Acute rhinosinusitis

Tailoring treatment to presentation

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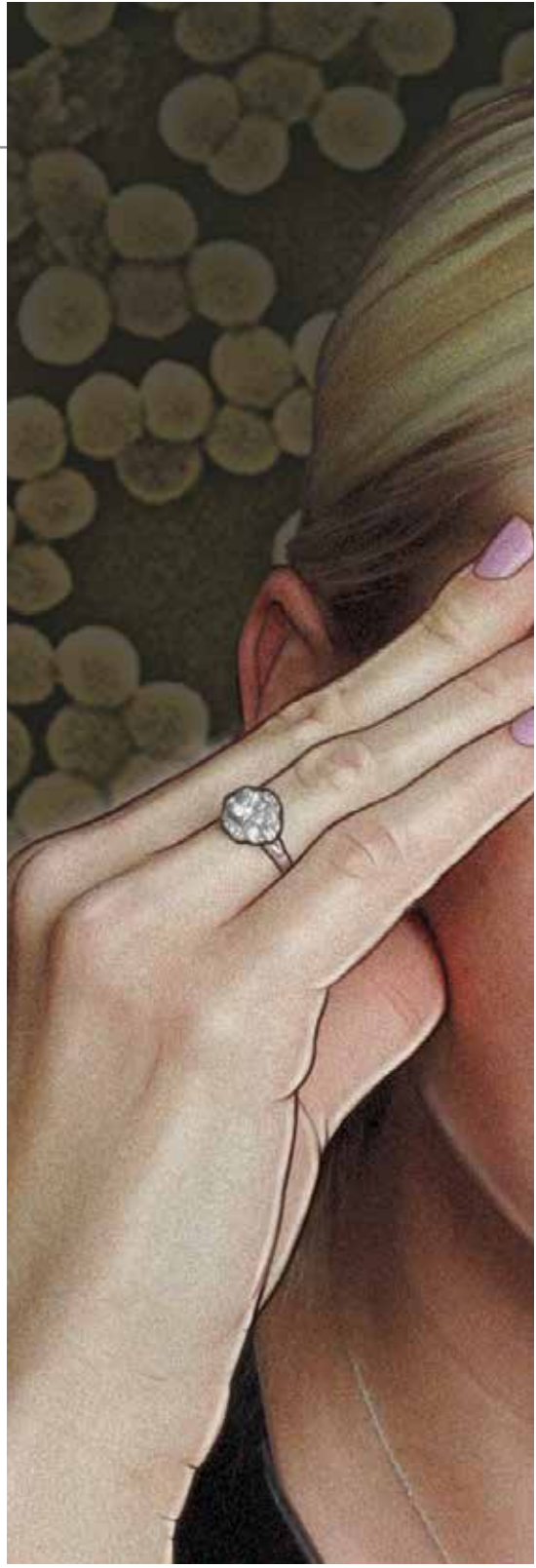
Acute rhinosinusitis is a common presentation in general practice. Determining whether the cause is viral or bacterial can be challenging. There is a plethora of medical treatments available but evidence suggests that not all are helpful. Surgery generally has no role in uncomplicated viral and bacterial disease but may provide benefit in certain situations, such as in the management of recurrent acute rhinosinusitis and complications.



Acute rhinosinusitis (ARS) is a common reason for patients to present to their GP and to be referred to otolaryngology specialists. On average, adults experience one to three episodes of viral ARS per year but children may experience many more episodes, depending on their exposure to viral pathogens. The annual prevalence exceeds that of other respiratory tract conditions such as allergic rhinitis, acute asthma and chronic bronchitis.[1] If ARS develops into chronic rhinosinusitis (CRS), the disease has profound effects on functional wellbeing and general health-related quality of life.[2-4]

