Lung Transplantation and Coronary Artery Disease

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Background. **Coronary artery disease (CAD) remains a relative contraindication to lung transplantation. We have offered lung transplantation and coronary revascularization to selected patients with discrete CAD and preserved left ventricular function. The purpose of this report is the following: (1) to examine the short-term and medium-term outcome of patients after coronary revascularization and lung 3transplantation; and (2) to compare the short-term and medium-term outcome of this cohort to a matched group of lung transplant recipients without CAD.**

Methods. **From January 2000 to March 2010, 27 patients with CAD underwent coronary revascularization and lung transplantation. The control group was matched based on age, diagnosis, lung allocation score, and type of procedure.**

Results. **Lung transplant recipients with CAD and the control group had similar incidence of primary graft dysfunction (grade III). The duration of mechanical ventilation, intensive care unit stay, and hospital stay were the same. At a mean follow-up of 3 years, the incidence of composite adverse cardiac events was similar in the 2 groups.**

Conclusions. **Lung transplant recipients with CAD and the control group also had similar medium-term survival. Lung transplantation can be considered in patients with preexistent CAD with acceptable early and medium-term outcomes.**

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Coronary artery disease (CAD) is considered a relative contraindication for lung transplantation in many centers. The rationale for this policy are several: (1) concern that chronic immunosuppression may accelerate coronary atherosclerosis [1]; (2) concern that patients with CAD may have a limited short-term and medium-term survival due to their atherosclerosis [2]; (3) presumption that concomitant lung transplantation and myocardial revascularization may be associated with a higher surgical risk; and (4) donor shortage.

There is a growing body of data suggesting that newer classes of immunosuppressive medications and utilization of statin drugs and antiplatelet agents may have a protective effect on progression of native coronary artery disease [3, 4]. In addition, multiple reports have demonstrated that coronary revascularization (either by percutaneous coronary intervention [PCI] or surgical revascularization) can lead to event-free, long-term survival [5, 6]. There are also several reports from experienced centers that concomitant coronary revascularization and lung transplantation can be performed with acceptable perioperative outcome [7–10]. Donor shortage remains a pressing issue in the field of lung transplantation. There are reports that the donor lung pool can be expanded without any adverse outcome [11–13]. To address donor shortage and implement a more rational matching-allocation system, some centers have advocated adoption of an "alternate program" where nonstandard donor organs are allocated to high-risk recipients after informed consent [14].

Given the increasing number of lung transplant candidates with CAD, we adopted a policy in 2000 to accept patients with CAD for lung transplantation provided that they had no other contraindications, they had discrete coronary artery lesions, and they had preserved left ventricular function. The purpose of this report is two-fold: (1) to report the short-term and medium-term outcome of this cohort of patients after coronary revascularization and lung transplantation; and (2) to compare the short-term and medium-term outcomes of this cohort to a matched group of patients without CAD.

Patients and Methods

This study was approved by the Institutional Review Board. The records of all patients who underwent lung transplantation at the University of California-Los Angeles from January 2000 to March 2010 were reviewed. During this period, 27 patients underwent lung transplantation and coronary revascularization and are the subject of this study.

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Abbreviation and Acronyms

BMS = bare metal stent
BOS = bronchiolitis obliterans syndrome
CABG = coronary artery bypass graft
CAD = coronary artery disease
CVA = cerebral vascular accident
DES = drug eluting stent
ICU = intensive care unit
LAS = lung allocation score
PCI = percutaneous coronary intervention
PGD = primary graft dysfunction

Coronary Artery Screening Protocol in Lung Transplant Candidates

Male candidates over the age of 40, female candidates over the age of 45, or younger candidates with symptoms suggestive of ischemic heart disease were routinely screened for CAD by coronary angiography. Myocardial stress studies were not performed as a screening tool or confirmatory study.

