Surgical treatment of primary pulmonary sarcomas

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Received 21 September 1998; received in revised form 6 January 1999; accepted 27 January 1999

Abstract

Objective: We sought to identify the long-term prognosis after surgical treatment for primary pulmonary sarcoma. Methods: Twenty-three patients were retrospectively identified as having been treated surgically for primary pulmonary sarcoma between 1981 and 1996. The records of all patients were reviewed, and the histopathology reexamined by a pathologist. Results: Fifteen patients were male and eight female; their ages ranged from 20 to 78 (mean 51) years. Tumors measured between 0.9 and 12.0 (mean 5.2) cm across the greatest diameter. The histologic diagnoses were malignant fibrous histiocytoma (8, three grade 1 or 2, two grade 3), synovial sarcoma (4), malignant schwannoma (3), leiomyosarcoma (3), and one case each of angiosarcoma, intimal sarcoma, epitheloid hemangioendothelioma, fibrosarcoma and primitive neuroectodermal tumor. Three patients were found to be unresectable. All three underwent radiation and chemotherapy. Lobectomies or bilobectomies were performed in 13 patients including two sleeve resections, one carinal resection, and one chest wall resection. Four patients underwent radical pneumonectomies. Three patients with invasion of the pulmonary artery, pulmonary veins or atrial wall underwent extended resections with the use of cardiopulmonary bypass. In two, a homograft was used to reconstruct the right ventricular outflow tract. Of the resected patients, six had a positive resection margin, and four had at least one positive lymph node in the specimen. Three patients underwent repeat pulmonary resections for recurrences. Eleven patients received postoperative chemotherapy and eight had radiation therapy. Follow-up was available on 22 patients, and ranged from 2 to 183 (mean 48) months; 14 patients are disease free, six died of disease, one died of surgical complications (operative mortality 5%), and two are alive with disease. Actuarial 3- and 5-year survival of the resected patients was 69%. Size and grade were not found to be correlated with significantly increased survival, but completeness of resection was \( P < 0.05 \). Conclusions: Resection of primary pulmonary sarcomas can produce an acceptable survival rate if the resection is complete. Cardiopulmonary bypass can be a useful adjunct when tumors involve a resectable area of the heart or great vessels. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Primary pulmonary sarcoma; Surgery; Malignant fibrous histiocytoma

1. Introduction

Primary malignant mesenchymal tumors, also known as soft tissue sarcomas, rarely arise in the lungs. The estimated relative incidence of primary lung sarcoma to lung cancer is 0.4% [1]. Due to the limited number of cases, there are only a few series describing the management of these tumors [1–4]. Furthermore, descriptions of patients with ‘primary pulmonary sarcomas’, especially prior to 1975, are confusing. Many reports included lymphoproliferative disorders or carcinomas in their cohorts. In this retrospective study, we review the experience accumulated while surgically treating patients with primary pulmonary sarcoma.

2. Materials and methods

Between 1981 and 1996, 23 patients were treated for a primary pulmonary sarcoma at the Thoracic Surgical Unit.
of the Massachusetts General Hospital. The medical records were reviewed for demographic data, presenting symptoms, findings at preoperative work-up, intraoperative reports, postoperative complications, postoperative adjuvant treatments and discharge status. In addition, follow-up was obtained either from the patients, if alive, or from the referring physicians. The hematoxylin and eosin stained slides of all patients were examined by a pathologist experienced in the field of soft tissue tumor pathology. Immunohistochemistry and electron microscopy were also performed. Actuarial survival was determined by the Kaplan–Meier method and survival differences were compared by the log-rank test. Tumor size and resectability, as well as histologic grade were analyzed for predictors of survival.

3. Results

3.1. Patient characteristics and preoperative findings

There were 23 patients (15 men, eight women) with an age range of 20 to 78 years (mean 51). Main presenting symptoms were cough (five patients), shortness of breath (five patients), asymptomatic mass on routine chest X-ray (four patients), chest pain (four patients), hemoptysis (three patients), and paraneoplastic syndrome (peripheral neuropathy and hypercalcemia) (one patient), fever (one patient).

3.2. Radiologic findings and tumor location

Preoperative chest roentgenograms and computed tomograms (CT) were reviewed. A lobar mass was diagnosed in 12, a hilar mass in seven, a peripheral nodule in two, chest wall invasion in one and tracheal invasion in one patient respectively. Lung or lobar collapse was seen in four patients.

