

## CASE REPORT

# Combined coronary artery bypass graft and liver/kidney transplantation in a liver failure patient with acute on chronic kidney failure and antiphospholipid syndrome

Emily Lin<sup>1</sup>  | Charles Bratton<sup>2</sup> | Minh-Tri Nguyen<sup>2</sup>  | Joshua Chung<sup>3</sup> | Michael De Vera<sup>2</sup> | Mina Rakoski<sup>1,4</sup>

<sup>1</sup>Department of Medicine, Loma Linda University Medical Center, Loma Linda, California

<sup>2</sup>Department of Transplant Surgery, Loma Linda University Health, Loma Linda, California

<sup>3</sup>Department of Cardiothoracic Surgery, Loma Linda University Health, Loma Linda, California

<sup>4</sup>Transplantation Institute, Loma Linda University Health, Loma Linda, California

## Correspondence

Mina O. Rakoski, MD, Loma Linda University Health, Transplant Institute, 197 East Caroline St, Ste 1400, San Bernardino, CA 92408, USA.  
Email: [mrakoski@llu.edu](mailto:mrakoski@llu.edu)

Coexisting coronary artery disease (CAD), end-stage liver disease (ESLD), renal failure, and hypercoagulable state poses a formidable clinical challenge. Here, we discuss the first known case of a patient with antiphospholipid syndrome (APLS), ESLD complicated by hepatorenal syndrome (HRS), and severe CAD who successfully underwent combined coronary artery bypass grafting (CABG) and simultaneous liver/kidney (SLK) transplant.

## 1 | CASE REPORT

A 63-year-old female with histologically proven autoimmune hepatitis (AIH), antiphospholipid syndrome (APLS), prior femoral deep vein thrombosis (DVT), and chronic kidney disease stage III presented to an outside hospital with decompensated AIH. She was found to have large volume ascites requiring paracentesis, fluid overload requiring bilevel positive airway pressure support, and acute on chronic renal failure secondary to HRS requiring renal replacement therapy. Imaging also revealed partially occlusive porto-splenic venous thrombosis which was treated with heparin drip. The patient was transferred to our center's intensive care unit (ICU) for urgent liver/kidney transplant evaluation. Her model for end-stage liver disease

(MELD-Na) score was 41 (total bilirubin 24.8 mg/dl, INR 2.4, creatinine 3.8 mg/dl, Na 123 mmol/L) and Karnofsky score was 10.

Pretransplant cardiac risk assessment revealed an ejection fraction of 75–80% on echocardiogram, but severe quadruple vessel disease (stenoses: 60% left anterior descending [LAD], 70% circumflex, 70% obtuse marginal [OM], 100% right coronary) was found on left heart catheterization. Multidisciplinary discussion involving cardiology, cardiothoracic (CT) surgery, hematology, transplant hepatology, transplant nephrology, and transplant surgery deemed the patient a poor candidate for percutaneous coronary intervention (PCI) due to risk of in-stent thrombosis in the setting of APLS-mediated hypercoagulable state. Patient was also deemed to be at high risk of bleeding if on dual antiplatelet therapy (DAPT) post-stenting given

**Abbreviations:** AIH, autoimmune hepatitis; APLS, antiphospholipid syndrome; CABG, coronary artery bypass grafting; CAD, coronary artery disease; CIT, cold ischemic time; CPB, cardiopulmonary bypass; CT, cardiothoracic; DAPT, dual anti-platelet therapy; DSA, donor-specific antibodies; DVT, deep vein thrombosis; ESLD, end-stage liver disease; ESRD, end-stage renal disease; HRS, hepatorenal syndrome; ICU, intensive care unit; LAD, left anterior descending; MELD-Na, model for end-stage liver disease; MMF, mycophenolate mofetil; OLT, orthotopic liver transplantation; OM, obtuse marginal; PCI, percutaneous coronary intervention; POD, postoperative day; SLK, simultaneous liver/kidney.

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her decompensated liver disease. Decision was made to place the patient on the waitlist and proceed with combined sequential coronary artery bypass grafting (CABG) and simultaneous liver/kidney (SLK) transplant. CT surgery determined that the patient could safely undergo CABG and be weaned off cardiopulmonary bypass (CPB) prior to transplant. Patient was made aware that a significant complication post-CABG would preclude our team from moving forward with liver and kidney transplantation.

An ABO-compatible liver/kidney offer from an 18-year-old deceased donor became available. MELD-Na at the time of surgery was 46. Once the donor was cross-clamped and liver was deemed satisfactory, the patient was brought to the operating room. The patient underwent CABG × 3 (left internal mammary artery graft to LAD artery, saphenous vein graft to OM 2 artery, saphenous vein graft to posterior descending artery) under CPB with standard heparin dosing. She was weaned off CPB at the end of the case and intraoperative echocardiogram demonstrated good biventricular function. Orthotopic liver transplant (OLT) was then performed using piggyback technique with 9.2-h cold ischemic time (CIT). The patient was transferred to ICU after chest and abdomen closure for hemodynamic optimization. Postoperative liver Doppler ultrasound showed patent hepatic vasculature. She subsequently underwent kidney transplantation later that same day with 24.4-h CIT.

