Cardiac Status amongst End Stage Renal Disease Patients on Maintenance Haemodialysis in Yemen: A Cross Sectional Study

K Aman[1], O Alhadrmy[2], R Aman[3], NA Qureshi[4], S Kassim[2]

ABSTRACT

Objectives: To assess the cardiac status, specifically, left ventricle among end stage renal disease (ESRD) Yemeni patients and to explore factors associated with left ventricular abnormalities.

Methods: A cross-sectional study was conducted among 105 patients in two haemodialysis centers in Aden, Yemen. The study was carried out during a period from November 2013 and early March 2014. Data collected included socio-demographic variables, clinical and biochemically assessments. Data analysis included descriptive statistics and multivariable logistic regression modelling.

Results: Patients' mean±SD age was 47.08±12.96 years. Of the 105 patients, 97.14% had different left ventricular abnormal echo-findings. Forty percent had left ventricular hypertrophy (LVH) and 38.1% left ventricular dilatation (LVD). In multivariable modelling, controlling for age and gender, concentric LVH was only significantly associated with systolic hypertension (systolic blood pressure ≥140mmhg, OR=4.60, 95% CI=1.89-11.21, p<0.001) and LVD was only significantly associated with anaemia (Haemoglobin <9, OR=2.43, 95% CI= 1.07-5.54, p<0.034).

Conclusion: Both left ventricle hypertrophy and dilation were significant and associated with systolic hypertension and anaemia.

Keywords: Cardiac status, haemodialysis, Yemen

From: [1]Aden University, Faculty of Medicine and Health Sciences, Department of Internal Medicine, Yemen, [2]Department of Internal Medicine, Taibah University, Al-Madinah Al-Munawwarah, Kingdom of Saudi Arabia, [3]Taibah Haemodialysis Centre, Al Gamhuria Teaching Hospital, Aden, Yemen, [4]National Centre of Complementary and Alternative Medicine, Ministry of Health, Al-Shimal Market, Riyadh, Kingdom of Saudi Arabia.

Correspondence: Dr O Alhadramy, Department of Internal Medicine, Taibah University Al-Madinah Al-Munawwarah, Kingdom of Saudi Arabia. E-mail: drhadramy@gmail.com

INTRODUCTION

Cardiovascular disease is highly prevalent among end stage renal disease (ESRD) patients. It accounting for about 42% of all fatalities among haemodialysis patients. Pre-existing cardiovascular diseases are present in more than 50% of patients starting haemodialysis program (2). Patients with chronic renal failure become exposed to hemodynamic stress that cause vascular and ventricular alteration which increase ventricular mass and later associated with cardiovascular morbidity and mortality (3).

Patients with ESRD become exposed to traditional as well as uremic, non-atherosclerotic risk factors, including LVH and fibrosis for left ventricular dysfunction. In uremic patient left ventricular abnormalities results from both LV pressure over load and LV volume overload, leading to myocyte death and increasing myocardial fibrosis, decreasing coronary perfusion which may become manifested as left ventricular diastolic dysfunction or may progress to left ventricular systolic dysfunction (3–5). Left ventricular pressure overload factors can result from systemic arterial resistance, elevated arteria systolic and diastolic blood pressure and large vessels compliance (6) leading to increase in left ventricular mass, relative wall thickness and decrease in left ventricular volume. Left ventricular dilatation and eccentric hypertrophy is caused by volume, preload factors including salt and fluid loading, anaemia, and large flow arterio-venous fistula (3).

Left ventricular hypertrophy is a histological diagnosis, but biopsy is not always applicable and other investigations are used for diagnosis. This may include invasive measurement as well as other expensive one with limited availability like magnetic resonance imaging, the “gold standard” technique, and cine cardiac computed tomography (7). For research purpose, an echocardiography is usually used. Echocardiography is a simple, non-invasive, and accurate test which is extremely useful in assessment of left ventricular function in dialysis patient. Baseline, at start of dialysis program and serial echocardiography is needed

for chronic renal failure patients on maintenance haemodialysis (8). M-mode and two dimensional echocardiography allow assessment of ventricular mass and volume for diagnosis of hypertrophy, its geometrical pattern and systolic function.

