DISCUSSION

LVRs has been shown to improve the QOL, respiratory physiology, and survival in highly selected patients.^{1,2} Significant cardiac comorbidity is generally considered a contraindication to LVRs. Untreated symptomatic severe aortic stenosis, however, is associated with a poor prognosis.³ In contrast, patients who undergo successful AVR for symptomatic aortic stenosis experience a significant survival benefit.³ Appropriate case selection allied with careful perioperative planning in this case resulted in QOL, functional, pulmonary, and prognostic benefits. A multidisciplinary approach was essential in providing an optimal outcome. A skilled anesthetist was required to ensure proper placement of the epidural catheter and double-lumen endotracheal tube and intraoperative management of the patient. An error in any of these areas could potentially lead to severe consequences. The epidural catheter was placed 4 hours before scheduled surgery, as this strategy has been shown to be safe despite full anticoagulation for CPB.⁴ A satisfactory postoperative thoracic epidural analgesia contributed to the patient's good compliance with physiotherapy and breathing exercises, thereby reducing the risks of postoperative sputum retention and chest infection. Careful anesthetic and intensive care management allowed for maintenance of cardiorespiratory stability and a successful planned early extubation, thereby minimizing the risks associated with mechanical ventilation. Daily medical management by the chest physicians in the perioperative period also ensured that the patient received optimal medical therapy for her emphysema.

The decision to perform the AVR first followed by reversal of anticoagulation prior to LVRs ensured that there was normal hemostasis during LVRs to minimize the risk of pulmonary hemorrhage. We also found it useful to divide the pleural adhesions while both lungs were deflated during CPB. We felt that it was important to achieve satisfactory cardiorespiratory stability and hemostasis before proceeding with the LVRs. A bioprosthetic valve was placed as the patient did not want anticoagulation associated with a mechanical valve. Although a tissue valve is not as durable as a mechanical valve, patients with an FEV₁ < 1 L have a mortality rate of approximately 10% per year. It is probable that a bioprosthetic valve may outlast the patient's life expectancy under these circumstances.⁵

In summary, careful perioperative planning and multidisciplinary strategies ensured a successful concomitant LVRs and AVR with satisfactory clinical outcome and marked benefit for the patient.

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Successful combined bilateral lung volume reduction and coronary artery bypass grafting surgery: Implications and advantages

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Coronary artery disease (CAD) is prevalent in patients with severe emphysema who are being considered for lung volume reduction surgery (LVRs).¹ The National Emphysema Treatment Trial excludes patients with a variety of cardiovascular risk factors from undergoing LVRs, as do many surgeons who perform the procedure outside the trial.² We describe a multidisciplinary approach that led to successful combined LVRs and coronary artery bypass grafting (CABG) surgery and discuss the implications and advantages relating to this combined approach.

CLINICAL SUMMARY

A 53-year-old man was referred for LVRS. He had been considered unsuitable for LVRS at another institution because of the presence of an occluded left anterior descending coronary artery that was not amenable to percutaneous intervention. He had poor pulmonary function caused by bilateral upper lobe severe emphysema (Table 1). He had stopped smoking 6 years previously and was motivated to improve. His left ventricular function was preserved. He consented to a combined bilateral LVRS and CABG. A multidisciplinary approach previously described was adopted.³

A thoracic epidural catheter was placed 4 hours before the scheduled operation to minimize the risk of epidural hematoma related to the impending systemic anticoagulation required for cardiopulmonary bypass (CPB) for CABG. The operation was performed through a median sternotomy. The left internal thoracic artery was used to graft the left anterior descending coronary artery. After CABG and during CPB, pleural adhesions on the deflated lungs were divided by using electrocautery. The patient was then weaned off CPB, and the anticoagulation was fully reversed. After satisfactory cardiorespiratory stability and hemostasis, the LVRS proceeded with the left followed by the right lung using single-lung ventilation. Approximately 30% of each lung was removed by using a stapler buttressed with bovine pericardium. An early extubation, adequate analgesia, and regular physiotherapy were ensured during the postoperative period. The chest drains were removed on postoperative day 5, and the patient was discharged home on day 9. At 4 months, he had a left basal pneumothorax that was successfully treated with chest tube drainage. At 6 months' follow-up, he had a marked improvement and had returned to full-time work (Table 1).

DISCUSSION

Most patients with end-stage emphysema have a history of smoking and are therefore at increased risk for CAD.

