

Off-pump coronary artery bypass grafting (OPCABG)—a ‘personal’ European perspective

David P. Taggart

Department of Cardiovascular Surgery, University of Oxford, Oxford, UK

Correspondence to: Prof. David P. Taggart. Department of Cardiovascular Surgery, University of Oxford, Oxford, UK. Email: David.Taggart@ouh.nhs.uk.

Abstract: Although popularised over two decades ago off-pump coronary artery bypass grafting (OPCABG) has seen a decrease in utilisation especially over the last decade. This has been due to publication of a number of trials which suggested inferior outcomes with OPCABG. However, the validity of the findings in these trials has been questioned on the basis of doubts over operator experience as witnessed by large numbers of cross-overs. Two more recent large randomised trials have shown very similar outcomes between on and off-pump surgery up to 1- and 5-year outcomes are imminently due. Furthermore several meta-analyses have reported that OPCABG reduces mortality, myocardial infarction and major morbidity in higher risk patients. Consequently there is a clear rationale for OPCABG in certain cohorts of patients and especially when combined with a no touch aortic technique in those with significant disease of the ascending aorta. The article discusses the importance of routine performance of OPCABG if it is to produce high quality results and especially in higher risk patients.

Keywords: Coronary artery bypass grafting (CABG); systemic inflammatory response syndrome; off-pump coronary artery bypass grafting (OPCABG); surgical revascularisation

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The current issue of *JTD* explores in detail all key aspects of off-pump coronary artery bypass grafting (OPCABG) both from an evidence basis and including key technical considerations. In this current article it is not my aim to review these again but rather give a personal perspective of where OPCABG is today and what is its likely future.

Although the first pioneer of CABG (OPCABG) was Kolessov in the 1960s (1) in Russia the concept was not really popularised until the early 1980s in South America (2). Following this there was then a rapid uptake in developed countries but over the last decade the percentage of OPCABG operations has fallen from around 20% of all CABG procedures to around 15%. Even in countries that perform a high proportion of OPCABG operations, such as Japan (where it still accounts for around 60% of all CABG operations) and India, the rate of OPCABG is currently decreasing. This begs the question as to why OPCABG not seem to have fulfilled its full potential and is now decreasing in popularity?

First, it is important to recognize that from the outset the rationale for OPCABG varied in different parts of the world. In the developing world OPCABG was seen as a way of permitting surgical revascularisation of the coronary arteries without the expense associated with cardiopulmonary bypass (CPB) which precluded many potential patients for CABG on economic grounds. In contrast in developed countries, where economic considerations were less of a driving force, the potential for OPCABG surgery to avoid the damaging effects of CPB and in particular the systemic inflammatory response syndrome proved an attractive hypothesis. This argument was becoming more relevant as percutaneous intervention increasingly attracted the less complex coronary disease meaning that patients undergoing CABG had more complex disease and were increasingly elderly with a far higher proportion of co-morbidities. Such patients were particularly susceptible to the damaging effects of CPB.

In the late 1990s and early 2000s several randomised

trials, which were often small and included only selected patients, suggested some benefits of OPCABG in reducing morbidity associated with conventional CABG. However, in 2009 the *NEJM* published the ROOBY trial (3) which dealt a major blow to the rationale for OPCABG when it reported increased cardiac mortality and morbidity as well as lower vein graft patency in patients randomised to OPCABG. Although the ROOBY trial was strongly criticised by some because of the relative inexperience of the participating surgeons (as witnessed by high cross over rates from off- to on-pump CABG at around 12%) the reputational damage to OPCABG was done. This damage was compounded by a Cochrane database meta-analysis and systematic review that again reported inferior outcomes with OPCABG compared to on pump surgery (4).

In contrast to these studies, a definitive and contemporary reality of OPCABG is provided by the results of the CORONARY (5) and GOPCABE (6) trials. These large randomised trials of respectively over 4,500 and 2,700 patients showed very similar 30-day and 1-year outcomes in terms of the composite endpoints of death, myocardial infarction, and stroke between OPCABG and conventional CABG. Even in GOPCABE where patients were aged over 75 years, (and consequently usually considered a higher risk group for conventional CABG), there was no difference in outcome between on- and off-pump surgery. These trials also showed a less than 1% increase in the need for repeat revascularisation with OPCABG by 1 year but a slight reduction in renal and respiratory injury in OPCABG patients. The definite conclusion of these two trials, which in contrast to ROOBY only employed highly experienced surgeons for both on and off-pump surgery, was that for most patients there was very little difference in outcomes, at least to 1 year, between the two techniques. This almost certainly reflects that major technological advances in all CPB components and conduct over the last two decades makes it immeasurably safer today and has dramatically reduced its adverse clinical consequences. The imminent presentation of the 5-year results of CORONARY will also put to rest the conflicting meta-analyses on whether OPCABG leads to a superior or inferior long-term survival (7,8).

So is there any role for OPCABG in contemporary practice and if so in which patients might it be of benefit? First, the most recent and definitive large meta-analysis of over 19,000 patients showed little difference in outcomes for most patients between OPCABG and conventional CABG (9). Crucially however it also reported that OPCABG did reduce the

risk of death, stroke and myocardial infarction, in higher risk patients. Second, few would argue that in the setting of a diseased or porcelain aorta the avoidance of any aortic manipulation is the most guaranteed way to reduce the risk of stroke (10,11). There is robust evidence that a so called 'no touch aortic technique' or 'anaortic' surgery, achieved by the use of *in-situ* internal mammary artery grafts with composite conduits including radial artery and/or vein, does significantly reduce the risk of stroke (10,11).

But there is a paradox. If a surgeon decides to only perform an OPCABG no-touch aortic technique in the occasional high-risk patient or those with an overtly diseased aorta it will be difficult to ever master the increased technical challenges of this approach. No operation that is only performed occasionally is a good operative strategy. Furthermore I believe that this argument applies even more in the setting of minimally invasive and robotic approaches where technical challenges are even greater.

But how many cases does a surgeon need to perform to remain competent in OPCABG surgery? In general terms it is recognised that outcomes from any activity that demands a high degree of proprioceptive skill (from surgery to tennis or playing musical instruments) are better if that activity is performed on a regular rather than infrequent basis. My very personal view is that it would be difficult to maintain competency in OPCABG and especially with a total arterial no touch aortic technique if not performing at least two of these operations a week. However, it was also notable to me during a recent visit to Japan to discuss OPCABG, that many Japanese surgeons—who may only perform one OPCABG operation per week—still achieve outstanding results.

So what is the future of OPCABG surgery in Europe? I believe that it will remain similar as to what happens today. Whereas the overall number of OPCABG cases in the UK is around 16%, this does not imply that all surgeons do an average of 16% of patients as OPCABG, but rather a handful of surgeons do a very high proportion of OPCABG while the majority of surgeons do almost no OPCABG. Professional societies must recognize the importance of maintaining and promoting a core of OPCABG surgical experts and centres that are prepared to continue to train other surgeons in OPCABG. Finally I think that the most robust evidence suggests that for most patients undergoing CABG an increased use of arterial grafts is more important in terms of a superior long-term outcome than whether the operation is performed on or off-pump.

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Footnote

Conflicts of Interest: Prof. DP Taggart has received speaking fees from Medtronic who produce stabilizers for off-pump surgery.

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