



Volume: 2, Issue: 7, 492-495
July 2015
www.allsubjectjournal.com
e-ISSN: 2349-4182
p-ISSN: 2349-5979
Impact Factor: 3.762

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Study of left ventricular function and relationship with electrocardiographic changes in newly diagnosed hypertensive patients

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Abstract

Background- This study was designed to study left ventricular function and ECG changes in newly diagnosed hypertensive patients.

Material and Methods - This study included 104 cases of newly diagnosed hypertensives and 30 controls, done in Department of Medicine, GRMC Gwalior from September 2013 to October 2014.

Results- In newly diagnosed hypertensives, incidence was more in males as compared to females. Most of patients presented in stage I of hypertension and mean blood pressure was 151.34 ± 8.66 mmHg. Of 23 smokers 7 had diastolic dysfunction. The incidence of diastolic dysfunction is high in age group 51-60 for both males & females.

Conclusion - Hypertension is a major cause of morbidity and mortality. As the age increases the incidence of hypertension also increases. Newly diagnosed hypertensives those with $QTc \geq 0.43$ & $VAT > 0.042$ have high risk for diastolic dysfunction so they should be preferentially screened by ECHO.

Keywords: Electrocardiography, hypertension and echocardiography.

1. Introduction

Hypertension is defined as a usual office blood pressure of 140/90 mm Hg or higher. Yet epidemiologic data show continuous positive relationships between the risk of coronary artery disease (CAD) and stroke deaths with systolic or diastolic blood pressure down to values as low as 115/75 mm Hg^[1]. Hypertension is one of the leading causes of the global burden of disease. Hypertension doubles the risk of cardiovascular diseases, including coronary heart disease (CHD), congestive heart failure (CHF), ischemic and hemorrhagic stroke, renal failure and peripheral arterial disease^[2]. The factors Hereditary, Obesity, High sodium intake, Excessive alcohol drinking (more than two to three portions a day), Smoking, Sleep apnea, Herbal remedies, Diet pills and other stimulants, such as ephedra, Physical inactivity and Psychological stress^[3] play important role in hypertension.

Electrocardiography is the recording of the electrical activity of the heart by instrument known as conventional electrocardiograph^[4]. A standard electrocardiogram (ECG) consists of 12 leads (hence it is also called a 12 lead ECG). These 12 leads are made of 6 limb leads (leads are attached to the wrists and ankles) and 6 precordial leads (V_{1-6} attached to chest). Limb leads are bipolar (leads I, II and III) or unipolar (leads aVR, aVL, and aVF)^[5]. LV systolic function can be assessed by M mode echocardiography or EF by 2D echocardiography. The latter is preferable. Standard measurement of cardiac function in hypertensive patients shows preserved EF, mid LV mechanics and diastolic filling impairment^[6].

2. Aims and Objectives- 1. To assess left ventricular function in newly diagnosed untreated hypertensive patients at different stages of hypertension, 2. To determine the prevalence of left ventricular dysfunction in newly diagnosed, untreated hypertensive patients and 3. To study associated risk factors in patients of hypertension association with left ventricular function

3. Materials and methods- This study was conducted in the patients presenting to Out Patient Department and Indoor Patients in Department of Medicine, GRMC, Gwalior from September 2013 to October 2014. This study included 104 cases and 30 controls. Data is collected and analyzed. Inclusion criteria - Age >15 yrs. Controls- normotensive patients. Exclusion criteria- Known hypertensive and co-morbidities like obesity (BMI > 25), metabolic syndrome, CAD, chronic renal failure, thyrotoxicosis, diabetics.

