นิพนธ์ต้นฉบับ

Result of coronary artery bypass surgery using cold blood cardioplegia technique for myocardial protection at Chulalongkorn Hospital

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Objective : *There were many techniques using for myocardial protection in coronary artery bypass surgery. Blood cardioplegia technique seems to be better than another techniques in many literatures. In our hospital, before 1995, crystalloid cardioplegia technique was used routinely for myocardial protection in coronary artery bypass surgery. Outcome of the patients were not satisfied us. Therefore,since 1995, aiming to improve the outcome, blood cardioplegia technique was adopted.*

Materials and Methods : *From January 1995 to September 1996, elective coronary artery bypass surgery with blood cardioplegia technique was underwent in 78 patients with age under 80 years old. All of the patients were operated under cardiopulmonary bypass with moderate hypothermia. Cold blood cardioplegia was infused through antegrade firstly and follow by retrograde route and saphenous vein graft later.*

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Result : *The mean age was 60.59 years old. Fifty-nine percent of the patients had ejection fraction (EF) more than 0.6 . Twenty-seven percent had EF between 0.4 to 0.59 and 14 percent had EF between 0.2 to 0.39. Thirty-seven patients (47%) had previous myocardial infarction. The mean total grafts was 3.27 grafts. The mean crossclamp time was 67.37 minutes and mean bypass time was 113.68 minutes. There were 3 patients (3.8%) need intra-aortic balloon pump for support and weaning from cardio-pulmonary bypass. All of the patients need dopamine less than 10 mcg/kg/min and adrenaline less than 0.1mcg/kg/min. After operation, atrial fibrillation occured in 12 patients (15.38%). Perioperative myocardial infarction occured in only one patient. Mortality rate was zero percent.*

Conclusion : *Myocardial protection during coronary artery bypass surgery with cold blood cardioplegia technique provide very good result.*

Key words : *Coronary artery bypass surgery, Cold blood cardioplegia, myocardial protection*

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วัตถุประสงค์ : *ได้มีการนำเทคนิคหลายอย่างมาใช้ในการป้องกันรักษาหัวใจ ระหว่างทำการผ่าตัดต่อเส้นเลือดหัวใจ เทคนิคที่ใช้ blood cardioplegia ดูเหมือนว่าจะดีกว่าวิธีอื่นๆ จากหลายๆ รายงาน ในโรงพยาบาลจุฬาลงกรณ์ ก่อนปี พ.ศ. 2538 ใช้ crystalloid cardioplegia ในการป้องกันรักษาหัวใจระหว่างทำการผ่าตัดต่อเส้นเลือดหัวใจแต่ผลยังไม่เป็นที่พอใจเท่าไรนัก ดังนั้นตั้งแต่ปี พ.ศ. 2538 เป็นต้นมา จึงได้มีการนำ blood cardioplegia มาใช้โดยมีวัตถุประสงค์ที่จะปรับปรุงผลการผ่าตัดให้ดีขึ้น*

วัสดุและวิธีการ : *ตั้งแต่เดือนมกราคม พ.ศ. 2538 ถึงเดือนกันยายน พ.ศ. 2539 มีผู้ป่วยตามนัด จำนวน 78 ราย ที่มีอายุน้อยกว่า 80 ปี ได้รับการผ่าตัดต่อเส้นเลือดหัวใจ โดยใช้ blood cardioplegia ในการป้องกันรักษาหัวใจระหว่างผ่าตัด ผู้ป่วยทุกคนได้รับการผ่าตัดโดยใช้เครื่องปอดหัวใจเทียมในภาวะอุณหภูมิต่ำปานกลาง โดยให้ cold blood cardioplegia ผ่านทางหลอดเลือดแดงใหญ่เป็นอันดับแรก และต่อด้วยการให้ย้อนทาง ทาง coronary sinus และท้ายที่สุดให้ผ่านทาง saphenous vein graft*

