Management of acute and chronic sinusitis

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Abstract

Sinusitis is a common condition for which patients often consult the community pharmacist. It is, however, challenging to differentiate between common forms of sinusitis as they have nearly identical clinical representations. This review article provides an overview of sinusitis, classification, differential diagnosis between viral sinusitis, bacterial sinusitis and chronic rhinosinusitis, therapeutic management, patient education and patient referral guidelines. In addition, the recently updated guidelines on sinusitis published by the American Academy of Otolaryngology–Head and Neck Surgery Foundation (2015), the European position paper on rhinosinusitis and nasal polyps, EPOS 2012 and the Canadian guidelines for acute bacterial rhinosinusitis (2014) will be reviewed.

Keywords: sinusitis, rhinosinusitis, nasal irrigation, decongestion, nasal corticosteroids

Introduction

Rhinosinusitis, commonly known as sinusitis, is characterised by inflammation of the lining of the paranasal sinuses and nasal cavity. The different types of sinusitis can be categorised on the basis of condition, causative organism and location.

Condition

• Acute rhinosinusitis (ARS) – symptoms normally last less than four weeks.
• Subacute rhinosinusitis – symptoms for a minimum of four weeks but less than twelve weeks.
• Recurrent acute rhinosinusitis – frequent multiple episodes per year with fewer complete resolutions.
• Chronic rhinosinusitis (CRS) – symptoms last more than twelve weeks.

Causative organism

• Acute bacterial rhinosinusitis (ABRS)
• Acute viral rhinosinusitis (AVRS)

Location

• Maxillary sinusitis – characterised by pain and pressure in the maxillary area located below the cheeks, above the teeth and on either side of the nose.
• Ethmoid sinusitis – characterised by pain or pressure between the eyes, the sides of the upper part of the nose.
• Frontal sinusitis – characterised by pain or pressure in the frontal sinus cavity in the forehead above the eyes.
• Sphenoid sinusitis – characterised by pain or pressure behind the eyes, often refers to the skull vertex (top of the head), or back of the head.

Epidemiology

In 2012 the national health survey reported twelve per cent of the US population, thus nearly one in eight adults, were diagnosed with rhinosinusitis in the previous year. Rhinosinusitis was diagnosed more frequently than hay fever (7%), bronchitis (4%), or chronic obstructive pulmonary disease (4%). Furthermore, rhinosinusitis was most likely to occur concurrently with asthma (13%) in individuals surveyed. Additional studies in Iran found that the prevalence of sinusitis was 53%; of that, maxillary sinusitis had a prevalence of 68%, followed by ethmoid sinusitis with 31%, sphenoid sinusitis with 19%, frontal sinusitis with 17% and fungal sinusitis with 39%. The Global Allergy and Asthma Network of Excellence (GA2LEN) in Europe found that the overall prevalence of chronic rhinosinusitis was 10.9% in adults aged between 15 and 75. This further confirmed the burden as a common chronic disease and pointed out the underestimation of this disease.

Aetiology

The most common bacterial organisms in community-acquired ARS are Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus and Moraxella catarrhalis; the latter being more prevalent in children. The most common viruses are rhinovirus, adenovirus, influenza virus and parainfluenza virus associated with the common cold. There are various factors that can predispose patients to ARS, namely:
• Medical conditions such as allergic rhinitis, vasomotor rhinitis, rhinitis medicamentosa, cystic fibrosis, immunodeficiency, gastro-oesophageal reflux, sarcoidosis, Wegener’s granulomatosis, periodontitis, asthma, hormones, diabetes mellitus and nasal tumours.
• Irritants such as noxious chemicals, environmental tobacco smoke, air pollution and chlorine.
• Anatomical abnormalities such as adenoidal hypertrophy, deviated nasal septum, immobile cilia, tumours, polyps, foreign object in nose and a long nasogastric tube.
• Other factors include swimming, diving and high-altitude climbing.