Fifteen percent of the patients who were suitable to undergo LVRS were found to have coexisting CAD in a report by Turnheer and colleagues.¹ Because dyspnea is often multifactorial, some patients will have severe and disabling symptoms from a combination of cardiac and pulmonary diseases. The National Emphysema Treatment Trial has shown that in highly selected patients, LVRS offer symptomatic and prognostic benefits.⁴ Although some candidates for LVRS have CADs that are amenable to percutaneous intervention, others have diseases that are not appropriate for such intervention and require CABG. However, these patients are often turned down for LVRS because significant cardiac comorbidity is generally considered a contraindication for LVRS. Appropriate case selection and a multidisciplinary approach have resulted in a successful combined cardiac procedure and LVRS in this case. The fact that the cardiac operation can be performed safely in conjunction with LVRS in highly selected patients has implications for 2 groups of patients.

The first groups of patients includes those who are denied an LVRS on the basis of concomitant cardiac diseases, such as valvular disease or CAD, that would either increase the risk of LVRS or limit their potential for full postoperative recovery. These patients might be considered for a combined operation.

The second group of patients consists of those who are denied a cardiac operation because of a perceived excessive operative risk caused by concomitant severe emphysema. In this group of patients, evaluation of suitability for LVRS could indicate that a combined operation might not only be feasible but might actually reduce the risks of the cardiac procedure by decreasing postoperative pulmonary complications.

There are a number of advantages in performing a combined operation: (1) improved patient convenience, such as only requiring a single hospital admission and operation; (2) reduced costs; and (3) avoidance of difficulties that are associated with performing the operations as a staged

TABLE 1. Symptoms and pulmonary function measurements before and after surgical intervention

	Preoperative baseline	6-mo Postoperative	Improvement (%)
Modified Medical Research Council Dyspnea Scale (degree of dyspnea)	Category 4 (severe)	Category 1 (slight)	
SF-36 Physical Function Score	30	70	
Normal full-time work (office based with intermittent travelling)	Unable	Back to normal full-time work	
FEV ₁ (% predicted)	1.40 L (45%)	2.60 L (84%)	85
FER (% predicted)	42 (52%)	73 (90%)	72
TLCO mmol CO · kPa ⁻¹ · min ⁻¹ (% predicted)	3.26 (36%)	3.68 (41%)	4
KCO (% predicted)	0.71 (49%)	0.85 (59%)	14
FRC (% predicted)	4.81 L (147%)	4.13 L (126%)	16
RV (% predicted)	4.43 L (212%)	3.22 L (153%)	38
RV/TLC	65%	47%	27
6-min Walk	195 m	360 m	84
Oxygen saturation on room air	90%	98%	9

SF-36, Short-Form 36; FEV₁, forced expiratory volume in 1 second; FER, forced expiratory ratio; TLCO, transfer factor of carbon monoxide; KCO, carbon monoxide transfer coefficient; FRC, functional residual capacity; RV, residual volume; TLC, total lung capacity.

procedure (eg, the risks of redo sternotomy to perform the second procedure [LVRS]). Even if one is performing a video-assisted thoracoscopic LVRS after CABG, there are likely to be adhesions relating to previous opening of the pleura to harvest the internal thoracic artery for use as a conduit. Pleural adhesions can make LVRS difficult and are associated with increased morbidity.

In summary, a multidisciplinary team approach has allowed this patient to undergo a successful combined LVRS and CABG. The ability to safely carry out a combined cardiac procedure and LVRS has important implications and advantages.

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Off-pump revascularization with the use of both internal thoracic arteries in a 3-year-old child with Kawasaki syndrome

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Kawasaki syndrome is a generalized vasculitis of unknown origin. Giant coronary artery aneurysms develop in 0.27% of cases.¹ We present the case of a 3-year-old boy with Kawasaki disease with giant coronary artery aneurysms after myocardial infarction. The patient underwent successful revascularization with both internal thoracic arteries (ITAs).

CLINICAL SUMMARY

A 3½-year-old boy had a history of acute Kawasaki disease in September 2003 at the age of 4 months, with giant coronary artery aneurysms (Figures 1 and 2) after standard treatment in the acute stage. During 32 months of follow-up he received treatment with an oral anticoagulant and aspirin, remaining in good general condition with a normal ejection fraction (EF) on transthoracic echocardiography (TTE).

In April 2006 after a varicella infection, his mother noticed slight cyanosis around the mouth, pale skin, and weakness. Physical examination revealed tachycardia, a third

FIGURE 1. Frontal projection of selective LCA injection showing the large aneurysm involving left main and proximal aspects of LAD and circumflex coronary arteries—acute stage.

heart sound, and a systolic murmur at the apex. On the electrocardiogram, new pathologic Q waves were seen in leads II, III, and aV_F. Myocardial damage markers were in the normal range. TTE revealed severe left ventricular dysfunction. The apex and the anterolateral part of the left ventricle were akinetic. This was also confirmed by thallium scintigraphy.

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