Case Study

A Case of Occupational Asthma Induced by Falcata Wood (Albizia falcataria)

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The American Thoracic Society issued a statement in 2002 that approximately 15% of adult asthma was likely to be work-related1. Funakoshi et al. reported that the population attributable risk of asthma due to occupational exposure was 22.7% in Japan2. In France, Ameille et al. reported flour (20.3%), isocyanates (14.1%), latex (7.2%), aldehyde (5.9%), persulphate salts (5.8%), and wood dust (3.7%) as agents responsible for occupational asthma. Occupational asthma (OA) induced by wood develops when sawdust is inhaled by a carpenter or log processor3). Occupational asthma, Falcata, Albizia falcataria

In Japan, the first report of OA was in 1926, and it was due to red cedar4). As the amount of imported wood increases, reports of OA due to wood have increased. So far, 17 kinds of wood have been reported5–7). Here we report a case of OA in Japan induced by Falcata (Albizia falcataria), which is distributed in the Moluccas, Papua New Guinea, and Solomon Islands, and is being afforested in Southeast Asia and the Pacific Ocean region.

Case

Case: 72-yr-old man
Chief complaint: Breathing difficulty with wheezing when cutting Falcata.
Personal medical history: Eczema since infancy. Tubercular pleurisy at the age of 28.
Family medical history: Nothing of special note.
Occupational history: Worker in wood furniture production. Had been working with wood since graduation from junior high school. Working in present position since the age of 18.
Smoking status: Nonsmoker, both present and past.
Alcohol consumption: One bottle of beer and two glasses of brandy every day.
Pets: None.

History of present illness: The patient had bronchial asthma at the age of 17. The main symptom was coughing with slight breathing difficulty. At 30 yr of age, he was struck by a severe asthma attack, and was unconscious overnight. From that time, his asthma attacks appeared only at the turn of the season. Control by drug therapy was excellent for about ten years from when he was 60 yr old, and there were no asthma attacks. The patient became conscious of breathing difficulty with wheezing after entering the factory at the age of 70 yr. He began to regularly visit a local doctor’s office once a week. He did not have the complaint of itchy eyes. Theophylline tablets were prescribed three times a day after each meal. Becromesazon inhalation medicine and Predonizoron tablets were prescribed for use during an attack. Recently, he noticed that the symptoms appeared when cutting Falcata with a circular saw. He could not enter the factory when Falcata was being cut. His symptoms appeared even if he entered the factory without knowing that Falcata had been cut. The severity of his symptoms gradually decreased when he left the factory and did not appear with wood other than Falcata. His symptoms disappeared after the processing of Falcata was discontinued.

Two other employees also complained of sneezing, runny nose and voice change after cutting Falcata. However, they did not suffer from breathing difficulty with wheezing. Employees at other factories have also complained of sneezing and runny nose after handling Falcata.

To confirm the diagnosis of occupational asthma (OA) induced by Falcata, the patient was hospitalized at the Osaka Prefectural Medical Center for Respiratory and Allergic Diseases on September 12, 2005. Signed informed consent was obtained from the patient for this study and the bronchial provocation test. This study and the bronchial provocation test were approved by the Hospital Ethics Committee.

Findings on admission: Height 160.8 cm, weight 60 Kg, temperature 36.5°C, pulse 76 beats per minute, blood pressure 140/75 mmHg, SpO2 97%. Neither anemia nor jaundice was found on the mucous membrane. The superficial lymph nodes were not palpable. Breathing and heart sounds were normal. No abnormality was found in the abdomen, limbs, and nervous system.

Chest X-ray on hospitalization: Evidence of tuberculosis that had occurred in the past was found but there was no other abnormality.

Examination results: Serum chemistry showed LDH of 266 IU/L, which is slightly high. Serum total IgE was very high at 17,900 U/ml. The IgE-RAST score for Dermatophagoides, Aspergillus, ragweed, orchard grass, and flour was 4. The IgE-RAST score for cryptomeria, soybean, latex, and Candida was 3. The IgE-RAST score for dogskin debris was 2. The IgE-RAST score for...
formalin was 0.

Pulmonary function test: VC 3.14 l (99.6%), FVC 2.90 l, FEV\textsubscript{1.0} 1.53 l, FEV\textsubscript{1.0} % 52.8%.

Obstructive pulmonary disorder of middle degree was observed. The flow volume on the spirogram showed a typical asthma type. After inhaling bronchodilator medicine, the value of the pulmonary function test improved to FVC 3.50 l and FEV\textsubscript{1.0} 1.73 l, but the improvement rate of FEV\textsubscript{1.0} % was not good at 13%.

We prepared a Falcata antigen extract and conducted testing for allergy.

Antigen extract preparation: Falcata wood dust was extracted (2% wt/vol) in phosphate buffered saline. After 8 h extraction at 4°C, the suspension was centrifuged at 3,000 rpm for 10 min, the pellet was discarded, and the remaining solution was filtered through a 0.22 \( \mu \)m pore size membrane and dialyzed against distilled water by tangential ultrafiltration in 3000 Da cut-off membranes (Millipore, Bedford, Mass). Finally, the extract was cryopreserved. The density of the protein in this extract was 0.69 mg/ml.

Intradermal Tests: The extract was diluted tenfold with the normal saline solution (NSS). NSS was used as negative control. The immediate type reaction was positive for the extract diluted 1000 times while no delayed type reaction was observed.

Precipitating antibody reaction: The subsidence line was observed between the patient’s serum and the extract diluted eight times.

Bronchial provocation test (BPT): To diagnose the OA induced by Falcata, BPT was conducted on September 13, 2005.

