

## Echocardiographic Assessment of Cardiac Dysfunction in Patients of Chronic Kidney Disease on Maintenance Hemodialysis

BK S<sup>1</sup>, Bassi SD<sup>2</sup>, Sah AK<sup>3</sup>, Acharya D<sup>4</sup>

### ABSTRACT

**Objectives:** The Aim of this study to assess and analyze the echocardiographic changes in chronic kidney disease patients on maintenance hemodialysis. **Material and methods:** We Performed Prospective study of echocardiographic changes in chronic kidney disease (CKD) patients undergoing maintenance hemodialysis at our institute. We performed M-mode echocardiography in 80 CKD patients without obvious clinical evidence of coronary artery disease, Valvular heart disease, congenital heart disease. Data was collected from November 2018 to Nov 2019. **Results:** 80 Patients Undergoing Hemodialysis were included in our study, out of them Echocardiography finding shown LV dilation and diastolic dysfunction in 39 (48.75%), left ventricular hypertrophy (LVH) in 41 (51.25%), systolic dysfunction and pericardial effusion in 22 (27.5%) and 11 (13.75%) patients respectively. RWMA was present in 10% and Valvular calcification was seen in 5 patients. In sub-group of patients with Hb<10 gm%, LVH was present in 32 (78.05%) vs 9 (21.95%) in patient group with Hb ≥ 10 gm% (p <0.01). Other Sub Group of Patients with BP > 140/90mmhg, LVH Was Present in 34 (82.92%) vs 7 (17.08%) in patients group with BP< 140/90 mm hg (p=0.02). In both sub group p value for systolic dysfunction, RWMA & pericardial effusion is statistically not significant. **Conclusion:** LV diastolic dysfunction and hypertrophy were most common echocardiographic findings. There was statistically significant correlation between anemia and presence of LVH and positive correlation between presence of hypertension and LVH.

**Keywords:** CKD, Diastolic dysfunction, Echocardiography: MHD, HB%, LVH

1. Dr. Shyam Kumar BK
2. Prof. S.D. Bassi
3. Dr. Alok Kumar Sah
4. Dr. Devendra Acharya

### Address for Correspondence:

Dr. Shyam Kumar B.K.  
Assistant Professor  
Department of Medicine  
Nepalgunj Medical College & Teaching Hospital  
Kohalpur, Banke

### INTRODUCTION

It has been noted that the epidemicity of chronic kidney disease, full spectrum of which range from asymptomatic state to obvious kidney failure is being increased. Kidney failure being the most visible aspect of this spectrum, it represents only a minimal of total population affected by kidney disease<sup>1</sup>. Chronic kidney disease (CKD) is not uncommon but fortunately treatable and preventable. It is recognized worldwide as a public health problem. Patients with CKD are at significantly increased risk for both morbidity and mortality from cardiovascular disease (CVD). Patients on dialysis have a 10- to 30-fold increased risk for cardiovascular mortality compared with the general population. CVD is the single most important cause of death among patients receiving long-term dialysis; accounting for 44% of overall mortality<sup>2</sup>. In the cardiovascular system, left ventricular hypertrophy (LVH) is the most frequent finding<sup>3</sup>. The prevalence of left ventricular systolic and diastolic dysfunction is less clear. Cardiac disease frequently predates is less clear. Cardiac disease frequently predates the start of dialysis and LVH is common in moderate to severe chronic renal failure. Echocardiography should be performed early in the course of CKD and may be valuable in the monitoring of therapy of these patients<sup>4</sup>.

One of the major structural cardiac anomalies in patients with CKD is left ventricular hypertrophy (LVH) and is associated with increase the risk for cardiac ischemia, congestive heart failure, as well as a very strong independent predictor of cardiovascular mortality<sup>5</sup>. Sudden cardiac death may be related to the high prevalence of left ventricular dysfunction secondary to the LVH in dialysis patients<sup>6</sup>.

