



PREVALENCE OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION IN CHRONIC KIDNEY DISEASE PATIENTS NOT ON HEMODIALYSIS.

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ABSTRACT:

Cardiovascular disease is the leading cause of morbidity and mortality in patients at every stage of Chronic Kidney Disease (CKD). These abnormalities begin even before progression to End Stage Renal Disease (ESRD) and initiation of Hemodialysis. Since many risk factors associated with CKD such as Hypertension and Diabetes can cause Left Ventricular Diastolic Dysfunction, a study was conducted to estimate the prevalence of LV Diastolic Dysfunction in CKD patients who have not progressed to ESRD (i.e. not on Hemodialysis).

INTRODUCTION:

CHRONIC KIDNEY DISEASE

Definition: Kidney damage for ≥ 3 months, as defined by structural or functional abnormalities of the kidney, with or without decreased GFR, manifest by either:

1. Pathological abnormalities; or Markers of kidney damage, including abnormalities in the composition of the blood or urine, or abnormalities in imaging tests.
2. $GFR < 60 \text{ ml/min/1.73m}^2$ for > 3 months with or without kidney damage.⁽¹⁾

The pathophysiology of CKD involves two broad sets of mechanisms of damage:

1. Initiating mechanisms specific to the underlying etiology (e.g., immune complexes and mediators of inflammation in certain types of glomerulonephritis, or toxin exposure in certain diseases of the renal tubules and interstitium).
2. A set of progressive mechanisms, involving hyper filtration and hypertrophy of the remaining viable nephrons, that are a common consequence following longterm reduction of renal mass, irrespective of underlying etiology.⁽²⁾

Chronic Kidney Disease (CKD) is associated with significantly increased morbidity and mortality. The global prevalence of CKD is 13.4%, with 10.6% being stages 3–5.⁽³⁾

Chronic renal failure affects almost every system of the body and results in various functional and structural abnormalities.⁽⁴⁾

Cardiovascular disease is the leading cause of morbidity and mortality in patients at every stage of CKD. The incremental

risk of cardiovascular disease in those with CKD compared to the age- and sex-matched general population ranges from 10- to 200-fold, depending on the stage of CKD. As a result, most patients with CKD succumb to cardiovascular disease before ever reaching stage 5 CKD. Between 30 and 45% of those patients who do reach stage 5 CKD have advanced cardiovascular complications.⁽⁴⁾

Echocardiogram allows for the evaluation of ventricular mass and volume, and has an excellent accuracy for the detection of hypertrophy, definition of its geometric pattern (concentric or eccentric), and quantification of systolic function. In addition, Doppler derived techniques can generate information regarding ventricular relaxation and its dynamics of filling, as well as concerning the presence of abnormalities in the cardiac valves and the pericardium.⁽⁴⁾

Diastolic dysfunction is characterized by alteration in ventricular relaxation and compliance, frequently followed by a compensatory increase in filling pressure in more advanced stages. The later phenomenon is usually responsible for the manifestations of cardiac failure, whatever the subjacent cause may be. Small studies reported a prevalence of Left Ventricular diastolic dysfunction in CKD patients varying from 50 to 65%, including predialysis, dialysis and post-transplant populations.⁽⁵⁻⁷⁾

Important causes of Diastolic Dysfunction include Ischemia, Hypertension, Diabetes Mellitus, Obesity, myocardial diseases, infiltrative diseases and aortic stenosis⁽⁸⁾

Table 1: Grading of Diastolic Dysfunction:⁽⁹⁾

| Grades | E/A on 2D-ECHO | Other parameter | Remarks |
|-----------|----------------|-----------------|-------------------------------------|
| Grade I | <1 | | |
| Grade II | 1 to 1.5 | Ea<7 | Pseudonormalization |
| Grade III | >2 | Shortened DT | Reversibility with Valsalva present |
| Grade IV | >2 | Shortened DT | Reversibility with Valsalva absent |

E: peak mitral flow velocity of early rapid filling wave

A: peak velocity of late filling wave caused by atrial contraction

Ea: Mitral Annulus velocity

DT: Deceleration Time

There is growing evidence suggesting that prevalence of cardiovascular disease among End Stage Renal Disease patients is already high by the time renal replacement treatment is initiated. Also, most of the important causes listed above for diastolic Dysfunction are directly or indirectly related to Chronic Kidney Disease.

