

Chapter 35

Chronic Sinusitis

Marc Riedl, MD, MS, University of California, San Diego, San Diego, California, USA

Chronic sinusitis, often called chronic rhinosinusitis (CRS) due to involvement of both the nose and sinuses, is a common medical condition affecting over 10% of the general population. In primary immunodeficiency diseases (PI), CRS is a very common complication due to the increased risk of infection and inflammation associated with many forms of PI. Additionally, CRS is often a prominent presenting symptom of PI such that screening for PI should be considered in individuals with severe and persistent CRS that does not respond to usual treatments. The following will briefly review CRS in PI including contributing factors, evaluation, and treatment.

Background

The sinuses are hollow cavities in the skull that have important functions:

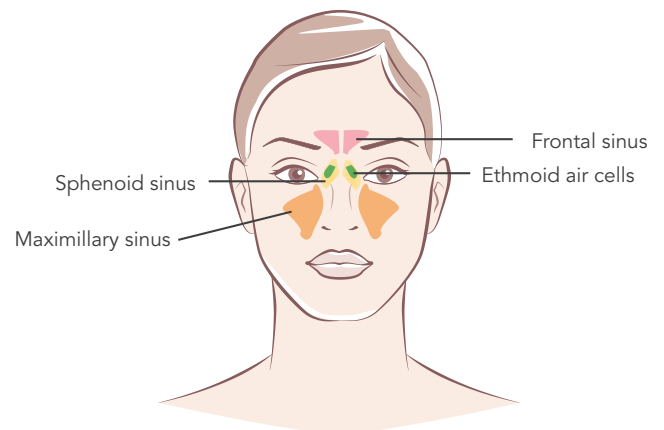
- Warming, humidifying, and filtering air before it goes into the lungs
- Improving the quality of our voice and speech
- Reducing the overall weight of the skull

The tissue lining the nose and sinuses can swell or contract with changes in temperature, humidity, and exposure to particles or allergens.

The paranasal sinuses of the head and face include specific cavities named for their location within the skull: maxillary, ethmoid, frontal, and sphenoid. (Figure 35:1) Normally, these sinuses have a specific drainage pattern by which cilia (tiny hair-like cells) continuously sweep mucous, microbes, and other particles out of the sinuses through ostia (small openings) into the nose and subsequently the throat. When inflammation from infection, allergy, or other irritants causes swelling of the sinus tissues, these ostia can become obstructed leading to accumulation of mucous, fluid, or bacteria. The ostiomeatal complex is an additional potential trouble spot in the sinuses. This is a series of narrow, bony openings along the inside wall of the nose. The ostiomeatal complex is a common drainage pathway for the frontal, maxillary, and ethmoid sinuses, and it is important for normal sinus drainage and ventilation. If the ostiomeatal complex is blocked due to swelling, mucous accumulation, or an anatomical abnormality, this can act as a bottleneck and lead

to chronic inflammation in multiple sinus cavities due to the lack of normal drainage. Typically with an acute viral or bacterial sinus infection that resolves, inflammation only lasts for several days; this is known as acute sinusitis. But if inflammation persists, CRS may develop. Any of the sinuses can be affected by CRS though the maxillary and ethmoid sinuses are most often involved.

Figure 35:1 Cavities of the Paranasal Sinuses



The chronic nasal and sinus inflammation of CRS can be due to several factors and is exacerbated in PI by the susceptibility to infection as well as the inability to adequately control inflammation. CRS is often divided into specific categories: CRS without nasal polyps, CRS with nasal polyps, allergic rhinosinusitis, and allergic fungal rhinosinusitis. Most people with PI are affected by CRS without nasal polyps, but it is important to consider the possibility of other

subtypes. Typically CRS with nasal polyps and allergic fungal rhinosinusitis can be identified by specific characteristic findings on sinus imaging (CT scans) or direct examination by rhinoscopy.

Symptoms

Common symptoms of CRS include chronic nasal obstruction (blockage), persistent mucous production from the nose or down the back of the throat (post-nasal drip), facial pain or pressure, and a reduction or loss in the sense of smell. Chronic cough is also a common symptom and may be seen more frequently in children than adults. These primary sinus and respiratory symptoms of CRS are important to recognize and report to a healthcare provider so that appropriate evaluation and treatment can be pursued. Studies suggest that uncontrolled CRS may contribute to other problems including fatigue, sleep disturbances, ear pain or pressure, dizziness, bad breath, and throat irritation. The course of CRS can be quite variable from person-to-person but involves chronic recurrent sinus symptoms lasting more than 12 weeks. Some individuals with CRS have constant, persistent sinus symptoms with episodes of modest worsening or improvement over time. Others have more distinct intermittent episodes of sinus symptoms with short asymptomatic periods in between.