3.3. Pulmonary function

Pulmonary function tests were obtained in 12 patients: they showed a normal pattern in six patients, an obstructive pattern in five patients, and a restrictive pattern in one patient.

3.4. Operative strategy (Table 1)

A correct preoperative diagnosis was obtained with bronchoscopy in three patients and with CT-guided transthoracic needle biopsy or fine needle aspiration in four patients. A false preoperative diagnosis was obtained in four patients. The size of the tumors varied from 0.9 and 12 cm (mean 5.2). Eleven tumors were 8 cm or greater. Lobectomies or bilobectomies were performed in 13 patients including two sleeve resections, one carinal resection, and one chest wall resection. Four patients underwent radical pneumonectomies. Three patients had extended radical resection with cardiopulmonary bypass support: two had tumor extension into the main pulmonary artery; a pulmonary homograft was used to reconstruct the right ventricular outflow tract. These patients are the subject of previous reports of the clinicopathological conferences at the Massachusetts General Hospital [5,6]. One patient had tumor growth into the left atrium and diaphragm. Three patients were found to be unresectable and underwent diagnostic thoracotomies only. Three patients underwent repeat pulmonary resections for recurrences. Of the resected patients, six had a positive resection margin (three of which died within 2 years), and four had at least one positive lymph node in the specimen (two of which died within 3 years). Thirteen patients had complete surgical resection with negative margins and negative lymph nodes.

3.5. Pathology

The histologic diagnoses were malignant fibrous histiocytoma (MFH) in eight patients (three grade 1, three grade 2, two grade 3), synovial sarcoma in four, malignant schwannoma in three, leiomyosarcoma in three, and one case each of angiosarcoma, intimal sarcoma, epitheloid hemangioendothelioma, fibrosarcoma and primitive neuroectodermal tumor.

3.6. Early results

One 67-year old patient who had undergone a simultaneous left radical pneumonectomy, diaphragm resection and a left lobectomy of the liver for recurrence of a leiomyosarcoma (the initial resection was a lingulectomy) died of postoperative cardiac arrest and subsequent multiple organ failure (operative mortality 5%).

3.7. Postoperative chemo- or radiation therapy

The three patients that were not resected underwent adjuvant chemo- and radiation therapy. Two of these patients died within 2 years of diagnosis; one is alive at 5 years. Eleven patients underwent postoperative chemotherapy and eight had radiation therapy. The majority of patients received an adriamycin-based multi-drug regimen.

3.8. Late follow-up

Follow-up was available on 22 patients, and ranged from 2 to 183 (mean 48) months; 14 patients are disease free, six died of disease, and two are alive with disease. Actuarial 3- and 5-year survival of the resected patients was 69% (Fig. 1). Size and grade were not found to be correlated with significantly increased survival (Figs. 2 and 3), but completeness of resection was (5-year survival: 83 vs. 52%, \( P < 0.05 \), only resected patients included) (Fig. 4).
4. Discussion

Primary lung sarcomas are rare tumors, and the few published large series, generally involving between 10 and 40 patients, originate from high volume thoracic surgical centers [1–3,7]. They usually metastasize hematogenously. Careful obtaining of the clinical history is essential, as it is always necessary to exclude a primary tumor elsewhere in the body. This would radically alter treatment strategies. This series presents long-term follow up on 23 patients treated at a single institution for primary pulmonary sarcoma. We could not identify a specific symptom at presentation, as most presenting symptoms would be commonly found in other lung cancers. Four patients (18%) were asymptomatic at presentation. Previous reports have similar findings [1–3,7]. Similarly, radiologic findings and preoperative pulmonary function tests were non-specific, and could have applied to any type of lung cancer.