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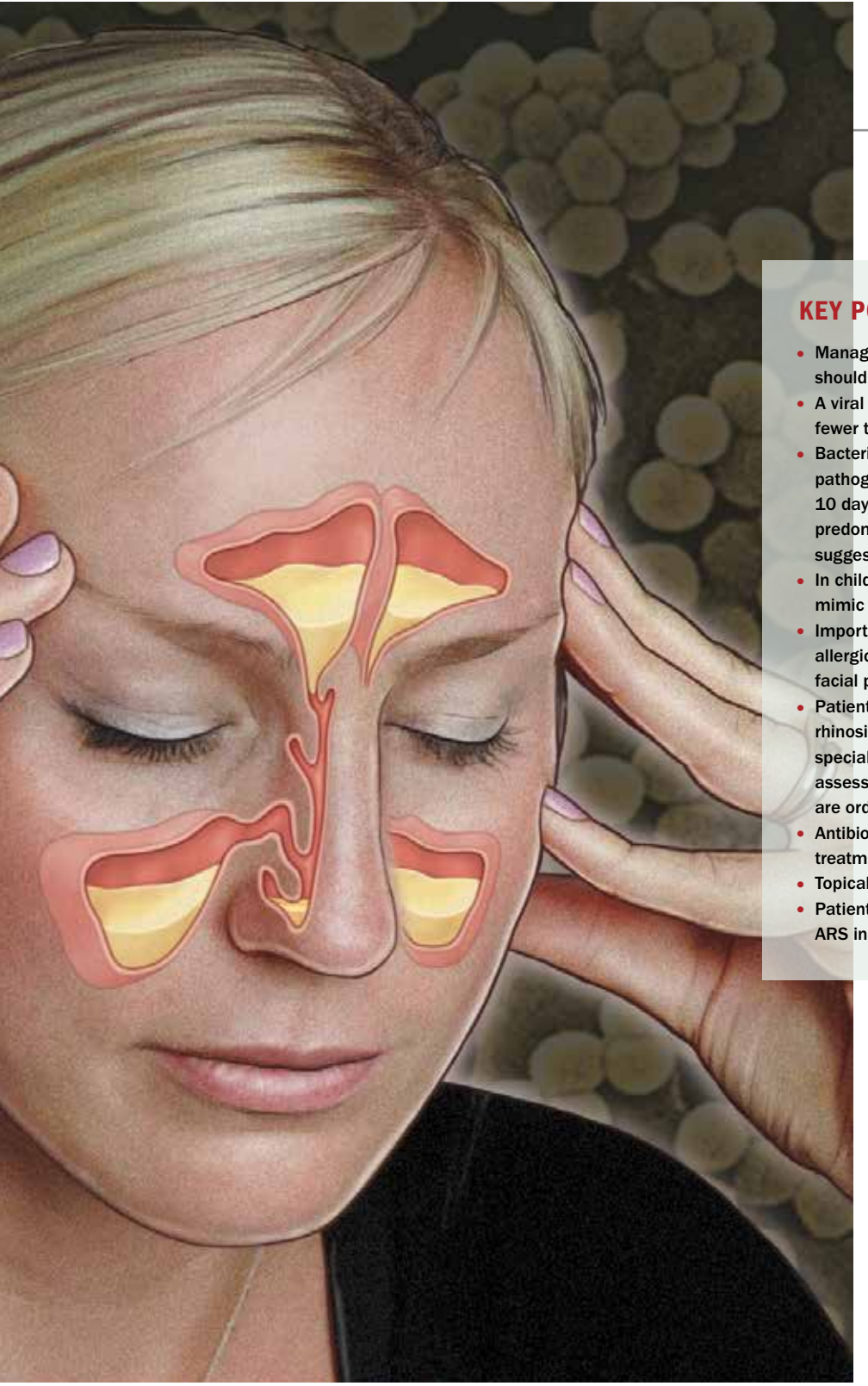
Earlier this year, the pathophysiology, diagnosis and management of various forms of rhinosinusitis were reviewed in the *International Consensus Statement on Allergy and Rhinology: Rhinosinusitis (ICAR:RS)*.[5] This statement provides a valuable and timely evidence-based update on all types of rhinosinusitis and their best management and is available online (http://onlinelibrary.wiley.com/doi/10.1002/alr.21695/full). The current article presents an update on the presentation and treatment of ARS; a second article, to be published in a later issue of *Medicine Today*, will focus on CRS.

Terminology and definitions

Replacement of the term 'sinusitis' with 'rhinosinusitis' was recommended by the American Academy of Otolaryngology Head and Neck Surgery in 1996, in order to emphasise the close relationship between the mucosal lining of the nasal cavity and the paranasal sinuses and acknowledge that sinusitis and rhinitis usually occur simultaneously.[6] The term rhinosinusitis has been widely adopted in the literature and otolaryngology community and is used in this article.

