ORIGINAL ARTICLE

Association of Left Ventricular Hypertrophy with Anemia in End Stage Renal Disease Patients

AZHAR ALI KHAN[1], AHMED AYYAZ[2], MUHAMMAD ASIF[3], *USMAN JAVED[4], SAIMA RASHEED[5], MUHAMMAD ALI SABIR[6]*

[1]Senior Registrar Sheikh Zayed Hospital Lahore
[2]Senior Registrar Nephrology, Sheikh Zayed Hospital, Lahore
[3]Assistant Professor Urology Azra Naheed Medical College
[4]Medical Officer, Nephrology Department, Sheikh Zayed hospital, Lahore
[5]Assistant Prof Biochemistry , Niazi Medical and Dental college Sargodha
[6]Postgraduate Trainee, Internal Medicine Shalamar Hospital, Lahore
Correspondence to Dr. Azhar Ali Khan, E.mail azhar_aq@hotmail.com , Tel 03214050219.

ABSTRACT

Background: The frequency of End Stage Renal Disease (ESRD) is rising globally and it has grown into an important public health problem. Left ventricular hypertrophy (LVH) is cardiac problem in which the myocardium of left ventricle becomes thickened. Anaemiais defined as the reduction in the quantity of the hemoglobin and the red blood cells. Anemia is one of the known contributory factors for the development of LVH.

Aim: To assess the association of Left ventricular hypertrophy with Anemia in patients on maintenance hemodialysis as detected by echocardiography

Methods: This cohort study was conducted at Sheikh Zayed Hospital's Dialysis Centre, Lahore for 1 year. The Non probability purposive sampling technique was used to include the patients of ESRD on Hemodialysis. Informed consent was taken from all the patients.

Results: In our study, the overall mean age was 46.4±13.1 years. There were 35 (58.3%) males in anemic and 33(55.0%) in non-anemic group. The LVH size for anemic group was 10.2±2.9 mm while for non-anemic was 8.2±1.4 mm. The LVH was found to be present in 32(53.3%) of anemic while in only 2(3.3%) of non-anemic cases. Risk of LVH in about 3 times high in ESRD patients with anemia i.e., RR=2.89 95%CI; 2.108, 3.963).

Conclusion: Our study results concluded that significant association was found between the Left ventricular hypertrophy with Anemia in patients on maintenance Hemodialysis as detected by echocardiography; however, Odd Ratio (OR) showed more risk in anemic patients as compared to other.

Keywords: Left ventricular hypertrophy, Anemia, Hemodialysis, Hemoglobin, ESRD

INTRODUCTION

The incidence and prevalence of Chronic Kidney Disease (CKD) are on the rise globally and it has grown into an important public health problem[1]. The ultimate outcome of CKD in majority of patients is End Stage Renal Disease (ESRD) requiring renal replacement therapy (RRT), which necessitates ever-growing dialysis and transplants and imposes huge economic burden on the healthcare systems[2]. The social and financial inferences of CKD are considerable not only because of morbidity and mortality, related to its conversion to ESRD, but also with accelerated cardiovascular disease (CVD)[3,4]. Cardiovascular Disease is the leading cause of mortality in patients with CKD accounting for 10 to 100 times higher in Hemodialysis patients[5]. It is important to note that the majority of patients with CKD die of CVD before reaching ESRD[6].

Patients with ESRD have high risk of CVD which includes Coronary artery disease, Left Ventricular Hypertrophy (LVH), Left Ventricular Diastolic Dysfunction (LVDD) and Heart failure[7]. LVH is the most prominent structural cardiovascular alteration in CKD patients and is found in approximately 30 to 45 percent of patients with CKD and more severe LVH is noted with decreasing glomerular filtration rate (GFR)[8,9]. Concentric LVH has been found in patients with CKD and documented by echocardiography in 42% patients when dialysis starts[10] and in as many as 75% patients who are taking dialysis from last 10 years[11]. Arterial Hypertension is associated with LVH in patients with CKD and it has been found that increase in arterial stiffness leads to LVH before start of Hemodialysis. Other risk factors for the development of LVH in patients with CKD principally include Body Mass Index, Anemia, Hypertension and Ischemic heart disease[12].

