

## CASE REPORT

### ANESTHETIC MANAGEMENT FOR ABDOMINAL HYSTERECTOMY IN HEART TRANSPLANT RECIPIENT

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#### Abstract

Every year, the number of heart transplants in the world, but also in our country, is increasing. Because of high survival rates and increased life expectancy, heart transplant patients are likely to require elective or emergent non-cardiac surgical procedures. Heart transplant recipients present unique anesthetic challenges due to modified autonomic physiology and modified drug response. We present the perioperative management of 41-years-old woman, with a heart transplant before 30 months, admitted to the hospital for elective abdominal hysterectomy.

**Key Words:** *abdominal hysterectomy, anesthetic management, heart transplant.*

#### Introduction

Heart transplantation is a huge successful story. The idea to put a human heart from a dead person into person who is in terminal heart disease was shocking in 1967, when Barnard was the first to perform a heart transplantation. For patients with final stage of heart failure, heart transplantation can be the only way to stay alive. More than 140,000 heart transplants have been performed till now. Worldwide, the number of transplants is increasing annually, with an average of 4,000-5,000 heart transplants per year, more than half of which are in the United States<sup>1</sup>.

Many transplant patients are a pediatric population.

In Macedonia, heart transplantation started in 2020, and so far, a total of 9 heart transplantations have been performed.

Patients that had cardiac transplantation have around 90% chance to survive one-year if they are in North America and around 80% if they are in Europe or some other parts of the world that report to the International Society for Heart and Lung Transplantation (ISHLT)(1). Five-years survival is 70%, while median survival is greater than 12 years, but unfortunately only 20% survive  $\geq 20$  years (2).

Because of advances in cardiac surgery, high survival rates and enlarge lifespan, all heart transplant patients, a lot of them still children, have high possibility to need elective or emergent non-cardiac operation after the heart transplant.

All patients after heart transplantation deserve special care. They all have modified autonomic physiology and modified drug response because of the denervation of the donor heart. All transplant patients have side effects from continuous use of immunosuppressive drugs and serious additional comorbidities that need a lot of preoperative preparation. A preoperative assessment is performed together with the patient's heart transplant team.

### **Case Report**

A 41-years-old female was admitted in our hospital for an elective surgery. The patient had a left adnexal cystic formation with elevated tumor markers. She had had a right adnexectomy 4 years ago because of endometrioid adenocarcinoma of the right ovary, stage Ia. Hysterectomy with left adnexectomy was indicated.

Patient had a history of an orthotopic heart transplant, performed 30 months ago. Heart transplantation was a result of end stage heart failure due to dilated cardiomyopathy. Transplantation was Redo cardiac surgery. The first surgery was for ASD and VSD closure at the age of two, and the second six years later for mitral valve replacement. Heart transplantation was performed with a biatrial technique which led the patient for need of permanent pacemaker (PM) due to the complete atrioventricular block as a result of surgical discontinuation of the cardiac conductive system. The immunosuppressive therapy of the patient was Tacrolimus and Mycophenolatemofetil.

The preanesthetic evaluation included new cardiology examination with cardiac ultrasound, complete laboratory examination, coagulation status, level of immunosuppressive drugs. Consultations with her cardiac anesthesiologist and her cardiologist were established. Subjectively, the patient had no complaints. From a cardiological point of view, the patient had no contraindications for gynecological surgery. The patient was objectively cardiac compensated, with regular blood pressure, on ECG rhythm of PM (regularly controlled by electrophysiologist) with regular record. Echocardiographic regular finding was with normal function of the graft with EF 71%.

On the day of the surgery the morning dose of immunosuppressive drugs were given, together with double antibiotic prophylaxis, glucocorticoids and proton pump inhibitor. In the operating theatre standard non-invasive monitoring was applied.

Pre-induction, heart rate (HR) was 90/min, blood pressure (BP) was 122/75 mmHg and SpO<sub>2</sub> was 98%. Preload was performed with infusion of 1/2L normal saline prior to induction of general anesthesia. After 3 minutes of preoxygenation, anesthesia was induced with 2mg midazolam, 0.1mg fentanyl, titrated doses of propofol (1mg/kg) and ketamine 20mg (0.03 mg/kg). Rocuronium 0.6mg/kg was used for muscle relaxation and intubation. A mixture of oxygen, air and sevoflurane (1-1.5%) was used to maintain anesthesia. Analgesia was provided by a multimodal approach (intermittent fentanyl boluses, non-steroid anti-inflammatory drug, paracetamol, Mg). The surgery lasted 95 minutes. HR strictly remained in the range of 88–91 beats/min and no dysrhythmias were noted perioperatively. The patient was extubated after the return of airway reflexes, then followed in the Intensive Care Unit for the next 24 hours. She

was hemodynamically stable, on double antibiotic therapy, LMWH 1.5 mg/kg, requiring high doses of analgetic (paracetamol, NSAIDs, morphine). The next day, after 24 hours, the patient was transferred to the ward, immunosuppressive drugs were started, level of Tacrolimus was monitored daily. She left the hospital after 6 days.