### MATERIAL AND METHODS

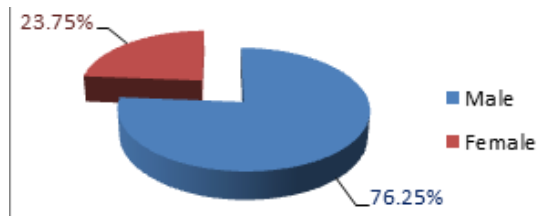
Eighty patients of CKD irrespective of etiology and duration of maintenance hemodialysis having ESRD (stage 5 CKD) who are under maintenance HD were included in the study. Data collected from November 2018 to November 2019. 2D-Echocardiography machine GE LOGIQ 400 PRO was used with 3.5 MHz transducer probe. Two dimensional echocardiography and M- mode performed along with blood parameters CBC, Calcium, blood urea, serum creatinine. E/A ratio less than 0.75 and more than 1.8 was considered as diastolic dysfunction. LVH was diagnosed when inter ventricular septum thickness or left ventricular posterior wall thickness was ≥12mm. Blood pressure of all patients was measured .Study was done in Nepalgunj Medical college and Teaching Hospital.

**STATISTICAL ANALYSIS**

All collected data entered into the SPSS V20 Software and analysis has been conducted and using chi square test and fisher exact test has been used to calculate statistically significant value. A 'p' value less than 0.05 were considered significant.

**RESULTS**

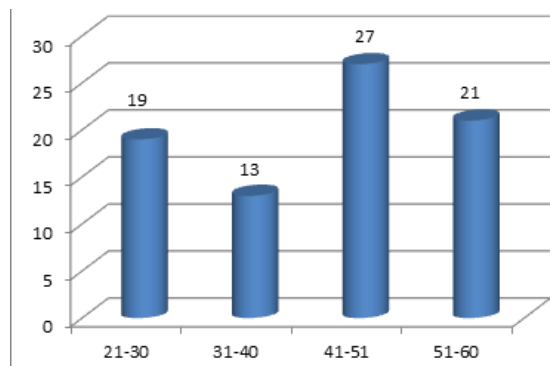
This study included 80 patients of CKD on MHD Clinical examination; suggested laboratory test and echocardiography were performed in every patient.



**Figure 1: Gender wise distribution**

Out of 80 patients, 76.25% (61) male and 23.75% (19) were female. Maximum patients were in age group between 41-50 years (34%) (Figure 1).

Mean age of the patients was 42.33 ± 12.48 (Figure 2).



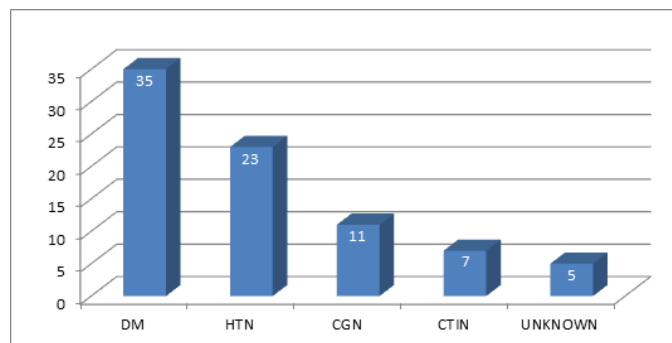
**Figure 2: Age wise distribution**

Basic demographic and clinical characteristic were shown in table I, where Hypertension was present in 76% mainly in age group more than 40 years.

Parameters	Range	Mean± SD
Age(Years)	20-68	42.33±12.48
Calcium (mg/dl)	6.8-13.5	9.87±1.72
Phosphorus (mg/dl)	3.5-12	7.72±2.01
Urea (mg/dl)	43-189	108.14±32.83
Creatinine (mg/.dl)	2.8-10.2	5.52±1.65
Hemoglobin % (gm/dl)	4.2-11.4	7.89±0.96
Serum albumin (gm/dl)	2.2-5	3.64±0.53
<b>Total cholesterol(mg./dl)</b>	<b>111-268</b>	<b>160.32±27.56</b>

**Table I: Basic demographic profile and parameters of study population**

Most common cause of CKD was diabetes 35(43.75%) followed by hypertension, chronic glomerulonephritis (CGN) and chronic tubulointerstitial nephritis (CTIN) in 23(28.75%), 11(13.75%), and 7(8.75%) cases respectively (Figure 3 & 4) (5%) were with unknown etiology.



