

Case Report

Tuberculosis of Middle Ear and Mastoid

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Objective: Review clinical manifestations, investigation, and treatment of tuberculosis of the middle ear.

Material and Method: A retrospective review of six cases diagnosed as tuberculosis of the middle ear at a tertiary referral center was included in the present study. The outcome measures were history, clinical manifestations, investigation, and treatment were reviewed in the medical records.

Results: The authors retrospectively reviewed data of our patients diagnosed as tuberculosis of the middle ear. It has been found that the most common manifestation is chronic otorrhea. Investigations are variable such as histopathology, tissue culture, or polymerase chain reaction for identification of tuberculosis. Treatment is mainly medication, however, surgery is considered for histopathology in selected cases.

Conclusion: Tuberculosis of the middle ear is a rare disease that requires high index of suspicion for diagnosis due to the variety of clinical manifestations. Identification of tuberculosis is a key for diagnosis and treatment.

Keywords: Tuberculous, Tuberculosis, Otitis media, Middle ear, Tuberculosis of middle ear

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Report of World Health Organization in 2010 showed 8.8 million (range 8.5-9.2 million) of tuberculosis globally⁽¹⁾. Most of the cases occurred in Asia (59%) and Africa (26%). Tuberculosis is divided into pulmonary and extra pulmonary tuberculosis. The most common extra pulmonary tuberculosis in the head and neck is tuberculous lymphadenitis⁽²⁻⁴⁾. Tuberculosis of the middle ear (TB middle ear) is a rare disease. The incidence of tuberculosis of the middle ear is about 0.05 to 0.9% of chronic infection of middle ear⁽⁵⁾. Regarding the variety of clinical manifestations, the diagnosis of TB middle ear is difficult and requires a high index of suspicion.

The aim of the present study was to report the clinical and laboratory diagnosis of patients with TB middle ear and to review the literature of all cases from Asian countries in the past decade.

Material and Method

The research has been approved by the institutional review board of the Faculty of Medicine, Siriraj Hospital, Mahidol University.

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The authors retrospectively reviewed data of six patients who were diagnosed as TB middle ear at the Department of Otorhinolaryngology, Faculty of Medicine, Siriraj Hospital, Mahidol University between 2000 and 2011. The criteria for diagnosis were patients with a history of chronic draining ears and at least one positive result of the following tests, histological examination as the granulomatous inflammation or caseating granuloma, acid-fast stain, culture, or polymerase chain reaction (PCR) for *Mycobacterium tuberculosis*.

The authors performed Pubmed searches of the English literatures printed between 2000 and 2011, using the terms (“tuberculosis or tuberculous”) and (“middle ear” or “otitis media” or “mastoid” or “mastoiditis”). Eighty-three studies were found. Twenty studies, including case reports, case series, and all studies, conducted in Asian countries were included.

Case Report

Case 1

A 21-year-old man was referred to Department of Otorhinolaryngology, Siriraj Hospital with a 2-month history of chronic draining left ear and otalgia, which did not respond to any treatment. Otoscopy showed a granulation tissue at anterosuperior quadrant

of the tympanic membrane. The tissue was removed for tissue culture and the eardrum perforation was found in that area. His audiogram showed left conductive hearing loss. CT temporal bone demonstrated fluid density in the left middle ear and mastoid cavity (Fig. 1). At first, tissue culture showed no growth, so the operation was scheduled for mastoidectomy for suspicious of cholesteatoma. On the field, granulation tissue with caseous-like (semisolid yellowish) material was revealed in both middle ear and mastoid cavity. Tissue pathological report from mastoid cavity showed granulomatous inflammation, but AFB stain was negative. The tissue culture returned positive for *Mycobacterium tuberculosis* complex. The patient was clinically improved after a six-month course of antituberculous drugs.

Case 2

A 52-year-old woman complained of retrobulbar pain in her left eye and left otorrhea for a period of one month. She also suffered from progressive left facial palsy, lower motor neuron lesion House-Brackmann grade II. Otoscopic examination found large tympanic membrane perforation with clear sticky discharge (Fig. 2). Audiogram showed profound sensorineural hearing loss on her left ear. CT temporal bone demonstrated soft tissue density with some bony destruction in the left mastoid cavity. Left simple mastoidectomy was performed for tissue biopsy and culture. The caseating granuloma had been reported in the pathological report; however, negative finding for the AFB stain and culture. The treatment for TB mastoiditis started. Finally, her clinical presentation was improved both ear infection and facial palsy after completion of anti-tuberculosis drugs.

