Middle Ear Tuberculosis: Diagnostic Criteria

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SUMMARY

Introduction Tuberculous otitis is a diagnostic problem due to the difficulty to obtain microbiological, histomorphological and cytological confirmation of the disease.

Objective Our objective was to compare clinical and radiological characteristic and development of otogenic complications in patients with tuberculous otitis and otitis with cholesteatoma as the most destructive form of chronic nonspecific otitis in the purpose of establishing the diagnostic criteria for tuberculous otitis.

Methods Medical records of 12 patients with tuberculous otitis and 163 patients with cholesteatoma treated at the Institute of Otorhinolaryngology and Maxillofacial Surgery in Belgrade during the eight-year period were analyzed. All of the patients underwent otomicroscopic, audiological and radiological examination of the thorax and temporal bone, microbiological examination of the secretion and histomorphological examination of the tissue taken during middle ear surgery. Statistical analysis was done using χ^2 test with Yates correction.

Results Otogenic complication as facial palsy and sensorineural hearing loss were more frequent in tuberculous otitis patients, than in cholesteatoma. Also, fistulas of the labyrinth and facial canal bone destruction were also more frequent in tuberculous otitis than in cholesteatoma. A larger extent of temporal bone destruction was noticed on CT scans of the temporal bone in half of the patents with tuberculous otitis. Coexistence with miliary pulmonary tuberculosis was detected in one third of the patients. There were no microbiological or histomorphological confirmations of the disease, except in one case with positive Ziehl-Neelsen staining.

Conclusion Tuberculous otitis media should be considered in patients with serious otogenic complications and with shorter duration of ear discharge, and in association with diagnosed miliary pulmonary tuberculosis and extensive temporal bone destruction. Polymerase chain reaction still is not reliable for diagnosis.

Keywords: tuberculous otitis media; cholesteatoma; chronic otitis; diagnosis

INTRODUCTION

Tuberculous otitis media (TOM) is a rare form of chronic otitis media and extrapulmonary tuberculosis (TBC). Incidence of all forms of tuberculosis is 0.04-1% or 4% of head and neck tuberculosis [1]. In 1960 tuberculosis bacilli were isolated from the ear, much later than it was first isolated by Koch in 1882 [2].

TOM is the result of haematogenous spread of the infection in patients with other forms of TBC. Rarely, it is the result of infection imported through perforated tympanic membrane. In children, aspiration of infected milk through the Eustachian tube during drinking or nursing was a very common way of infection in the first half of the 20th century [3]. At that period half of the children younger than one year and 27% younger than two years had TOM [4]. This disease became considerably rare in children by making BSG vaccination obligatory and with pasteurization of milk. Today, TOM is uncommon and is rarely thought of. The classic description of TOM indicates multiple perforations of tympanic membrane, painful suppurative otorrhoea, and preauricular adenopathy, frequent complications like paralysis of the facial nerve, sensorineural hearing loss (SNHL) and association with pulmonary TBC. A recent description of the disease includes large tympanic perforation, conductive hearing loss that suddenly becomes sensorineural, with pale granulation tissue and dense secretion similar to infected cholesteatoma. Cervical lymphadenopathy and facial palsy are rare [5].

Making the diagnosis is difficult: the process lasts from 14 to 70 days, because the culture of the tissue or secretion is usually negative [1]. According to data, positive acidoalcohol fast bacilli (AFB) smears are uncommon (2-14%), while histopathological examination rarely indicates TBC granuloma, but more frequently necrotizing granuloma [6, 7, 8]. Polymerase chain reaction (PCR) testing represents the only hope, although there are opinions that this method is not reliable. The CT of the temporal bone does not necessarily indicate bone destruction.

OBJECTIVE

The objective of the paper is to compare the clinical features of the disease, the CT imaging of the temporal bone and the appearance of suppurative complications in patients with presumptive TOM and patients with cholesteatoma, most destructive form of chronical otitis, and based on this to determine diagnostic criteria for TOM.

