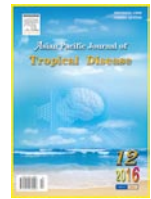




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Age is associated with latent tuberculosis in nurses

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ABSTRACT

Objective: To evaluate risk factors for developing latent tuberculosis (LTB) in Thai nurses.

Methods: A comparison study was conducted at Srinagarind Hospital, Khon Kaen, Thailand. Clinical factors were compared between persons with tuberculin conversion and those without tuberculin conversion identified by tuberculin skin test.

Results: There were 173 eligible persons with the LTB (34.7%). There were five workplaces where participants worked regularly including the general ward, surgical ward, pediatric ward, medical ward and critical care ward. In a multivariate model, two factors were significantly associated with LTB including age and history of tuberculosis in colleagues. The adjusted odds ratio (95% confidence interval) of both variables were 1.056 (1.004–1.104) and 0.202 (0.044–0.941).

Conclusions: Older age is associated with latent tuberculosis in nurses. LTB should be screened routinely and treated if diagnosed for nurses.

1. Introduction

Tuberculosis is still the public health problem particularly in the Southeast Asia area which accounted for 34% of total tuberculosis patients[1]. The World Health Organization also estimated that the prevalence of tuberculosis in Thailand was 163 patients per 100000 population in 2008[1].

Latent tuberculosis (LTB) causes no symptom but it is associated with future tuberculosis[2]. Approximately 1.3% of LTB patients developed active tuberculosis within 4 years[2]. Tuberculosis occurs in most healthcare workers (HCW) due to recent infection or LTB

rather than remote infection[2]. Treatment with either isoniazid or isoniazid-rifampentine is recommended by the Centers for Disease Control and Prevention to prevent further active tuberculosis[3].

LTB can be diagnosed by several methods such as the tuberculin skin test (TST). TST is cheap and has been used for a long time. It may, however, have issues with the accuracy of skin induration interpretation[4]. The interferon-gamma release assays (IGRAs) methods may be more sensitive and have less cross reactivity than TST but may have issues with cost, lack of data on future tuberculosis development and reversion of tests in healthcare workers[5]. All three tests are fairly concordant in several studies[6,7].

Prevalences of LTB varies among countries, co-morbid diseases and occupations. In the US army survey, the LTB rate was 1.3% out of 4569791 service members[8]. The rate in healthcare students in Italy was 3.3%, while it was 8.6% from a study conducted in Brazilian prisons[9,10]. HIV infected persons and HCW are at risk for having LTB. The prevalence of LTB in Thai HCW was 19.8%[11].

Diagnosis of LTB in HCW needs serial annual TSTs. A baseline TST may not represent LTB particularly in Thailand which is an endemic area for tuberculosis and universal bacille calmette guerin (BCG) vaccination. TST should be performed on HCWs annually.

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If the consecutive TST becomes positive after being negative at baseline, LTB is established[12]. The IGRAs method is not widely available in Thailand and other Asian countries due to high cost and unavailability.

Among several HCW, nurses and nursing assistants play important role in tuberculosis care and are the most reported occupations to be at the highest risk for having LTB due to long contact times with tuberculosis patients[13,14]. The adjusted odds ratios (OR) of having LTB in nurses from Turkey was 1.5 (1.29–1.66)[15]. The report from Thailand also showed that nurses had adjusted OR for LTB of 2.3 (1.3–4.1) compared to office workers[11]. Several factors such as age or household contact have been shown to be related with LTB[2]. Risk factors of LTB in nurses, particularly in Thailand, an endemic area of tuberculosis, are limited.

This study aimed to evaluate risk factors for developing LTB in Thai nurses. The results may be used to develop guideline to identify nurses at risk for LTB in Thai or Asian population where tuberculosis is as endemic as in Thailand. The specific aims of this study are to study the prevalence of LTB among nurses and to identify predictors of LTB among nurses in the endemic area of tuberculosis.

2. Materials and methods

2.1. Study design

A comparison study was done at Srinagarind Hospital, Khon Kaen University, Khon Kaen, Thailand, between nurses with tuberculin conversion and those who had negative results of TST in 2 consecutive years.

2.2. Study population

Nurses and nursing assistants who had results of TST within 2 consecutive years were recruited. Persons were excluded if they had any of these items including a history of recent or active tuberculosis, an abnormal chest X ray, a history of diabetes mellitus, HIV infection, or had received any immunosuppressive therapy. The study population was a part of the previous study[11]. Persons who worked in outpatient settings were excluded due to less contact time with the patients.

Participants with tuberculin conversion were compared with those who had negative results of TST in 2 consecutive years. Tuberculin conversion was defined if a person had a negative baseline TST on the first year and a positive TST in the next consecutive years. TST procedures were described elsewhere[11].

2.3. Data analysis

Baseline and clinical characteristics of those with and without tuberculin conversion were compared using descriptive statistics. Logistic regression analyses were executed to predict the development of LTB. All data analyses were performed with SAS software version 8.2.

