

Totally Endoscopic Coronary Artery Bypass on the Beating Heart in Jehovah's Witness and HIV Patients: Case Report

Roberto Casula, MD, FECS, Thanos Athanasiou, MD, PhD

The National Heart and Lung Institute, Imperial College of Science, Technology and Medicine, Department of Cardiothoracic Surgery, St Mary's Hospital, London, UK

ABSTRACT

Minimally invasive direct coronary artery bypass has been widely employed as an approach for revascularization of the left anterior descending coronary artery. Recent advances in minimally invasive cardiac surgery enhanced with technological assistance have meant that these operations are now being performed through smaller incisions. We present 2 cases, both of which emphasize the beneficial role of the DaVinci robotic system in performing bloodless coronary surgery without blood transfusion and in reducing blood contact in instances in which there is a high risk for infection. In the first case, a Jehovah's Witness patient, blood transfusion was not an option; in the second case, a human immunodeficiency virus (HIV)-positive patient, blood contact would have put the staff at risk for HIV infection.

INTRODUCTION

The usual indications for minimally invasive direct coronary artery bypass (MIDCAB) grafting are proximal occlusion, ostial lesions, failed percutaneous interventions on the left anterior descending (LAD) territory, and hybrid procedures for multivessel coronary disease. The advantages of MIDCAB are that sternotomy, cardiopulmonary bypass, and aortic manipulation can be avoided, thus making it possible to reduce blood loss, morbidity, length of hospital stay, and cost without compromising the quality of the surgical procedure [Magee 2002].

With the advent of robotic systems in cardiac surgery, it has become possible to harvest the left internal thoracic artery (LITA) and perform microvascular anastomosis of the LITA to the left anterior descending artery (LAD). Aptly named atraumatic coronary artery bypass (ACAB), this tech-

nique is a less invasive version of the MIDCAB procedure. ACAB involves a smaller skin incision, robotic LITA harvest, and manual coronary anastomosis and avoids rib retraction, which can result in tissue trauma. More recently, development of the articulated endoscopic stabilizer has allowed cardiac surgeons to perform beating heart totally endoscopic CAB (BHTECAB). The learning curve associated with this procedure has meant that surgeons have had to work hard to achieve preliminary clinical and angiographic patency results comparable to traditional surgical revascularization [Falk 2003].

We present 2 high-risk cases in which the DaVinci robotic system was used with success. The first patient was a Jehovah's Witness who would not accept blood transfusion or products, and the second patient was infected with the human immunodeficiency virus (HIV), so blood contact was undesirable.

CASE REPORTS

Case 1

A 48-year-old man who was a Jehovah's Witness presented with a 12-month history of angina on exertion and a positive exercise test. Comorbidity included history of smoking, hypertension, and hypercholesterolemia. Coronary angiography revealed a proximal LAD occlusion, with preserved ventricular function. Preoperative hemoglobin was 13.2 g/dL. Aspirin was discontinued for 1 week and oral ferrous sulfate supplements were commenced for 6 days prior to surgery. Despite refusing blood transfusion the patient consented to cardiopulmonary bypass and intraoperative use of cell saver. He underwent BHTECAB during which he suffered a total intraoperative blood loss of 140 mL. His pre- and postoperative angiogram and cosmetic results are presented in Figure 1.

Case 2

A 45-year-old male HIV-positive patient with 2-vessel disease presented with a 1-year history of angina on limited exertion and a positive exercise test. He had previously undergone a successful percutaneous angioplasty to his right coronary territory and was referred to our department for MIDCAB to the LAD. BHTECAB was attempted in this

Received January 12, 2004; accepted January 17, 2004.

Address correspondence and reprint requests to: T. Athanasiou, MD, PhD, Senior Registrar in Cardiothoracic Surgery and Senior Clinical Fellow in Robotic Cardiac Surgery, 70 St Olaf's Road, Fulham, London SW6 7DN, United Kingdom; 44-0207-886-1147; fax: 44-0207-886-1763 (e-mail: tathan5253@aol.com).