LVH is a powerful predictor for mortality of ESRD patients and is strongly related to the 60% higher risk of sudden mortality. Severe LVH may eventually lead to Left ventricular dilatation which itself is strong predictor of poor outcome. The level of hemoglobin is found to be strong enough that it can predict the severity of LVH in patients undergoing hemodialysis for prolonged time, with each 1gm/dl reduction in hemoglobin can cause a 6% upsurge in the risk of LVH[12]. The risk of the LVH was 32% more for every 0.5gm/dl reduction in hemoglobin level[13].

Thus, anemia is proved to be the risk factor of developing LVH and adverse outcomes in cases of renal dysfunction. It may also cause compensatory rise in the cardiac output, this rise in cardiac functioning may increase the growth and dilation of left ventricular, along with the other risk factors and metabolic irregularities related to the CKD. The partial regression of LVH in dialysis depended patient is possible with correction of anemia[14]. The relationship of LVH with anemia in patients of ESRD on maintenance Hemodialysis is not known in our population.

Received on 11-11-2019
Accepted on 24-05-2020

The objective of the study was to assess the association of left ventricular hypertrophy with anemia in patients on maintenance hemodialysis as detected by echocardiography.

MATERIAL AND METHOD

It was a cross sectional study. It was done at Sheikh Zayed Hospital Dialysis Centre, Lahore from 15th Jan 2016 to 30th August 2016 Non probability consecutive sampling technique was used. The sample size of 120 patients (60 patients in two groups) was estimated by using 95% confidence level, 80% power of test with expected finding of LVH among Anemic patients with End Stage Renal Disease with Hb>10g/dl &Hb<1
0g/dl of 25% & 50% respectively[14].

Selection criteria: Patients of ESRD, aged 18 years and above, male or female, with creatinine clearance < 15 ml/min and on maintenance Hemodialysis 2-3 times per week through arterio-venous Fistula, arterio-venous Grafts, Permanent dialysis catheters or temporary catheters were included.Patients having known valvular disease (Aortic Stenosis and aortic Regurgitation) on echocardiography were excluded.

Data collection procedure: All the patients undergoing maintenance hemodialysis were enrolled by non-probability purposive technique after taking informed consent. The data were collected on the questionnaire. The echocardiography was done by single observer before the start of next hemodialysis session. LVH was defined on the basis of echocardiographic estimation of left ventricular wall thickness on M-mode in the long axis parasternal view at papillary muscle level > 10mm.[27] Screening of anemia was done by checking hemoglobin level in blood sample at the same time which is routinely done. Anemia is defined as hemoglobin of less than 10 gm/dl in ESRD patients[15].

Data Analysis: Data for age, duration of dialysis was described by using Means ± SD. Data for Gender, Anemia, HTN, IHD and LVH status was described by using frequency and percentages. Age & Dialysis duration was analyzed by using "t" test. Association was determined by calculating relative risk. P value ≤0.05 was considered significant.

RESULTS

The mean age of anemic patients was 45.0±12.9 years and mean age of non-anemic patients was 47.8±13.2 years. There were 35(58.3%) males in anemic and 33(55%) in non-anemic group and again the difference observed was insignificant with p-value 0.854. Among anemic, 9(15%) had AV bridge graft, while 40(66.7%) had AV fistula. The mean duration of dialysis was 3.7±2.2 years in anemic while 3.9±2.1 years in non-anemic patients. The mean systolic blood pressure was 148±19mmHg and for non-anemic was 136±23mmHg. The mean diastolic blood pressure was 83±14mmHg and for non-anemic was 77±15mmHg. There were 50(83.3%) cases in anemic who had hypertension as compared to 36(60%) of non-anemic. The LVH size for anemic group was 10.2±2.9 mm while for non-anemic was 8.2±1.4mm. The difference observed was highly significant between two groups with p-value <0.001 (Table 1).

