinuses in detail. The ethmoid sinuses are frequently involved, and their lining may be thickened. Involvement beyond the maxillary sinuses may more commonly require surgical intervention. Also, other abnormalities such as cysts, polyps, and rostral nasal septal deviations may be seen and may be amenable to surgery. A coronal computerized tomographic scan should be obtained before surgery is contemplated. The controversy over the interpretation of radiographic abnormalities seen in the paranasal sinuses of children and the impact of this on ultrasonography have been well reviewed by Kuhn.²³

Further studies are required in several areas. Because there is considerable interobserver variation in reading sinus radiographs, it would be useful to compare the ultrasound images to another parameter in chronic sinusitis. For example, does a positive echo pattern predict response to treatment? Studies also need to be conducted that examine the reproducibility of ultrasound images over time and the changes in response to treatment.

In our clinic we restrict the clinical use of A-mode ultrasonography to screening for the presence of maxillary fluid. This technique is of great value in pregnant women to document the presence of fluid without the need to expose the patient to ionizing radiation.

RHINOSCOPY

Flexible

The introduction of flexible endoscopes with a small diameter (3 to 4 mm) and a tight light-bending radius (130 degrees) allows a detailed examination of the upper nasal cavities and posterior nasopharynx. A wide variety of diseases may be seen.²⁴⁻²⁶ In the context of sinusitis, pus may be visualized or factors that may obstruct the sinus ostia. The maxillary sinus ostia are not visualized with the flexible scope. Ostia seen passing laterally into the maxillary sinuses are generally secondary (accessory) ostia.

The use of the endoscope involves the administration of a topical local anesthetic and decongestant to the nasal mucosa. It should not replace the use of the head mirror and posterior pharyngoscopy in those patients who can tolerate it performed by those practitioners experienced in this technique.* Flexible endoscopy is of value in investigating atypical symptoms and recalcitrant symptoms, for identifying polyps high in the nasal vault, and in identifying structural abnormalities. The use of the flexible endoscope is especially useful in the investigation of symptoms related to postnasal drainage, because structures down to and including the vocal cords may be seen.

Rigid

The use of the rigid endoscopes for diagnostic purposes has been advocated by otolaryngologists as a preparation for functional endoscopic sinus surgery. After adequate topical anesthesia, the middle turbinates may be displaced medially to expose the middle meatus.²⁷ The rigid endoscopes are produced with a variety of fixed-angled lenses. The 0 degree and 30

*Georgitis JW, Schumacher MJ, Druce HM, et al. Flexible fiberoptic rhinolaryngoscopy. Position paper of Upper Airway Committee, American Academy of Allergy and Immunology (submitted for publication).

TABLE III. Adjunctive tests in sinusitis

Nonimaging
Nasal cytology
Maxillary sinus aspiration
Fiberoptic endoscopy
Rigid endoscopy
Imaging
Transillumination
Plain radiography
A-mode ultrasonography
Computer tomography
Magnetic resonance imaging

degrees may be most useful for general nasal diagnosis. The definition achieved with the rigid scopes is greater than that for the flexible instruments.

The images seen through the endoscopes may be captured by the use of a camera and videocassette recorder. Thus opinions may be sought from other specialists regarding questionable observations. The tapes may also be used for teaching and as a permanent record for medicolegal purposes.

The optimal timing for performing an endoscopic examination has not been determined. In chronic sinusitis if the examination is performed during exacerbations, more useful information may be obtained. The examination is less useful if the patient is seen during an antibiotic course. It may be desirable to wait until the completion of the antibiotics so that any residual disease may be assessed.

OTHER ADJUNCTIVE TESTS

Various other tests may be of value in the diagnosis of sinusitis (Table III).

INTEGRATED DIAGNOSTIC APPROACH

How far should one go in the diagnostic workup to confirm a diagnosis of sinusitis? Clinical practice varies from empiric management based on history to a full evaluation including the above tests, supplemented by imaging procedures. In our experience once patients have chronic symptoms, it is of great importance to work through a differential diagnosis, perform a thorough visualization of the upper respiratory tract, and identify factors that may predispose the continuation of symptoms. It is controversial regarding whether an empiric trial of comprehensive medical therapy should be started before adjunctive tests are ordered. Although this may be cost-effective, partial resolution of symptoms during a trial may yield more confusion about the origin. All of us have seen patients who claim resolution of symptoms while taking antibiotic therapy but have a relapse within 3 to

TABLE IV. Diagnostic approach to chronic sinus-related symptoms

1. History and physical examination
2. Detailed ear, nose, and throat physical examination
3. Flexible endoscopy (if conventional examination raises doubts about potential disease)
4. Allergy skin tests (if patient has clearcut allergic history)
5. Empiric 1 mo trial of medication
6. Diagnostic tests, including endoscopy
7. Imaging tests (usually coronal computed tomography)
8. Further medical therapy or referral for surgical evaluation

4 days of discontinuation of the drug. Repeated courses yield similar results, and diagnostic tests fail to reveal evidence of infection. Our general approach to chronic sinus-related symptoms is outlined in Table IV. There are of course patients who have already completed "adequate" medical therapy or who have constant symptoms. In these cases we would proceed immediately to a detailed evaluation.

I thank Maria J. Weingartner for excellent secretarial support.

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DISCUSSION

Dr. Fireman. I would like to comment on who should perform nasal endoscopic examinations. It is our belief that with appropriate training allergists and primary care physicians as well as otorhinolaryngologists should use the endoscope fairly routinely in the setting of what is believed to be chronic sinusitis.

Dr. Spector. A few comments on some of the techniques and studies in which I have been involved. We basically agree with what you have said, that there was not a place for transillumination because the sensitivity was so low. The only exception may be if you had sinusitis demonstrated on x-ray film, and you wanted to follow the patient. That might be one way of doing it without obtaining repeated x-ray films. The second study we looked at had total agreement regarding what the value or possible value of ultrasonography was. However, again in the study that we looked at, the sensitivity of ultrasonography was pretty low: for the maxillary sinus it was about 60%, for the frontal sinus 20%, and you cannot even evaluate the ethmoid sinus. Now is there any purpose when you have such low sensitivity in doing something like an ultrasound study? If somebody really refuses to have a sinus x-ray film or as the follow-up after an abnormal x-ray film, then maybe an ultrasound study will tell you something.

Dr. Wald. I would just like to make another comment about imaging and perhaps underscore why we must be very careful not to make this the sole gold standard for diagnosis. What we are seeing whether we are looking at radiographs or computed tomographic scans is inflammation. That certainly does not speak to the source of that inflammation, whether it is infectious or postinfectious or allergic inflammatory or other. That is something that we really must keep in mind.