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內文：

Abstract

To present the essential elements of an infection control/ exposure control plan for the oral healthcare settings with emphasis on tuberculosis

Introduction

- **In 2005, the Centers for Disease Control and prevention (CDC) published new guidelines for prevention the transmission of Mycobacterium tuberculosis (MBT)**
  - **→Apply to healthcare workers (HCWs)**
- **The magnitude of the risk varies by :**
  occupational group, prevalence, population

Etiology and Epidemiology

- **Robert Koch first described MBT**
  - **→carried in airborne particles (droplet nuclei) generated when patients cough, sneeze,shout, sing, talk**

Figure 1. MBT is carried in airborne particles called droplet nuclei that are generated when persons with infectious TB disease coughs, sneezes, shouts, sings, or talks.

- **Droplets nuclei are between 1-5 microns in diameters**
  - **→can remain in air for ours and can be carried by air throughout a room or building**

- **The probability of a person becoming infected depends on the concentration of droplets nuclei in the air and the duration of exposure**
- **Environmental factors**
  - **→confined space, inadequate ventilation, recirculation of air**

Population	Examples
Foreign-born persons from countries with a high incidence of TB disease who arrived in the U.S. within the past five years	Africa, Asia, Eastern Europe, Latin America, and Russia
Persons who frequently travel to countries with a high incidence of TB disease	
Residents and employees of settings that are high risk	Correctional facilities, long-term care facilities, and homeless shelters
Populations at high risk who are defined locally as having an increased incidence of TB disease	• Foreign-born persons • Hispanics • Blacks • Asians • Patients untreated for latent TB infection • HIV-infected patients • Patients receiving immunosuppressive therapy
Populations at high risk who are defined locally as medically underserved and who have low income	
Infants, children, and adolescents exposed to adults in high-risk categories	
HCWs who serve patients who are at high risk	
HCWs with unprotected exposure to a patient with TB disease	

˙When hosts inhale droplets nuclei
→the bacilli travel through upper respiratory tract, bronchi, to alveoli where a local infection is established
˙The immune response is predominantly cell-mediated (CD4+ and CD8+ T-cell)
˙Pulmonary macrophages present antigens to
→major-histocompatibility-complex (MHC) class II molecules (active CD4+ T-cells) and MHC class I molecules (active CD8+ T-cells)
˙within 2-10 weeks
→the immune response will limit further multiplicaiton of MBT
→if the quantity and virulence of TB bacilli is high, then the bacilli may disseminate throughout by lymphatic and hematogenous spread
˙TB causes approximately two million death annually
˙In 2005, 14097 cases were reported to CDC represented 2.9% decease than 2004
˙In 2005, TB case rate of 4.8 per 100000 represented 3.8% decline compared with 2004
˙The rate of TB in foreign-borne persons was 7.8 times that of those born in U.S.
˙Hispanics, Blacks, Asians had TB rates 7.3, 8.3, 19.6 times higher than whites
˙The multidrug-resistant (MDR) cases of TB increased by 13.3% in 2005 compared to 2003

Clinical menifestations

Latent TB infection (LTBI)

˙The immune response to MBT culminates in the formation of tuberculous granulomas
˙Those bacilli incarcerated in granulomas can remain viable for many years
˙Immunological test for MBT are positive, but these patients have no symptom,

no radiographic abnormalities, and all bacteriologic studies are negative

- Patients with LTBI are not contagious

Tuberculosis (TB disease)

- Approximately 5-10% of the people become infected with MBT and not treated for LTBI will develop TB disease
- The lung is the most common site for TB disease

Table 2. Diseases and conditions that increase the risk of progression from LTBI to TB Disease.[1,15,16]

• HIV infection • History of infection with MBT within the past two years • History of untreated or inadequately treated TB disease • Infants and children aged <4 years • Diabetes mellitus	• Chronic renal failure • Immunosuppressive therapy • Silicosis • Malignancies (carcinoma of the head, neck, lung; leukemia; lymphoma) • Intestinal bypass or gastrectomy • Body weight ≥10% below ideal weight

- Classic symptoms include chronic ill health, coughing with hemoptysis, low-grade fever, weight loss, and night sweats.
- About 15% of patients with TB disease present with an extrapulmonary site of infection
- Expectoration of the infected sputum may cause tuberculous tracheitis,laryngitis, and tuberculous ulcers on the tonsils and nasal cavity
- When the cervical lymph nodes are involved,they may caseate forming tuberculous abscesses or fibrosis and calcification

