EUROPEAN ACADEMIC RESEARCH
Vol. VI, Issue 5/ August 2018

Impact Factor: 3.4546 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Evaluation of alteration of cardiac structure in Hemodialysis Patients Using Echocardiography

YAGOUB ABDALLA ABDALLRAHMAN [1]
College of Medical Radiologic Sciences
Sudan University of Science and Technology, Khartoum, Sudan
MOHAMEDYOUSEF
College of Medical Radiologic Sciences
Sudan University of Science and Technology, Khartoum, Sudan
Batterjee Medical College, Department of Radiological Science
Jeddah, Saudi Arabia
MONA MOHAMED
ISLAM MERQANY
College of Medical Radiologic Sciences
Sudan University of Science and Technology, Khartoum, Sudan

Abstract:

Cardiovascular alterations contribute to a high mortality rate in patients with end-stage renal disease (ESRD). The aim of this study was to investigate the value of echocardiography for evaluation of the left ventricular structure of long-standing hemodialysis patients.

This study was done in the renal center in Sinnar Teaching Hospital in echocardiography department using sector probe of 3.5 MHz.

The study included 200 cases under regular hemodialysis, using questioner included patient personal data, and echocardiography findings and the data was analyzed using computer programs for analysis (SPSS).

The results of this study revealed that according to echocardiography findings 99% of the patients had a thick septum, 81% thick posterior wall, 76% dilated cardiomyopathy.

[1] Corresponding author: Yagoub Abdalla Abdallrahman

The study showed that the age had negative correlations with Septum, Posterior wall, and a positive correlation with, LVD. In related Weight, levels show negative correlations with the posterior wall, and a positive correlation with LVD, and Septum thickness, but the Duration showed a negative correlation with LVD, and positive correlation septum thickness, posterior wall thickness.

This study concluded that echocardiography could be used for follow up hearts of these patients and adjusts the suitable time for an intervention.

Key words: Echocardiography, Left ventricular mass, Hemodialysis, structure

INTRODUCTION

Arterial hypertension is the most common cardiovascular disease of adult age; however, with the expansion of routine blood pressure measurement in paediatrics and increasing prevalence of obesity in children [1], it is also becoming a paediatric issue. It has multifactorial etiopathogenesis and may lead to target organ damage (TOD), such as left ventricular hypertrophy (heart), increased pulse wave velocity (i.e. proof of increased vascular rigidity), microalbuminuria (kidney damage), and retinopathy (eye), even in children. Therefore, echocardiography is becoming increasingly used in arterial hypertension evaluation by monitoring the development of the left ventricular hypertrophy (LVH) and its remodelling and in determining its mass. This monitoring is used in childhood [2] and especially in adulthood [3] in stratification, i.e. the determination of cardiovascular risk, and helps in determining therapeutic strategy. Paediatric research about the effects of antihypertensive treatment on cardiac end-organ damage is limited, nevertheless, some data suggest that effective antihypertensive treatment may ameliorate cardiac geometry in children LVH is an adjustment mechanism to chronic pressure overload in arterial hypertension, which allows the left ventricle to maintain volume output against the increased systolic pressure. The hypertrophy is a risk factor for morbidity and mortality in hypertension – the presence of LVH worsens the prognosis in hypertensive patients. Moreover, hypertrophy and geometry of the left ventricle may stratify the risks in arterial hypertension patients independently and better than blood pressure and other risk factors. Adult patients with LVH have a significantly greater incidence of cardiovascular complications (heart failure, acceleration of coronary athero-sclerosis, myocardial infarction, renal failure) [4]. Studies conducted so far have shown a strong, continuous and independent relationship between left ventricular mass and subsequent cardiovascular morbidity [5]. Similar to micro-albuminuria, increased pulse wave velocity, vascular wall hypertrophy, and sclerotic plaques, the presence of LVH in hypertensive adult patients must be comprehensively examined and may lead to early and intensive antihypertensive treatment [6]. Although the risk of myocardial damage or substantial alteration of cardiac function in children is low, it is possible to diagnose and monitor heart muscle hypertrophy at this age The occurrence of LVH is more common especially in children with hypertension, and rises with increasing weight and the BMI of [7,8]. Recent studies have shown that up to 40% of children diagnosed with hypertension have the left ventricular mass (LVM) above the 95th percentile [9]. In children with primary hypertension, LVH has probably the strongest relationship to the daily variability of systolic blood pressure and nocturnal systolic pressure load [10]. However, LVH also depends on other factors (age, gender, height, growth factors, insulin resistance, etc.) [11]. Reduc- tion in obesity and decrease in insulin resistance are the most important factors for the normalization of left ventricular geometry [11]. It examines the relationship between the genetic predisposition to the development of LVH in hypertensive parents' children before the develop- ment of a hypertensive disease. LVH can also have physiological nature in young sportsmen (adaptation mech-anism), but in this case there is a risk of transition to pathological hypertrophy. In addition to comprehensive cardiological examination and the determination of left ventricle parameters, children with hypertension and diseases affecting the cardiovascular system (e.g. chronic renal disease) must also be monitored for systolic and diastolic heart function. LVH and myocardial dysfunction are important independent factors of cardiovascular risk in the case of chronic kidney disease [11] and after kidney transplantation [12] and children with chronic kidney disease even after kidney transplantation are in the highest risk of premature cardiac disease and death [13,14]. Similarly, children with diabetes Type 1, homozygous familial hypercholesterolaemia, after orthotopic heart transplantation, and Kawasaki disease with current coronary artery aneurysms were included in the same high risk group [14]. The mortality rate in patients with end-stage renal disease (ESRD) is much higher than in the general population despite advances in dialysis treatment. Cardiovascular structure and functional abnormalities, such as left ventricular hypertrophy (LVH), left ventricular (LV) systolic and diastolic dysfunction, accelerated atherosclerosis, arrhythmias and coronary artery calcification, contribute to high cardiovascular mortality in patients with ESRD [15].

