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Comprehensive Overview of Heart Transplant Procedures: Techniques, Risks, and Post-Surgery Care

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Abstract: ***A heart transplant is a critical procedure aimed at replacing a dysfunctional heart. This research paper aims to explain the entire procedure of heart transplant, including its various techniques and complications that might arise pre-and post-surgery. It also includes a section explaining the early and late complications that may emerge, as well as the potential causes of these problems.***

Keywords: Heart Transplant, Surgery, dysfunctional heart

1. Methodology

This research paper aims at providing an overview of the entire heart transplant procedure, starting from the prerequisites of the surgery to the post-surgery habits, risks, and complications. The main sources of this paper are pre-published papers from PubMed, alongside ResearchGate papers.

2. Discussion

A heart transplant is a procedure that is recommended when there is heart failure and other treatments are not effective. Heart failure can be due to several reasons:

- Coronary heart disease
- Cardiomyopathy
- Heart inflammation
- High blood pressure
- Ventricular arrhythmias
- Congenital heart defect

A heart transplant has to be conducted within **four hours** after the heart is removed from the donor's body.

There are many parameters on which the body has to be evaluated before declaring it eligible for a heart transplant, and getting eligibility for a heart transplant is limited as there are several contraindications:

- Major systemic disease
- Morbid obesity
- Cancer
- Renal failure
- Cirrhosis
- Severe lung diseases
- Advanced kidney disease
- Chronic infections (HIV, Hepatitis)

If a person isn't eligible for having a heart transplant, another option for them can be the **VAD** (Ventricular Assist Device), which is a mechanical pump that pumps blood from the ventricles to all the body parts.

Usually, when the body is assessed and the transplant is soon to be scheduled, the person is put on **GDMT** **(**Guideline-Directed Medical Therapy) for **three to six months**.

GDMT is a drug-based therapy, which mainly involves four classes of drugs: angiotensin-receptor neprilysin inhibitors/angiotensin-converting-enzyme inhibitors, beta-blockers, mineralocorticoid receptor antagonists, and sodium-glucose cotransporter-2 inhibitors.

An evaluation is conducted to assess any reversible factors along with the effectiveness of the ongoing medications.

Patients are strictly prohibited from alcohol consumption, illicit drug use, and salt-retaining medications. The presence of anxiety and depression might also be taken into consideration.

Preparation for Transplant

Once the examination of the recipient is completed and a donor's heart is available, the patient is prepared for the surgery. It is made sure that the patient is shaved, fasting, and washed. The surgery is performed under general anesthesia.

The two different types of heart transplantation

The Orthotopic approach and the Heterotopic approach are the two approaches that are observed during heart transplantation.

Orthotopic Approach-This is the more common approach, in which the donor's heart is implanted in the recipient's body and the recipient's heart is excised. This procedure is done in a normal anatomical position.

This approach further has two surgical techniques:

-Standard Biatrial Technique: In this technique, the recipient's original atria are left in place, and a bigger atrial anastomosis is used to connect in to the donor's heart. (*Anastomosis is basically a surgical connection drawn between things that are branched or diverged.)*

-Bicaval Technique**:** In this technique, the original atria of the recipient are completely removed. The main objective

of this technique is to obtain normal shaped atria; it also preserves the sinus node function and valvular function. The possible associated drawbacks include longer ischemic time and chances of narrowing of the caval anastomosis.

Heterotropic Approach: In this approach, the donor's heart is implanted in the recipient's chest without the recipient's heart being excised. This technique is usually used for patients suffering from severe pulmonary hypertension due to which the orthotropic technique cannot be executed. There are two published surgical techniques for the conduction of this procedure. The main procedure involves the recipient's heart not being excised and the donor's heart being transplanted in the recipient's thoracic cavity. This is followed by the donor's aorta being anastomosed to the recipient's aorta and the donor's PA anastomosed to the recipient's PA.

