ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 04 | April - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A COMPARATIVE STUDY OF CARDIAC CHANGES SEEN IN PATIENTS OF ISOLATED SYSTOLIC HYPERTENSION AND COMBINED SYSTOLIC AND DIASTOLIC HYPERTENSION WITH SPECIAL REFERENCE TO ELECTROCARDIOGRAPHY AND ECHOCARDIOGRAPHY

General Medicine

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ABSTRACT

Background: Hypertension leads to structural and functional cardiac changes. Differences between isolated systolic hypertension (ISH) and combined systolic and diastolic hypertension (SDH) require evaluation. **Objective:** To compare cardiac changes in ISH and SDH using electrocardiography and echocardiography.**Methods:** A cross-sectional study of 106 hypertensive patients was conducted and categorized into ISH (n=54) and SDH (n=52). ECG and echocardiographic parameters were analyzed. Results: SDH showed higher prevalence of left ventricular hypertrophy, increased LV mass index, and more severe diastolic dysfunction. **Conclusion:** SDH is associated with more advanced cardiac remodeling compared to ISH.

KEYWORDS

Hypertension; Isolated Systolic Hypertension; Left Ventricular Hypertrophy; Echocardiography; Diastolic Dysfunction

INTRODUCTION

Hypertension is a major global health concern and a leading cause of cardiovascular morbidity and mortality, predisposing individuals to stroke, myocardial infarction, heart failure, and chronic kidney disease [1]. Among its subtypes, isolated systolic hypertension (ISH), defined as systolic blood pressure ≥140 mmHg with diastolic blood pressure <90 mmHg, is commonly observed in the elderly and is primarily attributed to arterial stiffness and reduced vascular compliance [2]. In contrast, combined systolic and diastolic hypertension (SDH) results from increased peripheral vascular resistance and volume overload [3].

Both forms of hypertension lead to structural and functional cardiac changes, particularly left ventricular hypertrophy (LVH), which is an adaptive response to increased afterload and an independent predictor of adverse cardiovascular outcomes [4]. The pattern of LV remodeling, whether concentric or eccentric, reflects the underlying hemodynamic stress and has important prognostic implications [5].

Non-invasive modalities such as electrocardiography (ECG) and echocardiography (ECHO) play a crucial role in detecting these changes. While ECG provides insights into electrical remodeling, echocardiography offers a more sensitive assessment of cardiac structure and function, including left ventricular mass and diastolic performance [6,7].

Emerging evidence suggests that ISH and SDH differ in their impact on cardiac remodeling, with ISH often associated with persistent structural changes and impaired regression of LVH despite treatment [8]. Early detection of these alterations is essential for risk stratification and management. This study aims to compare the cardiac changes in patients with ISH and SDH, with special reference to electrocardiographic and echocardiographic findings

Materials and Methods

This hospital-based cross-sectional observational study was conducted in the Department of General Medicine at RKDF Medical College, Hospital and Research Centre, Bhopal, over a period of 18 months (April 2023 to September 2024). A total of 106 patients diagnosed with hypertension were included. Patients were categorized into two groups: isolated systolic hypertension (ISH) and combined systolic and diastolic hypertension (SDH). ISH was defined as systolic blood pressure (SBP) ≥140 mmHg with diastolic blood pressure (DBP) <90 mmHg, while SDH was defined as SBP ≥140 mmHg with DBP ≥90 mmHg. Ethical clearance was obtained from the institutional ethics committee, and informed written consent was taken from all participants. Sample size was calculated using the Daniel formula with 5% precision and 95% confidence interval.

Authors contribution: Dr. Vaishali Pandey, Dr. Priyanka Mishra were involved in patient recruitment, data collection and clinical management of study participants. Dr. Avneesh Singhai and Dr. Aayush Kumar contributed to study conceptualization, data analysis, interpretation of result and drafting of manuscript. All authors reviewed, edited and approved the final manuscript.

