Echocardiographic Assessment Of Left Ventricular Systolic Function Among Patients with Chronic Kidney Disease Managed In Ebn Sena Dialysis Center In Diyala

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Abstract

Background: Cardiovascular diseases are prevalent in patients with chronic kidney disease and represent the major hazard for mortality in this population . Left ventricular hypertrophy is a cardiovascular complication in patients with chronic kidney disease and end-stage renal disease. Left ventricular hypertrophy in dialysis patients has generally a bad prognostic value, because it represents a risk factor for the development of cardiac arrhythmias, ischemic heart disease, heart failure and sudden death.

Objective: To study left ventricular systolic functions by Echocardiography in patients with chronic renal failure on hemodialysis program and their relation with some risk factors.

Patients and Methods: 100 patients with end stage renal failure on dialysis were studied by echocardiography, the patients were divided into two groups, the first group with normal echo study , while the second group consisted of patients with left ventricular systolic dysfunction. Risk factors including age , sex , duration of dialysis , hypertension, DM, and hemoglobin levels were compared between the groups.

Results: Left Ventricular disorders occurred in 65% , 34% of patients showed left ventricular systolic dysfunction , , older age group, longer duration of dialysis , hypertension ,DM, and anemia were found to be significantly associated with left ventricular systolic dysfunction.

Conclusion: Our study concluded that large numbers of end-stage renal disease patients have hypertension and diabetes as the etiology of their disease, which could be prevented by better approach in controlling blood pressure and blood sugar.   Anaemia   is   a major problem and as a predictor of cardiovascular risk factor for those patients. Echocardiographic Left Ventricular Study are prognostic predictors in chronic kidney disease patients, which suggest that echocardiography may play a vital role in assessing cardiac morphology and functions in those patients.

Key words: Left Ventricular Systolic Dysfunction, Chronic Kidney Disease, Dialysis, End-Stage Renal Disease.

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Introduction

Cardiovascular disease is a significant cause of morbidity and mortality among dialysis patients .There are four main structural abnormalities of the heart have been described in patients with CRF: 1. LV hypertrophy, 2. Expansion of the nonvascular cardiac interstitium 3. Changes in vascular architecture, and 4. Myocardial calcification. All these abnormalities promote systolic as well as diastolic LV dysfunction which predisposes to symptomatic heart failure, which is a risk factor for premature death [11].

Echocardiography is increasingly used in the assessment of cardiac performance and is also invaluable in the demonstration of structural abnormalities such as LVH, valve lesions "with some extend calcification" and pericardial effusio [11]. Left ventricular hypertrophy is the single most important predictor of adverse cardiovascular events.

Chronic Renal Failure (CRF) is one of the common conditions which a physician comes across in day to day practice. Chronic Renal Failure affects every aspect of the lives of the patients and involves all systems of body and results in various abnormalities [1,2].

Chronic renal failure is defined as either kidney damage or GFR<60 mL/min/1.73m2 for > 3months. Kidney damage is defined as pathological abnormalities or markers of damage. The term end-stage renal disease (ESRD) represents a stage of CKD where the accumulation of toxins, fluid, and electrolytes normally excreted by the kidneys results in the uremic syndrome. This syndrome leads to death unless the toxins are removed by renal replacement therapy, using dialysis or kidney transplantation[3].Abnormalities in blood or urine tests or imaging studies [4].

It has been estimated from population survey data that at least 6% of the adult population in the United States has CKD at stages 1 and 2. An undetermined subset of this population will progress to more advanced stages of Chronic Kidney Disease. An additional 4.5% of the U.S. population is estimated to have stages 3 and 4 CKD [5].

Data available on the exact prevalence of various kidney diseases in the Arab world is very limited. In reviewing the recent literature, one found that there is no Arab country with up todate information on the epidemiology of CKD. Most of the collected data came from limited studies of about 100 patients or less . Based on their size and other design considerations, data from these studies have limited generalizability[6].

Hypertension and diabetes are the main causes of ESRD in seven of twelve Arab countries. Remarkably, Arab countries such as the UAE, Saudi Arabia, Bahrain and Kuwait, where the World Health Organization (WHO) estimates 'very high prevalence of diabetes' (in the 15–25% range), there is a lack of accurate data on the CKD prevalence [6].

Left ventricular (LV) systolic dysfunction is common among hemodialysis patients. With echocardiography, 15% of patients initiating maintenance dialysis treatment were found to have LV systolic dysfunction [12].After the start of maintenance hemodialysis, the incidence of systolic heart failure seems to increase[6].In a prospective study, (40%) of dialysis patients newly developed systolic heart failure by one year after starting dialysis therapy. Improvements in LV systolic function were observed in 46% of patients and these patients had a significantly better cardiovascular outcome than patients in

whom LV systolic function remained stable or decreased [7].

