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Effect of Asian sand dust on Japanese cedar pollinosis

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ABSTRACT

Objective: Asian sand dust (ASD), originating in the deserts of Mongolia and China, spreads over large areas and is associated with adverse effects on human health in East Asia, including asthma, heart disease, and some allergic diseases. However, the effect of ASD on patients with seasonal allergic rhinitis caused by Japanese cedar pollen (SAR-JCP), the most common form of allergic rhinitis, remains unclear. The aim of this study was to investigate the effect of ASD on SAR-JCP patients.
Methods: A total of 41 patients with SAR-JCP recorded nasal and ocular allergic symptom scores in a diary. We assessed the influence of ASD events on patients with SAR-JCP during the JCP season and before and after the JCP season.
Results: ASD events did not influence nasal and ocular allergy symptoms during the JCP season. Scores for sneezing and runny nose were significantly increased by ASD events in the pre-JCP season. Ocular symptom scores were significantly increased by ASD events in the post-JCP season.
Conclusion: Our results suggest that ASD may exacerbate allergy symptoms even before mass scattering of JCP, which usually does not cause allergic symptoms in patients with SAR-JCP. ASD also induced conjunctivitis symptoms after the JCP season. However, we did not observe any adverse effects of ASD on allergic symptoms during the JCP season.

1. Introduction

The number of patients with seasonal allergic rhinitis caused by Japanese cedar pollen (SAR-JCP) is increasing. Our data from a study of 1540 people indicated that the prevalence of SAR-JCP is 39.6% [1]. Economic losses as a result of SAR-JCP in Japan have been estimated on average to be over $3 billion annually. Therefore, SAR-JCP is regarded as a major public health problem in Japan [2,3]. Allergic rhinitis (AR), similar to other allergic diseases, has a multi-factorial origin that includes genetic and environmental aspects. Regarding genetic factors, it has been found that an interleukin-33 genetic variant is associated with SAR-JCP, which is the most common form of AR in Japan [4], and most recently, we have demonstrated that a genetic variant of the ORMDL3 locus at chromosome 17q21 is associated with SAR-JCP [5,6]. As for the environmental factors, several researchers have reported increasing concerns about the adverse health effects of Asian sand dust (ASD).

ASD arises from the desert areas of China, Mongolia, and Kazakhstan during the spring season. The ASD aerosol spreads over downwind areas including East China, Korea, and Japan. ASD is transported not only across Asia, but also across the Pacific Ocean to the United States [7–10], and it has been reported that ASD is also transported in a full circuit around the globe [11]. The frequency of ASD storms was noted to increase rapidly after the year 2000, and ASD storms might enter a new active period [12]. Similarly, there have been reports about the adverse health effects of Saharan dust [13,14]. In East Asia, ASD events have been significantly associated with an increase in daily mortality in patients with cardiovascular and respiratory disease [15,16] and increased daily admissions and clinic visits for respiratory disease [17–19], AR [20], or conjunctivitis [21]. In Japan, adverse effects on the lower respiratory tract associated with an ASD event, especially in patients with asthma, have been reported [22,23]. JCP is the most common allergen in AR in Japan, and the JCP season almost overlaps with the usual period of ASD events. Although the precise effect of ASD events on the symptoms of SAR-JCP remains unclear, some Japanese otolaryngologists have observed an increase in clinic visits of patients with SAR-JCP who experience worsening symptoms after an ASD event.

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As there are only few reports about the relationship between ASD and SAR-JCP, in this study, we have investigated the relationship between SAR-JCP symptoms and ASD events.

2. Methods

2.1. Study participants

A total of 41 participants, residents of the city of Fukui, Japan, aged ≥20 years, were recruited in 2006 (n = 22) and 2009 (n = 19). Patients with SAR-JCP were enrolled in this study if they had a radio-allergo-sorbent test (RAST) score ≥2 against JCP and allergy symptoms. All participants gave written informed consent before enrollment in the study. We designed the study as far as possible for participants who do not take anti-allergy medications. In this study, patients who took anti-allergic medicine were omitted to exclude the influence of the anti-allergic medicine. The study was approved by the ethics committee of the University of Fukui.

2.2. Measurement of environmental level of Asian sand dust

The city of Fukui is located on the west coast of Japan. Therefore, it seems to be directly affected by ASD because ASD arises from the deserts of East Asia. It is considered that the effect of ASD in Fukui is more severe than that in Tokyo, which faces the Pacific Ocean, because there is a high mountain range in the center of the Japanese Island. We defined ASD extinction days as days when visibility according to measurements of macroscopic visible horizontal distance by the Fukui Local Meteorological Observatory was <10 km because of the effect of ASD.

