

Persistent Pseudomonas Infection Mastoiditis—Local Antibiotic Treatment Is Superior than Systemic

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Abstract

Mastoiditis is a common complication of acute otitis media. It is common in younger age compared to adulthood. Mastoiditis occurs when an otitis media infection spread directly to involve the bone of mastoid air cell causing osteitis. Cholesteatoma can contribute to the development of mastoiditis. This typically leads to breakdown of some of the fine bony trabeculae of mastoid cells producing a coalescent mastoiditis with an emphyema in mastoid antrum. Cholesteatoma can contribute to the development of mastoiditis. The common treatment for mastoiditis is intravenous antibiotic. Our cases show that local antibiotic treatment is superior compared to systemic antibiotic in treating multi-drug resistant chronic Pseudomonas mastoiditis compared to intravenous antibiotic. However, if it presents together with cholesteatoma the main treatment is still early mastoidectomy.

Keywords

Antibiotic, Cholesteatoma, Drug-Resistant, Mastoidectomy, Mastoiditis

1. Introduction

Mastoiditis is defined as inflammation of a portion of the temporal bone referred to as the mastoid air cells. The mastoid air cells are epithelium lined bone septations that are continuous with the middle ear cavity. Mastoiditis is a common complication of acute otitis media [1]. It is common in younger age compared to adulthood [2]. Mastoiditis occurs when an otitis media infection spread directly to involve the bone of mastoid air cell causing osteitis. This typically leads to breakdown of some of the fine bony trabeculae of mastoid cells produc-

ing a coalescent mastoiditis with an emphyema in mastoid antrum. Cholesteatoma can contribute to the development of mastoiditis [3]. The common treatment for mastoiditis is intravenous antibiotic [1]. But in our case, patient show tremendous improvement with local antibiotic treatment.

2. Case Report

A-20s lady with no comorbid presented to us with complaint of persistent otorrhea for 3 years. There was no ear pain, reduces hearing, tinnitus or vertigo. She also did not complaint of any nasal symptoms.

Examination of the right ear showed ballooning of the ear canal anterior and posteriorly, and filled with keratin debris as shown in **Figure 1**. The right tympanic membrane was retracted with Tos 2 and Sade 2 at the pars flaccida and pars tensa respectively. Left ear examination was normal. Other oral cavities and rigid nasoendoscope examination showed normal examination.

She was treated as Right infected keratosis obturans and allowed home with ofloxacin ear drop for one week and water precaution and ear care advice. Pure Tone Audiometry (PTA) was done showed right mild to moderate mixed hearing loss and left hearing was normal. Swab for culture and sensitivity (C & S) of the right ear yielded moderate growth of *Pseudomonas aeruginosa* with sensitivity to ciprofloxacin, cefepime, gentamicin, piperacillin/tazobactam. Patient was continuing on ofloxacin ear drop and together with tablet ciprobay for one



Figure 1. A: Whitish keratin debris seen at the posteroinferior region; B: Attic retraction, no keratin seen.

week. Unfortunately, the ear discharge persists during clinic review 2 weeks later. On examination noted there was mucopus and present of keratin debris at the right external auditory canal (EAC) and posterior wall eroded exposing the right mastoid air cell. The right tympanic membrane was intact.

Her high-resolution tomography scan (HRCT) of temporal was done and reported as ballooning of right external ear canal with absence of right tympanic membrane and erosion of the right scutum (**Figure 2**). There was presence of soft tissue density within the right mesotympanum with thinning of tegmen tympani and erosion of mastoid air cells with features of mastoiditis. The head of right malleus and right incudomalleolar joint was abnormal with absence of right handle of malleus (**Figure 3**).

The patient underwent right modified radical mastoidectomy (MRM). Intra operatively noted cholesteatoma sac and granulation tissue occupying the mastoid cavity, antrum and middle ear. Incus was eroded. Malleus and stapes supra-structures including crus present. Facial nerve identified and preserved. The granulation tissue was sent for mycobacterium culture and sensitivity (C & S) and mycobacterium genome detection PCR and both results were negative. During admission c-reactive protein (CRP) is normal and ESR showed 68 during