Case 3

A 46-year-old woman suffered from left otalgia and aural fullness for two weeks. Otoscopic examination of the left ear showed a granulation tissue in the superior part of the eardrum with discharge. She was treated with oral antibiotics and eardrops but the signs and symptoms remained. Tissue biopsy was done at the outpatient department. Unfortunately, histology, AFB stain, and PCR were all negative. Her audiologic testing showed conductive hearing loss on the left side. Surgical exploration of the left middle ear showed granulation and necrotic tissue filled in the middle ear cavity including the ear ossicles, but not the mastoid. Even though the histology found no definite granuloma, the PCR and culture were positive for *Mycobacterium*

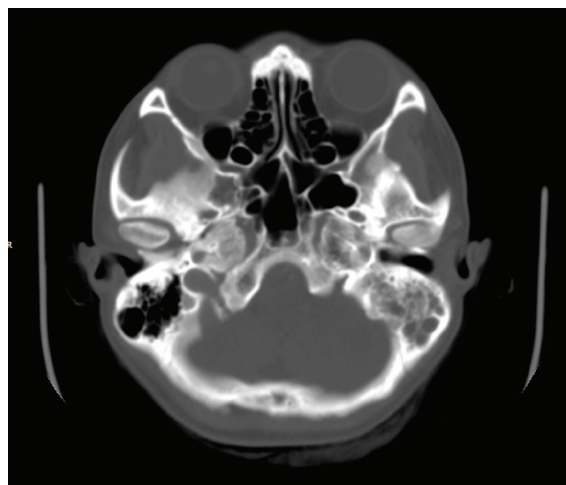


Fig. 1 Case 1; CT temporal bone showed fluid density in the mastoid cavity.

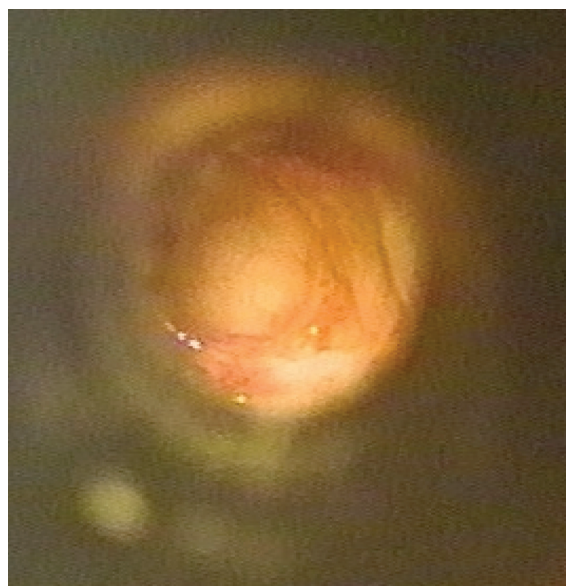


Fig. 2 Case 2; left tympanic membrane showed a large tympanic membrane perforation with clear discharge

tuberculosis complex. After completing her six-month antituberculous treatment, her hearing returned to normal and other symptoms have improved.

Case 4

A 59-year-old man, whose underlying diseases were DM type II, hypertension, dyslipidemia, and chronic kidney disease; his right ear was deaf for many years but he had never sought any medication for a cure. He developed right aural pain and drainage

for three weeks. Otoloscopic examination demonstrated a large granulation tissue attached to tympanic membrane with discharge. Tympanic membrane showed perforation after removing of granulation tissue. The tissue biopsy was conducted under local anesthesia. Histological result was acute inflammation and necrosis. *Pseudomonas aeruginosa* and *Citrobacter koseri* were isolated. The mycobacterium culture was negative, whereas PCR was positive for TB complex. He received antibiotics for two weeks and antituberculous drugs for six months. The underlying diseases were also controlled by the internal medicine doctor. At the fourth month of follow-up, otoscopy became normal; however, his right ear was still deaf.