Conventionally, thrice weekly haemodialysis session program is usually offered for ESRD patients, but in some developing countries, including Yemen, due to some limitation of the available haemodialysis machines, patient received only twice weekly 3–4 hourly each of haemodialysis session program (9). Assessment of left ventricular function amongst ESRD in Aden, Yemen is lacking and this could lead to that health need of these patients being neglected.

The present study aims were as follows: 1) to describe the characteristic of patients with ESRD on maintenance haemodialysis in two centres in Aden, Yemen and 2) to assess the cardiac status, specifically, left ventricle in these patients and to explore factors associated with left ventricular abnormalities. In the light of absence of past studies assessing the cardiac status of Yemeni patients attending ESRD in Aden, Yemen an open-ended approach was adopted with respect to any prior hypotheses testing.

METHODS

Study design, participants' recruitment and setting

A cross sectional study was performed on 105 patients with end stage renal disease (ESRD) on maintenance haemodialysis in two haemodialysis centers in Aden, Yemen. The study was carried out during a period from November 2013 and early March 2014.

Patients' inclusion and exclusion criteria

All adult Yemeni (18 years and older) patients received twice weekly 4 hours each of haemodialysis sessions with duration of haemodialysis of more than 3 months were included.

Patients who did not meet the aforementioned inclusion criteria and refused echo-study were excluded from this study.

Variables

These included items about socio-demographic characteristics of patients (age, sex, marital state, occupation), in addition, duration of haemodialysis, health condition (s) and access to haemodialysis (e.g. A-V fistula). Clinical data were obtained from patients file or directly from patients. Measurement of weight and height and calculation of body surface area (BSA) were assessed. Blood pressure measurements were carried out by a trained nurse prior to haemodialysis. A mercury sphygmomanometer was used in the contra-lateral arm in patient with A-V fistula.

An average value of a three consecutive reading during three haemodialysis session was taken. Systolic and diastolic hypertension was defined as values of >140 or > 90 mmHg respectively or arterial hypertension if both values are elevated. Mean arterial pressure (MAP), normal value range from 70-110, was calculated from the equation: MAP= [SBP+2(DBP)]/3, were SBP is systolic blood pressure and SBP is diastolic blood pressure.
Updated pre-dialysis para-clinical results of investigations including blood examination for haemoglobin, urea, creatinine, HBsAg and anti HCV were collected from patients' clinical records.

As for echocardiography, all patients were scheduled for 2 dimensional trans-thoracic and colour Doppler echo-study between November 2013 and March 2014. Echo-study was performed within 24 hours of the patient's last haemodialysis session. Two dimensional echocardiography was performed using commercially available ultrasound contron instrument, Sigma iris 440, in left lateral position using 3.5 MHZ transducer by a consultant experienced in echocardiography. M-mode echo evaluation followed the recommendations of the American Society of Echocardiography recommendation on M- mode evaluation (10),

included: 1) measurement of left ventricular internal dimension in end systole (LVIDs) and end diastole (LVIDd); 2) inter-ventricular septum (IVSd) and posterior wall thickness in diastole (LVPWd) and finally 3) measurement of left ventricular ejection fraction (EF) and fraction shortening (FS).

Left ventricular hypertrophy (LVH) was defined as left ventricular mass index of >131 gram/m^2 in male and >100 gram/m^2 in female (10) and was calculated using the formula: $0.00083 \times [(LVEDD+IVSd+PWd)^3-(LVEDD)^3 +0.6]$ and indexed to body surface area (11) were LVEDD (left ventricular end dimension in diastole), IVSd (interventricular septum thickness in diastole) and PWd, posterior wall thickness in diastole and measurements in millimetres.

Further evaluation of LVH into concentric or eccentric one was done by assessing LV relative wall thickness (RWT). RWT was calculated from the formula: 2× posterior wall thickness in diastole/LV internal dimension in diastole. Normal RWT is <0.45. Concentric or eccentric hypertrophy of LV is defined if RWT was >0.45 or <0.45 respectively (12) in the presence of LVH.

Left ventricular volume (LVV) was calculated as 0.001047 (LV end diastolic diameter $mm)^3$ (13) and indexed to BSA. Left ventricular dilatation was considered as left ventricular volume index of more than 90 ml/m^2 with or without left ventricular hypertrophy and with normal systolic function.

