A Safe and Cost-Effective Approach to Minimally Invasive Radial Artery Harvesting

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Purpose. We describe a minimally invasive, cost effective, and safe method of radial artery harvesting.

Description. After obtaining informed consent and completing a preoperative evaluation, 169 radial arteries were harvested. Harvesting was accomplished through a 3-cm proximal mid forearm incision with exposure provided by a modified self-retaining lighted retractor.

Evaluation. A total of 169 radial arteries were successfully harvested. The average incision length was 2.9 cm, radial artery length was 15.8 cm, and harvest time was 32.7 minutes. No trauma to the artery or graft spasm was evident. No procedure required conversion to an open technique. Superficial cellulitis occurred in 2 patients (1.2%) and wound infection in 1 (0.6%). Three patients (1.8%) experienced intermittent residual dysesthesia. All of the patients were highly satisfied with the excellent aesthetic results. This approach allowed for a substantial cost savings compared with other minimally invasive techniques.

Conclusions. Direct minimally invasive radial artery harvesting is an acceptable alternative approach to radial artery harvesting. This method is safe, cost effective, easily reproducible, and aesthetically pleasing.

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In the early 1970s, Carpentier and colleagues [1] first introduced the use of radial artery grafts for coronary artery bypass surgery. However, radial artery grafts were abandoned after documentation of poor patency [2, 3]. In 1989 a renewed interest in radial artery grafts took place after Acar and colleagues [4] reported patent conduits 15 years after implantation. Using improved surgical techniques and a variety of vasodilators, they reported a 1-year patency of 92%. Subsequent angiographic data has supported improved radial artery patency [5]. Consequently the radial has emerged as an acceptable conduit for coronary artery bypass grafting.

Traditional radial artery harvesting involves a longitudinal incision over the entire length of the volar surface of the forearm. The open technique results in a lengthy incision, greater local trauma, and may result in possible damage to the lateral brachial cutaneous nerve and superficial radial nerve.

We investigated an alternative method of radial artery harvesting to decrease the morbidity associated with the open technique. Although the endoscopic technique is efficacious, we are concerned by the costs as well as the steep learning curve for this technique. We describe a minimally invasive technique using direct visualization with a self-retained, lighted retractor.

Technology

Patients

In this series, 169 radial arteries were harvested. The average age of the patients was 62 years with 128 males (75.7%) and 41 females (24.3%). Sixty-one patients (36%) had diabetes mellitus. Patients were screened based on a suitable target vessel with greater than 80% stenosis and a negative preoperative Allen's test. Other factors taken into consideration included the patient's arm dominance, age, lifestyle, and history of renal insufficiency, Raynaud's disease, or previous trauma to the extremity, as well as physician preference.

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Fig 1. *RadLITE Tissue Retractor System (Teleflex Medical, Research Triangle Park, NC).*

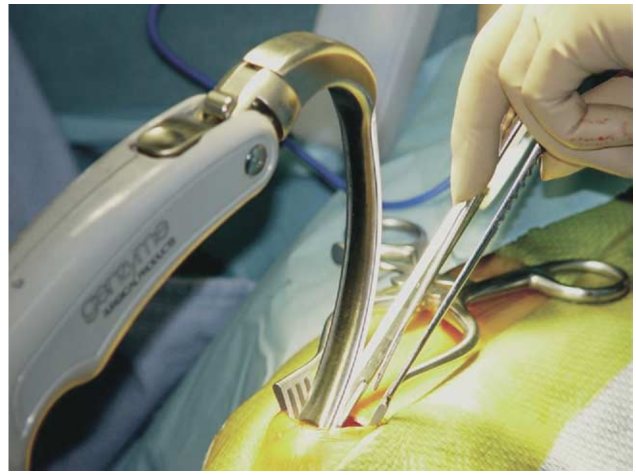

Fig 2. *The hands-free self-retaining system provides the operator with direct visualization for minimally invasive harvesting of the radial artery.*

Equipment

The equipment for this procedure includes a RadLITE Tissue Retractor System (Teleflex Medical, Research Triangle Park, NC), which is a modified version of the saphenous vein harvesting system (Fig 1). The system provides for direct visualization and hands-free retraction through the use of a pneumatic locking arm (Genzarm) designed for single-operator use. The arm is equipped with a number of blades that are compatible with a high transmission light panel. This panel is the only disposable component of the system.

The patient's arm is placed on an arm board, supinated, and abducted to a 90° angle from the body. The arm is firmly secured to prevent inadvertent movement during RadLITE retractor (Teleflex Medical) manipulation. The Genzarm is positioned on the operating room table below the arm board at the patient's umbilical level. Consequently this positioning allows for simultaneous harvesting of both the radial artery and the internal mammary artery. The CO_2 tank is positioned near the head of the bed and the light source is located behind the operator.

A 2.5 to 3.5 cm longitudinal incision is made on the volar surface of the forearm. This incision is positioned approximately 9 to 10 cm proximal to the wrist. We have found that the position of this incision at this level allows for maximum utilization of the retractor blade. Through this incision, the radial artery is located and its quality is assessed. A tunnel is created for the RadLITE blade (Teleflex Medical) by separating the anterior fascia between the brachioradialis and flexor carpi radialis muscle bundles. Under direct visualization, proximal dissection of the artery pedicle begins by positioning the blade into the space created above the artery (Fig 2) A blunt 8″ Beckman Weitlaner (Pilling [Teleflex Medical]) retracts the muscles providing greater visualization. During dissection, care is taken to identify and avoid the superficial radial nerve and lateral brachial cutaneous nerve. We believe that minimal manipulation decreases endothelial damage and the potential for vasospasm. Side branches are divided by the use of Starion Thermal Ligating Shears (Starion Instruments, Saratoga, CA), clips or ultrasonic coagulating devices. Proximal dissection of the artery is discontinued distal to the venous plexus and the radial recurrent artery. The artery is ligated with a right angle medium Hem-o-lok (Weck [Teleflex Medical]). The artery is transected and retrograde bleeding is assessed. The retractor is then repositioned distally. A similar tunnel is created, and the artery pedicle is dissected. The artery is ligated proximal to the superficial palmar artery. Once the artery has been removed, the retractor is placed into the tunnel in order to assess hemostasis. A drain is not routinely used, but may be placed if necessary. The incision is then closed in two layers of absorbable suture, and a sterile dressing is placed over the incision. A gauze wrap is applied and remains in place for 12 hours postoperatively. The arm can then be tucked at the patient's side for the remainder of the operation.

The artery is cannulated and prepared, which often involves complete skeletonization of the graft. A papaverine solution of 30 mg/mL is used for gentle dilatation to confirm side branch hemostasis, and the conduit is stored in a papaverine solution bath.

Clinical Experience

The patients were assessed for hand ischemia, bleeding, wound complications, thenar dysesthesia, forearm