Chronic Sinusitis

Alexander C. Chester

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Symptoms of chronic sinusitis include facial pain, rhinorrhea and malaise. Infection, allergies and vasomotor rhinitis / sinusitis are the usual causes. Physical examination, laboratory results and routine radiologic findings are often minimal. Computed tomographic scanning, however, may show pathology that is not apparent on standard radiographs. Nonpharmacologic treatments should be considered first. Increased exercise and nasal steam inhalation may help. Dietary restrictions or a change in environment are occasionally quite beneficial. Intranasal corticosteroids and brief courses of local decongestants are frequently appropriate. Systemic therapy, including decongestants, anti-inflammatory agents, antibiotics and, occasionally, antihistamines, offers treatment directed at the causes of chronic sinusitis. When aggressive medical treatment is unsuccessful, nasal surgery, particularly endoscopic surgery, directed at abnormalities of the ostiomeatal unit, may offer significant benefit for selected patients.

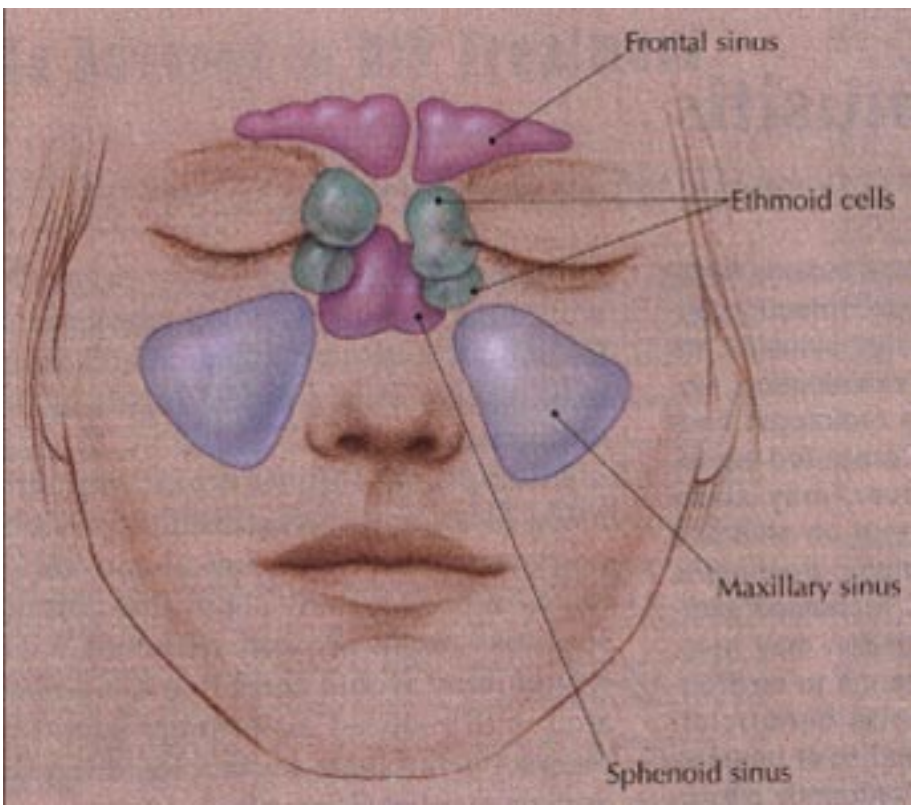

Figure 1. Frontal view of the sinuses.

Chronic sinusitis is one of the most prevalent chronic conditions in the USA, affecting almost 32 million persons. Definitions of the illness vary. While some authorities insist that the disease is characterized by nasal endoscopic findings of purulence or mucous membrane changes on computed tomographic (CT) scanning, others believe chronic sinusitis is characterized by the presence of a purulent nasal discharge for at least three weeks and, in some cases, for up to three months.