Burton , studied 70 prevalent hemodialysis patients with pre , intra and postdialysis echocardiography and found that 64% of these patients developed significant LV regional wall motion abnormalities (RWMA) [8] . It follows that an unchanged LV ejection fraction does not rule out regional LV systolic dysfunction. The study of Burton suggests that hemodialysis induced LV dysfunction occurs in a large proportion of patients[9].

The specific focus of this study is to investigate the effects of hemodialysis on left ventricular systolic function.

Patients and Methods

The protocol was in conformity with the ethical and scientific committee of Diyala University College of Medicine and health institution and informed consent was obtained from each patient.

Study sample subjects: The study enrolled 100 patients (65 males and 35 females) aged between 18 and 78 years, with a mean age of 49.5 ± 29.5 years. Hemodialysis (HD) was performed three times a week for 4 hours. All echocardiographic parameters were measured within 2 hours before or after a dialysis session.

The inclusion criteria: Patients included were those with ESRD on regular HD for more than three months, irrespective of the etiology, with an adequate acoustic window for performing echocardiography. All patients admitted to Ebn Sena Dialysis Center in Baquba Teaching Hospital During the period from 1st September 2016 to 1st April 2017.

Exclusion Criteria: Patients with other cardiac disorder such as valvular heart disease, congenital heart disease, all patients under the age of 18 years with chronic renal failure and patients infected with viral hepatitis.

Demographic and clinical data: Baseline characteristics collected included the following: Age, gender, weight and height, residence, socioeconomic status, dialysis duration, diabetes mellitus, hypertension, and smoking, presence of any kidney problems before dialysis.

Echocardiographic Data: Conventional echocardiographic study was performed using a GE, Vivid E9 ultrasound systems for each patient in cardiology department of Baquba Teaching Hospital. Measurements were obtained by means of three cardiac cycles. All echocardiographic data were measured by the same echocardiologist. The patients were examined in the left lateral decubitus position using standard parasternal long axis, short axis and apical views. The LV diameter and thickness were measured by two dimensional directed M-mode echocardiography.

Ejection fraction (EF) was measured, patients with ejection fraction <50% were considered to have systolic dysfunction . The LV ejection fraction was estimated by using the Teicholz method[10] .

Statistical Analysis

Continuous variables are reported as mean ± standard deviation. Univariate analysis was performed to determine the association between duration of dialysis and demographic features, risk factors and echocardiographic findings. A P-value < 0.05 was considered to be statistically significant, with a 95% confidence interval (CI). Calculations were done using SPSS version 20.

Results

As shown in tables 1, in the present study the age distribution of selected patients was ranging from 18 to 78 years. Majority of patients were in the age group of 50-59 years that included 34 patients (34%). With mean age of the patient's 50.7 + 13.4, the study group showed the majority of patients were

males (69%) and only 31% were females. The study showed most of patients were overweight with 56% of the selected patients, whereas 30% were within the ideal weight, and only 14 % of the patients were obese. The study showed that 68% of patients were nonsmokers.

The study showed that 52% of patients were resident in urban area , also showed that 30% of patients were low socioeconomic status while 65% of patients were medium and 5% were high socioeconomic status.   Among 100 patients selected, it can be categorized in to two groups : 40 have dialysis duration less than 12 months, the remaining patients have dialysis duration   more than 12 months as shown in table (1).

Table (1): Demographic and clinical data of the studied patients in Ebn Sena dialysis center.

Parameter			Results
Age in years			50.7$\pm$13.4
Gender Male/Female			69/31
BMI (kgm^2)		normal	30 %
		overweight	56 %
		obese	14 %
Dialysis Duration		< 12 month	40 %
		< 12 month	60 %
Socioeconomic status		low	30 %
		medium	65 %
		high	5 %
Residence		rural	48 %
		urban	52 %
Systolic blood pressure (mmHg)			157.9 $\pm$25.2
Diastolic blood pressure (mmHg)			91.9 $\pm$ 9.5
Diabetes Mellitus		no	65 %
		yes	35 %
Obstructive uropathy		no	83 %
		yes	17 %
Glomerulonephritis		no	93 %
		yes	7 %
APKD*		no	98 %
		yes	2 %
Unknown causes			12 %

* Adult Polycystic Kidney Disease

Etiology of CRF

Combined hypertension and diabetes was the leading cause of chronic renal failure . The results showed that 81% of patients were hypertensive with mean systolic blood pressure 157.9 + 25.2 mmHg and mean diastolic blood pressure 91.9 + 9.5 mmHg whereas only 19% of patients were normotensive , the study showed that 35% of patients were diabetic whereas 65% of patients were non diabetic .Also showed that obstructive uropathy in 17 patients as shown in table (1). The current study showed that chronic glomerulonephritis in 7 patients , also showed that Adult Polycystic Kidney Disease (APKD) in 2 patients (2%) , the

study showed that unknown causes of CRF in 12% of the patients as shown in table (1).

