Special Article

How to Implement a Heart Transplant Program for Patients with Advanced Heart Failure

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Introduction

Patients with heart failure (HF) refractory to guideline-directed medical therapy should be considered for advanced therapies, such as heart transplantation (HT), ventricular assist devices, or even palliative care in cases where these procedures are contraindicated or unavailable.[1] In this scenario, HT is the standard treatment.[1] Brazil has shown a significant increase in the number of transplants in recent years, but this number is still not compatible with the number of patients who require this treatment.[2] Furthermore, most transplants are concentrated in few regions and centers[2] (Figure 1). The following factors limit the growth in the number of HTs performed in Brazil: few qualified transplant centers, inadequate care for donors, critical condition of recipients, and limited access to medium- and long-term circulatory assist devices. Transplant centers aim to optimize recipients' clinical condition, to create logistical conditions to increase the efficiency of organ procurement, and to train professionals, thus generating a positive impact on the number and the outcomes of transplants. The organization of a transplant center with a multidisciplinary team is essential to improve not only the care provided to the recipient, but also the entire process involved in HT, including organ procurement. Transplant centers are composed of a broad multidisciplinary team responsible for evaluating and optimizing recipients' clinical conditions, evaluation of donors, operationalization of procurement, perioperative care, and long-term care of HT recipients (Figure 2). Teams are usually composed of the following: clinical cardiologists, cardiovascular surgeons dedicated to HT, nurses, biomedical doctors, intensive care specialists, infectious disease specialists, pathologists, immunologists, and others.

In this article, we will describe the functioning of one of the transplant centers in Brazil, which performs approximately 50 adult HTs annually and which works on a dedicated basis 24 hours a day, 7 days a week, with emphasis on the importance of a multidisciplinary team and each member's respective functions.[3]

Keywords

Heart Transplantation; Heart Failure; Interdisciplinary Research.

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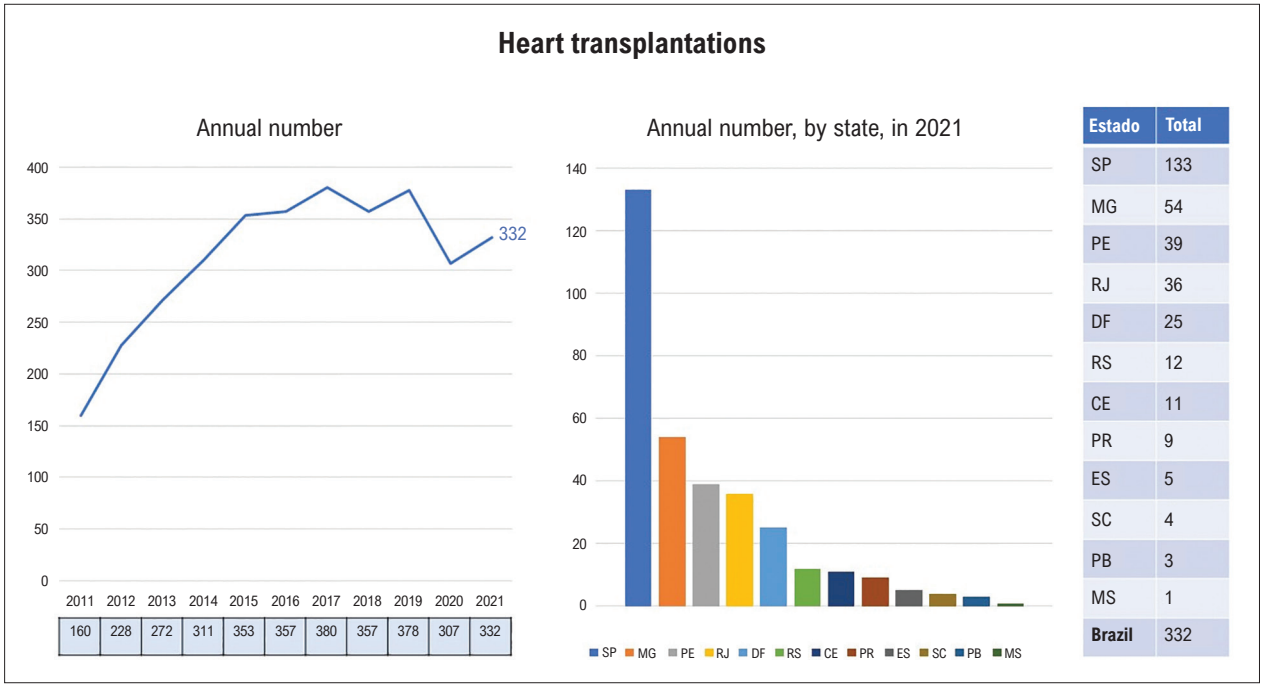
How is a transplant center team formed?

