Early to Midterm Results of Cardiac Surgery with Concomitant Pulmonary Resection

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Background: We report our experience of cardiac surgery with concomitant pulmonary resection, based on analysis of the results.

Methods: Eleven patients (1 woman, 10 men) underwent cardiac surgery simultaneously with pulmonary resection; ten of them through median sternotomy. The cancer pathology consisted of non-small cell carcinoma (n = 10), and benign teratoma (n = 1). All lung lesions were removed using a wedge resection. Cardiac procedures consisted of off-pump coronary artery bypass grafting (n = 4), aortic valve replacement (n = 3), mitral valve plasty (n = 2), total arch replacement (n = 1), and descending aorta replacement (n = 1). Lung wedge resections were performed after induction with protamine sulfate.

Results: The mean follow-up period was 19 ± 11 months (2–34). There was no operative mortality and no major cardiac complications. Three patients underwent a subsequent lobectomy through lateral thoracotomy. There were two postoperative deaths: one was from an unknown cause, 8 months postoperatively and another was from a lung cancer recurrence, 9 months after surgery. There were two local recurrences, 9 months and 14 months, postoperatively. The mean cancer-free period was 17 ± 10 (2–32) months.

Conclusion: Rates of operative mortality and morbidity following cardiac surgery with concomitant pulmonary resection were favorable, and early to midterm results were acceptable.

Keywords: lung cancer, concomitant cardiac surgery, wedge resection

Introduction

The simultaneous occurrence of lung cancer and cardiovascular disease is not uncommon and may occur due to the smoking habit that can be a risk factor in both diseases. There is controversy over the relative benefits of sequential and concomitant procedures, the choice of which depends on the individual institution. Some institutions conduct a staged surgical procedure in which the cardiac surgery is mostly performed first followed by the lung surgery. Potential problems with this approach include delay in the lung resection due to the postoperative recovery phase and the additional cost of two operations. However, the concomitant procedure also has its shortcomings, such as the risk of dissemination due to manipulation of the pulmonary lobe, mechanical stress on the cardiac chambers, inability to perform radical lymph node dissection, and the risk of increasing the amount of blood loss due to the effect of heparinization.

We studied a series of eleven patients who underwent concomitant pulmonary wedge resection and cardiac surgery. The aim of the study was to analyze the outcome of...
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these operations in terms of operative and postoperative complications and early to midterm outcome.

Patients and Methods

From February 2008 to January 2011 eleven patients underwent concomitant cardiac surgery with lung resection at our department of cardiovascular and thoracic surgery. The majority of patients (7 of 11, 64%) with lung cancer who were referred to us for lung cancer had known cardiovascular disease. The mean age was 71 ± 13 years old. A summary of the clinical data is presented in Table 1.

Four patients had coronary artery disease (1 two-vessel disease, 3 three-vessel disease). Five patients underwent valve procedures and two patients’ aortic procedures. Left ventricular function measured by echocardiography was assessed as normal in 10 (91%). Standard preoperative investigations consisted of body and brain computed tomography (CT), pulmonary function test, and sputum cytology. We did not perform routine bronchoscopy or CT guided needle biopsy preoperatively. We performed this method for only T1 tumors (diameter less than 3 cm). Patients with tumor larger than 3 cm underwent examination for lung cancer such as bronchoscopy or CT guided needle biopsy preoperatively for clinical staging.

A double lumen endotracheal intubation was used in all cases. Median sternotomy was applied in 10 patients. No additional incision was needed in any patient. All coronary artery bypass grafting was performed in an off-pump fashion. Cardiopulmonary bypass (CPB) was used in seven cases. The pulmonary resection was performed after the completion of cardiac procedures and hemostasis following protamine reverses. Wedge resections were applied for all patients. Nodal excision was not performed without any evidence of nodal enlargement on preoperative CT scan.

Follow-up visits, at each of which routine tests such as chest X-ray and CT were performed, were set for 3 months after surgery and thereafter at 6-monthly intervals. Survival rate and cancer-free rate were obtained using the Kaplan-Meier method.

