Background: Irritable bowel syndrome (IBS) is associated with bronchial asthma. However, published data on airway resistance or impedance in patients with IBS but without any respiratory symptoms are lacking. Methods: Patients with IBS but no respiratory symptoms underwent spirometry and airway resistance measurement using impulse oscillometry; the data were compared with those from 97 historical age- and sex-matched healthy control subjects. Results: Patients had lower FEV₁ (3.03 [0.74] vs. 3.35 [0.80] L/min; p=0.004) and FVC (3.56 [0.85] vs. 3.88 [0.9]; p=0.01) than healthy subjects; however, the values were within the normal range. Patients had a higher resistance at 5 Hz (0.45 [0.42] vs. 0.30 [0.15] kPa L/s; p=0.003); however, reactance at this frequency was not significantly different (-0.08 [0.30] vs. -0.10 [0.09] kPa L/s; p=0.438). Conclusion: Patients with IBS have increased airway resistance as compared to healthy subjects, as measured by impulse oscillometry; however, reactance is unchanged, indicating no change in elastic resistance. [Indian J Gastroenterol 2006;25:185-187]

A relationship between irritable bowel syndrome (IBS) and broncho-pulmonary disease was initially suspected in 1991, when White and co-workers reported bronchial hyper-responsiveness to be more frequent in patients with IBS. Further, Kennedi and colleagues showed an association between symptoms of IBS and those of bronchial hyper-responsiveness. It has been suggested that bronchial asthma may be more prevalent in IBS patients than in otherwise healthy subjects. We have recently shown a significant relationship between asthma and IBS in Iran. However, there are no data on airway mechanics in patients with IBS.

Body plethysmography is the gold standard for assessment of airway resistance. This method measures resistance of the entire airway from the mouth to the “average” alveolus. However, this equipment is expensive and cumbersome. Impulse oscillometry (IO) is an alternative method, which measures airway resistance by sending a sound wave produced by a loudspeaker into the lungs of a spontaneously breathing subject and looking for changes in flow in response to the dilatory effect of the applied energy. By applying sound waves of different frequencies during different phases of the respiratory cycle, the instrument can measure resistance (R), defined as the opposition of the respiratory system to the flow of air, at different levels in the respiratory tree. It can also measure ‘reactance’ (X), which represents the capacitance of the respiratory system (its elasticity) and the inertia of the column of air in the respiratory tree.

We used IO to determine whether patients with IBS but with no respiratory symptoms have alteration in airway resistance.

Methods

One hundred and seventeen consecutive patients attending the gastroenterology clinic of our institute with IBS who fulfilled the Rome II criteria and had no organic gastrointestinal disease, including ulcerative colitis, peptic ulcer, and gastro-esophageal reflux, were requested to participate in the study; six patients declined. Patients with respiratory symptoms and signs suggestive of chest disease or a previous history of chest disease, atopic upper or lower respiratory disease, and those with forced expiratory volume in first second (FEV₁) of less than 75% of the predicted value were excluded (n=14), as were current smokers and those who had been smoking within the past 6 months. Ex-smokers who had not smoked during the past six months were allowed to participate since it has been shown that adverse effects of smoking disappear after six months. The remaining 97 patients underwent pulmonary assessment.

Forced vital capacity (FVC) and forced expiratory volume in the first second (FEV₁) were measured using standard spirometry. This was followed by impulse oscillometry, using a standard technique. In brief, the subjects were seated and asked to breathe through a mouthpiece with the lips tightly closed around it, and the tongue kept below it; a noseclip was used to prevent nasal breathing. The patients supported their cheeks with their fingertips to ensure that the oropharynx behaved like a nondistensible airway, which can otherwise lead to reduced respiratory resistance (Rrs) values. Measurements were taken...
over one minute of normal breathing.

The equipment used for impulse oscillometry (IOS Jaeger, Würzburg, Germany) consisted of an impulse generator (a loudspeaker), a pneumotachograph, and a pressure transducer. The impulse interval was set at the default level of 0.33 seconds with a pulse length of 45 ms. The superimposed pressure oscillations during normal-volume spontaneous breathing are composed of several frequencies, allowing the assessment of resistance and reactance at several frequencies simultaneously. The frequency range of the signal was from 0 to 30 Hz, and we recorded R and X at 5 and 25 Hz.7

Records of 97 sex- and age-matched healthy subjects who had previously undergone pulmonary function tests (PFT) for setting up normative values were retrieved and used as control data.10

The ethics committee of the institution approved the research protocol, and all patients or their guardians provided written consent.

Data are reported as mean (SD). Student’s t test was used for inter-group comparisons, and p values below 0.05 were taken as significant.

Results

The patients and controls had similar age, height and weight (Table 1). Mean resistance (R) was significantly greater in the patients at both 5 Hz and 25 Hz. Reactance (X) was similar in patients and controls at 5 Hz, but was lower in the patients at 25 Hz (Table 2).

Discussion

Mechanical events in the respiratory tract begin with minor increments in airway resistance.6 An increase in driving pressures, caused by overuse of respiratory muscles, may mask these early stages of airway obstruction, especially in individuals with stronger muscles. Detection of these changes therefore needs the use of sensitive techniques.

