

## Local Complications after Harvesting of Radial Artery Conduit for Coronary Artery Bypass Grafting: Mayo Hospital Experience

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### Abstract

**Objectives:** To evaluate incidence of local complications of radial artery (RA) harvesting for coronary artery bypass grafting (CABG).

**Patients and Methods:** From March 2011 to January 2012, a total of 87 consecutive patients fulfilling the inclusion and exclusion criteria, who underwent CABG and had left radial artery used as a conduit were included in this study. Prospective surveillance of surgical site (radial artery harvest site) was assessed on a daily basis during the patient's stay in the Department of Cardiac Surgery, Mayo Hospital / KEMU, Lahore and were reassessed after one month and six months interval. Surgical site assessment includes cutaneous paraesthesia, compartment syndrome, hand Ischemia, donor arm weakness, superficial infection, wound deh-

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iscence, hematoma and impact of these complications on the quality of life.

**Results:** During the study period 6 Patients (6.8%) reported cutaneous paraesthesia around the thenar eminence after 6 months; 3 Patients (3.4%) developed donor arm weakness, normalized after 6 months. Superficial wound infection and Hematoma (not requiring re-exploration) was noted in 1.1% and 2.9% respectively. None of the patients developed compartment syndrome, hand Ischemia, wound dehiscence.

**Conclusions:** Findings confirm that the local complications after radial artery harvesting are rare and are clinically insignificant.

**Keywords:** Radial artery, Conduit, CABG.

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### Introduction

Radial artery was first used as a conduit for coronary artery bypass grafting by Carpentier and associates in 1973.<sup>1</sup> The superior long term patency of left internal mammary artery<sup>2</sup> over venous grafts has led to promotion of other arterial conduits for coronary artery bypass grafting. These arterial conduits include right internal mammary artery, gastro-epiploic artery, inferior epigastric artery and radial artery. Radial artery is a muscular artery<sup>3</sup> and its spasm<sup>4</sup> in the immediate post-operative period resulted in initial poor results. These initial poor results led to abandonment of its use. However, the development of antispasmodic agents like verapamil, nitroglycerine, phenoxybenzamine, papa-

verine was followed by its increased use in bypass grafting<sup>5</sup>. The radial artery is a user friendly conduit, with excellent handling characteristics and can be harvested easily and safely. It can reach comfortably any coronary target. It also offers superior hemodynamics when compared with venous grafts owing to its more uniform calibre and lack of any valves. It also gives immediate benefit of avoiding the frequently underestimated morbidity of leg wounds.<sup>6</sup>

We started using radial artery as a conduit in bypass in 2011 in our department in a redo case where left internal mammary artery and saphenous veins from both lower limbs were already used. The good result in this redo case led to use of radial artery as a second conduit after left internal mammary artery.

The neurologic complications of RA harvesting are associated with direct damage to lateral cutaneous nerve (branch of musculocutaneous nerve), supplying the radial aspect of forearm and superficial branch of radial nerve, supplying the thenar eminence in palm and the radial aspect of hand. However, these neurologic complications have been a rare consequence.<sup>7,8</sup> The aim of this study was to assess local complications after routine use of radial artery conduit for coronary artery bypass grafting.

## Patients and Methods

### Study Population

Total of 87 consecutive patients who underwent isolated coronary artery bypass grafting from March 2011 to January 2012, at cardiac surgery department, King Edward Medical University / Mayo Hospital Lahore were included in the study, RA was used for complete arterial myocardial revascularization.

Before operation each patient were examined for cutaneous paraesthesia and vascular alteration in the donor upper limbs. All of them underwent Allen test and positioning a pulse oximeter sensor on the thumb of the donor upper arm.

Because of possible competitive flow leading to reactive graft narrowing, coronary vessel for receiving the RA graft as conduit of choice were a critical proximal stenosis (greater than 70%), and adequate diameter at the anastomotic site (greater than 1.5 mm). We prefer anastomosing the RA as free graft to right coronary artery or lateral circumflex.

Those patients who had additional procedure like valvular surgery were excluded. The clinical conditions contraindicating RA harvesting were the pre-

operative presence of cutaneous neurologic symptoms, the history of traumatic hand and forearm injuries, baseline room air oxygen saturation less than 95%, if the Allen test results were positive, or if the Doppler study showed no significant increase in blood flow velocities in the ulnar artery.