Oral manifestations of TB

- The estimated prevalence of oral tuberculous lesions ranges from 0.05 to 5%
- Oral lesions are usually secondary, reflecting with infected sputum and hematogenous spread
- Patients with TB disease and HIV-infection, the palate and dorsum of the tongue were the most frequent sites of oral involvement
- Pain and cervical lymphadenopathy are common findings

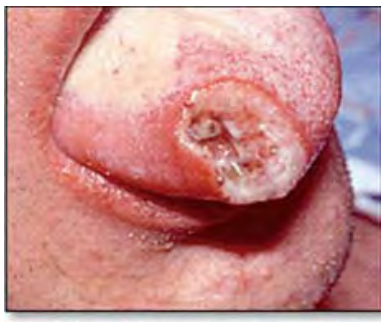
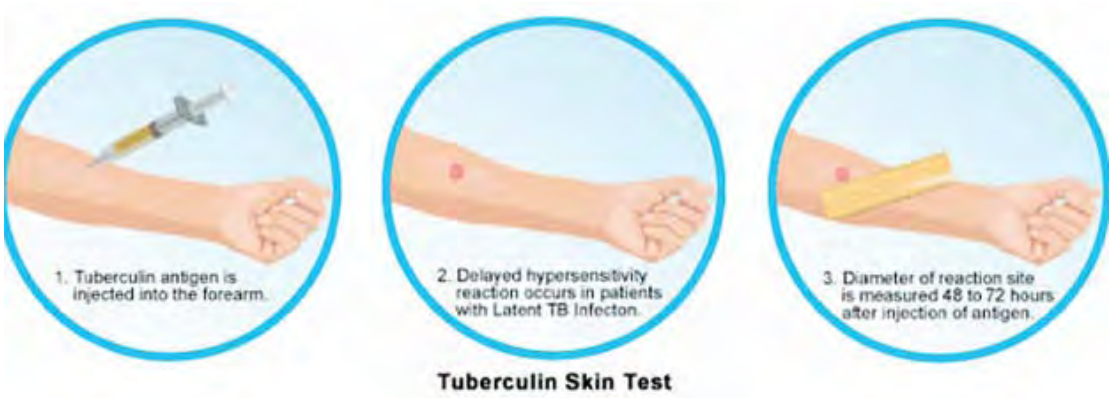


Figure 2. Oral tuberculous lesion of the dorsum of the tongue in a patient with both TB disease and HIV infection.

Diagnosis

Latent TB Infection

- The tuberculin skin test (TST)
  →The antigen is injected intracutaneously into the forearm
- TST evokes the delayed hypersensitivity reaction mediated by T-cells
- The test is read at 48-72 hours, and the diameter of the induration of erythema is measured



Tuberculin Skin Test

Induration of ≥5 mm	Induration of ≥10 mm	Induration of ≥15 mm
People with HIV infection	Foreign-born persons	People with no risk factors for TB
Close contacts of people with TB	HIV-negative persons who use illicit drugs People with no risk factors for TB	
People who have had TB disease before	People in residential facilities	
Illicit drug users	Children ≤4 years of age	

- **While the relative specificity of the TST is high**
  - **→false positive and false negative**
  - **→false positive : sensitization with MBT**
  - **→false negative : immunocompromised, recent exposure, very young child**

QuantiFERON -TB Gold (QFT-G) test (for LTBI)

- **Detects the release of interferon-gamma in fresh heparinized blood from sensitized persons when it is incubated with mixtures of synthetic peptides representing two proteins present in MBT**

TB disease

- **Definitive diagnosis requires the demonstration of MBT in the patient's tissues or secretions.**
- **Bacteriologic which includes obtaining a specimen of sputum, detection of acid-fast bacilli (AFB) in stained (Ziehl-Neelsen method) smears examined microscopically**
- **DNA probes specific for the genus Mycobacterium now are used routinely to identify**

Principles of Medical Management

Prevention

- **Immunization with viable Mycobacterium bovis BCG is the most widely used preventive measure to control tuberculosis worldwide**
- **BCG activates CD4+ T-cells by being taken up by macrophages**
  - **→interacted with MHC classII molecules**
- **But BCG will block phagosomes to bind MHC classI molecules**
  - **→can't elicit CD8+ T-cells**