The aim of this study was to investigate the value of echocardiography for evaluation of the left ventricular structure of long-standing hemodialysis patients

MATERIALS AND METHODS

Study design and population:

This study was performed on 200 patients under regular hemodialysis with ESRD and regular HD, but very ill patients or who are known cardiac disease patients were excluded. Presenting to four echocardiography units in Sinnar renal Center, sinnar state Sudan , in the period from October 2014 to February 2017. Approval of institutional ethical committee was obtained in addition to informed consent from all subjects. Height in meters and weight in kilograms.

Equipment used

All patients subjected to echocardiography by two dimensions machine estate, using lab gold 30 cardiovascular machine (Italy), with phased array probe2.5MHz

Heart ultrasound scanning technique:

Tran's thoracic echocardiography was performed on all patients. The examination was performed in a supine, or 30 degrees left lateral decubitus position, with the left arm raised up above the head. This position brings the heart out toward the chest wall, displaces the lingula of the left lung out of the way, and opens the inter costal space by spreading the ribs. The transducer is pressed firmly against the chest and moved back and forth slowly. The transducer is moved to different areas of the chest to provide a detailed view of the heart and its structures. At least four separate standard transducer positions which allow for different portions of the heart to be visualized in detail.

Statistics

Data were statistically analyzed using SPSS Statistics version 21 (USA). Categorical variables were expressed as number and percentage and analyzed using chi-square test. Continuous variables were expressed as mean± SD. A probability value $p < 0.05$ was considered statistically significant and a p-value <0.0001 was considered highly significant.

