

Radial artery graft function is not affected by age

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Objective: Extensive arterial grafting with the radial artery in elderly patients is still debated, because of the reduced life expectancy and the supposedly higher periprocedural morbidity caused by an accelerated atherosclerosis of arterial grafts in elderly patients, which might hamper functional results.

Methods: We reviewed our experience with patients undergoing radial artery myocardial revascularization (coronary artery bypass grafting) between January 2003 and December 2006, divided into 2 groups: elderly patients (≥ 70 years, group A) and young patients (≤ 60 years, group B). Hospital outcome and transit-time flowmetric maximum and mean flow, pulsatility index, and graft flow reserve were compared. Results were stratified by target vessel, surgical technique, and subgroups at risk.

Results: Hospital outcome, troponin I levels, and echocardiographic segmental kinetics were comparable in the 2 groups. Stratifying patients for target vessels, no differences in radial artery transit-time flowmetric results were recorded between the 2 groups either on-pump or off-pump, as free grafts or Y grafts, or in diabetic patients and hypertensive patients. Although graft flow reserve was significantly improved in all patients ($P < .05$ in the young and elderly groups, regardless of the target vessel, the surgical technique, and the comorbidities), graft flow reserve of radial artery grafts was comparable between elderly and young patients.

Conclusions: Radial artery coronary artery bypass grafting showed similar transit-time flowmetric functional results in elderly and young patients, regardless of the target vessel, the use or avoidance of cardiopulmonary bypass, the construction of proximal anastomoses, and the presence of comorbidities. These data explain the reported better results of arterial revascularization in the elderly and suggest an increase in extensive radial artery grafting in the last decades of life.

The recent demonstration of improved survival in patients undergoing arterial revascularization has led surgeons to increasingly use arterial grafts other than internal thoracic arteries to completely revascularize the heart.¹ Of these, the radial artery (RA) is the most frequently used arterial conduit worldwide.² However, saphenous vein grafts (SVGs) continue to be used extensively and are often considered the conduit of choice.^{3,4}

Moreover, with the exponential growth of the geriatric population referred for coronary artery bypass grafting (CABG), it is not surprising that the SVG continues to be the backbone of daily coronary revascularization.^{3,4} It is in fact the second

Abbreviations and Acronyms

EF	= ejection fraction
GFR	= graft flow reserve
IABP	= intra-aortic balloon pump
LITA	= left internal thoracic artery
OPCABG	= off-pump coronary artery bypass grafting
PI	= pulsatility index
RA	= radial artery
SVG	= saphenous vein graft
TTF	= transit-time flowmetry
WMSI	= wall motion score index

most frequently used conduit in both Society of Thoracic Surgeons National and EuroSCORE Databases.^{3,4} Furthermore, reluctance to use arterial grafts in elderly patients is based on concerns about long-term survival of this cohort of patients and on the concept that the extensive use of arterial grafts might be associated with an increased morbidity and mortality caused by excessive surgical invasiveness, prolonged operative time, and higher risk for arterial spasm with acute onset of ischemia.⁵ Despite the recent demonstration by Wildhirt and colleagues⁶ that RA grafts demonstrated good angiographic, morphometric, and basic flowmetric (mean flow and resistance index) results in aged patients, a detailed functional flowmetric behavior of these grafts has not been reported nor has the flowmetry stratified by the grafted vessel and surgical technique. In particular, graft flow reserve (GFR) has not been studied in this high-risk population.⁶ On the other hand, other authors confirmed RA graft safety in the young,⁷ others pointed out the critical role of a high-grade angiographic coronary stenosis regardless of age,⁸ and still others, on the other hand, reported a higher rate of occlusion in RA grafts compared with that of SVGs.⁹ Finally, recent studies pointed out that the prevalence of preexisting atherosclerotic lesions and calcification in the RA may hamper their functional short-term and long-term results, favoring arterial spasm, thus suggesting the avoidance of extensive arterial grafting in some high-risk categories, such as elderly, diabetic, and hypertensive patients.¹⁰ Therefore, the acceptance of extensive arterial revascularization in elderly patients is still questioned; studies focusing on this topic are still scarce, and to date, it is not clear whether age per se might be an exclusion criterion for RA grafting.

Moreover, surgeons have recently discovered the possibility for an intraoperative functional assessment of the quality of their CABGs with the aid of the transit-time flowmetry (TTF), the intraoperative results of which predict graft patency at angiographic follow-up.¹¹ Again, the literature lacks studies comparing intraoperative TTF findings of arterial grafts in elderly patients.

Therefore, it was the aim of the present study to systematically review our experience with the TTF method in elderly (>70 years) and young (<60 years) patients undergoing myocardial revascularization with RA grafts during the last 4 years at a single academic institution, stratifying results by target vessel, surgical technique used (on-pump and off-pump CABG and free graft or Y-graft), and associated risk factors (diabetes and hypertension).

Materials and Methods

The present study evaluates clinical and flowmetric results of a prospective series of elderly patients (>70 years, group A) undergoing RA CABG during isolated myocardial revascularization, performed either off-pump (OPCABG) or on-pump and either as free grafts or with a Y-graft construction, during the last 4 years at a single academic institution. The elderly patients were compared with a cohort of young patients (<60 years, group B) undergoing arterial CABG during the same time period. Patients aged 60 to 70 years were excluded from the study to better differentiate elderly from young patients, so as to obtain a significant difference in the mean age of the 2 groups analyzed.

The study protocol was approved by the institution's ethical committee/institutional review board, and informed consent was obtained from each patient. Sixty-five consecutive elderly patients and 53 consecutive young patients undergoing first-time elective CABG between January 2003 and December 2006 with RA grafts were enrolled in the study.

Thirty-six (55.4%) patients belonging to group A had diabetes, and 37 (56.9%) had hypertension. When young patients were considered, there were 37 (69.8%) diabetic and 28 (52.8%) hypertensive patients.

Exclusion criteria were additional cardiac or vascular surgical procedures and severe systemic comorbidities (dialysis, hepatic failure, cancer, and autoimmune disease).

Surgical Intervention

The RA was always harvested in a pedicled fashion. The RA was evaluated in all cases with the modified (percentage of arterial oxygen saturation) Allen test, the results of which were considered negative when hand vascularization became normal in less than 6 seconds and percentage of arterial oxygen saturation was recovered in the same time. The graft was harvested only from the nondominant forearm in all cases. Low-current electrocautery was used for the subcutaneous tissue and the deep fascia in the proximal half of the incision, with the distal deep fascia incised with scissors. The subsequent dissection continued with a harmonic scalpel (Ethicon Endo-Surgery, Cincinnati, Ohio) by using the hook blade and the variable mode at moderate intensity. RA branches that bled during or after transection, as well as the major collateral branches, were controlled with small clips. All RAs underwent gentle palpation before transection, and no cases of macroscopic calcification, atherosclerotic plaques, or both were detected. Topical vasodilators were not used during RA harvest at any time. After harvest, the RAs were placed in 100 mL of NaCl 0.9% with 50 mg of diltiazem, 30 mEq of papaverine buffered with 30 mEq of NaHCO₃, and 5000 IU of heparin until their use as

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