Case Reports

Arterial Myocardial Revascularization Using Bilateral Radial Artery

17 Years after Right Pneumonectomy

Nevzat Erdil, MD
Vedat Nisanoglu, MD
Huseyin Ilksen Toprak, MD
Feray Akgul Erdil, MD
Akin Kuzucu, MD
Bektas Battaloglu, MD

We report the case of a 51-year-old man who underwent arterial myocardial revascularization with the use of bilateral radial arteries, 17 years after undergoing a right pneumonectomy. We used a fast-track anesthesia protocol for the procedure. There was no perioperative complication, and postoperative recovery was uneventful. The patient was discharged from the hospital 5 days after the operation. ***(Tex Heart Inst J 2004;31: 96-8)***

After coronary artery bypass grafting (CABG), patients with a previous pneumonectomy are predisposed to a substantial risk of cardiopulmonary complications. The best surgical strategy for performing CABG on a patient with a single lung is unclear from the literature;[1] few such cases have been reported.[1-4] To our knowledge, this is the 1st report of arterial myocardial revascularization with use of bilateral radial arteries and fast-track anesthesia in a patient with a previous pneumonectomy.

Key words: *Angina, unstable/surgery; coronary artery bypass/methods; myocardial revascularization; pneumonectomy; postoperative care; preoperative care; risk factors; time factors*

From: *Departments of Cardiovascular Surgery (Drs. Battaloglu, N. Erdil, and Nisanoglu), Anesthesiology (Drs. Toprak and F.A. Erdil), and Thoracic Surgery (Dr. Kuzucu), Inonu University, Turgut Ozal Medical Center, 44315 Malatya, Turkey*

This paper was presented at the 13th World Congress of the Society of Cardiothoracic Surgeons, 1–5 November 2003, in San Diego.

Address for reprints: *Nevzat Erdil, MD, Inonu University, Turgut Ozal Medical Center, Department of Cardiovascular Surgery, 44069 Malatya, Turkey*

E-mail: nerdil@inonu.edu.tr

Case Report

In June 2003, a 51-year-old man with symptoms of unstable angina was admitted to our hospital for CABG. Seventeen years before, he had undergone a right pneumonectomy because of tuberculosis. There was no coronary risk factor except for family history and hypertension. Anteroposterior radiography and computed tomographic imaging of the chest showed a shift of the trachea and mediastinum to the right and hyperinflation of the left lung (Fig. 1). Arterial blood gas analysis indicated an alkaline pH and hypoxemia. Results of pulmonary function tests revealed moderate restrictive disease consistent with a history of pneumonectomy (Table I). Coronary angiography showed triple-vessel disease with 95% stenosis of the proximal left anterior descending coronary artery, 70% stenosis of the mid right coronary artery, and 80% stenosis of the proximal circumflex artery. Ventriculography indicated hypokinesia in 1 segment of the left ventricle. Results of tests for tuberculosis reactivation were negative.

In preparation for CABG, anesthesia was induced with a fast-track protocol, which included remifentanil, 1 μg/kg; etomidate, 0.2 mg/kg; and vecuronium bromide, 0.1 mg/kg. After intubation, anesthesia was maintained with a continuous infusion of remifentanil, 0.2 to 0.5 μg/kg/min, and propofol, 3 mg/kg/h. The patient was ventilated mechanically with oxygen on room air to maintain a PaO_2 between 150 and 250 mmHg and a $PaCO_2$ between 35 and 45 mmHg (tidal volume, 6–8 mL/kg). Because of the previous right pneumonectomy, a central catheter was inserted into the right internal jugular vein to monitor the central venous pressure. The patient underwent the procedure under cardiopulmonary bypass. Moderate systemic hypothermia, cold blood antegrade and retrograde cardioplegia, and warm reperfusion were applied for myocardial protection. The bilateral radial arteries were harvested. A midline sternotomy was performed after the lung was fully deflated, to avoid breaching the pleural space on the intact side. Ice slush was not used within the pericardial cavity for topical cooling. One of the radial arteries was anastomosed to the right coronary artery. The other radial artery was divided into 2 segments, which were used as Y grafts and anastomosed to the left anterior de-