Treatment of Infection with MBT

- **The goal of antibacterial chemotherapy is to induce selective toxicity**
- **One target is the bacterial cell wall**

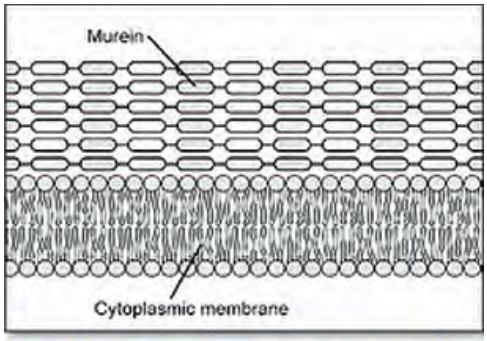


Figure 3A. In Gram-positive bacteria, the cell wall is composed of a thick layer of murein.

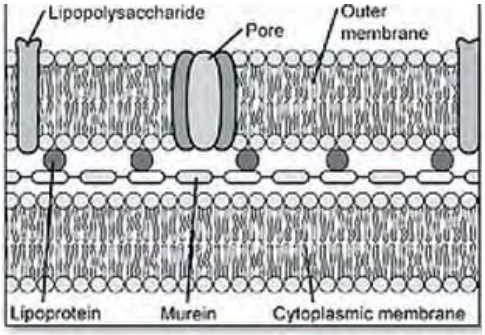


Figure 3B. The murein layer in Gram-negative bacteria is thinner but it is surrounded by a second, outer lipid bilayer membrane.

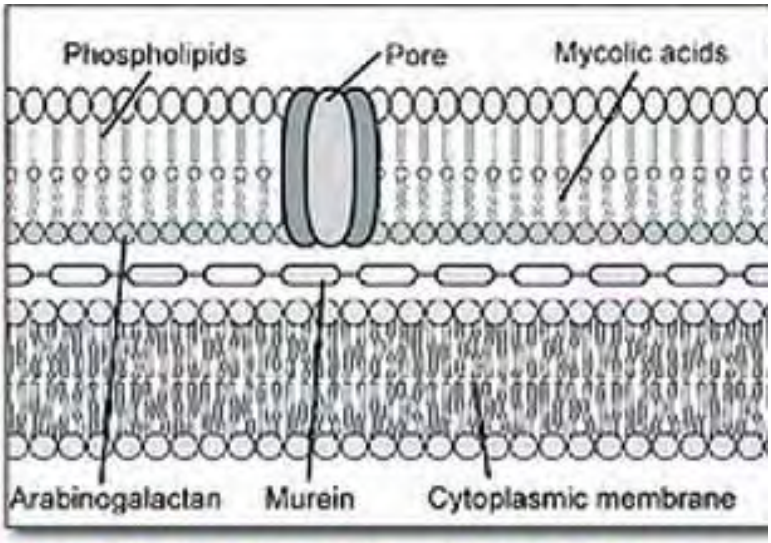


Figure 3C. The cell wall of mycobacteria, which includes the causative agent of tuberculosis, is similar to that of Gram-negative bacteria. The main difference being mycobacteria has a thick outer membrane composed of two leaflets that are asymmetrical in size and composition.

- **Standard antimycobacterial treatment regimens include antibiotics that target unique targets such as the synthesis of NAG-arabinogalactan and the early steps in mycolic acid synthesis**

Table 4. Antimycobacterial agents.[1,5]

First-line Drugs		
Drug	**Mechanism of Action**	**Adverse Drug Effects**
Ethambutol	Inhibits arabinosyl tranferase	Optic neuritis Loss of visual acuity
Pyrazinamide	Inhibits fatty acid synthetase[1]	Morbilliform rash Arthralgias Hyperuricemia
Isoniazid	Inhibits fatty acid synthetase[2]	Hepatitis Peripheral neuropathy Inhibits CYP450 enzymes
Rifamycins: Rifampin Rifabutin Rifapentin	Bind to RNA polymerase and inhibit transcription	Hepatitis Flu-like symptoms Morbilliform rash GI disturbances Induce CYP450 enzymes
Second-line Drugs		
Cycloserine	Inhibits monomer synthesis	Psychosis Seizures Peripheral neuropathy
Ethionamine	Inhibits fatty acid synthetase[2]	Hepatitis Hypothyroidism
Aminoglycosides: Streptomycin Capreomycin Kanamycin Amikacin	Bind to the 30S ribosomal subunit and inhibit translation	Ototoxicity Nephrotoxicity Neuromuscular blockade
Fluoroquinolones: Ciprofloxacin Ofloxacin Gatifloxacin Levofloxacin Moxifloxacin	Inhibit topoisomerase II (DNA gyrase), thereby releasing DNA with staggered double-stranded breaks	Nausea Abdominal pain Restlessness Confusion
Aminosalicylic acid	Competitive para-aminobenzoic acid antagonist	GI disturbances
Combination Drugs		
Rifamate	isoniazid + rifampin	
Rifater	isoniazid + rifampin + pyrazinamide	

