individual. During hard coughing, the tip may have descended even lower.

Based on our experience with these two individuals, we believe that a greater consideration should be given to matching transtracheal catheter length to patient lung size. Following placement of the 11-cm-long stent, the position of the catheter tip should be assessed relative to the carina. If the catheter tip is nearer than 2.0 cm to the carina on the postinsertion chest roentgenogram, we would recommend placement of a 9.0-cm SCOOP I catheter, rather than the usual 11.0-cm size. In addition, an end-expiratory postinsertion chest roentgenogram may be more appropriate than an inspiratory roentgenogram because it may better assess both catheter position and the presence of a pneumothorax. Furthermore, we would encourage reassessment of any individual with excessive cough weeks after the placement of the catheter since they might benefit from use of a shorter catheter. This would be particularly true in small patients with restrictive lung disease.

In summary, we have identified two individuals of short stature with pulmonary fibrosis who developed intolerance to transtracheal oxygen therapy manifested by excessive cough and mild hemoptysis. The symptoms in both individuals resolved following replacement with a shorter catheter. The initial use of a shorter catheter should be considered in patients using transtracheal oxygen delivery who present with the combination of small stature and low lung volume.

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Postpneumonectomy Syndrome in Adulthood
Surgical Correction Using an Expandable Prosthesis

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The postpneumonectomy syndrome is a rare complication occurring after right pneumonectomy and is seen mainly after pneumonectomy in childhood. The presenting symptoms are dyspnea, stridor, and recurrent pulmonary infections. The syndrome is caused by the shifting and rotation of the heart and mediastinum into the right hemithorax, and anterior herniation of the left lung. This causes tortuosity and stretching of the trachea and compression of the left main bronchus and lower lobe bronchus, eventually resulting in secondary tracheobronchomalacia. This report reviews two cases of postpneumonectomy syndrome following pneumonectomy in adulthood. After implantation of an expandable prosthesis, an anatomic correction of the shifted mediastinum was achieved, which in both cases resulted in instantaneous and sustained relief.

(Chest 1992; 101:1167-70)

I.V.C. = inspiratory vital capacity

The postpneumonectomy syndrome is a rare, delayed complication following right pneumonectomy. It is caused by a severe shift of the mediastinum to the right, which leads to stretching of the trachea and compression of the left main bronchus and lower lobe bronchus, resulting in compromised ventilation.

In the reviewed literature, the syndrome has been described mainly in children, but rarely in adults. We present two cases of postpneumonectomy syndrome that developed following pneumonectomy in adulthood; in both cases, treatment consisted of intrathoracic implantation of an expandable prosthesis.

CASE REPORTS

CASE 1

A 43-year-old woman underwent a right pneumonectomy at age 41, because of a squamous cell carcinoma of the intermediate bronchus. Postoperative classification was T2N1M0 (stage II). Postoperative recovery was uneventful. Four months after the operation however, she developed a nonproductive cough. After six months, she complained about dyspnea and had developed an inspiratory and expiratory stridor.

At that time, the chest x-ray film showed a severe mediastinal shift to the right and herniation of the left lung (Fig 1). The CT scan showed a marked rightward and posterior deviation of the mediastinum, including the heart and great vessels, and compression of the left lower lobe bronchus between the aorta and the pulmonary

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Figure 1. The chest x-ray film before (A, left) and after (B, right) the implantation of the prosthesis (case 1). The chest x-ray film before the operation shows a large herniation of the left lung to the right. Notice the tortuous course of the trachea. There is a remarkable correction after operation. The device projected over the trachea is the subcutaneous injection port.

Figure 2. CT-scan before (A, upper) and after (B, lower) implantation (case 1). Before operation, the mediastinum is shifted to the right, and the left lower lobe bronchus is compressed at the level of the aorta (arrow). After operation, the mediastinum was returned to a medial position, and the left lower lobe bronchus is not compressed (arrow).