Left ventricular systolic dysfunction was defined as FS <25. A Trans-mitral flow velocity ,which reflect trans-mitral pressure gradient, was used as one of echo-Doppler modalities for assessing left ventricular diastolic function (14). Doppler inflow velocity across mitral valve includes E and A wavs and E/A ratio (where E is mitral early diastolic velocity, and atrial mitral flow velocity). Accordingly left ventricular diastolic dysfunction was divided into mild, moderate (pseudo-normalization of LV filling pattern with normal mitral flow

despite presence of diastolic function, and E/A ratio becomes reversed by the use of Valsalva manoeuvre) and severe form. Colour Doppler echo-study was undertaken for assessment of valvular blood flow. Coronary artery disease was defined as angina and documented myocardial infarction by electrocardiography and/or previous history of coronary angioplasty or coronary artery bypass grafting surgery.

Two D echocardiography was used to evaluate valve structure including valve calcification. Heart valve calcification was defined as the presence or absence of aortic and mitral valve bright echo-calcification and determined visually and qualitatively.

Ethical approval

An ethical approval was obtained from medical ethics committee in faculty of Medicine and Health Science Aden University. Patients were debriefed about the aims of the study and consent was obtained from all patients participating in the study. Patients were informed that their participation was voluntary, were not obliged to answer question(s) that did not wish to, and their withdrawal from the study at any time will not affect their treatment. The confidentiality of the information obtained was assured and each questionnaire was assigned a code number.

Statistical analysis

Descriptive statistics was undertaken to report participants (patients) characteristics. Parametric analysis was conducted for normally distributed continuous variables, if Kolmogorov-Smirnova assumptions met, and presented as mean±standard deviation (M±SD). None parametric analysis was presented for none normally distributed variables and presented as median with range. Categorical variables were presented as numbers (N) with percentages. Factors associated with LVH (concentric, eccentric), LVD and LV systolic dysfunction were explored in bivariate analysis using both parametric and none parametric (Unpaired T tests,

The Mann Whitney Tests and Chi squared). Factors associated with outcome of interest LVH (concentric, eccentric), LVD and LV systolic dysfunction in bivariate analysis at $p \leq 0.05$ were considered to enter into Logistic regression modelling to detect the potential predictors for the outcomes of interest. Post hoc statistical sample power calculation [$R^2 = .154$ and 0.094 (for LVH concentric and LVD, respectively), predictors =3, $p \leq 0.05$] was conducted and found the sample power was sufficient to run the logistic regression modelling (observed statistical power = 0.96 and 0.79 for both LVH and LVD respectively). For all analyses, a two-sided $p < 0.05$ was considered statistically significant. The IBM SPSS for windows version 21.00 was used for all the analyses.

RESULTS

Table 1 shows the socio-demographic characteristics and aspects of haemodialysis of eligible 105 out of 108 patients. The mean age of participants' was 47.09 ±12.96 with 66% were unemployed.

Table 1: Characteristics and aspects of haemodialysis amongst ESRD patients (n=105)

Out of 105 ESRD patients, 102 (97.14%) had different echo-abnormalities. Table (2) shows the echocardiographic findings for the whole sample and different echo-abnormalities.

Table 2: Echocardiographic findings amongst ESRD patients and different echo-abnormalities (n = 105)

Table 3 shows association of left ventricular (LV) echo-abnormalities with diabetes mellitus (DM) and arterial hypertension (AHT) or both diseases (DM & AHT). Left ventricular dilatation with left ventricular volume >90 ml/m^2, with or without LV hypertrophy and with normal left ventricular systolic function, presented in 40 (38.09%) of the study group. Anti HCV positive cases were seen in 71 (67.62%) patients. And 15 (14.28%) were HBsAg

positive. As for the clinical and biomedical characteristic of the ESRD patients, the systolic, diastolic blood pressure and mean arterial blood pressure were 150.00 (range 80.00-200.00) , 80.00 (range 60.00-120.00) and 106.27 ±11.57 respectively. The urea (mg/dl) was 107.00 (range 56.00-290.00), creatinine (mg/dl), 8.13 ±2.56, and haemoglobin (g/dl) 9.66 ±1.55.

In bivariate analysis age, gender, marital status, education, employment, valvular lesion and CAD were not associated with LVH (concentric, eccentric), LVD and LV systolic dysfunction at $p < 0.05$. Of the clinical and biochemical parameters, systolic hypertension was found to be significantly associated ($p = 0.001$) with concentric LVH. Anemia was found to be associated with LVD ($p = 0.033$). In multivariable logistic regression modeling (Table 4), after controlling for age and gender, systolic hypertension sustained as the predictors for concentric LVH whilst anemia for LVD.

