LETTER

Impact of the Great East Japan Earthquake in 2011 on MS and NMOSD: a study in Sendai, Japan

INTRODUCTION

Stressful events can induce immunological alterations and could possibly impact the course of multiple sclerosis (MS)\(^1\)\(^2\). Thus stress management may be important to prevent relapse and reduce brain lesions in MS.\(^3\)\(^4\). Although major natural disasters cause severe physical and psychological stresses, few studies have analysed the influence of such natural disasters on MS and neuromyelitis optica spectrum disorders (NMOSD).

The Great East Japan Earthquake that measured magnitude 9.0 and triggered tsunami on 11 March 2011, devastated the Pacific coastal regions of Eastern Japan, especially the Iwate, Miyagi and Fukushima prefectures. Numerous after-shocks followed. Meltdown at the Fukushima No.1 nuclear power plant also resulted from the disaster. A total of 18 000 people died or are still unaccounted for, and half of them were Miyagi residents. About 320 000 people had to be evacuated at least temporarily in Miyagi prefecture alone. We studied the impact of the disaster in people with MS and NMOSD in Sendai City, the Miyagi prefecture’s capital with a population of one million.

PATIENTS AND METHODS

Two hundred and three patients (140 with MS fulfilling the 2010 McDonald Criteria and 63 with aquaporin 4-IgG-positive NMOSD fulfilling the 2015 International Consensus Diagnostic Criteria) seen at Tohoku University Hospital and three other major hospitals in Sendai, Japan, enrolled in the study (age: 42.8±11.9 in MS, 54.0±13.4 in NMOSD, disease duration: 12.7±9.9 in MS, 13.0±10.7 in NMOSD, annualised relapse rate: 0.68±0.57 in MS, 0.62±0.58 in NMOSD in the previous year of the disaster). They accounted for 62% of the patients registered in Miyagi prefecture for the national registry of MS and NMOSD.

We surveyed the survival, living conditions including refuge, continuation of therapy (interferon β for MS and oral corticosteroid and/or immunosuppressants for NMOSD), available healthcare services by a self-developed questionnaire and stress by the Visual Analogue Scale (VAS), relapse during 1 year before and after the earthquake (judged by neurologist’s examination and MRI findings), and expanded disability status scale (EDSS) scores in MS and NMOSD during 1 year period following the disaster.

We obtained written informed consents from all the patients and the study was approved by a local ethics committee. Statistical analysis was carried out by SPSS V15.0 (SPSS Inc, Chicago, USA). The p<0.05 in t-test was considered statistically significant.

RESULTS

Refuge

Domiciles of the patients at the time of disaster are shown in figure 1A. All patients including those living in the coastal region survived the disaster. Thirty-nine (27.9%) patients with MS and 13 (20.6%) patients with NMOSD took refuge at community centres, school gymnasiums, etc after the disaster, but no one was forced to live outdoors or in makeshift shelters. Most of the patients took refuge for the periods between 1 week and 1 month. There were 8 patients (4 with MS and 4 with NMOSD) who took refuge for more than 1 month. Two of these four patients with MS and three of these four patients with NMOSD were residents in the coastal areas and one patient with MS was from Fukushima moved away from the nuclear power plant.

Stress level

VAS scores were significantly higher at the time of disaster (March 2011) than in August 2011 (figure 1B-1) in MS (p<0.05) and NMOSD (p<0.05).

Relapse, treatment interruption and EDSS

Relapse did not increase during 1 year after the earthquake in patients with MS and NMOSD (figure 1B-2). Thirty-one (22.1%) patients with MS relapsed within a year after the earthquake, while 33 (23.6%) patients with MS had relapses within a year before the earthquake. Twenty-four patients (77%) out of these 31 who relapsed after the earthquake also had relapsed in a year before the earthquake.

There was no bias of distribution of the domiciles in patients with relapses during 1 year after the earthquake. VAS scores were not associated with refuge or relapse in patients with MS and NMOSD.

Most patients resumed hospital visit within 1½ month after the earthquake. Medication was uninterrupted in 97% of the patients. Two of six patients with MS with medication interruption (5–30 days) relapsed within 5 months after the earthquake. A few patients with MS chose to extend interferon β self-injection intervals to overcome drug shortage. Relapses of MS after the earthquake tended to be more frequent in patients with interruption of medication (2/6=33.3%) than those without interruption (29/140=20.7%), but the difference was not statistically significant. One of four patients with NMOSD with medication interruption relapsed 7 days following the disaster.

EDSS scores did not change during 1 year following the earthquake in patients with MS (3.3±2.4 before earthquake vs 3.4±2.4 after earthquake) and NMOSD (4.5±2.0 vs 4.5±2.0).

DISCUSSION

The Great East Japan Earthquake did impact many diseases (increased incidences of deep vein thrombosis, dementia, peptic ulcers, pneumonia and heart failure in the coastal areas after the disaster had been reported\(^5\)). Deterioration of the illnesses was associated with infection, poor hygiene, low temperature, congestion of refuge, shortage of water and food and lack of exercise.

As evidenced by our VAS data, the earthquake caused significant stress in our patients with MS and NMOSD (although recall bias can occur in the questionnaire-based evaluation of stress.), but we did not observe a significantly increased relapse rate or higher disability. In fact, Nisipeanu and Korczyn reported no increase of relapse in Israeli patients with MS exposed to missile attacks during the Persian Gulf War in 1991 and concluded that not all stress conditions increase exacerbations in patients with MS.\(^6\) Our patients who had relapses in the previous year appeared to be at higher risk of relapse following the disaster as well, and careful and uninterrupted management is even more important in patients with higher disease activity. Although our study is on a small-scale, providing uninterrupted therapy as well as general support to improve life conditions is probably of utmost importance to prevent exacerbation.
Figure 1  (A): domiciles of our patients with multiple sclerosis (MS) and neuromyelitis optica spectrum disorders (NMOSD) at the time of the Great East Japan Earthquake, 11 March 2011. Sendai city’s borders are shown with a bold line. Open circles represent patients who relapsed within a year of the earthquake, and black circles represent ones who did not relapse within a year of the earthquake. Shaded coastal areas were submerged by tsunami (The data was derived from ‘tsunami flood area overview map’ created by The Geospacial Information Authority of Japan). (B-1) Visual Analogue Scale (VAS) scores during 1 year before and after the earthquake in patients with MS and NMOSD. Black bars represent VAS scores shortly after the earthquake and grey bars are VAS scores 5 months after the earthquake. In both diseases, VAS scores were significantly higher at the time of disaster than a several months later, (B-2): annualised relapse rates (ARRs) during 1 year before and after the earthquake in patients with MS and NMOSD. Black bars represent ARR in the year before the earthquake, and grey bars are ARR in the year after the earthquake. There was no increase of ARRs after the earthquake in patients with MS and NMOSD. MS, multiple sclerosis, NMOSD, neuromyelitis optica spectrum disorders.
of MS and NMOSD at the time of major natural disasters.

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