associated airway disease has been reported as similar to that seen in sclerosing cholangitis.

A second hypothesis suggests that many of the extra-intestinal manifestations of IBD, including lung disease, are secondary to circulating inflammatory mediators and reactive oxygen species released by the inflamed bowel mucosa.\(^4\)\(^,\)\(^5\)\(^,\)\(^6\)\(^,\)\(^7\)\(^,\)\(^8\)\(^,\)\(^9\) Mucosal inflammation also creates the prospect for systemic absorption of luminal contents, including dietary antigens, digestive enzymes, or specific bacterial products capable of inducing systemic inflammation.\(^10\) For example, there are reports of detectable serum bacterial lipopolysaccharide and antibodies to bacterial lipid A and peptidoglycan in patients with IBD.\(^11\)\(^,\)\(^12\)\(^,\)\(^13\) This theory, however, is less likely to be accurate in the case of IBD-associated lung disease, as it clearly occurs after colectomy in patients who do not have any ongoing bowel inflammation.

In summary, chronic bronchitis and bronchiectasis are rare pulmonary complications of IBD that should be considered in IBD patients developing new, persistent and unexplained bronchopulmonary symptoms, particularly chronic productive cough. For these patients, early workup, with CT scans of the chest and PFTs to detect large airway disease, may be warranted. Furthermore, a therapeutic trial of oral steroids should be considered for these patients, as their symptoms appear extremely responsive to this treatment.

**References**


**Trepopneum Due to Interatrial Shunt Following Lung Resection**

*Salem Alfaifi, MB, ChB; and Stephen E. Lapinsky, MB, BCh*

Dyspnea and platypnea following pneumonectomy have been reported as a result of right-to-left interatrial shunt. We report on a case of trepopnea with marked positional arterial oxygen desaturation following right middle and lower lobectomy. A similar mechanism was found, with right-to-left interatrial shunting occurring predominantly in the right lateral position. Surgical repair corrected the clinical and physiologic abnormalities.

*(CHEST 1998; 113:1726-27)*

**Key words**: atrial septal defect; lung surgery; postoperative complications

Although shortness of breath following pneumonectomy is not uncommon, a rare but well-described cause is the development of right-to-left interatrial shunting, predominantly following right pneumonectomy.\(^1\) This was first reported in 1956,\(^2\) and 17 cases appear in the literature, with a clinical presentation usually of dyspnea and platypnea, with marked oxygen desaturation.\(^1\)\(^,\)\(^2\) We report on a case of dyspnea and trepopnea following right middle and lower lobectomy, with a similar pathophysiologic mechanism.

**Case Report**

A 59-year-old woman was investigated for a mass in the right middle lobe of her lung, which on biopsy specimen proved to be an adenocarcinoma. Preoperative investigations revealed no evidence of metastatic disease and normal lung functions. She underwent an uncomplicated right middle and lower lobe resection. She was discharged home from the hospital with mild shortness of breath 5 days postoperatively, but returned with increasing dyspnea 2 days later. Her shortness of breath was aggravated in the upright and right lateral position, but improved when lying on her left side. Physical examination revealed tachycardia and tachypnea. No jugular venous distention was

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Table 1—Arterial Blood Gas Measurements and Transesophageal Echocardiographic Flow Velocity Measurements Across the Interatrial Septal Defect

<table>
<thead>
<tr>
<th>Side Down</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIO2,*</td>
<td>0.21</td>
<td>0.21</td>
</tr>
<tr>
<td>pH</td>
<td>7.52</td>
<td>7.52</td>
</tr>
<tr>
<td>PCO2, mm Hg</td>
<td>32</td>
<td>31</td>
</tr>
<tr>
<td>PO2, mm Hg</td>
<td>56</td>
<td>42</td>
</tr>
<tr>
<td>Oxygen saturation, %</td>
<td>90</td>
<td>79</td>
</tr>
<tr>
<td>Flow velocity (right to left), cm/s</td>
<td>0.8</td>
<td>1.2</td>
</tr>
</tbody>
</table>

*FIo2 = fraction of inspired oxygen.

noted and chest auscultation was entirely clear. Cardiovascular examination revealed normal heart sounds with no evidence of added sounds or murmurs.

