EDITORIAL COMMENT

Impact of Type 1 and 2 Diabetes Mellitus on Long-Term Outcomes After CABG*

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It is well-established both that the prevalence of diabetes mellitus (DM) is rising rapidly in the developed world and that its presence is a significant risk factor for cardiovascular disease and death (1). Over the last decade, it also has become increasingly clear that for patients with diabetes who require coronary artery revascularization, in addition to optimal medical therapy, that the results of coronary artery bypass grafting (CABG) are superior to percutaneous coronary intervention in terms of significant reductions in mortality, myocardial infarction, and the need for repeat interventions but at the cost of a slightly increased risk of stroke (2,3).

Currently, at least one-quarter of patients undergoing CABG in developed countries have diabetes, with a far higher incidence in Asian countries. However, most previous studies addressing the impact of diabetes on outcomes after CABG have only considered its absolute presence or absence without classification as to whether it was type 1 or type 2 DM. And what little information does exist has presented a conflicting picture. One study reported that although DM was a predictor of early death after CABG in 767 patients with DM (of whom only 22% were insulin dependent) compared with 2,593 non-DM patients, operated on between 1988 and 1999, DM had no adverse impact on subsequent 5-year survival (4). By contrast, a single center study of 9,125 survivors of isolated CABG surgery between 1992 and 2002 reported lower cardiac-specific survival at 5 and 10 years in 735 patients with insulin-dependent DM, in comparison to 1,809 patients with noninsulin-dependent DM and 6,581 patients with no DM (p < 0.0001) (5). Furthermore, freedom from cardiac-related death was similar for patients with non-insulin-dependent DM and non-DM patients up to 6 years (p = 0.08) after surgery and was, counterintuitively, significantly lower thereafter (p = 0.004).

In this issue of the Journal, Holzmann et al. (6) address the impact of the presence of type 1 or type 2 DM on long-term outcomes after CABG. Type 1 DM was defined as onset at age < 30 years and treated only with insulin, whereas type 2 DM was defined as treatment only with diet or oral hypoglycemic agents alone, or in patients age ≥ 40 years at onset and treated either with insulin alone or additionally with oral hypoglycemic agents. Using 4 national Swedish Registries, in which individual patients have a unique personal identity number, the authors followed the outcome of primary isolated CABG in > 39,000 patients, between 2003 and 2013, of whom 725 (1.8%) had type 1 DM and 8,208 had type 2 DM (21%). The underlying premise for investigating potential differences in outcomes is the differing pathophysiology of type 1 and type 2 DM. Although the former is an autoimmune disease that destroys insulin-producing cells in the pancreas and has a relatively early age of onset, the latter tends to occur in older patients and is characterized by insulin resistance and obesity.

And indeed, there were striking differences in baseline characteristics in the 2 populations with DM. In contrast to patients with type 2 DM, those with type 1 DM were younger by around 8 years, had a much greater duration of DM (41 years vs. 10 years), were more likely to be female (42% vs. 23%) and had a higher incidence of end-stage renal failure (15% vs. 2.7%), peripheral vascular disease (24% vs. 13%), and heart failure (16.4% vs. 13%). But importantly, there were no significant clinical differences in body mass index, prior PCI, myocardial infarction, stroke, and

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atrial fibrillation. Overall, left ventricular ejection fraction defined as good (>50%), moderate (30% to 50%) or impaired (<30%) was fairly similar amongst the 3 groups. Glycemic control was also poorer in type 1 DM, with consistently higher levels of hemoglobin A1c. In terms of surgical risk, the 3 groups were similar, with mean Euro scores of around 4.

The key findings of this registry were that patients with type 1 DM had an approximate 2-fold increase in the risk of death at a mean follow-up of almost 6 years, whereas the mortality risk in those with type 2 DM was similar to that of the nondiabetic general population. This translated into clinically important differences in age-adjusted 10-year survival being around 80% for those without DM or type 2 DM but only around 40% for those with type 1 DM. For patients with type 1 DM, there was a significant increase in the hazard ratio for both cardiovascular and noncardiovascular deaths in comparison to type 2 DM, but not for repeat revascularization.

In comparison to non-DM patients, for type 1 DM, the adjusted hazard ratio for death according to sex was relatively similar between men and women (1.8 vs. 2.17), whereas for type 2 DM, the respective figures were 1.09 and 1.18. Similar findings were observed for the risk of death and MACE being approximately double for type 1 DM in comparison to non-DM patients that was also similar to the type 2 DM population.

The current study is easily the most definitive in terms of size to address the issue of the impact of type 1 and type 2 DM on long-term outcomes after CABG. The other obvious strengths of the current study are the use of contemporary national registries that provide virtually complete cover of a country and with relatively little missing data. As such, the results could be confidently applied to patients with DM undergoing CABG in similar developed healthcare systems. And the main message of the study is that the “low-hanging fruit” is the need to focus on both the increased incidence of cardiovascular and noncardiovascular deaths in patients with type 1 DM.

Although the authors are to be congratulated on an excellent and comprehensive analysis of their national databases, there are 2 caveats. The first is that there appears to be no effort to compare outcomes in patients with DM and multivessel coronary artery disease who received stents rather than surgery. The second is the relatively poor quality of CABG in a society with an advanced healthcare system. Although around 95% of patients received a single internal mammary artery, fewer than 5% of patients received a second arterial graft despite strong circumstantial evidence to support such a policy and particularly in patients with DM.

**REFERENCES**


**KEY WORDS** Isolated CABG, major adverse coronary event, prognosis, revascularization.