Understanding Sinusitis and Allergy:

The Asthma Center Education and Research Fund Manual

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PART SIX

Please read this introduction before using the manual. It will help you understand the importance behind treatment for sinusitis and respiratory allergies.

Sinusitis and Allergy Introduction

What is sinusitis, what are allergies, and what is the relationship between sinusitis and allergy? The term "sinusitis" is often used by individuals and the media to indicate symptoms of pressure or discomfort over parts of the face, symptoms typical of a "bad cold," significant nasal congestion, persistent post nasal drip, chronic throat clearing, headaches or severe "allergy symptoms."

From a medical point of view, sinusitis simply means inflammation of the sinuses or, more precisely, inflammation of the mucosal tissues lining the sinuses. Sinus inflammation can be caused by infection, allergy or other factors. Allergic inflammation can cause swelling of the sinus mucosa, interfering with the normal cleansing movement of mucus through the sinus passageways. Allergies are caused by an abnormal immune response to allergen exposures such as pollen, foods and animal danders. Allergic inflammation can occur in the nose and sinuses. Allergic inflammation of the sinus tissue can interfere with the normal clearing of bacteria within the sinus cavities leading to infection. Under these circumstances respiratory allergy can play a major role in repeated sinus infections.

Since chronic sinusitis can be the result of both allergy and infection, both underlying causes often need to be evaluated and effectively managed if the problem of chronic sinusitis is to be resolved. Allergy induced chronic sinusitis associated with repeated sinus infections can lead to significant alteration of the sinus mucosa and surrounding structures. Once damage occurs, restoration of full normal function of the sinus cavities may not be possible. Therefore, any delay in identifying and treating an underlying allergic component of chronic sinus disease can lead to years of unnecessary suffering.

Allergists often see sinus suffers who have undergone repeated treatments with antibiotics for symptoms of sinusitis or even after sinus surgery. Sinus symptoms often persist until the allergic component is finally identified and treated. Comprehensive management of the allergic component earlier in the disease process may prevent some cases of refractory sinusitis in which the sinus cavities are no longer capable of removing bacteria and are filled with scar tissue, bacteria and inflammation. In addition, nonallergic factors should also be evaluated in those with persistent sinus symptoms. This manual will inform you of the diagnostic and treatment options for acute, recurrent and chronic sinus disease as well as upper respiratory allergies.

Therefore, if you have recurrent or chronic sinus disease with symptoms persisting in spite of multiple antibiotics directed against bacterial infections, you should undergo an in-depth allergy and immunology evaluation. This evaluation will help to determine whether or not allergy and immunologic problems contribute to or cause your symptoms. If allergy and immunologic problems do play a role in your sinus symptoms, then several different treatment options beyond antibiotics may be available to you. All of these treatment options are extensively reviewed in this manual.

Sinusitis Introduction

Are you one of the millions of individuals affected by repeated bouts of sinusitis? Do you have symptoms of recurrent headaches, facial pressure, nasal and/or sinus congestion, post nasal drip, constant throat clearing, throat irritation, hoarseness, decreased sense of smell, coughing, or other symptoms typical of sinus disease and/or allergies?

Did you know that sinus disease may also cause you to feel tired, irritable, suffer from poor concentration, low energy, or just feel sick all the time? The discomfort associated with sinus disease can be so great that it keeps you from functioning well at work, school, or home. Recurrent or persistent symptoms of sinusitis may make you feel ill or just plain miserable much of the time. If you suffer from chronic sinusitis, it is likely you feel unable to find relief and that you are no longer in control of your symptoms.

Furthermore, complications from poorly treated sinusitis can lead to severe life threatening diseases including generalized infection (septicemia), infections of the sinus bones (osteomyelitis) and infections of the tissues around the eyes or in the brain. Sinus disorders can also trigger asthma.

So what is sinusitis? Who gets sinusitis? How is it treated? How do you reduce your risk? How do you prevent recurrences and complications? If you want to learn the answers to these questions and more, this manual is for you.

Sinusitis Facts

- 24-31 million Americans are affected with sinusitis annually
- Annual average loss of work time for sinusitis is 4 days per year per case
- Most occurrences of sinusitis begin as common colds
- Close to $11 billion per year is spent on treatments of sinusitis
- Surprisingly, the quality of life of individuals with chronic sinusitis is worse than those with heart failure

Respiratory allergy can play a major role in repeated sinus infections.

In the United States, close to $11 billion dollars is spent on sinus care each year. The cost of antibiotics, x-rays, doctor visits and even surgery can be a great burden for you, not to mention time lost from school and work and associated suffering. With such great costs in dealing with sinusitis, it makes sense to learn how to get the best care. **Parts 1** and **3** of this manual will help you ask the right questions, find the right solutions and be active and informed in getting the care that you need.

Since allergies can play such a significant role in causing and/or promoting sinusitis, you will also learn how to detect and manage allergies. Allergy of the nose affects more than 20% of Americans. If you have allergies, symptoms may exist year round (perennial) and/or at the change of seasons like fall and spring. If you suffer from sneezing or itching of the eyes, nose, throat, ears and roof of the mouth and/or get congested frequently, you may be experiencing telltale symptoms of upper respiratory allergies. **Part 2** (Upper Respiratory Allergies) of this manual will help you understand the triggers of allergies, how best to control symptoms with medications and allergy shots and how to prevent complications like sinusitis and asthma.

Allergy Facts

- 60 million Americans suffer from upper respiratory allergies annually
- Allergies account for over 6 million lost school days annually
- Allergies account for over 10.7 million lost work days annually
- Close to $18 billion dollars per year are spent on treatment of allergies

Parts 1 (Sinusitis) and **3** (Treatments for Sinusitis and Upper Respiratory Allergies) of this manual are dedicated to the medical treatment of sinus disease and upper respiratory allergies. These sections are dedicated to conventional and well accepted treatments used at **The Asthma Center** and other institutions and practices.

It is recognized that many people with upper respiratory allergies and sinus disease resort to use of complementary and alternative treatments, these treatments are also discussed (**Part 3, Chapter 13**). In general, many of these treatments are not scientifically proven and are not endorsed by most experts, but some may benefit some individuals.

Part 4 (Allergic Eye Disorders) of this manual discusses eye allergies, commonly connected with upper respiratory allergies. Special topics relating to sinusitis and upper respiratory allergies are located in **Part 5**. Topics such as air travel, scuba diving, sinus disease in children and home care for sinusitis and upper respiratory allergies are discussed. Frequently asked questions and a glossary of terms used in the manual are included in **Part 6**.

PART ONE

Sinusitis

Chapter 1 Anatomy and Function

What are the Sinuses and How do They Work

The purpose of the sinus cavities is not completely known, but there are several theories including:

- Adding to the quality of the voice by acting as sound chambers
- Humidifying and warming air for the lungs
- Increasing the exposure of smell receptors located in the top surface of the nose (*see Figure 16, page 29*)
- Absorbing any shock from injury to the head
- Secreting mucus to moisten the nose and provide bacteria destroying proteins (enzymes) to cleanse the nose
- Providing immunity with antibodies
- Providing temperature protection for the brain
- Helping facial growth
- Lightening the bones of the skull

Anatomically, the sinuses consist of 4 paired air filled chambers hollowed out in the skull and connected to the nose by small openings (ostia). The sinus cavities are named by their location: maxillary, ethmoid, frontal and sphenoid sinuses (see *Figures 1 and 2*). The size and shape of the sinuses vary due to age, especially for children.

Figure 1 Front View of the Sinuses

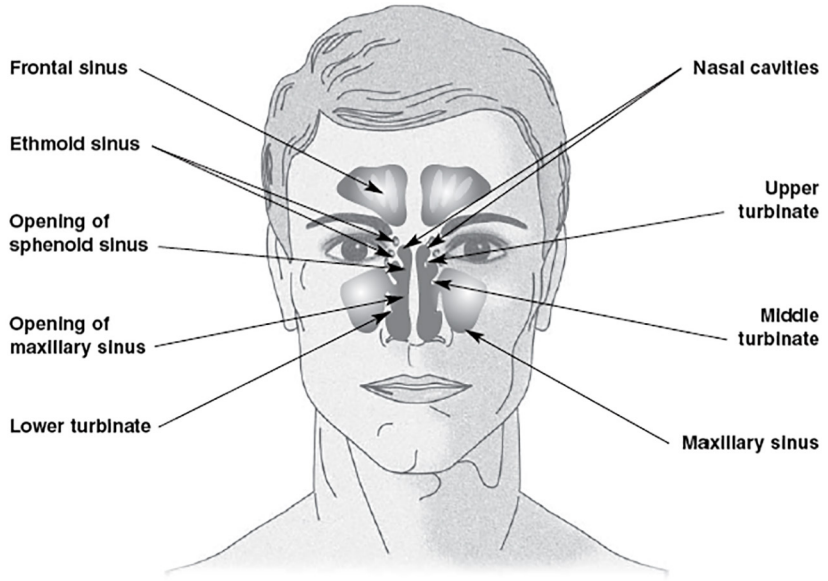
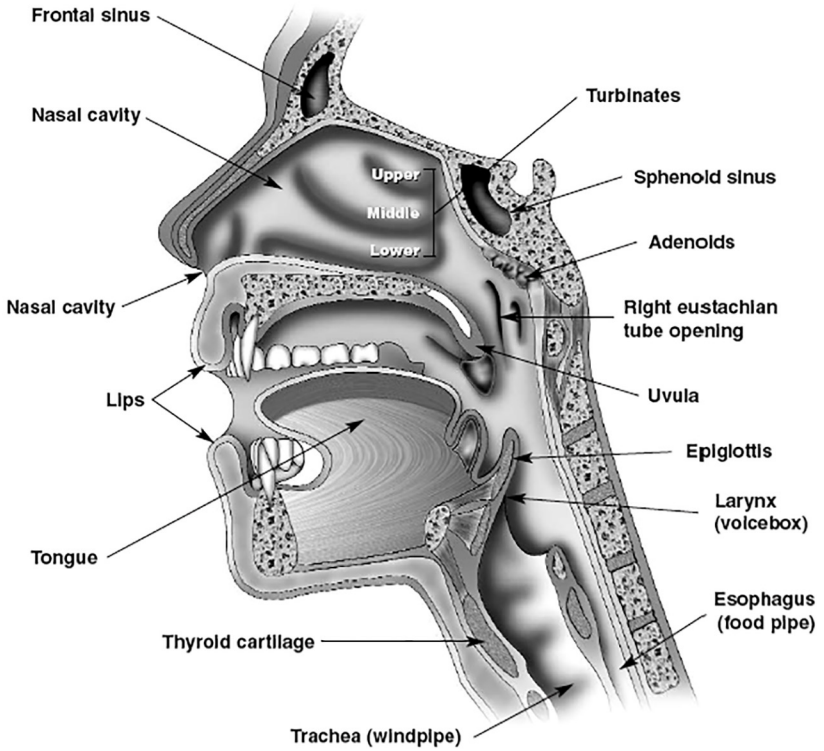


Figure 2 Side View of The Upper Airway

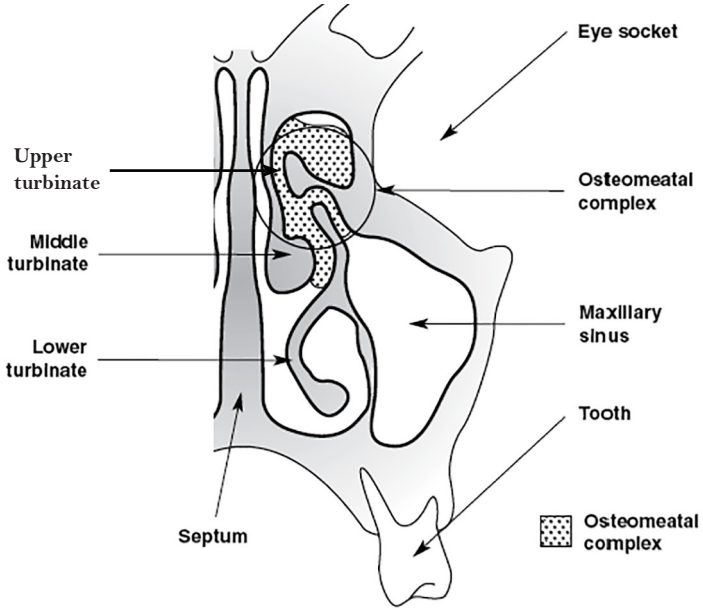


Maxillary Sinuses

The maxillary sinuses are the largest sinus cavities. They are located in the midface and are bordered by the eye sockets, upper jaw and upper teeth. Present at birth, the maxillary sinuses go through growth spurts from birth to age 3 and again from age 7-12. They reach full size by the teenage years. An adult size maxillary sinus is large enough to hold about 3 teaspoons of water. Mucus and air from the maxillary sinuses drain into the nose under the middle turbinates. The middle turbinate is part of a set of paired cone shaped bones (turbinates) on the outer walls of the nasal passage. Nasal turbinates are divided into the inferior (lower), middle and superior (upper) turbinates (see *Nasal Turbinates, page 8*).The turbinates have a rich blood supply which moisturizes air as it is inhaled. The space beneath the middle turbinate, including the outflow tract for mucus and air from the maxillary sinus, is called the osteomeatal complex (see *Figure 3*). Disease or blockage of mucus and air flow through the osteomeatal complex is a frequent cause of infection in the maxillary, ethmoid and frontal sinuses. Maxillary sinus pain is often felt in the upper teeth, behind the cheekbones and near the sides of the nose.

Figure 3 Osteomeatal Complex

Ninety percent of all sinus disease originates with blockage of the osteomeatal complex.



- The osteomeatal complex is the area below the middle turbinate where the anterior ethmoid, maxillary and frontal sinuses drain.
- 90% of all sinus disease originates with blockage of the osteomeatal complex

A serious, though rare, complication of maxillary sinusitis can occur when a bacterial infection within the sinus cavity spreads to the tissues surrounding the brain. This can result in meningitis, an inflammation of the membranes surrounding the brain. Pus can also penetrate the brain tissue, resulting in a brain abscess.

Ethmoid Sinuses

The ethmoid sinuses are the smallest of the sinuses and are located between the eye sockets. They are present at birth. By age 12, the ethmoid sinuses reach their adult size. The ethmoid sinuses are made up of a honeycomb of 4-17 small subchambers known as air cells. These air cells are divided into either anterior (front) or posterior (back) ethmoid air cells. The blood supply from the ethmoid sinuses drains into veins surrounding the eye sockets. Spread of infection from the ethmoid sinuses can infect the tissues around the eyes (periorbital cellulitis). Ethmoid sinus pain often is felt as pain around and behind the eyes.

Frontal Sinuses

The frontal sinuses, the second largest sinuses, are in the middle of the forehead. They may not be visible at birth. As they grow, they usually become visible by ages 4-6. Frontal sinuses reach full adult size by age 20. About 10% of adults have either no frontal sinuses

or ones that are underdeveloped (hypoplastic frontal sinuses). The blood supply from the frontal sinuses drains into veins around the eyes. Infection in the frontal sinuses can spread into or around the eyes. Frontal sinus pain is often felt above the eyebrows.

Sphenoid Sinuses

The sphenoid sinuses, the third largest of the sinuses, are either very small or absent at birth. They reach adult size by the late teen years. The sphenoid sinuses lie deep in the skull close to the optic nerve (nerve for vision), behind the ethmoid sinuses. Infection in the sphenoid sinus can spread into blood vessels in the brain, causing a brain infection (abscess or encephalitis) and/or a deep vein blood clot within the brain. Sphenoid sinus pain is often felt around the eyes, behind the eyes and at the top of the skull. Table 1 below provides a review of sinus pain locations.

Table 1

Sinus Pain Locations
• Frontal: Forehead pain
• Maxillary: Cheekbone pain, pain over the temple area, toothache
• Ethmoid: Pain around the eyes and in the forehead
• Sphenoid: Diffuse pain around the head, especially on top of the head

Nasal Turbinates

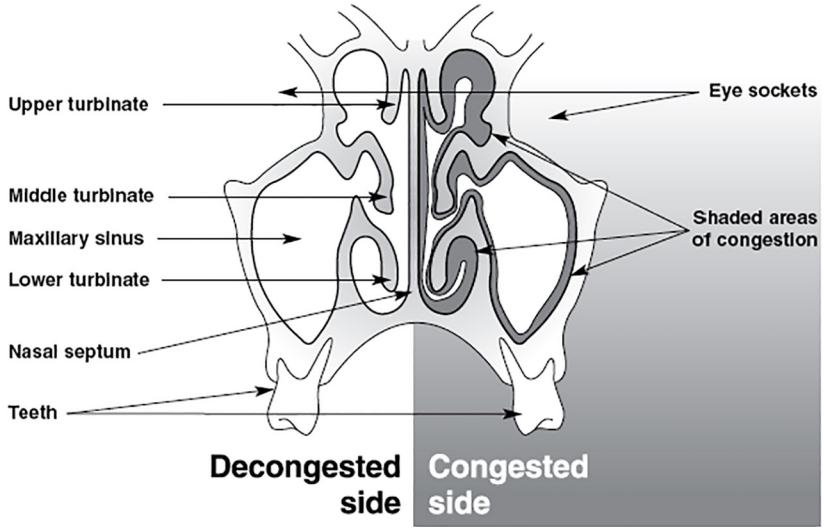
The sinuses empty into both nasal passageways. Positioned along these passageways are long bony structures rich in blood vessels called the nasal turbinates (*see Figures 1, 2 and 3*). Similar to the nasal and sinus membranes, the nasal turbinates are coated with mucosa. The turbinates serve multiple purposes (*see Table 2*).

Table 2

Functions of the Nasal Turbinates
• Adding and maintaining moisture in the nose
• Warming air before it enters the lungs
• Protecting sinus and tear duct openings from airborne particles, pollen and pollutants
• Source of allergy antibodies and allergic proteins

The blood vessels of the turbinates can widen and leak fluid into the nasal cavity in response to exposure to irritants and allergens, resulting in swollen turbinates. In fact, if you complain of nasal congestion, it is usually a result of swelling of the nasal turbinates. There also exists a normal cycling of congestion and decongestion that occurs between the right and left nasal turbinates (*see Figures 4 and 5)*. When one side is congested, the other side is decongested. Most of the time you are unaware of this. At times, swelling can become extreme leading to symptoms of severe congestion preventing air to enter the right or left side of the nose.

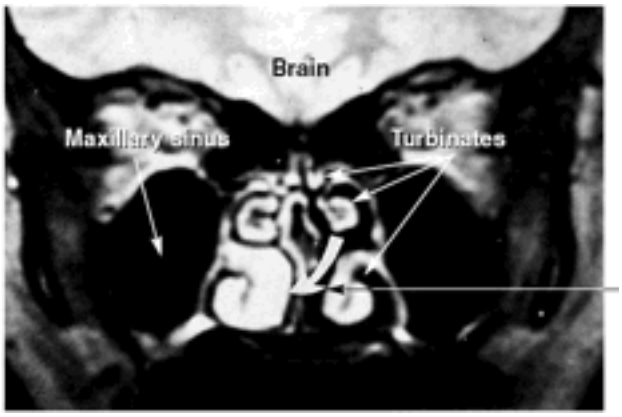
Figure 4 Nasal Cycle



Chronic inflammation from allergies, irritants and other causes can lead to enlargement of the turbinates known as turbinate hypertrophy. This condition can cause blockage of the mucous outflow from the sinuses which increases the risk for infection.

Figure 5 Nasal Turbinate Swelling seen on MRI

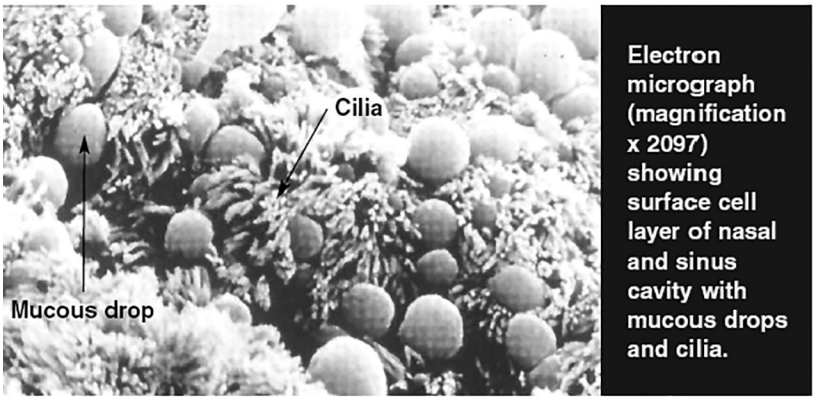
Turbinate swelling can lead to blockage of the sinuses.



MRI of turbinates showing normal swelling of turbinates during the nasal cycle. (see thickened arrow) relative to the decongested side. (see thin arrow)

Respiratory Mucous Membranes

Figure 6 Respiratory Mucous Membranes



A thin layer of tissue (mucous membrane) lines all of the bony surfaces of the sinus cavities. The lining is similar to the surface lining of the nasal passageways and airways of the lungs. The surface of this membrane is lined with microscopic cilia (respiratory hairs) (*see Figure 7*). These constantly moving hairs sweep mucus (mucous drops as seen in Figure 6) from the sinus cavities into the nasal passageway. Cells in mucous membranes manufacture mucus and proteins important in defense against bacteria, viruses, fungi allergy provoking proteins (allergens) and a variety of irritant particulates. Mucus is a clear slippery fluid that coats the respiratory membranes of the sinuses, nose and lungs. Mucus consists of water, blood cells, digestive enzymes, salt, immunity producing proteins (antibodies and other factors), dead cells, bacteria and other microorganisms and foreign pollutants.

Figure 7 Cilia (Respiratory Hairs)

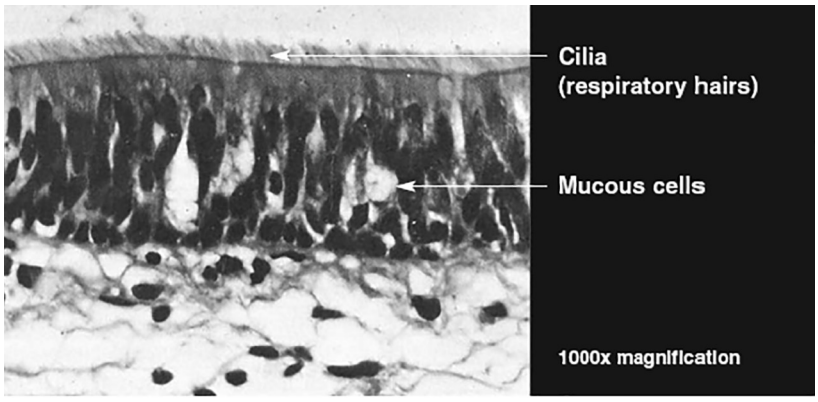
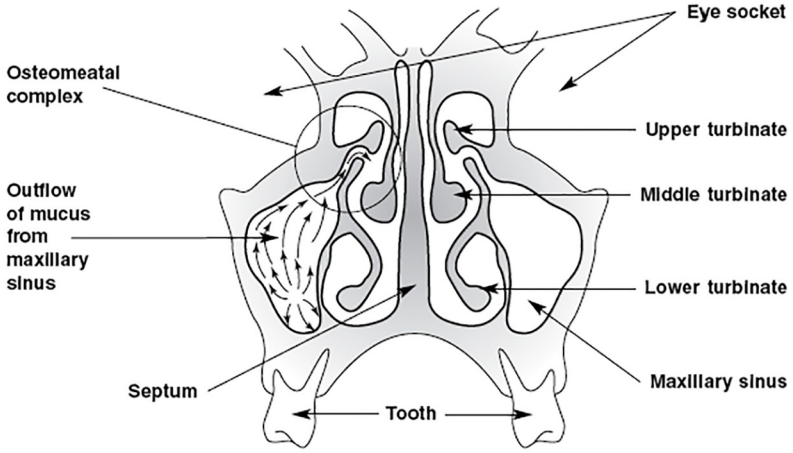


Figure 8 Mucociliary Clearance

Mucous and the underlying respiratory mucous membrane serve to protect the sinuses against infection.



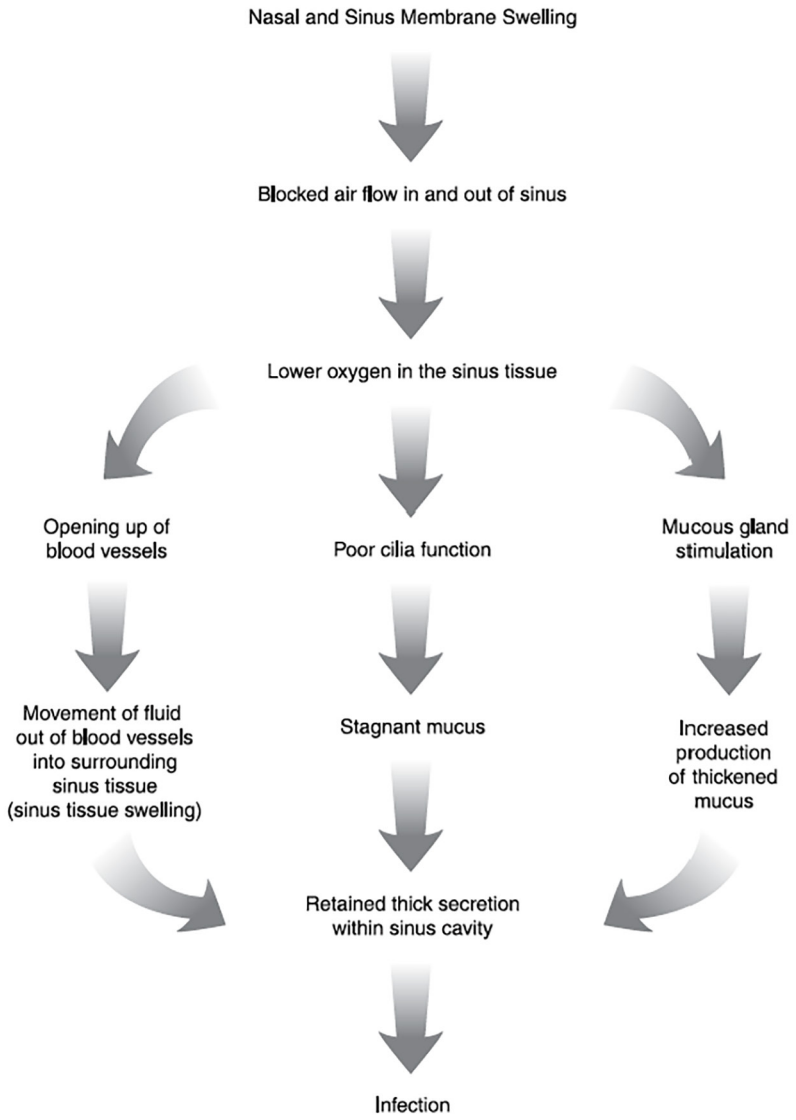
Mucus and the underlying respiratory mucous membrane serve to protect the sinuses against infection. It is estimated that 10% of the protective mucous coating of the nose and throat originates in the sinuses. Mucus cleanses the nose and throat. It flushes out invading microorganisms and pollutants through its constant movement down the upper respiratory tract (*see Figure 7*). Mucus plays a role in moderating the effects of humidity and temperature on the respiratory tract. There are millions of cilia that sweep back and forth on the average of 10-20 beats per second pushing the mucus along. Mucociliary clearance (*see Figure 8* and *Table 3*) clears the sinuses of their secretions in less than 10 minutes. The mucus then drains from the nose to the throat in 20-30 minutes

Table 3 Mucociliary Clearance

- The sweeping of mucus by cilia (respiratory hair) deters microorganisms from accumulating in the sinuses and thus reduces the risk of infection
- The sinuses produce up to 1 quart of mucus per day
- Decreased mucociliary clearance leads to poor sinus drainage

The mucus made in the nose and sinuses is affected by a variety of factors (*see Table 4*). Any blockage of mucous flow from the sinuses can increase the chance of infection. When the sinus passage is completely blocked by inflamed tissues, thickened mucus, or polyps, oxygen decreases in the sinus cavity. Decreased oxygen in the sinuses affects blood vessels and mucous production. This creates thick mucus secretions that stick within the sinuses and decrease mucociliary clearance (see *Figure 9*).

Figure 9 Membrane Swelling Leading to Sinus Infection



How Do You Test for Mucociliary Clearance?

A decrease in mucociliary clearance can be identified through a clinical test. A drop of saccharine is placed inside your nose while you are instructed not to sniff. You should detect a sweet taste within 5-8 minutes if mucociliary clearance is normal. Twelve minutes is considered slow and 12 minutes or longer indicates a defect in mucociliary transport.

A ciliary defect which decreases mucociliary clearance can be determined through biopsy (surgical sample of tissue) of the nasal mucosa analyzed under a very powerful microscope called an electron microscope. This examination can detect whether there is a structural defect (usually genetic in origin) in the ciliary structure. A well known but rare ciliary defect often detected by this study is called immotile cilia syndrome.

Other more common causes affecting mucociliary clearance are listed in Tables 4 and 5 below.

Table 4 Factors that Affect Mucus Production

- Histamine release and other chemicals from allergic responses to allergens (increase mucus production)
- Diseases: for example, cystic fibrosis (increase mucus production)
- Nerve tissue stimulation (increase or decrease mucus production)
- Body hydration, temperature, humidity (increase or decrease mucus production)
- Local blood supply (increase or decrease mucus production)
- Infections (increase mucus production)
- Hormones and Pregnancy (usually increase mucus production)
- Tobacco smoke exposure (usually increase mucus production)
- Radiation damage (decrease mucus production)
- Medications (increase or decrease mucus production)

Table 5 Causes of Impaired Mucociliary Clearance

- Active and secondhand tobacco smoke exposure
- Gastroesophageal reflux
- Narrowed nasal passages
- Nasal septal deviation
- Turbinate malformations

Causes of Impaired Mucociliary Clearance (continued)

- Nasal tumors
- Medications
- Nasal polyps
- Foreign bodies
- Ciliary defects from beta blockers, viruses, the environment, sulfur dioxide and genetic defects of cilia

Chapter 2 Sinusitis: Types, Diagnosis and Treatment

Although many individuals use "sinusitis" to mean sinus infection; sinusitis, or inflammation of the sinus mucous membranes, may be due to infection, allergy or irritation from a number of sources. Medical classification or labeling of sinusitis is based on how long symptoms have been present (*see Table 6*). Acute sinusitis lasting up to 4 weeks refers to a new onset of sinus symptoms. Subacute sinusitis refers to symptoms lasting 4 -12 weeks. Recurrent or relapsing acute sinusitis is defined as 3 or more episodes of isolated acute sinusitis within a 12-month period. Chronic sinusitis is the term used when symptoms last more than 12 weeks.

Table 6

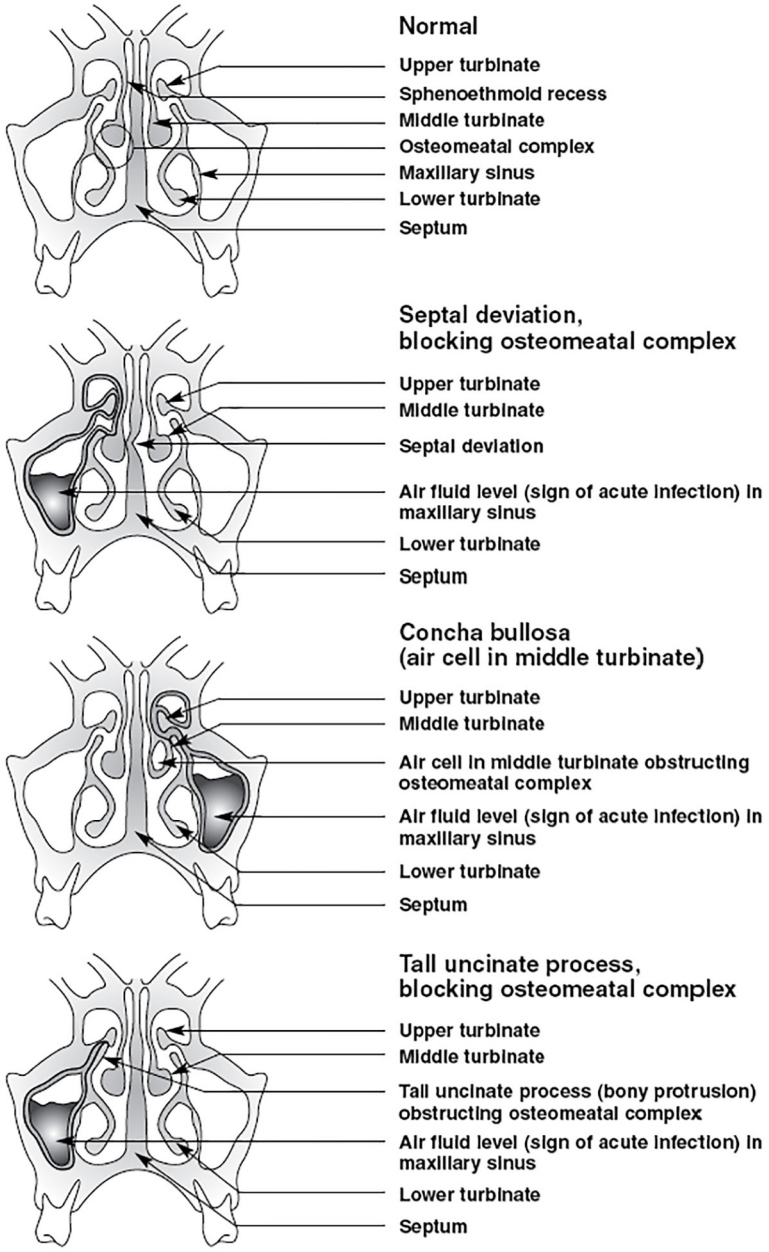
Types of Sinusitis (Rhinosinusitis)
• Acute: Lasts up to 4 weeks with complete relief of symptoms
• Subacute: Lasts longer than 4 weeks but less than 12 weeks
• Recurrent Acute: 3 or more acute sinusitis episodes within a year
• Chronic: sinusitis lasting more than12 weeks

Acute sinusitis often begins following a viral upper respiratory infection (common cold, viral rhinitis).

Acute Sinusitis lasting up to 4 weeks

Acute sinusitis often begins following a viral upper respiratory infection (common cold, viral rhinitis).The medical term sometimes used for acute sinusitis associated with a cold is rhinosinusitis. In fact, sinusitis without nasal symptoms is rare since the membrane of the nose and sinuses is contiguous. Viral infections can cause swelling of the mucous membranes surrounding the sinus drainage areas- especially the osteomeatal complex (passageway between sinuses and nasal cavity). Such infections impair mucociliary clearance of the sinuses (*see figure 8, page 11*). Chronic allergies and gastroesophageal reflux can also cause swelling and reduced mucociliary clearance. Other factors can play a role in why you could develop sinus infections. For example, nasal passages and/or sinus openings vary in size. Smaller structures have less tolerance for swelling, creating an increased risk of sinus infections. A septal deviation from the center of the nose (a curvature of the bone and cartilage structure which separates the right and left nostrils) may obstruct airflow through the nostrils (*see Figure 10*). This may also contribute to blockage of the sinus drainage sites. These problems can affect the normal mucociliary clearance leading to increased risk of sinus infections from retention of secretions, bacteria and pollutants in the sinuses (*see Figure 9*). The longer bacteria and viruses are retained in the sinus cavity the greater the chance of sinus infection. The unicate process is a bone protruding off the middle turbinate. An abnormally long uncinate process can also block the outflow tract of the maxillary sinus (*see Figure 10*).