Causative and Contributing Factors

CRS is a chronic inflammatory process that likely begins with an acute bacterial sinus infection. In most cases, an antibiotic and/or the immune system will clear the infection and sinus symptoms will resolve over several days. However, in some individuals, the infection or inflammation fails to resolve leading to a chronic inflammatory process that causes prolonged, persistent symptoms. This is particularly true in PI where the immune response may be inadequate to effectively control or clear an infection. The role of chronic or recurrent bacterial infection in the ongoing symptoms of CRS is controversial. The exact causes for the development of CRS are not entirely known and remain an area of ongoing research but identified factors contributing to CRS include the following:

Allergy: Environmental allergies are the most common risk factor for CRS in the general population. Allergic inflammation in the nose and sinuses may lead to chronic inflammatory symptoms and obstruction that additionally increases the risk of

recurrent sinus infections. Most allergic people who develop CRS are reactive to perennial (year-round) rather than seasonal allergens. Perennial allergens typically involve chronic exposure and include dust mites, indoor/outdoor molds, and animal dander.

Immunodeficiency: Impaired immune responses increase the frequency and severity of infectious sinusitis leading to CRS complications. Individuals with antibody deficiency conditions, such as Common Variable Immune Deficiency (CVID), hypogammaglobulinemia, Specific Antibody Deficiency (SAD), etc., are frequently affected by CRS, though other types of PI may also develop this complication.

Anatomical abnormalities: Significant obstruction of normal sinus drainage may increase the risk of recurrent bacterial infection and subsequent inflammation. Obstruction can be caused by allergic inflammation as described above but also can be due to structural tissue abnormalities: large nasal polyps, congenital formations such as concha bullosa (air cells in the nasal turbinates), deviated septum, or sinus cysts. In addition, previous sinus surgeries can sometimes lead to structural abnormalities due to scarring or disruption of the tissues that normally clear the sinuses using very fine-hair like structures (cilia) to sweep mucous, particles, allergens, and infectious organisms out of the sinus cavities.

Smoking: Active smoking is an important risk factor for CRS. Tissue inflammation in the nose and sinuses is caused by chronic exposure to the particles and chemicals found in tobacco or marijuana smoke.

Airborne irritants and pollutants: Chronic respiratory exposure to irritant chemicals (mostly a concern in occupational settings) may increase the risk of CRS. Frequent exposure to more common air pollutants, such as engine exhaust particles and carbon monoxide, may also increase CRS symptoms though it is unclear if these exposures play a causative role.

Evaluation

Evaluation for CRS starts with the clinical history to identify chronic sinus symptoms as described previously. This should include documentation of the primary symptoms of chronic obstruction, persistent mucous production, facial pain or pressure, and reduced sense of smell. Typically, symptoms are present for months (less than 12 weeks). The medical history should include information about any conditions or exposures known to be associated

with CRS (as described above) and determine any previous diagnostic tests, treatments, or procedures (such as sinus surgery) for the condition. A physical examination should be conducted to look for signs of nasal and/or sinus inflammation. Findings may include purulent (colored) mucous, swelling, or polyps in the sinuses. Rhinoscopy or nasal endoscopy may be performed to better visualize the nasal and sinus cavities. This involves the use of a slender fiberoptic scope inserted into the nose, usually after medication is given by nasal spray to temporarily shrink the nasal tissues. Radiographic imaging such as CT scans may also be performed to assess the deeper sinus tissues. Important CT findings in CRS include mucosal thickening, obstruction of the sinuses due to structural abnormalities, and fluid or mucous collections within specific sinus cavities. Additional important diagnostic tests to consider in the evaluation of CRS include allergy testing (skin or blood tests) to identify environmental allergies and laboratory testing for immunodeficiency if not already completed. In individuals with persistent infectious symptoms that have been unresponsive to antibiotics, sinus cultures can be considered to guide additional antibiotic therapy. However, cultures should be collected from the deep sinuses via nasal endoscopy; culture swabs from the anterior nose are not accurate and should not be used to guide treatment.

Management

Once CRS is diagnosed by a healthcare provider based on the evaluation above, the management plan will often consist of multiple components. It is important to recognize that CRS generally cannot be cured, but appropriate treatment can usually reduce symptoms and the burden of the condition.

Treatment of PI: In PI, a first important step in managing CRS is to ensure proper treatment is provided for the underlying immunodeficiency. For many individuals, this involves appropriate immunoglobulin (Ig) replacement therapy with dose adjustments made over time by the treating healthcare provider to prevent infections as effectively as possible while avoiding side effects. However, CRS may occur and persist despite Ig replacement therapy, likely due to multiple factors other than infection that contribute to the condition. Thus, CRS remains very common in PI, even with Ig replacement therapy. Studies support a reduction in the frequency and severity of sinusitis symptoms with Ig replacement therapy in types of PI that involve

antibody deficiency. The effect of higher dosing of Ig replacement therapy in CRS has not been firmly established.

