Bronchoplastic procedures for central carcinoid tumors: clinical experience

Alberto Terzi*, Alessandro Lonardoni, Birgit Feil, Irene Spilimbergo, Giovanni Falezza, Francesco Calabro

Thoracic Surgery Unit, Verona City Hospital, Ospedale Maggiore Azienda Ospedaliera di Verona, P.le Stefani 1, 37128 Verona, Italy

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Abstract

Objective: To evaluate the short-term and the long-term results of bronchoplastic resections (BR) performed for central carcinoid tumors (CCT). Methods: Retrospective study of patients who underwent BR for a CCT between 1966 and 2003. Results: BRs were performed in 25 patients out of 92 (27%) who were resected for CCT. Median age was 37 years. All patients were symptomatic. Preoperative bronchoscopy was diagnostic in 15 patients. The bronchoplasties performed were: 11 sleeve lobectomies, 1 sleeve segmentectomy, 8 wedge lobectomies, 4 flap lobectomies and 1 wedge segmentectomy. There were 22 typical and 3 atypical carcinoids without nodal metastasis. No major complications or mortality occurred. One patient with a typical carcinoid developed pretracheal metastatic adenopathy 19 years after resection. No recurrence or stenosis has occurred at the sites of bronchoplasty so far. Three patients died of unrelated disease. Overall the 10-, 15- and 20-year survival rates were 100, 100 and 71%. Conclusions: Bronchoplastic resections are the treatment of choice for CCT. Short- and long-term results are excellent. Life-long follow-up is necessary, however, due to the possibility of late recurrence.

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Keywords: Typical carcinoid; Atypical carcinoid; Bronchoplastic procedures

1. Introduction

Carcinoid tumors are uncommon lung neoplasms accounting for 1–2% of all lung tumors [1–3]. They affect both sexes equally, they are seen in patients of all ages and are the most common lung tumor in childhood [4]. In most cases carcinoids are located centrally, that is, they are visible at bronchoscopy in the bronchial tree; in a lower percentage of cases they are peripheral. Surgery is the treatment for choice of carcinoids. Because they are considered malignant tumors of low to intermediate grade and thus have a relatively benign course, lung sparing procedures are advisable for centrally located tumors whenever possible.

2. Patients and methods

We reviewed our experience with carcinoids, both typical and atypical, between 1966 and 2003. Out of a total of 152 patients who had a lung resection for a carcinoid tumor, 25 patients with a centrally located one, 22 typical carcinoids (TC) and 3 atypical carcinoids (AC), underwent a lung sparing procedure by means of a bronchoplastic resection. These patients accounted for 27% (25/92) of central carcinoid tumors (CCT) operated on in the same period, of which 73 were TC and 19 were AC. There were 10 males and 15 females with a median age of 37 years (range 21–70 years).

All patients were symptomatic and in most cases the symptoms were those of bronchial obstruction: cough, recurrent infections, fever, haemoptysis, dyspnea (Table 1). No one presented with the carcinoid syndrome. Preoperative evaluation was the same as that for patients with NSCLC. Before, CT scanning was available linear...
tomography of the chest was used. Flexible bronchoscopy has been performed in all patients since 1979, while before that time a rigid bronchoscope was used. Biopsy specimens have always been taken but a diagnosis of carcinoid was obtained preoperatively in 15 patients, and in the others no precise diagnosis was obtained from bronchoscopy. On chest X-ray lobar, bilobar or segmental atelectasis was present in 7 cases; the chest X-ray was considered abnormal in 21 cases while in the others it was considered normal. Preoperative functional evaluation included standard pulmonary function tests.

The definitive diagnosis of carcinoid tumor either typical or atypical was obtained after resection and the WHO/IASLC [5] classification was used. For specimens resected before this classification, slides were reviewed by a pathologist.

