**SINUSITIS: ACUTE AND CHRONIC**

*G. Joyce*

Sinusitis is an inflammatory process in the mucosal lining of the paranasal sinuses that may arise from a number of causes, ranging from simple, localised inflammation, to a serious systemic disorder. Most often, however, this condition is the sequela of an upper respiratory tract infection, and/or an allergic condition.

Sinusitis is increasingly recognised as a common and subtly presenting disease. It accounts for hundreds of thousands of lost days of work and is a great financial burden on individuals and the national health care system. In the USA, sinusitis is the fifth most common diagnosis for which an antibiotic is prescribed, and the primary diagnosis of sinusitis lead to expenditures of approximately 3.4 billion US dollars per annum.

New evidence points to links between sinusitis and asthma, as well as nasal polyposis. These links parallel the better-known connection between sinusitis and other upper respiratory tract infections and allergic rhinitis. As the prevalence of allergic diseases is rising dramatically, the co-morbid diseases arising there from, of which sinusitis is one, are increasing.

**DEVELOPMENTAL ANATOMY OF THE PARANASAL SINUSES**

Four paired paranasal chambers that constitute the paranasal sinuses are filled with air, and are connected to the nose by small openings, the ostea. These chambers include the frontal sinus, the ethmoidal sinuses, the maxillary sinuses and the sphenoid sinus.

A key concept in the treatment of sinusitis is the osteo-meatal unit, which represents a group of anatomical structures that synergistically control ventilation and proper mucociliary clearance of the paranasal sinuses.

**CLASSIFICATION**

Sinusitis can be classified chronologically into five categories:

1. Acute sinusitis
2. Recurrent acute sinusitis
3. Sub-acute sinusitis
4. Chronic sinusitis
5. Acute exacerbation of chronic sinusitis

**ACUTE SINUSITIS**

Because sinusitis is usually preceded by rhinitis, it rarely occurs without concurrent rhinitis. The American Academy of Otorhinolaryngology – Head
and Neck Surgery, decided that sinusitis would be best described as rhinosinusitis.

Pathophysiological characteristics of acute rhinosinusitis
Acute rhinosinusitis (ARS) is most often preceded by an upper respiratory infection. Allergy, trauma, or other environmental factors that lead to inflammation of the nose and paranasal sinuses may also predispose individuals to ARS.

Approximately 50% of common colds are caused by the human rhinovirus. (Other viruses include corona virus, influenza a & b viruses, parainfluenza virus, respiratory syncytial virus and adenovirus.)

The causes of secondary bacterial invasion of the sinuses are unknown, but a combination of factors such as nose-blowing, local or systemic immunity, virulence of the virus and environmental factors may lead to conditions that are conducive for bacterial entry and growth. Differentiating a viral upper respiratory tract infection from ARS is more challenging in children that in adults, mainly because the average child has three to eight upper respiratory tract viral infections per year. Decreased ciliary movement and increased mucus production, as a result of inflammation, is common in many of the above-mentioned situations.

Together with oedematous obstruction of the sinus ostia, a stage is set for secondary bacterial infection and conversion of mucus to mucopus. The latter impairs ciliary function further, and also increases congestion around the ostia, thus creating a vicious cycle.

Aetiology
Sinusitis is most common in the maxillary sinus, followed by the ethmoid, the frontal and sphenoid sinuses, in that order. The following are usually responsible for sinusitis.

Nasal infection
By far the most common factor and is often associated with the common cold. Infection spreads to the sinuses by way of the natural ostia from the cavities. Foreign bodies in the nose, partic-

Table 1. Definition of sinusitis

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<thead>
<tr>
<th>Definition of sinusitis</th>
<th>Period of Infection</th>
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<tbody>
<tr>
<td>Acute sinusitis</td>
<td>10 days to two weeks</td>
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<tr>
<td>Recurrent acute sinusitis</td>
<td>≥ 4 episodes of acute per year</td>
</tr>
<tr>
<td>Sub-acute sinusitis</td>
<td>4-12 weeks</td>
</tr>
<tr>
<td>Chronic sinusitis</td>
<td>&gt; 12 weeks</td>
</tr>
<tr>
<td>Acute exacerbation of chronic sinusitis</td>
<td>Worsening infection, returning to chronic baseline</td>
</tr>
</tbody>
</table>
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particularly in children, may lead to an infectious rhinitis that precedes sinusitis.

**Tonsillitis and adenoiditis**

Often lead to sinusitis, especially in children.

**Tooth infection**

The maxillary sinus is most commonly infected because of its close proximity to the teeth. This infection includes both the peri-apical abscess and periodontal abscess. Tooth extraction may be associated with maxillary sinus floor fractures and subsequent infection.

**Swimming**

Infected water can penetrate the sinuses from the nose, especially when diving, ducking or jumping in feet first.

