Case report

Double prosthetic replacement of pulmonary artery and superior vena cava and sleeve lobectomy for lung cancer

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Abstract

We present a case of double prosthetic replacement of the right pulmonary artery and superior vena cava combined with upper sleeve bi-lobectomy for a limited pT4N1 adenocarcinoma occurring in a patient with poor pulmonary reserve, which, to the best of our knowledge, has never been reported before. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

Centrally located lung cancers with invasion of great vessels are usually considered inoperable on biological or functional grounds.

More recently, however, complex bronchoplastic techniques have gained acceptance as adequate alternatives to pneumonectomy [1–3], and superior vena cava (SVC) resection has been performed with low morbidity, even if combined with tracheal resection [4,5].

2. Case report

A 68-year-old woman complaining of back pain for 2 months underwent a chest X-ray examination showing a right lung opacity. At bronchoscopy, a tumor was found occluding the right upper lobar bronchus and biopsy revealed a non-small cell lung cancer (NSCLC).

The chest CT-scan showed a 35 × 40 mm tumor within the right upper lobe hilum with almost complete lobar collapse and suspicion of SVC infiltration. No enlarged hilar or mediastinal lymph nodes were detected (Fig. 1A). Total body CT-scan and bone scan were negative for metastases.

The patient was a former smoker with chronic obstructive pulmonary disease (COPD). Cardiac and respiratory evaluation demonstrated a severe obstructive lung disease with a forced expiratory volume in 1 s (FEV1) of 1.05 l (49.9% of predicted value) and a diffusing lung capacity for carbon monoxide (DLCO%) of 41.7%.

Complete lung function showed a forced vital capacity (FVC) of 1.69 l (67% of predicted value), FEV1/FVC of 61%, residual volume by helium dilution (RV-He) of 2.94 l (145% of predicted value) and total lung capacity by helium dilution (TLC-He) of 4.67 l (95% of predicted value).

The patient was considered unfit in any case for a right pneumonectomy and underwent the surgical exploration through a right lateral muscle-sparing thoracotomy.

The V/Q (ventilation/perfusion lung scan) study was not performed preoperatively. On the basis of the CT-scan images, the upper lobe was judged as not significantly contributing to the lung function because it appeared to be severely destroyed and damaged by multiple bullae and emphysema. The patient was considered unfit in any case for a right pneumonectomy, and underwent the surgical exploration with the intent to perform a lobectomy or a bi-lobectomy, eventually associated with bronchoplastic reconstruction, and was thought to profit from the resection according to the so-called ‘lung volume reduction effect’ of surgery in emphysema patients.

At the intraoperative evaluation, the tumor had infiltrated the phrenic nerve, the lateral wall of the SVC for approximately 2 cm in length and the pulmonary artery (PA) from the external surface of the pericardium to the origin of the
segmental division for the upper lobe. The right upper bronchus appeared to be involved at the origin, with the tumor extending towards the intermediate bronchus.

A radical mediastinal nodal dissection was performed as a first step, and selected nodes (from subcarinal and lower paratracheal area) were sent for frozen section with no evidence of node metastases.

After intravenous injection of 5000 UI of sodium heparin,
the SVC was clamped for a total time of 24 min. A truncular resection was performed and the vein reconstructed by interposition of a \( \varnothing = 12 \) mm ringed polytetrafluoroethylene (PTFE) graft. A running suture with non-absorbable monofilament material (5/0 polypropylene) was used for both anastomoses (Fig. 2A).

The right PA was then clamped at the origin, and circumferentially resected in the portion between the origin of the anterior mediastinal branch for the upper lobe and the apical segmental branch for the lower lobe (Fig. 2B). The pulmonary resection was completed by an upper sleeve bi-lobectomy en-bloc with the phrenic nerve, pericardium, SVC and PA resection. The airway conduit was reconstructed by anastomosis between the right main and the lower lobar bronchi with two running sutures of 3/0 polypropylene. The PA was replaced by interposition of a \( \varnothing = 10 \) mm ringed PTFE graft with two running sutures of 5/0 polypropylene. The total arterial clamping time was 22 min.

A pericardial fat flap was used to cover the bronchial anastomosis. All excisional margins were intraoperatively tested and showed no microscopic residual disease. The postoperative course was complicated by pustum plugging requiring a single aspiration bronchoscopy on postoperative day 3 and by an episode of atrial fibrillation which was medically treated successfully. The two chest drains were removed on postoperative days 3 and 4.

Pathological examination showed a moderately differentiated adenocarcinoma of the lung with direct extension into a single intraparenchymal node, the pericardium, the PA and SVC wall (pT4N1, grading 2).

The patient was started on anticoagulation therapy from the day of surgery and is currently taking oral medications. She did not receive any postoperative adjuvant treatment, and 13 months after surgery, was asymptomatic and whole body CT-scan showed no evidence of relapse and patency of both prostheses (Fig. 1B).

3. Comment

In most instances, locally advanced bronchogenic carcinoma with infiltration of the PA or SVC (cT4) is regarded as an incurable disease, and whenever a radical resection is undertaken, it is often performed by pneumonectomy despite functionally normal distal parenchyma. However, in the last two decades, various lung-sparing techniques (sleeve resections of bronchus and/or PA) have emerged as the procedures of choice for patients with limited pulmonary reserve. Many reports are available on bronchoplastic procedures for NSCLC, but few have been performed in association with SVC resection and even less experience exists on PA resection.

The indications for SVC resection in lung cancer should be very carefully selected, as the oncological benefit is still uncertain [5–7]. The reported 5-year survival ranges from 0 to 29%, but the number of cases is small and the data are not easily comparable. In fact, some authors include thoracic malignancies other than NSCLC and there is no differentiation between tumor (T4) and nodal (N2) involvement of the SVC.

Clinical experience with the reconstruction of PA is even more limited. This approach has not become as popular as one might anticipate due to concern regarding postoperative complications and poor expected survival [8]. A recent paper from Rendina and co-workers [9], based on a series of 52 cases of resection of PA for lung cancer, showed morbidity and mortality rates comparable with those currently reported for standard lobectomy, and a comparable survival, stage by stage. Similar favorable results have been reported by Kaiser and co-workers [10].

Techniques of PA reconstruction range from direct oversewing, in cases of limited tangential resection, to patch closure, when more than one-third of the circumference has to be resected, to sleeve resection (so-called ‘vascular sleeve’), when the defect is greater than 50% of the arterial wall. The use of prosthetic materials such as PTFE has not become popular due to the risk of infection and thrombosis. In our case, the need for prosthetic replacement was determined by the distance between the two margins of the PA, which was not suitable for a sleeve reconstruction. The use of combined great vessels replacement and bronchial sleeve resection was dictated by the central origin of the tumor and allowed a radical resection in a patient otherwise inoperable for functional reasons, suggesting that even complex lung-sparing operations can be pursued with the intent of cure if a complete anatomical resection can be achieved.

References

