

A 6-year experience with radial artery conduit for myocardial revascularization

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Background: Excellent long-term patencies of arterial grafts are considered, superior to those of vein grafts. In this study, we present our 6 years experience in using radial artery as a conduit for myocardial revascularization. The aim of the present study was to assess the safety and early and mid term results of using radial artery in coronary artery bypass graft.

Methods: The radial artery used as a conduit in 308 cases was evaluated during past 6 years, and the results obtained were processed and analyzed.

Results: The operative morbidity comprised re-operation for bleeding in 3.2%, MI in 5%, with paresthesia and stitch abscess of the hand in 10% in and 3.5% respectively. Hospital mortality included 2 patients, one case being directly due to complication of harvesting radial artery.

Conclusion: The results of present study were satisfactory with acceptable morbidity and mortality and favored the application of this conduit to CABG patients.

Keywords: Radial artery; Conduit; Coronary artery bypass graft (CABG); Graft patency

Introduction

The superior long-term patency and survival of the internal thoracic artery in coronary artery bypass grafting, compared with saphenous vein, established the internal thoracic artery as the conduit of choice for myocardial revascularization. Use of the internal thoracic artery has expanded, and the possibility of similar performance by other arteries has motivated surgeons to investigate alternative arterial conduits namely the gastroepiploic artery, inferior epigastric artery, and radial artery.^{1,2} Excellent long-term patencies of arterial grafts are noted, superior to those of vein grafts,³⁻¹⁰ the use of arterial conduits can improve

the angiographic and clinical results especially among cases who previously developed in-stent restenosis.¹¹ Herein, we evaluated our 6-year experience with radial artery as a suitable conduit for coronary artery bypass graft (CABG), and analyzed its early and mid-term results.

Technique of harvesting: The artery from nondominant hand was used and before harvesting an Allen's test was performed. From the year 2003 on, in all patients an intraoperative Allen's test was performed by putting a bulldog over distal radial artery, checking for distal pulse and ischemic signs, and if distal pulse was absent, the clip was allowed to remain in place. An incision was made in the forearm beginning over the radial pulse at the wrist. It was then extended proximally over

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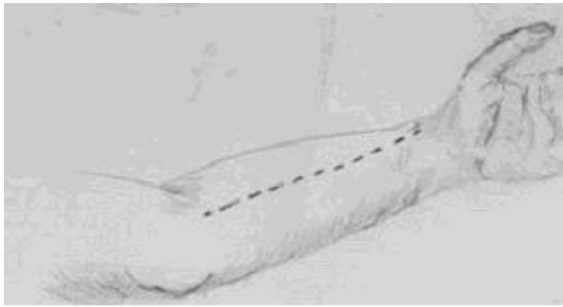


Figure 1: Incision used for harvesting radial artery

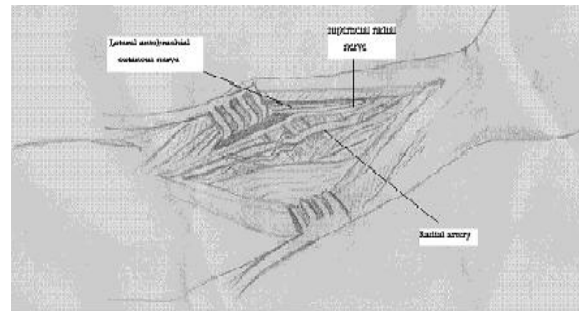


Figure 2: Surgical anatomy of radial artery showing radial artery, lateral antebrachial cutaneous nerve, and superficial radial nerve

the belly of the brachioradialis, taking care to preserve the superficial radial and lateral antebrachial cutaneous nerves. Dissection proceeded proximally up to the origin of the recurrent radial artery and distally to the tendons at the wrist. Radial artery was harvested along with adjacent veins and fatty tissues, and was flushed with papaverine, and was stored in dilute heparin- papaverine solution (Fig. 1-3).¹²

