Original Article

Use of Retrograde Cardioplegia in Coronary Artery Bypass Graft Surgery

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Abstract:

Background: Retrograde Cardioplegia is a widespread method for myocardial protection in coronary bypass surgery and to abroad range of open heart surgical procedures in addition to antigrade Cardioplegia,

Objectives: Is to evaluate the use of retrograde cardioplegia and its advantages in coronary bypass surgery at Ibn Al-Nafees Teaching Hospital, Department of Cardiac Surgery,

Patients and methods: This is a retrospective study that was conducted at Ibn Al-Nafees Teaching Hospital from the first of January to the first of October 2015, fifty patients with coronary artery dieses were admitted to the hospital and coronary artery bypass graft (CABG) surgery was done under cardiopulmonary bypass using retrograde cardioplegic canula through the coronary sinus from the right atrium in addition to antigrade cardioplegia from aortic root for myocardial protection during surgery on arrested heart using cold crystalloid cardioplegia.

Results: The fifty patients who were studied were operated upon, the age of patients was ranged from 37-79 year with a mean age 0f 60 year and male to female ratio was 3:1. 25 patients (50%)had left main coronary artery lesion ,all underwent bypass surgery on cardiopulmonary bypass machine using retrograde cardioplegia in addition to antegrade. in 45 patient (90%) the heart picked up (beating) spontaneously without using D.C shock while in five patient (10%) internal D.C shock was required for beating the heart from the state of ventricular fibrillation .In all patients , coming off from heart lung machine was easy with a small dose of inotropics agents. Intra aortic balloon pump was used in one patient. Only one early death observed in this study due to post operative renal failure.

Conclusion: Retrograde cardioplegia is a safe , widespread, and effective method for myocardial protection in addition to antegrade cardioplegia and this achieved longer time of protection during cardiac arrest . This method is very useful in patients with left main coronary artery disease.

Key words: retrograde cardioplegia, cardiac surgery, myocardial protection.

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Introduction:

The word cardioplegia combines the roots cardio-means the heart and plegia-means paralysis.(1).Technically this means arresting or stopping the heart, so that surgical procedure can be done in a standstill and bloodless field. The most common procedure for accomplishing asystole is infusion of cold (4c) high potassium cardioplegic solution into the coronary circulation either through the aortic route called antegrade method or through coronary sinus from right atrium called retrograde method.(2) This process protects the myocardium or heart muscle from damage during the period of ischemia.(3) Chemically the cardioplegic solution contains high potassium concentration (20-30mmol/L) will decrease the action potential of ventricular myocytes (4),causing diastolic arrest of the heart(5).Hypothermia is the other key component of most cardioplegic strategies to further lower myocardial metabolism during period of ischemia. This reduction in temperature with a chemical cardiac arrest can reduce myocardial oxygen consumption to by 97%.(6) The cold cardioplegia (4c) ensure that the heart cools down to an approximate temperature of around 15-20c s then slowing down the metabolism of the heart and thereby preventing damage to the heart muscle.(7)

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Patients and Methods:

This is a retrospective study that conducted at Ibn Al-Nafees Teaching Hospital, Department of Cardiac Surgery from first of January to first of October 2015 on patients with coronary artery disease whom underwent coronary artery bypass graft (CABG) .The information about patients in this study were retrieved from patients hospital records. This study performed to evaluate the use of retrograde cardioplegia in addition to antegrade method for protection of myocardium during CABG surgery. The cardioplegic solution used was St. Thomas crystalloid cardioplegia. Fifty patient with coronary artery disease were admitted to the hospital and underwent CABG surgery under cardiopulmonary bypass machine using retrograde catheter (with flexible stylet and self inflating balloon) from right atrium to coronary sinus to perfuse the coronary arteries with cold cardioplegic solution retrogradely in addition to antegrade canula through aortic root . Twenty

five patients were diagnosed preoperatively as having left main coronary artery lesion by coronary angiography. The strategy of using the cardioplegia was first through antigrade then intermittent multiple doses through retrograde canula. The standard surgical approach was through a median sternotomy, with aortic canula and single venous canula with cardiopulmonary bypass machine. The grafts which were left internal mammary artery (LIMA) and great saphenous vein (SVG). The number of grafts that have been done among the patients is shown in table(1).

