23
Original article

23 A STUDY OF ECHOCARDIOGRAPHIC DETECTION OF CARDIAC ABNORMALITIES IN PATIENTS OF CHRONIC KIDNEY DISEASE& PROGRESSION TO HF. Authors Dr Pratik Modi, Dr Ajay Rathod

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ABSTRACT: **Introduction:** In chronic kidney disease (CKD) patients,left ventricular (LV) diastolic dysfunction occurs frequently and is associated with heart failure (HF) and higher mortality. Left ventricular systolic dysfunction is associated with coronary artery disease (CAD) and is a major determinant of prognosis. The aim of this study was to assess indices of LV diastolic dysfunction in CKD patients.

Material and methods: Study included 118 CKD patients. All patients underwent transthoracic echocardiography. Diastolic function based on E and A, E/A ratio and pulmonary vein flow velocities as well as EF%, deceleration time, RA, LA volume were assessed. In dialysis patients examination was carried out before and after dialysis.

Observations:In CKD patients the stage of renal failure was associated with the significant increase in LV mass, systolic LV & diastolic LV dimensions and in the size of the LA. The increase the E/E' ratio between groups of patients was seen in this study. The reduction in deceleration time along with the decrease in estimated glomerular filtration rate was also observed in this study.

Conclusions: Early identification of factors involved is necessary to prevent this devastating process. Many indexes of contractility are used and each of them has imperfections. It seems that TVI, E, E/A ratio & E/E' ratio are good instruments for the early detection of left ventricular hypertrophy and diastolic dysfunction.

KEYWORDS:CKD, TTE, Diastolic dysfunction, systolic dysfunction.

INTRODUCTION:

Chronic kidney disease (CKD), which prevalence is still growing worldwide, confers a higher risk of coronary artery disease (CAD), chronic heart failure (CHF) and/or death independently of conventional cardiovascular risk factors [1–4]. In CKD patients, left ventricular (LV) diastolic dysfunction occurs frequently and is associated with heart failure (HF) and higher mortality [5]. Several studies have demonstrated that CKD severity was the most independent predictor of elevated LV filling pressure and could be responsible for impaired systolic and diastolic functions in pre-dialysis CKD [6]. Left ventricular diastolic dysfunction is observed even in patients with early stages of chronic kidney dysfunction [7]. It

was estimated that 15% of patients starting dialysis therapy have systolic dysfunction of the left ventricle while the prevalence of diastolic dysfunction at dialysis inception is much higher. Either systolic or diastolic dysfunction can lead to clinically evident congestive heart failure [8]. Left ventricular systolic dysfunction is often associated with severe CAD and it is a major determinant of prognosis [9]. Left ventricular diastolic dysfunction in CKD patients is of complex nature. According to studies, it may be influenced by the increase in LV preload due to progression of CKD stage [10]. Also LV hypertrophy, CAD, microvascular abnormalities, interstitial fibrosis, altered fluid and electrolyte metabolism and neurohumoral alterations might contribute to the development of LV diastolic dysfunction in patients with CKD [11]. Over-activation of the rennin–angiotensin–aldosterone system (RAAS) might play an important role in the pathomechanism since even a mild CKD results in early cardiac fibrosis with mild LV diastolic impairment and preserved systolic function [12].

Therefore the aim of this study was to assess LV echocardiographic indices in CKD patients including those on dialysis.

MATERIAL AND METHODS:

A cross-sectional analytical study of a population of 50 CKD patients was undertaken at Department of Internal Medicine, AMC MET MMC & LG Hospitals Ahmedabad. The IRB & Ethics committee of AMC MET approved this study. All patients signed informed consent form for TTE.

Inclusion criteria: Criteria for inclusion in the study was according to the criteria for the recognition KDOQI CKD and the recommendations of the ESC section of Echocardiography in 2009 on the recognition of diastolic dysfunction of the left ventricle.

Exclusion criteria:

State after kidney transplantation.

