



Prospects of Off-Pump Coronary Bypass Surgery – An Unsettled Issue

Dani Bitran MD and Ofer Merin MD

Department of Thoracic Surgery, Shaare Zedek Medical Center, Jerusalem, Israel

Key words: off-pump coronary artery bypass grafting, cardiopulmonary bypass, intracoronary shunts

IMAJ 2004;6:695–696

In this month's edition of *IMAJ*, Lev-Ran and colleagues report the results of off-pump coronary artery bypass grafting with 1,000 consecutive patients [1]. It is an important article demonstrating new trends in coronary bypass surgery.

Historically, cardiopulmonary bypass and cardioplegic arrest of the heart brought relative technical ease to cardiac surgery by providing a bloodless still surgical field while performing coronary anastomosis. This is indeed an important adjunct in guaranteeing safe and stable hemodynamics. There is no question that coronary bypass surgery during the last three decades of the 20th century demonstrated phenomenal success with outstanding early and late results in alleviating cardiac symptoms as well as prolonging life. It is estimated that in recent years approximately 1,000,000 CABG procedures are performed annually in the western world [2].

However, the use of cardiopulmonary bypass entails a host of accompanying problems. It induces a whole-body inflammatory response that is capable of causing significant morbidity [3]. Implicit in the technique of CPB is a non-pulsatile flow state that may also contribute to end-organ dysfunction. Employing CPB requires aortic cannulation and cross-clamping, which may lead to atheromatous embolization and organ damage, especially cerebral stroke and cognitive dysfunction.

In view of the above-mentioned potential complications of CPB, it is no surprise that during the early 1990s techniques of coronary bypass surgery without CPB, which were originally described at the inception of coronary bypass surgery, were revitalized and received tremendous momentum. The development of effective stabilizers and intracoronary shunts accelerated the popularity of off-pump coronary bypass surgery. It is currently estimated that 25% of all procedures in the United States and Europe are performed off-pump [4].

The goals set by off-pump coronary bypass surgery protagonists are to achieve: a) good early results (mortality, perioperative myocardial infarction) and late results (long-term graft patency, cardiac event-free survival rate, life expectancy) comparable to those of conventional CABG surgery; and b) better outcomes in

high risk patients due to the inherent morbidities attributed to the use of CPB.

Today, after more than 10 years of accumulated experience with off-pump CABG surgery, what lessons can be learned from reviewing the literature?

- Although off-pump CABG is more demanding, early results are comparable to those of standard CABG (mortality, perioperative myocardial infarction) [5–7].
- Long-term results are not yet fully established. However, early patency rates of grafts seem to be matching those of standard surgery. These issues have yet to be clarified [8].
- The high expectations of improved outcome by avoiding CPB complications failed to materialize. Most importantly is the severe problem of perioperative stroke. To date, randomized studies have failed to demonstrate an advantage of off-pump surgery [5,6]. However, a retrospective STS database analysis including 118,440 patients did demonstrate a stroke benefit for off-pump CABG compared with on-pump (1.25% vs. 1.99%, $P < 0.001$) [7].

While the question of cognitive dysfunction is still hotly debated, there is no conclusive evidence that off-pump CABG surgery is beneficial [5,6]. Nonetheless, some clear advantages should be mentioned. One is blood utilization, with most series showing significantly reduced utilization of blood products [9,10]; another is shorter extubation time and reduced hospital stay [6,9,11,12].

In the new era of evidence-based medicine, we need solid evidence proving the advantage of off-pump CABG surgery in order to convert all CABG surgery into this modality. This might explain why off-pump CABG surgery has not gained universal acceptance and has not become the standard of practicing CABG surgery. It is hoped that future publications will settle this much debated issue. Nevertheless, it can be stated unequivocally that in clinical scenarios such as elderly patients with severe calcified aorta, or patients with significant chronic renal failure, off-pump CABG is the modality of choice.