The LVH was found present in 32(53.3%) of anemic while in only 2(3.3%) of non-anemic cases. The difference was highly significant with p-value <0.001. Risk of LVH in about 3 times high in ESRD patients with anemia i.e., RR=2.89 95%CI; 2.108, 3.963) (Table 2).

Table 1: Baseline characteristics of patients

		Group	
		Anemic	**Non Anemic**
N		60	60
Age (Years)		45.0±12.9	47.8±13.2
Gender	Male	35 (58.3%)	33 (55%)
	Female	25 (41.7%)	27 (45%)
Angio access	AV bridge Graft	9 (15%)	12 20(%)
	AV fistula	40 (66.7%)	41 (68.3%)
	Permanent Catheter	8 (13.3%)	5 (8.3%)
	Temporary Catheter	3 (5%)	2 (3.3%)
Dialysis duration (Years)		3.7±2.2	3.9±2.1
SBP		148±19	136±23
DBP		83±14	77±15
Hypertension		5 (83.3%)	35(60%)
LVH Size (mm)		10.2±2.9	8.2±1.4*

* significant (p<0.05)

Table 2: Association of LVH with anemia

LVH	Group	
	Anemic	**Non Anemic**
Present	32 (53.3%)	2 (3.3%)
Absent	28 (46.7%)	58 (96.7%)
Total	60 (100%)	60 (100%)

Relative risk = 2.891 (95%CI: 2.108, 3.963)

DISCUSSION

In patients of CKD, the cardiovascular diseases are most prevalent and most common cause of mortality and severe morbidity[16]. Although coronary heart diseases and arrhythmias are common, LVH is also the most common cardiovascular disease in such cases[17,18]. LVH can be detected in >70% patients of ESRD and upsurges the risk for cardiac ischemia and congestive heart failure in ESRD patients taking dialysis[13,19]. In our study, the anemia was observed in 60(50%) patients on maintenance hemodialysis. The LVH size for anemic group was 10.2±2.9mm. The LVH was found to be present in 32(53.3%) of anemic while in only 2(3.3%) of non-anemic cases. The difference was highly significant with p-value <0.001.

Literature showed vast variation in rate of LVH in patients of CKD & ESRD. Naito et al., conducted a study and observed that the rate of LVH was 10% on ECG by applying Sokolow-Lyon criteria and 14% by applying Cornell criteria in CKD patients[20]. But, in Spanish study on hypertensive CKD patients, > 20% patients had LVH on ECG using by Cornell criteria[21]. In the meantime, Foley et al., observed that LVH was noted in 74% ESRD patients by using echocardiography before starting the dialysis[19], while Levin et al., observed overall incidence of LVH as 36% on echocardiography in ESRD patients[13]. In our study LVH was found to be present in 32 (53.3%) anemic patients while in 2 (3.3%) non-anemic cases. This difference was highly significant (p<0.01).

LVH in CKD patients is mainly recognized to anemia and hypertension[20,22]. Barde et al[23] presented that left

ventricular diastolic dysfunction & hypertrophy are the most common findings of echocardiography. There was significant relationship between anaemia and LVH. But this study was done in CKD non dialysis dependent patients where as we have conducted study in ESRD patients.

Laddha et al[24]. proposed on the basis of their findings that frequency of cardiovascular dysfunction in ESRD patients is high and left ventricular dysfunction was the most common cardiovascular dysfunction. Thus,LVH is a common abnormality in patients of ESRD. Diastolic dysfunction was more common than systolic dysfunction in ESRD patients. Major risk factors for LVH and diastolic dysfunction are hypertension and anaemia.

