Echocardiographic Predictors of Atrial Fibrillation after Coronary Artery Bypass Grafting

Thesis

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List of Abbreviations

Abb.	Full term
A Fib	*Atrial fibrillation*
AF	*Atrial fibrillation*
AFACS	*Atrial Fibrillation after Cardiac Surgery*
AKI	*Acute Kidney Injury*
BMI	*Body mass index*
CABG	*Coronary artery bypass graft*
CAD	*Coronary artery disease*
DM	*Diabetes mellitus*
ECG	*Electrocardiogram*
HTN	*Hypertension*
IHD	*Ischemic Heart Disease*
LA	*Left Atrium*
LAV	*Left Atrial Volume*
LTAF	*Long Term AF (more than 1 year)*
LVEDV	*Left Ventricle End Diastolic Volume*
LVEF	*Left Ventricle Ejection Fraction*
LVESV	*Left Ventricle End Systolic Volume*
LVGLS	*Left Ventricle Global Longitudinal Strain*
NOAF	*New Onset AF*
PAF	*Paroxysmal AF*
PCI	*Percutaneous Coronary Intervention*
POAF	*Post Operative Atrial Fibrillation*
TDI	*Tissue Doppler Imaging*

INTRODUCTION

Despite good progress in the management of patients with atrial fibrillation (AF), this arrhythmia remains one of the major causes of stroke, heart failure, sudden death, and cardiovascular morbidity in the world. Furthermore, the number of patients with AF is predicted to rise steeply in the coming years ***(Paulus et al., 2016).***

Postoperative atrial fibrillation (POAF) is common after both cardiothoracic and non-cardiothoracic surgery. AF has been reported in up to 5-40% of patients in the early postoperative period following coronary artery bypass graft (CABG) ***(Ashraf et al., 2012).***

Patients developing postoperative AF usually do not have previous arrhythmic history ***(Clavier et al., 2002).*** Early risk detection of AF would contribute to prevention and enable forehand treatment with proper medications. An incidence of AF most frequently occurs on second or third day after CABG. Seventy percent of patients develop this arrhythmia before the end of post-operative day 4 ***(Aranki et al., 1996).***

Optimal risk assessment needs to be done 24 hours before possible fibrillation appearance since prophylactic medication must be administered promptly ***(Sovilj et al., 2006).***

Owing to advances in surgery, surgical techniques, cardiopulmonary bypass (CPB), cardioplegic arrest, aortic cross

clamping time, anesthesia, and post operative care and despite a trend for patients undergoing these procedures to be of higher risk operative -mortality and morbidity remain low and in fact have declined in recent years. Despite this general decline in complications, the incidence of postoperative atrial fibrillation has not decreased and has actually appeared to be increasing, most likely attributable to the increasing proportions of CABG procedures performed in elderly patients ***(Rod et al., 2001).***

Although commonly regarded as a benign, self limiting, atrial fibrillation may result in significant morbidity including hemodynamic changes, hypertension, palpitations, pain, fatigue, dyspnea, or generalized anxiety. Postoperative atrial fibrillation is also associated with congestive heart failure, prolonged ventilation, readmission to the intensive care unit, and a threefold to four fold increased risk of early postoperative stroke and thromboembolic events (cerebral and other thromboembolisms), thus, demands antiarrhythmic or anticoagulant therapy ***(Hakala et al., 2002).***

AIM OF THE WORK

The aim of this study was to detect the echocardiographic parameters for prediction of post-operative atrial fibrillation in patients with ischemic heart disease undergoing coronary artery bypass grafting.

Chapter I

POSTOPERATIVE ATRIAL FIBRILLATION

Definition:

Atrial fibrillation (AF) is a supraventricular tachyarrhythmia characterized by uncoordinated atrial activation with subsequent deterioration of mechanical function ***(Elhadad et al., 2012)***.

Mechanisms of Atrial Fibrillation after Cardiac Surgery:

Atrial fibrillation is usually attributed to re-entry of multiple wavelets of excitation circulating throughout the atria. The exact electrophysiological mechanisms causing atrial fibrillation after cardiac surgery are incompletely understood ***(Haissaguerre et al., 1998).*** Although the importance of this mechanism among patients with postoperative atrial fibrillation has not yet been clarified ***(Frost et al., 1995).*** Re-entry and atrial fibrillation are facilitated when adjacent atrial regions have widely disparate refractory periods ***(Cox et al., 1993).*** Slowed atrial conduction also facilities re-entry, and this probably explains the observed relation between a prolonged P-wave duration, as measured from a signal-averaged electrocardiogram, and the increased risk for atrial fibrillation following cardiac surgery ***(Frost et al., 1995).*** Atrial incisions, atrial ischemia, and associated cardiac disease contribute not

only to abnormal atrial conduction and refractoriness but also to the increased frequency of triggering events.

