

# Prevalence Of Conduction Abnormalities On Resting Electrocardiogram In Patients With Systemic Hypertension

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## Abstract

### Background

Systemic hypertension is a major risk factor for cardiovascular diseases. Electrocardiographic (ECG) abnormalities have been found to be associated with higher cardiovascular events in several studies. In the present study we evaluated the prevalence of ECG conduction abnormalities in patients with Systemic hypertension in different age groups and their relation with Left Ventricular (LV) function.

### Materials and Methods

This study is a cross sectional study of 100 patients with Systemic Hypertension attending the Maharajah's Institute of Medical Sciences (MIMS), General Medicine, Nellimarla, outpatient department between January 2023 to June 2023.

Patients of 18 years or older with systemic hypertension of at least 6 months duration attending medical outpatient department were included in the study after obtaining informed consent. Patients with Coronary Heart Disease, Valvular Heart Disease and Cardiomyopathies were excluded.

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 27. Chi square test was used for association between qualitative variables

### Results

Data from a total of one hundred patients was analysed. Females comprised of 45 % of the study population. Conduction abnormalities were detected in 15% of the resting ECGs. Their prevalence was 5.9% in patients under 65 years age and 24.5% in patients of age 65 years and above while in the age group 75 years and above the prevalence of resting ECG abnormalities was 31.25% ( $P= 0.022$ ). Left ventricular dysfunction was present in 40% of patients with conduction abnormalities on resting ECG while it was 11.8% in patients without conduction abnormalities ( $p=0.014$ ).

### Conclusions

Conduction abnormalities are frequent in patients with Systemic Hypertension. Their prevalence increases with advancing age. Males appeared to be at higher risk for developing conduction abnormalities. LV dysfunction is more frequently observed in patients with conduction abnormalities.

**Abbreviations:** ECG – electrocardiographic, LV – left ventricular, MIMS – Maharaja Institute of Medical Sciences, SPSS - Statistical Package for Social Sciences.

**Keywords:** Conduction abnormalities, Electrocardiographic (ECG) abnormalities, Left ventricular (LV) dysfunction, Systemic hypertension

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## I. Introduction

Systemic hypertension is one of the major modifiable risk factors for cardiovascular diseases (1), the leading cause of mortality globally as well as in India. It is also one of the leaders of risk factor attributed deaths contributing to global mortality (2). The prevalence rates of Systemic Hypertension nearly doubled between the years 1990 and 2019 globally (3).

Cardiovascular, neurological, renal and ophthalmic involvement represent the end organ damage associated with hypertension. Electrocardiogram (ECG) is one of the easily available and easy to perform cardiovascular investigations which can detect abnormalities consistent with cardiac involvement. The prevalence of ECG abnormalities has been found to be increased in hypertensive patients when compared with normotensive individuals. Systemic hypertension is associated with increased risk of development of non-valvular atrial fibrillation (4). Studies have shown that, presence of abnormalities in resting ECG in patients with systemic hypertension might be independently associated with increased cardiovascular events and mortality (5,6,7). Thus

detection of ECG abnormalities could be an important method of risk stratification of hypertensive patients. There is a paucity of data on the risk stratification of patients with systemic hypertension in the local population.

## **II. Materials And Methods**

### ***Aims and objectives***

The primary aim of our study is to evaluate the prevalence of conduction abnormalities in resting ECG in patients with systemic hypertension attending the out-patient department. The other primary aim is to study the association of the resting ECG conduction abnormalities with the left ventricular function as assessed by echocardiography. The secondary aim is to study the prevalence of conduction abnormalities in different age groups and both sexes.

### ***Study design and subjects***

This study was a cross sectional study in patients attending the outpatient department of a medical college. One hundred patients diagnosed with systemic hypertension have been recruited into the study after informed consent. Institutional ethics committee approval has been obtained prior to the study.