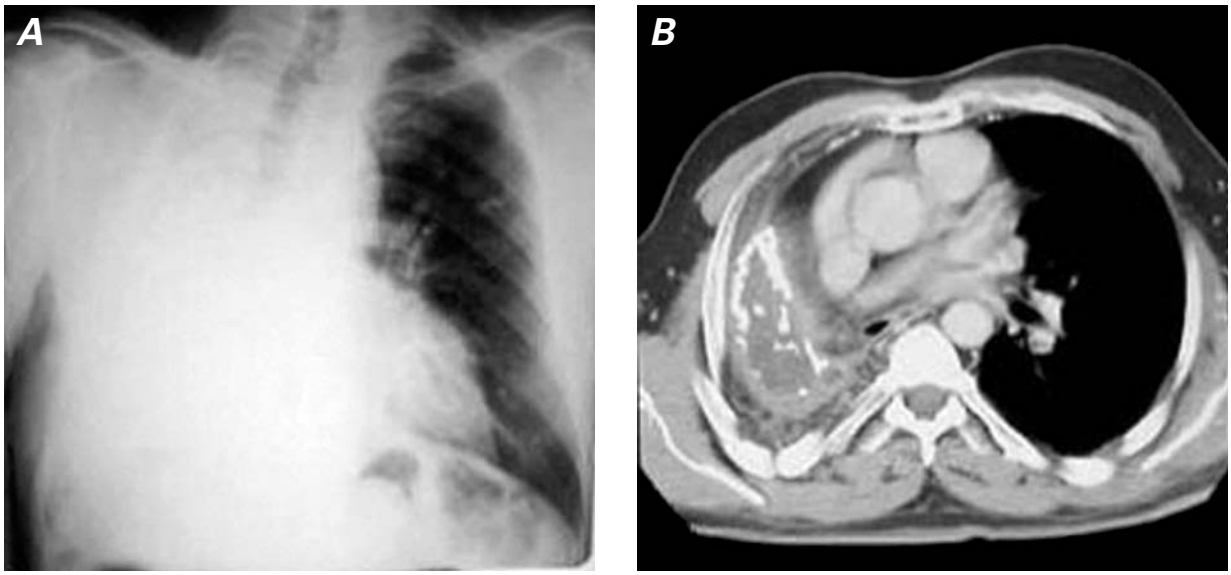

Fig. 1 *Chest radiography (**A**) and computed tomographic imaging (**B**) show a shift of the trachea and mediastinum to the right side, hyperinflation of the left lung, and postpneumonectomy space on the right side.*

TABLE I. Pulmonary Function, Carbon Monoxide Diffusion Capacity, and Arterial Blood Levels on Room Air

Test	Value	Percent of Predicted
FVC	1.9 L	43
FEV_1	1.5 L	45
FEV_1/FVC	83%	–
$FEF_{25\%–75\%}$	2.1 L/sec	54
DLCO	21 mL/mmHg/min	71
pH	7.47	–
PaO_2	72.6 mmHg	–
$PaCO_2$	38.7 mmHg	–
SaO_2	95.4%	–

DLCO = diffusion capacity of carbon monoxide; $FEF_{25\%–75\%}$ = forced expiratory flow between 25% and 75% of FVC; FEV_1 = 1st-second forced expiratory volume; FVC = forced vital capacity; $PaCO_2$ = partial pressure of carbon dioxide; PaO_2 = partial pressure of oxygen; SaO_2 = arterial oxygen saturation

scending and obtuse marginal coronary arteries. The patient was weaned from cardiopulmonary bypass without difficulty. After the operation, the patient had no need of inotropic or intra-aortic balloon pump support. He was extubated 2 hours postoperatively and was discharged from the hospital on the 5th postoperative day. When last seen, 6 months after surgery, the patient was in excellent physical condition and was free of angina.

Discussion

A previous pneumonectomy is not a contraindication to CABG but presents a challenge and raises several issues of surgical strategy. After CABG, patients with a single lung are at increased risk for cardiopulmonary complications that could be catastrophic. In a recent review of patients having undergone CABG with cardiopulmonary bypass after pneumonectomy, the mortality rate was 14.3%, the mean extubation time was 33 hours, and the postoperative pulmonary complication rate was 43%.[2] These results illustrate that CABG after previous pneumonectomy should be considered a high-risk procedure.

The choice of grafts is the surgeon's main concern in patients with a single lung. Use of the IMA is controversial in patients with borderline or impaired pulmonary function because of the possibility of injury to the phrenic nerve and breaching of the pleural space on the intact side. It is advisable to avoid harvesting of the IMA on the side of the intact lung.[2] In addition, the pedicled IMA may not be of sufficient length to reach the target vessel and may be kinked due to hyperinflation of the lung. Moreover, the increased pain associated with IMA harvesting may decrease postoperative pulmonary function.[5] Lung consolidation and atelectasis can occur as a result of poor lung expansion and postoperative effusion, particularly after opening of the pleura for IMA harvesting. In consideration of these disadvantages, radial arterial grafts seem to be a good alternative conduit for arterial revascularization, and they may ameliorate some of the risks associated with use

of the IMA in patients who have undergone a pneumonectomy. Saphenous vein grafts have also been used, with or without an IMA, for CABG in patients who have a single lung.[1-4] To our knowledge, this is the 1st report of arterial myocardial revascularization being performed with bilateral radial arteries in a patient with a previous pneumonectomy.

In order to avoid cold injury to the phrenic nerve and diaphragmatic paralysis, we did not use topical hypothermia in our patient. We thought that shortening the time of intubation might be beneficial; therefore, we used fast-track anesthesia to avoid pulmonary barotraumas and the complications of prolonged intubation. Following this protocol, it is possible to mobilize the patient earlier, which prevents the development of atelectasis and deep venous thrombosis. We also used nonsteroidal anti-inflammatory drugs in this patient, in order to relieve postoperative pain, restore respiratory effort, facilitate clearing of secretions, and minimize alveolar collapse.

In our opinion, it is possible, with careful management, to safely perform arterial myocardial revascularization using bilateral radial arteries in patients with adequate pulmonary function after pneumonectomy. In addition, fast-track anesthesia seems to be beneficial for use with the CABG procedure in such patients.

References

1. Kumar P, Swift SJ, Athanasiou T, Nelson JS, Glenville B. CABG 15-years after left pneumonectomy: feasibility of off-pump approach. Cardiovasc Surg 2003;11:305-7.
2. Diab KA, Khatib MF, Obeid M, Jamaleddine GW. Coronary artery bypass grafting after pneumonectomy. Eur J Cardiothorac Surg 2001;19:362-4.
3. Golbasi I, Turkay C, Sahin N, Oz N, Akbulut E, Gulmez H, Bayezid O. Coronary artery bypass grafting nine months after pneumonectomy. Tex Heart Inst J 2001;28:146-8.
4. Lippmann M, Au J. Coronary artery bypass surgery after previous pneumonectomy—two case reports. Scand Cardiovasc J 2000;34:541-2.
5. Cohen AJ, Moore P, Jones C, Miner TJ, Carter WR, Zurcher RP, et al. Effect of internal mammary harvest on postoperative pain and pulmonary function. Ann Thorac Surg 1993;56:1107-9.