Effect of Positions, Eating, and Bronchodilators on Gastroesophageal Reflux in Asthmatics

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Gastroesophageal reflux is common in asthmatics. To determine whether bronchodilators, the supine position, or eating affect gastroesophageal reflux, we performed ambulatory 24-hr pH monitoring on 44 controls and 104 unselected adult asthmatics. All asthmatics had discrete attacks of wheezing and documented reversible airway obstruction of at least 20%. The presence or absence of gastroesophageal reflux symptoms was not used as a criterion for patient selection. Chronic bronchodilator therapy was required by 71.2% of the asthmatics, and was continued during the test. Asthmatics had significantly worse GER than controls during the 3-hr postprandial period, which continued into the nonpostprandial period up to the next meal. Significant differences were present for esophageal mucosal acid contact time, frequency of reflux episodes, and clearance times. During the nonpostprandial periods asthmatics had four times the acid reflux as controls and 19-fold the frequency of prolonged reflux episodes. There were no differences between asthmatics on bronchodilators and those not on bronchodilators in any of the reflux parameters during the upright (postprandial, nonpostprandial) period or supine (sleep) period (P = NS). We conclude that: (1) regardless of the use of bronchodilator therapy, asthmatics have significant GER when asleep and after meals that continues beyond the postprandial period to the next meal; and (2) asthmatics receiving bronchodilators have similar gastroesophageal reflux patterns after eating, in the nonpostprandial period, and when asleep as asthmatics not receiving bronchodilators.

KEY WORDS: gastroesophageal reflux; asthma; bronchodilators; positions; eating.

Gastroesophageal reflux (GER) is common in asthmatics (1–3) and has been implicated in the precipitation of asthmatic episodes (4, 5). Mechanisms by which GER might invoke asthma include aspiration of gastric contents (1, 6–8) and triggering of a vagal reflex by acid reflux (9, 10). Either or both potential mechanisms might be activated by factors that promote GER, such as the use of bronchodilators (6, 11, 12), assuming the supine position (13, 14), and overeating (15).

We used 24-hr esophageal pH testing to determine the reflux patterns in asthmatics and to study the effects of positions, eating, and bronchodilators on GER.
MATERIALS AND METHODS

Controls. Forty-four volunteers who were without gastrointestinal complaints and were asymptomatic for GER were recruited from the hospital outpatient population and the employee staff. Volunteers were considered asymptomatic for GER if they had less than two episodes of GER symptoms (heartburn, postprandial chest pain, regurgitation) per year for the previous five years. Forty-two males and two females, ranging in age from 19 to 70 years with a mean of 47.9 ± 1.9 years (mean ± SE) were studied.

Patients. One hundred four asthmatics were consecutively referred from the outpatient and pulmonary clinics and the inpatient hospital. The presence or absence of GER symptoms was not used as a criterion for patient selection.

Group I. Asthmatics Receiving Chronic Bronchodilator Therapy. Seventy-four asthmatics (70 males, 4 females; age range 21–73 years, mean 53 ± 13 years) were studied while taking their usual combinations of theophylline, terbutaline, inhalants (adrenergic, anticholinergic, corticosteroid), and prednisone: theophylline only (400–1200 mg daily), 19 patients; theophylline (400–1200 mg daily) with terbutaline (5–15 mg daily) with or without inhalants (4–6 puffs daily), 50 patients; inhalants (4–16 puffs daily) with or without terbutaline, 5 patients.

Group II. Asthmatics Not Receiving Chronic Pulmonary Medication. Thirty asthmatics (29 males, 1 female; age range 27–65 years, mean 47 ± 13 years) were studied while receiving no pulmonary medications. Although patients may have used intermittent bronchodilators in the past for control of asthma, none required them at the time of the studies.

Documentation of Asthma. Asthma was defined as discrete episodes of wheezing and either a 20% improvement in forced expiratory volume in 1 sec (FEV₁) (16) following bronchodilator administration or a 20% decrease in FEV₁, after methacholine bronchoprovocation, which was performed in accordance with the American Thoracic Society guidelines (17).

Esophageal Manometry. Esophageal manometry was performed through the nose using a Narco Bio-systems motility transducer catheter and Physiograph recording system. The lower esophageal sphincter (LES) was identified by a sustained resting pressure area that relaxed with swallowing; it was measured in centimeters from the nose. When resting pressure was not elevated, the point of initial peristalsis, as determined on withdrawal of the catheter, was used to define the lower esophageal sphincter area.

Esophageal pH Testing. Twenty-four-hour esophageal pH testing was performed using standard methods with a Beckman pH electrode positioned 5 cm above the superior border of the manometrically determined LES and a Gastroreflux Data Analyzer (Del Mar Avionics). Supine or upright positions were recorded by the use of a switch on the recorder. Patients were instructed to remain upright (sitting, standing, or walking) during the day, to assume the supine position only when in bed at night; to eat their usual meals for breakfast, lunch, and dinner; to refrain from all other eating, including bedtime snacks; and to drink water at will. Monitoring was performed in a special hospital unit or at home depending on patient’s preference. In addition, a detailed diary of all events including meal times and sleep time was kept. The patients were freely ambulatory throughout the test period.

Reflux data analysis. A reflux episode was defined as a drop in pH below 4 that lasted for more than 10 sec. The acid contact time (percent of time that the pH was less than 4), the frequency of significant reflux episodes, and two clearance values were determined for the total 24-hr period, the upright period, and the supine period. The two clearance values were determined as follows: (1) frequency of prolonged (greater than 5 min) reflux episodes per hour. (2) mean duration of each reflux episode [total time (minutes) pH was less than 4 divided by the number of reflux episodes].

The following definitions were used: (1) Upright period—postprandial and nonpostprandial time. (a) postprandial period—the 3-hr period following each meal. (b) nonpostprandial period—the time remaining after the postprandial period but before the next meal. (2) supine period—the period from lying down in bed at night until arising in the morning.

Consumption of tobacco and alcohol was recorded as follows: (1) quit smoking, quit drinking: abstinence for at least the previous 12 months; (2) active smoking, active drinking: presently consuming or consumed in the previous 12 months; (3) nonsmoker, nondrinker: never smoked or quit more than one year ago with a total of less than one pack per day for six months; never drank alcohol or quit more than one year ago with a total of less than one drink per day for six months.

Statistical Analysis. The Mann-Whitney U test was used to detect differences in GER parameters between groups.

Table 1. Characteristics of Asthmatics and Controls

<table>
<thead>
<tr>
<th></th>
<th>Subjects (N)</th>
<th>Age* (mean ± SD)</th>
<th>Present smoker (%)</th>
<th>Quit or never smoked (%)</th>
<th>Present drinker (%)</th>
<th>Quit or never drank (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthmatics</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>On bronchodilators</td>
<td>74</td>
<td>52.9 ± 13.3</td>
<td>32.3</td>
<td>67.7</td>
<td>53.3</td>
<td>46.7</td>
</tr>
<tr>
<td>Not on bronchodilators</td>
<td>30</td>
<td>47.1 ± 13.1</td>
<td>42.1</td>
<td>57.9</td>
<td>69.2</td>
<td>30.8</td>
</tr>
<tr>
<td>Controls</td>
<td>44</td>
<td>47.9 ± 12.9</td>
<td>23.7</td>
<td>76.3</td>
<td>51.4</td>
<td>48.6</td>
</tr>
</tbody>
</table>

*P = NS; there were no differences between any of these groups in regards to age, smoking, or alcohol consumption.