

Early Results of Radial Artery as A Second Conduit in Coronary Artery Bypass Grafting in a Developing Country

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ABSTRACT

Aim: To determine early-outcome effects of Radial Artery (RA) use as a second arterial graft after left internal mammary artery (LITA) in patients undergoing coronary artery bypass grafting (CABG).

Methods: From March 2011 to September 2013, total of 167 consecutive patients fulfilling the inclusion and exclusion criteria, who underwent CABG at Mayo Hospital/KEMU, Lahore and had left RA used as a conduit were included in this study. All patients had modified Allen's test to access the collateral circulation of hand (Ulnar Artery). Patients having inadequate collateral ulnar circulation as determined by the modified Allen's test, patients with concomitant valvular disease requiring replacement, patients who became unstable on induction of anaesthesia and those with impaired renal function were excluded from the study. RA was used as a second arterial conduit after LITA to Left Anterior Descending artery. It was used on native coronary artery having more than 70 percent stenosis. Prospective surveillance of postoperative complications like arrhythmias, changes in ECG, use of inotropes, ICU stay, radial artery harvest site local complication, mortality were studied and CT angiogram was done to access the patency of radial artery in the first year.

Results: During the study, out of 167 patients, 108 (64%) were male and 59(36%) were female. The early postoperative complications included 1.19% mortality, perioperative MI of 1.1% and reoperation for bleeding was 1.7%. Local complications following RA harvesting included paresthesia of hand at 2.9% and Scar formation in 2.3%. CT angiography was performed after one year follow up in 86 patients, which showed patent RA graft in 84 (97.7%) patients. Two patients (2.3%) had RA stenosis.

Conclusions: The results indicate that RA can be used routinely in surgical revascularization of heart with good early results.

Keywords: Radial artery, Conduit, CABG.

INTRODUCTION

The radial artery is a muscular artery that was first used for aorto-coronary bypass by Carpentier in 1971¹, but its use was abandoned due to its spasm in the early postoperative period. However, with the availability of antispasmodic drugs like calcium channel blockers (Verapamil), Papaverine and Phenoxybenzamine to prevent its spasm have once again resulted in its function as a second conduit after Left Internal Mammary Artery in coronary artery bypass grafting². Moreover, RA and LITA grafting has a strong protective effect against progression of native coronary artery disease in previously grafted vessels. Multiple arterial grafting may improve long-term survival by preventing progression of atherosclerosis in the native coronary vessels³. Nevertheless, late survival results suggest that elderly (>70 years) primary multivessel CABG patients benefit substantially when RA is used as the second conduit in combination with ITA⁴.

The role of arterial grafts (right ITA, RA and Gastroepiploic artery) in CABG, other than LITA is not very common all around the world especially the developing countries like Pakistan. The reasons for this have mainly been a lack of trained manpower to harvest different arterial conduits when compared to harvest the great saphenous vein (SV), prolonged operating times with use of arterial grafts and increased risk of Sternal wound infection with use of bilateral mammary arteries.

In Pakistan, the cardiac surgeons mostly use great SV as a second conduit after LITA in CABG. The second best conduit for CABG is unclear especially in developing countries like Pakistan. We sought to determine if the purpose of a second arterial conduit, RA, would improve long-term result after CABG using the LITA and SV.

PATIENTS AND METHODS

A total of 167 consecutive patients who underwent isolated CABG from March 2011 to September 2013, at the cardiac surgery department, King Edward Medical University/Mayo Hospital Lahore were included in the study; RA was used as a second conduit after LITA to LAD. Patients with renal failure, undergoing valve replacement in addition to CABG and patients who became unstable on induction of anaesthesia were excluded from the study.

Intervention: Before operation each patient was examined for cutaneous paresthesia and Modified Allen's Test to access the collateral circulation of the hand (Ulnar artery). Because of the 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).

To minimize the risk of arterial spasm, an intravenous infusion of verapamil, was administered during the entire procedure and postoperatively for 24 hours followed by oral calcium channel blockers for 6 months, and immersion of a harvested radial artery in RA solution (Verapamil 5mg+Nitroglycerin 2.5mg+heparin 5000IU+R/L 300ml+NaCHO₃-0.3M).

