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# Evaluation of Right Ventricular Function in Uncontrolled Systemic Hypertension

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**Abstract:** ***Systemic hypertension is an important risk factor for coronary artery disease and cerebrovascular accident. Systemic hypertension not only influence left ventricular geometry and function but also that of the right ventricle. Echocardiography is non-invasive mode to assess right ventricular function. This study is aimed to evaluate right ventricular function in patients with uncontrolled systemic hypertension. The results underscore that right ventricular function is significantly affected in patients with uncontrolled systemic hypertension.***

**Keywords:** Right Ventricular Function, Uncontrolled Systemic Hypertension, Echocardiography, Cardiovascular Disease

## 1. Introduction

Systemic hypertension is an important risk factor for coronary artery disease and cerebrovascular accident. systemic hypertension causes increase in afterload and may cause left ventricular systolic and diastolic dysfunction by altering left ventricular geometry and structure producing left ventricular remodelling and hypertrophy. Little is known about the impact of systemic arterial hypertension on Right ventricular structure and function [1-3]. Transthoracic echocardiography plays a vital role in assessing the right ventricular function. This study was designed to evaluate right ventricular function in patients with uncontrolled systemic hypertension.

Few studies have investigated the impact of systemic hypertension on echocardiographic parameters of right ventricular structure and function. These studies have shown that patients with systemic hypertension have a higher prevalence of right ventricular dysfunction compared to non-hypertensive individuals.

The mechanisms underlying the impact of systemic hypertension on echocardiographic parameters of right ventricular function are due to increased left ventricular afterload leading to left ventricular hypertrophy and dysfunction.

**Objective:**
To Evaluate the impact of uncontrolled systemic hypertension on echocardiographic parameters of right ventricular function.

## 2. Methodology

A cross-sectional case-control study with patients with uncontrolled systemic hypertension as cases and patients without systemic hypertension as controls. Patients were selected from the cardiology OPD in MMC & RGGGH who visit for routine cardiac evaluation. ECHO parameters of RV function like TAPSE, RVS', IVRT, RV E, RV A, EV E/A, E wave Deceleration time were obtained in uncontrolled hypertensives and controls.

**Sample Size:**
100 participants- 50 cases and 50 controls

**Inclusion Criteria for Cases:**
Patient with uncontrolled systemic hypertension of age group >18 years

**Inclusion Criteria for Control:**
Patient of age group>18 years with no systemic hypertension with SBP >140 mm hg with antihypertensive drugs.

**Exclusion criteria for cases and control:**
1) Age < 18 years
2) Diabetes mellitus
3) Chronic kidney disease
4) Coronary artery disease
5) Congenital heart disease
6) Cardiomyopathies
7) Valvular heart disease
8) Pregnancy

**Statistical Analysis**
The data collected were entered into Microsoft excel 2019 and the master chart was created. The qualitative variable was expressed using frequency and percentage and the quantitative variable using mean and standard deviation. To compare the distribution of qualitative variables between the hypertensives and controls, chi square test was used. To compare the mean between the hypertensives and controls, independent samples t test was used. A P value of less than 0.05 was considered to be statistically significant.

## 3. Results

The mean age among the participants in the hypertensive group was 49.43 ± 6.34 years and that of the control group was 49.85 ± 6.23 years. The mean age was similar between the Uncontrolled hypertensives and controls with P value of more than 0.05. Among the uncontrolled hypertensives,

65.5% were males and among the controls, 67.5% were males. The mean heart rate was 72.22±9.86 beats per minute and 72.25 ± 9.49 beats per minute for the uncontrolled hypertensives and controls, respectively. The mean heart rate was similar between the groups with P value of more than 0.05. The mean systolic blood pressure among those in the uncontrolled hypertensive group was 159.90 ± 9.91 mmHg and for the controls, it was 109.20 ± 9.05 mmHg. The mean diastolic blood pressure for the uncontrolled hypertensives was 95.50 ± 8.39 mmHg and for the control it was 69.35 ± 8.49 mmHg. The mean systolic and diastolic blood pressure were significantly more among the uncontrolled hypertensives than the controls with P value of less than 0.05 (Table 1).

The mean TAPSE for the uncontrolled hypertensives group was 18.95 ± 1.30 mm and that of the control group was 21.05 ± 1.16 mm. The mean TAPSE was significantly higher in the control group than in the uncontrolled hypertensives group with P value of less than 0.05. The mean RVS among the hypertension group was 10.47 ± 1.07 and for the controls it was 11.64 ± 1.06. The mean RVS' was significantly more among the controls than the uncontrolled hypertensives with P value of less than 0.05. The mean IVRT for the uncontrolled hypertension and control groups were 81.18 ± 10.18 ms and 71.03 ± 4.46 ms, respectively. The mean was significantly higher in the uncontrolled hypertension group than in the control group with P value of less than 0.05.

The mean peak E for the uncontrolled hypertension group was 0.51 ± 0.05 m/s and for the control group, the mean was 0.66 ± 0.06 m/s. The mean peak E was higher in the control group than in the uncontrolled hypertension group with P value of less than 0.05. The mean Peak A for the uncontrolled hypertension group was 0.51 ± 0.04 and for the control group, it was 0.50 ± 0.05. The mean Peak A values were found to be similar between the groups with P value of more than 0.05 (Table 2).