Inclusion Criteria

- Age ≥18 years
- SBP ≥140 mmHg or patients on antihypertensive treatment
- DBP <90 mmHg or ≥90 mmHg
- Previously diagnosed or newly detected hypertensive patients
- Patients willing to give informed written consent

Exclusion Criteria

- Age <18 years
- SBP <140 mmHg without antihypertensive therapy
- Congenital or structural heart disease (e.g., valvular heart disease)
- Diabetes mellitus
- Malignancy or severe systemic illness
- Patients unwilling to participate or not providing consent

Data Collection and Procedures

Data were collected using a pre-designed proforma including detailed history, clinical examination, and relevant laboratory investigations. Blood pressure was recorded using a calibrated mercury sphygmomanometer after 5 minutes of rest in the sitting position with appropriate cuff size. Electrocardiography (ECG) and two-dimensional echocardiography were performed in all patients during the same visit to assess cardiac structural and functional changes. Patients were evaluated for evidence of left ventricular hypertrophy and other abnormalities.

Data were entered into Microsoft Excel and analyzed using SPSS software. Appropriate statistical tests were applied, and results were interpreted with a significance level of $p<0.05$.

RESULTS:

TABLE – 1 Baseline Characteristics and Blood Pressure Profile of Study Population

Parameter	ISH (n=54)	SDH (n=52)
Mean Age (years)	65.2 ± 8.6	58.4 ± 9.2
Gender (Male/Female)	32 / 22	30 / 22
Mean SBP (mmHg)	156.4	152.7
Mean DBP (mmHg)	84.5	98.3

TABLE-2 Comparison of Cardiac Changes by ECG and Echocardiography

Parameter	ISH (n=54)	SDH (n=52)
ECG LVH (Present/Absent)	18 / 36	28 / 24
Echo LVH (Present/Absent)	30 / 24	42 / 10
Mean LV Mass Index (g/m²)	110.6	128.4
Mean Ejection Fraction (%)	61.5	59.3
LV Geometry		
– Normal	10	5
– Concentric Remodeling	16	12
– Concentric Hypertrophy	20	25
– Eccentric Hypertrophy	8	10
Diastolic Dysfunction		
– Normal	24	14
– Grade I	18	20
– Grade II	10	12
– Grade III	2	6

The study demonstrates that patients with combined systolic and diastolic hypertension (SDH) exhibit more pronounced cardiac changes compared to isolated systolic hypertension (ISH). SDH patients showed higher prevalence of left ventricular hypertrophy on both ECG and echocardiography, along with increased left ventricular mass index. Concentric hypertrophy was the predominant geometric pattern, particularly in SDH, indicating sustained pressure overload. Additionally, SDH was associated with more advanced grades of diastolic dysfunction, reflecting impaired ventricular compliance. Although ejection fraction remained preserved in both groups, these findings suggest that SDH leads to more severe structural and functional cardiac remodeling than ISH.

DISCUSSION

The present study demonstrates that combined systolic and diastolic hypertension (SDH) is associated with more significant cardiac remodeling compared to isolated systolic hypertension (ISH). SDH patients showed higher prevalence of left ventricular hypertrophy and increased left ventricular mass index, indicating greater hemodynamic stress [9]. Concentric hypertrophy was more common in SDH, reflecting pressure overload, while ISH showed relatively milder changes [10]. Additionally, diastolic dysfunction was more severe in SDH, suggesting impaired ventricular compliance. Despite preserved ejection fraction in both groups, these findings highlight that SDH leads to more advanced structural and functional cardiac changes than ISH [11].

CONCLUSIONS

This study concludes that combined systolic and diastolic hypertension is associated with more pronounced cardiac structural and functional changes compared to isolated systolic hypertension. Patients with SDH demonstrated higher prevalence of left ventricular hypertrophy, increased left ventricular mass index, and more severe diastolic dysfunction. Although systolic function remained preserved in both groups, SDH showed greater evidence of adverse remodeling. Early detection using electrocardiography and echocardiography is essential for risk stratification and timely management to prevent cardiovascular complications.

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