CONTINUOUS RETROGRADE COLD BLOOD CARIOPLEGIA DECREASES THE INCIDENCE OF PERIOPERATIVE ARRHYTHMIAS IN PATIENTS UNDERGOING ISOLATED CORONARY ARTERY BYPASS GRAFTING.

Adnan Allaham, MD, FRCS

ABSTRACT

Objective: To show the effect of continuous cold retrograde blood cardioplegia on the recovery of the heart and on the incidence of perioperative arrhythmias in patients undergoing isolated coronary artery bypass grafting.

Patients and methods: This is a prospective study done on two groups of patients who underwent on pump coronary artery bypass grafting for isolated coronary artery disease between January 2009 and January 2011, each group consists of 134patients, well matched regarding age, sex, weight, EuroScore, and number of grafted vessels. In group one myocardial preservation was done by infusion of single dose cold crystalloid cardoplegia antegradely and continuous cold blood cardoplegia retrogradely all through the procedure, in group two this was done by single dose crystalloid cardioplegia followed by intermittent doses of cold blood cardoplegia retrogradely.

Results: spontaneous recovery of heart beat into sinus rhythm after removal of the aortic cross clamp was observed in 120/134 patients (90%) in group one compared to 101/134 patients (75%) in group two (P=0.004). 14 patients need defibrillation in group one, whereas this was needed in 33 patients in group 2 (P=0.002).In the postoperative period 3 patients(2%) in group one and 5 patients(4%) in group 2(P=0.47) remained in atrial fibrillation regardless defibrillation and amiodarone and magnesium sulphate infusion whereas transient atrial fibrillation was noticed in 4 patients(3%) in group one and six patients (4.5%)in group two(P=0.5).

Conclusion: It seems that with continuous retrograde cold blood cardioplegia the chances for spontaneous recovery of the heart into sinus rhythm is more and the incidence of perioperative arrhythmia is less.

Key words: CABG, Cardioplegia, Perioperative arrhythmias

INTRODUCTION

The prevalence of coronary artery disease (CAD) is increasing in most parts of the world (1). Treatment of symptomatic CAD is either by medications, percutaneous intervention, or when indicated by coronary artery bypass grafting(CABG) which can be done either off-pump on a beating heart in selected cases or on-pump in others using cardiopulmonary bypass machines, cross clamping and arresting the heart with application of different myocardial preservation techniques. This study was conducted to show the effect of two different myocardial preservation techniques on the spontaneous recovery of the heart into sinus rhythm and the incidence of perioperative arrhythmias.

PATIENTS AND METHODS

This is a prospective study done on two groups of patients who underwent on pump coronary artery bypass grafting for isolated coronary artery disease between January 2009 and January 2011 done by the author, each group consists of 134 patients, well matched regarding age, sex, weight, co morbidities, EuroScore, number of grafted vessels, and other variables are shown in(Table1). In group one, the myocardial preservation protocol consisted of an induction dose of antegrade cold (4°C) crystalloid cardioplegia (400-500 cc) alternated with retrograde cold blood cardioplegia 8-10°C (600cc of 1/4 concentration), then continuous retrograde cold blood cardioplegia (1/8 concentration), 50cc/min were infused all through aortic

cross clamping period, local hypothermia using slashed saline and moderate hypothermia with a drop of systemic temperature to 30-32°C. In group 2, myocardial preservation technique was the same except that intermittent doses of 50-100 cc of retrograde cold blood cardioplegia every 15 minutes for maintenance was used. Both groups received the hot shot (5-10 cc/kg) of oxygenated blood at 37°C retrogradely with a flow pressure in the coronary sinus of 30-40 mm Hg, just before declamping.

RESULTS

There was significant difference between the two groups of patients regarding the spontaneous recovery of the heart and the incidence of atrial fibrillation where after completion of the distal anastomosis and removal of aortic cross clamp spontaneous recovery of heart into sinus rhythm was observed in 120/134 patients (90%) in group one compared to 101/134 patients (75%) in group two(p=0.004). Intraoperatively 14 patients need defibrillation for transient ventricular fibrillation after declamping in group one, whereas this was needed in 33 patients in group 2(p=0.002).In the postoperative period the difference in arrhythmias is still valid but not as significant as in the intraoperative period where it was noticed that 3 patients(2%) in group one and 5 patients(4%) in group 2 remained in atrial fibrillation(p=0.47) regardless defibrillation and amiodarone and magnesium sulphate infusion.Transient atrial fibrillation was noticed in 4 patients(3%) in group one and six patients (4.5%)in group two(p=0.5) as well in the postoperative period..

Table 1: Patient characteristics in both groups.

	Group I	*Group I*
Age	54(26-81)yr	56(30-76)yr
Male	70%	72%
Female	30%	28%
DM	40%	42%
COPD	7%	6%
RF	1.5%	2.2%
EF<30	22%	24%
EuroScore	3.7(0-14)	3.6(0-16)
Emergency	5.9%	3.7%
Redo CABG	1.5%	2.2%
Number of anastomosis	3(2-5)	3(2-6)
LIMA	97%	97%
Mean AXC Time	40 min	38 min
Mean Pump Time	60 min	50 min
Minimal Nasopharyngeal Temp	26 C	28 C

DM:diabetes mellitus,COPD:chronic obstructive airway disease,RF: renal failure,EF:ejection fraction,CABG:coronary artery bypass grafting,LIMA:left internal mammary artery,AXC:aortic cross clamp.