Acute rhinosinusitis

ARS is defined as sinonasal inflammation lasting less than four weeks associated with sudden onset of symptoms.[5] In adults, the symptoms must include: nasal blockage/obstruction/congestion or nasal discharge



KEY POINTS

- Management of acute rhinosinusitis (ARS) should be tailored to the presentation.
- A viral episode of ARS is generally present for fewer than 10 days.
- Bacteria are generally thought to be the chief pathogen in ARS if symptoms persist beyond 10 days or worsen after five days. A unilateral predominance or presence of severe pain is also suggestive of bacterial infection.
- In children, inflammation of the adenoid pad can mimic or cause rhinosinusitis.
- Important differential diagnoses of ARS include allergic rhinitis, dental disease, headache and facial pain syndromes.
- Patients presenting with complications of rhinosinusitis require hospital admission and specialist consultation. Children should be assessed by an otolaryngologist before CT scans are ordered.
- Antibiotics are not always needed in the treatment of ARS.
- Topical corticosteroids are helpful for ARS.
- Patients experiencing four or more episodes of ARS in a year may benefit from specialist review.

(anterior/posterior) and facial pain/pressure or reduction or loss in sense of smell.[5] In children, the symptoms should include two or more of the following: nasal obstruction, discoloured nasal drainage or a cough.[5]

Chronic rhinosinusitis

Rhinosinusitis that persists beyond 12 weeks is defined as CRS.[5] This is an umbrella term that covers several persistent inflammatory disease states in the sinonasal cavities. CRS can be broadly divided into two types, depending on the presence or absence of nasal polyps.

Subacute rhinosinusitis

Rhinosinusitis lasting more than four but less than 12 weeks is sometimes referred to as 'subacute rhinosinusitis'.[5,6] To date there have been few clinical reports for patients in this group, who most likely have a slow to resolve episode of ARS or an evolving CRS. Use of the term subacute rhinosinusitis should be limited until there is better understanding of this condition.

Recurrent acute rhinosinusitis

Recurrent ARS is a clinical syndrome defined by four or more episodes of rhinosinusitis per year (i.e. more episodes than the population average) with distinct symptom-free intervals between these episodes.[5] Patients who suffer recurrent ARS may have predisposing factors and/or anatomical variations that increase their risk of infection (see below).

Pathophysiology

The body's defence of the sinonasal tract is complex and involves interrelated responses. Important mechanisms include

Figure 1. Nasal mucus in acute rhinosinusitis. Excessive production of nasal mucus can present as rhinorrhoea or post-nasal drip and may be a feature of any inflammatory disease of the nose. Other diagnostic criteria for rhinosinusitis should be sought before attributing excessive mucus production to a sinus problem.

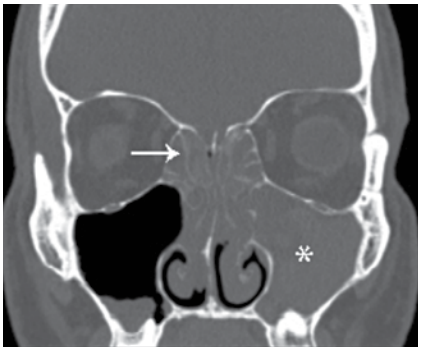


Figure 2. CT scan showing acute rhinosinusitis affecting the ethmoid sinus (arrow) and maxillary sinus (star). CT scans are not usually required to make a diagnosis of acute rhinosinusitis but may be ordered if the results will affect treatment or if a complication is suspected.

sneezing (to remove large particles), a mucus layer in the nasal cavity (to trap smaller particles), ciliary transport (to propel mucus to the nasopharynx) and the innate and adaptive immune system. However, mucosal swelling from the body's own response to inflammatory triggers can obstruct the sinuses and nose blowing can seed pathogens into the sinuses.[7]

ARS typically begins with a viral infection of the upper respiratory tract that causes epithelial damage and cytokine upregulation as well as activation of the parasympathetic nervous system. Activated inflammatory pathways in the nasal mucosa cause oedema, fluid extravasation, excessive mucus production and obstruction of the sinus ostia (Figures 1 and 2). Mucociliary transport is disrupted, either through paralysis of the cilia or by obstruction of sinus ostia. The impaired ventilation and drainage of the sinuses creates a favourable environment for bacterial secondary infection. Current estimates of the bacterial causes of ARS in children are *Streptococcus pneumonia* (30%), *Haemophilus influenza* (30%) and *Moraxella catarrhalis* (10%).[8]