Figure 10 Normal Sinus Anatomy and Anatomic Deviation



Symptoms of Acute Sinusitis

The early symptoms of acute sinusitis often include an abrupt onset of nasal congestion and clear nasal discharge. These symptoms typically last for several days. When normal mucociliary clearance is blocked, secretions collect in the sinuses (*see Table 3 mucociliary clearance, page 11*). This environment provides an excellent site of growth for microorganisms. The moisture, warmth and nutrients in retained mucus allow the multiplication of bacteria and viruses. Mucociliary clearance may also be decreased or blocked by nasal polyps (benign, grape-like, noncancerous, soft tissue growths) (*see Nasal Polyps and Sinus Disease page 37*) foreign objects which block the nose, thick mucus, or decreased ciliary function (*see Table 3 mucociliary clearance, page 11*). Bacterial infection is suspected when cold-like symptoms do not resolve within 7-10 days. Another sign of bacterial infection is the worsening of symptoms after 4-5 days. Other common symptoms of acute sinusitis may be present. These include: thickened or discolored nasal or post nasal discharge, facial pressure or pain, headache, decreased sense of smell, dental pain, sore throat, hoarseness, ear pressure, cough, fever, fatigue, and/or bad breath (*see Table 7*).

Table 7

Signs and Symptoms of Acute Sinusitis

- Nasal blockage or congestion
- Discolored post nasal drip
- Discolored nasal secretions
- Facial pressure, pain, or headache
- Decreased or absent sense of smell
- Dental Pain
- Ear pain, pressure, or fullness
- Cough
- Fever- low grade (less than 100 °F)
- Fatigue
- Bad breath
- Sore throat or hoarseness
- Dark circles and/or swelling around the eyes

Diagnosing Acute Sinusitis

Diagnosing sinusitis depends on a specific history, a thorough physical exam of the sinuses including an exam using a nasopharyngolaryngoscope and, finally, a radiographic exam by CT (*see Table 8*). CT of the sinuses is not always required for diagnosis if history, physical and nasopharyngolaryngoscopic exam are convincing. CT scans are often helpful when symptoms are vague, physical examination and endoscopic findings are not conclusive, or the response to therapy is poor. Additional laboratory tests may also be important in identifying causes of sinusitis (*see Table 9*).

Table 8

Diagnosing Sinus Disease

- History and physical examination
- Nasopharyngolaryngoscopy
- CT of sinuses
- Laboratory: allergy skin tests, blood work, sinus puncture and aspiration, cultures, nasal cytology (examination of secretions) and biopsy, sweat test, etc

Your doctor may use several techniques to diagnose acute sinusitis. Tenderness (pain) near the sinuses may be provoked during examination by applying direct pressure over the affected sinuses. The absence of facial tenderness, however, does not rule out acute sinus infection. Most physicians will examine the nose and throat with a light source. This allows a physician to see about 1 inch into the nose. Nasal discharge, turbinate membrane congestion and inflamed nasal membranes may be seen in the nose. Post nasal drip may also be seen in the throat. However, such nasal examination will not reveal some of the most important drainage areas of the sinuses such as the osteomeatal complex and the sphenoethmoid recess (where the sphenoid and posterior ethmoid sinuses drain) (*see Figure 10, page 16*).

A much better examination of the sinus openings is performed with a nasopharyngolaryngoscope (*see Figure 11*). A nasopharyngolaryngoscope is a very thin (about 3-4 millimeters [1/10 inch] in diameter) flexible fiberoptic endoscope (tube-like optical telescope). This instrument allows for direct visualization of the nasal septum, turbinates, mucosa, adenoids, eustachian tube openings, tonsils, back of the tongue, epiglottis and vocal cords (*see Figure 2*). The doctor first applies nasal decongestants and an anesthetic to the nasal passageway. Using this instrument, the doctor then can directly examine the anatomy of the entire nose, including the sinus openings (ostia). The exam lasts only a few minutes. After the exam, you may feel numbness in the nose and throat for up to an hour. An endoscopic exam may reveal pus (infected mucus) in the osteomeatal complex. Pus may also be seen in the sphenoid and posterior ethmoid sinus drainage sites. Pus may be noted in these areas even when a computerized tomography (CT) scan of the sinuses does not show evidence of infection or inflammation. Therefore the most accurate diagnosis will result from both endoscopic exam in which the upper airway is directly visualized combined with the results of CT scans (*see Table 9*).

Figure 11

Nasopharyngolaryngoscope

Nasal Cytology (examination of nasal secretions) and Biopsy

Nasal cytology (examination of nasal secretions) or biopsy of nasal tissue can be looked at under a microscope for diagnostic purposes. Nasal cytology involves the microscopic examination of nasal mucus obtained by blowing the nose into plastic wrap or introducing a cotton tipped swab into the nose. Results of cytology may help in the assessment of types of nasal and sinus inflamation but are never 100% diagnostic. This limitation prevents its common use. Biopsies are more definitive and can help if there is a question of cancer, invasive fungal disease, or for ruling in or out other unusual causes of sinusitis (ciliary disease, granulomatous disease).

CT Scan of Sinuses

Table 9

Sinus Imaging
• CT Scan: axial and coronal views- gold standard for diagnosing sinus disease
• MRI: defines soft tissues (mucous membranes, pus, fluid) well but not bony defects; overdiagnose physiologic (normal) swelling as sinusitis; good for diagnosing fungal sinusitis
• Conventional X-Rays: often underdiagnose ethmoid sinus disease; overdiagnose maxillary sinus disease
• Ultrasound: only good for diagnosing maxillary disease
• PET: experimental image reflecting metabolic activity in the sinuses

CT (computerized tomography) scan of the sinuses is the best radiologic technique for evaluation of sinusitis.

There are several imaging tests that can be used to diagnose sinus disease (*see Table 9*). The following sections will explain these tests in further detail. CT (computerized tomography) scan of the sinuses is the best radiologic technique for evaluation of sinusitis. CT scans provide excellent definition of the sinus cavities, nasal turbinates and osteomeatal complexes. They also provide a roadmap for surgery. The CT scan reveals the underlying bone surrounding the sinuses, evidence of infections, obstruction and complications. Two views are commonly performed- coronal and axial. The coronal view divides the sinuses into the front and back with vertical imaging cuts through the sinuses. The axial view scans the area from the front toward the back using horizontal imaging cuts. CT scans of the sinuses are usually performed without radiocontrast material (dye) and are best at outlining the bony and soft tissue structures of the sinuses.

CT scan findings consistent with sinusitis often include:

- Complete or partial sinus opacification: Loss of air space within the sinus due to tissue swelling and/or pus accumulation
- Mucosal thickening: swelling or heaping up of the normal lining of the sinuses
- Air fluid level: fluid collection (usually pus) within the sinuses producing a discrete layering effect resulting in a line separating air from fluid

- Blockage of osteomeatal complex

Examples of normal and abnormal Coronal and Axial Sinus CT scans are shown in Figures 12 and 13.

Figure 12 Normal and Abnormal Coronal Sinus CT

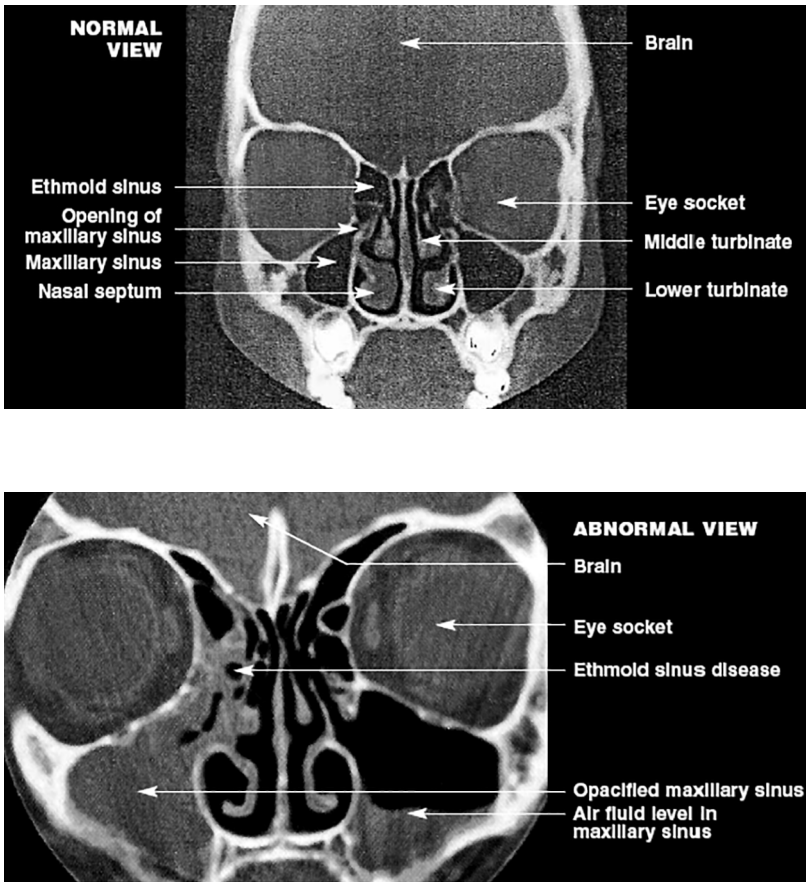
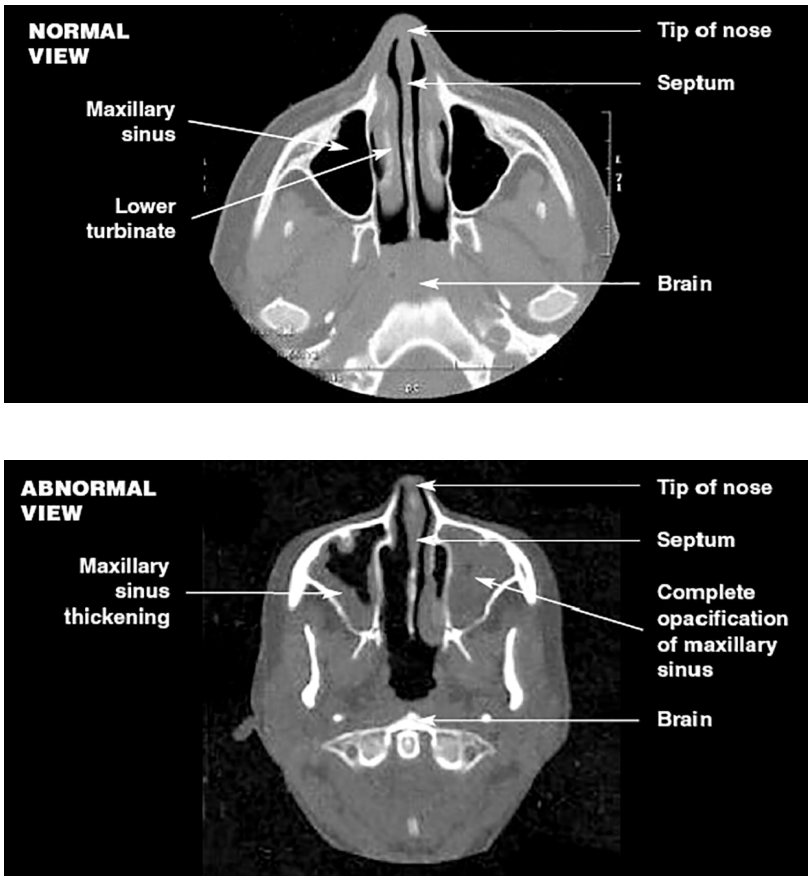


Figure 13 Normal and Abnormal Axial Sinus CT



CT can also identify complications from sinusitis, such as infection extending into the tissue in or around the eyes, brain, or surrounding bone. CT scans of the sinuses may show other abnormalities such as sinus polyps, cysts, or other growths.

MRI of the sinuses may falsely overdiagose sinusitis.

MRI of Sinuses

Magnetic resonance imaging (MRI) also allows for visualization of the sinuses. It provides images of soft tissue without using ionizing radiation like CT scans. MRI creates computer generated cross sectional views of the sinuses through radio waves and a magnet. MRI studies provide information on body functions like congestion. For example, MRI studies can show normal variation of congestion and decongestion in the nasal passageways (*see Figure 4, page 9*). MRI imaging of the sinuses may also be helpful in distinguishing sinus infection and inflammation from cancer. MRI has some disadvantages as compared to CT evaluation of sinusitis. The test lasts up to 1 hour and any body movement can distort the pictures. Those with cardiac pacemakers or other metallic implants cannot have an MRI due to the magnetic

In the United States, the average child has 3-8 acute viral upper respiratory infections a year. Adults usually have 2-3 per year.

Ninety percent of acute viral upper respiratory infections show rapid changes in the paranasal sinuses when viewed through a CT scan.

effect on metal. The MRI scan is much more expensive than CT scan for evaluation of sinusitis. It is generally less sensitive in evaluating bone than CT images. CT scans give a more accurate assessment of the space in the sinuses, the facial bones and the bones of the skull.

If you experience claustrophobia, you may have difficulty getting a CT or MRI of the sinuses. These images require lying on a table with a scanning device placed over your head. You must remain still. The examination may last 10-20 minutes for CT scans and 60 minutes for MRI. If you have reservations about this test, an open MRI may be easier.

Conventional X-ray, Ultrasound and PET Scans of Sinuses

Routine conventional x-rays and ultrasound have been used for the diagnosis of sinus infections for years. However, they have recognized limitations. The ethmoid sinuses, which are most commonly involved in sinusitis, are not adequately seen on conventional x-rays. X-rays often falsely diagnose maxillary sinus disease. Ultrasound techniques are also not particularly helpful. They can only evaluate the maxillary sinuses. While ultrasound is more sensitive than plain x-rays for imaging the maxillary sinuses, the findings are less specific and less reliable. PET (positron emission tomography) scans are currently being developed for sinus imaging. They are not routinely available and are investigational aids in the diagnosis and treatment of sinus cavity cancers.

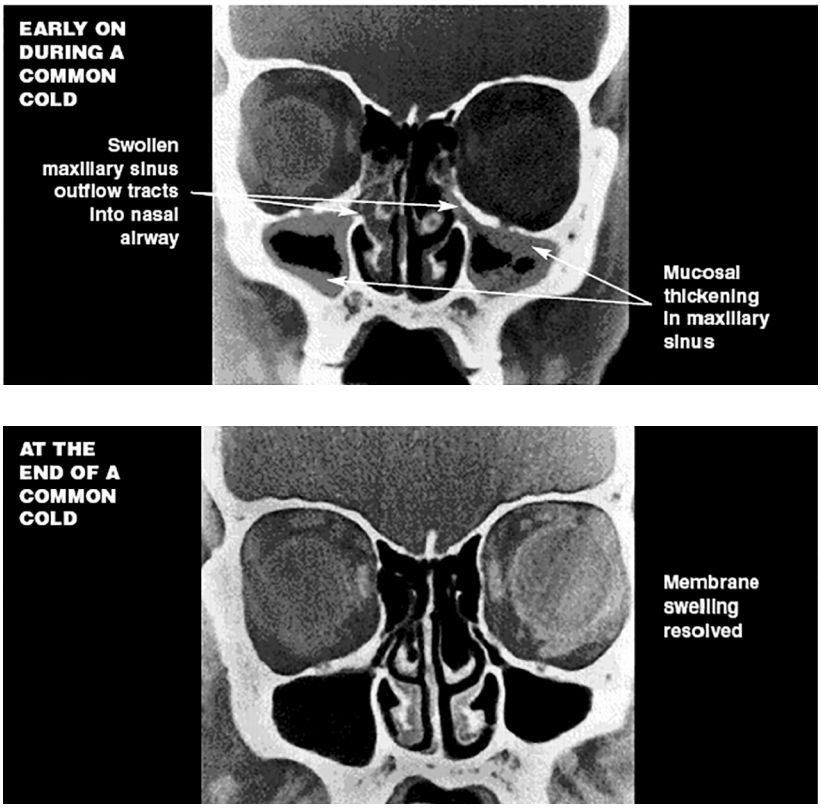
Causes of Acute Sinusitis

Viral Infections

A viral upper respiratory infection (common cold) usually precedes acute bacterial sinusitis. In the United States, the average child has 3-8 acute viral upper respiratory infections per year. Adults usually have up to 2-3 per year. Ninety percent of acute viral upper respiratory infections show rapid changes in the paranasal sinuses when viewed through a CT scan (*see Figure 14*). These changes on CT may take up to 21 days to resolve. Acute viral upper respiratory infections have therefore been called acute rhinosinusitis due to disease being present in both the nose and sinus cavities. This term indicates the combination of swelling and inflammation in the nasal passages and the sinuses. Far less frequent are bacterial infections of the sinuses. Bacterial infections affect roughly 0.5-2% of all acute viral upper respiratory infections. It is estimated that more than 1 billion cases of viral upper respiratory infections occur in the United States each year. Based on this number, approximately 20 million of these cases are complicated by acute bacterial sinusitis each year.

Figure 14 CT Scans of Viral Infection (Common Cold)

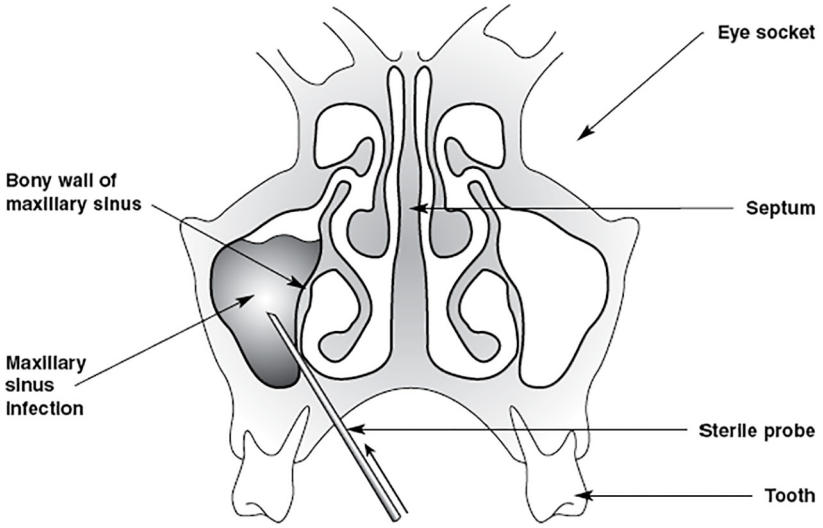
Bacterial infections complicate only 0.03-2% of all acute viral upper respiratory infections.



If you have an acute viral upper respiratory infection, it is likely that you will experience a combination of symptoms. These include sneezing, runny nose, nasal congestion, decreased sense of smell, facial pressure, post nasal drip, sore throat, cough, ear fullness, fever and/or joint aches. Contrary to popular belief, a change in the color of nasal discharge is not an absolute sign of bacterial infection. Color change may occur several days after the onset of a viral illness. Color change of mucus is caused by the influx of white blood cells (infection fighting cells) from the blood into the nose.

The point at which a viral upper respiratory infection becomes a bacterial infection (acute bacterial sinusitis) can be determined precisely by a technique known as a sinus puncture and aspiration (*see Figure 15*). This procedure involves passing a sterile probe through a puncture made in the bony wall of the sinuses. The sinuses are then rinsed with sterile water. Fluid is then removed (aspiration) and cultured for bacteria and/or fungi. Instead of a needle aspiration, ENT (Ear, Nose and Throat) physicians may use a rigid endoscope in the office to obtain a nasal or sinus culture. Properly done, this technique approximates the sensitivity and value of a surgical aspiration. Aspiration of the sinus is usually used for research or in unusual cases because of the discomfort and potential for complications.

Figure 15 Technique of Maxillary Sinus Puncture and Aspiration



Bacterial Sinusitis

Studies have shown that viral upper respiratory symptoms that last at least 7-10 days may be complicated by bacterial infections in 60% of affected adults. Because individual symptoms vary, physicians must rely on their clinical judgment to determine when an acute viral infection has been complicated by a bacterial infection. In general, it is assumed that an acute bacterial sinus infection occurs if the upper respiratory symptoms have persisted beyond 10 days. Bacterial sinusitis is usually accompanied by thickened nasal drainage, nasal congestion, facial pressure (especially one-sided or focused in one particular sinus area), post nasal drip, decreased sense of smell, fever, cough, fatigue, dental pain and/or ear pressure.

Most acute bacterial sinus infections in both children and adults are caused by 1 of 3 microorganisms: *Streptococcus pneumoniae, Haemophilus influenzae or Moraxella catarrhalis*. Other common organisms include other streptococcus species, *Staphylococcus* and anaerobic bacteria (bacteria that do not require an oxygen environment) (*see Table 10*).

Table 10 Bacterial Causes of Acute Sinusitis

- *Streptococcus pneumoniae*
- *Haemophilus influenza*
- *Moraxella catarrhalis*
- *Staphylococcus aureus*
- *Streptococcus pyogenes*
- Anaerobic bacteria

In the early stages of a common cold caused by a viral infection, you may ask your physician for antibiotics to "head off" an infection. There is no evidence to support this practice since antibiotics are ineffective against viral illnesses (*see Table 11*). **It is estimated by the Centers for Disease Control and Prevention (CDC) that 1/3 of the 154 million outpatient prescriptions written for antibiotics in the United States each year are unnecessary. This overuse of antibiotics promotes the development of antibiotic resistant bacteria. Self treatment with antibiotics left over from a previous prescription or not completing a course of antibiotics as prescribed may create a chronic bacterial infection resistant to common antibiotics and interfere with the normal healing process.**

Table 11

Antibiotics are Not Effective for the Common Cold

- Common colds and most upper respiratory infections are due to viruses
- Antibiotics are ineffective against viral infections and may in fact be harmful
- A common cold may last for 3-7 days
- Overuse of antibiotics for viral illnesses can lead to development of antibiotic resistant "super germs"

The Center for Disease Control and Prevention (CDC) states that 1/3 of the 154 million outpatient prescriptions written for antibiotics in the United States each year are unnecessary.

Cultures

Routine nasal and sinus cultures are not very helpful in the diagnosis of acute sinusitis. Cultures from sterile swabs inserted into the nose are unlikely to accurately identify the infecting organism since they become contaminated during the collection process by other bacteria in the nasal passageway. Moreover, the organisms that cause acute sinusitis are well known. Therefore, antibiotic treatment almost always begins without a culture.

Natural Course and Complications of Acute Sinusitis

Acute sinusitis may resolve without antibiotic therapy. However, you may develop chronic (long term) sinusitis with or without complications if not treated promptly. Also, if the full course of antibiotics is not completed, the infected mucus left in the sinuses may cause reinfection. Therefore, it is best to complete the full course of prescribed antibiotics to maximize the chance for complete resolution of a sinus infection. Acute sinusitis can result in some uncommon complications (*see Table 12 below).*

Table 12

Uncommon Complications of Acute Sinusitis

- Cellulitis: infection around soft tissues of the eye
- Orbital abscess: pus collection in the eye socket
- Sinus abscess (mucopyocele): pus collection in the sinus
- Meningitis: infection of surface membranes of the brain and spinal cord
- Cerebritis or abscess: infection of the brain tissue
- Cavernous vein thrombosis: infection or clot of venous drainage of the ethmoid and sphenoid sinuses
- Superior sagittal thrombophlebitis: infection or clot of the venous drainage of the frontal sinuses

A CT scan may help distinguish soft tissue infection from an abscess or other complications within or around the brain and eyes.

It is important to recognize the early signs of complications due to sinus disease. Signs and symptoms of complications include: fever (often over 102°F), severe headache, neck pain, drowsiness and visual disturbances. Complications in children commonly involve the tissue around the eyes. Such symptoms may include eyelid swelling, redness, drooping of the eyelid, bulging of the eye and visual impairment.

Antibiotic (Antimicrobial) Treatment Guidelines for Acute Bacterial Sinusitis

The most important treatment for acute bacterial sinusitis is the use of antibiotics

The most important treatment for acute bacterial sinusitis is the use of antibiotics. The choice of antibiotics depends on several factors:

- The suspected infecting bacteria
- How an antibiotic is absorbed, distributed and eliminated from the body (pharmacokinetic properties)
- Prior history of adverse reactions to antibiotics (drug allergies)
- Successful or unsuccessful individual response to an antibiotic in the past
- Degree of antibiotic resistance or particular bacteria in a particular geographic area
- Recent use of antibiotics for any reason (antibiotic resistant organisms)
- Young age (less than 5 years)
- Attendance in day care centers
- History of recent hospitalization (hospital-acquired infection)
- History of cancer and cancer treatment (possible immunosupression)

First line antibiotics for those with mild to moderate acute sinusitis who have not taken antibiotics for the prior 4-6 weeks are listed in Table 13. Note that these recommendations may change from year to year. In those with more moderate to severe symptoms, the fluoroquinolone class of antibiotics is preferred for adults.

The use of floroquinolones should always be weighed against the possibility of serious side effects such unusual joint or tendon pain, muscle weakness, a "pins and needles" tingling or prickling sensation, hallucinations and sun a induced rash. These reactions can occur within hours to weeks after initiating floroquinolone treatment. If a patient experiences any of these symptoms while taking flouroquinolone, treatment should be stopped and a non-flouroquinolone antibiotic should be substituted.

If you take antibiotics for acute sinusitis, you should normally respond within 72 hours. If there is no response, this may be considered a treatment failure. A change in antibiotic treatment is appropriate. Most antibiotics should be administered for a course of 10-14 days depending on the medication (the exceptions are Zithromax® which is effective with only 3-5 days of administration and some fluroquinolone antibiotics (Levoquin® and Avelox®) which are taken for 5 days.The recommendations for children with mild and moderate sinusitis without prior antibiotic therapy are the same as that for adults. However children should avoid tetracycline and fluoroquinolone (Levaquin®, Avelox® and Cipro®) antibiotics. Again, these recommendations may change from year to year. Sinusitis that fails to improve after 21-28 days of treatment may require high doses of broad spectrum antibiotics with or without the addition of antibiotics like clindamycin or metronidazole to cover anaerobic organisms.

Table 13

Antibiotic Treatment - no prior antibiotic use within 4-6 weeks

First Line Therapies for Mild to Moderate Symptoms

- amoxicillin [Children] (Amoxil®) or amoxicillin/clavulanate (Augmentin®)
- cefpodoxime proxetil (Vantin®)
- cefuroxime axetil (Ceftin®)
- cefdinir (Omnicef®)

First Line Therapies for Mild to Moderate Symptoms in those who are Penicillin-Allergic:

- trimethoprim and sulfamethoxazole (Bactrim®, Septra®)
- doxycycline (Doryx®, Vibramycin®)
- azithromycin (ZithromaxZ-PAK®)
- clarithromycin (Biaxin®)
- erythromycin (E.E.S.®,E-mycin®, Eryc®, Ery-Tab®, llosone®, PCE®)

First Line Therapies for Moderate to Severe Symptoms:

- levofloxacin (Levaquin®)
- moxifloxacin (Avelox®)

A different course of treatment is recommended if you have taken antibiotics within the last 4-6 weeks (*see Table 14 below*).

Table 14

Antibiotic Treatment - antibiotic use within 4-6 weeks

First Line Therapies for Adults:

- levofloxacin (Levaquin®)
- moxifloxacin (Avelox®)
- amoxicillin/clavulanate (Augmentin®)
- Combination therapy of amoxicillin/clavulanate with cefuroxime axetil (Augmentin® with Ceftin®)

First Line Therapies for Children:

- amoxicillin/clavulanate (Augmentin®)
- Combination therapy of amoxicillin/clavulanate (Augmentin®) or clindamycin (Cleocin®) with cefuroxime axetil (Ceftin®) or cefpodoxime proxetil (Vantin®)

First Line Therapies for Moderate to Severe Symptoms in those who are Penicillin·Allergic:

- azithromycin (Zithromax®, Z-PAK®)
- clarithromycin (Biaxin®)
- erythromycin (E.E.S.E.®, E-mycin®, Eryc®, Ery-Tab®, llosone®, PCE®)
- trimethoprim and sulfamethoxazole (Bactrim, Septra®)
- clindamycin (Cleocin®)

Antibiotic allergies may lead to avoidance of certain groups of antibiotics which can result in the use of less effective antimicrobial agents. A history of antibiotic allergy should be carefully evaluated, since a prior history of antibiotic allergy may no longer be a current problem. For example, the CDC in 2006 reported that 10% of Americans have been diagnosed with a penicillin allergy but less than 1% are truly allergic. Consequently, patients are put on more broad spectrum antibiotics that promote bacterial resistance. This applies to children as well as adults. Penicillin skin testing and oral challenge are a reliable way of assessing current true allergy to penicillin and may help de-label an individual as penicillin allergic.

This would promote cheaper and safer use of penicillin and cephalosporin antibiotics. If allergic, you may undergo specific antibiotic desensitization. Desensitization to many different antibiotics may be successfully carried out on an outpatient basis.

Chronic Sinusitis

Symptoms of Chronic Sinusitis

If you have chronic sinusitis, you may experience unique symptoms different from those of acute sinusitis. Chronic sinusitis must also be distinguished from symptoms caused by allergies, chronic headaches (for example, migraines) and viral upper respiratory infections (common colds). Individuals with chronic sinusitis may complain of the following: sinus pressure, sore throat, foul smelling breath, hoarseness, post nasal drip, decreased sense of smell, cough, or increased asthma symptoms. Other symptoms include ear pressure, congestion, dizziness and nose bleeds - particularly in children (see *Table 15*). These symptoms vary since the degree and location of inflammation in the sinuses may vary. Contrary to popular belief, headache is not the most common characteristic of chronic sinusitis. The most frequent complaint related to chronic sinusitis is nasal congestion with or without post nasal drip. Chronically infected sinuses are typically filled with dried secretions. Secretions may or may not drain easily into the nose. Other symptoms include sensitive facial fullness and loss of smell. You may experience fatigue, poor concentration and decreased productivity. You also may exhibit signs of depression.

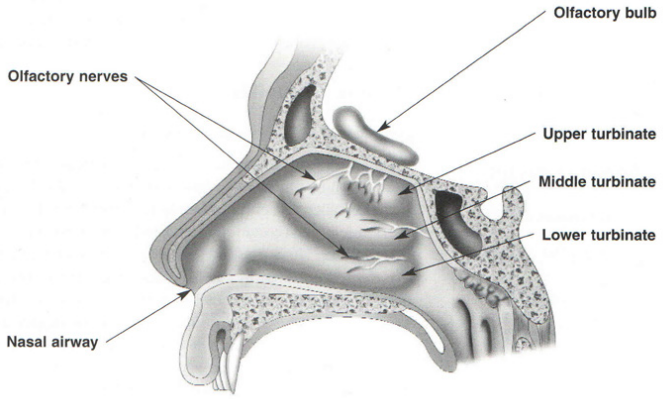
Table 15 Signs and Symptoms of Chronic Sinusitis

• Nasal blockage or congestion	• Discolored nasal secretions
• Facial pressure or pain	• Cough, exacerbation of asthma
• Decreased or absent sense of smell	• Post nasal drip
• Dark circles and/or puffiness around the eyes	• Ear pain, pressure, or fullness
• Recurrent ear infections	• Sore throat or hoarseness
• Bad breath	• Hives
• Fatigue, poor concentration, depression	

In contrast to acute sinusitis, you usually do not experience tenderness over the affected sinus and/or fever. Sometimes you may feel facial pain or a pressure sensation. This is worsened by lying down or bending over. Pain may also radiate into other areas of the face and head like the temple area or the top of the head.

Another common feature of chronic sinusitis is a lost or decreased sense of smell. Improved sense of smell usually occurs with successful treatment or when the disease resolves. Changes in sense of smell may be related to nasal blockage due to swelling of mucous membranes or from nasal polyps which prevent odor molecules from reaching odor receptors along the top surface of the nasal passage. Figure 16 shows the anatomy of smell perception.

Figure 16 Anatomy of Smell Perception



You may also have a distorted sense of smell due to a change in the bacteria found in the sinus and nasal passageways. This problem may be caused by anaerobic bacteria. Anaerobic bacteria grow well in low levels of oxygen, such as that found in blocked sinus cavities. Discharge containing anaerobic bacteria is often foul smelling and may affect smell perception. In addition, longstanding inflammation in the sinuses and nose may be toxic to the nerve endings responsible for the sense of smell. Damage to these nerve endings can cause permanent changes in smell.

Diagnosing Chronic Sinusitis

Diagnosis of chronic sinusitis is based on medical history, radiological studies, endoscopy, physical exam and laboratory tests. Chronic sinus disease should be considered if there is persistent unexplained nasal congestion and/or post nasal drip. A prior history of a short lived response to antibiotics with a subsequent recurrence of symptoms also suggests chronic sinusitis. It is possible that you may present with a relatively normal physical exam. However, you are more likely to have evidence of nasal congestion, turbinate swelling, nasal crusting (dried mucus) and/or post nasal drip present. A nasopharyngolaryngoscopic examination greatly helps assess whether there is a thickened mucous discharge draining from the sinus openings or blockage of the osteomeatal complex.

Sinus Imaging for Chronic Sinusitis

As with acute sinus disease, CT scans help assess chronic sinus disease. They can also track response to antibiotic therapy. CT scans also provide a roadmap for surgery. Special video assisted CT scans may be helpful in increasing the precision of surgical procedures (*see Surgical Treatments for Sinusitis, Chapter 4, page 43*). CT scans are usually performed without radiocontrast material (dye). However, if complications around the eye, brain, or facial bones are suspected, a dye study may be helpful.

Magnetic Resonance Imaging (MRI) is not as useful as a CT of the sinuses, but it may be of particular benefit in some unusual cases of chronic sinusitis. Specifically, an MRI may be important for assessing fungal sinusitis. Both viral and bacterial infections in the sinuses produce a certain signal intensity shown by MRI. In contrast, fungal infections have a low signal or no signal at all. This difference can help identify fungal sinus disease. Unlike CTs, MRIs are unable to clearly identify bone. Therefore MRI does not provide accurate landmarks for surgery or for assessing bony changes.

Causes of Chronic Sinusitis

Chronic sinusitis can be divided into infectious and noninfectious forms. Unlike acute sinusitis, viral infections play practically no role in infectious chronic sinusitis.

In chronic infectious sinusitis, the common organisms causing persistent sinus disease are well known (*see Table 16*).

Table 16

Bacterial Causes of Chronic Sinusitis
Streptococcus pneumoniae
Haemophilus influenzae
Pseudomonas aeruginosa
Staphylococcus aureus
Moraxella catarrhalis
Anaerobic bacteria

Multiple bacterial strains are typically present at the same time in chronic sinusitis. This is quite different from acute sinusitis where only one kind of bacteria usually predominates. Anaerobic organisms are frequently present in chronic sinusitis. Sinus cultures are typically not required. If a culture is needed, it can be taken through a nasopharyngolaryngoscope, although contamination from nasal bacteria may occur (*see page 18*). Aspiration of the sinus cavities offers the most accurate results, but is rarely used because of the discomfort and potential for complications (*see page 24*).

There are no national guidelines for the antibiotic treatment of chronic sinusitis. Experienced specialists use antibiotics similar to those for acute sinusitis. Physicians may also prescribe clindamycin (Cleocin®) and/or metronidazole (Flagyl®) to treat suspected anaerobic infections. First line treatment choices include amoxicillin/clavulanate (Augmentin®) or cefuroxime (Ceftin®) along with clindamycin (Cleocin®) or metronidazole (Flagyl®). If you are allergic to penicillin, the macrolide (Zithromax®, erythromycin, Biaxin®), or fluoroquinolone (Levaquin®, or Avelox®) antibiotics are used, although the latter should be used with caution due to effects on the tendon and muscle. Antibiotic treatment is prescribed for 6 weeks and often longer. Long term (≥ 3-6 weeks) antifungal medication has also been helpful in some cases.

