

Midterm-stage Follow-up for Tuberculosis Infection along the Coastal Region of Northern Miyagi after the Great East Japan Earthquake

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Abstract

During the early stage (2011-2012) after the Great East Japan Earthquake, the total number of tuberculosis (TB), pulmonary TB and latent tuberculosis infection (LTBI) patients significantly increased only in the coastal region of northern Miyagi, which was ravaged by a post-quake tsunami. Here, we investigated the midterm-stage follow-up (2013-2014) of TB infection in this region. Although the number of LTBI cases had significantly decreased, their prevalence had not returned to the levels recorded in the pre-disaster period. These results suggest that the influence of the Great East Japan Earthquake remains. Thus, we believe that it is necessary to continue strict monitoring of TB in the coastal region of northern Miyagi.

Keywords: Miyagi coastal region; The Great East Japan Earthquake; Tuberculosis

Introduction

In our previous study, we reported that the Great East Japan Earthquake struck off the northeast coast of Japan on March 11, 2011, following within an hour by catastrophic tsunamis that swept over the coastal region of the Miyagi Prefecture. Consequently, the number of residents forced into evacuation shelters approached one-half million. Conditions in these temporary residences were comparable to those in refugee camps and included several patients diagnosed with latent tuberculosis infections (LTBI), who put the other resident's risk [1]. In this study, we have compared the changes in tuberculosis (TB) cases early after the disaster with those by midterm post-disaster stage in the coastal region on northern Miyagi. By 2014, nearly all refugees had left the shelters [2]. Furthermore, almost the entire transport network had recovered [3]. These results suggest that the environment of this coastal region may have also recovered. For these reasons, we investigated the midterm-stage follow up (2013-2014) for tuberculosis infection in the tsunami-affected areas of the Great East Japan Earthquake.

Methods

Data acquisition

As previous reported, TB patients in Japan are all patients with TB are registered with regional public health centers and placed under state control [1]. Moreover, the coastal region reported to the health centers of Kesenuma, Ishinomaki, and Shiogama [1]. Patients in the coastal region were divided into two groups, those who were resident in the early stage (2011-2012) and those residents during the midterm-stage (2013-2014) after the disaster. In this study, annual data (measured from April 1 to March 31 of each year) for all patients with

TB between 2011 and 2015 were extracted from the database of the public health centers of the Miyagi Prefectural Government. Data for the early stage (2011-2013) and the midterm-stage (2013-2015) following the Great East Japan Earthquake were compared.

Methods for diagnosing TB included the septum smear test, interferon-gamma release assays (IGRA), *tubercle bacillus* laboratory cultures, polymerase chain reaction, chest radiography, and computed tomography [1]. As in our previous study, *tubercle bacillus* infections were classified as pulmonary tuberculosis, extra pulmonary tuberculosis, or LTBI, and the registered TB patients were categorized by sex, and in age groups of 10 years (range; 0-99 years old). Moreover, we investigated the incidence of TB patients (sputum smear-test or culture positive) requiring contact-person screening [1]. We screened for TBs by using the tuberculin skin test (TST) or IGRA and chest radiography.

Statistical analysis

Chi-square tests or two-tailed Fisher's exact tests were used to compare categorical data. All tests were two-sided, and a p-value of <0.05 was considered statistically significant.

Results

In the coastal region of northern Miyagi, the annual population numbers per year were 492,537 (2011) and 466,898 (2012) early after the Great East Japan Earthquake, and 463,438 (2013) and 460,067 (2014) midterm after the disaster. Over the study period (April 1, 2011 to March 31, 2015), 527 TB patients were registered in the area.

Following the earthquake, the annual TB cases per year were 95 (2011) and 89 (2012) in the early period, and 78 (2013) and 67 (2014) at midterm, indicating slight decrease between post-earthquake stages. (ns: 19.2 vs. 15.7 per 100,000 people, respectively) (Table 1).

	Early Stage (2011+2012)	Midterm stage (2013+2014)	Early vs. Mid
Population, n	959,435	923,505	
TB patients, n	184	145	ns
Per 100,000 people	19.2	15.7	
Female, n (%)	90 (48.9)	66 (45.5)	ns
Tuberculosis patients who required screening			
Total number, n	46	48	
Contact persons			
Total number, n	1,479	1,257	ns
Pulmonary TB, n	77	63	ns
Per 100,000 people	8.0	6.8	
Age, n (%)			
0–19 years	0 (0.0)	3 (0.5)	ns
20–49 years	8 (10.4)	10 (15.9)	ns
50–69 years	19 (24.5)	11 (17.5)	ns
≥ 70 years	50 (64.9)	38 (60.3)	ns
Extra pulmonary TB, n	28	30	ns
Per 100,000 people	2.9	3.2	
Age, n (%)			
0–19 years	1 (3.6)	1 (3.3)	ns
20–49 years	3 (10.7)	3 (10.0)	ns
50–69 years	3 (10.7)	7 (23.3)	ns
≥ 70 years	21 (75.0)	20 (75.0)	ns
LTBI, n	79	52	P=0.032
Per 100,000 people	8.2	6.8	
Age, n (%)			
0–19 years	2 (2.6)	9 (17.3)	P=0.007
20–49 years	30 (37.2)	18 (34.6)	ns
50–69 years	28 (35.9)	12 (23.1)	ns
≥ 70 years	19 (24.4)	13 (25.0)	ns
TB: Tuberculosis, LTBI: Latent Tuberculosis Infection.			

Table 1: TB patients in the coastal region of northern Miyagi.

The number of patients requiring contact screening (sputum smear-test or culture positive) were 46 at the early stage and 48 at the midterm stage after the disaster. The total number of TB patients who required contact screening did not change between early and midterm stage following the earthquake (Table 1).

