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Case Report: Perioperative Management of Combined Coronary Artery Bypass Grafting, Liver and Kidney Transplantation in a Patient With Antiphospholipid Syndrome

Samantha H. Garvanovic, MD,¹ Andrew H. Taniguchi, MD,¹ Uoo R. Kim, MD,¹ and Carin R. Mascetti, MD²

Coronary artery disease (CAD) is not uncommon in end-stage liver disease (ESLD). For patients with liver disease who are not candidates for angioplasty, coronary artery bypass grafting (CABG) alone may precipitate hepatic decompensation. A simultaneous CABG and orthotopic liver transplantation (OLT) may be indicated in the setting of high-risk coronary lesions with preserved heart function and advanced liver disease.¹ CABG-OLT reports are limited in the literature, and few cases describe cardiac or transplant surgeries individually in patients with antiphospholipid syndrome (APS). This case report is the first to discuss the perioperative considerations and management of simultaneous CABG-OLT, followed by a deceased donor kidney transplant (DDKT) in a patient with APS.

CASE DESCRIPTION

A 62-y-old female with ESLD due to autoimmune hepatitis was transferred to our tertiary care facility for OLT evaluation. Her medical history included multivessel CAD, stage III chronic kidney disease, and APS with a remote history of lower extremity deep vein thrombosis, for which

she was taking rivaroxaban. Her model for end-stage liver disease score was 28.

The patient initially presented to an outside hospital with abdominal pain. She received spontaneous bacterial peritonitis prophylaxis and underwent therapeutic paracentesis. She was found to have partially occlusive portal and splenic vein thromboses in the setting of interrupted anticoagulation, and a heparin infusion was started. Following transfer, heparin was intermittently held for bleeding and for procedures, and adjusted according to anti-Xa levels. Hematology recommended no additional anticoagulation, as the bleeding risk outweighed the risk of thrombosis, given her elevated international normalized ratio and severe thrombocytopenia.

Pretransplant evaluation revealed severe multivessel disease with >50% stenosis in 4 coronary arteries but normal cardiac function. Cardiology advocated against angioplasty as she was unlikely to tolerate antiplatelet therapy. Worsening kidney function related to hepatorenal syndrome resulted in continuous renal replacement therapy. After a multidisciplinary review, the patient was listed for CABG-OLT and subsequent DDKT.

A deceased brain death donor organ was available 6 d after transplant listing. Heparin was stopped and the patient received 4 units of fresh frozen plasma (FFP) for anticipated paracentesis, but she was taken to the operating room (OR) for CABG-OLT instead.

She arrived to the OR with the following lines: left internal jugular (IJ) triple lumen central line, left radial arterial line, and right femoral dialysis catheter. The left IJ catheter was replaced with a larger 9 French single lumen catheter for rapid transfusion. An 8.5 French double lumen catheter was placed in the right IJ to float a pulmonary artery catheter. The hemodialysis line was removed in anticipation of kidney transplant, and the left femoral artery was cannulated for additional hemodynamic monitoring. Despite mixed views on femoral artery cannulation, we find it beneficial on occasions when radial blood pressure measurements become unreliable. A transesophageal echocardiography probe was placed.

Before incision, 2 units of platelets were given, a 10-gram bolus of aminocaproic acid was administered, and a tranexamic acid (TXA) infusion was started at 2 mg/kg/h. The cardiopulmonary bypass (CPB) pump was primed with 4 units of FFP. Initiation of bypass was preceded by a decreased dose of heparin (< 300 units/kg), resulting in activated clotting time (ACT) > 500. ACT was monitored, and additional heparin was given by the perfusionist as needed.

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¹ Department of Anesthesiology, Loma Linda University Medical Center, Loma Linda, CA.

² Department of Anesthesiology, Saint Bernardine Medical Center, San Bernardino, CA.

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Correspondence: Samantha H. Garvanovic, MD, Department of Anesthesiology, Loma Linda University Medical Center, 11234 Anderson St, PO Box 933, Loma Linda, CA 92354. (sgarvanovic@llu.edu).

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A 3-vessel CABG was performed with a CPB duration of 90 min. The patient was weaned from bypass on a vasopressin infusion. Shortly after CPB the radial arterial line waveform dampened. Thus, the femoral arterial line was used for hemodynamic monitoring. Heparin was reversed with 75 mg of protamine. Point-of-care Quantra hemostasis analysis guided blood product administration. In total, the patient received 4 packed red blood cells (pRBCs), 6 FFP, 4 platelets, 440 mL of cell saver, and 1 unit cryoprecipitate to achieve hemostasis. The chest remained open to monitor for bleeding and to decrease donor organ ischemia time.

Transplant surgery followed. TXA was discontinued as there was no significant bleeding. Anhepatic time was 40 min, using piggyback method. Vasopressors were titrated to maintain mean arterial pressure > 65 mmHg and reperfusion was uneventful. Thromboelastography guided blood product administration, with an additional 4 pRBCs, 2 FFP, 2 platelets, 1 unit cryoprecipitate, and 125 mL of cell saver given. The chest and abdomen were inspected for hemostasis and closed. The patient remained intubated and was transported to the intensive care unit (ICU) on norepinephrine 2 µg/min and vasopressin 0.04 units/min.

