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S. Wongtim

S. Limthongkul

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Baker's asthma : a case report

Somkiat Wongtim*

Sukchai Limthongkul*

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Baker's asthma is a type of occupational asthma wherein a subject develops bronchial asthma from working in a bakery factory. The majority of patients with baker's asthma are allergic to wheat and rye flour. We herein describe the first case report in Thailand of a patient with baker's asthma who has occupationally exposed to flour dust for many years before developing the asthmatic symptoms.

The patient had been worked in a bakery in Bangkok for 16 years and had experienced symptoms of allergic rhinitis for 15 years. Two months prior to examination, he had a dry cough and chest tightness. On physical examination, there were normal breath sounds without wheezing. A pulmonary function test demonstrated normal results. A skin sensitivity to flour extracts test was performed with a positive reaction. He also had positive results for bronchial hyperresponsiveness (PC_{20} 1.2 mg/ml) for a methacholine inhalation challenge test. The specific bronchoprovocation challenge test to flour extracts was also performed with positive results (PC_{20} 4 mg/ml). The patient was treated with a short term of oral corticosteroids followed by long-term inhaled beclomethasone 250 µg bid for 6 months. He had significant improvement in symptom scores and bronchial hyperresponsiveness.

Key words : Baker's asthma, Occupational asthma, Bronchial hyperresponsiveness.

Reprint requests : Wongtim S, Department of Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand.

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สมเกียรติ วงษ์ทิม, ศักดิ์ชัย ลิ้มทองกุล. โรคหอบหืดในคนทำงานนึ่ง: รายงานผู้ป่วย. จุฬาลงกรณ์เวชสาร 2541 ต.ค: 42(10): 953-9

โรคหอบหืดในคนทำงานนึ่งเป็นโรคที่เกิดจากการประกอบอาชีพชนิดหนึ่งซึ่งเกิดขึ้นในคนงานที่ทำงานในโรงงานทำขนมปัง ผู้ป่วยส่วนใหญ่จะมีปฏิกิริยาภูมิแพ้ต่อแป้งสาลีหรือแป้งไรย์ที่ใช้ทำขนมปัง ผู้เขียนได้มีโอกาสพบผู้ป่วยหนึ่งรายซึ่งเป็นรายแรกในประเทศไทยที่มีอาการของหอบหืดจากการทำงานในโรงงานทำขนมปัง ผู้ป่วยเป็นชายอายุ 41 ปี ทำงานในโรงงานทำขนมปังแห่งหนึ่งในกรุงเทพมหานครมานาน 16 ปี โดยที่เขามีอาการของโรคเรื้อรังจากภูมิแพ้มานาน 15 ปี เมื่อประมาณ 2 เดือนที่ผ่านมาผู้ป่วยเริ่มมีอาการไอและแน่นหน้าอก ตรวจร่างกายไม่พบเสียงผิดปกติในปอด การตรวจสมรรถภาพปอดคืออยู่ในเกณฑ์ปกติ ผู้ป่วยได้รับการทดสอบผิวหนังด้วยน้ำยาสกัดจากแป้งไรย์ซึ่งปฏิกิริยาได้ผลบวก หลังจากนั้นผู้ป่วยได้รับการทดสอบเพื่อวัดความไวของหลอดลมด้วยน้ำยาเมทาโคลิน พบว่าหลอดลมมีความไวโดยมีค่าระดับความเข้มข้นของน้ำยาที่ทำให้สมรรถภาพปอดลดลงจากเดิม 20 % (PC_{20}) ประมาณ 1.2 มก./มล. และเมื่อทดสอบความไวของหลอดลมด้วยน้ำยาสกัดจากแป้งไรย์ก็ได้ PC_{20} ประมาณ 4 มก./มล. ผู้ป่วยได้รับการรักษาด้วยยาคอร์ติโคสเตอรอยด์ชนิดพ่น และขยายหลอดลมชนิดพ่นเป็นเวลานาน 6 เดือน ผู้ป่วยมีอาการดีขึ้น และความไวของหลอดลมดีขึ้นเป็น 3.5 มก./มล. และ 5.5 มก./มล. ตามลำดับ

