Bronchoscopic diagnosis and treatment of bronchial stump suture granulomas

Eight patients in whom new respiratory symptoms developed following pulmonary resection have been evaluated. The bronchial stumps in all of these patients had been closed with Tevdec suture material. The total number of pulmonary resections using Tevdec suture from January, 1971, to January, 1980, was 180, yielding an incidence of the complication of 4.4%. No patient had empyema or bronchopleural fistula. Symptoms included nonproductive cough (eight patients), hemoptysis (five patients), wheezing (two patients), and coughing up suture material (two patients). The underlying disease necessitating pulmonary resection was carcinoma in five patients, carcinoid adenoma in one patient, tuberculosis in one patient, and bronchiectasis in one patient. The median time interval between resection and development of respiratory symptoms was 18 months, with a range of 8 to 57 months. The chest roentgenograms showed no change from earlier postoperative films. Bronchoscopy under general anesthesia was performed in all eight patients. Granulation tissue around loosened Tevdec sutures was present in all patients so examined. No residual tumor or specific infection was identified. Immediate and sustained relief of symptoms was obtained in seven of eight patients by removal of the loosened sutures. One patient has had recurrence of minor hemoptysis 18 months following suture removal but has refused further endoscopy. Stainless steel staples have been used for bronchial stump closure in over 100 pulmonary resections since 1977 and no such complications have been seen.

William A. Baumgartner, M.D.*, and James B. D. Mark, M.D.,**
Stanford, Calif.

Uncomplicated bronchial stump healing is an important goal following all pulmonary resections. This mode of healing may be impeded by infection, long bronchial stumps, failure to cover the stump with pleura, and highly reactive suture material. Major complications of healing are bronchopleural fistula and empyema. In addition, lesser complications do occur.

In this report we describe the presentations of eight patients in whom new respiratory symptoms developed following pulmonary resection with or without bronchoplasty. They ultimately were relieved of symptoms by the removal of suture material used in the closure of the bronchial stump.

From the Department of Surgery, Division of Thoracic Surgery, Stanford University School of Medicine, Stanford, Calif.

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Address for reprints: James B. D. Mark, M.D., Department of Surgery, A-242, Stanford University School of Medicine, Stanford, Calif. 94305.
* Resident in Thoracic Surgery.
** Professor of Surgery and Head, Division of Thoracic Surgery.

Patients, methods, and results

Eight patients have undergone evaluation at Stanford University Medical Center for the development of new symptoms following pulmonary resections. The following are representative case histories.

CASE 1. A 63-year-old Mexican-American man presented to the clinic complaining of persistent cough for 4 1/2 weeks. He had undergone resection of the upper lobe of the right lung for adenocarcinoma 13 months previously, and he had been asymptomatic until the cough developed. He denied sputum production, hemoptysis, and fever. Chest roentgenogram on admission showed changes consistent with a previous surgical procedure but no evidence of recurrent disease. He was taken to the operating room for examination with both rigid and flexible bronchoscopes under general anesthesia. Bronchoscopic findings revealed granulation tissue with Tevdec suture material in the right upper lobe bronchial stump. Five sutures were removed and biopsy specimens of the granulation tissue were taken. Histopathological examination revealed acute inflammation and granulation tissue. There was no evidence of carcinoma. He is symptom free 19 months following bronchoscopy.

CASE 2. A 63-year-old white man presented to the clinic with complaints of coughing up particles resembling suture material. Thirteen months prior to this episode he had undergone right upper lobectomy with bronchoplasty followed by
Table I. Bronchial suture granulomas

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Sex, age (yr)</th>
<th>Diagnosis</th>
<th>Surgical procedure</th>
<th>Postop. symptoms</th>
<th>Interval between operation and symptoms (mo)</th>
<th>Time since bronchoscopy (mo)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M, 63</td>
<td>Carcinoma</td>
<td>Right upper lobectomy</td>
<td>Cough</td>
<td>13</td>
<td>20</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>2</td>
<td>M, 63</td>
<td>Carcinoma</td>
<td>Right upper lobectomy with bronchoplasty</td>
<td>Cough; expectoration of sutures</td>
<td>13</td>
<td>11</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>3</td>
<td>M, 45</td>
<td>Carcinoma</td>
<td>Right lower lobectomy</td>
<td>Cough; hemoptysis</td>
<td>18</td>
<td>23</td>
<td>Recurrent minor hemoptysis</td>
</tr>
<tr>
<td>4</td>
<td>M, 56</td>
<td>Carcinoma</td>
<td>Right lower lobectomy</td>
<td>Cough; hemoptysis</td>
<td>42</td>
<td>22</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>5</td>
<td>M, 38</td>
<td>Tuberculosis</td>
<td>Right upper lobectomy</td>
<td>Cough; wheeze</td>
<td>8</td>
<td>21</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>6</td>
<td>M, 23</td>
<td>Bronchiectasis</td>
<td>Lingulectomy</td>
<td>Cough; hemoptysis</td>
<td>57</td>
<td>12</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>7</td>
<td>F, 71</td>
<td>Carcinoid</td>
<td>Right lower lobectomy</td>
<td>Cough; hemoptysis</td>
<td>18</td>
<td>55</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>8</td>
<td>M, 26</td>
<td>Carcinoid</td>
<td>Left upper lobectomy with bronchoplasty</td>
<td>Cough; hemoptysis</td>
<td>4</td>
<td>5</td>
<td>Asymptomatic</td>
</tr>
</tbody>
</table>

mediastinal radiation for squamous cell carcinoma of the lung. By means of a rigid bronchoscope, six Tevdek sutures were removed without difficulty and a biopsy specimen of granulation tissue was taken. Pathological examination revealed no evidence of carcinoma. Ten months following bronchoscopy, he remains asymptomatic.