Contributing factors

Contributing factors for ARS (including recurrent ARS) include rhinitis (allergic and nonallergic), frequent exposure to viral infections, absent or incomplete vaccination history and immunodeficiency. Exposure to cigarette smoke[9] or air pollution[10-12] and allergic rhinitis[13-20] can cause mucosal swelling and other changes at the cellular level that have been shown to be linked to ARS.

Bacteria, viruses and fungi can all live in pool water and be a source of infection for swimmers. However, pool chlorine is a more common trigger for sinus inflammation, which often lasts for a couple of weeks after swimming and can cause symptoms of ARS or trigger an ARS episode. Nasal congestion, facial pain and headaches after swimming are most commonly related to chlorine and pressure changes from underwater swimming.[21,22]

Anatomical abnormalities may also predispose an individual to ARS. These include recirculation phenomena (from additional sinus openings), concha bullosae (air-filled middle turbinates), Haller cells (additional ethmoid air cells underneath the orbits [Figure 3]) and nasal septal deviations. Periapical infections of the maxillary molar teeth can also cause infection of the overlying sinus cavities.

There are additional factors that can predispose children to ARS. These include medical conditions such as cystic fibrosis, asthma, immunodeficiency, ciliary dyskinesias and exposure to parental smoking. Daycare attendance, which exposes children frequently to a large number of viral pathogens, is probably one of the most common associations with ARS.[23,24]

In young children (up to 5 years of age), adenoiditis may also be a significant contributing factor to ARS. The presentations of adenoiditis and ARS can be very similar, with each causing anterior and posterior nasal drainage. Often adenoiditis coexists with ARS and serves as a source of pathogens for recurrent infections. A diagnosis of adenoiditis can usually be made only by direct visualisation of the adenoids by nasendoscopy.

Important contributing factors in ARS are summarised in Box 1.

Diagnosis

A careful history should be taken for a patient presenting with suspected ARS, covering the four key symptom areas (i.e. nasal blockage, anterior/posterior nasal discharge, facial pain or pressure, and loss of sense of smell). Additional symptoms that may be present include cough, sore throat, hoarseness, malaise and fever. Anterior rhinoscopy may reveal mucosal oedema and discharge (Figure 1). Signs of the infective process may be apparent in other parts of the upper aerodigestive tract, such as the middle ear, tonsils and cervical lymph nodes.

Investigations for ARS play a role in detecting complications (if suspected) and in assessing disease severity (e.g. white cell count, inflammatory markers). It is generally best to avoid ordering investigations prior to specialist referral, in order to avoid unnecessary investigations or duplication. In particular, it is strongly recommended that GPs do not order CT scans in children prior to specialist review.[8]

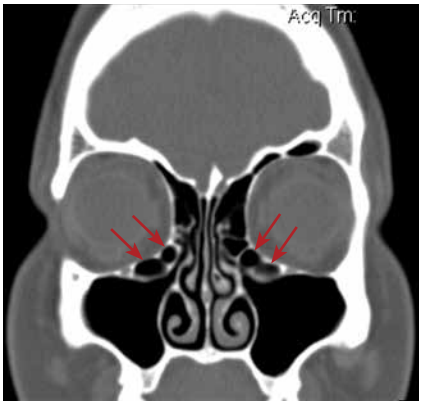


Figure 3. CT scan of sinuses with Haller cells (arrows), low-lying ethmoid cells that partially obstruct the drainage and ventilation of the maxillary sinuses and are believed to be an anatomical factor that predispose patients to recurrent acute rhinosinusitis. They can be removed with endoscopic sinus surgery.

Is it a viral or bacterial infection?

Determining whether an episode of rhinosinusitis is a viral or bacterial infection can be challenging because the symptoms are often similar. Most cases of rhinosinusitis begin with a viral upper respiratory tract infection but can eventually involve bacterial pathogens. Duration of symptoms is a key factor. A viral episode is generally present for fewer than 10 days. Bacteria are generally thought to be the chief pathogen if symptoms persist beyond 10 days or if symptoms worsen after five days. In addition, a bacterial infection is more likely to have a unilateral predominance and to produce a discoloured nasal discharge and moderate to severe localised pain; it is also more likely to cause a raised erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) level.