**Trauma**

Includes compound fractures of the sinuses, contusion, foreign bodies and barotraumas.

**General disease**

Includes measles, influenza, whooping cough and other specific diseases, particularly in children.

**Predisposing factors**

These include a poor general environment, lowered resistance, undue exposure, obstruction (anatomical, infective, allergic, tumors) and association with chest conditions, i.e. chronic bronchitis, asthma, bronchiectasis and cystic fibrosis.

**Microbiology of acute rhinosinusitis**

Bacteria are broadly classified into groups, based on their cell wall composition, morphological characteristics and metabolic requirements. (Important elements of inherent susceptibility or resistance of any bacterium to many antimicrobial agents.) These include S. pneumoniae (Gram-positive), *H. influenzae* (Gram-negative) and *M. catarrhalis* (Gram-negative). These bacteria colonize the nasopharynx in early childhood, and viral upper respiratory tract infections increases colonization with resultant bacterial otitis media and sinusitis in early childhood. Specific infections include infections due to fungi, syphilis, tuberculosis, leprosy and HIV-Aids.

**Clinical features of acute rhinosinusitis**

**Symptoms**

Can be divided into two broad groups:

- **General symptoms**: Malaise, headache and fever, indicative of general toxemia.
- **Local symptoms**: Stuffy nose, post-nasal discharge, headache (frontal, periorbital, facial), facial pressure, runny nose, altered taste and smell, eye pain, fatigue, sore throat, bad breath, ear popping or fullness, hoarseness, lightheadedness and nosebleed.

**Signs**

- **External signs and palpation of sinuses**: In the case of maxillary, frontal and ethmoidal sinuses, flushing of the cheeks with swelling, also in-
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volving the lower eyelid and in rare cases the inner canthus, can be seen. In frontal sinusitis, the forehead and upper eyelid may be affected and pressure on the floor of the sinus, just above the inner canthus, elicits tenderness. In maxillary sinusitis, there may be tenderness over the cheek, but is also associated with dental infections.

- **Anterior rhinoscopy**: The general redness and mucosal swelling of an accompanying rhinitis may obscure the local signs of an acute sinusitis, but when present, it will consist of a localized area of red, shiny and swollen mucous membrane in the neighbourhood of the ostium of the particular sinus. After shrinkage, by the application of cocaine and adrenaline (10% solution), it is easier to see local signs, e.g. pus or mucopus in the middle meatus.

- **Examination of the pharynx and nasopharynx**: Pus may be seen on the upper surface of the palate or trickling down the lateral pharyngeal gutter.

**Diagnosis of acute sinusitis**

**History**

The history is of fundamental importance: 'Listen to your patient and he/she will tell you the diagnosis'. Most patients' main complaints usually include one or more of the following symptoms: Nasal stuffiness, nasal airway obstruction, postnasal drainage, runny nose, bleeding nose, puffy eyes, eye pressure/pain, ear pressure/popping, headaches, facial pressure, hoarseness, sore throat, bad breath, aching teeth, changes in taste/smell, general fatigue, dizziness/lightheadedness, chronic cough, itchy nose, watery eyes, red eyes, scratchy throat, frequent throat clearing and sneezing.

**History of previous medication**

The patient's current medication may affect the severity of the disease, and its future management. Many patients with asthma use steroid medications chronically. These medications may mask symptoms of allergy, or temporarily control the size and extent of nasal polyps. Patients with asthma and polyposis may have Samter's syndrome (also called ASA triad: asthma, polyposis and aspirin sensitivity). Patients who have been taking aspirin, NSAIDs or other medications (e.g. homoeopathic) may have an increased coagulation time, and this should be kept in mind if surgery becomes indicated.

**Investigations**

- **Bacteriology**: This is of great importance, and an attempt must be made to culture the organisms responsible at the same time as treatment is started.

- **Nasal endoscopy**: The availability of rigid nasal endoscopes has permitted diagnosis and treatment of nasosinus disorders that were pre-
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viously unrecognised. (Currently, it is the most important diagnostic tool of ear, nose and throat surgeons.)

- **X-ray examination**: As the osteo-meatl complex is the key to the medical and surgical management of sinusitis in general, conventional x-rays have limited value, as it is not demonstrated on these pictures. Where possible, a limited CT scan of the sinuses is the radiograph of choice, as it is relatively inexpensive and more detailed.

**Differential diagnosis**

The diagnostic procedure should exclude the following conditions: Dental neuralgia, tempero-mandibular neuralgia, trigeminal neuralgia, migraine, temporal arthritis, trigeminal nerve lesions, nasopharyngeal tumours, brain stem lesions, specific fevers (erysipelas, nasal diphtheria, typhoid fever, etc., insect bites (produce local redness and swelling) and neoplasms of the sinuses.

