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# Ultrasound-Guided Femoral Nerve Block as an Anesthetic Alternative in the Management of Traumatic Injuries in Reconstructive Plastic Surgery in Heart Transplant Patients

Dr. Dennice Janete Felix Sifuentes

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## Abstract

Summary- We present the clinical case of a 23-year-old male patient with a history of heart transplantation who suffered a bicycle accident presenting a bloody area in the left tibial region which was subjected to taking and applying a skin graft and allograft placement in a donor area under sedation. And ultrasound-guided femoral nerve block without presenting hemodynamic changes during the trans-anesthetic and adequate analgesia, resulting in a very useful alternative for this type of patients since they present physiologicalanatomical changes after transplantation and it is required to maintain a hemodynamic state optimal to avoid peri operative complications

***Index terms—***

## 1 Introduction

hristian Bernard performed the first human heart transplant in 1967. Currently, the average frequency of this procedure is approximately 1% of the population with heart failure. Heart transplantation is the definitive treatment of advanced heart failure and has been shown to improve results and long-term survival (1,4) Currently, between 5000 and 1000 heart transplants are performed worldwide and this is increasing, on July 21, 1988, Dr. Rubén Argüero et al. They perform the first heart transplant in Mexico at the Specialty Hospital of the Medical Center "La Raza" of the Mexican Social Security Institute (1,5, **??**1). The 1-year survival rate for heart transplant recipients is close to 80-90% and is increasing every year and 5-year survival is 65% (1, **??**, **??**1). Heart transplanted patients are also exposed to trauma and accidents. The most common causes of trauma were car accidents and falls, which is why as anesthesiologists we must know the physiological and pharmacological problems of immunosuppression, the risks of infection, the potential for rejection and the behavior of these patients to anesthetic drugs **??**1.8). Transplanted patients are immunosuppressed and are more susceptible to the effects of soft tissue damage and poor bone healing. These patients should receive the same initial resuscitation as any trauma victim. And choosing the most appropriate anesthetic technique is a challenge, so it must be planned and analyzed before the surgical procedure minimizing hemodynamic changes. (2, 3, 4, 5) II.

## 2 Clinical Case

This is a 24-year-old male with a preoperative diagnosis of a bloody area in the left tibial region secondary to a bicycle fall in October 2018, which is programmed electively for taking and applying cutaneous auto grafting and allograft placement in the donor area. Which has the following important background; Post-operative cardiac transplant at 23 years due to heart failure and dilated cardiomyopathy secondary to vincristine, presenting after 15 days posttransplant acute pulmonary edema and pleural effusion so they put water seals on both sides, renal failure managed with hemodialysis from 23 years , at 6 months of extrauterine life, he presented leiomyosarcoma in his left shoulder without complications, which on the day of his pre-anesthetic evaluation used the following drugs: Sirolimus 1 mg per day. Mycophenolic acid 1 tablet every 12 hrs, spironolactone 25 mg every 12 hrs, furosemide 40 mg every 24 hrs, propanolol 20 mg every 12 hrs, pravastatin 10 mg every 24 hrs, omeprazole 40 mg every 24 hrs and prednisone 5 mg orally every 24 hrs. With Cushing syndrome fascie, weight 62 Kg

Height: 158 cm with the following laboratory report hemoglobin 12.6 mg / dl, hematocrit 41% platelets 233000, leukocytes 6100, Glucose 80 mg / dl, creatinine 0.8 mg / dl, Prothrombin time 14 sec Thromboplastin time 31.9 sec, fibrinogen 511mg / dl Na 140 meq K 3.6 meq. Electrocardiogram: Sinus rhythm Heart rate 100 per minute with mild hypertrophy of the right ventricle, no arrhythmias, no ST elevation, absence of q waves, no ventricular extrasystoles. Echocardiogram: Preserved systolic function, 70% ejection fraction, no data on right ventricular dysfunction or pericardial effusion. Sirolimus levels of 12.4 ng / ml. Cardiac catheterization without pulmonary hypertension and with coronary arteries without obstructive lesions.