RESULTS

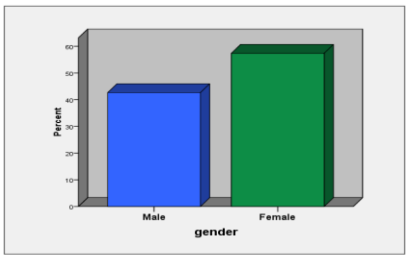

Figure 1: Frequency percentage according to gender of the patients

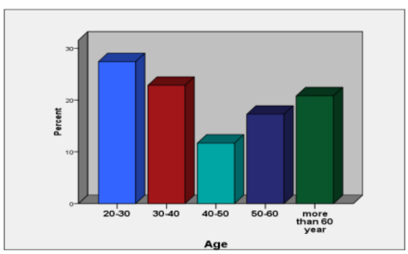

Figure 2: Frequency percentage according to age of the patients

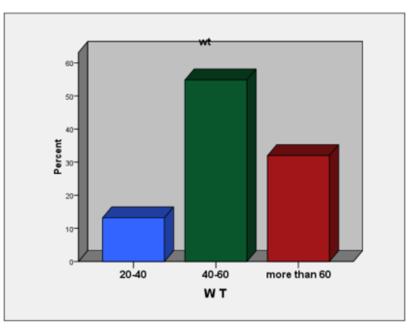

Figure 3: Frequency percentage according to weight

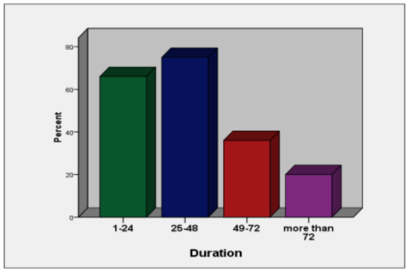

Figure 4: Frequency percentage according Hemodialysis Duration

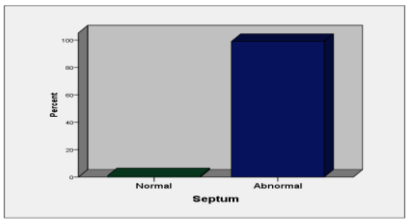

Figure 5: Frequency percentage according to Septum

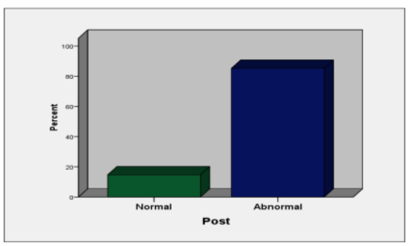

Figure 6: Frequency percentage according to Post wall thickness

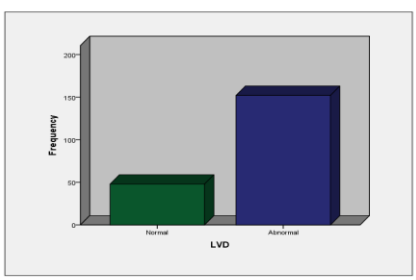

Figure 7: Frequency percentage according LVD

Table 1: Chi-Square Tests Hemodialysis Duration * septum

Duration		Septum		Total	Pearson Chi-Square	Sig (P-value)
		Normal	Abnormal			
1-24	Count	0	66	66	3.327[a]	.34
	Expected Count	.7	65.3	66.0		
25-48	Count	2	73	75		
	Expected Count	.8	74.2	75.0		
49-72	Count	0	36	36		
	Expected Count	.4	35.6	36.0		
more than 72	Count	0	20	20		
	Expected Count	.2	19.8	20.0		
Total	Count	2	195	197		
	Expected Count	2.0	195	197.0		

Table 2: Chi-Square Tests Hemodialysis Duration * post

Duration		POST		Total	Pearson Chi-Square	Sig (p_value)
		Normal	Abnormal			
1-24	Count	18	48	66	6.156[a]	.10
	Expected Count	12.5	53.5	66.0		
25-48	Count	9	68	77		
	Expected Count	14.6	62.4	77.0		
49-72	Count	8	28	36		
	Expected Count	6.8	29.2	36.0		
more than 72	Count	3	18	21		
	Expected Count	4.0	17.0	21.0		
Total	Count	38	162	200		
	Expected Count	38.0	162.0	200.0		

Table 3: Chi-Square Tests Hemodialysis Duration * LVD

Duration		LVD		Total	Pearson Chi-Square	Sig (p_value)
		Normal	Abnormal			
1-24	Count	51	15	66	9.212[a]	.027
	Expected Count	50.2	15.8	66.0		
25-48	Count	51	26	77		
	Expected Count	58.5	18.5	77.0		
49-72	Count	33	3	36		
	Expected Count	27.4	8.6	36.0		
more than 72	Count	17	4	21		
	Expected Count	16.0	5.0	21.0		
Total	Count	152	48	200		
	Expected Count	152.0	48.0	200.0		

