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ORIGINAL ARTICLE

Assessment of latent tuberculosis infection in psychiatric inpatients: A survey after tuberculosis outbreaks

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Abstract *Background/Purpose:* To investigate risk factors of latent tuberculosis infection (LTBI) among inpatients of chronic psychiatric wards with tuberculosis (TB) outbreaks.
Methods: In April 2013, inpatients of four all-male wards with TB outbreaks were tested for LTBI using the QuantiFERON-TB Gold in Tube (QFT) method. Based on this investigation, a retrospective study was conducted to assess risk factors for LTBI. Inpatients exposed to cluster-A or cluster-B TB cases were defined as contacts of cluster-A or cluster-B, and others, as nonclustered contacts.
Results: Among 355 inpatients with TB exposure, 134 (38%) were QFT-positive for LTBI. Univariate analysis showed that significant predictors for QFT-positivity were age, case-days of exposure to all TB cases (TB-all) and to sputum smear positive cases, number of source cases with cough, and exposure to cluster-A TB cases. Independent risk factors for LTBI were higher age [adjusted odds ratio (OR) 1.03, 95% confidence intervals (CI: 1.01–1.05)], TB-all exposure case-days $\geq$ 200 [adjusted OR 2.04 (1.06–3.92)] and exposure to cluster-A TB cases [adjusted OR 2.82 (1.30–6.12)] after adjustment for the sputum smear positivity, and cough variables of the source cases. The contacts of cluster-A had a greater risk of LTBI than did those of cluster-B, especially in the younger population ($\leq$50 years) after adjustment [adjusted OR 2.64 (1.03–6.76)].

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Conclusion: After TB outbreaks, more than one third of inpatients were QFT-positive for LTBI. Our findings suggest that, beside the infectiousness of source cases, intensity of exposure, and age of contacts, exposure to TB cases in potential genotyping clusters may be predictive for LTBI in this male psychiatric population.

Introduction

It is estimated that one third of the world's population are infected with *Mycobacterium tuberculosis* (MTB), and that most of the infected are in a state of latent tuberculosis infection (LTBI).[1] However, a person with LTBI carries a 5—10% lifetime risk of developing active tuberculosis (TB) disease.[2—4] Residents in a long-term care (LTC) facility are at risk of TB infection because of frequent disease transmission, and they also may have comorbidities that are associated with an increased risk of TB reactivation.[3—5] In addition, people with a mental illness may have a higher risk of TB infection than the general population.[6,7] Outbreaks of active TB in psychiatric institutions are not uncommon, and LTBI among psychiatric residents may comprise a reservoir for future TB diseases.[8—10] However, the burden of LTBI in this specific population has rarely been reported.

TB infection is associated with environmental, host, and bacterial factors. Risk factors for LTBI are as follows: birth in a country with a high TB incidence, employment in a TB-related place, older age, smoking, past TB history, and frequent contact with a source case responsible for TB transmission.[11—17] Furthermore, the risk of TB infection among contacts is increased by some characteristics of the source cases, including the ability to generate cough aerosols, grading of a positive sputum smear, and presence of a cavity on radiography.[18,19] Moreover, distinct MTB strains may differ in their capacities to cause secondary TB cases and LTBI, therefore, potential bacterial factors may influence the risk of TB transmission.[20,21] TB outbreaks may result from those risk factors that contribute to LTBI. However, for residents in LTC facilities experiencing TB outbreaks, little is known about the impact of those factors on the risk for LTBI. It is particularly worthwhile to evaluate the risk factors for LTBI in LTC psychiatric inpatients because of their vulnerability to acquiring TB infection.[7] With better understanding of the risk factors for LTBI, clinicians may be able to prioritize persons with the greatest need for LTBI testing and treating.[22]

In 2012, outbreaks of TB occurred in the LTC wards of a psychiatric hospital in Taiwan, and MTB genotyping disclosed the presence of two clustered MTB strains. In addition to systemic screenings for active cases, a survey for LTBI was conducted in 2013 using a whole blood interferon-gamma release assay (IGRA).[23] Because distinct MTB strains may be associated with different degrees of infectiousness, we had a great interest in the impact of the two different clustered strains on the risk of LTBI in contacts of this facility.[21] Based on this survey, we investigated the prevalence rate and predictors of LTBI in this specific population.

Methods

Setting and participants

This was a retrospective study of inpatients in chronic psychiatric wards of Taipei Veterans General Hospital (TPEVGH), Yuli branch (Taiwan). We reviewed the medical records and LTBI reports of enrolled inpatients. This study was approved by the institutional review board (IRB number: 2014-10-005A).

The Yuli branch of TPEVGH, which has 2500 beds, provides chronic care for mentally ill patients. In this hospital, the TB incidence rate has increased markedly since 2010. Based on DNA genotypes using spoligotyping, the 15-loci mycobacterial interspersed repetitive unit variable number tandem repeat (MIRU-VNTR) method, restriction fragment length polymorphism analysis, and exposure histories, no secondary cases shared an MTB strain identical to that of the source over a 1-year period after an index case was diagnosed.[24] Despite infection control efforts, 23 consecutive cases of pulmonary TB occurred in six all-male wards from January 2012 to April 2013 (Figure 1). Among them, nine cases carried clustered MTB strains that fell into two clusters. One cluster included seven cases in Ward A1, Ward A2, and Ward A3 (cluster-A), and the other included two cases in Ward B (cluster-B). The physical environments of these wards were relatively identical. For TB control and prophylactic treatment guided by the Centers for Disease Control of Taiwan, LTBI surveys were carried out in four target wards (Ward A1, Ward A2, Ward B, and Ward C1) where two or more clustered TB cases or four or more nonclustered ones stayed during their infectious periods. Inpatients who had been admitted to the four target wards during the TB outbreak period were tested for LTBI in April 2013.

Diagnostic test for LTBI

An IGRA-based tool, the QuantiFERON-TB Gold in Tube (QFT; Cellestis Limited, Melbourne, VIC, Australia) measure, was used to diagnose LTBI in this survey. Because the decision to test is also a decision to treat,[4] the QFT test was restricted to candidates of isoniazid preventive treatment for LTBI. Hence, inpatients were excluded from LTBI screening if they: (1) refused blood testing for LTBI