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Right Ventricular Dysfunction in Patients with End-Stage Renal Disease on Regular Hemodialysis

MSc Thesis

Submitted in Partial Fulfillment of the Master Degree in Cardiology

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محضر
اجتماع لجنة الحكم على الرسالة المقدمة من
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فى ....

تحت عنوان : باللغة الانجليزية: Right Ventricular Dysfunction in Patients with End-Stage Renal disease On Regular Hemodialysis

باللغة العربية : إعتلال البطين الأيمن لدى مرضى المرحلة النهائية للفشل الكلوى المعالجين بالديلزة المنتظمة

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Abstract :

Background : Hemodialysis (HD) has been associated with an increased risk of pulmonary hypertension . Ateriovenous fistula determines a chronic increase in preload which may impair right ventricular performance independently of post-load conditions

Aim of study : The study was a *prospective* study that was designed to investigate the impact of chronic dialysis therapy on right ventricular function by echocardiography in patients with ESRD treated by regular hemodialysis.

Methods : Study population consisted of 50 (31 male and 19 female) patients with ESRD treated with hemodialysis. The control group was consisted of 24age and gender matched healthy subjects (15 male and 9 female) without history of cardiovascular or renal dysfunction . All subjects in the HD and control groups underwent detailed history and physical examination as well as electrocardiography (ECG), echocardiography, and biochemical and hematological analysis.

Results : The mean age of the patients was 37.3±12.9 years in the HD group and 39.6 ± 12. 6 years in control group. LV mass index was increased in HD patients in comparison to control group (117.43±46.72 gm/m^2*vs* 80.13±13.40 gm/m, p value <.001) so the study found the prevalence LVH was 52% (26/50). The pulmonary hypertension with SPAP values > 35 mmHg was found in 34% (17/50) of patients receiving HD (mean ±SD =32.75±10.11mmHg).There was statistically significant decrease in RV function parameters in HD compared to control group (RV FAC ;37.54±9.86% vs 43.5±4.8 %, p value < 0.001, TAPSE ; 2.09±0.49 cm vs 2.61±0.36cm , p value < 0.001, lateral TDIS^0 ;11.86±2.86 cm/s vs16.04±3.60cm/s, p value < 0.001) .

Conclusion, RV dysfunction is highly prevalent among ESRD patients on regular hemodialysis and RV dysfunction was independent of LV hypertrophy, diastolic dysfunction of the LV and pulmonary hypertension.

Key words:

Right Ventricular Dysfunction in Patients with End-Stage Renal Disease on Regular Hemodialysis

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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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Introduction & Aim of the work

Introduction

Chronic renal failure (CRF) is associated with significantly increased morbidity and mortality. Chronic renal failure affects almost every system of the body and results in various functional and structural abnormalities. Cardiovascular complications are the main cause of death in patients with chronic kidney disease (CKD) undergoing hemodialysis therapy. [1,2] accounting for 40% of deaths in international registries. [3] The traditional risk factors for cardiovascular disease do not completely explain this excess risk, which seems to be influenced by the so-called non-traditional risk factors associated with CKD. [4] This set of factors accelerates the course of coronary artery disease (CAD) [5] and is associated with a higher prevalence of ventricular hypertrophy, myocardial fibrosis, valvulopathies, arrhythmias and sudden death .[7] The prevalence of clinical manifestations of cardiac disease at the start of end-stage renal disease (ESRD) therapy is high and these manifestations independently predict death. [8,10] More than 50% of the individuals starting a dialysis program present some type of pre-existent cardiovascular disease.[11] Clinical manifestations of cardiovascular disease were highly prevalent at the start of ESRD therapy: 14% had coronary artery disease, 19% angina pectoris, 31% cardiac failure, 7% dysrhythmia and 8% peripheral vascular disease.[12]

There is increasing evidence of the pivotal role of echocardiography in the improvement of quality of global clinical evaluation of advanced CKD patients. Current literature and clinical practice have emphasized the usefulness of the method for the diagnosis of clinical and subclinical cardiac dysfunction, the prediction of cardiovascular risk, and in the orientation and follow-up of treatment strategies. Guidelines recommend the echocardiogram for all dialysis patients 1–3 months after the start of renal replacement therapy and in intervals of 3 years subsequently, irrespective of the symptoms. [13]

End-stage renal disease is associated with a variety of cardiac alterations including left ventricular hypertrophy (LVH), LV dilation, and reduction in systolic and

diastolic function, with only 16% of new dialysis patients presenting with normal cardiac morphology and function. [(14)]

On echocardiography 15% had systolic dysfunction, 32% left ventricular dilatation and 74% left ventricular hypertrophy. [(15)] Patients undergoing chronic dialysis exhibit an increased prevalence of pulmonary hypertension during treatment15-20 % [(1,2)] .

However, while most available studies focused their attention on left ventricular function in dialysis patients **,** the impact of dialysis treatments on the development of right ventricular dysfunction (RVD) has not been fully investigated. But recently a retrospective study in which Paneni et al.[(16)] investigated the impact of different dialysis treatments on right ventricular function, showed that Compared to peritoneal dialysis, hemodialysis increases the risk of RVD, particularly in the presence of brachial ateriovenous fistula (AVF) [(17)]. A limitation of this study is represented by its *retrospective* design.