Some but not all studies also provide evidence for increased sympathetic activation preceding atrial fibrillation evidenced by elevated levels of right atrial norepinephrine ***(Pfisterer et al., 1997, Andrews et al., 1998, Rady et al., 1998).***

Not all evidence indicates that atrial ischemia plays a significant role in atrial fibrillation after cardiac surgery. The degree of atrial hypothermia has no effect on the atrial effective refractory period or on inducibility of atrial fibrillation in a canine model**.** The lower incidence of atrial fibrillation observed in pediatric cardiac surgery and in cardiac transplantation, situations in which atrial ischemia often occurs, suggests that atrial ischemia probably does not play the sole etiologic role ***(Almassi et al., 1997).***

Complications of Atrial Fibrillation after Cardiac Surgery:

Many complications of cardiac surgery occur more often in patients who develop postoperative atrial fibrillation than in patients who do not. Because ill patients more commonly develop atrial fibrillation, it is not surprising that atrial fibrillation is more frequent in patients returning to the operating room for complications, patients who are re-admitted to the intensive care unit in the postoperative period and patients requiring prolonged ventilation or re-intubation. Atrial

fibrillation also occurs more frequently in postoperative patients with pneumonia, perioperative myocardial infarction, cardiac arrest, ventricular arrhythmias or renal failure ***(Aranki et al., 1996)***.

Overall, patients who develop postoperative atrial fibrillation have significantly increased 30-day and 6-month mortality rates compared with patients who do not experience post-operative atrial fibrillation ***(Yousif et al., 1990).***

Although atrial fibrillation is often a marker for severity of illness and not necessarily a cause of increased morbidity, some complications may be more directly a consequence of the arrhythmia**.** Patients with atrial fibrillation after cardiac surgery are more likely than patients who do not develop postoperative atrial fibrillation to have a cerebrovascular accident during hospitalization. Atrial fibrillation may cause hypotension or pulmonary edema and stroke and cardiac index improve significantly in some patients after sinus rhythm is restored ***(Gentili et al., 1992)***.

Patients with atrial fibrillation are also more likely to need a permanent pacemaker post-operatively ***(Creswell et al., 1993).***

Even after adjustment for level of illness, patients with atrial fibrillation have longer stays in the intensive care unit and in the hospital overall ***(Aranki et al., 1996).***

Predictors of Atrial Fibrillation after Cardiac Surgery:

Atrial fibrillation (AF) has been recognized as the most common arrhythmia to occur after cardiac surgery. The reported incidence of AF after CABG surgery varies from 5% to 40%, with the arrhythmia usually occurring between second and fourth postoperative days ***(Haghjoo et al., 2008).*** Therefore much attention has focused on the prevention of AF in high risk patients ***(Maisel et al., 2001).***

To find the high risk group, multiple investigations have attempted to identify the demographic risk factors and the predictors of postoperative AF and different results were obtained. These discrepancies may be explained by the differences in the patient profiles.

Identification of patients at high risk and early risk detection of post operative AF remains a challenge and would contribute to prevention and enable forehand treatment with proper medications. Many risk factors have been described for the post-operative AF. These factors can be categorized into pre-operative, intra-operative and post-operative risk factors ***(Sovilj et al., 2006).***

- ***Preoperative predictors:***

Several demographic or preoperative factors such as age, sex, history of previous AF, hypertension, chronic lung diseases

have been shown to be preoperative risk factors for post operative AF.

- **Age:**

Old age is the most often reported independent risk factor for post operative AF.

- **Sex:**

Men are more likely to develop AF after CABG than women ***(Parikka et al., 1998).***

- **Left ventricular dysfunction and CHF:**

The multiple studies of preoperative ischemia research found that LVEF was lower in those who developed postoperative AF ***(Mathew et al., 2004).***

- **Hypertension:**

Hypertension has been incriminated as a predictor to postoperative AF and this may be related to increased atrial fibrosis and to the dispersion of atrial refractoriness ***(Haghjoo et al., 2008).***

- **Chronic lung disease:**

COPD is a predictor of AF after cardiac surgery as COPD patients have frequent premature atrial contractions that act as a trigger for the initiation of AF ***(Villareal et al., 2004).***