ผลการศึกษา : *อายุของผู้ป่วยเฉลี่ยเท่ากับ 60.59 ปี โดยมีผู้ป่วยที่มี ejection fraction (EF) มากว่า 0.6 เท่ากับ 59%. EF อยู่ระหว่าง 0.4 ถึง 0.59 เท่ากับ 27% และ EF อยู่ระหว่าง 0.2 ถึง 0.39 เท่ากับ 14% ในผู้ป่วยทั้งหมดนี้มี 47% ที่มีภาวะกล้ามเนื้อหัวใจตายมาก่อน จำนวนเส้นเลือดหัวใจที่ต่อเฉลี่ยเท่ากับ 3.27 เส้น ระยะเวลาที่หัวใจหยุดเต้นเฉลี่ยเท่ากับ 67.37 นาที และระยะเวลาที่ใช้ในการเดินเครื่องปอดหัวใจเทียมเท่ากับ 113.68 นาที มีผู้ป่วยจำนวน 3 ราย (คิดเป็น 3.8%) ที่จำเป็นต้องใช้ intra-aortic balloon pump ในการประคับประคองหัวใจและถอดผู้ป่วยออกจากเครื่องปอดหัวใจเทียม ผู้ป่วยทุกคนใช้ยา dopamine น้อยกว่า 10 ไมโครกรัม/กิโลกรัม/นาที และยา adrenaline น้อยกว่า 0.1 ไมโครกรัม/กิโลกรัม/นาที มีผู้ป่วย 12 ราย (15.38%) เกิด atrial fibrillation ภายหลังการผ่าตัด มีผู้ป่วยเพียงรายเดียวที่เกิดกล้ามเนื้อหัวใจตายระหว่างการทำผ่าตัด และไม่มีผู้ป่วยเสียชีวิตเลยแม้แต่รายเดียว*

สรุป : *การป้องกันรักษาหัวใจระหว่างการผ่าตัดเส้นเลือดหัวใจด้วย cold blood cardioplegia เป็นเทคนิคที่ได้ผลดีมากเทคนิคหนึ่ง*

The numbers of patients with coronary artery heart disease in our hospital has greatly increased since 1993. Coronary artery bypass surgery made up only 17% of the total pump cases (using heart-lung machines) in 1993 but this increased to 37% of the total pump cases in 1996. Many new techniques were applied during these operations, aiming to get the best result. Myocardial protection was one of the more important factors. There have been many techniques used for myocardial protection in coronary artery bypass surgery. The blood cardioplegia technique seems better than other techniques in many literature.[1-5] In our hospital, before 1995 the crystalloid cardioplegia technique was used for myocardial protection in coronary artery bypass surgery. This outcome were not satisfactory to us. Therefore, since 1995, and aiming to improve the outcome, the blood cardioplegia technique has been employed in our hospital.

Material and Methods

During January 1995 to September 1996, we had performed elective coronary artery bypass surgery in 78 patients. The patients who older than 80 years old, high risk age group were excluded from this study. The patients' age range from 40-79 years old. The mean age was 60.59 years old. The technique selected for myocardial protection in every patients was cold blood cardioplegia technique.

All of the patients were operated under cardiopulmonary bypass with moderate hypothermia. Arterial cannula was inserted in ascending aorta as high as possible and single two-stage venous cannula was inserted in right atrium. Retrograde cardioplegic catheter was inserted blindly through right atrium into coronary sinus and check their position outside the heart by palpation.[5] With this technique, we could placed the retrograde catheters into coronary sinus properly more than 90% by the first attempt. There were only 3 cases that failed to place the retrograde catheter into the coronary sinus. Left-sided blood was vented from ascending aorta. The blood cardioplegic solution that we used was mixed from blood and cardioplegic soultion (St. Thomas Formular 1, Mc Carthy) at 1 :1 ratio and cooled until reach 4 degree celcious before infusion. After crossclamped the aorta, cold blood cardioplegic solution was infused antegradely through large-bore needle at ascending aorta firstly about 500 ml until the heart beat stopped and followed by retrograde route about 300-500 ml depened on the severity of stenosis at the left coronary artery branches. Only saphenous vein graft that anastomosed to right coronary artery or its branches were infused with cold blood cardioplegic solution about 200 ml. after distal anastomosis had completed. The cardioplegic solution were infused into another saphenous vein graft in the patients who could not pass the retrograde catheter into coronary sinus. We started to rewarm the patients during performing the last distal anastomosis. After finished all distal anstomosis and removed the aortic clamp,

the heart beat spontaneously and return to sinus rhythm within 3 minutes. We waited until the heart beating forcefully and then deairing again. Partial clamp was applied at ascending aorta to perform proximal anastomosis. Finally, cardiopulmonary bypass were weaned off after finished all proximal anstomosis.