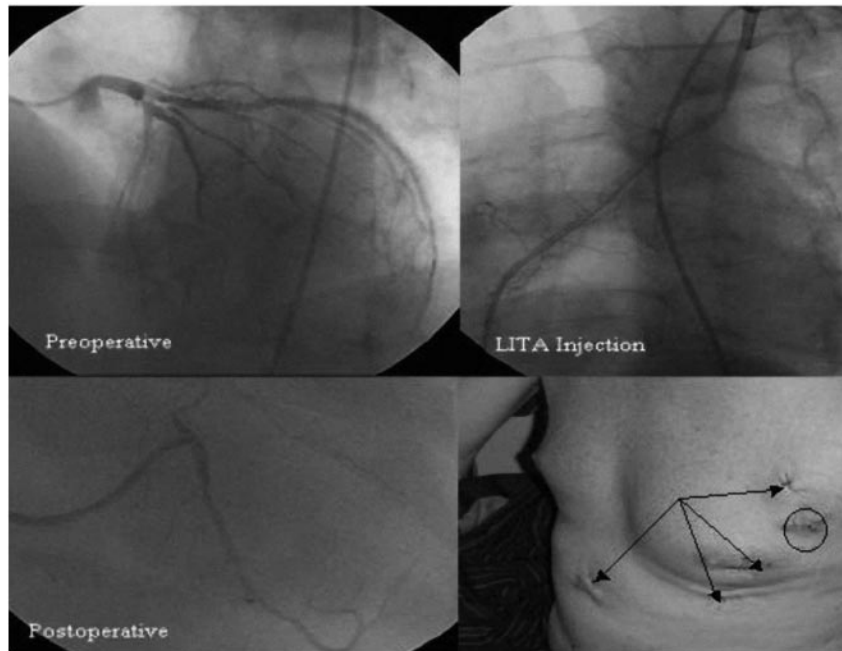


Figure 1. Preoperative and postoperative outcome of a Jehovah's Witness patient undergoing beating-heart totally endoscopic coronary artery bypass surgery. The 4 arrows indicate the 4 ports required, with the circle representing the insertion point of an endoscopic instrument to facilitate the coronary anastomosis. LITA indicates left internal thoracic artery.

patient, but because of difficulties encountered during the LAD preparation, a 4-cm skin incision had to be performed (converted to ACAB) (Figure 2). Total perioperative blood loss was 200 mL.

SURGICAL AND ANESTHETIC TECHNIQUES

We have previously described the details of patient positioning, anesthetic methods, and surgical technique used in this type of surgery [Casula 2003]. In both cases the DaVinci robotic system was used (Intuitive Surgical, Mountain View, CA, USA), and the LITA was dissected off the chest wall from its bifurcation distally up to the level of the first rib. A 12-mm port was placed under the left costal arch in order to introduce an endoscopic stabilizer (Intuitive Surgical). This device allowed stabilization of the target vessel by applying suction to the epicardium and improved visualization by continuous irrigation. We did not have access to a fourth robotic arm and thus used endoscopic forceps inserted and manipulated by the assistant surgeon to facilitate the console surgeon during the initial steps of the coronary anastomosis. The total surgical time for case 1 was 4 hours and for case 2 was 3.5 hours. LAD occlusion times were 42 and 16 minutes, respectively.

POSTOPERATIVE COURSE

Both patients were discharged home on day 3, and subsequently underwent postoperative angiography revealing a patent LITA. The patients were reviewed in the outpatient clinic 4 weeks postsurgery and had an unremarkable recovery.

DISCUSSION

Indications for robotic coronary revascularization procedures have not yet been clearly defined. The technique has been applied to selected elective patients such as those without significant left ventricle enlargement, left ventricular dysfunction, and intramyocardial coronary vessels. Relative contraindications to robotic surgery include anatomically small intrathoracic space or morbid obesity. Our experience sug-



Figure 2. Atraumatic coronary artery bypass in a human immunodeficiency virus-positive patient. Arrow 1 shows the endoscopic stabilizer in place and arrow 2 the left internal thoracic artery.

gests that other high-risk groups may benefit from MIDCAB, notably Jehovah's Witnesses and HIV-positive patients, and highlights the link between robotic techniques and the concept of bloodless surgery.

Our experience of blood-conserving surgery in these 2 patients supports recent evidence suggesting the superiority of ACAB over direct primary LAD stenting in patients suitable for hybrid myocardial revascularization (HMR) (multivessel disease involving the LAD) [Cisowski 2002, Stahl 2002]. In this procedure the patient undergoes 2 separate revascularization procedures, with the surgeon performing ACAB and the cardiologist performing coronary stenting. The order of these procedures depends on the severity of coronary disease and left ventricular function. The benefits of this approach are first, avoidance of sternotomy, and second, improved long-term survival rates along with the increased likelihood of freedom from reintervention of the LITA-to-LAD anastomosis. So far, long-term results of HMR are limited by the results of percutaneous interventions [Riess 2002, Stahl 2002].