Nasal and Nebulized Antibiotics for Treatment of Chronic Sinusitis

Nasal antibiotics and antifungal treatments can be sprayed directly into the nasal passageway.

These treatments may help decrease the development of sinus disease if you are prone to recurrent sinusitis. Application of a nasal antibiotic ointment like mupirocin (Bactroban®) or polymyxin B (Polysporin®) can help reduce acute relapse of sinusitis. Using nasal amphotericin (an antifungal drug) for 3-6 months has also been recommended for chronic sinusitis. These medications are usually well tolerated, though there have been some reports of nasal stinging.

Antibiotics can be aerosolized by a nebulizer into the nose and sinuses. Nebulization produces very small particles that can penetrate the sinus passageways. Medications are directly delivered to the infected sinus tissue and/or decrease the bacteria located in the nose. Aerosolized medications can be delivered in higher concentrations than medications taken orally or intravenously. The SinuNEB® and NasoNEB® irrigation nebulizer systems have been particularly helpful in this regard (*see Nasal Saline Irrigation, page 89*).

Nebulized antibiotics are considered a treatment option if oral antibiotics have not been effective. There have been limited studies on the effectiveness of nebulized antibiotics compared to oral antibiotics in chronic sinusitis. Nebulization of antibiotics for the treatment of chronic sinus disease has been used in Japan for many years. However, administration of nebulized antibiotics for chronic sinusitis in the United States has not been widely tested. A typical course of treatment is nebulization twice a day for 2-3 weeks. Side effects of nebulized medications include dryness around the nose and lips, cough, tongue or throat irritation and, at times, asthmatic reactions.

Intravenous Antibiotics for Chronic Sinusitis

Intravenous antibiotics have also been used to treat severe chronic sinusitis which has not responded to conventional therapy. Intravenous (IV) delivery offers greater absorption of antibiotics compared to oral or nasal dosing and thus can reach higher blood and sinus tissue levels. Therefore IV administration may increase the likelihood of eliminating bacteria within the sinuses. IV antibiotics require placement of a PICC (Peripherally Inserted Central Catheter) line into the arm. PICC lines require a same day hospital or outpatient surgical center procedure. Once placed, a PICC line provides easy IV access for medications. Antibiotics can easily be administered at home once or twice a day. This is an invasive procedure with the potential for complications and should be reserved for the most difficult cases of sinus disease.

Intravenous antibiotic treatment for chronic sinusitis is usually carried out over a period of 6 - 10 weeks depending on the extent of disease. Early studies have shown improvement in quality of life and reduction in sinus symptoms. Long term studies examining recurrence rates after 3 months showed that IV antibiotics resolved chronic sinusitis in only a minority of individuals. Most who did respond relapsed within 3 months. Complications occurred in 26% of those who discontinued treatment. Complications included swelling of the catheter site, infections from the catheter and toxicity from the antibiotic.

Immunoglobulin Treatment for Chronic Sinusitis

Gammaglobulin has been approved by the FDA to treat primary immunodeficiencies and certain autoimmune diseases. Reports have also shown the benefit of gammaglobulin replacement therapy to decrease the number of antibiotic courses needed for other allergic and chronic respiratory diseases such as chronic sinusitis, atopic dermatitis, urticaria and asthma.

Treatment with gammaglobulinhas been studied in a small group of children with chronic sinus disease who did not suffer from an underlying immunodeficiency. Such individuals received monthly infusions of intravenous gammaglobulin (IVIg). Treated individuals demonstrated a significant reduction in episodes sinusitis over 1 year. These findings suggest that IVIg or subcutaneous gammaglobulin (SCIg) may be an additional medical treatment for those with severe relapsing chronic sinus disease. Treatments with gammaglobulin may work by supplementing the body's immune system in fighting persistent infections. More studies need to be done to firmly establish its use. These treatments are very expensive. IVIg infusions cost over $5000 per infusion and are given every 4 weeks for at least a 6 month trial period.

Noninfectious Chronic Sinus Disease

Not all chronic sinus disease is caused by infections. This may account for many refractory cases with multiple antibiotic failures. In fact, many causes of chronic sinusitis are due to chronic inflammation without obvious infection. Often times special cell types called eosinophils are present in abundance within the sinus membrane, giving rise to the term chronic hyperplastic eosinophilic sinusitis. This noninfectious form of chronic sinusitis is often associated with nasal polyps (*see page 37*), asthma and aspirin sensitivity (*see page 38*).

Other noninfectious chronic sinus disease may be due to a special type of inflammation called granulomatous disease. At times, granulomatous disease may be associated with infections such as tuberculosis and fungi, but it is also possible that no infection may be seen. Sarcoidosis is the major cause of noninfectious granulomatous disease in the United States. Other noninfectious causes of granulomatous sinus disease include midline granuloma and Wegener granulomatosis. These diseases, in general, require biopsies for a correct diagnosis to be made.

Cancerous and noncancerous growths within the sinuses can also present with symptoms mimicking chronic sinusitis. CT and MRI scans in addition to biopsies are required to diagnose these problems. Sinus tissue cancers are rare, whereas benign polyps and cysts within the sinuses are very common.

Chapter 3 Acute and Chronic Sinusitis Risk Factors

Many risk factors contribute to the likelihood of developing acute or chronic sinusitis (*see Table 17*). Any anatomical abnormality that causes blockage of the osteomeatal complex or reduces mucociliary clearance puts you at risk for sinusitis. Most cases of sinusitis related to osteomeatal complex blockage result from either viral infection or allergies. This chapter addresses these factors more specifically.

Table 17

Risk factors for Developing Sinusitis
• Acute viral upper respiratory infections (common colds)
• Chronic nonallergic nasal congestion
• Allergic Rhinitis: resulting in swelling of mucous membranes
• Anatomic abnormalities: paradoxical turbinates off the nasal septum, concha bullosa, deviated septum, elongated uncinate process, polyps and adenoid enlargement
• Underlying disease: cystic fibrosis, immune disorders, Wegener granulomatosis, ciliary defects, gastroesophageal reflux disease (GERD) resulting in decreased local immunity and mucociliary function and HIV/AIDS
• Foreign bodies in the nose: result in blockage of osteomeatal complex
• Dental infections: can result in spread of infection to sinuses
• Indoor/outdoor pollutants: can cause irritation and swelling of membranes
• Barotrauma: tissue injury due to sudden changes in surrounding pressure (air travel, scuba diving) can disrupt drainage from sinuses
• Fungal infection: possible cause of chronic sinusitis

Any anatomical abnormality that causes blockage of the osteomeatal complex or reduces mucociliary clearance puts you at risk for sinusitis.

Medical Risk Factors

If you get an acute viral upper respiratory infection (common cold), have perennial and seasonal upper respiratory allergies, or have perennial nonallergic nasal congestion, your likelihood for getting sinus disease is high.

If you suffer from immune disorders, you will also be prone to recurrent respiratory infections. Immunodeficiency is suspected if you have recurrent or persistent sinus, ear, or lung bacterial infections, are infected with unusual bacteria, or have a family history of immunodeficiency. Decreased immune responses associated with disease states such as HIV/AIDS, diabetes, cancer, or immunosuppressive treatment for cancer or autoimmune diseases may put you at risk for frequent episodes of sinusitis. If you have sinusitis that has not improved with standard medical treatment, you should be tested for a weakened immune system. Evaluation for immunodeficiency often includes blood tests for assessment of circulating antibodies and the presence in the blood of specific antibodies and blood and skin tests for evaluation specific immune cells called lymphocytes.

In some cases, sinusitis may result from a bacterial invasion from an adjacent tooth infection. For example, sinusitis may be caused by spread of an infection which began as an upper tooth abscess. Sinusitis can also result from infected or enlarged adenoid tissue. Infected adenoid tissues may block normal mucociliary clearance. The adenoids are tonsil-like tissues in the nasal passageway just above the throat (*see Figure 2*). Adenoid disease is mostly seen in children. However, adults may also develop enlarged obstructing adenoids. As children grow into adults, the adenoids usually decrease in size or even disappear.

Other risk factors for sinusitis include systemic medical problems. Examples include Wegener granulomatosis (an autoimmune illness associated with septal perforations and inflammation in the lungs and kidneys), gastroesophageal reflux disease (GERD) and cystic fibrosis or cystic fibrosis variant syndrome.

Regarding GERD, studies have shown that reflux of stomach acid into the throat and nasal passage can cause inflammation of the sinus openings (ostia) leading to sinusitis. Individuals with chronic sinusitis have a high incidence of clinically significant reflux. Medical treatment for GERD in adults and children has been shown to significantly improve sinusitis symptoms.

Cystic fibrosis (CF) is a condition causing the accumulation of thickened secretions in the nose, sinuses and chest. Affected individuals often suffer from repeated sinus, lung and ear infections. Some individuals presenting with chronic sinusitis carry a gene mutation associated with cystic fibrosis. In the year 2000, researchers at Johns Hopkins University found that some participants diagnosed with chronic sinusitis were carriers of a mutated or altered CF gene. Some individuals with this genetic abnormality may have irregularities in the mucous membranes of the sinuses similar to that seen in cystic fibrosis. These irregularities may increase the chances of getting an infection.

Air Pollution

The health hazards of outdoor pollutants such as ozone, smog, sulfur dioxide, nitrogen dioxide and petroleum combustion products from the burning of fossil fuels (fumes from cars, trucks and industry) are well known. These pollutants have been shown to damage the respiratory lining and cilia and impair mucociliary clearance (*see Mucociliary Clearance, page 11*). Air pollution can also increase nasal congestion and affect immune responses in the nasal, sinus and lung tissues. Air pollutants can cause flares of asthma and nasal/sinus disease as well as worsening of other chronic lung conditions. Furthermore, these factors may increase the chances of contracting a respiratory infection which could lead to sinusitis or worsening sinusitis.

Indoor pollution is more a respiratory concern than outdoor pollution since 90% of adult time is spent indoors. Indoor pollutants include dust, mold, insect products, pesticides, electronic devices, construction dust and debris, combustion emissions (carbon monoxide, nitrogen dioxide), volatile organic compounds (VOCs) from outgassing of building products and furnishings, poor ventilation and, in some, cases secondhand tobacco smoke. These pollutants may also affect normal mucociliary clearance, sinus drainage and immune responses.

Post Nasal Drip

It is likely that you are unaware of the 1-2 pints of mucus your nose and sinuses normally produce daily when you are in good health. The production of large quantities of mucus is necessary to clear the respiratory tract of microorganisms and pollutants. You normally swallow small amounts of accumulated mucus every 30-40 seconds without notice. This prevents mucus from collecting in your throat. However, when your throat is very dry, you may become aware of post nasal drip. Normally mucus is clear. If post nasal drip is cloudy, milky, or turns color; this may indicate the presence of sinusitis. Mucus often becomes discolored due to the accumulation of inflammatory cells, bacteria and dead and fragmented cells.

Dryness of the throat can arise from many factors such as mouth breathing, dehydration, low humidity, sleeping in a cold or overheated room and excessive talking or singing. Anything that blocks the nasal passageway can produce mouth breathing: swollen mucous membranes from allergies, nasal polyps, enlarged turbinates, deviated septum and growths in the nose. If you have a sensitive throat or gag reflex, you may even vomit from excessive post nasal drip. Repetitive throat clearing may produce a post nasal drip sensation from an irritated feeling in the back of the throat. An unconscious habit of throat clearing can turn into a vicious cycle of throat clearing leading to throat irritation and further throat clearing. Table 18 suggests ways to reduce post nasal drip.

Table 18

Tips for Reducing Post Nasal Drip
• Drink water throughout the day (*see Drinking Water, page 94*)
• Add humidity to the bedroom during dry heating seasons (relative humidity should range from 35 - 45%)
• Avoid drafts from air conditioners, heating ducts, fans
• Avoid extremely cold temperatures in the bedroom at night (below 60 °F)
• Avoid alcohol and caffeinated beverages
• Use oral (not nasal) decongestants, nasal corticosteroids and antihistamine nasal sprays to improve nasal congestion and decrease mouth breathing
• Surgically correct underlying anatomical blockage and/or sinus disease
• Use nasal saline rinses

*In 1985, physicians from **The Asthma Center** were the first to describe a now widely used classification system for fungal sinus disease.*

Fungal Sinus Disease

Not all cases of sinusitis are due to bacterial or viral infections. Some cases of sinusitis may result from fungus growth within the sinuses. Fungus is neither bacteria nor virus, but is the general term encompassing molds and yeasts. You are exposed to a variety of fungi each day. You contact fungus by inhalation of mold spores and ingestion of foods contaminated by molds. Fungi commonly colonize (grow on) the skin, the upper and lower gastrointestinal tract, the respiratory tract (nose, sinuses and lungs) and the vagina. These colonies rarely cause symptoms of disease. They are just present in minute amounts and are suppressed by your immune system and competing bacteria.

Given the great amount of fungi exposures you have, remarkably few fungal infections require medical treatment. However fungal sinus disease does require medications and treatment and increasingly is recognized as a source of chronic sinusitis. In part, fungal sinusitis may result from damage to the sinus membranes by prior bacterial infections, surgery and frequent use of antibiotics.

In 1985, physicians from **The Asthma Center** were the first to describe a now widely used classification system for fungal sinus disease. There are currently 5 recognized kinds of fungal sinusitis (*see Table 19*). Fungal sinusitis is often diagnosed following sinus surgery when a sample of infected sinus mucosa is biopsied. The presence and type of fungus is then identified by special fungal stains and/or cultures.

Briefly the 5 types of fungal sinus disease are described below.

Table 19

Types of Fungal Sinus Disorders

- Allergic fungal sinusitis
- Chronic granulomatous fungal sinusitis
- Invasive fungal sinusitis
- Mycetoma or fungus balls
- Eosinophilic fungal rhinosinusitis

Allergic fungal sinusitis is the most common fungal infection associated with chronic sinusitis. This condition often occurs if you have nasal polyps and sinus disease. It is usually resistant to conventional medical and surgical treatments. Tissue within the sinuses is often covered with a characteristic thick gel-like discolored mucus filled with allergy cells (eosinophils). This gel is often described as "allergic mucin" and often contains fungal elements when properly stained and examined microscopically. Treatment of allergic fungal sinusitis includes surgery, oral and nasal corticosteroids, allergy injection therapy, leukotriene modifiers, antihistamines and oral decongestants. Unfortunately, oral antifungal treatment is usually not effective.

Although allergic fungal sinusitis is the most common fungal infection, other less common forms may affect you. Chronic granulomatous fungal sinusitis is a persistent form of sinusitis seen in otherwise healthy individuals with no complications involving the lung.

Allergic fungal sinusitis often occurs if you have nasal polyps and sinus disease.

This fungal disorder responds well to surgery without use of antifungal therapy. Invasive fungal sinusitis occurs in individuals with weakened immune systems. It is caused by invasion of fungus directly into the mucous membrane tissues, the walls of blood vessels and bony structures of the sinuses. You are susceptible to this illness if you have been treated with high doses of corticosteroids or immunosuppressant medications, suffer from immunodeficiency, or have advanced cancer. This is a serious infection associated with high mortality. Mycetoma or fungal balls (tangled masses of fungal elements) are seen in those who have had previous sinus disease, trauma, surgery, or foreign bodies in the sinus cavity. With this condition, there is no tissue invasion. The fungus slowly grows within the sinuses without penetration into the mucosal lining. Surgical removal of the fungus ball usually cures the problem.

Recent research from the Mayo Clinic has described a fifth form of fungal sinusitis called eosinophilic fungal sinusitis. In fact, these researchers claim that most cases of chronic sinusitis are related to the presence of fungus in the sinuses. Mayo Clinic researchers have shown that fungal cultures may be positive in 96% of those with chronic sinusitis. These procedures also showed the presence of allergic mucin. More recent studies from the Mayo Clinic have suggested that nasal antifungal drugs (amphotericin for 3-6 months) improved symptoms in individuals with this disorder. The data submitted by the Mayo Clinic has not yet been confirmed by other investigators.

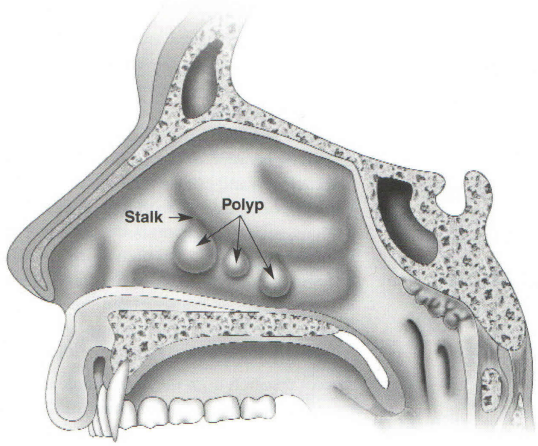
Nasal Polyps and Fungal Disease

Nasal polyps are noncancerous inflammatory growths found in the nasal passageway and sinuses (*see Figure 17*). Polyps usually grow from the mucous lining of the paranasal sinuses. They are often gray or pearl in color, glistening and small grape-like or finger-like projections. As polyps grow larger, they cause nasal obstruction and blockage of the sinus ostia (entrances connecting sinus cavities to the nose). Nasal polyps are frequently associated with recurrent sinusitis, asthma and nasal allergies. Chronic sinusitis associated with nasal polyps is often noninfectious and is often called chronic hyperplastic eosinophilic sinusitis due to the nature of the inflammation of the sinuses.

It is not entirely clear why nasal polyps develop. Nasal polyps may run in families. They are often related to recurrent infection and/or chronic allergen exposure. In addition, if you are aspirin intolerant, you may have greater risk for the development of nasal polyps. Polyps are seen in about 5-20% of individuals with respiratory allergies, but they can likewise occur in those who do not have upper respiratory allergies. Polyps are also associated with cystic fibrosis and allergic fungal sinusitis. In general, it would appear that any chronic inflammation of mucosal membranes may stimulate nasal polyp development.

Figure 17 Nasal Polyps

Recurrence rate of nasal polyps after surgery has been as high as 80%.



Medical treatments for nasal polyps include: oral, nasal, and nebulized corticosteroids; allergy injections; oral decongestants; leukotriene modifiers (particularly if you have aspirin sensitivity) and Xolair, an injectable medication approved for asthma and hives. Leukotriene modifiers (for example: Singulair®, Zyflo®) can reduce the buildup of leukotriene pathway chemicals. These chemicals produce inflammation in the upper and lower respiratory tracts and also promote nasal polyp development.

Surgical removal of nasal polyps (polypectomy) is the most immediate and effective therapy if you have nasal polyps that are promoting recurrent sinus infections, headaches and loss of sense of smell. This method is recommended when medical treatment has not been effective. Unfortunately, nasal polyps often recur following surgery. Some long term studies show the recurrence rate to be as high as 80%. Nasal polyps may take weeks to years to return. Following surgery, a combination of allergy injections (for allergic individuals), nasal corticosteroids, nasal irrigations, leukotriene modifiers, aspirin therapy, and possibly Xolair help reduce polyp recurrence. *(see page 131)*

If you are sensitive to aspirin, you may develop hives, asthmatic reactions, sinus symptoms, nasal polyp growth and/or anaphylaxis.

Aspirin Hypersensitivity, Nasal Polyps and Sinus Disease

Aspirin hypersensitivity or intolerance is a unique condition that affects a small percentage of the population. If you are sensitive to aspirin, you may develop hives, asthmatic reactions, sinus symptoms, nasal polyp growth and/or anaphylaxis (an immediate life threatening allergic reaction). Recent studies have shown that you may respond to aspirin desensitization. Aspirin desensitization is a method of lowering your sensitivity to aspirin. Desensitization is carried out by initially administering aspirin in very small doses and gradually increasing the dose every few hours. As doses are gradually increased, tolerance to aspirin is developed. The accumulated small doses of aspirin administered over a few days will often permit safe daily dosing of aspirin. This procedure can usually be carried out over a 1-3 day period on an outpatient basis. Typically, you should notice symptom improvement - especially in sense of smell - within 1 month of starting daily aspirin. Long term aspirin desensitization may also result a decreased recurrence rate of nasal polyps.

Therefore, after aspirin desensitization, you may have a decreased need for repeat sinus surgery or oral corticosteroids. Nasal congestion may also improve. Aspirin desensitization is best carried out soon after sinus surgery and polypectomy.

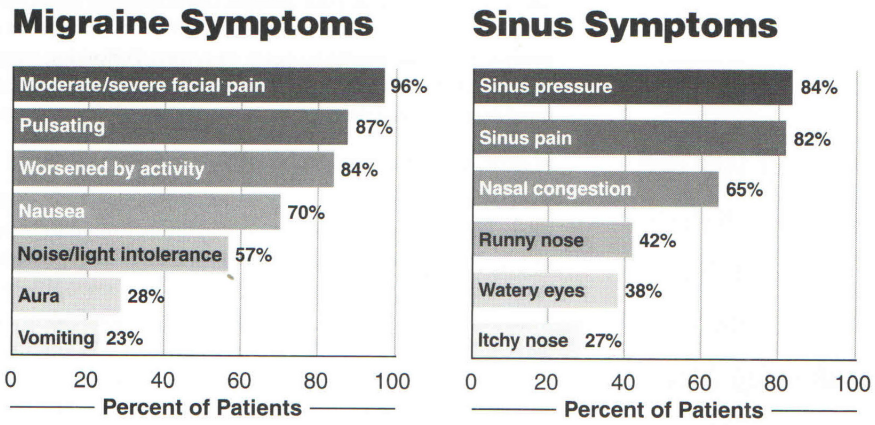
It should be noted that aspirin desensitization involves a risk of anaphylaxis and needs to be carried out by an experienced allergist in an appropriate setting. Up to 20% of individuals with nasal polyps will spontaneously convert from being aspirin tolerant to intolerant. Therefore, aspirin therapy may be considered if you have nasal polyps even without a history of aspirin reactions. This therapy may prevent recurrence of polyps and the development of aspirin intolerance.

Facial pain, pressure and headaches may stem from migraine, sinusitis and/or nasal allergies.

Sinus Headaches and Migraines

Migraines and sinusitis are common problems for about 10- 20% of Americans respectively. If you experience recurrent headaches associated with discomfort around the eyes and nasal congestion, you may believe you have "sinus headaches." However, you may actually have migraine headaches with no associated sinusitis. For example, in a recent study, 4 out of 10 individuals with a diagnosis of sinus headaches actually met criteria for the diagnosis of migraine headaches. In another study, 90% of participants who thought they had sinus headaches met criteria for migraine headaches. One reason for the confusion is due to widespread consumer advertisements directed at relief for "sinus" or "sinus headaches" for any pain felt in the midfacial area. Recent studies have shown that sinus symptoms like congestion, runny nose and tearing, typically attributed to sinus headaches, may be experienced during migraines. In addition, nasal allergy, chronic sinus disease and migraine can all be triggered by weather changes. Therefore, a history of weather change induced headaches does not help distinguish nasal allergy from symptoms of migraines or sinusitis. To complicate matters, up to 1/3 of individuals with upper respiratory allergies also have migraines. For a comparison of migraine and sinus symptoms, see Figure 18.

Figure 18 Migraine Symptoms versus Sinus Symptoms



Acute sinusitis headaches rarely cause vomiting, light and noise sensitivity, or nausea.

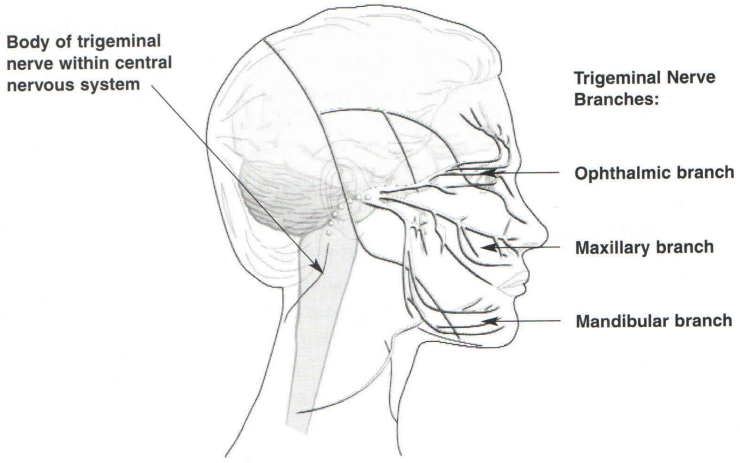
How then do you know when facial headache and pressure are due to sinusitis or allergies and when they are due to a migraine or other forms of headache? Without nasal discharge, fever and CT evidence of sinusitis, you may think you are experiencing "sinus headaches" but you may actually have nonsinus related migraine headaches. This is particularly true if headaches are associated with nausea, vomiting, visual disturbances and light and noise sensitivity. Headaches due to sinusitis are usually a result of acute sinusitis. Pain and pressure from sinusitis can be experienced in different locations (*see Chapter 1*). Most pain from sinusitis is probably due to inflammation. It may also be caused by pressure within the sinuses brought on by air or fluid trapped within the sinuses. Air may be blocked from entering or exiting the sinus as a result of swollen tissues. Air absorbed by inflamed sinuses creates a partial vacuum resulting from negative pressure within the sinuses. Such changes in pressure can produce intense sinus pressure and headaches. Furthermore, sinus headaches have been related to sinusitis following exposure to low pressure weather systems or during descent in an airplane or scuba diving. In these latter examples, pain may result from barotrauma (*see Special Topics, Part 5*).

Pressure experienced within your sinuses can trigger migraines.

Sinus headaches will usually significantly improve following effective treatment of acute sinusitis. Individuals with acute and chronic sinusitis or blockage of the paranasal sinuses will complain of headache and facial pain. The pain usually occurs at the beginning of the illness. Sinus headaches are often deep, dull, aching, or pulsatile. The ache is often combined with a feeling of heaviness or fullness. Acute sinusitis headaches rarely cause vomiting, light and noise sensitivity, or nausea. These latter symptoms are commonly experienced with migraine headaches. The intensity of the pain with acute or chronic sinusitis usually does not approach the pain experienced with migraine headaches. The pain of a sinus headache is often intensified by bending or shaking the head, straining, coughing, sneezing, or wearing a tight collar. If you suffer from both sinus disease and migraine, the pressure experienced within the sinuses can often trigger a migraine. Unfortunately, few recognize the connection among sinus disease, migraines and allergies. Consequently, people continue to suffer from symptoms and are incorrectly treated because they are not accurately diagnosed.

Reviewing anatomic relationships helps explain why what you think are sinus headaches may actually be migraines (*see Figure 19*). Migraine headaches are caused by the widening or dilation of blood vessels in and around the brain and the activation and inflammation of the trigeminal nerve and/or branches of the trigeminal nerve.

Figure 19 Trigeminal Nerve and Branches



Migraines maybe accompanied by runny nose, nasal congestion and tearing.

The trigeminal nerve consists of 3 distinct branches which supply the face. They including ophthalmic, maxillary and mandibular divisions (sensory pathway). Migraine pain is usually moderate to severe and often pulsating. It can be experienced on either one or both sides of the face or head and can be felt in various locations along the trigeminal nerve and its branches, such as on top of the head, behind the eyes, below or above the eyes, in the sinuses, or in the back of the head or neck. It is often associated with vomiting, nausea and sensitivity to light, noise and movement, with or without visual disturbances.

In addition to the pain, migraines may be accompanied by runny nose, nasal congestion and tearing. Therefore, when nasal symptoms occur during a migrainous event, they appear to be triggered neurologically, but can be confused with symptoms of sinus disease and/or allergy.

Adding further complexity and confusion to the source of your headache, you may experience headache due to acute sinusitis or upper respiratory allergies which can often trigger a migraine headache. In fact, you may find that improvement of your sinus and nasal symptoms leads to fewer migraines. This is particularly true if you have nasal allergies. In addition, if you have both allergies and migraine, you may experience less migraines when on allergy injections (*see Allergy Injections/Immunotherapy, Chapter 9*).

Other Causes of Facial Headache

Other causes of headaches in the sinus area may begin in the nose. Abnormalities of the nasal septum, either present from birth or caused by trauma, can exert pressure on the sensitive nasal wall. This can cause a sense of facial pain as well as chronic headache. Examples include:

- Deviated septum associated with blockage of the nasal passage (*see Figure 10, page 16*)
- Large concha bullosa (air filled turbinate) (*see Figure 10*)
- Large nasal septal spur (a bony ridge that grows abnormally off the septum)
- Presence of a blood collection (hematoma) in the septum or presence of a nasal tumor

Headaches caused by these conditions can usually be corrected by surgical techniques. Treatment for nasal allergies with medications such as antihistamines, decongestants and nasal corticosteroids may also help headaches.

Asthma and Sinus Disease

There is a well known link between asthma and sinusitis. Several theories as to why these two diseases are related have been put forth. These include:

- Inflammatory processes from exposure to common environmental irritants, infections and allergens which can affect the mucosal lining of the sinus and lower airway simultaneously
- Both the sinuses and lungs share nervous tissue connections between the nose, sinuses and lungs
- Post nasal drip may trigger cough and asthmatic inflammation
- The sinuses, nose and lungs make up one airway and respond together when one area is triggered

About half of all children and adolecents with asthma have at sometime had radiographic evidence or symptoms of sinusitis.

About half of all children and adolescents with asthma have at sometime had radiographic evidence or symptoms of sinusitis. Recent studies have also shown that asthma severity at times may be linked with the severity of sinus disease. Most studies indicate that asthmatic airway irritability of the lungs may improve with sinusitis treatment.

The precise relationship between asthma and sinusitis is still unknown. However, studies can explain the improvement in asthma with improvement in sinusitis by several possible mechanisms. These include:

- Decrease in post nasal drip into the lungs
- Decrease in irritant cough triggers (coughing can trigger asthma)
- Decrease in inflammatory chemicals from diseased sinuses that adversely affect the lungs
- Decrease in asthmatic irritability triggered by inflammatory processes in the throat and/or infected sinuses

If you have chronic sinus disease, you should be carefully evaluated for concurrent asthma and vice versa. Specific therapies for sinusitis may have a positive impact on asthma control.

Chapter 4 Surgical Treatment for Sinusitis

Sinus surgery may be required for severe sinusitis and related conditions. Approximately 175,000 individuals in the United States undergo sinus surgery every year. There have been remarkable changes in sinus surgical techniques over the past 20 years. These changes make sinus surgery easier to tolerate. Despite newer techniques, sinus surgery remains a serious and invasive procedure. It does not replace medical therapy, avoidance of irritant and allergic triggers and/or allergen immunotherapy, but instead is combined with these therapies. Sinus surgery is only considered when medical therapies have failed to improve symptoms and/or quality of life.

There are several sinus conditions for which surgery may be required. These include: recurrent chronic sinusitis, large nasal polyps, significant septal deviations or concha bullosa interfering with nasal function; noninfected cysts (mucoceles) that fill the sinuses; infected cysts (mucopyoceles); allergic or invasive fungal sinusitis where there is an extensive degree of content filling the sinuses, causing bone thinning and compression on surrounding tissues like the eye; suspected tumors; and serious eye or brain complications from spreading infection from the sinuses.

Nine out of ten surgeries performed endoscopically for sinus disease result in significant clincal improvement.

Functional Endoscopic Sinus Surgery (FESS)

Functional endoscopic sinus surgery (FESS) is the method of choice for sinus surgery. In fact, 9 out of 10 surgeries performed endoscopically for sinus disease result in significant clinical improvement. This procedure results in clearance of the obstruction between the sinuses and the nasal passageway by restoring the normal flow of mucus out of the sinuses. The goal of this surgery is to improve sinus drainage with minimal removal of sinus tissue. The sinus openings are surgically opened or enlarged and areas of tissue and bone inflammation are removed. These endoscopic procedures allow for improved drainage and mucociliary clearance by removing a minimal amount of tissue and bone while preserving most of the natural architecture. Sense of smell often improves after this type of surgery.

FESS involves the use of a fiberoptic endoscope through which the doctor can directly view the nasal airway and sinus openings. This precise visualization of the deep recesses within the nasal passageways allows for optimal surgery. In an operating room setting, surgical instruments can be manipulated alongside the endoscope for direct observation. This surgery is usually done under general anesthesia.

Surgeons can also be assisted by interventional video tomography (IVT). This digital x-ray-like imaging technique provides an accurate roadmap for surgery in which x-ray landmarks of your sinuses are seen in real time on a monitor by coordinating the position of the surgical instrument. This allows the surgeon to know his/her exact position at all times. This method is reserved for complex cases of chronic sinusitis or for repeat FESS procedures where normal anatomic landmarks no longer exist. It can also minimize the extent of surgery and reduce the risk of complications.

Endoscopic sinus surgery is relatively safe and minimally invasive. There are no skin surface incisions and very little post operative pain. Recovery is much faster than traditional sinus surgery. However, complications can occur (approximately 0.5% rate or 1 in 200). Complications include serious bleeding, permanent eye damage and leakage of cerebral spinal fluid (CSF- the fluid that surrounds the brain and spinal cord). Leakage of CSF fluid can lead to meningitis and headaches. Other complications can include nasal septal perforation, decrease or loss of sense of smell (which usually improves with this surgery) and post surgical scar tissue (adhesions) that limits normal mucociliary clearance and adds to further blockage in the nose and sinus ostia. In a small percentage of cases, repeat endoscopic surgery may be required if the initial procedure does not result in significant improvement of symptoms. It is well recognized that individuals who smoke after sinus surgery also have a significantly poorer long term prognosis than nonsmokers.

Although the success rate with FESS is high, this surgery will not cure environmental allergies and/or infection triggered by persistent environmental irritants like tobacco smoke.

Other Types of Sinus Surgery

Nasal turbinate hypertrophy or enlargement of turbinates can also be treated surgically. Surgical techniques may include the removal of bone (submucous resection) or removal of parts of the turbinate (partial turbinectomy) or complete turbinectomy. Other techniques in nasal turbinate modification are the use of radio waves or balloon reduction. Radiofrequency waves (somnoplasty) or radiofrequency ablation can decrease blood vessels under the mucous membranes in the turbinates without disturbing the function of the turbinates. This will result in a decreased size of the turbinates. Surgery to correct a deviated septum separating the right and left nostrils is called a septoplasty. A deviated septum may be present from birth or due to trauma. In either case, a severe deviation can lead to nasal obstruction and risk for sinusitis. Surgery to correct this problem can be performed endoscopically under local or general anesthesia and can be combined with FESS if needed.

Post Operative Care

Sinus surgery is usually a same day procedure performed in a hospital or outpatient surgical center. You can often return home the day of surgery after anesthesia has worn off. Overnight stays may be required if problems occur. These complications include excessive bleeding, swelling, asthma exacerbation, or other problems. Following surgery, you may require some pain control, antibiotics, corticosteroids and nasal irrigation. Nose packing (gauze packed in the nasal passageway) may or may not be resorbable, so you may require post operative removal by the ENT surgeon. ENT follow up is usually carried out at varying frequency over a period of 6-8 weeks. During these visits, the ENT surgeon will endoscopically clean and remove any crusting, dried blood and mucus in order to facilitate the return of normal functioning of the nasal and sinus passageways. The ENT also removes adhesions (bands of scar tissue) that may occur. Occasionally you may require post operative nasal irrigation by the ENT surgeon on a monthly basis to maintain a functioning nasal sinus communication. This process maintains openings and prevents debris from blocking these openings.

