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Infections and foreign bodies in ENT

Mriganka De
Shahram Anari

Abstract

Infections of the ear, nose and throat are common. The majority of these infections are managed by the primary care physicians and they settle with conservative and medical management. However, a small group can progress to become troublesome and develop complications to the extent that they may require surgical intervention. Some of the infections can lead to life-threatening complications therefore awareness and correct diagnosis along with appropriate management is paramount. Foreign bodies in the ear, nose and throat are commonly encountered. The location and type of foreign body can have an implication on the urgency of action and the possible complications. In this article the common ENT infections and foreign bodies and their management are discussed.

Keywords Foreign body; neck abscess; neck deep space infections; otitis externa; otitis media; quinsy; rhinosinusitis; sinusitis; tonsillitis

ENT infections

Ear infections

Ear infections can be broadly divided into infections of the outer ear canal (i.e. otitis externa) and the infections of the middle ear (otitis media). The infections can also be divided into acute and chronic. In this paper we will focus on the acute infections.

Acute otitis media: Otitis media is the inflammation and/or infection of the middle ear cleft and mastoid cavity. It is divided into acute and chronic. Acute otitis media (AOM) occurs in 1 in 10 children per annum. It is the most frequent complaint in infants below 3 years old. By 3 years of age, up to 85% of children will have had an episode of AOM. The incidence peaks between age 6 and 12 months, and recurrent acute otitis media is common, affecting 10–20% of children by age of one year.¹

AOM is a result of different host factors as well as environmental and microbiological factors. It often starts as a viral upper respiratory infection leading to bacterial superinfection later on.

The most common agent reported in the cultures is:

- *Streptococcus pneumoniae* (25–50%)
- *Haemophilus influenzae* (15–30%)
- *Moraxella catarrhalis* (3–20%).

Mriganka De FRCS(ORL-HNS) is an Ear, Nose and Throat Consultant at Heartlands Hospital, University Hospitals Birmingham NHS Foundation Trust, UK. Conflicts of interest: none declared.

Shahram Anari MD MSc FRCS(ORL-HNS) is an Ear, Nose and Throat Consultant at Heartlands Hospital, University Hospitals Birmingham NHS Foundation Trust, UK. Conflicts of interest: none declared.

However immunization against *S. pneumoniae* has reduced the number of hospital admissions and complications in children below 2 years old.²

Some of the most important risk factors are:³

- lack of breastfeeding
- use of pacifier
- immune deficiency
- day-care attendance
- premature birth
- overcrowded homes (multiple siblings)
- exposure to smoking
- craniofacial abnormalities
- gastroesophageal reflux.

Diagnosis: Clinical diagnosis is based on the acute history (the patient is unwell with temperature) and examination (the ear drum is inflamed and possibly bulging or perforated and discharging).

Treatment: The first line of treatment is analgesia and symptom control. Generally, AOM lasts about 3 days but it can last up to a week. If the patient is deteriorating after the first 48–72 hours then antibiotics need to be considered. Amoxicillin should be prescribed for 5–7 days.

If the child (especially below the age of 2 years) is unwell at the initial visit, antibiotics can be considered initially rather than waiting for 2–3 days.

Antibiotics make little difference to the number of children whose symptoms improve with conservative management. Systemic antibiotics make little difference to the number of children with recurrent infections, short-term hearing loss or perforated ear drum. Complications (such as mastoiditis) are rare with or without antibiotics.

The following are more likely to benefit from early antibiotics:⁴

- children under the age of 2 years.
- children with perforated ear drum and bilateral otorrhoea.

Complications: Acute otitis media can lead to the following complications:

- Acute mastoiditis: Increasing malaise with pain and swelling over the mastoid process. This often settles with intravenous antibiotics. If not, surgical intervention and drainage of the subperiosteal pus and cortical mastoidectomy is necessary. Some surgeons may consider inserting grommets at the same time (Figure 1).
- Facial palsy: This is often secondary to the effect of pus or pressure on the exposed facial nerve in the middle ear cleft. Ventilation tube (grommet) insertion and a course of antibiotics and steroids usually result in full recovery.
- Intracranial complications: Meningitis, lateral sinus thrombosis and brain abscess can rarely develop as a result of acute otitis media. The patient is very unwell with high temperature. Cross-sectional imaging and lumbar puncture is often required to make the diagnosis. Treatment is planned as a multidisciplinary approach involving the paediatric, ENT and the neurosurgical team.