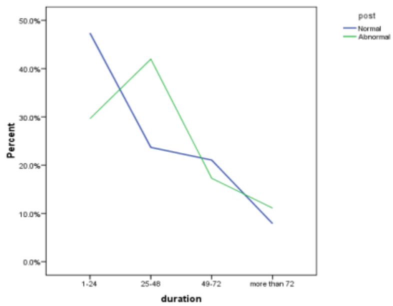

Figure 8: hemodialysis Duration*post

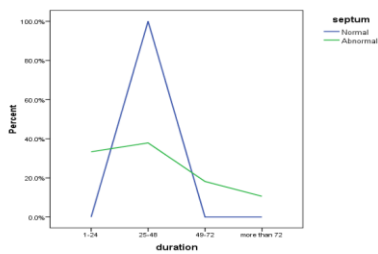

Figure 9: hemodialysis Duration*Septum

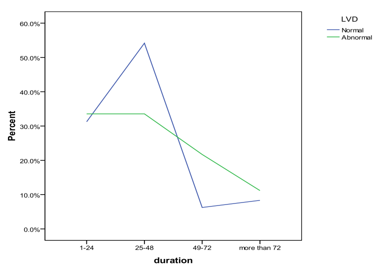

Figure 10: hemodialysis Duration*LVD

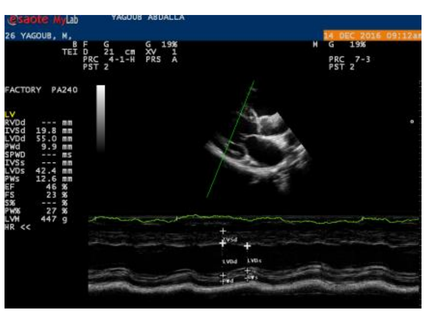

Figure (11)42years old female on dialysis for four years with DCM, LVD 55mm.

Figure (12)32years old female on dialysis for one year with DCM, LVD 54mm

Figure (13)60years old male on dialysis for 3years with DCM, LVD 57mm.

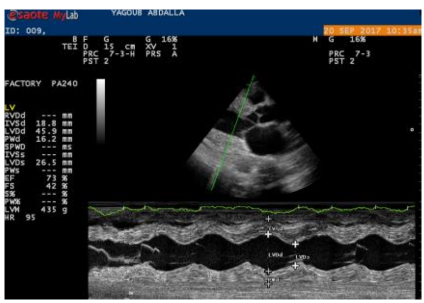

Figure (14)55years old male on dialysis for three years with LVH; septum is 18.8mm.

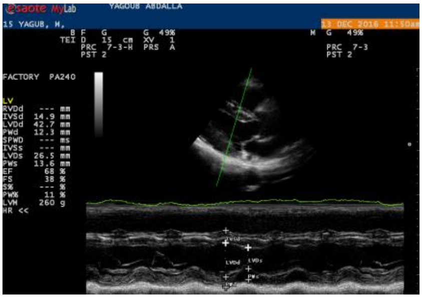

Figure (15)62years old male on dialysis for two years with LVH septum 14.9mm.

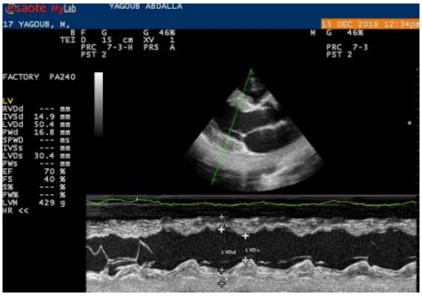

Figure (16)56years old male on dialysis for four years with LVH; septum is 14.9mm.

Figure (17)45years old male on dialysis for three years with LVH, septum thickness 12.3mm.

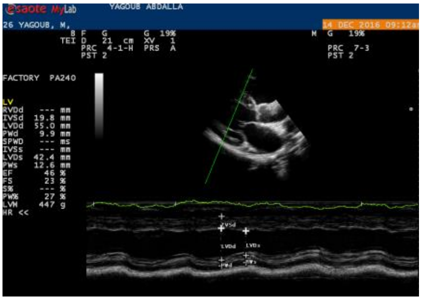

Figure (18)42years old male on dialysis for six years with LVH, septum thickness 19.8mm

Figure (19)28years old female on dialysis for four years with LVH septum thickness is 14.9mm

Figure (20)50years old female on dialysis for three years with LVH; septum thickness is 13.6mm.

