Otology Seminar --
Nontuberculous Mycobacterial Otitis Media and Mastoiditis

R3 曾一倫
97-09-09
Mycobacterium

- A genus of Actinobacteria
- Aerobic and nonmotile bacteria
- Acid-fast Gram-positive bacterium
- Cell wall: hydrophobic, waxy, and rich in mycolic acids → thick and hard
Mycobacterium

- *Mycobacterium tuberculosis* complex
  1) *M. tuberculosis*
  2) *M. bovis*
  3) *M. africanum*
  4) *M. microti*
  5) *M. canetti*
    - cause tuberculosis
- *M. leprae*
  - cause Hansen’s disease or leprosy
Mycobacterium

• Nontuberculous mycobacteria (NTM)
  ➢ all the other mycobacteria
  1) Pulmonary disease resembling tuberculosis
  2) Lymphadenitis
  3) Skin disease
  4) Disseminated disease (immunocompromised patient)
  5) Middle ear and mastoid infection → rare
     (the earliest report: 1976)
M. tuberculosis v.s. NTM

- **M. tuberculosis**
  - Person-to-person
  - High virulence
  - PPD +
  - Susceptible to drugs

- **NTM**
  - From environment
  - Lower virulence (most)
  - PPD –
  - Not the usual TB drug
Nontuberculous Mycobacteria (NTM)

- Atypical mycobacteria
- Anonymous mycobacteria
- Environmental mycobacteria
- Mycobacteria other than tuberculosis (MOTT)
Nontuberculous Mycobacteria (NTM)

- Isolated from soil, water, food, dust, and animals
- Now > 50 species → more than half can be pathogenic in human
- Human-to-human transmission → X
- Incidence: 1.0~1.8/100,000 persons
Ernest Runyon (1959) classification

<table>
<thead>
<tr>
<th>Group</th>
<th>Pigment production</th>
<th>Growth rate (days)</th>
<th>Species</th>
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<tbody>
<tr>
<td>I Photochromogens</td>
<td>Produce bright yellow pigment only in the presence of light</td>
<td>10–21</td>
<td><em>M. marinum</em></td>
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<td><em>M. kansasii</em></td>
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<td><em>M. simiae</em></td>
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<td><em>M. scrofulaceum complex:</em></td>
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<td><em>M. szulgai</em></td>
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<td><em>M. gordonae</em></td>
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<td>II Scotochromogens</td>
<td>Produce yellow-to-orange pigment independent of light</td>
<td>10–21</td>
<td><em>M. avium complex:</em></td>
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<td><em>M. avium</em></td>
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<td><em>M. intracellulare</em></td>
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<td><em>M. gastri</em></td>
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<td><em>M. terrae complex:</em></td>
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<td><em>M. terrae</em></td>
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<td><em>M. novum</em></td>
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<td><em>M. nonchromogenicum</em></td>
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<td><em>M. trivale</em></td>
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<td><em>M. xenopi</em></td>
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<td>III Nonchromogens</td>
<td>Usually do not produce pigment</td>
<td>10–21</td>
<td><em>M. fortuitum complex:</em></td>
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<td><em>M. fortuitum</em></td>
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<td><em>M. chelonii</em></td>
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<td><em>M. chelonii subsp. abscessus</em></td>
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<td><em>M. dienhoferi</em></td>
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<td><em>M. flavescens</em></td>
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<td><em>M. phlei</em></td>
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<td><em>M. smegmatis</em></td>
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<td>IV Rapid growers</td>
<td>Vary in pigment production</td>
<td>3–7</td>
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NTM Causing Middle Ear Infection

- Has been reported in 64 cases
  → 30 well-described cases in the English literature
- Peak age: childhood
  (93%: 5 m/o ~ 14 y/o)
- Adult: only 2 cases reported
  (42 y/o female and 63 y/o male)
- Male : Female → 2 : 1
- Most cases (93%): unilateral disease
Route of Entry

- Most possible: Direct inoculation
  - External ear
  - Eustachian tube
  - Direct contamination from infected instruments
    (Lowry et al.: 17 cases arose from contamination of otologic instruments)
  - Hematogenous routes
History, Symptoms, and Signs

- Intermittent otorrhea (100%)
- Previous ventilation tube insertion history (93%)
- Recurrent episodes of otitis media unresponsive to common antibiotic treatment and to tympanostomy tube (> 80%)
- Retroauricular bulging (20%)
- Pain (10%)
- Cervical lymphadenitis (7%)
ENT Local Findings

• Granulation tissue in the external auditory canal
• Aural polyps
• Thickened or perforated tympanic membrane
• Retroauricular fluctuance
• Fistula formation
Image Findings

- Mastoid films:
  - opacification of mastoid air cells
- CT scans of temporal bone:
  - extended opacification of the mastoid and of the middle ear

Audiogram

- Conductive hearing loss
Differential Diagnosis

• Tuberculosis infection
• Histiocytoses
• Wegner’s disease
• Syphilis
• Sarcoidosis
• Foreign body reaction
• Neoplastic growth
Diagnosis

• Mycobacterial tissue culture ➔ 2~6 weeks
• Tissue biopsy:
  - Granulomatous inflammation with necrosis
    (With or without caseous necrosis)
    (With or without acid-fast bacilli stain)
  - Indistinguishable from tuberculosis
• NTM-specific skin test
• Species-specific mycobacterial DNA probes and PCR
Epitheloid cell granuloma (G) Lymphocytes (L) Multinucleated giant cell (*)
Epithelioid and spindle histiocytes infiltrating bone trabeculae with numerous Ziehl-Nielsen-positive and PAS-positive atypical mycobacteria.

(A) Hematoxylin and eosin; (B) Ziehl-Nielsen; (C) PAS
Acid-fast stain (Ziehl-Nielsen stain)

A. Non Acid-fast bacteria
B. Acid-fast bacteria
Treatment

• Long-standing multidrug treatment based on cultural results

  +

• Surgical debulking or debridement
Medical Treatment

• Agents most often to be useful in the past:
  ➢ Cefoxitin, amikacin, doxycycline, erythromycin, sulfonamides, ciprofloxacin
  ➢ Antituberculous drugs: rifampin, isoniazid, pyrazinamide

• More recently:
  ➢ Azithromycin, clarithromycin, imipenem, quinolones

• Single Drug → resistance and clinical failure
Medical Treatment

- Antibiotic therapy should be continued for up to 6~9 months
  or
- At least 2~3 months after the symptoms have disappeared
Treatment -- Surgery

• 27/30 patients
• Mastoidectomy, exploratory tympanoplasty, …
• Ossicle chain: often intact
  ➢ 14 patients: need one secondary surgical interventions
  ➢ 7 patients: need at least three operation
Intraoperative view of the right ear

Granulation tissue completely involving the mastoid cavity and external meatus as observed during mastoidectomy (the tegmen is indicated by *). The bone of the posterior aspect of the external meatus is eroded (arrow)
Complications

- 63% of patients: had one or more postoperative complications
  - Wound dehiscence (10 patients)
  - Persisting otorrhea and granulations (7 patients)
  - Subperiosteal abscess (1 patient)
  - Dural localization (1 patient)
  - Recurrent cerebral abscess (1 patient)
Retarded Wound Healing
Conclusion

• NTM otitis media and mastoiditis → challenging head and neck infection
• Chronic painless, odorless otorrhea + external auditory canal granulation tissue + previous ventilation tube insertion → tissue culture and biopsy
• Treatment: a combination of surgical debridement and an adequate, protracted course of antibiotic treatment
References