She returned to the OR within 8 h of OLT for DDKT, intubated and on norepinephrine at 2 µg/min. The left femoral arterial line was removed for placement of a left kidney graft. One pRBC was transfused. Again, the patient remained intubated and was transferred to ICU on low-dose norepinephrine.

She was extubated on postoperative day (POD) 1. Rivaroxaban was restarted on POD 2. She was downgraded from ICU on POD 4. Her hospital course was complicated by biliary stricture requiring sphincterotomy and common bile duct stent placement. She was discharged to acute rehabilitation on POD 44. Her ICU and hospital length of stay were similar to other CABG-OLT cases reporting a mean ICU stay of 10 d and an overall length of stay ranging 7 to 59 d.¹

The patient was readmitted 6 d after discharge for respiratory distress due to bilateral pleural effusions. Rivaroxaban was held for procedures including thoracentesis and chest tube placement. Subsequent ultrasound revealed a deep vein thrombosis of the left great saphenous vein. A therapeutic heparin drip was started and titrated until chest tube removal. Hematology advocated for warfarin before discharge but also made dose recommendations should a direct-acting oral anticoagulant be continued. Eight months later the patient has good allograft function and no recurrent thromboses on apixaban.

DISCUSSION

This case report represents the first CABG-OLT performed at our institution. It adds to the literature by discussing the perioperative management of the first reported CABG-OLT and DDKT performed in a patient with APS.

Pretransplantation work-up is crucial in identifying high-risk patients. Angiographic multivessel CAD is associated with higher mortality after OLT.² If a patient is amenable to angioplasty, postintervention anticoagulation may delay transplant. Alternatively, a CABG alone may exacerbate hepatic dysfunction. Thus, patients with ESLD may be considered for CABG-OLT in the setting of multivessel CAD with preserved left heart function, who are not candidates for angioplasty, and would otherwise be denied OLT.¹

Combining cardiac surgery with OLT increases the risk of fibrinolysis and bleeding.³ However, APS is a rare condition characterized by arterial and venous thromboses resulting from autoantibodies against phospholipid-protein complexes.^{4,5} There is no consensus on optimal perioperative anticoagulation in APS.⁴⁻⁶ Therefore, decisions regarding anticoagulation are critical to balance the risk of bleeding and thrombosis and should be discussed with hematology.

Preoperative anticoagulation consisted of a heparin infusion given this patient's recent thrombosis. Unlike activated partial thromboplastin time and ACT, anti-Xa is unaffected by APS antibodies and is considered the gold standard for heparin monitoring.⁵ Although we did not perform preoperative heparin-celite ACT titration curve testing, it should be considered to provide a target ACT for CPB.⁵

Aminocaproic acid and TXA were used during CABG to decrease the risk of fibrinolysis.⁷ Both also significantly reduce intraoperative pRBC administration in OLT, with a similar risk for thromboembolic events.⁸ In the absence of significant bleeding, we stopped TXA after CABG to reduce the risk of thrombus formation. Studies using TXA in OLT have administered it at higher doses of 10 mg/kg/h and for a longer duration—until portal vein unclamping or for the entire case—with no significant difference in venous thrombosis.⁸ These studies were not performed in patients with APS, however.

One of the most serious complications of OLT is hepatic artery thrombosis, and patients with coagulation disorders are at increased risk.⁹ As the donor hepatic artery is directly flushed with heparinized saline before and after an uncomplicated anastomosis, systemic anticoagulation was not given during transplant to minimize the risk for bleeding. Immediate postoperative ultrasound is routinely performed to evaluate graft blood flow and aid in the early detection and treatment of hepatic artery thrombosis.

Although long-term warfarin is recommended in APS patients with a history of thrombosis, alternative agents should be considered in transplant recipients.¹⁰ Liver and kidney transplant patients receiving postoperative warfarin are at increased risk of bleeding complications when compared with direct-acting oral anticoagulants.^{11,12} However, these studies were not performed in patients with APS. Given the limited data in this specific population, our patient was restarted on rivaroxaban postoperatively as it does not require blood monitoring, has fewer dietary and drug interactions, and was previously tolerated.¹⁰ Although it is unclear why rivaroxaban was later changed to apixaban, in patients without APS, there is evidence of less bleeding events and similar rates of recurrent thromboembolism with apixaban.¹³

In conclusion, CABG-OLT should be offered to patients with severe CAD, who meet criteria, and whose cardiac risk factors would otherwise preclude them from receiving OLT.¹ Multiple case reports, including ours, demonstrate that combined CABG-OLT can be performed safely with proper patient selection and interdisciplinary coordination. We hope this report assists in developing strategies for managing CABG-OLT patients as well as patients with APS undergoing other complex surgeries.

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