

Sinusitis

Purpose: The purpose of this course is to provide an overview of sinus infections. The focus will be on understanding the difference between viral and bacterial sinus infections. By the end of the course the reader will have an understanding of appropriate treatment options for the patient who presents with a sinus infection.

Objectives

- Differentiate between viral and bacterial sinusitis
- Discuss the signs and symptoms of sinus infections
- List three diagnostic tests for the evaluation of sinus infections
- Discuss recommended antibiotics in the treatment of sinus infections
- List five non-pharmacological interventions in the treatment of sinus infections

Mary, a forty-three year white female, presents to her primary care physician's office with a cold that she "just cannot get rid of". The discharge is thick green and is accompanied by nasal congestion. These symptoms have been present for four days and accompanied by a headache, sore throat and fever of up to 100.7 degrees Fahrenheit.

Further details of the history reveal that her nasal discharge is thick green in the morning and clears as the day progresses. She reports that she also has a morning cough that is productive of the same green sputum. Her fever finally went away last night but she still feels tired and wiped out.

Her exam revealed vital signs within normal limits. Her nasal mucosa is inflamed with clear nasal discharge. The maxillary sinuses are mildly tender. She has no cervical adenopathy and her lungs are clear.

Last night she was at the local urgent clinic where the nurse practitioner recommended that she use nasal saline, steam inhalation, warm wash cloths to the face, nasal decongestants and antipyretics. She came to her doctor's office today because "that dumb nurse wouldn't give me any antibiotics".

Inflammation of one or more of the sinus cavities affects 29.5 million noninstitutionalized adults each year and accounts for 12.6 million visits to office-based physicians annually. It is the fifth most common diagnosis that prompted an antibiotic and its diagnosis and treatment annually cost the health care system 5.8 billion dollars ^{1, 2, 3}.

One of the most important jobs of the health care system is to differentiate between the common cold and sinus infections. The average adult has 2-4 colds every year while the average child has 6-8 colds annually⁴. Each cold does not warrant treatment with antibiotics. Unfortunately, like Mary, many patients have expectations of antibiotics prior to a health care encounter.

Definition

Viral sinusitis – also known as the common cold - is the presence of a sinus infection that lasts for one to two weeks with some improvement noted after seven days. A viral sinus infection transforms into a bacterial sinusitis when bacteria grows in the presence of a sinus obstruction that impairs drainage.

Viruses are the most common predecessor to a sinus infection but other potential contributors to sinus infections include: pollutants, allergies and nasal problems. Sinusitis without rhinitis is uncommon.

Inflammation of one or more of the paranasal sinuses defines sinusitis. Symptoms lasting less than 4 weeks are classified as acute sinusitis. If the signs and symptoms last 4-8 weeks than it is defined as sub-acute sinusitis; and signs and symptoms lasting longer than 8 weeks is labeled as chronic sinusitis. Three or more episodes over a 12 month period is considered recurrent sinusitis³.

Many different organisms can lead to bacterial sinus infections. While early in the course of the illness viruses are likely causing the symptoms; as the disease persists bacteria tends to grow.

Common organisms in bacterial sinusitis include: *Streptococcus pneumoniae*, *Haemophilus influenzae* and *Moraxella catarrhalis*. When facial erythema is accompanied by fever the clinician should consider *Staphylococcus aureus* as a possible etiological factor. Many other organisms may be present especially in the hospitalized or immunocompromised patient and include anaerobes, fungus and other types of bacteria.

Another definition that is important to understand is severe symptoms. Those with severe symptoms may warrant quicker treatment. Temperature of greater than 102 degrees Fahrenheit and purulent nasal discharge for at least 3-4 consecutive days in an ill child are severe symptoms⁴.

Signs and Symptoms

Most of the symptoms of bacterial sinusitis are nonspecific. The patient often presents with a prolonged cold with symptoms of nasal congestion, face or dental pain, purulent drainage, headache, cough and postnasal drainage. Facial pain is made worse by leaning forward or with head movement. Decreased ability to smell, bad breath, fatigue, fever, and sore throat may be present^{3, 5}.