Sinusitis can develop at any age, and 5–13% of upper respiratory tract infections (URTI) in children develop into ABRS. The peak incidence of sinusitis is between one and six years of age. Only the ethmoid and maxillary sinuses are present at birth, whereas the frontal and sphenoid sinuses aerate between five and six years of age. A child younger than one year is unlikely to have sinusitis.

Pathophysiology

The inflammation of sinuses and nasal mucosa causes excessive mucus production. Viral and bacterial infections impair the cilia, which transport mucus. Mucosal oedema leads to obstruction of the sinus ostia. Obstruction occurs in the ostia (drainage ducts) of the sinuses with associated increase in pressure and resulting pain over the implicated sinuses. The obstruction and slowed mucus transport cause accumulation of secretions and lowered oxygen tension within the nasal cavity; this environment further supports microbial growth. However, a discoloured purulent nasal discharge is a sign of inflammation and not necessarily microbial infection because colouration of nasal discharge is related to the presence of neutrophils rather than bacteria.

CRS, on the other hand, is defined as an inflammatory disorder and end-stage of untreated or partially treated ARS or severe atopy from nasal polyps. Biofilms including Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, Staphylococcus aureus and Pseudomonas aeruginosa have been commonly identified in CRS patients both with and without nasal polyps. The epithelial disruption present in CRS may contribute to biofilm formation. A biofilm is any group of microorganisms in which cells stick to each other and often also to a surface. These adherent cells are frequently embedded within a self-produced matrix of extracellular polymeric substance (EPS) which may also be referred to as slime (although not everything described as slime is a biofilm). Biofilms facilitate resistance to host defences and antibiotics, helping foster recalcitrant disease.

CRS can occur with nasal polyps (CRSswNP) and without nasal polyps (CRSsNP). Nasal polyps are non-cancerous, sac-like moveable non-tender growths within the nose or sinuses. They result from chronic neutrophilic inflammation and tissue remodelling. Furthermore, patients with asthma, aspirin sensitivity, allergic rhinitis and CRS are more likely to develop nasal polyps.

Diagnosis, signs and symptoms

Acute rhinosinusitis

ARS is diagnosed when a patient presents with less than four weeks of purulent (not clear) nasal drainage accompanied by nasal obstruction, facial pain/pressure/fullness, or both. The pharmacist should distinguish between AVRS and ABRS. This distinction is based on illness pattern and duration, because purulent nasal drainage as a sole criterion cannot distinguish between viral and bacterial infection.

Acute viral rhinosinusitis

AVRS is a self-limiting disease characterised by cough, sneezing, rhinorrhea, sore throat and nasal congestion. ARS typically peaks within three days then gradually declines and resolves within 10 – 14 days. AVRS is diagnosed when symptoms or signs of ARS are present for fewer than 10 days and symptoms are not worsening.

Acute bacterial rhinosinusitis

The cultures of secretions from the nasal cavity or nasopharynx do not differentiate between ABRS and AVRS, because nasal cultures correlate poorly with maxillary sinus cultures obtained by direct aspiration. According to the guidelines of the Infectious Disease Society of America for ABRS, patients normally present with the combination of high fever (> 39 °C), purulent discharge, or facial pain lasting at least three to four consecutive days at onset. ABRS is diagnosed when symptoms of ARS fail to improve within ten days or more beyond the onset of upper respiratory symptoms, or when symptoms of ARS worsen beyond ten days after an initial improvement (double worsening).

Additional signs and symptoms of ABRS include fever, cough, postnasal drip, fatigue, malaise, compromised sense of smell (hyposomia or anosmia), maxillary dental pain and ear fullness or pressure. The Canadian guidelines propose a mnemonic, PODS (facial Pain or fullness; nasal Obstruction, nasal purulence or coloured postnasal Discharge and Smell disorder).