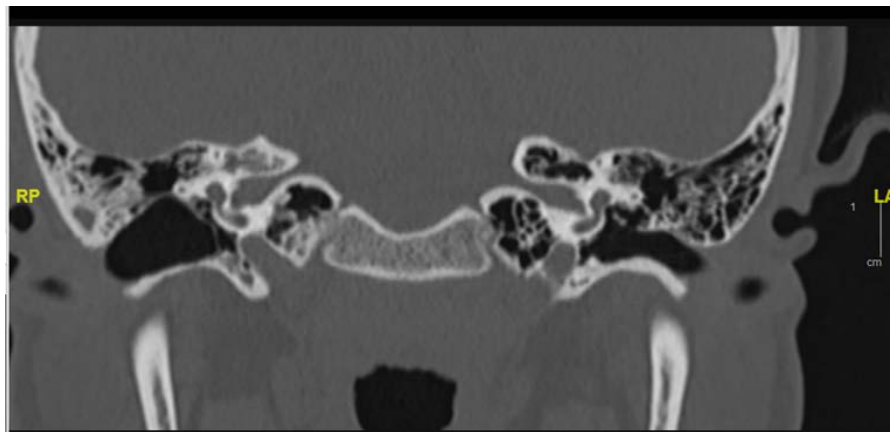


Figure 2. Erosion of the right scutum.

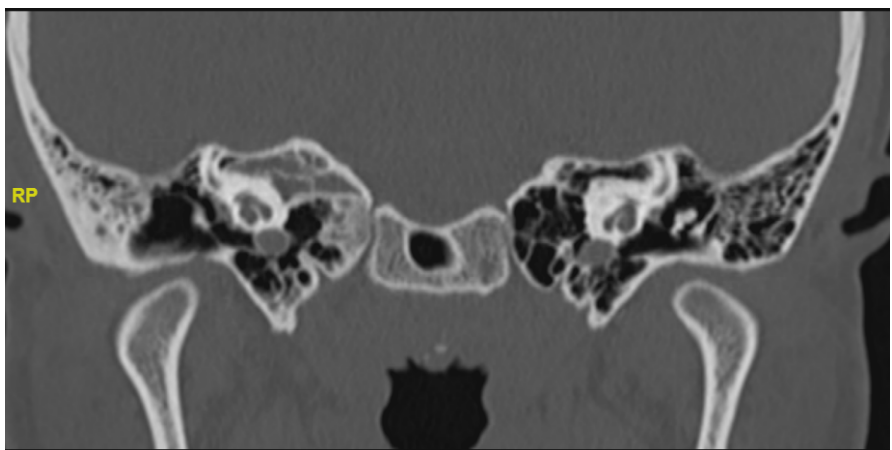


Figure 3. Absence of right handle of malleus.

admission The histopathology examination (HPE) confirmed the diagnosis cholesteatoma. The ear swab C + S during operation taken showed *Pseudomonas aeruginosa* (moderate growth). Patient's right ear was packed with bismuth iodine paraffine paste (BIPP) for 2 weeks.

Post operative and removal of BIPP, otoendoscopy noted thick yellowish-greenish discharge seen in external auditory canal and mastoid bowl there was persistent right otorrhoea and the ear swab C & S noted *Pseudomonas* sp. heavy growth sensitive to gentamicin, ceftazidime and piperacillin/tazobactam, but still resistant to ciprofloxacin. Patient then was readmitted to start on IV Tazocin and ofloxacin ear drop, but still showed no improvement in right ear mucopus discharge after 1 week of treatment. Then we packed the right ear using the ribbon gauze that was soaked with Poci-H (Polymyxin B + Neomycin + Hydrocortisone) ear drop and continue with IV Tazocin. After patient being on right ear packing for 1 week, the right ear discharge resolved and otoendoscope showed clear external auditory canal and mastoid bowl. There was no discharge or granulation tissue noted. The repeated ear swab C + S upon discharge showed no growth. After 8 months, patient was been discharged, she does not complain of ear discharge anymore and ear examination showed dry ear canal and mastoid bowl. There was no more granulation noted and right tympanic membrane was intact.

3. Discussion

Acute mastoiditis occurs when an otitis media infection spreads directly to involve the bone of the mastoid air cell system as an osteitis. This typically leads to breakdown of some of the fine bony trabeculae of the mastoid air cells, producing a coalescent mastoiditis with an emphyema in the mastoid antrum. In the pre-antibiotic era, 20% of cases of acute otitis media were complicated by acute mastoiditis and frequently associated with severe intracranial complications [1]. The infecting organism is usually a *Streptococcus pneumoniae* (up to 60%) *Streptococcus pyogenes*, *Pseudomonas aeruginosa* and *Staph aureus* [4]. Although mastoiditis can occur at any age, the majority of patients are less than two years of age, with a median age of 12 months [1].