DISCUSSION

This is the first study which included ESRD patients on maintenance haemodialysis in Aden, Yemen for echocardiography study of left ventricular structure and function. Left ventricular abnormalities are common in patients with ESRD patients. This can be manifested as LV hypertrophy, LV dilatation and LV systolic dysfunction. According to this study, a significant number of patients (97.14%) manifested different echocardiography abnormalities. Left ventricular hypertrophy [concentric (40%), eccentric (45.7%)] and LV dilatation (38.1%) may be associated with pressure and volume/flow overload in a form of hypertension, anaemia, arteriovenous fistula and sodium and water retention (15, 16). Studies showed that higher systolic and diastolic blood pressure and interdialysis weight gain is strongly related to higher LVMI.

In some hemodialysis patients LVD in response to chronic volume/flow overload is an independent factor for progressive LV hypertrophy (17). Some studies show that volume control, a predictor of increasing systolic blood pressure, lead to regression of LVH (16, 18). In the present study, concentric LV hypertrophy was only significantly associated with systolic hypertension consistent with a study that found progressive LV hypertrophy in haemodialysis patients associated with hypertension but not to other risk factors including anaemia(19). According to this research, anaemia, was not significantly correlated with LVH, which is inconsistent with other study (20).

Additionally, our study showed that LV dilatation with compensatory hypertrophy and normal systolic function is present in 40 (38.1%) of haemodialysis patients. Anaemia was a significant risk factor. A study by Thanakitcharu et al (21) demonstrated a significant regression in LVVI and reduction in LVMI in anaemia treated haemodialysis patients. Other risk factors for volume/flow overload and LV dilatation including AV fistula and rate of blood flow through it, were not assessed, and interdialytic fluid retention was not measured for the study group.

Like the present study, limitation of dialysis hours to only 8 weekly by receiving two days instead of three days per week of hemodialysis session, retention of salt and fluids in inter-dialysis period (22) and A-V fistula may expose haemodialysis patient to volume overload and lastly to cardiovascular events. Our patients received only twice a week haemodialysis session (a total of 6-8 hours/week), which may have more fluctuation of body fluids than more frequent one which as is the case by other study(9) and blood flow through AV fistula not studied here may limit results of this study. High flow AV fistula increases preload volume and resulted in high output heart failure. Improvement of heart failure symptoms occurs after precise modified banding procedure of high flow AV fistula with mentainance of patency in transplanted patients (23). This research calls for studies to

evaluate the blood flow through AV-fistula and assessment of iterdialytic fluid collection that have impact on cardiac functions.

Left ventricular systolic dysfunction presented in 12 (11.43%) predominantly affected by LV hypertrophy or dilatation [10 (83.33%) and 9 (75%) respectively]) and with regional or global wall hypokinesia (decreased LV contractility). Progressive LVH is associated with cardiac failure in most dialysis patients. Documented myocardial infarction was seen in 7(6.67%) of all patients and only one patient underwent coronary angioplasty. Uremic cardiomyopathy also could be a cause of systolic dysfunction due to anti-inotropic effect of uremic toxins. A study by Surry et al demonstrated reduction in serum level of the non-dialyzed uremic toxin, indoxyl sulphate by administration of oral absorbant substance, leads to reduction of cardiac fibrosis of patients with chronic kidney disease (24). In a related development, 83.33% of patients with impaired LV systolic function in this study were anti-hepatitis C virus sero-positive. HCV is known to produce different cardiovascular diseases including dilated and hypertrophic cardiomyopathy and systolic and diastolic dysfunction (25).

According to this study, LV diastolic dysfunction was predominant among ESRD patients (48.57%). In one study that used novel echo-measurement, higher prevalence of LV diastolic dysfunction was found (48% vs. 39%) compared to more conventional one (26). Diastolic dysfunction may be the cause of heart failure with normal systolic function in a large number of haemodialysis patients and is the cause of morbidity and mortality(26). Heart valve calcification was observed in 46 (43.81%) and valve dysfunction was seen in 52 patients (49.52%) of study group which is in accordance with other studies(27, 28) Calcium deposit, atherosclerosis and other traditional as well as uremia related risk factors may play a role.

