CSOM is a perforated tympanic membrane with persistent drainage from the middle ear. It is a disease that is well known to otolaryngologists. CSOM is defined as chronic otorrhea (ie, lasting >6-12 wk) through a perforated tympanic membrane. Chronic suppuration can occur with or without cholesteatoma, and the clinical history of both conditions can be very similar. The treatment plan for cholesteatoma always includes tympanomastoid surgery with medical treatment as an adjunct.

Pathophysiology

CSOM is initiated by an episode of acute infection. The pathophysiology of CSOM begins with irritation and subsequent inflammation of the middle ear mucosa. The inflammatory response creates mucosal edema. Ongoing inflammation eventually leads to mucosal ulceration and consequent breakdown of the epithelial lining. The host's attempt at resolving the infection or inflammatory insult manifests as granulation tissue, which can develop into polyps within the middle ear space. The cycle of inflammation, ulceration, infection, and granulation tissue formation may continue, eventually destroying the surrounding bony margins and ultimately leading to the various complications of CSOM.

Common bacteria: Pseudomonas aeruginosa, Staphylococcus aureus, Proteusspecies, Klebsiella pneumoniae, and diphtheroids are the most common bacteria cultured from chronically draining ears. Anaerobes and fungi may grow concurrently with the aerobes in a symbiotic relationship. The clinical significance of this relationship, although unproven, is theorized to be an increased virulence of the infection. Understanding the microbiology of this disease enables the clinician to create a treatment plan with the greatest efficacy and least morbidity.

P aeruginosais the most commonly recovered organism from the chronically draining ear. Various researchers over the past few decades have recovered pseudomonads from 48-98% of patients with CSOM.

Etiology

The diagnosis of CSOM requires a perforated tympanic membrane. These perforations may arise traumatically, iatrogenically with tube placement, or after an episode of acute otitis media, which decompresses through a tympanic perforation.

The mechanism of infection of the middle ear cleft is postulated to be translocation of bacteria from the external auditory canal through a perforation into the middle ear. Some authors suggest that the pathogenic organisms may enter through reflux of the eustachian tube. The data supporting this theory are inconclusive. Most of the pathogenic bacteria are those common to the external auditory canal.

The risk of developing otorrhea (but not necessarily CSOM) through a ventilation tube is reportedly 21-50%. Annually, more than a million tubes are placed in the United States for recurrent otitis media and otitis media with effusion. Studies have reported that 1-3% of patients with ventilation tubes develop this disease.

The risk of developing CSOM increases with the following circumstances:

- A history of multiple episodes of acute otitis media
- Living in crowded conditions
- Day care facility attendance
- Being a member of a large family

Studies trying to correlate the frequency of the disease with parental education, passive smoke, breastfeeding, socioeconomic status, and the annual number of upper respiratory tract infections are inconclusive.

Patients with craniofacial anomalies are special populations at risk for CSOM. Cleft palate, Down syndrome, cri du chat syndrome, choanal atresia, cleft lip, and microcephaly are other diagnoses that increase the risk of CSOM, presumably from altered eustachian tube anatomy and function.
Prognosis
Patients with CSOM have a good prognosis with respect to control of infection. The recovery of associated hearing loss varies depending on the cause. Conductive hearing loss can often be partially corrected with surgery. The goal of treatment is to provide the patient a safe ear.

Much of the morbidity of CSOM comes from the associated conductive hearing loss and the social stigma of an often fetid fluid draining from the affected ear. The mortality of CSOM arises from associated intracranial complications. CSOM itself is not a fatal disease. Although some studies report sensorineural hearing loss as a morbid complication of CSOM, other evidence conflicts with this claim.

History and Physical Examination
Patients with chronic suppurative otitis media (CSOM) present with a draining ear of some duration and a premorbid history of recurrent acute otitis media, traumatic perforation, or the placement of ventilation tubes. Typically, they deny pain or discomfort. A common presenting symptom is hearing loss in the affected ear. Reports of fever, vertigo, and pain should raise concern about intratemporal or intracranial complications. A history of persistent CSOM after appropriate medical treatment should alert the physician to consider cholesteatoma.

The external auditory canal may or may not be edematous and is not typically tender. The discharge varies from fetid, purulent, and cheeselike to clear and serous. Granulation tissue is often seen in the medial canal or middle ear space. The middle ear mucosa visualized through the perforation may be edematous or even polypoid, pale, or erythematous.

Complications of Disease
In the present era of antibiotics, complications from CSOM are rarely seen because of early antibiotic intervention. However, surgery does play an important role in managing CSOM with or without cholesteatoma.