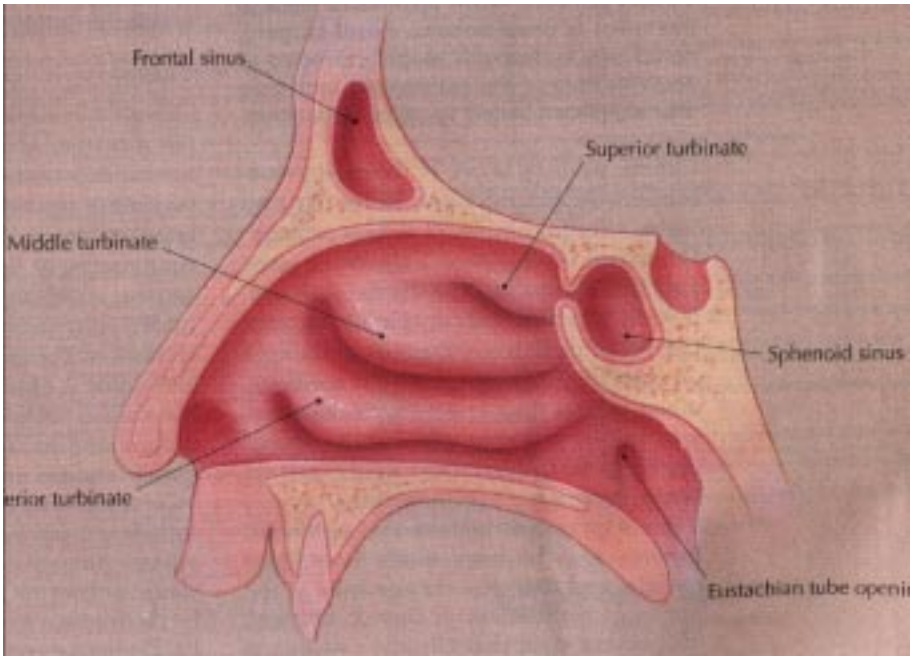

Figure 2A. An axial section of the nose, showing external landmarks.

Some clinicians believe that epithelial damage may be irreversible after three months and that this change itself is the defining characteristic of chronic sinusitis. Still others state that chronic sinusitis is primarily a disease involving obstruction of the ostiomeatal complex, a narrow area of sinus drainage (Figures 1 and 2a and 2b), with inflammation as a secondary manifestation. Moreover, membrane changes may resolve after surgical repair of the obstruction.

Attempts to define chronic sinusitis using histologic characteristics produce poor correlation with clinical and radiologic findings. Many claim that chronic sinusitis "resist accurate definition", although most would agree that it is associated with reduced air passage lateral to the middle turbinate and through the adjacent sinus ostia (Figures 2a and 2b).

Chronic sinusitis is defined clinically as a condition characterized by nasal symptoms, facial headache and malaise. This

clinical syndrome is not necessarily linked to specific radiographic findings.

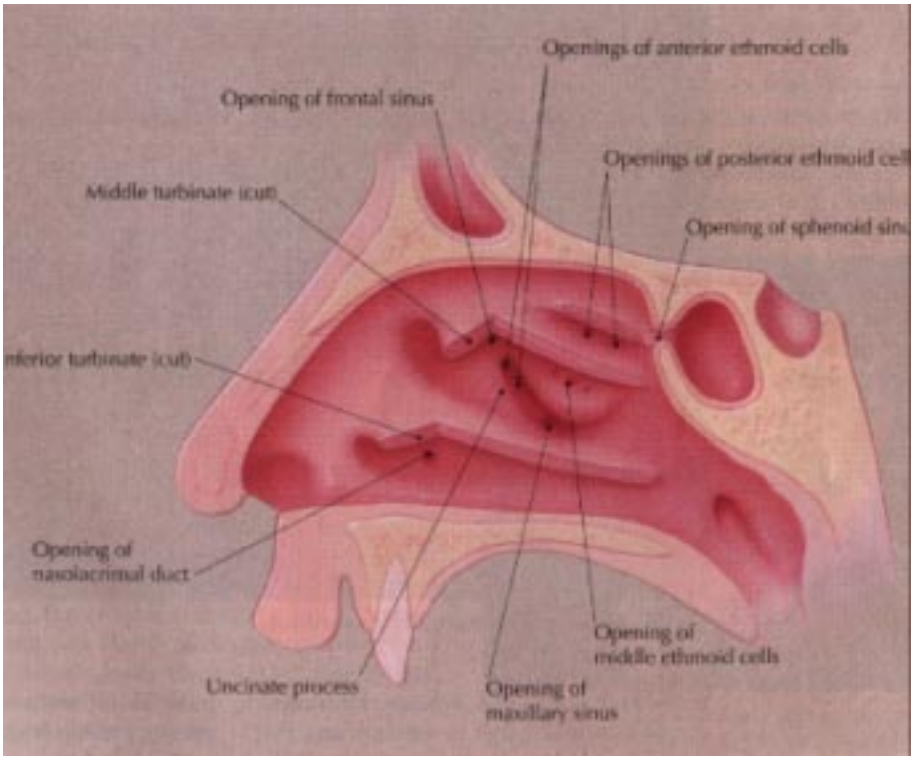

Figure 2B. Axial section of the nose, cut away to show sinus ostia.

Causes

Sinusitis syndromes include acute sinusitis, recurrent acute sinusitis, chronic sinusitis and acute sinusitis superimposed on chronic sinusitis. The pathologic mechanism of chronic sinusitis usually involves compromise of the sinus ostia by various causes, which may be superimposed on underlying anatomic abnormalities. Infections of the sinuses are usually rhinogenic, that is, spreading from the nose into the sinuses. Nasal swelling, nasal inflammation and nasal polyps can all predispose to chronic sinusitis.

Common categories of chronic sinusitis include chronic infectious sinusitis, chronic allergic sinusitis and chronic vasomotor sinusitis. Patients with acute sinusitis may be predisposed to chronic infectious sinusitis. Findings on microbiologic and cytologic examination of nasal secretions suggest the diagnosis of chronic infectious sinusitis. In some persons, immunoglobulin abnormalities predispose to infection. In chronic allergic sinusitis, allergic nasal mucosal swelling may occlude the sinus ostia. Although a hyperemic response of the sinus mucosa to ragweed pollen has been demonstrated, sinusitis symptoms are more

often the result of a mixture of mucosal swelling and superimposed infection.