People working as bakers are exposed to flour dust, potentially contaminated by fungi or mites, and polycyclic aromatic hydrocarbons from products formed during cooking as well as nitroso compounds from cooking byproducts.⁽¹⁾ It has been estimated that about 10-20% of bakers suffer from baker's asthma.⁽²⁾ In some countries, baker's asthma is the most prevalent type of occupational asthma. The majority of patients with baker's asthma are allergic to wheat and rye flour.⁽³⁻⁴⁾ Although there are many bakery factories in Bangkok, there has been no report of this disease in Thailand. Herein we describe a patient with baker's asthma who was exposed to flour dust for many years before developing the asthmatic symptoms.

Case report

A 41-year-old Thai man was referred to the Chest Unit, Chulalongkorn Hospital because of dry cough and chest tightness for 2 months. The patient had been diagnosed with allergic rhinitis for 15 years, one year after he began working as a baker in a bakery. He was administered antihistamine and nasal decongestant for symptomatic treatment and also occasionally with topical nasal corticosteroids. He never smoked. His family had no atopic tendency.

On physical examination, his temperature was 37°C with pulse rate 80/min, respiratory rate 20/min and blood pressure 120/80 mmHg. The jugular venous pressure was normal and the heart was normal without murmur. The lung was normal with no wheezing.

The hemoglobin was 12 gm/dl and the white blood cell count was 5100, with 70 percent neutrophils, 20 percent lymphocytes, 8 percent eosinophils and 2 percent monocytes. The blood chemistry was normal.

The chest roentgenogram was normal. Pulmonary function studies demonstrated that the FVC was 2.67 L (72.5%) predicted. The FEV₁ was 2.43 L, the FEV₁/FVC 91%, peak expiratory flow rate 7.26 L/S. He was suspected to have baker's asthma. The skin reactivity to allergens test, including flour extracts as well as the methacholine inhalation challenge and specific bronchoprovocation test were performed.

Extracts of rye flour were prepared by shaking the flour (100 gm) in phosphate-buffered saline (PBS) 500 ml at 4°C for 24 hours. The solution was then centrifuged at 1000 rpm for 15 min. The supernatant was filtered through filter paper. The filtrate was collected and then sterilized through millipore filter before use. The final concentration was 20% W/V. The concentration prepared for skin tests and inhalation tests were 0.002, 0.02, 0.2, 2 and 20% by making ten fold serial dilutions of the flour extracts.

Skin tests were performed by the prick method using three commercially available allergens: House dust and mites (*Dermatophagoides farinae*), cockroach, and mixed molds, as well as our own preparation of rye extracts. Phosphate-buffer saline and histamine phosphate were used as negative and positive controls, respectively. The wheal diameter was measured in two perpendicular directions at 15 minutes and the mean wheal diameter for each dilution was calculated. A positive skin reaction to the flour extracts was defined as the concentration that produced a mean wheal diameter of 2 mm. or more. It revealed that the 0.2 dilution produced the positive skin test.

The procedures for bronchoprovocation tests with methacholine and antigens has been described previously.⁽⁵⁾ Briefly, measurement of FEV₁ and FVC

were made by the best spirometric maneuver with two reproducible results before the test. The methacholine concentrations used were 0, 0.25, 0.5, 1, 5, 10 and 25 mg/ml. (diluent, PBS as control). The solutions were nebulized using the Pari Provocation test I (Pari Sternberg, Germany) and the aerosol was kept in the reservoir bag before inhalation by the subject via inspired and expired vital capacity until the bag was empty. The spirometric tests were repeated at 3 min after each inhalation. The test was terminated when the FEV_1 was decreased by 20% or more from the post-PBS level. The results were expressed as the provocative concentration of methacholine that produced a 20% decrease in the FEV_1 (PC_{20}) which was interpolated from the dose-response curve. It revealed that this patient had $PC_{20} = 1.2$ mg/ml. (Figure.1). The patient was then reversed by reversed by administration of short-acting β_2 agonist.

