Case Report

The Use of Retrograde Cerebral Perfusion in a Patient with Acute Ascending Aortic Dissection Following Elective Coronary Bypass Surgery: A Case Report.

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ABSTRACT

A 74 year old male patient presented with congestive heart failure and significant multivessel coronary artery disease. Following successful coronary artery bypass surgery, the patient developed an acute dissection of the ascending aorta. The patient was placed back on cardiopulmonary bypass and deep hypothermic circulatory arrest was instituted while the ascending aortic dissection was repaired. In an attempt to preserve brain tissue and decrease cerebral edema during hypothermic arrest, a modified form of retrograde cerebral perfusion was used. The patient tolerated the procedure and was weaned from cardiopulmonary bypass with the help of an intraaortic balloon pump. On the second postoperative day, the patient woke up and responded appropriately to verbal commands.

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INTRODUCTION

Cerebral protection during cardiac surgery with deep hypothermic circulatory arrest remains a challenge to the cardiac surgical team. Deep hypothermic circulatory arrest without retrograde cerebral perfusion and isolated partial cerebral antegrade perfusion is a technique that is commonly used but has many risks associated with it. (1-3). While deep hypothermic circulatory arrest provides a dry surgical field, cerebral preservation must be of prime concern. Canine studies have demonstrated that neurological compromise may appear if the cerebral ischemic period exceeds 60 minutes. (4). When retrograde cerebral perfusion is added to conventional hypothermic circulatory arrest, the risks of cerebral injury and embolization of air and particulate should decrease.

CASE REPORT

A 74 year old male patient presented with congestive heart failure and multivessel coronary artery disease. The patient was scheduled for elective coronary bypass surgery. The cardiopulmonary bypass circuit was prepared using a roller pump, a membrane oxygenator, a 4:1 blood cardioplegia system, a 40 micron arterial line filter, a custom tubing pack which included a 3/8 inch arterial roller head tubing, 3/8 inch arterial tubing and 1/2 inch venous tubing, and an in-line blood gas monitor. The patient was heparinized with 300 IU/kg of beef lung heparin. The patient was then cannulated using a 24 fr. arterial cannula and a 51:36 venous cannula. The patient was then placed on cardiopulmonary bypass in the usual fashion and the heart was arrested using a high potassium blood cardioplegic solution via both antegrade and retrograde delivery. During the cross clamp period the patient received low potassium retrograde cardioplegia in order to maintain cardiac arrest. The patient received five bypass grafts including four vein grafts and a left internal mammary graft. After completion of the operation, the patient was weaned from cardiopulmonary bypass without difficulty. The surgeon then placed a 22 fr. femoral cannula in the right femoral artery as well as the original cardioplegic cannula was reinserted and retrograde cardioplegia was administered to obtain cardiac arrest. While the patient was being cooled, the anesthesiologist placed ice bags around the patient’s head and administered 1 gram of sodium pentathol in an attempt to reduce cerebral edema. At this point retrograde cerebral perfusion was discussed. A 28 fr. right angle cannula was inserted into the superior vena cava. When a core temperature of 18°C was reached, the heart lung machine was turned off. A 3/8 in “y” type connector was cut into the arterial line at the surgical field. A sterile piece of 3/8 in tubing was obtained and connected to the 3/8 in connector near the femoral cannula. A tubing clamp was placed distal to the connector and forward flow was established through the tubing and an airless connection was made to the superior vena cava cannula. Retrograde cerebral perfusion was established using the patient’s central venous pressure as a guide to determine flow rate. The central venous pressure was maintained between 18 -25 mmHg with the flow ranging between 150-250 ml/min. The cerebral perfusate temperature was maintained at 18°C, which was the patient’s blood temperature. The retrograde cerebral perfusion period lasted the entire forty minutes of the arrest period. During this time a low potassium cardioplegic solution was infused continuously via a retrograde cardioplegic cannula in the coronary sinus. The cardioplegic solution temperature was maintained at 10°C. The aortic dissection was repaired using a synthetic patch graft. Following the aortic repair, the retrograde cardioplegia and retrograde cerebral perfusion were discontinued and the patient was placed back onto cardiopulmonary bypass and rewarmed to 37°C. The patient was then weaned in the usual fashion and all metabolic changes were corrected. The patient required intraaortic balloon counterpulsation to be successfully weaned from cardiopulmonary bypass. The circulatory arrest period lasted forty minutes. The cannulae were then removed by the surgeon. Protamine was administered by the anesthesiologist and hemostasis was achieved. The total cardiopulmonary bypass time was 192 minutes. The patient was transported to the intensive care unit in stable condition. The patient woke up on the second postoperative day and was responding to verbal commands.

DISCUSSION

Profound hypothermic circulatory arrest has been widely used in surgeries which involve the aorta and great vessels. A safe period of cerebral arrest in humans has not yet been clearly defined. Although many patients survive hypothermic circulatory arrest, there is a risk of neurologic compromise when these techniques are employed.

Retrograde cerebral perfusion techniques have been used since the early 1980’s. In 1980, Mills and Oschner documented the effectiveness of retrograde cerebral perfusion with hypothermia in the management of massive air embolism during cardiopulmonary bypass. (5).

Diffuse injury to the brain has been attributed to hypothermic circulatory arrest and may be the result of nonuniform cooling or embolization of air or microparticles. When retrograde...
cerebral perfusion is added to the technique of hypothermic circulatory arrest, the safe time limits of the surgery may be extended and many of the associated risks may be decreased.

REFERENCES