### Intervention

All peripheral intravenous and arterial lines were placed in the dominant arm before anesthetic induction. The RA always was harvested from the non-dominant arm; an incision was made from the wrist to the mid-antecubital fossa. The RA was harvested without use of electro-cautery. After the ante brachialis fascia was incised, the brachioradialis muscle was retracted laterally in its entire length before dissection of the RA. This maneuver allowed excellent exposure of the entire length of the RA. Two branches of the radial artery namely the takeoff of the radial recurrent artery approximately 1 cm distal to the radial edge of bicipital aponeurosis and superficial palmar artery mark the proximal and distal landmarks respectively for radial artery harvesting i.e. the radial artery is divided distal to the radial recurrent artery and proximal to the superficial palmar artery. All other branches were secured with liga-clips applied to both the ends (Fig. 1).



**Fig. 1:** Harvested radial artery with ligaclips.



**Fig. 2:** Lock stitch suture to skin of radial artery harvest site.

To minimize the risk of arterial spasm, an intravenous infusion of calcium channel blockers, such as verapamil, was administered during the entire operation, and local application of verapamil and nitro-glycerine solution. The harvested radial artery was put in warm verapamil – nitroglycerine solution. The surgical wound was closed in two layers with vicryl, continuous to subcutaneous tissue and prolene, lock – stitch suture to skin (Fig. 2).

### Assessment

The patients were assessed in immediate postoperative period for any hand ischemia,<sup>9</sup> hematoma formation, infection, early mobilization or development of compartment syndrome and then after one month and six months interval for any sensory alteration in forearm and hand, grip strength, and scar over the forearm.

### Outcome Parameters

The primary outcome was the incidence of cutaneous paraesthesia, compartment syndrome, hand Ischemia, donor arm weakness, superficial infection, wound dehiscence, hematoma and impact of these complications on the quality of life.

### Results

Between from March 2011 to January 2012, a total of 87 patients undergoing isolated CABG surgery were included in this study. The mean age was  $48.26 \pm 7.89$ , none of the patients developed compartment syndrome, hand Ischemia, wound dehiscence. During the study period 6 Patients (6.8%) reported cutaneous paraesthesia around the thenar eminence after 6 months; 3

Patients (3.4%) developed donor arm weakness, normalized after 6 months. Superficial wound infection and Hematoma (not requiring re-exploration) was noted in 1.1% and 2.9% respectively (Table 1).

All the patients were mobilised early on first post-operative day and most of the patients found it easier to mobilise, when compared with patients with saphenous vein grafts. The grip strength was within normal limits in all the patients and the scar was of good quality in all the patients.

### Discussion

The use of radial artery as second arterial conduit in coronary artery bypass grafting is increasing as more and more evidence is accumulating for its superior patency and reduction in mortality especially in women when compared with saphenous vein conduit.<sup>10</sup> Moreover, Radial artery internal diameter is close to coronary arteries as opposed to saphenous vein grafts, increasing its anatomical and physiological similarity.<sup>11</sup> Furthermore, absence of valves and thicker wall making better proximal anastomosis, are superior characteristics of the RA.<sup>12</sup> Nevertheless, forearm wound favors early recovery than leg wounds.<sup>13</sup>

Our experience shows that neurological abnormalities were present in 6% beyond 6 months. However, No patients reported limitations to their activities of daily living, confirming our opinion that the use of the RA does not predispose to major morbidity. The acceptable mechanisms of neurological abnormalities during RA harvesting are direct trauma to the nerves and edema and hematoma leading to carpal tunnel syndrome.

The results indicates lower risk of local complication of RA harvesting in the patients undergoing

**Table 1:** List of local complication of RA donor arm.

Complications	1 – 7 Days Patients (%)	1 Month Patients (%)	6 months Patients (%)
Cutaneous paresthesia	5 (5.7%)	6 (6.8%)	6 (6.8%)
compartment syndrome	–	–	–
Hand Ischemia	–	–	–
Donor arm weakness	3 (3.4%)	3 (3.4%)	–
Superficial infection	1 (1.1%)	–	–

Wound dehiscence	–	–	–
Hematoma	2 (2.9%)	–	–

CABG, promising its good long term outcome, and thus, confirming that its routine use for myocardial revascularization is a safe surgical technique.

### Conclusions

Local complications at the radial artery harvest site are minimal in patients undergoing coronary artery bypass grafting. The radial artery should be used routinely in all patients undergoing bypass surgery as second arterial conduit after left internal mammary artery as it is an excellent conduit especially in fat, female patients in whom the quality of saphenous vein conduit is miserable.

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