**Management of acute sinusitis**

**Medical treatment**

Sinusitis is a form of abscess and like an abscess it should be treated to eliminate the infection, and to promote drainage.

The main objectives are:

- To re-establish a normal sinus physiology
- Rapid sterilization of secretions
- Prevention of chronic sinusitis or complications.

The treatment of sinusitis in adults differs from that in children, in that medical therapy in children generally suffices and surgery is rarely necessary.

**Congestion**: Saline douching followed by nasal decongestants e.g. oxymetazoline – not to be given for longer than 10 days to prevent rebound rhinitis.

**Pain (due to osteo-meatl obstruction)**: Simple analgesics such as paracetamol or aspirin is usually sufficient.

**Secondary symptoms**: Post-nasal discharge, with resultant sore throat. Treatment of the sinusitis with e.g. systemic antibiotics and local decongestants usually puts an end to this problem.

**Surgical treatment**

**Relative indications**: Failure to respond to adequate medical treatment (persistent osteo-meatl obstruction) and fungal sinusitis.

**Absolute indications**: Orbital and intracranial complications. A sinus CT scan is of fundamental importance when planning surgery. Functional and endoscopic sinus surgery (FESS) is regarded as the ‘Rolls Royce’ of sinus surgery, directed at the disease at the osteo-meatl complex. The long-term post-operative management of underlying allergic manifestations is of paramount importance.

**Recommended antimicrobial therapy for adults with acute bacterial rhinosinusitis**

- Amoxyccilin is a cost-effective first line therapy in patients with β-lac-
tam allergy; doxycycline may be an alternative.

- If the patient does not respond to initial options, i.e. no improvement or worsening after 72 hours, a switch to fluoroquinolones such as gatifloxacin or moxifloxacin is recommended.

- The patient who had prior antimicrobial exposure or in whom the disease is clinically more severe, may require alternative antimicrobials as first line therapy. Other options include co-amoxiclav, cefuroxime, cotrimoxazole, clarithromycin and azithromycin.

- In areas where S. pneumoniae resistance (intermediate) is common, doubling the amoxycillin dose may be indicated. Macrolides are often significantly less effective against S. pneumoniae.

- Co-amoxiclav and the other β-lactams are indicated if β-lactamase production by the Gram negative rods is seen as a problem.

**Recommended antibiotic therapy for children with acute bacterial rhinosinusitis**

- Amoxycillin (>90% effective) is a cost effective first line agent. In β-lactam allergic individuals, cotrimoxazole and/or clindamycin may be alternatives.

- Patients not responding (within 72 hours) to first line therapy may be switched to co-amoxiclav or clindamycin.

- In the patient who had a recent course of antibiotics co-amoxiclav, cotrimoxazole or one of the cephalosporins e.g. cefuroximeacetil may be selected as firstline therapy. The newer macrolides may be alternatives in patients with β-lactam allergy.

- If S. pneumoniae resistance (intermediate) is present, doubling of the amoxycillin dose should be considered. In these cases, macrolides are not indicated as resistance is often higher against them (cross class resistance).

**CHRONIC SINUSITIS**

Chronic sinusitis is a widespread problem, which causes morbidity and in some cases, complications can lead to death. These patients are usually desperate, because more often than not, they will have had the problems for months or even years. Various forms of treatment would not have helped for long. Sinusitis is regarded as being chronic, when symptoms persist for longer than 12 weeks.

**Symptoms**

Typical symptoms are summarized in Table 2.

The symptoms of nasal obstruction, pain and post-nasal discharge, are virtually diagnostic, but anyone of these on its own, does not necessarily mean that the patient has sinusitis. Post-nasal discharge causes continual throat-clear-
ing, and is an important cause of secondary respiratory and gastric disorders. Intranasal conditions, such as allergies, a deviated septum, nasal polyps, foreign bodies, nose drop abuse and tumours predispose. Naso-pharyngeal disease, especially in children, often underlie recurrent sinus attacks.

Systemic diseases, their complications and treatment, can also manifest varying degrees of sinonasal disease, e.g. diabetes with secondary *Mucor* infection, auto-immune granulomas, fungal- and tubercular disease and immune suppressive patients.

Chronic sinusitis is the most common and important extrathoracic cause of a chronic cough, and should be considered, even if there are no symptoms of sinusitis.

**Signs**

As mentioned before, the osteo-meatal complex in the middle meatus of the nose, is the key concept in the diagnosis and management of sinusitis. Patients with chronic sinusitis will have an inflammatory lesion and often an anatomical abnormality in the middle meatus that causes poor ventilation and draining of mucus.

Assessment of patients with chronic symptoms therefore depends on visualization of the middle meatus. In order to do this, decongestion and some form of scope is necessary to see past the inferior turbinate, and visualize the middle meatus.

