



**Peer-Reviewed Case Report**

# Chronic Hemodialysis in a Patient with Left Ventricular Assist Device

**Amr Idris MD<sup>1\*</sup>, Georges Lolay MD<sup>2</sup>, Ana L Castellanos MD<sup>3</sup>, Navin Rajagopalan MD<sup>1</sup>, Maya Guglin MD<sup>1</sup>.**

<sup>1</sup> Department of Internal Medicine, Division of Cardiovascular Medicine, Linda and Jack Gill Heart Institute, University of Kentucky, Lexington, KY, USA 40503

<sup>2</sup> Department of Internal Medicine, University of Kentucky, Lexington, KY, USA 40503

<sup>3</sup> Department of Internal Medicine, Division of Nephrology, Bone & Mineral Metabolism, University of Kentucky, Lexington, KY, USA 40503

\* Corresponding author: [amr.idris@uky.edu](mailto:amr.idris@uky.edu)

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## Abstract

Renal dysfunction in the setting of heart failure is a common medical problem. This dysfunction can range from reversible ischemic changes to renal failure requiring renal replacement therapy. Patients who are candidates for mechanical circulatory support with left ventricular assistant device (LVAD) pose unique challenge with respect to receiving dialysis. We present a 47 year old patient who required renal replacement therapy peri-implantation of LVAD for management of acute on chronic kidney disease, and was discharged for chronic hemodialysis in an outpatient setting. In this report we highlight the challenges of managing volume overload in patients with impaired renal function refractory to optimal medical therapy as well as the possibility of implanting LVADs in patients on hemodialysis.

## Keywords

Ventricular assist device; heart failure; renal failure; hemodialysis; kidney injury

## Background

A significant number of patients with advanced heart failure have associated renal dysfunction before LVAD implantation. Medical management of those patients is often challenging as trying to treat one organ may lead to worsening of the other. The burden is exacerbated by the occasional need for renal



replacement therapy in the form of hemodialysis. Published studies on renal replacement therapy in the peri-implantation period of LVAD are limited by low number of nephrologists/dialysis teams who are experts in LVAD management during dialysis, and absence of specific details of renal replacement therapy utilized. For patients, who are not transplant candidates at the time of LVAD implant, but can potentially become heart or heart /kidney transplant candidates after a period of LVAD support, concomitant renal failure is of particular importance, and availability of chronic hemodialysis while on LVAD support may literally mean the difference between life and death.

We present a patient with advanced heart failure who suffered from acute deterioration of his chronic kidney disease requiring renal replacement therapy in the peri-implantation of LVAD, and was eventually discharged for chronic outpatient hemodialysis after LVAD.

### **Case Report**

A 47-year-old male with morbid obesity (weight 150 kg, body mass index 41.3), type 2 diabetes mellitus, hypertension, non-ischemic cardiomyopathy, and chronic kidney disease presented with shortness of breath and increased pedal edema bilaterally. Vital signs were within normal limits (HR 79 BPM and a BP 101/67). Physical examination revealed an obese male in distress. Cardiac auscultation disclosed mild tachycardia and a regular rhythm without murmurs, gallops, or rubs. Lung auscultation disclosed crackles bilaterally. Basic metabolic profile was significant for mild hyponatremia (132 mg/dL) as well as elevations in creatinine (3.95mg/dL [baseline: 1.98mg/dL]) and blood urea nitrogen (BUN: 72 mg/dL [baseline: 50 mg/dL]). NT-pro B-type Natriuretic Peptide (NT -proBNP) was 5540. Based on the clinical exam, he was diagnosed with acutely decompensated heart failure, and was initiated on intravenous diuretic therapy for preload reduction. Right heart catheterization was also performed (right atrium 27 mmHg, pulmonary artery systolic/diastolic/mean 86/38/52 mmHg, pulmonary capillary wedge pressure 51 mmHg, Cardiac index was 1.96), demonstrating low cardiac output, and thus inotropic therapy was also started. His right heart catheterization was complicated by respiratory arrest due to hypoventilation in the setting of sedation, had to be intubated and put on mechanical respiratory support. Despite optimal medical therapy, his renal function continued to decline (creatinine and BUN of 6.09 mg/dL and 109 mg/dL respectively) and he was unable to be weaned off Milrinone. Patient was evaluated by nephrology team, who determined that his renal deterioration was functional, and did not represent an intrinsic renal disease. He was started on hemodialysis, and one month thereafter, was declared to have end stage renal disease. Initially, there was some hesitancy on the part of the cardiac transplant team to offer LVAD transplantation due to logistics involved in dialysis patients; however, the patient's family had found a local dialysis center willing to accept the patient on mechanical support therapy. Eventually, after 2 months in the hospital, he underwent Heart Mate II LVAD implantation without any complications. Low dose intravenous Heparin and Warfarin were both started on postoperative day 1, and 28 days thereafter, was discharged home on warfarin with an international normalized ratio (INR) of 2, and a target range between 2 and 3. Postoperatively, he continued to require renal replacement therapy. On