METHODS

We analyzed medical documentation of 12 patients with TOM and 163 patients with cholesteatoma treated at the Institute of Otorhinolaryngology and Maxillofacial Surgery, Clinical Centre of Serbia in Belgrade from 1995 to 2003. Otomicroscopy, microbiological examination

of secretion, audiological examination and chest roentgenogram were done in all our patients and the CT imaging of the temporal bone in patients with complications. In all patients with TOM and cholesteatoma, the histopathological examination of the granulation tissue and secretion acquired during surgery was done with classical haematoxilin-eosin (HE) staining, and in patients with presumptive TOM, with Ziehl-Neelsen staining. In one patient with cervical lymphadenopathy, the biopsy of cervical lymph nodes was done. In patients with presumptive TOM, purified protein derivative (PPD) testing was done. The clinical features of the disease with a sudden onset, association of otological signs of the disease with pulmonary TBC or TBC lymphadenitis and a quick development of otogenic complications were the indication of possible TBC otitis media.

Patients with presumptive TOM were divided into two groups according to the duration of the symptoms: in the first group the disease lasted less than 4 months, and in the second group it lasted over 4 months. In the first group of 9 patients, 8 of them had otorrhoea, and one cervical lymphadenopathy and neck pain, with a rapid progression of peripheral facial palsy. In 2 patients from this group peripheral facial palsy appeared during conservative treatment and 3 patients suddenly developed severe SNHL. The chest x-ray of 4 patients in this group showed miliary pulmonary tuberculosis, and there were anamnestical data indicating subfebrility, general weakness and weight loss.

In the second group of 3 patients, the disease had an abrupt onset, with otogenic complications: 2 patients had facial palsy and one SNHL. None of these patients had history of otorrhoea.

Otomicroscopy confirmed total tympanic membrane perforation in all our patients with presumptive TOM, except one with cervical lymphadenopathy. Eleven patients with TOM underwent surgical treatment, with postoperative antituberculous therapy, and the patient with lymphadenitis was treated with medicamentose therapy only. Average follow-up period was 12.8 months.

Statistical analysis was conducted to determine the significant difference of the frequency rate of SNHL, facial palsy and the appearance of labyrinth fistula compared between the patients with TOM and cholesteatoma, applying χ^2 test for small independent samples with Yates correction.

RESULTS

In patients with TOM, the disease was of shorter duration, and in 4 patients it started with complications (33.3%). In one patient it was associated with tuberculous lymphadenitis (8.3%) and in 4 patients with miliary pulmonary tuberculosis (33.3%). Three patients with miliary pulmonary tuberculosis had otogenic complications, two of them facial palsy and one SNHL. Only one patient did not have any complications.

In half of our patients with TOM intraoperative findings showed bone destruction of the labyrinth and Fallopian canal. The incidence of bone destruction of the labyrinth in patients with cholesteatoma was considerably lower and it is around 13% (Table 1).

Severe SNHL was determined in 33.3% of the patients with TOM, facial palsy in 41.6%, and the destruction of the Fallopian canal in 33.3%. Destructive bone lesions were determined in 6 patients with TOM (50%).

In the group of patients with cholesteatoma, SNHL was confirmed in 1.2% of the patients, facial palsy in 1.8%, fistulas of the labyrinth in 6.9% and the destruction of the Fallopian canal in 6.1%. Statistical analysis showed that the incidence of complications in patients with cholesteatoma was significantly lower than in patients with TOM (Table 2).

Facial palsy, SNHL and destructive bone lesions were significantly more frequent in patients with TOM, than in patients with cholesteatoma (χ^2=4.364; p<0.05; χ^2=4.886; p<0.05; χ^2=7.234; p<0.05; χ^2=15.476; p<0.01).

The CT imaging of the temporal bone (Figure 1) mostly showed severe destructive changes of the labyrinth in the patients with TOM, in a group with tympanic perforation and facial palsy, lymphadenopathy and miliary pulmonary TBC (33,3%) (χ^2=15.242; p=0.01).

Intraoperatively, we discovered the presence of granulation tissue in 6 out of 9 patients with tympanic membrane perforation. In 3 patients, instead of altered mucosa, destructive bone lesions with bone necrosis predominated.