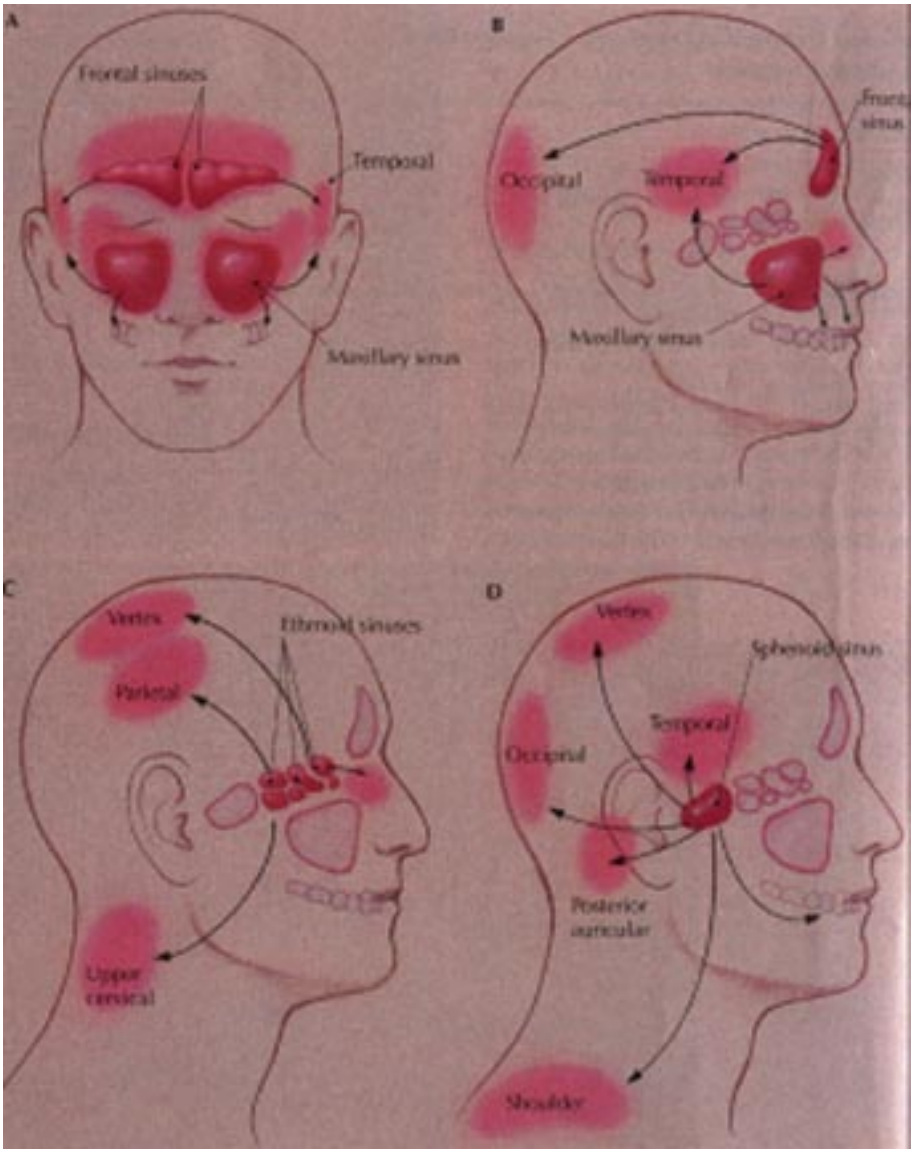

Figure 3. Pain referral patterns in sinus disease.

Chronic vasomotor sinusitis is related to vasomotor rhinitis. Clinical categories of this type of sinusitis include the following: physical hypersensitivity to changes in temperature, barometric pressure, drafts, irritants or other factors; emotional reactions to stressful situations, and idiopathic hypersensitivity, encompassing such entities as "autonomic imbalance", "constitutional diathesis", postviral nasal hyperreactivity and hormonal rhinitis. The edema and mucosal changes induced by vasomotor rhinitis predispose to infection.

Symptoms

Classic symptoms of chronic sinusitis include facial pain, nasal congestion, rhinorrhea (usually purulent) and cough (often worse at night). Referred sinus pain may occur in areas of the head other than the face (Figure 3) and is often worse in the morning. A sensation of pressure or pain in the ear is common, reflecting eustachian tube dysfunction. Additional complaints may include fatigue, dysequilibrium, dental pain, asthma, inability to focus mentally, minor visual changes and temporomandibular joint symptoms. Fever and leukocytosis are uncommon.

