

# Open Radical Nephrectomy In A Patient With Left Ventricular Assist Device: A Case Report

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## Abstract

Left ventricular assist devices (LVADs) are becoming increasingly resourceful tools in the treatment of medically refractory end-stage heart failure. Non-cardiac surgery in patients with LVADs requires careful co-ordination and surveillance due to high risk of complications. These obstacles present a unique challenge for the surgeon and thus require a multi-modal collaborative approach.

In this case study, we present, to our knowledge, the first documented case of open radical nephrectomy in a LVAD patient in the Southern Hemisphere. We bring forth primary issues around the procedure in this patient context, as well as discuss the strategies involved in maintenance of adequate anticoagulation, labile haemodynamics and their interaction with anaesthesia, and the benefits and risks of a laparoscopic versus open approach to nephrectomy.

## INTRODUCTION

Left ventricular assist devices (LVADs) are becoming increasingly resourceful tools in the treatment of medically refractory end-stage heart failure, with current devices utilised for bridge-to-recovery<sup>1</sup>, bridge-to-transplantation<sup>2</sup> and destination therapies<sup>3</sup>. These devices have been shown to provide a survival benefit, an increase in functional status and an improvement in quality of life<sup>4</sup>.

Non-cardiac surgery in patients with LVADs requires careful co-ordination and surveillance due to complications from the need for adequate anticoagulation, labile haemodynamics and device positioning. These obstacles present a unique challenge for the surgeon and thus require a multi-modal collaborative approach with anaesthetic and cardiac teams<sup>5</sup>.

Although there are documented cases of radical<sup>5</sup> and partial nephrectomies<sup>6</sup> in LVAD patients in the literature; in this case study, we present, to our knowledge, the first documented case of open radical nephrectomy in an LVAD patient in the Southern Hemisphere.

## CASE REPORT

A 62 year old male underwent an open left nephrectomy for a biopsy-proven left lower pole renal cell carcinoma (RCC) discovered during work-up for a heart transplant, which was

indicated for end-stage heart failure secondary to severe ischaemic cardiomyopathy.

One year previously the patient had suffered a massive anterolateral myocardial infarction with pulseless arrest. The coronary angiogram revealed a 100% ostial left anterior descending occlusion requiring percutaneous intervention together with a period of support from intra-aortic balloon pump (IABP) counterpulsation. Follow-up transthoracic echocardiography showed left ventricular akinesis and severe systolic impairment with a left ventricular ejection fraction of 20-30%. The patient was subsequently placed on the cardiac transplant recipient list.

Following this, a 1cm left lower pole renal mass was discovered incidentally during workup for transplantation, was biopsied and proven to be a RCC. As active malignancy is a contra-indication to heart transplant, definitive treatment of the RCC was necessary to satisfy recipient eligibility criteria, and the decision was made to remove the lesion.

Due to intractable symptomatic heart failure requiring multiple admissions and the need to improve cardiac status pre-nephrectomy, a LVAD (Heartware Device) was implanted prior to surgery.

Post LVAD implantation, the patient had clinically improved with no evidence of oedema or orthopnoea, a

normal jugular venous pressure and clear lung fields on auscultation. Follow up transthoracic echocardiogram showed that the LVAD was functioning satisfactorily and review of the pump showed good function with flows of 5.6 litres per minute at 2500rpm.

#### Operative course

Following review by the multidisciplinary team including the cardiothoracic surgeon, urologist, cardiologist and anaesthetist, the patient was deemed to be maximally optimised for surgery given his co-morbidities.

A careful peri-operative anti-coagulation regimen was maintained. Clopidogrel and warfarin were ceased 4 days pre-operatively with a heparin infusion commenced as coverage. Aspirin was continued and then withheld on the day of surgery. Intravenous heparin was ceased 4 hours prior to surgery, and at the time of operation the APTT was 36 and INR 1.3.