Moreover, the number of persons who had had contact with the patients was 1468 during the early stage and 1,257 during midterm stage post-disaster. The total number of contact persons did not change significantly between the two-stages (Table 1).

The distribution of TB patients did not differ according to sex or age group. During the early stage after the disaster, the number of patients

with pulmonary TB, extra pulmonary TB, and LTBI were 77, 28, and 79, respectively, and at midterm, the numbers of these patients were 63, 30 and 52, respectively. Furthermore, the number of patients with pulmonary TB had slight decreased between the early and midterm stages post disaster (8.0 vs. 6.8 per 100,000, respectively) (Table 1). The number of extra pulmonary TB patients did not differ significantly between early and midterm stages (2.9 vs. 3.2 per 100,000, respectively), while the number of LTBI patients had significantly decreased ($p < 0.032$: 8.1 vs. 5.6 per 100,000, respectively) (Table 1).

Our previous report indicated that in the pre-disaster period (2009~2010) prevalence of total TB, pulmonary TB, extra pulmonary

TB, and LTBI was 9.6, 6.7, 1.0, and 1.8 respectively [1]. In this study, the number of patients with pulmonary TB had returned to pre-disaster stage (6.7 vs. 6.8 per 100,000, respectively) (Table 2); however, the total number of total TB, extra pulmonary TB, and LTBI cases had not returned: (total TB: $p < 0.001$: 9.6 vs. 15.7 per 100,000, respectively), (extra pulmonary TB: $p < 0.003$: 1.0 vs. 3.2 per 100,000, respectively), and (LTBI: $p < 0.001$: 1.8 vs. 6.8 per 100,000, respectively) (Table 2).

	Pre-disaster (2009+2010)	Midterm stage (2013+2014)	Pre vs. Mid
Population, n	993,209	923,505	
TB patients, n	95	145	$p < 0.001$
Per 100,000 people	9.6	15.7	
Female, n (%)	50 (58.9)	90 (48.9)	ns
Pulmonary TB, n	67	63	ns
Per 100,000 people	6.7	6.8	
Age, n (%)			
0–19 years	0 (0.0)	3 (0.5)	
20–49 years	12 (17.9)	10 (15.9)	ns
50–69 years	17 (25.4)	11 (17.5)	ns
≥ 70 years	38 (56.7)	38 (60.3)	ns
Extra pulmonary TB, n	10	30	$p < 0.003$
Per 100,000 people	1.0	3.2	
Age, n (%)			
0–19 years	0	1 (3.3)	ns
20–49 years	1 (10)	3 (10.7)	ns
50–69 years	3 (30)	7 (23.3)	ns
≥ 70 years	6 (60)	20 (75.0)	ns
LTBI, n	18	52	$p < 0.001$
Per 100,000 people	1.8	6.8	
Age, n (%)			
0–19 years	3 (16.7)	9 (17.3)	ns
20–49 years	9 (50)	18 (34.6)	ns
50–69 years	6 (33.4)	12 (23.1)	ns
≥ 70 years	0	13 (25.0)	ns
TB: Tuberculosis, LTBI: Latent Tuberculosis Infection.			

Table 2: TB patients in the coastal region of Northern Miyagi.

Discussion

Several studies have shown that the incidence of and mortality from TB increased after World Wars I and II [4,5]. A similar trend was also observed by Drobniowski and Verlander [6] upon reviewing data on TB infection rates during 36 conflicts that occurred between 1975 and 1995. More recently, a threefold increase in number of smear-positive TB cases was reported during the 1999 conflict in the Democratic Republic of Timor-Leste [7].

Several risk factors associated with a situational crisis such as malnutrition, overcrowding, and disruption of health services can contribute to increasing the burden of TB infections [8]. A combination of these factors, in addition to the long-term obstruction of traffic in the coastal region of northern Miyagi due to the damage caused by tsunami may have contributed to exacerbating the risk of LTBI progression to its active status, which coupled with overcrowding in the shelters, could have increased its transmission among the residents. Furthermore, as demonstrated by our previous study the conditions in the shelters created along the northern coastal region after the Great East Japan Earthquake may have been inappropriate for evacuees, thus contributing to the increase in the number of TB cases.

After the war in Kosovo, the incidence of TB declined annually in all-forms, from 85.9 per 100,000 residents in 2000 to 52.9 cases per 100,000 residents in 2005, while that of new smear-positive pulmonary TB declined from 20.2 cases per 100,000 residents in 2000 to 11.0 cases per 100,000 in 2005 [9]. Directly Observed Treatment Short-course (DOTS) was successfully implemented in Kosovo which showed that this strategy can be used to control TB, even when a region is rebuilding its political and healthcare infrastructure [9]. Throughout DOTS implementation in Kosovo, the program remained under “temporary” United Nation-administration and financial recovery [10]. By 2014, in the coastal region of northern Miyagi nearly all the refugees had left the shelters [2]. Furthermore, almost the entire transport network had recovered [3]. In this study, we found that the total number of TB, pulmonary TB, and LTBI cases had significantly decreased. These results suggest that the healthcare infrastructure may have recovered by midterm stage after the disaster.

In 2013, report given by the Miyagi Prefectural Government reveals that the prevalence of TB among the total Miyagi population had decreased to below the national level [11]. In contrast, here we report that, in Miyagi’s coastal region, the prevalence of pulmonary TB had returned to the pre-disaster level, whereas the prevalence of total TB, extra pulmonary TB, and LTBI had not. These results suggest that the

influence of the Great East Japan Earthquake may remain. Thus, we believe that strict monitoring of TB is necessary in the coastal region of northern Miyagi.

Disclosure

The authors declare that there is nothing to disclose and no conflict of interest.

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