

Heart, Lung and Circulation (2016) xx, 1–7  
 1443-9506/04/\$36.00  
<http://dx.doi.org/10.1016/j.hlc.2016.10.018>

# Distal Anastomosis Support for Coronary Artery Bypass Grafting: A New Surgical Technique and Current Outcomes

Junfeng Yang, Liangshan Wang, Haitao Li, Changcheng Liu, Bo Li, Hui Li, Rui Liu, Chengxiong Gu\*

Department of Cardiac Surgery, Beijing An Zhen Hospital of Capital Medical University, Beijing, People's Republic of China

Received 9 August 2016; received in revised form 18 October 2016; accepted 27 October 2016; online published-ahead-of-print xxx

## Background

Saphenous vein graft (SVG) failure remains the Achilles' heel of coronary artery bypass grafting (CABG) and grafts performed on the right coronary artery (RCA) system always have the worst patency compared with those performed on the left coronary system. The aim of this study was to introduce the distal anastomoses support (DAS) procedure and investigate the effect of DAS on the mid-term graft patency of SVG-PDA.

## Methods

Between May and September 2013, 100 patients with an RCA severe lesion who underwent isolated OPCABG (CABG alone group, n=50) or CABG with DAS for anastomoses of SVG-PDA (CABG plus DAS group, n=50) were evaluated retrospectively.

## Results

Patency rates of SVG-PDA at two years were significantly higher in the CABG plus DAS group compared to the CABG alone group (94.0% vs 74.0%,  $P = 0.006$ ). However, there was no significant difference between the two groups with regard to freedom from MACCE at two years ( $92.0 \pm 3.8\%$  versus  $82.0 \pm 5.4\%$ ,  $P = 0.08$ ). No death occurred in both groups, and freedom from angina at two years did not differ significantly between two groups ( $80.0\%$  vs  $92.0\%$ ,  $P = 0.62$ ). In multivariate logistic regression analysis, diffuse disease was the independent predictor of graft occlusion (OR = 11.05, 95% CI 2.14–57.12,  $P = 0.004$ ), but concomitant DAS (OR = 0.04, 95% CI 0.003–0.350,  $P = 0.004$ ), proximal stenosis > 75% (OR = 0.09, 95% CI 0.02–0.50,  $P = 0.006$ ), and male gender (OR = 0.05, 95% CI 0.007–0.301,  $P = 0.001$ ) were protective factors.

## Conclusions

Concomitant DAS could improve mid-term patency of SVG-PDA. Adding the DAS procedure to CABG may be a new choice for patients with an RCA severe lesion.

## Keywords

Coronary artery bypass grafting • Distal anastomosis support • Mid-term patency • Saphenous vein graft • Posterior descending coronary artery

## Introduction

Saphenous vein graft (SVG) is the most common conduit of coronary artery bypass grafting (CABG) operations. However, SVG failure remains the Achilles' heel of CABG. Several studies have shown that SVG failure occurred in approximately 25% of patients during the first two years after surgery

and almost 50% of SVG failed at 10 years[1,2]. An important factor related to patency of SVG is the target coronary artery [3]. It is well proven that grafts performed on the posterior descending artery (PDA) or the main right coronary artery (RCA) have the worst patency, compared with those performed on the left anterior descending coronary artery (LAD), diagonal artery, and circumflex branches[1,4–6].

\*Corresponding author at: Department of Cardiac Surgery, Beijing An Zhen Hospital of Capital Medical University, Beijing 100029, People's Republic of China. Tel.: +86-10-64456983; fax: +86-10-64456888, Email: [anzhengu@sina.com](mailto:anzhengu@sina.com)

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Please cite this article in press as: Yang J, et al. Distal Anastomosis Support for Coronary Artery Bypass Grafting: A New Surgical Technique and Current Outcomes. Heart, Lung and Circulation (2016), <http://dx.doi.org/10.1016/j.hlc.2016.10.018>

Given the anatomic spatial relationship between the RCA and diaphragm, anastomoses of the RCA system may be crushed by the diaphragm during diastole, especially when standing. Thus, the anastomoses become deformed and consequently lead to the changes of haemodynamic characteristics of blood flow, which may influence graft patency. In this study, we created a distal anastomoses support (DAS) and fixed it on the heart beside the anastomoses. Moreover, we found that DAS seemed to improve mid-term patency of SVG-PDA compared with off-pump CABG (OPCABG) alone.

