Chapter 15
Infection Control in Extrapulmonary TB

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15.1 Introduction: Transmission of Tuberculosis

Tuberculosis (TB) remains one of the major global public health problems. In 2015, an estimated 10.4 million people developed TB, and 1.8 million died from the disease, 400,000 of whom were HIV-positive [1, 2].

Transmission of *M. tuberculosis* occurs from one person to another through the airborne route, when an infected person speaks, coughs or sneezes. These activities produce liquid particles called droplet nuclei, which contain *M. tuberculosis* microorganisms. Another possibility to create these droplets is during the following medical procedures: sputum induction, bronchoscopy, endotracheal intubation, drainage of tuberculous abscesses and autopsy [3, 4].

Droplet nuclei between 1 and 5 μm pose the highest risk of transmitting infection. They remain suspended in the air for longer periods of time and find their way to alveolar space. These droplets need to carry only one viable *M. tuberculosis* microorganism to transmit infection [5].

Transmission of TB is affected by the infectiousness of patient, environmental conditions and timing of exposure. The infectiousness of a TB patient depends directly from the number of droplet nuclei carrying *M. tuberculosis*. There are also some other factors contributing to the infectiousness of TB: the site of disease, the presence of productive cough and results of sputum smears, the presence of cavitation, the duration of adequate chemotherapy and willingness of the patient to cover mouth and nose during coughing.

Although airborne route is the most important route for healthcare-associated transmission of *M. tuberculosis*, occasionally there are other routes via bronchoscopes, during organ transplantation, autopsies and during injection of laboratory animals with *M. tuberculosis*.

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15.2 Infection Control Strategies

Pulmonary TB is the most common and important form of the disease from the perspective of infection control. TB infection prevention and control is structured in three levels of measures:

1. Administrative procedures, which reduce the risk of exposure to persons with infectious TB
2. Environmental controls, which reduce the concentration of infectious droplet nuclei and prevent their spread
3. Personal respiratory protection that protects HCWs during their work

The most important administrative measures include early identification of potentially infectious TB patients, prompt isolation and initiation of anti-tuberculosis treatment. Other measures include a risk assessment of transmission in the facility, preparation of infection control plan and training of HCWs to implement the plan. It is mandatory to assign one person to evaluate and monitor the implementation of the IC plan.

Exposure to infectious droplet nuclei usually cannot be totally eliminated. Therefore, various environmental control measures are used to reduce the concentration of droplet nuclei in the air. Environmental measures include ventilation, ultraviolet germicidal irradiation (UVGI) and portable air-cleaning devices.

Third component is targeting protection of HCW by reducing the risk of transmission to them or reducing the risk of disease if infection has occurred. These measures are usage of personal respirators (N95), training of HCWs on respiratory protection and training patients on respiratory hygiene and cough etiquette procedures [6, 7].

15.3 Extrapulmonary Tuberculosis

Extrapulmonary tuberculosis (EPTB) is an infection caused by *M. tuberculosis*, which affects tissues and organs outside the lungs. The AIDS pandemic has emphasised the importance of EPTB. TB can affect almost every organ in our body. The most common forms of extrapulmonary TB are lymph node TB, gastrointestinal TB, spinal TB and joint TB [8].

In majority of these extrapulmonary sites, without pulmonary or laryngeal involvement, TB is usually not contagious. However, sometimes irrigation of tuberculous lesions can produce infectious droplet nuclei resulting in transmission of *M. tuberculosis*. EPTB can be infectious when diagnostic or therapeutic procedures are performed on infected lesions.

Persons with extrapulmonary TB disease may have concurrent unsuspected pulmonary or laryngeal TB disease. Therefore, all patients with EPTB should be referred for site-specific investigation and have a chest X-ray and if possible a sputum specimen.

The clinical picture of EPTB is atypical, and therefore it is very difficult to obtain correct microbiological samples for the confirmation of diagnosis. But, nowadays the modern diagnostic methods (computerised tomographic scan, magnetic resonance, laparoscopy, etc.) provide great support in diagnosis and localization of EPTB [9].

Although evidence of transmission (other than direct inoculation) of MTB from extrapulmonary sources is lacking in the current literature, in-depth evaluations of the infectiousness and risk of transmission from extrapulmonary TB have not been adequately documented in the literature [10].

15.3.1 Tuberculous Laryngitis

Involvement of larynx is usually accompanied with pulmonary involvement and high degree of infectiosity. More than one half of cases with laryngeal tuberculosis have hematogenous origin and are infectious. Infection control activities are same as described above [6, 7].

15.3.2 Tracheobronchial Tuberculosis

Tracheobronchial tuberculosis (TBTB) is defined as tuberculous infection of the tracheobronchial tree with microbial and also histopathological evidence. Diagnosis is usually delayed due to nonspecific symptoms. Tracheobronchial stenosis is one of the most common long-term complications of TBTB. This disease is reported in approximately 10–39% of the patients with pulmonary tuberculosis. Infection control remains a challenge for these diseases. Delays in diagnosis and atypical symptoms can amplify the transmission rate of disease.

15.3.3 Tuberculosis at Autopsy

TB is an unusual finding at autopsy (about 1 case/300 autopsies), but it still poses an occupational risk being 100–200 times higher that of the general public [11].

Infection control strategies comprise:

- Appropriate autopsy room design and ventilation
- Choice of personal protective equipment
- Risk assessment of deceased
- Routine disinfection and decontamination
- Use of methods to minimise the production of infected aerosol and protection against any aerosol created
- Monitoring the health of medical staff

To prevent cutaneous TB, the Royal College of Pathologists Guidelines (http://www.rcpath.org) include recommendations on standard autopsy clothing and appropriate gloves ("doublegloving" with both latex and neoprene cut-resistant gloves), together with observation of standard precautions.

15.3.4 Spinal TB

Skeletal TB accounts for 10–20% of all EPTB, with spinal involvement in 50–60% of all skeletal TB cases. Between 50% and 75% of patients with osteoarticular TB and up to 50% of patients with spinal TB have an associated primary lung focus or have a reported history of pulmonary TB.

A total of 29 individual cases of concomitant pulmonary and spinal TB have been reported in the literature. Respiratory transmission of TB has been documented in patients with AFB smear-negative sputum. One study found that those with extrapulmonary TB increased the TB transmission rate, suggesting that the infectiousness of extrapulmonary TB has previously been underestimated [12].

The Centers for Disease Control and Prevention recommends that "persons diagnosed with extrapulmonary TB disease should be evaluated for the presence of concurrent pulmonary TB disease"; however, further description of the extent of that evaluation is lacking. According to Mandell's principles and practice of infectious diseases, a CXR should be routinely obtained in Pott's disease since abnormal radiographs can have important health ramifications [6].

Airborne isolation of patients with suspected EPTB, including spinal TB, is justified until chest X-ray and sputum smear results are known and cultures have been obtained. Although, there is documentation of AFB smear-negative transmission of pulmonary TB, it is customary to discontinue isolation once negative AFB sputum smear results are known.

Advantages of taking an aggressive approach to isolation and documentation of active pulmonary TB include minimising healthcare worker and patient exposure to a potentially infectious patient.

In conclusion, transmission and outbreaks caused by *M. tuberculosis* still represent a challenge. To address this issue, TB infection control measures should be strengthened around the world, particularly in resource-constrained countries and those with high prevalence of TB and HIV [13, 14].

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