Pathohistological examination of the mucosa in most of the cases indicated unspecific granulation tissue with lymphoplasmocytic infiltration, the presence of macrophages and bone tissue necrosis. The biopsy of the lymph node in 1 patient with lymphadenopathy and CT imaging with the destruction of the temporal bone confirmed TBC granuloma. Only in this case histological findings indicated TBC process (Figure 2). Ziehl-Neelsen staining was positive in only one patient with presumptive TOM, which was the case of cervical lymphadenopathy.

Table 1. Clinical characteristics of tuberculous otitis media

Parameter	Groups		Total
	Fast onset	Slow onset	
Number of patients	3	9	12
Lymphadenitis	0	1 (11.1%)	1 (8.3%)
Sensorineural hearing loss	1 (33.3%)	3 (33.3%)	4 (33.3%)
Facial palsy	2 (66.7%)	3 (33.3%)	5 (41.6%)
Cholesteatoma	0	2 (22.2%)	2 (16.7%)
Labyrinth fistula	0	2 (22.2%)	2 (16.7%)
Fallopian canal destruction	0	4 (44.4%)	4 (33.3%)
Granulations	0	6 (66.7%)	6 (50.0%)
Oedema	3 (100.0%)	3 (33.3%)	6 (50.0%)

Table 2. Incidence of complications in tuberculous and chronic cholesteatoma otitis

Parameter	Groups		Statistical significance
	Tuberculous otitis	Cholesteatoma	
Number of patients	12	163	
Facial palsy	5 (41.6%)	3 (1.8%)	χ^2=4.364; p<0.05
Sensorineural hearing loss	4 (33.3%)	2 (1.2%)	χ^2=4.886; p<0.05
Labyrinth fistula	2 (16.7%)	11 (6.9%)	χ^2=7.234; p<0.05
Fallopian canal destruction	4 (33.3%)	10 (6.1%)	χ^2=15.476; p<0.01

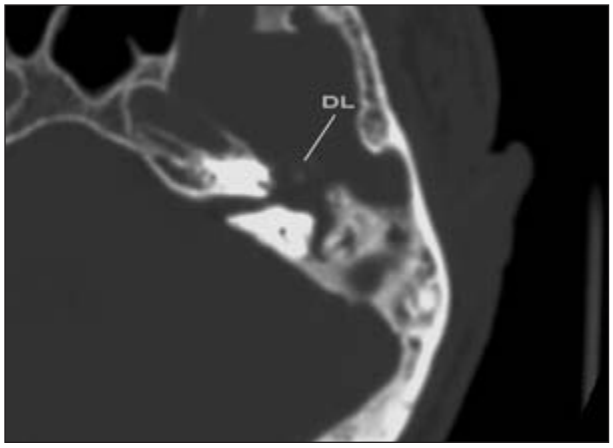

Figure 1. CT of temporal bone in a patient with tuberculous otitis
DL – destructed labyrinth

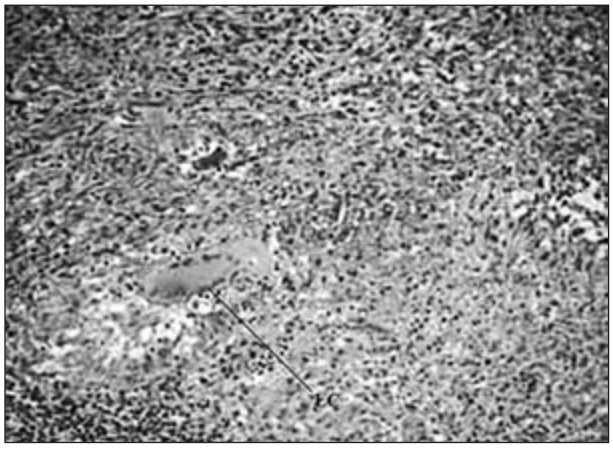

Figure 2. Cervical lymph node with typical TBC granuloma
LC – Langhans giant cells

DISCUSSION

In spite of therapy progress and the prevention of tuberculosis, today it is still the most common infection worldwide. It is estimated that currently there are about eight million people in the world with active tuberculosis [9]. Luckily, tuberculosis of the middle ear and of the temporal bone are rare localizations with the incidence of 0.9 to 0.04% of all suffering from TBC, or 0.04% of all suffering from chronical otitis, or 4% of the patients with TBC of the head and neck [1, 8, 10]. Tuberculous otitis media remains a diagnostic challenge for many clinicians, because of its unspecific clinical features and inability to confirm the infection by microbiological and histopathological examinations.