The current article by Lev-Ran and colleagues [1] is an important contribution to the documented experience concerning off-pump surgery. It is the largest experience in Israel. However, this study could have elucidated the subject and increased our knowledge considerably more had they employed a better methodology. It is

CABG = coronary artery bypass grafting
CPB = cardiopulmonary bypass

not clear how the selection process to off/on pump surgery was made. It would have been more informative to compare the results of the off-pump patient group with those of their standard on-pump patients. Nevertheless, despite these shortcomings, it is an important contribution to one of the most important and disputed fields in modern cardiac surgery.

References

1. Lev-Ran O, Fevni D, Neshet N, et al. Off-pump artery bypass grafting: single center experience with 1,000 consecutive patients. *IMAJ* 2004;6:665-9.
2. Popovic JC. National hospital discharge survey, 1999. Annual summary with detailed diagnosis and procedure data. National Center for Health Statistics. *Vital Health Stat* 2001;13:35-6.
3. Matata BM, Sosnowski AW, Galnanes M. Off pump bypass graft operation significantly reduces oxidative stress and inflammation. *Ann Thorac Surg* 2000;69:785-91.
4. Mack MJ, Brown PP, Kugelmass AD, et al. Current status and outcomes of coronary revascularization 1999 to 2002: 148,396 surgical and percutaneous procedures. *Ann Thorac Surg* 2004;77(3):761-6; discussion 766-8.
5. Angelini GD, Taylor FC, Reeves BC, et al. Early and midterm outcomes after off-pump and on-pump surgery in beating heart against cardioplegic arrest studies (BHACAS 1 and 2): a pooled analysis of two randomized controlled trials. *Lancet* 2002;359:1194-9.
6. Van Dijk D, Nierich AP, Jansen EWL, et al. Early outcome after off-pump versus on-pump coronary bypass surgery: results from a randomized

- study. *Circulation* 2001;104:1761-6.
7. Mack MJ, Bachand D, Acuff T, et al. Improved outcomes in coronary artery bypass grafting with beating heart techniques. *J Thorac Surg* 2002;124:598-607.
8. Puskas JD, Williams WH, Mahoney EM, et al. Off-pump vs conventional coronary artery bypass grafting: early and 1-year graft patency, cost, and quality of life outcomes: a randomized trial. *JAMA* 2004;291(15):1841-9.
9. Cleveland JC, Shroyer LW, Chen AY, et al. Off-pump coronary artery bypass grafting decreases risk-adjusted mortality and morbidity. *Ann Thorac Surg* 2001;72:1282-9.
10. Miani A, Levine RL, Connolly MW. Change in transfusion requirement comparing conventional coronary artery bypass grafting (CCABG) and off-pump coronary artery grafting (OPCAB). *Blood* 2000;96:659A.
11. Lancy RA, Soller BR, Vander S, et al. Off-pump coronary artery bypass surgery: a case matched comparison of clinical outcomes and costs. *Heart Surg Forum* 2000;3:277-81.
12. Straka Z, Brucek P, Varek T, et al. Routine immediate extubation for off-pump coronary artery bypass grafting without thoracic epidural analgesia. *Ann Thorac Surg* 2002;74:1544-7.

Correspondence: Dr. D. Bitran, Dept. of Thoracic Surgery, Shaare Zedek Medical Center, Jerusalem 91031, Israel.
 Phone: (972-2) 655-5171
 Fax: (972-2) 652-8394
 email: cts-szmc@szmc.org.il

You'd better learn secretarial skills or get married.

★

You ought to go back to driving a truck

Modeling agency's advice to Marilyn Monroe in 1944

Director of the Grand Ole Opry fires Elvis Presley in 1954

Applications for 2004-2005 now available

The Nash Family Foundation (NFF) is accepting applications for its 2005 Medical Training Fellowship. The program is designed to support Israeli hospitals and medical centers by providing short term (1-3 months) professional training to Israeli physicians for continued study at North American medical centers.

Applications must be postmarked by November 15, 2004. Applications and instructions may be obtained by contacting the Nash Family Foundation

E mail: info@nashff.org

Telephone: (212) 221-9491