Treatment of Latent TB infection

- Progression from LTBI to TB disease is highest during the first 2 years
- HIV infection is the most risk factor
- Isoniazid, given 9 months in a single daily dose, for the treatment of LTBI

- Patient who become TST positive following exposure to patients with intolerance to isoniazid and those patients with intolerance to isoniazid may be treated with rifampin for 4 months
- Two drugs to MDR TB disease, for 9 to 12 months

Treatment of LTBI in Pregnant Patients

- To prevent maternal and congenital TB disease
- MBT infection in utero is result of (1)hematogenous infection through the umbilical vein (2)prenatal aspiration of infected amniotic fluid
- Isoniazid safe used

Treatment of TB Disease

- Treatment of Susceptible TB Disease
- Treatment of Resistant TB Disease
- Treatment of TB Disease in Patient with HIV Infection
- Treatment of TB disease in the Pregnant Patient

TB Infection-Control Strategies in Oral Healthcare Settings

- OHCWs and patients with infectious TB disease will generate droplet nuclei by coughing, sneezing, laughing, and talking
- A TB infection-control plan that is part of its written infection control/exposure control protocol

- Inadequate to prevent the spread of organisms through droplet nuclei 1-5μm in diameter, and additional measures (e.g. transmission-based precautions) are necessary to prevent the spread of MBT
- TB infection-control component should be based on a three-level hierarchy of administrative, environmental, and respiratory-protection controls

Administrative Controls

- The first and most important level
- To reduce the risk of exposure to persons who might have infectious TB disease

TB Risk Assessment for the Oral Healthcare Setting

- Every oral healthcare setting should conduct initial and ongoing (annual) evaluations of TB risk for the setting
- TB risk assessment for the community will determine the types of administrative, environmental, and respiratory-protection controls that are needed for the particular setting
- Consult with the local or state health department

TB Infection-Control Program the Oral Healthcare Setting

- With patients with undiagnosed or unsuspected infectious TB disease
- Specific precautions: prevalence of TB in the community, patient population served, and the type of services provided in a particular setting

TB infection-control protocol

- Prompt identification of patients with suspected or confirmed infectious TB disease
- Separation of patients with suspected and confirmed TB disease from other OHCWs and patients

- Referral for a medical evaluation and/or required oral healthcare procedures to a facility with appropriate environmental controls and respiratory-protection controls

Identification of Patients with Suspected or Confirmed TB Disease

Reviewing medical histories (initial and periodic update), including a review of organ systems

- Their history of exposure to TB, LTBI, and any history of TB disease
- Any medical conditions that increase the risk of TB disease
- Any signs and symptoms of TB disease

- Patients with a history of LTBI and confirmed TB disease should be questioned about the status of their antimycobacterial treatment
- Provisional diagnosis of respiratory TB disease should be considered for any patient with signs and symptoms of infection in the lungs or airways, coughing for >3 weeks, loss appetite, unexplained weight loss, night sweats, bloody sputum or hemoptysis, hoarseness, fever, fatigue, and chest pain

Isolation of Patients with Suspected or Confirmed TB Disease from Other Patients and OHCWs

- Isolated from other patients and OHCWs and instructed to observe strict respiratory hygiene and cough etiquette procedures
- Should wear a surgical mask
- When coughing or sneezing, they should turn their heads away from other persons and cover their mouth and nose with their hands or preferably a disposable facial tissue

Referral of Patients with Suspected or Confirmed TB Disease for a Medical Evaluation and/or Required Urgent Dental Care

- Routine dental care should be postponed until a physician confirms the patient
- Patients with suspected or confirmed TB disease requiring urgent dental care must be promptly referred on an oral healthcare facility that meets the requirements for an airborne infection isolation (All) room
- While performing procedures on such patients, OHCWs should use at least an N95 disposable respiratory