Oxymetazoline nasal spray is recommended for decongestion and a nasal endoscope is the ideal instrument, although an ordinary Welch-allyn otoscope fitted with a number 3 aural speculum, is generally adequate.

Other significant signs are:

- Chronic post-nasal drip which usually leads to hypertrophic nodules, oedema and erythema of the posterior pharyngeal wall.
- Signs of Eustachian tube malfunction can often be seen.
- Tenderness of the upper teeth, cheeks, the frontal sinus region and the eyelids.
- Signs of complications, e.g. medial swelling of the upper eyelid, proptosis, loss of visual acuity, loss of eye movements, swelling over the frontal sinus, and signs of meningeal irritation must be sought.

**Special investigations**

The single most important investigation of the examination is a coronal

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<th>Table 2. Symptoms of sinusitis</th>
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<tbody>
<tr>
<td>• Nasal obstruction</td>
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<tr>
<td>• Facial pain and headache</td>
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<tr>
<td>• Post-nasal drip</td>
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<tr>
<td>• Pressure between the eyes</td>
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<tr>
<td>• Anosmia</td>
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<tr>
<td>• Epiphora</td>
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<tr>
<td>• Intermittent fever</td>
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<tr>
<td>• Accompanying otological, gastric, respiratory and renal problems</td>
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computed tomographic (CT) scan of the paranasal sinuses.

Some of the most important investigations that need to done include Coronal CT scan of the paranasal sinuses, microscopy, culture and sensitivity of middle meatal fluid and postnasal discharge, full blood, ESR, and CRP, immuno-globulin assessment and skin tests and blood CAP RAST for allergies.

Treatment
The treatment is aimed at restoring the health of the mucous membrane of the osteo-meatal unit, and combating the infection of the sinuses and the complications or secondary effects of these infections.

<table>
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<th>Table 3. Summary of causes of osteomeatal obstruction</th>
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<tr>
<td><strong>Inflammatory legions</strong></td>
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<tr>
<td>• Mucositis</td>
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<td>• Polypoidal disease</td>
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<tr>
<td>• Pur</td>
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<tr>
<td>• Thick mucus</td>
</tr>
<tr>
<td>• Cysts</td>
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<tr>
<td><strong>Anatomical legions</strong></td>
</tr>
<tr>
<td>• Concha bullosa</td>
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<tr>
<td>• Paradoxically curved middle turbinates</td>
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<tr>
<td>• Abnormally formed and placed uncinate processes</td>
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<tr>
<td>• Accessory ostia of the maxillary sinus</td>
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<tr>
<td>• Haller cells under the orbit that obstruct the ostium</td>
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<tr>
<td>• Bullous anterior ethmoid air cells</td>
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<td>• Septal deviations</td>
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Table 4. Summary of treatment modalities

<table>
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<tr>
<th>Medical treatment</th>
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<tbody>
<tr>
<td>• Decrease osteo-meatal oedema (decongestant nasal spray)</td>
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<tr>
<td>• Restore ciliary activity (treat underlying pathology)</td>
</tr>
<tr>
<td>• Eradicate bacterial infection (Refer to treatment of infection in acute sinusitis)</td>
</tr>
<tr>
<td>• Must not thicken mucus production (old antihistamines)</td>
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<tr>
<th>Physiotherapy</th>
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<tr>
<td>• Promote movement of thick mucus plugs (nebulization, ultrasound, laser)</td>
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<tr>
<td>• Stimulate the blood flow in the sinus mucosa</td>
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<table>
<thead>
<tr>
<th>Surgical treatment</th>
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<tbody>
<tr>
<td>• Remove irreversible disease in the osteo-meatal units</td>
</tr>
<tr>
<td>• Remove anatomical lesions in the osteo-meatal units</td>
</tr>
<tr>
<td>• Restore ventilation and mucus clearance of the units</td>
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</table>

It is of fundamental importance to mention that antihistamines should not be used to try and shrink mucous membranes, as they tend to increase the viscosity of the mucous, and may predispose secondary infection.

Corticosteroids (anti-inflammatory agents) decrease oedema and decrease the inflammatory infiltrate of the membranes, and they also stimulate ciliary activity.

Oral prednisolone or equivalent should be used as a single morning dose for five days, and then on alternate days for a further five doses.
NSAIDs may cause goblet cell hypertrophy with increased mucus production and are contra-indicated in these patients.

**Surgical treatment**

Functional endoscopic sinus surgery (FESS) is the treatment of choice, as it is directed to diseases in the osteo-meatal complex. The indications for surgery are the same as mentioned before under the heading of acute sinusitis.

**WHEN TO REFER**

Refer patients to an ENT specialist if:

- Medical treatment according to stated guidelines is unsuccessful
- Orbital- or intra-cranial complications develop
- Nasal polyposis
- Fungal sinus disease.

**FURTHER READING**