Blood conservation surgery requires little or no use of allogeneic blood transfusion [Goodnough 1999, Spahn 2000]. This aspect is particularly desirable in operations on patients who do not wish to have blood transfusions (Jehovah's Witnesses) and instances for which blood may not be available or ready or is medically contraindicated (eg, autoimmune hemolytic anemia). This concept can be further expanded to cases in which blood contact avoidance is desirable, such as in the HIV-positive patient. Due to the nature of risk factors for transmission of HIV, these patients are frequently coinfecting with hepatitis C, for which there is no effective prophylactic regimen [Frater 2000]. The risk of exposure of operating-theater staff to infected blood is related to several factors, particularly duration of the operation, amount of blood loss, and number of needles used [Quebbeman 1991]. The effect of using minimally invasive strategies to reduce this risk has not yet been investigated, although it is easy to see that by, for example, reducing the amount of instrumentation and the number of people in contact with the patient's blood, this risk may be reduced.

Up until August 2002, 490 TECAB procedures had been performed using the DaVinci system on the arrested heart, and 100 on the beating heart [Falk 2003]. The majority of these cases were ACAB procedures, because BHTECAB has a high conversion rate. This rate (BHTECAB to MIDCAB) has, however, decreased from 50% to 20% with the latest generation endostabilizers. In our institution the conversion

rate is approximately 35%, and we have up until now performed 8 BHTECAB and 32 ACAB procedures.

The concept of bloodless surgery in the 2 cases described in this report has had the dual effect of either reducing blood loss in patients in whom replacement is an issue (eg, Jehovah's Witnesses) or reducing exposure of operating-theater staff to infected blood (eg, HIV patients). The nature of minimally invasive surgery, which aims to reduce trauma to tissues, complements this concept, ultimately aiming to achieve as bloodless a coronary revascularization procedure as possible. Strategies such as HMR provide an alternative and less invasive option to traditional CAB grafting, making bloodless surgery in patients requiring multiple revascularizations more possible.

REFERENCES

- Casula RP, Athanasiou T, Cherian A, Bacon R, Foale R, Darzi A. 2003. Totally endoscopic robotically enhanced coronary artery bypass on the beating heart. *J R Soc Med* 96(8):400-1.
- Cisowski M, Drzewiecki J, Drzewiecka-Gerber A, et al. 2002. Primary stenting versus MIDCAB: preliminary report: comparison of two methods of revascularization in single left anterior descending coronary artery stenosis. *Ann Thorac Surg* 74(4):S1334-9.
- Falk V, Jacobs S, Gummert JF, Walther T, Mohr FW. 2003. Computer-enhanced endoscopic coronary artery bypass grafting: the Da Vinci experience. *Semin Thorac Cardiovasc Surg* 15(2):104-11.
- Frater RW. 2000. Cardiac surgery and the human immunodeficiency virus. *Semin Thorac Cardiovasc Surg* 12(2):145-7.
- Goodnough LT, Brecher ME, Kanter MH, AuBuchon JP. 1999. Transfusion medicine, part I: blood transfusion. *N Engl J Med* 340:439-47; 342:1666-8.
- Magee MJ, Mack MJ. Robotics and coronary artery surgery. 2002. *Curr Opin Cardiol* 17(6):602-7.
- Quebbeman EJ, Telford GL, Hubbard S, et al. 1991. Risk of blood contamination and injury to operating room personnel. *Ann Surg* 214(5): 614-20.
- Riess FC, Bader R, Kremer P, et al. 2002. Coronary hybrid revascularization from January 1997 to January 2001: a clinical follow-up. *Ann Thorac Surg* 73(6):1849-55.
- Spahn DR, Casuutt M. 2000. Eliminating blood transfusions: new aspects and perspectives. *Anesthesiology* 93(1):242-55.
- Stahl KD, Boyd WD, Vassiliades TA, Karamanoukian HL. 2002. Hybrid robotic coronary artery surgery and angioplasty in multivessel coronary artery disease. *Ann Thorac Surg* 74(4):S1358-62.