Comparative study of Short term results between On-pump versus Off-pump CABG in Patients with Preoperative mild to moderate renal impairment

Thesis

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Mohammed Suleiman Mohammed

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List of Abbreviations

Abb.	Full term
ACE	Angiotensin converting enzyme inhibitors
ACT	Activated clotting time
AF	Atrial fibrillation
AHA/ACC	American heart association / American college of cardiology
AKI	Acute kidney injury
AKIN	Acute kidney injury network
aPTT	Activated partial thromboplastin time
ARBS	Angiotensin receptor blockers
ARF	Acute renal failure
ARF-D	Acute renal failure requiring dialysis
AT	Antithrombin
BMI	Body mass index
BS	Bowman's space
BUN	Blood urea nitrogen
CABG	Coronary artery bypass graft
CAD	Coronary artery disease
CKD	Chronic kidney disease
ClCr	Creatinine clearance
COPD	Chronic obstructive pulmonary disease
CPB	Cardiopulmonary bypass
CRRT	Continuous renal replacement therapy
CRT	Cardiac resynchronization therapy
CVA	Cerebrovascular stroke
CVS	Cardiovascular surgery
CVVH	Continuous veno-venous-hemofiltration
DA1	Dopamine receptor 1
DM	Diabetes mellitus
DPRS	Deep Pericardial Retracting Sutures
EABV	Effective arterial blood volume
ECC	Extracorporeal circulation

List of Abbreviations (Cont...)

Abb.	Full term
ECG	Electrocardiogram
eGFR	Estimated Glomerular filtration rate
ESC	European society of cardiology
ESRD	End stage renal disease
G1	Gastrointestinal
GFR	Glomerular filtration rate
Hb AIC	Glycosylated hemoglobin
HCT	Hematocrit
HTN	hypertension
ICD	Implantable Cardioverter Defibrillator
ICU	Intensive care unit
IHD	Intermittent hemodialysis
IM	Internal mammary artery
INR	International normalized ratio
ITA	Internal thoracic artery
IVC	Inferior vena cava
KDIGO	Kidney Disease Improving Global Outcomes
LAD	Left anterior descending artery
LaD	Left atrial dilatation
LIMA	Left internal mammary artery
LM	Left main coronary artery
LV	Left ventricle
MDRD	Modification of diet in renal disease
MI	Myocardial infarction
NAC	N-acetyl cysteine
NGAL	Neutrophil gelatinase-associated lipocalin
NKF	National kidney foundation
NSAIDs	Non-steroidal anti-inflammatory drugs
ONCAB	On pump coronary artery bypass surgery
OPCAB	Off pump coronary artery bypass
PA	Pulmonary artery

List of Abbreviations (Cont...)

Abb.	Full term
PCI	Percutaneous coronary intervention
PDA	Posterior descending artery
PTCA	Percutaneous transluminal coronary angioplasty
PVD	Peripheral vascular disease
RBF	Renal blood flow
RCA	Right coronary artery
RCT	Randomized controlled trial
RD	Renal dysfunction
RIFLE	Risk, Injury, Failure, Loss, End stage renal disease
RRT	Renal replacement therapy
RV	Right ventricle
SCr	Serum creatinine
SIRS	Systemic inflammatory response syndrome
STS	Society of Thoracic Surgeons
SVC	Superior vena cava
SVG	Saphenous vein graft
TIA	Transient ischemic attack
TPN	Total parenteral nutrition
TTE	Transthoracic echocardiography
UOP	Urine output
VS	Versus
WHO	World health organization

INTRODUCTION

Coronary artery disease (CAD) is the leading illness threatening human health in developed countries; and it is increasingly becoming a significant public health problem in developing countries. According to the latest WHO data published in May 2014, death due to CAD in Egypt reached 107.2 thousand people in 2012 by percentage 20.5 % of total deaths. Therefore, CAD is considered the 1st cause of death in Egypt as well as worldwide ***(Who statistics, 2015).***

The chronic kidney disease (CKD) population has grown exponentially over the past decade and is projected to grow consistently in the next decade due to an increase in the incidence of obesity and diabetes and a decrease in mortality rates. Cardiovascular disease is the leading cause of morbidity and mortality in patients with CKD However, there is a "treatment risk paradox", in that these high-risk patients have lower rates of medical therapy, referral for stress testing, cardiac catheterization, and revascularization compared with low-risk patients ***(Bangalore et al., 2015).***