Selection Criteria for Lung Transplant Candidates With CAD

Patients with diffuse CAD or patients with an ejection fraction of less than 0.50 and concomitant CAD were rejected for transplantation. Patients with discrete coronary lesions (>50% in the left main coronary artery or >70% in other major vessels) and preserved ejection fraction (who were otherwise acceptable candidates) were accepted for lung transplantation. It should be emphasized that this cohort had no other relative contraindication and were otherwise deemed to be good candidates for lung transplantation.

Coronary Revascularization Protocol

All patients with CAD as described above, who were deemed a candidate for single lung transplantation (age >60, no evidence of septic lung disease, and [or] pulmonary hypertension) were considered for PCI or coronary artery bypass grafting (CABG), depending on their anatomy (Fig 1). Patients with left main CAD, or whose anatomy was not suitable for PCI, were referred for concomitant CABG and single lung transplant. All others were referred for PCI followed by single lung transplantation. Bare metal stents were used as clinically indicated. These patients were kept on clopidogrel bisulfate (Bristol Meyers Squibb, New York, NY) for 1 month. Starting in 2004, drug eluting stents were used selectively. These patients were kept on clopidogrel from 6 to 12 months and underwent the transplant procedure on clopidogrel.

Patients in need of double lung transplantation were scheduled for concomitant CABG at the time of lung transplantation. Coronary artery bypass grafting and lung transplantation were performed on cardiopulmonary bypass. Saphenous vein grafts were used as conduits as clamshell incision and transverse sternotomy precluded use of internal mammary arteries.

Control Group

Each lung transplant recipient with CAD was matched to a lung transplant recipient without CAD (1:3 ratio). Matching

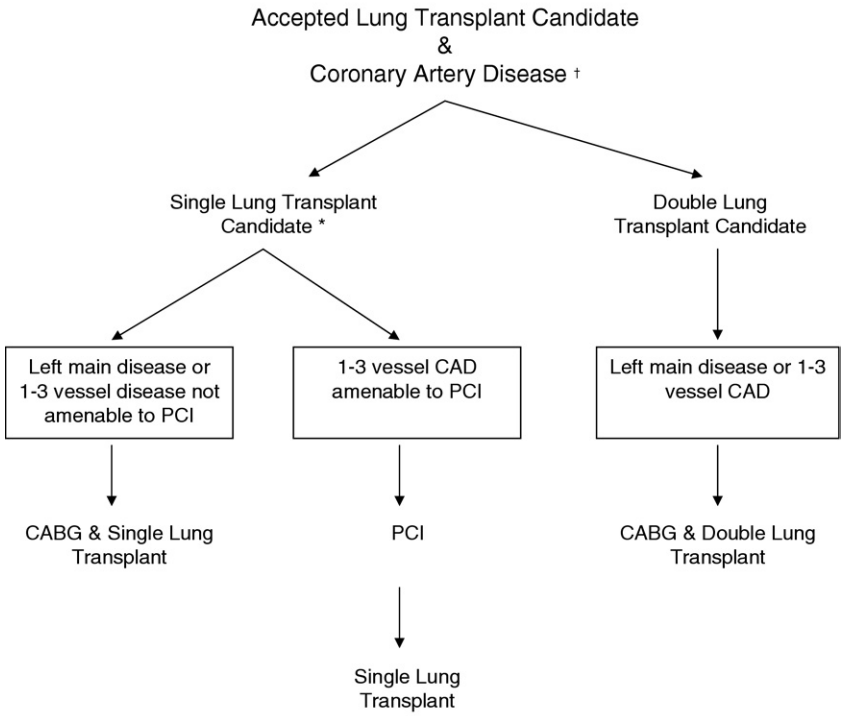

*Fig 1. Coronary revascularization protocol among the accepted lung transplant candidates with coronary artery disease. († = criteria for acceptance of lung transplant candidates with CAD: discrete coronary artery lesions with preserved ventricular function who are otherwise acceptable candidates. * = criteria for single lung transplantation: age > 60, no evidence of septic lung disease, and [or] pulmonary hypertension; CABG = coronary artery bypass grafting; CAD = coronary artery disease; PCI = percutaneous coronary intervention.)*