Acute bacterial rhinosinusitis in children

The European position paper on rhinosinusitis EPOS 2012, defines acute rhinosinusitis in children as:

- The presence of two or more symptoms, one of which should be either nasal blockage/obstruction/congestion or nasal discharge (anterior/posterior nasal drip) for a minimum of three days:
  - ± facial pain/pressure
  - ± cough (persistent daytime cough for ten days or more)
  - ± fever ≥ 39 °C
  - ± daytime drowsiness/malaise
- and either
  - Endoscopic signs of:
    - nasal polyps, and/or
    - mucopurulent discharge primarily from middle meatus and/
Minor symptoms include ear pain, dizziness, halitosis, dental pain and loss of smell.10

**Chronic rhinosinusitis**

CRS has a duration of more than 12 weeks with two or more symptoms of nasal obstruction, facial pain/pressure/fullness, purulent nasal discharge and hyposmia. Patients should be assessed for evidence of sinonasal inflammation, which can be visualised during anterior rhinoscopy, nasal endoscopy or on computed tomography. Inflammation is documented when one visualises purulent rhinorrhea or oedema in the middle meatus or anterior ethmoid region, polyps in the nasal cavity or middle meatus, and on radiographic findings of inflammation.2

**Chronic rhinosinusitis in children**

Chronic rhinosinusitis in young children is diagnosed when two or more symptoms – of which one should be nasal obstruction, discoloured discharge and/or frontal pain – or cough is present for more than 12 weeks. Additional diagnostic information includes questions on allergy and positive allergy testing should be performed. Adenoids (nasopharyngeal tonsils) are a prominent contributor to CRS in children.15

**Diagnostic imaging**

Radiographic imaging is not recommended in the diagnosis of uncomplicated ARS unless a complication or alternative diagnosis is suspected. Plain sinus radiography cannot be used to distinguish between bacterial and viral aetiologies; air-fluid levels are visible in patients with viral or bacterial rhinosinusitis. Sinus computed tomography should not be used for routine evaluation of ABRS, but it can define anatomical abnormalities and identify suspected complications. Magnetic resonance imaging can be used to identify suspected tumours or fungal sinusitis, which may involve adjacent soft tissue structures.4

**Management**

The goals of treatment for both acute and chronic rhinosinusitis are to control infection if present, reduce tissue oedema, facilitate drainage, maintain patency of the sinus ostia and break the pathologic cycle that leads to CRS.1

**Acute viral rhinosinusitis management**

AVRS is a self-limiting condition and supportive therapy should be tailored to an individual’s symptom profile. Symptomatic treatment includes nonsteroidal anti-inflammatory drugs (NSAIDs) and/or paracetamol, oral and topical decongestants and saline nasal rinses.16 Antibiotics should be avoided in ARVS as the causative organisms are viral and not bacterial.3

**Acute bacterial rhinosinusitis management**

The American Academy of Otolaryngology—Head and Neck Surgery Foundation published the new updated clinical guidelines

**Table I: Summary of the characteristics of acute viral rhinosinusitis and acute bacterial rhinosinusitis**1,4

<table>
<thead>
<tr>
<th>Classification</th>
<th>Acute viral rhinosinusitis</th>
<th>Acute bacterial rhinosinusitis</th>
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<tbody>
<tr>
<td>Causes</td>
<td>Rhinovirus, adenovirus, influenza virus and parainfluenza virus</td>
<td>Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus and Moraxella catarrhalis</td>
</tr>
<tr>
<td>Duration</td>
<td>Peaks within three days then gradually declines and resolves within 10–14 days</td>
<td>More than 10 days but less than four weeks (Worsens within 10 days after initial improvement)</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Cough, sneezing, rhinorrhea, sore throat and nasal congestion</td>
<td>‘PODS’ facial Pain or fullness, nasal Obstruction, nasal purulence or discoloured Discharge and Smell disorder</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Symptoms less than 10 days: No purulent discharge No PODS symptoms</td>
<td>Symptoms persisting beyond 10 days or failure to improve in 10 days of onset Purulent nasal secretions or nasal obstruction and additional PODS symptom</td>
</tr>
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on adult sinusitis in 2015 and recommends an approach for watchful waiting (without antibiotic therapy) as initial therapy for ABRS. Changes from the previous guidelines include enhanced information on patient education and counselling. Specifically, the goals are to improve diagnostic accuracy for adult rhinosinusitis, promote appropriate use of ancillary tests to confirm diagnosis and guide management, and promote judicious use of systemic and topical therapy, which includes radiography, nasal endoscopy, computed tomography, and testing for allergy and immune function. Although antibiotics were once routinely prescribed on suspicion of ABRS, treatment emphasis has shifted as antimicrobial resistance rates have increased.