It is well established that the presence and progression of cardiovascular disease and chronic kidney disease are often intimately associated. Furthermore, it has been well described that this high-risk patient population has an increased prevalence of

known atherosclerotic. Associated risk factors including hypertension, diabetes mellitus smoking, and dyslipidemia. The increase in these accelerated disease processes has resulted in cardiovascular related complications to be one of the leading causes of death in patients with chronic renal disease ***(Boulton et al., 2011).***

Coronary artery bypass grafting (CABG) is associated with reduction of mortality and remains a standard of care in patients with extensive coronary artery disease (CAD) as compared to precutaneous coronary intervention (PCI) and medical treatment alone ***(Kowalewski et al., 2016)***.

CABG is a widely performed operation. It can be executed with the use of cardiopulmonary bypass (CPB) (on-pump) or off-pump coronary artery bypass (OPCAB), which has been developed to decrease peri-operative complications related to the use of CPB ***(Paparella et al., 2015)*** Globally, 1.25 million cardiac surgeries are performed annually***(Garg et al., 2012).***

Elevated pre-operative serum creatinine (SCr) is considered an independent risk factor for postoperative mortality and morbidity in patients undergoing cardiac surgery. The overall mortality risk for patients with preoperative SCr>130 mmol/L (1.5 mg/dL) ranges from 5% to 30% and the probability of death increases with the increasing preoperative SCr level ***(Miceli et al., 2011).***

In patients undergoing CABG, CKD is associated with longer hospitalization and higher rates of hospital morbidity and mortality. CKD, even from mild to moderate, implies an increase in mortality after CABG. Prognosis is even more reserved in patients with chronic kidney disease in the terminal phase ***(Barbosa et al., 2011).***

Despite (CABG) success, Post-operative acute kidney injury (AKI) is still a well-known complication of cardiac surgery. It is well known that independent risk factors for the development of acute renal failure (ARF) were increased preoperative creatinine levels ***(Simon et al., 2007).*** Other risk factors include advanced age; race; diabetes mellitus (DM), heart failure (HF), the use of ACE inhibitors, angiotensin receptor blockers (ARBs), or non-steroidal anti-inflammatory drugs (NSAIDs), exposure to contrast media prior to surgery, cardiopulmonary bypass, vasopressors, cardiovascular collapse, and preoperative proteinuria. Preexisting CKD appears to be the most predictable risk factor for AKI following CABG ***(Huen & Parikh et al., 2012).***

AKI complicates 2.3% of isolated CABG cases, with an incidence as high as 14%-15% among patients with pre-operative chronic kidney disease CKD. Prior studies examining the association between on-pump CABG and post-operative renal function have been inconclusive. However; these studies have been generally underpowered to examine the association in patients with CKD ***(Chawla et al., 2012).***

Even patients with mild renal dysfunction before surgery are more likely to experience AKI with a compromised outcome. A milder degree of renal dysfunction is associated with adverse renal outcomes and greater mortality, the risk of AKI is increased 4.8-fold for each 1 mg/dL increment in SCr ***(Ortega-Loubon et al., 2016).***

ARF is linked to multiple postoperative complications leading to prolonged hospitalization and increased costs. The use of continuous renal replacement therapy (CRRT) is a rare but devastating complication of cardiac surgery. In patients with acute renal failure requiring dialysis (ARF-D), the incidence of serious infections including sepsis, was 58.5% as compared with 3.3% in all cases ***(Simon et al., 2007).***

AKI is used to reflect the entire spectrum of what is defined as the abrupt reduction in renal function, in hours or days, in which ARF is characterized by a decrease in the glomerular filtration rate and/or urinary volume, in addition to the loss of basic functions, such as the inability to maintain the hydro-electrolyte and basic acid balance ***(Nina et al., 2013).***

Serum creatinine is a specific marker of renal dysfunction however, because its generation is determined by age, race, muscle mass, and dietary intake other than filtration creatinine, it can remain within the normal range when renal function is significantly impaired ***(Miceli et al., 2011).***