The patient was extubated on postoperative day (POD) one. Basilixumab immunosuppression was followed by mycophenolate mofetil, tacrolimus, and steroids. Home rivaroxaban was restarted on POD 7. Postoperative course was complicated by poor oral intake requiring gastrostomy feeding tube placement and biliary anastomotic stricture and low-grade cholangitis requiring biliary stent placement and antibiotics. She was discharged on POD 56 with labs demonstrating Na 136 mmol/L, BUN 39 mg/dl, creatinine 1.1 mg/dl, total bilirubin 0.5 mg/dl, and INR 1.2.

One year postoperatively, the patient is back to baseline functional status. She is fully independent with ECOG 0 and remains clinically well. Endobiliary stents were removed at 1 year post-transplant and patient continues to demonstrate normal cardiac and allograft function (Na 142 mmol/L, BUN 21 mg/dl, creatinine 0.97 mg/dl, total bilirubin 0.5 mg/dl, INR 1.2).

## 2 | DISCUSSION

Our case highlights two unique areas of uncertainty with SLK transplantation—1. the presence of significant CAD and 2. APLS-mediated hypercoagulable state at the time of transplant. Performing cardiac surgery on patients with coexisting CAD and ESKD is a high-risk endeavor with mortality rates as high as 68% among patients with Child C cirrhosis.<sup>1</sup> ESKD patients often present with coagulopathy, thrombocytopenia, and renal failure which contribute to poor surgical outcomes. ESKD patients also have low systemic vascular resistance which may compromise myocardial reperfusion in those undergoing cardiac surgery.<sup>2</sup> Conversely, uncorrected CAD may jeopardize outcomes in patients undergoing organ transplant due to

the risk of perioperative myocardial infarction and inadequate forward flow to newly grafted organs.<sup>3</sup>

Despite these risks, combined transplant and cardiac surgery may be warranted in certain cases, particularly if optimization of cardiac function with medical or catheter-based intervention is not feasible. One case series demonstrated that patients undergoing combined CABG-OLT had an average graft and patient survival rate of 80% at 2-year follow-up, though patients included in that study had lower MELD-Na scores than our patient (range 9–31).<sup>4</sup> Studies have also shown that patients undergoing simultaneous open-heart surgery and kidney transplant have similar morbidity and mortality rates compared to those who delay transplant until after cardiac surgery.<sup>5</sup> Notably, there have been two reported cases of successful combined cardiac surgery with SLK transplantation, though both involved aortic valve replacement as opposed to CABG.<sup>3</sup>

Another noteworthy aspect of our case relates to the patient's APLS-mediated hypercoagulable state. In one meta-analysis, researchers revealed a higher prevalence of thrombotic complications in AIH patients when antiphospholipid antibody was present, though these results were largely based on case reports.<sup>6</sup> The most common hepatic manifestation in APLS patients is porto-splenic venous thrombosis, which has been documented in limited case studies.<sup>7,8</sup> Of these cases, most are adequately treated with anticoagulation or transjugular intrahepatic portosystemic shunt.<sup>9</sup> Only those with clinical manifestations of cirrhosis are ultimately listed for transplant, which was the case for our patient.

While PCI is often used for CAD in the pretransplant setting, our patient was at high risk of in-stent restenosis given her APLS-mediated hypercoagulable state. At the same time, her underlying coagulopathy put her at risk of pre- and perioperative rebleeding with DAPT. Furthermore, given her high MELD-Na score and need for urgent transplant, the decision was made that delaying surgery until after the full 6 months of DAPT therapy recommended for elective noncardiac cases was not an option. While open-heart surgery indeed confers a greater degree of risk compared to PCI,<sup>10,11</sup> urgent CABG-SLK was deemed the best option in our patient's case, and she underwent all three operations successfully.

The logistics of organizing an open-heart procedure followed by SLK transplant was challenging, so coordination between teams was crucial. Once the patient was listed, the surgeons discussed the logistics of the case and committed to scheduling flexibility to prioritize the case when donor organs became available. Anesthesia teams and OR staff were also given notice about the logistics of the case—CABG was to be immediately followed by liver transplant then kidney transplant. Planning also took into consideration donor details and logistics. Fortunately, organs from an 18-year-old donor with kidney donor profile index of 8 were allocated to our patient, ensuring that slightly longer CIT would be tolerated. A backup liver patient was also in-house in case complications from the CABG precluded SLK transplantation.

Overall, patients presenting with significant CAD and liver/kidney failure require multidisciplinary preoperative evaluation. Our case highlights that despite high perioperative risk, combined CABG and SLK

transplantation can be successfully performed in a dialysis-dependent patient with MELD > 40 and underlying hypercoagulable state.

## DISCLOSURE

The authors of this manuscript have no conflicts of interest to disclose as described by the *American Journal of Transplantation*.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## ORCID

Emily Lin  <https://orcid.org/0000-0002-5326-2886>

Minh-Tri Nguyen  <https://orcid.org/0000-0002-1093-5956>

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