Although the success rate with FESS is high, this surgery will not cure environmental allergies and infection triggered by persistent environmental irritants such as tobacco smoke or an underlying immunodeficiency. In addition, you may still require medical therapy to treat the underlying causes of chronic sinusitis, even after surgery.

What Happens if Surgery Fails

As with any treatment, there are cases of surgical failure. Additional options at this point include use of extraordinary measures:

- Aspirin therapy and/or desensitization (*see page 38*)
- Administration of antibiotics over long periods by oral, nasal, or intravenous routes (*see page 26*)
- Administration of oral antifungal drugs (like Sporanox® or Nizoral®) or prolonged nasal antifungal therapy
- Additional surgery
- Xolair (anti-IgE) Therapy
- Irrigation with high potency nasal corticosteroids (*see page 76)*
- Oral corticosteroids (*see page 76*)
- Complementary and alternative medicine treatments (*see page 83*)
- Full allergy and immunologic evaluation and treatment
- Broncho-Vaxom

Broncho-Vaxom (bacterial-lysate)

Broncho-Vaxom is an extract of different bacterial species that are frequently responsible for sinusitis and other respiratory infections. It is thought to work by stimulating the immune system which increases the body's defense system against these common pathogens. Studies in Europe and Mexico have shown that taking Broncho-Vaxom leads to fewer infections and reduces the need for antibiotics in individuals with recurrent sinusitis or throat infections and bronchitis. Though the FDA has not approved this medication for use in the United States, it is commercially available and frequently used in other developed countries for chronic bronchitis and recurrent infections of the respiratory tract, in particular sinusitis, rhinopharyngitis and middle ear infection in both adults and children.

Part Two

Upper Respiratory Allergies

One of the most treatable risk factors for acute and chronic sinusitis is upper respiratory allergy. If your sinus problems have not resolved, a thorough allergy and immunology evaluation may be your best bet in finding long term relief. Unfortunately, many individuals with long standing sinus disease who have had a poor response to various medications or even sinus surgery, may never have had their potential underlying allergies evaluated or adequately treated. Since upper respiratory allergy is present in 20% of the general population, it is not uncommon to have allergy playing a major role in sinus disease. In fact, some studies have shown the presence of both allergy and sinus disease occurring in the same individual to be as high as 70%.

So what is the connection between allergies and sinus disease? The mucous membranes of the nose and the sinuses are part of the same membrane surface. Inflammation (both allergic and nonallergic) affecting the nose is likely to therefore affect the sinuses. Studies have shown that allergic reactions in the nose may also occur within the sinuses. For example, if you have an allergic reaction to pollen experimentally placed in your nose, you may also demonstrate allergic changes in your sinuses. These changes can be seen by CT scan or PET scan of the sinuses. Such allergic responses are often accompanied by increased pressure in the sinuses, headache, ear pain, or congestion. If similarly challenged with nonirritating salt water control solution, no changes in x-rays or symptoms are observed.

Of all the predisposing causes of sinus disease, underlying allergy may be the trigger that lends itself to the most effective long lasting treatment and relief. Therefore, treating underlying nasal allergies will always decrease the risk for sinus infections.

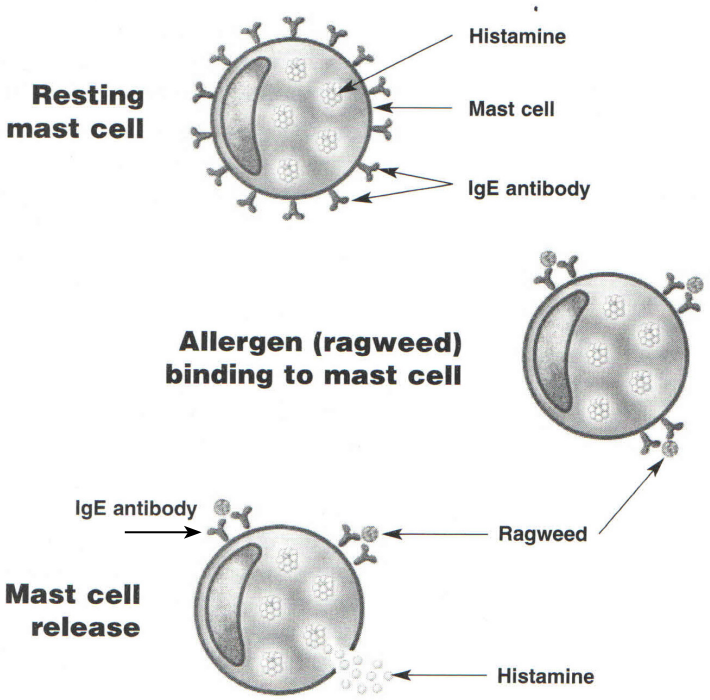
Allergies may also occur independent of sinus disease. With or without sinusitis, upper respiratory allergies are often underestimated. Allergies have been found to have a negative impact on work and school performance, impair learning and affect sleep patterns. They are also a major cause of lack of school attendance and absenteeism from work. The following pages will help you understand what causes and triggers allergies and how you can get the best treatments available. So how do you find out which sinus sufferers have allergies? To start, understanding the mechanism behind allergies and the triggers of reactions can be extremely helpful.

Chapter 5 Mechanism of Allergic Reactions

Unique, chemically rich mast cells line the mucous membranes of the nose, sinuses and lungs, ready to release histamine and other chemical mediators (leukotrienes, tryptase, etc.), which can cause inflammation of the nose, sinuses and bronchial tubes. In allergic reactions, the allergy antibody, IgE, serves as the bridge between allergic substances and the mast cells. When allergens bind to IgE on the mast cell surface, they release chemicals (*see Figure 20*). In other circumstances, mast cells release their chemicals without an allergic trigger (for example, following a cold). The effects of mast cell mediator release depend on where the reaction occurs. For example, if mast cell release occurs in the eye; you will experience the symptoms of eye allergies (allergic conjunctivitis); if release occurs in the nose or sinuses, you will experience the symptoms of hayfever (allergic rhinitis) and possibly allergic sinus pressure; if the reaction occurs in the lungs, you will experience asthma symptoms.

The inflammation in these different areas is all due to accumulation of various cells (eosinophils, neutrophils, lymphocytes, macrophages, etc.), swelling (edema) and increased mucous production.

Figure 20 Mast Cell Release



Chapter 6

Environmental Airborne Allergens

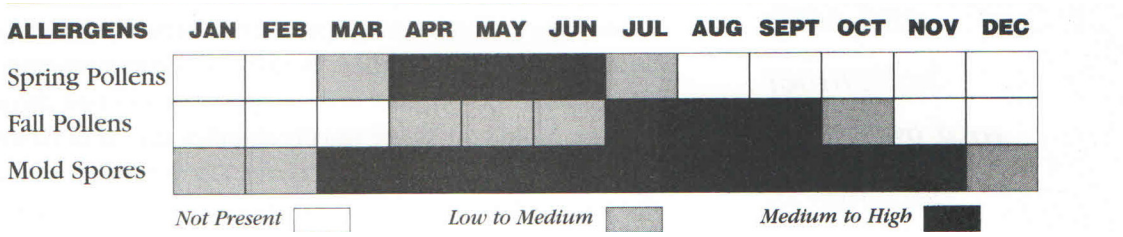
Early May is a particularly difficult time for seasonal allergy sufferers

Allergens are particles, usually composed of proteins, capable of causing an allergic response. These particles are often airborne in indoor and outdoor environments and are generally very small and not visible to the naked eye. Indoor allergens tend to be present throughout the year, whereas outdoor allergens tend to be present only during specific seasons. You should be aware of the allergens in your environment. Tracking pollen is a helpful way of anticipating allergy symptoms. Pollen awareness can help you avoid relevant allergens, plan outdoor activities and choose appropriate treatment options. In some cases, allergen immunotherapy may be recommended (*see Chapter 9*).

Outdoor Allergens

Outdoor airborne allergens, also known as seasonal allergens, are persistantly present in the air in the Delaware Valley during the spring, summer and fall seasons (*see Figure 21*). They include tree pollen, grass pollen, weed pollen and mold spores. Tree and grass pollen predominate during the spring season. Weed pollen predominates during the late summer and early fall. Mold spores tend to be present in significant levels throughout the warmer weather months and decline in colder weather.

Figure 21 Calendar of Allergen Exposure in the Delaware Valley



Tree pollen typically appears in mid-March, peaks in late April and early May and gradually declines in early June

Pollen and mold spore levels in the outdoor environment in Philadelphia and southern New Jersey are monitored with sophisticated collection instruments by the specialists at The Asthma Center from March through October each year. The Asthma Center has been analyzing the air pollen and mold spore as the only certified monitoring station in the Delaware Valley since 1992. We are certified by the American Academy of Allergy, Asthma, and Immunology through its National Allergy Bureau. Air samples are measured in 2 locations, Center City Philadelphia and Mt. Laurel, NJ. Published studies by The Asthma Center physicians have shown striking similarities between urban (Center City Philadelphia) and suburban pollen and mold spore counts. Pollen and mold spore counts are reported on The Asthma Center's website (www.asthmacenter.com). They are also available on The Asthma Center Education and Research Fund website (www.asthmacenter.org). Automatic daily email reports from our pollen monitoring station are available through our website. These counts are also provided to the National Allergy Bureau (part of the American Academy of Allergy, Asthma and Immunology) and local newspapers, TV and radio. Comparative analysis of pollen reports and forecasts from non-certified sources, although widely available through the internet, have not been shown to accurately reflect the tree pollen and mold spore counts in our area.

Tree Pollen

Grass pollen typically appears in early April, peaks in May and declines in June

Tree pollen is produced by a wide variety of tree species as a means of reproduction during the spring season. Effective pollination depends on the transport of these particles by wind currents. In the Delaware Valley, airborne tree pollen typically appears in mid-March, peaks in late April and early May and gradually declines in early June. The dominant tree pollen types seen in the local area include juniper, cedar, maple, birch, oak and pine.

The Pine Barrens is located in southern New Jersey and is the main source of pine pollen in our area. It is home to 2 species of pine, but the dominant species is the pitch pine (*Pinus rigida*) whose pollen is shed from late April to May.

Grass Pollen

Grass pollen, similar to tree pollen, is produced by a variety of grass species as a means of reproduction during the spring season. Effective pollination depends on the transport of these particles by wind currents. In the Delaware Valley, airborne grass pollen typically appears in early April, peaks throughout the month of May and gradually declines during June. Early May is a particularly difficult time for seasonal allergy sufferers as both tree and grass pollen are at peak levels. First reported by The Asthma Center, there is a second, less intense burst of grass pollen that often appears in late August and early September. The 4 dominant grass pollen types seen in the Delaware Valley include Kentucky, orchard, rye and timothy.

Weed Pollen

Weed pollen typically appears in early August, peaks in late August and early September and gradually declines in late October

Weed pollen is produced by a wide variety of weed species as a means of reproduction during the late summer and early fall seasons. A few species also produce pollen during the early and midsummer seasons. Effective pollination depends on the transport of these particles by wind currents. In the Delaware Valley, weed pollen typically appears in early August, peaks in late August and early September and gradually declines in late October. Ragweed is the most dominant weed pollen in the local area; other common types of weed pollen include English Plantain, Lamb's Quarters, Sheep Sorrel and Sage.

Molds

Molds, also known as fungi, produce spores and other fungal particles which are airborne in abundant numbers during the warmer weather months. In the Delaware Valley, molds first appear in early spring and persist throughout the summer and fall seasons. Mold counts are usually significantly reduced during winter months, reaching their lowest levels with snow cover. There is no true peak to the mold season, though the highest levels have generally been observed during the midsummer to late fall. The majority of mold spores and other fungal particles in the air are unable to be identified due to their small size and lack of distinctive characteristics. The most dominant identifiable types of molds in the local area include *Alternaria, Cladosporium*, *Basidiospores*, *Ascospores* and *Epicoccum.*

Indoor Allergens

Indoor allergens, also known as perennial allergens, are generally present in the indoor environment throughout the year with no significant variation.

Indoor allergens, also known as perennial allergens, are generally present in the indoor environment throughout the year with no significant seasonal variation. These allergens have taken on an increased importance over recent decades as a result of a pattern of increased time spent indoors and improved home construction with better insulation which has fostered greater exposure. The mixture of perennial allergens found in a specific indoor environment is determined by climate, season, altitude and the presence of pets, rodents and cockroaches. An unusual indoor allergen may be peculiar to a particular environment - for example, airborne flour in a bakery. The major indoor allergens in metropolitan Philadelphia and southern New Jersey include dust mite allergens, cat allergens, dog allergens, cockroach allergens and mold spores and other fungal elements.

Dust Mite Allergens

Dust mites (*Dermatophagoides pteronyssinus and Dermatophagoides farinae*) represent a major source of indoor allergens in the Delaware Valley and in many parts of the world. They are dependent on high ambient humidity (greater than 50%) and have an optimal growth temperature from 65°- 80°F Dust mites are found chiefly in carpets, pillows, mattresses, bedding, upholstered furniture, draperies and stuffed animals. These organisms are microscopic and cannot be seen by the naked eye.

The actual allergenic proteins produced by dust mites are believed to be digestive enzymes which are excreted in fecal particles. Little or no dust mite allergen is airborne in undisturbed conditions but rather requires a disturbance, such as vacuuming, to produce significant airborne levels for relatively short periods of time. You have your most intimate encounters with dust mites when your nose, eyes and skin are in close contact with pillows, blankets, mattresses, carpeting and upholstered furniture

Cat and Dog Allergens

Cat and dog allergens are major indoor allergens in homes and private cars where cats and dogs are present. The main cat allergen is a protein found in the skin, saliva and urine. Cats produce other allergens as well, such as cat albumin, which are of much less clinical importance.

Cat allergen can be airborne in an indoor environment even in undisturbed conditions. This explains how you may experience an acute onset of allergic symptoms upon entering a home with a cat without any obvious disturbance. Similar reactions are typically not observed if you are dust mite allergic as dust mite allergens require a disturbance to become airborne. Cat and dog allergens are both carried by small particles that remain airborne for long periods of time.

Cockroach Allergens

Cockroach has been recognized as a major source of indoor allergen in some urban environments. Several species of cockroaches are common in houses, with the best known types being the German cockroach and the American cockroach. German cockroaches are common in cities in the United States, particularly in inner city apartments. Many individuals who live in crowded, poorly cleaned areas have cockroach allergy.

The presence of mold or mold derived toxins in an indoor environment does not necessarily mean there are associated effects on health

The 4 chief German cockroach allergens are found in feces, saliva and on the outside surfaces of cockroaches. Similar to dust mite, little or no cockroach allergen is airborne in undisturbed conditions. Cockroach allergen becomes airborne for short periods of time following a disturbance such as vacuuming.

Indoor Mold Allergens

Mold allergens associated with mold spores and other fungal elements can be a major source of indoor allergens, particularly in homes where damp or wet areas exist. Areas of mold growth are often difficult to detect, hiding under floors and behind walls. The mixture of mold spores seen indoors tends to differ from the mixture seen outdoors. The most prominent fungal species seen indoors include *Penicillium*, *Aspergillus* and *Cladosporium*. Unique molds like *Stachybotrys* may be found in some indoor settings where extensive water damage has occurred. If molds are suspected, special culture techniques and air sampling specimens may be performed. A thorough inspection may be required by experts in environmental contamination and mold removal.

There have been many claims made about associations between damp environments and health effects. Possible reasons for these connections include: allergic reactions; direct irritation by fungal mold elements; toxins released from molds (*Aspergillus, Fusarium, Penicillium, Stachybotrys*); volatile organic compounds (VOCs); or other immune responses stimulated by mold. Individuals with damp environments often present with symptoms of congestion, cough, mucous discharge, headache, shortness of breath, eye itching, dizziness, restless legs, fatigue and abdominal pain. Most individuals with exposure to mold contaminants do not have typical allergic symptoms. Whether all indoor molds produce health problems beyond allergic reactions is still widely debated. Therefore, the presence of mold or mold derived toxins in an indoor environment does not necessarily mean there are associated effects on health.

Chapter 7 Seasonal Allergic Rhinitis (SAR)

Definition/Causes

Seasonal allergic rhinitis (SAR) or intermittent allergic rhinitis is a form of nasal inflammation (rhinitis) which is triggered by exposure to airborne pollen particles during the spring and fall seasons. The spring allergy season in the Delaware Valley correlates with airborne levels of tree and grass pollen, and usually begins in mid-March, peaks in late April and early May and ends in early June. Spring allergies have also been known as rose fever. The fall allergy season in the Delaware Valley correlates with airborne levels of weeds (particularly ragweed) pollens and usually begins in mid-August, peaks in late August and early September and ends in late October. SAR is also known more commonly as hayfever.

Signs and Symptoms of Seasonal Allergic Rhinitis

The classic symptoms of SAR include itching of the nose, ears, throat and roof of the mouth, sneezing, nasal congestion, runny nose and clear, watery nasal discharge. Examination of the nostrils reveals a pale appearance and swelling of the lining of the nose and nasal turbinates (*see page 8*). Examination of the exterior of the nose often shows a horizontal crease across the bridge of the nose caused by repetitive use of the "allergic salute" (wiping the nose with the palm of the hand in an upward motion).

Associated seasonal allergic involvement of the eyes, known as seasonal allergic conjunctivitis (SAC), includes symptoms and physical examination findings of itching of the eyes, tearing, "bloodshot" eyes, eyelid swelling and purple discoloration below the eyes known as "allergic shiners" (*see Allergic Conjunctivitis, page 100*). Other frequently associated symptoms of allergic rhinitis include sinus pressure, post nasal drip, ear fullness and popping, cough and fatigue.

SAR can predispose to respiratory infections such as sinusitis and otitis media (infection of the middle ear). SAR is often accompanied by other allergic disorders including asthma and atopic dermatitis (allergic eczema). If you have SAR, it is likely other family members have hayfever and/or other allergic disorders.

As important as the primary symptoms of allergic rhinitis are, there are many secondary psychosocial consequences associated with SAR. These can range from decreased concentration to fatigue and sleep disorders and may interfere with your ablitly to work or enjoy a favorite activity. Additionally, children with SAR can be prone to having irritable episodes and acting out. A list of some common secondary symptoms associated wtih SAR may be found below:

- Decreased concentration and focus
- Limited activities
- Decreased decision-making capacity
- Impaired hand-eye coordination
- Problems remembering things
- Irritability
- Sleep disorders
- Fatigue
- Missed days of work or school
- More motor vehicle accidents

The allergen skin test is the most sensitive and most accurate test for the detection of allergies.

Diagnostic Studies

Several diagnostic studies are useful in the diagnosis and long term management of SAR. These studies include: allergen skin testing and allergen blood tests, microscopic examination of nasal secretions (nasal cytology) and an endoscopic examination of the entire nasal airway. Other less commonly used studies include testing of mucociliary clearance (*see page 11*) and nasal provocation challenges

The allergen skin test is the most sensitive and most accurate test for the detection of allergies. There are two levels of skin testing known as epicutaneous testing and intradermal testing. In epicutaneous testing, small amounts of allergens are pricked into a superficial layer of skin called the epidermis. Allergens which are negative for allergic reactivity on epicutaneous testing require intradermal testing. In intradermal testing, larger amounts of allergens are injected into a deeper layer of skin called the dermis. In both types of skin testing, allergies are identified through the formation of swelling (wheal) and redness (flare) responses at the sites of the allergen pricks or injections. Multiple environmental allergens are evaluated on skin testing, including tree, grass and weed pollens which are responsible for SAR.

ImmunoCap tests for allergies are not as sensitive as allergen skin testing.

ImmunoCAP tests are blood tests which detect levels of allergens in the blood. They are not as sensitive as allergen skin testing and generally are used only when skin testing is not available or cannot be performed because of a skin rash or because of suppression of skin test reactivity by certain medications. Other blood tests such as complete blood counts and total serum IgE levels may also be helpful in suggesting the presence of allergies, but do not identify specific allergies.

Nasal cytology (nasal smear) involves the microscopic examination of nasal mucus obtained by blowing the nose into plastic wrap or introducing a cotton tipped swab into the nose. Nasal smears are useful in differentiating infectious rhinitis from allergic rhinitis.

Examination of nasal mucus caused by allergic rhinitis typically reveals large numbers of inflammatory white blood cells known as eosinophils.

Diagnosis

The diagnosis of SAR is based on a combination of the following criteria:

- Characteristic clinical symptoms by history (for example: itchy, watery eyes; itchy, runny nose; nasal congestion; sneezing; etc.); other less specific symptoms may also be present (for example: headaches; post nasal drip; fatigue; etc.)
- Seasonal pattern of symptoms by history (spring and/or fall occurrence)
- Typical physical examination findings (for example: pale, swollen nasal turbinates; clear, watery nasal discharge; etc.)
- Positive skin tests and/or blood tests for allergic sensitivity for spring and/or fall seasonal allergens (for example: tree pollen, grass pollen and/or weed pollen)
- Good correlation of timing of occurrence of clinical symptoms with timing of appearance of seasonal allergens noted to be significant (allergic) on skin test and/or blood tests
- Presence of concomitant allergic disorders (asthma and/or atopic dermatitis)
- Positive family history (immediate relatives with allergic disorders)
- Presence of complications of allergic rhinitis (acute and/or chronic sinusitis, otitis media and/or nasal polyps, or asthma)

Chapter 8 Perennial Allergic Rhinitis

Definition/Causes

Perennial allergic rhinitis (PAR) or persistent allergic rhinitis is a form of nasal allergy which is triggered by exposure to allergens present in the environment throughout the year. These allergens exist predominantly indoors and include dust mite, animal dander, mold spores and cockroach.

Signs and Symptoms of Perennial Allergic Rhinitis

The classic symptoms of PAR are similar to SAR and can include itching of the nose, ears, throat and palate, sneezing, nasal congestion, postnasal drip, runny nose, cough and watery nasal discharge. However, unlike SAR, the symptoms of PAR may be subtle and only include 1 or 2 symptoms simultaneously, such as nasal congestion and postnasal drip, making the diagnosis more difficult and easily missed. Anyone with chronic nasal symptoms which are unexplained should undergo an allergy evaluation to assess for PAR. Multiple environmental allergens responsible for PAR, such as dust mite, animal dander, mold spore and cockroach, may be evaluated by skin testing and/or blood tests.

Examination of the nose may reveal similar findings to those listed under SAR (*see page 52*). A mucous drip in the throat may also be present. Blood testing is less sensitive than skin testing in identifying allergens likely to cause PAR.

Other frequently associated symptoms and conditions with PAR include eye itching, tearing, redness and swelling, sinus pressure, ear fullness and popping, fatigue, respiratory infections such as acute and/or chronic sinusitis and otitis media (infection of the middle ear), asthma and atopic dermatitis (allergic eczema). If you have PAR, you most likely have a family history of hayfever or other allergic disorders.

Diagnostic Studies

Diagnostic studies are the same as for SAR. These studies are useful in the diagnosis and long term management of PAR

Diagnosis

The diagnosis of PAR is based on a combination of the following criteria:

- Characteristic clinical symptoms by history
- Perennial (year round) pattern of symptoms by history may fluctuate randomly in intensity throughout the year and may flare up following specific exposures (for example: pets, heavy dust, moldy basements, etc.)
- Typical physical examination findings
- Positive skin test and/or blood tests for allergic sensitivity for perennial allergens (dust mite, cockroach, cat, dog and/or mold spores)

- Good correlation of occurrence of clinical symptoms with exposure to specific allergens noted to be significant (allergic) on skin test and/or blood test (may not always be obvious in the case of allergens which are unseen in the environment such as dust mite)
- Presence of concomitant allergic disorders (asthma and/or atopic dermatitis)
- Positive family history (immediate relatives with allergic disorders)
- Presence of complications of perennial allergic rhinitis (acute and/or chronic sinusitis, otitis media and/or nasal polyps, asthma or allergic conjunctivitis.

Chapter 9

Allergen Injections/Immunotherapy

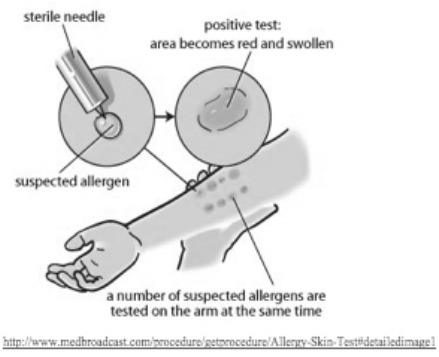
Allergy shots are cost effective in reducing nasal and eye symptoms, decreasing medication use and improving quality of life.

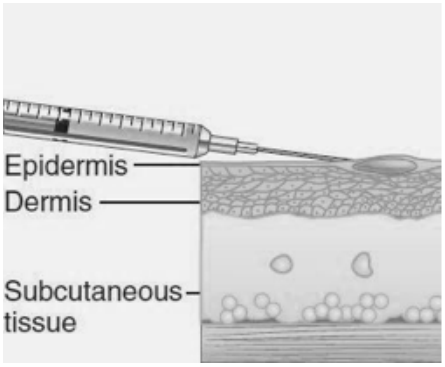
Allergy Shots should only be given under the direct supervision of a skilled physician, skilled in the management of anaphylaxis.

Allergen injection therapy (also know as Subcutaneous Immunotherapy [SCIT], allergen immunotherapy or allergy shots) is a treatment for reducing specific sensitivity to allergens by actually changing the underlying mechanism of allergy that causes symptoms rather than treating symptoms alone. Immunotherapy is thought to work by causing a number of changes in the immune system which ultimately decrease allergic sensitivity. These immunologic changes include: a rise in IgG antibodies that "block" allergen binding to the IgE antibody, a decrease in the production of IgE antibody and a decrease in the release of the chemical mediators that cause allergic reactions (*For a diagram demonstrating the allergic process, see Figure 22, page 81*).

For more than 100 years, allergen immunotherapy (allergy shots) has been a very effective treatment for hayfever of the nose and eyes. Multiple studies over the years have shown that allergy shots are cost effective in reducing nasal and eye symptoms, decreasing medication use and improving quality of life. For years, individuals have told allergists that they also experience less upper respiratory infections while on allergy shots. Recent studies have confirmed the value of immunotherapy for reducing cases of sinusitis and the development of asthma. A recent study in 2004 confirmed what allergists have known for years: that immunotherapy for sinusitis led to a significant reduction of sinus symptoms (51% decrease in sinus pain, nasal green/yellow mucus, nasal congestion), reduction of antibiotic use, an improved quality of life with 72% fewer lost days of work or school annually and a reduction in nasal/sinus surgical procedures. It is clear that allergy can trigger sinusitis, and immunotherapy remains an important and unique treatment for chronic allergy sufferers.

Figure 22 Prick and Intradermal Testing





The experience of **The Asthma Center** physicians and other allergists nationwide supports allergen injections as a form of therapy for those with recurrent sinusitis in which allergy appears to play a significant role. Although sinusitis and allergy can be separate and independent processes, allergy appears to worsen existing sinusitis. Upper respiratory allergy often plays a significant role in maintaining chronic inflammation of all of the mucosal membranes including those of the sinuses. In **The Asthma Center** physicians' experience, allergen injections are particularly important in those allergic individuals not responding to medical and surgical treatment for chronic sinusitis.

More importantly, allergy shots have also been shown to prevent asthma in patients who only have allergic rhinitis. This is a highly valuable but under-recognized benefit of allergen injections- particularly in light of the fact that 70% of allergic rhinitis pediatric patients will develop asthma and 50-60% of adults with allergic rhinitis will develop asthma.

Allergen immunotherapy may be of benefit if medications for allergies and sinus disease and/or surgery for sinusitis do not work. Treatment is carried out over a long period of time (3-5 years in most cases). At first, only very weak solutions of allergens are administered. The dose is then gradually increased in order to induce tolerance without reactions. The goal is to achieve a high maintenance dose which affords the best symptom relief. The benefit of allergy shots has been shown to last years after discontinuation of effective therapy.

In the interest of your safety, allergy shots should not be given at home, by self injection, friends, family members, or neighbors even if they are healthcare professionals.

Allergy shots should only be given under the direct supervision of a trained healthcare provider (preferably a physician or nurse practitioner), skilled in the management of anaphylaxis (a severe allergic reaction), in a facility fully equipped to manage a reaction.

If you receive allergen injections under any other circumstances, you are putting yourself at serious risk. National guidelines make it clear that allergy shots should not be self administered outside of a medical facility.

Therefore, allergen injections should only be given in a physician's office with a qualified healthcare provider immediately available for the management of reactions. Proper medication(s) and equipment must be available to treat mild or severe reactions. You must remain in the office for at least 30 minutes following your injection(s). It is advised that you carry epinephrine with you on the day of your shots. Epinephrine autoinjectors are epinephrine products that are antidotes for any significant adverse reactions that may occur outside the office.

With rare exceptions, if you receive beta-blocker medications, you cannot receive immunotherapy since you might not respond to emergency epinephrine treatment in the event you have a reaction to your allergy shots.

Sublingual Immunotherapy

Sublingual Immunotherapy (SLIT) is an alternative form of immunotherapy that has been used in Europe and, more recently, in the US. (RagwiTek for ragweed allergen, GrasTek for grass allergen and Oralair for grass allergens, Odactra for dust mite.) SLIT is administered as a tablet that dissolves under the tongue, and is scheduled as a daily dose starting months before the pollen season and continued through the end of the season or daily all year round for dust mites. The tablets contain relevant allergens to which the patient is sensitive and suppresses daily symptoms. Clinical studies have shown that subcutaneous immunotherapy (allergy shots) has better clinical outcomes, and stimulate a stronger immune response than SLIT. SLIT can only be used for monosensitive patients (i.e patients who are allergic to only one allergen) and since most patients are polysensitive, SLIT would not be beneficial. SLIT has the advantage of being administered at home, however, the compliance with SLIT is no better than with the patients receiving SCIT shots in the office. SLIT may have a slight advantage of less risk of systemic anaphylaxis. Our practice documented the first case of anaphylaxis in the United States in a patient using SLIT. An epinephrine autoinjector should be available for patients using SLIT. The local reaction rate in the mouth is high for SLIT and typicall resolves after several doses. A recent study compared the effect of SLIT with conventional individual pharmacological treatment of allergic rhinitis. The study was a review of multiple studies done in individuals with seasonal grass or ragweed-induced allergies and perennial dust mite allergies. SLIT was better than antihistamine or montelukast therapy alone, but was not as good as the first-line therapy of nasal steroids in reducing nasal symptoms. SLIT may have had some greater improvement in symptoms in individuals with perennial dust mite-induced allergies. The study also called into question the value of SLIT when use of OTC nasal steroids may be more effective but less expanisve and require less days treated.

Chapter 10 Environmental Avoidance of Allergens and Irritants

Outdoor air pollution is a concern of many individuals, especially those who suffer from respiratory diseases such as allergies, sinusitis and asthma. However, the quality of indoor air is of greater concern since most adults spend up to 90% of their time indoors. Indoor levels of many pollutants and allergens can be higher than outdoor levels. In fact, the Environmental Protection Agency (EPA) has identified poor indoor air quality as 1 of the top 5 environmental risks to public health in the United States. Indoor air contains as many as 30 million particulates/cubic foot of air, 99% of which are invisible. Indoor pollutants like smoke, chemicals, and allergens like dust mite, pet dander and mold spores commonly trigger respiratory illnesses. In an attempt to improve indoor air quality and reduce exposure to irritants and allergens, central whole house air cleaners or portable room air cleaners are often recommended (*see Air Cleaners, page 63*).

These triggers include: house dust, house dust mites, molds, animal dander (dog, cat and other animals), pollen, foods, medications and other home or workplace allergens (*see Table 20*). Avoidance of allergic triggers is only of benefit if a specific allergen can be identified as a causative agent. Decisions regarding many environmental control measures should be based on the severity of symptoms. For example, removing a pet from your home will only be of value if it has been established through allergy testing that you are definitely allergic to the pet's animal dander. In addition, you may be sensitive to environmental irritants including cigarette smoke, air pollutants, cold air, humidity, infections, stress and exercise. Once a specific factor (allergic or nonallergic) is identified as a causative agent, your physician can make recommendations to help you avoid the aggravating factor or at least minimize exposure to a known trigger. This chapter will help you identify some specific triggers and how to avoid them.

Avoidance Measures

Table 20

Environmental Triggers of Allergy and Sinusitis
1) Pollen
2) Dust mites
3) Mold
4) Animal dander
5) Work/environmental pollution - cigarette smoke/irritants/odors/diesel fumes and combustion pollutants
6) Cockroaches
7) Foods

House Dust Mites

Dust mites need human skin scales as food and moisture and heat to thrive.

Dust mites are the most common and important indoor allergens causing allergy symptoms (*see page 50*). Dust mites are thought to cause most cases of chronic post nasal drip in adults and are the most common cause of persistent asthma in children. Based on this observation, if you have sensitivity to house dust mite on allergy skin testing and symptoms of chronic nasal, sinus, eye and ear allergy, asthma and/or allergic eczema (atopic dermatitis), you may greatly benefit from environmental controls that limit dust mite exposure. In addition, you may also have significant benefits from allergy shots.

A dust mite is an insect that is usually so small it is invisible to the human eye. They do not bite or cause any other diseases other than those related to allergic reactions. It is usually no longer than 1/100th of an inch. Dust mites eat human skin scales and are often found in areas with the greatest skin scale concentration. These locations include bedding, pillows, furniture and carpeting. Dust mites also need moisture to survive.

Therefore, the greater the food supply (skin scales) and the greater the humidity, the greater the number of dust mites. If you sleep in a bed covered with a comforter or quilt and lie on a thick mattress pad, you will transfer lots of moisture through skin evaporation into your bedding.

Your bedding then acts as a reservoir of heat, moisture and food for optimum dust mite growth. It is not uncommon to experience your worst symptoms at night or in the morning. A simple solution is to encase pillows with inexpensive dust mite-proof covers, sealing the dust mites and their feces in the pillow. This encasing should be changed once a week and washed in very hot water. Placing your pillow in the dryer for 15 minutes will also kill off dust mites. Fluffing the pillow after drying will help remove the dead mites.

For similar reasons, dust mites also accumulate in clothing. They may continue to live and grow in number when clothing is stored in closets and drawers. Rugs and furniture are also excellent breeding grounds for house dust mites.

Relative Humidity

The amount of moisture in the air is referred to as relative humidity. The more moisture the air holds, the higher the relative humidity. Maximum water vapor in the air is equivalent to 100% humidity. The amount of moisture that air can hold is dependent on temperature. As the temperature rises, its maximum water vapor. Since dust mites need moisture to thrive, if you deprive them of moisture, their numbers diminish. Generally, dust mites do not do well if the relative humidity in the home is less than 45%. When the home's relative humidity rises above 70%, dust mites have all the moisture they need to thrive. Therefore, you may want to monitor humidity with a gauge (hygrometer) and dehumidify your home. Home dehumidification is easy to accomplish with portable room dehumidifiers (takes water out of the air)

Cockroaches

Cockroach antigens can cause symptoms of respiratory allergy if you are sensitive to cockroach antigen (*see page 51*). Cockroaches are found in most urban environments. They are often not noticed during the day since they usually come out at night. During the day, they often congregate in large numbers in areas that are narrow, dark and preferably moist and warm. They tend to gather under appliances, between kitchen cabinets, or within walls or crevices. Dozens to hundreds may huddle in a small space because they like to dwell together. They often are seen scurrying across floors, usually along the joint of the floor and wall of a room. Cockroaches eat any available human or animal food. Therefore, keep all packages sealed or in plastic containers. Leave no food open, including pet food.

