



Avoidance of Dialysis in an End-stage Renal Disease Patient Status-post off-pump Coronary Artery Bypass Grafting

Juan A Siordia^{1*}, Sreekumar Subramanian²

¹ Research Assistant, University of Arizona College of Medicine, Tucson, Arizona, United States

² General Surgeon, University of Arizona College of Medicine, Tucson, Arizona, United States

ARTICLE INFO

Article type:
Case Report

Article history:
Received: 11 Apr 2015
Revised: 08 Nov 2015
Accepted: 09 Feb 2017

Keywords:
Cardiac Surgery
Dialysis
Off-Pump CABG

ABSTRACT

Certain benefits are clearly associated with the use of off-pump coronary artery bypass grafting (CABG) as compared with the on-pump CABG. The superiority is more evident in patients with multiple co morbidities including renal failure.

We reviewed the medical records of a 67-year-old male with a past medical history that was significant for multiple cardiovascular diseases and new-onset end-stage renal disease. The case was suffering from dyspnea and work-up was suggestive of non-ST elevation myocardial infarction and congestive heart failure.

During the hospital course, he developed end-stage renal disease requiring hemodialysis. Further cardiac evaluation presented three-vessel coronary artery disease. The patient underwent off-pump CABG. Post-operatively, the patient had minimal complications and did not receive hemodialysis for 53 days.

Off-pump CABG has evident short-term benefits for patients with the end-stage renal disease requiring dialysis, including possible improvement in cardiac function and avoidance of hemodialysis.

► Please cite this paper as:

Siordia A, Subramanian S. Avoidance of Dialysis in an End-stage Renal Disease Patient Status-post off-pump Coronary Artery Bypass Grafting. *J Cardiothorac Med.* 2017; 5(1): 543-546.

Introduction

Coronary artery bypass grafting (CABG) is a common procedure performed by cardiac surgeons. For the past 35 years, CABG has been performed primarily with cardiopulmonary bypass (on-pump CABG) and cardioplegic arrest (1). Stopping the beating of the heart allowed surgeons to accurately place anastomoses between the bridging conduit and the targeted coronary artery. However, in the mid-1990s, a new method of CABG which avoided the use of cardiopulmonary bypass (off-pump CABG) was developed. The aim of this procedure was to reduce post-operative complications, particularly cerebrovascular episodes, neurocognitive disorders, decreased myocardial activity, and systemic inflammatory response (2-3). However, the results from the Randomized On/Off Bypass (ROOBY) trial in 2009 did not suggest any significant differences in the 30-day or one-year

outcomes between the patients undergoing on-pump and off-pump CABG. However, there was a statistically significant difference between these patients in terms of graft patency with the lower rates observed in the off-pump group ($P < 0.01$) (1). Since then, the favor of off-pump CABG has diminished to only 19% of all CABG procedures performed in the veteran population (4).

However, many studies have discovered particular benefits for off-pump CABG including decreased operative time, hemorrhage, transfusion, respiratory failure, ventilator duration, and renal injury (4-8). Post-operative benefit is described in patients with the renal disease, particularly those with end-stage renal disease requiring dialysis (6-8). More specifically, renal replacement therapy (RRT) is less used in patients with the renal disease after off-pump CABG compared to on-pump CABG (6). Herein, we present the case of a patient with the

*Corresponding author: Juan A. Siordia, University of Arizona College of Medicine, Tucson, Arizona, United States. Tel: 5202235713; Fax: 5202235713; Email: jas@email.arizona.edu.

© 2017 mums.ac.ir All rights reserved.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

new-onset end-stage renal disease suffering from cardiorenal syndrome type 1, who was relieved from hemodialysis treatment 53 days after receiving off-pump CABG.

Case report

A 67-year-old man with a past medical history significant for diabetes mellitus type 2, hypertension, hyperlipidemia, and prior transient ischemic attacks presented to the emergency department as a referral from another local hospital for signs and symptoms suggestive of congestive heart failure. He underwent cardiac catheterization, which showed three-vessel coronary artery disease with significant stenosis in the left anterior descending (LAD), circumflex, and right coronary arteries (RCA; Figure 1). Echocardiography also revealed an ejection fraction of 30% with no significant valvular pathology.

During the hospital stay, he acquired end-stage renal disease having a creatinine of 4.0 mg/dL, blood urea nitrogen of 74 mg/dL, and minimal urine output even after the administration of intravenous furosemide. The nephrology team diagnosed cardiorenal syndrome type 1 and recommended hemodialysis treatment. The cardiac surgery service team was consulted due to the high SYNTAX score of 32-33, which necessitated a three-vessel CABG procedure. The Society of Thoracic Surgeons (STS) predicted the mortality rate of 13% and the cerebrovascular accident risk of 20%. The cardiac surgery team evaluation led to performing off-pump CABG.

