MINIMALLY INVASIVE CORONARY ARTERY BYPASS GRAFTING: THE RIB CAGE-LIFTING TECHNIQUE

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Minimally invasive approaches for cardiac operations have recently gained widespread interest, albeit with some reservations.¹⁻³ Inasmuch as the most "invasive" part of a cardiac operation is cardiopulmonary bypass (CPB), the

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principal attribute of a minimally invasive procedure should be avoidance of CPB. If this can be combined with a surgical approach that preserves chest wall integrity, a truly minimally invasive technique can be used. This report describes our initial experience with the rib cage-lifting technique, in which left internal thoracic artery (LITA) to left anterior descending (LAD) coronary artery and right internal thoracic artery (RITA) to right coronary artery (RCA) anastomoses were performed without CPB and through the space gained by lifting the rib cage upward.

Patients and methods. Between April 1997 and September 1997, 24 patients underwent coronary artery bypass grafting with the rib cage-lifting technique. There were 22 male and two female patients whose ages ranged

For bilateral ITA grafting, a 10 cm midline transverse incision is performed parallel to and 1 cm above the costal arch (Fig. 1). An inferior mini-sternotomy is performed at the level of the fifth intercostal space. The ITAs are taken down with the aid of Favaloro retractors. The LITA-LAD anastomosis is performed as described earlier. For the RITA-RCA anastomosis, the heart is exposed with the use of a pediatric sternal retractor. A wide U-shaped suture buttressed with Teflon felt is placed at the acute margin of the heart and pulled toward the patient's left shoulder to expose the inferior surface of the heart. Another heavy U-shaped suture is placed around the RCA at an appropriate level and pulled caudally to expose and stabilize the RCA. Additional stabilization is achieved as described earlier. The rest of the anastomosis is performed in a conventional manner. One or two figure-

Fig. 2. Operative photograph showing the exposure and the stabilization method during coronary arteriotomy.

of-eight steel wires are used to reapproximate the rib cage to the sternum.

Pharmacologic interventions to slow the heart rate or temporarily stop the heart are often not required. Rarely, intravenous injections of metoprolol in 2.5 mg doses or isoflurane inhalations are used to decrease the heart rate and contractility.

Results. Total operation time was 69 ± 12 minutes for the patients having LITA-LAD grafting and 126 ± 9 minutes for those having bilateral ITA grafting. The ITA-coronary artery anastomoses took 6 to 10 minutes to construct (mean 7.2 ± 0.9 minutes). Patients were extubated in the intensive care unit after hemodynamic stabilization was confirmed (mean length of intubation time including the operation was 196 ± 33 minutes). Patients stayed in the intensive care unit overnight (mean 16 ± 3 hours). Mean amount of mediastinal drainage was 255 ± 25 ml. No blood transfusions were needed, and no operative morbidity or deaths occurred. Mean hospital discharge time was 3 ± 1 days.

All patients underwent a follow-up coronary angiogram, 13 before hospital discharge and 11 during the second postoperative month. Graft patency rate was 100% in 27 anastomoses.

All patients were contacted during the second and fourth postoperative months. All were symptom-free, and 16 of 17 employed patients were working full time in the second postoperative month. Mean length of postoperative time without working was 19 ± 3 days in nine patients who work for themselves and exactly 60 days in seven patients in government service. One patient had retired from working.

Discussion. A minimally invasive approach should not compromise the reliability of the cardiac repair; that is, a standard or perfect operation should be performed. More-

over, it should not violate chest wall integrity to a great extent and create anatomic defects such as rib resections, and it should avoid CPB if possible. The rib cage-lifting technique fulfills these criteria and also offers several advantages over the commonly used minithoracotomy type operations. The primary advantage of the rib cage-lifting approach is that, owing to the generous space gained by lifting the rib cage upward, a perfectly harvested ITA graft can be perfectly anastomosed to the usual site on the LAD artery. In contrast, in the minithoracotomy type operations the site of the anastomosis is often dictated by the location of the small window. The presented stabilization technique avoids the use of cumbersome devices through an already small incision. The technique also avoids sutures or intravascular devices to control bleeding, which may cause vessel injury.⁴ The rib cage-lifting approach yields superior cosmetic results and is reasonably painless, and the early results are encouraging. However, it is a technically demanding procedure and requires considerable experience in performing coronary anastomoses on the beating heart.

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