POSTOPERATIVE PERIOD OF BYPASS GRAFT SURGERY

Comparative Study between Conventional Heart Lung Machine and Those Subjected to Beating Heart Surgery

Thesis

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Ashraf Hussein Zaki

Dedication

To:

My

Family

ABSTRACT

Conventional bypass grafting using cardioplegic arrest continues to be associated with some complications that may negate an otherwise successful procedure. Interest in off-pump bypass grafting (OPCABG) in the mid-1990s presented surgeons with the option of revascularization without the potential complications of extracorporeal support if CPB can be avoided; a reduction in peri-operative morbidity and mortality is anticipated.

The aim of our study is to compare both techniques regarding mortality, morbidity, complications and brain injury in both groups of patients with ischemic heart disease.

Patients and methods: Eighty patients (pts) were subjected to CABGs, 40 with off pump (group I) and the other 40 pts with on pump (group II) techniques. Patients in both groups were matching as regards age, sex, risk factors, and number of bypassed coronaries. Pre-operatively and postoperatively all patients were subjected to clinical examination, ECG, chest X-ray, trans echocardiography, routine laboratory tests and serum S100 B protein as well as Neuron Serum Enolase (NSE). Brain injury will be evaluated by using Glasgow Coma Scale and the neuromediators.

Results: Intra-operatively, group I pts had statistically significant shorter operative time (3.6 ± 0.6 vs. 4.1± 0.7 hours in group II, $p < 0.001$), less intra-operative bleeding –of medical causes - with lower intra-operative use of blood products (55% of pts in group I vs. 100% of group II) & lower incidence of arrhythmias (25% vs. 60% of group II). Post-operatively, group I showed statistically significant shorter stay in intensive care unit (2.8 ± 0.7 vs. 3.8 ± 1.3 days in group II; $p < 0.001$), earlier extubation (9.4 ± 4 vs 15.5 ± 11.6 hours in group II; $p < 0.002$), lower pulmonary complications as regard atelectasis, chest infection (5% vs 22.5% in group II; $p < 0.02$), lower cardiac complications as regard atrial

fibrillation , low cardiac output & need for use of inotropic support (55% vs 82.5% in group II; $p < .007$), less hypothermic with lower incidence of postoperative bleeding with less need for use of blood products & reopening. Group I showed significantly less renal (22.5% vs 52.5% in group II; $p < 0.05$) and less hepatic impairment than in pts of group II (20% vs 55% in group II, $p < 0.05$). No statistically difference between both groups as regards cardiac ischemia, cardiac arrest, ECG changes, trans-thoracic echocardiographic findings, hematemesis, and sternal wound infection. Finally, group I showed lower incidence of neurological deficits (whether reversible or permanent) (5% vs 27.5% in group II; $p<0.006$).

Despite the latter, postoperative values of neuromediators S100B protein & NSE showed a significant increase in both groups compared to preoperative serum level denoting some brain ischemia (as regard S100B protein, 60 vs 20 pg/ml preoperatively in group I; $p < 0.05$ and 100 vs 35 pg/ml preoperatively in group II; $p < 0.05$), (NSE, 22 vs 6 ug/L preoperatively in group I; $p < 0.05$ and 20 vs 7 ug/L preoperatively in group II; $p<0.05$). However; there is no statistically significant difference between both groups regarding the percent of increase of both mediators postoperatively (1.88% in group I vs 1.7% in group II; P value: non significant).

Conclusions: 1. In the view of S100B and NSE serum levels in both groups, no significant difference between both groups regarding cerebral ischemia 2. Off-pump Coronary artery bypass grafting is effective with success rate comparable to On-pump CABG. 3. Off-pump technique is safer in patients with preoperative bleeding disorders, renal/hepatic impairment, pulmonary disorders, or high risk for stroke e.g. calcific aortic roots. 4. Off-pump technique saves expenses due to fewer complications and less postoperative stay in intensive care unit.