Haemoglobin < 8 g/dl.

Ongoing treatment for Malignancy or received treatment in past.

Active hepatitis B or C.

Repeatedly elevated blood levels of transaminases: alanine transaminase (ALT), aspartate transaminase (AST).

Other: HIV infection or other immune disorders, connective tissue diseases, therapy with immunosuppressive drugs, significant arrhythmias, indwelling cardiac pacemaker (CRT, ICD), h/o venous thrombosis or pulmonary embolism, hyperthyroidism and hypothyroidism, ejection fraction (EF) < 45%, hypertrophic cardiomyopathy, obesity.

All patients underwent transthoracic echocardiography (TTE). Echocardiographic examination was performed in accordance with the recommendations of the ESC section of Echocardiography of 2009. Measurements were made in the M-dimensional and two-dimensional 2D presentation. Flow

parameters were evaluated using Doppler (continuous wave method – CW, pulse method- PM and tagged color method) and TDI. In the study, the following indices were assessed: size of the left atrium (LA), end-diastolic dimension of intraventricular septum (IVSd), left ventricle (LVIDd) and left ventricle posterior wall of the (PWd). The results of these measurements were used to evaluate LVEF (%) indicating LV systolic function and LVMI. The spectrum of mitral inflow was recorded using pulsed Doppler examination with Doppler gate placed at the end of mitral leaflets in apical 4-chamber view.

Diastolic dysfunction was assessed by determining the velocities of early (E) and late (A) diastolic transmitral flow, the ratio E-to-A (E/A), deceleration time (DT), isovolumic relaxation time (IVRT) and pulmonary vein flow velocities. Indices of LV diastolic function were analysed depending on the severity of CKD in the study groups.

Three basic types of diastolic dysfunction were distinguished:

1. Impaired relaxation: mild diastolic dysfunction (normal LV filling pressure at rest).
2. Pseudo-normalization: moderate diastolic dysfunction (mildly or moderately elevated LV filling pressure).
3. Restriction: severe diastolic dysfunction (significantly elevated LV filling pressure).

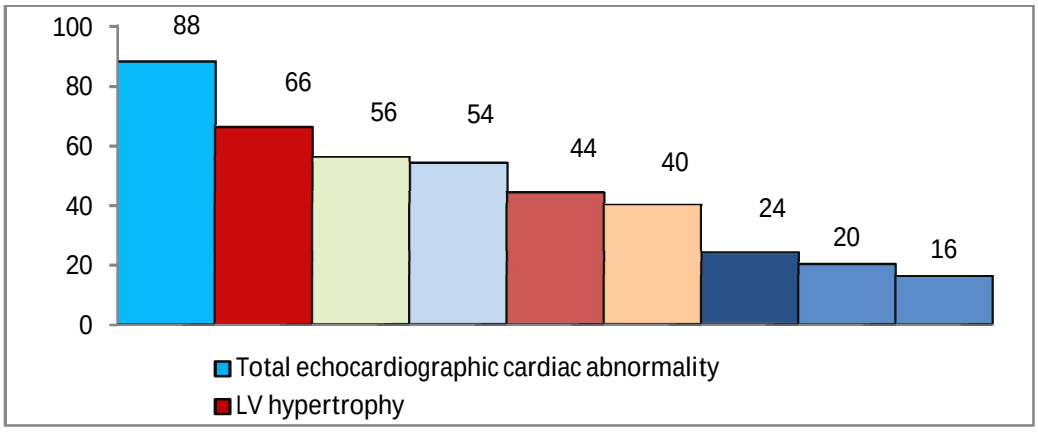
In dialysis patients examination was carried out before & after dialysis.