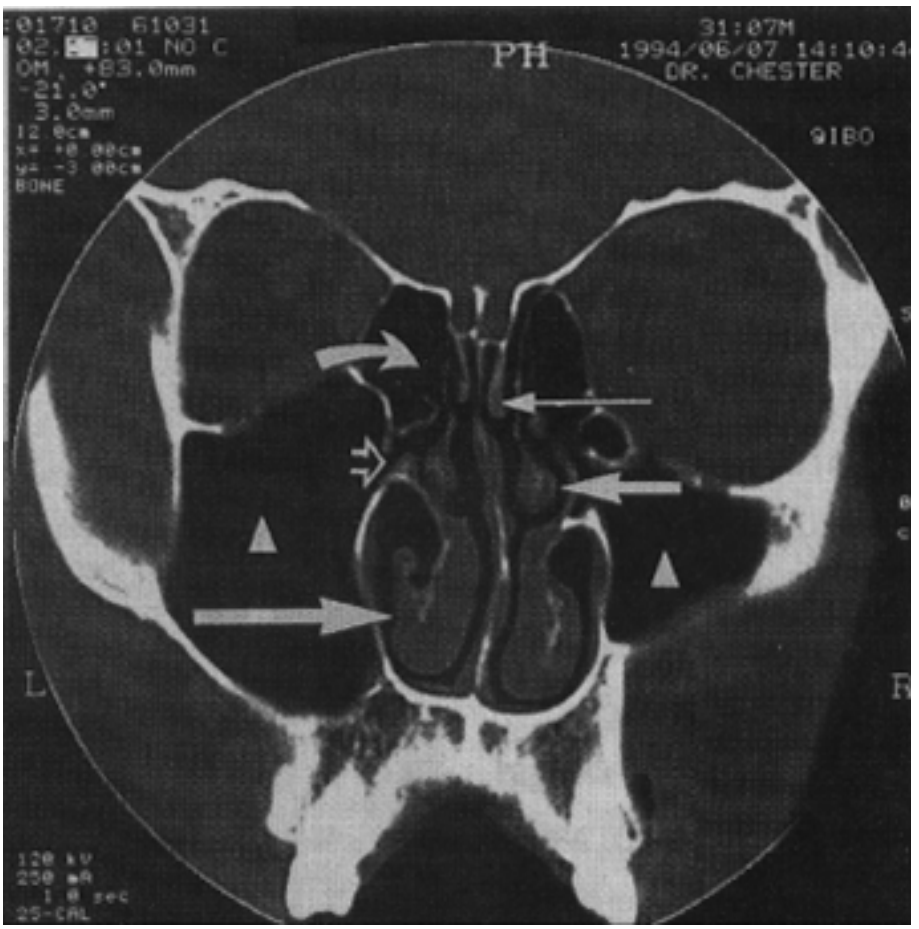

Figure 4. CT scan (single section through the ostiomeatal complex) showing the maxillary sinuses (triangles), the ethmoid sinuses (curved arrow), the absence of uncinate because of previous surgery (open arrow), the superior or supreme turbinate.

Diagnostic Considerations

Table 1. Selected Differential Diagnostic Considerations in Chronic Sinusitis

Symptom	Cause
Headache, facial pain	Dental disease
	Temporomandibular joint pain
	Tumor
	Vascular or tension headache
Malaise, fatigue	Allergic conditions not associated with chronic sinusitis
	Depression
	Medication side effects
Rhinitis, postnasal drip, chronic cough	Asthma
	Chronic rhinitis of any cause
	Gastroesophageal reflux
	Nasal mucosa abnormalities
	Nasal polyps.

The diagnosis of chronic sinusitis rests largely on the history (Table 1). Palpation, transillumination and anterior rhinoscopy are of minimal value in establishing the diagnosis. Detailed rhinoscopy may identify nasal abnormalities that predispose to chronic sinusitis (eg, nasal polyps, foreign bodies, membrane inflammation) and may reveal infection from a particular sinus ostium (Figure 2a and 2b). Factors that predispose patients to the development of chronic sinusitis are listed in Table 2.

Table 2. Factors Predisposing to Chronic Sinusitis

Allergic rhinitis
Cystic fibrosis
Disorders of ciliary motility* (including ciliary dysmotility and immobile cilia disorder)
Environmental irritants
Foreign bodies
Hypertrophied adenoids
Immunodeficiency disorders (including IgA deficiency and IgG subclass deficiency)*
Kartagener's syndrome*
Nasal anatomic abnormalities
Nasal polyps
Overuse of nasal sprays
Smoking
Swimming and diving
Tumors*
Upper respiratory tract infection
Wegener's granulomatosis*
* Uncommon causes of chronic sinusitis.

Routine sinus radiographs do not clearly show the ethmoid sinuses and the nearby ostiomeatal unit. However, radiographs may provide information about the lower third of the nasal cavity and maxillary, frontal, sphenoid and posterior ethmoid sinuses. Routine sinus radiographs usually are not helpful in the evaluation of chronic sinusitis.

CT scanning is the modality that provides the greatest information concerning the nose and sinuses (Figure 4, 5 and 6). CT scanning is especially helpful in demonstrating the anterior ethmoid cells, the upper two-thirds of the nasal cavity and the frontal recess. Also, CT scanning can clarify anatomic relationships (Table 3), guide endoscopic surgery and provide information about response to treatment.

