Coronary artery bypass grafting is superior to percutaneous coronary intervention in patients with left ventricular dysfunction

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Network Meta-Analysis of Treatment Strategies in Patients with Coronary Artery Disease and Low Left Ventricular Ejection Fraction

Coronary artery bypass grafting is superior to percutaneous coronary intervention in patients with left ventricular dysfunction

Running Title: CABG is the choice in left ventricular dysfunction

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With minor differences when estimating the historical aspects of coronary artery bypass graft surgery (CABG), we may agree that the discussions about the impact of CABG on patients suffering from coronary artery disease (CAD) are going on for around sixty years now. The historical landmarks that cogently shaped

diagnosis and therapy of CAD in the way we understand it today are out there for quite some time and it should be compulsory for every practitioner to review all in depth for understanding.

The introduction of selective coronary angiography by Sones and Shirey (1) paved the way to attempt direct myocardial reconstruction and revascularization. This included patch graft reconstruction of the left main stem by Senning (2), the performance of coronary endarterectomy by Effler et al (3) and direct coronary artery grafting using the reversed saphenous vein graft by Favaloro et al (4) and the internal mammary artery by Green et al (5). Garrett et al are credited by having actually performed the first saphenous vein CABG operation reported a few years later (6). Critical was to recognize that there was a need to know what happened after the operation was completed. Sheldon et al (7) pioneered postoperative studies in revascularized patients and years later Chesebro et al (8) convinced the community to add antiplatelet medication to help maintaining open the grafts over time. The second revolution in the treatment of CAD exploded after Grüntzig performed for the first time a percutaneous transluminal angioplasty revascularization (PTCA) of a diseased coronary artery (9). The rest is history and presumably we are aware of it.

In the meantime, thousands of publications have addressed both methods of myocardial revascularization. We still today discuss about the eventual benefits of both approaches and which the best methods is. More than 40 years after the introduction of PTCA, there are still fights aiming at demonstrating superiority of one over the other. Notwithstanding myriads or written pages and graphs derived from all sort of studies, from institutional case series to meta-analyses and randomized trials, it seems that some questions have still no clear or convincing answers, at least for a part of the community. In fact, a number of questions are still the same we had three or four decades ago. The controversies are almost the same that were depicted in the monumental contribution of Favaloro when critically summarizing the first thirty years of CABG (10).

In this issue of the Journal, Yokoyama et al address one of those controversies, which the optimal treatment for patients with CAD and reduced left ventricular ejection fraction (LVEF) is (11). They have conducted a network meta-analysis comparing CABG, PTCA and optimal medical therapy (OMT) in patients with CAD and low LVEF. After analyzing 18,855 patients with CAD with low EF treated with CABG, PCI or OMT collected from 3 randomized trials (RCT) and 10 propensity score-matched studies, all-cause mortality was significantly lower in patients with CABG compared to those with PCI or OMT while no difference was observed between PCI and OMT and the rates of MI were significantly lower in patients treated with CABG compared to those treated with PCI or OMT. With the only exception that subgroup analysis by limiting the PCI group to patients receiving drug-eluting stent (DES) showing similar all-cause mortality between CABG and PCI, while both CABG and PCI were associated with lower all-cause mortality compared to OMT. Authors concluded by saying that their study demonstrated that CABG is the appropriate treatment strategy in patients with CAD and low LVEF.

This is the main conclusion that authors can draw from this meta-analysis. It makes sense, of course. Some critics may argue that the definition of low EF could be refined. Is really <50% an appropriate cutoff value to define low EF? This is an old story. In fact, Favaloro also discussed about this 30 years ago and stated that analysis of the status of the left ventricle in most of the publications at the time comparing CABG and PTCA divided the angioplastic patients by ejection fraction above and below 45%, which probably does not appropriately analyze patients with a more severe reduction of ejection fraction (10). These studies do not clearly address the actual percentage of patients with severe LV dysfunction with an EF<25%, to say something. Which is the proportion of patients with real dysfunction across these studies? What is imortant to understand is that CABG performed better than PCI at any level of LV dysfunction. The recent study by Sun et al (12) referenced by the authors as number 33 investigated patients with an EF<35%. There were more mortality and MACCE in patients who underwent PCI. The lower the EF, the more beneficial CABG entering the fifth year of follow-up.

Interestingly enough there were no statistically significant differences between PCI and OMT in mortality, MACCE, MI, and repeat revascularization. One may argue then if there are no significant differences, why not support OMT insted of PCI? This is very likely not to be supported by anyone. The final attractive finding is that when using DES for revascularization, PCI with DES seems to be associated with similar mortality

compared with CABG and that PCI with DES was associated with reduced mortality in comparison with OMT. The latter will sure require more data and analysis. In the present study, the follow-up of studies was usually short with the exception of the study of DeVore et al (13).

The topic of PCI with DES in comparison with CABG looking at survival outcomes will need more investigation in the future. Authors suggest that PCI with DES may have comparable survival outcomes with CABG in patients with low EF. This is still controversial despite recent data. Looking at specific subsets of patients like those with left main disease, some very recent data from Jeong et al (14) suggest that there are no significant differences between DES and CABG with respect to the incidences of MACCE, serious composite outcome, and all-cause mortality in patients with and without diabetes mellitus with LMCA disease although authors state that their sample size could be a limitation. Furthermore, Ono et al (15) just a few days ago highlight in this extended follow-up of the SYNTAX trial (16) that there were no significant differences at 10 years in all-cause death and estimated life expectancy between PCI and CABG in the elderly (>70 years). These latest studies do not specifically address ventricular function as the current meta-analysis does (11). In the end, it is all about statistics? Is everybody trying to squeeze data as much as possible aiming at convincing the others by defending a specific hypothesis? Are the methods worthwhile? Are the trials optimal? Are they different between cardiology and cardiac surgery? This has been pointed out by Robinson et al (17) as it seems that focus of the study is an issue.

Closing, the value of the study of Yokoyama et al is that their study demonstrated that CABG remains the treatment of choice in patients with CAD and low LVEF. Other aspects need further investigation when it comes to DES. Surgery, after sixty years, continues to be the option in triple-vessel disease also in patients with low EF. The final controversial question is: do we need more investigation with this regard?

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Conflict of interest

The authors declare no conflicts of interest with regards this contribution

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Data Availability Statement

Data have been retrieved from publicly available sources (PubMed) and from the original article JOCS-2021-OA-0579