Hemoglobin levels in CRF

The mean hemoglobin levels among patients admitted for hemodialysis was 8.8 + 1.2 gm%. The range of hemoglobin levels in the present study was between 6 – 12 gm%. However majority of the patients (52%) had hemoglobin levels between 7.0-8.9 gm%, followed by 39 patients (39%) in between 9.0-10.9 gm%.as shown in tables 2 and 3 respectively.

Table (2): Descriptive Statistics of Hemoglobin levels among studied patients.

Level of Hb (gm%)	No.	Minimum	Maximum	Mean	Std. Deviation
HB	100	6.0	12.0	8.8	1.2
Valid No.	100				

Table (3): The distribution of the levels of Hemoglobin among studied patients.

Level of Hb (gm%)	Frequency	Percent
5 - 6.9	5	5.0
7- 8.9	52	52.0
9 - 10.9	39	39.0
>11	4	4.0
Total	100	100.0

In this study, among 100 patients with CRF, their mean ejection fraction was 54.5±8.8%, minimum EF was 33 % and maximum EF was 70 % as shown in table (4).

Table (4): Echocardiographic Ejection Fraction percentages among patients admitted to Ebn Sena dialysis center.

	No.	Minimum	Maximum	Mean	Std. Deviation
Left Ventricular Ejection Fraction (%)	100	33	70	54.5	8.8

The current study showed 66 % have EF > % as shown in table (5). 50% the remaining 34 % patients have EF <50

Table (5): Frequency Distribution of Ejection Fraction percentages among studied patients.

Ejection Fraction %	Frequency	Percent
>50	66	66.0
<50	34	34.0
Total	100	100.0

The result showed that 23 (23%) had left ventricular dilatation by measuring Left Ventricular End Diastolic Dimension (LVEDD), out of them 21% had mild dilatation and 2 of them moderate Left Ventricular Dilatation as shown in table (6).

Table (6): Frequency Distribution of Left Ventricular End Diastolic Dimension among patients admitted to Ebn Sena dialysis center.

LVEDD (mm)	Frequency	Percent
*42 - 59 (**39 – 53) normal	77	77.0
*60 - 63 (**54 – 57) mild	21	21.0
*64 - 68 (**54 – 57) moderate	2	2.0
Total	100	100.0

*Males ** Females

Comparative study between patients with normal echocardiographic study and patients with left ventricular systolic dysfunction: In this study, patients can be categorized into two groups according to their left ventricular systolic function: group I with normal function account for 66 dialysis patients, and group II which includes 34 patients with disturbed left ventricular systolic function. When

patients with left ventricular disorders compared with patients with normal echo they appeared to have statistically significant differences among patients with older age group, longer duration of dialysis, hypertension, diabetes Mellitus, hemoglobin level with no significant difference regarding the sex as shown in table(7).

Table (7): Compares different parameters between patients with normal echo and patients with impaired systolic function among studied patients.

Parameter	Group I No. 34	Group II No. 66	P Value
Age	35.5±16	55.5±13.4	0.032
gender M/F	21/13	48/18	0.66
Duration of dialysis (months)	8.5±5	48.2±10	0.001
Systolic blood pressure (mmHg)	120.5±15	159.3±18	0.001
Diastolic blood pressure (mmHg)	78.8±9	99.2±17	0.004
Hemoglobin (gm/dl)	8.8±2	7.2±2.9	0.04

Discussion

A non-invasive diagnostic modalities, such as echocardiography is utilized for diagnosing cardiovascular function. Echocardiography provides an excellent way to visualize the structural details of the anatomy of cardiac cavity, dimensions and wall motions[11].

Demographic Characteristics: In the present study the majority of patients were in the age group of 50-59 years, with mean age of the patient's 50.7 year. The mean age of the patients according to the current study was nearly higher than that reported in Al-Anbar-Iraq [12] ,which was found to be 48 years, and lower than that reported in the USA and the Kingdom of Saudi Arabia , which was found to be 60 and 55 years, respectively [13] and also slightly similar to that reported in Iran(51.6) years[14].