Otitis externa: Otitis externa is the inflammation and/or infection of the ear canal lining and/or its underlying bony structure. This condition can be acute or chronic. It is a common condition.



Figure 1 Acute mastoiditis in a child. The pinna has been pushed forward due to post-auricular swelling over the mastoid bone. (Photo: Courtesy of Mr Andrew Robson, ENT Consultant)

Acute otitis externa (AOE) is caused by bacterial infection, with *Pseudomonas aeruginosa* and *Staphylococcus aureus* the most common pathogens. The mild forms can present with an itchy sensation but more commonly the patient complains of significant pain. This is due to inflammation and swelling of the soft tissue in a very confined bony ear canal. The acute phase can take some time to settle.

Chronic otitis externa (COE) is often caused by allergies or underlying inflammatory dermatologic conditions. The symptoms in COE are much milder than the acute form and they are mainly in the form of itchy sensation rather than pain; the discharge is also much less compared to the AOE.

Diagnosis: Patients complain of watery otorrhoea, pain and itching, almost always in both ears. It is often precipitated by swimming. The patients may report minor trauma (such as scratching of the ear canal while cleaning it with their nails, etc.) preceding the symptoms. The condition is also seen in swimmers (swimmer's ears) and it is more common in patients with reduced immunity such as diabetes.

Examination of the ear in AOE shows ear canal inflammation and narrowing. The otorrhoea is not as copious as one would usually see in AOM. Pain is the hallmark of this condition. Tenderness with movement of the tragus or pinna is a classic finding.

Treatment: Analgesia, aural toilet (ear suction under the microscope) along with appropriate topical medical treatment is the treatment of choice.

Topical ear drops are often a mixture of antibiotics and steroids. In cases where fungal infection is suspected or proven on pus swab culture, topical antifungal treatment is indicated.

The choice of topical antibiotics is based on a number of factors including tympanic membrane status. If the ear drum is perforated and there is no middle ear infection, it is advisable to avoid potentially ototoxic ear drops. Topical steroids or quinolones are the preferred option.

Chronic OE is managed by avoidance of precipitating factors (water precautions, change of shampoo, avoidance of trauma) and calming agents such as EarCalm™ spray and Betnovate scalp lotion.

Complications: Otitis externa can spread to the pinna and/or facial skin and result in perichondritis and/or cellulitis. In these cases, systemic antibiotic treatment is indicated to avoid further complications.

Oral antibiotics are reserved for cases in which the infection has spread beyond the ear canal. Occasionally, AOE can be so painful as to require admission for pain control.

Rarely, the infection can spread to the underlying bones and osteomyelitis of the skull base can ensue. This condition is known as necrotizing otitis externa (also known as malignant otitis externa due to its grim prognosis in the past). This condition should be suspected in any patient with otitis externa when the patient is not responding to the treatment and a deep seated earache continues to be present; the diagnosis is supported by findings on cross sectional imaging and analysis of inflammatory markers. It is more prevalent in patients with reduced immunity (e.g. diabetes) and the elderly. The symptoms and signs are unilateral. The pathology is secondary to *Pseudomonas* infection. Patients with necrotizing otitis externa require prolonged treatment with antibiotics for several weeks.

Nasal infections (rhinosinusitis)

Rhinitis is inflammation of the nasal lining. It often implies that there is no major inflammation present in the sinuses. Sinusitis (or rhinosinusitis), however, implies that the sinuses are involved. Infective sinusitis refers to bacterial or fungal infection of the sinuses.

Rhinosinusitis can be divided into acute and chronic. The chronic type can be divided into those with or without polyps. The European position paper on rhinosinusitis (EPOS) sets out the criteria for diagnosis of this condition.⁵ Acute infections only will be discussed in this article.

