Role of 2D Speckle Tracking Echocardiography in Detecting Subclinical Abnormalities of Left Ventricular Systolic Function in Chronic Renal Failure Patients with Normal Ejection Fraction

Thesis

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Mohamed Gamal Mohamed

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List of Abbreviations

Abb.	Full term
BSA	*Body surface aewa*
cTnI	*Cardiac troponin I*
cTnT	*Cardiac troponin T*
CV	*Cardio vascular*
CVA	*Cerebrovascular accident*
CVD	*Cardiovascular disease*
EF	*Ejection fraction*
ESRD	*End stage renal disease*
GFR	*Glomerular filtration rate*
GLS	*Global longitudinal strain*
HD	*Hemodialysis*
HGB	*Hemoglobin*
HsCRP	*High sensitivity C-reactive protein*
HsTnI	*High seneitivity troponin I*
IVS	*Inter ventricular septum*
KDOQI	*Kidney Disease Outcomes Quality Initiative*
LA	*Left atrium*
LAVI	*Left atrium volume index*
LV	*Left ventricle*
LVEDD	*Left ventricular end diastolic diameter*
LVEDV	*Left ventricular end diastolic volume*
LVESD	*Left ventricular end systolic diameter*
LVESV	*Left ventricular end systolic volume*
LVH	*Left ventricular hypertrophy*
LVMI	*Left ventricular Mass index*
NO	*Nitric oxide*
NT-proBNP	*N-terminal prohormone Brain naturitic peptide*
PE	*Pulmonary embolism*
PTH	*Parathyroid hormone*

List of Abbreviations (Cont...)

Abb.	Full term
PWT	*Posterior wall thickness*
RAAS	*Renin-angiotensin-aldosterone system*
RRT	*Renal replacement therapy*
SCD	*Sudden cardiac death*
SWMA	*Segmental wall motion abnormality*
TDI	*Tissue Doppler imaging*
TIBC	*Total iron binding capacity*
TLR4	*Tall like receptor 4*
TSAT	*Transferretin saturation*
VSMC	*Vascular smooth muscle cell*

INTRODUCTION

Chronic kidney disease (CKD) is a worldwide public health problem and cardiovascular mortality is estimated to be at least 10- to 100-fold higher in patients with end stage renal disease (ESRD) than in the age matched general population ***(Chan et al., 2011).***

Uremia is associated with an increased risk of cardiovascular diseases, including coronary artery disease, myocardial infarction, and heart failure. Mortality is increased by 10- to 20-fold in dialysis patients compared with healthy individuals ***(Bradbury et al., 2007).***

The worldwide rise in the number of patients with chronic kidney disease (CKD) and consequent end-stage renal disease (ESRD) necessitating renal replacement therapy (RRT) and attendant cardiovascular disease (CVD) is threatening to reach epidemic proportions over the next decade, and only a small number of countries have robust economies able to meet the challenges posed ***(Gouda et al., 2011)***.

In Egypt, one of the developing countries, poverty has emerged as one of the most challenging socio-economic problems, with 22.9% of the total populations within the national poverty line. A change in global approach to CKD from treatment of ESRD to much more aggressive primary and secondary prevention is therefore imperative ***(Gouda et al., 2011)***.

Left ventricular (LV) dysfunction is one of the major determinants for prognosis in patients with chronic kidney disease (CKD) ***(Yan et al., 2011).***

Most studies have used the conventional echocardiographic parameters of cardiac function, such as ejection fraction and fraction shortening, which are frequently normal in uremic patients ***(Yan et al., 2011)***.

Recent echocardiographic studies have shown that strain analysis of the myocardium is a very sensitive method for predicting clinical outcomes in various heart diseases ***(D'Hooge et al., 2000)***.

In practice, speckle tracking may be readily applied to echocardiographic images to provide additional information on myocardial strain patterns in patients with renal disease, and one report showed it to be more accurate than TDI, partly because TDI is beam-angle-sensitive. Speckle tracking could have a role in assessing patients with symptoms of heart failure and preserved EF ***(Jia et al., 2010).***

Because myocardial strain abnormalities are associated with a worse prognosis. Identification of such abnormalities might encourage clinicians to modify treatment strategies so as to optimize blood pressure control and avoid high ultrafiltration volumes during dialysis sessions. Future interventional studies are required to test whether these measures will translate into improved outcomes ***(Sharma et al., 2006)***.

Aim of the Work

The aim of this study is to identify early markers of cardiovascular disease in end stage renal disease patients using speckle tracking echocardiography.

Chapter 1

CARDIOVASCULAR DISEASES IN HEMODIALYSIS PATIENTS

The number of patients with end stage renal disease (ESRD) is rapidly growing. Regular hemodialysis (HD) as a renal replacement therapy for ESRD patients is associated with extremely high mortality rates up to seven times greater than in the general population ***(Colado et al., 2010).***

Prevalence of cardiovascular diseases in hemodialysis patients:

Cardiovascular diseases (CVDs) present in all stages of chronic kidney disease (CKD) and reach around 30 to 44% of those beginning HD ***(Allan et al., 2013).***

CVDs are the major causes of death in HD patients accounting for 40% to 45% of all deaths. The total mortality from CV causes in HD patients is divided as follows: 4.7% acute myocardial infarction (AMI), 4.8% congestive heart failure (CHF), 26.9% arrhythmia and sudden cardiac death (SCD), 3.1% cerebrovascular accidents (CVA), 0.3% pulmonary embolism (PE), 1.9% other cardiac causes and 0.9% other vascular causes ***(Allan et al., 2013).***

Figure (1) shows CVD mortality in general population compared with ESRD on regular hemodialysis patients.