Cholesteatoma concerning the shape and form of the lesion has been termed as a growth of abnormal keratinizing squamous epithelium with a collection of keratin debris [5], cystic lesion [5], three-dimensional structure [6], cystic mass with a surrounding inflammatory reaction [7], middle ear tumor [4], a form of chronic otitis media [8], and "epidermoid cyst". There are two major types of middle ear cholesteatomas, congenital and acquired [9]. Congenital cholesteatomas are derived from remnants of epithelium that get trapped behind the tympanic membrane during development. Acquired cholesteatomas do not result from an embryologic phenomenon, but are the result of pathologic changes that cause the uncontrolled growth of squamous keratinized epithelium in the middle ear. While the lesions are benign, they can erode into the Central Nerv-

ous System (CNS) and cause severe complications.

The definitive treatment for cholesteatoma is surgical removal of the disease to provide a safe and dry ear [10]. Patients often present with debilitating pain and hearing loss, and it is very important to explain that the goal of surgery is cholesteatoma removal and this may not restore the patient's hearing to normal [11]. The type of surgery performed depends largely on the type and location of the cholesteatoma. Broadly, there are two major types of mastoidectomy: canal wall up and canal wall down [12]. Canal wall up mastoidectomy preserves the posterior bony external auditory canal, which separates the ear canal from the mastoid cavity. This patient underwent modified radical mastoidectomy in view of the disease was extensive.

When the cholesteatoma is infected, it is very difficult to cure. Cholesteatoma can contribute to the development of mastoiditis. Since the lesion has no blood supply, systemic antibiotics cannot get inside the center of the mass [10].

As in our patient, the ear swab C + S came back as *Pseudomonas aeruginosa* moderate growth and sensitive to ciprofloxacin, cefepime, gentamicin, piperacillin/tazobactam. *Pseudomonas aeruginosa* gram-negative motile anaerobe rod that is capable of producing several destructions local and systemic largely to a variety of enzymes and exotoxin. [4] Colonization of pseudomonas on damaged tissue is extremely common. Patient was started with ofloxacin ear drop but the ear discharge has not improved. Ear swab C & S was repeated and showed *Pseudomonas aeruginosa* which resistant to ciprofloxacin. Ciprofloxacin resistant toward pseudomonas is a known fact leading to in-patient treatment as no oral form is available. *Pseudomonas aeruginosa* exhibits the highest rates of resistance to the fluoroquinolones, with resistance to ciprofloxacin and levofloxacin ranging from 20% to 35% [13].

Study done by LY Chong *et al.* 2021 shows that topical quinolones may be slightly more effective at resolving ear discharge at one to two weeks than oral quinolones (risk ratio (RR) 1.48, 95% confidence interval (CI) 1.24 to 1.76. [14]

Most drops marketed specifically for otologic use contain *Neomycin* combined with a cationic detergent (Polymyxin B). Neomycin has remained fairly effective over the last 2 decades for gram-positive organisms, but it has lost almost all of its effectiveness for combating gram-negative organisms. Study by R Mosges 2011 shows that the investigational drug containing the antibiotics combination Polymyxin B sulfate, *Neomycin* sulfate and *Gramicidin* [Polyspectran* (PS)] was more effective compared to glycerol, which has been used for decades in swimmer's ear infections because of its strictly physical effect of dehydrating microorganisms by osmosis. [15]

However, one needs to out weight the benefit as some of these local antibiotics are ototoxic. Ototoxicity from topical preparations can involve both middle ear and inner ear structures. Antimicrobials, specifically antibacterial drops, are commonly used to treat bacterial infections. Fluoroquinolones (e.g. ciprofloxacin, ofloxacin) are effective against *Pseudomonas* and *Staphylococcus* species and are generally considered safe to use in the presence of tympanic membrane

perforation [16]. Aminoglycoside such as neomycin, gentamycin should not be used in presence of tympanic membrane rupture as it will damage cochlear hair cell [17].

4. Conclusions

We believed local antibiotic treatment is superior compared to systemic antibiotic in treating multi-drug resistant chronic *Pseudomonas* mastoiditis compared to intravenous antibiotic. However, if it presents together with cholesteatoma the main treatment is still early mastoidectomy.

Consents

The informed consent from the patient was obtained by the patient.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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