Case 5

A 44-year-old woman presented with left otalgia and otorrhea for three weeks. Otoloscopic examination showed an eardrum perforation, middle ear mass and minimal discharge. Audiologic testing showed conductive hearing loss. After several courses of oral antibiotics and eardrops, the clinical pictures were still not improved. Chest x-ray revealed reticulonodular infiltration at right upper lung, but sputum AFB was negative. Left tympanomastoidectomy was performed. A lot of granulation tissues were found in middle ear cavity that involved ossicles and mastoid cavity. Histologic report showed granulomatous inflammation and negative for AFB stain. The acid-fast cultures of sputum and tissue from mastoid were positive for *Mycobacterium tuberculosis* complex. The patient received antituberculous drugs for six months. One year later, her symptoms have improved both otalgia and hearing loss. Her tympanic membrane healed itself, however it re-perforated without sign of infection.

Case 6

A 26-year-old Burmese woman, who immigrated to Thailand, had been having chronic painless drainage in both ears for one year. Neither medical treatment nor avoiding water pouring into her ear improved the symptoms. Otoloscopic examination revealed the multiple perforations on her left ear and the right showed perforation with white necrotic tissue in the middle ear (Fig. 3). There was no discharge or lesion at nasopharynx. Audiogram showed bilateral conductive hearing loss. Her chest x-ray was normal. Tissue culture and PCR for tuberculosis on the right showed *Mycobacterium tuberculosis* complex and positive for TB complex, respectively. The antituberculous drug regimen was continued for six

months. The otoscopic examination showed the improvement of the necrotic tissue both ears as well as chronic otorrhea, but tympanic membrane still perforated. After completion of the anti-tuberculosis drug, the tympanoplasty I due to the normal movement of ossicles, was conducted in both ears, in the duration of one year apart. The final audiogram found normal pure tone average.

Summary of case series is shown in Table 1.

Discussion

The classical features of tuberculous otitis media are painless otorrhea, single or multiple perforations of the tympanic membrane, severe hearing loss, and granulation tissue in the middle ear cleft mucosa⁽⁶⁾.

From reviews, the most frequent symptom was the chronic draining ear, which was found nearly 100% in every study as shown in Table 2. In the largest series from Korea⁽⁷⁾, most of the aural discharges were mucopurulent. Otalgia was not described as a typical feature. In the presented series, the authors found aural discharge and pain in 71% and 57% of cases, respectively. Otalgia may result from pressure effect of granulation tissues and secondary infection. Peripheral facial palsy was reported in 0 to 37% of tuberculous otitis media⁽⁶⁻¹⁰⁾. Some patients presented with complications of otitis media such as acute mastoiditis⁽¹¹⁾, postauricular abscess and fistula^(3,12-14), petrositis⁽¹⁵⁾, otitic hydrocephalus⁽¹²⁾ and meningitis⁽¹⁶⁾. In the present series, the authors found only one patient who presented with facial paralysis and one with chronic otitis media with effusion.



Fig. 3 Case 6; right ear showed necrotic tissue involved ossicles.

Table 1. Summary of case series

Case	History	PTA (dB)		Aural polyp	TM perforation	Gross finding	Mastoidectomy	Identification of TB	CXR	CT temporal bone finding
		R	L							
1L	Otorrhea	20	35 [#]	+	Single	Caseating material	Simple	Tissue culture	-	Fluid density
2L	Otorrhea Facial palsy	28	110*	-	Single	Caseating granuloma	Simple	neg	-	Soft tissue density
3L	Otorrhea Otagia	17	47 [#]	+	Single	Granulation tissue	Simple	Tissue culture and PCR	-	N/A
4R	Otorrhea Otagia	113*	23	+	Single	N/A	-	Tissue PCR	-	N/A
5L	Otorrhea and otagia	20	40 [#]	-	Single	Granulomatous inflammation	Simple	Tissue culture	+	N/A
6B	Painless otorrhea	38 [#]	33 [#]	White necrotic tissue	Multiple	N/A	-	Tissue culture and PCR	-	N/A

R = right ear; L = left ear; B = both ears; PTA = pure tone average (500, 1,000, 2,000 Hz); OME = otitis media with effusion; PCR = polymerase chain reaction; N/A = not applicable

