

# Embedded Left Anterior Descending Artery During Coronary Bypass Operations: A 15-year Experience



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Received 27 January 2015; received in revised form 31 March 2015; accepted 22 April 2015; online published-ahead-of-print 27 May 2015

## Background

Revascularisation of the left anterior descending coronary artery (LAD) is the most important part of coronary artery bypass grafting (CABG) operations. We analysed the results of CABG in patients with embedded LADs compared to age and gender-matched controls.

## Methods

Among 4,102 patients undergoing primary on-pump CABG from January, 1999, through April, 2014, 92 had embedded LADs. Direct dissection (n= 19) or retrograde probe technique (n= 73) was utilised to expose the LAD. Controls had epicardial courses of the LAD. A retrospective study was performed and follow-up information was obtained.

## Results

Cross clamp and cardiopulmonary bypass times were longer ( $63.5 \pm 8.5$  vs.  $46.6 \pm 20$ ,  $p < 0.001$ ; and  $81.4 \pm 21.4$  vs.  $60.1 \pm 20.8$ ,  $p < 0.001$ , respectively) in the study group in which four patients had right ventricular injury (n = 3, direct dissection; n = 1, retrograde probe). The groups did not differ in terms of associated comorbidities, number of grafts, reoperation rate for bleeding, duration of intensive care unit stay, and duration of hospital stay. There were no hospital deaths in either group. Kaplan-Meier analysis showed similar survival rates postoperatively.

## Conclusions

In patients with embedded LADs, surgical outcomes following on-pump CABG compare favourably with the age- and gender-matched controls.

## Keywords

Cardiac anatomy/pathologic anatomy • Coronary artery bypass grafts/ CABG • Embedded left anterior descending coronary artery/LAD

## Introduction

The postoperative short- and long-term goals of coronary bypass grafting (CABG) operations largely depend on the revascularisation of the left anterior descending (LAD) artery [1–3]. An LAD which is embedded deeply in the interventricular groove may technically complicate the procedure with the risks inherent in the localisation and exposure of the artery, such as injury to the major septal, diagonal

branches [4] or to the right ventricular free wall [5], all potentially increasing operative morbidity and mortality. Moreover, in this context, surgical anastomosis of suboptimal quality is likely to occur, which increases the probability of less than ideal blood flow in the long term. The impact of an embedded LAD on the outcome of coronary bypass operations has not been completely studied.

This study was performed to compare, after CABG operations, the early and late clinical outcomes (such as

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mortality, morbidity, late coronary intervention and late death) of patients who had embedded LADs with those of their age- and gender-matched counterparts who had epicardial courses of the LAD.

## Material and Methods

After obtaining institutional review board approval, a prospective database was utilised to identify patients undergoing CABG. From January 1, 1999, through April 30, 2014, 4,102 patients underwent primary CABG procedures utilising cardiopulmonary bypass (CPB) with or without a concomitant cardiac procedures or a carotid endarterectomy (CEA) by a single surgeon. Among these, 92 consecutive patients had embedded LADs. A direct dissection ( $n = 19$ ), or retrograde probe technique, [6] ( $n = 73$ ) — complemented with distal arteriotomy and dissection — was utilised to expose the artery during the operations.

These patients were matched with 92 others using the same database. Matched variables were age ( $\pm 2$ ; 61.5 vs. 61.3 years), gender (53 male, 39 female, both groups), and date of operation ( $\pm 30$  days). The data were extrapolated utilising a retrospective review of medical records, which included patient age, sex, weight, BMI, diagnosis, comorbidities (diabetes, hypertension, COPD), presence of a past and/or new myocardial infarction, specifics of the operation (type and number of grafts, and CC and CPB times), hospital morbidities, and survival. A new myocardial infarction was defined using elevated levels of cardiac biomarkers of necrosis and one or both of the following ECG criteria: 1) a new (or presumably new) significant ST/T wave change or left bundle-branch block (LBBB), 2) development of pathological Q waves on the postoperative ECG. A recent follow-up was obtained via patient contact.