Acute rhinosinusitis (ARS) is defined as inflammation of the nasal and sinus lining lasting less than 12 weeks. ARS is a very common condition affecting 6–15% of the population. ARS often starts as a viral infection and 0.5–2.0% of these cases develop acute bacterial rhinosinusitis (ABRS).⁵

Multiple personal and environmental factors such as seasonal trends and climate variation, sinus and nasal anatomical factors, allergy, ciliary impairment and smoking are associated with an increased incidence of ARS.

The most common viruses responsible for viral rhinitis and rhinosinusitis are:

- Rhinoviruses
- Coronaviruses.

The most common bacteria in ABRS are:

- *S. pneumoniae*
- *H. influenza*
- *M. catarrhalis*
- *S. aureus*
- streptococcal species and anaerobic bacteria are also seen in ABRS.

Diagnosis: The diagnosis of ARS is almost exclusively made on the history and clinical examination.

Patients with ARS complain of:

- nasal blockage, congestion or stuffiness
- nasal discharge or postnasal drip (often mucopurulent)
- facial pain or pressure
- headache
- reduction/loss of the sense of smell
- malaise or pyrexia

Clinical signs of pus discharging from the nose support the diagnosis. Swelling over the maxillary sinus is rarely due to ARS and it may imply a dental cause especially if it is unilateral. Swelling over the eyes and the forehead however often can be a complication of ARS.

Treatment: ARS resolves without antibiotic treatment in most cases. Symptomatic treatment (i.e. analgesia with nasal douches and decongestants and topical steroids) is the preferred initial management for patients with mild symptoms. Antibiotic therapy should be reserved for patients with high fever or severe (especially unilateral) facial pain. For initial treatment, the most narrow-spectrum agent active against the likely pathogens should be used (e.g. coamoxiclav). If associated dental infection is suspected, addition of metronidazole is indicated.

Intranasal corticosteroids are considered to address the nasal inflammation in ARS. However, in patients with severe ARS, oral corticosteroids may be used for a short period to relieve headache, facial pain and other acute symptoms.

Complications can occur in up to 20% of acute sinusitis cases admitted to the hospital.⁵ The complications can be broadly divided into intracranial and extracranial types.

Intracranial complications such as meningitis or brain abscess can be a life threatening complication of this condition. Patients are generally unwell and have not responded to medical treatment. A high level of suspicion and cross-sectional imaging along with medical assessment for meningitis (e.g. lumbar puncture) can confirm the diagnosis. Treatment is multidisciplinary.

Extracranial complications: Orbital cellulitis and Pott's puffy tumour are the most common conditions encountered in everyday practice.

Orbital cellulitis: Inflammation of the orbital contents can result from direct or indirect extension of infection from the sinuses; this is known as post-septal orbital cellulitis (PSOC). Pre-septal cellulitis can be seen as a complication of sinusitis but it is more often the result of skin or lacrimal sac inflammation.

The inflammation in PSOC can vary from inflammation to florid pus collection. Clinically, this is identified in a patient who is unwell with raised temperature and signs of upper airway infection (i.e. recent upper respiratory tract infection). On examination, the patient may have nasal discharge and the eye looks swollen.

The following signs can indicate a varying severity of orbital involvement:

- periorbital oedema
- periorbital erythema
- chemosis
- ophthalmoplegia
- proptosis
- reduction in visual acuity
- reduction in colour perception (a sign of pressure on the optic nerve; necessitating prompt action).

If there is no clinical concern regarding vision or intracranial complications, then the patient can be commenced on antibiotics, nasal decongestants and nasal steroids. If the patient does not respond to medical treatment or deteriorates within 24–48 hours then a CT scan of the sinuses (including the brain) is indicated. Presence of an orbital abscess then requires surgical intervention. Intracranial complications are managed within a multidisciplinary team.

The varying stages of orbital involvement have been classified according to the CT scan findings using Chandler's classification (Table 1).

Pott's puffy tumour (PPT) is very rare. It is due to osteomyelitis and/or a sub-periosteal abscess of the frontal bone as a result of direct or vascular spread of infection. It presents as a swelling of the forehead over the frontal sinuses. If the CT scan confirms presence of abscess and the patient has not responded to medical treatment, surgical intervention is indicated (Figure 2).