Table 3. Chronic Sinusitis: Common Anatomic Abnormalities Evident on CT Scan

Concha bullosa (an air-filled middle turbinate)
Nasal polyposis
Ostiomeatal occlusion
Paradoxic curvature of the turbinate
Septal deviation
Septal spur.

CT examination, usually performed after medical therapy for sinusitis, shows the ostiomeatal complex well. This unit, which is crucial for proper sinus function, receives drainage from the frontal, maxillary, and anterior and middle ethmoid sinuses. Mucous membrane thickening, septal deviation, turbinate abnormalities and other causes of ostiomeatal compromise are demonstrated on standard 2-mm coronal sections. However, normal results on CT scanning do not always rule out chronic sinusitis.

It is important to remember that in the absence of appropriate symptoms, abnormalities demonstrated on CT scanning may not be clinically significant. In one study that compared CT scans performed to evaluate sinus disease with scans performed to evaluate orbital disease, abnormalities were common in the latter group: some type of nasal or sinus abnormality was noted in over 50 percent of patients with orbital disease.

In most cases, little diagnostic value is lost through use of a more limited CT scan in which the coronal sections are spaced wider in all areas except the ostiomeatal complex. The characteristics of chronic inflammatory disease, which include mucoperiosteal thickening, soft tissue mass and ethmoid osteitis, are still demonstrated along with other anatomic features. By using this method, CT scanning may be only somewhat greater than the cost of routine sinus radiographs. This method also reduces scanning time and radiation exposure.

Although initial reports were enthusiastic, magnetic resonance imaging (MRI) appears to have a more limited role in the diagnosis of sinusitis. MRI is more useful than CT scanning in delineating soft tissue structures, but poor bone resolution restricts its ability to define nasal anatomy.

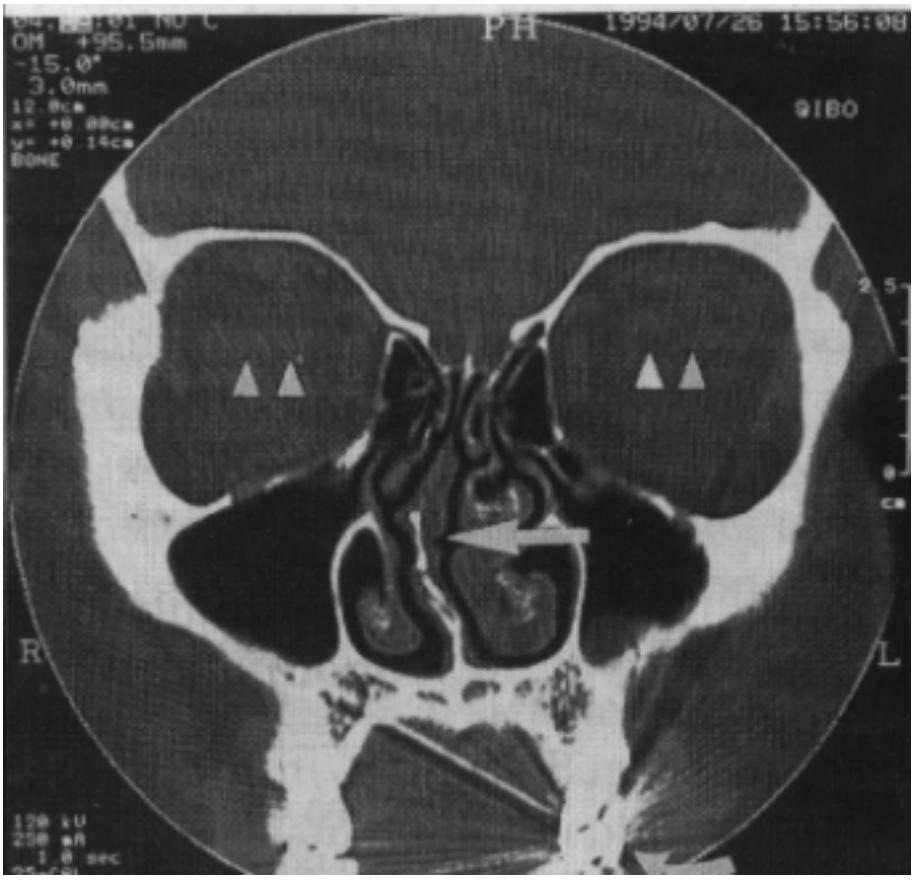

Figure 5. CT scan showing a septum deviated to the right (straight arrow). Artifact caused by tooth fillings is shown by the curved arrow. Double triangles mark the orbits.

Therapy

Environmental Considerations

Some climates are worse than others for persons with chronic sinusitis. The damp weather of the northern temperate zones is usually the most problematic. For some patients, certain seasons or particular geographic regions in which the concentration of allergens is high may be troublesome. Additionally, atmospheric inversions and drops in barometric pressure seem to cause sinus difficulties apart from any effect they may exert on air pollution or allergen concentration. For example, some patients may report feeling worse before a rainstorm.