Patient is admitted to the operating room after authorization of informed consent is monitored, Blood Pressure 130-80 mmHg, Heart Rate 103 per minute, Respiratory Rate 18-22 breaths per minute, O2 Saturation 96-97%. Ondasetron 4 mg is administered intravenously, sedation with midazolam 2 mg intravenously, fentanyl 65 mcg intravenously, Oxygen is placed through nasal tips 3 liters per min, aseptic and antisepsis of the inguinal region is performed, subsequently scanned with Sonosite Edge II ultrasound with transducer linear 13-6 Hz with stimuplex for neurostimulation with 0.3-0.5 mA 0.3 ms 2 Hz, same region is located femoral artery and vein with pulsed doppler and doppler, femoral nerve is identified, skin is infiltrated with 2 cc of 1% lidocaine, 50 mm echogenic needle is inserted in the plane reaching the femoral nerve sheath and 20 ml of 2% ropivacaine is administered for surgical anesthesia, without presenting transanesthesia complications, latency 7 minutes satisfactory analgesia, cleaning and debridement of bloody area and taking of skin graft of left thigh approximately 5 cm and placed graft in bloody area of left tibia, as well as placement of aloinjerto of cultured skin (EPIFAST) in donor area.

No changes in hemodynamic parameters were observed after the administration of sedation, or after the administration of local anesthetic, buprenorphine was administered 130 mcg intravenously for postoperative analgesia, see Fig

# 3 Discussion

Patients with advanced HF before transplantation show different degrees of systolic or diastolic dysfunction (or both). The first leads to a decrease in ejection fraction and cardiac output, the second results in higher filling pressures. The reduction in cardiac output results in a reduction in the supply of blood, oxygen and nutrients to the terminal organs, which is only aggravated by partial venous congestion. After the cardiac output improves, and final organ is largely restored. But the transplant does not completely restore the patient to a non-pathological state. **??**1, 3.4) The heart in normal conditions is innervated by sympathetic and parasympathetic fibers of the autonomic nervous system. And the sympathetic innervations towards the heart comes from the cervical ganglia and the upper thoracic sympathetic chain (T1-T4), the branches of the vagus nerves contribute to parasympathetic entry. The cardiac plexus, containing the sympathetic parasympathetic and postganglionic preganglionic fibers, is found at the base of the heart. The autonomic nervous system is the conduit through which it provides a supply of visceral sensory fibers to the pericardium (1,3,9).

During the transplant, the postganglionic neural axons that innervate the heart are transected, which is why it is considered a denervated heart. The cardiac reserves of nor epinephrine are depleted and the autonomous influence on the heart ceases. This includes the response to baroreceptors. Afferent denervation prevents vasoregulatory responses by means of the renin-angiotensin axis, and the perception of pain secondary to ischemia (angina) is lost. (4, 5) That is why we chose a nerve block for our patient to avoid as much as possible hemodynamic changes that could cause decreased cardiac output.

Coronary allograft vasculopathy (CAV) has been an important impediment to the long-term survival of heart transplant recipients, and one third of the patients developed atrio-ventricular communication after 5 years. Atrioventricular arrhythmias are rare but ectopic. Extrasystoles are common. The presence of arrhythmias generally indicates a severe acute rejection of coronary heart disease allograft (4,5) In the case of our patient, he entered with a sinus rhythm which he maintained throughout the perioperative period. In neuroaxial blockade, the appropriate level of blockage should be taken into account, since a level of blockage that is too high can inhibit sympathetic nerves and cause vasodilation that is unfavorable for a transplanted heart; a very low level is not suitable for surgery since the resulting pain may cause an increase in myocardial oxygen consumption. (1,5) Azathioprine withdrawal in the perioperative period in patients taking warfarin may precipitate bleeding, since bleeding 6-mercaptopurine, the immediate metabolite of azthioprine, induces liver micro enzymes that metabolize warfarin. Local anesthetics such as bupivacaine can have cardio toxic effects at a conventional dose in these patients if they also have impaired renal function. (1) By choosing a nerve block for our patient, we minimize the risk of complications due to coagulation disorders, although were not present in the same should be avoided, using ropivacaine further reduces the risk of cardiac arrhythmias.

Peripheral nerve block has taken great importance in recent years and with the advances in technology such as the use of ultrasound to guide them have increased the safety and complications of both neuroaxial anesthesia and general anesthesia, nerve block Ultrasound guided femoral, taking the femoral artery and vein as a reference, the transducer is placed transversely on the anterior aspect of the anterior thigh below the inguinal ligament see Fig 2, on the femoral artery identifying the femoral artery, femoral vein, the iliac muscle, fascia lata, iliac fascia, and Sartorius muscle. The femoral nerve is below the iliac fascia at the angle between the iliac muscle and the femoral artery, see **??**ig 3, flat techniques are preferred to visualize the path of the needle and it has been used successfully in hip and surgery. Knee for post-surgical analgesia since it grants post-surgical analgesia on the

anterior thigh and knee (12, 13). That is why we decided to implement it in the management of skin loss lesions in reconstructive plastic surgery.