CSOM without prompt, proper treatment can progress to a variety of mild to life-threatening complications that can be separated into 2 subgroups: intratemporal and intracranial. Intratemporal complications include petrositis, facial paralysis, and labyrinthitis. Intracranial complications include lateral sinus thrombophlebitis, meningitis, and intracranial abscess. Sequelae include hearing loss, acquired cholesteatoma, and tympanosclerosis.

Petrositis
Petrositis occurs when the infection extends beyond the confines of the middle ear and mastoid into the petrous apex. Patients may present with Gradenigo syndrome (ie, retro-orbital pain, aural discharge, and abducens palsy). A CT scan of the head and temporal bone helps define the extent of the disease, diagnose any intracranial spread, and plan a surgical approach. Treatment includes systemic antibiotics with petrosectomy.

Facial paralysis
Facial paralysis can be observed in CSOM with or without cholesteatoma. Surgical exploration with removal of diseased mucosa, granulation tissue, and inspissated pus (usually by mastoidectomy) should be undertaken promptly.

Labyrinthitis
Labyrinthitis occurs when the infection spreads to the inner ear. This may happen emergently or over an extended period. The infection gains access to the inner ear through the round and oval windows or through one of the semicircular canals exposed by bony erosion. The 4 categories of labyrinthitis have been recognized as acute serous, acute suppurative, chronic, and labyrinthine sclerosis.

The symptoms of acute serous labyrinthitis are acute onset of vertigo and hearing loss. Early surgical exploration to remove the infection mitigates damage to the labyrinth.

Patients with acute suppurative labyrinthitis present with profound hearing loss, tinnitus, and vertigo with associated nausea and vomiting. Patients initially demonstrate nystagmus with the rapid
component directed toward the affected ear; they later demonstrate nystagmus away from the affected ear after destruction of the membranous labyrinth. Treatment includes aggressive surgical debridement (including labyrinthectomy) to prevent the possibly lethal intracranial complications of meningitis or encephalitis. Administration of broad-spectrum antibiotics with cerebrospinal fluid penetration is also necessary. Culture and sensitivities should direct any changes in the antibiotic regimen.

Chronic labyrinthitis is characterized by the gradual onset of vertigo, tinnitus, and hearing loss. Most commonly, the infection reaches the labyrinth through the lateral canal. Treatment involves mastoidectomy, culture, and appropriate medical therapy.

Labyrinthine sclerosis occurs as the inflammation in the labyrinth causes the body to replace it with fibrous tissue and new bone.

Lateral sinus thrombophlebitis

Lateral sinus thrombophlebitis occurs as the infection extends through the mastoid bone into the sigmoid or lateral sinus. The infected thrombus may release septic emboli causing distal infarcts. Patients present with altered mental status, possible seizures, and fever. Mastoidectomy with surgical excision of the thrombus and culture-directed antimicrobial treatment are the first steps in the management of sinus thrombophlebitis.

Meningitis

Meningitis develops as a consequence of direct or hematogenous spread of the infection. If meningitis is suspected, a lumbar puncture should be performed to recover the causative organism for culture and sensitivity prior to the initiation of empiric broad-spectrum antibiotic therapy. When stable, patients are taken to the operating room for surgical removal of the cholesteatoma or middle ear infection. Patients with CSOM may develop intracranial abscesses, but it is rare.

Intracranial abscesses

The various intracranial abscesses that may occur can be extradural, subdural, or parenchymal.

A patient with an extradural abscess may present with meningitic signs and symptoms or may be asymptomatic. Regardless of the presentation, imaging to define the abscess should be acquired, and the abscess should be drained with the assistance of neurosurgeons as needed.

Patients with subdural abscesses are very ill and exhibit meningeal signs, possible seizures, and hemiplegia. Prompt neurosurgical consultation, adequate imaging, drainage, and antibiotics are the appropriate treatment. Otologic surgery to remove the nidus of infection is necessary once the patient has stabilized.

Parenchymal abscesses occur as the infection spreads through the tegmen tympani or tegmen mastoideum to the temporal lobe or the cerebellum. Their presentation may be indolent, as this disease initially grows in "silent" areas of the brain. However, if the clinician suspects intracranial involvement, the previous plan of imaging, neurosurgical drainage, and antibiotic therapy is the standard of care.

Conductive hearing loss as a consequence of CSOM may result from the perforated tympanic membrane, a disruption in the ossicular chain, or both. Surgical removal of the infection and cholesteatoma with ossicular chain reconstruction mitigates morbidity associated with decreased hearing.

Approach Considerations

Reasonable chronic suppurative otitis media (CSOM) treatment plans can be developed without lab studies. Prior to instituting systemic therapy, a culture should be obtained for sensitivity.