Today, clinical features are altered and contemporary diagnostic criteria are defined by literature data. The existence and course of chronic otitis are more important clinical characteristics of TOM than positive culture of mycobacterium [11]. The clinical features of the disease are either a total defect of the tympanic membrane or a completely intact tympanic membrane. If the membrane is intact, it is pale, tense and immobile, with a strong vascular pattern. Multiple perforations are very rare and atypical. Ear suppuration does not react to antibiotic therapy applied either locally or parenterally. The mucosa of the mastoid cavity is changed, with granulation tissue which is pale and similar to oedematous mucosa. Temporal bone destruction can exist in a sense of sequestration or fistulas, especially cochlear, and, in radiography imaging, it is not different from other nonspecific osteomyelitic processes. Lymphadenopathy of the neck is possible and the association with other forms of pulmonary or extrapulmonary TBC. Cases with a sudden onset of the disease, pain and hearing loss, preauricular swelling and granulation tissue in the external auditory canal prominating through tympanic perforation have been also described. CT imaging in these cases show the clouding of the mastoid without necrosis of the bone, while histological analysis shows granuloma with necrosis [8]. Associated infections are common, up to 58% [8, 12, 13]. Unbalance between clinical findings and functional disorders which can be drastic, like facial palsy (16% in adults, 35% in children) or a sudden or progressive SNHL is especially important [14].

Microbiological confirmation is often difficult or impossible to obtain, even with PSR method [11]. With Ziehl-Neelsen staining of the smears and tissue, we rarely find red-coloured bacilli, and PCR testing is not accurate enough [6, 7, 14]. One out of our 12 patients had a positive result of Ziehl-Neelsen staining of granulation tissue obtained from the middle ear.

Histopathological features of TOM are not a typically formed granuloma, only Langerhans giant cells can be disclosed, which can suggest other diseases like syphilis, other granulomatous inflammations, mycoses etc. Only one group of authors have proved the existence of TBC granuloma in mucosa of the temporal bone [15]. A very common finding is necrotic tissue in frozen sections of the tissue. Haematoxilin-eosin staining indicates lymphoplasmocytic infiltration with groups of histiocytes which is not common for TBC. None of our patients had a typical TBC granuloma in the temporal bone tissue. Histopathological findings indicated necrotic osteomyelitis in patients with associated miliary TBC, and in other patients nonspecific lymphoplasmocytic infiltration with presence of macrophages. Zielh-Neelsen staining of the granuloma could not reveal mycobacteria [16, 17].

PPD testing is not a reliable diagnostic procedure, especially in countries with a high prevalence of TBC, like Serbia. PPD test is positive in 74 to 98% in patients with TBC lymphadenitis, and in patients with miliary TBC in up to 68%. In our study the test was positive in 50% of the patients.

In cases of TOM it is almost impossible to apply the diagnostic principles for extrapulmonary TBC. In these patients it is hard to prove the existence of TBC infection with microbiological, histological or cytological analysis of tissue and fluids. Often, the limiting factor is a small amount of tissue or fluid [18].

Methods for rapid identification of bacilli and unconventional methods (immunological and enzyme tests, PCR) are valuable in following the course and the results of treatment Immunodiagnostic methods are suitable for testing body fluids like liquor. Enzyme testing can determine a high level of adenosine deaminase and interferon gamma in tuberculous pleural effusion and abdominal extrapulmonary tuberculosis. PCR testing is considered to be most

reliable, but it cannot confirm TBC infection if singly used [11, 19]. In our study these methods were not applied.