When a general anesthesia is chosen, it should be taken into account that the transplanted heart does not have sympathetic, parasympathetic or sensory innervation since it was lost in the transplant surgery, and the loss of vagal influence causes a resting heart rate higher than normal (91-101 bpm). Two P waves can be observed so there is a P: 1 that represents the SA of the recipient node and the other one that represents the donor SA node. Although the innate pacemaker remains intact from the original heart, its electrical activity cannot be conducted through the suture line. (1,3) Intrinsic mechanisms and coronary selfregulation remain intact, carotid sinus massage and Valsalva maneuver have no effect on heart rate, there is loss of cardiac bar reflexes and loss of sympathetic response to laryngoscopy and tracheal intubation. The denervated heart may have a more dull heart rate response at an anesthetic depth or inadequate analgesia. In the denervated heart, the response of catecholamines is different from that of the normal heart because intact sympathetic nerves are required for the normal uptake and metabolism of catecholamines. The transplanted heart may respond to direct-acting drugs (eg, sympathomimetics) (5,10, **??**1).

Epinephrine and norepinephrine have an increased inotropic effect on heart transplant recipients. Both have a greater proportion of ? to ? or inotropic to vasoconstrictor. Dopamine acts by the release of norepinephrine and is a less effective inotropic in the denervated heart (1,4,5). Isoproterenol and dobutamine have similar effects on denervated and normal hearts. Therefore, both are effective inotropics in the denervated heart and are frequently used Ephedrine, has reduced responses on blood pressure and heart rate. There is still a response of venous contrition reflects hypotension. Therefore, intravascular volume is even more important. Circulating catecholamines cause a delayed increase in rate and contractility (5). The Frank-Starling mechanism remains operative in the transplanted heart (4,10, **??**1) Patients with a transplanted heart are "dependent on preload." (3) These patients are at high risk of presenting atrial flutter or fibrillation in a few years, this is due to the onset of reinnervation, complete neuronal control is achieved after 15 years of transplantation (5) First degree atrioventricular block is frequent, and up to 30% have a right branch block (4) Vagolytics, such as atropine, are ineffective in increasing heart rate, other positive chronotropic medications, such as ephedrine and is oproterenol. Inhaled anesthetics have myocardial depressing properties, they are well tolerated unless there is significant heart failure, dopamine is an ineffective inotropic. Epinephrine / nor epinephrine may have exaggerated beta-mimetic effects on heart rate because the increase in blood pressure will not lead to a decrease in heart rate through the baroreceptor reflex (i.e., the efferent vagus nerve). Implanted mechanical pacemakers normally work in heart transplant recipients since the heart cables are placed directly in the myocardium (2, 3, 4,5). In the case presented, there was no need to use any vasoactive drug since the patient had hemodynamic stability.

Trans esophageal echocardiography has a very important role prior to surgery, invasive hemodynamic monitoring in heart transplant recipients is performed according to the type of surgery and the hemodynamic state of the patient (3, 4,5) Some authors prefer general anesthesia , since there is the possibility of an altered response to hypotension after spinal or epidural anesthesia. In our patient we chose a safer technique that was ultrasound-guided neurostimulation-guided femoral nerve block to maintain surgical anesthesia and optimal postoperative analgesia. Preoperative evaluation is of great importance to determine the safest anesthetic application to the post-transplant patient. Professionals should focus the evaluation on the current function of the heart taking into account the level of exercise tolerance, evaluation of the transesophageal echocardiogram and stress test results, and / or should request a cardiology assessment. An echocardiography should be performed to detect Vasculopathy that is common in patients more than 1 year after transplantation and is the most frequent cause of repeated transplantation or death after 1 year (4,5,6). Close communication must be made between the surgeon and the anesthesiologist, to detect preoperative arrhythmias that occur in 5% of patients, complete blood count, renal function tests, liver function tests, serum electrolytes as well as coagulation tests. Cyclosporine should be administered 4-7 days prior to surgery to maintain therapeutic levels. As well as the administration of prednisone or methylprednisolone **??**1. 4, 5) Patients with heart transplants often receive corticosteroid therapy, it is important to provide more glucocorticoids to those patients who present with chronic corticosteroid use (5 mg / day of prednisone or equivalent). (one)

IV.

