EDITORIAL

Vol. 9 No. 4 October-December 2024

doi: 10.35366/117833

Mechanical circulatory support and coronary artery bypass grafting in ischemic cardiomyopathy. *Veritas Filia Temporis*

Soporte circulatorio mecánico y revascularización coronaria en cardiomiopatía isquémica. Veritas Filia Temporis

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Keywords: coronary artery bypass grafting, mechanical circulatory support, ischemic cardiomyopathy.

Palabras clave: *revascularización coronaria, soporte circulatorio mecánico, cardiomiopatía isquémica.*

Coronary artery bypass grafting (CABG) in patients with low ejection fraction carries a significant risk of perioperative mortality and morbidity related to the development of postcardiotomy shock. Preoperative optimization with pharmacological or mechanical support (MCS) is highly required. Multiple series and analysis found postoperative mortality rate between 6.5-7.5%.[1-3]

I read with interest the manuscript by Soomer et al,[4] in which they found a better survival with early vs delayed Impella implantation in patients underwent CABG with left ventricular failure. They analyzed 27 patients who underwent simultaneous Impella implantation during CABG surgery and 15 patients who underwent delayed Impella therapy. Survival after 30 days (75.6 vs 47.6%, p = 0.04) and 1 year (69.4 vs 29.8%, p = 0.03) was better in the cohort receiving simultaneous Impella implantation. The results are promising and attractive; however as always, the most sophisticated truth lies in the small details.

It is very important to understand the mixed and heterogeneous substrate of ischemic cardiomyopathy. There is usually a combined coexistence between normal, stunned, hibernating and scar myocardium in the same myocardial region. Often there is an element of overlapping between two or more of these states, in fact, all together could represent the same process in different phases.[5] This concept guide to interpret feasibility studies with judgment and extreme care.

The STICH trial was a randomized multicenter non-blinded controlled trial, that compared medical therapy versus CABG, in patients with coronary disease and left ventricular dysfunction.[6] Among the conclusions obtained in that study, the following stand out:

1. Patients assigned to CABG had fewer mortality rates and hospitalizations for cardiovascular disease (the difference was borderline, p = 0.05). However, there was no difference between medical therapy and surgery with respect to mortality from any cause.
2. CABG was related to an early risk of mortality. About age, the older, the greater the likelihood of postoperative mortality due to non-cardiovascular causes.

How to cite: Orozco-Hernández EJ. Mechanical circulatory support and coronary artery bypass grafting in ischemic cardiomyopathy. *Veritas Filia Temporis*. Cir Card Mex. 2024; 9 (4): 118-120. https://dx.doi.org/10.35366/117833

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3. There was no benefit of CABG in patients without left coronary artery disease and/or class III/IV angina.
4. The study was not blind, and the difference between the two groups, regarding the motility for any cause, may be due to a limited follow-up of the patients.

We need to keep in mind that viable myocardium does not equate to ischemic myocardium. According to the above, the results in this study were subjected to various analyzes of specific topics. STICH viability sub-study reported the effects of myocardial viability (evaluated by DES and SPECT) in 5.1 years of follow-up. Patients with viability (with or without CABG) were more likely to survive in the univariate analysis, however, this benefit was not demonstrated in the multivariate analysis.[7] It is mandatory to highlight important facts of this study: a) only half of the STICH study underwent viability studies; b) MRI or PET was not used; c) there is no interaction between the effect of CABG and the presence or absence of viability, the fact of having myocardial viability does not adequately identify which patients would benefit more from surgical revascularization. STICH sub-study ischemia specifically studied STICH patients with myocardial ischemia during stress testing. No benefit of CABG was demonstrated versus medical therapy, based only on the presence or absence of ischemia.[8] The 2021 American College of Cardiology/American Heart Association/Society for Cardiovascular Angiography and Interventions (ACC/AHA/SCAI) guideline for coronary revascularization assigned a class 1 recommendation, level of evidence B-R for CABG in patients with severe left ventricle (LV) dysfunction (ejection fraction < 35%).[9]

However, taking into account that the assessment of myocardial viability and ischemia, failed to guide with certainty and precision the indication of CABG in ischemic cardiomyopathy (results to be taken with caution), the analytical approach turned towards the evaluation of anatomical and hemodynamic variables. Panza et al. studied the following factors in the STICH population: extent of coronary heart disease (3 vessels), EF ≤ 27% and LVESV index ≥ 79 ml/m^2. Their conclusions guided them to recommend surgical revascularization in patients who had two or more previously referred criteria.[10] All on this in correlation to match regional viability with coronary revascularization targets (adequate size and acceptable run-off) and to achieve complete revascularization. Some authors recommended that patients with severe ischemic cardiomyopathy should undergo right heart catheterization to identify degree of cardiogenic shock [cardiac index (CI) < 2.2 l/min/m^2], the degree of LV decompensation [pulmonary capillary wedge pressure (PCWP) > 20 mmHg] and right ventricular (RV) dysfunction [pulmonary artery pulsatility index (PAPi) < 2]. CABG could be performed directly if there is not any of those parameters. If unresponsive to medical treatment alone, and persist with some degree of cardiogenic shock, they may be candidates to receive mechanical support either preoperatively or intraoperatively.[11] On the other hand, Singh et al. does not evaluate the response to medical treatment; they recommended direct pre op MCS (Impella, IABP or ECMO) on the patient with cardiogenic shock, and an strong consideration of preemptive Impella on the patient without cardiogenic shock with very low ejection fraction (25%).[12] As we can see, this decision represents a complex dilemma, very similar to the blindness on the ideal setting, strategy and timing for postcardiotomy extracorporeal support, venoarterial (VA) extracorporeal membrane oxygenation (ECMO) following cardiac surgery shows an overall survival between 25 to 42%.[13] Moreover, the reports focus on mechanical circulatory support on ischemic cardiomyopathy undergoing CABG, are limited to small case series. Sommer et al.[4] found a better survival after CABG with early Impella implantation, all the patients had ischemic cardiomyopathy and on post cardiotomy low cardiac output. A simplistic take on this finding is that we should be used more liberally, and prevent more mortality. However, usually the big answers are in the small details.

There is no information in this small sample about viability and ischemia evaluation, as well LV end systolic volume index and the preoperative hemodynamic parameters (CI, PCWP, Papi). Without this, it is very difficult to conclude the real impact of the MCS timing. Not all the patients with ischemic cardiomyopathy are necessarily extreme high risk. I think a preoperative evaluation that combine the anatomic, functional and hemodynamic areas, will lead to a more precise indication of the MCS on this complex population, resulting in more favorable survival. The debate is ongoing, the published small cohorts showed a modest favorable results with prophylactic MCS.[14,15] The rationale behind preemptive LV unloading is to mitigate the effects of the cardiopulmonary bypass while waiting for the ventricle to recover, thereby maintaining end-organ perfusion and avoiding high doses of vasopressors. I agree with that statement, However, the risk-to-benefit ratio is unclear at this point. MCS can also result in serious complications. A careful judgment of the indications for MCS has the potential to improve the safety of CABG for high-risk patients but requires well-designed, long term and prospective studies to evaluate its impact on patient outcomes. *Temporis filia veritas* (truth as a daughter of time), an ancient proverb expressing the notion that the truth often reveals itself only after the passage of time.

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