Determining when a viral sinus infection has transformed into a bacterial sinus infection is a challenging venture. The diagnosis of bacterial sinusitis on clinical or radiographic grounds is only 30-50 percent accurate as many patients deemed to have bacterial sinusitis have sterile sinus aspirates⁵. Despite this, the literature still uses the presence of symptoms persisting after 7-10 days with at least two of the following: headache, poor response to decongestants, colored nasal discharge, or facial/sinus pain^{5, 6} as the standard method to diagnose bacterial sinusitis.

Common symptoms of viral upper respiratory infections (URI) include runny nose, fever (more common in kids), malaise, headache, nasal discharge, cough, laryngitis, injected conjunctiva and anorexia. The symptoms typically peak in 3-5 days and resolve in one to two weeks. It is not unusual for mild cough and congestion to persist beyond 14 days in a viral URI⁵.

Fever tends to occur early in the course of viral URI and resolves within two to three days. After the resolution of the fever – which is often accompanied by headaches or myalgias – the sinus symptoms become more noticeable. Purulent nasal discharge often appears after a few days and many people mistakenly think this is an indication for an antibiotic.

When a patient presents with signs and symptoms consistent with a viral URI it is important to rule out other conditions. Otitis media often accompanies a viral URI and would be suggested by a fever, ear pain and on exam a red, immobile tympanic membrane. Recent upper respiratory infections commonly predisposes patients to otitis media. Mucous and edema in the nose, throat and eustachian tubes allow secretions to build up and obstruct the middle ear. Infection – either bacterial or viral – can then develop. In addition to sinus infections, secretions from allergies can result in the same problem. After the infection has resolved an effusion may persist for up to a few months.

Abuse of nose drops also known as rhinitis medicamentosa needs to be a consideration in someone with a diagnosis of sinusitis. A patient with a viral upper respiratory tract infection may use topical decongestants to relieve symptoms. While this is a recommended treatment option it can lead to a misdiagnosis of sinusitis if the patient uses the medication for longer than the recommended three days. With continued use, tachyphylaxis occurs, leading to more frequent use and a shorter duration of action.

For example, if a patient has been using the decongestant nasal spray for 7 days and then decides to stop treatment, he may develop some rebound congestion and go to the doctor. The patient will complain of nasal congestion (beyond day 7-10) that is unresponsive to treatment. Unless a good history is obtained, including determining the frequency and duration of the use of the topical decongestant, it is possible sinusitis will be misdiagnosed instead of rhinitis medicamentosa.

Rhinitis – both allergic and nonallergic - is a common condition that is often confused with sinusitis. Rhinitis is an inflammation of the lining of the nasal cavity and presents with symptoms such as congestion, sneezing, runny nose and post-nasal discharge. It may be also be associated with facial pain, congestion and episodic symptoms. Multiple conditions are linked to rhinitis including: nasal polyps, pregnancy and overuse of topical decongestants. Medications – such as beta-blockers, angiotensin converting enzyme inhibitors, hydrochlorothiazide, prazosin, estrogen, non-steroidal anti-inflammatory medications and cocaine - can also lead to rhinitis.

Allergic rhinitis commonly runs in families and should be suspected in those with a family history of asthma, allergic rhinitis or atopic dermatitis. It presents with sneezing, runny and itchy nose, watery and itchy eyes, cough and postnasal drainage.

Physical exam can help differentiate between rhinitis and sinusitis. Rhinitis presents with nasal congestion and evidence that the patient has been itching. Allergic rhinitis may co-exist with allergic conjunctivitis with symptoms such as red, watery and itchy eyes. Allergic shiners – dark circles under the eyes - may be present in allergic rhinitis, but is often present in acute sinusitis as well. In allergic rhinitis the nasal mucosa may be boggy, bluish and pale. There may be a nasal crease as a result of frequently rubbing the nose in what is called the allergic salute.

Timing of the symptoms is another factor that can help differentiate allergic rhinitis from sinusitis. Symptoms that coincide with the grass or tree pollens or a

new exposure to a dusty or moldy environment may suggest an allergic cause of the symptoms.

Other conditions to consider include bronchitis and pneumonia.

Inflammation of the bronchi defines bronchitis. Symptoms are cough, chest tightness and shortness of breath. Cough is often productive of green or yellow sputum. It may start with sinus or other symptoms suggestive of a viral upper respiratory tract infection and then spreads to the chest.