Eleven patients underwent a full sleeve lobectomy (8 right upper, 2 left upper, 1 middle), one a left S6 sleeve segmentectomy, 8 patients underwent a wedge lobectomy (5 right upper, 1 left upper, 2 middle), 4 a flap bronchoplasty (right lower lobe) and 1 a left S6 wedge segmentectomy (Figs. 1–3). Bronchoplastic procedures were performed whenever the tumor was too close to the bronchial opening or when the bronchial orifice (either lobar or segmental) was involved, in order to avoid unnecessary loss of functional lung tissue. In one patient with a TC, laser therapy was used as the first treatment but the carcinoid recurred after 6 months and the patient was eventually resected. Surgical resection was performed either through an anterolateral or posterolateral thoracotomy, according to the preference of the surgeon and the age of the patient (young female patients were operated on through a submammary anterolateral thoracotomy for aesthetic reasons). A systematic mediastinal lymph node dissection was carried out in 18 cases and nodal sampling in the others. Frozen section examination of the edges of the bronchus was obtained in all patients and when negative margins were confirmed by the pathologist the bronchoplastic procedure was completed. Interrupted sutures were always used (choronic catgut and silk at the beginning and polyglactan or polidioxanon 3/0 or 4/0 later) either for full sleeve resections or for the other bronchoplasties. Wedge resections were always large wedge resections leaving a small part of the wall of the bronchus. Interrupted sutures were placed starting at both ends of the resection; they were evenly spaced and were added one by one from each side to reach the side opposite to the small part of the bronchus and were tied after all the sutures had been placed.

Table 1

<table>
<thead>
<tr>
<th>Presenting symptoms</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough</td>
<td>14</td>
<td>56%</td>
</tr>
<tr>
<td>Fever/infection</td>
<td>12</td>
<td>48%</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>8</td>
<td>32%</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>4</td>
<td>16%</td>
</tr>
</tbody>
</table>

Fig. 1. Endobronchial carcinoid protruding in the left lower bronchus (originating on the spur between left B6 and basal bronchus).

Fig. 2. CT scan showing a tumor protruding into left lower bronchus (same case as above).

Fig. 3. Sleeve segmentectomy; stitches in place to be tied.
The suture line was always covered with a pedicled pericardial fat pad or parietal pleura. At the end of the operation, before extubation, the bronchial tree was inspected using a flexible bronchoscope to evaluate the suture line, the patency and the alignment of the bronchial anastomosis and to aspirate secretions and blood.

However, the longest follow-up for the three ACs is 43 months. Cumulative survival rate (Kaplan–Meier) showed a 5, 10 and 15 years survival rate of 100% and a 71% survival rate at 20 years (Fig. 4). Three patients with TC died of unrelated diseases 216, 232 and 340 months after operation.

3. Results

The postoperative course was uneventful in most patients; sputum retention was the only complication observed and vigorous chest physiotherapy was enough to solve the problem. As a standard procedure we performed a fiber-optic bronchoscopy 7 days after the operation to check the suture line, unless the clinical course made it necessary to perform it earlier, and another one after about 1 month. No deformation or stenosis was detected in those patients who underwent wedge or flap bronchoplasty as well as in those who underwent a full sleeve resection.

No patients had metastatic nodal involvement. In one case carinal nodes showed a granulomatous flogosis and the presence of mycobacterium tuberculosis; she was treated with anti-tubercular drugs. The stage of the disease was IA or B in 21 cases and IIB (T3N0) in 4 cases.

A frozen section of the bronchial wall diagnosed as negative during the operation proved positive at the definitive examination in one patient with TC, but she refused further surgery and is being followed-up; after 16 months no sign of recurrence has been detected.

One patient with a TC developed pretracheal adenopathy 19 years after a right upper sleeve lobectomy; she underwent clinical evaluation for dry, persistent cough. After negative chest X-ray and bronchoscopy, a CT scan of the chest showed enlarged pretracheal nodes, after which a mediastinoscopy was performed; biopsy specimens showed nodes, which were metastatic from the carcinoid tumor. A median sternotomy was then performed with removal of the involved nodes. Five years later the same patient underwent a left thoracotomy for a indeterminate nodule which proved to be a lung adenocarcinoma. Follow-up ranged from 7 to 446 months (mean 137 months). So far, apart from the patient described above neither recurrence in the site of bronchoplasty nor distant metastases have occurred in these patients, and no patient showed stenosis at bronchoscopy.