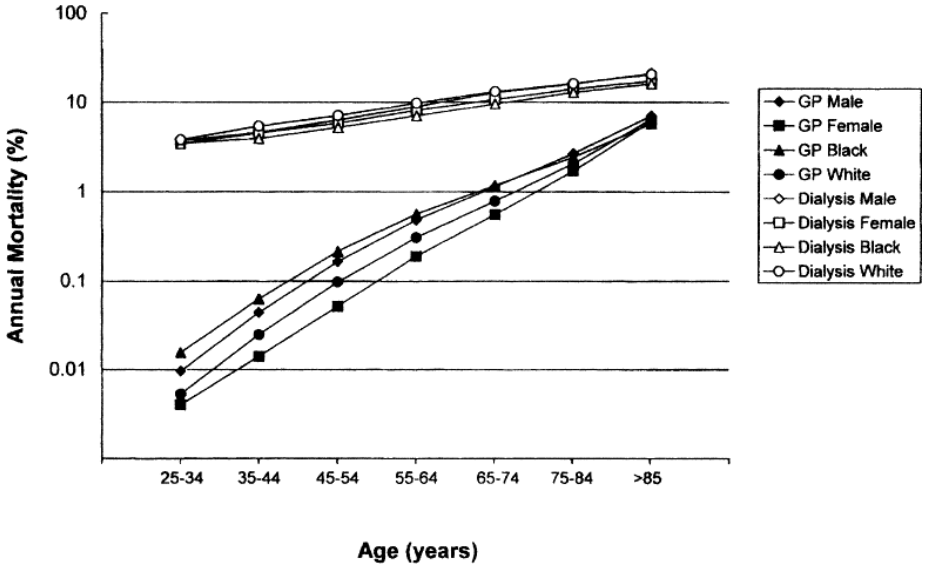

Figure (1): CVD mortality (death from arrhythmias, cardiomyopathy, cardiac arrest, myocardial infarction, atherosclerotic heart disease, and pulmonary edema) in the general population compared with patients with ESRD treated by dialysis ***(Sarnak et al., 2013)***.

The prevalence of CVD is increased in all patients with CKD, not only in end-stage renal disease (ESRD). Of notice, the prevalence of left ventricular hypertrophy (LVH) increases as glomerular filtration declines. Also, as many as 30% of patients reaching ESRD already have clinical evidence of ischemic heart disease or heart failure. Furthermore, it is important to note that patients with a reduced glomerular filtration rate (GFR) are more likely to die of CVD than they are to develop ESRD ***(Wright et al., 2002).***

Figure (2) shows the main causes of death in HD patients.

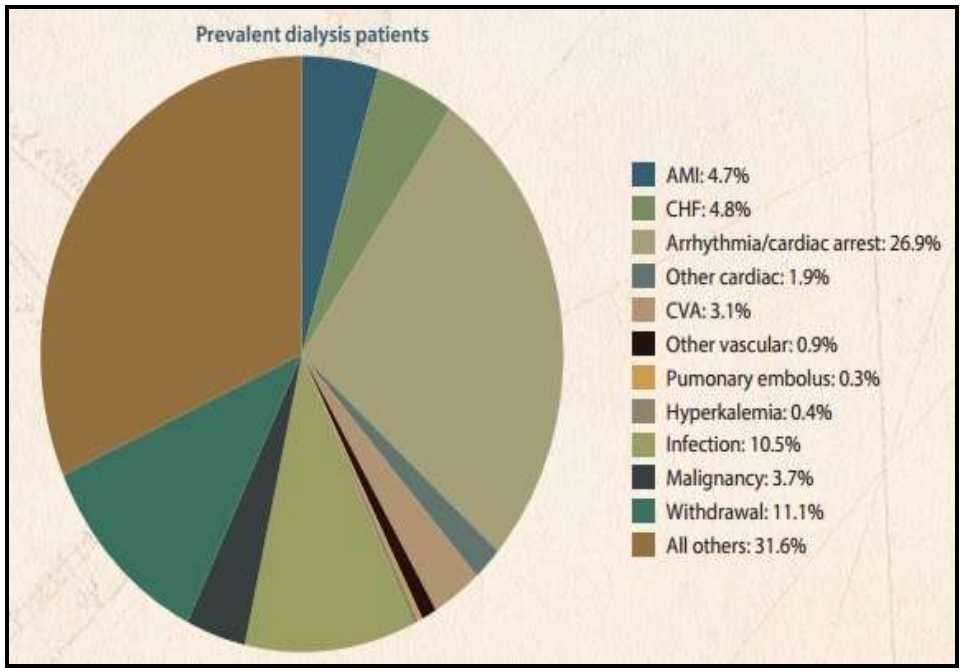

Figure (2): Causes of death in prevalent HD patients ***(Allan et al., 2013).***

Risk factors for CVDs in HD patients:

Risk factors for CVDs in HD patients include both traditional risk factors "e.g. age, sex, D.M., HTN, smoking, obesity, positive family history, sedentary lifestyle, and the unique exclusive non-traditional risk factors including inflammation and C-reactive protein (CRP), oxidative stress, endothelial dysfunction, lack of nitric oxide (NO) availability, hyper-homocysteinemia, dysregulation of calcium (Ca) and phosphate (P) metabolism and anemia ***(Gansevoort et al., 2013).***