Results

There were no operative mortalities or hospital deaths. None of the patients required re-exploration for excessive bleeding. Perioperative or postoperative myocardial infarctions were not detected. Prolonged ventilation was not required in any of the patients. There were no episodes of deep sternal or chest space infection and no pneumonia, prolonged air leakage, re-exploration, tamponade, or stroke. One patient developed postoperative paroxysmal atrial fibrillation, which was treated with an anti-arrhythmic agent.

The average period of hospital stay was 16 ± 5 days. The mean intubation time was 9 ± 5 hours and the mean ICU stay 21 ± 10 hours.

The pathological findings consisted of six cases of adenocarcinoma (55%); three, of bronchioalveolar carcinoma (28%); one, of squamous cell carcinoma (9%); and one, of benign teratoma (9%) (Table 2). There was no pleural invasion. Three patients had a subsequent lobectomy; 2, a lobectomy with a 1b-nodal dissection; and 1, an upper segmental resection.

Patient follow-up was complete (Table 3). The mean follow-up period was 19 ± 11 months (2–34). There were two postoperative deaths, one due to unknown cause 8 months postoperatively and the other due to lung cancer recurrence 9 months after surgery. There were two local recurrences, 9 months and 14 months postoperatively. The mean cancer-free period was 17 ± 10 (2–32) months. No patient underwent adjuvant chemotherapy.

According to Kaplan-Meier analysis, the operated patients had an 80% chance of 2-year survival, with a 2-year cancer-free rate of 79%.
Discussion

There have been few large-scale studies of lung resection with concomitant cardiac surgery, about which there is still no widely accepted consensus. At our institution, we have decided to perform cardiac surgery with concomitant wedge resection.

The shortages of our strategy were that its cost, stress and pain were double if the lesion requires subsequent lobectomy. The advantages are as follows: firstly, if the resected tumor is a bronchioloalveolar carcinoma (BAC), this procedure can be a complete, curative treatment. Secondly, the perioperative risks are fewer than for concomitant lobectomy: our result show very few complications, with no empyema, deep sternitis, or prolonged air leakage, possibly due to the safety of using only wedge resection techniques. Thirdly, a second-stage operation can be used to perform a complete radical nodal dissection through a lateral thoracotomy, an operative approach frequently used by general thoracic surgeons, especially for the lower lobes.

Compared to previous case reports, our study has older patients mean age of 71. In some cases, the secondary lobectomy for adenocarcinoma was delayed for the observation purposes. The population of Japan is rapidly aging. Complete resection remains the treatment of...
choice for early non-small cell lung cancer, but the risks of surgery are high in elderly patients, in whom it is difficult to determine whether curative resection is feasible.6) As several previous studies have shown, concomitant lobectomy is possible, but the indications for this approach should be studied carefully. These depend on many factors, such as age, activity of daily living, performance status, and tumor progression. A surgical strategy to suit each case should be worked out. As Brutel and colleagues demonstrated,7) causes of death are various and complex, and there may be no demonstrable relationship between tumor stage and survival.

In all cases, the isolated coronary artery bypass was performed in an off-pump fashion in our institute. As a result, we were able to avoid the adverse effects of using CPB, which has been demonstrated to have an inhibitory effect on the various components of the immune system.8–10) It has been shown for instance that the activity of natural killer cells is inhibited by CPB and remains so in the immediate postoperative period. Schoenmakers and colleagues,11) however, found no evidence that off-pump surgery is superior to on-pump in patients undergoing concomitant cardiac and pulmonary surgery. Dyszkiewicz et al. and Ochi et al.,2,12) on the other hand, do cite benefits of off-pump coronary artery bypass grafting (OPCAB) with lung resection.

**Conclusion**

From our experience, we conclude that cardiac surgery with concomitant lung wedge resection can be performed safely. The early-to-midterm survival rate was satisfactory, and the cancer-free rate was acceptable. OPCAB is a reasonable choice for isolated coronary bypass grafting with concomitant lung resection.

**Disclosure Statement**

The authors report no conflicts of interest in the writing of this report.

**References**