Sensitivity of Spirometric Measurements to Detect Airway Obstruction in Infants


Purpose of the Study. To demonstrate the ability of forced expiratory flow (FEF) volume curves from increased lung volumes to discriminate among infants with differing severities of respiratory symptoms and to compare the ability of variables used to quantify the flow volume curves to detect airway obstruction.

Study Population. Infants referred to a pediatric pulmonary clinic were classified into 2 groups. Group 1 patients had previous respiratory symptoms but were asymptomatic on the date of evaluation. Group 2 patients were symptomatic with current respiratory symptoms, such as coughing, rhonchi, or wheezing on the date of evaluation.

Methods. Before spirometry, infants received 50 to 75 mg/kg chloral hydrate orally; measurements were obtained while the infants were sleeping in the supine position. Forced expiratory maneuvers were performed with the increased-volume, rapid-thoracic compression technique. Flow volume curves were quantified with forced vital capacity (FVC), FEF at 50% of FVC, FEF at 75%, forced expiratory volume in 0.5 second (FEV0.5), and FEV0.5/FVC, which were expressed as z scores.

Results. All variables except FVC had z scores that were significantly less than 0 and distinguished groups 1 and 2 with progressively lower z scores. The mean z scores for the flow variables (FEF at 50%, FEF at 75%, and FEF at 25–75%) were more negative than the z scores for the timed expired volumes (FEV0.5 and FEV0.5/FVC) for both groups. In general, measures of flow identified a greater number of infants with abnormal lung function than did measures of timed volume; FEF at 50% had the best performance in detecting abnormal lung function.

Conclusions. Forced expiratory maneuvers performed with the increased-volume, rapid-compression technique could discriminate among groups of infants with respiratory symptoms of differing severity. Measures of forced expiratory flow were better than timed expiratory volumes in detecting abnormal airway function.

Reviewer's Comments. Because routine, standardized spirometric measurements among infants with respiratory diseases were not readily available in the past, several investigations used the increased-volume, rapid-thoracic compression technique to assess lung function in this age group. This study extends the body of evidence obtained with this technique and highlights the importance of forced expiratory flow measurements as being better than timed expiratory volumes in detecting abnormal airway function in this age group. The challenge remains to develop this technique into a more practical procedure that can be incorporated into routine clinical practice.

JOHN M. JAMES, MD
Fort Collins, CO

Environmental Exposures

Effects of Ambient Air Pollution on Symptom Severity and Medication Use in Children with Asthma


Purpose of the Study. To investigate the short-term effects of ambient air pollution on asthma symptoms and medication use among children with persistent asthma.

Study Population. A total of 133 children (5–13 years of age) with mild/moderate asthma were studied. The mean duration of asthma was 5.3 years. The children were enrolled from 1 center participating in the Childhood Asthma Management Program study. During the run-in period of the Childhood Asthma Management Program study, before being placed on 1 of the study controller medications...
or placebo, the subjects had preventative therapy suspended and were monitored for 28 to 112 days while using only albuterol as needed and orally administered prednisone for treatment of severe exacerbations.

Methods. The children and their caregivers completed daily diary cards for an average of 58 days, recording medication use and asthma severity. Air pollution and temperature data were collected by the Puget Sound Clean Air Agency (Seattle, WA). Particulate matter (PM) and carbon monoxide (CO) were measured. PM is a complex aerosol of solid and liquid, organic and inorganic materials, including dust, soot, smoke, pollen, acid droplets, and secondary aerosols. PM with an aerodynamic diameter of ≤10 μm (PM10) and PM with an aerodynamic diameter of ≤2.5 μm (PM2.5) were measured. Recent research has indicated that PM2.5 may be more strongly associated with asthma than larger particles. PM2.5 and PM10 concentrations were measured nephelometrically. CO monitoring sites were located in areas of high traffic volume. CO data were averaged, to diminish the influence of random sources of air pollution on any given day.

Results. Asthma severity and medication use were both associated with elevated PM2.5, PM10, and CO concentrations. Increasing asthma severity was most significantly seen 1 day after pollution exposure. With adjustment for confounders, 1 day after a 10 μg/m3 increase in PM2.5 levels, there was a 1.2-fold increase in the odds of having a serious asthma attack and a 1.08-fold increase in β-receptor agonist use. The association of air pollutants with medication use was weaker than that with asthma severity. Stronger associations with asthma severity and rescue inhaler use were found with CO levels than with PM levels.

Conclusions. Increases in PM and CO levels were associated with higher risks of increasing asthma severity and rescue medication use among children with moderate/severe asthma in the Seattle area.

Reviewer’s Comments. The authors noted that there is no biological plausibility of a direct association between CO levels and asthma exacerbations. The primary effect of CO exposure is anoxia, which results in confusion, headache, and nausea. The authors speculated that CO levels may serve as a marker for exposure to combustion byproducts, particularly diesel and gasoline exhaust particles.