Study limitations

This study has some limitations. Abnormal echocardiography findings of left ventricle in this group of population may not reflect a cause effect relationship because of cross-section design of this study. Also, this was a healthcare based study, and the results cannot be generalized to general population. In this study coronary artery disease was not significantly associated with left ventricular disorders. This is may be explained by the fact that most of CAD occurs at micro-arterial circulation. In addition the presence of diastolic heart failure in this group of patients was not mentioned as clinical examination was not the subject of this study. However, the findings of this study make some sense that ESRD patients manifest a variety of left ventricular structural and functional disorders and its significant association with systolic hypertension and anaemia. As the patient were assessed during the haemodialysis period, the authors of this study feel that haemodialysis services need to be improved to facilitate follow up of the patient serially with echo-study starting at initiation of dialysis and at least bi-annually thereafter in order to get a clear cardiac prognostic window about patient's evaluation in relation to end stage renal diseases.

CONCLUSION

The present study shows high prevalence of left ventricular echo-cardio-graphic abnormalities in patients of ESRD on maintenance haemodialysis. Left Ventricle (LV) hypertrophy occurs more frequently and only significantly related to systolic hypertension while LV dilatation significantly associated with anaemia. This study calls for further research to identify other important factors with great impact on cardiac status of ESRD patients on haemodialysis program.

ACKNOWLEDGMENTS

We acknowledge the support of Abood and Taibah haemodialysis centre's staff in data collection and arrangement patients' interviews and medical records accessibility. We acknowledge Dr saeed Shaibani' cardiac centre for facilitating a free echo-study of all patients. We as well acknowledge the collaboration of participating patients in this study.

AUTHORS' NOTE

KA was the principle investigator, conceived and designed the study, reviewed the literature. RA and KA supervised, collected and processed the data. Both KA and SK analysed the data and interpreted the results and wrote the first draft of the manuscript. OH and NA contributed to writing and critically reviewed the paper. All authors were involved in drafting, reviewing and approving the manuscript.

REFERENCES

1. U.S. Renal Data System. USRDS 2013 Annual Data Report: Atlas of End-Stage Renal Disease in the United States. 2013.Atlas of CKD & ESRD. At: http://www.usrds.org/atlas.aspx. 2013.
2. Foley RN, Herzog CA, Collins AJ. Smoking and cardiovascular outcomes in dialysis patients: The United States Renal Data System Wave 2 Study1, 2. Kidney international 2003; **63:** 1462–7.
3. Ritz E. Left ventricular hypertrophy in renal disease: beyond preload and afterload. Kidney Int 2009; **75:** 771–3.
4. Gross ML, Ritz E. Hypertrophy and fibrosis in the cardiomyopathy of uremia--beyond coronary heart disease. Semin Dial 2008; **21:** 308–18.
5. Dorn GW, 2nd. Apoptotic and non-apoptotic programmed cardiomyocyte death in ventricular remodelling. Cardiovasc Res 2009; **81:** 465–73.
6. Malik J, Tuka V, Mokrejsova M, Holaj R, Tesar V. Mechanisms of chronic heart failure development in end-stage renal disease patients on chronic hemodialysis. Physiol Res 2009; **58:** 613–21.
7. Mark PB, Johnston N, Groenning BA, Foster JE, Blyth KG, Martin TN, et al. Redefinition of uremic cardiomyopathy by contrast-enhanced cardiac magnetic resonance imaging. Kidney Int 2006; **69:** 1839–45.
8. K/DOQI clinical practice guidelines for cardiovascular disease in dialysis patients. Am J Kidney Dis 2005; 45(4 Suppl 3):S1–53.
9. Manotham K, Tiranathanagul K, Praditpornsilpa K, Eiam-Ong S. Target quantity for twice-a-week hemodialysis: the EKR (equivalent renal urea clearance) approach. J Med Assoc Thai 2006; **89 Suppl 2:** S79–85.

