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Occupational Asthma and Farming[1]

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Respiratory hazards that farmers and family members may be exposed to include various grains that can be contaminated with fungi, bacteria or microbial toxins; pesticides; solvents; gasoline and diesel fuels; and irritant gases such as oxides of nitrogen and ammonia. The specific issue to be discussed in this CMASH newsletter is occupational asthma.

Occupational asthma is asthma which occurs after a variable period of symptomless exposure to a known sensitizing agent. Known sensitizing agents on the farm include both plant and animal matter. Known allergens related to farming include:

- Plant
  - Grain dust (all types of grain)
- Animal
  - Cow dander
  - Cow urine
  - Egg yolk proteins
  - Fungi
  - Grain mite
  - Grain weevil
  - Meal worm
  - Pig urine
  - Pig dander (Alternaria, Aspergillus, Cladosporium)
  - Poultry mites
  - Poultry dander
- Chemicals
  - Antibiotics used in feed (spiramycin, amprolium)
  - Formaldehyde
  - Glutaraldehyde

A farmer works with a large amount of organic matter. Many times this work is in a confined space such as a swine confinement barn, silo or chicken coop. Because of limited ventilation in these structures, the concentration of potential allergens in the air is markedly increased.

The typical clinical presentation is that the patient has increasing symptoms of shortness of breath, wheezing or chest tightness which eventually causes the farmer to seek medical care. Many times farmers will have repeated diagnoses of "bronchitis" before the recurrent nature of the condition suggest asthma. Farmers may have been exposed their whole life (i.e. many years) before becoming sensitized.

Four patterns have been recognized in response to exposure to allergens. There is an immediate response (symptoms occur 10 minutes to an hour after exposure), a late response (symptoms occur 6-12 hours after exposure), a dual response (patient has both immediate and late symptoms), and a recurrent nocturnal response (see Figure 1). Other than the immediate response pattern it is extremely difficult from the history to see a clear association between a farm exposure and asthma.

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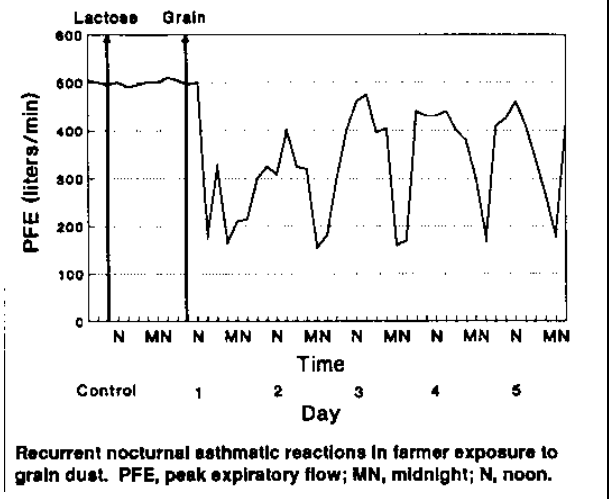
Unlike non-farm work, where the patient is generally exposed to the allergen only on specified work days, the farmer may be exposed to the allergen seven days a week. However, an attempt should be made to see if there is a pattern related to certain work activity, remembering that the asthma reaction may be delayed from the time of exposure. As the asthma becomes chronic, the farmer may now react to many irritants and only a careful review of the period when the symptoms began may reveal an association with a particular allergen. Additionally, data from factory workers with occupational asthma indicates that the longer patients with work-related asthma are exposed to the allergen which causes their symptoms the more likely their symptoms will persist, even when they are removed from exposure.



Recurrent nocturnal asthmatic reactions in farmer exposure to grain dust. PFE, peak expiratory flow; MN, midnight; N, noon.

Figure 1.

Farmers with work related asthma will typically have a positive methacholine challenge test and an elevated serum IgE. They may or may not have eosinophilia. Skin tests with the normal battery of antigens such as pollens, molds, cat and dog dander may or may not be positive. Since these skin tests are positive in up to 20% of asymptomatic individuals, they are not helpful in excluding a specific farm-related allergen. Serum RASTs are commercially available for a large number of potential farm-related allergens. Commercially available RASTs for farm related allergens include:

- Plant
  - Grain dust
  - Specific types of grain (i.e. corn, rye, wheat)
- Animal
  - Chicken feathers
  - Cow dander
  - Duck feathers
  - Egg proteins
  - Goat epithelium
  - Goose feathers
  - Horse hair
  - Molds
  - Rabbit hair
  - Rabbit epithelium
  - Sheep epithelium
  - Storage mites
  - Swine epithelium
  - Turkey feathers

The sensitivity and specificity of the RAST varies by substance. A positive test only documents exposure, it does not document that a particular antigen is the causal agent.

There are other exposures on a farm which can make a farmer wheeze. These include overexposure to ammonia (used as a fertilizer or a waste gas in a swine confinement barn), overexposure to organophosphate pesticides (pharmacological reaction), and overexposure to oxides of nitrogen (silo-filler's disease or its late sequalae, bronchiolitis obliterans).

A farmer may also have non-work related asthma but his/her symptoms are exacerbated by exposure to non-specific irritants such as grain dust. This can be recognized by an onset of asthma which predates farm exposures and/or is clearly caused by some non-farm allergen.

If possible, it is important to determine the specific allergen. The most effective treatment for asthma is to eliminate or minimize allergen exposure. Improved ventilation, proper respiratory protection or having another person do a particular task are all potential ways to intervene. Documentation of a particular allergen is done by reviewing the potential association between the patient's symptoms and exposures and following up with lung function studies. Changes in pre- and post--exposure PFTs, decreasing methacholine sensitivity with removal from exposure, and peak flow monitoring are all objective methods of following up on a patient with suspected occupational asthma. Peak flow monitoring is the least expensive and most sensitive method.