The mean E/A among the uncontrolled hypertension and control group was 0.99 ± 0.10 and 1.33 ± 0.14, respectively. The mean E/A was more among the controls than the uncontrolled hypertensives with P value of less than 0.05 (Fig 1). The mean E wave deceleration time was 183.80 ± 17.26 ms in the uncontrolled hypertension group and 146.90 ± 22.10 ms in the control group. The mean E wave deceleration time was more in the uncontrolled hypertensive group than in the control group with P value of less than 0.05 (Fig 2).

**Table 1:** Baseline characteristics between the study groups

| Variables | | Uncontrolled Hypertension (n=50) | Control (n=50) | P value |
|---|---|---|---|---|
| Age ( in years) | | 49.43 ± 6.34 | 49.85 ± 6.23 | 0.763 |
| Sex | Male | 25 (65.5) | 27 (67.5) | 0.639 |
| | Female | 15 (37.5) | 13 (32.5) | |
| Heart rate (BPM) | | 72.22 ± 9.86 | 72.25 ± 9.49 | 0.991 |
| SBP (mmHg) | | 159.90±9.91 | 109.20±9.05 | 0.001 |
| DBP (mmHg) | | 95.50 ± 8.39 | 69.35 ± 8.49 | 0.001 |

**Table 2:** Standard doppler echocardiographic analysis between the groups

| Variables | Uncontrolled Hypertension, (n=50) | Control (n=50) | P value |
|---|---|---|---|
| TAPSE (mm) | 18.95 ± 1.30 | 21.05 ± 1.61 | 0.001 |
| RVS' | 10.47 ± 1.07 | 11.64 ± 1.06 | 0.001 |
| IVRT (ms) | 82.18 ± 10.18 | 71.03 ± 4.46 | 0.001 |
| Peak E (m/s) | 0.51 ± 0.05 | 0.66 ± 0.06 | 0.001 |
| Peak A (m/s) | 0.51 ± 0.04 | 0.50 ± 0.05 | 0.137 |
| E/A | 0.99 ± 0.10 | 1.33 ± 0.14 | 0.001 |
| E wave DT (ms) | 183.80 ± 17.26 | 146.90 ± 22.10 | 0.001 |

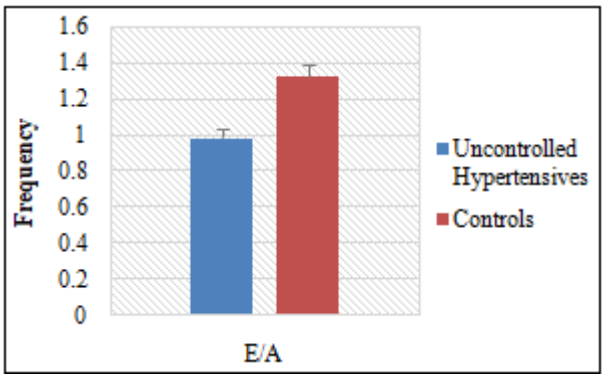


**Figure 1:** Bar chart showing comparison of E/A between uncontrolled hypertensives and controls,

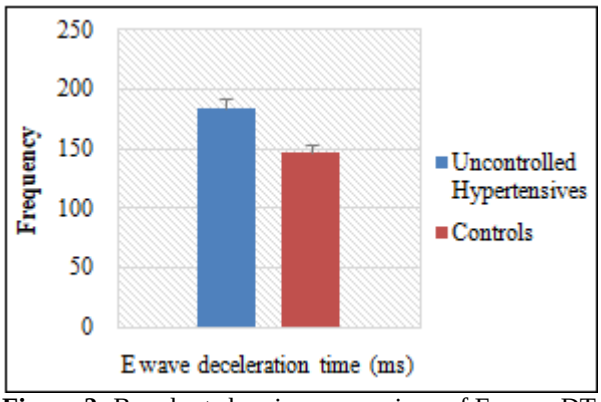


**Figure 2:** Bar chart showing comparison of E wave DT between uncontrolled hypertensives and controls

## 4. Discussion

TAPSE, a good estimate of right ventricular globalsystolic function [4], was decreased in Uncontrolled hypertensive group. Uncontrolled hypertensive group had reduced right ventricular E/A ratio(fig 1) and right ventricular E peak velocity when compared to the control group. RVS' which is an indicator for right ventricular longitudinal systolic function is significantly higher in controls than uncontrolled hypertensives. Isovolumic relaxatation time of right ventricle is increased in uncontrolled hypertensive group when compared to controls. RV filling pressure changes in uncontrolled hypertensive patients are similar to that note by Myslinki et al [5]. Majority of studies [6-10] showed Right ventricular diastolic dysfunction in hypertensive patients as seen in our study.

## 5. Conclusion

This study highlights the impact of systemic hypertension on echocardiographic parameters of right ventricular structure and function in the Indian population. The findings underscore the importance of regular cardiac screening in hypertensive patients and the need for aggressive management of cardiovascular risk factors

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