If CSOM is unresponsive to medical treatment, a fine-cut CT scan of the temporal bone may provide an explanation. A fine-cut CT scan may reveal bone erosion from a cholesteatoma, ossicular erosion, involvement of the petrous apex, coalescent mastoiditis, erosion of the fallopian canal, and a
subperiosteal abscess. Possible reasons for failed treatment include an occult cholesteatoma or a foreign body.

CT scanning is a necessary adjunct to treatment if the clinician suspects a neoplasm or anticipates intratemporal or intracranial complications.

MRI scans of the temporal bone and brain should be obtained if intratemporal or intracranial complications are suspected. By clearly depicting soft tissues, MRI can reveal dural inflammation, sigmoid sinus thrombosis, labyrinthitis, and extradural and intracranial abscesses.

An audiogram should be performed. Conductive hearing loss is expected, but mixed hearing loss may indicate more extensive disease and should alert the treating physician of impending complications.

Treatment

Patients with chronic suppurative otitis media (CSOM) respond more frequently to topical therapy than to systemic therapy. Successful topical therapy consists of 3 important components: selection of an appropriate antibiotic drop, regular aggressive aural toilet, and control of granulation tissue.

Inpatient care is rarely necessary for the patient with CSOM. In patients for whom the otolaryngologist chooses systemic parenteral antibiotics, inpatient hospitalization may be required. Otherwise, excluding complications, this disease can be treated effectively in the outpatient setting. Patients who present with suspected intracranial complications to hospitals that function without CT scanning capabilities or neurosurgical care should be transferred as soon as possible to an institution with such capabilities. Antibiotic therapy should be started prior to transfer.

Medication Summary

An expert panel of the American Academy of Otolaryngology-Head and Neck Surgery has provide guidelines for the use of antibiotics in chronic suppurative otitis media (CSOM). The panel concluded that topical antibiotics alone constitute first-line treatment for most patients, barring systemic infection. If systemic infection is present, oral or, if necessary, parenteral antibiotics are warranted.

Although studies suggest only a slight risk of sensorineural hearing loss in humans from short courses of topical aminoglycosides, the risk of vestibular toxicity appears to be much higher.

The introduction of fluoroquinolones, which have no potential for ototoxicity, relegates aminoglycosides to a secondary treatment alternative in most areas. Patients who receive aminoglycoside drops when fluoroquinolone drops are available and subsequently develop sensorineural hearing loss or balance disturbance may blame their physician.

Surgery for Chronic Ear Disease

Patients with CSOM that is unresponsive to topical and/or systemic medical therapy with appropriate aural toilet and control of granulation tissue require surgery. The modern surgery for chronic otitis media was popularized in the 1950s. Prior to this, ear surgery was primarily successful at draining active infection, and there was less concern about long-term functional outcomes. Current goals for surgery for chronic ear disease include a dry, safe ear and the preservation of the normal structure and functioning to the greatest extent possible.

In patients with CSOM without cholesteatoma, surgery is considered if the perforation is persistent and long-standing and causes clinical symptoms, such as recurrent ear discharge and hearing loss. The age, general physical condition, fitness for general anesthesia, and coexisting diseases of the patient also play an important role in considering surgery.

General indications for surgery are as follows:

- Perforation that persists beyond 6 weeks
- Otorrhea that persists for longer than 6 weeks despite antibiotic use
- Cholesteatoma formation
• Radiographic evidence of chronic mastoiditis, such as coalescent mastoiditis
• Conductive hearing loss
For patients with early or mild CSOM cholesteatoma, aural toilet and repeated suction clearance of the ear with watchful expectancy may be performed; for patients with advanced disease, exploration of the mastoid and tympanoplasty is recommended.

The principal aim of surgery for CSOM is first to clear out the disease and only then, if possible, to reconstruct the patient’s hearing. Hearing reconstruction is often completed in a planned second-stage operation in patients with cholesteatoma. Staging the ear allows for the development of a healthy, air-containing middle ear space. Further inspection of the middle ear and mastoid cavity can confirm that the cholesteatoma has been eradicated. Silastic or other material is often placed in the middle ear and mastoid cavity to prevent postoperative scarring. This material is then removed during the second-stage procedure.

Contraindications (relative and absolute) to surgery for tubotympanic disease are as follows:

• Surgery on the only hearing ear
• Poor general physical condition, old age, or debility that makes general anesthesia risky
• Patients unwilling to undergo surgery
• Surgery on patients with unilateral vestibular ablation

Contraindications to surgery for atticoantral disease are as follows:

• Early or mild cholesteatoma amenable to aural toilet
• Patients who are severely ill and those with complications secondary to cholesteatoma, such as a brain abscess (drainage of the brain abscess and intravenous administration of antibiotics should be considered first)