Detailed instructions for conducting and evaluating peak flow measurements used to determine the etiologic

allergen in work related asthma are available from us on request (1-800-446-7805).

At the minimum, primary treatment is to reduce exposure. Ideally the patient is able to eliminate the exposure. Given the potential economic consequences of this removal, some patients elect to continue working. Steroid and/or cromolyn inhalants to prevent asthma attacks are typically used in such situations.

How much occupational asthma occurs among farmers in Michigan is not known. A study of farmers in Scotland found a 15% prevalence of occupational asthma or rhinitis. We are interested in how often occupational asthma in farmers is diagnosed in Michigan and would appreciate it if you would write Ken Rosemnan, M.D., B-338 Clinical Center, Michigan State University, East Lansing, MI 48824 or call 1-800-446-7805 if you have patients with this diagnosis.

SELECTED LITERATURE REVIEWS

Schwartz DA, Landas SK, Lassise DL, Burmneister FF, Hunninghake GW and Merchant JA. *Airway Injury in Swine Confinement Workers.* Annals of Internal Medicine 1992; 116:630-635.

Author Abstract:

- **Objective:** To determine whether work-related respiratory symptoms are indicative of underlying lung disease among swine confinement workers and, if so, to identify whether respiratory changes were more indicative of airway or of interstitial lung injury.

- **Design:** Nested case-control study within a population-based longitudinal study. Setting: University hospital.

- **Participants:** Study participants were randomly selected from a group of 207 swine confinement workers followed longitudinally. Of these, 43 workers with respiratory symptoms were identified, and 31 were randomly selected for inclusion in this study. Three control groups (swine confinement workers, neighbor farmers, and blue collar workers) without work-related respiratory symptoms were frequency-matched by age, sex, and smoking status to the symptomatic swine confinement workers.

- **Measurements:** Spirometry and lung volumes, diffusing capacity of carbon monoxide, chest radiograph, methacholine airway challenge, and bronchoalveolar lavage were done. An endobronchial biopsy was done in the last 27 participants evaluated.

- **Results:** Although spirometric measures of airflow were similar between the symptomatic swine confinement workers and the three control groups, swine confinement cases were found to have significant elevations in residual volume (126.5 ± 28.2 L) when compared to swine confinement controls (115.4 ± 38.4 L; $P \leq 0.05$), neighborhood farmer controls (101.1 ± 29.4 L; $P \leq 0.005$), and blue collar controls (106.4 ± 30.4 L; $P \leq 0.05$). Swine confinement cases also had an enhanced airway response to inhaled methacholine and had thickening of the epithelial basement membrane of the lobar bronchi. No parenchymal injury was observed in the swine confinement cases.

- **Conclusions:** Our findings suggest that swine confinement workers who have work-related respiratory symptoms are at risk for airway, but not parenchymal, lung injury, and that spirometry may not accurately reflect the extent of airway injury.

Ylonen J, Mantyjarvi R, Taivainen A, and Virtanen *T. IgG and IgE Antibody Responses to Cow Dander and Urine in Farmers With Cow-Induced Asthma.* Clinical and Experimental Allergy 1992; 22:83-90.

Author Abstract. Cow-asthmatic farmers' and negative control subjects' IgG and IgE antibody responses to bovine epithelial antigen (BEA) and urinary antigen (BUA) were studied by enzyme-linked immunosorbent assay (ELISA) and Western blotting. The anti-BEA IgE responses of 10 highly reactive sera were also studied by crossed radio immunoelectrophoresis (CRIE). The relative amount of allergens common to both BEA and BUA was measured by IgE ELISA inhibition and found to be 3%. In immunoblotting the IgG reactivity of the asthmatic farmers to BEA and BUA declined along their anti-BEA IgE ELISA titres. Control subjects had IgG antibodies mainly to high molecular weight components (50-70 kD) but lacked detectable IgE responses. The IgE reactivity of the asthmatic farmers was directed to only a few components. A total of two main allergens were found in cow dander (20 and 22kD) and one in cow urine (2OkD). The 20 kD component was shown to be the most important allergen in cow antigen extracts. In CRIE, seven reactive arcs were detected. Arcs 1, 2 and 5 were detected by all 10 sera and arc 3 by six and arc 7 by seven sera.

FOCUS MEETING ON AGRICULTURAL ILLNESS AND INJURIES SCHEDULED

We are in the process of preparing a report on agricultural illness and injuries in Michigan.

We will be holding five regional meetings with farmers, farm representatives and cooperative extension service agents around the state to discuss the report. We will be developing workplans from these meetings to reduce the occurrence and morbidity of agricultural illness and injuries. The meetings will be held around Saginaw, Kalamazoo, Ingham, Traverse City and Marquette. If you are interested in attending, please write or call us at 1-800-446-7805.

REFERENCES

Chaii-Yeung M, Enarson DA and Kennedy SM. *Impact of Grain Dust on Respiratory Health.* American Review of Respiratory Disease 1992; 145:476-487.

A good review of the health effects of grain dust from the acute (asthma, grain fever, harvester's lung disease) to the chronic (COPD).

Chan-Yeung M and Lam S. *State of Art: Occupational Asthma.* American Review of Respiratory Disease 1986; 133:686-703.

Still the best review of occupational asthma.