the day of discharge, his creatinine (Cr) and blood urea nitrogen (BUN) were 5.07 mg/dL and 40 mg/dL, respectively. Since discharge, his outpatient hemodialysis has been uneventful, without significant changes in LVAD pump flow and pulsatile index. Has not had any bleeding or hemolysis complications related to anticoagulation and dialysis respectively. On his three month follow up, he reported feeling well, stating his insulin requirements has substantially decreased. He is active and has been walking several blocks without having any difficulties, which is a dramatic change from his pre-LVAD lifestyle. He has intentionally lost over 40 Lbs of weight and is making progress towards becoming a heart/kidney transplant candidate.

### **Discussion**

LVAD is a well-established therapy that is employed either as a bridge to transplant or as a destination therapy for patients with heart failure refractory to conventional medical therapy. Recent data have shown that LVADs are associated with improved survival and better functional status for an extended period of time. Criteria for candidate selection for long term LVAD therapy are not as strict as for heart transplantation, and more comorbid conditions are allowed (2). Specifically, renal insufficiency, which is secondary to heart failure, known as cardio-renal syndrome, should not preclude patients from mechanical circulatory support, especially since kidney function may improve after LVAD. Several studies have demonstrated dramatic improvements in renal function after LVAD implantation in patients with baseline creatinine values of 3.1–4.1 mg/dL and even in those dependent on short term renal replacement therapy before LVAD implantation (3-7).

End stage renal disease with the need for chronic hemodialysis is a separate issue. Currently, it is considered a contraindication for LVAD implantation (1). Nevertheless, there are few dialysis centers that accept a patient with an LVAD. Typically, patients on LVAD and chronic hemodialysis are not dialysis dependent pre-implant, and become dependent on renal replacement therapy as a result of acute kidney injury in the postoperative period. They require prolonged ventilatory support and suffer from right ventricular failure post-LVAD (8).

Access is yet another challenge for patients with LVAD who requires dialysis. First, fistula maturation is delayed or does not occur at all because of non-pulsatile or marginally pulsatile blood flow (9). Second, these patients are at higher than normal risk of infection because of the driveline. LVAD driveline exit-site infection and subsequent bacteremia that can spread to LVAD itself, is one of the most common causes of morbidity and mortality in these patients (10). Patel and colleagues recommend that if hemodialysis is pursued, long-term dialysis catheters should be avoided due to their high risk for infections (11). Some authors advocate peritoneal dialysis in order to minimize the risk of infection (12).

In summary, patients with cardiac induced renal failure requiring renal replacement therapy in the pre-implantation period can still be considered for LVAD, especially as a bridge to transplantation. There are challenging and unique issues that arises in the course of delivering renal replacement therapy to an LVAD patient in either inpatient or outpatient setting. Appropriate selection of



candidates for implantation is critical for ensuring the best outcomes. If a patient is considered a candidate for implantation, a multidisciplinary team, including the cardiothoracic surgeon, heart failure physician, and LVAD nurses should involve themselves closely in educating dialysis unit team, nephrologists, patient, and family members about LVAD management during renal replacement therapy.

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