After obtaining informed consent, the patient

transferred to operation room. The anesthesiology team performed appropriate sedation and intubation followed by a transesophageal echocardiogram confirming reduced ventricular function. Besides, median sternotomy along with the left internal mammary artery (LIMA) and saphenous vein harvesting was conducted. After revealing the heart beneath the pericardium, the LIMA was attached to the LAD. A piece of saphenous vein graft (SVG) was sutured and used as a conduit between the posterior descending artery (PDA) and the aorta. Another length of SVG was then used to attach the aorta to the obtuse marginal branch. The viability and security of the anastomoses was checked, then median sternotomy was closed in the appropriate fashion. Finally, the surgery completed after skin closure.

The patient was extubated early the next morning. He experienced multiple drops in the heart rate and blood pressure, particularly whenever he stood upright, however, symptoms and values improved when lying down. The patient was observed throughout his stay by the cardiac surgeon and the nephrology team. Renal function improved significantly which eliminated the need for further hemodialysis and vascath central venous catheter. Although he acquired pneumonia during his post-operative stay, he was quickly treated with antibiotics before being discharged.

The patient remained with stage 3 chronic kidney disease, but did not require further hemodialysis. The improvement in renal function was explained regarding the lack of

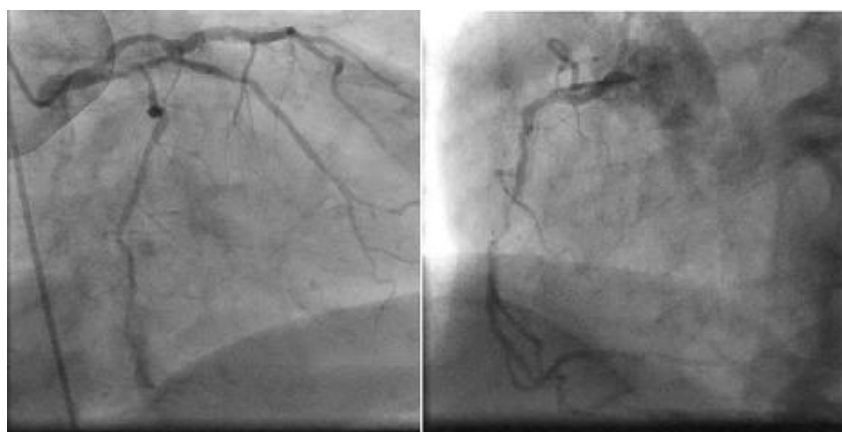


Figure 1. (left) The left anterior descending (LAD) artery was a large, heavily calcified vessel which gave rise to a small 1st diagonal from its proximal portion and a small 2 mm 2nd diagonal from its mid portion before it wrapped around the apex. The LAD had 70% stenosis in the proximal portion before takeoff of the 1st septal perforated. After the 2nd diagonal, the mid-to-distal LAD had 2 sequential 60% stenotic areas. The left circumflex was 70% stenotic with heavy calcification near the proximal portion. (Right) The right coronary artery (RCA) had 50% proximal stenosis followed by diffuse, calcified 80% stenosis of the proximal-to-mid portion of the vessel. There was 70% stenosis in the posterior descending artery (PDA).

Cardiopulmonary bypass plus improvement in cardiac function. The patient did not need further hemodialysis for 53 days post-operation, when he

returned to the emergency department due to acute exacerbation of the coronary heart disease.

Discussion

Many studies have compared the outcomes of off-pump CABG with on-pump CABG in order to determine the benefits of avoiding cardiopulmonary bypass. The ROOBY trial in 2009 suggested disfavor toward off-pump CABG after revealing no significant differences between the two techniques except for the decreased patency rate for off-pump CABG compared to on-pump CABG (82.6% vs. 87.8%; $P < 0.01$). On the contrary, neurologic outcomes revealed no significant differences between the two procedures, thus, it refutes the claim that off-pump CABG was more neurologically protective (1). However, our study did not fully account for surgeons' experience regarding off-pump CABG. Contrary to the claim that no significant differences exist while accounting for expertise, it defines an expert as one who has performed greater than 50 off-pump CABGs. It disregards that off-pump CABG poses greater difficulty to the anastomotic technique and may present a steep learning curve.

