

## EDITORIAL COMMENT

# Does Percutaneous Coronary Intervention Compromise the Outcome of Subsequent Coronary Artery Bypass Grafting?\*

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Percutaneous coronary intervention (PCI) has traditionally been used as first-line therapy for limited coronary artery disease while coronary artery bypass grafting (CABG) has been the mainstay of therapy for patients with more advanced multivessel and left main disease. With the more frequent use of PCI in patients with advanced and complex disease, there is an increasing number of patients who present for CABG who have had previous PCI. A key factor in this “PCI first” approach must be that the outcome of CABG is not jeopardized by a prior PCI procedure(s). The question therefore is when a patient who has had a previous PCI presents for CABG, is that patient at higher risk for the surgical procedure and subject to worse long-term outcomes than a similar patient presenting for CABG who has not had previous PCI?

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It is the general sense of most practicing cardiac surgeons that many patients with 1 or especially multiple previous PCIs who present for CABG are, in fact, worse candidates than they would have been before PCI. Every cardiac surgeon can cite anecdotal cases of “full metal jackets” of long stenting in a vessel, making bypass either impossible or suboptimal due to the necessity of placing a graft so distal in a vessel that graft patency and benefit from surgical revascularization is compromised. Likewise, every surgeon has seen patients who presented with normal left ventricular function before an initial PCI only to present for CABG years later after multiple percutaneous interventions with a

significantly depressed left ventricular function. Whether this is a detrimental effect of PCI or the result of progression of native disease has been the subject of much debate and conjecture. These anecdotal experiences are supported by retrospective studies documenting that operative mortality and morbidity as well as survival are compromised in patients undergoing CABG who have had a previous PCI compared with those who have not. This was first reported in the pre-stent era and more recently with stents (1). The largest report is from 2 Canadian centers showing that patients with prior PCI had greater in-hospital mortality (odds ratio: 1.93,  $p = 0.003$ ) despite fewer comorbidities (2). Two subsequent single-center studies also support this observation. The first compared 2,626 patients with no prior PCI with 679 patients with prior PCI undergoing subsequent CABG and a sub-analysis comparing the impact of prior PCI on 621 diabetic patients with triple-vessel disease (3,4). Both studies reported significantly worse early mortality and adverse clinical events in patients with prior PCI. More recently, Chocron et al. (5) in a post hoc analysis of the IMAGINE (Ischemia Management with Accupril post-bypass Graft via Inhibition of the coNverting Enzyme) study found that in patients with left ventricular ejection fraction  $>40\%$  having a history of PCI before surgery there was a worse outcome post-CABG than in those with no prior PCI (5).

There are a number of hypotheses as to why previous PCI may adversely affect outcomes with CABG (6). Patients may present with more advanced disease due to the beneficial effect of PCI in delaying surgery until later in life when the disease has progressed. However, it may also be that patients present in a more unstable clinical state. Another reason can be compromise of left ventricular function and loss of collateral circulation due to occlusion of side branches especially when “long stenting” is performed. Distal microembolization in the downstream vessel from stents is another possible cause of left ventricular dysfunction. Endothelial dysfunction induced by stenting is a known occurrence, and it is possible that it could have an adverse effect on adjacent graft patency. Furthermore, the necessity to bypass the coronary artery more distally where it is smaller with more diffuse disease especially in patients with multiple stents rather than in the optimal target vessel landing zone for a bypass more proximally can also be a cause of worse outcomes after CABG. Periprocedural management and outcomes can be adversely affected by the now universal dual antiplatelet regimens in patients with stents who present for CABG. Excessive post-operative bleeding in patients operated on with platelet inhibition and, conversely, stent thrombosis with post-operative myocardial infarction in patients in whom the antiplatelet regimen has been stopped before CABG are causes of early adverse outcomes.

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In this issue of the *Journal*, Yap et al. (7) retrospectively reviewed outcomes after CABG in 13,184 patients of whom 11% had a previous PCI over a 7-year period in 6 hospitals and in an additional 8 hospitals during the last year of study. It is unclear whether the length of follow-up was similar in the 2 different population groups. Contrary to previously published series, they found that prior PCI was not a risk factor for unadjusted or adjusted short- or mid-term mortality at a mean of 3.3 years after CABG. So how does one reconcile this conflicting information with that from the previously published studies as well as the experience of most surgeons, and how should this guide us in clinical practice?

Although this is a meticulous study, there are a number of limitations of information contained in the database and of the study that preclude generalization of the results to other clinical practice settings. First, the study is a retrospective analysis of clinical practice in 2 states in Australia, which may not necessarily correlate with practice patterns in other geographic areas. With a previous PCI having been performed in only 11% of patients undergoing CABG, which is much less than one sees elsewhere, one would expect that complex stenting in more advanced disease was not often performed. Furthermore, we are given no information as to the number of patients who had multiple previous PCI procedures or the proportion of patients who received drug-eluting versus bare-metal stents, all of which may affect outcomes. We also do not have information on the number of patients who may have not have survived after PCI and therefore never received a CABG.

Therefore, despite the findings of this study, one should still be cautious about the assumption that a PCI procedure is “free” of cost regarding no added risk of undergoing subsequent CABG. All the shortcomings of a retrospective, observational study in a relatively small population are present. At this level of study, it is impossible to get

sufficiently “granular” on patient-specific issues that may affect outcomes. For example, we have no information on whether multiple repeat PCI procedures were performed and how frequently long stenting was used, both of which are likely to compromise the short- and long-term outcomes of a subsequent surgical operation. Common sense dictates that, as with most things in life, moderation is the key and nothing replaces good clinical judgment on an individual patient level.

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