From the result of the pulmonary function test, the BPT standard was modified. The decrease in FEV\textsubscript{1.0} % was reduced from 20% or more to 10–15%, considering the subjective symptom, physical condition and clinical findings.

A control challenge with NSS was performed before antigen provocation. BPT was begun with the extract diluted 100,000 times and, if the result was negative, was continued with the extract diluted 10,000 times, 1,000 times, 300 times, 100 times, and 10 times. The aerosolized Falcata extract was inhaled from a jet nebulizer (Nissho type 7A, Azwell, Japan) at tidal breathing for 2 min. Wheezing and defective ventilation of the left lung field were detected by auscultation immediately after the extract diluted 100 times was inhaled. FEV\textsubscript{1.0} was 1.36 l and the decrease in FEV\textsubscript{1.0} % was 12.3%. Therefore, the immediate type response was judged to be positive. Immediately after BPT, a chest X-ray examination was done to examine the defective ventilation of the left lung field, but there was no pulmonic atelectasis. After inhaling the bronchodilator medicine, the abnormality detected by auscultation and the patient’s subjective symptom disappeared, and the value of the pulmonary function test improved to FEV\textsubscript{1.0} 1.69 l. Up to 2 h after inhalation of the bronchodilator medicine, FEV\textsubscript{1.0} was greater than the level before the BPT. However, it returned to the level before BPT after 4 h. FEV\textsubscript{1.0} at 6 h after BPT was 1.49 l and no abnormality was detected in the medical examination and subjective symptoms. Therefore, the late type response was judged
to be negative. The patient was discharged from hospital on the same day. The symptoms of wheezing and breathing difficulty did not appear on the day of hospital discharge nor on the next day. The patient consulted a local doctor 24 h after BPT and was found to be in good condition with no abnormality detected due to the examination.

Discussion

The patient’s asthma is adult-onset asthma of the middle degree. Due to the patient’s age and lack of adequate ventilatory reserve, we judged it dangerous for him to be assigned the criterion of a positivity of 20% or more, which does not match the decrease in FVE₁₀₀ of 12.3%. However, because wheezing was observed by auscultation and as a subjective symptom, the immediate type response was judged to be positive.

Though BPT was originally planned for two days with one-night hospitalization, we canceled the implementation of BPT on the first day because his breath function was unexpectedly bad. BPT was conducted on the second day. The patient could not spend three days in hospital due to his work. The patient’s discharge was permitted on the condition that he reported to us or consulted his local doctor as soon as he felt a bad condition in his body and he consulted his local doctor on the following day. We contacted his local doctor, and obtained her consent.

In OA, a late type response often occurs⁶,⁸, and has been pointed out to involve type III hypersensitivity. The respiratory symptom of this case appeared only immediately after exposure, and only the immediate type response was positive in the BPT. However, the precipitating antibody reaction to the Falcata antigen extract was positive, and the existence of IgG to Falcata was confirmed.

In this case, the IgE-RAST test showed very high scores for many antigens. The patient eats foods containing wheat and soybean but had not experienced any allergic symptoms from them. He goes without a mask during the season of ragweed and cryptomeria pollen, but does not suffer from rhinitis or conjunctivitis. The specific Falcata IgE could not be measured.

Matsumoto et al. reported a case of OA caused by Ayous wood dust⁶. The respiratory symptom appeared not only immediately after exposure but also several hours later, and BPT with Ayous wood extract demonstrated immediate and later type responses (dual response), but the precipitating antibody reaction to the Ayous antigen extract was negative.

Ricciardi et al. reported that 10 patients of OA caused by iroko wood dust underwent tests for allergy⁸. The intradermal test results with iroko extract were positive in 4 patients, whereas the skin prick test result and the specific IgE determination were negative for all patients. BPT with iroko wood extract showed a dual response. Ricciardi et al. suggested that OA due to iroko wood may be induced by immunologic mechanisms other than IgE-mediated immediate hypersensitivity reactions⁸.

Though the mechanism of asthma induced by Falcata is uncertain, the possibility of type I hypersensitivity is suggested because the immediate type response in the intradermal test and the BPT with a Falcata extract were positive. Further research is needed to clarify the OA mechanism of Falcata wood.

The scientific name of Falcata is Albizia falcataria. Falcata is known by many names such as “White Albizia,” “Sengon Laut,” “Tedehu Pute,” “Selawoku,” “Sika,” “Tawa Sela,” “Bai,” and “Wahogon.” It is a broadleaf tree of the legume family, originally from Indonesia i.e., the Moluccas as well as Papua New Guinea and the Solomon Island. It grows rapidly and can be used in about five years. Falcata wood can make land fertile by the peculiar nitrogen fixing activity of the legume family⁹. Therefore, Falcata wood has attracted attention as a solution for environmental problems caused by harvesting timber and is being afforested in the Southeast Asian region.

In Japan, imports of Falcata wood began in 1987. Japanese enterprises use it to promote a good corporate image of concern for the environment. Falcata wood is very light and soft due to its rapid growth. It is easier to handle than other woods, and thus can help prevent work-related musculoskeletal disorders such as low back pain.

Falcata wood is used for furniture, boxes, packing, matches, molding, and pulp. When its wood dust is inhaled, some workers have complained of upper respiratory symptoms such as sneezing and runny nose. This is the first case of OA caused by Falcata wood to be reported.

When the cause of an OA is identified, its removal and avoidance of antigen exposure are most effective for treatment and prevention. However, it is often difficult for workers to comply with these strictures for social and economic reasons. In this case, the patient was a manager as well as a worker at his factory of several employees, and it was thus possible for him to discontinue the handling of Falcata wood.

To the best of our knowledge, this is the first case report of occupational asthma induced by Falcata wood.

References

3) Ameillé J, Pauli G, Calastreng-Crinquand A, Vervloet