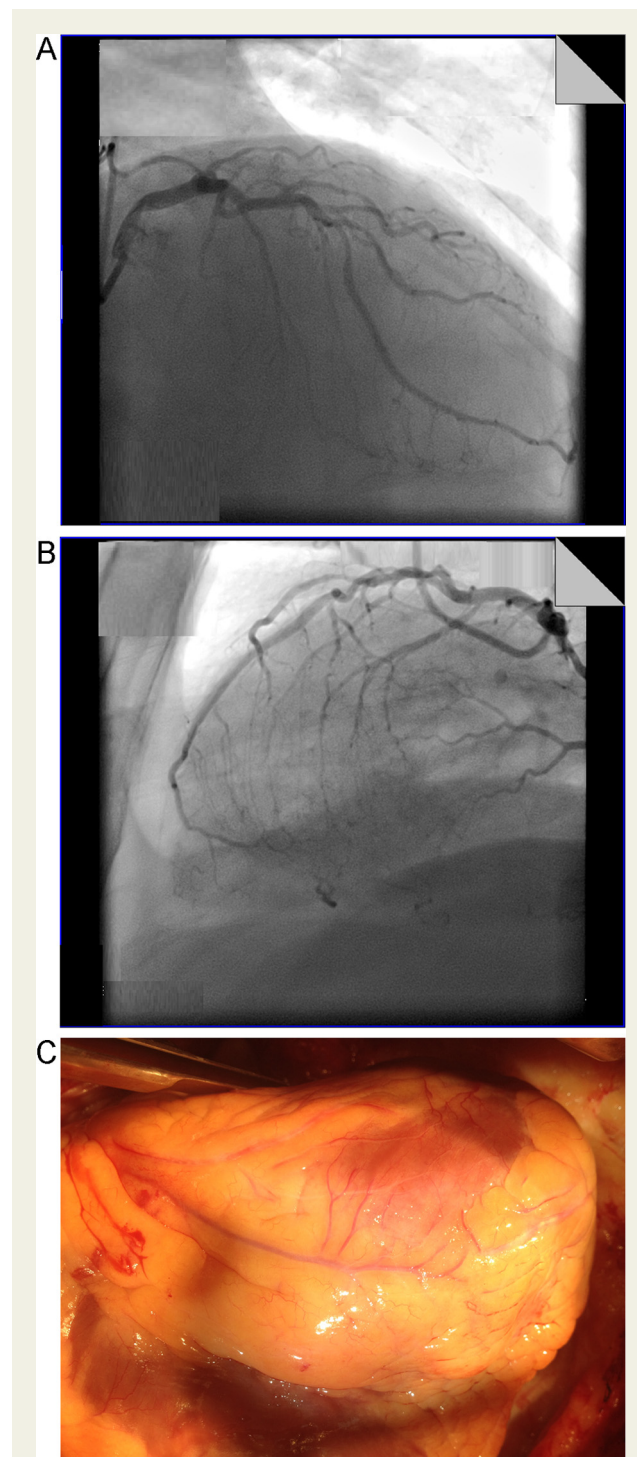
“Embedded LAD” is used to define an operative finding in which LAD is overlapped proximally by fatty tissue with or without a layer of muscle (Figure 1), which is generally unnoticeable on a coronary angiogram. None of the patients in this study had a myocardial bridging — characterised by systolic compression of the tunnelled segment of the LAD on coronary angiography — which is defined as muscle overlying the intramyocardial (tunnelled) segment of an epicardial coronary artery [7].

Preoperative patient characteristics are summarised in Table 1.

Angina Class III and IV patients were operated on an urgent basis either on the day of referral or the following day. None of the patients required a preoperative intra-aortic balloon pump (IABP). The LAD was embedded beneath a thick layer of epicardial adipose (4 mm to 7 mm thick) ( $n = 42$ ) and an accompanying slice of muscular tissue (1 mm to 3 mm thick) ( $n = 50$ ).

## Technique

Our surgical technique for a typical CABG procedure is described elsewhere [8]; in brief, it included general



**Figure 1** Preoperative coronary angiogram showing A) right anterior oblique and B) left anterior oblique, and operative photograph C) showing embedded LAD on same patient.

anaesthesia, median sternotomy and cardiopulmonary bypass utilising membrane oxygenators, blood cardioplegia, and aortic cross-clamping. When an embedded LAD was encountered during the operations, a direct dissection was attempted to localise the LAD. This included longitudinal

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