Oropharyngeal, salivary and deep space neck infections

Infection of the oropharyngeal area is a common condition affecting both children and adults. The most common infection is acute tonsillitis. Most of these conditions settle down with conservative management in primary care. However, some fail to respond and develop complications (e.g. spread to deep neck spaces) which require specialist input.

Acute tonsillitis is an acute inflammation of the pharyngeal tonsils. In UK general practice, recurrent sore throat has an annual incidence of 100 per 1000 population;⁶ however, not all recurrent sore throats are due to tonsillitis. Tonsillitis can be associated with pharyngitis (inflammation of pharynx) and presents with acute onset sore throat, malaise and pyrexia. It is of viral origin in 40–60% of cases. Group A beta haemolytic streptococcus is the most common cause of bacterial tonsillitis and pharyngitis; spread is by droplet transmission. It is believed up to 30% of sore throats in children and up to 15% of sore throats in adults are due to bacterial tonsillitis.⁶ Tonsillitis can be part of systemic diseases such as infectious mononucleosis, characterized by inflamed swollen tonsils. The diagnosis of tonsillitis is based on clinical findings of pharyngeal inflammation and tonsillar hypertrophy with or without tonsillar exudates and tender cervical lymphadenopathy. Throat swabs for culture and sensitivity are not very useful in the management of tonsillitis although they may assist management in protracted illness.

Infectious mononucleosis (IM) is common in young adults and is caused by the Epstein–Barr virus (EBV). IM leads to severe systemic upset, acute tonsillar inflammation/enlargement, liver function derangement and splenomegaly. Patients need to avoid contact sport for 6 weeks due to the risk of splenic rupture. The condition is usually diagnosed by Monospot test which needs to be interpreted with caution as its sensitivity is less than 50% in children and 70–90% in adults. There is secondary bacterial infection in 30% of IM cases, hence the need for antibiotics. Ampicillin needs to be avoided as it may lead to severe

Chandler's classification of orbital cellulitis

1	Pre-septal cellulitis
2	Orbital cellulitis without abscess
3	Sub-periosteal orbital abscess
4	Intra-orbital abscess
5	Cavernous sinus thrombosis

Table 1

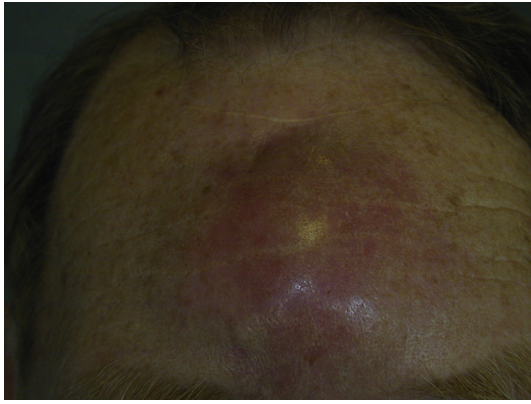


Figure 2 Potts Puffy Tumour. Note the swelling over the central forehead. (Photo: Courtesy of Mr Andrew Robson, ENT Consultant)

allergic rash. In case of significant tonsillar swelling, affecting the airway, one may prescribe a short course of systemic steroids.

Management of acute tonsillitis is mainly supportive with adequate analgesia and hydration. A Cochrane review of antibiotic use for sore throat shows benefit of reducing illness by 1 day and reduction of chance of developing quinsy. Although universal use of antibiotics is not justified, antibiotic therapy is appropriate in patients who have severe symptoms at the initial assessment and in those who show no signs of improvement within 48–72 hours.⁷ Indications for admission are rare, and include absolute dysphagia, upper airway obstruction and failure to improve at home.

Acute tonsillitis can lead to peritonsillar abscess (quinsy), deep neck space infections and very rarely scarlet fever, rheumatic fever and glomerulonephritis. Quinsy is characterized by marked trismus, unilateral peritonsillar swelling and deviation of uvula to the opposite side. Quinsy is managed by needle aspiration and/or incision and drainage of the abscess along with intravenous antibiotics, steroids and fluid replacement (Figure 3).