Table(1) number of grafted vessels:

Coronary artery disease	Number of patients	Percentage
Single vessel disease	2	4%
2 vessels disease	15	30%
3 vessels disease	30	60%
4 vessels disease	3	6%

In 49 patients LIMA grafted to left anterior descending coronary artery (LAD), while right coronary, obtuse marginal, diagonal and ramus intermedius were grafted using SVG.
The ejection fraction of left ventricle was assessed preoperatively by echocardiography and its sown in table(2).

Table(2) Percentage of ejection fraction:

Percentage of ejection fraction	Number of patients	Percentage
25% - 30%	5	10%
30% - 40%	15	30%
40% - 50%	20	40%
50% - 60%	6	12%
Above 60%	4	8%

Results:
The fifty patients who were studied were operated upon .The age of patients was ranged from 37-79 year with a mean age of 60 year and regarding the sex it was 33 male and 17 female with a male-female ratio about 3:1. Twenty five patient (50%) had left main coronary artery disease, all underwent CABG on cardiopulmonary bypass machine with full systemic heparinization and using of retrograde cardioplegia in addition to antegrade method. There was no any problems in inserting the retrograde canula or any injury to coronary sinus in all patients. In forty five patients (90%) the heart picked up (beating) spontaneously after declamping the aorta without need of internal electrical D.C shock witch means good myocardial protection ,while in five patients (10%) they needed D.C shock in order to beat the heart . All patients came from bypass machine easily by gradual weaning from the heart lung machine with using of small dose of inotropic drugs like dobutamine or adrenalin or milrenon the cross clamp time and heart lung machine time is shown in table (3) . Intra aortic balloon pump was used in one patient postoperatively due to hypotension with no response to inotropic agents. Only one early death observed in this study in a patient with low ejection fraction (25%) due to postoperative renal failure in intensive care unit.

Table (3) Cross Clamp and Cardiopulmonary Bypass time

Cross Clamp Time	Number of patients	Percentage
Less than 45 min.	15	30%
45-60 min.	25	50%
60-75 min.	8	16%
Above 75 min	2	4%
Cardiopulmonary Bypass Time	**Number of patients**	**Percentage**
Less than 60 min.	2	4%
60-90 min.	30	60%
90-120 min.	15	30%
Above 120 min.	3	6%

Discussion:
Retrograde cardioplegia is especially recommended certain cases such as patients with severe coronary artery disease involving the left main coronary artery .(8), among our patients half of them had left main coronary artery disease. The other advantage of retrograde cardioplegia is in redo CABG(9),unfortunately there was no any redo CABG in our study. In redo CABG, retrograde cardioplegia diminishes the likelihood of embolization via previous atheromatus venous graft by antigrade cardioplegia(10). The efficacy and safety of using retrograde cardioplegia alone for myocardial protection has cretin limitation especially for right ventricular protection(11), in our study we use both retrograde and antigrade cardioplegia in all cases .Regarding rate of complication of retrograde cardioplegic catheter like failure of putting the catheter , it is easy in well experienced hands, the use of retrograde catheter is associated very rarely with complication such as perforation of the coronary sinus by the catheter tip during catheter insertion or rupture of coronary sinus during infusion of cardioplegia due to over pressurization of the coronary sinus or over inflation of the balloon(12). This

complication needs meticulous repair and it is difficult and potentially lethal(12), possibly due to post repair thrombosis, however reports of complications are rare . In our study no any catheter complications was happened.

Conclusion:

Retrograde cardioplegia is a safe, widespread, and effective method for myocardial protection in addition to antegrade cardioplegia during coronary bypass surgery.

It gives longer time of protection when the surgery needs longer time.

In experienced hand the use of retrograde catheter is associated very rarely with complication.

It is very beneficial in cases of left main coronary artery disease.

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