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Abbreviations

ASE	American Society of Echocardiography
AVF	Ateriovenous fistula
AT	Acceleration time
CAD	Coronary artery disease
CKD	Chronic kidney disease
CMR	Cardiac magnetic resonance
CRT	Cardiac resynchronizing therapy
DBP	Diastolic blood pressure
Ecclx	LV eccentricity index
EF	Ejection fraction
ET	Ejection time
ESRD	End stage renal disease
FAC	Fractional area change
IVA	Isovolumic acceleration
IVC	Inferior vena cava
IVCT	Isovolumic contraction time
IVRT	Isovolumic relaxation time
HD	Hemodialysis
LVEDD	Left ventricular end-diastolic diameter
LVESD	Left ventricular end-systolic diameter
LVH	Left ventricular hypertrophy
LVMI	Left ventricular mass
K/DOQI	National Kidney Foundation Dialysis Outcome Quality Initiative
MBF	Myocardial blood flow
MI	Myocardial infarction
MPI	Myocardial performance index
MRI	Magnetic resonance imaging
LTDIS'	Lateral tricuspid(tissue Doppler image)systolic excursion velocity
LV	Left ventricle
PA	Pulmonary artery
PD	Peritoneal dialysis
PADP	Pulmonary artery diastolic pressure
PH	Pulmonary hypertension
PLAX	Parasternal long-axis
PSAX	Parasternal short-axis
PWT	Posterior wall thickness
PVR	Pulmonary vascular resistance
RA	Right atrium

RVEDD	Right ventricular end-diastolic diameter
RVESD	Right ventricular end-systolic diameter
RV dp/dt	Rate of pressure rise of right ventricle
RV IVA	Right ventricle isovulomic acceleration time
RIMP	Right ventricular index of myocardial performance
RV	Right ventricle
RV EF	Right ventricle ejection fraction
RV FAC	Right ventricle fractional area change
RVH	Right ventricular hypertrophy
RVOT	Right ventricular outflow tract
RVSP	Right ventricular systolic pressure
RVS^{O}	Right ventricle systolic excursion
SBP	Systolic blood pressure
SD	Standard deviation
SPAP	Systolic pulmonary artery pressure
STDIS'	Septal tricuspid(tissue Doppler image)systolic excursion velocity
SWT	Septal wall thickness
TAM	Tricuspid annular motion
TAPSE	Tricuspid annular plane systolic excursion
TDI	Tissue Doppler Imaging
TDIS	Tricuspid annular systolic excursion velocity
TR	Tricuspid regurgitation
USRDS	Unite State Renal Data System
2D	Two-dimensional
3D	Three-dimensional

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Value of tissue Doppler imaging (TDI) in assessment of right ventricular function in patient with chronic renal failure on regular dialysis

Thesis

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INTRODUCTION

Cardiovascular disease is the leading cause of mortality in patients undergoing dialysis, accounting for 50% of deaths [1]. In particular, heart failure is the most common finding in these patients and is associated with poor prognosis ***(Trespalacios et al., 2003)***.

Hemodialysis (HD) which is usually carried out via a surgically created native arteriovenous fistula (AVF) has been associated with an increased risk of pulmonary hypertension ***(Yigla et al., 2003; Beigi et al., 2009; Yigla et al., 2008; Bozbas et al., 2009)***, a condition reported as a predictor of mortality in these patients ***(Yigla et al., 2009)***.

The incidence of pulmonary hypertension in HD patients ranges from 17 to 60% and is associated with the presence of AVF ***(Yigla et al., 2003; Beigi et al., 2009; Yigla et al., 2008; Bozbas et al., 2009)***. The leading mechanism underlying pulmonary hypertension development in these patients is the volume/pressure overload imposed by the shunt which increases right ventricular output and pulmonary pressures.

On the other hand, AVF determines a chronic increase in preload which may impair right ventricular performance independently of post-load conditions ***(Piazza and Goldhaber, 2005)***.

Although patients undergoing chronic dialysis exhibit an increased prevalence of pulmonary hypertension during treatment, data on the development of right ventricular dysfunction (RVD) are lacking. Moreover, in patients with pulmonary hypertension, survival has been related to cardiac function rather than pulmonary pressure values ***(D'Alonzo et al., 1991)***.

Importantly, RVD may also affect left ventricular filling via interventricular interaction ***(Piazza and Goldhaber, 2005)***.

In recent years, the assessment of right ventricular function by tissue Doppler imaging (TDI) has been established as a common approach to detect preclinical abnormalities of cardiac function and has also been proposed as a reliable predictor of prognosis ***(Dandel et al., 2007)***.

Previous works regarding the relation between pulmonary hypertension and dialysis have mostly investigated the impact of volume overload on TDI indices of left ventricular function, showing an increased prevalence of diastolic dysfunction in these patients ***(Gulel et al., 2008; Hayashi et al., 2006)***.

However, data on the prevalence of RVD in patients undergoing chronic dialysis are still lacking. This study is designed to investigate the impact of chronic dialysis therapy on right ventricular function.

Echocardiography is a widely available imaging technique particularly suitable for follow-up studies, because of its non-Invasive nature. low cost, and lack of ionizing radiation or radioactive agent and it is the first available imaging modality for screening for pulmonary hypertension but assessment of RV function is challenging due to the pet complex geometry of the right ventricle (RV).

The development of technology for measurement of regional myocardial velocities by means of tissue Doppler and software have offered researchers a promising new technology for noninvasive assessment of RV myocardial function ***(Sutherland et al., 1999)***. Shortly thereafter studies reported on the applicability of tissue Doppler based deformation analysis in the RV as well ***(Kowalski et al., 2001; Jamal et al., 2003)***. These new parameters seemed clinically useful and potentially less load dependent than other echocardiographic markers of RV myocardial performance.

AIM OF WORK

To detect early change in right ventricular functions by tissue Doppler imaging (TDI) in patients with chronic renal failure on regular hemodialysis.

Chapter I

ANATOMY AND PHYSIOLOGY OF RIGHT VENTRICLE

Historical background

For over a thousand years, the world's view of the pulmonary circulation hewed to the teachings of Galen, who believed that blood was produced in the liver, then delivered by the right ventricle (RV) to the tissues and organs where it was consumed. In Galen's view, blood "seeped" into the left ventricle (LV) directly from the RV via invisible pores in the interventricular septum. While it may now seem self evident that this is impossible, Galen viewed blood movement as a low volume ebb and flow ***(Clifford, 2010)***.

In the 13th century, Ibn al-Nafis of Syria rejected Galen's description and speculated that blood from the RV reached the LV via the lungs. While he deserves credit for the first accurate description of the pulmonary circulation, his works were lost and largely forgotten until quite recently, and it does not seem likely that they influenced the understanding of circulatory physiology in the western world ***(West et al., 2008)***.

The first detailed description of the RV and pulmonary circulation to receive significant attention in the western world appeared near the beginning of the 16th century in the midst of