[#] Conductive hearing loss, * Sensorineural hearing loss

On otologic examination, tympanic membrane perforation was found in the majority of our cases (71%). The classic multiple perforations of eardrum were not common, this may result from fusion of small perforations of the tympanic membrane⁽⁷⁾. The granulation and aural polyp were also commonly found in either the external ear canal or middle ear cavity undergoing surgery. The ossicles were sometimes found necrotic or eroded⁽¹⁷⁾. Secondary infection could be found in some cases^(9,18). The authors found aural polyps and granulation tissue in the mastoid cavity about 71% in patients.

Pulmonary tuberculosis is the common presentation of Mycobacterium infection⁽¹⁾. Nevertheless, it can infect more than one organ. Tuberculosis can occur in either immunocompetent or immunocompromised patients, but the latter tend to have more severe symptoms. The risk of TB is increased in HIV patients. Of all tuberculous patients, 12 to 14% also suffered HIV infection⁽¹⁾. Unfortunately, the majority of studies did not report on the HIV test. It is important to search for concomitant tuberculosis, even though 40 to 50% of patients with TB middle ear have no TB of other organs⁽¹⁹⁾. Some patients had a previous history of tuberculosis^(7,10), but most were first diagnosis. Other rare conditions were reported in concomitant with tuberculosis otitis media such as TB petrositis⁽¹⁵⁾, TB craniovertebral junction⁽²⁰⁾, TB laryngitis⁽²¹⁾ and TB epididymitis⁽⁹⁾. There were two reports of patients that underwent kidney transplant who received immunosuppressive drugs^(4,22) (as shown in Table 2). One of our patients had concomitant pulmonary tuberculosis and none had HIV infection.

Investigations for tuberculosis of the middle ear are variable and not specific for diagnosis. The histopathological diagnosis is very important. The characteristic features of tuberculosis are granulomatous inflammation and caseous necrosis. In many cases, the definite histological result required repeated biopsies⁽¹⁷⁾. The acid-fast stain is helpful for diagnosis; however, it has low sensitivity and is positive only in 27%⁽⁸⁾. Positive result does not necessarily indicate the presence of *M. tuberculosis* complex, because other Mycobacteria and Norcadia can also be positive⁽²³⁾. The culture of *Mycobacterium tuberculosis* is a definite diagnosis but very few are positive because of the low number of mycobacteria in specimens and the use of aminoglycoside eardrops⁽⁷⁾. Moreover, mycobacteria need time to grow. The PCR for TB is effective and rapid method⁽¹⁰⁾, but the limitation is its availability and high cost, especially

Table 2. Clinical manifestations from literature reviews

No.	Author	No. of case	Age range (yr)	Symptoms			Ear examination		Associated TB	Remarkd
				Otorrhea	Otalgia	Facial palsy	Abscess	Granulation		
1	Grewal D, 2000 ⁽¹²⁾	3	9-17	3	1	NA	1	3	NA	NA
2	Sethi A, 2005 ⁽¹⁵⁾	1	11	1	0	0	0	1	1*	AntiHIV-neg
3	Meher R, 2006 ⁽¹³⁾	5	3-13	5	1	1	3	3	NA	NA
4	Nalini B, 2006 ⁽⁴⁾	117	19	1	1	NA	NA	1	NA	S/P kidney transplant
5	Mohindra S, 2006 ⁽²⁰⁾	1	21	1	1	0	NA	1	1 ^{##,@}	NA
6	Prasad KC, 2007 ⁽³⁾	165	NA	4	NA	NA	3	4	0	NA
7	Arya M, 2009 ⁽¹⁴⁾	1	14	1	0	NA	1	NA	0	AntiHIV-neg
8	Parab SR, 2010 ⁽²¹⁾	1	36	1	NA	NA	NA	0	1 ^{**,#}	AntiHIV-neg
9	Awan MS, 2002 ⁽¹⁹⁾	2	19-40	2	NA	NA	NA	NA	2 ^{**}	NA
10	Ergün I, 2004 ⁽²²⁾	1	27	1	0	0	1	NA	0	S/P kidney transplant
11	Nishrike S, 2003 ⁽⁸⁾	12	24-72	12	2	0	NA	10	10 ^{**}	NA
12	Lee ES, 2000 ⁽¹¹⁾	13	7 mo-19	12	NA	NA	1	0	NA	NA
13	Cho YS, 2006 ⁽⁷⁾	52	5-59	NA	7	5	NA	1	6 (4 ^{**} , 2 ^{##})	NA
14	Kim CW, 2007 ⁽¹⁸⁾	1	8	1	0	NA	NA	NA	0	NA
15	Park SH, 2010 ⁽³⁰⁾	1	40 days	1	NA	1	NA	1	1 ^{**}	NA
16	Kwon M, 2010 ⁽⁹⁾	14	18-73	14	2	3	1	6	8 (8 ^{**} , 1 ^{##} , 1 ⁺)	NA
17	Hsiao CH, 2011 ⁽²³⁾	7	34-63	1	NA	NA	NA	NA	2 ^{**}	NA
18	Shu MT, 2011 ⁽²⁹⁾	1	66	1	NA	NA	NA	NA	1 ^{**}	NA
19	Tang IP, 2010 ⁽²⁸⁾	4	5-26	4	2	1	NA	3	1 ^{##}	NA
20	Abes GT, 2011 ⁽¹⁰⁾	12	18-56	5	1	0	NA	4	6 ^{**}	NA
21	Limviriyakul S	6	21-59	5	4	1	0	5	2 ^{**}	AntiHIV-neg