Later on, it was proposed that few corrections in the hemoglobin level or anemia by using the recombinant human glycoprotein i.e. erythropoietin, can help to regress the progression of LVH[25] Ifeoma et al[26]., found that anemia is significantly associated with LVH in ESRD cases. They found a very strong relationship between LVH and CKD in developing nations. London et al observed that the anemia can be present in about >50% ESRD patients and that it could elucidate the high rate of LVH in ESRD patients[27].

CONCLUSION

Our study results concluded that there is significant association between the LVH with anemia in patients on maintenance hemodialysis as detected by echocardiography, however RR showed more risk in anemic patients as compared to other.

REFERENCES

1. Hemmelgarn BR, James MT, Manns BJ, O'Hare AM, Muntner P, Ravani P, Quinn RR, Turin TC, Tan Z, Tonelli M, Alberta Kidney Disease Network. Rates of treated and untreated kidney failure in older vs younger adults. Jama. 2012 Jun 20;307(23):2507-15.
2. Centers for Disease Control and Prevention (CDC. Prevalence of chronic kidney disease and associated risk factors--United States, 1999-2004. MMWR. Morbidity and mortality weekly report. 2007 Mar 2;56(8):161.
3. Jha V, Garcia-Garcia G, Iseki K, Li Z, Naicker S, Plattner B, Saran R. Chronic kidney disease: global dimension and perspectives. The Lancet. 2013 Jul 20;382(9888):260-72.
4. Couser WG, Remuzzi G, Mendis S, Tonelli M. The contribution of chronic kidney disease to the global burden of major noncommunicable diseases. Kidney international. 2011 Dec 2;80(12):1258-70.
5. Zhang L, Wang F, Wang L, Wang W, Liu B, Liu J, et al. Prevalence of chronic kidney disease in China: a cross-sectional survey. The Lancet 2012;379(9818):815-22.
6. Baigent C, Landray MJ, Reith C, Emberson J, Wheeler DC. The effects of lowering LDL cholesterol with simvastatin plus ezetimibe in patients with chronic kidney disease (Study of Heart and Renal Protection): a randomised placebo-controlled trial. The Lancet. 2011 Jun 25;377(9784):2181-92.
7. Taddei S, Nami R, Bruno RM, Quatrini I, Nuti R. Hypertension, left ventricular hypertrophy and chronic kidney disease. Heart failure reviews 2011;16(6):615-20.
8. Moran A, Katz R, Jenny NS, Astor B, Bluemke DA, Lima JA, Siscovick D, Bertoni AG, Shlipak MG. Left ventricular hypertrophy in mild and moderate reduction in kidney function determined using cardiac magnetic resonance imaging and cystatin C: the multi-ethnic study of atherosclerosis (MESA). American journal of kidney diseases. 2008 Nov 1;52(5):839-48.
9. Nardi E, Palermo A, Mule G, Cusimano P, Cottone S, Cerasola G. Left ventricular hypertrophy and geometry in hypertensive patients with chronic kidney disease. Journal of hypertension. 2009 Mar 1;27(3):633-41.
10. Cerasola G, Nardi E, Palermo A, Mulè G. Epidemiology and pathophysiology of left ventricular abnormalities in ch kidney disease: a review mortality. 2011; 12:15.
11. Weiner DE, Tighiouart H, Elsayed EF, Griffith JL, Salem DN, Levey AS, Sarnak MJ. The relationship between nontraditional risk factors and outcomes in individuals with stage 3 to 4 CKD. American journal of kidney diseases. 2008 Feb 1;51(2):212-23.
12. Krane V, Heinrich F, Meesmann M, Olschewski M, Lilienthal J, Angermann C, Störk S, Bauersachs J, Wanner C, Frantz S. Electrocardiography and outcome in patients with diabetes mellitus on maintenance hemodialysis. Clinical Journal of the American Society of Nephrology. 2009 Feb 1;4(2):394-400.