2.3. Measurement of environmental levels of Japanese cedar pollen

We placed a Durham-type pollen sampler in our laboratory in a position that allowed free air movement on all sides [24]. Glass slides coated with glycerin jelly were exposed to the air for 24 h at a time, and pollen particles collected on the slides were counted daily by microscopy after staining with crystal violet solution (Polysciences, Inc., Japan). The total daily pollen count was expressed as the number of pollen particles per square centimeter.

2.4. Survey of symptoms

The participants recorded symptoms (sneezing, runny nose, stuffy nose, itchy eye, watery eye, and interference of daily life) and medication use in allergy diaries [25]. We assessed symptom changes by summing the scores of each symptom 2 or 3 days before and after ASD events.

2.5. Statistical analysis

All data analyses were performed with Wilcoxon's test using MedCalc Software (Ostend, Belgium). In this study, a p value <0.05 was considered statistically significant.

3. Results

3.1. The effect of Asian sand dust before and during the Japanese cedar pollen season

Symptom diary data were analyzed from the surveillance period (11 February–20 March 2009), which included 5 ASD extinction days: February 15 and 21 and March 16, 17, and 18 (Fig. 1). We defined the days from February 12 to 14, the days before the ASD event in the pre-JCP season, as period I; February 15–17 as period II, the days after the ASD event in the pre-JCP season; March 13–15 as period III, the days before the ASD event during the JCP season; and March 16–18 as period IV, the days after the ASD event during the JCP season.

Sneezing scores significantly increased during period II than period I (0.82 ± 0.60 vs. 1.35 ± 0.98, $p < 0.05$). Runny nose scores also increased significantly during this period (0.98 ± 0.89 vs. 1.45 ± 1.25, $p < 0.05$) (Fig. 2). Scores for nasal obstruction and eye itch did not change in this period (0.40 ± 0.50 vs. 0.60 ± 0.70, p = 0.213; 0.20 ± 0.30 vs. 0.50 ± 0.80, p = 0.260, respectively), and there were no significant changes in any symptom score observed during period IV compared to that observed in period III (sneezing: 1.61 ± 0.90 vs. 1.53 ± 0.87; runny nose: 1.80 ± 1.11 vs. 1.86 ± 1.12; nasal obstruction: 1.20 ± 0.90 vs. 1.20 ± 0.60; itchy eye: 1.10 ± 0.80 vs. 1.20 ± 0.70).

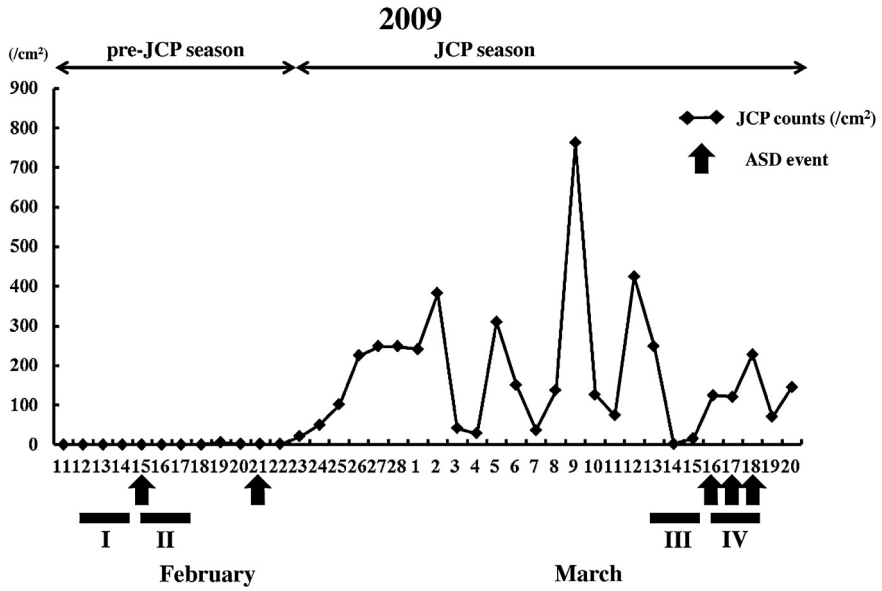

Fig. 1. Japanese cedar pollen and Asian sand dust events in 2009. We defined February 11–22 as the pre-JCP season and February 23–March 20 as the JCP season. Period I, February 12–14, indicated the days before an ASD event in the pre-JCP season, and February 15–17 as period II, the days after the ASD event in the pre-JCP season. March 13–15 as period III, the days before the ASD event during the JCP season, and March 16–18 as period IV, the days after the ASD event during the JCP season.