Hence, this study was carried out to estimate the prevalence of Left Ventricular Diastolic Dysfunction in Chronic Kidney Disease patients not on Hemodialysis.

METHODS:

Chronic Kidney Disease patients not on Hemodialysis, without any underlying primary cardiac disease were included in the study. A total of 50 cases were selected randomly from the OPD and IPD of Department of Medicine, Indian Institute of Medical Science and Research, Badnapur, Jalna. The study was approved by the Institutional Ethics Committee. A written consent was obtained from all subjects after explaining the need for study and the procedures involved. 2D Echocardiography and Doppler study was done in the Cardiology Department of the same institute. Statistical analysis was done using Graph Pad Prism software Version 8.4.

RESULTS:

In this study, a total of 50 patients were enrolled. Of them, 31 were female and 19 were male. The mean age of the study group was 43.81 years.

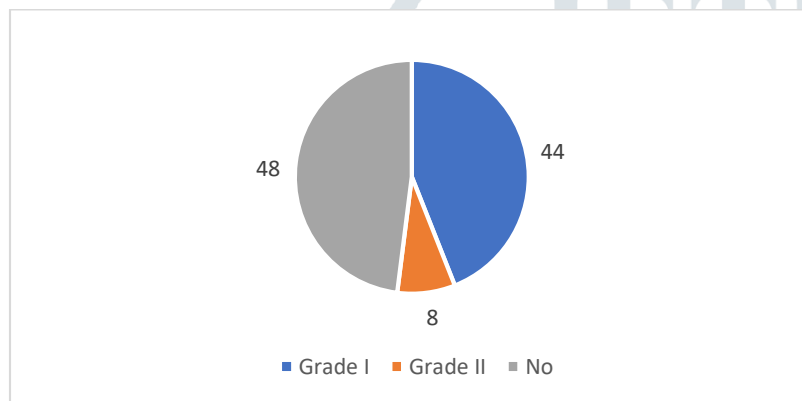
Table 2: Age distribution

| Age | Frequency | Percentage |
|-------|-----------|------------|
| <40 | 5 | 10.0 |
| 41-50 | 22 | 44.0 |
| 51-60 | 5 | 10.0 |
| 61-70 | 18 | 36.0 |
| Total | 50 | 100.0 |

Table 3: Gender distribution

| Sex | Frequency | Percentage |
|--------|-----------|------------|
| Female | 31 | 62.0 |
| Male | 19 | 38.0 |
| Total | 50 | 100.0 |

Of the 50 cases, 24 had Normal Left Ventricular Diastolic Dysfunction and 26 had Diastolic Dysfunction. Among these 26 cases, 22 had Grade I Diastolic Dysfunction and 4 had Grade II Diastolic Dysfunction.



Graph 1: Prevalence of Diastolic Dysfunction in CKD patients not on Hemodialysis

DISCUSSION:

Since Cardiovascular abnormalities are the leading causes of morbidity and mortality in Chronic Kidney Disease patients, a thorough Cardiovascular evaluation is warranted frequently in such patients. This study shows that even before progressing to End Stage Renal Disease and requiring Hemodialysis, more than 50% patients have Diastolic Dysfunction. Severe diastolic dysfunction, also called Restrictive filling can lead to Diastolic Heart Failure or Heart Failure with preserved Ejection Fraction (HFpEF).^(9,10)

CONCLUSION:

Cardiovascular abnormalities are an important predictor of morbidity and mortality in Chronic Kidney Disease patients. Of the various abnormalities, left ventricular diastolic dysfunction is an early predictor of Cardiovascular events since it is present well before the progression of disease in to End Stage Renal Disease (ESRD) and initiation of Hemodialysis. Proper control of various risk factors associated with CKD that can cause Diastolic Dysfunction may help in improving the survival of these patients.

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