DISCUSSION

Symptomatic coronary artery disease is treated medically, by percutaneous interventional (PCI) techniques or surgically by coronary artery bypass grafting. However different surgical techniques were described for management of coronary artery disease which is divided in two major groups: The first is the classical on pump surgery and the second is the off-pump (beating heart) technique. Here we discus different strategies of myocardial preservation in patients undergoing CABG by the classical on pump technique. Myocardial preservation aim to maintain the function of both cardiomayocytes and conduction system as normal as possible after applying aortic cross clamp all through this ischemic period. Different crystalloid cardioplegic solutions and blood cardioplegia were used at different temperatures (Normothermia, Tepid, or cold), antegradely through aortic root or retrogradely through coronary sinus or both. The pattern of infusion of cardioplegic solution could be continuous or intermittent, in this study we compared the effect of two different myocardial preservation methods and we prospectively observe spontaneous recovery of the heart into sinus rhythm, or the need for defibrillation, and the occurrence of perioperative arrhythmias.

Perioperative arrhythmia which can occur immediately intraoperatively, early or late in the post operative period is rather a common complication of CABG surgery whether done on pump or off pump(2), the incidence is varying between 7-40%(3); it might be transient or permanent. When it occurs immediately intraoperativelly after removal of aortic cross clamp regardless pharmacological interference by amiodarone and magnesium sulphate protocol where it makes weaning from cardio pulmonary bypass more difficult and sometimes hazardous. Atrial fibrillation decreases cardiac output about 25% due to loss of atrial contractions (4), so every effort should be done to decrease the incidence of this arrhythmia after cardiac surgery. As shown in our study and other studies (5-9) using continuous cold blood cardioplegia is a strategy that might decrease the incidence of perioperative arrhythmias and increase the chances for spontaneous recovery of sinus rhythm. Even the aim of this study was not to compare the incidence of perioperative arrhythmias in off pump and on pump CABG, it have been shown in other studies(2) that the incidence of perioperative arrhythmias in both techniques is nearly the same. In conclusion, in the classical on pump CABG It seems that with continuous retrograde cold blood cardioplegia the chances for spontaneous recovery of the heart into sinus rhythm is more and the incidence of perioperative arrhythmia is less.

REFERENCES

1. American heart association statistical update. Heart disease and stroke statistics; 2006 update. *Circulation.* 2006;113:e85–e151
2. Choi Y, Kwang J,Seong SWook ,et al. Risk factors of atrial fibrillation following off-pump coronary artery bypass graft surgery: predictive value of C-reactive protein and transfusion requirement. Eur J Cardiothorac Surg 2009;36:838-843.
3. J. Siebert, L. Anisimowicz, R. Lango. Atrial fibrillation after coronary artery bypass grafting: does the type of procedure influence the early postoperative incidence? Eur J Cardiothorac Surg 2001;19:455-459
4. Fuster V, Rydén LE, Cannom DS, et al. ACC/AHA/ESC 2006 Guidelines for the Management of Patients with Atrial Fibrillation.Circulation 114 (7): e257–354.
5. Louagie Y,Gonzalez E, Jamart J et al. Assessment of Continuous Cold Blood Cardioplegia in Coronary Artery Bypass Grafting. The Annals of Thoracic Surgery 1997, 63(3): 689-696.

6. Baron O, Roussel J,Delaroche O et al. Prospective clinical and biological comparison of three blood cardioplegia techniques in low-risk CABG patients: better is worse than good enough. Cardiovascular Surgery 2003, 11(6) :489-495.
7. Khuri S, Warner K, Josa M et al. The superiority of continuous cold blood cardioplegia in the metabolic protection of the hypertrophied human heart. J Thorac Cardiovasc Surg (1988), 95:442–454.
8. Louagie Y, Gonzales E, Jamart J *et al.* Assessment of continuous cold blood cardioplegia in coronary artery bypass grafting. Ann Thorac Surg 1997,63 :689–696.
9. Jasinski M, Wos S, Kadziola Z et al. Does simultaneous antegrade and retrograde cardioplegia improve functional recovery and myocardial homeostasis?. J Card Surg 2000,(15):354–361.
10. Baretti R,Mizuno A,Buckberg G,et al.Cold continuous antegrade blood cardioplegia:high versus low hematocrit.European J of Cardiothorc Surg 2001,19(5):640-646
11. Ericson A,Takashima S,and Vaaga J.Warm and cold continuous blood cardioplegia provides similar myocardial protection.Ann Thorac Surg 1999,68:454-459.
12. Bezon F,Choplain J,Khalifa A,et al.Continuous retrograde blood cardioplegia ensures prolonged aortic cross clamping time without increasing operative risk.Interact CardioVasc Thorac Surg 2006,5:403-407.