Acute supraglottitis is a bacterial infection in children between 2 and 7 years characterized by sore throat, high temperature, drooling associated with progressive inspiratory stridor secondary inflammation of supraglottis (mainly of the loose connective tissue of epiglottis). This is commonly caused by *H influenzae* type B; however, other bacteria such as staphylococci, beta haemolytic streptococci and pneumococci are becoming more common with universal use of vaccination against *H. influenzae*. The disease is declining in incidence as a result of the vaccination programme. This is an acute airway emergency that needs to be managed appropriately. The patient needs to be assessed and in the case of a child where the airway is endangered or assessment is not possible, the child should be transferred to theatre followed by immediate assessment and intubation if required. Tracheostomy is rarely required as the inflammation settles down within a few days and the patient can be extubated safely. Medical management includes intravenous antibiotics (e.g. third-generation cephalosporins), intravenous fluid and steroids, blood culture, throat swabs and transfer to a high dependency unit or an intensive care unit. Patient usually responds within 24–48 hours and can be extubated.

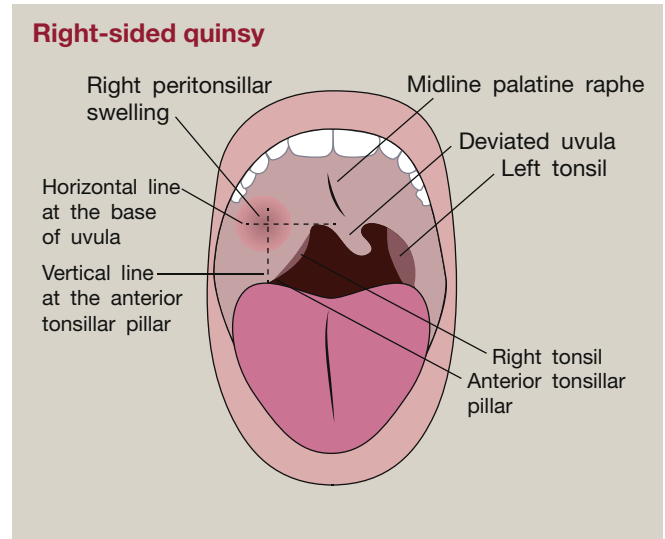


Figure 3 Right-sided quinsy demonstrated by right peritonsillar swelling and uvula pushed to the left. The tonsil on the side of quinsy is often hidden from view due to the surrounding swelling. Quinsies are almost invariably associated with some degree of trismus. Note the safe aspiration point at the intersection of two imaginary lines (one running horizontally at the base of the uvula and the other running vertically at the anterior tonsillar pillar).

Salivary gland infections: Mumps (commonly caused by paramyxovirus) is the most common cause of non-suppurative infection of the parotid gland in children. It causes bilateral tender parotid enlargement, trismus and malaise. Treatment is conservative.

Recurrent non-suppurative sialadenitis of parotid and sub-mandibular salivary glands is secondary to obstruction of the ducts (due to stones, strictures or mucous plug). Clinically, patients complain of painful swelling of the gland when eating. Treatment is conservative (i.e. massaging the gland, hydration and sialogogues) or in recurrent cases involves sialo-endoscopy, stone extraction or duct dilatation.

Suppurative sialadenitis can be acute or chronic. Acute bacterial sialadenitis is commonly seen in dehydrated immunocompromised patients and caused by retrograde contamination from the oral cavity characterized by painful swollen salivary gland, pyrexia and purulent discharge from the ductal orifice. Investigations include ultrasound to rule out any abscess formation or any obvious duct obstruction. Sialogram is often employed after the acute phase has subsided to look for duct pathology but it can treat the problem by flushing the duct. Management involves intravenous fluid and antibiotics (commonly co-amoxiclav). In the event of abscess formation surgical drainage is required. Recurrent acute sialadenitis may also require surgical removal of the gland.⁸

Deep neck space infections: Neck space infections are common ENT emergencies. Neck space infections can be potentially life threatening due to airway compromise and they can be fatal if not managed appropriately.⁹ The neck is divided into several potential spaces by cervical fascia (fibrous connective tissue that dictates presentation, spread and treatment of deep neck space

infections). The most important spaces are the submandibular, parapharyngeal, retropharyngeal, prevertebral and carotid spaces, all of which connect to each other. Submandibular space is made of two compartments: submental and submandibular.

