Abstracts

Abstracts for AOHC Session 2102

Frontiers in Occupational and Environmental Medicine

1 Comparison of the Prevalence of Sensitization to Common Allergens in Workers Exposed and Unexposed to Animal Allergens

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Background: Exposure to high molecular weight occupational allergens, such as laboratory animal allergens, is associated with a high prevalence of allergic sensitization to these allergens. Additionally, sensitization to occupational allergens may promote sensitization to common aeroallergens.

Objective: We aim to compare the prevalence of allergic sensitization to common aeroallergens among laboratory animal workers to that of demographically similar worker groups unexposed to animal allergens. We will also examine the prevalence of sensitization to common allergens as a function of race/ethnicity and socioeconomic status.

Methods: Cross-sectional data from university employees in three departments were collected. Demographic, occupational and medical variables were determined by questionnaire. Skin prick testing for laboratory animal and common allergens was performed. Serum IgE latex antibodies were measured.

Preliminary Results: 110 workers from three university departments have been tested and enrollment is ongoing. Data analysis will focus on prevalence rates of sensitization by department, controlling for demographic variables.

2 A Proposed Curvilinearity Index for Quantifying Airflow Obstruction.

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Background: While FEV_1 is the primary indicator of airway obstruction, curvilinearity in the expiratory flow-volume curve is used to support the quantitative assessment of obstruction by FEV_1. Currently, there is no available index to quantify a pathological contour of curvilinearity.

Study Purpose: We propose a "curvature" index (k_{max}) and compare FEV_1 values to the index in a sequential sample of spirometric data.

Methods: A hyperbolic function ($b_0Q + b_1Q \cdot V + b_2V = 1$) is fit to a fixed segment of the descending phase of the expiratory flow-volume curve where Q = flow rate and V = volume. Three coefficients (b_0 , b_1 , b_2) are estimated from the patient's flow-volume data. A previously developed biomechanical interpretation of this relationship associates the coefficient b_1 with the rate of airway-resistance increase as exhaled volume increases. A global curvature index k_{max} ($= b_1 / \sqrt{2}(b_0b_2 + b_1)$) is defined to quantify the curvilinearity phenomenon.

Analyses and Results: Sixty seven (67) sequential patients undergoing pulmonary function testing were analyzed for k_{max} and FEV_1 using the statistical program SYSTAT. Individual k_{max} estimates appeared to correspond well with the degree of curvilinearity observed and were related, in an exponential manner, with FEV_1.

Conclusions: We defined a curvature index to quantify the curvilinearity phenomenon observed in the expiratory limb of the flow volume loop tracing of patients with obstructive lung disease. This new index uses data from a major segment of the tracing and our preliminary data finds an exponential relationship with FEV_1. It allows the putative association between curvilinearity and obstructive lung disease to be examined quantitatively in clinical practice and in future epidemiological studies of pulmonary function.

3 Severity Measured in Chicago Public House Projects by Using PH of Exhaled Breath Condensate

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Background: The pH of exhaled breath condensate (EBC) is a promising biomarker in measuring asthma severity. To date there have been no studies of EBC pH among public housing residents. We conducted a study to determine the relationship between asthma severity and EBC pH in such a population.

Method: Subjects were recruited in Chicago public housing developments. Asthma severity was measured using national guidelines. EBC samples were collected and pH was measured. EBC pH is being compared to asthma severity scores.

Results: Fifty-five residents living in 3 different developments enrolled and 49 of them produced sufficient quantities of EBC for pH measurement. Data analysis is ongoing.

Significance: EBC pH collection and measurement is possible in the setting of public housing developments. Because EBC pH measurement is objective, repeatable, and non-invasive, it may prove to be useful in studies of the respiratory effects of occupational and environmental exposures.

4 An Observational Study of Prophylactic Antibiotic Therapy in Anthrax Workers at the United States Postal Service Trenton, New Jersey Processing and Distribution Center

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Objective: The objective is to evaluate the risks and benefits associated with anthrax antibiotic prophylaxis in a population of workers, who were involved in the remediation of an anthrax-contaminated postal facility.

Methods: During the period from October 26, 2001 until October 26, 2003, 344 remediation workers were involved in the clean-up of the Trenton Postal Distribution Center (PDC), which had been contaminated with B. anthracis spores in October 2001. An occupational medicine provider prescribed anthrax antibiotic prophylaxis with doxycyline to interested individuals. Workers taking doxycyline were monitored for adverse drug side effects and anthrax infections every two weeks via questionnaires and telephone conversations.

Results: Of the 244 remediation workers, who entered the study, 52 declined antibiotic prophylaxis prior to entering the Trenton PDC. Of the 292 workers left, 209 reported no significant antibiotic side effects and 83 reports significant side effects. Of these 83 remaining workers, who experienced side effects, 64 discontinued their antibiotic prophylaxis, while 19 continued therapy despite the side effects. These 19 workers experienced significantly more vomiting ($p=0.01$) and diarrhea ($p=0.026$) than their 64 fellow workers, who discontinued antibiotic prophylaxis. There were no reported cases of anthrax infections.