Inclusion criteria were Patients diagnosed with systemic hypertension of six months duration or more, aged 18 years or more and able to and willing to give informed consent. Patients with known coronary heart disease, valvular heart disease and cardiomyopathies were excluded as are those not able to give informed consent.

Patients were recruited into the study between January 2023 and June 2023. A baseline resting 12 lead ECG was obtained for all the patients. All the ECGs were reviewed and reported by a qualified cardiologist. The ECGs were reported as normal or abnormal and the presence or absence of conduction abnormalities. The specific conduction abnormalities were also mentioned if present in each ECG. The cardiologist also performed standard echocardiography on all patients and assessed the left ventricular function and reported.

All patients were subjected to a detailed history taking and clinical evaluation including blood pressure and pulse rate measurement according to standard protocol, and general physical examination and systemic examination. Routine investigations including fasting blood sugar and lipid profile, renal function tests, liver function tests have been advised to all patients.

### ***Statistical methods***

The data collected from the patients was tabulated using Microsoft Excel. Data was analysed using Statistical Package for Social Sciences (SPSS) version 27. Data was expressed as absolute numbers and proportions for categorical variables. Chi square test was used to assess the association between qualitative variables. A P value of less than 0.05 was considered to be accepted as statistically significant.

## **III. Results**

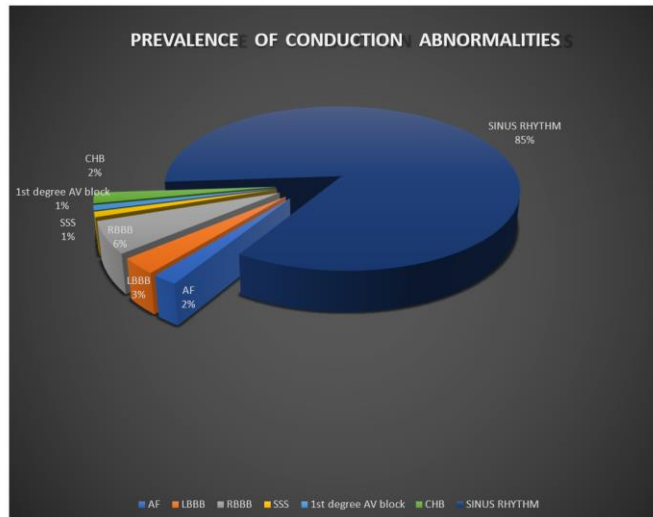
Data from a total of one hundred patients were analysed. There were 55 % males while females comprised of 45 %. Patients above the age of 64yrs comprised 49% of the total number of participants while 16% of the patients were 75 years of age or more.

Twelve lead resting ECGs were available for all the one hundred patients. Overall conduction abnormalities were detected in 15% of the resting ECGs, while one patient's ECG fulfilled the criteria for left ventricular hypertrophy. The remaining 84% ECGs were within normal limits.

The distribution of various conduction abnormalities on ECG has been depicted in figure 1. Six patients (6%) had right bundle branch block while three patients (3%) had left bundle branch block. Two patients had complete heart block while one patient each had sinus node dysfunction and first- degree atrioventricular block.

CONDUCTION ABNORMALITIES - 15

- AF – 2
- LBBB – 3
- RBBB - 6
- SSS - 1
- 1<sup>st</sup> degree Av block – 1
- Complete heart block – 2



The age related prevalence of conduction abnormalities has been depicted in table 1, figure 2.

