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Anesthetic Management of a Percutaneous Mitral Valve Repair (MVR) with the MitraClip System in a Twice Renal Transplanted Patient

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Abstract

Chronic renal failure is strongly related to poor outcomes, in cardiovascular system, such as: cardiac dilatation, left ventricular dysfunction and mitral valve regurgitation. Mitral calcification and regurgitation play an important role in prediction of morbidity and mortality in patients on dialysis. Percutaneous mitral valve repair (MVR) with the MitraClip system, which has begun to be used in severe mitral insufficiency patients with multiple comorbid medical conditions, including renal disease, is a new, alternative method. This intervention is not associated with cardiopulmonary bypass, thus; it has been proven to be safe and effective in risky patients. In this report, we would like to share our anesthetic experience in successful mitral valve repair by MitraClip system in a patient who had undergone renal transplantation twice.

Keywords

Renal Transplantation, MitraClip Implantation, Anesthesia

1. Introduction

Chronic kidney disease (CKD) is associated with increased severity of cardiovascular problems, including severe left ventricular (LV) systolic dysfunction leading to reduced LV ejection fraction, LV remodeling, heart failure and also; vascular and valvular calcifications [1] [2]. It has been suggested that; volume overload seen in hemodialysis patients cause dilatation of the valves thus leading to regurgitation [3]. Mitral dysfunction has been

*Corresponding author.

reported to be observed in 55% of CKD patients [1]. Hence, these patients carry a high risk for surgeries related to cardiovascular system. Increased risk for perioperative cardiovascular morbidity and mortality make these patients ineligible for conventional surgical mitral valve replacement. However; prolonged life expectancy after renal transplantation in this population, continuing advances in percutaneous valve technology, multidisciplinary communication between related staff have introduced a new percutaneous technique; resembling to edge-to-edge surgical method; MitraClip system; into clinical practice [4] [5].

An anesthesiologist plays an essential role in this aspect. For improving postoperative conditions; it is important to understand the pathophysiology and anesthetic implications in these patients.

This article presents the case of a patient who underwent kidney transplantation twice and then percutaneous MVR with the MitraClip system. The case report describes the anesthetic management of this rare condition.

2. Case Report

A 50 years old woman, with a body mass index (BMI) of $24 \text{ kg}\cdot\text{m}^{-2}$ was referred to our hospital with NYHA class III symptoms of heart failure. She had a history of right renal transplantation in 1999, and left renal transplantation in 2003. Then she had undergone coronary artery bypass grafting 2 years before. Since then she was under immunosuppressive and antihypertensive treatment. Her transthoracic echocardiographic examination revealed significant biventricular impairment (LV ejection fraction 25%-severe right ventricular dysfunction) and increased pulmonary artery systolic pressure (SPAP = 50 mmHg). In laboratory parameters; hemoglobin: 11.2 gr/dL (12 - 15 gr/dl), K: 5.4 meq/L (3.50 - 5.50 mEq/L), creatinine: 2.3 mg/dL (0.5 - 1.5 mg/dL), blood urea nitrogen (BUN): 106 mg/dL (6 - 21 mg/dL) were remarkable. She was diagnosed as severe (+4) mitral regurgitation patient and scheduled for percutaneous mitral valve repair (MVR) with the MitraClip system at our hospital. She was under immunosuppressive therapy consisting of prednisolone, mycophenolate mofetil and tacrolimus. She was taken to the cardiac catheterization laboratory, on the morning of the procedure. She was monitorized with a five-lead electrocardiography system. She had pulse-oximetry probe and non-invasive blood pressure measurement as baseline values. In the mean-time, a peripheral venous access route and radial artery cannulation were performed. She was administered 1 g iv ceftriaxone for antibiotic prophylaxis. Before tracheal intubation, we applied thiopental sodium ($5 \text{ mg}\cdot\text{kg}^{-1}$), rocuronium ($0.5 \text{ mg}\cdot\text{kg}^{-1}$), and fentanyl ($2 \mu\text{g}\cdot\text{kg}^{-1}$). Then, urinary catheterization was achieved. For decreasing volume overload, we applied 20 mg furosemide intravenously. A 3-dimensional transesophageal echocardiography was placed. Anesthesia was maintained with sevo-flurane (1.5% - 2%) and oxygen/ N_2O mixture. Intraoperative mechanical ventilation was provided; so as to keep ETCO_2 between 30 - 35 mmHg, with a respiratory rate of 10 - 12 breaths $\cdot\text{minute}^{-1}$ and a tidal volume of $6 \text{ ml}\cdot\text{kg}^{-1}$. By this time, right and left femoral veins and the left femoral artery were used for vascular access. The cardiologist advanced the MitraClip device via the right femoral vein. Then, under fluoroscopy and TEE, interatrial septum was punctured, and we applied heparin to keep activated clotting time $> 250 \text{ s}$. Thus, MitraClip was carefully positioned over the mitral valve. At the end of this procedure we administered intravenous protamine for reversal of anticoagulation. The duration of anesthesia was 90 minutes while the procedure lasted 70 minutes. The procedure was achieved successfully, and the intubated patient was transferred to intensive care unit (ICU) for monitorized follow up. She was extubated as cooperated and oriented after 6 hours, with a stable hemodynamics, and normal urinary output. The length of stay in ICU was 3 days. Postprocedurally; MR grade improved from severe to mild. She was discharged from hospital on 4th day. At her 1st - 2nd month controls, there was neither complaints nor abnormal laboratory findings. Patient consent was obtained.

