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Clinical and Echocardiographic Correlation in Left Ventricular Dysfunction: A Prospective Observational Study.

Vinod Shisode*.

Associate Professor. MGM Medical College. Aurangabad, Maharashtra, India.

ABSTRACT

Left ventricular (LV) dysfunction is a leading cause of morbidity and mortality, often presenting with non-specific symptoms such as dyspnea and fatigue. Echocardiography remains the gold standard for diagnosing and classifying LV dysfunction. This study aimed to correlate clinical features with echocardiographic findings in patients with suspected LV dysfunction. A prospective observational study was conducted over one year at a tertiary care center, enrolling 40 patients aged ≥18 years presenting with symptoms suggestive of LV dysfunction. Clinical assessment included evaluation of dyspnea, orthopnea, fatigue, and edema. All patients underwent transthoracic echocardiography to assess left ventricular ejection fraction (LVEF), diastolic function, and wall motion abnormalities. Data were analyzed using descriptive statistics and Pearson's correlation. Dyspnea was the most common symptom (87.5%), followed by fatigue (70%) and orthopnea (55%). Echocardiography revealed that 70% had LVEF <40%, indicating systolic dysfunction. Diastolic dysfunction was present in 30%. A significant correlation was found between clinical symptoms and reduced LVEF ($p<0.05$), particularly with dyspnea, orthopnea, and fatigue. There is a strong clinical and echocardiographic correlation in LV dysfunction. Integrating both approaches enhances diagnostic accuracy and guides effective management.

Keywords: Left ventricular dysfunction, Echocardiography, Clinical correlation

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Corresponding author

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INTRODUCTION

Left ventricular (LV) dysfunction represents a significant contributor to morbidity and mortality worldwide, particularly in patients with cardiovascular disease [1]. It encompasses both systolic and diastolic dysfunction, which can occur independently or together, leading to heart failure and other severe cardiac complications. Clinical signs and symptoms such as dyspnea, fatigue, orthopnea, and peripheral edema are often indicative of LV dysfunction, yet these findings alone may be nonspecific and insufficient for early or accurate diagnosis [2]. Echocardiography, being a non-invasive and widely available imaging modality, plays a pivotal role in the assessment of cardiac structure and function. It allows for the evaluation of left ventricular ejection fraction (LVEF), wall motion abnormalities, and diastolic filling parameters, thereby providing essential insights into the severity and type of ventricular dysfunction [3].

Correlating clinical features with echocardiographic findings is crucial for prompt diagnosis, risk stratification, and guiding appropriate management [4, 5]. This prospective observational study aims to analyze the clinical presentation of patients with suspected LV dysfunction and correlate these with echocardiographic parameters.

METHODOLOGY

This prospective observational study was conducted over a period of one year in the Department of Cardiology at a tertiary care hospital. A total of 40 patients suspected of having left ventricular dysfunction based on clinical presentation were included in the study. Patients aged 18 years and above who presented with symptoms such as dyspnea, fatigue, orthopnea, or peripheral edema and were referred for echocardiographic evaluation were recruited. Written informed consent was obtained from all participants prior to inclusion in the study.

Patients with known congenital heart disease, pericardial diseases, or significant valvular heart diseases were excluded from the study. A detailed history was obtained for each patient, including demographic data, comorbidities, and presenting complaints. Clinical examination was carried out to assess vital signs, jugular venous pressure, presence of peripheral edema, and auscultatory findings. Each patient underwent standard laboratory investigations as per institutional protocol.

All included patients were subjected to transthoracic echocardiography using standard imaging protocols. Left ventricular ejection fraction (LVEF) was calculated using the modified Simpson's method. Additional parameters such as left ventricular end-diastolic and end-systolic dimensions, wall motion abnormalities, diastolic function, and left atrial size were also assessed. Diastolic dysfunction was evaluated based on mitral inflow patterns, tissue Doppler imaging, and E/e' ratio.

