Commentary Left ventricle restoration. Keep the door open.

Marco Moscarelli[1] and Carlo Olevano[2]

[1]GVM Care and Research
[2]Southampton General Hospital

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Abstract

Surgical left ventricle restoration (SVR) was firstly by Cooley in 1958 with the "linear suture technique", and three decades later, Dor used a circular patch to reconstruct the left ventricle excluding the scarred parts of the septum and ventricular wall. It gained popularity and eventually almost abandoned after the contrasting literature evidences. Hassanabad et al. presented a comprehensive review of current literature on surgical ventricle restoration (SVR) techniques and clinical outcomes, trying to understand if SVR has still a substantial role in the modern medicine.

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Carlo Olevano[1], Marco Moscarelli[2]

1 Moscati Hospital, Dept. of Cardiovascular surgery, Avellino, Italy

[2] Anthea Hospital, GVM Care & Research, Dept. of Cardiovascular surgery Bari, Italy

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Abstract

Surgical left ventricle restoration (SVR) was firstly by Cooley in 1958 with the "linear suture technique", and three decades later, Dor used a circular patch to reconstruct the left ventricle excluding the scarred parts of the septum and ventricular wall. It gained popularity and eventually almost abandoned after the contrasting literature evidences. Hassanabad et al. presented a comprehensive review of current literature on surgical ventricle restoration (SVR) techniques and clinical outcomes, trying to understand if SVR has still a substantial role in the modern medicine.

The worldwide human and economic burden of congestive heart failure (HF) has rapidly grown in the last two decades with an estimated overall cost of $108 billons per annum with $65 billons attributed to direct expense accounted for by hospitalization and $48 billons to indirect costs; US is responsible for 28.4% of total spend while Europe account for 6.8% (1).

Heart transplantation remains the treatment of choice for patients with medically refractory end-stage HF, nevertheless the need for immunosuppression and the limited donor supply have restricted the selection criteria, leaving physicians seeking for alternative therapies (2,3).

Hassanabad et al. presented a comprehensive review of current literature on surgical ventricle restoration (SVR) techniques and clinical outcomes, trying to understand if SVR has still a substantial role in the modern medicine. They also critically analysed data on left ventricle morphology and size, mitral valve disfunction

and arrhythmias (4). Cardiac remodelling is generally accepted as a determinant of the clinical course of HF and comprises changes in left ventricle cavity diameters, mass, geometry and function. As early as few hours after heart injury, the initial remodelling mechanism leads to reparation of necrotic area through cellular rearrangement of the ventricular wall in order to preserve cardiac output. As the heart remodels, the left ventricle increase in diameter and become less elliptical and more spherical (5). The rationale behind surgical ventricular restoration, as we know, is to reverse left ventricle remodelling, restoring a more physiological heart geometry and and improving mitral valve functioning reducing left ventricle diameter and papillary muscle distances.

This "correction" was firstly described by Cooley in 1958 with the "linear suture technique", while three decades later, Dor used a circular patch to reconstruct the left ventricle excluding the scarred parts of the septum and ventricular wall. These techniques were adopted and modified by many surgeons in the modern era (6,7).

Data on the performance of SVR are not univocal. The surgical Treatment for Ischemic Heart Failure (STICH) Trial found that the addition of SVR to coronary artery bypass grafting (CABG) reduce the end-systolic volume index significantly compared with CABG alone; however this anatomical conversion was not associated with a more favourable death-rate or hospitalization for cardiac causes. Nonetheless, SVR may remain a valuable strategy combined with CABG in selected HF patients with a scar in the left anterior descending artery territory, especially if a post-operative left ventricle end systolic volume (LVESV) index < 70 mL/2 can be achieved, as recently reported by European Society of Cardiology (ESC) and European Association for Cardio- Thoracic Surgery (EACTS) (Class of Recommendation IIb; level of evidence B) (8,9).

Ischemic mitral regurgitation (IMR) is a frequent complication of chronic ischemic heart disease. In the failing heart, IMR occurs duo to annular dilatation secondarily to left ventricle and papillary muscles morphology and functional changes (10). The effects of mitral valve surgery in patients with significant IMR in the setting of HF is still controversial. H Wu et al. didn't find any improvement in long-term survival among more than one hundred patients with severe left ventricle dysfunction that underwent mitral valve annuloplasty (11).

More recently the Randomized Ischemic Mitral Evolution (RIME) trial and POINT trial demonstrated the efficacy of adding valve repair to CABG on ventricular remodelling, ejection fraction, symptoms and degree of mitral regurgitation but not with regard to mortality (12, 13,14).

The prognostic stratification of patients with ischemic cardiomyopathy undergoing SVR is a potential area of future study and improvement for surgical intervention. In this direction, Toso et al. demonstrated that patients who underwent SVR with an elevated level of N-terminal pro-B-type natriuretic peptide combined with presence of restrictive filling pattern had the worst outcome in terms of mortality, hospitalization for HF and major adverse cardiac events (MACE) at 36 months (15).

Magnetic resonance imaging (MRI) has been gaining popularity in the context of HF, given the potential to identify the ideal candidates for SVR procedure. Yamazaki et al. confirmed the importance of preoperative LVESV index as a predictor of MACE following SVR. Patient with preoperative LVESV index of >130 ml^2 had worst outcome compared to intermediate (LVESV index 100 to 130 ml^2) and lower (LVESV index <100 ml^2) group (16).

Right ventricle volume along function MRI assessment may also have predictive value in the risk stratification of SVR. (17). As highlighted by Hassanabad et al., the study of left ventricle myofiber orientation and stress is now possible thanks the advance on MRI technology and mathematical modelling. After successful SVR and aneurysm plication, left ventricle myofibers orientation is significantly rearranged resulting in a more uniform stress distribution and subsequently reduced oxygen demand. Notably, given the most recent developments, MRI technology is definitely a promising field of research in SVR prognostic stratification.

Surgical restoration remains a complex procedure that and needs multi-disciplinary approach. As such should be performed in high-volume and specialized centres. However, there are evidences to suggest that it might be a viable option for eligible / selected cardiac transplant patients.

Glossary

CABG= Coronary artery bypass grafting

HF= Heart failure

IMR= Ischemic mitral regurgitation

LVESV= Left ventricle end systolic volume

MACE= Major adverse cardiac events

MRI= Magnetic resonance imaging

STICH = The surgical Treatment for Ischemic Heart Failure

SVR= Surgical ventricle restoration

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