

## Commenting on cardiology–cardiac surgery intersections

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Doenst and coworkers have to be congratulated for their comprehensive review on cardiac surgery in 2014 [1]. They elegantly address the marked progress achieved in cardiac surgery across the different disease entities, which has led to a remarkable low peri-operative adverse event rate and excellent long-term outcome.

By nature of their review, they also cover disease entities which may be treated either by interventional or surgical modalities and comment on the relative merit of each therapeutic strategy. In their summary, they discuss in more detail guideline-based decision making for invasive treatment of coronary and valvular heart disease. Since we witness a marked technological improvement in interventional devices translating into better safety and higher success rates of interventional treatment strategies, the editors would like to comment on the obvious conflicting issues arising in the selection of appropriate treatment strategies either by guidelines, substantiated treatment decisions or driven by medical innovation.

In line with their well-written section on the role of coronary artery bypass graft surgery (CABG), it is common practice to recommend bypass surgery to our patients with stable or silent angina and severe three-vessel disease with (or without) diabetes mellitus. The majority of trials comparing percutaneous coronary interventions (PCI) with CABG are dealing with stable coronary artery disease. The information that in the acute phase of myocardial infarction

(NSTEMI or STEMI), PCI represents the preferred revascularization procedure, whereas CABG is performed in a minority of such patients, is not in the focus of their review but should be mentioned for completeness.

In balancing CABG versus PCI, the authors refer to meta-analyses and, in particular, the SYNTAX trial [2]. Despite the undisputable value of the SYNTAX trial for clinical decision making, some limitations of this trial must be addressed. First, the trial end point is defined for 1 year and later follow-ups are—in a strict sense—not substantiated by the trial design. Furthermore, more patients were lost to follow-up in the surgical group and accounting these as patients with endpoints would markedly reduce the effectiveness of surgery. Also, the forced total revascularization outside proven clinical relevance for specific lesions (e.g., stress-induced ischemia) and inclusion of chronic total occlusions (CTO) at a time with less developed CTO devices may have contributed to better outcomes in the surgical group. Most importantly, however, the interventional procedures and stents used in SYNTAX are no longer applied in clinical practice, raising the issue of the relevance of the findings obtained in the SYNTAX trial on contemporary care. Thus, while we await the results of the SYNTAX II trial, testing second generation stents and ischemia-guided interventions, significant uncertainty on the best treatment modality will remain in the gray zone of three-vessel disease with moderate and eventually even severe risk features.

In a recent publication in the *New England Journal* by Bangalore and coworkers on more than 18,446 propensity score matched patients with multi-vessel disease treated by either CABG or PCI with everolimus eluting stents, no difference in death was observed at 2.9 years of follow-up (3.1 versus 2.9 %, HR 1.04,  $P = 0.05$ ) [3]. As expected, there were more repeat interventions in the PCI group

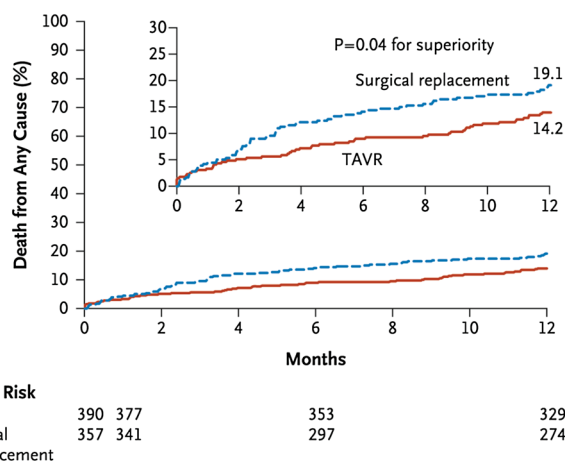
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(7.2 % per year versus 3.1 %, HR 2.35,  $P < 0.001$ ), but remarkably significantly less strokes following PCI (0.7 % per year versus 1.0 %, HR 0.62,  $P < 0.001$ ). In this large trial, they observed more myocardial infarctions in the PCI group (1.9 % per year versus 1.51 %, HR 1.51,  $P < 0.001$ ). However, the relevance of this finding may be challenged since troponin elevations post bypass surgery are markedly higher than after PCI bringing up the hypothesis that a patient with bypass surgery may have already experienced threatening myocardial infarction during the surgical procedure. Thus, based on solid scientific data, a responsible physician may select PCI with new generation stents in multi-vessel disease as the preferred strategy for his patients.

The second major topic in the manuscript by Doenst and coworkers, which obviously crosses with advanced interventional cardiology, is related to the best choice in contemporary treatment of valvular heart disease and, in particular, to the invasive treatment of calcified aortic stenosis in the elderly. While cardiac surgery in this field has been an established procedure for many decades, catheter-based therapies are still in its infancy. However, catheter-based device technologies are improving astonishingly fast and due to the accrued robust body of experience in dedicated interventional teams, this procedure has become a well-standardized exercise. Doenst and coworkers provide data from the GARY registry indicating superior survival of surgery versus TAVI in patients with Euroscore  $<10$  and mixed outcome in patients with Euroscore  $>10$ . However, there are more robust and complete clinical data for practice in Germany available from the AQUA-registry. These data covering the years until 2013 have been reported in meetings and are presently submitted for publication. This data base provides compelling evidence of an equivalent low in-hospital mortality of surgery versus TAVI in Euroscore  $<10$  (range 2–3 %) but a markedly better performance of TAVI in more severe risk groups (a nearly twice as high mortality of surgery versus TAVI in patients with Euroscore 10–20, and twice as high mortality of surgery versus TAVI in patients with Euroscore  $>20$ ). Interestingly, trans-apical aortic valve implantation procedures, still offered in some surgical centers as a routine alternative procedure to transvascular TAVI, are associated with a higher in-hospital mortality across all Euroscore classes as compared to transvascular TAVI. Trans-apical aortic valve implantation outperforms surgery in very high risk patients. Preliminary data from the AQUA-registry covering the year 2014 indicate a further reduction in mortality of the TAVI procedure when compared to the results of year 2013. The AQUA-registry data are supported by the results of larger randomized trials such as the US CoreValve Pivotal Trial [4] or the NOTION trial [5], indicating the superiority of TAVI in severe aortic stenosis (Fig. 1).



**Fig. 1** Kaplan–Meier cumulative frequency of death from any cause with reprint permission from the *New England Journal of Medicine* [4]. The curve demonstrates superiority of transcatheter aortic valve replacement (TAVR) in comparison to surgical replacement at 1 year

Thus, the rapidly emerging field of PCI or TAVI versus surgery is a challenge for the commonly proposed criteria of optimal patient care. There are renowned capacities in cardiac surgery strongly arguing that good clinical practice must reflect what is written in the guidelines. However, while guidelines provide good guidance to therapy based on results generated and published in the past, they may definitely not reflect optimal contemporary treatment. Awaiting rewriting of guidelines but withholding beneficial treatments for our dear patients may thus in fact be unethical. Since both cardiac surgery and cardiology are dedicated to provide the very best care for the individual patient, the current progress in interventional technologies and innovation in practice in medicine is very good news for the patients and all steps that are needed to translate optimal care must be taken.

#### Compliance with ethical standards

**Conflict of interest** None of the authors have any conflict of interest to report.

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