Airborne cockroach dust (body parts and/or feces) can be a very strong allergen and may also spread disease including bacteria ingested by the cockroach. Diseases such as salmonella have been known to be transmitted by cockroaches.

Chemical Fumes

Strong irritating odors often result from volatile gases released from newly purchased carpets, furniture, flooring, glues, adhesives and/or polymer/plastic leveling compounds beneath floors, tiles, or carpeting. Other sources include insulation, plastics, wallpaper, painting, floor finishing, household repairs and remodeling due to "outgassing" or release of fumes.

At times either natural or artificial heating of a synthetic such as vinyl or vinyl-fiber glass (screens) can produce irritating outgassing chemicals. It is a good idea to test for irritating outgassing by exposing yourself to a sample of the material or any glues/adhesive or other potential outgassers prior to carrying out a project if you have known sensitivities. Removing volatile smells can be facilitated by fresh air ventilation and using air cleaners with carbon filters to trap odor molecules.

Carpeting

Carpeting frequently becomes the home for animal dander, mold, dust mites and numerous insects and microorganisms. As human and pet dander as well as food and other organic products fall onto rugs, they will often dissolve into fine dust and penetrate deep into the bottom of the carpet, creating an ideal food supply for dust mites. Dust mite exposure may be a particular problem in crawling infants or young children playing directly on carpeting when these children have eczema, upper respiratory allergies, or asthma. Even deep regular cleaning is of limited use since the supply of food is ongoing.

The carpet or its padding may themselves become important allergens. For example, wool carpets break down over time, releasing wool antigen into the air and causing respiratory symptoms if you are sensitive.

Finally chemical release from carpeting under padding or from glues may cause severe symptoms in allergy, sinus and asthma sufferers. New carpeting often has a chemical smell from outgassing due to 4-PC (styrene-butadiene), a chemical released from the backing. It is best to fresh air ventilate areas with new carpets to remove the outgassing fumes.

Furniture

Furniture that has been exposed to moisture, food, or soiling from humans or pets may harbor insects, mold, dust mites, animal dander, or other important allergens. Bringing a used piece of furniture into your home or moving a piece from a previously humid area in the home (for example, the basement) may bring a new source of allergen and contamination into your living quarters. Each time you sit on an upholstered piece of furniture, you aerosolize some of its content or have direct skin contact, provoking symptoms in the nose, sinuses and/or chest. If you buy used furniture, make sure you know if the previous owners had pets.

Pets

Dogs, cats and other furry mammals (like gerbils, rabbits and rodents) shed allergenic skin dander continuously. Further, "house breaking" accidents lead to aerosolized urine. These potent allergens only cause symptoms if you are sensitive (allergic) to these specific allergens (*see page 50*). Such allergen accumulation can be retained in a home and its furnishings for years after the pet is no longer present. Further, the accumulation of moisture, pet urine and dander often leads to mold contamination which is difficult to remove and in itself can be an important

source of household allergens.

Urine that seeps through carpeting and the wood flooring below can only be removed by removing the carpeting and flooring beneath. For more recommendations on pet dander avoidance, see The Bedroom and Air Cleaners.

Air Conditioning

Air conditioning improves quality of life during the hot summer months. However, while it cools and dehumidifies air, it does not clean it. It may actually contaminate clean air. Room units containing cooling coils that sit outside of the window, and maintenance is often neglected. The coils and filters often become contaminated with mold, bacteria and allergens over time. These contaminants can accumulate and spread to the interior of the unit including the blower fan. Thus, mold and other organisms can be aerosolized in your home, posing serious health problems.

At the end of each season, remove window units and have them cleaned. New filters should be placed in the unit once or twice a season. Air conditioners create condensation that needs to either evaporate or drain out safely. Check that no water accumulation from condensation is feeding a mold problem in your home.

The Bedroom

In addition to the bedroom issues discussed above regarding dust mites, there are other considerations. High room humidity, leaks, excessive sweating under blankets, or just showering play a role in promoting dust mite, mold and bacterial growth. Having a humidifier running excessively in a room can lead to mold and mite contamination. If you have an unusually dry house during the winter (less than 35% relative humidity), use a cool mist humidifier which contains a humidistat. The humidistat shuts the unit down when the proper humidity has been reached. Avoid other types of humidifiers (for example, ultrasonic, steam, or evaporative pad type [paper/filter type] units where a fan blows across a soaked filter).These ultrasonic, steam and evaporative units can easily be contaminated with mold and bacteria and aerosolized allergens.

Plants and fish tanks can be great sources for dust mite, mold and bacteria contamination in the bedroom and should be avoided.

Small pets such as hamsters, gerbils and mice in a bedroom are a source for allergens particularly if they are allowed on bed surfaces. Larger pets including dogs, cats, rabbits, birds, etc should not be allowed in the bedroom because they are also excellent sources of allergens and provide food for dust mites, bacteria and molds.

Filler within stuffed animals may contain strong allergens including vegetable bean and nut products. Stuffed animals and throw pillows may also be sources for dust mite contamination. Once inside the object, dust mites are hard to remove and continue to contaminate clean bedding unless measures are taken to reduce their growth.

Clothing in the room can become contaminated with dust mites. Clothes are prone to this type of contamination when exposed to moisture found in a cool closet with a damp or moldy odor. Dry cleaning may rid clothing of some contamination, but you must also find a dry closet not predisposed to moisture problems. Clothing may also be contaminated by animal dander or pollen from outdoor exposure. It is best to wash clothing immediately after exposure to these allergens.

Bedroom Suggestions for Allergy and Sinus Sufferers

a. Old mattresses and pillows should be replaced with new products. Used ones are usually contaminated with dust mites, etc.

b. Wash all sheets, pillow cases, quilt or comforter covers and mattress pads weekly in very hot water. Dry thoroughly before use.

c. Cover all mattresses, pillows and anything else not washed regularly in dust mite proof encasings.

d. Avoid stuffed animals or extra throw pillows on the bed.

e. Avoid excessive moisture in the bedroom. Check the humidity with a relative humidity meter (hygrometer), keeping it below 45%. Adjust bedding to avoid excessive sweating.

f. Avoid plants and pets/fish tanks in the bedroom. Pets should not lie on your bed.

g. Clean your closets regularly. Make sure the closets have good ventilation and do not smell of mold or mildew.

h. Wash or dry clean clothing frequently. Infrequently used clothes can be tumbled in a warm or hot dryer from time to time.

i. Service any air conditioner, so it will not be a source of mold, bacteria, or dust mite contamination.

j. Avoid scents, perfumes, pesticides, strong odors, or other irritants. Avoid using fabric softeners or fragrances in detergents. If the wash has too strong a laundry odor, double rinse.

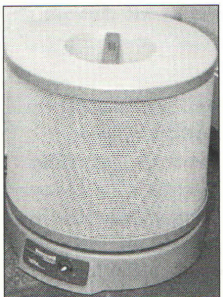
k. Treat the home for cockroaches if present.

I. Remove animals from the home or at least from the bedroom.

m. Use a HEPA filter air cleaner in frequently occupied rooms like bedrooms (see below).

Air Filters

Air cleaners have been used for many years to reduce allergen exposure in the home. Furnaces and air conditioners are normally equipped with panel fiberglass or paper air filters. It is important to recognize that only a tiny fraction of the allergens contained in the home circulate through the central heating system. The main function of these air filters is to prevent dust and dirt from causing malfunction of the equipment in which they are installed.



Unfortunately, they remove only the larger particles (15% or less of all the particles in the air). The effective range of a typical furnace panel air filter, which drops off with the particle size of the pollutants, is less than 5-10 microns in size (a micron is 1/25th of an inch). Particles that are 10 microns or larger include pollen, lint and some dust particles. Particles less than 10 microns in size are visible only with a microscope. Examples of such particles include tobacco smoke (which ranges from 0.01-1.0 microns), dust (which ranges from 0.1-30.0 microns) and smudging particles (which range from 0.1- 5.0 microns).

There are several inexpensive furnace filters that can be used to improve air filtration. Self installed 3M Filtrete™ filters (Ultra 1250 and Micro 1000) are the most efficient (1-888-364-3577 or www.3M.com/filtrete). They have pleated electrostatically charged filters that are very efficient in trapping particles less than 1 micron. They should be replaced every 1-3 months depending on their condition.

Some air cleaners go beyond panel filters in cleansing the air. There are several types of air cleaners available as either central units or room units. Unfortunately, central units range from $30 to $300 and simply replace the filter in the central system with a better panel filter. There are also other types of central air cleaning units which are much more expensive and must be installed by a contractor. The efficiency of these units can differ a great deal and work only when the fan, heating or cooling, is on. Room air cleaners are more portable and are designed to clean the air in an individual room. These devices cost anywhere from $100 to more than $500.They also differ significantly in their effectiveness and depend highly on the quantity of air that they filter and the type of filter used in the unit. Please read product information before purchasing any of these types of air cleaners to be certain that the filter's air flow is adequate for the size of the room in which it is to be used. It is extremely important to determine if the room air cleaner exchanges air between 5 and 6 times per hour.

There are 5 types of filter devices that you can use. The first filters are known as electrostatic precipitators, which provide airborne particles an electrical charge as they pass through an electrical field and causes them to stick to an oppositely charged portion within the filter. A drawback to these specific air cleaner units when used in the bedroom is a clicking or static sound made during dust impaction on the plates within the filter. Electrostatic filters also produce a small amount of ozone that may be irritating if you have allergies, sinus disease, or asthma.

Other filters known as "electrats" use static electricity within the filters to adhere the particles, making the particles stick. These electrostatic and electrat filters require less electricity than other filters, but they may cost more in the long run because of the need to frequently replace them.

The third type of air cleaner device is known as an ionizer, which charges particles within the air, enabling them to stick to walls and surfaces in the room. In actuality, they do little to remove allergens from a room and may actually make a room look dirtier. Ionizers also produce small amounts of ozone.

It is important to remember that air cleaners are one part of an environmental control program and not a shortcut to avoid effective control measures

A fourth type of air cleaner that is widely advertised uses heat to clean and filter the air. This is a relatively new type of air cleaner that has not been adequately studied. There are no replacement filters required with these units.

A final type of air cleaner is known as a HEPA filter, which has been shown in several clinical studies to significantly reduce allergy and asthma symptoms and improve sleep quality. These air cleaners are very effective in removing animal allergens from the air. HEPA filters have an extended surface composed of microscopic glass and synthetic fibers, and they can remove 99.97% of particulate matter, catching particles that are more than 0.3 microns in diameter. These units usually require periodic filter replacement, including a charcoal filter every 3 months and the inner HEPA filter every 6-12 months, depending on the volume of air within the room and the number of hours the unit is turned on daily. Most HEPA filters do produce a white noise when in operation. There are some quiet HEPA filter units available.

An air cleaner will not make dust disappear and is effective only when the air is circulated through it. However, if you live in a home undergoing rennovations or with a dust prone environment that contains carpeting, drapes, pets, smoke, or a gas forced air heating system, an air cleaner such as the HEPA filter can be beneficial in reducing the indoor air pollution. The Asthma Center specialists recommend that an air cleaner be used as an aid to lower airborne animal dander in selected rooms like the bedroom.

An additional aid for removing dust and other airborne particles is to employ a small inexpensive filter that can be fitted over the room air vents, especially in bedrooms where the allergic family member sleeps. This is considered to be a help in homes that have animals for prolonged periods of time.

It is important to remember that air cleaners in general are one part of an environmental control program and not a shortcut to avoid effective control measures. For more information on air cleaners, visit the following websites:

Panel Filters:	www.3M.com/filtrete
HEPA Filters:	www.honeywell.com www.broan.com www.vector-vacuums.com www.whirlpool.com
Certification Agencies:	www.aham.org www.ashrae.org
Electrostatic Precipitators:	www.honeywell.com www.trane.com wwwfriedrich.com www.hoover.com

Air Duct Cleaning

Heating, ventilation and air conditioning (INAC) systems can be a collection site for a variety of contaminants (for example: mold, fungi, bacteria and very small particles of dust) that could adversely affect health. The removal of such contaminants from the HVAC system and home is one component in an overall plan to improve indoor air quality. Duct cleaning generally refers to the cleaning of various heating and cooling system components of these forced air systems, including the supply and return air ducts and registers, grills and diffusers, heat exchangers, heating and cooling coils, condensate drain pans (drip pans), fan motor and fan housing and the air handling unit housing.

According to the Environmental Protection Agency (EPA), knowledge about the potential benefits and possible problems of air duct cleaning is limited. Duct cleaning has never been shown to actually prevent health problems nor do studies conclusively demonstrate that particle (for example, dust) levels in homes increase because of dirty air ducts or decrease after cleaning. This is because much of the dirt that accumulates inside air ducts adheres to duct surfaces and does not necessarily enter the living space. While the debate about the value of duct cleaning continues, no evidence suggests that such cleaning would be detrimental, provided that it is done properly. If a service provider fails to follow proper duct cleaning procedures, duct cleaning can cause indoor air problems. You should consider having your ducts cleaned if:

- There is a substantial visible mold growth inside hard surface (for example, sheet metal) ducts or on other components of your HVAC system.
- Ducts are infested with vermin (rodents or insects).
- Ducts are clogged with excessive amounts of dust and debris and/or particles are actually released into the home from your supply registers. This may happen particularly in newly constructed homes or after extensive home renovations.

Methods of duct cleaning vary. The most effective way to clean HVAC systems is a source removal method. Typically, a service provider will use specialized tools to dislodge dirt and other debris in ducts, then vacuum them out with a high powered vacuum cleaner. The service provider also may propose applying chemical biocides, designed to kill microbiological contaminants, to the inside of the duct work and to other system components. Some service providers may suggest applying chemical treatments (sealants or other encapsulants) to encapsulate or cover the inside surfaces of the air ducts and equipment housings because they believe it will control mold growth or prevent the release of dirt particles or fibers from ducts. These practices have yet to be fully researched and should not be routinely done.

According to the EPA, duct cleaning services typically - but not always - range in cost from $450 - $1000 per HVAC system, depending on the services offered, the size of the system to be cleaned, system accessibility, climactic region, level of contamination and type of duct material.

Air duct cleaning companies must meet stringent requirements to become a National Air Duct Cleaners Association (NADCA) Member. Among those requirements, members must have certified Air System Cleaning Specialists (ASCS) on staff, who have taken and passed the NADCA certification examination. Passing the exam demonstrates extensive knowledge in HVAC design and cleaning methodologies. NADCA members have signed a Code of Ethics to protect the consumer and follow NADCA standards for cleaning. A list of NADCA members can be obtained at www.nadca.com.

A thorough visual inspection is the best way to verify the cleanliness of your HVAC system. Some service providers use remote photography to document conditions inside ducts. All portions of the system should be visibly clean; you should not be able to detect any debris with the naked eye. For a comprehensive post cleaning consumer checklist, visit the EPA website at www.epa.gov. The EPA recommends that you show this checklist to the service provider before the work begins. After completing the job, the service provider should show you each component of your system to verify that the job was performed satisfactorily.

For more information on air duct cleaning, contact the following:

U.S. Environmental Protection Agency (EPA) Office of Radiation and Indoor Air
Indoor Environments Division
1200 Pennsylvania Avenue NW Washington, DC 20460
202-564-7076
www.epa.gov

North American Insulation Manufacturers Association (NAIMA)
11 Canal Center Plaza #103, Alexandria, VA 22314Alexandria, VA 22314
703-684-0084
www.naima.org

National Air Duct Cleaners Association (NADCA)
1518 K Street Nw, Suite 503
Washington, DC 20005
202-737-2926
www.nadca.com

Indoor Air Quality Information Clearinghouse (IAQ Info)
600 Maryland Ave SW
Washington, DC 20024
202-484-1307

Water Sources

Bathrooms

Leaks and excessive moisture are the main problems that lead to mold growth and other biological contamination and possible wood damage in the home.

Sinks

Sink faucets and valves are often a source of leaks. Water can leak into the vanity, rotting the wood and promoting mold growth. Water falling behind the vanity along the wall because of improper installation or worn caulking can lead to undetected rot and mold growth. Similar problems can occur with poorly installed tubs and showers.

If your bathroom smells like mold, look for it because it is likely present.

Toilets

Check for water leaks and excessive condensation. If the toilet leaks or tips from side to side, have it repaired. If the wax ring on which the toilet sits is broken, a water stain may be noted on the ceiling below. Sewer gas may leak into the bathroom, causing an unpleasant odor and, perhaps, symptoms.

Showers and Tubs

Water leaking out of the shower onto the floor can get under tiles if caulking or grouting is not monitored properly. As the water accumulates, the floors and subfloor can rot and be a source for mold contamination. There is no telling where this water and mold contamination may go within the house, possibly causing severe allergy or toxic symptoms. Keep your shower curtain in the tub and prevent unnecessary leaks. Replace the shower curtain or its liner when it begins to smell or becomes discolored. Make sure that shower glass door railings are properly caulked and water tight. The undersurface of shower doors is also a common source of mold growth and should be periodically cleaned with a fungicidal bleach solution.

Dry out your shower after bathing. After you shower, dissipate moisture and mold growth by opening shower curtains or doors, turning on the exhaust fan, opening a window and/or keeping the bathroom door open to permit adequate circulation. These simple measures will hasten the drying of the damp ceiling, walls, flooring, shower curtains, walls and materials in order to prevent mold growth.

Moisture accumulating on bathroom walls or ceilings may be enhanced due to the rapid cooling of these surfaces from high room humidity immediately following a shower. The rapid cooling is usually due to poor insulation between the outside of the home and the surface area. In such a situation, the moisture in the air has had a chance to dissipate, and condensation onto walls or ceilings is promoted by the unusually cool surfaces.

Dust rich in organic debris is a great food source for mold growth. Dust all rooms regularly that are exposed to moisture. Also check air conditioning or heating ducts entering a bathroom to determine that they are clean and filtered.

Black grout mold usually lives just below the surface and can be dissolved with a diluted bleach solution.

Chapter 11 Nonallergic Nasal Conditions

Nonallergic Rhinitis

Nonallergic rhinitis is a diagnosis of exclusion in which no allergic, structural, or systemic cause can be found to explain rhinitis symptoms. There is no universally accepted definition of perennial nonallergic rhinitis, though a useful description is that it is a disease that persists over 9 months each year and produces 2 or more of the following symptoms: watery or mucous secretions, nasal congestion and/or sneezing. The symptoms are due to a hyperreactive nasal mucosa (nasal lining) which is responsive to nonspecific triggers. These conditions do not respond to allergy shots.

Vasomotor Rhinitis

Vasomotor rhinitis is a form of nonallergic rhinitis. This term has been used to describe rhinitis symptoms associated with changes in temperature, barometric pressure or relative humidity, alcohol, odors, bright lights, or hot, spicy foods. Symptoms can be variable and consist mainly of stuffy and runny nose; sneezing and itching occur less commonly. The mechanism which accounts for vasomotor rhinitis is unknown. Treatment consists of mucolytic agents, nasal corticosteroids nasal antihistamines, oral decongestants and nasal anticholinergic agents. Vasomotor rhinits often accompaines allergic rhinitis.

Gustatory Rhinitis

Gustatory rhinitis is another form of nonallergic rhinitis. This term describes a syndrome of abundant watery nasal discharge immediately following ingestion of typically hot, spicy foods. This mechanism most likely is mediated by the vagus nerve which is stimulated by eating. Treatment with nasal anticholinergics prior to eating may offer some relief.

Nonallergic Rhinitis with Eosinophilia Syndrome

Nonallergic rhinitis with eosinophilia syndrome (NARES) is a form of perennial nonallergic rhinitis defined by the following characteristics: perennial (year round). symptoms of sneezing, profuse watery, runny nose and nasal itching, eosinophilia (the presence of eosinophils) on nasal smear and no evidence of allergies on skin testing or by blood tests. The cause of the syndrome is unclear. Nasal corticosteroids, oral/ nasal antihistamines, mucolytics and nasal anticholinergic agents are used to treat this condition.

Atrophic Rhinitis

Primary atrophic rhinitis is a form of rhinitis which occurs in elderly individuals due to reduced blood flow to the nasal membranes. Symptoms include nasal congestion and a constant foul odor in the nose caused by thick dry crusts. The condition is characterized by progressive atrophy (deterioration) of the lining of the nose from reduced blood flow to the nasal membranes. You may experience associated headaches and chronic sinusitis. A secondary form of atrophic rhinitis can result from chronic nasal infections, chronic sinusitis, nasal surgery, trauma and radiation. Salt water irrigation and emollient ointments are usually helpful for atrophic rhinitis.

Rhinitis Associated with Systemic Disease

Rhinitis can be seen as a complication of multiple systemic diseases. The most notable association of rhinitis with a concomitant chronic illness is its association with thyroid disease. Increased nasal secretions in hypothyroidism have been noted in several clinical studies. Nasal congestion has been noted in up to 64% of individuals with hypothyroidism, and complaints of excessive nasal discharge and "recurrent colds" have been noted in up to 55% of individuals with hypothyroidism.

Other systemic diseases that have been linked with rhinitis include migraine (*see page 37*), kidney failure, diabetes mellitus, Wegener granulomatosis, Sjogren syndrome, sarcoidosis, relapsing polychondritis and midline granuloma. Rhinitis may be the first symptom detected in these disorders. A variety of unusual infections have been found to cause chronic nasal symptoms. These infections include tuberculosis, syphilis, leprosy, sporotrichosis, blastomycocis, histoplasmosis and coccidioidomycocis. These infections usually cause nasal ulcers and related crust formation which can lead to nasal blockage and/or bleeding.

Adequate treatment of rhinitis associated with systemic diseases requires treatment of the underlying disorders. In some circumstances, nasal biopsies may be required to make a diagnosis.

Nasal and Sinus Tumors

Benign and malignant nasal and sinus tumors are rare, though they may be a cause of rhinitis and sinus symptoms. Tumors can block the nasal airway as well as cause bleeding, reduced sense of smell and pain. Nasal cancers have been associated with prolonged occupational exposure to chemicals such as nickel, wood or leather dusts, chromate, formaldehyde and chlorophenol. Early presumptive diagnosis of these tumors may be possible through use of CT or MRI scans. Nasal and sinus tumors typically require biopsy and/or surgical excision by an ENT surgeon

Rhinitis Associated with Pregnancy

Significant nasal symptoms occur in approximately 30% of pregnant women. Pregnancy associated hormonal changes have direct and indirect effects on nasal blood flow and mucous glands which result in rhinitis symptoms.

Nasal symptoms may begin with pregnancy or may be an extension of preexisting chronic rhinitis. Women who have nasal symptoms that begin with pregnancy may experience vasomotor rhinitis of pregnancy. Symptoms associated with this syndrome are present only during pregnancy, tend to be most prominent in the second half of pregnancy and usually disappear within 5 days of delivery.

Preexisting chronic rhinitis, similar to asthma, can improve, worsen, or remain unchanged during pregnancy. In a clinical study of 348 pregnant women with preexisting rhinitis (90% with allergies), nasal symptoms worsened during pregnancy in 34% of these women, improved in 15% and remained unchanged in 45%. The incidence of sinusitis during pregnancy has been reported to be 1.5%, a 6-fold increase over the non-pregnant population.

Appropriate treatment of rhinitis during pregnancy involves identification of the cause of the rhinitis and the use of acceptable medications which are safe in pregnancy.

Rhinitis Associated with Medications

Recent pharmacological studies have suggested that patients taking Alpha-1 adrenergic antagonists, also known as alpha blockers, for benign prostate hyperplasia (BPH) may be at risk for developing rhinitis. BPH is a medical condition affecting men where the prostate enlarges and slows or blocks urine flow. Alpha blockers relax the muscle of the prostate and bladder neck, which allows urine to flow more easily. Common alpha blockers include terazosin (Hytrin®), doxazosin (Cardura®), tamsulosin (Flomax®), alfuzosin (Uroxatral®), and silodosin (Rapaflo®).

Part Three

Treatment for Sinusitis and Upper Respiratory Allergies

Chapter 12 Medical Treatments for Allergies and Sinusitis

There are three common treatments for allergic rhinitis (hayfever) and related sinusitis: avoidance of offending allergens (*see Environmental Avoidance, Chapter 10*), medications to relieve symptoms and immunotherapy to reduce the underlying allergic reaction (*see Allergy Injections/Immunotherapy, Chapter 9*). The medical treatment of allergic rhinitis and sinusitis is similar, but there are some key exceptions (*see Table 21*). Antibiotics are frequently used in the treatment of acute and chronic sinusitis (*see Sinusitis: Types, Diagnosis and Treatment, Chapter 2*). In contrast, antibiotics are never used for allergic rhinitis unless there is a complicating infection in the ears, nose, throat, sinuses, or chest.

Table 21

Medical Treatments of Allergies and Sinusitis

	Allergies	Sinusitis
Antibiotics	None except with an infectious complication	Yes
Decongestants	Yes	Yes
Corticosteroids- nasal and sometimes oral	Yes	Yes
Mucolytics-mucous thinners	Yes	Yes
Antihistamines	Yes	No, Rarely used unless allergies present
Anticholinergic Sprays	Yes	Yes
Leukotriene modifiers	Yes	Yes
Immunizations-Influenza/Pnuemoccocus	No	Yes
Salt water sprays and irrigation	Yes	Yes

Besides antibiotics, there are several classes of medications commonly used to treat both allergy and sinus symptoms. However, the dose, formulation and frequency may vary. Instructions should be followed precisely for the best results. All side effects should be reviewed with your physician. The following is a summary of the common medications used for sinusitis and allergic rhinitis.

Decongestants

Nasal decongestants cannot be used for more than 3-5 days due to "rebound" nasal congestion

Decongestants are usually quite effective for controlling symptoms of nasal and sinus congestion. Swollen, inflamed mucous membranes cause congestion. By constricting blood vessels in swollen mucous membranes, these tissues shrink and therefore decongest because constricted blood vessels allow for less fluid to leak into the inflamed tissues. Decongestants may cause several side effects. These include: nervousness, tremor, palpitations, insomnia, decreased appetite, fast heart rate, increased blood pressure and urinary retention in males with prostate enlargement.

Nasal decongestants are sprayed directly into the nose. They may relieve congestion without system wide side effects. However, nasal decongestants (nasal sprays) can not be used for more than 3-5 days due to "rebound" nasal congestion. "Rebound" nasal congestion occurs when turbinate swelling quickly returns (often more severely) or "rebounds" following frequent use of nasal decongestants. A vicious cycle of repetitive use of these sprays to treat rebound congestion makes it difficult to stop using the nasal decongestant spray. Congestion quickly returns following use of the nasal spray causing you to feel dependent on the spray. It is not unusual to see people "hooked" on nasal decongestant sprays, carrying a large spray bottle in their pockets and needing to use it every few hours. Nasal decongestant sprays can be purchased over the counter. There are many generic and brand name products. Some well known brands include: Afrin®, Neo-Synephrine® and 4-Way® Nasal Spray. The active ingredients are often oxymetazoline, xylometazoline, or naphazoline.

Decongestants can be used if you have controlled high blood pressure; however, blood pressure should be monitored frequently during initial use of any decongestant

Decongestant tablets, capsules and liquids are available both over the counter and by prescription. Decongestants may be combined with other active ingredients, like pain medicines, antihistamines and mucous thinners. Pseudoephedrine and phenylephrine are the most commonly used oral decongestants. Phenylephrine has recently been shown not to be effective in reducing nasal congestion. Some common over the counter brands (actually behind the counter since you have to ask for the product but do not require a prescription) containing decongestant combinations include: Advil® Cold and Sinus, Claritin D®, Dimetapp®, Sudafed®, Triaminic®, Tylenol® Sinus, Allegra-D®, and Zyrtec-D®. Frequently prescribed products containing decongestants include: Semprex-D®, and Clarinex D®.

Decongestants should not be used if you have uncontrolled high blood pressure, prostate enlargement, overactive thyroid conditions, or insomnia. Decongestants can be used if you have controlled high blood pressure; however, blood pressure should be monitored frequently during initial use of any decongestant. You should avoid decongestants if you have a history of recent strokes, severe heartbeat irregularities, or unstable angina (chest pain). It is possible you may experience sleeplessness when taking decongestants. This side effect can be decreased by using lower doses and/or shorter acting products early in the morning. If you are taking MAO inhibitors like phenelzine sulfate (Nardil®), tranylcypromine sulfate (Parnate®), or isocarboxazid (Marplan®) (for treatment of depression), you should avoid decongestants altogether.

If in the past you have experienced jumpiness, jitters, palpitations, or a racy feeling from oral decongestants, an oral tolerance induction program may be recommended. This program involves a progressive slow dose increase, starting with very low doses given daily. The dose is gradually increased over 1-2 months. A slow increase of decongestants over time often prevents the racy feelings formerly experienced.

In this way, doses that achieve nasal and sinus decongestion can be reached without side effects. Such tolerance usually remains effective while the medicine is maintained on a daily basis. If you stop taking decongestants, the tolerance is lost, and the program will need to be repeated

Table 22 includes some common decongestants.

Table 22

Decongestants/ Drying agents

Drying Agents

Pamine (methscopolamine) 2.5mg; 5mg

Robinul (glycopyrrolate) 1mg

Decongestants

Sudafed (pseudoephedrine) 15mg/5ml

Sudafed 12°;24°(pseudoephedrine hydrochloride 120mg; 240mg)

Sudafed PE (phenylephrine) 10mg

Mucolytics/Expectorants

Mucolytic/expectorant medications can change the physical properties of the mucus by thinning it. They also increase the ability of the cilia to clear and drain mucus (*see Mucociliary Clearance, page 11*). Thinner mucus may be more easily penetrated by other medications such as antibiotics.

Guaifenesin is the most commonly prescribed mucolytic. Effective doses are only slightly lower than doses that typically cause nausea and vomiting. Taking guaifenesin with food may decrease the side effects. Guaifenesin is found in many over the counter liquid cough medications. It is often taken in doses too low to be optimally effective. Guaifenesin is also available in tablet form over the counter (Mucinex®) or in combination with a decongestant or cough medication. Examples include: Mucinex®D, and Mucinex®DM.

Iodinated glycerol and other iodine based mucolytics were widely used in the past. However, they may cause thyroid problems if used for lengthy periods of time or during pregnancy. N-acetylcysteine is also an expectorant. It has limited use for sinusitis and allergic rhinitis and may be quite irritating.

Table 23 includes some common mucolytics/expectorants.

Table 23

Mucolytics/Expectorants

Mucinex (guaifenesin) (OTC) 600mg /1200mg

Mucinex (guaifenesin) (Children's) (OTC) 100mg/5ml liquid

Mucinex Mini Melts(OTC) (guaifenesin) 100 mg

Oral Corticosteroids

Oral corticosteroids such as Medrol® (methylprednisolone) or Deltasone® (prednisone) are sometimes used to treat sinusitis or severe allergies. Corticosteroids decrease inflammation in the sinuses and nose. In fact, they are the most effective anti-inflammatory medications available. With decreased inflammation, the mucous membranes lining the sinus cavities and nose shrink back toward their normal size. Corticosteroids are often used along with antibiotics, allowing the antibiotic better entry into inflamed tissue. Corticosteroids are also useful in shrinking nasal polyps. However, after corticosteroid treatment stops, polyps often return to their previous size. Oral corticosteroids are also used to treat allergic fungal sinusitis. Sometimes, extended courses of corticosteroids may be necessary to control this condition. However, as with polyps, symptoms can return once corticosteroids are stopped.

Oral corticosteroids have many side effects which limit their long term use. Short term use can cause increased appetite, increased energy, weight gain, stomach irritation, ulceration, irritability and acne. Long term use can cause more significant problems such as osteoporosis (demineralization of the bones), glaucoma, cataracts, diabetes and loss of body salts and minerals. An unusual but rare complication that can occur with short or long term use of corticosteroids is avascular necrosis. This serious bone condition usually affects the hips and may ultimately require surgery. Fortunately, the risk of developing avascular necrosis is very low, and the benefits of corticosteroids typically outweigh the remote risk of this condition.

Long term use of oral corticosteroids can also cause adrenal insufficiency. The adrenal gland normally secretes vital hormones known as corticosteroids. With oral corticosteroid use longer than a month, the adrenal gland may be suppressed in secreting corticosteroids important for normal body function. Very long courses, especially with high doses, can cause the adrenal gland to stop working completely. The adrenal gland will restart after stopping corticosteroids. However, it may take months to years for the adrenal gland to recover completely.

The daily secretion of corticosteroids is essential to remaining healthy. This is particularly important when the body is under physical stress (for example: severe illness or infection, surgery, or physical trauma). If a person undergoes surgery, the body normally responds to this physical stress by secreting 5-10 times the usual amount of natural corticosteroids. The adrenal gland response is also required for other important body functions. If you have been on oral corticosteroid medications and require surgery, an assessment for risks from adrenal insufficiency should be undertaken. Supplementary corticosteroids before, during, or after surgery may be required.

Corticosteroids should not be confused with anabolic steroids (testosterone) which are used and/or abused by body builders and other athletes. Anabolic steroids can be toxic to the liver.

Nasal Corticosteroids

Use of nasal corticosteroid sprays is a good way to benefit from corticosteroid medications without suffering system wide complications due to oral corticosteroids.

Nasal corticosteroids help to shrink nasal tissue swelling over time. However nasal corticosteroids do not reach the inside of the sinus cavities unless the patient has had previous sinus surgery to open up the sinus ostia. These anti-inflammatory sprays can also keep drainage pathways open. Corticosteroid nasal sprays can relieve sinus inflammation caused by allergies, decrease nonallergic inflammation and shrink nasal polyps. Nasal corticosteroids for acute sinusitis have been shown to decrease the severity and duration of symptoms. There are many different brands (*see Table 24*), many of which are over the counter. They usually take a few days to have full effect. Nasal corticosteroids are most effective if they are used on a daily basis. Unlike decongestant nasal sprays, nasal corticosteroid sprays are not addictive. Nasal corticosteroids do not cause a rebound effect (*see page 74)*. Nasal corticosteroids can be administered by sprays, aerosols, nasal irrigation, or by nasal drops.

There is some potential controversy concerning the use of nasal corticosteroids in children. Physicians and parents are concerned about growth suppression. This concern is mostly focused on the long term regular use of nasal corticosteroids, frequent repeated short term use of oral corticosteroids, or persistent use of high dose inhaled corticosteroids for asthma. Fortunately, very little corticosteroid is absorbed into the bloodstream from the majority of nasal corticosteroid sprays. Corticosteroid effects can be further minimized by using brands that permit only low absorption into the bloodstream and/or have been shown through studies not to affect growth. The Asthma Center physicians recommend that growth in children using any form of corticosteroids be tracked using a stadiometer. This state of the art instrument accurately measures height. Long term height measurements are then used to assess whether growth suppression is an issue before the problem becomes significant.

