Viewpoint

Surgical Treatment of Cardiomyopathy

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Heart failure is a syndrome that encompasses different etiologies, but all of them result in a cardiac functional disorder that impacts the filling or ejection capacity of the ventricle.[1] Drug treatment has made notable progress in recent years, generating a significant improvement in patient's quality of life, in addition to a decrease in mortality and hospital admissions. Despite this, surgical treatment remains fundamental in managing different cardiomyopathies.[2]

The main objective of any modality of surgical treatment in the context of heart failure is the improvement of cardiac output, either by removing the primary insult, thus allowing ventricular recovery, or by correcting structural changes that contribute unfavorably to ventricular remodeling.

Ischemic Cardiomyopathy

Ischemic heart disease is the most common cause, and at the same time, it is the main isolated risk factor that favors the increased incidence of heart failure in the world.[3]

Several improvements incorporated in coronary artery bypass graft surgery have made the procedure safer and more effective, so patients who were previously candidates for heart transplants are now frequently revascularized. Hausmann et al. showed that, with the more comprehensive indication of myocardial revascularization in this scenario, patients with advanced heart failure due to ischemic cardiomyopathy now represent 29.3% of recipients who are candidates for transplantation in the studied center, in comparison with data from the same period by the International Society of Heart and Lung Transplantation, which indicated that 47.2% of recipients had an ischemic etiology.[4]

Those individuals with coronary artery disease and ventricular dysfunction with adequate distal coronary beds benefit from myocardial revascularization and have superior survival compared to those with optimized clinical treatment.[5] In these patients, the myocardial viability study did not prove to have a significant interaction with the effect of surgical treatment on the survival outcome, so the viability result should not be considered in isolation for indicating or not surgery. It is important to emphasize that the beneficial effect of myocardial revascularization does not only translate into improving the left ventricular ejection fraction since the mechanism that favors its result is, above all, the protective effect against fatal myocardial infarction and sudden death secondary to coronary events. Therefore, the objective of treatment goes beyond improving ventricular function, also adding to the prevention of cumulative damage to the myocardium. Thus, the assessment regarding the anatomical extent of coronary disease and the possibility of performing successful revascularization should guide decision-making.[6-8]

In addition to improving the survival of patients with ventricular dysfunction undergoing myocardial revascularization, the STICH study also demonstrated better results from this procedure in association with left ventricular reconstruction in a selected group of patients.[9,10] The rationale for the technique resides in correcting the remodeling of the left ventricle by reducing its size, readjusting the elliptical shape, and removing areas of myocardial fibrosis. When there is evidence of absence of myocardial viability, dyskinesia of more than 35% of the anterior wall, and left ventricular indexed systolic volume greater than 60 ml/m^2, this procedure is associated with improved contractility and decreased mortality.[11,12]

Secondary Mitral Insufficiency

Dilated cardiomyopathy is often accompanied by secondary mitral regurgitation. The mechanisms involved include the apical traction of the chordae tendineae and the dilation of the mitral annulus, resulting from the dilation and remodeling of the left ventricle, without, therefore, structural alteration of the valve apparatus.[13] The onset of mitral regurgitation in this context is a marker of poor prognosis, associated with worse quality of life, increased hospitalizations due to heart failure, and increased mortality.[14]

However, few of these patients receive any surgical intervention because of the high mortality of those undergoing valve replacement and the controversial results of conservative techniques.[15,16] In the first case, valve replacement with preservation of the chordae tendineae (which may be associated with fixation of the papillary muscles) maintains ventricular geometry and annulopapillary continuity in order to favor remodeling and counterbalance the acute worsening of cardiac function in the postoperative period and its impact on mortality.[17,18] In the second, the reduction annuloplasty alone has demonstrated a high incidence of recurrence of mitral regurgitation of up to 60% after 3 to 5 years, being recommended the combination of techniques that address the subvalvular apparatus, mainly through the repositioning of the papillary muscles, which by turn makes this procedure complex and less reproducible.[19,20]

Cardiac resynchronization

With the evolution of cardiac dysfunction, ventricular desynchronization may occur, negatively impacting cardiac

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output. Ventricular resynchronization therapy in these patients is known to improve functional class, decrease the frequency of hospitalizations and contribute to ventricular remodeling.

Classically, the indications are effective in patients with refractory heart failure with optimized drug therapy, functional class III or IV, left ventricular ejection fraction less than 35%, in sinus rhythm, and with QRS greater than 150 ms[21]The expansion of these indication criteria has been the object of several studies currently, mainly for less symptomatic patients.

Heart transplantation and circulatory assist devices

Orthotopic heart transplantation remains the therapy of choice for advanced heart failure refractory to optimized clinical treatment. Its technique is well established, and its short and medium-term results are quite satisfactory, with a 1-year survival of around 81%, with a mortality rate of 5% per year, mainly related to vascular disease of the graft.[22]

One of its main limitations relates to the scarcity of donors, which throughout history has encouraged the development of alternative techniques for the surgical treatment of heart failure. Procedures such as cardiomyoplasty and partial left ventriculotomy aimed to reduce the tension exerted on the ventricle wall, according to Laplace's Law. However, the lack of consistent results and the high perioperative mortality meant that these techniques were less and less used.[23]

Left ventricular assist devices(LVAD) have evolved to provide long-term circulatory assistance as a bridge to transplantation or destination therapy. Its effectiveness in improving survival and quality of life has been proven, but adverse events related to bleeding, infection, and increased risk of stroke are also relevant.[24]

The REMATCH study evaluated patients with advanced HF who were not heart transplant candidates undergoing continuous axial flow assist device implantation compared to optimized medical treatment. There was a significant improvement in survival and quality of life in the group that received the device implantation in the first two years, proving an acceptable alternative in patients not eligible for transplantation.[25] Subsequently, the new generation of magnetic levitation centrifugal flow pump proved superior to the previous generation, as it presented better outcomes in terms of survival free of disabling stroke and reoperation due to device malfunction.[26]

Conclusion

Surgical treatment of cardiomyopathies can reverse and/or improve ventricular dysfunction. Approaches aimed at restoring ventricular remodeling, when treating the primary cause is not feasible, have lower success rates, with heart transplantation being the therapy of choice for refractory cases, with excellent long-term results. In this context, mechanical circulatory assistance also plays an important role as a safe and effective therapeutic option, although it still has limitations mainly related to its high cost in our setting.

Author Contributions

Conception and design of the research: Gaiotto FA; Acquisition of data and Analysis and interpretation of the data: Cardoso LF; Writing of the manuscript: Cardoso LF, Steffen SP; Critical revision of the manuscript for important intellectual content: Steffen SP, Gaiotto FA.

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