BRIEF COMMUNICATIONS

BILATERAL MINIMALLY INVASIVE DIRECT CORONARY ARTERY BYPASS GRAFTING WITH THE USE OF TWO ARTERIAL GRAFTS

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Single-vessel coronary artery bypass grafting (CABG) of the left internal thoracic artery (LITA) to the left anterior descending coronary artery (LAD) with minithoracotomy has been shown to produce excellent results with almost no mortality.[1] However, this procedure is limited because only the LAD and diagonal branches are accessible through the left minithoracotomy. Furthermore, this procedure cannot be used in patients with double or triple vessel disease. We have developed a new technique that allows us to perform minimally invasive direct CABG in the setting of multivessel disease, using small bilateral anterior thoracotomies. Small left and right anterior thoracotomies and direct coronary artery revascularization with arterial grafts were performed in one patient. A new surgical approach to CABG for the LAD and right coronary artery (RCA), without the use of extracorporeal circulation, is described.

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Case report. A 47-year-old man had a history of increasing postinfarction angina and severe congestive heart failure. Cardiac catheterization revealed total occlusions

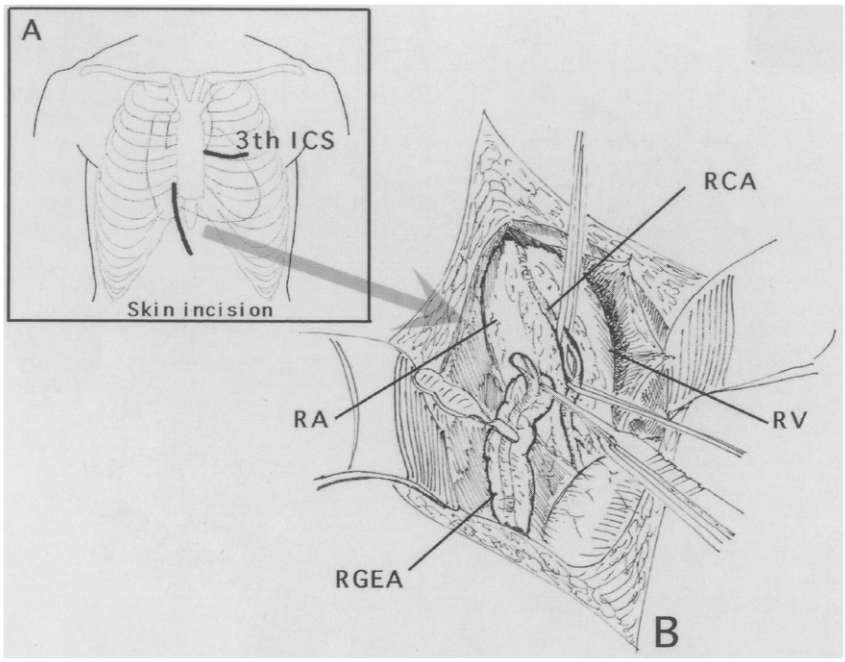

Fig. 1. A, The minithoracotomies consisted of a limited anterior thoracotomy incision in the third intercostal space and a right parasternal incision from the level of the sixth costal cartilage to the eighth costal cartilage and extending 5 cm below the xiphoid process. **B,** The right coronary artery was isolated between two slings with the previously dissected internal thoracic artery present in the operative field. *ICS,* Intercostal space; *RA,* right atrium; *RV,* right ventricle; *RCA,* right coronary artery; *RGEA,* right gastroepiploic artery.