# 4 Mmunosuppressors to Avoid Rejection

The immunosuppressive drugs available today can be classified into: Inductors: OKT3, thymoglobulins and antagonists of IL-2 receptors (daclizumab and basiliximab). Anticalcineurinics: Cyclosporine and tactrolimus. Antimetabolites or purine synthesis inhibitors: Mycophenolate mofetil and azathioprine. Corticosteroids Antiproliferatives Sirolimus and everolimus.

These drugs can be combined in various ways, constituting immunosuppression guidelines, which can be classified according to their indication: induction, maintenance and rejection. r purpose to block the immune response in the initial period of transplantation (when it is more intense), but with the cost of a higher incidence of infections and neoplasms. (14) In the case of our patient he was being treated with sirolimus and steroids.

V.

# 5 Transanesthetic

The objective of surgical intra-management of patients with heart transplants who undergo non-cardiac surgery is to avoid hypotension, vasodilation and acute decrease in preload due to the importance of diastolic volume to maintain cardiac output (8). Standard monitoring is indicated and varies according to the type of surgery, anesthesia technique and the patient's condition. Invasive CVP and arterial monitoring were not used in this case due to the patient's preoperative period as it was thermodynamically stable, the surgical risk was minimal in this case given the anesthetic management that was performed (3,4,8).

Side effects of immunosuppressive medications, which could have an impact on the management of anesthesia. The use of medications that produce active metabolites such as morphine, meperidine and non-depolarizing muscle relaxants should be prevented. Any anesthetic that inhibits or induces CYP-450 can affect the plasma concentration of tacrolimus. Barbiturates induce CYP-450, therefore lowering the blood level of tacrolimus. Propofol inhibits CYP-450, respiratory failure has been observed in approximately one third of patients with the administration of tacrolimus and propofol (4, 5, 6,7) Cyclosporine has shown a similar behavior with barbiturates, fentanyl and is oflurane. Infectious complications are an important cause of morbidity and mortality; the causative agents associated were bacteria (43.6%), viruses (41.7%), fungi (10.2%), P pneumocyst is carinii (4%) and protozoa (0.6%). (3) Oral to nasal intubation is preferred since there is a risk of infection with the latter caused by nasal flora. Airway obstruction may occur in patients with lympho proliferative processes and diabetes (5), such as In the case of our patient who presented leiomyosarcoma in the left shoulder, cyclosporine can lead to gingival hyperplasia and cause bleeding (4), non-steroidal anti-inflammatory drugs should be avoided to control pain due to the risk of bleeding, so in our patient we use opioids for its management. (5) The dose of benzodiazepines should be reduced when the patient consumes immunosuppressants as they increase their potency. Atracurium and cisatracurium are preferred since these are safer in patients with liver and kidney disorders. Neostigmine generally has no effect on heart transplantation. But precautions should be taken when reinnervation begins (> 1 year post-transplant) because there is evidence of bradycardia and cardiac arrest with neostigmine despite the concurrent use of an antimuscarinic agent. Cyclosporic increases the analgesic effect of fentanyl (4.5.6).

In the case of our patient, the presence of clinical signs of Sepsis such as elevated temperature, elevated white blood cells, cell count and the presence of chills was monitored.

# 6 VI.

# 7 Postoperative Care

Preload status, renal function and infection prevention should be monitored. Immunosuppressants should be continued after the operation and the blood level should be monitored. In the case of our patient, the healing was followed by accelerating it in the donor area with the application of cutaneous allograft which was removed after 5 days presenting complete recapitalization and without presenting infection data. And the integration of the skin graft in the traumatized area was observed at 7 days (5, 7.9).

VII.