## **Discussion**

All heart transplant patients require detailed evaluation and preparation before the planned non-cardiac surgery. Complications that may occur during the surgery depend on the period in which the transplant was performed. Patients in the early period after transplantation, the first year, are much more sensitive. In the initial period of transplantation, all elective operations should be cancelled and postponed for later. During this period, patients are exposed to an increased risk of complications: acute rejection (acute graft dysfunction is usually manifested as right ventricular dysfunction), complications related to immunosuppression, infection, exacerbation of concomitant diseases (renal dysfunction, hepatic dysfunction, diabetes mellitus as a result of steroid use, hypertension, lung diseases).

In the period of one year after the transplantation, the late period, the risk of acute rejection is reduced, and the immunosuppressive regimen is usually stabilized. But this period brings other concerns and the possibility of complications such as: allograft vasculopathy (usually this is the main risk for non-functioning graft and for rejection in the period one year after transplantation), risk for disturbance of the immunosuppressive mode, as well as the risk of malignant disease. Our patient was transplanted 30 months ago thus belonging to the late group, a stable immunosuppressive regimen has already been established for her, so she was in the best possible condition for operative elective intervention.

The transplanted heart has certain specificities, both in hemodynamics and in pharmacology. The main feature of the transplanted heart is cardiac autonomic denervation, which is the result of the explantation of the own heart. The transplanted heart has a higher heart rate because parasympathetic innervation is missing. The maneuvers of Valsalva are not effective, but the Frank-Starling effect persists, so the denervated heart responds to increased venous return, preload by increasing stroke volume and cardiac output. The denervated heart is very much dependent on appropriate intravascular volume and preload, thus heart transplant patients are referred to as "preload dependent" (3).

In order to avoid acute vasodilatation and hypotension, we managed our patient under pure general anesthesia without central neuraxial blockade, although different anesthetic techniques (general, regional) have been successfully used in patients with a history of transplantation (4,5). If general anesthesia is chosen, it is important to perform appropriate volume replenishment and reduce the risk of hypotension during induction of anesthesia. Availability of a direct-acting vasopressor agent is mandatory.

Neuraxial techniques are acceptable, but it should be noted that they may cause severe hypotension with a severe decrease in systemic vascular resistance, marked vasodilatation and decreased venous return to the heart, all of these as a result of denervated heart and lost

sympathetic innervation. But, prior application of fluids in combination with a vasopressor will alleviate or prevent hypotension.

In terms of pharmacology, the transplanted heart responds differently to certain drugs. Ephedrine as a vasopressor that has an effect through autonomic system is not effective, while direct acting phenylephrine is effective as a result of alpha and beta receptors that in the transplanted heart are intact. We were ready with infusion and bolus doses of phenylephrine at induction and during anesthesia of our patient.

The transplanted heart to vasodilator agents like nitroglycerin and hydralazine, as well as anesthetic agents with vasodilator effects like propofol, can not respond with a compensatory reflex tachycardia and this can lead to deep hypotension. Therefore, these agents should be administered slowly, in small doses. Propofol in our patient was administered slowly and in minimal doses.

For the treatment of bradycardia, anticholinergic drugs are not very effective, but chronotropic agents with direct action are much more effective.

Among commonly used anesthetics and side effects, it is useful to mention that although rare, heart block and asystole have been described after administration of neostigmine in patients with cardiac transplantation (6). The probable explanation is reinnervation of parasympathetic in the transplanted heart(4).

Almost all heart transplant patients receive chronic corticosteroid therapy and are highly likely to have adrenal suppression. For this reason, extra glucocorticoids are usually given in relation with the expected stress. In our patient, we gave her a daily dose, but also an additional dose of Methylprednisolone.

Prophylaxis of surgical infection with antibiotics is mandatory because transplant patients are on chronic immunosuppressive therapy. Our patient received dual antibiotic prophylaxis.

Our patient had standard non-invasive monitoring that we practice for all patients. The possibility of additional invasive monitoring was prepared if necessary. But, it is important to mention that the high incidence of fatal infections with invasive lines outweighs the benefits derived from invasive monitoring.

One of the most important things in the operative course is to avoid perioperative hypovolemia. Every volume loss, blood loss, must be treated promptly. It is crucial to give enough volume, to maintain the preload and to keep the patient stable, and application of direct-acting vasopressors can also be helpful.

Regarding the postoperative period, we have a small amount of data on the outcome of heart transplant patients subjected to noncardiac operative interventions. The most common problem remains infection. A retrospective study of 116 noncardiac surgical procedures after prior cardiac transplantation showed that infection happened in 7% of these procedures and was the most common postoperative complication(7). It is important to be aware that the immunosuppressed patient does not show the typical signs and symptoms of sepsis - fever and leukocytosis. That's why, a high level of suspicion is needed, and to be aware that these patients had a lot of hospital

stays and they all know many things related to their illness. They also have continuous relation and trust with some of the transplant team.

### **Conclusion**

Anesthesiologic treatment of heart transplant patients is a challenging for any anesthesiologist and requires knowledge of specificities associated with altered autonomic physiology and modified drug response. It is important to keep the anesthetic technique simple and always to maintain the preload.

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