3. Results

There were 213 persons who met the study criteria, among which 40 persons were excluded due to an outpatient working location. In total, 173 persons were included in the analysis, of which 60 persons (34.7%) had tuberculin conversion and were designated as the case group.

The baseline characteristics and variables related to tuberculosis of the case and control groups were presented in Table 1. The case group was characterized by being of an older age, which had more male participants, a longer duration of employment, more persons with BCG scars, more histories of tuberculosis in family members, of tuberculosis exposure in the past year, of prevention by any methods and of using surgical masks.

Table 1

Baseline characteristics of participants with and without TST conversion.

Variables	No conversion [n = 113, (%)]	Conversion [n = 60, (%)]	P	
Median age (range) (years)	31.5 (19–50)	38 (23–57)	0.089	
Female gender	109 (96.5)	54 (90.0)	0.097	
Median duration of employment (years)	8 (2–25)	13.5 (2–25)	0.206	
Location	General ward	19 (16.8)	16 (26.7)	
	Surgery	18 (15.9)	8 (13.3)	
	Pediatric	16 (14.2)	7 (11.7)	
	Medicine	13 (11.5)	10 (16.7)	
	CCU	47 (41.6)	19 (31.7)	
Tuberculosis related variables	BCG scar	74 (65.5)	45 (76.3)	0.146
	History of tuberculosis in family	9 (8.0)	6 (10.2)	0.627
	History of tuberculosis in colleagues	15 (13.3)	2 (3.4)	0.039
	History tuberculosis exposure in the past year	63 (55.8)	38 (64.4)	0.274
	Prevention related variables	History of prevention by any methods	88 (77.9)	49 (83.1)
History of using surgical mask use		99 (87.6)	54 (90.0)	0.640
History of using N95 mask		10 (40.0)	7 (33.3)	0.641
History of using high efficiency particulate air mask		0 (0.0)	1 (20.0)	1.000
Use of surgical mask at all times		47 (51.1)	28 (57.1)	0.493

Data for no conversion and conversion groups may not be total of 113 and 60 persons, respectively due to missing data in individuals.

In a multivariate model that included all significant variables at the univariate level (Table 1), the only two significant factors for tuberculin conversion were age and history of tuberculosis in colleagues (Table 2). The adjusted ORs [95% confidence interval (CI)] of both variables were 1.056 (1.004–1.104) and 0.202 (0.044–0.941).

Table 2

The two significant factors for tuberculin conversion.

Variables	ORs (95% CI)	Adjusted ORs (95% CI)
Age	1.053 (1.004–1.104)	1.056 (1.004–1.104)
History of TB in colleagues	0.229 (0.051–1.039)	0.202 (0.044–0.941)

Results of univariate and multivariate regression analyses showed independent variables, their crude ORs and adjusted ORs with 95% CI for being TST conversion.

4. Discussion

The LTB prevalence in HCW is varied among countries and can be high as 79%[16]. In the previous Thai report, it showed the overall LTB rate in HCW was 19.3%[11]. This study showed the LTB rate in nurses who worked at patient wards was 34.7%, while the LTB rates in nurses in Brazil, Saudi Arabia, and Germany were 54.5%, 12.9%, and 9.7%[17-19].

Some work locations such as medicine or the emergency department are reported to be at a higher risk for tuberculosis[16]. In this current study, working in medicine wards had higher numbers

of participants with tuberculin conversion (Table 1). It was not, however, statistically significant in multivariate analysis. In other words, working locations were not an independent factor for LTB in nurses.

The only two significant factors for LTB in nurses were age and a history of tuberculosis in colleagues (Table 2). The first one was a predictor and the latter one was a protector for LTB. With an increase of age by one year, the chance of having LTB will increase 5%. There were two studies also showing that older age was the important risk factor for LTB. An age over 55 years increases risk of LTB by 14.7 times in health care workers in Germany, while an age over 35 years had adjusted OR of 9.49 (2.22–40.50) for LTB in a study from Malaysia[18,20]. A study from Taiwan found that age was associated with LTB diagnosed by the IGRAs methods but not TST[21]. The study populations between these two studies were different. The study from Taiwan was more general and included HIV patients, but this study enrolled only nurses. The median age of those who had tuberculin conversion in this study was 38 years. If one has tuberculin conversion and is aged over 38 years, treatment for LTB may be needed.

Having a history of tuberculosis in colleagues was found to be a protector for LTB in nurses. The risk of LTB decreases by 80% if any nurse had this history. The study from Malaysia showed that if HCW had close contact with active tuberculosis, the risk of LTB increased 8.69 times[20]. If nurses had colleagues with tuberculosis, they may protect themselves more seriously or be more aware about tuberculosis to account for the apparent protective effect. As a result, a history of tuberculosis in colleagues was shown to be a protector in the analysis.

The main limitations of this study are the small study population and missing data. Further studies should be performed to evaluate the association between LTB and future active tuberculosis in this study population.

Older age was positively associated with LTB in nurses, while a history of tuberculosis in colleagues was negatively associated. TST should be performed routinely for nurses who work in the patient wards.

Conflict of interest statement

We declare that we have no conflict of interest.

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