Alan B. Goldsobel, MD
San Jose, CA

PROSPECTIVE STUDY OF AIR POLLUTION AND BRONCHITIC SYMPTOMS IN CHILDREN WITH ASTHMA


Purpose of the Study. To examine the effects of air pollutants, including particulate matter (PM), organic carbon (OC), elemental carbon, and other traffic-related pollutants, on bronchitic symptoms among children with asthma.

Study Population. Twelve Southern California communities were studied. In 1993, fourth graders and seventh graders were recruited from schools in 12 neighborhoods. Children with a history of asthma who completed ≥2 years of study questionnaires (1996–1999) were included in the analysis. There were 475 children in the study.

Methods. Questions regarding bronchitic symptoms were asked each year. Positive responses included daily cough for 3 consecutive months, 3 consecutive months of congestion or phlegm, or the occurrence of bronchitis. Other questions addressed smoke exposure and participation in team sports. A number of demographic questions were also asked. Air pollution monitoring stations were established in the 12 neighborhoods. The following were measured: ozone, PM of <10 μm, nitrogen dioxide (NO2), PM of <2.5 μm (PM2.5), OC, and elemental carbon. Annual averages for these pollutants were calculated, and 4-year mean levels (1996–1999) for each community were established.

Results. Of the 475 children in the study with asthma, 184 (38.7%) experienced bronchitic symptoms during the first year. Children with a history of wheezing in the year before the study or with allergy were significantly more likely to report symptoms. During the 4 years of the study, the average pollutant concentrations varied 4- to 10-fold among the communities. There was very little variation within each community from year to year. The odds ratio (OR) for bronchitic symptoms among children with asthma varied from 0.80 for ozone to 1.81 for PM2.5 among the communities. Within communities, the ORs were >1 for every pollutant. In special models for 2 pollutants, ie, OC and NO2, ORs were only modestly decreased when other pollutants were controlled for and the effects of OC and NO2 were not altered by other pollutants. NO2 effects were modified by participation in team sports, with an increase in the OR for bronchitic symptoms among participating children.

Conclusions. Among children with asthma, there were associations of bronchitic symptoms with PM2.5, OC, NO2, and ozone levels. Importantly, OC and NO2 effects were not confounded by other pollutants. These 2 pollutants deserve greater attention with respect to bronchitic symptoms associated with air pollution among patients with asthma.

Reviewer’s Comments. This is another important study that helps to establish the effects of air pollution on children with asthma. The study was conducted in California, and the air pollution components that were investigated were derived from vehicular traffic more than industry. This article also demonstrates the need to investigate more extensively the effects of NO2 and OC among children with asthma.

FREDERICK E. LEICKLY, MD
Indianapolis, IN

RELATIONSHIP OF OUTDOOR AIR QUALITY TO PEDIATRIC ASTHMA EXACERBATION


Purpose of the Study. To determine the relationship of outdoor air quality parameters to asthma exacerbations among children.

Study Population. Pediatric patients who had experienced an emergency department visit or an inpatient hospitalization at Cincinnati Children’s Hospital for treatment of acute asthma were studied.

Methods. The number of emergency department visits and hospitalizations for treatment of asthma were determined by review of emergency department logs and a hospital computer database. Air quality data were obtained from a centrally located monitoring station. Ozone concentrations were continuously monitored, and data were recorded as daily averages and the highest 1-hour average concentration for each day. Concentrations of airborne particulates <10 μm in diameter were obtained by using a volumetric air sampler with a size-selective inlet, and 24-hour average values were calculated. Pollen and
**EFFECTS OF AMBIENT AIR POLLUTION ON SYMPTOM SEVERITY AND MEDICATION USE IN CHILDREN WITH ASTHMA**

Alan B. Goldsobel

*Pediatrics* 2004;114;535

<table>
<thead>
<tr>
<th>Updated Information &amp; Services</th>
<th>including high resolution figures, can be found at: /content/114/Supplement_1/535.2.full.html</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subspecialty Collections</td>
<td>This article, along with others on similar topics, appears in the following collection(s):</td>
</tr>
<tr>
<td></td>
<td><strong>Pharmacology</strong></td>
</tr>
<tr>
<td></td>
<td>/cgi/collection/pharmacology_sub</td>
</tr>
<tr>
<td></td>
<td><strong>Allergy/Immunology</strong></td>
</tr>
<tr>
<td></td>
<td>/cgi/collection/allergy:immunology_sub</td>
</tr>
<tr>
<td></td>
<td><strong>Asthma</strong></td>
</tr>
<tr>
<td></td>
<td>/cgi/collection/asthma_sub</td>
</tr>
<tr>
<td>Permissions &amp; Licensing</td>
<td>Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: /site/misc/Permissions.xhtml</td>
</tr>
<tr>
<td>Reprints</td>
<td>Information about ordering reprints can be found online: /site/misc/reprints.xhtml</td>
</tr>
</tbody>
</table>
EFFECTS OF AMBIENT AIR POLLUTION ON SYMPTOM SEVERITY AND MEDICATION USE IN CHILDREN WITH ASTHMA

Alan B. Goldsobel

_Pediatrics_ 2004;114;535

The online version of this article, along with updated information and services, is located on the World Wide Web at:
/content/114/Supplement_1/535.2.full.html