Key word: Postoperative, CABG, on-pump, off-pump

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List of Abbreviations

Abbreviation	***The meaning***
ABG	*Arterial Blood Gas*
ACT	*Activated Clotting Time*
ACTH	*Adrenocorticotropic Hormone*
ADH	*Anti-Diuretic Hormone*
AF	*Atrial Fibrillation*
AHA/ACC	*American Heart Association/American College of Cardiology*
ALI	*Acute Lung Injury*
ARDS	*Acute Respiratory Distress Syndrome*
ARF	*Acute Renal Failure*
ASD	*Atrial Septal Defect*
CABG	*Coronary Artery Bypass Grafting*
CAD	*Coronary Artery Disease*
CBC	*Complete Blood Count*
CPB	*Cardio-Pulmonary Bypass*
COP	*Cardiac Output*
COPD	*Chronic Obstructive Pulmonary Disease*
CXR	*Chest X Ray*
DM	*Diabetes Mellitus*
DVT	*Deep Venous Thrombosis*
EF	*Ejection Fraction*
GCS	*Glasgow Coma Scale*
GFAP	*Glial Fibrillary Associated Protein*
GIT	*Gastro-Intestinal Tract*
Hb	*Hemoglobin*
Hct	*Hematocrit*
HIT	*Heparin Induced Thrombocytopenia*
HITT	*Heparin Induced Thrombocytopenia and Thrombosis*
HTN	*Hypertension*
IABP	*Intra-Aortic Balloon Pump*
IDDM	*Insulin Dependent Diabetes Mellitus*
IL	*Interleukin*
IMA	*Internal Mammary Artery*
LAD	*Left Anterior Descending*
LBBB	*Left Bundle Branch Block*

LCOP	*Low Cardiac OutPut*
LIMA	*Left Internal Mammary Artery*
LV	*Left Ventricle*
LVEDD	*Left Ventricular End Diastolic Diameter*
LVEF	*Left Ventricular Ejection Fraction*
LVESD	*Left Ventricular End Systolic Diameter*
MBP	*Myelin Basic Protein*
MI	*Myocardial Infarction*
MIDCAB	*Minimally Invasive Direct Coronary Artery Bypass*
MR	*Mitral Regurge*
NIDDM	*Non Insulin Dependent Diabetes Mellitus*
NO.	*Number*
NSE	*Neuron Specific Enolase*
NSTEMI	*Non ST Elevation Myocardial Infarction*
OPCABG	*Off Pump Coronary Artery Bypass Grafting*
PCI	*Percutaneous Coronary Interventions.*
PE	*Pulmonary Embolism*
PTCA	*Percutaneous Transluminal Coronary Angioplasty*
PVC	*Premature Ventricular Contraction*
RWMA	*Regional Wall Motion Abnormality*
STEMI	*ST Elevation Myocardial Infarction*
TECAB	*Total Endoscopic Coronary Artery Bypass*
TIA	*Transient Ischemic Attack*
TMR	*TransMyocardial laser Revascularization*
TNF	*Tumor Necrosis Factor*
VF	*Ventricular Fibrillation*

Introduction

INTRODUCTION

For more than three decades, conventional coronary artery bypass grafting (full sternotomy, cardiopulmonary bypass, and cardioplegic arrest) has been the treatment of choice for patients with multi-vessel coronary artery disease [(1)]. Conventional coronary artery bypass grafting (CABG) is both safe and effective. Nevertheless, the use of cardiopulmonary bypass (CPB) and cardioplegic arrest are associated with several adverse effects [(2)] and is associated with substantial morbidity [(3)].

Adverse effects of CPB with clinical sequelae are increased capillary permeability, platelet damage with impaired hemostasis, hemodilution, alteration of fluid balance and urine output, coagulopathies, increase levels of several hormones (e.g. catecholamine, rennin, angiotensin, anti-diuretic hormone), electrolytes imbalance, acid-base disturbance, hypothermia, depressed cardiac function, cardiac arrhythmias, cerebral dysfunction due to embolic or ischemic events, respiratory disorders (Acute respiratory distress syndrome, pulmonary edema, atelectasis), and finally GIT dysfunction (bleeding).

The CPB requires cannulations and cross-clamping of the ascending aorta, which may lead to atheromatous macroemboli. Myocardial ischemia and inadequate cardioplegic protection of the

atria have been reported to increase the incidence of postoperative AF.

Cardiopulmonary bypass represents a unique medical condition that induces a systemic inflammatory response for which the human immune system has not yet evolved a specific response. Consequently, when confronted with the multiple insults of CPB, the magnitude of the immune system response is exaggerated, confusing, and complex. For example, the post-bypass period is characterized by large fluid shifts, temperature changes, coagulation disturbances, and increased concentrations of catecholamines and stress hormone. An exaggerated inflammatory response to reperfusion may be largely responsible for systemic vasodilation during rewarming, fever, postoperative bleeding, and reperfusion injury to the heart, brain, kidney, and gut, leading to either permanent organ injury or transient dysfunction.

Off pump coronary artery bypass grafting does reduce the elaboration of key mediators of the systemic inflammatory response and decrease the concentrations of cytokines such as TNFa, IL-6, IL-8, IL-10 and decrease the indices of complement activation, such as C3a and C5a and attenuate other indices, including platelets, thromboglobulin, and procalcitonin. Finally, OPCAB decreases reactive oxygen species-induced injury**.** Consequently, if CPB can be avoided, a reduction in perioperative morbidity and mortality is anticipated, with faster recovery, shorter hospitalization, and less