* TB petrositis (infection of petrous part of the temporal bone), ** TB lung, # TB larynx, ## TB lymph node, @ TB vertebra, + TB epididymitis

Table 3. Investigations and otologic surgery for TB middle ear

No.	Country	AFB stain	Culture TB	Histology	PCR	PPD	Surgery
1	Grewal D, 2000 ⁽¹²⁾	NA	NA	3/3	NA	NA	3
2	Sethi A, 2005 ⁽¹⁵⁾	0/1	NA	1/1	1/1	NA	1
3	Meher R, 2006 ⁽¹³⁾	NA	NA	5/5	NA	NA	5
4	Nalini B, 2006 ⁽⁴⁾	1/1	NA	0/1	NA	NA	0
5	Mohindra S, 2006 ⁽²⁰⁾	NA	1/1	1/1	NA	NA	0
6	Prasad KC, 2007 ⁽³⁾	NA	0/4	4/4	NA	3/4	4
7	Arya M, 2009 ⁽¹⁴⁾	1/1	NA	1/1	NA	1/1	1
8	Parab SR, 2010 ⁽²¹⁾	1/1	1/1	NA	NA	NA	0
9	Awan MS, 2002 ⁽¹⁹⁾	0/1	NA	2/2	NA	NA	2
10	Ergün I, 2004 ⁽²²⁾	1/1	1/1	1/1	NA	0/1	1
11	Nishiike S, 2003 ⁽⁸⁾	3/11 ears	9/10 ears	6/6 ears	5/7 ears	7/7 ears	NA
12	Lee ES, 2000 ⁽¹¹⁾	NA	0/1	1/1	0/1	NA	1
13	Cho YS, 2006 ⁽⁷⁾	D/C = 2/20 ears Tissue = 9/42 ears	D/C = 0/20 Tissue = 0/42	49/53 ears	7/8 ears	NA	42 ears
14	Kim CW, 2007 ⁽¹⁸⁾	0/1	0/1	1/1	NA	NA	1
15	Park SH, 2010 ⁽³⁰⁾	NA	NA	NA	1/1	NA	0
16	Kwon M, 2010 ⁽⁹⁾	D/C = 1/7 Tissue = 7/12	D/C = 3/7 Tissue = 2/3	11/12	4/5	NA	8
17	Hsiao CH, 2011 ⁽²³⁾	1/2	2/2	2/2	NA	NA	2
18	Shu MT, 2011 ⁽²⁹⁾	1/1	NA	1/1	NA	NA	0
19	Tang IP, 2010 ⁽²⁸⁾	NA	1/1	4/4	NA	NA	4
20	Abes GT, 2011 ⁽¹⁰⁾	1/7	1/3	7/9	7/8	10/12	11
21	Limviriyakul S	D/C = 0/1 Tissue = 1/5	D/C = 1/1 Tissue = 3/5	3/5	3/3	0	4

in Thailand⁽²⁴⁾. The tuberculin skin test demonstrates active TB infection in patients with a previous negative result and living in low-burden areas^(10,25). In endemic areas, many patients have had BCG vaccine that can alter the result of the test (Table 3).