**Figure 3: Basic disease of the study population**

On comparing the echocardiographic findings in patients with Hb <10 gm% vs patients with Hb ≥ 10 gm%, statistically significant (<0.01) the number of patients had LVH: 77.1% vs 25% (Table II).

Echocardiographic Findings	Hb Level				P-Value
	<10mg/dl		≥10mg/dl		
	N (48)	60%	N(32)	40%	
<b>LVH</b>					
Absent	11	22.9	24	75	<0.01
Present	37	77.1	8	25	
<b>Decreased (&lt;55%)</b>					
Absent	31	64.6	26	81.25	0.08(NS)
Present	17	35.4	6	18.75	
<b>RWMA</b>					
Absent	42	87.5	30	93.75	0.29 (NS)
Present	6	12.5	2	6.25	
<b>Pericardial Effusion</b>					
Absent	43	89.6	25	78.2	0.06 (NS)
Present	5	10.4	7	21.8	

**Table II: Hemoglobin level and echocardiographic parameters**

Similarly majority patients with LVH had hypertension (63.94%) compared to normotensives (36.85%) and it was statistically significant (P=0.02) (Table III) RWMA and pericardial effusion was present in 11.4% and 16.4% respectively although it was statistically not significant.

Echocardiographic Findings	Hypertension				P-Value
	≥140/90 mmHg		<140/90 mmHg		
	N (19)	23.75%	N(61)	76.25%	
<b>LVH</b>					
Absent	12	63.15	22	36.06	<0.02
Present	7	36.85	39	63.94	
<b>Decreased (&lt;55%)</b>					
Absent	16	84.21	41	67.21	0.17
Present	3	15.79	20	32.79	
<b>RWMA</b>					
Absent	18	94.73	54	88.52	0.46
Present	1	5.27	7	11.4	
<b>Pericardial Effusion</b>					
Absent	18	94.73	51	83.6	0.18
Present	1	5.27	10	16.4	

**Table III: Association between HTN with LV dysfunction**

## DISCUSSION

In our study Out of 80 patients, 76.25% (61) male and 23.75% (19) were female. Male to female ratio 3.21:1. In Michel Dahan et al study it was 1.85:1.7 DS Chafekar et al study it was found 4.67:1.8

Maximum patients were in age group between 41-50 yrs. (34%) (Figure 1). Mean age of the patients was 42.33 ± 12.48 (Figure 2). The mean age of the present study was compared with others studies, the mean age in the other studies are 41.1±12.1 years in N.P. Singh et al. 9 48.7±13.5 years in the Micheal Dahan et al<sup>7</sup>.

Most common cause of CKD was diabetes 35(43.75%) followed by hypertension, chronic glomerulonephritis (CGN) and chronic tubulointerstitial nephritis (CTIN) in 23(28.75%), 11(13.75%), and 7(8.75%) cases respectively (Figure 3 & 4) (5%) were with unknown etiology<sup>8</sup>. The commonest cause for chronic kidney disease reported by N.P Singh et al was diabetes mellitus in 9 patients (18%), chronic glomerulonephritis in 3 patient (6%), hypertension in 4 patient (8%), DM+HTN in 18 patient (36%), and other in 16 patient (32%) N.P Singh et al<sup>9</sup>. On comparing the echocardiographic findings in patients with Hb <10 gm% vs patients with Hb ≥ 10 gm%, statistically significant (<0.01) result was found majority of patients had LVH: 77.1% vs 25% (Table II). In subgroup of patients with hemoglobin level <10gm%, LVH was seen in 77.41% compared to 23.68% in patients with hemoglobin of ≥10 gm% (P<0.01)<sup>10</sup>. In our study majority patients with LVH had hypertension (63.94%) compared to normotensives (36.05%) and it was statistically significant (P=0.02) (Table III) RWMA and pericardial effusion was present in 11.4% and 16.4% respectively although it was statistically not significant. In a study conducted by Laddha M et al. in 2014, reported LVH in 74%, systolic dysfunction in 24.3% diastolic dysfunction in 61.4% and pericardial effusion

in 14.35% of ESRD patients on hemodialysis<sup>11</sup>. Zoccall C et al. had reported incidence of LVH and systolic dysfunction of 77% and 22% respectively in ESRD population on hemodialysis<sup>12</sup>. SA Kale et al (2001) had found that hypertension was identified as important risk factor for all three LV disorders LVH, diastolic dysfunction and systolic dysfunction<sup>13</sup>. Robert N. Foley et al (1995) had found abnormalities of left ventricular structure and functions were very frequent on baseline echocardiography: 73.9% had left ventricular hypertrophy, 35.5% had left ventricular dilatation and 14.8% had systolic dysfunction in ESRD patients<sup>14</sup>.