Table 24 includes some common nasal sprays and corticosteroids

Table 24 Nasal sprays and Nasal corticosteroids

Astelin (azelastine) 0.1% / Astepro 0.15% (nasal antihistamine)
Atrovent Nasal Spray (ipratroprium) 0.03% ; 0.06% (nasal anticholinergic)
Afrin (OTC) 0.05%(oxymetazoline) (squeeze bottle version) (nasal corticosteroid)
Dymista (azelastine/fluticasone) (combination nasal antihistamine and corticosteroid)
Flonase (fluticasone) (OTC) (nasal corticosteroid)
Nasacort Allergy 24 hrs (triamcinolone acetonide) (OTC) (nasal corticosteroid)
Nasarel (flunisolide) (nasal corticosteroid)
Rhinocort Allergy (OTC)(budesonide) (nasal corticosteroid)
Omnaris (ciclesonide) (nasal corticosteroid)
Patanase (olopatadine hydrochloride) (nasal antihistamine)
Nasonex (mometasone furoate) (nasal corticosteroid)
Qnasl (beclomethasone) 40mcg; 80mcg (nasal corticosteroid)
Veramyst (fluticasone) (nasal corticosteroid)

Nasal sprays and Nasal corticosteroids continued

Zetonna (ciclesonide) (nasal corticosteroid)

Saline Solution/Gel (Ocean, Ayr, Baby Ayr) (OTC)

Sinus Buster (capsaicin) OTC

Saline Irrigation with:

Pulmicort (Budesonide) 0.5mg/2ml (corticosteroid)
Mupirocin 2%-3" strip
Ipratropium (0.02%) (anticholinergic)

Anticholinergics

Anticholinergic drugs are a class of medications that can reduce mucous production. This class of medications may be effective where others fail. Topical anti-cholinergics are applied to the nose. Atrovent® (0.03%, 0.06%) spray (ipratropium bromide) is used for watery post nasal drip and clear runny nose. It may not be useful for thickened secretions. Anticholinergic medication is generally very well tolerated. However, it occasionally may cause excessive nasal drying, crusting, bleeding and, rarely, rashes. This medication should be avoided if you have narrow-angle glaucoma, prostate enlargement, or bladder obstruction.

Oral anticholinergic agents are also available by prescription. These products usually contain methscopolamine, glycopyrrolate, scopolamine, or hyoscyamine. They help dry secretions without producing sedation. Some of the older antihistamines like Benadryl®, Chlor-Trimeton® and Atarax® have anticholinergic properties, although they are not classified as anticholinergic drugs. Like nasal anticholinergics, oral anticholinergics should be avoided if you have narrow-angle glaucoma, prostate enlargement, or bladder obstruction.

Some common anticholinergic medications are listed in Table 25.

Table 25

Anticholinergics

Atrovent® Nasal Spray 0.03%

Atrovent® Nasal Spray 0.06%

Ipratropium Nasal Spray 0.03%

Ipratropium Nasal Spray 0.06%

Levbid® (ER) Tablet (hyoscyamine) 0.375mg

Levsin®/SL Tablets (hyoscyamine) 0.125mg

Levsin® Elixir (hyoscyamine) 0.125mg/5mL

Levsin® Drops (hyoscyamine) 0.125mg.mL

Levsinex® Timecaps (hyoscyamine) 0.375mg

Robinul® glycopyrrolate 1 mg

Antihistamines

Antihistamines are medications that have some similarities in structure to histamines that cause allergic reactions. Histamines are released during allergic reactions. They cause sneezing, itching and watery mucus in the upper airway. Antihistamines work by attaching to the same receptors that histamines use to cause allergic symptoms. By occupying these sites, they effectively block histamines from causing allergic symptoms. Therefore, antihistamines prevent the effects of histamines. It is common to have sinus symptoms and mistakenly reach for over the counter antihistamines for relief. Antihistamines are effective if you have allergies but may or may not play a role in sinusitis. Older antihistamines (for example, Benadryl®) have a drying effect. This drying effect can thicken secretions. This can actually lead to more sinus problems. Second generation antihistamine products like Claritin®, Allegra®, Clarinex® Zyrtec® and Xyzl® do not have drying effects. However, they still have a limited role in treatment of sinusitis unless allergies are present. Azelastine(Astelin®) and olopatadine (Patanase®) are currently the only antihistamines available for nasal use. They usually wor within 30-45 minutes after application to the nose and have a unique ability to decrease nasal congestion. Many of the commonly used over the counter and prescription antihistamines are listed below in Tables 26 and 27. Some are antihistamines alone while others are combination products with decongestants, mucolytics, or drying agents.

Table 26 Antihistamines

Allegra (fexofenadine) (OTC) 30mg (ODT) 60mg; 180mg mg; oral susp (30mg/5ml)
Atarax (hydroxyzine) 10mg; 25mg; syrup (10mg/5ml)
Benadryl (diphenhydramine) (OTC) 25 mg pill; elixir (12.5mg/5ml)
Chlorpheniramine maleate (OTC) 4mg;12 mg; syrup (2mg/5ml)
Clarinex (desloratadine) 2.5mg; 5mg (ODT*); 5mg pill; syrup (2.5mg/5ml)
Claritin (loratadine) (OTC) 10mg; 5mg chewable; syrup (5mg/5ml)
Claritin Reditabs (loratadine) (OTC) 10mg
Xyzal (levocetirizine) 5 mg; syrup (2.5mg/5ml)
Zyrtec (cetirizine) (OTC) 5mg chewable pill; 10mg pill; syrup (5mg/5ml)

Table 27 Antihistamines with decongestants

Allegra D 12hrs; 24hrs(OTC) (fexofenadine 60mg;180mg; pseudoephedrine 120mg;240mg)
Bromfed DM Syrup (brompheniramine 2mg; pseudoephedrine 30mg; dextromethorphan 10mg/5ml
Clarinex D 12hrs; 24hrs (desloratadine 5mg/10mg; pseudoephedrine 120mg/240mg)
Claritin D12hrs; 24hrs(OTC) (loratadine 5mg; 10mg; pseudoephedrine l20mg/240mg)
Dimetapp(OTC) (brompheniramine maleate 2mg; phenylephrine HCL 5mg/10ml)

Antihistamines with decongestants continued

Semprex D (acrivastine 5mg; pseudoephedrine 60mg)
Zyrtec D 12hrs(OTC)(cetirizine 5mg; pseudoephedrine 120mg)

Leukotriene Modifiers

Leukotrienes are chemicals generated from several inflammatory cells in mucosal tissues lining the nose and sinus passageways. Leukotrienes are released in sites of allergic inflammation such as the nose, sinus mucosa, eyes, lungs and skin. Studies have shown that leukotrienes are formed through a specific series of chemical reactions at the time of allergic inflammation. The chemical reactions occur in a specific order known as the leukotriene pathway. Leukotriene mediators activate leukotriene receptors on tissue causing tissue swelling, mucous production and leaking of fluid from mucosal blood vessels (edema). Receptors for leukotrienes have been found in nasal and sinus tissue and in high concentrations in nasal polyps. After exposure to allergens or irritants, leukotrienes are released from the mucous membranes of the nose, sinuses and/or chest causing symptoms of swelling and obstruction. These reactions can lead to osteomeatal complex blockage (*see page 11*), reduced mucociliary clearance (*see page 11*) and subsequent increased risk for sinusitis (*see page 13*).

Leukotriene modifiers have been available since 1997 for treatment of asthma. Examples of these medications are Singulair® (montelukast), Accolate® (zafirlukast) and Zyflo® (Ziluton) (*see Table 28*). By modifying leukotriene effects, they reduce the symptoms of allergies, asthma and, possibly, sinusitis and nasal polyps. Although leukotriene modifiers are used for treatment of sinusitis and nasal polyps, especially for those with aspirin intolerance, it is an "off-label" use and not yet in alignment with FDA recommendations. Side effects are uncommon, but they include headache, nausea, stomach upset, pain, fever, muscle ache, fatigue, sore throat, laryngitis and liver enzyme elevation. The Asthma Center physicians recommend that you are monitored for these side effects. Blood tests for liver enzymes may be drawn during the course of treatment with leukotriene modifiers.

Table 28

Luekotriene Modifiers

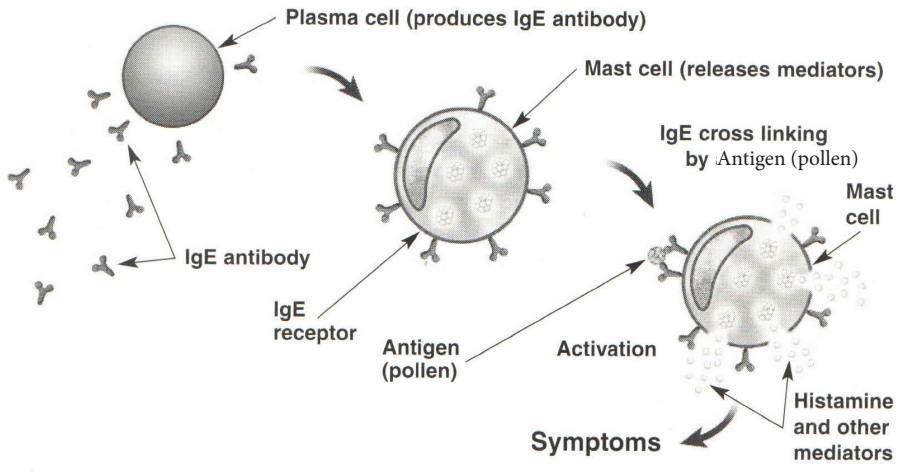
Accolate (zafirlukast) 10mg; 20 mg
Singulair (montelukast) 4mg chewable; granules (Age 2-5); 5mg chewable (Age 6-14); 10mg (Age 15+)
Zyflo (zilueton) CR 600 mg

Xolair® (Anti-IgE Therapy)

Xolair® (omalizumab) is the first in a new class of medications that are specifically bioengineered to target IgE (the antibody at the source of allergic reactions) in the treatment of allergic disease and, in particular, asthma and chronic hives. This injectable treatment is indicated if you have moderate to severe allergic asthma or chronic hives and have not responded to comprehensive therapy. Unlike current pharmaceutical treatments, Xolair® represents a revolutionary approach to the management of asthma through immunological modulation of the role of lgE in allergic asthma. Its mechanism of action in hives is unknown.

Xolair® is indicated for the treatment of adults and adolescents over the age of 6 years with moderate to severe persistent allergic asthma and adults and adolocents 12 years and older with chronic hives. It has been shown to be helpful for allergic rhinitis, particularly in reducing and/or preventing nasal polyps, but is not approved by the FDA for this indication. In order to qualify individuals for Xolair® treatment, the presence of allergy should be confirmed by an elevated total serum IgE level and allergy testing. Although Xolair® is currently indicated for the treatment of allergic asthma, it also appears to be effective in treating respiratory symptoms involving the ears, nose, throat and sinuses. New biologics may also be efficacious, including those which target IL-4, IL-5, and IL-13 (chemical mediators in the allergic cascade).

Figure 23 Allergic Cascade with Mast Cell, IgE and Mediator Release



Selected individuals with asthma and allergies and/or sinusitis have noted significant improvements in symptoms of allergies and sinus conditions with Xolair® therapy.

Mucolytics

Mucolytics are agents used to facilitate drainage of nasal and sinus secretions. Although they are found to be helpful by many, currently there is little scientific evidence to document their effectiveness. These products, especially guaifenesin, are commonly combined with other agents like antihistamines and decongestants.

Analgesics

Analgesics are pain relieving medications. If you have sinusitis, you will often feel pain and pressure and require pain relief. If you are aspirin tolerant, aspirin or other non steroidal anti-inflammatory drug (NSAID) products can be helpful in relieving pain. Precautions should be taken if you have underlying gastrointestinal problems (like GE reflux, gastritis, peptic ulcer disease) or bleeding problems. Children and adolescents should avoid using aspirin since it is linked with Reye's Syndrome which can affect children. However, NSAIDs like Motrin® may be used for this age group. If you are aspirin intolerant, Tylenol® or the newer COX2 NSAIDs (for example, Celebrex®, Mobic®) may be appropriate. First doses of these products, however, should be taken in a physician's office to ensure safety. Use of aspirin and aspirin desensitization for sinusitis and nasal polyps is discussed on page 38.

Immunizations and Sinusitis

Since viral upper respiratory illnesses trigger most cases of acute sinusitis or flare ups of chronic sinusitis, a yearly influenza vaccine is usually advisable. Influenza or "flu" commonly causes a respiratory illness much worse than the common cold. It can cause infection associated with severe swelling of tissues in the sinuses, ears, throat and lungs. Flu vaccines are indicated in anyone six months or older. If you have chronic medical conditions such as chronic sinusitis, recurrent acute sinusitis and/or persistent asthma, it is especially recommended that you receive a yearly influenza vaccination. Also, if you are over 65, you are a candidate for the high potency flu shot as your age makes you less likely to have an effective immune response to the conventional dose of the flu caccine. Flu vaccinations are administered by injection into the arm. Side effects occur in less than 10% of individuals. Side effects include local shot site soreness and swelling and mild fever. The flu vaccine is given between September and March.

A second vaccination which is helpful for preventing recurrent or chronic sinusitis is the pneumococcal vaccine (Pneumovax®, Prevnar®). These vaccines protect you from several strains of Streptococcus pneumoniae organisms. These organisms commonly cause bacterial respiratory infections including sinusitis. If you are under 65, this vaccine should be repeated in 10 years. Side effects are seen in less than 10% of individuals. Side effects include tenderness, redness and swelling at the site of injection -usually the upper arm. These vaccines can be given any time of the year. Influenza and pneumococcal vaccines are not indicated for uncomplicated allergic rhinitis.

Chapter 13

Complementary and Alternative Medicine Treatments for Sinusitis and Allergic Rhinitis

There is a growing trend among Americans to seek out complementary and alternative treatments for chronic medical problems including sinusitis and allergic rhinitis. In recent polls, 42% of adults use alternative treatments alone; 58% use such treatments along with standard medical care. It is estimated that in the United States, consumers spend nearly $17 billion annually on a variety of complementary supplements. These include vitamins, minerals, herbs, botanical products and sports nutrition products.

Complementary and alternative therapies are distinct terms. Complementary remedies are added to standard medical treatments. Alternative therapies replace standard medical care. In the past, complementary and alternative therapies failed to gain widespread approval by physicians for treatment of sinus and allergic disease. A lack of scientific evidence for the advertised claims, lack of standardization of contents and lack of regulatory supervision over the manufacturing of products have resulted in a lack of credibility as to whether these therapies are safe and/or effective. Today, physicians are more knowledgeable about alternative treatments. However, until scientific evidence supports their use, many treatments should be considered only after careful evaluation. Basically, it is "Buyer Beware" since these are unregulated and, in many cases, still unproven therapies. While some complementary therapies may be helpful, others are clear quackery. **Remember that "natural" does not necessarily mean safe or effective.** You may consider trying these remedies as long as they make you feel better, are not harmful and do not interfere with your prescribed medications. It is important to inform your physician of any complementary or alternative therapies you have taken since they may interfere with the effectiveness of conventional medicine.

Remember that "natural" does not necessarily mean safe or effective

Although most of these therapies lack scientific support, a discussion of their potential benefits and risks is warranted. Complementary and alternative medicines that have been suggested as helpful for sinusitis and/or allergies include: acupuncture/acupressure, reflexology, massage, chiropractic therapy, relaxation techniques, biofeedback, breathing exercises, yoga, hydrotherapy, moist heat, water therapy, homeopathy, herbal remedies, nutritional supplements, antioxidants and aromatherapy.

Acupuncture/Acupressure

Acupuncture is an ancient Chinese practice. It is based on the theory that your body has a natural flow of energy or chi. That energy travels along 14 pathways in the body to maintain good health. When the flow of chi is disrupted, pain or disease such as sinusitis occurs. Blocking these paths through acupuncture provides relief through the restoration of normal flow. The technique of acupuncture is performed by inserting very fine needles into your skin at specific points.

These needles are typically rotated by hand. A mild electric current can also be applied to the acupuncture needle. You generally, should not feel discomfort related to the needle. Some technicians may apply heat, pressure, friction, suction, or electromagnetic impulses to further stimulate the acupuncture needles.

Acupressure is a technique in which the practitioner uses his or her hands to stimulate certain points on the skin. This procedure also can be self applied without the need of a practitioner. Pressure is applied for 5 minutes at specific pressure points. It unblocks the pathways and restores the natural flow of chi.

Acupuncture or acupressure may cause the body to release certain hormones called endorphins. Endorphins help relieve pain. They also add to the feeling of relaxation. Studies have shown that other hormones like, serotonin, may also be released by acupuncture. This adds to the calm feeling associated with this treatment.

There are very specific acupuncture points used for sinusitis and upper respiratory allergies. However, there are limited studies showing the effectiveness of acupuncture and acupressure in the treatment of sinusitis or allergic rhinitis. The American Academy of Otolaryngology-Head and Neck Surgery list acupuncture as a treatment option for allergic rhinitis ,but they cite a low level of evidence. A more recent study found that patients who undergo acupuncture had decreased sneezing and itching of the ears and palate at the end of four weeks of therapy and a sustained improvement for an additional four weeks after therapy was completed. These patients, however, lacked significant change in many other primary and secondary outcome measurements and, therefore, more studies are needed to elucidate the benefits of acupuncture over traditional pharmacological therapy.

If you are considering acupuncture, choosing a practitioner who has proper credentials is important. Acupuncturists receive certification from a number of agencies: The American Academy of Medical Acupuncture (310-379-8261 or *www.medicalacupuncture.org*), The American Association of Oriental Medicine (866-455-7999 or *www.aaaomonline.org*) and/or The National Certification Commission for Acupuncture and Oriental Medicine (904-598-1005 or *www.nccaom.org*). Some states also issue certification as well. New Jersey requires certification for acupuncturists. To see if an acupuncturist is licensed in New Jersey, you may call the Acupuncture Examining Board at 973-273-8092.You can also visit their website at *www.njconsumeraffairs.gov/acu*. Pennsylvania requires acupuncturists to register with the State Board of Medicine or State Board of Osteopathic Medicine. To see if an acupuncturist is registered in Pennsylvania, you may call the Pennsylvania State Board of Medicine at 717-783-1400.You can also visit their website at *www.dos.state.pa.us/bpoa/site/default.asp*.

Reflexology

Reflexology is a form of massage therapy. The idea behind reflexology is that there are reflex areas in your hands and feet corresponding to every part of your body. Applying pressure to these areas leads to healing. There is no clear scientific evidence that reflexology is effective or explains its mechanism. Nevertheless, a recent study suggests that chronic sinusitis may respond to this form of massage therapy. For sinus disease and nasal congestion, daily massage on the tips of the fingers and the toes with the thumb and index finger for 20-30 seconds is usually enough force to relieve some discomfort. There is no current certification for practitioners of reflexology.

Massage

You may find that massaging the sinus areas relieves pain, pressure and headache. Massage may help your body's ability to counter pain by producing endorphins. Massaging sinuses may also bring a fresh blood supply into the area. The State Board of Nursing regulates massage therapist licensing in New Jersey. To see if a massage therapist is licensed in New Jersey, you may call the State Board of Nursing at 973-504-6430. You can also visit the Consumer Affairs website at *www.njconsumeraffairs.gov* to verify if a massage therapist is licensed. The State Board of Massage Therapy regulates and licenses persons providing massage therapy services to the general public in the Commonwealth of Pennsylvania. They can be reached at 717-783-7155 or by visiting *www.dos.pa.gov/ProfessionalLicensing/BoardsCommissions/MassageTherapy/Pages/default.aspx*

Chiropractic Therapy

Chiropractic therapy is another alternative method for treating sinus and allergic disease. It is based on the theory that abnormal positioning of spinal bones interferes with healthy nerve impulses. Chiropractors believe these nerve impulses control all body functions. Chiropractors believe sinus drainage, nasal congestion and headaches may be triggered by nerve impulses caused by misalignment of spinal bones. Practitioners correct the abnormal spinal bone positioning. The technique is called "adjustment" or "spinal manipulation." These adjustments return the spinal bones to a more normal position. This is supposed to relieve pain and ill health. You may experience relief with subtle spinal adjustments. There is no scientific evidence to prove the effectiveness of this therapy for sinus and allergic diseases. However, there are few side effects to this therapy. Chiropractors do not have prescription licenses but often incorporate herbs, vitamins and other therapies with their manipulation treatment.

New Jersey requires certification for chiropractors. To see if a chiropractor is licensed in New Jersey, you may call the State Board of Chiropractic Examiners at 973-504-6395. You can also visit their website at *http://www.njconsumeraffairs.gov/chi.* Pennsylvania also requires certification for chiropractors. To see if a chiropractor is licensed in Pennsylvania, you may call the Pennsylvania Department of State, Bureau of Professional and Occupational affairs at 717-787-8503. You can also visit their licensing verification website at *https://www.mylicense.state.pa.us*

Relaxation Techniques

Many alternative approaches can reduce stress, including: biofeedback, breathing exercises, meditation and yoga. These methods are thought to help control the pain, stress and anxiety associated with sinusitis and severe allergic rhinitis. They also are thought to have general healing properties

Biofeedback

Biofeedback is a relaxation method for chronic pain management. Electrodes are placed on your forehead. These sensors measure electrical activity related to body functions such as breathing, pulse rate and muscle contractions that may be due to tension.

Feedback from the sensors may show whether or not you are successfully controlling your body functions. The idea is to allow you to learn how to consciously relax your own muscles. You can learn techniques such as imagery, concentration, or visualization to control your body. There have been no specific studies showing the effectiveness of biofeedback for the treatment of sinus pain or nasal congestion.

Breathing Exercises and Meditation

Breathing relaxation techniques are helpful if you become anxious from illness. Anxiety produces rapid, shallow breathing with occasional shortness of breath and tension. Deep breathing exercises may counter this feeling. It could actually have a calming effect on your body. Breathing exercises are usually done by focusing on taking deep breaths for several seconds and then slowly exhaling. These exercises should be done while sitting in a quiet, peaceful room. Stress may also be controlled through a variety of meditation techniques. The goal is to develop a state of relaxation while remaining awake. In transcendental meditation, focusing on one sound or one word (mantra) while sitting quietly and breathing deeply may create this level of relaxation.

Yoga

Meditative processes associated with yoga may provide mental calmness. The calmness can help conditions connected with chronic pain and tension. Individuals who practice yoga traditionally chant a mantra (Om). This helps in concentrating and focusing the mind. This simple chant may have a benefit if you have sinusitis. Recent studies have shown that the sound vibrations from chanting can aid in opening the sinuses. Researchers found that healthy sinuses have high nitrous oxide levels on exhalation. This suggests that air is better ventilated between the sinuses and the nose. When the mouth is closed and a humming sound like "Om" is made, similar results were found. Chanting and humming, therefore, may create sound vibrations which encourage air flow between sinus membranes and nasal passages. These practices may help enhance proper sinus drainage. They also keep the sinuses free of infection.

Hydrotherapy

Hydrotherapy is the use of water to promote healing. Hydrotherapy may be achieved through steam inhalation, nasal irrigation, or warm compresses. These techniques help loosen nasal secretions and cleanse nasal passages of mucus. They also improve drainage and breathing. For aromatic steam, several herbal remedies to soothe inflamed nasal and sinus membranes have been suggested:

1. Put 2 teaspoons of chopped fresh ginger into steaming water in a sink, warm mist humidifier, or tea kettle. After the ginger tea is simmered for 20 minutes, drape a towel over your head and breathe in the steam for 4 -5 minutes
2. Add 1 teaspoon of over the counter Vicks® VapoRub® ointment to steaming water. Breathe in the steam for several minutes.
3. Add a few drops of eucalyptus, peppermint, or menthol into steaming water. Alternatively, put a drop of eucalyptus oil into hot water, drape a towel over the head and inhale the steam.

Another technique of hydrotherapy involves alternating hot and cold compresses on the sinus area every 2 minutes. Repeating this 3 times a day reduces congestion and opens the sinuses. For more information on therapeutic nasal irrigation, see the section on nasal saline irrigation on page 89.

Aromatherapy

Aromatherapy has been used for many centuries. It is a method for soothing the body and mind. Essential oils are distilled from plants, flowers, trees, roots and herbs. These oils have a comforting smell that can be used for medicinal purposes. The theory is that the sense of smell sends chemical impulses to several parts of the brain. The positive effects of pleasant scents may reduce anxiety, some skin conditions, pain, blood pressure, headache and cigarette craving. Currently, no research supports aromatherapy for sinusitis or allergic rhinitis. However, many popular respiratory products with aromatic smells are widely used for upper and lower respiratory conditions. Such products include Vicks® VapoRub®, Sinus Buster ®, capsaicin and Tiger Balm. These products may include eucalyptus, menthol, anise, fennel and tolu balsam.

Homeopathic remedies are exempt from FDA "safe and effective" requirements

Homeotherapy

Homeopathy is based on the concept that natural substances (plants, roots, etc.) given in large amounts cause symptoms. However, when given in extremely small doses, these same natural substances can actually cure or prevent symptoms. A basic homeopathic principle is that the more dilute a substance is, the more effective. There are no well done published clinical trials in the medical literature supporting the idea that homeopathic remedies work. In fact, prior to World War II, all medical schools in the United States teaching homeopathy were closed or abandoned homeopathy as part of their educational program because it lacked a scientific basis.

It is said, but not proven, that homeopathy focuses on subtle, yet powerful, electromagnetic forces. These forces are thought to heal through activation of the immune response. Homeopathic remedies are made from plant, animal, or mineral substances. Only the most dilute substances are used. This is thought to ensure that only the smallest, most effective traces of the active ingredient remain. The Food and Drug Administration (FDA) does not regulate the manufacturing, labeling and dispensing of homeopathic remedies. Homeopathic remedies appeal to some people because they are often labeled as "natural" and are so diluted that they rarely cause side effects.

Several unsupported studies contend that homeopathic remedies such as Zicam® may help in improving allergic rhinitis and sinus symptoms. They are thought to reduce the symptoms of flu and asthma. The benefit of homeopathic treatments seems to be more than a placebo effect in some small poorly designed trials. Response to homeopathic treatments is usually within one week. Their long term effectiveness, however, has not been established. The NIH supported National Center for Complementary and Alternative Medicine has stated that "systematic reviews have not found homeopathy to be a definitively proven treatment for any medical condition." One product labeled as a homeopathic remedy - "Sinus Buster"- is a topical capsaicin product that has been studied and shown to to be effective for non-allergic rhinitis and post nasal drip.

Many homeopathic remedies have been recommended for the treatment of acute sinusitis and allergic rhinitis (*see Table 29*). Individual doses and strengths may vary. Homeopathic medications come in liquid drops, syrups, tiny sugar pills, or ointments. Homeopathic medication can be self administered from off the shelf remedies or administered under the guidance of a homeopathic practitioner. Homeopathic remedies may at times cause allergic reactions since they may contain animal and plant proteins.

Table 29 Common Homeopathic Remedies for Allergy and Sinus Problems

Remedy	**Ailment**
Allium cepa	Allergy, cold
Ambrosia	Itchy, watery eyes; congestion
Apis	Sore throat, upper respiratory infection
Arsenicum	Asthma symptoms
Arundo	Watery or itchy eyes, runny nose
Belladona	Sinus pain, swelling and congestion
Bryonia	Headache
Chamomillia	Earache
Ephrasia	Allergy
Gelsemium	Headache
Hepar sulfur	Sinus infection
Histaminum	Itching, swelling and overall allergic response
Kali bichromicum	Stringy postnasal drip, Sinus pain
Mercurius	Sinus pain
Natrum mur	Hayfever
Nux vomica silicea	Acute sinusitis
Sabadilla	Sneezing, watery eyes
Solidago	Runny nose
Spigella	Sinus pain
Wyethia	Itching throat, difficulty swallowing

Nasal saline irrigation

Nasal saline irrigation works by promoting mucociliary clearance through the removal of mucus, pus and crusted materials.

Nasal saline irrigation is an inexpensive, safe and effective treatment for sinusitis. It also helps relieve symptoms of allergic rhinitis, nonallergic rhinitis, nasal dryness and the common cold. This simple process involves flushing the nose with liquid or aerosolized saline (salt water). Nasal saline irrigation can be valuable in managing flares of sinusitis. It can reduce or even eliminate the need for frequent and/or prolonged courses of antibiotics and other sinus medications. This action decreases adverse reactions to antibiotics and prevents the emergence of difficult to treat antibiotic resistant strains of bacteria. Nasal saline irrigation has been used safely in both adults and children. It has no documented serious adverse effects except for a case of a parasitic brain infection that occured with using contaminated well water in a nasal irrigation system. Most individuals with chronic sinusitis using daily saline irrigation have improved symptoms, improved quality of life and decreased medication use, including antibiotics.

Nasal saline irrigation works by promoting mucociliary clearance (*see page 11*) through the removal of mucus, pus, superficial bacteria and viruses and crusted materials. It also moistens the lining of the nose and sinuses and thins mucus. Nasal saline irrigation maximizes the benefit of jointly administered sinus and nasal medications.

Saline solutions for use in nasal sinus irrigation can be purchased in pharmacies. Examples are Ocean® Nasal Spray and Blairex® Broncho Saline® or generic nasal saline. Alternatively, saline solutions can be made at home by mixing 1/2 teaspoon of non iodized salt in 8 ounces of sterile distilled water (contains no minerals). The unused portion of the homemade saline can be refrigerated and used for up to 5 days.

Nasal saline can be sprayed in the nose as a mist or sniffed in or squirted in with a bulb syringe or squeeze bottle or poured in with a netipot. The saline can then exit the nasal passageway or pass through the back of the throat.

Nasal Saline Irrigation Devices

There are many nasal saline irrigation devices currently available for both adults and children. Six of the most popular and effective include:

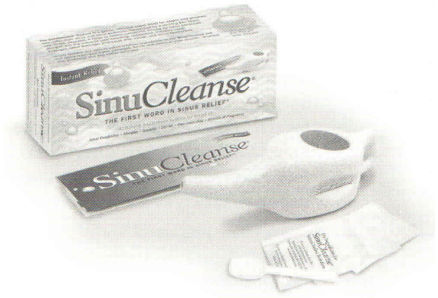
1. SinuCleanse® Complete Sinus Irrigation System (*see Figure 23*)
2. SinuNEB™ system
3. NasoNEB® system (*see Figure 24*)
4. NeilMed Sinus Rinse Bottle (*see Figure 25*)
5. Grossan Hydro Pulse Nasal/Sinus Irrigation System® (*see Figure 26*)
6. Pretz® Solution and Ponaris® Emollient

The following is a brief review of the highlights of each device.

The SinuCleanse® Neti Pot System

The SinuCleanse® Neti Pot System is a gentle, effective, safe and simple to use method of nasal saline irrigation for adults and children. It was inspired by the "nettie pot." The nettie pot is a fragile glass or ceramic device shaped like a teapot. It has been used for centuries in India to clean the nasal passages during yoga. The SinuCleanse® System consists of a plastic "nettie pot" and 10 premixed, premeasured packets of ingredients for making the SinuCleanse® Natural Saline Solution. The salt solution contains no additives. Nasal saline irrigation with the SinuCleanse® System, or other similar neti pot systems can be performed on a daily or an "as needed" basis. It is simple to use and comes with detailed instructions.

Figure 24 The SinuCleanse® Complete Sinus Irrigation System



The neti pot should be cleansed after each use with warm water and gentle detergent. The neti pot is also top rack dishwasher safe. The neti pot is intended for use by one individual. Children and adults unable to blow their noses should not use a neti pot. An adult should help children. If you have persistent drainage or blockage, discomfort from nasal irrigations, or nasal bleeding or pain, you should discontinue neti pot use.

The SinuCleanse® System does not require a prescription and it can be obtained directly from Med-Systems, Inc. at 1-888-547-5492 or www.sinucleanse.com. The NeilMed NasaFlo neti pot is available at neilmed.com or by calling 1-877-477-8633

SinuNEB™ system

The SinuNEB™ System aerosolizes antibiotics and other medications directly into the target areas of the nose and sinuses. It can also be used for nasal saline irrigation. The SinuNEB™ System consists of an air compressor, tubing and a nebulizer with a nose piece and a medication reservoir. The system is assembled and the medications and/or saline solutions are administered according to physician recommendations.

Safety Considerations: This system is not used for lung medications. Condensation in the tubing is a common occurrence during nebulization. If you see water in the tubing after a treatment, let the compressor run for 2 - 3 minutes with only the tubing attached. Also you may dry the tubing by removing it from the compressor and draining the water into the sink. Hang the tubing up with the ends down and allow it to fully air dry. To keep the compressor free from

dust, store it in the original packaging when not in use. Clean the parts by washing them with a mild liquid detergent. They may also be washed by placing them in the silverware basket in your dishwasher. Once dry, reassemble the nebulizer for the next day's treatment.

The air filter in the compressor is designed to last for 500 hours of normal use. Check the condition of the filter after 10-12 treatments. If it appears soiled (gray), clogged, or wet, replace the filter. New filters are available by calling SinusPharmacy at l-877-SINUS44 (1-877-746-8744).

SinuNEB™ is available only by prescription. It can be ordered directly with Sinus Pharmacy at www.sinuspharmacy.com or by calling l -877-SINUS44.

NasoNEB® system

The NasoNEB® system is similar to the SinuNEB™ system in that it aerosolizes antibiotics and other medications directly into the target areas of the nose and sinuses. The NasoNEB® system delivers large particles that are readily filtered by the nose to ensure a large percentage of medication is delivered to the nasal passages and paranasal sinuses, and that no drug is delivered to the lungs, reducing the risk of unwanted complications. Several clinical studies have demonstrated a reduction in the amount of baceteria in the target areas after antibiotic administration with NasoNEB®.

Treatment and saftey considerations: During treatment, it is important to keep the back of your throat open so the air has somewhere to exit. Treatment should take 1-2 minutes and should not exceed 5 minutes, regardless of how much drug is left in the cup. Intially, treatment may loosen some crusts in the nose, resulting in minor nose bleeds and irritation in the nose. Gently cleaning the nose after use may reduce irritation and improve healing.

NasoNEB® is available only by prescription. Dispensing pharmacies can be found by going to *www.nasoneb.com* or by calling 1-866-960-9833.

Figure 25 NasoNEB® System

NeilMed® Sinus Rinse Bottle

The NeilMed® sinus rinse is a saline based solution used to cleanse the nose and sinuses. It has been shown to improve nasal congestion and symptoms associated with excess mucous production, as well as night time cough, constant throat clearning, and fullness and pressure in the sinuses. The NeilMed® bottle works by delivering a high volume isotonic solution at low pressure to the nasal sinuses which when used in conjunction with corticosteroids greatly improves nasal symptoms associated with sinusitis.

Treatment and saftey considerations: The NeilMed® sinus rinse is safe for use in children 5 and older. It is important to use clean and previously boiled, distilled or filtered water through a 0.2 micron filter for nasal irrigation. The use of tap water is not recommended because the source is unknown. Homemade saline solutions should never be used as these may contain impurites which will irriate the nasal passageway and sinuses. The product is safe for use daily or as needed, but the bottle should be replaced every 3 months.

There are no medications in the solution and, therefore, a prescription is not necessary. The NeilMed® sinus rinse bottle can be bought over the counter at most major pharmacies. For additional information visit *www.neilmed.com* or call 1-877-477-8633.