Dyspnea was progressive, and two years after pneumonectomy, the patient could no longer engage in normal daily activity. It was decided to attempt an operative correction. The right pleural cavity was opened by a miniposterolateral incision. The heart abutted the right-lateral chest wall, the trachea was extremely flexible and showed a marked shift to the right. An expandable prosthesis with a subcutaneous injection port was implanted in the right pleural cavity. After implantation, the prosthesis was inflated with 150 ml of sterile saline solution (any further increase in the volume of the prosthesis caused a rise of the central venous pressure).

The patient experienced immediate and sustained relief from dyspnea. The stridor had disappeared, and the exercise perform-
The clinical presentation of this syndrome is entirely different from the orthodoxy with severe hypoxemia after pneumonectomy.

A review of the literature reveals only a few case reports. At our hospital where more than 640 pneumonectomies were performed between 1970 and 1988, the syndrome was diagnosed only once. The syndrome has only been described after pneumonectomy of the right lung. The reason for this is that the mediastinal structures shift further after right pneumonectomy than after resection of the left lung. This report reviews two cases of postpneumonectomy syndrome that developed after pneumonectomy in adulthood. In the literature, most of the reports deal with cases of pneumonectomy in childhood or adolescence. This can be explained in terms of the greater compliance of the lung, the greater elasticity of the mediastinal structures and the softer cartilage. The syndrome is caused by altered anatomic relations. The heart and the great vessels are shifted into the right hemithorax. The trachea is deviated right-posteriorly before curving back into the left hemithorax anteriorly. Due to this deviation, the left main bronchus is compressed between the spinal column and the left pulmonary artery and the left lower lobe bronchus is compressed between the aorta and the left pulmonary artery. In addition, the left lower lobe bronchus becomes kinked because it makes a sharp angle crossing the aorta. Furthermore, stretching of the trachea and the left main bronchus causes a loss of elasticity in the myoelastic elements, which no longer support the cartilage adequately. This results in secondary tracheobronchomalacia, which in turn causes collapse of the distal trachea and left main bronchus when the intrathoracic pressure rises during coughing or forced expiration. According to Wasserman et al., the tortuosity and elongation of the trachea cause increased air turbulence and stridor which are most noticeable during inspiration. The tracheobronchomalacia, the turbulence of the air, and the compression of the left main bronchus and the left lower lobe bronchus all cause a marked increase in the work of breathing and compromise the patient’s exercise performance.

In the past, various techniques have been proposed to prevent or correct mediastinal shift after pneumonectomy. These include filling the postpneumonectomy space with Lucite balls, right pneumonectomy, release of pleural adhesions, and surgical fixation of the pericardium of the pulmonary artery to the sternum. On one occasion, nonexpandable Silastic implants were inserted in the right pleural

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**Table 1—Spirometry and Blood Gas Values Before and After Implantation**

<table>
<thead>
<tr>
<th></th>
<th>Patient 1</th>
<th></th>
<th>Patient 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td>IVC, ml</td>
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<tr>
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<td>13.6</td>
<td>12.8</td>
<td>13.2</td>
</tr>
<tr>
<td>PaO₂, kPa (Exercise)</td>
<td>10.6 (9*)</td>
<td>11.3 (11.3*)</td>
<td>7.5 (9*)</td>
<td>13.6 (15.5*)</td>
</tr>
<tr>
<td>PaCO₂, kPa (Rest)</td>
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<td>4.0</td>
<td>4.4</td>
<td>5.4</td>
</tr>
<tr>
<td>PaCO₂, kPa (Exercise)</td>
<td>4.1</td>
<td>3.6</td>
<td>5.3</td>
<td>5.6</td>
</tr>
</tbody>
</table>

*Exercise in kilojoules.

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**Figure 3**. Ventilation-perfusion scintigram before (PRE) and after (POST) implantation. The upper images show the perfusion (Q, technetium 99m) and ventilation (V, krypton 81m) before operation. The arrow indicates the ventilation-perfusion mismatch in the left lower lobe. The lower images show the perfusion and ventilation after operation. The mismatch has disappeared, and the left lung is in normal position.