TB Education and Training Program for OHCWs

- The level of training will vary according to the risk classification of the setting

Screening for LTBI and TB Disease in OHCWs

The administration, reading, and interpretation of TST or other tests are to be performed by trained personnel as follows:

- Baseline TB Screening: All OHCWs should receive baseline TB screening at the time of hire, using the two-step TST or a single BAMT such as the QFT-G
- Follow-up TB Screening: After baseline testing, follow-up TB screening should be performed annually. All OHCWs should be symptom screened, and those with baseline-negative results should be retested (TST or BAMT)

Management of Baseline-positive or Newly-positive OHCWs

- OHCWs with positive test results should be evaluated promptly for TB disease.

- To determined whether the infection is occupational or community acquired
- Baseline-positive and newly-positive OHCWs and those with documented treatment for LTBI or TB disease should receive one chest radiograph as part of the evaluation to rule out TB disease
- If the result of the initial radiographic examination is negative, no further radiographs are necessary unless symptoms suggestive of TB disease develop
- OHCWs with positive test results should be reminded about the signs and symptoms of TB disease and the need for prompt evaluation of any pulmonary symptoms

TB Infection-Control Strategies in Oral Healthcare Settings

Administrative Controls

- Preventive Therapy
- Workplace Restrictions for OHCWs
- Environmental Controls
- Respiratory Protection Controls

Preventive Therapy

- Should be offered to all personnel with baseline-positive TST or BAMT results if they are younger that 35 years
- Should further be offered to the all personnel, regardless of age, who conversion of their TST or BAMT results
- Be provided through the local or state health department or by other healthcare providers

Post-exposure Management of OHCWs

- After an exposure to MBT, TST or BAMT testing should be done on personnel known to have had negative results on previous testing
- If the initial post-exposure test is negative, repeat the test 12 weeks after exposure
- Do not perform TST or BAMT testing or chest radiographs on personnel with previous positive test results, unless they have symptoms suggestive of TB disease

Workplace Restrictive for OHCWs

- Personnel with TB disease should be excluded from the workplace until documentation is provided from their healthcare provider that
  - They are receiving adequate therapy
  - Their cough has resolved
  - They have had three consecutive sputum smears collected on different days with negative results for AFB

- Personnel with TB disease who discontinue treatment before cured should be promptly evaluated for their infectious state

- Do not restrict personnel from their usual duties if they are receiving preventing therapy because of positive TST results
- Instruct them to seek prompt evaluation if symptoms suggestive of TB disease develop

Immunocompromised OHCWs

- Referred to their personal health professionals

- Offer accommodations for work settings in which they would have the lowest possible risk for occupational exposure to MBT

Environmental Controls

- Are physical or mechanical measures intended to prevent the spread and reduce the concentration of infectious droplet nuclei 1-5μm in diameter in ambient air
- Patients with suspected or confirmed TB disease requiring urgent dental care must be treated in a room meeting requirements for airborne infection isolation

- All rooms provide negative pressure in the room so air flows under the door gap into the room
- They have an air exchange rate of 6-12 ACH, and a direct exhaust of air from the room to the outside of the building, or provide for a recirculation of air through a high efficiency particulate air filter

Respiratory Protection Controls

- Use of respiratory equipment in situations that pose a high risk for exposure
- Performing urgent dental care on a patient with suspected or confirmed TB disease must wear at least an N95 disposable respirator
- N95 disposable respirators are nonpowered, air-purifying, particulate-filter respirator

- The N (not resistant to oil)-series respirators are available with filtration efficiencies of 95% (N95), 99% (N99), and 99.7% (N100) when challenged with 0.3μm particles

Summary

- The risk of MBT transmission in the oral healthcare setting is low, but the consequences of exposure can be substantial
- TB infection-control surveillance
- Post-exposure management strategies
- TB infection-control protocol for patients with suspected or confirmed TB disease

題號	題目
1	Where is the most common extrapulmonary sites in the head and neck involved by TB? (A) tongue (B) cervical lymph nodes (C) nasal cavity (D) ear
答案(B)	出處：Oral & Maxillofacial Pathology (P.173)
題號	題目
2	Primary oral lesions are usually associated with (A) erythema of skin (B) enlarged regional lymph nodes (C) enlarged of parotid gland (D) pain of ear
答案(B)	出處：Oral & Maxillofacial Pathology (P.194)