The present study group showed most of patients were males (69%)which is higher than that reported in Al-Anbar, Iraq (53%) [13] ,and showed most of patients were

overweight with 56% of the selected patients and obesity in (14%), and showed that 68% of patients were nonsmokers, also showed that 52% of patients were resident in urban area, also depend on daily income, type of job and education level, it was estimated that 30% of patients were low socioeconomic status while 65% of patients were medium and 5% were high socioeconomic status, 40% of patients have dialysis duration less than 12 months, the remaining patients have dialysis duration on more than 12 months.

The current study found that there is a significant gender differences in relation to the frequency and distribution. This finding is in agreement with other results from other studies from KSA (60.1% males and 39.9% females), India (67.8% males and 32.2% females), and Japan (54.4% males and 45.6% females) [15]. but differs from study conducted in AL-Anbar and in Iran [13,16].

Rizvi SA and Manzoor K conducted study on 874 patients in Pakistan . The mean age of

the patients were 47.4 years with a range of 17-85 years. There were 506 (57.8%) male patients and 368 (42.2%) female patients with M:F ratio of 1.3:1. The majority of their patients, (66%) were beyond 40 years of age . The breakdown of the origin of referrals was 651(74%) urban 233 (26%) rural population [17] .

The effects of smoking in the dialysis population are not well-established than in the general population. A meta-analysis shows that there was a significantly higher risk of mortality in dialysis patients who smoke compared to those who do not. However, there does not appear to be a higher incidence of cardiovascular events in smokers versus non-smokers with ESRD [18].

In CKD patients treated with hemodialysis, larger body size or greater muscle mass, represented by higher BMI, is associated with greater survival. Their study showed a significant incrementally inverse relationship between BMI and all-cause as well as cardiovascular mortality in those patients. These findings have important clinical implications in dialysis patient care management [19].

Other study showed that obesity is also related to CKD epidemiology since obesity appears to be an important risk factor for CKD (20–23) . The prevalence of obesity has increased in the last few decades. Over 3,000 million adults worldwide are obese [16]. The prevalence of a body mass index of at least 35 among incident dialysis patients has increased by 64% over the past decade, and if trends continue 20% of all patients will initiate dialysis with this degree of obesity.

In Syria, obesity was found to be present in 38.2%, with the prevalence in women nearly one and half times more than in men [20]. Obesity affects 16–50% of individuals with diabetes in the Arab world, 20–38% have hyperlipidemia, 24-46 % have hypertension and, although data are incomplete,

nephropathy and retinopathy rates appear to be quite high [21, 22] . Moreover, in a review of obesity prevalence in the Arab world, it was concluded that one-third of Arabs are obese and women have particularly higher rates of obesity as defined by a body mass index of 30[23].

In the current study, we observed impaired systolic function, the current study showed 66 % have EF > 50% the remaining 34 % patients have EF <50 %, their mean ejection fraction was 54.5±8.8.

Agarwal S *et al.*, conducted study in 2003 to assess the prevalence of systolic and diastolic dysfunction in patients of chronic renal failure on conservative management on sixty patients with varying degree of chronic renal failure were subjected to two-dimensional M mode echocardiography. The mean left ventricular ejection fraction (LVEF) in patients with mild/moderate CRF (58.1 ± 6.9%) and severe CRF (55.4 ± 9.8%) was significantly lower than the controls (63.7 ± 5.1%). Although the mean fractional shortening (FS) in the three groups was similar, 7 (23%) patients with mild/moderate CRF and 5 [16%] patients with severe CRF had FS ≤ 25% which was statistically significant. The prevalence of left ventricular hypertrophy along with systolic dysfunction in severe CRF group was 30%, which was significantly higher than mild/moderate CRF group (3.3%) [4]. Parfrey PS et al., conducted study on 432 end-stage renal disease patients who survived at least 6 months had an echocardiogram on initiation of dialysis therapy. On initiation of ESRD therapy 16% of patients had systolic dysfunction, 41% concentric LV hypertrophy, 28% LV dilatation, and only 16% had normal echocardiograms [24].

Our study concluded that large numbers of ESRD patients have hypertension and diabetes as the etiology of their disease, which could be prevented by better approach in controlling blood pressure and blood

sugar. Anaemia is a major problem and as a predictor of cardiovascular risk factor for those patients. Echocardiographic Left Ventricular Study are prognostic predictors in CKD patients, which suggest that echocardiography may play a vital role in assessing cardiac morphology and functions in CKD patients.

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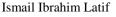
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