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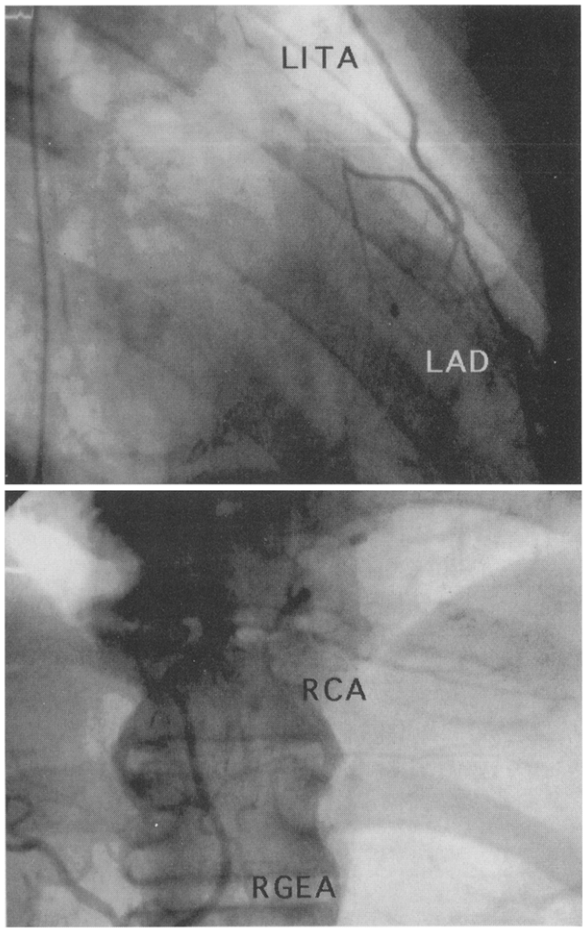

Fig. 2. *Top,* Angiogram demonstrating the anastomosis between the LITA and the LAD. *Bottom,* The RGEA-RCA anastomosis is shown in left anterior oblique projection. Selective injection of the celiac trunk with visualization of the proximal portion of the pedicled RGEA.

of the proximal LAD, proximal RCA, and an obtuse marginal artery. Left ventriculography demonstrated diffuse hypokinesis and a left ventricular ejection fraction of 22%. Minimally invasive CABG with the LITA and the right gastroepiploic artery (RGEA) in situ was planned to revascularize the LAD and the RCA. The patient was intubated with a double-lumen endotracheal tube to permit selective ventilation. A limited anterior thoracotomy incision was performed in the third intercostal space, the cartilaginous portion of the third and fourth ribs was resected, and the pericardium was incised longitudinally (Fig. 1). A right lower parasternal incision was then made, extending from the sixth costal cartilage to 5 cm below the xiphoid process. The sixth and seventh costal cartilages were longitudinally incised. The pleura were incised lateral to the edge of the sternum and the right pleural cavity was entered. The pericardium was then incised, exposing the RCA and the right atrium. The LITA was harvested for a short length from the level of the second intercostal space to the level of the fifth intercostal space. The peritoneum was then opened in the midline, and the RGEA was harvested. After systemic heparinization (1 mg/kg), the LITA and RGEA were injected with 3 ml of a solution containing papaverine. The RGEA was then routed anterior to the pylorus and the left lobe of the liver and inserted into the pericardium through a hole in the diaphragm. The ends of the grafts were brought through the incision and prepared for grafting. Stay sutures were applied to the diaphragmatic pericardium and pulled upward, thus providing adequate exposure of the right atrioventricular sulcus. The anastomotic site of the LAD was dissected, and the LAD was then occluded proximally and distally with a 4-0 Prolene suture (Ethicon, Inc., Somerville, N.J.) passed twice around the vessel. To avoid direct compression of the coronary artery, we passed the needle through a small piece of silicone tubing as described by Califiore and associates.[1] Both 4-0 sutures were gently snared to ensure as bloodless an operative field as possible. The LITA-LAD anastomosis was completed without extracorporeal circulation with 8-0 propylene suture. The RCA (segment 3) was then surrounded with two 4-0 polypropylene looping sutures (Prolene), and the RGEA-RCA anastomosis was performed with a running 8-0 Prolene suture on the beating heart. Both pedicles were fixed next to the anastomosis sites. Heparin was reversed with protamine, bleeding was carefully controlled, and the thoracotomy was closed. Ventricular pacing wires and a single drainage tube were placed. The patient was extubated in the operating room. Neither blood nor inotropic drugs were required. Total operative time (initial incision to dressing) was 3 hours 30 minutes. The drainage tube was removed the day after the operation. An angiographic study, performed after the operation, showed patent LITA and RGEA grafts (Fig. 2). Discharge was 4 days after the operation. The patient was free of symptoms 4 months after the operation.

