Case Report

Redo Cardiac Surgery in a Patient with Severe Peripheral Vascular Disease and Pericardial Adhesions Using Subclavian Arterial Cannulation and Port-Access Technology

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ABSTRACT

Patients viewed as conventionally inoperative candidates are now given alternative surgical choices. The ability to provide new technology such as the port-access minimally invasive approach, kinetic venous assist, and specialized cannulae have made this possible. This case report discusses the ability to apply and modify this new technology to provide a successful surgical outcome in a patient with severe peripheral vascular disease and dense mediastinal adhesions.

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INTRODUCTION

Patients with a history of multiple open heart surgeries present a challenging scenario for the surgical team. The likelihood of surgical complications increases with each additional surgery. Reoperative complications such as sternal infection, pericarditis, and life-threatening situations such as cardiac injury during redo sternotomy must be considered. The presence of peripheral vascular disease is very ominous in terms of cannulation choices and may frequently render a patient inoperable. With the advent of minimally invasive heart surgery, specialized cannulae, and port-access technology (1), there may now be options that allow operation in many of these patients.

CASE REPORT

The patient was a 77 year old male, 68 in tall and 72 kg in weight. The calculated body surface area was 1.84 m². Of interest, this was the patient’s fourth hospital admission for open heart surgery. Shortness of breath and fatigue hospitalized the patient 4 years and 1 month prior to this admission. Aortic valve replacement was performed for treatment of severe aortic valve stenosis. Two years later, he developed angina pectoris and required mitral annuloplasty with saphenous vein grafts to the right coronary artery and left anterior descending coronary arteries. In December 1997, exactly 4 years after his first surgery, the patient presented with severe congestive heart failure secondary to recurrent mitral insufficiency. Both vein grafts were patent. Mitral valve replacement was abandoned when severely dense calcified mediastinal and pericardial adhesions were found. The chest was closed and the patient was discharged home following an uneventful postoperative course.

One month after his discharge, the patient remained severely symptomatic and was scheduled for port-access mitral valve replacement. It was determined that port-access would be an ideal approach to the left atrium via a small right anterior thoracotomy utilizing femoral artery cannulation. This would obviate the need to dissect the pericardial adhesions. The endoaortic clamp, manufactured by Heartport Inc.*, allows occlusion of the ascending aorta and delivery of antegrade cardioplegia without applying a cross clamp to the aorta. The following components were used to construct the perfusion circuit: a centrifugal pump, a hollow-fiber membrane oxygenator*, a venous reservoir bag, an arterial line filter, an additional centrifugal pump to provide kinetic assisted venous drainage (2), an aortic vent line, a pulmonary vent line, and a general pump suction. A 4:1 blood:crystalloid cardioplegia system was used to deliver warm antegrade blood cardioplegia. The pump circuit was primed with 1800 ml balanced electrolyte solution, 1 unit packed red cells, 100 ml 25% albumin, 100 ml mannitol, and 7000 IU heparin.

The patient was anesthetized and prepped for surgery. Right and left radial arterial lines were placed. The patient’s right jugular area was prepped and an endopulmonary vent cannula* was inserted percutaneously under fluoroscopic control. Scarring around the coronary sinus from previous surgeries prevented the insertion of the endocoronary sinus catheter. Through a left groin incision, a 28 Fr endovenous drainage cannula* was inserted via the femoral vein and positioned in the inferior vena cava and right atrium. An attempt to place a 21 Fr endoaortic return cannula into the femoral artery was not successful due to severe plaque in the external iliac artery. Therefore, the right subclavian artery was selected for the arterial return site. A 16 Fr arterial cannula* was directed into the distal arch by fluoroscopy. Test flows were satisfactory.

The iliac stenosis also created difficulty in retrograde passage of the endoaortic clamp*. Percutaneous balloon angioplasty with a 6 mm x 10 cm balloon allowed the successful insertion of the endoaortic clamp into the ascending aorta with correct placement confirmed via fluoroscopy. Cardiopulmonary bypass was initiated in accordance with Heartport protocol (3). Mitral valve replacement was accomplished through a small right anterior thoracotomy. After 3 hours, the endoaortic clamp was deflated and the patient spontaneously converted to normal sinus rhythm. The patient was successfully weaned from cardiopulmonary bypass after 3 h 35 min. The patient awoke 6 hours after surgery, neurologically intact. He subsequently made an uneventful recovery and continues to be asymptomatic at the present time.

DISCUSSION

Cannulation of the subclavian artery and the use of the Heartport endopulmonary vent and endoartic clamp made this surgery possible. The construction of the circuit and perfusion technique were important. Incorporating a centrifugal pump in the circuit enabled the monitoring of flow resistance via the numerical flow readout, thus reducing the risk for aortic dissection. Systemic hypothermia allowed a decrease in systemic pump flow from an index of 2.4 L/min/m² to 1.5 L/min/m². This reduced flow provided adequate tissue perfusion, as documented by frequent arterial blood gas analysis. The Heartport technology of specialized cannulas, catheters, and instruments has made the port-access approach and the mini-thoracotomy possible. According to Spencer et al, benefits of port-access surgery include shorter overall recovery times of only 2 to 3 weeks, and patients are often discharged from the hospital within 2 to 4 days after surgery (4). Spencer feels that the minimally invasive or port-access approach to mitral valve surgery has irrevocably changed the options for surgically treating mitral valve disease.

By incorporating new technology and products to meet this...
patient’s surgical needs, the port-access system contributed to a successful surgical outcome for a patient who had been deemed inoperable 6 months earlier.

REFERENCES