Materials and Methods

Radial artery graft was used for CABG in 308 patients during March 1999 to March 2006. Exclusion criteria for harvesting radial artery was, EF<30%, age>70 years, patient's not signing

the informed consent, localized hand and forearm problems such as burn, recent fracture etc, professions needing manual dexterity and meticulousness, urgent operation in unstable patients, and poor target vessels for graft. Calcium channel blocker was administered for 3-6 months in the post-operative period. Radial artery was never dilated by intraluminal injection. Early and mid term complications and clinical outcomes were evaluated in these patients with a mean follow up of 15 ± 4.3 months. Allen's test was performed before operation in all patients.

Results

A total of 308 patients, 240 male and 68

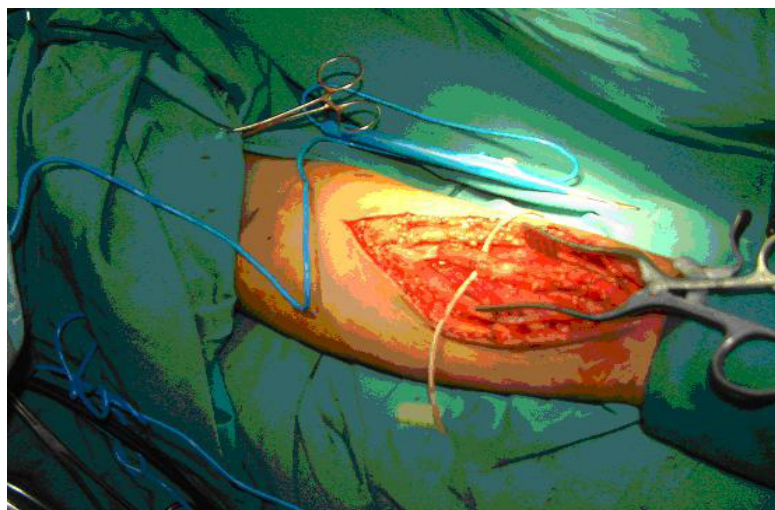


Figure 3: Operative view of radial artery



Figure 4: Case of Phlegmasia cerulea dolens (PCD) leading to venous gangrene of upper limb

68 female, m undergoing CABG had one (n=286) or two (n=22) distal anastomosis from radial graft conduit in addition to other conduits. The patients aged from 26 to 78 years (mean=55±4.8 years). On the average, 3.5 grafts per patient were performed, with elective and urgent operations being 94% and 6% respectively. In 22% of the patients, total arterial conduit was used. The operative morbidity was re-operation for bleeding in 3.2%, MI in 5%, with paresthesia and stitch abscess in the hand in 10% and 3.5% respectively. Mean x-time was 46±9 minutes and the mean CPB time was 85±11 minutes. Hospital mortality included 2 patients, one case being directly due to complication in harvesting radial artery.

This patient was a 56-year-old woman who developed upper extremity DVT complicated by Phlegmasia cerulea dolens (PCD), which led to venous gangrene (Fig. 4, 5) and after heparin therapy resulted in hemorrhagic cerebral stroke and death two weeks after CABG. Progression of PCD to venous gangrene is an extremely rare event with only a handful of cases reported previously. During the follow up with a mean of 21±6.2 months, all patients were alive, free from cardiac event and had favorable function classes.

Discussion

The use of radial artery for coronary artery bypass graft has enjoyed a revival, based on the belief that it helped improve long-term results of coronary operations. The encouraging reports of early and 5-year patency rates, supports its continued use as bypass graft.^{7,9,10,13-22} Most studies reported the advantage of the radial artery graft over the saphenous vein graft, in relation to patency rate, freedom from cardiac events, and survival.¹⁷