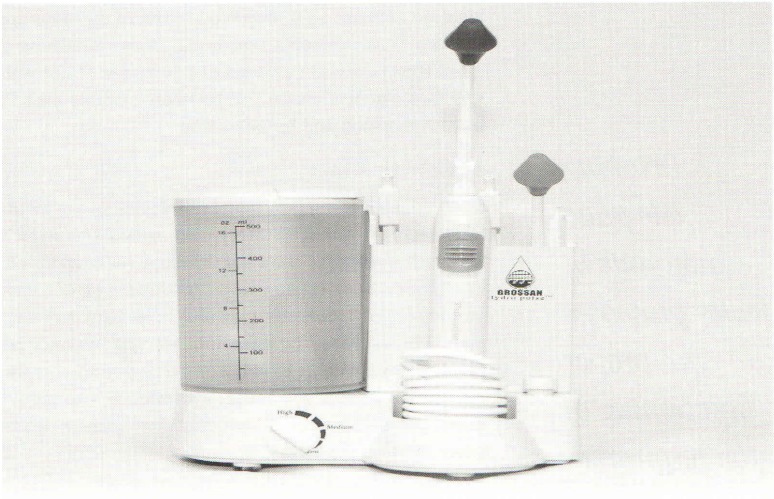
Figure 26 NeilMed® Sinus Rinse Bottle

The Grossan Hydro Pulse Nasal/Sinus Irrigation System®

The Grossan Hydro Pulse Nasal/Sinus Irrigation System® is a device which uses "pulsating irrigation." The unit consists of a Grossan sinus irrigator tip attached to a WaterPik oral irrigator. The Grossan tip is a cone shaped silicon nasal adapter from which the saline irrigation fluid is expelled under pressure in a pulsating flow. This pressure is adjustable by the control knobs on the WaterPik. The irrigation solution can be a homemade saline solution (1/2 teaspoon salt in 8 ounces of distilled water). The solution can also be made by adding a spoonful of "Sinusal" (supplied by Grossan) to the WaterPik receptacle and dissolving with warm water. The Grossan tip is easy to use and is applied alternatively to each nostril. During the irrigation, the head should be slightly bent forward. The fluid is directed into one nostril and drained out the other. The irrigation is done with approximately 500mL of saline solution. The entire process lasts 3-4 minutes. Antibiotics or corticosteroid solutions/suspensions can be added to the irrigation fluid when necessary.

Nasal irrigation with the Grossan Hydro Pulse Nasal/Sinus Irrigation System® has been performed for 30 years. It has proven effective and safe for adults and children down to 4 years of age. It can be obtained from pharmacies without a prescription. More information on this product can be found at www.grossan.com.

Figure 27 Grossan Hydro Pulse Nasal/Sinus Irrigation System®



Pretz® solution and Ponaris® emollient

Pretz® solution is based on Dr. Pretz's original formulation of 3% glycerin in saline initially developed in the early 1900s.The present day solution also contains Yerba Santa, an additional moisturizer. With the combination of glycerin and Yerba Santa, Pretz® solution is less drying than a standard saline irrigation solution.

Pretz® solution reduces crusting, dryness and congestion. It also lubricates and soothes inflamed tissues. Pretz® solution can be used safely as often as needed with no rebound effect.

The Pretz® product line includes:

- Pretz® Irrigation: a nasal and sinus irrigation solution in an 8-ounce bottle; it has an angled spout which gets up into the sinuses for maximum benefit;
- Pretz® Spray: a moisturizing solution in a nasal spray bottle

Pretz® solution is available over the counter in pharmacies. You can find more information on this product at wwwparnellpharm.com/Pretz.htm.

Ponaris is another over the counter mucosal emollient that can be applied directly to the nose through a nasal dropper or nebulizer. It is made of essential oils of cajeput, eucalyptus and peppermint. These ingredients are prepared in cotton seed oil. It has a soothing and moisturizing effect on dry nasal membranes.

Drinking adequate amounts of water promotes proper functioning of the respiratory tract.

Moist heat

If you suffer from sinus disease, sinus pressure and/or nasal congestion, you may also find relief with the application of moist heat. Application of moist heat may actually increase drainage as well as blood flow to the sinus area. Moist heat can be applied through: warm showers, which also allows inhalation of steam; application of warm, moist towels; use of moist heating pads; use of hot water bottles with damp cloths; or special moist heat packs. This technique can be used to decrease the pain of sinus and nasal congestion and inflammation.

Drinking Water

Many specialists suggest that drinking adequate amounts of water promotes proper functioning of the respiratory tract. It helps moisten mucus and clear secretions. Some specialists recommend drinking water as much as 8 or more eight ounce glasses of water a day. Having water readily accessible makes frequent drinking easier. Liquids other than water may also help. However, caffeinated beverages and alcohol should be avoided. The minimum amount of water needed may be figured out by dividing your weight in half. For every pound, you should drink 1 ounce of water per day. For instance, if you weigh 150 pounds, you would require (150/2) 75 ounces of water per day. Caution should be taken with excess water ingestion which may pose other medical problems.

Herbal Remedies

An excellent source of information on herbal medicine is the Physicians' Desk Reference (PDR) for Herbal Medicines.

Herbal medicine uses different parts of a plant including flowers, fruit, bark, seeds and vines to treat disease. These parts are made into medicinal remedies. Traditional herbal therapies have been the mainstay of many Eastern and Western medicinal styles including Chinese medicine, Ayurvedic medicine (Eastern Indian), Native American medicine (naturopathic) and homeopathy. In fact, 80% of the world's population uses herbal medicine of some kind. In the United States, use and sale of herbal treatments have increased, reaching into the multimillion dollar range. They are available in grocery stores, drug stores and health food or natural food stores. Herbal remedies can be in a variety of forms including: liquid or capsules; as a tincture made from the whole herb in an alcohol solution; or an extract made from one or more parts of the herb. Extracts are usually diluted in a solution of water and alcohol. These are considered more potent than tinctures.

Choosing remedies can be somewhat confusing. They vary widely from manufacturer to manufacturer. The exact contents on the product label may not necessarily be present in the amounts stated. Some ingredients may not be listed on labels. In addition, products can be contaminated with other ingredients like pesticides, heavy metals, or other unapproved drugs. For example, a recent study found that 14 of 70 Ayurvedic herbal medicines made in South Asia, but marketed in the United States, contained high levels of lead, mercury and/or arsenic.

It is important to realize that dosing with herbs is an inexact science. The potencies may vary from batch to batch or between manufacturers. The Dietary Supplement, Health and Education Act passed in 1994 has categorized herbal therapies as supplements. Therefore, the same Food and Drug Administration (FDA) guidelines that govern prescription or over the counter medications do not apply to herbal remedies. In fact, as long as products were marketed prior to 1994, an herbal manufacturer is not required to provide the FDA with any information regarding adverse effects of the product. An excellent source of information on herbal medicine is the Physicians' Desk Reference® (PDR®) for Herbal Medicines™. This is a monograph that features over 700 profiles on medicinal herbs. Many of the findings include comments by the German regulatory authority called Commission E. This is a highly regarded world authority on herbal medications. The PhytoPharm US. Institute of Phytopharmaceuticals has reviewed other remedies extensively. These are also included in the PDR® for Herbal Medicines™. The products are listed in generic form, not under proprietary names. Discussions include different names for the herbal remedies, descriptions of the botanical parts used, the actions and pharmacologies of the herbs, contraindications, adverse events and dosages.

A number of herbal remedies have been used successfully for upper respiratory allergies and sinusitis. Two recent studies have shown the benefits of butterbur, also known as butter dock or bog rhubarb, for seasonal allergic rhinitis and a dry mixture of 11 traditional Chinese herbs for perennial allergic rhinitis.

Nutritional/Dietary Supplements

Vitamin C, although widely taken for common colds, has not been scientifically proven to prevent them.

Vitamins and minerals in doses larger than daily allowances have been suggested to improve the body's natural defenses against many illnesses. Such treatments are often used for colds. They may also prevent acute sinusitis. These products include zinc and Vitamin C. Zinc is available as a lozenge, nasal gel, or pill. Studies on the effectiveness of zinc in reducing infection length have had varied success. Some studies have shown zinc's benefit. Others have found that zinc has no effect on infection length. Zinc should be taken according to a recommended dosing regime. Excessive amounts of zinc can lead to nausea and vomiting. It can also affect serum high density lipoprotein (HDL) and cholesterol levels. Vitamin C, although widely taken for common colds, has not been scientifically proven to prevent them. It is possible that larger doses could reduce the duration of symptoms. However, diarrhea, nausea and vomiting may also occur with large doses. A recent study reported subjects on 800 mg/day of Vitamin E had less nasal symptoms compared to placebo. Vitamin E supplements may have some value in some individuals with seasonal allergic rhinitis, but more work needs to be done to confirm this observation.

Nutritional supplements including vitamins, minerals, herbs and other compounds are not regulated by the federal government. This is different than prescription medications where manufacturers must meet strict standards by the FDA for safety, efficacy and quality of manufacturing. With unregulated supplements, the products may or may not contain what is claimed on the label and may contain impurities.

Quality Control Labels

The nongovernmental, nonprofit organization known as U.S. Pharmacopeia (USP) is a well respected and recognized agency that sets quality standards for pharmaceutical products. Recently USP has started a Dietary Supplement Verification Program (DSVP). This program signifies that a dietary supplement has undergone vigorous independent tests by the USP. The DSVP mark on a supplemental bottle assures consumers that the product contains the ingredients at the stated strengths and has been tested for purity and disintegration properties. It also verifies that products are manufactured in sanitary environments. This program only certifies products that are legally marketed in the United States. Post marketing assessments ensure that manufacturers continue to follow USP manufacturing guidelines. The DSVP mark, however, does not mean that the product is safe or has a health benefit. Details on the DSVP mark can be found online at http://www.usp.org/dietary-supplements/overview

Two other private organizations have certification programs for nutritional supplements. The best known is ConsumerLab.com. ConsumerLab buys products through various sources (retail stores, internet, marketing companies) and does independent testing on the products. Tests are done for ingredients, strength, contamination and dissolubility. A product passing the test may display a label - CL "Approved Product Quality" Seal. The National Sanitation Foundation (NSF) International - known for testing water products - also tests dietary supplements. Testing is done by NSF labs, and products will display the NSF mark.

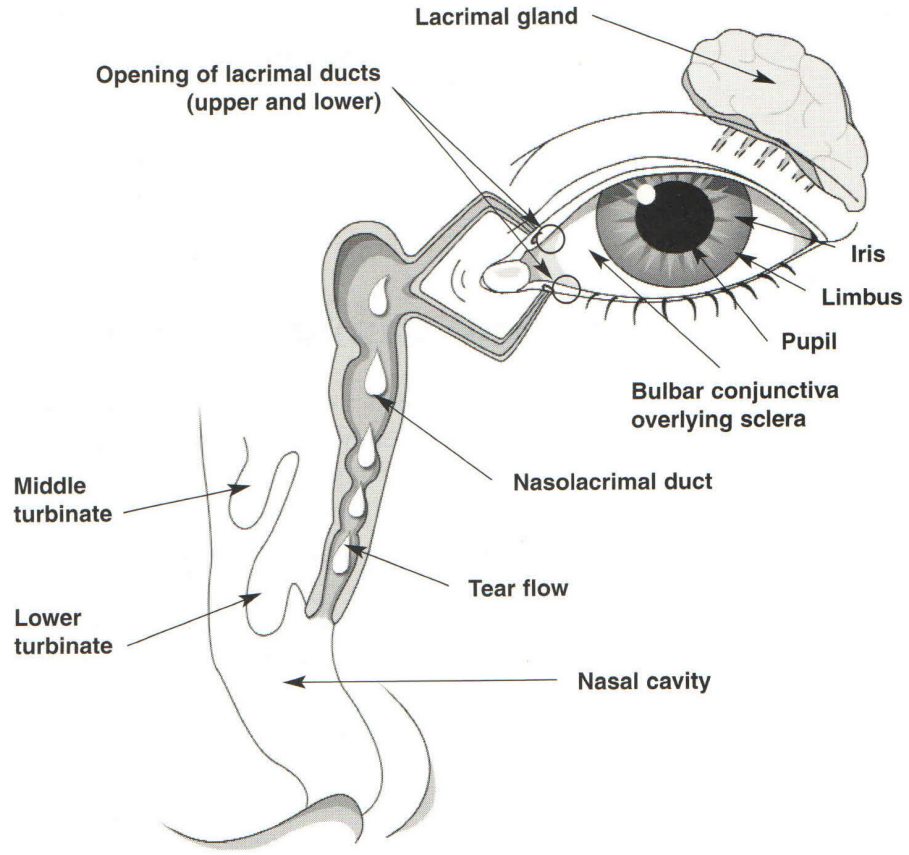
Antioxidants

Antioxidants are nutritional supplements. They help neutralize free radicals formed in the body. Free radicals are oxygen byproducts that can have both toxic and swelling effects on different body tissues. Antioxidant therapy, including Vitamin E and beta carotene, has been recommended to prevent these effects. Taking a daily multivitamin with Vitamin E and beta carotene may help in the treatment and prevention of sinusitis. Large doses of Vitamin E and/or beta carotene, however, have not been effective. Fresh fruits and vegetables contain antioxidants and some products have been formulated to optimize on the antioxidant contents of some fruits and vegetables. These products are currently being studied for their anti-inflammatory effects in upper and lower respiratory allergic conditions.

Part Four

Allergic Eye Disorders

Figure 28 Eye Anatomy



The eye is commonly involved in allergic reactions. The conjunctiva is the part of the eye that is most frequently affected during common allergic reactions involving air borne allergens. The conjunctiva consists of a clear membrane covering the white of the eye and the inside of the eyelid. It begins at the eyelid edge and covers the inside of the eyelid, including most of the white of the eye (sclera) up to the limbus. The limbus is the point where the conjunctiva ends and the cornea begins. The cornea is made out of a tough transparent tissue that is needed for vision. For a complete view of the eye anatomy, see Figure 28 above.

The conjunctiva is loose tissue, rich in fluids, blood vessels and cells. Some of the cells like mast cells are rich in chemical mediators (histamines) involved in allergic reactions (*see page 48*). Bound to the mast cell surface are hundreds of thousands of IgE receptors which can attach to allergens such as pollen, dust mite and animal dander. When airborne allergens contact the conjunctiva, they can attach to IgE antibodies on the mast cell surface, beginning an allergic reaction in the eye. Once mediators are released from mast cells, the conjunctiva blood vessels respond by opening and leaking fluids. The eye becomes red, inflamed, swollen and very itchy.

Allergic conditions of the eyes or tissue around the eyes include the following:

- Allergic conjunctivitis (seasonal or perennial)
- Atopic keratoconjunctivitis
- Vernal keratoconjunctivitis
- Giant papillary conjunctivitis
- Allergic conditions involving the eyelid including contact dermatitis and atopic dermatitis (not discussed in this manual)

Chapter 14 Allergic Conjunctivitis

Allergic conjunctivitis is a common allergic problem involving the conjunctiva of the eyes. It is most frequently associated with symptoms of itchy, watery eyes often occurring during the spring and fall allergy seasons. Repeatedly rubbing the eyes perpetuates the itchy feeling and creates a repetitive cycle of itching.

Allergic conjunctivitis may be seasonal, tiggered by spring and fall pollen. Symptoms may also be year round with exposure to allergens such as dust mites, indoor molds, or pet dander. Symptoms may also be episodic, occuring with intermittent exposure to specific allergens such as pets.

Seasonal allergic conjunctivitis is the most common allergic disease affecting the eye. Symptoms can be severe and quite intolerable, but not dangerous since they do not cause any permanent damage to the eye. The disease usually is self limiting with avoidance of the allergen. Seasonal allergic conjunctivitis occurs more frequently than perennial allergic conjunctivitis. Symptoms typically occur in the spring and fall, depending on your specific sensitivities and the time and extent of pollination.

Perennial allergic conjunctivitis typically results from exposure to dust mites, animal dander and/or mold or other allergens that are present year round in home or work environments. Because of constant exposure to these allergens, symptoms are year round and similar to the symptoms of the seasonal condition. However, they may wax and wane depending on indoor allergen concentrations.

Allergic conjunctivitis is a common problem. More than 25% of the population suffer from nasal allergy symptoms. At least half of these allergy sufferers have some symptoms of allergic conjunctivitis. On occasion, allergic conjunctivitis can occur alone, without nasal or sinus symptoms

If you suffer from allergic conjunctivitis, you may develop dark discoloration or circles below your eyes, often called “allergic shiners.” You may complain of fullness in your eyes or perhaps a burning sensation. The eyes often tear and may become swollen or even swell shut in severe cases. Your eyes may be red or appear normal, even though the itching is quite severe. You may complain of intolerance to bright lights (photophobia),

or occasionally have blurred vision. When symptoms are severe, the need to rub your eyes may become overwhelming because of the intense itching.

Diagnosis

Diagnosis of allergic conjunctivitis is based on presentation of typical allergic symptoms in the nose and eyes (*see Table 30*) and a skin test or laboratory study which confirms allergies. Symptoms usually affect both eyes. Most of the time, symptoms are clearly linked to the outdoors, work, or home allergen exposures. Walking into a house and suddenly experiencing itchy eyes when exposed to a pet makes the diagnosis obvious.

However, year round symptoms that increase and decrease without a clear cause can make the diagnosis of allergic conjunctivitis quite difficult, especially if it is complicated by other concurrent medical problems such as dry eyes or other eye disease.

Because you may know what tends to affect you, you may be able to specifically identify the offending allergen(s). Allergy skin tests should support the diagnosis. These tests can also assist in designing environmental controls (*see Environmental Avoidance, page 58)* and in formulating an allergy serum if allergy injection therapy (*see Allergy Injections, page 56*) is necessary.

Nonallergic conditions need to be considered and ruled out before the final diagnosis of allergic conjunctivitis is made. Among these considerations are:

- Dry eyes (and watery eyes as overcompensation for dryness)
- Presence of a foreign body/particle
- Overuse of eye medications (topical decongestants used to "get the red out") can cause red, irritated eyes even after all allergic or other symptoms have resolved; in this case, the treatment actually causes the disease
- Cosmetic or other contact allergy of the eyelids
- Contact lens related problems
- Medication induced conjunctivitis
- Work environment and hobbies - nonspecific air pollution from work or hobbies can cause irritated, red, watery, burning, or stinging eyes
- Atopic dermatitis
- Eye or Eyelid Infections: Eye infections may be difficult to exclude early in the development of eye symptoms since they may be similar to that of allergy. Eye infections usually begin in one eye at a time, while allergy usually affects both eyes at the same time. The discharge from an infected eye may begin as clear but often becomes cloudy or discolored with time. In contrast, allergic conjunctivitis is always associated with a clear discharge. Eye infections may be associated with swelling or tenderness of the small lymph nodes in front of the ear, while this is not observed in allergic conjunctivitis.

Table 30 Common Types and Symptoms of Allergic Conjunctivitis

	Allergic	Viral	Bacterial
Primary Complaints	Itching, often severe	Burning, irritation discomfort	Irritation
Tearing	Profuse	Profuse	Moderate
Discharge	Minimal pinkish or milky	Minimal	Profuse, purulent (pus)
Redness	Gerneralized	Gerneralized	Gerneralized
Other Findings	Nasal and/or chest symptoms	Occasional sore throat and fever	Occasional lid swelling

Itching and tearing may cause you great distress, interfering with your ability to read, concentrate, work, attend school, or even sleep. If you experience these problems, the following treatments are available:

- HEPA filters can limit exposure to airborne allergens (*see Air Cleaners, page 63*)
- Encasement of pillows and mattress may be used for dust mite allergy control (*see House Dust Mite, page 59*)
- Cold compress over the eyes can give immediate, but temporary relief of symptoms.
- When environmental controls prove inadequate in the management of symptoms, the following medications may help:
  - Oral antihistamines (*see Antihistamines, page 79*).
  - Topical antihistamines or mast cell stabilizers may be effective (see *Table 30*).
  - Dual acting antihistamine and mast cell stabilizers (*see Table 31*) .
  - In severe cases, combinations of medications including adding a topical nonsteroidal anti-inflammatory drug (NSAID) (*see Analgesics, page 82*) or temporary use of topical corticosteroids may be necessary.
  - Rarely, oral corticosteroids are used for a short period when symptoms are extraordinarily severe. Nasal corticosteroids are often helpful in the chronic treatment of eye allergies.
  - If you have persistent or troublesome symptoms and continuing allergen exposure, allergy injection therapy or allergy shots should be considered to lower your sensitivity to the offending allergen (*see Allergy Injections/ Immunotherapy, page 56*).

Chapter 15 Atopic Keratoconjunctivitis

Atopic keratoconjunctivitis is a chronic inflammatory condition that affects both the conjunctiva and the eyelids. It is associated with atopic dermatitis, a condition characterized by dry, itchy, easily irritated skin. Atopic dermatitis generally consists of eczema of the skin just above the forearm, on the back of the legs, hands, face and neck. This skin condition often begins in childhood and improves or resolves as you age. However, it is possible to have this condition into adulthood. Approximately 3% of the population has atopic dermatitis, and only a minority of these individuals has associated allergic eye conditions such as atopic keratoconjunctivitis.

If you suffer from atopic keratoconjunctivitis, you may suffer from severe itching, particularly of the eye and the skin over the eye. Unlike allergic conjunctivitis, the skin around your eyes may become dry, scaly, or reddened. The skin in this area may have barely visible microwrinkles, be thickened, or have a slight increase in pigmentation from constant rubbing. Your lid margins may show loss of eyelashes. The underside of your upper lid may have islands of tissue (papillary hypertrophy) which may be irritated by contact lenses or may irritate the cornea. This complication is an important medical problem since it may result in damage to your vision if neglected. Symptoms of atopic keratoconjunctivitis may be seasonal, perennial, or both.

Diagnosis

Diagnosis of atopic keratoconjunctivitis is based on the presentation of typical symptoms and the chronic nature of these symptoms. You may have an association with atopic dermatitis and/or a family history of allergy. A history of symptoms of seasonal flares or worsening with certain allergen exposures is supportive of the diagnosis. Not wearing your contact lenses may help differentiate atopic keratoconjunctivitis from giant papillary conjunctivitis (*see page 105*) due to contact lens use.

Treatment

• Environmental controls for environmental allergens at home, school, or in the work environment identified as triggering symptoms (*see Environmental Avoidance, page 57*)
• When environmental allergen controls prove inadequate in the management of symptoms, the following medications may help:

- -Topical antihistamines and decongestants (*see Table 31*).
- -Topical mast cell stabilizers or dual acting mast cell stabilizers and antihistamines (especially with symptoms of photophobia and tearing) (*see Table 31*).
- -If response is inadequate, a 7-10-day course of topical corticosteroids should be considered (*see Table 31*).
- -Oral antihistamines often help control itching (*see Antihistamines, page 79*).
- -Oral or topical cyclosporin A may be useful in resistant cases

-For severe flares of symptoms, oral corticosteroids are usually effective. The use of topical corticosteroids or Elidel® cream or Protopic® ointment applied to the skin around the eye and eyelid may be helpful in controlling associated atopic dermatitis.

Chapter 16 Vernal Conjunctivitis

Vernal conjunctivitis is an inflammatory eye condition that affects the conjunctiva and eyelids. The inflammation of the conjunctiva is chronic, severe and persistent. It affects both eyes and worsens from seasonal flares after exposure to an allergen. This condition usually begins in childhood and resolves around puberty, but it may also continue into adulthood.

Vernal conjunctivitis is most often seen in individuals with West African and Mediterranean descent. It occurs more commonly in hot climates and has a higher frequency among young men.

If you suffer from vernal conjunctivitis, you may suffer from severe light sensitivity (photophobia) and itching. You may also complain of droopy eyelids, eyelid spasms and a sensation of something stuck in your eye. Your eyelid skin and margins may be normal. Often the mucosa of the underside of the upper lid is heaped into giant bumps of mucosal tissue referred to as cobblestones or papillae. Unlike allergic conjunctivitis in which the discharge is clear and very liquidy, you will often have a thick sticky string-like mucous discharge that may need to be removed manually from time to time.

Diagnosis

Diagnosis of vernal conjunctivitis is based on the presentation of typical symptoms. You may have an allergy history or a family history of allergy. Identification and avoidance of relevant allergen(s) is extremely important. Allergy skin testing is the most sensitive method to determine potential sensitivity to particular allergens.

Treatment

- Environmental controls for environmental allergens at home, school, or in the work environment identified as triggering symptoms (*see Environmental Avoidance, page 58*)
- When environmental allergen controls prove inadequate in the management of symptoms, the following medications may help:
  - -Topical antihistamines, decongestants, mast cell stabilizers or dual acting mast cell stabilizers and antihistamines (*see Table 31*).
  - -In severe cases, a burst of oral corticosteroids or frequent application of topical corticosteroids is needed to relieve unbearable symptoms. Prolonged use of corticosteroids should be avoided because of their association with the complication of glaucoma and/or cataracts.
  - -Topical cyclosporin A may be useful in severe cases.

-Complication of corneal ulceration may require a combination of antibiotics, corticosteroid ointment and a gauze pressure dressing over the eye.
-Immunotherapy (allergy shots) should be considered to lower your sensitivity to known allergens (*see Allergy Injection/Immunotherapy, page 56*).

Chapter 17 Giant Papillary Conjunctivitis

Giant papillary conjunctivitis is a chronic inflammatory condition affecting the mucous membranes of the upper eyelids. It is most often caused by soft contact lenses, but it can occur with any type of lens, ocular prosthesis, or even exposed sutures.

If you suffer from giant papillary conjunctivitis, you may suffer from itchy eyes following removal of your contact lenses, irritation, redness, burning, mucous discharge, light sensitivity (photophobia) and increasing contact lens intolerance. These symptoms may begin months to years following your initial use of contact lenses. Severe symptoms such as blurring of vision can occur due to movement of your lenses secondary to the presence of giant cobblestones of mucosal tissue beneath the eyelid or from debris deposited on the lens during the underlying inflammatory process. This condition may occur more frequently if you also have underlying allergies.

Diagnosis

Diagnosis of giant papillary conjunctivitis is primarily based on removal of contact lenses to differentiate between this condition and atopic keratoconjunctivitis.

Treatment

- Reduce contact lens use or discontinue lens use.
- Topical mast cell stabilizers and dual acting topical ophthalmic medications
- Topical corticosteroids are effective in controlling more difficult symptoms (*see Table 31*).
- When symptoms clear up, it may be possible to resume contact lens use if you switch to an alternative lens type along with the use of preventive medication

Chapter 18 General Approach to the Treatment of Allergic Eye Disease

Treatment is tailored to your underlying disease and response to medications. Based on these principles, there are 3 types of possible therapies to consider:

a. If allergy plays a clear role in your disease, avoidance therapy including the use of a HEPA filter air cleaner and limiting allergen exposure make great sense.

b. Medication rarely cures symptoms, but may offer relief and control of symptoms as well as prevent complications resulting from the inflammatory process.

c. Finally, if you have allergic symptoms not adequately responding to medication, you should consider immunotherapy or allergy injection therapy in order to reduce sensitivity to the offending allergens.

Since the eye is easily and directly accessible, initial treatment include topical medication that can be directly applied to the eye. These medications may avoid potential systemic side effects from those taken orally.

Table 31 Topical Medications

Antihistamines	Emedastine(Emadine®) levocabastine (Livostin®)
Vasoconstrictors:	tetrahydrozoline (Visine®) (OTC) naphazoline (Albalon®, Allerest®, All Clear,™ Naphcon®, Vasocon® ,VasoClear®) (OTC)
Combinations	
Antihistamine and decongestant	antazoline and naphazoline (Vascon®-A) (OTC), naphazoline and pheniramine (Opcon-A® Naphcon-A® Visine-A®) (OTC)
Mast cell stabilizer and antihistamine:	olopatadine (Patanol®) ketotifen (Zaditor™) (OTC) azelastine (Optivar®) epinastine (Elestar™) olopatadine (Pataday®) olopatadine (Pazeo®) ketotifen (Alaway) (OTC) bepotastine (Bepreve®)
Mast cell stabilizer:	cromolyn sodium (Crolom®, Opticrom) lodoxamide (Alomide®) nedocromil Sodium (Alocril®) pemirolast (Alamast®)
NSAID:	ketorolac (Acular®) diclofenac (Voltaren®)
Corticosteroid:	loteprednol (Alrex) FML

OTC = over the counter

Antihistamines

Antihistamines reduce itching by competing with mast cell released histamines for their receptor sites in the conjunctiva. When combined with decongestants, they also decrease redness and tearing. Topical antihistamines have the advantage of not being associated with fatigue and other side effects often associated with oral antihistamines.

Vasoconstrictors/Decongestants

Vasoconstrictors are mostly over the counter products sold under various names. They reduce symptoms by constricting blood vessels in the conjunctiva, thus decreasing redness and tearing as blood vessels become narrower and less leaky. Attempts to discontinue a decongestant following prolonged use are often associated with a recurrence of symptoms since dependence can develop from overuse. These medications are not recommended for prolonged use.

Mast Cell Stabilizers

Mast cell stabilizers prevent or limit mast cells from releasing chemical mediators that cause symptoms in allergic conjunctivitis. Since they prevent mast cells from releasing chemicals that lead to inflammation, they are anti-inflammatory in their actions. Some medications such as Pazeo®, Bepreve®, and Lastacaft® appear to have both mast cell stabilizing actions as well as antihistaminic effects.

NSAIDs (nonsteroidal anti-inflammatory drugs)

Ketorolac (Acular®) is the only topical NSAID approved for treatment of allergic conjunctivitis. It blocks prostaglandin production at the site of allergic inflammation in the conjunctiva and can reduce itching of the eyes.

Corticosteroids

Corticosteroids are the most effective anti-inflammatory topical treatments for allergic conjunctivitis. Corticosteroids are used sparingly because of potential side effects including cataracts, glaucoma and infection. If you are using topical corticosteroids on a frequent basis, you should have your intraocular pressure checked after 3 months of usage and yearly thereafter. Ophthalmic corticosteroids should never be used without the supervision of a physician. A viral eye infection can easily be misdiagnosed as allergic eye disease and applying topical corticosteroids could seriously adversely affect the eye.

Part Five

Special Topics

Chapter 19 Airline Travel, Sinus and Ear Disease and Upper Respiratory Allergies

Introduction

Modern air travel provides many comforts and conveniences for passengers. It also presents special challenges for those with nasal and sinus disease. The most significant of these problems include:

- Rapid changes in barometric pressure
- Low cabin humidity
- Exposure to contagious respiratory infections
- Exposure to environmental allergens and irritants

Changes in Barometric Pressure

The earth's atmosphere is composed of gases which include nitrogen, oxygen and carbon dioxide. Air is denser at sea level than in the upper atmosphere. It becomes progressively less dense at increasing altitudes. A barometer is an instrument used to measure air pressure. The barometric pressure depends upon the molecular concentration of the air since air is less dense at higher altitudes. The barometric pressure decreases with increases in altitude. When descending below sea level (scuba diving) the pressure will increase as air becomes more dense (*see Scuba Diving - Chapter 20*)

Your body is best adapted for living at or near sea level. Activities above (or below) sea level can present problems related to barometric pressure changes. As you ascend in the atmosphere, the air density and air pressure fall. At 18,000 feet the atmospheric pressure is approximately half of that at sea level and at 36,000 feet is about a quarter.

According to the laws of physics, as barometric pressure falls at higher altitudes, air (gas) volume expands. This concept is important for air travelers since air within the sinuses and other body cavities will expand with increasing altitude. This is generally not a problem if the gases within the sinuses exchange freely with the outside environment (aircraft cabin). The exchange occurs through the sinus ostia and nasal passages. This free exchange of air allows for expanded gases to escape from the sinuses to the outside. This permits equalization of pressure inside and outside of the sinuses. However partial or total blockage of the sinus openings and nasal passages can stop this free exchange of air. The expansion of gases within the sinuses during ascent of an airplane can cause a buildup of pressure in the sinuses. This can create extreme pain and discomfort.

However, most sinus problems from air travel occur during plane descent. During descent the gases in the sinuses begin to compress into a smaller volume as the altitude decreases and the barometric pressure increases. The free exchange of air between the sinuses and aircraft cabin normally equalizes pressure as cabin air enters through the nose to fill the

nose to fill the less dense air in the sinuses. However, if the sinus ostia and nasal passages are blocked, the pressure of air outside the sinuses can cause severe sinus discomfort and damage as higher pressure cabin air presses against the blocked sinus passageways. In extreme cases this pressure can cause inflammation of the lining of the sinuses. It can also cause rupture of sinus tissues and hemorrhage of blood into the sinuses called sinus barotrauma. Barotrauma is tissue damage from atmospheric pressure changes. Typical symptoms of barotrauma include sinus pain, nosebleeds, dental pain, cough and altered facial nerve sensations. Treatment of sinus barotrauma includes the use of decongestants, analgesics, oral corticosteroids and saline irrigation.

Barotrauma similarly can affect the free flow of air through the eustachian tube into the middle ear. Outside pressure on the eardrum may vary from that inside the middle ear because of eustachian tube dysfunction (poor air movement through the eustachian tube). Consequently, popping and pressure in the ear during air descent or going up rapidly in an elevator are both related to barotrauma.

Barometric pressure changes are unavoidable in air travel. To minimize the impact of these changes, the following measures are recommended:

- Optimize sinus and nasal health prior to airline travel with aggressive management of allergic rhinitis, sinusitis, nonallergic rhinitis, nasal polyps and other upper respiratory diseases.
- Avoid air travel (if possible) if you have an acute upper respiratory illness.
- Take a short acting oral decongestant and/or a nasal decongestant spray approximately 1 hour prior to takeoff for flights less than 4 hours. Oral corticosteroids may be helpful in some cases. Under certain circumstances, or for flights longer than 4 hours, take a repeat dose in-flight and/or 1 hour before descent.

Low Cabin Humidity

The relative humidity in the cabin of a commercial aircraft is typically very low. This lack of moisture can lead to drying and irritation of the lining of the nose and sinuses. To best maintain hydration of the nose and sinuses, the following measures are recommended:

- Keep the entire body well hydrated by adequate intake of fluids.
- Avoid beverages that cause dehydration such as alcohol and caffeinated beverages.
- Use saline nasal sprays frequently during flights.

Exposure to Contagious Respiratory Infections

A confined aircraft cabin can lead to the spread of contagious respiratory infections. Such infections can be complicated by development of acute sinusitis and/or worsening of chronic sinusitis. Studies have shown that as high as 20% of air travelers will develop an acute upper respiratory tract infection within days of air travel. There are few ways to avoid exposures to respiratory infections. Frequent hand washing using antibacterial soap and wiping down seat trays and arm rests with 90% alcohol wipes and wearing a mask may help. However, the latter can be uncomfortable, inconvenient and socially unacceptable.

Exposure to Environmental Allergens and Irritants

A confined aircraft cabin can present travelers with intense exposures to environmental allergens. These include pet dander (on the clothing and hair of pet owners) and irritants such as strong perfumes and tobacco smoke from clothing and hair of other passengers. Such contact can cause inflammation of the lining of the nose and sinuses. It can also result in tissue swelling. This swelling causes blockage of the sinus ostia and nasal passages. Such blockage can contribute to sinus pain from barometric pressure changes. It can also lead to sinusitis. To minimize these results, the following measures are recommended:

- Maximize sinus and nasal health prior to air travel with aggressive management of allergic rhinitis, nonallergic rhinitis, acute/chronic sinusitis and other upper respiratory disease.
- Take all recommended daily sinus and nasal medications on the day of air travel.
- Bring "rescue" medications such as antihistamines, decongestants and oral corticosteroids. Use these medications if there are unexpected and unavoidable allergen and/or irritant exposures during flight.

Chapter 20 Scuba Diving, Sinus Disease and Upper Respiratory Allergies

Since the development of the self contained underwater breathing apparatus (SCUBA) in 1943, there has been an explosive growth in recreational diving. This growth has been accompanied by an associated increase in diving related injuries, the most common of which involve the ears and sinuses.

