Use of extended radial artery conduit for complete arterial revascularization

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Abstract

We have developed a new technique to elongate the radial artery (RA) with the distal segment of the left internal thoracic artery (LITA). The left anterior descending (LAD) artery is examined to determine the site of the LITA-LAD anastomosis and the length of LITA required to perform the anastomosis. The distal segment of the LITA beyond this length is divided in order to elongate the RA. This extended conduit is long enough to perform complete arterial revascularization and to reach the ascending aorta for the proximal anastomosis. Between January 1998 and December 2010, 113 patients were operated on using this technique. There was no early mortality among the whole group. Two patients (1.8%) had perioperative myocardial infarction. Three patients (3.5%) had re-interventions. We conclude that this technique makes the optimal use of both arterial conduits and could be a valuable alternative option for patients who are selected for complete arterial revascularization.

Keywords: Coronary artery bypass grafting • Arterial grafts • Radial artery • Revascularization • Myocardial

INTRODUCTION

In the last two decades, the radial artery (RA) has emerged as a major alternative arterial conduit in preference to saphenous vein grafts or when traditional grafts are unsuitable or unavailable in coronary artery bypass grafting (CABG) [1, 2]. However, to optimize the use of RA as a coronary bypass conduit, several technical considerations have been emphasized [3]. In an earlier report [4], we showed that the best hospital outcome, using the RA, is obtained when this conduit is proximally anastomosed to the aorta. However, when both the right coronary artery and the circumflex artery must be grafted, the RA is too short to reach the aorta for the proximal anastomosis. In an attempt to offer complete arterial revascularization, we have developed a technique that makes the optimal use of both the left internal thoracic artery (LITA) and the RA.

METHODS

Radial artery extension technique

The LITA may be used as a pedicled graft with its adjacent veins and pleura attached, or it may be skeletonized. The LITA should be fully mobilized up to the left subclavian artery and down to the epigastric bifurcation. The pleura is opened to allow the LITA to lie anterior to the hilum of the left lung. The LITA is passed through a window in the pericardium anterior to the phrenic nerve. To gain the maximum length, the LITA may be skeletonized by dividing the branches in the anterior intercostal space close to the LITA. This technique preserves the collateral supply to the sternum and may reduce the incidence of wound complications [5]. The LITA is preserved in a gauze soaked in arterial vasodilation solution as reported earlier [4].

We performed a preoperative duplex sonographic examination before harvesting the RA to confirm a functioning palmar collateral circulation. Recently, we have been depending solely on the preoperative clinical assessment of the ulnar collateral blood supply using a modified Allen’s test [6]. Harvesting the RA has been described earlier. The side branches are then isolated and either clipped or ligated with the harmonic scalpel.

We place a small cannula in the proximal end of the graft and gently flush the entire graft with papaverine, being careful not to over-distend the vessel. The entire RA pedicle graft is then wrapped in papaverine-soaked gauze [7].

Before initiating the cardiopulmonary bypass, the left anterior descending (LAD) artery is examined to determine the site of the LITA-LAD anastomosis and the length of LITA required to perform the anastomosis. The distal segment of the LITA beyond this length is divided in order to elongate the RA. This segment could be as long as 8–10 cm if the LITA is optimally harvested. This segment is anastomosed in an end-to-end fashion with the RA, using a small-needled 7-0 polypropylene suture (Prolene, Ethicon, Inc., Somerville, NJ, USA) (Fig. 1). In our experience, the use of a Silber vasovasostomy clamp and a Portex® Epidural Catheter (Smiths Medical, Kent, UK) (Fig. 1) is helpful in performing this anastomosis. This extended RA-LITA conduit is long enough to supply all target vessels beyond the LAD (Fig. 2).

Finally, the extended conduit is anastomosed proximally to the ascending aorta using 6-0 Prolene suture.
RESULTS

From January 1998 until December 2010, 113 patients were operated on using this technique. Table 1 shows the baseline characteristics of the patient population. The mean age was 55.1 ± 0.5 years and the majority of the patients (90.3%) were male. Fourteen patients (12.3%) had peripheral vascular disease and six patients (5.3%) had a previous cerebro-vascular accident. The mean number of distal anastomoses per patient was 3.2 ± 0.8.

Table 2 shows the main early postoperative complications. There was no early mortality among the whole group. Two patients (1.8%) had perioperative myocardial infarction. Graft occlusion was angiographically detected in four patients (3.5%); two patients were treated with percutaneous coronary intervention and two patients underwent redo CABG. No other readmissions or recurrent angina have been registered.

DISCUSSION

The presented technique is an additional option to the existing methods to offer a complete arterial revascularization. This technique makes use of the entire LITA and entire RA without operative mortality and with acceptable morbidity. The extended conduit is long enough to reach the ascending aorta for the proximal anastomosis. It has been shown that aorta–RA grafting is followed by less perioperative cardiac events than after ITA–RA grafting [4]. This is explained by possible initial higher flow rates in grafts originating directly from the ascending aorta than in grafts originating more peripherally [8]. Composite grafts are relatively technically difficult compared with conventional aorto-coronary RA grafts. Another disadvantage of composite grafts is the reliance on single inflow (proximal left ITA) to supply all grafted territories [4].

Inspecting the coronary anatomy is important before deciding to use the present technique. In the case of poor quality of the distal coronary arteries or moderate proximal stenosis, the use of RA is discarded to avoid spasm and competitive flow, respectively. In addition, both the LITA and RA should be carefully examined before planning to use either the extended RA conduit or rather a composite Y-graft.

No technical problems have been posed by this technique as the RA–LITA end-to-end anastomosis is less demanding than the LITA–RA Y anastomosis. Another distinct advantage is that the LITA–LAD anastomosis is made in the area where both arteries have their maximal diameter. The ideal elastic and physiological properties of the mid segment of the LITA are optimally used [9]. In a certain subset of patients, such as diabetic and obese patients, the proposed technique may avoid the use of bilateral internal thoracic arteries and its inherent risk of impaired sternal healing [10, 11].
Conflict of interest: none declared.

REFERENCES