4. Results - Our study contains 104 cases and 30 controls. In newly diagnosed hypertensives, incidence was more in males 72/104 (69.23%) as compared to females 32/104 (30.76%) in table 1. Most of males are present in age group 51-60 years (16/72, 30.55%) and females are present in age group 51-60 years (12/32, 37.5%) in table 2. Ghabrahat was most common symptom (20/104, 19.32%) followed by breathlessness (16/104, 15.28%) in table 3. Most of patients presented in stage I of hypertension and mean blood pressure was 151.34±8.66mmHg (table 4). Of 23 smokers 7 had diastolic dysfunction (table 5). In cases group of newly diagnosed hypertensives the mean EF in smokers was 58.09±8.13 while in non-smokers it was 58.63±5.05 (table 6). Out of 23 patients diagnosed with diastolic dysfunction (22.11%), the incidence of diastolic dysfunction is more in males (18/23, 78.26%) as compared to females (5/23, 21.74%) table 7. Most of diastolic dysfunction patients presented in stage I of hypertension (15/23, 65.21%) table 8. The incidence of diastolic dysfunction is high in age group 51-60 for both males & females (table 9). The association of diastolic dysfunction with age > 50 years is significant (table 10). Patients with left ventricular hypertrophy have a higher diastolic dysfunction than patients without left ventricular hypertrophy (table 11). Using Romhilt Estes criteria in diagnosis of hypertension ECG has a sensitivity of 40% & sensitivity of 98% (table 12). Using Sokolow Lyon index ECG has as sensitivity of 70% & specificity of 81.25% (table 13). ECG basis of diagnosis of diastolic dysfunction is significant when using VAT 0.042±0.006 (ventricular activation time) & QTc 0.44±0.12 (table 14). Using QTc as ≥0.43 the correlation of QTc with diastolic dysfunction is significant (table 15)

5. Tables

Table 1: Sex Distribution of study population: cases & controls

Sex	No. of patients	
	Cases	Controls
Males	72(69.23%)	20(66.67%)
Females	32(30.76%)	10(33.33%)
Total	104	30

Table 2: Age distribution: cases

Age in years	No. of patient		Total
	M	F	
<20	1	0	1(0.9%)
21-30	4	0	4(3.8%)
31-40	10	6	16(15.38%)
41-50	16	8	24(23.07%)
51-60	22	12	34(32.69%)
61-70	16	5	21(20.19%)
71-80	3	1	4(3.8%)
Total	72	32	100

Table 3: Symptomatology of cases

Symptom	No. of patients	Percentage
Ghabrahat	20	19.32
Breathlessness	16	15.38
Chest pain	10	9.6
Fever	8	7.6
Cough	4	3.8

Table 4: Distribution of patients according to stages of hypertension

Parameters	No. of patients	Percentage
Stage I	76	73.07%
Stage II	28	26.93%
Total	104	100%

Table 5: Correlation of smoking in newly diagnosed hypertension with diastolic dysfunction

Parameter	Diastolic dysfunction	No diastolic dysfunction	Total
Smokers	7	15	22
Non smokers	16	66	82
Total	23	81	104

Table 6: Smoking & ejection fraction in newly diagnosed hypertensives

Smoking	Ejection fraction
Hypertensive Smokers	58.09±8.13
Hypertensive Non smokers	58.63±5.05

Table 7: Incidence of diastolic Dysfunction in males & females

Diastolic dysfunction	No. of patient	Percentage
Males	18	78.26%
Females	5	21.74%
Total	23	100%

Table 8: Incidence of diastolic dysfunction in newly diagnosed hypertensives by stage of hypertension

Diastolic dysfunction	No. of patient	Percentage
Stage I	15	65.21%
Stage II	8	34.79%
Total	23	100%

Table 9: Incidence of diastolic dysfunction with age and sex

Age in years	No. of patient		Total
	M	F	
<20	0	0	0
21-30	0	0	0
31-40	0	0	0
41-50	4	1	5
51-60	9	3	12
61-70	5	1	6
71-80	0	0	0
Total	18	5	23

M- Males and F- Females

Table 10: Correlation of diastolic dysfunction with age > and <50 years

Age (in Yrs)	Diastolic dysfunction	No diastolic dysfunction	Total
>50	18	41	59
<50	5	40	45
Total	23	81	104

$\chi^2= 5.577$, D.F. = 1; $p=0.018$ (significant)

Table 11: Left ventricular hypertrophy as a marker of diastolic dysfunction: correlation of diastolic dysfunction with left ventricular hypertrophy

Parameter	Diastolic dysfunction	No diastolic dysfunction	Total
Lvh	16	24	40
No lvh	7	57	64
Total	23	81	104