The coronary trial in 2012 supported the results of the ROOBY trial by focusing on high-risk patients. It selected patients who were aged more than 70 years and had peripheral arterial disease, cerebrovascular disease or carotid stenosis of at least 70%, and renal insufficiency. The trial indicated that there were no significant differences between off-pump and on-pump CABG procedures in terms of the 30-day rate of mortality, myocardial infarction, cerebrovascular accident, or new-onset renal failure requiring dialysis (9.8% vs 10.3%; hazard ratio for off-pump group, 0.95; $P = 0.59$). It also took into account the expertise of the participating surgeons by only allowing those who had performed 100 off-pump CABG procedures during more than two years. That trial, it reflected reduced rates of blood transfusion, respiratory complications, and acute kidney injury (5).

Other studies supported the use of off-pump CABG for patients with comorbidities. Ngaage et al. showed that patients experienced adverse cardiac and cerebrovascular events (ACCE) depending on the comorbidities and the type of CABG procedure performed. In fact, certain comorbidities altered the outcomes of each CABG technique. Low ejection fraction (30-50%) and prior myocardial infarction concomitant with hypertension, hypercholesterolemia, and obesity showed more ACCE after on-pump CABG. Females, octogenarians, and those with left main stem disease would also have ACCE with on-pump CABG. Low-risk profiles had more ACCE associated with off-pump CABG. Therefore, on-pump CABG should be performed in patients with high-risk comorbidities (7). The presented patient had a low ejection fraction with ischemic

cardiomyopathy, making off-pump CABG favorable for him according to Ngaage et al.

Patients with extensive renal disease experience perform better with off-pump CABG. Patients with low glomerular filtration who underwent on-pump CABG are at increased risk of early morbidity and mortality (8). The outcome differences between off and on-pump CABGs is noted in the early post-operative period. Similarly, Chawla et al. linked in-hospital mortality and renal replacement therapy with chronic kidney disease patients. The statistical difference is similar if death and renal replacement therapy incidences were accounted for separately. That study further added that patients with poor preoperative renal function experience better survival with off-pump CABG compared to on-pump CABG (6).

Our case had new-onset end-stage renal disease requiring hemodialysis. However, after off-pump CABG, the patient was relieved from hemodialysis for more than 50 post-operative days. Although these studies support the use of off-pump CABG in high-risk patients with short-term outcomes, they do not show a significant long-term difference in favor of off-pump CABG. Nevertheless, certain complications are reduced when avoiding dialysis including electrolyte abnormalities, infection, and hemorrhage. These studies support the fact that off-pump CABG is more favorable for patients with significant renal disease (2).

Acknowledgments

None

Conflict of Interest

The authors declare no conflict of interest.

References

1. Shroyer AL, Grover FL, Hattler B, Collins JF, McDonald GO, Kozora E, et al. On-pump versus off-pump coronary-artery bypass surgery. *N Engl J Med*. 2009; 361:1827-37.
2. Zamorano JA, Valenzuela JA, Garcia JE. Cirugía de revascularización coronaria: con o sin circulación extracorpórea? *Estudios*. 2011; 1:8.
3. van Dijk D, Nierich AP, Jansen EW, Nathoe HM, Suyker WJ, Diephuis JC, et al. Early outcomes after off-pump versus on-pump coronary bypass surgery. *Circulation*. 2001; 104:1761-6.
4. Emerson DA, Hynes CF, Trachiotis GD. Long-term outcomes after off-pump or conventional coronary artery bypass grafting within a veteran population. *Innovations (Phila)*. 2015; 10:133-7.
5. Lamy A, Devereaux PJ, Prabhakaran D, Taggart DP, Hu S, Paolasso E, et al. Off-pump or on-pump coronary-artery bypass grafting at 30 days. *N Engl J Med*. 2012; 366:1489-97.
6. Chawla LS, Zhao Y, Lough FC, Schroeder E, Seneff MG, Brennan JM. Off-pump versus on-pump coronary artery bypass grafting outcomes stratified by

- preoperative renal function. *J Am Soc Nephrol.* 2012; 23:1389-97.
7. Ngaage DL, Rogers S, Tang A, Sogliani F. On or off pump coronary bypass? Insight from matched and principal component analyses of 8779 operations. *J Cardiovasc Surg (Torino).* 2015; 56:447-54.
 8. Garcia Fuster R, Paredes F, Garcia Pelaez A, Martin E, Canovas S, Gil O, et al. Impact of increasing degrees of renal impairment on outcomes of coronary artery bypass grafting: the off-pump advantage. *Eur J Cardiothorac Surg.* 2013; 44:732-42.