Clearly, pollutants have an impact on chronic sinusitis. Nasal irritation induces turbinate swelling and causes ciliary dysfunction. Subtle changes in air quality can cause chronic nasal and sinus problems. When a patient has symptoms of rhinitis and sinusitis while working in a particular office building (sick building syndrome), increasing fresh air ventilation or changing buildings may provide relief. High-efficiency particulate air filters and electrostatic filters may also be helpful in reducing irritants.

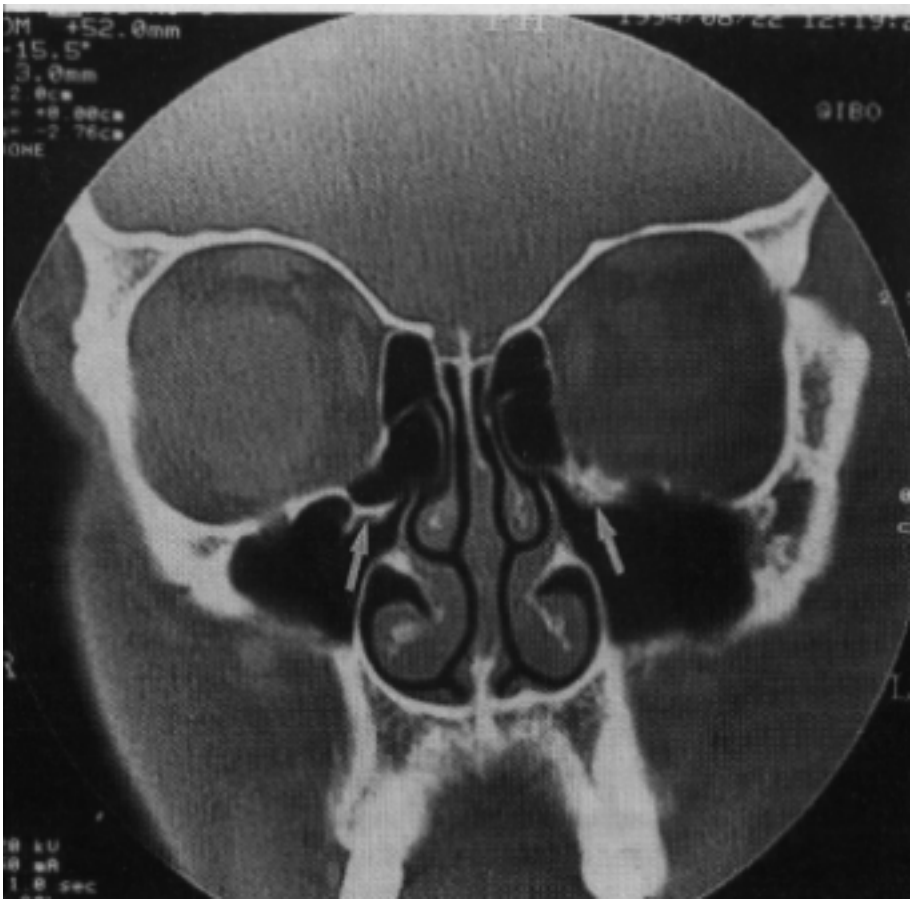

Figure 6. CT scan demonstrating the ostiomeatal unit (just medial to both arrows); it is partially blocked by Haller cells (arrows), an ethmoid sinus variant.

Personal Habits

While fatigue and sleep deprivation may predispose persons to chronic sinusitis, excessive sleep may exacerbate the condition. In one study, the recumbent position increased nasal congestion and caused an additional 20 percent reduction in ostial patency in patients with chronic sinus disease. Therefore, patients should be advised to spend no more than the usual amount of time reclining in

bed. In cases of unilateral obstruction, patency of the affected side may be improved if the patient sleeps on the unaffected side in a lateral recumbent position. This response may occur as a result of nasal reflexes triggered by external thoracic pressure.

For some patients, increasing nasal sympathetic discharge by vigorous exercise has an invigorating, decongesting effect; for others, exercise can worsen symptoms. Also, eyeglasses may pinch the nasal bridge and can cause sinus congestion. A better fit or contact lenses can offer relief.

Drug Side Effects

Chronic sinusitis may be caused of exacerbated by many medications. Drugs that influence vascular tone also have an effect on the tone of nasal mucosal vessels and resistance nasal vessels. Examples include antihypertensive sympatholytic agents and beta blockers. The anticholinergic effects of antidepressants, antipsychotics and tranquilizers can exert an undesirable drying effect. Some persons, particularly those with asthma and sinusitis, are sensitive to aspirin and nonsteroidal anti-inflammatory drugs (NSAIDs). Avoiding these medications may improve symptoms.

Occasionally, use of oral contraceptive agents appears to aggravate chronic sinusitis, presumably by the same mechanism that causes alteration of the nasal mucosa during the menstrual cycle. Menstruation may initiate nasal symptoms by vasomotor changes or premenstrual fluid retention.

Diet

The contribution of food allergies to chronic sinusitis is controversial. Older reports have linked certain foods to complaints of nasal stuffiness, facial pressure and fatigue. Elimination of products such as milk, wheat or red wine may be beneficial, although controlled studies are lacking.