$\chi^2=12.07$, d. f=1, $P=0.005$

Table 12: ECG basis of diagnosis of left ventricular Hypertrophy Romhilt Estes

	Lvh	NO Lvh	Total
Romhilt estes positive	16	1	17
Romhilt estes negative	24	63	87
Total	40	64	104

False positives=1; False negatives= 24.
Sensitivity=40%, Specificity=98%

Table 13: ECG basis of diagnosis of left ventricular hypertrophy Sokolow-lyon index

	Lvh	NO Lvh	Total
Sokolow lyon positive	28	12	40
Sokolow lyon negative	12	52	64
Total	40	64	104

False positives=12; False negatives= 12.
Sensitivity=70%; Specificity=81.25%

Table 14: Ecg basis for diagnosis of diastolic dysfunction in newly diagnosed hypertensives

Para Meters	Diastolic dysfunction with hypertension	Total No. of Hypertensives	Controls	P value
QTc	0.44±0.12	0.42±0.16	0.40±0.01	0.02
VAT	0.042±0.006	0.04±0.006	0.038±0.008	0.012
PR interval	0.13±0.01	0.13±0.01	0.13±0.017	0.72
Axis	48.26±17.60	54.13±17.65	43±14.75	0.6

Table 15: Correlation of diastolic dysfunction with prolonged QTc (≥0.43)

QTc Interval	Diastolic dysfunction	No diastolic dysfunction	Total
≥0.43	12	9	21
<0.43	11	72	83
Total	23	81	104

$\chi^2=18.74$, d.f=1, P<0.001(significant)

6. Discussion

The present study was planned to study left ventricular functions both systolic & diastolic in patients with newly diagnosed hypertension & to study correlation of left ventricular function with electrocardiographic changes. The present study found that as age increases, the prevalence of hypertension increases & maximum cases were found in age group 51-60 years (32.69%). It is comparable with results of Joshi *et al.* (2012) [7] who reported maximum prevalence of hypertension in age group 50-59 (28.9%). The prevalence of diastolic dysfunction in our study was 22.11%, this is comparable to study of Fischer *et al.* (2003) [8]. The prevalence of diastolic dysfunction in hypertension varies from 30 to 65%. The mean age of patients with diastolic dysfunction in our study was 54.95±8.14. In our study as age advances the incidence of diastolic dysfunction increases. These findings are comparable to past studies [9]. At age cutoff of >50 years the association of age with diastolic dysfunction is significant (p=0.018). Of the 23 patients with diastolic dysfunction 18 were males. Our study did not find any comparable difference in diastolic dysfunction on basis of sex. These findings were similarly studied by Carvalho *et al.* (2013) [10]. In our study 22 patients were smokers (incidence was 21.15%). In study of Parikh *et al.* (2011) [11] the incidence was in 21.1%. The QTc in patients with diastolic dysfunction was 0.44±0.12. While in controls it was 0.40±0.01. The relation of QTc ≥ 0.43 & diastolic dysfunction is significant (χ

$\chi^2=18.74$, d.f=1, P<0.001). Using prolonged QTc (≥0.43) we can screen patients of newly diagnosed hypertension for echocardiography for confirmation. These results were also confirmed in study by Khalife *et al.* (2012) [12]. In present study VAT was prolonged with diastolic dysfunction (0.042±0.006 vs. 0.038±0.005, P = 0.012.) Boles U *et al.* (2010) [13] concluded that prolongation of VAT is associated with Diastolic Dysfunction in patients with newly diagnosed untreated hypertension.

7. Conclusions

Hypertension is a major cause of morbidity and mortality. As the age increases the incidence of hypertension also increases. Special attention for diagnosis of diastolic dysfunction should be given to newly diagnosed hypertensive patients >50 years. ECG criteria for diagnosis of LVH in newly diagnosed hypertensive have low sensitivity. So a normal ECG in a patient of newly diagnosed hypertension does not rule out LVH. So the clean chit should not be given to any patient with normal ECG. Newly diagnosed hypertensives those with QTc≥0.43 & VAT >0.042 have high risk for diastolic dysfunction so they should be preferentially screened by ECHO.

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