# Radial Artery Bypass Graft Is a Feasible and Durable Conduit for Challenging Infrainguinal Revascularization: 17 Years of Melbourne Experience☆

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**WHAT THIS PAPER ADDS**

This study demonstrates favorable long-term patency and limb salvage rates of radial artery infrainguinal bypass grafts. Therefore, in patients in need of challenging revascularization and without suitable autogenous conduit, a radial artery bypass can be performed safely as a more durable alternative to a prosthetic bypass.

**Objectives:** The superiority of autogenous venous conduits in infrainguinal bypass surgery is well established. In the absence of suitable leg or arm veins the radial artery can be utilized as an alternative autogenous conduit. In contrast to cardiac surgery, experience with the radial artery as a conduit for infrainguinal bypass surgery is limited. The purpose of this study was to review the outcomes of our radial artery bypasses over the last 17 years.
**Methods:** All radial artery bypasses performed between 1995 and 2012 were identified from a prospective database. Patency, limb salvage, and survival were calculated using the Kaplan—Meier survival estimate method.
**Results:** Twenty-nine radial artery bypasses were performed in 28 patients. Median follow-up was 55 months (range 1—170). Twelve-month primary, assisted primary, and secondary patency rates were 49%, 62%, and 73% respectively; Both 3-year and 5-year primary, assisted primary, and secondary patency rates were 49%, 56% and 67% respectively. Limb salvage rate was 75% at 1- and 5-year follow-up. Patient survival at 1, 3, and 5 years was 96%, 88%, and 76%.
**Conclusions:** For patients with need of challenging infrainguinal revascularization without suitable autogenous venous conduit, a radial artery bypass can be performed safely with favorable long-term patency and limb salvage rates.

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## INTRODUCTION

Despite advances in endovascular techniques, infrainguinal bypass surgery continues to play an important role in revascularization for peripheral arterial occlusive disease (PAOD). The superiority of great saphenous vein (GSV) grafts in infrainguinal bypass surgery is well established.[1,2] However, it is not uncommon for patients presenting with PAOD to have a history of prior varicose vein surgery or cardiac and/or lower extremity revascularization using one or both great saphenous veins. In case of absent great saphenous veins, alternative conduit options are arm vein, cryopreserved vein, prosthetic, or radial artery (RA). The use of an arm vein as conduit is an accepted technique with superior patency rates than prosthetic grafts,[3,4] while the patency results of cryopreserved veins have been disappointing.[5] The radial artery (RA) has proven to be a durable conduit in cardiac surgery, with (long-term) equal or superior patency rates over GSV grafts.[6—8] However, due to its short length, unconventional harvesting procedure, and lack of familiarity among vascular surgeons, the use of the RA for peripheral revascularization is rare. Reports in the literature of isolated infrainguinal RA grafts are limited to case reports of up to three patients.[9—11] Limb salvage surgery using a radial forearm flap or radial artery flow-through graft as a composite distal bypass graft with an overlying skin flap for wound or ulcer coverage has also been described, but in relatively small series of up to 10 patients.[12—14] In this paper, we report our experience with RA bypass grafts for infrainguinal revascularization over a period of 17 years.

## METHODS

From 1995 to 2012 we prospectively collected a consecutive series of patients undergoing infrainguinal reconstruction for peripheral arterial occlusive disease with RA conduits under a protocol approved by the local ethics committees. A retrospective review of patient notes was then undertaken to capture clinical data, including presenting symptoms, investigation findings, operation details, and follow-

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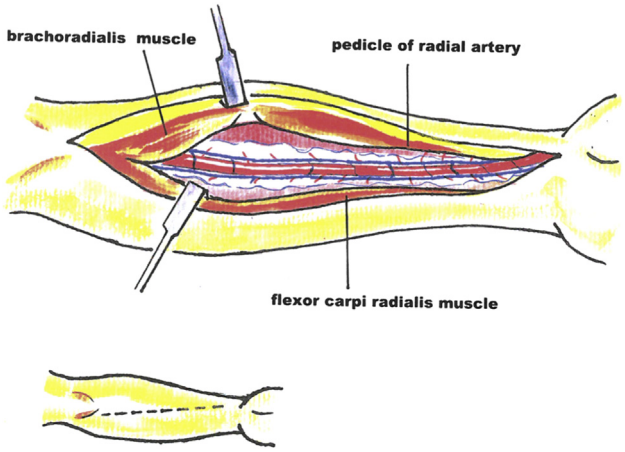


**Figure 1.** Harvesting of radial artery graft. Incision and dissection in the groove between brachioradialis and flexor carpi radialis muscles.

up. The indication for radial artery conduit use in infrainguinal bypass surgery was an absent or unsuitable vein, but with increasing experience it was also used as the primary conduit of choice in a small number of suitable patients.