Aetiology of neck space infections: The most common causes of deep neck space infections are:

- Tonsillitis and quinsy.
- Odontogenic: The spread is dictated by relationship of the affected tooth to the mylohyoid line of the mandible. Infection anterior to the 2nd molar tooth spreads to the floor of mouth whereas the infection posterior to 2nd molar tends to spread to the submandibular and parapharyngeal space.¹⁰
- IV drug users.
- Trauma.
- Others: Foreign body, upper respiratory tract infections and lymphadenitis, sialoadenitis, epiglottitis, and iatrogenic and Idiopathic.

Most deep neck space infections are polymicrobial.⁹ Organisms relate to the source of infection: anaerobic predominate in cases of odontogenic cause and streptococcus in cases of pharyngo-tonsillar infection. Klebsiella infection is common in diabetic patients.¹¹ Staphylococcal infections are common with paediatric population and most of them are of methicillin-resistant strain.¹²

Clinical features: In children, the most common presentation is cervical lymphadenitis secondary to upper respiratory tract infection. This usually affects retropharyngeal or parapharyngeal nodes and may result in abscess formation. Retropharyngeal abscess is more common in children.¹² These typically present with symptoms of high temperature, dysphagia, hot potato voice, trismus, torticollis and shortness of breath.

In adults the clinical features are similar to children. Patients can have preceding upper respiratory infection or dental infection. Extensive deep neck space infections are found more commonly in immunocompromised patients (diabetes mellitus, HIV or IV drug abuser).¹³

Ludwig's angina is an inflammation of the floor of the mouth which has the potential for airway compromise. This is usually secondary to a dental source of infection. Patients can present with a sore throat, pain in the mouth and neck and stertor. The tongue is pushed to the roof or extruding out of their oral cavity (depending on the extent of the inflammation). Early diagnosis and management is crucial. Pre-emptive intubation secures the airway until the infection and inflammation has subsided, negating the need for emergency tracheostomy in most cases.

Investigations: Contrast-enhanced CT scan is the modality of choice for investigating deep neck space infections. Imaging studies must include the thorax to rule out mediastinal collection. Typically, the scan shows a rim enhancing hypodense lesion with central necrosis. It also helps with surgical planning and airway management (Figure 4).

Ultrasonography is useful in superficial neck space infection for both diagnostic and therapeutic purposes, as in small abscesses needle aspiration may be curative.¹⁴

Treatment: Treatment involves securing the airway (if compromised) as a matter of priority followed by use of broad spectrum antibiotics (and then changing antibiotics based on culture and sensitivity). Patients will need cross-sectional



Figure 4 CT scan of neck with contrast shows a right parapharyngeal abscess and gas (caused by a gas-producing micro-organism).

imaging in the form of a contrast CT scan followed by drainage of pus collection and management of complications.

In the absence of airway compromise, abscesses smaller or equal to 2 cm can be initially managed by intravenous antibiotics, whereas surgical drainage is indicated in larger abscesses. The surgical plan is guided by the CT scan findings and clinical picture. Surgical interventions are achieved by trans-cervical surgical incision and drainage, intraoral drainage (sometimes aided by tonsillectomy) or ultrasound-guided needle aspiration.

Complications: Evidence shows complications secondary to deep neck space infection can be up to 30%. The main complications are upper airway compromise, mediastinitis, internal jugular vein thrombosis, sepsis and septic emboli.

Mediastinitis can result from the infection spreading through the prevertebral space. This space (also known as the danger space) is between the alar fascia and prevertebral muscle. Infection can enter from surrounding spaces and spread inferiorly to mediastinum. Mediastinitis has a high morbidity and may be fatal; management should be in liaison with the infectious disease and the thoracic team for appropriate medical and surgical treatment.