Clinical cardiologist

Training a cardiologist specializing in HF and transplantation is fundamental in order to improve care for patients with advanced cardiovascular disease. In recent years, there has been an increased incentive to train cardiologists in this area due to advances in the treatment of HF, the emergence of new treatment modalities, and the complexity of immunosuppressive therapy during the post-transplant period.[4] In 2010, a group of societies published a document with the competencies required of specialists in HF and HT, highlighting that patients with stage D HF should be evaluated by these professionals.[5] This specialty was formally recognized by the American Board of Internal Medicine and by the Heart Failure Association/European Society of Cardiology, in 2013 and 2014, respectively.[4]

When evaluating patients, before indicating HT, the cardiologist must detect reversible causes of HF that could be amenable to surgical intervention or other specific treatments. When this is not the case, the evaluation of the patient for HT begins. At this point, the objective is to assess whether there are indications and/or potential contraindications to HT, by means of adequate interpretation of the clinical condition and complementary exams, such as ergospirometry test, right heart catheterization, viral serology, immunological panel, and others.[6,7] These exams are essential in deciding whether or not to include a patient in the waitlist for HT. Once included in the waitlist, the patient is monitored, in either an outpatient or a hospital environment, with the transplant center team until the time of the procedure. The clinical cardiologist also participates in donor evaluation. Clinical and anthropometric characteristics of the donor, as well as the brain death process are obtained by the procurement nurse by means of a form sent by the transplant center. The information is passed on to the clinical and surgical team who, together, define whether the donor is favorable for the HT. During the procurement process, it is necessary to identify, by means of data on medical history, physical examination, and laboratory tests, whether any change occurred in the condition that would make the transplant unfeasible at that moment. Subsequently, immunosuppressive therapy and antibiotic prophylaxis are also defined, which are individualized and defined together with the team's infectious disease specialist. In the perioperative care of HT, the cardiology specialist faces the challenges and peculiarities of the postoperative period of HT, namely, primary graft dysfunction, acute right ventricular dysfunction, acute rejection, and infections.[8] Late follow-up after HT takes place in the same transplant center where the procedure was performed. Medical follow-up of these patients consists of periodic assessment of graft



Estado	Total
SP	133
MG	54
PE	39
RJ	36
DF	25
RS	12
CE	11
PR	9
ES	5
SC	4
PB	3
MS	1
Brazil	332

Figure 1 – *Heart transplantation statistics. Adapted from: Associação Brasileira de Transplante de Órgãos.*[2]

