This case report describes the perioperative care of two adult patients undergoing surgery for congenital heart disease with chronic renal transplant dysfunction. Careful attention to antirejection medication, line placement, conduct of bypass, renal protective medication, and potential need for postoperative hemodialysis is critical for minimizing morbidity and preserving renal allograft function.

Introduction

The number of people who have undergone renal transplantation in the United States continues to grow. These patients may also require surgery for congenital heart disease, including adult congenital heart disease. Renal transplant recipients who undergo cardiac surgery are at risk for infection, impairment of renal function due to cardiopulmonary bypass, and rejection. In fact, the in-hospital mortality of patients with previous renal transplant undergoing cardiac valve replacement is reported to range from 14%-28.6% [1]. Careful preoperative planning and perioperative management with input from the nephrology service is critical to ensure the best outcome for both the heart and the renal allograft [2]. We present the cases of two adult patients with chronic renal allograft impairment who required surgery for congenital heart disease and the strategies used to protect their allografts.

Case 1:

Patient A is a 47 year old, 65.4 kg male with a history of tetralogy of Fallot (s/p repair), severe mitral regurgitation, moderate aortic regurgitation with ascending aortic and root dilation, paroxysmal atrial fibrillation, lysosomal storage disease, renal transplant and obstructive sleep apnea. He received a classic Blalock-Taussig shunt at the age of 6 months and had a complete repair of his tetralogy of Fallot at the age of 5 years. He had recently been complaining of fatigue and increased pedal edema. He had received a renal transplant from a living donor 10 years prior to his presentation for surgery. He had some chronic renal allograft dysfunction, and his preoperative creatinine was 2.1 mg/dL. The patient was taking cyclosporine A 25 mg every 12 hours.

The plan for renal allograft protection included continuation of cyclosporine A at a dose of 25mg Q12 hours, maintenance of a mean arterial pressure (MAP) of 60-70 mmHg on cardiopulmonary bypass with flows of 2.4 L/min/m2, fenoldopam infusion at 0.03-0.07 mcg/kg/min, close monitoring of urine output, and placement of a temporary hemodialysis catheter, if needed. Continuous ultrafiltration was used on bypass.

The patient underwent a graft replacement of the aortic root and ascending aorta with a 29 mm St. Jude Medical (St. Jude Medical, St. Paul, Minnesota) mechanical composite graft, a mitral valve
replacement with a 33 mm St. Jude Medical mechanical prosthesis, and a modified cryo-maze for his atrial fibrillation. Aortic crossclamp time was 275 minutes, and the time spent on cardiopulmonary bypass was 321 minutes.

The patient weaned from bypass on epinephrine, fenoldopam, and nitroglycerine, and his intraoperative urine output was 244 mL. His baseline creatinine and creatinine throughout his hospitalization is shown in Figure 1. Postoperative hemodialysis was not required. He left the hospital on postoperative day 13 with a creatinine of 1.35 mg/dL.

Case 2:

Patient B is a 28 year old, 30.4 kg female with a history of spondyloepiphyseal dysplasia, hypertension, and living donor renal transplant. She was transferred to our hospital after a hypertensive crisis and subsequent diagnosis of severe aortic stenosis and severe aortic insufficiency. A renal transplant had been performed when the patient was 10 years old for ESRD due to focal segmental glomerular sclerosis. She had chronic allograft dysfunction with a creatinine of 2.81 mg/dL on admission to our hospital. She was prescribed tacrolimus 2 mg QAM and 1.5 mg QHS and prednisone 5 mg QD as her antirejection regimen, and she had been having issues with hyperkalemia since admission.

The plan for management of the renal allograft included continuation of antirejection medicines. A tacrolimus infusion was initiated at the start of bypass and was titrate based on blood levels. Our normal steroid regimen of methylprednisolone 20 mg/kg was given after induction with a dose of hydrocortisone of 100 mg/m2 before separation from cardiopulmonary bypass. We also planned to maintain a MAP of 60-70 on CPB with flows of 2.4 L/min/m2 and to deliver a fenoldopam infusion at 0.05 mcg/kg/min. Continuous ultrafiltration was used. We also planned to place a temporary hemodialysis at the end of the case, if warranted.