## Materials and Methods

### Patients

This study was approved by the regional ethics committee of Beijing Anzhen Hospital and all patients signed informed consent. One hundred patients with a RCA severe lesion who underwent isolated OPCABG (CABG alone group,  $n=50$ ) or CABG with DAS for anastomoses of SVG-PDA (CABG plus DAS group,  $n=50$ ) between May and September 2013 were included. Patients who underwent PDA endarterectomy were excluded. A RCA severe lesion in this study was defined by the presence of at least one of seven criteria according to the SYNTAX score: proximal stenosis 50–99%, total occlusion, severe tortuosity, lesion length  $>20$  mm, heavy calcification, thrombus formation and diffuse disease[7]. The severity of the RCA lesion was based on the last coronary angiography before operation. Of this cohort, all patients received revascularisation of the RCA.

### Operation Technique

The left internal mammary artery (LIMA) and the great saphenous vein were routinely harvested. The most common grafting patterns in our operations are LIMA to the LAD and SVG to other target vessels sequentially. Detailed surgical procedures of OPCAB are described in a previous study [8]. The posterior descending artery is preferred for

revascularisation when the RCA is the target vessel in CABG[9]. All patients were operated on by the same surgeon (Dr Cheng-Xiong Gu) and the decision to apply the DAS for anastomoses of SVG-PDA was at the discretion of Dr Gu. However, we also tried to apply the DAS for patients with diffuse lesion of PDA.

Producing the DAS was quite simple. Firstly, we obtained a  $2\times 2$ -cm square Dacron heart graft and folded it in half. Then, an auto pericardium patch or saphenous vein patch was used to cover the Dacron heart graft and the sides were sutured with a 6-0 Prolene thread. Finally, two DAS were created and fixed on the heart beside the anastomoses, which is shown in Figure 1.

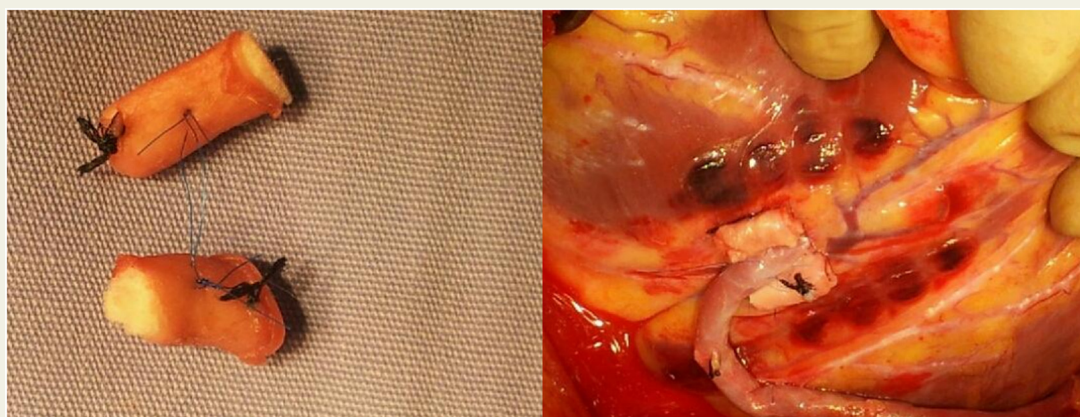
### Follow-Up and Endpoints

Baseline and operative characteristics of the patients were determined from the medical records. All patients returned for follow-up visit between December 2014 and September 2015. Ninety-six were examined with 64-slice CT coronary angiography (CTA) and the remaining four patients underwent coronary angiography (CAG). Moreover, they were asked about hospitalisation for unstable angina, heart failure, myocardial infarction or stroke. The mean follow-up duration was  $20.4\pm 4.3$  (maximum, 30) months.

The primary endpoint was occlusion of SVG-PDA on the follow-up CTA or CAG. Graft occlusion was defined as the absence of visible opacification of the graft in the aortogram and a string sign was considered as graft patency in our study. In sequential grafts, we only analysed the segment performed to the PDA. The second endpoint included mid-term death, angina, and a composite of major adverse cardiac or cerebrovascular events (MACCE), which were defined as non-fatal myocardial infarction, cerebrovascular accident, hospitalisation for heart failure, or need for revascularisation.

### Statistical Analysis

This study used Stata SE12.0 (StataCorp, College Station, TX) and SPSS version 19.0 (SPSS Inc., Chicago, IL, USA) for data analysis. Data were expressed as means  $\pm$  standard



**Figure 1** Distal anastomosis support beside the anastomosis on posterior descending coronary artery at operation.

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