Infection and inflammation of the lung is pneumonia. It can be caused by bacteria, virus and fungi. Symptoms are shortness of breath, cough and fever. A chest x-ray is often necessary to definitively diagnose the condition.

Inflammation in the supraglottic region of the oropharynx with inflammation of the epiglottis and surrounding areas defines acute epiglottitis. This is an acute condition and is a medical emergency. Its incidence is less common with improved vaccinations – specifically the *Haemophilus influenzae* B vaccine - and is more common in adults than in children. The onset and progression of symptoms is rapid. Presentation is typically a sore throat, painful swallowing and a muffled voice. Adults often have an upper respiratory tract infection preceding the onset of epiglottitis.

In sinusitis, kids are more likely to complain of persistent nasal discharge and a daytime cough and less likely to complain of headache and facial pain. Kids often have nausea due to swallowing of mucous and may even vomit after gagging on mucous or excessive coughing^{3,7}.

Chronic sinusitis is more subtle in its presentation. Nasal congestion is the main symptom but it may also co-exist with headache, fatigue and post-nasal drip. Those with chronic sinusitis may have allergic rhinitis, a deviated septum or nasal polyps, or be immunocompromised.

The health care provider always needs to be on the lookout for serious complications of sinus infections such as meningitis, orbital cellulitis, osteomyelitis or abscess formation. Worrisome signs and symptoms include: diplopia, swelling of the forehead or periorbital area or abnormal extraocular function.

Signs

Nasal inflammation and edema along with purulent secretions are hallmark signs of sinusitis. But the physical exam is not helpful in the diagnosis of sinusitis as it is often difficult to differentiate between viral and bacterial etiology on exam⁴.

Purulent secretions are not always visualized even when acute sinusitis is present. If present, nasal secretions are often clear at the onset of the cold and become thicker and purulent within the first week and then begin to clear by day 5 to 7³. Tenderness over the affected sinuses is often noticed. In addition, there can be mucosal redness and post nasal drainage noted in the throat.

Transillumination that results in complete opacification is helpful and partial opacification is a non-specific finding¹. Tenderness over the forehead and cheeks is often present¹, but not as commonly in children⁴. Dark circles under the eyes result from poor venous blood flow because of the inflammation.

Diagnostic Tests

Imaging the sinuses are typically not done, but can be useful when there is a complicated course, the patient is not responding to treatment, the diagnosis is in questions or if complications are suspected. The Sinus and Allergy Health Partnership does not advocate the use of radiographs, computed tomography (CT) or magnetic resonance imaging scans to diagnose uncomplicated cases of acute bacterial sinusitis⁸.

Sinus x-rays are not very accurate as many patients with disease will have negative x-rays. Ultrasound – which is the test of choice in the pregnant patient - can be done but has poor sensitivity and specificity³.

Computerized tomography (CT) is a much more sensitive study. It is the test of choice before sinus surgery and helps in the diagnosis of fungal sinusitis³. While frequently used it does have drawbacks including it is associated with radiation exposure and is expensive. It is helpful in a case of recurrent or chronic sinusitis or if there is involvement of the orbit and other complications of sinusitis.

Magnetic resonance imaging (MRI) is not as good at diagnosing sinus infections when compared to CT scan, but it is useful for determining if any soft-tissue involvement is present. MRI may also be useful in evaluating persistent disease for more rare causes of sinusitis such as allergic fungal sinusitis or Wegener granulomatosis. It also helps evaluate for the presence of tumors³.

Nasal cytology – while not very helpful in acute sinusitis - can help differentiate other conditions such as allergic or nonallergic rhinitis, nasal polyposis or eosinophilic nonallergic rhinitis or vasomotor rhinitis³.

Sinus puncture with culture is the gold standard for diagnosis of infection and identifying the offending organism. It is rarely used because it is expensive and invasive. Nasal-sinus biopsy can also determine if a lesion is cancerous, evaluate for fungal disease, evaluate the function of the cilia and look for a granuloma³.

Nasal endoscopy is used in some instances, such as those who have not responded to therapy, and are typically performed by an otolaryngologist. This will help show a deviated septum, nasal polyps or other abnormalities as well as in the evaluation of the spread of infection.