### *Radial artery harvest*

Prior to harvest of the RA an Allen's test was routinely performed. If the hand did not re-perfuse within 5 seconds upon release of the ulnar artery, the test was considered positive and the radial artery was not harvested.

The patient is positioned in the standard fashion for infrainguinal bypass surgery with the arm at 90 degrees placed on an arm board. The skin of the entire forearm and arm is prepared with alcoholic iodine solution and the hand wrapped in a sterile drape. A linear incision is made in the supine forearm 2 cm below the midpoint of the elbow crease to approximately 2 cm above the wrist crease, where the radial pulse is felt (Fig. 1). The radial pedicle lies in a groove between brachioradialis muscle laterally and the flexor carpi radialis medially (Fig. 1). The RA with its venae comitantes is then mobilized using the "no-touch technique", to minimize spasm. Side branches are divided between metal clips (Fig. 2A). The distal RA is doubly clipped at the wrist and divided 2 cm proximal from the wrist joint to preserve collateral circulation (Fig. 2B). The arterial pedicle is kept moist by spraying a solution of papaverine in ringer lactate (30 mg in 20 mL — 3.2 mmol/L — mixed with an equal volume of heparinized blood to buffer the acidity of the papaverine). Part of the solution is injected retrogradely into the RA (Fig. 2C) and the distal end of the artery is clipped. The RA pedicle is then mobilized proximally all the way to within 1 cm of the bifurcation of the brachial artery and doubly clipped and divided (Fig. 2D). The ulnar artery at its origin is left undisturbed. The interosseal artery usually originates from the ulnar artery, and is therefore preserved. If it is encountered coming off the proximal radial artery, it is preserved by clipping the radial artery distally to it. The radial pedicle is then stored in the papaverine solution until ready for use. The wound is closed in two layers with or without a drain as required. To prevent RA spasm, patients were prescribed 10 mg of amlodipine twice daily for 3 months postoperatively, unless contraindicated. Furthermore, patients were routinely prescribed a single anti-platelet agent.

Follow-up was performed postoperatively at 1, 3, 6, and 12 months and annually thereafter. Patency was routinely assessed by clinical examination, ankle—brachial indices,

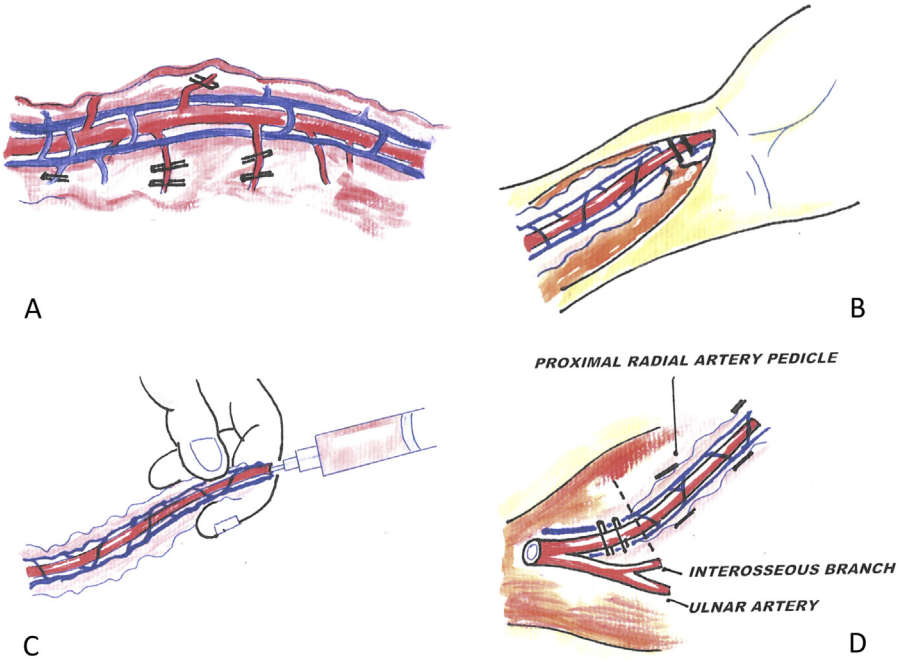


**Figure 2.** Harvesting of radial artery graft. (A) Clipping of side branches of radial artery (RA) pedicle. (B) Distal RA pedicle clipping. (C) Injection of papaverine solution into distal end of pedicle. (D) Proximal RA pedicle clipping.