Assessment: The patients were accessed for operative time, ventilation time, hospital stay, radial artery spasm related complications like arrhythmias, changes in ECG and local complications at the radial artery harvest site like ischemia of the hand, compartment syndrome, paresthesia and anesthesia from damage to nerves during harvesting of the radial artery. The patient had a CT angiogram done to access for the patency of radial artery graft after one year.

Outcome parameters: The primary outcome was the incidence RA stenosis on CT angiogram and secondary outcome parameters were perioperative MI, reoperation for bleeding, permanent stroke, renal failure, respiratory failure, Septicaemia, Operative mortality and harvested site local complication.

RESULTS

From March 2011 to September 2013, a total of 167 patients undergoing isolated CABG surgery were included in this survey. The median age was 48.26±7.89, 108 (64%) were men and 59 were women (36%). RA was used as a second conduit after LITA to anastomosis Right Coronary Artery (RCA) in 65 patients (38.9%), obtuse marginal in 29%, Diagonal-17% and sequential graft in 4%. CT angiography was performed after one year follow up in 86 patients, which showed patent RA graft in 84 (97.7%). Two patients (2.3%) had RA stenosis, one with RA to RCA occluded at aortic end, stump visualized; other RA to RCA showed the normal origin, normal proximal segment, mid segment has slight stenosis (?Artifact due to overlying metallic clips), distal segment before insertion was normal (Table 1).

The early postoperative complications were 1.19% mortality, perioperative MI of 1.1% and reoperation for bleeding was 1.7% (Table 2). Local complication following RA harvesting accounts paresthesia of hand at 2.9% and Scar formation in 2.3% (Table 3).

Table 1: RA anastomosis with target native coronary artery (n=167) and CT angiography finding (n= 86)

Complications	=n (n=167)	CT angiography Finding (n=86)	
		Patent	Stenosis
Right coronary artery	65(38.9%)	30(34.8%)	2(2.3%)*
Obtuse marginal	49(29.3%)	26(30.2%)	
Diagonal	29(17.3%)	17(19.7%)	
Ramus Intermediate	17(10.17%)	8(9.3%)	
Sequential	7(4.19%)	3(3.4%)	

*see text for detail, site of stenosis

Table 2: Post operative complication (n=167)

Complications	=n
Perioperative MI	2 (1.19%)
Reoperation for bleeding	3 (1.79%)

Permanent stroke	1(0.5%)
Renal failure	3 (1.79%)
Respiratory failure	-
Septicemia	-
Operative mortality	2 (1.19%)

Table 3: Local complication of RA donor arm after one year (n=167)

Complications	=n
Cutaneous paresthesia	5(2.9%)
Scar (hypertrophic/keloid)	4(2.3%)
Wound dehiscence	-
Donor arm weakness	3(1.79%)

DISCUSSION

A number of studies have reported a favorable impact of the RA grafting approach in CABG survival compared with the conventional Saphenous Vein approach for multi vessel coronary revascularization^{5,6,7,8}. The mechanistic cause is RA internal diameter close to coronary arteries as opposed to saphenous vein grafts, increasing its anatomical and physiological similarity⁹. Furthermore, absence of valves and thicker wall making better anastomosis, are superior characteristics of the RA. There are multiple studies documenting overall general excellent long-term RA durability^{7,8,9}. Moreover, RA is also advocated based on direct and indirect properties of the graft, such as its ease of harvest and favorable suturing characteristics, its length and bilateral availability, avoidance of injury of midline crossing ITA grafts at re sternotomy, and avoidance of an increased wound healing complication reported with bilateral ITA^{5,6,7,8}.

Several ongoing studies, including the Radial Artery Versus Saphenous Vein Patency (RSVP), the Radial Artery Patency Study (RAPS), and the Radial Artery Patency and Clinical Outcome (RAPCO) trials have all shown excellent patency rates of radial artery grafts^{10,11,12}.

There is also increasing evidence that the use of RA as a second conduit after LITA to LAD results in improved survival especially in the elderly over 70 years of age and also elderly females¹³. This most probably results from poor quality great SV especially in the elderly females, resulting in poor immediate and early results.

CONCLUSION

The radial artery should be used routinely in all patients undergoing bypass surgery as a second arterial conduit after left internal thoracic 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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