**CASE 3.** A 71-year-old white woman underwent right lower lobectomy for carcinoid adenoma in January, 1976. She had been asymptomatic for 18 months when she noticed the onset of cough with intermittent hemoptysis but not systemic symptoms. Chest roentgenogram showed no evidence of recurrent disease. Fiberoptic bronchoscopy revealed findings similar to those in the previous two cases. Four Tevdek sutures were removed. Biopsy specimens from the surrounding granulation tissue contained no evidence of recurrent tumor.

**Comment.** The eight patients included seven men and one woman whose ages ranged from 23 to 71 years with a mean of 48 years. A summary of the patient characteristics and data is presented in Table I. All of the patients had cough as a presenting complaint. The median time interval between resection and development of respiratory symptoms was 18 months (range 8 to 57 months). The chest roentgenogram showed no change from earlier postoperative films.

All patients underwent bronchoscopy under general anesthesia. Endoscopy in all instances was initiated with the flexible fiberoptic bronchoscope. Because we were unable to remove all exposed sutures with this instrument in four of the cases, use of the Jackson bronchoscope was necessary in these patients. Although in many instances bronchoscopy for this purpose can be performed safely and effectively under topical anesthesia, some such procedures may be technically difficult and require alternate use of different bronchoscopes. For this reason we prefer general anesthesia, which produces the best operative conditions and maximal patient comfort. There was no postoperative mortality or morbidity. All exposed sutures were removed and biopsies of the granulation tissue were performed in each case. No residual tumor or specific infection was identified. Immediate and sustained relief (follow-up period of 5 to 55 months with a mean of 20 months) was obtained in seven of eight patients. One patient has had recurrence of minor hemoptysis 18 months following bronchoscopy and suture removal but has refused further endoscopy.

**Discussion**

It is generally accepted that bronchopleural fistula is the most dreaded bronchial complication associated with pulmonary resection. This postoperative problem is related in part to the mode of healing of the bronchial stump. Minor complications are also attributed to impaired bronchial stump healing. Our report illustrates one of these problems, that is, reactive suture material causing increased inflammation. The resultant granulation tissue leads to the emergence of new symptoms suggestive of recurrence of the primary disease process. The concept of suture material causing impaired bronchial stump healing has been appreciated since the advent of clinical pulmonary operations. Brunn in 1929 described a one-stage lobectomy in which chromic catgut was used. The fundamental principles of healing of bronchial stumps after pulmonary resection are described in detail by Rienhoff, Gannon, and Sherman. Other proponents of the use of absorbable suture material in bronchial stump closure are Björk and Sherman and Conant. These authors related experience with patients who developed cough with expectoration of suture material when silk was used for bronchial stump closure. They reported chromic catgut to be a satisfactory suture for successful closure of the bronchial stump. Fewer bronchopleural fistulas occurred
in these groups of patients than in those in whom silk was used for bronchial closure. Following this experience, Jack reported a reduction in the number of bronchopleural fistulas when chromic catgut was used in pulmonary resections. Plastic adhesive was used for bronchial closure in order to diminish further the inflammatory response. However, this was unsuccessful for maintaining good bronchial stump closure.

Scott and associates addressed the problem of healing of the bronchial stump when different methods of stump closure were used. They compared closure strength and inflammatory reaction when silk, chromic catgut, and stainless steel staples were used for bronchial closure in experimental animals. Staple closures were superior in strength and showed little inflammatory reaction. With the availability and our increasing experience with the staple apparatus, its benefits in pulmonary resection are increasingly being appreciated. When performing bronchoplastic procedures or sleeve resections, we are now using interrupted polyglycolic suture material for bronchial closure or anastomosis. Precise surgical techniques, including control of infection, covering bronchial stumps with pleura, and creation of short stumps, must also be used for prevention of these complications following pulmonary operation.

The bronchial stumps of eight patients in this report were closed with Tevdec, a multifilament plastic, nonabsorbable suture material. Since we began to use stainless steel staples at our institution, over 100 pulmonary resections have been performed. No cases of bronchopleural fistula or granuloma with associated symptoms have been observed since that time. It is hoped that with the continuing use of staples for bronchial closure, the incidence of bronchopleural fistula as well as lesser complications, as reported herein, will continue to diminish.

REFERENCES
1 Brunn H: Surgical principles underlying one stage lobectomy. Arch Surg 180:490-515, 1929
5 Jack GD: Bronchial closure. Thorax 20:8-12, 1965