**Case 2**

A 45-year-old woman who had undergone a mastectomy due to breast carcinoma at the age of 41 and a right pneumonectomy six years later due to a pulmonary metastasis, developed progressive dyspnea one month after pneumonectomy. At referral, respiratory function studies showed a significant reduction in pulmonary volumes compared to the expected normal values after right pneumonectomy (Table 1). Blood gas values were normal at rest, but the PaO₂ dropped severely at exercise (Table 1). Radiology studies showed a severe mediastinal herniation of the left lung and a right posterior shift of the heart and great vessels. The CT-scan showed compression of the left lower lobe bronchus between the left pulmonary artery and the spine. Bronchoscopy showed that the ostium of the left lower lobe had been reduced to a slit. She was operated upon in the same way as the first patient. The volume of the prosthesis was 1,000 ml, and after implantation, 900 ml of sterile saline solution was added. Central venous pressure remained normal. Immediately after operation, the stridor and dyspnea disappeared, and respiratory function studies showed significant improvement (Table 1). Exercise was well tolerated with normal PaO₂, and the patient could live a normal life again.

**Discussion**

The postpneumonectomy syndrome is a very rare complication occurring after right pneumonectomy, presenting with stridor, dyspnea, and recurrent pulmonary infections.
cavity in a 23-year-old man. Very recently, an expandable prosthesis was successfully inserted in a five-month-old infant.

In the two patients described in this paper, an expandable prosthesis with a subcutaneous injection port was implanted in the right thoracic cavity. The volume of the prosthesis could easily be adjusted after operation. The implantation of the prosthesis required an incision of only a few centimeters. In our opinion, this is the best means of solving this unusual problem. An early diagnosis of this syndrome seems important if secondary tracheobronchomalacia is to be prevented.

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Thymic Cyst Presenting as Horner’s Syndrome*

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We describe a case of Horner’s syndrome secondary to a thymic cyst. Following successful surgical removal of the cyst, the patient’s symptoms resolved. To the best of our knowledge, a similar case has not been reported.

(Chest 1992; 101:1170-71)

Horner’s syndrome consists of the classic clinical manifestations of miosis, partial ptosis, and apparent anhidrosis and pain. The pupil is variably miotic, depending on the location, completeness, and chronicity of the deficit. Horner’s syndrome may occur with a lesion anywhere along the oculosympathetic pathway.

Thymic cysts are uncommon lesions derived from the thymopharyngeal duct. They usually are found in asymptomatic adults, although cardiac compression due to extrinsic pressure or rupture in the pericardial space and chest pain secondary to intracystic infection have been reported.

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CASE REPORT

A 64-year-old man was discovered by chance to have Horner’s syndrome in January 1990. The patient did not remember when the onset of ptosis occurred. He was asymptomatic and had no previous history of migraine. On physical examination, the only positive findings were ptosis on the right and the fact that the right pupil was 2 mm smaller than the left. There was no evidence of anhidrosis or enophthalmos. Elemental blood analysis, an electrocardiographic study, and thyroid function test results were normal.

FIGURE 1. Computed tomographic scan obtained after intravenous administration of contrast material demonstrates a large cervical cyst (T) and deviation of the trachea and the right carotid artery (arrow).

We report a patient suffering from Horner’s syndrome due to a cystic tumor of the thymus growing from the upper portion of the mediastinum into the neck. Horner’s syndrome was due to extrinsic compression of the sympathetic plexus that accompanies the carotid. To our knowledge, there are no previous descriptions of thymic cysts leading to Horner’s syndrome.

FIGURE 2. Microscopic study of the cyst revealed a wall lined by columnar epithelium with thymic tissue (hematoxylin-eosin, original magnification × 400).

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Thymic Cyst Presenting as Horner’s Syndrome (Fraile et al)