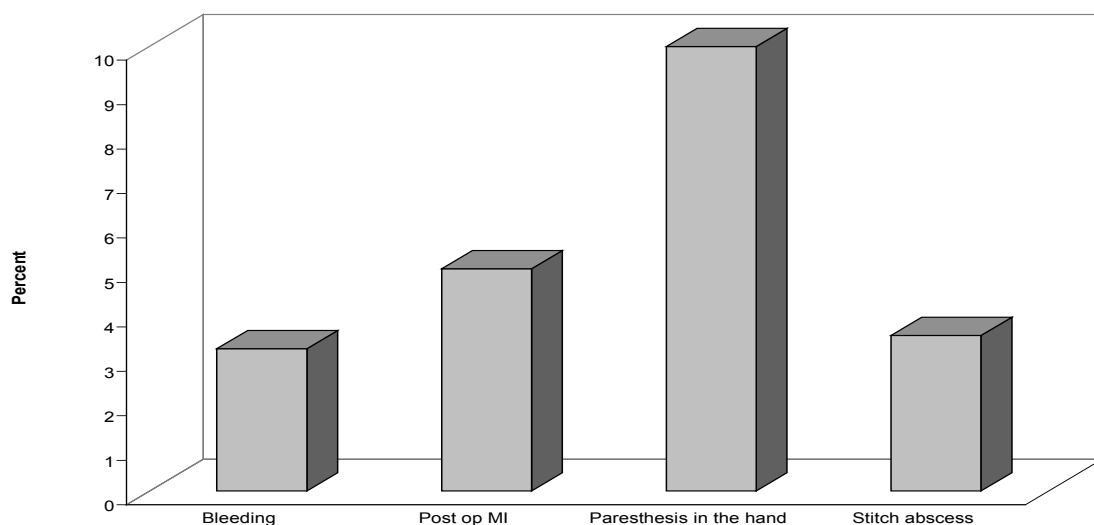


Figure 5: Operative morbidity

Our findings were in accord with those of other researchers and in favor of using this conduit compared to other conduits. The initial use of radial artery for myocardial revascularization was abandoned due to high incidence of early occlusion. The revival of this method was attributable to the improvement in harvesting techniques as well as the introduction of antispasm prophylaxis by calcium channel blockers. Extrafascial, non-touch technique harvest is one of the techniques to minimize trauma during harvest.

The extrafascial technique of radial artery harvest is safe and an easily reproducible method with minimal arm complications and good mid-term clinical and angiographic results.²³ The non-touch technique for radial artery harvesting used in present study was the same as the method described above, and we believe that 6 years of its widespread practice led to increasing experience of our surgical team. In addition, the use of calcium channel blocker resulted in excellent quality of our harvested conduits. As reported previously, the radial artery harvested for coronary artery bypass grafting could be conducted with minimally serious long-term upper limb morbidity in higher risk patients.²⁴ This was consistent with our findings, regarding acceptable range of reoperation for bleeding (3.2%), MI (5%), with respective paresthesia and stitch abscess in the hand of 10% and 3.5%. Hospital mortality was reported in 2 patients, one case being directly due to complication in harvesting radial artery. This related to a 56-year-old woman who developed upper extremity DVT complicated by Phlegmasia cerulea dolens (PCD), which led to venous gangrene (Fig. 4) followed by hem-

orrhagic cerebral stroke and death two weeks after CABG. Progression of PCD to venous gangrene is an extremely rare event with only a handful of recorded cases. This very rare case doubled our mortality, and it seemed that such complication with associated mortality for myocardial revascularization might be even lower, although a mortality rate of 1% is within acceptable range in CABG patients. During the follow up with a mean of 21 months $\pm$ 6.2 SD, all patients were alive, free from cardiac events and had favorable function classes, which indicated the safety of using this conduit in CABG patients. A prolonged follow-up and additional angiographic studies are needed for better analysis of the results and substantiating the true long term patency of this conduit.

In view of the excellent early and mid-term results of CABG with radial artery conduit, we recommend the routine use of radial artery conduit in selected patients. We also encourage our colleagues to carry out further researches with randomized controlled trials involving angiographic studies along with corresponding follow up, in order to establish the true long-term patency of aforementioned radial artery conduit.

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