

Thoracoscopic Lung Cancer Resection with Simultaneous Heart Valve Procedure

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INTRODUCTION

Comorbidity of primary lung cancer and heart valve disease, both requiring surgical therapy, characterizes a high-risk group of patients necessitating prompt diagnosis and treatment. Recently, the rate of minimal invasive approach for patients who were not indicated for conventional thoracotomy surgery due to their high-risk status with the procedure has increased as treatment for heart valve disease. We herein report four patients of lung cancer resection with simultaneous valve procedure though thoracoscopic technique [Bablekos 2016].

CASE REPORT

Here, we present a series of four male patients who received combined surgical treatment for heart valve and lung disease in a one-step procedure between July 2018 and October 2020. Their mean age was 61 (47-72) years. The patients' demographic data are shown in Table 1. (Table 1) Two patients presented with a documented lung tumor and concomitant mitral regurgitation was found at their preoperative assessment. The other two patients presented with a known tricuspid regurgitation and a lung lesion on their preoperative chest X-rays, and one patient presented with atrial myxoma and a lung tumor of the right lower lobe found during the initial evaluation for his cardiac disease.

The standard preoperative assessment included chest X-rays, C/T of the thorax, abdomen, and brain, bronchoscopy, bone scan, lung function testing, echocardiography, and coronary angiogram. Ventricular function assessed by echocardiography and ventriculography was normal in all patients. Three of the four patients had a preoperative diagnosis of non-small-cell lung cancer. All patients were operated on the basis of an absence of mediastinal lymphadenopathy and metastatic disease, according to the results of their preoperative evaluation. The thoracic portions were done by one team, and the cardiac portions were performed by another team.

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Operative technique and data: After induction of anesthesia, all patients with a known or suspected malignant lung tumor had a double-lumen endotracheal tube positioned in order to achieve one-lung ventilation. All patients were operated through thoracoscopic approach. After gaining access in chest cavity, pulmonary resection was carried out before systemic heparinization, and CPB was established. Patients with known NSCLC underwent anatomic lung resection consisting of right middle lobectomy and right lower lobectomy (or wedge resection). Hilar lymph node excision was carried out. None of the patients with lung cancer presented with N2 disease. Frozen section analysis confirmed R0 resection in all three patients with lung cancer and revealed the presence of benign lesions in the other one limiting the extent of lung resection. After lung resection was performed and hemostasis was secured, systemic heparinization and institution of CPB was carried out. CPB was instituted via femoral arterial and venous cannulation through a 2-3 cm transverse incision in the right groin. Retrograde perfusion was performed through the right femoral artery (18-24 Fr). All procedures were performed through total thoracoscopic approach. Among them, patients who underwent tricuspid valve surgery and right atrial tumor resection did not undergo cardiopulmonary bypass. The mean CPB time was 147.3 minutes (78-217 minutes), and cross-clamp time was 125.5 minutes (111-140 minutes). The double lumen tube left in place was not changed out during the cardiac portion of the case. All patients with mitral regurgitation received valvuloplasty with artificial tendineae implantation and annuloplasty (No.30 Physio II ring/No.34 Cosgrove band). The other two patients received tricuspid valvuloplasty (No.28 Cosgrove band) and right atrial tumor resection, respectively. Rib blocks with local anesthetic were used to manage discomfort in these patients.

Clinical outcome: All patients were transferred to the ICU postoperatively. Hemodynamic monitoring was conducted to all patients using Swan-Ganz catheterization. Minimal inotropic support was needed before final hemodynamic stabilization. Mean blood loss was 272.5 cc (110-400 cc). No patient required re-exploration for excessive bleeding. No patients received blood transfusion postoperatively. After hemodynamic stabilization was obtained, weaning from mechanical ventilation was successful, with a mean ventilatory support before extubation of 12.25 h (9-19 h). (Table 2)

There was no perioperative mortality that occurred. All patients recovered uneventfully and were discharged from the ICU within 24 hours postoperatively. No new atrial fibrillation or other arrhythmia occurred. The mean length of postoperative stay was 7.5 d (7-9 d).