CT scan is helpful for diagnosis of TB middle ear⁽⁸⁾. The findings are the soft tissue in the middle ear cavity, intact mastoid air cells without sclerotic change and soft tissue thickening of EAC with intact scutum⁽²⁶⁾. The present series found positive tissue AFB stain, tissue culture, and histology in one, four, and three out of seven patients, respectively. However, positive PCR was found in all patients who can afford to take the test. This might be concluded that the PCR for tuberculosis is useful for diagnosis in patients suspected for tuberculosis of the middle ear.

Treatment of tuberculosis is mainly medical. The first-line drugs are isoniazid, rifampicin, pyrazinamide, and ethambutol. The WHO standard recommendation is isoniazid, rifampicin, pyrazinamide,

and ethambutol for two months, then isoniazid and rifampicin for another four months⁽¹⁾. This is the same regimen in both pulmonary and extra-pulmonary tuberculosis, except for tuberculosis of central nervous system. Surgical intervention is indicated for obtaining tissues for diagnosis, removing bony sequestrum, and treating the complications such as subperiosteal abscess. However, this is still controversial for treatment of facial nerve palsy^(9,17,27).

Conclusion

Tuberculosis of middle ear is an uncommon disease. The clinical manifestations are variable and not specific; therefore, this is difficult for diagnosis and can delay treatment. High index of suspicion is required in cases with chronic otitis media with treatment failure, especially in endemic areas such as Asian countries. Antituberculous drugs are the main treatment and surgical interventions are performed in selected cases.

Declaration of interest: The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper

Potential conflicts of interest

None.

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วัณโรคหูชั้นกลางและมาสตอยด์

ศิริพร ลิ้มปวีริยะกุล, สาครินทร์ บุญบรรเจิดสุข, ศรัณู ประกายรุ่งทอง, วรุตม์ พงศาพิชญ์

วัตถุประสงค์: เพื่อศึกษาทบทวนเกี่ยวกับวัณโรคของหูชั้นกลางในแง่ อาการ อาการแสดง การสืบค้น การวินิจฉัย และการรักษา
วัสดุและวิธีการ: เป็นการทบทวนย้อนหลังของผู้ป่วย 6 ราย ที่ได้รับการวินิจฉัยว่าเป็นวัณโรคหูชั้นกลาง ที่โรงพยาบาลศิริราช จากการรวบรวมประวัติ การตรวจร่างกาย การสืบค้น รวมถึงการรักษา จากบันทึกการรักษาในผู้ป่วยแต่ละราย

ผลการศึกษา: ผู้นิพนธ์ได้ทำการรวบรวมข้อมูลของผู้ป่วยในแต่ละรายที่ได้รับการวินิจฉัยว่าเป็นวัณโรคหูชั้นกลาง พบว่าอาการและอาการแสดงที่พบมากที่สุด คือ น้ำไหลออกจากหูเรื้อรัง การสืบค้นเพื่อหาสาเหตุแตกต่างกันไปในผู้ป่วยแต่ละราย เช่น การส่งชิ้นเนื้อทางพยาธิวิทยา การส่งเพาะเชื้อวัณโรคทั้ง จากเนื้อเยื่อหรือน้ำหนอง และการส่ง PCR for *Mycobacterium complex*
การรักษาหลักที่สำคัญ คือ การให้ยาต้านวัณโรค ส่วนการผ่าตัดนั้นพิจารณาเป็นราย ๆ ไป

สรุป: วัณโรคหูชั้นกลางเป็นโรคที่พบได้ไม่บ่อย การวินิจฉัยเป็นไปได้ยาก เนื่องจากอาการและอาการแสดงซึ่งมีความแตกต่างกันในผู้ป่วยแต่ละราย การวินิจฉัยและการรักษาพิจารณาจากการตรวจพบเชื้อวัณโรคเป็นสำคัญ