OBSERVATIONS:

1. Echocardiographic Parameters in patient of this study:
   On TTE the mean values of observed parameters were found as follows,

Parameters	Mean ± SD
1. LVEF(%)	52.1 ± 13
2. Peak E(m/sec)	1.05 ± 0.48
3. Peak A (m/sec)	1.05 ± 0.51
4. E/A ratio	0.97 ± 0.4
5. LVIDd(cm)	4.88 ± 0.76
6. LV mass index(g/m2):	
Male	145.5 ± 4.3
Female	123 ± 2.3
7. LVPWd(cm)	1.21 ± 0.20
8. IVSD(cm)	1.22 ± 0.21

2. Echocradiographic assessment of cardiac involvement In CKD patients:



3. **LV systolic dysfunction in haemodialysis patients and patient on conservative treatment**:

   In our study, out of 50 patients of CKD, there are 36 patients on hemodialysis and 14 patients on conservative management. Out of 36 hemodialysed patients, 12 patients having systolic dysfunction and there is no systolic dysfunction in patient on conservative management. Thus, LV systolic dysfunction is common in patients on hemodialysis than those on conservative treatment. This correlates with S.Agarwal, P.Dangri, O.P.Kalrastydy. So, severe form of cardiac disease is more in ESRD.

4. **LV Dilatation in patient on haemodialysis & on conservative management**:

   In our study, out of 50 patients of CKD, there were 36 patients on haemodialysis and 14 patients on conservative treatment. Out of 36 patients on haemodialysis, LV dilatation is present in 10 patients and there is no LV dilatation in patient on conservative management. So, LV dilatation is more common in patient on haemodialysis than on conservative management. This is compared with Mathenge RN study115.Thus, progression of cardiac disease is more in ESRD.

5. **Echocardiographically detectable pericardial effusion in symptomatic and asymptomatic patients of CKD**:

   In our study, out of 22 asymptomatic patients (no cardiac symptoms), pericardial effusion is present in 10 (45%) patients & thus echocardiogram is a useful tool for early diagnosis of pericardial effusion before initiation of symptoms in uremic patient population. This is matched with VaziriN.D.study, which also shows high prevalence of pericardial effusion in asymptomatic CKD patients58.

DISCUSSION:

The analysis of echocardiographic parameters in this study showed that in CKD patients increasing stage of renal failure was associated with the significant increase in both systolic and diastolic left ventricular dimensions and in the size of the left atrium.

In more than half of the patients with formed arteriovenous fistula increased left ventricle end-diastolic dimension and worsening of diastolic function (shortening of deceleration time, E wave, the increase in E/A) were observed.

In agreement with Parfrey et al. study, it has been observed that shortly after the dialysis session, a reduction in diastolic diameter of the LV and an increase in the thickness of the LV wall occur which is associated with volume depletion by ultrafiltration (data not shown). Steady growth of interventricular septal thickness in end diastole and systole as well as the increase of LV muscle mass were observed in CKD patients along with the rising CKD stage. Left ventricular muscle mass was over 1.5-times higher in dialysis patients that in CKD stage II subjects. According to Zoccali et al. the increase in mass of 1 g/m 2.7/month was associated with a 62% increase in the incident risk of fatal and non-fatal cardiovascular events in dialysis patients. They also suggested that changes in LV mass index represent a stronger predictor of mortality and cardiovascularcomplications than LV mass itself. Also Miyzato et al. [6] in their study of patients with chronic kidney disease noticed increased LV mass.

CONCLUSIONS: In conclusion, in CKD patients maladaptive events leading to LVH, structural changes myocardium as well as diastolic dysfunction and even systolic failure occur frequently. Thus, early identification and treatment of factors involved in order to prevent this devastating process. Many indexes of contractility have been developed and each of them has imperfections. Now it seems that TVI and E, E/A ratio and E/E' parameters are good instruments for the early detection of LVH and diastolic dysfunction as they are important risk factors for cardiovascular morbidity and mortality in CKD.The limitation of this study is the fact that the number of subjects was relatively small and all patients came from a single centre and thus there is a possibility of bias in the selection process. Greater study group is needed to produce a more accurate representation of the prevalence of diastolic dysfunction in CKD. Moreover, our study population consisted of CKD patients with normal LV EF.

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