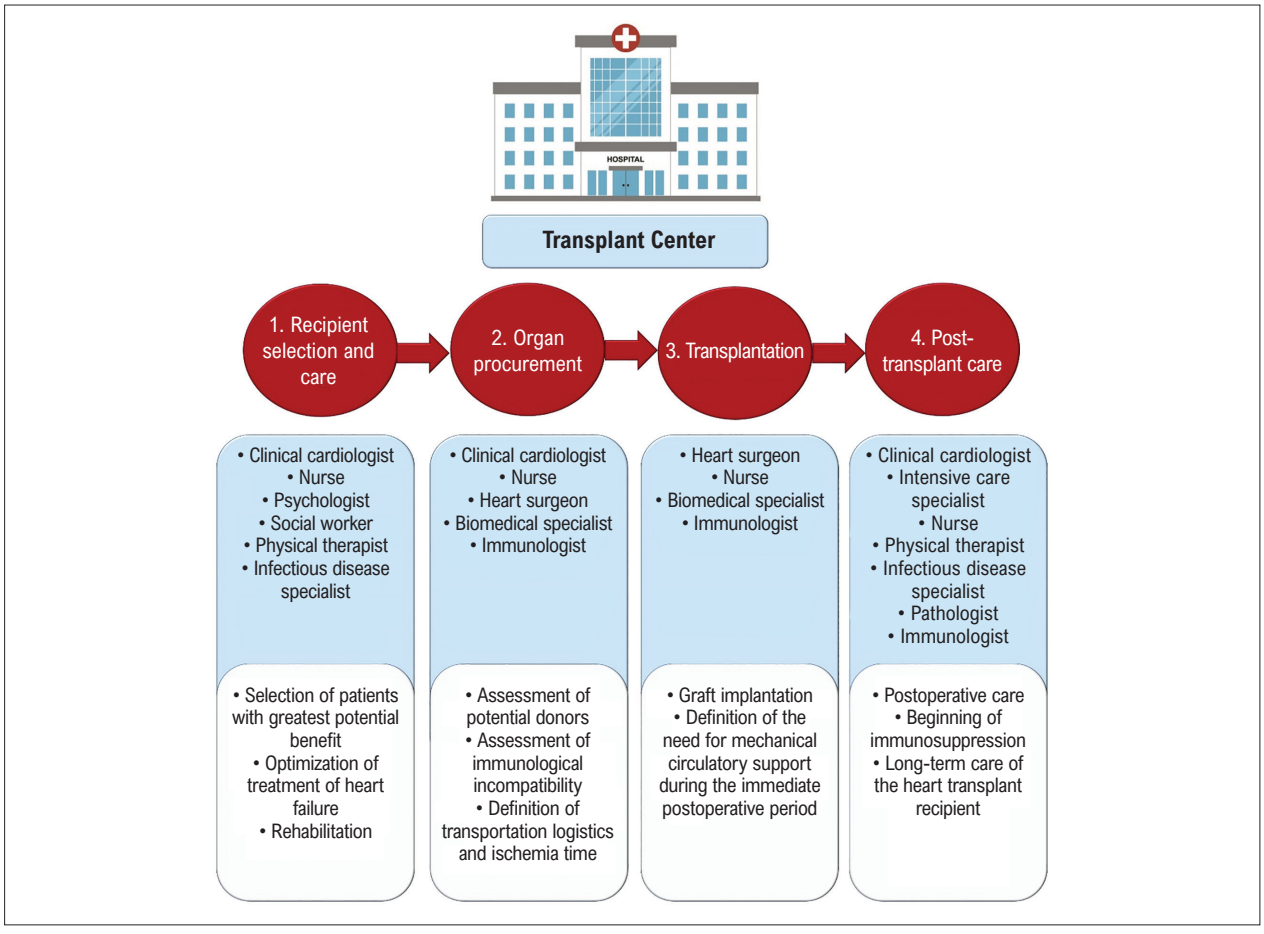


Figure 2 – *Role of the multidisciplinary team in different phases of heart transplantation.*

function, adjustment of immunosuppressive medications, and control of late complications that may occur, including acute rejection, opportunistic infections, pathologies related to the use of immunosuppressants (systemic arterial hypertension, diabetes mellitus, hypercholesterolemia, osteoporosis, and others), reactivation of Chagas disease, graft vascular disease, and neoplasms.[1]

Cardiovascular surgeon

The heart surgeon plays crucial roles. In addition to the surgical procedure itself, he or she acts during the process of evaluation of the recipient, procurement, and the postoperative period. In order to outline the surgical strategy and individualize the procedure, it is essential for the surgeon to get to know the recipient by participating in meetings with the entire transplant center team. Procurement is the first stage of the surgical procedure. Joint evaluation of donor data with the clinical team is crucial for better results. During the procurement process, the surgical team analyzes the logistics to be applied in order to minimize the graft ischemia time. This analysis is especially important in cases of remote procurement. Synchrony between the procurement and implant teams is also worth underscoring. The transfer of the recipient to the operating room occurs only after meticulous evaluation of the graft by the procurement team.

Other medical specialties

In addition to the cardiologist and the heart surgeon, three other medical specialties are directly involved in the different phases that involve HT.

The immunologist plays a crucial role in defining the compatibility of the donated organ with the recipient, by carrying out virtual and real cross-matching, in addition to working together with the clinical cardiologist in the post-HT period in the identification of specific antibodies against the donor, which are the substrate for antibody-mediated rejection.

The pathologist also plays an important role in defining the presence of both cellular and antibody-mediated rejection, in addition to providing data on the explanted heart, which often makes it possible to identify previously unknown pathologies and, thus, define conditions that should be investigated in the transplant recipient's relatives.

Finally, the infectious disease specialist assists the clinical cardiologist at different moments of the process, from pre-transplant care, especially in services where most transplants occur in a priority condition, where patients are hospitalized for many months while waiting for a heart and are, therefore, subject to infections related to prolonged hospitalization, until the follow-up after HT, guiding prophylaxis and/or treatment of opportunistic infections and infections related to the surgical procedure or hospitalization.

Assisting nurse

During the pre-HT phase, patients who are candidates require careful evaluation by the entire multidisciplinary team. In patients undergoing outpatient evaluation, the assisting nurse schedules all the appointments with other professionals. For hospitalized patients, the nurse works as a coordinator so that these professionals can make their evaluations in a synchronized and early manner.