Spicy foods (ie, garlic, horseradish root, cayenne pepper) may help clear the sinuses, although, again, no scientific studies have been conducted.

Local Treatments

Nasal saline spray is often helpful in moistening dry, inflamed nasal membranes and reducing mucus viscosity. In some persons, nasal saline spray has a separate decongestant effect. Some commercial preparations, however, contain a preservative that may be irritating.

Warm saline nasal rinses may be helpful, but occasionally they are counterproductive. The solution can be prepared by mixing 1/4

tsp of table salt with 7 oz of warm water and can be instilled using a bulb syringe or a pulsating jet of water (Water Pic with nasal adapter, Teledyne Water Pic, Ft Collins, Colo; telephone: 800-525-1774). Wetting agents, such as propylene and polyethylene glycol, may offer an additional benefit for the patient.

Steam inhalation, with or without added astringents (eucalyptus, pine oil or menthol), is usually helpful. Membrane warming rather than membrane wetting may be more responsible for the decongestant effect, since inhaling hot dry air is also often effective. Nasal steamers offer convenience (Steam Inhaler, Bernhard Industries, Inc, Miami, Fla; telephone: 305-861-2536, and Virotherm, Sunbeam-Oster Household Products, Schaumburg, Ill; telephone: 800-621-8854). Many patients simply inhale steam from a cup of hot water. Using a damp face cloth heated in the microwave is also quite practical, although the patient should be cautioned to avoid burns. Recently, inhalation of steam has been shown to be of no benefit in persons with the common cold; however, these results should not be extrapolated to persons with chronic sinusitis.

During colder months, humidification helps prevent drying, irritation, swelling and secondary infection. It also decreases nasal mucus viscosity. Although steam humidification appears superior to cold mist or ultrasonic devices, allergists have raised concerns about the effect of steam on mold growth and dust mite proliferation.

Nasal decongestant sprays may be of help when used sparingly, three times a day for up to three days. Alpha$_1$-adrenergic receptor sympathomimetic catecholamines (phenylephrine) and alpha$_2$-adrenergic receptor imidazoline derivatives (naphazoline) (Privine), tetrahydrozoline (Tyzine), oxymetazoline and xylometazoline (Otrivin)) are two effective drug classes that act on nasal capacitance vessels. Chronic use of these drugs induces rhinitis medicamentosa, a condition of rebound swelling, often requiring the use of systemic corticosteroids. The risk of rebound swelling is lower when more dilute nasal sprays are used. Adding water to the spray bottle to accomplish a 1:2 to 1:10 dilution is helpful.

Intranasal corticosteroids have been shown to be effective for seasonal and perennial allergic rhinitis, perennial nonallergic eosinophilic rhinitis and nasal polyps (Table 4). They may offer useful ancillary treatment for chronic sinusitis. Cromolyn, a locally applied blocker of the immediate and late nasal response to allergen challenge, may have a less substantial role in the treatment of chronic sinusitis.

Table 4. Potency of Selected Intranasal Corticosteroids

Drug	Topical potency relative to hydrocortisone = 1	Systemic potency
Triamcinolone (Nasacort)	1.000	5.3
Flunisolide (Nasalide)	3.000	12.8
Beclomethasone (Beconase AQ, Vancenase AQ)	5.000	3.5
Budesonide (Rhinocort)	10.000	1.0
Fluticasone (Flonase)	20.000	N/A.

Systemic Therapy

Systemic decongestants can be of great help in relieving symptoms of chronic sinusitis. Pseudoephedrine, 60 to 120 mg, and phenyl-propanolamine, 30 to 100 mg, are commonly used alpha-adrenergic agonists that reduce nasal blood flow. Nasal stuffiness and resistance are reduced within 30 minutes, an effect that persists for up to four hours. When sustained-release formulations are used, this effect lasts even longer. The effect on blood pressure is usually minimal or nonexistent.

Because chronic rhinitis is characterized by hyperreactivity to methacholine, anticholinergics have been used as therapy. Intranasal ipratropium is effective as treatment for vasomotor rhinitis and perennial nonallergic rhinitis. Use of this drug as a therapeutic agent in chronic sinusitis is unclear, especially since anticholinergic agents, local and systemic, cause diminished mucociliary clearance.

Antihistamines should be used only selectively in chronic sinusitis. Histamine is not usually implicated in this disorder and the drying effects of nonspecific antihistamines in infectious chronic sinusitis may cause inspissation of the sinus contents.

Allergic inflammation, often seasonal, predisposes some individuals to chronic sinusitis. For these, a selective histamine H_1 blocker may be a desirable option.

Anti-inflammatory agents may be helpful in certain persons with chronic sinusitis. Patients with inflammatory sinus disorders that are not responsive to local corticosteroids may benefit from the use of systemic corticosteroids. Although controlled trials involving patients with chronic sinusitis are lacking, the effect of corticosteroids can occasionally be dramatic.