Internal jugular thrombosis can lead to sepsis and septic emboli. Treatment requires antibiotics and anticoagulation in liaison with the haematology team.

ENT foreign bodies

Nasal foreign bodies

Nasal foreign bodies (NFBs) are a common occurrence in children especially between 2 and 5 years of age. In adults, repeated insertion of objects into the nose or other orifices can be associated with psychiatric illness.

NFBs can be divided into animate and inanimate or organic and non-organic objects. Inert objects such as plastic beads cause very little reaction whereas organic objects such as peas can cause inflammatory reactions. NFBs can cause local irritation,

infection, nasal discharge, epistaxis, septal perforation and aspiration if left untreated. A chronic unilateral nasal discharge in a child could be a sign of nasal foreign body and needs to be investigated. Ignored or undiagnosed NFBs can lead to formation of a rhinolith.

Batteries can cause tissue damage as a direct effect of corrosive material leakage and by creating a direct current when the cathode and anode are connected through the nasal lining and secretions. Batteries need to be removed as soon as possible as they can cause tissue damage within a few hours.

The best chance to remove nasal foreign bodies in children is the first attempt. It is crucial that the correct equipment is available. Smooth and firm objects such as beads are best removed by a wax hook as forceps manipulation is most likely to push them further into the nasal cavity (Figure 5). If the child does not cooperate then NFB needs to be removed under general anaesthesia.

Ear foreign bodies

The same principles discussed in NFBs apply to the ear foreign bodies (EFBs); however, there are some differences between the two organs.

While the NFB is removed as soon as possible, there is generally less urgency in removing inanimate non-organic objects from the ear canal as they usually do not cause any immediate problem. Also, while the primary care provider or the emergency room physician may attempt removing the NFB, it is often best to leave removal of the EFBs to specialists as special instruments are needed and often a microscope is used for better visualization.

Button batteries pose the same risk in the ear canal as they do in the nose and they need to be removed as soon as possible.

Insects can cause distress due to the noise they generate. In these cases, the best initial step of action (by primary care provider) is to drown the insect by instilling an oil-based drop (such as olive oil) into the ear canal. The dead insect can then be removed by the specialist at the earliest opportunity.

Upper aerodigestive tract foreign bodies

Ingested or inhaled foreign bodies (FBs) are common in children and in adults. They can be life threatening and cultural factors dictate the type of foreign body ingested. Foreign bodies could be

small toys, coins or foods like fish bones and meat bolus with or without bones (e.g. lamb meat). Pharyngo-oesophageal FBs with sharp edges (e.g. a piece of chicken bone) or button batteries need to be prioritized due to risk of perforation if not treated appropriately. The vast majority of swallowed FBs pass through the digestive tract and are egested often undetected. The main complications of foreign bodies are aspiration, migration of foreign body, oesophageal perforation and abscess. Plain radiographs with lateral view can help in the diagnosis and localization of the foreign body. The FBs are removed under general anaesthesia in case of children. In the case of adults, FBs can be removed with different techniques ranging from flexible or rigid angled nasoendoscopy and curved forceps under local anaesthesia to flexible oesophagoscopy and rigid endoscopy under general anaesthesia.¹⁵

Acute aspiration of FBs in the airway needs to be treated by 'Heimlich's manoeuvre'. This has become part of public education and first aid procedure. The manoeuvre involves compression of upper abdomen to exert pressure on the diaphragm and subsequently on the lungs to expel the FB. In infants, it involves lying the child on an adult's knee and pressing firmly on the upper abdomen. Peak incidence of inhaled FB is between 1 and 3 years of age and there is typically a history of choking episode. If the child is well enough then a chest x-ray will help with diagnosis and localization of FB. The main complications of untreated tracheobronchial tree FBs are pneumonia and pneumothorax. In the acute emergency with a compromised airway, high flow oxygen and Heliox (i.e. helium and oxygen) buys time for definitive treatment. Removal is achieved by the ENT surgeon aided by senior paediatric anaesthetist using a bronchoscope and optical forceps under general anaesthesia. Once the FB is removed, meticulous examination of the tracheobronchial tree must be undertaken to exclude fragments or further FBs or any anatomical variations. The child should be closely monitored for 24 hours. Children with a history of inhaled foreign body and persistent respiratory symptoms should be assumed to have a foreign body in the lung and managed appropriately. ◆