# 8 Conclusions

The anesthesiologist should have a solid knowledge about the newly established functions of a transplanted heart, its specific perioperative care considerations and the pharmacological effects of immunosuppressive medications, the importance of preload dependence; administering direct vasoactive drugs if necessary; and awareness of the infectious risk, potential for rejection, and the possible side effects of an immunosuppressive regimen are very important to prevent perioperative complications (5,14). So the success of the anesthetic surgical procedure is due to the maintenance of the preload, the sinus rhythm and after load. (4,8) In the clinical case, we present a safer and more effective alternative for the management of traumatic injuries in reconstructive plastic surgery without significant changes in hemodynamic parameters and with adequate postoperative analgesia and without peri anesthetic complications (12,13) Bibliography

**2**

Figure 1: Figure1:Figure 2 :

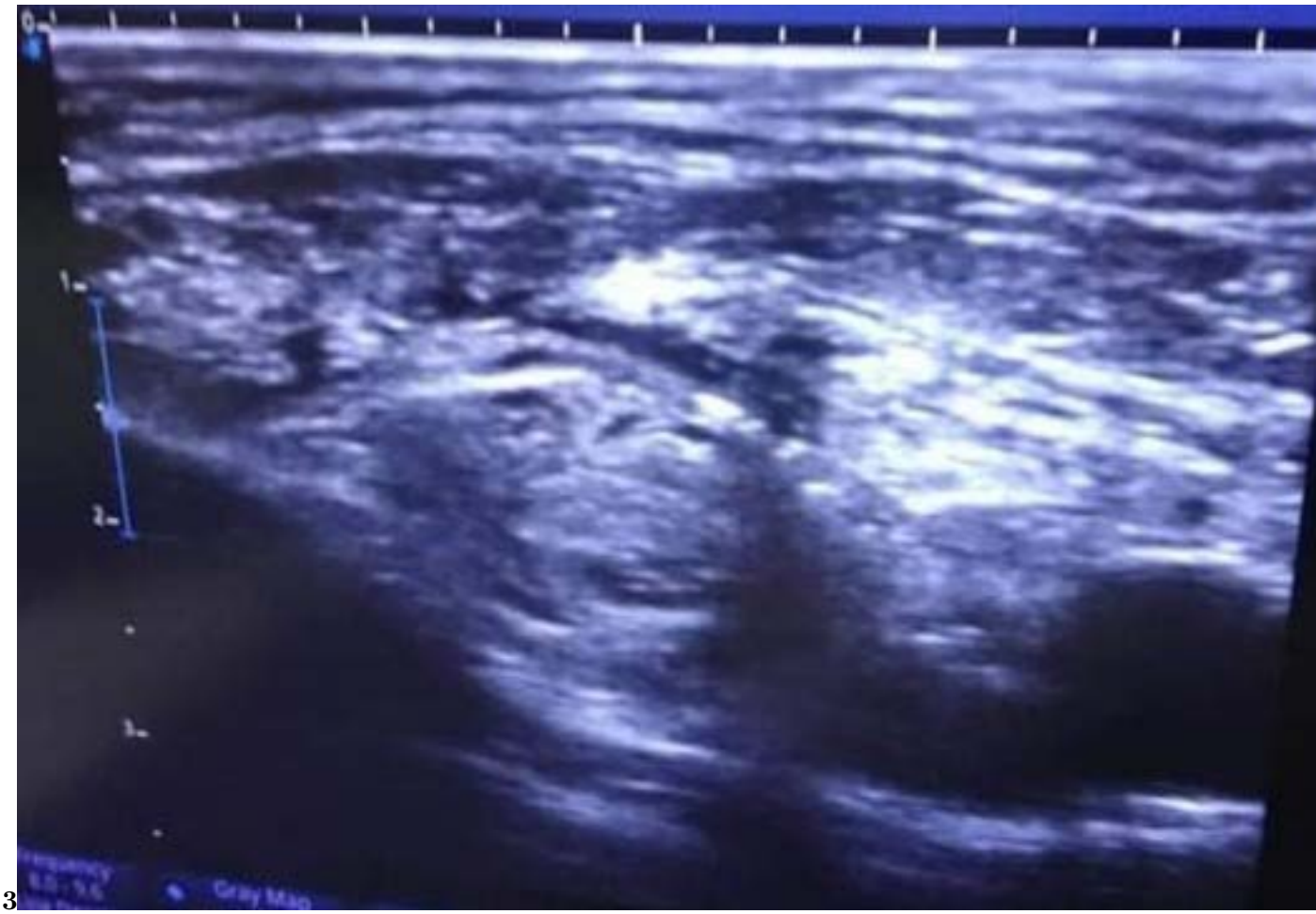


Figure 2: Figure 3 :

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