10. Lang RM, Bierig M, Devereux RB, Flachskampf FA, Foster E, Pellikka PA, et al. Recommendations for chamber quantification: a report from the American Society of Echocardiography's Guidelines and Standards Committee and the Chamber Quantification Writing Group, developed in conjunction with the European Association of Echocardiography, a branch of the European Society of Cardiology. Journal of the American Society of Echocardiography 2005; **18:** 1440–63.
11. Devereux RB, Alonso DR, Lutas EM, Gottlieb GJ, Campo E, Sachs I et al. Echocardiographic assessment of left ventricular hypertrophy: comparison to necropsy findings. Am J Cardiol 1986 **15:** 450–8.
12. Sarnak MJ, Levey AS, editors. Epidemiology of cardiac disease in dialysis patients. Seminars in Dialysis 1999: Wiley Online Library.
13. Pombo JF, Troy BL, Russell RO. Left ventricular volumes and ejection fraction by echocardiography. Circulation 1971; **43:** 480–90.
14. Nagueh SF, Appleton CP, Gillebert TC, Marino PN, Oh JK, Smiseth OA et al. Recommendations for the evaluation of left ventricular diastolic function by echocardiography. J Am Soc Echocardiogr 2009; **22:** 107–33.
15. Glassock RJ, Pecoits-Filho R, Barberato SH. Left ventricular mass in chronic kidney disease and ESRD. Clin J Am Soc Nephrol 2009; 4 Suppl 1: S79–91.
16. Kim ED, Sozio SM, Estrella MM, Jaar BG, Shafi T, Meoni LA et al. Cross-sectional association of volume, blood pressures, and aortic stiffness with left ventricular mass in incident hemodialysis patients: the Predictors of Arrhythmic and Cardiovascular Risk in End-Stage Renal Disease (PACE) study. BMC Nephrol 2015; **16:** 131.
17. Unver S, Kavlak E, Gumusel HK, Celikbilek F, Esertas K, Muftuoglu T et al. Correlation between hypervolemia, left ventricular hypertrophy and fibroblast growth factor 23 in hemodialysis patients. Ren Fail 2015; **37:** 951–6.

18. Hur E, Usta M, Toz H, Asci G, Wabel P, Kahvecioglu S et al. Effect of fluid management guided by bioimpedance spectroscopy on cardiovascular parameters in hemodialysis patients: a randomized controlled trial. Am J Kidney Dis 2013; **61:** 957–65.

19. Foley RN, Curtis BM, Randell EW, Parfrey PS. Left ventricular hypertrophy in new hemodialysis patients without symptomatic cardiac disease. Clin J Am Soc Nephrol 2010; 5: 805–13.

20. Jiang JP, Hou FF, Gao LZ, Pan YB, Yang NS, Chen W et al. [Improvement of left ventricular hypertrophy by anemic-correcting erythropoietin therapy in chronic renal insufficiency]. Zhonghua Nei Ke Za Zhi 2005; **44:** 25–9.

21. Thanakitcharu P, Siriwiwatanakul N. Hemoglobin response and influence on left ventricular hypertrophy after 24-week treatment of a biosimilar epoetin-alfa in hemodialysis patients with anemia. J Med Assoc Thai 2007; **90:** 2574–86.

22. Choi SH, Shin DS, Jung ES, Kim AJ, Park H, Sung J et al. Prognostic implication of interdialytic fluid retention during the beginning period in incident hemodialysis patients. Tohoku J Exp Med 2012; **226:** 109–15.

23. Gkotsis G, Jennings WC, Malik J, Mallios A, Taubman K. Treatment of high flow arteriovenous fistulas after successful renal transplant using a simple precision banding technique. Ann Vasc Surg 2015; 23.

24. Lekawanvijit S, Kompa AR, Manabe M, Wang BH, Langham RG, Nishijima F et al. Chronic kidney disease-induced cardiac fibrosis is ameliorated by reducing circulating levels of a non-dialysable uremic toxin, indoxyl sulfate. PLoS One 2012; **7:** e41281.

25. Demir M, Demir C. Effect of hepatitis C virus infection on the left ventricular systolic and diastolic functions. South Med J 2011; **104:** 543–6.

26. de Bie MK, Ajmone Marsan N, Gaasbeek A, Bax JJ, Groeneveld M, Gabreels BA, et al. Left ventricular diastolic dysfunction in dialysis patients assessed by novel speckle tracking strain rate analysis: prevalence and determinants. International journal of nephrology 2012; 2012.

27. Avila-Diaz M, Mora-Villalpando C, Prado-Uribe Mdel C, Orihuela-Rodriguez O, Villegas-Antelo E, Gomez-Noriega AM, et al. De novo development of heart valve calcification in incident peritoneal dialysis patients. Arch Med Res 2013; **44:** 638–44.