The clinical findings were then correlated with echocardiographic results to determine the extent and type of left ventricular dysfunction. Data were entered and analyzed using SPSS software version 23. Descriptive statistics were used to summarize demographic and clinical characteristics, and Pearson's correlation coefficient was applied to evaluate the strength of association between clinical features and echocardiographic parameters. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Age and Gender Distribution of Patients (n = 40)

Age Group (Years)	Male (n)	Female (n)	Total (n)	Percentage (%)
18–30	2	1	3	7.5%
31–45	6	4	10	25.0%
46–60	10	5	15	37.5%
>60	8	4	12	30.0%
Total	26	14	40	100%

Table 2: Clinical Symptoms in Study Participants

Clinical Feature	Number of Patients (n)	Percentage (%)
Dyspnea (NYHA Class II-IV)	35	87.5%
Orthopnea	22	55.0%
Paroxysmal Nocturnal Dyspnea (PND)	18	45.0%
Pedal Edema	20	50.0%
Fatigue	28	70.0%

Table 3: Echocardiographic Findings

Echocardiographic Parameter	Mean ± SD / Frequency (n)	Range / Percentage (%)
Left Ventricular Ejection Fraction (LVEF)	38.4% ± 9.2%	20% – 50%
LVEF < 40% (systolic dysfunction)	28	70.0%
Diastolic Dysfunction (any grade)	12	30.0%
Regional Wall Motion Abnormalities (RWMA)	18	45.0%
Left Atrial Enlargement	15	37.5%

Table 4: Correlation of Clinical Symptoms with LVEF

Clinical Feature	Mean LVEF (%)	p-value	Statistical Significance
Dyspnea Present (n=35)	36.2	0.01	Significant
Orthopnea Present (n=22)	34.5	0.03	Significant
Fatigue Present (n=28)	35.7	0.04	Significant
No Dyspnea (n=5)	48.6	–	–

DISCUSSION

This prospective observational study aimed to evaluate the clinical and echocardiographic correlation in patients with suspected left ventricular (LV) dysfunction. A total of 40 patients were studied over a period of one year. The findings revealed significant associations between classical clinical symptoms and echocardiographic parameters, particularly left ventricular ejection fraction (LVEF), underscoring the utility of echocardiography in confirming clinical suspicion and guiding the management of LV dysfunction [7].

The age distribution in our study showed a predominance of patients in the age group of 46–60 years (37.5%) and >60 years (30.0%), consistent with known epidemiology where LV dysfunction, particularly heart failure, is more prevalent in the middle-aged and elderly population. Male predominance (65%) was observed, which aligns with global trends indicating higher cardiovascular risk in males due to both biological and behavioral factors.

Clinically, dyspnea was the most common symptom, reported in 87.5% of patients. This was followed by fatigue (70%), pedal edema (50%), orthopnea (55%), and paroxysmal nocturnal dyspnea (PND) (45%). These symptoms are typical of both systolic and diastolic heart failure. The presence of orthopnea and PND was significantly associated with lower LVEF, indicating more advanced systolic dysfunction in these patients. Fatigue, often due to poor cardiac output and reduced perfusion, was also notably correlated with reduced ejection fraction [8, 9].

Echocardiographic evaluation demonstrated that 70% of patients had reduced LVEF (<40%), signifying systolic LV dysfunction. Diastolic dysfunction was present in 30% of patients, highlighting that a substantial number had either preserved or mildly reduced ejection fraction with impaired filling. The mean LVEF among all patients was 38.4% ± 9.2%, which is within the range defined for heart failure with reduced ejection fraction (HFrEF). Additionally, regional wall motion abnormalities (RWMA) were noted in 45% of patients, suggestive of underlying ischemic heart disease, and 37.5% of patients had left atrial enlargement, indicating chronic pressure overload and diastolic dysfunction.

Statistical analysis demonstrated a strong correlation between clinical features and LVEF. Patients with dyspnea had a significantly lower mean LVEF (36.2%) compared to those without dyspnea

(48.6%), with a p-value of 0.01. Orthopnea and fatigue were also significantly associated with reduced LVEF, with p-values of 0.03 and 0.04, respectively. These findings support the notion that clinical symptoms, although subjective, can provide important initial clues regarding cardiac dysfunction but must be confirmed with echocardiographic assessment for accurate diagnosis and classification.

The results of this study underscore the importance of integrating clinical evaluation with echocardiographic findings in the diagnosis and management of LV dysfunction. While history-taking and physical examination remain foundational in clinical practice, echocardiography provides objective, quantifiable insights into cardiac structure and function that guide therapeutic decisions. Early identification of systolic or diastolic dysfunction allows for timely initiation of evidence-based treatments, such as ACE inhibitors, beta-blockers, and diuretics, potentially improving morbidity and quality of life in these patients.

In conclusion, this study highlights a strong correlation between clinical symptoms and echocardiographic indicators of LV dysfunction. Echocardiography should be considered a critical extension of the clinical examination, especially in symptomatic patients, to ensure accurate diagnosis, appropriate management, and improved clinical outcomes.

CONCLUSION

There is a strong clinical and echocardiographic correlation in LV dysfunction. Integrating both approaches enhances diagnostic accuracy and guides effective management.

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