Treatments

Treatment goals include: controlling infection, reversing the obstruction and reducing edema. Treatment entails hydration, medications to control symptoms and antibiotics.

Non-pharmacological

Comfort measures are important in both viral and bacterial sinus infections. Reducing nasal congestion can be accomplished with the use of nasal saline and a bulb syringe. Recent evidence suggests that the use of nasal saline improves rhinorrhea, congestion, sore throats, cough and the number of sick days in children with cold symptoms⁹. In addition salt water gargles, rest and cool mist vaporizers are all measure to ease symptoms.

Hydration can help thin mucus. It is recommended that one drinks 8-10 glasses of liquid each day. Increasing the humidity can be done with a vaporizer, but the worry for the growth of microorganisms in the vaporizer is a concern and

many clinicians recommend the use of steamy showers instead. Application of a warm facial pack, such as a washcloth, can be helpful.

Over the Counter Medications

Over the counter medications have yielded mixed results for children. Children should not have any medications that contain aspirin in them as this will increase the risk of Reye's syndrome.

Over the counter medications are more effective in adults but some caution must be exercised. Adults with co-morbid medical conditions may have contraindications to some over the counter medications.

Antihistamines are medications that dry nasal secretions, reduce sneezing and dry watery eyes. While effective in the treatment of allergic symptoms, their use in sinus infections is generally not recommended because they may thicken secretions. Antihistamines are also associated with many side effects including: confusion, constipation, dry mouth, urinary retention (use caution in men with prostate enlargement), and blurred vision.

Decongestants reduce the symptoms of nasal obstruction. These medications come in oral form, as a nasal spray and as a vapor inhaler. Decongestants promote drainage, reduce the symptoms and may promote healing. Oral and topical decongestants may increase blood pressure and should be used with caution, if at all, in patients with cardiac conditions. Topical decongestants should be given for no longer than 3-5 days.

Mucolytic agents such as guaifenesin may help thin secretions but have limited data demonstrating their effectiveness. Analgesics and antipyretics can

reduce pain and fever and are useful adjuncts in the treatment of sinus infections.

Antibiotics for Acute Sinusitis

Sinus infections lasting less than seven days rarely warrant antibiotics as less than 2 percent of common colds are bacterial in nature⁴. Nonetheless, antibiotics are overprescribed for multiple reasons such as a desire of the provider to please the patient and misinformed prescribers. Antibiotics should be avoided for the common cold because they are not helpful, may increase antibiotic resistance and increase the risk of side effects.

Patients who present with symptoms of a sinus infection for less than seven days most likely have a viral infection and will not benefit from antibiotic treatment. These patients warrant symptomatic treatment.

When symptoms are present for 7-10 days than a bacterial infection should be suspected and antibiotics considered. Although recent research suggests that antibiotics may not be justified even in the patient who has sinus infections lasting longer than 7-10 days¹⁰. In the adult, observation without antibiotics for up to 7 days may be warranted in those with an uncomplicated bacterial sinusitis as evidence by mild pain and a temperature of less than 101 degrees Fahrenheit¹¹.

Treatment is empiric as obtaining a culture is an invasive technique. If after 3-5 days symptoms have not improved or symptoms return within two weeks of being on an antibiotic suspect a resistant pathogen. Patients who do not

respond to amoxicillin after 3-5 days may be switched to amoxicillin-clavulanate or cefuroxime axetil³.

First line agents for the treatment of sinusitis are amoxicillin in both adults and children and trimethoprim-sulfamethoxazole (TMP-SMX) in adults as an alternative to amoxicillin. These medications are generally effective, well tolerated and are inexpensive. Unfortunately, they do not combat resistant strains and do not cover resistant *Streptococcus pneumoniae*. Bacterial resistance appears to be more common in children than adults.

Allergy to penicillin can be treated with cephalosporins, macrolides or quinolones. Caution must be used with cephalosporins in the patient with penicillin allergy as there is some cross sensitivities between these two classes.

Length of treatment is generally 10-14 days. The antibiotic should be continued for 7 days after the patient starts to feel better to assure that the organism is completely eradicated.