4. Discussion

Carcinoid tumors, grouped together in the WHO/IASLC classification [5], are clearly distinct from other neuroendocrine carcinomas like large cell neuroendocrine carcinoma or small cell carcinoma and are subclassified into typical and atypical. They are considered malignant tumors of low to intermediate grade. In TCs foci of coagulation necrosis are absent and mitotic figures are 1 or less per 10 high power fields, while in AC mitoses are 2–10 per 10 high power fields and foci of coagulation necrosis may be present. Since mitotic activity is the more important factor separating TC from AC, the distinction between the two may be impossible on small fiber-bronchoscopic specimens. In our experience a diagnosis of carcinoid tumor was made preoperatively in 15 cases, but in no case could the tumor be classified with certainty as typical or atypical, on the other hand it may be very difficult also to evaluate small foci of necrosis and to count mitotic figures on frozen sections during the operation, thus for intraoperative surgical management a diagnosis of carcinoid tumor should be sufficient bearing in mind, according to Thomas [6], that all such patients should be treated and staged similarly to other patients with lung cancer.

The best surgical treatment of central carcinoids is no longer controversial: lung saving procedures appear to be the treatment of choice [7–10]. Since carcinoids, unlike bronchogenic carcinoma, do not spread submucosally, a surgical margin as small as 5 mm is considered adequate [11]. Accordingly any attempt to save lung parenchyma by means of bronchoplastic techniques, either sleeve, wedge or flap, to avoid a bilobectomy or a pneumonectomy or even a lobectomy is justified. In the present series we performed one segmental sleeve resection; it could be questioned the wisdom of performing segmental sleeve resection due to the risk of post-surgical stenosis, however, there is an anatomically ideal site to perform it, the superior segment of left lower lobe. This segment can be removed with a sleeve of the lower lobe bronchus and then an anastomosis between the bronchus to the basilar segments and the proximal stump of the lower bronchus can be performed with minimal risk of stenosis. In our experience on these 25 patients, 15- and 20-year survival was 100 and 71% and no patient died of causes related to the disease and it compares with the 15- and 20-year survival of the other 51 typical and 16 atypical CCT (84 and 75% for TC and 54% for AC) (Fig. 4). The TNM staging system does not seem appropriate for carcinoid tumors since stages IA or IIB
(T3N0) have the same prognosis, and even in N1 or N2 patients long-term survival has been reported as high as 95% at 10 years for TC and 54% for AC [6]. No one of the 25 patients of the present series had metastatic nodes, however, the intraoperative finding of metastatic nodes does not change the surgical strategy because a conservative resection whenever does not preclude a complete resection is to be recommended; differently a clinical N2 disease requires a mediastinoscopy only in cases that preoperative diagnosis is different from carcinoid tumor otherwise surgery remains the treatment of choice because no role for induction chemo- and radiation therapy has been established till now.

We agree with El Jamal [7] that a policy of conservative resection should be followed since it is safe and allows curative resection, provided that distal lung parenchyma is functional. One of the keys to the success of bronchoplastastic procedures to be successfully is that a frozen section of the bronchial margins be obtained and that it be negative both to reduce the risk of local recurrence and the risk of anastomotic dehiscence. Unfortunately, in our experience a negative margin at frozen section proved to be positive at the definitive examination. Although, some authors [12,13] have reported long-term survival (longer than 20 years) in patients with positive post-resection margins, we suggested further operation. Unfortunately the patient refused, accepting only follow-up; however, she is free of evidence of disease 16 months later.

In our experience no recurrence occurred at the bronchoplasty site, and unlike others [14], we observed no early or late bronchial deformation or stenosis in the group of patients treated with a wedge or flap bronchoplasty.

In conclusion, conservative BR should be performed whenever this does not preclude complete resection, to save lung tissue in patients with both typical or ACs. Due to the possibility of loco-regional or distant recurrence even years after the resection, as occurred in our and others’ experience, we think that a long follow-up of these patients is needed both to establish the results of surgery as suggested by El Jamal [7] and to detect and treat any recurrence in time.

References