Table 1. Baseline characteristics of patients

	Patient I	Patient II	Patient III	Patient IV	Total
Age (year)	65	47	60	72	61
Sex (male)	Yes	Yes	Yes	Yes	4/4
BMI (m/kg ²)	25.3	19.4	22.1	24.2	22.75
Hypertension	Yes	No	No	No	1/4
Ejection fraction (%)	70	62	71	56	64.75
Heart valve disease					
Mitral regurgitation	Yes	Yes	No	No	2/4
Tricuspid regurgitation	No	No	Yes	No	1/4
Atrial myxoma	No	No	No	Yes	1/4
Pulmonary lesion					
Right lower lobe	Yes	Yes	No	Yes	3/4
Right middle lobe	No	No	Yes	No	1/4

Table 2. Perioperative data

	Patient I	Patient II	Patient III	Patient IV	Total
Heart surgery procedure					
Mitral valvuloplasty	Yes	Yes	No	No	2/4
Tricuspid valvuloplasty	No	No	Yes	No	1/4
Resection of right atrial tumor	No	No	No	Yes	1/4
Lung surgery procedure					
Lobectomy	No	Yes	Yes	Yes	3/4
Wedge resection	Yes	No	No	No	1/4
Operative data					
CPB time (min)	155	217	139	78	147.25
Cross-clamp time (min)	111	140	N/A	N/A	125.5
24-hour drainage (cc)	400	320	110	260	272.5
Mechanical ventilation (h)	10	11	9	19	12.25
Postoperative stay (d)	7	7	7	9	7.5
Histopathological outcome					
Adenocarcinoma	Yes	No	No	Yes	2/4
Granuloma	No	Yes	Yes	No	2/4
Clinical staging	T1bN0M0	N/A	N/A	T1bN0M0	

Histopathological data: According to the results of postoperative histopathological examination, the lung pathology consisted of non-small-cell lung cancer in two patients (adenocarcinoma staged as T1bN0M0), both highly differentiated. The other two patients had benign lesions, both granuloma. The absence of N2 disease was determined by intraoperative sampling.

Follow up: Follow up, ranging from three to 27 months (mean: 15 months), was available for all patients. All patients with pulmonary malignancy were alive after surgery without signs of local or distant recurrence of the tumor. All four patients had good performance status with normal ventricular function at the postoperative echocardiography controls. One patient with mitral valvuloplasty were under oral anticoagulants.

DISCUSSION

Surgery is the cornerstone of curative treatment for non-small cell lung cancer. However, cancer and heart disease may coexist, particularly coronary, but also valvular disease, most likely due to the same risk factors. Heart valve disease can be incidentally discovered during preoperative evaluation of LC. The conventional treatment for heart valve disease is open-heart surgery under median sternotomy with CPB. As a less-invasive treatment method for valve disease, thoracoscopic technology performed without open-heart surgery has become widely used [Drevet 2019].

Treatment strategy includes simultaneous staged procedures, but the use of cardiopulmonary bypass (CPB) in an oncologic context still is controversial. Combined procedures have a high level of in hospital mortality reaching 7% [Brutel 1995]. The concomitant approach is associated with substantially higher perioperative morbidity, rendering the staged

approach the preferred one. However, the second stage usually is delayed by 4-6 weeks, allowing recovery and complete healing of the sternum enabling lateral decubitus for pulmonary resection. But this delay potentially leads to unresectability or metastatic spreading [Nagata 2018]. In the past decade, thoracoscopic heart valve procedure has become a safe alternative strategy in the treatment of severe valve disease. There were no deaths in this group of patients during the follow up.

CONCLUSION

Pulmonary resection followed by thoracoscopic heart valve surgery can safely be performed, and this strategy could be a viable option for patients with both lung cancer and severe heart valve disease.

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