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Radial Artery Harvest Using Endoscopic Techniques

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ABSTRACT

Background: Endoscopic vessel harvest for coronary artery bypass conduit has become a routine procedure. With the advancement of endoscopic equipment, radial arteries can be safely harvested with excellent cosmetic results.

Methods: One hundred consecutive patients undergoing coronary artery bypass grafting underwent endoscopic radial artery harvest without complications requiring intervention. The vessel was accessed through a 3-cm long, longitudinal incision performed several millimeters medial to the palpated artery to avoid the lateral antebrachial cutaneous nerve. Commercially available endoscopic retractors, using ultrasonic or direct-current shears, were used to ligate side branches and mobilize the pedicled artery and satellite veins. Ligation was performed with clips at the wrist, endo-loops proximally, and endoshears for transection.

Results: Patient age ranged from 42 to 88 years; 70% of the patients were men, and 26% were diabetic. Left radial arteries were preferentially harvested. All arteries were used and no further conduit was needed because of inadequate length. In 2 patients subcutaneous hematomas formed postoperatively and resolved without exploration. Although some thenar dysthesia was present in 14 patients, no permanent neurovascular injuries occurred. There were no infections, although skin edges did get traumatized from the retractor.

Comment: Radial arteries can be harvested in a reproducible, safe, and efficient manner with less morbidity and better patient satisfaction.

INTRODUCTION

The use of radial arteries (RAs) as coronary bypass conduits has steadily increased since the discovery of a patent RA some 17 years after it was thought to be occluded [Acar 1993]. Studies have proven the early patency or RA grafts [Bhan 1999], with mid- to long-term results showing superior patency compared to saphenous vein grafts [Tatoulis 2002, Iaco 2001]. Lingering concerns over neurovascular injuries to the hand, preponderance of spasm, and cosmetics apparently account for the reluctance to widen the use of RAs. In our institution harvesting strategies to minimize induction of spasm have optimized the success of the RA as a conduit since 1996, with over 900 arteries used to date. We report a strategy that allows safe, reproducible, timely harvest of the RA using endoscopic techniques with small incisional access.

PATIENTS AND TECHNIQUE

From September 2002 to January 2003, 100 consecutive patients undergoing coronary artery bypass grafting (CABG) had endoscopic radial artery harvest (ERAH) performed primarily on the left arm. Patient age ranged from 42 to 88 years. Four patients had previous CABG. None of the patients were placed on calcium channel blockers for spasm prophylaxis. All patients had radial and ulnar artery ultrasound scans to measure size, check for calcific and atherosclerotic disease, and confirm acceleration of flow in the ulnar artery with radial artery occlusion. Contraindications to harvesting the RA included drop in ulnar accelerations, abnormal Allen test, diameter less than 1.8 mm, or calcification. Using these criteria, none of the harvested arteries were excluded from use.

The patient was positioned with the arm extended to 90 degrees. The arm was prepped from fingertips to chest circumferentially and included in the draping of the chest. The RA was harvested of its full length concurrently with internal mammary artery harvest. All harvests were performed by the same physician's assistant. The time required to perform the harvest was approximately 45 minutes for the first 25 cases and decreased to less than 30 minutes after the first 25 cases.

Incisions were placed 2 fingerbreadths from the wrist crease with the hand flexed. A 3-cm incision was placed several millimeters medial and longitudinal to the palpated radial artery because incisions made in this location tend to avoid the lateral antebrachial cutaneous nerve branch, which is fairly superficial and likely accounts for most of the thenar dysthesias postoperatively. The fascia was then entered and side branches directly divided and the tunnel expanded until the

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low-profile Ultra-Retractor (Cardiovations-Johnson and Johnson, Somerville, NJ, USA) could be advanced into the incision.

We continued the dissection toward the elbow using harmonic scalpel shears (Ethicon Endosurgery, Cincinnati, OH, USA) or direct-current shears (Starion Instruments, Saratoga, CA, USA) to divide the fascia between the brachioradialis and flexor carpi radialis groups, exposing the arterial bed. Branches were ligated with the shears, taking the RA with the satellite veins as a pedicle. We have harvested the RA with the pedicle since our initial use in 1996. We do not skeletonize the radial artery and have not observed any clinical impact on graft patency. Careful attention is paid to the lateral aspect, because the superficial radial nerve is adjacent to the pedicle. It is most susceptible to injury in the area where the brachioradialis tendon emerges. Harvesting continues up to the vein "bridge" that overlies the artery just distal to numerous posterior arterial branches and venous tributaries, because little useful length is achieved above this point, and it is the greatest risk area for inadvertent venous branch injury.

The distal end of the RA was clipped with hemoclips and divided. The first 6 patients had proximal 2- to 3-cm counterincisions to clip the proximal RA; subsequently this procedure was done endoscopically. Two Ticron endo-loops (US Surgical, Norwalk, CT, USA) were endoscopically placed on the artery proximally, then transected with endoshears. The artery was not cannulated but was placed in a papaverine solution until anastomosed to the internal thoracic artery prior to grafting. The incision was closed with 5-0 Monocryl (Ethicon, Somerville, NJ, USA), wrapped with compressive dressings, and then tucked at the patient's side.

RESULTS

No wound complications or motor nerve or vascular injuries occurred. Two patients had postoperative small hematomas. These patients were on clopidogrel (Plavix) and were fully heparinized prior to time of surgery. Neither patient underwent exploratory surgery, and the hematomas completely resolved in both patients. Fourteen patients had thenar dysthesia, which lasted 6 to 8 weeks in 3 of the patients; there were no permanent deficits.

Although the early series required a counterincision to ligate the artery at the elbow, all arteries were harvested endoscopically without injury. One artery that looked suspicious for thermal injury at the wrist end was sent to pathology and sectioned without evidence of luminal irregularity. The "Y" technique from the internal thoracic artery was used for all artery bypasses, and all anastomoses were performed off pump. Requirement of additional conduit because of inadequate length did not occur.

Patient follow-up periods ranged from 4 to 8 months. A total of 372 anastomoses were performed: 110 left anterior descending, 64 diagonal, 116 circumflex, and 82 to right coronary distribution. Electrocardiogram results, based on the criterion of new Q-wave formation, indicated that there were 2 postoperative inferior myocardial infarctions without angina. Two patients underwent cardiac catheterization: one for ungraftable distal right coronary disease with stenting of the right coronary artery and one for anginal symptoms. All grafts were patent. There was one death, which was related to complications from a hip fracture. There were no reoperations.

COMMENT

Although the full incision for harvesting the RA has been accepted by patients, the opportunity to have a small incision in a visible part of the anatomy has been met with patient requests for this approach. We use the RA in all patients, including patients undergoing redo surgery and patients with coronary artery disease requiring valve surgery. The only exclusion criterion is if bilateral RAs have inadequate collateral circulation. Although there are reports of various sensory and motor innervation losses [Denton 2001, Aseed 2001], patients have not experienced this in our series. No wound infections occurred, although the scope did slightly traumatize the skin edges.

Medial placement of the initial incision avoids lateral antebrachial cutaneous nerve contact and the likely source for temporary thenar dysthesias. Ultrasonic or direct-current shears allow complete RA harvest with little thermal spread, although in our experience the direct-current shears appear to have less thermal injury potential.

RAs can be endoscopically harvested in a reproducible, safe, efficient manner with less morbidity and greater patient satisfaction than open techniques. Although the open technique was used in our prior experience, we have converted to the ERAH technique without donor site or graft performance complications. Despite encouraging early results, we do not have comprehensive postoperative angiographic studies, and long-term follow-up will be required to assess function and durability of these grafts.

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