DISCUSSION

Echocardiography (ECHO) is the basic non-invasive imaging method in paediatric cardiology, which is capable of detailed assessment of heart morphology and function, employing a variety of methods (2D (two-dimensional) imaging, M-mode, colour Doppler mapping and measurement of blood flow velocity, tissue Doppler imaging, stress test and contrast examination, three-dimensional imaging). Echocardiography does not stress the patient; it is repeat-able, well reproducible and repeated measurements allow the dynamics of monitored parameters to be compared and assessed. In pediatric cardiology, echocardiography is used particularly in prenatal and postnatal diagnoses of congenital heart defects and their follow-up monitoring (defects without surgery, after radical or palliative correction). However, heart structure and function are also monitored in children with arrhythmia, infection or inflammation of the heart, cardiomy- opathy and in the case of functional disorders (chest pain, tendency to collapse) as well as hypertension.

This study was conducted in the renal center in Sennar Teaching Hospital on 200 patients on regular dialysis, 43% of them male, and 57% are female Figure (1)

These patients categorize age wise into four groups, the most frequent age group ranged from 20 to 30 years old composed of 54patients which are 27%, and the next group is 30 to 40 years old composed of 44patients which are 22.0%. The third group more than 60 years old composed of 42patients which are 21.0% and the fourth group from 50 to 60 years old composed of 36patients which are 18.0% and the last group is 40 to 50 years old composed of 24patients which are 12.0%smallFigure (2).

The body weight of 110patients was ranged from 40.0 - 60.0 kg and represented 55%, 62patients (31%) more than 60.0 kg and the last index of 28patients (14%) were 20.0 -40.0 kg, respectively hemodialysis always associated with weight loss. (Because of the filtering of blood sugar) Figure (3).

This study showed that 38% of the patients stand on dialysis for 25-48 months followed by 33% on dialysis for 1-24 months (66 patients) then 18% (36 patients) stand for 49-72 months and finally 11%(22patients) stand for more than 72 months Figure (4).

This study revealed that only 1% of patients (2patients) have normal septum thickness and 99% (198 patients) had thick septum wall. Figure (5), in considering posterior wall thickness 19% of patients (38patients)had a normal posterior wall thickness, and 81% (162 patients) had a thick posterior wall. Figure (6). This is a little bit higher than *Foley et a*l. who's studied 432 dialysis patients prospectively in the 1980s focused on distortions of left ventricular architecture, namely LVH. They found that 75% had LVH. [16,17].And relatively in line with Zoccali et al. they studied 254 patients in 2008 they concluded that77% had LVH.[18] and more near to Mallamaci et al. whose studied 246 patients in 2001 and found that 79% had LVH. [19]
Where that 76% of patients (152patients) had dilated cardiomyopathy left ventricular diameter at end diastole (LVD) is more than 53mm, the residual 24% (48patients) had a normal left ventricular diameter. Figure (7).

This study showed that: there is no statistically significant association between hemodialysis duration and septum change (P-value= 0.34). (Table 1) ,post-change (P-value= 0.10.). (Table 2) but There is a statistically significant association with LVD change (p-value= 0.02.). (Table 3)

Compare to patients with Echocardiography studies. Age levels show negative correlations with Septum. Weight levels show negative correlations with a posterior wall, and a positive correlation with Septum, LVD.

Duration levels showed negative correlations with LVD, and a positive correlation with Septum, posterior wall.

CONCLUSIONS:

The study concluded that 99% had a thick septum, 81% thick posterior wall, 76% dilated cardiomyopathy.

The study showed that the Age had negative correlations with Septum, Posterior wall, LVD, , and a positive correlation with, LVD

Tran's thoracic echocardiography scanning is very important to detect any change that may occur in the heart during long-term hemodialysis; further research needs in hearts of these patients.

REFERENCES

[1] National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, The fourth report in the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents, Pediatrics 114 (2004) 555–576.