**Antibiotics**

As mentioned earlier, the American Academy of Otolaryngology–Head and Neck Surgery Foundation recommends an approach of watchful waiting (without antibiotic therapy) as initial therapy of ABRS and deferring antibiotic treatment of selected patients for up to seven days after diagnosis, limiting management to symptomatic relief. Antibiotics are started if the patient's condition fails to improve by seven days following ABRS diagnosis or worsens at any time. Wait-and-see antibiotic prescriptions (WASP), or a safety-net antibiotic prescription (SNAP), can provide a sense of security for patients who agree to initial watchful waiting with instruction to fill the prescription and begin antibiotic therapy if they fail to improve within seven days or if they worsen at any time. They should also call the physician's practice and let them know they have begun antibiotic therapy. This will avoid the expense and inconvenience of another visit to the doctor.

Most guidelines recommend amoxicillin as first-line therapy because of its safety, efficacy, low cost and narrow microbiological spectrum. Amoxicillin is effective against the most common bacterial organisms in ABRS (*Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus*). An amoxicillin dose of 1 g eight hourly for five days is recommended by the South African Antibiotic Stewardship programme (SAASP). The use of high-dose amoxicillin with clavulanate (2 g orally twice daily) is recommended for adults with ARBS who are at high risk of being infected with an amoxicillin-resistant organism. This risk exists in patients older than 65 years, recent hospitalisation, antibiotic use within the past month, or those who are immunocompromised. In patients with penicillin allergy, azithromycin 500 mg daily for three days is recommended as first-line therapy by the 2015 SAASP antibiotic guidelines for South Africa. A history of antibiotic use in the previous four to six weeks increases the risk for antibiotic resistance. Guidelines suggest a respiratory fluoroquinolone (moxifloxacin) or high-dose amoxicillin-clavulanate should be considered. The recommended duration of therapy is five to seven days for adults.

According to the new American Academy of Paediatrics (AAP) clinical practice guidelines, 2013, for the diagnosis and management of ABRS, the patient should be placed on an antibiotic. For those, however, who meet only one criterion (persistent nasal symptoms), a further three-day observation period is appropriate before antimicrobials are prescribed. They recommend either amoxicillin-clavulanate (90 mg/kg/day) or high-dose amoxicillin (90 mg/kg/day) as first-line antibiotic choice. Depending on the resistance patterns of *S. pneumoniae*, low-dose amoxicillin may be used. The AAP recommends a minimum 10-day-course of antibiotics in paediatrics, although some clinicians may choose to discontinue the antibiotics after a five-day-course if the child's condition has improved. Any child with systemic illness, complications of sinusitis or who is not tolerant of oral antibiotics should be admitted for parenteral antibiotic treatment.

Since immunisation of children with the 13-valent pneumococcal conjugate vaccine (PCV) was introduced, the prevalence of invasive *S. pneumoniae* isolates that are penicillin-resistant has decreased from 11% to 8%. This trend was confirmed by a study conducted by Orlarte et al where *S. pneumoniae* isolates declined in children with chronic sinusitis at Texas Children's Hospital. A substantial reduction of PCV-13 serotypes was observed.

