



KEY POINT SUMMARY

OBJECTIVES

The study investigated the contributing factors of a tuberculosis outbreak in an acute care community hospital and how air pressure difference between patient room and corridor impacted the risk of tuberculosis infection.

Nosocomial Transmission of Tuberculosis Associated With a Draining Abscess

Hutton, M. D., Stead, W. W., Cauthen, G. M., Bloch, A. B., Ewing, W. M.

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Key Concepts/Context

Tuberculosis (TB) is a bacterial infection of lungs and other body parts caused by strains of mycobacteria (*Mycobacterium tuberculosis*). Typical symptoms include chronic cough with blood-tinged sputum, fever, night sweats, and so on.

Tuberculosis can cause significant morbidity and death. It is usually spread by air when infected people transmit their saliva through air by coughing and sneezing.

The tuberculin skin test is used to screen people with high risk of tuberculosis infection. The test involves the injection of tuberculin and the measurement of the diameter of induration (palpable raised hardened area) on the forearm.

Air pressure difference between neighboring spaces is an important environmental measure in preventing airborne transmission of infections. A negative pressured room is a room where enough air is evacuated to prevent air from flowing out of the room and into neighboring spaces. A positive pressured room is a room where enough air is supplied to prevent air in neighboring spaces from entering the room.

Methods

In this observational study, cases of tuberculin conversion were identified through tuberculin skin tests among 442 employees and 50 students whose previous tuberculin test results were negative. A case of tuberculin conversion was identified if current tuberculin induration was at least 10mm with an increase of at least 6mm from previous negative result within 24 months. Patients and visitors with tuberculin induration of at least 10mm were identified as tuberculin reactors. The source of outbreak was identified through laboratory studies on species identification and susceptibility. An aerosol dispersion study was conducted by using thermal anemometer and smoke tubes to identify velocity and direction of air



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flow in isolation rooms where the suspected source case patient stayed. Prevalence of tuberculin conversion was compared among groups of employees and students with different levels of exposure to suspected source case reported by employees and students through questionnaire surveys. Prevalence of tuberculin reactivity was compared among patient room locations to examine the effect of proximity to the suspected source case.

Findings

A patient with a large tuberculous abscess was identified as the source case. In all three units where the source case patient was cared during the hospital stay, the aerosol dispersion study showed that air flowed from the positive-pressured isolation rooms where the infectious patient stayed to neighboring spaces. Patients and visitors who stayed closer to the positive pressure rooms had higher risk of tuberculin reactivity. Prevalence of tuberculin reaction in these patients and visitors was 2.9 times the prevalence in other patients and visitors. Exposure to the patient with tuberculosis infection was associated with increased risk of tuberculin conversion and reactivity among employees and students.

Limitations

There were several limitations of this study:

- Because the investigation was a retrospective observational study, data collection on exposure to tuberculosis were mainly dependent on memory of employees and students which might contain errors.
- Previous history of tuberculin skin test results in patient and visitors was not available. This might have biased the results because tuberculin reactivity found in some patients and visitors might not be related to the tuberculosis outbreak in the study.
- The airflow study used simulation to estimate the flow pattern and the airborne transmission of tuberculosis. The simulation might not be accurate.

Design Implications

The ventilation system for isolation rooms housing potentially infectious patients with confirmed or suspected tuberculosis should be appropriately designed to make sure that the isolation rooms are negatively pressured in relation to neighboring spaces and the air in the isolation rooms is ventilated directly to the outside and away from the air intake outlets.

Commissioning and routine maintenance should be conducted on the ventilation system to verify the actual air flow pattern and air change rate.