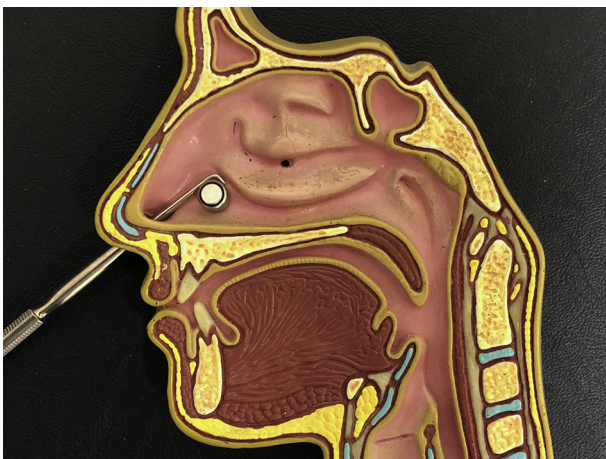


Figure 5 Button battery is removed using a wax hook with a back-to-front motion

REFERENCES

- 1 Rovers MM, Schilder AGM, Zielhuis GA, Rosenfeld RM. Otitis media. *Lancet* 2004; **363**: 465–73.
- 2 Hernández-Vaquero GE, Soto-Galindo GA, Treviño González JL. Update in pediatric acute otitis media: a review. *Ann Otolaryngol Rhinol* 2017; **4**: 1173.
- 3 Kong K, Coates H. Natural history, definitions, risk factors and burden of otitis media. *Med J Aust* 2009; **191**: S39–43.
- 4 Nice Guideline. Otitis media (acute): antimicrobial prescribing. NICE guideline [NG91] Published date: March 2018; online (accessed May 2018).
- 5 Fokkens WJ, Lund VJ, Mullol J, et al. EPOS 2012: European position paper on rhinosinusitis and nasal polyps 2012. *Rhinology* 2012;(Suppl 23); 1–298.
- 6 BMJ Clinical Evidence. Recurrent throat infections (tonsillitis). <http://clinicalevidence.bmj.com> (accessed 1 June 2018).
- 7 Del Mar GB, Glasziou PP, Spinks AB. Antibiotics in sore throat (Cochrane review). In: *The Cochrane library*. Oxford: update software, 2002. Issue 4.

- 8 Fattahi TT, Lyu PE, Van Sickels JE. Management of acute suppurative parotitis. *J Oral Maxillofac Surg* 2002; **60**: 446–8.
- 9 Bakir S, Tanriverdi MH, Gün R, et al. Deep neck space infections: a retrospective review of 173 cases. *Am J Otolaryngol Head Neck Med Surg* 2012; **33**: 56–63.
- 10 De M, Sonsale A Otolaryngology head & neck surgery series: laryngology. Chapter: infections of the fascial spaces of the head & neck. India. Theime2014: PP209.
- 11 Lee YG, Kanagalingam J. Bacteriology of deep neck spaces: a retrospective review of 96 consecutive cases. *Singapore Med J* 2011; **52**: 351–5.
- 12 Cottichia JM, Getnick GS, Yun RD, Arnold GE. Age-site and time specific difference in paediatric deep neck spaces. *Arch Otolaryngol Head Neck Surg* 2004; **128**: 1361–4.
- 13 Lee YG, Kanagalingam J. Deep neck space abscesses: Singapore experience. *Eur Arch Oto-Rhino-Laryngol* 2011; **268**: 609–14.
- 14 Maroldi R, Farina D, Ravenello M, et al. Emergency imaging. Assessment of Deep neck space infections. *Semin Ultrasound CT MR* 2012; **33**: 432–42.
- 15 Lam HC, Woo JK, Van Hasselt CA. Management of ingested foreign bodies: retrospective review 5240 patients. *J Laryngol Otolaryngol* 2001; **115**: 954–7.