28. Arjona Barrionuevo JD, Gonzales Vargas-Machuca MF, Gomez Pulido F, Gil Sacaluga L, Gentil Govantes MA, Martinez-Martinez A. Transthoracic echocardiographic findings in patients with chronic kidney disease awaiting kidney transplantation. Transplant Proc 2010; **42:** 3123–5.

Table 1: Characteristics and aspects of haemodialysis amongst ESRD patients (n=105)

Variables	**N (%), Mean ±SD or Median (range)**
Age/year	47.09 ±12.96
Gender	
Male	71 (67.6)
Female	34 (32.4)
Education	
Illiterate	19 (18.1)
Primary and secondary school education	61 (58.1)
University undergraduate	25 (23.8)
Emplyment status	
Employed	36 (34.2)
Unemployed	69 (65.7)
Marital status	
Married	82 (78.1)
Other status	23 (21.9)
Body Mass Index	22.00 (14.5-35.61)
Duration (months) of haemodialysis	58.60 ±41
Access	
Arterio-venous fistula	103 (98.10)
Other (permenant cathether & graft)	2 (1.90)
Health conditions	
Arterial hypertension	32 (30.5)
Diabetes mellitus	5 (4.8)
Polycystic kidney	11 (10.0)
Pyelonephritis	8 (7.6)
Glomerulonephitis	6 (5.7)
Nephrotic syndrome	1 (1.0)
Unknown	6 (5.7)
Obstructive uropathy	9 (8.6)
Artial hypertension and diabetes	13 (12.4)
Other causes (e.g postpartum hemorrhage)	14 (13.3)

Table 2: Echocardiographic findings amongst ESRD patients and different echo-abnormalities (n=105)

Variables	**Mean ±SD**
Left ventricular dimension in end diastole (LVIDd)	50.70±7.75
Left ventricular dimension in end systole (LVIDs)	33.70±8.16
Interventricular septum in diastole (IVSd)	13.40±2.96
Posterior wall thickness in diastole (PWd)	10.29±1.95
Left ventricular volume index (LVVI)	92.74±39.36
Left ventricular mass index (LVMI)	152.17±46.43
Fraction shortening (FS)	32.31±6.48
Number and Percentage of patients with different echocardiographic abnormalities N (%)	
Left ventricle concentric hypertrophy	42 (40)
Left ventricle eccentric hypertrophy	48 (45.7)
Left ventricular dilatation	40 (38.1)
Left ventricle systolic dysfunction	12 (11.43)
Left ventricle diastolic dysfunction	51 (48.57)
Valve dysfunction: stenosis & or incompetence	52 (49.52)
Mitral	25(23.8)
Aortic	7 (6.7)
Mitral and aortic	20 (19)

All dimensions (Mean±SD) in echocardiographic measurements were in millimetres

Table 3: Left ventricle echo-abnormalities among diabetic and hypertensive patients

Echo-abnormalities	**Whole sample N (%)**	**DM N (%)**	**AHT N (%)**	**DM & AHT N (%)**
LV concentric hypertrophy	42 (40.0)	2 (4.7)	14(33.33)	9 (21.43)
Systolic dysfunction	12 (11.43)	2 (16.67)	1(8.33)	-
LV Diastolic dysfunction	51 (48.57)	3 (5.88)	18(35.29)	11(21.56)

DM= diabetes mellitus; AHT= arterial hypertension

Table 4: Adjusted factors associated with concentric LVH and LVD in ESRD patients

Explanatory variables	AOR (95% CI)*	P-value
Concentric LVH		
Age	0.99 (0.96-1.03)	.868
Gender		
Female	1	
Male	1.17 (0.47-2.90)	.737
Systolic hypertension		
No (systolic BP<140mmhg)	1	
Yes (systolic BP ≥140mmhg)	4.60 (1.89-11.21)	.001
Left ventricle dilation		
Age	1.00 (0.97-1.03)	.979
Gender		
Female	1	
Male	2.21 (0.87-5.62)	.095
Anemia		
No (HB ≥ 9)	1	
Yes(HB < 9)	2.43 (1.07-5.54)	.034

*****AOR (95% CI) = adjusted odd ratio and 95% confidence interval