Antibiotics: The role of antibiotics in treating CRS is currently unclear. Antibiotic treatment is recommended for the treatment of acute bacterial sinusitis in individuals with PI due to the increased risk of more severe infectious complications in this population. However, the chronic persistent sinus symptoms of CRS are unlikely to be due to a simple persistent bacterial infection and treatment with antibiotics alone is unlikely to be effective. As CRS is driven by multiple factors and a complex inflammatory response, management plans frequently require non-antibiotic treatment aimed at controlling inflammation. Thus, prolonged or chronic antibiotic treatment for the management of persistent CRS symptoms is generally not recommended; rather antibiotics should be reserved for treatment of clear acute bacterial sinusitis exacerbations. However, when evidence of persistent bacterial infection is present (persistent purulent colored mucous, findings on CT scan or by direct rhinoscopy), a prolonged course of antibiotics for four to six weeks may be beneficial. Rarely, longer antibiotic courses are considered, but the associated risks and side effects should be carefully evaluated. Antibiotics should be selected by the healthcare professional based on suspected or confirmed causative bacteria. Gradual improvement in symptoms is expected over the course of antibiotic treatment. If symptoms fail to improve, consideration should be given to obtaining a culture from the sinuses (typically done by ear, nose, and throat specialists) to guide further treatment. CRS can sometimes be complicated by specific infections such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and anaerobes. These may require very specific antibiotic regimens so proper cultures are important in determining the most effective treatment. As noted earlier, antibiotics alone are usually insufficient to treat or control CRS and other non-antibiotic therapies must be used.

Nasal irrigation: One of the most effective management procedures is daily sinus rinses with a saline solution to physically remove mucous, particles, allergens, and infectious organisms. Irrigation also improves the function of sinus cilia that naturally clear the sinuses. Larger volume rinses with a neti-pot, squeeze bottle, or water pick with nasal irrigating device are thought to be more effective than low volume saline nasal sprays. To reduce the

risk of contamination or infection, it is important to use distilled water or water sterilized by boiling or other means. A variety of over-the-counter saline packets are available, or it is possible to make buffered saline solution weekly using available recipes.

Intranasal corticosteroids: Topical steroids are an important anti-inflammatory medication for the treatment of CRS. These are most commonly given by nasal spray with several formulations available over-the-counter or by prescription. Nasal corticosteroids work slowly to reduce inflammation such that daily use for several weeks is necessary to see maximal benefits from the treatment. Nasal irrigation first followed by intranasal steroids seem to work best. Additionally, spray technique is important to ensure optimal results and to avoid injury to the anterior nose, so it is important for individuals to review this with their healthcare provider. For CRS that is unresponsive to nasal steroid sprays, short-term use of nasal rinses with a diluted steroid solution may be more effective in some cases.

Anti-leukotriene drugs: Leukotrienes are an inflammatory mediator that can contribute to the symptoms of mucous production and sinus swelling in some people with CRS. Medications that specifically block the effects of leukotrienes can sometimes be helpful for symptom control when added to other treatment measures. Medications in this class include montelukast, zafirlukast, and zileuton.

Allergy treatment: Effective allergy treatment is an important part of controlling CRS. This is most often achieved with the anti-inflammatory intranasal steroids and/or anti-leukotriene medications listed above. Oral or nasal antihistamines can also be useful to relieve symptoms of itching, sneezing, or dripping. Allergen immunotherapy (injections or sublingual tablets or drops) can be considered though the efficacy of this desensitization therapy for individuals with PI is unknown.

Oral corticosteroids: Short courses of oral corticosteroids such as prednisone may be useful in managing severe flares of CRS. However due to the considerable side effects and risks, systemic corticosteroids are rarely used for this purpose, and this is particularly true in PI where avoidance of the immunosuppressive effects is preferred.

Smoking cessation: Smoking causes chronic inflammation of both the upper and lower airway such that smoking cessation is an important part of improving CRS symptoms. In addition, it is

also recommended that household members be encouraged to stop smoking since secondhand smoke has similar toxicity.

Additional medical therapies in development:

Since CRS can be difficult to treat in some individuals, additional treatments are being studied. These include nebulized or topical antimicrobials for the sinuses, the placement of sinus devices that slowly deliver local medications to the sinus tissues, and targeted antibody medications (biologics) aimed at blocking specific inflammatory pathways. The benefit of these approaches for CRS has not been firmly established and the safety in PI conditions is not known.

Sinus surgery: Sinus surgery for CRS should be considered only when comprehensive maximal medical therapy has failed to result in substantial symptom improvement. In some instances, identified anatomical abnormalities or obstructions may need to be addressed by sinus surgeons in an effort to restore proper sinus drainage. Occasionally, severe inflammation cannot be improved with medication and removal of affected tissues is necessary for future medical therapy to be effective in controlling CRS. If sinus surgery is considered, it is very important that medical therapy be implemented or continued as well so that improvements achieved with surgery can be maintained following the procedure. Individuals with PI should be sure to discuss any planned surgical procedure with their immunodeficiency specialist so that appropriate PI expertise is available throughout the surgical period.

Summary

CRS is a chronic inflammatory condition affecting individuals with and without PI. The condition may be complicated in PI by susceptibility to recurrent infection which makes condition-specific PI treatment a critical part of CRS management. However, CRS is clearly multifactorial, and treatment or prevention of infection alone is insufficient to control symptoms in most cases. Therefore it is important for individuals with PI and CRS to consider and discuss all contributing factors with their healthcare team. Often, a multidisciplinary team that includes the primary care provider, immunologist, allergist, and ENT specialist is helpful in optimizing treatment outcomes.

Additional Reading

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