## CONCLUSION

Cardiovascular abnormalities in CKD were observed in large numbers of patients among those left ventricular dysfunction was the commonest cardiovascular abnormality. Cardiac structural as well as functional abnormalities were common in patients with CKD on Maintenance Hemodialysis found more in those with hypertension and anemia. LVH is the commonest cardiac abnormality in CKD patients followed by diastolic dysfunction. Both conditions are more common in hypertensive and anemic patients. LVH has got prognostic implications because this group of ESRD patients having higher mortality of diastolic dysfunction or sudden cardiac death. Echocardiography is a cost effective noninvasive diagnostic tool which can detect early changes in the cardiac parameters. This is important for risk stratification and early preventive measures. Thus echocardiographic screening of CKD patients has both therapeutic and prognostic implications.

## REFERENCES

- Schiffrin E L, Lipman Mark L, Mann Johannes F E .Chronic kidney disease: Effect on the cardiovascular system. *Circulation* 2007;116:25-97.
- USRDS 2005 Annual Data Report. The National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2005.
- Bullock RE, Hassem AA, Simpson I et al. Cardiac abnormalities and exercise tolerance in patients receiving renal replacement therapy. *BMJ* 1984; 28: 1479-84.
- Greaves SC, Gamble GD, Collins JF et al. Determinants of left ventricular hypertrophy and systolic dysfunction in chronic renal failure. *Am J Kidney Dis* 1994; 24: 768-76.
- Parfrey PS, Foley RN, Harnett JD, Kent GM, Murray DC et. al (1996) Outcome and risk factors for left ventricular disorders in chronic uremia. *Nephrol Dial Transplant* 11: 12771285
- Silverberg JS, Sniderman AD, Barre PE, Prichard SS. Impact of left ventricular hypertrophy on survival in end stage renal disease. *Kidney International* 1989;36:286- 290.
- Dahan M, Siohan P, Viron B, Michel C, Paillolle C, R G Mignon et al. Relationship between left ventricular hypertrophy, myocardial contractility and overload condition in haemodialysis patients: An echocardiographic study. *Am J Kid Dis* 1997; 30; 780-85.
- Chafekar DS, RM Rajani, BA Krishna. Left ventricular function in end stage renal disease-Non invasive assessment in patients on hemodialysis. *JAPI* 1994; 42: 216-18.
- 9.Singh NP, Chandreshkar, M Nair, Gopal K, Ajita J et al The cardiovascular and hemodynamic effects of erythropoietin in chronic renal failure. *JAPI* 1999; 47:284-89.

10. Levin A, Thompson CR, Ethier, m J, Carlisle EJ, Tobe S, et al (1999) left ventricular mass index increase in early renal disease impact of decline in hemoglobin. *Am J Kidney Dis*: 34 125-134.
11. Laddha M, V Sachdeva, PM Diggikar, PK Sapathy, AL Kakrani (2014) Echocardiographic assessment of cardiac dysfunction in patients of end stage renal disease on hemodialysis. *JAPI* 62: 28-32.
12. Zocall C, Benedetto FA, Mallamaci F, Tripepi G, Giaccone G, et al. (2004) Prognostic value of echocardiographic indicators of left ventricular systolic function in asymptomatic dialysis patients. *J Am Soc Nephrol* 15: 1029-1037.
13. SA Kale et al. Left ventricular disorders in patients of end stage renal disease entering hemodialysis programme. *Indian J Nephrol* 2001;11:12-16.
14. Foley RN, Parfrey PS, Harnett JD, et al. Clinical and echocardiographic disease in patients starting end-stage renal disease therapy. *Kidney Int* 1995;47:186-92.