Discussion. The introduction of a minimally invasive cardiac procedure simplifies techniques for surgeons and improves postoperative results.[1-3] CABG with the LITA used to bypass the LAD results in a 10-year patency rate of 85% to 90%.[4] In addition, the elective use of the RGEA as an in situ graft also has excellent patency rates. Recently, the use of a left minithoracotomy to perform the anastomosis between the LITA and the LAD has been advocated. The procedure can be performed on a beating heart with or without the aid of a thoracoscope[3] or with the support of extracorporeal circulation.[5] Minimally invasive CABG can be performed on the beating heart with surprisingly little hemodynamic disturbance, particularly when the native vessel is totally occluded. On the basis of this case report, we think that the minimally invasive CABG operation can be extended to patients with multivessel disease.

To retain the benefits of minimally invasive CABG and avoid the invasiveness of conventional CABG, we developed a new method of coronary revascularization in which we used bilateral minimally invasive CABG in a patient with multivessel disease. This method is suitable for

treating patients with a proximally occluded or stenosed LAD or RCA. A right-sided minimally invasive CABG allows better exposure of the RCA and is recommended for those patients who require RGEA grafting. The procedure can be used with or without femorofemoral bypass. To the best of our knowledge, this is the first report of the use of bilateral minimally invasive CABG in a patient with multivessel disease. The utility of bilateral minimally invasive CABG with in situ arterial grafts has been demonstrated in the present study. The absence of a major thoracotomy may decrease patient discomfort, hospital stay, overall recovery time, and cost while providing the benefit of complete revascularization similar to that offered by standard open chest CABG. This technique is limited to revascularization of only the LAD and proximal RCA because of accessibility of the vessels. It should be emphasized that exposure of the posterior descending coronary artery for grafting is technically difficult with this approach. If the long-term results of LITA grafting to the LAD and RGEA grafting to the RCA can be accomplished with the use of this less invasive technique, a new surgical option for the management of multivessel coronary artery disease may be at hand.

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MIGRATION OF IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR PATCH INTO THE RIGHT ATRIUM

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Sudden cardiac death caused by ventricular arrhythmia has been successfully aborted with implantable cardioverter-defibrillators. Because of the improvement of the design and function of the devices inserted, frequently the procedure is performed even in patients with high-risk conditions.

Transvenous systems for the most part have replaced epicardial lead systems because of the decreased morbidity and mortality. Nonetheless, on occasion technical considerations necessitate insertion of epicardial patches. Rare but serious complications can occur as in the following case with migration of the patch into one of the cardiac chambers.

Case report. A 28-year-old woman who had postpartum cardiomyopathy in 1987 and aborted sudden cardiac death underwent implantation of an epicardial defibrillator. Because of high defibrillation thresholds with a transvenous lead system, an epicardial system with three patches was implanted through a left subcostal approach. The patient later underwent generator change because it was approaching end of life in 1993.

In December 1995, the patient was seen because of epigastric discomfort and fever. This started an interval after a miscarriage. Pelvic inflammatory disease was ruled out. On the basis of blood cultures positive for *Staphylococcus,* she was given intravenous antibiotic therapy. Despite appropriate treatment, the patient continued to have febrile episodes and persistent positive blood cultures, and disseminated intravascular coagulation developed. A two-dimensional echocardiogram with a bubble test was done, which revealed a pedunculated mass in the right atrium measuring approximately 2 by 5 cm. There was no evidence of atrial septal defect and there was no intracardiac lead suspected on echocardiography. Because of the large size and pedunculated nature of this mass, fear of massive pulmonary embolism led to the decision to remove it. In addition, because of the lack of any other source of sepsis in the presence of disseminated intravascular coagulation and persistent positive blood cultures, this mass was believed to be the source of the sepsis. While in the hospital the patient had one episode of syncopal ventricular fibrillation appropriately detected and converted to normal sinus rhythm by the defibrillator device.

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