The patient underwent aortic valve replacement with a 19 mm St Jude Medical HP mechanical valve, a Konno aortoventriculoplasty, and a posterior annular enlargement with autologous pericardial patch. Aortic crossclamp time was 186 minutes, and the time spent on cardiopulmonary bypass was 273 minutes.

The patient weaned from cardiopulmonary bypass uneventfully and transported to the CVICU on fenoldopam and esmolol, and the intraoperative urine output was 1130 mL. Due to the generous urine output, we elected not to place a temporary hemodialysis catheter, and fortunately, postoperative hemodialysis was not required. She left the hospital on postoperative day 12 with a creatinine of 1.55 mg/dL (Figure 1).

Discussion

Antirejection Medications:

The continuation of antirejection medications in the perioperative period is critical. Knowledge of the preoperative antirejection regimen and discussion with the patientâ€™s nephrologist about how to handle dosing intraoperatively and postoperatively should take place before surgery. Conversion from oral to intravenous dosing should be considered, and plans should be made for checking drug levels and adjusting doses as needed. Care should also be taken to continue steroid medications intraoperatively.
The renal allograft is placed in the pelvis, and usually anastomosed to the external iliac artery and vein. (Figure 2) It is critical to know the location of the transplanted kidney. Vascular access should be avoided on the side with the allograft. In addition, if emergency femoral cannulation for bypass is a possibility, it should be done on the opposite side to avoid arterial or venous obstruction to the allograft.

Conduct of Bypass:

Our institutional practice in patients over 10 years of age is to use a bypass flow of 2.4 L/min/m2. We use continuous ultrafiltration while on bypass. Mannitol was added to the cardioplegia solution, as is our normal practice, and care was take to avoid acidemia. We added packed red blood cells to the bypass pump as needed to maintain a hematocrit of 30% in order to optimize oxygen delivery.

Renal Protective Medication:

In these cases, we used a continuous infusion of fenoldopam that was initiated on bypass and continued postoperatively. Fenoldopam is a selective dopamine 1 (DA1) receptor agonist. It induces vasodilation of the renal and mesenteric arteries. Fenoldopam is also natriuretic due to DA1 effects on the proximal convoluted tubule. Although it is promoted for the prevention and therapy for acute kidney injury in cardiac surgery, a recent randomized clinical trial (RCT) concluded that fenoldopam infusion did not reduce the need for renal replacement therapy or risk of 30-day mortality in patients with AKI after cardiac surgery. This study also found that the infusion was associated with an increased rate of hypotension.

Although the use of fenoldopam for renal protection in cardiac surgery is controversial, with the most recent data suggesting that its use does not help reduce the need for RRT, we felt that its use during our cases would be of potential benefit. In addition, the use of fenoldopam has not been described in the population with a renal allograft. The infusion range that we used was 0.03-0.07 mcg/kg/min which was substantially lower than that used in the recent RCT.

Other medications that can be potentially helpful in prevention and treatment of AKI in cardiac surgery include aspirin, statins, antioxidants (N-acetylcysteine), diuretics, and erythropoietin.

Hemodialysis Access:

The need for postoperative renal replacement therapy (RRT) should be considered preoperatively. Appropriate catheters should be obtained. In our cases, we elected not to place a hemodialysis catheter. Both patients were left intubated at the end of the case, and we felt that we could easily place the catheter in the ICU postoperatively. In Case 2, the intraoperative urine output was very encouraging, which supported this decision.

Conclusion

Impaired renal function and acute kidney injury are known complications of cardiac surgery. Perioperative strategies for renal protection are described and some continue to be controversial. Patients who have had a kidney transplant and may have allograft dysfunction are at a high risk of perioperative morbidity and mortality, and an increased risk of future allograft failure. We describe the perioperative management of two patients with previous renal transplant with renal
allograft dysfunction who required surgery for their adult congenital heart disease. We maintain that preoperative planning and preparation are critical for arranging the best outcome possible for both the cardiac disease and the precious renal allograft.

References