Nasopharyngeal cultures are not helpful in differentiating between viral and bacterial causes of rhinosinusitis but can assist with antibiotic selection when necessary.

Differential diagnosis

Important differential diagnoses of ARS include allergic rhinitis, dental disease, and headache and facial pain syndromes.

Allergic rhinitis

Allergic rhinitis is an important differential diagnosis in both adults and children who present with symptoms of ARS because it can cause many of the same symptoms and create a confusing clinical picture. Patients with allergic rhinitis often have a history of atopy or allergy or have observed that their symptoms are exacerbated with exposure to certain allergens or at a particular time of year or in a certain type of environment. Sneezing, watery rhinorrhoea, nasal and ocular itchiness and watery eyes suggest that allergic rhinitis may be part of a patient's syndrome. Mucopurulent discharge, facial pain and anosmia are uncommon in allergic rhinitis.

Dental disease

Patients with dental disease can present with sinus pain, sometimes in the absence of a toothache. The other diagnostic criteria for ARS are typically not met.

Headache and facial pain syndromes

A number of headache and facial pain syndromes can mimic rhinosinusitis. These include tension-type headache, atypical facial pain, migraine, paroxysmal hemicrania, temporal arteritis, cluster headache and midfacial segment pain. Ocular pain syndromes such as glaucoma can also mimic ARS. Temporomandibular joint disorders can cause facial pain. The other nasal symptoms of rhinosinusitis are typically absent in these conditions, although these may be present in cluster headaches.

Patients with headache syndromes who have sinus disease demonstrated on CT scan can present a confusing picture. It is worth remembering that around 35% of individuals who do not have sinus disease have some sinus changes (typically mucosal inflammation) on a CT scan of the sinuses.[25]

Complications

Complications from ARS are uncommon but may be serious. They can be divided into three types: orbital (70%), intracranial (20%) and osseous (10%).[5] Orbital complications occur primarily in young children but intracranial and osseous complications can occur at any age.[26] The complications of ARS are described in Box 2.

Patients presenting with complications of ARS require an urgent (same-day) specialist consultation (generally via an emergency department), treatment with intravenous antibiotics and sometimes surgical treatment. ARS that has progressed to involve a complication is a serious medical condition that may progress rapidly with serious morbidity or mortality. A CT scan of the paranasal sinuses is usually needed (except for preseptal cellulitis) to confirm the diagnosis. Patients who are immunocompromised (including patients with diabetes mellitus) are at risk of severe invasive fungal sinus infections, which can

1. IMPORTANT CONTRIBUTING FACTORS IN ACUTE RHINOSINUSITIS

- Upper respiratory infections (viral, bacterial, fungal)
- Craniofacial abnormalities
- Nasal obstruction – e.g. adenoid infection (in children), rhinitis (allergic and nonallergic), nasal polyps, adenoid infection
- Trauma
- Dental infections
- Prior surgery
- Anatomical variations (e.g. septal deviation, concha bullosae, Haller cells)
- Ciliary dyskinesias
- Medical conditions (e.g. asthma, cystic fibrosis)
- Incomplete vaccination history
- Immunodeficiency (congenital or acquired)
- Exposure to environmental factors (e.g. cigarette smoke, air pollution, chlorinated swimming pools)

2. COMPLICATIONS OF ACUTE RHINOSINUSITIS

Orbital complications

The orbital complications of ARS can be divided into preseptal cellulitis, orbital cellulitis, subperiosteal abscess, orbital abscess and cavernous sinus thrombosis.[26] Preseptal cellulitis is essentially eyelid cellulitis as tissues in front of the orbital septum are outside the orbit. Signs of orbital cellulitis include chemosis (conjunctival oedema), proptosis, eye pain and tenderness and diplopia. If a subperiosteal abscess develops then visual acuity may become impaired. Management involves intravenous antibiotics and surgical drainage of any abscess. Early referral and treatment can prevent progression of the infection.