The CT imaging of the temporal bone is not specific for TBC. There is a wide range of possibilities, from a mild clouding of the mastoid cavity to the sequestration of the bone, which depends on the duration of the process. Chest roentgenogram is more indicative of diagnosis, and it is positive in less than 50%, and according to some authors up to 94% of the cases [8]. In our group of patients every third patient had miliary pulmonary TBC. CT showed a large destruction of the bone in one third of the patients with presumptive TOM (33.3%), who had also miliary pulmonary TBC. In one case there was the destruction of the labyrinth. On the other hand, in only 5 out of 163 patients with cholesteatoma (0.03%), CT indicated the destruction of the labyrinth. In other patients with presumptive TOM, CT showed clouding of the mastoid cavity with a mild or extensive destruction of the bone trabecules in the mastoid, but without any specific findings indicative of cholesteatoma.

In 25% of our patients, the disease started with otogenic complications, like facial palsy or hearing loss, but without any otorrhoea. After a short duration of the disease complications appeared in 41.6% of the patients, i.e. we had complications in 74.9% of the patients with TOM. Compared to the incidence of complications in patients with cholesteatoma (0.3%), incidence in patients with TOM was significantly higher.

CONCLUSION

The basic principle in the diagnostics of TOM is suspected tuberculosis process in patients with active pulmonary tuberculosis, a positive illness history, patients living in endemic environment or those exposed to TBC or in contact with other persons suffering from TBC. The next step is a mandatory CT imaging of the temporal bone in patients with facial palsy and sudden hearing loss, especially without pain or otorrhoea. We should suspect tuberculous process if otorrhoea is of shorter duration (a few months) and if there is a rapid development of otogenic complications.

Microbiological and histolopathological verification should be conducted, but negative results do not rule out TBC. PCR testing represents a most reliable, but still controversial diagnostic method for middle ear tuberculosis.

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Туберкулоза средњег ува: дијагностички критеријуми

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КРАТАК САДРЖАЈ

Увод Хронични туберкулозни отитис представља дијагностички проблем због отежане и поуздане микробиолошке, хистопатолошке и молекуларнобиолошке потврде обољења.

Циљ рада Циљ рада је био да се упореде клиничке и радиолошке одлике, клинички ток и појава компликација код туберкулозног отитиса и хроничног отитиса с холестеатомом, као најдеструктивнијег облика неспецифичног хроничног отитиса, те на основу тога успоставе дијагностички критеријуми за препознавање туберкулозног отитиса.

Методе рада Анализирана је медицинска документација 12 болесника с туберкулозним отитисом и 163 одрасла болесника с холестеатомом која су лечена у Институту за оториноларингологију и максилофацијалну хирургију Клиничког центра Србије у Београду током осмогодишњег периода. Сви болесници подвргнути су аудиолошком испитивању, а потом су урађени радиографија плућа, компјутеризована томографија (*CT*) темпоралне кости, микробиолошка анализа секрета из ува и хистопатолошка анализа секрета и запаљењског ткива узетог током операције. Подаци су обрађени применом χ^2-теста за мале независне узорке уз Јејтсову (*Yates*) корекцију.

Резултати Отогене компликације, периферна парализа фацијалног нерва, тешка акутна сензоринеурална наглувост, фистула лабиринта и оштећење Фалопијевог канала били су значајно чешћи код болесника с туберкулозним отитисом него с холестеатомом. Већи обим оштећења унутрашњег ува забележен је на *CT* налазу темпоралне кости код половине болесника с туберкулозом ува. Удруженост туберкулозног отитиса и милијарне туберкулозе плућа дијагностикована је код трећине болесника. Микробиолошка и хистопатолошка потврда обољења није добијена, осим у једном случају позитивног бојења по Цил-Нелсену (*Ziehl-Neelsen*).

Закључак Основни дијагностички критеријуми код туберкулозе средњег ува су: висок степен сумње на обољење код болесника с отогеним интратемпоралним компликацијама и краткотрајном секрецијом или изостанком секреције из ува, удруженост с туберкулозом плућа и већи степен оштећења унутрашњег ува на *CT* налазу темпоралне кости. *PPD* проба је неспецифична, а микробиолошка и хистопатолошка потврда болести и даље проблематична. *PCR* тест је поузданија метода, мада није довољна за постављање дијагнозе.

Кључне речи: туберкулоза средњег ува; холестеатом; хронични отитис; дијагноза

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