Conclusions: Three hundred forty-four remediation workers entered a postal facility, which had a significant potential for infection with B. anthracis. Out of this cohort, 116 workers declined antibiotic prophylaxis initially or after experiencing antibiotic side effects, yet no worker contracted anthrax. This may have been due to the time-honored practices of administrative controls, engineering controls, and personal protective equipment. Therefore, we conclude that, in the setting of the proper use of personal protective equipment, antibiotic prophylaxis against anthrax may not be necessary.

5 Description of a medical screening program for utility workers exposed at the World Trade Center Site.

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Background: This is the first description of a cohort of electrical utility workers involved in the rescue and rebuilding efforts at the World Trade Center. The utility company initiated its World Trade Center screening program in February 2002. The screening program has evaluated over 3,000 workers.

Methods: This report is a description of the medical screening program; details of the medical screening exam, history taking and a description of an exposure index (EI). The EI is a numerical score based on several exposure factors. The factors include: location within the World Trade Center zones, amount of time spent within the zones, use of respirator, and job type.

Results: We examine the cohort to see if those with a higher EI have increased medical symptoms and determine if the EI is a useful clinical instrument.

6 Profile of Massachusetts Firefighters Retiring under Heart Presumption Legislation: 1997–2004

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Abstract: Coronary heart disease (CHD) is the leading cause of lifetime mortality among firefighters and accounts for 45% of "on-duty" deaths. 38 states compensate firefighters who develop CHD by law. However, little is known regarding the occupational and medical risk factors underlying these disability retirements.

We propose to describe the profile of 281 firefighters awarded retirement pensions (1997 to 2003) for heart disease death or disability from the Commonwealth of Massachusetts. We will compare those retiring due to "on-duty" disease events with those retiring due to cumulative CHD (manifesting off-duty). We will also compare the CHD retirees with a control group of 310 well-characterized Massachusetts firefighters examined in 1996/1997 and documented to be alive and professionally active in 1998.

7 Concentrated ambient fine particles (CAFP) paradoxically increases heart rate variability in aged rats

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Background: Epidemiologic studies reveal strong association between increased short-term particulate pollution and increased cardiovascular morbidity in elderly; seen as decreased heart rate variability (HRV) from increased sympathetic tone leading to arrhythmias. This study measures response to CAFP using aged rat as surrogate model.

Method: Ten 22 month old rats implanted with telemetric ECG devices. Five animals exposed to CAFP while 5 breathed filtered air over 3 days. Pre and post-exposure ECG

recordings analyzed for HRV and heart rate (HR). Statistical analysis: one-way ANOVA.
Results: Animals responded acutely to CAFP with increased HRV and decreased HR, suggestive of increased parasympathetic tone. Controls showed acclimation. HRV and HR fully reversible. No significant differences due to small number of animals.
Conclusions: Findings paradoxical to epidemiologic studies. CAFP may stimulate irritant receptors in upper airway triggering overall vagal response in rats. Why this mechanism dominates in rat, and not in human, needs further research.

8 Occupational and Nosocomial Exposure from Patients Presenting with Acute Generalized Vesicular-Pustular Rash Illnesses (VPRI)

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Background: VPRI are usually contagious, and isolation delays pose exposure risks for healthcare workers (HCW) and the community that have not been well described previously. We evaluated acute VPRI admissions to Emergency Departments (ED) and inpatient units for diagnoses and exposure potential.
Methods: Patients with acute VPRI were enrolled prospectively at 13 hospitals. Study hospitals had an average of 462 beds and 35 negative-pressure rooms (range 24–96). Detailed information on exposure and diagnoses was collected from patient/staff interviews and active patient charts.
Results: Of 35 patients with acute VPRI (27 with varicella), 28 had a respiratory pathogen; 67% were placed in respiratory isolation within 15 minutes. Thirty-four had a pathogen spread by contact; 45% were placed in contact isolation within 15 minutes. 38 HCWs had 15 minutes exposure to study patients in the ED; 211 other patients were exposed to study patients in the ED. Advance hospital notification was received in 10 cases.
Conclusions: VPRI are usually contagious. Delayed isolation can result in significant exposures for HCWs, patients and visitors. Infection control processes for VPRI can be improved.

9 Health Effects of Methamphetamine Laboratory Investigation in Law Enforcement Personnel

Roxana Witter, MD. Occupational Medicine Residency, University of Colorado Health Science Center/National Jewish Hospital
Background: Investigation of illicit methamphetamine (meth) manufacturing laboratories can expose law enforcement officers to dangerous levels of hydrochloric acid, iodine, ammonia and methamphetamine. Little is known about the health consequences of these meth lab exposures.
Methods: This investigation used a detailed questionnaire to ask 300 federal, state and local law enforcement personnel about their meth lab exposures, use of personal protective equipment (PPE) and health effects.
Preliminary results: 60% of law enforcement personnel responding to the questionnaire had some kind of health effect as a result of meth lab investigation. The predominant health effects include headaches, respiratory systems effects, sore throat and skin problems. Respirators and other PPE are used in 70–80% of investigations.
Conclusions: Methamphetamine lab investigation is associated with high amounts of health effects. PPE use is not universal. Further analysis will investigate if exposure characteristics, PPE use and host factors are predictive of meth lab associated symptoms.