**Corticosteroids**

Intranasal corticosteroids (INCSs) are effective as anti-inflammatory agents due to their actions on reducing proinflammatory and increasing anti-inflammatory gene transcription, reducing airway inflammation and suppressing proinflammatory mediators, cell chemotactic factors and adhesion molecules. For mild to moderate ABRS, INCSs promote sinus drainage and improve sinus ventilation. Systemic therapy with corticosteroids should be avoided in most patients due to limited evidence and an increased risk of adverse events. In a clinical study, mometasone furoate for 15 days significantly improved symptom scores, beginning at day two, compared with amoxicillin for 10 days (*p* < 0.002) or placebo (*p* < 0.001). Compared with placebo, mometasone furoate was associated with significantly improved quality of life for patients with ABRS (*p* = .047). INCSs are effective in reducing the number and size of nasal polyps in CRSwNP. Adverse effects of INCSs are generally minor (epistaxis, headache and nasal itching), but long-term use of INCSs has not been shown to affect systemic cortisol levels and is considered to be safe.

Since patients may not be familiar with the optimal method for using the INCS, pharmacists should describe or demonstrate how to properly administer a nasal steroid. Instructions are summarised in Table III.

<table>
<thead>
<tr>
<th>Table III: Patient instructions for optimal use of topical nasal steroid</th>
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<tbody>
<tr>
<td>1. Shake the bottle.</td>
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<tr>
<td>2. Look down by bending the neck and looking towards the floor.</td>
</tr>
<tr>
<td>3. Put the nozzle just inside the nose using the right hand for the left nostril and left hand for the right nostril.</td>
</tr>
<tr>
<td>4. Aim towards the outer wall and squirt once or twice as directed; do not aim towards the nasal septum to prevent irritation and bleeding.</td>
</tr>
<tr>
<td>5. Change hands and repeat for the other side.</td>
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<tr>
<td>6. Do not sniff hard.</td>
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</table>
Adjunctive therapies

Adjunctive therapies that have been investigated for symptomatic relief of ABRS include analgesics, decongestants, antihistamine, saline nasal irrigation, mucolytics and intranasal corticosteroids. Decongestants are alpha-1 adrenergic receptor agonists which have a vasoconstrictive effect on nasal mucosa. Topical decongestants, e.g. oxymetazoline nasal spray, reduce congestion of sinus and nasal mucosa and are superior to a single orally administered dose of pseudoephedrine. Decongestants should not be used for more than three to five consecutive days to prevent rebound congestion and rhinitis medicamentosa. Systemic decongestants should be used with caution in patients with cardiovascular disease or uncontrolled hypertension.

Antihistamine

Antihistamine therapy can be considered for patients with ARS whose symptoms support a significant allergic component. In this regard, second-generation H1 receptor antagonists cause less anticholinergic side-effects. Antihistamines have no role in symptomatic relief of ABRS in non-atopic patients since antihistamine may worsen congestion by drying the nasal mucosa.

Saline nasal irrigation

Nasal saline irrigation, alone or in conjunction with other adjunctive measures, may improve quality of life (QoL), decrease symptoms and medication use for ARS, particularly in patients with frequent sinusitis. Buffered hypertonic (3–5%) saline irrigation showed a modest benefit for ARS in two clinical trials. Compared with isotonic saline, hypertonic saline may have a superior anti-inflammatory effect and better ability to thin mucus and transiently improve mucociliary clearance. Saline spray should not be confused with saline irrigation, because irrigation is more effective in expelling secretions. Delivery methods include pulsatile irrigation, atomiser, bulb/syringe, squeeze bottle and low pressure irrigation (Neti pot). Only water that was sterile when purchased or has been sterilised by boiling should be used for nasal irrigation to prevent inducing further sinus infection.