Table 1: Medications for Sinusitis

First Line
TMP-SMX
Amoxicillin*
Second Line
Amoxicillin-clavulanate*
Cefuroxime axetil*
Cefprozil*

Third Line
Clarithromycin*
Azithromycin*
Ciprofloxacin
Levofloxacin
Gatifloxacin
Moxifloxacin
Other
Clindamycin*
*Medications used in both adults and children for sinusitis + TMP-SMX – can be used in children but there is a high degree of resistance No mark – only for use in adults

Nasal steroids have been used for the treatment of sinus infections but its use is questionable at best. Some patients with recurrent sinus infections especially if afflicted with allergies may benefit from nasal steroids. Generally, the

treatment of acute sinusitis with nasal steroids does not improve the course of the disease¹⁰.

Gastroesophageal reflux disease is associated with worsening of sinusitis. Treatment of GERD can help in the management of sinusitis³.

Patients who do not respond to treatment should be evaluated for medication compliance, underlying factors or resistant organisms. Continued treatment for another 10-14 days may be considered in those with a partial response. Those who did not respond well should be changed to a different medication that has better coverage versus resistant organisms. A CT scan may be considered in those who do not respond well to treatment.

Chronic Sinusitis

Those with sinusitis for greater than twelve weeks should have an otolaryngologist consult. Multiple diagnostic tests should be considered including: a CT scan, nasal endoscopy, nasal and sinus cultures, and possibly an allergy test. Antibiotic selection in chronic sinusitis is similar but may include a drug that has anaerobic coverage (clindamycin or metronidazole) and may be given for a longer period of time. Typically, antibiotics are given for 2 to 4 weeks and occasionally up to 12 weeks. Oral corticosteroids may help those with nasal polyps or chronic sinus infections that have a lot of swelling. The use of nasal corticosteroids is of questionable benefit in both acute and chronic sinusitis. The patient should be evaluated for any structural abnormality, tumors, allergies or immunodeficiency.

Prevention

Sinus infections are common infections, but for those with recurrent infections should address why this happens. Environmental factors may strongly affect the sinuses and include: mold, pollution, cigarette smoke or barotrauma. Evaluation for an untreated or under treated allergic rhinitis, nasal polyps or a septal deviation is suggested. Referral to an otolaryngologist or allergist may be appropriate.

Alternative Treatments

A lot of attention has been paid to alternative medication in the management of the common cold. While data is not conclusive, there has been some evidence that certain medications may provide aid in the treatment of the common cold.

Alternative medications are not regulated as tightly as traditional medications, but most are free of serious side effects. There can be a lot of variation among individuals as it is impossible to comment on the interactions these medications may have on individual physiologies, medical co-morbidities and other pharmacological agents taken by individuals.

Echinacea may stimulate white blood cells and shorten the duration of the common cold. Zinc – a common product in many lozenges – may reduce the duration of the common cold. The effects of Vitamin C on the common cold is minimal⁵.

While many of these medications have been looked at in common colds, few have been studied in bacterial sinus infections.

Nursing Interventions

Nurses are often the first health care provider contacted when the symptoms of sinus infections are present. Nurses need to be able to elicit a good history from the patient and initiate patient education. Patients who have symptoms that are not severe and consistent with a viral URI should be educated about the symptomatic therapies for the management of symptoms. Nurses need to educate the patient about the typical course of resolution of symptoms and when follow up with the health care provider is appropriate.

Key points

- Ascertain how long the symptoms have been present and the details of the symptoms
- Determine if severe symptoms are present
- Discuss non-pharmacological interventions which are helpful
- Discuss over the counter medications that may be helpful and which are not helpful
- Teach patient to follow up with health care provider if severe symptoms are present or if symptoms do not improve after 7-10 days.

Case Study Conclusion

The primary care provider agreed with the treatment initiated at the urgent clinic. The nurse provided teaching to about when to follow up if no better.

Despite the patient's insistence that an antibiotic is necessary to treat the infection, the physician did not prescribe one.

Four days later, the patient called back reporting that she got worse overnight and spiked a fever of 100.4 degrees Fahrenheit and developed facial tenderness with continued nasal discharge.

At this point she was treated with amoxicillin twice a day for 10 days with a complete resolution of her symptoms. She was also counseled about the use of nasal saline, decongestants, and antipyretics.

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