The nurse's assessment aims to evaluate the recipient's conditions, habits, and adherence to drug treatment; to update the patient's vaccination schedule; to educate; and to create or improve conditions so that the patient can be included in the HT waitlist. It is also up to the nurse to interview and evaluate the caregiver of the potential HT candidate. Together with the psychology and social service team, the nurse assesses the family nucleus and identifies whether there is a caregiver capable of assuming the responsibility of caring for the HT candidate after the procedure. After inclusion in the waitlist, the nurse communicates with the patient and the caregiver regarding all the general guidelines related to the waiting process, how the selection of donors occurs, and the criteria for compatibility with the recipient. The patient on the waitlist is accompanied by the nurse in scheduled consultations and in educational meetings with caregivers. During this period, the nurse's role is important to resolve doubts and to reduce the anxiety of patients and family members, thus strengthening the bond with them.[9]

Procurement nurse

During initial evaluation of a potential donor, the nurse's role is fundamental to the procurement process, involving discussion about the clinical and management conditions of the potential donor and the immunological interfaces in relation to the recipient, in addition to the logistics of the entire process. When a donor becomes available, the transplant center informs the place of offer and time of procurement, blood type, mechanism of death, time of brain death, occurrence and duration of cardiorespiratory arrest, doses of vasoactive drugs, urinary output, presence of infection and use of antibiotics, medical history, habits and addictions, immunological evaluation, use of blood products, electrocardiogram, chest X-ray, and, when available, echocardiogram and coronary angiography. At this moment, the procurement nurse verifies this information together with the Brazilian Organ and Tissue Procurement Service and the hospital where the donor is located. Subsequently, the procurement nurse communicates this verified information to the clinical cardiologist, initiating a brief discussion about the case, together with the surgical team, regarding whether to accept or refuse the proposed donor and, consequently, whether or not to perform the HT. Whenever possible, the procurement nurse goes to the hospital, evaluates the donor, and suggests strategies to minimize the potentially deleterious effects of the brain death process.

Psychologist

HF and depression are frequently associated, especially in highly limited patients who are being evaluated for inclusion in the transplant waitlist. The psychologist's role, in both psychological evaluation and follow-up of HT candidates, is fundamental to deciding whether the patient

is emotionally prepared to be included in the waitlist and to endure the waiting time for an organ, which is, in most cases, long. The psychologist can even identify new problems that need to be solved together with the medical team. The long waiting time for a compatible organ, in both inpatients and outpatients awaiting heart transplantation, generates feelings of anxiety and, often, depression, which must be identified by the attending psychologist and promptly treated. However, the psychologist's role also extends to the post-HT phase. Many changes occur within a short timeframe, and the patient needs to adapt to a new life, gaining confidence to return to work and general activities that were limited by HF.[9]

Social worker

The objective of social assessment of HT candidates is to identify socioeconomic and educational factors that may be considered a risk for the patient after the transplant is performed. The social service team analyzes the patient's and caregiver's abilities to accept and adhere; the identification of the caregiver within the family nucleus; the assessment of socioeconomic conditions such as family income, level of education, housing conditions, and profession of the patient/provider; and, finally, the patient's conditions related to travel to the hospital when called for transplantation. Furthermore, the social service team can promote, together with family members, structural changes that allow the transplanted patient to live in the residence in question. After performing the HT, this team must then verify that the interventions proposed to overcome the difficulties have really been implemented and that conditions are adequate for the patient to be discharged.

Biomedical doctor

The biomedical specialist plays a fundamental role during organ procurement. Once a potential donor has been identified, the biomedical specialist assists in evaluating the entire logistics, under the supervision of the procurement surgeon, with the aim of minimizing graft ischemia time during procurement, especially when procurement is done remotely. In addition to this assessment, the biomedical doctor assists the surgeon in the act of procurement, either directly in the operation or indirectly by assisting in the preparation and infusion of the graft preservation solution.

Logistics from procurement to transplantation

Prolonged ischemia time, particularly longer than 4 hours, is an independent risk factor for early graft failure and death.[1] For this reason, in continent-sized countries like Brazil, the issue of procurement logistics is of the utmost importance. Approximately 50% of procurements occur at distances greater than 100 km, which makes it difficult to use ambulances. In these cases, cooperation with the Military Police and Civil Police make it possible to use helicopters, and partnerships with the Brazilian Air Force and the Secretary of State make it possible to use airplanes for remote procurement. Moreover, as procurement occurs at unpredictable moments, it is fundamental to have a full team available 24 hours a day, 7 days a week.

Conclusion

The structuring of a HT center involves training and synchronizing the work of an extensive multidisciplinary team. The objectives of this team are to select recipients with an appropriate profile, to optimize their preoperative clinical conditions, to create procurement logistics that minimize ischemia time and immunological incompatibilities, and to provide long-term care to HT recipients. A clinical cardiologist with experience and specialization in HT plays a central role in this team. Therefore, we believe that it is essential for the Brazilian Ministry of Health to support the creation of residency programs for an additional year in HT, as well as specialized supplementary programs in hospitals with large volume, structure, and tradition in performing this procedure. In this manner, it will be possible to expand transplant centers in Brazil and to provide life-saving treatment to patients who need it.

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