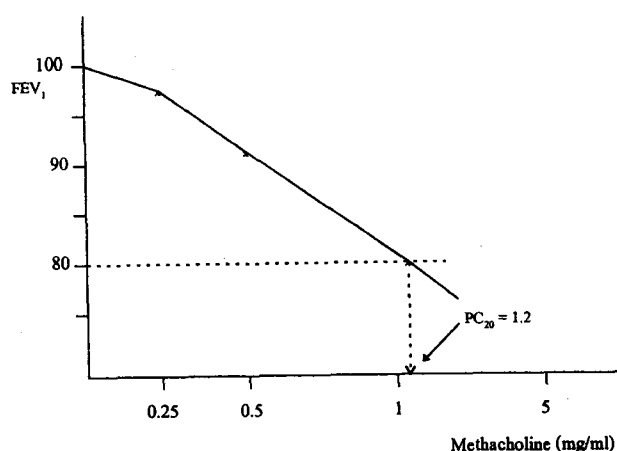


Figure 1. Methacholine challenge test showing $PC_{20} = 1.2$ mg/ml.

Bronchoprovocation tests with the flour extracts were performed on the same day as the methacholine test, 1 hr after the FEV_1 and FVC had

returned to the baseline level. The dilution that gave a positive skin testing (2 mm wheal) was used as the initial concentration, (0.2% W/V dilution). The procedure was continued to the next higher concentration and it was terminated when then the FEV_1 was decreased by 20% from baseline and PC_{20} also could be interpolated from the dose response curve (4 mg/ml) as shown in figure 2. Measurements of spirometric value were made every 2 hr for 6 hours to demonstrate the late phase reaction.

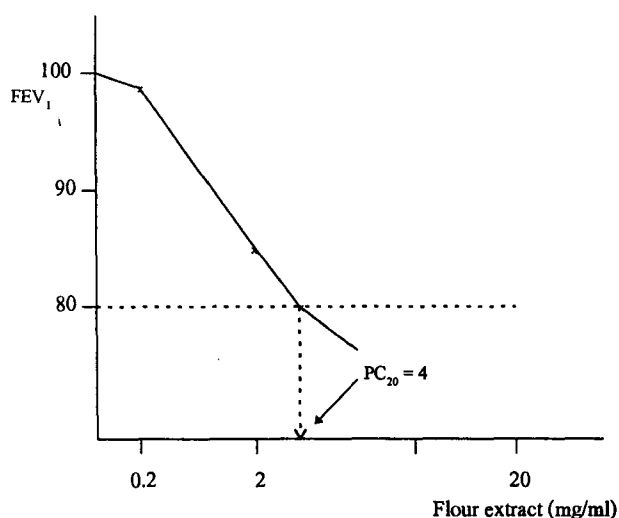


Figure 2. Bronchoprovocation test with flour extract showing $PC_{20} = 4$ mg/ml.

The patient was administered inhaled corticosteroids (beclomethasone 500 μ g bid) for six months and inhaled β_2 agonist (salbutamal 200 μ g) when needed. Then, methacholine inhalation and bronchoprovocation with flour extracts were repeated again. It was found that PC_{20} to the methacholine and the flour extract were improved significantly to 3.5 mg/ml and 5.5 mg/ml respectively, ($p < 0.05$) (as shown in Figure. 3).