Pieces of Equipment Required to Carry Out this Procedure

- Preserved donor heart
- Eligible recipient
- **Cardiopulmonary bypass** (equipment used to make sure that a bloodless field is present during the cardiac surgery)
- Surgical blades

Procedure of the Surgery

A heart transplant requires open-heart surgery and is conducted in the following steps:

- The patient is prepared for the surgery; any jewelry is removed, and the patient changes into a hospital gown.
- The patient's arm is connected to an IV line to infect medicines as well as inject fluids.
- The urine in the bladder is drained by a flexible tube.
- Another tube is put into the stomach via the mouth or nose to drain the stomach fluids.
- The heart transplant surgery is performed under general **anesthesia**. Once the patient is in deep sleep, a breathing tube is put in the mouth to reach the lungs and is attached to a machine called a ventilator.
- The chest skin is cleaned with an antiseptic solution.
- An incision is made from just below the Adam's apple to just above the navel.
- The **breastbone** (sternum) is split in half and is separated part to reach the heart.
- Aorta and pulmonary veins are separated and the inferior and superior vena cava are secured with tape.
- The **cardiopulmonary bypass** is initiated at the temperature of **32°C**.
- Once the blood is pumping through the machine and has been completely diverted, the diseased heart is removed.
- The donor's heart is sewn into place, and all the blood vessels are connected to it carefully.
- Once the donor's heart is properly placed, blood is directed into the heart from the machine, and once completed, the cardiopulmonary bypass machine is removed.
- To initiate a heartbeat, the surgeon gives a shock to the heart with small paddles.
- Afterward, once the heartbeat is initiated, it is observed and monitored.
- Then the **sternum** is rejoined and put back with small wires for support.
- The skin over the sternum is sewn, and the incision is closed via surgical staples.
- At last, the operated area is covered with a dressing or bandage.

Post-Transplant Complications

There are several effects and complications that people may go through after having a heart transplant. Sometimes, the body of the recipient may reject a donor organ, and various kinds of rejections can happen on the conditions or circumstances they are associated with, such as:

1) Hyper-acute rejection (Early complication)

This is a condition when the graft is completely destroyed due to the action of antibodies of the recipient's body on the donor's heart. Usually, this is observed when a patient is given a wrong blood type, and the only way to stop this is the immediate removal of the tissue causing this reaction to save the recipient's life.

2) Acute cellular rejection
3) Antibody-mediated rejection
4) Cardiac allograft vasculopathy (Delayed complication)

This is a late side effect whose chances increase with the passage of time after surgery. CAV is a process due to which the coronary arteries of the allograph start to narrow.

This is caused due to both immune-mediated (mismatch of the donor and recipient) and non-immune-mediated (age, coronary artery disease, smoking, hypertension, etc.) reasons.

5) Graft dysfunction
6) Early graft dysfunction
7) Late graft dysfunction

After the heart transplant is complete, there are chances that the person develops infections due to the suppression of the immune response or other reasons as well.

The recipient is most vulnerable to infections in the first six months after having a heart transplant, and the chances of getting infections decrease as time passes.

One of the important and common infections that people tend to catch post-heart transplant is **Cytomegalovirus.** According to reports, it affects almost 47% of the people within one year of transplant.

If it isn't treated and identified at the earliest, it can lead to *cardiac allograft vasculopathy* and post-transplant *lymphoproliferative* disorder.

Post-Transplant Precautions

The incision area needs to be looked after, medicines need to be taken on time, and regular tests and checkup appointments should be attended.

Rejection is one of the main concerns after a heart transplant, so anti-rejection medicines should be taken on a regular.

A 24/7 caretaker needs to be available to look after the patient initially after the transplant is complete to make sure no inconvenience is caused and for a speedy recovery.

Post-Transplant Nutrition and Diet

After undergoing a heart transplant, the patient is put on several medications, and the diet needs to be adjusted accordingly. The following factors are taken into consideration to make sure the patient is healthy and meeting the nutritional requirements of the body:

- Maintaining the ideal body weight
- Limiting sugar intake
- The intake of saturated fats should be decreased and cholesterol should be controlled.
- Sodium intake should be restricted.

3. Conclusion

It can be concluded that a heart transplant is a critical and complex procedure that can have several complications both before and after the transplant is done. This procedure can be done broadly by two methods, with the most widely used one being the Orthotopic approach.

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