[2] E. Lurbe, R. Cifkova, J.K. Cruickshank, et al., European Society of Hypertension, Management of high blood pressure in children and adolescents: recommendations of the European Society of Hypertension, Journal of Hypertension 27 (2009) 1719–1742.

[3] A.V. Chobanian, G.L. Bakris, H.R. Black, et al., The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report, The Journal of the American Medical Association 289 (2003) 2560–2572 (PR).

[4] M.A. Gnahem Wisam, J. Murin, J.J. Bulas, et al., Hypertrofia ľavej komory u hypertonikov, Bratislavské lekárske listy 101 (2000) 456–459.

[5] P. Verdecchia, G. Carini, A. Circo, et al., Left ventricular mass and cardiovascular morbidity in essential hypertension: the MAVI study, Journal of the American College of Cardiology 38 (2001) 1829–1835.

[6] J. Bulas, J. Murín, K. Kozlíková, Echokardiografická charakteristika hypertrofie ľavej komory srdca, Kardiologia 7 (1998) 92–98.

[7] C. Hanevold, J. Waller, S. Daniels, et al., The effects of obesity, gender, and ethnic group on left ventricular hypertrophy and geometry in hypertensive children: a collaborative study of the International Pediatric Hypertension Association, Pediatrics 113 (2004) 328–333.

[8] A.B.R. Maggio, Y. Aggoun, L.M. Marchand, et al., Associations among obesity, blood pressure and left ventricular mass, The Journal of Pediatrics 152 (2008) 489–493.

[9] M. Litwin, A. Niemirska, J. Śladowska, et al., Left ventricular hypertrophy and arterial wall thickening in children with essential hypertension, Pediatric Nephrology 21 (2006) 811–819.

[10] P.S. Sharma, J. Mohammed, B. Thomas, et al., Nighttime blood pressure, systolic blood pressure variability, and left ventricular mass index in children with hypertension, Pediatric Nephrology 28 (2013) 1275–1282.

[11] M.Ch. Matteucii, E. Wühl, S. Picca, et al., Left ventricular geometry in children with mild to moderate chronic renal insufficiency, Journal of the American Society of Nephrology 17 (2006) 218–226.

[12] Y.T. Lindblad, J. Axelsson, R. Balzano, et al., Left ventricular diastolic dysfunction by tissue Doppler echocardiography in pediatric chronic kidney disease, Pediatric Nephrology 28 (2013) 2003–2013.

[13] M.M. Mitsnefes, Cardiovascular disease in children with chronic kidney disease, Journal of the American Society of Nephrology 23 (2012) 578–585. , http://dx.doi.org/10.1681/ASN.2011111115.

[14] R.-E.W. Kavey, V. Allada, S.R. Daniels, et al., Cardiovascular risk reduction in high-risk pediatric patients. A scientific statement from the American Heart Association

Expert Panel on Population and Prevention Science; the Councils on Cardiovascular Disease in the Young, Epidemiology and Prevention, Nutrition, Physical Activity and Metabolism, High Blood Pressure Research, Cardiovascular Nursing, and the Kidney in Heart Disease; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research, Circulation 114 (2006) 2710–2738.

[15]Longenecker JC, Coresh J, Powe NR, Levey AS, Fink NE, Martin A, Klag MJ: Traditional cardiovascular disease risk factors in dialysis patients compared with the general population: the CHOICE study. J Am Soc Nephrol 2002; 13: 1918–1927.

[16].Foley RN, Parfrey Pet al. The prognostic importance of left ventricular geometry in uremic cardiomyopathy.J Am Soc Nephrol1995; 5: 192–2031

[17].Foley RN, Parfrey PS, Sarnak MJ. Epidemiology of cardiovascular disease in chronic renal disease. J Am SocNephrol 1998; 9(12 Suppl): S16-S23.

[18].Zoccali C, Benedetto FAet al. Prognostic value of echocardiographic indicators of left ventricular systolic function in asymptomatic dialysis patients.J Am Soc Nephrol2004; 15: 1029–1037.

[19].Mallamaci F, Zoccali C, Tripepi Get al. Diagnostic potential of cardiac natriuretic peptides in dialysis patients.Kidney Int2001; 59:1559–1566