10 A Preventive Program for Decreasing Sensitization in Beryllium Workers

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Background: A beryllium ceramics facility used engineering to reduce airborne beryllium levels. Workers hired subsequently were not protected from beryllium sensitization (1998 sensitization prevalence in workers with 2 years or less since hire 11.9% (7/59)). The company initiated a comprehensive exposure reduction program incorporating increased respiratory and dermal exposure prevention and particle migration control.
Methods: New employees were administered the blood beryllium lymphocyte proliferation test at hire and 3, 6, 12, and 24 months of employment. We considered those with 2 abnormal tests to be sensitized.
Results: Between 1/2000 and 8/2004, 99 were hired who worked at least 3 months; we excluded 4 with abnormal tests at hire and 3 without periodic tests. One employee became sensitized, at 24 months (1.1%, 1/92). This is significantly lower than the 11.9% (7/59) prevalence observed previously.
Conclusions: This preventive program successfully reduced beryllium sensitization among workers in the first 2 years of employment.

11 Associations among Patella and Other Lead Biomarkers, Renal Function and Genetic Polymorphisms in Korean Lead Workers

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Data from the third evaluation in a longitudinal study of current and former lead workers were analyzed in order to compare and contrast associations between patella lead and renal function with those of other lead measures and assess effect modification by genotype on these associations. Renal function was assessed with blood urea nitrogen, serum creatinine, measured and calculated creatinine clearances, and urinary N-acetyl-β-D-glucosaminidase (NAG) and retinol-binding protein. Polymorphisms for the genes encoding δ-aminolevulinic acid dehydratase, endothelial nitric oxide synthase, and the vitamin D receptor were studied. In 652 lead workers, mean (SD) blood, patella, and tibia lead were 30.9 (16.7) μg/dl, 75.1 (101.1) and 33.6 (43.4) μg Pb/g bone mineral, respectively, and were correlated (Spearman's $r = 0.51 - 0.74$). Patella lead was associated ($p < 0.05$) with NAG in all lead workers. In models of effect modification by age, higher patella lead was also associated with higher serum creatinine in older participants. Similar associations were observed for blood and tibia lead. No effect modification on associations between patella lead and renal function by any of the genotypes was observed.

12 Arsenic Methylation and Genetic Polymorphisms in a Bladder Cancer Case-Control Study in Argentina

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Background: Exposure to arsenic is a major health concern worldwide. Many studies have shown that ingestion of arsenic in drinking water is a strong risk factor for several forms of cancer.
The main metabolic pathway for ingested inorganic arsenic is methylation, and the end metabolites of this process are methylarsonic acid (MMA) and dimethyl arsinic acid (DMA), which are excreted in urine. MMA may be the most toxic metabolite of this process, as several studies have shown a relationship of higher MMA to cancer. In addition, certain genetic polymorphisms in arsenic methylation regulation have been related to an increased risk of cancer.
In this study, we propose to investigate the relationship of these genetic polymorphisms to the relative proportion of MMA in the urine.
Methods: Cases and controls for bladder cancer were obtained from a bladder cancer case-control study in Argentina where there is a relatively high exposure to arsenic in water. Details of this study have been published elsewhere.
Buccal cells were obtained from all cases and controls as a source of genomic DNA and were tested for GST (M1, T1), MTHFR, and NQO1 polymorphisms. Urinary samples were also obtained from each case and control and urinary concentrations of metabolites were measured.
Statistical analysis of the relationship between genetic polymorphisms and the relative proportion of arsenic species in urine will be performed. Our hypothesis is that certain genetic polymorphisms are related to the proportion of MMA in the urine, and thus are related to the risk of cancer.

13 The Association between Whole-Body Vibration Frequencies and Lower Back Disorders among Urban Taxi Drivers

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Objective: To explain how the analysis of vibration frequencies can be used to understand the contribution of vibration to lower back disorders. **Background:** Long-term whole-body vibration (WBV) exposure is associated with low back pain, sciatica, early spinal degeneration, and herniated lumbar disc.
Methods: 247 male taxi drivers contributed 432 WBV measurements. The Nordic Musculoskeletal Questionnaire was used to access the lower back pain prevalence among the drivers. Each WBV measurement is being characterized by the ordinal number of frequency peaks, by the distribution of the peaks around 1–2 Hz, 4 Hz, and 10–20 Hz, and by the maximum amplitude. Four Hz was chosen as one of the key frequencies of the investigation because it is the natural resonant frequency of the spine. By analyzing the vibration frequency distribution and self-reported lower back pain with logistic regression, we hope to determine which vibration frequencies are most detrimental to the human spine.