Normally at sea level barometric pressure is equal inside and outside the sinus cavity. As a diver descends in the water, the surrounding barometric pressure increases. This change in pressure impacts the air filled sinus cavities. According to the laws of physics, the volume of a gas varies inversely with pressure when temperature is held constant. Accordingly, the volume of gas in the sinuses decreases as the surrounding barometric pressure increases as the diver descends in the water. Conversely the volume of gas in the sinuses increases as the surrounding barometric pressure decreases as the diver surfaces (ascends) to the top. This contraction or expansion of gas in the sinuses can result in barotrauma to the sinuses. During descent, contraction of gas causes a vacuum within the sinuses leading to swelling and/or bleeding within the sinuses. Conversely, during ascent in the water, expansion of the gas within the sinus which can cause fracture of the sinus walls. Neurologic abnormalities including blindness and meningitis can also occur from barotrauma. Barotrauma most commonly affects the maxillary sinuses; though other sinuses can be affected as well.

To avoid barotrauma, it is critical to maintain equal pressure inside and outside of the sinuses. This equalization is achieved through the use of compressed air delivered via a pressure regulator placed in the mouth of the diver. To work correctly, open air passageways from the mouth and nose into the paranasal sinuses are required.

When these passageways are compromised from allergic rhinitis (hayfever), nonallergic rhinitis, acute and chronic sinusitis, viral upper respiratory infections (common cold) and/or anatomic abnormalities such as nasal polyps or nasal septal deviations, barotrauma can occur.

The best treatment of sinus barotrauma is prevention. Diving should be avoided in the presence of active nasal and/or sinus symptoms resulting from upper respiratory disorders and/or anatomic abnormalities (noted above). All efforts should be made to remedy respiratory disorders and surgically correct anatomic defects. Although not formally studied, pretreatment in those susceptible to barotrauma may be helpful. This may include use of nasal corticosteroids and decongestants. When sinus barotrauma does occur in spite of prevention efforts, it is usually treated symptomatically.

Chapter 21 Sinusitis in Children

Sinusitis in children is similar to sinusitis in adults. However, there are some major differences. Sinus structures in children are smaller than in adults or may even be absent early in life. Therefore, nasal and sinus mucosal membrane swelling can more easily block narrow passageways which can lead to sinusitis. Children have more viral upper respiratory infections (common colds) than adults (children average 6- 8 per year while adults have 2- 4). Upper respiratory allergies occur more frequently in children with sinusitis (8 of 10 children with chronic sinusitis also have allergies). Sinusitis may also occur more frequently as a result of any of the following: secondhand tobacco smoke, day care, foreign bodies in the nose (peanuts, beads, etc.), silent gastroesophageal reflux, congenital abnormalities (cleft palate), cystic fibrosis, primary immunodeficiency and enlarged adenoids.

Symptoms of sinusitis may also be less distinct than in adults. Children often do not complain of symptoms. Younger children may have persistent runny noses. Older children may complain of post nasal drip and cough. Parents may have trouble telling the difference between sinusitis and allergies or a common cold. Symptoms of sinusitis may also include bad breath, throat clearing and headaches. Eye and brain complications from sinusitis are more common in children. These structures are much closer to the developing sinuses and may get infected more easily.

Viral infections (common colds) usually last longer in children than adults. Parents should suspect sinusitis if children have a runny nose lasting more than 10 days. Worsening of symptoms after 5-7 days of upper respiratory infection can also be a sign of sinusitis. Parents should suspect sinusitis when the above noted symptoms are associated with facial pain and pressure, ear pain or pressure, fatigue, cough and upper tooth pain (*see Table 32*).

Table 32 Symptoms of Sinusitis in Children

1) Common cold lasting longer than 10 days
2) Clear or discolored runny nose/post nasal drip
3) Cough
4) Nasal congestion
5) Vomiting associated with gagging on mucus
6) Irritability, poor concentration, fatigue
7) Puffiness around eyes
8) Headache in children older than 6
9) Upper jaw tooth pain
10) Facial pain and pressure
11) Ear pain and pressure

Diagnostic workup and treatment for sinusitis in children are similar to that of adults. Medication dosing needs to be adjusted for weight and age. Children should avoid certain antibiotic classes like tetracyclines and fluoroquinolones. Most nasal sprays, decongestants, leukotriene modifiers and mucolytics can be used in even very young children.

Endoscopic surgery is not commonly recommended in young children. This is due to concern with facial growth and sinus development after surgery. Surgery is recommended in only the most severe cases or when there is a potential for brain and eye complications from sinusitis.

Chapter 22 Home Care for Sinus Disease and Upper Respiratory Allergy

While taking medications and being under the care of a physician are your best treatment options, there are many things you can do at home to improve your health.

Bedroom humidifiers or cool mist vaporizers may help during winter, especially if your heating system is causing excessive dryness. These devices keep mucous membranes from drying or crusting. Humidity should be adjusted to 40-45% for comfort. Lower humidity minimizes the potential of mold and dust mite growth. Humidity gauges (hydrometers) are available in most hardware stores. Humidifiers for dry air and dehumidifiers for excessive humidity also help to maintain normal nasal membranes.

Most individuals do not blow their noses properly. You should avoid forceful blowing in order to limit physical damage to inflamed membranes. Blowing your nose with great effort may force infected mucus up through sinus openings and thus may seal the sinuses with infective bacteria and viruses (*see Causes of Acute Sinusitis, page 22*). Infectious material may also be forced up the eustachian tube leading to ear infections. It will be far better to gently squeeze the side of your nose with a tissue to remove excess mucus, thus squeezing the remaining

mucus to the back of your throat and swallowing or spitting out material. Alternatively, try gently blowing out the remaining mucus with low pressure.

You should also avoid secondhand smoke, pollutants, very cold or dry air and others with active infections. This decreases nasal inflammation, preserves mucociliary clearance and prevents infections.

Steam treatments and nasal irrigation (*see Nasal Saline Irrigation, page 89*) also help prevent infections.

Some people report increased mucus in the nose and throat after eating certain foods, especially milk. There are no scientific studies supporting this claim. However, if you have this feeling, you should avoid those specific foods.

Wash your hands throughout the day. This is especially important after sneezing or blowing your nose. Viruses and bacteria may survive on your hands or on surfaces for hours. Use disposable tissues instead of handkerchiefs.

HEPA air filters also may help to remove particulates from the air. These filters can remove 99% of particulates in the air, including bacteria, viruses, pollen, mold spores, animal dander and dust. These filters require proper maintenance to work properly (*see Air Cleaners, page 63*).

Part Six

Frequently Asked Questions

1. What is sinusitis?

Sinusitis is an inflammatory condition involving the mucous membranes of the sinuses. Inflammation is usually the result of an infection and/or allergy. The sinuses are air filled cavities in the skull covered with mucous membranes, existing within the cheek bones and around and behind the eyes.

2. Who is affected by sinusitis?

You can be affected by sinusitis at any age, from infancy to your senior years.

3. What causes sinusitis?

Sinusitis in most cases is related to blockage of mucous flow from the sinus cavity into the nose. This blockage may be related to inflammation, allergies, polyps, or congenital abnormalities. Once the sinus openings are obstructed, viruses or bacteria present within the mucous lined cavity can begin to multiply and invade tissues, resulting in further inflammation and pressure.

4. What are the different types of sinusitis?

In general, there are two main types of sinusitis:

Acute sinusitis: Symptoms begin over a short period of time and are usually caused by bacterial infections, allergies, or a viral infection such as the common cold; symptoms usually resolve over a few days to a few weeks (less than 4 weeks) (*see Acute Sinusitis, page 15*).

Chronic sinusitis: Symptoms persist longer than 12 weeks and can recur over many years and are most often caused by bacterial infections, fungal infections and chronic allergies (*see Chronic Sinusitis, page 28*).

5. What increases the risk of developing sinusitis?

There are several factors that increase the risk including: allergies, disorders of the immune system (immunodeficiency), anatomic abnormalities (for example, nasal polyps), changes in air pressure (for example: air travel, scuba diving) and reactions to irritants, pollutants and second-hand tobacco smoke (*see Chapter 3, Acute and Chronic Risk Factors, page 33*).

6. What are the symptoms of sinusitis?

Typical symptoms of sinusitis include: congestion, thickened post nasal drip, discolored mucus from the nose, facial pain and pressure, headaches, cough, toothache, reduced sense of smell or taste, bad breath and constant throat clearing. You may also develop fatigue, tiredness, poor concentration (*see Symptoms of Acute Sinusitis, page 17 and Symptoms of Chronic Sinusitis, page 28*).

7. How can you distinguish among sinusitis, the common cold and allergies

If you have a common cold, you usually have a runny nose that is watery but can become thick and yellow. You may experience low grade (less than 100°F) fever, sneezing, weakness and fatigue. Symptoms may start abruptly within hours and last 5-10 days, peaking within the first 5 days. If you have allergies, you do not have a fever and typically present with

a clear nasal discharge and/or watery eyes. You may experience congestion, itching and sneezing. Itching can be experienced in the nose, throat and eyes. If you have sinusitis, you usually have more persistent, thickened mucous discharge present for more than 10 days. Changes in acute nasal congestion and discolored discharge that occurs after 5 days may also be a sign of acute sinusitis. Sinusitis can lead to headache and cough. Fever may or may not be present. See Table 33 for a comparison of these conditions.

Table 33 How do you tell if you have sinusitis, a cold, or allergies?

	Symptoms	Onset	Typical Duration
Sinusitis	Congestion Green, brown or gray nasal discharge Post nasal drip Pressure in the face Headache Cough	Develops as a complication after a cold. Can also be triggered by allergies	Can last weeks, months, or possibly years if not treated
Colds	Runny nose with watery to thick yellow discharge Sneezing, Weakness and fatigue	Symptoms develop within 1-3 days of exposure to the cold virus	5-7 days
Allergies	Congestion runny nose with thin, watery discharge, Sneezing Wheezing Itchy nose, throat and eyes	Symptoms begin almost immediately after exposure to specific allergen(s); if seasonal allergies, symptoms occur at the same time every year; if perennial allergies, symptoms are present year round	Symptoms last as long as you are exposed to the allergen; if that allergen is present year round, symptoms may be chronic

8. When do you see a specialist? Which specialist should you see?

If you have failed 2 courses of antibiotics for treatment of sinusitis or have had recurrent (more than 3 episodes) of sinusitis each year, or if you have had chronic or severe seasonal nasal congestion, post nasal drip, sneezing and itchy, watery eyes, you should see a specialist. If you have sinusitis in addition to any of the following - chronic allergies, asthma, nasal polyps, impaired immune system - you should be evaluated by a specialist. If you have a history of aspirin reactions or have developed sinusitis while pregnant, you should also be evaluated by a specialist. Depending on your condition, you may seek out the help of either an allergist or an otolaryngologist (ENT surgeon). An allergist treats the medical aspects of sinusitis and has expertise in the evaluation and management of allergic and irritant triggers and complications in the lower airways like asthma. An otolaryngologist deals more with surgically correctable conditions that are associated with sinusitis like septal deviations, polyps, brain and eye complications of sinusitis as well as medically refractory sinusitis. In chronic sinusitis, the collaborative efforts of an allergist and ENT surgeon are often required for optimal care.

9. How are sinusitis and allergic rhinitis medically treated

If sinusitis is caused by bacterial infection, treatment usually begins with the use of an antibiotic. Which antibiotic is best depends on your age, weight, previous use of antibiotics, past history of treatment, whether your condition is acute or chronic and your physician's estimation of the probable bacteria causing your infection. In addition, both sinusitis and allergic rhinitis may require use of decongestants (oral and perhaps nasal), nasal corticosteroid sprays and analgesics to help control symptoms. In people with longstanding allergies, allergen immunotherapy (allergy shots) may be very effective for both allergic rhinitis and sinusitis. For more information on treatments for sinusitis and upper respiratory allergies, see Part 3.

10. What medications or treatments can you use at home to treat your sinusitis and allergic rhinitis?

There are a number of nonmedical treatments that are available including complementary medicine as well as use of steam, heat and nasal irrigations. Nasal irrigation with salt water is particularly useful in cleansing the nose and sinuses. Additionally, methods of relaxation may be helpful in reducing pain and pressure (*see Chapter 13*).

11. What are the complications from sinusitis?

The most serious complications include infections in and around the brain as well as in and around the eyes. These require immediate attention of a surgeon. In addition, chronic loss of smell and deterioration of quality of life are common complications of persistent sinusitis.

12. What can you do to prevent another episode of sinusitis?

If you are prone to developing recurrent acute sinusitis or have chronic sinusitis, several preventive strategies may be appropriate including: 1) avoid people who have acute respiratory infections; 2) receive yearly influenza vaccinations and possibly a pneumococcal vaccination; 3) for those with chronic allergies, an aggressive and comprehensive treatment plan for underlying allergies including environmental controls and allergy injections is extremely important; 4) nasal irrigation; 5) nasal antibiotic or steroid irrigations may also help at the first onset of change in secretions and may avoid the need for oral antibiotics; 6) avoid allergy triggers, pollutants and irritants, particularly secondhand smoke; 7) avoid breathing dry air and use home humidifiers to increase moisture to the nose.

13. What are the complications of allergic rhinitis?

Many complications of unmanaged allergic rhinitis can occur. These include recurrent sinusitis, nasal polyps, asthma, decreased or loss of smell, snoring, cough, fatigue and irritability.

Glossary

Abscess	Collection of pus in a cavity usually surrounded by inflamed or swollen tissue
Acupuncture	Ancient Asian therapy using needles to "puncture" the skin at certain points, helping to reduce pain
Acute	Description of any disorder that occurs suddenly
Acute sinusitis	An infection lasting less than 4 weeks that affects the lining of the sinuses
Adenoids	Lymphoid (tonsil-like) tissue that sits in the nasopharynx (back of the nose and upper part of the throat). Lymph tissue helps the body defend against respiratory infections.
Airways	Part of the respiratory tract (trachea, bronchi) that moves air in and out of the body
Allergen	Foreign substance (pollen, cat dander, etc.) that causes release of histamines and other chemicals, resulting in an allergic reaction if you are sensitive to that particular allergen. Common allergens include dust mites, animal dander, pollen and molds. An allergen is a type of antigen (see below).
Allergic mucin	Appearance of sinus tissues with fungal elements as a result of allergic fungal sinusitis
Allergic rhinitis	The result of an allergic reaction when the nasal passages become inflamed. Also called hayfever, nasal allergies or upper respiratory allergies
Allergist-Immunologist	A medical doctor who is specially trained to diagnose and treat allergic and immune disorders. An allergist-immunologist has completed 4 years of undergraduate education, 4 years of medical school, 3 years of an internship and residency, concentrating in a medical specialty such as pediatrics or internal medicine and 2 years of a fellowship, concentrating in allergy and immunology exclusively. An allergist-immunologist must be board certified first by either the American Board of Internal Medicine or the American Board of Pediatrics and then must be certified by the American Board of Allergy and Immunology. The responsibilities of an allergist-immunologist are to diagnose and treat medical abnormalities of the immune system, particularly those that involve inflammation of the skin and respiratory system. Allergists-immunologists commonly treat disorders such as hayfever, asthma, eczema, reactions to bee stings, hives, food and drug allergies, and respiratory disorders caused by environmental factors and physical reactions to irritants. Allergists-immunologists use a thorough medical history and detailed physical examination to determine a course of treatment specific to individuals. The most common therapies used are drug therapy, avoidance of allergens and irritants, and allergen immunotherapy (shots).
Allergy	The result of an allergic reaction usually triggered by a known allergen. Reactions can occur in the skin, eye, nose, oral cavity, chest, and/or gastrointestinal tract.

Anaerobic	Ability to live without oxygen
Anaerobic bacteria	Special bacteria or microorganisms that can live and grow without oxygen or in a low level of oxygen. Also called: anaerobes
Analgesics	Pain relieving medications
Anaphylaxis	An induced systemic or generalized sensitivity, usually of a life threatening nature; at times the term is used for anaphylactic shock. It is commonly used to denote the immediate, transient kind of immunologic (allergic) reaction characterized by contraction of smooth muscle and dilation of capillaries due to release of pharmacologically active substances, classically initiated by the combination of antigen (allergen) with IgE allergy antibodies.
Antibiotic	Medications used to kill or slow down bacterial infections. These drugs help your body's immune system rid itself of bacteria. An antibiotic is a kind of antimicrobial therapy. Antibiotics are effective against bacterial but not viral infections.
Antibody	Types of proteins made by the immune system to neutralize, damage, or clear specific antigens in the body
Antigen	Molecules that induce an immune response and the formation of antibodies
Antihistamine	Medications used to control allergic reactions by stopping histamines from interacting with allergic receptors. These can be administered in spray, liquid, ointment, pill, cream, or injection form.
Antimicrobial	Any agent that kills microorganisms or suppresses their growth. Examples are antibiotics, antiviral and antifungal medications.
Apnea	abscence of breathing commonly occurring during sleep
Aspiration	Removal or suction, of a gas, fluid, or tissue from a body cavity or organ from unusual accumulations
Asthma	Respiratory disease characterized by sudden, repeated shortness of breath caused by blockage and/or inflammation of the airways. The attacks may be accompanied by wheezing and coughing.
Bacteria	Single celled microorganisms. Certain forms of bacteria may invade the body and cause infections.
Barotrauma	Tissue injuries resulting from rapid changes in air pressure

Benign	Any condition that is nonmalignant or noncancerous in nature
Biopsy	Process of removing tissue for diagnostic examination
Cavernous sinus thrombosis	Severe problem related to sinusitis in which there is an inflammation of the venous areas on each side of the ethmoid and sphenoid sinuses
Cellulitis	Bacterial infection of the skin and underlying tissues that can cause tissue damage and blood poisoning if untreated
Centers for Disease Control and Prevention (CDC)	Federal agency which serves as the national leader for developing disease prevention and control, environmental health, health promotion and educational activities
Cerebritis	Infection/inflammation of the brain tissue
Cerebrospinal fluid (CSF)	Fluid that surrounds and protects the brain and spinal cord
Chronic	Description of any condition lasting for a prolonged period of time
Chronic sinusitis	Sinus condition in which continuous sinusitis lasts twelve weeks or longer
Cilia	Microscopic hairs lining the mucous membranes of the nose, sinuses and lower respiratory tract that sweep mucus through the system
Cold	Viral infection of the upper respiratory system causing congestion, fever, watery eyes and general fatigue. Also called: acute viral upper respiratory tract infection, common cold
Concha bullosa	Middle turbinate (see turbinate) in the nose enlarged by air cells located in the center of the turbinate that can contribute to sinus disease by blocking passageways
Congestion	Excessive amount of fluid accumulated in body tissues which can result in a blockage to outflow from that tissue
Conjunctiva	Mucous membrane that lines the inner surface of the eyelids and is continued over the surface of the eyeball
Corticosteroids	Drugs used to control inflammatory swelling. Glucocorticosteroids are typically used to treat allergies, sinus diseases and other irritations of the lower respiratory tract. They can be administered by liquid, spray, pill, ointment, cream, intravenously (IV), or into muscle (IM). Also called: steroids

CSF Leak Seepage of cerebrospinal fluid from the spinal cord or brain into the nose, ears, or sinuses. It can occur after head trauma, ear or sinus surgery; or occasionally spontaneously.

CT scan Abbreviation for computerized tomography. This is an X-ray imaging technique used for viewing different parts of the body, particularly the sinuses. The results of many x-rays are digitalized and combine to produce an image that represents slices through the sinus passageways.

Cyst Sac of fluid or semisolid material causing abnormal lumps or swelling. They can occur in the nose or sinuses. They can cause blockage of the airways or sinus drainage openings at times.

Cystic fibrosis (CF) Genetic disorder marked by frequent lung and sinus problems and an inability to absorb certain nutrients from food. The disease results from unusually thick mucus with interference with the normal function of the airway and sinuses. It can cause nasal polyps, recurrent sinusitis and chronic lung disease.

Dander Mixture of saliva, dead skin scales, skin oils and urine which shed from animals and may cause allergic reactions in some sensitive people

Decongestant Medication used to relieve nasal congestion, resulting in better drainage, air movement and breathing

DSVP Abbreviation for Dietary Supplement Verification Program. This program by the United States Pharmacopeia signifies that dietary supplements have been tested and verified for ingredients, product and manufacturing processes.

Encephalitis Inflammation of the brain

Endorphins Hormones released by the body that help relieve pain

Endoscope Flexible fiberoptic instrument used to examine internal channels of the body. For example, a nasopharyngolaryngoscope is an endoscope used to examine the entire nose.

Enzyme A protein that acts as a catalyst to induce chemical changes in other substances, itself remaining apparently unchanged in the process

Eosinophil A type of white blood cell that is attracted to allergic reactions in tissues and play a role in allergic reactions

Epiglottis A thin flap of flexible cartilage in front of the voicebox that folds back over and protects the voicebox during swallowing

Ethmoid Sinus Sinuses located behind the bridge of the nose and between the eyes

Eustachian tube Tubes connecting the middle ear to the nose that assist in air exchange and middle ear drainage

Frontal sinuses Sinuses located over the eyes in the brow area

Functional endoscopic sinus surgery (FESS) Sinus surgery performed with a fiberoptic endoscope allowing restoration of nasal sinus function with minimal surgery

Fungi Microorganisms including forms of yeasts and molds, used in the production of many antibiotics and other drugs. Allergy to fungi can trigger sinusitis, allergies and asthma. Also called: mold, mildew

Gastroesophageal Reflux Disease (GERD) Backflow of stomach acid into the esophagus. Frequent occurrences may cause esophagitis, laryngitis, bronchitis, rhinitis, or sinusitis. Also called: GERD, acid reflux, heartburn

Herb Plants used for medicinal purposes

Histamine Chemical released by mast cells in body tissues during an allergic reaction, resulting in inflammation, nasal stuffiness, or bronchoconstriction in asthma

Hives Small, raised areas on the skin that produce an itching sensation. They are usually the result of an allergic reaction or hypersensitivity to foods, drugs, infection, or other physical agents (heat, cold, friction). Also called: urticaria, wheal

Homeopathy A form of drug therapy, based on the idea that medicinal substances that create certain effects in healthy persons can be used in treating illnesses with similar symptoms when administered in small doses. It can be used to treat various conditions such as allergic rhinitis, migraines, asthma and the flu.

Hydrotherapy Therapeutic use of water such as a warm whirlpool bath

Hyperreactivity Heightened nonallergic response even after the original irritant is gone, in which the mucous membranes still react with swelling, watery discharge, sneezing and/or cough. This can occur in the nose and lungs.

Hypertrophy General increase in bulk of a part or organ, not due to tumor formation

Immunoglobulin Antibodies and proteins located in tissue fluids and serum. Immunoglobulin E (lgE) is the most important antibody in allergic reactions

Immunosuppression A depressed or nonfunctioning immune system, which may be caused by natural unresponsiveness (tolerance), artificially induced by chemical medications, biological or physical agents, or caused by disease

Immunotherapy Allergy treatment administered through a series of shots beginning with small doses very often and gradually increasing the dosage as well as intervals between shots. The process desensitizes the person to the particular allergen being injected in the shots

Inflammation Localized tissue reaction to injury, allergy, or infection caused by increased blood supply in the area. Symptoms and signs of inflammation can include heat, swelling, redness and pain. Inflammation in the sinuses is usually coupled with infection

lnterventional Video Tomography (IVT) A 3-dimensional imaging technique used for sinus surgery. It combines CT images of the sinuses with real time video allowing a more precise surgical technique.

Laryngitis Inflammation of the larynx resulting involving the vocal cords

Larynx Organ in the respiratory tract that produces voice, located between the pharynx and the trachea. Also called: voicebox

Leukotriene modifiers Medications that block the production or activity of leukotrienes and reduce the symptoms associated with allergies, asthma and sinusitis

Lymph tissue Network of fibers and cells found in varying degrees around the lymphocytes. There are three types of lymph tissue: nodular, diffuse and loose.

Mast cells Special cells in the mucous lining of the nose, sinuses, skin, eyes and lungs that are responsible for releasing chemicals such as histamine during an allergic reaction

Maxillary sinuses Sinuses located under the cheekbones

Meningitis Inflammation of the meninges or membranes that protect the brain and spinal cord. It may be either bacterial, viral, or fungal in nature.

Microorganism Microscopic plant or animal life form; often used to identify disease causing bacteria, viruses or fungi

MRI Abbreviation for magnetic resonance imaging. This test takes a series of sectional pictures of the body without using radiation. Also called: MR

Mucocele Mucus filled sac or cavity that can grow in the sinus.

Mucociliary clearance The process of the nasal passages and sinuses clearing themselves of bacteria and trapped particles through the production and flow of mucus

Mucolytic/expectorant Medications that work by changing the physical properties of the mucus, thereby increasing the ability of the cilia to clear and drain mucus

Mucopyocele Pus filled sac that can grow and eventually destroy the bony walls of the sinuses

Mucosa Mucous membranes lining certain body structures

Mucous membranes Soft, pink layer of tissue that lines cavities and protects the respiratory tract, sinuses, GI tract, urinary tract, tear ducts, middle ears, eustachian tubes and saliva ducts. These membranes secrete fluids containing mucus.

Mucus	Slippery secretion secreted by the mucous membranes that lubricates and protects the body
Nasal corticosteroids	Medications taken through the nose that can shrink nasal tissue and keep drainage pathways open. They can reduce sinus inflammation from allergies and nonallergic inflammation and shrink nasal polyps.
Nasal cycle	The process of congestion and decongestion alternating in the nasal passages every few hours each day. The process occurs through the regular shrinking and swelling of the nasal passages; most people are unaware of it happening.
Nasal polyps	Noncancerous mucus filled sacs projecting into the sinuses or nasal cavity resulting or related to inflammation, allergic reaction, aspirin intolerance, cystic fibrosis, or allergic fungal sinusitis.
Nasal septum	Central partition of the nose separating the two nasal passages made of cartilage and bone. It is covered by mucous membranes and provides support to the nose
Nasopharyngo-laryngoscope	Endoscopic instrument, electrically lighted, for examination of the nasal passages, nasopharynx (throat) and larynx (voicebox)
Nasopharynx	Passage connecting the area behind the nose to the top of the throat
National Institutes of Health (NIH)	This medical research center is part of the U.S. Department of Health and Human Services. The goal of its research is to acquire new knowledge to prevent, detect, diagnose and treat disease and disability.
NSAIDs	Abbreviation for nonsteroidal anti-inflammatory drugs. These are available over the counter or by prescription for relief and fever reduction. They are similar to aspirin.
Obstructed	Blocked or clogged
Olfaction	Medical term for the sense of smell
Oral corticosteroids	Medications taken by mouth used to decrease inflammation in the sinuses and to shrink nasal polyps. They are often used with antibiotics.
Orbit	Medical term for cavities in the skull containing the eyeballs and related blood vessels, muscles and nerves
OSA	Abbreviation for obstructeive sleep apnea. It is a disorder in which you have recurrent disruptions of sleep caused by blockage of the airway. It is a common cause for loud snoring
Osteomeatal complex (OMC)	A passageway or area into which the maxillary, frontal and anterior ethmoid sinuses all drain under the middle turbinate. It is considered the origin of most acute sinus disease

Osteomyelitis	Inflammation of the bone marrow and adjacent bone
Ostia (plural of ostium)	Small openings, especially one of entrance into a hollow organ or canal
Ostial blockage	Total or partial blockage of the tiny openings (ostia) in the sinuses through which air and mucus pass
Otolaryngologist (ENT)	Surgical specialist who treats ear, nose, throat and larynx disorders
Ozone	Gaseous pollutant that can irritate and inflame respiratory membranes and cause bronchitis, rhinitis and sinusitis. It is formed by volatile organic compounds (VOCs) reacting with nitrogen oxides in the presence of the sun.
Pansinusitis	Condition resulting when all of the sinuses on one or both sides of the nose are inflamed
Paranasal sinuses	Medical term for the sinuses or cavities filled with air around the nose and eyes
Periorbital cellulitis	An infection of the tissues surrounding the eye
PET scan	Abbreviation for positron emission tomography. This diagnostic examination involves gathering images from the detection of radiation from the emission of positrons (tiny particles emitted from radioactive substances). This test is currently being developed for sinus imaging and can be useful in the diagnosis and treatment of sinus cavity cancers.
Pharmacokinetic properties	How a drug gets absorbed, distributed and eliminated from the body
Pharynx	Medical term for the throat. It connects the back of the mouth and nose to the esophagus and trachea.
Photophobia	Sensitivity to light
Placebo effect	Helpful reaction experienced during clinical drug studies in which you are given sugar pills rather than actual medications, often related to psychological suggestion that you are taking actual medications
Pollen	Male fertilization agent of flowering plants, trees, grasses and weeds that causes allergic reactions
Polypectomy	Process of removing nasal polyps
Polyps	Noncancerous grape shaped tissue projecting from a normal body surface area, including the nose, sinuses, or ears. They originally have the same cellular structure as their tissues of origin but may continue to enlarge.

Post nasal drip Mucous drip down the back of the throat

Pulmonary Relating to the lungs

Pus Yellowish or greenish creamy liquid composed of microorganisms, white blood cells, dead or dying tissue cells and digestive enzymes that collect at the site of infected tissue and usually drain from the site. Also called: purulence or purulent discharge, infected mucus

Recurrent acute sinusitis Acute sinusitis episodes occurring 3 or more times a year

Relative humidity (RH) Ratio of water vapor or moisture in the air to the amount of moisture that same air at that same temperature is capable of holding when saturated. This number is expressed as a percentage. Cold air cannot typically hold as much moisture as warm air.

Respiratory system Organ system including the lungs that transports oxygen into the bloodstream and expels carbon dioxide from the body

Rhinitis Inflammation of the nasal mucous membranes resulting from infection, allergy, or inhalation of irritating material. Also called: runny or congested nose

Rhinitis medicamentosa Irritated or inflamed mucous membranes caused by excessive use of nasal decongestants sprays.

Rhinosinusitis The occurrence of inflammation of the mucous membranes of both the nose and the sinuses. Sometimes referred to as sinusitis.

Samter's Syndrome (Aspirin Triad) Condition in individuals with asthma who are also sensitive to aspirin. Nasal polyps usually develop after the onset of asthma. Also called: aspirin sensitivity or aspirin intolerance or Aspirin Exacerbated Respiratory Disease (AERD)

Septal deviation An abnormal curvature of the nasal septum

Septicemia Systemic disease caused by the spread of microorganisms and their toxins via the circulating blood; formerly called "blood poisoning"

Sinuses These are cavities adjacent to each side of the nose where they drain. The frontal, maxillary and sphenoid sinuses are singular, paired cavities, while the ethmoids are a group of cavi- ties, each having its own drainage path into the nose. Also called: paranasal sinuses

Skin testing Small amount of allergen is placed on or injected into your skin. If you have an allergy to that allergen, swelling, itching, or hives will occur at the site of the injection within minutes.

Somnoplasty (radial frequency turbinostomy)	Use of radiofrequency waves to reduce the blood vessels by coagulation under the mucous membranes without disturbing the function of the turbinate
Sphenoid sinuses	Sinuses located behind the ethmoid sinuses in the upper nose and behind the eyes
Stadiometer	Precise height measuring device
Subacute sinusitis	Sinus infection lasting more than four weeks but less than 12 weeks
Submucousal resection	Removal of the turbinate bone
Superior sagittal thrombophlebitis	Infection or clot of venous drainage of frontal sinuses
Supplement	Any material that enhances a diet lacking in nutrients, vitamins and minerals. It can be taken by capsule, caplet, pill, or liquid.
Thrush	A yeast infection caused by a mold or fungus called Candida albicans, producing white spots on the inside of the cheeks, tongue, palate and gums. Also called: oral candidiasis
Tonsils	Collections of lymph tissue on both sides of the pharynx
Topical anticholinergics	Medications applied to the nose that reduce mucous production
Turbinate	Any of the structures, shaped like a top, along the outer walls of the nasal passages. The turbinates are divided into inferior, middle and superior turbinates.
Turbinate Hypertrophy	Prolonged enlargement of the turbinates due to inflammation and swelling
Turbinectomy	Removal of all or parts of the turbinate
Uncinate process	A bone protruding off the middle turbinate. An abnormally long uncinate process can block the outflow tract of the maxillary sinus.
USP	Abbreviation for United States Pharmacopeia. This nongovernmental, nonprofit organization promotes the public health by distributing standards and information about medicines, healthcare technologies and medical practices.
Uvula	The tissue mass hanging down from the soft palate in the back of the throat.

Virus Microscopic agents, composed of RNA and a protein capsule, that invade host cells of other organisms and cause infection by multiplying

Viscous Sticky, thick; a word usually applied to describe liquids that are resistant to flow.

Vasomotor rhinitis Nonallergic nasal condition with symptoms of clear nasal discharge, membrane swelling, nasal congestion and sneezing. It is often diagnosed when no other cause for the symptoms can be determined. Also called: perennial nonallergic rhinitis, non allergic rhinitis

Volatile organic compounds (VOC) Toxic chemicals found in gasoline fumes, paints, glues, sealants, printer's ink, degreasers, new carpets, some cleaning materials and wax removers. They are toxic to the body and can combine with nitrogen oxides in the sun to form ground level ozone which can irritate the nose, sinuses and lungs.

Wheeze Whistling, squeaking, or puffing sound heard during breathing when airways are blocked. The sound is usually heard during expiration of air but sometimes is heard during inspiration.

Xolair Monoclonal biologic protein used by injection for allergic moderate to severe persistant asthma, chronic hives, and may be helpful (though not FDA approved) for other allergic conditions like allergic rhinitis, nasal polyps, and atopic dermatitis.

Clinical Research

The allergists at The Asthma Center are actively involved in research with new medications for the treatment of sinusitis, asthma and allergies.

If you or your children would be interested in becoming a paid volunteer to participate in our clinical research studies, please contact a study coordinator for our research company, Allergy and Asthma Research of NJ, Inc.

For more information, call our study center at (215) 677-3840.

Education and Research Fund

The Asthma Center Education and Research Fund, a non-profit (501(c)(3)) Charitable Foundation, is an independent educational and research organization focusing on asthma, allergies and sinus disease. The fund's mission is to:

- Produce educational materials (like this manual) and programs designed to improve knowledge about a variety of upper and lower respiratory condtions.
- Promote and enhance awareness through education via distribution of free educational material to the public, nurses, teachers and physicians in the Delaware Valley.
- Support and advance research in order to improve, prevent, and treat, a variety of chronic respiratory diseases.
- Reporting pollen and mold sporre levels to organizations including the AAAAI

The Asthma Center Education and Research Fund was founded in 1994 by allergists specializing in asthma, allergic disorders and sinus disease who recognized unmet needs in local communities throughout the Delaware Valley. As a result of these unmet needs, many individuals sustained poor quality of life and in many cases emergency room visits and hospitalizations from chronic respiratory symptoms.

In an effort to change this situation, **The Asthma Center Education and Research Fund** began publishing and distributing free comprehensive educational materials. The organization also initiated asthma and allergy awareness programs through radio, print media, free screenings, lecture series, social media and through our active blog (*www.asthmacenter.com*). **The Asthma Center Education and Research Fund** has created a website, *www.asthmacenter.org*, to increase access to these educational materials and resources by making them easily available to the public.

The Asthma Center Education and Research Fund supports original research in the specialty of asthma, allergy and sinus disease which has been published in national peer-reviewed journals. **The Asthma Center Education and Research Fund** also supports local pollen and mold spore collection and interpretation in the Delaware Valley. Daily pollen and mold spore counts are then made available to the public and are reported to the National Allergy Bureau, a national data base organized by the American Academy of Allergy, Asthma, and Immunology. These counts are reported to local media and used for TV, radio, and print and are emailed to those with email subscriptions.

To make a tax deductible donation call:
The Asthma Center Education and Research Fund
(215) 569-1111

For more Information

www.asthmacenter.org

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If you have a question regarding this manual, you can direct your questions to The Asthma Center Education and Research Fund at 215-569-1111.

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