3. Discussion

This case represents the improvement in quality of life of a patient after percutaneous MVR following renal transplantation. Actually, cardiovascular problems are expected to relieve after renal transplantation. Melchor *et al.*, demonstrated improvement in mitral valve function by 50%, and 25% at the first week and fourth month following kidney transplantation, respectively [6]. The patient in this case, however, couldn't have any progress in her health status after renal transplantation.

In the literature; the need for surgery after a solid organ transplantation has been reported to be between 15% - 41% [7]. Although, the history of open heart surgery in renal transplants dates back to 1970's, this is the first case report to describe a percutaneous technique in a renal transplant recipient [8]. Recently; renal transplantation in Turkey, has already been promoted by increased number of both cadaveric and living donors. Our patient had

cadaveric renal transplantation twice in her history. These operations had been achieved at different hospitals four years apart from each other. As far as we could learn, the reason of first graft failure was recurrent urinary tract infections. Nevertheless, she had a better quality of life, so she referred to a cardiologist and accepted to have an open heart surgery for coronary revascularization in 2013 at another hospital. In 2015, she became a candidate for mitral valve replacement. Preoperatively, we evaluated both the graft function and other organs' functional states. Her ECG and echocardiography were normal except for decreased right ventricular performance, left ventricular dysfunction, and moderate to severe (3+) mitral regurgitation. We had our preparations as if the patient was to undergo an open heart surgery. She had cyclosporine 4 h before the procedure, as well as iv midazolam as premedication before entering the cardiac catheterization laboratory. We chose percutaneous MVR with the MitraClip system as a feasible intervention for this patient. In this type of patients; usually avoidance from surgical repair has been reported due to comorbidities, geriatric age or conservative approach of the clinician [9]. In a study by Yamamura *et al.*, severe complications, especially infections; were described in renal transplant patients, following open heart surgery [10]. Recently, this new, alternative percutaneous technique has been used to be preferred in patients with multiple comorbidities [11] [12]. Kottenberg *et al.* demonstrated the immediate hemodynamic and pulmonary benefits of this intervention in comparison to mitral valve surgery [13].

We had evaluated the filling pressures of the heart before the procedure by echocardiography. Besides; as a precaution against infections, central venous pressure monitorization wasn't required. However, we had a urinary catheter to follow up of urinary output. We tried to avoid hypotension, but keep the filling pressures of the heart at normal values which was also important for normal graft function, with the aid of transesophageal echocardiography.

In a recent study by Kainuma *et al.*, advanced levels of kidney disease affected the success of mitral valve repair poorly on long term outcomes [14]. In other studies, baseline kidney functions were reported to be correlated highly with the function of normal mitral valve [15] [16].

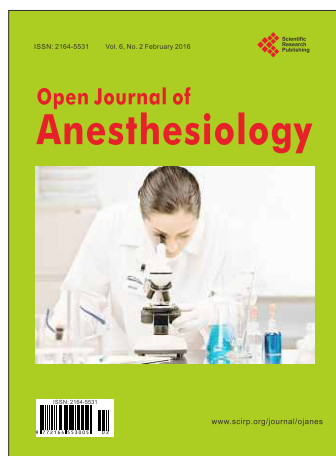
We aimed rapid sequence intubation and facilitation of extubation; thus we preferred sevoflurane and fentanyl with rocuronium. The cardiac catheterization laboratory is away from ICU at our hospital, so we usually don't attempt to extubate patients at the laboratory, even if the patient is without any problems. The long distance in between makes the anesthesiologist to hesitate about airway and hemodynamic control during the transport. Thus, as soon as the patient was transported to ICU safely, we began to wean the patient with a stable hemodynamic profile, normal urinary output and arterial blood gases. The patient's serum creatinine levels measured at postoperative day 1, discharge, 1st month and 2nd month after the procedure were in normal range.

As the incidence of renal transplantation is increased, the number of anesthesiologists referred for different types of surgeries in these patients will increase. They are difficult to manage for not only their special therapies, but also impaired organ system reserves. Minimally invasive and/or percutaneous techniques might be in favor of these patients. A multidisciplinary approach is mandatory for balancing the interindividual risk-benefit ratio and decision-making. The present case aimed to report a successful anesthetic management and improvement of mid term outcomes of a renal transplanted patient in the light of a transcatheter technique.

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