Aspirin and NSAIDs can trigger asthma, rhinitis and sinusitis in susceptible persons. However, these drugs are sometimes helpful in attenuating the symptoms of chronic sinusitis.

Antibiotic therapy is appropriate for chronic infectious sinusitis. Anaerobic organisms, *Staphylococcus aureus* and alpha-hemolytic streptococci are considered more common than the bacteria of acute sinusitis (*Streptococcus pneumoniae, Moraxella catarrhalis* and *Haemophilus influenzae*). Initially, amoxicillin administered for at least 10 to 14 days or, for those who are allergic to penicillin, trimethoprim-sulfamethoxazole (Bactrim, Cortim, Septra, etc) is a reasonable choice. With persisting infection or rapid recurrence, a more prolonged course of the antibiotics would be indicated (three to four weeks). Cases of suspected resistance would be appropriately treated with cefaclor (Ceclor), cefuroxime axetil (Ceftin), cefizime (Suprax) or amoxicillin-clavulanate (Augmentin) for four to six weeks.

In the absence of purulent nasal discharge, the use of antibiotics for chronic sinusitis has been questioned. Some clinicians believe that most cases do not represent an infectious process and do not require treatment with antibiotics. Most authorities, however, consider evidence for the importance of antibiotics to be strong and mounting, although adequate controlled trials are still lacking. Few objective markers exist for measuring treatment progress or progression of chronic sinusitis, yet treatment with antibiotics may be quite helpful even in the absence of a purulent nasal discharge, significant local tenderness, fever or other signs of infection. Patients often find a brief course of antibiotics to be of great benefit.

Nasal Surgery and Specialist Referral

Chronic sinusitis that fails to respond to medical therapy calls for evaluation by CT scanning and referral to an otolaryngologist. Examination, including nasal endoscopy and CT scanning, may reveal abnormalities amenable to surgical correction.

When chronic sinusitis is unresponsive to aggressive medical management, nasal surgery can provide improvement that is often dramatic. Most surgeons restrict surgery to cases in which an anatomic or pathologic mucosal abnormality that restricts ostiomeatal unit patency can be demonstrated. Others, however, have expanded the indications to include chronic facial pain and/or headaches thought to be of sinogenic origin without evidence of ostiomeatal obstruction.

The technique of functional endoscopic nasal surgery allows the selective removal of disease in key areas. Under rigid endoscopic guidance, adequate aeration and drainage can be restored

by removing less mucosa than with conventional surgery, thereby causing less damage to normal nasal functioning (Figure 7). Of primary importance is the ostiomeatal unit, the patency of which can be achieved using the endoscopic method. By reestablishing function of the ostiomeatal unit, ventilation and mucociliary clearance are also reestablished. Functional endoscopic nasal surgery often restores sinus health, with complete or at least moderate relief of symptoms achieved in 80 to 90 percent of patients.

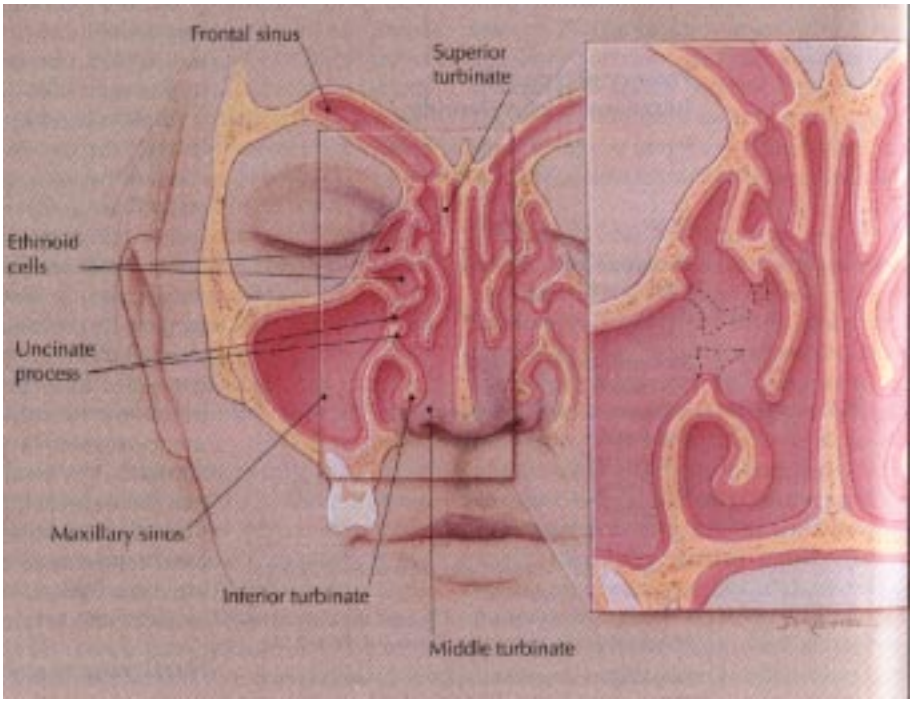

Figure 7. Coronal section showing the ostiomeatal unit before and after functional endoscopic nasal surgery. Dotted lines represent area affected by surgery.