Airway resistance is classically measured using body plethysmography. However, IO provides measurements of airway resistance that correlate well with those at plethysmography both in healthy subjects and in patients with pulmonary disease.11 Using IO, typical patterns of resistance and reactance have been recognized in different types of pulmonary diseases. For instance, obstruction of peripheral airways, such as in chronic bronchitis, is associated with increased resistance and decreased reactance at 5 Hz, and an increase in resonance frequency.11

Our findings suggest the presence of a dormant airway resistance in patients with IBS who had no respiratory complaints. Though these patients had lower FEV1, FVC and mean flow rates than healthy subjects, the reductions in these parameters were not adequate to label these patients as having pulmonary disease. However, IO revealed definite evidence of airway resistance in these patients. Patients with such subclinical abnormalities may be at greater risk of developing symptomatic lung disease in future.12 This implies that lung involvement in IBS patients may be more common than the previous beliefs based on study of symptomatic pulmonary involvement.5

We conclude that patients with IBS have evidence of subclinical increased airway resistance.

Table 1: Characteristics of patients with IBS and healthy controls undergoing impedance oscillometry

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Patients (n=97)</th>
<th>Controls (n=97)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>37.8 (12.7)</td>
<td>37.7 (13.3)</td>
<td>0.99</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>164.2 (18.2)</td>
<td>162.4 (13.3)</td>
<td>0.61</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>69.9 (13.9)</td>
<td>68.0 (14.9)</td>
<td>0.19</td>
</tr>
<tr>
<td>Male (%I)</td>
<td>35 (36%)</td>
<td>35 (36%)</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Values as mean (SD)

Table 2: Spirometry and impulse oscillometry data in patients with IBS and healthy controls

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Patients (n=97)</th>
<th>Controls (n=97)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC (L)</td>
<td>3.56 (0.85)</td>
<td>3.88 (0.90)</td>
<td>0.011</td>
</tr>
<tr>
<td>FEV1 (L)</td>
<td>3.03 (0.74)</td>
<td>3.35 (0.80)</td>
<td>0.004</td>
</tr>
<tr>
<td>FEV1/FVC ratio</td>
<td>85.1 (7.4)</td>
<td>85.8 (3.6)</td>
<td>0.453</td>
</tr>
<tr>
<td>FEF25-75 (L/s)</td>
<td>3.20 (1.24)</td>
<td>3.80 (0.98)</td>
<td>0.000</td>
</tr>
<tr>
<td>Rnu (Kpa.s/L)</td>
<td>0.46 (0.43)</td>
<td>0.32 (0.02)</td>
<td>0.003</td>
</tr>
<tr>
<td>Runu (Kpa.s/L)</td>
<td>0.33 (0.32)</td>
<td>0.24 (0.01)</td>
<td>0.000</td>
</tr>
<tr>
<td>Xnu (Kpa.s/L)</td>
<td>-0.08 (0.30)</td>
<td>-0.11 (0.09)</td>
<td>0.438</td>
</tr>
<tr>
<td>Xnnu (Kpa.s/L)</td>
<td>-0.01 (0.13)</td>
<td>-0.06 (0.04)</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Values as mean (SD)

References

5. Amra B, Hoseini-Asl MK, Rahmani AR, Golshan M,
A 32-year-old man developed fecal discharge from his wound following appendectomy for presumed acute appendicitis. He was re-operated on ten days later and seven large ileal perforations (1-3 cm each) were identified. The diseased ileum was resected and primary anastomosis done, following which he developed entero-cutaneous fistula in the right iliac fossa and was referred to our hospital. Examination showed multiple erythematous, papular lesions with central umbilication over his trunk and extremities. Some of the papules had healed with central porcelain-colored scar formation (Fig 1a). On enquiring, he revealed that the rash had appeared in crops over the last 6 months. The right bulbar conjunctiva showed dilated vessels with a fornix-based wedge of circumscribed conjunctival congestion surrounding an area of scleral thinning evident by the bluish tinge due to visibility of the choroidal vasculature (Fig 1b).

Hemogram and liver function tests were normal. Serological tests for HIV and systemic lupus were negative. CT fistulogram suggested distal ileo-cutaneous fistula. Histology of the skin lesions revealed papular mucinosis. Histology of the resected ileum revealed fibrinoid necrosis with lymphocytic and neutrophilic infiltration and stenotic endothelial proliferation of the submucosal arterioles.

A diagnosis of Degos’ disease was made. The patient had a favorable outcome with enteral and parenteral nutritional support and octreotide injections.

Degos’ disease (malignant atrophic papulosis) is a rare vasculitis syndrome described in Caucasians, characterized by infarction of small-caliber arterioles of the dermis, central nervous system and gastrointestinal submucosa. Infarction of subconjunctival vessels may lead to focal scleral thinning. The majority present with widespread asymptomatic skin rash, followed within days, weeks or even years by an acute abdomen or cerebrovascular accident. Failure to recognize the rash before laparotomy may lead to failure to recognize the cause of acute abdomen.

R Rajesh, Adhish Basu, Sarath Chandra Sistla, S Jagdish, Davinder Mohan Thappa, Bhawana Ashok Badhe

Departments of Surgery, *Dermatology and **Pathology, Jawaharlal Institute of Postgraduate Medical Education and Research, Pondicherry

References


Correspondence to: Dr Basu, 90 Ballygunge Place, Kolkata 700 019. E-mail: adhishbasu@rediffmail.com

Amra, Emami, Drooshi, Golshan

Airway resistance in irritable bowel syndrome


Correspondence to: Dr Amra, PO Box 81655/755, Isfahan, Iran. Fax: +98 (311) 625 1700. E-mail: amra@med.mui.ac.ir

Received December 13, 2005. Received in final revised form March 11, 2006. Accepted April 10, 2006