CONDUCTION ABNORMALITIES – AGE RELATED

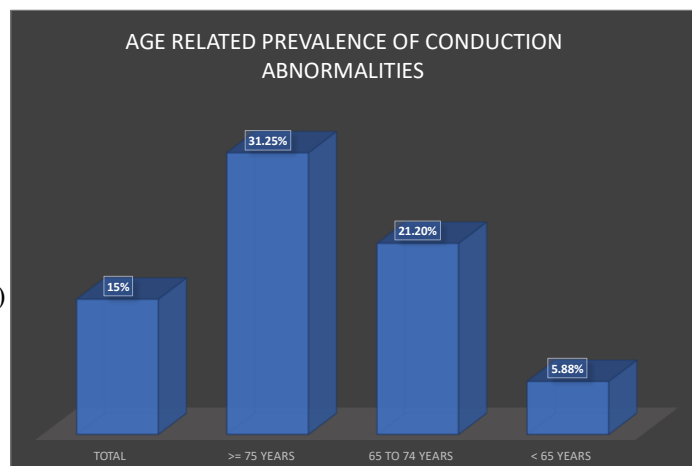
AGE Category		CONDUCTION ABNORMALITIES		Total
		Present	Absent	
< 65 YEARS AGE		3	48	51
	65 To 74 YEARS AGE	7	26	33
	>= 75 YEARS AGE	5	11	16
Total		15	85	100

AGE RELATED CONDUCTION ABNORMALITIES	Chi-Square	p-value
	7.638	0.022

5% Level of Significant: There is association between Age and conduction abnormalities

AGE RELATED PREVALENCE OF CONDUCTION ABNORMALITIES

- Total – 15% (15 in 100)
- >=75 – 31.25% (5 in 16)
- 65 to 74 – 21.2% (7 in 33)
- <65 years – 5.88% (3 in 51)



Their prevalence was 5.9% in patients under 65 years age and 24.5% in patients of age 65 years and above while in the age group 75 years and above the prevalence of resting ECG abnormalities was 31.25% (P=

0.022). The prevalence of conduction abnormalities in resting ECG was 21.8% in males while females had a prevalence of 6.7% table 2.

CONDUCTION ABNORMALITIES – GENDER RELATED

GENDER RELATED CONDUCTION ABNORMALITIES CROSSTABULATION				
GENDER		CONDUCTION ABNORMALITIES		Total
		Present	Absent	
Male		12	43	55
	Female	3	42	45
Total		15	85	100

GENDER RELATED CONDUCTION ABNORMALITIES	Chi-Square	p-value
	4.456	0.035
Significant at 5% Level		

Non valvular atrial fibrillation on resting ECG was present in two patients (2% prevalence). One patient was 76 years old while the other patient was of 70 years age. Both the patients with non- valvular atrial fibrillation were males.

Echocardiogram with colour doppler data was analysed for all the one hundred patients. Left ventricular dysfunction was seen in sixteen (16%) patients. The prevalence of left ventricular dysfunction as measured by echocardiography has been analysed in relation to the presence of conduction abnormalities on resting ECG (table 3). Left ventricular dysfunction was present in 6 out of 15 patients (40%) with conduction abnormalities on resting ECG while left ventricular dysfunction was present in only 10 out of 85 (11.8%) patients without conduction abnormalities on resting ECG (p=0.014).

LV DYSFUNCTION IN CONDUCTION ABNORMALITIES

LV DYSFUNCTION IN CONDUCTION ABNORMALITIES CROSSTABULATION				
CONDUCTION ABNORMALITIES		LV DYSFUNCTION		Total
		Present	Absent	
PRESENT		6	9	15
	ABSENT	10	75	85
Total		16	84	100

LV DYSFUNCTION IN CONDUCTION ABNORMALITIES	Chi-Square	p-value
	7.563	0.014
Significant: There is association between conduction abnormalities and LV dysfunction		

IV. Discussion

In the present study we examined the prevalence of baseline ECG conduction abnormalities in patients with systemic hypertension in local population. ECG conduction abnormalities have been correlated with left ventricular function as assessed by Echocardiography. Systemic hypertension is one of the most common and highly prevalent cardiovascular risk factors in the society. The management goal of hypertension should be, early diagnosis, institution of evidence based treatment and optimal control of blood pressure. End organ damage is the major cause of morbidity and mortality in patients with hypertension and can be present without significant symptoms. Comprehensive management of Hypertension should include investigations to assess end organ function. ECG is a simple and widely available noninvasive investigation of cardiovascular diseases. ECG has

been recommended to be performed as a baseline investigation in all patients with systemic hypertension with or without known cardiovascular disease (8). ECG images can easily be transferred for interpretation and expert opinion sought.