Result

The ejection fraction (EF) of the left ventricle in all patients were measured by echocardiography. Fifty-nine percent of them had EF more than 0.6, 27 percent had EF between 0.4-0.59 and 14 percent had EF between 0.2-0.39. There were 37 patients (47%) had previous history of myocardial infarction. The total grafts range from 2 to 5 grafts (mean 3.27 grafts.) The graft conduits that used in this study were only internal thoracic artery and saphenous vein grafts. The internal thoracic artery were used in 63 patients.(80 %) The cross-clamp time was range from 33-168 minutes (mean = 67.37 minutes) and total cardiopulmonary bypass time was range from 51-235 minutes (mean = 113.68 minutes) All of the patients could off weaned from cardiopulmoary bypass well, except three patients (3.8%) who required intra-aortic balloon pump (IABP) support for weaning off cardiolulmonary bypass. All of the IABP could removed from those patients within 48 hours and needed not to reinsert again. There was only one patients who developed perioperative myocardial infarction. The inotropic drugs used in all patients were only dopamine and adrenaline. The dose of dopamine was less than 10 mcg/kg/min and the dose of adrenaline was less than 0.1 mcg/kg/min. Most of them could extubated within 24 hours after operation. The common postoperative arrhythmia was atrial fibrillation (AF). There were 12 patients (15.38%) who developed new AF. All of them were well-controlled with digitalis. All of the patients were survived with symptom-free.

Discussion

Ther were many factors that influence the outcome of the patients who underwent cardiac surgery. Myocardial protection was one of the important factors. Cardioplegic solution was worldwide accepted for myocardial protection in order to arrest the heart during working with it. The major composition of cardioplegic solution is potassium that arrested the heart in deporalizing state. Crystalloid cardioplegia do not contained oxygen and nutrients to supply the myocardium during arrested. Therefore, oxygenated blood was mixed to cardioplegic solution to provide energy to the heart. The route of infusion also plays the major role, especially, in coronary artery heart disease. It has been proposed that cardioplegia might be more effective if delivered in a combined fashion.[6] Homogeneous delivery of antegrade cardioplegia is limited by chronic coronary stenosis or occlusion.[6-1] Retrograde cardioplegia has also been demonstrated to underperfuse the right ventricle and the interventricular septum in

many studies.[12-15] Sequential use of both routes of administration should facilitate more homogeneous distribution of cardioplegia.[16,17] In some conditions which the proximal right coronay artery and left anterior descending coronary artery were severely occluded, both antegrade and retrograde delivery would not enough to protect the heart. Other strategies of delivery may be required for optimal myocardial protection. In this condition, we performed the distal anastomosis of right coronary artery first and promptly infused cardioplegia through the sapheneous vein graft after the anastomosis was finished. When the combined technique is employed, it is appropiate to begin with the antegrade route to hasten the onset of diastolic arrest.

Atrial fibrillation was one of the most common postoperative arrhythmia in patients who underwent coronary artery bypass surgery. Its pathophysiology was unclear but it appeared to be directly related to the effect of surgery. (pericarditis, change in autonomic tone, cardioplegia, myocardial damage, fluid shifts, etc.) The incidence is generaly varied from 20-30%.[18,19] If not promptly treated, this benign problem could increase surgical morbidity, cost and length of hospital stay. In this study, the incidence of atrial fibrillation was about 15% (2 times less than usual).

In conclusion, myocardial protection during coronary artery bypass surgery with cold blood cardioplegia technique provide very good result and less postoperative morbidity.

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