Children with preseptal cellulitis do not routinely require a CT scan. This imaging is frequently over-ordered and exposes patients to unnecessary radiation. Most patients with preseptal cellulitis respond quickly to intravenous antibiotics. It is always best to arrange for a child with suspected preseptal or orbital cellulitis to be reviewed by an otolaryngologist before ordering any imaging. If a scan is needed (because an orbital complication is suspected), it is important to request a CT scan of the sinuses and orbits (not just the orbits) because otherwise the scan may need to be repeated. It is strongly recommended that GPs do not order CT scans in children prior to specialist review.[8]

Intracranial complications

Intracranial complications include an epidural, subdural or brain abscess, meningitis, cerebritis and sagittal or cavernous sinus thrombosis. These complications should be considered in a patient presenting with ARS who has severe lethargy, headaches, photophobia, cranial neuropathies, seizures, papilloedema or focal neurological deficits.

Osseous complications

Osseous complications of ARS include osteomyelitis of the frontal and maxillary bones. Clinical features include localised tenderness, erythema or fluctuance of the overlying skin.

occasionally progress very rapidly and lead to severe tissue damage and death.

Medical management

Antibiotics

The decision about whether to prescribe antibiotics when ARS is suspected to be bacterial, rather than viral, is still controversial. Traditionally, antibiotics have been given, but this practice has been questioned because the spontaneous recovery rate is high. Four systematic reviews of randomised controlled trials of ARS treatment have shown a benefit from antibiotic treatment compared with placebo for bacterial ARS, but the benefit was small.[27-30] In an analysis of five trials, the rate of cure at seven to 15 days improved from 86% (in the placebo group) to 91% (in the antibiotic group).[27] The number needed to treat to show an improvement in one patient ranged between 11 and 15, and adverse events were higher in the antibiotic groups compared with placebo groups.[27-30]

The decision as to whether to prescribe antibiotics for ARS needs to take into account patient expectations. Educating patients about the small benefit of antibiotics relative to the risk of adverse events takes time but is a worthwhile aspect of evidence-based medicine. One option is to provide patients with an antibiotic prescription but to advise them not to fill the prescription unless there has been no improvement in symptoms at seven days or if their symptoms significantly worsen at any stage.

The benefits and risks of different antibiotics for ARS have been examined in multiple systematic reviews. According to the *ICAR:RS*, amoxicillin, with or

without clavulanate, is the first-line antibiotic of choice.[5] Second-line antibiotics for patients who have failed amoxicillin or amoxicillin–clavulanate or for patients who are allergic to amoxicillin include cefuroxime, trimethoprim–sulfamethoxazole, doxycycline or a fluoroquinolone. The recommended duration of therapy is typically five to 10 days.

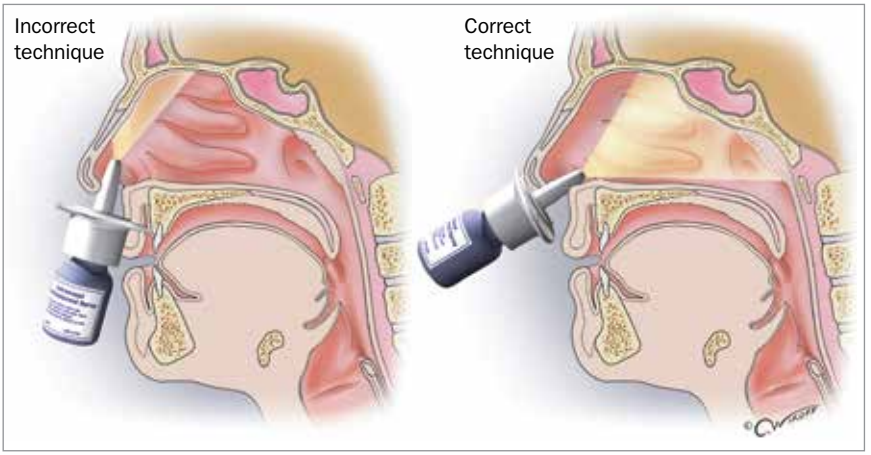
The choice of amoxicillin alone versus amoxicillin–clavulanate remains controversial, both in the literature and in clinical practice. A number of factors may need to be taken into account. *Therapeutic Guidelines: Antibiotic 15* recommends initial treatment with amoxicillin alone, withholding the addition of clavulanate to those who have an inadequate response to therapy in 48 to 72 hours.[31] However, if resistant organisms are suspected, amoxicillin–clavulanate should be considered as first-line treatment.[31] A Cochrane review has shown rates of noncompliance due to adverse events to be higher in patients who are treated with amoxicillin–clavulanate compared with amoxicillin alone.[27] It may be better to prescribe an antibiotic that is better tolerated, in the hope that the full course will be completed.