All histological material was reviewed in an effort to exclude those patients who formerly would have been considered as carrying a diagnosis of pulmonary sarcomas, but under current nomenclature do not. When needed to support the diagnosis, immunohistochemical and ultrastructural studies by electron microscopy were performed. All tumor
grades were reevaluated. Malignant fibrous histiocytoma was the most common histologic cell type diagnosed in this study, occurring in a third of our patients. Prior to the recognition of MFH as a distinct neoplasm in the mid-1960s, it was usually classified as a variant of fibrosarcoma, leiomyosarcoma or liposarcoma [8]. This may account for the relatively large number of leiomyosarcomas and fibrosarcomas reported in most older series [2,9]. MFH has since been recognized as the most common soft tissue sarcoma in adults, and is distinct from other sarcomas in that it is composed of both histiocyte-like and fibroblast-like cells by light and electron microscopic examination [8,10]. Survival after complete surgical resection for MFH has been reported to be improved as compared with survival after resection for other sarcomas [8]. Our study seems to support this conclusion since four out of our eight patients with MFH are long-term survivors who survived more than 5 years with no evidence of disease. Two are alive with no evidence of disease 2 and 3 years postoperatively. One patient has undergone chemotherapy and radiation therapy for a chest wall and skin recurrence, and another patient died 4 months postoperatively in rehabilitation from an unknown cause. Synovial sarcoma, a morphologically well defined neoplasm of the soft tissues, was the next common lesion seen after MFH. Synovial sarcomas are characterized by an atypical spindle cell proliferation, and are, in most recent series, the second most common primary pulmonary sarcoma [1,7,11]. Leiomyosarcoma, the most commonly reported primary pulmonary sarcoma in most previous series, was seen in only three patients in our study [1–3,7].

CT-guided needle biopsy was used in four patients only. This is likely due to the fact that it is a historical series. Bronchoscopy yielded a diagnosis in three cases where the tumor was invading the airway. In the majority of patients, diagnosis was made during formal thoracotomy. Complete resection has been shown in all previous series to be a significant predictor of improved survival [1,2,7]. Our study exhibits similar findings. For that reason, we believe that aggressive resection of centrally located primary pulmonary sarcomas is justified in otherwise healthy patients. The aim at surgery is to achieve negative margins, and perform a thorough mediastinal lymph node dissection in an effort to adequately stage the patient. We have used cardiopulmonary bypass support and various techniques of right ventricular outflow tract reconstruction to achieve radical resection in three patients, and have found it a useful adjunct when tumors involved a resectable area of the heart or great vessels.

In a report from the Mayo Clinic [3], size was thought to have an impact on survival. In the most recent updated series of 42 patients from Memorial Sloan–Kettering Cancer Center [7], there was a distinct trend in which survival was better in patients with tumors less than or equal to 5 cm. We did not find that the size of tumor was correlated with a significantly increased survival. In Janssen et al., report, the grade of malignancy appeared to be a prognostic factor as well [2]. We could not correlate these findings. Postopera-
tive chemo- and radiation therapy is now routinely given if resection margins or lymph nodes were positive. Recurrences, if localized, should be resected with the same aim at negative margins as during the first resection.

In conclusion, our data demonstrate that resection of primary pulmonary sarcomas produces an acceptable survival rate if the resection is complete. MFH might carry a slightly better prognosis than other primary pulmonary sarcomas. Cardiopulmonary bypass is a useful adjunct when tumors involve a resectable area of the heart or great vessels.

References


Appendix A. Conference discussion

Dr P. Van Schil (Edegem, Belgium): There were some patients with positive lymph nodes that I noted from your slides. Do you consider preoperative mediastinoscopy in these patients? And what do you do in case of N2 disease? And secondly, there were some irresectable tumors or positive resection margins in your series. Do you advocate induction chemo- or chemoradiotherapy in these kind of tumors?

Dr Bacha: In terms of the first question, yes, we do advocate mediastinoscopy in every case. Now, those are sarcomas which typically do not spread to lymph nodes, but spread hematogenously, so that most metastases are found in other organs of the body. However, we do advocate mediastinoscopy in every case as for any other lung cancer. That has been the philosophy of the service for a long time.

In terms of N2 disease, now, we would give induction chemoradiation therapy and then proceed with surgery. We would also perform a mediastinal lymph node dissection at the time of surgery, mainly for staging purposes but also in a curative intent.

Dr A. End (Vienna, Austria): What is your protocol for follow-up?

Dr Bacha: It’s the same protocol as we would use, again, for any lung cancer patient, which means that the surgeon sees the patient at least twice, at 1 month after discharge and at 6 months after discharge, and then usually the oncologist takes over.

Dr Walesby (London, UK): You state that by using cardiopulmonary bypass to remove the tumors is an acceptable practice, but did the patients in whom this technique was used come into the long survival category? It has been my impression that although it may be technically possible to achieve a resection this way, that many do not have long survivals. That is, they are not thereafter in a ‘good risk’ group? What are your findings?

Dr Bacha: All three survived. In two of them we achieved negative margins. In one, we could not achieve negative margins, because we kept resecting the infundibulum and the margins kept coming back positive, we then closed. And this patient, surprisingly, I have to say, a year later underwent a heart-lung transplant for those positive margins. He was alive and doing well one year post-transplant.