The operation was performed in a cardiothoracic theatre with a cardiothoracic anaesthetist and a cardiothoracic surgeon on standby. A right radial arterial line and right internal jugular central line was placed. The patient was placed in the right lateral position and a left-sided supra-11th rib incision was used. The pleura was lifted and a small hole repaired during retroperitoneal dissection. The left kidney was mobilised, and the left adrenal gland spared. Three renal arteries were identified, ligated and cut with O-silk and Ligaclips, and the veins were stapled with an Endo GIA. The kidney was subsequently removed. Surgicell bolsters and Flo seal were applied generously to the renal bed and abdominal wall wound for meticulous haemostasis. A Blake drain was left in the renal bed. Estimated blood loss was 100mL, with a procedure time of approximately 150 minutes. Anaesthetic course was unremarkable, with the patient remaining haemodynamically stable throughout the case with an average mean arterial pressure of 80mmHg and VAD flows maintained at 4.3-4.5 litres per minute.

#### Post-operative recovery

Heparin and warfarin was restarted 4- and 24-hours post-operatively, respectively.

Post-operatively, there was a significant drop in haemoglobin from 134 g/L to 75 g/L, with significant wound ooze and left abdominal wall bruising noted. The patient, however, remained asymptomatic. Abdominal CT day-3 post-operatively revealed extensive left lateral abdominal

wall haematoma underlying the wound and surrounding the drain insertion site measuring 165 x 44 x 65mm [Figure 1]. A further collection posterior to the spleen, measuring 82 W x 23L x 66 H, was also identified.

#### Figure 1

Abdominal CT day-3 post-operatively revealed extensive left lateral abdominal wall haematoma measuring 165 x 44 x 65mm.



These were both likely due to venous ooze in the setting of an INR of 2.9. Bleeding was managed conservatively with compression dressings. Drain output was minimal and the drain was removed day-5 post-operatively.

Follow up CT performed on day-6 for complaint of abdominal distension showed interval improvement in the haematomas. Clopidogrel was restarted 7 days postoperatively.

Pathological evaluation identified a 13 x 10 x 6mm clear cell RCC with peri-nephric fat invasion (Fuhrman grade 2; T3aN0M0), excised with clear margins.

The patient was subsequently discharged day-15 post-operatively. Creatinine preoperatively was 109 umol/L with an estimated glomerular filtration rate (eGFR) of 60 mL/min/BSAc. Post operatively this stabilised at a creatinine of 165 umol/L with eGFR of 37 mL/min/BSAc at 6 week follow up.

#### DISCUSSION

This case presents a unique challenge to an otherwise routine surgical procedure, given the employment of a LVAD and the risks associated with it.

Due to the biologically inert composition of the LVAD lining, contact with moving blood results in pro-coagulatory

events, with platelet activation occurring in response to contact with the device<sup>7, 8</sup>. The significantly increased risk of thrombo-embolic disease necessitates anti-coagulation in persons with these implants. This need for strict anti-coagulation complicates surgical intervention, and in some cases, can lead to a deviation from standard management in comparison to patients without assist devices.

An open incision was performed in place of a laparoscopic approach, the rationale being that the laparoscopic approach decreases cardiac output through the induction of a pneumoperitoneum, which poses an increased risk in a patient with augmented cardiac support. Furthermore, the open approach provided ease of access to the renal hilum, shorter operating time<sup>9</sup>, and lower level of technical difficulty<sup>10</sup> in the setting of anticoagulation and high anaesthetic risk. Despite an overall lower risk of complications<sup>11</sup>, a laparoscopic approach has a higher failure-to-rescue rate<sup>11</sup> with an increase in operating time.

The disadvantages of the open approach are larger incision which is associated with longer post-operative recovery and risk of developing abdominal wall bleeding once full anti-coagulation is restarted<sup>12</sup>. Unfortunately, this complication was seen in this case despite meticulous haemostasis with the application Flo Seal and Surgicell.

Despite similar oncological outcomes and reduced over-all mortality with partial nephrectomy<sup>13</sup>, a radical nephrectomy was performed in this case based on the theoretical risk of bleeding from the resection margin in the setting of early reinitiation of anticoagulation. Particularly in the setting of potential transplantation a nephron sparing approach would have been ideal, but this option was deemed to be too high risk given the need for continuous aggressive anticoagulation to minimise thrombotic complications in the setting of continuous-flow LVAD implantation.

Given that malignancy is a contraindication for cardiac transplantation, surgical intervention is increasingly being used in these patients with LVADs. This case highlights the issues surrounding surgery in these patients, including the importance of a coordinated multidisciplinary team approach and the need for careful haemodynamic monitoring and strict anticoagulation control in the pre-operative, peri-operative and post-operative periods.

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