Corticosteroids

Intranasal corticosteroid sprays that act through anti-inflammatory and possibly decongestant actions offer a modest improvement in symptoms and rate of resolution of ARS symptoms. Adverse events are infrequent and systemic uptake is limited. Intranasal corticosteroids can be used as monotherapy or as an adjuvant to antibiotic therapy. A spray that is available over the counter, such as mometasone (200 µg daily), may be trialled before a prescription-only product (which may be more expensive).

Compliance with topical corticosteroid therapy is often poor. To minimise the aerosol from ending up in the oral cavity (which can lead to a bad taste in some individuals), patients should be taught to aim the spray nozzle outwards (towards the ear) and to not sniff inwards during or after spray delivery (Figures 4a and b). Correct technique will also help patients avoid epistaxis, which typically occurs when the spray or nozzle hits the nasal septum over time.

According to *ICAR:RS*, systemic corticosteroids are not recommended in cases of uncomplicated ARS.[5] However, when headache or facial pain is the predominant symptom they may offer some relief.[5]



Figures 4a and b. Use of intranasal corticosteroid sprays. a (left). Patients instinctively position nasal spray bottles either upright or pointing inwards at the nasal septum (which can cause nose bleeding), and often follow the spray delivery with a vigorous inward sniff. b (right). Correct technique involves angling the bottle more horizontally and pointing it outwards, towards the ear. Sniffing should be avoided. This technique ensures that the lateral nasal wall and sinuses are the main target, and that the spray is not immediately sniffed into the mouth (often causing a bad taste), bypassing the nose altogether.

Other treatments

Nasal saline irrigation in patients with ARS has been shown in systematic reviews to offer a possible improvement in symptoms and is unlikely to lead to significant harm.[5] Decongestants, antihistamines, mucolytics and ipratropium bromides are generally not recommended for ARS because clinical studies have not demonstrated any improvement over placebo.

Surgical management

Surgery generally has no role in uncomplicated ARS. However, patients with recurrent ARS may benefit from otolaryngology review and consideration of endoscopic sinus surgery. Properly selected patients for surgery may benefit symptomatically year round and achieve a reduction in number of infections per year and antibiotic usage.

Surgery does have a role in the management of complications of ARS. In addition, it should be considered for patients for whom appropriate medical management is not available (e.g. patients with intolerances to multiple antibiotics). Surgery also has a role in treatment of ARS for patients with fungal disease.

All patients who undergo sinus surgery and then have ongoing issues with their sinuses should be referred back to an ENT specialist for assessment. Technical failures in improving the function of the sinuses after surgery occasionally occur and can often be managed with further medical or surgical therapy. In particular, the frontal sinuses can be prone to stenosis after initial endoscopic sinus surgery, and a secondary procedure (Lothrop procedure) may be needed to maintain patency in the long term. Another example is the management of nasal polyps, in which surgery plays a role in managing an essentially medical condition. Ongoing medical care will always be needed for patients who have nasal polyps.

Vaccination

Patients who suffer from recurrent ARS need to have all possible triggers of their recurrent mucosal inflammation addressed. It is important to encourage patients to keep their vaccinations up to date, including influenza vaccination. Routine use of the pneumococcal conjugate vaccine is reducing the frequency of infections caused by *S. pneumoniae*.[32]

Conclusion

ARS is generally very well managed in the primary care setting. Consideration of differential diagnoses like allergic rhinitis or facial pain syndromes is important, but a careful history and examination are usually all that is necessary to make the correct diagnosis and select an appropriate management plan. Convincing patients that antibiotics are not always needed remains a challenge. Patients with a suspected complication need urgent referral (probably via an emergency department) to an ENT specialist. Specialist referral should also be considered (in a timely fashion) for patients who have symptoms that persist beyond four weeks or who develop four or more infections in a 12-month period. MT

References

A list of references is included in the website version of this article (www.medicinetoday.com.au).

Text

COMPETING INTERESTS: None.

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