Mucolytics and expectorants

Guaifenesin is used as an expectorant to loosen phlegm and bronchial secretions. This product is available over-the-counter and is sometimes recommended to “loosen” nasal discharge, but there is no evidence regarding the effect on symptomatic relief of ARS. According to Elahl and Elahl, N-acetyl cysteine on nasal mucociliary clearance in healthy volunteers, exerted measurable effects and therefore may be beneficial in conditions associated with disruption of mucociliary clearance such as rhinitis and sinusitis.

Chronic rhinosinusitis management

Adult chronic rhinosinusitis management

The aims of treatment in CRS include elimination of the infection, reduced sinonasal inflammation and maintained patent sinonasal passage drainage. CRS may be associated with precipitating factors like allergies, cystic fibrosis, gastroesophageal reflux, sinonasal anatomic obstruction in the ostiomeatal unit and immunologic disorders. Therefore the management of these risk factors should be optimised. Acute exacerbations of CRS should be treated with oral antibiotics as recommended by American, European and Canadian guidelines/position papers. Biofilms including Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis, Staphylococcus aureus and Pseudomonas aeruginosa have been commonly identified in CRS patients both with and without nasal polyps. Empiric antibiotics are used to treat acute exacerbations and should be prescribed after considering local antibiotic sensitivity patterns. Effective options include amoxicillin-clavulanate, second- and third-generation cephalosporins and respiratory fluoroquinolones (gemifloxacin, levofloxacin and moxifloxacin) in patients with penicillin allergy.

In a meta-analysis, treatment of CRSwNP with INCs showed improved symptoms and patient-reported outcomes. Proven efficacy and safety of INCs in allergic rhinitis in children makes INCs the first line of treatment in CRS. Available data does not justify the use of short-term oral antibiotics for the treatment...
Asthma exacerbations of CRS should be treated like acute respiratory tract infections, and saline was not as effective as an intranasal corticosteroid therapy. It is recommended that patients with CRS who have persistent or recurrent symptoms be referred to a physician for further evaluation.

**Patient education**

The action statement of the American Academy of Otolaryngology–Head and Neck Surgery Foundation strongly advocates for patient education and counseling. Table IV provides a patient information sheet on diagnosis of acute sinusitis.

**When to refer patients**

Patients should be referred to a physician when the following are present:

- Persistent or recurrent episodes with severe symptoms
- Recurrent ARBS or treatment failure after extended courses of antibiotic
- Rhinosinusitis symptoms lasting more than 12 weeks
- Patients with ARBS present with visual symptoms (e.g., diplopia, decreased visual acuity, disconjugate gaze, difficulty opening the eye)
- Severe headache
- Somnolence
- High fever
- Periorbital/orbital cellulitis and abscesses. The skin over the nose will be very red, swollen, and sensitive to pressure
- Loss of consciousness
- Neurological symptoms

**Conclusion**

This article provides an overview of rhinosinusitis, both viral and bacterial as well as chronic rhinosinusitis from an evidence-based perspective. It is recommended that patients with viral rhinosinusitis be given analgesics, decongestants, and reassurance. Acute bacterial rhinosinusitis should be managed with an approach of watchful waiting without antibiotics. Concerned patients can ask the physician for a WASP or a SNAP before initiating antibiotics since most patients’ symptoms resolve without antibiotic treatment. Serious complications are rare. Patients with moderate to severe disease for more than 10 days should be given antimicrobial therapy with amoxicillin-clavulanate being first-line therapy. Chronic rhinosinusitis is diagnosed when symptoms persist for more than 12 weeks where intranasal corticosteroid therapy is proved to be safe and effective. Referral should be considered in patients who have not responded to first-line antibiotic therapy or where patients are at risk of complications. Community pharmacists are poised to play a significant role in the appropriate treatment of rhinosinusitis through proper recognition of cardinal symptoms and clinical manifestations, patient education and evidence-based pharmacotherapy.

**References**