Chest radiograph demonstrated a small right pneumothorax that resolved over the following 7 days. Volume loss compatible with her previous surgery was noted in the right hemithorax. Pulmonary function tests revealed no evidence of airflow limitation with an FVC of 1.9 L (72% predicted) and FEV1/FVC ratio of 84%. Arterial blood gas in a sitting position demonstrated a PaO2 of 40 mm Hg on room air, improving to 52 mm Hg on 100% oxygen. Arterial blood gas determinations were performed in the left and right lateral positions due to her marked positional dyspnea. These demonstrated worsening of her hypoxemia in the right lateral position (Table 1). ECG demonstrated no abnormalities other than a sinus tachycardia, and a ventilation-perfusion scan suggested a low probability for pulmonary embolism. Pulmonary angiogram was performed that demonstrated no evidence of pulmonary emboli, or arteriovenous abnormalities. Bronchoscopy was normal. Transesophageal echocardiogram revealed no abnormalities, and a transesophageal echocardiogram with bubble study was therefore performed. This clearly demonstrated an atrial septal defect with bidirectional flow, right-to-left flow increasing in the right lateral position. Measured flow velocity across the defect increased on turning from the left to the right lateral position (Table 1). Right and left heart catheterization revealed no interatrial pressure gradient, with no evidence of left-to-right shunt on oximetry. However, left atrial oxygen saturation dropped from 90 to 44% on turning to the right side. Coronary angiogram was normal as was left ventricular function.

At open heart surgery, the upper rim of fossa ovalis was not fused to the septum, forming a mobile flap over an interatrial opening. Changes in the position of the heart caused this opening to widen. The defect was closed by suturing the fossa ovalis to the interatrial septum. Postoperatively, her arterial oxygen saturation improved to 95% on room air, and she was subsequently discharged home from the hospital with no evidence of dyspnea.

**DISCUSSION**

Hypoxemia due to right-to-left interatrial shunting, an unusual but well-described cause of postpneumonectomy dyspnea, has recently been reviewed.1,3 This case describes a similar abnormality following right middle and lower lobe lobectomy. The most striking symptom was trepopnea, with marked dyspnea and oxygen desaturation in the right lateral position. As in previously reported cases, this interatrial shunt may occur without significant change in right atrial pressure.1,3 This has been attributed to directional streaming of blood from the right to the left atrium as a result of shifting of the heart position following lung resection.1,4,5 Changes in body position such as the upright position may aggravate this streaming effect. Significant distortion of the cardiac anatomy has been demonstrated using MRI in such cases.1 The right atrium may become compressed and the interatrial septum lies horizontally over the opening of the inferior vena cava. Other mechanisms for right-to-left shunting may include small pressure gradients produced by right atrial compression, pressure gradients occurring transiently during the cardiac cycle, or changes in right atrial compliance as a result of shift of the mediastinum.

Our patient presented with trepopnea, which usually suggests significant ventilation-perfusion mismatch or a pulmonary shunt in the lung that is dependent during dyspnea. This is attributed to accentuated perfusion in the dependent lung, resulting in increased shunt. Our initial investigations were directed at this possibility. Trepopnea due to atrial septal defect is unusual and occurred as a result of shift of the heart and mediastinum. In the right lateral position, the weight of the heart may pull down on the interatrial septum, causing widening of the defect. In the left lateral position, the flap appeared to close by gravitational effects. Although the defect clearly widened in the right lateral position, shunting from the right to the left atrium would not occur without an associated streaming effect or some change in pressure due to compression of the right atrium.

Although uncommon, interatrial shunting should be considered in any patient with unexplained dyspnea or hypoxemia after lung resection surgery. This appears significantly more common after right lung surgery, and a positional change in symptoms or oxygen saturation should be a clue to the diagnosis.

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