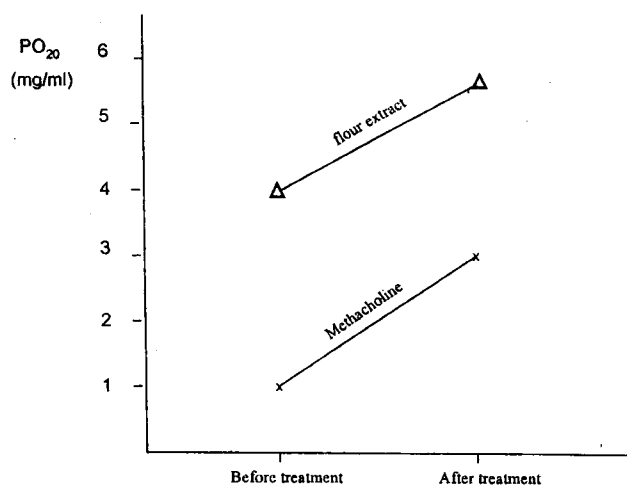


Figure 3. PC_{20} to methacholine and flour extract were improved after the treatment

Discussion

This is the first case of Baker's asthma reported in Thailand. By conjecture there should be many people with asthma symptoms due to occupational exposure to flour in this country but they are unrecognized because it has been estimated that about 10-20% of bakers and grain workers have work-related respiratory symptoms.⁽⁶⁻⁸⁾ No appropriate epidemiologic study has ever been done in Thailand. This case had a definitive diagnosis of asthma due to flour exposure because the skin test and the bronchoprovocation test to the flour extract were positive. The diagnosis of Baker's asthma is usually based on a compatible clinical history, presence of reversible airflow limitation, presence of nonspecific bronchial hyperresponsiveness and the positive skin test to the flour extract.⁽⁹⁾ Nonspecific bronchial hyperresponsive (NBHR) usually evaluated by methacholine inhalation test is the characteristic feature of asthmatic patients.⁽¹⁰⁾ The definitive tests for the diagnosis of occupational asthma are the bronchoprovocation challenge test with the specific agent and the demonstration of specific IgE to the

causative agent by RAST.⁽¹¹⁻¹³⁾ This case was shown to have positive specific bronchoprovocation challenge and reaction to the flour extract. The assessment of NBHR evaluated by methacholine should be performed before the specific bronchoprovocation test. Because in the case of exaggerated NBHR, it was recommended to start with very low concentration of the challenging agent to prevent serious reaction. Betaagonist may have some effect on the PC_{20} of the bronchoprovocation with flour extract. However, we used shorting β_2 agonist and waited at least one hour before the specific challenge to get the minimal interference.

The onset of respiratory symptoms in Baker's asthma varied between a few months to a few years after flour exposure.^(1,14) The onset of asthma was usually preceded by nasal symptoms, such as sneezing, rhinorrhea and itchy eyes that represented allergic rhinoconjunctivitis. The majority of patients with Baker's asthma were allergic to wheat and rye flour. There was also much cross reactivity between antigens in these flours and those in other cereals, such as barley and triticals, but less to oats, corn and rice. By counter immunoelectrophoresis study, there were about 40 different allergen identified from wheat extract. However, the major allergens were found in albumin, globulin, gliadin and glutinin fractions.⁽¹⁵⁾

Other antigens such as fungie, (eg Aspergillus and Altenaria) and grain mites (Glycyphagus destructor) which contaminated the flour have been implicated as the sensitized causes of asthma in bakers. Food additives such as alpha-amylase, and papain used in bakeries, could also cause asthmatic sensitization in these workers.^(16, 17)

Prevention is the best method of management of asthma in bakery workers. They should avoid

exposure to the sensitizing agents by changing to other types of work. However, many sensitized bakers still had symptomatic asthma even after they left the bakery industry. If the subject can not change the type of work they should use a protective device such as a respirator to decrease the allergen exposure, and also use other engineering methods to decrease the dust in the worker room. Symptomatic cases should be treated with inhaled bronchodilators such as β_2 agonist to relief the bronchoconstriction and inhaled corticosteroids to suppress airways inflammation. It was shown that inhaled corticosteroid could diminish the frequency of acute asthmatic attacks and improve the degree of bronchial hyperresponsiveness.

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