Yuen Ying tin et al (9) in a cross sectional study, evaluated 504 hypertensive patients aged 18–80 years, recruited in a general outpatient clinic, to determine the prevalence of major electrocardiographic abnormalities in patients with hypertension in primary care in Hong Kong, and to determine the association of major electrocardiographic abnormalities with patients' socio-economical background, cardiovascular disease and cardiovascular risk factors. 6.3% had probable IHD, 0.4% had complete LBBB, 4.0% had LVH and 1.0% had AF. Probable IHD was associated with smoking ( $P = 0.032$ ), hypercholesterolemia ( $P = 0.037$ ) and higher 10-year CV risk ( $P = 0.04$ ). Complete LBBB was associated with smoking ( $P = 0.021$ ) and hypercholesterolemia ( $P = 0.022$ ). LVH was associated with male gender ( $P = 0.001$ ) and longer duration of hypertension ( $P = 0.035$ ).

In the present study the prevalence of conduction abnormalities was 15% and it increased with increasing age, with patients greater than 74 years showing a prevalence of 31.25% while it was 21.2% in the 65 – 74 years age group and 5.9% in the below 65 years age group. Our study results indicate that elderly hypertensive population are more likely to exhibit ECG conduction abnormalities. There was also a significant gender difference in the prevalence of ECG conduction abnormalities viz, 21.8% in males vs 6.7% in females. Atrial fibrillation is a common arrhythmia in elderly population which has been well documented in longitudinal population based studies (10). The present study showed a 2% prevalence of non valvular atrial fibrillation in the study population. However the small number of events and absence of longer ECG recordings may not represent the true prevalence rates and might be an underestimation.

Arttu O Lehtonen et al (11) studied the prevalence and prognosis of ECG abnormalities in hypertensive and normotensive individuals in a nationwide population sample of 5800 Finns. The presence of 15 ECG abnormalities was evaluated. The age- and sex-adjusted prevalence rates of ECG abnormalities were generally higher in the hypertensive participants than in normotensive individuals. Among the ECG abnormalities, left ventricular hypertrophy (LVH) by Sokolow-Lyon criteria, LVH with ST-depression and negative T wave, positive T wave in lead aVR (AVRT+), and poor R-wave progression predicted coronary heart (CHD) and cardiovascular disease (CVD) in hypertensive participants. Prolonged QT interval, abnormal P-wave indices, left axis deviation and early repolarization pattern were not associated with CHD or CVD.

Echocardiography is the gold standard in the assessment of LV function. Wall motion abnormalities of the left ventricle are commonly observed in patients with presence of left ventricular hypertrophy in ECG (12). We combined both ECG and Echocardiography findings to assess the relation of ECG abnormalities to LV function. Hypertensive patients with ECG conduction abnormalities are found to have Left ventricular systolic dysfunction significantly more frequently than those without ECG conduction abnormalities, 40% vs 11.76%. These findings suggest that those patients of systemic hypertension with baseline ECG conduction abnormalities represent higher risk subsets for cardiac damage and deserve earlier evaluation of LV function.

### **Limitations of the study**

Ours was a cross sectional study comprising of relatively smaller number of patients. There was no long term follow up hence clinical outcomes could not be assessed. Prevalence of ECG conduction abnormalities was based on onetime ECG testing. Longtime ECG monitoring is likely to reveal more instances of intermittent conduction abnormalities on ECG.

## **V. Conclusions**

Conduction abnormalities are frequent in patients with Systemic Hypertension. Their prevalence increases with advancing age. Males appeared to be at higher risk for developing conduction abnormalities. LV dysfunction is more frequently observed in patients with conduction abnormalities. Hence ECGs and Echocardiograms should be considered in patients with Systemic Hypertension.

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