13. Levin A, Thompson CR, Ethier J, Carlisle EJ, Tobe S, Mendelssohn D, Burgess E, Jindal K, Barrett B, Singer J, Djurdjev O. Left ventricular mass index increase in early renal disease: impact of decline in hemoglobin. American Journal of Kidney Diseases. 1999 Jul 1;34(1):125-34.
14. Hanafusa N, Nomura T, Hasegawa T, Nangaku M. Age and anemia management: relationship of hemoglobin levels with mortality might differ between elderly and nonelderly hemodialysis patients. Nephrology Dialysis Transplantation. 2014 Dec 1;29(12):2316-26.
15. Levin A. Anemia and left ventricular hypertrophy in chronic kidney disease populations: a review of the current state of knowledge. Kidney International. 2002 May 1;61:S35-8.
16. Foley RN, Parfrey PS, Sarnak MJ. Clinical epidemiology of cardiovascular disease in chronic renal disease. American Journal of Kidney Diseases. 1998 Nov 1;32(5):S112-9.
17. Middleton RJ, Parfrey PS, Foley RN. Left ventricular hypertrophy in the renal patient. Journal of the American Society of Nephrology. 2001 May 1;12(5):1079-84.
18. Levin A, Djurdjev O, Thompson C, Barrett B, Ethier J, Carlisle E, Barre P, Magner P, Muirhead N, Tobe S, Tam P. Canadian randomized trial of hemoglobin maintenance to prevent or delay left ventricular mass growth in patients with CKD. American journal of kidney diseases. 2005 Nov 1;46(5):799-811.
19. Foley RN, Parfrey PS, Harnett JD, Kent GM, Martin CJ, Murray DC, Barre PE. Clinical and echocardiographic disease in patients starting end-stage renal disease therapy. Kidney international. 1995 Jan 1;47(1):186-92.
20. Naito Y, Tsujino T, Matsumoto M, Sakoda T, Ohyanagi M,. Adaptive response of the heart to long-term anemia induced by iron deficiency. American Journal of Physiology-Heart and Circulatory Physiology. 2009 Mar;296(3): H585-93.
21. Calderón A, Barrios V, Escobar C, Ferrer E, Barrios S, González-Pedel V, Montoro P, Navarro-Cid J. Detection of left ventricular hypertrophy by different electrocardiographic criteria in clinical practice. Findings from the Sara study. Clinical and Experimental Hypertension. 2010 May 1;32(3):145-53.
22. Glassock RJ, Pecoits-Filho R, Barberato SH. Left ventricular mass in chronic kidney disease and ESRD. Clinical Journal of the American Society of Nephrology. 2009 Dec 1;4(Supplement 1):S79-91.
23. Barde R, Patel HV, Shah PR. A study of anemia prevalence in CKD patients on maintenance hemodialysis: A single centre study. Journal of Evidence Based Medicine and Healthcare. 2015;2(39):6344-48.
24. Laddha M, Sachdeva V, Diggikar PM, Satpathy PK, Kakrani AL. Echocardiographic assessment of cardiac dysfunction in patients of end stage renal disease on haemodialysis. J Assoc Physicians India. 2014 Jan;62(1):28-32.
25. Foley RN, Curtis BM, Randell EW, Parfrey PS. Left ventricular hypertrophy in new hemodialysis patients without symptomatic cardiac disease. Clinical Journal of the American Society of Nephrology. 2010 May 1;5(5):805-13.
26. Ulasi II, Arodiwe EB, Ijoma CK. Left ventricular hypertrophy in African Black patients with chronic renal failure at first evaluation. Ethnicity and Disease. 2006 Sep 1;16(4):859.
27. London GM. Left ventricular hypertrophy: why does it happen?. Nephrology Dialysis Transplantation. 2003 Nov 1;18(suppl 8): viii2-6.